523-0770698-00121A

Rockwell
International

Collins instruction book

Part 1

HF-8054( )
Receiver

Part 1 of this instruction book includes:

Description	*523-0770699*
HF-8054 Supplement	*523-0770700*
HF-8054A Supplement	*523-0770701*
Installation	*523-0770702*
Operation	*523-0770703*
Theory	*523-0770704*
Maintenance	*523-0770705*
Parts List	*523-0770706*
Diagrams	*523-0770707*

Collins Telecommunications
Products Division
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Cedar Rapids, Iowa 52406

Printed in the United States of America

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introduction

DESIGN FEATURES

The HF-8054/8054A Receiver is a 4-channel ISB hf receiver that features flexibility, low-cost design, and high performance characteristics. The HF-8054( ) Receiver has a frequency range of 250.00 kHz to 29.999 99 MHz tunable in 10-Hz or 100-Hz steps over its entire range. In its basic configuration, it includes the following modes of operation: ISB (A3A, A3J, A3B, A9B), AM (A3, A3H), and CW (A1, A2).

- The HF-8054( ) Receiver makes an excellent manually controlled receiver for either a receive-only site or a full communications station.
- The HF-8054A Receiver makes an excellent remotely controlled receiver and, using an HF-8094 Receiver Control, it can be remotely controlled up to 8 km (5 mi) over field wire or for unlimited distances over standard telephone circuits or radio links.
- Multiple HF-8054A Receiver installations can be controlled from one HF-8094 Receiver Control or one processor.
- The HF-8054( ) Receiver includes features not normally found in other commercial receivers such as:

  NET DATA mode: compatible to netted data link type operations such as TADIL A and LINK 11. Includes an AGC crowbar circuit for the fast response time required for this type of operation.

  AGC busing: in ISB operation, allows the gain of inactive channels to be controlled by the AGC levels of active channels, thus reducing the background noise of the inactive channels.

(To be supplied)

Built in test (BIT) monitors: fault detectors and performance monitors are available to be used for fault detection and isolation. This feature is ideally suited for use by a processor in a BIT diagnostic routine.

- The HF-8054( ) Receiver is very flexible and is available with many options. Some of these options are strictly plug-in card changes/additions that can be accomplished easily by the customer or field technician. Other options require wiring and front panel modifications that require factory or service center changes. Some available options are as follows:

  Various bandwidth if filters: can be added to meet a specific customer requirement.

  1-Hz tuning: recommended for processor controlled receiver applications that require fine frequency resolution.

  Oven standard: added to provide an accurate temperature-stabilized 1-MHz frequency standard.

  External frequency standard: used with a 100-kHz, 1-MHz, or 5-MHz external frequency standard.

  Frequency standard switch: used to provide an automatic switchover from an external frequency standard to the 1-MHz oven standard if for any reason the external frequency standard signal is lost.

  Digital vbfo: can be added for accurate CW (A1) or RTTY operation.

  AFC (automatic frequency control): added to provide an automatic lock to the received frequency.

- The HF-8054( ) Receiver makes an excellent building block for an expanding system with no changes required to the receiver when expanding from a single receiver to a multiple receiver station and/or a complete duplex system. All system interconnections are made from the rear of the receiver and all local controls are on the front panel.
- The HF-8054( ) Receiver is designed for ease of maintenance with front panel fault indicators and a meter to monitor specific outputs. Faults can be isolated and the unit can be placed on-line with a minimum downtime using plug-in circuit cards and modules.
- The HF-8054( ) Receiver can be rack-mounted in a standard 483-mm (19-in) rack or in a small desktop cabinet. Provisions are made for optional slide mounting in rack/cabinet installations.

INSTRUCTION BOOK

This instruction book is divided into two parts.

Part 1 includes all instructions on the basic unit and supports repair of the basic unit to card/module replacement and/or replacement of components at the unit level.

Part 2 includes card, module, and options instructions sheets necessary to support repair to component parts of the cards and modules.

SERVICE BULLETINS/SERVICE INFORMATION LETTERS

The following listed service bulletins (SB) and service information letters (SIL) are those that are applicable to the HF-8054( ) Receiver and are included in the text of this instruction book. Other applicable SB/SIL released before the instruction book was shipped are included in the front of the instruction book.

Note

Service bulletins/service information letters are written in numerical sequence against the whole HF-80 family: therefore, all SB-/SIL numbers are not included in the listing. Service Bulletins are numbered in sequence for the life of the equipment. Service information letters are numbered in sequence starting at 1 for each calendar year.

SB/SIL	DESCRIPTION	ISSUE DATE

HF-8054( )
Receiver

Rockwell
International

description

Collins Telecommunications Products Division

Printed in USA

523-0770699-001218
1 January 1981

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List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
Title	1 Jan 81
List of Effective Pages	1 Jan 81
1 thru 14	1 Jan 81

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE	INITIAL	REV NO	REVISION DATE	INSERTION DATE	INITIAL
1st Ed	1 Jan 81						

description

1. GENERAL

The HF-8054/8054A Receiver provides reception of AM, CW, and 4-channel ISB signals over the frequency range of 250.00 kHz to 29.999 99 MHz in 10-Hz or 100-Hz steps. The HF-8054 Receiver is locally controlled from its front panel, but the HF-8054A Receiver may be locally controlled from its front panel or remotely controlled using a compatible control/processor. Options available can provide 1-Hz tuning, additional bandwidth filter selection, internal high-stability frequency reference (oven standard), external frequency standard adapter, automatic frequency control, variable beat frequency oscillator (for A1 CW), and frequency display. In addition, remote control of the HF-8054 Receiver is an available option.

Receive-line audio and receive if output signals are available as well as a headphone jack and a built-in speaker for monitoring received signals.

Remote control of the HF-8054A Receiver is provided by FSK, RS-232C, or MIL-STD-188C data signals. The signaling method is changed by changing strapped clips on serial interface A13. As many as 16 HF-8054A Receivers can operate in parallel when using the HF-8094 Receiver Control. Up to 32 HF-8054A Receivers can operate in parallel when using a processor. For multiple receiver operation from one control or processor, RS-232C or MIL-STD-188C data signaling must be used.

The receiver can be mounted in a standard 483-mm (19-in) rack using an optional slide-mounting kit. It can also be mounted in a desk-top enclosure or in a console-style equipment cabinet.

The receiver can be operated from a 100-, 115-, 215-, or 230-V ac, 47- to 420-Hz power source.

2. EQUIPMENT SUPPLIED/ CONFIGURATION

Equipment supplied in the HF-8054( ) Receiver and its configuration is listed in table 1.

3. ASSOCIATED EQUIPMENT

Associated equipment required for operation but not supplied as a part of the HF-8054( ) Receiver is listed in table 2.

4. ACCESSORIES

For detailed information (including manufacturer's part number and physical description) pertaining to equipment mounting racks and preassembled interconnecting cables, refer to the following system instruction books:

TITLE	PART NUMBER
HF-80 1-kW Transmitter/ Transceiver Systems.	523-0767370
HF-80 3-kW Transmitter/ Transceiver Systems	523-0767386
HF-80 10-kW Transmitter/ Transceiver Systems	523-0767402

5. OPTIONS

Options available for the HF-8054( ) Receiver are listed in table 3.

6. EQUIPMENT SPECIFICATIONS

Specifications for the HF-8054( ) Receiver are listed in table 4.

Table 1. Equipment Supplied/Configuration.

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001	
Main chassis	634-8177-001	X	X	
Bottom cover	634-8179-001	X	X	
Top cover	634-8181-001	X	X	
Rear panel	642-2462-001	X	X	
Cable assembly W1	634-8226-001	X	X	Interconnects TB1.
Cable assembly W2	634-8227-001	X	X	Interconnects TB2.
Cable assembly W3	634-8225-001	X	X	Interconnects J47, TB3, and audio connections (speaker cable).
Rf cable assembly J40/J22	637-1525-002	X	X	Interconnects J40 and J22 (RCV ANT).
Rf cable assembly J38/J23	637-1525-003	X	X	Interconnects J38 and J23 (CH B2 IF OUT).
Rf cable assembly J37/J24	635-1525-003	X	X	Interconnects J37 and J24 (CH A2 IF OUT).
Rf cable assembly J36/J25	637-1525-003	X	X	Interconnects J36 and J25 (CH B1 IF OUT).
Rf cable assembly J35/J26	637-1525-003	X	X	Interconnects J35 and J26 (CH A1 IF OUT).
Rf cable assembly J41/J42	637-1526-002	X	X	Interconnects J41 and J42 (9.45-MHz receive if).
Rf cable assembly, 450-kHz if	642-2454-001	X	X	Interconnects J50, J51, J52, and J53 (450-kHz if from channel A1 if).
Rf cable assembly J34/J59	637-1526-003			Interconnects J34 and J59 (450-kHz if from vbfo).
Rf cable assembly J32/J58	637-1526-004			Interconnects J32 and J58 (9.9-MHz if from AFC).
Rf cable assembly AFC	646-6534-001			Interconnects J50, J51, J52, J53, and J56 (450-kHz if from channel A1).
Power supply A1	635-9649-001	X	X	Input can be switched for 100, 115, 215, or 230 V ac (47 to 420 Hz).
Front panel assembly A2	634-8200-001	X	X	10-Hz tuning
	634-8200-002			100-Hz tuning, frequency display, AGC = OFF, VOICE, DATA, FAX
(Cont)	634-8200-003			100-Hz tuning, frequency display, AFC, vbfo

Table 1. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001	
Front panel assembly A2 (Cont)	634-8200-004			100-Hz tuning, frequency display
LED status display A2A1	635-0825-013	X	X	
Switch mounting board A2A2	638-6873-001			AGC = OFF, VOICE, DATA, FAX
	638-6873-002	X	X	AGC = OFF, FAST, MED, SLOW
Frequency switch-board A2A3	635-0830-001			100-Hz tuning
	635-0830-002	X	X	10-Hz tuning
Dvbfo switchboard A2A4	638-6437-001			
Frequency display cable A2W1	634-8289-001			Interconnects A2P8, A2P2, and cable assembly 634-8210-001 (P2).
AFC A3	642-3224-001			
Vbfo A4	638-6067-002			
Channel B2 if A5	638-6975-006	X	X	Same as 638-6975-003 except has AGC decay time constants: FAST = 15 - 30 ms, MED = 70 - 150 ms, SLOW = 1 - 2 s.
	638-6975-003			Includes 2.85-kHz LLSB if filter and CH B2 SSB audio detector. AGC decay time constants: VOICE = 1 - 2 s, DATA = 15 - 30 ms, FAX = 3 - 6 s.
Channel A2 if A6	638-6975-005	X	X	Same as 638-6975-002 except has AGC decay time constants: FAST = 15 - 30 ms, MED = 70 - 150 ms, SLOW = 1 - 2 s.
	638-6975-002			Includes 2.85-kHz UUSB if filter and CH A2 SSB audio detector. AGC decay time constants: VOICE = 1 - 2 s, DATA = 15 - 30 ms, FAX = 3 - 6 s.
Channel B1 if A7 (Cont)	638-6975-004	X	X	Same as 638-6975-001 except has AGC decay time constants: FAST = 15 - 30 ms, MED = 70 - 150 ms, SLOW = 1 - 2 s.

Table 1. Equipment Supplied/Configuration (Cont).

<table>
<tr><th colspan="2">SUBASSEMBLY/CIRCUIT CARD</th><th colspan="2">RECEIVER</th><th colspan="6" rowspan="2">DESCRIPTION/FUNCTION</th></tr>
<tr><th>TITLE</th><th>PART NUMBER</th><th>HF-8054
622-3474-001</th><th>HF-8054A
622-3475-001</th></tr>
<tr><td>Channel B1 if A7
(Cont)</td><td>638-6975-001</td><td></td><td></td><td colspan="6">Includes 2.85-kHz LSB if filter and CH B1 SSB audio detector. AGC decay time constants:
VOICE = 1 - 2 s,
DATA = 15 - 30 ms,
FAX = 3 - 6 s.</td></tr>
<tr><td rowspan="2">Channel A1 if A8</td><td>638-6871-002</td><td>X</td><td>X</td><td colspan="6">Same as 638-6871-001 except has AGC decay time constants:
FAST = 15 - 30 ms,
MED = 70 - 150 ms,
SLOW = 1 - 2 s.</td></tr>
<tr><td>638-6871-001</td><td></td><td></td><td colspan="6">Includes 2.85-kHz USB and 16-kHz AM if filters and AM and CH A1 SSB audio detectors. AGC decay time constants:
VOICE = 1 - 2 s,
DATA = 15 - 30 ms,
FAX = 3 - 6 s.</td></tr>
<tr><td rowspan="10">Filter A8A2</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td colspan="6">Contains optional bandwidth filters in addition to those included on the channel B and/or channel A if cards. Filters (bandwidths in kHz) available on each filter card are as follows:</td></tr>
<tr><td>LSB
FL2</td><td>A
FL3</td><td>B
FL4</td><td>C
FL5</td><td>D
FL6</td><td>E
FL7</td></tr>
<tr><td rowspan="2">637-2515-001</td><td rowspan="2"></td><td rowspan="2"></td><td>NA</td><td>6.0</td><td>3.0</td><td>1.0</td><td>0.5</td><td>0.2</td></tr>
<tr><td colspan="6">Part of AC-8055 IF Filters Kit 622-3452-001</td></tr>
<tr><td rowspan="2">637-2515-002</td><td rowspan="2"></td><td rowspan="2"></td><td>NA</td><td>6.0</td><td>NA</td><td>NA</td><td>NA</td><td>0.2
USB</td></tr>
<tr><td colspan="6">Part of AC-8055 IF Filters Kit 622-3452-002</td></tr>
<tr><td rowspan="2">637-2515-003</td><td rowspan="2"></td><td rowspan="2"></td><td>NA</td><td>6.0</td><td>3.0</td><td>1.0
USB</td><td>0.5
USB</td><td>0.2
USB</td></tr>
<tr><td colspan="6">Part of AC-8055 IF Filters Kit 622-3452-003</td></tr>
<tr><td rowspan="2">637-2515-004</td><td rowspan="2"></td><td rowspan="2"></td><td>2.75</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td colspan="6">(non-ISB radio)</td></tr>
<tr><td rowspan="2">(Cont)</td><td rowspan="2">637-2515-005</td><td rowspan="2"></td><td rowspan="2"></td><td>2.75</td><td>6.0</td><td>3.0</td><td>1.0</td><td>0.5</td><td>0.2</td></tr>
<tr><td colspan="6">Part of AC-8055 IF Filters Kit 622-3452-004 (non-ISB radio)</td></tr>
</table>

Table 1. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION						
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001							
Filter A8A2 (Cont)				LSB FL2	A FL3	B FL4	C FL5	D FL6	E FL7	
	637-2515-006			NA	6.0	3.0	1.0	0.5	1.0	Part of AC-8055 IF Filters Kit 622-3452-005
	637-2515-007			0.2 USB	NA	NA	NA	NA	NA	(non-ISB radio)
	637-2515-008			NA	NA	NA	NA	NA	0.37 USB	
	637-2515-009			2.75 LSB	NA	NA	1.0	NA	0.2	(non-ISB radio)
	637-2515-010			NA	6.0	NA	NA	NA	NA	Part of AC-8055 IF Filters Kit 622-3452-006
✗	637-2515-011			NA	6.0	NA	1.0	NA	0.2	Part of AC-8055 IF Filters Kit 622-3452-007
	637-2515-012			2.75 LSB	3.0	1.0	0.5	0.3	0.2	(non-ISB radio)
	637-2515-013			NA	0.25 USB	0.7 USB	0.7 LSB	0.25 LSB	5.0	Part of AC-8055 IF Filters Kit 622-3452-008
Rf translator A9	637-1767-002	X	X							Standard
	637-1767-003									High performance
Control A10	638-6629-001	X	X							
Parallel input A11	642-3135-001		X							
Parallel output A12	642-3137-001		X							
Serial interface A13 (Cont)	638-6896-001		X							Can be switched for 7-bit ASCII or 8-bit character data format. Can be switched for various serial controls: FSK; EIA RS-232C (CCITT V.24); or MIL-STD-188C.

Table 1. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001	
Serial interface A13 (Cont)				Can be switched for various baud rates: 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19 200 bauds.
Synthesizer voltage regulator A14	635-0656-001	X	X	
Synthesizer subcarrier generator A15	638-6962-001	X	X	
Synthesizer reference A16	642-2451-001	X	X	Can be strapped for an internal (INT) or external (EXT) frequency standard. If strapped EXT, external phase-lock must be installed.
External phase-lock A16A4	635-0655-001		X	Can be strapped for 100-kHz, 1-MHz, or 5-MHz external frequency standard. Part of AC-8012 Oven Standard Kit (622-3460-001) and AC-8013 External Standard Kit (622-3461-001).
Synthesizer end decade	635-0657-001	X	X	Installed as A18 provides 10-Hz tuning. Installed as A19 provides 100-Hz tuning. With appropriate decades added, installed as A17 provides 1-Hz tuning.
Synthesizer 100/10-Hz decade	623-2080-004		X	Installed as A19 for 10-Hz tuning. Not installed for 100-Hz tuning. Two installed, one as A19 and one as A18, for 1-Hz tuning.
Synthesizer 1-kHz decade A20	623-2080-003	X	X	
Synthesizer 10-kHz decade A21	623-2080-002	X	X	
Synthesizer 100-kHz decade A22	623-2080-001	X	X	
Synthesizer output A23	635-4930-002	X	X	
Synthesizer chassis assembly A24	634-8201-001	X	X	
Rf cable assembly J43/J29 (P/O A24)	637-1526-003	X	X	Interconnects J43 and J29 (118.8-MHz inj in).
Rf cable assembly J45/J28 (P/O A24)	637-1526-003	X	X	Interconnects J45 and J28 (variable inj in).

Table 1. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001	
Rf cable assembly J44/J32 (P/O A24) or Rf cable assembly J44/J57 (P/O A24)	637-1526-006	X	X	Interconnects J44 and J32 (9.9-MHz inj in).
				Interconnects J44 and J57 (9.9-MHz inj in, AFC).
Rf cable assembly A1-if (P/O A24) or Rf cable assembly, vbfo (P/O A24)	637-1529-001	X	X	Interconnects A24-E1 and J34 (450-kHz inj in).
				Interconnects A24-E1 and J60 (450-kHz inj in, vbfo).
Rf cable assembly B1-if (P/O A24)	637-1529-001	X	X	Interconnects A24-E1 and J39 (450-kHz inj in).
Rf cable assembly A2-if (P/O A24)	637-1529-001	X	X	Interconnects A24-E7 and J54 (456.29-kHz inj in).
Rf cable assembly B2-if (P/O A24)	637-1529-001	X	X	Interconnects A24-E5 and J55 (443.71-kHz inj in).
Synthesizer sideboard (P/O A24)	638-6973-001	X	X	
Synthesizer chassis (P/O A24)	634-8178-001	X	X	
Synthesizer bottom cover (P/O A24)	634-8186-001	X	X	
Synthesizer top cover	642-2409-001	X	X	
Receive audio A25	635-0748-002	X	X	
Receive audio A26	635-0748-002	X	X	
Rfi filter A27	637-2712-004	X	X	
Sideboard assembly A28	634-8224-001	X	X	
Sideboard	638-6627-001	X	X	
Cable assembly	634-8210-001	X	X	Interconnects P11, J11, and P2 (frequency control).
Cable assembly	634-8228-001	X	X	Interconnects J19, P4, P5, P3, and J12 (status control and display).
Oven standard, oscillator assembly A29	637-9135-001			Part of AC-8012 Oven Standard Kit (622-3460-001). 1-MHz oven standard.

Table 1. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		RECEIVER		DESCRIPTION/FUNCTION
TITLE	PART NUMBER	HF-8054 622-3474-001	HF-8054A 622-3475-001	
Frequency standard switch A30	646-6558-001			Can be switched for 100-kHz, 1-MHz, or 5-MHz external frequency standard. Automatically switches over from an external frequency reference input to the oven standard upon loss of the external frequency standard. Can be used only if oven standard is installed. Part of AC-8015 Frequency Standard Switch Kit (622-3499-001).
Power cable	426-1034-010	X	X	
Maintenance kit	637-1769-001	X	X	2-A fuse installed for 100- or 115-V ac operation. 1-A fuse installed for 215- or 230-V ac operation.
Hexwrench, 0.062 in (1)	024-0058-000			
Hexwrench, 0.050 in (1)	024-0057-000			
2-A fuse (5)	264-0305-000			
1-A fuse (5)	264-4280-000			
Lamps (2)	262-1106-000			
Instruction sheet	637-1777-001			

Table 2. Associated Equipment.

EQUIPMENT	TYPE	FUNCTION	CHARACTERISTIC
Headphones	Any	Provide headphone monitoring of the HF-8054( ) Receiver audio	Standard 600-Ω headphone
Receiver control	HF-8094 or equivalent	Provides serial data control signals to the HF-8054A Receiver in remote applications (not used for HF-8054 Receiver)	Provides serial data control signals using FSK, EIA RS-232C (CCITT V.24), or MIL-STD-188C signals. Selectable data rates: 75, 109, 150, 300, or 600 bauds using FSK signals; 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19 200 bauds using RS-232C or MIL-STD-188C signals.
Antenna	Any	Provides 50-Ω unbalanced antenna signal source.	Standard 50-Ω receive antenna

Table 3. Options.

OPTION	PART NUMBER	FUNCTION
AC-8012 Oven Standard Kit	622-3460-001	Internal oven frequency standard with a stability of 1 x 10^{-8} over the specified operating temperature range. Implemented by adding oven oscillator assembly (637-9135-001), 2-wire cable harness, a coaxial cable, and an external phase-lock (635-0655-001).
AC-8013 External Standard Kit	622-3461-001	Permits operation from an external frequency of 100 kHz, 1 MHz, or 5 MHz as desired. Implemented by adding a coaxial cable harness with rf connector mounted on rear panel and installing an external phase-lock (635-0655-001).
AC-8014 Frequency Display Kit	622-3470-001	Provides an LED display in 10-Hz increments of the frequency selected in the HF-8054( ) Receiver either locally or remotely. In local operation this display agrees with the frequency switchboard setting in the HF-8054( ) Receiver front panel. In remote operation this display agrees with the frequency switchboard setting on the receiver control.
	622-3470-002	Same as 622-3470-001 except LED display is in 100-Hz increments.
AC-8015 Frequency Standard Switch Kit	622-3499-001	Provides automatic switchover from an external frequency reference input to the oven-stabilized frequency standard upon loss of the external input. The nominal external input level should be 0.5 to 2.0 V ac into 50 ohms at 5.0 MHz, 1.0 MHz, or 100 kHz. When the kit is installed, a continuous 100-kHz output, 1.5 V ac nominal, is available at a BNC jack for peripheral equipment. This kit is intended for factory installation. The oven standard must be installed for the AC-8015 to operate.
AC-8017 100-Hz to 10-Hz Tuning Conversion Kit	622-3453-001	10-Hz tuning increment capability. Implemented by installing a synthesizer 100/10-Hz decade card (623-2080-004) in the A19 slot, by moving the synthesizer end decade (635-0657-001) from the A19 slot to the A18 slot, and by changing the front panel frequency switchboard from 635-0830-001 to 635-0830-002.
AC-8018 10-Hz to 1-Hz Tuning Conversion Kit	622-3454-001	1-Hz tuning increment capability is recommended for processor controlled units only. Implemented by installing an additional synthesizer 100/10-Hz decade (623-2080-004) in the A18 slot and moving the synthesizer end decade (635-0657-001) from the A18 slot to the A17 slot.
AC-8019 100-Hz to 1-Hz Tuning Conversion Kit	622-3455-001	1-Hz tuning increment capability is recommended for processor-controlled units only. Implemented by installing two synthesizer 100/10-Hz decades (623-2080-004), one in the A19 slot and one in the A18 slot, by moving synthesizer end decade (634-0657-001) from the A19 slot tothe A17 slot, and by changing the front panel frequency switchboard from 635-0830-001 to 635-0830-002.

Table 3. Options (Cont).

OPTION	PART NUMBER	FUNCTION
AC-8055 IF Filters Kit	622-3452-001	Provides five additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-001) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, B = 3.0 kHz, C = 1.0 kHz, D = 0.5 kHz, E = 0.2 kHz).
	622-3452-002	Provides two additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-002) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, E = 0.2 kHz). 0.2-kHz filter offset by 1 kHz to USB.
	622-3452-003	Provides five additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-003) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, B = 3.0 kHz, C = 1.0 kHz, D = 0.5 kHz, E = 0.2 kHz). 1.0-, 0.5-, and 0.2-kHz filters offset by 1 kHz to USB.
	622-3452-004	For use with non-ISB radio. Provides six additional if bandwidth filters including LSB (2.75 kHz). Implemented by installing A8A2 filter (637-2515-005) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, B = 3.0 kHz, C = 1.0 kHz, D = 0.5 kHz, E = 0.2 kHz).
	622-3452-005	Provides five additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-006) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, B = 3.0 kHz, C = 1.0 kHz, D = 0.54 kHz, E = 0.1 kHz).
	622-3452-006	Provides one additional if bandwidth filter. Implemented by installing A8A2 filter (637-2515-010) and applying the appropriate stick-on decal to the BANDWIDTH switch (A = 6.0 kHz).
	622-3452-007	Provides three additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-011) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 6.0 kHz, C = 1.0 kHz, E = 2.0 kHz).
	622-3452-008	Provides five additional if bandwidth filters. Implemented by installing A8A2 filter (637-2515-013) and applying the appropriate stick-on decals to the BANDWIDTH switch (A = 0.25 U, B = 0.7 U, C = 0.7 L, D = 0.25 L, E = 5.0 kHz). A offset by 1125 Hz to USB, B offset by 1275 Hz to USB, C offset by 1275 Hz to LSB, and D offset by 1125 Hz to LSB.
CA-8030 Slide Mounting Kit	622-3418-001	Mounting support with slides for 483-mm (19-in) rack-mounted HF-8054( ) Receivers. (Required for rack-mount installations.)

Table 4. Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Electrical (Signal levels are open circuit from 50-ohm source.)	
Modes of operation	A3A, A3J, A3B, A9B (ISB); A3, A3H (AM); A1, A2 (CW)
Frequency range	250.000 kHz to 29.999 999 MHz
Tuning increments	10-Hz or 100-Hz; optional 1-Hz for processor control applications
Frequency stability	Not less than 5 x 10^{-7} over specified temperature range; drift rate of not more than 3 x 10^{-8} per week Optional oven standard provides not less than 1 x 10^{-8} over specified temperature range; drift rate not more than 1 x 10^{-8} per week after 72 hours of continuous operation Optional external standard provides stability equal to the stability of the 100-kHz, 1-MHz, or 5-MHz external standard used; input impedance, 50 Ω; input level, 0.1 to 1.0 V rms
Frequency tune time	5 ms max; 2 ms nom
[redacted]	
✓ Standard rf translator	ISB: 250 kHz to 1.599 99 MHz; 2 μV hard (-107 dB mW) for 10 dB (s+n)/n, 1.6 to 29.999 99 MHz; 0.7 μV hard (-116 dB mW) for 10 dB (s+n)/n. AM (30% mod): 1.6 to 20.999 99 MHz; 5.7 μV hard (-98 dB mW) for 10 dB (s+n)/n.
High performance rf translator	ISB: 250 kHz to 1.599 99 MHz; 2.8 μV hard (-104 dB mW) for 10 dB (s+n)/n, 1.6 to 29.999 99 MHz; 1 μV hard (-113 dB mW) for 10 dB (s+n)/n. AM (30% mod): 250 kHz to 1.599 99 MHz; 23.1 μV hard (-86 dB mW) for 10 dB (s+n)/n, 1.6 to 29.999 99 MHz; 8 μV hard (-95 dB mW) for 10 dB (s+n)/n.
Digital vbfo	
Tuning range	±9.99 kHz in 10-Hz steps
Frequency stability	Same as frequency standard (see frequency stability above)
[redacted]	
/ Standard rf translator	In band: -47 dB below either of two input tones at 0.1 volt per tone. Out of band: from either of two input tones of -15 dB mW per tone, 50 kHz or more off tune frequency; second and third order distortion products are -60 dB.
High performance rf translator	In band: -47 dB below either of two input tones at 0.1 volt per tone. Out of band: from either of two input tones of -15 dB mW per tone, 50 kHz or more off tune frequency; second order distortion products are -65 dB, third order distortion products are -100 dB.
Spurious responses to external signals	If rejection: 100 dB min Image rejection: 100 dB min Other spurious signals: -80 dB min at 20 kHz or more off center frequency

Table 4. Equipment Specifications (Cont).

<table>
<tr><th>CHARACTERISTIC</th><th>SPECIFICATION</th></tr>
<tr><td>Internal spurious emissions</td><td>Equivalent to 0.5 μV max input signals over the 1.6- to 29.999 99-MHz frequency range</td></tr>
<tr><td>Audio outputs</td><td>Line: 600 Ω, 10%, balanced; 0 dB mW, nom; adjustable from -20 to +10 dB mW; total harmonic distortion, 1% max for 1-kHz tone at -20 to +10 dB mW in ISB mode.
Headphone: 600 Ω nom; capable of +10 dB mW min; total harmonic distortion, 5% max for 1-kHz tone at +10 dB mW in ISB mode
Speaker: 8 Ω nom; capable of 2 W peak min, total harmonic distortion, 5% max for 1-kHz tone at 2 W output in ISB mode</td></tr>
<tr><td>AGC threshold</td><td>1 μV max</td></tr>
<tr><td>AGC control</td><td>6-dB rise in audio out for signal increase from 1 μV to 2 V</td></tr>
<tr><td>AGC time constants</td><td><table>
<tr><th>AGC MODE</th><th>ATTACK TIME</th><th>DECAY TIME</th></tr>
<tr><td>FAST</td><td>20 ms, max</td><td>15 to 30 ms</td></tr>
<tr><td>MED</td><td>20 ms, max</td><td>70 to 150 ms</td></tr>
<tr><td>SLOW</td><td>20 ms, max</td><td>1 to 2 seconds</td></tr>
<tr><td colspan="3">(Applicable to HF-8054A Receiver, 622-3475-002 only.)</td></tr>
<tr><td>DATA</td><td>20 ms, max</td><td>15 to 30 ms</td></tr>
<tr><td>VOICE</td><td>20 ms, max</td><td>1 to 2 seconds</td></tr>
<tr><td>FAX</td><td>2 seconds, max</td><td>3 to 6 seconds</td></tr>
</table></td></tr>
<tr><td>AGC crowbar</td><td>AGC crowbar action provides fast reaction of AGC to stop signal level changes between local and distant stations in data networks. It is enabled in NET DATA mode and for channel A1 (USB) and channel B1 (LSB) ifs only. Crowbar action is initiated by a decrease in received signal level of 20 dB or by application of an end of message signal.</td></tr>
<tr><td>AGC bus</td><td>AGC bus interconnects AGC lines of ifs by operation of AGC bus switches.</td></tr>
<tr><td>Squelch</td><td>Operates on audio snr of voice signals below 1000 Hz; applicable to speaker output only</td></tr>
<tr><td>If output</td><td>20 mV nom at 450 kHz into 50 Ω for 3-μV input signal</td></tr>
<tr><td>Bandwidths</td><td>ISB: Channel A1 (USB) -2 dB points: carrier +250 Hz max and carrier +3100 Hz min.
Channel B1 (LSB) -2 dB points: carrier -250 Hz min and carrier -3100 Hz max.
Channel A2 (UUSB) -2 dB points: carrier +3190 Hz max and carrier +6040 Hz max.
Channel B2 (LLSB) -2 dB points: carrier -3190 Hz min and carrier -6040 Hz min.
AM or CW: with 16 selected 16 kHz bandwidth is 16 ±4 kHz with center frequency at carrier frequency. Provisions for up to five additional filters that can be selected in AM or CW mode using the BANDWIDTH switch.</td></tr>
</table>

Table 4. Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Antenna input impedance	50 Ω nom, unbalanced
Rf overload protection	Up to 100-V rf input, power on or off
Built-in test (BIT) functions	Fault detectors: located on power supply outputs, phase-locked loops of frequency synthesizer and vbfo, and injection signal outputs. Provides fault summary indications and individual fault indications in serial monitor data. Performance monitors: located on audio outputs, AGC levels, and if signal level. Individual performance monitor status provided in serial monitor data.
Duty cycle	Continuous
Power requirements	100/115/215/230 V ±10%, 47 to 420 Hz, single-phase ac, 80 watts maximum
Serial control and monitor interface characteristics	
Output data levels	FSK: -10 to +5 dB mW into 600 Ω, 0 dB mW nominal RS-232C/MIL-STD-188C: ±6 ±1 V dc into 3 to 6 kΩ
Input data levels	FSK: -25 to +5 dB mW (20 dB snr min) RS-232C/MIL-STD-188C: ±6 ±1 V dc
Line output impedance	FSK: 600 Ω nom RS-232C/MIL-STD-188C: 300 Ω max when transmitting, 50 kΩ min when not transmitting
Line input impedance	FSK: 600 Ω nom RS-232C/MIL-STD-188C: 47 kΩ nom
FSK tone frequencies	Mark: 1280 Hz Space: 2133 Hz
Data rates	FSK: 75, 109, 150, 300, 600 bauds RS-232C/MIL-STD-188C: 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, 19 200 bauds
Data format	Selectable 7-bit ASCII code or 8-bit character code
Line characteristics	FSK: 600 Ω balanced RS-232C/MIL-STD-188C: unbalanced, line to ground
Environmental	
Temperature	Full performance: 0 to +50 °C (+32 to +122 °F) Reduced performance: -20 to 0 °C (-4 to +32 °F) Nonoperating: -57 to +71 °C (-71 to 160 °F)
Humidity	0 to 95% relative humidity
Altitude	Operating: 0 to 3048 m (10 000 ft), 0 to +50 °C (+32 to +122 °F); 0 to 4572 m (15 000 ft), 0 to +25 °C (+32 to +77 °F) Nonoperating: 0 to 12 192 m (40 000 ft), -57 to +71 °C (-71 to +160 °F)
Shock	Bench handling (MIL-STD-810C, procedure V, method 516.2)
Vibration	1.5 g, 5.5 to 55 Hz (MIL-STD-810C, procedure X, method 514.2)
Physical	
Size	177 mm (7 in) high x 483 mm (19 in) wide x 619 mm (24.4 in) deep with handles
Weight	21.8 kg (48 lb) max
Mounting	Desk-top cabinet or standard 483-mm (19-in) rack with optional slide mounting kit for rack

HF-8054
Receiver

Rockwell
International

supplement

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1. GENERAL

The purpose of this supplement is to provide a general description of the HF-8054 Receiver (figure 1). When used with the HF-8054( ) Receiver Instruction Book (523-0770698), this supplement provides the user with a complete instruction book on the HF-8054 Receiver.

2. DESCRIPTION

The HF-8054 Receivers have the characteristics listed in table 1. Equipment supplied in the HF-8054 Receiver and its configuration is listed in table 2. The function/description (if significant) of the cables/assemblies is listed in the HF-8054( ) Receiver description section (523-0770699).

(To Be Supplied.)

HF-8054 Receiver
Figure 1

Because of its flexibility, all configurations of the HF-8054 Receiver may not be listed in tables 1 and 2. Blank columns have been provided in the tables so that if your HF-8054 Receiver is not included, you may add it. The next revision to this supplement should contain your configuration.

3. DIFFERENCE DATA

All HF-8054 Receivers are similar except for options installed. Options are available in kit form or may be installed at the factory. These options are covered functionally in the HF-8054( ) Receiver theory section and in detail in the appropriate card/module sections.

Refer to table 2 for the differences in the HF-8054 Receiver complement. As a result of some options, the following subassembly differences should be noted.

a. With dvbfo option installed (factory installation), rf cable assembly J34/J59 637-1526-003, front panel assembly 634-8200-003, dvbfo switchboard A2A4 638-6437-001, and vbfo A4 638-6067-002 are used.
b. With AFC option installed (factory installation), rf cable assembly J32/J58 637-1526-004, rf cable assembly AFC 646-6534-001, front panel assembly 634-8200-003, and AFC A3 642-3224-001 are used.
c. With oven standard option installed, external phase-lock 635-0655-001 and oven oscillator assembly 637-9135-001 are used.
d. With external standard option installed, external phase 635-0655-001 and cable assembly W1 637-9136-001 are used.
e. With frequency standard switch option installed (factory installation), external phase-lock 635-0655-001, oven oscillator assembly 637-9135-001, and frequency standard switch 646-6558-001 are used.
f. With frequency display option installed (factory installation), frequency display A2A5 637-1781-006 or 637-1781-008 and freqquency display cable A2W1 634-8289-001 are used.
g. With 100-Hz tuning option installed, synthesizer 100/10-Hz decade A19 623-2080-004 is removed and synthesizer end decade A18 635-0657-001 is placed in the A19 assembly position.
h. With 1-Hz tuning option installed, synthesizer end decade A18 635-0657-001 is placed in the A17 assembly position and a synthesizer 100/10-Hz decade 623-2080-004 is added in the A18 assembly position. This option used only with a processor control tuning.

Table 1. HF-8054 Receiver Characteristics.

CHARACTERISTICS	HF-8054 RECEIVER 622-3474-( )										
	-001	-002	-003	-004	-005						
Tuning: 100 Hz	X										
10 Hz											
Bandwidths (kHz):											
USB - A1	2.85										
UUSB - A2	2.85										
LSB - B1	2.85										
LLSB - B2	2.85										
A											
B											
C											
D											
E											
16	X										
ISB 2-channel											
4-channel	X										
AFC											
Dvbfo											
Remote control											
Oven standard											
External standard											
Frequency standard switch											
Frequency display											
AGC: OFF-FAST-MED-SLOW	X										
OFF-VOICE-DATA-FAX											
Rf translator: Standard	X										
High performance											

Table 2. Equipment Supplied/Configuration.

SUBASSEMBLY/CIRCUIT CARD		HF-8054 RECEIVER 622-3474-( )								
TITLE	PART NUMBER	-001								
Main chassis	634-8177-001	X								
Bottom cover	634-8179-001	X								
Top cover	634-8181-001	X								
Rear panel	642-2462-001	X								
Cable assembly W1	634-8226-001	X								
Cable assembly W2	634-8227-001	X								
Cable assembly W3	634-8225-001	X								
Rf cable assembly J40/J22	637-1525-002	X								
Rf cable assembly J38/J23	637-1525-003	X								
Rf cable assembly J37/J24	637-1525-003	X								
Rf cable assembly J36/J25	637-1525-003	X								
Rf cable assembly J35/J26	637-1525-003	X								
Rf cable assembly J41/J42	637-1526-002	X								
Rf cable assembly, 450-kHz if	642-2454-001	X								
Rf cable assembly J34/J59	637-1526-003									
Rf cable assembly J32/J58	637-1526-004									
Rf cable assembly, AFC	646-6534-001									
Power supply A1	635-9649-001	X								
Front panel assembly A2	634-8200-001	X								
	634-8200-002									
	634-8200-003									
	634-8200-004									
LED status display A2A1	635-0825-013	X								
Switch mounting board A2A2	638-6873-001									
	638-6873-002	X								
Frequency switchboard A2A3	635-0830-001	X								
	635-0830-002									
Dvbfo switchboard A2A4	638-6437-001									

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054 RECEIVER 622-3474-( )								
TITLE	PART NUMBER	-001								
Frequency display A2A5	637-1781-006									
	637-1781-008									
Frequency display cable A2W1	634-8289-001									
AFC A3	642-3224-001									
Vbfo A4	638-6067-002									
Channel B2 if A5	638-6975-006	X								
	638-6975-003									
Channel A2 if A6	638-6975-005	X								
	638-6975-002									
Channel B1 if A7	638-6975-004	X								
	638-6975-001									
Channel A1 if A8	638-6871-002	X								
	638-6871-001									
Filter A8A2	637-2515-001									
	637-2515-002									
	637-2515-003									
	637-2515-004									
	637-2515-005									
	637-2515-006									
	637-2515-007									
	637-2515-008									
	637-2515-009									
	637-2515-010									
	637-2515-011									
	637-2515-012									
	637-2515-013									
Rf translator A9	637-1767-002	X								
	637-1767-003									
Control A10	638-6629-001	X								

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054 RECEIVER 622-3474-( )								
TITLE	PART NUMBER	-001								
Parallel input A11	642-3135-001									
Parallel output A12	642-3137-001									
Serial interface A13	638-6896-001									
Synthesizer voltage regulator A14	635-0656-001	X								
Synthesizer subcarrier generator A15	638-6962-001	X								
Synthesizer reference A16	642-2451-001	X								
External phase-lock A16A4	635-0655-001									
Synthesizer end decade	635-0657-001	X								
Synthesizer 100/10-Hz decade	623-2080-004									
Synthesizer 1-kHz decade A20	623-2080-003	X								
Synthesizer 10-kHz decade A21	623-2080-002	X								
Synthesizer 100-kHz decade A22	623-2080-001	X								
Synthesizer output A23	635-4930-002	X								
Synthesizer chassis assembly A24	634-8201-001	X								
Rf cable assembly J43/J29	637-1526-003	X								
Rf cable assembly J45/J28	637-1526-003	X								
Rf cable assembly J44/J32	637-1526-006	X								
or Rf cable assembly J44/J57										
Rf cable assembly A1-if	637-1529-001	X								
or Rf cable assembly vbfo										
Rf cable assembly B1-if	637-1529-001	X								
Rf cable assembly A2-if	637-1529-001	X								
Rf cable assembly B2-if	637-1529-001	X								
Synthesizer sideboard	638-6973-001	X								
Synthesizer chassis	634-8178-001	X								
Synthesizer bottom cover	634-8186-001	X								

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054 RECEIVER 622-3474-( )								
TITLE	PART NUMBER	-001								
Synthesizer top cover	642-2409-001	X								
Receive audio A25	635-0748-002	X								
Receive audio A26	635-0748-002	X								
Rfi filter A27	637-2712-004	X								
Sideboard assembly A28	634-8224-001	X								
Sideboard	638-6627-001	X								
Cable assembly	634-8210-001	X								
Cable assembly	634-8228-001	X								
Oven standard, oscillator assembly A29	637-9135-001									
Frequency standard switch A30	646-6558-001									
Power cable	426-1034-010	X								
Maintenance kit	637-1769-001	X								

HF-8054A
Receiver

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International

supplement

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1. GENERAL

The purpose of this supplement is to provide a general description of the HF-8054A Receiver (figure 1). When used with the HF-8054( ) Receiver Instruction Book (523-0770698), this supplement provides the user with a complete instruction book on the HF-8054A Receiver.

2. DESCRIPTION

The HF-8054A Receivers have the characteristics listed in table 1. Equipment supplied in the HF-8054A Receiver and its configuration is listed in table 2. The function/description (if significant) of the cables/assemblies is listed in the HF-8054( ) Receiver description section (523-0770699).

(To Be Supplied)

HF-8054A Receiver
Figure 1

Because of its flexibility, all configurations of the HF-8054A Receiver may not be listed in tables 1 and 2. Blank columns have been provided in the tables so that if your HF-8054A Receiver is not included, you may add it. The next revision to this supplement should contain your configuration.

3. DIFFERENCE DATA

All HF-8054A Receivers are similar except for options installed. Options are available in kit form or may be installed at the factory. These options are covered functionally in the HF-8054( ) Receiver theory section and in detail in the appropriate card/module sections.

Refer to table 2 for the differences in the HF-8054A Receiver complement. As a result of some options, the following subassembly differences should be noted.

a. With dvbfo option installed (factory installation), rf cable assembly J34/J59 637-1526-003, front panel assembly 634-8200-003, dvbfo switchboard A2A4 638-6437-001, and vbfo A4 638-6067-002 are used.
b. With AFC option installed (factory installation), rf cable assembly J32/J58 637-1526-004, rf cable assembly AFC 646-6534-001, front panel assembly 634-8200-003, and AFC A3 642-3224-001 are used.
c. With oven standard option installed, external phase-lock 635-0655-001 and oven oscillator assembly 637-9135-001 are used.
d. With external standard option installed, external phase-lock 635-0655-001 and cable assembly W1 637-9136-001 are used.
e. With frequency standard switch option installed (factory installation), external phase-lock 635-0655-001, oven oscillator assembly 637-9135-001, and frequency standard switch 646-6558-001 are used.
f. With frequency display option installed (factory installation), frequency display A2A5 637-1781-006 or 637-1781-008 and frequency display cable A2W1 634-8289-001 are used.
g. With 100-Hz tuning option installed, synthesizer 100/10-Hz decade A19 623-2080-004 is removed and synthesizer end decade A18 635-0657-001 is placed in the A19 assembly position.
h. With 1-Hz tuning option installed, synthesizer end decade A18 635-0657-001 is placed in the A17 assembly position and a synthesizer 100/10-Hz decade 623-2080-004 is added in the A18 assembly position. This option used only with a processor control tuning.

Table 1. HF-8054A Receiver Characteristics.

CHARACTERISTICS	HF-8054A RECEIVER 622-3475-( )										
	-001	-002	-003	-004	-005						
Tuning: 100 Hz		X	X	X	X						
10 Hz	X										
Bandwidths (kHz):											
USB - A1	2.85	2.85	2.85	2.85	2.85						
UUSB - A2	2.85	2.85	2.85								
LSB - B1	2.85	2.85	2.85	2.85							
LLSB - B2	2.85	2.85	2.85								
A			6.0								
B											
C			1.0								
D											
E			0.2								
16	X	X	X	X	X						
ISB 2-channel				X							
4-channel	X	X	X								
AFC			X								
Dvbfo			X								
Remote control	X	X	X	X	X						
Oven standard		X	X	X	X						
External standard		X	X	X	X						
Frequency standard switch		X	X	X	X						
Frequency display		X	X	X	X						
AGC: OFF-FAST-MED-SLOW	X		X	X	X						
OFF-VOICE-DATA-FAX		X									
Rf translator:											
Standard	X		X		X						
High performance		X		X							

Table 2. Equipment Supplied/Configuration.

SUBASSEMBLY/CIRCUIT CARD		HF-8054A RECEIVER 622-3475-( )								
TITLE	PART NUMBER	-001	-002	-003	-004	-005				
Main chassis	634-8177-001	X	X	X	X	X				
Bottom cover	634-8179-001	X	X	X	X	X				
Top cover	634-8181-001	X	X	X	X	X				
Rear panel	642-2462-001	X	X	X	X	X				
Cable assembly W1	634-8226-001	X	X	X	X	X				
Cable assembly W2	634-8227-001	X	X	X	X	X				
Cable assembly W3	634-8225-001	X	X	X	X	X				
Rf cable assembly J40/J22	637-1525-002	X	X	X	X	X				
Rf cable assembly J38/J23	637-1525-003	X	X	X	X	X				
Rf cable assembly J37/J24	637-1525-003	X	X	X	X	X				
Rf cable assembly J36/J25	637-1525-003	X	X	X	X	X				
Rf cable assembly J35/J26	637-1525-003	X	X	X	X	X				
Rf cable assembly J41/J42	637-1526-002	X	X	X	X	X				
Rf cable assembly, 450-kHz if	642-2454-001	X	X		X					
Rf cable assembly J34/J59	637-1526-003			X						
Rf cable assembly J32/J58	637-1526-004			X						
Rf cable assembly, AFC	646-6534-001			X						
Power supply A1	635-9649-001	X	X	X	X	X				
Front panel assembly A2	634-8200-001	X								
	634-8200-002		X							
	634-8200-003			X						
	634-8200-004				X	X				
LED status display A2A1	635-0825-013	X	X	X	X	X				
Switch mounting board A2A2	638-6873-001		X							
	638-6873-002	X		X	X	X				
Frequency switchboard A2A3	635-0830-001		X		X	X				
	635-0830-002	X		X						
Dvbfo switchboard A2A4	638-6437-001			X						

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054A RECEIVER 622-3475-( )								
TITLE	PART NUMBER	-001	-002	-003	-004	-005				
Frequency display A2A5	637-1781-006		X		X	X				
	637-1781-008			X						
Frequency display cable A2W1	634-8289-001		X	X	X	X				
AFC A3	642-3224-001			X						
Vbfo A4	638-6067-002			X						
Channel B2 if A5	638-6975-006	X		X						
	638-6975-003		X							
Channel A2 if A6	638-6975-005	X		X						
	638-6975-002		X							
Channel B1 if A7	638-6975-004	X		X	X					
	638-6975-001		X							
Channel A1 if A8	638-6871-002	X		X	X	X				
	638-6871-001		X							
Filter A8A2	637-2515-001									
	637-2515-002									
	637-2515-003									
	637-2515-004									
	637-2515-005									
	637-2515-006									
	637-2515-007									
	637-2515-008									
	637-2515-009									
	637-2515-010									
	637-2515-011									
	637-2515-012									
	637-2515-013			X						
Rf translator A9	637-1767-002	X		X		X				
	637-1767-003		X		X					
Control A10	638-6629-001	X	X	X	X	X				

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054A RECEIVER 622-3475-( )								
TITLE	PART NUMBER	-001	-002	-003	-004	-005				
Parallel input A11	642-3135-001	X	X	X	X	X				
Parallel output A12	642-3137-001	X	X	X	X	X				
Serial interface A13	638-6896-001	X	X	X	X	X				
Synthesizer voltage regulator A14	635-0656-001	X	X	X	X	X				
Synthesizer subcarrier generator A15	638-6962-001	X	X	X						
Synthesizer reference A16	642-2451-001	X	X	X	X	X				
External phase-lock A16A4	635-0655-001		X	X	X	X				
Synthesizer end decade	635-0657-001	X	X	X	X	X				
Synthesizer 100/10-Hz decade	623-2080-004	X								
Synthesizer 1-kHz decade A20	623-2080-003	X	X	X	X	X				
Synthesizer 10-kHz decade A21	623-2080-002	X	X	X	X	X				
Synthesizer 100-kHz decade A22	623-2080-001	X	X	X	X	X				
Synthesizer output A23	635-4930-002	X	X	X	X	X				
Synthesizer chassis assembly A24	634-8201-001	X	X	X	X	X				
Rf cable assembly J43/J29	637-1526-003	X	X	X	X	X				
Rf cable assembly J45/J28	637-1526-003	X	X	X	X	X				
Rf cable assembly J44/J32 or	637-1526-006	X	X		X	X				
Rf cable assembly J44/J57				X						
Rf cable assembly A1-if or	637-1529-001	X	X		X	X				
Rf cable assembly vbfo				X						
Rf cable assembly B1-if	637-1529-001	X	X	X	X	X				
Rf cable assembly A2-if	637-1529-001	X	X	X	X	X				
Rf cable assembly B2-if	637-1529-001	X	X	X	X	X				
Synthesizer sideboard	638-6973-001	X	X	X	X	X				
Synthesizer chassis	634-8178-001	X	X	X	X	X				
Synthesizer bottom cover	634-8186-001	X	X	X	X	X				

Table 2. Equipment Supplied/Configuration (Cont).

SUBASSEMBLY/CIRCUIT CARD		HF-8054A RECEIVER 622-3475-( )								
TITLE	PART NUMBER	-001	-002	-003	-004	-005				
Synthesizer top cover	642-2409-001	X	X	X	X	X				
Receive audio A25	635-0748-002	X	X	X	X	X				
Receive audio A26	635-0748-002	X	X	X						
Rfi filter A27	637-2712-004	X	X	X	X	X				
Sideboard assembly A28	634-8224-001	X	X	X	X	X				
Sideboard	638-6627-001	X	X	X	X	X				
Cable assembly	634-8210-001	X	X	X	X	X				
Cable assembly	634-8228-001	X	X	X	X	X				
Oven standard, oscillator assembly A29	637-9135-001		X	X	X	X				
Frequency standard switch A30	646-6558-001		X	X	X	X				
Power cable	426-1034-010	X	X	X	X	X				
Maintenance kit	637-1769-001	X	X	X	X	X				

HF-8054( )
Receiver

Rockwell International

installation

Collins Telecommunications Products Division

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1 January 1981

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installation

1. GENERAL

The HF-8054( ) Receiver is ready, as shipped, for mounting in a 178-mm- (7-in-) high space in a standard 483-mm (19-in) equipment rack. This section contains information for installing the receiver in a rack and making the unit operational.

All interconnecting cables are attached to the receiver at the rear panel. The headphone jack is located on the front panel for operator convenience.

The HF-8054( ) Receiver operates with natural convective cooling in single-unit installations. In multiple-unit installations or where other heat-producing equipment is installed in the same cabinet, it is desirable to install a cabinet blower to remove hot air and prevent excessive temperature buildup.

Note

> For detailed information (including manufacturer's part number and physical description) pertaining to equipment mounting racks and preassembled interconnecting cables, refer to the following system instruction books.

TITLE	PART NUMBER
HF-80 1-kW Transmitter/ Transceiver Systems	523-0767370
HF-80 3-kW Transmitter/ Transceiver Systems	523-0767386
HF-80 10-kW Transmitter/ Transceiver Systems	523-0767402

2. UNPACKING AND INSPECTION

Unpack the receiver carefully and check each item received against the shipping invoice. Inspect the items for evidence of damage during shipment. All claims for damage in shipment should be filed promptly with the transportation company involved. If claims for damage are filed, save the original packing cases and materials.

3. PREINSTALLATION CHECK AND REQUIREMENTS

3.1 Strapping

3.1.1 Input Power

Caution

> Do not operate the primary input voltage selector switches with power applied. Be sure switches are in proper position with proper fuse installed before applying.
>
> Do not remove or install plug-in cards or modules with power on. Damage to cards or modules may result.
>
> Connect the ground terminal located on the rear panel to a ground strap that is securely connected to earth ground. (Ground strap should be #14 AWG or larger.)

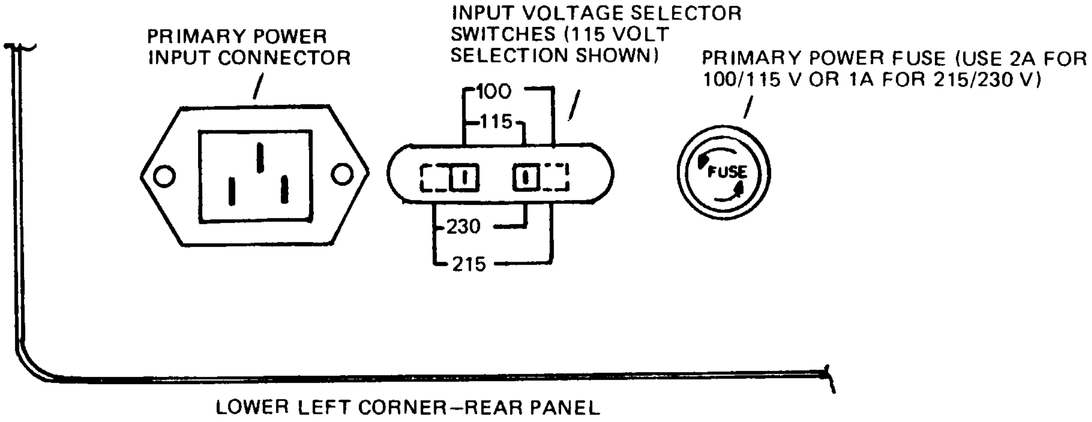
Switches are provided for strapping the unit for the desired primary input power. The unit may be operated from 100, 115, 215, or 230 volts ac, nominal input. In the lower left corner of the rear panel, set the primary input voltage selector switches to the position corresponding to the value nearest the primary input voltage. Figure 1 shows the switches set to the 115-volt position and location of primary power fuse holder.

Fuses are provided in the maintenance kit supplies with the receiver. For 100 or 115 V ac operation install a 2-ampere fuse, for 215 or 230 V ac operation, install a 1-ampere fuse.

3.1.2 Remote Control (HF-8054A Receiver Only)

Both the receiver and the associated receiver control or processor must operate at the same baud rate and signaling format. This is accomplished by the proper strapping of the serial interface, parallel output, and parallel input cards using the dipswitches and straps provided.

Figure 2 is a partial view of serial interface A13 with the dipswitches shown. These switches control baud rate, FSK/RS-232C signaling, word format,



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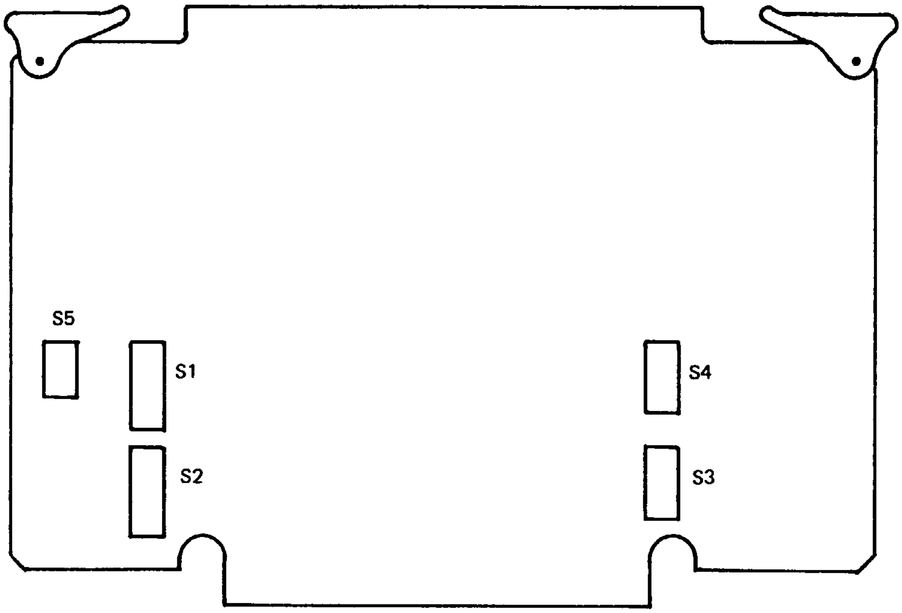
Primary Input Voltage Selector Switches
Figure 1



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Serial Interface Dipswitch Locations
Figure 2

EIA/MIL-STD-188C polarity, parity, number of stop bits, application, and address recognition enable/-disable as follows. (Note: Switch #1 of each dipswitch is toward the top of the card.)

a. Baud Rate

All eight of the switches in S1 and switches 1, 2, and 3 of S2 control the baud rate. Closing one and only one of these switches will select the baud rate as shown in table 1.

Table 1. Baud Rate Selection.

DIPSWITCH	SWITCH	BAUD RATE
S1	1	19 200
S1	2	9 600
S1	3	4 800
S1	4	2 400
S1	5	1 200
S1	6	600
S1	7	300
S1	8	150
S2	1	109
S2	2	75
S2	3	External

b. EIA/MIL-STD-188C Polarity

Open switch 4 of S2 for EIA data polarity and close switch 4 of S2 for MIL-STD-188C polarity.

c. Receiver Operation

Open switch 5 of S2 on serial interface A13.

d. 8-BIT/ASCII Word Format, Parity, and Number of Stop Bits

Switches 6, 7, and 8 of S2 control the basic character format according to table 2.

Table 2. Format Selection.

S2 SWITCH *			WORD FORMAT	PARITY	NUMBER OF STOP BITS
8	7	6			
C	C	C	ASCII	Even	2
C	C	0	ASCII	Odd	2
C	0	C	ASCII	Even	1
C	0	0	ASCII	Odd	1
0	C	C	8-bit	None	2
0	C	0	8-bit	None	1
0	0	C	8-bit	Even	1
0	0	0	8-bit	Odd	1

*0 = OPEN C = CLOSED

e. FSK/RS-232C Signaling

Dipswitches S3 and S4 control the type of signaling. Close only switches 1, 2, and 3 of S3 and S4 for FSK. (Note: For FSK signaling, EIA data polarity should be selected. See 3.1.2b.) For RS-232C signaling, close only switches 4, 5, and 6 of S3 and S4.

f. Address Recognition Enable/Disable

Open switch 1 of S5 to enable address recognition. Close switch 1 of S5 to disable address recognition. When address recognition is disabled, the receiver or control will accept a word with any address if the word is otherwise correct.

g. Parallel Input (Refer to figure 3.)

Figure 3 is a partial view of parallel input A11 with dipswitch location shown. Close S1 switches 1 thru 8 and S2 switch 1. All other switches are open.

h. Parallel Output Strapping

Parallel output A12 must be strapped for proper operation at initial installation and/or following testing and troubleshooting. Strapping is accomplished using jumper clips over the square pins marked E1 through E6.

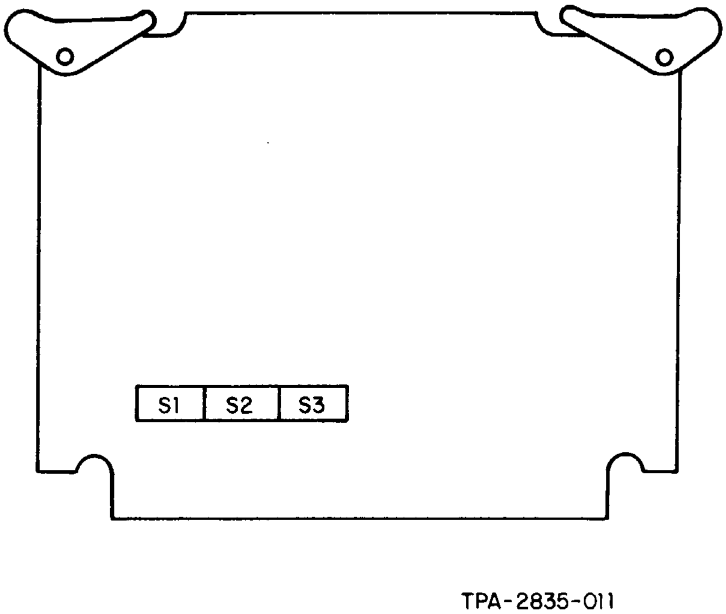
Place one jumper connector on each of the square pin pairs labeled E1 thru E4.

Pin pair E5 is strapped between the middle and top pins for a flashing fault indicator or strapped between the middle and bottom pins for a non-flashing fault indicator.

Pin pair E6 is strapped between the middle and left pins.

3.1.3 Address (HF-8054A Receiver Only)

The ADDRESS switch on the HF-8094 Receiver Control front panel develops a 4-bit binary output. Each receiver must be strapped, at interconnecting cable connector J14, to correspond to the address bit pattern for that unit. (When a processor is used to control the receiver, up to 32 units may be controlled using a 5-bit binary output.) Figure 4 shows the strapping for the connector pins associated with each address. Connect a short jumper wire between pins 9-13, as applicable, and ground (pin 22 and/or 24) on the wiring harness connector mating J14 on the receiver.



Parallel Input Dipswitch Locations
Figure 3

In a single receiver installation where an HF-8094 Receiver Control operates one-to-one with an HF-8054A Receiver, no strapping is needed. Address 0 (00000) is set by leaving all address pins open. In this case, the ADDRESS selector on the HF-8094 Receiver Control must be set at 0.

3.1.4 Frequency Standard

3.1.4.1 Internal Standard

A temperature-compensated crystal oscillator provides an internal 100-kHz frequency standard. To use the internal frequency standard, the strap on synthesizer reference A16 must be set to the INT (internal) position. Refer to figure 5 for placement of strap.

3.1.4.2 Oven Standard

Note

The strapping requirements are the same with a factory installed oven standard as with a field installed AC-8012 Oven Standard Kit.

To use the oven standard, the strap on synthesizer reference A16 must be set to the EXT (external) position and the strap on external phase-lock A16A4 must be set to the 1-MHz position. Refer to figure 5 for placement of straps.

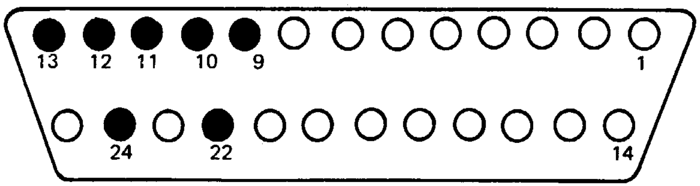
3.1.4.3 External Frequency Standard

Note

The strapping requirements are the same with a factory installed external frequency standard option as with a field installed AC-8013 External Standard Kit.

To use the external frequency standard (frequency standard switch A30 not installed), the strap on synthesizer reference A16 must be set to the EXT (external) position and the strap on external phase-lock A16A4 must be set to the frequency position of the external standard (100-kHz, 1-MHz, or 5-MHz). Refer to figure 5 for placement of straps.

WIRING HARNESS CONNECTOR MATING
WITH J14 ON REAR PANEL OF REMOTE UNIT



VIEW FROM WIRING (REAR) SIDE

ADDRESS NUMBER	REMOTE UNIT STRAPPING REQD FOR ADDRESS RECOGNITION				
	A5	A4	A3	A2	A1
0	–	–	–	–	–
1	–	–	–	–	X
2	–	–	–	X	–
3	–	–	–	X	X
4	–	–	X	–	–
5	–	–	X	–	X
6	–	–	X	X	–
7	–	–	X	X	X
8	–	X	–	–	–
9	–	X	–	–	X
10	–	X	–	X	–
11	–	X	–	X	X
12	–	X	X	–	–
13	–	X	X	–	X
14	–	X	X	X	–
15	–	X	X	X	X
16	X	–	–	–	–
17	X	–	–	–	X
18	X	–	–	X	–
19	X	–	–	X	X
20	X	–	X	–	–
21	X	–	X	–	X
22	X	–	X	X	–
23	X	–	X	X	X
24	X	X	–	–	–
25	X	X	–	–	X
26	X	X	–	X	–
27	X	X	–	X	X
28	X	X	X	–	–
29	X	X	X	–	X
30	X	X	X	X	–
31	X	X	X	X	X
PIN	13	12	11	10	9

X INDICATES PIN STRAPPED TO GROUND
(PIN 22 OR 24).
–INDICATES OPEN (NO STRAP REQUIRED).

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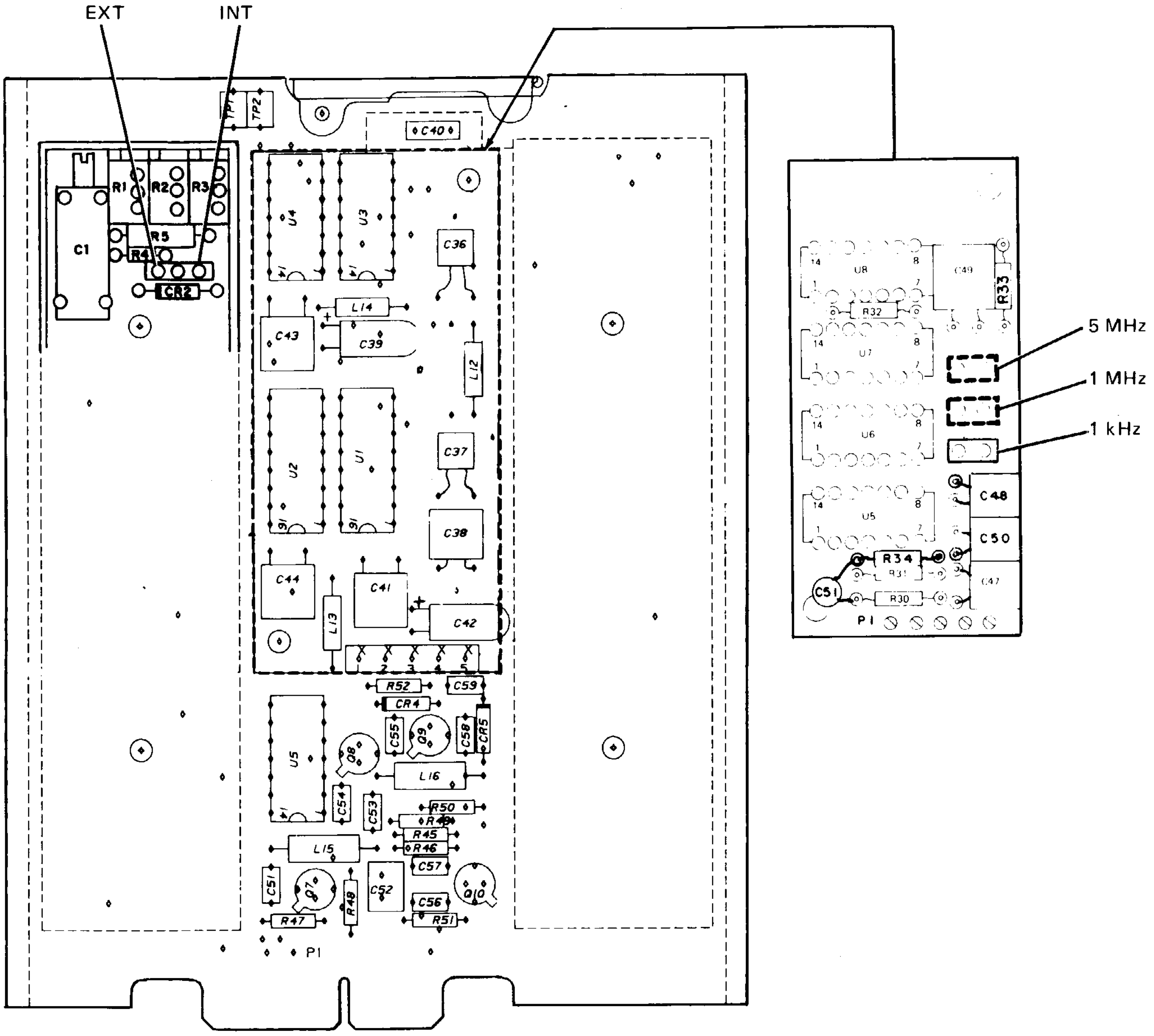
Strapping for Unit Address
Figure 4



TPA-2973-019

Strapping for External Frequency Standard
Figure 5

3.1.4.4 Frequency Standard Switch

Note

> The strapping requirements are the same with a factory installed frequency standard switch option as with a field installed AC-8015 Frequency Standard Switch Kit.

To use the frequency standard switch, the strap on synthesizer reference A16 must be set to the EXT (external) position and the strap on external phase-lock A16A4 must be set to the 1-MHz position. Refer to figure 5 for placement of straps.

To enable the use of external standard, the frequency selector switch on frequency standard switch A30 must set to the frequency position of the external standard (100-kHz, 1-MHz or 5-MHz).

3.2 Line Audio Outputs

Note

> Receive line audio outputs may be adjusted to any desired level within the amplifier range (-20 to +10 dB mW output for a 3-μV rf input). These adjustments are accessible through the top dust cover.

The receive line audio outputs are adjusted at the factory so that 0 dB mW output with a 3-μV rf input in the ISB modes. If your requirements for audio output are different from this, make line audio adjustments as outlined in the maintenance section of this instruction book.

3.3 Operation

The receiver operation was within the specified standards when the unit was shipped from the factory. The minimum performance test in the maintenance section should be performed to ensure that the equipment is operating within specifications.

4. CABLING (Refer to figure 6.)

4.1 Receiver to HF-8094 Receiver Control (HF-8054A Receiver Only)

Maximum allowable separation between the HF-8094 Receiver Control and receiver is dependent upon the characteristics of the transmission lines used, the method of signaling, and the transmission data rates selected. When using FSK signaling and #16 AWG shielded twisted-pair cable or field wire, maximum line length should be not more than 8 kilometers (5 miles). Transmission of the FSK data signals over private carrier leased lines, commercial telephone lines, microwave links, or satellite communications links permits unlimited separation between the receiver control and receiver. When using RS-232C or MIL-STD-188C signaling, maximum line length should be not more than 152 metres (500 feet).

Preassembled cables are available from Rockwell-Collins as part of kit AC-8091 (part number 622-3449-XXX) for use in remote control and receiver installations.

4.2 Multiple Receivers to Remote Control (HF-8054A Receivers Only)

Remote control of multiple receivers is accomplished by connecting in parallel all control data bus (J14-2 and J14-6) and monitor data bus (J14-3 and J14-16) of the receivers. Each receiver must be strapped for a unique address, as described in paragraph 3.1.3. The receivers must also be strapped for the same data rates, same parity, and same signal levels. (The signal level strapped must be either RS-232C or MIL-STD-188C; FSK cannot be used for multiple receiver systems.)

4.3 Receiver to Primary Power Source

Separation between receiver and primary power source (100, 115, 215, 230 V ac) should be kept to a minimum. A preassembled power cable is supplied as a part of the receiver.

4.4 Receiver to External Speaker

Separation between receiver and external speaker should be kept to a minimum. However, field grade twisted-pair wire should be acceptable for most external speaker requirements. Terminal clips or wires can be attached to the receiver. Refer to applicable speaker for connection requirements. Jumper between TB3-1 and TB3-2 is removed for external speaker, and external speaker leads are connected to TB3-2 and TB3-3.

4.5 Receiver to HF-8060 Preselector and/or Antenna

Separation between receiver and preselector or antenna should be kept to a minimum. Preassembled cables are available from Rockwell-Collins for use in installations where the preselector and antenna are used or where only an antenna is used.

Preassembled cable, type AC-8060 (622-3456-XXX), is available from Rockwell-Collins for use in receiver and preselector installations. A BNC-to-BNC rf cable of similar length is also required for receiver-to-preselector installations

If a preselector is not used, a BNC-to-antenna connector rf cable is required.

4.6 Receiver to External Frequency Standard

Separation between receiver and external frequency standard should be kept to a minimum. A BNC-to-external frequency standard connector rf cable is required.)

4.7 Receiver ID Output to External Detector or TTY Converter

Separation between receiver and external receiver audio modem should be kept to a minimum. Two external receive audio connector rf cables are required.

4.8 Receiver Mute Line

The receiver may be muted by connecting an external mute line to TB1-10. This line must be grounded to mute, open, or high-level logic 1 to receive. If high-level logic 1 is used for receive, applied voltage must not exceed +30 V dc.

4.9 Receiver to AGC Output Monitor

AGC output signals provided by channels A1, A2, B1, and B2 if's are proportional to the gain reduction of the receiver. The AGC output signals are caused by AGC action or by manual or remote rf gain control. Channel A1 AGC is on TB1-8, channel B1 AGC is on TB1-9, channel A2 AGC is on TB2-8, and channel B2 AGC is on TB2-9. These outputs can be used as an indicator of signal strength when AFC is enabled. Output indicates signal strength above a 1-μV input. To monitor the AGC outputs, a resistive load of not less than 10 k ohm may be connected. External lines connected to these terminals must be shielded to prevent noise or hum pickup from modulating the gain of the receiver.

4.10 Connections for Space Diversity

Note

> Diversity reception is a form of reception used to compensate for signal fading. In space diversity, the same signal is received from more than one transmission path (separate spaced antennae) separated far enough to minimize the effects of fading.

Space diversity connections using the HF-8054A Receivers can be accomplished using one of several different methods:

a. Manual control (audio combining)
b. Manual control (AGC cross-coupling)
c. Remote-controlled master receiver to slave receiver
d. Locally-controlled master receiver to slave receiver

Space diversity connections using the HF-8054 Receivers can be accomplished only by using:

a. Manual control (audio combining)
b. Manual control (AGC cross-coupling)

Refer to the space diversity systems using HF-8054( ) Receivers supplement 523-0770881 for detailed information on these space diversity connections. The following paragraphs give a brief description of the connections.

4.10.1 Manual Control (Audio Combining)

The simplest space diversity receiving system consists of two separate receivers operating at the same frequency but using separate spaced antennae. The audio (or if) outputs from these receivers are connected to one RTTY converter or suitable audio combiner that has provisions for diversity inputs.

Under fading conditions, the background noise increases in the receiver experiencing fading. This can be alleviated by using a sophisticated audio combiner or by cross-coupling the AGC lines of the receivers. Refer to paragraph 4.10.2 for instructions for AGC cross-coupling.

4.10.2 Manual Control (AGC Cross-Coupling)

The space diversity receiving system using AGC cross-coupling consists of the manual control (audio combining) system described in paragraph 4.10.1 with the AGC lines of the receivers cross-coupled.

On the HF-8054( ) Receivers, AGC cross-coupling is accomplished by connecting the channel A1 AGC input/output (TB1-8) on one receiver to the channel A1 AGC input/output (TB1-8) on the other receiver in the system. Similarly all other active channels are cross-connected. Care must be taken that the AGC lines are shielded to prevent pick-up of hum and noise. A good ground return must be established between receivers (interconnect TB1-7 with bus wire). Do not add any external capacitor filters or resistors.

4.10.3 Remote-Controlled Diversity Receivers

When two HF-8054A Receivers are connected as a diversity pair they may be connected for remote control. This space diversity system uses audio combining, AGC cross-coupling, and the remote control for setting the receiver pair to the same control settings and for system monitoring.

In this method, the control data output of the receiver control is connected to the control data input (J14-2, -14) of receiver no 1, the monitor data output (J14-3, -16) of receiver no 1 is connected to the control data input (J14-2, -14) or receiver no 2, and the monitor data output (J14-3, -16) of receiver no 2 is connected to the monitor data input of the receiver control. The diversity master input (J14-8) of receiver no 1 is grounded and the receiver fault output (TB2-12) of receiver no 1 is connected to the receiver fault input (TB2-11) of receiver no 2. Audio combining and AGC cross-coupling are connected as described in paragraphs 4.10.1 and 4.10.2.

4.10.4 Master Receiver to Slave Receiver

Using the HF-8054A Receivers, it is possible to set up a space diversity system with a master receiver controlling a slave receiver. This is accomplished by causing the master receiver to provide serial control data for the slave receiver.

This space diversity system uses audio combining, AGC cross-coupling, and a master-slave receiver pair.

In this method, the master receiver serial interface A13 is set for control operation (close switch 5 of S2 on A13). Connect the monitor data output (J14-3, -16) of the master receiver to the control data input (J14-2, -14) of the slave receiver. The receiver fault output (TB2-12) of the slave receiver is connected to the receiver fault input (TB2-11) of the master receiver. Audio combining and AGC cross-coupling are connected as described in paragraphs 4.10.1 and 4.10.2

5. INSTALLATION PROCEDURES

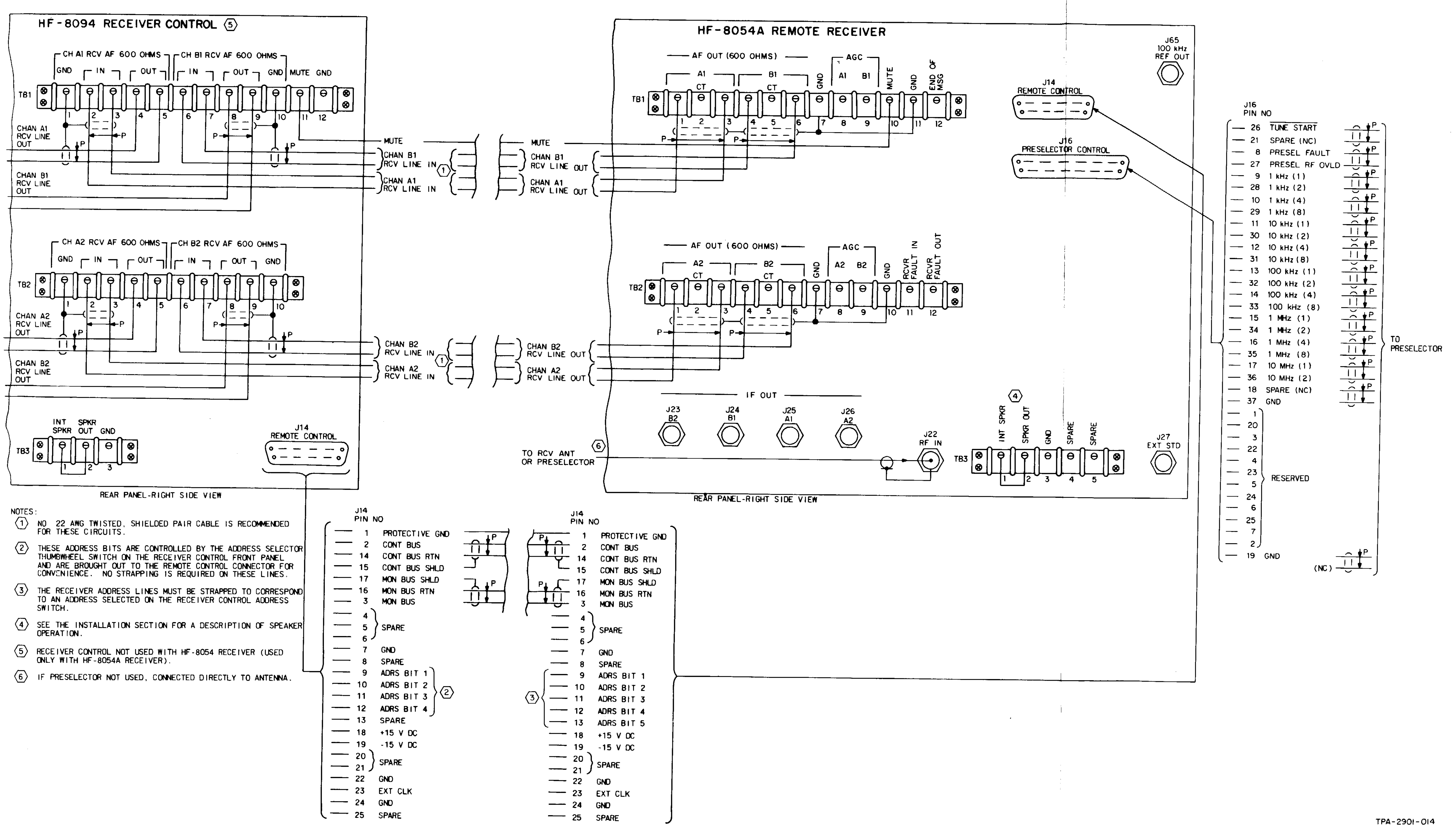
Figure 7 shows the outline and mounting dimensions of the HF-8054/8054A Receiver. The receiver has standard 483-mm (19-in) rack-mounting characteristics and can be mounted using four mounting screws through the edges of the front panel; however, on all rack-mounting configurations, slide mounting is recommended for ease of service and side support. When installation is complete, ensure that all electrical connections are made (including strapping) and that all dust covers and shields are in place.

5.1 Installation of Slide Mounts

a. Refer to figures 7 and 8. Attach the CA-8030 Mounting Kit (slide rails) to the proper location in the CA-8020( ) Equipment Cabinet or CA-8026 Equipment Desk Cabinet and to the receiver.
b. Lift the receiver, position it squarely, and engage the slides of the mounting kit. Slide the receiver completely into the cabinet to assure that the slides function properly.
c. Connect a ground strap (#14 AWG or larger) from the GND terminal, located on the rear of the receiver, to a suitable ground point in the equipment cabinet. Be sure that the cabinet ground point is free of paint or foreign material.
d. Refer to cabling, paragraph 4, and make the necessary cable connections as applicable to your unit.
e. Slide the receiver into place in the equipment cabinet, and secure it with four screws on each side of the front panel.

6. POSTINSTALLATION CHECK/REQUIREMENTS

There is no postinstallation check/requirements to be performed on the receiver as a unit. The operation procedures presented in the operation section of this instruction book may be used as a postinstallation operational check.



NOTES:

① NO 22 AWG TWISTED, SHIELDED PAIR CABLE IS RECOMMENDED FOR THESE CIRCUITS.

② THESE ADDRESS BITS ARE CONTROLLED BY THE ADDRESS SELECTOR THUMBWHEEL SWITCH ON THE RECEIVER CONTROL FRONT PANEL AND ARE BROUGHT OUT TO THE REMOTE CONTROL CONNECTOR FOR CONVENIENCE. NO STRAPPING IS REQUIRED ON THESE LINES.

③ THE RECEIVER ADDRESS LINES MUST BE STRAPPED TO CORRESPOND TO AN ADDRESS SELECTED ON THE RECEIVER CONTROL ADDRESS SWITCH.

④ SEE THE INSTALLATION SECTION FOR A DESCRIPTION OF SPEAKER OPERATION.

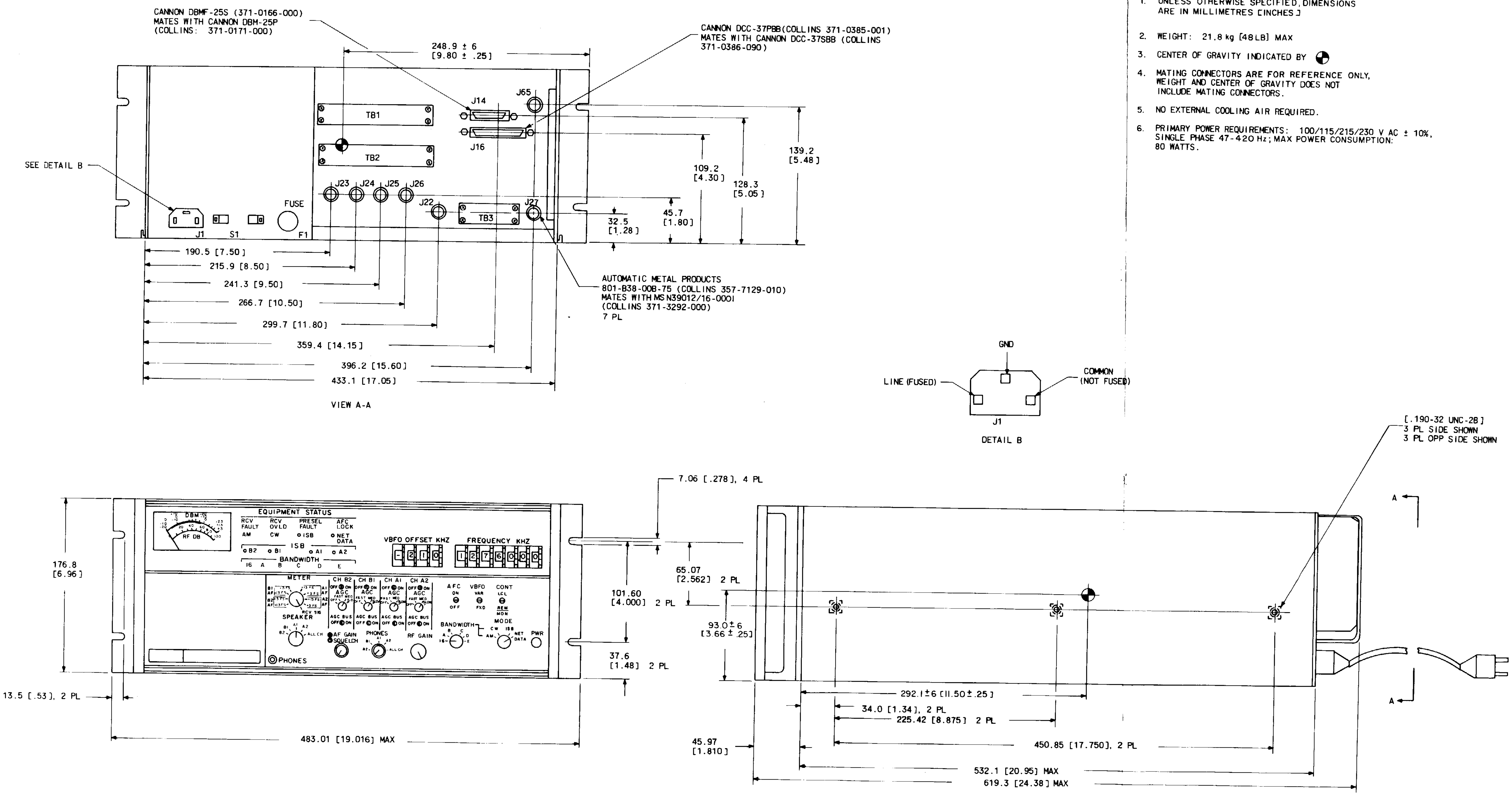
⑤ RECEIVER CONTROL NOT USED WITH HF-8054 RECEIVER (USED ONLY WITH HF-8054A RECEIVER).

⑥ IF PRESELECTOR NOT USED, CONNECTED DIRECTLY TO ANTENNA.

TPA-2901-014

HF-8054( ) Receiver, Typical Installation
Figure 6

NOTES:
1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN MILLIMETRES [INCHES]
2. WEIGHT: 21.8 kg [48LB] MAX
3. CENTER OF GRAVITY INDICATED BY ◒
4. MATING CONNECTORS ARE FOR REFERENCE ONLY, WEIGHT AND CENTER OF GRAVITY DOES NOT INCLUDE MATING CONNECTORS.
5. NO EXTERNAL COOLING AIR REQUIRED.
6. PRIMARY POWER REQUIREMENTS: 100/115/215/230 V AC ± 10%, SINGLE PHASE 47-420 Hz; MAX POWER CONSUMPTION: 80 WATTS.



TPA-2851-014

HF-8054( )Receiver, Outline and Mounting Dimensions
Figure 7

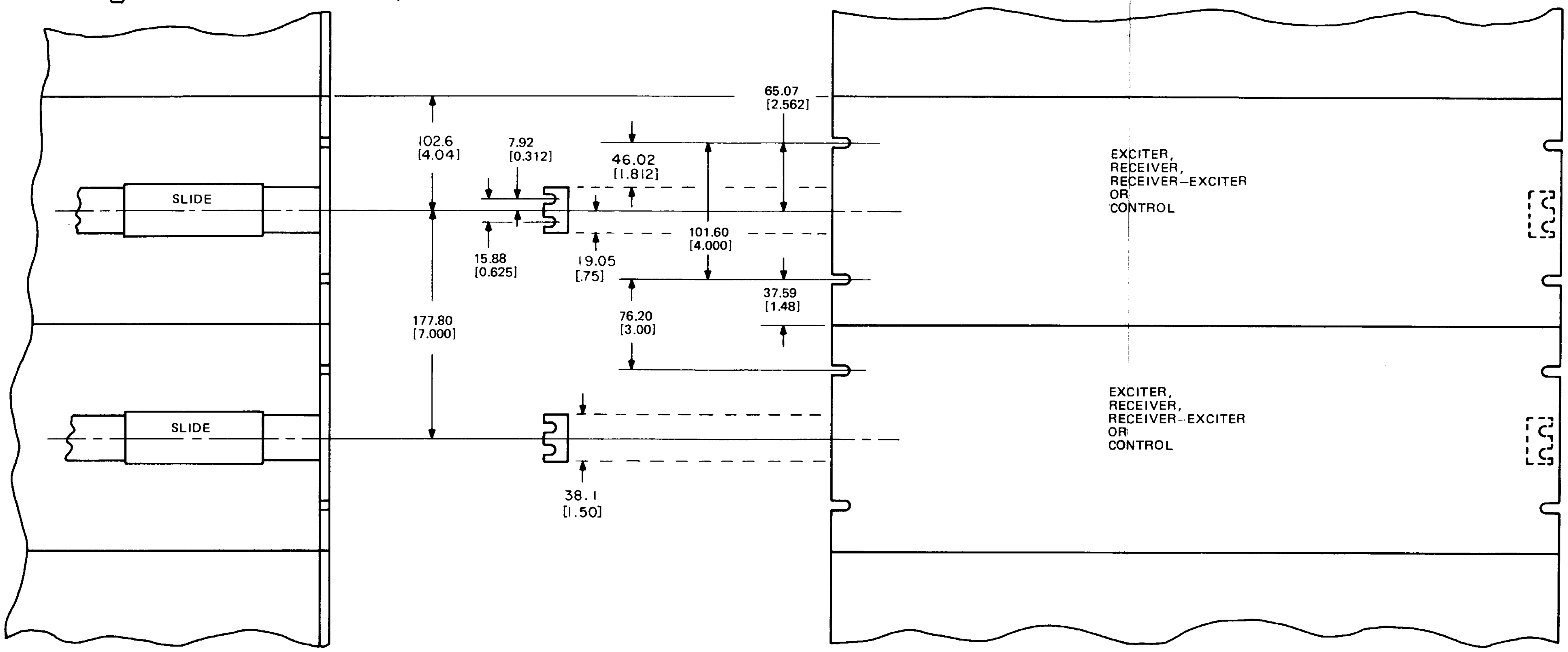
NOTES:

① SLIDE BRACKETS MOUNT TO REAR SURFACE OF FRONT CABINET RAILS AND FRONT SURFACE OF REAR RAILS.

② a. FOR CABINETS WITH THREADED MOUNTING HOLES USE SCREWS AND FLAT WASHERS FROM BRACKET SIDE INTO CABINET SCREW MUST NOT PROJECT BEYOND PANEL MOUNTING SURFACE.

b. FOR CABINETS WITH CLEARANCE HOLES IN THE RAILS, THE HOLES USED FOR MOUNTING THE SLIDE BRACKETS MUST BE COUNTERSUNK AND FLAT HEAD SCREWS USED FOR MOUNTING.

③ DIMENSIONS ARE IN MILLIMETRES [INCHES].



TP5-1869-013

Installation of Slides in Rack Mounts
Figure 8

Space Diversity Systems Using HF-8054( ) Receivers

Rockwell
International

supplement

Collins Telecommunications Products Division

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supplement

1. GENERAL

The purpose of this supplement is to provide information regarding the use of the HF-8054( ) Receivers for space diversity reception. When used with the HF-8054( ) Receiver instruction book 523-0770698 and HF-8094 Receiver Control instruction book 523-0770751, this supplement provides the user with a complete instruction book for space diversity systems using the HF-8054( ) Receivers.

Diversity reception is a form of reception used to compensate for signal fading. In space diversity reception, the same signal is received from more than one signal path (separate antennae) separated far enough to minimize the effects of fading.

Space diversity systems using the HF-8054A Receivers can be controlled using one of several different methods.

a. Remote-controlled master receiver to slave receiver
b. Master receiver to slave receiver
c. Manual control (AGC crosscoupling)

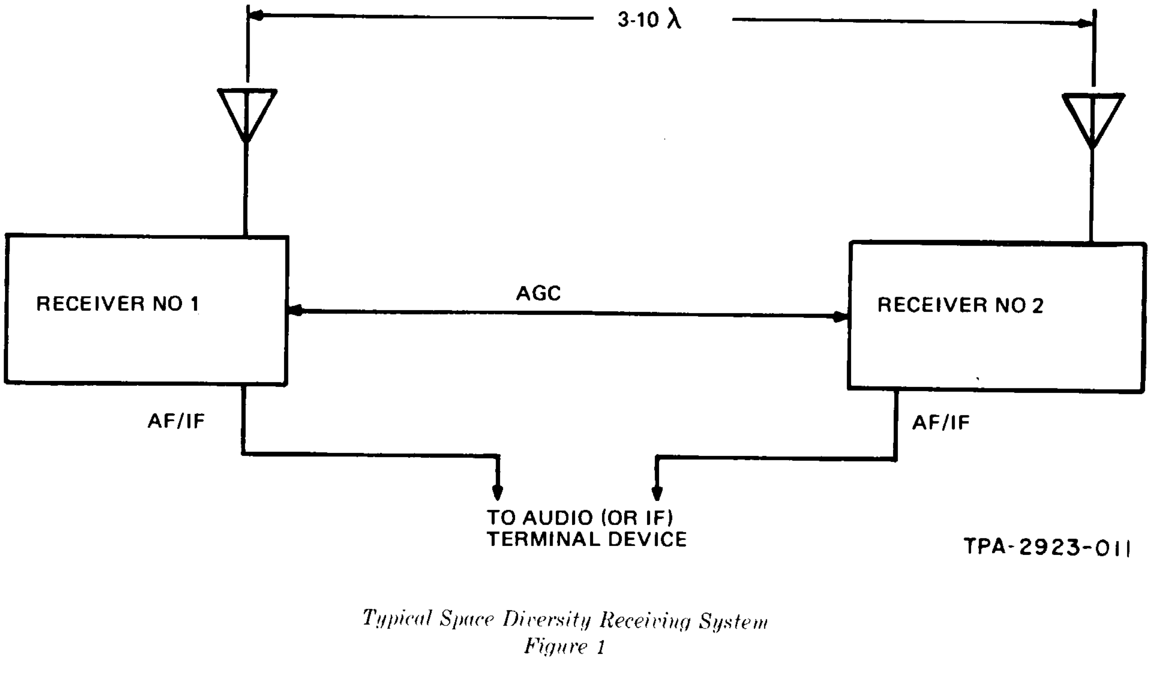
Space diversity reception using the HF-8054 Receivers can be accomplished only by manual control (AGC crosscoupling).

2. DESCRIPTION

2.1 Functional Theory (Refer to figure 1)

In a space diversity receiver system, two or more receivers are tuned to the same signal and their audio or if outputs are combined in such a way as to make use of the signal with the highest signal-to-noise ratio.

Tests conducted in the 2- to 30-MHz range indicate that, with antenna spacings of the order of 3- to 10-wavelengths, signals from connected receivers tend to fade more or less independently. If a receiver is connected to each antenna, and the audio or if outputs are correctly utilized, signal loss due to fading may be minimized.



Typical Space Diversity Receiving System
Figure 1

This explanation is oversimplified to the degree that the individual output of either receiver is the sum of signal plus noise, and when the signal fades, the connected receiver output signal-to-noise ratio is usually degraded. This results not only in the reduction of the output signal applied to the common bus, but also adds to the noise component supplied by the weak-signal receiver, unless this receiver is suitably controlled.

Receivers connected for space diversity operation are normally operated from a common AGC bus whose potential is derived from the separate AGC outputs of the connected receivers. In this way the receiver(s) whose signals are the strongest at the moment, dominate the system, and the other receiver(s) are biased to a reduced gain condition. This automatically reduces the receiver gain and its contribution of noise to the combined output.

2.2 Remote-Controlled Master Receiver to Slave Receiver

This system provides complete control of the system from a receiver control.

When the master and slave-receiver CONT switches are in the REM position, all front panel control information is supplied from the receiver control to the master receiver. The master receiver then retransmits this control information to the slave receiver(s). Front panel controls that are remotely controlled are mode, bandwidth, frequency, AGC, AFC, rf gain, vbfo, etc.

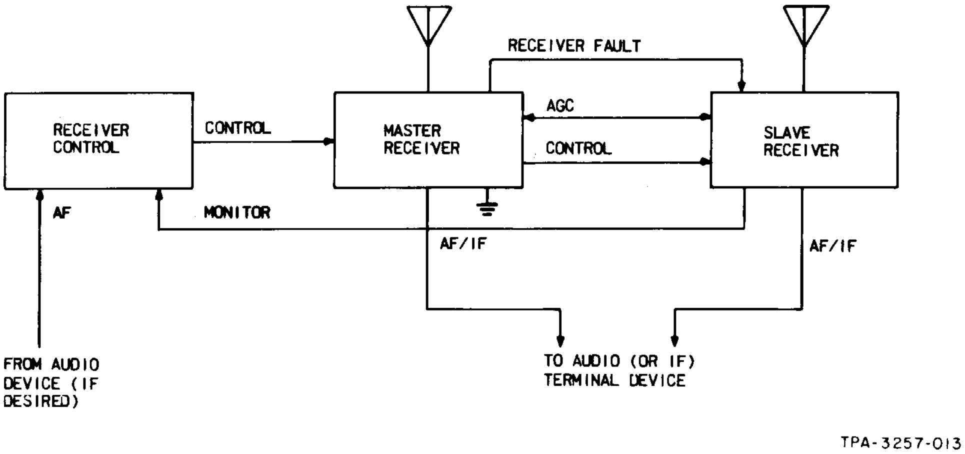
The master-receiver receiver fault out is interconnected to the slave-receiver fault in to summarize the system receiver fault signals in the slave-receiver monitor bus. The front panel RCV FAULT indicator on the master receiver indicates when a fault occurs in the master receiver only. The front panel RCV FAULT indicator on the slave receiver indicates when a fault occurs in either receiver.

2.2.1 Normal Configuration (Refer to figure 2)

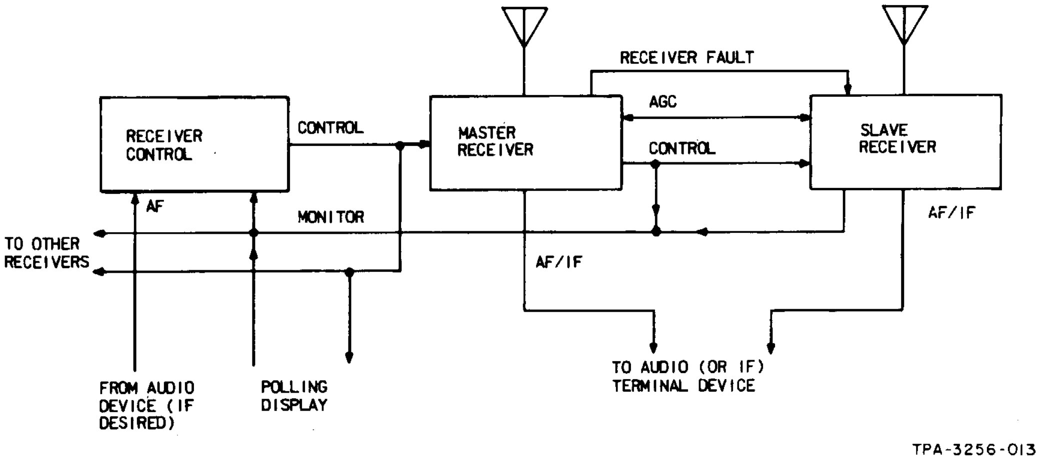
This configuration of the space diversity receiving system provides control information from the receiver control. This control information is supplied to and through the master receiver to the slave receiver. When supplied to the slave receiver, the slave receiver initiates monitor data and supplies status information to the receiver control. The status information to the receiver control is the status of the space diversity receiving system. Note the slave-receiver monitor outputs are a summary of the receiver control, master-receiver, and slave-receiver control signals and faults.

2.2.2 Polling Configuration (Refer to figure 3)

This configuration of the space diversity receiving is essentially the same as the one discussed in paragraph 2.2.1. The only difference between this configuration and the normal configuration is that the monitor bus (control signals) from the master receiver is also supplied to the receiver control monitor bus. When in polling mode, this prevents the polling operation from requesting status of another



Remote-Controlled Master Receiver to Slave Receiver (Normal Configuration), Block Diagram
Figure 2

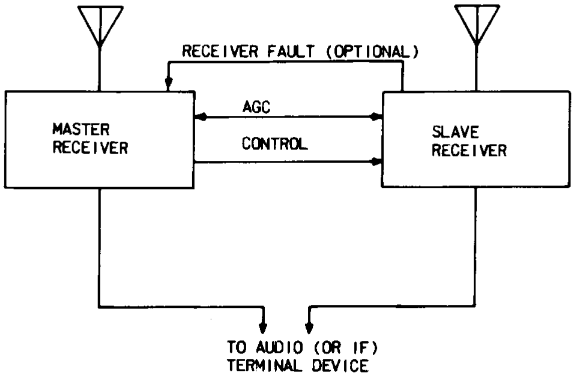


Remote-Controlled Master Receiver to Slave Receiver (Polling Configuration), Block Diagram
Figure 3

receiver or diversity pair until after the slave-receiver monitor word is transmitted to the receiver control. The slave-receiver monitor signal (system summary) is displayed by the polling status display device.

2.3 *Master Receiver to Slave Receiver (Refer to figure 4)*

This space diversity receiving system provides complete control of the system from the master receiver. In this system the master receiver performs the functions of a receiver control.



Master Receiver to Slave Receiver, Block Diagram
Figure 4

When the master-receiver CONT switch is in the LCL position and the slave-receiver CONT switch is in the REM position, the control functions normally controlled by a receiver control are controlled by the master receiver. Mode, bandwidth, frequency, AGC, AFC, vbfo, etc are controlled by the master receiver. Note, however, that rf gain is not controlled by the master receiver. The master-receiver rf gain is an analog gain control and is not inputted to the control scheme. Thus the slave receiver receives what appears to be a maximum rf gain control signal (all logic 0's) and sets slave receiver rf gain for maximum. To equalize this effect, the master RF GAIN control should be set to maximum.

The slave-receiver receiver fault out may be connected to the master-receiver receiver fault in to summarize the system receiver fault signals on the master receiver RCV FAULT indicator.

2.4 *Manual Control (AGC Crosscoupling, refer to figure 1)*

This space diversity receiving system requires separate control of each receiver. This can be done by operating the receivers locally or remotely (HF-8054A Receivers only). The controls of each receiver should be set to identical positions (mode, bandwidth, frequency, AGC, AFC, rf gain, vbfo, etc).

3. INSTALLATION

3.1 *Remote-Controlled Master Receiver to Slave Receiver*

3.1.1 *General*

Refer to the HF-8054( ) Receiver instruction book, installation section 523-0770702, and verify that the serial interface A13 of the receiver control and each receiver is switched for the same type of signalling, data rate, and parity.

Check that each receiver in the master-slave combination is strapped for the same address.

3.1.2 Normal Configuration

Interconnect the receiver control and receivers as shown in figure 5. Note that there is only one receiver control and only one receiver pair in this type of a space diversity receiver system. Interconnect the system as follows:

a. Connect the receiver-control control bus (J14-2, -14, -15) to the master-receiver control bus (J14-2, -14, -15).
b. Connect the receiver-control monitor bus (J14-3, -16, -17) to the slave-receiver monitor bus (J14-3, -16, -17).
c. Connect the master-receiver monitor bus (J14-3, -16, -17) to the slave-receiver control bus (J14-2, -14, -15). (This provides the receiver-control control signals, interfaced through the master receiver, to the slave receiver.)
d. Connect the master-receiver receiver fault out (TB2-12) to slave-receiver receiver fault in (TB2-11). (This provides the monitor bus with a receiver fault summary that includes any master-receiver faults.)
e. Crosscouple all AGC lines; master A1 AGC to slave A1 AGC line (TB1-8), master B1 AGC to slave B1 AGC line (TB1-9), master A2 AGC to slave A2 AGC line (TB2-8), and master B2 AGC to slave B2 AGC line (TB2-9).
f. Interconnect all receiver signal common grounds (TB1-7).
g. Connect the master-receiver diversity master (J14-8) to ground. (This straps the status request of master-receiver monitor word 4 to ground to permit continuous update of the slave-receiver status. The master receiver provides continuous update of its status because of the receiver-control control word 4 status request.)
h. Connect the receive line outputs as shown in figure 5 to the audio combiner: TB1-1, -3 to channel A1 audio, TB1-4, -6 to channel B1 audio, TB2-1, -3 to channel A2 audio, and TB2-4, -6 to channel B2 audio.
i. Connect each RF IN jack to a separate antenna/antenna system.

3.1.3 Polling Configuration

Interconnect the receiver control and receivers as shown in figure 5. This system is interconnected the same as the normal configuration of the remote-controlled master-receiver to slave-receiver system, except as follows:

a. Refer to the HF-8094 Receiver Control instruction book, installation section 523-0770963, and verify that serial interface A13 in the receiver control is switched for polling operation.
b. In addition to connecting the receiver-control monitor bus to the slave-receiver monitor bus, the receiver-control monitor bus (J14-3, -16, -17) is also connected to the master-receiver monitor bus (J14-3, -16, -17). Note that the master-receiver monitor bus remains connected to the slave-receiver control bus. (This provides the fast response monitor bus required for polling.)

3.2 Master Receiver to Slave Receiver

Refer to the HF-8054( ) Receiver instruction book, installation section 523-0770702, and verify that serial interface A13 of each receiver is switched for the same type of signalling, data rate, and parity.

Check that each receiver in the master-slave combination is strapped for the same address.

Change the switching on the master receiver serial interface A13 for control operation (close switch 5 of S2). Note, this is done only on the master receiver serial interface A13.

Interconnect the receivers as shown in figure 6. Interconnect the system as follows:

a. Connect the master-receiver monitor bus (J14-3, -16, -17) to the slave-receiver(s) control bus (J14-2, -14, -15).
b. If desired, connect the master-receiver receiver fault in (TB2-11) to slave-receiver receiver fault out (TB2-12). (This provides the master receiver with a receiver fault summary that includes any slave-receiver faults.)
c. Crosscouple all AGC lines; master A1 AGC to slave A1 AGC line (TB1-8), master B1 AGC to slave B1 AGC line (TB1-9), master A2 AGC to slave A2 AGC line (TB2-8), and master B2 AGC to slave B2 AGC line (TB2-9).
d. Interconnect all receiver signal common grounds (TB1-7).
e. Interconnect the receive line outputs as shown in figure 6 to the audio combiner: TB1-1, -3 to channel A1 audio, TB1-4, -6 to channel B1 audio, TB2-1, -3 to channel A2 audio, and TB2-4, -6 to channel B2 audio.

f. Connect each RF IN jack to a separate antenna/antenna system.

3.3 Manual Control (AGC Crosscoupling)

This is the most effective simple method of space diversity reception. Any HF-8054/8054A Receiver may be used in this combination.

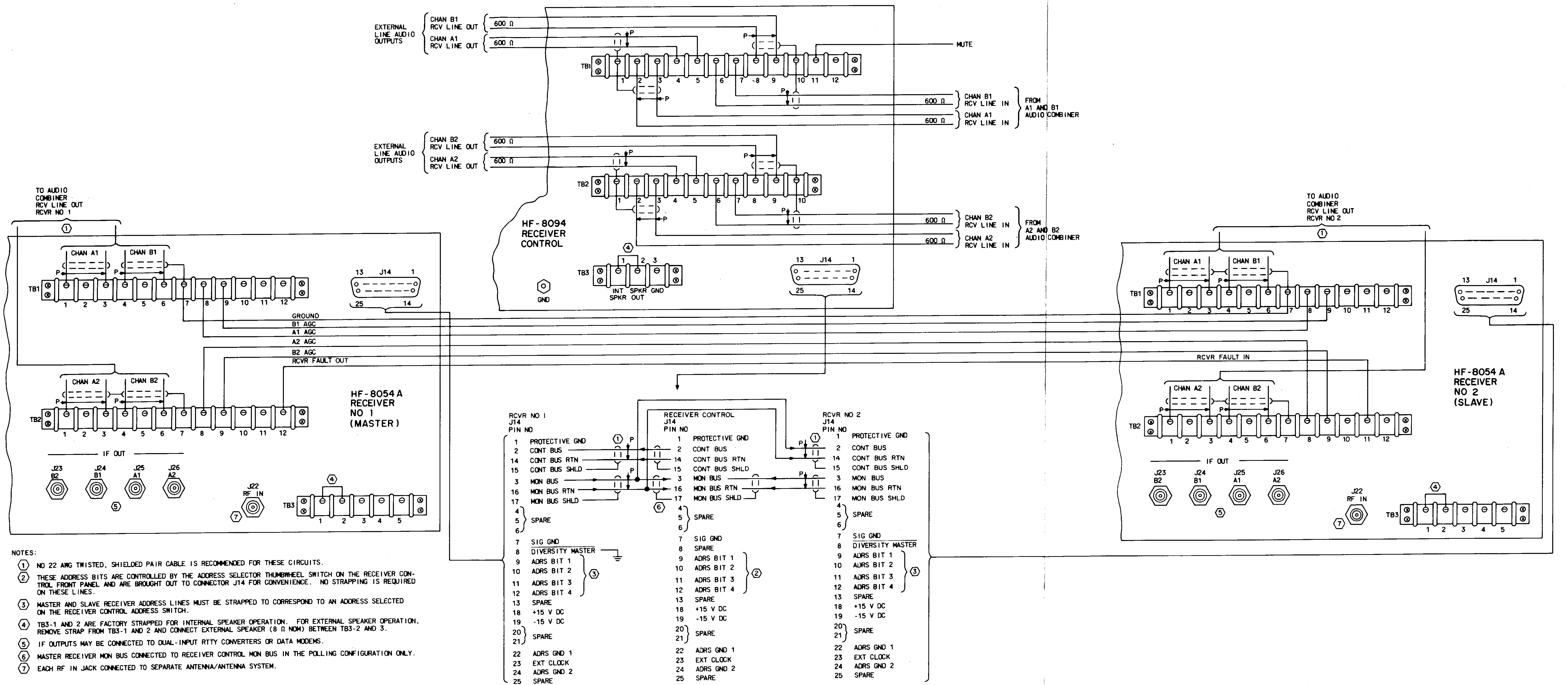
Interconnect the receivers as shown in figure 7. As many receivers as deemed necessary may be crosscoupled. Interconnect the system as follows:

a. Crosscouple all AGC lines; A1 AGC to all A1 AGC lines (TB1-8), B1 AGC to all B1 AGC lines (TB1-9), A2 AGC to all A2 AGC lines (TB2-8), and B2 AGC to all B2 AGC lines (TB2-9).

b. Interconnect all receiver signal common grounds (TB1-7).

c. Interconnect the receive line outputs as shown in figure 7 to the audio combiner: TB1-1, -3 to channel A1 audio, TB1-4, -6 to channel B1 audio, TB2-1, -3 to channel A2 audio, and TB2-4, -6 to channel B2 audio.

d. Connect each RF IN jack to a separate antenna/antenna system.



NOTES:

① NO 22 AWG TWISTED, SHIELDED PAIR CABLE IS RECOMMENDED FOR THESE CIRCUITS.

② THESE ADDRESS BITS ARE CONTROLLED BY THE ADDRESS SELECTOR THUMBWHEEL SWITCH ON THE RECEIVER CONTROL FRONT PANEL AND ARE BROUGHT OUT TO CONNECTOR J14 FOR CONVENIENCE. NO STRAPPING IS REQUIRED ON THESE LINES.

③ MASTER AND SLAVE RECEIVER ADDRESS LINES MUST BE STRAPPED TO CORRESPOND TO AN ADDRESS SELECTED ON THE RECEIVER CONTROL ADDRESS SWITCH.

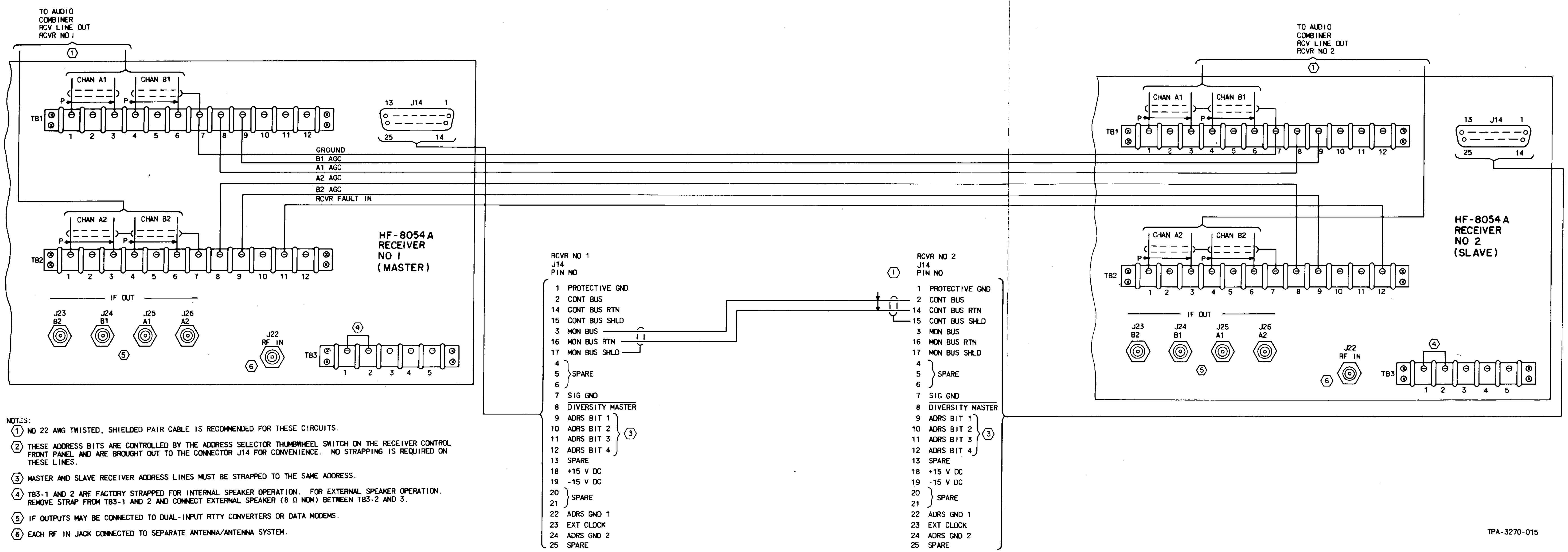
④ TB3-1 AND 2 ARE FACTORY STRAPPED FOR INTERNAL SPEAKER OPERATION. FOR EXTERNAL SPEAKER OPERATION, REMOVE STRAP FROM TB3-1 AND 2 AND CONNECT EXTERNAL SPEAKER (8 Ω NOM) BETWEEN TB3-2 AND 3.

⑤ IF OUTPUTS MAY BE CONNECTED TO DUAL-INPUT RTTY CONVERTERS OR DATA MODEMS.

⑥ MASTER RECEIVER MON BUS CONNECTED TO RECEIVER CONTROL MON BUS IN THE POLLING CONFIGURATION ONLY.

⑦ EACH RF IN JACK CONNECTED TO SEPARATE ANTENNA/ANTENNA SYSTEM.

Remote-Controlled Master Receiver to Slave Receiver,
Typical Installation
Figure 5



NOTES:

① NO 22 AWG TWISTED, SHIELDED PAIR CABLE IS RECOMMENDED FOR THESE CIRCUITS.

② THESE ADDRESS BITS ARE CONTROLLED BY THE ADDRESS SELECTOR THUMBWHEEL SWITCH ON THE RECEIVER CONTROL FRONT PANEL AND ARE BROUGHT OUT TO THE CONNECTOR J14 FOR CONVENIENCE. NO STRAPPING IS REQUIRED ON THESE LINES.

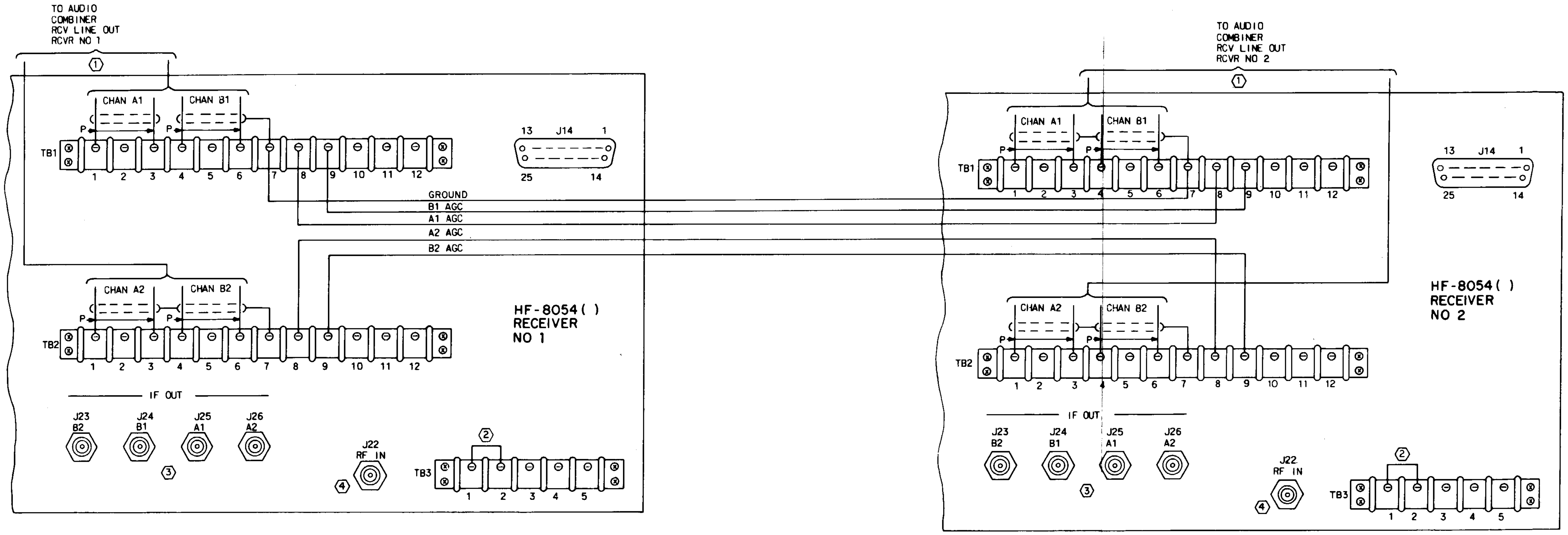
③ MASTER AND SLAVE RECEIVER ADDRESS LINES MUST BE STRAPPED TO THE SAME ADDRESS.

④ TB3-1 AND 2 ARE FACTORY STRAPPED FOR INTERNAL SPEAKER OPERATION. FOR EXTERNAL SPEAKER OPERATION, REMOVE STRAP FROM TB3-1 AND 2 AND CONNECT EXTERNAL SPEAKER (8 Ω NOM) BETWEEN TB3-2 AND 3.

⑤ IF OUTPUTS MAY BE CONNECTED TO DUAL-INPUT RTTY CONVERTERS OR DATA MODEMS.

⑥ EACH RF IN JACK CONNECTED TO SEPARATE ANTENNA/ANTENNA SYSTEM.

Master Receiver to Slave Receiver, Typical Installation
Figure 6



NOTES:

① NO 22 AWG TWISTED. SHIELDED PAIR CABLE IS RECOMMENDED FOR THESE CIRCUITS.

② TB3-1 AND 2 ARE FACTORY STRAPPED FOR INTERNAL SPEAKER OPERATION. FOR EXTERNAL SPEAKER OPERATION, REMOVE STRAP FROM TB3-1 AND 2 AND CONNECT EXTERNAL SPEAKER (8 Ω NOM) BETWEEN TB3-2 AND 3.

③ IF OUTPUTS MAY BE CONNECTED TO DUAL-INPUT RTTY CONVERTERS OR DATA MODEMS.

④ EACH RF IN JACK CONNECTED TO SEPARATE ANTENNA/ANTENNA SYSTEM.

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Manual Control (AGC Crosscoupling), Typical Installation
Figure 7

4. OPERATION

4.1 General

Refer to the HF-8054( ) Receiver instruction book, operation section 523-0770703, and HF-8094 Receiver Control instruction book, operation section 523-0770964, for operating procedures for specific modes of operation. The following procedures explain only that portion of the operating procedures required to make each space diversity receiver system operate.

4.2 Remote-Controlled Master Receiver to Slave Receiver

a. Set slave receiver as follows:

PWR switch to on (pressed and latched in).

CONT switch to REM.

SPEAKER switch, AF GAIN control, and SQUELCH control, as desired, to monitor any channel on the speaker at the slave receiver.

PHONES switch and PHONES level control, as desired, to monitor any channel at the PHONES jack on the slave receiver.

b. Set the master receiver as follows:

PWR switch to on (pressed and latched in).

CONT switch to REM.

SPEAKER switch, AF GAIN control, and SQUELCH control, as desired, to monitor any channel on the speaker at the master receiver.

PHONES switch and PHONES level control, as desired, to monitor any channel at the PHONES jack on the master receiver.

c. Set the HF-8094 Receiver Control as follows:

PWR switch to on (pressed and latched in).

CONT switch to NORM.

SPEAKER switch, AF GAIN control, and SQUELCH control, as desired, to monitor any channel on the speaker at the receiver control.

PHONES switch and PHONES level control, as desired, to monitor any channel at the PHONES jack on the receiver control.

MODE switch to the desired operating mode.

BANDWIDTH switch (if CW or AM mode is selected) to 16 or an optional bandwidth (A, B, C, D, E).

Note

If an optional bandwidth is selected, each receiver used must have an if filter installed in the selected bandwidth slot. The selected if filters must have a bandpass that encompasses the received signal.

Applicable channel enable switches to ON (if ISB mode is selected).

Note

For every channel enabled, each receiver used must have the applicable if card installed.

Normal operating procedures may be followed for the remainder of the front panel controls on the receiver control (AFC, VBFO, VBFO OFFSET KHZ, FREQUENCY KHZ, RF GAIN, AGC, and AGC BUS).

Note

Each receiver's (master and slave) operating conditions will be controlled by the receiver control front panel controls. Equipment status indicators on the receiver control front panel will indicate the status of the space diversity receiver system.

4.3 Master Receiver to Slave Receiver

a. Set slave receiver as follows:

PWR switch to on (pressed and latched in).

CONT switch to REM.

RF GAIN control to maximum (full cw).

SPEAKER switch, AF GAIN control, and SQUELCH control, as desired, to monitor any channel on the speaker at the slave receiver.

PHONES switch and PHONES level control, as desired, to monitor any channel at the PHONES jack on the slave receiver.

b. Set the master receiver as follows:

PWR switch to on (pressed and latched in).

CONT switch to LCL.

RF GAIN control to maximum (full cw).

SPEAKER switch, AF GAIN control, and SQUELCH control, as desired, to monitor any channel on the speaker at the master receiver.

PHONES switch and PHONES level control, as desired, to monitor any channel at the PHONES jack on the master receiver.

MODE switch to the desired operating mode.

BANDWIDTH switch (if CW or AM mode is selected) to 16 or an optional bandwidth (A, B, C, D, E).

Note

If an optional bandwidth is selected, each receiver used must have an if filter installed in the selected bandwidth slot. The selected if filters must have a bandpass that encompasses the received signal.

Applicable channel enable switches to ON (if ISB mode is selected).

Note

For every channel enabled, each receiver used must have the applicable if card installed.

Normal operating procedures may be followed for the remainder of the front panel controls on the receiver control (AFC, VBFO, VBFO OFFSET KHZ, FREQUENCY KHZ, AGC, and AGC BUS).

Note

Each receiver's (master and slave) operating conditions will be controlled by the master-receiver front panel controls. Equipment status indicators on the master-receiver front panel will indicate the status of the master receiver, except the RCV FAULT will indicate the status of the space diversity receiver system. Equipment status indicators on the slave-receiver front panel will indicate the status of the slave receiver only.

4.4 Manual Control (AGC Crosscoupling)

Each receiver must be set up identical (unless otherwise noted) as follows:

PWR switch to on (pressed and latched in).

CONT switch to LCL.

SPEAKER switch, AF GAIN control, and SQUELCH control as desired to monitor any channel on the speaker at each receiver. (Speaker controls need not be set identical on each receiver.)

PHONES switch and PHONES level control as desired to monitor any channel at the PHONES jack on each receiver. (Phones controls need not be set identical on each receiver.)

MODE switch to the desired operating mode.

BANDWDITH switch (if CW or AM mode is selected) to 16 or an optional bandwidth (A, B, C, D, E).

Note

If an optional bandwidth is selected, each receiver used must have an if filter installed in the selected bandwidth slot. The selected if filters must have a bandpass that encompasses the received signal.

Applicable channel enable switches to ON (if ISB mode is selected).

Note

For every channel enabled each receiver used must have the applicable if card installed.

Normal operating procedures may be followed for the remainder of the front panel controls on the receiver control (AFC, VBFO, VBFO OFFSET KHZ, FREQUENCY KHZ, RF GAIN, AGC, and AGC BUS).

Note

Each receiver's operating conditions will be controlled by their own front panel controls. Equipment status indicators on their front panels will indicate their own status, except the RCV FAULT will indicate the status of the space diversity receiver system if the receive fault in and receive fault out lines are cross-connected.

5. MAINTENANCE

5.1 General

This paragraph contains information to maintain a space diversity system using HF-8054( ) Receivers. Testing/troubleshooting procedures isolate a fault to a system component. Refer to the appropriate instruction book for fault isolation and repair of the system components.

5.2 Test Equipment/Power Requirements

Table 1 lists all test equipment required to test and troubleshoot a space diversity system using HF-8054( ) Receivers.

Power required to perform testing and fault isolation procedures given in this supplement is the normal operating power for the HF-8054( ) Receiver and HF-8094 Receiver Control; and also the power required to operate associated test equipment.

5.3 Testing/Troubleshooting Procedures

After the receivers are installed, individually test each receiver in accordance with the test procedures provided in the HF-8054( ) Receiver instruction book, maintenance section 523-0770705. Perform the testing/troubleshooting procedures in table 2.

The testing/troubleshooting procedures are presented in tabular format and permit isolation of a fault to a system component. A test setup diagram is presented in figure 2 and testing/troubleshooting procedures are presented in table 2.

5.4 Fault Isolation

Some failures that may occur in the space diversity system using HF-8054( ) Receivers can be quickly isolated to a system component by using front panel control and monitor features along with the terminal board connections on the rear panel. Table 3 contains a brief description of indications and isolation of apparent failures.

Table 1. Test Equipment Required.

ITEM	MINIMUM SPECIFICATION	REPRESENTATIVE TYPE
Vtvm (2)	-20 to +10 dB mW	HP 410C
Attenuator (2)	0 to 20 dB at 2 to 30 MHz	HP 8494B
Power splitter	2 to 30 MHz	HP 11850A
Rf signal generator	0 to 500 μV at 2 to 30 MHz	HP 8640B-001
Resistor (2)	600 ±10%	Any

Table 2. Testing/Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	Connect receivers and test equipment as shown in figure 8. **Note** For these tests do not connect the audio outputs to an audio combiner or output device.		
2. Channel A1 AGC crosscoupling	a. Connect 600-Ω loads and vtvm's to channel A1 audio outputs (TB1-1, -3). b. Set the front panel controls of each receiver as follows: PWR to ON CONT to LCL MODE to ISB CH A1 enable to ON CH A1-AGC to FAST or DATA CH A1-AGC BUS to OFF RF GAIN to full cw AFC to OFF VBFO to FXD FREQUENCY KHZ to 4000.00 c. Set the attenuators for 0 dB. d. Set rf signal generator for 4.00100 MHz. **Note** Allow test equipment and receivers to warm up for 5 minutes. e. Adjust the rf signal generator output level for 100 μV.		
	f. Set attenuator no 1 for 20 dB and observe receiver no 1 audio output.	NLT 10-dB decrease.	Check that AGC levels at TB1-8 on both receivers are the same. If not, repair wiring. If they are, recheck both receivers.
	g. Set attenuator no 1 for 0 dB.		
	h. Set attenuator no 2 for 20 dB and observe receiver no 2 audio output.	NLT 10 dB decrease.	Same as step 2.f.
3. Channel B1 AGC crosscoupling (Cont)	a. Connect 600-Ω loads and vtvm's to channel B1 audio outputs (TB1-4, -6).		

Table 2. Testing/Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	b. Set the front panel controls of each receiver as follows: PWR to on CONT to LCL MODE to ISB CH B1 enable to ON CH B1-AGC to FAST or DATA CH B1-AGC BUS to OFF RF GAIN to full cw AFC to OFF VBFO to FXD FREQUENCY KHZ to 4000.00		
	c. Set the attenuators for 0 dB.		
	d. Set rf signal generator for 3.99900 MHz.		
	e. Adjust the rf signal generator output level for 100 μV.		
	f. Set attenuator no 1 for 20 dB and observe receiver no 1 audio output.	NLT 10-dB decrease.	Check that AGC levels at TB1-9 on both receivers are the same. If not, repair wiring. If they are, recheck both receivers.
	g. Set attenuator no 1 for 0 dB.		
	h. Set attenuator no 2 for 20 dB and observe receiver no 2 audio output.	NLT 10-dB decrease.	Same as step 3.f.
4. Channel A2 AGC crosscoupling	a. Connect 600-Ω loads and vtvm's to channel A2 audio outputs (TB2-1, -3).		
	b. Set the front panel controls of each receiver as follows: PWR to on CONT to LCL MODE to ISB CH A2 enable to ON CH A2-AGC to FAST or DATA CH A2-AGC BUS to OFF RF GAIN to full cw AFC to OFF VBFO to FXD FREQUENCY KHZ to 4000.00		
	c. Set the attenuators for 0 dB.		
	d. Set rf signal generator for 4.00529 MHz.		
(Cont)	e. Adjust the rf signal generator output level for 100 μV.		

Table 2. Testing/Troubleshooting Procedures (Cont).

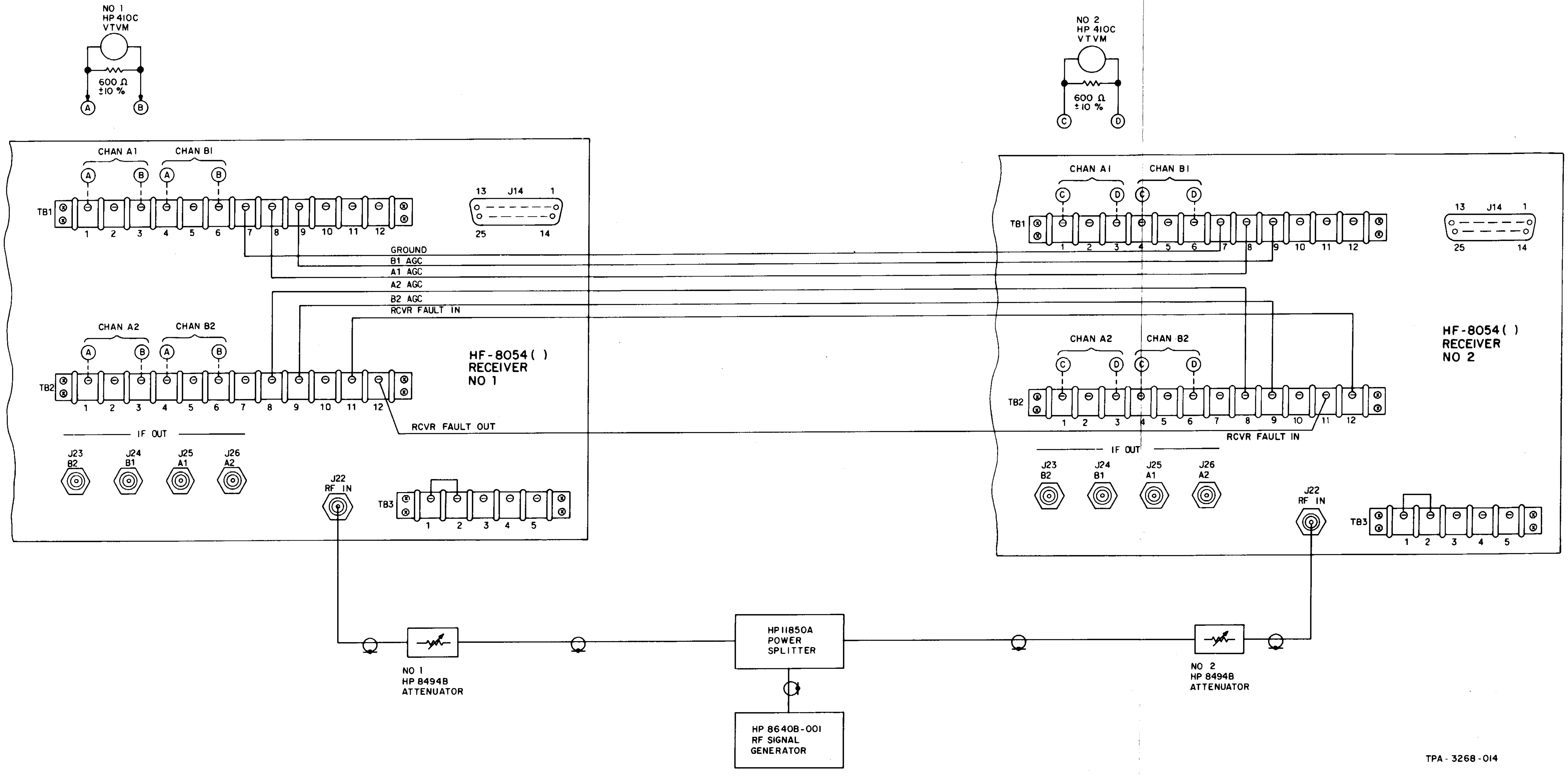
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	f. Set attenuator no 1 for 20 dB and observe receiver no 1 audio output.	NLT 10-dB decrease.	Check that AGC levels at TB2-8 on both receivers are the same. If not, repair wiring. If they are, recheck both receivers.
	g. Set attenuator no 1 for 0 dB.		
	h. Set attenuator no 2 for 20 dB and observe receiver no 2 audio output.	NLT 10-dB decrease.	Same as step 4.f.
5. Channel B2 AGC crosscoupling	a. Connect 600-Ω loads and vtvm's to channel B2 audio outputs (TB2-4, -6).		
	b. Set the front panel controls of each receiver as follows: PWR to on CONT to LCL MODE to ISB CH B2 enable to ON CH B2-AGC to FAST or DATA CH B2-AGC BUS to OFF RF GAIN to full cw AFC to OFF VBFO to FXD FREQUENCY KHZ to 4000.00		
	c. Set the attenuators for 0 dB.		
	d. Set rf signal generator for 3.99471 MHz.		
	e. Adjust the rf signal generator output level for 100 μV.		
	f. Set attenuator no 1 for 20 dB and observe receiver no 1 audio output.	NLT 10-dB decrease.	Check that AGC levels at TB2-8 on both receivers are the same. If not, repair wiring. If they are, recheck both receivers.
	g. Set attenuator no 1 for 0 dB.		
	h. Set attenuator no 2 for 20 dB and observe receiver no 2 audio output.	NLT 10-dB decrease.	Same as step 5.f.
6. Receiver fault cross-connection	a. At each receiver, set PWR switch to off.		
	b. Set PWR switch of receiver no 1 to on, CONT switch to LCL.	Receiver no 1 RCV FAULT indicator lights.	Repair or replace receiver no 1.
(Cont)			

Table 2. Testing/Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6. (Cont)	c. Change any FREQUENCY KHZ digit on receiver no 1.	Receiver no 1 RCV FAULT indicator goes out.	Same as step 6.b.
	d. Set PWR switch of receiver no 2 to on, CONT switch to LCL.	Receivers no 1 and 2 RCV FAULT indicators light.	Both receivers or receiver no 2 RCV FAULT indicators do not light, repair or replace receiver no 2. Receiver no 1 RCV FAULT indicator does not light, check voltage at TB2-11 of receiver no 1. If logic 1, repair or replace receiver no 1. If logic 0, check voltage at TB2-12 of receiver no 2. If logic 1 at TB2-12, fix wiring. If logic 0 at TB2-12, repair or replace receiver no 2.
	e. Change any FREQUENCY KHZ digit on receiver no 2.	Receivers no 1 and 2 RCV FAULT indicators go out.	Receiver no 1 RCV FAULT indicator does not go out, check voltage at TB2-11 of receiver no 1. If logic 0, repair or replace receiver no 1. If logic 1, repair or replace receiver no 2. Both receivers or receiver no 2 RCV FAULT indicators do not go out, check voltage at TB2-11 of receiver no 2. If logic 0, repair or replace receiver no 2. If logic 1, repair or replace receiver no 1.
	f. Set PWR switch of receiver no 1 to off.		
	g. Set PWR switch of receiver no 1 to on.	Receivers no 1 and 2 RCV FAULT indicators light.	Receiver no 2 RCV FAULT indicator does not light, check voltage at TB2-11 of receiver no 2. If logic 1, repair or replace receiver no 2. If logic 0, check
(Cont)			

Table 2. Testing/Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6. (Cont)			voltage at TB2-12 of receiver no 1. If logic 1 at TB2-12, fix wiring. If logic 0 at TB2-12 repair or replace receiver no 1.
	h. Change any frequency digit on receiver no 1.	Receivers no 1 and 2 RCV FAULT indicators go out.	Receiver no 2 RCV FAULT indicator does not go out, check voltage at TB2-11 of receiver no 2. If logic 0, repair or replace receiver no 2. If logic 1, repair or replace receiver no 1. Receiver no 1 RCV FAULT indicator does not go out, check voltage at TB2-11 of receiver no 1. If logic 0, repair or replace receiver no 1. If logic 1, repair or replace receiver no 2.



Space Diversity Receiver System, Test Setup
Figure 8

Table 3. Fault Isolation.

INDICATION	ISOLATION OF APPARENT FAILURE
REMOTE-CONTROLLED MASTER RECEIVER TO SLAVE RECEIVER SYSTEM	
Receiver control RCV FAULT indicator lights	a. Normal receiver indication when power is turned on (caused by power supply fault latching circuit on receiver, control A10). Clear by changing any FREQUENCY KHZ digit. b. Check that receiver control CONT switch is in NORM and master-receiver and slave-receiver CONT switches are in REM. c. Set master-receiver and slave-receiver CONT switch to LCL and check that fault can be cleared at the receiver front panel. If receiver faults do not clear, disconnect receiver fault in line from slave receiver TB2-11. Repeat fault clearing procedures in local operation; replace receiver whose fault does not clear.
Receiver control BUSY indicator lights	a. Check slave-receiver CONT switch is in REM. If it is remote, check busy function of receiver control and receiver.
No receive audio	a. If in ISB mode, check that the appropriate channel is enabled (at least one channel must be enabled to receive any audio in ISB mode). b. If in AM or CW mode, check that bandwidth selected is installed in each receiver. If not, set BANDWIDTH selector to 16 and check operation. c. In CW mode, noise but no audio. Should VBFO be turned on? d. Check that antenna is connected to receiver RF IN jacks. e. Check that audio interconnect is compatible with system being used. f. Set receiver CONT switches to LCL and operate receivers from their own front panel. Replace receiver(s) that audio cannot be received on.
MASTER RECEIVER TO SLAVE RECEIVER SYSTEM	
Master-receiver RCV FAULT indicator lights (Cont)	a. Normal indication when power is turned on (caused by power supply fault latching circuit on control A10). Clear by changing any FREQUENCY KHZ digit. b. Check that master-receiver CONT switch is in LCL position. c. If slave-receiver receive fault out connected to master-receiver receive fault in, check that slave-receiver CONT switch is in REM position.

Table 3. Fault Isolation (Cont).

INDICATION	ISOLATION OF APPARENT FAILURE
MASTER RECEIVER TO SLAVE RECEIVER SYSTEM (Cont)	
Master-receiver RCV FAULT indicator lights (Cont)	d. If slave-receiver receive fault out connected to master-receiver receive fault in, disconnect receive fault line. Check if master-receiver fault can be cleared.
Slave-receiver RCV FAULT indicator lights	a. Normal indication when power is turned on (caused by power supply fault latching circuit on control A10). Clear by changing any FREQUENCY KHZ digit (on master receiver if slave-receiver CONT switch in REM). b. Check that slave-receiver CONT switch is in REM and master-receiver CONT switch is in LCL position. c. Set slave-receiver CONT switch to LCL and check if receiver fault can be cleared from slave receiver front panel.
No receive audio	a. If in ISB mode, check that the appropriate channel is enabled (at least one channel must be enabled to receive any audio in ISB mode). b. If in AM or CW mode, check that bandwidth selected is installed in each receiver. If not, set BANDWIDTH selector to 16 and check operation. c. In CW mode, noise but no audio. Should VBFO be turned on? d. Check that antenna is connected to receiver RF IN jacks. e. Check that audio interconnect is compatible with system being used. f. Set receiver CONT switches to LCL and operate receivers from their own front panel. Replace receiver(s) that audio cannot be received on.
MANUAL CONTROL (AGC Crosscoupling) SYSTEM	
Receiver RCV FAULT indicator lights	a. Normal indication when power is turned on (caused by power supply fault latching circuit on control A10). Clear by changing any FREQUENCY KHZ digit. b. Check that receiver CONT switch is in LCL.
No receive audio (Cont)	a. If in ISB mode, check that the appropriate channel is enabled (at least one channel must be enabled to receive any audio in ISB mode). b. If in AM or CW mode, check that bandwidth selected is installed in each receiver. If not, set BANDWIDTH selector to 16 and check operation.

Table 3. Fault Isolation (Cont).

INDICATION	ISOLATION OF APPARENT FAILURE
MANUAL CONTROL (AGC Crosscoupling) SYSTEM (Cont)	
No receive audio (Cont)	c. In CW mode, noise but no audio. Should VBFO be turned on? d. Check that antenna is connected to receiver RF IN jacks. e. Check that audio interconnect is compatible with system being used.

HF-8054( )
Receiver

Rockwell
International

operation

Collins Telecommunications Products Division

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operation

1. GENERAL

All controls and indicators necessary for operation of a receiver system are located on the front panel of the HF-8054/8054A Receiver. Operation of the receivers differs only in that the HF-8054A Receiver can be controlled locally or remotely using an HF-8094 Receiver Control or processor while the HF-8054 Receiver must be operated locally.

When the HF-8054A Receiver is connected to a receiver control and set for remote operation, the mode, channel enable, bandwidth, frequency, rf gain, AGC, AFC, and vbfo front-panel controls on the receiver do not affect the operation of the receiver. Likewise, with the receiver set for local operation, the corresponding controls on the receiver control do not affect the operation of the receiver. Audio controls, signals, and monitors of the receiver and receiver control remain enabled whether being operated remotely or locally.

This section of the instruction book contains instructions for operating the HF-8054( ) Receiver. The operator should be aware of several general characteristics of the receiver and receiver control when operating the radio. Refer to paragraph 3.3 for this information.

Note that channel B1, A2, B2 if and audio circuits are active only in ISB (independent sideband) or NET DATA modes. In ISB and NET DATA operation, channel A1 output signals are USB (upper sideband), channel B1 output signals are LSB (lower sideband), channel A2 output signals are UUSB (upper-upper sideband) and channel B2 output signals are LLSB (lower-lower sideband). In all other modes, only channel A1 circuits are active and provide signal outputs regardless of if filter selected.

2. CONTROLS AND INDICATORS

Controls and indicators of the HF-8054( ) Receiver are shown in figure 1 and are listed in table 1 along with their function. All controls and indicators listed are applicable to all units unless otherwise indicated.

3. OPERATING PROCEDURES

3.1 Line Audio Adjustments

Line audio output levels of the receiver may be adjusted by qualified operator when his application requires it. The line audio adjustments are shown in figure 2 and listed in table 2. Refer to maintenance section for audio output adjustment procedures.

3.2 Normal (Local) Operating Procedures

3.2.1 General

When power is turned on or restored to the remote receiver, it is normal for the RCV FAULT indicator to light. This is caused by latching the receiver fault circuit when power interruptions are detected. The RCV FAULT is cleared by changing one of the frequency digits on the receiver.

Note that all channel line audio output levels are individually monitored by the front panel meter, as selected by the METER switch. When the METER switch is in the RCV SIG position, the if channel with the strongest signal strength determines the meter reading.

Headphones can be used to monitor any channel independent of the speaker switch.

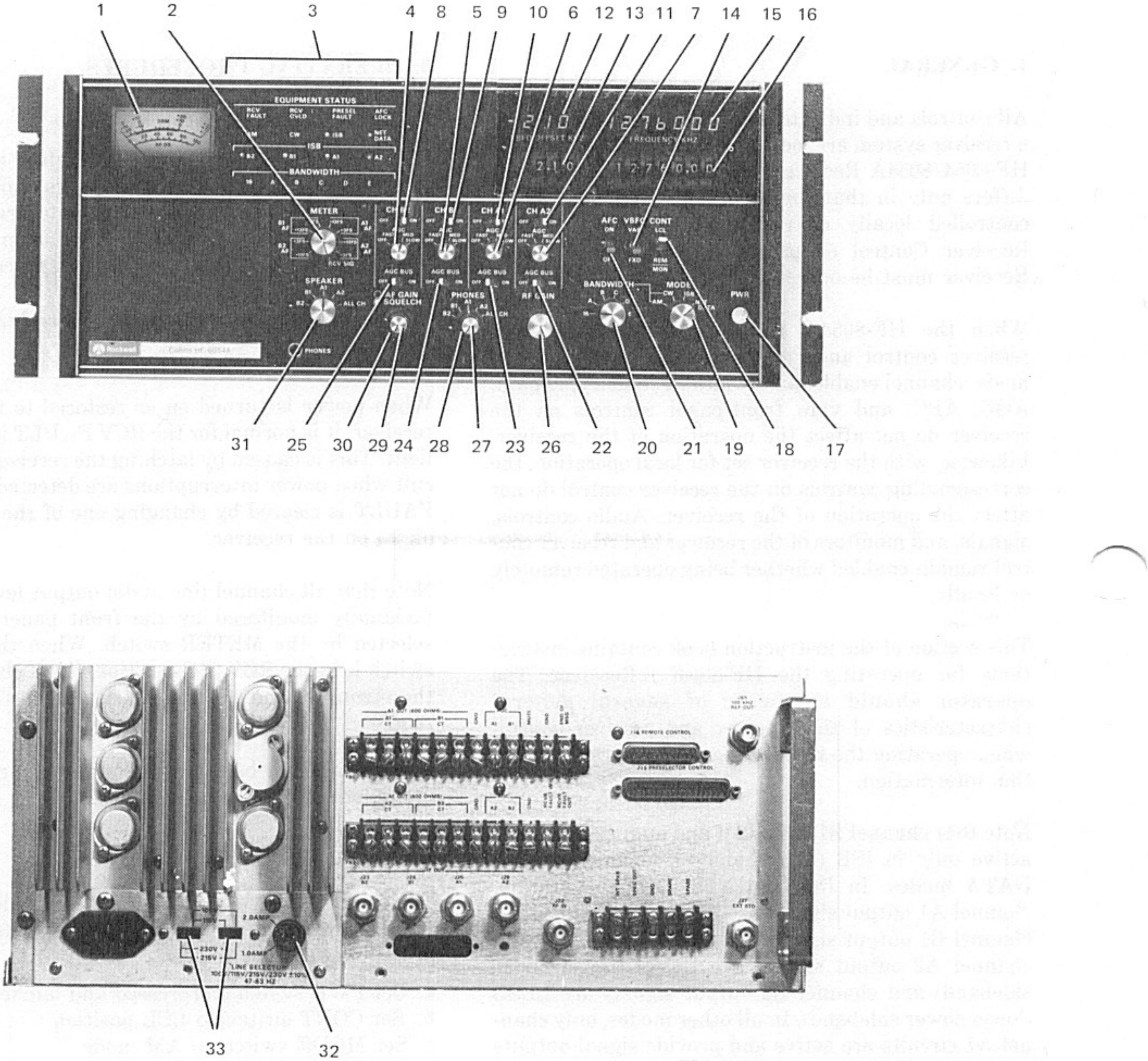
3.2.2 AM Operation

To operate the receiver locally in AM mode and with no special options or applications, follow the procedures outlined below:

a. Set PWR switch on (pressed and latched inward).
b. Set CONT switch to LCL position.
c. Set MODE switch to AM mode.
d. Set BANDWIDTH switch to desired if filter.
   1. 16 (FL8, if attenuator pad)

Note

If filter A8A2 is not installed in your unit, 16 must be selected. If filter A8A2 is installed, 16 or any filter installed on filter A8A2 may be selected.



TPA-3009-017

HF-8054( ) Receiver, Controls and Indicators
Figure 1

Table 1. HF-8054( ) Receiver, Controls and Indicators.

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
1	Meter A2M1	Indicates levels as selected by METER switch A2S1.
2	METER switch A2S1	Selects signal levels to be measured by meter A2M1. Selectable positions are as follows: a. B2 AF +13FS position monitors channel B2 receive line audio output (indicates +13 dB mW full scale). b. B2 AF +3FS position monitors channel B2 receive line audio output (indicates +3 dB mW full scale). c. B1 AF +13FS position monitors channel B1 receive line audio output (indicates +13 dB mW full scale). d. B1 AF +3FS position monitors channel B1 receive line audio output (indicates +3 dB mW full scale). e. A1 AF +13 FS position monitors channel A1 receive line audio output (indicates +13 dB mW full scale). f. A1 AF +3FS position monitors channel A1 receive line audio output (indicates +3 dB mW full scale). g. A2 AF +13FS position monitors channel A2 receive line audio output (indicates +13 dB mW full scale). h. A2 AF +3FS position monitors channel A2 receive line audio output (indicates +3 dB mW full scale). i. RCV SIG position monitors (AGC level) receive rf input signal (indicates 0 to 100 dB above a 1-μV rf input signal).
3	EQUIPMENT STATUS indicators (color)	
	RCV FAULT A2A1DS5 (red)	Indicates power supply low voltage, synthesizer fault, or vbfo synthesizer fault. Indicated when fault signal is supplied by power supply A1, synthesizer voltage regulator A14, synthesizer subcarrier generator A15, and/or vbfo A4. (Synthesizer fault signal from synthesizer voltage regulator A14 is a summary of all synthesizer loss-of-lock signals supplied by A16 through A23.)
	RCV OVERLOAD A2A1DS6 (red)	Indicates a receive rf signal overload condition from translator module A9 or from associated preselector.
	PRESEL FAULT A2A1DS23 (red)	Indicates a preselector fault. Indicated by a preselector fault signal from associated preselector.
	AFC LOCK A2A1DS3 (yellow) (used with AFC option only)	Indicates that AFC (automatic frequency control) is locked to a signal.
	AM A2A1DS2 (yellow)	Indicates that AM operating mode is selected.
	CW A2A1DS7 (yellow)	Indicates that CW operating mode is selected.
(Cont)	ISB A2A1DS4 (yellow)	Indicates that ISB operating mode is selected.

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
3 (Cont)	NET DATA A2A1DS22 (yellow)	Indicates that NET DATA operating mode is selected.
	ISB channel indicators	
	B2 A2A1DS10 (yellow)	Indicates that B2 (LLSB) receive circuits are enabled.
	B1 A2A1DS9 (yellow)	Indicates that B1 (LSB) receive circuits are enabled.
	A1 A2A1DS12 (yellow)	Indicates that A1 (USB) receive circuits are enabled.
	A2 A2A1DS13 (yellow)	Indicates that A2 (UUSB) receive circuits are enabled.
	BANDWIDTH indicators	
	16 A2A1DS14 (yellow)	Indicates that 16-kHz if attenuator pad (FL8) is selected.
	A A2A1DS17 (yellow)	Indicates that optional if filter A (FL3) is selected.
	B A2A1DS18 (yellow)	Indicates that optional if filter B (FL4) is selected.
	C A2A1DS15 (yellow)	Indicates that optional if filter C (FL5) is selected.
	D A2A1DS16 (yellow)	Indicates that optional if filter D (FL6) is selected.
	E A2A1DS19 (yellow)	Indicates that optional if filter E (FL7) is selected.
4	Channel B2 AGC switch A2S24	Selects AGC attack and decay times for channel B2. AGC switch is a 4-position switch with the following positions: OFF-VOICE-DATA-FAX or OFF-FAST-MED-SLOW. a. In OFF position, AGC is disabled. b. In DATA or FAST position, AGC attack time of 20 milliseconds maximum and decay time of 15 to 30 milliseconds is enabled. 66 – 33Hz c. In MED position, AGC attack time of 20 milliseconds maximum and decay time of 70 to 150 milliseconds is enabled. 14 28Hz – 6.66Hz d. In VOICE or SLOW position, AGC attack time of 20 milliseconds maximum and decay time of 1 to 2 seconds is enabled. e. In FAX position, AGC attack time of 2 seconds maximum and decay time of 3 to 6 seconds is enabled.
5	Channel B1 AGC switch A2S25	Same as A2S24 except used for channel B1.
6	Channel A1 AGC switch A2S26	Same as A2S24 except used for channel A1.
7	Channel A2 AGC switch A2S27	Same as A2S24 except used for channel A2.
8	CH B2 (ON/OFF) enable switch A2S5	Enables/disables channel B2 circuits in ISB and NET DATA modes only.
9	CH B1 (ON/OFF) enable switch A2S3	Enables/disables channel B1 circuits in ISB and NET DATA modes only.
10	CH A1 (ON/OFF) enable switch A2S2	Enables/disables channel A1 circuits in ISB and NET DATA modes only.

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
11	CH A2 (ON/OFF) enable switch A2S4	Enables/disables channel A2 circuits in ISB and NET DATA modes only.
12	VBFO OFFSET KHZ display A2A5U15 thru A2A5U19 (used with frequency display option only and only when dvbfo option is installed)	Displays bcd vbfo offset frequency as set by VBFO OFFSET KHZ switches or a remote receiver control. a. A2A5U15 displays direction of vbfo offset frequency from carrier (+ or -). b. A2A5U16 displays ones kilohertz. c. A2A5U17 displays hundreds hertz. d. A2A5U18 displays tens hertz. e. A2A5U19 displays ones hertz.
13	VBFO OFFSET KHZ controls A2S18A thru A2S18D (used with dvbfo option only)	Sets bcd frequency for vbfo as indicated by thumb wheel display. a. A2S18A selects the direction of the offset of the dvbfo signal (+ or -). b. A2S18B selects ones kilohertz. c. A2S18C selects hundreds hertz. d. A2S18D selects tens hertz.
14	VBFO switch A2S11 (used with dvbfo option only)	Selects the bfo injection signal to be used. a. VAR position enables dvbfo. b. FXD position selects the fixed 450-kHz injection signal.
15	FREQUENCY KHZ display A2A5U20 thru A2A5U26 (used with frequency display option only)	Displays bcd frequency as set by FREQUENCY KHZ controls or a remote receiver control. a. A2A5U20 displays tens megahertz. b. A2A5U21 displays ones megahertz. c. A2A5U22 displays hundreds kilohertz. d. A2A5U23 displays tens kilohertz. e. A2A5U24 displays ones kilohertz. f. A2A5U25 displays hundreds hertz. g. A2A5U26 displays tens hertz. h. A2A5U27 displays ones hertz (option).
16 (Cont)	FREQUENCY KHZ controls A2S17A thru A2S17G	Sets bcd frequency as indicated by thumb-wheel display. a. A2S17A selects tens megahertz.

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
16 (Cont)		b. A2S17B selects ones megahertz. c. A2S17C selects hundreds kilohertz. d. A2S17D selects tens kilohertz. e. A2S17E selects ones kilohertz. f. A2S17F selects hundreds hertz. g. A2S17G selects tens hertz.
17	PWR switch A2S28	Sets power on/off. When pressed and latched (inward position), power is applied to the receiver. When pressed and unlatched (outward position), power is removed from the receiver.
18	CONT switch A2S13 (preset option not installed)	Selects use and method of controlling the HF-8054A Receiver. a. LCL position allows unit to be controlled locally. (HF-8054 Receiver must be kept in LCL position for operation.) b. REM position allows unit to be controlled remotely. REM position disables local control of mode, bandwidth, frequency, rf gain, bfo, AGC, AGC, and vbfo signals. Local audio controls, signals, and monitors remain enabled. c. MON position is a momentary position that enables local controls and sets the monitor bit (word 4, character 5, bit 1) of the receiver control monitor response. This may be used, for example, to command a processor control to modify a stored preset table of operating frequency and mode information to that set on the local controls.
	CONT switch A2S13 (used with preset option installed)	Selects method of controlling the HF-8054 Receiver (preset option not used in HF-8054A Receiver). a. NORM position allows unit to be controlled using the front panel controls. b. PSET position allows unit to be controlled using the PRESET switch A2S14 and CHAN selector A2A6.
Not shown (is mounted just right of CONT switch A2S13)	PRESET switch A2S14 (used with preset option only)	Selects preset controlling functions when CONT switch is in PSET position. a. OPER position selects the control functions preset on the channel selected by CHAN selector A2A6. The preset functions include frequency mode and bandwidth. b. STORE position presets the channel selected by CHAN selector A2A6 to the control settings on the front panel. The preset functions include frequency, mode, and bandwidth.
19	MODE switch A2S21	Selects the receiver operating mode and bandwidth.
(Cont)		a. AM position selects AM mode, enables BANDWIDTH switch A2S22 and channel A1.

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

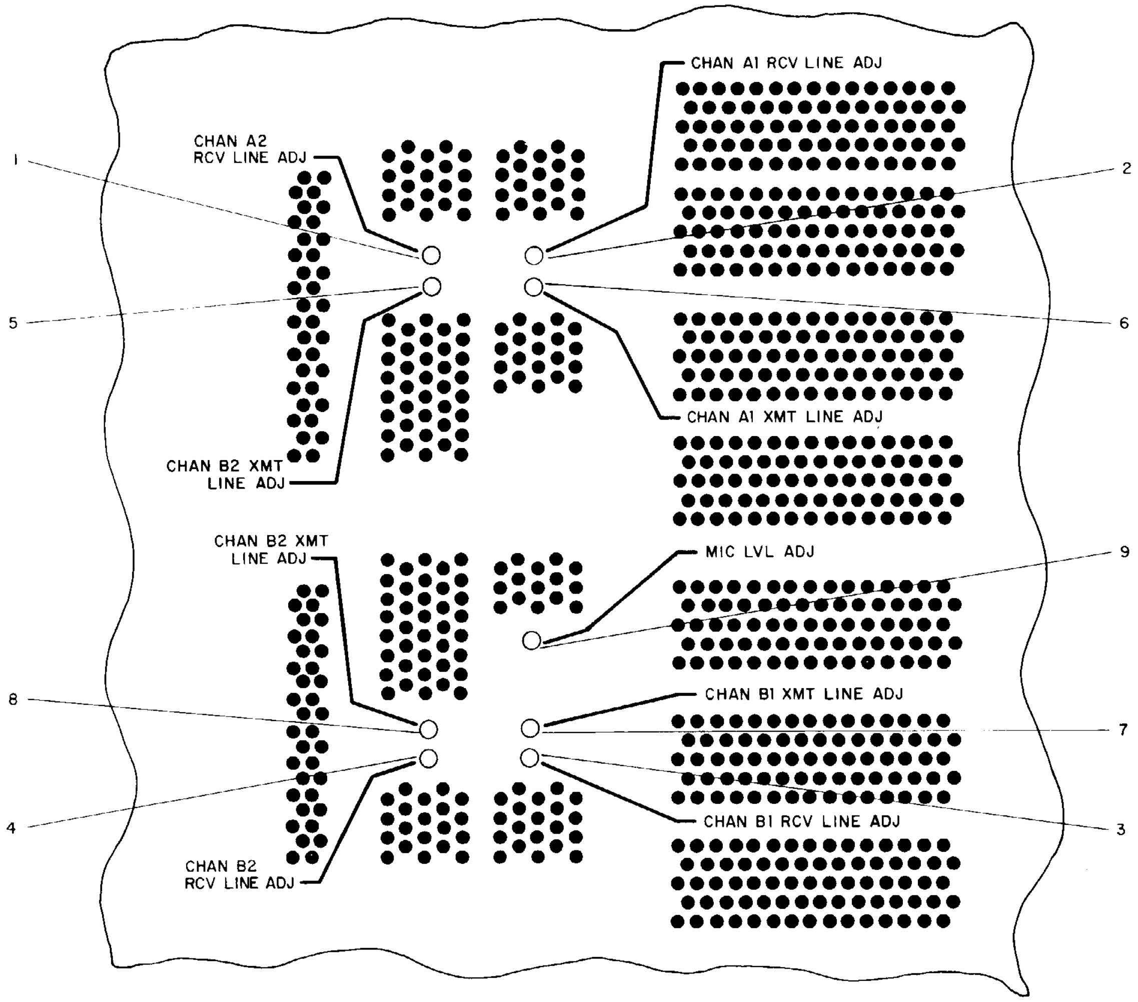
INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
19 (Cont)		b. CW position selects CW mode, enables BANDWIDTH switch A2S22 and channel A1. c. ISB position selects ISB mode and allows enabling the CH A1, CH B1, CH A2, CH B2 enable switches and the AGC BUS switches. d. NET DATA position selects NET DATA mode and allows enabling the CH A1 and CH B1 enable switches. **Note** Although the CH A2 and CH B2 enable switches and the AGC BUS switches are not disabled in the NET DATA mode they should be set to OFF in NET DATA mode.
20	BANDWIDTH switch A2S22	Selects receive operating bandwidth when MODE switch A2S21 is in AM or CW position. a. 16 position selects if attenuator pad (16-kHz bandwidth). b. A position selects bandpass filter FL3 (optional filter). c. B position selects bandpass filter FL4 (optional filter). d. C position selects bandpass filter FL5 (optional filter). e. D position selects bandpass filter FL6 (optional filter). f. E position selects bandpass filter FL7 (optional filter).
21	AFC switch A2S12 (used with AFC option only)	Sets AFC (automatic frequency control) on or off.
22	CH A2 - AGC BUS switch A2S8	Used in ISB mode to connect channel A2 AGC to common bus. When connected to AGC bus (ON), the if generating the strongest AGC voltage sets the gain of the other if's connected to the AGC bus.
23	CH A1 - AGC BUS switch A2S6	Same as A2S8 except connects channel A1 AGC to common bus.
24	CH B1 - AGC BUS switch A2S7	Same as A2S8 except connects channel B1 AGC to common bus.
25	CH B2 - AGC BUS switch A2S9	Same as A2S8 except connects channel B2 AGC to common bus.

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
26	RF GAIN control A2R11	Controls rf AGC threshold/level, which in turn controls the gain of the rf and if circuits in the receiver. Disabled in NET DATA mode (maximum rf gain).
27	PHONES level control (◉) A2S19B	Controls headphone volume, full clockwise equals maximum volume.
28	PHONES switch (○) A2S19A	Selects audio to be monitored at PHONES jack J1 on the receiver front panel. a. B2 position selects channel B2 receive audio. b. B1 position selects channel B1 receive audio. c. A1 position selects channel A1 receive audio. d. A2 position selects channel A2 receive audio. e. ALL CH position selects receive audio of all channels (B2, B1, A1, A2).
29	○ AF GAIN control A2S16A	Controls volume of speaker.
30	◉ SQUELCH control A2S16B and A2S16C	Enables/disables squelch and controls the squelch threshold. In extreme counterclockwise position, squelch is disabled. When control is moved clockwise, squelch is enabled and squelch threshold is adjusted by further clockwise rotation of the control. *Note* Speaker squelch operates (breaks squelch) only on audio signals below 1000 Hz.
31	SPEAKER switch A2S15	Switches the selected audio to the speaker amplifier. a. B2 position selects channel B2 audio input. b. B1 position selects channel B1 audio input. c. A1 position selects channel A1 audio input. d. A2 position selects channel A2 audio input. e. ALL CH position selects audio input of all channels (B2, B1, A1, A2).
32	Fuse A1F1 (located on rear panel)	Fuse in power line. 2 A used for 100/115-V ac operation, 1 A used for 215/230-V ac operation.
33 (Cont)	Power selection switch A1S1A and A1S1B (located on rear panel)	Controls input power strapping of power transformer in power supply A1. a. In 100-V position, power transformer strapped for 100-V ac operation (90 to 110 V ac).

Table 1. HF-8054( ) Receiver, Controls and Indicators (Cont).

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
33 (Cont)		b. In 115-V position, power transformer strapped for 115-V ac operation (103 to 127 V ac). c. In 215-V position, power transformer strapped for 215-V ac operation (193 to 237 V ac). d. In 230-V position, power transformer strapped for 230-V ac operation (207 to 253 V ac).



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Top Cover Adjustments
Figure 2

Table 2. Line Audio Adjustments.

INDEX NUMBER	ADJUSTMENT	PURPOSE
1	CH A1 RCV LINE ADJ A25R28 (accessible through top cover)	Controls channel A1 receive line audio. Normally adjusted for 0-dB mW audio output (as read on front panel meter) for a 3-μV input in ISB modes. Adjustable from -20- to +10-dB mW audio output with a 3-μV input.
2	CH B1 RCV LINE ADJ A25R65 (accessible through top cover)	Controls channel B1 receive line audio. Normally adjusted for 0-dB mW audio output (as read on front panel meter) for a 3-μV input in ISB modes. Adjustable from -20- to +10 dB mW audio output with a 3-μV input.
3	CH A2 RCV LINE ADJ A26R28 (accessible through top cover)	Controls channel A2 receive line audio. Normally adjusted for 0-dB mW audio output (as read on front panel meter) for a 3-μV input in ISB modes. Adjustable from -20- to +10-dB mW audio output with a 3-μV input.
4	CH B2 RCV LINE ADJ A26R65 (accessible through top cover)	Controls channel B2 receive line audio. Normally adjusted for 0-dB mW audio output (as read on front panel meter) for a 3-μV input in ISB modes. Adjustable from -20- to +10-dB mW audio output with a 3-μV input.

   2. A (FL3, optional filter)
   3. B (FL4, optional filter)
   4. C (FL5, optional filter)
   5. D (FL6, optional filter)
   6. E (FL7, optional filter)

e. Set FREQUENCY KHZ thumb-wheel controls to desired operating frequency.

f. Set channel A1 AGC switch to desired AGC decay time.
   1. OFF, AGC is disabled.
   2. DATA or FAST equals 15 to 30 milliseconds.
   3. MED equals 70 to 150 milliseconds.
   4. VOICE or SLOW equals 1 to 2 seconds.
   5. FAX equals 3 to 6 seconds.

g. Set RF GAIN control to full gain (clockwise).

h. To monitor audio with headphones, connect headphones to PHONES jack. Set PHONES switch to CH A1, and adjust PHONES level control for comfortable listening level.

i. With ◉ SQUELCH control full ccw, set SPKR switch to CH A1 and adjust ○ AF GAIN control for a comfortable listening level. With no signal input, adjust ◉ SQUELCH control until noise just squelches.

3.2.3 CW Operation

To operate the receiver locally in CW mode and with no special options or applications, follow the procedures outlined below:

a. Set PWR switch on (pressed and latched inward).

b. Set CONT switch to LCL position.

c. Set MODE switch to CW mode.

d. Set BANDWIDTH switch to desired if filter.
   1. 16 (FL8, if attenuator pad)

Note

If filter A8A2 is not installed in your unit, 16 must be selected. If filter A8A2 is installed, 16 or any filter installed on filter A8A2 may be selected.

   2. A (FL3, optional filter)
   3. B (FL4, optional filter)
   4. C (FL5, optional filter)
   5. D (FL6, optional filter)
   6. E (FL7, optional filter)

e. Set FREQUENCY KHZ thumb-wheel controls to desired operating frequency.

Note

Speaker squelch operates (breaks squelch) only on audio signals below 1000 Hz.

f. If receiver is to receive CW and DVBFO option is not installed, adjust FREQUENCY KHZ thumbwheel controls off the CW operating frequency by 300 to 2700 Hz (until frequency tone is pleasant to operator). If receiver is to receive CW and DVBFO option is installed, set VBFO switch to VAR and adjust the VBFO OFFSET KHZ controls to a frequency tone that is pleasant to the operator.

g. Set channel A1 AGC switch to desired AGC decay time.
   1. OFF, AGC is disabled.
   2. DATA or FAST equals 15 to 30 milliseconds.
   3. MED equals 70 to 150 milliseconds.
   4. VOICE or SLOW equals 1 to 2 seconds.
   5. FAX (not recommended).

h. Set RF GAIN control to full gain (clockwise).

i. To monitor audio with headphones, connect headphones to PHONES jack. Set PHONES switch to CH A1 and adjust PHONES level control for comfortable listening level.

j. With ◉ SQUELCH control full ccw, set SPKR switch to CH A1 and adjust ○ AF GAIN control for a comfortable listening level. With no signal input, adjust ◉ SQUELCH control until noise just squelches.

Note

The optional dvbfo can be especially useful in CW mode when receiving single-channel FSK RTTY signals. If the receiver is tuned to the center frequency of the FSK RTTY signal (midway between mark and space frequencies), and the VBFO OFFSET KHZ is set to the center frequency of the associated audio converter, the receiver mark/space audio signal will be precise and stable without the need for fine tuning to achieve good copy. Operation is further improved if the receiver contains optional narrow-band if filters centered at the tuned frequency, which can be switched in to remove possible interference.

3.2.4 ISB Operation

To operate the receiver locally in ISB mode and with no special options or applications, follow the procedures outlined below:

a. Set PWR switch on (pressed and latched inward).

b. Set CONT switch to NORM position.

c. Set MODE switch to ISB mode.

Note

BANDWIDTH switch is disabled in ISB mode. Channels enabled and their bandwidths are controlled by the channel enable switches (table 1, items 8 through 11).

CH A1 (USB) — (2.85 kHz, carrier +250 Hz to +3100 Hz)

CH B1 (LSB) — (2.85 kHz, carrier -250 Hz to -3100 Hz)

CH A2 (UUSB) — (2.85 kHz, carrier +3190 Hz to +6040 Hz)

CH B2 (LLSB) — (2.85 kHz, carrier -3190 Hz to -6040 Hz)

d. Set FREQUENCY KHZ thumb-wheel controls to desired operating frequency.

e. Set CH A1, CH B1, CH A2, CH B2 (or any combination of these) enable switches to ON. If more than one channel is enabled, it might be desirable to set the appropriate AGC BUS switches to ON.

Note

When set to ON, AGC BUS switches allow the gain of inactive channels to be controlled by the AGC level of the active channels, thus reducing the background noise of inactive channels.

f. Set appropriate AGC switch (channel A1, B1, A2, B2) to desired AGC decay time.
   1. OFF, AGC is disabled.
   2. DATA or FAST equals 15 to 30 milliseconds.
   3. MED equals 70 to 150 milliseconds.
   4. VOICE or SLOW equals 1 to 2 seconds.
   5. FAX equals 3 to 6 seconds.

g. Set RF GAIN control to full gain (clockwise).

h. To monitor audio with headphones, connect headphones to PHONES jack. Set PHONES switch to appropriate channel (whichever channel to be monitored by the operator). Adjust PHONES level control for comfortable listening level. The PHONES switch may be set to monitor CH A1, CH B1, CH A2, CH B2, or to monitor all (ALL CH) channels simultaneously.

i. With ◉ SQUELCH control full ccw, set SPKR switch to appropriate channel and adjust ○ AF GAIN control for a comfortable listening level. With no signal input, adjust ◉ SQUELCH control until noise just squelches. The SPKR switch may be set to monitor CH A1, CH B1, CH A2, CH B2, or to monitor all (ALL CH) channels simultaneously.

3.2.5 NET DATA Operation

Note

> NET DATA is a special mode used when the receiver is operating in a data network system such as TADIL A or LINK 11. It should not be used for normal operations.

To operate the receiver locally in NET DATA mode and with no special options or applications, follow the procedures outlined below:

a. Set PWR switch on (pressed and latch inward).
b. Set CONT switch to NORM position.
c. Set MODE switch to NET DATA mode.

Note

> In NET DATA mode, BANDWIDTH switch is disabled, AGC switches are disabled, and RF GAIN control is disabled (rf gain latched to maximum gain). For proper NET DATA operation, AGC BUS switches must be set to OFF and CH A2 and CH B2 enable switches set to OFF. Channel A1 (USB), channel B1 (LSB), or both (ISB) may be used in NET DATA operation. Channels A1 and B1 are enabled and bandwidths are controlled by channel enable switches (table 1, items 9 and 10).
>
> CH A1 (USB) — (2.85 kHz, carrier +250 Hz to +3100 Hz)
>
> CH B1 (LSB) — (2.85 kHz, carrier -250 to -3100 Hz)

d. Set FREQUENCY KHZ thumb-wheel controls to desired operating frequency.
e. Set CH A1, CH B1, or both CH A1 and CH B1 enable switches to ON. (AGC BUS switches must be set to OFF.)
f. To monitor audio with headphones, connect headphones to PHONES jack. Set PHONES switch to appropriate channel (whichever channel to be monitored by the operator). Adjust PHONES level control for comfortable listening level. The PHONES switch may be set to monitor CH A1, CH B1, or to monitor both (ALL CH) channels simultaneously.
g. With ◉ SQUELCH control full ccw, set SPKR switch to appropriate channel and adjust ○ AF GAIN control for a comfortable listening level. With no signal input, adjust ◉ SQUELCH control until noise just squelches. The SPKR switch may be set to monitor CH A1, CH B1, or to monitor both (ALL CH) channels simultaneously.

3.2.6 Built-In Test (BIT) Operation

The HF-8054( ) Receiver has many BIT features used in detecting and isolating faults. Two types of monitors are used: fault detectors and performance monitors. The fault detectors monitor functions that are not dependent on an external signal input. Performance monitors depend on an external signal input to generate performance signal levels at various points in the receiver.

The fault detectors monitor:

a. Power supply voltages
b. Synthesizer phase-locked loops
c. Synthesizer output injection levels

The performance monitors indicate:

a. Audio line output levels
b. If AGC levels
c. If signal level (rf performance monitor).
d. External frequency standard input

Any fault occurance results in a summary receiver fault signal that lights the front panel RCV FAULT indicator.

In the HF-8054A Receiver, all fault and performance monitor information is available in the serial monitor data. Also, the remote control interface includes integral parity error, framing error, and sequence error detection. For a complete description of each of these, refer to paragraph 4.3.7.5.

4. REMOTE OPERATION (HF-8054A RECEIVER ONLY)

4.1 General

To operate the HF-8054A Receiver from an HF-8094 Receiver Control or a processor, the CONT switch on the receiver is set to the REM position. This transfers control to the remote control device except for audio monitoring. The local operator is still able to monitor audio levels, audio signals, and set speaker squelch using the receiver front panel meter, controls, and speaker.

The MON position on the receiver CONT switch sets the receiver to local control and sets the monitor bit in the monitor data. This can be used, as an example, to set the receiver front panel data into a preset table in a processor. The MON position has no function when used with the HF-8094 Receiver Control.

4.2 Operating Procedures Using the HF-8094 Receiver Control

With the exception of setting the receiver control CONT switch to the NORM position and the HF-8054A Receiver CONT switch to the REM position, operating procedures for the HF-8094 Receiver Control are identical to operating the local receiver (paragraph 3.2). When in remote operation, the RCV FAULT is cleared by changing a frequency digit on the HF-8094 Receiver Control Front Panel.

The following paragraphs contain the operating characteristics of the HF-8094 Receiver Control and is given for information only.

4.3 Operating Characteristics

4.3.1 Power Failure and Initialization

When primary power to the HF-8094 Receiver Control is initially applied, or reapplied after a power interruption, the receiver control transmits all command information and requests monitor information from the addressed HF-8054A Receiver. When primary power is applied to a receiver, after power has been applied to the receiver control, the receiver control again transmits all command information from the front-panel control settings and requests updated status from the addressed receiver. When power is applied or restored in a system containing more than one receiver, the receiver control can initialize only the currently addressed unit. The remaining receivers must be initialized manually, one at a time, by selecting the appropriate address and transmitting the desired operating parameters.

4.3.2 CONT Switch Operation

The user must be aware that if front panel controls are changed while the CONT switch is in the TEST mode, their settings may no longer correspond to the receiver operating conditions. Consequently, when the next command to the receiver is initiated (in the NORM mode), some of these settings may be transmitted to the receiver, causing it to change its operating conditions to correspond to the control settings.

The NORM position of the CONT switch is used for normal remote control operation. The TEST position is used to verify that the receiver control is operational and that it can communicate with itself internally. In the TEST mode, the data from the receiver control is transmitted directly to its own display unit. Frequency information displayed will follow the positioning of the frequency thumb-wheel switches, and mode, bandwidth, and channel enable indicators will follow positioning of the front-panel mode, bandwidth, and channel enable controls. When the CONT switch is returned to the NORM position, the receiver control automatically updates to the status information from the receiver without changing the operating conditions of the receiver.

In the TEST mode, the flashing fault indicator (paragraph 4.3.5) is a normal indication, and flashing may become erratic or halt momentarily as front-panel controls are operated.

4.3.3 Address Selection

The receiver control communicates with only one at a time of up to 16 receivers being controlled. The ADDRESS switch contains numbers from 0 through 15 corresponding to binary coding of the four address bits of the data words.

When the ADDRESS switch is rotated to an address, the receiver control automatically requests a complete status update from the addressed receiver. This is done by transmitting an abbreviated 2-character status request only for words 1, 2, 3, and 4. The receiver control status and frequency displays then update with the operating conditions of the newly addressed receiver.

No command transmission will be initiated from the receiver control to the newly addressed receiver until changes are made to the front panel control settings of the receiver control. Thus the operating status of the receiver will remain unchanged. This sequence of operation permits an operator to address a receiver solely for the purpose of current status inspection or verification.

4.3.4 BUSY Indicator Operation

The BUSY indicator on the receiver control front panel is lit whenever the addressed receiver CONT switch is placed in the LCL position. When this indicator is lit, the control unit automatically and continuously requests words 1, 2, 3, and 4 monitor data from the receiver. This continuously updates all status information to the receiver control. The operator is thus alerted to the current status of the addressed receiver while it is being locally controlled at the remote site. As long as the BUSY indicator remains lit, commands from the receiver control to the addressed receiver are inhibited.

When the receiver is again returned to remote operation (CONT to REM), the BUSY indicator turns off and the receiver control transmits all current front-panel switch and control settings to the addressed receiver. This causes the receiver operational status to revert to the conditions currently selected on the receiver control front panel.

4.3.5 No Indication of Monitor Response

If for any reason the receiver control fails to receive monitor data transmissions from the addressed receiver (data transmission link inoperative, unit inoperative, unit power disabled, addressed unit does not exist, etc), the receiver fault indicator (RCV FAULT) will flash at approximately a 0.25-Hz rate (2 seconds on, 2 seconds off). Flashing is normal, however, when the front-panel CONT switch is in the TEST position.

4.3.6 Polling Operation

The polling strapping option discussed in the installation section permits the receiver control to function in a polling mode of operation. This mode of operation is intended for use when an auxiliary system status display is used to display the current status of more than one remote receiver.

In the polling mode of operation the receiver control automatically and sequentially requests status data from all sixteen possible remote addresses. As status data is received from each addressed remote receiver, it is then transmitted by the receiver control, on the common system control bus, to a remote status display for update of the display. The remote status display must be connected to the system control bus to receive the updated display information. If no status response is received from a polled unit, no status data is transmitted to the status display by the receiver control.

Since the status display connects to the common system control bus, it is programmed to recognize its own unique address, and the receiver control is programmed to use this same address (00000 for ADB5 through ADB1) when communicating with the status display. Therefore, when using the polling capability along with a remote status display and the 8-bit character data format, only fifteen of the sixteen address combinations are available for remote receiver assignment, since the status display itself requires one of the addresses. If, however, the 7-bit ASCII character data format is used in the system, all sixteen remote receiver addresses are available for use because the address assigned to the status display is not among the sixteen addresses (of the 32 possible in this format) controlled by the thumb-wheel address selector switch of the receiver control.

4.3.7 Control and Monitor Data Transmission

Under normal operating conditions, the receiver control transmits control information to the addressed receiver only upon initiation from the front panel controls.

Operation of the frequency thumb-wheel switches initiates transmission of a frequency control word (word 1), along with a request for a frequency status response from the receiver. Likewise, operation of any of the front-panel remote-function switches initiates control transmission, with monitor request, of the corresponding word for which the function is defined. When no control word transmission is pending, the receiver control reverts to its idle state.

In the idle state, the receiver control continuously transmits the 2-character, word 4 monitor request. This keeps the front-panel status indicators up to date on any of the word 4 monitor status information (such as the various fault bits) that may change dynamically during normal operation of the remote unit. Monitor word transmission from a receiver is transmitted only when requested by the receiver control.

The data transmitted and received on the control and monitor buses is serial, asynchronous, and is organized in groups of characters called words. The format is independent of the type of signaling (FSK, RS-232C, or MIL-STD-188C) used. The data formats are user selected by internal strapping. One format uses 7-BIT ASCII coded characters and is described in paragraphs 4.3.7.1 and 4.3.7.2. The other format uses an 8-bit character code and is described in paragraphs 4.3.7.3 and 4.3.7.4. Regardless of the format selected, there are four control words and four monitor data words used by the receiver control.

4.3.7.1 ASCII Word Format

A word consists of three special nonfunctional characters that are used to establish word boundaries, and eleven functional characters that contain address and front-panel control/status information. Refer to figure 3.

The three special nonfunctional characters are selected from carriage return (CR), line feed (LF), execute (X), hyphen (-) and dollar sign ($). Refer to figures 4 and 5. CR and LF are the first two special nonfunctional characters of each ASCII control word and execute (X) ends each of the ASCII control words. The hyphen (-) is the first two special nonfunctional characters of each ASCII monitor word, and the dollar sign ($) is used to end each of the monitor words.

The eleven functional characters of the control and monitor words consist of two address, one sequence designator, and eight characters for control/status information.

The control and monitor data word formats are similar with one exception, control word 4 is shortened to seven ASCII characters in order to transmit status information as fast as possible. Monitor word 4 contains all eleven ASCII characters. The first five characters of each word are organized the same: two nonfunctional characters are used to establish synchronization, the first two functional characters establish the address, and the third functional character serves as the sequence designator. As many as 32 units (00 through 31) can be addressed on one control or monitor bus, using bcd coded combinations of the two-address characters. Five binary coded address lines with internal pullup to logic one are available at the remote control connector of the HF-8054A Receiver and may be strapped to any combination. However, in the HF-8094 Receiver Control, only four of the five address bits are controlled by the address selector thumb-wheel switch (ADB5 is not used), limiting the number of addresses to 16 (00 through 15). Table 3 describes the relationship between address line strapping (ADB4 through ADB1), the corresponding bcd address digits and the remote control address selector. Only X's require strapping to ground; the dashes remain unstrapped or open address lines.

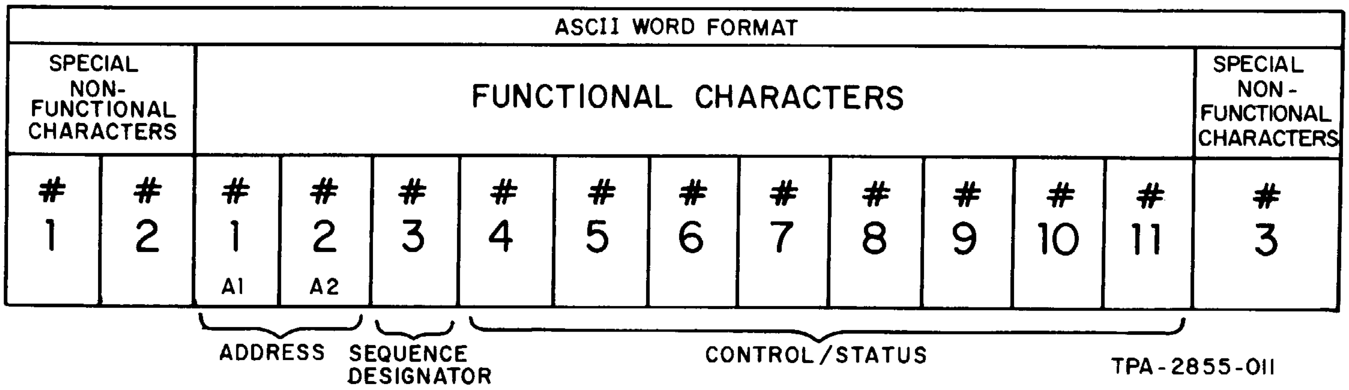
The third functional ASCII character in each word is the sequence designator. Refer to table 4. The sequence designator is used to define the word number and type (control only, control with status request, or status request only) of the word represented.

Data rates are switchable on the serial interface card A13 from 75 to 19 200 bauds. The levels are strappable for either RS-232C (+6-V dc level defined as a logic 0) or MIL-STD-188C (+6-V dc level defined as a logic 1) compatibility. See the installation section for switching and strapping instructions.

4.3.7.2 *ASCII Character Format*

The special nonfunctional ASCII characters are used as word boundary delimiters for each of the control and monitor words. The nonfunctional characters are encoded/decoded in terms of a 7-bit code shown in table 5.

The functional characters contain the control and monitor data and are encoded/decoded in terms of a 4-bit code also shown in table 5. A logic 1 selects or enables a function, while a logic 0 disables a function.



ASCII Word Format
Figure 3

	CHARACTER SIGNIFICANCE	ASCII PRINT CHAR'S	FUNCTIONAL BIT CODING			
			WT 8	WT 4	WT 2	WT 1
	CR LF A1 A2 SD F1 F2 F3 F4 F5 F6 F7 F8 X		WORD 1 CHARACTER SEQUENCE			
CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A1 (1)
SD	SEQUENCE DESIGNATOR	0,1,2	NA	NA	NA	NA
F1	FREQUENCY- 10 MHz (BCD)	0,1,2	0	0	10 MHz (2)	10 MHz (1)
F2	FREQUENCY- 1 MHz (BCD)	0-9	1 MHz (8)	1 MHz (4)	1 MHz (2)	1 MHz (1)
F3	FREQUENCY- 100 kHz (BCD)	0-9	100 kHz (8)	100 kHz (4)	100 kHz (2)	100 kHz (1)
F4	FREQUENCY- 10 kHz (BCD)	0-9	10 kHz (8)	10 kHz (4)	10 kHz (2)	10 kHz (1)
F5	FREQUENCY- 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
F6	FREQUENCY- 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
F7	FREQUENCY- 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
F8	FREQUENCY- 1 Hz (BCD)	0-9	1 Hz (8)	1 Hz (4)	1 Hz (2)	1 Hz (1)
X	EXECUTE	X	NA	NA	NA	NA
	CR LF A1 A2 SD M1 M2 M3 M4 M5 M6 M7 M8 X		WORD 2 CHARACTER SEQUENCE			
CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	4,5,6	NA	NA	NA	NA
M1	RF GAIN CONTROL	0-9, A-F	0	0	0	RF GAIN (16)
M2	RF GAIN CONTROL	0-9, A-F	RF GAIN (8)	RF GAIN (4)	RF GAIN (2)	RF GAIN (1)
M3	BANDWIDTH FILTER ENABLES	0-9, A-F	FL E ENBL	FL D ENBL	FL C ENBL	FL B ENBL
M4	AGC TIME CONSTANTS (B2-A2)	0-9, A-F	B2 AGC (2)	B2 AGC (1)	A2 AGC (2)	A2 AGC (1)
M5	BW FILTER ENABLES, VBFO, AFC ENABLE	0-9, A-F	FL A ENBL	16 kHz ENBL	VBFO ENBL	AFC ENBL
M6	AGC TIME CONSTANTS (B1-A1)	0-9, A-F	B1 AGC (2)	B1 AGC (1)	A1 AGC (2)	A1 AGC (1)
M7	MODE SELECT ENABLES	0-9, A-F	NET DATA	AM	CW	ISB
M8	ISB CHANNEL ENABLES	0-9, A-F	B2	B1	A1	A2
X	EXECUTE	X	NA	NA	NA	NA
	CR LF A1 A2 SD V1 V2 V3 V4 V5 V6 V7 V8 X		WORD 3 CHARACTER SEQUENCE			
CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	8,9,A	NA	NA	NA	NA
V1	VBFO SIGN (0=+)	0,1	0	0	0	VBFO SIGN
V2	VBFO FREQUENCY, 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
V3	VBFO FREQUENCY, 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
V4	VBFO FREQUENCY, 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
V5	AUXILIARY	0-9,A-F	-	-	-	-
V6	AUXILIARY	0-9, A-F	-	-	-	-
V7	RESERVED	0	0	0	0	0
V8	AGC BUS	0-9, A-F	B2	B1	A1	A2
X	EXECUTE	X	NA	NA	NA	NA
	CR LF A1 A2 SD K1 X		WORD 4 CHARACTER SEQUENCE			
CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	C,D,E	NA	NA	NA	NA
K1	RESERVED	0	0	0	0	0
X	EXECUTE	X	NA	NA	NA	NA

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ASCII Character Control Word Format
Figure 4

	CHARACTER SIGNIFICANCE	ASCII PRINT CHAR'S	FUNCTIONAL BIT CODING			
			WT 8	WT 4	WT 2	WT 1

- - A1 A2 SD F1 F2 F3 F4 F5 F6 F7 F8 $ WORD 1 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	1	NA	NA	NA	NA
F1	FREQUENCY- 10 MHz (BCD)	0,1,2	0	0	10 MHz (2)	10 MHz (1)
F2	FREQUENCY- 1 MHz (BCD)	0-9	1 MHz (8)	1 MHz (4)	1 MHz (2)	1 MHz (1)
F3	FREQUENCY-100 kHz (BCD)	0-9	100 kHz (8)	100 kHz (4)	100 kHz (2)	100 kHz (1)
F4	FREQUENCY- 10 kHz (BCD)	0-9	10 kHz (8)	10 kHz (4)	10 kHz (2)	10 kHz (1)
F5	FREQUENCY- 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
F6	FREQUENCY-100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
F7	FREQUENCY- 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
F8	FREQUENCY- 1 kHz (BCD)	0-9	1 Hz (8)	1 Hz (4)	1 Hz (2)	1 Hz (1)
$	END DELIMETER	$	NA	NA	NA	NA

- - A1 A2 SD M1 M2 M3 M4 M5 M6 M7 M8 $ WORD 2 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	5	NA	NA	NA	NA
M1	RF GAIN CONTROL	0-9, A-F	0	0	0	RF GAIN (16)
M2	RF GAIN CONTROL	0-9, A-F	RF GAIN (8)	RF GAIN (4)	RF GAIN (2)	RF GAIN (1)
M3	BANDWIDTH FILTER ENABLES	0-9, A-F	FL E ENBL	FL D ENBL	FL C ENBL	FL B ENBL
M4	AGC TIME CONSTANTS (B2-A2)	0-9, A-F	B2 AGC (2)	B2 AGC (1)	A2 AGC (2)	A2 AGC (1)
M5	SW FILTER ENABLES, VBFO, AFC ENABLE	0-9, A-F	FL A ENBL	16 kHz ENBL	VBFO ENBL	AFC ENBL
M6	AGC TIME CONSTANTS (B1-A1)	0-9, A-F	B1 AGC (2)	B1 AGC (1)	A1 AGC (2)	A1 AGC (1)
M7	MODE SELECT ENABLES	0-9, A-F	NET DATA	AM	CW	ISB
M8	ISB CHANNEL ENABLES	0-9, A-F	B2	B1	A1	A2
$	END DELIMITER	$	NA	NA	NA	NA

- - A1 A2 SD V1 V2 V3 V4 V5 V6 V7 V8 $ WORD 3 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS. L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	9	NA	NA	NA	NA
V1	VBFO SIGN (0=+)	0 1	0	0	0	VBFO SIGN
V2	VBFO FREQUENCY, 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
V3	VBFO FREQUENCY, 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
V4	VBFO FREQUENCY, 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
V5	AUXILIARY	0	-	-	-	-
V6	AUXILIARY	0	-	-	-	-
V7	RESERVED	0	0	0	0	0
V8	AGC BUS	0-9, A-F	B2	B1	A1	A2
$	END DELIMITER	$	NA	NA	NA	NA

- - A1 A2 SD S1 S2 S3 S4 S5 S6 S7 S8 $ WORD 4 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	D	NA	NA	NA	NA
S1	FAULT SUMMARY	0-3	0	0	RCVR FAULT	RCVR OVLD
S2	AF MONITORS	0-9, A-F	B2	B1	A1	A2
S3	SYNTHESIZER FREQUENCY LOCK FAULTS	0-9, A-F	0	10 Hz	100 Hz	1 kHz
S4	SYNTH FREQ LOCK/SYNTH OUT LOCK/FREQ REF FAULTS	0-9, A-F	10 kHz	100 kHz	SYNTH OUT	FREQ REF
S5	SUBCARRIER LOCK/VBFO SYNTH/PWR SPLY FAULTS	0-7	0	SUBCARRIER	VBFO SYNTH	PWR SPLY
S6	IF AGC MONITORS	0-9, A-F	B2	B1	A1	A2
S7	EXT STD/AFC LOCK/RF PERF MONITORS	0-3	0	EXT STD	AFC LOCK	RF PERF
S8	PRESEL FAULT/DATA ERROR/LOCAL/MONITOR	0-9, A-F	PRESEL FAULT	DATA ERROR	LOCAL CONTROL	MONITOR
$	END DELIMITER	$	NA	NA	NA	NA

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ASCII Character Monitor Word Format
Figure 5

Table 3. Address Number, Binary Data Pattern, and Address Recognition Strapping.

ADDRESS THUMB-WHEEL NUMBER	TRANSMITTED BINARY ADDRESS DATA				RECEIVER STRAPPING REQUIRED FOR ADDRESS RECOGNITION			
	A4	A3	A2	A1	A4 (ADB4)	A3 (ADB3)	A2 (ADB2)	A1 (ADB1)
0	1	1	1	1	-	-	-	-
1	1	1	1	0	-	-	-	X
2	1	1	0	1	-	-	X	-
3	1	1	0	0	-	-	X	X
4	1	0	1	1	-	X	-	-
5	1	0	1	0	-	X	-	X
6	1	0	0	1	-	X	X	-
7	1	0	0	0	-	X	X	X
8	0	1	1	1	X	-	-	-
9	0	1	1	0	X	-	-	X
10	0	1	0	1	X	-	X	-
11	0	1	0	0	X	-	X	X
12	0	0	1	1	X	X	-	-
13	0	0	1	0	X	X	-	X
14	0	0	0	1	X	X	X	-
15	0	0	0	0	X	X	X	X

Note

- indicates no strapping, X indicates strapping to ground.

Table 4. Control and Monitor Word Sequence Designators.

SEQUENCE DESIGNATORS				SIGNIFICANCE
WORD 1	WORD 2	WORD 3	WORD 4	
0	4	8	C	Control word with request for status followup.
*1	5	9	D	Control word only -- no status followup desired.
**2	6	A	E	No command -- status followup only desired.

*Monitor words 1, 2, 3, and 4 contain sequence designators 1, 5, 9, or D respectively.

**These sequence designators are used to request monitor words 1, 2, 3, or 4 and must be followed immediately by the X (control word terminator), thereby bypassing the data characters in the control word structure.

Table 5. ASCII Character Codes.

4-BIT FUNCTION CODE				ASCII CHARACTER	ASCII CHARACTER 7-BIT CODE						
8 2^3	4 2^2	2 2^1	1 2^0		b_7	b_6	b_5	b_4	b_3	b_2	b_1
0	0	0	0	0	0	1	1	0	0	0	0
0	0	0	1	1	0	1	1	0	0	0	1
0	0	1	0	2	0	1	1	0	0	1	0
0	0	1	1	3	0	1	1	0	0	1	1
0	1	0	0	4	0	1	1	0	1	0	0
0	1	0	1	5	0	1	1	0	1	0	1
0	1	1	0	6	0	1	1	0	1	1	0
0	1	1	1	7	0	1	1	0	1	1	1
1	0	0	0	8	0	1	1	1	0	0	0
1	0	0	1	9	0	1	1	1	0	0	1
1	0	1	0	A	1	0	0	0	0	0	1
1	0	1	1	B	1	0	0	0	0	1	0
1	1	0	0	C	1	0	0	0	0	1	1
1	1	0	1	D	1	0	0	0	1	0	0
1	1	1	0	E	1	0	0	0	1	0	1
1	1	1	1	F	1	0	0	0	1	1	0
				*CR	0	0	0	1	1	0	1
				*LF	0	0	0	1	0	1	0
				*X	1	0	1	1	0	0	0
				*-	0	1	0	1	1	0	1
				*$	0	1	0	0	1	0	0

*Denotes special nonfunctional character

4.3.7.2.1 Control Word

In the following paragraphs the bit structure is shown for a typical control word. The control word is being sent to a receiver with an address of 15 and the sequence designator tells the receiver that this is a control word with a request for a status followup. The frequency the receiver will tune to is 27.548 300 MHz.

a. Word 1 (Frequency Control Word)

Note

The following characters are the same for all four control words so the format for these characters will only be shown for word 1:
Nonfunctional: # 1 (CR), #2 (LF), #3 (X)
Functional: #1 (A1), #2 (A2)

Nonfunctional character #1 — Set bits for carriage return (CR).

NONFUNCTIONAL CHARACTER #1						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
0	0	0	1	1	0	1

Nonfunctional character #2 — Set bits for line feed (FL).

NONFUNCTIONAL CHARACTER #2						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
0	0	0	1	0	1	0

Functional character #1 — Set bits to select MSD of address.

FUNCTIONAL CHARACTER #1			
8	4	2	1
0	0	A1	A1

WILL ACCEPT
0-3

EXAMPLE
1
0 0 0 1

Functional character #2 — Set bits to select LSD of address.

FUNCTIONAL CHARACTER #2			
8	4	2	1
A2	A2	A2	A2

WILL ACCEPT
0-9

EXAMPLE
5
0 1 0 1

Functional character #3 — Set bits for 0 to select sequence designator.

FUNCTIONAL CHARACTER #3			
8	4	2	1
NA	NA	NA	NA

WILL ACCEPT
0, 1, 2

EXAMPLE
1
0 0 0 0

Functional character #4 — Set bits to select 10-MHz frequency.

FUNCTIONAL CHARACTER #4			
8	4	2	1
0	0	10 MHz	10 MHz

WILL ACCEPT
0, 1, 2

EXAMPLE			
2			
0	0	1	0

Functional character #5 — Set bits to select 1-MHz frequency.

FUNCTIONAL CHARACTER #5			
8	4	2	1
1 MHz	1 MHz	1 MHz	1 MHz

WILL ACCEPT
0-9

EXAMPLE			
7			
0	1	1	1

Functional character #6 — Set bits to select 100-kHz frequency.

FUNCTIONAL CHARACTER #6			
8	4	2	1
100 kHz	100 kHz	100 kHz	100 kHz

WILL ACCEPT
0-9

EXAMPLE			
5			
0	1	0	1

Functional character #7 — Set bits to select 10-kHz frequency.

FUNCTIONAL CHARACTER #7			
8	4	2	1
10 kHz	10 kHz	10 kHz	10 kHz

WILL ACCEPT
0-9

EXAMPLE			
4			
0	1	0	0

Functional character #8 — Set bits to select 1-kHz frequency.

FUNCTIONAL CHARACTER #8			
8	4	2	1
1 kHz	1 kHz	1 kHz	1 kHz

WILL ACCEPT
0-9

EXAMPLE			
8			
1	0	0	0

Functional character #9 — Set bits to select 100-Hz frequency.

FUNCTIONAL CHARACTER #9			
8	4	2	1
100 Hz	100 Hz	100 Hz	100 Hz

WILL ACCEPT
0-9

EXAMPLE			
3			
0	0	1	1

Functional character #10 — Set bits to select 10-Hz frequency. (Only used with receiver that can be tuned to 10 Hz or 1 Hz. Set to zeros for 100-Hz tuning.)

FUNCTIONAL CHARACTER #10			
8	4	2	1
10 Hz	10 Hz	10 Hz	10 Hz

WILL ACCEPT
0-9

EXAMPLE			
0			
0	0	0	0

Functional character #11 — Set bits to select 1-Hz frequency. (Only used with receiver that can be tuned to 1 Hz. Set to zeros for 10-Hz and 100-Hz tuning.)

FUNCTIONAL CHARACTER #11					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	0
1 Hz	1 Hz	1 Hz	1 Hz		0-9		0 0 0 0

Nonfunctional character #3 — Set bits for execute (X).

NONFUNCTIONAL CHARACTER #3						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
1	0	1	1	0	0	0

b. Word 2 (Mode Control Word)

Functional character #3 — Set bits to 4 to select sequence designator.

FUNCTIONAL CHARACTER #3					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	4
NA	NA	NA	NA		4, 5, 6		0 1 0 0

Word 2 functional characters #4 and #5 provide approximately 3-dB gain reduction per step. All zeros code indicates maximum gain (no gain reduction), all ones code indicates minimum gain (maximum gain reduction, approximately 93 dB). From a remote control unit, the least significant bit, rf gain (1), is not controllable and is always zero. Therefore, only up to 16-bit wts (0 through 30, even numbered wts only) are available with approximately 6-dB gain reduction per step (maximum gain reduction, approximately 90 dB).

Functional character #4 — Set bit to enable rf gain bit wt 16 (example: bit wt 16)

FUNCTIONAL CHARACTER #4					WILL		EXAMPLE
8	4	2	RF GAIN 1	--	ACCEPT	---	1
0	0	0	(16)		0, 1		0 0 0 1

Functional character #5 — Set bits to enable rf gain bit wts 8, 4, 2, 1 (example: bit wt 13). When combined with functional character #4, provides up to 32-bit wts (0 through 31) rf gain control.

FUNCTION CHARACTER #5					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	D
RF GAIN (8)	RF GAIN (4)	RF GAIN (2)	RF GAIN (1)		0-9, A-F		1 1 0 1

Word 2 functional characters #6 and part of #8 (filter enables) are associated with AM, CW, and FM modes. The FL 16 bit in character #8 is a standard 16-kHz bandwidth filter; FL A through FL E are optional bandwidth filters (selected to suit specific requirements). Only one of the bandwidth filters should be enabled at any one time.

Functional character #6 — Set bits to enable filter B, C, D, or E (example: FL E enabled).

FUNCTIONAL CHARACTER #6					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	8
FLE EN	FLD EN	FLC EN	FLB EN		0, 1, 2, 4, 8		1 0 0 0

Functional character #7 — Set bits to set AGC decay times of channels A2 and B2. Bits wts 1 and 2 correspond to channel A2 bcd wts 1 and 2. Bit wts 4 and 8 correspond to channel B2 bcd wts 1 and 2. AGC set as follows:

bcd wt 0 = AGC DECAY FAST or DATA
1 = AGC DECAY SLOW or VOICE
2 = AGC DECAY MED or FAX
3 = AGC DECAY OFF

(example: channel A2 AGC off, channel B2 AGC slow).

FUNCTIONAL CHARACTER #7					WILL		EXAMPLE
CH B2 8	CH B2 4	CH A2 2	CH A2 1	--	ACCEPT	---	7
AGC	AGC	AGC	AGC		0-9, A-F		0 1 1 1

Functional character #8 — Set bits to enable filter A or 16, vbfo, and AFC (example: FL A, vbfo, and AFC are enabled).

FUNCTIONAL CHARACTER #8					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	B
FLA EN	FL16 EN	VBFO EN	AFC EN		0-9, A, B		1 0 1 1

Functional character #9 — Set bits to set AGC decay times of channels A1 and B1. Bit wts 1 and 2 correspond to channel A1 bcd wts 1 and 2. Bits wts 4 and 8 correspond to channel B1 bcd wts 1 and 2. AGC set as shown for character #7 (example: channel A1 AGC fast, channel B1 AGC med).

FUNCTIONAL CHARACTER #9					WILL		EXAMPLE
CH B1 8	CH B1 4	CH A1 2	CH A1 1	--	ACCEPT	---	8
AGC	AGC	AGC	AGC		0-9, A-F		1 0 0 0

Functional character #10 — Set bits to select MODE (example: ISB mode enabled).

FUNCTIONAL CHARACTER #10					WILL		EXAMPLE
NET 8	4	2	1	--	ACCEPT	---	1
DATA EN	AM EN	CW EN	ISB EN		1, 2, 4, 8		0 0 0 1

Functional character #11 — Set bits to select ISB channel. Mode must be ISB or NET DATA (example: channels B2, A1 enabled).

FUNCTIONAL CHARACTER #11					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	A
B2 EN	B1 EN	A1 EN	A2 EN		0-9, A-F		1 0 1 0

c. Word 3 (VBFO Control Word)

Functional character #3 — Set bits to 8 to select sequence designator.

FUNCTIONAL CHARACTER #3					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	8
NA	NA	NA	NA		8, 9, A		1 0 0 0

Functional characters #4 through #7 set vbfo offset frequency (example: +4500 Hz).

Functional character #4 — Set bit to set vbfo offset sign (0 = +, 1 = -, example: +)

FUNCTIONAL CHARACTER #4					WILL		EXAMPLE
8	4	2	VBFO 1	--	ACCEPT	---	0
0	0	0	SIGN		0, 1		0 0 0 0

Functional character #5 — Set bits to set vbfo offset 1 kHz (example: 4 kHz).

FUNCTIONAL CHARACTER #5					WILL		EXAMPLE
VBFO 8	VBFO 4	VBFO 2	VBFO 1	--	ACCEPT	---	4
1 kHz	1 kHz	1 kHz	1 kHz		0-9		0 1 0 0

Functional character #6 — Set bits to set vbfo offset 100 Hz (example: 500 Hz).

FUNCTIONAL CHARACTER #6					WILL		EXAMPLE
VBFO 8	VBFO 4	VBFO 2	VBFO 1	--	ACCEPT	---	5
100 Hz	100 Hz	100 Hz	100 Hz		0-9		0 1 0 1

Functional character #7 — Set bits to set vbfo offset 100 Hz (example: 00 Hz).

FUNCTIONAL CHARACTER #7					WILL		EXAMPLE
VBFO 8	VBFO 4	VBFO 2	VBFO 1	--	ACCEPT	---	0
10 Hz	10 Hz	10 Hz	10 Hz		0-9		0 0 0 0

Functional characters #8 through #10 are not used and the bits are set to zero.

Functional character #11 — Set bits to enable AGC common bus line (example: channels A1 and B1 connected to bus line, channels A2 and B2 are not).

FUNCTIONAL CHARACTER #11							
B2	8	B1	4	A1	2	A2	1
AGC BUS		AGC BUS		AGC BUS		AGC BUS	

WILL
ACCEPT
0-9, A-F

EXAMPLE			
6			
0	1	1	0

d. Word 4 (Key Control Word)

Contains only four functional characters. Functional characters #1 and #2 are identical to words 1, 2, and 3 as explained above.

Functional character #3 — Set bits to C to select sequence designator.

FUNCTIONAL CHARACTER #3							
	8		4		2		1
NA		NA		NA		NA	

WILL
ACCEPT
C, D, E

EXAMPLE			
C			
1	1	0	0

Functional character #4 contains no functional data and the bits are set to zero.

4.3.7.2.2 Monitor Word

In the following paragraphs the bit structure that differs from that of the control word is shown. The bit structure that is the same for the control and monitor words is noted. The address characters (functional characters #1 and #2) are the same as for the control word and will not be repeated here.

a. Word 1 (Frequency Monitor Word)

Note

The following characters are the same for all four monitor words so the format for these characters will only be shown for word 1:
Nonfunctional: #1 (-), #2 (-), #3 ($)

Nonfunctional character #1 — Set bits for hyphen (-).

NONFUNCTIONAL CHARACTER #1						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
0	1	0	1	1	0	1

Nonfunctional character #2 — Set bits for hyphen (-).

NONFUNCTIONAL CHARACTER #2						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
0	1	0	1	1	0	1

Functional character #3 — Set bits for 1 to select sequence designator.

FUNCTIONAL CHARACTER #3			
8	4	2	1
NA	NA	NA	NA

WILL ACCEPT
1

EXAMPLE			
1			
0	0	0	1

Functional characters #4 through #11 same as for control word 1 (paragraph 4.3.7.2.1.a).

Nonfunctional character #3 — Set bits for dollar sign ($)

NONFUNCTIONAL CHARACTER #3						
b^7	b^6	b^5	b^4	b^3	b^2	b^1
0	1	0	0	1	0	0

b. Word 2 (Mode Monitor Word)

Functional character #3 — Set bits for 5 to select sequence designator.

FUNCTIONAL CHARACTER #3			
8	4	2	1
NA	NA	NA	NA

WILL ACCEPT
5

EXAMPLE			
5			
0	1	0	1

Functional characters #4 through #11 same as for control word 2 (paragraph 4.3.7.2.1.b).

c. Word 3 (VBFO Monitor Word)

Functional character #3 — Set bits for 9 to select sequence designator.

FUNCTIONAL CHARACTER #3			
8	4	2	1
NA	NA	NA	NA

WILL ACCEPT
9

EXAMPLE			
9			
1	0	0	1

Functional characters #4 through #11 same as for control word 3 (paragraph 4.3.7.2.1.c).

d. Word 4 (Performance and Fault Monitor Word)

Word 4 contains performance monitor and fault information that can be used in a processor-controlled system to detect faults in the receiver or units controlled by the receiver, or to detect unsatisfactory performance in the receive signal path.

Functional character #3 — Set bits for D to select sequence designator.

FUNCTIONAL CHARACTER #3					WILL		EXAMPLE
8	4	2	1	--	ACCEPT	---	D
NA	NA	NA	NA		D		1 1 0 1

Functional character #4 — Receiver fault and receive overload monitor, logic 1 indicates fault/overload (example: receiver fault, no receive overload).

FUNCTIONAL CHARACTER #4					WILL		EXAMPLE
8	4	RECEIVER 2	RECEIVE 1	--	ACCEPT	---	2
0	0	FAULT	OVERLOAD		0-3		0 0 1 0

Functional character #5 — Af monitors, logic 0 indicates line audio output exceeds -6 dB of nominal AGC controlled output level (example: all channels have audio output within monitor range).

FUNCTIONAL CHARACTER #5					WILL		EXAMPLE
B2 8	B1 4	A1 2	A2 1	--	ACCEPT	---	0
AF MON	AF MON	AF MON	AF MON		0-9, A-F		0 0 0 0

Functional character #6 — Synthesizer 10-Hz, 100-Hz, and 1-kHz loss-of-lock faults, logic 1 indicates out of lock (example: all signals locked).

FUNCTIONAL CHARACTER #6					WILL		EXAMPLE
8	10-Hz 4	100-Hz 2	1-kHz 1	--	ACCEPT	---	0
0	LOCK FAULT	LOCK FAULT	LOCK FAULT		0-7		0 0 0 0

Functional character #7 — Synthesizer 10-kHz, 100-kHz, and output (1-MHz and 10-MHz) loss-of-lock faults and synthesizer reference faults (9.9-MHz, 118-MHz, or 450-kHz injection levels insufficient), logic 1 indicates out of lock/fault (example: 10-kHz and 100-kHz unlocked, output locked and injection levels sufficient).

FUNCTIONAL CHARACTER #7					WILL		EXAMPLE
10-kHz 8	100-kHz 4	SYNTH 2	SYNTH 1	--	ACCEPT	---	C
LOCK FAULT	LOCK FAULT	OUTPUT LOCK FAULT	REF LOCK FAULT		0-9, A-F		1 1 0 0

Functional character #8 — Synthesizer subcarrier and vbfo synthesizer loss-of-lock faults, logic 1 indicates out of lock for either subcarrier injection phase-lock loop and for vbfo synthesizer phase-lock loop. Receiver power supply fault, logic 1 indicates loss of any of the power supply voltages except +5 V dc. Loss of +5 V dc power voltage will cause a logic 0 to be presented regardless of the state of the other power supply voltages (example: synthesizer subcarrier unlocked, vbfo synthesizer locked, receiver power supply fault).

FUNCTIONAL CHARACTER #8				WILL ACCEPT	EXAMPLE
8	4	2	1	0-7	5
0	SYNTH SUBCAR LOCK FAULT	VBFO SYNTH LOCK FAULT	RECEIVER PWR SPL FAULT		0 1 0 1

Functional character #9 — If AGC monitors, logic 0 indicates signal level NLT 20 dB above AGC threshold (example: B1 signal level low, all others NLT 20 dB above AGC threshold).

FUNCTIONAL CHARACTER #9				WILL ACCEPT	EXAMPLE
8	4	2	1	0-9, A-F	4
B2 AGC MON	B1 AGC MON	A1 AGC MON	A2 AGC MON		0 1 0 0

Functional character #10 — External standard, logic 1 when operating using an external frequency standard reference; AFC lock monitor, logic 1 when AFC is enabled and has acquired lock with an input signal; rf performance monitor, logic 0 when if output of channel A1 if amplifier exceeds 0.5 V rms (corresponds to 100-mV rms receiver input signal) (example: using an external frequency standard, AFC not enabled, no rf signal input).

FUNCTIONAL CHARACTER #10				WILL ACCEPT	EXAMPLE
8	4	2	1	0-7	4
0	EXT STD	AFC LOCK MON	RF PERF MON		0 1 0 0

Functional character #11 — Preselector fault, logic 1 indicates fault; data error, logic 1 if any of the following errors exist — received character parity, framing error, overrun error, invalid character sequence; local control, logic 1 when CONT switch is LCL or MON position; monitor, logic 1 when CONT switch in MON position (example: no preselector fault, no data error, CONT switch in LCL position).

FUNCTIONAL CHARACTER #11				WILL ACCEPT	EXAMPLE
8	4	2	1	0-9, A-F	2
PRESEL FAULT	DATA ERROR	LOCAL CONTROL	MONITOR		0 0 1 0

4.3.7.3 8-Bit Word Format

The control and monitor data word formats are identical with one exception; control word 4 uses only the first two characters of the five characters shown in figure 6. Monitor word 4 contains all five characters. Status request is accomplished by sending only the first two characters of the desired word.

4.3.7.4 8-Bit Character Format

The first character of each word is organized the same; it uses bits b8 and b7 for word synchronization, bits b6 and b5 for word identification, and bits b4 through b1 for unit identification. As many as 16 units can be addressed on one control and monitor bus, using all combinations of the 4-bit addresses. The address of each unit is established by strapping the proper pins to ground in the mating connector for J14. Refer to the installation section. Bits b8 and b7 of the second character in each control word determine whether the control word sent from the control is new control information or a status request only. Bits b8 and b7 of the second character in each monitor word are always the same; bit b8 is always logic 0 and bit b7 is always logic 1.

The following paragraphs give the bit structure that is used for each of the four control words.

a. Word 1 (Frequency Control Word)

Character 1 — Set bits as indicated in figure 6.

Character 2 — Set b8 and b7 as indicated in note 1 of figure 6.

Remainder of word 1 — Set pattern to correspond to bcd frequency information to be transmitted to the controlled receiver (logic 1 enable, logic 0 disable).

b. Word 2 (Mode Control Word)

Character 1 — Set bits as indicated in figure 6.

Character 2 — Set b8 and b7 as indicated in note 1 of figure 6.

Remainder of character 2, set b5 through b1 for rf gain reduction steps, bcd 1 through 31. Because the LSB (b1) is always logic 0 in the remote control unit, 15 steps of gain reduction (approximately 6 dB per step) are available for a total gain reduction of 90 dB.

Character 3 — Set one bit only of b8 through b5 (and character 4, b8 and b7) to logic 1 to select filter.

Bits b4 through b1 are set as follows to select AGC decay time.

CHANNEL B2		CHANNEL A2		AGC
b4	b3	b2	b1	
1	1	1	1	OFF
1	0	1	0	SLOW
0	1	0	1	FAST
0	0	0	0	MED

Character 4 — Set one bit only of b8 and b7 (and character 3, b8 through b5) to logic 1 to select filter. Set b6 and b5 to logic 1 to enable function. Set b4 through b1 as outlined for character 3 b4 through b1. (Selects AGC decay time for channels B1 and A1.)

Character 5 — Set appropriate bit to logic 1 to enable desired function, logic 0 to disable function.

Note

For AM and CW mode, a filter (character 3, b8 through b5 or character 4 b8 or b7) must be selected. Know the complement of filters in the receiver being controlled. For ISB and NET DATA mode, one or more channels (B2, B1, A1, A2) must be enabled.

c. Word 3 (VBFO Control Word)

Character 1 — Set bits as indicated in figure 6.

Character 2 — Set b8 and b7 as indicated in note 1 of figure 6.

Remainder of character 2, set b5 to logic 0 if vbfo offset is positive, logic 1 if negative. Set b4 through b1 to bcd code of desired vbfo 1-kHz frequency digit.

Character 3 — Set b8 through b1 to bcd code of desired 100-Hz and 10-Hz vbfo frequency digits.

Character 4 — Not used.

<table>
<tr><th rowspan="2">WORD</th><th rowspan="2">CHARACTER</th><th rowspan="2">STOP BIT</th><th rowspan="2">PARITY BIT</th><th colspan="8">CHARACTER BIT POSITION</th><th rowspan="2">START BIT</th><th rowspan="2"></th></tr>
<tr><th>B8</th><th>B7</th><th>B6</th><th>B5</th><th>B4</th><th>B3</th><th>B2</th><th>B1</th></tr>
<tr><td rowspan="10">1</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">WORD SYNC</td><td colspan="2">SUBADDRESS</td><td colspan="4">ADDRESS</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">CMD/STATUS RQST</td><td colspan="2">FREQ (10 MHz)</td><td colspan="4">FREQ (1 MHz)</td><td rowspan="2">0</td><td rowspan="2">①</td></tr>
<tr><td>$\overline{C}$=0</td><td>$\overline{S}$=1</td><td>(2)</td><td>(1)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">FREQ (100 kHz)</td><td colspan="4">FREQ (10 kHz)</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">FREQ (1 kHz)</td><td colspan="4">FREQ (100 Hz)</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">FREQ (10 Hz)</td><td colspan="4">FREQ (1 Hz)</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="10">2</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">WORD SYNC</td><td colspan="2">SUBADDRESS</td><td colspan="4">ADDRESS</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">CMD/STATUS RQST</td><td colspan="6">RF GAIN CONTROL</td><td rowspan="2">0</td><td rowspan="2">①②</td></tr>
<tr><td>$\overline{C}$=0</td><td>$\overline{S}$=1</td><td>0</td><td>(16)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">FILTER SELECT</td><td colspan="2">CHAN B2 AGC</td><td colspan="2">CHAN A2 AGC</td><td rowspan="2">0</td><td rowspan="4">③</td></tr>
<tr><td>FLE</td><td>FLD</td><td>FLC</td><td>FLB</td><td>(2)</td><td>(1)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">FILTER SELECT</td><td>VBFO</td><td>AFC</td><td colspan="2">CHAN B1 AGC</td><td colspan="2">CHAN A1 AGC</td><td rowspan="2">0</td></tr>
<tr><td>FLA</td><td>16 kHz</td><td>ENABLE</td><td>ENABLE</td><td>(2)</td><td>(1)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">MODE SELECT</td><td rowspan="2">CHAN B2 ENABLE</td><td rowspan="2">CHAN B1 ENABLE</td><td rowspan="2">CHAN A1 ENABLE</td><td rowspan="2">CHAN A2 ENABLE</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>NET DATA</td><td>AM</td><td>CW</td><td>ISB</td></tr>
<tr><td rowspan="10">3</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">WORD SYNC</td><td colspan="2">SUBADDRESS</td><td colspan="4">ADDRESS</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">CMD/STATUS RQST</td><td rowspan="2">0</td><td rowspan="2">VBFO SIGN</td><td colspan="4">VBFO OFFSET FREQ (1 kHz)</td><td rowspan="2">0</td><td rowspan="2">①</td></tr>
<tr><td>$\overline{C}$=0</td><td>$\overline{S}$=1</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">VBFO OFFSET FREQ (100 Hz)</td><td colspan="4">VBFO OFFSET FREQ (10 Hz)</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td><td>(8)</td><td>(4)</td><td>(2)</td><td>(1)</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="8">AUXILIARY</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="4">RESERVED</td><td rowspan="2">CHAN B2 AGC BUS</td><td rowspan="2">CHAN B1 AGC BUS</td><td rowspan="2">CHAN A1 AGC BUS</td><td rowspan="2">CHAN A2 AGC BUS</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="7">4</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">WORD SYNC</td><td colspan="2">SUBADDRESS</td><td colspan="4">ADDRESS</td><td rowspan="2">0</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>A4</td><td>A3</td><td>A2</td><td>A1</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">X</td><td colspan="2">CMD/STATUS RQST</td><td rowspan="2">RECEIVER FAULT</td><td rowspan="2">RECEIVE OVERLOAD</td><td rowspan="2">B2 AF MON</td><td rowspan="2">B1 AF MON</td><td rowspan="2">A1 AF MON</td><td rowspan="2">A2 AF MON</td><td rowspan="2">0</td><td rowspan="2">①④</td></tr>
<tr><td>$\overline{C}$=0</td><td>$\overline{S}$=1</td></tr>
<tr><td>3</td><td>1</td><td>X</td><td>0</td><td>10 Hz LOCK FAULT</td><td>100 Hz LOCK FAULT</td><td>1 kHz LOCK FAULT</td><td>10 kHz LOCK FAULT</td><td>100 kHz LOCK FAULT</td><td>SYN OUT LOCK FAULT</td><td>FREQ REF FAULT</td><td>0</td><td rowspan="3">⑤</td></tr>
<tr><td>4</td><td>1</td><td>X</td><td>0</td><td>SUBCARR LOCK FAULT</td><td>VBFO SYNTH FAULT</td><td>RECEIVER PWR SPLY FAULT</td><td>B2 AGC MON</td><td>B1 AGC MON</td><td>A1 AGC MON</td><td>A2 AGC MON</td><td>0</td></tr>
<tr><td>5</td><td>1</td><td>X</td><td>0</td><td>EXTERNAL STANDARD</td><td>AFC LOCK MON</td><td>RF PERF MON</td><td>PRE-SELECTOR FAULT</td><td>DATA ERROR</td><td>LOCAL CONTROL</td><td>MONITOR</td><td>0</td></tr>
</table>

NOTES:

① THE COMMAND (C) AND STATUS (S) REQUEST BITS ARE CODED AS FOLLOWS:

B8	B7	
C	S	SIGNFICANCE
0	0	COMMAND WORD WITH STATUS REQUEST
0	1	COMMAND WORD ONLY-NO STATUS DESIRED
1	0	STATUS REQUEST ONLY (2 CHARACTER SEQUENCE)
1	1	THIS COMBINATION NOT ALLOWED

② RF GAIN CONTROL IS FIVE BITS BINARY CODED, APPROXIMATELY 3-dB GAIN REDUCTION PER STEP (PROCESSOR CONTROL APPLICATIONS) OR FOUR BITS (LEAST SIGNIFICANT BIT SET TO ZERO), APPROXIMATELY 6-dB GAIN REDUCTION PER STEP (CONTROL UNIT APPLICATIONS). ALL "ZERO" CODE INDICATES NO GAIN REDUCTION, PROGRESSING IN BINARY STEPS TO THE ALL "ONES" CODE FOR MAXIMUM GAIN REDUCTION.

③ FILTER BANDWIDTH DESIGNATIONS ARE DEFINED AS FOLLOWS:

16 -- FL1
A -- FL3
B -- FL4
C -- FL5
D -- FL6
E -- FL7

④ WORD 4 COMMAND OR STATUS REQUEST IS ONLY TWO CHARACTERS LONG.

⑤ CHARACTERS 3, 4, AND 5 OF MONITOR WORD 4 CONTAIN FAULT AND PERFORMANCE MONITOR BITS FOR WHICH NO CORRESPONDING CONTROL BITS EXIST. THE "DATA ERROR" BIT IS THE LOGICAL SUM OF THE FOLLOWING CONDITIONS:

A. RECEIVED CHARACTER PARITY ERROR.
B. FRAMING ERROR (NO VALID STOP RECEIVED WITH THE CHARACTER).
C. OVERRUN ERROR (PREVIOUS CHARACTER WAS NOT PROCESSED BEFORE THE CURRENT CHARACTER WAS RECEIVED).
D. INVALID CHARACTER SEQUENCE.

⑥ 1 = LOGIC 1
0 = LOGIC 0
X = FUNCTION OF STRAPPING
(1) = BIT WEIGHT

TPA-2581-014

8-Bit Character Control and Monitor Word Format
Figure 6

Character 5 — b8 through b5 not used. Set b4 through b1 to logic 1 to connect appropriate channels to AGC bus line.

d. Word 4 (Key Control and Monitor Word)

Character 1 — Set bits as indicated in figure 6.

Character 2 — Set b8 and b7 as indicated in note 1 of figure 6.

Remainder of word 4 — Status information only as follows. (Information sent to control station from receiver for monitoring purposes.)

4.3.7.5 Performance Monitor and Fault Information

Word 4 contains performance monitor and fault information that can be used in a processor-controlled system to detect faults in the receiver or units controlled by the receiver, or detect unsatisfactory performance in the receive signal path.

a. Fault Monitors

Receiver fault (character 2, b6) — Logic 1 fault summary of synthesizer lock fault and power supply fault. Latches on power supply fault to indicate short term power failures. Requires control sending frequency command (word 1) to reset to logic 0.

Receive overload (character 2, b5) — Logic 1 when receive rf overload exists in receiver or preselector, logic 0 if no receive rf overload.

10-Hz lock fault (character 3, b7) — Logic when 10-Hz decade phase-lock loop is unlocked, logic 0 if locked.

100-Hz lock fault (character 3, b6) — Logic 1 when 100-Hz decade phase-lock loop is unlocked, logic 0 if locked.

1-kHz lock fault (character 3, b5) — Logic 1 when 1-kHz decade phase-lock loop is unlocked, logic 0 if locked.

10-kHz lock fault (character 3, b4) — Logic 1 when 10-kHz decade phase-lock loop is unlocked, logic 0 if locked.

100-kHz lock fault (character 3, b3) — Logic 1 when 100-kHz decade phase-lock loop is unlocked, logic 0 if locked.

Synthesizer output lock fault (character 3, b2) — Logic 1 when 10/1-MHz phase-lock loop is unlocked, logic 0 if locked.

Frequency reference fault (character 3, b1) — Logic 1 when any synthesizer reference injection output (9.9 MHz, 118 MHz, or 450 kHz) is insufficient, logic 0 if all are satisfactory.

Subcarrier lock fault (character 4, b7) — Logic 1 when either subcarrier phase-lock loop is unlocked, logic 0 if both are locked.

Vbfo synthesizer fault (character 4, b6) — Logic 1 when vbfo phase-lock loop is unlocked, logic 0 if locked.

Receiver power supply fault (character 4, b5) — Logic 1 if any power supply voltage (except +5 V dc) fails, logic 0 if all power supply voltages are okay or +5 V dc supply fails.

Preselector fault (character 5, b4) — Logic 1 if receiver receives preselector fault indication from associated preselector, logic 0 if no fault.

Data error (character 5, b3) — Logic 1 when data error occurs in receiving control information since last monitor data response, logic 0 if no data error. Reset when any monitor word is transmitted from receiver.

b. Performance Monitors

Logic 0 signal from the rf performance monitor indicates presence of signal.

Channel B2 af monitor (character 2, b4), channel B1 af monitor (character 2, b3), channel A1 af monitor (character 2, b2) channel A2 af monitor (character 2, b1) — Logic 0 when receive audio out exceeds a level that is 6 dB below nominal AGC controlled output level, logic 1 if less than 6 dB below nominal AGC controlled output level.

Channel B2 AGC monitor (character 4, b4), channel B1 AGC monitor (character 4, b3), channel A1 AGC monitor (character 4, b2), channel A2 AGC monitor (character 4, b1) — Logic 0 when received signal is 20 dB or more above AGC threshold, logic 1 if less than 20 dB above AGC threshold.

External standard (character 5, b7) — Logic 1 when external standard is being used, logic 0 when internal standard is being used (logic level not defined when internal/external switchover module is not used).

AFC lock monitor (character 5, b6) — Logic 1 when AFC is on and locked on frequency, logic 0 when AFC is unlocked.

RF performance monitor (character 5, b5) — Logic 0 when signal level at channel A1 if input exceeds 0.5 V rms (equivalent to 100-mV rms input signal), logic 1 when signal is less than this.

Local control (character 5, b2) — Logic 1 when receiver is in local control mode, logic 0 when in remote.

Monitor (character 5, b1) — Logic 1 when receiver front-panel control switch is pressed to MON position. Can be used, for example, for operator to store front panel settings in preset table in the processor.

HF-8054( )
Receiver

Rockwell
International

theory

Collins Telecommunications Products Division

Printed in USA

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1 January 1981

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Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
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theory

1. GENERAL

This section provides functional theory of the HF-8054( ) Receiver to the circuit card/module level. Theory for individual circuit cards/modules is presented in the applicable circuit card/module section of this instruction book.

The HF-8054( ) Receiver controls and monitors are located on the front panel (refer to figure 1). The HF-8054 Receiver is locally controlled only, and does not have parallel input A11, parallel output A12, or serial interface A13. Note also that in the HF-8054 the CONT switch must be kept in the LCL position. The HF-8054A Receiver is locally or remotely controlled depending on the setting of the CONT switch. When the CONT switch is in the REM position, the HF-8054A Receiver is controlled by the HF-8094 Receiver Control, a processor, or other compatible control through REMOTE connector J14 on the rear panel of the HF-8054A Receiver.

2. FUNCTIONAL THEORY

The HF-8054( ) Receiver is frequency-controlled directly from the front panel. Bcd frequency signals from the front panel applied directly to the frequency synthesizer A16 through A23 and to the control A10. The bcd frequency signals applied are used to establish the frequency of the vfo output (109.35 to 79.350 01 MHz) from the synthesizer and to control the band-switch output from the control card.

The HF-8054( ) Receiver is operating mode-controlled directly from the front panel. Mode signals from the front panel are applied directly to receive audio card and receive if card (refer to table 1 for af/if cards versus channels). These signals control all mode switching. Placing the MODE switch in CW or AM position enables the BANDWIDTH switch and requires an if filter to be selected. Operation in CW and AM mode is only through channel A1 and the selected filter. In AM or CW mode, if no filter A8A2 is instal-

Table 1. IF and AF Channel Selection.

SWITCHES		FILTER USED	IF CHANNEL USED (CARD)	AF CHANNEL USED (CARD)
MODE	BANDWIDTH			
AM or CW	16	A8 PAD	A1 (A8)	A1 (A25)
	A	A8A2FL3		
	B	A8A2FL4		
	C	A8A2FL5		
	D	A8A2FL6		
	E	A8A2FL7		
ISB or NET DATA	*A1	A8FL1	A1 (A8)	A1 (A25)
	*B1	A7FL1	B1 (A7)	B1 (A25)
	*A2	A6FL1	A2 (A6)	A2 (A26)
	*B2	A5FL1	B2 (A5)	B2 (A26)

*BANDWIDTH switch not enabled, bandwidth selected by channel enable switch(es) set to ON. If channel enable switch not set ON, channel not used.

led, BANDWIDTH control must be set to 16. If filter A8A2 is installed, position 16 selects 16-kHz pad on channel A1 if A8, and positions A, B, C, D, and E select optional filters mounted on filter A8A2. When MODE switch is in ISB or NET DATA position, any/all channels (A1, B1, A2, B2) can be enabled by setting the applicable enable switch(es) to the ON position. When enabled, the selected channel(s) use the associated if/af circuits indicated in table 1.

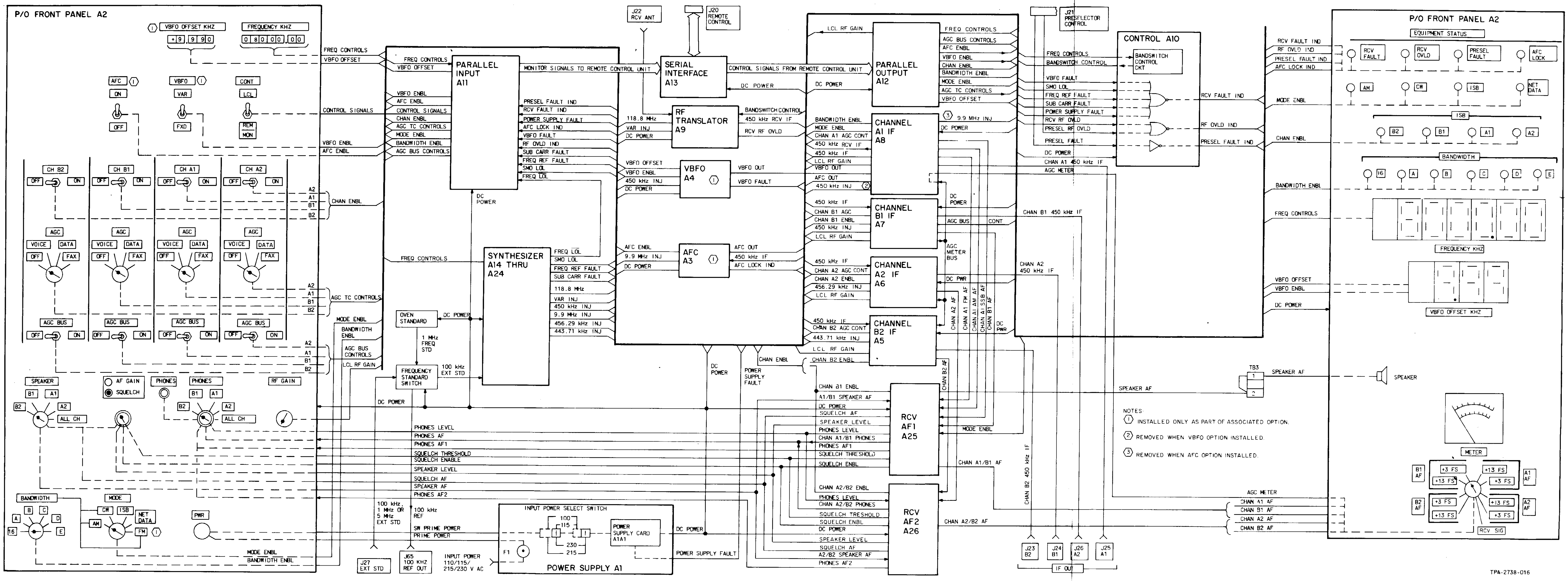
The HF-8054A Receiver receives rf signals at the RF IN jack. These signals are supplied to rf translator module A9 where they are mixed with the vfo injection signal and a fixed 118.8-MHz injection signal to supply a 9.45-MHz receive if signal to channel A if A8. In the channel A1 if card, the signal is mixed with a fixed 9.9-MHz injection signal to produce a final if of 450 kHz. This signal is filtered and detected on the applicable if card and the resulting audio signal is supplied to receive audio A25/A26. The receive audio is amplified and supplied to the speaker, phones, and receive audio line outputs.

In the ISB mode, the 450-kHz IF USB signal is supplied to the channel A1 if circuits, the 450-kHz if LSB signal is supplied to the channel B1 if circuits, the 450-kHz if UUSB signal is supplied to the channel A2 if circuit, and the 450-kHz if LLSB signal is supplied to the channel B2 if circuit. The detected USB/LSB audio signals are supplied to the receive audio A25 and the detected UUSB/LLSB audio signals are supplied to the receive audio A26. Receive audio A25/A26 provides separate phones, receive line audio outputs, and separate audio inputs to the speaker amplifier.

In the AM or CW mode, the 450-kHz if signal (USB) is supplied to the channel A1 if circuit. It is filtered by a selectable bandwidth filter and detected. The detected AM/CW signal is supplied to receive audio A25.

When set to CW and with the VBFO option installed, an offset tone can be provided for A1 CW operation by setting the VBFO switch to VAR. The tone is variable up to ±9990 Hz in 10-Hz increments and is set with the VBFO OFFSET KHZ controls on the front panel.

With the AFC option installed and the AFC switch ON, the receiver will lock on to any received carrier within ±50 Hz of the tuned carrier frequency and as weak as -126 dB mW.



NOTES

① INSTALLED ONLY AS PART OF ASSOCIATED OPTION.

② REMOVED WHEN VBFO OPTION INSTALLED.

③ REMOVED WHEN AFC OPTION INSTALLED.

HF-8054( ) Receiver, Block Diagram
Figure 1

2.1 *Receive Function (Refer to figure 2.)*

The receive signals, 250 kHz to 29.999 999 MHz, are supplied from an antenna to the rear panel RF IN jack. These rf signals are supplied to rf translator A9, through the receive overload circuit, input filter, and peak limiter to the receive rf bandpass filters. Band 1 is selected if the frequency control is set to 0 to 529.99 kHz. Band 2 is selected if the frequency control is set to 530 kHz to 1.599 99 MHz. Band 3 is selected if the frequency control is set to 1.600 to 29.999 99 MHz.

From the selected bandpass filter, the received rf signal is mixed with a 109.350 00- to 79.350 01-MHz variable injection signal to produce a 109.35-MHz if signal. This if is filtered by a crystal filter and mixed with a 118.8-MHz fixed injection signal to produce a 9.45-MHz receive if output from rf translator A9.

The 9.45-MHz receive if is supplied to channel A if A8 where it is mixed with a 9.9-MHz fixed injection frequency to supply a 450-kHz if through the selected if filter (refer to table 1) to the audio detectors and AGC output amplifiers. The 2.85-kHz USB if filter and selectable 16-kHz if filter (pad) are on channel A1 if A8, the 2.85-kHz LSB if filter (ISB) is located on channel B1 if A7, the 2.85-kHz UUSB if filter (ISB) is located on channel A2 if A6, and the 2.85-kHz LLSB if filter (ISB) is located on channel B2 if A5. Bandwidth switching and ISB switching are accomplished on the HF-8054( ) front panel and the filter selection is accomplished on the associated if card. Optional filter A8A2 is used to provide selection of if filters in AM and CW modes. Spaces for optional bandwidth filters (called A, B, C, D, and E) are available on filter A8A2. If filters A, B, C, D, and E are determined by the requirements of the user.

AFC.

If the AFC option is installed and AFC switch is set to ON, automatic frequency control is enabled. The 450-kHz IF output translated carrier frequency from the channel A IF is supplied to the AFC card where it is mixed with a 450-kHz injection reference signal. If the received IF signal is ±50 Hz of the 450-kHz reference signal, a voltage reference is provided for automatic frequency control. The 9.9-MHz injection signal supplied to the AFC card is voltage-controlled by the derived reference voltage and is changed until a 450-kHz if output is provided from the channel A IF. When the 450-kHz reference signal and 450-kHz IF output from the channel A if are in sync, an AFC lock condition occurs and the AFC will track a received carrier signal drift of ±1000 Hz of the tuned carrier frequency as long as the rate does not exceed 10 Hz per second.

The channel A1 450-kHz if output is supplied to the AM envelope detector and the channel A1 SSB product detector. The AM af output at J5-8 is supplied to receive audio A25 (AF1) at J14-35. The channel A1 SSB af output at J5-34 is supplied to receive audio A25 at J14-34. This channel A1 (AM or SSB [USB]) receive audio is supplied through audio amplifiers as channel A1 line audio J14-30, -31, and -32 to TB1-1, -2, and -3; as phones audio at J14-12, to J12-12, to P3-40 and PHONES jack J1; and as speaker audio at J14-9, to J12-38, to P3-12, through SPEAKER switch and AF GAIN control to P3-30, to J12-21, to J14-45, through speaker amplifier to J14-19, and P12-1 to speaker LS1.

vBFO

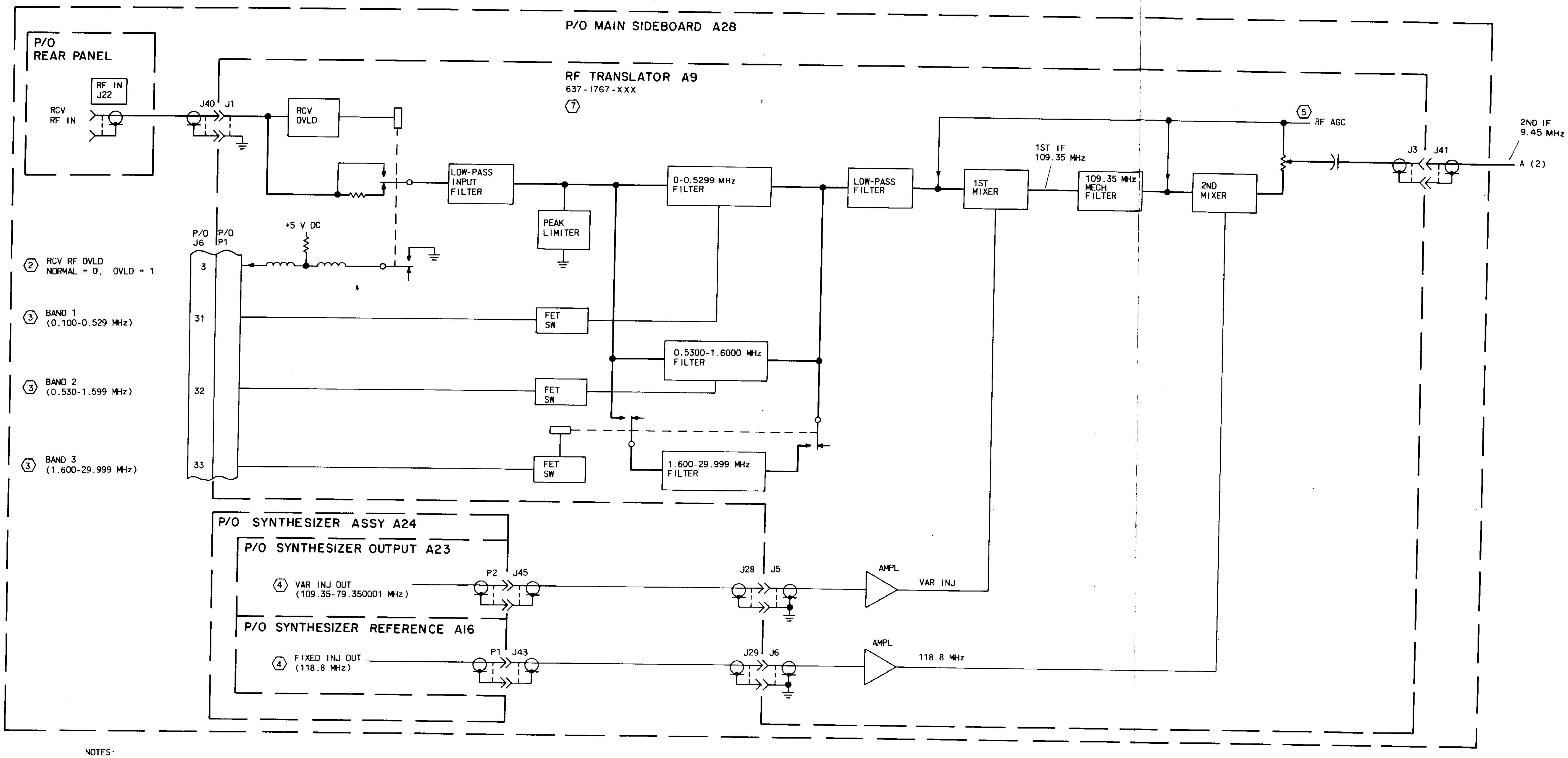
If the vbfo option is installed and VBFO switch is set to ON, an offset frequency as set by the VBFO OFFSET KHZ switches is developed by VBFO A4. The 450-kHz vbfo input is changed to a 450- ±9.99-kHz signal output and supplied as an offset 450-kHz injection frequency to the channel A1 IF A8. The resultant SSB (USB) output provides the ±9990-Hz vbfo signal for A1 CW operation as set on the front panel.

The channel B1 450-kHz if output is supplied to the channel B1 SSB (LSB) product detector (ISB or NET DATA modes only, channel B1 enabled). The channel B1 SSB af output at J4-34 is supplied to receive audio A25 (AF1) at J14-50. This channel B1 receive audio is supplied through audio amplifiers as channel B1 line audio at J14-26, -54, and -55 to TB1-4, -5, and -6; as phones audio at J14-12, to J12-12, to P3-39, through PHONES switch to PHONES jack J1; and as speaker audio at J14-21, to J12-36, to P3-15 through SPEAKER switch and AF GAIN control to P3-30, to J12-21, to J14-45, through speaker amplifier to J14-19, and P12-1 to speaker LS1.

The channel A2 450-kHz (456.29-kHz) if output is supplied to the channel A2 SSB (UUSB) product detector (ISB or NET DATA modes only, channel A2 enabled). The channel A2 SSB af output at J3-34 is supplied to receive audio A26 (AF2) at J15-35. This channel A2 receive audio is supplied through audio amplifiers as channel A2 line audio at J15-30, -31, and -32 to TB2-1, -2, and -3; as phones audio at J15-12, to J12-11, to P3-40, through PHONES switch to PHONES jack J1; and as speaker audio at J15-9, to J12-50, to P3-1 through SPEAKER switch and AF GAIN control to P3-30, to J12-21, to J14-45, through speaker amplifier to J14-19, and P12-1 to speaker LS1.

The channel B2 450-kHz (443.71-kHz) if output is supplied to the channel B2 SSB (LLSB) product detector (ISB or NET DATA modes only, channel B2 enabled).

The channel B2 SSB af output at J2-34 is supplied to receive audio A26 at J15-50. This channel B2 receive audio is supplied through audio amplifiers as channel B2 line audio at J15-26, -54, and -55 to TB2-4, -5, and -6; as phones audio at J15-12, to J12-11, to P3-40, through PHONES switch to PHONES jack J1; and as speaker audio at J15-21, to J12-49, to P3-2 through SPEAKER switch and AF GAIN control to P3-30, to J12-21, to J14-45, through speaker amplifier to J14-19, and P12-1 to speaker LS1.



NOTES:

① PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

② REFER TO MONITOR CONTROL FOR FAULT AND STATUS INDICATORS AND METERING CIRCUITS.

③ REFER TO MODE AND OPERATING CONTROLS, FREQUENCY OPERATING CONTROLS FOR BANDPASS FILTER AND FREQUENCY SELECTION.

④ REFER TO FREQUENCY CONTROL (SYNTHESIZER) FOR FREQUENCY GENERATION.

⑤ REFER TO MODE AND OPERATING CONTROLS, RF AND SQUELCH FOR AGC AND SQUELCH OPERATION.

⑥ REFER TO MODE AND OPERATING CONTROLS, MODE AND BANDWIDTH FOR MODE, BANDWIDTH FILTER, AND RECEIVE AF SELECTION.

⑦ STANDARD BANDPASS FILTERING:
637-1767-002 BROADBAND 109.35 MHz FILTER (±6.10 kHz AT 0.5 dB POINTS).
637-1767-003 NARROW BAND HIGH PERFORMANCE 109.35 MHz FILTER (±7.50 kHz AT 3 dB POINTS).

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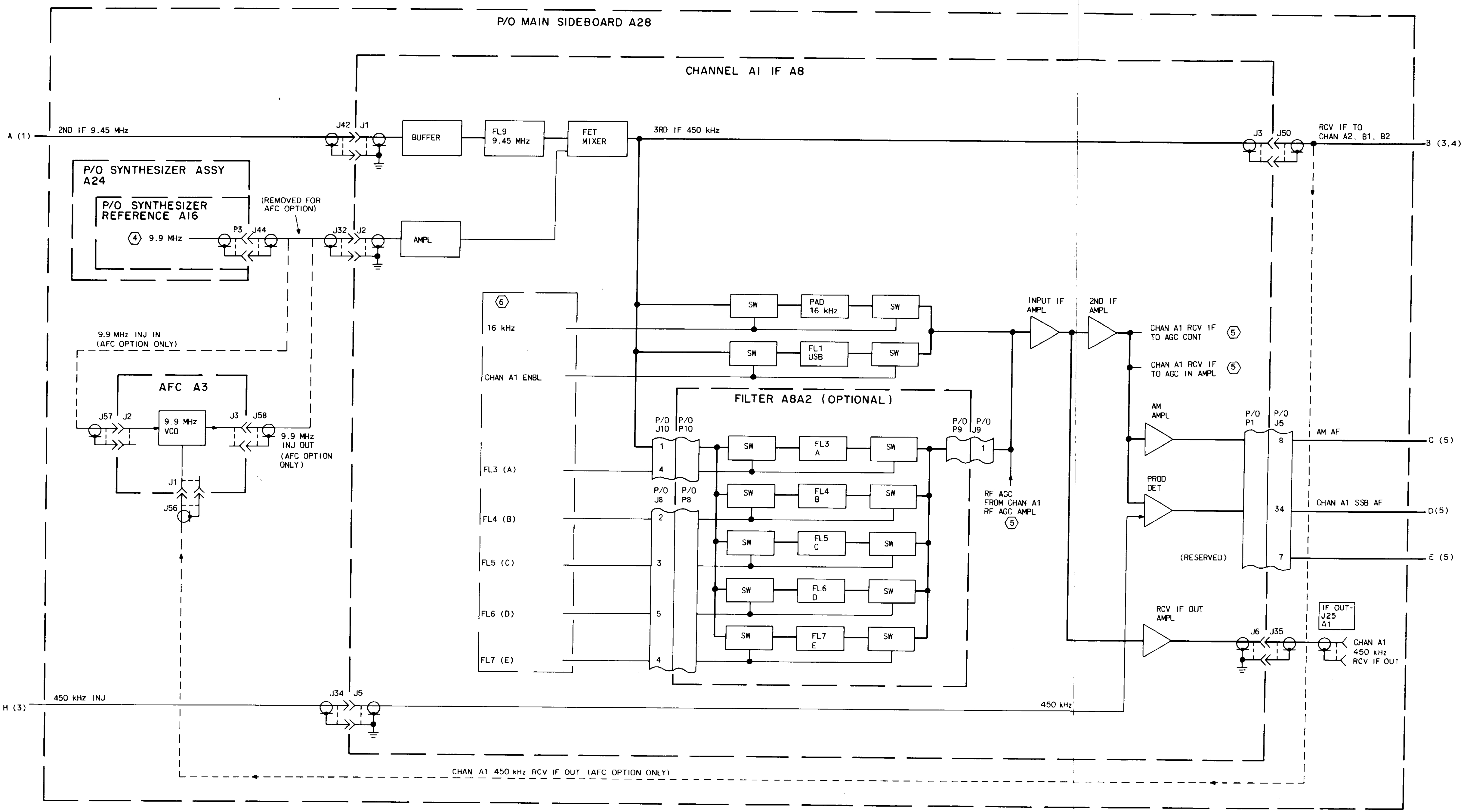
Receive Function, Block Diagram
Figure 2 (Sheet 1 of 5)



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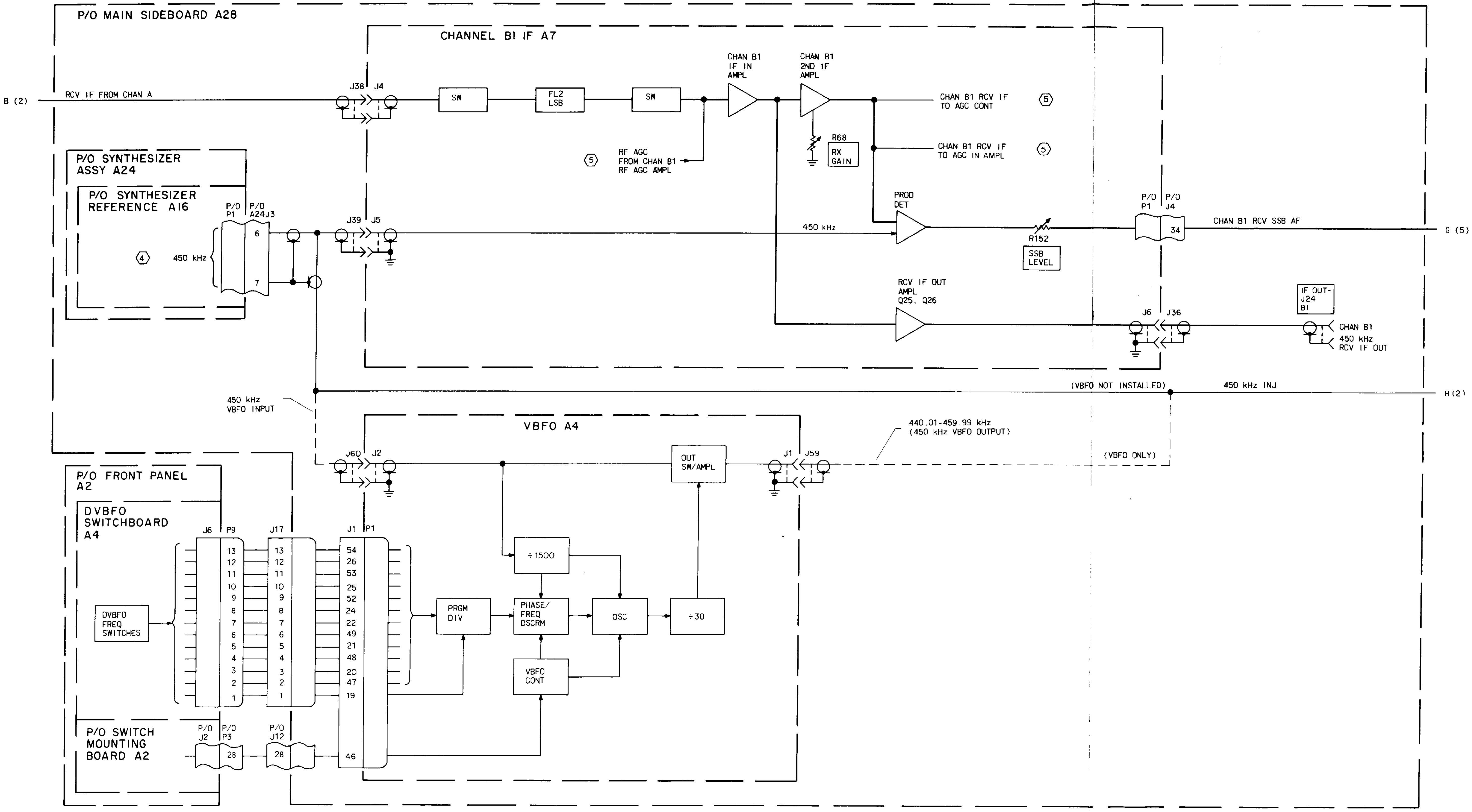
Receive Function, Block Diagram
Figure 2 (Sheet 2)



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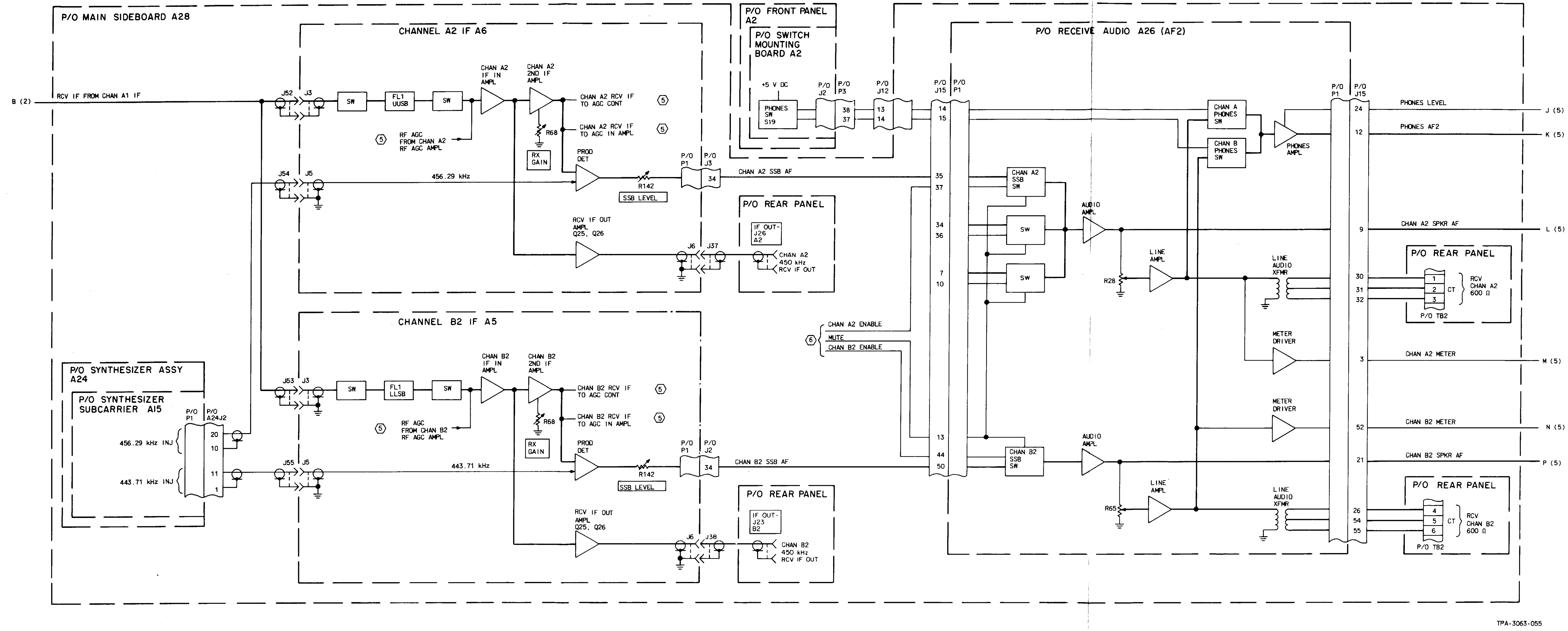
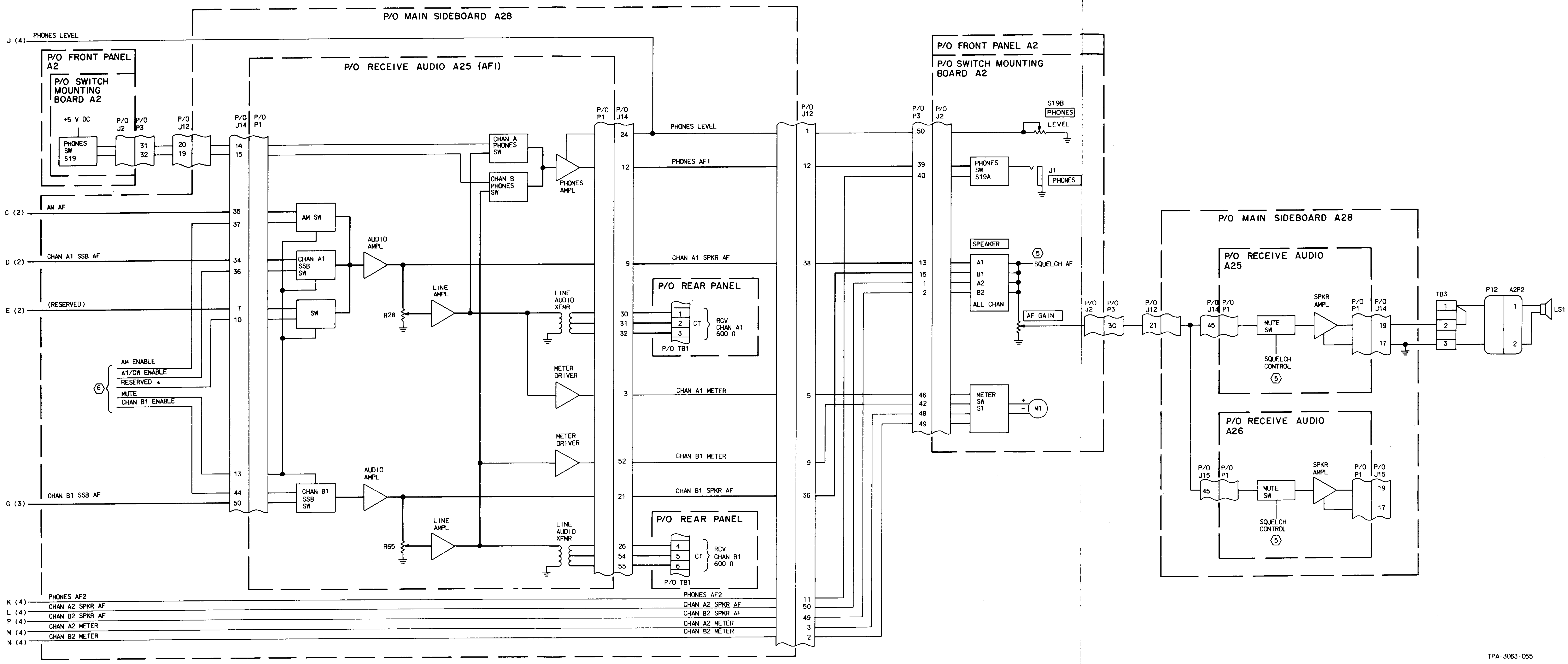
Receive Function, Block Diagram
Figure 2 (Sheet 3)



Receive Function, Block Diagram
Figure 2 (Sheet 4)



Receive Function, Block Diagram
Figure 2 (Sheet 5)

2.2 Mode and Operating Controls

The mode and operating controls consist of the front panel switches and an external remote control device, if used. The HF-8054( ) Receiver has a frequency control, speaker control, squelch control, AGC control, local/remote control, af gain control, phones with level adjust, rf gain control, bandwidth control, mode control, and a power switch. The HF-8054A Receiver can use an external remote control device such as the HF-8094 Receiver Control.

2.2.1 Mode and Bandwidth (Refer to figure 3.)

Note that figure 3 covers any optional configuration of the HF-8054( ) Receiver. However, this discussion is based on the following configured receiver:

a. A 4-position MODE switch: AM, CW, ISB, and NET DATA.
b. A 6-position BANDWIDTH switch.
c. Filter card A8A2 installed with filters A, B, C, D, and E.
d. Full 4-channel ISB configuration with channel A1 if A8, channel B1 if A7, channel A2 if A6, channel B2 if A5, channel A1/B1 audio A25, and channel A2/B2 audio A26 installed.

When the MODE switch is set to the AM mode, an AM enable signal (+5 V dc) is supplied at P4-6, to J19-6, to J14-37, and enables the AM audio switch in receive audio A25. The AM enable signal is also supplied to the BANDWIDTH switch, and the appropriate bandwidth for the desired operation must be selected.

With the BANDWIDTH switch in the 16 position, a 16 (FL8) signal (+5 V dc) is supplied at P3-17, to J12-34, to J5-14, and enables the 16-kHz pad in channel A1 if A8.

With the BANDWIDTH switch in the A position, an A (FL3) signal (+5 V dc) is supplied at P3-23, to J12-28, to J5-15, to A8A2P10-4, and enables the A filter (optional bandwidth) on filter A8A2.

With the BANDWIDTH switch in the B position, a B (FL4) signal (+5 V dc) is supplied at P3-24, to J12-27, to J5-43, to A8A2P8-2, and enables the B filter (optional bandwidth) on filter A8A2.

With the BANDWIDTH switch in the C position, a C (FL5) signal (+5 V dc) is supplied at P3-19, to J12-32, to J5-16, to A8A2P8-3, and enables the C filter (optional bandwidth) on filter A8A2.

With the BANDWIDTH switch in the D position, a D (FL6) signal (+5 V dc) is supplied at P3-20, to J12-31, to J5-45, to A8A2P8-5, and enables the D filter (optional bandwidth) on filter A8A2.

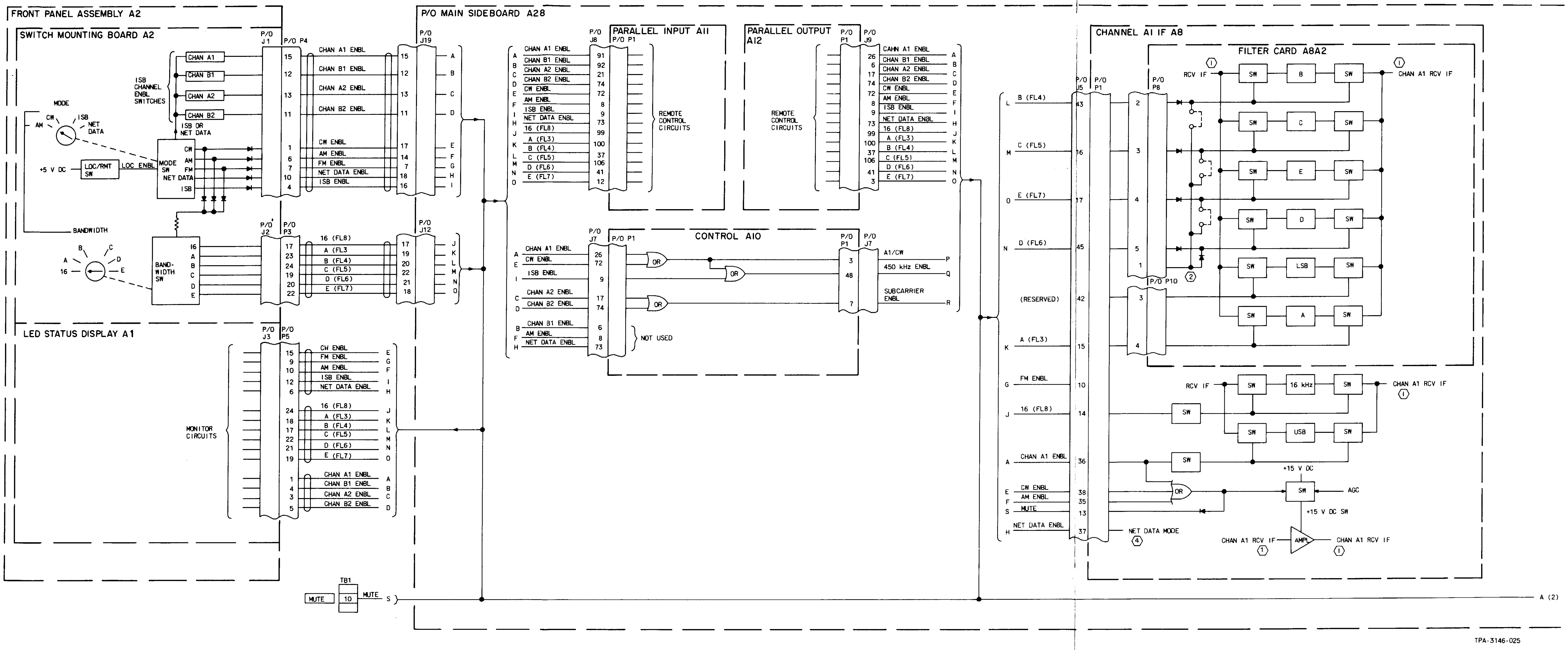
With the BANDWIDTH switch in the E position, an E (FL7) signal (+5 V dc) is supplied at P3-22, to J12-29, to J5-17, to A8A2P8-4, and enables the E filter (optional bandwidth) on filter A8A2.

When the MODE switch is set to the CW mode, a CW enable signal (+5 V dc) is supplied at P4-1, to J19-1, to J7-72, through A1/CW enabling circuit, to J14-36 and enables the (A1) SSB audio switch in receive audio A25. The CW enable signal is also supplied to the bandwidth switch, and the appropriate bandwidth for the desired operation must be selected.

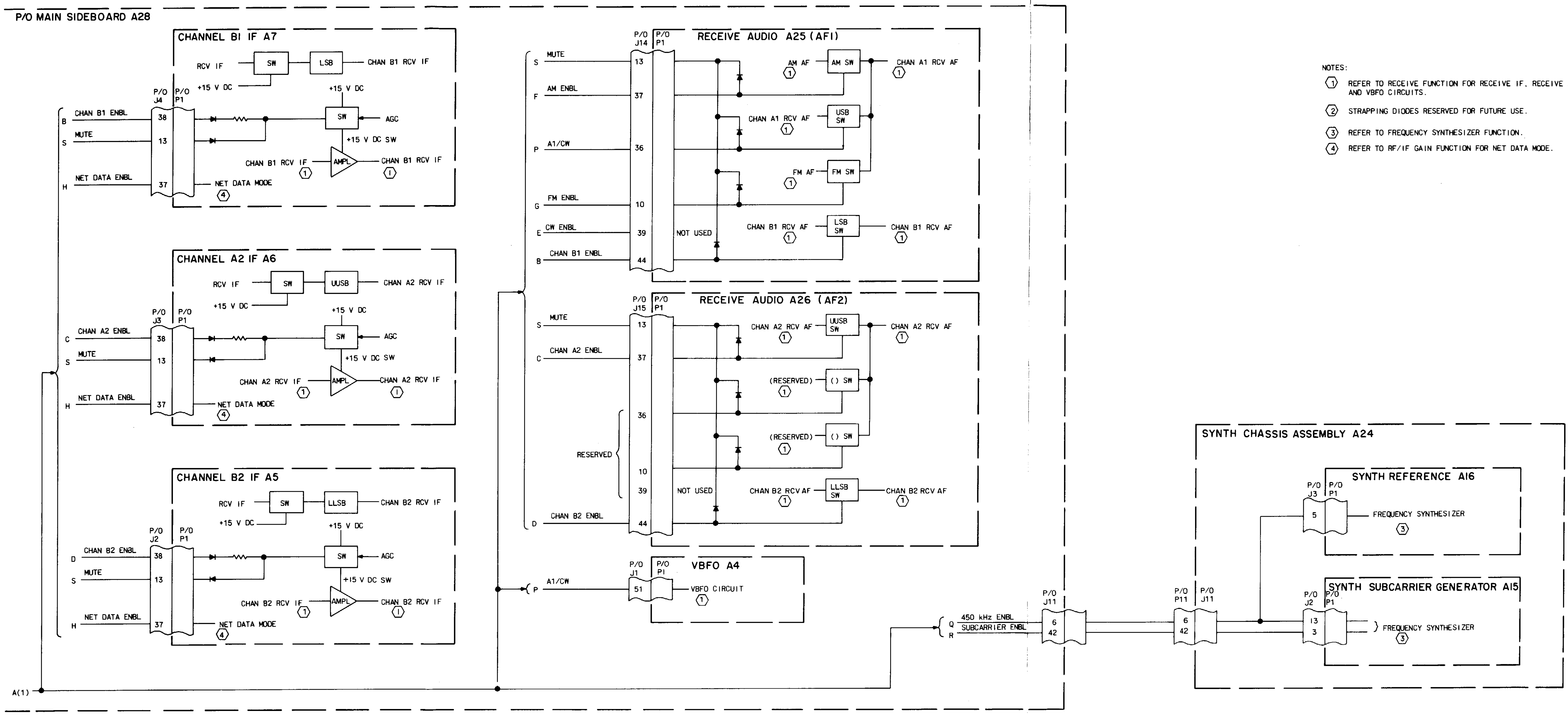
When the MODE switch is set to the ISB mode, an ISB enable signal (+5 V dc) is supplied to the channel enable switches on the front panel. CH A1 enable switch (in ISB mode) provides a CH A1 enable signal at P4-15, to J19-15, to J7-9, through A1/CW enabling circuit to J14-36 and enables the (A1) SSB audio switch in receive audio A25. CH B1 enable switch (in ISB mode) provides CH B1 enable signal at P4-12, to J19-12, to J14-44 and enables the (B1) ISB audio switch in receive audio A25. CH A2 enable switch (in ISB mode) provides CH A2 enable signal at P4-13, to J19-13, to J15-37, and enables the (A2) AM audio switch in receive audio A26. CH B2 enable switch (in ISB mode) provides CH B2 enable signal at P4-11, to J19-11, to J15-44, and enables the (B2) ISB audio switch in receive audio A26.

Figure 4 shows a simplified diagram of the mode and bandwidth selection described in the foregoing paragraphs.

When an external controlling device is used, the same mode and bandwidth operations apply, except the control signals are supplied as serial data to serial interface A13 and converted from serial data to parallel data in parallel output A12. The outputs of parallel output A12 are supplied to the internal control circuits of the receiver.



Mode and Bandwidth, Block Diagram
Figure 3 (Sheet 1 of 2)



NOTES:

1. REFER TO RECEIVE FUNCTION FOR RECEIVE IF, RECEIVE AF, AND VBFO CIRCUITS.
2. STRAPPING DIODES RESERVED FOR FUTURE USE.
3. REFER TO FREQUENCY SYNTHESIZER FUNCTION.
4. REFER TO RF/IF GAIN FUNCTION FOR NET DATA MODE.

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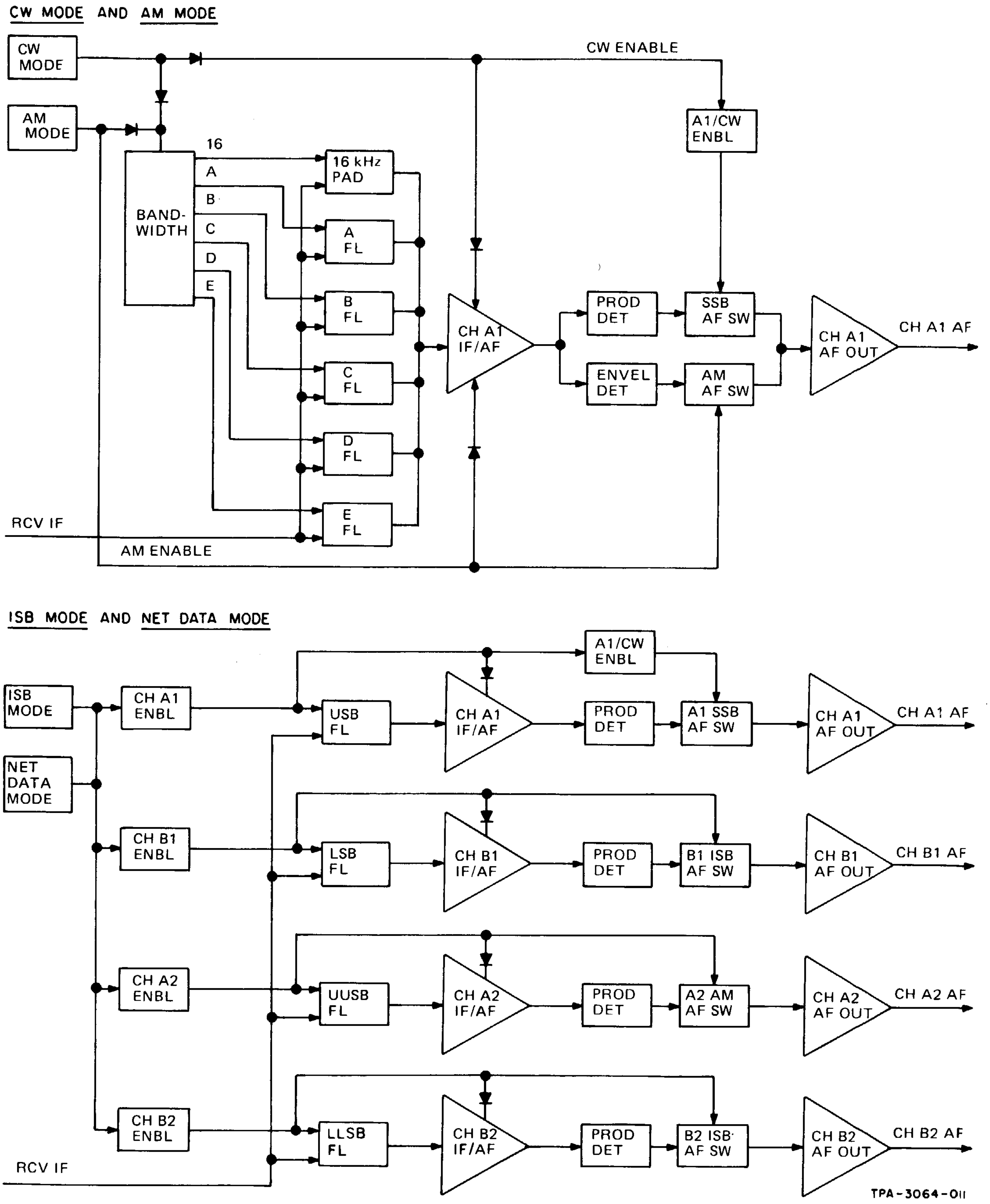
Mode and Bandwidth, Block Diagram
Figure 3 (Sheet 2)



Mode and Bandwidth Selection, Simplified Diagram
Figure 4

2.2.2 *Audio (Refer to figure 5.)*

The HF-8054( ) Receiver audio can be monitored at tne PHONES jack, at the internal speaker, at an external speaker, or through an external line audio circuit from TB1 and/or TB2.

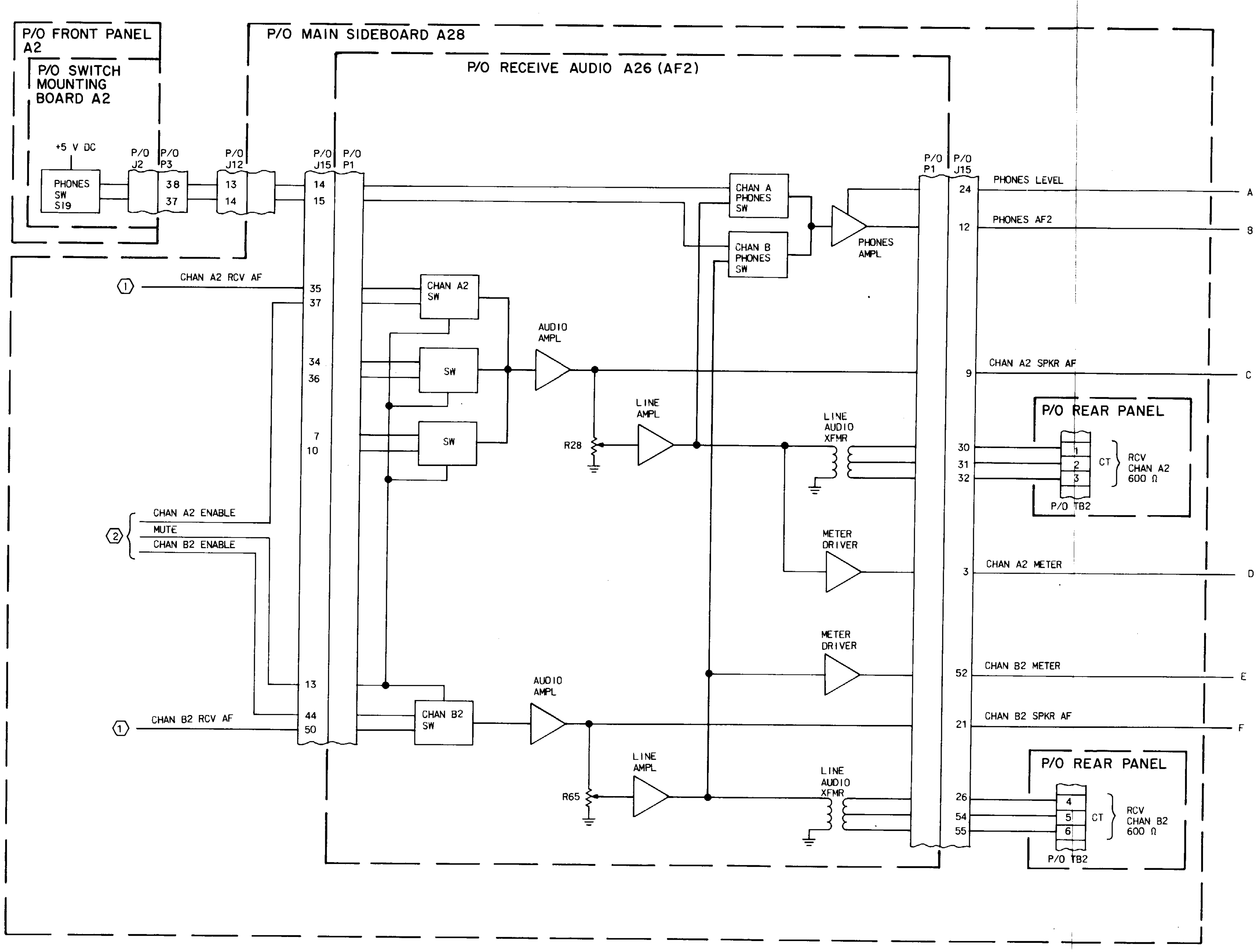
Phones audio is supplied by the headphone audio amplifier in receive audio A25 and A26. PHONES switch A2S19 selects audio channel (A1, B1, A2, B2, or all). If channel A1 is selected (PHONES switch in A1 position), a logic 1 signal is supplied through P3-31, J12-20, and J14-14 to channel A1 phones switch in receive audio A25 (AF1). Channel A1 receive audio is supplied through the channel A1 phones switch, the phones audio amplifier, J14-12, J12-12, P3-39, and PHONES switch A2S19 to PHONES jack J1. If channel B1 is selected (PHONES switch in B1 position), a logic 1 signal is supplied through P3-32, J12-19, and J14-15 to channel B1 phones switch in receive audio A25 (AF1). Channel B1 receive audio is supplied through the channel B1 phones switch, the phones audio amplifier, J14-12, J12-12, P3-39, and PHONES switch A2S19 to PHONES jack J1. If channel A2 is selected (PHONES switch in A2 position), a logic 1 signal is supplied through P3-38, J12-13, and J15-14 to channel A2 phones switch in receive audio A26 (AF2). Channel A2 receive audio is supplied through the channel A2 phones switch, the phones audio amplifier, J15-12, J12-11, P3-40, and PHONES switch A2S19 to PHONES jack J1. If channel B2 is selected (PHONES switch in B2 position), a logic 1 signal is supplied through P3-37, J12-14, and J15-15 to channel B2 phones switch in receive audio A26 (AF2). Channel B2 receive audio is supplied through the channel B2 phones switch, the phones audio amplifier, J15-12, J12-11, P3-40, and PHONES switch A2S19 to PHONES jack J1. If all channels are selected (PHONES switch in ALL CH position), channels A1, B1, A2, and B2 receive audio are all supplied as described above. Phones audio level is adjusted using the phones level adjust located in the center of the PHONES switch.

Speaker audio is supplied by the line audio amplifier in receive audio A25 and A26. SPEAKER switch A2S15 selects audio channel (A1, B1, A2, B2, or all). If channel A1 is selected (SPEAKER switch in A1 position), channel A1 receive audio is supplied through J14-9, J12-38, P3-13, A2S15, A2S16A, P3-30, J12-21, J14-45, through mute switch and speaker amplifier in receive audio A25 (AF1). The speaker amplifier output is supplied through J14-19 to TB3-2, and speaker amplifier common is supplied through J14-17 to TB3-3. If channel B1 is selected (SPEAKER switch in B1 position) channel B1 receive audio is supplied through J14-21, J12-36, P3-15, A2S15, A2S16A, P3-30, J12-21, J14-45, through mute switch and speaker amplifier in receive audio A25 (AF1). The speaker amplifier output is supplied through J14-19 to TB3-2, and speaker amplifier common is supplied through J14-17 to TB3-3. If channel A2 is selected (SPEAKER switch in A2 position), channel A2 receive audio is supplied through J15-9, J12-50, P3-1, A2S15, A2S16A, P3-30, J12-21, J14-45, through mute switch and speaker amplifier in receive audio A25 (AF1). The speaker amplifier output is supplied through J14-19 to TB3-2, and speaker amplifier common is supplied through J14-17 to TB3-3. If channel B2 is selected (SPEAKER switch in B2 position), channel B2 receive audio is supplied through J15-21, J12-49, P3-2, A2S15, A2S16A, P3-30, J12-21, J14-45, through mute switch and speaker amplifier in receive audio A25 (AF1). The speaker amplifier output is supplied through J14-19 to TB3-2, and speaker amplifier common is supplied through J14-17 to TB3-3. If all channels are selected (SPEAKER switch in ALL CH position), channels A1, B1, A2, and B2 receive audio are all supplied as described above. For internal speaker, TB3-2 is jumpered to TB3-1 and speaker audio is supplied from TB3-1 through P12-1 to loudspeaker LS1, common from TB3-3 through P12-2 to loudspeaker LS1. For external speaker, TB3-2 is connected directly to external speaker (jumper between TB3-2 and TB3-1 is removed) and speaker audio is supplied from TB3-2 to external loudspeaker, common from TB3-3 is connected directly to external loudspeaker common. Speaker audio is volume-controlled by AF GAIN control A2A16A.

SQUELCH control A2S16B-A2S16C enables/disables squelch and controls the squelch threshold level. In the full counterclockwise position, a ground squelch disable $\overline{\text{(squelch enable)}}$ signal is supplied through P3-27, J12-24, and J14-46 to the squelch output switch in receive audio A25 (AF1), disabling squelch control. In any other position of the SQUELCH control, squelch switch A2S16C is open (squelch enable signal applied) and a squelch threshold signal is applied with maximum squelch threshold applied at full clockwise position. Squelch threshold level is controlled by A2S16B and supplied through P3-29, J12-22, and J14-47 to the squelch circuits in the receive audio A25 card (AF1). Remote squelch is not available in the HF-8054A Receiver.

Line audio is supplied by line audio amplifiers in receive audio A25 and A26. Channel A1 line audio is supplied through a line audio transformer and J14-30, -31, -32 to TB1-1, -2, -3 respectively, for external use.

TB1-1 to TB1-3 is a 600-ohms balanced output; TB1-2 is the transformer center tap. The channel A1 line audio output level can be set by adjusting A25R28. Channel B1 line audio is supplied through a line audio transformer and J14-26, -54, -55 to TB1-4, -5, -6 respectively, for external use. TB1-4 to TB1-6 is a 600-ohms balanced output; TB1-5 is the transformer center tap. The channel B1 line audio output level can be set by adjusting A25R65. Channel A2 line audio is supplied through a line audio transformer and J15-30, -31, -32 to TB2-1, -2, -3 respectively, for external use. TB2-1 to TB2-3 is a 600-ohms balanced output; TB2-2 is the transformer center tap. The channel A2 line audio output level can be set by adjusting A26R28. Channel B2 line audio is supplied through a line audio transformer and J15-30, -31, -32 to TB2-1, -2, -3 respectively, for external use. TB2-1 to TB2-3 is a 600-ohms balanced output; TB2-2 is the transformer center tap. The channel B2 line audio output level can be set by adjusting A26R65.



NOTES:

① TO RECEIVE FUNCTION.

② TO MODE AND BANDWIDTH FUNCTION.

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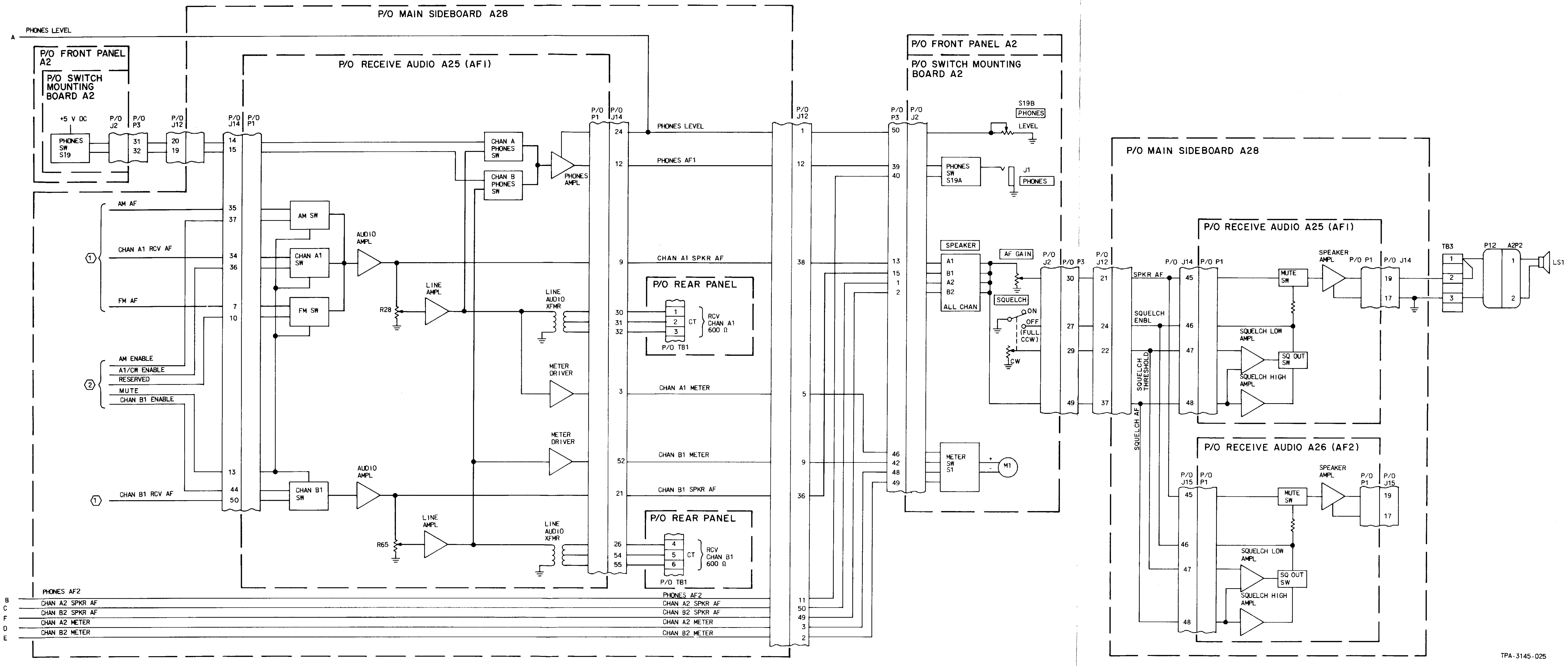
Audio Circuits, Block Diagram
Figure 5 (Sheet 1 of 2)



Audio Circuits, Block Diagram
Figure 5 (Sheet 2)

2.2.3 *IF/RF Gain Control (Refer to figure 6.)*

If/rf gain of the HF-8054( ) Receiver is controlled by pin diode attenuators located along the signal path in the rf and if amplifiers. The attenuators are controlled by three gain control inputs:

a. AGC detector
b. Local (front panel) rf gain control
c. Remote rf gain control

The if/rf gain control circuits provide an output signal that is proportional to the gain reduction imposed by the gain control circuit. This signal is available on the rear panel of the receiver. This AGC signal line can be used to feed in an external gain control signal, such as when two receivers are cross-coupled for diversity operation.

Each of the if amplifiers (channel A1, B1, A2, and B2) has an independent if AGC circuit so that, in ISB operation, the audio and if output signal levels of each if are independent of the signal levels in the opposite sideband. When the signal level in either if reaches a level approximately 20 dB above AGC threshold, an rf AGC voltage is fed to rf translator A9 through gating diodes.

An AGC bus is provided to permit AGC cross-coupling of two or more channels. When enabled, the AGC bus will project the AGC signal of the channel (with AGC bus enabled) having the highest AGC level.

The AGC attack and decay times are dependent on the change in signal level and the AGC time selected. Refer to table 2 for the selected attack and decay times. In the OFF position, the AGC action for that channel is completely disabled. A crowbar decay time of 10 to 13 milliseconds is used in NET DATA mode where the normal AGC decay times are too slow. The crowbar action is initiated either by a decrease in received signal of about 20 dB or by application of an end of message signal.

When the receiver is using remote control with AGC disabled, if/rf gain is controlled by the remote rf gain input. This control voltage has the same sensitivity as the AGC output voltage (50 mV/dB) and originates in a d/a converter circuit in parallel output card A12. The digital input to the d/a converter is a 5-bit binary signal (see remote control word format, figures 8 through 10) that provides a total gain control range of 93 dB in 3-dB steps.

RF GAIN control A2R11 controls attenuation of pin diode attenuators in the if amplifiers and rf translator. The local rf gain output is from the wiper of A2R11 and applied through P3-26, J12-25, J5-39, J4-39, J3-39, and J2-39 to the AGC amplifiers on the channel A1 if A8, channel B1 if A7, channel A2 if A6, and channel B2 if A5 cards. The remote rf gain output is supplied through J10-86, J5-39, J4-39, J3-39, and J2-39 to the AGC amplifiers (in HF-8054A Receiver only).

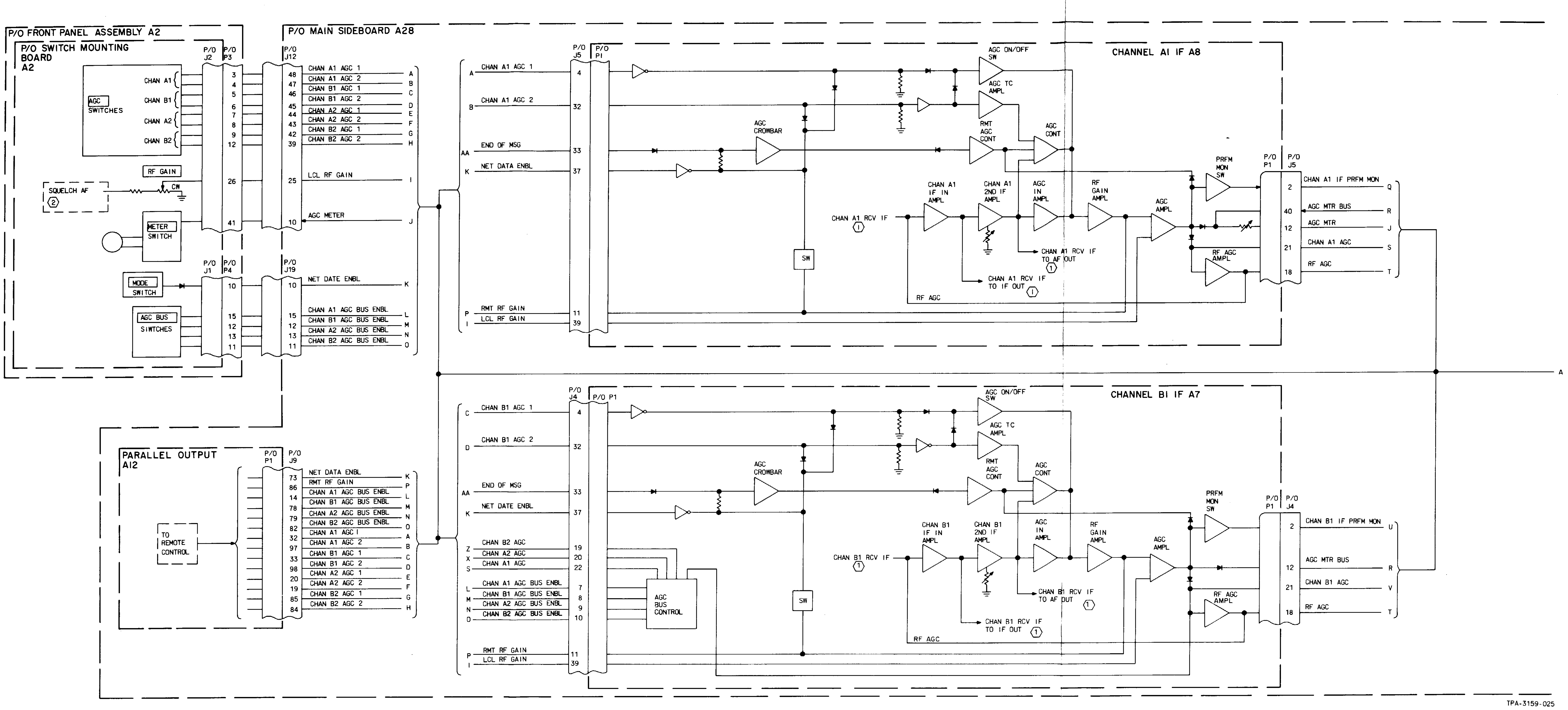
AGC switches control each channel's AGC decay time in the receiver. Refer to table 3. With AGC switch in the OFF position, logic 1 is supplied on the AGC 1 and AGC 2 control lines. With AGC switch in the FAST or DATA position, logic 0 is supplied on the AGC 1 and AGC 2 control lines. With AGC switch in the MED or FAX position, logic 0 is supplied on the AGC 1 control line and logic 1 is supplied on the AGC 2 control line. With AGC switch in the SLOW or VOICE position, logic 1 is supplied on the AGC 1 control line and logic 0 is supplied on the AGC 2 control line. Remote control signals are applicable only to the HF-8054A Receiver.

Table 2. AGC Time Constants.

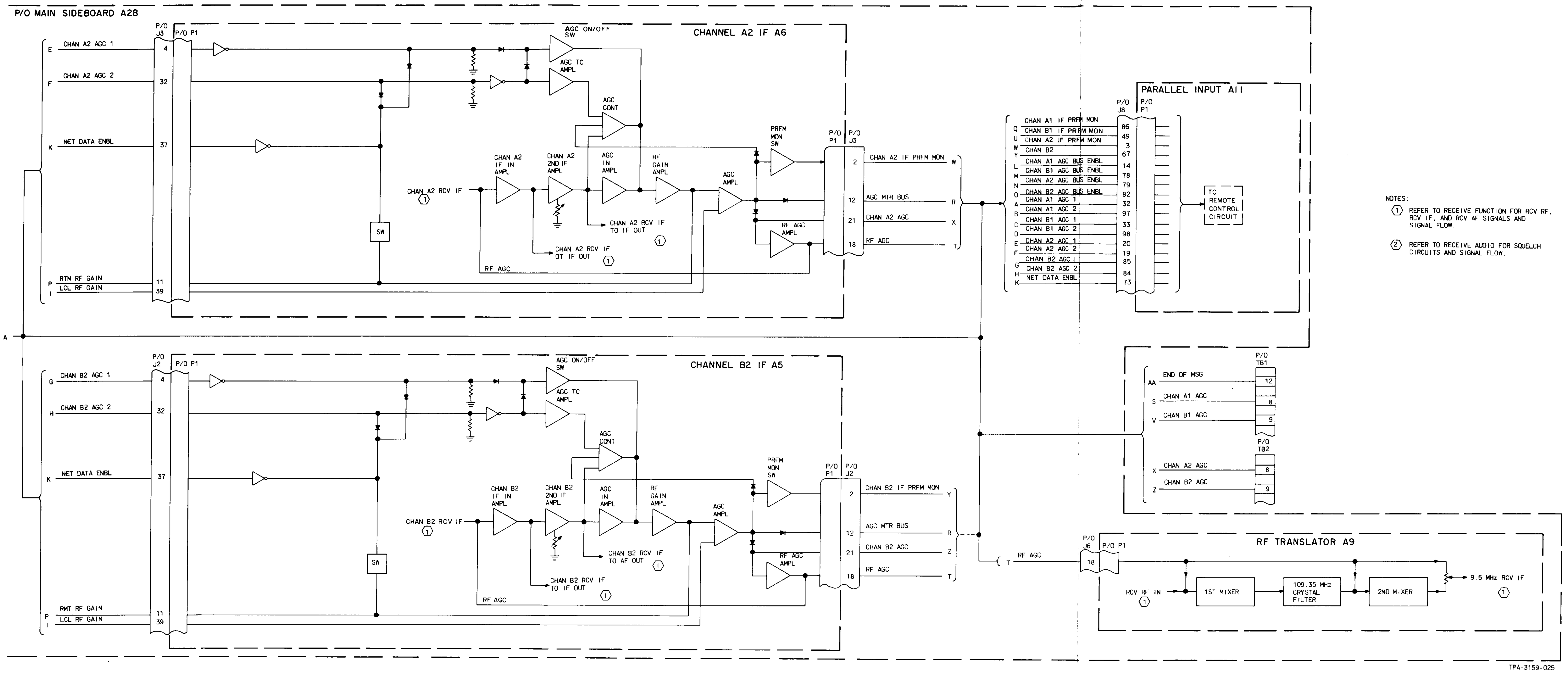
AGC MODE	ATTACK TIME	DECAY TIME
FAST	20 ms max	15 to 30 ms
MEDIUM	20 ms max	70 to 150 ms
SLOW	20 ms max	1 to 2 seconds
DATA	20 ms max	15 to 30 ms
VOICE	20 ms max	1 to 2 seconds
FAX	2 seconds max	3 to 6 seconds

Table 3. AGC Control Circuits.

CHANNEL	CIRCUIT IN LOCAL OPERATION	CIRCUIT IN REMOTE OPERATION	AGC SWITCH POSITION			
			OFF	FAST OR DATA	MED OR FAX	SLOW OR VOICE
A1 (A2S26)	P3-3, J12-48, J5-4	J9-32, J5-4	1	0	0	1
	P3-4, J12-47, J5-32	J9-97, J5-32	1	0	1	0
B1 (A2S25)	P3-5, J12-46, J4-4	J9-33, J4-4	1	0	0	1
	P3-6, J12-45, J4-32	J9-98, J4-32	1	0	1	0
A2 (A2S27)	P3-7, J12-44, J3-4	J9-20, J3-4	1	0	0	1
	P3-8, J12-43, J3-32	J9-19, J3-32	1	0	1	0
B2 (A2S24)	P3-9, J12-42, J2-4	J9-85, J2-4	1	0	0	1
	P3-12, J12-39, J2-32	J9-84, J2-32	1	0	1	0



IF/RF Gain Control, Block Diagram
Figure 6 (Sheet 1 of 2)



NOTES:

① REFER TO RECEIVE FUNCTION FOR RCV RF, RCV IF, AND RCV AF SIGNALS AND SIGNAL FLOW.

② REFER TO RECEIVE AUDIO FOR SQUELCH CIRCUITS AND SIGNAL FLOW.

IF/RF Gain Control, Block Diagram
Figure 6 (Sheet 2)

2.2.4 Frequency Control (Refer to figure 7.)

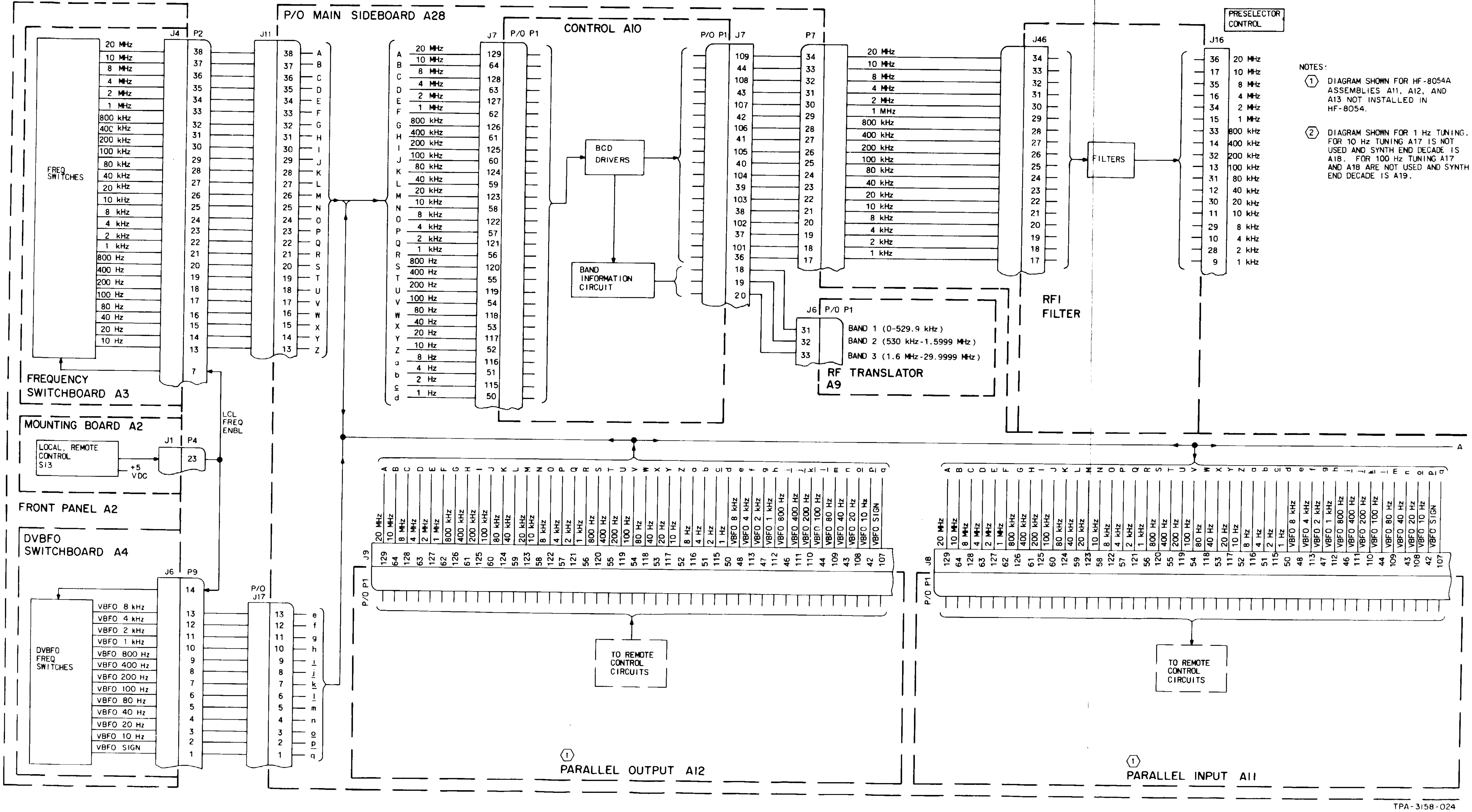
The receiver frequency is controlled by parallel bcd frequency inputs to the frequency synthesizer. These parallel bcd inputs are supplied directly from the front panel or from a remote control (in HF-8054A Receiver only) through serial interface A13 and parallel output A12.

Parallel bcd frequency inputs in 10-Hz steps are supplied directly from thumb-wheel switches on A2A3 through P2 and J11 to J7, J8, and P11. If remote control is used (for HF-8054A Receiver only), parallel frequency inputs are supplied directly from the parallel output card through J9 to J7, J8, and P11.

Parallel 1-kHz to 20-MHz bcd inputs supplied to J7 are also supplied through buffer/drivers in control A10, through J7 and P7 to J46, through rfi filters to preselector connector J16. The parallel bcd inputs supplied at J7 are also band decoded, and band signals are supplied from J8 to J6 and rf translator module A9.

Parallel bcd frequency inputs supplied to P11 are supplied through P11 to the appropriate decade on the synthesizer sideboard. The 1-Hz bcd inputs are supplied through A24J4 to end decade A17 (1-Hz tuning only). The 10-Hz bcd inputs are supplied through A24-J5 to 10-Hz decade A18 (1-Hz tuning only) or end decade A18 (10-Hz tuning only). The 100-Hz bcd inputs are supplied through A24J6 to 100-Hz decade A19 (1-Hz and 10-Hz tuning) or end decade A19 (100-Hz tuning only). The 1-kHz bcd inputs are supplied through A24J7 to 1-kHz decade A20. The 10-kHz inputs are supplied through A24J8 to 10-kHz decade A21. The 100-kHz bcd inputs are supplied through A24J9 to 100-kHz decade A22. The 1-MHz and 10-MHz bcd inputs are supplied through A24J10 to synthesizer output A23.

Refer to paragraph 2.4 for frequency synthesizer operation.



NOTES:

① DIAGRAM SHOWN FOR HF-8054A ASSEMBLIES A11, A12, AND A13 NOT INSTALLED IN HF-8054.

② DIAGRAM SHOWN FOR 1 Hz TUNING. FOR 10 Hz TUNING A17 IS NOT USED AND SYNTH END DECADE IS A18. FOR 100 Hz TUNING A17 AND A18 ARE NOT USED AND SYNTH END DECADE IS A19.

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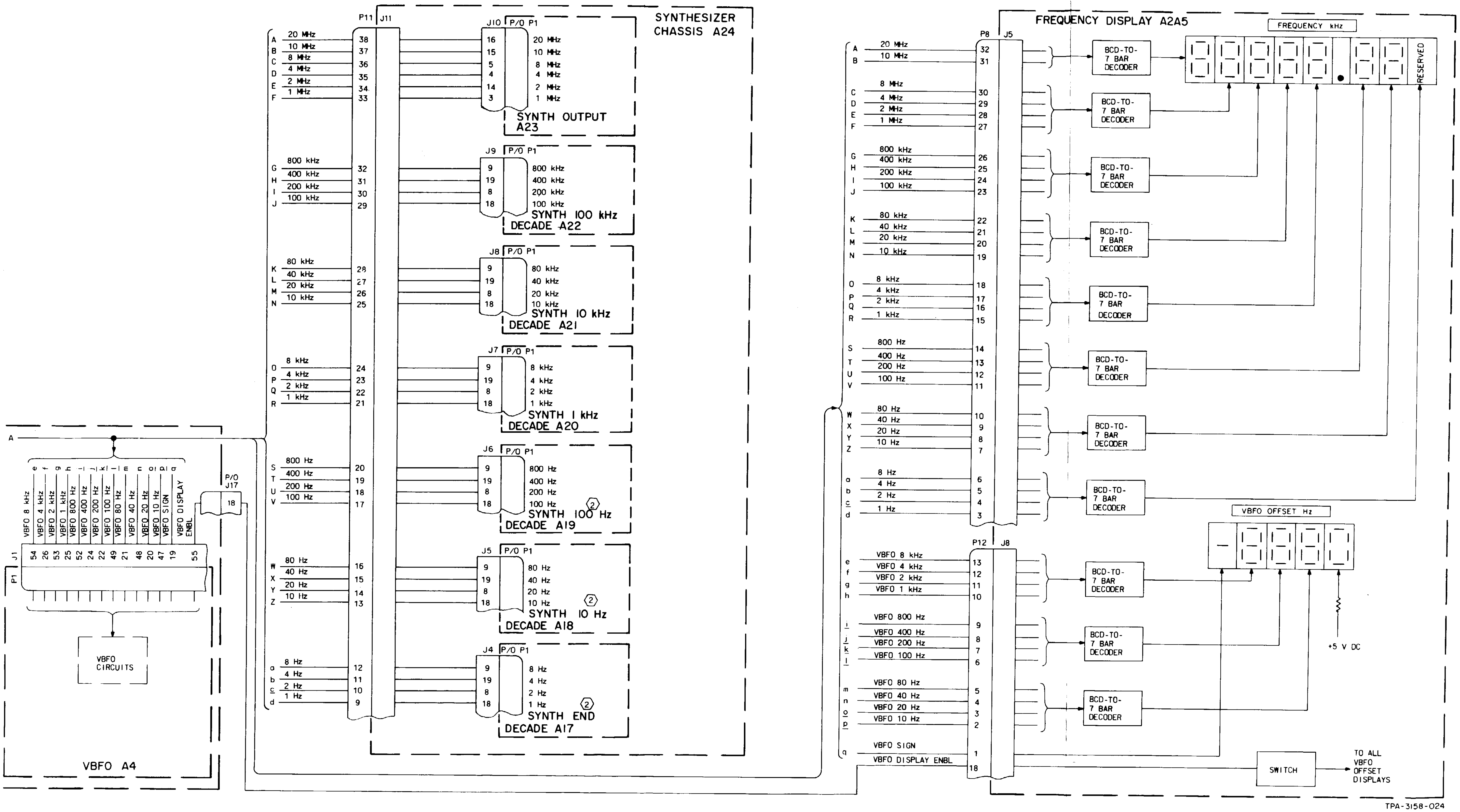
Frequency Control, Block Diagram
Figure 7 (Sheet 1 of 2)



Frequency Control, Block Diagram
Figure 7 (Sheet 2)

2.3 Remote Control Operation (HF-8054A Receiver Only)

The HF-8094 Receiver Control unit is designed as a companion to the HF-8054A Receiver. This control unit provides all the functions required to remotely control and monitor the operation of the receiver. The control unit generates the serial data required to control the receiver, and accepts serial monitor data from the receiver for display of the current operating status. When remote processor control of the receiver is desired, the processor must generate the serial data characters required to control the receiver and interpret the monitor data from the receiver. In processor control applications, the receiver control interface requirements are similar to a serial data terminal in operation, with formatted messages from the processor controlling operation of the receiver and messages from the receiver to the processor reporting operating status of the receiver. An RS-232C serial, asynchronous, input/output interface capability is required in the processor for remote control of the receiver.

The following paragraphs describe the characteristics applicable to remote control of the receiver and operation of the remote control circuits in the receiver.

2.3.1 General

Two methods of serial data signaling are available in the HF-8054A Receiver. Each method is switch selectable on the serial interface card. The two methods are frequency-shift keyed audio tones (FSK) and RS-232C data logic levels. In conjunction with selection of the RS-232C signaling, switching is available to invert the polarity of the RS-232C data for compatibility with the logic polarity and voltage levels defined in MIL-STD-188C.

When the FSK method is selected, only one exciter may be controlled and monitored by a single HF-8094 Receiver Control. When the RS-232C logic level signaling method is selected, up to 16 individually addressable receivers may be controlled and monitored by a single HF-8094 Receiver Control. Up to 32 individually addressable receivers may be controlled and monitored by a processor. The RS-232C control can be by direct connection to the receiver control or processor, or by transmission over data modems over longer distances.

Two separate sets of data lines are used for serial control of the exciter. One set, called the control bus, is used to receive command data. The other set, called the monitor bus, is used to transmit status information. When using FSK signaling, the control and monitor buses are balanced 600-ohm audio lines. When switched for RS-232C signaling, the control and monitor buses are unbalanced line to ground. The data transmission rate on the control and monitor buses are switch selectable on the serial interface card. Transmission rates are 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, and 19 200 bauds. The usable data rates for the FSK signaling method are limited to not more than 600 bauds. Each remote receiver must be set for the same data rate and parity as the associated receiver control or processor.

Data transmitted and received on the control and monitor buses is serial, asynchronous, and organized in one of two formats, ASCII or 8-bit character. In the ASCII format, the characters are made up of 9, 10, or 11 bits, consisting of one start bit, seven data bits, one parity bit (optional) and one or two (optional) stop bits, in that order. The ASCII characters are then organized into 13 character words. In the 8-bit character format, the characters are made up of 11 bits, consisting of one start bit, eight data bits, one parity bit, and one stop bit, in that order. The 8-bit characters are then formed into five character words. Control data bits are determined by settings of the front panel switches and controls on the receiver control, or by program control for processor control applications. Monitor data bits are determined by the current operational status of the receiver.

Except for those monitor bits that have no corresponding control functions (such as fault bits and performance monitoring bits), the control and monitor words have identical data formats. The formats are summarized in figures 8, 9, and 10 and are explained in detail in the operations section of this manual.

	CHARACTER SIGNIFICANCE	ASCII PRINT CHAR'S	FUNCTIONAL BIT CODING			
			WT 8	WT 4	WT 2	WT 1

CR LF A1 A2 SD F1 F2 F3 F4 F5 F6 F7 F8 X WORD 1 CHARACTER SEQUENCE

CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A1 (1)
SD	SEQUENCE DESIGNATOR	0,1,2	NA	NA	NA	NA
F1	FREQUENCY- 10 MHz (BCD)	0,1,2	0	0	10 MHz (2)	10 MHz (1)
F2	FREQUENCY- 1 MHz (BCD)	0-9	1 MHz (8)	1 MHz (4)	1 MHz (2)	1 MHz (1)
F3	FREQUENCY- 100 kHz (BCD)	0-9	100 kHz (8)	100 kHz (4)	100 kHz (2)	100 kHz (1)
F4	FREQUENCY- 10 kHz (BCD)	0-9	10 kHz (8)	10 kHz (4)	10 kHz (2)	10 kHz (1)
F5	FREQUENCY- 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
F6	FREQUENCY- 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
F7	FREQUENCY- 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
F8	FREQUENCY- 1 Hz (BCD)	0-9	1 Hz (8)	1 Hz (4)	1 Hz (2)	1 Hz (1)
X	EXECUTE	X	NA	NA	NA	NA

CR LF A1 A2 SD M1 M2 M3 M4 M5 M6 M7 M8 X WORD 2 CHARACTER SEQUENCE

CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	4,5,6	NA	NA	NA	NA
M1	RF GAIN CONTROL	0-9, A-F	0	0	0	RF GAIN (16)
M2	RF GAIN CONTROL	0-9, A-F	RF GAIN (8)	RF GAIN (4)	RF GAIN (2)	RF GAIN (1)
M3	BANDWIDTH FILTER ENABLES	0-9, A-F	FL E ENBL	FL D ENBL	FL C ENBL	FL B ENBL
M4	AGC TIME CONSTANTS (B2-A2)	0-9, A-F	B2 AGC (2)	B2 AGC (1)	A2 AGC (2)	A2 AGC (1)
M5	BW FILTER ENABLES, VBFO, AFC ENABLE	0-9, A-F	FL A ENBL	16 kHz ENBL	VBFO ENBL	AFC ENBL
M6	AGC TIME CONSTANTS (B1-A1)	0-9, A-F	B1 AGC (2)	B1 AGC (1)	A1 AGC (2)	A1 AGC (1)
M7	MODE SELECT ENABLES	0-9, A-F	NET DATA	AM	CW	ISB
M8	ISB CHANNEL ENABLES	0-9, A-F	B2	B1	A1	A2
X	EXECUTE	X	NA	NA	NA	NA

CR LF A1 A2 SD V1 V2 V3 V4 V5 V6 V7 V8 X WORD 3 CHARACTER SEQUENCE

CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	8,9,A	NA	NA	NA	NA
V1	VBFO SIGN (0=+)	0,1	0	0	0	VBFO SIGN
V2	VBFO FREQUENCY, 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
V3	VBFO FREQUENCY, 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
V4	VBFO FREQUENCY, 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
V5	AUXILIARY	0-9,A-F	-	-	-	-
V6	AUXILIARY	0-9, A-F	-	-	-	-
V7	RESERVED	0	0	0	0	0
V8	AGC BUS	0-9, A-F	B2	B1	A1	A2
X	EXECUTE	X	NA	NA	NA	NA

CR LF A1 A2 SD K1 X WORD 4 CHARACTER SEQUENCE

CR	CARRIAGE RETURN	CR	NA	NA	NA	NA
LF	LINE FEED	LF	NA	NA	NA	NA
A1	ADDRESS M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	C,D,E	NA	NA	NA	NA
K1	RESERVED	0	0	0	0	0
X	EXECUTE	X	NA	NA	NA	NA

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ASCII Character Control Word Format
Figure 8

- - A1 A2 SD F1 F2 F3 F4 F5 F6 F7 F8 %   WORD 1 CHARACTER SEQUENCE

	CHARACTER SIGNIFICANCE	ASCII PRINT CHAR'S	FUNCTIONAL BIT CODING			
			WT 8	WT 4	WT 2	WT 1
-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	1	NA	NA	NA	NA
F1	FREQUENCY- 10 MHz (BCD)	0,1,2	0	0	10 MHz (2)	10 MHz (1)
F2	FREQUENCY- 1 MHz (BCD)	0-9	1 MHz (8)	1 MHz (4)	1 MHz (2)	1 MHz (1)
F3	FREQUENCY-100 kHz (BCD)	0-9	100 kHz (8)	100 kHz (4)	100 kHz (2)	100 kHz (1)
F4	FREQUENCY- 10 kHz (BCD)	0-9	10 kHz (8)	10 kHz (4)	10 kHz (2)	10 kHz (1)
F5	FREQUENCY- 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
F6	FREQUENCY-100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
F7	FREQUENCY- 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
F8	FREQUENCY- 1 kHz (BCD)	0-9	1 Hz (8)	1 Hz (4)	1 Hz (2)	1 Hz (1)
%	END DELIMETER	%	NA	NA	NA	NA

- - A1 A2 SD M1 M2 M3 M4 M5 M6 M7 M8 %   WORD 2 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	5	NA	NA	NA	NA
M1	RF GAIN CONTROL	0-9, A-F	0	0	0	RF GAIN (16)
M2	RF GAIN CONTROL	0-9, A-F	RF GAIN (8)	RF GAIN (4)	RF GAIN (2)	RF GAIN (1)
M3	BANDWIDTH FILTER ENABLES	0-9, A-F	FL E ENBL	FL D ENBL	FL C ENBL	FL B ENBL
M4	AGC TIME CONSTANTS (B2-A2)	0-9, A-F	B2 AGC (2)	B2 AGC (1)	A2 AGC (2)	A2 AGC (1)
M5	SW FILTER ENABLES, VBFO, AFC ENABLE	0-9, A-F	FL A ENBL	16 kHz ENBL	VBFO ENBL	AFC ENBL
M6	AGC TIME CONSTANTS (B1-A1)	0-9, A-F	B1 AGC (2)	B1 AGC (1)	A1 AGC (2)	A1 AGC (1)
M7	MODE SELECT ENABLES	0-9, A-F	NET DATA	AM	CW	ISB
M8	ISB CHANNEL ENABLES	0-9, A-F	B2	B1	A1	A2
%	END DELIMITER	%	NA	NA	NA	NA

- - A1 A2 SD V1 V2 V3 V4 V5 V6 V7 V8 %   WORD 3 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D. (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS. L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	9	NA	NA	NA	NA
V1	VBFO SIGN (0=+)	0,1	0	0	0	VBFO SIGN
V2	VBFO FREQUENCY, 1 kHz (BCD)	0-9	1 kHz (8)	1 kHz (4)	1 kHz (2)	1 kHz (1)
V3	VBFO FREQUENCY, 100 Hz (BCD)	0-9	100 Hz (8)	100 Hz (4)	100 Hz (2)	100 Hz (1)
V4	VBFO FREQUENCY, 10 Hz (BCD)	0-9	10 Hz (8)	10 Hz (4)	10 Hz (2)	10 Hz (1)
V5	AUXILIARY	0	-	-	-	-
V6	AUXILIARY	0	-	-	-	-
V7	RESERVED	0	0	0	0	0
V8	AGC BUS	0-9, A-F	B2	B1	A1	A2
%	END DELIMITER	%	NA	NA	NA	NA

- - A1 A2 SD S1 S2 S3 S4 S5 S6 S7 S8 %   WORD 4 CHARACTER SEQUENCE

-	HYPHEN	-	NA	NA	NA	NA
-	HYPHEN	-	NA	NA	NA	NA
A1	ADDRESS, M.S.D (BCD)	0-3	0	0	A1 (2)	A1 (1)
A2	ADDRESS, L.S.D. (BCD)	0-9	A2 (8)	A2 (4)	A2 (2)	A2 (1)
SD	SEQUENCE DESIGNATOR	D	NA	NA	NA	NA
S1	FAULT SUMMARY	0-3	0	0	RCVR FAULT	RCVR OVLD
S2	AF MONITORS	0-9, A-F	B2	B1	A1	A2
S3	SYNTHESIZER FREQUENCY LOCK FAULTS	0-9, A-F	0	10 Hz	100 Hz	1 kHz
S4	SYNTH FREQ LOCK/SYNTH OUT LOCK/FREQ REF FAULTS	0-9, A-F	10 kHz	100 kHz	SYNTH OUT	FREQ REF
S5	SUBCARRIER LOCK/VBFO SYNTH/PWR SPLY FAULTS	0-7	0	SUBCARRIER	VBFO SYNTH	PWR SPLY
S6	IF AGC MONITORS	0-9, A-F	B2	B1	A1	A2
S7	EXT STD/AFC LOCK/RF PERF MONITORS	0-3	0	EXT STD	AFC LOCK	RF PERF
S8	PRESEL FAULT/DATA ERROR/LOCAL/MONITOR	0-9, A-F	PRESEL FAULT	DATA ERROR	LOCAL CONTROL	MONITOR
%	END DELIMITER	%	NA	NA	NA	NA

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ASCII Character Monitor Word Format
Figure 9

WORD	CHARACTER	STOP BIT	PARITY BIT	CHARACTER BIT POSITION								START BIT	
				B8	B7	B6	B5	B4	B3	B2	B1		
1	1	1	X	WORD SYNC 1	1	SUBADDRESS 0	0	ADDRESS A4	A3	A2	A1	0	
	2	1	X	CMD/STATUS RQST $\overline{C}=0$	$\overline{S}=1$	FREQ (10 MHz) (2)	(1)	FREQ (1 MHz) (8)	(4)	(2)	(1)	0	①
	3	1	X	FREQ (100 kHz) (8)	(4)	(2)	(1)	FREQ (10 kHz) (8)	(4)	(2)	(1)	0	
	4	1	X	FREQ (1 kHz) (8)	(4)	(2)	(1)	FREQ (100 Hz) (8)	(4)	(2)	(1)	0	
	5	1	X	FREQ (10 Hz) (8)	(4)	(2)	(1)	FREQ (1 Hz) (8)	(4)	(2)	(1)	0	
2	1	1	X	WORD SYNC 1	1	SUBADDRESS 0	1	ADDRESS A4	A3	A2	A1	0	
	2	1	X	CMD/STATUS RQST $\overline{C}=0$	$\overline{S}=1$	RF GAIN CONTROL 0	(16)	(8)	(4)	(2)	(1)	0	①②
	3	1	X	FILTER SELECT FLE	FLD	FLC	FLB	CHAN B2 AGC (2)	(1)	CHAN A2 AGC (2)	(1)	0	③
	4	1	X	FILTER SELECT FLA	16 kHz	VBFO ENABLE	AFC ENABLE	CHAN B1 AGC (2)	(1)	CHAN A1 AGC (2)	(1)	0	
	5	1	X	MODE SELECT NET DATA	AM	CW	ISB	CHAN B2 ENABLE	CHAN B1 ENABLE	CHAN A1 ENABLE	CHAN A2 ENABLE	0	
3	1	1	X	WORD SYNC 1	1	SUBADDRESS 1	0	ADDRESS A4	A3	A2	A1	0	
	2	1	X	CMD/STATUS RQST $\overline{C}=0$	$\overline{S}=1$	0	VBFO SIGN	VBFO OFFSET FREQ (1 kHz) (8)	(4)	(2)	(1)	0	①
	3	1	X	VBFO OFFSET FREQ (100 Hz) (8)	(4)	(2)	(1)	VBFO OFFSET FREQ (10 Hz) (8)	(4)	(2)	(1)	0	
	4	1	X	AUXILIARY								0	
	5	1	X	RESERVED				CHAN B2 AGC BUS	CHAN B1 AGC BUS	CHAN A1 AGC BUS	CHAN A2 AGC BUS	0	
4	1	1	X	WORD SYNC 1	1	SUBADDRESS 1	1	ADDRESS A4	A3	A2	A1	0	
	2	1	X	CMD/STATUS RQST $\overline{C}=0$	$\overline{S}=1$	RECEIVER FAULT	RECEIVE OVERLOAD	B2 AF MON	B1 AF MON	A1 AF MON	A2 AF MON	0	①④
	3	1	X	0	10 Hz LOCK FAULT	100 Hz LOCK FAULT	1 kHz LOCK FAULT	10 kHz LOCK FAULT	100 kHz LOCK FAULT	SYN OUT LOCK FAULT	FREQ REF FAULT	0	⑤
	4	1	X	0	SUBCARR LOCK FAULT	VBFO SYNTH FAULT	RECEIVER PWR SPLY FAULT	B2 AGC MON	B1 AGC MON	A1 AGC MON	A2 AGC MON	0	
	5	1	X	0	EXTERNAL STANDARD	AFC LOCK MON	RF PERF MON	PRE-SELECTOR FAULT	DATA ERROR	LOCAL CONTROL	MONITOR	0	

NOTES:

① THE COMMAND (C) AND STATUS (S) REQUEST BITS ARE CODED AS FOLLOWS:

B8	B7	
C	S	SIGNFICANCE
0	0	COMMAND WORD WITH STATUS REQUEST
0	1	COMMAND WORD ONLY-NO STATUS DESIRED
1	0	STATUS REQUEST ONLY (2 CHARACTER SEQUENCE)
1	1	THIS COMBINATION NOT ALLOWED

② RF GAIN CONTROL IS FIVE BITS BINARY CODED, APPROXIMATELY 3-dB GAIN REDUCTION PER STEP (PROCESSOR CONTROL APPLICATIONS) OR FOUR BITS (LEAST SIGNIFICANT BIT SET TO ZERO), APPROXIMATELY 6-dB GAIN REDUCTION PER STEP (CONTROL UNIT APPLICATIONS). ALL "ZERO" CODE INDICATES NO GAIN REDUCTION, PROGRESSING IN BINARY STEPS TO THE ALL "ONES" CODE FOR MAXIMUM GAIN REDUCTION.

③ FILTER BANDWIDTH DESIGNATIONS ARE DEFINED AS FOLLOWS:

16 -- FL1
A -- FL3
B -- FL4
C -- FL5
D -- FL6
E -- FL7

④ WORD 4 COMMAND OR STATUS REQUEST IS ONLY TWO CHARACTERS LONG.

⑤ CHARACTERS 3, 4, AND 5 OF MONITOR WORD 4 CONTAIN FAULT AND PERFORMANCE MONITOR BITS FOR WHICH NO CORRESPONDING CONTROL BITS EXIST. THE "DATA ERROR" BIT IS THE LOGICAL SUM OF THE FOLLOWING CONDITIONS:

A. RECEIVED CHARACTER PARITY ERROR.
B. FRAMING ERROR (NO VALID STOP RECEIVED WITH THE CHARACTER).
C. OVERRUN ERROR (PREVIOUS CHARACTER WAS NOT PROCESSED BEFORE THE CURRENT CHARACTER WAS RECEIVED).
D. INVALID CHARACTER SEQUENCE.

⑥ 1 = LOGIC 1
0 = LOGIC 0
X = FUNCTION OF STRAPPING
(1) = BIT WEIGHT

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8-Bit Character Control and Monitor Word Format
Figure 10

2.3.2 Receiver Serial Control Operation

2.3.2.1 Control Inputs (Refer to figure 11.)

Control data signals generated by the HF-8094 Receiver Control or processor are applied to the receiver as control information. These control signals are transferred over the control bus in serial format. If the receiver CONT switch is in the REM position, the serial information received controls the operation of the receiver.

Control data is applied to a serial data processor on the receiver serial interface card. Word and status information is decoded from the control data and is used to determine strobe address information. The control data is then applied to the data input of four word serial-to-parallel converters on the receiver parallel output card. Each serial-to-parallel converter is enabled before it accepts and processes the control data. This occurs when the strobe address input is decoded and an enable signal is generated by the word enable circuit.

The serial-toparallel converters decode the serial input information and convert it to parallel output levels. These outputs provide all control signals necessary to control the receiver remotely. The outputs are also supplied to the parallel input card where they are processed and returned to the receiver control or processor as monitor data. This provides an indication on the front panel of the receiver control or to the processor of the control information received by the receiver. When the receiver CONT switch is in the LCL or MON position, the register outputs of the parallel output card are disabled, and the internal parallel control lines are controlled by the receiver front panel controls.

2.3.2.2 Monitor Outputs (Refer to figure 11.)

When the receiver CONT switch is in the REM position, monitor signals indicating frequency, rf gain, AGC, bandwidth, mode, and related control and enable signals are applied, in parallel, from the receiver parallel output card to the receiver parallel input card for processing and application to the receiver serial interface card. Fault and performance monitor indications are applied from appropriate areas of the receiver to the receiver parallel input card for processing and application to the receiver serial interface card. The receiver serial interface card output to the receiver control is a series of monitor words in serial format. (Refer to figures 9 and 10 for monitor word formats.)

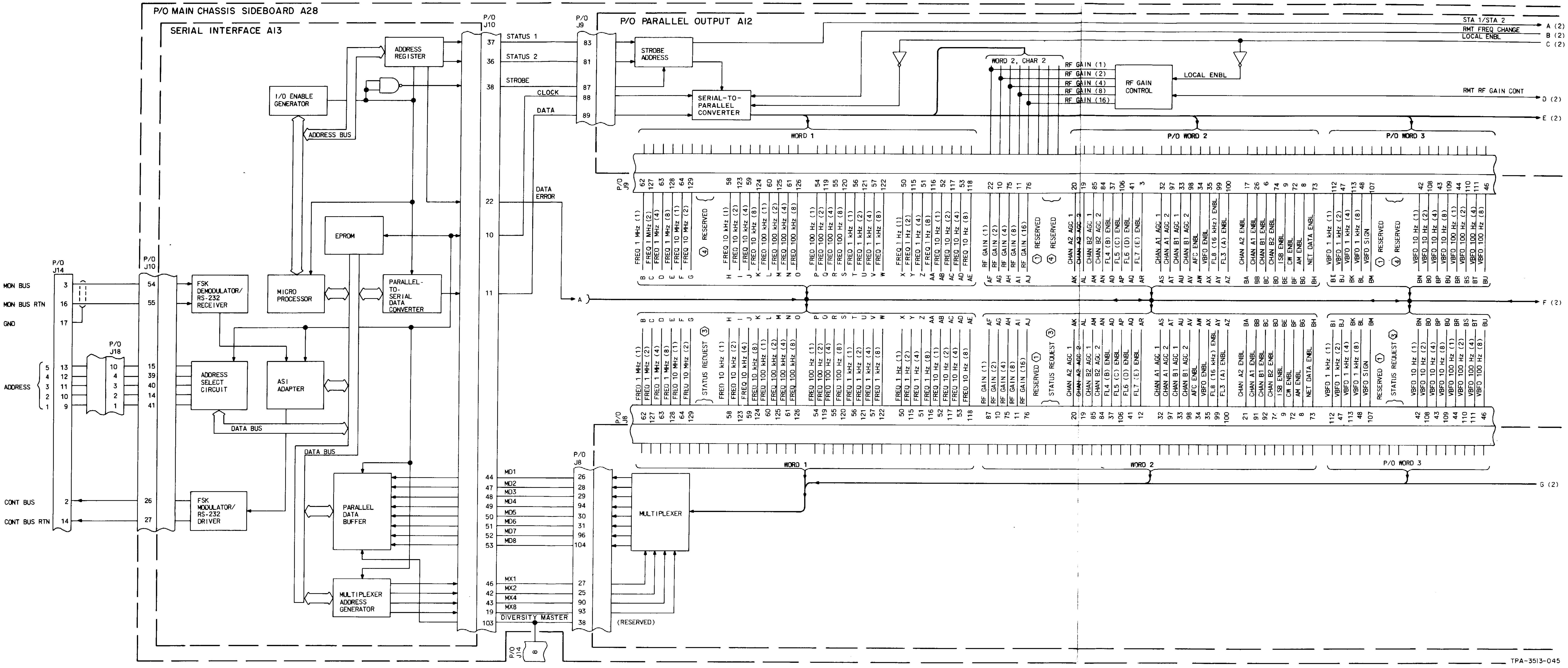
Four separate words are required to supply a complete status report to the remote control. These four words are independent of each other, thus can be transmitted at any time and in any sequence.

Monitor (and control) word timing is accomplished by a crystal-controlled oscillator on the receiver serial interface card. A divider reduces the frequency to the desired values. Switching permits selection of the baud rate for clock inputs to the various circuits. Selection is from 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, and 19 200 bauds.

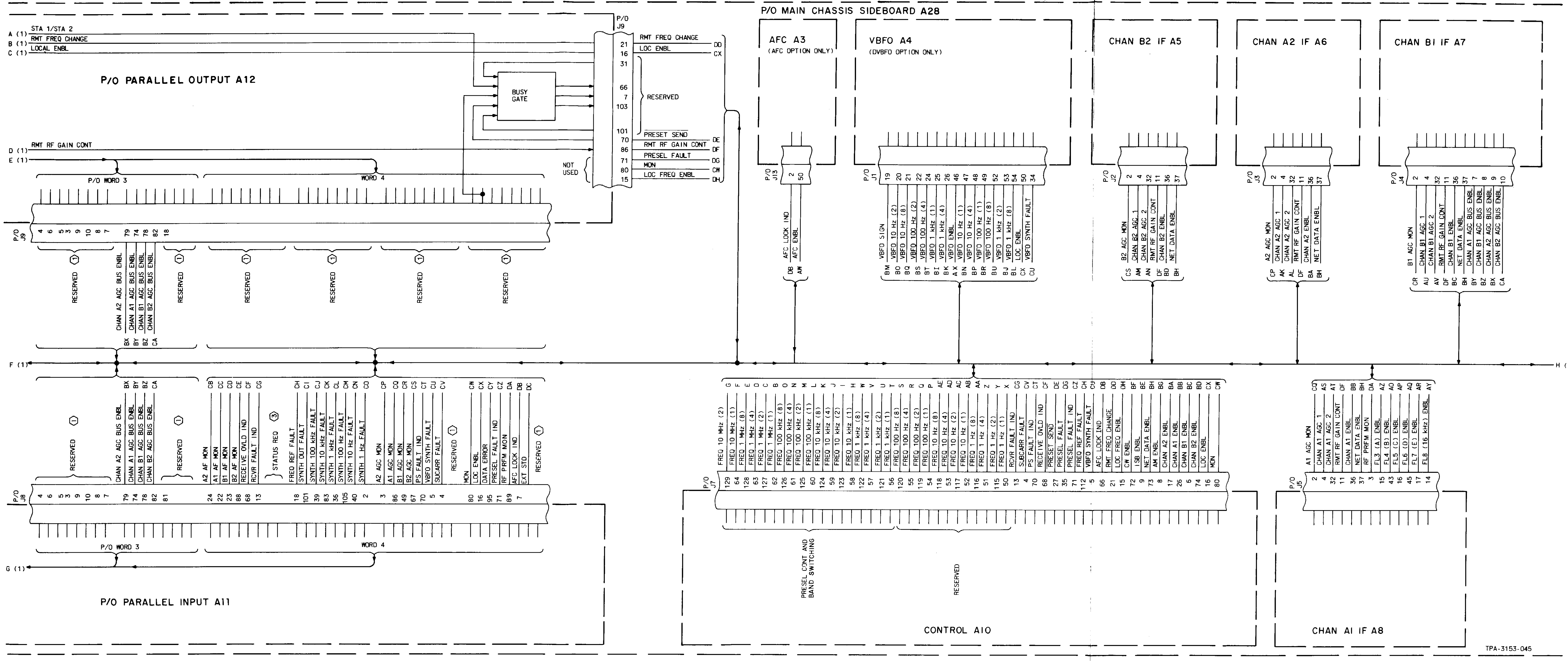
Monitor information (performance monitors and faults) from the receiver cards is fed to multiplexers on the receiver parallel input card. This monitor data is clocked out through the receiver serial interface card, which shifts the serial data through the FSK keyer or RS-232C driver circuit to the external monitor bus and receiver control.

With the receiver CONT switch in the LCL or MON position, operation of the monitor circuits is identical to that described above. However, the outputs of the storage registers on the parallel output card (which store the receiver control data) are disabled and the internal control lines (mode, frequency, bandwidth, etc) are controlled by the receiver front panel controls. Thus, the receiver front panel controls determine receiver operation and their control signals are applied to the parallel input card for processing and application to the receiver control as monitor data. Because of this, the monitor data from the receiver always contains the applied operational status of the receiver whether it is operated locally or remotely.

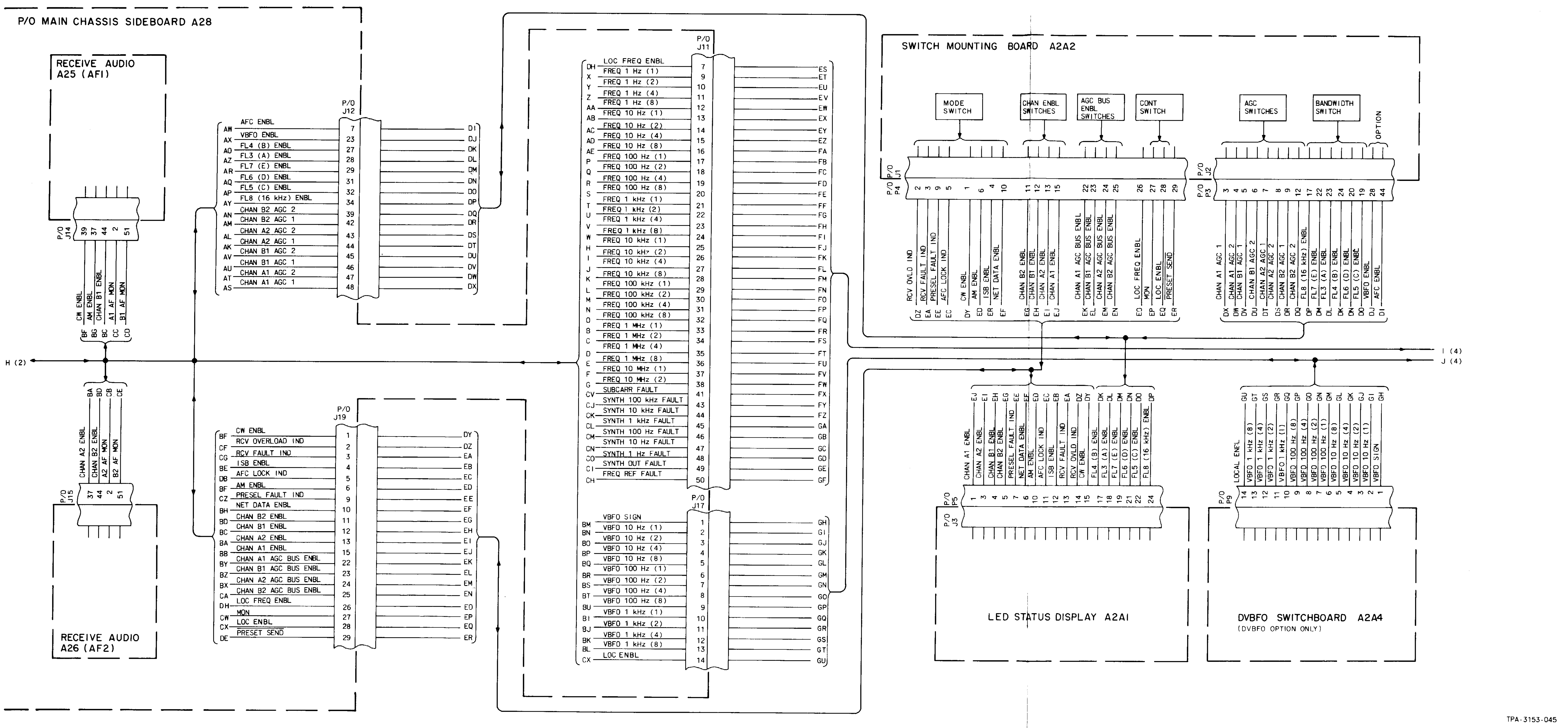
The LCL and MON positions of the CONT switch are identical, except that in the LCL position the local control bit of the monitor data is set to logic 1. In the MON position, both the local control bit and the monitor data bit of monitor data are set to logic 1. The monitor bit is used as a flag in processor control applications, indicating that some programmed action needs to be initiated by the processor control.



Remote Control, Block Diagram
Figure 11 (Sheet 1 of 4)



Remote Control, Block Diagram
Figure 11 (Sheet 2)



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Remote Control, Block Diagram
Figure 11 (Sheet 3)

NOTES:

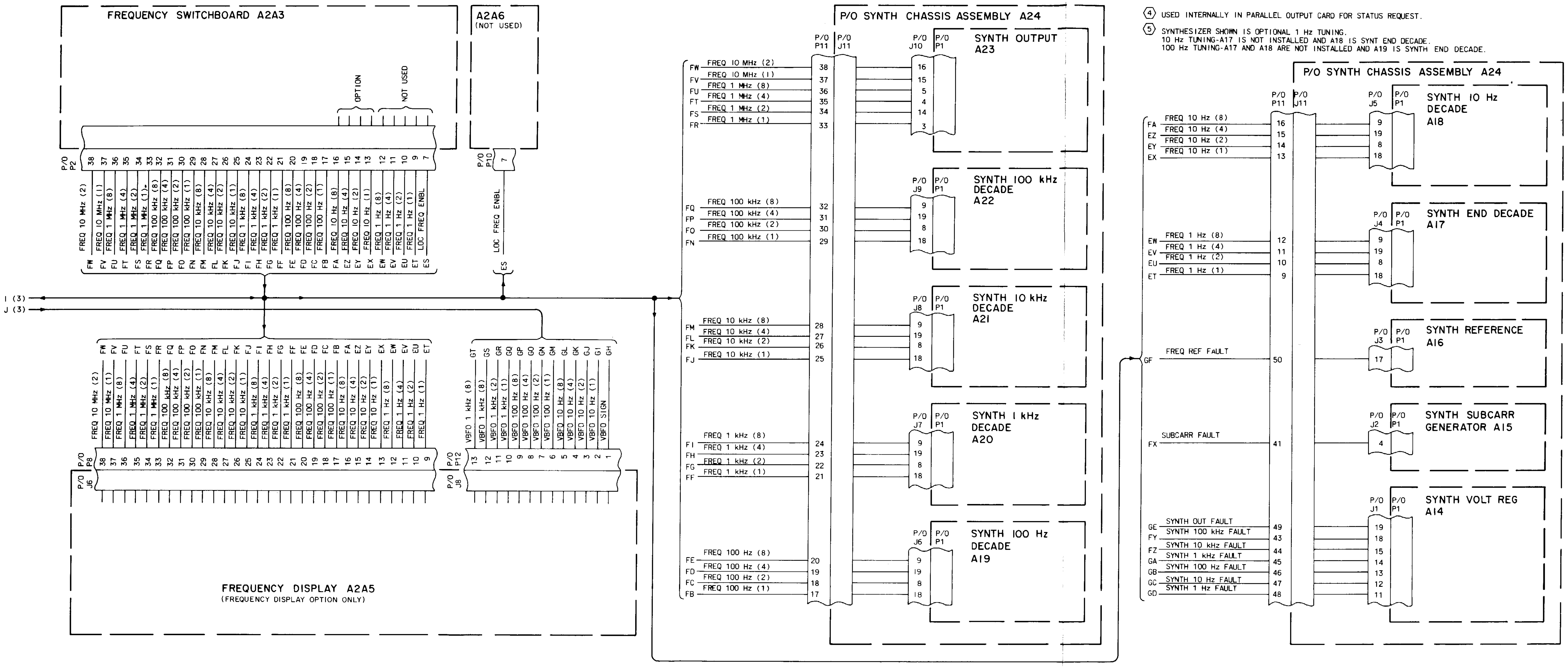
⟨1⟩ UNASSIGNED, RESERVED FOR FUTURE USE.

⟨2⟩ NOT USED IN RCVR, USED ONLY IN CONTROLS.

⟨3⟩ STATUS REQUEST, INTERNALLY STRAPPED IN PARALLEL INPUT CARD SO ALL WORDS RECEIVE SAME STATUS REQUEST.

⟨4⟩ USED INTERNALLY IN PARALLEL OUTPUT CARD FOR STATUS REQUEST.

⟨5⟩ SYNTHESIZER SHOWN IS OPTIONAL 1 Hz TUNING.
10 Hz TUNING-A17 IS NOT INSTALLED AND A18 IS SYNT END DECADE.
100 Hz TUNING-A17 AND A18 ARE NOT INSTALLED AND A19 IS SYNTH END DECADE.



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Remote Control, Block Diagram
Figure 11 (Sheet 4)

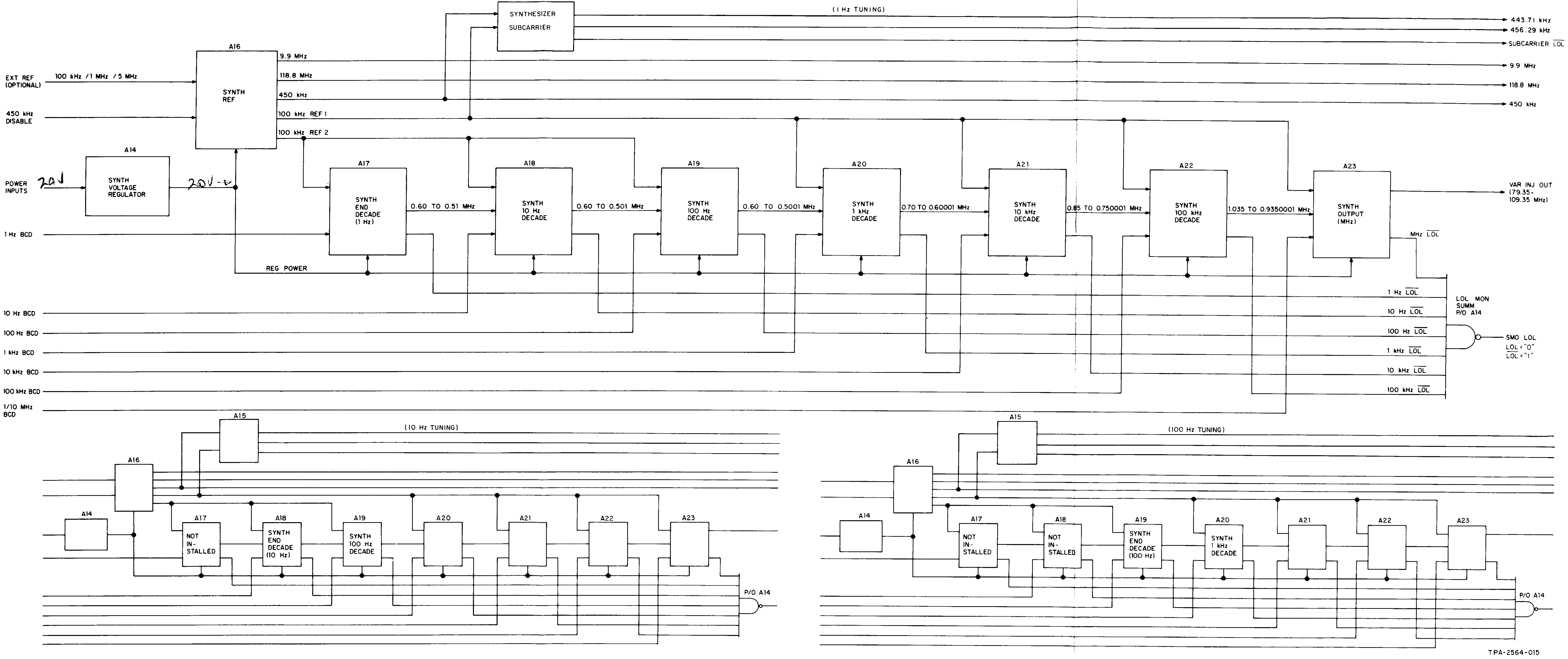
2.4 Frequency Synthesizer

2.4.1 General (Refer to figure 12.)

The frequency synthesizer used in the HF-8054( ) Receiver can be accurately tuned in 1-, 10-, or 100-Hz steps. The tuning increment is determined by the use and placement of the associated frequency decade circuit cards. The frequency synthesizer uses a 9.9-MHz tcxo (temperature-compensated crystal oscillator) as a base for generating the required synthesizer frequencies. Using dividers and multipliers, the synthesizer produces the following fixed frequencies.

a. 9.9-MHz injection frequency
b. 118.8-MHz injection frequency
c. 100-kHz synthesizer reference frequency
d. 450-kHz USB and LSB injection frequency
e. 456.29-kHz UUSB injection frequency
f. 443.71-kHz LLSB injection frequency

Using the 100-kHz synthesizer reference frequency and the associated decades, the variable injection frequency for the selected output frequency is generated. The variable injection frequency is 109.350 000 to 79.350.001 MHz (the higher the selected output frequency, the lower the variable injection frequency). Note that figure 12 shows the synthesizer complement for 1-, 10-, and 100-Hz tuning.



Frequency Synthesizer, Simplified Block Diagram
Figure 12

2.4.2 Synthesizer Reference (Refer to figure 13.)

The synthesizer reference uses a 9.9-MHz tcxo as a base for generating the required synthesizer frequencies. When used with an external reference, the 9.9-MHz tcxo is supplied with a tracking voltage generated by the 100-kHz reference signal and the external frequency standard. When not used with the external reference, an internal temperature compensation network is used to maintain a constant frequency output from the tcxo.

The 9.9-MHz tcxo output is supplied through an output amplifier and used as 9.9-MHz fixed injection output.

The 9.9-MHz tcxo output is applied to a times-12 circuit that produces a 118.8-MHz fixed injection input.

The 9.9-MHz txco output is applied to a divide-by-11 circuit that produces a 900-kHz base frequency. The 900-kHz base frequency is applied to a divide-by-2 circuit that produces a 450-kHz USB and LSB injection frequency. The 900-kHz base frequency is also applied to a divide-by-9 circuit that produces two 100-kHz reference outputs. The 100-kHz reference frequency outputs applied to each of the synthesizer decades as a reference for variable injection frequency generation and to the subcarrier generator circuit card. In addition, the 450-kHz signal is applied to the subcarrier generator card.

The frequency standard switch applies the external reference signal to the synthesizer reference module. If the external standard malfunctions or the signal is interrupted, the frequency standard switch automatically switches to the internal standard, preventing loss of service.

2.4.3 Synthesizer Subcarrier Generator (Refer to figure 13.)

The subcarrier generator uses three phase-locked loops to produce output frequencies of 456.29-kHz and 443.71-kHz. These frequencies are used in the exciter when using channel A2 (UUSB) and channel B2 (L-LSB) modes of operation.

The subcarrier generator receives input reference signals of 450-kHz and 100-kHz in addition to the 450-kHz enable signal. The output signals are the 456.29-kHz injection signal, the 443.71-kHz injection signal, and a subcarrier generator status signal.

The 456.29-kHz phase-locked loop consists of loop mixer (Q5), squaring amplifier (U6D, E, F), phase/frequency detector (U1, U2, U3), integrator-filter (U4A, B), and vco-buffer (Q1, Q2, Q3).

The 443.71-kHz phase-locked loop consists of loop mixer (Q7), squaring amplifier (U6A, B, C) phase/frequency detector (U17, U18, U19), integrator-filter (U20A, B) and vco-buffer (Q8, Q9, Q10).

The 6.29-kHz phase-locked loop consists of divide-by-100 circuit (U7, U13), phase/frequency detector (U8, U9, U10), divide-by-629 circuit (U15, U16), integrator-filter (U11A), 629-kHz vco (U12) and logic converter (Q4).

2.4.4 Synthesizer End Decade (Refer to figure 13.)

The synthesizer end decade receives bcd inputs and a fixed 100-kHz reference signal and provides a 0.60- to 0.51-MHz variable reference output to the next decade step.

The synthesizer end decade can be used as the 1-, 10-, or 100-Hz decade to provide the appropriate reference frequency to the next decade in the synthesizer. As implied by its name, it is the end decade, that is, if used as a 1-Hz decade it provides 1-Hz tuning (accuracy), if used as a 10-Hz decade it provides 10-Hz tuning (accuracy), and if used as a 100-Hz decade it provides 100-Hz tuning (accuracy).

The synthesizer end decade contains a phase-lock loop consisting of a phase/frequency discriminator, variable vco, variable divider, and a lock detector. The 100-kHz reference signal is applied to the phase/frequency discriminator where it is compared with the 100-kHz signal from the variable divider. The phase/frequency discriminator develops a tracking voltage output (based on the phase/frequency difference of the 100-kHz signals). The tracking voltage drives the variable vco to the frequency as determined by the bcd input (programmed division ratio of variable divider).

The variable vco signal is divided (division ratio of the variable divider) and applied as 100-kHz variable reference to the phase/frequency discriminator. When the inputs to the phase/frequency discriminator are the same frequency and in phase, a lock signal output is supplied.

The variable vco signal is applied to the fixed divide-by-10 output circuit and the 0.60- to 0.51-MHz end decade output signal is supplied to the next decade step.

2.4.5 Synthesizer Decades (Refer to figure 13.)

The synthesizer decade bcd inputs, a fixed 100-kHz reference signal, and a variable high reference signal, and provides a variable reference signal to the next decade step. Refer to table 4 for the input/output difference of the synthesizer decades.

Table 4. Decade Versus Input/Output Frequencies.

DECADE	HI REF INPUT FREQ (MHz)	HI REF OUTPUT FREQ (MHz)
100 kHz	0.85 to 0.750 001	1.035 to 0.935 001
10 kHz	0.70 to 0.600 01	0.85 to 0.750 001
1 kHz	0.60 to 0.500 1	0.70 to 0.600 01
100 Hz	0.60 to 0.501	0.60 to 0.500 1
10 Hz	0.60 to 0.51	0.60 to 0.501

The synthesizer decades differ only in strapping and vco coils. These differences result in the different input and output frequencies as shown in table 3.

These synthesizer decades can be used as the 10- and 100-Hz decades and are used on the 1-, 10-, and 100-kHz decades to provide the appropriate reference frequency for the next decade in the synthesizer. For 1-Hz tuning, two 100/10-Hz decades are used, one as the 10-Hz decade and one as the 100-Hz decade. For 10-Hz tuning, one 100/10-Hz decade is used as the 100-Hz decade. For 100-Hz tuning, no 100/10-Hz decade is used.

The synthesizer decade contains two phase-lock loops. The translator phase-lock loop consists of a phase/frequency discriminator, variable vco, variable divider, and a lock detector. The 100-kHz reference signal is applied to the phase/frequency discriminator where it is compared with the 100-kHz signal from the variable divider. The phase/frequency discriminator develops a tracking voltage output based on the phase/frequency difference of the 100-kHz signals. The tracking voltage drives the variable vco to the frequency, as determined by the bcd input (programmed division ratio of variable divider). The tracking voltage is also applied as a reference voltage to the variable vco in the output phase-lock loop. The variable vco signal output in the translator phase-lock loop is applied to the mixer in the output phase-lock loop.

The variable vco signal output in the translator phase-lock loop is also divided (division ratio of the variable divider) and applied as 100-kHz variable reference to the phase/frequency discriminator. When the inputs to the phase/frequency discriminator are the same frequency and in phase, a translator lock signal output is supplied.

The output phase-lock loop consists of a phase/frequency discriminator, variable vco, mixer and squaring amplifier, and a lock detector. A high reference signal (refer to table 3) is applied to the phase/frequency discriminator where it is compared with the difference frequency from the mixer. The phase/frequency discriminator develops a tracking voltage output based on the phase/frequency difference of the high reference signal and the difference frequency from the mixer. The tracking voltage drives the variable vco to the frequency, as determined by the high reference input and reference voltage supplied by the translator phase-lock loop. The variable vco signal, in the output phase-lock loop, is supplied to a fixed divide-by-10 output circuit, and the output of the divide-by-10 network is supplied to the next decade step.

The variable vco signal, in the output phase-lock loop, is also mixed with the variable vco signal of the translator phase-lock loop, and a difference frequency reference is supplied through a squaring amplifier and applied to the phase/frequency discriminator. When the inputs to the phase/frequency discriminator are the same frequency and in phase, an output lock signal output is applied.

When lock signals are supplied by both the translator and output phase-lock loops, they are ANDed and supply a decade lock signal output.

2.4.6 Synthesizer Output Module (Refer to figure 13.)

The synthesizer output module receive units/tens MHz bcd inputs, a fixed 100-kHz reference signal, and a variable high reference signal, and provides a 109.35- to 79.350 001-MHz variable injection signal output to the unit under control.

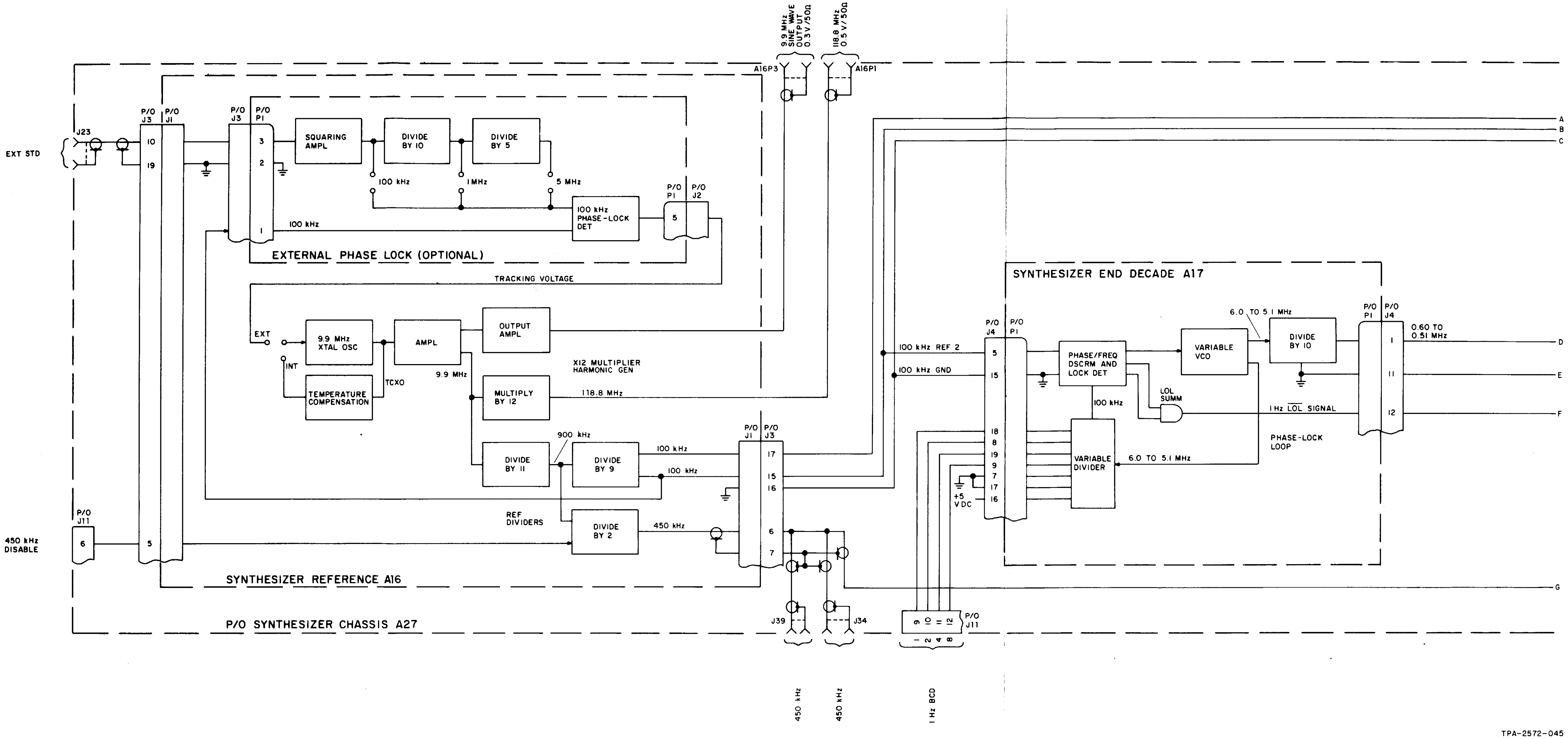
The synthesizer output module contains two phase-lock loops. The translator phase-lock loop consists of a phase/frequency discriminator, variable vco, variable divider, voltage/gain control, and a lock detector. The 100-kHz reference signal is applied to the phase/frequency discriminator where it is compared with the 100-kHz signal from the variable divider. The phase/frequency discriminator develops a tracking voltage based on the phase/frequency difference of the 100-kHz signals and the operation of the voltage/gain control circuit caused by the 10- and 20-MHz bcd inputs. The tracking voltage drives the variable vco to the frequency as determined by the bcd input (programmed division ratio of variable divider). The tracking voltage is also applied as a reference voltage to the voltage/gain control in the output phase-lock loop. The variable vco signal output in the translator phase-lock loop is applied to the mixer in the output phase-lock loop.

The variable vco signal output in the translator phase-lock is also divided (division ratio of the variable divider) and applied as 100-kHz variable reference to the phase/frequency discriminator. When the inputs to the phase/frequency discriminator are the same frequency and in phase, a translator lock signal output is supplied.

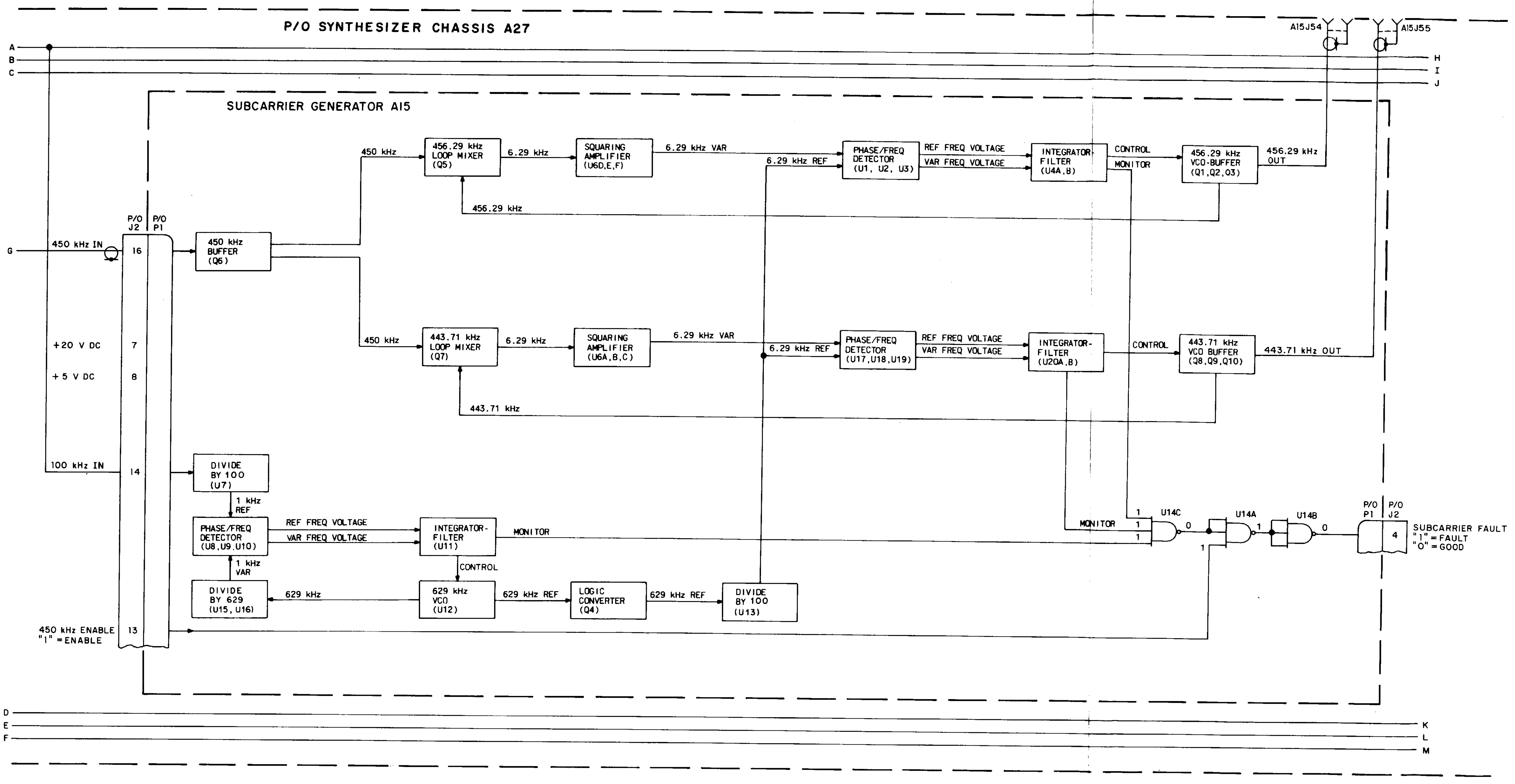
The output phase-lock loop consists of a phase/frequency discriminator, variable vco, mixer and quaring amplifier, voltage/gain control, and a lock detector. A high reference signal is applied to the phase/frequency discriminator where it is compared with the difference frequency from the mixer. The phase/frequency discriminator develops a tracking voltage output based on the phase/frequency difference of the high reference signal and the difference frequency from the mixer, and the operation of the voltage/gain control circuit caused by the translator phase-lock loop tracking voltage. The tracking voltage drives the variable vco to the frequency, as determined by the high reference input, and the reference voltage supplied by the translator phase-lock loop is supplied to the unit under control as the variable injection control signal.

The variable vco signal, in the output phase-lock loop, is also mixed with the variable vco signal of the translator phase-lock loop, and a difference frequency reference is supplied through a squaring amplifier and applied to the phase/frequency discriminator. When the inputs to the phase/frequency discriminator are the same frequency and in phase, an output lock signal output is supplied.

When lock signals are supplied by both the translator and output phase-lock loops, they are ANDed and supply a MHz decade lock signal output.



Frequency Synthesizer, Block Diagram
Figure 13 (Sheet 1 of 4)



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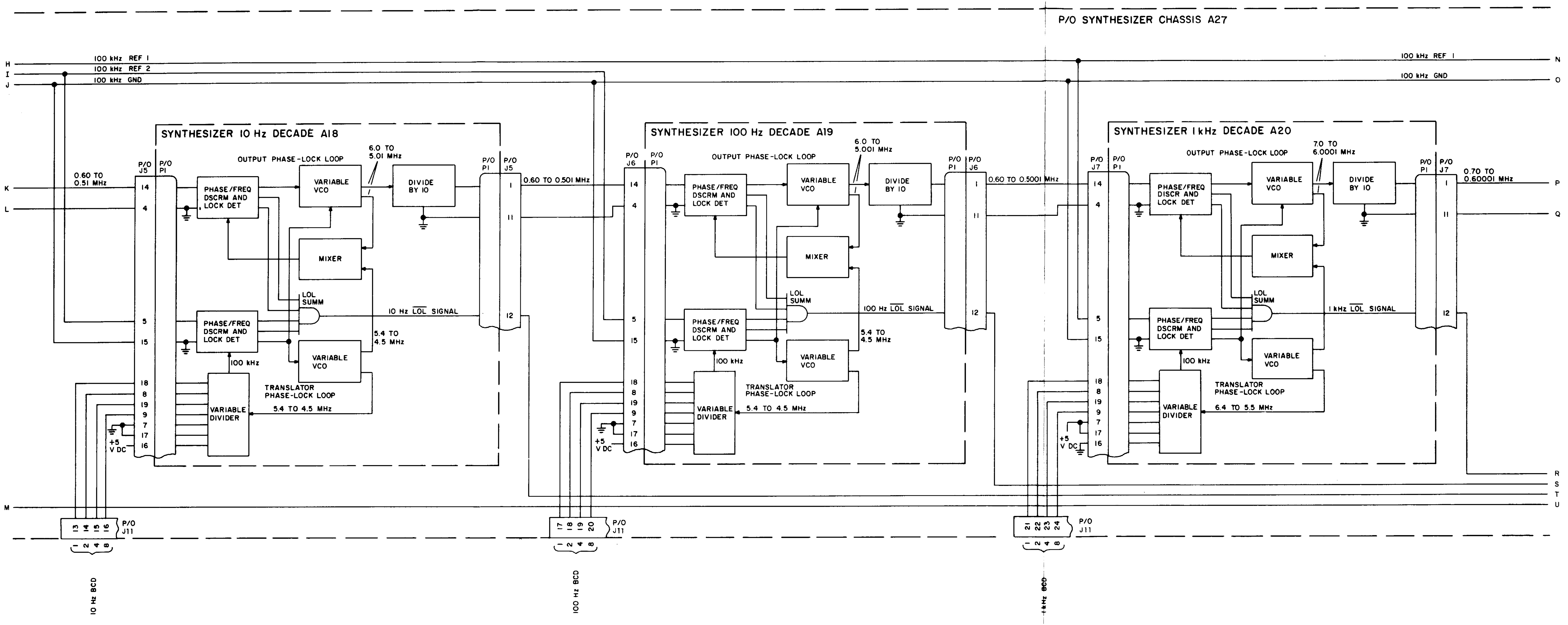
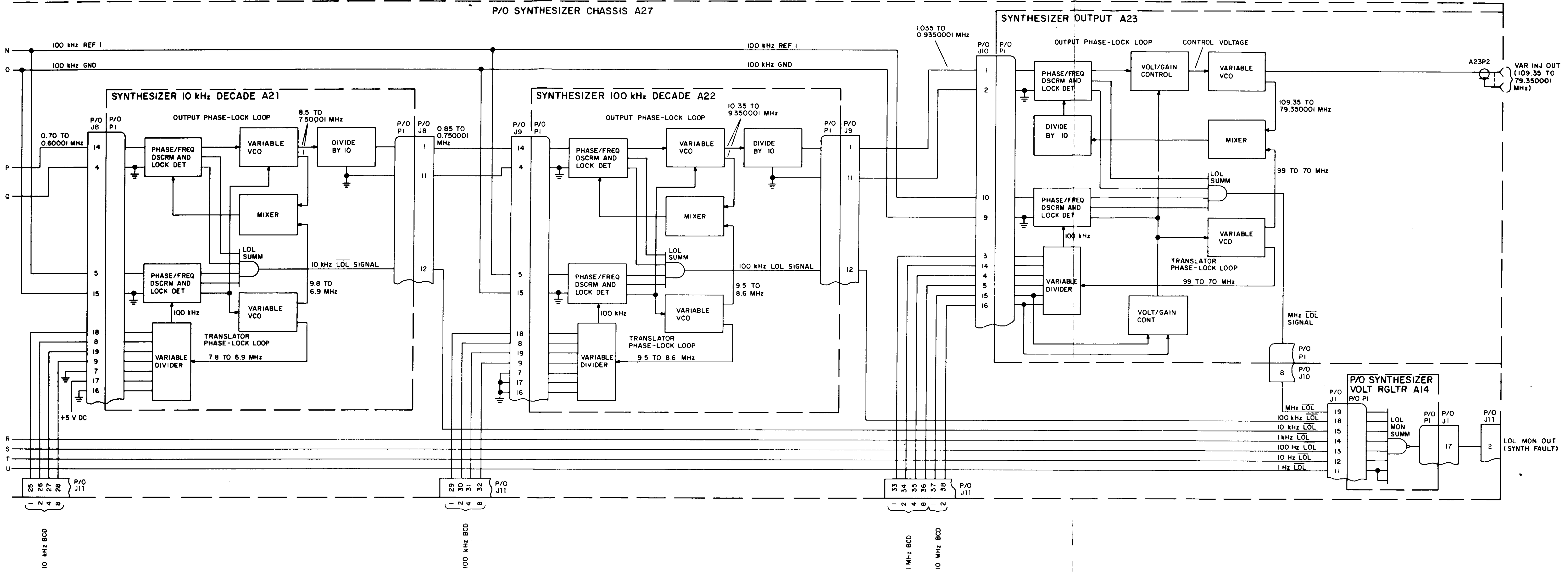
Frequency Synthesizer, Block Diagram
Figure 13 (Sheet 2)



Frequency Synthesizer, Block Diagram
Figure 13 (Sheet 3)



Frequency Synthesizer, Block Diagram
Figure 13 (Sheet 4)

2.5 Monitor Functions (Refer to figure 14.)

Local monitors in the receiver consist of LEDs on LED STATUS DISPLAY A2A1 and frequency display A2A3, and the front panel meter indications. All front panel monitor information and some additional monitor information is contained in the monitor data supplied by the HF-8054A Receiver to a control/display station. Likewise, some control information is supplied to the HF-8054A Receiver from a control station. Using the 8-bit character word format or 7-bit ASCII word format, monitor information supplied to the parallel input card is transmitted to a control/display station and control information supplied from the parallel output card is received from a control station. (Refer to table 5 for location of signals in control/monitor word format.)

2.5.1 Fault and Status Indicators

All fault and status indicators are lit by a logic 1 signal to LED status display A2A1. Refer to the LED status display section of this instruction book for detailed information.

a. AFC LOCK (DS3) is lit by an AFC lock signal A2J3-11. The logic 1 AFC lock signal is supplied by AFC card A3. In the HF-8054A Receiver, the AFC lock is also supplied to the parallel input card. The AFC lock signal indicates that the AFC is locked on the received carrier frequency.

b. RCV FAULT (DS5) is lit by a receive fault signal at A2J3-13. The logic 1 receive fault signal is supplied by control A10. In the HF-8054A Receiver, the receive fault signal is also supplied to the parallel input card. The receive fault signal from the control card is a summary of a power supply fault signal, a synthesizer reference fault signal, a synthesizer fault signal (smo lol), a vbfo synthesizer fault signal, a subcarrier fault signal, and an (external) receive fault signal.

   A logic 0 power supply fault signal is supplied by power supply module A1. In the HF-8054A Receiver, the power supply fault signal is also supplied to the parallel input card. The power supply fault signal from the power supply module is a summary fault signal resulting from the loss of +8-, +15-, +18-, +24-, or -15-V dc power supply outputs. The power supply fault signal will produce a receive fault signal from control A10. A receive fault, when caused by a power supply fault, is cleared only by changing frequency.

   A logic 1 synthesizer fault signal (smo lol) is supplied by voltage regulator A14 in the frequency synthesizer. The synthesizer fault signal from the synthesizer subassembly is a summary fault signal resulting from loss of lock on any of the synthesizer decades (1-, 10-, or 100-Hz end decade, 10-Hz decade, 100-Hz decade, 1-kHz decade, 10-kHz decade, 100-kHz decade, and 1/10-MHz output module). The synthesizer fault signal will produce a receive fault signal from control A10. A receive fault signal, when caused by a synthesizer fault signal, is cleared when the cause of the fault is removed.

   A logic 1 vbfo synthesizer fault signal is supplied by vbfo A4. In the HF-8054A Receiver, the vbfo synthesizer fault signal is also supplied to the parallel input card. The vbfo synthesizer fault signal from the vbfo card is a vbfo synthesizer loss-of-lock signal. The vbfo synthesizer fault signal will produce a receive fault signal from control A10. A receive fault signal, when caused by a vbfo synthesizer fault signal, is cleared when the cause of the fault is removed.

   A logic 1 synthesizer reference fault signal is supplied by synthesizer reference A16 in the frequency synthesizer. In the HF-8054A Receiver, the synthesizer reference fault signal is also supplied to the parallel input card. The synthesizer reference fault signal is a summary fault signal resulting from loss of 9.9-MHz injection frequency, loss of 118-MHz injection frequency, or loss of 450-kHz injection frequency (when 450-kHz enable is applied). A receive fault signal, when caused by a synthesizer reference fault signal, is cleared when the cause of the fault is removed.

   A logic 1 subcarrier fault signal is supplied by synthesizer subcarrier card A15. In the HF-8054A Receiver, the subcarrier fault signal is also supplied to the parallel input card. The subcarrier fault signal from the synthesizer subcarrier card is a summary fault signal resulting from loss-of-lock of the 456.29-kHz injection, loss-of-lock of the 443.71-kHz injection, loss-of-lock of the reference input to the synthesizer subcarrier card, or from the loss of the 450-kHz enable signal to the synthesizer subcarrier card. The subcarrier fault signal will produce a receive fault signal from control A10. A receive fault signal, when caused by a subcarrier fault signal, is cleared when the cause of the fault is cleared.

   A logic 0 (external) receive fault signal is supplied at TB2-11. The (external) receive fault signal is provided for use in diversity receiver connections to provide a fault indication when any receiver in the system has failed. The (external) receive fault signal will produce a receive fault signal from control A10. A receive fault signal, when caused by (external) receive fault signal, is cleared when the cause of the fault is removed.

c. RCV OVERLOAD (DS60 is lit by a receive overload signal at A2J3-14. The logic 1 receive overload signal is supplied by control A10. In the HF-8054A Receiver, the receive overload signal is also supplied to the parallel input card. The receive overload signal from the control card is a summary of preselector rf overload signal from an associated preselector and a receive rf overload from rf translator module A9.
d. PRESEL FAULT (DS23) is lit by a preselector fault signal at A2J3-7. The logic 1 preselector fault signal is supplied by control A10. In the HF-8054A Receiver, the preselector fault signal is also supplied to the parallel input card. The preselector fault signal from the control card is supplied as a logic 1 by the associated preselector and through a driver in control A10.

2.5.2 Mode Indicators

All mode indicators are lit by a logic 1 signal to LED status display A2A1. Refer to LED status display section of this instruction book for detailed information.

a. FM (DS1) is lit by an FM enable signal at A2J3-9. The logic 1 is supplied by MODE control switch on switch mounting board A2A2.
b. AM (DS2) is lit by an AM enable signal at A2J3-10. The logic 1 is supplied by MODE control switch on switch mounting board A2A2. In the HF-8054A Receiver, the AM enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
c. ISB (DS4) is lit by an ISB enable signal at A2J3-12. The logic 1 is supplied by MODE control switch on switch mounting board A2A2. In the HF-8054A Receiver, the ISB enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
d. CW (DS7) is lit by a CW enable signal at A2J3-15. The logic 1 is supplied by MODE control switch on switch mounting board A2A2. In the HF-8054A Receiver, the CW enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
e. NET DATA (DS22) is lit by a NET DATA enable signal at A2J3-6. The logic 1 is supplied by MODE control switch on switch mounting board A2A2. In the HF-8054A Receiver, the NET DATA enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.

2.5.3 ISB Channel Enable Indicators

All ISB channel enable indicators are lit by a logic 1 signal to LED status display A2A1. Refer to LED status display section of this instruction book for detailed information. ISB channel indicators will light only in ISB or NET DATA modes as the enabling logic 1 pull-up is removed in all other settings of the MODE switch.

a. CH A1 (DS12) is lit by a channel A1 enable signal at A2J3-1. The logic 1 is supplied by CH A1 enable switch on switch mounting board A2A2. In the HF-8054A Receiver, the channel A1 enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
b. CH B1 (DS9) is lit by a channel B1 enable signal at A2J3-4. The logic 1 is supplied by CH B1 enable switch on switch mounting board A2A2. In the HF-8054A Receiver, the channel B1 enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
c. CH A2 (DS19) is lit by a channel A2 enable signal at A2J3-3. The logic 1 is supplied by CH A2 enable switch on switch mounting board A2A2. In the HF-8054A Receiver, the channel A2 enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
d. CH B2 (DS10) is lit by a channel B2 enable signal at A2J3-5. The logic 1 is supplied by CH B2 enable switch on switch mounting board A2A2. In the HF-8054A Receiver, the channel B2 enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.

2.5.4 BANDWIDTH Indicators

All BANDWIDTH indicators are lit by a logic 1 signal to LED status display A2A1. Refer to LED status display section of this instruction book for detailed information. BANDWIDTH indicators will light only in AM, CW, or FM modes as the enabling logic 1 pull-up is removed in all other settings of the MODE switch.

a. 16 (DS14) is lit by an FL8 (16-kHz) enable signal at A2J3-24. The logic 1 is supplied by BANDWIDTH control switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL8 (16-kHz) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
b. A (DS17) is lit by an FL3 (A) enable signal at A2J3-18. The logic 1 is supplied by BANDWIDTH con-

trol switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL3 (A) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.

c. B (DS18) is lit by an FL4 (B) enable signal at A2J3-24. The logic 1 is supplied by BANDWIDTH control switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL4 (B) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
d. C (DS15) is lit by an FL5 (C) enable signal at A2J3-18. The logic 1 is supplied by BANDWIDTH control switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL5 (C) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
e. D (DS16) is lit by an FL6 (D) enable signal at A2J3-24. The logic 1 is supplied by BANDWIDTH control switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL6 (D) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.
f. E (DS19) is lit by an FL7 (E) enable signal at A2J3-18. The logic 1 is supplied by BANDWIDTH control switch on switch mounting board A2A2. In the HF-8054A Receiver, the FL7 (E) enable signal may also be supplied by the parallel output card and is supplied to the parallel input card.

2.5.5 FREQUENCY KHZ and VBFO OFFSET KHZ Displays (Refer to figure 7.)

All FREQUENCY KHZ and VBFO OFFSET KHZ displays are lit by the bcd supplied as the frequency control signals to the frequency synthesizer and/or the vbfo card. These bcd's are supplied from the frequency switchboard A2A3 and dvbfo switchboard A2A4, to the associated control circuits and the frequency display A2A5. In the HF-8054A Receiver, the frequency control signals may also be supplied by the parallel output card and are supplied to the parallel input card.

2.5.6 Metering

The front panel meter is controlled by the METER switch. METER switch A2A2S1 in the HF-8054( ) has nine positions: B2 AF: +13FS and +3FS; B1 AF: +13FS and +3FS; A1 AF: +13FS and +3FS; A2 AF: +13FS and +3FS; and RCV SIG.

a. In the B2 AF: +13FS and +3FS positions, a dc signal proportional to the channel B2 receive audio is supplied from receive audio A26 (AF2) through J15-52, J12-2, P3-49, and METER switch A2A2S1 to meter M1. In both positions A2A2R1 is in parallel with meter to ground to provide a calibrated full-scale reading of +3-dB mW full-scale deflection. In the B2 AF +13FS position, A2A2R2 is added in parallel with meter to ground to cause an effective reading of +13-dB mW full-scale deflection.
b. In the B1 AF: +13FS and +3FS positions, a dc signal proportional to the channel B1 receive audio is supplied from receive audio A25 (AF1) through J14-52, J12-9, P3-42, and METER switch A2A2S1 to meter M1. In both positions A2A2R1 is in parallel with meter to ground to provide a calibrated full-scale reading of +3-dB mW full-scale deflection. In the B1 AF +13FS position, A2A2R2 is added in parallel with meter to ground to cause an effective reading of +13-dB mW full-scale deflection.
c. In the A1 AF: +13FS and +3FS positions, a dc signal proportional to the channel A1 receive audio is supplied from receive audio A25 (AF1) through J14-3, J12-5, P3-46, and METER switch A2A2S1 to meter M1. In both positions A2A2R1 is in parallel with meter to ground to provide a calibrated full-scale reading of +3-dB mW full-scale deflection. In the A1 AF +13FS position, A2A2R2 is added in parallel with meter to ground to cause an effective reading of +13-dB mW full-scale deflection.
d. In the A2 AF: +13FS and +3FS positions, a dc signal proportional to the channel A2 receive audio is supplied from receive audio A26 (AF2) through J15-3, J12-3, P3-48, and METER switch A2A2S1 to meter M1. In both positions A2A2R1 is in parallel with meter to ground to provide a calibrated full-scale reading of +3-dB mW full-scale deflection. In the AF +13FS position, A2A2R2 is added in parallel with meter to ground to cause an effective reading of +13-dB mW full-scale deflection.
e. In the RCV SIG position, an rf AGC meter signal is supplied from the channel A1 if card A8 through J5-12, J12-10, P3-41, and METER switch A2A2S1 to meter M1. This AGC meter signal is supplied by an AGC meter bus which commons the channel A1, channel B1, channel A2, and channel B2 AGC meter outputs. The output of this AGC bus is the strongest AGC signal applied by any of the four if channels. In the RCV SIG position, the meter is zeroed at 0 dB with up to 1-μV signal input and calibrated in dB above 1 μV with full-scale deflection of 100 dB above 1-μV rf signal input.

2.5.7 Remote Monitors Not Used Internally

Remote monitors in the HF-8054A consist of performance monitors which indicate by logic level the status of specific areas of the HF-8054A. All of these monitors indicate by presence of a logic 1 that the circuit is operational.

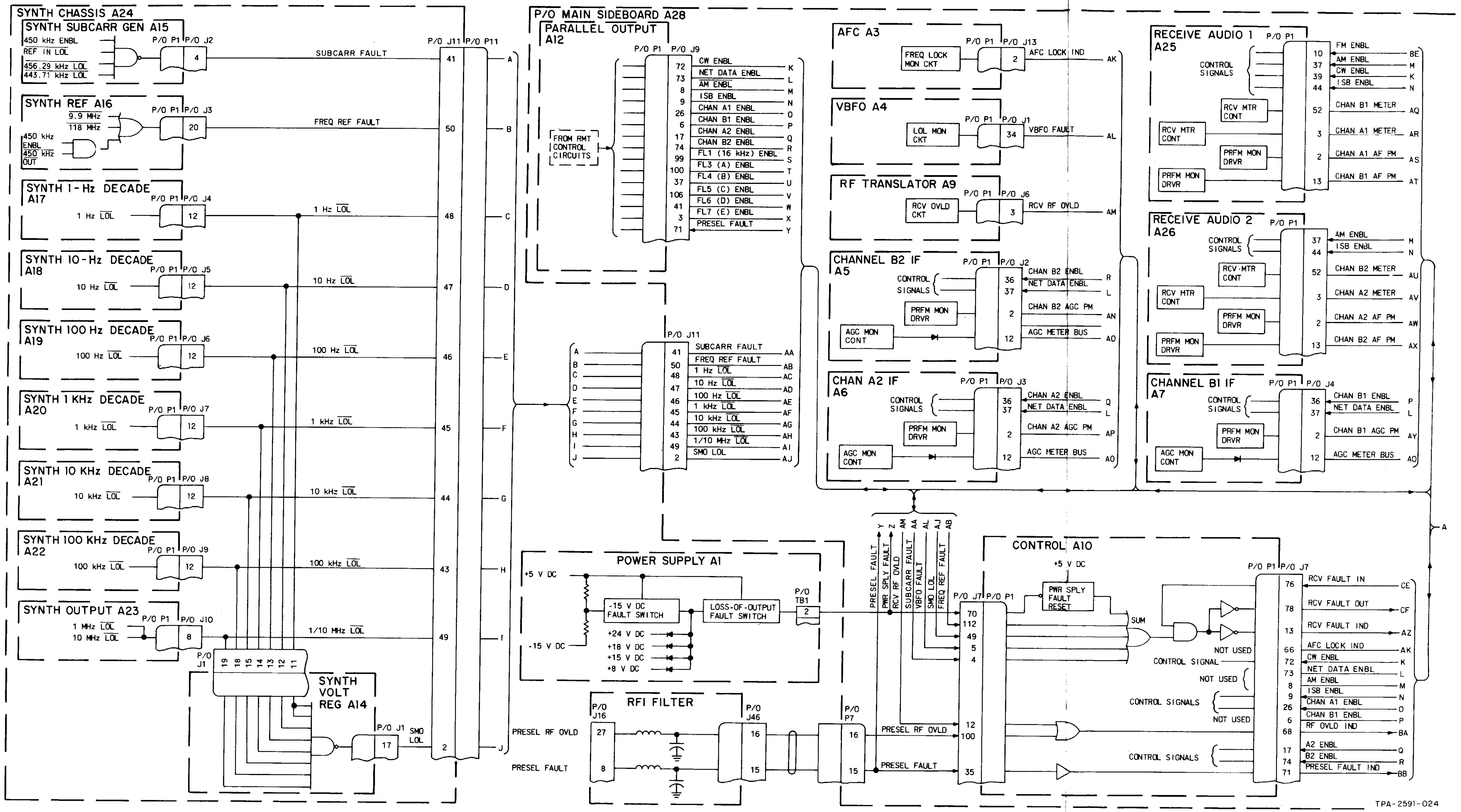
a. 10-Hz $\overline{\text{LOL}}$ signal is supplied by synthesizer 10-Hz decade A18 to the parallel input card.
b. 100-Hz $\overline{\text{LOL}}$ signal is supplied by synthesizer 100-Hz decade A19 to the parallel input card.
c. 1-kHz $\overline{\text{LOL}}$ signal is supplied by synthesizer 1-kHz decade A20 to the parallel input card.
d. 10-kHz $\overline{\text{LOL}}$ signal is supplied by synthesizer 10-kHz decade A21 to the parallel input card.
e. 100-kHz $\overline{\text{LOL}}$ signal is supplied by synthesizer 100-kHz decade A22 to the parallel input card.
f. 1/10-MHz $\overline{\text{LOL}}$ signal is supplied by synthesizer output module A23 to the parallel input card.
g. Channel A1 af performance monitor is supplied by receive audio A25 (AF1) to parallel input card. The channel A1 af performance monitor logic 0 indicates when the channel A1 audio output exceeds the minimum performance level (6 dB below nominal AGC controlled output levels).
h. Channel B1 af performance monitor is supplied by receive audio A25 (AF1) to parallel input card. The channel B1 af performance monitor logic 0 indicates when the channel B1 audio output exceeds the minimum performance level (6 dB below nominal AGC controlled output levels).
i. Channel A2 af performance monitor is supplied by receive audio A26 (AF2) to parallel input card. The channel A2 af performance monitor logic 0 indicates when the channel A2 audio output exceeds the minimum performance level (6 dB below nominal AGC controlled output levels).
j. Channel B2 af performance monitor is supplied by receive audio A26 (AF2) to parallel input card. The channel B2 af performance monitor logic 0 indicates when the channel B2 audio output exceeds the minimum performance level (6 dB below nominal AGC controlled output levels).
k. Channel A1 AGC performance monitor is supplied by channel A1 if A8 to parallel input card. The channel A1 AGC performance monitor logic 0 indicates when the AGC level corresponds to a signal input NLT 20 dB above AGC threshold. When there is no AGC or AGC is off, a logic 1 will be present at this monitor.
l. Channel B1 AGC performance monitor is supplied by channel B1 if A7 to parallel input card. The channel B1 AGC performance monitor logic 0 indicates when the AGC level corresponds to a signal input NLT 20 dB above AGC threshold. When there is no AGC or AGC is off, a logic 1 will be present at this monitor.
m. Channel A2 AGC performance monitor is supplied by channel A2 if A6 to parallel input card. The channel A2 AGC performance monitor logic 0 indicates when the AGC level corresponds to a signal input NLT 20 dB above AGC threshold. When there is no AGC or AGC is off, a logic 1 will be present at this monitor.
n. Channel B2 AGC performance monitor is supplied by channel B2 if A5 to parallel input card. The channel B2 AGC performance monitor logic 0 indicates when the AGC level corresponds to a signal input NLT 20 dB above AGC threshold. When there is no AGC or AGC is off, a logic 1 will be present at this monitor.
o. Rf performance monitor is supplied by channel A1 if A8 to parallel input card. The rf performance at logic 0 indicates when the channel A1 if 9.45-MHz input exceeds 0.5 V rms. This level corresponds to a received input of 100 mV rms (-13 dB mW) with AGC off, and RF GAIN full cw.
p. External standard signal is supplied by frequency standard switch A30 to parallel input card. The external standard signal at logic 1 indicates that the frequency standard switch has selected the external frequency standard input signal.

Table 5. Location of Signals in Control/Monitor Words.

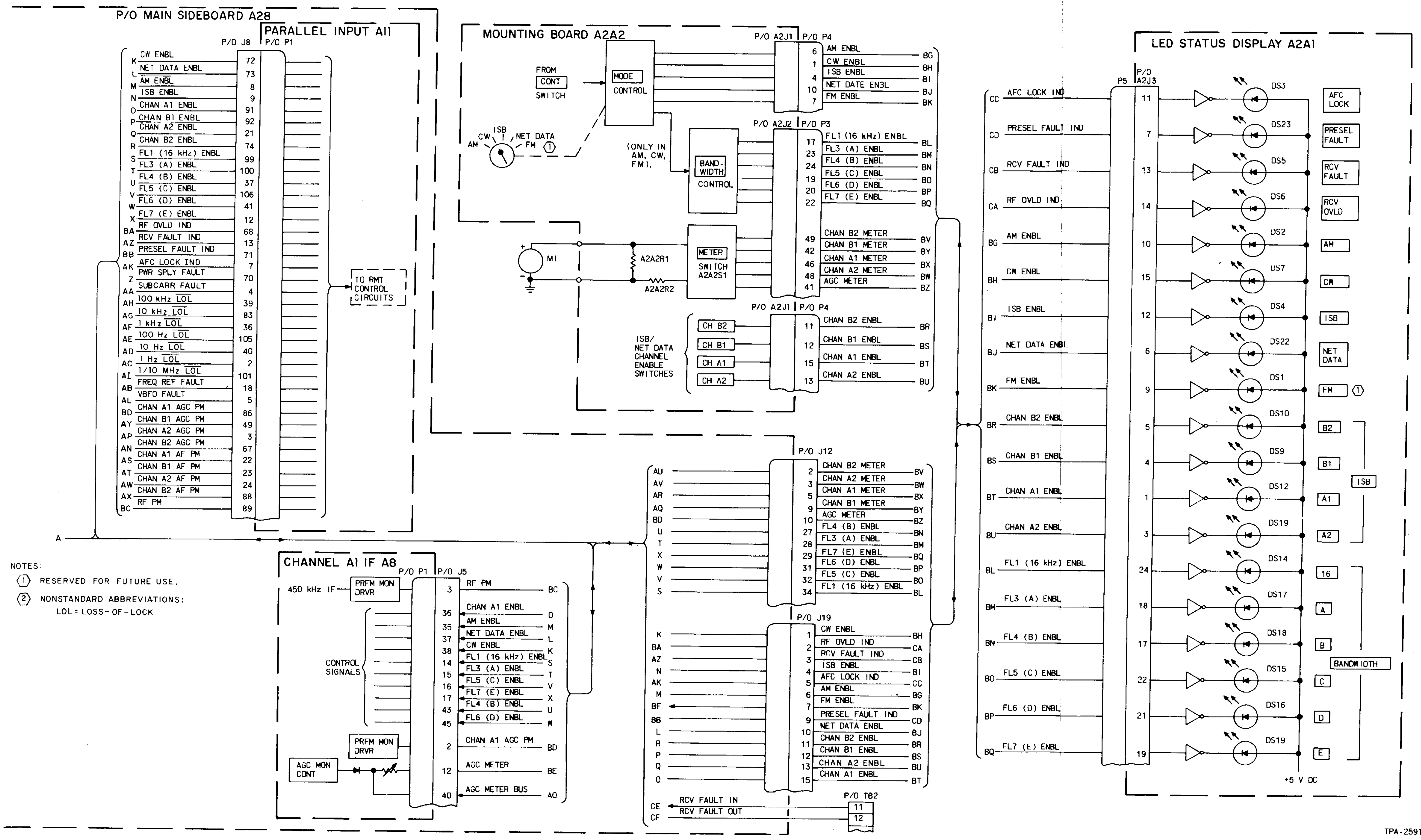
SIGNAL	8-BIT CHARACTER			7-BIT ASCII		
	WORD	CHARACTER	BIT	WORD	FUNCTIONAL CHARACTER	WT
Fault and Status Indicators						
AFC lock	4	5	6	4	10	2
Receive fault	4	2	6	4	4	2
• Power supply fault	4	4	5	4	8	1
• Synth reference fault	4	3	1	4	7	1
• Synth fault (smo lol)	-	-	-	-	-	-
• Vbfo synth fault	4	4	6	4	8	2
• Subcarr fault	4	4	7	4	8	4
• (Ext) receive fault	-	-	-	-	-	-
Receive overload	4	2	5	4	4	1
Preselector fault	4	5	4	4	11	8
Mode Indicators						
FM	-	-	-	-	-	-
AM	2	5	7	2	10	4
ISB	2	5	5	2	10	1
CW	2	5	6	2	10	2
NET DATA	2	5	8	2	10	8
ISB Channel Enable Indicators						
CH A1	2	5	2	2	11	2
CH B1	2	5	3	2	11	4
CH A2	2	5	1	2	11	1
CH B2	2	5	4	2	11	8
BANDWIDTH Indicators						
16	2	4	7	2	8	4
A	2	4	8	2	8	8
B	2	3	5	2	6	1
C	2	3	6	2	6	2
D	2	3	7	2	6	4
E	2	3	8	2	6	8
FREQUENCY KHZ BCD Signals						
1 Hz (1)	1	5	1	1	11	1
1 Hz (2)	1	5	2	1	11	2
1 Hz (4)	1	5	3	1	11	4
1 Hz (8)	1	5	4	1	11	8
10 Hz (1)	1	5	5	1	10	1
10 Hz (2)	1	5	6	1	10	2
10 Hz (4)	1	5	7	1	10	4
10 Hz (8)	1	5	8	1	10	8
100 Hz (1)	1	4	1	1	9	1
100 Hz (2)	1	4	2	1	9	2
100 Hz (4)	1	4	3	1	9	4
100 Hz (8)	1	4	4	1	9	8
1 kHz (1)	1	4	5	1	8	1
1 kHz (2)	1	4	6	1	8	2
1 kHz (4)	1	4	7	1	8	4

Table 5. Location of Signals in Control/Monitor Words (Cont).

SIGNAL	8-BIT CHARACTER			7-BIT ASCII		
	WORD	CHARACTER	BIT	WORD	FUNCTIONAL CHARACTER	WT
1 kHz (8)	1	4	8	1	8	8
10 kHz (1)	1	3	1	1	7	1
10 kHz (2)	1	3	2	1	7	2
10 kHz (4)	1	3	3	1	7	4
10 kHz (8)	1	3	4	1	7	8
100 kHz (1)	1	3	5	1	6	1
100 kHz (2)	1	3	6	1	6	2
100 kHz (4)	1	3	7	1	6	4
100 kHz (8)	1	3	8	1	6	8
1 MHz (1)	1	2	1	1	5	1
1 MHz (2)	1	2	2	1	5	2
1 MHz (4)	1	2	3	1	5	4
1 MHz (8)	1	2	4	1	5	8
10 MHz (1)	1	2	5	1	4	1
10 MHz (2)	1	2	6	1	4	2
VBFO OFFSET KHZ BCD Signals						
10 Hz (1)	3	3	1	3	7	1
10 Hz (2)	3	3	2	3	7	2
10 Hz (4)	3	3	3	3	7	4
10 Hz (8)	3	3	4	3	7	8
100 Hz (1)	3	3	5	3	6	1
100 Hz (2)	3	3	6	3	6	2
100 Hz (4)	3	3	7	3	6	4
100 Hz (8)	3	3	8	3	6	8
1 kHz (1)	3	2	1	3	5	1
1 kHz (2)	3	2	2	3	5	2
1 kHz (4)	3	2	3	3	5	4
1 kHz (8)	3	2	4	3	5	8
SIGN	3	2	5	3	4	1
Remote monitors Not Used Internally						
10 Hz LOL	4	3	7	4	6	4
100 Hz LOL	4	3	6	4	6	2
1 kHz LOL	4	3	5	4	6	1
10 kHz LOL	4	3	4	4	6	8
100 kHz LOL	4	3	3	4	6	4
1/10 MHz LOL	4	3	2	4	6	2
Channel A1 AF PM	4	2	2	4	5	2
Channel B1 AF PM	4	2	3	4	5	4
Channel A2 AF PM	4	2	1	4	5	1
Channel B2 AF PM	4	2	4	4	5	8
Channel A1 AGC PM	4	4	2	4	9	2
Channel B1 AGC PM	4	4	3	4	9	4
Channel A2 AGC PM	4	4	1	4	9	1
Channel B2 AGC PM	4	4	4	4	9	8
RF PM	4	5	7	4	10	1
External Standard	4	5	5	4	10	4



Monitors Function, Block Diagram
Figure 14 (Sheet 1 of 2)



NOTES:
① RESERVED FOR FUTURE USE.
② NONSTANDARD ABBREVIATIONS:
LOL = LOSS-OF-LOCK

TPA-2591-024

Monitors Function, Block Diagram
Figure 14 (Sheet 2)

2.6 Power Distribution (Refer to figure 15.)

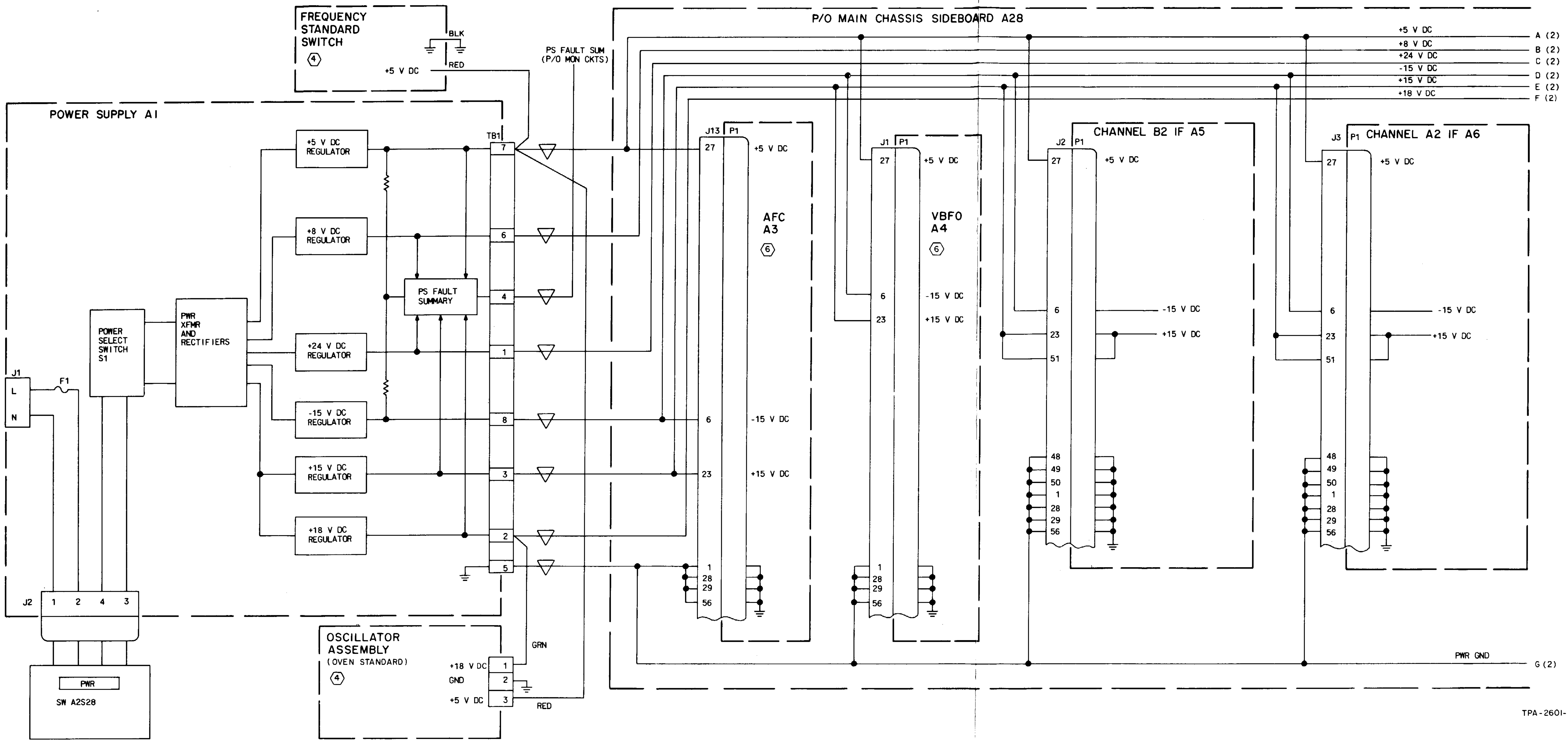
Primary power distribution in the HF-8054( ) Receivers is controlled by power supply A1. Input power to the power supply is connected to A1J1 on the rear panel, supplied through A1F1 (rear panel), A1S15 (front panel), and A1S1 (rear panel) to the input power transformer (P/O A1). Power supply A1 uses rectifiers and regulators to produce the following base output voltages: +5, +8, +15, +18, +24, and -15 V dc.

These voltages are supplied to cards and modules in the receiver and are the only voltages used, except for the following special applications.

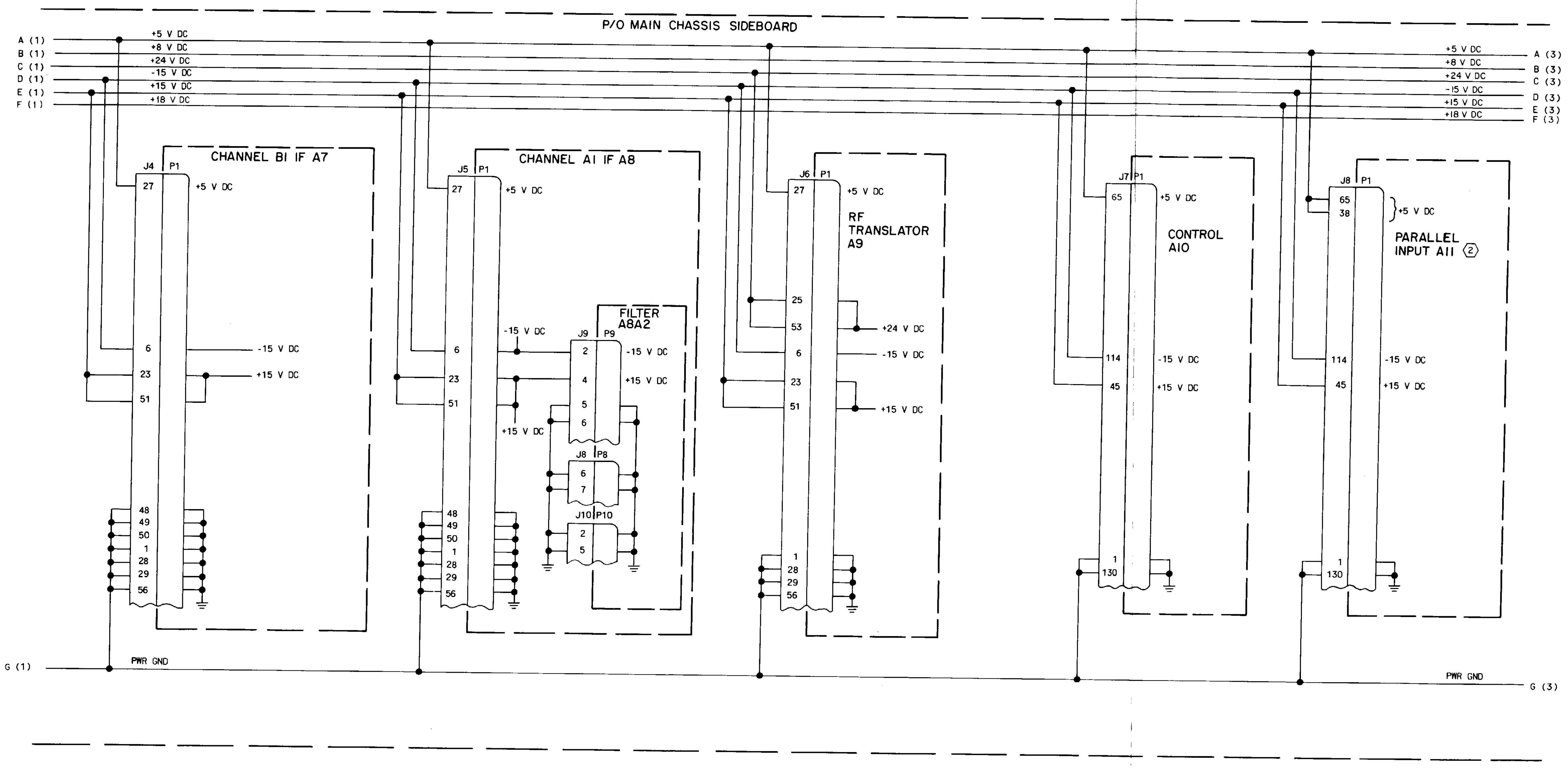
In receive audio A25 and A26, the -15-V dc input is used with a 5-V dc regulator to produce -5 V dc for a squelch reference voltage.

In parallel output A12, the +15-V dc input is used with a 5.6-V dc regulator to produce +5.6 V dc B+ for output storage registers.

In synthesizer voltage regulator A14, the +24-, and +8-V dc inputs are used with series regulators to produce regulated +20- and regulated +5.2-V dc outputs for synthesizer control and B+ voltages.



Power Distribution, Block Diagram
Figure 15 (Sheet 1 of 4)



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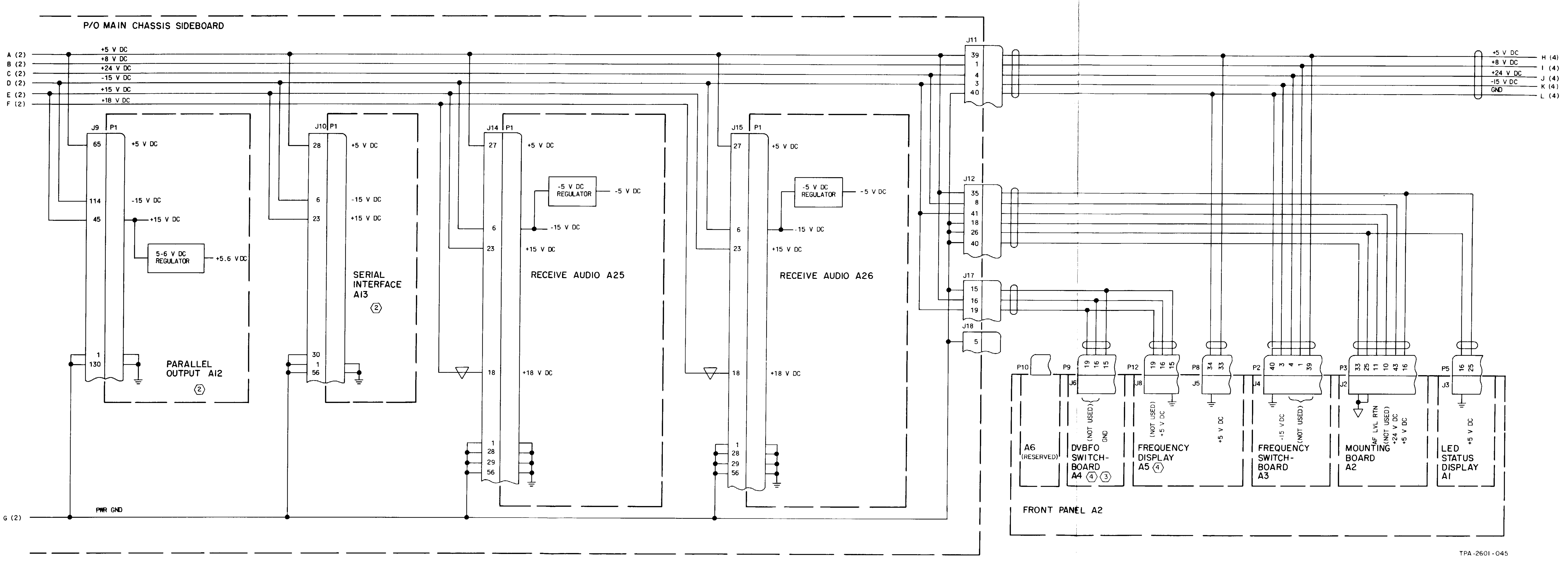
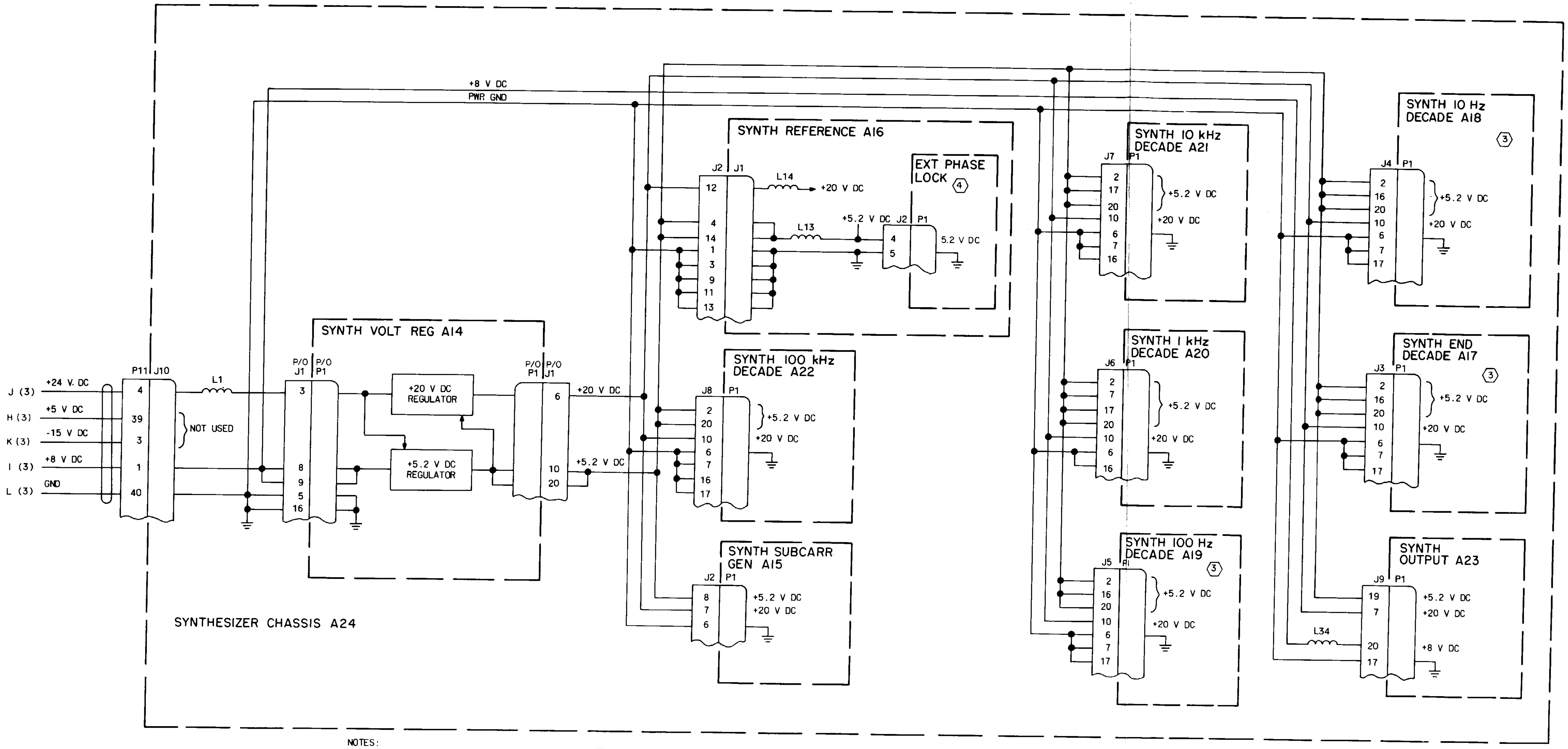
Power Distribution, Block Diagram
Figure 15 (Sheet 2)



Power Distribution, Block Diagram
Figure 15 (Sheet 3)



NOTES:

① NONSTANDARD SYMBOLS
INDICATES HARD WIRED
INDICATES RIBBON CABLE

② INCLUDED ONLY IN REMOTE UNITS.

③ SYNTHESIZER END DECADE IS:
A19 FOR 100 Hz TUNING (A17 AND A18 NOT USED).
A18 FOR 10 Hz TUNING (A17 NOT USED).
A17 FOR 1 Hz TUNING.

④ OPTIONAL

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Power Distribution, Block Diagram
Figure 15 (Sheet 4)

HF-8054( )
Receiver

Rockwell
International

maintenance

Collins Telecommunications Products Division

Printed in USA

523-0770705-001218
1 January 1981

table of contents

maintenance

HF-8054( ) Receiver

523-0770705-001218

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1st Ed	1 Jan 81						

1. GENERAL

This section contains information necessary to maintain the HF-8054/8054A Receiver. Testing and troubleshooting procedures isolate a fault to a circuit card or chassis-mounted components. Refer to the appropriate circuit card section in this instruction book for fault isolation and repair of components on circuit cards. Figure 1 shows the location of HF-8054/8054A subassemblies.

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 7.4, Electrostatic Discharge Sensitive Devices Precautions, before performing maintenance on this equipment.

2. TEST EQUIPMENT AND TOOLS

Table 1 lists all test equipment and tools required to test, troubleshoot, align, and repair the HF-8054/8054A.

3. TESTING/TROUBLESHOOTING

3.1 Fault Isolation

Some failures that may occur in the HF-8054/8054A can be quickly isolated to a faulty card or assembly by using the front panel control and monitor features. Table 2 contains a brief description of indications and isolation of apparent failures.

3.2 Test Point, Voltage and Signal Levels

As an additional aid in testing and troubleshooting, voltage and signal levels that are easily accessible are given in table 3. These levels, when used with tables 2, 4, and 5, further enable the user to isolate and identify faults.

Note

> To check signal levels on A1 power supply, the bottom dust cover must be removed from the HF-8054/8054A. To check all other signal levels, the top dust cover must be removed from the HF-8054/8054A. In addition, to check synthesizer signal levels on cards A14 through A23, the synthesizer top cover must be removed.

Table 1. Test Equipment and Tools.

ITEM	MINIMUM SPECIFICATION	REPRESENTATIVE TYPE
TEST EQUIPMENT		
Vom		Any
Storage oscilloscope		Tektronix 549
Card/module extenders	1-to-1 card/module extenders sufficient to extend card/module above chassis configuration (need 130-pin edge-on extender, 56-pin edge-on extender, rf module extender, synthesizer extender, (7) subminiax coax extenders, and a subminiax to BNC coax extender).	Collins TS-8010 (622-3431-001) includes: (1) 635-0913-001 (1) 635-0915-001 (1) 635-0915-002 (7) 635-9686-001 (1) 635-9686-002 (1) 637-2843-001

Table 1. Test Equipment and Tools (Cont).

ITEM	MINIMUM SPECIFICATION	REPRESENTATIVE TYPE
TEST EQUIPMENT (Cont)		
6-dB pad (2)		Measurements, Inc., 800P-3
Rf signal generator (2)		HP 8640B-001
Dvm		Fluke 8000A
Rf voltmeter	50-Ω load and high impedance	Boonton 92C
Counter	0 to 110 MHz	Anadex CF735 with Option C
Multifunction meter		HP 410C
Wave analyzer		HP 3851A
Distortion analyzer		HP 333A
Spectrum analyzer		HP 141T display HP 8552B IF HF 8553B IF
Audio oscillator		HP 204C
Hybrid transformer		Any
Variable attenuator	0 to 10 dB, 0 to 500 kHz	Daven RFB-551-50
Switching device	Capable of switching 9.0000- to 10.0000-MHz signals at a manual rate and automatically at 0.25 s on to 2.5 x off (AGC switching).	Any
TOOLS		
Flux	Rosin type	Kester 1544
Solder	0.5 mm (0.020 inch) diameter, 63/37 rosin flux core	Gardiner type QQS571E SN63 WRMA P-2
Solvent	TF/Methylene Chloride Azeotrope	Du Pont, Freon TMC
Soldering iron	40-watt, 0.1588-cm (1/16-inch) tip	Weller model WP-40 with model ST-1 tip
Solder sucker	Plunger type with sufficient vacuum to draw molten solder from work area	Soldavac model SV-026
Needle-nose pliers	10.2 cm (4 inch) long with 3 cm (1.125 inch) nose	Utica model 46
Diagonal cutters	12 cm (4.75 inch) long with 1.3 cm (0.5 inch) cutting edge	Kraeuter model 83
Small brush	Nylon bristles, 1.3 cm (0.5 inch), typical length	Trumball McFall model Keller-Hull No. 1
Pipe cleaners	12.7 cm (5 inch), typical length, industrial quality	B.L. Long, industrial pipe cleaners

(To Be Supplied)

Subassembly Location
Figure 1

Table 2. Fault Isolation.

INDICATION	ISOLATION OF APPARENT FAILURE
Meter lights are dim, or fuse fails.	a. Check that rear panel power selector switches are set to the line voltage being used.
	b. Check that correct fuse is installed for line voltage being used.
RCV FAULT indicator lights.	a. Normal indication when power is turned on (caused by power supply fault latching circuit on A10 control card). Clear by changing any FREQUENCY KHZ digit.
	b. Check that CONT switch is in LCL position.
	c. Check frequency synthesizer LOL summary at A14TP8 (refer to table 3). If LOL is indicated, check A14TP1 thru A14TP7. If LOL input is not indicated at any test point A14TP1 thru A14TP7, replace A10 control card. If LOL input is indicated at any test point A14TP1 thru A14TP7, replace associated decade or output module. If LOL input is not cleared by replacing the associated decade, replace the next lower decade (ie, if 100-kHz LOL is indicated, replace 10-kHz decade, etc).
	d. If LOL summary at A14TP8 indicates no LOL, check power supply voltages at A1TB1 (refer to table 3). If any voltage is faulty, determine if a short circuit exists in a card by removing one card at a time (refer to figure 12 in theory section of this instruction book as an aid in power isolation).
No speaker receive audio (speaker output)	a. Check SPKR switch position (channel B1, A2, B2 audio operates only in ISB mode).
	b. Check jumper on rear panel between speaker output/input terminals. If internal speaker is used, jumper should be between TB3-1 and TB3-2. If external speaker is used, jumper should be removed. Ground strap should be connected between TB3-3 and external speaker common. External speaker line should be connected between TB3-2 and external speaker audio line.
	c. Check headphone audio, same channel, or front panel meter indication for audio. If audio is present here, replace A25 or A26 receive audio card (as applicable).
	d. Set METER switch to RCV SIG position; check that receive signal is indicated. If signal is indicated, replace A25 or A26 receive audio card. If fault remains, replace A8 channel A1 if card.
	e. If audio outputs are normal for channel A1, but not channel B1, A2, B2 (ISB mode only), replace A25 or A26 receive audio card. If fault remains, replace A7 channel B1 if card, A6 channel A2 if card, or A5 channel B2 if card.
Speaker receive audio (noise only)	If receive input signal is known to be present and receiver is properly set up (correct frequency, correct mode, AGC on, local control, rf gain full (cw), etc) and speaker output is only noise, the audio and if circuits are operating. Replace A9 rf translator module.

Table 3. Test Point, Voltage, and Signal Levels.

CARD/MODULE	TEST POINT	FUNCTION	SIGNAL, DESCRIPTION
Power supply A1	TB1-1	+24 V dc	+24 V dc.
	TB1-2	+18 V dc	+18 V dc.
	TB1-3	+15 V dc	+15 V dc.
	TB1-4	Power supply fault	Fault ≅ +5 V dc (indicates low voltage in +24-, +18-, +15-, +8-, or -15-V dc supplies), no fault ≅ 0 V dc.
	TB1-5	Ground	0 V dc (signal common).
	TB1-6	+8 V dc	+8 V dc.
	TB1-7	+5 V dc	+5 V dc.
	TB1-8	-15 V dc	-15 V dc.
Vbfo A4	TP1	Ground	0 V dc (signal common).
	TP2	Vbfo synt fault	Fault ≅ +5 V dc (out-of-lock), no fault = 0 V dc.
	TP3	Vbfo enable	Enable ≅ +5 V dc, disable ≅ 0 V dc.
	TP4	Rf xmt	Xmt = +5 V dc, $\overline{\text{xmt}}$ ≅ 0 V dc.
	TP8	Vbfo display enable	Enable ≅ +5 V dc, disable ≅ 0 V dc.
	TP9	450-kHz enable	Enable ≅ +5 V dc, disable ≅ 0 V dc.
Channel B2 if A5	TP2	B2 AGC performance monitor	AGC greater than 20 dB above AGC threshold ≅ 0 V dc, no AGC ≅ +5 V dc.
	TP4	+15 V dc switched	Normal operation ≅ +15 V dc, mute applied ≅ 0 V dc. Muted by applying 0 V dc at P1-13.
Channel A2 if A6	TP2	A2 AGC performance monitor	AGC greater than 20 dB above AGC threshold ≅ 0 V dc, no AGC ≅ +5 V dc.
	TP4	+15 V dc switched	Normal operation ≅ +15 V dc, mute applied ≅ 0 V dc. Muted by applying 0 V dc at P1-13.
Channel B1 if A7	TP2	B1 AGC performance monitor	AGC greater than 20 dB above AGC threshold ≅ 0 V dc, no AGC ≅ +5 V dc.
	TP4	+15 V dc switched	Normal operation ≅ +15 V dc, mute applied ≅ 0 V dc. Muted by applying 0 V dc at P1-13.
Channel A1 if A8	TP1	+15 V dc switched	Normal operation ≅ +15 V dc, mute applied ≅ 0 V dc. Muted by applying 0 V dc at P1-13.
	TP2	Rf performance monitor	9.45 MHz if signal at J1 in excess of 0.5 V rms ≅ 0 V dc, low if signal at J1 ≅ +5 V dc.
(Cont)	TP3	FL1 enable	Enable ≅ 0 V dc (ground), disable ≅ -15 V dc. Enabled by +5 V dc at A8P1-14.

Table 3. Test Point, Voltage, and Signal Levels (Cont).

CARD/MODULE	TEST POINT	FUNCTION	SIGNAL, DESCRIPTION
	TP4	Chan A1 enable	Enable ≅ 0 V dc (ground), disable ≅ -15 V dc. Enabled by +5 V dc at A8P1-36.
	TP5	A1 AGC performance monitor	AGC greater than 20 dB above AGC threshold ≅ 0 V dc, no AGC ≅ +5 V dc.
Control A10	TP1	Ground	0 V dc (signal common)
	TP2	Tune start	Pulse (50 ms min, 150 ms typical), enable ≅ 0 V dc pulse. See note 3.
	TP3	Band 3 (1.6-30 MHz)	Enable ≅ 0 V dc, disable ≅ +5 V dc. Enabled when bcd frequency inputs are between 1.60 and 29.999999 MHz.
	TP4	Band 1 (0-0.52 MHz)	Enable ≅ 0 V dc, disable ≅ +5 V dc. Enabled when bcd frequency inputs are between 0 and 0.529999 MHz.
	TP5	Band 2 (0.53-1.59 MHz)	Enable ≅ 0 V dc, disable ≅ +5 V dc. Enabled when bcd frequency inputs are between 0.53 and 1.599999 MHz.
	TP6	450-kHz enable	Enable ≅ +5 V dc, disable ≅ 0 V dc. Enabled when in ISB mode or in CW mode.
	TP7	Subcarrier enable	Enable ≅ +5 V dc, disable ≅ 0 V dc. Enabled when in ISB mode with A2 and/or B2 enabled.
	TP8	A1/CW	Enable ≅ +5 V dc, disable ≅ 0 V dc. Enable when in ISB mode with A1 enabled, or in CW mode.
Parallel input A11	TP1	Ground	0 V dc (signal common)
	TP2	WD4G (output)	Word initiate strobes (gates); initiate ≅ +5 V dc, $\overline{\text{initiate}}$ ≅ 0 V dc (not used in HF-8054A).
	TP3	WD3G (output)	
	TP4	WD1G (output)	
	TP5	WD2G (output)	
Parallel output A12	TP1	Ground	0 V dc (signal common)
	TP2	Data (input)	Serial data from serial interface card (0- or +5-V dc logic levels)
	TP3	Clock (input)	Gated data clock from serial interface card (0- or +5-V dc logic levels)
	TP4	Word 4 load strobe	Load pulse (≅+5 V dc) generated on reception of word 4 data
(Cont)	TP5	Remote RF gain control (output)	Analog dc level (0 to -5.0 V dc), depending on remote RF GAIN setting (MAX ≅ 0 V dc). In local operation ≅ 0 V dc

Table 3. Test Point, Voltage, and Signal Levels (Cont).

CARD/MODULE	TEST POINT	FUNCTION	SIGNAL, DESCRIPTION
	TP6	Word 2 load strobe	Load pulse (≅+5 V dc) generated on reception of word 2 data.
	TP7	ADRG (output)	Address gate pulse (≅+5 V dc) generated by a change in the address (not used in HF-8054A).
	TP8	Remote frequency change (output)	Load pulse (≅+5 V dc) generated on reception of word 1 data.
	TP9	Word 3 load strobe	Load pulse (≅+5 V dc) generated on reception of word 3 data.
Serial interface A13	TP1	Ground	0 V dc (signal common)
	TP2	Strobe (output)	Strobe pulse (≅+5 V dc) to parallel output card
	TP3	Clock (output)	Gated data clock (0- or +5-V dc large levels) to parallel output card
	TP4	Data (output)	Serial data (0- or +5-V dc logic levels) to parallel output card
	TP5	Serial data (input)	Received serial line data (0- or +5-V dc logic levels). RS-232C or FSK detected data signals
	TP6	Serial data (output)	Transmitted serial line data (0- or +5-V dc logic levels). Data signals prior to level setting or FSK modulation
	TP7	Microprocessor clock output	921.6 kHz clock output (0- or +5-V dc logic levels) to frequency divider.
	TP8	Halt input	Ground (0 V dc) applied at this input halts microprocessor program. Normal +5 V dc enables microprocessor.
	TP9	Reset input	Power supply interrupt reset ≅ +5 V dc, $\overline{\text{reset}}$ ≅ 0 V dc; to microprocessor.
Synthesizer voltage regulator A14	TP1	1-Hz $\overline{\text{LOL}}$ (input)	Loss of lock ≅ 0 V dc, $\overline{\text{loss of lock}}$ ≅ +5 V dc. Signal received from associated decade card (including output module).
	TP2	10-Hz $\overline{\text{LOL}}$ (input)	
	TP3	100-Hz $\overline{\text{LOL}}$ (input)	
	TP4	1-kHz $\overline{\text{LOL}}$ (input)	
	TP5	10-kHz $\overline{\text{LOL}}$ (input)	
	TP6	100-kHz $\overline{\text{LOL}}$ (input)	
	TP7	MHz $\overline{\text{LOL}}$ (input)	
(Cont)	TP8	LOL summary (freq synt fault)	Fault ≅ +5 V dc, $\overline{\text{Fault}}$ = 0 V dc. Supplied to control card.

Table 3. Test Point, Voltage, and Signal Levels (Cont).

CARD/MODULE	TEST POINT	FUNCTION	SIGNAL, DESCRIPTION
	TP9	+5.2 V dc reg (output)	+5.2 V dc
	TP10	+24 V dc (input)	+24 V dc
	TP11	+8 V dc (input)	+8 V dc
	TP12	+20 V dc reg (output)	+20 V dc
	TP13	Ground	0 V dc (signal common)
Synthesizer subcarrier generator A15	TP1	Ground	0 V dc (signal common)
	TP2	Subcarrier fault	Fault ≅ +5 V dc, $\overline{\text{fault}}$ ≅ 0 V dc. Fault caused by loss of lock in synthesizer subcarrier generator, loss of 456.29-kHz injection, or loss of 443.71-kHz injection. Subcarrier fault circuit disabled when 450-kHz enable signal is removed.
Synthesizer reference A16	TP1	Ground	0 V dc (signal common)
	TP2	Frequency reference fault	Fault ≅ +5 V dc, no fault ≅ 0 V dc. Fault caused by loss of 9.9-MHz injection, loss of 118-MHz injection, or when 450-kHz enable is applied the loss of the 450-kHz injection. 450-kHz injection fault circuit disabled when 450-kHz enable signal is removed.
Receive audio AF1 A25	TP1	Ground	0 V dc (signal common)
	TP2	Ch A1 audio input	10 mV nominal (AM, ch A1 rcv af, or ch A1 sidetone)
	TP3	Squelch trigger	Normal ≅ +5 V dc, squelch ≅ -15 V dc
	TP4	Squelch high channel	Output of upper bandpass filter
	TP5	Squelch low channel	Output of lower bandpass filter
	TP6	Speaker input	150 mV at maximum volume
	TP7	Headphone input	150 mV for 10 mV at audio input
	TP8	Ch B1 audio input	10 mV nominal (ch B1 rcv af).
Receive audio AF2 A26	TP1	Ground	0 V dc (signal common)
	TP2	Ch A2 audio input	10 mV nominal (ch A2 rcv af)
	TP3	Squelch trigger	Normal ≅ +5 V dc, squelch ≅ -15 V dc
	TP4	Squelch high channel	Output of upper bandpass filter
	TP5	Squelch low channel	Output of lower bandpass filter
	TP6	Speaker input	150 mV at maximum volume
(Cont)	TP7	Headphone input	150 mV for 10 mV at audio input

Table 3. Test Point, Voltage, and Signal Levels (Cont).

<table>
<tr><th>CARD/MODULE</th><th>TEST POINT</th><th>FUNCTION</th><th>SIGNAL, DESCRIPTION</th></tr>
<tr><td></td><td>TP8</td><td>Ch B2 audio input</td><td>10 mV nominal (ch B2 rcv af)</td></tr>
<tr><td colspan="4">Note
The following are fixed injection levels that are accessible by extending the synthesizer subcarrier generator card A15, the synthesizer reference card A16, and the synthesizer output module A23. All levels are measured out-of-circuit with a 50-ohm load into an rf voltmeter except as noted.</td></tr>
<tr><td>Synthesizer subcarrier A15</td><td>J1-20</td><td>456.29-kHz injection</td><td>456.29 kHz, 0.3 V rms (measured in circuit with a high impedance load into an rf voltmeter). Supplied to channel A2 if card (A6J5).</td></tr>
<tr><td></td><td>J1-1</td><td>443.71-kHz injection</td><td>443.71 kHz, 0.3 V rms (measured in circuit with a high impedance load into an rf voltmeter). Supplied to channel B2 if card (A5J5).</td></tr>
<tr><td>Synthesizer reference A16</td><td>J1-6</td><td>450-kHz injection</td><td>450 kHz, 0.3 V rms (measured in circuit with a high impedance load into an rf voltmeter). Supplied to channel A1 if card (A8J5), channel B1 if card (A7J5), and/or VBFO card (A4J2).</td></tr>
<tr><td></td><td>P1</td><td>118.8-MHz injection</td><td>118.8 MHz, 0.5 V rms. Supplied to rf translator module (A9J6).</td></tr>
<tr><td></td><td>P3</td><td>9.9-MHz injection</td><td>9.9 MHz, 0.3 V rms. Supplied to channel A if card (A8J3) or AFC card (A3J2).</td></tr>
<tr><td>Synthesizer A23 output</td><td>P2</td><td>109.35- to 79.35-MHz variable injection</td><td>109.35 to 79.35 MHz, 0.5 V rms. Front panel FREQUENCY kHz of 00 000.00 ≅ 109.350 00 MHz, 29 999.99 ≅ 79.350 01 MHz. Supplied to rf translator module (A9J5).</td></tr>
<tr><td colspan="4">Note
1. All signal levels are rms unless otherwise noted.
2. Nominal voltage levels only are given unless otherwise noted.
3. Enable ≅ 0 V dc, disable ≅ the pullup voltage in the pa when the pa control cable is connected (pa control cable not connected presents an open circuit only).</td></tr>
</table>

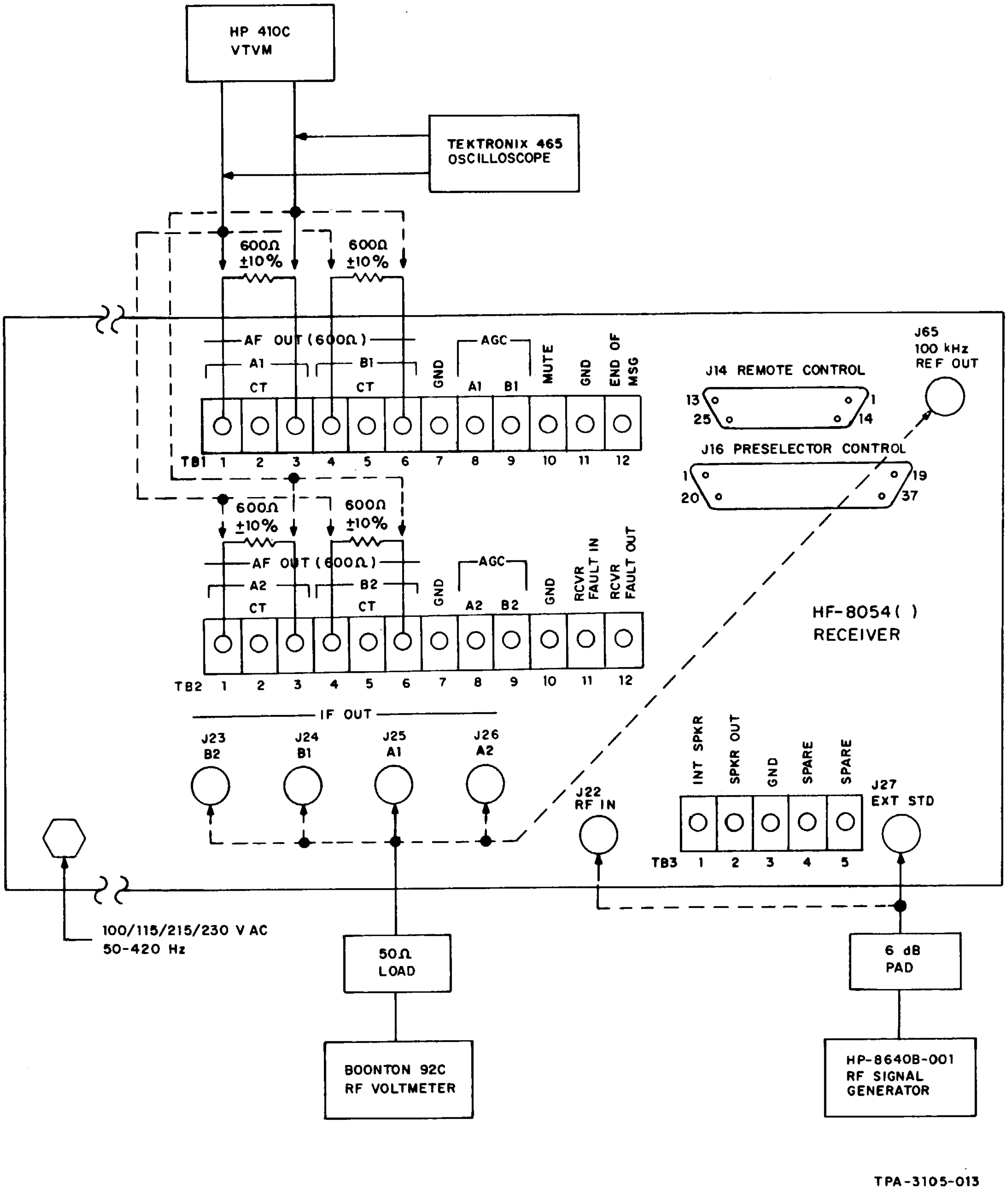
3.3 Testing/Troubleshooting Procedures

The testing/troubleshooting procedures isolate a fault to a circuit card or chassis-mounted component. A test setup diagram is shown in figure 2. Testing/troubleshooting procedures are presented in tabular format. Table 4 presents a minimum performance test procedure that permits a quick check of the performance of the receiver using a minimum amount of test equipment. Table 5 presents a detailed performance test procedure that permits complete repair of the unit and returns the unit to satisfactory operation.

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 7.4, Electrostatic Discharge Sensitive Devices Precautions, before performing maintenance on this equipment.

The test procedures in tables 4 and 5 are presented in a manner that allows complete testing or testing of specific characteristics only. After completion of



Test Setup
Figure 2

setup (test 1), test procedures may be entered at any numbered test.

Note

Unless otherwise specified in testing, all rf signals inputs are open-circuit inputs (in series with 6-dB pad), rf signals are not modulated, rf outputs are loaded with 50 ohms, and audio outputs are loaded with 600 ohms.

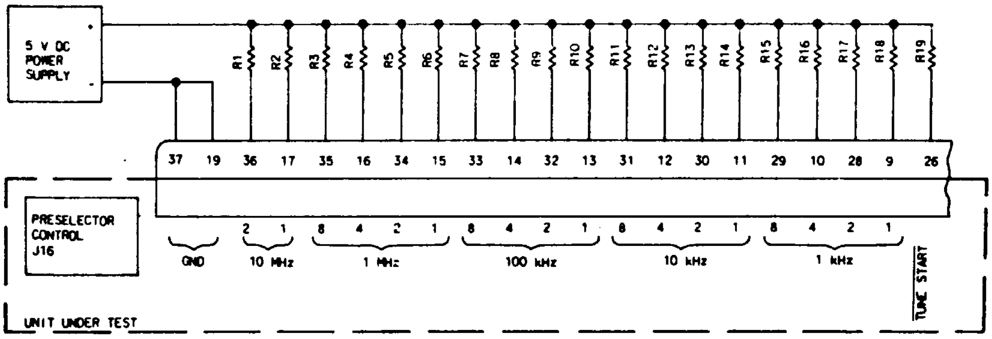
Meter level readings in testing apply with factory level settings. Readings may not be valid if field level adjustments have been made.

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top and bottom chassis covers of unit to be tested. b. Set unit LINE SELECTOR for power source available (100/115/215/230 V ac). **Note** Ensure that proper fuse is installed for power source used. c. Connect unit to available power source. d. Refer to test setup, figure 2.	**Note** In all tests, if power is removed a frequency digit must be changed when power is restored to clear RCV FAULT indication.	
2. Initial checks	**Note** To make the initial checks, set unit on edge to gain access to A1TB1. **Caution** If repair has been made to the power supply or any power circuits, remove all plug-in cards/modules. a. Front panel controls set as follows: PWR to on CONT to LCL MODE to AM BANDWIDTH to 16 FREQUENCY kHz to 2000.00 VBFO to FXD CH A1 - AGC to FAST or FAX RF GAIN to full cw		
	b. Measure dc voltages between the following points and ground (A1TB1-5):		Check power supply A1 and check for shorts on output voltage lines.
	A1TB1-1	+24 ±1.0 V dc	
	A1TB1-2	+18 ±1.0 V dc	
	A1TB1-3	+15 ±1.0 V dc	
	A1TB1-6	+8 ±1.0 V dc	
	A1TB1-7	+5 ±0.5 V dc	
	A1TB1-8	-15 ±1.0 V dc	
(Cont)	**Note** Perform step 2.c only if repair has been made to power supply or any power circuits.		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Measure dc voltages between the following points and ground:		Check wiring from A1TB1. Check for shorts on output lines, or check repaired power circuit.
	Channel A1 IF A8:		
	J5-6	-15 ±1.0 V dc	
	J5-23	+15 ±1.0 V dc	
	J5-27	+5 ±0.5 V dc	
	RF translator A9:		
	J6-25	+24 ±1.0 V dc	
	Receive audio (AF1) A25:		
	J14-18	+18 ±1.0 V dc	
	Synthesizer voltage regulator A14:		
	A24J1-8	+8 ±1.0 V dc	
3. Preselector control outputs	a. Connect a 15-kΩ load between +5 V dc and each of the output pins of PRESELECTOR CONTROL J16 located on the rear panel. (See following figure.)		



	b. Front panel controls set as follows:		
	PWR to on CONT to LCL MODE to AM BANDWIDTH to 16 FREQUENCY kHz to 000.00 VBFO to FXD CH A1-AGC to FAST or FAX RF GAIN to full cw		
(Cont)			

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	c. Set the FREQUENCY KHZ controls at each of the following frequencies and note the logic output at J16:	**Note** There is no internal pullup voltage on preselector control outputs, therefore test jig or equivalent must be connected.	Check control A10 and frequency switch board A2A3.

FREQUENCY KHZ SETTING	BCD FREQUENCY (MHz)																	
	10		1				0.1				0.01				0.001			
	2	1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
	J16-( )																	
	36	17	35	16	34	15	33	14	32	13	31	12	30	11	20	10	28	0
000.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 111.00	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
12 222.00	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
13 333.00	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
14 444.00	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
15 555.00	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
16 666.00	0	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
27 777.00	1	0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1
28 888.00	1	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
29 999.00	1	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1

Logic 1 = NLT +3.0 V dc; Logic 0 = NMT 0.5 V dc.

Note

It is not necessary to check all the above frequencies, but as a minimum check 000.00, 16 666.00, and 29 999.00.

(Cont)

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	d. Connect an oscilloscope to J16-26.		
	e. Note oscilloscope display when switching CONT switch from LCL to REM (oscilloscope to internal trigger, 50 ms sweep).	Tune start pulse is generated when CONT switch is switched from LCL to REM.	Check control A10 and CONT switch A2S13.
	f. Note oscilloscope display when switching CONT switch from REM to LCL.	Tune start pulse is generated when CONT switch is switched from REM to LCL.	Same as step 3.e
	g. Note oscilloscope display when rotating FREQUENCY KHZ thumbwheels.	Tune start pulse is generated for any frequency digit change (when CONT switch is in LCL).	Check control A10, and frequency switch board A2A3.
	h. Remove test setup of step 3.a.		
4. Control inputs	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 2000.00 VBFO to FXD CH A1 - AGC to FAST or FAX RF GAIN to full cw **Caution** In the following procedures, when applying +5-V dc or 0-V dc (ground to the indicated points, apply these levels through a 100-ohm (or more) series limiting resistor. The +5-V dc source should be obtained from the receiver power supply (A1TB1-7) so that the integrated circuit supply voltages are not exceeded by the applied levels.		
	b. Apply +5 V dc to J16-8.	PRESEL FAULT indicator lights.	Check control A10 and LED status display A2A1.
(Cont)	c. Remove +5 V dc from J16-8.	PRESEL FAULT indicator goes out.	Same as step 4.b

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	d. Apply +5 V dc to J16-27.	RCV OVERLOAD indicator lights.	Same as step 4.b
	e. Remove +5 V dc from J16-27.	RCV OVERLOAD indicator goes out.	Same as step 4.b.
	f. Set SPEAKER switch to ALL CH. Adjust AF GAIN (speaker volume) to hear a level of noise.		
	g. Apply a ground to TB1-10 (on rear panel).	Noise from speaker should be muted (volume greatly reduced).	Check receiver audio (AF1) A25.
	h. Remove ground from TB1-10.	Noise level returns.	Same as step 4.g
	i. Set CH A1 enable to OFF.	Noise level is removed from speaker.	Same as step 4.g
	j. Set CH A2 enable to ON.	Noise level returns.	Check receive audio (AF2) A26.
	k. Apply a ground to TB1-10.	Noise from speaker should be muted (volume greatly reduced).	Same as step 4.j
	l. Remove ground from TB1-10.	Noise level returns.	Same as step 4.j
	m. Set CH A2 enable to OFF.	Noise level is removed from speaker.	Same as step 4.j
	n. Set CH B1 enable to ON.	Noise level returns.	Check receive audio (AF1) A25.
	o. Apply a ground to TB1-10.	Noise from speaker should be muted (volume greatly reduced).	Same as step 4.n
	p. Remove ground from TB1-10.	Noise level returns.	Same as step 4.n
	q. Set CH B1 enable to OFF.	Noise level is removed from speaker.	Same as step 4.n
	r. Set CH B2 enable to ON.	Noise level returns.	Check receive audio (AF2) A26.
(Cont)	s. Apply a ground to TB1-10.	Noise from speaker should be muted (volume greatly reduced).	Same as step 4.r

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	t. Remove ground from TB1-10.	Noise level returns.	Same as step 4.r
	u. Set CH B2 enable to OFF.	Noise level is removed from speaker.	Same as step 4.r
5. FREQUENCY KHZ control	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to FAX CH A1-AGC to FAST RF GAIN to full cw		
	b. Rotate each frequency switch through range.	All frequencies between 000.00 and 29 999.99 kHz can be selected (display same as frequency switch setting if display used).	Check control A10, frequency display A2A5, and frequency switch board A2A3.
6. MODE switch	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 2000.00 VBFO to FXD CH A1-AGC to FAST or FAX RF GAIN to full cw Note Step 6.f. applicable only with FM option installed.		
	b. Note front panel mode indication.	CW indicator is lit.	Check MODE switch A2S21 and LED status display A2A1.
	c. Set MODE switch to AM.	AM indicator lights.	Same as step 6.b
	d. Set MODE switch to ISB.	ISB indicator lights.	Same as step 6.b
	e. Set MODE switch to NET DATA.	NET DATA and ISB indicators light.	Same as step 6.b
(Cont)	f. Set MODE switch to FM.	FM indicator lights.	Same as step 6.b

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. Channel enable switches	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON CH A2 enable to ON CH B1 enable to ON CH B2 enable to ON FREQUENCY KHZ to 2000.00 VBFO to FXD All AGC to FAST or FAX RF GAIN to full cw		
	b. Note front panel ISB indicators.	A1, A2, B1, and B2 indicators are lit.	Check channel enable switches and LED status display A2A1.
	c. Set MODE switch to NET DATA.	A1, A2, B1, and B2 indicators are lit.	Same as step 7.b
	d. Set CH A1 enable to OFF.	A1 indicator goes out. A2, B1, and B2 indicators remain lit.	Check A2S.
	e. Set CH A2 enable to OFF.	A2 indicator goes out. A1 indicator remains out. B1 and B2 indicators remain lit.	
	f. Set CH B1 enable to OFF.	B1 indicator goes out. A1 and A2 indicator remain out. B2 indicator remains lit.	Check A2S.
	g. Set CH B2 enable to OFF.	B2 indicator goes out. A1, A2, and B1 indicators remain out.	Check A2S.
8. BANDWIDTH switch (Cont)	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16. FREQUENCY KHZ to 2000.00 VBFO to FXD CH A1 - AGC to FAST or FAX RF GAIN to full cw Note Step 8.k applicable only if FM option is installed.		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	b. Note front panel BANDWIDTH indication.	16 indicator is lit.	Check MODE switch A2S21, BANDWIDTH switch A2S22, and LED status display A2A1.
	c. Set BANDWIDTH switch to A.	A indicator lights.	Same as step 8.b
	d. Set BANDWIDTH switch to B.	B indicator lights.	Same as step 8.b
	e. Set BANDWIDTH switch to C.	C indicator lights.	Same as step 8.b
	f. Set BANDWIDTH switch to D.	D indicator lights.	Same as step 8.b
	g. Set BANDWIDTH switch to E.	E indicator lights.	Same as step 8.b
	h. Repeat steps 8.b through 8.g with MODE switch in AM position.	Same as step 8.b through 8.g	Same as step 8.b
	i. Repeat steps 8.b through 8.g with MODE switch in ISB position.	All BANDWIDTH indicators to out and remain out.	Same as step 8.b
	j. Repeat steps 8.b through 8.g with MODE switch in NET DATA position.	Same as step 8.i	Same as step 8.b
	k. Repeat steps 8.b through 8.g with MODE switch in FM position.	Same as steps 8.b through 8.g	Same as step 8.b
9. Receive performance	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 500.00 VBFO to FXD All AGC to FAST or FAX RF GAIN to full cw SPEAKER to A1 SQUELCH to off (full ccw).		
	b. Connect rf signal generator to RF IN J22 jack on rear panel.		
	c. Set rf signal generator to 501.00 kHz.		
	d. Set rf signal generator level for 100 μV.		
	e. Note output of speaker.	Tone is heard.	Check A2S15 and receive audio (AF1) A25.
(Cont)	f. Set METER switch to CH A1 (+3FS). Note meter indication.	NLT -2 dB mW	Check A2S1 and receive audio (AF1) A25.

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	g. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check A2S1 and channel A1 if A8.
	h. Repeat step 9.d thru 9.g with the rf signal generator and receiver at the following frequencies: RF SIG GEN — RECEIVER 1 001.00 kHz — 1 000.00 kHz 15 001.00 kHz — 15 000.00 kHz	Same as steps 9.e, 9.f, and 9.g	Same as steps 9.e, 9.f, and 9.g
	Note Steps 9.i and 9.o are applicable only to receivers with ISB and/or NET DATA option installed.		
	i. Set CH B1 enable to ON and FREQUENCY kHz to 500.00.		
	j. Set rf signal generator to 499.00 kHz.		
	k. Set rf signal generator level for 100 µV.		
	l. Set SPEAKER switch to B1. Note output of speaker.	Tone is heard.	Check A2S15 and receive audio (AF1) A25.
	m. Set METER switch to CH B1 (+3FS). Note meter indication.	NLT -2 dB mW	Check A2S1 and receiver audio (AF1) A25.
	n. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check A2S1 and channel B1 if A7.
	o. Repeat steps 9.k thru 9.n with the rf signal generator and receiver at the following frequencies: RF SIG GEN — RECEIVER 999.00 kHz — 1 000.00 kHz 14 999.00 kHz — 15 000.00 kHz	Same as steps 9.l, 9.m, and 9.n	Same as steps 9.l, 9.m, and 9.n
	Note Steps 9.p thru 9.r are applicable only to receivers with ISB option installed.		
	p. Set CH A2 enable to ON.		
	q. Set rf signal generator to 505.29 kHz and FREQUENCY KHZ to 500.00.		
(Cont)	r. Set rf signal generator level for 100 µV.		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	s. Set SPEAKER switch to A2. Note output of speaker.	Tone is heard.	Check A2S15 and receive audio (AF2) A26.
	t. Set METER switch to CH A2 (+3FS). Note meter indication.	NLT -2 dB mW	Check A2S1 and receive audio (AF2) A26.
	u. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check A2S1 and channel A2 if A6.
	v. Repeat steps 9.r thru 9.u with the rf signal generator and receiver at the following frequencies: RF SIG GEN — RECEIVER 1 005.29 kHz — 1 000.00 kHz 15 005.29 kHz — 15 000.00 kHz	Same as steps 9.s, 9.t, and 9.u	Same as steps 9.s, 9.t, and 9.u
	w. Set CH B2 enable to ON.		
	x. Set rf signal generator to 494.71 kHz and FREQUENCY KHZ to 500.00.		
	y. Set rf signal generator level for 100 μV.		
	z. Set SPEAKER switch to B2. Note output of speaker.	Tone is heard.	Check A2S15 and receive audio (AF2) A26.
	aa. Set METER switch to CH B2 (+3FS). Note meter indication.	NLT -2 dB mW	Check A2S1 and receive audio (AF2) A26.
	ab. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check A2S1 and channel B2 if A5.
	ac. Repeat steps 9.y thru 9.ab with the rf signal generator and receiver at the following frequencies: RF SIG GEN — RECEIVER 994.71 kHz — 1 000.00 kHz 14 994.71 kHz — 15 000.00 kHz	Same as steps 9.z, 9.aa, and 9.ab	Same as steps 9.z, 9.aa, and 9.ab
10. AGC switches (Cont)	(Channel A1) a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A1 enable to ON		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	CH A1 - AGC to FAST or FAX RF GAIN to full cw SPEAKER to A1 SQUELCH to off (full ccw) AF GAIN to mid-range		
	b. Connect rf signal generator to RF IN jack J22 on rear panel.		
	c. Set rf signal generator to 4001.00 kHz and receiver to 4000.00 kHz.		
	d. Set rf signal generator level for 100 μV.		
	e. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check channel A1 if A8 and A2S26.
	f. Disconnect rf signal generator.	Meter reading decreases with no noticeable delay.	Same as step 10.e
	g. Set CH A1 - AGC to SLOW or VOICE.		
	h. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	NLT 30 dB	Same as step 10.e
	i. Disconnect rf signal generator.	After approximately 1 second delay, meter reading decreases.	Same as step 10.e
	j. Set CH A1 - AGC to OFF.		
	k. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	Meter reading does not change when rf signal generator is connected.	Same as step 10.e
	(Channel B1)		
	l. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH B1 enable to ON CH B1-AGC to FAST or FAX RF GAIN to full cw SPEAKER to B1 SQUELCH to off (full ccw) AF GAIN to mid-range		
(Cont)	m. Connect rf signal generator to RF IN jack J22 on rear panel.		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	n. Set rf signal generator to 3999.00 kHz and receiver to 4000.00 kHz.		
	o. Set rf signal generator level for 100 μV.		
	p. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check channel B1 if A7 and A2S25.
	q. Disconnect rf signal generator.	Meter reading decreases with no noticeable delay.	Same as step 10.p
	r. Set CH B1 - AGC to SLOW or VOICE.		
	s. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	NLT 30 dB	Same as step 10.p
	t. Disconnect rf signal generator.	After approximately 1 second delay, meter reading decreases.	Same as step 10.p
	u. Set CH B1 - AGC to OFF.		
	v. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	Meter reading does not change when rf signal generator is connected.	Same as step 10.p
	(Channel A2)		
	w. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A2 enable to ON CH A2 - AGC to FAST or FAX RF GAIN to full cw SPEAKER to A2 SQUELCH to off (full ccw). AF GAIN to mid-range		
	x. Connect rf signal generator to RF IN jack J22 on rear panel.		
	y. Set rf signal generator to 4005.29 kHz and receiver to 4000.00 kHz.		
	z. Set rf signal generator level for 100 μV.		
(Cont)	aa. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check channel A2 if A6 and A2S27.

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	ab. Disconnect rf signal generator.	Meter reading decreases with no noticeable delay.	Same as step 10.aa
	ac. Set CH A2 - AGC to SLOW or VOICE.		
	ad. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	NLT 30 dB	Same as step 10.aa
	ae. Disconnect rf signal generator.	After approximately 1 second delay, meter reading decreases.	Same as step 10.aa
	af. Set CH A2 - AGC to OFF.		
	ag. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	Meter reading does not change when rf signal generator is connected.	Same as step 10.aa
	(Channel B2)		
	ah. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH B2 enable to ON CH B2 - AGC to FAST or FAX RF GAIN to full cw SPEAKER to B2 SQUELCH to off (full ccw) AF GAIN to mid-range		
	ai. Connect rf signal generator to RF IN jack J22 on rear panel.		
	aj. Set rf signal generator to 3994.71 kHz and receiver to 4000.00 kHz.		
	ak. Set rf signal generator level for 100 μV.		
	al. Set METER switch to RCV SIG. Note meter indication.	NLT 30 dB	Check channel B2 if A5 and A2S24.
	am. Disconnect rf signal generator.	Meter reading decreases with no noticeable delay.	Same as step 10.al
	an. Set CH B2 - AGC to SLOW or VOICE.		
(Cont)	ao. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	NLT 30 dB	Same as step 10.al

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	ap. Disconnect rf signal generator.	After approximately 1 second delay, meter reading decreases.	Same as step 10.al
	aq. Set CH B2 - AGC to OFF.		
	ar. Reconnect rf signal generator to RF IN jack J22 on rear panel. Note meter indication.	Meter reading does not change when rf signal generator is connected.	Same as step 10.al
11. RF GAIN control	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A1 enable to ON VBFO to FXD All AGC to OFF RF GAIN to full cw SPEAKER to CH A1 SQUELCH to off (full ccw) AF GAIN to mid-range		
	b. Connect rf signal generator to RF IN jack J22 on rear panel.		
	c. Set rf signal generator to 4001.00 kHz and receiver to 4000.00 kHz.		
	d. Set rf signal generator level for 100 μV.		
	e. Set METER switch to RCV SIG.		
	f. Slowly rotate RF GAIN to full ccw.	Meter reading increases and audio level decreases as RF GAIN is rotated ccw. At full ccw (minimum gain) no audio tone is present and meter indicates NLT 90 dB.	Check A2R11 and channel A1 if A8.
12. SQUELCH/ AF GAIN control	(Channel A1/B1)		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A1 enable to ON, other channel enables to OFF VBFO to FXD All AGC to OFF		
(Cont)			

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	RF GAIN to full cw SPEAKER to CH A1 SQUELCH to full cw		
	b. Connect rf signal generator to RF IN jack J22 on rear panel.		
	c. Set rf signal generator to 4000.50 kHz and receiver to 4000.00 kHz.		
	d. Set rf signal generator level for 100 μV.		
	e. Disconnect rf signal generator.		
	f. Adjust SQUELCH control ccw to point where background noise is first heard.	Background noise is heard.	Check A2S16C and receive audio (AF1) A25.
	g. Slowly adjust SQUELCH cw until background noise disappears.		
	h. Reconnect rf signal generator to RF IN jack J22 or rear panel.	Squelch is broken and audio tone is heard from speaker.	Same as step 12.f.
	i. Adjust AF GAIN control to full cw and full ccw.	Maximum speaker volume at full cw, minimum speaker volume at full ccw.	Same as step 12.f.
	j. Disconnect rf signal generator.	After a slight delay, speaker should squelch, no audio tone, no background noise.	Same as step 12.f.
	(Channel A2/B2)		
	k. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A2 enable to ON VBFO to FXD All AGC to OFF RF GAIN to full cw SPEAKER to CH A2 SQUELCH to full cw		
	l. Connect rf signal generator to RF IN jack J22 on rear panel.		
(Cont)	m. Set rf signal generator to 4005.79 kHz and receiver to 4000.00 kHz.		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	n. Set rf signal generator level for 100 µV.		
	o. Disconnect rf signal generator.		
	p. Adjust SQUELCH control ccw to point where background noise is first heard.	Background noise is heard.	Check A2S16C and receive audio (AF2) A26.
	q. Slowly adjust SQUELCH cw until background noise disappears.		
	r. Reconnect rf signal generator to RF IN jack J22 on rear panel.	Squelch is broken and audio tone is heard from speaker.	Same as step 12.p
	s. Adjust AF GAIN control to full cw and full ccw.	Maximum speaker volume at full cw, minimum speaker volume at full ccw.	Same as step 12.p
	t. Disconnect rf signal generator.	After a slight delay, speaker should squelch, no audio tone, no background noise.	Same as step 12.p
13. PHONES check	(Channel A1/B1)		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A1 enable to ON VBFO to FXD All AGC to FAST RF GAIN to full cw SQUELCH to OFF (full ccw)		
	b. Plug headphones into PHONES jack.		
	c. Set rf signal gnerator to 4001.00 kHz and receiver to 4000.00 kHz.		
	d. Set rf signal generator level for 100 µV.		
	e. Set PHONES switch to CH A1.	Audio tone should be heard in headphones.	Check A2S19 and receive audio (AF1) A25.
(Cont)	f. Adjust PHONES level control to full ccw and full cw.	Minimum headphones volume at full ccw, maximum headphones volume at full cw.	Same as step 13.e

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
13. (Cont)	g. Set PHONES switch to CH B1.	Background noise only in headphones.	Same as step 13.e
	h. Set rf signal generator to 3999.00 kHz.	Audio tone should be heard in headphones.	Same as step 13.e
	i. Set PHONES switch to CH A1.	Background noise only in headphones.	Same as step 13.e
	(Channel A2/B2)		
	j. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A2 enable to ON VBFO to FXD All AGC to FAST RF GAIN to full cw SQUELCH to off (full ccw)		
	k. Plug headphones into PHONES jack.		
	l. Set rf signal generator to 4005.29 kHz and receiver to 4000.00 kHz.		
	m. Set rf signal generator level for 100 µV.		
	n. Set PHONES switch to CH A2.	Audio tone should be heard in headphones.	Check A2S19 and receive audio (AF2) A26.
	o. Adjust PHONES level control to full ccw and full cw.	Minimum headphones volume at full ccw, maximum headphones volume at full cw.	Same as step 13.n
	p. Set PHONES switch to CH B2.	Background noise only in headphones.	Same as step 13.n
	q. Set rf signal generator to 3994.71 kHz.	Audio tone should be heard in headphones.	Same as step 13.n.
	r. Set PHONES switch to CH A2.	Background noise only in headphones.	Same as step 13.n.

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. SPEAKER check	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB BANDWIDTH to any CH A1 enable to ON, CH B1 enable to ON, CH A2 enable to ON, CH B2 enable to ON VBFO to FXD All AGC to FAST RF GAIN to full cw SQUELCH to off (full ccw)		
	b. Set rf signal generator to 4001.00 kHz and receiver to 4000.00 kHz.		
	c. Set rf signal generator level for 100 μV.		
	d. Set SPEAKER switch to CH A1.	Audio tone should be heard from speaker.	Check A2 S15 and receive audio (AF1) A25.
	e. Set SPEAKER switch to ALL CH.	Audio tone should be heard from speaker, slightly reduced in volume.	Same as step 14.d.
	f. Set SPEAKER switch to CH B1.	Background noise only in headphones.	Same as step 14.d
	g. Set rf signal generator to 3999.00 kHz.	Audio tone should be heard from speaker.	Same as step 14.d
	h. Set SPEAKER switch to ALL CH.	Audio tone should be heard from speaker, slightly reduced in volume.	Same as step 14.d
	i. Set SPEAKER switch to CH A2.	Background noise only in headphones.	Check A2S15 and receive audio (AF2) A26.
	j. Set rf signal generator to 4005.29 kHz.	Audio tone should be heard from speaker.	Same as step 14.i
	k. Set SPEAKER switch to ALL CH.	Audio tone should be heard from speaker, slightly reduced in volume.	Same as step 14.i
	l. Set SPEAKER switch to CH B2.	Background noise only in speaker.	Same as step 14.i
(Cont)	m. Set rf signal generator to 3994.71 kHz.	Audio tone should be heard from speaker.	Same as step 14.i

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)	n. Set SPEAKER switch to ALL CH.	Audio tone should be heard from speaker, slightly reduced in volume.	Same as step 14.i
	o. Set SPEAKER switch to CH A1.	Background noise only in speaker.	Same as step 14.d
15. VBFO switch (applicable only if vbfo option installed).	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to VAR CH A1 - AGC to FAST RF GAIN to full cw SPEAKER to CH A1		
	b. Check that each frequency digit of the VBFO OFFSET KHZ can be set.	All frequencies between -9990 and +9990 Hz in 10-Hz increments can be selected.	Check vbfo A4, VBFO switch A2S11, and dvbfo switch board A2A4.
	c. Set VBFO switch to FXD.	VBFO OFFSET KHZ frequency display goes blank.	Same as step 15.b
	d. Connect rf signal generator to RF IN jack J22 on rear panel.		
	e. Set rf signal generator to 4000.00 kHz and receiver to 4000.00 kHz.	No audio tone from speaker	Same as step 15.b
	f. Set VBFO switch to VAR.		
	g. Adjust VBFO OFFSET KHZ to +1.00 kHz.	1000-Hz audio tone from speaker	Same as step 15.b
	h. Adjust VBFO OFFSET KHZ to -1.00 kHz.	1000-Hz audio tone from speaker	Same as step 15.b
	i. Adjust VBFO OFFSET KHZ to ±0.00 kHz.	No audio tone from speaker	Same as step 15.b
16. CONT switch (applicable only if remote control option installed) (Cont)	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw	No faults are lit. CW and BANDWIDTH-16 indicators are lit. FREQUENCY KHZ indicates 4000.00 kHz.	Check control A10 and switch mounting board A2A2.

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
16. (Cont)	b. Connect a compatible receiver control to the unit under test.		
	c. Set receiver control PWR to on and make changes to the following receiver control front-panel controls: MODE switch BANDWIDTH switch FREQUENCY KHZ switches VBFO switch AGC switches RF GAIN control TUNING control	Changing of receiver control front panels has no effect on the unit under test displays/indications.	Check parallel input A11, parallel output A12, and serial interface A13.
	d. Set the receiver control front-panel controls as follows: PWR to on CONT to NORM MODE to AM BANDWIDTH to A FREQUENCY KHZ to 1666.66 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to MIN		
	e. Set the unit under test CONT switch to REM.	Faults do not light. AM and BANDWIDTH-A indicators light. FREQUENCY KHZ indicates 1666.66 kHz.	Same as step 12.a
	f. Make changes to the following unit under test controls. MODE switch BANDWIDTH switch FREQUENCY KHZ switches VBFO switch AGC switches RF GAIN control	Changing of unit under test controls has no effect on the unit under test displays/indicators.	Same as step 12.a
	g. Make changes to the controls listed in step 12.c.	Unit under test is controlled by receiver control.	Same as step 12.c
17. Indicators (Cont)	a. Front panel controls set as follows: PWR to off CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz		

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. (Cont)	VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Set PWR switch on.	RCV FAULT indicator lights.	Check control A10
	c. Change any FREQUENCY KHZ digit.	RCV FAULT indicator goes out.	Same as step 17.b
	d. Apply +5 V dc to P16-8.	PRESEL FAULT indicator lights.	Check control A10, rfi card, and LED status display A2A1.
	e. Remove +5 V dc from P16-8.	PRESEL FAULT indicator goes out.	Same as step 17.d
	f. Apply +5 V dc to P16-27.	RCV OVERLOAD indicator lights.	Same as step 17.d
	g. Remove +5 V dc from P16-27.	RCV OVERLOAD indicator goes out.	Same as step 17.d
	h. To check mode indicators perform test 7.	Same as test 7	Same as test 7
	i. To check BANDWIDTH indicators perform test 8.	Same as test 8	Same as test 8
	j. To test FREQUENCY KHZ display perform test 5.	Same as test 5	Same as test 5
	k. To test VBFO OFFSET KHZ display perform test 11.	Same as test 15	Same as test 15
18. Receive overload operation	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Set receiver frequency to any frequency between 1.6 and 30.0 MHz.		
	c. Connect an rf signal generator to RF IN jack J22 on the rear panel.		
	d. Set rf signal generator to 4.0 MHz. Increase rf signal generator output until RCV OVERLOAD indicator lights. Note rf signal generator output level.	NLT 2.5 V rms (open circuit)	Check rf translator A9
	e. Remove rf signal generator	Note RCV OVERLOAD indicator goes out.	Same as step 18.d

Table 4. HF-8054( ) Receiver, Minimum Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
19. Shutdown	a. Set PWR switch off. b. Disconnect unit from power source. c. Disconnect all test equipment. d. Set unit LINE SELECTOR for power source in installation to be used (100/115/215/230 V ac). **Note** Ensure that proper fuse is installed for power source used. e. Install top and bottom chassis covers on unit tested.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top and bottom chassis covers and synthesizer top cover of unit to be tested. b. Set unit LINE SELECTOR for power source available. (100/115/215/230 V ac). Note Ensure that proper fuse is installed for power source used. c. Connect unit to available power source. d. Refer to test setup, figure 2.	Note In all tests, if power is removed, a frequency digit must be changed when power is restored to clear RCV FAULT indication.	
2. Initial checks	Note To make the initial checks, set unit on edge to gain access to A1TB1. Caution If repair has been made to the power supply or any power circuits, remove all plug-in cards/modules. a. Front panel controls set as follows: PWR to on CONT to LCL MODE to AM BANDWIDTH to 16 FREQUENCY KHZ to 2000.00 VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Measure dc voltages between the following points and ground (A1TB1-5):		Check power supply A1 and check for shorts on output voltage lines.
	A1TB1-1	+24 ±1.0 V dc	
	A1TB1-2	+18 ±1.0 V dc	
	A1TB1-3	+15 ±1.0 V dc	
	A1TB1-6	+8 ±1.0 V dc	
	A1TB1-7	+5 ±0.5 V dc	
	A1TB1-8	-15 ±1.0 V dc	
(Cont)	Note Perform step 2.c only if repair has been made to power supply or any power circuits.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Measure dc voltages between the following points and ground.		Check wiring from A1TB1, check for shorts on output lines, or check repaired power circuit.
	Channel A1 IF A8:		
	J5-6 J5-23 J5-27	-15 ±1.0 V dc +15 ±1.0 V dc +5 ±0.5 V dc	
	Rf translator A9:		
	J6-25	+24 ±1.0 V dc	
	Receive audio (AF1) A25:		
	J14-18	+18 ±1.0 V dc	
	Synthesizer voltage regulator A14:		
	A24J1-8	+8 ±1.0 V dc	
3. Sensitivity	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 110.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
	b. Connect an rf signal generator to RF IN jack J22 on rear panel.		
	(Channel A1)		
	c. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		
	d. Note noise level with no signal input. Adjust rf signal generator frequency to receiver frequency +1000 Hz and signal level for a 10-dB increase on the audio voltmeter from the noise level with no signal input.	Note input signal level for information only (frequency outside specified limits of receiver).	Check rf translator A9 and channel A1 if A8.
(Cont)	e. Repeat step 3.d with the receiver at each of the following frequencies.	(Open circuit microvolts)	Same as step 3.d

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td>
<table>
<tr><th rowspan="2">FREQUENCY (kHz)</th><th colspan="2">MAXIMUM INPUT FOR 10-dB INCREASE</th></tr>
<tr><th>WITH RF TRANSLATOR 637-1767-002</th><th>WITH RF TRANSLATOR 637-1767-003</th></tr>
<tr><td>250.00</td><td>1.7 μV</td><td>2.4 μV</td></tr>
<tr><td>530.00</td><td>1.7 μV</td><td>2.4 μV</td></tr>
<tr><td>540.00</td><td>1.7 μV</td><td>2.4 μV</td></tr>
<tr><td>1 550.00</td><td>1.7 μV</td><td>2.4 μV</td></tr>
<tr><td>1 600.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
<tr><td>4 000.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
<tr><td>8 000.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
<tr><td>16 000.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
<tr><td>22 000.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
<tr><td>29 990.00</td><td>0.62 μV</td><td>0.9 μV</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td></td><td>(Channel B1)
f. Set CH A1 enable to OFF and CH B1 enable to ON.
g. Set receiver for 4000.00 kHz.
h. Connect an audio voltmeter and 600-Ω load across TB1-4 and TB1-6.
i. Note noise level with no signal input. Adjust rf signal generator frequency to receiver frequency -1000 Hz and signal level for a 10-dB increase on the audio voltmeter from the noise level with no signal input.</td><td>Same as 4000.00 kHz in CH A1 (preceding chart)</td><td>Check rf translator A9 and channel B1 if A7.</td></tr>
<tr><td>(Cont)</td><td>(Channel A2)
j. Set CH B1 enable to OFF and CH A2 enable to ON.
k. Set receiver for 4000.00 kHz.
l. Connect an audio voltmeter and 600-Ω load across TB2-1 and TB-3.
m. Note noise level with no signal input. Adjust rf signal generator frequency to receiver frequency +5290 Hz and signal level for a 10-dB increase on the audio voltmeter from the noise level with no signal input.</td><td>Same as 4000.00 kHz in CH A1 (preceding chart)</td><td>Check rf translator A9 and channel A2 if A6.</td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

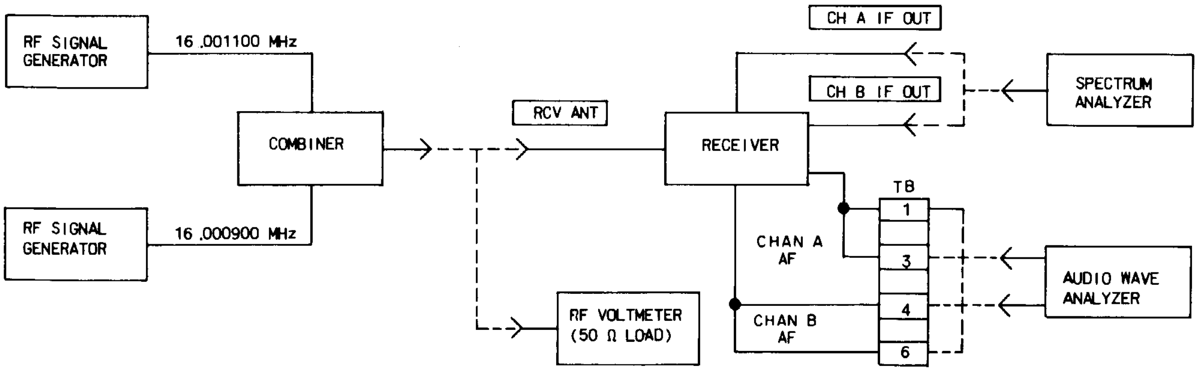
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	(Channel B2) n. Set CH A2 enable of OFF and CH B2 enable to ON. o. Set receiver for 4000.00 kHz. p. Connect an audio voltmeter and 600-Ω load across TB2-4 and TB2-6.		
	q. Note noise level with no signal input. Adjust rf signal generator frequency to receiver frequency -5290 Hz and signal level for a 10-dB increase on the audio voltmeter from the noise level with no signal input.	Same as 4000.00 kHz in CH A1 (preceding chart)	Check rf translator A9 and channel B2 if A5.
	(AM - channel A1) r. Set MODE switch to AM and BANDWIDTH switch to 16. s. Set receiver for 4000.00 kHz. t. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		
	u. Note noise level with no signal input. Adjust rf signal generator frequency to 4000.00 kHz, modulated 30% with 1000 Hz. Adjust rf signal generator level for 10-dB increase from noise level with no signal input.	5.6 μV maximum (with 637-1767-002), 7.9 μV maximum (with 637-1767-003)	Same as step 3.d
4. Gain	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 250.00 kHz VBFO to FXD All AGC to FAST RF GAIN to full cw b. Connect an rf signal generator to RF IN jack J22 on rear panel.		
(Cont)	(Channel A1) c. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3. d. Connect an rf voltmeter (with a 50-Ω load) to J25 A1 IF OUT jack on rear panel.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>4. (Cont)</td><td>e. Adjust rf signal generator frequency to receiver frequency +1000 Hz and level for 3 μV.</td><td>Audio voltmeter indicates NLT -3 dB mW, rf voltmeter indication not specified.</td><td>Check channel A1 if A8, receive audio A25, and rf translator A9.</td></tr>
<tr><td></td><td>f. Repeat step 4.e at each of the following frequencies:
<table>
<tr><th>FREQUENCY (kHz)</th><th>AUDIO OUTPUT</th><th>IF OUTPUT</th></tr>
<tr><td>530.00</td><td>NLT -3 dB mW</td><td>Not specified</td></tr>
<tr><td>1 550.00</td><td>NLT -3 dB mW</td><td>Not specified</td></tr>
<tr><td>1 600.00</td><td>NLT -3 dB mW</td><td>Not specified</td></tr>
<tr><td>4 000.00</td><td>NLT -3 dB mW</td><td>15 to 30 mV</td></tr>
<tr><td>8 000.00</td><td>NLT -3 dB mW</td><td>15 to 30 mV</td></tr>
<tr><td>16 000.00</td><td>NLT -3 dB mW</td><td>15 to 30 mV</td></tr>
<tr><td>22 000.00</td><td>NLT -3 dB mW</td><td>15 to 30 mV</td></tr>
<tr><td>29 900.00</td><td>NLT -3 dB mW</td><td>15 to 30 mV</td></tr>
</table></td><td></td><td>Same as step 4.e</td></tr>
<tr><td></td><td>(Channel B1)
g. Connect an audio voltmeter and 600-Ω load across TB1-4 and TB1-6.
h. Connect an rf voltmeter (with a 50-Ω load) to J24 B1 IF OUT jack on rear panel.
i. Set CH A1 enable to OFF and CH B1 enable to ON.
j. Set receiver to 4000.00 kHz.</td><td></td><td></td></tr>
<tr><td></td><td>k. Adjust rf signal generator frequency to 3.999 MHz and level for 3 μV.</td><td>Audio voltmeter indicates NLT -3 dB mW, rf voltmeter indicates 15 to 30 mV.</td><td>Check channel B1 if A7, receive audio A25, and rf translator A9.</td></tr>
<tr><td></td><td>(Channel A2)
l. Connect an audio voltmeter and 600-Ω load across TB2-1 and TB2-3.
m. Connect an rf voltmeter (with a 50-Ω load) to J26 A2 IF OUT jack on rear panel.
n. Set CH B1 enable to OFF and CH A2 enable to ON.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>o. Set receiver to 4000.00 kHz.</td><td></td><td></td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	p. Adjust rf signal generator frequency to 4.00529 MHz and level for 3 μV.	Audio voltmeter indicates NLT -3 dB mW, rf voltmeter indicates 15 to 30 mV.	Check channel A2 if A6, receive audio A26, and rf translator A9.
	(Channel B2) q. Connect an audio voltmeter and 600-Ω load across TB2-4 and TB2-6. r. Connect an rf voltmeter (with a 50-Ω load) to J23 B2 IF OUT jack on rear panel. s. Set CH A2 enable to OFF and CH B2 enable to ON. t. Set receiver to 4000.00 kHz.		
	u. Adjust rf signal generator frequency to 3.99471 MHz and level for 3 μV.	Audio voltmeter indicates NLT -3 dB mW, rf voltmeter indicates 15 to 30 mV.	Check channel B2 if A5, receive audio A26, and rf translator A9.
	(AM - channel A1) v. Set MODE switch to AM and BANDWIDTH switch to 16. w. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3. x. Connect an rf voltmeter (with a 50-Ω load) to J25 A1 IF OUT jack on rear panel. y. Set receiver to 4000.00 kHz. z. Adjust rf signal generator frequency to 4000.00 kHz, modulated 30% with 1000 Hz.		
	aa. Adjust rf signal generator output level to 2 μV.	Audio voltmeter indicates NLT -3 dB mW, rf voltmeter indicates 15 to 30 mV.	Same as step 4.e
5. In-band intermodulation	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 4000.00 kHz VBFO to FXD All AGC to FAST RF GAIN to full cw		
(Cont)	b. Connect two rf signal generators to unit under test as shown in figure 3.		



In-Band Intermodulation Test Setup
Figure 3

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	(Channel A1) c. Set one rf signal generator to 4.001 100 MHz. d. Set second rf signal generator to 4.000 900 MHz. e. Using an rf vtvm (with 50-Ω load) connected at output of combiner, independently adjust each rf signal for 100 mV rms. f. Connect the 2-tone signal to RF IN jack J22 on rear panel. g. Connect audio wave analyzer (with 600-Ω load) to TB1-1 and TB1-3 (channel A1 af). h. Measure and record 900 Hz and 1100 Hz on the audio wave analyzer.	Reference.	

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

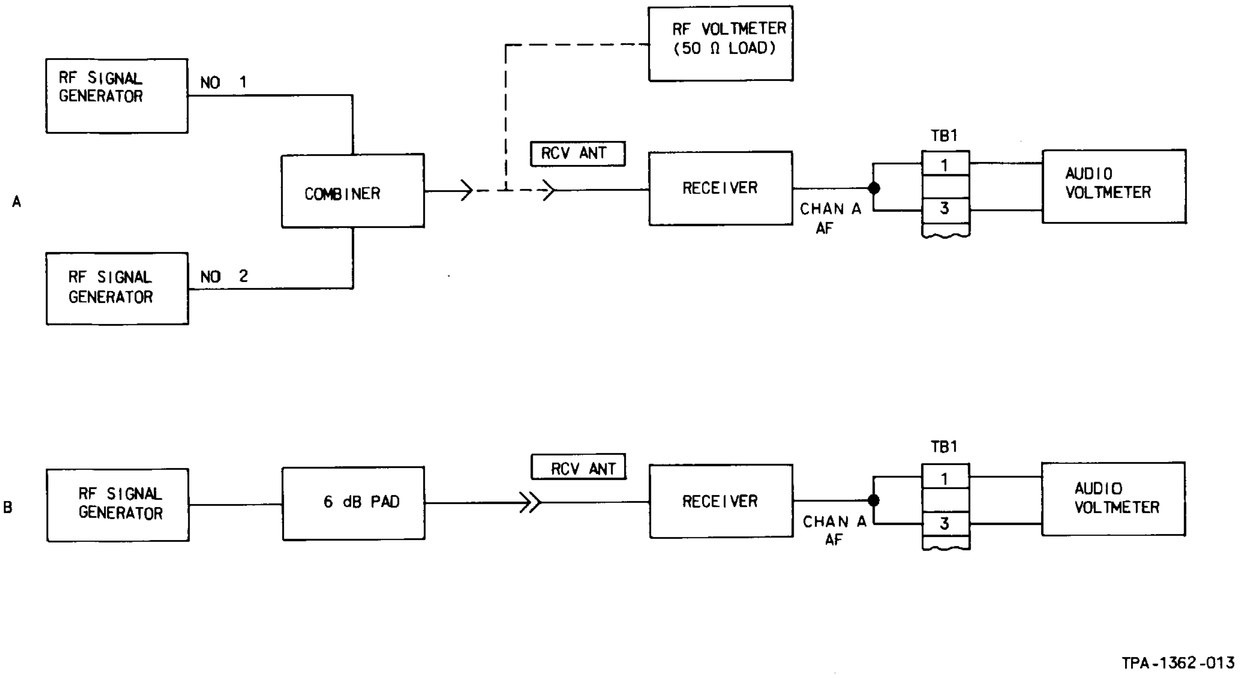
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	i. Measure the second and third order intermodulation products on the audio wave analyzer. 200 Hz (lower 2nd) 700 Hz (lower 3rd) 1300 Hz (upper 3rd) 2000 Hz (upper 2nd)	NLT 47 dB down from reference of test 5.h.	Perform receiver alignment procedures, check bypass and feedthru capacitors, or return to factory for repair.
	j. Connect a spectrum analyzer at J25 A1 IF OUT jack on rear panel.		
	k. With spectrum analyzer set for manual sweep, 200 Hz/division, and 10-Hz bandwidth measure and record 450.900 kHz and 451.100 kHz.	Reference.	
	l. Measure the second and third order intermodulation products on the spectrum analyzer. 450.200 kHz (lower 2nd) 450.700 kHz (lower 3rd) 451.300 kHz (upper 3rd) 452.000 kHz (upper 2nd)	NLT 47 dB down from reference of test 5.k.	Same as step 5.i
	(Channel B1)		
	m. Set receiver for 4 002.00 kHz, CH A1 enable to OFF, and CH B1 enable to ON.		
	n. Connect audio wave analyzer (with 600-Ω load) to TB1-4 and TB1-6 (channel B1 af).		
	o. Measure and record 900 Hz and 1100 Hz on the audio wave analyzer.	Reference	
	p. Measure the second and third order intermodulation products on the audio wave analyzer. 200 Hz (upper 2nd) 700 Hz (upper 3rd) 1300 Hz (lower 3rd) 2000 Hz (lower 2nd)	NLT 47 dB down from reference of test 5.o	Same as step 5.i
	q. Connect spectrum analyzer at J24 B1 IF OUT jack on rear panel.		
	r. With spectrum analyzer, measure and record 449.100 kHz and 448.900 kHz.	Reference	
(Cont)	s. Measure the second and third order intermodulation products on the spectrum analyzer. 449.800 kHz (upper 2nd) 449.300 kHz (upper 3rd) 448.700 kHz (lower 3rd) 448.000 kHz (lower 2nd)	NLT 47 dB down from reference of test 5.r	Same as step 5.i

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	(Channel A2)		
	t. Set receiver for 4000.00 kHz, CH B1 enable to OFF, and CH A2 enable to ON.		
	u. Set one rf signal generator to 4.005 390 MHz.		
	v. Set second rf signal generator to 4.005 190 MHz.		
	w. Using an rf vtvm (with 50-Ω load) connected at output of combiner, independently adjust each rf signal for 100 mV rms.		
	x. Connect the 2-tone signal to RF IN jack J22 on rear panel.		
	y. Connect audio wave analyzer (with 600-Ω load) to TB2-1 and TB2-3 (channel A2 af).		
	z. Measure and record 900 Hz and 1100 Hz on the audio wave analyzer.	Reference	
	aa. Measure the second and third order intermodulation products on the audio wave analyzer. 200 Hz (lower 2nd) 700 Hz (lower 3rd) 1300 Hz (upper 3rd) 2000 Hz (upper 2nd)	NLT 47 dB down from reference of step 5.z	Same as step 5.i
	ab. Connect spectrum analyzer at J26 A2 IF OUT jack on rear panel.		
	ac. With spectrum analyzer, measure and record 455.190 kHz and 455.390 kHz.	Reference	
	ad. Measure the second and third order intermodulation products on the spectrum analyzer. 452.490 kHz (lower 2nd) 454.990 kHz (lower 3rd) 455.590 kHz (upper 3rd) 456.290 kHz (upper 2nd)	NLT 47 dB down from reference of step 5.ac	Same as step 5.i
	(Channel B2)		
	ae. Set receiver for 4000.00 kHz, CH A2 enable to OFF, and CH B2 enable to ON.		
	af. Set one rf signal generator to 3.994 610 MHz.		
(Cont)	ag. Set second rf signal generator to 3.994 810 MHz.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	ah. Using an rf vtvm (with 50-Ω load) connected at output of combiner, independently adjust each rf signal for 100 mV rms.		
	ai. Connect the 2-tone signal to RF IN jack J22 on rear panel.		
	aj. Connect audio wave analyzer (with 600-Ω load) to TB2-4 and TB2-6 (channel B2 af).		
	ak. Measure and record 900 Hz and 1100 Hz on the audio wave analyzer.	Reference	
	al. Measure the second and third order intermodulation products on the audio wave analyzer. 200 Hz (upper 2nd) 700 Hz (upper 3rd) 1300 Hz (lower 3rd) 2000 Hz (lower 2nd)	NLT 47 dB down from reference of step 5.ak	Same as step 5.i
	am. Connect spectrum analyzer at J23 B2 IF OUT jack on rear panel.		
	an. With spectrum analyzer, measure and record 444.810 kHz and 444.610 kHz.	Reference	
	ao. Measure the second and third order intermodulation products on the spectrum analyzer. 445.710 kHz (upper 2nd) 445.010 kHz (upper 3rd) 444.410 kHz (lower 3rd) 443.910 kHz (lower 2nd)	NLT 47 dB down from reference of step 5.an	Same as step 5.i
6. Out-of-band intermodulation	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF FREQUENCY KHZ to 2000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
	b. Connect two rf signal generators to unit under test as shown in figure 4A.		
	c. Set one rf signal generator to 2.050 000 MHz.		
(Cont)	d. Set second rf signal generator to 4.051 000 MHz.		



Out-of-Band Intermodulation Test Setup
Figure 4 .

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6. (Cont)	e. Using an rf vtvm (with 50-Ω load) connected at output of combiner, independently adjust each rf signal for 50 mV rms.		
	f. Connect the 2-tone signal to RF IN jack J22 on rear panel.		
	g. Connect an audio voltmeter (with 600-Ω load) to TB1-1 and TB1-3 (channel A af).		
	h. Note audio output level.	Reference	
	i. Disconnect 2-tone setup and reconnect one rf signal generator to unit under test as shown in figure 4B.		
	j. Set the rf signal generator to the receiver frequency +1000 Hz.		
	k. Adjust rf signal generator output to produce same level on audio voltmeter as was referenced in step 6.h.	NMT 4.0 μV rms	Perform receiver alignment procedures. Check bypass and feedthru capacitors, or return to factory for repair.
(Cont)			

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6. (Cont)	l. Repeat steps 6.b thru 6.k at the following settings:		

RCVR FREQ	RF SIG GEN #1	RF SIG GEN #2	STEP 6.k INDICATION
2 000.00 kHz	2 050.00 kHz	2 099.00 kHz	NMT 1.3 μV rms
27 000.00 kHz	27 050.00 kHz	27 099.00 kHz	NMT 1.3 μV rms

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. Squelch operation	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON VBFO to FXD AGC to FAST or FAX RF GAIN to full cw SPEAKER to A1		
	b. Set the receiver to any frequency between 1600 and 29 990 kHz (rf signal generator disconnected).		
	c. Set SQUELCH control full ccw. Adjust SQUELCH control cw just out-of-detent.		
	d. Adjust AF GAIN for audible signal and note speaker output.	Speaker should not squelch on normal receiver noise.	Check A2S16C and receive audio (AF1) A2S.
	e. Rotate SQUELCH control cw about 45 degrees from off position.	Speaker output should squelch on noise only after 1 - 3 seconds.	Check A2S16B, A2S16C, and receive audio (AF1) A2S.
	f. Connect an rf signal generator to the RF IN jack J22 on rear panel.		
	g. Set rf signal generator to the receiver frequency +1000 Hz.		
	h. Adjust the rf signal generator for a 10-μV rf input.	Speaker should break squelch and audio tone should be heard in speaker.	Same as step 7.e
	i. Disconnect rf signal generator.	After 1- to 3-second delay, speaker output should squelch on noise only.	Same as step 7.e
	j. Return SQUELCH to off (full ccw).		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

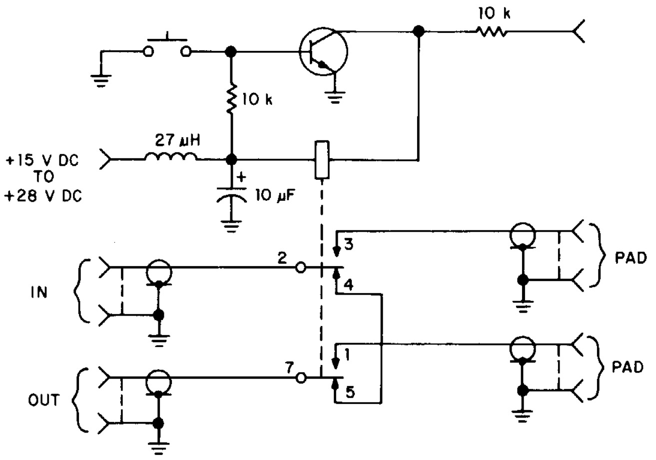
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Audio distortion	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON, other channel enables to OFF VBFO to FXD All AGC to FAST or FAX RF GAIN to full cw. b. Connect an rf signal generator to RF IN jack J22 on rear panel. c. Set receiver to any frequency between 1600.00 kHz and 29 999.99 kHz.		
	(Channel A1) d. Set rf signal generator to receiver frequency +1000 Hz and adjust for an rf input of 10 mV. e. Connect an audio distortion analyzer and 600-Ω load across TB1-1 and TB1-3. f. Measure audio distortion.	NMT 1%.	Check receive audio (AF1) A25.
	(Channel B1) g. Set CH A1 enable to OFF and CH B1 enable to ON. h. Set rf signal generator to receiver frequency -1000 Hz and adjust for an rf input of 10 mV. i. Connect an audio distortion analyzer and 600-Ω load across TB1-4 and TB1-6. j. Measure audio distortion.	NMT 1%	Same as step 8.f
	(Channel A2) k. Set CH B1 enable to OFF and CH A2 enable to ON. l. Set rf signal generator to receiver frequency +5290 Hz and adjust for an rf input of 10 mV. m. Connect an audio distortion analyzer and 600-Ω load across TB2-1 and TB2-3. n. Measure audio distortion.	NMT 1%	Check receive audio (AF2) A26.
(Cont)			

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	(Channel B2) o. Set CH A2 enable to OFF and CH B2 enable to ON. p. Set rf signal generator to receiver frequency -5290 Hz and adjust for an rf input of 10 mV. q. Connect an audio distortion analyzer and 600-Ω load across TB2-4 and TB2-6. r. Measure audio distortion.	NMT 1%	Same as step 8.n
	(AM - channel A1) s. Set MODE switch to AM and BANDWIDTH switch to 16. t. Set rf signal generator to receiver frequency and adjust for 50%, 1000-Hz modulation. u. Measure audio distortion.	NMT 3%.	Same as step 8.f
	(Phones - channel A1) v. Set MODE switch to ISB, set CH B2 enable to OFF, and CH A1 enable to ON. w. Connect an audio distortion analyzer and 600-Ω load across PHONES jack output. x. Set PHONES switch to A1 and PHONES level control full cw. y. Set rf signal generator to receiver frequency +1000 Hz and output level of 100 μV. Adjust PHONES level control for an audio output across PHONES jack output of +10 dB mW. z. Measure audio distortion.	NMT 3%	Same as step 8.f
(Cont)	(PHONES - channel B1) aa. Set CH A1 enable to OFF and CH B1 enable to ON. ab. Set PHONES switch to B1 and PHONES level control full cw. ac. Set rf signal generator to receiver frequency -1000 Hz and output level of 100 μV. Adjust PHONES level control for an audio output across PHONES jack output of +10 dB mW. ad. Measure audio distortion.	NMT 3%	Same as step 8.f

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	(Phones - channel A2) ae. Set CH B1 enable to OFF and CH A2 enable to ON. af. Set PHONES switch to A2 and PHONES level control full cw. ag. Set rf signal generator to receiver frequency +5290 Hz and output level of 100 μV. Adjust PHONES level control for an audio output across PHONES jack output of +10 dB mW.		
	ah. Measure audio distortion.	NMT 3%	Same as step 8.n
	(Phones - channel B2) ai. Set CH A2 enable to OFF and CH B2 enable to ON. aj. Set PHONES switch to B2 and PHONES level control full cw. ak. Set rf signal generator to receiver frequency -5290 Hz and output level of 100 μV. Adjust PHONES level control for an audio output across PHONES jack output of +10 dB mW.		
	al. Measure audio distortion.	NMT 3%	Same as step 8.n
	(Speaker - channel A1) am. Connect an 8-Ω, 4-W resistor between TB3-2 and TB3-3. Disconnect strap between TB3-1 and TB3-2. an. Set CH B2 enable to OFF and CH A1 enable to ON. ao. Set SPEAKER switch to A1. ap. Set rf signal generator to receiver frequency +1000 Hz and adjust for an rf input of 10 mV. aq. Connect an audio distortion analyzer across the 8-Ω resistor and adjust AF GAIN control for 4 V rms across the resistor.		
(Cont)	ar. Measure audio distortion.	NMT 5%	Same as step 8.f



TPA-3265-013

AGC Switching Device
Figure 5

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. AGC characteristics	(Channel A1) a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON VBFO to FXD CH A1 - AGC to FAST or DATA RF GAIN to full cw b. Connect an rf signal generator through an AGC switching device (figure 5) to RF IN jack J22 on rear panel. Note Connect variable attenuator set for 30 dB to AGC switching device (pad inputs). c. Set receiver to 4000.00 kHz. d. Connect audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	e. Set rf signal generator to receiver frequency +1000 Hz and 3 μV at RF IN jack J22 on rear panel.		
	f. Note audio output level (in dB's).	Reference	
	g. Increase rf signal input in 10-dB steps from 3 μV to 1 V rms at RF IN jack J22 on rear panel.	Gradual audio increase up to 6 dB max above reference	Check AGC switch A2S6, channel A1 if A8, and rf translator A9.
	h. Connect an oscilloscope to A1 IF OUT J25 on rear panel.		
	i. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	j. Observe oscilloscope level.	Reference	
	k. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	l. Reference decay time (time for if signal to return to reference level ±6 dB).	15 to 30 ms (AGC FAST/DATA decay)	Same as step 9.g
	m. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel. **Note** Steps 9.n through 9.q apply only if your receiver AGC switch have a MED position.		
	n. Set CH A1 - AGC switch to MED.		
	o. Observe oscilloscope level.	Reference	
	p. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	q. Reference decay time (time for if signal to return to reference level, ±6 dB).	0.07 to 0.15 seconds (AGC MED decay)	Same as step 9.g
	r. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	s. Set CH A1 - AGC switch to SLOW or VOICE.		
	t. Observe oscilloscope level.	Reference	
(Cont)	u. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	v. Reference decay time (time for audio output to return to reference level ±6 dB).	1.0 to 2.0 seconds (AGC SLOW/VOICE decay)	Same as step 9.g
	w. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	Note Steps 9.x through 9.aa apply only if your receiver AGC switches have a FAX position.		
	x. Set CH A1 - AGC switch to FAX.		
	y. Observe oscilloscope level.	Reference	
	z. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	aa. Reference decay time (time for if signal to return to reference level ±6 dB).	3 to 6 seconds (AGC FAX decay)	Same as step 9.g
	ab. Set CH A1 - AGC switch to OFF.		
	ac. Set METER switch to RCV SIG position.		
	ad. Increase rf signal generator output to 1.0 V rms at RF IN jack J22 on rear panel.		
	ae. Note meter deflection.	Meter does not deflect.	Check AGC switch A2S6 and channel A1 if A8.
	(Channel B1)		
	af. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH B1 enable to ON VBFO to FXD CH B1 AGC to FAST or DATA RF GAIN to full cw		
	ag. Connect an rf signal generator through an AGC switching device (figure 5) to RF IN jack J22 on rear panel.		
	ah. Set receiver to 4000.00 kHz.		
(Cont)	ai. Connect audio voltmeter and 600-Ω load across TB1-4 and TB1-6.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	aj. Set rf signal generator to receiver frequency -1000 Hz and 3 µV at RF IN jack J22 on rear panel.		
	ak. Note audio output level.	Reference	
	al. Increase rf signal input in 10-dB steps from 3 µV to 1 V rms at RF IN jack J22 on rear panel.	Gradual audio increase up to 6 dB max above reference at 1-V rms input.	Check B1-AGC switch A2S7 channel B1 if A7, and rf translator A9.
	am. Connect an oscilloscope to B1 IF OUT J24 on rear panel.		
	an. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	ao. Observe oscilloscope level.	Reference	
	ap. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 µV) using AGC switching device.		
	aq. Reference decay time (time for if signal to return to reference level ±6 dB).	15 to 30 ms (AGC FAST/DATA decay)	Same as step 9.ah
	ar. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel. Note Steps 9.as through 9.av apply only if your receiver AGC switches have a MED position.		
	as. Set CH B1 - AGC switch to MED.		
	at. Observe oscilloscope level.	Reference	
	au. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 µV), using AGC switching device.		
	av. Reference decay time (time for if signal to return to reference level ±6 dB).	0.07 to 0.15 seconds (AGC MED decay)	Same as step 9.ah
	aw. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	ax. Set CH B1 - AGC switch to SLOW or VOICE.		
(Cont)	ay. Observe oscilloscope level.	Reference	

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	az. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	ba. Reference decay time (time for audio output to return to reference level ±6 dB).	1.0 to 2.0 seconds (AGC SLOW/VOICE decay)	Same as step 9.ah
	bb. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	Note Steps 9.bc through 9.bf apply only if your receiver AGC switches have a FAX position.		
	bc. Set CH B1-AGC switch to FAX.		
	bd. Observe oscilloscope level.	Reference	
	be. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	bf. Reference decay time (time for if signal to return to reference level ±6 dB).	3 to 6 seconds (AGC FAX decay)	Same as step 9.al
	bg. Set CH B1 - AGC switch to OFF.		
	bh. Set METER switch to RCV SIG position.		
	bi. Increase rf signal generator output to 1.0 V rms at RF IN jack J22 on rear panel.		
	bj. Note meter deflection.	Meter does not deflect.	Check AGC switch A2S7 and channel B1 if A7.
	(Channel A2)		
	bk. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A2 enable to ON VBFO to FXD CH A2 AGC to FAST or DATA RF GAIN to full cw		
	bl. Connect an rf signal generator through an AGC switching device (figure 5) to RF IN jack J22 on rear panel.		
(Cont)	bm. Set receiver to 4000.00 kHz.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	bn. Connect audio voltmeter and 600-Ω load across TB2-1 and TB2-3.		
	bo. Set rf signal gnerator to receiver frequency +5290 Hz and 3 μV at RF IN jack J22 on rear panel.		
	bp. Note audio output level.	Reference	
	bq. Increase rf signal input in 10-dB steps from 3 μV to 1 V rms at RF IN jack J22 on rear panel.	Gradual audio increase up to 6 dB max above reference at 1-V rms input.	Check A2 - AGC switch A2S8 channel A2 if A6, and rf translator A9.
	br. Connect an oscilloscope to A2 IF OUT J26 on rear panel.		
	bs. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	bt. Observe oscilloscope level.	Reference	
	bu. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	bv. Reference decay time (time for if signal to return to reference level ±6 dB).	15 to 30 ms (AGC FAST/DATA decay)	Same as step 9.ca
	bw. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	Note Steps 9.bx through 9.ca apply only if your receiver AGC switches have a MED position.		
	bx. Set CH A2 - AGC switch to MED.		
	by. Observe oscilloscope level.	Reference	
	bz. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	ca. Reference decay time (time for if signal to return to reference level ±6 dB).	0.07 to 0.15 seconds (AGC MED decay).	Same as step 9.ca
	cb. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
(Cont)	cc. Set CH A2 - AGC switch to SLOW or VOICE.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	cd. Observe oscilloscope level.	Reference	
	ce. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	cf. Reference decay time (time for audio output to return to reference level ±6 dB).	1.0 to 2.0 seconds (AGC SLOW/ VOICE decay)	Same as step 9.ca
	cg. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel. **Note** Steps 9.ch through 9.cu apply only if your receiver AGC switches have a FAX position.		
	ch. Set CH A2 - AGC switch to FAX.		
	ci. Observe oscilloscope level.	Reference	
	cj. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	ck. Reference decay time (time for if signal to return to reference level ±6 dB).	3 to 6 seconds (AGC FAX decay)	Same as step 9.ca
	cl. Set CH A2 - AGC switch to OFF.		
	cm. Set METER switch to RCV SIG position.		
	cn. Increase rf signal generator output to 1.0 V rms at RF IN jack J22 on rear panel.		
	co. Note meter deflection.	Meter does not deflect.	Check AGC switch A2S8 and channel A2 if A6.
	(Channel B2)		
	cp. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH B2 enable to ON VBFO to FXD CH B2 AGC to FAST or DATA RF GAIN to full cw		
(Cont)	cq. Connect an rf signal generator through an AGC switching device (figure 5) to RF IN jack J22 on rear panel.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	cr. Set receiver to 4000.00 kHz.		
	cs. Connect audio voltmeter and 600-Ω load across TB2-4 and TB2-6.		
	ct. Set rf signal generator to receiver frequency -5290 Hz and 3 μV at RF IN jack J22 on rear panel.		
	cu. Note audio output level.	Reference	
	cv. Increase rf signal input in 10-dB steps from 3 μV to 1 V rms at RF IN jack J22 on rear panel.	Gradual audio increase up to 5 dB above reference at 1-V rms input.	Check B2 - AGC switch A2S9, channel B2 if A5, and rf translator A9.
	cw. Connect an oscilloscope to B2 IF OUT J23 on rear panel.		
	cx. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	cy. Observe oscilloscope level.	Reference	
	cz. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	da. Reference decay time (time for if signal to return to reference level ±6 dB).	15 to 30 ms (AGC FAST/DATA decay)	Same as step 9.cn
	db. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel. **Note** Steps 9.dc through 9.df apply only if your receiver AGC switches have a MED position.		
	dc. Set CH B2 - AGC switch to MED.		
	dd. Observe oscilloscope level.	Reference	
	de. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 μV), using AGC switching device.		
	df. Reference decay time (time for if signal to return to reference level ±6 dB).	0.07 to 0.15 seconds (AGC MED decay)	Same as step 9.cn.
(Cont)	dg. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	dh. Set CH B2 - AGC switch to SLOW or VOICE.		
	di. Observe oscilloscope level.	Reference	
	dj. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 µV), using AGC switching device.		
	dk. Reference decay time (time for audio output to return to reference level ±6 dB).	1.0 to 2.0 seconds (AGC SLOW/ VOICE decay)	Same as step 9.cn
	dl. Set rf signal generator to 1 mV at RF IN jack J22 on rear panel.		
	Note Steps 9.dm through 9.dp apply only if your receiver AGC switches have a FAX position.		
	dm. Set CH B2 - AGC switch to FAX.		
	dn. Observe oscilloscope level.	Reference	
	do. Reduce rf signal level at RF IN jack J22 on rear panel by 30 dB from 1 mV (to 10 µV), using AGC switching device.		
	dp. Reference decay time (time for if signal to return to reference level ±6 dB).	3 to 6 seconds (AGC FAX decay)	Same as step 9.cn
	dq. Set CH B2 - AGC switch to OFF.		
	dr. Set METER switch to RCV SIG position.		
	ds. Increase rf signal generator output to 1.0 V rms at RF IN jack J22 on rear panel.		
	dt. Note mter deflection.	Meter does not deflect.	Check AGC switch A2S9 and channel B2 if A5.
10. Cross side-band rejection	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
(Cont)			

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	b. Connect an rf signal generator to RF IN jack J22 on rear panel. c. Set receiver to any frequency between 1600.00 kHz and 29 999.99 kHz.		
	(Channel A1) d. Set rf signal generator to receiver frequency +1000 Hz and adjust for an rf input of 1 μV.		
	e. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3.	Reference audio level	
	f. Set rf signal generator to receiver frequency -1000 Hz.		
	g. Increase rf signal generator output to produce reference level of step 10.e.	NLT 60-dB increase in rf signal generator output. Note If rf signal generator output is increased more than 60 dB and level of step 10.e is not reached, indication is normal and reference level need not be produced.	Check if filters, perform receiver alignment procedures, or return to factory for repair.
	h. Set rf signal generator to receiver frequency +5290 Hz.		
	i. Adjust rf signal generator output to produce reference level of step 10.e.	NLT 60-dB increase in rf signal generator output	Same as step 10.g
	(Channel B1) j. Set CH A1 enable to OFF and CH B1 enable to ON.		
	k. Set rf signal generator to receiver frequency -1000 Hz and adjust for an rf input of 1 μV.		
	l. Connect an audio voltmeter and 600-Ω load across TB1-4 and TB1-6.	Reference audio level	
(Cont)	m. Set rf signal generator to receiver frequency +1000 Hz.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	n. Increase rf signal generator output to produce reference level of step 10.l.	NLT 60-dB increase in rf signal generator output	Same as step 10.g
	o. Set rf signal generator to receiver frequency -5290 Hz.		
	p. Adjust rf signal generator output to produce reference level of step 10.l.	NLT 60-dB increase in rf signal generator output	Same as step 10.g
	(Channel A2)		
	q. Set CH B1 enable to OFF and CH A2 enable to ON.		
	r. Set rf signal generator to receiver frequency +5290 Hz and adjust for an rf input of 1 μV.		
	s. Connect an audio voltmeter and 600-Ω load across TB2-1 and TB2-3.	Reference audio level	
	t. Set rf signal generator to receiver frequency +1000 Hz.		
	u. Adjust rf signal generator output to produce reference level of step 10.s.	NLT 60-dB increase in rf signal generator output	Sasme as step 10.g
	(Channel B2)		
	v. Set CH A2 enable to OFF and CH B2 enable to ON.		
	w. Set rf signal generator to receiver frequency -5290 Hz and adjust for an rf input of 1 μV.		
	x. Connect an audio voltmeter and 600-Ω load across TB2-4 and TB2-6.	Reference audio level	
	y. Set rf signal generator to receiver frequency -1000 Hz.		
	z. Adjust rf signal generator output to produce reference level of step 10.x.	NLT 60-dB increase in rf signal generator output	Same as step 10.g
11. AGC voltage input/output (Cont)	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON VBFO to FXD CH A1 - AGC to FAST or DATA RF GAIN to full cw		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. (Cont)	b. Connect an rf signal generator to RF IN jack J21 on rear panel. c. Set Receiver to 4000 kHz.		
	(Channel A1) d. Connect a dvm and 10-kΩ load between channel A1 - AGC output (TB1-8) and ground (TB1-7). e. Set rf signal generator to receiver frequency +1000 Hz.		
	f. Adjust rf signal generator level to 1 μV.	Reference input (AGC output 0 V dc nom.)	
	g. Change the rf signal generator level in 20-dB steps and note the associated AGC outputs.		Check channel A1 if A8 (adjust A8R136 to obtain 4.00 ±0.3 V dc, if required).

RF INPUT SIGNAL (from reference level)	AGC OUTPUT
0 dB	0.07 dc nom
+20 dB	1.00 ~~0.07~~ V dc nom
+40 dB	2.00 V dc nom
+60 dB	3.00 V dc nom
+80 dB	4.00 ±0.3 V dc
+100 dB	5.00 V dc nom

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
	(Channel B1) h. Set CH A1 enable to OFF, CH B1 enable to ON, and CH B1 - AGC to FAST or DATA. i. Connect a dvm and 10-kΩ load between channel B1 - AGC output (TB1-9) and ground (TB1-7). j. Set rf signal generator to receiver frequency -1000 Hz.		
	k. Adjust rf signal generator level to 1 μV.	Reference input (AGC output 0 V dc nom)	
(Cont)	l. Change the rf signal generator in 20-dB steps and note the associated AGC outputs.	Same as step 11.g	Check channel B1 if A7 (adjust A7R55 to obtain 4.00 ±0.3 V dc, if required).

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. (Cont)	(Channel A2)		
	m. Set CH B1 enable to OFF, CH A2 enable to ON, and CH A2 - AGC to FAST or DATA.		
	n. Connect a dvm and 10-kΩ load between channel A2 - AGC output (TB2-8) and ground (TB2-7).		
	o. Set rf signal generator to receiver frequency +5290 Hz.		
	p. Adjust rf signal generator level to 1 μV.	Reference input (AGC output 0 V dc nom)	
	q. Change the rf signal generator in 20-dB steps and note the associated AGC out outputs.	Same as step 11.g	Check channel A2 if A6 (adjust A6R55 to obtain 4.00 ±0.3 V dc, if required).
	(Channel B2)		
	r. Set CH A2 enable to OFF, CH B2 enable to ON, and CH B2 - AGC to FAST or DATA.		
	s. Connect a dvm and 10-kΩ load between channel B2 - AGC output (TB2-9) and ground (TB2-7).		
	t. Set rf signal generator to receiver frequency -5290 Hz.		
	u. Adjust rf signal generator level to 1 μV.	Reference input (AGC output 0 V dc nom)	
	v. Change the rf signal generator in 20-dB steps and note the associated AGC outputs.	Same as step 11.g	Check channel B2 if A5 (adjust A5R55 to obtain 4.00 ±0.3 V dc, if required).
12. Image and if rejection	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
	b. Connect an rf signal generator to RF IN jack J22 on rear panel.		
(Cont)	c. Connect audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>12. (Cont)</td><td>d. Set rf signal generator to receiver frequency +1000 Hz and adjust for 0 dB mW on audio voltmeter.
e. Set the rf signal generator frequency to each of the following frequencies and note the increase in dB from the reference required to obtain 0 dB mW on the audio voltmeter.
<table><tr><th>RF INPUT FREQUENCY</th><th>RF INPUT INCREASE</th></tr><tr><td>9.449 MHz</td><td>NLT 100 dB</td></tr><tr><td>0.451 MHz</td><td>NLT 100 dB</td></tr><tr><td>3.099 MHz</td><td>NLT 100 dB</td></tr><tr><td>22.899 MHz</td><td>NLT 100 dB</td></tr></table></td><td>Reference rf signal generator input</td><td>Check channel A if A8, rf translator A9, or return to factory for repair.</td></tr>
<tr><td>13. Internal spurious signals
(Cont)</td><td>a. Front panel controls set as follows:
PWR to on
CONT to LCL
MODE to ISB
CH A1 enable to ON
VBFO to FXD
AGC to OFF
RF GAIN to full cw
b. Connect a 50-Ω load to RF IN jack J22 and ground.
c. Connect audio voltmeter and 600-Ω load across TB1-1 and TB1-3.
d. Set receiver to each of the following frequencies and reference audio voltmeter reading at each frequency.</td><td>Note
Increase AF GAIN control so that the internal spurious tones are audible. Peak audio voltmeter on tone. If a spurious signal cannot be located at any given frequency, it has been suppressed beyond detection and is a normal indication.</td><td></td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>13. (Cont)</td><td>
<table>
<tr><th>RECEIVER REFERENCE SETTING</th><th>AUDIO OUTPUT</th></tr>
<tr><td>449 kHz</td><td>Reference</td></tr>
<tr><td>2 409 kHz</td><td>Reference</td></tr>
<tr><td>29 409 kHz</td><td>Reference</td></tr>
<tr><td>9 674 kHz</td><td>Reference</td></tr>
<tr><td>10 174 kHz</td><td>Reference</td></tr>
<tr><td>9 899 kHz</td><td>Reference</td></tr>
<tr><td>19 799 kHz</td><td>Reference</td></tr>
<tr><td>*13 499 kHz</td><td>Reference</td></tr>
<tr><td colspan="2">*Applicable only if vbfo is installed.</td></tr>
</table>
e. Remove 50-Ω load from RF IN jack J22.
f. Connect an rf signal generator to RF IN jack J22 on rear panel.
g. Set receiver 10 kHz off each frequency listed in step 12.d.
<table>
<tr><th>RECEIVER SETTING</th></tr>
<tr><td>459 kHz</td></tr>
<tr><td>2 419 kHz</td></tr>
<tr><td>29 419 kHz</td></tr>
<tr><td>9 684 kHz</td></tr>
<tr><td>10 184 kHz</td></tr>
<tr><td>9 909 kHz</td></tr>
<tr><td>19 809 kHz</td></tr>
<tr><td>*13 509 kHz</td></tr>
<tr><td>*Applicable only if vbfo is installed.</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>h. Set rf signal generator 1000 Hz above each receiver frequency and note rf input at each frequency requited to obtain reference audio output.</td><td></td><td>Check channel A if A8, rf translator A9, or return to factory for repair.</td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>13. (Cont)</td><td colspan="2">
<table>
<tr><th>RF SIGNAL GENERATOR FREQUENCY</th><th>REQUIRED INPUT</th></tr>
<tr><td>460 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>2 420 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>29 420 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>9 685 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>10 185 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>9 910 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>19 810 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td>*13 510 kHz</td><td>NMT 0.5 μV</td></tr>
<tr><td colspan="2">*Applicable only if vbfo is installed.</td></tr>
</table>
</td><td></td></tr>
<tr><td>14. Bandwidth</td><td>Note
When performing bandwidth tests, filter complement of unit under test must be known.
a. Front panel controls set as follows:
PWR to on
CONT to LCL
MODE to ISB
CH A1 enable to ON
FREQUENCY KHZ to 4000.00 kHz
VBFO to FXD
CH A1 - AGC to OFF
RF GAIN to full cw
b. Connect an rf signal generator to RF IN jack J22 on rear panel.
c. Connect audio voltmeter and 600-Ω load across TB1-1 and TB1-3.
d. Set signal generator to 4000.00 kHz at 1 μV rms.</td><td></td><td></td></tr>
<tr><td></td><td>e. Increase (or decrease) signal generator frequency to find peak response on audio voltmeter.</td><td>Reference level. Note peak frequency.</td><td>For channel A1, check channel A1 if A8.</td></tr>
<tr><td></td><td>Note
If audio response is distorted due to overdrive of if circuits, reduce rf signal level until distortion is not present.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>f. Increase signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level to step 14.e.</td><td>Frequency NLT 4003.10 kHz</td><td>Same as step 14.e.</td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)	g. Decrease signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.e.	Frequency NMT 4000.25 kHz	Same as step 14.e.
	h. Set MODE switch to CW (or AM) mode. Set BANDWIDTH switch to position of filter to be tested. **Note** Bandwidth (in kHz) of selectable filters is silkscreened (using decals) on front panel of unit under test. Normal silkscreen and associated part numbers of selectable filters is shown in chart that follows step i.		
	i. Repeat steps 14.d thru 14.h for each of the following filters (as required).		For selectable filters, check filter card A8A2.

FILTER (SILKSCREEN)	COLLINS PART NUMBER	3 dB POINTS (kHz)	
		UPPER	LOWER
6	526-9963-060	4003.00	3997.00
5	526-8323-010	4002.50	3997.50
3	526-9963-040	4001.50	3998.50
1	526-9963-030	4000.50	3999.50
1U	526-9974-030	4001.50	4000.50
0.7U	526-8322-020	4001.625	4000.925
0.7L	526-8321-020	3999.075	3998.375
0.5	526-9963-020	4000.25	3999.75
0.5U	526-9974-020	4001.25	4000.75
0.37U	526-9999-010	4001.885	4001.515
0.3	526-9963-090	4000.15	3999.85
0.25U	526-8322-010	4001.25	4001.00
0.25L	526-8321-010	3999.00	3998.75
0.2	526-9963-010	4000.10	3999.90
0.2U	526-9974-010	4001.10	4000.90
0.1	293-1333-010	4000.05	3999.95
16	*	4006.00	3994.00
16	**	4008.00	3992.00

*16-kHz pad, 6-dB points with narrowband high performance rf translator.
**16-kHz pad, 6-dB points with broadband rf translator.

(Cont)

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)	j. Connect audio voltmeter and 600-Ω load across TB1-4 and TB1-6.		
	k. Set MODE to ISB, CH A1 enable to OFF, and CH B1 enable to ON. Set CH B1 - AGC to OFF.		
	l. Set signal generator to 3999.00 kHz at 1 μV rms.		
	m. Increase (or decrease) signal generator frequency to find peak response on audio voltmeter.	Reference level. Note peak frequency.	For channel B1, Check channel B1 if A7.
	n. Increase signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.m.	Frequency NLT 3999.75 kHz	Same as step 14.m
	o. Decrease signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.m.	Frequency NMT 3996.90 kHz	Same as step 14.m
	p. Connect audio voltmeter and 600-Ω load across TB2-1 and TB2-3.		
	q. Set MODE to ISB, CH B1 enable to OFF, and CH A2 enable to ON. Set CH A2 - AGC to OFF.		
	r. Set signal generator to 4005.00 kHz at 1 μV rms.		
	s. Increase (or decrease) signal generator frequency to find peak response on audio voltmeter.	Reference level. Not peak frequency.	For channel A2, check channel A2 if A6.
	t. Increase signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.s.	Frequency NLT 4006.04 kHz	Same as step 14.s
	u. Decrease signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.s.	Frequency NMT 4003.19 kHz	Same as step 14.s
	v. Connect audio voltmeter and 600-Ω load across TB2-4 and TB2-6.		
	w. Set MODE to ISB, CH A2 enable to OFF, and CH B2 enable to ON. Set CH B2 - AGC to OFF.		
	x. Set signal generator to 3995.00 kHz at 1 μV rms.		
(Cont)	y. Increase (or decrease) signal generator frequency to find peak response on audio voltmeter.	Reference level. Note peak frequency.	For channel B2, check channel B2 if A5.

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)	z. Increase signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.y.	Frequency NLT 3996.81 kHz	Same as step 14.y
	aa. Decrease signal generator frequency to the point where the audio voltmeter level is 3 dB below reference level of step 14.y.	Frequency NMT 3993.96 kHz	Same as step 14.y
15. Frequency accuracy	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 9999.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Connect a highly accurate 10-MHz standard to RF IN jack J22 on rear panel.		
	c. Connect a frequency counter and 600-Ω load across TB1-1 and TB1-3.		
	d. Note audio output frequency.	1000 ±5 Hz	Check frequency synthesizer A14 through A24.
16. External spurious signals	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
	b. Connect an rf signal generator to RF IN jack J22 on rear panel.		
	c. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		
	d. Set rf signal generator to 4001.00 kHz at 1 μV rms.		
	e. Adjust rf signal generator frequency for peak response on audio voltmeter.	Reference voltmeter reading.	
(Cont)	f. Set rf signal generator to 4101.00 kHz at 1 μV rms.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>16. (Cont)</td><td>g. Increase the rf signal generator level to return the audio to reference in step 16,e. Rf signal generator frequency may be varied slightly to locate spurious response.</td><td></td><td></td></tr>
<tr><td></td><td>h. Note increase in rf signal generator level.</td><td>NLT 80 dB</td><td>Check bypass and feedthru capacitors or return to factory for repair.</td></tr>
<tr><td></td><td>i. Repeat steps 16.f thru 16.h at each of the following frequencies:
<table>
<tr><th>SIGNAL GENERATOR FREQ</th><th>RF VOLTMETER</th></tr>
<tr><td>3901.00 kHz</td><td>NLT 80 dB DOWN</td></tr>
<tr><td>4051.00 kHz</td><td>NLT 80 dB DOWN</td></tr>
<tr><td>3951.00 kHz</td><td>NLT 80 dB DOWN</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>17. Oven standard test</td><td>Note
This test applies for factory installed oven standard or field installed AC-8012 Oven Standard Kit.</td><td></td><td></td></tr>
<tr><td></td><td>a. Front panel controls set as follows:
PWR to on
CONT to LCL
MODE to ISB
CH A1 enable to ON
FREQUENCY KHZ to 9999.00 kHz
VBFO to FXD
CH A1 - AGC to FAST
RF GAIN to full cw</td><td></td><td></td></tr>
<tr><td></td><td>b. Connect a highly accurate 10-MHz standard to RF IN jack J22 on rear panel.</td><td></td><td></td></tr>
<tr><td></td><td>c. Connect a frequency counter and 600-Ω load across TB1-1 and TB1-3.</td><td></td><td></td></tr>
<tr><td></td><td>d. Note audio output frequency.</td><td>1000 ±0.3 Hz (after 1-hour warmup)</td><td>Check oven standard or frequency synthesizer A14 through A24.</td></tr>
</table>

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
18. External standard test	**Note** This test applies for factory installed external standard or field installed AC-8013 External Standard Kit.		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 999.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Connect a highly accurate 1-MHz standard to RF IN jack J22 on rear panel.		
	c. Connect a frequency counter and 600-Ω load across TB1-1 and TB1-3.		
	d. Connect an rf signal generator to the EXT STD jack J27 on rear panel.		
	e. Strap synthesizer reference for external and external phase-lock for 100 kHz.		
	f. Set rf signal generator for 100 kHz at 90 mV rms.	Reference audio output frequency	
	g. Vary rf signal generator ±1 Hz from 100 kHz and observe audio output.	Step 18.f reference ±100 Hz	Check frequency synthesizer A14 through A24.
	h. Repeat steps 18.f and 18.g with level at 1.0 V rms.	Same as steps 18.f and 18.g	Same as step 18.g
	i. Strap external phase-lock for 1 MHz.		
	j. Set rf signal generator for 1 MHz at 90 mV rms.	Reference audio output frequency	
	k. Vary rf signal generator ±10 Hz from 1 MHz and observe audio output.	Step 18.j reference ±100 Hz	Same as step 18.g
	l. Repeat steps 18.j and 18.k with level at 1.0 V rms.	Same as steps 18.j and 18.k	Same as step 18.g
	m. Strap external phase-lock for 5 MHz.		
	n. Set rf signal generator for 5 MHz at 90 mV rms.	Reference audio output frequency	
	o. Vary rf signal generator ±50 Hz from 5 MHz and observe audio output.	Step 18.n reference ±100 Hz	Same as step 18.g
	p. Repeat steps 18.n and 18.o with level at 1.0 V rms.	Same as steps 18.n and 18.o	Same as step 18.g

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
19. Frequency display test	**Note** This test applies for factory installed frequency display or field installed AC-8014 Frequency Display Kit.		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to any VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Rotate tens MHz digit (FREQUENCY KHZ controls) through its range (0, 1, 2).	Frequency display follows.	Check frequency display A2A5 and frequency switchboard A2A3.
	c. Rotate one MHz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	d. Rotate hundreds kHz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	e. Rotate tens kHz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	f. Rotate ones kHz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	g. Rotate hundreds Hz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	h. Rotate tens Hz digit (FREQUENCY KHZ controls) through its range (0 thru 9).	Same as step 19.b	Same as step 19.b
	i. If 1-Hz frequency control/display used, set control 1 Hz digit through its range.	Same as step 19.b	Check frequency display A2A5 and associated control input.
20. Frequency standard switch test	**Note** This test applies for factory installed frequency standard switch or field installed AC-8015 Frequency Standard Switch Kit.		
(Cont)	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB`		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
20. (Cont)	CH A1 enable to ON FREQUENCY KHZ to 999.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw		
	b. Connect a highly accurate 1-MHz standard to RF IN jack J22 on rear panel.		
	c. Connect a frequency counter and 600-Ω load across TB1-1 and TB1-3.		
	d. Connect an rf signal generator to EXT STD jack J27 on rear panel.		
	e. Switch frequency standard switch for 100 kHz input.		
	Note External phase-lock must be strapped for 100-kHz input and for external input.		
	f. With oven standard connected internally to frequency standard switch set rf signal generator for 100 kHz at 90 mV rms.	Reference audio output frequency	
	g. Vary rf signal generator ±1 Hz from 100 kHz and observe audio output.	Step 20.f reference ±100 Hz	Check frequency standard switch A30 and frequency synthesizer A14 through A24.
	h. Disconnect rf signal generator from EXT STD jack J27 on rear panel.		
	i. Note audio output frequency.	1000 ±5 Hz	Same as step 20.g
	j. Disconnect oven standard A29 from frequency standard switch A30.		
	k. Note audio output frequency.	None	Check frequency synthesizer A14 through A24.
	l. Reconnect rf signal generator to EXT STD jack J27 on rear panel. Reconnect oven standard A29 to frequency standard switch A30.		
	m. Repeat steps 20.f and 20.g with level at 1.0 V rms	Same as steps 20.f and 20.g	Same as step 20.g
	n. Switch frequency standard switch for 1 MHz.		
(Cont)	o. Set rf signal generator for 1 MHz at 90 mV rms.	Reference audio output frequency	

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
20. (Cont)	p. Vary rf signal generator ±10 Hz from 1 MHz and observe audio output.	Step 20.o reference ±100 Hz	Same as step 20.g
	q. Repeat steps 20.o and 20.p with level at 1.0 V rms.	Same as steps 20.o and 20.p	Same as step 20.g
	r. Switch frequency standard switch for 5 MHz.		
	s. Set rf signal generator for 5 MHz at 90 mV rms.	Reference audio output frequency	
	t. Vary rf signal generator ±50 Hz from 5 MHz and observe audio output.	Step 20.s reference ±100 Hz	Same as step 20.g
	u. Repeat steps 20.s and 20.t with level at 1.0 V rms.	Same as steps 20.s and 20.t	Same as step 20.g
	v. Connect frequency counter to 100 KHZ REF OUT jack J65 on rear panel.		
	w. Observe frequency.	100 kHz ±5 Hz when oven standard used. When external standard, used accuracy equivalent to accuracy of external standard.	Same as step 20.g
	x. Remove frequency counter from J65 and connect rf voltmeter with 50-Ω load to 100 KHZ REF OUT jack J65 on rear panel.		
	y. Note audio voltmeter level.	NLT 1.0 V rms	Same as step 20.g
21. Dvbfo test	**Note** This test applies for factory installed dvbfo or field installed AC-8056 VBFO Kit.		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw		
	b. Note VBFO OFFSET KHZ display (if used).	Blank	Check VBFO A4 and frequency display A2A5.
(Cont)	c. Set VBFO switch to VAR. Note VBFO OFFSET KHZ display (if used).	Same display indication as shown on DVBFO switchboard A2A4	Check VBFO A4, DVBFO switchboard A2A4, and frequency display A2A5.

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
21. (Cont)	d. Connect an rf signal generator to RF IN jack J22 on rear panel.		
	e. Set rf signal generator to 4.000 00 MHz at 10 μV.		
	f. Connect a frequency counter and 600-Ω load across TB1-1 and TB1-3.		
	g. Set the VBFO OFFSET KHZ controls through the full range of the vbfo (-9.99 to +9.99) while listening to the audio output.	Audio frequency changes smoothly (frequency and loudness).	Check VBFO A4.
	h. Set the VBFO OFFSET KHZ at each of the following frequencies and note the counter reading.		Same as step 21.g
	-6.66	6660 ±5 Hz	
	-3.33	3330 ±5 Hz	
	-1.00	1000 ±5 Hz	
	+1.99	1990 ±5 Hz	
	+5.55	5550 ±5 Hz	
	+9.00	9000 ±5 Hz	
	i. Set the VBFO OFFSET KHZ controls through the full range of the VBFO and note the VBFO OFFSET KHZ display.	Must agree with indication of DVBFO switchboard A2A4.	Check frequency display A2A5.
22. Automatic frequency control	**Note** This test applicable only for units with AFC option installed.		
	a. Front panel controls set as follows: PWR to ON CONT to LCL MODE to CW BANDWIDTH to 16 FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to full cw AFC to ON		
	b. Connect an rf signal generator to RF IN jack J22 on rear panel.		
	c. Set rf signal generator to 4.000 00 MHz at 0.22 μV.		
	d. Note AFC LOCK indicator.	AFC LOCK indicator lights.	Check AFC A3 and LED status display A2A1.
(Cont)	e. Disconnect rf signal generator from RF IN jack J22.		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
22. (Cont)	f. Set rf signal generator to 4.000 05 MHz at 0.11 μV.		
	g. Reconnect rf signal generator to RF IN jack J22 on rear panel.		
	h. Note AFC LOCK indicator.	Same as step 22.d	Check AFC A3.
	i. Disconnect rf signal generator from RF IN jack J22.		
	j. Set rf signal generator to 3.999 95 MHz at 0.11 μV.		
	k. Reconnect rf signal generator to RF IN jack J22 on rear panel.		
	l. Note AFC LOCK indicator.	Same as step 22.d	Check AFC A3.
23. Remote control test	*Note* This test applies to HF-8050A Receivers and HF-8050 Receivers with field installed AC-8090 Remote Control Kit.		
	a. Front panel controls set as follows: PWR to on CONT to LCL MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 2000.00 kHz VBFO to FXD CH A1 - AGC to FAST RF GAIN to full cw	No faults are lit. ISB and A1 indicators are lit.	Check control A10 and switch mounting board A2A2.
	b. Connect a compatible receiver control to the unit under test.		
	c. Set receiver control PWR to on and make changes to the following receiver control front panel controls: MODE switch BANDWIDTH switch FREQUENCY KHZ controls VBFO switch AGC switches RF GAIN control	Changing of receiver control front panel controls has no effect on the unit under test displays/ indications.	Check parallel input A11, parallel output A12, and serial interface A13.
(Cont)	d. Set the receiver control front panel controls as follows: PWR to on CONT to NORM MODE to AM BANDWIDTH to A FREQUENCY KHZ to 1666.66 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to MIN		

Table 5. HF-8054( ) Receiver, Detailed Performance Test Procedure (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
23. (Cont)	e. Set the unit under test CONT switch to REM.	Faults do not light. AM and BANDWIDTH-A indicators light.	Same as step 23.a
	f. Make changes tothe following unit under test controls: MODE switch BANDWIDTH switch FREQUENCY KHZ controls VBFO switch AGC switches RF GAIN control	Changing of unit under test controls has no effect on the unit under test displays/indicators.	Same as step 23.a
	g. Rotate receiver control FREQUENCY KHZ controls and note receiver control FREQUENCY KHZ display.	The receiver control display and receiver display (if applicable) agree, and agree with receiver control FREQUENCY KHZ setting.	Same as step 23.c
	h. Set the receiver control front panel controls as follows: PWR to on CONT to NORM MODE to ISB CH A1 enable to ON FREQUENCY KHZ to 4000.00 kHz VBFO to FXD CH A1 - AGC to OFF RF GAIN to MAX		
	i. Connect an rf signal generator to the RF IN jack J22 on the rear panel.		
	j. Connect an audio voltmeter and 600-Ω load across TB1-1 and TB1-3.		
	k. Set rf signal generator to 4001.00 kHz and adjust rf signal generator for a reference level on audio voltmeter.	Reference audio voltmeter reading. Note Reference level must be set below saturation level of audio circuits.	
	l. Step receiver control RF GAIN control 1 step ccw. Note audio voltmeter reading.	-6 ±2-dB change per step 23.j	Check parallel output A12.
	m. Increase rf signal generator level as needed to obtain reference of step 23.k.	Same as step 23.k	
	n. Repeat steps 23.l and 23.m until MIN position reached.	Same as step 23.l	Same as step 23.l

4. ALIGNMENT/ADJUSTMENT

Procedures in this section are instructions for properly aligning the receiver. It is assumed that no malfunctions exist in the receiver when these procedures are performed. If a malfunction is suspected, refer to detailed performance test procedures for troubleshooting information. All other adjustments are made in card maintenance and repair.

4.1 Line Audio Adjustments (Receive Audio Cards)

Note

Receive line audio inputs may be adjusted to any desired gain level within the amplifier range (-20 to +10 dB mW output for a 3-μV rf input). These adjustments are accessible through the top dust cover (figure 6).

4.1.1 CH A1 RCV LINE ADJ A25R28

A25R28 controls channel A1 receive line audio output.

a. Set METER switch to A1 AF (+13FS) position.
b. Set MODE switch to ISB.
c. Set CH A1 enable switch to ON, CH A1 - AGC BUS switch to OFF, and CH A1 - AGC switch to FAST or VOICE.
d. Set RF GAIN control fully clockwise.
e. Connect rf signal generator output to RF IN jack. Adjust rf signal generator output frequency to approximately 1 kHz above setting of receiver frequency. Apply a 3-μV input to RF IN jack.
f. Adjust A25R28 (CH A1 RCV LINE ADJ) for a level as required for the application in which the receiver is being used.

4.1.2 CH B1 RCV LINE ADJ A25R65

A25R65 controls channel B1 receive line audio output.

a. Set METER switch to B1 AF (+13FS) position.
b. Set MODE switch to ISB.
c. Set CH B1 B1 enable switch to ON, CH B1 - AGC BUS switch to OFF, and CH B1 - AGC switch to FAST or VOICE.
d. Set RF GAIN control fully clockwise.
e. Connect rf signal generator output to RF IN jack. Adjust rf signal generator output frequency to approximately 1 kHz above setting of receiver frequency. Apply a 3-μV input to RF IN jack.
f. Adjust A25R65 (CH B1 RCV LINE ADJ) for a level as required for the application in which the receiver is being used.

4.1.3 CH A2 RCV LINE ADJ A26R28

A26R28 controls channel A2 receive line audio output.

a. Set METER switch to A2 AF (+13FS) position.
b. Set MODE switch to ISB.
c. Set CH A2 enable switch to ON, CH A2 - AGC BUS switch to OFF, and CH A2 - AGC switch to FAST or VOICE.
d. Set RF GAIN control fully clockwise.
e. Connect rf signal generator output to RF IN jack. Adjust rf signal generator output frequency to approximately 5290 Hz above setting of receiver frequency. Apply a 3-μV input to RF IN jack.
f. Adjust A26R28 (CH A2 RCV LINE ADJ) for a level as required for the application in which the receiver is being used.

4.1.4 CH B2 RCV LINE ADJ A26R65

A26R65 controls channel B2 receive line audio output.

a. Set METER switch to B2 AF (+13FS) position.
b. Set MODE switch to ISB.
c. Set CH B2 enable switch to ON, CH B2 - AGC BUS switch to OFF, and CH B2-AGC switch to FAST or VOICE.
d. Set RF GAIN control fully clockwise.
e. Connect rf signal generator output to RF IN jack. Adjust rf signal generator output frequency to approximately 5290 Hz below setting of receiver frequency. Apply a 3-μV input to RF IN jack.
f. Adjust A26R28 (CH B2 RCV LINE ADJ) for a level as required for. the application in which the receiver is being used.

4.2 Meter Adjustments

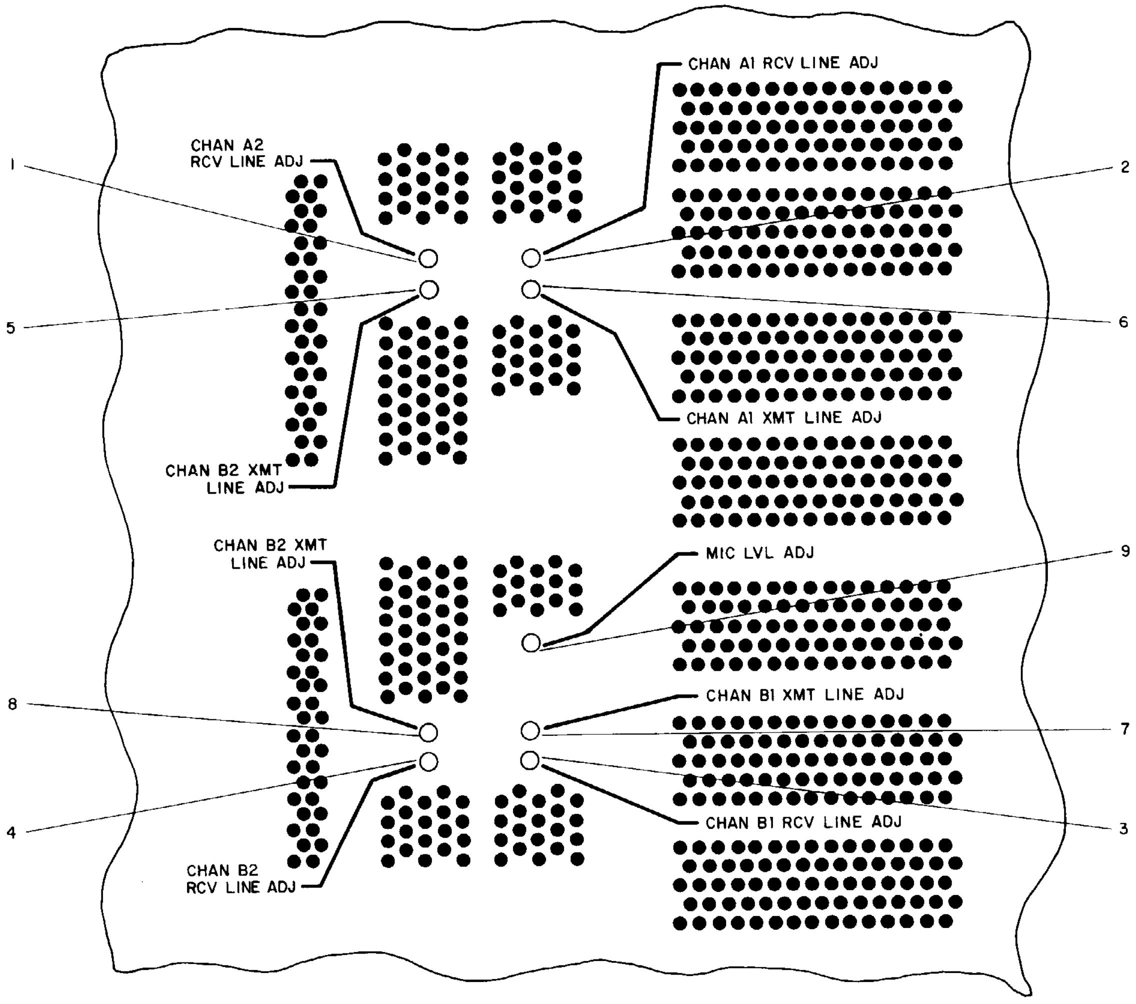
Meter adjustments are required only if the meter circuit is repaired and/or the associated card is replaced. If the associated card is replaced, make only those adjustments applicable to that card.

Note

The variable resistors for the audio meter adjustements are accessible only by extending receive audio card A25/A26.

4.2.1 Channel A1 Receive Audio Meter Adjustment (A25R43)

a. With power off, extend receive audio A25.
b. Terminate channel A1 receive audio line output with 600 ohms (between TB1-1 and -3).



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Top Cover Adjustments
Figure 6

c. Set METER switch to A1 AF (+13FS) position.
d. Set PWR switch to on.
e. Set MODE switch to ISB.
f. Set CH A1 enable switch to ON, CH A1 - AGC BUS switch to OFF, and CH A1 - AGC switch to OFF.
g. Connect rf signal generator to RF IN jack. Adjust rf signal generator output to frequency approximately 1-kHz above setting of receiver.
h. Connect audio voltmeter across TB1-1 and -3. Adjust rf signal generator output until audio voltmeter indicates +10 dB mW. (Use RF GAIN control to adjust for an undistorted +10-dB mW audio signal at TB1-1 and -3.)

Note

If audio voltmeter contains internal 600-ohm load, remove 600-ohm load between terminals being measured. Failure to do so will result in erroneous readings.

i. With METER switch set at A1 AF (+13FS) position, adjust A25R43 for +10-dB mW reading on front panel meter.

Note

When audio meter adjustments are complete set power off and reinstall receive audio A25/A26 in the unit.

4.2.2 Channel B1 Receive Audio Meter Adjustment (A25R80)

a. With power off, extend receive audio A25.
b. Terminate channel B1 receive audio line output with 600 ohms (between TB1-4 and -6).
c. Set METER switch to B1 AF (+13FS) position.
d. Set PWR switch to on.
e. Set MODE switch to ISB.

f. Set CH B1 enable switch to ON, CH B1 - AGC BUS switch to OFF, and CH B1 - AGC switch to OFF.
g. Connect rf signal generator to RF IN jack. Adjust rf signal generator output to frequency approximately 1-kHz below setting of receiver.
h. Connect audio voltmeter across TB1-4 and -6. Adjust rf signal generator output until audio voltmeter indicates +10 dB mW. (Use RF GAIN control to adjust for an undistorted +10-dB mW audio signal at TB1-4 and -6.) Refer to note following step 4.2.1.h.
i. With METER switch set at B1 AF (+13FS) position, adjust A25R80 for +10-dB mW reading on front panel meter. Refer to note following step 4.2.1.i.

4.2.3 Channel A2 Receive Audio Meter Adjustment (A26R43)

a. With power off, extend receive audio A26.
b. Terminate channel A2 receive audio line output with 600 ohms (between TB2-1 and -3).
c. Set METER switch to A2 AF (+13FS) position.
d. Set PWR switch to on.
e. Set MODE switch to ISB.
f. Set CH A2 enable switch to ON, CH A2 - AGC BUS switch to OFF, and CH A2 - AGC switch to OFF.
g. Connect rf signal generator to RF IN jack. Adjust rf signal generator output to frequency approximately 5290 Hz above setting of receiver.
h. Connect audio voltmeter across TB2-1 and -3. Adjust rf signal generator output until audio voltmeter indicates +10 dB mW. (Use RF GAIN control to adjust for an undistorted +10-dB mW audio signal at TB2-1 and -3.) Refer to note following step 4.2.1.h.
i. With METER switch set at A2 AF (+13FS) position, adjust A26R43 for +10-dB mW reading on front panel meter. Refer to note following step 4.2.1.i.

4.2.4 Channel B2 Receive Audio Meter Adjustment (A26R80)

a. With power off, extend receive audio A26.
b. Terminate channel B2 receive audio line output with 600 ohms (between TB2-4 and -6).
c. Set METER switch to B2 AF (+13FS) position.
d. Set PWR switch to on.
e. Set MODE switch to ISB.
f. Set CH B2 enable switch to ON, CH B2 - AGC BUS switch to OFF, and CH B2 - AGC switch to OFF.
g. Connect rf signal generator to RF IN jack. Adjust rf signal generator output to frequency approximately 5290 Hz below setting of receiver.
h. Connect audio voltmeter across TB2-4 and -6. Adjust rf signal generator output until audio voltmeter indicates +10 dB mW. (Use RF GAIN control to adjust for an undistorted +10-dB mW audio signal at TB2-4 and -6.) Refer to note following step 4.2.1.h.
i. With METER switch set at B2 AF (+13FS) position, adjust A26R80 for +10-dB mW reading on front panel meter. Refer to note following step 4.2.1.i.

4.2.5 Receive Signal Meter Adjustment (Channel A1 if)

Note

The variable resistor for this adjustment is accessible only by extending channel A1 if card A8.

a. With power off, extend channel A1 if A8.
b. Set METER switch to RCV SIG position.
c. Set PWR switch to on.
d. Set MODE switch to ISB.
e. Set CH A1 enable switch to ON, CH A1 - AGC BUS switch to OFF.
f. Set RF GAIN control to obtain +4.0 ±0.05 V dc on CH A1 AGC line (TB1-8).
g. With METER switch set at RCV SIG position, adjust A8R120 for an 80-dB reading on front panel meter.
h. Set PWR switch off and reinstall channel A1 if A8 in the unit.

5. DISASSEMBLY/ASSEMBLY

Warning

Do not attempt disassembly or assembly of the unit with primary power applied.

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 7.4, Electrostatic Discharge Sensitive Devices Precautions, before performing maintenance on this equipment.

5.1 Disassembly

After removing the top and bottom cover plates of the HF-8054/8054A, the circuit cards all plug directly into connectors mounted on the chassis. The power supply, located at the rear of the unit, is secured to the chassis by screws. Subassemblies located behind the front panel are made accessible by removing the front panel. Subassemblies other than the plug-in circuit cards are interconnected by connectors mounted on ribbon-type cables.

Note

Retain hardware removed during disassembly for use in reassembly. Refer to unit parts list as an aid in disassembly and assembly.

5.1.1 Meter Lamp Replacement

a. Grasp spring-loaded white terminal block and pull block away from back of meter until lamps are clear. Rotate block 90 degrees and gently release.
b. Remove and replace meter lamps.
c. Grasp spring-loaded white terminal block and carefully rotate the block back to its original position.

5.1.2 LED Status Display A2A1 Removal

a. Remove unit top cover.
b. Remove front panel from unit by removing four hexhead screws and attaching hardware.
c. Remove four Phillips-head screws that secure LED status display to hexposts/front panel.
d. Disconnect plug P5 form LED status display jack A2J3.
e. Carefully pull LED status display from front panel mounted position (pull straight back).

5.1.3 Switch Mounting Board A2A2 Removal

a. Remove unit top cover.
b. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

c. Remove upper overlay panel from front panel as follows:
    1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
    2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
    3. Left upper edge bar from front panel.
    4. Carefully remove upper overlay panel.
d. Remove lower overlay panel from front panel as follows:
    1. Remove all knobs from front panel switches and controls.
    2. Remove four Phillips-head screws and lockwashers that secure back of front panel to lower edge bar.
    3. Lift lower edge bar from front panel.
    4. Remove lower overlay panel.
e. Remove attaching hardware from all switches, controls, and connectors on the front panel.
f. Disconnect plugs P3 and P4 from switch mounting board jacks A2J2 and A2J1 respectively.
g. Remove switch mounting board by removing three Phillips-head screws and attaching hardware (screwheads on front of front panel). Use care so as not to damage wiring of wire mounted controls and connectors.

5.1.4 Frequency Display A2A5 Removal

a. Remove unit top cover.
b. Remove four Phillips-head screws and attaching hardware.
c. Disconnect plug P8 from jack A2J5 on frequency display.
d. Carefully pull frequency display from front panel mounted position.

5.1.5 Frequency Switchboard A2A3 Removal

a. Remove unit top cover.
b. Remove frequency display A2A5 per paragraph 5.1.4.
c. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

d. Remove upper overlay panel from front panel as follows:
    1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.

   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.
   4. Carefully remove upper overlay panel.
e. Remove cover plate on back of front panel by removing five Phillips-head screws and attaching hardware (screwheads on front of front panel).
f. Disconnect plug P2 from frequency switchboard jack A2J4.
g. Remove frequency switchboard by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).

5.1.6 DVBFO Switchboard A2A4 Removal

a. Remove unit top cover.
b. Remove frequency display A2A5 per paragraph 5.1.4.
c. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

d. Remove upper overlay panel from front panel as follows:
   1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to pannel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.
   4. Carefully remove upper overlay panel.
e. Remove cover plate on back of front panel by removing five Phillips-head screws and attaching hardware (screwheads on front of front panel).
f. Disconnect plug P9 from dvbfo switchboard jack A2J6.
g. Remove dvbfo switchboard by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).

5.1.7 Speaker Removal

a. Remove unit top cover.
b. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

c. Remove upper overlay panel from front panel as follows:
   1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.
   4. Carefully remove upper overlay panel.
d. Remove speaker overlay panel from front panel as follows:
   1. Remove all knobs from front panel switches and controls.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to lower edge bar.
   3. Lift lower edge bar from front panel.
   4. Remove speaker overlay panel.
e. Disconnect jack J47 from speaker plug A2P2.
f. Remove speaker by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).

5.2 Assembly

Except for the subassemblies that require mounting to the rear of the front panel before the panel is attached to the chassis, assembly of the unit is not in any certain order. The plug-in circuit cards are keyed so each card can be inserted in only the correct connector.

5.2.1 Speaker Installation

a. Mount speaker to front panel using four Phillips-head screws and attaching hardware (screwheads on front of front panel).
b. Mount panel support (middle bar on front panel) to front panel by using four Phillips-head screws and lockwashers.
c. Install speaker overlay panel and lower overlay panel into slot of middle bar on front panel.
d. Carefully install lower edge bar and secure to front panel by using four Phillips-head screws and lockwashers.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care when installing upper overlay panel.

e. Carefully install upper overlay panel into slot of middle bar on front panel.

f. Carefully install upper edge bar and secure to front panel by using four Phillips-head screws and lockwashers.
g. Install all knobs on front panel switches and controls.
h. Plug jack J47 into speaker plug A2P2.
i. Install front panel to unit using four hexhead screws and attaching hardware.
j. Install unit top cover.

5.2.2 DVBFO Switchboard A2A4 Installation

a. Install dvbfo switchboard in front panel using four Phillips-head screws (screwheads on front of front panel).
b. Install cover plate to back of front panel using five Phillips-head screws and attaching hardware (screwheads on front of front panel).
c. Mount panel support (middle bar on front panel) to front panel by using four Phillips-head screws and lockwashers.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care when installing upper overlay panel.

d. Carefully install upper overlay panel into slot of middle bar on front panel.
e. Carefully install upper edge bar and secure to front panel by using four Phillips-head screws and lockwashers.
f. Plug P9 into dvbfo switchboard jack A2J6.
g. Install front panel to unit using four hexhead screws and attaching hardware.
h. Install frequency display A2A5 per paragraph 5.2.4.
i. Install unit top cover.

5.2.3 Frequency Switchboard A2A3 Installation

a. Install frequency switchboard in front panel using four Phillips-head screws (screwheads on front of front panel).
b. Install cover plate to back of front panel using five Phillips-head screws and attaching hardware (screwheads on front of front panel).
c. Mount panel support (middle bar on front panel) to front panel by using four Phillips-head screws and lockwashers.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care when installing upper overlay panel.

d. Carefully install upper overlay panel into slot of middle bar on front panel.
e. Carefully install upper edge bar and secure to front panel by using four Phillips-head screws and lockwashers.
f. Plug P2 into frequency switchboard jack A2J4.
g. Install front panel to unit by using four hexhead screws and attaching hardware.
h. Install unit top cover.

5.2.4 Frequency Display A2A5 Installation

a. Carefully slide frequency display in place in front panel.
b. Connect plug P8 to jack A2J5 on frequency display.
c. Secure frequency display using four Phillips-head screws and attaching hardware.
d. Install unit top cover.

5.2.5 Mounting Board A2A2 Installation

a. Carefully install mounting board to front panel using three Phillips-head screws and attaching hardware (screwheads on front of front panel). Use care not to damage wiring of wire mounted controls and connectors.
b. Install the necessary attaching hardware on all front panel switches, controls, and connectors.
c. Mount panel support (middle bar on front panel) to front panel by using four Phillips-head screws and lockwashers.
d. Install lower overlay panel and speaker overlay panel into slot of middle bar on front panel.
e. Carefully install lower edge bar and secure to front panel by using four Phillips-head screws and lockwashers.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care when installing upper overlay panel.

f. Carefully install upper overlay panel into slot of middle bar on front panel.
g. Carefully install upper edge bar and secure to front panel by using four Phillips-head screws and lockwashers.
h. Install all knobs on front panel switches and controls.
i. Plug P3 and P4 into mounting board jacks A2J2 and A2J1 respectively.
j. Install front panel to unit using four hexhead screws and attaching hardware.
k. Install unit top cover.

5.2.6 LED Status Display A2A1 Installation

Caution

LED status display must be correctly positioned and pushed straight into front panel slot.

a. Carefully push LED status display into front panel mounted position.
b. Secure LED status display to hexposts/front panel using four Phillips-head screws.
c. Plug P5 into LED status display jack A2J3.
d. Install front panel to unit using four hexhead screws and attaching hardware.
e. Install unit top cover.

6. REPAIR

Repair of the HF-8054/8054A consists of replacing subassemblies and chassis-mounted components. For replacement of subassemblies, refer to paragraph 5. Use standard shop practices to replace chassis-mounted components.

7. CIRCUIT CARD REPAIR

7.1 General

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 7.4, Electrostatic Discharge Sensitive Devices Precautions, before performing maintenance on this equipment

The following paragraphs provide information for repair and replacement of components mounted on subassemblies or circuit cards. Testing and troubleshooting procedures for circuit cards and subassemblies are included in the individual instruction sheets in the instruction book. The following is a list of tools and materials necessary for repair of circuit cards.

a. Flux, Kester 1544 or equivalent
b. Solder, 0.5 mm (0.020 inch) diameter, 63/37 rosin flux core or equivalent
c. Solvent, Freon TMC
d. Soldering iron, 40-watt, 1.588-mm (1/16 inch) tip
e. Solder sucker, plunger type
f. Needle-nose pliers
g. Small brush
h. Pipe cleaners
i. Diagonal cutters

7.2 Replacement of Resistors, Diodes, and Capacitors

7.2.1 Removal

Note

Before removing diodes or polarized capacitors, note polarity marking and orientation on the circuit card.

Caution

Do not apply heat at a thru hole for more than 8 seconds.

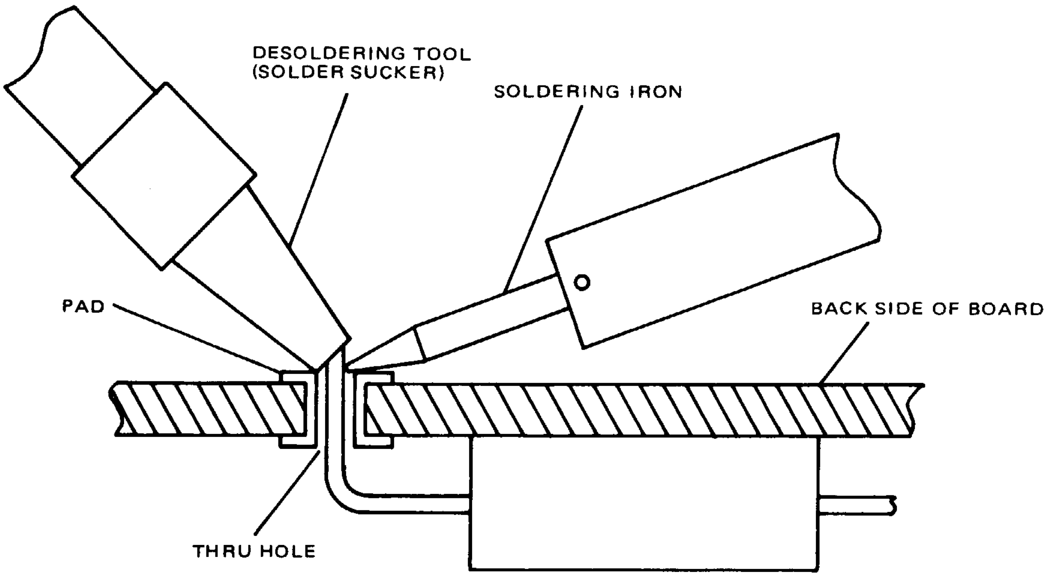
a. On back side of board (side opposite components), place soldering iron on pad of component to be removed until solder begins to melt (refer to figure 7).
b. Use a solder sucker, and remove solder from hole. More solder may be required to conduct heat into hole and provide better suction for removal.
c. Use needle-nose pliers to remove lead from hole. It may be necessary to reheat lead, as a certain amount of solder will remain in thru hole.
d. When component has been removed, reheat thru holes and, using a solder sucker, remove excess solder. Reheat procedure as necessary until holes are clean as indicated by lack of solder on walls, top, or bottom.

7.2.2 Installation

a. Using a small brush or tip of a pipe cleaner dipped in solvent, carefully clean both sides of surface area, thru holes, and pads.
b. Observe polarity markings and properly orient component. Shape leads of the replacement component so that leads fit freely into correct thru holes.
c. Gently maneuver component, inserting leads into proper thru holes, until component is inserted to proper depth or until body of component makes contact with surface of circuit board.

Note

Do not crimp or bend leads to hold component in position for soldering. Protruding portion of lead should remain straight to prevent damage to circuit board if subsequent replacement is required.



2-Lead Component Removal Diagram
Figure 7

d. Using small diagonal cutters, cut leads so that protruding length (approx 1.5 mm (1/16 in)) matches that of other components.
e. Using flux and solder sparingly, solder each lead on side opposite component. Ensure that component does not shift position during soldering procedure.
f. Carefully inspect all new solder joints for evidence of poor connection, cold solder, or short circuit. Solder should completely fill thru hole without excess. Refer to figure 8.
g. Using a small brush or the tip of a pipe cleaner dipped in solvent, thoroughly clean all new soldered joints. Ensure that all flux and rosin are removed. Solder joints should appear clean, smooth, and bright.

7.3 Replacement of Multilead Components (Transistors, Transformers, Dual-in-Line Packages, Relays, Etc)

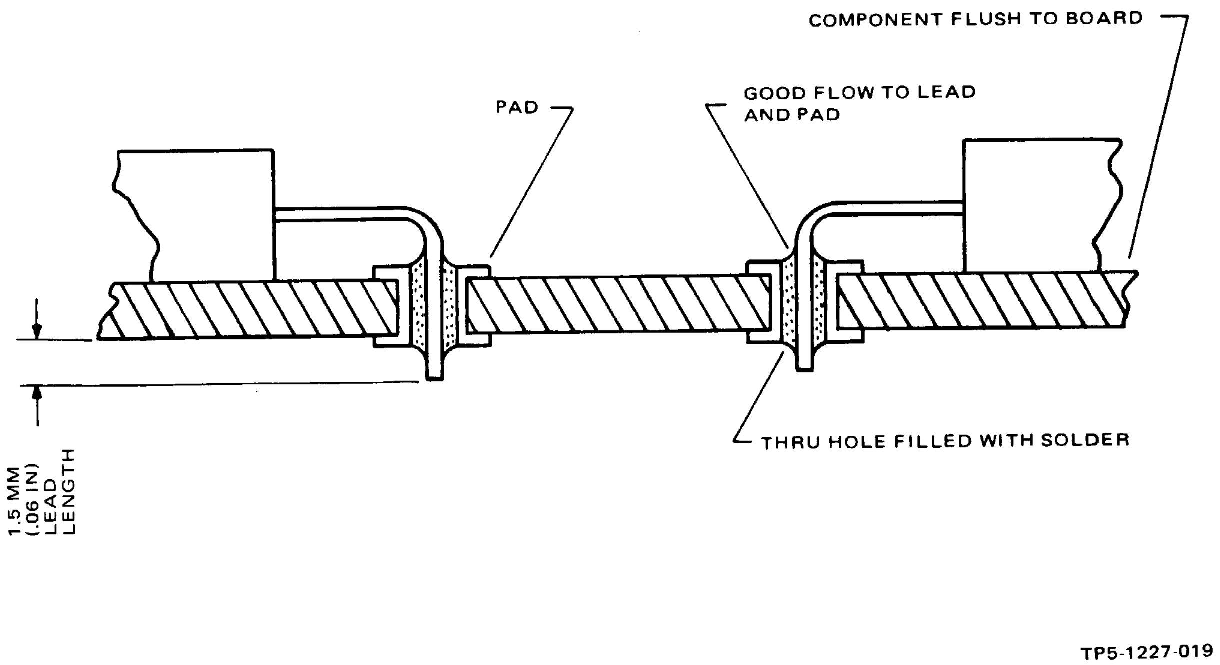
7.3.1 Removal

a. Locate component to be removed. Note position, lead conformation, and physical alignment of component. Observe position of orientation tab (if any). Determine pads and thru holes used for mounting.
b. Lay circuit board flat on a clean surface with component side facing down.

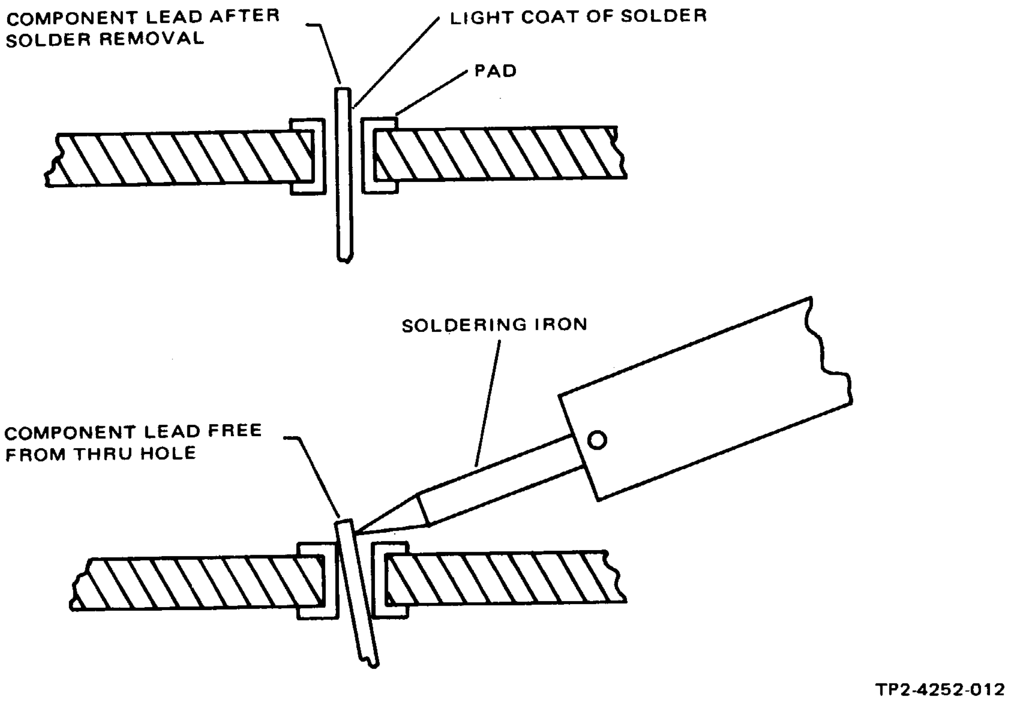
Caution

Do not apply heat at a pad or thru hole for longer than 8 seconds.

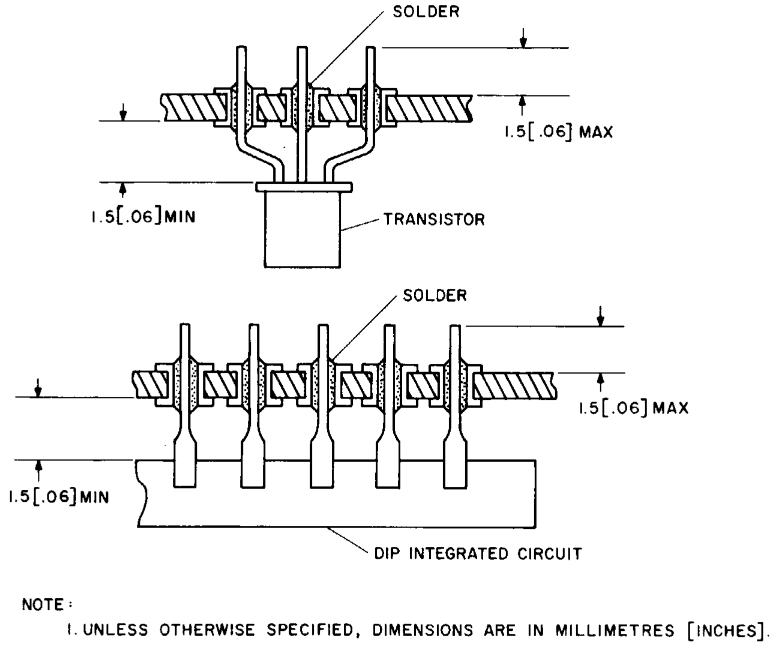
c. Place soldering iron tip to one pad and lead until solder beings to melt. Use a solder sucker to remove excess solder. More solder may be required to conduct heat into hole and to provide better suction for solder removal. Refer to figure 9.
d. Allow circuit board to cool before applying heat to thru hole in same area. Repeat procedure for each lead.
e. When all leads have been unsoldered, remove component from board.
f. When component has been removed, reheat each hole. When solder is melted, use a solder sucker to remove excess solder. Allow circuit board to cool before reapplying heat in same area. Repeat procedure as required until each thru hole is clean, as indicated by absence of solder on walls, top, and bottom.



2-Lead Component Installation Diagram
Figure 8



Multilead Component Removal Diagram
Figure 9



Multilead Component Installation Diagram
Figure 10

7.3.2 Installation

a. Using a small brush or tip of a pipe cleaner dipped in solvent, carefully clean both sides of circuit board in mounting area. Clean mounting holes and pads.
b. Carefully bend leads of new component to same configuration as old one so that leads fit freely into correct thru holes. Do not cut leads at this time.
c. Gently maneuver component, inserting leads into proper thru holes. Continue with rocking movement until component is inserted to proper depth.

Note

Do not crimp or bend leads to hold component in position for soldering. The protruding portion of lead should remain straight to prevent damage to circuit board if subsequent replacement is required.

d. Using small diagonal cutters, cut leads so that protruding length (approx 1.5 mm (1/16 in)) matches that of other components.

Caution

Do not apply heat at a thru hole for longer than 8 seconds.

e. Using flux and solder sparingly, solder each lead at side opposite component. Ensure that component does not shift position during soldering procedure.
f. Allow circuit board to cool before applying heat to other thru holes.
g. Carefully inspect all new solder joints for evidence of poor connections, cold or excess solder, or short circuits. Solder should completely fill hole without excess (refer to figure 10).
h. Using a small brush or tip of pipe cleaner dipped in solvent, thoroughly clean all new soldered joints. Ensure that all flux is removed. Solder joints should appear clean, smooth, and bright.

7.4 Electrostatic Discharge Sensitive Devices Precautions

A static charge is produced by friction between, and separation of, dissimilar materials. Potentials of one to twenty kilovolts are commonly generated on the human body or insulated surfaces. Voltages of this magnitude can produce both immediate and latent failure in electrostatic discharge sensitive (ESDS) devices. Highly sensitive (0 to 400 volts) ESDS devices include metal-oxide-semiconductor (MOS) without input protection (C-MOS, D-MOS, N-MOS, P-MOS, V-MOS, etc) and surface acoustic wave (SAW). Most other solid state electronic devices are ESDS and fall in the moderatly sensitive (400 to 2500 volts) or marginally sensitive (2500 to 15 000 volts) range.

Note

> Dry weather (relative humidity less than 30 percent) multiplies the accumulation of static charges on a surface. In a low-humidity environment, the handling procedures specified are of greater importance and should be adhered to without exception.

7.4.1 Handling of ESDS Devices

Caution

> Nylon or synthetic gloves should not be used when handling ESDS devices. Excessive static can build up on this type of material. Handle ESDS devices by their case whenever possible. Avoid touching the leads on contacts even though grounded.

The transport of ESDS devices at the component level requires that all device leads be effectively shorted together. This can be accomplished by one of the following methods.

a. Insert device in high density conductive foam.
b. Insert device in aluminum foil lined individual packages.
c. Insert device in a dual-in-line carrier tube made of aluminum of specially coated plastic. (Must be labeled as static charge dissipative.)

The label shown below shall be shown on all individual part containers:

Caution

> This component can be damaged by static electricity. Special handling methods and materials must be utilized.

Anti-static protection is required for ESDS devices from the time they are received until they are terminated in a protective subassembly. If ESDS devices are in subassemblies that do not provide adequate ESDS device protection, they are still vulnerable to static damage.

The transport of circuit board or module subassemblies containing ESDS devices requires that contact with exposed subassemblies be prevented. Conductive plastic bags, not clear polyvinyl, are well suited to this purpose. Plastic bags should be adequate in size to enclose the subassembly being transported. After the subassembly containing ESDS devices is installed in the top level unit, normal ESDS devices handling is adequate.

7.4.2 Storage of ESDS Devices

The methods of handling described in paragraph 7.4.1 are appropriate for storage.

Caution

> Lead corrosion may result if the device or assembly is stored in a high temperature/high humidity environment.

7.4.3 Testing of Subassemblies Containing ESDS Devices

Observe the following precautions when testing any subassembly containing ESDS devices.

a. Remove power from test fixtures or equipment before inserting/removing any ESDS device or subassembly containing an ESDS device.
b. All test equipment must be well grounded.
c. Apply dc source power to ESDS device or subassembly containing an ESDS device before applying any signal voltages.
d. Remove signal voltages from ESDS device or subassembly containing an ESDS device before removing dc source power.
e. Dielectric strength or insulation resistance checks are not recommended for any ESDS device or subassembly containing an ESDS device.

7.4.4 Replacement of ESDS Devices

Protective carriers for ESDS devices should be placed on grounded conductive work station surfaces. This permits the dissipation of any static charge prior to removal, transfer, or insertion of any ESDS device into a subassembly.

It is recommended that an ionized air blower be used in the work area where personnel are handling ESDS devices and that personnel work in the path of the ionized air. The blower should be operated for 3 minutes before handling an ESDS device so that residual static charges may be removed. In lieu of an ionized air blower, a grounded wrist strap in contact with bare skin can be used.

Warning

If a grounded wrist strap is used, make sure no voltages exist in the area of the work station.

Observe the following precautions when replacing an ESDS device.

a. Soldering iron tips, special tools, and hand tools should be well grounded.

b. Only uninsulated metal hand tools should be used. All hand tools shall be placed on the conductive work station surface when not in use.

c. The leads of the ESDS devices should be in contact with a conductive material, except when being installed, to avoid buildup of static charge.

d. ESDS devices should not be installed (inserted) in, or removed from, circuits with the power on because transient voltages may cause damage.

e. All unused input leads of the ESDS device must be connected to ground or the ESDS device supply, whichever is applicable for the logic circuit involved.

HF-8054( )
Receiver

Rockwell
International

parts list

Collins Telecommunications Products Division

Printed in USA

523-0770706-001218
1 January 1981

list of illustrations

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
Title	1 Jan 81
List of Effective Pages	1 Jan 81
1 thru 41	1 Jan 81
42 Blank	1 Jan 81

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE	INITIALS	REV NO	REVISION DATE	INSERTION DATE	INITIALS
1st Ed	1 Jan 81						

parts list

1. INTRODUCTION

1.1 General

The purpose of this parts list, prepared by Collins Telecommunications Products Division of Rockwell International, is for identification, requisition, and issuance of parts.

Parts listed meet critical equipment design specification requirements. Use only part numbers specified in this parts list for replacement of parts.

1.2 Group Assembly Parts List

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers assigned in sequence to correspond with item numbers on the illustrations.

PART NO Column — Listed are MIL standard, vendor, or Collins part numbers. Collins part numbering system consists of 10 digits as follows: a 3-digit family number, a 4-digit serial number, and a 3-digit dash number.

INDENT Column — Items are coded 1, 2, 3, etc, to indicate the relationship to the next higher assembly.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, federal manufacturer's code, reference designation, attaching part (AP), reference to other figures, and effectivities.

Attaching parts are identified by (AP) following the part or parts they attach.

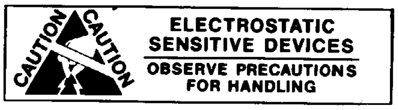
Effectivities are identified by the following methods: MCN (Manufacturer Control Number) 101 and up; CI (Configuration Identifier) 5-digit number; REV (Revision Identifier) dash (—) denotes original, letter A first change, letter B second change, etc. One of the above identifiers is listed on each chassis and/or replaceable assembly. Service Bulletins are identified by SB 1, SB 2, etc.

UNITS PER ASSY Column — Quantities specified are per item number. Letters AR denote the selection of parts as required. Letters REF refer to an assembly completely assembled on a preceding figure and illustration.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

Caution

This equipment contains electrostatic discharge sensitive devices, indicated in the description column by (ESDS). Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section before assembly/disassembly or repair is performed. All illustrations that contain ESDS devices have the following symbol attached.



1.3 Numerical Index

PART NUMBER Column — Part numbers are listed in alphanumeric sequence.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

TTL REQ Column — Listed is the total quantity of parts or assemblies covered in the Group Assembly Parts List.

1.4 Reference Designation Index

REFERENCE DESIGNATION Column — Reference designations are listed in alphanumeric sequence.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

PART NUMBER Column — Part numbers listed are for items that have reference designations assigned.

1.5 How To Use This Parts List

To locate a part number if the assembly in which the part is used is known, turn to the List of Illustrations and find the page number for the assembly in which the part is used. Locate the part and its index number on the illustration and find the index number on the Group Assembly Parts List page to determine its description and part number.

To locate the illustration for a part if the part number is known, refer to the Numerical Index and find the part number. Turn to the Group Assembly Parts List and find the first figure and index number indicated in the Numerical Index for that part. If this figure shows the part in a section or system of the equipment other than the one desired, refer to the other figure numbers listed in the Numerical Index.

To locate the illustration for a part if the reference designation is known, refer to the Reference Designation Index and find the symbol; turn to the Group Assembly Parts List and find the figure and index number indicated in the index.

1.6 Manufacturer's Code, Name, and Address

CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO 1201 SOUTH 2ND ST MILWAUKEE WI 53204
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
05574	VIKING INDUSTRIES INC DATACON DIV 21001 NORDHOFF ST CHATSWORTH CA 91311
08664	ACCO INDUSTRIES INC BRISTOL DIV 40 BRISTOL ST WATERBURY CT 06720
09353	C AND K COMPONENTS INC 103 MORSE STREET WATERTOWN MA 02172
12294	ERIE TECHNOLOGICAL PRODUCTS OF CANADA LTD 5 FRASER AVE TRENTON ONTARIO CAN K8V 5S1
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
14208	MINNEAPOLIS SPEAKER CO 3806 GRAND AVE S MINNEAPOLIS MN 55409
17217	GORE W L AND ASSOCIATES INC 555 PAPER MILL ROAD NEWARK DE 19711
17235	CONTROL DATA CORP CONNECTOR OPNS 31829 W LA TIENDA DR WESTLAKE VILLAGE CA 91361
18677	SCANBE MFG CO 3445 FLETCHER AVE EL MONTE CA 91731
23730	MARK EYELET AND STAMPING INC 63 WAKELEE RD WOLCOTT CT 06716
27687	GREER A MICRODOT CO MAYFIELD DR P O BOX 68 SMYRNA TN 37167
28520	HEYMAN MANUFACTURING CO 147 MICHIGAN AVE KENILWORTH NJ 07033
31918	ITT SCHADOW INC 8081 WALLACE RD EDEN PRAIRIE MN 55343
55616	ELFAB CORP 4200 WILEY POST RD P O BOX 34555 DALLAS TX 75234
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
65092	WESTON INSTRUMENTS DIV SANGAMO WESTON INC 614 FRELINGHUYSEN AVE NEWARK NJ 07114

CODE	MANUFACTURER'S NAME AND ADDRESS
70903	BELDEN CORP 2000 S BATAVIA AVE GENEVA IL 60134
71124	BRAND-REX CO RT 32 P O BOX 498 WILLIMANTIC CT 06226
71400	BUSSMANN MFG DIV MCGRAW-EDISON CO 502 EARTH CITY PLAZA P O BOX 14460 ST LOUIS MO 63178
71468	ITT CANNON ELECTRIC DIV INTERNATIONAL TELEPHONE AND TELEGRAPH CO 666 E DYER RD SANTA ANA CA 92702
71590	GLOBE-UNION INC CENTRALAB ELECTRONICS DIV HWY 20 W P O BOX 858 FORT DODGE IA 50501
71785	TRW CINCH CONNECTORS 1501 MORSE AVE ELK GROVE VILLAGE IL 60007
72606	GASKET MFG CO 18001 S MAIN ST GARDENA CA 90248
72962	ESNA DIV OF AMERACE CORP 2330 VAUXHALL ROAD UNION NJ 07083
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
75037	MINNESOTA MINING AND MFG CO ELECTRO PRODUCTS DIV 3M CENTER ST PAUL MN 55101
75382	KULKA ELECTRIC CORP 633-643 S FULTON AVE MT VERNON NY 10550
76854	OAK INDUSTRIES INC SWITCH DIV 100 S MAIN ST CRYSTAL LAKE IL 60014
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
77250	PHEOLL MFG CO DIV OF ALLIED PRODUCTS CORP 5700 W ROOSEVELT RD CHICAGO IL 60650
77969	RUBBERCRAFT CORP OF CALIF LTD 1800 W 220TH ST TORRANCE CA 90507
79807	WROUGHT WASHER MFG INC 2100 S O BAY ST MILWAUKEE WI 53207
79963	ZIERICK MFG CO RADIO CIRCLE MT KISCO NY 10549
81349	MILITARY SPECIFICATION
86797	ROGAN CORP 3455 WOODHEAD DR NORTHBROOK IL 60062
91314	LEWIS SPRING AND MFG CO 2652 W NORTH AVE CHICAGO IL 60647
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
94375	AUTOMATIC CONNECTOR INC 400 MORELAND RD COMMACK NY 11725
95146	ALCO ELECTRONIC PRODUCTS INC P O BOX 1348 LAWRENCE MA 01842
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

1.7 Usable on Codes

The following usable on codes have been assigned in this manual:

USABLE ON CODE	UNIT PART NUMBER	FIG-ITEM
A	622-3474-001	1-
B	622-3475-001	1-
C	622-3475-002	1-
D	622-3475-003	1-
E	622-3475-004	1-
F	622-3475-005	1-
G	634-8200-001	2-
H	634-8200-002	2-
J	634-8200-003	2-
K	634-8200-004	2-
L	638-6873-001	3-
M	638-6873-002	3-

1.8 Reference Designation Prefixes

The following prefixes have been assigned in this manual:

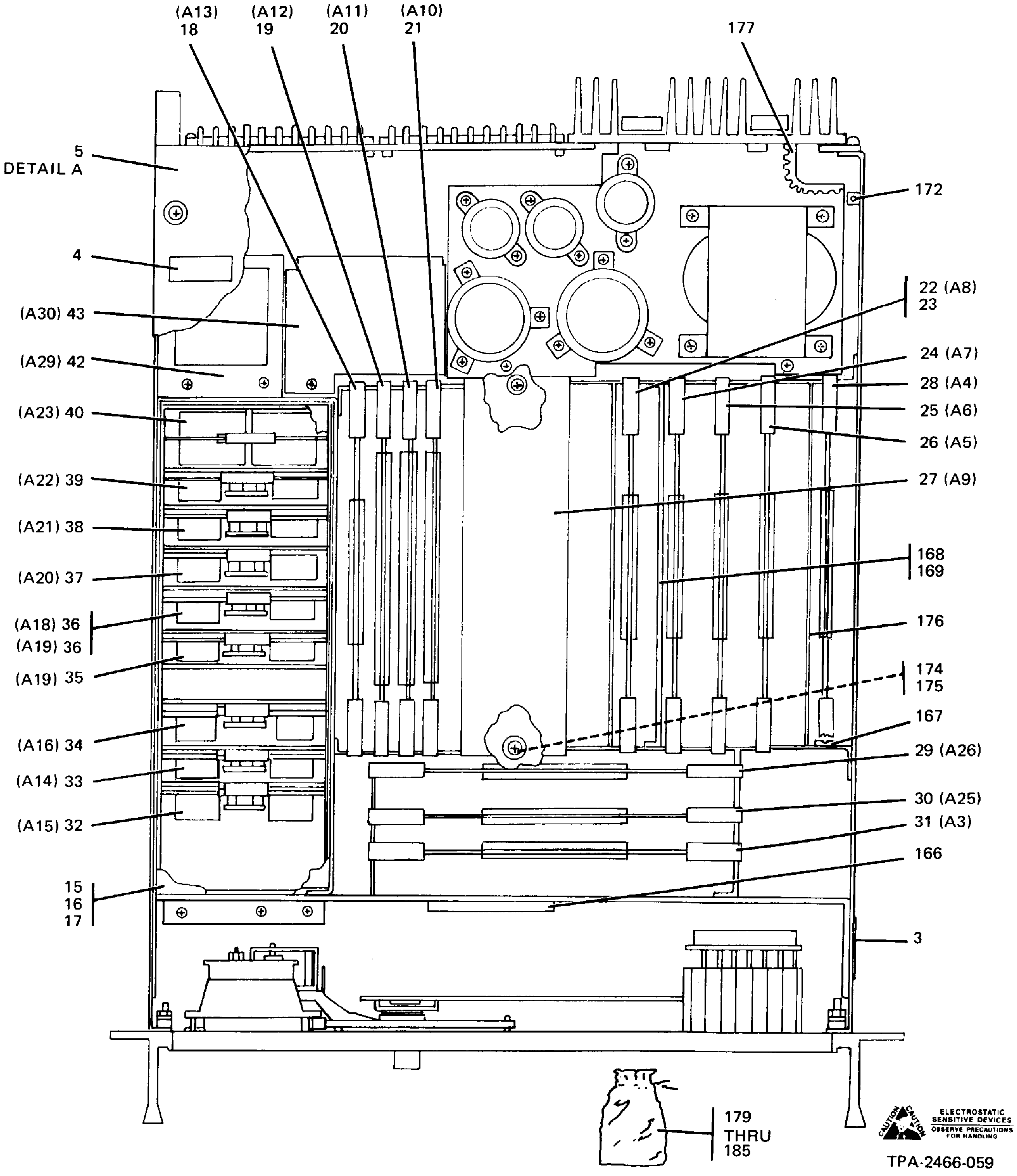
PREFIX	UNIT PART NUMBER	FIG-ITEM
A1	635-9649-001	1-44
A2	634-8200-001	1-164
A2	634-8200-002	1-164
A2	634-8200-003	1-164
A2	634-8200-004	1-164
A2A1	635-0825-013	2-49
A2A2	638-6873-001	2-59
A2A2	638-6873-002	2-59
A2A3	635-0830-001	2-41
A2A3	635-0830-002	2-41
A2A4	638-6437-001	2-42
A2A5	637-1781-006	2-48
A2A5	637-1781-008	2-48
A2W1	634-8289-001	2-67
A3	642-3224-001	1-31
A4	638-6067-002	1-28
A5	638-6975-003	1-26
A5	638-6975-006	1-26
A6	638-6975-002	1-25
A6	638-6975-005	1-25
A7	638-6975-001	1-24
A7	638-6975-004	1-24
A8	638-6871-001	1-22
A8	638-6871-002	1-22
A9	637-1767-002	1-27
A9	637-1767-003	1-27
A10	638-6629-001	1-21
A11	642-3135-001	1-20
A12	642-3137-001	1-19
A13	638-6896-001	1-18
A14	635-0656-001	1-33
A15	638-6962-001	1-32
A16	642-2451-001	1-34
A18	635-0657-001	1-36
A19	623-2080-004	1-35
A19	635-0657-001	1-36
A20	623-2080-003	1-37
A21	623-2080-002	1-38
A22	623-2080-001	1-39
A23	635-4930-001	1-40
A23	635-4930-002	1-40
A24	634-8201-001	1-45
A25	635-0748-002	1-30
A26	635-0748-002	1-29
A27	637-2712-004	1-89
A28	634-8224-001	1-49
A28	634-8224-002	1-49
A29	622-3460-001	1-42
A30	622-3499-001	1-43
W1	634-8226-001	1-126
W2	634-8227-001	1-139
W3	634-8225-001	1-150

1.9 Configuration Identifiers

The following CI's/REV LTR's were used in compiling data for this manual:

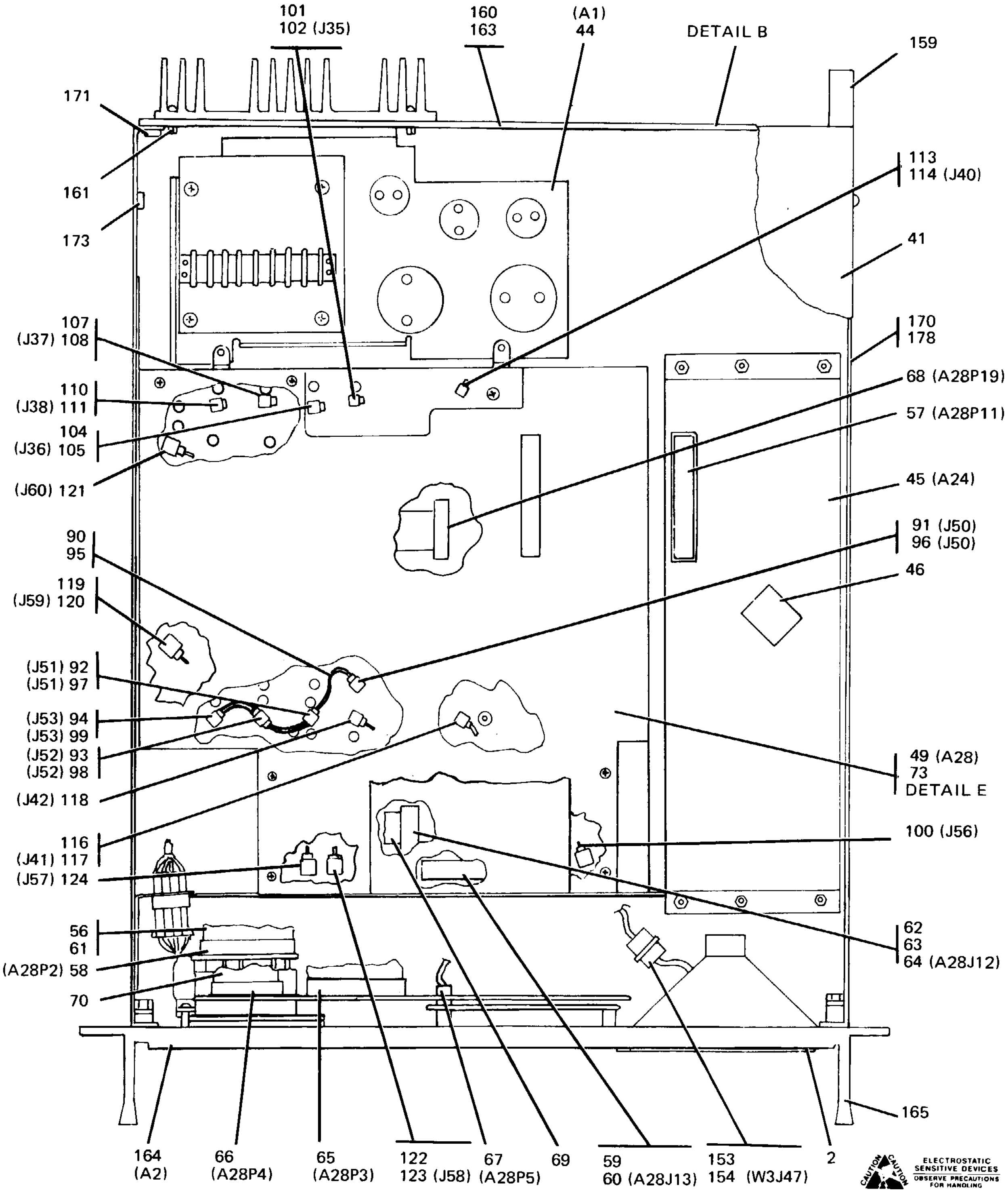
CI/ REV LTR	UNIT PART NUMBER	FIG-ITEM
B	622-3474-001	1-
H	622-3475-001	1-
H	622-3475-002	1-
H	622-3475-003	1-
H	622-3475-004	1-
H	622-3475-005	1-
C	634-8200-001	2-
C	634-8200-002	2-
C	634-8200-003	2-
C	634-8200-004	2-
D	638-6873-001	3-
E	638-6873-002	3-
A	634-8201-001	4-
F	638-6973-001	5-
N	637-2712-004	6-

2. GROUP ASSEMBLY PARTS LIST



HF-8054/54A Receiver
Figure 1 (Sheet 1 of 5)

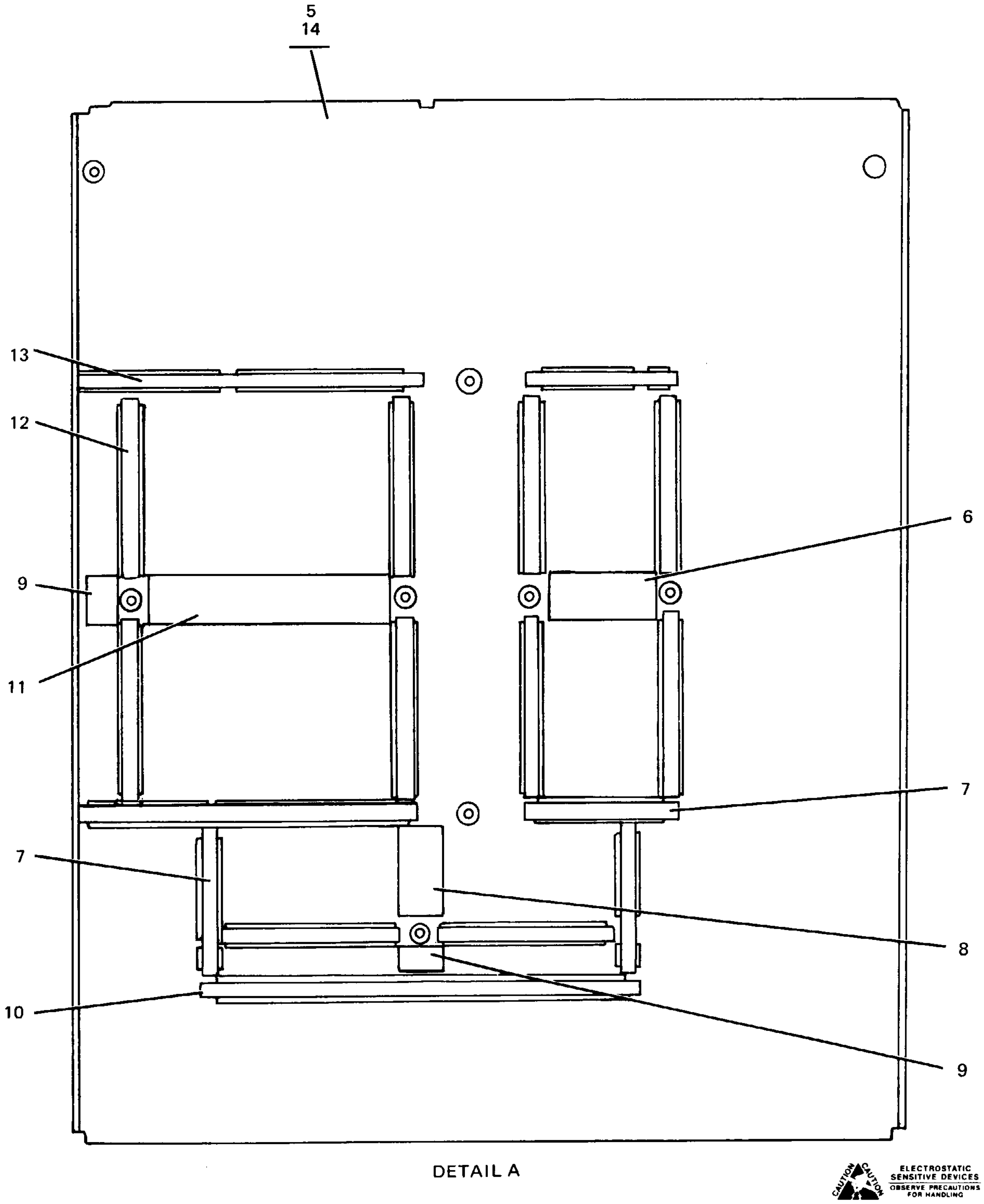
GROUP ASSEMBLY PARTS LIST



TPA-2466-059

HF-8054/54A Receiver
Figure 1 (Sheet 2)

GROUP ASSEMBLY PARTS LIST

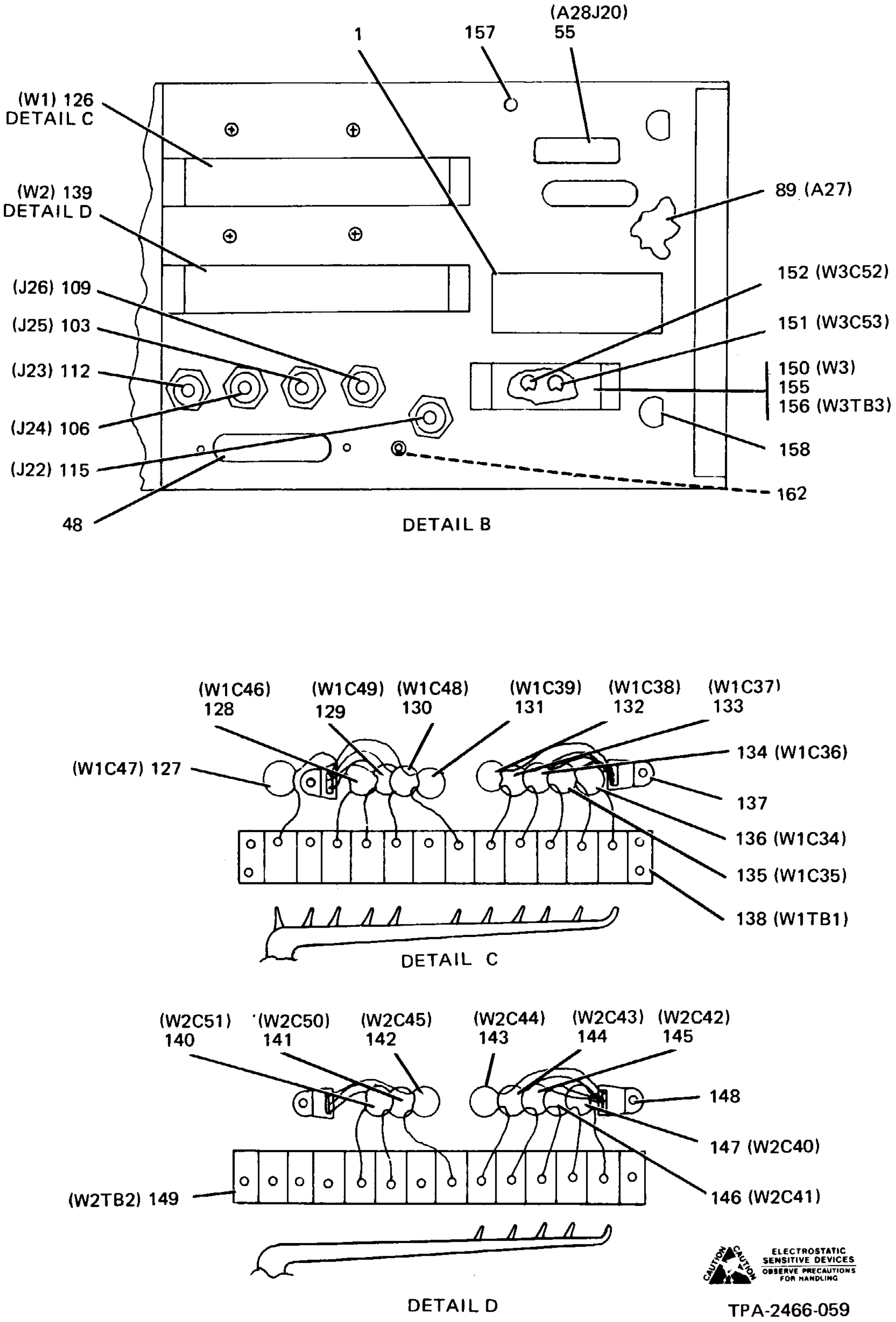


ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TPA-2466-059

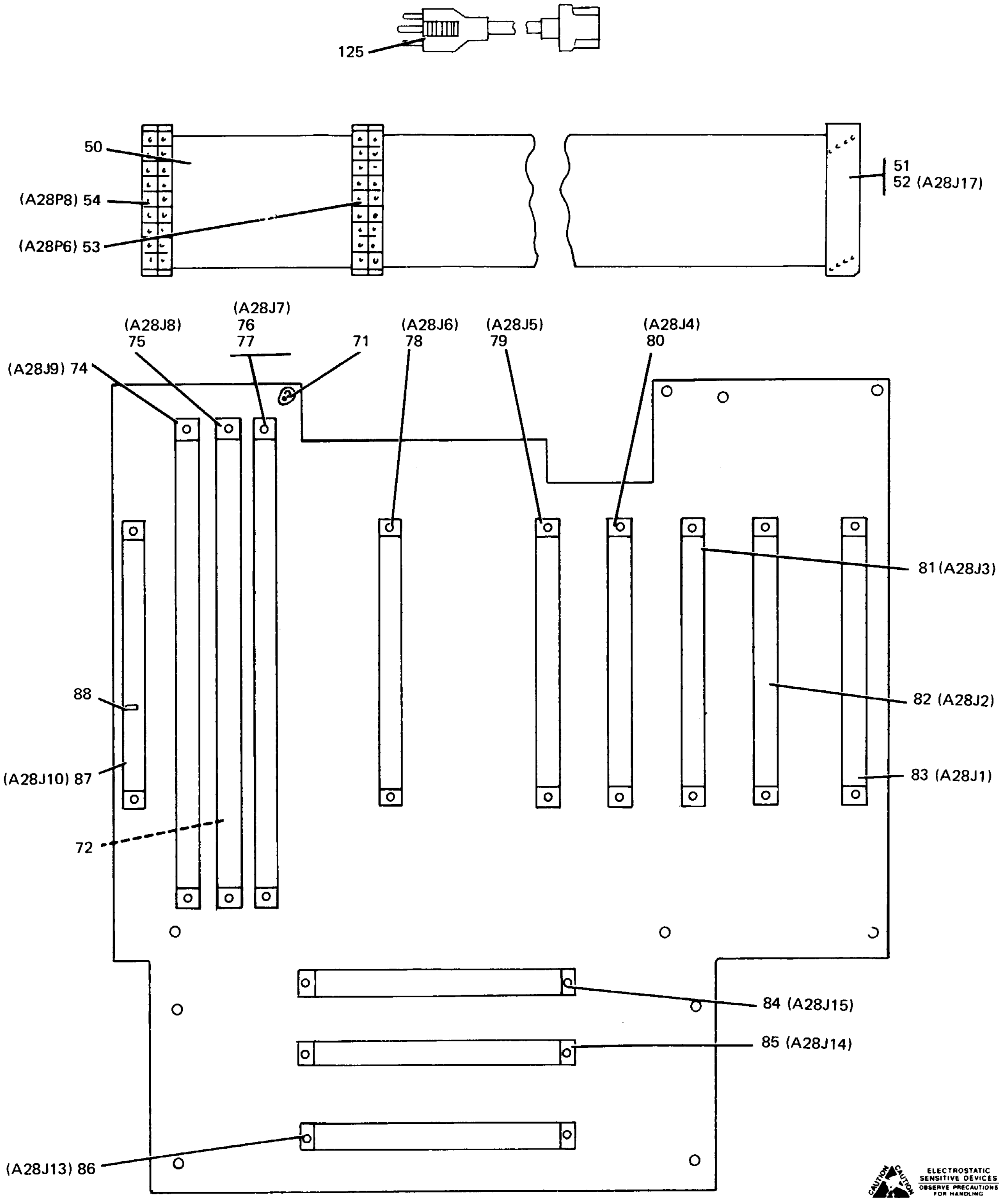
HF-8054/54A Receiver
Figure 1 (Sheet 3)

GROUP ASSEMBLY PARTS LIST



HF-8054/54A Receiver
Figure 1 (Sheet 4)

GROUP ASSEMBLY PARTS LIST



DETAIL E

TPA-2466-059

HF-8054/54A Receiver
Figure 1 (Sheet 5)

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-	622-3474-001	1	RECEIVER, HF-8054	1	A
	622-3475-001	1	RECEIVER, HF-8054A	1	B
	622-3475-002	1	RECEIVER, HF-8054A	1	C
	622-3475-003	1	RECEIVER, HF-8054A	1	D
	622-3475-004	1	RECEIVER, HF-8054A	1	E
	622-3475-005	1	RECEIVER, HF-8054A	1	F
1	642-0021-000	2	PLATE, IDENT	1	A
1	642-0023-000	2	PLATE, IDENT	1	B,C,D,E F
	MS51957-11	2	SCREW,MACH STL, 4-40 X 1/8 (96906) 343-0131-000 (AP)	2	
2	634-8193-001	2	INSERT, IDENT	1	A
2	634-8194-001	2	INSERT, IDENT	1	B,C,D,E F
3	637-9295-001	2	LABEL, FEATURE	1	
4	280-1368-350	2	LABEL,PRESSURE (12998)	1	
5	634-8181-001	2	COVER, TOP	1	
	MS51957-28	2	SCREW,MACH SST, 6-32 X 3/8 (96906) 343-0169-000 (AP)	7	
	MS51957-30	2	SCREW,MACH SST, 6-32 X 1/2 (96906) 343-0171-000 (AP)	2	
6	635-9679-002	3	CUSHION, CKT CD	1	
7	635-9677-003	3	GASKET, SHIELDING	4	
8	635-9679-005	3	CUSHION, CKT CD	1	
9	635-9679-004	3	CUSHION, CKT CD	2	
10	635-9677-008	3	GASKET, SHIELDING	1	
11	635-9679-006	3	CUSHION, CKT CD	1	
12	635-9677-001	3	GASKET, SHIELDING	10	
13	635-9677-002	3	GASKET, SHIELDING	2	
14	634-8180-001	3	COVER, TOP-PRSD	1	
15	634-8185-001	2	COVER, TOP-CARD RACK	1	A
15	642-2409-001	2	COVER ASSY, TOP-CARD RACK	1	B,C,D,E F
	MS51957-3	2	SCREW,MACH CD PL STL, 2-56 X 1/4 (96906) 343-0124-000 (AP)	5	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	5	
16	635-9679-003	3	CUSHION	2	
17	634-8185-001	3	COVER	1	
18	638-6896-001	2	INTERFACE, SERIAL A13 (ESDS)	1	B,C,D,E F
19	642-3137-001	2	OUTPUT, PARALLEL A12 (ESDS)	1	B,C,D,E F
20	642-3135-001	2	INPUT, PARALLEL A11 (ESDS)	1	B,C,D,E F
21	638-6629-001	2	CONTROL A10 (ESDS)	1	
22	638-6871-001	2	IF, CHANNEL A1 A8 (ESDS)	1	A,C
22	638-6871-002	2	IF, CHANNEL A1 A8 (ESDS)	1	B,D,E,F
23	622-3452-007	2	KIT, IF FILTERS (AC-8055) (ESDS)	1	D
24	638-6975-001	2	IF, CHANNEL B1 A7 (ESDS)	1	A,C
24	638-6975-004	2	IF, CHANNEL B1 A7 (ESDS)	1	B,D,E,F
25	638-6975-002	2	IF, CHANNEL A2 A6 (ESDS)	1	A,C
25	638-6975-005	2	IF, CHANNEL A2 A6 (ESDS)	1	B,D
26	638-6975-003	2	IF, CHANNEL B2 A5 (ESDS)	1	A,C
26	638-6975-006	2	IF, CHANNEL B2 A5 (ESDS)	1	B,D
27	637-1767-002	2	TRANSLATOR, RF A9 (ESDS)	1	A,B,D
27	637-1767-003	2	TRANSLATOR, RF A9 (ESDS)	1	C,E,F
28	638-6067-002	2	VBFO A4 (ESDS)	1	D
29	635-0748-002	2	AUDIO, RECEIVE A26 (ESDS)	1	A,B,C,D
30	635-0748-002	2	AUDIO, RECEIVE A25 (ESDS)	1	
31	642-3224-001	2	AFC A3 (ESDS)	1	D
32	638-6962-001	2	SUBCARRIER, SYNTHESIZER A15 (ESDS)	1	A,B,C,D
33	635-0656-001	2	REGULATOR, VOLTAGE-SYNTHESIZER A14	1	
34	642-2451-001	2	REFERENCE, SYNTHESIZER A16 (ESDS)	1	
35	623-2080-004	2	DECADE, SYNTHESIZER A19	1	B,D
36	635-0657-001	2	DECADE, END-SYNTHESIZER A18 (ESDS)	1	B,D

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-36	635-0657-001	2	DECADE, END-SYNTHESIZER A19 (ESDS)	1	A,C,E,F
37	623-2080-003	2	DECADE, SYNTHESIZER A20	1	
38	623-2080-002	2	DECADE, SYNTHESIZER A21	1	
39	623-2080-001	2	DECADE, SYNTHESIZER A22	1	
40	635-4930-001	2	OUTPUT, SYNTHESIZER A23	1	A
40	635-4930-002	2	OUTPUT, SYNTHESIZER A23	1	B,C,D,E F
41	634-8179-001	2	COVER, BOTTOM	1	
	MS51957-28	2	SCREW,MACH SST, 6-32 X 3/8 (96906) 343-0169-000 (AP)	8	
42	622-3460-001	2	KIT, OVEN STANDARD A29 (AC-8012)	1	C,D,E,F
43	622-3499-001	2	SWITCH, FREQUENCY STANDARD A30 (AC-8015) (ESDS)	1	C,D,E,F
44	635-9649-001	2	POWER SUPPLY A1	1	
45	634-8201-001	2	CHASSIS ASSEMBLY, SYNTHESIZER A24 (SEE FIG 4)	1	
	P313-0045-000	2	NUT,PLAIN,HEX SST, 6-32 (77250) 313-0045-000 (AP)	6	
	310-0071-000	2	WASHER,LOCK SST, 0.151 ID X 0.239 OD (79807) (AP)	6	
	310-0046-000	2	WASHER,FLAT SST, 0.147 ID X 0.312 OD (79807) (AP)	6	
	MS51957-28	2	SCREW,MACH SST, 6-32 X 3/8 (96906) 343-0169-000 (AP)	6	
	623-1379-001	2	BUSHING, COAX (AP)	7	
46	3484-1000	2	CLAMP,CABLE (75037) 150-0836-010	1	
47			NOT USED		
48	637-4472-002	2	PLATE, COVER	1	
	MS35649-244	2	NUT,PLAIN,HEX SST, 4-40 (96906) 313-0043-000 (AP)	2	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	2	
	MS51957-15	2	SCREW,MACH STL, 4-40 X 3/8 (96906) 343-0135-000 (AP)	2	
49	634-8224-001	2	SIDEBOARD A28	1	A,B,C,E F
49	634-8224-002	2	SIDEBOARD A28	1	D
	M24308-26-1	2	SCREW ASSY (81349) 371-0062-000 (AP)	2	
	MS51957-13	2	SCREW,MACH STL, 4-40 X 1/4 (96906) 343-0133-000 (AP)	16	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	16	
	310-6340-000	2	WASHER,FLAT SST, 0.125 ID X 0.281 OD (79807) (AP)	8	
	540-9039-003	2	POST, HEX .112-40X.44 (AP)	8	
50	647-7201-001	3	CABLE, DISPLAY-VBFO	1	D
51	88089-4	4	CONNECTOR,RCPT ELEC (00779) 372-2653-140	1	
52	499440-3	4	CONNECTOR,RCPT ELEC (00779) 372-2653-130 A28J17	1	
53	88377-4	4	CONNECTOR,RCPT ELEC (00779) 372-2648-040 A28P6	1	
54	88377-4	4	CONNECTOR,RCPT ELEC (00779) 372-2648-040 A28P8	1	
55	DBM25S	3	CONNECTOR,RCPT ELEC (71468) 371-0221-000 A28J20	1	
56	634-8210-001	3	CABLE, SPECIAL PURPOSE	1	
57	88379-8	4	CONNECTOR,RCPT ELEC (00779) 372-2648-080 A28P11	1	
58	88379-7	4	CONNECTOR,RCPT ELEC (00779) 372-2648-070 A28P2	1	
59	1-88203-1	4	CONNECTOR,RCPT ELEC (00779) 372-2653-100	1	
60	499442-5	4	CONNECTOR,RCPT ELEC (00779) 372-2653-090 A28J13	1	
61	3365-50	4	CABLE,SP,ELEC (75037) 424-0307-030	AR	
62	634-8228-001	3	CABLE, SPECIAL PURPOSE	1	
63	1-88203-1	4	CONNECTOR,RCPT ELEC (00779) 372-2653-100	1	
64	499442-5	4	CONNECTOR,RCPT ELEC (00779) 372-2653-090 A28J12	1	
65	88379-8	4	CONNECTOR,RCPT ELEC (00779) 372-2648-080 A28P3	1	
66	3471-0000	4	CONNECTOR,PLUG ELEC (75037) 372-2634-140 A28P4	1	
67	88377-5	4	CONNECTOR,RCPT ELEC (00779) 372-2648-050 A28P5	1	
68	3471-0000	4	CONNECTOR,PLUG ELEC (75037) 372-2634-140 A28P19	1	
69	3365-50	4	CABLE,SP,ELEC (75037) 424-0307-030	AR	
70	3365-34	4	CABLE,SP,ELEC (75037) 424-0307-010	AR	
71	MS25036-101	3	TERMINAL,LUG (96906) 304-0127-000	7	
72	MS25036-144	3	TERMINAL,LUG (96906) 304-1251-000	1	
73	638-6627-001	3	CIRCUIT BOARD, SIDEBOARD	1	
74	BS1020F65PAF	4	CONNECTOR,RCPT ELEC (55616) 372-2274-050 A28J9	1	
75	BS1020F65PAF	4	CONNECTOR,RCPT ELEC (55616) 372-2274-050 A28J8	1	
76	637-9314-001	4	CONNECTOR,MODIFIED A28J7	1	
77	BW1020F65PAF	5	CONNECTOR,RCPT ELEC (55616) 372-2274-040	1	
78	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J6	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-79	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J5	1	
80	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J4	1	
81	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J3	1	
82	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J2	1	
83	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J1	1	
84	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J15	1	
85	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J14	1	
86	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J13	1	
87	BS1225F28PFF	4	CONNECTOR,RCPT ELEC (17235) 372-7515-010 A28J10	1	
88	97096900	4	CONNECTOR,RCPT ELEC (17235) 372-7600-280	13	
89	637-2712-004	2	FILTER, RFI A27 (SEE FIG 6)	1	
	M24308-26-1	2	SCREW ASSY (81349) 371-0062-000 (AP)	2	
	MS51957-3	2	SCREW,MACH CD PL STL, 2-56 X 1/4 (96906) 343-0124-000 (AP)	2	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	2	
	540-9006-003	2	POST, ELEC-MECH (AP)	2	
90	642-2454-001	2	CABLE, COAX-RF	1	A,B,C,E F
	623-1379-001	2	BUSHING, COAX (AP)	4	
91	51-330-3188	3	CONNECTOR,RCPT ELEC (98291) 357-7374-010 J50	1	
92	51-071-0019	3	CONNECTOR,TEE (98291) 357-7533-010 J51	1	
93	51-330-3188	3	CONNECTOR,RCPT ELEC (98291) 357-7374-010 J52	1	
94	51-071-0019	3	CONNECTOR,TEE (98291) 357-7533-010 J53	1	
95	646-6534-001	2	CABLE, COAX	1	D
	623-1379-001	2	BUSHING, COAX (AP)	5	
	055-905-0069	2	FLOAT,CONNECTOR (98291) 357-8985-020 (AP)	2	
96	51-071-0019	3	CONNECTOR,TEE (98291) 357-7533-010 J50	1	
97	51-071-0019	3	CONNECTOR,TEE (98291) 357-7533-010 J51	1	
98	51-071-0019	3	CONNECTOR,TEE (98291) 357-7533-010 J52	1	
99	51-330-3188	3	CONNECTOR,RCPT ELEC (98291) 357-7374-010 J53	1	
100	51-330-3188	3	CONNECTOR,RCPT ELEC (98291) 357-7374-010 J56	1	
101	637-1525-003	2	CABLE, COAX	1	
	646-7008-001	2	SPRING, GND (AP)	2	
	623-1379-001	2	BUSHING, COAX (AP)	1	
102	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J35	1	
103	801-B3800B75	3	CONNECTOR,RCPT ELEC (94375) 357-7129-010 J25	1	
104	637-1525-003	2	CABLE, COAX	1	
	623-1379-001	2	BUSHING, COAX (AP)	1	
105	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J36	1	
106	801-B3800B75	3	CONNECTOR,RCPT ELEC (94375) 357-7129-010 J24	1	
107	637-1525-003	2	CABLE, COAX	1	
	623-1379-001	2	BUSHING, COAX (AP)	1	
108	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J37	1	
109	801-B3800B75	3	CONNECTOR,RCPT ELEC (94375) 357-7129-010 J26	1	
110	637-1525-003	2	CABLE, COAX	1	
	623-1379-001	2	BUSHING, COAX (AP)	1	
111	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J38	1	
112	801-B3800B75	3	CONNECTOR,RCPT ELEC (94375) 357-7129-010 J23	1	
113	637-1525-002	2	CABLE, COAX	1	
	623-1379-001	2	BUSHING, COAX (AP)	1	
114	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J40	1	
115	801-B3800B75	3	CONNECTOR,RCPT ELEC (94375) 357-7129-010 J22	1	
116	637-1526-002	2	CABLE, COAX	1	
	623-1379-001	2	BUSHING, COAX (AP)	1	
117	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J41	1	
118	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J42	1	
119	637-1526-003	2	CABLE, COAX	1	D
	623-1379-001	2	BUSHING, COAX (AP)	2	
120	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J59	1	
121	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J60	1	
122	637-1526-003	2	CABLE, COAX	1	D
	623-1379-001	2	BUSHING, COAX (AP)	2	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-123	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J58	1	
124	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 J57	1	
125	17250	2	CABLE ASSY,PWR (70903) 426-1034-010	1	
126	634-8226-001	2	HARNESS, WIRING W1	1	
	P313-0045-000	2	NUT,PLAIN,HEX SST, 6-32 (77250) 313-0045-000 (AP)	4	
	MS35649-244	2	NUT,PLAIN,HEX SST, 4-40 (96906) 313-0043-000 (AP)	2	
	310-0071-000	2	WASHER,LOCK SST, 0.151 ID X 0.239 OD (79807) (AP)	4	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	2	
	MS51957-30	2	SCREW,MACH SST, 6-32 X 1/2 (96906) 343-0171-000 (AP)	4	
	MS51957-15	2	SCREW,MACH STL, 4-40 X 3/8 (96906) 343-0135-000 (AP)	2	
127	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C47	1	
128	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C46	1	
129	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C49	1	
130	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C48	1	
131	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C39	1	
132	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C38	1	
133	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C37	1	
134	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C36	1	
135	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C35	1	
136	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W1C34	1	
137	403	3	TERMINAL,LUG (79963) 304-1089-000	2	
138	353-18-12-001	3	TERMINAL STRIP (71785) 367-0020-000 W1TB1	1	
139	634-8227-001	2	HARNESS, WIRING W2	1	
	P313-0045-000	2	NUT,PLAIN,HEX SST, 6-32 (77250) 313-0045-000 (AP)	4	
	MS35649-244	2	NUT,PLAIN,HEX SST, 4-40 (96906) 313-0043-000 (AP)	2	
	310-0071-000	2	WASHER,LOCK SST, 0.151 ID X 0.239 OD (79807) (AP)	4	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	2	
	MS51957-30	2	SCREW,MACH SST, 6-32 X 1/2 (96906) 343-0171-000 (AP)	4	
	MS51957-15	2	SCREW,MACH STL, 4-40 X 3/8 (96906) 343-0135-000 (AP)	2	
	642-2455-001	2	GUARD, CABLE (AP)	1	
	630-2189-001	2	GUARD, CABLE (AP)	1	
	115-0260-003	2	SPACER (74970) 150-1012-030 (AP)	4	
140	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C51	1	
141	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C50	1	
142	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C45	1	
143	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C44	1	
144	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C43	1	
145	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C42	1	
146	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C41	1	
147	CK63AW103M	3	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 W2C40	1	
148	403	3	TERMINAL,LUG (79963) 304-1089-000	2	
149	353-18-12-001	3	TERMINAL STRIP (71785) 367-0020-000 W2TB2	1	
150	634-8225-001	2	CABLE ASSY, SPEAKER W3	1	

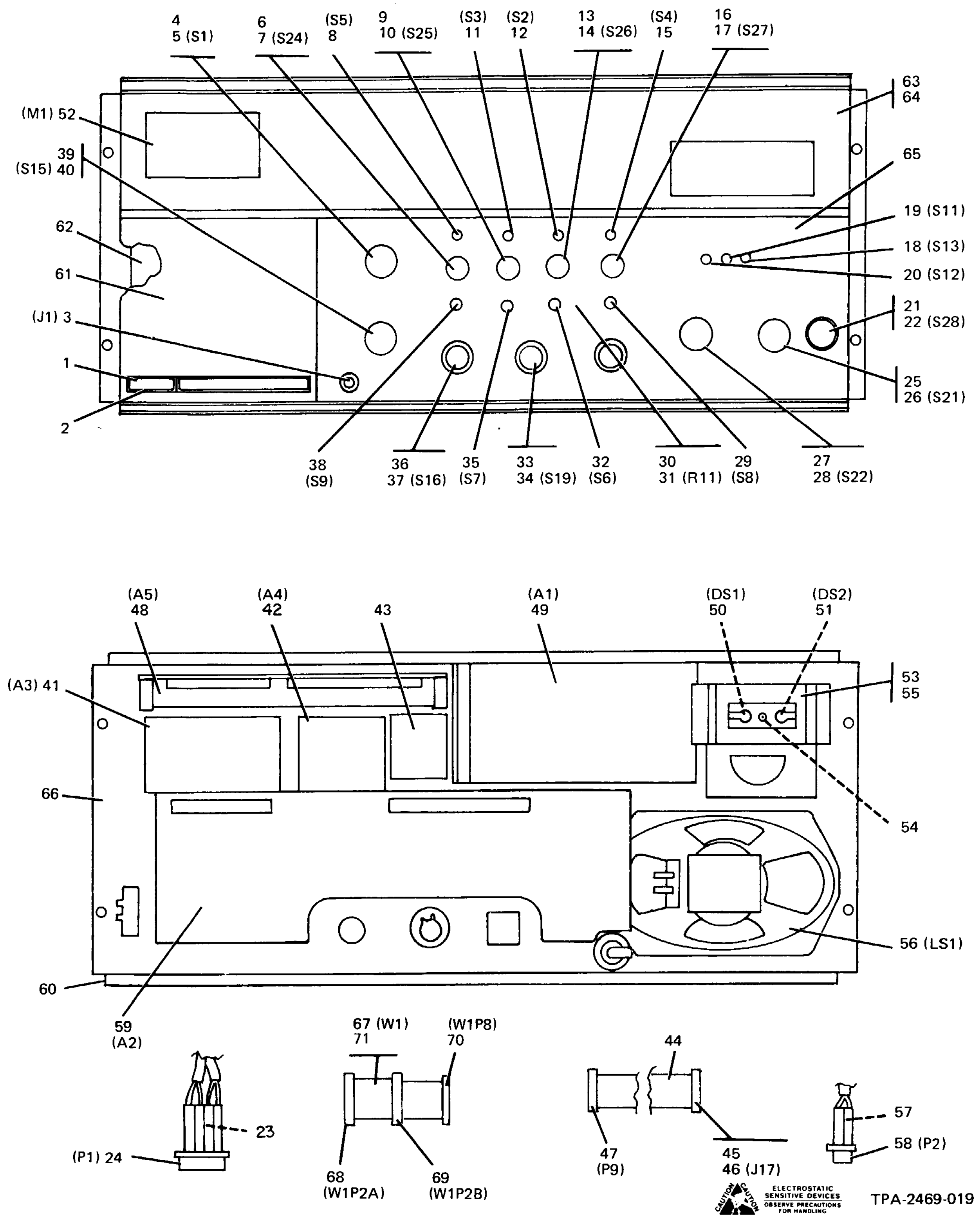
GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-	P313-0045-000	2	NUT,PLAIN,HEX SST, 6-32 (77250) 313-0045-000 (AP)	4	
	310-0071-000	2	WASHER,LOCK SST, 0.151 ID X 0.239 OD (79807) (AP)	4	
	MS51957-30	2	SCREW,MACH SST, 6-32 X 1/2 (96906) 343-0171-000 (AP)	4	
151	805-014X5V0103Z	3	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 W3C53	1	
152	805-014X5V0103Z	3	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 W3C52	1	
153	60617-1	3	SOCKET CONTACT (00779) 372-5884-060	2	
154	1-480318-0	3	HOUSING,SOCKET (00779) 372-5884-330 W3J47	1	
155	600J	3	JUMPER,BARRIER (75382) 367-0854-000	1	
156	353-18-05-001	3	TERMINAL STRIP (71785) 367-0013-000 W3TB3	1	
157	403	2	TERMINAL,LUG (79963) 304-1089-000	1	
	MS35649-244	2	NUT,PLAIN,HEX SST, 4-40 (96906) 313-0043-000 (AP)	1	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	1	
	MS51957-15	2	SCREW,MACH STL, 4-40 X 3/8 (96906) 343-0135-000 (AP)	1	
158	P500	2	BUTTON,PL PLSTC (28520) 308-0312-020	2	A,B
159	637-9121-001	2	SUPPORT, RADIO	1	
	P325-0051-000	2	SCREW,MACH STL, 10-32UNF-2A X 1/2 (77250) 325-0051-000 (AP)	2	
160	642-2462-001	2	PANEL, REAR	1	
	MS51958-61	2	SCREW,MACH SST, 10-32 X 3/8 (96906) 343-0226-000 (AP)	2	
	MS51957-29	2	SCREW,MACH SST, 6-32 X 7/16 (96906) 343-0170-000 (AP)	7	
	P343-0311-000	2	SCREW,MACH NP BRS, 8-32 X 1/2 (77250) 343-0311-000 (AP)	1	
	MS35338-99	2	WASHER,SPRING CD PL BRZ, 0.168 ID X 0.293 OD (96906) 310-0098-000 (AP)	1	
	310-0057-000	2	WASHER,FLAT BRS, 0.172 ID X 0.375 OD (79807) (AP)	1	
161	333-1455-030	3	NUT,SLFLKG CD PL STL, 6-32 (27687)	9	
162	333-1455-040	3	NUT,SLFLKG CD PL STL, 8-32 (27687)	1	
163	642-2462-002	3	PANEL, REAR	1	
164	634-8200-001	2	PANEL ASSEMBLY, FRONT A2 (SEE FIG 2)	1	A,B
164	634-8200-002	2	PANEL ASSEMBLY, FRONT A2 (SEE FIG 2)	1	C
164	634-8200-003	2	PANEL ASSEMBLY, FRONT A2 (SEE FIG 2)	1	D
164	634-8200-004	2	PANEL ASSEMBLY, FRONT A2 (SEE FIG 2)	1	E,F
165	635-9616-001	2	FLANGE, CHASSIS MTG	2	
	P334-0268-000	2	NUT,PLAIN,HEX SST, 10-32 (77250) 334-0268-000 (AP FOR 164,165)	4	
	MS35338-138	2	WASHER,LOCK SST, 0.194 ID X 0.334 OD (96906) 310-0284-000 (AP FOR 164,165)	4	
	541-6104-002	2	SPACER, SLEEVE (AP FOR 164,165)	4	
	P312-0116-000	2	STUD,CONT THD STL, 10-32 X 1 (77250) 312-0116-000 (AP FOR 164,165)	4	
166	280-2745-020	2	LABEL,PRESS SENS (12998)	1	B,C,D,E F
167	23071-4	2	CARD GUIDE,PC (18677) 150-0810-040	26	
168	646-7013-001	2	PARTITION	1	
169	646-7014-001	2	SHEET, INSULATING	2	
	MS35649-244	2	NUT,PLAIN,HEX SST, 4-40 (96906) 313-0043-000 (AP FOR 168,169)	4	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP FOR 168,169)	4	
	MS51957-13	2	SCREW,MACH STL, 4-40 X 1/4 (96906) 343-0133-000 (AP FOR 168,169)	4	
170	634-8177-001	2	CHASSIS, ELEC EQPT	1	
171	333-1455-050	3	NUT,SLFLKG CD PL STL, 10-32 (27687)	10	
172	68NA7-68-62	3	NUT,SLFLKG,PL AL, 6-32 (72962) 333-5620-000	4	
	MS20470AD3-4	3	RIVET,SOLID AL, 3/32 DIA X 1/4 (96906) 305-1155-000 (AP)	8	
173	333-1455-030	3	NUT,SLFLKG CD PL STL, 6-32 (27687)	4	
174	634-8177-013	3	SPACER	2	
175	MS21209C0620	3	INSERT,SCR THD SST, 6-32 X 0.276 (96906) 012-2125-000	11	
176	638-4566-001	3	PLATE, INSULATING	3	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-177	MS21266-2N	3	PLASTIC CHANNEL (96906) 150-0175-000	AR	
178	634-8177-002	3	CHASSIS, WELDED	1	
179	637-1769-001	2	KIT, MAINTENANCE	1	
180	637-1777-001	3	INSTRUCTION SHEET	1	
181	024-0057-000	3	KEY,SCH SCR (08664)	1	
182	024-0058-000	3	KEY,SCH SCR (08664)	1	
183	AGC250-1	3	FUSE,CRTG (71400) 264-0721-000	5	
184	AGC250-2	3	FUSE,CRTG (71400) 264-0723-000	5	
185	MS25237-327-15	3	LAMP,INCAND (96906) 262-1106-000	2	

GROUP ASSEMBLY PARTS LIST



Front Panel Assembly A2
Figure 2

GROUP ASSEMBLY PARTS LIST

FIG- ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-	634-8200-001	1	PANEL ASSEMBLY, FRONT A2 [ESDS] [SEE FIG 1-164 FOR NHA]	REF	G
	634-8200-002	1	PANEL ASSEMBLY, FRONT A2 [ESDS] [SEE FIG 1-164 FOR NHA]	REF	H
	634-8200-003	1	PANEL ASSEMBLY, FRONT A2 [ESDS] [SEE FIG 1-164 FOR NHA]	REF	J
	634-8200-004	1	PANEL ASSEMBLY, FRONT A2 [ESDS] [SEE FIG 1-164 FOR NHA]	REF	K
1	623-9008-001	2	INSERT,HOUSEMARK	1	
2	632-5201-001	2	HOLDER,INSERT	1	
	P313-0132-000	2	NUT,PLAIN,HEX SST, 4-40 (77250) 313-0132-000 (AP)	2	
	MS51959-12	2	SCREW,MACH SST, 4-40 X 3/16 (96906) 342-0043-000 (AP)	2	
3	M641-6-1	2	JACK,TEL (81349) 358-1040-000 A2J1	1	
4	RB67-1DCML	2	KNOB,RING SKRTD (86797) 281-0650-010	1	
5	280565BF1	2	SWITCH,RTRY (76854) 259-7201-250 A2S1	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
6	RB67-0ML	2	KNOB,ROUND (86797) 281-0650-140	1	
7	MRB1-10SPC	2	SWITCH,RTRY (95146) 259-2933-010 A2S24	1	
8	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S5	1	
9	RB67-0ML	2	KNOB,ROUND (86797) 281-0650-140	1	
10	MRB1-10SPC	2	SWITCH,RTRY (95146) 259-2933-010 A2S25	1	
11	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S3	1	
12	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S2	1	
13	RB67-0ML	2	KNOB,ROUND (86797) 281-0650-140	1	
14	MRB1-10SPC	2	SWITCH,RTRY (95146) 259-2933-010 A2S26	1	
15	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S4	1	
16	RB67-0ML	2	KNOB,ROUND (86797) 281-0650-140	1	
17	MRB1-10SPC	2	SWITCH,RTRY (95146) 259-2933-010 A2S27	1	
18	7207P3PD9V40B	2	SWITCH,TGL (09353) 266-5415-170 A2S13	1	
19	7101P3PD9V40B	2	SWITCH,TGL (09353) 266-5415-130 A2S11	1	J
20	7101P3PD9V40B	2	SWITCH,TGL (09353) 266-5415-130 A2S12	1	J
21	F1-15H4	2	BUTTON,PUSH (31918) 266-7508-210	1	
22	NE15F01-0003-00	2	SWITCH,PUSH (31918) 266-7524-010 A2S28	1	
	MS51957-3B	2	SCREW,MACH SST, 2-56 X 1/4 (96906) 343-0072-000 (AP)	4	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	
	540-9006-003	2	POST,ELEC-MECH (AP)	2	
23	60618-1	2	PIN CONTACT (00779) 372-5884-200	4	
24	1-480426-0	2	HOUSING,PIN (00779) 372-5884-480 A2P1	1	
25	RB67-1DCML	2	KNOB,RING SKRTD (86797) 281-0650-010	1	
26	280567BF1	2	SWITCH,ROTARY (76854) 259-7201-270 A2S21	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
27	RB67-1DCML	2	KNOB,RING SKRTD (86797) 281-0650-010	1	
28	280568BF1	2	SWITCH,ROTARY (76854) 259-7201-280 A2S22	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
29	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S8	1	
30	RB67-1DCML	2	KNOB,RING SKRTD (86797) 281-0650-010	1	
31	RV2NAYSD103B	2	RESISTOR,VAR 10K, 20%, 1W (81349) 380-2507-000 A2R11	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
32	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S6	1	
33	RB67-1-0ML9	2	KNOB,CONCENTRIC (86797) 281-0650-030	1	
34	259-8017-030	2	SWITCH,RTRY (71590) A2S19	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
35	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S7	1	
36	RB67-1-0ML9	2	KNOB,CONCENTRIC (86797) 281-0650-030	1	
37	382-0047-030	2	RESISTOR,VAR CERMET,10K,25K,10%,1W,2SECT (01121) A2S16	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
38	7101P4PD9V40B	2	SWITCH,TGL (09353) 266-5415-800 A2S9	1	
39	RB67-1DCML	2	KNOB,RING SKRTD (86797) 281-0650-010	1	
40	280566BF1	2	SWITCH,ROTARY (76854) 259-7201-260 A2S15	1	
	P313-0064-000	2	NUT,PLAIN,HEX SST, 3/8-32 (77250) 313-0064-000 (AP)	1	
41	635-0830-002	2	SWITCHBOARD, FREQUENCY A2A3	1	G,J
41	635-0830-001	2	SWITCHBOARD, FREQUENCY A2A3	1	H,K
	MS35649-224	2	NUT,PLAIN,HEX SST, 2-56 (96906) 313-0037-000 (AP)	4	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	

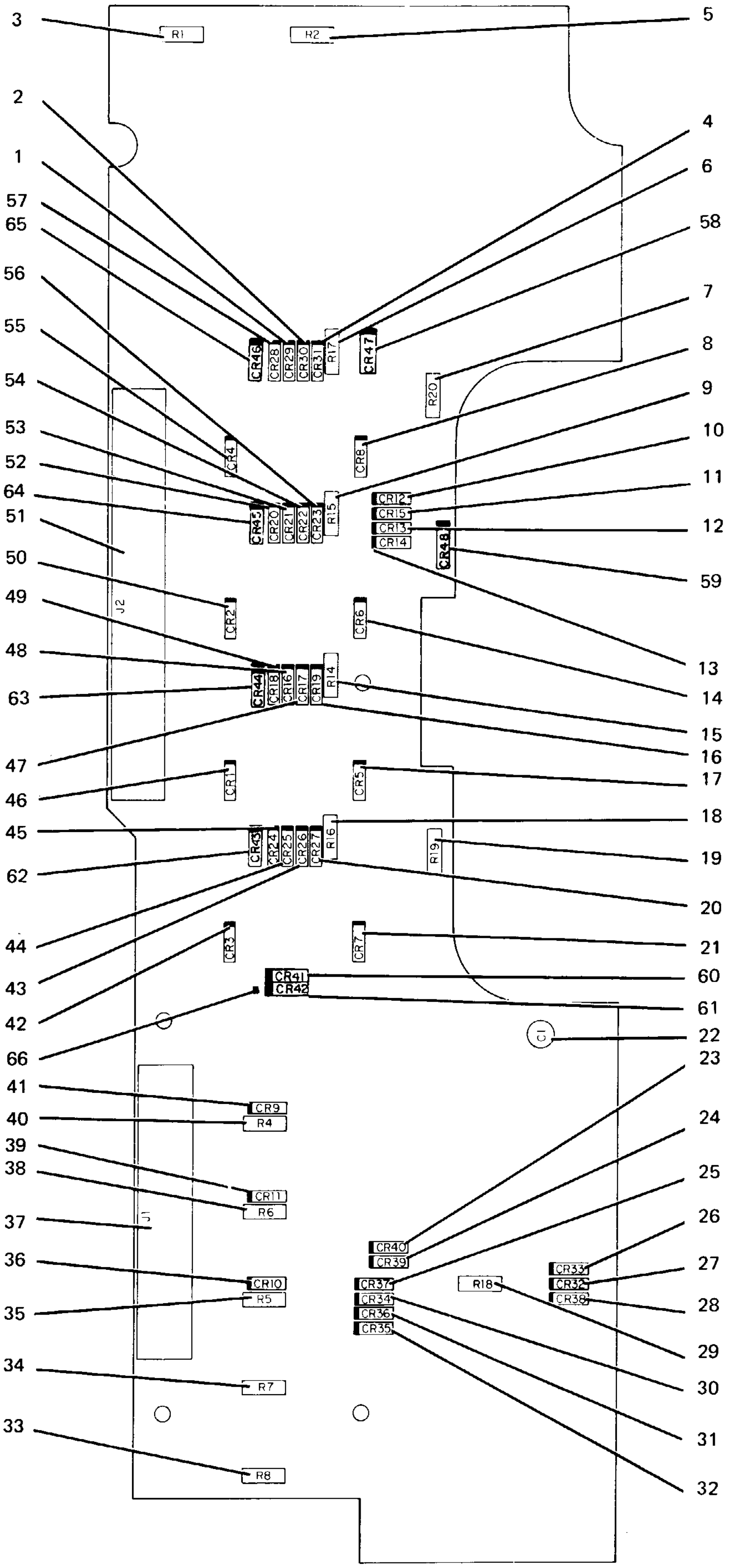
GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-	MS51957-5B	2	SCREW,MACH SST, 2-56 X 3/8 (96906) 343-0674-000 (AP)	4	
42	638-6437-001	2	SWITCHBOARD, VBFO A2A4	1	J
	MS35649-224	2	NUT,PLAIN,HEX SST, 2-56 (96906) 313-0037-000 (AP)	4	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	
	MS51957-5B	2	SCREW,MACH SST, 2-56 X 3/8 (96906) 343-0674-000 (AP)	4	
43	634-8273-001	2	COVER, PLATE	1	G,H,K
44	637-3761-001	2	CABLE, DISPLAY-BFO	1	J
	MS35649-224	2	NUT,PLAIN,HEX SST, 2-56 (96906) 313-0037-000 (AP FOR 43,44)	4	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP FOR 43,44)	4	
	MS51957-5B	2	SCREW,MACH SST, 2-56 X 3/8 (96906) 343-0674-000 (AP FOR 43,44)	4	
45	88089-4	3	CONNECTOR,RCPT ELEC (00779) 372-2653-140	1	
46	499440-3	3	CONNECTOR,RCPT ELEC (00779) 372-2653-130 A2J17	1	
47	88377-4	3	CONNECTOR,RCPT ELEC (00779) 372-2648-040 A2P9	1	
48	637-1781-006	2	DISPLAY, FREQUENCY A2A5 [ESDS]	1	H,K
48	637-1781-008	2	DISPLAY, FREQUENCY A2A5 [ESDS]	1	J
	MS51957-3	2	SCREW,MACH CD PL STL, 2-56 X 1/4 (96906) 343-0124-000 (AP)	4	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	
	310-6320-000	2	WASHER,FLAT SST, 0.092 X 0.219 OD (79807) (AP)	4	
	637-1546-000	2	BRACKET, CKT BD (AP)	2	
49	635-0625-013	2	DISPLAY, STATUS-LED A2A1	1	
	MS51957-3B	2	SCREW,MACH SST, 2-56 X 1/4 (96906) 343-0072-000 (AP)	8	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	
	540-9006-003	2	POST,ELEC-MECH (AP)	4	
50	MS25237-327-15	2	LAMP,INCAND (96906) 262-1106-000 A2DS1	1	
51	MS25237-327-15	2	LAMP,INCAND (96906) 262-1106-000 A2DS2	1	
	P343-0291-000	2	SCREW,MACH NP BRS, 4-40 X 3/4 (77250) 343-0291-000 (AP FOR 50,51)	1	
	340-1010-000	2	SPRING,HELICAL (91314) (AP FOR 50,51)	1	
	P313-0051-000	2	NUT,PLAIN,HEX NP BRS, 4-40 (77250) 313-0051-000 (AP FOR 50,51)	4	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP FOR 50,51)	2	
	MS25036-144	2	TERMINAL,LUG (96906) 304-1251-000 (AP FOR 50,51)	3	
	310-6340-000	2	WASHER,FLAT SST, 0.125 ID X 0.281 OD (79807) (AP FOR 50,51)	2	
	MS51957-18B	2	SCREW,MACH SST, 4-40 X 5/8 (96906) 343-0024-000 (AP FOR 50,51)	2	
	637-1779-000	2	BLOCK,INSULATOR (AP FOR 50,51)	1	
52	7521	2	METER,DC AMP 45 OHMS RES (65092) 450-0151-010 A2M1	1	
53	635-9614-001	2	BRACKET,LIGHT	1	
	P313-0051-000	2	NUT,PLAIN,HEX NP BRS, 4-40 (77250) 313-0051-000 (AP FOR 52,53)	1	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP FOR 52,53)	1	
	MS25036-144	2	TERMINAL,LUG (96906) 304-1251-000 (AP FOR 52,53)	4	
	P343-0285-000	2	SCREW,MACH NP BRS, 4-40 X 1/4 (77250) 343-0285-000 (AP FOR 52,53)	1	
	P343-0291-000	2	SCREW,MACH NP BRS, 4-40 X 3/4 (77250) 343-0291-000 (AP FOR 52,53)	2	
54	333-1455-020	3	NUT,SLFLKG CD PL STL, 4-40 (27687)	1	
55	635-9614-002	3	BRACKET,LIGHT	1	
56	X8014-1	2	LOUDSPEAKER,PM (14208) 271-0250-010 A2LS1	1	
	MS35649-264	2	NUT,PLAIN,HEX CRES,6-32 (96906) 313-0002-000 (AP)	4	
	MS51957-28B	2	SCREW,MACH SST, 6-32 X 3/8 (96906) 343-0034-000 (AP)	4	
57	60618-1	2	PIN CONTACT (00779) 372-5884-200	2	
58	1-480319-0	2	HOUSING,PIN (00779) 372-5884-320 A2P2	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-59	638-6873-002	2	MOUNTING BOARD, SWITCH A2A2 (SEE FIG 3)	1	G,J,K
59	638-6873-001	2	MOUNTING BOARD, SWITCH A2A2 (SEE FIG 3)	1	H
	MS51957-3B	2	SCREW,MACH SST, 2-56 X 1/4 (96906) 343-0072-000 (AP)	8	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	4	
	540-9096-003	2	POST,ELEC-MECH (AP)	4	
60	635-9601-001	2	BAR,EDGE-PANEL	2	
	MS51957-13B	2	SCREW,MACH SST, 4-40 X 1/4 (96906) 343-0019-000 (AP)	8	
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP)	8	
61	635-9602-001	2	GRILL,SPEAKER	1	
62	637-1547-001	2	BAFFLE,SPEAKER	1	
63	635-9625-007	2	PANEL,OVERLAY-UPPER	1	G,H,K
63	637-3776-003	2	PANEL,OVERLAY-UPPER	1	J
64	635-9625-004	3	PANEL	1	
65	637-3788-001	2	PANEL,OVERLAY-LOWER	1	G,H
65	637-3788-002	2	PANEL,OVERLAY-LOWER	1	J
	MS51957-13B	2	SCREW,MACH SST, 4-40 X 1/4 (96906) 343-0019-000 (AP FOR 61-65)	4	K
	MS35338-135	2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (96906) 310-0279-000 (AP FOR 61-65)	4	
	635-9615-001	2	SUPPORT,PANEL (AP FOR 61-65)	1	
66	637-3784-001	2	PANEL,SWITCH MOUNTING		
67	634-8289-001	2	ACCESSORY KIT, WIRE HARNESS A2W1	1	H,J,K
68	88379-7	3	CONNECTOR,RCPT ELEC (00779) 372-2648-070 A2W1P2A	1	
69	88481-7	3	CONNECTOR,ELEC (00779) 372-2654-030 A2W1P2B	1	
70	88377-6	3	CONNECTOR,RCPT ELEC (00779) 372-2648-060 A2W1P8	1	
71	MTF5072-40BL	3	CABLE,SP,ELEC 40 COND, 2.050IN WD (17217) 424-0862-080	AR	

GROUP ASSEMBLY PARTS LIST



TPA-2484-019

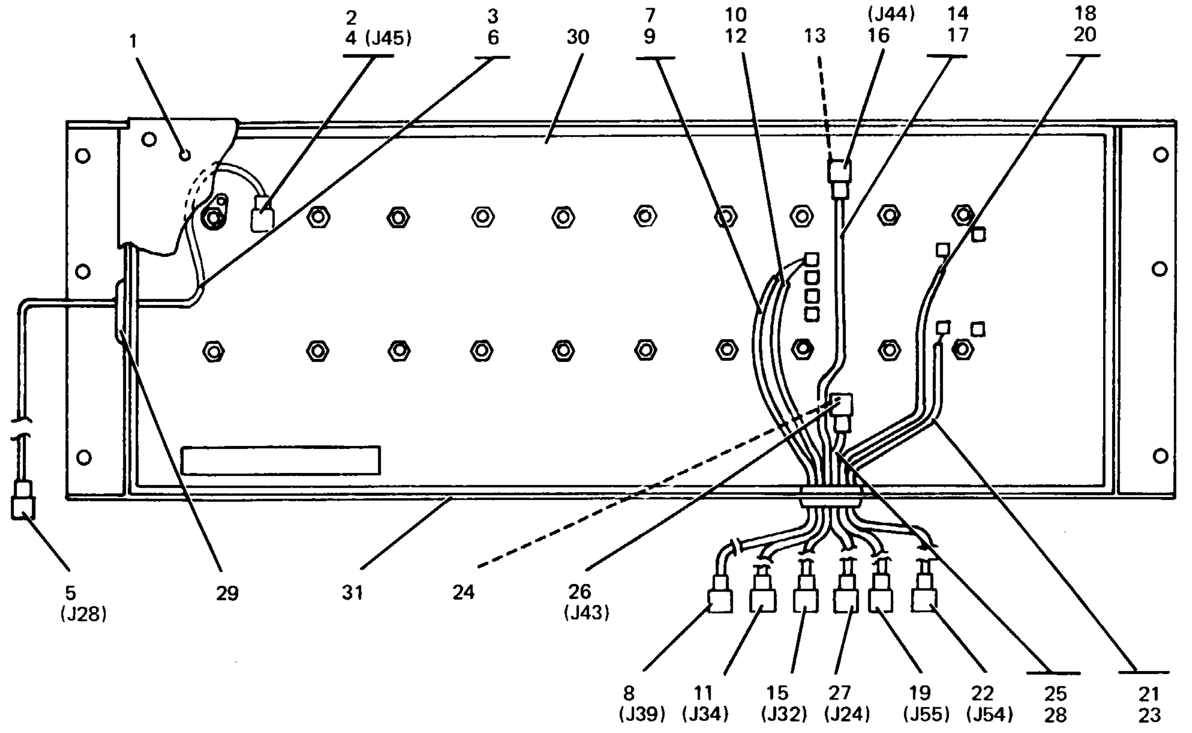
Switch Mounting Board A2A2
Figure 3

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
3-	638-6873-001	1	MOUNTING BOARD, SWITCH A2A2 (SEE FIG 2-59 FOR NHA)	REF	L
	638-6873-002	1	MOUNTING BOARD, SWITCH A2A2 (SEE FIG 2-59 FOR NHA)	REF	M
1	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR29	1	
2	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR30	1	
3	RN55D1540F	2	RESISTOR,FXD FILM, 154 OHMS, 1%, 1/8W (81349) 705-0957-000 A2A2R1	1	
4	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR31	1	L
5	RN55D16R9F	2	RESISTOR,FXD FILM, 16.9 OHMS, 1%, 1/8W (81349) 705-0911-000 A2A2R2	1	
6	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R17	1	
7	RCR07G560KS	2	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W (81349) 745-0704-000 A2A2R20	1	
8	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR8	1	
9	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R15	1	
10	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR12	1	
11	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR15	1	
12	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR13	1	
13	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR14	1	
14	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR6	1	
15	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R14	1	
16	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR19	1	L
17	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR5	1	
18	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R16	1	
19	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R19	1	
20	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR27	1	L
21	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR7	1	
22	199D226X0015DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 15V (56289) 184-9102-140 A2A2C1	1	
23	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR40	1	
24	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR39	1	
25	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR37	1	
26	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR33	1	
27	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR32	1	
28	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR38	1	
29	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R18	1	
30	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR34	1	
31	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR36	1	
32	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR35	1	
33	RCR07G105KS	2	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W (81349) 745-0857-000 A2A2R8	1	
34	RCR07G104KS	2	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (81349) 745-0821-000 A2A2R7	1	
35	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R5	1	
36	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR10	1	
37	87478-5	2	HOUSING,CONN,EL (00779) 372-0043-450 A2A2J1	1	
38	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R6	1	
39	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR11	1	
40	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A2A2R4	1	
41	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR9	1	
42	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR3	1	
43	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR26	1	
44	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR25	1	
45	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR24	1	L
46	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR1	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
3-47	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR17	1	
48	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR16	1	
49	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR18	1	L
50	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR2	1	
51	87478-8	2	HOUSING,CONN,EL (00779) 372-0043-530 A2A2J2	1	
52	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR20	1	L
53	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR21	1	
54	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR22	1	
55	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR4	1	
56	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR23	1	L
57	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR28	1	L
58	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR47	1	M
59	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR48	1	M
60	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR41	1	M
61	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR42	1	M
62	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR43	1	M
63	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR44	1	M
64	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR45	1	M
65	1N4454GE	2	SEMICOND DEVICE (03508) 353-3644-010 A2A2CR46	1	M
66	372-2601-026	2	CONTACT,ELEC	4	M

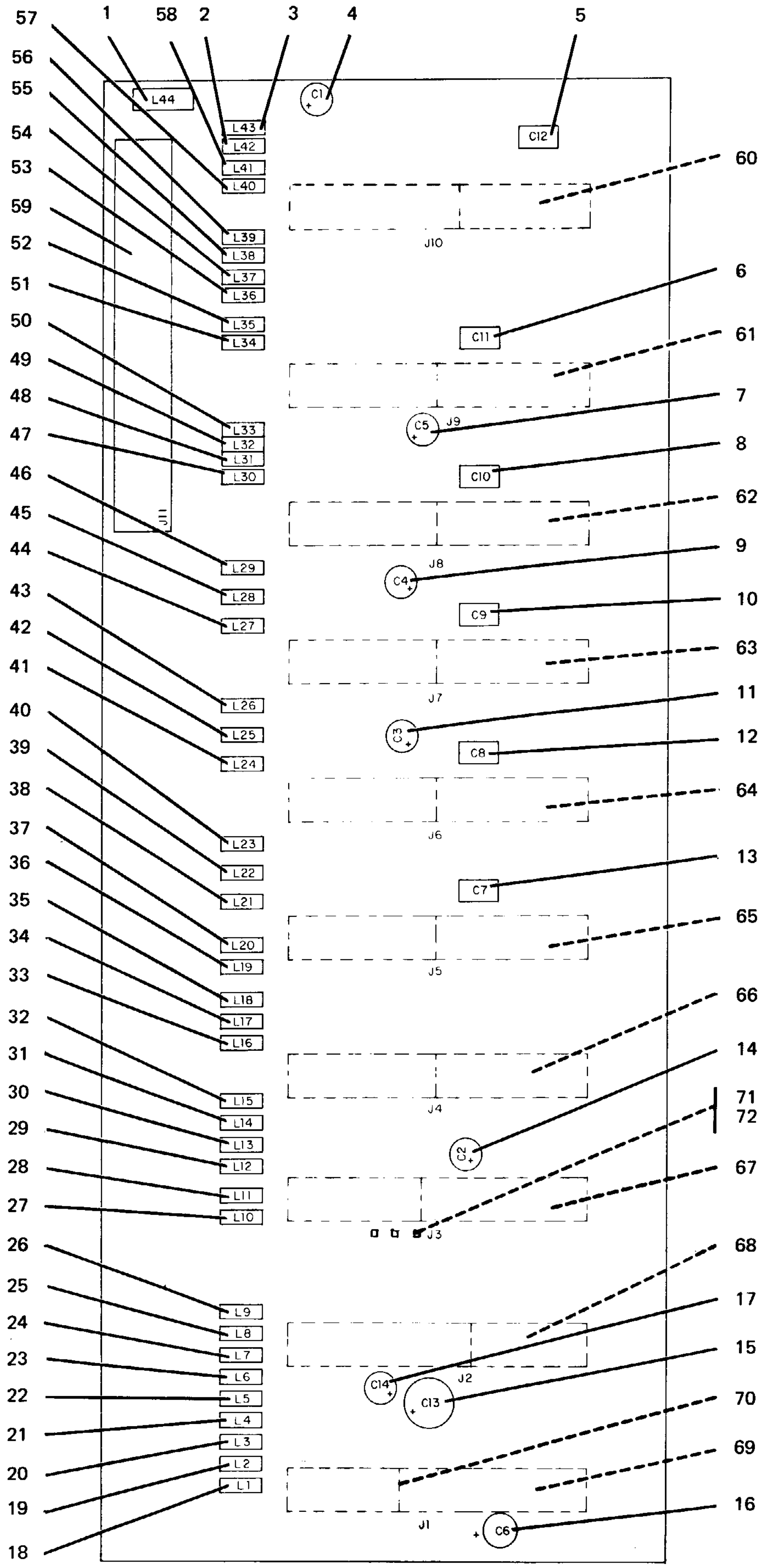


Synthesizer Chassis Assembly A24
Figure 4

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
4-	634-8201-001	1	CHASSIS ASSEMBLY, SYNTHESIZER A24 (SEE FIG 1-45 FOR NHA)	REF	
1	634-8186-001	2	COVER, BOTTOM	1	
	MS51957-3	2	SCREW,MACH CD PL STL, 2-56 X 1/4 (96906) 343-0124-000 (AP)	6	
	MS35338-134	2	WASHER,LOCK SST, 0.088 ID X 0.172 OD (96906) 310-0275-000 (AP)	6	
2	623-1379-001	2	BUSHING	1	
3	637-1526-003	2	CABLE ASSY, RF COAXIAL	1	
	4007-4HT	2	TERMINAL,LUG (77147) 304-0015-000 (AP)	1	
4	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J45	1	
5	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J28	1	
6	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
7	637-1529-001	2	CABLE ASSY, RF COAXIAL	1	
8	52-312-9094	3	JACK,RA,BLKHD (98291) 357-7207-320 A24J39	1	
9	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
10	637-1529-001	2	CABLE ASSY, RF COAXIAL	1	
11	52-312-9094	3	JACK,RA,BLKHD (98291) 357-7207-320 A24J34	1	
12	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
13	623-1379-001	2	BUSHING	1	
14	637-1526-006	2	CABLE ASSY, RF COAXIAL	1	
15	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J32	1	
16	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J44	1	
17	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
18	637-1529-001	2	CABLE ASSY, RF COAXIAL	1	
19	52-312-9094	3	JACK,RA,BLKHD (98291) 357-7207-320 A24J55	1	
20	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
21	637-1529-001	2	CABLE ASSY, RF COAXIAL	1	
22	52-312-9094	3	JACK,RA,BLKHD (98291) 357-7207-320 A24J54	1	
23	RG178BU	3	CABLE,RF (81349) 425-1538-000	AR	
24	623-1379-001	2	BUSHING	1	
25	637-1526-003	2	CABLE ASSY, RF COAXIAL	1	
26	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J43	1	
27	52-312-9040	3	CONNECTOR,RCPT ELEC (98291) 357-7207-220 A24J24	1	
28	425-1528-000	3	CABLE,SP,ELEC (71124)	AR	
29	7-50-60	2	GROMMET,RBR (77969) 201-0088-000	2	
30	638-6973-001	2	SIDEBOARD, SYNTHESIZER (SEE FIG 5)	1	
	P313-0156-00	2	NUT,PLAIN,HEX NP BRS, 4-40 (77250) 313-0156-000 (AP)	22	
	MS35338-97	2	WASHER,SPRING CD PL BRZ, 0.115 ID X 0.209 OD (96906) 310-0095-000 (AP)	22	
	DIE845	2	WASHER,FLAT SST, 0.119 ID X 0.218 OD (72606) 310-0460-000 (AP)	22	
	P343-0289-000	2	SCREW,MACH NP BRS, 4-40 X 1/2 (77250) 343-0289-000 (AP)	22	
31	634-8178-001	2	CHASSIS,PRSD	1	

GROUP ASSEMBLY PARTS LIST



TPA-2489-019

Synthesizer Sideboard (P/O A24)
Figure 5

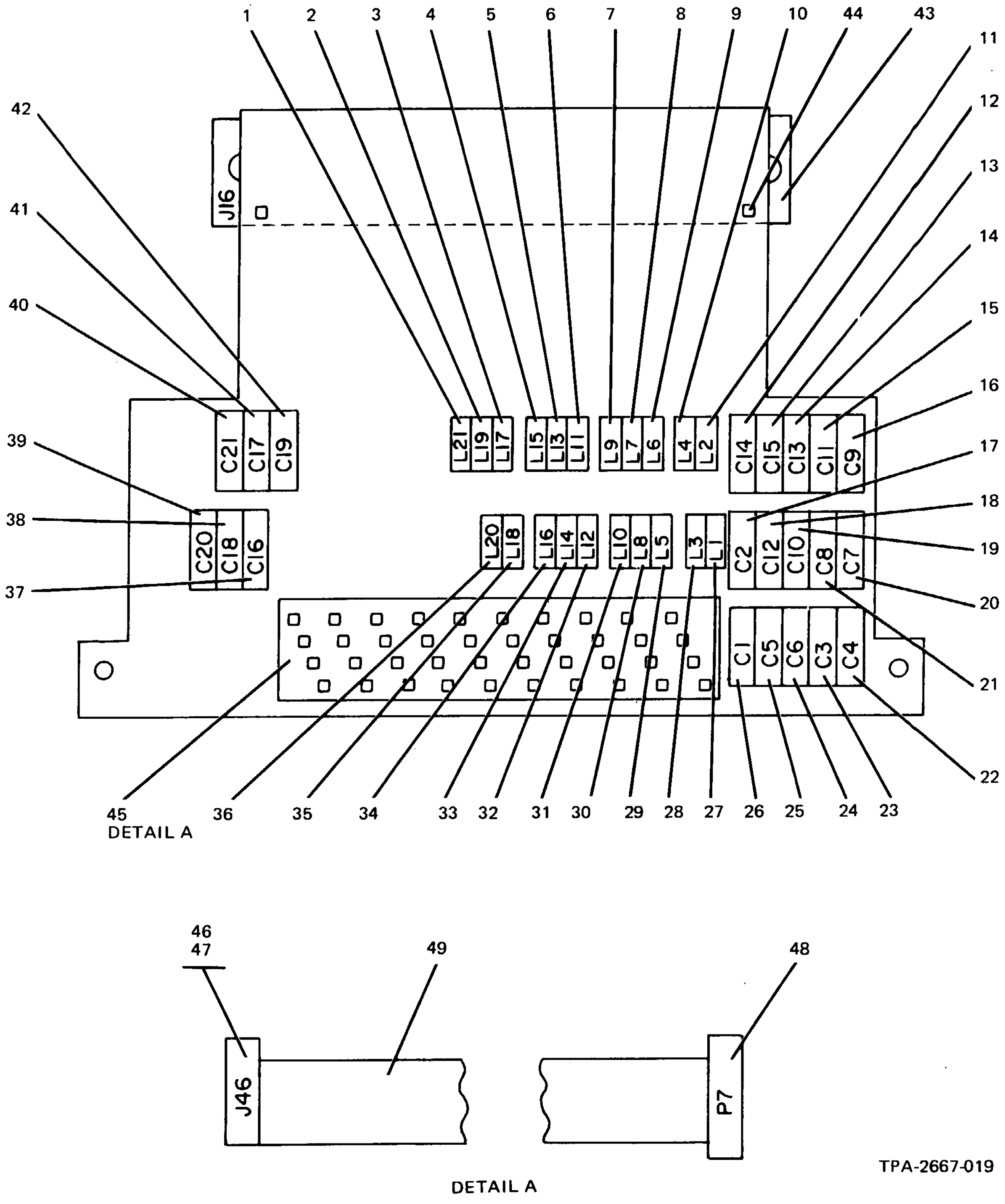
GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5-	638-6973-001	1	SIDEBOARD, SYNTHESIZER (P/O A24) (SEE FIG 4-30 FOR NHA)	REF	
1	MS75089-11	2	COIL,RF 100UH (96906) 240-2715-370 A24L44	1	
2	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L42	1	
3	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L43	1	
4	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C1	1	
5	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C12	1	
6	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C11	1	
7	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C5	1	
8	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C10	1	
9	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C4	1	
10	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C9	1	
11	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C3	1	
12	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C8	1	
13	CD5FY151J0	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (93790) 912-4141-400 A24C7	1	
14	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C2	1	
15	199D1009	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 25V (56289) 184-9102-260 A24C13	1	
16	199D475X0035DE3	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-830 A24C6	1	
17	199D336X0010DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (56289) 184-9102-090 A24C14	1	
18	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L1	1	
19	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L2	1	
20	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L3	1	
21	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L4	1	
22	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L5	1	
23	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L6	1	
24	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L7	1	
25	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L8	1	
26	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L9	1	
27	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L10	1	
28	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L11	1	
29	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L12	1	
30	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L13	1	
31	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L14	1	
32	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L15	1	
33	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L16	1	
34	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L17	1	
35	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L18	1	
36	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L19	1	
37	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L20	1	
38	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L21	1	
39	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L22	1	
40	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L23	1	
41	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L24	1	
42	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L25	1	
43	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L26	1	
44	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L27	1	
45	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L28	1	
46	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L29	1	
47	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L30	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5-48	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L31	1	
49	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L32	1	
50	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L33	1	
51	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L34	1	
52	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L35	1	
53	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L36	1	
54	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L37	1	
55	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L38	1	
56	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L39	1	
57	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L40	1	
58	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A24L41	1	
59	87478-8	2	HOUSING,CONN,EL (00779) 372-0043-530 A24J11	1	
60	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J10	1	
61	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J9	1	
62	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J8	1	
63	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J7	1	
64	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J6	1	
65	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J5	1	
66	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J4	1	
67	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J3	1	
68	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J2	1	
69	3VN10-1CDD3	2	CONNECTOR,RCPT ELEC (05574) 372-7086-010 A24J1	1	
70	091-0071-000	2	CONNECTOR,RCPT ELEC (05574) 372-7600-270	10	
71	372-2601-012	2	CONTACT,ELEC	8	
72	M153SBRTTIN	2	EYELET,MTLC COP, 0.047 DIA X 0.085 (23730) 307-1270-000	8	

GROUP ASSEMBLY PARTS LIST



RFI Filter A27
Figure 6

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-	637-2712-004	1	FILTER, RFI A27 (SEE FIG 1-89 FOR NHA)	REF	
1	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L21	1	
2	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L19	1	
3	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L17	1	
4	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L15	1	
5	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L13	1	
6	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L11	1	
7	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L9	1	
8	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L7	1	
9	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L6	1	
10	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L4	1	
11	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L2	1	
12	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C14	1	
13	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C15	1	
14	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C13	1	
15	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C11	1	
16	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C9	1	
17	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C2	1	
18	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C12	1	
19	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C10	1	
20	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C7	1	
21	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C8	1	
22	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C4	1	
23	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C3	1	
24	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C6	1	
25	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C5	1	
26	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C1	1	
27	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L1	1	
28	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L3	1	
29	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L5	1	
30	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L8	1	
31	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L10	1	
32	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L12	1	
33	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L14	1	
34	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L16	1	
35	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L18	1	
36	MS75085-07	2	COIL,RF 100UH (96906) 240-2047-000 A27L20	1	
37	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C16	1	
38	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C18	1	
39	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C20	1	
40	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C21	1	
41	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C17	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-42	805-014X5V0103Z	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 100V (12294) 913-3680-000 A27C19	1	
43	DCU37PBF	2	CONNECTOR,PLUG ELEC (71468) 371-0385-090 A27J16	1	
44	372-2601-010	2	CONTACT,ELEC	2	
45	637-9313-001	2	CABLE, RIBBON	1	
46	88089-1	3	CONNECTOR,RCPT ELEC (00779) 372-2653-160	1	
47	499440-6	3	CONNECTOR,RCPT ELEC (00779) 372-2653-150 A27J46	1	
48	3471-0000	3	CONNECTOR,PLUG ELEC (75037) 372-2634-140 A27P7	1	
49	MTF5072-34BL	3	CABLE,SP,ELEC 34 COND, 1.743IN WD (17217) 424-0862-070	AR	

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BS1225F28PFF	1-78	
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	1-81	
	1-82	
	1-83	
	1-84	
	1-85	
	1-86	
	1-87	10
BW1020F65PAF	1-77	1
CD5FY151J0	5-5	
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	5-10	
	5-12	
	5-13	6
CK63AW103M	1-127	
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	1-145	
	1-146	
	1-147	18
DBM25S	1-55	1
DCU37PBF	6-43	1
DIE845	4-30	22
F1-15H4	2-21	1
MRB1-10SPC	2-7	
	2-10	
	2-14	
	2-17	4
MS20470AD3-4	1-172	8
MS21209C0620	1-175	11
MS21266-2N	1-177	AR
MS25036-101	1-71	7
MS25036-144	1-72	
	2-51	
	2-53	8
MS25237-327-15	1-185	
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MS25237-327-15	2-51	4
MS35338-134	1-15	
	1-89	
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	2-48	
	2-49	
	2-59	
	4-1	41
MS35338-135	1-48	
	1-49	
	1-126	
	1-139	
	1-157	
	1-169	
	2-51	
	2-53	
	2-60	
	2-65	42
MS35338-138	1-165	4
MS35338-97	4-30	22
MS35338-99	1-160	1
MS35649-224	2-41	
	2-42	
	2-44	12
MS35649-244	1-48	
	1-126	
	1-139	
	1-157	
	1-169	11
MS35649-264	2-56	4
MS51957-11	1-1	2
MS51957-13	1-49	
	1-169	20
MS51957-13B	2-60	
	2-65	12
MS51957-15	1-48	
	1-126	
	1-139	
	1-157	7
MS51957-18B	2-51	2
MS51957-28	1-5	
	1-41	
	1-45	21
MS51957-28B	2-56	4
MS51957-29	1-160	7
MS51957-3	1-15	
	1-89	
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	2-44	12
MS51958-61	1-160	2
MS51959-12	2-2	2
MS75085-07	5-2	
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MS75085-07	6-28	
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	6-36	64
MS75089-11	5-1	1
MTF5072-34BL	6-49	AR
MTF5072-40BL	2-71	AR
M153SBRTTIN	5-72	8
M24308-26-1	1-49	
	1-89	4
M641-6-1	2-3	1
NE15F01-0003-00	2-22	1
P312-0116-000	1-165	4
P313-0045-000	1-45	
	1-126	
	1-139	
	1-150	18
P313-0051-000	2-51	
	2-53	5
P313-0064-000	2-5	
	2-26	
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	2-40	7
P313-0132-000	2-2	2
P313-0156-00	4-30	22
P325-0051-000	1-159	2
P334-0268-000	1-165	4
P343-0285-000	2-53	1
P343-0289-000	4-30	22
P343-0291-000	2-51	
	2-53	3
P343-0311-000	1-160	1
P500	1-158	2
RB67-0ML	2-6	
	2-9	
	2-13	
	2-16	4
RB67-1-0ML9	2-33	
	2-36	2
RB67-1DCML	2-4	
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	2-39	5
RCR07G104KS	3-34	1
RCR07G105KS	3-33	1
RCR07G271KS	3-6	
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RCR07G560KS	3-7	1
RG178BU	4-6	AR
	4-9	AR
	4-12	AR
	4-17	AR
	4-20	AR
	4-23	AR
RN55D1540F	3-3	1
RN55D16R9F	3-5	1
RV2NAYSD103B	2-31	1
X8014-1	2-56	1
012-2125-000	1-175	11
024-0057-000	1-181	1
024-0058-000	1-182	1
055-905-0069	1-95	2
091-0071-000	5-70	10
1-480318-0	1-154	1
1-480319-0	2-58	1
1-480426-0	2-24	1
1-88203-1	1-59	
	1-63	2
1N4454GE	3-1	
	3-2	
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1N4454GE	3-60	
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	3-65	48
115-0260-003	1-139	4
150-0175-000	1-177	AR
150-0810-040	1-167	26
150-0836-010	1-46	1
150-1012-030	1-139	4
17250	1-125	1
184-9102-090	5-4	
	5-7	
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	5-11	
	5-14	
	5-17	6
184-9102-140	3-22	1
184-9102-260	5-15	1
184-9102-830	5-16	1
199D1009	5-15	1
199D226X0015DB1	3-22	1
199D336X0010DB1	5-4	
	5-7	
	5-9	
	5-11	
	5-14	
	5-17	6
199D475X0035DE3	5-16	1
201-0088-000	4-29	2
23071-4	1-167	26
240-2047-000	5-2	
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	5-49		280566BF1	2-40	1
	5-50		280567BF1	2-26	1
	5-51		280568BF1	2-28	1
	5-52		281-0650-010	2-4	
	5-53			2-25	
	5-54			2-27	
	5-55			2-30	
	5-56			2-39	5
	5-57		281-0650-030	2-33	
	5-58			2-36	2
	6-1		281-0650-140	2-6	
	6-2			2-9	
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	6-4			2-16	4
	6-5		3VN10-1CDD3	5-60	
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	6-9			5-64	
	6-10			5-65	
	6-11			5-66	
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	6-29			5-69	10
	6-30		304-0015-000	4-3	1
	6-31		304-0127-000	1-71	7
	6-32		304-1089-000	1-137	
	6-33			1-148	
	6-34			1-157	5
	6-35		304-1251-000	1-72	
	6-36	64		2-51	
240-2715-370	5-1	1		2-53	8
259-2933-010	2-7		305-1155-000	1-172	8
	2-10		307-1270-000	5-72	8
	2-14		308-0312-020	1-158	2
	2-17	4	310-0046-000	1-45	6
259-7201-250	2-5	1	310-0057-000	1-160	1
259-7201-260	2-40	1	310-0071-000	1-45	
259-7201-270	2-26	1		1-126	
259-7201-280	2-28	1		1-139	
259-8017-030	2-34	1		1-150	18
262-1106-000	1-185		310-0095-000	4-30	22
	2-50		310-0098-000	1-160	1
	2-51	4	310-0275-000	1-15	
264-0721-000	1-183	5		1-89	
264-0723-000	1-184	5		2-22	
266-5415-130	2-19			2-41	
	2-20	2		2-42	
266-5415-170	2-18	1		2-44	
266-5415-800	2-8			2-48	
	2-11			2-49	
	2-12			2-59	
	2-15			4-1	41
	2-29		310-0279-000	1-48	
	2-32			1-49	
	2-35			1-126	
	2-38	8		1-139	
266-7508-210	2-21	1		1-157	
266-7524-010	2-22	1		1-169	
271-0250-010	2-56	1		2-51	
280-1368-350	1-4	1		2-53	

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310-0284-000	1-165	4		1-45	21
310-0460-000	4-30	22	343-0170-000	1-160	7
310-6320-000	2-48	4	343-0171-000	1-5	
310-6340-000	1-49			1-126	
	2-51	10		1-139	
312-0116-000	1-165	4		1-150	14
313-0002-000	2-56	4	343-0226-000	1-160	2
313-0037-000	2-41		343-0285-000	2-53	1
	2-42		343-0289-000	4-30	22
	2-44	12	343-0291-000	2-51	
313-0043-000	1-48			2-53	3
	1-126		343-0311-000	1-160	1
	1-139		343-0674-000	2-41	
	1-157			2-42	
	1-169	11		2-44	12
313-0045-000	1-45		3471-0000	1-66	
	1-126			1-68	
	1-139			6-48	3
	1-150	18	3484-1000	1-46	1
313-0051-000	2-51		353-18-05-001	1-156	1
	2-53	5	353-18-12-001	1-138	
313-0064-000	2-5			1-149	2
	2-26		353-3644-010	3-1	
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	2-31			3-4	
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	2-37			3-10	
	2-40	7		3-11	
313-0132-000	2-2	2		3-12	
313-0156-000	4-30	22		3-13	
325-0051-000	1-159	2		3-14	
333-1455-020	2-54	1		3-16	
333-1455-030	1-161			3-17	
	1-173	13		3-20	
333-1455-040	1-162	1		3-21	
333-1455-050	1-171	10		3-23	
333-5620-000	1-172	4		3-24	
334-0268-000	1-165	4		3-25	
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3365-50	1-61	AR		3-27	
	1-69	AR		3-28	
340-1010-000	2-51	1		3-30	
342-0043-000	2-2	2		3-31	
343-0019-000	2-60			3-32	
	2-65	12		3-36	
343-0024-000	2-51	2		3-39	
343-0034-000	2-56	4		3-41	
343-0072-000	2-22			3-42	
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	2-59	20		3-44	
343-0124-000	1-15			3-45	
	1-89			3-46	
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343-0131-000	1-1	2		3-49	
343-0133-000	1-49			3-50	
	1-169	20		3-52	
343-0135-000	1-48			3-53	
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	3-60		372-2648-040	1-53	
	3-61			1-54	
	3-62			2-47	3
	3-63		372-2648-050	1-67	1
	3-64		372-2648-060	2-70	1
	3-65	48	372-2648-070	1-58	
357-7129-010	1-103			2-68	2
	1-106		372-2648-080	1-57	
	1-109			1-65	2
	1-112		372-2653-090	1-60	
	1-115	5		1-64	2
357-7207-220	1-102		372-2653-100	1-59	
	1-105			1-63	2
	1-108		372-2653-130	1-52	
	1-111			2-46	2
	1-114		372-2653-140	1-51	
	1-117			2-45	2
	1-118		372-2653-150	6-47	1
	1-120		372-2653-160	6-46	1
	1-121		372-2654-030	2-69	1
	1-123		372-5884-060	1-153	2
	1-124		372-5884-200	2-23	
	4-4			2-57	6
	4-5		372-5884-320	2-58	1
	4-15		372-5884-330	1-154	1
	4-16		372-5884-480	2-24	1
	4-26		372-7086-010	5-60	
	4-27	17		5-61	
357-7207-320	4-8			5-62	
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	4-19			5-64	
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357-7374-010	1-91			5-66	
	1-93			5-67	
	1-99			5-68	
	1-100	4		5-69	10
357-7533-010	1-92		372-7515-010	1-78	
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	1-98	5		1-82	
357-8985-020	1-95	2		1-83	
358-1040-000	2-3	1		1-84	
367-0013-000	1-156	1		1-85	
367-0020-000	1-138			1-86	
	1-149	2		1-87	10
367-0854-000	1-155	1	372-7600-270	5-70	10
371-0062-000	1-49		372-7600-280	1-88	13
	1-89	4	380-2507-000	2-31	1
371-0221-000	1-55	1	382-0047-030	2-37	1
371-0385-090	6-43	1	4007-4HT	4-3	1
372-0043-450	3-37	1	403	1-137	
372-0043-530	3-51			1-148	
	5-59	2		1-157	5
372-2274-040	1-77	1	424-0307-010	1-70	AR
372-2274-050	1-74		424-0307-030	1-61	AR
	1-75	2		1-69	AR
372-2601-010	6-44	2	424-0862-070	6-49	AR
372-2601-012	5-71	8	424-0862-080	2-71	AR
372-2601-026	3-66	4	425-1528-000	4-28	AR

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	4-12	AR		1-101	
	4-17	AR		1-104	
	4-20	AR		1-107	
	4-23	AR		1-110	
426-1034-010	1-125	1		1-113	
450-0151-010	2-52	1		1-116	
499440-3	1-52			1-119	
	2-46	2		1-122	
499440-6	6-47	1		4-2	
499442-5	1-60			4-13	
	1-64	2		4-24	29
51-071-0019	1-92		623-2080-001	1-39	1
	1-94		623-2080-002	1-38	1
	1-96		623-2080-003	1-37	1
	1-97		623-2080-004	1-35	1
	1-98	5	623-9008-001	2-1	1
51-330-3188	1-91		630-2189-001	1-139	1
	1-93		632-5201-001	2-2	1
	1-99		634-8177-001	1-170	1
	1-100	4	634-8177-002	1-178	1
52-312-9040	1-102		634-8177-013	1-174	2
	1-105		634-8178-001	4-31	1
	1-108		634-8179-001	1-41	1
	1-111		634-8180-001	1-14	1
	1-114		634-8181-001	1-5	1
	1-117		634-8185-001	1-15	
	1-118			1-17	2
	1-120		634-8186-001	4-1	1
	1-121		634-8193-001	1-2	1
	1-123		634-8194-001	1-2	1
	1-124		634-8200-001	1-164	1
	4-4			2-	REF
	4-5		634-8200-002	1-164	1
	4-15			2-	REF
	4-16		634-8200-003	1-164	1
	4-26			2-	REF
	4-27	17	634-8200-004	1-164	1
52-312-9094	4-8			2-	REF
	4-11		634-8201-001	1-45	1
	4-19			4-	REF
	4-22	4	634-8210-001	1-56	1
540-9006-003	1-89		634-8224-001	1-49	1
	2-22		634-8224-002	1-49	1
	2-49	8	634-8225-001	1-150	1
540-9039-003	1-49	8	634-8226-001	1-126	1
540-9096-003	2-59	4	634-8227-001	1-139	1
541-6104-002	1-165	4	634-8228-001	1-62	1
600J	1-155	1	634-8273-001	2-43	1
60617-1	1-153	2	634-8289-001	2-67	1
60618-1	2-23		635-0656-001	1-33	1
	2-57	6	635-0657-001	1-36	
622-3452-007	1-23	1		1-36	2
622-3460-001	1-42	1	635-0748-002	1-29	
622-3474-001	1-	1		1-30	2
622-3475-001	1-	1	635-0825-013	2-49	1
622-3475-002	1-	1	635-0830-001	2-41	1
622-3475-003	1-	1	635-0830-002	2-41	1
622-3475-004	1-	1	635-4930-001	1-40	1
622-3475-005	1-	1	635-4930-002	1-40	1
622-3499-001	1-43	1	635-9601-001	2-60	2
623-1379-001	1-45		635-9602-001	2-61	1

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635-9614-002	2-55	1
635-9615-001	2-65	1
635-9616-001	1-165	2
635-9625-004	2-64	1
635-9625-007	2-63	1
635-9649-001	1-44	1
635-9677-001	1-12	10
635-9677-002	1-13	2
635-9677-003	1-7	4
635-9677-008	1-10	1
635-9679-002	1-6	1
635-9679-003	1-16	2
635-9679-004	1-9	2
635-9679-005	1-8	1
635-9679-006	1-11	1
637-1525-002	1-113	1
637-1525-003	1-101	
	1-104	
	1-107	
	1-110	4
637-1526-002	1-116	1
637-1526-003	1-119	
	1-122	
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	4-25	4
637-1526-006	4-14	1
637-1529-001	4-7	
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	4-21	4
637-1546-000	2-48	2
637-1547-001	2-62	1
637-1767-002	1-27	1
637-1767-003	1-27	1
637-1769-001	1-179	1
637-1777-001	1-180	1
637-1779-000	2-51	1
637-1781-006	2-48	1
637-1781-008	2-48	1
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637-3776-003	2-63	1
637-3784-001	2-66	
637-3788-001	2-65	1
637-3788-002	2-65	1
637-4472-002	1-48	1
637-9121-001	1-159	1
637-9295-001	1-3	1
637-9313-001	6-45	1
637-9314-001	1-76	1
638-4566-001	1-176	3
638-6067-002	1-28	1
638-6437-001	2-42	1
638-6627-001	1-73	1
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638-6873-002	2-59	1
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638-6896-001	1-18	1
638-6962-001	1-32	1
638-6973-001	4-30	1
	5-	REF
638-6975-001	1-24	1
638-6975-002	1-25	1
638-6975-003	1-26	1
638-6975-004	1-24	1
638-6975-005	1-25	1
638-6975-006	1-26	1
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642-0023-000	1-1	1
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642-2451-001	1-34	1
642-2454-001	1-90	1
642-2455-001	1-139	1
642-2462-001	1-160	1
642-2462-002	1-163	1
642-3135-001	1-20	1
642-3137-001	1-19	1
642-3224-001	1-31	1
646-6534-001	1-95	1
646-7008-001	1-101	2
646-7013-001	1-168	1
646-7014-001	1-169	2
647-7201-001	1-50	1
68NA7-68-62	1-172	4
7-50-60	4-29	2
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705-0957-000	3-3	1
7101P3PD9V40B	2-19	
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7101P4PD9V40B	2-8	
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745-0728-000	3-6	
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745-0821-000	3-34	1
745-0857-000	3-33	1
7521	2-52	1
801-B3800B75	1-103	
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	6-42	23
87478-5	3-37	1
87478-8	3-51	
	5-59	2
88089-1	6-46	1
88089-4	1-51	
	2-45	2
88377-4	1-53	
	1-54	
	2-47	3
88377-5	1-67	1
88377-6	2-70	1
88379-7	1-58	
	2-68	2
88379-8	1-57	
	1-65	2
88481-7	2-69	1
912-4141-400	5-5	
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913-1188-000	1-127	
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A13	1-18	638-6896-001
A14	1-33	635-0656-001
A15	1-32	638-6962-001
A16	1-34	642-2451-001
A18	1-36	635-0657-001
A19	1-35	623-2080-004
A19	1-36	635-0657-001
A2	1-164	634-8200-001
A2	1-164	634-8200-002
A2	1-164	634-8200-003
A2	1-164	634-8200-004
A2	2-	634-8200-001
A2	2-	634-8200-002
A2	2-	634-8200-003
A2	2-	634-8200-004
A2A1	2-49	635-0825-013
A2A2	2-59	638-6873-002
A2A2	2-59	638-6873-001
A2A2	3-	638-6873-001
A2A2	3-	638-6873-002
A2A2CR1	3-46	1N4454GE
A2A2CR10	3-36	1N4454GE
A2A2CR11	3-39	1N4454GE
A2A2CR12	3-10	1N4454GE
A2A2CR13	3-12	1N4454GE
A2A2CR14	3-13	1N4454GE
A2A2CR15	3-11	1N4454GE
A2A2CR16	3-48	1N4454GE
A2A2CR17	3-47	1N4454GE
A2A2CR18	3-49	1N4454GE
A2A2CR19	3-16	1N4454GE
A2A2CR2	3-50	1N4454GE
A2A2CR20	3-52	1N4454GE
A2A2CR21	3-53	1N4454GE
A2A2CR22	3-54	1N4454GE
A2A2CR23	3-56	1N4454GE
A2A2CR24	3-45	1N4454GE
A2A2CR25	3-44	1N4454GE
A2A2CR26	3-43	1N4454GE
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A2A2CR28	3-57	1N4454GE
A2A2CR29	3-1	1N4454GE
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A2A2CR30	3-2	1N4454GE
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A2A2CR32	3-27	1N4454GE
A2A2CR33	3-26	1N4454GE
A2A2CR34	3-30	1N4454GE
A2A2CR35	3-32	1N4454GE
A2A2CR36	3-31	1N4454GE
A2A2CR37	3-25	1N4454GE
A2A2CR38	3-28	1N4454GE
A2A2CR39	3-24	1N4454GE
A2A2CR4	3-55	1N4454GE
A2A2CR40	3-23	1N4454GE
A2A2CR41	3-60	1N4454GE
A2A2CR42	3-61	1N4454GE
A2A2CR43	3-62	1N4454GE
A2A2CR44	3-63	1N4454GE
A2A2CR45	3-64	1N4454GE
A2A2CR46	3-65	1N4454GE
A2A2CR47	3-58	1N4454GE
A2A2CR48	3-59	1N4454GE
A2A2CR5	3-17	1N4454GE
A2A2CR6	3-14	1N4454GE
A2A2CR7	3-21	1N4454GE
A2A2CR8	3-8	1N4454GE
A2A2CR9	3-41	1N4454GE
A2A2C1	3-22	199D226X0015DB1
A2A2J1	3-37	87478-5
A2A2J2	3-51	87478-8
A2A2R1	3-3	RN55D1540F
A2A2R14	3-15	RCR07G271KS
A2A2R15	3-9	RCR07G271KS
A2A2R16	3-18	RCR07G271KS
A2A2R17	3-6	RCR07G271KS
A2A2R18	3-29	RCR07G271KS
A2A2R19	3-19	RCR07G271KS
A2A2R2	3-5	RN55D16R9F
A2A2R20	3-7	RCR07G560KS
A2A2R4	3-40	RCR07G271KS
A2A2R5	3-35	RCR07G271KS
A2A2R6	3-38	RCR07G271KS
A2A2R7	3-34	RCR07G104KS
A2A2R8	3-33	RCR07G105KS
A2A3	2-41	635-0830-002
A2A3	2-41	635-0830-001
A2A4	2-42	638-6437-001
A2A5	2-48	637-1781-006
A2A5	2-48	637-1781-008
A2DS1	2-50	MS25237-327-15
A2DS2	2-51	MS25237-327-15
A2J1	2-3	M641-6-1
A2J17	2-46	499440-3
A2LS1	2-56	X8014-1
A2M1	2-52	7521
A2P1	2-24	1-480426-0
A2P2	2-58	1-480319-0
A2P9	2-47	88377-4
A2R11	2-31	RV2NAYSD103B
A2S1	2-5	280565BF1
A2S11	2-19	7101P3PD9V40B
A2S12	2-20	7101P3PD9V40B
A2S13	2-18	7207P3PD9V40B
A2S15	2-40	280566BF1
A2S16	2-37	382-0047-030
A2S19	2-34	259-8017-030
A2S2	2-12	7101P4PD9V40B

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A2S28	2-22	NE15F01-0003-00
A2S3	2-11	7101P4PD9V40B
A2S4	2-15	7101P4PD9V40B
A2S5	2-8	7101P4PD9V40B
A2S6	2-32	7101P4PD9V40B
A2S7	2-35	7101P4PD9V40B
A2S8	2-29	7101P4PD9V40B
A2S9	2-38	7101P4PD9V40B
A2W1	2-67	634-8289-001
A2W1P2A	2-68	88379-7
A2W1P2B	2-69	88481-7
A2W1P8	2-70	88377-6
A20	1-37	623-2080-003
A21	1-38	623-2080-002
A22	1-39	623-2080-001
A23	1-40	635-4930-001
A23	1-40	635-4930-002
A24	1-45	634-8201-001
A24	4-	634-8201-001
A24C1	5-4	199D336X0010DB1
A24C10	5-8	CD5FY151J0
A24C11	5-6	CD5FY151J0
A24C12	5-5	CD5FY151J0
A24C13	5-15	199D1009
A24C14	5-17	199D336X0010DB1
A24C2	5-14	199D336X0010DB1
A24C3	5-11	199D336X0010DB1
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A24C5	5-7	199D336X0010DB1
A24C6	5-16	199D475X0035DE3
A24C7	5-13	CD5FY151J0
A24C8	5-12	CD5FY151J0
A24C9	5-10	CD5FY151J0
A24J1	5-69	3VN10-1CDD3
A24J10	5-60	3VN10-1CDD3
A24J11	5-59	87478-8
A24J2	5-68	3VN10-1CDD3
A24J24	4-27	52-312-9040
A24J28	4-5	52-312-9040
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A24J32	4-15	52-312-9040
A24J34	4-11	52-312-9094
A24J39	4-8	52-312-9094
A24J4	5-66	3VN10-1CDD3
A24J43	4-26	52-312-9040
A24J44	4-16	52-312-9040
A24J45	4-4	52-312-9040
A24J5	5-65	3VN10-1CDD3
A24J54	4-22	52-312-9094
A24J55	4-19	52-312-9094
A24J6	5-64	3VN10-1CDD3
A24J7	5-63	3VN10-1CDD3
A24J8	5-62	3VN10-1CDD3
A24J9	5-61	3VN10-1CDD3
A24L1	5-18	MS75085-07
A24L10	5-27	MS75085-07
A24L11	5-28	MS75085-07
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A27C10	6-19	805-014X5V0103Z
A27C11	6-15	805-014X5V0103Z
A27C12	6-18	805-014X5V0103Z
A27C13	6-14	805-014X5V0103Z
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A27C15	6-13	805-014X5V0103Z
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A27C3	6-23	805-014X5V0103Z
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A27J46	6-47	499440-6
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A27L10	6-31	MS75085-07
A27L11	6-6	MS75085-07
A27L12	6-32	MS75085-07
A27L13	6-5	MS75085-07
A27L14	6-33	MS75085-07
A27L15	6-4	MS75085-07
A27L16	6-34	MS75085-07
A27L17	6-3	MS75085-07
A27L18	6-35	MS75085-07
A27L19	6-2	MS75085-07
A27L2	6-11	MS75085-07
A27L20	6-36	MS75085-07
A27L21	6-1	MS75085-07
A27L3	6-28	MS75085-07
A27L4	6-10	MS75085-07
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A27L6	6-9	MS75085-07
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A27L8	6-30	MS75085-07
A27L9	6-7	MS75085-07
A27P7	6-48	3471-0000
A28	1-49	634-8224-001
A28	1-49	634-8224-002
A28J1	1-83	BS1225F28PFF
A28J10	1-87	BS1225F28PFF
A28J12	1-64	499442-5
A28J13	1-60	499442-5
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A28J2	1-82	BS1225F28PFF
A28J20	1-55	DBM25S
A28J3	1-81	BS1225F28PFF
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A28J8	1-75	BS1020F65PAF
A28J9	1-74	BS1020F65PAF
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A28P2	1-58	88379-7
A28P3	1-65	88379-8
A28P4	1-66	3471-0000
A28P5	1-67	88377-5
A28P6	1-53	88377-4
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A3	1-31	642-3224-001
A30	1-43	622-3499-001
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A5	1-26	638-6975-003
A5	1-26	638-6975-006
A6	1-25	638-6975-002
A6	1-25	638-6975-005
A7	1-24	638-6975-001
A7	1-24	638-6975-004
A8	1-22	638-6871-001
A8	1-22	638-6871-002
A9	1-27	637-1767-002
A9	1-27	637-1767-003
J22	1-115	801-B3800B75
J23	1-112	801-B3800B75
J24	1-106	801-B3800B75
J25	1-103	801-B3800B75
J26	1-109	801-B3800B75
J35	1-102	52-312-9040
J36	1-105	52-312-9040
J37	1-108	52-312-9040
J38	1-111	52-312-9040
J40	1-114	52-312-9040
J41	1-117	52-312-9040
J42	1-118	52-312-9040
J50	1-91	51-330-3188
J50	1-96	51-071-0019
J51	1-92	51-071-0019
J51	1-97	51-071-0019
J52	1-93	51-330-3188
J52	1-98	51-071-0019
J53	1-94	51-071-0019
J53	1-99	51-330-3188
J56	1-100	51-330-3188
J57	1-124	52-312-9040
J58	1-123	52-312-9040
J59	1-120	52-312-9040
J60	1-121	52-312-9040
W1	1-126	634-8226-001
W1C34	1-136	CK63AW103M
W1C35	1-135	CK63AW103M
W1C36	1-134	CK63AW103M
W1C37	1-133	CK63AW103M
W1C38	1-132	CK63AW103M
W1C39	1-131	CK63AW103M
W1C46	1-128	CK63AW103M
W1C47	1-127	CK63AW103M
W1C48	1-130	CK63AW103M
W1C49	1-129	CK63AW103M
W1TB1	1-138	353-18-12-001
W2	1-139	634-8227-001
W2C40	1-147	CK63AW103M
W2C41	1-146	CK63AW103M
W2C42	1-145	CK63AW103M
W2C43	1-144	CK63AW103M
W2C44	1-143	CK63AW103M
W2C45	1-142	CK63AW103M
W2C50	1-141	CK63AW103M
W2C51	1-140	CK63AW103M
W2TB2	1-149	353-18-12-001
W3	1-150	634-8225-001
W3C52	1-152	805-014X5V0103Z
W3C53	1-151	805-014X5V0103Z
W3J47	1-154	1-480318-0
W3TB3	1-156	353-18-05-001

HF-8054( ) Receiver

Rockwell
International

diagrams

Collins Telecommunications Products Division

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1 January 1981

list of illustrations

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

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Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE	INITIALS	REV NO	REVISION DATE	INSERTION DATE	INITIALS
1st Ed	1 Jan 81						

diagrams

1. CONFIGURATION STATUS CONTROL

Collins Telecommunications Products Division of Rockwell International uses a 2-character (maximum) alphabetic identifier for configuration identification. The alphabetic identifier is preceded by the letters REV (revision) and starts with — (dash) if no changes have been made. The first change is identified as A, second as B, continuing through Z to AA, AB, and ultimately to ZZ.

Note

> The alphabetic identifier is not a serial number; therefore, many units or subassemblies may exist with the same identifier.

Incorporation of design changes in a unit or subassembly that has been returned to Rockwell-Collins for repair or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly is marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

> A reworked unit may not contain all design changes made prior to the reworked alphabetic identifier, but does contain all changes required to make unit operation identical to newly manufactured unit with the same alphabetic identifier. Therefore, a unit reworked to a specific alphabetic identifier may physically appear different from a newly manufactured unit at the same alphabetic identifier.

Only alphabetic identifiers that result in schematic changes are covered in this section. Therefore, if a unit or subassembly has an identifier that alphabetically falls between identifiers on the schematic changes page, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier alphabetic identifier listed on the schematic changes page.

2. CONFIGURATION EFFECTIVITY

Refer to the schematic changes page preceding each subassembly schematic for any subassembly changes that may have occurred and the corresponding alphabetic identifier covering each change.

Note

> Configuration history before 1 January 1981 is not recorded in this section.

Listed below are the units/subassemblies with the latest alphabetic identifier covered by this document.

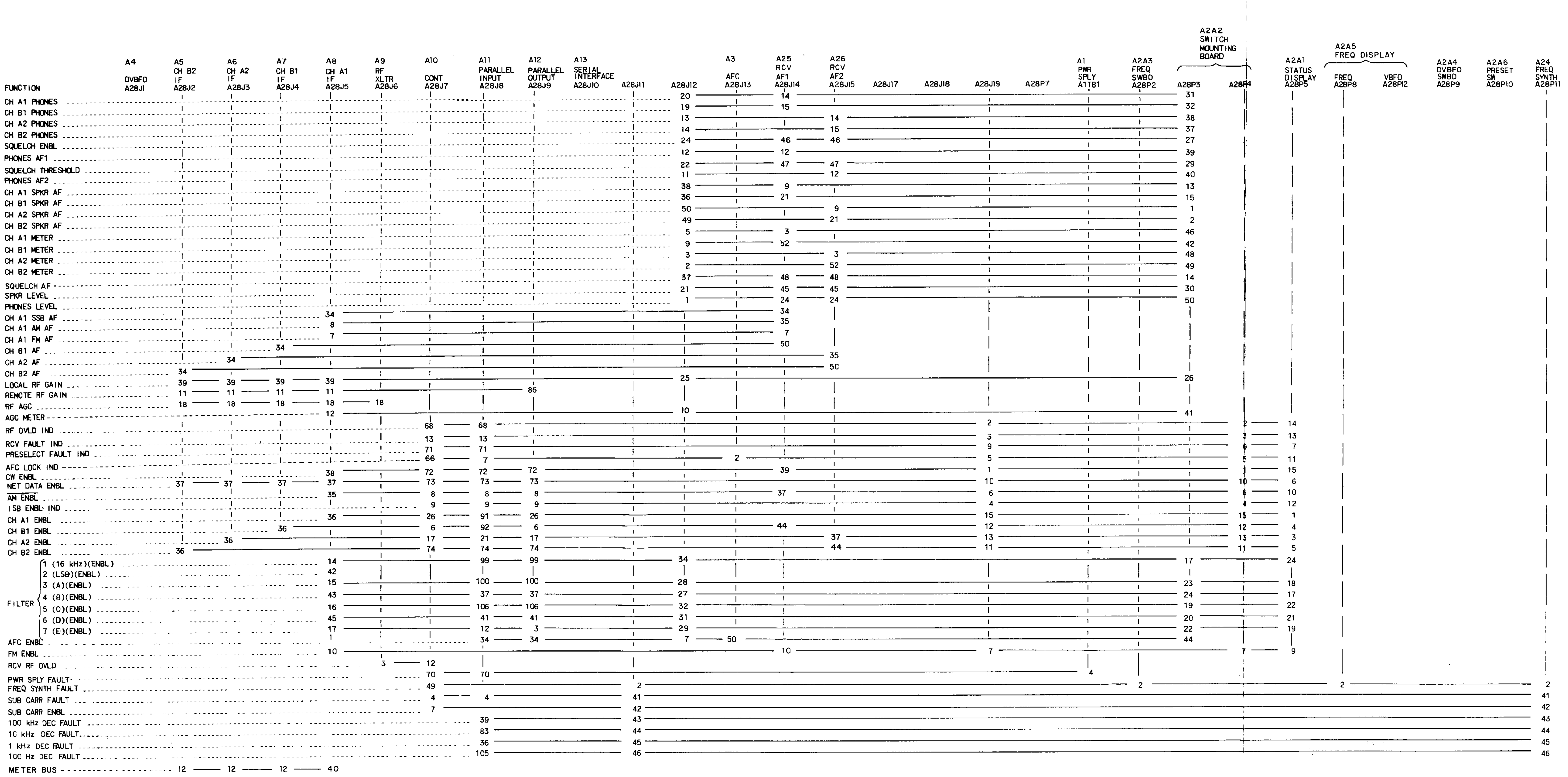
UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
HF-8054 Receiver	622-3474-001	REV B
HF-8054A Receiver	622-3475-001	REV H
	622-3475-002	REV H
	622-3475-003	REV H
	622-3475-004	REV H
	622-3475-005	REV H
Front panel assembly A2	634-8200-001	REV C
	634-8200-002	REV C
	634-8200-003	REV C
	634-8200-004	REV C
LED status display A2A1	635-0825-013	REV N
Mounting board A2A2	638-6873-001	REV D
	638-6873-002	REV E
Frequency switchboard A2A3	635-0830-001	REV H
	635-0830-002	REV H
DVBFO switchboard A2A4	638-6437-001	REV A
Frequency display A2A5	637-1781-006	REV G
	637-1781-008	REV G
Frequency display cable A2W1	634-8289-001	REV B
Synthesizer chassis assembly A24	634-8201-001	REV A
Circuit card assembly	638-6973-001	REV F
Rf cable assembly J43/J24	637-1526-003	REV B
Rf cable assembly J45/J28	637-1526-003	REV B

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Rf cable assembly J44/J32 or J44/J57	637-1526-004	REV C
Rf cable assembly A1-1F or VBFO	637-1529-001	REV A
Rf cable assembly B1-1F	637-1529-001	REV A
Rf cable assembly A2-1F	637-1529-001	REV A
Rf cable assembly B2-1F	637-1529-001	REV A
Rfi filter A27	637-2712-004	REV N
Sideboard assembly A28	634-8224-001	REV —
Sideboard	638-6627-001	REV B
Cable assembly	634-8210-001	REV —
Cable assembly	634-8228-001	REV —
Cable assembly W1	634-8226-001	REV —
Cable assembly W2	634-8227-001	REV —
Cable assembly W3	634-8225-001	REV —
Rf cable assembly J40/J22	637-1525-002	REV A
Rf cable assembly J38/J23	637-1525-003	REV A
Rf cable assembly J37/J24	637-1525-003	REV A
Rf cable assembly J36/J25	637-1525-003	REV A
Rf cable assembly J35/J26	637-1525-003	REV A
Rf cable assembly J41/J42	637-1526-002	REV —
Rf cable assembly 450-kHz IF	642-2454-001	REV —
Rf cable assembly J34/J59	637-1526-003	REV B
Rf cable assembly J32/J58	637-1526-004	REV C
Rf cable assembly AFC	646-6534-001	REV —

SCHEMATIC CHANGES

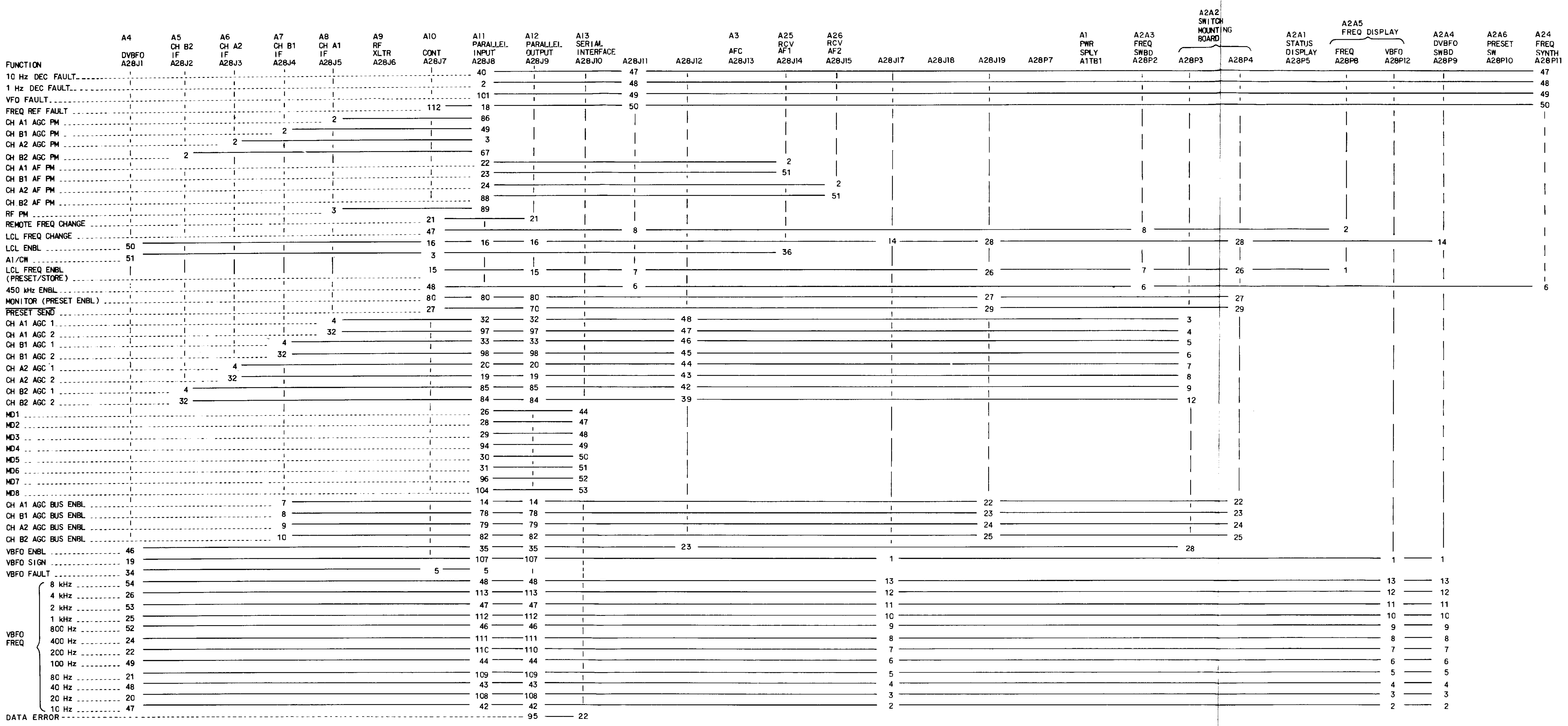
REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	(This page will contain schematic revision information.)		

Chassis, Main Sideboard, and Ribbon Cabling,
Schematic Diagram
Figure 1 (Sheet A)



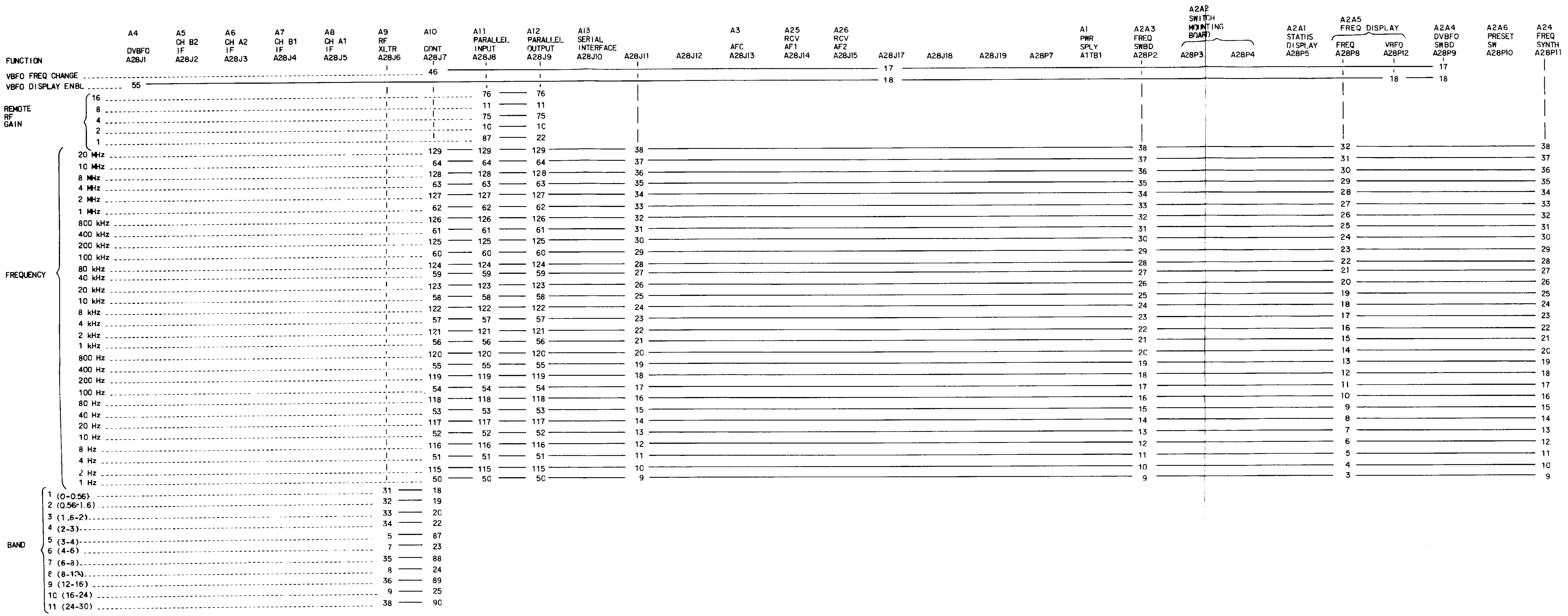
634-6736

Chassis, Main Sideboard, and Ribbon Cabling, Schematic Diagram
Figure 1 (Sheet 1 of 7)



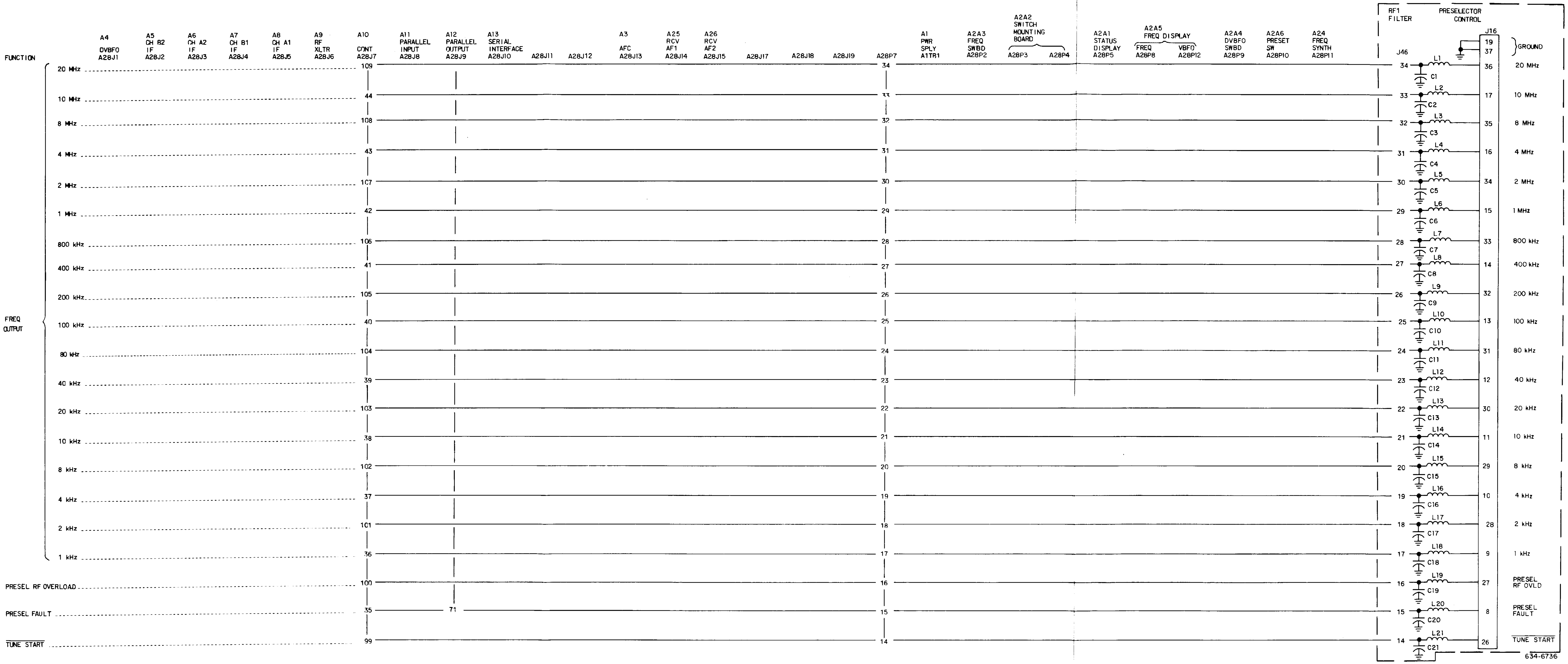
634-6736

Chassis, Main Sideboard, and Ribbon Cabling, Schematic Diagram
Figure 1 (Sheet 2)

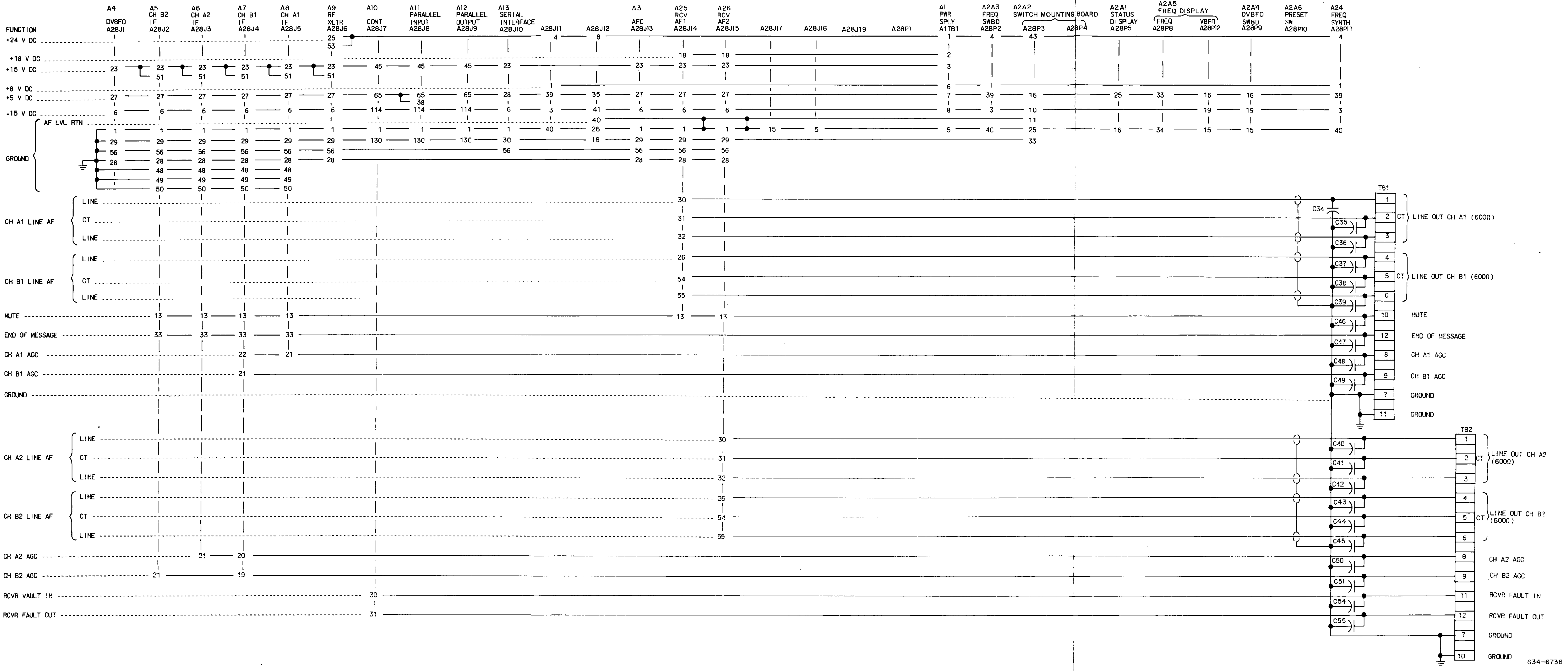


634-6736

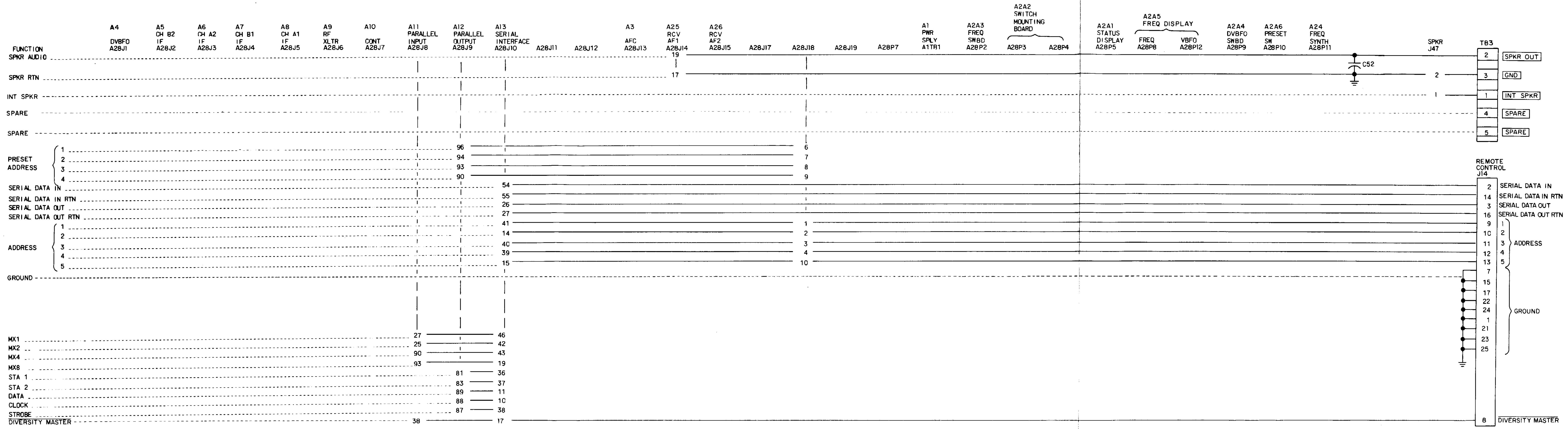
Chassis, Main Sideboard, and Ribbon Cabling, Schematic Diagram
Figure 1 (Sheet 3)



Chassis, Main Sideboard, and Ribbon Cabling,
Schematic Diagram
Figure 1 (Sheet 4)



Chassis, Main Sideboard, and Ribbon Cabling, Schematic Diagram
Figure 1 (Sheet 5)



NOTES:

1. UNLESS OTHERWISE SPECIFIED, CAPACITANCE VALUES ARE 0.01 μF AND INDUCTANCE VALUES ARE 100 μH
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. NON-STANDARD ABBREVIATIONS:
   CH = CHANNEL
4. OVEN FREQ STD OPTION ONLY.
5. EXT FREQ STD OPTION ONLY.
6. SHOWN WITH FREQ STD SWITCH OPTION.

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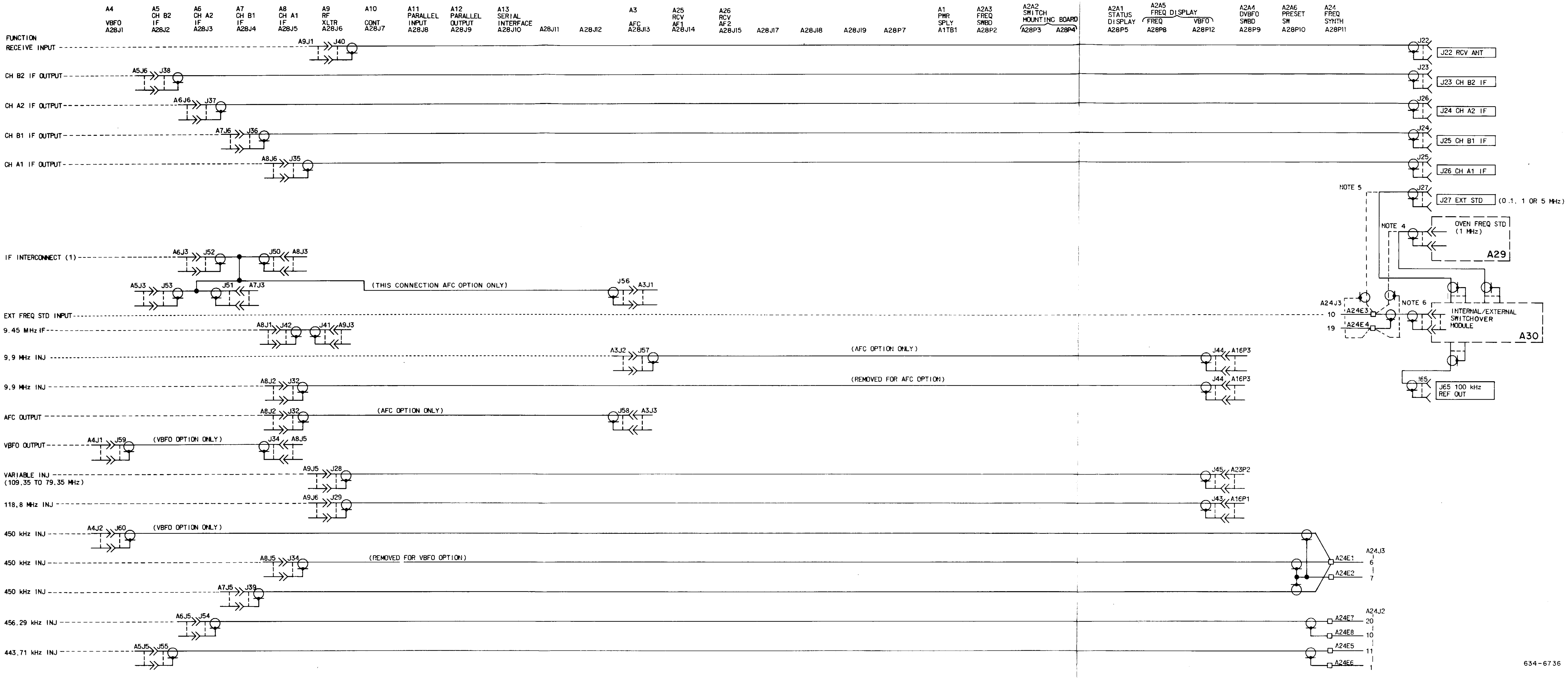
Chassis, Main Sideboard, and Ribbon Cabling,
Schematic Diagram
Figure 1 (Sheet 6)



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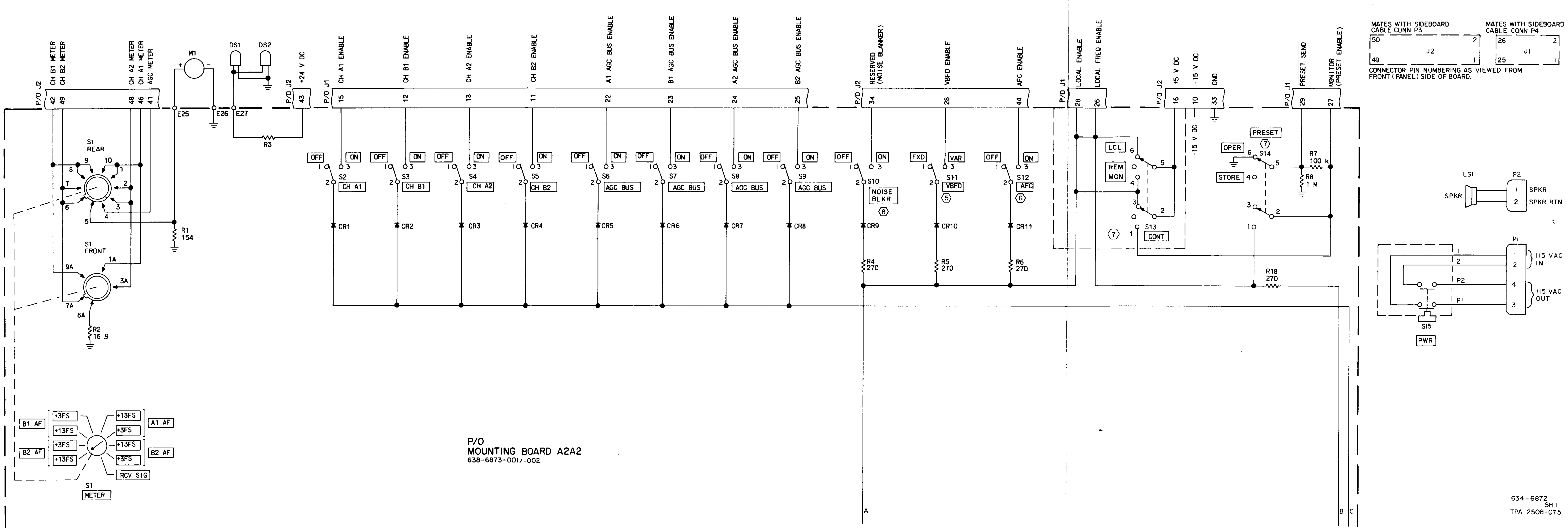
Chassis, Main Sideboard, and Ribbon Cabling,
Schematic Diagram
Figure 1 (Sheet 7)

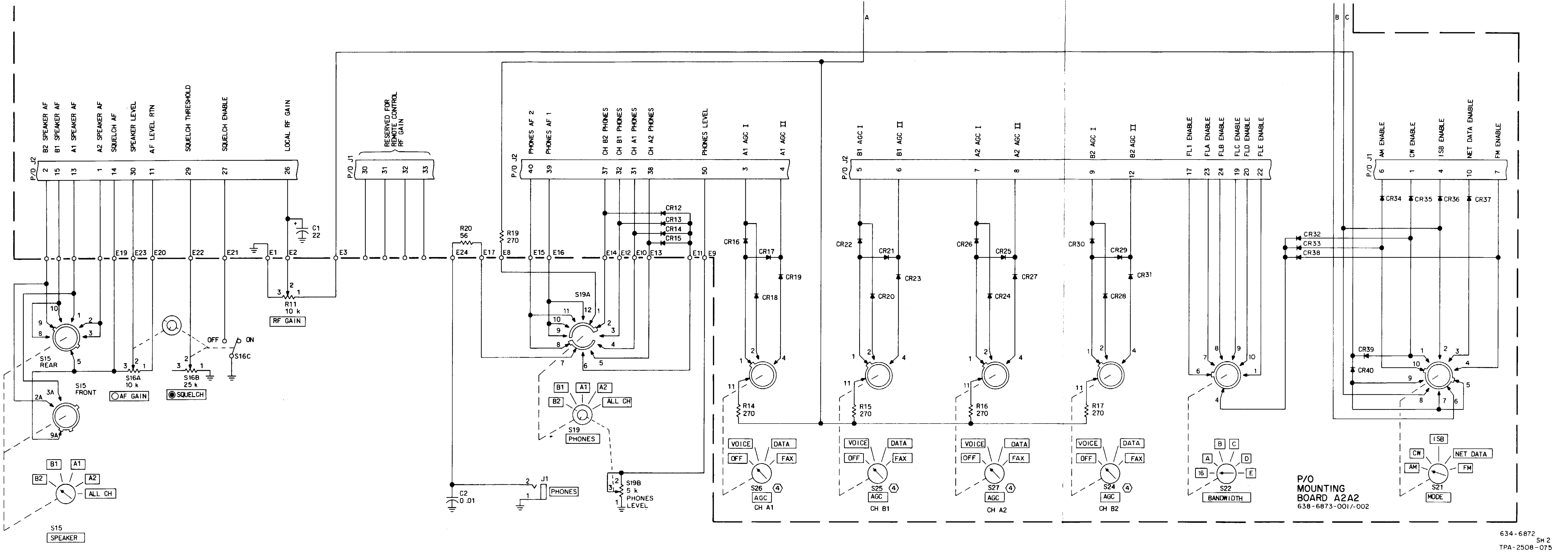
SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	(This page will contain schematic revision information.)		

Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet A)



Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet 1 of 8)



Front Panel Assembly A2 (634-8200-XXX), Schematic Diagram
Figure 2 (Sheet 2)

FRONT PANEL ASSEMBLY CONFIGURATION:

REF DES	SUBASSEMBLIES USED	634-8200-XXX			
		-001	-002	-003	-004
A1	635-0825-013	X	X	X	X
A2	638-6873-001		X		
	638-6873-002	X		X	X
A3	635-0830-001		X		X
	635-0830-002	X		X	
A4	638-6437-001			X	
A5	637-1781-006		X		X
	637-1781-008			X	
A6	635-0900-001				
W1	634-8289-001		X	X	X
S1	METER	X	X	X	X
S2	CH A1-ON/OFF	X	X	X	X
S3	CH B1-ON/OFF	X	X	X	X
S4	CH A2-ON/OFF	X	X	X	X
S5	CH B2-ON/OFF	X	X	X	X
S6	(A1) AGC BUS	X	X	X	X
S7	(B1) AGC BUS	X	X	X	X
S8	(A2) AGC BUS	X	X	X	X
S9	(B2) AGC BUS	X	X	X	X
S10	NOISE BLKR				
S11	VBFO			X	
S12	AFC			X	
S13	CONT-LCL/REM/MON	X	X	X	X
	CONT-NORM/PSET				
S14	PRESET-OPER/STORE				
S21	MODE-AM/CW/ISB/NET DATA	X	X	X	X
	MODE-AM/CW/ISB/NET DATA/FM				
S22	BANDWIDTH	X	X	X	X
S24	(B2) AGC ⟨4⟩	X	X	X	X
S25	(B1) AGC ⟨4⟩	X	X	X	X
S26	(A1) AGC ⟨4⟩	X	X	X	X
S27	(A2) AGC ⟨4⟩	X	X	X	X

ALL THE ABOVE SWITCHES ADDED TO A2A2 AT NEXT HIGHER ASSEMBLY 634-8200-XXX.

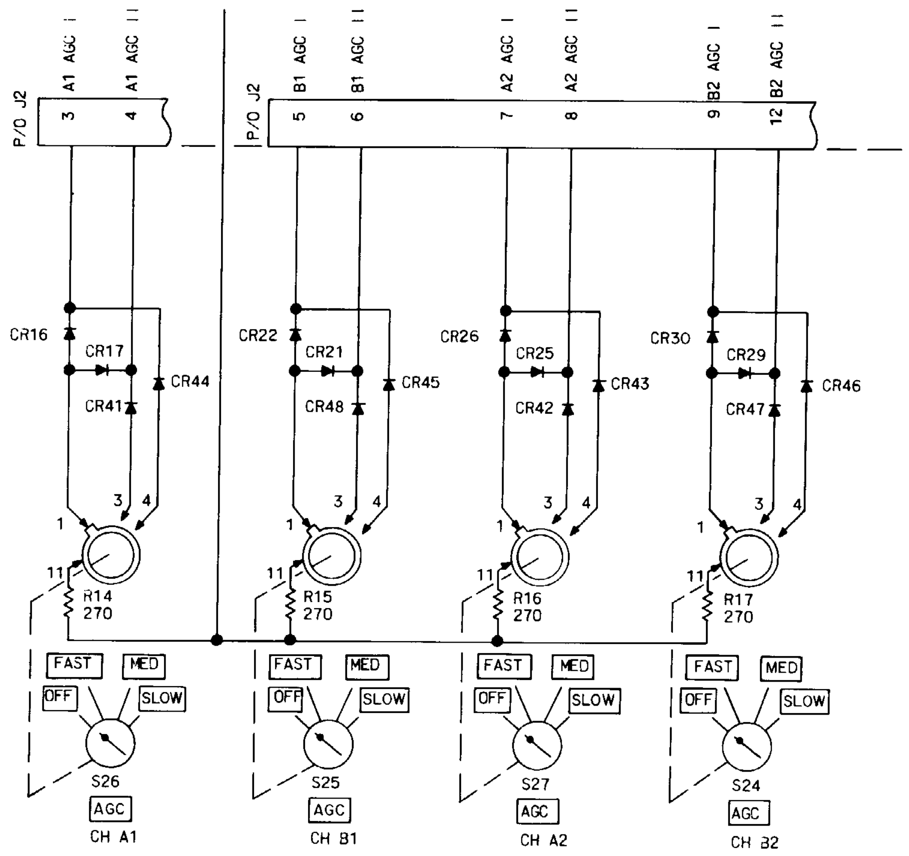
NOTES:

⟨1⟩ UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND DIODES ARE 1N4454.

⟨2⟩ PARTIAL REFERENCE DESIGNATION ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

⟨3⟩ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

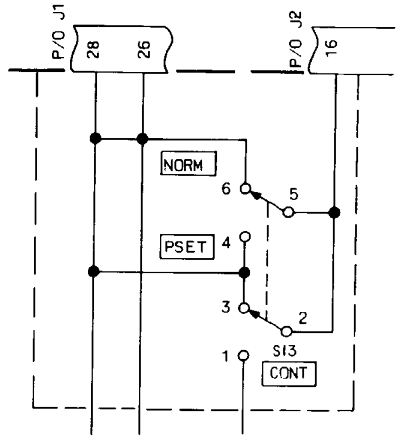
⟨4⟩ A2S24 THROUGH A2S27 SILKSCREENING AND ASSOCIATED PARTS LAYOUT FOR CONFIGURATION 634-8200-002. A2S24 THROUGH A2S27 SILKSCREENING AND ASSOCIATED PARTS LAYOUT FOR CONFIGURATIONS 634-8200-001, -003, -004 IS AS FOLLOWS:



⟨5⟩ A2S11 USED WITH VBFO OPTION ONLY.

⟨6⟩ A2S12 USED WITH AFC OPTION ONLY.

⟨7⟩ 3-POSITION A2S13 SHOWN USED WITH ALL CONFIGURATIONS EXCEPT WHEN PRESET OPTION INSTALLED. A2S14 AND 2-POSITION A2S13 (SHOWN BELOW) USED WITH PRESET OPTION ONLY.

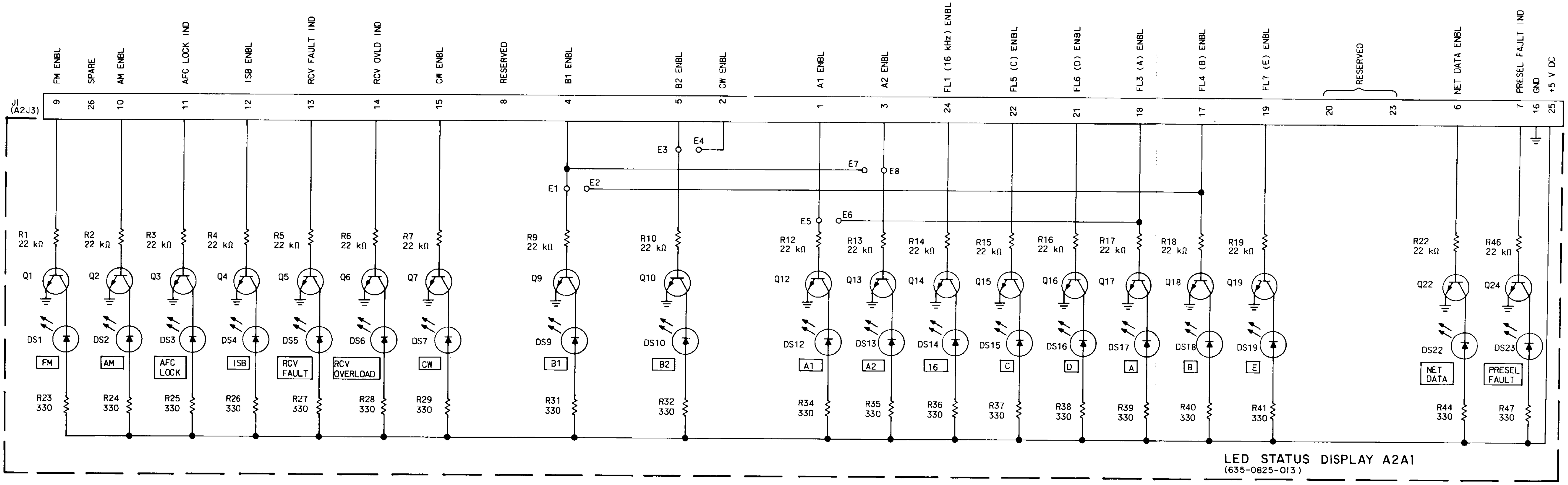


⟨8⟩ A2S10 USED WITH NOISE BLANKER OPTION ONLY.

⟨9⟩ NONSTANDARD ABBREVIATIONS:
CH = CHANNEL
BLKR = BLANKER
PSET = PRESET

634-6872
SH.3
TPA-2508-075

Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet 3)

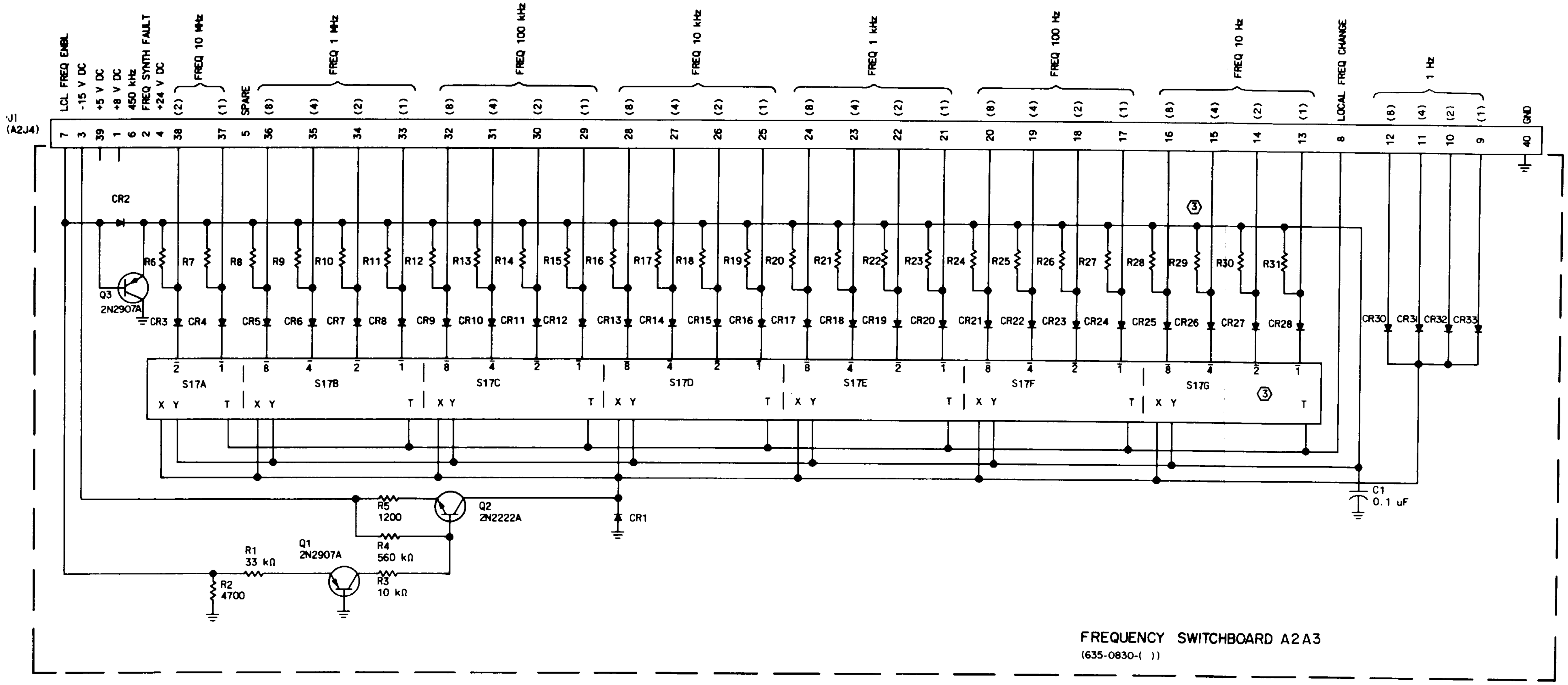


⟨1⟩ Q1-Q24 ARE TYPE 2N2222A.
DS3, DS5, DS6, DS8, AND DS23 ARE TYPE HP5082-4684 (RED) LED.
DS1, DS2, DS4, DS7, AND DS9-DS22 ARE TYPE HP5082-4584 (YELLOW) LED.

⟨2⟩ UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS.

634-6872
TPA-2508-075 SH 4

Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet 4)



NOTES:

① ALL DIODES ARE TYPE 1N4454.

② UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS. R6-R31 ARE 33 kΩ

③ THE 10 Hz FREQUENCY DIGIT S17G AND ASSOCIATED COMPONENTS R28 THRU R31 ARE PART OF 635-0830-002 ONLY. IN THE 635-0830-001 CR25 THRU CR28 CATHODES ARE CONNECTED THE SAME AS CR30 THRU CR33 CATHODES.

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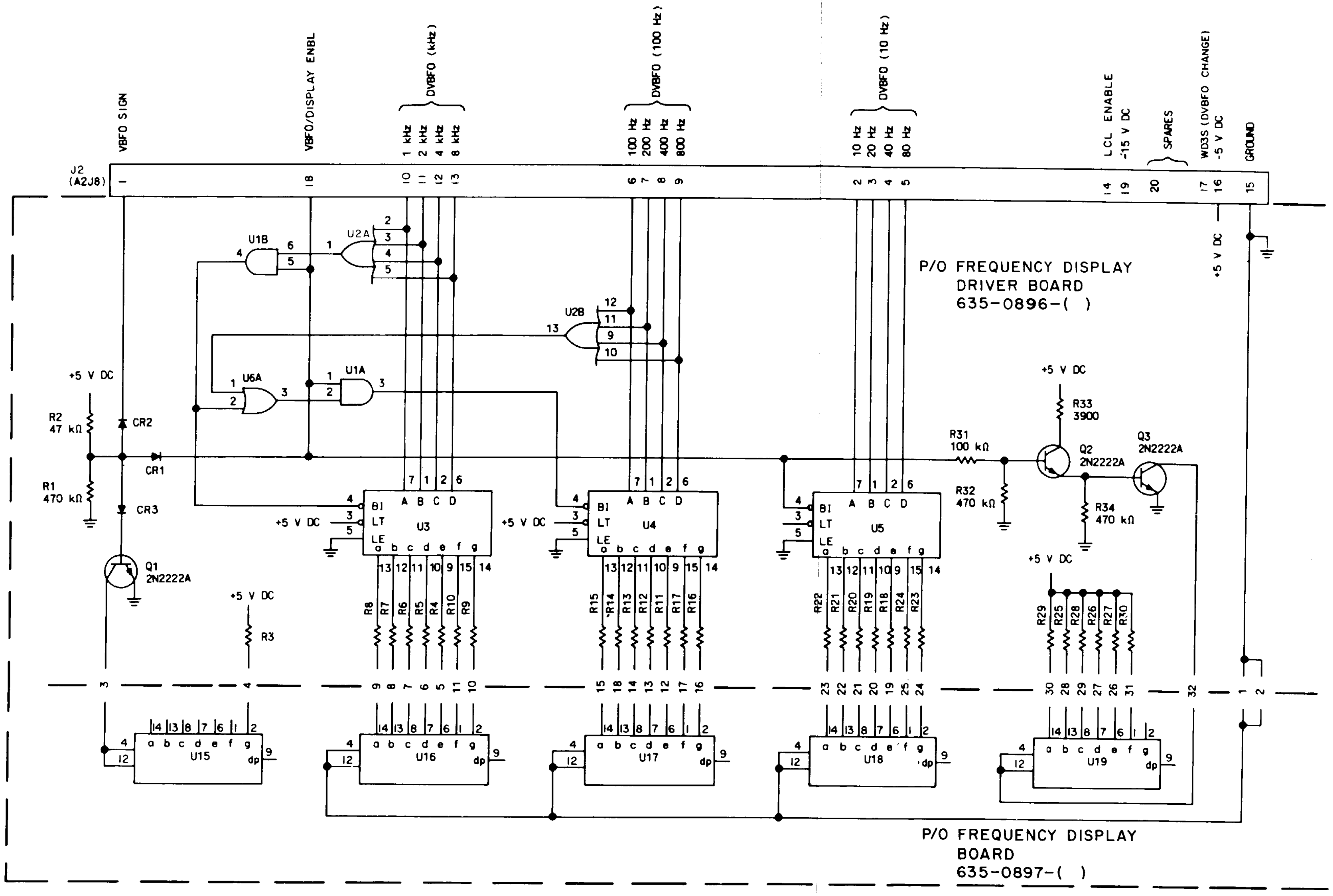
SH5
TPA-2508-075

Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet 5)

CIRCUITS USED PER FREQUENCY DISPLAY A2A5

			CIRCUIT	637-1781-( )	
				-006	-008
FREQUENCY DISPLAY DRIVER BOARD	VBFO DISPLAY ENABLE	VBFO DISPLAY ENABLE	U1		X
			U2		X
		1 KHz	U3		X
		100 Hz	U4		X
		10 Hz	U5		X
	OPER FREQ DISPLAY DRIVERS	DISPLAY BLANKING	U6	X	X
		10 MHz	U7	X	X
		1 MHz	U8	X	X
		100 kHz	U9	X	X
		10 kHz	U10	X	X
		1 kHz	U11	X	X
		100 Hz	U12	X	X
		10 Hz	U13		X
		1 Hz	U14		X
FREQUENCY DISPLAY BOARD	VBFO DISPLAY	SIGN	U15		X
		1 kHz	U16		X
		100 Hz	U17		X
		10 Hz	U18		X
		1 Hz	U19		X
	OPER FREQ DISPLAY	10 MHz	U20	X	X
		1 MHz	U21	X	X
		100 kHz	U22	X	X
		10 kHz	U23	X	X
		1 kHz	U24	X	X
		100 Hz	U25	X	X
		10 Hz	U26		X
		1 Hz	U27		



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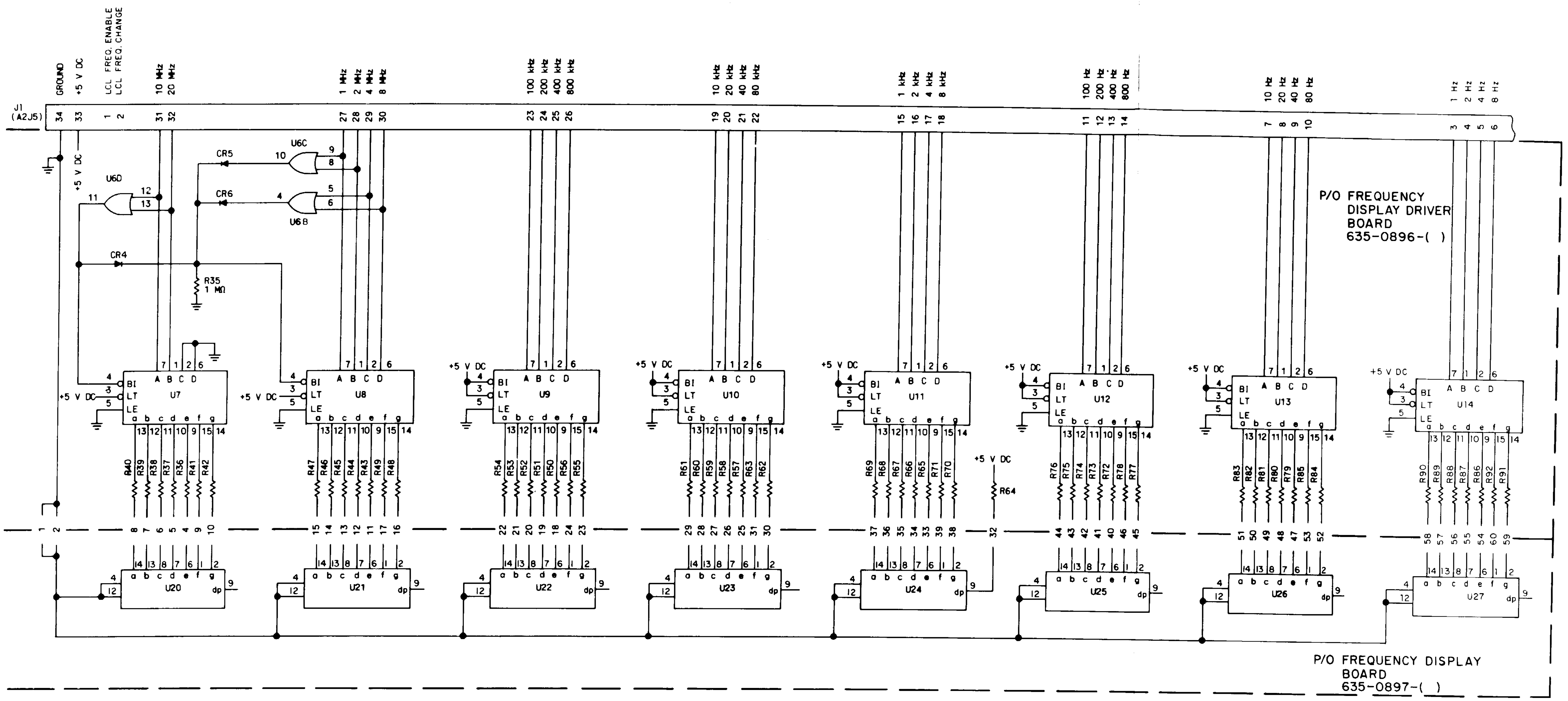
SH 6
TPA-2508-075

Front Panel Assembly A2 (634-8200-XXX), Schematic Diagram
Figure 2 (Sheet 6)



NOTES:

⟨1⟩ RESISTORS R3 THRU R30 AND R36 THRU R92 ARE 180 OHM.

⟨2⟩ DIODES ARE TYPE 1N4454.

⟨3⟩ POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)	
		+5	GND
U1	MC14081BCP	14	7
U2	MC14072BCP	14	7
U3, U4, U5, AND U7 THRU U14	MC14511BCP	16	8
U6	MC14071BCP	14	7
U15 THRU U27	MAN3640A		

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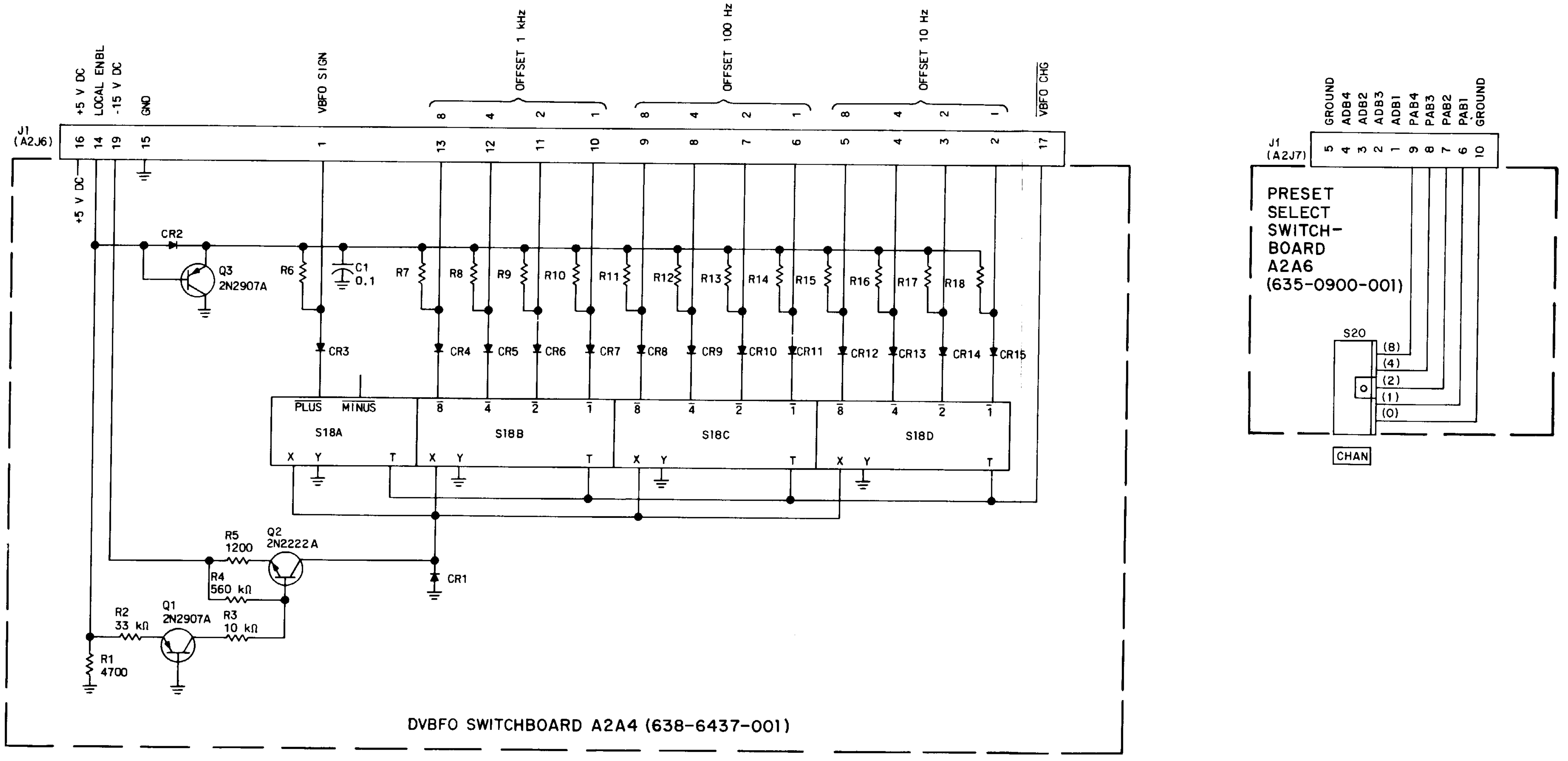
SH 7
TPA-2508-075

Front Panel Assembly A2 (634-8200-XXX), Schematic Diagram
Figure 2 (Sheet 7)



NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND DIODES ARE 1N4454.

② R6-R18 ARE 33 kΩ.

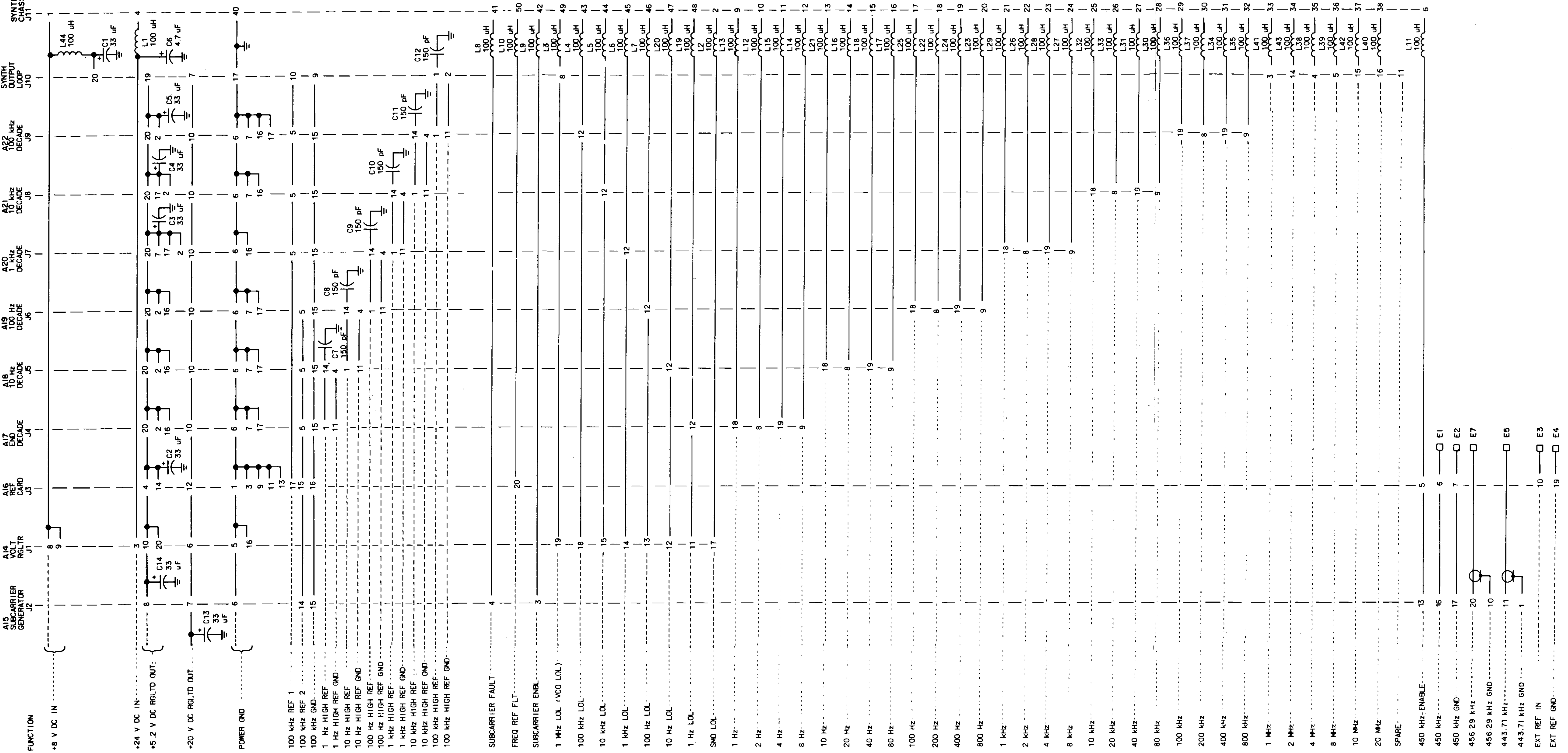
634-6872
SH 8
TPA-2508-075

Front Panel Assembly A2 (634-8200-XXX),
Schematic Diagram
Figure 2 (Sheet 8)

SCHEMATIC CHANGES

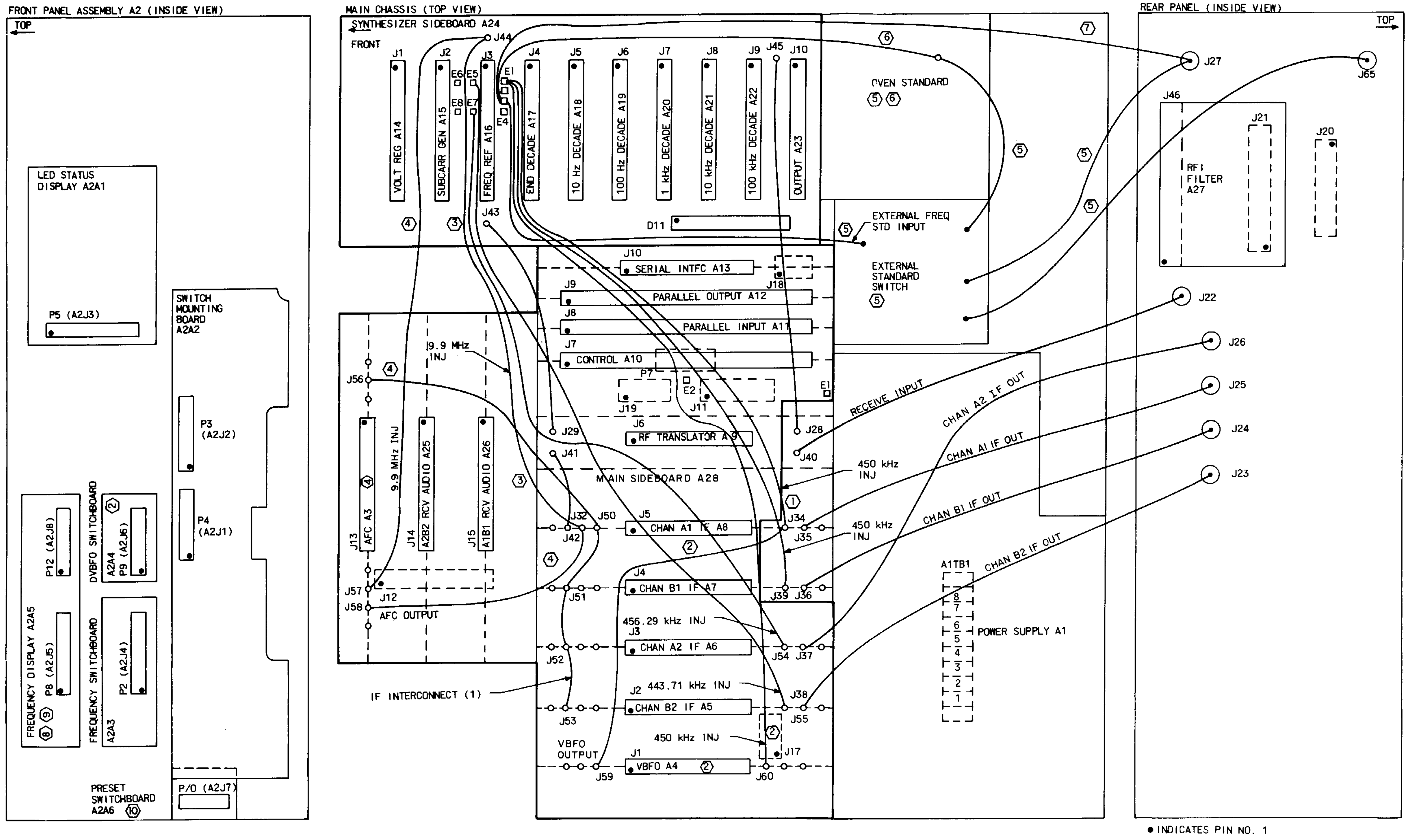
REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	(This page will contain schematic revision information.)		

Synthesizer Chassis A24 (634-8200-001), Schematic Diagram
Figure 3 (Sheet A)



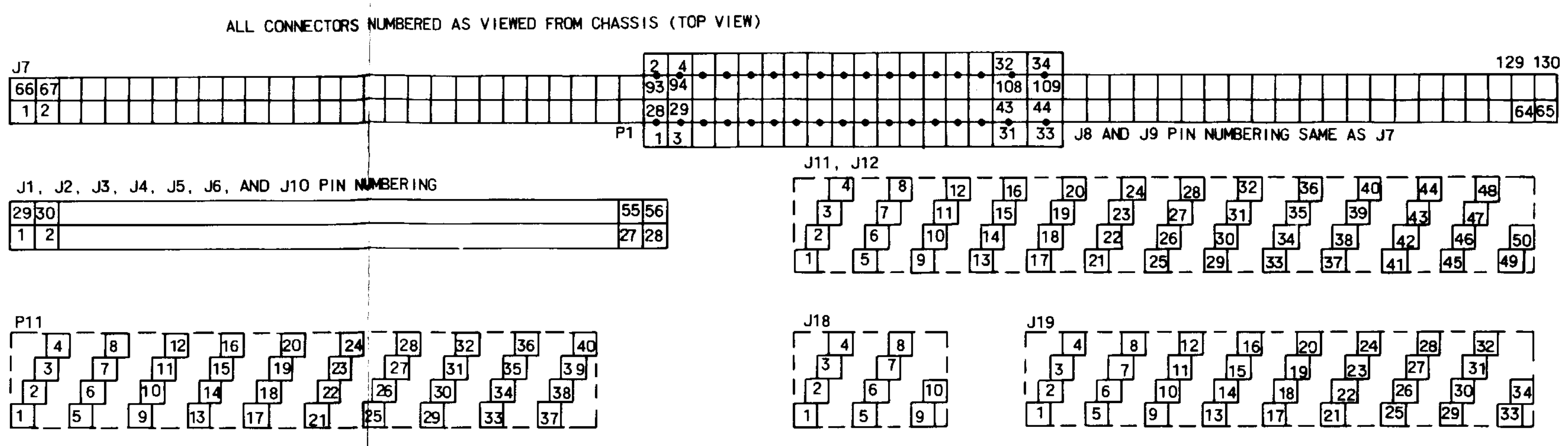
634-6886

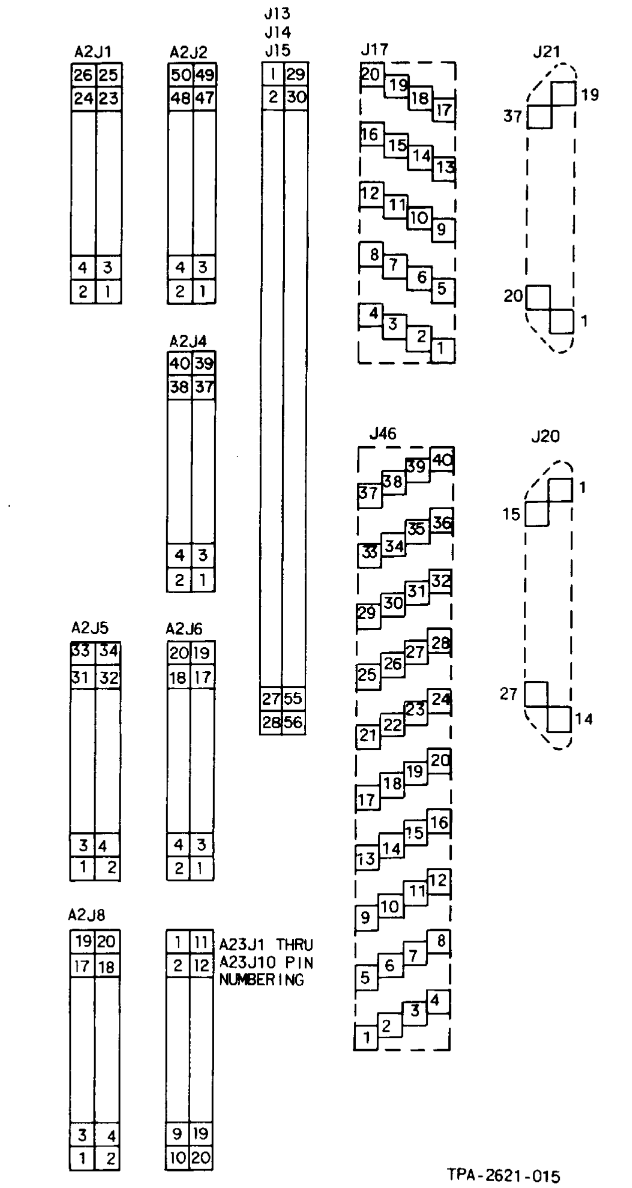
Synthesizer Chassis A24 (634-8200-001), Schematic Diagram
Figure 3



● INDICATES PIN NO. 1

ALL CONNECTORS NUMBERED AS VIEWED FROM CHASSIS (TOP VIEW)





CHASSIS INTERCONNECTS

INTERCONNECT	HF-8054		HF-8054A	
	STANDARD	OPTIONS	STANDARD	OPTIONS
SUBMINIAX COAXIAL INTERCONNECTS				
J22 TO J40	X		X	
J23 TO J38	X		X	
J24 TO J36	X		X	
J25 TO J35	X		X	
J26 TO J37	X		X	
J27 TO EXT STD SW (EXT STD IN)		⑤		⑤
J27 TO A24E3		⑦		⑦
A24E3 TO OVEN STD P1		⑥		⑥
A24E3 TO EXT STD SW J1 (SW STD IN)		⑤		⑤
OVEN STD P1 TO EXT STD SW (OVEN STD IN)		⑤		⑤
J28 TO J45	X		X	
J29 TO J43	X		X	
J32 TO J44	X	③	X	③
J32 TO J58		④		④
J34 TO A24E1	X	①	X	①
J34 TO J59		②		②
J39 TO A24E1	X		X	
J41 TO J42	X		X	
J44 TO J57		④		④
J50 TO J51, J52, J53	X	③	X	③
J50 TO J51, J52, J53, J56		④		④
J54 TO A24E7	X		X	
J55 TO A24E5	X		X	
J60 TO A24E1		②		②
J65 TO EXT STD SW (100 kHz OUT)		⑤	/	⑤
RIBBON CABLE INTERCONNECTS				
J12, J19 TO P3, P4, P5	X		X	
P2, TO P11, J11	X		X	
P7 TO J46	X		X	
J17 TO P9		②		②
P2 TO P8		⑧ ⑨		⑧ ⑨
P9 TO P12		⑨		⑨
J18 TO P10		⑩		NA

NOTES:

DVBFO KIT (AC-8056)

① REMOVED FOR DVBFO OPTION.

② ADDED FOR DVBFO OPTION.

AFC OPTION

③ REMOVED FOR AFC OPTION.

④ ADDED FOR AFX OPTION.

EXTERNAL STANDARD SWITCH KIT (AC-8015)

⑤ ADDED FOR EXTERNAL STANDARD SWITCH OPTION.

OVEN STANDARD KIT (AC-8012)

⑥ ADDED FOR OVEN STANDARD OPTION.

EXTERNAL STANDARD KIT (AC-8013)

⑦ ADDED FOR EXTERNAL STANDARD OPTION.

FREQUENCY DISPLAY KIT (AC-8014)

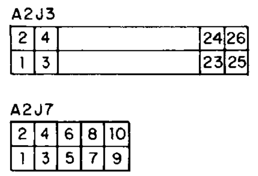
⑧ ADDED FOR FREQUENCY DISPLAY OPTION.

VBFO DISPLAY OPTION

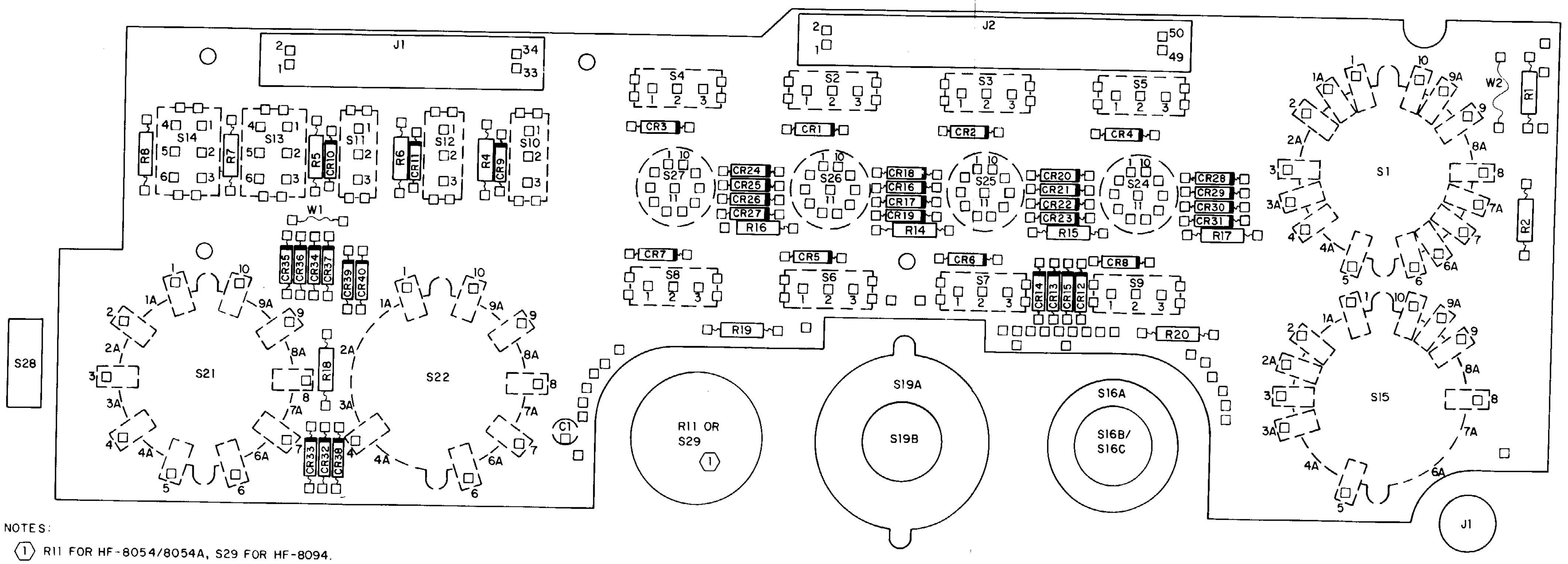
⑨ ADDED FOR VBFO/FREQUENCY DISPLAY OPTION.

PRESET OPTION

⑩ ADDED FOR PRESENT OPTION (PRESET OPTION NOT AVAILABLE AS PART OF HF-8054A, BUT CAN BE INSTALLED IN ITS REMOTE CONTROL).



HF-8054( ) Receiver, Cabling, Connector Layout, and Pin Numbering
Figure 4



NOTES:

① R11 FOR HF-8054/8054A, S29 FOR HF-8094.

TPA-2624-014

Switch Mounting Board A2A2, Layout and Pin Numbering
Figure 5

CONTROL / STATUS BIT WORD FORMAT

HF-80 8-BIT WORD NO.	HF-80 8-BIT CHARACTER NO.	HF-80 8-BIT BIT NO.	ASCII 7-BIT WORD NO.	ASCII 7-BIT CHARACTER NO.	ASCII 7-BIT BIT WT.	EXCITER, AND EXCITER CONTROL PARALLEL OUTPUT PIN NO.	EXCITER, AND EXCITER CONTROL PARALLEL INPUT PIN NO.	EXCITER, AND EXCITER CONTROL FUNCTION	RECEIVER, AND RECEIVER CONTROL PARALLEL OUTPUT PIN NO.	RECEIVER, AND RECEIVER CONTROL PARALLEL INPUT PIN NO.	RECEIVER, AND RECEIVER CONTROL FUNCTION
1	2	8	1	6	8			NOT USED			NOT USED
1	2	7	1	6	4			NOT USED			NOT USED
1	2	6	1	6	2	129	129	FREQ 10 MHz (2)	129	129	FREQ 10 MHz (2)
1	2	5	1	6	1	64	64	FREQ 10 MHz (1)	64	64	FREQ 10 MHz (1)
1	2	4	1	7	8	128	128	FREQ 1 MHz (8)	128	128	FREQ 1 MHz (8)
1	2	3	1	7	4	63	63	(4)	63	63	↓ (4)
1	2	2	1	7	2	127	127	(2)	127	127	↓ (2)
1	2	1	1	7	1	62	62	(1)	62	.62	↓ (1)
1	3	8	1	8	8	126	126	FREQ 100 kHz (8)	126	126	FREQ 100 kHz (8)
1	3	7	1	8	4	61	61	↓ (4)	61	61	↓ (4)
1	3	6	1	8	2	125	125	↓ (2)	125	125	↓ (2)
1	3	5	1	8	1	60	60	↓ (1)	60	60	↓ (1)
1	3	4	1	9	8	124	124	FREQ 10 kHz (8)	124	124	FREQ 10 kHz (8)
1	3	3	1	9	4	59	59	↓ (4)	59	59	↓ (4)
1	3	2	1	9	2	123	123	↓ (2)	123	123	↓ (2)
1	3	1	1	9	1	58	58	↓ (1)	58	58	↓ (1)
1	4	8	1	10	8	122	122	FREQ 1 kHz (8)	122	122	FREQ 1 kHz (8)
1	4	7	1	10	4	57	57	↓ (4)	57	57	↓ (4)
1	4	6	1	10	2	121	121	↓ (2)	121	121	↓ (2)
1	4	5	1	10	1	56	56	↓ (1)	56	56	↓ (1)
1	4	4	1	11	8	120	120	FREQ 100 Hz (8)	120	120	FREQ 100 Hz (8)
1	4	3	1	11	4	55	55	↓ (4)	55	55	↓ (4)
1	4	2	1	11	2	119	119	↓ (2)	119	119	↓ (2)
1	4	1	1	11	1	54	54	↓ (1)	54	54	↓ (1)
1	5	8	1	12	8	118	118	FREQ 10 Hz (8)	118	118	FREQ 10 Hz (8)
1	5	7	1	12	4	53	53	↓ (4)	53	53	↓ (4)
1	5	6	1	12	2	117	117	↓ (2)	117	117	↓ (2)
1	5	5	1	12	1	52	52	↓ (1)	52	52	↓ (1)
1	5	4	1	13	8	116	116	FREQ 1 Hz (8)	116	116	FREQ 1 Hz (8)
1	5	3	1	13	4	51	51	↓ (4)	51	51	↓ (4)
1	5	2	1	13	2	115	115	↓ (2)	115	115	↓ (2)
1	5	1	1	13	1	50	50	↓ (1)	50	50	↓ (1)
2	2	8	2	6	8			NOT USED			NOT USED
2	2	7	2	6	4			↓			NOT USED
2	2	6	2	6	2			↓			NOT USED
2	2	5	2	6	1	76	76	↓	76	76	RF GAIN (16)
2	2	4	2	7	8	11	11	↓	11	11	↓ (8)
2	2	3	2	7	4	75	75	↓	75	75	↓ (4)
2	2	2	2	7	2	10	10	↓	10	10	↓ (2)
2	2	1	2	7	1	22	87	↓	22	87	↓ (1)
2	3	8	2	8	8	3	12	NOT USED	3	12	FL7 (E) ENBL
2	3	7	2	8	4	41	41	↓	41	41	FL6 (D) ENBL
2	3	6	2	8	2	106	106	↓	106	106	FL5 (C) ENBL
2	3	5	2	8	1	37	37	↓	37	37	FL4 (B) ENBL
2	3	4	2	9	8	84	84	↓	84	84	B2 AGC (2)
2	3	3	2	9	4	85	85	↓	85	85	B2 AGC (1)
2	3	2	2	9	2	19	19	↓	19	19	A2 AGC (2)
2	3	1	2	9	1	20	20	↓	20	20	A2 AGC (1)
2	4	8	2	10	8	100	100	NOT USED	100	100	FL3 (A) ENBL
2	4	7	2	10	4	99	99	↓	99	99	FL1 (16 kHz) ENBL
2	4	6	2	10	2	35	35	↓	35	35	VBFO ENBL
2	4	5	2	10	1	34	34	↓	34	34	AFC ENBL
2	4	4	2	11	8	98	98	↓	98	98	B1 AGC (2)
2	4	3	2	11	4	33	33	↓	33	33	B1 AGC (1)
2	4	2	2	11	2	97	97	↓	97	97	AI AGC (2)
2	4	1	2	11	1	32	32	PEAK CLIPPER ENBL	32	32	A1 AGC (1)
2	5	8	2	12	8	73	73	NOT USED	73	73	DATA NET ENBL
2	5	7	2	12	4	8	8	AM ENBL	8	8	AM ENBL
2	5	6	2	12	2	72	72	CW ENBL	72	72	CW ENBL
2	5	5	2	12	1	9	9	ISB ENBL	9	9	ISB ENBL
2	5	4	2	13	8	74	74	B2 ENBL	74	74	B2 ENBL
2	5	3	2	13	4	6	92	B1 ENBL	6	92	B1 ENBL
2	5	2	2	13	2	26	91	A1 ENBL	26	91	A1 ENBL
2	5	1	2	13	1	17	21	A2 ENBL	17	21	A2 ENBL

CONTROL / STATUS BIT WORD FORMAT

HF-80 8-BIT WORD NO.	HF-80 8-BIT CHARACTER NO.	HF-80 8-BIT BIT NO.	ASCII 7-BIT WORD NO.	ASCII 7-BIT CHARACTER NO.	ASCII 7-BIT BIT WT.	EXCITER, AND EXCITER CONTROL PARALLEL OUTPUT PIN NO.	EXCITER, AND EXCITER CONTROL PARALLEL INPUT PIN NO.	EXCITER, AND EXCITER CONTROL FUNCTION	RECEIVER, AND RECEIVER CONTROL PARALLEL OUTPUT PIN NO.	RECEIVER, AND RECEIVER CONTROL PARALLEL INPUT PIN NO.	RECEIVER, AND RECEIVER CONTROL FUNCTION
3	2	8	3	6	8			NOT USED			NOT USED
3	2	7	3	6	4			↓			NOT USED
3	2	6	3	6	2			↓			NOT USED
3	2	5	3	6	1	107	107	↓	107	107	VBFO SIGN
3	2	4	3	7	8	48	48	↓	48	48	VBFO FREQ 1 kHz (8)
3	2	3	3	7	4	113	113	↓	113	113	↓ (4)
3	2	2	3	7	2	47	47	↓	47	47	↓ (2)
3	2	1	3	7	1	112	112	↓	112	112	↓ (1)
3	3	8	3	8	8			NOT USED	46	46	VBFO FREQ 100 Hz (8)
3	3	7	3	8	4			↓	111	111	↓ (4)
3	3	6	3	8	2			↓	110	110	↓ (2)
3	3	5	3	8	1			↓	44	44	↓ (1)
3	3	4	3	9	8			↓	109	109	VBFO FREQ 10 Hz (8)
3	3	3	3	9	4			↓	43	43	↓ (4)
3	3	2	3	9	2			↓	108	108	↓ (2)
3	3	1	3	9	1			↓	42	42	↓ (1)
3	4	8	3	10	8	7	7	NOT USED	7	7	NOT USED
3	4	7	3	10	4	8	8	↓	8	8	↓
3	4	6	3	10	2	10	10	↓	10	10	↓
3	4	5	3	10	1	9	9	↓	9	9	↓
3	4	4	3	11	8	3	3	↓	3	3	↓
3	4	3	3	11	4	5	5	↓	5	5	↓
3	4	2	3	11	2	6	6	↓	6	6	↓
3	4	1	3	11	1	4	4	↓	4	4	↓
3	5	8	3	12	8			NOT USED			NOT USED
3	5	7	3	12	4			↓			↓
3	5	6	3	12	2			↓			↓
3	5	5	3	12	1	18	81	↓	18	81	↓
3	5	4	3	13	8	82	82	PILOT CARRIER ENBL	82	82	B2 AGC BUS
3	5	3	3	13	4	78	78	PA L PWR ENBL	78	78	B1 AGC BUS
3	5	2	3	13	2	14	14	PA HV ENBL	14	14	AI AGC BUS
3	5	1	3	13	1	79	79	PA LV ENBL	79	79	A2 AGC BUS
4	2	8	4	6	8			NOT USED			NOT USED
4	2	7	4	6	4			NOT USED			NOT USED
4	2	6	4	6	2	(12)	13	EXCTR FLT	(12)	13	RCVR FLT
4	2	5	4	6	1	92 (68)	68	REMOTE KEY (MON)	92 (68)	68	RF OVLD FLT
4	2	4	4	7	8		88	B2 AF MON		88	B2 AF MON
4	2	3	4	7	4		23	B1 AF MON		23	B1 AF MON
4	2	2	4	7	2		22	AI AF MON		22	AI AF MON
4	2	1	4	7	1		24	A2 AF MON		24	A2 AF MON
4	3	8	4	8	8	(2)	2	NOT USED	(2)	2	NOT USED
4	3	7	4	8	4	(40)	40	10 Hz LOCK IND	(40)	40	10 Hz LOCK IND
4	3	6	4	8	2		105	100 Hz LOCK IND		105	100 Hz LOCK IND
4	3	5	4	8	1		36	1 kHz LOCK IND		36	1 kHz LOCK IND
4	3	4	4	9	8		83	10 kHz LOCK IND		83	10 kHz LOCK IND
4	3	3	4	9	4		39	100 kHz LOCK IND		39	100 kHz LOCK IND
4	3	2	4	9	2		101	SYNTH OUT LOCK IND		101	SYNTH OUT LOCK IND
4	3	1	4	9	1		18	FREQ REF FLT		18	FREQ REF FLT
4	4	8	4	10	8	(69)	69	NOT USED	(69)	69	NOT USED
4	4	7	4	10	4	(77)	4	SUBCARRIER LOCK FLT	(77)	4	SUBCARRIER LOCK FLT
4	4	6	4	10	2	(5)	5	EXCTR RF MON	(5)	5	VBFO SYNTH FLT
4	4	5	4	10	1	(13)	70	EXCTR PS FLT	(13)	70	RCVR PS FLT
4	4	4	4	11	8	(67)	67	NOT USED	(67)	67	B2 AGC MON
4	4	3	4	11	4		49	EXT STANDARD		49	B1 AGC MON
4	4	2	4	11	2		86	A1 IF MON		86	A1 AGC MON
4	4	1	4	11	1	(105)	3	NOT USED	(105)	3	A2 AGC MON
4	5	8	4	12	8	(70)	77	PA READY	(70)	77	NOT USED
4	5	7	4	12	4	(104)	102	PA FLT	(104)	102	EXT STANDARD
4	5	6	4	12	2	(27)	7	PA RF MON	(27)	7	AFC LOCK MON
4	5	5	4	12	1	(92)	89	CPLR FLT	(92)	89	RF XLATOR MON
4	5	4	4	13	8	(28)	71	PRESEL FLT	(28)	71	PRESEL FLT
4	5	3	4	13	4	(29)	95	DATA ERROR	(29)	95	DATA ERROR
4	5	2	4	13	2	(95)	16	LOCAL CONTROL	(95)	16	LOCAL CONTROL
4	5	1	4	13	1	(30)	80	MONITOR	(30)	80	MONITOR

TPA-2876-014

Remote Control Word Format and Pin Assignment
Figure 6

523-0770698-00121A

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Part 2

HF-8054( )
Receiver

Part 2 of this instruction book includes:

Power Supply	*523-0767948*
LED Status Display	*523-0767946*
Frequency Switchboard	*523-0767947*
DVBFO Switchboard	*523-0770518*
Frequency Display	*523-0767975*
AFC	*523-0770519*
VBFO	*523-0770520*
Channel B1/A2/B2 IF	*523-0770708*
Channel A1 IF	*523-0770709*
Filter	*523-0767967*
RF Translator	*523-0767959*
Control	*523-0770710*
Parallel Input	*523-0770711*
Parallel Output	*523-0770712*
Serial Interface	*523-0770713*
Synthesizer Voltage Regulator	*523-0767974*
Synthesizer Subcarrier Generator	*523-0770714*
Synthesizer Reference	*523-0770715*
Synthesizer End Decade	*523-0767973*
Synthesizer Decade	*523-0767972*
Synthesizer Output	*523-0767971*
Receive Audio	*523-0767956*
Frequency Standard Switch	*523-0770716*
TS-8010 Card Extender Kit	*523-0767968*
Options:	
AC-8012 Oven Standard Kit	*523-0768671*
AC-8013 External Standard Kit	*523-0768672*
AC-8014 Frequency Display Kit	*523-0770521*
AC-8015 Frequency Switch Kit	*523-0770717*
AC-8017/8017A 100- to 10-Hz Conversion Kit	*523-0768676*
AC-8018 10- to 1-Hz Conversion Kit	*523-0768673*
AC-8019 100- to 1-Hz Conversion Kit	*523-0768677*
AC-8055 IF Filters Kit	*523-0768674*

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Power Supply (635-9649-001)

Rockwell International

instructions

Collins Telecommunications Products Division

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2nd Revision, 1 January 1981

1. DESCRIPTION

Power Supply 635-9649-001, shown in figure 1, is a module that contains a power transformer, a 2-section input power strapping switch, six power regulators, and a planar circuit card with full-wave rectifiers and an output fault circuit.

The power supply module consists of four primary functional areas: input power switching, power transformer and rectifiers, regulators, and the output fault summary circuit. Refer to figure 2 for a block diagram of the power supply module.

2. PRINCIPLES OF OPERATION

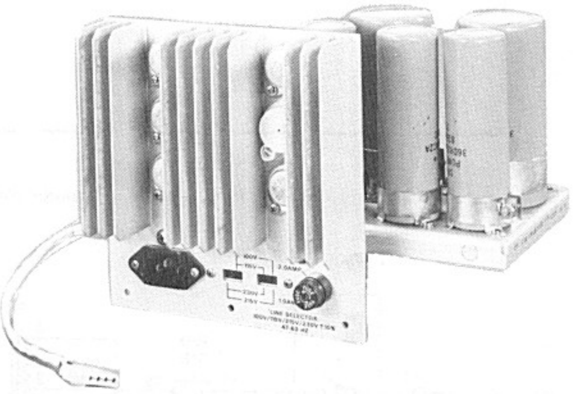
2.1 General

This power supply is fuse protected (2 A for 100/115 V ac; 1 A for 215/230 V ac) and supplies a loss-of-output fault indication. The input power is switchable between 100-, 115-, 215-, and 230-V ac single phase. Output voltages supplied are +24, +18, +15, +8, +5, and -15 V dc.

2.2 Input Power Switching (Refer to figure 3.)

The input power circuit consists of a fuse protector, power on-off switch S2, power control switch S1, and power transformer T1.

Note that power control switch S1 is a dual switch having two 2-position switches. S1A (low pin numbers) selects between series connection (215, 230 V ac) and parallel connection (110, 115 V ac) of transformer T1. S1B (high pin numbers) selects between less-turns ratio (115, 230 V ac) and more-turns ratio (110, 215 V ac) of transformer T1.



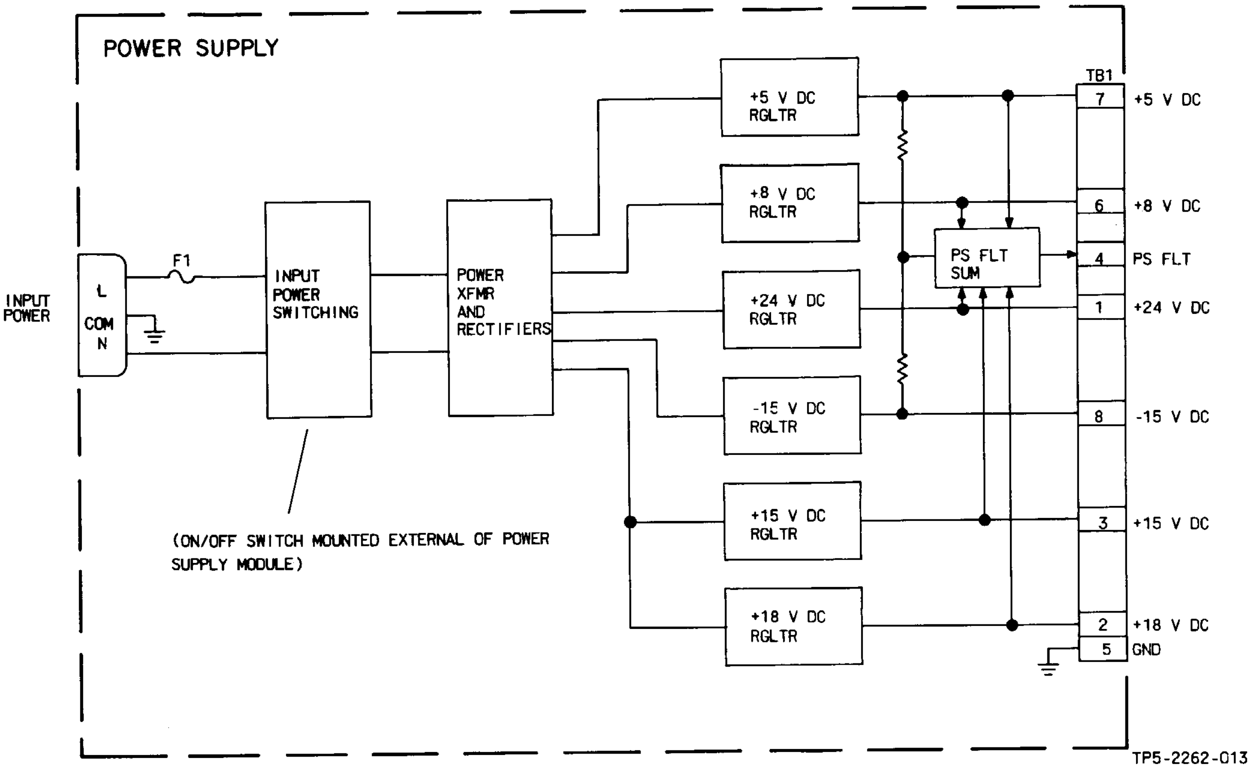
Power Supply
Figure 1

2.3 Power Transformer, Rectifiers, and Regulators (Refer to figure 4.)

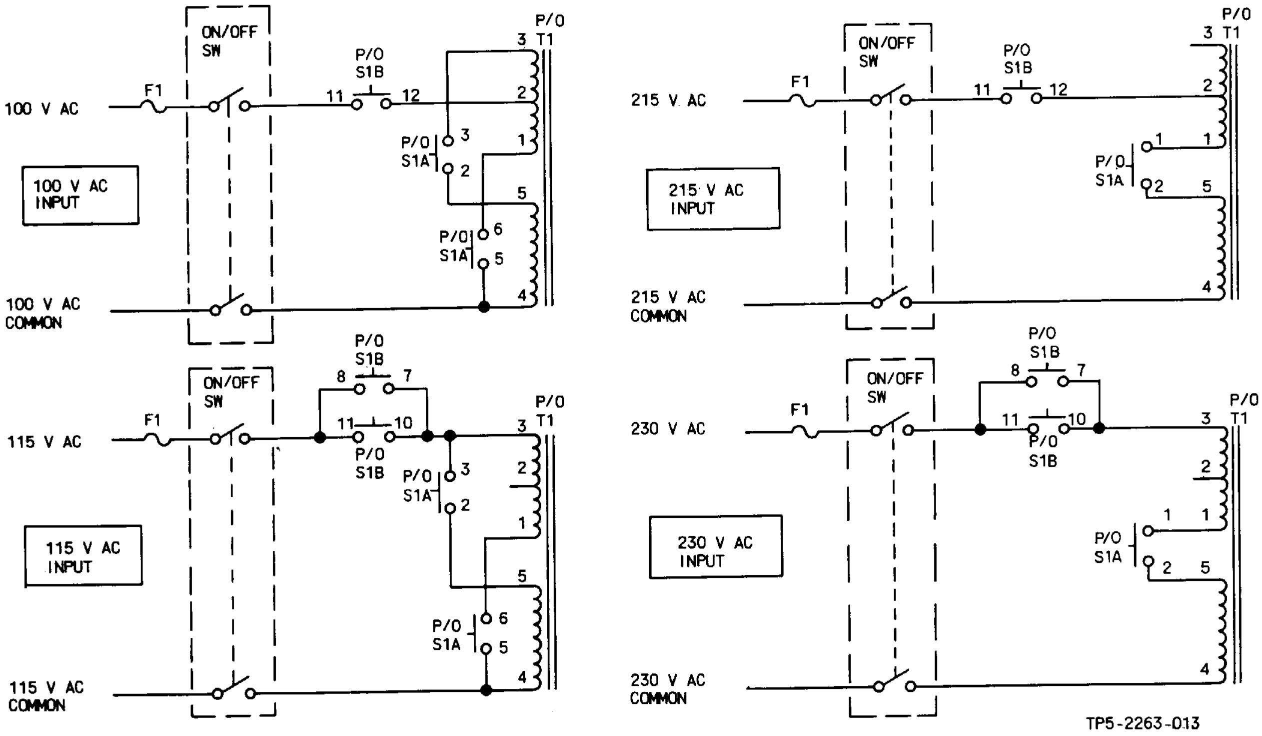
Power supply outputs are generated by the dual secondary of T1, full-wave rectified by five rectifier circuits, and regulated by six micromodule regulators. Each regulator has its own input rectifier circuit, except the +18- and +15-V dc regulators share a rectifier.

2.4 Fault Summary (Refer to figure 5.)

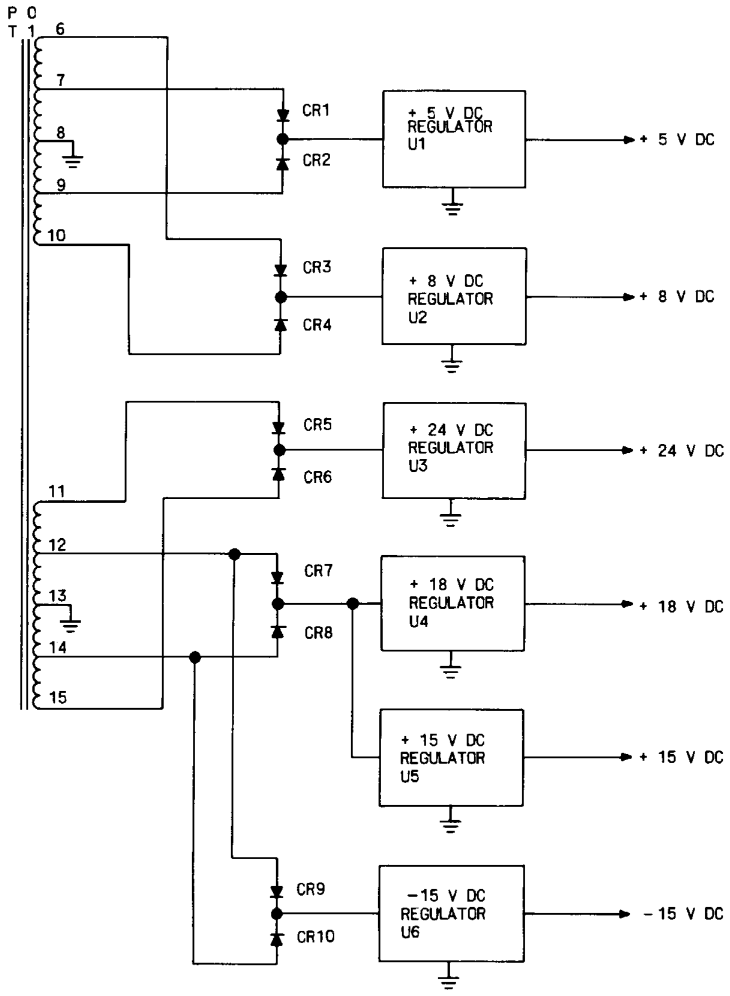
A fault summary circuit provides constant monitoring of power supply outputs and generates a fault output if any positive output drops below +5 V dc or if the negative output goes any more positive than -5 V dc.



Power Supply, Block Diagram
Figure 2

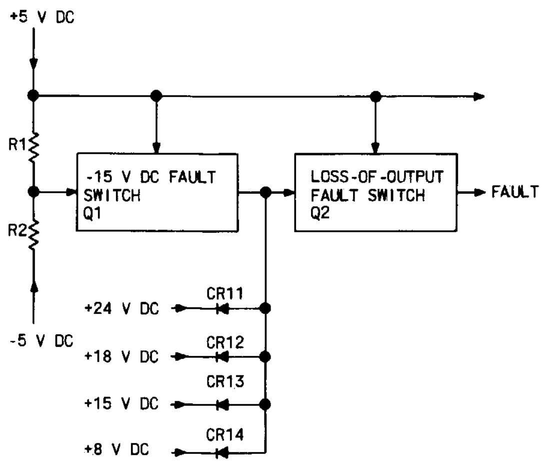


Input Power Transformer Switching
Figure 3



TP5-2260-013

Power Transformer, Rectifiers, and Regulators
Figure 4



TP5-2261-013

Fault Summary
Figure 5

With all outputs normal, Q1 is cut off and +5 V dc is supplied through R4 and R6 to switch on Q2. This provides a logic 0 (ground) fault summary output, indicating all supplies are operating.

If the +5-V dc output decreases to a level low enough to cut off Q2, the logic 0 (ground) fault signal is removed and a logic 1 (open circuit) fault signal is supplied.

With +5 V dc at normal, if the -15-V dc output goes positive to a level at approximately -5 V dc or less, Q1 switches on and supplies a ground signal through R6 to cut off Q2. The logic 0 (ground) fault signal is removed and a logic 1 (+5-V dc) fault signal is supplied.

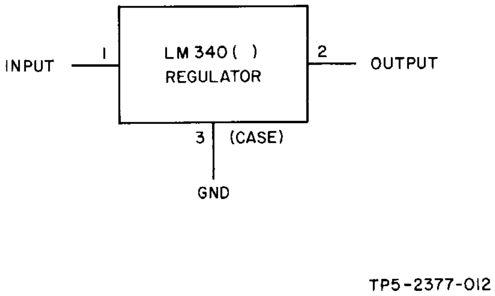
With +5 V dc at normal, if the +24-, +18-, +15-, or +8-V dc output falls below approximately +5 V dc, Q2 is cut off, the logic 0 (ground) fault signal is removed, and a logic 1 (+5-V dc) fault signal is supplied.

2.5 Voltage Regulators (Refer to figure 6 and to table 1.)

The LM340/320 series of three terminal regulators is available with several fixed output voltages, making them useful in a wide range of applications. One of these is local on-card regulation, eliminating the distribution problems associated with single-point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, and other solid-state electronic equipment. Although designed as fixed-voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

Table 1. Electrical Characteristics.

CHARACTERISTIC	LM340T-5/ 7805KC	LM340T-8/ 7808KC	LM340T-15/ 7815KC	LM320K-15	LM340T-18/ 7818KC	LM340T-24/ 7824KC
Max input voltage	35 V (except LM340T-24, 40 V)					
Operating temperature	0 to +70° C (+32 to +158° F)					
Storage temperature	-65 to +150° C (-85 to +302° F)					
Line regulation						
100 mA out	50 mV max	80 mV max	150 mV max	150 mV max	180 mV max	240 mV max
500 mA out	100 mV max	160 mV max	300 mV max	300 mV max	360 mV max	480 mV max
Output voltage	4.75 V min 5.25 V max	7.6 V min 8.4 V max	14.25 V min 15.75 V max	14.25 V min 15.75 V max	17.1 V min 18.9 V max	22.8 V min 25.2 V max
Ripple rejection	60 dB typical	55 dB typical	50 dB typical	50 dB typical	48 dB typical	44 dB typical



Voltage Regulator
Figure 6

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the power supply module are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 2 check total performance of the power supply module. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Table 2. Power Supply, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove bottom cover of unit containing power supply to be tested. *Note* For a quick check these loads need not be installed. Leave power supply connected in unit and perform all test procedures. b. Disconnect all output leads from A1TB1. c. Connect the following loads between A1TB1 pins indicated and A1TB1-5 (black wire). A1TB1- (WIRE COLOR) LOAD 7 (violet) 5 Ω 6 (blue) 10 Ω 1 (brown) 40 Ω 2 (red) 22 Ω 3 (orange) 15 Ω 8 (gray) 22 Ω		
2. LINE SELECTOR switch	a. Connect power supply to 50-V ac source and set power on. b. Measure dc voltage at A1E5 with LINE SELECTOR switch set at each of the following positions:		Check CR5, CR6, S1A, S1B, and T1.
(Cont)	100 V	11.8 to 16.0 V dc	

Table 2. Power Supply, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	115 V	13.0 to 14.0 V dc	
	215 V	6.9 to 7.5 V dc	
	230 V	6.5 to 7.0 V dc	
	c. Set power off and remove 50-V ac source.		
3. Output voltage	a. Connect power supply to 103-V ac source.		
	b. Set LINE SELECTOR switch to 115 V and set power on.		
	c. Measure dc voltage at each of the following outputs:		Check the following components and circuits associated with each:
	<u>A1TB1-</u>		
	7 (+5 V)	+4.8 to +5.2 V dc.	U1, CR1, CR2, and T1.
	6 (+8 V)	+7.6 to +8.4 V dc.	U2, CR3, CR4, and T1.
	1 (+24 V)	+23 to +25 V dc.	U3, CR5, CR6, and T1.
	2 (+18 V)	+15.5 to +18.7 V dc.	U4, CR7, CR8, and T1.
	3 (+15 V)	+14.4 to +15.6 V dc.	U5, CR7, CR8, and T1.
	8 (-15 V)	-14.6 to -15.4 V dc.	U6, CR9, CR10, and T1.
	d. Set power off. Disconnect 103-V ac source and connect power supply to 127-V ac source.		
	e. Set power on and measure dc voltage at each of the following outputs:		
	<u>A1TB1-</u>		
	7 (+5 V)	+4.8 to +5.2 V dc.	U1, CR1, CR2, and T1.
	6 (+8 V)	+7.6 to +8.4 V dc.	U2, CR3, CR4, and T1.
	1 (+24 V)	+23 to +25 V dc.	U3, CR5, CR6, and T1.
	2 (+18 V)	+17.3 to +18.7 V dc.	U4, CR7, CR8, and T1.
	3 (+15 V)	+14.4 to +15.6 V dc.	U5, CR7, CR8, and T1.
	8 (-15 V)	-14.6 to -15.6 V dc.	U6, CR9, CR10, and T1.
	f. Set power off and disconnect 127-V ac source.		

Table 2. Power Supply, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. Output ripple	a. Connect power supply to 103-V ac source.		
	b. Set LINE SELECTOR switch to 115 V and set power on.		
	c. Measure ac ripple voltage at each of the following outputs:		Check the following components and circuits associated with each.
	<u>A1TB1-</u>		
	7 (+5 V)	NMT 5 mV.	C14, CR1, CR2, and T1.
	6 (+8 V)	NMT 5 mV.	C15, CR3, CR4, and T1.
	1 (+24 V)	NMT 5 mV.	C16, CR5, CR6, and T1.
	2 (+18 V)	NMT 350 mV.	C17, CR7, CR8, and T1.
	3 (+15 V)	NMT 5 mV.	C18, CR7, CR8, and T1.
	8 (-15 V)	NMT 5 mV.	C18, CR9, CR10, and T1.
	d. Set power off. Disconnect 103-V ac source and connect power supply to 127-V ac source.		
	e. Set power on and measure ac ripple voltage at each of the following outputs:		
	<u>A1TB1-</u>		
	7 (+5 V)	NMT 5 mV.	C14. CR1. CR2, and T1.
	6 (+8 V)	NMT 5 mV.	C15. CR3, CR4, and T1.
	1 (+24 V)	NMT 5 mV.	C16, CR5. CR6, and T1.
	2 (+18 V)	NMT 5 mV.	C17. CR7. CR8. and T1.
	3 (+15 V)	NMT 5 mV.	C18. CR7. CR8, and T1.
	8 (-15 V)	NMT 5 mV.	C19. CR9. CR10, and T1.
	f. Set power off and disconnect 127-V ac source.		

Table 2. Power Supply, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Fault	a. Connect power supply to 103-V ac source. b. Set LINE SELECTOR switch to 115 V and set power on. c. Measure dc output voltage at A1TB1-4 (fault) as each of the following dc output voltages is shorted to A1TB1-5 (ground). *Note* Only one short applied at a time. A1TB1-	*Note* There is no +5-V dc output fault indication in the power supply. +5-V dc output fault indicated by associated control card circuits and front-panel indicator.	Check the following components and circuits associated with each.
	7 (+5 V)	NMT 0.10 V dc.	R5, Q2, and Q1.
	6 (+8 V)	+4.5 to +5.5 V dc.	CR14.
	1 (+24 V)	+4.5 to +5.5 V dc.	CR11.
	2 (+18 V)	+4.5 to +5.5 V dc.	CR12.
	3 (+15 V)	+4.5 to +5.5 V dc.	CR13.
	8 (-15 V)	+4.5 to +5.5 V dc.	R1 and Q1.
	d. Measure dc output voltage at A1TB1-4 (fault) with no shorted outputs applied.	NMT 0.2 V dc.	R2, Q1, R4, R6, R3, and Q2.
	e. Check that all output voltages are restored when shorts are removed. f. Set power off and disconnect 103-V ac source.		
6. Transformer regulation	a. Remove all output loads. b. Connect power supply to 125-V ac source. c. Set LINE SELECTOR switch to 115 V and set power on.		
	d. Measure dc voltage at CR5 and CR6 cathode.	NMT 45.0 V dc.	Check T1 and associated circuits.
	e. Set power off and disconnect 127-V ac source.		

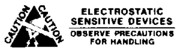
4. REPAIR

Repair of the power supply module is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 *Introduction*

> **Caution**
>
> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and also in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 7). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

5.2 *Parts List*

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses, and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

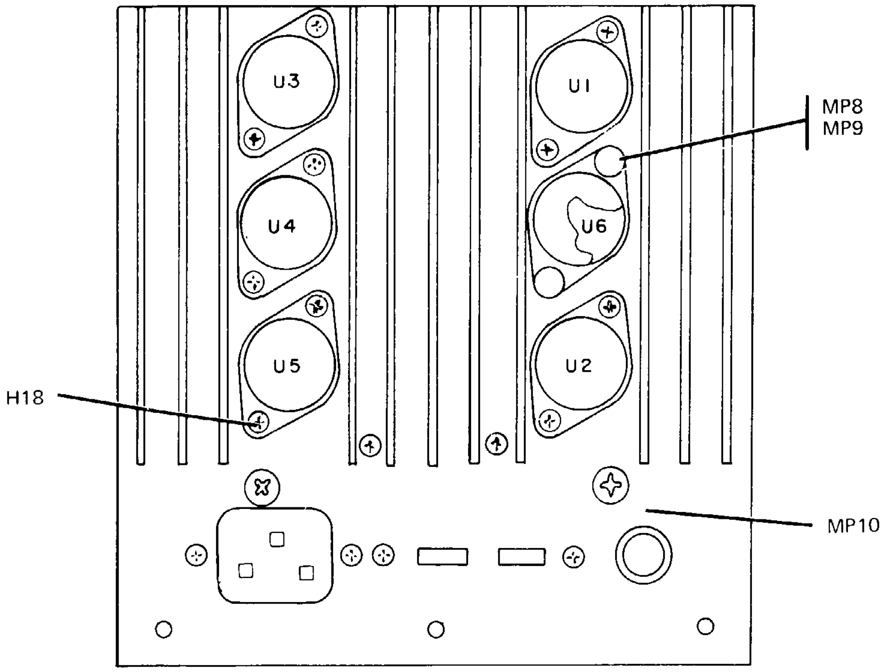
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
13103	THERMALLOY CO INC 2021 W VALLEY VIEW LANE P O BOX 34829 DALLAS TX 75234
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
14099	SEMTECH CORP 652 MITCHELL ROAD NEWBURY PARK CA 91320
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051

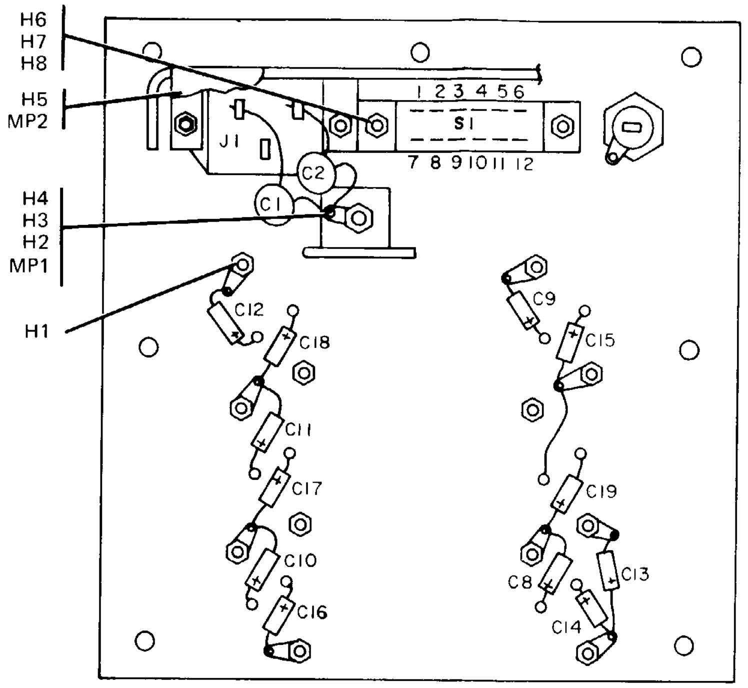
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
71400	BUSSMANN MFG DIV MCGRAW-EDISON CO 502 EARTH CITY PLAZA P O BOX 14460 ST LOUIS MO 63178
71785	TRW CINCH CONNECTORS 1501 MORSE AVE ELK GROVE VILLAGE IL 60007
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
77250	PHEOLL MFG CO DIV OF ALLIED PRODUCTS CORP 5700 W ROOSEVELT RD CHICAGO IL 60650
79807	WROUGHT WASHER MFG INC 2100 S O BAY ST MILWAUKEE WI 53207
80205	NATIONAL AEROSPACE STANDARDS COMMITTEE AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA INC 1725 DE SALES N W WASHINGTON DC 20036
81349	MILITARY SPECIFICATION
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO 5555 N ELSTON AVE CHICAGO IL 60630
91314	LEWIS SPRING AND MFG CO 2652 W NORTH AVE CHICAGO IL 60647
91886	MALCO A MICRODOT CO 12 PROGRESS DR MONTGOMERYVILLE PA 18936
96906	MILITARY STANDARD
98330	POLYPHASE INSTRUMENT CO E FOURTH ST BRIDGEPORT PA 19405

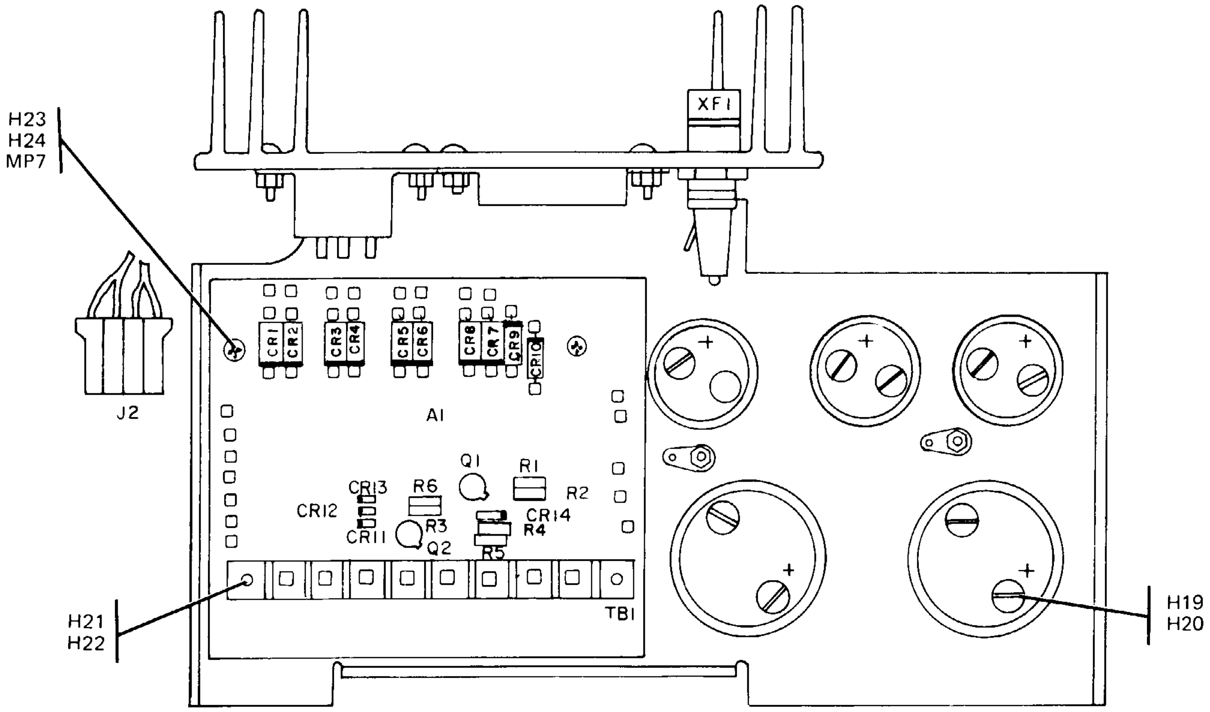
6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Power Supply	635-9649-001	REV E
Power Supply Card	635-0903-001	REV B







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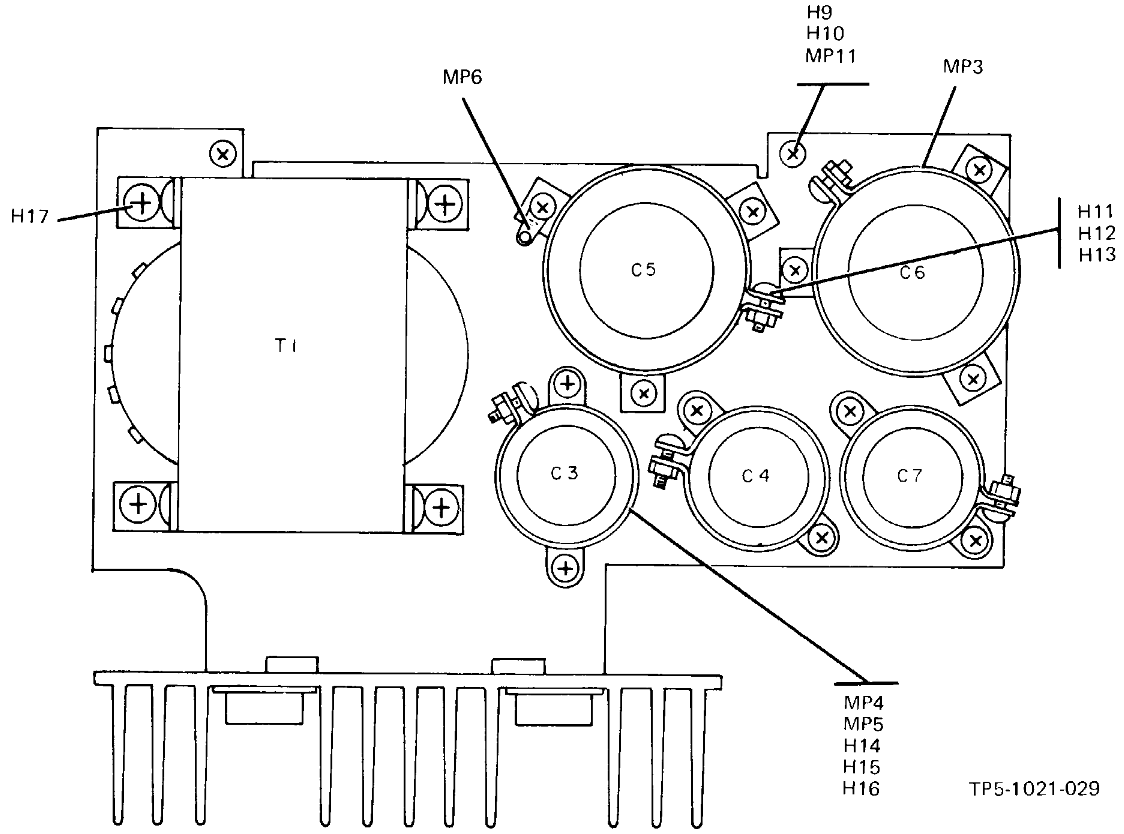


TP5-1021-029

Power Supply, Schematic Diagram
Figure 7 (Sheet 1 of 3)

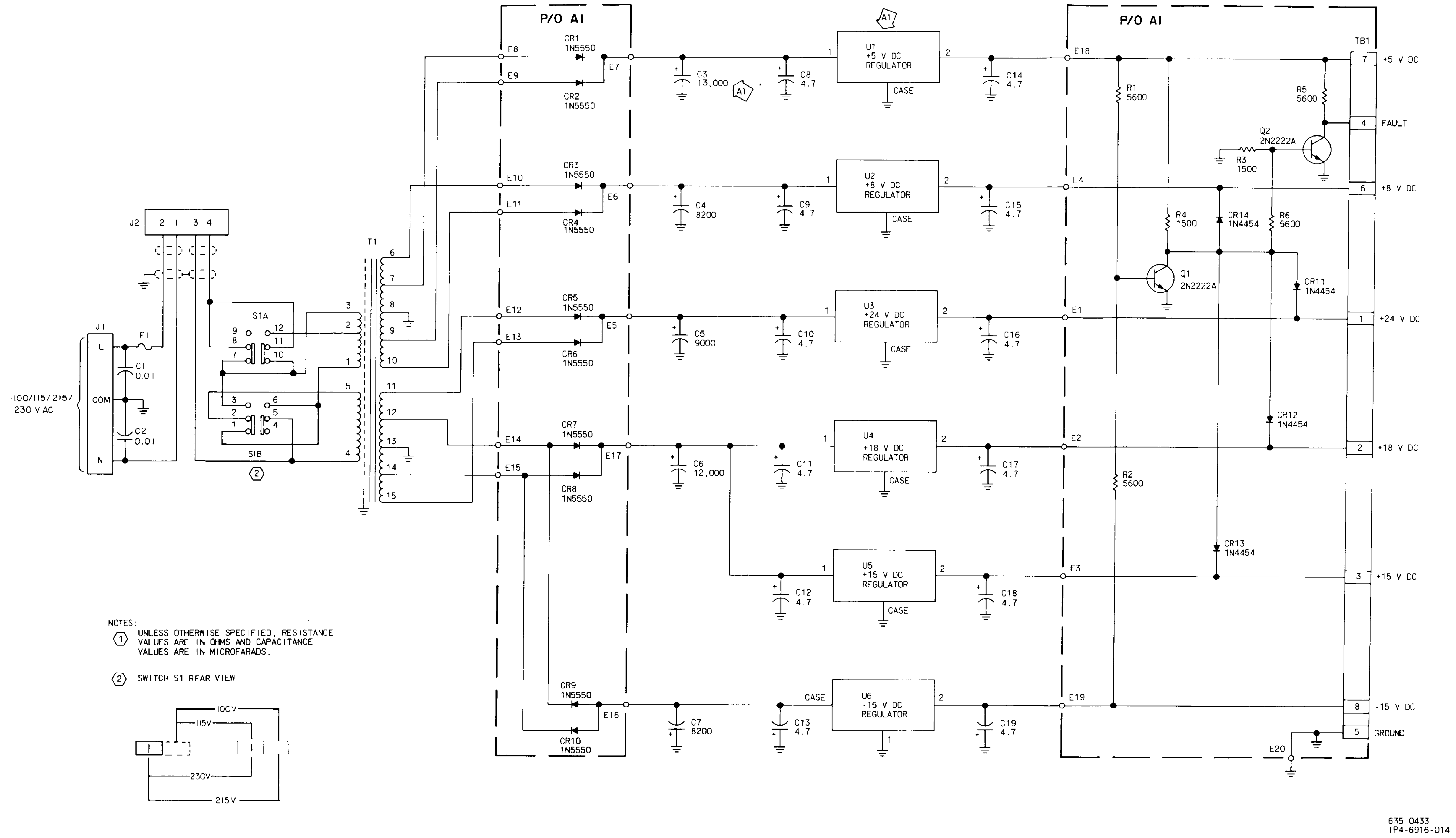
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	POWER SUPPLY	635-9649-001			635-9649-001
A1	POWER SUPPLY CARD	635-0903-001			635-0903-001
C1,C2	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V	913-3013-000		56289	36C175A
C3	CAPACITOR,FXD ELCTLT, 13000UF, P100%M10%, 15VDC	183-1278-080		56289	36D133G015AC2B
C4	CAPACITOR,FXD ELCTLT, 8200UF, 40%, 50V	183-1278-580		56289	36DX822G040AC2A
C5	CAPACITOR,FXD ELCTLT, 9000UF, P100%M10%, 50V	183-1278-380		56289	36D902G050BC2A
C6	CAPACITOR,FXD ELCTLT, 12000UF, P100%M10%, 40VDC	183-1278-190		56289	36D123G040BC2B
C7	CAPACITOR,FXD ELCTLT, 8200UF, 40%, 50V	183-1278-580		56289	36DX822G040AC2A
C8-C19	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 50V	184-9087-560		81349	M39003-01-2369
H1	SCREW,MACH NP BRS, 6-32 X 1/2 (QTY 2)	343-0332-000		77250	P343-0332-000
H2	SCREW,MACH SST, 10-32 X 1/2 (QTY 6)	343-0228-000		96906	MS51958-63
H3	WASHER,LOCK SST, 0.194 ID X 0.334 OD (QTY 14)	310-0284-000		96906	MS35338-138
H4	NUT,PLAIN,HEX SST, 10-32 (QTY 2)	313-0019-000		96906	MS35650-304
H5	SCREW,MACH STL, 4-40 X 7/16 (QTY 2)	343-0136-000		96906	MS51957-16
H6	SCREW,MACH SST, 4-40 X 5/16 (QTY 2)	343-0134-000		96906	MS51957-14
H7	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 2)	310-0279-000		96906	MS35338-135
H8	NUT,PLAIN,HEX SST, 4-40 (QTY 2)	313-0132-000		77250	P313-0132-000
H9	SCREW,MACH SST, 6-32 X 5/8 (QTY 2)	343-0173-000		96906	MS51957-31
H10	WASHER,FLAT BRS, 0.147 ID X 0.312 OD (QTY 18)	310-0055-000		79807	310-0055-000
H11	SCREW,MACH SST, 6-32 X 1/2 (QTY 2)	343-0171-000		96906	MS51957-30
H12	WASHER,LOCK SST, 0.150 ID X 0.317 OD (QTY 5)	373-8020-000		96906	MS35335-58
H13	NUT,PLAIN,HEX CRES,6-32 (QTY 5)	313-0002-000		96906	MS35649-264
H14	SCREW,MACH NP BRS, 6-32 X 3/8 (QTY 12)	343-0330-000		77250	P343-0330-000
H15	NUT,PLAIN,HEX NP BRS, 6-32 (QTY 26)	313-0140-000		77250	P313-0140-000
H16	WASHER,LOCK BRZ, 0.141 ID X 0.239 OD (QTY 28)	310-0078-000		79807	310-0078-000
H17	WASHER,FLAT PSVT CRES, 0.195 ID X 0.354 OD (QTY 4)	310-0740-520		80205	NAS620C10L
H18	SCREW,MACH NP BRS, 6-32 X 7/16 (QTY 10)	343-0331-000		77250	P343-0331-000
H19	SCREW,MACH NP BRS, 10-32 X 1/4 (QTY 10)	343-0343-000		77250	P343-0343-000
H20	WASHER,LOCK BRZ, 0.194 ID X 0.323 OD (QTY 10)	310-0081-000		79807	310-0081-000
H21	SCREW,MACH SST, 6-32 X 1/2 (QTY 5)	343-0171-000		96906	MS51957-30
H22	NUT,PLAIN,HEX SST, 6-32 (QTY 4)	313-0045-000		77250	P313-0045-000
H23	SCREW,MACH SST, 10-32 X 3/8 (QTY 4)	343-0226-000		96906	MS51958-61
H24	WASHER,FLAT BRS, 0.203 ID X 0.437 OD (QTY 4)	310-0059-000		79807	310-0059-000
J1	CONNECTOR,RCPT ELEC	368-0385-010		82389	EAC301
J2	HOUSING,SOCKET	372-5884-490		00779	1-480424-0
MP1	TERMINAL,LUG (QTY 1)	304-1466-010		91886	2115
MP2	COVER, CONN	635-9618-001			
MP3	CLAMP, MTG (QTY 2)	139-1183-000		56289	4586-48
MP4	RETAINER, CAP (QTY 3)	139-3284-000		56289	4586-97A
MP5	TERMINAL,LUG (QTY 12)	304-0016-000		77147	4007-6HT
MP6	TERMINAL,LUG (QTY 10)	304-1259-000		96906	MS25036-103
MP7	POST, HEX (QTY 4)	540-9540-003			540-9540-003
MP8	COVER,XSTR	352-9107-010		13103	8903NW
MP9	BUSHING,INSULATOR (QTY 2)	547-8177-014			547-8177-014
MP10	HEATSINK, POWER SUPPLY	635-9613-001			
MP11	RING,RETAINING (QTY 2)	340-0641-000		91314	340-0641-000
S1	SWITCH,SLIDE	266-0217-030		82389	11E1067
T1	TRANSFORMER,PWR	662-0605-010		98330	R103870
U1	REGULATOR,VOLT	351-1342-010		07263	UA78H05SC
U2	INTEGRATED CIRCUIT REGULATOR	351-1120-100		07263	7808KC
U3	INTEGRATED CIRCUIT REGULATOR	351-1120-140		07263	7824KC
U4	INTEGRATED CIRCUIT REGULATOR	351-1120-130		07263	7818KC
U5	INTEGRATED CIRCUIT REGULATOR	351-1120-120		07263	7815KC
U6	INTEGRATED CIRCUIT REGULATOR	351-1124-030		27014	LM320K15
XF1	FUSEHOLDER	265-1171-000		71400	HKPH
	POWER SUPPLY CARD A1	635-0903-001			635-0903-001
CR1-CR10	SEMICOND DEVICE	353-3718-040		14099	1N5550
CR11-CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
Q1,Q2	TRANSISTOR	352-0661-020		07263	2N2222A
R1,R2	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R3,R4	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R5,R6	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
TB1	TERMINAL,BOARD	367-1599-070		71785	8-176-2

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed: C3 from 10,000 µF to 13,000 µF U1 from type 7805KC to type UA78H05SC	635-9649-001 REV E and above

Power Supply, Schematic Diagram
Figure 7 (Sheet 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.

② SWITCH S1 REAR VIEW

Power Supply, Schematic Diagram
Figure 7 (Sheet 3)

Instructions

LED Status Display
635-0825-( )

523-0767946-004211

LED Status Display, 635-0825-( )

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767946-004211
4th Edition, 1 October 1980

1. DESCRIPTION

The LED Status Display 635-0825-( ), shown in figure 1, consists of up to 23 transistor-switch-controlled 5-V dc LED's. LED's are lighted when +5 V dc is applied at connector pin 25, a ground is applied at connector pin 16, and a positive voltage is applied to the connector pin associated with the individual LED. Refer to table 1 and figure 2 for signals (positive to light) and their associated connector pins and LED's.

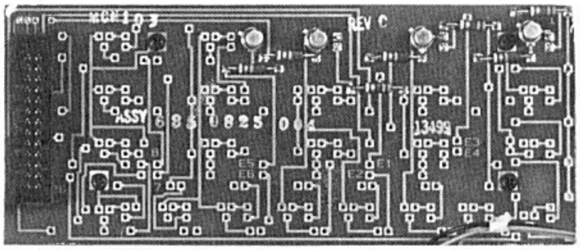
2. TESTING/TROUBLESHOOTING PROCEDURES

2.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the LED status display are listed in the maintenance section of this instruction book.

2.2 Testing

The test procedures in table 2 check total performance of the LED status display. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



TP5-2347-017

LED Status Display
Figure 1

3. REPAIR

Repair of the LED status display is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

NOTICE: This section replaces third edition dated 1 June 1979.

Table 1. LED Status Display, Configuration Matrix.

LED	APPLIED SIGNAL [SILKSCREEN IF DIFFERENT]	JUMPER	INPUT PIN (A2J3)	LED STATUS DISPLAY									
				635-0825-( )									
				-001	-002	-003	-004	-005	-006	-007	-008	-009	-010
DS1	Sidetone en [RF OUT]		9		X	X		X	X	X		X	
DS2	PA READY ind		10		X	X		X	X	X		X	
DS3	PA FAULT ind		11		X	X		X	X	X		X	
DS4	KEY ind		12		X	X		X	X	X		X	
DS5	R/E FAULT ind		13			X			X				
DS5	RCV FAULT ind		13	X			X				X		X
DS5	EXCTR FAULT ind		13		X			X		X		X	
DS6	RCV OVERLOAD		14	X		X	X		X		X		X
DS7	AFC LOCK ind		15										X
DS8	COUPLER FAULT ind		8		X	X		X	X	X		X	
DS9	LSB (FL2)	R9 to E2	17		X	X						X	
DS9	AM en	R9 to E1	4	X							X		X
DS10	SSB en [SSB/CW]	R10 to E3	5	X							X		X
DS10	CW en	R10 to E4	2		X	X						X	
DS11	ISB en		1		X	X						X	
DS12	USB (FL1)	R12 to E6	18		X	X						X	
DS12	ISB en	R12 to E5	1	X							X		X
DS13	AM en	R13 to E7	4		X	X						X	
DS13	FM en	R13 to E8	3										X
DS14	16 (FL8)		24	X							X		X
DS15	A (FL3)		22	X							X		X
DS16	B (FL4)		21	X							X		X
DS17	USB (FL1) [U]		18	X							X		X
DS18	LSB (FL2) [L]		17	X							X		X
DS19	C (FL5)		19	X							X		X
DS20	D (FL6)		20	X							X		X
DS21	E (FL7)		23	X							X		X
DS22	BUSY		6	X	X	X						X	X
DS23	PRESEL FAULT ind		7	X		X	X		X	X	X	X	X
				-011	-012	-013	-014						
DS1	Sidetone enbl [RF OUT]		9		X		X						
DS2	PA READY ind		10		X		X						
DS2	AM enbl		10			X							
DS3	PA FAULT ind		11		X		X						
DS3	AFC LOCK ind		11			X							
DS4	KEY ind		12		X		X						

Table 1. LED Status Display, Configuration Matrix (Cont).

LED	APPLIED SIGNAL [SILKSCREEN IF DIFFERENT]	JUMPER	INPUT PIN (A2J3)	LED STATUS DISPLAY									
				635-0825-( )									
				-011	-012	-013	-014						
DS4	ISB enbl		12			X							
DS5	R/E FAULT ind		13				X						
DS5	RCV FAULT ind		13	X		X							
DS5	EXCTR FAULT ind		13		X								
DS6	RCV OVERLOAD		14	X		X	X						
DS7	AFC LOCK ind		15	X			X						
DS7	CW enbl		15			X							
DS8	COUPLER FAULT ind		8		X		X						
DS8	BUSY		8			X							
DS9	AM enbl	R9 to E1	4		X								
DS9	B1 enbl	R9 to E1	4			X							
DS10	CW enbl	R10 to E4	2		X								
DS10	B2 enbl	R10 to E3	5			X							
DS11	PEAK CLIPPER		1		X								
DS12	A1 enbl	R12 to E5	1			X							
DS13	PILOT CARRIER	R13 to E8	3		X								
DS13	A2 enbl	R13 to E8	3			X							
DS14	ISB ind		24		X								
DS14	FL1 enbl [16]		24			X							
DS15	B1 ind		22		X								
DS15	FL5 enbl [C]		22			X							
DS16	A1 ind		21		X								
DS16	FL6 enbl [D]		21			X							
DS17	FL3 enbl [A]		18			X							
DS18	B2 ind		17		X								
DS18	FL4 enbl [B]		17			X							
DS19	A2 ind		19		X								
DS19	FL7 enbl [E]		19			X							
DS20			20										
DS21			23										
DS22	NET DATA enbl		6			X							
DS23	PRESEL FAULT ind		7	X	X	X	X						

NOTES:

X indicates LED and associated circuit are installed in LED status display and any associated jumpers are installed.

A blank indicates LED and associated circuit are <u>not</u> installed in LED status display, and any associated jumpers are removed.

Table 2. LED Status Display, Testing and Troubleshooting Procedures.

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing LED status display to be tested. b. If local unit, remove control card A10. Install A10 extender. If control unit, remove parallel output card A12. Install A12 extender. *Note* Control card A10 in local unit or parallel output card A12 in control unit is not installed during these tests. c. Connect a test lead to (+5 V dc). *Note* This test lead is used for biasing on the switching transistors.				
2. LED Status Display 635-0825-001 and 635-0825-008	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead. b. Check that each LED goes out when test lead is removed from associated extender pin. c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	ISB	DS12	DS12, Q12, R12, and R34.
	8	4	AM	DS9	DS9, Q9, R9, R31, Q23, and R45.
	72	5	SSB/CW	DS10	DS10, Q10, R10, and R32.
	7	6	BUSY	*DS22	DS22, Q22, R22, and R44.
	28	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	12	13	RCV FAULT	DS5	DS5, Q5, R5, and R27.
(Cont)	67	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28

*Applicable only to 635-0825-001.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	97	17	L	DS18	DS18, Q18, R18, and R40.
	32	18	U	DS17	DS17, Q17, R17, and R39.
	34	19	C	DS19	DS19, Q19, R18, and R41.
	35	20	D	DS20	DS20, Q20, R20, and R42.
	98	21	B	DS16	DS16, Q16, R16, and R38.
	33	22	A	DS15	DS15, Q15, R15, and R37.
	99	23	E	DS21	DS21, Q21, R21, and R43.
	100	24	16	DS14	DS14, Q14, R14, and R36.
	e. Connect +5 V dc to extender pin 72 (A2J3-5).			DS10 (SSB/CW) lights.	DS10, Q10, R10, R32, Q23, and R45.
	f. Connect test lead to extender pin 74 (A2J3-1).			DS12 (ISB) lights.	DS12, Q12, R12, and R24.
				DS10 (SSB/CW) goes out.	Q23 and R45.
	g. Remove +5 V dc from extender pin 72 and test lead from extender pin 74.				
3. LED Status Display 635-0825-002	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	ISB	DS11	DS11, Q11, R11, and R33.
	9	2	CW	DS10	DS10, Q10, R10, and R32.
(Cont)	8	4	AM	DS13	DS13, Q13, R13, and R35.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	7	6	BUSY	DS22	DS22, Q22, R22, and R44.
	13	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	77	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	12	13	EXCTR FAULT	DS5	DS5, Q5, R5, and R27.
	97	17	LSB	DS9	DS9, Q9, R9, Q23, and R45.
	32	18	USB	DS12	DS12, Q12, R12, and Q34.
	e. Connect +5 V dc to extender pin 9 (A2J3-2)			DS10 (CW) lights.	DS10, Q10, R10, R32, Q23, and R45.
	f. Connect test lead to extender pin 74 (A2J3-1).			DS11 (ISB) lights.	DS11, Q11, R11, and R33.
				DS10 (CW) goes out.	Q23 and R45.
	g. Remove +5 V dc from extender pin 9 and test lead from extender pin 74.				
4. LED Status Display 635-0825-003	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
(Cont)	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	ISB	DS11	DS11, Q11, R11, and R33.
	9	2	CW	DS10	DS10, Q10, R10, and R32.
	8	4	AM	DS13	DS13, Q13, R13, and R35.
	7	6	BUSY	DS22	DS22, Q22, R22, and R44.
	28	7	PRESEL	DS23	DS23, Q24, R46, and R47.
	13	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	77	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	12	13	R/E FAULT	DS5	DS5, Q5, R5, and R27.
	67	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28.
	97	17	LSB	DS9	DS9, Q9, R9, R31, Q23, and R45.
	32	18	USB	DS12	DS12, Q12, R12, and Q34.
	e. Connect +5 V dc to extender pin 9 (A2J3-2).			DS10 (CW) lights.	DS9, Q9, R9, R31, Q23, and R45.
	f. Connect test leads to extender pin 74 (A2J3-1).			DS11 (ISB) lights.	DS11, Q11, R11, and R33.
				DS10 (CW) goes out.	Q23 and R45.
	g. Remove +5 V dc from extender pin 9 and test lead from extender pin 74.				
5. LED Status Display 635-0825-004 and 635-0825-011 (Cont)	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead. b. Check that each of the LED's go out when test lead is removed from associated extender pin.				

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	3	13	RCV FAULT	DS5	DS5, Q5, R5, and R27.
	67	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28.
	2	15	AFC LOCK	*DS7	DS7, Q7, R7, and R29.
6. LED Status Display 635-0825-005	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead. b. Check that each LED goes out when test lead is removed from associated extender pin. c. Connect test lead to extender pin indicated in step d and check that the associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	70	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	4	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	3	13	EXCTR FAULT	DS5	DS5, Q5, R5, and R27.
7. LED Status 635-0825-006 and 635-0825-014 (Cont)	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead. b. Check that each LED goes out when test lead is removed from extender associated extender pin. c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				

*Applicable only to 635-0825-011.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	70	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	4	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	3	13	R/E FAULT	DS5	DS5, Q5, R5, and R27.
	67	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28.
	2	15	AFC LOCK	*DS7	DS7, Q7, R7, and R29.
8. LED Status Display 635-0825-007	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	70	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	4	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	3	13	EXCTR FAULT	DS5	DS5, Q5, R5, and R27.

*Applicable only to 635-0825-014.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. LED Status Display 635-0825-009	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	ISB	DS11	DS11, Q11, R11, and R33.
	9	2	CW	DS10	DS10, Q10, R10, and R32.
	8	4	AM	DS13	DS13, Q13, R13, and R35.
	7	6	BUSY	DS22	DS22, Q22, R22, and R44.
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	70	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	4	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	3	13	EXCTR FAULT	DS5	DS5, Q5, R5, and R27.
	97	17	LSB	DS9	DS9, Q9, R9, Q23, and R45.
	32	18	USB	DS12	DS12, Q12, R12, and Q34.
(Cont)					

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	e. Connect +5 V dc to extender pin 9 (A2J3-2).			DS10 (CW) lights.	DS10, Q10, R10, R32, Q23, and R45.
	f. Connect test lead to extender pin 74 (A2J3-1).			DS11 (ISB) lights.	DS11, Q11, R11, and R33.
				DS10 (CW) goes out.	Q23 and R45.
	g. Remove +5 V dc from extender pin 9 and test lead from extender pin 74.				
10. LED Status Display 635-0825-010	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	ISB	DS12	DS12, Q12, R12, and R34.
	73	3	FM	DS13	DS13, Q13, R13, and R35.
	8	4	AM	DS9	DS9, Q9, R9, R31, Q23, and R45.
	72	5	SSB/CW	DS10	DS10, Q10, R10, and R32.
	7	6	BUSY	DS22	DS22, Q22, R22, and R44.
	28	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	12	13	RCV FAULT	DS5	DS5, Q5, R5, and R27.
	67	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28.
	2	15	AFC LOCK	DS7	DS7, Q7, R7, and R29.
	97	17	L	DS18	DS18, Q18, R18, and R40.
	32	18	U	DS17	DS17, Q17, R17, and R39.
(Cont)	34	19	C	DS19	DS19, Q19, R18, and R41.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	35	20	D	DS20	DS20, Q20, R20, and R42.
	98	21	B	DS16	DS16, Q16, R16, and R38.
	33	22	A	DS15	DS15, Q15, R15, and R37.
	99	23	E	DS21	DS21, Q21, R21, and R43.
	100	24	16	DS14	DS14, Q14, R14, and R36.
	e. Connect +5 V dc to extender pin 72 (A2J3-5).			DS10 (SSB/CW) lights.	DS10, Q10, R10, R32, Q23, and R45.
	f. Connect test lead to extender pin 74 (A2J3-1).			DS12 (ISB) lights.	DS12, Q12, R12, and R24.
				DS10 (SSB/CW) goes out.	Q23 and R45.
	g. Remove +5 V dc from extender pin 72 and test lead from extender pin 74.				
11. LED Status Display 635-0825-012	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead.				
	b. Check that each LED goes out when test lead is removed from associated extender pin.				
	c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A3J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	74	1	PEAK CLIPPER	DS11	DS11, Q11, R11, and R33.
	9	2	CW	DS10	DS10, Q10, R10, and R32.
	73	3	PILOT CARRIER	DS13	DS13, Q13, R13, and R35.
	8	4	AM	DS9	DS9, Q9, R9, and R31.
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
(Cont)	70	8	COUPLER FAULT	DS8	DS8, Q8, R8, and R30.

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	5	9	RF OUT	DS1	DS1, Q1, R1, and R23.
	69	10	PA READY	DS2	DS2, Q2, R2, and R24.
	4	11	PA FAULT	DS3	DS3, Q3, R3, and R25.
	68	12	KEY	DS4	DS4, Q4, R4, and R26.
	3	13	EXCTR FAULT	DS5	DS5, Q5, R5, and R27.
	NA (A2J2-24)	17	B2	DS18	DS18, Q18, R18, and R40.
	NA (A2J2-22)	19	A2	DS19	DS19, Q19, R19, and R41.
	NA (A2J2-20)	21	A1	DS16	DS16, Q16, R16, and R38.
	NA (A2J2-19)	22	B1	DS15	DS15, Q15, R15, and R37.
	NA (J9-9)	24	ISB	DS14	DS14, Q14, R14, and R36.
12. LED Status Display 635-0825-013	a. Check that none of the LED's listed in step d are lighted before associated extender pin is connected to test lead. b. Check that each LED goes out when test lead is removed from associated extender pin. c. Connect test lead to extender pin indicated in step d and check that associated LED lights when test lead is connected.				
	d. EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	26	1	A1	DS12	DS12, Q12, R12, and R34.
	17	3	A2	DS13	DS13, Q13, R13, and R35.
	6	4	B1	DS9	DS9, Q9, R9, R31, Q23, and R45.
	74	5	B2	DS10	DS10, Q10, R10, and R32.
	73	6	NET DATA	DS22	DS22, Q22, R22, and R44.
(Cont)					

Table 2. LED Status Display, Testing and Troubleshooting Procedures (Cont).

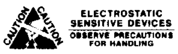
TEST	PROCEDURE			NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	EXTENDER PIN NO	A2J3 PIN NO	PANEL MARKING	ASSOCIATED LED	CHECK
	71	7	PRESEL FAULT	DS23	DS23, Q24, R46, and R47.
	NA (J14-10)	9	FM	DS1	DS, Q1, R1, and R23.
	8	10	AM	DS2	DS2, Q2, R2, and R24.
	66	11	AFC LOCK	DS3	DS3, Q3, R3, and R25.
	9	12	ISB	DS4	DS4, Q4, R4, and R26.
	13	13	RCV FAULT	DS5	DS5, Q5, R5, and R27.
	68	14	RCV OVERLOAD	DS6	DS6, Q6, R6, and R28.
	72	15	CW	DS7	DS7, Q7, R7, and R29.
	NA (J9-37)	17	FLB	DS18	DS18, Q18, R18, and R40.
	NA (J9-100)	18	FLA	DS17	DS17, Q17, R17, and R39.
	NA (J9-12)	19	FLE	DS19	DS19, Q19, R18, and R41.
	NA (J9-41)	21	FLD	DS16	DS16, Q16, R16, and R38.
	NA (J9-106)	22	FLC	DS15	DS15, Q15, R15, and R37.
	NA (J9-99)	24	16 kHz	DS14	DS14, Q14, R14, and R36.

4. PARTS LIST/DIAGRAMS

4.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and also in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 2). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

4.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

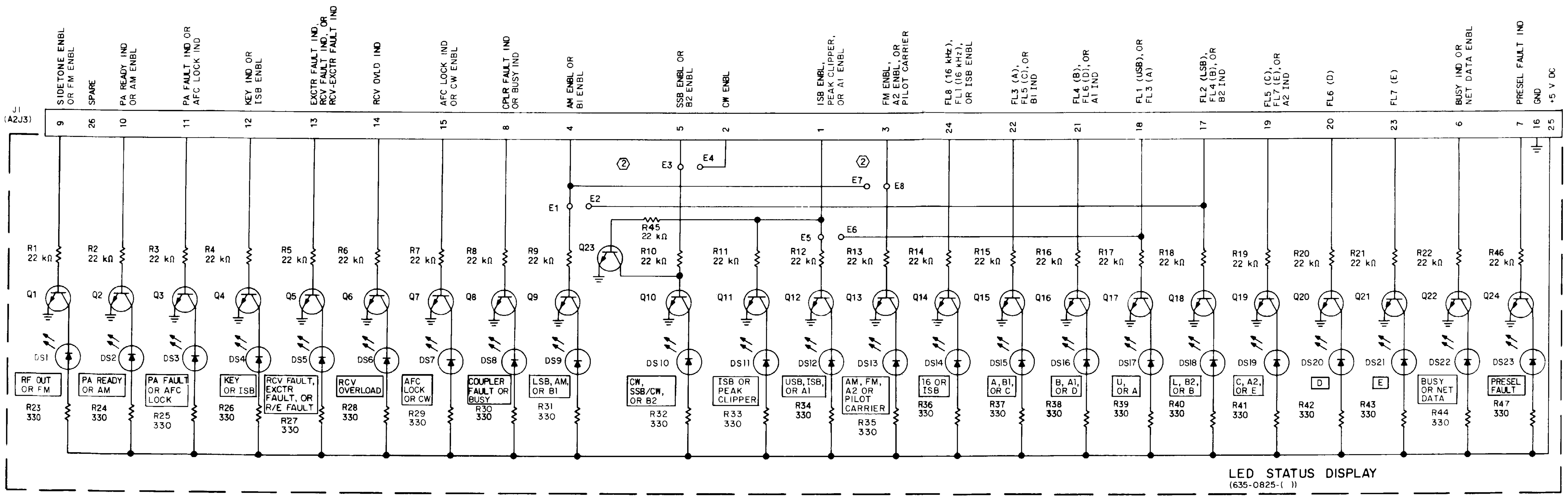
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
04404	HEWLETT-PACKARD CO AUTOMATIC MEASUREMENT DIV 974 E ARQUES AVE SUNNYVALE CA 94086
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
81349	MILITARY SPECIFICATION

4.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
LED status display	635-0825-001	REV C
LED status display	635-0825-002	REV E
LED status display	635-0825-003	REV E
LED status display	635-0825-004	REV D
LED status display	635-0825-005	REV D
LED status display	635-0825-006	REV D
LED status display	635-0825-007	REV G
LED status display	635-0825-008	REV J
LED status display	635-0825-009	REV J
LED status display	635-0825-010	REV —
LED status display	635-0825-011	REV P
LED status display	635-0825-012	REV P
LED status display	635-0825-013	REV N
LED status display	635-0825-014	REV —



NOTES:

① Q1-Q24 ARE TYPE 2N2222A.
DS3, DS5, DS6, DS8, AND DS23 ARE TYPE HP5082-4684 (RED) LED.
DS1, DS2, DS4, DS7, AND DS9-DS22 ARE TYPE HP5082-4584 (YELLOW) LED.

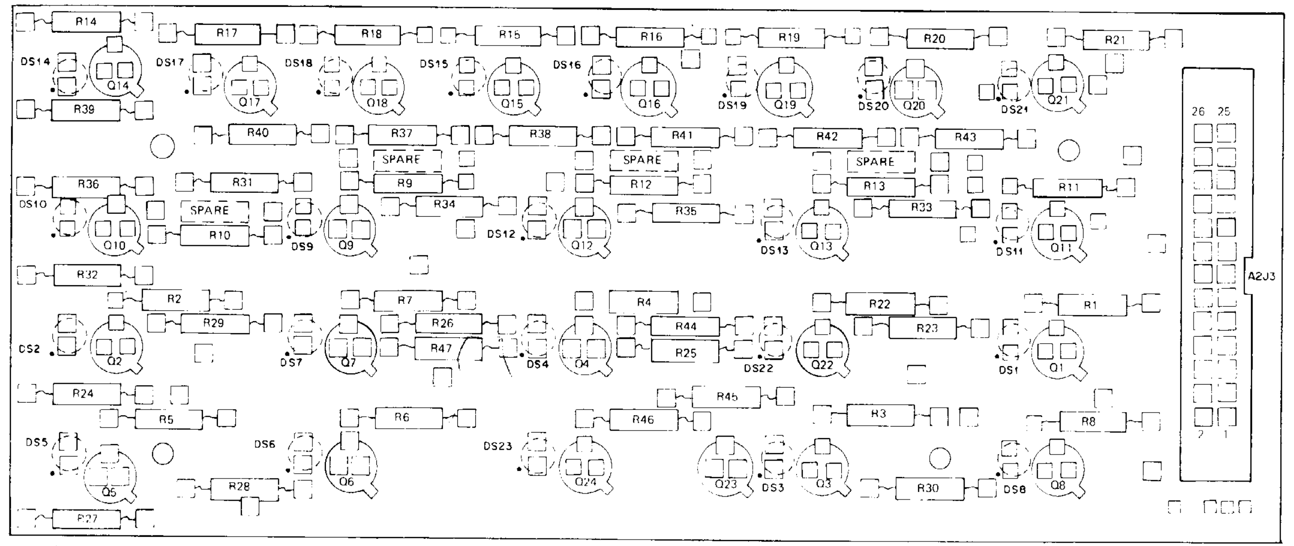
② E1 THRU E8 CONNECTED AS FOLLOWS:

JUMPER	635-0825-( )													
	-001	-002	-003	-004	-005	-006	-007	-008	-009	-010	-011	-012	-013	-014
R9 TO E1	X							X		X		X	X	
R9 TO E2		X	X						X					
R10 TO E3	X							X		X			X	
R10 TO E4		X	X						X			X		
R12 TO E5	X							X		X			X	
R12 TO E6		X	X						X					
R13 TO E7		X	X						X					
R13 TO E8										X		X	X	

③ UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS.

④ REFER TO PARTS LIST FOR ACTUAL CIRCUITS USED IN EACH CONFIGURATION OF THE LED STATUS DISPLAY.

TPA-2371-014



NOTE: ALL LEDS ARE MOUNTED ON BOTTOM OF BOARD

TP5-1156-013

LED Status Display, Schematic Diagram
Figure 2 (Sheet 1 of 3)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	LED STATUS DISPLAY	635-0825-001			
DS1-DS4	NOT USED				
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7,DS8	NOT USED				
DS9,DS10	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS11	NOT USED				
DS12	DIODE LIGHT EMI	353-0232-010		04404	HLMP1401
DS13	NOT USED				
DS14- DS22	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q4	NOT USED				
Q5,Q6	TRANSISTOR	352-0661-020		07263	2N2222A
Q7,Q8	NOT USED				
Q9,Q10	TRANSISTOR	352-0661-020		07263	2N2222A
Q11	NOT USED				
Q12	TRANSISTOR	352-0661-020		07263	2N2222A
Q13	NOT USED				
Q14-Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5,R6	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R7,R8	NOT USED				
R9,R10	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R11	NOT USED				
R12	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R13	NOT USED				
R14-R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23-R26	NOT USED				
R27,R28	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R29,R30	NOT USED				
R31,R32	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R33	NOT USED				
R34	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R35	NOT USED				
R36-R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-002			
DS1,DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS6,DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS13	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS14- DS21	NOT USED				
DS22	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6,Q7	NOT USED				
Q8-Q13	TRANSISTOR	352-0661-020		07263	2N2222A
Q14-Q21	NOT USED				
Q22,Q23	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6,R7	NOT USED				
R8-R13	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R14-R21	NOT USED				
R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23-R27	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R28,R29	NOT USED				
R30-R35	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R36-R43	NOT USED				
R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
	LED STATUS DISPLAY	635-0825-003			
DS1,DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS13	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS14- DS21	NOT USED				
DS22	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q6	TRANSISTOR	352-0661-020		07263	2N2222A
Q7	NOT USED				
Q8-Q13	TRANSISTOR	352-0661-020		07263	2N2222A
Q14-Q21	NOT USED				
Q22-Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R6	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R7	NOT USED				
R8-R13	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R14-R21	NOT USED				
R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23-R28	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R29	NOT USED				
R30-R35	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R36-R43	NOT USED				
R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-004			
DS1-DS4	NOT USED				
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7-DS22	NOT USED				
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q4	NOT USED				
Q5,Q6	TRANSISTOR	352-0661-020		07263	2N2222A
Q7-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5,R6	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R7-R26	NOT USED				
R27,R28	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R29-R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-005			
DS1,DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS6,DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6,Q7	NOT USED				
Q8	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6,R7	NOT USED				
R8	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R9-R22	NOT USED				
R23-R27	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R28,R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-006			
DS1,DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS22	NOT USED				
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q6	TRANSISTOR	352-0661-020		07263	2N2222A
Q7	NOT USED				
Q8	TRANSISTOR	352-0661-020		07263	2N2222A
Q9-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R6	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R7	NOT USED				
R8	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R9-R22	NOT USED				
R23-R28	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R31-R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-007			
DS1,DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS6,DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS22	NOT USED				
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6,Q7	NOT USED				
Q8	TRANSISTOR	352-0661-020		07263	2N2222A
Q9-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6,R7	NOT USED				
R8	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R9-R22	NOT USED				
R23-R27	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R28,R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R31-R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-008			
DS1-DS4	NOT USED				
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7,DS8	NOT USED				
DS9,DS10	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS11	NOT USED				
DS12	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS13	NOT USED				
DS14- DS21	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS22	NOT USED				
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q4	NOT USED				
Q5,Q6	TRANSISTOR	352-0661-020		07263	2N2222A
Q7,Q8	NOT USED				
Q9,Q10	TRANSISTOR	352-0661-020		07263	2N2222A
Q11	NOT USED				
Q12	TRANSISTOR	352-0661-020		07263	2N2222A
Q13	NOT USED				
Q14-Q21	TRANSISTOR	352-0661-020		07263	2N2222A
Q22	NOT USED				
Q23,Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5,R6	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R7,R8	NOT USED				
R9,R10	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R11	NOT USED				
R12	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R13	NOT USED				
R14-R21	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R22-R26	NOT USED				
R27,R28	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R29,R30	NOT USED				
R31,R32	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R33	NOT USED				
R34	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R35	NOT USED				
R36-R43	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R44	NOT USED				
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-009			
DS1-DS2	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS5	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS6,DS7	NOT USED				
DS8	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS13	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS14- DS21	NOT USED				
DS22	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6,Q7	NOT USED				
Q8-Q13	TRANSISTOR	352-0661-020		07263	2N2222A
Q14-Q21	NOT USED				
Q22-Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6,R7	NOT USED				
R8-R13	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R14-R21	NOT USED				
R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23-R27	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R28,R29	NOT USED				
R30-R35	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R36-R43	NOT USED				
R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-010			
DS1-DS4	NOT USED				
DS5,DS6	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
DS7	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS8	NOT USED				
DS9,DS10	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS11	NOT USED				
DS12	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS13	NOT USED				
DS14- DS22	DIODE, LIGHT EMI	353-0232-010		04404	HLMP1401
DS23	DIODE, LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q4	NOT USED				

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
Q5-Q7	TRANSISTOR	352-0661-020		07263	2N2222A
Q8	NOT USED				
Q9,Q10	TRANSISTOR	352-0661-020		07263	2N2222A
Q11	NOT USED				
Q12	TRANSISTOR	352-0661-020		07263	2N2222A
Q13	NOT USED				
Q14-Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5-R7	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R8	NOT USED				
R9,R10	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R11	NOT USED				
R12	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R13	NOT USED				
R14-R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23-R26	NOT USED				
R27-R29	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R30	NOT USED				
R31,R32	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R33	NOT USED				
R34	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R35	NOT USED				
R36-R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-011			
DS1-DS4	NOT USED				
DS5,DS6	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS7	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS8-DS22	NOT USED				
DS23	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q4	NOT USED				
Q5-Q7	TRANSISTOR	352-0661-020		07263	2N2222A
Q8-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5-R7	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R8-R26	NOT USED				
R27-R29	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R30-R44	NOT USED				
R45,R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-012			
DS1,DS2	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS5	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS6,DS7	NOT USED				
DS8	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS11	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS12	NOT USED				
DS13- DS16	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS17	NOT USED				
DS18, DS19	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS20- DS22	NOT USED				
DS23	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6,Q7	NOT USED				
Q8-Q11	TRANSISTOR	352-0661-020		07263	2N2222A
Q12	NOT USED				
Q13-Q16	TRANSISTOR	352-0661-020		07263	2N2222A
Q17	NOT USED				
Q18,Q19	TRANSISTOR	352-0661-020		07263	2N2222A
Q20-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6,R7	NOT USED				
R8-R11	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R12	NOT USED				
R13-R16	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R17	NOT USED				
R18,R19	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R20-R22	NOT USED				
R23-R27	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R28,R29	NOT USED				
R30-R33	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R34	NOT USED				
R35-R38	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R39	NOT USED				
R40,R41	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R42-R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS

LED Status Display, Schematic Diagram
Figure 2 (Sheet 2)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	LED STATUS DISPLAY	635-0825-013			
DS1	NOT USED				
DS2	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS5,DS6	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS7-DS10	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS11	NOT USED				
DS12-DS19	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS20, DS21	NOT USED				
DS22	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS23	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1	NOT USED				
Q2-Q10	TRANSISTOR	352-0661-020		07263	2N2222A
Q11	NOT USED				
Q12-Q19	TRANSISTOR	352-0661-020		07263	2N2222A
Q20,Q21	NOT USED				
Q22	TRANSISTOR	352-0661-020		07263	2N2222A
Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1	NOT USED				
R2-R10	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R11	NOT USED				
R12-R19	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R20,R21	NOT USED				
R22	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R23	NOT USED				
R24-R32	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R33	NOT USED				
R34-R41	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R42,R43	NOT USED				
R44	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
	LED STATUS DISPLAY	635-0825-014			
DS1,DS2	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS3	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS4	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS5,DS6	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS7	DIODE,LIGHT EMI	353-0232-010		04404	HLMP1401
DS8	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
DS9-DS22	NOT USED				
DS23	DIODE,LIGHT EMI	353-0232-030		04404	HLMP1301
J1	HOUSING,CONN,EL	372-0043-410		00779	87478-4
Q1-Q8	TRANSISTOR	352-0661-020		07263	2N2222A
Q9-Q23	NOT USED				
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R8	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R9-R22	NOT USED				
R23-R30	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R31-R45	NOT USED				
R46	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS

LED Status Display, Schematic Diagram
Figure 2 (Sheet 3)

Instructions

Frequency Switchboard (635-0830-001, -002)

523-0767947-003211

Frequency Switchboard (635-0830-001, -002)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

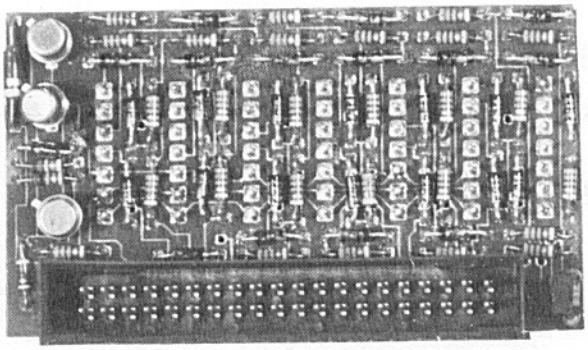
523-076947-003211

3rd Edition, 1 October 1980

1. DESCRIPTION

Frequency Switchboard 635-0830-001, -002, shown in figure 1, consists of a 7/8-section thumb-wheel frequency selector switch, a local frequency enable circuit, and logic pullup for logic outputs.

The thumb-wheel frequency selector switches are set for the appropriate digits of the desired frequency, and a parallel bcd frequency control output is supplied from the frequency switchboard. Refer to table 1 and figure 2 for a logic truth table and the pins associated with the bcd outputs.



Frequency Switchboard
Figure 1

2. TESTING/TROUBLESHOOTING PROCEDURES

2.1 Test Equipment and Power Requirements

Test equipment and power sources required to voltage test, troubleshoot, and repair the frequency

Table 1. Frequency Switchboard, Logic Truth Table.

THUMB WHEEL (kHz)	A2J4 PIN NO			
10,000	37	38	NA	NA
1,000	33	34	35	36
100	29	30	31	32
10	25	26	27	28
1	21	22	23	24
.1	17	18	19	20
* .01	13	14	15	16
FREQUENCY DIGIT	BCD OUTPUT			
	1	2	4	8
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

*Not used on 635-0830-001

NOTICE: This section replaces second edition dated 1 June 1978.

switchboard are listed in the maintenance section of this instruction book.

2.2 Testing

The test procedures in table 2 check total performance of the frequency switchboard. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

3. REPAIR

Repair of the frequency switchboard is accomplished using the standard planar card repair procedures.

Table 2. Frequency Switchboard, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing frequency switchboard to be tested. **Note** Testing procedures (test 2) on frequency switchboard used in the controls (HF-8090/8091/8092) can be accomplished with the top cover in place. b. If local unit, remove control card A10. Install A10 extender. If control unit, remove parallel input card A11. Install A11 extender. **Note** Control card A10 in local unit or parallel input card A11 in control unit are not installed during tests 3 through 5. c. Apply power to unit.		
2. Testing procedures when installed in control	a. Set CONT switch to TEST.		
	b. Rotate frequency switches through their complete range.	Note that frequency display readout agrees with frequency switch setting.	Proceed to test 3.
3. Testing and troubleshooting procedures	a. Set CONT switch to LCL or NORM. b. Connect dvm to first extender pin shown in chart.		
	c. Rotate associated thumb wheel through its range.	Refer to chart.	If no logic 1 indications, check Q3 and CR2. If no logic 0 indications, check Q1, Q2, and associated components.

Table 2. Frequency Switchboard, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			If other malfunctions exist, check components associated with A2J4 pin number of thumb wheel in question.
(Cont)	d. Repeat steps b and c for each extender pin shown in chart.		

THUMB WHEEL (kHz)	BCD OUTPUT	EXTENDER PIN NO	A2J4 PIN NO	THUMB-WHEEL POSITION									
				0	1	2	3	4	5	6	7	8	9
10 000	2	129	38	0	0	1		Not applicable					
	1	64	37	0	1	0							
1000	8	128	36	0	0	0	0	0	0	0	0	1	1
	4	63	35	0	0	0	0	1	1	1	1	0	0
	2	127	34	0	0	1	1	0	0	1	1	0	0
	1	62	33	0	1	0	1	0	1	0	1	0	1
100	8	126	32	0	0	0	0	0	0	0	0	1	1
	4	61	31	0	0	0	0	1	1	1	1	0	0
	2	125	30	0	0	1	1	0	0	1	1	0	0
	1	60	29	0	1	0	1	0	1	0	1	0	1
10	8	124	28	0	0	0	0	0	0	0	0	1	1
	4	59	27	0	0	0	0	1	1	1	1	0	0
	2	123	26	0	0	1	1	0	0	1	1	0	0
	1	58	25	0	1	0	1	0	1	0	1	0	1
1	8	122	24	0	0	0	0	0	0	0	0	1	1
	4	57	23	0	0	0	0	1	1	1	1	0	0
	2	121	22	0	0	1	1	0	0	1	1	0	0
	1	56	21	0	1	0	1	0	1	0	1	0	1
0.1	8	120	19	0	0	0	0	0	0	0	0	1	1
	4	55	18	0	0	0	0	1	1	1	1	0	0
	2	119	17	0	0	1	1	0	0	1	1	0	0
	1	54	16	0	1	0	1	0	1	0	1	0	1
*0.01	8	118	15	0	0	0	0	0	0	0	0	1	0
	4	53	14	0	0	0	0	1	1	1	1	0	0
	2	117	13	0	0	1	1	0	0	1	1	0	0
	1	52	12	0	1	0	1	0	1	0	1	0	1

Logic 1 NLT +3.0 V dc.

Logic 0 NMT 0.5 V dc.

*Applicable only to 635-0830-002.

Table 2. Frequency Switchboard, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. Frequency change signal	a. Set CONT switch to LCL or NORM.		
	b. Connect dvm to extender pin 47 (local unit A10 extender) or extender pin 13 (control unit A11 extender).		
	c. Slowly rotate each frequency switch through its complete range.	Note a logic 1 spike between each frequency switch position.	Replace associated switch thumb wheel.
	Note Steps d and e are applicable only to frequency switchboards installed in local units.		
	d. Set CONT switch to REM (not applicable to controls).	Note that there is no logic 1 spike between each frequency switch position.	Unit malfunction.
	e. Rotate all frequency switches through their complete range.	Note the voltage at the associated A2J4 pins for each frequency setting of each switch. 0 V on all pins.	Unit malfunction.

Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

4.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 2). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

4.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applied to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

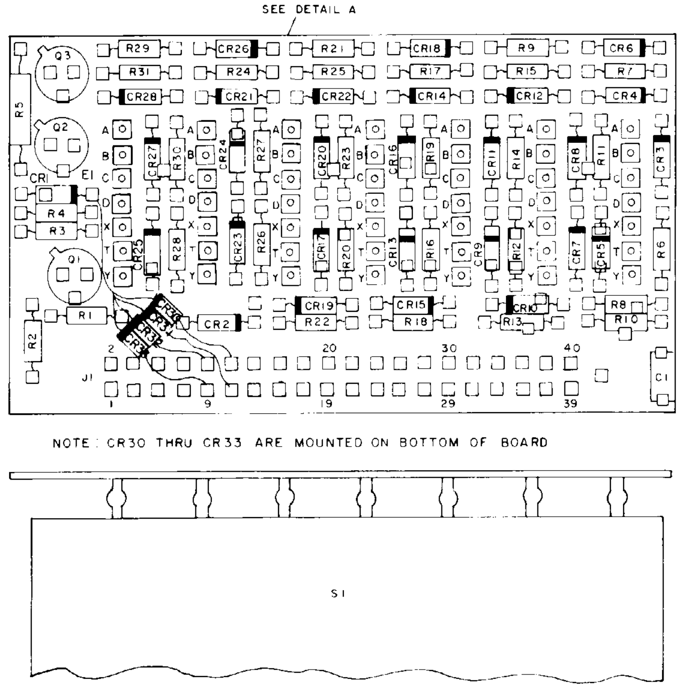
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP, Inc. P.O. Box 3608 Harrisburg, PA 17105
03508	General Electric Co. Semi-Conductor Products Dept. W. Genesee St. Auburn, NY 13021
04713	Motorola, Inc. Semiconductor Products Group 5005 E. McDowell Rd. Phoenix, AZ 85008
07126	Digitran Co., The 855 South Arroyo Parkway Pasadena, CA 91105
07263	Fairchild Camera and Instrument Corp. Semiconductor Div. 464 Ellis St. Mountain View, CA 94042
81349	Military Specifications

4.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

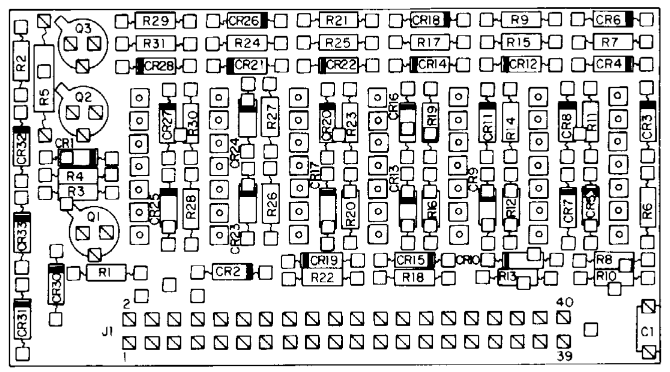
CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Frequency switchboard	635-0830-001	REV H
Frequency switchboard	635-0830-002	REV H



DETAIL A

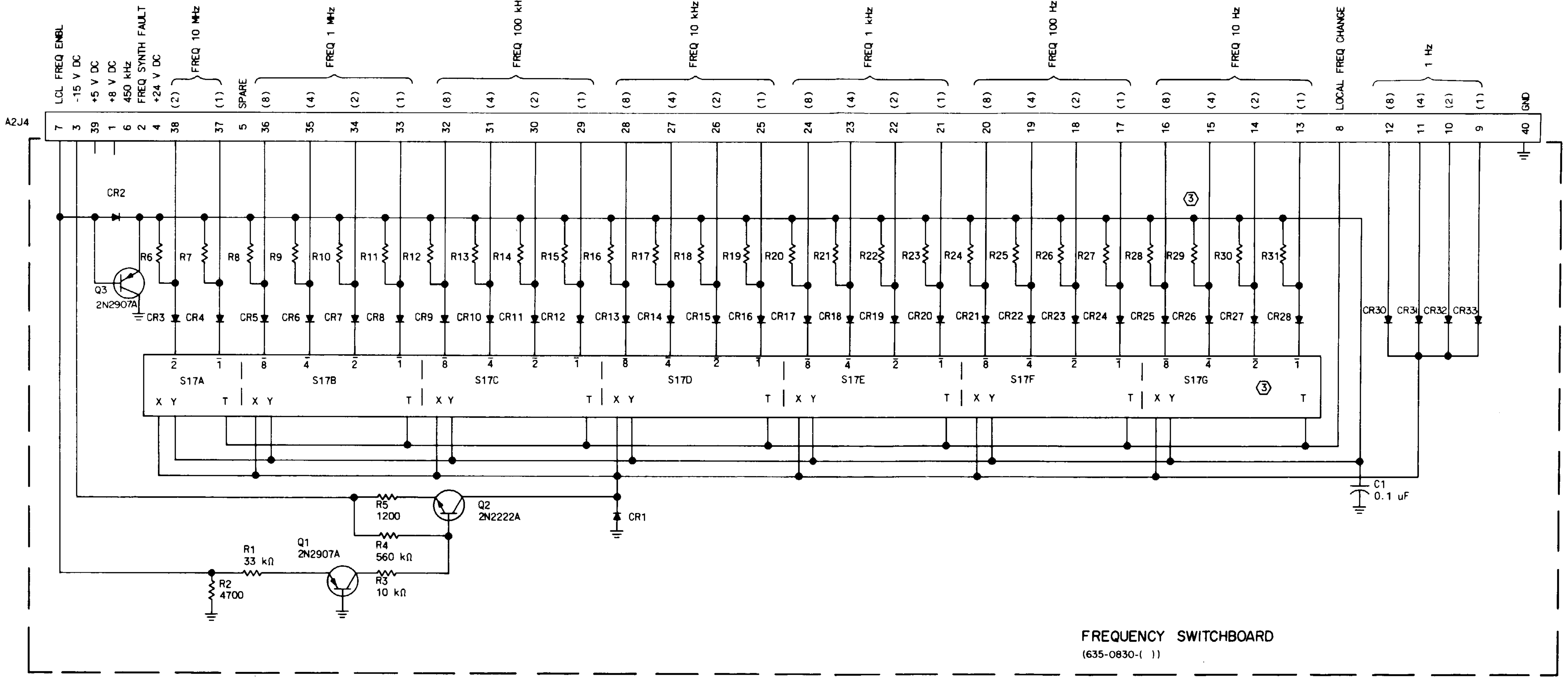
CI 77123

TP5-1040-019



CI 77273

TPA-2404-011



NOTES:

① ALL DIODES ARE TYPE 1N4454.

② UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS. R6-R31 ARE 33 kΩ.

③ THE 10 Hz FREQUENCY DIGIT S17G AND ASSOCIATED COMPONENTS R28 THRU R31 ARE PART OF 635-0830-002 ONLY. IN THE 635-0830-001 CR25 THRU CR28 CATHODES ARE CONNECTED THE SAME AS CR30 THRU CR33 CATHODES.

TPA-0155-014

Frequency Switchboard, Schematic Diagram
Figure 2 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FREQUENCY SWITCHBOARD	635-0830-001	A		
	FREQUENCY SWITCHBOARD	635-0830-002	B		
CR1-CR28	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR29	NOT USED				
CR30-CR33	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 50V	913-5019-320		81349	CK05BX104K
J4	HOUSING,CONN,EL	372-0043-480		00779	87478-7
Q1	TRANSISTOR	352-0551-010		04713	2N2907A
Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3	TRANSISTOR	352-0551-010		04713	2N2907A
R1	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R2	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R3	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R4	RESISTOR,FXD CMPSN, 560K, 10%, 1/8W	745-2440-000		81349	RCR05G564KS
R5	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R6-R27	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R28-R31	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000	B	81349	RCR05G333KS
S1	SWITCH ASSEMBLY	259-9651-010	A	07126	29C63
S1	SWITCH ASSEMBLY	259-9651-020	B	07126	29C64

Frequency Switchboard, Schematic Diagram
Figure 2 (Sheet 2)

DVBFO Switchboard (638-6437-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

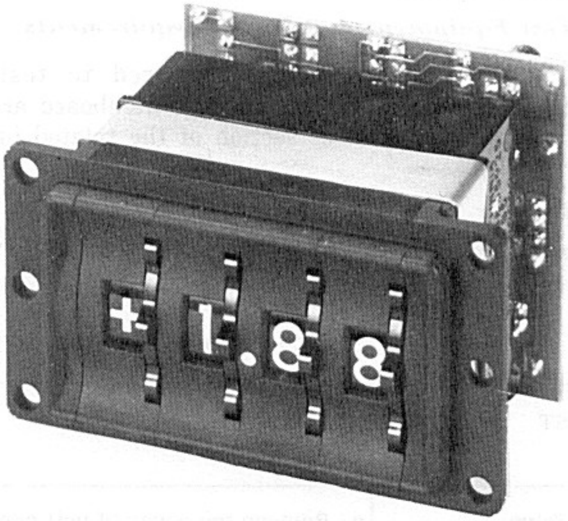
523-0770518-001211
1 October 1980

1. DESCRIPTION

The DVBFO Switchboard 638-6437-001, shown in figure 1, consists of a 4-section thumb-wheel frequency selector switch with sign, a local frequency enable circuit, and logic pullup for logic outputs.

The dvbfo switchboard is used to generate a frequency offset output. This is accomplished by setting the thumb-wheel frequency selector switches to the appropriate digits of the desired frequency, and a parallel bcd frequency control output is supplied. Refer to table 1 for a logic truth table, and to figure 2 for the bcd output pins.

Refer to the dvbfo switchboard schematic, figure 2. The S18A section of the thumbwheel switch is used to generate a (+) or (-) sign output. With S18A set to the (+) position the output equals a logic 0, and in the (-) position the output equals a logic 1.



DVBFO Switchboard
Figure 1

Table 1. DVBFO Switchboard, Logic Truth Table.

FREQUENCY DIGIT	SELECTOR (Hz)	1000 (S18B)				100 (S18C)				10 (S18D)			
	BCD OUTPUT	8	4	2	1	8	4	2	1	8	4	2	1
	A2J6 PIN NO	13	12	11	10	9	8	7	6	5	4	3	2
0		0	0	0	0	0	0	0	0	0	0	0	0
1		0	0	0	1	0	0	0	1	0	0	0	1
2		0	0	1	0	0	0	1	0	0	0	1	0
3		0	0	1	1	0	0	1	1	0	0	1	1
4		0	1	0	0	0	1	0	0	0	1	0	0

Table 1. DVBFO Switchboard, Logic Truth Table (Cont).

FREQUENCY DIGIT	SELECTOR (Hz)	1000 (S18B)				100 (S18C)				10 (S18D)			
	BCD OUTPUT	8	4	2	1	8	4	2	1	8	4	2	1
	A2J6 PIN NO	13	12	11	10	9	8	7	6	5	4	3	2
5		0	1	0	1	0	1	0	1	0	1	0	1
6		0	1	1	0	0	1	1	0	0	1	1	0
7		0	1	1	1	0	1	1	1	0	1	1	1
8		1	0	0	0	1	0	0	0	1	0	0	0
9		1	0	0	1	1	0	0	1	1	0	0	1

2. TESTING/TROUBLESHOOTING PROCEDURES

2.1 Test Equipment and Power Requirements

Test equipment and power required to test, troubleshoot, and repair the dvbfo switchboard are listed in the maintenance section of the related instruction book.

2.2 Testing

The test procedures in table 2 check the total performance of the dvbfo switchboard. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

3. REPAIR

Repair of the dvbfo switchboard is accomplished using the standard planar card repair procedures. Refer to the maintenance section of the related instruction book for planar card repair procedures.

Table 2. DVBFO Switchboard, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing dvbfo switchboard to be tested. **Note** Testing procedures (test 2) on dvbfo switchboard used in the controls (HF-8090/8091/8092) can be accomplished with the top cover in place. b. If control unit, remove parallel input card A11. Install it on an extender card and place it in the control unit. c. Apply power to unit.		
2. Testing procedures when installed in control	a. Set CONT switch to LCL, set VBFO switch to VAR. b. Rotate dvbfo frequency switches through their complete range.	Note that dvbfo frequency display readout agrees with frequency switch setting.	Proceed to test 3.

Table 2. DVBFO Switchboard, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. Testing and troubleshooting procedures</td><td>a. Set CONT switch to LCL, set VBFO switch to VAR.
b. Connect dvm to first connector pin shown in chart.
c. Rotate associated thumb wheel through its range.
d. Repeat steps b and c for each connector pin shown on card.</td><td>Refer to chart.</td><td>If no logic 1 indications, check Q3 and CR2.
If no logic 0 indications, check Q1, Q2, and associated components.
If other malfunctions exist, check components associated with A2J6 pin number of thumb wheel in question.</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th rowspan="2">THUMB WHEEL (kHz)</th><th rowspan="2">BCD OUTPUT</th><th rowspan="2">EXTENDER PIN NO</th><th rowspan="2">A2J6 PIN NO</th><th colspan="10">THUMB-WHEEL POSITION</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td>1000</td><td>8</td><td></td><td>13</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td></td><td>4</td><td></td><td>12</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>2</td><td></td><td>11</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>1</td><td></td><td>10</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>100</td><td>8</td><td></td><td>9</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td></td><td>4</td><td></td><td>8</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>2</td><td></td><td>7</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>1</td><td></td><td>6</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>10</td><td>8</td><td></td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td></td><td>4</td><td></td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>2</td><td></td><td>3</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td></td><td>1</td><td></td><td>2</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td colspan="14">Logic 1 = NLT +3.0 V dc.
Logic 0 + NMT 0.5 V dc.</td></tr>
</table>
</td></tr>
<tr><td>4. Dvbfo frequency change signal</td><td>**Note**
Applicable only to dvbfo switchboards installed in control units.
a. Set CONT switch to NORM.
b. Connect dvm to A11 extender.
c. Slowly rotate each dvbfo frequency switch through its complete range.</td><td>Note a logic 0 spike between each switch position.</td><td>Replace associated switch thumb wheel.</td></tr>
</table>

Table 2. DVBFO Switchboard, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Local/remote operation	**Note** Applicable only to dvbfo frequency switchboards installed in local units.		
	a. Set CONT switch to REM.		
	b. Rotate all dvbfo frequency switches through their complete range.	Note the voltage at the associated A2J6 pins for each setting of each switch. 0 V on all pins.	Unit malfunction.

4. PARTS LIST/DIAGRAMS

4.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 2). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

4.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

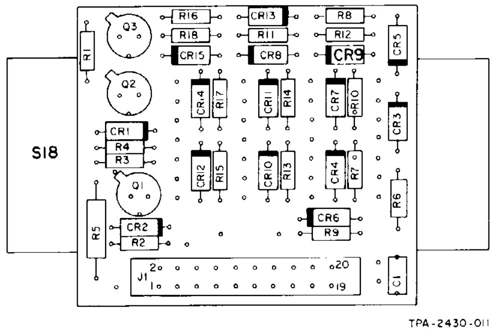
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

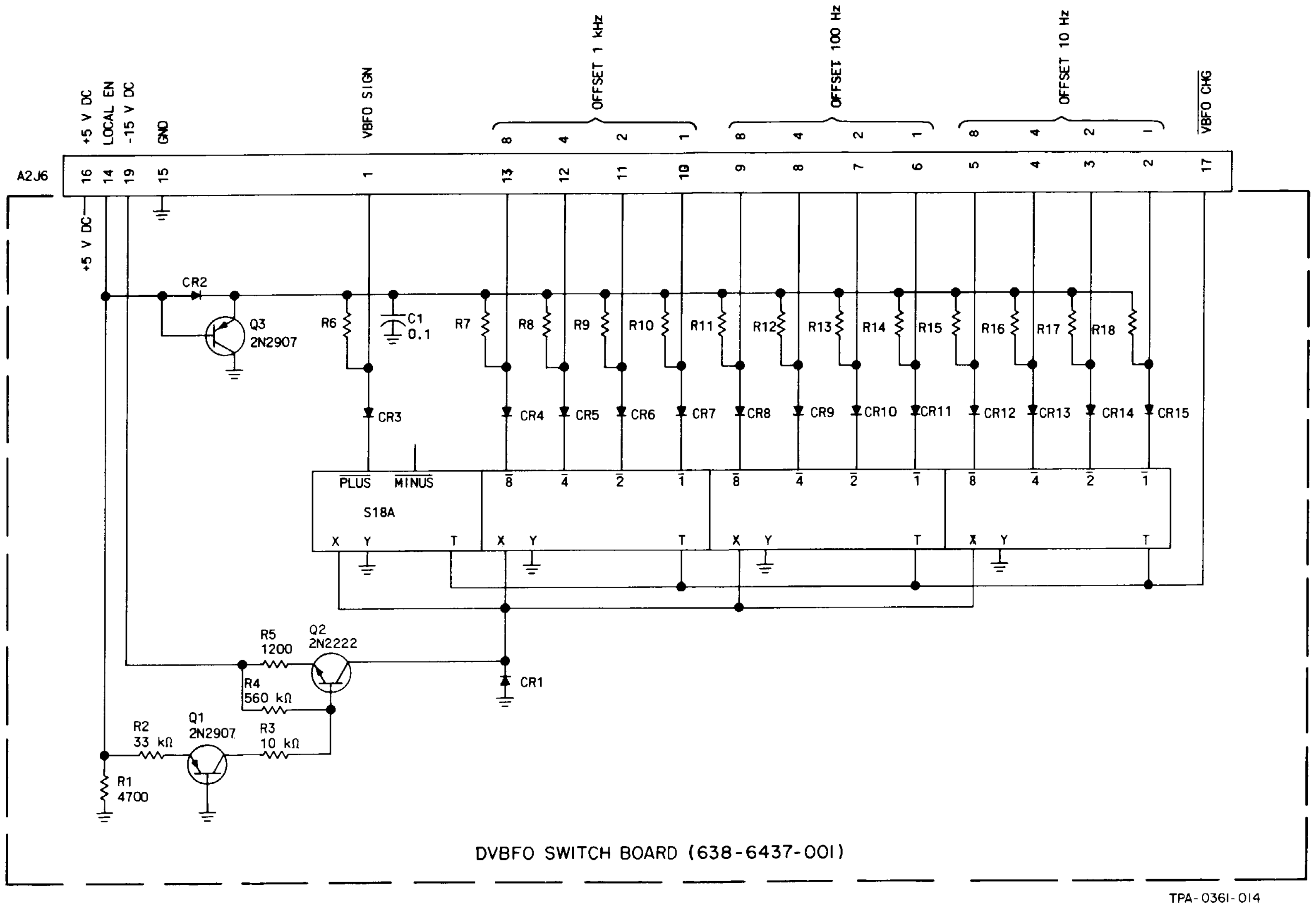
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
07126	DIGITRAN CO THE 855 SOUTH ARROYO PARKWAY PASADENA CA 91105
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
81349	MILITARY SPECIFICATION

4.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Dvbfo switchboard	638-6437-001	REV A





NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND DIODES ARE 1N4454.

② R6-R18 ARE 33 kΩ.

DVBFO Switchboard, Schematic Diagram
Figure 2 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	DVBFO SWITCHBOARD	638-6437-001			
CR1-CR15	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 50V	913-5019-320		81349	CK05BX104K
J1	HOUSING,CONN,EL	372-0043-380		00779	87478-3
Q1	TRANSISTOR	352-0551-010		15818	2N2907A
Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3	TRANSISTOR	352-0551-010		15818	2N2907A
R1	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R2	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R3	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R4	RESISTOR,FXD CMPSN, 560K, 10%, 1/8W	745-2440-000		81349	RCR05G564KS
R5	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R6-R18	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
S1-S17	NOT USED				
S18	SWITCH ASSEMBLY	259-9651-060		07126	29C80

DVBFO Switchboard, Schematic Diagram
Figure 2 (Sheet 2)

Frequency Display
(637-1781-(   ))

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767975-004211
4th Edition, 1 June 1979

1. DESCRIPTION

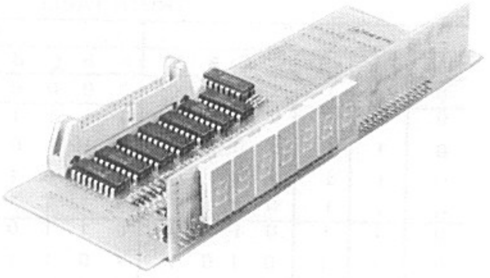
The Frequency Display 635-1781-(   ) consists of two subassemblies hard-wired together. One subassembly, the frequency display driver board, contains the logic and decoder/driver circuits. The other, the frequency display board, contains the 7-segment displays. The subassemblies are 2-layer circuit boards with a cable connector on the section containing the decoder/drivers. Figure 1 is a picture of the assembled subassemblies.

2. PRINCIPLES OF OPERATION

2.1 General

The frequency display configuration differences are as follows:

a. 637-1781-001, -006, 100 Hz operating frequency display and no BFO frequency display.
b. 637-1781-002, -007, 10 Hz operating frequency display and no BFO frequency display.
c. 637-1781-003, -008, 10 Hz operating frequency display and BFO frequency display of ±0-9990 Hz (operating frequency can be expanded to 1 Hz by adding display device U27).
d. 637-1781-004, -009, 1 Hz operating frequency display and BFO frequency display of ±0-9990 Hz.
e. 637-1781-005, -010, 100 Hz operating frequency display and no BFO frequency display (can be expanded to 10/1 Hz operating frequency display and/or BFO frequency display by adding display devices U26/U27 and/or U15 through U19).



TP5-2370-017

Frequency Display
Figure 1

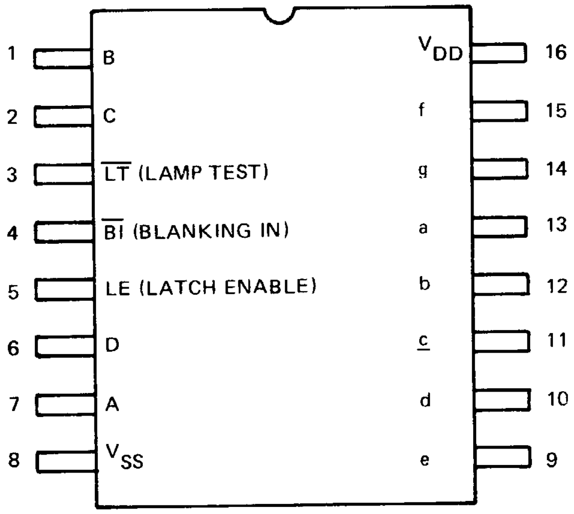
2.2 Theory of Operation (Refer to figure 4.)

For each frequency digit, a 4-bit binary input is applied to the decoder/driver. This input data is decoded into seven binary outputs. These logic-level outputs are applied directly to the 7-segment display associated with the decoder/driver. Each output causes a certain LED segment to light to form a part of the numeral equivalent to the 4-bit binary input to the board.

Figure 2 shows the decoder/driver input-output truth table and the 7-segment display connections.

The units and tens megahertz displays are blanked if the frequency is not within the 1- to 30-MHz range (for which these digits would be needed). This suppresses the leading zeros in lower frequency displays. The blanking (suppression) input ($\overline{BI}$ at logic 0 level) is generated by OR gates U6B-U6D. When all inputs

NOTICE: This section replaces third edition dated 1 January 1979.

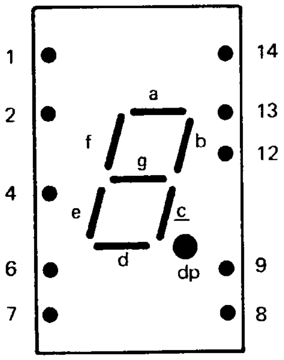


BCD–TO–7–SEGMENT DECODER/DRIVER

TRUTH TABLE

INPUTS				OUTPUTS		
LE	$\overline{BI}$	$\overline{LT}$	D C B A	a b c d e f g	DISPLAY
0	0	1	X X X X	0 0 0 0 0 0 0	BLANK
0	1	1	0 0 0 0	1 1 1 1 1 1 0	0
0	1	1	0 0 0 1	0 1 1 0 0 0 0	1
0	1	1	0 0 1 0	1 1 0 1 1 0 1	2
0	1	1	0 0 1 1	1 1 1 1 0 0 1	3
0	1	1	0 1 0 0	0 1 1 0 0 1 1	4
0	1	1	0 1 0 1	1 0 1 1 0 1 1	5
0	1	1	0 1 1 0	0 0 1 1 1 1 1	6
0	1	1	0 1 1 1	1 1 1 0 0 0 0	7
0	1	1	1 0 0 0	1 1 1 1 1 1 1	8
0	1	1	1 0 0 1	1 1 1 0 0 1 1	9
0	1	1	1 0 1 0	0 0 0 0 0 0 0	BLANK
0	1	1	1 0 1 1	0 0 0 0 0 0 0	BLANK
0	1	1	1 1 0 0	0 0 0 0 0 0 0	BLANK
0	1	1	1 1 0 1	0 0 0 0 0 0 0	BLANK
0	1	1	1 1 1 0	0 0 0 0 0 0 0	BLANK
0	1	1	1 1 1 1	0 0 0 0 0 0 0	BLANK

X = DON'T CARE



7–SEGMENT LED DISPLAY

PIN NO.	PIN CONNECTIONS
1	ANODE F
2	ANODE G
3	NO PIN
4	COMMON CATHODE
5	NO PIN
6	ANODE E
7	ANODE D
8	ANODE C
9	ANODE DP
10	NO PIN
11	NO PIN
12	COMMON CATHODE
13	ANODE B
14	ANODE A

TP5-2300-011

Decoder/Driver and Display Elements Operation
Figure 2

to the decoder/driver are at logic 0, the OR gate outputs cause the $\overline{BI}$ input to be logic 0, causing a blanking command to be applied to the display. For this input to the indicators, no LED segments light and the display remains off, or blank.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test and troubleshoot the frequency display board are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check the total performance of the frequency display. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Table 1. Frequency Display Testing and Troubleshooting Procedures.

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>1. Test setup</td><td>Set PWR switch on and CONT switch to TEST. Set FREQUENCY KHZ display for all O's.</td><td></td><td></td></tr>
<tr><td>2. Zero suppression and decimal point display</td><td>Set FREQUENCY KHZ display for 500 kHz. Observe FREQUENCY KHZ readout display.</td><td>Units' and tens' zeros of MHz range suppressed (blanked). Zeros for kHz and tenths displayed. Decimal point after fifth digit from left displayed.</td><td>If MHz-range zeros displayed, check U6B, U6C, U6D, and U7.
If decimal point not displayed, check U24.</td></tr>
<tr><td>3. Digit selection and display (applicable only when used with thumbwheel frequency control switches)</td><td>Rotate each FREQUENCY kHz switch through all its positions. (Leftmost switch has positions 0, 1, and 2 only.) Observe readout display to see that corresponding selected digit is displayed.
Note
Wait approx 1 second after switching for time delay to elapse and circuit to strobe in new digit.
If switch is changed too slowly, strobe signal may be generated while old number is still applied to circuit. In this case, the new number will not be displayed even though switch is set to new position. Switch away from and back to new position if this occurs.</td><td>Readout digit displayed corresponds to that selected on thumbwheel switch.</td><td>Refer to schematic diagram and check decoder/driver and readout unit corresponding to digit showing malfunction.
For normal display, decoder/driver inputs and outputs at logic 1 are listed below for each digit.
<table>
<tr><th>DIGIT</th><th>INPUTS</th><th>OUTPUTS</th></tr>
<tr><td>0</td><td>(all 0's)</td><td>a+b+c+d+e+f</td></tr>
<tr><td>1</td><td>A</td><td>b+c</td></tr>
<tr><td>2</td><td>B</td><td>a+b+c+e+g</td></tr>
<tr><td>3</td><td>A+B</td><td>a+b+c+d+g</td></tr>
<tr><td>4</td><td>C</td><td>b+c+f+g</td></tr>
<tr><td>5</td><td>A+C</td><td>a+c+d+f+g</td></tr>
<tr><td>6</td><td>B+C</td><td>c+d+e+f+g</td></tr>
<tr><td>7</td><td>A+B+C</td><td>a+b+c</td></tr>
<tr><td>8</td><td>D</td><td>a+b+c+d+e+f+g</td></tr>
<tr><td>9</td><td>A+D</td><td>a+b+c+f+g</td></tr>
</table></td></tr>
<tr><td>4. Frequency display (applicable only when used with incremental tuning frequency control)</td><td>Set DIAL switch to FINE. Rotate TUNING dial through complete frequency range and observe FREQUENCY KHZ display.</td><td>All digits are displayed in sequence through complete frequency range of unit under test.</td><td>Same as test 3.</td></tr>
</table>

Table 1. Frequency Display Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Vbfo digit selection and display (applicable only when used with thumbwheel dvbfo control switches)	Set BFO switch to VAR. Rotate each VBFO OFFSET Hz switch through all its positions. Observe readout display to see that corresponding selected digit is displayed. **Note** Wait approx 1 second after switching for time delay to elapse and circuit to strobe in new digit. If switch is changed too slowly, strobe signal may be generated while old number is still applied to circuit. In this case, the new number will not be displayed even though switch is set to new position. Switch away from and back to new position if this occurs.	Readout digit displayed corresponds to that selected on thumbwheel switch.	Same as test 3.
6. Vbfo display (applicable only when used with incremental tuning vbfo control)	Set BFO switch to TUNE. Rotate TUNING dial through complete vbfo range and observe VBFO OFFSET HZ display.	All digits are displayed in sequence through complete vbfo range of unit under test.	Same as test 3.

4. REPAIR

Repair of the frequency display is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

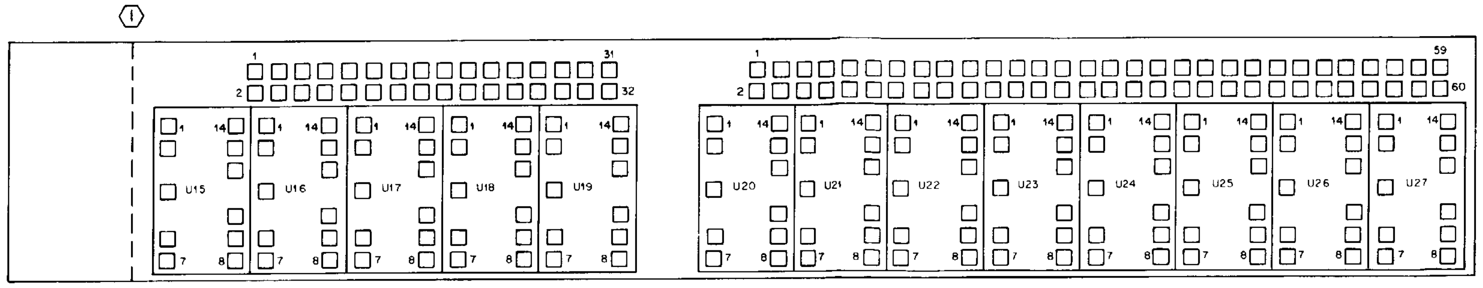
This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator.

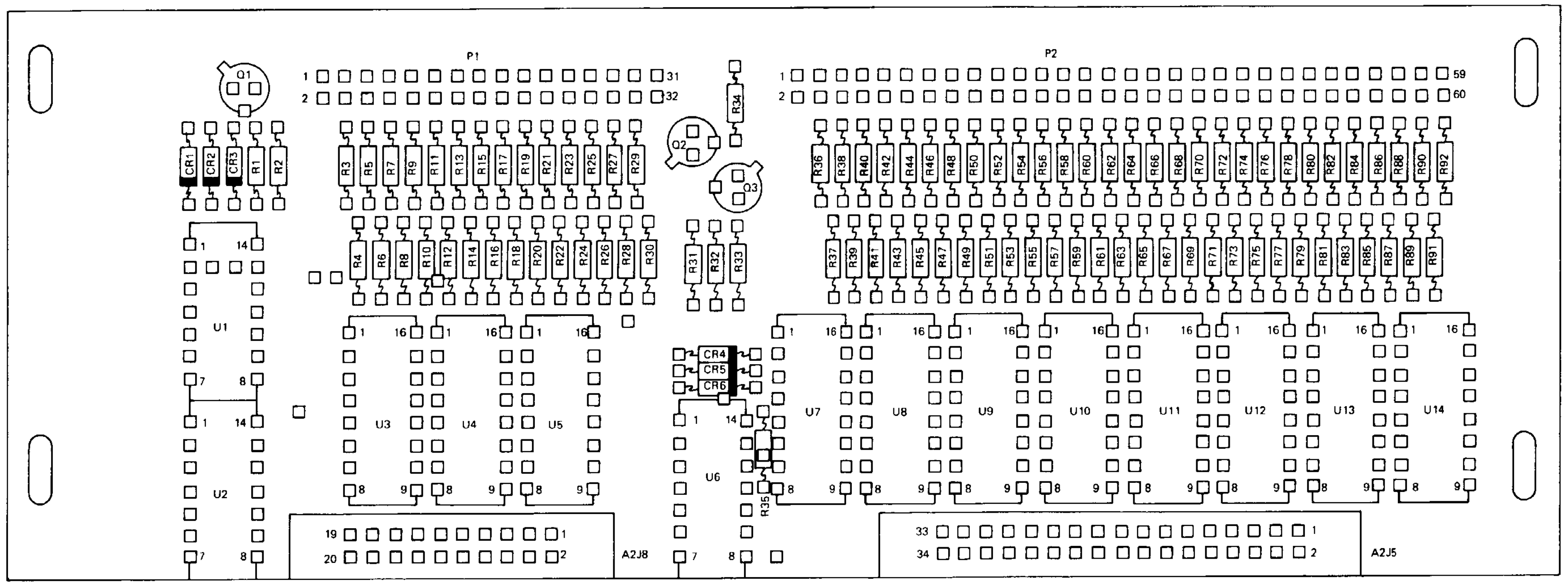
Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

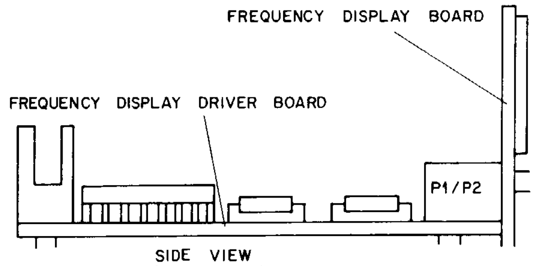
COLLINS CIRCUIT CARD/ SUBASSEMBLY	PART NUMBER	LATEST EFFECTIVITY
Frequency Display	637-1781-001	REV B
Frequency Display	637-1781-002	REV B
Frequency Display	637-1781-003	REV F
Frequency Display	637-1781-004	REV F
Frequency Display	637-1781-005	REV F
Frequency Display	637-1781-006	REV G
Frequency Display	637-1781-007	REV G
Frequency Display	637-1781-008	REV G
Frequency Display	637-1781-009	REV G
Frequency Display	637-1781-010	REV G
Frequency Display Driver Board	635-0896-001	REV H
Frequency Display Driver Board	635-0896-002	REV H
Frequency Display Driver Board	635-0896-004	REV G
Frequency Display Board	635-0897-001	REV C
Frequency Display Board	635-0897-002	REV C
Frequency Display Board	635-0897-003	REV D
Frequency Display Board	635-0897-004	REV E
Frequency Display Board	635-0897-005	REV F
Frequency Display Board	635-0897-006	REV F
Frequency Display Board	635-0897-007	REV F
Frequency Display Board	635-0897-008	REV F



FREQUENCY DISPLAY BOARD 635-0897-( )



FREQUENCY DISPLAY DRIVER BOARD 635-0896-( )



SIDE VIEW
(ASSEMBLED)
637-1781-( )

NOTE:

① FREQUENCY DISPLAY BOARD 635-0895-005, -006, -007, AND -008 IS A SHORTENED BOARD.

TP5-1039-014

Frequency Display, Schematic Diagram
Figure 3 (Sheet 1 of 4)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FREQUENCY DISPLAY	637-1781-001	A		
	FREQUENCY DISPLAY	637-1781-002	B		
	FREQUENCY DISPLAY	637-1781-003	C		
	FREQUENCY DISPLAY	637-1781-004	D		
	FREQUENCY DISPLAY	637-1781-005	E		
	FREQUENCY DISPLAY	637-1781-006	F		
	FREQUENCY DISPLAY	637-1781-007	G		
	FREQUENCY DISPLAY	637-1781-008	H		
	FREQUENCY DISPLAY	637-1781-009	J		
	FREQUENCY DISPLAY	637-1781-010	K		
	FREQUENCY DISPLAY DRIVER BD	635-0896-001	A,F		
	FREQUENCY DISPLAY DRIVER BD	635-0896-002	B,G		
	FREQUENCY DISPLAY DRIVER BD	635-0896-004	C,D,E,H J,K		
	FREQUENCY DISPLAY BD	635-0897-001	A,E		
	FREQUENCY DISPLAY BD	635-0897-002	B		
	FREQUENCY DISPLAY BD	635-0897-003	C		
	FREQUENCY DISPLAY BD	635-0897-004	D		
	FREQUENCY DISPLAY BD	635-0897-005	F,K		
	FREQUENCY DISPLAY BD	635-0897-006	G		
	FREQUENCY DISPLAY BD	635-0897-007	H		
	FREQUENCY DISPLAY BD	635-0897-008	J		
	FREQUENCY DISPLAY DRIVER BD	635-0896-001			
CR1-CR3	NOT USED				
CR4-CR6	SEMICOND DEVICE 1N4454	353-3644-010		03508	1N4454GE
J1-J4	NOT USED				
J5	HOUSING,CONN,EL	372-0043-450		00779	87478-5
P1	CONNECTOR,HDR	372-0028-030		00779	1-87566-6
P2	CONNECTOR,HDR	372-0028-040		00779	3-87566-0
R1-R34	NOT USED				
R35	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R36-R78	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/8W	745-2314-000		81349	RCR05G181KS
U1-U5	NOT USED				
U6	INTEGRATED CIRCUIT MC14071BCP	351-8287-010		04713	MC14071BCP
U7-U12	INTEGRATED CIRCUIT MC14511BCP	351-8304-010		04713	MC14511BCP
	FREQUENCY DISPLAY DRIVER BD	635-0896-002	B,G		
CR1-CR3	NOT USED				
CR4-CR6	SEMICOND DEVICE 1N4454	353-3644-010		03508	1N4454GE
J1-J4	NOT USED				
J5	HOUSING,CONN,EL	372-0043-450		00779	87478-5
P1	CONNECTOR,HDR	372-0028-030		00779	1-87566-6
P2	CONNECTOR,HDR	372-0028-040		00779	3-87566-0
R1-R34	NOT USED				
R35	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R36-R85	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/8W	745-2314-000		81349	RCR05G181KS
U1-U5	NOT USED				
U6	INTEGRATED CIRCUIT MC14071BCP	351-8287-010		04713	MC14071BCP
U7-U13	INTEGRATED CIRCUIT MC14511BCP	351-8304-010		04713	MC14511BCP
	FREQUENCY DISPLAY DRIVER BD	635-0896-004	C,D,E,H J,K		
CR1-CR6	SEMICOND DEVICE 1N4454	353-3644-010		03508	1N4454GE
J1-J4	NOT USED				
J5	HOUSING,CONN,EL	372-0043-450		00779	87478-5
J6,J7	NOT USED				
J8	HOUSING,CONN,EL	372-0043-380		00779	87478-3
Q1-Q3	TRANSISTOR 2N2222A	352-0661-020		07263	2N2222A
R1	RESISTOR,FXD CMPSN, 470K, 10%, 1/8W	745-2437-000		81349	RCR05G474KS
R2	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R3-R30	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/8W	745-2314-000		81349	RCR05G181KS
R31	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R32	RESISTOR,FXD CMPSN, 470K, 10%, 1/8W	745-2437-000		81349	RCR05G474KS
R33	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R34	RESISTOR,FXD CMPSN, 470K, 10%, 1/8W	745-2437-000		81349	RCR05G474KS
R35	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R36-R92	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/8W	745-2314-000		81349	RCR05G181KS
U1	INTEGRATED CIRCUIT MC14081BCP	351-8287-030		04713	MC14081BCP
U2	INTEGRATED CIRCUIT MC14072BCP	351-8287-040		04713	MC14072BCP
U3-U5	INTEGRATED CIRCUIT MC14511BCP	351-8304-010		04713	MC14511BCP
U6	INTEGRATED CIRCUIT MC14071BCP	351-8287-010		04713	MC14071BCP
U7-U14	INTEGRATED CIRCUIT MC14511BCP	351-8304-010		04713	MC14511BCP
	FREQUENCY DISPLAY BD	635-0897-001	A,E		
U1-U19	NOT USED				
U20-U25	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-002	B		
U1-U19	NOT USED				
U20-U26	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-003	C		
U1-U14	NOT USED				
U15-U27	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-004	D		
U1-U14	NOT USED				
U15-U27	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-005	F,K		
U1-U19	NOT USED				
U20-U25	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A

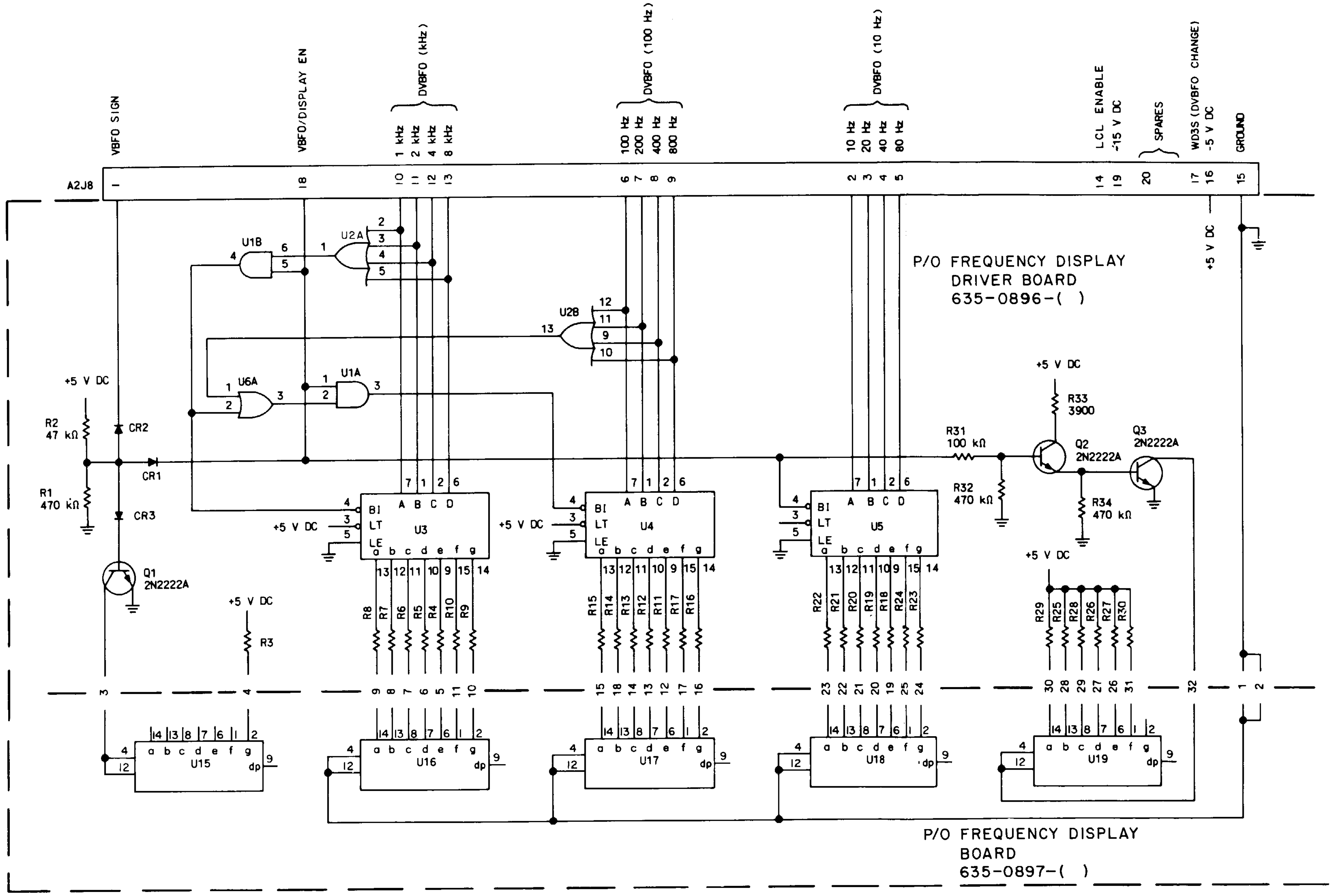
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FREQUENCY DISPLAY BD	635-0897-006	G		
U1-U19	NOT USED				
U20-U26	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-007	H		
U1-U14	NOT USED				
U15-U26	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A
	FREQUENCY DISPLAY BD	635-0897-008			
U1-U14	NOT USED				
U15-U26	SEMICOND DEVICE MAN3640A	262-1461-010		50522	MAN3640A

Frequency Display, Schematic Diagram
Figure 3 (Sheet 2)

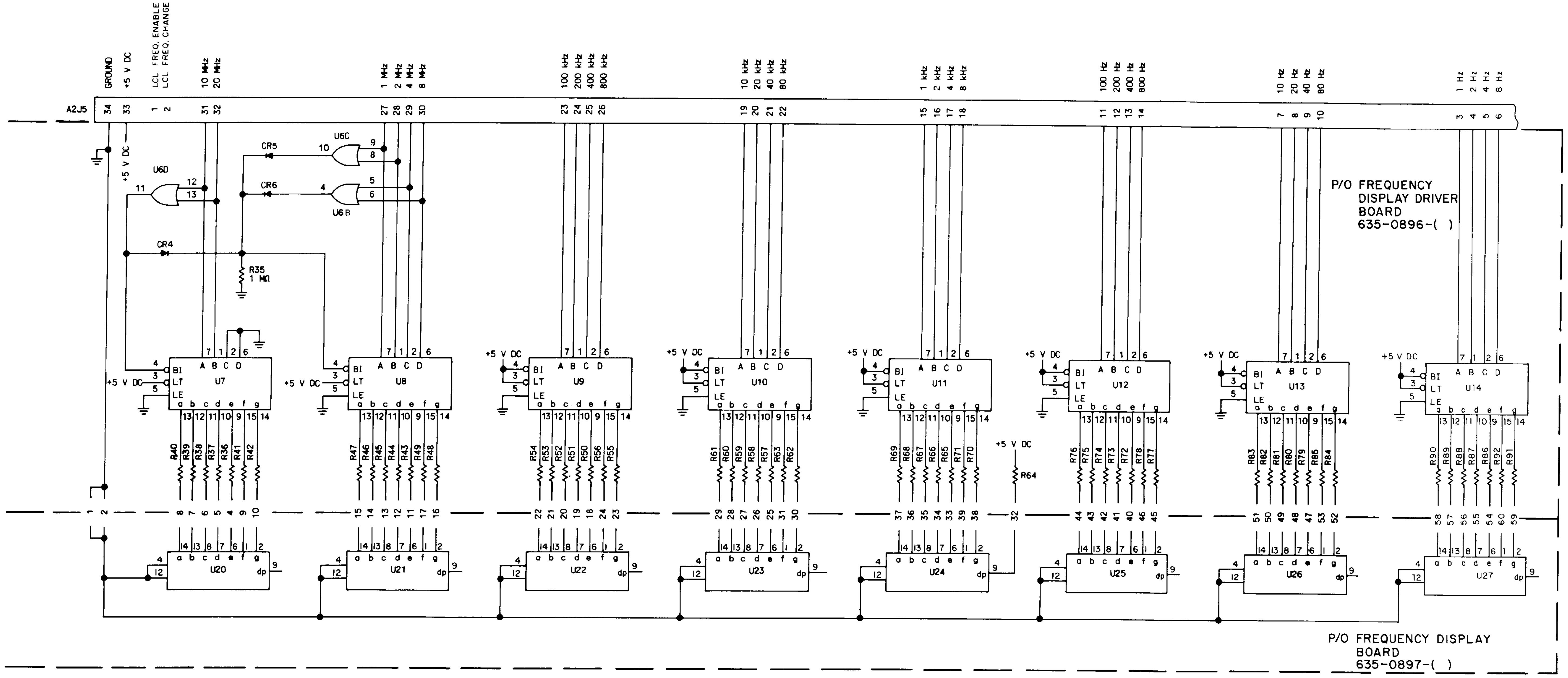
CIRCUITS USED PER FREQUENCY DISPLAY

			CIRCUIT	637-1781-( )									
				-001	-002	-003	-004	-005	-006	-007	-008	-009	-010
FREQUENCY DISPLAY DRIVER BOARD	VBFO DISPLAY ENABLE	VBFO DISPLAY ENABLE	U1			X	X	X			X	X	X
			U2			X	X	X			X	X	X
		1 kHz	U3			X	X	X			X	X	X
		100 Hz	U4			X	X	X			X	X	X
		10 Hz	U5			X	X	X			X	X	X
	OPER FREQ DISPLAY DRIVERS	DISPLAY BLANKING	U6	X	X	X	X	X	X	X	X	X	X
		10 MHz	U7	X	X	X	X	X	X	X	X	X	X
		1 MHz	U8	X	X	X	X	X	X	X	X	X	X
		100 kHz	U9	X	X	X	X	X	X	X	X	X	X
		10 kHz	U10	X	X	X	X	X	X	X	X	X	X
		1 kHz	U11	X	X	X	X	X	X	X	X	X	X
		100 Hz	U12	X	X	X	X	X	X	X	X	X	X
		10 Hz	U13		X	X	X	X		X	X	X	X
		1 Hz	U14			X	X	X			X	X	X
FREQUENCY DISPLAY BOARD	VBFO DISPLAY	SIGN	U15			X	X				X	X	
		1 kHz	U16			X	X				X	X	
		100 Hz	U17			X	X				X	X	
		10 Hz	U18			X	X				X	X	
		1 Hz	U19			X	X				X	X	
	OPER FREQ DISPLAY	10 MHz	U20	X	X	X	X	X	X	X	X	X	X
		1 MHz	U21	X	X	X	X	X	X	X	X	X	X
		100 kHz	U22	X	X	X	X	X	X	X	X	X	X
		10 kHz	U23	X	X	X	X	X	X	X	X	X	X
		1 kHz	U24	X	X	X	X	X	X	X	X	X	X
		100 Hz	U25	X	X	X	X	X	X	X	X	X	X
		10 Hz	U26		X	X	X			X	X	X	
		1 Hz	U27				X*					X	



TPA-0277-025

Frequency Display, Schematic Diagram
Figure 3 (Sheet 3)



NOTES:

① RESISTORS R3 THRU R30 AND R36 THRU R92 ARE 180 OHM.

② DIODES ARE TYPE 1N4454.

③ POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)	
		+5	GND
U1	MC14081BCP	14	7
U2	MC14072BCP	14	7
U3, U4, U5, AND U7 THRU U14	MC14511BCP	16	8
U6	MC14071BCP	14	7
U15 THRU U27	MAN3640A		

TPA-0277-025

Frequency Display, Schematic Diagram
Figure 3 (Sheet 4)

AFC
(642-3224-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

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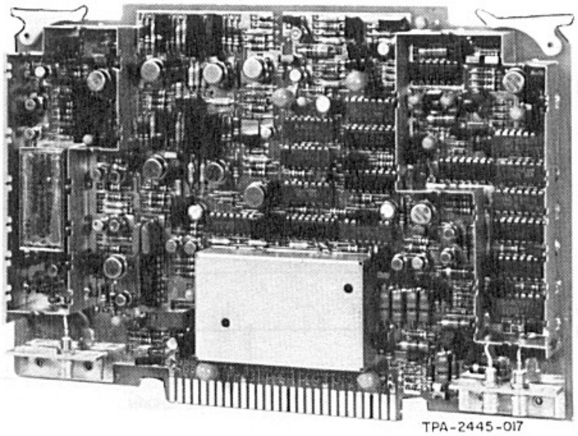
1 October 1980

1. DESCRIPTION

AFC 642-3224-001, figure 1, is a 2-layer planar card with a 56-pin edge-on connector (28 pins each side). This planar card has three sheet-metal assemblies that provide necessary rf isolation. The AFC card has subminiax rf connectors for connecting 450-kHz carrier input (J1), 9.9-MHz receiver injection output (J2), and 9.9-MHz reference input (J3).

The AFC card consists of a high gain if amplifier and limiter section, a quadrature phase detector, threshold type lock indicator, vcxo and switchable loop filter, 9.9-MHz pin diode switch, a 450-/455-kHz phase-locked loop, and necessary control logic circuits.



AFC
Figure 1

2. PRINCIPLES OF OPERATION

2.1 General

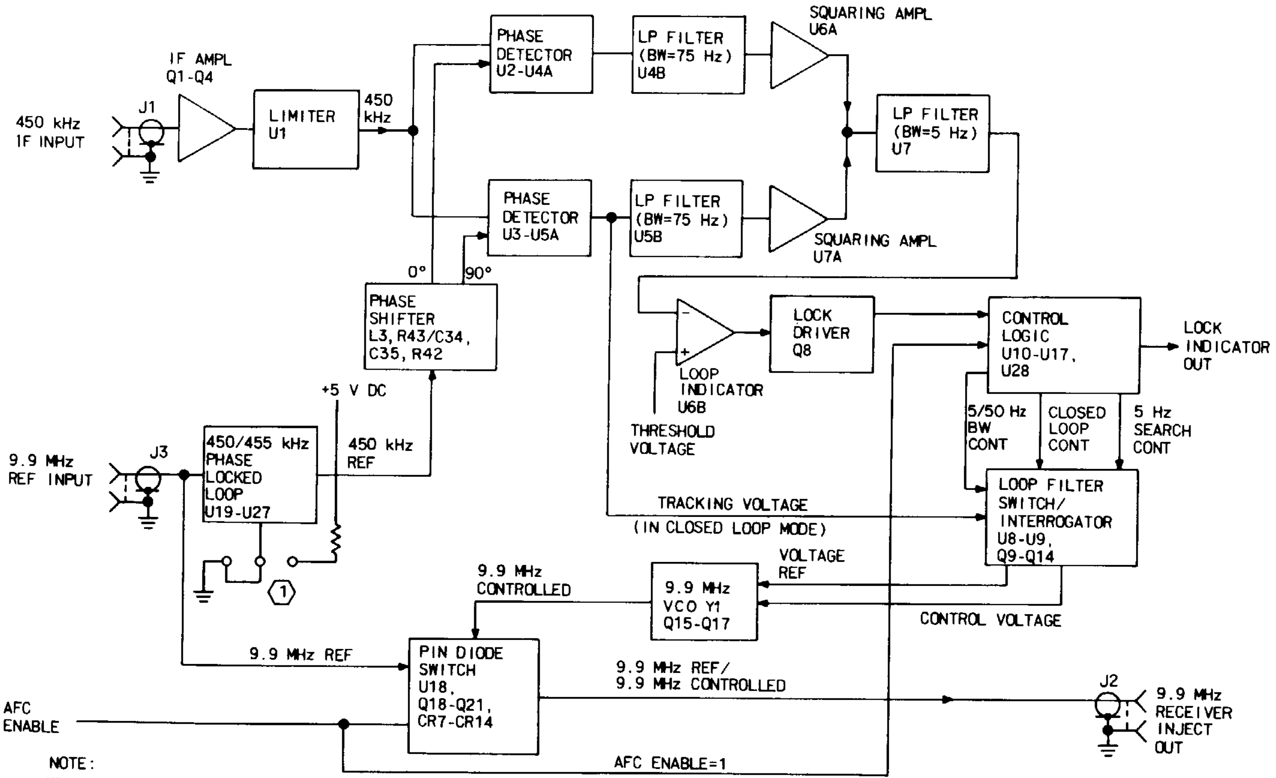
The following paragraphs describe how the AFC card accepts a low level received carrier signal, compares its phase relationship to a standard 9.9-MHz reference and corrects the phase of the received signal to maintain phase coherence over a wide range of signal levels and phase variations. The AFC card uses the AFC enable signal and a varying signal proportional to the phase difference between the received signal and a 9.9-MHz reference to automatically vary AFC signal bandwidth and the output control voltage of a switchable loop filter. The control voltage is applied to a voltage-controlled crystal oscillator (vcxo) to maintain phase coherence with the incoming received signal. The vcxo output signal is routed, via the 9.9-MHz pin diode switch, to the final mixer stage of the receiver to generate the 450-/455-kHz if signal. When AFC is disabled, the pin diode switch terminates the vcxo output and applies the synthesizer generated 9.9-MHz signal to the mixer.

2.2 *IF Amplifier and Limiter Section (Refer to figures 2 and 7)*

Refer to the simplified block diagram, figure 2, and to the AFC control card schematic, figure 7, for this and future circuit descriptions.

The if amplifier stages provide signal amplification and input impedance matching. Each of the FET amplifier stages Q2 through Q4 is designed for approximately 13 dB of signal gain. Heavy dc and ac degeneration maintain AFC signal gain almost independent of normal device parameter variation.

The crystal filter FL1 is a 4-pole monolithic design with a 250-Hz 3-dB bandwidth. The Gaussian response characteristic maintains a phase change-versus-frequency of not more than one degree per hertz to stabilize phase-locked loop (pll) operation. Skirt selectivity is the maximum obtainable consistent with the phase specification in order to provide maximum rejection of close-in interfering signals.



NOTE:
① STRAPPED FOR 450 kHz OPERATION AS SHOWN.

TPA-2602-013

AFC, Block Diagram
Figure 2

Diodes CR1 and CR2 are configured in a back-to-back arrangement and normally do not conduct unless the amplified carrier signal becomes large enough to overdrive amplifier Q4. These diodes then provide clean, symmetrical limiting at a level sufficient to guarantee that Q4 is not overdriven and drive signal to the limiter stage U1 is constant.

The limiter integrated circuit U1 is capable of 80-dB gain at these frequencies. However, the stage is heavily loaded and voltage-limited to maintain its gain at about 43 dB. Even though the if signal is heavily limited, L2 and C21/22 constitute a resonant tank at 450/455 kHz and the amplified signal applied to the quadrature phase detectors is a constant amplitude sine wave.

2.3 Quadrature Phase Detector (Refer to figure 2)

The 450-/455-kHz reference signal from the 450-/455-kHz reference loop is applied to a passive wide-band phase-shift network consisting of L3-R43 and R42/C34/C35. The reactance of L3 at 450 kHz is chosen to be approximately equal to the magnitude of R43 resulting in a +45-degree shift of the signal through Q6. Similarly, the signal through Q7 undergoes a -45-degree shift due to the negative reactance of C34/C35. The net 90-degree phase difference, then, is applied to the quadrature detectors consisting of U2 and U3. Each detector output signal is proportional to the cosine of the angular difference between the 450-/455-kHz reference signal and the received carrier. Both detectors are operated in an overdriven condition to obtain a nearly triangular (rather than sinusoidal) output. This results in a nearly linear variation in output near the zero axis crossing. Low-pass filtering is accomplished at the detector outputs to remove the remaining residual if signal. The differential output is converted to single-ended in amplifiers U4A and U5A.

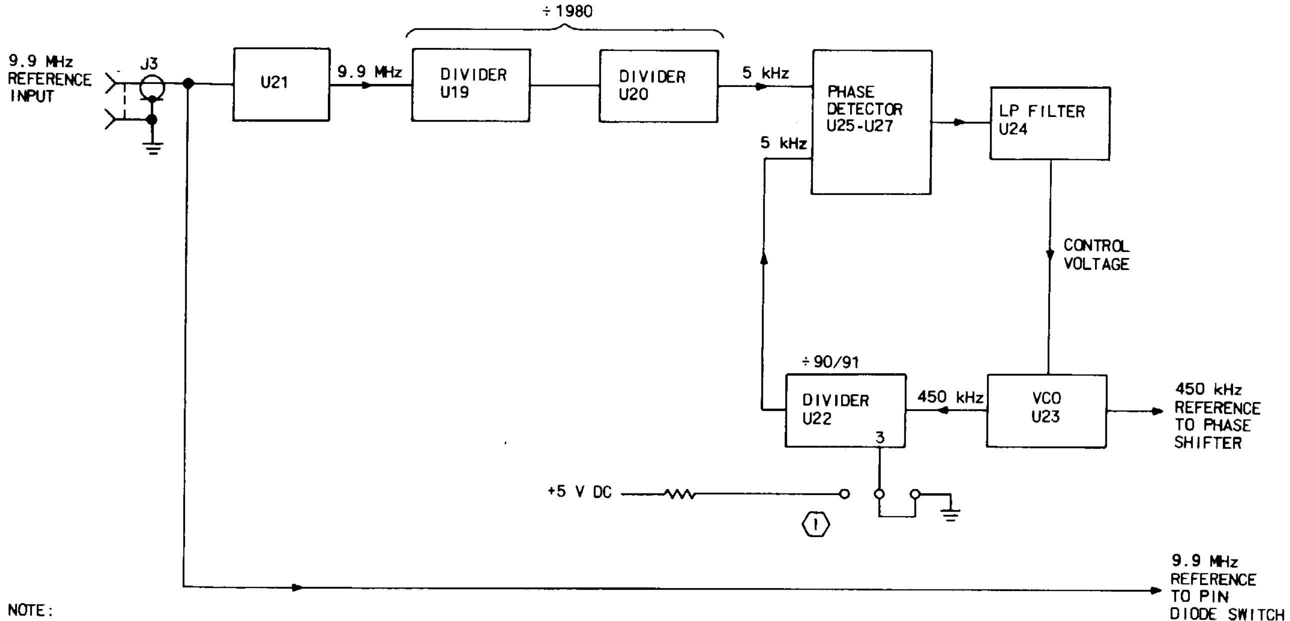
Active low-pass filters consisting of operational amplifiers U4B and U5B were incorporated for purposes of providing additional rejection of interfering close-in signals. The AFC control is most often used to acquire and track SSB and DSB signals with carrier suppression up to 20 dB. If the incoming suppressed carrier signal is moderately weak, the residual carrier to which the AFC must acquire and track is reduced yet another 20 dB and may actually be below the ambient noise level. The phase detectors respond to the angular difference between the reference and received signals as we noted earlier. Even during a locked condition, a low amplitude undesired signal presented to the phase detectors will result in modulation of the detector output which will ultimately modulate the 9.9-MHz vcxo. As interfering signal levels rise, the difference frequency appearing at the phase detector outputs can actually drive the vcxo sufficiently to cause the loop to lose lock. This happens when the peak excursion of the phase detectors is large enough to correspond to an instantaneous phase difference between the carrier and reference vectors of approximately 90 degrees. Consequently, large amounts of rejection are required to maintain a satisfactory lock in the presence of large close-in signals. The active low-pass stages provide additional protection outside of their 75-Hz bandwidth.

2.4 450/455 kHz Phase-Locked Loop (Refer to figure 3)

The 9.9-MHz reference input at J3 is fed to the 9.9-MHz pin diode switch (to be discussed later), and to the 450-kHz phase-locked loop. This 9.9-MHz reference is fed through U21 to a divide-by-1980 network consisting of U19 and U20. The 5-kHz output from U20 is fed into the phase detector (U25-U27). The second 5-kHz input to the phase detector comes from the 450-kHz vco (U23), and is fed into the divide-by-90/91 section (U22). The output of the low-pass loop filter (U24) drives the vco in a direction such that the divided output of U22 is 5 kHz and at a constant phase with the reference. In the case shown, the division ratio is 90 and vco frequency is 450 kHz. When the division ratio is changed (by changing the strapping) to 91, the vco frequency is automatically adjusted to 455 kHz to maintain the same 5-kHz phase detector input frequency. This signal is in phase lock with the reference signal. Two outputs from the vco are utilized; one provides a signal to the divider stage (U22) and the other is filtered to obtain a sine-wave reference for phase shifter use.

2.5 Threshold Type Lock Indicator (Refer to figures 2 and 7)

Squaring amplifiers, whose output is proportional to the total energy in each channel, are summed and weighted before application to the 5-Hz low-pass filter stage, U7B. The output drives a comparator U6B which incorporates positive feedback thereby providing some hysteresis following loop lock to prevent momentary loss of lock on weak signals. The lock indicator automatically switches loop bandwidths following carrier acquisition, enables certain inhibit functions in control logic, switches the loop to a stable tracking mode after signal acquisition and provides a



NOTE:
① U22-3 STRAPPED FOR 450 kHz OPERATION AS SHOWN.

TPA-2603-013

450-/455-kHz Phase-Locked Loop, Simplified Block Diagram
Figure 3

visible indication to the radio operator of lock status via the front-panel lock indicator light.

Operation of the lock indicators is predicated upon a weighting of the I and Q channels according to

$$g(V) = \alpha a-b$$

where a and b represent the I and Q outputs and α is the weighting function. From a statistical point of view, the weighting function permits offsetting of the decision point superimposed on the probability density function of the combined output. This fictional point then divides the areas corresponding to probability of a valid carrier acquisition and that corresponding to a false lock indication. From this it can be deduced that these two requirements are in opposition to one another and that an improvement in one parameter is usually at the expense of the other.

A "miss probability" of 8 percent for a carrier 20 dB below pep with full-modulation signal-to-noise ratio of 12 dB in a 2800-Hz audio bandwidth corresponds to a weighting factor of 1.825. The calculated false alarm probability is 0.5 percent or 20 seconds mean-time-between-false-acquisition with the latter persisting for about 100 milliseconds on the average.

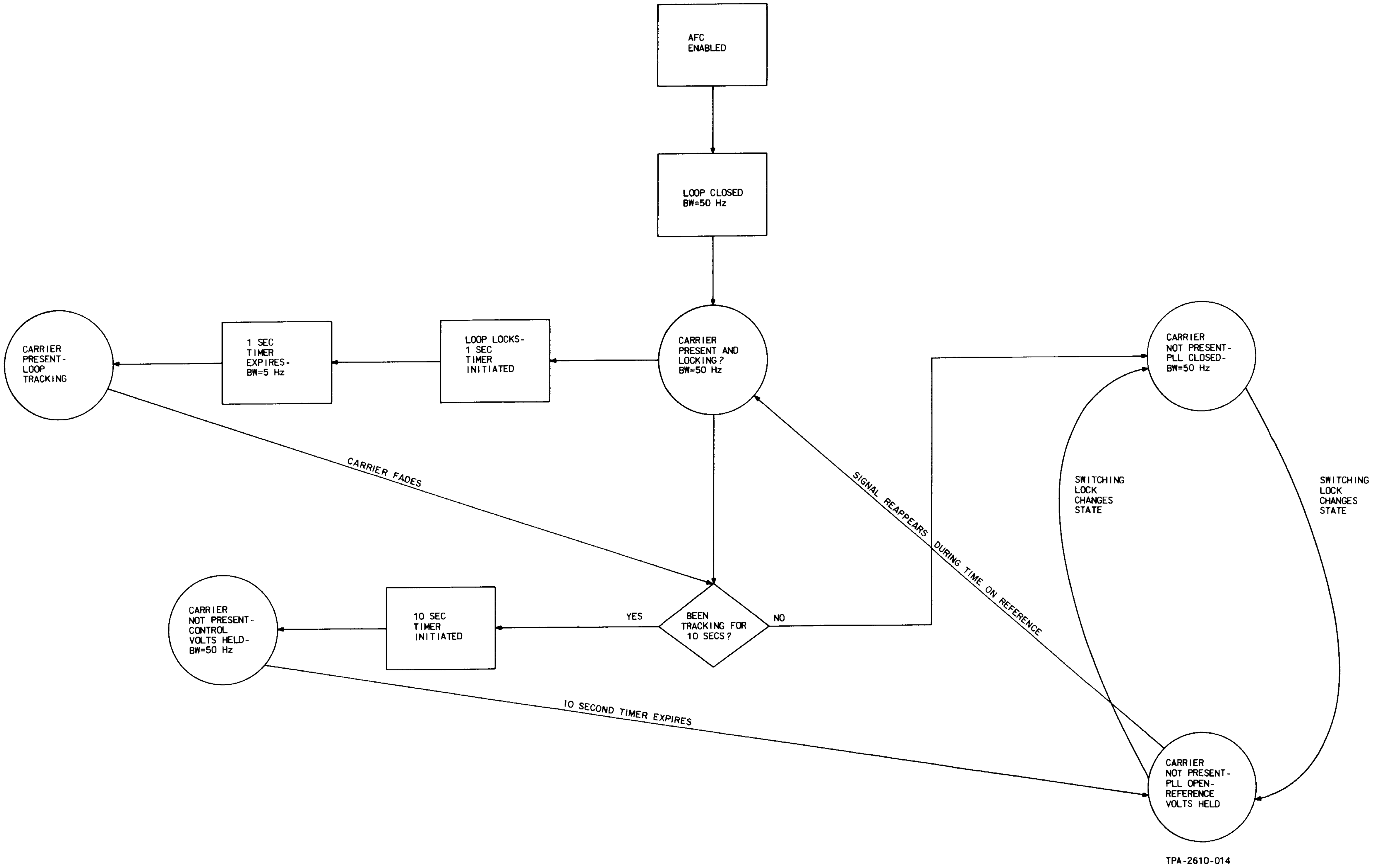
2.6 Control Logic

Control and decision logic circuits, consisting of four timers and associated gating circuitry are explained using the logic sequence diagram. (Refer to figure 4.)

The AFC acquisition starts once the AFC is enabled. Initially, the loop bandwidth is set at 50 Hz and the 1-second timer started to allow initial conditions to be established and loop transients to settle out. During this 1-second period, if the carrier signal is present and is not facing, the loop will lock. Once the loop has locked and the 1-second timer has elapsed, the loop bandwidth is switched to 5 Hz for tracking. The AFC is now operational.

Should the AFC lose lock or the carrier signal fade or disappear, the AFC operational sequence diagram (refer to figure 4) is utilized to determine the sequence that is followed by the control and decision circuits to reacquire the carrier. The AFC reacquisition, as shown in this diagram, can be accomplished by using one of several different paths that are determined by the decision circuits and dependent upon what has transpired in the recent past.

If a signal is acquired, the direction of movement on the chart is to the left. The 1-second timer expires



AFC Operational Sequence, Block Diagram
Figure 4

and the loop bandwidth is automatically reduced to 5 Hz for tracking purposes.

If the newly acquired carrier should fade or is suddenly lost, movement is toward a decision block that inquires if the loop had been tracking for at least 10 seconds. If the answer is "no" then the loop moves toward a "search" mode in the loop at the extreme right-hand side of the diagram which will be discussed later. In the event that the AFC control had been tracking continuously for at least 10 seconds prior to carrier loss, the most recent value of vco tracking voltage is retained forcing the control to pause for 10 seconds at the frequency where the carrier was lost. At this point, one of two things will happen; either the 10-second counter will expire and the control will initiate the search mode previously mentioned or, if the carrier reappears within ±5 Hz of the vco tracking frequency, reacquisition will occur. Note that the loop bandwidth was automatically widened to 50 Hz at the time carrier was lost to facilitate relocking if the carrier reappears during the timeout.

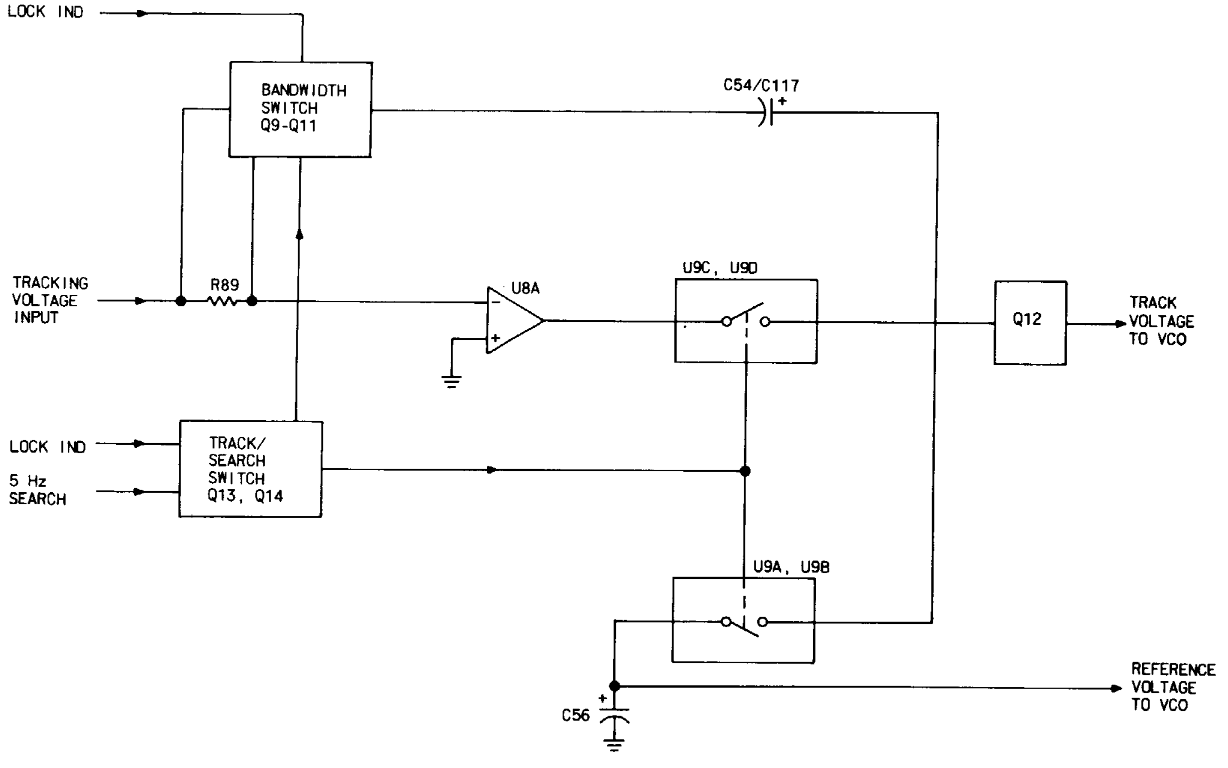
If a carrier had not been present at the time that AFC was enabled, the control logic would have inquired if we had previously been tracking for at least 10 seconds (decision block at the center of the diagram). Lest this seem redundant since we have only now enabled AFC, this feature permits short-term "false acquisition" due to random noise or to tuning through the carrier without enabling the HOLD function at the lower left-hand corner.

Once the decision has been made that the loop was not tracking for 10 seconds or more, the logic translates to the right-hand side of the diagram where an assymetrical switching clock transitions between the two states shown until reacquisition occurs. This clock positions the 9.9-MHz vco on a reference voltage corresponding to 9.90000 MHz for approximately 20 percent of the switching period (a "home" position) and in the closed-loop condition for the remainder of the 5-Hz switching clock period.

This brief overview was intended to describe basic AFC control operation; a more detailed circuit description follows in succeeding sections.

2.7 Switchable Loop Filter and VCXO (Refer to figures 4 and 5)

The loop filter is used to filter the input tracking voltage through the active low-pass filter consisting



Loop Filter Switch/Integrator, Simplified Block Diagram
Figure 5

of U8A, R89, and C54/C117. The tracking voltage is then routed through U9C, U9D (when closed), and Q12 to the vcxo. At the vcxo, this tracking voltage enables the vcxo output to track changes of the input carrier frequency within the range of constants of the AFC loop.

The lock indicator output is used to control the bandwidth switch (Q9-Q11) by switching between 50 Hz in the open-loop (search) mode to 5 Hz in the closed-loop (track) mode. This switch (Q9-Q11) changes the input bandwidth of the loop filter by shunting resistors R88 and R90 as needed to correspond with the search and track modes.

The lock indicator and 5-Hz search inputs to the track/search switch (Q13, Q14) are used to control the operation of the analog switch U9 and Q11. Switch Q11 provides an actual ground to capacitors C54/117 during the time that the loop filter is open-looped thereby preventing noise impulses from charging or discharging loop capacitors with resultant modulation of the vcxo.

The anlog switch U9 has two steps, closed loop (search and track), and hold (position that U9 is shown in). During the hold position of U9 (the 10-second timer countdown), the output control voltage fed to the vcxo is the tracking voltage on C54/C117. This reference voltage is used to keep the vcxo at or near the last known carrier signal center frequency during the 10-second hold time to maintain receiver frequency at the point where the carrier last disappeared. In the closed-loop (track) position of switches Q13 and Q14, the U9C and U9D sections of the analog switch are closed, and the loop tracking voltage is fed to the vcxo. In the open-loop (search) position of switches Q13 and Q14, the loop section (U9C, U9D) and reference voltage section (U9A, U9B) of the analog switch will switch at a 5-Hz search rate. During the search mode, analog switch U9 will be controlled by an assymetrical 5-Hz control waveform and in the closed loop position 80 percent of the time, on the reference voltage 20 percent of the time. This 4:1 ratio of closed-to-open-loop time of U9 increases acquisition probability. During closed-loop operation, the vcxo uses the input tracking voltage to control the 9.9-MHz vcxo output.

2.8 9.9-MHz Pin Diode Switch (Refer to figure 6)

The pin diode switch consists of T-section configurations that open and close signal paths while providing correct impedance termination of signal sources. The pin diode switch is shown responding to an AFC enable input (top), and to an AFC disable input (bottom). Figure 6 shows that with an AFC enable signal, the current path shown has CR12 cut off, thus blocking the 9.9-MHz reference signal flow to J2. With CR12 cut off, CR8 and CR9 are conducting allowing the controlled 9.9-MHz vcxo signal to pass out to J2. Figure 6 shows that with an AFC disable input, the current path shown has CR8 cut off, thus blocking the controlled 9.9-MHz vcxo signal flow to J2. With CR8 cut off, CR12 is conducting allowing the 9.9-MHz reference signal to pass out to J2.

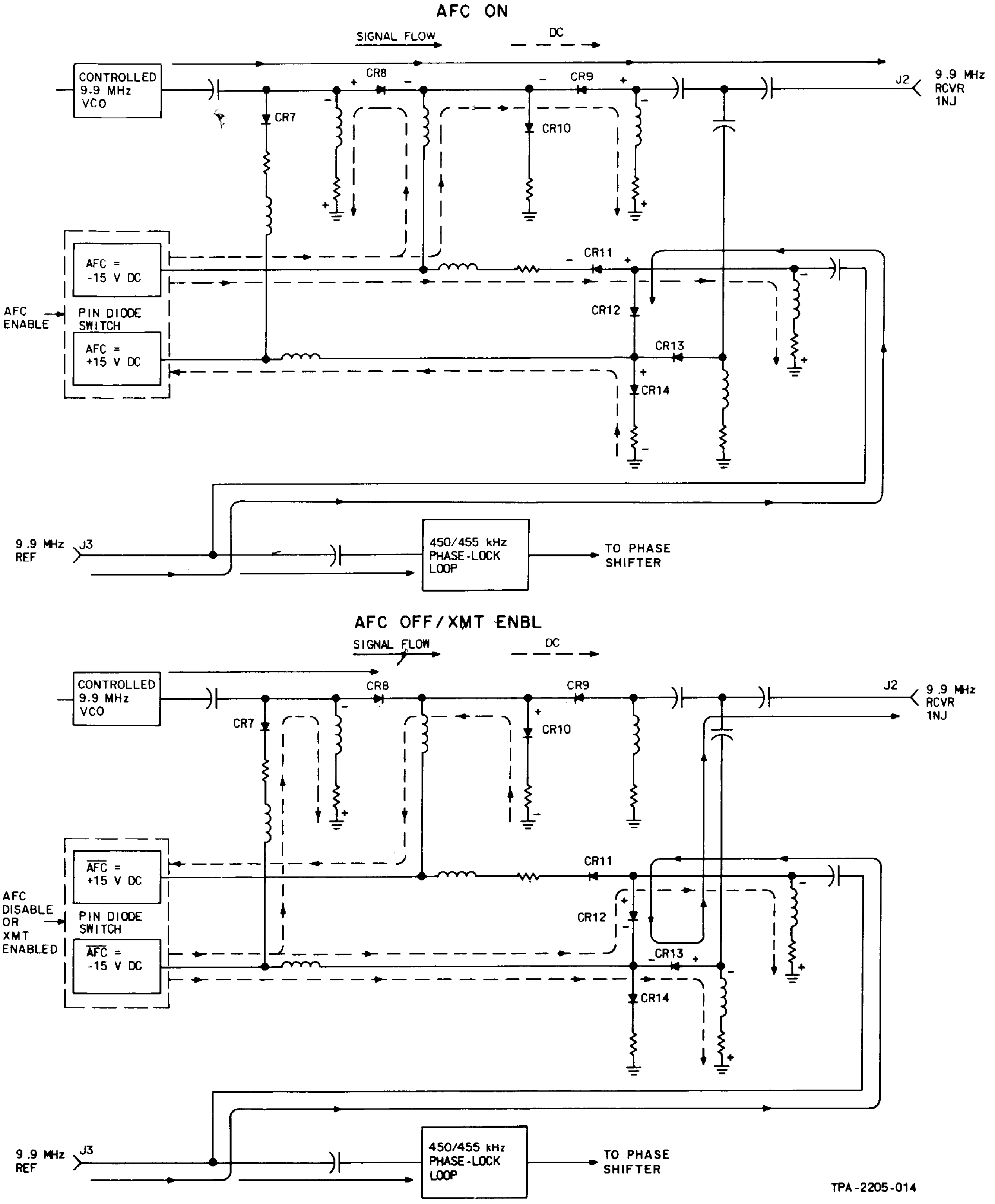
3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the AFC are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check total performance of the AFC control. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



9.9-MHz Pin Diode Switch, Flow Diagram
Figure 6

Table 1. AFC, Testing, and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Initial test setup	a. Remove the AFC card from the hf receiver.		
	b. Insert card extender into hf receiver and insert AFC card into card extender, also insert the three coaxial cable extenders and connect them to AFC card.		
	c. Ensure that the strapping of U22 is correct by using vom to measure the resistance of U22 pin 3 to ground.	0 ohms	Check that strapping is across the two lower pins near C124 on AFC card.
	d. Set hf control power to on.		
	e. Using a vom, measure the voltage on the following pins of P1:		
	P1-27	+5 ±0.25 V dc	Check hf receiver power supply outputs.
	P1-23	+15 ±0.5 V dc	
	P1-10	+24 ±1 V dc	
	P1-6	-15 ±0.5 V dc	
2. If amplifier gain check	a. With the hf control set to ON, allow a warmup period.		
	Note Allow for a 3-minute warmup once power is applied to AFC card before continuing procedures to permit the crystal oven to stabilize.		
	b. Using a signal generator, apply an 8-MHz (-70 dB mW) input signal at RCV ANT J21. Ensure the 9.9-MHz reference signal is connected to J3.		
	c. Using an oscilloscope, measure the peak-to-peak voltage at the junction of C23 and C38.	1.0 V p-p signal at a frequency of 450 kHz.	Check Q1-Q4 and associated circuitry. (13-dB mW gain per stage). Check U1 and associated circuitry.
	d. Slowly decrease the 450-kHz input down to -92 while monitoring the junction of C23 and C38 on the oscilloscope.	The 1.0 V p-p voltage remains constant down to about -90 dB mW.	Check Q1-Q4. Check U1 and associated circuitry.
3. 450-kHz loop operation (Cont)	a. Using an oscilloscope, check the level of signal at U21 pin 11 (on the rear of the AFC card).	TTL level at 9.9 MHz.	Check U21 and associated circuitry.

Table 1. AFC, Testing, and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	b. Using an oscilloscope, check the signal at U19 pin 12.	Symmetrical square wave at 990 kHz.	Replace U19.
	c. Using an oscilloscope, check the signal at U20 pin 1.	A series of pulses of approximately 1-μs duration at a 5-kHz repetition rate.	Replace U20.
	d. Using an oscilloscope, check the signal at the right-hand side of R38 (component side of card).	450-kHz sine wave at approximately 0.4 to 0.5 V p-p amplitude.	Check U22-U27 and associated circuitry.
	e. Using a vom, measure the dc voltage at the right-hand end of R161 (rear of card).	Approximately +5 to 6.5 V dc.	Change the value of C112 until voltage falls within level stated in normal indication column with frequency at 450 kHz ±1 Hz.
4. Phase detector check	a. Connect an oscilloscope (with dual trace) channel A probe to U4 pin 1 and channel B probe to U5 pin 1; using dual trace, monitor both channels.		
	b. Increase the input frequency at J1 to 450.005 Hz.	4.0 V p-p signals at U4 pin 1 and U5 pin 1 that are 90° out of phase with each other.	Check U2-U5 and associated circuitry.
	c. Set the input frequency at J1 to 450 kHz.		
5. Loop signal acquisition	a. Monitoring the signal at U4 pin 1 using an oscilloscope, set the AFC ON/OFF switch to ON.	Signal goes to approximately 0 V dc and the difference signal has disappeared. The lock indicator on control is lit.	
	b. After 15 seconds, while monitoring U14 pin 1, remove input signal at J1.	Switches to logic 1 (+3 to +5 V dc) for 10 seconds, then switches to logic 0 (0.0 to +2 V dc).	Refer to paragraph 4 and readjust R105. Check U15 and associated circuitry.
	c. Replace input signal at J1. Reduce input signal level at J1 to -106 dB mW. Switch the AFC ON/OFF switch several times between ON and OFF.	The loop retains its lock condition.	Check U6 and control logic circuitry. Check U8 and associated circuitry. Check C56.
(Cont)			

Table 1. AFC, Testing, and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	d. Using an oscilloscope set on dual trace, with channel A probe monitor P1-16 and with channel B probe monitor P1-2, remove the input at J1.	The channel A signal drops to logic 0 immediately, 10 seconds later the channel B signal drops to logic 0 and the lock indicator light on the control goes out.	Check U15 and its associated circuitry.
	e. Reapply the 450-kHz input to J1 while monitoring P1-16 and P1-2 on dual trace oscilloscope.	Both signals return to logic 1 and lock indicator lights.	Check U16, U28, and associated circuitry. Check U8 and associated circuitry.
	f. Disable the AFC ON/OFF switch on the control and remove 450-kHz input at J1.	Lock indicator light on the control goes out.	
	g. Replace the 450-kHz input at J1 and offset this input frequency 50 Hz above or below 450 kHz.		
	While this input is offset, set the AFC ON/OFF switch to ON.	The lock indicator should light within 1 second after AFC is enabled (an average time of 10 tries).	Check U16, U15, and associated circuitry.
	h. Slowly vary the input at J1, with the AFC ON/OFF switch set to ON, above and below 450-kHz input until a deviation of 1000 Hz is realized.	The lock indicator remains lit during variations not exceeding a 10-Hz per second rate.	Check U16, U15, U28, U11, U13, and associated circuitry.
	i. While monitoring P1-20 with an oscilloscope, remove input to J1.	After 10 seconds signal switches between a logic 1 and logic 0 at a 5-Hz rate.	Check U12, U17, U10, U11, U14, and associated circuitry.
6. Hold function check	a. Set the 450-kHz input signal level at J1 for -90 dB mW and offset the 450-kHz signal 10 Hz (450 010 Hz).		
	b. Monitor the vcxo frequency at the anode of CR7 using a frequency counter.		
	c. Set the AFC ON/OFF switch to ON and ensure a lock state for at least 15 seconds.	The lock indicator is lit. The frequency counter reads 9.9 MHz.	Check CR15, C16, Q17, Q16, Q15, and associated circuitry.
	d. Disconnect the input signal at J1 while monitoring the vcxo output frequency (with frequency counter set for a 1-second sample rate).	Vcxo output frequency holds at 9.900 010 Hz.	Refer to paragraph 4 and check adjustment of R172. Check C54 or C117.

4. ALIGNMENT/ADJUSTMENT

4.1 Strapping U22 for 450-kHz Operation

Refer to figure 7 and connect a shorting wire between E12 and E13 (bottom two pins next to C124) on card.

4.2 Switch Clock Adjustment (R110)

a. Using an oscilloscope check for a 10-Hz frequency at the output of U12A pin 2.
b. If 10 Hz is not observed, adjust R110 until 10 Hz is measured at U12A pin 2.

4.3 7.25-V dc Reference Adjustment (R95)

a. Connect a high impedance voltmeter between P1 pin 5 and ground.
b. Set the AFC enable/disable switch to disable.
c. The high impedance voltmeter should read 7.25 ±0.01 V dc; if not, adjust R95 until 7.25 ±0.01 V dc is indicated on the voltmeter.

4.4 9.9-MHz VCXO Adjustment (C116)

a. Ensure that power has been applied to the AFC control for more than 3 minutes (crystal oven warmup time) before making this adjustment.
b. Using a frequency counter, measure the frequency at the anode of CR7. 9.900 000 Hz should be observed; if not, carefully adjust C116 for exactly 9.900 000 Hz.

4.5 10-Second Hold Adjustment (R105)

a. Using an oscilloscope monitor the signal at U5 pin 1. This difference frequency signal and dc voltage should decrease to zero when the AFC enable/disable switch is set to enable.
b. Wait for at least 15 seconds and disconnect the receive input signal.
c. Then monitor U14A pin 1 with the oscilloscope. A logic 1 will appear at this point and remain for approximately 10 ±1 seconds, then switch to a logic 0.
d. If the hold time is incorrect, adjust R105 to obtain the proper duration of 10 ±1 seconds.

4.6 Balance Adjustment (R172)

a. Connect the receive input signal to J1 on the AFC control card.
b. Set the receive input signal 10 Hz above 450 kHz at -90-dB mW.
c. Set the AFC enable/disable switch to enable.
d. After the AFC is locked on for at least 15 seconds, using an oscilloscope, observe the inband noise signal at U5A pin 1.
e. With the scope dc coupled, set the inband noise signal to the center of the screen and set the scope input to 0.5 volts per centimetre.
f. Remove the receive input signal, if the inband noise signal moves either side of the scope centered position before the 10-second hold period has elapsed, adjust R172until inband noise signal remains centered for at least 10 seconds.
g. Repeat steps b through f with the receive input signal set 10 Hz below 450 kHz at -90 dB mW.

4.7 VCXO 300-mV Adjustment (R113)

a. Connect a rf voltmeter between the anode of CR7 and ground.
b. Connect the receive input signal (450 kHz) to J1 on the AFC control card.
c. Set the AFC enable/disable switch to enable.
d. Once the lock indicator has been lit for more than 15 seconds, adjust R113 for a 300-mV rms output at the anode of CR7.

5. REPAIR

Repair of the AFC control is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

> **Caution**
>
> This equipment contains electrostatic discharge senstivie (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 7). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifer assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

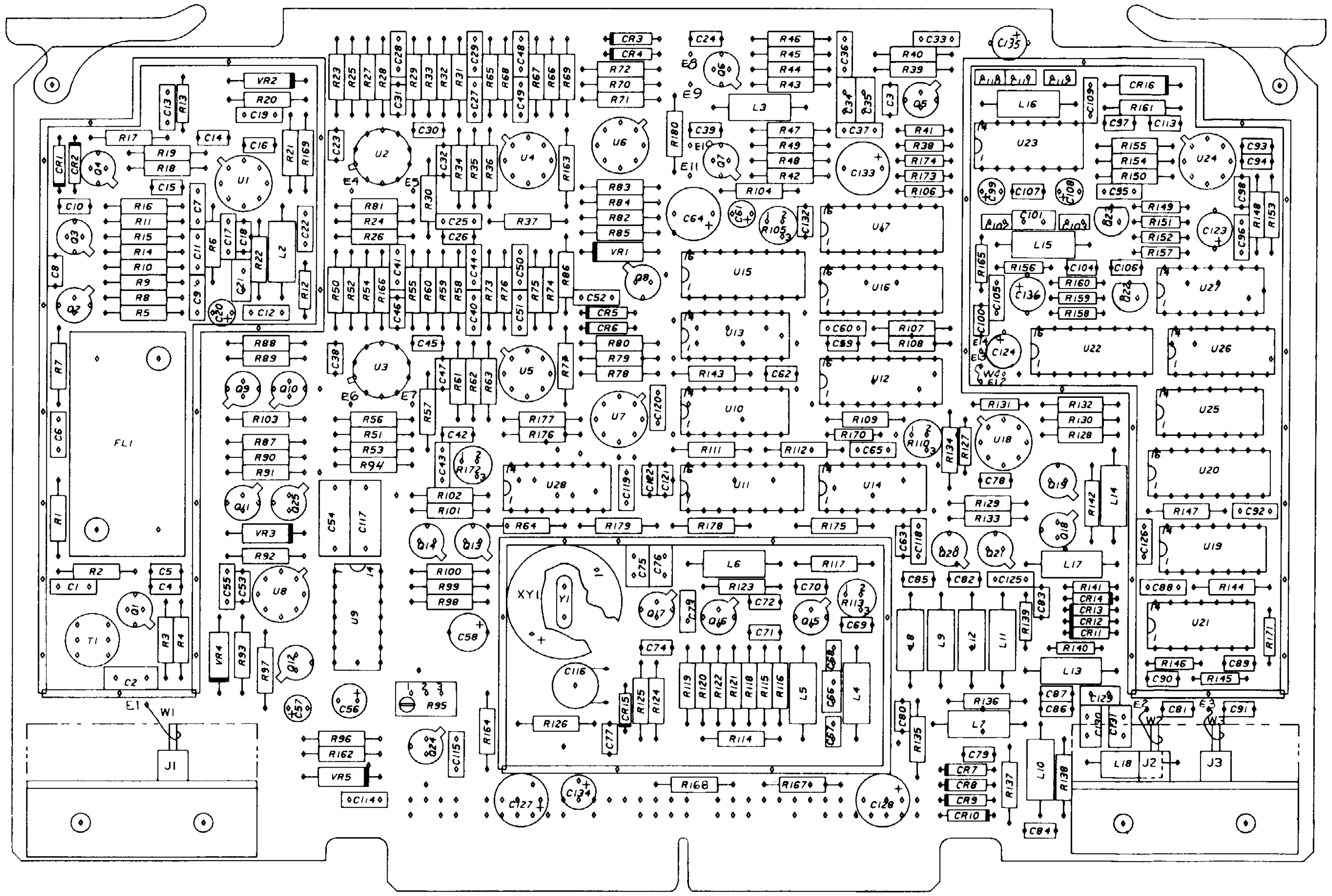
CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
00809	CROVEN LTD 500 BEECH ST WHITBY ONTARIO CANADA
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
07910	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
12020	OVENAIRE DIV OF WALTER KIDDE AND CO INC 706 FORREST ST P O BOX 1528 CHARLOTTESVILLE VA 22901
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
17540	ALPHA INDUSTRIES INC 20 SYLVAN RD WOBURN MA 01801
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801

CODE	MANUFACTURER'S NAME AND ADDRESS
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
25088	SIEMENS CORP 186 WOOD AVE S ISELIN NJ 08830
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
31039	NATIONAL SCREW PRODUCTS CO INC 14401 W 11 MILE RD P O BOX 3815 OAK PARK MI 48237
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
91293	JOHANSON MFG CO P O BOX 329 BOONTON NJ 07005
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
AFC	642-3224-001	REV C



CAUTION ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

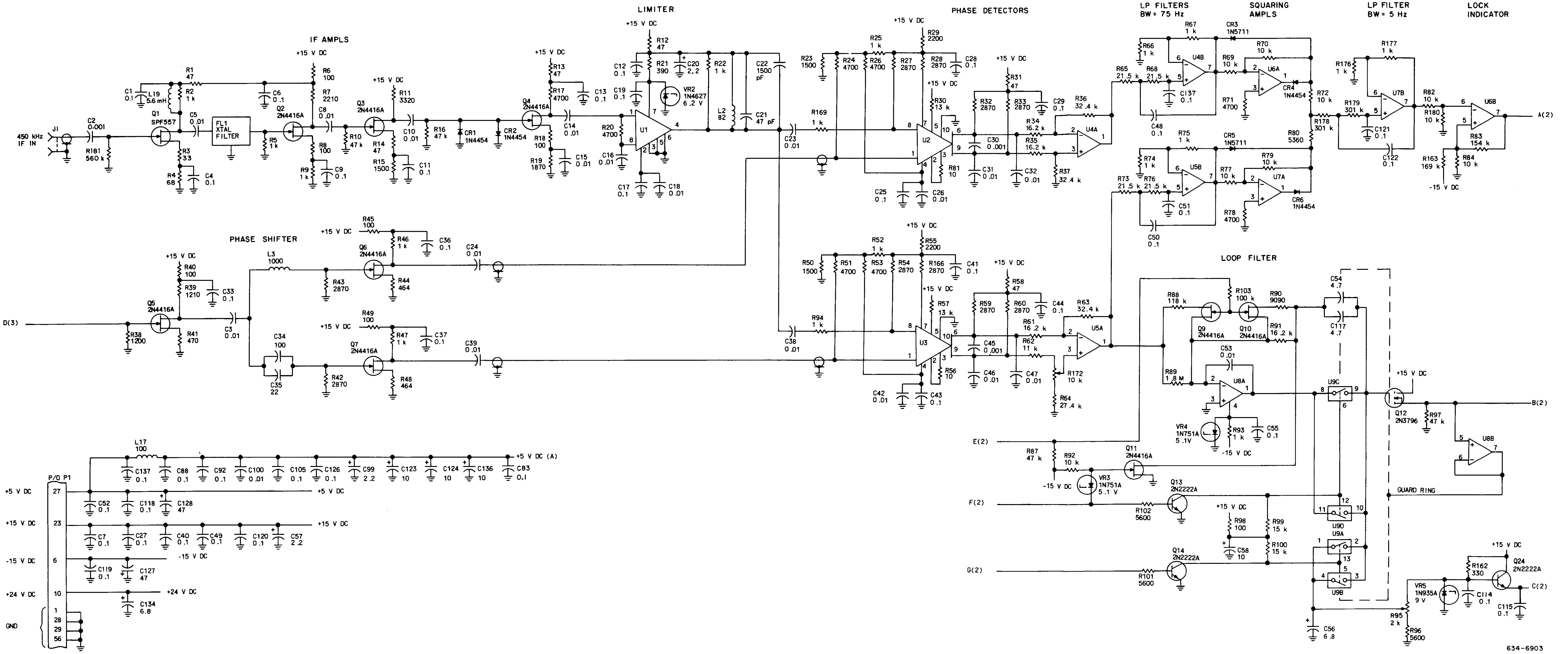
TPA-2269-014

AFC, Schematic Diagram
Figure 7 (Sheet 1 of 6)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	AFC (ESDS)	642-3224-001			
CR1,CR2	SEMICOND DEVICE	353-3644-050		03508	1N4454A
CR3	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR4	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR5	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR6	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR7-CR14	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR15	SEMICOND DEVICE	922-6131-010		25088	BB-109
CR16	SEMICOND DEVICE	922-6139-020		17540	D6522B
C1	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C2	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K
C3-C5	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C6,C7	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C8	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C9	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C10	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C11-C13	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C14-C16	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C17	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C18	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C19	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C20	CAPACITOR,FXD ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C21	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		72136	DM5E470J050WV
C22	CAPACITOR,FXD CER DIEL, 1500PF, PORM10%, 100V	913-3281-140		18796	8131-100C0G152K
C23,C24	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C25	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C26	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C27-C29	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C30	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C31,C32	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C33	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C34	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050		72136	DM5F101J050WV
C35	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030		72136	DM5E220D300WV
C36,C37	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C38,C39	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C40,C41	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C42	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C43,C44	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C45	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C46,C47	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C48-C52	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C53	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C54	CAPACITOR,FXD CER DIEL, 4.7UF, 20%, 50V	913-3279-320		16546	CY50C475M
C55	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C56	CAPACITOR,FXD ELCTLT, 6.8UF, 20%, 25V	184-9102-230		56289	199D685X0025CB1
C57	CAPACITOR,FXD ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C58	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C59	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C60	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C61	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C62,C63	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C64	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C65	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C66	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 50V	912-4141-310		72136	DM5E560J050WV
C67,C68	CAPACITOR,FXD CER DIEL, 0.00047UF, 5%, 100V	913-3117-080		56289	1CC0G471X5100C4
C69,C70	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C71	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C72	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C73	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050		72136	DM5F101J050WV
C74	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C75,C76	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 50V	912-4141-360		72136	DM5F910J050WV
C77	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C78-C87	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C88	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C89-C91	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C92	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C93,C94	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C95,C96	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C97	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C98	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C99	CAPACITOR,FXD ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C100	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C101	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050		72136	DM5F101J050WV
C102, C103	CAPACITOR,FXD CER DIEL, 0.00068UF, 5%, 100V	913-3117-090		56289	2CC0G681X5100C4
C104	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C105	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C106, C107	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C108	CAPACITOR,FXD ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C109	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C110	CAPACITOR,FXD CER DIEL, 82PF, PORM10%, 100V	913-3281-410		18796	8121-100C0G820K
C111	CAPACITOR,FXD CER DIEL, 0.00047UF, 5%, 100V	913-3117-080		56289	1CC0G471X5100C4
C112	CAPACITOR,FXD CER DIEL, 15PF, 5%, 75V	913-1098-180		72982	8101A075C0G0-150J
C113	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C114, C115	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C116	CAPACITOR,VAR AIR DIEL, 1.0 TO 16.0PF	922-0595-070		91293	5453
C117	CAPACITOR,FXD CER DIEL, 4.7UF, 20%, 50V	913-3279-320		16546	CY50C475M
C118-C122	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C123, C124	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C125, C126	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C127, C128	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C129	CAPACITOR,FXD MICA DIEL, 18PF, PORM 0.5PF, 100V	912-4141-140		72136	DM5C180D100WV
C130, C131	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 50V	912-4141-460		72136	DM5F241J050WV
C132	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C133	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C134	CAPACITOR,FXD TNTLM ELCTLT, 6.8UF, 20%, 35V	184-9102-400		56289	199D685X0035DB1
C135, C136	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
FL1	FILTER,BP,XTAL	293-1339-020		00136	2B599
J1-J3	CONNECTOR,PLUG ELEC	357-7207-010		98291	52-307-3188
L1	NOT USED				
L2	COIL,RF 82UH	240-2715-360		96906	MS75089-10
L3	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L4	COIL,RF 0.56UH	240-2715-100		96906	MS75087-10
L5	COIL,RF 10UH	240-2715-250		96906	MS75088-13
L6	COIL,RF 82UH	240-2715-360		96906	MS75089-10
L7-L14	COIL,RF 68UH	240-2715-350		96906	MS75089-9
L15	COIL,RF 270UH	240-2715-420		96906	MS75089-16
L16	COIL,RF 220UH	240-2715-410		96906	MS75089-15
L17	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L18	COIL,RF 1.80UH	240-2715-160		96906	MS75088-4
Q1-Q7	TRANSISTOR (ESDS)	352-0756-050		17856	2N4416A
Q8	TRANSISTOR	352-0551-010		15818	2N2907A
Q9-Q11	TRANSISTOR (ESDS)	352-0756-050		17856	2N4416A
Q12	TRANSISTOR (ESDS)	352-1018-010		04713	2N3796
Q13,Q14	TRANSISTOR	352-0661-020		07263	2N2222A
Q15-Q17	TRANSISTOR	352-0440-000		07910	2N918
Q18	TRANSISTOR	352-0661-020		07263	2N2222A
Q19	TRANSISTOR	352-0551-010		15818	2N2907A
Q20	TRANSISTOR	352-0661-020		07263	2N2222A
Q21	TRANSISTOR	352-0551-010		15818	2N2907A
Q22,Q23	TRANSISTOR	352-5501-010		04713	MPS2222A
Q24	TRANSISTOR	352-0661-020		07263	2N2222A
Q25	TRANSISTOR (ESDS)	352-0605-010		04713	2N2608
R1	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R2	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R3	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R4,R5	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R6	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R7	RESISTOR,FXD FILM, 2.21K, 1%, 1/8W	705-3605-160		81349	RN55D2211F
R8	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R9	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R10	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R11	RESISTOR,FXD FILM, 3.32K, 1%, 1/8W	705-1021-000		81349	RN55D3321F
R12,R13	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/8W	745-2292-000		81349	RCR05G470KS
R14	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R15	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R16	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R17	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R18	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R19	RESISTOR,FXD FILM, 1.87K, 1%, 1/8W	705-1009-000		81349	RN55D1871F
R20	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R21	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R22	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R23	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R24	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R25	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R26	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R27,R28	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R29	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R30	RESISTOR,FXD FILM, 13K, 1%, 1/8W	705-3605-530		81349	RN55D1302F
R31	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R32,R33	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R34,R35	RESISTOR,FXD FILM, 16.2K, 1%, 1/8W	705-1054-000		81349	RN55D1622F
R36,R37	RESISTOR,FXD FILM, 32.4K, 1%, 1/8W	705-3605-720		81349	RN55D3242F
R38	RESISTOR,FXD CMPSN, 1.2K, 5%, 1/8W	745-1863-510		81349	RCR05G122JS
R39	RESISTOR,FXD FILM, 1.21K, 1%, 1/8W	705-1000-000		81349	RN55D1211F
R40	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R41	RESISTOR,FXD CMPSN, 470 OHMS, 5%, 1/8W	745-1863-410		81349	RCR05G471JS
R42,R43	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R44	RESISTOR,FXD FILM, 464 OHMS, 1%, 1/8W	705-0980-000		81349	RN55D4640F
R45	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R46,R47	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R48	RESISTOR,FXD FILM, 464 OHMS, 1%, 1/8W	705-0980-000		81349	RN55D4640F
R49	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R50	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R51	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R52	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R53	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R54	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R55	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R56	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000		81349	RCR07G100KS
R57	RESISTOR,FXD FILM, 13K, 1%, 1/8W	705-3605-530		81349	RN55D1302F
R58	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R59,R60	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R61	RESISTOR,FXD FILM, 16.2K, 1%, 1/8W	705-1054-000		81349	RN55D1622F
R62	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R63	RESISTOR,FXD FILM, 32.4K, 1%, 1/8W	705-3605-720		81349	RN55D3242F
R64	RESISTOR,FXD FILM, 27.4K, 1%, 1/8W	705-1065-000		81349	RN55D2742F
R65	RESISTOR,FXD FILM, 21.5K, 1%, 1/8W	705-1060-000		81349	RN55D2152F
R66,R67	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R68	RESISTOR,FXD FILM, 21.5K, 1%, 1/8W	705-1060-000		81349	RN55D2152F
R69,R70	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R71	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R72	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R73	RESISTOR,FXD FILM, 21.5K, 1%, 1/8W	705-1060-000		81349	RN55D2152F
R74,R75	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R76	RESISTOR,FXD FILM, 21.5K, 1%, 1/8W	705-1060-000		81349	RN55D2152F
R77	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R78	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R79	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R80	RESISTOR,FXD FILM, 5.36K, 1%, 1/8W	705-1031-000		81349	RN55D5361F
R81	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000		81349	RCR07G100KS
R82	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R83	RESISTOR,FXD FILM, 154K, 1%, 1/8W	705-1101-000		81349	RN55D1543F
R84	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R85,R86	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R87	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R88	RESISTOR,FXD FILM, 118K, 1%, 1/8W	705-3604-040		81349	RN55D1183F
R89	RESISTOR,FXD CMPSN, 1.8MEGO, 10%, 1/4W	745-0866-000		81349	RCR07G185KS
R90	RESISTOR,FXD FILM, 9.09K, 1%, 1/8W	705-1042-000		81349	RN55D9091F
R91	RESISTOR,FXD FILM, 16.2K, 1%, 1/8W	705-1054-000		81349	RN55D1622F
R92	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R93,R94	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R95	RESISTOR,VAR 2K, 10%, 1W	382-0011-010		80294	3282W1-202
R96	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R97	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R98	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R99,R100	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R101, R102	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R103	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R104	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R105	RESISTOR,VAR 1 MEG,PORM20%,0.5W	382-0027-160		80294	3329H1-105
R106	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R107	RESISTOR,FXD CMPSN, 0.39MEGO, 10%, 1/4W	745-0842-000		81349	RCR07G394KS
R108	RESISTOR,FXD CMPSN, 39K, 10%, 1/4W	745-0806-000		81349	RCR07G393KS
R109	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R110	RESISTOR,VAR 500K, 10%, 0.5W	382-0027-150		80294	3329H1-504
R111	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R112	RESISTOR,FXD CMPSN, 39K, 10%, 1/4W	745-0806-000		81349	RCR07G393KS
R113	RESISTOR,VAR 200 OHMS, 10%, 0.5W	382-0027-050		80294	3329H1-201
R114	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R115	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R116	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R117	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R118	RESISTOR,FXD CMPSN, 3.6K, 5%, 1/4W	745-0768-000		81349	RCR07G362JS
R119	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R120	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R121	RESISTOR,FXD CMPSN, 3.6K, 5%, 1/4W	745-0768-000		81349	RCR07G362JS
R122	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R123	RESISTOR,FXD CMPSN, 3.6K, 5%, 1/4W	745-0768-000		81349	RCR07G362JS
R124, R125	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R126	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R127	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R128	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R129	RESISTOR,FXD CMPSN, 82K, 10%, 1/4W	745-0818-000		81349	RCR07G823KS
R130	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R131	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R132	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R133	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R134	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R135	RESISTOR,FXD CMPSN, 51 OHMS, 5%, 1/4W	745-0702-000		81349	RCR07G510JS
R136-R138	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R139	RESISTOR,FXD CMPSN, 51 OHMS, 5%, 1/4W	745-0702-000		81349	RCR07G510JS
R140, R141	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/8W	745-2338-000		81349	RCR05G821KS
R142	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R143	RESISTOR,FXD CMPSN, 39K, 10%, 1/4W	745-0806-000		81349	RCR07G393KS
R144	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R145, R146	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R147, R148	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R149	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R150	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R151	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R152	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R153	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R154, R155	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS

AFC, Schematic Diagram
Figure 7 (Sheet 2)

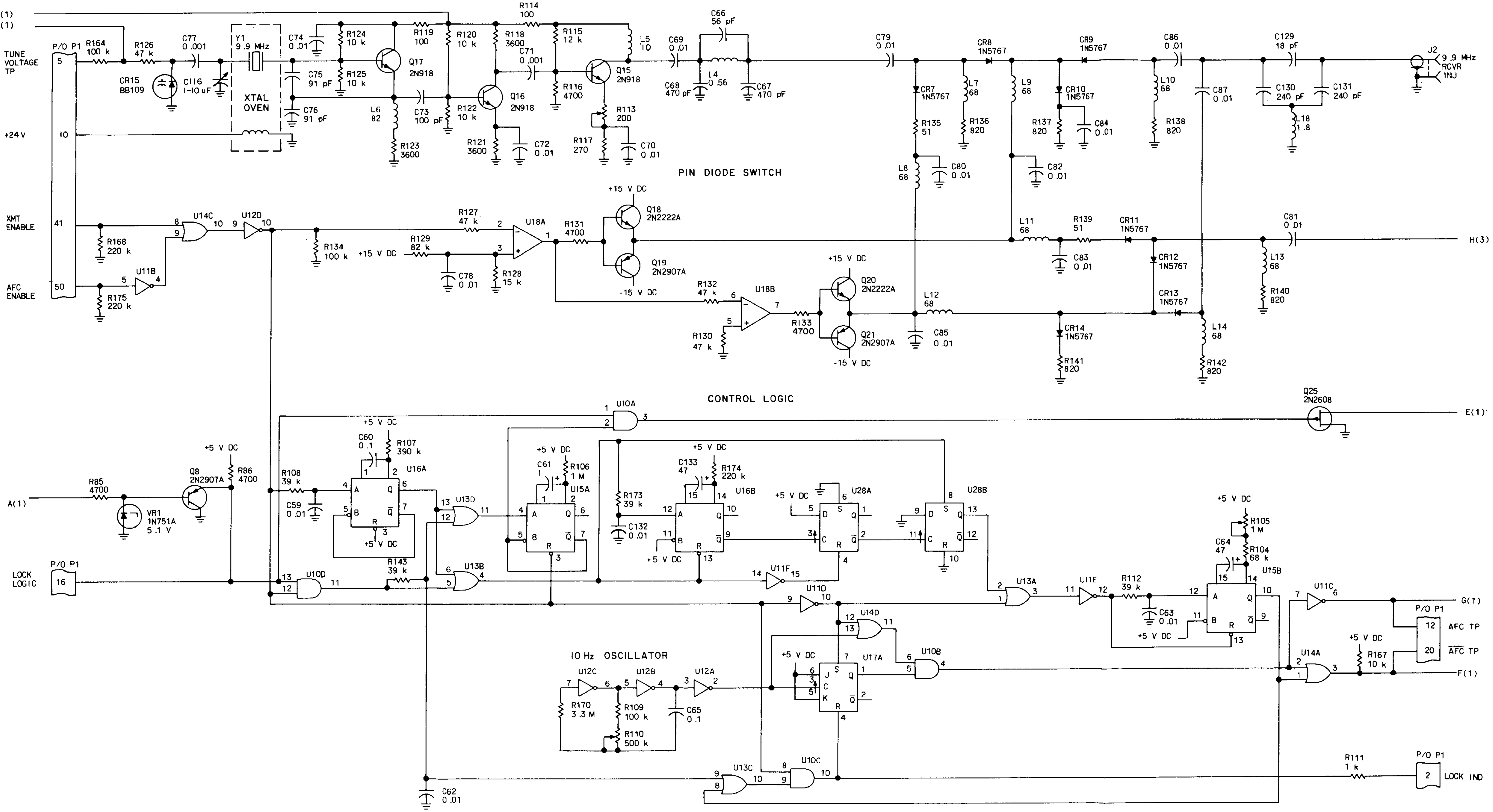


AFC, Schematic Diagram
Figure 7 (Sheet 3)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R156	RESISTOR,FXD CMPSN, 18K, 10%, 1/8W	745-2386-000		81349	RCR05G183KS
R157	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R158	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R159	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R160	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R161	RESISTOR,FXD CMPSN, 18K, 10%, 1/4W	745-0794-000		81349	RCR07G183KS
R162	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R163	RESISTOR,FXD FILM, 169K, 1%, 1/8W	705-1103-000		81349	RN55D1693F
R164	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R165	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R166	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W	705-1018-000		81349	RN55D2871F
R167	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R168	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R169	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R170	RESISTOR,FXD CMPSN, 3.3MEGO, 5%, 1/8W	745-1864-370		81349	RCR05G335JS
R171	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R172	RESISTOR,VAR 10K, 10%, 0.5W	382-0027-100		80294	3329H1-103
R173	RESISTOR,FXD CMPSN, 39K, 10%, 1/8W	745-2398-000		81349	RCR05G393KS
R174	RESISTOR,FXD CMPSN, 220K, 10%, 1/8W	745-2425-000		81349	RCR05G224KS
R175	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R176, R177	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R178, R179	RESISTOR,FXD FILM, 301K, 1%, 1/8W	705-1115-000		81349	RN55D3013F
R180	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
T1	TRANSFORMER,RF	278-0444-090		20462	278-0444-090
U1	INTEGRATED CIRCUIT	351-1125-010		02735	CA3076
U2,U3	INTEGRATED CIRCUIT	351-0043-010		04713	MC1596G
U4-U8	INTEGRATED CIRCUIT	351-1071-020		34335	1558H
U9	INTEGRATED CIRCUIT (ESDS)	351-8252-010		02735	CD4066BE
U10	INTEGRATED CIRCUIT (ESDS)	351-8297-010		02735	CD4081BF
U11,U12	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U13,U14	INTEGRATED CIRCUIT (ESDS)	351-8306-010		27014	CD4071BMJ
U15,U16	INTEGRATED CIRCUIT (ESDS)	351-8479-010		04713	MC14538BCP
U17	INTEGRATED CIRCUIT (ESDS)	351-8258-010		27014	CD4027BMJ
U18	INTEGRATED CIRCUIT	351-1071-020		34335	1558H
U19	INTEGRATED CIRCUIT	351-1636-010		01295	SN74LS90N
U20	INTEGRATED CIRCUIT (ESDS)	351-8882-010		04713	MC14569BCP
U21	INTEGRATED CIRCUIT	351-1523-010		27014	DM54LS00J
U22	INTEGRATED CIRCUIT (ESDS)	351-8882-010		04713	MC14569BCP
U23	INTEGRATED CIRCUIT	351-7768-010		04713	MC1648P
U24	INTEGRATED CIRCUIT	351-1071-020		34335	1558H
U25	INTEGRATED CIRCUIT (ESDS)	351-8160-080		31039	SCL4011BC
U26	INTEGRATED CIRCUIT (ESDS)	351-8184-020		04713	MC14023BAL
U27	INTEGRATED CIRCUIT (ESDS)	351-8185-030		07263	F4012DM
U28	INTEGRATED CIRCUIT (ESDS)	351-8160-030		31039	SCL4013BC
VR1	SEMICOND DEVICE	353-2710-000		07263	1N751A
VR2	SEMICOND DEVICE	353-3591-510		04713	1N4627
VR3,VR4	SEMICOND DEVICE	353-2710-000		07263	1N751A
VR5	SEMICOND DEVICE	353-3157-000		81483	1N935A
XY1	OVEN,XTAL	292-0329-050		12020	PCL1-43-05
Y1	CRYSTAL UNIT,QTZ 9.900000MHZ	289-7157-080		00809	289-7157-080

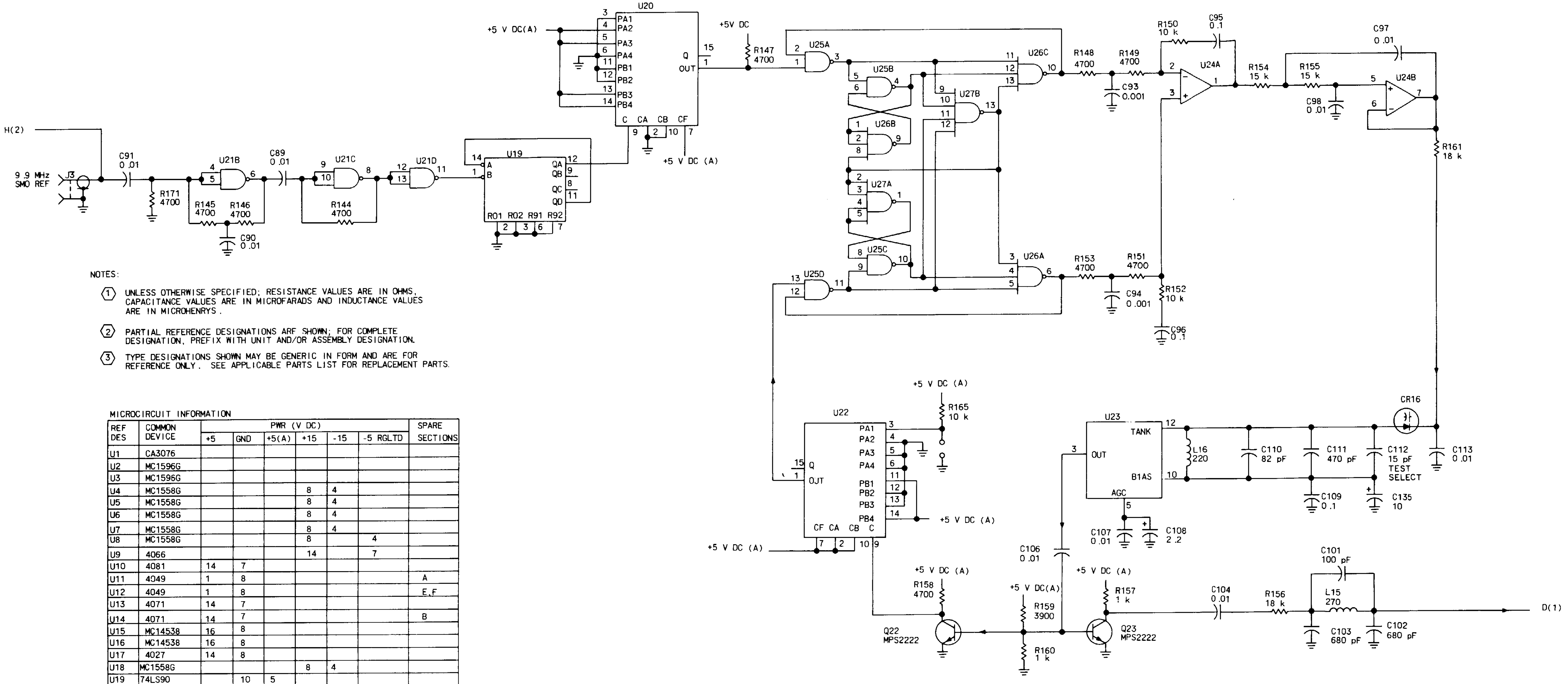
AFC, Schematic Diagram
Figure 7 (Sheet 4)



634-6903

AFC, Schematic Diagram
Figure 7 (Sheet 5)

450/455 kHz PHASE LOCKED LOOP



NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② PARTIAL REFERENCE DESIGNATIONS ARF SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE	PWR (V DC)						SPARE SECTIONS
		+5	GND	+5(A)	+15	-15	-5 RGLTD	
U1	CA3076							
U2	MC1596G							
U3	MC1596G							
U4	MC1558G				8	4		
U5	MC1558G				8	4		
U6	MC1558G				8	4		
U7	MC1558G				8	4		
U8	MC1558G				8		4	
U9	4066				14		7	
U10	4081	14	7					
U11	4049	1	8					A
U12	4049	1	8					E,F
U13	4071	14	7					
U14	4071	14	7					B
U15	MC14538	16	8					
U16	MC14538	16	8					
U17	4027	14	8					
U18	MC1558G				8	4		
U19	74LS90		10	5				
U20	MC14569		8	16				
U21	74LS00		7	14				A
U22	MC14569		8	16				
U23	MC1648		7,8	14,1				
U24	MC1558G		4		8			
U25	4011		7	14				
U26	4023		7	14				
U27	4012		7	14				
U28	4013	14	7					

634-6903

AFC, Schematic Diagram
Figure 7 (Sheet 6)

VBFO
(638-6067-002)

Rockwell International

instructions

Collins Telecommunications Products Division

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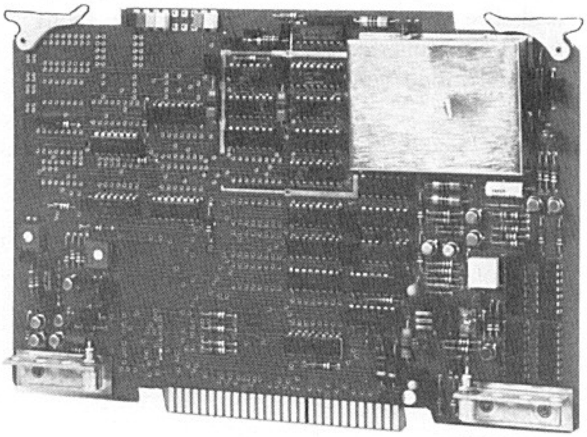
1. DESCRIPTION

VBFO 638-6067-002 as shown in figure 1 is a 2-layer planar card with a 56-pin edge-on connector (2 layers, 28 pins each) and two subminiax rf connectors.

The vbfo consists of a synthesized bfo which uses several different inputs to determine its output frequency.



TPA-2446-017

VBFO
Figure 1

2. PRINCIPLES OF OPERATION

2.1 General

The vbfo produces a bfo offset if frequency output (440.01 to 459.99 kHz in 10 Hz steps) that is operational only in the receive modes of CW, SSB, or ISB.

The vbfo circuits are enabled by a vbfo enable signal (logic 1) at P1-46. The vbfo/450-kHz control enables the vco, output switching, and the phase/frequency discriminator. Refer to figure 2.

The vbfo receives the following inputs:

a. 450-kHz reference.
b. Vbfo/450-kHz switching inputs.
c. Parallel bcd vbfo input.
d. Necessary associated control signals to activate and control the vbfo output frequency.

2.2 Synthesized BFO

A 450-kHz reference input signal at J2 is applied through buffer circuit Q16 and is divided by 1500 (by fixed dividers U38, U39, and U33) to produce 300-Hz reference frequency signals. These are applied to sampling gates U9A, U9B, U9C, and U9D in the voltage-controlled oscillator (vco), through sampling logic circuits U34, Q4, and Q5.

Synchronous reversible up/down counters U19, U24, U27, U31, and U32 form a programmable frequency divider with variable division ratios ranging from 44 001 to 45 999, with 45 000 the division ratio for 0 vbfo offset from the selected operating frequency. The division ratios for the various vbfo settings are determined by the bcd frequency information from the preset vbfo (parallel bcd) input. The +/-signal is determined externally, and is fed in at P1-19 which conditions up/down and reset logic circuit U13 and U14. The output of the programmable divider circuit is applied through the phase/frequency discriminator and then to the sampling gates in the vco assembly.

The vco assembly generates an output frequency that ranges from 13.2003 to 13.7997 MHz with 13.500 MHz as the center frequency (0 vbfo offset). The output from the vco assembly is used as the clock signal for the programmable divider circuit and is divided by 30 (by fixed divider circuits U3 and U1) to become the vbfo output signal that ranges from 440.01 to 459.99 kHz.

For offsets which are greater than 0.00 kHz, the division ratio of the programmable dividers is accomplished by loading 45 000 into the counters, adding the vbfo offset frequency, and then allowing the counters to count down to 00 000. Assume that the bfo is set to the maximum deviation of 9.990 kHz above the operating frequency. The +/- input goes to + (logic 1), which causes the up/down and reset logic circuit to set the programmable divider circuit to the required 45 000 division ratio and to a countdown state. The 999 input from the bcd frequency input is loaded, making a total division ratio of 45 999 (the countdown starting point). The counter circuit then divides by counting down to 00 000. The clock input to the divider circuit, at this point, will be different from the required 13.7997 MHz depending upon the previous vbfo offset frequency. This causes the output of the counter circuit applied to the sampling gates to be less than 300-Hz nominal frequency. The sampling gates in the vco assembly function basically as a phase comparator. The 300-Hz control inputs, produced from 450-kHz reference input, enable the gates at the 300-Hz control (logic 0) pulse rate. If the input signal from the programmable divider is out of phase, the out-of-phase portion of the signal is passed through the gates during the enable period. The more out of phase the input signal, the greater the amplitude of the output signal from the gates. The output of the gates is filtered and amplified by capacitor C29 and FET Q8 to produce a dc error voltage. The dc error voltage is applied across voltage variable capacitance diode VR4. As the voltage across VR4 increases, its capacitance decreases, thus increasing the frequency of the voltage-controlled oscillator circuit U4. Conversely, as the dc error voltage across VR4 decreases, the capacitance increases and decreases the oscillator circuit frequency. As the vco output frequency increases toward 13.7997 MHz, the output frequency of the programmable divider circuit increases toward 300 Hz which, in turn, decreases the error voltage applied to VR4. When the oscillator output frequency reaches 13.7997 MHz, the output from the programmable divider circuit is 300 Hz (13.7997 MHz ÷ 45.999). The vco circuit locks at this frequency and remains until the bfo frequency information is changed. The 13.7997-MHz oscillator frequency is divided by 30 to produce the 459.99-kHz if output signal that is applied to if amplifier for use in the SSB, ISB, and CW modes of operation.

If the bfo is set to a deviation below the operating frequency, the synthesizer functions are the same except the +/- input goes to logic 0 and the programmable divider circuit is set to a count-up state. For an offset of -9.990 kHz, the bfo begins counting at 55 000 plus the deviation, bfo offset of 9.990 kHz or, a 55 999 start counting point. The count progresses toward a maximum count of 100 000. This produces the division ratio of 44 001 (100 000 minus 55 999). The error voltage applied to VR4 decreases and causes the output frequency to decrease. When the output of the programmable divider reaches 300 Hz, the oscillator output frequency will lock at 13.2003 and when divided by 30 will produce the 440.01-kHz vbfo output signal.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the vbfo are listed in the maintenance section of this instruction book.

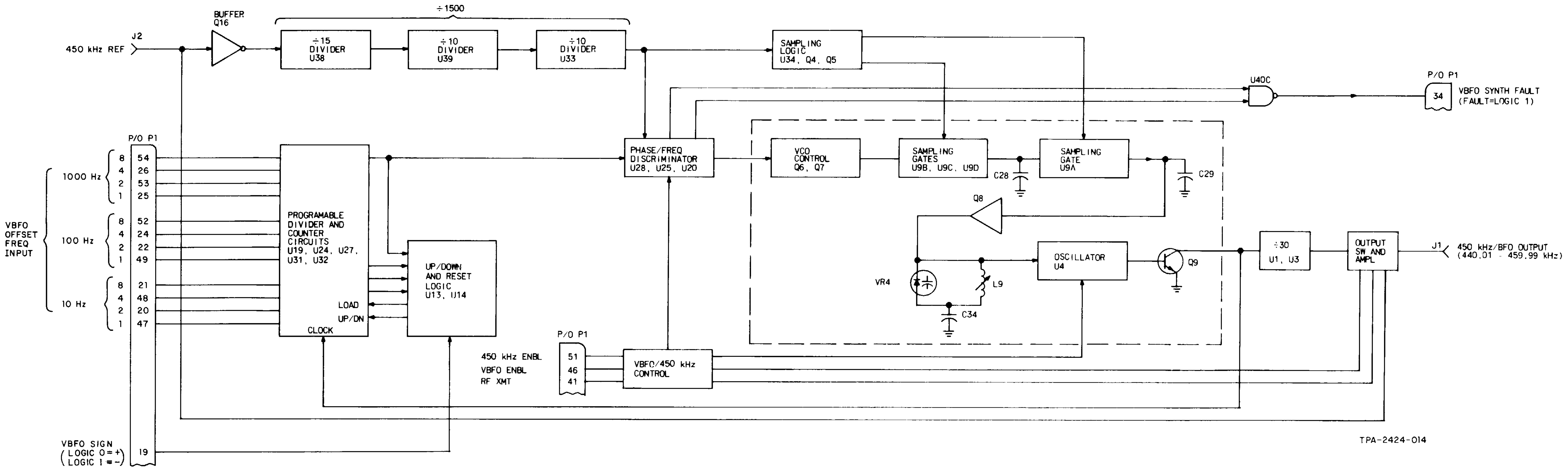
3.2 Testing

The test procedures in this section check total performance of the vbfo. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Note

In the testing/troubleshooting procedures and the alignment/adjustment, the front panel controls are set as follows for the indicated mode/condition.

MODE/ CONDITION	HF-8050( )	HF-8054( )	HF-8070( )
CW mode	MODE to SSB/CW	MODE to CW	MODE to CW
Vbfo enabled	BFO to VAR	VBFO to VAR	BFO to VAR
Vbfo disabled	BFO to FIX	VBFO to FXD	BFO to FIX



VBFO, Block Diagram
Figure 2

Table 1. VBFO, Testing, and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing the vbfo that is to be tested. b. Remove vbfo card. Install it on an extender card and place it in the unit. c. Set unit LINE SELECTOR for power source available (100/115/215/230 V ac). Note Ensure that proper fuse is installed for power source used. d. Connect unit to available power source.		
2. Initial check	a. Front-panel controls set as follows: PWR to on. CONT to LCL. Mode to CW. BANDWIDTH to 16 (receiver only). KEY to NORM (receiver-exciter only). Vbfo disabled. AGC to FAST. RF GAIN to full cw.		
	b. Measure dc voltages between the following points and ground (TP1).		Check associated power supply.
	P1-23	+15 ±1.0 V dc.	
	P1-27	+5 ±0.5 V dc.	
3. Vbfo/450-kHz output switch	a. Front-panel controls set as follows: PWR to on. CONT to LCL. Mode to AM. BANDWIDTH to 16 (receiver only). KEY to NORM (receiver-exciter only). Vbfo disabled. AGC to OFF. RF GAIN to full cw.		
(Cont)			

Table 1. VBFO, Testing, and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	**Note** Logic 1 = NLT+3.0 V dc Logic 0 = NMT 0.5 V dc		
	b. Note logic level at TP8.	Logic 0	Check U21 and associated circuit.
	c. Note output frequency at J1.	0 Hz	Check U21, U29, and associated circuits.
	d. Repeat steps 3.b and 3.c at each of the following conditions:		Same as step 3.b and 3.c.

MODE	VBFO	TP8	J1
AM	Enabled	Logic 0	0 Hz
Receiver only:			
CW	Disabled	Logic 0	450 kHz
CW	Enabled	Logic 1	*Vbfo
Receiver-exciter only:			
CW	Disabled	Logic 0	450 kHz
CW	Enabled	Logic 1	**Vbfo
CW	Enabled	Logic 1	*Vbfo

*Vbfo frequency equals 450 kHz plus the algebraic sum of the vbfo offset.

**With receiver-exciter in transmit J1 will be 450 kHz.

	Caution In the following procedures, when applying +5 V dc or 0 V dc (ground) to the indicated points, apply these levels through a 100-ohm series limiting resistor. The +5 V dc source should be obtained from the receiver power supply so that the integrated circuit supply voltages are not exceeded by the applied levels.		
	Note 450-kHz enable (P1-51).		
(Cont)	e. Apply +5 V dc to TP4, rf xmt (receiver only). Set KEY switch to LOCK (receiver-exciter only).		

Table 1. VBFO, Testing, and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td>f. Repeat steps 3.b and 3.c at each of the following conditions:</td><td></td><td>Same as step 3.b and 3.c.</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>MODE</th><th>VBFO</th><th>TP8</th><th>J1</th></tr>
<tr><td>AM</td><td>Disabled</td><td>Logic 0</td><td>0 Hz</td></tr>
<tr><td>AM</td><td>Enabled</td><td>Logic 0</td><td>0 Hz</td></tr>
<tr><td>Receiver only:</td><td></td><td></td><td></td></tr>
<tr><td>CW</td><td>Disabled</td><td>Logic 0</td><td>450 kHz</td></tr>
<tr><td>CW</td><td>Enabled</td><td>Logic 1</td><td>450 kHz</td></tr>
<tr><td>Receiver-exciter only:</td><td></td><td></td><td></td></tr>
<tr><td>CW</td><td>Disabled</td><td>Logic 0</td><td>450 kHz</td></tr>
<tr><td>CW</td><td>Enabled</td><td>Logic 1</td><td>450 kHz</td></tr>
</table>
</td></tr>
<tr><td></td><td>g. Remove +5 V dc from TP4 (receiver only). Set KEY switch to NORM (receiver-exciter only).</td><td></td><td></td></tr>
<tr><td></td><td>h. Connect a spectrum analyzer to J1.</td><td></td><td></td></tr>
<tr><td></td><td>i. Set vbfo offset frequency for 1000 Hz.</td><td></td><td></td></tr>
<tr><td></td><td>j. Note level of 451-kHz if signal at J1.</td><td>Reference</td><td></td></tr>
<tr><td></td><td>k. Measure level of sidebands caused by 300-Hz vbfo reference signal at J1.</td><td>NLT 70 dB below 451-kHz reference.</td><td>Check bypass and feedthrough capacitors and circuits associated with J1 output or return to factory for repair.</td></tr>
<tr><td></td><td>l. Apply +5 V dc to TP4, rf xmt (receiver only). Set KEY switch to LOCK (receiver-exciter only).</td><td></td><td></td></tr>
<tr><td></td><td>m. Measure level of 451 kHz if signal at J1.</td><td>NLT 70 dB below reference in step 3.j.</td><td>Check U29A and associated circuits.</td></tr>
<tr><td></td><td>n. Note level of 450 kHz if signal at J1.</td><td>Reference</td><td></td></tr>
<tr><td></td><td>o. Remove +5 V dc from TP4 (receiver only). Set KEY switch to NORM (receiver-exciter only).</td><td></td><td></td></tr>
<tr><td></td><td>p. Measure level of 450-kHz if signal at J1.</td><td>NLT 70 dB below reference in step 3.n.</td><td>Check U29D and associated circuits.</td></tr>
<tr><td></td><td>q. Set vbfo offset frequency for 9990 Hz.</td><td></td><td></td></tr>
<tr><td></td><td>r. Using a distortion analyzer, measure total harmonic distortion at J1.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>s. Set vbfo offset frequency for 0000 Hz.</td><td></td><td></td></tr>
</table>

Table 1. VBFO, Testing, and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	t. Measure total harmonic distortion at J1.	NMT 3%	Same as step 3.k.
	u. Apply +5 V dc to TP4, rf xmt (receiver only). Set KEY switch to LOCK (receiver-exciter only).		
	v. Measure total harmonic distortion at J1.	NMT 3%	Same as step 3.k.
	w. Remove +5 V dc from TP4 (receiver only). Set KEY switch to NORM (receiver-exciter only).		
4. Frequency accuracy	a. Front-panel controls set as follows: PWR to on. CONT to LCL. Mode to CW. BANDWIDTH to 16 (receiver only). KEY to NORM (receiver-exciter only). Vbfo enabled. AGC to OFF. RF GAIN to full cw.		
	b. Connect a frequency counter to J1.		
	c. Measure the frequency outputs listed below. Check both positive and negative offset.	±5 Hz of listed output.	Check phase-lock loop.
	d. At each frequency measure vbfo synthesizer fault output using a dvm connected at TP2.	NMT 0.5 V dc.	Check U40C and associated circuit.
(Cont)			

OFFSET (Hz)	OUTPUT FREQUENCY	
	POSITIVE OFFSET (kHz)	NEGATIVE OFFSET (kHz)
9990	459.99	440.01
9980	459.98	440.02
9970	459.97	440.03
9960	459.96	440.04
9950	459.95	440.05
9940	459.94	440.06
9930	459.93	440.07
9920	459.92	440.08
9910	459.91	440.09

Table 1. VBFO, Testing, and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>4. (Cont)</td><td colspan="3">
<table>
<tr><th rowspan="2">OFFSET (Hz)</th><th colspan="2">OUTPUT FREQUENCY</th></tr>
<tr><th>POSITIVE OFFSET (kHz)</th><th>NEGATIVE OFFSET (kHz)</th></tr>
<tr><td>9900</td><td>459.90</td><td>440.10</td></tr>
<tr><td>9800</td><td>459.80</td><td>440.20</td></tr>
<tr><td>9700</td><td>459.70</td><td>440.30</td></tr>
<tr><td>9600</td><td>459.60</td><td>440.40</td></tr>
<tr><td>9500</td><td>459.50</td><td>440.50</td></tr>
<tr><td>9400</td><td>459.40</td><td>440.60</td></tr>
<tr><td>9300</td><td>459.30</td><td>440.70</td></tr>
<tr><td>9200</td><td>459.20</td><td>440.80</td></tr>
<tr><td>9100</td><td>459.10</td><td>440.90</td></tr>
<tr><td>9000</td><td>459.00</td><td>441.00</td></tr>
<tr><td>8000</td><td>458.00</td><td>442.00</td></tr>
<tr><td>7000</td><td>457.00</td><td>443.00</td></tr>
<tr><td>6000</td><td>456.00</td><td>444.00</td></tr>
<tr><td>5000</td><td>455.00</td><td>445.00</td></tr>
<tr><td>4000</td><td>454.00</td><td>446.00</td></tr>
<tr><td>3000</td><td>453.00</td><td>447.00</td></tr>
<tr><td>2000</td><td>452.00</td><td>448.00</td></tr>
<tr><td>1000</td><td>451.00</td><td>449.00</td></tr>
<tr><td>0000</td><td>450.00</td><td>450.00</td></tr>
</table>
</td></tr>
<tr><td>5. Vbfo synthesizer fault</td><td>a. Front-panel controls set as follows:
PWR to ON.
CONT to LCL.
Mode to CW.
BANDWIDTH to 16 (receiver only).
KEY to NORM (receiver-exciter only).
Vbfo enabled.
AGC to OFF.
RF GAIN to full cw.</td><td></td><td></td></tr>
<tr><td></td><td>b. Using the thumbwheel switches, set vbfo offset frequency for 00 Hz.</td><td></td><td></td></tr>
<tr><td></td><td>c. Measure output at P1-34*(vbfo synthesizer fault).</td><td>NMT 0.5 V dc.</td><td>Check U20 and associated circuit.</td></tr>
<tr><td></td><td>d. Disconnect 450-kHz reference at J2.</td><td></td><td></td></tr>
<tr><td></td><td>e. Measure output at P1-34.*</td><td>NLT +3.0 V dc.</td><td>Same as step 7.c.</td></tr>
<tr><td></td><td>f. Reconnect 450-kHz reference at J2.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>g. Measure output at P1-34.*
* T.P. 2.</td><td>NMT 0.5 V dc.</td><td>Same as step 7.c.</td></tr>
</table>

Table 1. VBFO, Testing, and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	h. Repeat steps 7.c thru 7.g with vbfo offset Hz at each of the following settings: +7770 +3330 -3330 -7770	Same as steps 7.c. thru 7.g.	Same as step 7.c.
6. Test complete	a. Set PWR switch off. b. Disconnect external power from rear panel. c. Remove vbfo from extender and extender from unit. d. Reinstall vbfo in unit. e. Reinstall unit top cover.		

4. ALIGNMENT/ADJUSTMENT

4.1 Voltage Adjustment

a. Perform table 1, test 1 and test 2.
b. Connect a dvm between bottom end of R28 and ground TP1.
c. Set front-panel controls as follows:

PWR to on.
CONT to LCL.
Mode to CW.
BANDWIDTH to 16 (receiver only).
KEY to NORM (receiver-exciter only).
Vbfo enabled.
AGC to OFF.
RF GAIN to full cw.

d. Adjust R7 for 12.0 ±0.1 V dc at R28.
e. Remove dvm.

4.2 Oscillator Adjustments

Note

To perform these adjustments, the oscillator can shield must be removed. Do not make these adjustments unless a repair has been made and necessary adjustment is indicated.

4.2.1 Oscillator Adjustment

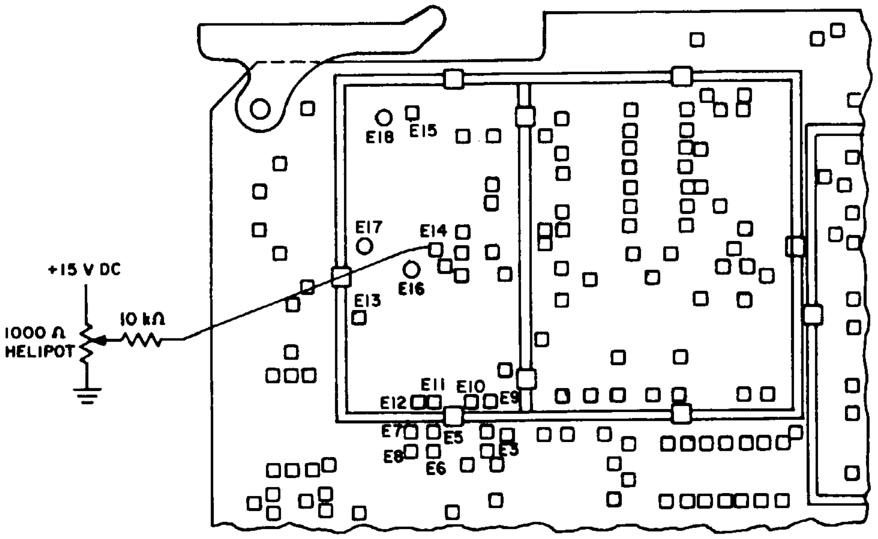
a. Perform table 1, test 1 and test 2.
b. Adjust R30 and R37 to maximum cw position.
c. Connect a helipot to C29, as shown in figure 3.
d. Connect a dvm to C29 (where helipot is connected).
e. Apply a ground at bottom end of R13.
f. Connect a frequency counter at J1.
g. Set front-panel controls as follows:

PWR to on.
CONT to LCL.
Mode to CW.
BANDWIDTH to 16 (receiver only).
KEY to NORM (receiver-exciter only).
Vbfo enabled.
AGC to OFF.
RF GAIN to full cw.

h. Adjust the helipot for 5.5 ±0.1 V dc at C29.
i. Adjust L9 for a frequency of 450.0 ±0.33 kHz at J1. Tuning slug should be toward the top of L9.

4.2.2 Frequency Range

a. Adjust the helipot for 3.5 ±0.1 V dc at C29. Frequency should be 460.000-kHz minimum.
b. Adjust the helipot for 7.3 ±0.1 V dc at C29. Frequency should be 440.000-kHz maximum.



TPA-1361-011

Setup for Oscillator Adjustments
Figure 3

Note

If step a or b is out of range, readjustment of L9 in the direction of the range error could correct the problem. If both steps a and b are out of range, repair is indicated.

c. Remove helipot, dvm, and frequency counter.
d. Remove R13 ground.

4.3 Output Level

a. Perform table 1, test 1 and test 2.
b. Connect an rf voltmeter through a 50-ohm load to J1.
c. Set front panel-controls as follows:

PWR to on.
CONT to LCL.
Mode to CW
BANDWIDTH to 16 (receiver only).
KEY to NORM (receiver-exciter only).
Vbfo enabled.
AGC to OFF.
RF GAIN to full cw.

d. Adjust R30 for 300 ±10 mV rms at J1.
e. Apply +5 V dc at TP4 (yellow).
f. Adjust R37 for 300 ±10 mV rms at J1.
g. Remove +5 V dc from TP4.
h. Remove rf voltmeter.

5. REPAIR

Repair of the vbfo is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

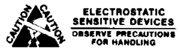
6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identifed in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 4). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

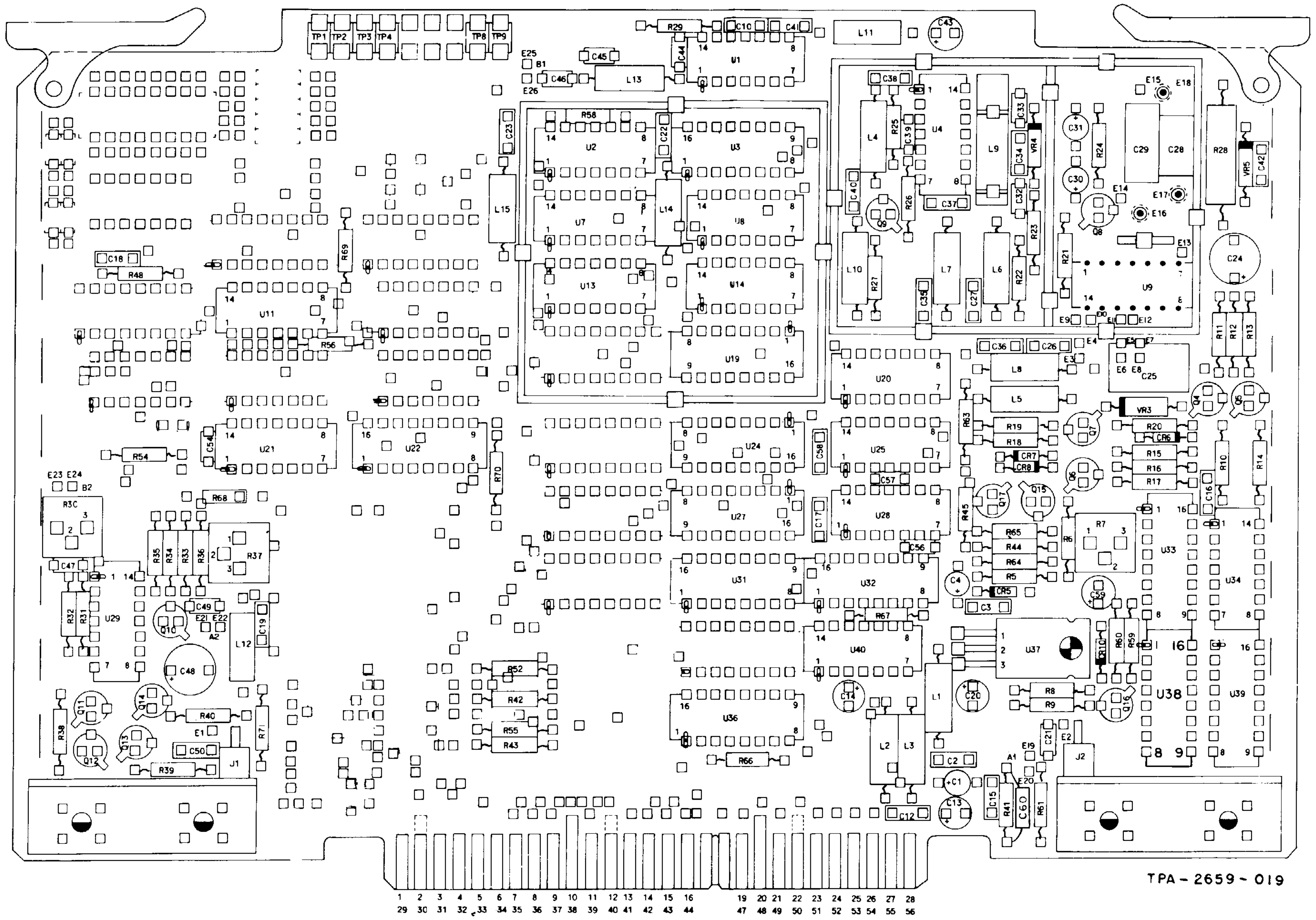
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
01121	ALLEN-BRADLEY CO 1201 SOUTH 2ND ST MILWAUKEE WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04099	CAPCO INC FORESIGHT INDUSTRIAL PARK P O BOX 2164 GRAND JUNCTION CO 81501
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
96341	MICROWAVE ASSOCIATES INC NORTHWEST INDUSTRIAL PARK SOUTH AVE BURLINGTON MA 01803
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
VBFO	638-6067-002	REV D



VBFO, Schematic Diagram
Figure 4 (Sheet 1 of 4)

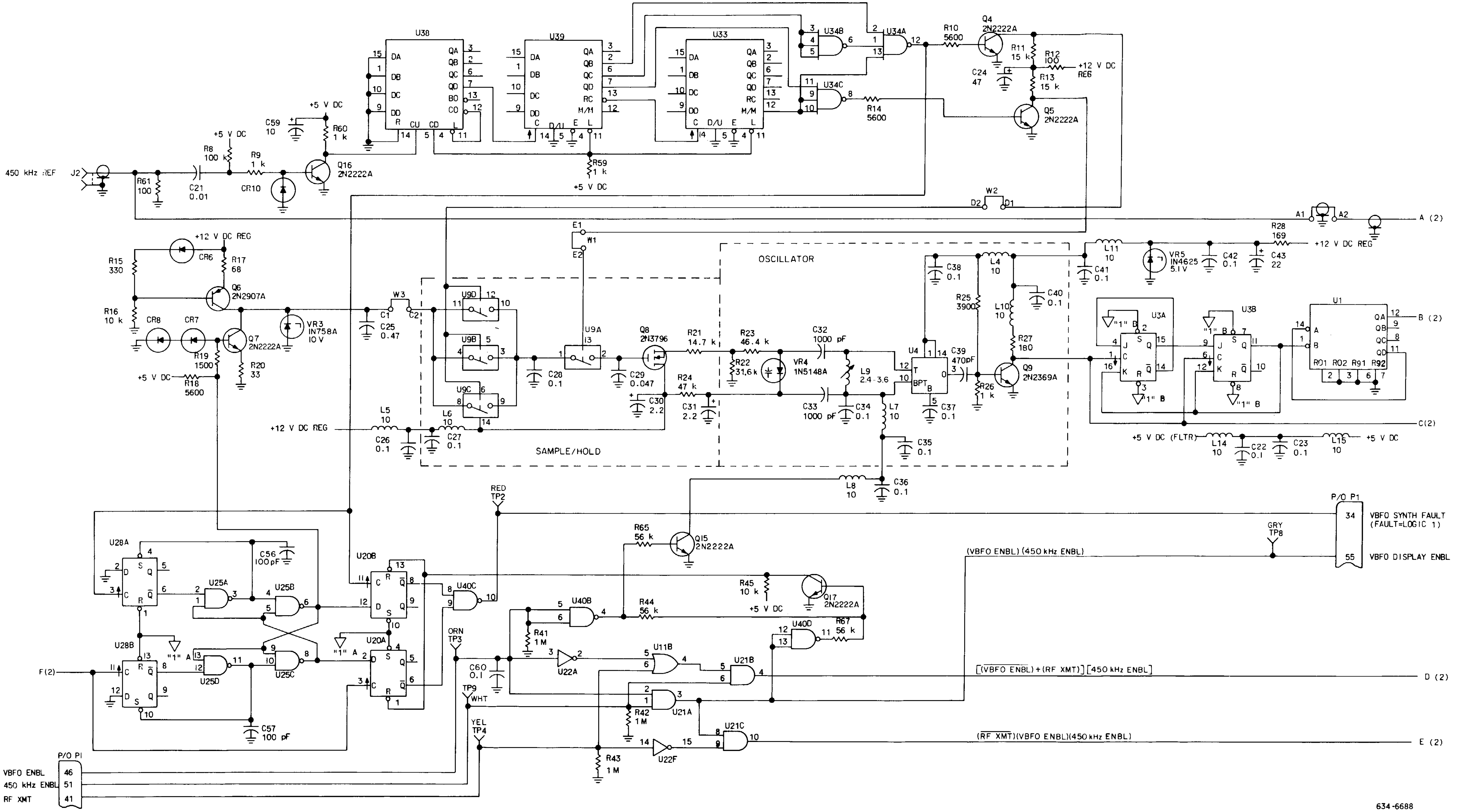
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	VBFO (ESDS)	638-6067-002			
CR1-CR4	NOT USED				
CR5-CR8	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR9	NOT USED				
CR10	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C2,C3	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C4	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C5-C9	NOT USED				
C10	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C11	NOT USED				
C12	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C13	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C14	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1
C15-C19	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C20	CAPACITOR,FXD TNTLM ELCTLT, 15UF, 20%, 20V	184-9102-180		56289	199D156X0020DB1
C21	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C22,C23	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C24	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C25	CAPACITOR,FXD PLSTC DIEL, 0.47UF, 5%, 50V	933-1084-210		56289	LP88A1A474J
C26,C27	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C28	CAPACITOR,FXD PLSTC DIEL, 0.1UF, 10%, 50V	933-1081-080		04099	CRC1-080
C29	CAPACITOR,FXD PLSTC DIEL, 0.047UF, 10%, 50V	933-1043-500		04099	CRC5-500
C30,C31	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C32,C33	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C34-C38	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C39	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C40-C42	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C43	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1
C44	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C45,C46	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C47	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C48	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C49	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C50	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C51-C53	NOT USED				
C54	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C55	NOT USED				
C56,C57	CAPACITOR,FXD CER DIEL, 100PF, 10%, 200V	913-4006-000		81349	CK05BX101K
C58	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C59	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C60	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
J1,J2	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
L1	COIL,RF 33UH	240-2715-310		96906	MS75089-5
L2,L3	COIL,RF 1UH	240-2715-130		96906	MS75088-1
L4-L8	COIL,RF 10UH	240-2715-250		96906	MS75088-13
L9	COIL,RF,VAR 2.4 TO 3.6UH	240-2739-010			240-2739-010
L10,L11	COIL,RF 10UH	240-2715-250		96906	MS75088-13
L12	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L13	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L14,L15	COIL,RF 10UH	240-2715-250		96906	MS75088-13
Q1-Q3	NOT USED				
Q4,Q5	TRANSISTOR	352-0661-020		07263	2N2222A
Q6	TRANSISTOR	352-0551-010		15818	2N2907A
Q7	TRANSISTOR	352-0661-020		07263	2N2222A
Q8	TRANSISTOR (ESDS)	352-1018-010		04713	2N3796
Q9	TRANSISTOR	352-0596-030		14433	2N2369A
Q10-Q17	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	NOT USED				
R5	RESISTOR,FXD FILM, 226 OHMS, 1%, 1/8W	705-0965-000		81349	RN55D2260F
R6	RESISTOR,FXD FILM, 1.91K, 1%, 1/8W	705-3605-130		81349	RN55D1911F
R7	RESISTOR,VAR 200 OHMS, 20%, 1/2W	382-0038-020		91637	101T200R0
R8	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R9	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R10	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R11	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R12	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R13	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R14	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R15	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R16	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R17	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R18	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R19	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R20	RESISTOR,FXD CMPSN, 33 OHMS, 10%, 1/4W	745-0695-000		81349	RCR07G330KS
R21	RESISTOR,FXD FILM, 14.7K, 1%, 1/8W	705-1052-000		81349	RN55D1472F
R22	RESISTOR,FXD FILM, 31.6K, 1%, 1/8W	705-1068-000		81349	RN55D3162F
R23	RESISTOR,FXD FILM, 46.4K, 1%, 1/8W	705-1076-000		81349	RN55D4642F
R24	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R25	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R26	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R27	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R28	RESISTOR,FXD FILM, 169 OHMS, 1%, 1/2W	705-7059-000		81349	RN65D1690F
R29	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R30	RESISTOR,VAR 1K, 20%, 1/2W	382-0038-040		91637	101T10000
R31	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R32	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R33	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R34	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R35	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS

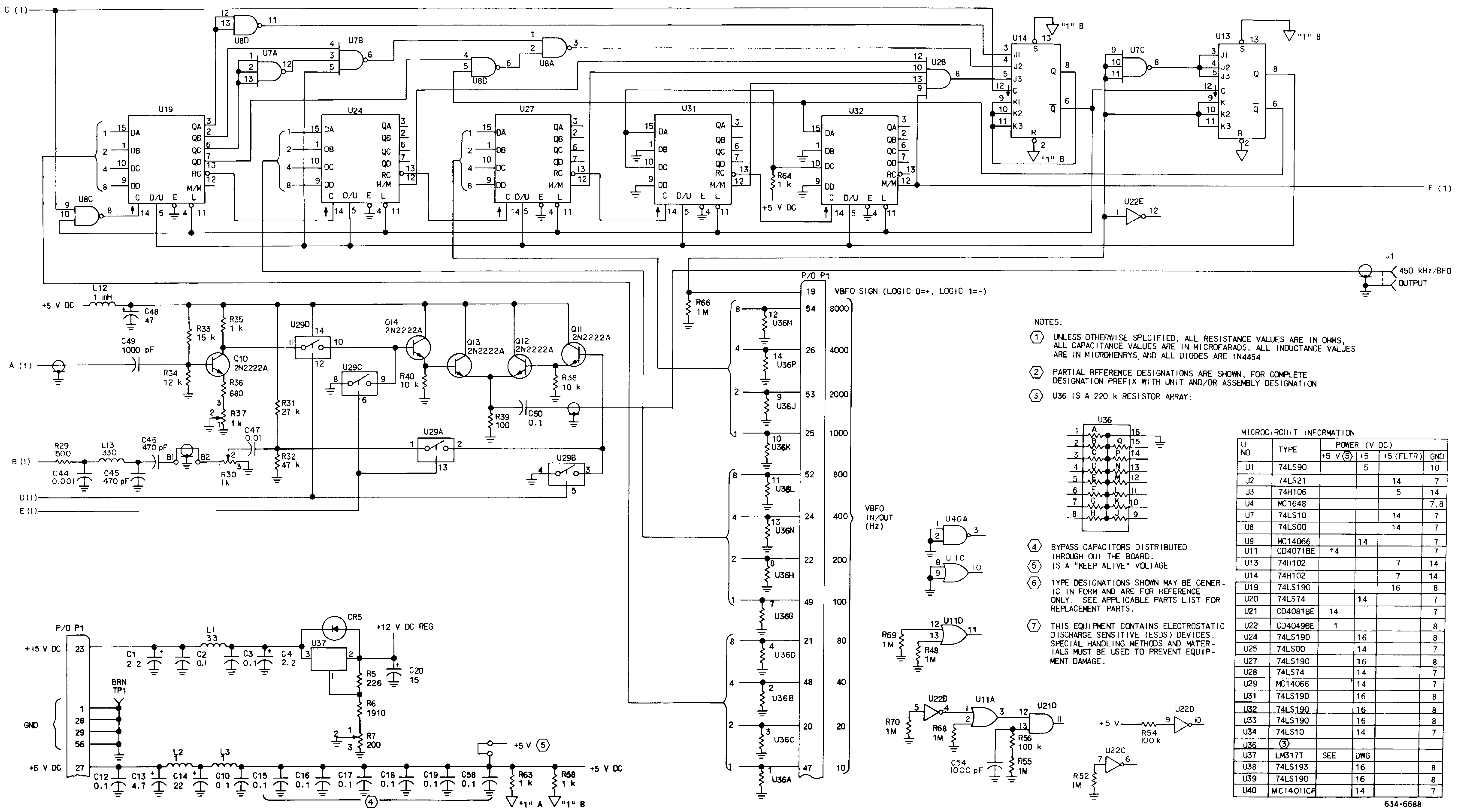
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R36	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R37	RESISTOR,VAR 1K, 20%, 1/2W	382-0038-040		91637	101T10000
R38	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R39	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R40	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R41-R43	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R44	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R45	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R46,R47	NOT USED				
R48	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R49-R51	NOT USED				
R52	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R53	NOT USED				
R54	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R55	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R56	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R57	NOT USED				
R58-R60	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R61	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R62	NOT USED				
R63,R64	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R65	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R66	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R67	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R68-R70	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5-TP7	NOT USED				
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-011
TP9	JACK,TIP WHT	360-0484-010		74970	105-1101-011
U1	INTEGRATED CKT	351-1636-010		01295	SN74LS90N
U2	INTEGRATED CKT	351-1785-010		01295	SN74LS21N
U3	INTEGRATED CKT	351-7766-010		07263	74H106PC
U4	INTEGRATED CKT	351-7768-010		04713	MC1648P
U5,U6	NOT USED				
U7	INTEGRATED CKT	351-1523-230		27014	DM74LS10N
U8	INTEGRATED CKT	351-1523-110		18324	N74LS00N
U9	INTEGRATED CKT (ESDS)	351-8252-010		02735	CD4066BE
U10	NOT USED				
U11	INTEGRATED CKT (ESDS)	351-8287-010		02735	CD4071BE
U12	NOT USED				
U13,U14	INTEGRATED CKT	351-7767-010		07263	74H102
U15-U18	NOT USED				
U19	INTEGRATED CKT	351-1948-010		01295	SN74LS190N
U20	INTEGRATED CKT	351-1525-040		04713	SN74LS74AN
U21	INTEGRATED CKT (ESDS)	351-8287-030		02735	CD4081BE
U22	INTEGRATED CKT (ESDS)	351-8159-210		07263	F4049BPC
U23	NOT USED				
U24	INTEGRATED CKT	351-1948-010		01295	SN74LS190N
U25	INTEGRATED CKT	351-1523-110		18324	N74LS00N
U26	NOT USED				
U27	INTEGRATED CKT	351-1948-010		01295	SN74LS190N
U28	INTEGRATED CKT	351-1525-040		04713	SN74LS74AN
U29	INTEGRATED CKT (ESDS)	351-8252-010		02735	CD4066BE
U30	NOT USED				
U31-U33	INTEGRATED CKT	351-1948-010		01295	SN74LS190N
U34	INTEGRATED CKT	351-1523-230		27014	DM74LS10N
U35	NOT USED				
U36	RESISTOR NETWORK 220K, 5%, 1.25W PKG	350-4030-010		01121	316A224
U37	INTEGRATED CKT	351-1271-010		27014	LM317T
U38	INTEGRATED CKT	351-1527-060		34335	SN74LS193N
U39	INTEGRATED CKT	351-1948-010		01295	SN74LS190N
U40	INTEGRATED CKT	351-8159-040		04713	MC14011UBCP
VR1,VR2	NOT USED				
VR3	SEMICOND DEVICE	353-2724-000		81483	1N758A
VR4	SEMICOND DEVICE	922-6095-200		96341	1N5148A
VR5	SEMICOND DEVICE	353-3591-490		04713	1N4625

VBFO, Schematic Diagram
Figure 4 (Sheet 2)



VBFO, Schematic Diagram
Figure 4 (Sheet 3)



NOTES:

① UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS AND ALL DIODES ARE 1N4454

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION

③ U36 IS A 220 k RESISTOR ARRAY:

④ BYPASS CAPACITORS DISTRIBUTED THROUGH OUT THE BOARD.

⑤ IS A "KEEP ALIVE" VOLTAGE

⑥ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

⑦ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

U NO	TYPE	POWER (V DC)			
		+5 V ⑤	+5	+5 (FLTR)	GND
U1	74LS90		5		10
U2	74LS21			14	7
U3	74H106			5	14
U4	MC1648				7,8
U7	74LS10			14	7
U8	74LS00			14	7
U9	MC14066		14		7
U11	CD4071BE	14			7
U13	74H102			7	14
U14	74H102			7	14
U19	74LS190			16	8
U20	74LS74		14		7
U21	CD4081BE	14			7
U22	CD4049BE	1			8
U24	74LS190		16		8
U25	74LS00		14		7
U27	74LS190		16		8
U28	74LS74		14		7
U29	MC14066		14		7
U31	74LS190		16		8
U32	74LS190		16		8
U33	74LS190		16		8
U34	74LS10		14		7
U36	③				
U37	LM317T	SEE	DWG		
U38	74LS193		16		8
U39	74LS190		16		8
U40	MC14011CP		14		7

634-6688

VBFO, Schematic Diagram
Figure 4 (Sheet 4)

Channel B1/A2/B2 IF (638-6975-( ))

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0770708-001211
1 January 1981

1. DESCRIPTION

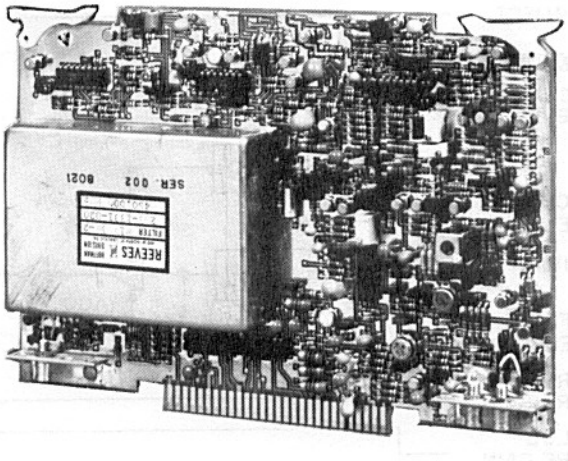
Channel B1/A2/B2 IF, 638-6975-( ), shown in figure 1, is a 2-layer planar card with a 56-pin, edge-on connector (2 layers, 28 pins each) and three subminiax rf connectors. The 56-pin connector (P4) is for all signals to or from the card except i.f. input (P1), i.f. output (P6), and 450-kHz injection (P5, for the SSB product detector).

The channel B1/A2/B2 i.f. card consists of i.f. amplifier, product detector, and AGC circuits. Differences between the circuit cards are in the i.f. sideband and AGC time constants. The filter passband is 2.85 kHz at the 1-dB points. Center frequencies are LSB, 448.325 kHz; LLSB, 445.385 kHz; and USSB, 454.615 kHz. (The USB filter is on circuit card 638-6871-001, -002.) AGC time constants for the applicable AGC switch position are:

FAST	10 ms attack, 15 - 30 ms decay
MED	10 ms attack, 70 - 150 ms decay
SLOW	10 ms attack, 1 - 2 s decay
VOICE	10 ms attack, 1 - 2 s decay
DATA	10 ms attack, 15 - 30 ms decay
FAX	1.5 ±0.5 s attack, 3 - 6 s decay

The card configuration differences are as follows:

a. 638-6975-001 LSB filter, VOICE-DATA-FAX time constants, and end-of-message signal AGC crowbar.



Channel B1/A2/B2 IF
Figure 1

b. 638-6975-002 UUSB filter and VOICE-DATA-FAX time constants.

c. 638-6975-003 LLSB filter and VOICE-DATA-FAX time constants.

d. 638-6975-004 LSB filter, FAST-MED-SLOW time constants, and end-of-message signal AGC crowbar.

e. 638-6975-005 UUSB filter and FAST-MED-SLOW time constants.
f. 638-6975-006 LLSB filter and FAST-MED-SLOW time constants.

2. PRINCIPLES OF OPERATION

2.1 General

The channel B1/A2/B2 i.f. card receives i.f., 450-kHz injection, and control signals and develops the following outputs:

a. 450-kHz receive i.f.
b. Product-detected channel SSB audio
c. AGC signals
d. Performance monitor signals
e. Front panel meter AGC and receive-signal-strength signals

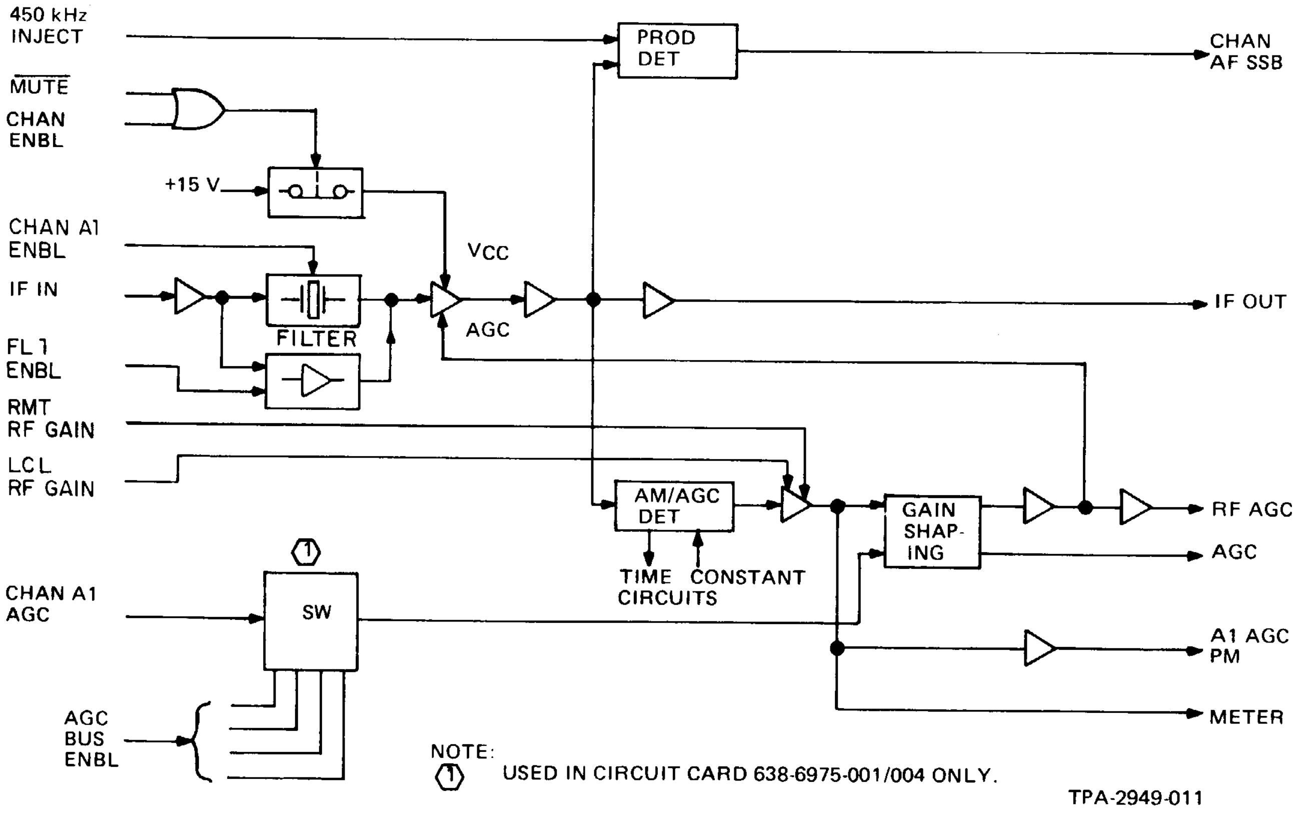
2.2 IF and AF Signals (Refer to figure 2.)

The 450-kHz i.f. signal is applied to gain-controlled amplifier stages through crystal filter FL1 if the CH A1 enable switch is ON or through amplifier Q10 if FL1 is enabled. The filter center frequency is different for each of the circuit card configurations and depends on the sideband of operation. The amplifier stages have switched collector voltages. Voltage presence is inhibited by the MUTE or enabled by the CHAN ENABLE input.

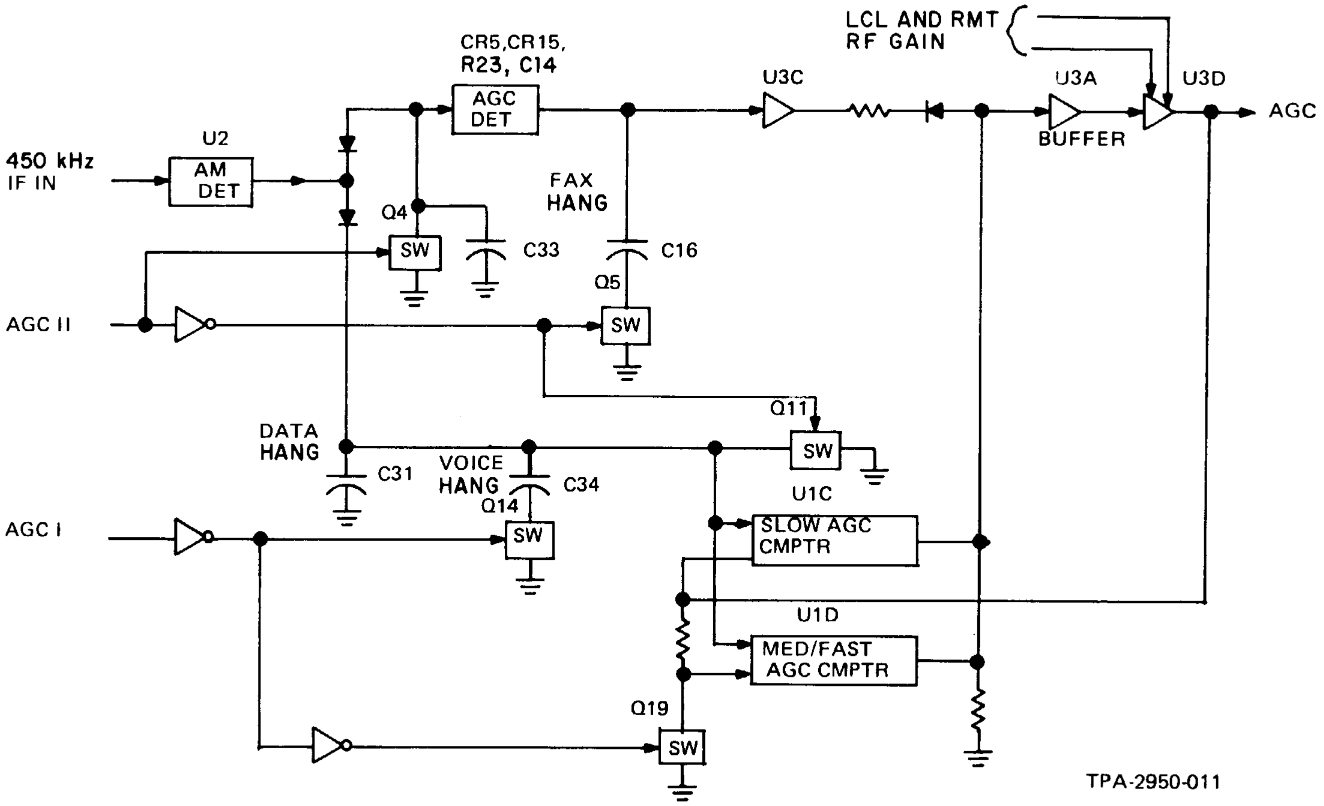
The amplified i.f. signal is applied to a product detector, AGC detector, and additional amplifiers. A 450-kHz injection signal is applied to the product detector for detecting the audio in the i.f. signal. This audio signal and the amplified i.f. signal are applied to other circuit cards as channel B1, A2, or B2 signals, depending on the i.f. filter used.

2.3 AGC Signals (Refer to figures 3 and 4.)

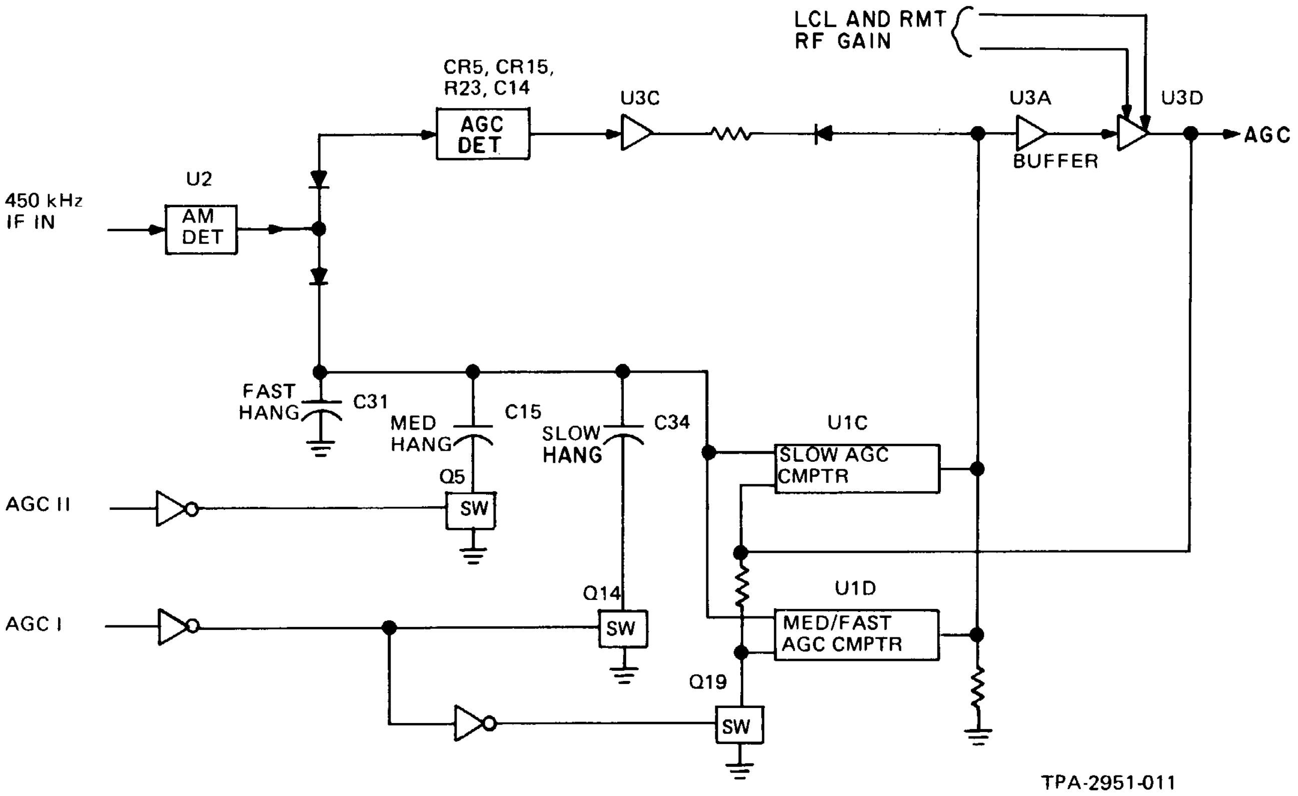
The i.f. signal is applied to an AM detector. The AM detector output is applied to an AGC detector and to the AGC circuits. AGC signals are developed through rc time constants selected by the receiver AGC switch. The AGC I and AGC II inputs to the AGC circuits control the time constant selection. Table 1 lists the logic levels associated with the receiver AGC switch positions.



IF and AGC Signal Paths
Figure 2



AGC Time Constant Circuit for 638-6975-001/002/003
Figure 3



AGC Time Constant Circuit for 638-6975-004/005/006
Figure 4

Table 1. AGC I and AGC II Logic Levels.

AGC		SWITCH POSITION	
I	II		
1	1	OFF	OFF
0	0	FAST	DATA
0	1	MED	FAX
1	0	SLOW	VOICE

The AGC I signal controls the slow or voice time constant. The AGC II signal controls the fast or data and medium or fax time constants. For the 638-6975-001 through -003 circuit cards, the AGC II signal grounds capacitors in the AGC detector circuit and grounds the AM detector output applied to the AGC comparator circuits. For the 638-6975-004 through -006 circuit cards, the AGC II signal grounds a capacitor in the AGC detector output. This enables the medium or fax time constant capacitor in the AGC hang circuit. The AGC I signal selects the appropriate AGC comparator and the slow or voice time constant capacitor in both circuit card configurations. (The differences are illustrated in figures 3 and 4.)

The selected (enabled) AGC comparator inputs are the AM detector output, modified by the selected hang time constant capacitor, and the AGC output from U3D. The comparator output, an AGC analog voltage, is applied through buffer amplifier U3A to amplifier U3D. This amplifier is gain-controlled by the local or remote rf gain signal. The amplifier output is used as a performance monitor and received-signal-strength signal and is also applied to a gain shaping circuit. The gain shaping amplifier keeps the AGC signal linear with respect to the received-signal strength. Output from this amplifier is fed back as the i.f. amplifier AGC, and output as the AGC signal to other circuit cards.

In the 638-6975-001 and -004 (LSB) circuit cards, a switching network applies the CH A1 AGC (USB) signal to the gain shaping amplifier. This occurs when the channel A1 and any other channel AGC bus is enabled. Since both the LSB and USB i.f. AGC signals are input to the amplifier, the higher level signal will control the amplifier output. Thus, the channel A1 (USB) i.f. AGC may control the channel B1 (LSB) i.f. AGC as well as other following circuits that use the AGC output from the 638-6975-001 or -004 circuit card.

2.4 AGC Crowbar (Refer to figures 5 and 13.)

The AGC crowbar circuits discharge the AGC capacitors when the i.f. signal level drops below about three volts or, in the 638-6975-001 and -004 (LSB) cards, when the END OF MSG signal (in NET DATA mode) is applied. This permits the i.f. amplifier to operate at maximum gain for weak receive signals.

When the i.f. signal drops below the reference voltage level at U1B, the comparator output goes positive to gate on Q7 to discharge AGC capacitors C21 and C80, Q5 to ground the AGC preamplifier input, and Q30 to ground inputs to the AGC comparators. This causes the AGC signal to go to zero, allowing maximum i.f. amplifier gain.

The 638-6975-001 and -004 cards have an additional crowbar trigger circuit. When the receiver is in the NET DATA mode, a logic 0 is applied to the junction of CR31, CR32, and the inverting input of U6B. (Refer to the schematic diagram figure 13.) The momentary END OF MSG pulse places a logic 1 at this junction. The resulting logic 0 outpulse is applied to AGC crowbar comparator U1B, inverting input. The positive output pulse from U1B momentarily gates on Q7, Q5, and Q30 to cause the AGC time constant capacitors to discharge. This permits the next net data message to be applied at full i.f. amplifier gain.

2.5 Differential Output Operational Amplifier 351-1050-030 (Refer to figure 6.)

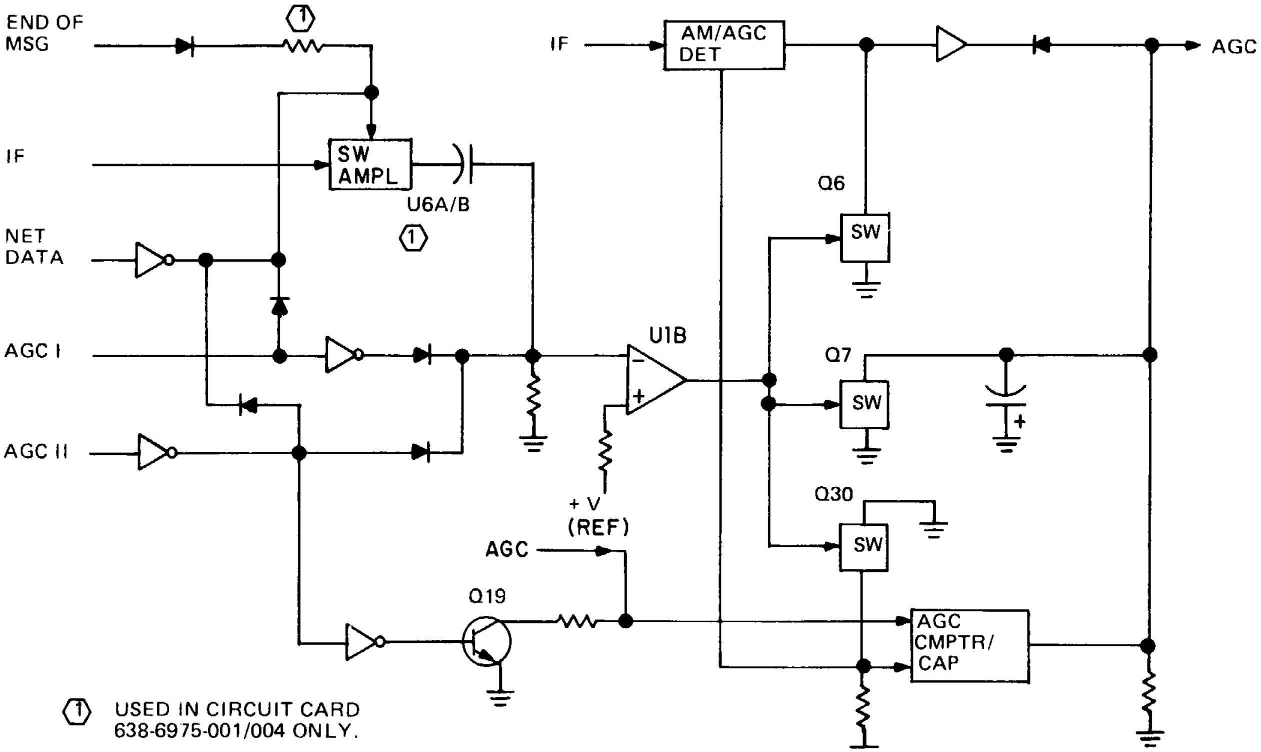
The 351-1050-030 is a wide-band general-purpose operational amplifier which features both differential inputs and outputs. Open loop gain is adjustable with external feedback components.

2.6 Quad Operational Amplifier 351-1141-030 (Refer to figure 7.)

The 351-1141-030 consists of four independent, high-gain, internally frequency-compensated operational amplifiers that are designed to operate from a single power supply over a wide range of voltages. Common applications include transducer amplifiers, dc gain blocks, and all conventional operational amplifier circuits.

2.7 Quad Operational Amplifier 351-1370-020 (Refer to figure 8.)

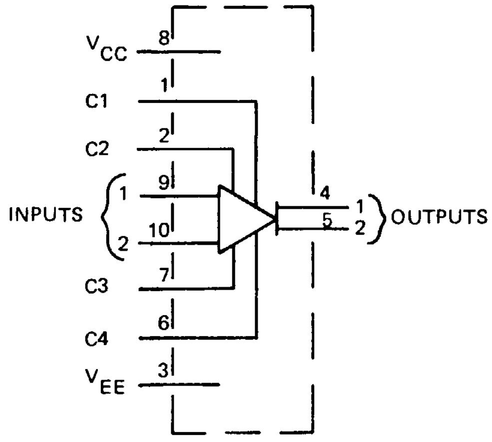
The 351-1370-020 consists of four independent, high-speed operational amplifiers with internally-adjusted input offset voltage. The amplifiers have low noise and offset voltage drift. Common applications include high-speed integrators, sample-and-hold circuits, and d/a converters.



1 USED IN CIRCUIT CARD 638-6975-001/004 ONLY.

TPA-2952-011

AGC Crowbar Circuit
Figure 5



CHARACTERISTICS

SUPPLY VOLTAGE: V_{CC} +8 V DC MAX., V_{EE} −8 V DC MAX.

INPUT DIFF VOLTAGE: ± 8 V DC MAX.

INPUT COMMON MODE VOLTAGE: ± 3.0 V PEAK

INPUT RESISTANCE: 2.0 M OHM TYPICAL

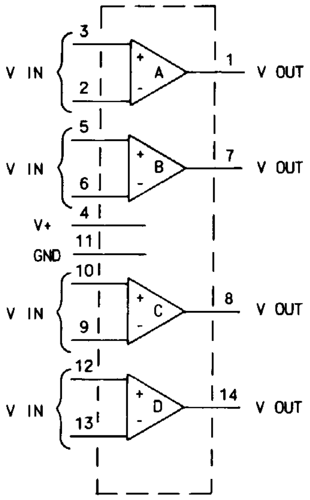
OUTPUT RESISTANCE: 50 OHM TYPICAL

OPEN LOOP GAIN: SINGLE ENDED– 750 V/V MIN, 1500 V/V TYPICAL; DIFFERENTIAL – 1500 V/V MIN,. 3000 V/V TYPICAL

BANDWIDTH: OPEN LOOP–2.0 MHz TYPICAL; CLOSED LOOP –10.0 MHz TYPICAL

TP5-2282-011

Differential Output Operational Amplifier 351-1050-030
Figure 6



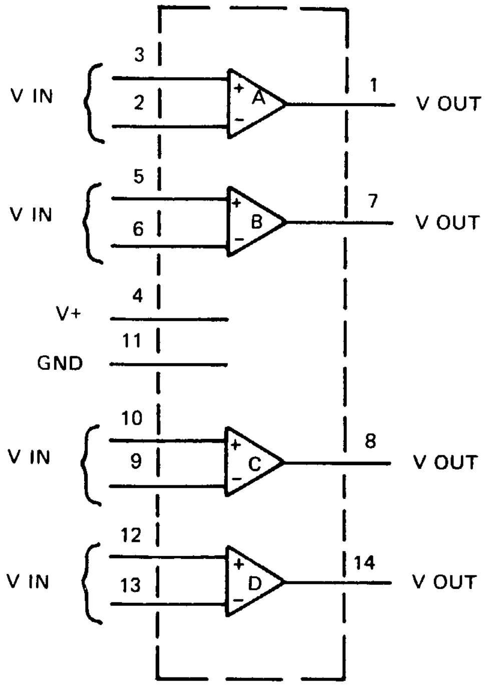
CHARACTERISTICS

SUPPLY VOLTAGE (V+): 32 V DC MAX
INPUT DIFF VOLTAGE: 32 V DC MAX
INPUT COMMON MODE VOLTAGE: V+ (-1.5 V DC)
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ①
VOLTAGE GAIN: 25 MIN

NOTE:
① SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2289-013

Quad Operational Amplifier 351-1140-030
Figure 7



CHARACTERISTICS

SUPPLY VOLTAGE (V+). 18 V DC MAX
INPUT DIFF VOLTAGE: 30 V DC MAX
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ①
VOLTAGE GAIN: 50 MIN

NOTE:

① POWER DISSIPATION OF 500 mV CANNOT BE EXCEEDED.

TPA-2899-011

Quad Operational Amplifier 351-1370-020
Figure 8

2.8 Balanced Modulator-Demodulator 351-0043-020 (Refer to figure 9.)

The 351-0043-020 is designed for use where the output voltage is a product of an input voltage (signal) and a switching function carrier. Typical applications include suppressed carrier and amplitude modulation, synchronous detection, FM detection, phase detection, and chopper applications.

2.9 Dual Comparator 351-1166-010 (Refer to figure 10.)

The 351-1166-010 consists of two independent comparators. Each is high speed, requires low input current, and has an open-collector output. The comparators are compatible with RTL, DTL, and TTL, and capable of handling up to 25 mA at the output.

2.10 Quad Voltage Level Shifter 351-8458-010 (Refer to figure 11.)

The 351-8458-010 consists of four voltage level-shifting circuits operating as low-to-high voltage level shifters. A low-voltage input at pin 3, 6, 10, or 14 will be output as a high voltage (equivalent to pin 16) at pin 4, 5, 11, or 13, respectively, when the appropriate enable input (pin 2, 7, 9, or 15) is at logic 1. A logic 0 on the enable input causes a high-impedance output regardless of the input voltage. If the voltage at pin 1 is greater than that at pin 16, the 351-8458-010 operates as a high-to-low-voltage level shifter.

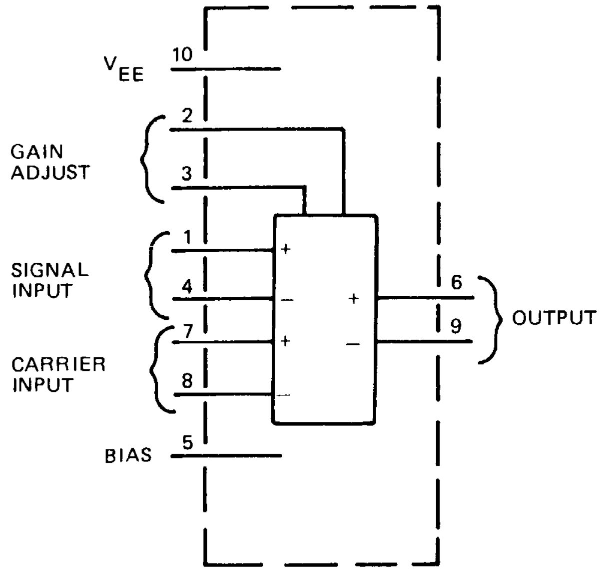
2.11 COS/MOS Quad Bilateral Switch 351-8252-010 (Refer to figure 12.)

The 351-8252-010 consists of four bilateral switches in one package. The 351-8252-010 bilateral switches exhibit a low closed-switch impedance (60 to 360 ohms, typical) and relative constant impedance (±5 ohms) over the full input signal range.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the channel B1/A2/B2 i.f. card are listed in the maintenance section of this instruction book.



CHARACTERISTICS

APPLIED VOLTAGE: 30 V DC MAX PIN–TO–IN.

DIFFERENTIAL INPUT VOLTAGE: ±5 V DC MAX

CARRIER SUPPRESSION: 65 dB TYPICAL AT 0.5 MHz; 50 dB TYPICAL AT 10 MHz.

TRANSADMITTANCE BANDWIDTH:
CARRIER INPUT–300 MHz TYPICAL;
SIGNAL INPUT–80 MHz TYPICAL

SINGLE-ENDED INPUT RESISTANCE (SIGNAL INPUT): 200 k OHM TYPICAL (AT 5.0 MHz)

SINGLE-ENDED INPUT RESISTANCE (SIGNAL INPUT): 40 k OHM TYPICAL (AT 10 MHz)

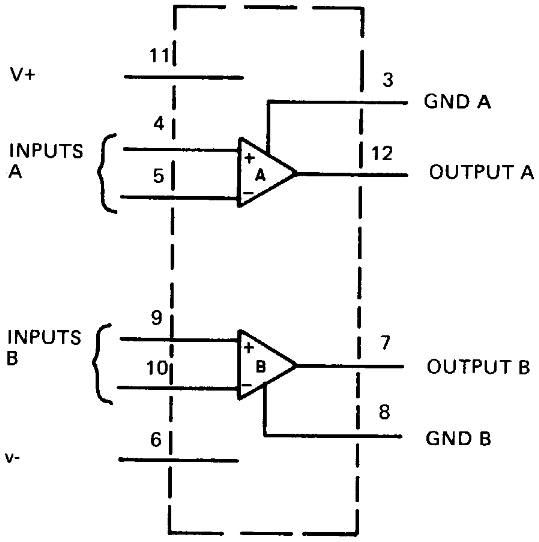
DIFFERENTIAL OUTPUT VOLTAGE SWING: 8.0 V P–P TYPICAL

TP5-2291-011

Balanced Modulator-Demodulator 351-0043-020
Figure 9

3.2 Testing

Test procedures in table 2 check total performance of the channel B1/A2/B2 i.f. card. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

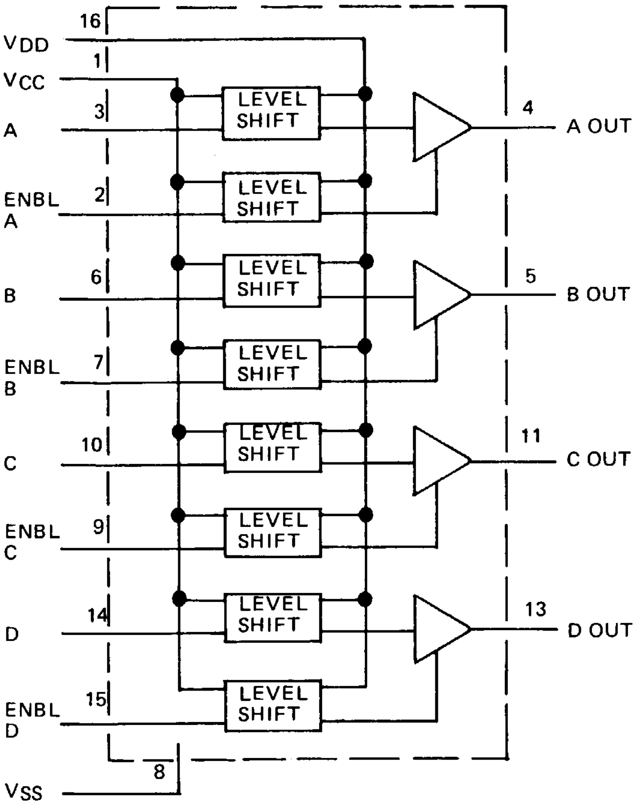


CHARACTERISTICS

SUPPLY VOLTAGE: V+ +18 V MAX;
V- -25 V MAX; 36 V MAX TOTAL
POWER DISSIPATION: 500 mW MAX
INPUT DIFF VOLTAGE: ±5 V MAX
OUTPUT SHORT CIRCUIT DURATION:
10 SECONDS MAX
VOLTAGE GAIN: 10 MIN.

TPA-2900-011

Dual Comparator 351-1166-010
Figure 10



CHARACTERISTICS:

SUPPLY VOLTAGE (V_{CC}, VDD REFERENCED TO V_{SS}): +20 V MAX
INPUT VOLTAGE (ALL INPUTS): +20 V MAX
INPUT CURRENT, ANY ONE INPUT: ±10 mA DC MAX
POWER DISSIPATION (TOTAL): 500 mW TO +60°C, 200 mW +60 TO +85°C; MAX

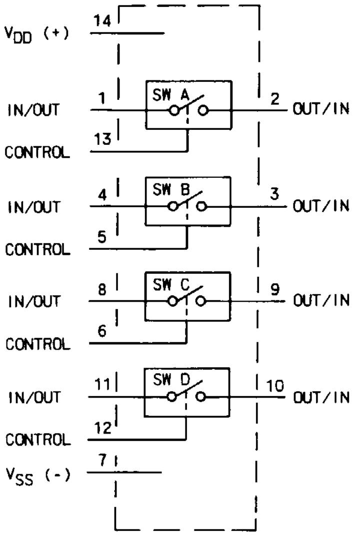
TRUTH TABLE (LOW-TO-HIGH LEVEL SHIFT)

INPUT		OUTPUT
A,B,C,D	ENBL A,B,C,D	A,B,C,D
0	1	0
1	1	1
X	0	HI Z

X=DON'T CARE
0=V_{SS} VOLTAGE
1=V_{CC} AT INPUTS; V_{DD} AT OUTPUTS

TPA-2898-011

Quad Voltage Level Shifter 351-8458-010
Figure 11



TYPICAL CHARACTERISTICS

V_{DD} TO V_{SS} VOLTS	CONTROL VOLTS	CLOSED-SWITCH IMPEDANCE		TYPICAL OPEN-SWITCH IMPEDANCE
		TYPICAL	MAX	
15	15	60-145Ω	220-320Ω	10 kΩ
10	10	89-190Ω	400-550Ω	10 kΩ
5	5	160-360Ω	3000-5500Ω	10 kΩ

NOTE: CONTROL VOLTAGE MUST EQUAL V_{DD} TO CLOSE SWITCH.
CONTROL VOLTAGE MUST EQUAL V_{SS} TO OPEN SWITCH.

TP5-2283-013

COS/MOD Quad Bilateral Switch 351-8252-010
Figure 12

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
	Note Front panel control settings (at the beginning of each test) are listed only for those controls where settings affect the test. Unlisted controls may be set in any position.		
1. Setup	a. Remove top cover of unit.		
	b. Remove channel B1/A2/B2 i.f. card, as applicable. Install it on extender card and place extender card in unit. Connect coax extender cables between card connectors P5 and P6 and unit. Connect coax extender cable between P1 and rf sig gen (through 6-dB attenuator).		
	c. Set unit LINE SELECTOR switch to 115 V. Ensure that fuse is 2 A.		
	d. Connect unit to 115-V ac power source and set PWR on.		
	e. Measure dc voltages on card between following pins and ground:		
	P1-23 P1-51 P1-6 P1-27	+15.0 ±1.0 V dc +15.0 ±1.0 V dc -15.0 ±1.0 V dc +5.0 ±0.5 V dc	Check associated power supply.
2. Channel enable	a. Set CH B1/A2/B2 switch, as applicable, to OFF.		
	b. Measure dc voltage between TP2 (red) and ground.	Not more than 0.5 V dc	Check U1A, Q1, and associated components.
	c. Set CH B1/A2/B2 switch, as applicable, to ON.		
	d. Measure dc voltage between TP2 (red) and ground.	Not less than +12 V dc	Check U1A, Q1, and associated components.
	e. On rear panel of unit, temporarily ground MUTE terminal (TB1-10).		
	f. Measure dc voltage between TP2 (red) and ground.	Not more than +0.5 V dc	Check U1A, Q1, and associated components.
	g. Remove ground from MUTE.		
3. I.f. sensitivity and gain (Cont)	a. Set all AGC switches OFF, MODE to ISB, and RF GAIN to max cw. Set CH B1/A2/B2, as applicable, ON and others OFF.		

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	b. Set sig gen output to 5 μV (as shown on sig gen meter) and frequency as shown for i.f. card being tested. **Note** If HP 8640B sig gen is used, apply -9.0 V to FM INPUT and set FM to DC. This permits the sig gen frequency to be tuned lower than the normal limit. 638-6975-001, -004 448.325 kHz 638-6975-002, -005 454.615 kHz 638-6975-003, -006 445.385 kHz		
	c. Connect distortion analyzer input to applicable channel AF OUT (between balanced-output terminals) on rear panel. Connect 600-ohm resistor between same two terminals.		
	d. Set reference level on distortion analyzer.		
	e. Set analyzer mode to distortion and measure sensitivity of i.f. amplifier.	Not less than 10 dB	Proceed to step j.
	f. Connect rf voltmeter through 50-ohm adapter to applicable channel IF connector on rear panel.		
	g. Set sig gen output level to 90 μV (as shown on sig gen meter) and frequency to near center of filter passband (listed in step b).		
	h. Set applicable channel AGC to FAST or DATA.		
	i. Measure i.f. output level.	22 ±5 mV	Proceed to step m.
	I.F. SENSITIVITY AND GAIN TESTING COMPLETE		
	TROUBLESHOOTING		
	j. Connect rf voltmeter through 50-ohm adapter to applicable channel IF connector on rear panel.		
	k. Set sig gen output level to obtain approx 25-mV output at IF connector.		
	l. Adjust L7 for peak output at IF connector.	Max output level	If signal not adjustable or not present, signal trace to find malfunctioning stage.
(Cont)			

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td>m. Set sig gen output level to 28 μV. Record V dc at P4-21.</td><td></td><td></td></tr>
<tr><td></td><td>n. Reduce sig gen output to 9 μV. Monitor dc V at P4-21 (AGC) while adjusting R99 to obtain 0.85 V dc.</td><td></td><td>If R99 does not control voltage, check Q22/Q23, Q24, Q25/Q26, and associated circuits.</td></tr>
<tr><td></td><td>o. Increase sig gen output to 28 mV.</td><td></td><td></td></tr>
<tr><td></td><td>p. Adjust R55 to obtain +5.0 V dc at P4-21.</td><td></td><td>If R55 does not allow voltage to be properly adjusted, perform AGC tests, then repeat test 3.</td></tr>
<tr><td>4. I.f. selectivity</td><td>a. Refer to test 3 and perform equipment setup given in steps a through g.</td><td></td><td></td></tr>
<tr><td></td><td>b. Set distortion analyzer to audio voltmeter mode.</td><td></td><td></td></tr>
<tr><td></td><td>c. Set sig gen output level for 10-mV audio output and frequency to applicable center frequency of circuit card being tested.
638-6975-001, -004 448.325 kHz
638-6975-002, -005 454.615 kHz
638-6975-003, -006 445.385 kHz</td><td></td><td></td></tr>
<tr><td></td><td>d. Adjust distortion analyzer for 0-dB reference level.</td><td></td><td></td></tr>
<tr><td></td><td>e. Adjust sig gen frequency above and below center frequency listed for applicable card until voltmeter indication is 1 dB below 0 dB. Note frequencies (in kHz).</td><td></td><td>Check filter FL1.</td></tr>
<tr><td>(Cont)</td><td colspan="2">
<table>
<tr><th>CARD PART NO ENDING</th><th>MAX LOW FREQ</th><th>MIN HIGH FREQ</th></tr>
<tr><td>-001
-004</td><td>446.90</td><td>449.75</td></tr>
<tr><td>-002
-005</td><td>453.19</td><td>456.04</td></tr>
<tr><td>-003
-006</td><td>443.96</td><td>446.81</td></tr>
</table>
</td><td></td></tr>
</table>

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>4. (Cont)</td><td>f. Set sig gen frequency to applicable center frequency of circuit card. Increase sig gen output level 60 dB greater than that set in step c.</td><td></td><td></td></tr>
<tr><td></td><td>g. Adjust distortion analyzer for 0-dB reference level.</td><td></td><td></td></tr>
<tr><td></td><td>h. Adjust sig gen frequency above and below center frequency listed for applicable card until voltmeter indication is 1 dB below 0 dB. Note frequencies (in kHz).
<table>
<tr><th>CARD PART NO ENDING</th><th>MIN LOW FREQ</th><th>MAX HIGH FREQ</th></tr>
<tr><td>-001</td><td rowspan="2">446.45</td><td rowspan="2">450.25</td></tr>
<tr><td>-004</td></tr>
<tr><td>-002</td><td rowspan="2">452.74</td><td rowspan="2">456.54</td></tr>
<tr><td>-005</td></tr>
<tr><td>-003</td><td rowspan="2">443.46</td><td rowspan="2">447.26</td></tr>
<tr><td>-006</td></tr>
</table></td><td></td><td>Check filter FL1.</td></tr>
<tr><td>5. Audio output</td><td>a. Connect channel A1 i.f. card J1 to sig gen through 6-dB attenuator.</td><td></td><td></td></tr>
<tr><td></td><td>b. Set sig gen frequency as shown for i.f. card being tested.
638-6975-001, -004 449 kHz
638-6975-002, -005 455 kHz
638-6975-003, -006 445 kHz</td><td></td><td></td></tr>
<tr><td></td><td>c. Set sig gen output to 90 μV.</td><td></td><td></td></tr>
<tr><td></td><td>d. Set applicable channel AGC to FAST or DATA and RF GAIN to max cw position.</td><td></td><td></td></tr>
<tr><td></td><td>e. Temporarily connect 600-ohm resistor and audio voltmeter between P4-34 and ground.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>f. Measure audio output at P4-34.</td><td>10 mV ac</td><td>Adjust R142 to obtain 10 mV.
If R142 does not control signal, check P5 for 450 kHz at 7 ±1 dB mW. Check Q27, Q28, U5, and associated components.</td></tr>
</table>

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	g. Disconnect setup from P4-34.		
6. AGC output voltage	a. Refer to test 3 and perform equipment setup given in steps a through e.		
	b. Set applicable channel AGC to FAST or DATA.		
	c. Set sig gen output level to 280 μV.		
	d. Measure voltage at P4-21.	+0.90 ±0.2 V dc	Adjust R99 as necessary. If R99 adjusted, perform test 3. If R99 does not adjust level, check U1, U2, U3, and associated components.
	e. Set sig gen output level to 28 mV.		
	f. Measure voltage at P4-21.	+5.0 ±0.1 V dc	Check U3A/C/D, Q9, Q10, and associated components.
	g. Measure voltage at P24-18.	+3.0 ±0.1 V dc (Voltage at P4-21 should be 5.0 V. Adjust RF GAIN to obtain +5 V if necessary.)	Adjust R57 as necessary. If R57 does not adjust level, check Q12/Q13 and associated components. If necessary, replace R56 with test select value of 820 Ω, 1000 Ω, 1200 Ω, 1500 Ω, or 1800 Ω.
7. AGC time constants	a. Disconnect sig gen and 6-dB attenuator from i.f. card. Connect sig gen and 6-dB attenuator to signal input of rf signal level switch. Connect switch output to P1 on i.f. card.		
	b. Connect 30 dB of attenuation to rf signal level switch attenuator connectors.		
	c. Connect scope trigger to rf signal level switch trigger output. Connect scope vertical input to applicable channel i.f. output connector on rear panel.		
	d. Apply dc voltage (+15 to +28 V) to rf signal level switch.		
(Cont)	e. Set sig gen output level to 2.7 mV.		

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

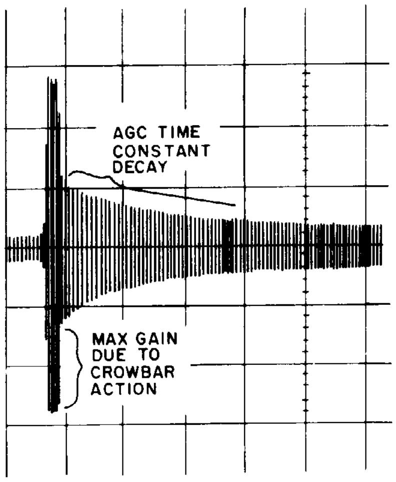
<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td rowspan="3">7. (Cont)</td><td rowspan="2">f. While observing scope, depress and release level switch and measure AGC attack and decay times.

SIGNAL RESPONSE INCLUDING CROWBAR ACTION
TPA-3068-011</td><td>As indicated for applicable card:</td><td>Proceed to step h.</td></tr>
<tr><td colspan="2">
<table>
<tr><td colspan="3">638-6975-001, -002, -003</td></tr>
<tr><td>AGC TC</td><td>*ATTACK</td><td>DECAY</td></tr>
<tr><td>DATA</td><td>10 ms max</td><td>15 to 30 ms</td></tr>
<tr><td>VOICE</td><td>10 ms max</td><td>1 to 2.2 s</td></tr>
<tr><td>FAX</td><td>2 s max</td><td>3 to 10 s</td></tr>
<tr><td colspan="3">638-6975-004, -005, -006</td></tr>
<tr><td>AGC TC</td><td>*ATTACK</td><td>DECAY</td></tr>
<tr><td>FAST</td><td>10 ms max</td><td>15 to 30 ms</td></tr>
<tr><td>SLOW</td><td>10 ms max</td><td>1 to 2.2 s</td></tr>
<tr><td>MED</td><td>10 ms max</td><td>70 to 150 ms</td></tr>
<tr><td colspan="3">*Measured when signal is within 3 dB of steady state level.</td></tr>
</table>
</td></tr>
<tr><td>g. Set unit AGC time constant switch to other positions, repeating step f for each position.
AGC TIME CONSTANTS TESTING COMPLETE</td><td></td><td></td></tr>
<tr><td></td><td>TROUBLESHOOTING
h. To adjust decay time, perform steps i through l. If rise time faulty, go to step m.
i. Set sig gen output level to 900 µV. Adjust rf signal level switch attenuator for 4 dB of attenuation.
j. Connect scope vertical input to U1-14.
k. Depress level switch and permit output to scope to stabilize.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>l. Observe scope and release level switch.</td><td>U1-14 just starts to switch positive toward end of sweep.</td><td>Adjust R74 as necessary. (When correctly adjusted, U1-14 will switch on 4-dB decrease but will not on 3-dB decrease.)</td></tr>
</table>

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

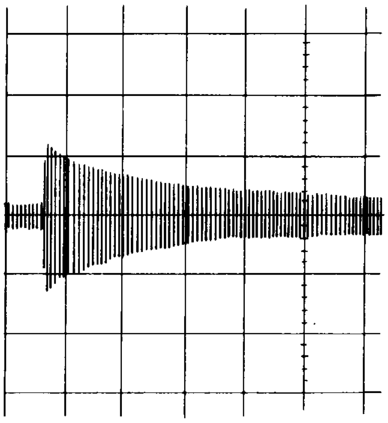
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	m. No adjustable components are included for rise time. For all rise times other than FAX, check C14 and associated components. For FAX rise time malfunctions, check C16.		If R74 does not correct decay time and decay is incorrect for SLOW/VOICE time constant, check U4C, Q14, Q19, U1D, and associated components. If decay is incorrect for FAST/DATA or MED/FAX time constants, check U4A, Q11, Q5, U1C, and associated components.
8. AGC crowbar; applicable to 638-6975-001 and -004 only (Cont)	a. Connect variable attenuator to rf signal level switch attenuator connectors. Set attenuation to 30 dB. b. Set sig gen output level to 28 mV and frequency to 9.449 MHz. c. Depress and release level switch and observe scope display for crowbar action.  SIGNAL RESPONSE WITHOUT CROWBAR ACTION TPA-3069-011		

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	d. Decrease attenuation, then repeat step c. Continue until crowbar action no longer occurs.		
	e. Note attenuation just before crowbar action ceases to occur.	20 ±3 dB	Check U1B, Q7, and associated components.
	f. Set MODE to NET DATA and AGC to FAST or DATA.		
	g. Observe scope while momentarily applying a +5-V logic 1 to P4-33, simulating an end-of-message signal.	I.f. output momentarily limits as circuit crowbars.	Check U6B, U1B, Q7, and associated components.
	h. Set MODE to position other than NET DATA.		
	i. Repeat step g.	I.f. output does not limit.	Check U6B and associated components.
	Note To check TADIL A crowbar operation, use the SA-1914/TSC-60(V) Radio Frequency Switching Unit.		
	j. Set MODE to NET DATA, AGC to FAST or DATA, and RF GAIN to max cw position.		
	k. Connect two sig gens to SA-1914 RF1 IN and RF2 IN. Set RF1 sig gen to 449 kHz and RF2 sig gen to 448 kHz.		
	l. Connect SA-1914 RF OUT directly to channel B1 i.f. card P1.		
	m. Connect SA-1914 TRIG OUT to scope trigger and scope vertical input to P4-34 (SSB AF output), or to channel B1 IF OUT jack on rear panel.		
	n. Set SA-1914 MODE SELECTOR to RF2 OFF.		
	o. Set RF1 sig gen output level to 28 mV and RF2 sig gen output level to 28 μV.		
(Cont)	p. Adjust scope so sweep is just below trigger threshold. (Sweep speed approx 0.5 s/div.)		

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

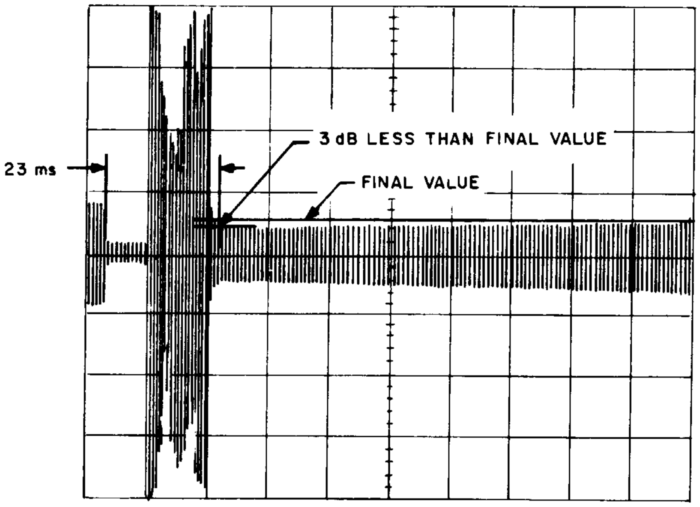
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	q. Set MODE SELECTOR to RF1 OFF and observe audio output on scope.	Audio output is within 3 dB of final level within 23 ms after sig gen rf out switched off.	
	r. Set both sig gen output levels to 10 mV.		
	 TADIL A CROWBAR ACTION TPA-3070-011		
	s. Repeat step q.		
	t. Disconnect test setup.	Same as step q.	
9. AGC bus switching; applicable to 638-6975-001 and -004 only	a. Connect sig gen rf output (through 6-dB attenuator) to P1 on card. Set sig gen frequency to 449 kHz and output level to 100 μV.		
	b. Set CH B1 enable to ON, CH B1 AGC to FAST, CH B1 AGC BUS to ON and all other AGC BUS switches to OFF. Set RF GAIN to max cw position.		
	c. Measure dc voltage at P4-21.	Not more than +1 V	Check for logic 0 at P4-7. If present, check U7 and U8.
	d. Turn on sig gen rf.		
	e. Record voltage at P4-22.		
(Cont)	f. Set CH A1 AGC BUS to ON.		

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	g. Measure dc voltage at P4-24.	Voltage near that recorded in step e	Check for logic 1 at P4-7. If present, check U7 and U8.
	h. Set CH B1 AGC BUS to OFF and CH A2 AGC BUS to ON.		
	i. Measure dc voltage at P4-20.	Voltage near that recorded in step e	Check for logic 1 at P4-9. If present, check U7 and U8.
	j. Set CH A2 AGC BUS to OFF and CH B2 AGC BUS to ON.		
	k. Measure dc voltage at P4-19.	Voltage near that recorded in step e	Check for logic 1 at P4-10. If present, check U7 and U8.
10. AGC off	a. Set sig gen output to 28 mV.		
	b. Connect scope to P4-34.		
	c. Observe scope display and switch CH B1 AGC to OFF.	Signal level increases due to no AGC action.	Check U4A, U4B, and associated components.
11. AGC performance monitor (applicable to all cards)	a. Turn off sig gen rf output.		
	b. Monitor dc voltage at TP1 (A1 AGC PM) and slowly decrease RF GAIN to point where voltage at TP1 goes to less than +1.0 V (logic 0).		
	c. Measure AGC signal voltage at P4-21.	Not more than +0.8 V dc	Check Q2 and associated components.
12. Rf gain and meter bus	a. Turn off sig gen rf.		
	b. Set AGC to OFF and RF GAIN to max ccw position.		
	c. Check for +4.0 ±0.5 V dc to P4-39. (Adjust RF GAIN, if necessary, to set voltage.)		
	d. Measure dc V at P4-21.	Not less than +8 V dc	Check U3D and associated components.
	e. Adjust RF GAIN to obtain +4.0 V at P4-21.		
(Cont)	f. Measure dc V at P4-12.	4 ±0.2 V dc	Check CR10.

Table 2. Channel B1/A2/B2 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	**Note** Steps g thru i can be performed only if HF-8094( ) Remote Control is connected to HF-8054( ).		
	g. Set HF-8054( ) CONT to REM.		
	h. Adjust HF-8094( ) RF GAIN to obtain -4.0 ±0.5 V dc at HF-8054( ) P4-11.		
	i. Measure dc V at HF-8054( ) P4-21.	+3.9 ±0.1 V dc	Check U3D and associated components.
	j. Tests completed. Turn off power. Disconnect all test equipment and reinstall circuit card in unit.		

4. ALIGNMENT/ADJUSTMENT

4.1 AGC Time Constant Decay (Adjustment of R74)

With no signal input to card, adjust R74 to produce +1.85 V at U1-10.

4.2. SSB Audio Output Level (Adjustment of R142)

a. Apply 448 kHz if testing 638-6975-001, -004; 455 kHz if testing 638-6975-002, -005; or 445 kHz if testing 638-6975-003, -006; 280-μV input to P1 of channel B1/A2/B2 i.f. card.
b. Set MODE to ISB; AGC to ON; CH A1 to ON; CH B1 to ON if testing 638-6975-001, -004, CH A2 to ON if testing 638-6975-002, -005, or CH B2 to ON if testing 638-6975-003, -006; and RF GAIN to max cw position.
c. Connect 600-ohm resistor and audio voltmeter between P4-34 and ground.
d. Adjust R142 to product 120 mV rms at P1-34.

4.3 I.f. Amplifier Alignment (Alignment of L7)

a. Set AGC to OFF; MODE to ISB; CH A1 to ON; CH B1 to ON if testing 638-6975-001, -004, CH A2 to ON if testing 638-6975-002, -005, or CH B2 to ON if testing 638-6975-003, -006; and RF GAIN to max cw position.
b. Apply input of 488 kHz if testing 638-6975-001, -004; 455 kHz if testing 638-6975-002, -005; or 445 kHz if testing 638-6975-003, -006 to P1 at level sufficient to produce approx 25 mV rf at P6.
c. Adjust L7 to obtain peak voltage at P6. (L7 has two adjustment peaks; either may be used.)

4.4 I.f. Amplifier and AGC Gain (Adjustment of R99 and R55)

a. Apply 448 kHz if testing 638-6975-001, -004, 455 kHz if testing 638-6975-002, -005, or 445 kHz if testing 638-6975-003, -006; 280-mV input to P1 of channel A1 i.f. card.
b. Set AGC to OFF; CH A1 to ON; CH B1 to ON if testing 638-6975-001, -004, CH A2 to ON if testing 638-6975-002, -005, or CH B2 to ON if testing 638-6975-003, -006; and MODE to ISB.
c. Adjust R99 to produce +850 mV at P4-21.
d. Increase sig gen output by 40 dB (to 28 mV).
e. Adjust R55 to obtain +5.0 V at P4-21.
f. Repeat steps a through e until no further adjustment is necessary.
g. Disconnect sig gen from P1 of channel A1 i.f. card.
h. Adjust RF GAIN to obtain +5.00 ±0.05 V at P4-21.
i. Adjust R57 to obtain +3.0 ±0.05 V at P4-18.

5. REPAIR

Repair of the control card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

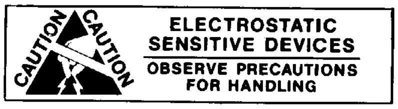
6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacture code and manufacturer's part number are listed for each reference designator.

6.2 Parts list

REF DES COLUMN—Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column—Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column—Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column—Part variations within a group of equipment are indicated by a letter code (A, B, C, etc.). Absence of a code indicates part applies to all models.

MFR CODE Column—Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column—Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

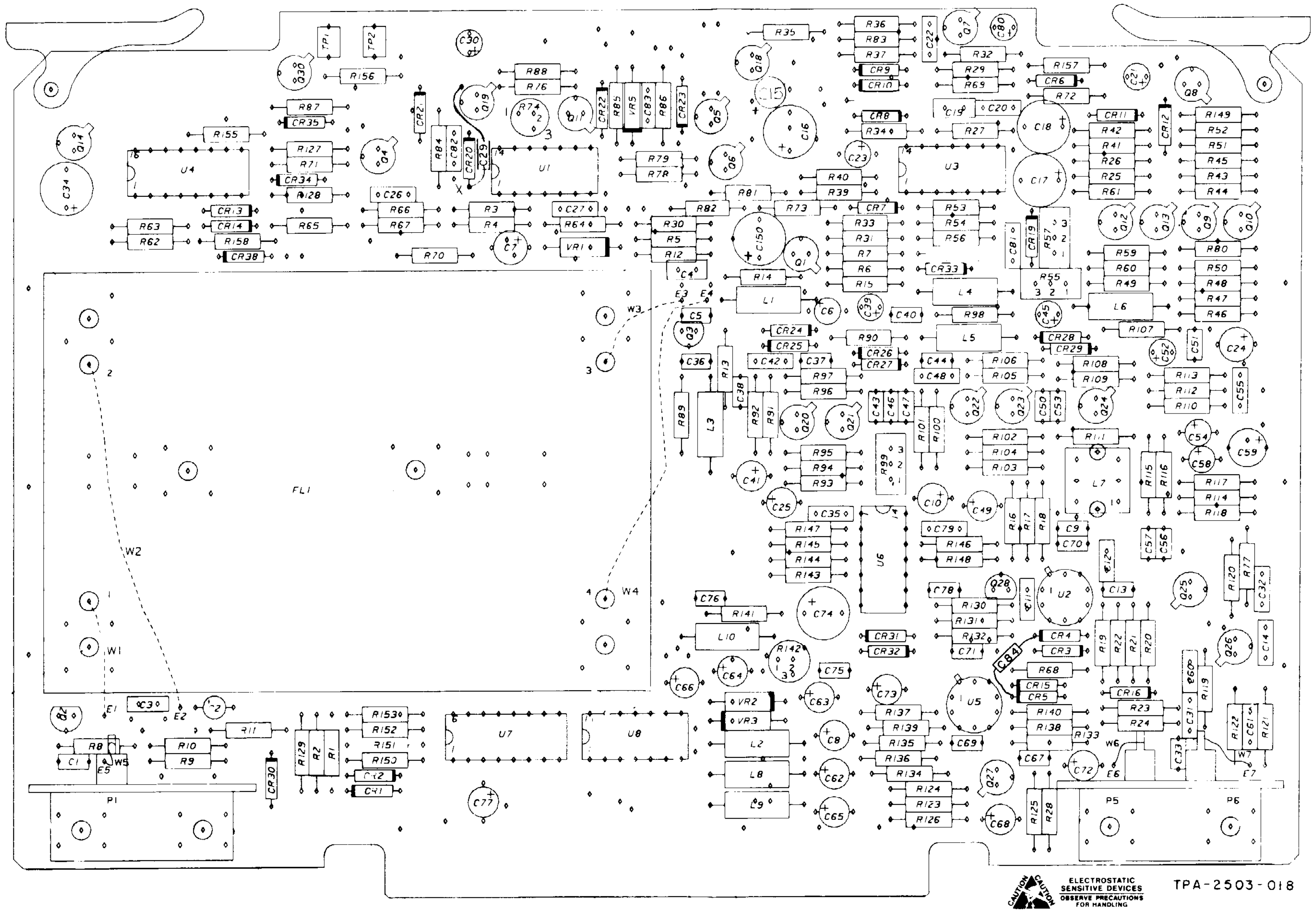
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
00872	TELEDYNE SYSTEMS CO MICROELECTRONICS DIV 12964 PANAMA ST LOS ANGELES CA 90066
02111	SPECTROL ELECTRONICS CORP SUB OF CARRIER CORP 17070 E GALE AVE CITY OF INDUSTRY CA 91745
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
09021	AIRCO ELECTRONICS FOSTER BROOK RD P O BOX 334 BRADFORD PA 16701
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Channel B1/A2/B2 IF	638-6975-001	REV E
Channel B1/A2/B2 IF	638-6975-002	REV E
Channel B1/A2/B2 IF	638-6975-003	REV E
Channel B1/A2/B2 IF	638-6975-004	REV E
Channel B1/A2/B2 IF	638-6975-005	REV E
Channel B1/A2/B2 IF	638-6975-006	REV E



Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 1 of 6)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CHANNEL B1 IF (ESDS)	638-6975-001	A		
	CHANNEL A2 IF (ESDS)	638-6975-002	B		
	CHANNEL B2 IF (ESDS)	638-6975-003	C		
	CHANNEL B1 IF (ESDS)	638-6975-004	D		
	CHANNEL A2 IF (ESDS)	638-6975-005	E		
	CHANNEL B2 IF (ESDS)	638-6975-006	F		
CR1-CR4	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR5,CR6	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR7-CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR15	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR16	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR17, CR18	NOT USED				
CR19	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR20-CR23	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR24	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR25, CR26	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR27	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR28	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR29	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR30-CR32	SEMICOND DEVICE	353-3644-010	A,D	03508	1N4454GE
CR33-CR35	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR36, CR37	NOT USED				
CR38	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C2	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C3	CAPACITOR,FXD MICA DIEL, 9PF, PORM 0.5PF, 300V	912-4141-530		72136	DM5C090D300WV
C4	CAPACITOR,FXD MICA DIEL, 20PF, PORM 0.5PF, 100V	912-4141-150		93790	CD5EA200D0
C5	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C6	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C7,C8	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C9	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C10	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C11,C12	CAPACITOR,FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0
C13	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C14	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C15	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 25V	184-9102-210	D,E,F	56289	199D155X0025AB1
C16	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100	A,B,C	56289	196D235
C17,C18	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 25V	184-9102-250		56289	199D226X0025PE4
C19	CAPACITOR,FXD MICA DIEL, 300PF, 5%, 50V	912-4141-480		93790	CD5FY301J0
C20	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-5019-120		81349	CK05BX222K
C21	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C22	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C23	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C24	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C25	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C26,C27	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440	A,D	81349	CK06BX104K
C28	NOT USED				
C29	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-5019-140		81349	CK05BX332K
C30	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C31	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C32	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C33	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200	A,B,C	81349	CK05BX103K
C34	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 25V	184-9102-250		56289	199D226X0025PE4
C35	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-330	A,D	81349	CK06BX333K
C36	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C37	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C38	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C39	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C40	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C41	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C42	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C43	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C44	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C45	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C46,C47	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C48	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C49	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C50	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C51	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C52	CAPACITOR,FXD CER DIEL, 0.39UF, PORM10%, 50V	913-5019-510		81349	CK06BX394K
C53	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C54	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C55	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C56	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-5019-120		81349	CK05BX222K
C57	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C58	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C59	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C60	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		93790	CD5EY470J0
C61	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C62-C66	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C67	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C68	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C69,C70	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C71	CAPACITOR,FXD CER DIEL, 150PF, 10%, 200V	913-4008-000		81349	CK05BX151K

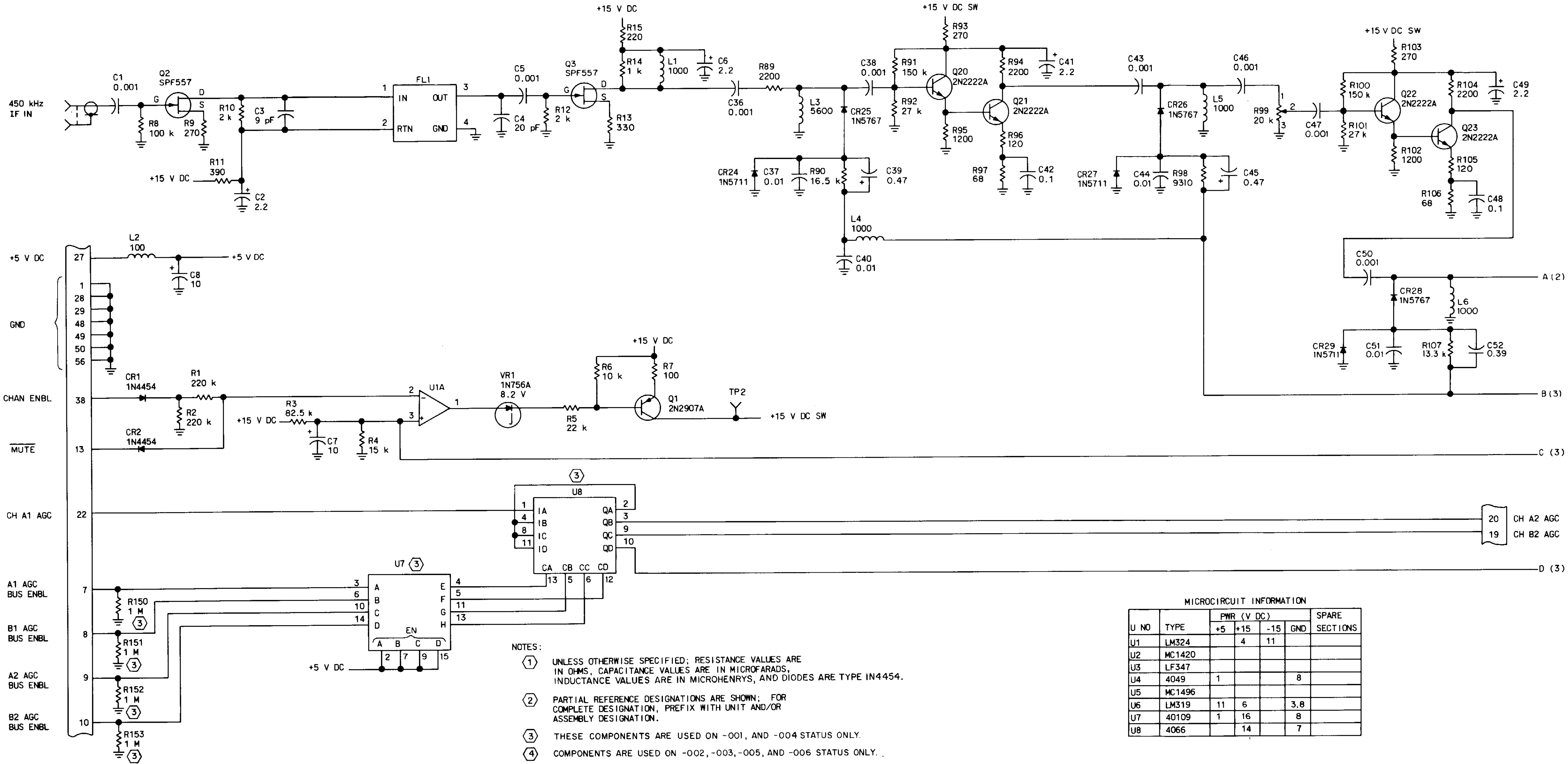
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C72,C73	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C74	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C75,C76	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C77	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C78	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000	A,D	81349	CK05BX102K
C79	CAPACITOR,FXD CER DIEL, 0.22UF, PORM10%, 50V	913-5019-480	A,D	81349	CK06BX224K
C80	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C81	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C82	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C83	CAPACITOR,FXD CER DIEL, 0.33UF, PORM10%, 50V	913-5019-500		81349	CK06BX334K
C84	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 300V	912-4141-020		93790	CD5CC100D0
C85-C149	NOT USED				
C150	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
FL1	FILTER,BP	293-1331-020	A,D	00136	293-1331-020
FL1	FILTER,BP	293-1331-030	B,E	00136	293-1331-030
FL1	FILTER,BP	293-1331-040	C,F	00136	293-1331-040
L1	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L2	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L3	COIL, SHIELDED 5600UH	637-3767-001			637-3767-001
L4-L6	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L7	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L8,L9	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L10	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
P1	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
P2-P4	NOT USED				
P5,P6	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
Q1	TRANSISTOR	352-0551-010		15818	2N2907A
Q2,Q3	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q4	TRANSISTOR (ESDS)	352-0605-010	A,B,C	04713	2N2608
Q5	TRANSISTOR	352-0605-010		04713	2N2608
Q6	TRANSISTOR (ESDS)	352-0759-010		00872	2N4091
Q7	TRANSISTOR (ESDS)	352-1069-010		17856	2N5432
Q8	TRANSISTOR	352-0661-020		07263	2N2222A
Q9,Q10	TRANSISTOR	352-0551-010		15818	2N2907A
Q11	TRANSISTOR (ESDS)	352-0605-010	A,B,C	04713	2N2608
Q12,Q13	TRANSISTOR	352-0661-020		07263	2N2222A
Q14	TRANSISTOR (ESDS)	352-0605-010		04713	2N2608
Q15-Q17	NOT USED				
Q18	TRANSISTOR	352-0605-010		04713	2N2608
Q19-Q27	TRANSISTOR	352-0661-020		07263	2N2222A
Q28	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q29	NOT USED				
Q30	TRANSISTOR (ESDS)	352-0759-010	A,D	00872	2N4091
R1,R2	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R3	RESISTOR,FXD FILM, 82.5K, 1%, 1/8W	705-1088-000		81349	RN55D8252F
R4	RESISTOR,FXD FILM, 15K, 1%, 1/8W	705-3605-560		81349	RN55D1502F
R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R6	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R7	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R8	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R9	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R10	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R11	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R12	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R13	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R14	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R15	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R16	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R17	RESISTOR,FXD FILM, 121K, 1%, 1/8W	705-1096-000		81349	RN55D1213F
R18	RESISTOR,FXD FILM, 22.1K, 1%, 1/8W	705-3605-640		81349	RN55D2212F
R19	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R20	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R21	RESISTOR,FXD CMPSN, 0.12MEGO, 10%, 1/4W	745-0824-000		81349	RCR07G124KS
R22	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R23	RESISTOR,FXD CMPSN, 0.56MEGO, 5%, 1/4W	745-0847-000		81349	RCR07G564JS
R24	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R25	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R26	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R27	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/4W	745-0893-000		81349	RCR07G106KS
R28	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000	B,C,E,F	81349	RCR07G560KS
R29	RESISTOR,FXD CMPSN, 0.82MEGO, 10%, 1/4W	745-0854-000		81349	RCR07G824KS
R30	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R31	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R32	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R33	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R34	RESISTOR,FXD CMPSN, 18K, 10%, 1/4W	745-0794-000		81349	RCR07G183KS
R35	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R36	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R37	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN55D4752F
R38	NOT USED				
R39	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R40	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R41,R42	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R43	RESISTOR,FXD FILM, 36.5K, 1%, 1/8W	705-1071-000		81349	RN55D3652F
R44	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W	705-3605-810		81349	RN55D4992F
R45	RESISTOR,FXD FILM, 37.4K, 1%, 1/8W	705-3605-750		81349	RN55D3742F
R46	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R47	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R48	RESISTOR,FXD FILM, 9.09K, 1%, 1/8W	705-1042-000		81349	RN55D9091F
R49	RESISTOR,FXD FILM, 25.5K, 1%, 1/8W	705-3605-670		81349	RN55D2552F

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R50	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R51	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R52	RESISTOR,FXD FILM, 15K, 1%, 1/8W	705-3605-560		81349	RN55D1502F
R53	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R54	RESISTOR,FXD CMPSN, 0.33MEGO, 10%, 1/4W	745-0839-000		81349	RCR07G334KS
R55	RESISTOR,VAR NON-WW,20K, 10%	382-0052-470		02111	64W203
R56	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R57	RESISTOR,VAR NON-WW,10K, 10%	382-0052-460		02111	64W103
R58	NOT USED				
R59	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R60	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R61	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R62,R63	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R64	RESISTOR,FXD FILM, 25.5K, 1%, 1/8W	705-3605-670		81349	RN55D2552F
R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R66	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R67	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R68,R69	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R70	RESISTOR,FXD CMPSN, 2.7MEGO, 5%, 1/4W	745-0871-000	A,B,C	81349	RCR07G275JS
R71	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R72	RESISTOR,FXD CMPSN, 4.7MEGO, 5%, 1/4W	745-0880-000		81349	RCR07G475JS
R73	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R74	RESISTOR,VAR 20K, 10%, 0.5W	382-0027-110		80294	3329HCT1-203
R75	NOT USED				
R76	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R77	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R78	RESISTOR,FXD CMPSN, 0.18MEGO, 10%, 1/4W	745-0830-000		81349	RCR07G184KS
R79	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R80	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R81,R82	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R83	RESISTOR,FXD FILM, 36.5K, 1%, 1/8W	705-1071-000		81349	RN55D3652F
R84	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R85	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R86	RESISTOR,FXD CMPSN, 0.27MEGO, 5%, 1/4W	745-0835-000		81349	RCR07G274JS
R87	RESISTOR,FXD CMPSN, 82K, 10%, 1/4W	745-0818-000		81349	RCR07G823KS
R88	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R89	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R90	RESISTOR,FXD FILM, 16.5K, 1%, 1/8W	705-3605-580		81349	RN55D1652F
R91	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R92	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R93	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R94	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R95	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R96	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/4W	745-0716-000		81349	RCR07G121KS
R97	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R98	RESISTOR,FXD FILM, 9.31K, 1%, 1/8W	705-3605-460		81349	RN55D9311F
R99	RESISTOR,VAR NON-WW,20K, 10%	382-0052-470		02111	64W203
R100	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R101	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R102	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R103	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R104	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R105	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/4W	745-0716-000		81349	RCR07G121KS
R106	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R107	RESISTOR,FXD FILM, 13.3K, 1%, 1/8W	705-1050-000		81349	RN55D1332F
R108	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R109	RESISTOR,FXD CMPSN, 0.18MEGO, 10%, 1/4W	745-0830-000		81349	RCR07G184KS
R110	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R111	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W	745-0782-000		81349	RCR07G822KS
R112	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R113	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R114	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R115	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W	745-0812-000		81349	RCR07G563KS
R116	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R117	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R118	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R119	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R120	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R121	RESISTOR,FXD CMPSN, 22 OHMS, 10%, 1/4W	745-0689-000		81349	RCR07G220KS
R122	RESISTOR,FXD CMPSN, 360 OHMS, 5%, 1/4W	745-0732-000		81349	RCR07G361JS
R123, R124	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R125	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R126	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R127	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R128	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000	A,D	81349	RCR07G104KS
R129	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000	A,D	81349	RCR07G103KS
R130	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R131, R132	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R133	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R134, R135	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R136	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R137, R138	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R139	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R140	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R141	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R142	RESISTOR,VAR 2K, 10%, 0.5W	382-0027-080		80294	3329HCT1-202
R143	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000	A,D	81349	RCR07G472KS

Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS, AND DIODES ARE TYPE IN4454.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ THESE COMPONENTS ARE USED ON -001, AND -004 STATUS ONLY.

④ COMPONENTS ARE USED ON -002, -003, -005, AND -006 STATUS ONLY.

⑤ THESE COMPONENTS ARE USED ON -001, -002, AND -003 ONLY.

⑥ THESE COMPONENTS ARE USED ON -004, -005, AND -006 ONLY.

MICROCIRCUIT INFORMATION

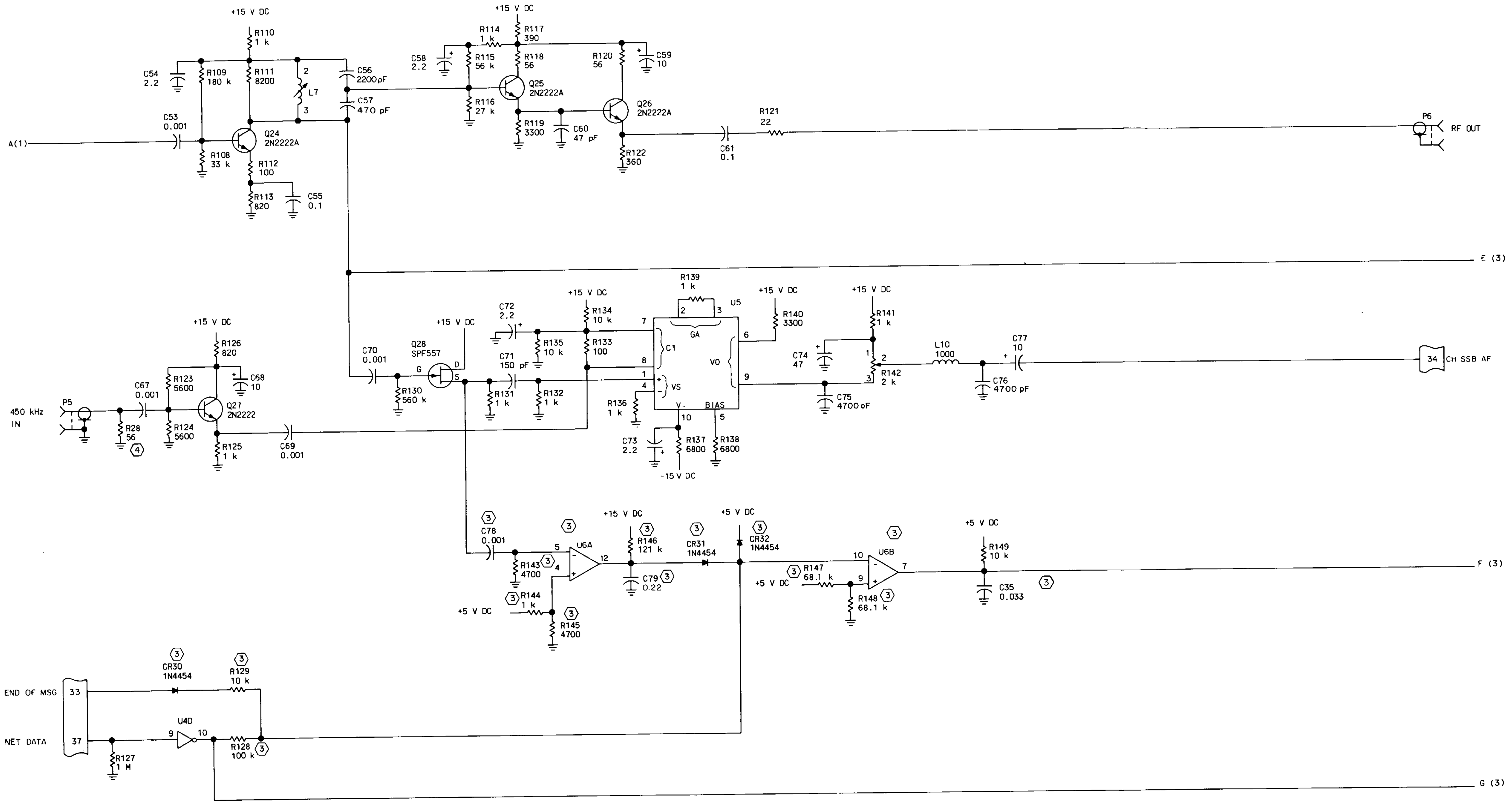
U NO	TYPE	PWR (V DC)				SPARE SECTIONS
		+5	+15	-15	GND	
U1	LM324		4	11		
U2	MC1420					
U3	LF347					
U4	4049	1			8	
U5	MC1496					
U6	LM319	11	6		3.8	
U7	40109	1	16		8	
U8	4066		14		7	

Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 3)

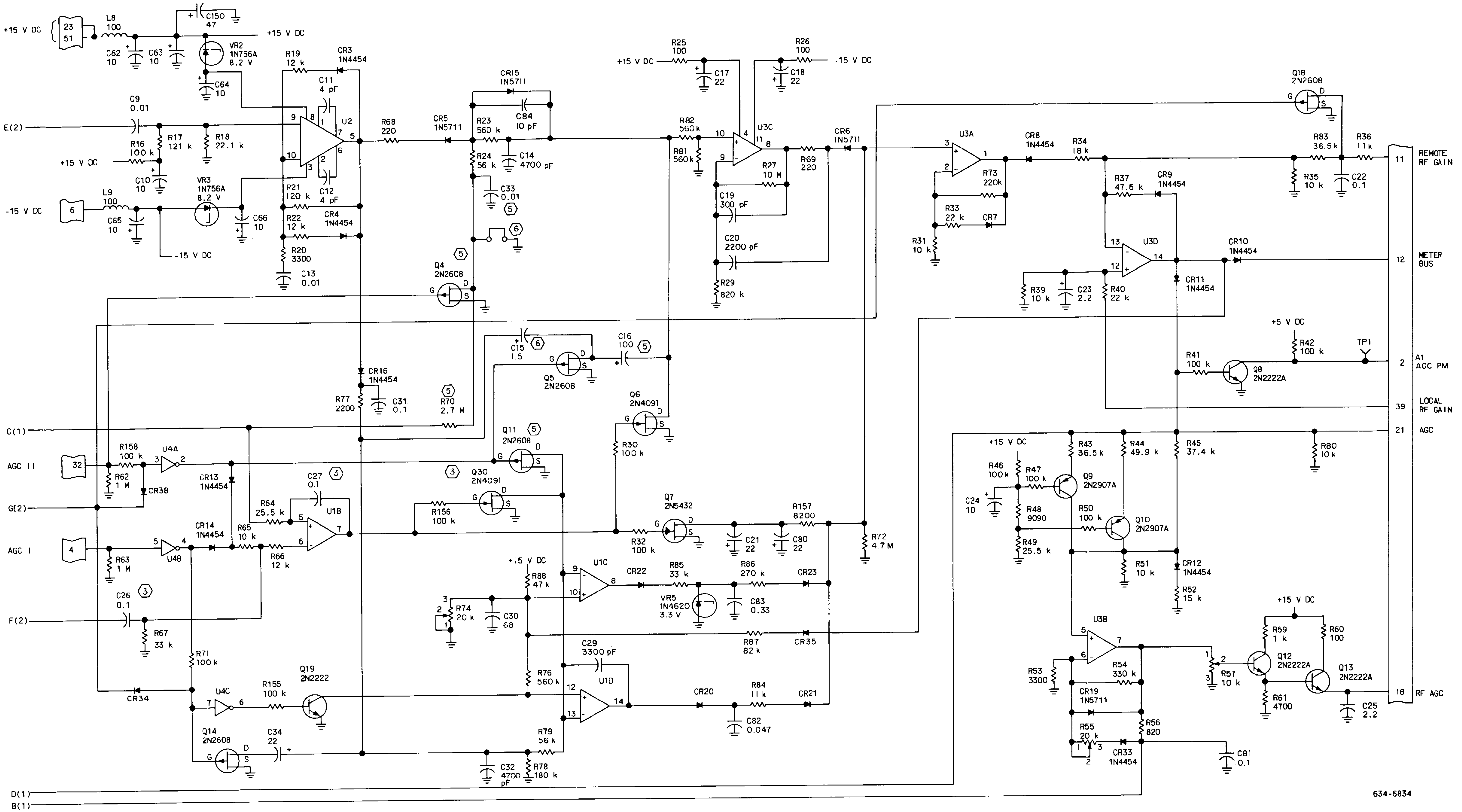
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R144	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000	A,D	81349	RCR07G105KS
R145	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000	A,D	81349	RCR07G472KS
R146	RESISTOR,FXD FILM, 121K, 1%, 1/8W	705-1096-000	A,D	81349	RN55D1213F
R147, R148	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000	A,D	81349	RN55D6812F
R149	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R150-R153	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000	A,D	81349	RCR07G105KS
R154	NOT USED				
R155	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R156	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R157	RESISTOR,FXD FILM, 8.2 OHMS, 5%, 1/4W	745-0910-150		09021	CF1-4-8R20J
R158	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
U1	AMPLIFIER,QUAD	351-1141-030		12040	LM324N
U2	INTEGRATED CIRCUIT	351-1050-030		04713	MC1420G
U3	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,QUAD	351-1370-020		27014	LF347N
U4	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U5	INTEGRATED CIRCUIT	351-0043-020		04713	MC1496G
U6	INTEGRATED CIRCUIT	351-1166-010	A,D	27014	LM319N
U7	INTEGRATED CIRCUIT (ESDS)	351-8458-010	A,D	02735	CD40109BE
U8	INTEGRATED CIRCUIT (ESDS)	351-8252-010	A,D	02735	CD4066BE
VR1-VR3	SEMICOND DEVICE	353-2720-000		81483	1N756A
VR4	NOT USED				
VR5	SEMICOND DEVICE	353-3591-440		04713	1N4620

Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 4)



Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 5)



Channel B1/A2/B2 IF, Schematic Diagram
Figure 13 (Sheet 6)

Channel A1 IF
(638-6871-( ))

Rockwell International

instructions

Collins Telecommunications Products Division

523-0770709-001211
1 January 1981

Printed in USA

1. DESCRIPTION

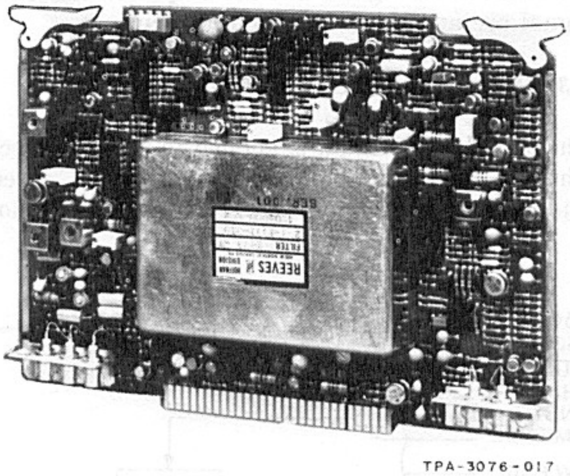
Channel A1 IF, 638-6871-( ), shown in figure 1, is a 3-layer planar card with a 56-pin, edge-on connector (2 layers, 28 pins each), three on-card connectors and five subminiax rf connectors. The 56-pin connector (P4) is for all signals to or from the card except bandwidth filter (J8, J9, J10), i.f. input (P1), i.f. outputs (P3 and P6), 9.0-MHz injection (P2, for the mixer), and 450-kHz injection (P5, for the SSB product detector).

The channel A1 i.f. card consists of mixer, i.f. amplifier, product detector, and AGC circuits. Difference between the circuit cards is in the AGC time constants. The filter passband is 2.85 kHz at the 1-dB points with center frequency i.f. 451.675 kHz for USB operation. (The LSB, LLSB, and UUSB filters are on circuit cards 638-6975-001 through -006.) AGC time constants for the applicable AGC switch position are:

FAST	20 ms attack, 15 - 30 ms decay
MED	20 ms attack, 70 - 150 ms decay
SLOW	20 ms attack, 1 - 2 s decay
VOICE	20 ms attack, 1 - 2 s decay
DATA	20 ms attack, 15 - 30 ms decay
FAX	1.5 ±0.5s attack, 3-6s decay

The card configuration differences are as follows:

a. 638-6871-001 — VOICE-DATA-FAX time constants.



Channel A1 IF
Figure 1

b. 638-6871-002 — FAST-MED-SLOW time constants.

2. PRINCIPLES OF OPERATION

2.1 General

The channel A1 i.f. card receives the 9.45-MHz i.f., 9-MHz and 450-kHz injections, and control signals. The card develops the following outputs:

a. 450-kHz receive i.f.
b. AM and SSB audio
c. AGC signals
d. Performance monitor signals
e. Front panel meter AGC and receive-signal-strength signals

2.2 IF and AF Signals (Refer to figure 2.)

The 9.45-MHz i.f. signal and 9.0-MHz injection are applied to mixer U1 to develop a 450-kHz i.f. signal. The 450-kHz i.f. is applied to gain-controlled amplifier stages through filter FL1 and is output to the channel B1/A2/B2 i.f. cards. The amplifier stages have switched collector voltages. Voltage presence is inhibited by the MUTE or enabled by the CHAN A1, AM, or CW ENABLE inputs.

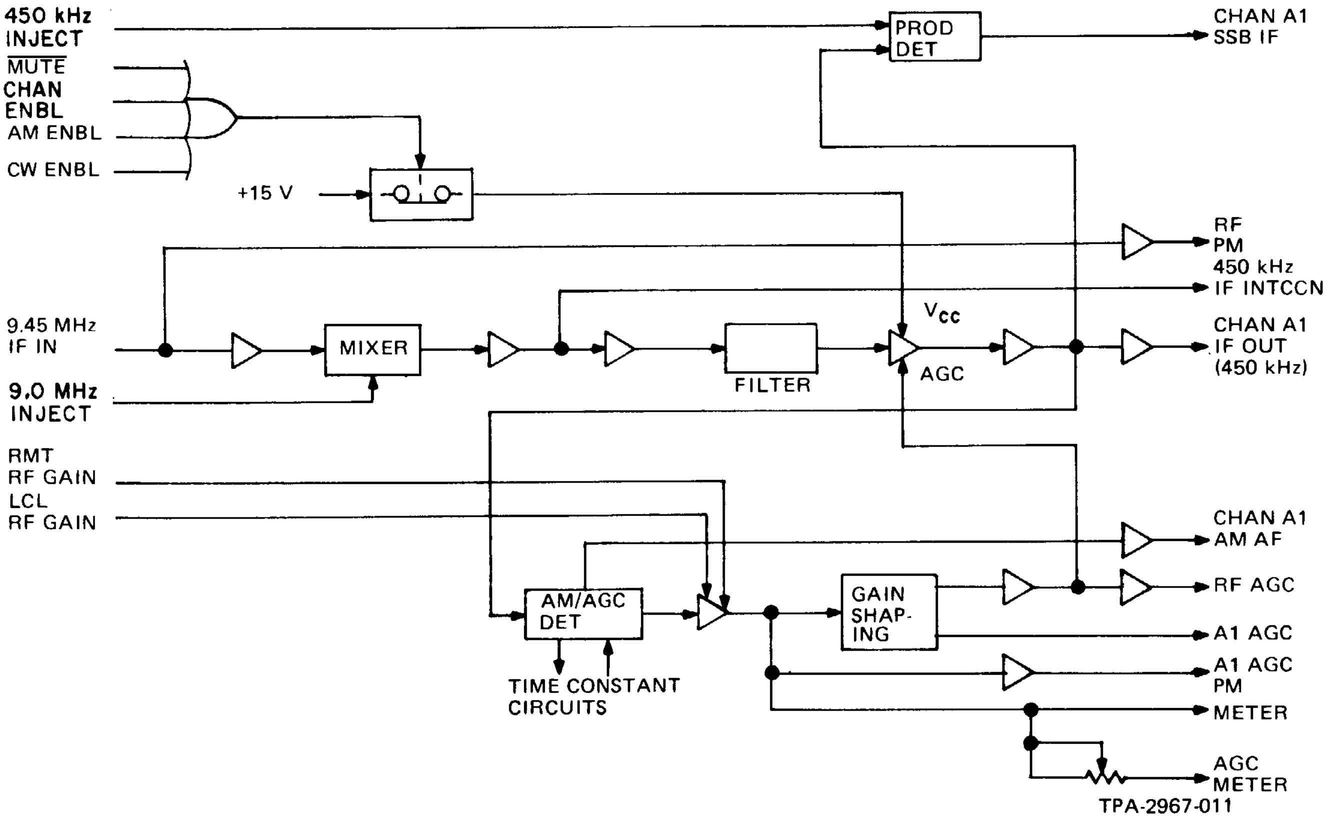
The amplified i.f. signal is applied to a product detector, AM detector, AGC detector, and additional amplifiers. A 450-kHz injection signal is applied to the product detector for detecting the audio in the i.f. signal. The AM detector detects the AM audio in the i.f. These audio signals and the amplified 450-kHz i.f. signal are applied to other circuit cards.

2.3 AGC Signals (Refer to figures 3 and 4.)

The 450-kHz i.f. signal is applied to an AM detector. The AM detector output is applied to an AGC detector and to the AGC circuits. AGC signals are developed through rc time constants selected by the receiver AGC switch. The AGC I and AGC II inputs to the AGC circuits control the time constant selection. Table 1 lists the logic levels associated with the receiver AGC switch positions.

The AGC I signal controls the slow or voice time constant. The AGC II signal controls the fast or data and medium or fax time constants. For the 638-6871-001 circuit card, the AGC II signal grounds capacitors in the AGC detector circuit and grounds the AM detector output applied to the AGC comparator circuits. For the 638-6871-002 circuit card, the AGC II signal grounds a capacitor in the AGC detector output. This enables the medium or fax time constant capacitor in the AGC hang circuit. The AGC I signal selects the appropriate AGC comparator and the slow or voice time constant capacitor in both circuit card configurations. (The differences are illustrated in figures 3 and 4.)

The selected (enabled) AGC comparator inputs are the AM detector output, modified by the selected hang time constant capacitor, and the AGC output



IF and AGC Signal Paths
Figure 2

Table 1. AGC I and AGC II Logic Levels.

AGC		SWITCH POSITION	
I	II		
1	1	OFF	OFF
0	0	FAST	DATA
0	1	MED	FAX
1	0	SLOW	VOICE

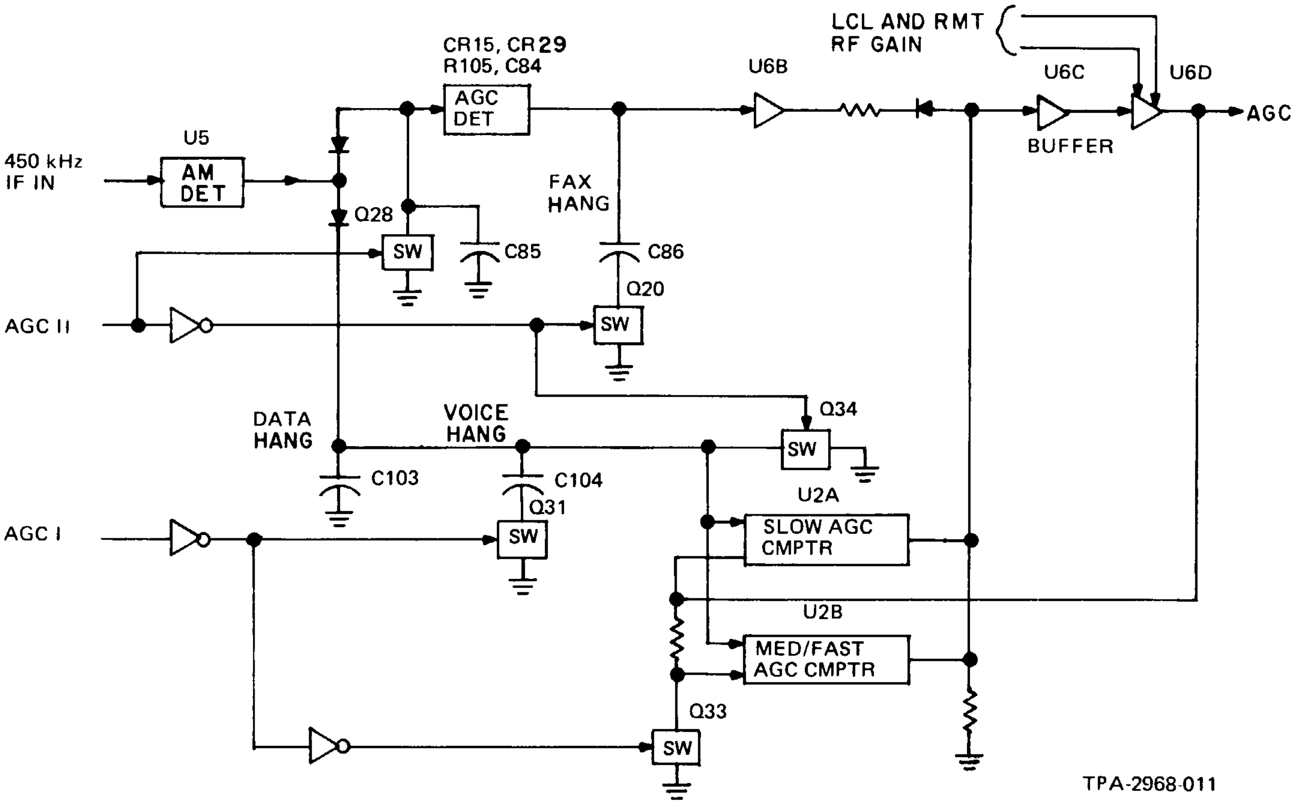
from U6D. The comparator output, an AGC analog voltage, is applied through buffer amplifier U6C to amplifier U6D. This amplifier is gain-controlled by the local or remote rf gain signal. The amplifier output is used as an AGC performance monitor and AGC and received-signal-strength signal for the front panel meter. The output is also applied to a gain shaping circuit. The gain shaping amplifier keeps the AGC signal linear with respect to the received-signal strength. Output from this amplifier is fed back as the i.f. amplifier AGC, and output as the A1 AGC signal to other circuit cards.

2.4 AGC Crowbar (Refer to figures 5 and 11.)

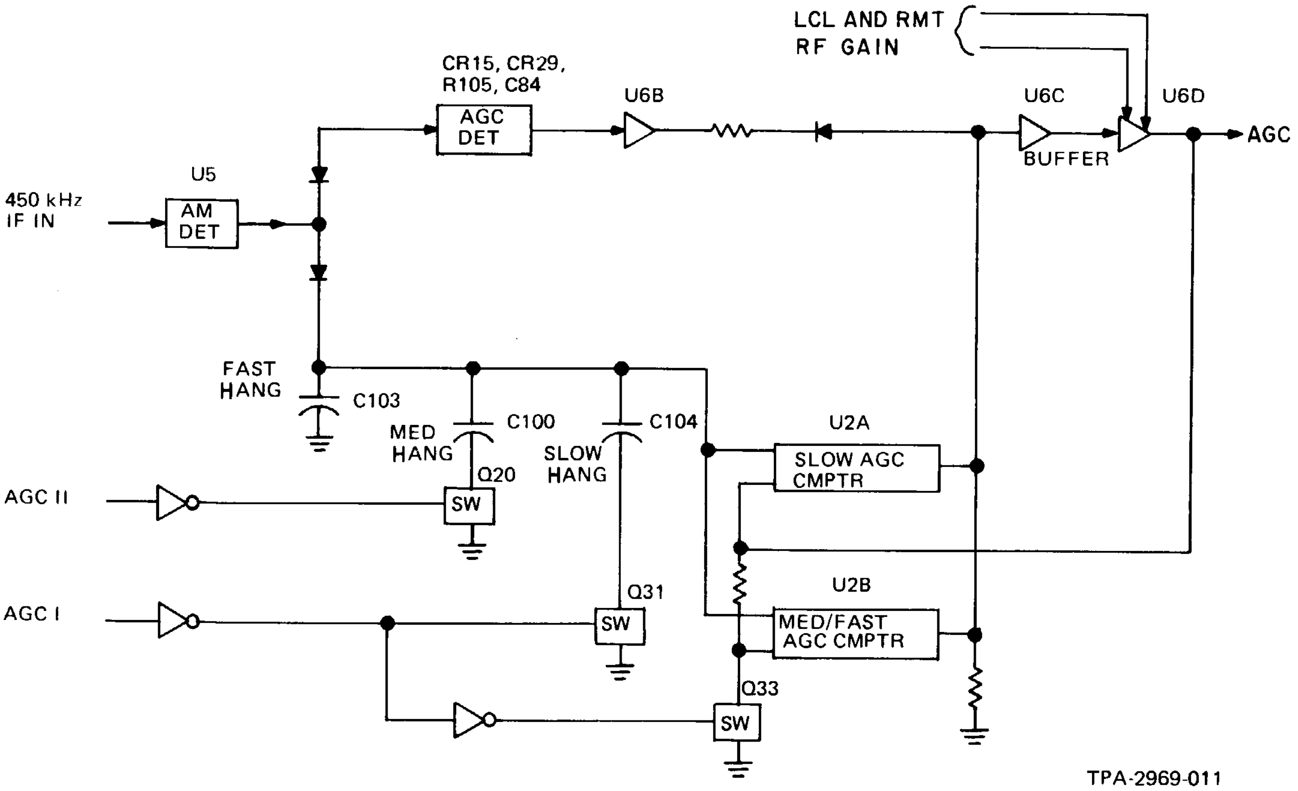
The AGC crowbar circuits discharge the AGC capacitors when the i.f. signal level drops below about three volts or when the END OF MSG signal (in NET DATA mode) is applied. This permits the i.f. amplifier to operate at maximum gain for weak receive signals.

When the i.f. signal drops below the reference voltage level at U2D, the comparator output goes positive to gate on Q30 to discharge AGC capacitors C91 and C118, Q29 to ground the AGC preamplifier input, and Q32 to ground inputs to the AGC comparators. This causes the AGC signal to go to zero, allowing maximum i.f. amplifier gain.

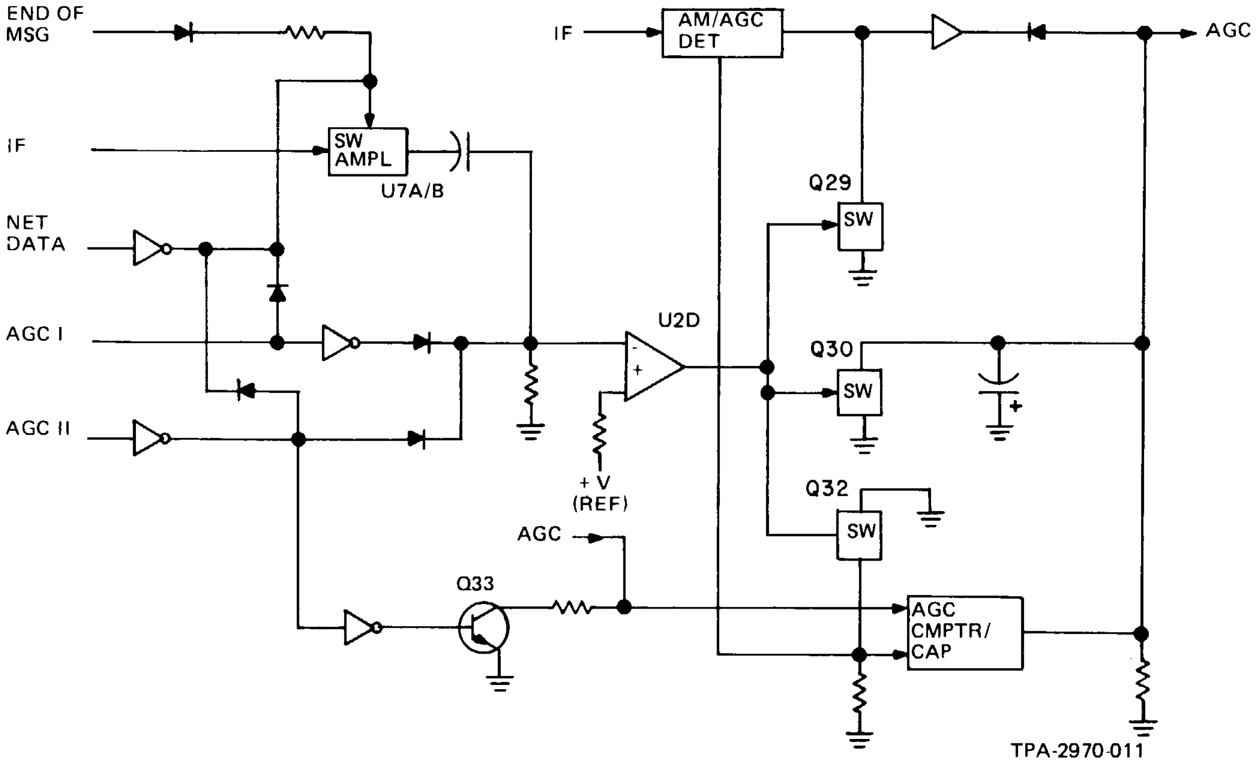
When the receiver is in the NET DATA mode, a logic 0 is applied to the junction of CR36, CR37, and the inverting input of U7B. (Refer to the schematic



AGC Time Constant Circuit for 638-6871-011
Figure 3



AGC Time Constant Circuit for 638-6871-002
Figure 4.



AGC Crowbar Circuit
Figure 5

diagram, figure 11.) The momentary END OF MSG pulse places a logic 1 at this junction. The resulting logic 0 output pulse is applied to AGC crowbar comparator U2D, inverting input. The positive output pulse from U2D momentarily gates on Q30, Q29, and Q32 to cause the AGC time constant capacitors to discharge. This permits the next net data message to be applied at full i.f. amplifier gain.

2.5 Differential Output Operational Amplifier 351-1050-030 (Refer to figure 6.)

The 351-1050-030 is a wide-band general-purpose operational amplifier which features both differential inputs and outputs. Open loop gain is adjustable with external feedback components.

2.6 Quad Operational Amplifier 351-1141-030 (Refer to figure 7.)

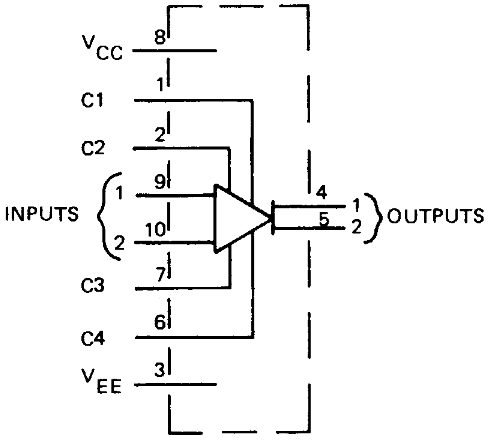
The 351-1141-030 consists of four independent, high-gain internally frequency-compensated operational amplifiers that are designed to operate from a single power supply over a wide range of voltages. Common applications include transducer amplifiers, dc gain blocks, and all conventional operational amplifier circuits.

2.7 Quad Operational Amplifier 351-1370-020 (Refer to figure 8.)

The 351-1370-020 consists of four independent, high-speed operational amplifiers with internally-adjusted input offset voltage. The amplifiers have low noise and offset voltage drift. Common applications include high-speed integrators, sample-and-hold circuits, and d/a converters.

2.8 Balanced Modulator-Demodulator 351-0043-020 (Refer to figure 9.)

The 351-0043-020 is designed for use where the output voltage is a product of an input voltage (signal) and a switching function carrier. Typical applications include suppressed carrier and amplitude modulation, synchronous detection, FM detection, phase detection, and chopper applications.



CHARACTERISTICS

SUPPLY VOLTAGE: V_{CC} +8 V DC MAX., V_{EE} –8 V DC MAX.

INPUT DIFF VOLTAGE: ±8 V DC MAX.

INPUT COMMON MODE VOLTAGE: ±3.0 V PEAK

INPUT RESISTANCE: 2.0 M OHM TYPICAL

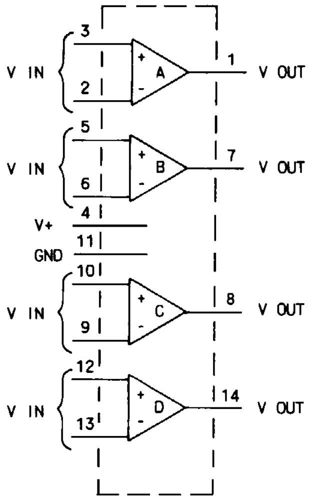
OUTPUT RESISTANCE: 50 OHM TYPICAL

OPEN LOOP GAIN: SINGLE ENDED– 750 V/V MIN, 1500 V/V TYPICAL; DIFFERENTIAL – 1500 V/V MIN,. 3000 V/V TYPICAL

BANDWIDTH: OPEN LOOP–2.0 MHz TYPICAL; CLOSED LOOP –10.0 MHz TYPICAL

TP5-2282-011

Differential Output Operational Amplifier 351-1050-030
Figure 6



CHARACTERISTICS

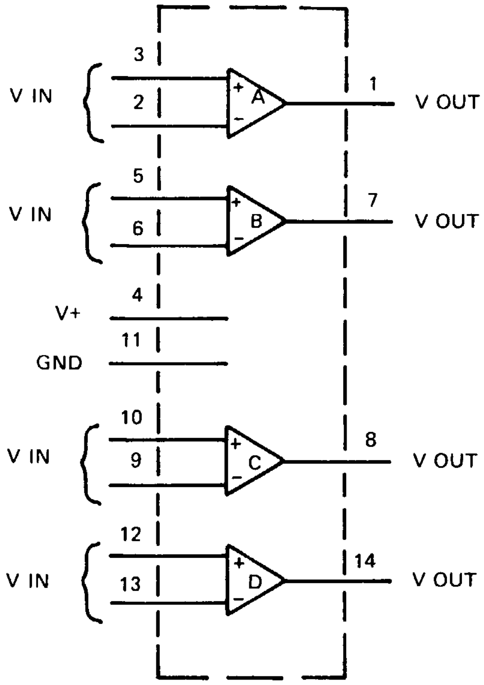
SUPPLY VOLTAGE (V+): 32 V DC MAX
INPUT DIFF VOLTAGE: 32 V DC MAX
INPUT COMMON MODE VOLTAGE: V+ (-1.5 V DC)
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ①
VOLTAGE GAIN: 25 MIN

NOTE:

① SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2289-013

Quad Operational Amplifier 351-1141-030
Figure 7



CHARACTERISTICS

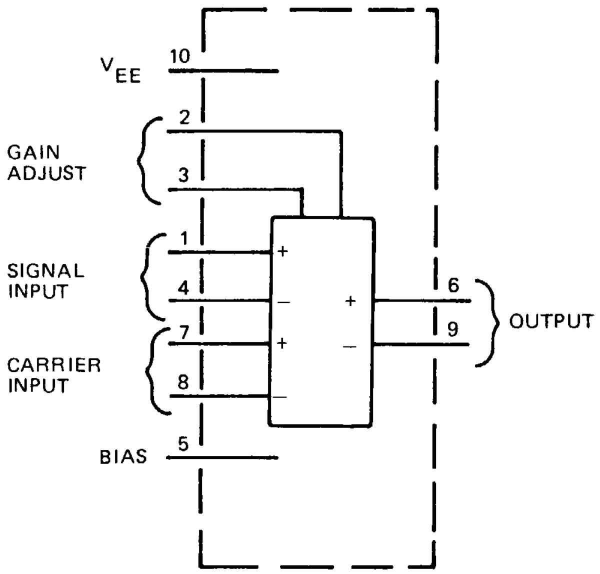
SUPPLY VOLTAGE (V+). 18 V DC MAX
INPUT DIFF VOLTAGE: 30 V DC MAX
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ①
VOLTAGE GAIN: 50 MIN

NOTE:

① POWER DISSIPATION OF 500 mV CANNOT BE EXCEEDED.

TPA-2899-011

Quad Operational Amplifier 351-1370-020
Figure 8



CHARACTERISTICS

APPLIED VOLTAGE: 30 V DC MAX PIN–TO–IN.

DIFFERENTIAL INPUT VOLTAGE: ±5 V DC MAX

CARRIER SUPPRESSION: 65 dB TYPICAL AT 0.5 MHz; 50 dB TYPICAL AT 10 MHz.

TRANSADMITTANCE BANDWIDTH:
CARRIER INPUT–300 MHz TYPICAL;
SIGNAL INPUT–80 MHz TYPICAL

SINGLE-ENDED INPUT RESISTANCE (SIGNAL INPUT): 200 k OHM TYPICAL (AT 5.0 MHz)

SINGLE-ENDED INPUT RESISTANCE (SIGNAL INPUT): 40 k OHM TYPICAL (AT 10 MHz)

DIFFERENTIAL OUTPUT VOLTAGE SWING: 8.0 V P–P TYPICAL

TP5-2291-011

Balanced Modulator-Demodulator 351-0043-020
Figure 9

2.9 Dual Comparator 351-1166-010
(Refer to figure 10.)

The 351-1166-010 consists of two independent comparators. Each is high speed, requires low input current, and has an open-collector output. The comparators are compatible with RTL, DTL, and TTL, and capable of handling up to 25 mA at the output.

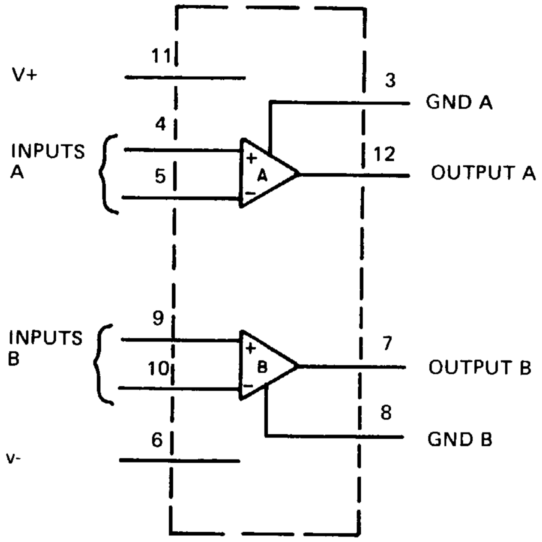
3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the channel A1 i.f. card are listed in the maintenance section of this instruction book.

3.2 Testing

Test procedures in table 2 check total performance of the channel A1 i.f. card. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



CHARACTERISTICS

SUPPLY VOLTAGE: V+ +18 V MAX;
V- -25 V MAX; 36 V MAX TOTAL
POWER DISSIPATION: 500 mW MAX
INPUT DIFF VOLTAGE: ±5 V MAX
OUTPUT SHORT CIRCUIT DURATION:
10 SECONDS MAX
VOLTAGE GAIN: 10 MIN.

TPA-2900-011

Dual Comparator 351-1166-010
Figure 10

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit.		
	Note Front panel control settings (at the beginning of each test) are listed only for those controls whose settings affect the test. Unlisted controls may be set in any position.		
	b. Remove channel A1 i.f. card. Install it on extender card and place extender card in unit. Connect coax extender cables between card and unit.		
	c. Set unit LINE SELECTOR switch to 115 V. Ensure that fuse is 2 A.		
	d. Connect unit to 115-V ac power source and set PWR on.		
	e. Measure dc voltages on card between following pins and ground:		
	P4-23 P4-51 P4-6 P4-27	+15.0 ±1.0 V dc +15.0 ±1.0 V dc -15.0 ±1.0 V dc +5.0 ±0.5 V dc	Check associated power supply
2. Channel enable	a. Set CH A1 switch to OFF. Set MODE to ISB.		
	b. Measure dc voltage between TP1 (brown) and ground.	Not more than 0.5 V dc	Check U2C, Q5, and associated components.
	c. Set CH A1 switch to ON.		
	d. Measure dc voltage between TP1 (brown) and ground.	Not less than +12 V dc	Check U2C, Q5, and associated components.
	e. Set CH A1 switch to OFF. Set MODE to CW.		
	f. Measure dc voltage between TP1 (brown) and ground.	Not less than +12 V dc	Check CR4.
	g. Set MODE to AM.		
	h. Measure dc voltage between TP1 (brown) and ground.	Not less than +12 V dc	Check CR3.
(Cont)	i. On rear panel of unit, temporarily ground MUTE terminal (TB1-10).		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	j. Measure dc voltage between TP1 (brown) and ground.	Not more than +0.5 V dc	Check U1A, Q1, and associated components.
	k. Remove ground from MUTE.		
3. I.f. sensitivity and gain	a. Set PWR off.		
	b. Connect channel A1 i.f. card P1 to sig gen through 6-dB attenuator.		
	c. Set PWR on, all AGC switches OFF, and RF GAIN to max cw. Set CH A1 to ON and others OFF.		
	d. Set sig gen output to 1 μV (as shown on sig gen meter) and frequency to 9.4485 MHz.		
	e. Connect distortion analyzer input to channel A1 AF OUT between balanced output terminals on rear panel. Connect 600-ohm resistor between same two terminals.		
	f. Set reference level on distortion analyzer.		
	g. Set analyzer mode to distortion and measure sensitivity of i.f. amplifier.	Not less than 10 dB	Proceed to step 1.
	h. Connect rf voltmeter through 50-ohm adapter to channel A1 IF OUT connector on rear panel.		
	i. Set sig gen output level to 30 μV (as shown on sig gen meter).		
	j. Set channel A1 AGC to FAST or DATA.		
	k. Measure i.f. output level.	25 ±5 mV	Proceed to step u.
	IF SENSITIVITY AND GAIN TESTING COMPLETE		
	TROUBLESHOOTING		
	l. Connect rf voltmeter through 50-ohm adapter to A1 IF OUT connector on rear panel.		
	m. Set sig gen output level to obtain approx 25-mV output at IF connector.		
	n. Adjust T1, T2, and L13 for peak output at IF connector. (L13 has two peaks. Use one giving greatest signal output.)	Max output level	If signal not adjustable or not present, signal trace to find malfunctioning stage.
(Cont)	o. Set sig gen to 10.351 MHz.		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	p. Adjust C3 and C5 to null output at IF connector. (C3 and C5 have two nulling positions. Use position giving greatest nulls.) Increase sig gen output as necessary to detect sharp nulls.	Min output level	Check circuit between Q1 and U1.
	q. Set sig gen to 9.448 MHz.		
	r. Adjust T1 for peak output at IF connector. Change sig gen output as necessary.		
	s. Set MODE to AM and BANDWIDTH to 16.		
	t. Adjust L7 for peak output at IF connector. Repeat step g.		
	u. Inhibit rf (turn off or disconnect) to P1.		
	v. Using rf voltmeter with high-z probe, monitor 9.9-MHz leakage at P3. Adjust R8 to null 9.9-MHz signal level.		
	w. Set sig gen output level to 10 mV at 9.4485 MHz.		
	x. Monitor rf voltage at P3 (with high-z probe) while adjusting R19 to obtain 28 mV rf.		If R19 does not control voltage, check Q1, Q4, U1, and associated components.
	y. Measure and record rf voltage at P3.		
	z. Measure rf voltage at Q9-d.	2.5 times that recorded in step y	Adjust R39 as necessary. Check Q8, Q9, FL1, and associated components.
	aa. Set MODE to AM and BANDWIDTH to 16.		
	ab. Measure and record rf voltage at P3.		
	ac. Measure rf voltage at Q9-d.	2.5 times that recorded in step ab	Adjust R43 as necessary. Check Q10, Q11, and associated components.
	ad. Set MODE to ISB.		
	ae. Set sig gen output level to 10 μV. Switch off AM function.		
(Cont)	af. Record dB level at P1-21.		

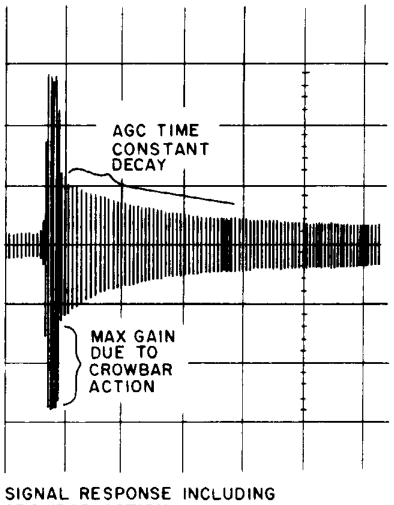
Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	ag. Reduce sig gen output to 3.2 μV. Monitor dc V at P1-21 while adjusting R59 to obtain 6 dB less than recorded in step af.		If R59 does not control voltage, check Q14/ Q15, Q16, Q17/Q18, and associated components.
	ah. Increase sig gen output to 10 mV.		
	ai. Adjust R136 to obtain +5.0 V dc at P1-21.		If R136 does not allow voltage to be properly adjusted, perform AGC tests then repeat test 3.
	aj. Repeat steps i, j, and k.		
4. I.f. selectivity	a. Refer to test 3 and perform equipment setup given in steps a through f, except connect audio voltmeter and 600-ohm resistor between P4-34 and ground. Set RF GAIN to max cw and CH A1 AGC to OFF. Remove receive audio circuit cards from unit.		
	b. Set distortion analyzer to audio voltmeter mode.		
	c. Vary sig gen frequency to obtain peak audio output voltage. Record frequency. Set output level for 10-mV audio output.		
	d. Adjust distortion analyzer reference level for 0-dB indication.		
	e. Adjust sig gen frequency above and below frequency recorded in step c until voltmeter indication is 1 dB less than set in step d. Note frequencies (in MHz).	Max low frequency = 9.446 90 Min high frequency = 9.449 75	Check filter FL1.
	f. Set sig gen frequency to center frequency. Increase sig gen output level 60 dB greater than that set in step c.		
	g. If necessary, readjust distortion analyzer for 0-dB indication.		
	h. Adjust sig gen frequency above and below center freq until voltmeter indication is 1 dB less than set in step g. Note frequencies (in MHz).	Min low frequency = 9.446 45 Max high frequency = 9.450 25	Check filter FL1.
5. Audio output	a. Connect channel A1 i.f. card P1 to sig gen through 6-dB attenuator.		
(Cont)	b. Set sig gen frequency to 9.4485 MHz.		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	c. Set sig gen output to 30 µV.		
	d. Set CH A1 AGC to FAST or DATA and RF GAIN to max cw position.		
	e. Temporarily connect 600-ohm resistor and audio voltmeter between P4-34 and ground.		
	f. Measure audio output at P4-34.	10 ±1 mV ac	Set sig gen output to 30 µV. Adjust R95 to obtain 10 mV at P4-34. If R95 does not control signal, check P5 for 450 kHz at 7 ±1 dB mW. Check Q19, U4, and associated components.
	g. Set MODE to AM and BANDWIDTH to 16.		
	h. Set sig gen for 50% AM (1000 Hz) at 30-µV output.		
	i. Connect 600-ohm resistor between P4-8 and measure audio output.	10 ±1 mV ac	Set sig gen output to 30 µV. Adjust R145 to obtain 10 mV at P4-8. If R145 does not control signal, check U5, U27, and associated components.
	j. Disconnect setup from P4-8 and -34. Turn off PWR. Replace receive audio cards. Turn on PWR.		
6. AGC output voltage	a. Refer to test 3 and perform equipment setup given in steps a through d.		
	b. Set applicable CH A1 AGC to FAST or DATA and RF GAIN to max cw position.		
	c. Set sig gen frequency to 9.4485 MHz and output level to 100 µV.		
	d. Measure voltage at P4-21.	+0.90 ±0.2 V dc	Adjust R59 as necessary. If R59 adjusted, perform test 3. If R59 does not adjust level, check U2, U5, U6, and associated components.
(Cont)			

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>6. (Cont)</td><td>e. Set sig gen output level to 10 mV.</td><td></td><td></td></tr>
<tr><td></td><td>f. Measure voltage at P4-21.</td><td>+5.0 ±0.1 V dc</td><td>Check U6B/C/D, Q22, Q23, and associated components.</td></tr>
<tr><td></td><td>g. Measure voltage at P4-18.</td><td>+3.0 ±0.1 V dc (Voltage at P4-21 should be 5.0 V. Adjust RF GAIN to obtain +5 V if necessary.)</td><td>Adjust R140 as necessary.
If R140 does not adjust level, check Q24/Q25 and associated components, or replace R138 from test selected values of 820 Ω, 1000 Ω, 1200 Ω, 1500 Ω or 1800 Ω. If R138 replaced, repeat tests 3 and 6.</td></tr>
<tr><td>7. AGC time constants</td><td>a. Disconnect sig gen and 6-dB attenuator from P1 on chan A1 i.f. card. Connect sig gen and 6-dB attenuator to signal input of rf signal level switch. Connect switch output to P1 on i.f. card.</td><td></td><td></td></tr>
<tr><td></td><td>b. Connect 30 dB of attenuation to rf signal level switch attenuator connectors.</td><td></td><td></td></tr>
<tr><td></td><td>c. Connect scope trigger to rf signal level switch trigger output. Connect scope vertical input to channel A1 IF output connector on rear panel.</td><td></td><td></td></tr>
<tr><td></td><td>d. Apply dc voltage (+15 to +28 V) to rf signal level switch.</td><td></td><td></td></tr>
<tr><td></td><td>e. Set sig gen output level to 1.0 mV.</td><td></td><td></td></tr>
<tr><td></td><td>f. While observing scope, depress and release level switch and measure AGC attack and decay times.</td><td>As indicated for applicable card:
638-6871-001</td><td>Proceed to step h.</td></tr>
<tr><td>(Cont)</td><td>

SIGNAL RESPONSE INCLUDING CROWBAR ACTION
TPA-3068-011</td><td colspan="2"><table>
<tr><th>AGC TC</th><th>*ATTACK</th><th>DECAY</th></tr>
<tr><td>DATA
VOICE
FAX</td><td>10 ms max
10 ms max
1 s max</td><td>15 to 30 ms
1 to 2.2 s
3 to 6 s</td></tr>
</table>
638-6871-002
<table>
<tr><th>AGC TC</th><th>*ATTACK</th><th>DECAY</th></tr>
<tr><td>FAST
SLOW
MED</td><td>10 ms max
10 ms max
10 ms max</td><td>15 to 30 ms
1 to 2.2 s
70 to 150 ms</td></tr>
</table>
*Measured when signal is within 3 dB of steady state level.</td></tr>
</table>

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	g. Set unit AGC time constant switch to other positions, repeating step f for each position. AGC TIME CONSTANTS TESTING COMPLETE		
	TROUBLESHOOTING		
	h. To adjust decay time, perform steps i through l. If rise time faulty, go to step m.		
	i. Set sig gen output level to 300 μV. Adjust rf signal level switch attenuator for 4 dB of attenuation.		
	j. Connect scope vertical input to U2-7.		
	k. Depress level switch and permit output to scope to stabilize.		
	l. Observe scope and release level switch.	U2-7 just starts to switch positive toward end of sweep.	Adjust R166 as necessary. (When correctly adjusted, U2-7 will switch on 4-dB decrease but will not switch on 3-dB increase.) If R166 does not correct decay time and decay is incorrect for SLOW/VOICE time constant, check U3D, Q31, Q33, U2B, and associated components. If decay is incorrect for FAST/DATA or MED/FAX time constants, check U3A, Q34, Q20, U2A, and associated components.
	m. No adjustable components are included for rise time. For all rise times other than FAX, check C84 and associated components. For FAX rise time malfunctions, check C86.		
8. AGC crowbar	a. Connect variable attenuator to rf signal level switch attenuator connectors. Set attenuation to 30 dB.		
(Cont)	b. Set sig gen output level to 10 mV and frequency to 9.4485 MHz.		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

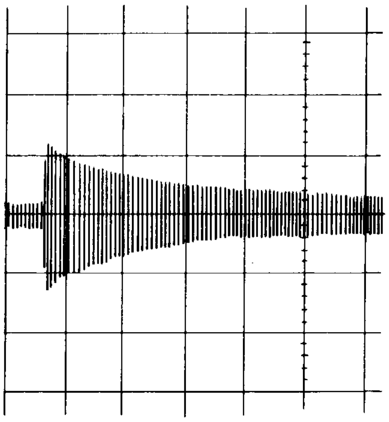
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	c. Depress and release level switch and observe scope display for crowbar action.  SIGNAL RESPONSE WITHOUT CROWBAR ACTION TPA-3069-011		
	d. Decrease attenuation, then repeat step c. Continue until crowbar action no longer occurs.		
	e. Note attenuation just before crowbar action ceases to occur.	20 ±3 dB	Check U2D, Q30, and associated components.
	f. Set MODE to NET DATA and AGC to FAST or DATA.		
	g. Observe scope while momentarily applying a +5-V logic 1 to P4-33, simulating an end-of-message signal.	I.f. output momentarily limits as circuit crowbars.	Check U7B, U2D, Q30, and associated components.
	h. Set MODE to position other than NET DATA.		
	i. Repeat step g. **Note** To check TADIL A crowbar operation, use the SA-1914/TSC-60(V) Radio Frequency Switching Unit.	I.f. output does not limit.	Check U7B and associated components.
(Cont)	j. Set MODE to NET DATA, AGC to FAST or DATA, and RF GAIN to max cw position.		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

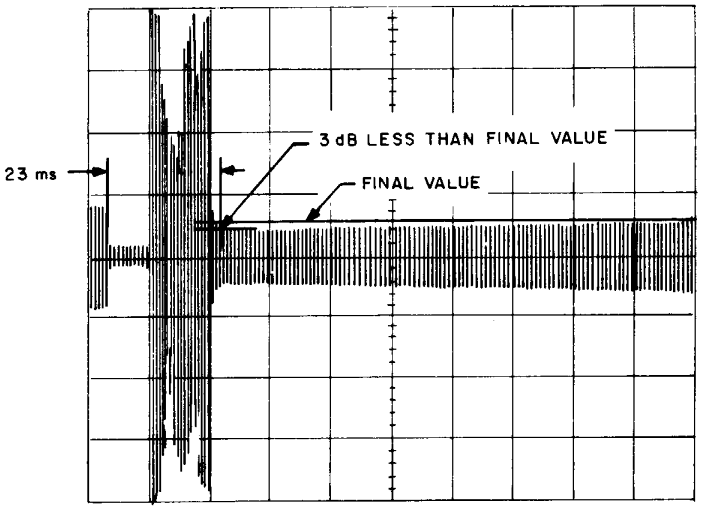
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	k. Connect two sig gens to SA-1914 RF1 IN and RF2 IN. Set RF1 sig gen to 9.451 MHz and RF2 sig gen to 9.452 MHz.		
	l. Connect SA-1914 RF OUT directly to channel A1 i.f. card P1.		
	m. Connect SA-1914 TRIG OUT to scope trigger and scope vertical input to P4-34 (SSB AF output), or to channel A1 IF OUT jack on rear panel.		
	n. Set SA-1914 MODE SELECTOR to RF 2 OFF.		
	o. Set RF1 sig gen output level to 10 mV and RF2 sig gen output level to 10 μV.		
	p. Adjust scope so sweep is just below trigger threshold. (Sweep speed approx 0.5 s/div.)		
	q. Set MODE SELECTOR to RF1 OFF and observe audio output on scope.	Audio output is within 3 dB of final level within 23 ms after sig gen rf out switched off.	
	 TADIL A CROWBAR ACTION TPA-3070-011		
	r. Set both sig gen output levels to 3 mV.		
	s. Repeat step q.	Same as step q.	
	t. Disconnect test setup.		

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. AGC off	a. Connect sig gen and 6-dB attenuator to P1. Set sig gen frequency to 9.4485 MHz.		
	b. Set sig gen output to 10 mV.		
	c. Connect scope to P4-34.		
	d. Observe scope display and switch CH A1 AGC to OFF.	Signal level increases due to no AGC action.	Check U3A, U3F, and associated components.
10. AGC performance monitor	a. Turn off sig gen rf.		
	b. Monitor dc voltage at TP5 (A1 AGC PM) and slowly decrease RF GAIN to point where voltage at TP5 goes less than +1.0 V (logic 0).		
	c. Measure AGC signal voltage at P4-21.	Not more than +0.7 V dc	Check Q21 and associated components.
11. Rf performance monitor	a. Set RF GAIN to max cw position.		
	b. Turn on sig gen rf output.		
	c. Change sig gen output level to level at which voltage at TP2 just switches to logic 0.		
	d. Note sig gen output level.	Not more than 1.0 V rms	Check Q2 and associated components.
12. Rf gain and meter bus	a. Turn off sig gen rf.		
	b. Set AGC to OFF and RF GAIN to max ccw position. Set METER to RCV SIG. Select MODE other than NET DATA.		
	c. Adjust RF GAIN to obtain +4.0 ±0.5 V dc to P4-39.		
	d. Measure dc V at P4-21.	Not less than +8 V dc	Check U6D and associated components.
	e. Measure dc V at P4-40.	4 ±0.2 V dc	Check CR10.
	f. Adjust RF GAIN to obtain +5.0 ±0.05 V at P4-12.		
(Cont)	g. Observe front panel meter.	Full-scale	Adjust R120, as necessary, for full-scale. (R120 is to be set to produce 63 ±1 mV across 100 ohms at P4-12.)

Table 2. Channel A1 IF, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	Note Steps h thru k can be performed only if HF-8094( ) is connected to HF-8054( ).		If R120 ineffective, check CR20 and meter.
	h. Set HF-8054( ) CONT to REM.		
	i. Adjust HF-8094( ) RF GAIN to obtain -4.0 ±0.5 V dc at HF-8054( ) P4-11.		
	j. Measure dc V at HF-8054( ) P4-21.	+4 ±0.1 V dc	Check U6D and associated components.
	k. Set HF-8054( ) CONT to LCL.		
13. Filter enable inputs	a. Set MODE to AM. Set BANDWIDTH switch to each listed position and measure indicated pins for logic 1. (All other pins should be logic 0.)		Check BANDWIDTH switch. Check circuit card connector terminals.
	POSITION PINS	LOGIC	
	16 P4-42, J10-3	1	
	A P4-15, J10-4	1	
	B P4-43, J8-2	1	
	C P4-16, J8-3	1	
	D P4-45, J8-5	1	
	E P4-17, J8-4	1	
	b. Set MODE to CW and repeat measurements for each BANDWIDTH switch position.	Same as for step a.	
	c. Tests completed. Turn off power. Disconnect all test equipment and reinstall circuit card in unit.		

4. REPAIR

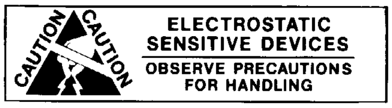
Repair of the control card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 11). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification. Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter coed (A, B, C, etc.). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

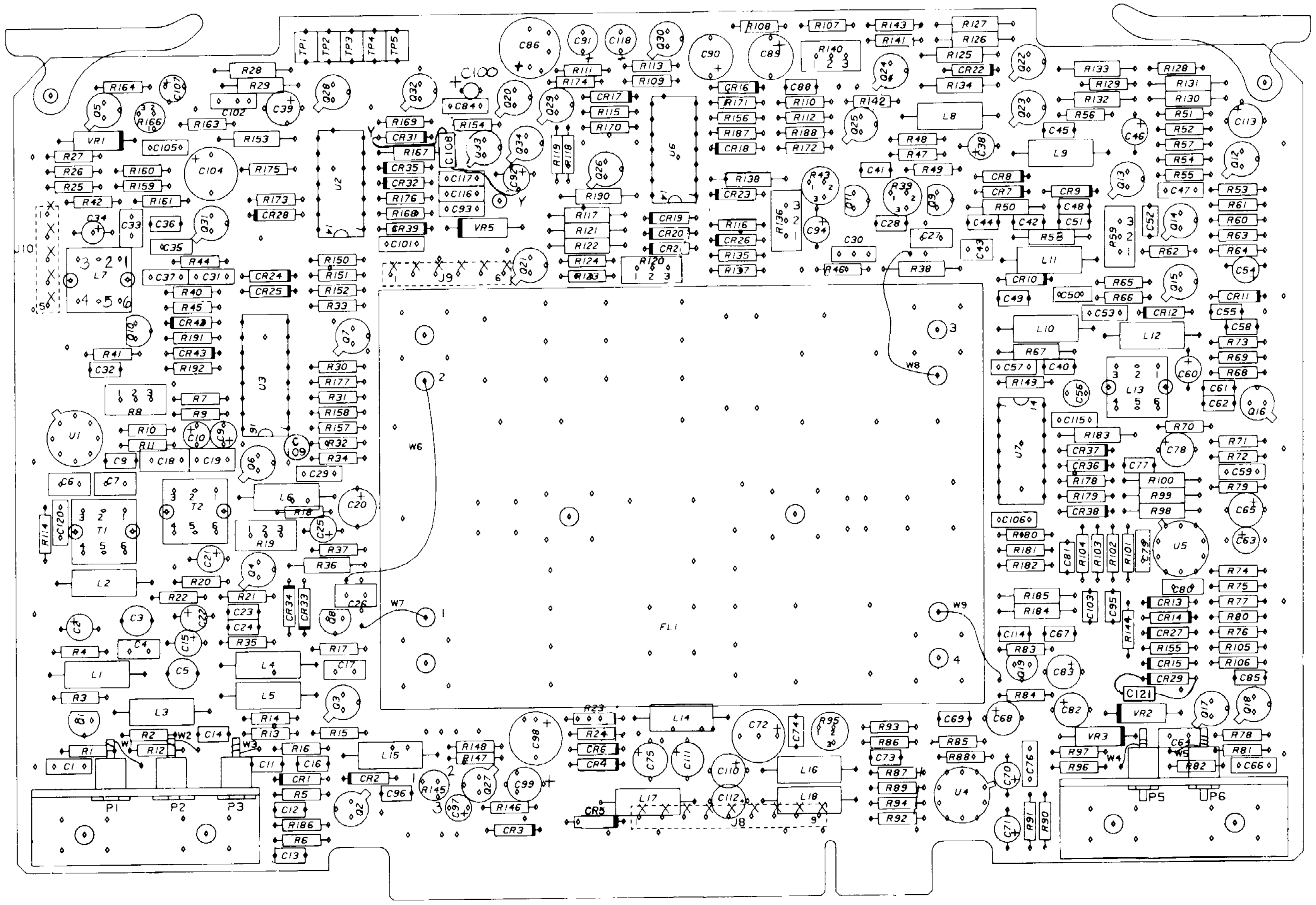
CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
00872	TELEDYNE SYSTEMS CO MICROELECTRONICS DIV 12964 PANAMA ST LOS ANGELES CA 90066
02111	SPECTROL ELECTRONICS CORP SUB OF CARRIER CORP 17070 E GALE AVE CITY OF INDUSTRY CA 91745
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042

CODE	MANUFACTURER'S NAME AND ADDRESS
09021	AIRCO ELECTRONICS FOSTER BROOK RD P O BOX 334 BRADFORD PA 16701
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
CHANNEL A1 IF	638-6871-001	REV G
CHANNEL A1 IF	638-6871-002	REV G



CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

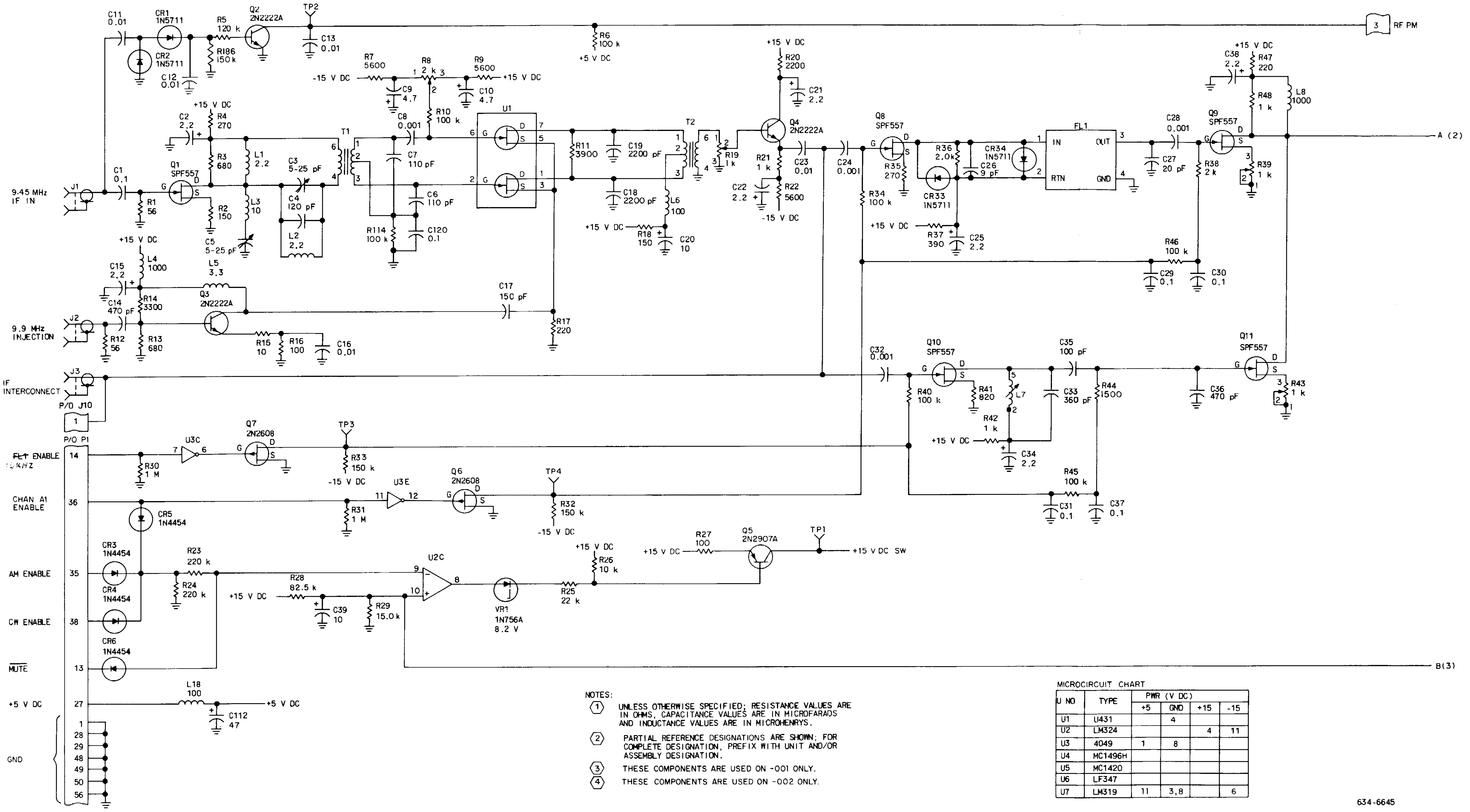
TPA-2497-018

Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 1 of 6)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CHANNEL A1 IF (ESDS)	638-6871-001	A		
	CHANNEL A1 IF (ESDS)	638-6871-002	B		
CR1,CR2	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR3-CR6	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR7	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR8,CR9	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR10	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR11	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR12	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR13, CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR15, CR16	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR17-CR25	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR26	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR27, CR28	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR29	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR30	NOT USED				
CR31, CR32	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR33, CR34	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR35-CR39	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR40, CR41	NOT USED				
CR42, CR43	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C2	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C3	CAPACITOR,VAR CER DIEL, 5 TO 25PF, 100V	917-1256-030		72982	518-024A5-25PF
C4	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 50V	912-4141-380		93790	CD5FY121J0
C5	CAPACITOR,VAR CER DIEL, 5 TO 25PF, 100V	917-1256-030		72982	518-024A5-25PF
C6,C7	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370		93790	CD5FY111J0
C8	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C9,C10	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C11-C13	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C14	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C15	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C16	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C17	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C18,C19	CAPACITOR,FXD CER DIEL, 2200PF, PORM5%, 100V	913-3281-300		18796	8131-100C0G222J
C20	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C21,C22	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C23	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C24	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C25	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C26	CAPACITOR,FXD MICA DIEL, 9PF, PORM 0.5PF, 300V	912-4141-530		72136	DM5C090D300WV
C27	CAPACITOR,FXD MICA DIEL, 20PF, PORM 0.5PF, 100V	912-4141-150		93790	CD5EA200D0
C28	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C29-C31	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C32	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C33	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500		93790	CD5FY361J0
C34	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C35	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050		93790	CD5FY101J0
C36	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C37	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C38	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C39	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C40	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C41	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C42	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C43	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C44	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C45	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C46	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C47	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C48	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C49	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C50	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C51,C52	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C53	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C54	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C55	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C56	CAPACITOR,FXD CER DIEL, 0.39UF, PORM10%, 50V	913-5019-510		81349	CK06BX394K
C57	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C58	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C59	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C60	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C61	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-5019-120		81349	CK05BX222K
C62	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C63	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C64	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		93790	CD5EY470J0
C65	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C66	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C67	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C68	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C69	CAPACITOR,FXD CER DIEL, 150PF, 10%, 200V	913-4008-000		81349	CK05BX151K
C70,C71	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C72	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C73,C74	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C75	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C76	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C77	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C78	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C79,C80	CAPACITOR,FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0
C81	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C82,C83	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C84	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C85	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200	A	81349	CK05BX103K
C86	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
C87	NOT USED				
C88	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-5019-120		81349	CK05BX222K
C89,C90	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 25V	184-9102-250		56289	199D226X0025PE4
C91	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C92	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C93	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C94	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C95,C96	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C97	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C98	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C99	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C100	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 25V	184-9102-210	B	56289	199D155X0025AB1
C101-C103	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C104	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 25V	184-9102-250		56289	199D226X0025PE4
C105	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C106	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-380		81349	CK06BX333K
C107	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C108	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-5019-140		81349	CK05BX332K
C109	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C110, C111	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C112	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
C113	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-610		56289	199D106X0020CE3
C114	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C115	CAPACITOR,FXD CER DIEL, 0.22UF, PORM10%, 50V	913-5019-480		81349	CK06BX224K
C116	CAPACITOR,FXD CER DIEL, 0.33UF, PORM10%, 50V	913-5019-500		81349	CK06BX334K
C117	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 100V	913-5019-400		81349	CK06BX473K
C118	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C119	NOT USED				
C120	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C121	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 300V	912-4141-020		93790	CD5CC100D0
FL1	FILTER,BP	293-1331-010		00136	293-1331-010
J1-J7	NOT USED				
J8	HOUSING,CONN	372-2625-018			372-2625-018
J9	HOUSING,CONN	372-2625-015			372-2625-015
J10	HOUSING,CONN	372-2625-014			372-2625-014
L1	COIL,RF 2.2UH	240-2715-170		96906	MS75088-5
L2	COIL, SHIELDED 2.2UH	637-3767-002			
L3	COIL, SHIELDED 10UH	637-3767-004			
L4	COIL, SHIELDED 1000UH	637-3767-005			
L5	COIL, SHIELDED 3.3UH	637-3767-003			
L6	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L7	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L8	COIL, SHIELDED 1000UH	637-3767-005			
L9	COIL,RF 6800UH	240-2715-590		96906	MS75089-33
L10-L12	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L13	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L14	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L15	COIL,RF 5600UH	240-2715-580		96906	MS75089-32
L16-L18	COIL,RF 100UH	240-2715-370		96906	MS75089-11
P1-P3	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
P4	NOT USED				
P5,P6	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
Q1	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q2-Q4	TRANSISTOR	352-0661-020		07263	2N2222A
Q5	TRANSISTOR	352-0551-010		15818	2N2907A
Q6,Q7	TRANSISTOR (ESDS)	352-0605-010		04713	2N2608
Q8-Q11	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q12-Q18	TRANSISTOR	352-0661-020		07263	2N2222A
Q19	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q20	TRANSISTOR (ESDS)	352-0605-010		04713	2N2608
Q21	TRANSISTOR	352-0661-020		07263	2N2222A
Q22,Q23	TRANSISTOR	352-0551-010		15818	2N2907A
Q24,Q25	TRANSISTOR	352-0661-020		07263	2N2222A
Q26	TRANSISTOR	352-0605-010		04713	2N2608
Q27	TRANSISTOR	352-0661-020		07263	2N2222A
Q28	TRANSISTOR (ESDS)	352-0605-010	A	04713	2N2608
Q29	TRANSISTOR (ESDS)	352-0759-010		00872	2N4091
Q30	TRANSISTOR (ESDS)	352-1069-010		17856	2N5432
Q31	TRANSISTOR (ESDS)	352-0605-010		04713	2N2608
Q32	TRANSISTOR (ESDS)	352-0759-010		00872	2N4091
Q33	TRANSISTOR	352-0661-020		07263	2N2222A
Q34	TRANSISTOR (ESDS)	352-0605-010	A	04713	2N2608
R1	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R2	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/8W	745-2311-000		81349	RCR05G151KS
R3	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/8W	745-2335-000		81349	RCR05G681KS
R4	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R5	RESISTOR,FXD CMPSN, 120K, 10%, 1/8W	745-2416-000		81349	RCR05G124KS
R6	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R7	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/8W	745-2368-000		81349	RCR05G562KS
R8	RESISTOR,VAR NON-WW,2K, 10%	382-0052-440		02111	64W202
R9	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/8W	745-2368-000		81349	RCR05G562KS
R10	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R11	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R12	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R13	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/8W	745-2335-000		81349	RCR05G681KS
R14	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R15	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/8W	745-2268-000		81349	RCR05G100KS
R16	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R17	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R18	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/8W	745-2311-000		81349	RCR05G151KS
R19	RESISTOR,VAR NON-WW,1K, 10%	382-0052-430		02111	64W102
R20	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R21	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R22	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/8W	745-2368-000		81349	RCR05G562KS
R23,R24	RESISTOR,FXD CMPSN, 220K, 10%, 1/8W	745-2425-000		81349	RCR05G224KS
R25	RESISTOR,FXD CMPSN, 22K, 10%, 1/8W	745-2389-000		81349	RCR05G223KS
R26	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R27	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R28	RESISTOR,FXD FILM, 82.5K, 1%, 1/8W	705-1088-000		81349	RN55D8252F
R29	RESISTOR,FXD FILM, 15K, 1%, 1/8W	705-3605-560		81349	RN55D1502F
R30,R31	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R32,R33	RESISTOR,FXD CMPSN, 150K, 10%, 1/8W	745-2419-000		81349	RCR05G154KS
R34	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R35	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R36	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R37	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/8W	745-2326-000		81349	RCR05G391KS
R38	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R39	RESISTOR,VAR 1K, 10%, 0.5W	382-0027-070		80294	3329HCT1-102
R40	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R41	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/8W	745-2338-000		81349	RCR05G821KS
R42	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R43	RESISTOR,VAR 1K, 10%, 0.5W	382-0027-070		80294	3329HCT1-102
R44	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/8W	745-2347-000		81349	RCR05G152KS
R45,R46	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R47	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R48	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R49	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R50	RESISTOR,FXD FILM, 16.5K, 1%, 1/8W	705-3605-580		81349	RN55D1652F
R51	RESISTOR,FXD CMPSN, 150K, 10%, 1/8W	745-2419-000		81349	RCR05G154KS
R52	RESISTOR,FXD CMPSN, 27K, 10%, 1/8W	745-2392-000		81349	RCR05G273KS
R53	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/8W	745-2344-000		81349	RCR05G122KS
R54	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/8W	745-2308-000		81349	RCR05G121KS
R55	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/8W	745-2298-000		81349	RCR05G680KS
R56	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R57	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R58	RESISTOR,FXD FILM, 9.31K, 1%, 1/8W	705-3605-460		81349	RN55D9311F
R59	RESISTOR,VAR NON-WW,20K, 10%	382-0052-470		02111	64W203
R60	RESISTOR,FXD CMPSN, 150K, 10%, 1/8W	745-2419-000		81349	RCR05G154KS
R61	RESISTOR,FXD CMPSN, 27K, 10%, 1/8W	745-2392-000		81349	RCR05G273KS
R62	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/8W	745-2344-000		81349	RCR05G122KS
R63	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R64	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R65	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/8W	745-2308-000		81349	RCR05G121KS
R66	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/8W	745-2298-000		81349	RCR05G680KS
R67	RESISTOR,FXD FILM, 13.3K, 1%, 1/8W	705-1050-000		81349	RN55D1332F
R68	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R69	RESISTOR,FXD CMPSN, 180K, 10%, 1/8W	745-2422-000		81349	RCR05G184KS
R70	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/8W	745-2374-000		81349	RCR05G822KS
R71	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R72	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/8W	745-2338-000		81349	RCR05G821KS
R73	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R74	RESISTOR,FXD CMPSN, 56K, 10%, 1/8W	745-2404-000		81349	RCR05G563KS
R75	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R76	RESISTOR,FXD CMPSN, 27K, 10%, 1/8W	745-2392-000		81349	RCR05G273KS
R77	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R78	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R79	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/8W	745-2326-000		81349	RCR05G391KS
R80	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R81	RESISTOR,FXD CMPSN, 360 OHMS, 5%, 1/8W	745-1863-380		81349	RCR05G361JS
R82	RESISTOR,FXD CMPSN, 22 OHMS, 10%, 1/8W	745-2280-000		81349	RCR05G220KS
R83	RESISTOR,FXD CMPSN, 560K, 10%, 1/8W	745-2440-000		81349	RCR05G564KS
R84-R87	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R88,R89	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/8W	745-2371-000		81349	RCR05G682KS
R90	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R91	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R92	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R93	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R94	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R95	RESISTOR,VAR 2K, 10%, 0.5W	382-0027-080		80294	3329HCT1-202
R96	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R97	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/8W	745-2298-000		81349	RCR05G680KS
R98	RESISTOR,FXD FILM, 22.1K, 1%, 1/8W	705-3605-640		81349	RN55D2212F
R99	RESISTOR,FXD FILM, 121K, 1%, 1/8W	705-1096-000		81349	RN55D1213F
R100	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R101	RESISTOR,FXD CMPSN, 120K, 10%, 1/8W	745-2416-000		81349	RCR05G124KS

Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ THESE COMPONENTS ARE USED ON -001 ONLY.

④ THESE COMPONENTS ARE USED ON -002 ONLY.

MICROCIRCUIT CHART

U NO	TYPE	PWR (V DC)			
		+5	GND	+15	-15
U1	U431		4		
U2	LM324			4	11
U3	4049	1	8		
U4	MC1496H				
U5	MC1420				
U6	LF347				
U7	LM319	11	3,8		6

Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 3)

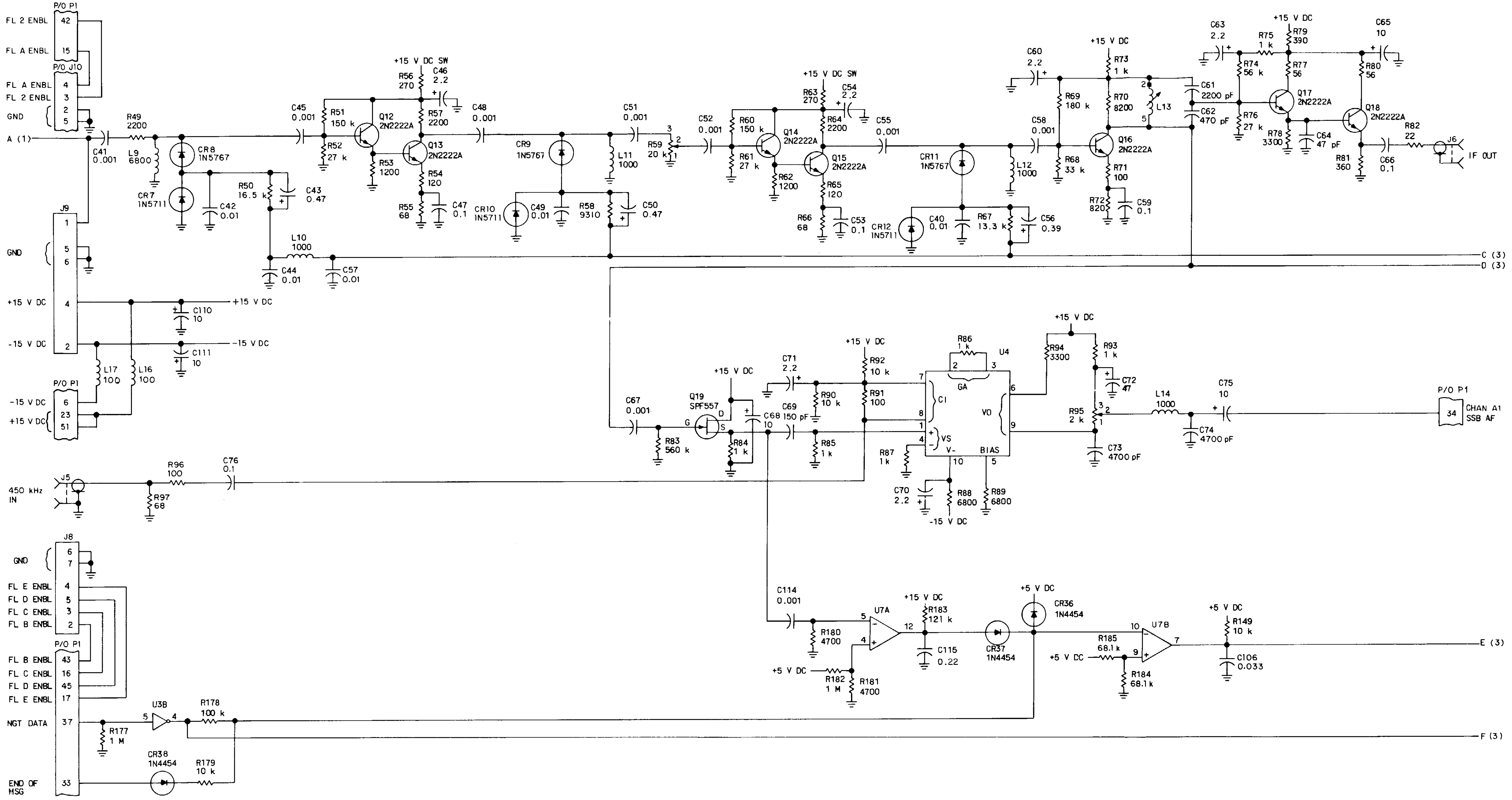
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R102, R103	RESISTOR,FXD CMPSN, 12K, 10%, 1/8W	745-2380-000		81349	RCR05G123KS
R104	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R105	RESISTOR,FXD CMPSN, 560K, 5%, 1/8W	745-1864-190		81349	RCR05G564JS
R106	RESISTOR,FXD CMPSN, 56K, 10%, 1/8W	745-2404-000		81349	RCR05G563KS
R107, R108	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R109	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R110	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/8W	745-1864-850		81349	RCR05G106KS
R111	RESISTOR,FXD FILM, 8.2 OHMS, 5%, 1/4W	745-0910-150		09021	CF1-4-8R20J
R112	RESISTOR,FXD CMPSN, 820K, 10%, 1/8W	745-2446-000		81349	RCR05G824KS
R113, R114	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R115	RESISTOR,FXD CMPSN, 22K, 10%, 1/8W	745-2389-000		81349	RCR05G223KS
R116	RESISTOR,FXD CMPSN, 18K, 10%, 1/4W	745-0794-000		81349	RCR07G183KS
R117	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN55D4752F
R118	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R119	RESISTOR,FXD CMPSN, 22K, 10%, 1/8W	745-2389-000		81349	RCR05G223KS
R120	RESISTOR,VAR NON-WW,10K, 10%	382-0052-460		02111	64W103
R121	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R122	RESISTOR,FXD FILM, 36.5K, 1%, 1/8W	705-1071-000		81349	RN55D3652F
R123, R124	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R125	RESISTOR,FXD FILM, 37.4K, 1%, 1/8W	705-3605-750		81349	RN55D3742F
R126	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W	705-3605-810		81349	RN55D4992F
R127	RESISTOR,FXD FILM, 36.5K, 1%, 1/8W	705-1071-000		81349	RN55D3652F
R128, R129	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R130	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R131	RESISTOR,FXD FILM, 9.09K, 1%, 1/8W	705-1042-000		81349	RN55D9091F
R132	RESISTOR,FXD FILM, 25.5K, 1%, 1/8W	705-3605-670		81349	RN55D2552F
R133	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R134	RESISTOR,FXD FILM, 15K, 1%, 1/8W	705-3605-560		81349	RN55D1502F
R135	RESISTOR,FXD CMPSN, 330K, 10%, 1/8W	745-2431-000		81349	RCR05G334KS
R136	RESISTOR,VAR NON-WW,20K, 10%	382-0052-470		02111	64W203
R137	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R138	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R139	NOT USED				
R140	RESISTOR,VAR NON-WW,10K, 10%	382-0052-460		02111	64W103
R141	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R142	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R143	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R144	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R145	RESISTOR,VAR 5K, 10%, 0.5W	382-0027-090		80294	3329HCT1-502
R146	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R147	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/8W	745-2368-000		81349	RCR05G562KS
R148, R149	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R150	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R151	RESISTOR,FXD CMPSN, 12K, 10%, 1/8W	745-2380-000		81349	RCR05G123KS
R152	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R153	RESISTOR,FXD FILM, 25.5K, 1%, 1/8W	705-3605-670		81349	RN55D2552F
R154	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R155	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R156	RESISTOR,FXD CMPSN, 4.7MEGO, 10%, 1/8W	745-1864-810		81349	RCR05G475KS
R157, R158	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R159	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R160	RESISTOR,FXD CMPSN, 56K, 10%, 1/8W	745-2404-000		81349	RCR05G563KS
R161	RESISTOR,FXD CMPSN, 180K, 10%, 1/8W	745-2422-000		81349	RCR05G184KS
R162	NOT USED				
R163	RESISTOR,FXD CMPSN, 560K, 10%, 1/8W	745-2440-000		81349	RCR05G564KS
R164	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R165	NOT USED				
R166	RESISTOR,VAR 20K, 10%, 0.5W	382-0027-110		80294	3329HCT1-203
R167	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R168	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R169	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R170	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R171	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R172	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R173	RESISTOR,FXD CMPSN, 82K, 10%, 1/8W	745-2410-000		81349	RCR05G823KS
R174	RESISTOR,FXD CMPSN, 220K, 10%, 1/8W	745-2425-000		81349	RCR05G224KS
R175	RESISTOR,FXD CMPSN, 2.7MEGO, 5%, 1/8W	745-1864-350	A	81349	RCR05G275JS
R176	RESISTOR,FXD CMPSN, 270K, 5%, 1/8W	745-1864-110		81349	RCR05G274JS
R177	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R178	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R179	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R180, R181	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R182	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R183	RESISTOR,FXD FILM, 121K, 1%, 1/8W	705-1096-000		81349	RN55D1213F
R184, R185	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R186- R188	RESISTOR,FXD CMPSN, 560K, 5%, 1/8W	745-1864-190		81349	RCR05G564JS
R188, R189	NOT USED				
R190	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R191, R192	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
T1	TRANSFORMER,RF	278-0432-020		02113	278-0432-020
T2	TRANSFORMER,RF	278-0432-010		02113	278-0432-010
U1	TRANSISTOR	351-1151-010		17856	U431
U2	AMPLIFIER,QUAD	351-1141-030		12040	LM324N
U3	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U4	INTEGRATED CIRCUIT	351-0043-020		04713	MC1496G
U5	INTEGRATED CIRCUIT	351-1050-030		04713	MC1420G
U6	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,QUAD	351-1370-020		27014	LF347N
U7	INTEGRATED CIRCUIT	351-1166-010		27014	LM319N
VR1-VR3	SEMICOND DEVICE	353-2720-000		81483	1N756A
VR4	NOT USED				
VR5	SEMICOND DEVICE	353-3591-440		04713	1N4620

Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 4)



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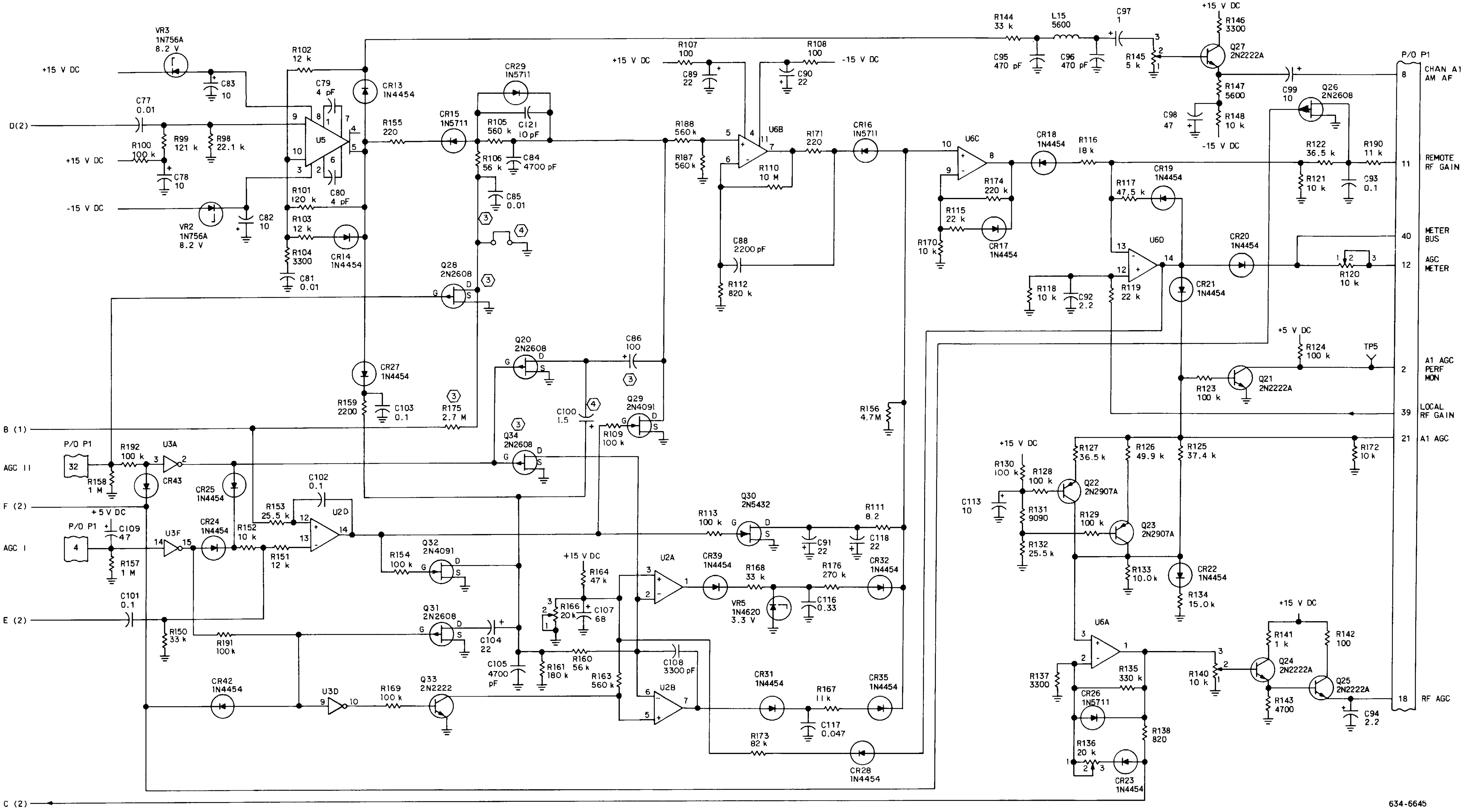
Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 5)



Channel A1 IF, Schematic Diagram
Figure 11 (Sheet 6)

Filter
(637-2515-( ))

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

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1. DESCRIPTION

Filter 637-2515-( ), shown in figure 1, is a 2-layer planar card with one 7-pin, one 6-pin, and one 5-pin blue-line connector. The filter card mates with a channel A if card and provides additional selectable filters.

The filter card consists of six filter circuits and a CW strapping circuit. Refer to table 1.

2. PRINCIPLES OF OPERATION (Refer to figure 4.)

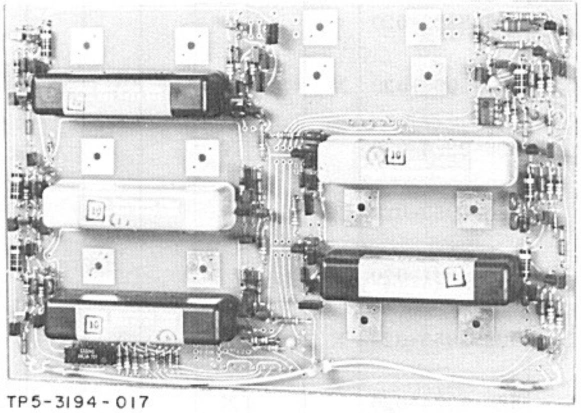
2.1 *General*

The filter card receives 450 kHz if from the channel A if card, makes filter selection as controlled by the FL2 through FL7, or CW mode switching inputs, and supplies 450-kHz filtered if to the channel A if card.

2.2 *CW Mode Strapping*

CW mode can be strapped to FL4, FL5, FL6, or FL7. To strap CW mode for the desired filter, CR11 is connected as follows:

a. For FL4(B), connect CR11 anode to E1 and cathode to E2.
b. For FL5 (C), connect CR11 anode to E1 and cathode to E3.
c. For FL6 (D), connect CR11 anode to E1 and cathode to E4.
d. For FL7 (E), connect CR11 anode to E1 and cathode to E5.



Filter
Figure 1

2.3 *Bandpass Filter Control Circuits*

The filter card provides filter selection of 450-kHz if signals. Filter selection is initiated by the CW mode control signal or by a bandwidth control signal. This means only that these signals are applied to the filter card to initiate filter selection and does not reflect a mode of operation or selection of a bandwidth.

FL2 (LSB), FL3 (A), FL4 (B), FL5 (C), FL6 (D), and FL7 (E) are selected when the associated enable signal is applied to the filter card. FL4 (B), FL5 (C), FL6 (D), and FL7 (E) can also be selected by CW mode signal when strapped as described in paragraph 2.2. These filters are optional and the following are typical frequency bandwidths.

NOTICE: This section replaces third edition dated 1 January 1979.

Table 1. Filter Complement.

REF DES	COLLINS PART NO	FILTER 637-2515-( )															DESCRIPTION
		001	002	003	004	005	006	007	008	009	010	011	012	013			
FL2	526-9956-010				X	X				X			X				2.75 kHz bandwidth (LSB 250 - 3000 Hz)
FL3	526-9963-060	X	X	X		X	X				X	X					6.0 kHz bandwidth (AM ±3000 Hz)
	526-9963-040												X				3.0 kHz bandwidth (AM ±1500 Hz)
	526-8322-011													X			0.25 kHz bandwidth (USB 1000 - 1250 Hz)
FL4	526-9963-040	X		X		X	X										3.0 kHz bandwidth (AM ±1500 Hz)
	526-9963-030												X				1.0 kHz bandwidth (AM ±500 Hz)
	526-8322-020													X			0.7 kHz bandwidth (USB 925 - 1625 Hz)
FL5	526-9963-030	X				X	X			X		X					1.0 kHz bandwidth (AM ±500 Hz)
	526-9974-030			X													1.0 kHz bandwidth (USB 500 - 1500 Hz)
	526-9963-020												X				0.5 kHz bandwidth (AM ±250 Hz)
	526-8321-020													X			0.7 kHz bandwidth (LSB 925 - 1625 Hz)
FL6	526-9963-020	X				X	X										0.5 kHz bandwidth (AM ±250 Hz)
	526-9974-020			X													0.5 kHz bandwidth (USB 750 - 1250 Hz)
	526-9963-090												X				0.3 kHz bandwidth (AM ±150 Hz)
	526-8321-010													X			0.25 kHz bandwidth (LSB 1000 - 1250 Hz)
FL7	526-9963-010	X				X				X		X	X,				0.2 kHz bandwidth (AM ±100 Hz)
	526-9974-010		X	X				X									0.2 kHz bandwidth (USB 900 - 1100 Hz)
	293-1333-010						X										0.1 kHz bandwidth (AM ±50 Hz)
	526-9999-010								X								0.37 kHz bandwidth (USB 1515 - 1885 Hz)
	526-8323-010													X			5.0 kHz bandwidth (AM ±2500 Hz)
CR11	353-3644-010		X														Anode to E1, cathode to E5

a. FL2 (LSB), 2.7 kHz, LSB
b. FL3 (A), 6 kHz, AM
c. FL4 (B), 3 kHz, AM
d. FL5 (C), 1 kHz, AM
e. FL6 (D), 0.5 kHz, AM
f. FL7 (E), 0.2 kHz, AM

2.4 Dual Operational Amplifier 351-1071-070 (Refer to figure 2.)

The 351-1071-070 consists of two operational amplifiers in one package designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components.

2.5 Quad Operational Amplifier 351-1141-030 (Refer to figure 3.)

The 351-1141-030 consists of four independent, high-gain, internally frequency-compensated operational amplifiers that are designed to operate from a single power supply over a wide range of voltages. Common applications include transducer amplifiers, dc gain blocks, and all conventional operational amplifier circuits.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the filter card are listed in the maintenance section of this instruction book.

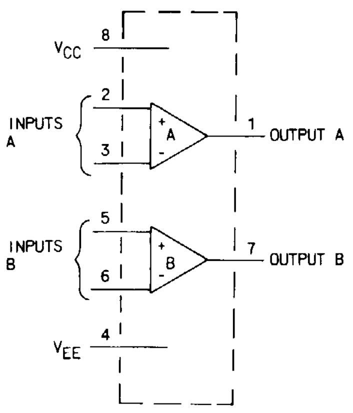
3.2 Testing

The test procedures in table 2 check total performance of the filter card. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

4. ALIGNMENT/ADJUSTMENT

4.1 Filter Amplifier Gain Adjustment

a. Set front-panel MODE switch to AM and BANDWIDTH switch to 16. Set AGC switch to FAST.
b. Measure signal at channel A if J1 with no receive input signal.

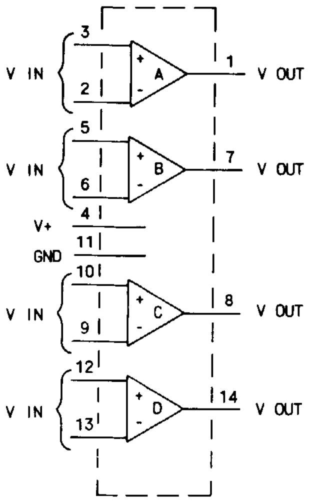


CHARACTERISTICS
SUPPLY VOLTAGE: V_{CC} +18 V DC MAX
V_{EE} -18 V DC MAX
INPUT DIFF VOLTAGE: ±30 V MAX
INPUT COMMON MODE VOLTAGE:
±15 V MAX ①
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ②
INPUT RESISTANCE: 300 kΩ MIN, 2.0 MΩ MAX
OUTPUT RESISTANCE: 75Ω TYPICAL
VOLTAGE GAIN: 15 MIN

NOTES:
① FOR SUPPLY VOLTAGE LESS THAN ±15.0 V, MAX INPUT VOLTAGE EQUAL TO SUPPLY VOLTAGE.
② SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2285-013

Dual Operational Amplifier 351-1071-070
Figure 2



CHARACTERISTICS

SUPPLY VOLTAGE (V+): 32 V DC MAX
INPUT DIFF VOLTAGE: 32 V DC MAX
INPUT COMMON MODE VOLTAGE: V+ (-1.5 V DC)
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ⟨1⟩
VOLTAGE GAIN: 25 MIN

NOTE:
⟨1⟩ SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2289-013

Quad Operational Amplifier 351-1141-030
Figure 3

4.1.1 AM Filters

a. Connect receive input of 9.4500 MHz to channel A if.
b. Set receive signal to 50 μV (9.4500 MHz). Find a passband response minimum between 9.4493 and 9.4489 MHz at channel A if J4. Measure voltage gain between channel A if J1 and J4; should be 8.2 ±2.0 dB.
c. Set front-panel BANDWIDTH switch to position associated with filter being gain adjusted (refer to table 3).
d. Find a passband response minimum between 9.4493 and 9.4489 MHz at channel A if J4. Measure voltage gain between channel A if J1 and J4; should be 8.2 ±2.0 dB. Select value of gain adjust resistor shown in table 3. (200 through 750 Ω) to give a voltage gain of 8.2 ±2.0 dB.

4.1.2 LSB Filter

a. Connect receive input of 9.4517 MHz to channel A if.
b. Set receive signal to 50 μV (9.4517 MHz). Find a passband response minimum between 9.4507 and 9.4511 MHz at channel A if J4. Measure voltage gain between channel A if J1 and J4. Should be 8.2 ±2.0 dB.
c. Set front-panel BANDWIDTH switch to position associated with filter being gain adjusted (refer to table 3).
d. Find a passband response minimum between 9.4507 and 9.4511 MHz at channel A if J4. Measure voltage gain between channel A if J1 and J4. Should be 8.2 ±2.0 dB. Select value of gain adjust resistor shown in table 3 (200 through 750 Ω) to give a voltage gain of 8.2 ±2.0 dB.

4.1.3 USB Filters

a. Connect receive input of 9.4490 MHz to channel A if.
b. Set receive signal to 50 μV (9.4490 MHz). Find a passband response minimum between 9.44 and 9.44 MHz at channel A if J4. Should be 8.2 ±2.0 dB. Note this level for reference.
c. Set front panel BANDWIDTH switch to position associated with filter being adjusted (refer to table 3).
d. Find a passband response minimum between 944 and 9.44 MHz at channel A if J4. Measure voltage gain between channel A if J1 and J4. This should

Table 2. Filter, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing the control that is to be tested.		
	b. Remove channel A if (with filter installed).		
	c. Remove filter from channel A if.		
	d. Test channel A if.		
	e. When channel A if operation is verified mount filter on channel A if. Install channel A if with filter on an extender card and place it in the unit.		
	f. Set unit LINE SELECTOR switch to 115 V.		
	g. Connect unit to 115-V ac power source and set power on.		
	h. Measure dc voltages between the following pins and ground (P8-6, 7; P9-5, 6; or P10-2, 5):		
	P9-4 P9-2	+15 ±1.0 V dc. -10 ±1.0 V dc.	Check associated power supply.
2. 2.75-kHz LSB filter measurement	**Note** This test applies only to 2.75-kHz LSB filter (526-9956-010).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to LSB.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4517 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.450250 MHz.	Check FL2, Q9, Q10, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.453000 MHz.	Check FL2, Q9, Q10, and associated circuit.

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. 6-kHz AM filter measurement	**Note** This test applies only to 6-kHz AM filter (526-9963-060).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to A. **Note** If 6-kHz filter is in any filter slot other than A, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.447000 MHz.	Check FL3, Q11, Q12, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.453000 MHz	Check FL3, Q11, Q12, and associated circuit.
4. 3-kHz AM filter measurement	**Note** This test applies only to 3-kHz AM filter (526-9963-040).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to B. **Note** If 3-kHz filter is in any filter slot other than B, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
(Cont)	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448500 MHz.	Check FL4, Q1, Q2, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.451500 MHz.	Check FL4, Q1, Q2, and associated circuit.
5. 1.0-kHz AM filter measurement	*Note* This test applies only to 1.0-kHz AM filter (526-9963-030).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to C. *Note* If 1.0-kHz filter is in any filter slot other than C, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.449500 MHz.	Check FL4, Q3, Q4, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.450500 MHz.	Check FL5, Q3, Q4, and associated circuit.
5A. 1.0-kHz USB filter measurement	*Note* This test applies only to 1.0-kHz USB filter (526-9974-030).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to C. *Note* If 1.0-kHz filter is in any filter slot other than C, set BANDWIDTH switch to that position.		
(Cont)	b. Set AGC switch to OFF.		

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5A. (Cont)	c. Set receive input at channel A if J2 for 9.4490 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448500 MHz.	Check FL4, Q3, Q4, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.449500 MHz.	Check FL5, Q3, Q4, and associated circuit.
6. 0.5-kHz AM filter measurement	*Note* This test applies only to 0.5-kHz AM filter (526-9963-020).		
	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to D.		
	Note If 0.5-kHz filter is in any filter slot other than D, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.449750 MHz.	Check FL6, Q5, Q6, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.450250 MHz.	Check FL6, Q5, Q6, and associated circuit.
6A. 0.5-kHz USB filter measurement	*Note* This test applies only to 0.5-kHz USB filter (526-9974-020).		
(Cont)	a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to D.		

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6A. (Cont)	**Note** If 0.5-kHz filter is in any filter slot other than D, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4490 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448750 MHz.	Check FL6, Q5, Q6, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.449250 MHz.	Check FL6, Q5, Q6, and associated circuit.
7. 0.2-kHz AM filter measurement	**Note** This test applies only to 0.2-kHz AM filter (526-9963-010).		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to E.		
	Note If 0.2-kHz filter is in any filter slot other than E, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.449900 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.450100 MHz.	Check FL7, Q7, Q8, and associated circuit.

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7A. 0.2-kHz USB filter measurement	**Note** This test applies only to 0.2-kHz USB filter (526-9974-010).		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to E. **Note** If 0.2-kHz filter is in any filter slot other than E, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4490 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448900 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.449100 MHz.	Check FL7, Q7, Q8, and associated circuit.
8. 0.1-kHz AM filter measurement	**Note** This test applies only to 0.1-kHz AM filter (293-1333-010).		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to E. **Note** If 0.1-kHz filter is in any filter slot other than E, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
(Cont)	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.449950 MHz.	Check FL7, Q7, Q8, and associated circuit.

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.450050 MHz.	Check FL7, Q7, Q8, and associated circuit.
9. 0.37-kHz USB filter measurement	**Note** This test applies only to 0.37-kHz USB filter (526-9999-010).		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to E. **Note** If 0.37-kHz filter is in any filter slot other than E, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4483 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448115 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.448485 MHz.	Check FL7, Q7, Q8, and associated circuit.
10. 5.0-kHz AM filter measurement	**Note** This test applies only to 5.0-kHz AM filter (526-8323-010).		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to E. **Note** If 5.0-kHz filter is in any filter slot other than E, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4500 MHz.		
(Cont)	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference	

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.447500 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.452500 MHz.	Check FL7, Q7, Q8, and associated circuit.
11. 0.25-kHz USB filter measurement	Note This test applies only to 0.25-kHz USB filter 526-8322-010.		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to A.		
	Note If 0.25-kHz filter is in any filter slot other than A, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4489 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if.J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448750 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.449000 MHz.	Check FL7, Q7, Q8, and associated circuit.
11A. 0.25-kHz LSB filter measurement	Note This test applies only to 0.25-kHz LSB filter 526-8321-010.		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to D.		
	Note If 0.25-kHz filter is in any filter slot other than D, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
(Cont)	c. Set receive input at channel A if J2 for 9.4511 MHz.		

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11A. (Cont)	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.451000 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.451250 MHz.	Check FL7, Q7, Q8, and associated circuit.
12. 0.7-kHz USB filter measurement	**Note** This test applies only to 0.7-kHz USB filter 526-8322-020.		
	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to B. **Note** If 0.7-kHz filter is in any filter slot other than B, set BANDWIDTH switch to that position.		
	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4487 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.448375 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.449075 MHz.	Check FL7, Q7, Q8, and associated circuit.
12A. 0.7-kHz LSB filter measurement	**Note** This test applies only to 0.7-kHz LSB filter 526-8321-020.		
(Cont)	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to D. **Note** If 0.7-kHz filter is in any filter slot other than D set BANDWIDTH switch to that position.		

Table 2. Filter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12A. (Cont)	b. Set AGC switch to OFF.		
	c. Set receive input at channel A if J2 for 9.4513 MHz.		
	d. Using an rf voltmeter, measure rf voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4.	Reference.	
	e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NMT 9.450925 MHz.	Check FL7, Q7, Q8, and associated circuit.
	f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note input frequency.	NLT 9.451625 MHz.	Check FL7, Q7, Q8, and associated circuit.

Table 3. Filter Amplifier Gain/Passband Component Selection.

BANDWIDTH SWITCH POSITION	FILTER	GAIN ADJUST	PASSBAND TRIM CAPACITORS
LSB	FL2	R31	C31, C34, C58, C64
A	FL3	R38	C38, C41, C59, C65
B	FL4	R3	C3, C6, C54, C60
C	FL5	R10	C10, C13, C55, C61
D	FL6	R17	C17, C20, C56, C62
E	FL7	R24	C24, C27, C57, C63

be 8.2 ±2.0 dB. Select value of gain adjust resistor shown in table 3 (330 thru 1500 Ω) to give a voltage gain equal to 8.2 ±2.0 dB.

4.2 Filter Passband Measurement

a. Set front-panel MODE switch to SSB/CW and BANDWIDTH switch to position associated with filter having it passband measured (refer to table 3).
b. Set AGC switch to OFF.
c. Set receive input at channel A if J2 for receive if input frequency shown in table 4.
d. Using an rf voltmeter, measure voltage at channel A if J4. Adjust receive input level and frequency for a 70-mV peak reading at channel A if J4. Note this level for reference.
e. Adjust input frequency down until rf voltage at channel A if J4 is 3 dB below level of step d. Note the input frequency. If more than the lower 3 dB frequency of the applicable filter in table 4, select value of associated passband adjust capacitors (refer to table 3) until the lower 3-dB frequency is not more than that listed in table 4.
f. Adjust input frequency up until rf voltage at channel A if J4 is 3 dB below level of step d. Note the input frequency. If less than the upper 3 dB frequency of the applicable filter in table 4, select value of associated passband adjust capacitors (refer to table 3) until the upper 3-dB frequency is not less than that listed in table 4.

Table 4. Filter Passband Frequencies.

FILTER PASSBAND	RECEIVE IF INPUT	LOWER 3 dB (NMT)	UPPER 3 dB (NLT)
LSB 2.75 kHz	9.4517 MHz	9.450250 MHz	9.453000 MHz
AM 6 kHz	9.4500 MHz	9.447000 MHz	9.453000 MHz
AM 3 kHz	9.4500 MHz	9.448500 MHz	9.451500 MHz
AM 1 kHz	9.4500 MHz	9.449500 MHz	9.450500 MHz
USB 1 kHz	9.4490 MHz	9.448500 MHz	9.449500 MHz
AM 0.5 kHz	9.4500 MHz	9.449750 MHz	9.450250 MHz
USB 0.5 kHz	9.4490 MHz	9.448750 MHz	9.449250 MHz
AM 0.2 kHz	9.4500 MHz	9.449900 MHz	9.450100 MHz
USB 0.2 kHz	9.4490 MHz	9.448900 MHz	9.449100 MHz
AM 0.1 kHz	9.4500 MHz	9.449950 MHz	9.450050 MHz
USB 0.37 kHz	9.4483 MHz	9.448115 MHz	9.448485 MHz
AM 5 kHz	9.4500 MHz	9.447500 MHz	9.452500 MHz
USB 0.25 kHz	9.4489 MHz	9.448750 MHz	9.449000 MHz
LSB 0.25 kHz	9.4511 MHz	9.451000 MHz	9.451250 MHz
USB 0.7 kHz	9.4487 MHz	9.448375 MHz	9.449075 MHz
LSB 0.7 kHz	9.4513 MHz	9.450925 MHz	9.451625 MHz

4.3 CW Mode Strapping

Input to enable CW mode filter is strapped as required for special applications. If FL8 (16-kHz passband) is to be used, CW mode diode strapping is not required. Refer to table 5 for strap-filter selection for CW mode.

Table 5. CW Mode Strapping.

INPUT	ANODE STRAP	DIODE	CATHODE STRAP	FILTER SELECTED
P8-1	E1	CR11	E2	FL4
			E3	FL5
			E4	FL6
			E5	FL7

5. REPAIR

Repair of the filter card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

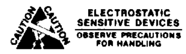
6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in the identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figures 4 and 5). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applied to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

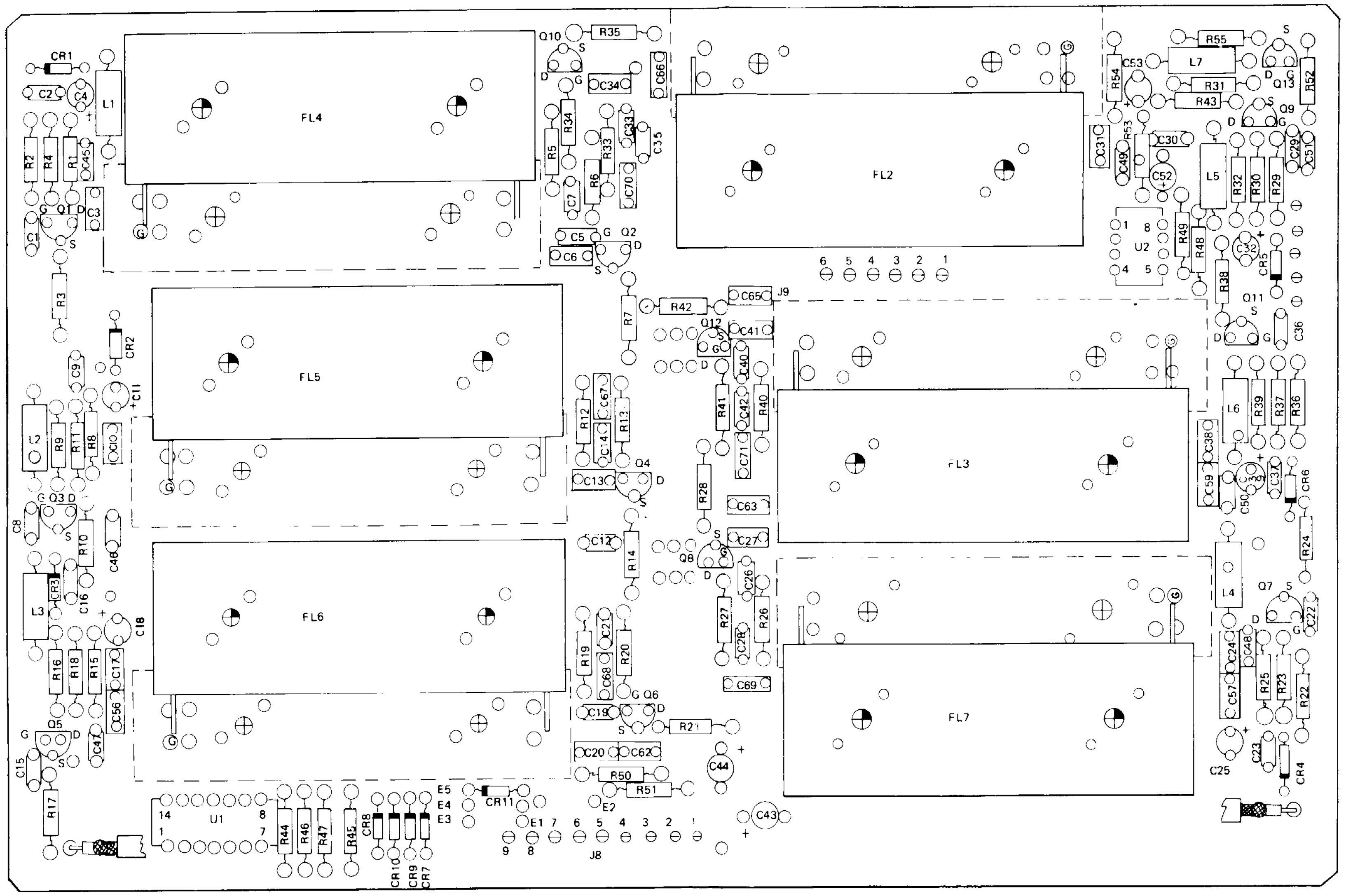
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
81349	MILITARY SPECIFICATION
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Filter	637-2515-001	REV L
Filter	637-2515-002	REV L
Filter	637-2515-003	REV L
Filter	637-2515-004	REV J
Filter	637-2515-005	REV L
Filter	637-2515-006	REV L
Filter	637-2515-007	REV J
Filter	637-2515-008	REV L
Filter	637-2515-009	REV J
Filter	637-2515-010	REV J
Filter	637-2515-011	REV K
Filter	637-2515-012	REV L
Filter	637-2515-013	REV —
Filter board	635-0905-001	REV —
Filter board	635-0905-002	REV —
Resistor, test select	638-1468-001	REV A



TP5-4945-019

ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

Filter, Schematic Diagram
Figure 4 (Sheet 1 of 4)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FILTER	637-2515-001	A		
	FILTER	637-2515-002	B		
	FILTER	637-2515-003	C		
	FILTER	637-2575-005	D		
	FILTER	637-2515-006	E		
	FILTER	637-2515-008	F		
	FILTER	637-2515-009	G		
	FILTER	637-2515-010	H		
	FILTER	637-2515-011	J		
	FILTER	637-2515-012	K		
	FILTER	637-2515-013	L		
CR1-CR10	NOT USED				
CR11	SEMICOND DEVICE	353-3644-010	B	03508	1N4454GE
C1,C2	NOT USED				
C3	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	A,C,D,E	93790	CD5FY361J0
C3	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	K	93790	CD5FY111J0
C3	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	L	93790	CD5FY101J0
C4,C5	NOT USED				
C6	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	A,C,D,E	93790	CD5FY361J0
C6	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	K	93790	CD5FY111J0
C6	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	L	93790	CD5FY101J0
C7-C9	NOT USED				
C10	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	A,C,D,E G,J	93790	CD5FY111J0
C10	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 50V	912-4141-470	K	93790	CD5FY271J0
C10	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	L	93790	CD5FY101J0
C11,C12	NOT USED				
C13	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	A,C,D,E G,J	93790	CD5FY111J0
C13	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 50V	912-4141-470	K	93790	CD5FY271J0
C13	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	L	93790	CD5FY101J0
C14-C16	NOT USED				
C17	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 50V	912-4141-470	A,D,E	93790	CD5FY271J0
C17	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	C,K	93790	CD5FY101J0
C17	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300	L	93790	CD5EY510J0
C18,C19	NOT USED				
C20	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 50V	912-4141-470	A,D,E	93790	CD5FY271J0
C20	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	C,K	93790	CD5FY101J0
C20	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300	L	93790	CD5EY510J0
C21-C23	NOT USED				
C24	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430	A,B,C,D G,J,K	93790	CD5FY181J0
C24	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V (A2)	912-4141-430	F	93790	CD5FY181J0
C24	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450	F	93790	CD5FY221J0
C24	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	L	93790	CD5FY361J0
C25,C26	NOT USED				
C27	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430	A,B,C,D G,J,K	93790	CD5FY181J0
C27	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V (A2)	912-4141-430	F	93790	CD5FY181J0
C27	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450	F	93790	CD5FY221J0
C27	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	L	93790	CD5FY361J0
C28-C30	NOT USED				
C31	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030	D,G,K	93790	CD5EC220D0
C32,C33	NOT USED				
C34	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030	D,G,K	93790	CD5EC220D0
C35-C37	NOT USED				
C38	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	A,B,C,D E,H,J,K	93790	CD5FY361J0
C38	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300	L	93790	CD5EY510J0
C39,C40	NOT USED				
C41	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 50V	912-4141-510	A,B,C,D E,H,J	72136	DM5F391J050WV
C41	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	K	93790	CD5FY361J0
C41	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300	L	93790	CD5EY510J0
C42-C55	NOT USED				
C56	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400	C	93790	CD5FY151J0
C56	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	K	93790	CD5FY101J0
C57	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	L	93790	CD5FY111J0
C58	NOT USED				
C59	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 50V	912-4141-510	A,B,C,D E,J	72136	DM5F391J050WV
C59	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	H	93790	CD5FY361J0
C60,C61	NOT USED				
C62	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400	C	93790	CD5FY151J0
C62	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	K	93790	CD5FY101J0
C63	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370	L	93790	CD5FY111J0
C64	NOT USED				
C65	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500	A,B,C,D E,J	93790	CD5FY361J0
C65	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 50V	912-4141-510	H	72136	DM5F391J050WV
FL1	NOT USED				
FL2	FILTER,BANDPASS, 2.75KHZ, LSB	526-9956-010	D,G,K		526-9956-010
FL3	FILTER,BANDPASS, 6KHZ, AM	526-9963-060	A,B,C,D E,H,J		
FL3	FILTER,BANDPASS, 0.3KHZ, AM	526-9963-090	K		
FL3	FILTER,BANDPASS, 0.25KHZ, USB	526-8322-010	L		
FL4	FILTER,BANDPASS, 3KHZ, AM	526-9963-040	A,C,D,E K		
FL4	FILTER,BANDPASS, 0.7KHZ, USB	526-8322-020	L		
FL5	FILTER,BANDPASS, 1KHZ, AM	526-9963-030	A,D,E,G J,K		
FL5	FILTER,BANDPASS, 1KHZ, USB	526-9974-030	C		
FL5	FILTER,BANDPASS, 0.7KHZ, LSB	526-8321-020	L		
FL6	FILTER,BANDPASS, 0.5KHZ, AM	526-9963-020	A,D,E,K		
FL6	FILTER,BANDPASS, 0.5KHZ, USB	526-9974-020	C		
FL6	FILTER,BANDPASS, 0.25KHZ, LSB	526-8321-010	L		
FL7	FILTER,BANDPASS, 0.2KHZ, AM	526-9963-010	A,D,G,J K		
FL7	FILTER,BANDPASS, 0.2KHZ, USB	526-9974-010	B,C		
FL7	FILTER,BANDPASS, 0.1KHZ, AM	293-1333-010	E	00136	28489
FL7	FILTER,BANDPASS, 0.37KHZ, USB	526-9999-010	F		
FL7	FILTER,BANDPASS, 5KHZ, AM	526-8323-010	L		
R1-R6	NOT USED				
R7	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	A,C,D,E	81349	RCR07G681JS
R7	RESISTOR,FXD CMPSN, 560 OHMS, 5%, 1/4W	745-0739-000	K	81349	RCR07G561JS
R7	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000	L	81349	RCR07G511JS
R8-R13	NOT USED				
R14	RESISTOR,FXD CMPSN, 560 OHMS, 5%, 1/4W	745-0739-000	A,C,D,E G,J	81349	RCR07G561JS
R14	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	K	81349	RCR07G681JS
R14	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000	L	81349	RCR07G511JS
R15-R20	NOT USED				
R21	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W (A3)	745-0738-000	A,D,E	81349	RCR07G511JS
R21	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	A,D,E	81349	RCR07G681JS
R21	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000	C,L	81349	RCR07G511JS
R21	RESISTOR,FXD CMPSN, 430 OHMS, 5%, 1/4W	745-0735-000	K	81349	RCR07G431JS
R22-R27	NOT USED				
R28	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (A4)	745-0737-000	A,B,C,D F,G	81349	RCR07G471KS
R28	RESISTOR,FXD CMPSN, 620 OHMS, 5%, 1/4W	745-0741-000	A,B,C,D F,G	81349	RCR07G621JS
R28	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (A5)	745-0737-000	E	81349	RCR07G471KS
R28	RESISTOR,FXD CMPSN, 820 OHMS, 5%, 1/4W	745-0745-000	E	81349	RCR07G821JS
R28	RESISTOR,FXD CMPSN, 620 OHMS, 5%, 1/4W	745-0741-000	J,K	81349	RCR07G621JS
R28	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000	L	81349	RCR07G511JS
R29-R34	NOT USED				
R35	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (A6)	745-0737-000	D,G	81349	RCR07G471KS
R35	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	D,G	81349	RCR07G681JS
R35	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	K	81349	RCR07G681JS
R36-R41	NOT USED				
R42	RESISTOR,FXD CMPSN, 430 OHMS, 5%, 1/4W	745-0735-000	A,B,C,D E,H,J	81349	RCR07G431JS
R42	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	K	81349	RCR07G681JS
1 R7,R14, R21,R28, R35,R42	RESISTOR, TEST SELECT	638-1468-001			
	RESISTOR,FXD CMPSN, 200 OHMS, 5%, 1/4W	745-0723-000		81349	RCR07G201JS
	RESISTOR,FXD CMPSN, 220 OHMS, 5%, 1/4W	745-0724-000		81349	RCR07G221JS
	RESISTOR,FXD CMPSN, 240 OHMS, 5%, 1/4W	745-0726-000		81349	RCR07G241JS
	RESISTOR,FXD CMPSN, 270 OHMS, 5%, 1/4W	745-0727-000		81349	RCR07G271JS
	RESISTOR,FXD CMPSN, 300 OHMS, 5%, 1/4W	745-0729-000		81349	RCR07G301JS
	RESISTOR,FXD CMPSN, 330 OHMS, 5%, 1/4W	745-0730-000		81349	RCR07G331JS
	RESISTOR,FXD CMPSN, 360 OHMS, 5%, 1/4W	745-0732-000		81349	RCR07G361JS
	RESISTOR,FXD CMPSN, 390 OHMS, 5%, 1/4W	745-0733-000		81349	RCR07G391JS
	RESISTOR,FXD CMPSN, 430 OHMS, 5%, 1/4W	745-0735-000		81349	RCR07G431JS
	RESISTOR,FXD CMPSN, 470 OHMS, 5%, 1/4W	745-0736-000		81349	RCR07G471JS
	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
	RESISTOR,FXD CMPSN, 560 OHMS, 5%, 1/4W	745-0739-000		81349	RCR07G561JS
	RESISTOR,FXD CMPSN, 620 OHMS, 5%, 1/4W	745-0741-000		81349	RCR07G621JS
	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000		81349	RCR07G681JS
	RESISTOR,FXD CMPSN, 750 OHMS, 5%, 1/4W	745-0744-000		81349	RCR07G751JS
	RESISTOR,FXD CMPSN, 820 OHMS, 5%, 1/4W (A1)	745-0745-000		81349	RCR07G821JS
	RESISTOR,FXD CMPSN, 910 OHMS, 5%, 1/4W (A1)	745-0747-000		81349	RCR07G911JS
	RESISTOR,FXD CMPSN, 1K, 5%, 1/4W (A1)	745-0748-000		81349	RCR07G102JS
R42	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000	L	81349	RCR07G511JS
	CIRCUIT CARD ASSY	635-0905-001			
CR1-CR10	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C2	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C3	NOT USED				
C4	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C5	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C6	NOT USED				
C7	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C8	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C9	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C10	NOT USED				
C11	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C12	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C13	NOT USED				
C14	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C15	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C16	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C17	NOT USED				
C18	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C19	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C20	NOT USED				
C21	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C22	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C23	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C24	NOT USED				
C25	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C26	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C27	NOT USED				
C28	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C29	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C30	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C31	NOT USED				
C32	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C33	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C34	NOT USED				
C35	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C36	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C37	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C38	NOT USED				
C39	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C40	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C41	NOT USED				
C42	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C43,C44	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 35V	184-9102-800		56289	199D155X0035BE3
C45-C51	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C52	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 35V	184-9102-800		56289	199D155X0035BE3
C53	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C54-C65	NOT USED				
C66-C71	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
L1-L3	INDUCTOR, SHIELDED, 5600UH	637-3767-001			637-3767-001
L4-L6	COIL,RF 5600UH	240-2715-580		96906	MS75089-32
L7	COIL,RF 560UH	240-2715-460		96906	MS75089-20
Q1-Q13	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
R1	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R2	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R3	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R4	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R5	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R6	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R7	NOT USED				
R8	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R9	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821~~-000~~		81349	RCR07G104KS
R10	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R11	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R12	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R13	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R14	NOT USED				
R15	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R16	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R17	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R18	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R19	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R20	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R21	NOT USED				
R22	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R23	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R24	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R25	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R26	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R27	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R28	NOT USED				
R29	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R30	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R31	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R32	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R33	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R34	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R35	NOT USED				
R36	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R37	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R38	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R39	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R40	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R41	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R42	NOT USED				
R43	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R44-R49	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R50	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R51	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R52	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R53	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R54	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R55	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
U1	AMPLIFIER,QUAD	351-1141-030		12040	LM324N
U2	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC

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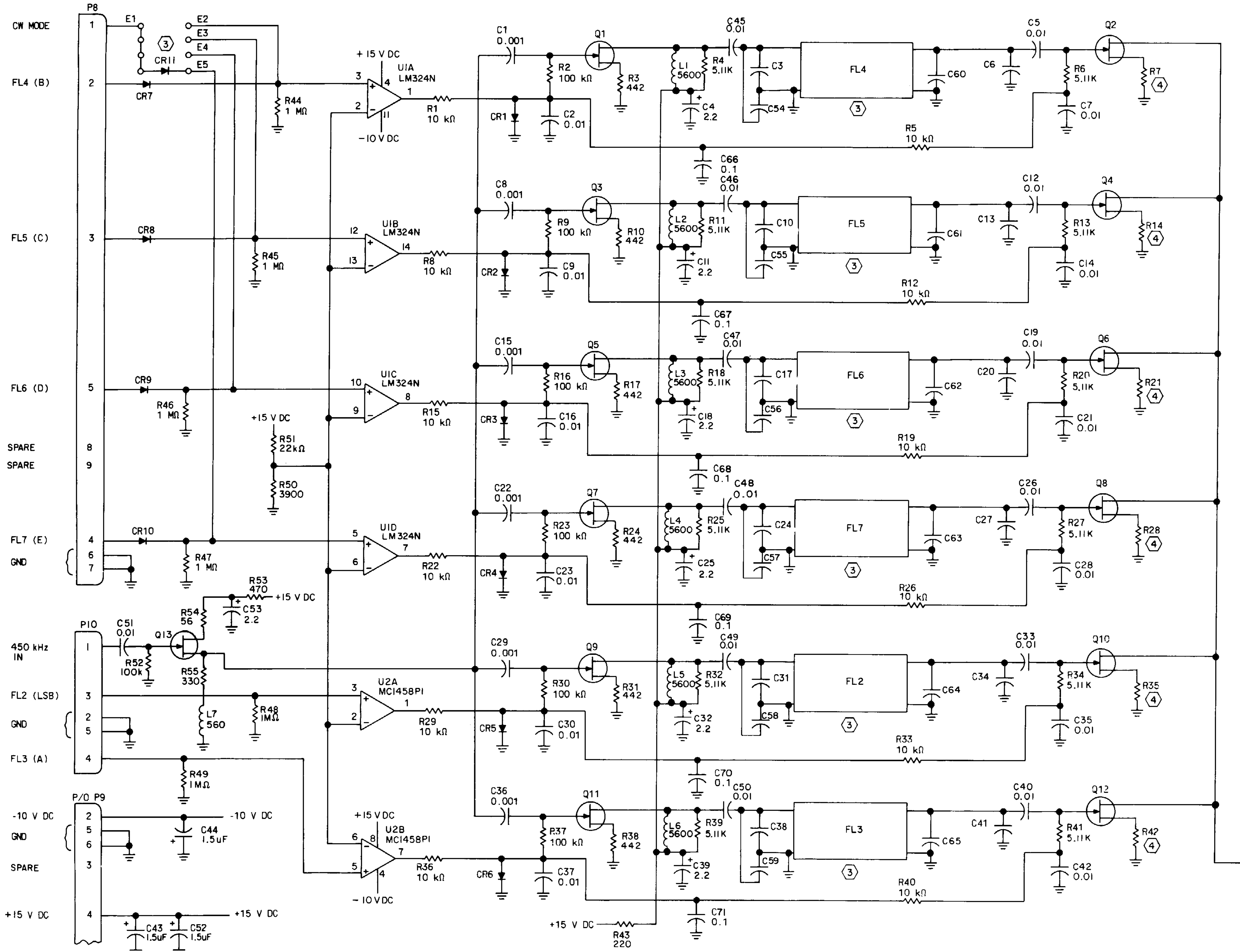
1 USED IF FILTER SECTION DOES NOT MEET SPECIFICATIONS/GAIN

Filter, Schematic Diagram
Figure 4 (Sheet 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS. DIODES ARE TYPE 1N4454, AND FETS ARE TYPE SPF557.

② PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATIONS

③ THE FOLLOWING COMPONENTS ARE PART OF ASSEMBLY 637-2515-XXX
FL2 FL7
C3, 6, 10, 13, 17, 20; 24, 27, 31, 34, 38, 41
C54-65
R7, 14, 21, 28, 35, 42
CR11

④ TEST SELECT RESISTOR 637-1468-001 MAY BE USED AS REQUIRED BY PRODUCTION A1 TEST METHOD

⑤ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

⑥ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

③

REF DES	637-2515-( )										
	-001	-002	-003	-005	-006	-008	-009	-010	-011	-012	-013
CR11	NA	E1-E5	NA	NA	NA	NA	NA	NA	NA	NA	NA
FL4	3 kHz AM	NA	3 kHz AM	3 kHz AM	3 kHz AM	NA	NA	NA	NA	1 kHz AM	0.7 kHz USB
C3	360 pF	NA	360 pF	360 pF	360 pF	NA	NA	NA	NA	110 pF	
C6	360 pF	NA	360 pF	360 pF	360 pF	NA	NA	NA	NA	110 pF	
C54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
C60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
R7	680	NA	680	680	680	NA	NA	NA	NA	560	510
FL5	1 kHz AM	NA	1 kHz USB	1 kHz AM	1 kHz AM	NA	1 kHz AM	NA	1 kHz AM	0.5 kHz AM	0.7 kHz LSB
C10	110 pF	NA	110 pF	110 pF	110 pF	NA	110 pF	NA	110 pF	270 pF	
C13	110 pF	NA	110 pF	110 pF	110 pF	NA	110 pF	NA	110 pF	270 pF	
C55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
C61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
R14	560	NA	560	56C	560	NA	560	NA	560	680	510
FL6	0.5 kHz AM	NA	0.5 kHz USB	0 5 kHz AM	0.5 kHz AM	NA	NA	NA	NA	0.3 kHz AM	0.25 kHz LSB
C17	270 pF	NA	100 pF	270 pF	270 pF	NA	NA	NA	NA	100 pF	
C20	270 pF	NA	100 pF	270 pF	270 pF	NA	NA	NA	NA	100 pF	
C56	NA	NA	150 pF	NA	NA	NA	NA	NA	NA	100 pF	
C62	NA	NA	150 pF	NA	NA	NA	NA	NA	NA	100 pF	
A3 R21	680	NA	510	680	680	NA	NA	NA	NA	430	510
FL7	0 2 kHz AM	0.2 kHz USB	C.2 kHz USB	0.2 kHz AM	0.1 kHz AM	0.37 kHz USB	0.2 kHz USB	NA	0.2 kHz AM	0.2 kHz AM	5 kHz AM
C24	180 pF	180 pF	180 pF	180 pF	NA	220 pF A2	180 pF	NA	180 pF	180 pF	
C27	180 pF	180 pF	180 pF	180 pF	NA	220 pF	180 pF	NA	180 pF	180 pF	
C57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
C63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
A4 R28	620	620	620	620	820 A5	620	620	NA	620	620	510
FL2	NA	NA	NA	2.75 kHz LSB	NA	NA	2.75 kHz LSB	NA	NA	2.75 kHz LSB	NA
C31	NA	NA	NA	22 pF	NA	NA	22 pF	NA	NA	22 pF	NA
C34	NA	NA	NA	22 pF	NA	NA	22 pF	NA	NA	22 pF	NA
C58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A6 R35	NA	NA	NA	680	NA	NA	680	NA	NA	680	NA
FL3	6 kHz AM	6 kHz AM	6 kHz AM	6 kHz AM	6 kHz AM	NA	NA	6 kHz AM	6 kHz AM	3 kHz AM	0.25 kHz USB
C38	360 pF	360 pF	360 pF	360 pF	360 pF	NA	NA	360 pF	360 pF	360 pF	
C41	390 pF	390 pF	390 pF	390 pF	390 pF	NA	NA	390 pF	390 pF	360 pF	
C59	390 pF	390 pF	390 pF	390 pF	390 pF	NA	NA	390 pF	390 pF	NA	
C65	360 pF	360 pF	360 pF	360 pF	360 pF	NA	NA	360 pF	360 pF	NA	
R42	430	430	430	430	430	NA	NA	430	430	680	510

LAST USED
R55, C71, CR11, U2, Q13, L7

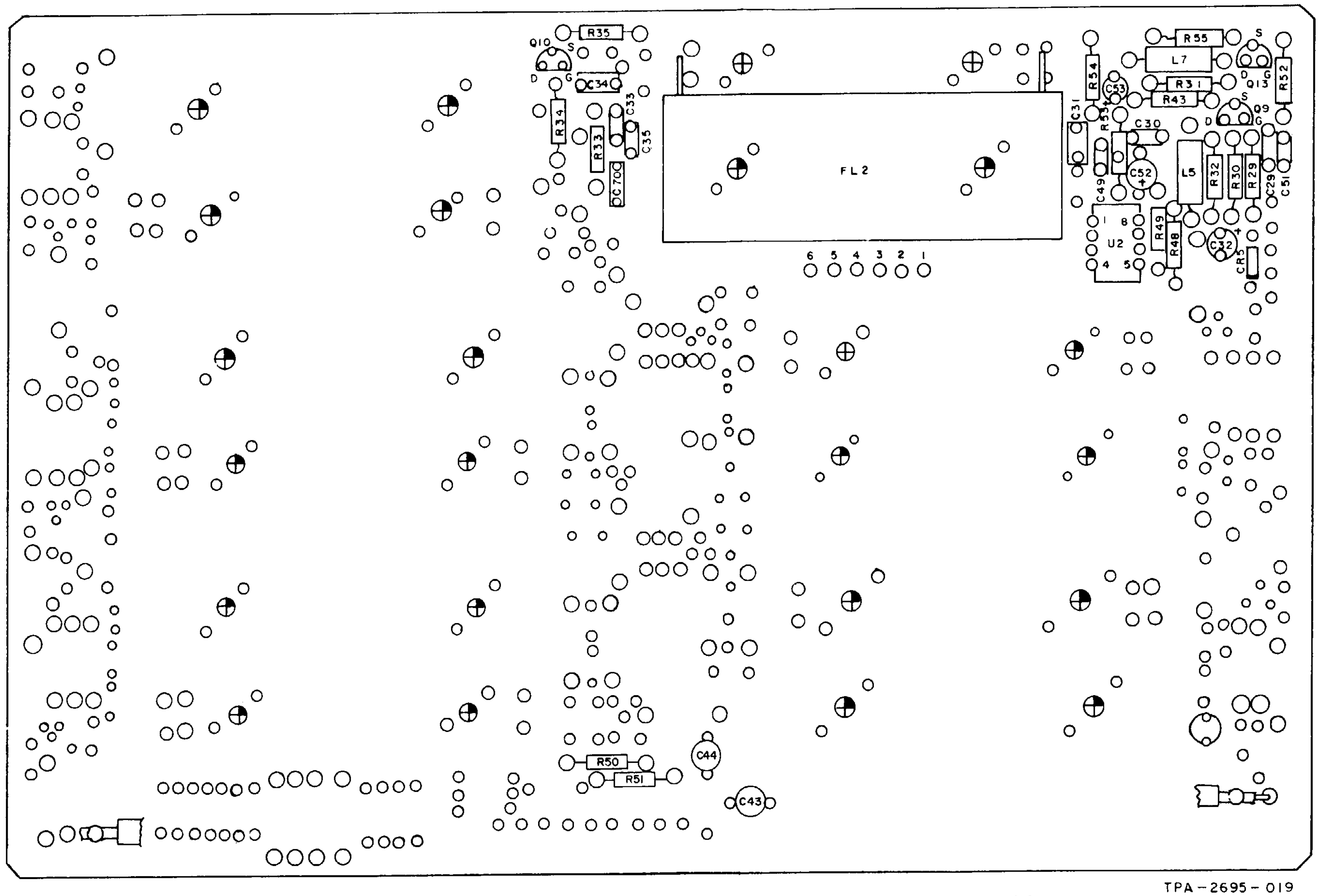
635-0441-001

Filter, Schematic Diagram
Figure 4 (Sheet 3)

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Added 820 Ω, 910 Ω, and 1 kΩ resistors to list of test selects.	638-1468-001, REV A and above.
A2	Changed C24 and C27 from 180 pF to 220 pF.	637-2515-008, REV H and above.
A3	Changed R21 from 510 Ω to 680 Ω.	637-2515-001, -005, -006 REV J and above.
A4	Changed R28 from 470 Ω to 620 Ω.	637-2515-001, -002, -003, -005, -008, -009 REV J and above.
A5	Changed R28 from 470 Ω to 820 Ω.	637-2515-006, REV J and above.
A6	Changed R35 from 470 Ω to 680 Ω.	637-2515-005, -009 REV J and above.
None	Corrected schematic values of C45 through C51.	All units.

Filter, Schematic Diagram
Figure 4 (Sheet 4)



CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

Filter (637-2515-004, -007), Schematic Diagram
Figure 5 (Sheet 1 of 3)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FILTER	637-2515-004	A		
	FILTER	637-2515-007	B		
C1-C30	NOT USED				
C31	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030	A	93790	CD5EC220D0
C31	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430	B	93790	CD5FY181J0
C32,C33	NOT USED				
C34	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030	A	93790	CD5EC220D0
C34	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430	B	93790	CD5FY181J0
FL1	NOT USED				
FL2	FILTER, BANDPASS, 2.75KHZ, LSB	526-9956-010	A		526-9956-010
FL2	FILTER, BANDPASS 0.2KHZ, AM	526-9974-010	B		
R1-R34	NOT USED				
R35	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (A6)	745-0737-000	A	81349	RCR07G471KS
R35	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000	A	81349	RCR07G681JS
R35	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (A7)	745-0737-000	B	81349	RCR07G471KS
R35	RESISTOR,FXD CMPSN, 620 OHMS, 5%, 1/4W	745-0741-000	B	81349	RCR07G621JS
R35	RESISTOR, TEST SELECT	638-1468-001			
	RESISTOR,FXD CMPSN, 200 OHMS, 5%, 1/4W	745-0723-000		81349	RCR07G201JS
	RESISTOR,FXD CMPSN, 220 OHMS, 5%, 1/4W	745-0724-000		81349	RCR07G221JS
	RESISTOR,FXD CMPSN, 240 OHMS, 5%, 1/4W	745-0726-000		81349	RCR07G241JS
	RESISTOR,FXD CMPSN, 270 OHMS, 5%, 1/4W	745-0727-000		81349	RCR07G271JS
	RESISTOR,FXD CMPSN, 300 OHMS, 5%, 1/4W	745-0729-000		81349	RCR07G301JS
	RESISTOR,FXD CMPSN, 330 OHMS, 5%, 1/4W	745-0730-000		81349	RCR07G331JS
	RESISTOR,FXD CMPSN, 360 OHMS, 5%, 1/4W	745-0732-000		81349	RCR07G361JS
	RESISTOR,FXD CMPSN, 390 OHMS, 5%, 1/4W	745-0733-000		81349	RCR07G391JS
	RESISTOR,FXD CMPSN, 430 OHMS, 5%, 1/4W	745-0735-000		81349	RCR07G431JS
	RESISTOR,FXD CMPSN, 470 OHMS, 5%, 1/4W	745-0736-000		81349	RCR07G471JS
	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
	RESISTOR,FXD CMPSN, 560 OHMS, 5%, 1/4W	745-0739-000		81349	RCR07G561JS
	RESISTOR,FXD CMPSN, 620 OHMS, 5%, 1/4W	745-0741-000		81349	RCR07G621JS
	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/4W	745-0742-000		81349	RCR07G681JS
	RESISTOR,FXD CMPSN, 750 OHMS, 5%, 1/4W	745-0744-000		81349	RCR07G751JS
	RESISTOR,FXD CMPSN, 820 OHMS, 5%, 1/4W (A1)	745-0745-000		81349	RCR07G821JS
	RESISTOR,FXD CMPSN, 910 OHMS, 5%, 1/4W (A1)	745-0747-000		81349	RCR07G911JS
	RESISTOR,FXD CMPSN, 1K, 5%, 1/4W (A1)	745-0748-000		81349	RCR07G102JS
	CIRCUIT CARD ASSY	635-0905-002			
	CIRCUIT CARD ASSY	635-0905-002			
CR1-CR4	NOT USED				
CR5	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1-C28	NOT USED				
C29	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C30	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C31	NOT USED				
C32	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C33	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C34	NOT USED				
C35	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C36-C42	NOT USED				
C43,C44	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 35V	184-9102-800		56289	199D155X0035BE3
C45-C48	NOT USED				
C49	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C50	NOT USED				
C51	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C52	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 35V	184-9102-800		56289	199D155X0035BE3
C53	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-220		56289	199D225X0025BB1
C54-C69	NOT USED				
C70	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
L1-L4	NOT USED				
L5	COIL,RF 5600UH	240-2715-580		96906	MS75089-32
L6	NOT USED				
L7	COIL,RF 560UH	240-2715-460		96906	MS75089-20
Q1-Q8	NOT USED				
Q9,Q10	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
Q11,Q12	NOT USED				
Q13	TRANSISTOR (ESDS)	352-1068-010		04713	SPF557
R1-R28	NOT USED				
R29	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R30	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R31	RESISTOR,FXD FILM, 442 OHMS, 1%, 1/8W	705-0979-000		81349	RN55D4420F
R32	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R33	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R34	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R35-R42	NOT USED				
R43	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R44-R47	NOT USED				
R48,R49	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R50	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R51	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R52	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R53	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R54	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R55	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
U1	NOT USED				
U2	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC

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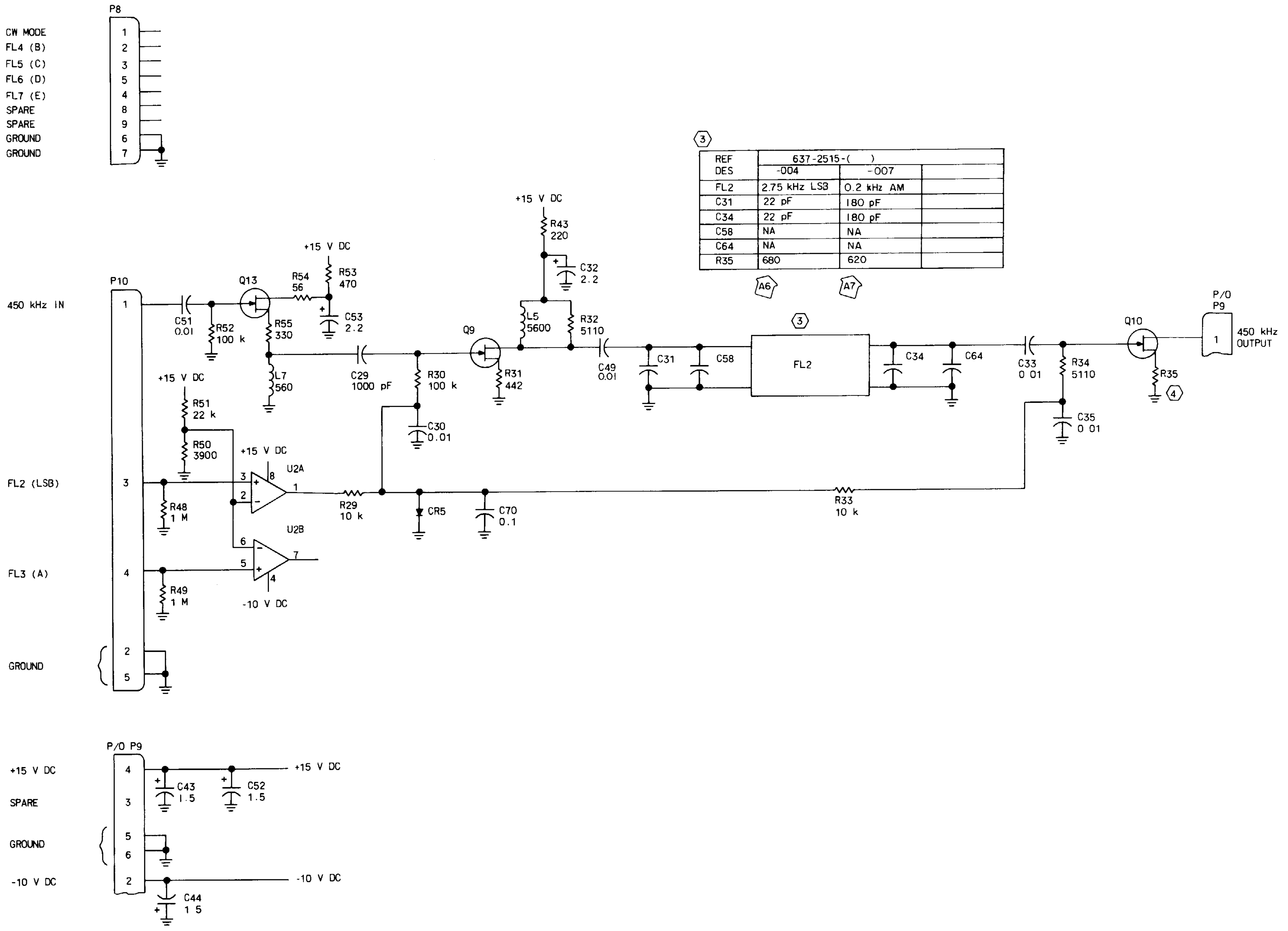
1 USED IF FILTER SECTION DOES NOT MEET SPECIFICATIONS/GAIN

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A6	Changed R35 from 470 Ω to 680 Ω.	637-2515-004, REV J and above.
A7	Changed R35 from 470Ω to 620 Ω.	637-2515-007, REV J and above.
None	Corrected Schematic value of C49.	All units

Filter (637-2515-004, -007), Schematic Diagram
Figure 5 (Sheet 2)



⟨3⟩

REF DES	637-2515-( )		
	-004	-007	
FL2	2.75 kHz LSB	0.2 kHz AM	
C31	22 pF	180 pF	
C34	22 pF	180 pF	
C58	NA	NA	
C64	NA	NA	
R35	680	620	

NOTES:

⟨1⟩ UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS, DIODES ARE TYPE IN4454, AND FETS ARE TYPE SPF557.

⟨2⟩ PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATIONS.

⟨3⟩ THE FOLLOWWING COMPONENTS ARE PART OF ASSEMBLY 637-2515-004.
FL2
C31,34,58,64
R35

⟨4⟩ TEST SELECT RESISTOR 637-1468-001 MAY BE USED AS REQUIRED BY PRODUCTION TEST METHOD.

⟨5⟩ THIS DRAWING TO BE USED WITH 635-0905-002 AND ASSEMBLY 637-2515-004.

⟨6⟩ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

⟨7⟩ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

635-0441-002

Filter (637-2515-004, -007), Schematic Diagram
Figure 5 (Sheet 3)

RF Translator (637-1767-( ))

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767959-302211
2nd Edition, 1 June 1978
3rd Revision, 1 January 1981

1. DESCRIPTION

RF Translator 637-1767-( ), shown in figure 1, is a module enclosed in an rf secure compartment (metal box construction). The rf translator module contains a metal box subassembly with internal shielding between various circuit elements and three 2-layer planar cards. It uses a 56-pin edge-on connector (2 layers, 28 pins each) and four subminiax rf connectors for external connections.

The rf translator module consists of two mixers, a receive overload, and rf filter circuits.

The rf translator configuration differences are as follows:

a. 637-1767-001, FL14, 109.350 00-MHz filter, ±7.50 kHz at 3-dB points (narrow-band filter).
b. 637-1767-002, FL14, 109350 00 MHz filter, ±6.10 kHz at 0.5-dB points (broadband filter).
c. 637-1767-003, FL14, 109.350 00-MHz filter, ±6.00 kHz at 1-dB points. High performance front end has +35-dB mW third-order intercept point.

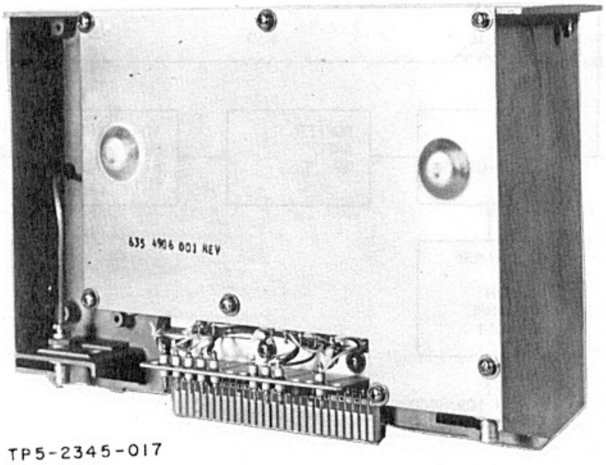
2. PRINCIPLES OF OPERATION

2.1 *General (Refer to figure 2.)*

The rf translator converts the 100-kHz (0.100-MHz) to 30.0-MHz receive rf input to a 9.45-MHz receive if frequency.

2.2 *Receive Function (Refer to figure 2.)*

When a receive signal is supplied to the rf translator, it is overload checked and supplied through K1 to the associated bandpass filter. If an overload exists, Q1 causes K1 to deenergize, and the receive rf is loaded through R4 and supplied as receive rf through K1 to the associated bandpass filter.



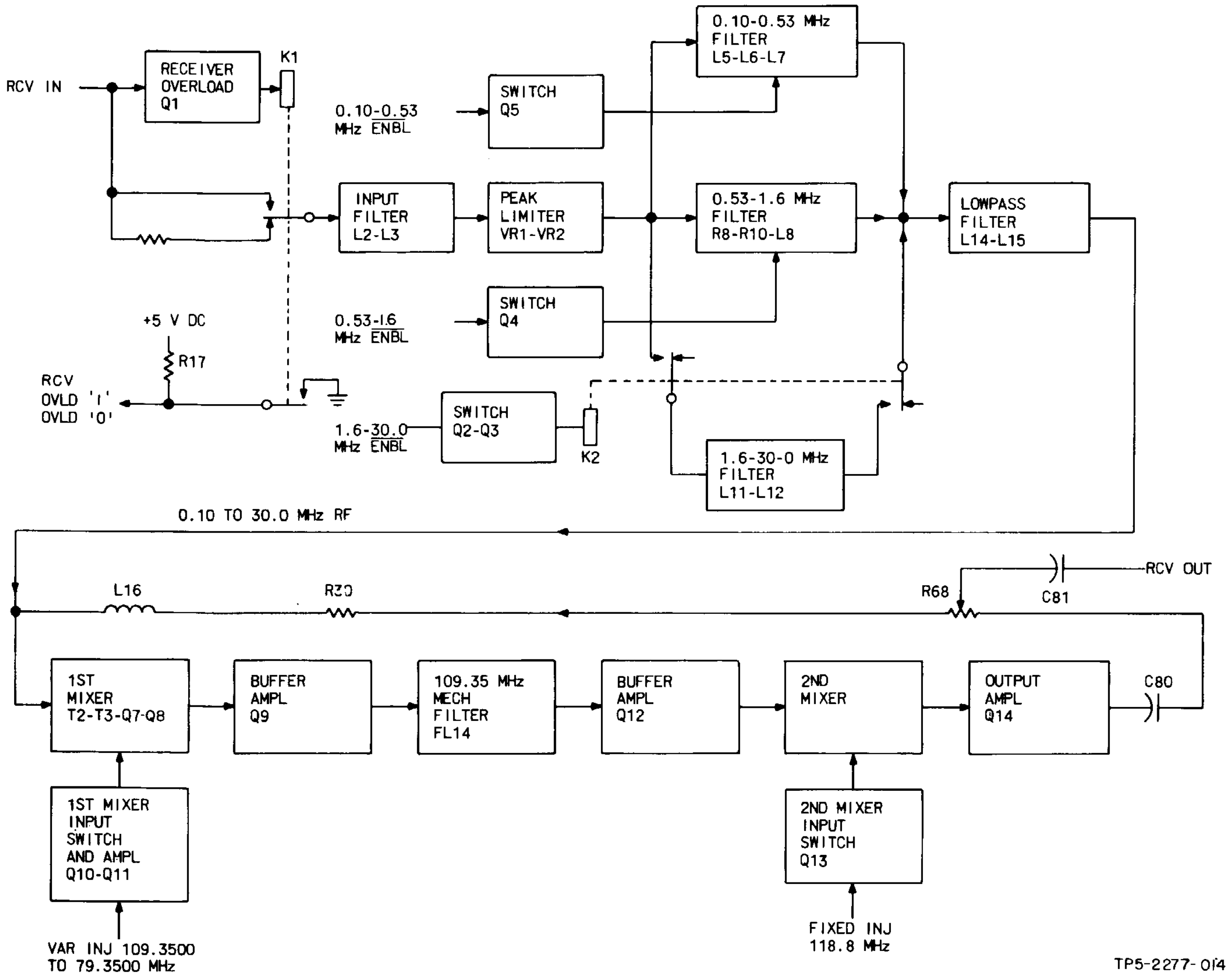
TP5-2345-017

RF Translator
Figure 1

The bandpass filter is selected by the receiver frequency control. Enable signals from the receiver frequency control enable filter L5-L7 for 100- to 530-kHz (0.10- to 0.53-MHz) operation; enable filter R8-R10-L8 for 530-kHz to 1.6-MHz (0.53- to 1.6-MHz) operation; and energize K2 to enable filter L11-L12 for 1.6- to 30.0-MHz operation.

The signal from K1 is supplied through the selected bandpass filter and through low-pass filter L14-L15 to the grounded gate balanced FET first mixer circuit T1-T2, Q7-Q8.

In the first mixer the 100-kHz to 30.0-MHz signal is mixed with a 109.3500- to 79.3500-MHz variable injection signal to provide a 109.35-MHz if signal. This signal is supplied through FET buffer amplifier Q9, mechanical filter FL14, and a second FET buffer amplifier Q12 to the second mixer circuit.



Functional Block Diagram
Figure 2

In the second mixer the 109.35-MHz if signal is mixed with a 118.8-MHz fixed injection signal to provide a 9.45-MHz receive if output signal. The receive if output signal is supplied through output amplifier Q14 and output control R68 to the rf translator receive if output.

2.3 RF Mixer SRA-1 (Refer to figure 3.)

The SRA-1 is a broadband ring modulator mixer device used in 50-ohm rf/if applications.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

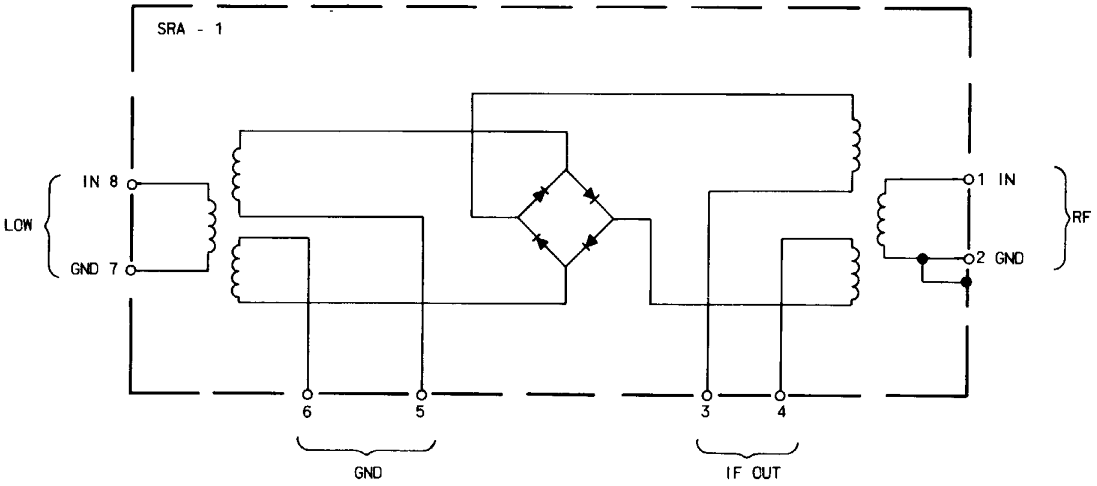
Test equipment and power sources required to test, troubleshoot, and repair the rf translator module are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check total performance of the rf translator module. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Note

In emergencies, RF Translator 637-1767-001 can be replaced by RF Translator 635-4903-001. In this type of repair, use the test procedures given in table 1 to test RF Translator 635-4903-001.



CHARACTERISTICS
PEAK INPUT POWER: 50 mW MAX.
PEAK CURRENT, ANY PORT: 40 mA MAX.
FREQUENCY RANGE (MHz):
LOW - 0.5 TO 500
RF - 0.5 TO 500
IF - DC TO 500
CONVERSION LOSS: 6.5 dB TYPICAL, 8.5 dB MAX. (SIGNAL AT IF PORT, OUTPUT AT RF PORT)
TEST CURRENT WHEN CHECKING CONTINUITY MUST NOT EXCEED 20 mA.

ISOLATION (dB):
LOW BAND EDGE;
LOW TO RF - 35 dB MIN.
LOW TO IF - 30 dB MIN.
MID-RANGE;
LOW TO RF - 30 dB MIN.
LOW TO IF - 25 dB MIN.
UPPER BAND EDGE;
LOW TO RF - 25 dB MIN.
LOW TO IF - 20 dB MIN.

TP5-2278-013

RF Mixer SRA-1
Figure 3

Table 1. RF Translator, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing the rf translator that is to be tested.		
	b. Remove rf translator. Install rf translator on extender and place it in the unit.		
	c. Set unit LINE SELECTOR switch to 115 V.		
	d. Connect unit to 115-V ac power source and set power on.		
	e. Measure dc voltages between the following pins and ground (P1-1, 28, 29, 56):		
	P1-25	+24.0 ±1.0 V dc	Check associated power supply.
	P1-53		
	P1-23	+15.0 ±1.0 V dc	
	P1-51		
	P1-27	+5.0 ±0.2 V dc	
	P1-6	-15.0 ±1.0 V dc	

Table 1. RF Translator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. Receiver SSB sensitivity	a. Set front panel MODE switch to SSB/CW and BANDWIDTH switch to USB.		
	b. Connect an rf signal generator to J1 (RW ANT jack on rear panel).		
	c. Connect an audio vtvm to ~~A6TP2~~ A26TP2 (SSB audio).		
	d. Set the rf signal generator to 250.0 kHz and receiver front panel frequency controls to 249.0 kHz.		
	e. Set the rf signal generator level at 0.00 μV.		
	f. Note noise level on audio vtvm.	Reference	
	g. Adjust rf signal generator level to 0.30 μV and note signal level on audio vtvm.	NLT 2 dB above reference	Check M1, Q14, Q12, FL14, Q9, Q8, Q7, Q5, and associated circuits.
	h. Repeat steps e, f, and g with rf signal generator at each of the following frequencies: (receiver front panel frequency controls set 1000 Hz below each frequency given).	**Note** Signal strength of step g varies with frequency.	
	500 kHz	NLT 3 dB above reference	Same as step g.
	1.0 MHz	NLT 3 dB above reference	Check Q4 and associated circuits.
	1.6 MHz	NLT 10.5 dB above reference	Check Q2, Q3, K2, and associated circuits.
	5.0 MHz	NLT 10.5 dB above reference	Same as 1.6 MHz.
	10.0 MHz	NLT 10.5 dB above reference	
	15.0 MHz	NLT 10.5 dB above reference	
	20.0 MHz	NLT 10.5 dB above reference	
	25.0 MHz	NLT 10.5 dB above reference	
	30.0 MHz	NLT 10.5 dB above reference	
3. Receiver gain	a. Connect an rf signal generator to J1 (RCV ANT jack on rear panel).		
	b. Connect an rf vtvm (with 50-Ω load) to J3.		
	c. Set the rf signal generator and receiver front panel frequency controls to 1.600 MHz.		
(Cont)	d. Set the rf signal generator level at -30 dB mW.		

Table 1. RF Translator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	e. Note the signal level on the rf vtvm.	NLT -12.0 dB mW	Same as test 2.
	f. Repeat steps d and e at each of the following frequencies:		
	5.0 MHz 10.0 MHz 15.0 MHz 20.0 MHz 25.0 MHz 29.9 MHz	NLT -11.5 dB mW NLT -11.5 dB mW NLT -10.1 dB mW NLT -11.5 dB mW NLT -11.5 dB mW NLT -11.1 dB mW	
4. Receiver overload protection	a. Connect an rf signal generator to J1 (RCV ANT jack on rear panel).		
	b. Connect a dvm to P1-3. Note voltage.	0 V	Check Q1, K1, and associated circuits.
	c. Set the rf signal generator and the receiver front panel frequency controls to 500 kHz.		
	d. Increase the rf signal generator output level until the receive overload relay just clicks.		
	e. Note rf output level of rf signal generator.	1.4 to 1.9 V rms	Same as step b.
	f. Note dvm reading.	NLT +3.0 V dc	Check K1 and associated output circuit.
	g. Remove rf signal generator.		
5. Receive AGC	a. Remove rf translator from extenders and install it in unit.		
	b. Remove channel A if. Install it on extender card and place it in unit.		
	c. Connect an rf signal generator to J1 (RCV ANT jack on rear panel).		
	d. Connect an rf vtvm (with high impedance probe) to J3 (A8J1).		
	e. Set front panel AGC switch to OFF.		
	f. Set the rf signal generator and receiver front panel frequency controls to 15.0000 MHz.		
	g. Set the rf signal generator level at -30 dB mW.		
	h. Note the signal level on the rf vtvm.	Reference	
	i. Set front panel AGC switch to FAST.		
(Cont)	j. Increase rf signal generator level until reference on rf vtvm is reached.		

Table 1. RF Translator, Testing and Troubleshooting Procedures (Cont).

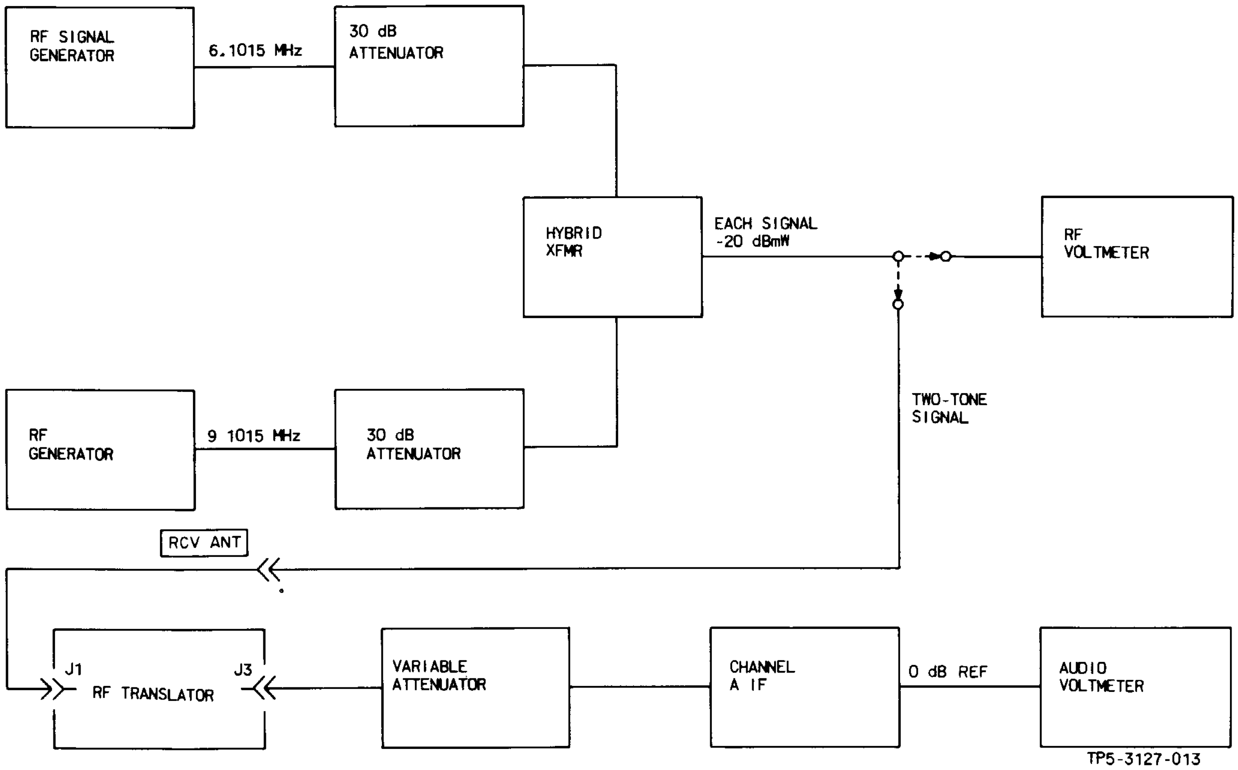
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	k. Note increase in rf signal generator level.	37 to 43 dB	Check CR19, CR20, CR22, CR23, and associated circuits.
	l. Remove channel A if from extenders and install it in unit.		
	m. Remove rf translator. Install it on extender card and place it in unit.		
6. Filter ripple	a. Connect an rf signal generator to J1 (RCV ANT jack on rear panel).		
	b. Connect an rf vtvm (with 50-Ω load) to J3.		
	c. Set the rf signal generator and receiver front panel frequency controls to 15.0000 MHz.		
	d. Set the rf signal generator level for -10-dB mW rf vtvm reading.	Reference	
	e. Adjust the rf signal generator down to 14.9970 MHz and up to 15.0030 MHz while noting the variation in the rf vtvm reading.	NMT 0.7-dB variation	Check M1, FL14, and associated circuits. If only slightly out of tolerance, adjustment of L24 and L20 may remedy indication.
	f. Adjust the rf signal generator down to 14.9940 MHz and up to 15.0060 MHz while noting the variation in the rf vtvm reading.	NMT 5.0-dB variation	Same as step e.
7. Receiver intermodulation, 3rd order products	a. Connect two rf signal generators to rf translator as shown in figure 4.		
	b. Set one rf signal generator to 6.1015 MHz.		
	c. Set the second rf signal generator to 9.1015 MHz.		
	d. Using the rf vtvm (with 50-Ω load) connected at the output of the hybrid transformer, independently adjust each rf signal generator for -20-dB mW outputs.		
	e. Connect the two-tone signal to J1 (RCV ANT jack on rear panel).		
	f. Set the receiver front panel frequency controls to 3000.00 kHz.		
	g. Slightly adjust (300 to 2000 Hz) the frequency of the 6.1015-MHz generator for a peak audio output (at A6TP2) as indicated on the audio voltmeter.		
(Cont)	h. Adjust the variable attenuator for 0-dB reference on the audio voltmeter.	Reference	

Table 1. RF Translator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	**Note** Adjust variable attenuator for a 0-dB reference at point where AGC just begins to affect the audio output.	Reference	
	i. Note 6.1015-MHz rf signal generator output.		
	j. Set the receiver front panel frequency controls to 6100.00 kHz.		
	k. Slightly adjust the frequency of the 6.1015-MHz generator for a peak audio output as indicated on the audio voltmeter.		
	l. Adjust the output level of the rf signal generator for 0-dB reference in step h on the audio voltmeter.		
	m. Note the decrease in dB of the rf signal generator output from that referenced in step i.	NLT 83 dB down	To repair, return to factory
	n. Repeat steps g through m with the receiver front panel frequency controls at each of the following settings:		
	12100.00 kHz 21300.00 kHz 24300.00 kHz	NLT 83 dB down NLT 83 dB down NLT 83 dB down	Same as step m.
8. Receiver intermodulation, 2nd order products	a. Connect two rf signal generators to rf translator as shown in figure 4.		
	b. Set one rf signal generator to 6.1015 MHz.		
	c. Set the second rf signal generator to 9.1015 MHz.		
	d. Using the rf vtvm (with 50-Ω load) connected at the output of the hybrid transformer, independently adjust each rf signal generator for -20-dB mW outputs.		
	e. Connect the two-tone signal to J1 (RCV ANT jack on rear panel).		
	f. Set the receiver front panel frequency controls to 3000.00 kHz.		
	g. Slightly adjust (300 to 2000 Hz) the frequency of the 6.1015-MHz generator for a peak audio output (at A6TP2) as indicated on the audio voltmeter.		
(Cont)	h. Adjust the variable attenuator for 0-dB reference on the audio voltmeter.	Reference	

Table 1. RF Translator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	**Note** Adjust variable attenuator for a 0-dB reference at point where AGC just begins to affect the audio output.	Reference	
	i. Note 6.1015-MHz rf signal generator output.		
	j. Set the receiver front panel frequency controls to 6100.00 kHz.		
	k. Slightly adjust the frequency of the 6.1015-MHz generator for a peak audio output as indicated on the audio voltmeter.		
	l. Adjust the output level on the rf signal generator for 0-dB reference in step h on the audio voltmeter.		
	m. Note the decrease in dB of the rf signal generator output from that referenced in step i.	NLT 70 dB down	To repair, return to factory.
	n. Repeat steps g through m with the receiver front panel frequency controls at 15 200.00 kHz.	NLT 70 dB down	Same as step m.



Receive Intermodulation Test Setup
Figure 4

4. ALIGNMENT/ADJUSTMENT

4.1 Receiver Alignment (Adjustment of T3, L24, L26, and L29)

a. Connect an rf signal generator through a 6-dB load to J1 (RCV ANT jack on rear panel).
b. Connect an rf vtvm (with 50-Ω load) to J3.
c. Set input to J1 at 15.0000 MHz and -30 dB mW.
d. Set front panel controls for 15 000.0 kHz.
e. Set R68 (receive gain) at full counterclockwise position.
f. Adjust T3, L24, L26, and L29 for maximum output, as indicated by vf vtvm.
g. Perform step f a minimum of three times.

4.2 Mixer Balance (Adjustment of R31)

a. Use a dvm with a 10-μH choke in series with a test probe to measure voltage readings at T2-2 and T2-5 to ground.
b. Adjust R31 for equal dc voltage reading at T2-2 and T2-5 to ground.

4.3 Injection Level Adjustment (Adjustment of T4)

a. Connect an rf vtvm (set to 10-V scale) between T2-1 and ground.
b. Vary input frequency from 2.0 to 29.9 MHz, and note that voltage varies between 3.0 and 7.0 V rms and that the higher voltage readings occur between 27 and 29.9 MHz.
c. If voltage exceeds the limits of step b or is higher at other than 27 to 29.9 MHz, adjust slug of T4 to achieve the desired levels.

4.4 Translator Gain Adjustment (Adjustment of R68, T1, and T2)

a. Set the rf signal generator for 15.000 00 MHz at -30 dB mW and the front panel frequency controls to 15 000.00 kHz.
b. Connect an rf vtvm (with 50-Ω load) to J3.
c. Adjust R68 for -10-dB mW reading on the rf vtvm.
d. Set the rf signal generator for 29.9000 MHz at -30 dB mW and the front panel frequency controls to 15 000.00 kHz.
e. Using a pointed plastic tool, carefully adjust the leads and windings of T1 and T2 for maximum reading on the rf vtvm.

Note

The objective is to make the output at 29.900 00 MHz as large as possible with an output difference between 29.900 00 and 15.000 00 MHz of not more than 1.0 dB.

f. Repeat steps c, d, and e until no improvement is possible.

4.5 Final Noise Balance (Adjustment of R31)

a. Set the front panel frequency controls for 15 000.00 kHz and disconnect the rf signal generator.
b. Connect an audio voltmeter to the channel A if SSB audio output. Reference the background noise level on the audio voltmeter.
c. Adjust R31 (20-turn potentiometer) for a minimum noise level. Make this adjustment very slowly to assure a true minimum.

4.6 T1 and T2 Position Fixing

Note

If T1 and T2 require position fixing, it is recommended that the rf translator be returned to the factory. If field repair of T1 and T2 is desired, the following procedures may be used. Do not make these adjustments unless repair has been made to the T1 and/or T2 area of the rf translator.

a. Set the rf signal generator for 29.900 00 MHz at -24 dB mW and the front panel frequency controls to 15 000.00 kHz.
b. Connect an rf vtvm (with 50-Ω load) to J3. Reference the rf vtvm reading.
c. Using a pipe cleaner, carefully apply a very thin coat of Q-Max to the windings of T1 and T2 and the support rods that hold T1 and T2 in position.
d. After Q-Max is applied, it may be necessary to slightly readjust wires for maximum output. Refer to paragraph 4.4.

5. REPAIR

Repair of the rf translator module is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

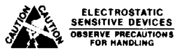
6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 5). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

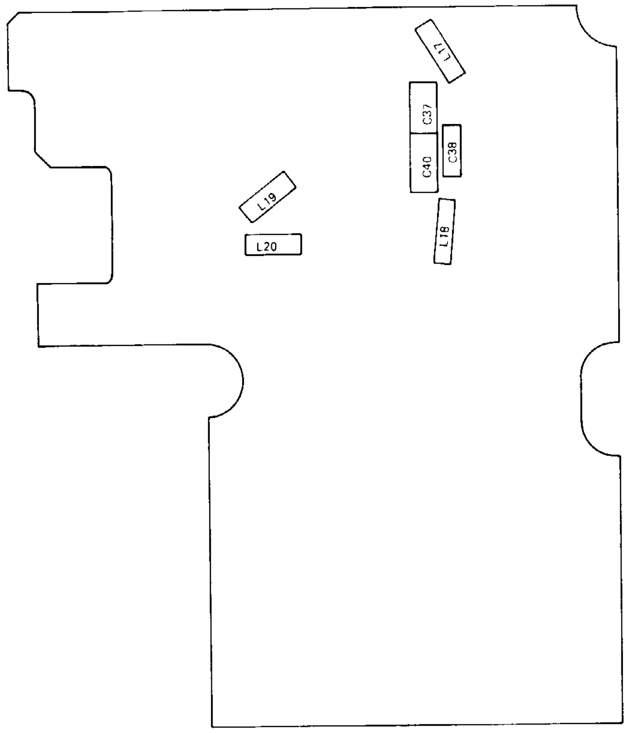
CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
01526	GENERAL ELECTRIC CO DATA COMMUNICATION PRODUCTS DEPT GENERAL ELECTRIC DR WAYNESBORO VA 22980
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
03550	VANGUARD ELECTRONICS CO INC 930 W HYDE PARK BLVD INGLEWOOD CA 90302
04222	AVX CERAMICS DIV OF AVX CORP 19TH AVE SOUTH P O BOX 867 MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
05375	VARI-L CO INC 3883 MONACO PKY DENVER CO 80207
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
10646	CARBORUNDUM CO THE P O BOX 337 NIAGARA FALLS NY 14302
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406

CODE	MANUFACTURER'S NAME AND ADDRESS
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72962	ESNA DIV OF AMERACE CORP 2330 VAUXHALL ROAD UNION NJ 07083
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV 2500 HARBOR BLVD FULLERTON CA 92634
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
77250	PHEOLL MFG CO DIV OF ALLIED PRODUCTS CORP 5700 W ROOSEVELT RD CHICAGO IL 60650
79807	WROUGHT WASHER MFG INC 2100 S O BAY ST MILWAUKEE WI 53207
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
91314	LEWIS SPRING AND MFG CO 2652 W NORTH AVE CHICAGO IL 60647
91719	GENERAL INSTRUMENTS INC DALLAS TX 75260
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
95445	RCA CORP RCA FREQUENCY BUREAU 50 BROAD ST NEW YORK NY 10004
96095	AVX CERAMICS DIV OF AVX CORP SENECA AVE OLEAN NY 14760
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP 135 W MAGNOLIA BLVD BURBANK CA 91502
99800	AMERICAN PRECISION INDUSTRIES INC DELEVAN DIV 270 QUAKER RD EAST AURORA NY 14052

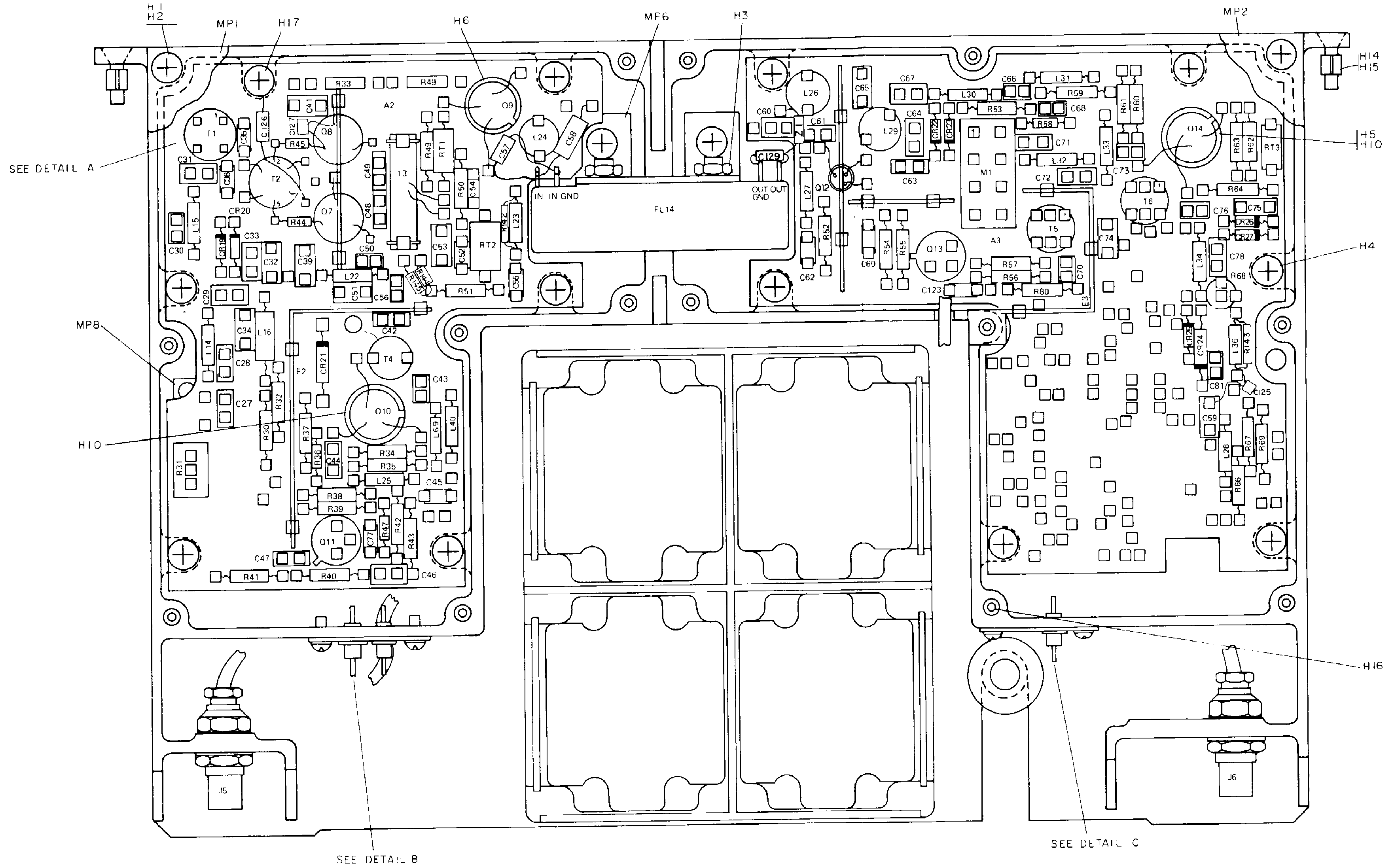
6.3 Equipment Covered

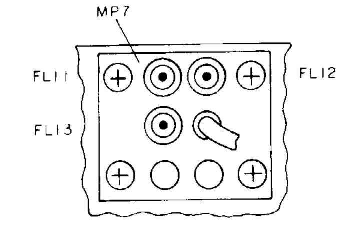
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Rf translator module	637-1767-001	REV Y
Rf translator module	637-1767-002	REV Y
Rf translator module	637-1767-003	REV W
Rf translator module	637-1767-004	REV Y
Rf filter board A1	635-0780-002	REV L
Rf filter board A1	635-0780-004	REV P
First mixer board A2	635-0782-002	REV AB
First mixer board A2	635-0782-004	REV AB
First mixer board A2	642-3587-001	REV A
Second mixer board A3	635-0784-002	REV T



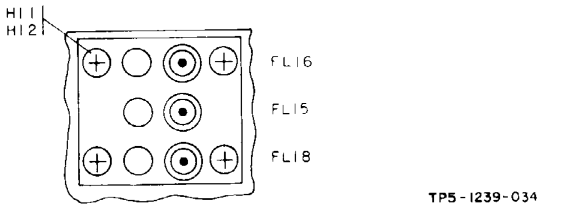
DETAIL A





DETAIL B

001/002/004



DETAIL C

TP5-1239-034

ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

RF Translator, Schematic Diagram
Figure 5 (Sheet 1 of 9)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	RF TRANSLATOR	637-1767-001	A		
	RF TRANSLATOR	637-1767-002	B		
	RF TRANSLATOR	637-1767-003	C		
	RF TRANSLATOR	637-1767-004	D		
A1	RF FILTER BOARD	635-0780-002	A,B,D		
A1	RF FILTER BOARD	635-0780-004	C		
A2	FIRST MIXER BOARD	635-0782-002	A,D		
A2	FIRST MIXER BOARD	635-0782-004	B		
A2	FIRST MIXER BOARD (ESDS)	642-3587-001	C		
A3	SECOND MIXER BOARD	635-0784-002			
C1-C56	NOT USED				
C57	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 50V (B3)	912-4141-310	A	72136	DM5E560J050WV
C57	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 50V	912-4141-330		72136	DM5E680J050WV
C57	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V (D1)	912-4141-280	C	93790	CD5EY470J0
C58	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 50V (B3)	912-4141-310	A	72136	DM5E560J050WV
C58	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		72136	DM5E470J050WV
C58	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 50V (D1)	912-4141-330	C	93790	CD5EY680J0
C59-C125	NOT USED				
	CAPACITOR, TEST SELECT C126				
C126	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (A2)	912-4141-540		72136	DM5C020D300WV
C126	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (A2)	912-4141-070		72136	DM5C030D300WV
C126	CAPACITOR,FXD MICA DIEL, 4PF, PORM 0.5PF, 300V (A2)	912-4141-080		72136	DM5C040D300WV
C126	CAPACITOR,FXD MICA DIEL, 5PF, PORM 0.5PF, 300V (A2)	912-4141-010		72136	DM5C050D300WV
C126	CAPACITOR,FXD MICA DIEL, 6PF, PORM 0.5PF, 300V (A2)	912-4141-090		72136	DM5C060D300WV
	CAPACITOR, TEST SELECT C127				
C127	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (A8)	912-4141-060		72136	DM5C010D300WV
C127	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (A8)	912-4141-540		72136	DM5C020D300WV
C128	NOT USED				
C129	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (C5)	912-4141-070	B	72136	DM5C030D300WV
C130-C132	CAPACITOR,FXD ELCTLT, 2.2UF, 20%, 25V (B1)	184-9102-220		56289	199D225X0025BB1
C133	CAPACITOR,FXD ELCTLT, 22UF, 20%, 10V (B1)	184-9102-080		56289	199D226X0010CB1
C134-C205	NOT USED				
	CAPACITOR, TEST SELECT C206				
C206	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (D1)	912-4141-060	C	93790	CD5CC010D0
C206	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D1)	912-4141-540	C	72136	DM5C020D300WV
C206	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (D1)	912-4141-070	C	93790	CD5CC030D0
C207-C210	NOT USED				
	CAPACITOR, TEST SELECT C211				
C211	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (D1)	912-4141-060	C	93790	CD5CC010D0
C211	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D1)	912-4141-540	C	72136	DM5C020D300WV
C211	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (D1)	912-4141-070	C	93790	CD5CC030D0
C212-C247	NOT USED				
	CAPACITOR, TEST SELECT C248				
C248	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (D1)	912-4141-060	C	93790	CD5CC010D0
C248	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D1)	912-4141-540	C	72136	DM5C020D300WV
C248	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (D1)	912-4141-070	C	93790	CD5CC030D0
	CAPACITOR, TEST SELECT C249				
C249	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (D1)	912-4141-060	C	93790	CD5CC010D0
C249	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D1)	912-4141-540	C	72136	DM5C020D300WV
C249	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (D1)	912-4141-070	C	93790	CD5CC030D0
	CAPACITOR, TEST SELECT C250				
C250	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V (D1)	912-4141-060	C	93790	CD5CC010D0
C250	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D1)	912-4141-540	C	72136	DM5C020D300WV
C250	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V (D1)	912-4141-070	C	93790	CD5CC030D0
C251	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (D1)	913-4018-000	C	81349	CK05BX102K
FL1-FL13	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL14	FILTER,BP 109.35 MHZ	293-1222-030	A	00136	293-1222-030
FL14	FILTER,BP 109.35 MHZ	293-1330-010	B,D	00136	293-1330-010
FL14	FILTER,BP 109.35 MHZ	293-1222-050	C		
FL15, FL16	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL17	NOT USED				

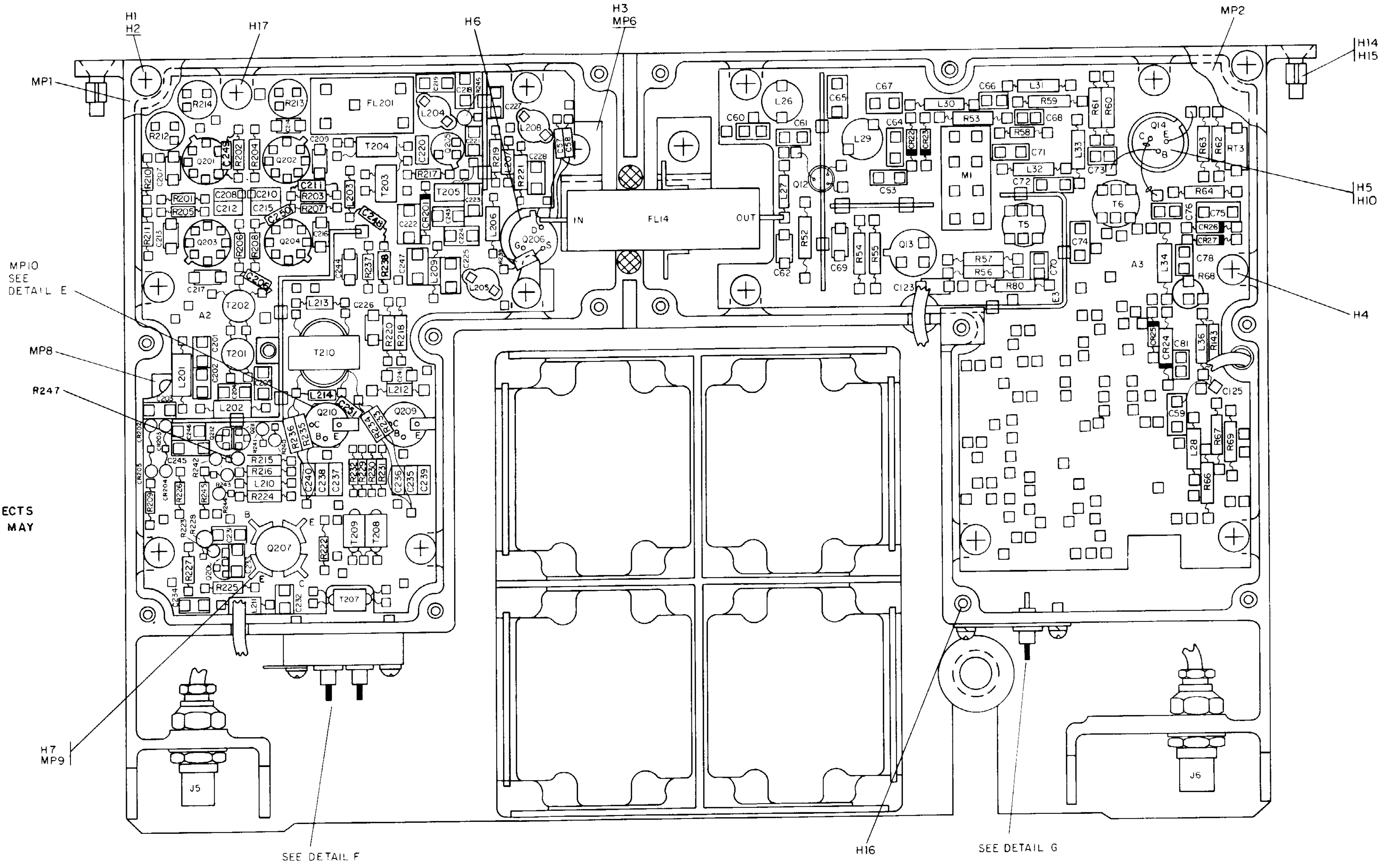
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
FL18	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL19, FL20	NOT USED				
FL21	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL22-FL32	NOT USED				
FL33-FL36	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL37-FL55	NOT USED				
FL56	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL57	FILTER,RAD INTR 1750PF	241-5006-010	C	81349	FL38GW1ED3-0001
H1	SCREW,MACH NP BRS, 4-40 X 1/4 (QTY 44)	343-0285-000		77250	P343-0285-000
H2	WASHER,LOCK BRZ, 0.115 ID X 0.202 OD (QTY 48)	310-0396-000		79807	310-0396-000
H3	NUT,SLFLKG,HEX AL, 4-40 (QTY 2)	333-0346-000	A,B	72962	69NM40
H3	NUT,PLAIN,HEX NP BRS, 2-56 (QTY 2)	313-0050-000	C	77250	P313-0050-000
H4	WASHER,FLAT BRS, 0.125 ID X 0.312 OD (QTY 25)	310-0054-000		79807	310-0054-000
H5	SCREW,MACH SST, 4-40 X 3/16 (QTY 3)	342-0043-000		96906	MS51959-12
H6	HEAT SINK,ELEC (QTY 1)	352-9604-010		98978	TXB3-032-037R
H7	NUT,PLAIN,HEX NP BRS, 8-32 (QTY 1)	313-0143-000	C	77250	P313-0143-000
H8	SCREW,MACH NP BRS, 2-56 X 7/16 (QTY 4)	343-0302-000	C	77250	P343-0302-000
H9	TERMINAL,LUG (QTY 1)	304-0014-000	C	77147	4040-2HT
H10	HEATSINK,ELEC (QTY 2)	352-9555-050		98978	TX0522B
H11	SCREW,MACH NP BRS, 2-56 X 3/16 (QTY 9)	343-0298-000		77250	P343-0298-000
H12	WASHER,SPRING CD PL BRZ, 0.088 ID X 0.172 OD (QTY 11)	310-0093-000		96906	MS35338-96
H13	SCREW,MACH NP BRS, 4-40 X 5/16 (QTY 5)	343-0286-000		77250	P343-0286-000
H14	SCREW,MACH SST, 6-32 X 7/16 (QTY 2)	342-0063-000		96906	MS51959-29
H15	RING,RETAINING (QTY 2)	340-0641-000		91314	340-0641-000
H16	SCREW,MACH NP BRS, 4-40 X 3/16 (QTY 1)	343-0284-000		77250	P343-0284-000
H17	TERMINAL,LUG (QTY 3)	304-0015-000		77147	4007-4HT
J1	CONNECTOR,RCPT ELEC	357-7207-030		98291	52-309-3188
J2	NOT USED				
J3	CONNECTOR,RCPT ELEC	357-7207-030		98291	52-309-3188
J4	NOT USED				
J5,J6	CONNECTOR,RCPT ELEC	357-7207-030		98291	52-309-3188
L1-L43	NOT USED				
L44-L47	COIL,RF 220UH	240-2723-060		96906	MS75085-11
L48-L56	NOT USED				
L57	COIL,RF 12UH	240-1581-000		96906	MS14046-5
L58	COIL,RF 4.70UH (B1)	240-2711-210	A	99800	240-2711-210
L58	COIL,RF 120UH	240-2715-380		96906	MS75089-12
L59,L60	COIL,RF 15UH	240-1602-000		96906	MS75101-9
MP1	COVER, NO 1 (QTY 1)	635-4905-001	A,B		
MP1	COVER, NO 1 (QTY 1)	646-7128-001	C		
MP2	COVER, NO 2 (QTY 1)	635-4910-001			
MP3	COVER, NO 3 (QTY 1)	635-4906-001			
MP4	BRACKET, FILTER-NO 1 (QTY 1)	635-9691-001			
MP5	BRACKET, FILTER-NO 2 (QTY 1)	635-9692-001			
MP6	BRACKET, FILTER-NO 4 (QTY 1)	635-9694-001	A,B		
MP6	BRACKET, MOUNTING (QTY 1)	646-7130-001	C		
MP7	PLATE, FILTER (QTY 2)	635-9667-001	A,B		
MP7	PLATE, MOUNTING (QTY 1)	646-7129-001	C		
MP7	PLATE, FILTER (QTY 1)	635-9667-001	C		
MP8	LUG, GROUND (QTY 1)	635-9668-001			
MP9	SPACER (QTY 1)	541-6088-002	C		541-6088-002
MP10	NUT, HEX-SPECIAL (QTY 2)	646-7131-001	C		
Q1-Q8	NOT USED				
Q9	TRANSISTOR, FET, U322(TEST SELECT)	637-9117-002	A,B,D		
Q10	TRANSISTOR	352-0766-010	A,B,D	95445	2N5109
Q11-Q13	NOT USED				
Q14	TRANSISTOR	352-0766-010		95445	2N5109
Q15-Q205	NOT USED				
Q206	TRANSISTOR,FET	352-1041-010	C	17856	U322
Q207	TRANSISTOR,RF	352-1191-010	C	04713	MRF511
Q208	NOT USED				
Q209, Q210	TRANSISTOR, MODIFIED	646-7126-001	C		2N3375
R1-R16	NOT USED				
R17	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R18-R138	NOT USED				
R139	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W (A11)	745-0722-000	A	81349	RCR07G181KS
	RESISTOR, TEST SELECT R139				
R139	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R139	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R139	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R139	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R140-R232	NOT USED				
R233-R236	RESISTOR,FXD CMPSN, 1K, 10%, 1W	745-3352-000	C	81349	RCR32G102KS
R237, R238	NOT USED				
R239	RESISTOR,FXD CMPSN, 100 OHMS, 5%, 1/8W	745-1863-250	C	81349	RCR05G101JS
R239	RESISTOR,FXD CMPSN, 33 OHMS, 5%, 1/8W (D1)	745-1863-130	C	81349	RCR05G330JS
Z1	RESISTOR, 470K	637-3793-001	B		
	RF FILTER BOARD A1	635-0780-002	A,B		
	RF FILTER BOARD A1	635-0780-004	C		

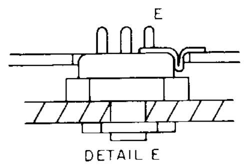
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CR1,CR2	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR1,CR2	SEMICOND DEVICE	353-3723-010	C	03508	STB707
CR3	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR4	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR5	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR5	SEMICOND DEVICE	922-6119-010	C	28480	1N5767
CR6	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR7	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR7	SEMICOND DEVICE	922-6119-010	C	28480	1N5767
CR8-CR10	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR11	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR11	SEMICOND DEVICE	922-6119-010	C	28480	1N5767
CR12	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR13	SEMICOND DEVICE	353-3644-010	A,B	03508	1N4454GE
CR13	SEMICOND DEVICE	922-6119-010	C	28480	1N5767
CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR15-CR17	NOT USED				
CR18	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR19, CR20	SEMICOND DEVICE (D3)	353-3644-010	C	03508	DA27395E
C1	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-2834-000	A,B	81349	CM05FD181J03
C1	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03
C2	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03
C3	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C4	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C5	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V	912-4141-070		72136	DM5C030D300WV
C6	CAPACITOR,FXD MICA DIEL, 18PF, PORM 0.5PF, 100V	912-4141-140		72136	DM5C180D100WV
C7	CAPACITOR,FXD MICA DIEL, 200PF, 5%, 50V	912-4141-440	A,B	72136	DM5F201J050WV
C7	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430	C	93790	CD5FY181J0
C8	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 50V	912-4141-360		72136	DM5F910J050WV
C9,C10	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C11-C13	NOT USED				
C14-C17	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C18	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100COG332K
C19	CAPACITOR,FXD PLSTC DIEL, 0.015UF, 5%, 150V	933-1084-030		56289	LP88A1V153J
C20	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100COG332K
C21,C22	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C23	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100COG332K
C24	CAPACITOR,FXD CER DIEL, 1500PF, PORM10%, 100V	913-3281-140		18796	8131-100COG152K
C25	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100COG332K
C26	NOT USED				
C27	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050	A,B	72136	DM5F101J050WV
C27	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 50V	912-4141-330	C	93790	CD5EY680J0
K1,K2	RELAY,AMT	974-1065-090		01526	3SAV1087A2
L1	COIL,RF 220UH	240-2723-060		96906	MS75085-11
L2,L3	COIL,RF	240-2745-010		99800	BP3391
L4	COIL,RF 220UH	240-2524-000		96906	MS90538-20
L5	COIL,RF 1000UH	240-2540-000		96906	MS90539-15
L6,L7	COIL,RF 27UH	240-2040-000		96906	MS75084-17
L8,L9	COIL,RF 1000UH	240-2540-000		96906	MS90539-15
L10	COIL,RF 220UH	240-2524-000		96906	MS90538-20
L11	COIL,RF 3.30UH	240-2715-190		96906	MS75088-7
L12	COIL,RF 3.30UH	240-2715-190	A,B	96906	MS75088-7
L12	COIL,RF 3.90UH	240-2715-200	C	96906	MS75088-8
L13-L20	NOT USED				
L21	COIL,RF 220UH	240-2723-060		96906	MS75085-11
Q1,Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3-Q5	TRANSISTOR	352-0551-010		04713	2N2907A
Q6-Q22	NOT USED				
Q23	TRANSISTOR	352-0661-020	C	07263	2N2222A
R1	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R2	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R3	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R4	RESISTOR,FXD CMPSN, 2.2K, 10%, 1W (B2)	745-3366-000	A,B	81349	RCR32G222KS
R4	RESISTOR,FXD CMPSN, 15K, 10%, 1W	745-3401-000		81349	RCR32G153KS
R5	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R6	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R7	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R8,R9	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R10	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R11	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R12	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R13-R17	NOT USED				
R18	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R19	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R20	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R21	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R22	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R23	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R24	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R25	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R26	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R27	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R28	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W (D3)	745-0773-000	C	81349	RCR07G472KS
R29-R137	NOT USED				
R138	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000	A,B	81349	RCR07G472KS
VR1,VR2	SEMICOND DEVICE	353-2714-000		81483	1N753A
	FIRST MIXER BOARD A2	635-0782-002	A		

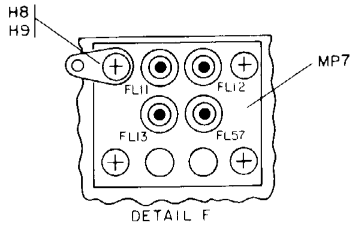
RF Translator, Schematic Diagram
Figure 5 (Sheet 2)



NOTE:
LOCATIONS ON TEST SELECTS
C206, 211, 248, 249, 250, MAY
VARY.

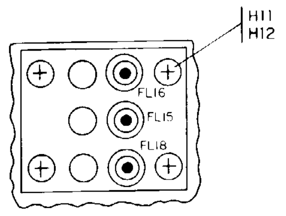


DETAIL E



DETAIL F

003



DETAIL G

ELECTROSTATIC
SENSITIVE DEVICES
OBSERVE PRECAUTIONS
FOR HANDLING

TP5-1239-034

RF Translator, Schematic Diagram
Figure 5 (Sheet 3)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CR1-CR18	NOT USED				
CR19, CR20	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR21	SEMICOND DEVICE	353-6442-010		04713	1N4001
C1-C27					
C28	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V	912-4141-180		93790	CD5EY270J0
C29	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C30	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
C31	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V (C1)	912-4141-280		93790	CD5EY470J0
C31	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 50V	912-4141-240		93790	CD5EY360J0
C32	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C33	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 50V	912-4141-460		93790	CD5FY241J0
C34	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C35,C36	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 50V	913-5019-280		81349	CK05BX473K
C37	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C38	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 50V	913-5019-280		81349	CK05BX473K
C39	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C40	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C41	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C42	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030		93790	CD5EC220D0
C43	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C44	CAPACITOR,FXD MICA DIEL, 33PF, 2%, 50V	912-4141-210		93790	CD5EY330G0
C45	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C46	CAPACITOR,FXD MICA DIEL, 5PF, PORM 0.5PF, 300V (A10)	912-4141-010		93790	CD5CC050D0
C46	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C47	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V (A10)	912-4141-300		93790	CD5EY510J0
C47	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C48,C49	CAPACITOR,FXD MICA DIEL, 18PF, PORM 0.5PF, 100V (A5)	912-4141-140		93790	CD5CA180D0
C48,C49	CAPACITOR,FXD MICA DIEL, 20PF, PORM 0.5PF, 100V	912-4141-150		93790	CD5EA200D0
C50	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C51	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C52	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C53	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C54,C55	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C56	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V (C1)	913-3279-110		16546	CY20C103M
C56	CAPACITOR,FXD CER DIEL, 1000PF, 20%, 50V	913-3279-030		16546	CY10C102M
C57-C76	NOT USED				
C77	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (A5)	913-4018-000		81349	CK05BX102K
C77	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		93790	CD5EY470J0
C78-C133	NOT USED				
C134	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (C7)(C8)	912-4141-400		93790	CD5FY151J0
L1-L13	NOT USED				
L14	COIL,RF 0.22UH	240-2015-000		96906	MS75083-05
L15	COIL,RF 0.27UH	240-2016-000		96906	MS75083-06
L16	COIL,RF 220UH	240-2723-060		96906	MS75085-11
L17,L18	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L19,L20	COIL,RF 2.70UH (A5)	240-2028-000		96906	MS75084-05
L19,L20	COIL,RF 1UH	240-2023-000		96906	MS75083-13
L21	NOT USED				
L22,L23	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L24	COIL,RF,VAR	242-0439-030		02113	115CLWNDR2-5TURNS
L25	COIL,RF 0.15UH	240-2013-000		96906	MS75083-03
L26-L39	NOT USED				
L40	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L41-L68	NOT USED				
L69	COIL,RF 0.15UH (A5)	240-2013-000		96906	MS75083-03
Q1-Q6	NOT USED				
Q7,Q8	TRANSISTOR, FET U322 (MATCHED SET)	637-9117-001			
Q9,Q10	NOT USED				
Q11	TRANSISTOR	352-0766-010		95445	2N5109
RT1	RESISTOR,THRM 40 OHMS, 10%, 0.5W	714-1725-000		10646	0325F5-016
RT2	RESISTOR,THRM 100 OHMS, 10%, 1W	714-1730-000		10646	0550F5-256
R1-R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R31	RESISTOR,VAR 1K, 5%, 3/4W	381-1853-170		81349	RT24C2W102
R32	RESISTOR,FXD FILM, 226 OHMS, 1%, 1/8W	705-0965-000		81349	RN55D2260F
R33	RESISTOR,FXD FILM, 681 OHMS, 1%, 1/8W	705-0988-000		81349	RN55D6810F
R34	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W	745-4382-000		81349	RCR07G4R7JS
R35	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R36	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/8W	745-2323-000		81349	RCR05G331KS
R37	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (C2)	745-0728-000		81349	RCR07G271KS
R37	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R38	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R39	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R40	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/4W	745-0686-000		81349	RCR07G180KS
R41	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R42	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R43	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W (C2)	745-0755-000		81349	RCR07G152KS
R43	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R44,R45	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A7)	745-2277-000		81349	RCR05G180KS
R44,R45	RESISTOR,FXD CMPSN, 22 OHMS, 5%, 1/8W	745-1863-090		81349	RCR05G220JS
R46	NOT USED				
R47	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/8W (A5)	745-2301-000		81349	RCR05G820KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R47	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/8W	745-2298-000		81349	RCR05G680KS
R48	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R49	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R50	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R51	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W (A5)	745-0701-000		81349	RCR07G470KS
R51	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R52-R141	NOT USED				
R142	RESISTOR,FXD CMPSN, 2.2K, 5%, 1/8W (A1)(C4)	745-1863-570		81349	RCR05G222JS
R142	RESISTOR,FXD CMPSN, 1.6K, 5%, 1/8W	745-1863-540		81349	RCR05G162JS
R143	NOT USED				
R144, R145	RESISTOR,FXD CMPSN, 110 OHMS, 5%, 1/8W (A5)	745-1863-260		81349	RCR05G111JS
T1	TRANSFORMER,RF	278-0430-160		03550	22027
T2	TRANSFORMER,RF	278-0430-190		03550	22487
T3	TRANSFORMER,RF	278-0431-020		02113	278-0431-020
T4	TRANSFORMER,RF	278-0431-010		02113	278-0431-010
	FIRST MIXER BOARD A2	635-0782-004	B		
CR1-CR18	NOT USED				
CR19, CR20	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR21	SEMICOND DEVICE	353-6442-010		04713	1N4001
C1-C27	NOT USED				
C28	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V	912-4141-180		93790	CD5EY270J0
C29	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C30	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
C31	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 50V	912-4141-240		93790	CD5EY360J0
C32	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C33	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 50V	912-4141-460		93790	CD5FY241J0
C34	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C35,C36	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 50V	913-5019-280		81349	CK05BX473K
C37	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C38	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 50V	913-5019-280		81349	CK05BX473K
C39	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C40	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C41	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C42	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030		93790	CD5EC220D0
C43	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C44	CAPACITOR,FXD MICA DIEL, 33PF, 2%, 50V	912-4141-210		93790	CD5EY330G0
C45	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C46	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C47	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C48,C49	CAPACITOR,FXD MICA DIEL, 20PF, PORM 0.5PF, 100V	912-4141-150		93790	CD5EA200D0
C50	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C51	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C52	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C53	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C54,C55	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C56	CAPACITOR,FXD CER DIEL, 1000PF, 20%, 50V	913-3279-030		16546	CY10C102M
C57-C76	NOT USED				
C77	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C78-C133	NOT USED				
C134	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
L1-L13	NOT USED				
L14	COIL,RF 0.22UH	240-2015-000		96906	MS75083-05
L15	COIL,RF 0.27UH	240-2016-000		96906	MS75083-06
L16	COIL,RF 220UH	240-2723-060		96906	MS75085-11
L17,L18	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L19,L20	COIL,RF 1UH	240-2023-000		96906	MS75083-13
L21	NOT USED				
L22,L23	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L24	COIL,RF,VAR	242-0439-030		02113	115CLWNDR2-5TURNS
L25	COIL,RF 0.15UH	240-2013-000		96906	MS75083-03
L26-L39	NOT USED				
L40	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L41-L68	NOT USED				
L69	COIL,RF 0.15UH	240-2013-000		96906	MS75083-03
Q1-Q6	NOT USED				
Q7,Q8	TRANSISTOR, TEST SELECT	637-9117-001			
Q9,Q10	NOT USED				
Q11	TRANSISTOR	352-0766-010		95445	2N5109
RT1	RESISTOR,THRM 40 OHMS, 10%, 0.5W	714-1725-000		10646	0325F5-016
RT2	RESISTOR,THRM 100 OHMS, 10%, 1W	714-1730-000		10646	0550F5-256
R1-R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R31	RESISTOR,VAR 1K, 5%, 3/4W	381-1853-170		81349	RT24C2W102
R32	RESISTOR,FXD FILM, 226 OHMS, 1%, 1/8W	705-0965-000		81349	RN55D2260F
R33	RESISTOR,FXD FILM, 681 OHMS, 1%, 1/8W	705-0988-000		81349	RN55D6810F
R34	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W	745-4382-000		81349	RCR07G4R7JS
R35	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R36	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/8W	745-2323-000		81349	RCR05G331KS
R37	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R38	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R39	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R40	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/4W	745-0686-000		81349	RCR07G180KS

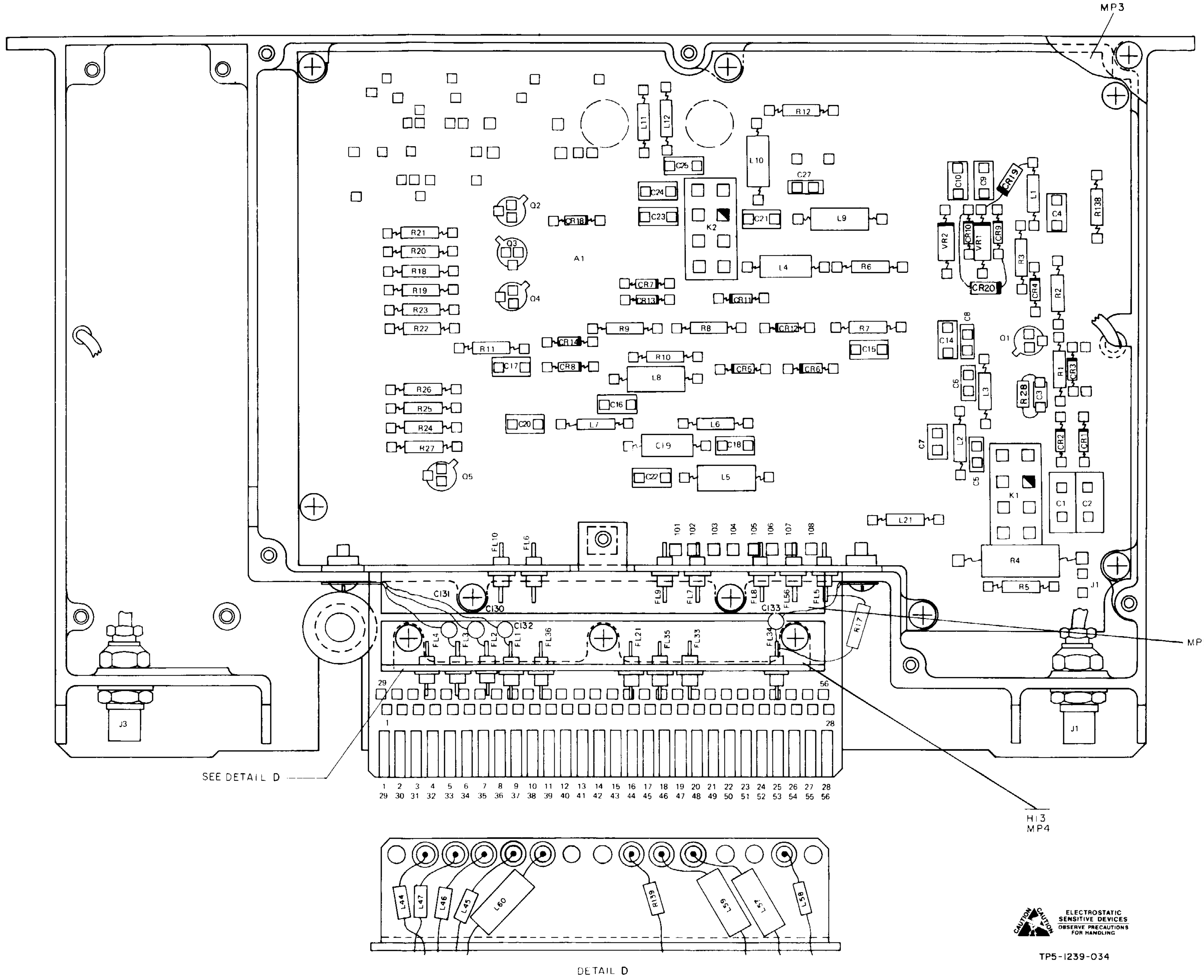
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R41	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R42	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R43	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R44,R45	RESISTOR,FXD CMPSN, 22 OHMS, 5%, 1/8W	745-1863-090		81349	RCR05G220JS
R46	NOT USED				
R47	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/8W	745-2298-000		81349	RCR05G680KS
R48	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R49	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R50	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R51	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R52-R141	NOT USED				
R142	RESISTOR,FXD CMPSN, 1.6K, 5%, 1/8W	745-1863-540		81349	RCR05G162JS
R143	NOT USED				
R144, R145	RESISTOR,FXD CMPSN, 110 OHMS, 5%, 1/8W	745-1863-260		81349	RCR05G111JS
T1	TRANSFORMER	278-0430-160		03550	22027
T2	TRANSFORMER	278-0444-020		20462	278-0444-020
T3	TRANSFORMER	278-0431-020		02113	278-0431-020
T4	TRANSFORMER	278-0431-010		02113	278-0431-010
	FIRST MIXER BOARD A2 (ESDS)	642-3587-001			
CR1-CR200	NOT USED				
CR201-CR205	SEMICOND DEVICE	922-6119-010		28480	1N5767
C1-C200	NOT USED				
C201	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C202	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 300V	912-4141-020		93790	CD5CC100D0
C203	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 50V	912-4141-380		93790	CD5FY121J0
C204, C205	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		93790	CD5EY330J0
C206	NOT USED				
C207	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C208	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C208	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C209	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C210	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C210	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C211	NOT USED				
C212	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C212	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C213, C214	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C215	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C215	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C216, C217	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C218	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C219	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V	912-4141-280		93790	CD5EY470J0
C220	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C220	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C221	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V	912-4141-540		72136	DM5C020D300WV
C222, C223	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C224	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V	912-4141-030		93790	CD5EC220D0
C225	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		93790	CD5EY330J0
C225	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 50V (D2)	912-4141-280		93790	CD5EY470J0
C226, C227	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C228	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C229, C230	NOT USED				
C231	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C232	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 50V	912-4141-350		93790	CD5EY820J0
C233	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C234	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C235-C240	CAPACITOR,FXD, CER CHIP, 330PF, 50V, 5%	351-4068-170		96095	18085A331JA8060
C235-C240	CAPACITOR,CHIP,FXD CER DIEL, 330PF, 5%, 50V (D2)	913-3667-190		04222	18085A331JA8060
C241	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C242	NOT USED				
C243	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C244	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C245	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C246, C247	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C248	CAPACITOR,FXD MICA DIEL, 2PF, PORM 0.5PF, 300V (D2)	912-4141-540		72136	DM5C020D300WV
FL1-FL200	NOT USED				

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
FL201	FILTER, CRYSTAL	293-1222-040		00136	2Q85
L1-L200	NOT USED				
L201, L202	COIL,RF 0.15UH	240-1562-000		96906	MS18130-1
L203	COIL,RF 0.22UH	240-2015-000		96906	MS75083-05
L204	COIL, RF, VAR, 0.106UH-0.164UH	242-0439-020		02113	115CLWNDY4-5TURNS
L205	COIL, RF, VAR, 0.081UH-0.117UH	242-0439-100		02113	115CLWNDORG3-5TURNS
L206, L207	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L208	COIL, RF, VAR, 0.059UH-0.074UH	242-0439-030		02113	115CLWNDR2-5TURNS
L209	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L210	COIL,RF 0.22UH	240-2015-000		96906	MS75083-05
L211	COIL,RF 0.33UH	240-2017-000		96906	MS75083-07
L212	COIL,RF 0.47UH	240-2019-000		96906	MS75083-09
L213	COIL,RF 0.27UH	240-2016-000		96906	MS75083-06
L214	COIL,RF 0.33UH (D2)	240-2017-000		96906	MS75083-07
Q1-Q200	NOT USED				
Q201-Q204	TRANSISTOR,DUAL (ESDS)	352-6003-010		91719	MEM955
Q201-Q204	TRANSISTOR, MATCHED MEM955 (D2) (ESDS)	646-7028-001			
Q205	TRANSISTOR,FET	352-1042-010		17856	U310
Q206, Q207	NOT USED				
Q208	TRANSISTOR	352-5500-010		04713	MPS2907A
Q209, Q210	NOT USED				
Q211	TRANSISTOR	352-5501-010		04713	MPS2222A
Q212	TRANSISTOR	352-5500-010		04713	MPS2907A
R1-R200	NOT USED				
R201-R208	RESISTOR,FXD CMPSN, 10K, 5%, 1/8W	745-1863-730		81349	RCR05G103JS
R209	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R210, R211	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W NOT USED	745-2365-000		81349	RCR05G472KS
R212-R214	RESISTOR,VAR 10K, 10%, 0.5W	382-0027-100		80294	3329HCT1-103
R215	RESISTOR,FXD CMPSN, 10K, 5%, 1/8W	745-1863-730		81349	RCR05G103JS
R216	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R217	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R218	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R219	RESISTOR,FXD CMPSN, 33 OHMS, 10%, 1/4W	745-0695-000		81349	RCR07G330KS
R220	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R221	RESISTOR,FXD CMPSN, 1.8K, 10%, 1/8W	745-2350-000		81349	RCR05G182KS
R221	RESISTOR,FXD CMPSN, 1K, 5%, 1/8W (D2)	745-1863-490		81349	RCR05G102JS
R222	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/8W	745-2338-000		81349	RCR05G821KS
R222	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/8W (D2)	745-2335-000		81349	RCR05G681KS
R223	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R224, R225	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W	745-2277-000		81349	RCR05G180KS
R226	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/8W	745-2344-000		81349	RCR05G122KS
R227	RESISTOR,FXD CMPSN, 150 OHMS, 5%, 1/8W	745-1863-290		81349	RCR05G151JS
R228	RESISTOR,FXD FILM, 15 OHMS, 1%, 1/8W	705-3600-090		81349	RN55D15R0F
R229, R230	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/8W	745-2356-000		81349	RCR05G272KS
R231, R232	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/8W	745-2292-000		81349	RCR05G470KS
R233-R236	NOT USED				
R237	RESISTOR,FXD CMPSN, 150 OHMS, 5%, 1/8W	745-1863-290		81349	RCR05G151JS
R237	RESISTOR,FXD CMPSN, 560 OHMS, 5%, 1/8W (D2)	745-1863-430		81349	RCR05G561JS
R238	RESISTOR,FXD CMPSN, 75 OHMS, 5%, 1/8W (D2)	745-1863-220		81349	RCR05G750JS
R239	NOT USED				
R240	RESISTOR,FXD CMPSN, 10K, 5%, 1/8W	745-1863-730		81349	RCR05G103JS
R241	RESISTOR,FXD CMPSN, 15K, 5%, 1/8W	745-1863-770		81349	RCR05G153JS
R242-R244	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R245	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R246	RESISTOR,FXD CMPSN, 10K, 5%, 1/8W	745-1863-730		81349	RCR05G103JS
R247	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W (D2)	745-2317-000		81349	RCR05G221KS
T1-T200	NOT USED				
T201	TRANSFORMER,RF	278-0444-030		20462	278-0444-030
T202	TRANSFORMER,RF	278-0444-040		20462	278-0444-040
T203	TRANSFORMER,RF	278-0444-050		20462	278-0444-050
T204	TRANSFORMER,RF	278-0444-060		20462	278-0444-060
R205	TRANSFORMER,RF	278-0444-070		20462	278-0444-070
T206	NOT USED				
T207	TRANSFORMER,RF	278-0439-060		20462	278-0439-060
T208, T209	TRANSFORMER,RF	278-0439-070		20462	278-0439-070
T210	TRANSFORMER,RF	278-0439-050		20462	278-0439-050
	SECOND MIXER BOARD A3	635-0784-002			
CR1-CR21	NOT USED				
CR22, CR23	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR24	SEMICOND DEVICE (A3)	353-6442-010		04713	1N4001
CR25	SEMICOND DEVICE (A3)	353-3644-010		03508	1N4454GE

RF Translator, Schematic Diagram
Figure 5 (Sheet 4)



CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TP5-1239-034

RF Translator, Schematic Diagram
Figure 5 (Sheet 5)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CR26, CR27	SEMICOND DEVICE	922-6119-010		28480	1N5767
C1-C58	NOT USED				
C59	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C60	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 50V	912-4141-240		72136	DM5E360J050WV
C61	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V (A4)	912-4141-220		72136	DM5E330J050WV
C61	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V	912-4141-180		72136	DM5E270J050WV
C62	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C63	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		72136	DM5C150D300WV
C64	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370		72136	DM5F111J050WV
C65	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (A6)	913-4018-000		81349	CK05BX102K
C65	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		72136	DM5F221J050WV
C66	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C67	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 50V	912-4141-460		72136	DM5F241J050WV
C68	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C69	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C70	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C71	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 50V	912-4141-320		72136	DM5E620J050WV
C72	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		72136	DM5F151J050WV
C73	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V (A4)	913-3279-110		16546	CY20C103M
C73	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V (C9)	913-3279-180		16546	CY20C104M
C73	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C74,C75	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C76	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C77	NOT USED				
C78	CAPACITOR,FXD MICA DIEL, 24PF, PORM 0.5PF, 50V	912-4141-160		72136	DM5E240D050WV
C79,C80	NOT USED				
C81	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C82-C122	NOT USED				
C123	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V (A4)	912-4141-180		72136	DM5E270J050WV
C123	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C124	NOT USED				
C125	CAPACITOR,FXD CER DIEL, 4700PF, 20%, 50V (A4)	913-3279-090		16546	CY10C472M
L1-L25	NOT USED				
L26	COIL,RF,VAR	242-0439-020		02113	242-0439-020
L27	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L28	COIL,RF 22UH	240-2039-000		96906	MS75084-16
L29	COIL,RF,VAR	242-0439-020		02113	242-0439-020
L30	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L31	COIL,RF 27UH	240-2040-000		96906	MS75084-17
L32,L33	COIL,RF 0.15UH	240-2013-000		96906	MS75083-03
L34	COIL,RF 0.39UH (A4)	240-2018-000		96906	MS75083-08
L34	COIL,RF 0.33UH (A9)	240-2017-000		96906	MS75083-07
L34	COIL,RF 0.27UH (C3)	240-2016-000		96906	MS75083-06
L34	COIL,RF 0.33UH	240-2017-000		96906	MS75083-07
L35	NOT USED				
L36	COIL,RF 220UH (A4)	240-2723-060		96906	MS75085-11
M1	MIXER,RF (C6)	277-0405-010		05375	CM1P
M1	MIXER,RF	277-0405-020			277-0405-020
Q1-Q11	NOT USED				
Q12	TRANSISTOR,FET	352-1042-010		17856	U310
Q13	TRANSISTOR	352-0766-010		95445	2N5109
Q14	(SEE 637-1767-001)				
RT1,RT2	NOT USED				
RT3	RESISTOR,THRM 40 OHMS, 10%, 0.5W	714-1725-000		10646	0325F5-016
R1-R51	NOT USED				
R52	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R53	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R54	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R55	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/4W	745-0692-000		81349	RCR07G270KS
R56,R57	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R58	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
R59	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R60,R61	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R62	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W	745-4382-000		81349	RCR07G4R7JS
R63	RESISTOR,FXD CMPSN, 15 OHMS, 10%, 1/4W	745-0683-000		81349	RCR07G150KS
R64	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R65	NOT USED				
R66,R67	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (A3)	745-0749-000		81349	RCR07G102KS
R68	RESISTOR,VAR 100 OHMS, 30%, 1/2W	382-0008-040		73138	62PR100
R69	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R70-R79	NOT USED				
R80	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W (A4)	745-0710-000		81349	RCR07G820KS
R80	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
R81-R142	NOT USED				
R143	RESISTOR,FXD CMPSN, 22 OHMS, 10%, 1/4W (A4)	745-0689-000		81349	RCR07G220KS
T1-T4	NOT USED				
T5	TRANSFORMER,RF	278-0430-170		03550	22026
T6	TRANSFORMER,RF	278-0430-150		03550	22028

MODIFICATION HISTORY

Note

First mixer board A2 635-0782-002 has used three configurations of baseboard 600-1993-716. These baseboard configurations are identified only by the CI stamped following the baseboard number. Each baseboard may contain a different component layout and/or different printed circuits.

a. Initial configuration 600-1993-716 CI 77116

b. Revised configuration 600-1993-716 CI 77266

c. Current configuration 600-1993-716 CI 77486

Changes to configurations a and b were made only to update cards in factory stock to the current configuration at the time of the revision.

FIRST MIXER BOARD A2 635-0782-002
BASEBOARD 600-1993-716 CI 77116
MODIFICATION HISTORY

Note

Differences between 600-1993-716 CI 77116 before REV K and initial instruction book schematic/parts list are as follows:

C29 was 180 pF. L14 was 0.27 μH.
C31 was 56 pF. R47 was 47 Ω.

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
None	Changed: C29 from 180 pF to 150 pF. C31 from 56 pF to 36 pF. L14 from 0.27 μH to 0.22 μH.	REV K and above
A1	Added R142,2200 Ω.	REV K and above
A5	Added: R144, 110 Ω. R145, 110 Ω. Changed: C48 from 18 to 20 pF. C49 from 18 to 20 pF. C77 from 1000 pF to 47 pF. L19 from 2.7 μH to 1.0 μH. L20 from 2.7 μH to 1.0 μH. R51 from 47 Ω to 100 Ω.	REV K and above
A7	Changed: R44 from 18 Ω to 22 Ω. R45 from 18 Ω to 22 Ω.	REV K and above
A10	Changed: C46 from 5 pF to 15 pF. C47 from 51 pF to 330 pF.	REV K and above

FIRST MIXER BOARD A2 635-0782-002
BASEBOARD 600-1993-716 CI 77266
MODIFICATION HISTORY

Note

600-1993-716 CI 77266 and initial instruction book schematic/parts list are compatible.

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Added R142, 2200 Ω.	REV E and above
A5	Added: L69, 0.15 μH. R144, 110 Ω. R145, 110 Ω. Changed: C48 from 18 pF to 20 pF. C49 from 18 pF to 20 pF. C77 from 1000 pF to 47 pF. L19 from 2.7 μH to 1.0 μH. L20 from 2.7 μH to 1.0 μH. R47 from 82 Ω to 68 Ω. R51 from 47 Ω to 100 Ω.	REV F and above
A7	Changed: R44 from 18 Ω to 22 Ω. R45 from 18 Ω to 22 Ω.	REV H and above
A10	Changed: C46 from 5 pF to 15 pF. C47 from 51 pF to 330 pF.	REV W and above
C1	Changed: C56 from 0.01 pF to 1000 pF.	REV W and above
C2	Changed: R37 from 270 Ω to 220 Ω. R43 from 1500 Ω to 2200 Ω.	REV W and above
C4	Changed: R142 from 2200 Ω to 1600 Ω.	REV W And above

Note

Second mixer board A3 635-0784-002 has used two configurations of baseboard 600-1993-717. These baseboard configurations are identified only by the CI stamped following the baseboard number. Each baseboard may contain a different component layout and/or different printed circuits.

a. Initial configuration 600-1993-717 CI 77116 (635-0784-002 through REV D).

b. Current configuration 600-1993-717 CI 77486.

Changes to configuration a (after REV D) were made only to update cards in factory stock to the current configuration at the time of the revision.

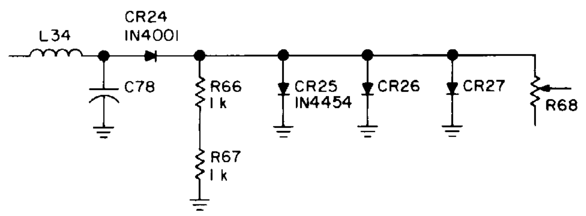
SECOND MIXER BOARD A3 635-0784-002
BASEBOARD 600-1993-717 CI 77116
MODIFICATION HISTORY (AFTER REV D)

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A4	Changed A3L34 from 0.33 μH to 0.27 μH.	REV H and above

Note

All changes to 635-0782-002 shown in the remainder of this modification history are for the current configuration baseboard 600-1993-716 CI 77486.

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Added A2R142, 2200 Ω.	635-0782-002, REV G and above
A2	Added C126, test select of 2 pF to 6 pF.	637-1767-001, REV C and above
A3	Deleted A3CR24, 1N4001; A3CR25, 1N4454; A3R66, 1 kΩ; and A3R67, 1 kΩ (circuit was as shown below).	635-0784-002, REV C and above



REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A4	Deleted A3L36, 220 μH (replaced with A3R143). Added A3C125, 4700 pF. Added A3R143, 22 Ω. Changed: A3C61 from 33 pF to 27 pF. A3C73 from 0.01 μF to 0.1 μF. A3L34 from 0.39 μH to 0.33 μH. A3R80 from 82 Ω to 68 Ω.	635-0784-002, REV C and above
A5	Added A2L69, 0.15 μH. Added A2R144, 110 Ω. Added A2R145, 110 Ω. Changed: A2C48 from 18 pF to 20 pF. A2C49 from 18 pF to 20 pF. A2C77 from 1000 pF to 47 pF. A2L19 from 2.7 μH to 1.0 μH. A2L20 from 2.7 μH to 1.0 μH. A2R47 from 82 Ω to 68 Ω. A2R51 from 47 Ω to 100 Ω.	635-0782-002, REV G and above
A6	Changed A3C65 from 1000 pF to 220 pF.	635-0784-002, REV D and above
None	Changed second mixer A3 635-0784-002 baseboard configuration from 600-1993-717 CI 77116 to 600-1993-717 CI 77486.	635-0784-002, REV E and above

Note

All changes to 635-0784-002 shown in the remainder of this modification history are for the current configuration baseboard 600-1993-717 CI 77486.

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A7	Changed: A2R44 from 18 Ω to 22 Ω. A2R45 from 18 Ω to 22 Ω.	635-0782-002, REV J and above
A11	Changed R139 from 180 Ω to test select of 82 Ω to 220 Ω.	637-1767-001, REV F and above
A8	Added C127, test select of 1 pF or 2 pF.	637-1767-001, REV H and above
A9	Changed A3L34 from 0.33 μH to 0.27 μH.	635-0784-002, REV G and above
A10	Changed: A2C46 from 5 pF to 15 pF. A2C47 from 51 pF to 330 pF.	635-0782-002, REV L and above
C1	Changed: A2C31 from 47 pF to 36 pF. A2C56 from 0.01 μF to 1400 pF.	635-0782-002 REV M and above
B1	Added C130, 2.2 μF electrolytic. Added C131, 2.2 μF electrolytic. Added C132, 2.2 μF electrolytic. Added C133, 22 μF electrolytic. Changed L58 from 4.7 μH to 120 μH.	637-1767-001, REV K and above
B2	Changed A1R4 from 2200 Ω to 15 kΩ.	635-0780-002 REV H and above
C2	Changed: A2R37 from 270 Ω to 220 Ω. A2R43 from 1500 Ω to 2200 Ω.	635-0782-002, REV R and above
C3	Changed L34 from 0.27 μH to 0.33 μH.	635-0784-002, REV M and above
B3	Changed: C57 from 56 pF to 68 pF. C58 from 56 pF to 47 pF.	637-1767-001, REV P and, above

Note

Modification history through 637-1767-XXX REV P has been included in all 637-1767-002 rf translators.

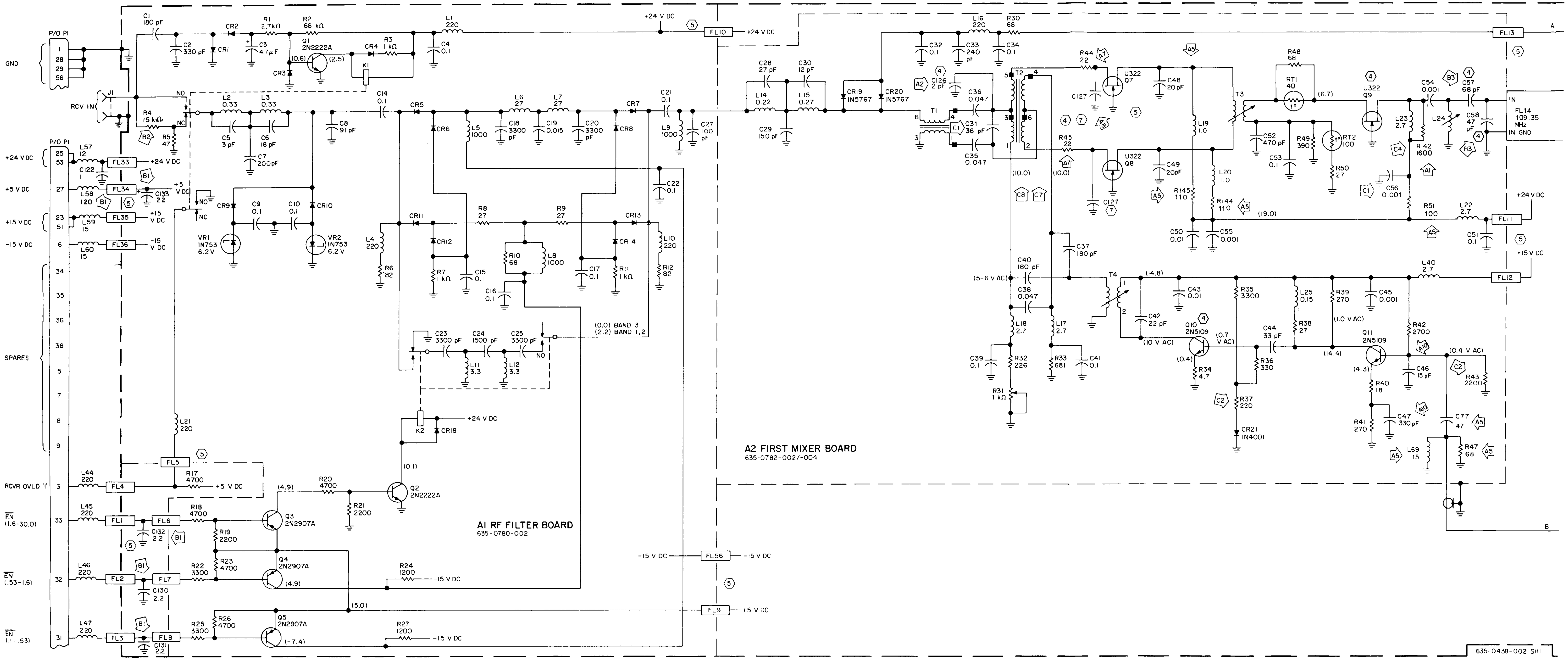
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
C4	Changed: A2R142 from 2200 Ω to 1600 Ω.	635-0782-002, REV T and above
C5	Added: C129, 3 pF. Z1, 637-3793-001	637-1767-002 only, REV R and above
C6	Changed A3M1 from 277-0405-010 to 277-0405-020 (no schematic change).	635-0784-002, REV P and above
C7	Added: A2C134, 150 pF.	635-0782-002/ -004, REV AA and above
C8	Relocated A2C37 and A2C40. Deleted A2C134, 150 pF from across T2-4 and T2-1.	635-0782-002/ -004, REV AB and above
C9	Changed A3C73 from 913-3279-180 to 913-3279-200 (no schematic change).	635-0784-002, REV R and above

Note

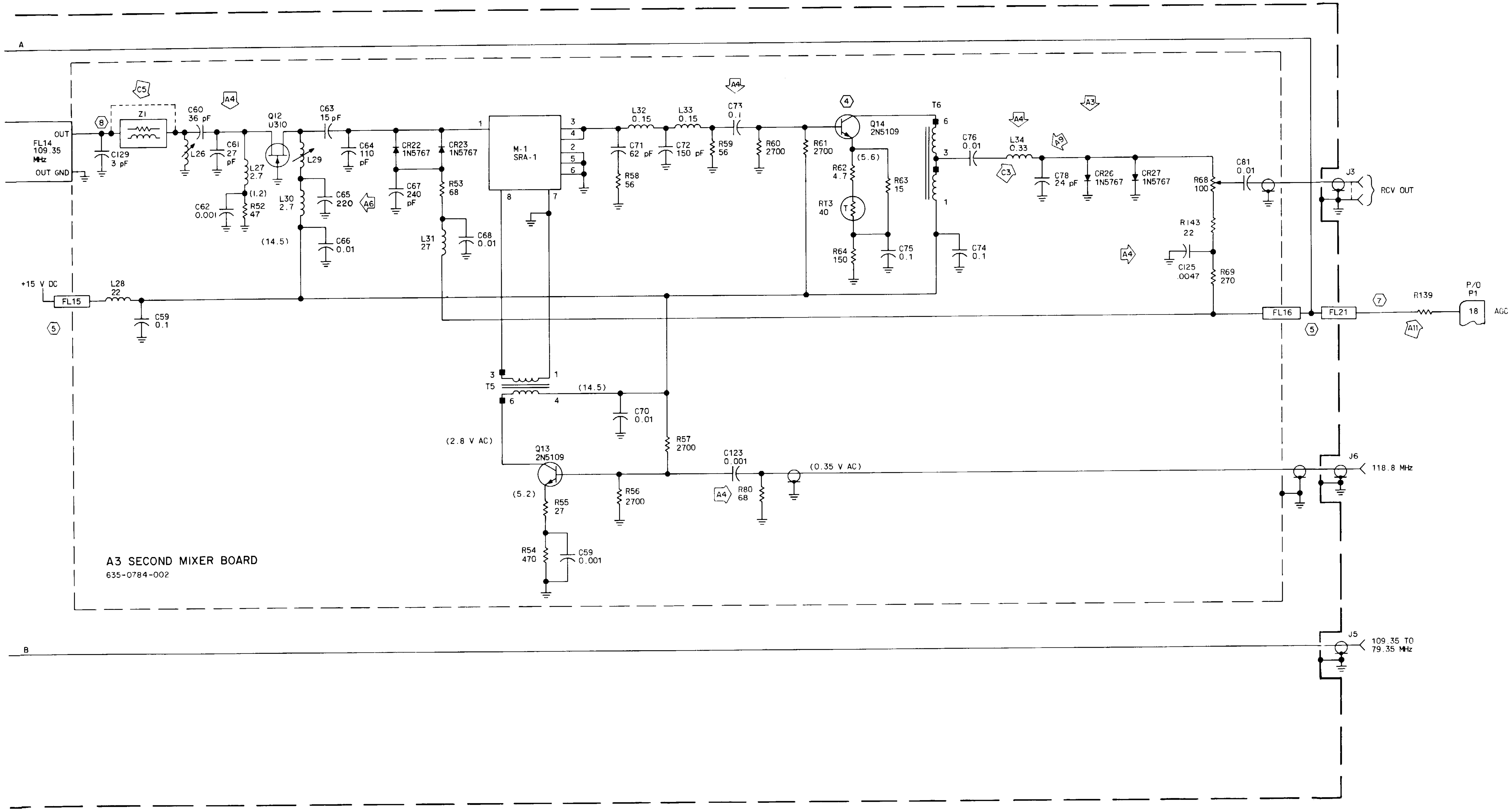
Modification history through 637-1767-XXX REV LL (except C5) has been incorporated in all 637-1767-003 rf translators.

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
D1	Changed following capacitors from 2 μF to test select: C206, C211, C248, C249, and C250. Added C251, 0.001 μF. Changed C57 from 68 pF to 47 pF and C58 from 47 pF to 68 pF. Changed R239 from 100 Ω to 33 Ω.	637-1767-003, REV Y and above
D2	Changed A2C208, A2C210, A2C212, A2C215, A2C220, A2C235-A2C240 from 351-4068-170 to 913-3667-190 (no schematic change). Changed A2C225 from 33 pF to 47 pF. Added A2L214, 0.33 μH. Changed A2Q201-A2Q204 from 352-6003-010 to 646-7028-001 (no schematic change). Changed: A2R221 from 1800 Ω to 1000 Ω. A2R222 from 820 Ω to 680 Ω. A2R237 from 150 Ω to 560 Ω. Deleted A2R238, 75 Ω, from in parallel with A2C247. Added A2R247, 220 Ω.	642-3587-001, REV B and above
D3	Added A1CR19 and A1CR20, 1N4454 Added A1R28, 4700 Ω	635-0780-004, REV R and above

RF Translator, Schematic Diagram
Figure 5 (Sheet 6)



RF Translator (637-1767-001, -002), Schematic Diagram
Figure 5 (Sheet 7)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② UNLESS OTHERWISE SPECIFIED, DIODES ARE TYPE 1N4454.

③ PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

④ INSTALLED ON NEXT HIGHER ASSEMBLY (637-1767-001, -002, -003, -004).

⑤ ALL FILTERS ARE 1750 pF, EXCEPT BANDPASS FILTER FL14.

⑥ U322, A2Q7 AND A2Q8, MATCHED SET.

⑦ TEST SELECT: R139 FROM 82Ω TO 270Ω.
C126 FROM 2pF TO 6pF OR REMOVED A2
A8 C127 FROM 1pF OR 2pF OR REMOVED
C206 1pF, 2pF, 3pF OR REMOVED
C211 1pF, 2pF, 3pF OR REMOVED DI
C248 1pF, 2pF, 3pF OR REMOVED
C249 1pF, 2pF, 3pF OR REMOVED
C250 1pF, 2pF, 3pF OR REMOVED

⑧ FOR 637-1767-001, DELETE C129 AND REPLACE Z1 WITH BUS WIRE, COMPONENTS C129 AND Z1 ARE USED ON 637-1767-002 ONLY.
FL14 ON 637-1767-001 IS 293-1220-030.
FL14 ON 637-1767-002 IS 293-1330-010.
FL14 ON 637-1767-004 IS 293-1330-010.
FOR 637-1767-003, USE SHEET 3 INSTEAD OF SHEET 1, SHEET 3 APPLICABLE ONLY TO 637-1767-003.

⑨ MULTIPLE LOCATIONS ARE SHOWN FOR TEST SELECT CAPACITORS C206, C211, C248, C249, AND C250. CAPACITORS ARE ADDED AT LOCATIONS SHOWN OR DELETED PER TEST REQUIREMENTS (671-1703-001).

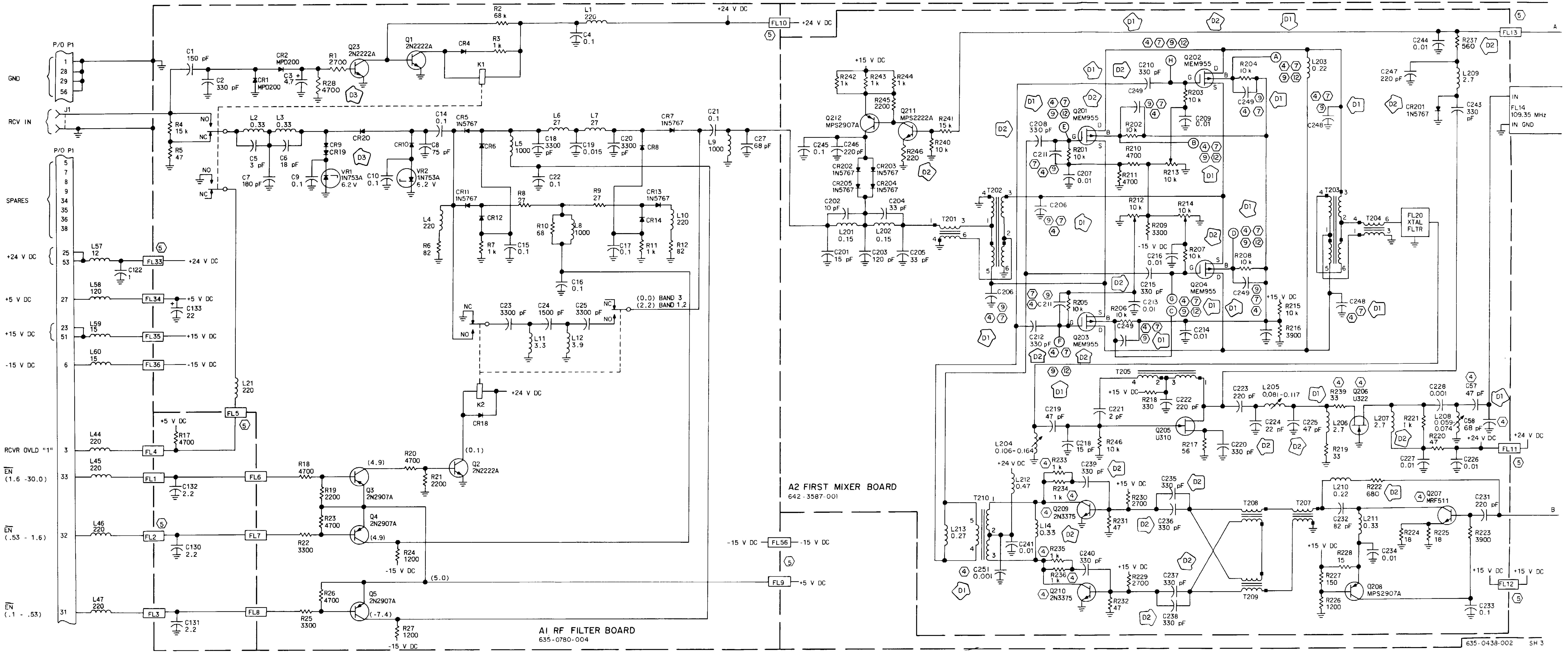
⑩ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

⑪ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

⑫ TEST SELECT CAPACITOR C250 MAY BE LOCATED BETWEEN POINTS:
A AND E,F,G, OR H
OR B AND E,F,G, OR H
OR C AND E,F,G, OR H
OR D AND E,F,G, OR H
DI

635-0438-002 SH 2

RF Translator, Schematic Diagram
Figure 5 (Sheet 8)



RF Translator (637-1767-003 only), Schematic Diagram
Figure 5 (Sheet 9)

Control
(638-6629-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0770710-001211
1 January 1981

1. DESCRIPTION

Control 638-6629-001, shown in figure 1, is a 2-layer planar card with a 130-pin edge-on connector (2 layers, 65 pins each).

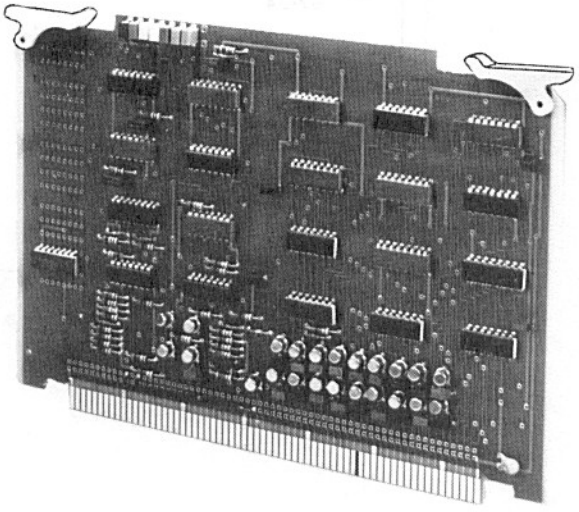
The control card consists of bcd parallel frequency control circuits, frequency band control circuits, tune start control circuit, receive mode enable circuits, and monitor control circuits.

2. PRINCIPLES OF OPERATION

2.1 General

The control card:

a.. Receives parallel bcd inputs and supplies buffered, current-driven parallel bcd outputs.
b. Uses the parallel bcd inputs to produce frequency band control outputs.
c. Produces a receiver fault output from a fault summary circuit having fault inputs from:
  1. Power supply
  2. Frequency reference
  3. Synthesizer
  4. Vbfo
  5. Subcarrier
d. Produces an rf overload indication from a fault summary of the preselector and the receiver rf overload inputs.
e. Receives a preselector fault signal and supplies a buffered, current-driven preselector fault output.
f. Receives a local frequency change, vbfo frequency change, remote frequency change, or a local enable signal change and produces a tune start pulse output.



TPA-3067-017

Control
Figure 1

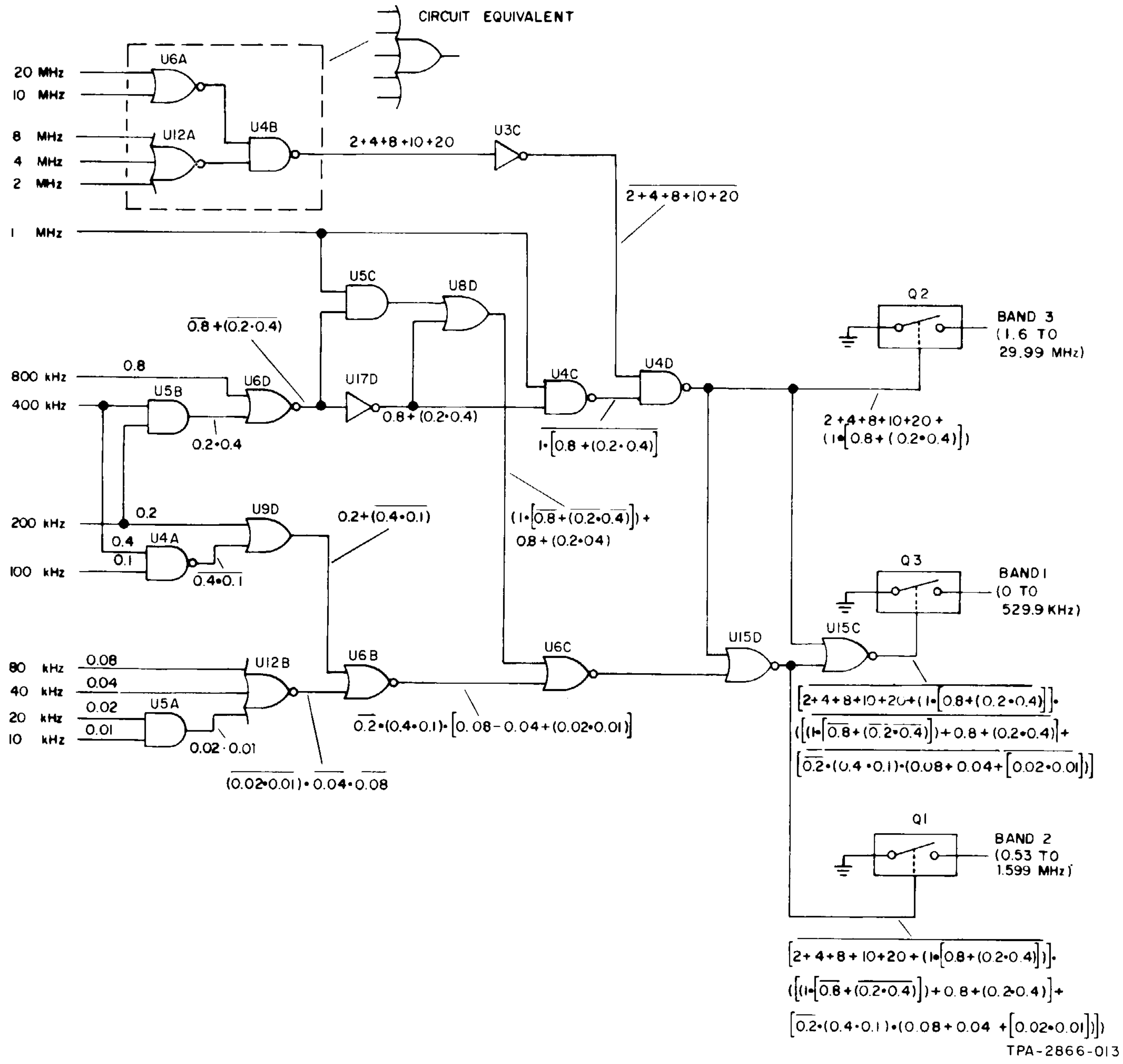
g. Receives CW, A1, and ISB enable signals to produce an A1/CW or 450-kHz enable output; and A2 and B2 enable signals, to produce a subcarrier enable output.

2.2 BCD Frequency Control Circuits (Refer to figure 6.)

The bcd frequency control circuits are parallel-to-parallel bcd control signals. Bcd signals from 1 kHz to 20 MHz are supplied to the control card and provide transistor-switched ground or open-circuit output signals.

2.3 Band Control Output Circuits (Refer to figure 2.)

The band control output circuits receive parallel bcd input control signals and convert them to three band



Band Control Output Circuits
Figure 2

output signals. Frequency ranges of the bands are as follows: band 1 — 0 to 529.9 kHz, band 2 — 530 kHz to 1.599 MHz, and band 3 — 1.600 to 29.999 MHz.

Refer to table 1 and figure 2, and note that any bcd frequency input that lies between the low and the high frequency of each band on the table provides the associated band output control signal.

2.4 *Fault and Monitor Circuits (Refer to figure 3.)*

The following fault and monitor circuits are included in this control card.

a. Receiver fault signal (logic 1 = fault) is generated when one or more of the following input signals are logic 1:

1. Power supply fault
2. Subcarrier fault
3. Frequency reference fault
4. Synthesizer fault
5. Vbfo fault
6. Receiver fault input

A restored-power-on condition or a power supply fault input causes the receiver fault to be latched in the fault mode. The power supply fault is

Table 1. Band Control Circuits, Logic Table

FREQ (MHz)	FREQ (MHz) CONTROL INPUTS														BAND
	20	10	8	4	2	1	0.8	0.4	0.2	0.1	0.08	0.04	0.02	0.01	
29.99	1	0	1	0	0	1	1	0	0	1	1	0	0	1	(max)
20.00	1	0	x	x	x	x	x	x	x	x	x	x	x	x	
10.00	0	1	x	x	x	x	x	x	x	x	x	x	x	x	
8.00	x	x	1	0	0	x	x	x	x	x	x	x	x	x	3
4.00	x	x	0	1	x	x	x	x	x	x	x	x	x	x	
2.00	x	x	0	x	1	x	x	x	x	x	x	x	x	x	
1.80	x	x	x	x	x	1	1	0	0	x	x	x	x	x	
1.60	0	0	0	0	0	1	0	1	1	0	0	0	0	0	(min)
1.59	0	0	0	0	0	1	0	1	0	1	1	0	0	1	(max)
1.50	0	0	0	0	0	1	0	1	0	1	x	x	x	x	
1.40	0	0	0	0	0	1	0	1	x	x	x	x	x	x	
1.20	0	0	0	0	0	1	0	x	1	x	x	x	x	x	
1.10	0	0	0	0	0	1	0	x	x	1	x	x	x	x	2
0.80	0	0	0	0	0	0	1	0	0	x	x	x	x	x	
0.60	0	0	0	0	0	0	0	1	1	x	x	x	x	x	
0.58	0	0	0	0	0	x	0	1	x	1	1	0	0	x	
0.54	0	0	0	0	0	x	0	1	x	1	0	1	x	x	
0.53	0	0	0	0	0	0	0	1	0	1	0	0	1	1	(min)
0.52	0	0	0	0	0	0	0	1	0	1	0	0	1	0	(max)
0.50	0	0	0	0	0	0	0	1	0	1	0	0	x	x	
0.40	0	0	0	0	0	0	0	1	0	x	x	x	x	x	
0.20	0	0	0	0	0	0	0	0	1	x	x	x	x	x	
0.10	0	0	0	0	0	0	0	x	x	1	x	x	x	x	
0.08	0	0	0	0	0	0	0	x	x	x	1	0	0	x	1
0.04	0	0	0	0	0	0	0	x	x	x	0	1	x	x	
0.03	0	0	0	0	0	0	0	x	x	x	0	x	1	1	
0.02	0	0	0	0	0	0	0	x	x	x	0	x	1	x	
0.01	0	0	0	0	0	0	0	x	x	x	x	x	x	1	
0.00	0	0	0	0	0	0	0	x	x	x	x	x	x	x	

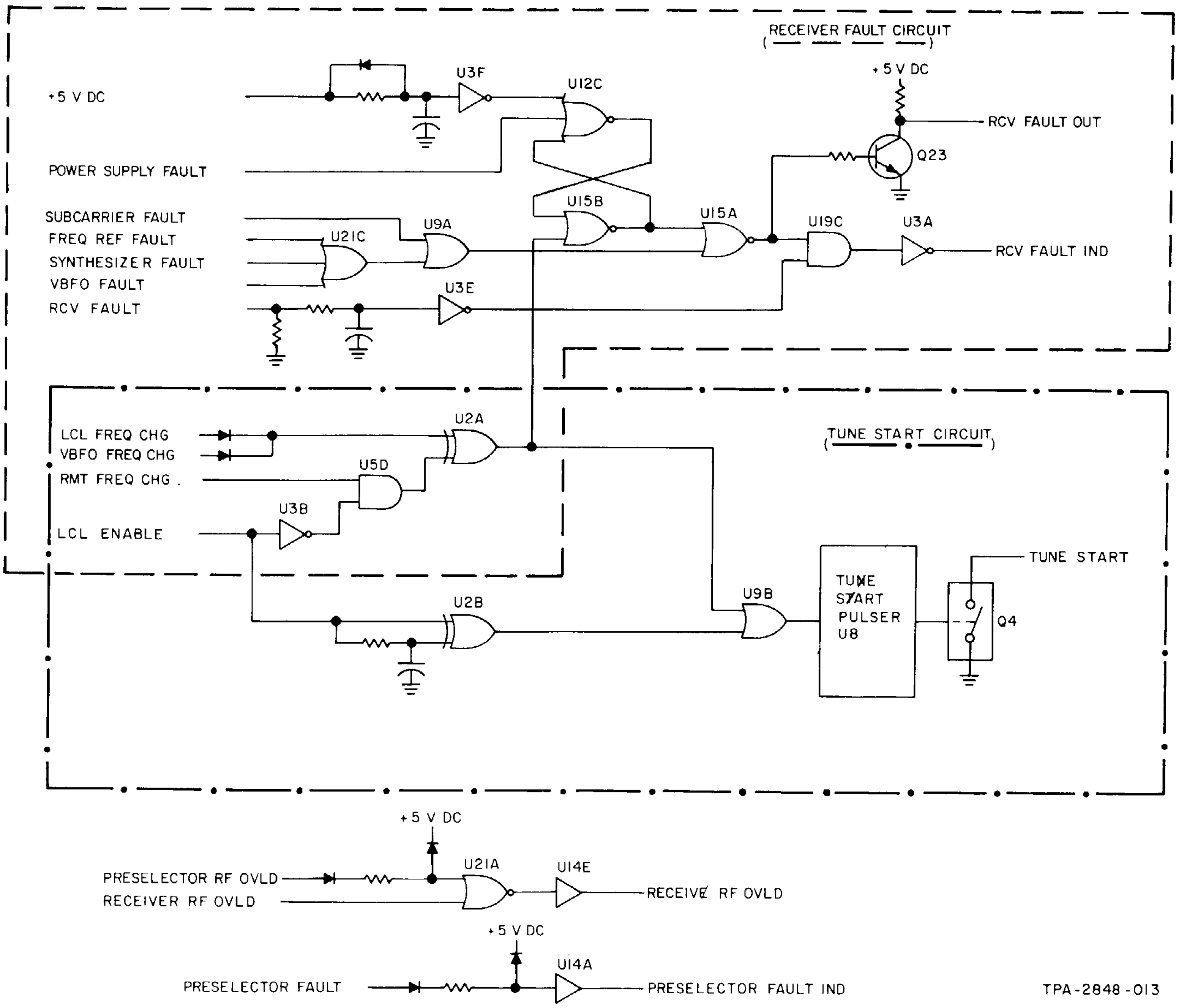
1 = logic 1; 0 = logic 0

x = Either logic 1 or logic 0 except:
Bcd for band 3 cannot exceed 29.999 MHz or fall below 1.60 MHz; bcd for band 2 cannot exceed 1.599 MHz or fall below 0.53 MHz; and bcd for band 1 cannot exceed 0.529 MHz.

cleared by changing frequency. The other faults are cleared when the fault is removed.

b. Receive rf overload indication (logic 1 = overload) is generated by a preselector rf overload (logic 1) or a receive rf overload (logic 1) input. The +5 V dc connected through the diode in the preselector rf overload input line is a high-level protector that prevents any signal in excess of +5 V dc from being applied to NOR gate U21A.

c. Preselector fault indication (logic 1 = fault) is generated by a preselector fault (logic 1) input. The +5 V dc connected through the diode in the



Fault, Monitor, and Tune Start Circuits
Figure 3

preselector fault input line is a high-level protector that prevents any signal in excess of +5 V dc from being applied to buffer/driver U14A.

2.5 Tune Start Circuit (Refer to figure 3.)

The tune start pulse (ground at TP2) is initiated by making a frequency change or a change in the local-remote status to the receiver. The tune start pulser U8 is retriggerable and holds TP2 at ground as long as the frequency or local-remote status is constantly changing.

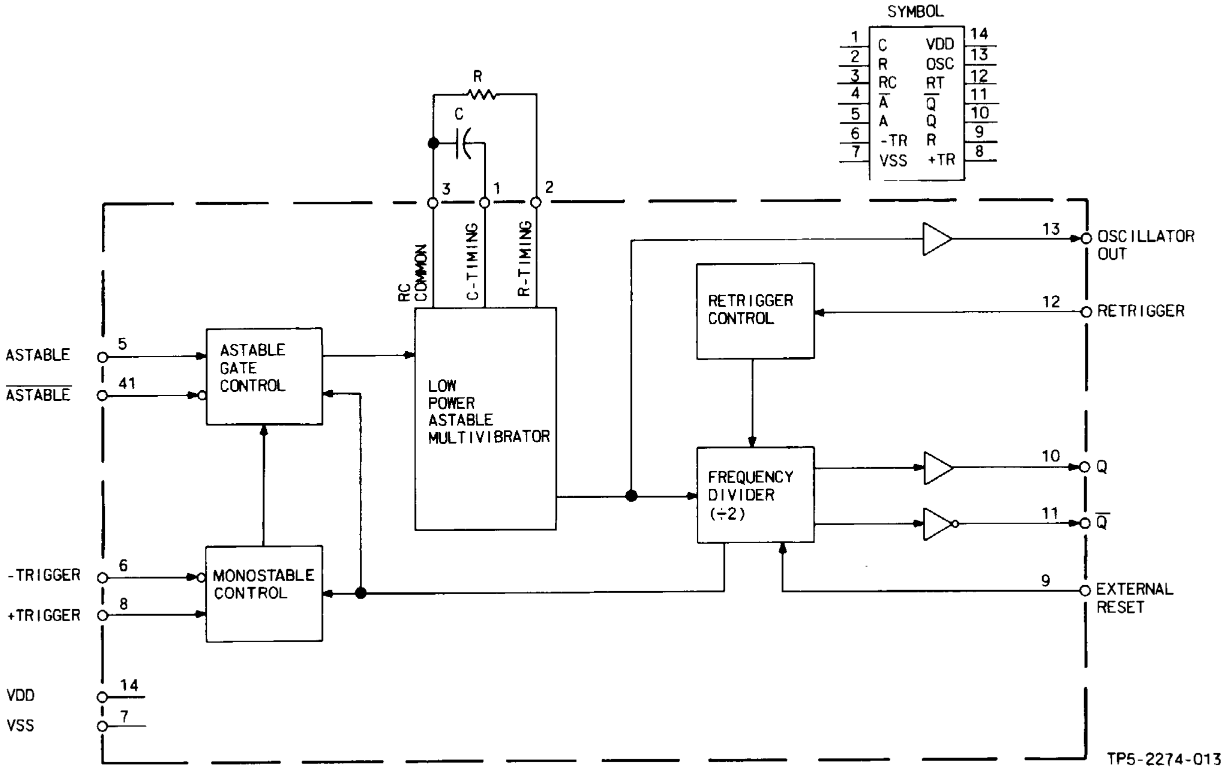
With the local enable signal (logic 1) applied, a logic 1 local frequency change signal applied causes a logic 1 + trigger to be applied to pulser U8 (monostable multivibrator).

With the local enable signal removed (logic 0 applied), a logic 1 remote frequency signal applied causes a logic 1 + trigger to be applied to pulser U8.

2.6 Monostable Multivibrator (COS/MOS Lower-Power Monostable/Astable Multivibrator 351-8200-020) (Refer to figure 4 and table 2.)

The 351-8200-020 is a gateable astable multivibrator with logic techniques incorporated to permit positive or negative edge-triggered monostable multivibrator action having retriggering and external counting options.

Inputs include + trigger, - trigger, astable, $\overline{\text{astable}}$, retrigger, and external reset. Buffered outputs are Q, $\overline{Q}$, and oscillator. In all modes of operation, an external capacitor must be connected between C-timing



COS/MOS Linear Power Monostable/Astable Multivibrator, 351-8200-020
Figure 4

and RC-common terminals, and an external resistor must be connected between the R-timing and RC-common terminals.

Astable operation is enabled by a high level on the astable input. The period of the square wave at the Q and $\overline{Q}$ outputs in this mode of operation is a function of the external components employed. True input pulses on the astable input or complement pulses on the $\overline{\text{astable}}$ input allow the circuit to be used as a gateable multivibrator. An output whose period is half of that which appears at the Q terminal is available at the oscillator output terminal. However, a 50-percent duty cycle is not guaranteed at this output.

A high level should be applied to the external reset whenever V_{DD} is applied or removed. In the monostable mode, positive-edge triggering is accomplished by application of a leading-edge pulse to the + trigger input and a low level to the - trigger input. For negative-edge triggering a trailing edge pulse is applied to the - trigger and a high level is applied to the + trigger. Input pulses may be of any duration relative to the output pulse. The multivibrator can be retriggered (on the leading edge only) by applying a common pulse to both the retrigger and trigger inputs. In this mode, the output pulse remains high as long as the input pulse period is shorter than the period determined by the RC components.

An external countdown option can be implemented by coupling Q to an external N counter and resetting the counter with the trigger pulse. The counter output pulse is fed back to the astable input and has a duration equal to N times the period of the multivibrator.

A high level on the external reset input assures no output pulse during an ON power condition. This input can also be activated to terminate the output pulse at any time.

2.7 Exclusive OR Gate 351-8159-190 (Refer to figure 5.)

Exclusive OR gate 351-8159-190 consists of four 2-input exclusive OR gates in a package. The exclusive OR gate is commonly used as a pulse generator similar to that shown in figure 5.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

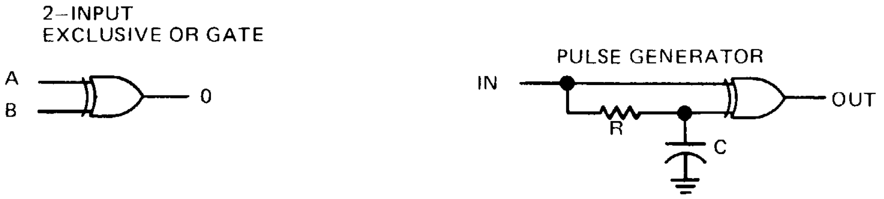
Test equipment and power sources required to test, troubleshoot, and repair the control card are listed in the maintenance section of this instruction book.

Table 2. COS/MOS Linear Power Monostable/Astable Multivibrator 351-8200-020, Logic Truth Table.

FUNCTION	TERMINAL CONNECTIONS				OUTPUT PERIOD OR PULSE WIDTH
	V_{DD}	V_{SS}	INPUT PULSE	OUTPUT PULSE	
Astable multivibrator					
Free running	4, 5, 6, 14	7, 8, 9, 12	None	10, 11, 13	$t_A(10, 11) = 4.40$ RC
True gating	4, 6, 14	7, 8, 9, 12	5	10, 11, 13	$t_A(13) = 2.20$ RC
Complement gating	6, 14	5, 7, 8, 9, 12	4	10, 11, 13	
Monostable multivibrator					
Positive-edge trigger	4, 14	5, 6, 7, 9, 12	8	10, 11	$t_M(10, 11) = 2.48$ RC
Negative-edge trigger	4, 8, 14	5, 7, 9, 12	6	10, 11	
Retriggerable	4, 14	5, 6, 7, 9	8, 12	10, 11	
*External countdown	14	5, 6, 7, 8, 9, 12	None	10, 11	

*Input pulse to reset of external counting chip. External counting chip output to terminal 4.

NOTE: In all cases external resistor between terminals 2 and 3 and external capacitor between terminals 1 and 3.



INPUTS		OUTPUT
A	B	0
0	0	0
1	0	1
0	1	1
1	1	0

INPUT	OUTPUT	
0	0	
1	0	
0 → 1	⎍	NOTE 1
1 → 0	⎍	NOTE 1

NOTE:
1. PULSE WIDTH DEPENDANT ON VALUE OF R AND C.

TP5-2268-011

Exclusive OR Gate, 351-8159-190
Figure 5

3.2 Testing

The test procedures in table 3 check total performance of the control card. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Table 3. Control, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing control that is to be tested. **Caution** Make sure PWR switch is turned off and card is not installed backward in following step. **Note** Front panel control settings (at the beginning of each test) are listed only for those controls whose settings affect the test. Unlisted controls may be set in any position. b. Remove control. Install it on extender card and place it in unit. c. Set unit LINE SELECTOR switch to 115 V. d. Connect unit to 115-V ac power source and set power on. **Caution** All measurements on P1 pins must be made with extreme care. Shorting 5-volt sources to any CMOS output device will damage the device.		
	e. Measure dc voltages between P1-65 and ground (TP1, brown).	+5 ±0.5 V dc	Check 5-V power supply.
2. Frequency outputs (Cont)	**Note** In this test, four frequencies are selected on the front panel FREQUENCY control. For each frequency, the frequency output line logic levels are measured at the rear panel PRESELECTOR CONTROL connector, J21. To provide collector voltage for the output transistors, a 4700-ohm resistor is placed in series with +5 V dc. The resistor is then sequentially connected to applicable pins of J21 and the logic level at the pins measured. The following chart gives the frequencies, applicable pin numbers, and the correct logic levels.		

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	a. Sequentially connect a 4700-ohm resistor between each of frequency outputs on J21 and +5 V dc. (+5 V may be obtained at pwr sply TB1-7.)		
	b. Measure voltage at pins and note that logic outputs are indicated in the following chart for each indicated frequency setting.	Logic 1 = +3 to +5 V Logic 0 = 0 to +0.5 V	Refer to figure 6 and check circuit associated with each abnormal output.

J16 PIN NO	36	17	35	16	34	15	33	14	32	13	31	12	30	11	29	10	28	9
ASSOCIATED P1 PIN NO	109	44	108	43	107	42	106	41	105	40	104	39	103	38	102	37	101	36
FREQUENCY (kHz)	BDC (MHz)						BCD (kHz)											
	20	10	8	4	2	1	800	400	200	100	80	40	20	10	8	4	2	1
29 999.00	1	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
16 666.00	0	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
10 000.00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 000.00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Logic 1 equals +3.0 to +5.0 V dc.

Logic 0 equals 0 to 0.5 V dc.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
	c. Disconnect 4700-ohm resistor.		
3. Band decode check	a. Measure voltage at TP4, TP5, and TP3. Note that logic outputs are as indicated in the following chart for each indicated frequency.	Logic 1 = +3 to +5 V Logic 0 = 0 to +0.5 V	Refer to figure 6 and check circuits associated with each abnormal output.

FREQUENCY (kHz)	BAND 1 TP4	BAND 2 TP5	BAND 3 TP3
29 999.99	1	1	0
16 666.66	1	1	0
2 000.00	1	1	0
1 999.99	1	1	0
1 600.00	1	1	0
1 599.99	1	0	1
0 530.00	1	0	1
0 529.99	0	1	1
0 000.00	0	1	1

Logic 1 equals +3.0 to +5.0 V dc.

Logic 0 equals 0 to 0.5 V dc.

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. Synthesizer, frequency reference, vbfo, and subcarrier faults	a. Temporarily connect +5 V (available at P1-65) to P1-49 (synthesizer fault input).	RCV FAULT indicator lights.	Proceed to step g.
	b. Remove connection and temporarily connect +5 V to P1-112 (frequency reference fault input).	RCV FAULT indicat indicator goes out when ground removed and lights when ground connected.	Check U21C.
	c. Remove connection and temporarily connect +5 V to P1-5 (vbfo fault input).	RCV FAULT indicator goes out when ground removed and lights when ground connected.	Check U21C.
	d. Remove connection and temporarily connect +5 V to P1-4 (subcarrier fault input).	RCV FAULT indicator goes out when ground removed and lights when ground connected.	Check U9A.
	e. Measure voltage at P1-78 (rcv fault output).	Not less than +3.0 V dc	Check U3E and Q23.
	f. Remove +5 V from P1-4.		
	TESTING COMPLETE		
	TROUBLESHOOTING		
	g. Measure dc voltage at P1-13.	Not less than +3.0 V dc	Check U21C, U9A, U15A, U19C, and U3A.
5. Power supply fault	a. Temporarily connect +5 V (available at P1-65) to P1-70.	RCV FAULT indicator lights.	Proceed to step d.
	b. Remove +5 V from P1-70.	RCV FAULT indicator remains lit.	Proceed to step e.
	c. Change any front panel frequency control.	RCV FAULT indicator goes out.	Proceed to step g.
	POWER SUPPLY FAULT TESTING COMPLETE		
	TROUBLESHOOTING		
	d. Measure dc voltage at P1-13.	Not less than +3.0 V dc.	Check U12C, U15A, U15B, and U19C.
(Cont)	e. Measure dc voltage at U15B-4.	Not less than +3.0 V dc. Repeat test 5.	Proceed to step f.

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	f. Measure dc voltage at U2A-3.	Not more than +0.5 V dc.	Check U2A, U15B, and U15A.
	g. Measure dc voltage at U15B-5 while changing any front panel frequency control.	Logic 1 pulse, returning to not more than +0.5 V dc after frequency is changed.	Check U2A, Proceed to step h.
	h. Measure dc voltages at following pins while changing any front panel frequency control:		
	P1-16	Not less than +3.0 V dc	Check U2A, U5D, and U3B.
	P1-21	Not more than +0.5 V dc	
	P1-47	Logic 1 pulse, returning to not more than +0.5 V dc after frequency is changed	
6. +5-V dc fault	a. Momentarily ground P1-65.	RCV FAULT indicator lights.	Check +5-V dc circuits.
	b. Immediately remove P1-65 ground.	RCV FAULT indicator remains on.	Check U3F and associated circuits.
	c. Change any front panel frequency control.	RCV fault indicator goes out.	Repeat test 5.
7. Preselector fault	a. Apply +5 V dc to P1-35.	PRESEL FAULT indicator lights.	Proceed to step c.
	b. Remove +5 V dc from P1-35.	PRESEL FAULT indicator goes out.	Proceed to step d.
	PRESELECTOR FAULT TESTING COMPLETE		
	TROUBLESHOOTING		
	c. Measure dc voltage at P1-71.	Not less than +3.0 V dc	Check U14A and associated circuit.
	d. Measure dc voltage at P1-71.	Not more than +0.5 V dc	Check U14A and associated circuit.

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Rf overload	a. Connect +5 V dc to P1-100.	RCV OVERLOAD indicator lights.	Proceed to step g.
	b. Remove +5 V dc from P1-100.	RCV OVERLOAD indicator goes out.	Proceed to step h.
	c. Connect rf signal generator directly to J1 (RCV ANT jack on rear panel).		
	d. Set rf signal generator and receiver front panel controls to 600 kHz.		
	e. Increase rf signal generator output level until receive overload relay just clicks.	RCV OVERLOAD indicator lights.	Proceed to step i.
	f. Remove rf signal generator output.	RCV OVERLOAD indicator goes out.	Proceed to step k.
	RF OVERLOAD TESTING COMPLETE		
	TROUBLESHOOTING		
	g. Measure dc voltage at P1-68.	Not less than +3.0 V dc	Check U21A, U14E, and associated circuit.
	h. Measure dc voltage at P1-100.	Not more than +0.5 V dc.	Check U21A, U14E, and associated circuit.
	i. Measure dc voltage at P1-12.	Not more than +0.5 V dc.	Check receive rf overload circuits.
	j. Measure dc voltage at P1-68.	Not more than +0.5 V dc.	Check U21A and associated circuit.
	k. Measure dc voltage at P1-12.	Not less than +3.0 V dc.	Check receive rf overload circuit.
9. Tune start	a. Connect 4700-ohm resistor between TP2 and +5 V dc. (Leave connected until test 9 complete.)		
	b. Measure output at TP2 while changing front panel frequency controls.	Logic 0 (ground) output pulse whose duration continues as long as frequency controls are constantly changing.	Proceed to step m.
	c. Measure output at TP2 when front panel frequency controls are set.	Not less than +3.0 V dc.	Proceed to step o.
(Cont)	d. Set front panel CONT switch to REM.		

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	e. Measure output at TP2 while changing front panel frequency controls.	Not less than +3.0 V dc (local frequency changes locked-out)	Proceed to step p.
	Note Steps f, g, and h are performed only if unit under test is connected remotely.		
	f. Measure output at TP2 while changing remote control frequency controls.	Logic 0 (ground) output pulse whose duration continues as long as frequency controls are constantly changing.	Proceed to step q.
	g. Set front panel CONT switch to LCL.		
	h. Measure output at TP2 while changing remote control frequency controls.	Not less than +3.0 V dc (remote frequency changes locked-out).	Check U3B and U5D.
	i. Measure output at U2B-4 while changing remote control frequency controls.	Logic 0 (ground) output pulse whose duration continues as long as CONT switch is constantly changing.	Check U2B and associated circuit.
	j. Remove 4700-ohm resistor from TP2.		
	TUNE START TESTING COMPLETE		
	TROUBLESHOOTING		
	m. Measure input at P1-47 while changing front panel frequency controls.	Logic 1 input pulse at each switching of frequency control.	Check local frequency change output circuits.
	n. Measure output at U9B-4 while changing front panel frequency controls.	Logic 1 pulse at each switching of frequency control.	Check U2A and U9B. If pulses are present, check U8 and Q4.
	o. Measure dc voltage at P1-47.	Not more than +0.5 V dc.	Check local frequency change output circuits. Check Q8.
	p. Measure dc voltage at P1-16.	Not more than +0.5 V dc.	Check local enable circuits. If circuits are functioning, check U3B, U5D, and U2A.
(Cont)			

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	q. Measure input at P1-21 while changing remote control frequency controls.	Logic 1 input pulse at each switching of remote control frequency controls.	Check remote frequency change input circuits. If circuits are functioning, check U5D and U2A.
10. 450-kHz enable	a. Set front panel MODE switch to ISB. Set all CH switches to OFF.		
	b. Measure output at TP6.	Not less than +3.0 V dc.	Proceed to step e.
	c. Set front panel MODE switch to AM.		
	d. Measure output of TP6.	Not more than +0.5 V dc.	Proceed to step f.
	450-kHz ENABLE TESTING COMPLETE		
	TROUBLESHOOTING		
	e. Measure dc voltage at P1-9.	Not less than +3.0 V dc.	Check ISB enable circuits. Check U20C.
	f. Measure dc voltage at P1-72, -26, and -9.	Not more than +0.5 V dc.	Check ISB, CW, and AM circuits. Check U20C and U20D.
11. A1/CW enable	a. Set front panel MODE switch to CW.		
	b. Measure output at TP8.	Not less than +3.0 V dc.	Proceed to step g.
	c. Set front panel MODE switch to ISB.		
	d. Measure output at TP8.	Not more than +0.5 V dc.	Proceed to step h.
	e. Set CH A1 to ON.		
	f. Measure output at TP8.	Not less than +3.0 V dc.	Proceed to step i.
	A1/CW ENABLE TESTING COMPLETE		
	g. Measure dc voltage at P1-72.	Not less than +3.0 V dc.	Check CW enable circuits. Check U20D.
(Cont)	h. Measure dc voltage at P1-72 and -26.	Not more than +0.5 V dc.	Check CW and A1 enable circuits. Check U20D.

Table 3. Control, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. (Cont)	i. Measure dc voltage at P1-26.	Not less than +3.0 V dc.	Check CH A1 enable circuits. Check U20D.
12. Subcarrier enable	a. Make sure CH A2 and CH B2 switches are OFF.		
	b. Measure output at TP7.	Not more than +0.5 V dc.	Proceed to step g.
	c. Set CH A2 to ON.		
	d. Measure output at TP7.	Not less than +3.0 V dc.	Proceed to step h.
	e. Set CH A2 to OFF and CH B2 to ON.		
	f. Measure output at TP7.	Not less than +3.0 V dc.	Proceed to step i.
	SUBCARRIER ENABLE TESTING COMPLETE		
	TROUBLESHOOTING		
	g. Measure dc voltage at P1-17 and -74.	Not more than +0.5 V dc.	Check CH A2 and CH B2 enable circuits. If dc voltage at logic 0, check U20B.
	h. Measure dc voltage at P1-17.	Not less than +3.0 V dc.	Check CH A2 enable circuit. Check U20B.
	i. Measure dc voltage at P1-74.	Not less than +3.0 V dc.	Check CH B2 enable circuit. Check U20B.

4. ALIGNMENT/ADJUSTMENT

4.1 AGC Time Constant Delay (Adjustment of R166)

With no signal input to card, adjust R166 to produce +1.85 V at U2-3.

4.2 AGC Meter Full-Scale Deflection (Adjustment of R120)

a. Apply 9.449-MHz, 10-mV input to P1.
b. Set MODE to ISB, AGC to OFF, CH A1 to ON, and METER to CH A1 +13FS.
c. Using RF GAIN, set voltage at P4-21 to +5 ±0.05 V.
d. Adjust R120 to produce +50 ±1 mV at P4-12. Note that front panel meter is deflected full-scale.

4.3 SSB Audio Output Level (Adjustment of R95)

a. Apply 9.449-MHz, 100-μV input to P1.
b. Set MODE to ISB, AGC to ON, CH A1 to ON, and RF GAIN to max cw position.
c. Connect 600-ohm resistor and audio voltmeter between P4-34 and ground.
d. Adjust R95 to produce 10 mV rms at P4-34.

4.4 AM Audio Output Level (Adjustment of R145)

a. Apply 9.449-MHz, 50% AM with 1000-Hz, 100-μV input to P1.
b. Set MODE to AM, BANDWIDTH to 16, AGC to ON, CH A1 to ON, and RF GAIN to max cw position.
c. Connect 600-ohm resistor and audio voltmeter between P4-8 and ground.
d. Adjust R145 to produce 10 mV rms at P4-34.

4.5 Mixer Balance (Adjustment of R8)

a. Disconnect P1 from any signal source.
b. Measure 9.9-MHz rf voltage (using high-impedance probe) at P3.
c. Adjust R8 to null 9.9-MHz signal at P3.
d. Reconnect P1.

4.6 IF Amplifier Alignment (Alignment of T1, T2, L7, L13, C3, and C5)

a. Set AGC to OFF, MODE to ISB, CH A1 to ON, and RF GAIN to max cw position.
b. Apply 9.4485-MHz input to P1 at level sufficient to produce approximately 25-mV rf at P6.
c. Adjust T1, T2, and L13 to obtain peak voltage at P6. (L13 has two adjustment peaks; either may be used.)
d. Set sig gen frequency to 10.351 MHz (image frequency).
e. Adjust C3 and C5 to null voltage at P6. (Increase sig gen output level as necessary to detect sharp null. Each capacitor has two null positions; either position may be used.)
f. Set sig gen to 9.4485 MHz.
g. Repeat T1, adjusting sig gen output level as necessary to detect peak.
h. Set MODE to AM and BANDWIDTH to 16.
i. Adjust L7 for peak voltage at P6.

4.7 IF Amplifier Gain (Adjustment of R19, R39, and R43)

a. Apply 9.4485-MHz, 10-mV input to P1.
b. Set AGC to OFF, CH A1 to ON, and MODE to ISB.
c. Adjust R19 to produce 28 mV rms at P3.
d. Measure rf voltage at Q9-d.
e. Adjust R39 to obtain 70 mV rf at Q9-d. (Voltage at Q9-d is to be 2.5 times voltage at P3.)
f. Set MODE to AM and BANDWIDTH to 16.
g. Measure rf voltage at Q9-d.
h. Adjust R43 to obtain 70-mV rf at Q9-d. (Voltage at Q9-d is to be 2.5 times voltage at P3.)
i. Set AGC to ON and RF GAIN to max cw position.
j. Set sig gen output to 100 μV.
k. Adjust R59 to obtain +0.85 V at P4-21.
l. Increase sig gen output by 40 dB (to 10 mV).
m. Adjust R136 to obtain +5.0 V at P4-21.
n. Repeat steps j through m until no further adjustment is necessary.
o. Disconnect sig gen from P1.
p. Adjust RF GAIN to obtain +5.00 ±0.05 V at P4-21.
q. Adjust R140 to obtain +3.0 ±0.05 V at P4-18.

5. REPAIR

Repair of the control card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is

THIS PAGE NOT APPLICABLE
REFERS TO A1 IF. BOARD

performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 6). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagrams to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

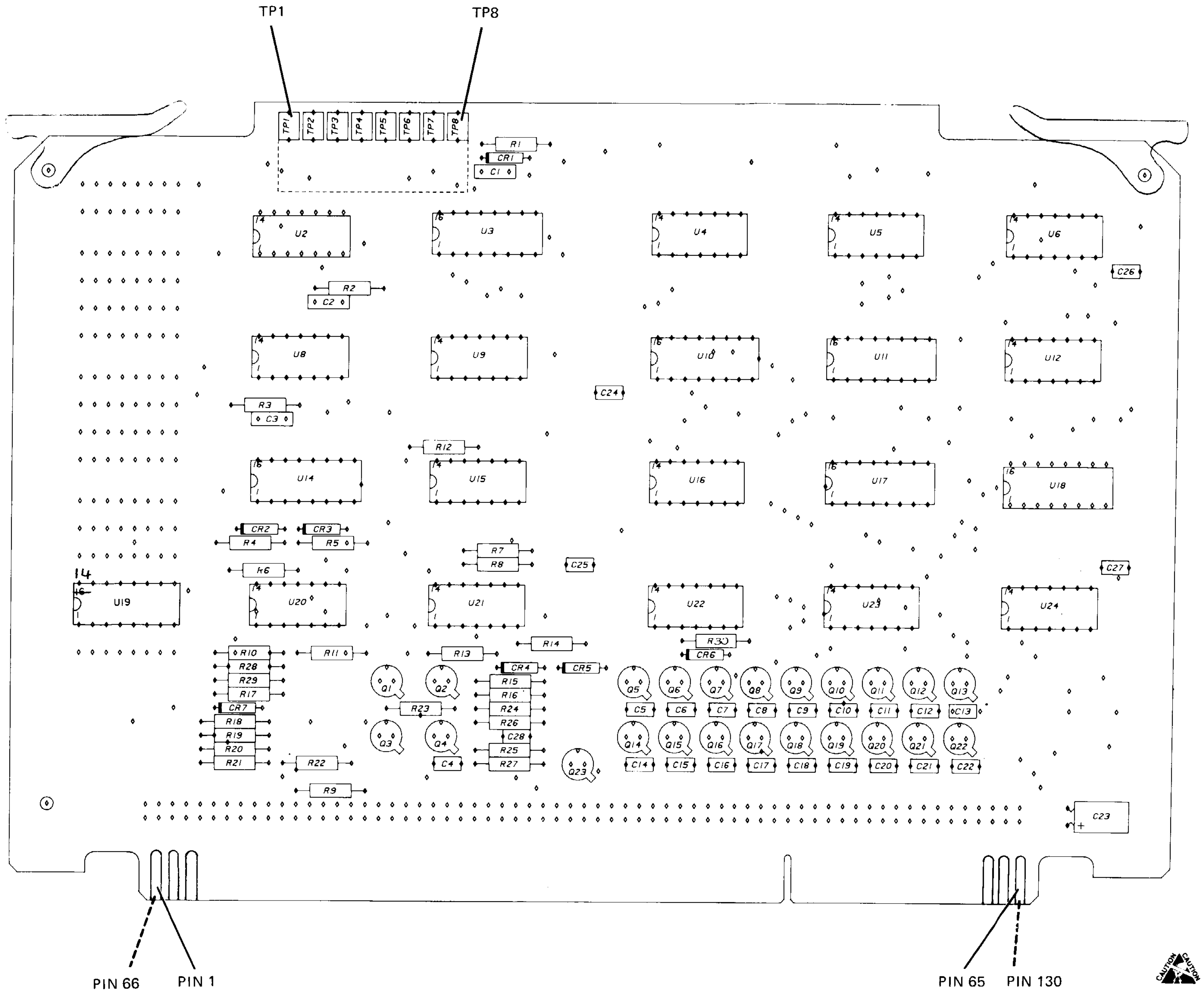
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
01121	ALLEN-BRADLEY CO 1201 SOUTH 2ND ST MILWAUKEE WI 53204
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
81349	MILITARY SPECIFICATION

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Control	638-6629-001	REV D



CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

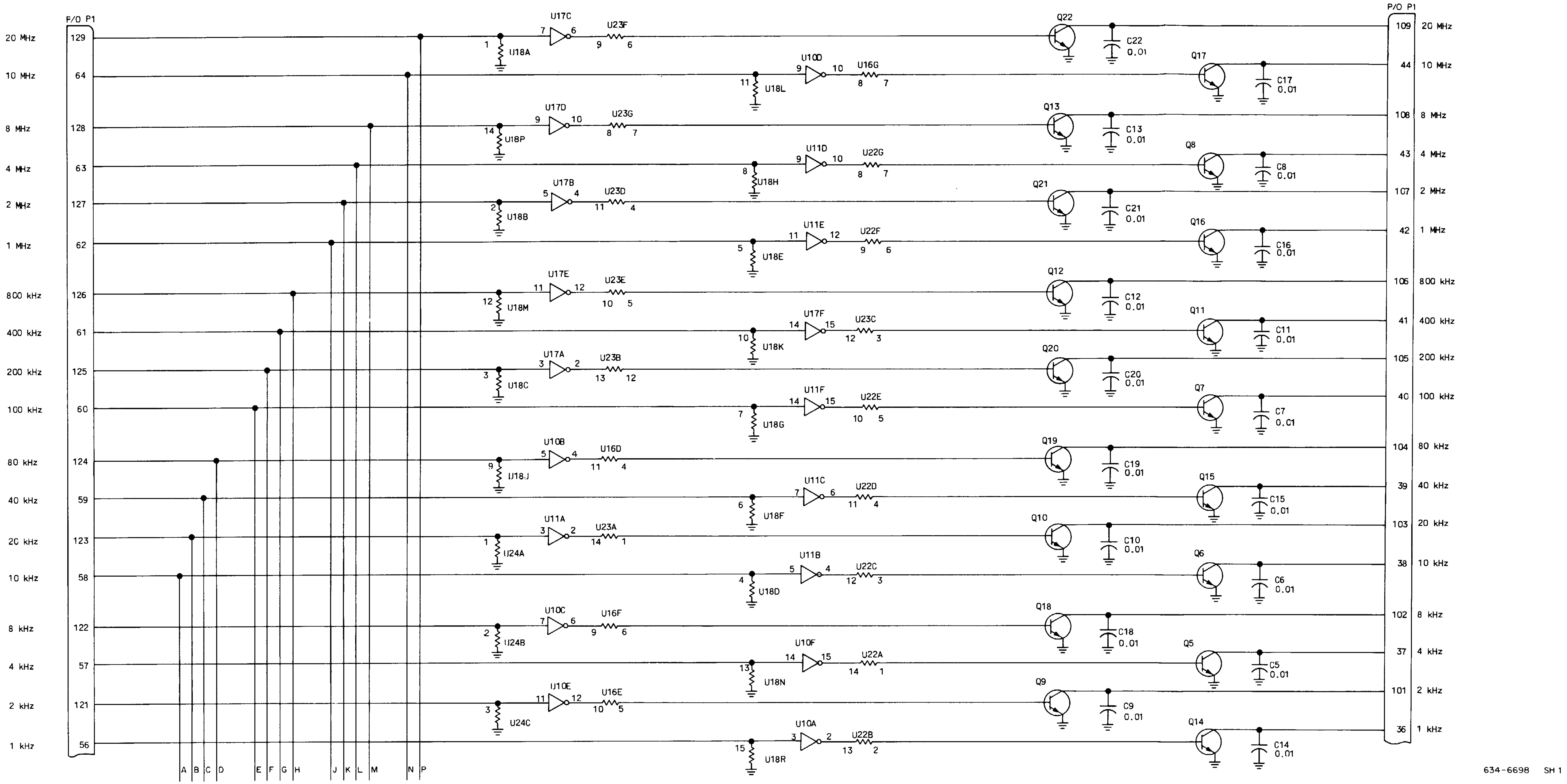
TPA-2507-018

Control, Schematic Diagram
Figure 6 (Sheet 1 of 4)

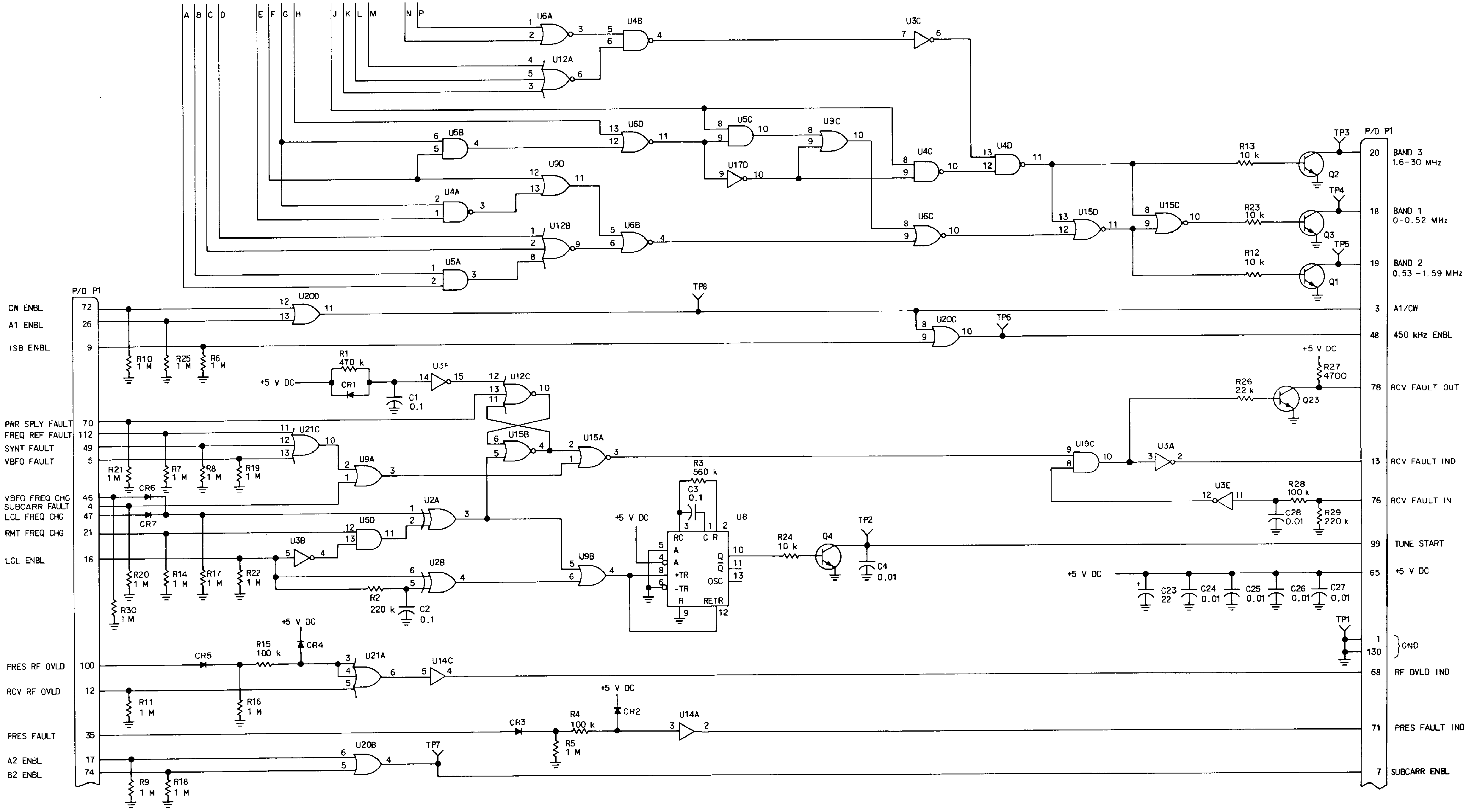
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CONTROL (ESDS)	638-6629-001			
CR1-CR7	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1-C3	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C4-C22	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C23	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1
C24-C28	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
Q1-Q23	TRANSISTOR	352-0661-020		07263	2N2222A
R1	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R2	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R3	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R4	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R5-R11	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R12,R13	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R14	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R15	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R16-R22	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R23,R24	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R25	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R26	RESISTOR,FXD CMPSN, 22K, 5%, 1/4W	745-0796-000		81349	RCR07G223JS
R27	RESISTOR,FXD CMPSN, 4.7K, 5%, 1/4W	745-0772-000		81349	RCR07G472JS
R28	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R29	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R30	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-011
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-011
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-011
U1	NOT USED				
U2	INTEGRATED CIRCUIT (ESDS)	351-8159-190		07263	4030BPC
U3	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U4	INTEGRATED CIRCUIT (ESDS)	351-8159-040		04713	MC14011UBCP
U5	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-030		02735	CD4081BE
U6	INTEGRATED CIRCUIT (ESDS)	351-8159-020		04713	MC14001UBCP
U7	NOT USED				
U8	MICROCIRCUIT (ESDS)	351-8200-020		02735	CD4047BE
U9	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-010		02735	CD4071BE
U10,U11	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U12	INTEGRATED CIRCUIT (ESDS)	351-8159-150		04713	MC14025UBCP
U13	NOT USED				
U14	INTEGRATED CIRCUIT (ESDS)	351-8159-220		07263	4050BPC
U15	INTEGRATED CIRCUIT (ESDS)	351-8159-020		04713	MC14001UBCP
U16	RESISTOR NTWK DUAL-IN-LINE, 10K, 2%, 125V	350-4027-090		01121	314B103
U17	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U18	RESISTOR NETWORK 220K, 5%, 1.25W PKG	350-4030-010		01121	316A224
U19	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-030		02735	CD4081BE
U20	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-010		02735	CD4071BE
U21	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-050		02735	CD4075BE
U22,U23	RESISTOR NTWK DUAL-IN-LINE, 10K, 2%, 125V	350-4027-090		01121	314B103
U24	RESISTOR NTWK DUAL-IN-LINE, 100K, 2%, 125V	350-4027-140		01121	314A104

Control, Schematic Diagram
Figure 6 (Sheet 2)



Control, Schematic Diagram
Figure 6 (Sheet 3)

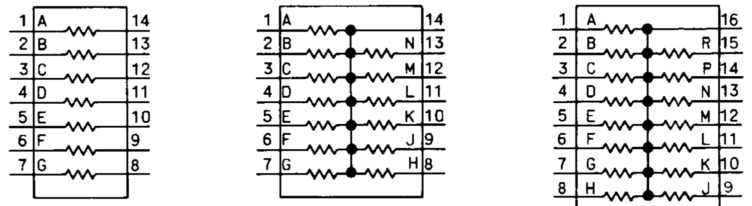


NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, TRANSISTORS ARE TYPE 2N2222A AND DIODES ARE TYPE 1N4454.

2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

3. U16, U22, U23- 10 k U24-100 k U18-220 k



4. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

5. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

MICROCIRCUIT INFORMATION

U NO.	TYPE	PWR (V DC)		SPARE SECTIONS
		+5	GND	
U1	SPARE			
U2	F4030PC	14	7	C, D
U3	F4049PC	1	8	
U4	F4011UBPC	14	7	
U5	CD4081BE	14	7	
U6	F4001UBPC	14	7	
U7	SPARE			
U8	CD4047AE	14	7	
U9	CD4071BE	14	7	
U10	F4049PC	1	8	
U11	F4049PC	1	8	
U12	F4025UBPC	14	7	
U13	SPARE			
U14	F4050PC	1	8	B,C,D,E,F
U15	F4001UBPC	14	7	
U16	NOTE 3			A,B,C
U17	F4049PC	1	8	
U18	NOTE 3		16	
U19	CD4081BE	14	7	A, B, D
U20	CD4071BE	14	7	A
U21	CD4075	14	7	B
U22	NOTE 3			
U23	NOTE 3			
U24	NOTE 3		14	D,N

634-6698 SH 2

Control, Schematic Diagram
Figure 6 (Sheet 4)

Rockwell
International

instructions

Parallel Input
(642-3135-001)

Collins Telecommunications Products Division
523-0770711-001211
1 January 1981
Printed in USA

1. DESCRIPTION

Parallel Input 642-3135-001, shown in figure 1, is a 2-layer planar card with a 130-pin (2 layers, 65 pins each) edge-on connector. All test points are mounted at the top edge of the card for easy access with the card installed in the unit.

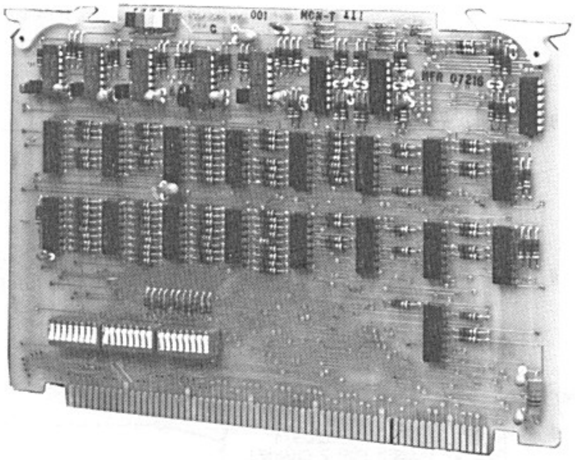
The parallel input card consists of sixteen 8-channel data selectors (multiplexers), ten multivibrators (gate generators), and three 8-section dip switches.

2. PRINCIPLES OF OPERATION

2.1 General (Refer to figure 2.)

The parallel input card is designed for use in HF-80 four-channel and two-channel equipment. Dip switches S1, S2, and S3 are placed on the card to permit selection of the desired configuration.

The parallel input card consists of two primary circuits: the 8-channel data selectors and the gate generators. Each data selector receives up to eight inputs developed by the unit front-panel controls and monitor circuits. Address bits, from the serial interface card, select individual inputs for transfer to the single output from the data selectors. These address bits are developed from word gate signals produced by the multivibrator circuits when the card is configured for two-channel equipment. When the card is configured for four-channel equipment, the address bits are generated on the serial interface card.

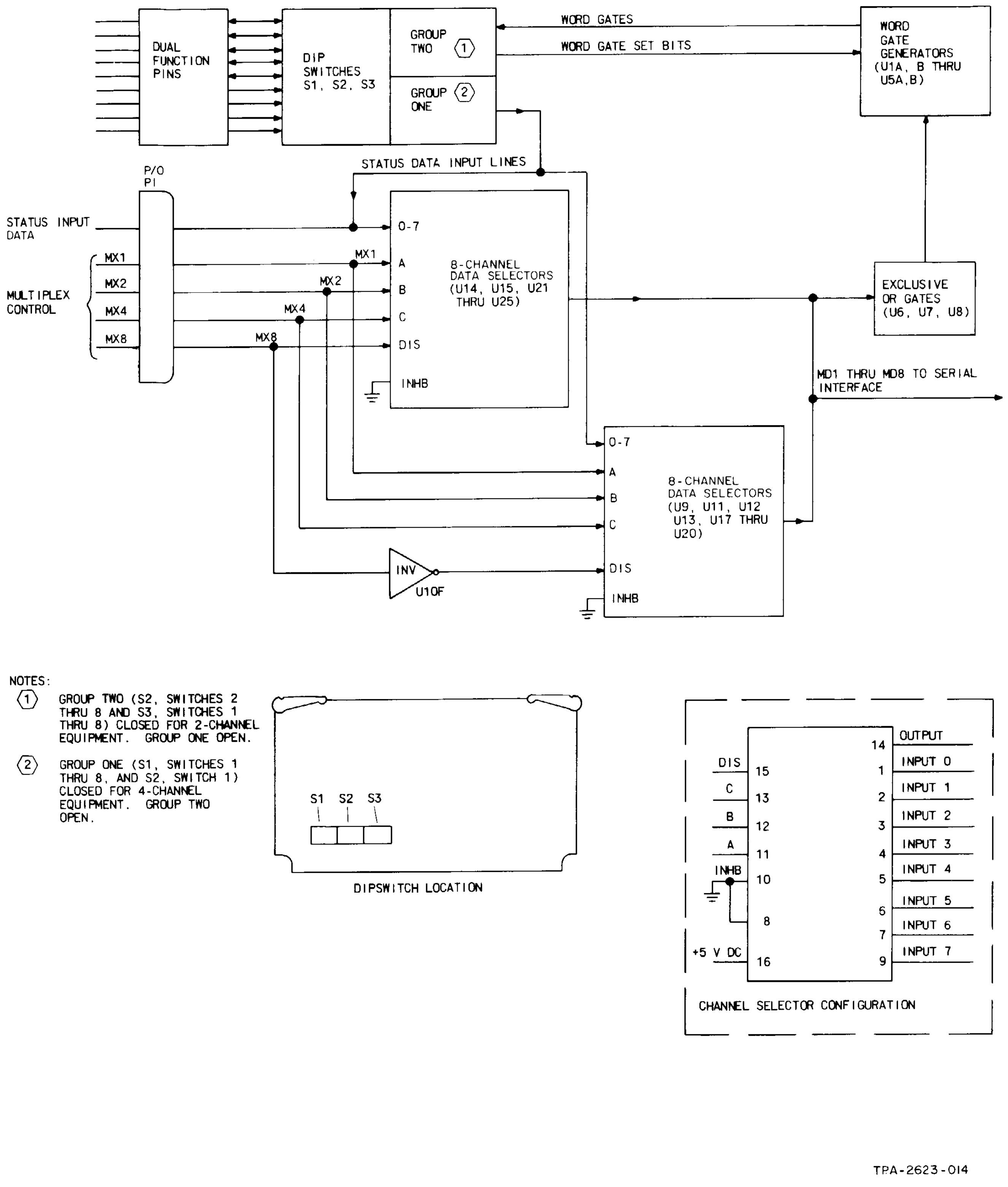

TPA-2840-017

Parallel Input
Figure 1

2.2 Multiplexers (Refer to figure 2 and figure 3, the schematic diagram.)

The multiplexers are integrated circuits functioning as 8-channel data selectors. (Refer to table 1 for a truth table of the data selector.) The circuit arrangement is two sections of eight multiplexers each. The MX8 input selects the active section. When at a logic 1 level, the disable input to a multiplexer keeps its output at a high impedance. A logic 0 disable input permits an output to be transferred from one of the eight input lines. MUX 8 is connected to the disable inputs of the first section and inverted by U10F and applied to the disable inputs of the second section to ensure one section is always disabled while the other is enabled.

The MX1, MX2, and MX4 inputs, applied simultaneously to all multiplexers, control which of



NOTES:

① GROUP TWO (S2, SWITCHES 2 THRU 8 AND S3, SWITCHES 1 THRU 8) CLOSED FOR 2-CHANNEL EQUIPMENT. GROUP ONE OPEN.

② GROUP ONE (S1, SWITCHES 1 THRU 8, AND S2, SWITCH 1) CLOSED FOR 4-CHANNEL EQUIPMENT. GROUP TWO OPEN.

Parallel Input, Block Diagram
Figure 2

the eight input signals (0-7) to each multiplexer is transferred to the output line. (Refer to the truth table of table 1.) The resulting output signals from the eight multiplexers are the eight data bits (MD1 through MD8) of the control word for the unit under control. These data bits are coupled to the serial interface card for parallel-to-serial conversion, word formation, ASCII or 8-bit formatting, and application to the control bus.

2.3 Gate Generators (Refer to figure 2 and figure 3, the schematic diagram.)

When the parallel input card is configured for two-channel equipment and a front-panel control is switched to a different position, a gate signal is developed by one of five gate generators. Each of these generator circuits is two multivibrators connected in series, that develop a single output pulse. The output is a word or address gate signal, determined by the inputs to the exclusive OR gates, and applied to the serial interface card.

An input pulse to the first multivibrator causes an output pulse from that multivibrator of about 0.1-second width which is the input to the second multivibrator. The second circuit does not trigger until the end (1-to-0 transition) of the first output pulse. This delay gives time for switch settling into the final position selected.

The output from the second multivibrator is a 0.1-millisecond pulse for the word gates and a 10-microsecond pulse for the address gate.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the parallel input card are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in tables 2 and 3 check the total performance of the parallel input card. The procedures in table 2 are for the following equipments:

HF-8010/8010A Exciter
HF-8050/8050A Receiver
HF-8070/8070A Receiver-Exciter
851S Receiver
HF-8090, HF-8091, HF-8092, and HF-8095 Controls.

The procedures in table 3 are for the following equipments:

HF-8014/8014A Exciter
HF-8054/8054A Receiver
HF-8093 and HF-8094 Controls.

These procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic diagram to trace the source of the fault.

Table 1. 8-Channel Data Selector Truth Table.

C	B	A	INHIBIT	DISABLE	OUTPUT
0	0	0	0	0	X0
0	0	1	0	0	X1
0	1	0	0	0	X2
0	1	1	0	0	X3
1	0	0	0	0	X4
1	0	1	0	0	X5
1	1	0	0	0	X6
1	1	1	0	0	X7
M	M	M	1	0	0
M	M	M	M	1	HIGH IMPEDANCE

X = transfer to output
M = don't care

Table 2. Parallel Input, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	**Note** The testing and troubleshooting procedures herein are for 1- or 2-channel configurations of the HF-8010/8010A, HF-8050/8050A, HF-8070/8070A, 851S, HF-8090, HF-8091, HF-8092, and HF-8095. These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installing the questionable parallel input in the control unit. During these tests when a control unit is referred to it is a receiver-exciter control, an exciter control, or a receiver control. When a local unit is referred to it is a receiver-exciter, an exciter, or a receiver. a. Remove top cover of unit containing parallel input to be tested. b. Remove parallel input. c. Set the dip switches for two-channel operation. (Group 1 open, group 2 closed). Refer to figure 2 for dip switch location. d. Place the parallel input card on the card extender and place it in the unit. e. Set control unit and local unit LINE SELECTOR switches to 115 V.		
(Cont)			

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. (Cont)	f. Connect control unit and local unit to 115-V ac power source and set power on.		
	g. Measure dc voltages, on the card under test, between the following pins and ground (TP1, brown):		
	P1-45 P1-65 P1-114	+15 ±1.0 V dc. +5 ±0.5 V dc. -15 ±1.0 V dc.	
	h. Strap local unit for address 0.		
	i. Connect local unit to control unit.		
2. Word and address gates	a. Connect oscilloscope to TP2 (red).		
	b. Set control unit KEY switch to LOCK and note oscilloscope.	A logic level 1, 100-μs (nominal) pulse.	Check U2A, U2B, U8D, and associated circuit.
	c. Set control unit KEY switch to NORM and note oscilloscope.	Same as step b.	Same as step b.
	d. Connect oscilloscope to TP3 (orange).		
	e. Set control unit PA PWR switch to STBY and note oscilloscope.	A logic level 1, 100-μs (nominal) pulse.	Check U3A, U3B, U10A, S3, and associated circuit.
	f. Set control unit PA PWR switch to OFF and note oscilloscope.	Same as step e.	Same as step e.
	g. Connect oscilloscope to TP 4 (yellow).		
	h. Rotate each control unit FREQUENCY KHZ thumb wheel and note oscilloscope when changing positions.	A logic level 1, 100-μs (nominal) pulse.	Check U1A, U1B, S2 and associated circuit.
	i. Connect oscilloscope to TP5 (green).		
(Cont)	j. Set control unit MODE switch to each mode position and note oscilloscope when changing positions.	A logic level 1, 100-μs (nominal) pulse.	Check U5A, U5B, U6, U7, U10C, S3, and associated circuit.

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	k. Connect oscilloscope to P1-88.		
	l. Rotate control unit ADDRESS switch and note oscilloscope when changing positions.	A logic level 1, 100-μs (nominal) pulse.	Check U4A, U4B, S3 and associated circuit.
	m. Connect +5-V dc input to P1-66.		
	n. Check voltage levels at:		
	TP2	NLT +4.0 V dc.	Check CR1.
	TP3	NLT +4.0 V dc.	Check CR2.
	TP4	NLT +4.0 V dc.	Check CR4.
	TP5	NLT +4.0 V dc.	Check CR3.
	o. Remove +5 V dc from P1-66.		

Note

Tests 3 through 18 are output tests. During all of these tests serial interface card A13 is removed from unit under test and mux inputs are strapped according to word and character being tested. To strap a logic 1 input, connect a 4700-Ω resistor in series between the mux input pin and +5 V dc. To strap a logic 0 input, connect directly from the mux input pin to ground. See following chart and figure for mux input/output strapping and setup requirements. Where front-panel controls are shown, these controls may be used to apply the appropriate inputs. If they are not used their associated front-panel connector must be disconnected.

MUX CONTROL LINES INPUT STRAPPING				*OUTPUTS PRESENTED BY PARALLEL INPUT CARD									
				WORD NO	CHARACTER NO	OUTPUT BIT NO							
MX8	MX4	MX2	MX1			1	2	3	4	5	6	7	8
P1-93	P1-90	P1-25	P1-27			P1-26	P1-28	P1-29	P1-94	P1-30	P1-31	P1-96	P1-104
0	0	0	0	1	2	P1-62	P1-127	P1-63	P1-128	P1-64	P1-129	P1-38	P1-103
0	0	0	1	1	3	P1-58	P1-123	P1-59	P1-124	P1-60	P1-125	P1-61	P1-126
0	0	1	0	1	4	P1-54	P1-119	P1-55	P1-120	P1-56	P1-121	P1-57	P1-122
0	0	1	1	1	5	P1-50	P1-115	P1-51	P1-116	P1-52	P1-117	P1-53	P1-118
0	1	0	0	2	2	P1-87	P1-10	P1-75	P1-11	P1-76	NA	NA	NA
0	1	0	1	2	3	P1-20	P1-19	P1-85	P1-84	P1-37	P1-106	P1-41	NA

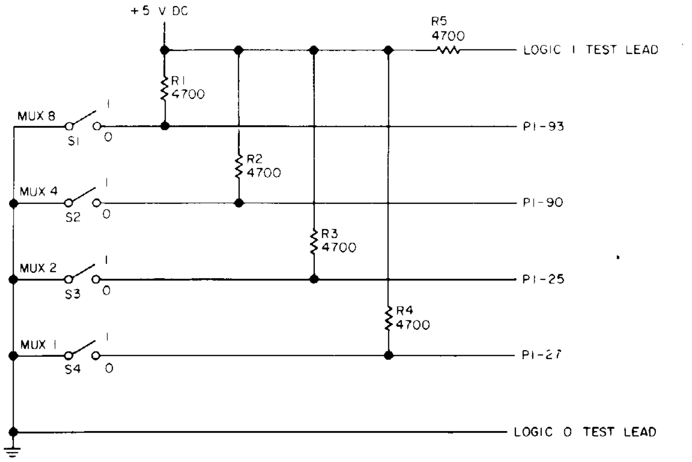
*Outputs presented at the bit no pins are the inputs at the bit no pins associated with the word no/character no.

(Cont)

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)			

MUX CONTROL LINES INPUT STRAPPING				*OUTPUTS PRESENTED BY PARALLEL INPUT CARD									
				WORD NO	CHARACTER NO	OUTPUT BIT NO							
MX8	MX4	MX2	MX1			1	2	3	4	5	6	7	8
P1-93	P1-90	P1-25	P1-27			P1-26	P1-28	P1-29	P1-94	P1-30	P1-31	P1-96	P1-104
0	1	1	0	2	4	P1-32	P1-97	P1-33	P1-98	P1-34	P1-35	P1-99	P1-100
0	1	1	1	2	5	P1-21	P1-91	P1-92	P1-74	P1-9	P1-72	P1-8	P1-73
1	0	0	0	3	2	P1-112	P1-47	P1-113	P1-48	P1-107	NA	NA	NA
1	0	0	1	3	3	P1-42	P1-108	P1-43	P1-109	P1-44	P1-110	P1-111	P1-46
1	0	1	0	3	4	NA	NA	NA	NA	NA	NA	NA	NA
1	0	1	1	3	5	P1-79	P1-14	P1-78	P1-82	P1-81	NA	NA	NA
1	1	0	0	4	2	NA	NA	NA	NA	P1-68	NA	NA	NA
1	1	0	1	4	3	P1-18	P1-101	P1-39	P1-83	P1-36	P1-105	P1-40	P1-2
1	1	1	0	4	4	P1-3	P1-86	P1-49	P1-67	P1-70	P1-5	P1-4	P1-69
1	1	1	1	4	5	P1-80	P1-16	P1-95	P1-71	NA	NA	NA	NA
*Outputs presented at the bit no pins are the inputs at the bit no pins associated with the word no/character no.													



TYPICAL MUX INPUT/OUTPUT TEST SETUP

TP5-4247-013

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. Word 1, character 2 outputs</td><td>a. Strap mux control lines for word 1, character 2.
b. Apply logic 1 inputs at inputs associated with word 1, character 2 (see chart).
Note
FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position these switches apply logic 0 inputs.
c. Apply logic 0 inputs at inputs associated with word 1, character 2 (see chart).</td><td>Verify that associated outputs are at logic 1.
Verify that associated outputs are at logic 0.</td><td></td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th colspan="2">FRONT-PANEL CONTROL</th><th>BIT NO</th><th>INPUTS P1-( )</th><th>OUTPUTS P1-( )</th><th>IF ABNORMAL CHECK</th></tr>
<tr><td>1 MHz</td><td>1</td><td>1</td><td>62</td><td>26</td><td>U25, U18</td></tr>
<tr><td></td><td>2</td><td>2</td><td>127</td><td>28</td><td>U15, U19</td></tr>
<tr><td></td><td>4</td><td>3</td><td>63</td><td>29</td><td>U23, U20</td></tr>
<tr><td></td><td>8</td><td>4</td><td>128</td><td>94</td><td>U21, U17</td></tr>
<tr><td>10 MHz</td><td>1</td><td>5</td><td>64</td><td>30</td><td>U24, U11</td></tr>
<tr><td></td><td>2</td><td>6</td><td>129</td><td>31</td><td>U16, U13</td></tr>
<tr><td>NA</td><td></td><td>7</td><td>38</td><td>96</td><td>U22, U12</td></tr>
<tr><td>NA</td><td></td><td>8</td><td>103</td><td>104</td><td>U14, R42, U9</td></tr>
</table>
</td></tr>
<tr><td>4. Word 1, character 3 outputs
(Cont)</td><td>a. Strap mux control lines for word 1, character 3.
b. Apply logic 1 inputs at inputs associated with word 1, character 3 (see chart).
Note
FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs.
c. Apply logic 0 inputs at inputs associated with word 1, character 3 (see chart).</td><td>Verify that associated outputs are at logic 1.
Verify that associated outputs are at logic 0.</td><td></td></tr>
</table>

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)			

FRONT-PANEL CONTROL		BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
10 kHz	1	1	58	26	U25, U18
	2	2	123	28	U15, U19
	4	3	59	29	U23, U20
	8	4	124	94	U21, U17
100 kHz	1	5	60	30	U24, U11
	2	6	125	31	U16, U13
	4	7	61	96	U22, U12
	8	8	126	104	U14, U9

5. Word 1, character 4 outputs	a. Strap mux control lines for word 1, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 1, character 4 (see chart). **Note** FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs.	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 1, character 4 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL		BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
100 Hz	1	1	54	26	U25, U18
	2	2	119	28	U15, U19
	4	3	55	29	U23, U20
	8	4	120	94	U21, U17
1 kHz	1	5	56	30	U24, U11
	2	6	121	31	U16, U13
	4	7	57	96	U22, U12
	8	8	122	104	U14, U9

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td rowspan="5">6. Word 1, character 5 outputs</td><td>a. Strap mux control lines for word 1, character 5.</td><td></td><td rowspan="3"></td></tr>
<tr><td>b. Apply logic 1 inputs at inputs associated with word 1, character 5 (see chart).</td><td>Verify that associated outputs are at logic 1.</td></tr>
<tr><td>Note
FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs.</td><td></td></tr>
<tr><td>c. Apply logic 0 inputs at inputs associated with word 1, character 5 (see chart).</td><td>Verify that associated outputs are at logic 0.</td><td></td></tr>
<tr><td colspan="3">
<table>
<tr><th>FRONT-PANEL CONTROL</th><th>BIT NO</th><th>INPUTS P1-( )</th><th>OUTPUTS P1-( )</th><th>IF ABNORMAL CHECK</th></tr>
<tr><td>NA</td><td>1</td><td>50</td><td>26</td><td>U25, R68, U18</td></tr>
<tr><td>NA</td><td>2</td><td>115</td><td>28</td><td>U15, R64, U19</td></tr>
<tr><td>NA</td><td>3</td><td>51</td><td>29</td><td>U23, R60, U20</td></tr>
<tr><td>NA</td><td>4</td><td>116</td><td>94</td><td>U21, R56, U17</td></tr>
<tr><td>*10 Hz 1</td><td>5</td><td>52</td><td>30</td><td>U24, R52, U11</td></tr>
<tr><td>2</td><td>6</td><td>117</td><td>31</td><td>U16, R49, U13</td></tr>
<tr><td>4</td><td>7</td><td>53</td><td>96</td><td>U22, R46, U12</td></tr>
<tr><td>8</td><td>8</td><td>118</td><td>104</td><td>U14, R43, U9</td></tr>
<tr><td colspan="5">*Applicable only with 10-Hz front-panel tuning.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">7. Word 2, character 2 outputs

(Cont)</td><td>a. Strap mux control lines for word 2, character 2.</td><td>Note
Grounded input as noted in chart will always be logic 0 output.</td><td rowspan="2"></td></tr>
<tr><td>b. Apply logic 1 inputs at inputs associated with word 2, character 2 (see chart).</td><td>Verify that associated outputs are at logic 1.</td></tr>
</table>

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	**Note** RF GAIN switch applies logic 1 input in the position indicated in the chart (positions read as MAX minus X number of positions). In the MAX position, this switch applies logic 0 inputs.		
	c. Apply logic 0 inputs at inputs associated with word 2, character 2 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL		BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA		1	87	26	U25, R69, U18
RF GAIN	MAX-1	2	10	28	U15, R65, U19
	MAX-2	3	75	29	U23, R61, U20
	MAX-4	4	11	94	U21, R57, U17
	MAX-8	5	76	30	U24, R53, U11
NA		6	*	31	U16, U13
NA		7	38	96	U22, U12
NA		8	103	104	U14, R42, U9

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Word 2, character 3 outputs	a. Strap mux control lines for word 2, character 3.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 2, character 3 (see chart).	Verify that associated ouputs are at logic 1.	
	Note AGC switch applies logic 1 input in the position indicated in the chart. In the AGC-SLOW position, this switch applies logic 0 inputs.		
(Cont)	c. Apply logic 0 inputs at inputs associated with word 2, character 3 (see chart).	Verify that associated outputs are at logic 0.	

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)			

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
AGC-FAST (B)	1	20	26	U25, U18
AGC-OFF (B)	2	19	28	U15, U19
AGC-FAST (A)	3	85	29	U23, U20
AGC-OFF (A)	4	84	94	U21, U17
NA	5	37	30	U24, U11
NA	6	106	31	U16, U13
NA	7	41	96	U22, U12
NA	8	*	104	U14, U9

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. Word 2, character 4 outputs	a. Strap mux control lines for word 2, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 2, character 4 (see chart). **Note** MODE switch and/or BANDWIDTH switch applies logic 1 input in the position indicated in the chart. In the ISB position, the MODE switch applies logic 0 inputs.	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 2, character 4 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL (MODE)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
SSB/CW-USB or USB	1	32	26	U25, R70, U18
SSB/CW-LSB or LSB	2	97	28	U15, R66, U19
*SSB/CW-A	3	33	29	U23, R62, U20
*SSB/CW-B	4	98	94	U21, R58, U17
*SSB/CW-C	5	34	30	U24, R54, U11
*SSB/CW-D	6	35	31	U16, R50, U13
*SSB/CW-E	7	99	96	U22, R47, U12
*SSB/CW-16	8	100	104	U14, R44, U9

*SSB/CW applicable only on receiver control.

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>10. Word 2, character 5 outputs</td><td>a. Strap mux control lines for word 2, character 5.</td><td></td><td></td></tr>
<tr><td></td><td>b. Apply logic 1 inputs at inputs associated with word 2, character 5 (see chart).

Note

MODE switch applies logic 1 input in the position indicated in the chart. In any other position, the MODE switch applies logic 0 input.</td><td>Verify that associated outputs are at logic 1.</td><td></td></tr>
<tr><td></td><td>c. Apply logic 0 inputs at inputs associated with word 2, character 5 (see chart).</td><td>Verify that associated outputs are at logic 0.</td><td></td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>FRONT-PANEL CONTROL (MODE)</th><th>BIT NO</th><th>INPUTS P1-( )</th><th>OUTPUTS P1-( )</th><th>IF ABNORMAL CHECK</th></tr>
<tr><td>NA</td><td>1</td><td>21</td><td>26</td><td>U25, R71, U18</td></tr>
<tr><td>NA</td><td>2</td><td>91</td><td>28</td><td>U15, R67, U19</td></tr>
<tr><td>NA</td><td>3</td><td>92</td><td>29</td><td>U23, R63, U20</td></tr>
<tr><td>ISB</td><td>4</td><td>74</td><td>94</td><td>U21, R59, U17</td></tr>
<tr><td>*CW</td><td>5</td><td>9</td><td>30</td><td>U24, R55, U11</td></tr>
<tr><td>CW, LSB, USB, ISB, or SSB/CW</td><td>6</td><td>72</td><td>31</td><td>U16, R51, U13</td></tr>
<tr><td>AM</td><td>7</td><td>8</td><td>96</td><td>U22, R48, U12</td></tr>
<tr><td>NA</td><td>8</td><td>73</td><td>104</td><td>U14, R45, U9</td></tr>
<tr><td colspan="5">*CW applicable only on exciter control and receiver-exciter control.</td></tr>
</table>
</td></tr>
<tr><td>11. Word 3, character 2 outputs</td><td>a. Strap mux control lines for word 3, character 2.</td><td>Note

Grounded input as noted in chart will always be logic 0 output.</td><td></td></tr>
<tr><td></td><td>b. Apply logic 1 inputs at inputs associated with word 3, character 2 (see chart).</td><td>Verify that associated outputs are at logic 1.</td><td></td></tr>
<tr><td>(Cont)</td><td>c. Apply logic 0 inputs at inputs associated with word 3, character 2 (see chart).</td><td>Verify that associated outputs are at logic 0.</td><td></td></tr>
</table>

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. (Cont)			

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	112	26	U18, R103, U25
NA	2	47	28	U19, R97, R15
NA	3	113	29	U20, R91, U23
NA	4	48	94	U17, R86, U21
NA	5	107	30	U11, R81, U24
NA	6	*	31	U13, U16
NA	7	38	96	U12, U22
NA	8	103	104	U9, R42, U14

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. Word 3, character 3 outputs	a. Strap mux control lines for word 3, character 3.		
	b. Apply logic 1 inputs at inputs associated with word 3, character 3 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 3, character 3 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	42	26	U18, R104, U25
NA	2	108	28	U19, R98, U15
NA	3	43	29	U20, R92, U23
NA	4	109	94	U17, R87, U21
NA	5	44	30	U11, R82, U24
NA	6	110	31	U13, R78, U16
NA	7	111	96	U12, R75, U22
NA	8	46	104	U9, R72, U14

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
13. Word 3, character 4 outputs	a. Strap mux control lines for word 3, character 4.	**Note** Grounded input as noted in chart will always be logic 0 output. Verify that all associated outputs are at logic 0.	

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	*	26	U18, U25
NA	2	*	28	U19, U15
NA	3	*	29	U20, U23
NA	4	*	94	U17, U21
NA	5	*	30	U11, U24
NA	6	*	31	U13, U16
NA	7	*	96	U12, U22
NA	8	*	104	U9, U14

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. Word 3, character 5 outputs	a. Strap mux control lines for word 3, character 5.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 3, character 5 (see chart). **Note** PA PWR and P CAR switches apply logic 1 inputs in the positions indicated in the chart. In the OFF positions these switches apply logic 0 inputs.	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 3, character 5 (see chart).	Verify that associated outputs are at logic 0.	

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>14. (Cont)</td><td colspan="3">
<table>
<tr><th>FRONT-PANEL CONTROL</th><th>BIT NO</th><th>INPUTS P1-( )</th><th>OUTPUTS P1-( )</th><th>IF ABNORMAL CHECK</th></tr>
<tr><td>PA PWR-STBY</td><td>1</td><td>79</td><td>26</td><td>U18, R105, U25</td></tr>
<tr><td>PA PWR-HIGH PWR</td><td>2</td><td>14</td><td>28</td><td>U19, R99, U15</td></tr>
<tr><td>PA PWR-LOW PWR</td><td>3</td><td>78</td><td>29</td><td>U20, R93, U23</td></tr>
<tr><td>P CAR-ON</td><td>4</td><td>82</td><td>94</td><td>U17, R8, U21</td></tr>
<tr><td>NA</td><td>5</td><td>81</td><td>30</td><td>U11, R83, U24</td></tr>
<tr><td>NA</td><td>6</td><td>*</td><td>31</td><td>U13, U16</td></tr>
<tr><td>NA</td><td>7</td><td>*</td><td>96</td><td>U12, U22</td></tr>
<tr><td>NA</td><td>8</td><td>*</td><td>104</td><td>U9, U14</td></tr>
<tr><td colspan="5">*Grounded input.</td></tr>
</table>
</td></tr>
<tr><td>15. Word 4, character 2 outputs</td><td>a. Strap mux control lines for word 4, character 2.</td><td>Note
Grounded input as noted in chart will always be logic 0 output.</td><td></td></tr>
<tr><td></td><td>b. Apply logic 1 inputs at inputs associated with word 4, character 2 (see chart).
Note
KEY switch in the LOCK position applies a logic 1 input and in the NORM position applies a logic 0 input.</td><td>Verify that associated outputs are at logic 1.</td><td></td></tr>
<tr><td>(Cont)</td><td>c. Apply logic 0 inputs at inputs associated with word 4, character 2 (see chart).</td><td>Verify that associated outputs are at logic 0.</td><td></td></tr>
</table>

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
15. (Cont)			

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	*	26	U18, U25
NA	2	*	28	U19, U15
NA	3	*	29	U20, U23
NA	4	*	94	U17, U21
KEY-LOCK	5	68	30	U11, R12, U24
NA	6	*	31	U13, U16
NA	7	38	96	U12, U22
NA	8	103	104	U9, R42, U14

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
16. Word 4, character 3 outputs	a. Strap mux control lines for word 4, character 3.		
	b. Apply logic 1 inputs at inputs associated with word 4, character 3 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 4, character 3 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	18	26	U18, R106, U25
NA	2	101	28	U19, R100, U15
NA	3	39	29	U20, R94, U23
NA	4	83	94	U17, R88, U21
NA	5	36	30	U11, R84, U24
NA	6	105	31	U13, R79, U16
NA	7	40	96	U12, R76, U22
NA	8	2	104	U9, R73, U14

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. Word 4, character 4 outputs	a. Strap mux control lines for word 4, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 4, character 4 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 4, character 4 (see chart).	Verify that associated outputs are at logic 0.	

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	3	26	U18, R107, U25
NA	2	86	28	U19, R101, U15
NA	3	49	29	U20, R95, U23
NA	4	67	94	U17, R89, U21
NA	5	70	30	U11, R85, U24
NA	6	5	31	U13, R80, U16
NA	7	4	96	U12, R77, U22
NA	8	69	104	U9, R74, U14

18. Word 4, character 5 outputs	a. Strap mux control lines for word 4, character 5.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 4, character 5 (see chart).	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 4, character 5 (see chart).	Verify that associated outputs are at logic 0.	

Table 2. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
18. (Cont)			

FRONT-PANEL CONTROL	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	80	26	U18, R108, U25
NA	2	16	28	U19, R102, CR24, C28, U15
NA	3	95	29	U20, R96, U23
NA	4	71	94	U17, R90, U21
NA	5	*	30	U11, U24
NA	6	*	31	U13, U16
NA	7	*	96	U12, U22
NA	8	*	104	U9, U14

*Grounded input.

Table 3. Parallel Input, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	**Note** The testing and troubleshooting procedures herein are for 1-, 2-, 3-, or 4-channel configurations of the HF-8014/8014A, HF-8054/8054A, HF-8093, and HF-8094. These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installing the questionable parallel input in the control unit. During these tests when a control unit is referred to it is an exciter control, or a receiver control. When a local unit is referred to it is a receiver-exciter, an exciter, or a receiver.		
	a. Remove top cover of unit containing parallel input to be tested.		
	b. Remove parallel input.		
	c. Set the dip switches for four-channel operation. (Group 1 closed, group 2 open.) Refer to figure 2 for dip switch location.		
	d. Place the parallel input card on the card extender and place it in the unit.		
	e. Set control unit and local unit LINE SELECTOR switches to 115 V.		
(Cont)	f. Connect control unit and local unit to 115-V ac power source and set power on.		

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. (Cont)	g. Measure dc voltages, on the card under test, between the following pins and ground (TP1, brown):		
	P1-45 P1-65 P1-114	+15 ± 1.0 V dc. +5 ±0.5 V dc. -15 ±1.0 V dc.	
	h. Strap local unit for address 0.		
	i. Connect local unit to control unit.		

Note

Tests 2 through 17 are output tests. During all of these tests serial interface card A13 is removed from unit uder test and mux inputs are strapped according to word and character being tested. To strap a logic 1 input, connect a 4700-Ω resistor in series between the mux input pin and +5 V dc. To strap a logic 0 input, connect directly from the mux input pin to ground. See following chart and figure for mux input/output strapping and setup requirements. Where front-panel controls are shown, these controls may be used to apply the appropriate inputs. If they are not used their associated front-panel connector must be disconnected. Signal names are given in parentheses ( ) where there is not a front-panel control.

MUX CONTROL LINES INPUT STRAPPING				*OUTPUTS PRESENTED BY PARALLEL INPUT CARD									
				WORD NO	CHARACTER NO	OUTPUT BIT NO							
MX8	MX4	MX2	MX1			1	2	3	4	5	6	7	8
P1-93	P1-90	P1-25	P1-27			P1-26	P1-28	P1-29	P1-94	P1-30	P1-31	P1-96	P1-104
0	0	0	0	1	2	P1-62	P1-127	P1-63	P1-128	P1-64	P1-129	P1-38	P1-103
0	0	0	1	1	3	P1-58	P1-123	P1-59	P1-124	P1-60	P1-125	P1-61	P1-126
0	0	1	0	1	4	P1-54	P1-119	P1-55	P1-120	P1-56	P1-121	P1-57	P1-122
0	0	1	1	1	5	P1-50	P1-115	P1-51	P1-116	P1-52	P1-117	P1-53	P1-118
0	1	0	0	2	2	P1-87	P1-10	P1-75	P1-11	P1-76	NA	NA	NA
0	1	0	1	2	3	P1-20	P1-19	P1-85	P1-84	P1-37	P1-106	P1-41	P1-12

*Outputs presented at the bit no pins are the inputs at the bit no pins associated with the word no/character no.

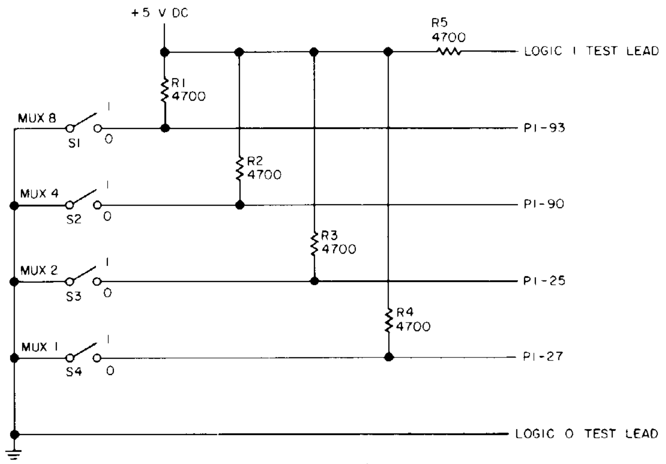
(Cont)

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. (Cont)			

MUX CONTROL LINES INPUT STRAPPING				*OUTPUTS PRESENTED BY PARALLEL INPUT CARD									
				WORD NO	CHARACTER NO	OUTPUT BIT NO							
MX8	MX4	MX2	MX1			1	2	3	4	5	6	7	8
P1-93	P1-90	P1-25	P1-27			P1-26	P1-28	P1-29	P1-94	P1-30	P1-31	P1-96	P1-104
0	1	1	0	2	4	P1-32	P1-97	P1-33	P1-98	P1-34	P1-35	P1-99	P1-100
0	1	1	1	2	5	P1-21	P1-91	P1-92	P1-74	P1-9	P1-72	P1-8	P1-73
1	0	0	0	3	2	P1-112	P1-47	P1-113	P1-48	P1-107	NA	NA	NA
1	0	0	1	3	3	P1-42	P1-108	P1-43	P1-109	P1-44	P1-110	P1-111	P1-46
1	0	1	0	3	4	P2-4	P2-6	P2-5	P2-3	P2-9	P2-10	P2-8	P2-7
1	0	1	1	3	5	P1-79	P1-14	P1-78	P1-82	P1-81	NA	NA	NA
1	1	0	0	4	2	P1-24	P1-22	P1-23	P1-88	P1-68	P1-13	NA	NA
1	1	0	1	4	3	P1-18	P1-101	P1-39	P1-83	P1-36	P1-105	P1-40	P1-2
1	1	1	0	4	4	P1-3	P1-86	P1-49	P1-67	P1-70	P1-5	P1-4	P1-69
1	1	1	1	4	5	P1-80	P1-16	P1-95	P1-71	P1-89	P1-7	P1-102	P1-77

*Outputs presented at the bit no pins are the inputs at the bit no pins associated with the word no/character no.



TYPICAL MUX INPUT/OUTPUT TEST SETUP

TP5-4247-013

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. Word 1, character 2 outputs	a. Strap mux control lines for word 1, character 2. b. Apply logic 1 inputs at inputs associated with word 1, character 2 (see chart). **Note** FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position these switches apply logic 0 inputs. c. Apply logic 0 inputs at inputs associated with word 1, character 2 (see chart).	 Verify that associated outputs are at logic 1. Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)		RECEIVER FRONT-PANEL CONTROL (SIGNAL)		BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
1 MHz	1	1 MHz	1	1	62	26	U25, U18
	2		2	2	127	28	U15, U19
	4		4	3	63	29	U23, U20
	8		8	4	128	94	U21, U17
10 MHz	1	10 MHz	1	5	64	30	U24, U11
	2		2	6	129	31	U16, U13
NA		NA		7	38	96	U22, U12
NA		NA		8	103	104	U14, R42, U9

3. Word 1, character 3 outputs (Cont)	a. Strap mux control lines for word 1, character 3. b. Apply logic 1 inputs at inputs associated with word 1, character 3 (see chart). **Note** FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs. c. Apply logic 0 inputs at inputs associated with word 1, character 3 (see chart).	 Verify that associated outputs are at logic 1. Verify that associated outputs are at logic 0.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
10 kHz 1	10 kHz 1	1	58	26	U25, U18
2	2	2	123	28	U15, U19
4	4	3	59	29	U23, U20
8	8	4	124	94	U21, U17
100 kHz 1	100 kHz 1	5	60	30	U24, U11
2	2	6	125	31	U16, U13
4	4	7	61	96	U22, U12
8	8	8	126	104	U14, U9

4. Word 1, character 4 outputs	a. Strap mux control lines for word 1, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 1, character 4 (see chart).	Verify that associated outputs are at logic 1.	
	Note FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs.		
	c. Apply logic 0 inputs at inputs associated with word 1, character 4 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
100 Hz 1	100 Hz 1	1	54	26	U25, U18
2	2	2	119	28	U15, U19
4	4	3	55	29	U23, U20
8	8	4	120	94	U21, U17
1 kHz 1	1 kHz 1	5	56	30	U24, U11
2	2	6	121	31	U16, U13
4	4	7	57	96	U22, U12
8	8	8	122	104	U14, U9

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Word 1, character 5 outputs	a. Strap mux control lines for word 1, character 5.		
	b. Apply logic 1 inputs at inputs associated with word 1, character 5 (see chart). **Note** FREQUENCY KHZ switches apply logic 1 inputs in the positions indicated in the chart. In the 0 position, these switches apply logic 0 inputs.	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 1, character 5 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	NA	1	50	26	U25, R68, U18
NA	NA	2	115	28	U15, R64, U19
NA	NA	3	51	29	U23, R60, U20
NA	NA	4	116	94	U21, R56, U17
*10 Hz 1	*10 Hz 1	5	52	30	U24, R52, U11
2	2	6	117	31	U16, R49, U13
4	4	7	53	96	U22, R46, U12
8	8	8	118	104	U14, R43, U9

*Applicable only with 10-Hz front-panel tuning.

6. Word 2, character 2 outputs	a. Strap mux control lines for word 2, character 2.	**Note** Grounded input as noted in chart will always be logic 0 output.	
(Cont)	b. Apply logic 1 inputs at inputs associated with word 2, character 2 (see chart).	Verify that associated outputs are at logic 1.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
6. (Cont)	**Note** RF GAIN switch applies logic 1 input in the position indicated in the chart (positions read as MAX minus X number of positions). In the MAX position, this switch applies logic 0 inputs.		
	c. Apply logic 0 inputs at inputs associated with word 2, character 2 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)		BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	RF GAIN	(1)	1	87	26	U25, R69, U18
NA		(2)	2	10	28	U15, R65, U19
NA		(4)	3	75	29	U23, R61, U20
NA		(8)	4	11	94	U21, R57, U17
NA		(16)	5	76	30	U24, R53, U11
NA	NA		6	*	31	U16, U13
NA	NA		7	38	96	U22, U12
NA	NA		8	103	104	U14, R42, U9

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. Word 2, character 3 outputs	a. Strap mux control lines for word 2, character 3.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 2, character 3 (see chart).	Verify that associated ouputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 2, character 3 (see chart).	Verify that associated outputs are at logic 0.	
(Cont)			

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	AGC-A2 (1)	1	20	26	U25, U18
NA	AGC-A2 (2)	2	19	28	U15, U19
NA	AGC-B2 (1)	3	85	29	U23, U20
NA	AGC-B2 (2)	4	84	94	U21, U17
NA	FL4 (B) ENBL	5	37	30	U24, U11
NA	FL5 (C) ENBL	6	106	31	U16, U13
NA	FL6 (D) ENBL	7	41	96	U22, U12
NA	FL7 (E) ENBL	8	12	104	U14, U9

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Word 2, character 4 outputs	a. Strap mux control lines for word 2, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 2, character 4 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 2, character 4 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
PEAK CLIP ENABLE	AGC-A1 (1)	1	32	26	U25, R70, U18
NA	AGC-A1 (2)	2	97	28	U15, R66, U19
NA	AGC-B1 (1)	3	33	29	U23, R62, U20
NA	AGC-B1 (2)	4	98	94	U21, R58, U17
NA	AFC ENBL	5	34	30	U24, R54, U11
NA	VBFO ENBL	6	35	31	U16, R50, U13
NA	FL1 ENBL	7	99	96	U22, R47, U12
NA	FL3 (A) ENBL	8	100	104	U14, R44, U9

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. Word 2, character 5 outputs	a. Strap mux control lines for word 2, character 5.		
	b. Apply logic 1 inputs at inputs associated with word 2, character 5 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 2, character 5 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (MODE) (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (MODE) (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
12 ENBL	A2 ENBL	1	21	26	U25, R71, U18
A1 ENBL	A1 ENBL	2	91	28	U15, R67, U19
B1 ENBL	B1 ENBL	3	92	29	U23, R63, U20
B2 ENBL	B2 ENBL	4	74	94	U21, R59, U17
ISB ENBL	ISB ENBL	5	9	30	U24, R55, U11
CW ENBL	CW ENBL	6	72	31	U16, R51, U13
AM ENBL	AM ENBL	7	8	96	U22, R48, U12
NA	DATA NET ENBL	8	73	104	U14, R45, U9

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. Word 3, character 2 outputs	a. Strap mux control lines for word 3, character 2.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 3, character 2 (see chart).	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 3, character 2 (see chart).	Verify that associated outputs are at logic 0.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	1	112	26	U18, U103, U25
NA	VBFO 2	2	47	28	U19, R97, R15
NA	1 kHz 4	3	113	29	U20, R91, U23
NA	8	4	48	94	U17, R86, U21
NA	(VBFO SIGN)	5	107	30	U11, R81, U24
NA	NA	6	*	31	U13, U16
NA	NA	7	38	96	U12, U22
NA	NA	8	103	104	U9, R42, U14

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. Word 3, character 3 outputs	a. Strap mux control lines for word 3, character 3.		
	b. Apply logic 1 inputs at inputs associated with word 3, character 3 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 3, character 3 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	1	1	42	26	U18, R104, U25
NA	VBFO 2	2	108	28	U19, R98, U15
NA	10 Hz 4	3	43	29	U20, R92, U23
NA	8	4	109	94	U17, R87, U21
NA	1	5	44	30	U11, R82, U24
NA	VBFO 2	6	110	31	U13, R78, U16
NA	100 Hz 4	7	111	96	U12, R75, U22
NA	8	8	46	104	U9, R72, U14

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. Word 3, character 4 outputs	a. Strap mux control lines for word 3, character 4.	**Note** Grounded input as noted in chart will always be logic 0 output. Verify that all associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P2-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	NA	1	4	26	U18, U25
NA	NA	2	6	28	U19, U15
NA	NA	3	5	29	U20, U23
NA	NA	4	3	94	U17, U21
NA	NA	5	9	30	U11, U24
NA	NA	6	10	31	U13, U16
NA	NA	7	8	96	U12, U22
NA	NA	8	7	104	U9, U14

13. Word 3, character 5 outputs	a. Strap mux control lines for word 3, character 5.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 3, character 5 (see chart). **Note** PA PWR and PILOT CARR switches apply logic 1 inputs in the positions indicated in the chart. In the OFF positions these switches apply logic 0 inputs.	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 3, character 5 (see chart).	Verify that associated outputs are at logic 0.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
13. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
PA PWR-STBY	A2 AGC BUS	1	79	26	U18, R105, U25
PA PWR-HIGH PWR	A1 AGC BUS	2	14	28	U19, R99, U15
PA PWR-LOW PWR	B1 AGC BUS	3	78	29	U20, R93, U23
PILOT CARR-ON	B2 AGC BUS	4	82	94	U17, R8, U21
NA	NA	5	81	30	U11, R83, U24
NA	NA	6	*	31	U13, U16
NA	NA	7	*	96	U12, U22
NA	NA	8	*	104	U9, U14

*Grounded input.

14. Word 4, character 2 outputs	a. Strap mux control lines for word 4, character 2.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 4, character 2 (see chart).	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 4, character 2 (see chart).	Verify that associated outputs are at logic 0.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
(A2 AF MON)	(A2 AF MON)	1	24	26	U18, U25
(A1 AF MON)	(A1 AF MON)	2	22	28	U19, U15
(B1 AF MON)	(B1 AF MON)	3	23	29	U20, U23
(B2 AF MON)	(B2 AF MON)	4	88	94	U17, U21
(REMOTE KEY (MON))	(RF OVLD MON)	5	68	30	U11, R12, U24
(EXCITER FLT)	(RECEIVER FLT)	6	13	31	U13, U16
NA	NA	7	38	96	U12, U22
NA	NA	8	103	104	U9, R42, U14

*Grounded input.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
15. Word 4, character 3 outputs	a. Strap mux control lines for word 4, character 3.		
	b. Apply logic 1 inputs at inputs associated with word 4, character 3 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 4, character 3 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
(FREQ REF FLT)	(FREQ REF FLT)	1	18	26	U18, R106, U25
(SYNTH OUT LOCK FLT)	(SYNTH OUT LOCK FLT)	2	101	28	U19, R100, U15
(100 kHz LOCK FLT)	(100 kHz LOCK FLT)	3	39	29	U20, R94, U23
(10 kHz LOCK FLT)	(10 kHz LOCK FLT)	4	83	94	U17, R88, U21
(1 kHz LOCK FLT)	(1 kHz LOCK FLT)	5	36	30	U11, R85, U24
(100 Hz LOCK FLT)	(100 Hz LOCK FLT)	6	105	31	U13, R79, U16
(10 Hz LOCK FLT)	(10 Hz LOCK FLT)	7	40	96	U12, R76, U22
NA	NA	8	2	104	U9, R73, U14

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
16. Word 4, character 4 outputs	a. Strap mux control lines for word 4, character 4.		
	b. Apply logic 1 inputs at inputs associated with word 4, character 4 (see chart).	Verify that associated outputs are at logic 1.	
	c. Apply logic 0 inputs at inputs associated with word 4, character 4 (see chart).	Verify that associated outputs are at logic 0.	

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
NA	(A2 AGC MON)	1	3	26	U18, R107, U25
(A1 IF MON)	(A1 AGC MON)	2	86	28	U19, R101, U15
(EXT STANDARD)	(B1 AGC MON)	3	49	29	U20, R95, U23
NA	(B2 AGC MON)	4	67	94	U17, R89, U21
(EXCTR PS FLT)	(RCVR PS FLT)	5	70	30	U11, R85, U24
(EXCTR RF MON)	(VBFO SYNTH FLT)	6	5	31	U13, R80, U16
(SUBCARR LOCK FLT)	(SUBCARR LOCK FLT)	7	4	96	U12, R77, U22
NA	NA	8	69	104	U9, R74, U14

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. Word 4, character 5 outputs	a. Strap mux control lines for word 4, character 5.	**Note** Grounded input as noted in chart will always be logic 0 output.	
	b. Apply logic 1 inputs at inputs associated with word 4, character 5 (see chart).	Verify that associated outputs are at logic 1.	
(Cont)	c. Apply logic 0 inputs at inputs associated with word 4, character 5 (see chart).	Verify that associated outputs are at logic 0.	

Table 3. Parallel Input, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. (Cont)			

EXCITER FRONT-PANEL CONTROL (SIGNAL)	RECEIVER FRONT-PANEL CONTROL (SIGNAL)	BIT NO	INPUTS P1-( )	OUTPUTS P1-( )	IF ABNORMAL CHECK
(MONITOR)	(MONITOR)	1	80	26	U18, R108, U25
(LCL CONT)	(LCL CONT)	2	16	28	U19, R102, CR24, C28, U15
(DATA ERROR)	(DATA ERROR)	3	95	29	U20, R96, U23
(PRESEL FLT)	(PRESEL FLT)	4	71	94	U17, R90, U21
(CPLR FLT)	(RF XLATOR MON)	5	*	30	U11, U24
(PA RF MON)	(AFC LOCK MON)	6	*	31	U13, U16
(PA FLT)	(EXT STANDARD)	7	*	96	U12, U22
(PA READY)	NA	8	*	104	U9, U14

*Grounded input.

4. REPAIR

Repair of the parallel input card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

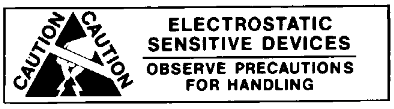
5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

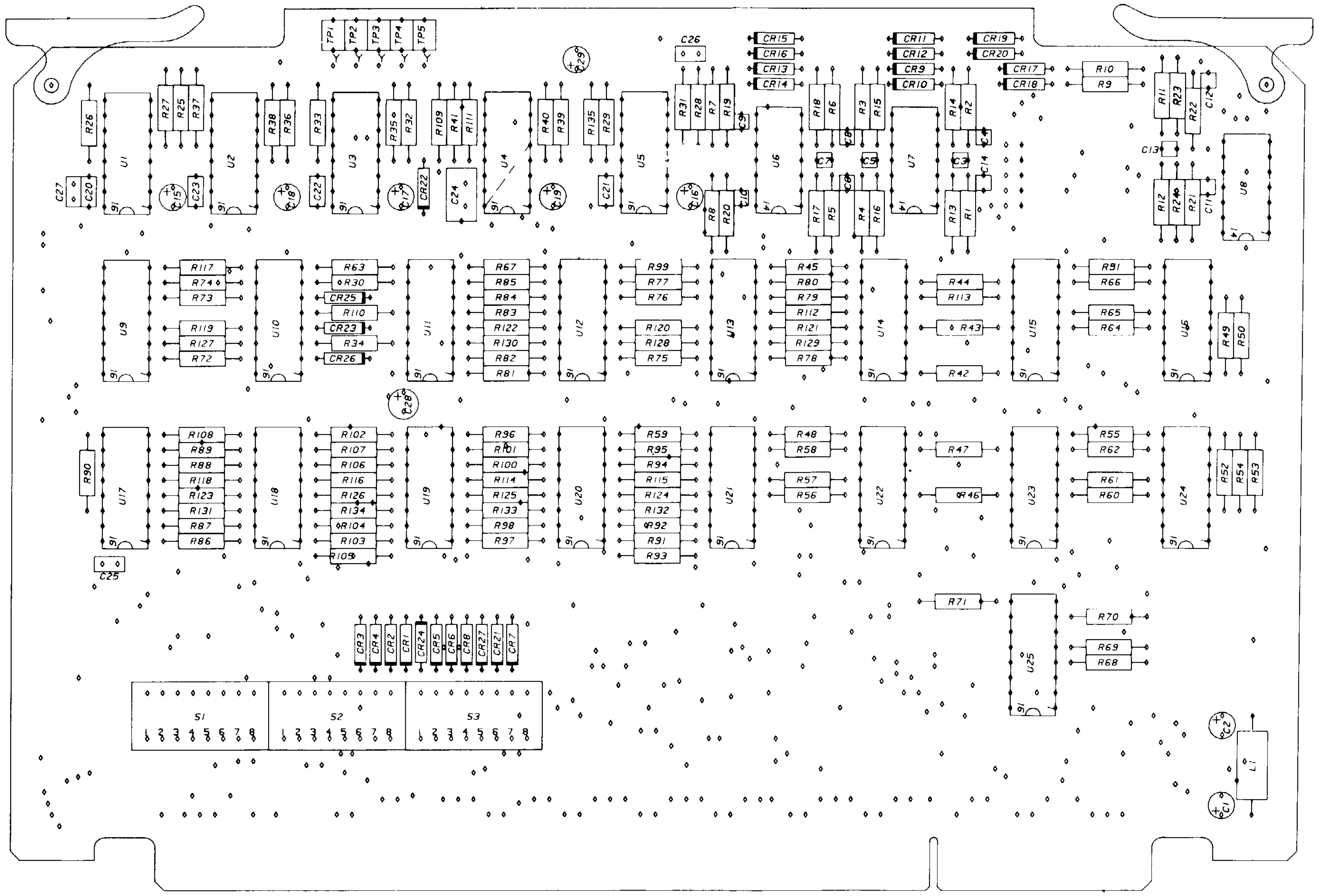
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
27264	MOLEX INC CORPORATE HQ 2222 WELLINGTON COURT LISLE IL 60532
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
81349	MILITARY SPECIFICATION
96906	MILITARY STANDARD

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Parallel Input	642-3135-001	REV D



ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

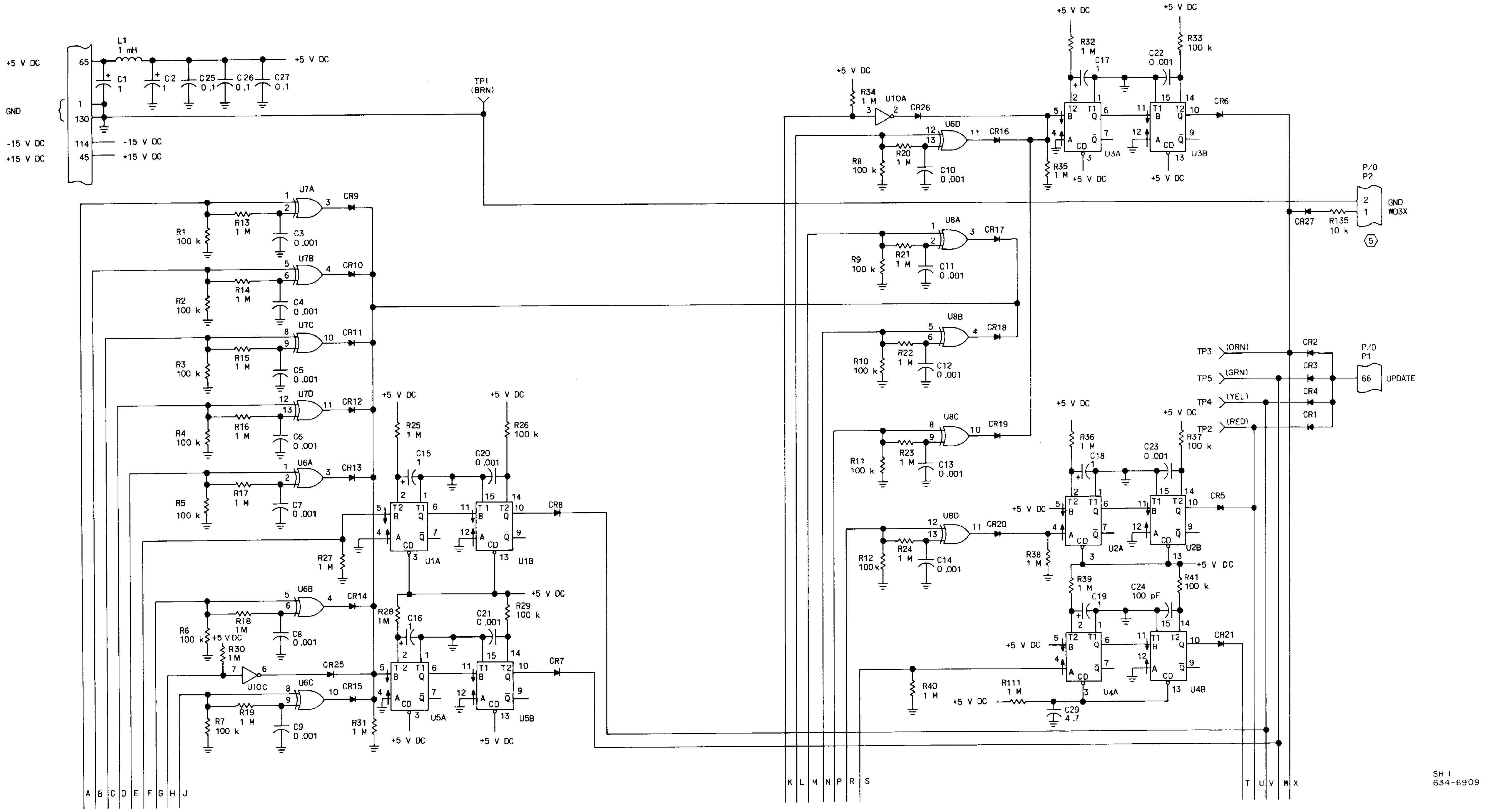
TPA-2502-018

Parallel Input, Schematic Diagram
Figure 3 (Sheet 1 of 6)

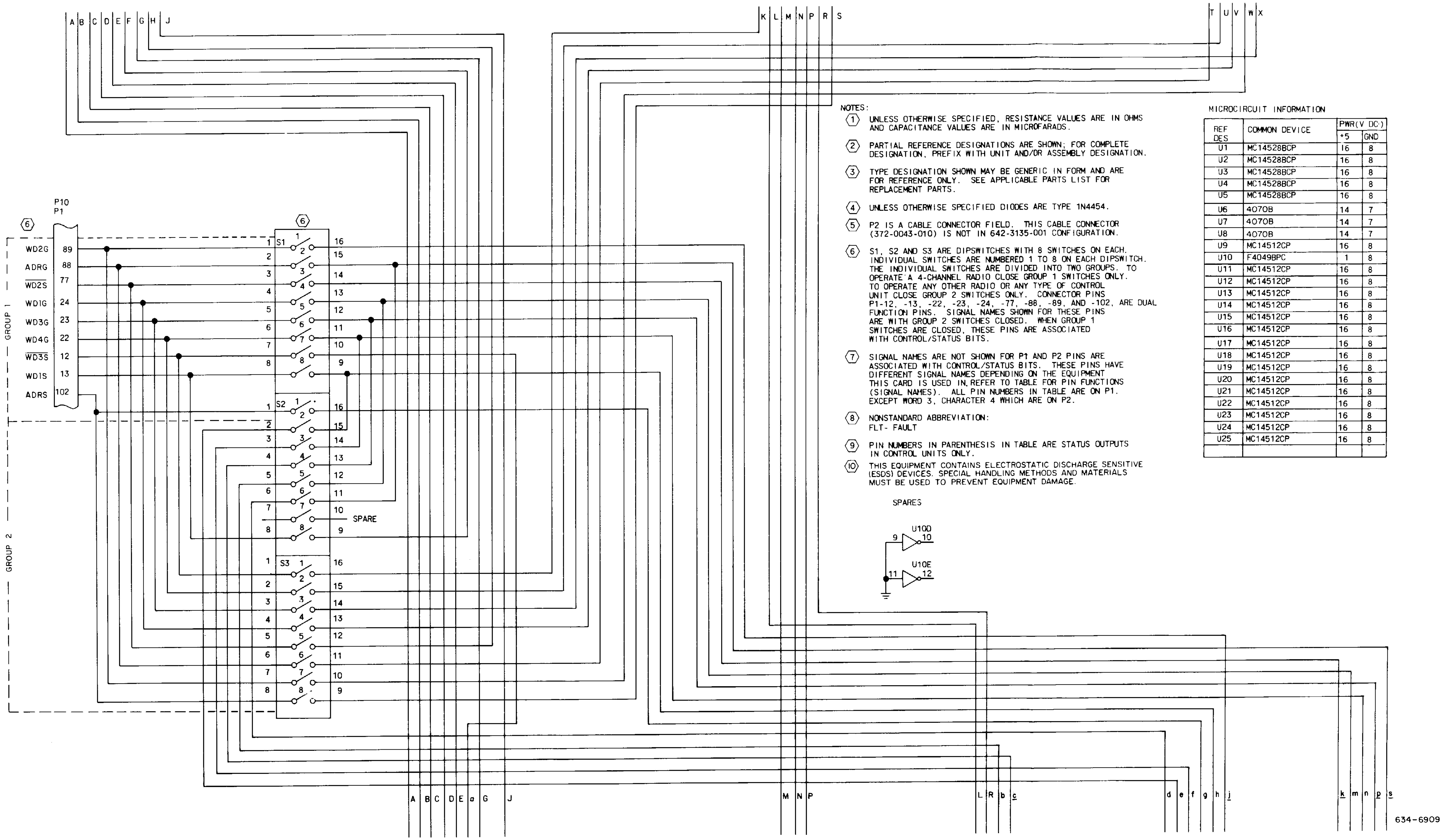
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	PARALLEL INPUT (ESDS)	642-3135-001			
CR1-CR27	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1,C2	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C3-C14	CAPACITOR,FXD CER DIEL, 1000PF, 20%, 50V	913-3279-030		16546	CY10C102M
C15-C19	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C20-C23	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C24	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C25-C27	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-680		16546	CY20C104M
C28,C29	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
L1	COIL,RF 1000UH	240-2540-000		96906	MS90539-15
R1-R12	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R13-R25	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R26	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R27,R28	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R29	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R30-R32	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R33	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R34-R36	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R37	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R38-R40	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R41	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R42-R108	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R109	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R110	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R111-R118	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R119-R126	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R127-R134	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R135	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
S1-S3	SWITCH,DUAL PKG	266-0243-050		27264	A10040-108
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
U1-U5	INTEGRATED CIRCUIT (ESDS)	351-8421-020		07263	4528BPC
U6-U8	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U9	INTEGRATED CIRCUIT DATA SELECTOR	351-8420-020		04713	MC14512BCP
U10	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U11-U25	INTEGRATED CIRCUIT DATA SELECTOR	351-8420-020		04713	MC14512BCP

Parallel Input, Schematic Diagram
Figure 3 (Sheet 2)



Parallel Input, Schematic Diagram
Figure 3 (Sheet 3)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ TYPE DESIGNATION SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

④ UNLESS OTHERWISE SPECIFIED DIODES ARE TYPE 1N4454.

⑤ P2 IS A CABLE CONNECTOR FIELD. THIS CABLE CONNECTOR (372-0043-010) IS NOT IN 642-3135-001 CONFIGURATION.

⑥ S1, S2 AND S3 ARE DIPSWITCHES WITH 8 SWITCHES ON EACH. INDIVIDUAL SWITCHES ARE NUMBERED 1 TO 8 ON EACH DIPSWITCH. THE INDIVIDUAL SWITCHES ARE DIVIDED INTO TWO GROUPS. TO OPERATE A 4-CHANNEL RADIO CLOSE GROUP 1 SWITCHES ONLY. TO OPERATE ANY OTHER RADIO OR ANY TYPE OF CONTROL UNIT CLOSE GROUP 2 SWITCHES ONLY. CONNECTOR PINS P1-12, -13, -22, -23, -24, -77, -88, -89, AND -102, ARE DUAL FUNCTION PINS. SIGNAL NAMES SHOWN FOR THESE PINS ARE WITH GROUP 2 SWITCHES CLOSED. WHEN GROUP 1 SWITCHES ARE CLOSED, THESE PINS ARE ASSOCIATED WITH CONTROL/STATUS BITS.

⑦ SIGNAL NAMES ARE NOT SHOWN FOR P1 AND P2 PINS ARE ASSOCIATED WITH CONTROL/STATUS BITS. THESE PINS HAVE DIFFERENT SIGNAL NAMES DEPENDING ON THE EQUIPMENT THIS CARD IS USED IN, REFER TO TABLE FOR PIN FUNCTIONS (SIGNAL NAMES). ALL PIN NUMBERS IN TABLE ARE ON P1. EXCEPT WORD 3, CHARACTER 4 WHICH ARE ON P2.

⑧ NONSTANDARD ABBREVIATION:
FLT- FAULT

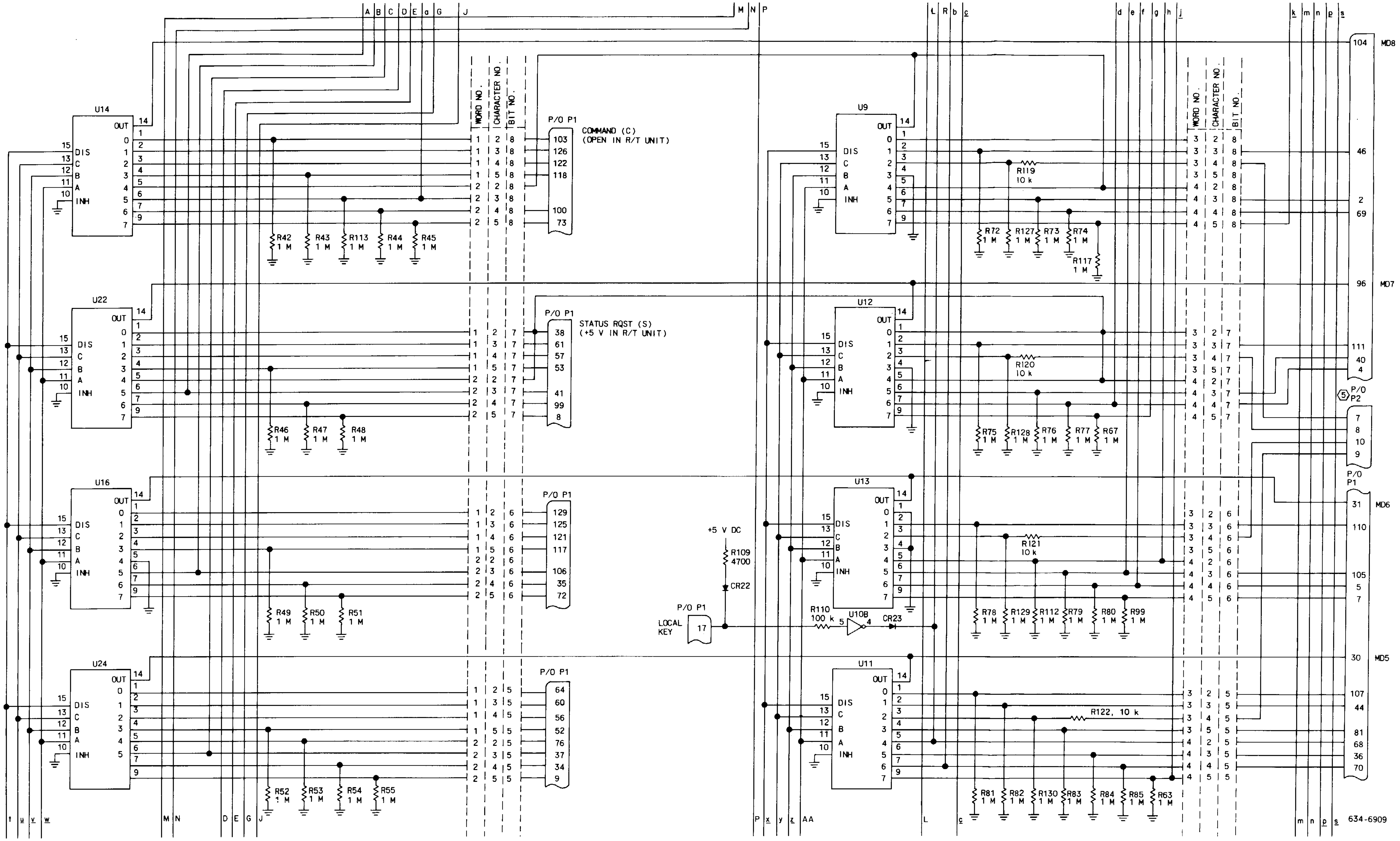
⑨ PIN NUMBERS IN PARENTHESIS IN TABLE ARE STATUS OUTPUTS IN CONTROL UNITS ONLY.

⑩ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

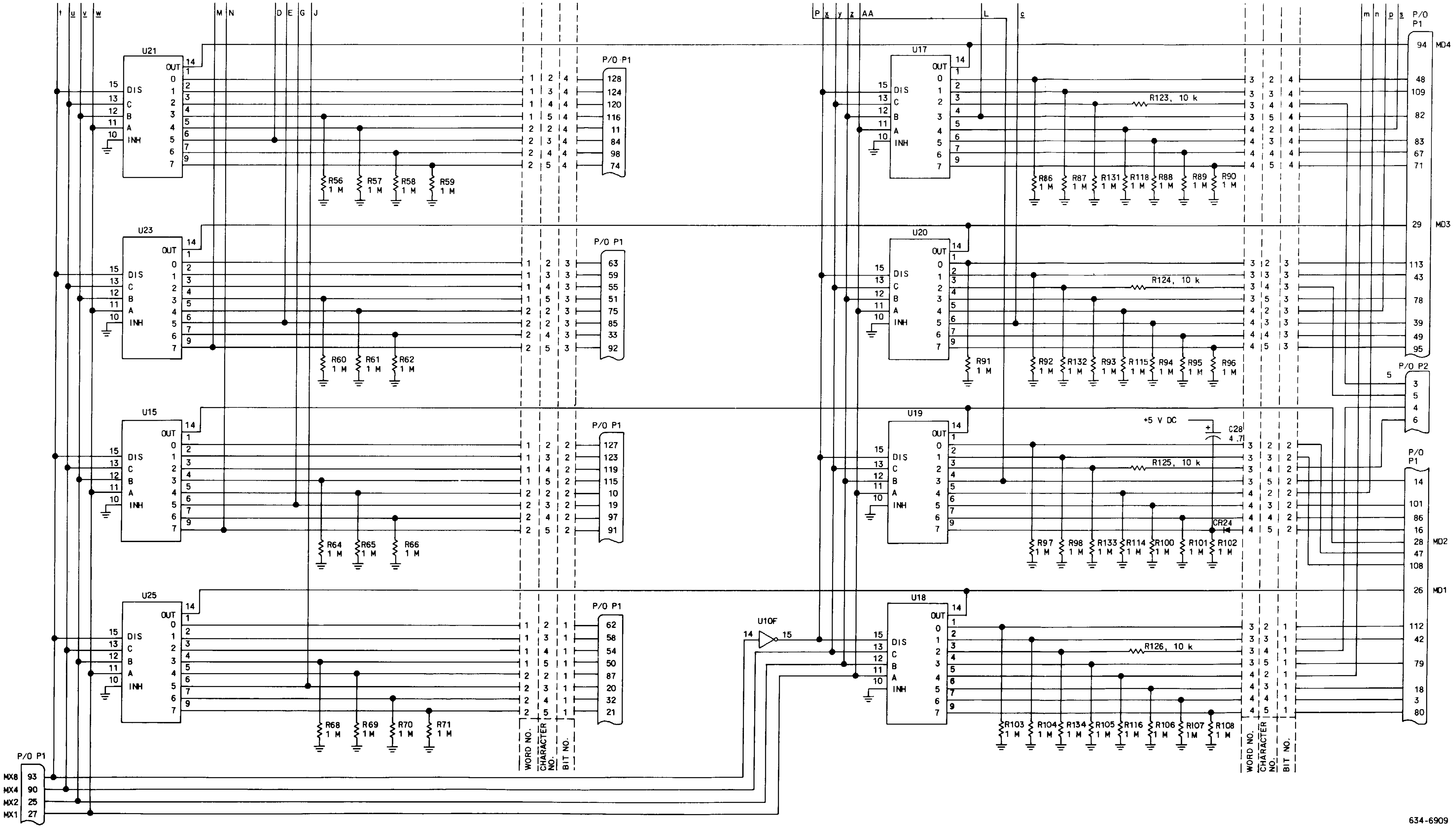
MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE	PWR(V DC)	
		+5	GND
U1	MC14528BCP	16	8
U2	MC14528BCP	16	8
U3	MC14528BCP	16	8
U4	MC14528BCP	16	8
U5	MC14528BCP	16	8
U6	4070B	14	7
U7	4070B	14	7
U8	4070B	14	7
U9	MC14512CP	16	8
U10	F4049BPC	1	8
U11	MC14512CP	16	8
U12	MC14512CP	16	8
U13	MC14512CP	16	8
U14	MC14512CP	16	8
U15	MC14512CP	16	8
U16	MC14512CP	16	8
U17	MC14512CP	16	8
U18	MC14512CP	16	8
U19	MC14512CP	16	8
U20	MC14512CP	16	8
U21	MC14512CP	16	8
U22	MC14512CP	16	8
U23	MC14512CP	16	8
U24	MC14512CP	16	8
U25	MC14512CP	16	8

Parallel Input, Schematic Diagram
Figure 3 (Sheet 4)



Parallel Input, Schematic Diagram
Figure 3 (Sheet 5)



Parallel Input, Schematic Diagram
Figure 3 (Sheet 6)

Parallel Output (642-3137-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

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1 January 1981

1. DESCRIPTION

Parallel Output 642-3137-001, shown in figure 1, is a 2-layer planar card with a 130-pin (2 layers, 65 pins each) edge-on connector. All test points are mounted at the top edge of the card for easy access with the card installed in the unit.

The parallel output card consists of 6 primary circuits: 16 serial-to-parallel shift registers (4 for each parallel output word), 4 power-on-clear flip-flops, a strobe multiplexer, an rf gain control, a fault indicator flasher, and an update/busy indicator/address gate (ADRG) generator.

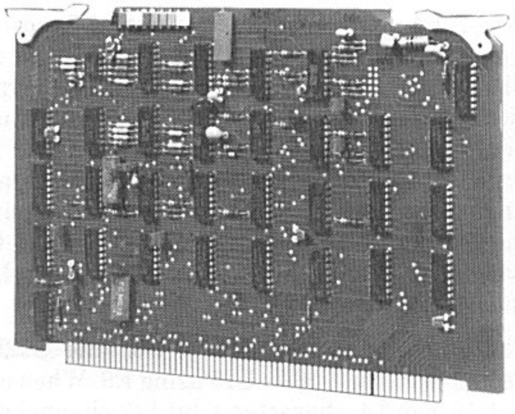
2. PRINCIPLES OF OPERATION (Refer to figure 2.)

2.1 General

The parallel output card receives the serial input data from the serial interface card. The shift registers convert the serial data to parallel outputs for application to front panel indicators. The rf gain control circuit is only used in the remote mode of the receiver circuits. The power-on-clear circuit initially sets all the outputs to clear. After initial turn-on, update, address gate, and busy indicator signals are continually generated for use by control unit circuits.

2.2 Power-On-Clear (Refer to figure 2 and figure 3, the schematic diagram.)

When power is applied to the parallel output card, the rc time constants of C15 and R28, and C19 and R37, generate a logic 1 voltage for approximately 1 second. These momentary logic 1's are applied to the set terminals of flip-flops U5B, U17A, U17B, and U5A. The logic 1 at the set inputs drives the $\overline{Q}$ output to a logic 0. The logic 0 is applied to the enable lines of the 16 shift register, clearing all the shift registers to an initial open-circuit condition.



TPA-2838-017

Parallel Output
Figure 1

2.3 Serial-to-Parallel Shift Registers

The 16 shift registers are electronically arranged in 4 groups of 4. Each group of shift registers represents one word, each shift register represents one character of the word, and each register output represents one of the eight data bits of the word. (This information is shown in detail in the table of the schematic diagram (figure 3).)

When the local enable signal at P1-16 is logic 0, the enable input to all the shift registers is logic 1 which enables their operation. In this condition, the data input (P1-89) is applied to the character-5 register of each word group. The clock input (P1-88) clocks the data serially through each of the registers in a word group. When all 8 bits of characters 2 through 4 are loaded, a strobe signal at the register strobe inputs will cause the data to be stored in the registers. With the enable inputs at logic 1, the stored data is applied through buffers to the eight outputs of the shift registers.

Strobe signals to each of the word groups of registers are generated by multiplexer U7. Outputs from this 8-channel multiplexer are determined by the inputs to the A (STA 1) and B (STA 2) control inputs (P1-83 and -81).

2.4 *Fault Indicator Flasher (Refer to figure 2 and the schematic diagram.)*

Free-running astable multivibrator U8, positive edge trigger monostable multivibrator U32, and exclusive OR gate U12B develop an on-off (flash) signal to indicate a receiver-exciter fault. During normal operation, the strobe signal to the U32 retrigger input occurs at a rate that keeps the multivibrator continuously triggered. The output of U32 is connected to the external reset of U8. The output of U8 (a logic 1) is synchronized with the strobe signal and applied to exclusive OR gate U12B.

The other input to exclusive OR gate U12B is connected to either U16 or U15 using E6. When connected to U16, word 4, character 4, bit 1 (2-channel receiver/exciter fault bit) is applied to U12B. When connected to U15, word 4, character 2, bit 5(4-channel receiver/exciter fault bit) is applied to U12B.

When the receiver/exciter fault bit is logic 0 and the output from multivibrator U8 is logic 1, a fault indication (logic 1) is produced at the output of exclusive OR gate U12B-4. Since multivibrator U8 if free-running, the fault indication will be an on-off (flashing) signal. A steady fault indication is provided at connector P1-105.

In the event a malfunction interrupts monitor data transmission between the control and remote units (interconnection interruption or serial interface card malfunction, for example) the strobe signal to the U32 retrigger input goes to logic 0 allowing multivibrator U8 to free run at a 0.25-Hz rate.

2.5 *RF Gain Control (Refer to figure 2 and the schematic diagram.)*

The rf gain control circuits develops a dc voltage output proportional to the binary input signals to multiplexers U2 and U10. Control input signals (pins A, B, and C) to the multiplexers are obtained from serial-to-parallel shift register U18. The various dc output levels are developed by changing the input resistors to U1A.

In the remote mode of operation, the inputs to U9A and B are at logic 0. The rf gain (U18-7) signal is logic 0; this causes multiplexer U10 to be enabled and U2 to be inhibited. When the rf gain level is adjusted to the point where the rf gain signal goes to logic 1, U10 is inhibited and U2 is enabled (through inverter U11E). Thus the various input resistor values are selected to control the dc output level from amplifiers U1A and U1B.

2.6 *Update/Busy Indicator/Address Gate Generator*

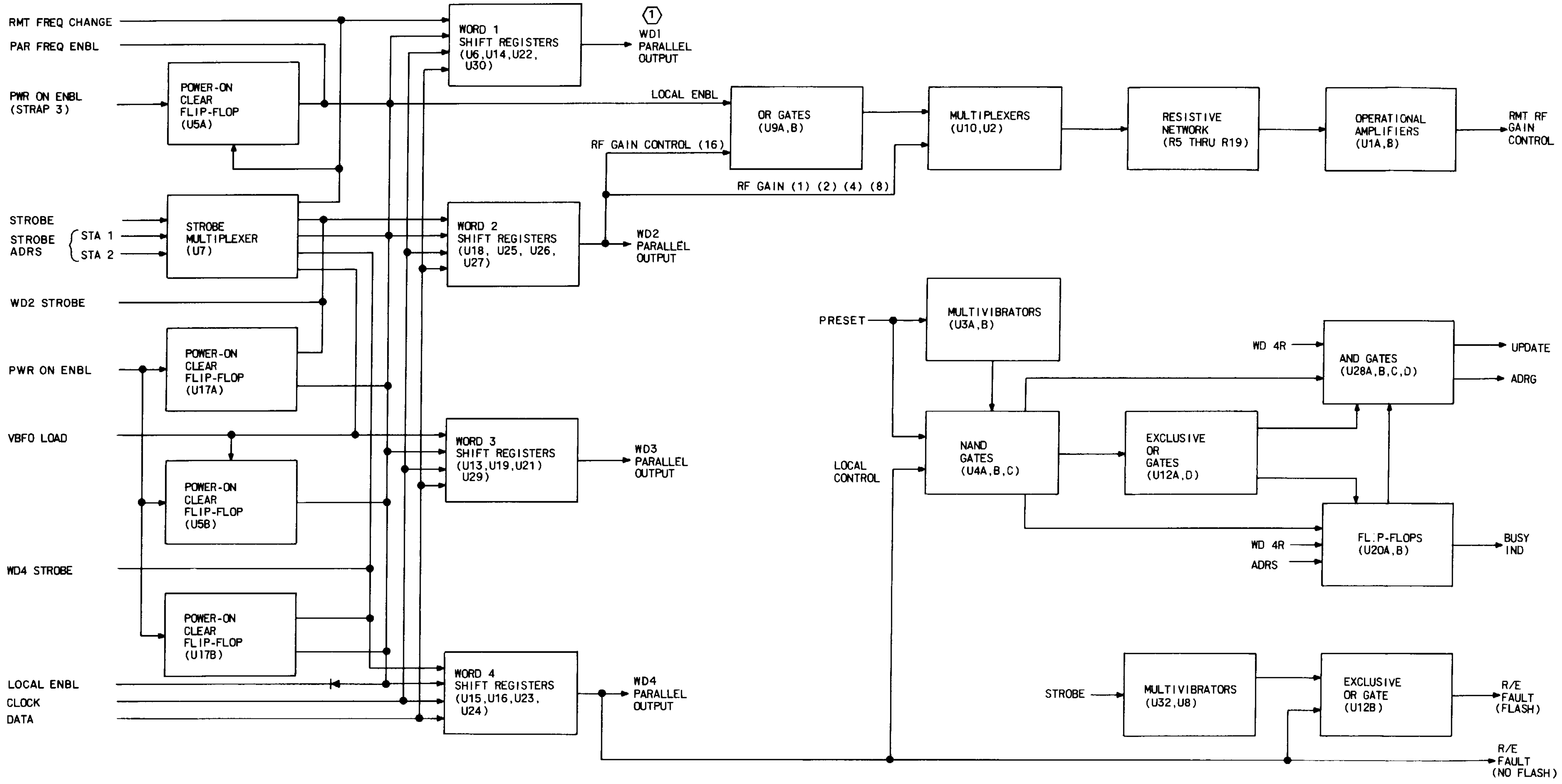
This circuit develops address gate and update pulses, and a driving voltage for the unit front-panel BUSY indicator. (These signals are used in the control unit only.)

Whith the unit front-panel CONT switch in NORM and no busy signal input from the unit being controlled, the input to U4A-1 is logic 0 and the input to U4A-2 is logic 1. This develops a logic 0 from exclusive OR gate U12D and AND gate U28B preventing the BUSY indicator on the unit front panel from lighting. This same signal is clocked through U20A to inhibit U28D from gating out WD4R pulses which are used as update requests.

When a busy signal input is received in the monitor data, the input to U4A-1 goes to logic 1. This develops a logic 1 to U28A-2 and to the busy indicator output causing the BUSY indicator to light and causing an output of continuous WD4R pulses as an address gate signal. The input to U28C-8 is logic 0 keeping the update output inhibited.

When the front panel CONT switch is changed from NORM to TEST in a not-busy condition, U4A-1 is logic 0 keeping the busy indicator output at logic 0. Switching from NORM to TEST causes U12C to develop a momentary output pulse that triggers U3A, causing a logic 0 output from U4B-4. This causes the exclusive OR gate to momentarily go to logic 1 and set U20A-1 to logic 1. The momentary logic 1 at U28D-13 permits one WD4R pulse to be gated out (P1-66) as an update pulse.

With a busy signal present (U4A-1 at logic 1) when the CONT switch is placed in the TEST position, the



NOTES:

① REFER TO THE SCHEMATIC DIAGRAM FOR WORD FORMAT.

② NONSTANDARD ABBREVIATIONS:
ADRG = ADDRESS REGISTER
R/E = RECEIVER/EXCITER

TPA-2833-014

Parallel Output, Block Diagram
Figure 2

set pulse to U20A-6 is developed as previously described; however, the resulting logic 1 from U4A-3 causes U12D-11 to be logic 0. This switches off the front-panel BUSY indicator, and causes the Q output from U20A to go to logic 0. The resulting update output is one logic 1 pulse and the ADRG output is inhibited.

When the front-panel CONT switch is changed from TEST to NORM, the logic 1 output pulse from U3B-10 is developed as previously described. With a not-busy signal present, U4A-3 is logic 1 enabling U28C to gate the WD4R pulses to U28D. The logic 1 at U12D-13 inhibits gate U28B. The logic 0 output from U28B-4 is the BUSY indicator output, the D input to U20A, and an inhibiting input to U28A. The resulting Q output from U20A inhibits gate U28D, developing a logic 0 update output.

With a busy signal present when the CONT switch is set to NORM, U4A-3 is logic 0 which causes the update output to be logic 0. The logic 1 outputs a logic 1 BUSY indicator signal and enables gate U28A. The WD4R input to U28A-1 is then gated out as continuous ADRG pulses.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the parallel output card are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in tables 1 and 2 check the total performance of the parallel output card. The procedures in table 1 are for the following equipments:

HF-8010/8010A Exciter
HF-8050/8050A Receiver
HF-8070/8070A Receiver-Exciter
851S Receiver
HF-8090, HF-8091, HF8092, and HF-8095 Controls.

The procedures in table 2 are for the following equipments:

HF-8014/8014A Exciter
HF-8054/8054A Receiver
HF-8093 and HF-8094 Controls.

These procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic diagram (figure 3) to trace the source of the fault.

Table 1. Parallel Output, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	**Note** The testing and troubleshooting procedures herein are for 1- or 2-channel configurations of the HF-8010/8010A, HF-8050/8050A, HF-8070/8070A, 851S, HF-8090, HF-8091, HF-8092, and HF-8095. These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installing the questionable parallel output in the control unit. During these tests when a control unit is referred to it is a receiver-exciter control, or a receiver control. When a local unit is referred to it is a receiver-exciter, an exciter, or a receiver.		

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. (Cont)	a. Remove top cover of unit containing the parallel output that is to be tested. b. Remove parallel output. Strap pin pair E6 between middle and right pins. Install it on an extender card and place it in the control unit. c. Set control unit and local unit LINE SELECTOR switches to 115 V. d. Connect control unit and local unit to 115-V ac power source and set power on. e. Measure dc voltages, on the card under test, between the following pins and ground (TP1, brown):		
	P1-45 P1-65 P1-114	+15 ±1.0 V dc. +5 ±0.5 V dc. -15 ±1.0 V dc.	Check associated power supply.
	f. Strap local unit for address 0. g. Connect local unit to control unit.		
2. Data inputs, word 1	a. Set control unit CONT switch to TEST. **Note** Word 1 tests can also be accomplished with the control unit CONT switch in NORM and local unit CONT switch in LCL. Then set local unit controls to positions indicated.		
(Cont)	b. Set control unit FREQUENCY KHZ controls for 29 999.9(9).	Frequency display reads 29 999.9(9). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Set control unit FREQUENCY KHZ controls for 16 666.6(6).	Frequency display reads 16 666.6(6). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	d. Set control unit FREQUENCY KHZ controls for 02 000.0(0).	Frequency display reads 02 000.0(0). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	Note Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.		

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO	LOGIC LEVELS			IF ABNORMAL CHECK
		P1-( )	29 999.9(9)	16 666.6(6)	02 000.0(0)	
10 MHz	(2)	129	1	0	0	U6, U5, U7, U11, and associated circuits.
	(1)	64	0	1	0	
1 MHz	(8)	128	1	0	0	
	(4)	63	0	1	0	
	(2)	127	0	1	1	
	(1)	62	1	0	0	
100 kHz	(8)	126	1	0	0	U14, U5, U7, U11, and associated circuits.
	(4)	61	0	1	0	
	(2)	125	0	1	0	
	(1)	60	1	0	0	
10 kHz	(8)	124	1	0	0	
	(4)	59	0	1	0	
	(2)	123	0	1	0	
	(1)	58	1	0	0	

(Cont)

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)			

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO P1-( )	LOGIC LEVELS			IF ABNORMAL CHECK
			29 999.9(9)	16 666.6(6)	02 000.0(0)	
1 kHz	(8)	122	1	0	0	U22, U5, U7, U11, and associated circuits.
	(4)	57	0	1	0	
	(2)	121	0	1	0	
	(1)	56	1	0	0	
100 Hz	(8)	120	1	0	0	
	(4)	55	0	1	0	
	(2)	119	0	1	0	
	(1)	54	1	0	0	
10 Hz (with no 10-Hz tuning)	(8)	118	0	0	0	U30, U5, U7, U11, and associated circuits.
	(4)	53	0	0	0	
	(2)	117	0	0	0	
	(1)	52	0	0	0	
10 Hz (with 10-Hz tuning)	(8)	118	1	0	0	
	(4)	53	0	1	0	
	(2)	117	0	1	0	
	(1)	52	1	0	0	
1 Hz (with no 1-Hz tuning)	(8)	116	0	0	0	U30, U5, U7, U11, and associated circuits.
	(4)	51	0	0	0	
	(2)	115	0	0	0	
	(1)	50	0	0	0	
1 Hz (with 1-Hz tuning)	(8)	116	1	0	0	
	(4)	51	0	1	0	
	(2)	115	0	1	0	
	(1)	50	1	0	0	

Note

If a processor control is used, the 1-Hz outputs can be checked in the same manner that the other frequency outputs are checked.

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. Data inputs, word 2	a. Set control unit CONT switch to TEST. Note Word 2 tests can also be accomplished with the control unit CONT switch in NORM and local unit CONT switch in REM. Then measure voltages at local unit or control unit parallel output card (the card being tested). Rf gain test, steps b and c, is applicable to receiver and receiver-exciter controls only.		
	b. Set control unit RF GAIN control to MAX.		
	c. Connect a dvm to TP5 (green).	Note dc levels as shown in chart for different RF GAIN positions.	Check U18, U9, U11, U1, and associated circuits. Check also circuit indicated in chart.

RF GAIN CONTROL SETTINGS		TP5 (DC VOLTS)	IF ABNORMAL CHECK	
MAX	1	0.000 ±0.010	None	and U10.
	*	-0.158 ±0.010	R20	
	2	-0.316 ±0.010	R19	
	*	-0.475 ±0.020	R19, R20	
	3	-0.634 ±0.020	R18	
	*	-0.792 ±0.030	R18, R20	
rotated	4	-0.950 ±0.030	R17	
from MAX	*	-1.108 ±0.040	R17, R20	
ccw toward	5	-1.266 ±0.040	R16	
MIN	*	-1.417 ±0.050	R16, R20	
	6	-1.568 ±0.050	R15	
	*	-1.712 ±0.060	R15, R20	
	7	-1.855 ±0.060	R14	
	*	-2.022 ±0.070	R14, R20	
	8	-2.188 ±0.070	R13	
MIN	*	-2.332 ±0.080	R13, R20	

(Cont)

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			

RF GAIN CONTROL SETTINGS		TP5 (DC VOLTS)	IF ABNORMAL CHECK	
MAX	9	-2.465 ±0.080	R12	and U2.
	*	-2.619 ±0.090	R12, R20	
	10	-2.773 ±0.090	R11	
	*	-3.002 ±0.100	R11, R20	
	11	-3.130 ±0.100	R10	
↓	*	-3.283 ±0.110	R10, R20	
rotated	12	-3.439 ±0.110	R9	
from MAX	*	-3.570 ±0.120	R9, R20	
ccw toward	13	-3.700 ±0.120	R8	
MIN	*	-3.886 ±0.130	R8, R20	
	14	-4.072 ±0.130	R7	
	*	-4.218 ±0.140	R7, R20	
	15	-4.363 ±0.140	R6	
	*	-4.532 ±0.150	R6, R20	
↓	16	-4.700 ±0.150	R5	
MIN	*	-4.858 ±0.160	R5, R20	

*Controlled by least significant bcd input for rf gain control, available only on processor controls. Bcd for least significant bcd signal at MAX setting is bit wt 0. Bcd signal for most significant bcd signal at one step beyond MIN setting is bit wt 31.

Note

AGC tests, steps d through f, are applicable to the receiver and receiver-exciter controls only.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
	d. Set control unit AGC switch to FAST.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
	e. Set control unit AGC switch to OFF.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
(Cont)	f. Set control unit AGC switch to SLOW.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td>Note
Logic 1 = NLT +3.0 V dc.
Logic 0 = NMT 0.5 V dc.</td><td></td><td></td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th rowspan="2">PARALLEL OUTPUT</th><th rowspan="2">PIN NO P1-( )</th><th colspan="3">AGC SWITCH POSITION</th><th rowspan="2">IF ABNORMAL CHECK</th></tr>
<tr><th>FAST</th><th>OFF</th><th>SLOW</th></tr>
<tr><td>CH A AGC OFF</td><td>84</td><td>0</td><td>1</td><td>0</td><td rowspan="4">U26, U17, U7, U11, and associated circuits.</td></tr>
<tr><td>CH A AGC FAST</td><td>85</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>CH B AGC OFF</td><td>19</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>CH B AGC FAST</td><td>20</td><td>1</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td></td><td>Note
Bandwidth tests, steps g and h, are applicable to the receiver control only.
g. Set control unit MODE switch to SSB/CW.
h. Set control unit BANDWIDTH switch to each of its positions.</td><td>The display associated with the BANDWIDTH switch positions lights. Refer to chart for logic levels and associated parallel output pin numbers.</td><td>Measure logic levels as indicated in chart.</td></tr>
<tr><td>(Cont)</td><td>Note
Logic 1 = NLT +3.0 V dc.
Logic 0 = NMT 0.5 V dc.</td><td></td><td></td></tr>
</table>

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			

PARALLEL OUTPUT	PIN NO P1-( )	BANDWIDTH SWITCH POSITION								IF ABNORMAL CHECK
		16	A	B	USB	LSB	C	D	E	
FL8	100	1	0	0	0	0	0	0	0	U27, U17, U7, U11, and associated circuits.
FL3	33	0	1	0	0	0	0	0	0	
FL4	98	0	0	1	0	0	0	0	0	
FL1	32	0	0	0	1	0	0	0	0	
FL2	97	0	0	0	0	1	0	0	0	
FL5	34	0	0	0	0	0	1	0	0	
FL6	35	0	0	0	0	0	0	1	0	
FL7	99	0	0	0	0	0	0	0	1	

	Note Mode tests, step i, are applicable to the receiver control only.		
	i. Set MODE switch (receiver control only) to each of its positions.	The display associated with the MODE switch position lights. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
(Cont)	**Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.		

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td colspan="3">
<table>
<tr><th rowspan="2">PARALLEL OUTPUT</th><th rowspan="2">PIN NO P1-( )</th><th colspan="3">MODE SWITCH POSITION</th><th rowspan="2">IF ABNORMAL CHECK</th></tr>
<tr><th>*SSB/CW</th><th>*AM</th><th>ISB</th></tr>
<tr><td>SSB EN</td><td>72</td><td>1</td><td>0</td><td>1</td><td rowspan="5">U25, U17, U7, U11, and associated circuits.</td></tr>
<tr><td>AM EN</td><td>8</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>FM EN</td><td>73</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>CW EN</td><td>9</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>ISB EN</td><td>74</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td colspan="6">*In these positions the display and logic levels associated with the BANDWIDTH switch position are also activated.</td></tr>
</table>
</td></tr>
<tr><td></td><td>Note
Mode tests, step j, are applicable to the exciter and receiver-exciter controls only.</td><td></td><td></td></tr>
<tr><td></td><td>j. Set MODE switch (exciter and receiver-exciter controls only) to each of its positions.</td><td>The display associated with the MODE switch position lights. Refer to chart for logic levels and associated parallel output pin numbers.</td><td></td></tr>
<tr><td>(Cont)</td><td>Note
Logic 1 = NLT +3.0 V dc.
Logic 0 = NMT 0.5 V dc.</td><td></td><td></td></tr>
</table>

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td colspan="3">
<table>
<tr><th rowspan="2">PARALLEL OUTPUT</th><th rowspan="2">PIN NO P1-( )</th><th colspan="5">MODE SWITCH POSITION</th><th rowspan="2">IF ABNORMAL CHECK</th></tr>
<tr><th>CW</th><th>LSB</th><th>USB</th><th>AM</th><th>ISB</th></tr>
<tr><td>SSB EN</td><td>72</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td rowspan="5">U25, U17, U7, U11, and associated circuits.</td></tr>
<tr><td>AM EN</td><td>8</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>FM EN</td><td>73</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>CW EN</td><td>9</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>ISB EN</td><td>74</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>FL1 (USB) EN</td><td>32</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td rowspan="2">U27, U17, U7, U11, and associated circuits.</td></tr>
<tr><td>FL2 (LSB) EN</td><td>97</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>4. Data inputs, word 3</td><td>a. Set control unit CONT switch to TEST.
Note
Word 3 tests can also be accomplished with control unit CONT switch in NORM and local unit CONT switch in REM. Then measure voltages at local unit parallel output card (the card being tested).
Pa tests, steps b through e, are applicable to the exciter and receiver-exciter controls only.</td><td></td><td></td></tr>
<tr><td></td><td>b. Set control unit PA PWR switch to OFF.</td><td>Check logic levels at the associated parallel output pin numbers as shown in chart.</td><td></td></tr>
<tr><td></td><td>c. Set control unit PA PWR switch to STBY.</td><td>Check logic levels at the associated parallel output pin numbers as shown in chart.</td><td></td></tr>
<tr><td>(Cont)</td><td>d. Set control unit PA PWR switch to HIGH PWR.</td><td>Check logic levels at the associated parallel output pin numbers as shown in chart.</td><td></td></tr>
</table>

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	e. Set control unit PA PWR switch to LOW PWR. **Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

PARALLEL OUTPUT	PIN NO P1-( )	PA PWR SWITCH POSITION				IF ABNORMAL CHECK
		OFF	STBY	HIGH PWR	LOW PWR	
PA LV EN	79	0	1	1	1	U19, U5, U7, U11, and associated circuits.
PA HV EN	14	0	0	1	1	
LO PWR EN	78	0	0	0	1	

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
	Note Pilot carrier tests, steps f and g, are applicable to the exciter and receiver-exciter controls only.		
	f. Set control unit P CAR switch to OFF.	Logic level 0 at P1-82 (NMT 0.5 V dc).	Check U19, U5, U7, U11, and associated circuits.
	g. Set control unit P CAR switch to ON.	Logic level 1 at P1-82 (NLT +3.0 V dc).	
	Note Dvbfo tests, steps h through k, are applicable only to the receiver and receiver-exciter controls with a dvbfo option installed.		
(Cont)	h. Set the control unit MODE switch to SSB/CW or CW and BFO switch to VAR.		

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	i. Set digital VBFO controls for +9990 Hz.	VBFO frequency display reads +9990. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	j. Set digital VBFO controls for -6660 Hz.	VBFO frequency display reads -6660. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	k. Set digital VBFO controls for +1000 Hz.	VBFO frequency display reads +1000. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	Note Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.		

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO	LOGIC LEVELS			IF ABNORMAL CHECK
		P1-( )	+9990	-6660	+1000	
DVBFO 1 kHz	(8)	48	1	0	0	U29, U5, U7, U11, and associated circuits.
	(4)	113	0	1	0	
	(2)	47	0	1	0	
	(1)	112	1	0	1	
DVBFO 100 Hz	(8)	46	1	0	0	U21, U5, U7, U11, and associated circuits.
	(4)	111	0	1	0	
	(2)	110	0	1	0	
	(1)	44	1	0	0	
DVBFO 10 Hz	(8)	109	1	0	0	
	(4)	43	0	1	0	
	(2)	108	0	1	0	
	(1)	42	1	0	0	
DVBFO SIGN		107	1	0	1	U29, U5, U7, U11, and associated circuits.

(Cont)

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	**Note** Analog vbfo tests, steps l and m, are applicable only to the receiver and receiver-exciter controls with an analog vbfo option installed. l. Set the control unit MODE switch to SSB/CW or CW and BFO switch to VAR.		
	m. Rotate the BFO control through its complete range.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

BCD OUTPUT SIGNAL		LOGIC LEVELS				LOGIC DISPLAY	IF ABNORMAL CHECK
		PARALLEL OUTPUT PIN NO P1-( )					
		48	113	47	112		
- (Full ccw)	1	1	1	1	1		U29, U5, U7, U11, and associated circuits.
	2	1	1	1	0		
	3	1	1	0	1		
	4	1	1	0	0		
	5	1	0	1	1		
	6	1	0	1	0		
	7	1	0	0	1		
Rotated from - cw toward +	8	1	0	0	0		
	9	0	1	1	1		
	10	0	1	1	0		
	11	0	1	0	1		
	12	0	1	0	0		
	13	0	0	1	1		
	14	0	0	1	0		
	15	0	0	0	1		
+ (Full cw)	16	0	0	0	0		

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Data inputs, word 4	a. Set control unit CONT switch to NORM.		
	b. Set local unit CONT switch to LCL.		
	Note System key test, steps c and d, is applicable only to exciter and receiver-exciter controls.		
	c. Set local unit KEY switch to LOCK.	Control unit KEY display lights. Logic level 1 at P1-68 (NLT +3.0 V dc).	Check U15, U17, U7, U11, and associated circuits.
	d. Set local unit KEY switch to NORM.	Control unit KEY display goes out. Logic level 0 at P1-68 (NMT 0.5 V dc).	
	e. Set local unit PWR switch off and back on.	Control unit EXCTR FAULT, RCV FAULT, or R/E FAULT lights. Logic level 1 at P1-12 (NLT +3.0 V dc).	Check U16, U12, U32, U8, U17, U7, U11, and associated circuits.
	f. Change any frequency control on local unit front panel.	Control unit EXCTR FAULT, RCV FAULT, or R/E FAULT goes out. Logic level 0 at P1-12 (NMT 0.5 V dc).	
	Note Receive overload test, steps g and h, is applicable only to receiver and receiver-exciter controls.		
	g. Connect +5 V dc to local unit J16-27.	Control unit RCV OVERLOAD lights. Logic level 1 at P1-67 (NLT +3.0 V dc)	Check U16, U17, U7, U11, and associated circuits.
	h. Remove +5 V dc from local unit J16-27.	Control unit RCV OVERLOAD goes out. Logic level 0 at P1-67 (NMT 0.5 V dc).	Same as step g.
(Cont)	**Note** Coupler fault test, steps i and j, is applicable only to exciter and receiver-exciter controls.		

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	i. Connect +5 V dc to local unit J15-1.	Control unit COUPLER FAULT lights. Logic level 1 at P1-13 (NLT +3.0 V dc).	Same as step g.
	j. Remove +5 V dc from local unit J15-1.	Control unit COUPLER FAULT lights. Logic level 0 at P1-13 (NMT 0.5 V dc).	
	Note Rf out test, steps k and l, is applicable only to exciter and receiver-exciter controls.		
	k. Connect ground signal to local unit J15-5.	Control unit RF OUT lights. Logic level 1 at P1-5 (NLT +3.0 V dc).	
	l. Remove ground signal from local unit J15-5.	Control unit RF OUT goes out. Logic level 0 at P1-5 (NMT 0.5 V dc).	
	Note Pa fault test, steps m and n, is applicable only to exciter and receiver-exciter controls.		
	m. Connect +5 V dc to local unit J15-3.	Control unit PA FAULT lights. Logic level 1 at P1-77 (NLT +3.0 V dc).	
	n. Remove +5 V dc from local unit J15-3.	Control unit PA FAULT goes out. Logic level 0 at P1-77 (NMT 0.5 V dc).	
	Note Pa ready test, steps o and p, is applicable only to exciter and receiver-exciter controls.		
(Cont)	o. Connect ground signal to local unit J15-21.	Control unit PA READY lights. Logic level 0 at P1-69 (NMT 0.5 V dc).	

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	p. Remove ground signal from local unit J15-21.	Control unit PA READY goes out. Logic level 0 at P1-69 (NMT 0.5 V dc).	Same as step g.
	q. Press and hold local unit CONT switch to MON.	Logic level 1 at P1-30 (NLT +3.0 V dc).	Check U24, U17, U7, U11, and associated circuits.
	r. Set local unit CONT switch to REM.	Logic level 0 at P1-30 (NMT 0.5 V dc).	
	s. Set local unit CONT switch to LCL.	Logic level 1 at P1-95 (NLT +3.0 V dc).	
		Control unit BUSY indicator lights. Logic level 1 at P1-7 (NLT +3.0 V dc).	Check U28, U20, U12, U4, U24, U17, U7, U11, and associated circuits.
	t. Set local unit CONT switch to REM.	After short delay logic level 0 at P1-95 (NMT 0.5 V dc).	Same as step s.
		After short delay control unit BUSY indicator goes out. Logic level 0 at P1-7 (NMT 0.5 V dc).	
	u. Set local unit CONT switch to LCL.		
	v. Apply a ground to local unit A13U51A-6.		
	w. Apply a ground to local unit A13U51A-3.		
	x. Remove ground from local unit A13U51A-3.		
	y. Apply ground to local unit A13U16A-1, 2, 8.		
	z. Remove ground from local unit A13U16A-1, 2, 8.	Logic level 1 at P1-29 (NLT +3.0 V dc).	Same as step q.
	aa. Remove ground from local unit A13U51A-6.		
(Cont)	ab. Apply ground to local unit A13U42A-3.	Logic level 0 at P1-29 (NMT 0.5 V dc).	

Table 1. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	ac. Remove ground from local unit A13U42A-3.		Same as step q.
	ad. Apply +5 V dc to local unit J16-8.	Control unit PRESEL FAULT lights. Logic level 1 at P1-28 (NLT +3.0 V dc).	
	ae. Remove +5 V dc from local unit J16-8.	Control unit PRESEL FAULT goes out. Logic level 0 at P1-28 (NMT 0.5 V dc).	

Table 2. Parallel Output, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	**Note** The testing and troubleshooting procedures herein are for 1-, 2-, 3-, and 4-channel configurations of the HF-8014/8014A, HF-8054/8054A, HF-8093, and HF-8094 These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installing the questionable parallel output in the control unit. During these tests when a control unit is referred to it is an exciter control, or a receiver control. When a local unit is referred to it is an exciter, or a receiver.		
	a. Remove top cover of unit containing the parallel output that is to be tested.		
	b. Remove parallel output. Strap pin pair E6 between middle and left pins. Install it on an extender card and place it in the control unit.		
	c. Set control unit and local unit LINE SELECTOR switches to 115 V.		
	d. Connect control unit and local unit to 115-V ac power source and set power on.		
	e. Measure dc voltages, on the card under test, between the following pins and ground (TP1, brown):		
	P1-45	+15 ±1.0 V dc.	Check associated power supply.
	P1-65	+5 ±0.5 V dc.	
	P1-114	-15 ±1.0 V dc.	
	f. Strap local unit for address 0.		
	g. Connect local unit to control unit.		
2. Data inputs, word 1	a. Set control unit CONT switch to TEST. **Note** Word 1 tests can also be accomplished with the control unit CONT switch in NORM and local unit CONT switch in LCL. Then set local unit controls to positions indicated.		
	b. Set control unit FREQUENCY KHZ controls for 29 999.9(9).	Frequency display reads 29 999.9(9). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
(Cont)			

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Set control unit FREQUENCY KHZ controls for 16 666.6(6).	Frequency display reads 16 666.6(6). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	d. Set control unit FREQUENCY KHZ controls for 02 000.0(0). **Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.	Frequency display reads 02 000.0(0). Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO	LOGIC LEVELS			IF ABNORMAL CHECK
		P1-( )	29 999.9(9)	16 666.6(6)	02 000.0(0)	
10 MHz	(2)	129	1	0	0	U6, U5, U7, U11, and associated circuits.
	(1)	64	0	1	0	
1 MHz	(8)	128	1	0	0	
	(4)	63	0	1	0	
	(2)	127	0	1	1	
	(1)	62	1	0	0	
100 kHz	(8)	126	1	0	0	U14, U5, U7, U11, and associated circuits.
	(4)	61	0	1	0	
	(2)	125	0	1	0	
	(1)	60	1	0	0	
10 kHz	(8)	124	1	0	0	
	(4)	59	0	1	0	
	(2)	123	0	1	0	
	(1)	58	1	0	0	

(Cont)

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)			

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO	LOGIC LEVELS			IF ABNORMAL CHECK
		P1-( )	29 999.9(9)	16 666.6(6)	02 000.0(0)	
1 kHz	(8)	122	1	0	0	U22, U5, U7, U11, and associated circuits.
	(4)	57	0	1	0	
	(2)	121	0	1	0	
	(1)	56	1	0	0	
100 Hz	(8)	120	1	0	0	
	(4)	55	0	1	0	
	(2)	119	0	1	0	
	(1)	54	1	0	0	
10 Hz (with no 10-Hz tuning)	(8)	118	0	0	0	U30, U5, U7, U11, and associated circuits.
	(4)	53	0	0	0	
	(2)	117	0	0	0	
	(1)	52	0	0	0	
10 Hz (with 10-Hz tuning)	(8)	118	1	0	0	
	(4)	53	0	1	0	
	(2)	117	0	1	0	
	(1)	52	1	0	0	
1 Hz (with no 1-Hz tuning)	(8)	116	0	0	0	U30, U5, U7, U11, and associated circuits.
	(4)	51	0	0	0	
	(2)	115	0	0	0	
	(1)	50	0	0	0	
1 Hz (with 1-Hz tuning)	(8)	116	1	0	0	
	(4)	51	0	1	0	
	(2)	115	0	1	0	
	(1)	50	1	0	0	

Note

If a processor control is used, the 1-Hz outputs can be checked in the same manner that the other frequency outputs are checked.

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. Data inputs, word 2	a. Set control unit CONT switch to TEST. **Note** Word 2 tests can also be accomplished with the control unit CONT switch in NORM and local unit CONT switch in REM. Then measure voltages at local unit or control unit parallel output card (the card being tested). Rf gain test, steps b and c, is applicable to receiver controls only. b. Set control unit RF GAIN control to MAX. c. Connect a dvm to TP5 (green).	Note dc levels as shown in chart for different RF GAIN positions.	Check U18, U9, U11, U1, and associated circuits. Check also circuit indicated in chart.

RF GAIN CONTROL SETTINGS		TP5 (DC VOLTS)	IF ABNORMAL CHECK	
MAX	1	0.000 ±0.010	None	and U10.
	*	-0.158 ±0.010	R20	
	2	-0.316 ±0.010	R19	
	*	-0.475 ±0.020	R19, R20	
	3	-0.634 ±0.020	R18	
↓	*	-0.792 ±0.030	R18, R20	
rotated	4	-0.950 ±0.030	R17	
from MAX	*	-1.108 ±0.040	R17, R20	
ccw toward	5	-1.266 ±0.040	R16	
MIN	*	-1.417 ±0.050	R16, R20	
	6	-1.568 ±0.050	R15	
	*	-1.712 ±0.060	R15, R20	
	7	-1.855 ±0.060	R14	
	*	-2.022 ±0.070	R14, R20	
↓	8	-2.188 ±0.070	R13	
MIN	*	-2.332 ±0.080	R13, R20	

(Cont)

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			

RF GAIN CONTROL SETTINGS		TP5 (DC VOLTS)	IF ABNORMAL CHECK	
MAX	9	-2.465 ±0.080	R12	and U2.
	*	-2.619 ±0.090	R12, R20	
	10	-2.773 ±0.090	R11	
	*	-3.002 ±0.100	R11, R20	
	11	-3.130 ±0.100	R10	
	*	-3.283 ±0.110	R10, R20	
rotated	12	-3.439 ±0.110	R9	
from MAX	*	-3.570 ±0.120	R9, R20	
ccw toward	13	-3.700 ±0.120	R8	
MIN	*	-3.886 ±0.130	R8, R20	
	14	-4.072 ±0.130	R7	
	*	-4.218 ±0.140	R7, R20	
	15	-4.363 ±0.140	R6	
	*	-4.532 ±0.150	R6, R20	
	16	-4.700 ±0.150	R5	
MIN	*	-4.858 ±0.160	R5, R20	

*Controlled by least significant bcd input for rf gain control, available only on processor controls. Bcd for least significant bcd signal at MAX setting is bit wt 0. Bcd signal for most significant bcd signal at one step beyond MIN setting is bit wt 31.

	Note AGC tests, steps d through f, are applicable to the receiver controls only.		
	d. Set channel A1 AGC BUS switch to ON.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
	e. Rotate channel A1 AGC control switch through all its positions.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
(Cont)	f. Repeat steps d and e for channels A2, B1, and B2.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	**Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.		

PARALLEL OUTPUT	PIN NO P1-( )	AGC SWITCH POSITION				IF ABNORMAL CHECK
		OFF	FAST	MEDIUM	SLOW	
CH A1 AGC 1	32	1	0	0	1	Check U26,U27, &17, U7, U11, and associated circuits.
CH A1 AGC 2	97	1	0	1	0	
CH A2 AGC 1	20	1	0	0	1	
CH A2 AGC 2	19	1	0	1	0	
CH B1 AGC 1	33	1	0	0	1	
CH B1 AGC 2	98	1	0	1	0	
CH B2 AGC 1	85	1	0	0	1	
CH B2 AGC 2	84	1	0	1	0	

	Note Bandwidth tests, steps g and h, are applicable to the receiver control only.		
	g. Set control unit MODE switch to SSB/CW.		
	h. Set control unit BANDWIDTH switch to each of its positions.	The display associated with the BANDWIDTH switch positions lights. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
(Cont)	**Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.		

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			

PARALLEL OUTPUT	PIN NO P1-( )	BANDWIDTH SWITCH POSITION								IF ABNORMAL CHECK
		16	A	B			C	D	E	
										U26, U27, U17, U7, U11, and associated circuits.
FL3	100	0	1	0			0	0	0	
FL4	37	0	0	1			0	0	0	
FL1	99	1	0	0			0	0	0	
FL5	106	0	0	0			1	0	0	
FL6	41	0	0	0			0	1	0	
FL7	3	0	0	0			0	0	1	

Note

Mode tests, step i, are applicable to the receiver control only.

PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
i. Set MODE switch (receiver control only) to each of its positions.	The display associated with the MODE switch position lights. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.

PARALLEL OUTPUT	PIN NO P1-( )	MODE SWITCH POSITION				IF ABNORMAL CHECK
		NET DATA	*CW	*AM	ISB	
AM EN	8	0	0	1	0	U25, U17, U7, U11, and associated circuits.
DATA NET EN	73	1	0	0	0	
CW EN	72	0	1	0	0	
ISB EN	9	0	0	0	1	

*In these positions the display and logic levels associated with the BANDWIDTH switch position are also activated.

Note

Mode tests, step j, are applicable to the exciter controls only.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
(Cont)	j. Set MODE switch (exciter controls only) to each of its positions.	The display associated with the MODE switch position lights. Refer to chart for logic levels and	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	j. (Cont) Note Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc. Note Channel select tests, steps k through m, are applicable to receiver control only.	associated parallel output pin numbers.	
	k. Place MODE switch in the ISB position.		
	l. Place CH B2 switch to ON position.	The display associated with the CH B2 ON position lights. Refer to chart for logic levels and associated parallel output pin numbers.	
	m. Repeat step l for CH B1, CH A1, and CH A2 switches.		

PARALLEL OUTPUT	PIN NO P1-( )	CH SWITCH POSITION		IF ABNORMAL CHECK
		ON	OFF	
A2 ENBL	17	1	0	Check U25, U17, U7, U11, and associated circuits.
A1 ENBL	26	1	0	
B1 ENBL	6	1	0	
B2 ENBL	74	1	0	

	Note Channel select tests, steps n through p, are applicable to exciter control only.		
	n. Place MODE switch in ISB position.		
	o. Place channel A1 CHANNEL ENABLE switch in LINE position and then to MIC position.	The display associated with channel A1 lights. Refer to chart for logic levels and associated parallel output pin numbers.	
(Cont)	p. Repeat step o for channels A2, B1, and B2.	Same as step o.	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>3. (Cont)</td><td colspan="3">
<table>
<tr><th rowspan="2">PARALLEL INPUT</th><th rowspan="2">PIN NO P1-( )</th><th colspan="3">CHANNEL ENABLE SWITCH POSITION</th><th rowspan="2">IF ABNORMAL CHECK</th></tr>
<tr><th>LINE</th><th>OFF</th><th>MIC</th></tr>
<tr><td>A2 ENBL</td><td>17</td><td>1</td><td>0</td><td>1</td><td rowspan="4">U25, U17, U7, U11, and associated circuits.</td></tr>
<tr><td>A1 ENBL</td><td>26</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>B1 ENBL</td><td>6</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>B2 ENBL</td><td>74</td><td>1</td><td>0</td><td>1</td></tr>
</table>
</td></tr>
<tr><td></td><td>Note
Vbfo and AFC enable tests, steps q through t, are applicable to receiver controls only.</td><td></td><td></td></tr>
<tr><td></td><td>q. Set control unit AFC switch to OFF.</td><td>Logic level 0 at P1-34. (NMT 0.5 V dc.)</td><td></td></tr>
<tr><td></td><td>r. Set control unit AFC switch to ON.</td><td>Logic level 1 at P1-34. (NLT +3.0 V dc.)</td><td>Check U26, U27, U17, U7, U11, and associated circuits.</td></tr>
<tr><td></td><td>s. Set control unit VBFO switch to FXO.</td><td>Logic level 0 at P1-35. (NMT 0.5 V dc.)</td><td></td></tr>
<tr><td></td><td>t. Set control unit VBFO switch to VAR.</td><td>Logic level 1 at P1-35. (NLT 3.0 V dc.)</td><td>Same as step s.</td></tr>
<tr><td>(Cont)</td><td>Note
Peak clip enable test, step u and v, are applicable to exciter controls only.</td><td></td><td></td></tr>
</table>

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	u. Set control unit PEAK CLIP switch to OFF.	Logic level 0 at P1-32. (NMT 0.5 V dc.)	Same as step s.
	v. Set control unit PEAK CLIP switch to ON.	Logic level 1 at P1-32. (NLT 3.0 V dc.)	
4. Data inputs, word 3	a. Set control unit CONT switch to TEST. Note Word 3 tests can also be accomplished with control unit CONT switch in NORM and local unit CONT switch in REM. Then measure voltages at local unit parallel output card (the card being tested). Pa tests, steps b through e, are applicable to the exciter and receiver-exciter controls only.		
	b. Set control unit PA PWR switch to OFF.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
	c. Set control unit PA PWR switch to STBY.	Check logic levels at the associated parallel output pin numbers as shown in chart.	
(Cont)	d. Set control unit PA PWR switch to HIGH PWR.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	e. Set control unit PA PWR switch to LOW PWR. **Note** Logic 1 = NLT +3.0 V dc. Logic 0 = NMT 0.5 V dc.	Check logic levels at the associated parallel output pin numbers as shown in chart.	

PARALLEL OUTPUT	PIN NO P1-( )	PA PWR SWITCH POSITION				IF ABNORMAL CHECK
		OFF	STBY	HIGH PWR	LOW PWR	
PA LV EN	79	0	1	1	1	U19, U5, U7, U11, and associated circuits.
PA HV EN	14	0	0	1	1	
LO PWR EN	78	0	0	0	1	

	Note Pilot carrier tests, steps f and g, are applicable to the exciter controls only.		
	f. Set control unit PILOT CARR switch to OFF.	Logic level 0 at P1-82 (NMT 0.5 V dc).	Check U19, U5, U7, U11, and associated circuits.
	g. Set control unit PILOT CARR switch to ON.	Logic level 1 at P1-82 (NLT +3.0 V dc).	
	Note Dvbfo tests, steps h through k, are applicable only to the receiver with a dvbfo option installed.		
(Cont)	h. Set the control unit MODE switch to CW and the VBFO switch to VAR.		

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	i. Set digital VBFO controls for +9990 Hz.	VBFO frequency display reads +9990. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	j. Set digital VBFO controls for -6660 Hz.	VBFO frequency display reads -6660. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.
	k. Set digital VBFO controls for +1000 Hz.	VBFO frequency display reads +1000. Refer to chart for logic levels and associated parallel output pin numbers.	Measure logic levels as indicated in chart.

Note

Logic 1 = NLT +3.0 V dc.
Logic 0 = NMT 0.5 V dc.

BCD OUTPUT SIGNAL		PARALLEL OUTPUT PIN NO P1-( )	LOGIC LEVELS			IF ABNORMAL CHECK
			+9990	-6660	+1000	
DVBFO 1 kHz	(8)	48	1	0	0	U29, U5, U7, U11, and associated circuits.
	(4)	113	0	1	0	
	(2)	47	0	1	0	
	(1)	112	1	0	1	
DVBFO 100 Hz	(8)	46	1	0	0	U21, U5, U7, U11, and associated circuits.
	(4)	111	0	1	0	
	(2)	110	0	1	0	
	(1)	44	1	0	0	
DVBFO 10 Hz	(8)	109	1	0	0	
	(4)	43	0	1	0	
	(2)	108	0	1	0	
	(1)	42	1	0	0	
DVBFO SIGN		107	1	0	1	U29, U5, U7, U11, and associated circuits.

(Cont)

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	a. Set control unit CONT switch to NORM.		
	b. Set local unit CONT switch to LCL.		
	Note System key test, steps c and d, is applicable only to exciter controls.		
	c. Set local unit KEY switch to LOCK.	Control unit KEY display lights. Logic level 1 at P1-68 (NLT +3.0 V dc).	Check U15, U17, U7, U11, and associated circuits.
	d. Set local unit KEY switch to NORM.	Control unit KEY display goes out. Logic level 0 at P1-68 (NMT 0.5 V dc).	
	e. Set local unit PWR switch off.	Control unit EXCTR FAULT flashes. Logic level 1 follows light at P1-12 (NLT +3.0 V dc.)	Check U16, U12, U32, U8, U17, U7, U11, and associated circuits.
	f. Set local unit PWR switch to ON. Change any frequency control on local unit front panel.	Control unit EXCTR FAULT goes out. Logic level 0 at P1-12 (NMT 0.5 V dc).	
	Note Receive overload test, steps g and h, is applicable only to receiver controls.		
	g. Connect +5 V dc to local unit J16-27.	Control unit RF OVERLOAD lights. Logic level 1 at P1-68 (NLT-+3.0 V dc)	Check U16, U17, U7, U11, and associated circuits.
	h. Remove +5 V dc from local unit J16-27.	Control unit RF OVERLOAD goes out. Logic level 0 at P1-68 (NMT 0.5 V dc).	Same as step g.
(Cont)	**Note** Coupler fault test, steps i and j, is applicable only to exciter controls.		

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	i. Connect +5 V dc to local unit J15-1.	Control unit COUPLER FAULT lights. Logic level 1 at P1-92 (NLT +3.0 V dc).	Same as step g.
	j. Remove +5 V dc from local unit J15-1.	Control unit COUPLER FAULT lights. Logic level 0 at P1-92 (NMT 0.5 V dc).	
	Note Rf out test, steps k and l, is applicable only to exciter controls.		
	k. Connect ground signal to local unit J15-5.	Control unit RF OUT lights. Logic level 1 at P1-5 (NLT +3.0 V dc).	
	l. Remove ground signal from local unit J15-5.	Control unit RF OUT goes out. Logic level 0 at P1-5 (NMT 0.5 V dc).	
	Note Pa fault test, steps m and n, is applicable only to exciter controls.		
	m. Connect +5 V dc to local unit J15-3.	Control unit PA FAULT lights. Logic level 1 at P1-104 (NLT +3.0 V dc).	
	n. Remove +5 V dc from local unit J15-3.	Control unit PA FAULT goes out. Logic level 0 at P1-104 (NMT 0.5 V dc).	
	Note Pa ready test, steps o and p, is applicable only to exciter controls.		
(Cont)	o. Connect ground signal to local unit J15-21.	Control unit PA READY lights. Logic level 0 at P1-70 (NMT 0.5 V dc).	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	p. Remove ground signal from local unit J15-21.	Control unit PA READY goes out. Logic level 0 at P1-70 (NMT 0.5 V dc).	Same as step g.
	q. Press and hold local unit CONT switch to MON.	Logic level 1 at P1-30 (NLT +3.0 V dc).	Check U24, U17, U7, U11, and associated circuits.
	r. Set local unit CONT switch to REM.	Logic level 0 at P1-30 (NMT 0.5 V dc).	
	s. Set local unit CONT switch to LCL.	Logic level 1 at P1-95 (NLT +3.0 V dc).	
		Control unit BUSY indicator lights. Logic level 1 at P1-7 (NLT +3.0 V dc).	Check U28, U20, U12, U4, U24, U17, U7, U11, and associated circuits.
	t. Set local unit CONT switch to REM.	After short delay logic level 0 at P1-95 (NMT 0.5 V dc).	Same as step s.
		After short delay control unit BUSY indicator goes out. Logic level 0 at P1-7 (NMT 0.5 V dc).	
	u. Set local unit CONT switch to LCL.		
	v. Apply a ground to local unit A13U51A-6.		
	w. Apply a ground to local unit A13U51A-3.		
	x. Remove ground from local unit A13U51A-3.		
	y. Apply ground to local unit A13U16A-1, 2, 8.		
	z. Remove ground from local unit A13U16A-1, 2, 8.	Logic level 1 at P1-29 (NLT +3.0 V dc).	Same as step q.
	aa. Remove ground from local unit A13U51A-6.		
(Cont)	ab. Apply ground to local unit A13U42A-3.	Logic level 0 at P1-29 (NMT 0.5 V dc).	

Table 2. Parallel Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	ac. Remove ground from local unit A13U42A-3.		Same as step q.
	ad. Apply +5 V dc to local unit J16-8.	Control unit PRESEL FAULT lights. Logic level 1 at P1-28 (NLT +3.0 V dc).	
	ae. Remove +5 V dc from local unit J16-8.	Control unit PRESEL FAULT goes out. Logic level 0 at P1-28 (NMT 0.5 V dc).	

4. UNIT STRAPPING

The parallel output card must be strapped for proper operation at initial installation and/or following testing and troubleshooting. Strapping is accomplished using jumper clips over the square pins marked E1 through E6.

Place jumper connectors (quantity 4) on each of the square pin pairs labeled E1 through E4.

Pin pair E5 is strapped between the middle and top pins for a flashing fault indicator or strapped between the middle and bottom pins for a nonflashing fault indicator.

Pin pair E6 is strapped between the middle and right pins for character 4, bit 1 fault position (2-channel equipment) or character 2, bit 6 fault position (4-channel equipment).

5. REPAIR

Repair of the parallel output card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration,' schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

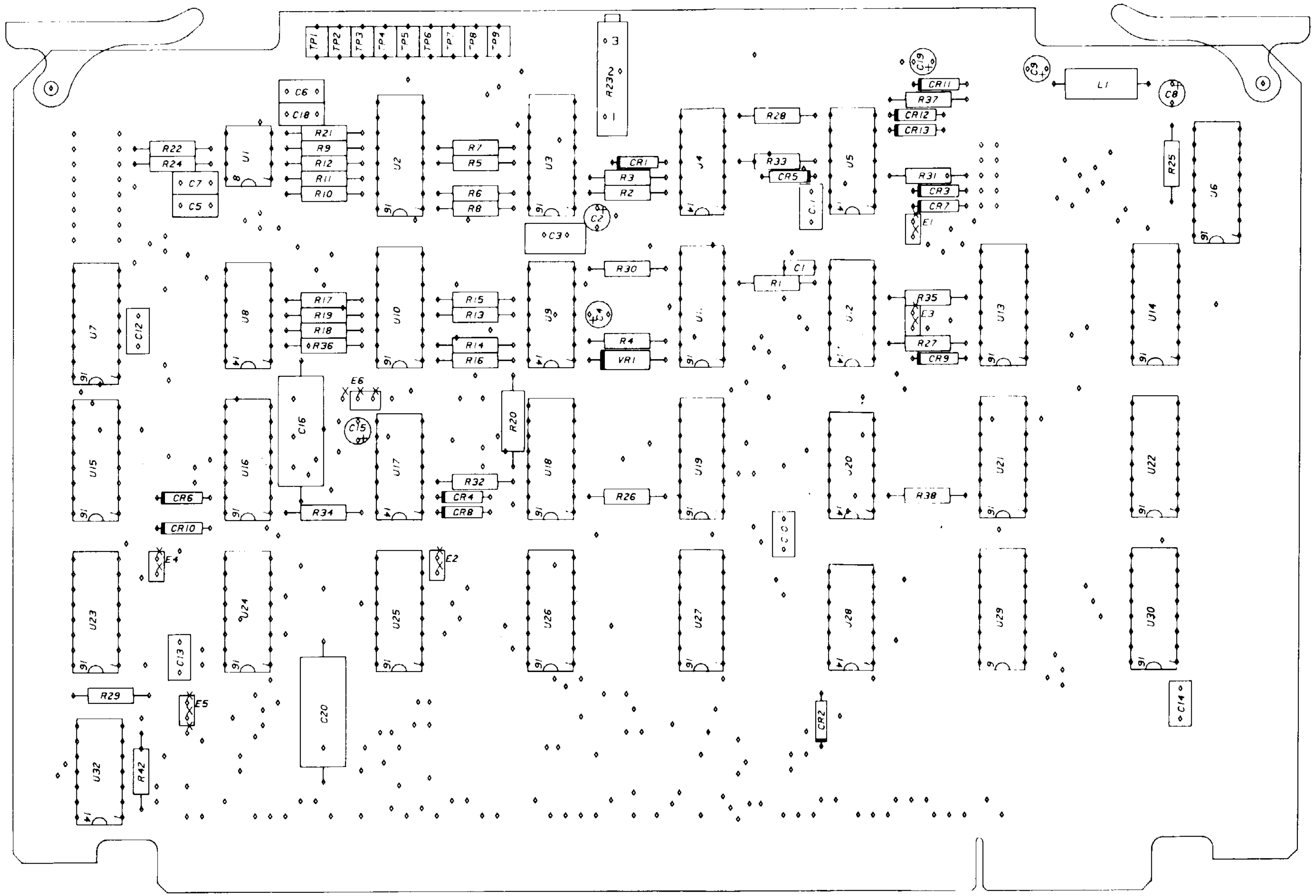
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04099	CAPCO INC FORESIGHT INDUSTRIAL PARK P O BOX 2164 GRAND JUNCTION CO 81501
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
22526	BERG ELECTRONICS INC YOUK EXPRESSWAY NEW CUMBERLAND PA 17070
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
96906	MILITARY STANDARD

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Parallel Output	642-3137-001	REV F



TPA-2686-019

CAUTION ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

Parallel Output, Schematic Diagram
Figure 3 (Sheet 1 of 6)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	PARALLEL OUTPUT (ESDS)	642-3137-001			
CR1-CR13	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C2	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C3	CAPACITOR,FXD MICA DIEL, 100FF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C4	CAPACITOR,FXD TNTLM ELCTLT, 15UF, 20%, 15V	184-9102-130		56289	199D156X0015CB1
C5-C7	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C8	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C9	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1
C10-C14	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C15	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C16	CAPACITOR,FXD PLSTC DIEL, 1UF, 10%, 50V	933-1081-200		04099	CRC1-200
C17	NOT USED				
C18	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C19	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C20	CAPACITOR,FXD PLSTC DIEL, 1UF, 10%, 50V	933-1081-200		04099	CRC1-200
E1-E6	CONNECTOR,JMPR SYS	372-0046-010		22526	65474-001
L1	COIL,RF 1000UH	240-2540-000		96906	MS90539-15
R1	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R2,R3	RESISTOR,FXD CMPSN, 1.8MEGO, 10%, 1/4W	745-0866-000		81349	RCR07G185KS
R4	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R5	RESISTOR,FXD FILM, 10.2K, 1%, 1/8W	705-3605-480		81349	RN55D1022F
R6	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R7	RESISTOR,FXD FILM, 11.8K, 1%, 1/8W	705-3605-510		81349	RN55D1182F
R8	RESISTOR,FXD FILM, 13K, 1%, 1/8W	705-3605-530		81349	RN55D1302F
R9	RESISTOR,FXD FILM, 14K, 1%, 1/8W	705-1051-000		81349	RN55D1402F
R10	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W	705-1053-000		81349	RN55D1542F
R11	RESISTOR,FXD FILM, 17.4K, 1%, 1/8W	705-3605-590		81349	RN55D1742F
R12	RESISTOR,FXD FILM, 19.6K, 1%, 1/8W	705-1058-000		81349	RN55D1962F
R13	RESISTOR,FXD FILM, 22.1K, 1%, 1/8W	705-3605-640		81349	RN55D2212F
R14	RESISTOR,FXD FILM, 26.1K, 1%, 1/8W	705-1064-000		81349	RN55D2612F
R15	RESISTOR,FXD FILM, 30.9K, 1%, 1/8W	705-3605-710		81349	RN55D3092F
R16	RESISTOR,FXD FILM, 38.3K, 1%, 1/8W	705-1072-000		81349	RN55D3832F
R17	RESISTOR,FXD FILM, 51.1K, 1%, 1/8W	705-1078-000		81349	RN55D5112F
R18	RESISTOR,FXD FILM, 76.8K, 1%, 1/8W	705-3605-900		81349	RN55D7682F
R19	RESISTOR,FXD FILM, 154K, 1%, 1/8W	705-1101-000		81349	RN55D1543F
R20	RESISTOR,FXD FILM, 309K, 1%, 1/4W	705-3601-230		81349	RN60D3093F
R21,R22	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R23	RESISTOR,VAR 10K, 10%, 3/4W	382-0012-290		80294	3006P1-103
R24	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R25,R26	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R27	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R28-R35	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R36	RESISTOR,FXD CMPSN, 0.68MEGO, 10%, 1/4W	745-0851-000		81349	RCR07G684KS
R37,R38	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R39-R41	NOT USED				
R42	RESISTOR,FXD CMPSN, 2.7MEGO, 10%, 1/4W	745-0872-000		81349	RCR07G275KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-011
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-011
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-011
TP9	JACK,TIP WHT	360-0484-010		74970	105-1101-011
U1	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC
U2	INTEGRATED CKT (ESDS)	351-8227-010		07263	F4051PC
U3	INTEGRATED CIRCUIT (ESDS)	351-8479-010		04713	MC14538BCP
U4	INTEGRATED CIRCUIT (ESDS)	351-8159-040		04713	MC14011UBCP
U5	INTEGRATED CIRCUIT (ESDS)	351-8159-110		07263	4013BPC
U6	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
U7	INTEGRATED CKT (ESDS)	351-8227-010		07263	F4051PC
U8	MICROCIRCUIT (ESDS)	351-8200-020		02735	CD4047BE
U9	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-010		02735	CD4071BE
U10	INTEGRATED CKT (ESDS)	351-8227-010		07263	F4051PC
U11	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U12	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U13-U16	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
U17	INTEGRATED CIRCUIT (ESDS)	351-8159-110		07263	4013BPC
U18,U19	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
U20	INTEGRATED CIRCUIT (ESDS)	351-8159-110		07263	4013BPC
U21-U27	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
U28	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-030		02735	CD4081BE
U29,U30	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
U31	NOT USED				
U32	MICROCIRCUIT (ESDS)	351-8200-020		02735	CD4047BE
VR1	SEMICOND DEVICE	353-2710-000		07263	1N751A

Parallel Output, Schematic Diagram
Figure 3 (Sheet 2)

NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ TYPE DESIGNATION SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

④ UNLESS OTHERWISE SPECIFIED; DIODES ARE TYPE IN4454.

⑤ P2 IS A CABLE CONNECTOR FIELD. THIS CABLE CONNECTOR (372-0043-010) IS NOT IN 642-3137-001 CONFIGURATION.

⑥ THE FOLLOWING PARTS PROVIDE FOR REMOTE CONTROL OF LOCAL/REMOTE IN A RADIO AND ARE NOT IN 642-3137-001 CONFIGURATION: R39. R40. R41, Q1, Q2, AND U31.

⑦ SIGNAL NAMES ARE NOT SHOWN FOR P1 AND P2 PINS THAT ARE ASSOCIATED WITH CONTROL/STATUS BITS. THESE PINS HAVE DIFFERENT SIGNAL NAMES DEPENDING ON THE EQUIPMENT THIS CARD IS USED IN. REFER TO TABLE FOR PIN FUNCTIONS (SIGNAL NAMES). ALL PIN NUMBERS IN TABLE ARE ON P1, EXCEPT WORD 3, CHARACTER 4 WHICH ARE ON P2.

⑧ NONSTANDARD ABBREVIATION; FLT = FAULT

⑨ PIN NUMBERS IN PARENTHESIS IN TABLE ARE STATUS OUTPUTS IN CONTROL UNITS ONLY.

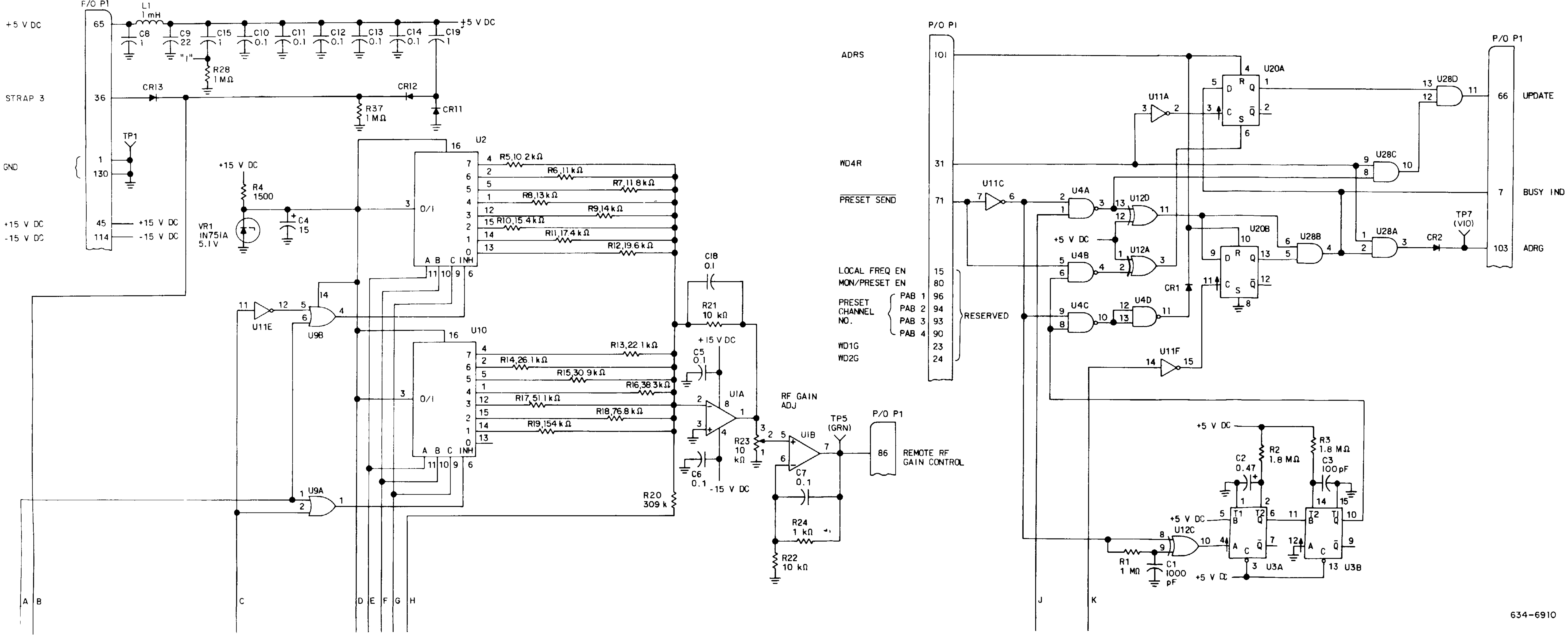
⑩ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE OR COLLINS PN	PWR (V DC)	
		+5	GND
U1	MC1458P1		
U2	F4051PC	16	8,7
U3	MC14538BCP	16	8
U4	MC14011CP	14	7
U5	F4013BPC	14	7
U6	CD4094BE	16	8
U7	F4051PC	16	8,7
U8	CD4047AE	14	7
U9	MC14071BCP		7
U10	F4051PC	16	8,7
U11	F4049BPC	1	8
U12	MC14070BCP	14	7
U13	CD4094BE	16	8
U14	CD4094BE	16	8
U15	CD4094BE	16	8
U16	CD4094BE	16	8

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE OR COLLINS PN	PWR (V DC)	
		+5	GND
U17	F4013BPC	14	7
U18	CD4094BE	16	8
U19	CD4094BE	16	8
U20	F4013BPC	14	7
U21	CD4094BE	16	8
U22	CD4094BE	16	8
U23	CD4094BE	16	8
U24	CD4094BE	16	8
U25	CD4094BE	16	8
U26	CD4094BE	16	8
U27	CD4094BE	16	8
U28	MC14081BCP	14	7
U29	CD4094BE	16	8
U30	CD4094BE	16	8
U31	CD4094BE	16	8
U32	CD4047AE	14	7



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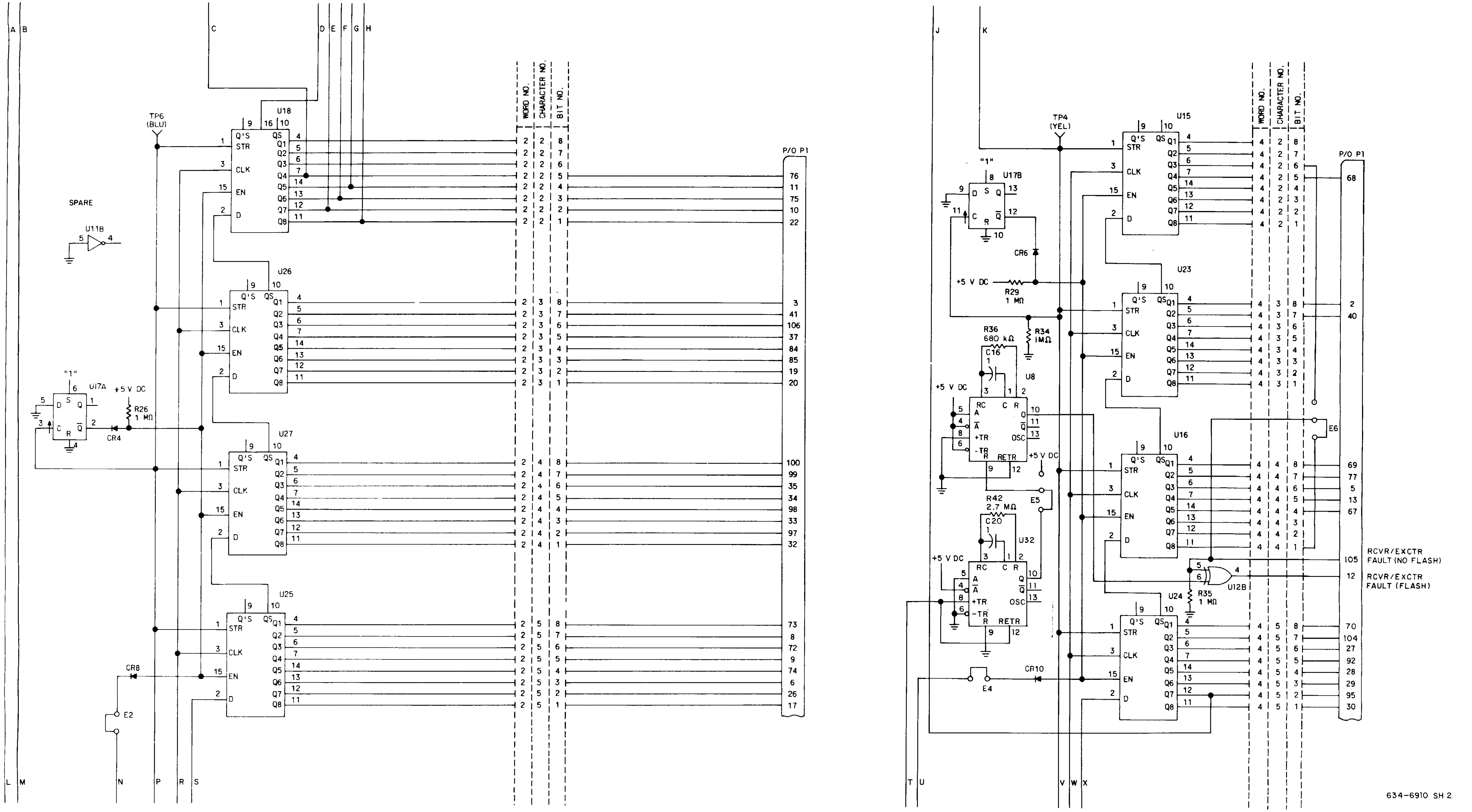
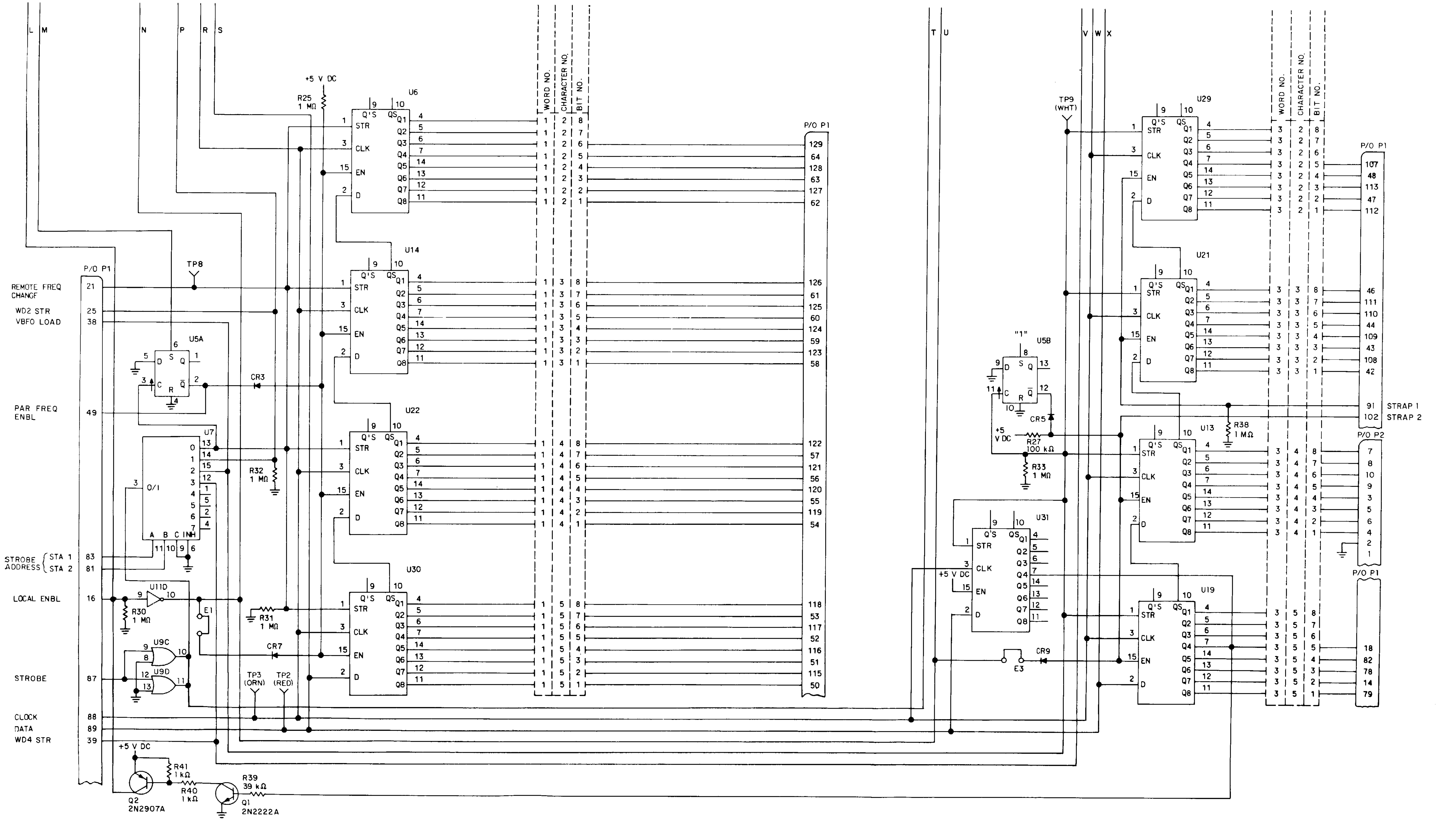
Parallel Output, Schematic Diagram
Figure 3 (Sheet 3)



Parallel Output, Schematic Diagram
Figure 3 (Sheet 4)



Parallel Output, Schematic Diagram
Figure 3 (Sheet 5)

PIN FUNCTION (SIGNAL NAME) TABLE

CONTROL / STATUS BIT — WORD FORMAT | EQUIPMENT TYPE

HF-80 8-BIT			ASCII 7-BIT			HF-80XX 2-CHANNEL RADIOS AND HF-80XX 2-CHANNEL CONTROLS			851S-1/2, HF-8095			4-CHANNEL EXCITER, AND 4-CHANNEL EXCITER CONTROL			4-CHANNEL RECEIVER, AND 4-CHANNEL RECEIVER CONTROL		
WORD NO.	CHARACTER NO.	BIT NO.	WORD NO.	CHARACTER NO.	BIT WT.	PARALLEL OUTPUT PIN NO.	PARALLEL INPUT PIN NO.	FUNCTION	PARALLEL OUTPUT PIN NO.	PARALLEL INPUT PIN NO.	FUNCTION	PARALLEL OUTPUT PIN NO.	PARALLEL INPUT PIN NO.	FUNCTION	PARALLEL OUTPUT PIN NO.	PARALLEL INPUT PIN NO.	FUNCTION
1	2	8	1	6	8		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)			NOT USED			NOT USED
1	2	7	1	6	4		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)			NOT USED			NOT USED
1	2	6	1	6	2	129	129	FREQ 10 MHz (2)	129	129	FREQ 10 MHz (2)	129	129	FREQ 10 MHz (2)	129	129	FREQ 10 MHz (2)
1	2	5	1	6	1	64	64	FREQ 10 MHz (1)	64	64	FREQ 10 MHz (1)	64	64	FREQ 10 MHz (1)	64	64	FREQ 10 MHz (1)
1	2	4	1	7	8	128	128	FREQ 1 MHz (8)	128	128	FREQ 1 MHz (8)	128	128	FREQ 1 MHz (8)	128	128	FREQ 1 MHz (8)
1	2	3	1	7	4	63	63	(4)	63	63	(4)	63	63	(4)	63	63	(4)
1	2	2	1	7	2	127	127	(2)	127	127	(2)	127	127	(2)	127	127	(2)
1	2	1	1	7	1	62	62	(1)	62	62	(1)	62	62	(1)	62	62	(1)
1	3	8	1	8	8	126	126	FREQ 100 kHz (8)	126	126	FREQ 100 kHz (8)	126	126	FREQ 100 kHz (8)	126	126	FREQ 100 kHz (8)
1	3	7	1	8	4	61	61	(4)	61	61	(4)	61	61	(4)	61	61	(4)
1	3	6	1	8	2	125	125	(2)	125	125	(2)	125	125	(2)	125	125	(2)
1	3	5	1	8	1	60	60	(1)	60	60	(1)	60	60	(1)	60	60	(1)
1	3	4	1	9	8	124	124	FREQ 10 kHz (8)	124	124	FREQ 10 kHz (8)	124	124	FREQ 10 kHz (8)	124	124	FREQ 10 kHz (8)
1	3	3	1	9	4	59	59	(4)	59	59	(4)	59	59	(4)	59	59	(4)
1	3	2	1	9	2	123	123	(2)	123	123	(2)	123	123	(2)	123	123	(2)
1	3	1	1	9	1	58	58	(1)	58	58	(1)	58	58	(1)	58	58	(1)
1	4	8	1	10	8	122	122	FREQ 1 kHz (8)	122	122	FREQ 1 kHz (8)	122	122	FREQ 1 kHz (8)	122	122	FREQ 1 kHz (8)
1	4	7	1	10	4	57	57	(4)	57	57	(4)	57	57	(4)	57	57	(4)
1	4	6	1	10	2	121	121	(2)	121	121	(2)	121	121	(2)	121	121	(2)
1	4	5	1	10	1	56	56	(1)	56	56	(1)	56	56	(1)	56	56	(1)
1	4	4	1	11	8	120	120	FREQ 100 Hz (8)	120	120	FREQ 100 Hz (8)	120	120	FREQ 100 Hz (8)	120	120	FREQ 100 Hz (8)
1	4	3	1	11	4	55	55	(4)	55	55	(4)	55	55	(4)	55	55	(4)
1	4	2	1	11	2	119	119	(2)	119	119	(2)	119	119	(2)	119	119	(2)
1	4	1	1	11	1	54	54	(1)	54	54	(1)	54	54	(1)	54	54	(1)
1	5	8	1	12	8	118	118	FREQ 10 Hz (8)	118	118	FREQ 10 Hz (8)	118	118	FREQ 10 Hz (8)	118	118	FREQ 10 Hz (8)
1	5	7	1	12	4	53	53	(4)	53	53	(4)	53	53	(4)	53	53	(4)
1	5	6	1	12	2	117	117	(2)	117	117	(2)	117	117	(2)	117	117	(2)
1	5	5	1	12	1	52	52	(1)	52	52	(1)	52	52	(1)	52	52	(1)
1	5	4	1	13	8	116	116	FREQ 1 Hz (8)	116	116	FREQ 1 Hz (8)	116	116	FREQ 1 Hz (8)	116	116	FREQ 1 Hz (8)
1	5	3	1	13	4	51	51	(4)	51	51	(4)	51	51	(4)	51	51	(4)
1	5	2	1	13	2	115	115	(2)	115	115	(2)	115	115	(2)	115	115	(2)
1	5	1	1	13	1	50	50	(1)	50	50	(1)	50	50	(1)	50	50	(1)
2	2	8	2	6	8		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)			NOT USED			NOT USED
2	2	7	2	6	4		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)						NOT USED
2	2	6	2	6	2			NOT USED			NOT USED						NOT USED
2	2	5	2	6	1	76	76	RF GAIN (16)	76	76	RF GAIN (16)	76	76		76	76	RF GAIN (16)
2	2	4	2	7	8	11	11	(8)	11	11	(8)	11	11		11	11	(8)
2	2	3	2	7	4	75	75	(4)	75	75	(4)	75	75		75	75	(4)
2	2	2	2	7	2	10	10	(2)	10	10	(2)	10	10		10	10	(2)
2	2	1	2	7	1	22	87	(1)	22	87	(1)	22	87		22	87	(1)
2	3	8	2	8	8	3		NOT USED	3		NOT USED	3	12	NOT USED	3	12	FL7 (E) ENBL
2	3	7	2	8	4	41	41	VBFO ENBL	41	41	VBFO ENBL	41	41		41	41	FL6 (D) ENBL
2	3	6	2	8	2	106	106	AFC ENBL	106	106	RESERVED	106	106		106	106	FL5 (C) ENBL
2	3	5	2	8	1	37	37	AGC CROWBAR ENBL	37	37	AGC CROWBAR ENBL	37	37		37	37	FL4 (B) ENBL
2	3	4	2	9	8	84	84	USB AGC OFF	84	84	USB AGC OFF	84	84		84	84	B2 AGC (2)
2	3	3	2	9	4	85	85	USB AGC FAST	85	85	USB AGC FAST	85	85		85	85	B2 AGC (1)
2	3	2	2	9	2	19	19	LSB AGC OFF	19	19	LSB AGC OFF	19	19		19	19	A2 AGC (2)
2	3	1	2	9	1	20	20	LSB AGC FAST	20	20	LSB AGC FAST	20	20		20	20	A2 AGC (1)
2	4	8	2	10	8	100	100	FL8 ENBL	100	100	FL8 ENBL	100	100	NOT USED	100	100	FL3 (A) ENBL
2	4	7	2	10	4	99	99	FL7 ENBL	99	99	FL7 ENBL	99	99		99	99	FL1 (16 kHz) ENBL
2	4	6	2	10	2	35	35	FL6 ENBL	35	35	FL6 ENBL	35	35		35	35	VBFO ENBL
2	4	5	2	10	1	34	34	FL5 ENBL	34	34	FL5 ENBL	34	34		34	34	AFC ENBL
2	4	4	2	11	8	98	98	FL4 ENBL	98	98	FL4 ENBL	98	98		98	98	B1 AGC (2)
2	4	3	2	11	4	33	33	FL3 ENBL	33	33	FL3 ENBL	33	33		33	33	B1 AGC (1)
2	4	2	2	11	2	97	97	FL2 ENBL	97	97	FL2 ENBL	97	97		97	97	A1 AGC (2)
2	4	1	2	11	1	32	32	FL1 ENBL	32	32	FL1 ENBL	32	32	PEAK CLIPPER ENBL	32	32	A1 AGC (1)
2	5	8	2	12	8	73	73	FM ENBL	73	73	FM ENBL	73	73	NOT USED	73	73	DATA NET ENBL
2	5	7	2	12	4	8	8	AM ENBL	8	8	AM ENBL	8	8	AM ENBL	8	8	AM ENBL
2	5	6	2	12	2	72	72	SSB ENBL	72	72	SSB ENBL	72	72	CW ENBL	72	72	CW ENBL
2	5	5	2	12	1	9	9	CW ENBL	9	9	CW ENBL	9	9	ISB ENBL	9	9	ISB ENBL
2	5	4	2	13	8	74	74	ISB ENBL	74	74	ISB ENBL	74	74	B2 ENBL	74	74	B2 ENBL
2	5	3	2	13	4	6	92	RESERVED	6	92	RESERVED	6	92	B1 ENBL	6	92	B1 ENBL
2	5	2	2	13	2	26	91	RESERVED	26	91	RESERVED	26	91	A1 ENBL	26	91	A1 ENBL
2	5	1	2	13	1	17	21	RESERVED	17	21	RESERVED	17	21	A2 ENBL	17	21	A2 ENBL
3	2	8	3	6	8		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)			NOT USED			NOT USED
3	2	7	3	6	4		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)						NOT USED
3	2	6	3	6	2			NOT USED			NOT USED						NOT USED
3	2	5	3	6	1	107	107	VBFO SIGN	107	107	VBFO SIGN	107	107		107	107	VBFO SIGN
3	2	4	3	7	8	48	48	VBFO FREQ 1 kHz (8)	48	48	VBFO FREQ 1 kHz (8)	48	48		48	48	VBFO FREQ 1 kHz (8)
3	2	3	3	7	4	113	113	(4)	113	113	(4)	113	113		113	113	(4)
3	2	2	3	7	2	47	47	(2)	47	47	(2)	47	47		47	47	(2)
3	2	1	3	7	1	112	112	(1)	112	112	(1)	112	112		112	112	(1)
3	3	8	3	8	8	46	46	VBFO FREQ 100 Hz (8)	46	46	VBFO FREQ 100 Hz (8)			NOT USED	46	46	VBFO FREQ 100 Hz (8)
3	3	7	3	8	4	111	111	(4)	111	111	(4)				111	111	(4)
3	3	6	3	8	2	110	110	(2)	110	110	(2)				110	110	(2)
3	3	5	3	8	1	44	44	(1)	44	44	(1)				44	44	(1)
3	3	4	3	9	8	109	109	VBFO FREQ 10 Hz (8)	109	109	VBFO FREQ 10 Hz (8)				109	109	VBFO FREQ 10 Hz (8)
3	3	3	3	9	4	43	43	(4)	43	43	(4)				43	43	(4)
3	3	2	3	9	2	108	108	(2)	108	108	(2)				108	108	(2)
3	3	1	3	9	1	42	42	(1)	42	42	(1)				42	42	(1)
3	4	8	3	10	8	7	7	NOT USED	7	7	NOT USED	7	7	NOT USED	7	7	NOT USED
3	4	7	3	10	4	8	8		8	8		8	8		8	8	
3	4	6	3	10	2	10	10		10	10		10	10		10	10	
3	4	5	3	10	1	9	9		9	9		9	9		9	9	
3	4	4	3	11	8	3	3		3	3		3	3		3	3	
3	4	3	3	11	4	5	5		5	5		5	5		5	5	
3	4	2	3	11	2	6	6		6	6		6	6		6	6	
3	4	1	3	11	1	4	4		4	4		4	4		4	4	
3	5	8	3	12	8			NOT USED			NOT USED			NOT USED			NOT USED
3	5	7	3	12	4												
3	5	6	3	12	2												
3	5	5	3	12	1	18	81		18	81		18	81		18	81	
3	5	4	3	13	8	82	82	PILOT CARRIER ENBL	82	82	VBFO TUNE	82	82	PILOT CARRIER ENBL	82	82	B2 AGC BUS
3	5	3	3	13	4	78	78	PA L PWR ENBL	78	78	VBFO PARALLEL ENBL	78	78	PA LO PWR ENBL	78	78	B1 AGC BUS
3	5	2	3	13	2	14	14	PA HV ENBL	14	14	FINE TUNE	14	14	PA HV ENBL	14	14	A1 AGC BUS
3	5	1	3	13	1	79	79	PA LV ENBL	79	79	RESERVED	79	79	PA LV ENBL	79	79	A2 AGC BUS
4	2	8	4	6	8		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)		103	$\overline{\text{COMMAND}}$ ($\overline{\text{C}}$)			NOT USED			NOT USED
4	2	7	4	6	4		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)		38	$\overline{\text{STATUS}}$ $\overline{\text{REQUEST}}$ ($\overline{\text{S}}$)			NOT USED			NOT USED
4	2	6	4	6	2			NOT USED	27	105	UP/$\overline{\text{DOWN}}$	(12)	13	EXCTR FLT	(12)	13	RCVR FLT
4	2	5	4	6	1	92 (68)	68	REMOTE KEY (MON)	92	68	TUNE RATE (16)	92 (68)	68	REMOTE KEY (MON)	92 (68)	68	RF OVLD FLT
4	2	4	4	7	8			NOT USED	28	4	(8)		88	B2 AF MON		88	B2 AF MON
4	2	3	4	7	4				29	39	(4)		23	B1 AF MON		23	B1 AF MON
4	2	2	4	7	2				95	5	(2)		22	A1 AF MON		22	A1 AF MON
4	2	1	4	7	1				30	70	(1)		24	A2 AF MON		24	A2 AF MON
4	3	8	4	8	8	(2)	2	AFC LOCK	(2)	2	NOT USED	(2)	2	NOT USED	(2)	2	NOT USED
4	3	7	4	8	4	(40)	40	EXCTR RF MON	(40)	40	NOT USED	(40)	40	10 Hz LOCK IND	(40)	40	10 Hz LOCK IND
4	3	6	4	8	2		105	CHAN A XMT AF MON		105	NOT USED		105	100 Hz LOCK IND		105	100 Hz LOCK IND
4	3	5	4	8	1		36	CHAN A RCV AF MON		36	CHAN A AF MON		36	1 kHz LOCK IND		36	1 kHz LOCK IND
4	3	4	4	9	8		83	CHAN A AGC MON		83	CHAN A AGC MON		83	10 kHz LOCK IND		83	10 kHz LOCK IND
4	3	3	4	9	4		39	CHAN B XMT MON		39	NOT USED		39	100 kHz LOCK IND		39	100 kHz LOCK IND
4	3	2	4	9	2		101	CHAN B RCV MON		101	CHAN B AF MON		101	SYNTH OUT LOCK IND		101	SYNTH OUT LOCK IND
4	3	1	4	9	1		18	CHAN B AGC MON		18	CHAN B AGC MON		18	FREQ REF FLT		18	FREQ REF FLT
4	4	8	4	10	8	(69)	69	PA RDY	(69)	69	NOT USED	(69)	69	NOT USED	(69)	69	NOT USED
4	4	7	4	10	4	(77)	4	PA FLT	(77)	4		(77)	4	SUBCARRIER LOCK FLT	(77)	4	SUBCARRIER LOCK FLT
4	4	6	4	10	2	(5)	5	PA RF MON	(5)	5		(5)	5	EXCTR RF MON	(5)	5	VBFO SYNTH FLT
4	4	5	4	10	1	(13)	70	CPLR FLT	(13)	70		(13)	70	EXCTR PS FLT	(13)	70	RCVR PS FLT
4	4	4	4	11	8	(67)	67	RF OVLD FLT	(67)	67	RF OVLD FLT	(67)	67	NOT USED	(67)	67	B2 AGC MON
4	4	3	4	11	4		49	SYNTH FLT		49	SYNTH		49	EXT STANDARD		49	B1 AGC MON
4	4	2	4	11	2		86	PS FLT		86	PS FLT		86	A1 IF MON		86	A1 AGC MON
4	4	1	4	11	1	(12)	3	RCVR/EXCTR FLT	(12)	3	RCVR FLT	(105)	3	NOT USED	(105)	3	A2 AGC MON
4	5	8	4	12	8	(70)		NOT USED	(70)		NOT USED	(70)	77	PA READY	(70)	77	NOT USED
4	5	7	4	12	4	(104)		NOT USED	(104)		NOT USED	(104)	102	PA FLT	(104)	102	EXT STANDARD
4	5	6	4	12	2	(27)	7	VBFO SYNTH FLT	(27)	7	VBFO SYNTH FLT	(27)	7	PA RF MON	(27)	7	AFC LOCK MON
4	5	5	4	12	1	(92)		NOT USED	(92)		NOT USED	(92)	89	CPLR FLT	(92)	89	RF XLTR MON
4	5	4	4	13	8	(28)	71	PRESEL FLT	(28)	71	PRESEL FLT	(28)	71	PRESEL FLT	(28)	71	PRESEL FLT
4	5	3	4	13	4	(29)	95	DATA ERROR	(29)	95	DATA ERROR	(29)	95	DATA ERROR	(29)	95	DATA ERROR
4	5	2	4	13	2	(95)	16	LOCAL CONTROL	(95)	16	LOCAL CONTROL	(95)	16	LOCAL CONTROL	(95)	16	LOCAL CONTROL
4	5	1	4	13	1	(30	80	MONITOR	(30)	80	MONITOR	(30)	80	MONITOR	(30)	80	MONITOR

634-6910

Parallel Output, Schematic Diagram
Figure 3 (Sheet 6)

Serial Interface
(638-6896-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

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1 January 1981

1. DESCRIPTION

Serial Interface 638-6896-001, shown in figure 1, is a 2-layer planar card with a 56-pin edge-on connector (2 layers, 28 pins each).

The serial interface card consists of the following primary circuits; an FSK/RS-232 select switch, an FSK receiver, an RS-232 receiver, an asynchronous communications interface adapter (ACIA), a microprocessor circuit, a parallel-to-serial output shift register, a strobe decoder, a word subaddress latch, a bit/band rate and clock generator, data input buffers, an FSK keyer, FSK transmit enable gate, and an RS-232 driver.

2. PRINCIPLES OF OPERATION

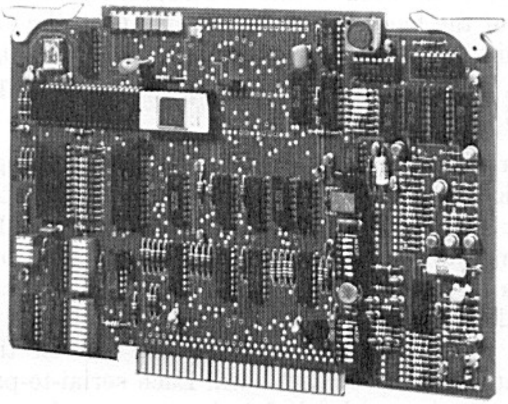
2.1 General (Refer to figure 2.)

As a serial data receiver, the serial interface card receives FSK, RS-232C, of MIL-STD-188C serial data control signals and checks for address, command status, and data errors. It then provides error, clock, word subaddress, strobe, and serial data outputs for decoding by a parallel output card.

As a serial data transmitter, the serial interface card receives parallel data inputs and a transmit word initiate and provides FSK, RS-232C, or MIL-STD-188C serial data monitor signals. The serial data monitor signals are supplied to the associated unit/control.

2.2 Serial Data Inputs and Outputs

When strapped accordingly, the serial interface card receives and transmits data according to one of the following types of control techniques.



Serial Interface
Figure 1

a. FSK (mark = 1280 Hz, space = 2133 Hz) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, or 600 bauds.

b. EIA RS-232C (mark = -6 ±1 V dc, space = +6 ±1 V dc) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bauds.

c. MIL-STD-188C (mark = +6 ±1 V dc, space = -6 ±1 V dc) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bauds.

The control word inputs may be in either HF-80 8-bit format or ASCII 7-bit format. When applied to the asynchronous communications interface adapter, the control word is reformatted so that each control word is composed of five 11-bit characters. The last two or three bits of each character group are stop and parity bits. The first bit is a start bit. In the 8-bit format, the first character of each control word is reserved for equipment address, word identification (subaddress), and word sync information. Bits seven and eight of the second character in each word are reserved for command and status request control bits. The remaining characters of each word carry frequency, control, and monitor information. In the 7-bit format, separate characters are used for equipment address, subaddress, word sync, and command and status request control bits.

Refer to figure 3. Control (and monitor) word timing is accomplished by a crystal-controlled oscillator on the microprocessor chip. A divider reduces the frequency to the desired values. Strapping permits selection of the baud rate for clock inputs to the various circuits. Selection is from 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, and 19,200 bauds. (Clock frequency is 16 times baud rate).

Refer to figure 2. Monitor data (serial data input) is applied to the microprocessor on the serial interface card. Word and status information is decoded from the monitor data and is used to determine strobe address information. The monitor data is then applied serially through a shift register to the data input of four word serial-to-parallel converters on the associated parallel output card. Each serial-to-parallel converter is enabled before it accepts and processes the monitor data. This occurs when the strobe address input is decoded and an enable signal is generated by the word enable circuit.

Refer to figure 2. Control information (serial data output) is stored in the multiplexers on the associated parallel input card. Mux control is supplied by the microprocessor through the multiplexer output latch on the serial interface card. The mux address information enables the applicable multiplexer on the parallel input card, which transfers the stored parallel information to the serial interface card. The serial interface card then formats the information into 8-bit or 7-bit format and outputs it serially, using the ACIA, through the FSK keyer or RS-232C driver circuit to the control data output.

2.3 Monitor Data (Refer to figure 2.)

Monitor data (serial data input) is received by the FSK/RS-232C select and applied to the appropriate receiver. In FSK, the FSK receiver applies the received FSK signal to the FSK demodulator where a 1280-Hz signal is converted to a logic 1 output and a 2133-Hz signal is converted to a logic 0 output.

In RS-232C or MIL-STD-188C operation, the RS-232C receiver converts a +6-V dc input to a logic 0 (ground) output and converts a -6-V dc input to a logic 1 (+4.7-V dc) output.

The asynchronous communications interface adapter (ACIA) receives the monitor data input and converts it to HF-80 8-bit format and applies it to the microprocessor. If the monitor data is command data (command bit = 0), the microprocessor converts the data word to parallel receive data outputs and clocks the data through the parallel to serial converter to the appropriate storage registers on the parallel output card. The serial interface card then supplies the word subaddress and strobe so that the data is accepted into the appropriate storage register in the associated parallel output card as determined by the word subaddress.

2.4 Control Data (Refer to figure 2.)

Control data (serial data output) is transmitted by an FSK keyer (for FSK operation) or by a line driver (for RS-232C or MIL-STD-188C operation).

In FSK operation, the FSK keyer converts logic 0 outputs from the asynchronous communications interface adapter (ACIA) to 1280-Hz FSK signals and logic 1 outputs from the ACIA to 2133 Hz.

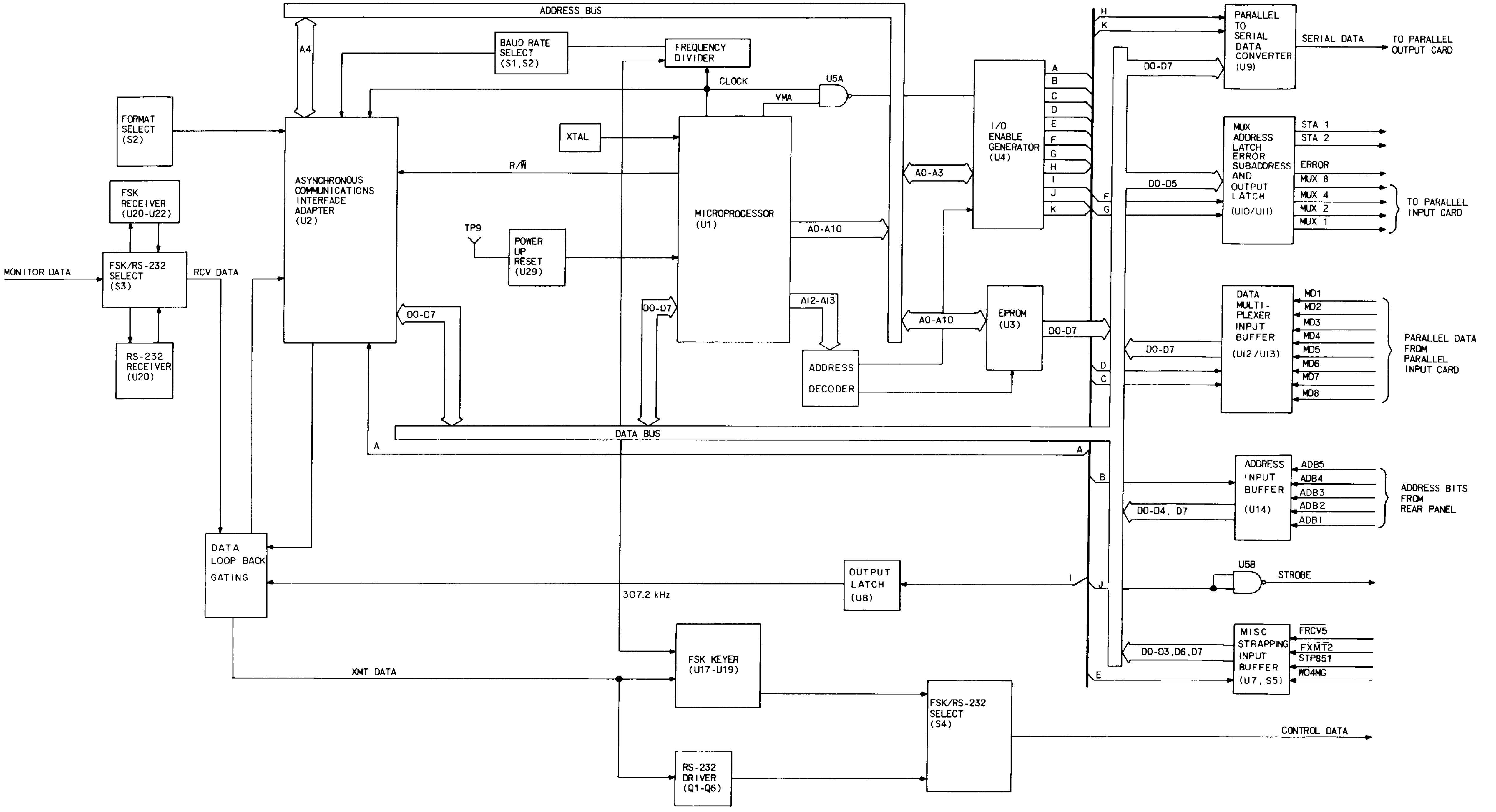
In RS-232 operation, the line driver converts logic 0 inputs to the line driver to +6 V dc and logic 1 inputs to the line driver to -6 V dc.

In MIL-STD-188C operation, the line driver converts logic 0 inputs to the line driver to -6 V dc and logic 1 line inputs to the line driver to +6 V dc.

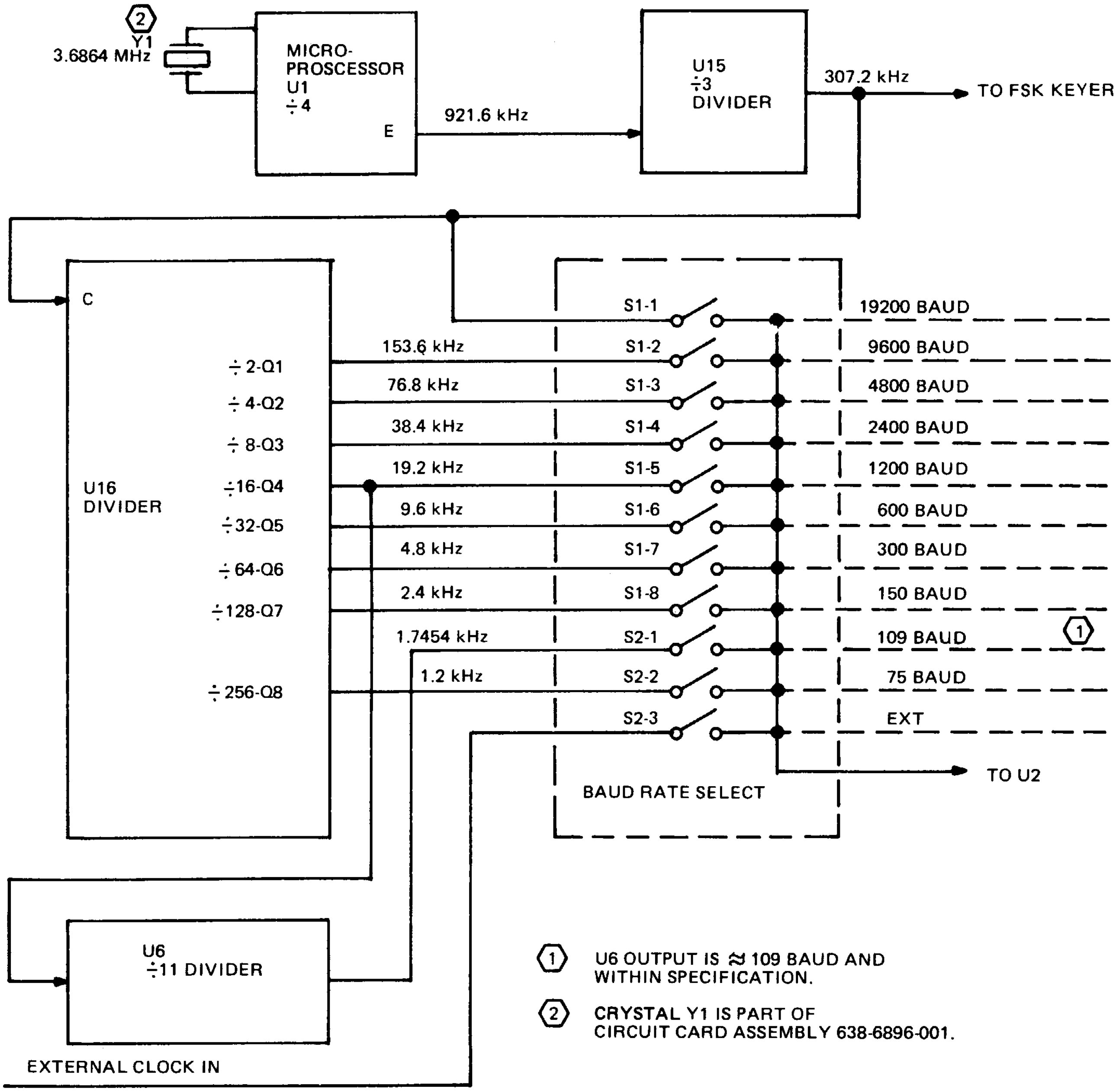
Parallel input data are address selected by the microprocessor and applied to the ACIA. The ACIA supplies the data as serial output (so) data to the line driver or FSK keyer. The serial data is converted to the appropriate signal data and supplied to the associated remote unit/control.

2.5 Purpose of Strapping

Unit strapping is accomplished using five dipswitches located on the UUT, S1 through S5. These control baud rate, FSK/RS-232 signaling, word format, EIA/MIL-STD-188C polarity, parity, number of stop bits, radio or control, and address recognition enable/disable. The card outline in figure 4 shows the location of these dipswitches. Switch 1 of each dipswitch is towards the top of the card.

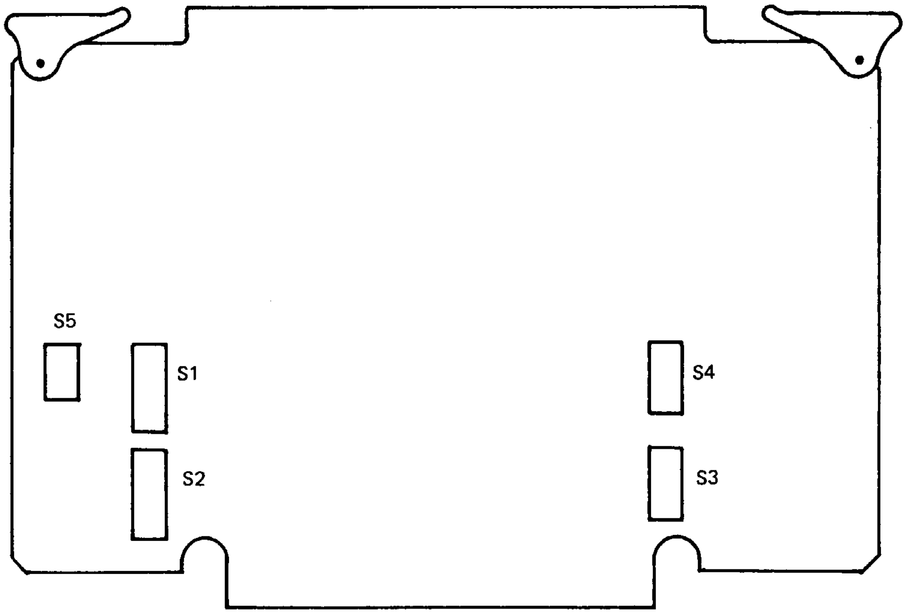


Serial Interface, Block Diagram
Figure 2



TPA-2678-011

Bit and Baud Rate Generator, Block Diagram
Figure 3



TPA-2674-011

Dipswitch Location
Figure 4

Address strapping is accomplished by applying the necessary logic levels to ADB1 through ADB5 (pins 41, 14, 40, 39, and 15 respectively).

2.5.1 FSK Control

Close only switches 1, 2, and 3 of S3 and S4 for FSK. Open switch 4 of S2 for FSK (to provide EIA data polarity).

2.5.2 RS-232C Control

Close only switches 4, 5, and 6 of S3 and S4 for RS-232C.

2.5.3 EIA-MIL-STD-188C Control

Open switch 4 of S2 for EIA data polarity. Close switch 4 of S2 for MIL-STD-188C polarity.

2.5.4 Parity, HF-ASCII Word Format, and Number of Stop Bits

Switches 6, 7, and 8 of S2 control the basic character format according to tabulation below:

*SWITCH			WORD FORMAT	PARITY	NO OF STOP BITS
8	7	6			
C	C	C	ASCII	Even	2
C	C	O	ASCII	Odd	2
C	O	C	ASCII	Even	1
C	O	O	ASCII	Odd	1
O	C	C	HF-80	None	2
O	C	O	HF-80	None	1
O	O	C	HF-80	Even	1
O	O	O	HF-80	Odd	1

*O = Open, C = Closed

2.5.5 *Address Recognition*

Open switch 1 of S5 to enable address recognition. Close switch 1 of S5 to disable address recognition. When address recognition is disabled, the UUT will accept a word with any address if the word is otherwise correct.

2.5.6 *Radio/Control Selection*

Open switch 5 of S2 for radio. Close switch 5 of S2 for control.

All eight of the switches in S1 and switches 1, 2, and 3 of S2 control the baud rate. Closing one and only one of these switches will select the baud rate as given:

BAUD RATE SELECTION

DIPSWITCH	SWITCH	BAUD RATE
S1	1	19,200
S1	2	9,600
S1	3	4,800
S1	4	2,400
S1	5	1,200
S1	6	600
S1	7	300
S1	8	150
S2	1	109
S2	2	75
S2	8	EXTERNAL

2.5.7 *Polling Control*

In addition to the internal strapping options listed above, an additional strapping option permits a control unit to function in a polling mode of operation. This mode of operation is intended for use when an auxiliary system status display is used to display the current status of several or more remote equipments.

In the polling mode of operation, the control unit automatically and sequentially requests status information from all sixteen possible remote addresses. As a status information is received from each addressed remote unit, it is then transmitted by the control unit, on the common system control bus, to a remote status display for update of the display. The remote status display must be connected to the system control bus to receive the updated display information. If no status response is received from a polled unit, no status data is transmitted to the status display by the control unit.

Since the status display device connects to the common system control bus, it is programmed to recognize its own unique address, and the remote control unit is programmed to use this same address (00-000 for ADB5 through ADB1) when communicating with the status display. Therefore, when using the polling capability along with an external system status display and the 8-bit byte character data format, only fifteen of the sixteen address combinations are available for remote unit assignment, since the display unit itself requires one of the addresses. If, however, the 7-bit ASCII character data format is used in the system, all sixteen remote unit addresses are available for use because the address assigned to the status display is not among the sixteen addresses (of the 32 possible in this format) controlled by the thumbwheel address selector switch of the remote control unit.

Open switch 2 of S5 to disable polling. Close switch 2 of S5 to enable polling.

2.6 *Asynchronous Communications Interface Adapter (ACIA) (Refer to figure 5.)*

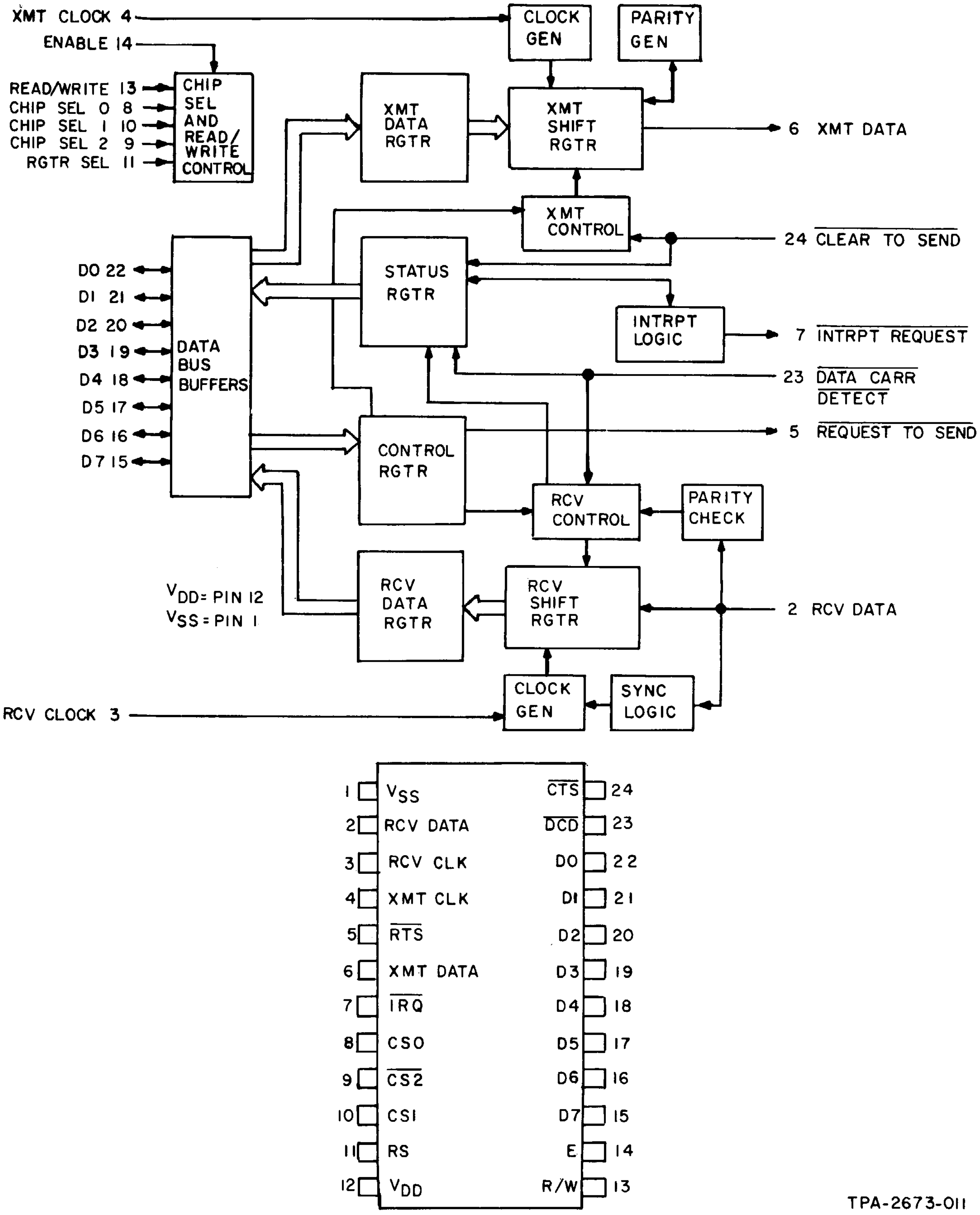
The ACIA is an LSI subsystem which allows the user to use either ASCII or HF-80 8-bit word formatting. When used in conjunction with a microprocessor, the ACIA has the flexibility to handle various baud rates, parity modes, bits per word, and number of stop bits per word. The device is constructed on a single 24-lead dual-in-line package. All inputs and outputs are directly compatible with MTOS/MTNS logic, and also with TTL/DTL/CMOS logic without the need for interfacing components. The strobed outputs (D0 through D7) are interfaced directly with the microprocessor data bus.

2.7 *Processor (Refer to figure 2.)*

Processor circuit controls all operations on the serial interface card through the use of a software program packaged in a 16K (2K x 8) EPROM.

The processor circuit consists of the following components with associated gating circuits:

a. Microprocessing unit (MPU)
b. Electrically programmable read-only memory (EPROM)
c. ACIA
d. Clock generator
e. I/O enable generator



Asynchronous Communications Interface Adapter 351-8455-010
Figure 5

2.7.1 Microprocessor (Refer to figure 6.)

Microprocessing unit (MPU) is the central processing device. Through the software program, the MPU controls the receiving and transmitting of control and monitor information, address generation, strobe generation and timing, display programing, and system polling. The MPU is controlled by the following inputs:

a. Clock - Provides timing/gating signals. The crystal mounted external to the MPU provides a stable reference which is divided by four on the MPU.
b. Reset - Used to reset and start MPU from a power-down condition resulting from a power failure or initial startup.

The MPU generates two control signals that are used to enable peripherals: valid memory address (VMA) and read/write (R/$\overline{W}$). The VMA signal is gated with the clock in U5A and then is applied to I/O enable generator U4. This signal indicates to the peripherals that a valid memory address from the MPU is on the address bus. The R/$\overline{W}$ output signal is used by the ACIA to set its circuits in a read or write operation. The 8-bit data bus (D0 through D7) provides bidirectional bus for transferring data to and from memory and the peripherals. The address bus (A0 through A15), a 16-bit bus, provides 65 kilabytes of addressing for the MPU to retrieve and transmit information.

The reset pulse is generated by U29 whenever the +5 V dc is interrupted and then reapplied.

2.7.2 EPROM (Refer to figure 7.)

The electrically programmable read-only memory (U3) contains the program for the MPU. The program in the EPROM controls the MPU after startup. The MPU communicates with the EPROM through the address bus and the data bus. The EPROM consists of a 16, 384-bit cell matrix, X and Y address decoders, Y gating circuit, output data buffers and program circuits. The EPROM is packaged in a ceramic, 24-lead dual-in-line package and is TTL, CMOS, and DTL logic compatible.

2.7.3 I/O Generator - Decoder/Demultiplexer (Refer to figure 8.)

I/O enable generator U4 is a binary decoder that decodes address bus lines A0, A1, A2, and A3, (refer to table 1) generating enabling signals to enable the

Table 1. I/O Generator Truth Table.

INPUTS						OUTPUTS															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = High level, L = Low level, X = Don't care various input and output decoders and the ACIA. The I/O generator employs low-power Schottky transistor-to-transistor logic (TTL) and is packaged in a dual-in-line configuration.

2.8 *Noninverting, 3-State Buffer (Refer to figure 9.)*

Data multiplexer inputs U12, U13, address select inputs U14, and miscellaneous strapping input are accessed by the processor through noninverting, 3-state buffers. Inputs/outputs 1 through 4 are controlled by disable A while inputs/outputs 5 and 6 are controlled by disable B.

3. TESTING AND TROUBLESHOOTING

3.1 *Test Equipment and Power Requirements*

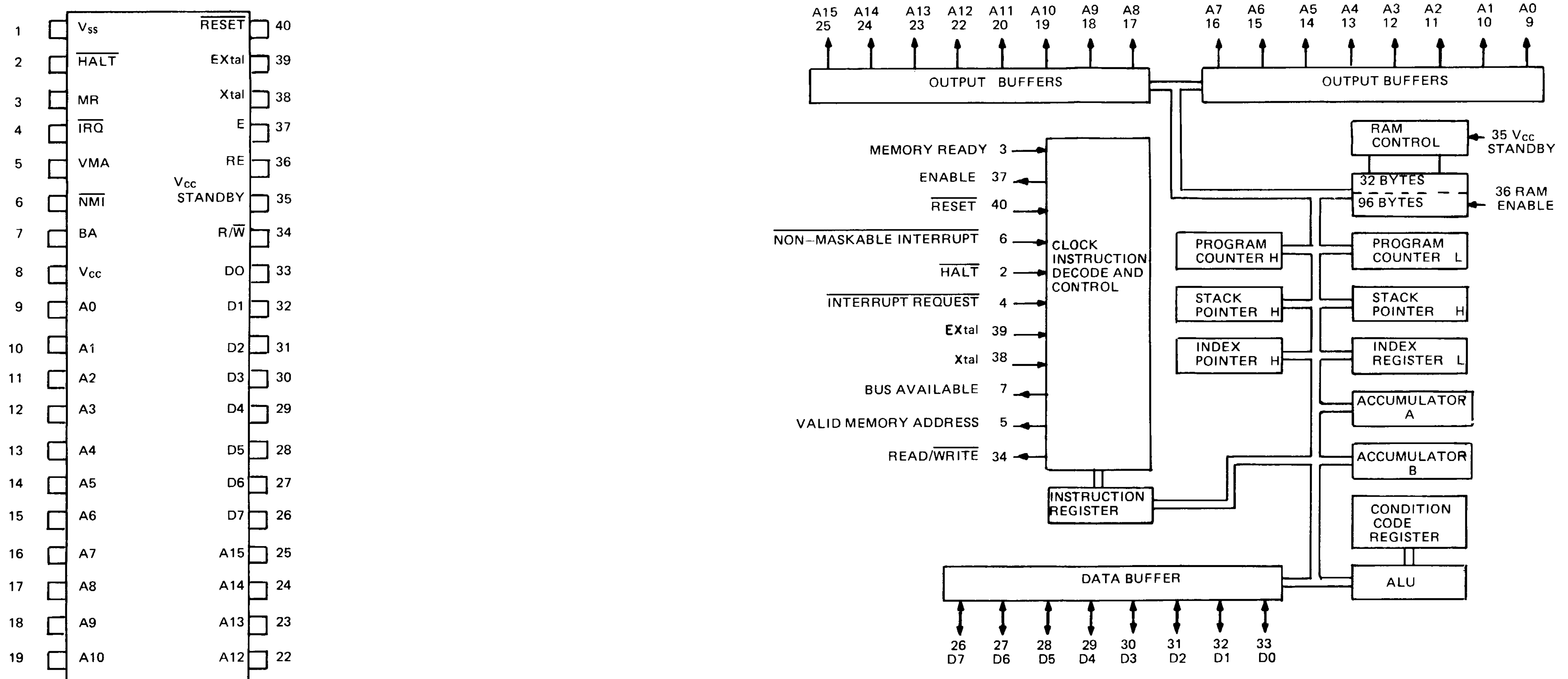
Test equipment and power sources required to test, troubleshoot, and repair the serial interface card are listed in the maintenance section of this instruction book.

3.2 *Testing*

The test procedures in table 2 check total performance of the serial interface card. These test procedures will confirm that a problem exists on the serial interface card and isolate it to a functional area.

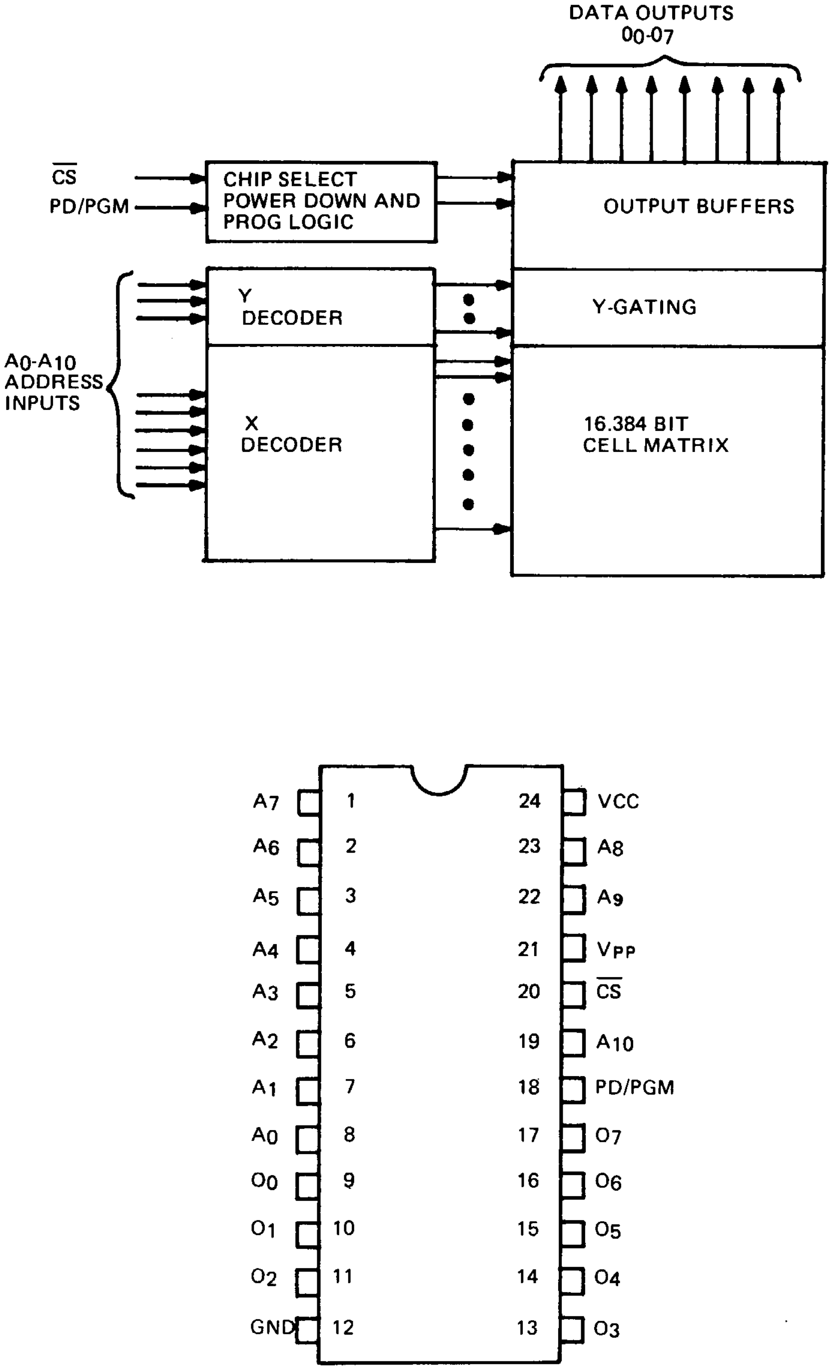
3.3 *Troubleshooting*

It is recommended that the serial interface card be returned to Collins Telecommunications Products Division for repair. The serial interface card is controlled by the microprocessor running a software program stored in the EPROM. It is necessary to have the software program and a method of controlling the program to isolate a fault to a specific component or circuit.



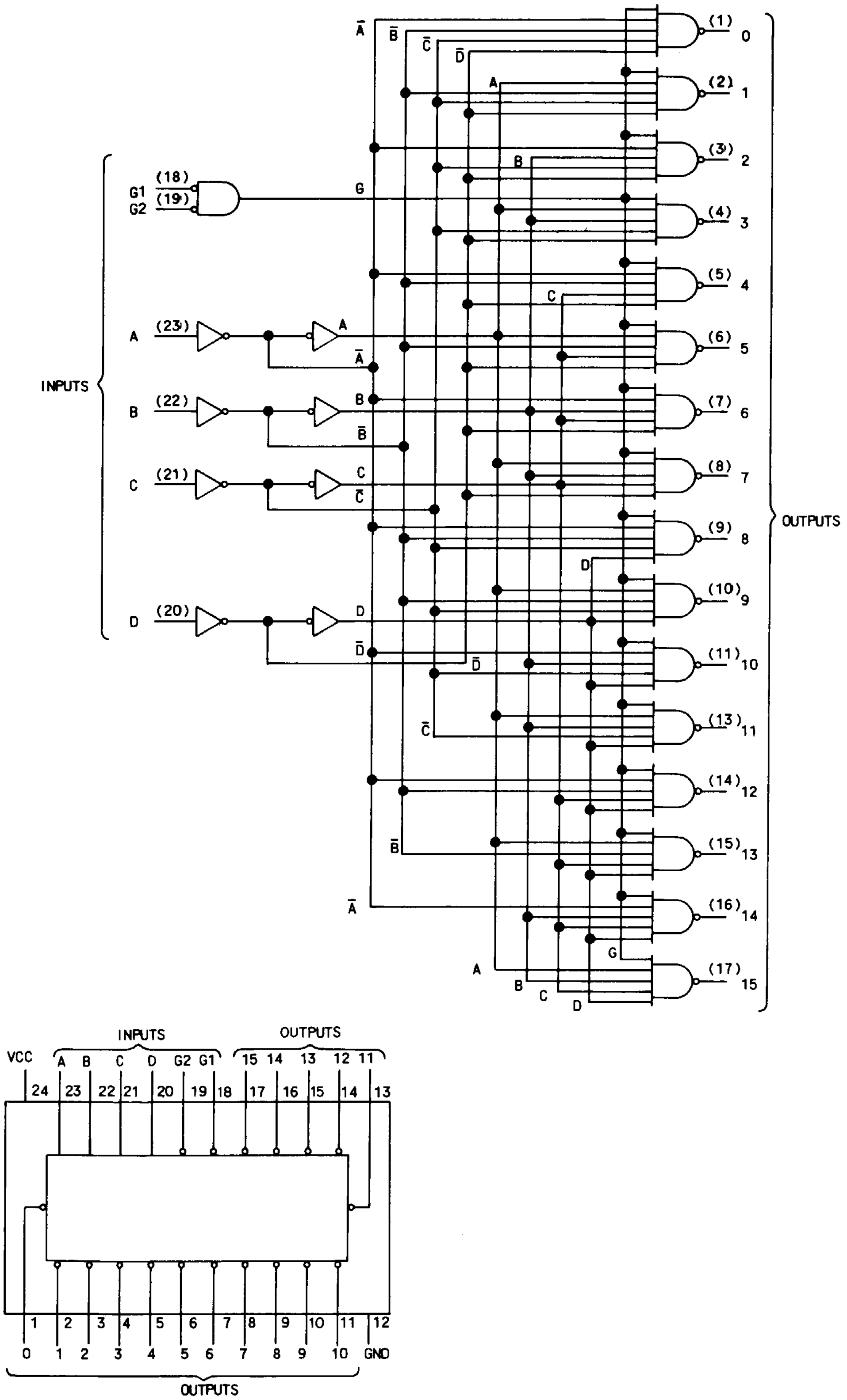
TPA-2672-013

Microprocessor 351-8676-010
Figure 6



TPA-2675-011

EPROM 647-2751-001
Figure 7



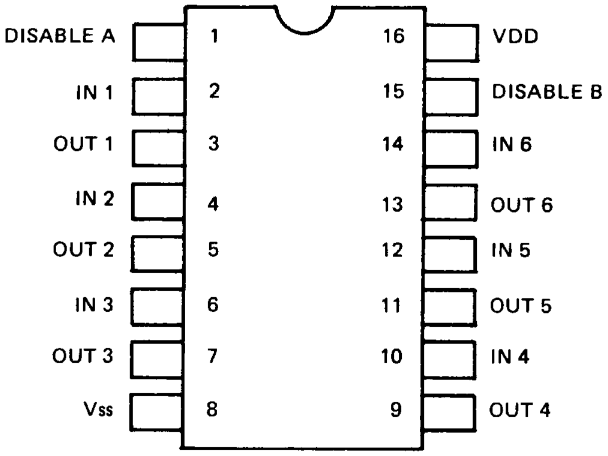
TPA-2677-014

Decode/Demultiplexer 351-1526-090
Figure 8

IN$_n$	APPROPRIATE DISABLE INPUT	OUT$_n$
0	0	0
1	0	1
X	1	HIGH IMPEDANCE

NOTE: X = DON'T CARE

TRUTH TABLE



PIN CONFIGURATION

TPA-2676-011

Noninverting, 3-State Buffer 351-8490-010
Figure 9

Table 2. Serial Interface, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	*Note* These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installating the questionable serial interface in the control unit. During these tests when a control unit is referred to it is a receiver-exciter control, an exciter control, or a receiver control. When a local unit is referred to it is a receiver-exciter, an exciter, or a receiver. For all tests, the serial interface card is strapped for HF-80 8-bit format. (Refer to paragraph 2.5.4.) a. Remove top cover of unit containing the serial interface to be tested. b. Remove serial interface. Install it on an extender card and place it in the control unit. c. Set unit LINE SELECTOR switches to 115 V. d. Connect units to 115-V ac power source and set power on. e. Measure dc voltages between the following pins and ground (TP1, brown):		
	J1-23	+15 ±1.0 V dc.	Check associated power supply.
	J1-28	+5 ±0.5 V dc.	
	J1-6	-15 +1.0 V dc.	
	f. Strap local unit for address 0.		
	g. Connect local unit to a control unit.		
2. FSK data levels	*Note* UUT must be strapped for FSK operation. a. Connect an audio voltmeter between J1-26 and J1-27.		
(Cont)	b. Open EIA-MIL-STD-188C polarity switch.		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont)

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Note audio voltmeter reading. d. Close EIA-MIL-STD-188C polarity switch. e. Note audio voltmeter reading. f. Open EIA-MIL-STD-188C polarity switch.	0 ±5 dB mW. Step c reading ±5 dB mW.	Check U18, U17 and associated circuits.
3. Serial data command with status request	a. Set local unit front-panel CONT switch to REM. b. Set control unit ADDRESS to 0. **Note** Local unit is strapped for address 0 recognition. c. Set control unit front-panel controls as follows: FREQUENCY KHZ to 29999.9 (0). MODE to ISB. CH A1 to ON (receiver only) RF GAIN to full ccw (receiver only) CH A1 AGC to DATA and AGC BUS to ON (receiver only) CHANNEL ENABLE A1 to LINE (exciter only) KEY to NORM (exciter only) PA PWR to STBY (exciter only) PILOT CARR to OFF (exciter only) PEAK CLIP to OFF (exciter only) CONT to NORM. d. Set control unit ADDRESS to 1. e. Change any and all of controls in step c. f. Note response signals on the control unit as follows:		
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	EQUIPMENT STATUS indicators	No change in indications.	Check U14, and associated address circuits.
	BANDWIDTH indicators (receiver only).	No change in indications.	
	FREQUENCY KHZ indicators.	No change in indications.	
	g. Set control unit ADDRESS to 0.		
	h. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications, MODE indicates A1 ISB (exciter and receiver).	Check U7, U9, U10, U11, U1, U2, U3, U4, and associated circuits.
	FREQUENCY KHZ indicators.	Indicates 29999.9 (0) kHz.	
	Note Do not connect ground lead to J1-30 until frequency indication is normal (29999.9).		
	i. Connect a storage oscilloscope to TP6 (blue). Sweep time = 10 ms. Trigger = TRIGGER. Vert scale = 1 V per division. Horiz sweep = Normal. Display = STORE.		
	j. Connect a jumper from J1-30 to ground.	R/E FAULT indicator flashes at 0.5-Hz rate (2 s on, 2 s off). **Note** Flashing starts approximately 7 seconds after ground connected to J1-30.	
	k. On control unit, change any FREQUENCY KHZ control (thumbwheel control only).	Oscilloscope display should look similar to command word with status request word 1 (refer to figure 10). Each frequency change changes data pattern.	Check U1 thru U4, U7, U24, U9, U29, U30, and associated circuits.
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)		**Note** Without special equipment it is impossible to note exact waveform. Look at spacing and bits of data.	
	l. Erase scope and repeat step k as often as necessary to obtain a good result. **Note** 10-MHz and 1-MHz frequency controls change bit pattern of word 1, character 2. 100-kHz and 10-kHz frequency controls change bit pattern of word 1, character 3. 1-kHz and 100-Hz frequency controls change bit pattern of word 1, character 4. 10-Hz and 1-Hz frequency controls (if applicable) change bit pattern of word 1, character 5.		
	m. Erase scope. On control unit, change RF GAIN control position.	Oscilloscope display should look similar to command word with status request, word 2 (refer to figure 10). Each RF GAIN control changes data pattern. Refer to note of step k.	Same as step k.
	n. Erase scope and repeat step m as necessary to obtain a good result. **Note** RF GAIN control changes bit pattern of word 2, character 2. A1 AGC switch changes bit pattern of word 2, character 4. VBFO enable switch (if applicable) changes bit pattern of word 2, character 4.		
(Cont)	MODE control changes bit pattern of word 2, character 5.		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	o. Erase scope. On control unit, change PA PWR control position.	Oscilloscope display should look similar to command word with status request word 3 (refer to figure 10). Each PA PWR control change changes data pattern. Refer to note of step k.	Same as step k.
	p. Erase scope and repeat step o as often as necessary to obtain a good result. **Note** VBFO 1-kHz and sign controls (if applicable) change bit pattern of word 3, character 2. VBFO 100-Hz and 10-Hz controls (if applicable) change bit pattern of word 3, character 3. PA PWR control changes bit pattern of word 3, character 5. P CAR switch changes bit pattern of word 3, character 5.		
	q. Erase scope. On control unit, change KEY control position.	Oscilloscope display should look similar to command word with status request word 4. (Refer to figure 10.) Each application or removal of a key changes data pattern. Refer to note of step k.	Same as step k.
	r. Erase scope and repeat step q as often as necessary to obtain a good result.		
	s. Erase scope. On control unit (with continuous tuning control) set DIAL switch to FINE and rotate TUNING knob.	Oscilloscope display should look similar to command word with status request word 4. (Refer to figure 10.) Each change of TUNING knob rotation speed changes data pattern. Refer to note of step k.	Same as step k.
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	t. Erase scope and repeat step s as often as necessary to obtain a good result.		
	u. Remove jumper from J1-30 to ground.		
4. Serial data status only	a. Repeat steps 3.a. through 3.i.		Same as test 3.
	b. Set local unit front-panel controls as follows:		
	FREQUENCY KHZ to 29999.9 (0).		
	MODE to ISB.		
	RF GAIN to full ccw (receiver only).		
	CH A1 AGC to DATA (receiver only).		
	CH A1 AGC BUS to ON (receiver only).		
	CHANNEL ENABLE A1 to LINE (exciter only).		
	KEY to NORM (exciter only).		
	PA PWR to STBY (exciter only).		
	PILOT CARR to OFF (exciter only).		
	CONT to LCL.		
	c. Change any or all of the above front-panel controls on the control unit.		
	d. Note response signals on the control unit.	No changes.	
	e. Set control unit ADDRESS to 0.		
	f. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications, mode indicates ISB (exciter and receiver). BUSY indicator is lit.	
	ISB indicators (receiver only).	Indicate A1.	
(Cont)	FREQUENCY KHZ indicators.	Indicates 29999.9 (0) kHz.	

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	g. Connect a storage oscilloscope to TP6 (blue). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = SINGLE SWEEP. Display = STORE.		
	h. Note oscilloscope waveform.	Should look similar to status request only words (refer to figure 10). **Note** Without special equipment it will be impossible to note exact waveform. Look at spacing and bits of data.	
	i. Repeat steps g and h as often as necessary to obtain a good result.		
5. Serial data status only	a. Repeat steps 3.a through 3.i.		Same as test 3.
	b. Set local unit front-panel controls as follows: FREQUENCY KHZ to 29999.9 (0). MODE to ISB. RF GAIN to full ccw (receiver only). CH A1 AGC to DATA (receiver only). CH A1 AGC BUS to ON (receiver only). CHANNEL ENABLE A1 to LINE (exciter only). KEY to NORM (exciter only). PA PWR to STBY (exciter only). PILOT CARR to OFF (exciter only). CONT to LCL.		
(Cont)	c. Change any or all of the above front-panel controls on the control unit.		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	d. Note response signals on the control unit.	No changes.	
	e. Set control unit ADDRESS to 0.		
	f. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications mode indicates ISB (exciter and receiver). BUSY indicator is lit.	
	ISB indicators.	Indicate A1.	
	FREQUENCY KHZ indicators.	Indicates 29999.9 (0) kHz.	
	g. Connect a storage oscilloscope to TP5 (green). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = SINGLE SWEEP. Display = STORE.		
	h. Note oscilloscope waveform.	Should look similar to monitor word(s)/ command word(s) with no status request, (refer to figure 10). **Note** Without special equipment it will be impossible to note exact waveform. Look at spacing and bits of data.	
	i. Repeat steps g and h as often as necessary to obtain a good result.		
6. FSK receiver sensitivity	a. Connect local unit to a control unit through a 40-dB attenuator in both the monitor and data lines.		Check U34A and associated circuits.
	b. Repeat test 3.	Results should be same as test 3 results.	

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. Address recognition	a. Set local unit CONT switch to REM.		
	b. Set control unit ADDRESS to 0.		
	c. Set control unit front-panel controls as follows:		
	FREQUENCY KHZ to 29999.9(9).		
	MODE to ISB.		
	RF GAIN to full ccw (receiver only).		
	CH A1 AGC to DATA (receiver only).		
	CH A1 AGC BUS to ON (receiver only).		
	CHANNEL ENABLE A1 to LINE (exciter only).		
	KEY to NORM (exciter only).		
	PA PWR to STBY (exciter only).		
	PILOT CARR to OFF (exciter only).		
	d. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications mode indicates ISB. PA READY might be lit (exciter only).	Check U1 thru U4, U7, U6, U8, U9, U20, U21, U11, U12, and associated circuits.
	ISB indicators.	Indicates A1.	
	FREQUENCY KHZ indicators.	Indicates 29999.9 (9) kHz.	
	e. Set control unit ADDRESS to 1.		
	f. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	EXCTR FAULT, RCV FAULT, or R/E FAULT indicator flashes at a 0.25-Hz rate (on 2 seconds, off 2 seconds). All other indications should remain the same.	Check U1, U2, U3, U4, U5, U27, U28, U29, U30, U8, and associated circuits. Check also busy circuit on parallel output.
(Cont)	ISB indicators.	No change from step d.	

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

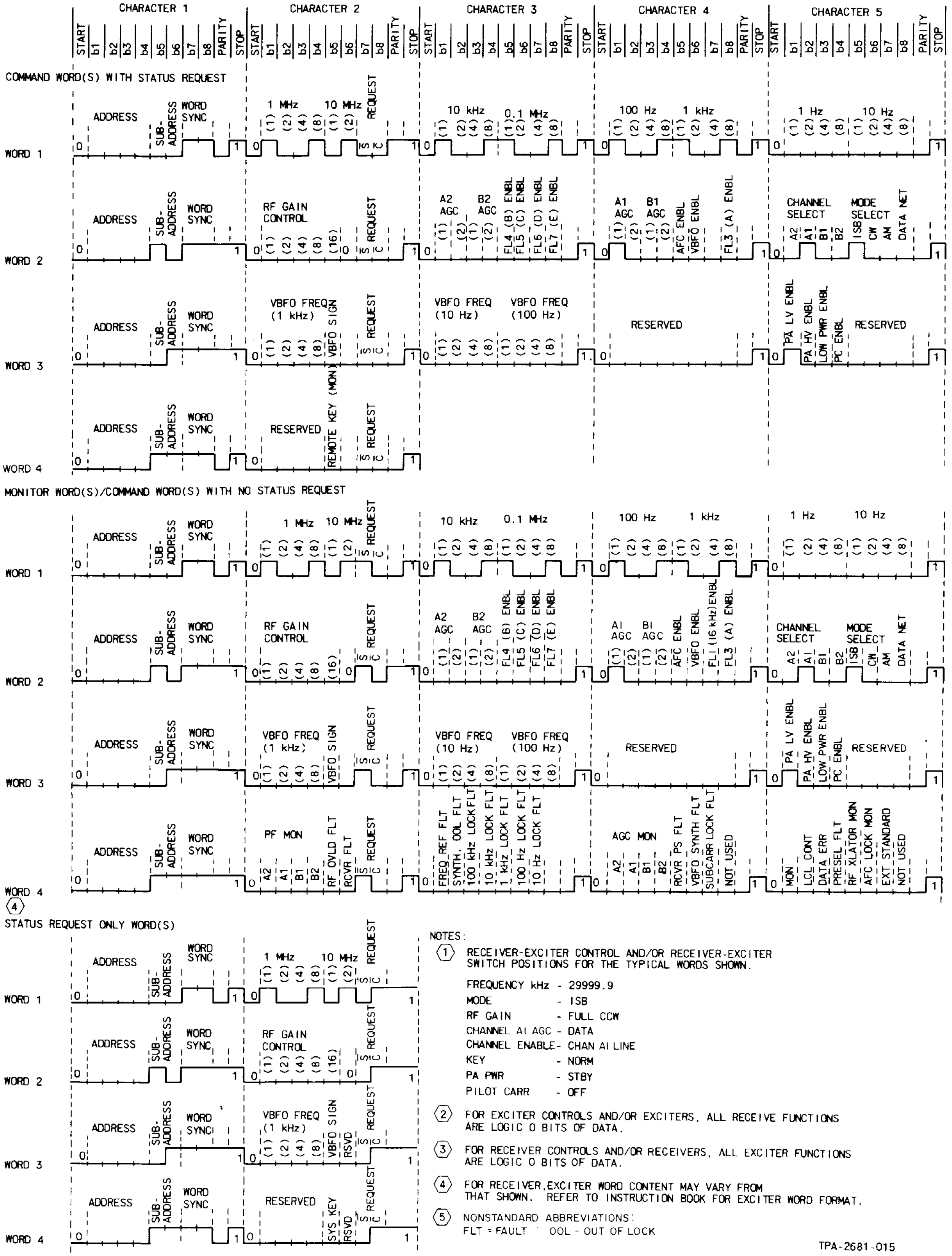
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	FREQUENCY KHZ indicators.	No change from step d.	Check U1, U2, U3, U4, U5, U27, U28, U29, U30, U8, and associated circuits. Check also busy circuit on parallel output.
	g. Note response signals on the control unit with the ADDRESS to each position 2 through 15.	Same as step f.	
8. Word 4 continuous transmit	a. Set control unit ADDRESS to 0.		
	b. Set control unit CONT switch to NORM.		
	c. Connect oscilloscope to TP6 (blue). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = NORMAL	Continuous data monitored on oscilloscope should look similar to status request only word, word 4.	Check U1 thru U4, U7, U23, U24 and associated circuits.
	d. Apply a ground to J1-30.	Continuous data on oscilloscope is terminated.	Same as step c.
	e. Remove J1-30 ground.		
9. Data loop back	a. Set control unit address to 0.		
	b. Disconnect control unit from local unit.		
	c. Set control unit CONT switch to TEST.		
	d. Connect a dual-trace storage oscilloscope with upper trace to TP6 (blue) and lower trace to TP5 (green).		
	e. Set oscilloscope as follows: Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = NORMAL.		
	f. Set control unit front-panel controls as follows: FREQUENCY KHZ to 29999.0 (9). MODE to ISB. RF GAIN to full ccw (receiver only). CH A1 AGC to DATA (receiver only). CH A1 AGC BUS to ON (receiver only). CHANNEL ENABLE A1 to LINE (exciter only).		
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	KEY to NORM (exciter only). PA PWR to STBY (exciter only). PILOT CARR to OFF (exciter only).		
	g. Set oscilloscope display to STORE.		
	h. Erase display. Set FREQUENCY KHZ to 29999.9(9).	Both oscilloscope traces are identical and look similar to command word with status request, word 1. (Refer to figure 10.)	Check U1 through U4 and associated circuits.
	i. Erase display. Set MODE control to AM.	Both oscilloscope traces are identical and look similar to command word with status request, word 2. (Refer to figure 10.)	Same as step h.
	j. Erase display. Set PA PWR to HIGH PWR.	Both oscilloscope traces are identical and look similar to command word with status request, word 3. (Refer to figure 10.)	Same as step h.
	k. Erase display. Set KEY control to LOCK.	Both oscilloscope traces are identical and look similar to command word with status request, word 4. (Refer to figure 10.)	Same as step h.
	l. Set control unit CONT switch to NORM.		
	m. Repeat steps g through j.	Upper trace same as steps g through j. Lower trace, straight line.	Same as step h.
10. Baud rate check	a. Note baud rate strapped in unit.	Reference.	
	b. Strap baud rate for 75.		
	c. Repeat test 10.	Same as test 10 except monitor word spacing increases as baud rate decreases and vice versa.	Same as test 10.
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	d. Strap baud rate for 19 200. e. Repeat test 10. f. Return to baud rate strapping referenced in step a.		



NOTES:

① RECEIVER-EXCITER CONTROL AND/OR RECEIVER-EXCITER SWITCH POSITIONS FOR THE TYPICAL WORDS SHOWN.

FREQUENCY kHz - 29999.9
MODE - ISB
RF GAIN - FULL CCW
CHANNEL A1 AGC - DATA
CHANNEL ENABLE- CHAN A1 LINE
KEY - NORM
PA PWR - STBY
PILOT CARR - OFF

② FOR EXCITER CONTROLS AND/OR EXCITERS, ALL RECEIVE FUNCTIONS ARE LOGIC 0 BITS OF DATA.

③ FOR RECEIVER CONTROLS AND/OR RECEIVERS, ALL EXCITER FUNCTIONS ARE LOGIC 0 BITS OF DATA.

④ FOR RECEIVER,EXCITER WORD CONTENT MAY VARY FROM THAT SHOWN. REFER TO INSTRUCTION BOOK FOR EXCITER WORD FORMAT.

⑤ NONSTANDARD ABBREVIATIONS:
FLT = FAULT OOL = OUT OF LOCK

TPA-2681-015

Timing Diagram/Typical Waveforms
Figure 10

4. ALIGNMENT/ADJUSTMENT

4.1 Control Data Strapping

For strapping instructions and information, refer to paragraph 2.5 of this instruction.

4.2 Adjustment of FSK Detector Symmetry

a. Perform test setup of table 2, test 1.
b. Strap card for FSK signaling (refer to paragraph 2.5.1).
c. Strap card for 1200 bauds (refer to paragraph 2.5.6).
d. Strap for odd parity (refer to paragraph 2.5.4).
e. Apply a 0-dB mW FSK signal with a symmetrical 1:1 (mark, space) data pattern between P1-54 and P1-55.
f. Using an oscilloscope, monitor the waveform at TP5 (green) to ground (TP1, brown).
g. Adjust R67 to obtain best symmetry of the waveform at TP5.

5. REPAIR

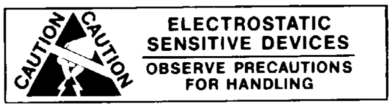
Repair of the serial interface card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 11). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

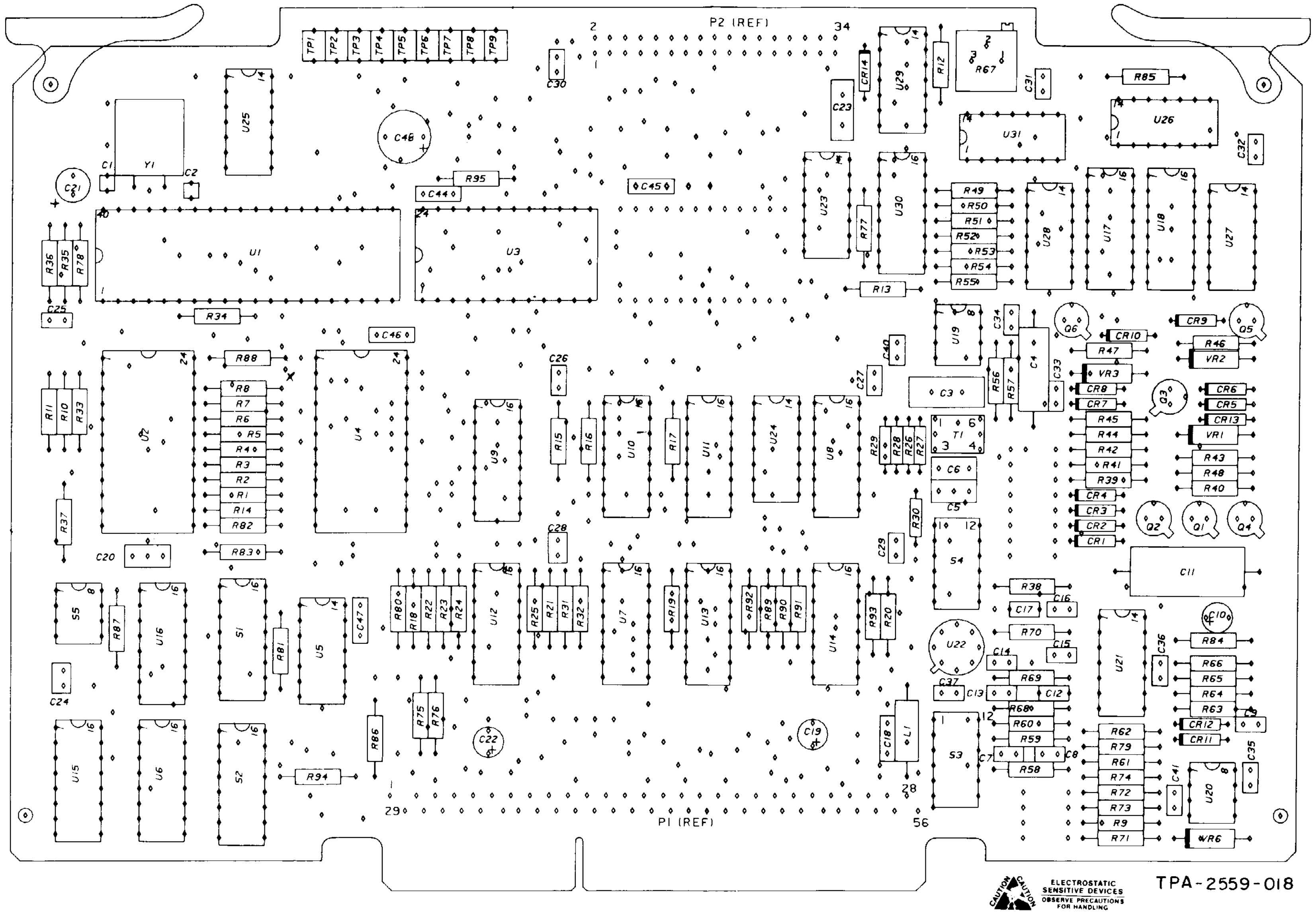
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
07388	TOROTEL INC 13402 S 71 HIGHWAY GRANDVIEW MO 64030
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
27264	MOLEX INC CORPORATE HQ 2222 WELLINGTON COURT LISLE IL 60532
27735	F-DYNE ELECTRONICS 449 HOWARD AVE BRIDGEPORT CT 06605
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
96906	MILITARY STANDARD

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Serial Interface	638-6896-001	REV F



Serial Interface, Schematic Diagram
Figure 11 (Sheet 1 of 5)

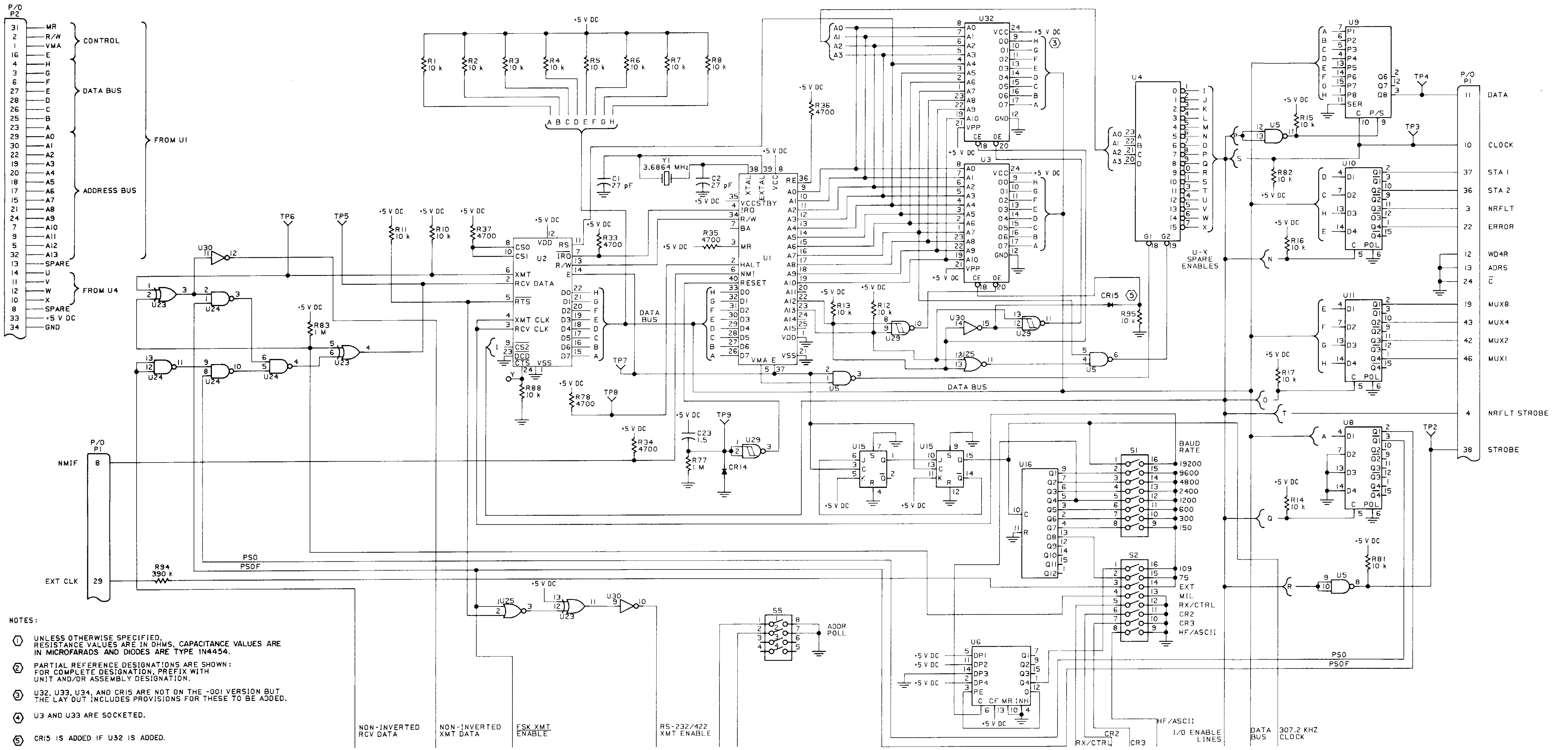
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SERIAL INTERFACE (ESDS)	638-6896-001			
CR1-CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1,C2	CAPACITOR,FXD CER DIEL, 27PF, 10%, 100V	913-1098-570		72982	8111A100C0G0-270K
C3	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-2864-000		72136	DM15F471J300WV4CR
C4	CAPACITOR,FXD PLSTC DIEL, 0.0056UF, 10%, 80V	933-1039-320		27735	PE1S0056-80-10
C5,C6	CAPACITOR,FXD CER DIEL, 1UF, 20%, 50V	913-3279-270		16546	CY30C105M
C7-C9	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-680		16546	CY20C104M
C10	CAPACITOR,FXD TNTLM ELCTLT, 15UF, 20%, 15V	184-9102-130		56289	199D156X0015CB1
C11	CAPACITOR,FXD PLSTC DIEL, 0.047UF, 10%, 200V	933-1039-040		27735	PE1S047-200-10
C12	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C13	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-680		16546	CY20C104M
C14-C16	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C17	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C18	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C19	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C20	CAPACITOR,FXD CER DIEL, 0.22UF, 20%, 50V	913-3279-220		16546	CY30C224M
C21	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C22	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C23	CAPACITOR,FXD CER DIEL, 1.5UF, 20%, 50V	913-3279-280		16546	CY40C155M
C24-C37	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C38,C39	NOT USED				
C40,C41	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C42,C43	NOT USED				
C44-C47	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C48	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
L1	COIL,RF 1UH	240-2715-130		96906	MS75088-1
Q1	TRANSISTOR	352-0551-010		15818	2N2907A
Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3	TRANSISTOR	352-0551-010		15818	2N2907A
Q4	TRANSISTOR	352-0661-020		07263	2N2222A
Q5	TRANSISTOR	352-0551-010		15818	2N2907A
Q6	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R8	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R9	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R10-R21	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R22-R25	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R26-R30	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R31,R32	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R33-R38	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R39-R41	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R42	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R43	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R44,R45	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R46,R47	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R48	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R49-R52	RESISTOR,FXD FILM, 20.5K, 1%, 1/8W	705-1059-000		81349	RN55D2052F
R53,R54	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R55,R56	RESISTOR,FXD FILM, 48.7K, 1%, 1/8W	705-1077-000		81349	RN55D4872F
R57,R58	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R59,R60	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R61	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R62	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R63	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R64	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R66	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R67	RESISTOR,VAR WW, 2K, PORM5%, 3/4W	381-1721-050		81349	RT22C2P202
R68-R70	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R71	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R72	RESISTOR,FXD CMPSN, 0.82MEGO, 10%, 1/4W	745-0854-000		81349	RCR07G824KS
R73	RESISTOR,FXD CMPSN, 0.18MEGO, 10%, 1/4W	745-0830-000		81349	RCR07G184KS
R74	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R75-R77	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R78	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R79	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R80	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R81,R82	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R83	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R84	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R85	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R86,R87	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R88	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R89-R94	RESISTOR,FXD CMPSN, 0.39MEGO, 10%, 1/4W	745-0842-000		81349	RCR07G394KS
R95	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
S1,S2	SWITCH,DUAL PKG	266-0243-050		27264	A10040-108
S3,S4	SWITCH,DUAL PKG	266-0243-030		27264	A10040-106
S5	SWITCH,DUAL PKG	266-0243-010		27264	A10040-104
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-011
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-011
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-011
TP9	JACK,TIP WHT	360-0484-010		74970	105-1101-011
T1	TRANSFORMER, RF	677-0324-320		07388	26077
U1	MICROPROCESSOR (ESDS)	351-8676-010		04713	MC6802P
U2	INTEGRATED CIRCUIT COMM INTFC ADAPTER (ESDS)	351-8455-010		04713	MC6850P
U3	INTEGRATED CIRCUIT EPROM (ESDS)	647-2751-001			2716

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
U4	INTEGRATED CIRCUIT DECODER	351-1526-090		27014	DM74LS154N
U5	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U6	INTEGRATED CIRCUIT COUNTER (ESDS)	351-8277-010		04713	MC14526BCP
U7	INTEGRATED CIRCUIT (ESDS)	351-8490-010		04713	MC14503BCP
U8	INTEGRATED CIRCUIT (ESDS)	351-8159-160		07263	4042BPC
U9	INTEGRATED CIRCUIT (ESDS)	351-8159-230		07263	4021BPC
U10,U11	INTEGRATED CIRCUIT (ESDS)	351-8159-160		07263	4042BPC
U12-U14	INTEGRATED CIRCUIT (ESDS)	351-8490-010		04713	MC14503BCP
U15	INTEGRATED CIRCUIT (ESDS)	351-8159-180		07263	4027BPC
U16	INTEGRATED CIRCUIT (ESDS)	351-8159-240		07263	4040BPC
U17	INTEGRATED CIRCUIT (ESDS)	351-8315-010		07263	F4520PC
U18	INTEGRATED CIRCUIT (ESDS)	351-8253-010		04713	MC14018BCP
U19	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC
U20	INTEGRATED CIRCUIT AMPLIFIER	351-1286-010		07263	UA1558RM
U21	INTEGRATED CIRCUIT	351-1114-010		27014	LM565CN
U22	INTEGRATED CIRCUIT COMPARATOR	351-1094-060		12040	LM311H
U23	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U24	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U25,U26	INTEGRATED CIRCUIT (ESDS)	351-8159-320		07263	4001BPC
U27	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U28	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U29	INTEGRATED CIRCUIT (ESDS)	351-8342-010		02735	CD4093BE
U30	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U31	INTEGRATED CIRCUIT (ESDS)	351-8159-320		07263	4001BPC
VR1	SEMICOND DEVICE	353-2938-000		01295	1N746A
VR2,VR3	SEMICOND DEVICE	353-2712-000		12954	1N752A
VR4,VR5	NOT USED				
VR6	SEMICOND DEVICE	353-2708-000		81483	1N750A
Y1	CRYSTAL UNIT,QTZ 3.6864MHZ	289-7120-060		00136	289-7120-060M20

Serial Interface, Schematic Diagram
Figure 11 (Sheet 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND DIODES ARE TYPE 1N4454.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ U32, U33, U34, AND CR15 ARE NOT ON THE -001 VERSION BUT THE LAY OUT INCLUDES PROVISIONS FOR THESE TO BE ADDED.

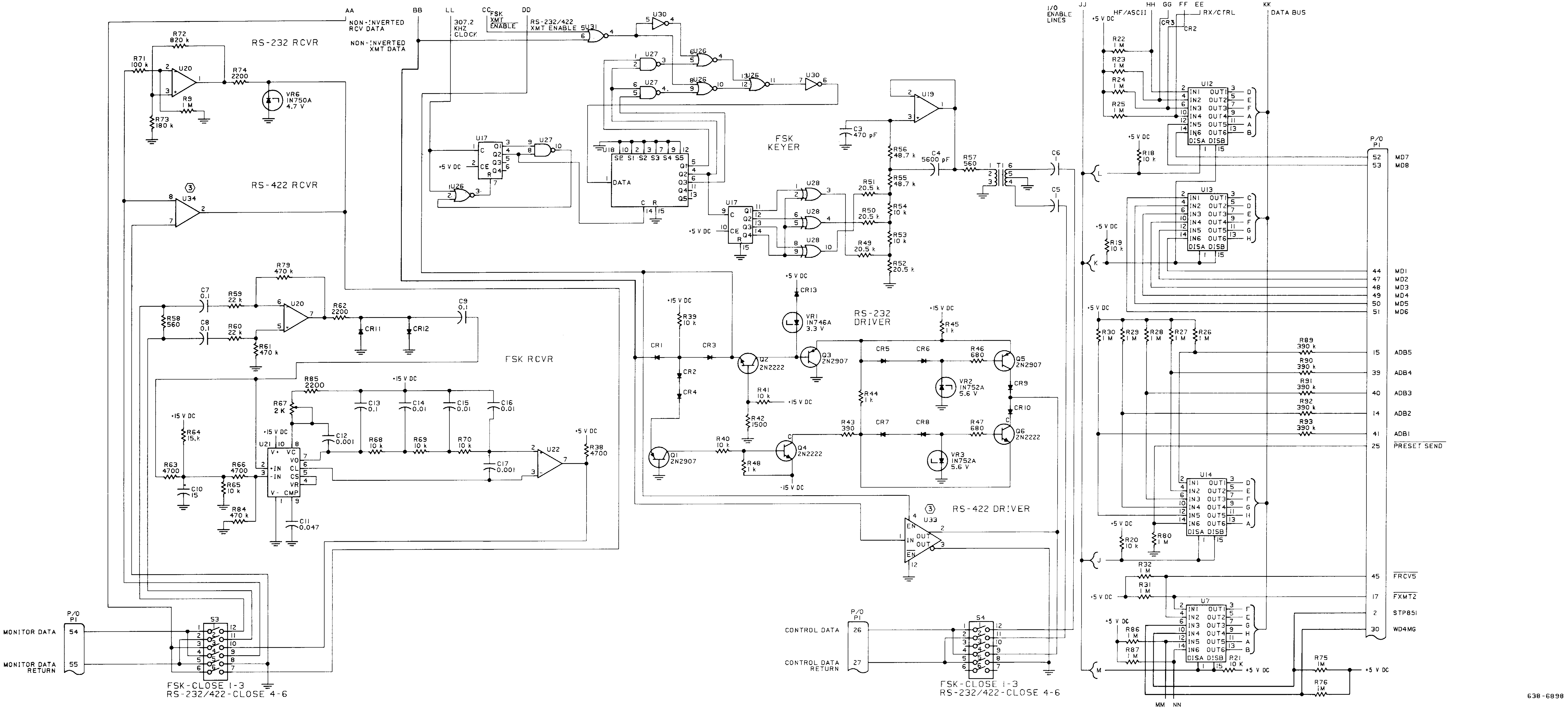
④ U3 AND U33 ARE SOCKETED.

⑤ CR15 IS ADDED IF U32 IS ADDED.

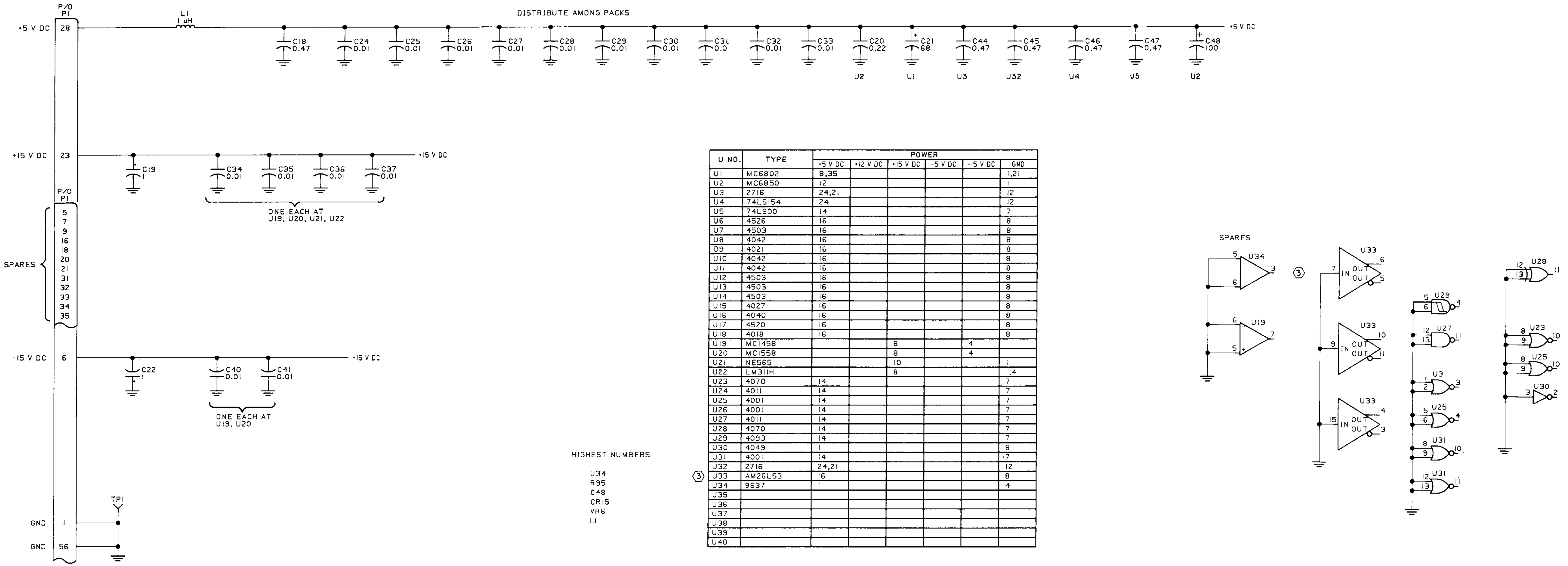
⑥ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

638-6898

Serial Interface, Schematic Diagram
Figure 11 (Sheet 3)



Serial Interface, Schematic Diagram
Figure 11 (Sheet 4)



U NO.	TYPE	POWER					
		+5 V DC	+12 V DC	+15 V DC	-5 V DC	-15 V DC	GND
U1	MC6802	8,35					1,21
U2	MC6850	12					1
U3	2716	24,21					12
U4	74LS154	24					12
U5	74LS00	14					7
U6	4526	16					8
U7	4503	16					8
U8	4042	16					8
U9	4021	16					8
U10	4042	16					8
U11	4042	16					8
U12	4503	16					8
U13	4503	16					8
U14	4503	16					8
U15	4027	16					8
U16	4040	16					8
U17	4520	16					8
U18	4018	16					8
U19	MC1458			8		4	
U20	MC1558			8		4	
U21	NE565			10			1
U22	LM311H			8			1,4
U23	4070	14					7
U24	4011	14					7
U25	4001	14					7
U26	4001	14					7
U27	4011	14					7
U28	4070	14					7
U29	4093	14					7
U30	4049	1					8
U31	4001	14					7
U32	2716	24,21					12
③ U33	AM26LS31	16					8
U34	9637	1					4
U35							
U36							
U37							
U38							
U39							
U40							

HIGHEST NUMBERS

U34
R95
C48
CR15
VR6
L1

638-6898

Serial Interface, Schematic Diagram
Figure 11 (Sheet 5)

Synthesizer Voltage Regulator (635-0656-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767974-003211
3rd Edition, 1 October 1980

1. DESCRIPTION

Synthesizer Voltage Regulator 635-0656-001, shown in figure 1, is a 2-layer planar card with a 20-pin edge-on connector (2 layers, 10 pins each).

The synthesizer voltage regulator consists of a +20-V dc series regulator, a +5.2-V dc series regulator, and a loss-of-lock summary monitor.

2. PRINCIPLES OF OPERATION

2.1 General

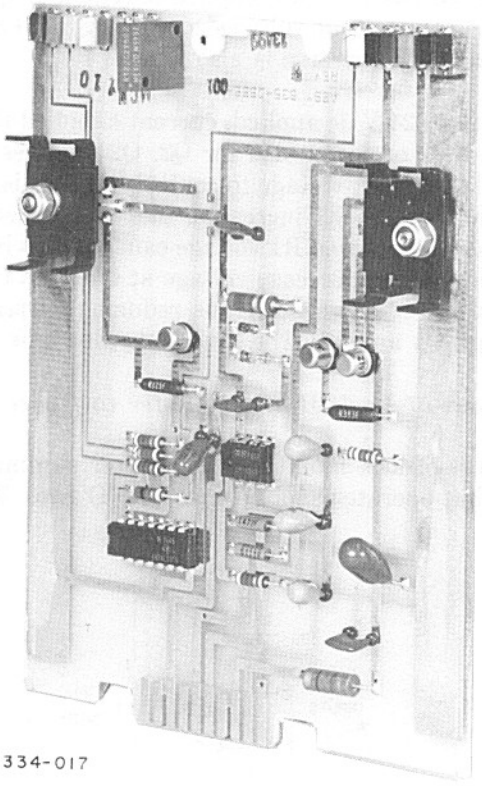
The synthesizer voltage regulator receives +24- and +8-V dc inputs and supplies regulated outputs of +20 and +5.2 V dc.

The synthesizer voltage regulator receives seven monitor inputs and provides one monitor summary output.

2.2 +5.2-V DC Series Regulator (Refer to figure 3.)

The +5.2-V dc series regulator consists of a current/voltage regulator (Q3-Q4), a current control (Q5), a voltage control (U1B), and a reference regulator (VR1).

With +8 and +24 V dc applied, voltage control U1B is enabled. The +24 V dc is applied through R2 to reference regulator VR1. Reference regulator VR1 voltage is applied through R7 to noninverting (reference) input of U1B, and the +5.2-V dc output is applied directly to the inverting input of U1B. Note that R7 is adjusted for an optimum 5.2-V dc regulated output. As the +5.2-V dc output increases, a lower voltage output of U1B is applied to regulator Q3-Q4 base, reducing the output voltage/current of the +5.2-V dc regulator. The inverse is also true.



Synthesizer Voltage Regulator
Figure 1

With +8 V dc applied, current through Q3-Q4 and R6 provides bias for Q5. Q5 supplies an inverted dc output voltage to control Q3-Q4; that is, as the current through R6 increases, the voltage across R6 increases.

NOTICE: This section replaces second edition dated 1 June 1978.

Increased R6 voltage causes Q5 to increase conduction and decrease voltage at Q3-Q4 base. Conduction of Q3-Q4 is decreased, thus reducing current flow through Q1 and R1. The inverse is also true.

2.3 +20-V DC Series Regulator (Refer to figure 3)

The +20-V dc series regulator consists of current/voltage regulator Q1, current control Q2, and voltage control U1A.

With +24-V dc input applied, and +5.2-V dc regulated output supplied, voltage control U1A is enabled. The +5.2-V dc output is applied to the noninverting (reference) input of U1A, and the +20-V dc output is supplied through voltage divider R2 and R4 and applied to the inverting input of U1A. As the voltage at the junction of R3-R4 increases, a lower voltage output of U1A is applied to regulator Q1 base, reducing the output voltage/current of the +20-V dc regulator. The inverse is also true.

With the +24 V dc applied, current supplied through Q1 and R1 provides bias for Q2. Q2 supplies an inverted dc output voltage to control Q1; that is, as the current through R1 increases, the voltage across R1 increases. Increased R1 voltage causes Q2 to increase conduction and decrease voltage at Q1 base. Conduction of Q1 is decreased, thus reducing current flow through Q1 and R1. The inverse is also true.

2.4 Loss-of-Lock Monitor (Refer to figure 3.)

The loss-of-lock monitor is a monitor summary circuit that operates as a normal NAND gate. With all loss-of-lock signals in the normal state (all lock signals present), all logic 1 signals are applied to NAND gate U2 providing a logic 0 output from U2. If any lock signal is lost, a logic 0 is applied by the associated decade to the loss-of-lock monitor and a logic 1 loss-of-lock output is supplied. Note that any (or all) logic 0 inputs to U2 provide a logic 1 output from U2.

2.5 Dual Operational Amplifier 351-1071-070 (Refer to figure 2.)

The 351-1071-070 consists of two operational amplifiers in one package designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components.

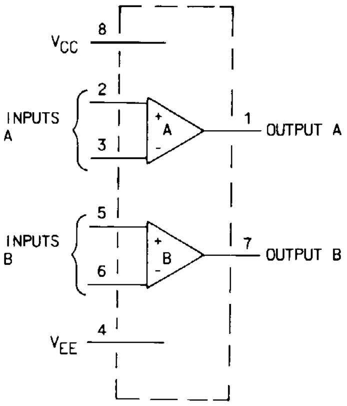
3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer voltage regulator are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check total performance of the synthesizer voltage regulator. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



CHARACTERISTICS
SUPPLY VOLTAGE: V_{CC} +18 V DC MAX
V_{EE} -18 V DC MAX
INPUT DIFF VOLTAGE: ±30 V MAX
INPUT COMMON MODE VOLTAGE:
±15 V MAX ①
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ②
INPUT RESISTANCE: 300 kΩ MIN, 2.0 MΩ MAX
OUTPUT RESISTANCE: 75Ω TYPICAL
VOLTAGE GAIN: 15 MIN

NOTES:
① FOR SUPPLY VOLTAGE LESS THAN ±15.0 V, MAX INPUT VOLTAGE EQUAL TO SUPPLY VOLTAGE.
② SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2285-013

Dual Operational Amplifier 351-1071-070
Figure 2

Table 1. Synthesizer Voltage Regulator, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of the unit containing the synthesizer voltage regulator to be tested.		
	b. Remove cover from synthesizer section of unit.		
	c. Remove synthesizer voltage regulator, install it on an extender card, and place it in the unit.		
	d. Set unit LINE SELECTOR switch to 115 V.		
	e. Connect unit to 115-V ac power source and set power on.		
	f. Measure dc voltage from TP10 to TP13 (ground).	+24.0 ±0.5 V dc.	Check unit power supply.
	g. Measure dc voltage from TP11 to TP13 (ground).	+8.0 ±0.04 V dc.	Check unit power supply.
2. +5.2 V dc	a. Measure dc voltage from TP9 to TP13 (ground).	+5.2 ±0.05 V dc.	Adjust R7 for +5.2 ±0.05 V dc. If R7 adjustment does not correct the problem, check U1B, Q3, Q4, Q5, and associated circuit.
3. +20-V dc regulator	a. Measure dc voltage from TP12 to TP13 (ground).	NLT +19.7 V dc, NMT +20.6 V dc.	Check U1A, Q1, Q2, and associated circuit.
4. Loss-of-lock monitor	a. Measure voltage from TP8 to TP13 (ground).	NMT 0.5 V dc.	Check dc voltages at TP1 thru TP7. If all voltages are NLT +3.5 V dc, check U2 and associated circuit. If any voltages are less than +3.5 V dc, check unit synthesizer card associated with the input.
	b. Monitor voltage from TP8 to TP13 for steps c thru j.		
	c. Apply a ground signal to TP1.	NLT +3.5 V dc.	Check U2.
	d. Remove ground from TP1 and apply it to TP2.	NLT +3.5 V dc.	Check U2.
	e. Remove ground from TP2 and apply it to TP3.	NLT +3.5 V dc.	Check U2.
	f. Remove ground from TP3 and apply it to TP4.	NLT +3.5 V dc.	Check U2.
(Cont)	g. Remove ground from TP4 and apply it to TP5.	NLT +3.5 V dc.	Check U2.

Table 1. Synthesizer Voltage Regulator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	h. Remove ground from TP4 and apply it to TP6.	NLT +3.5 V dc.	Check U2.
	i. Remove ground from TP6 and apply it to TP7.	NLT +3.5 V dc.	Check U2.
	j. Remove ground from TP7.		
5. Shutdown	a. Set power off. b. Remove synthesizer voltage regulator from card extender and reinstall it in the unit. c. Replace cover on synthesizer section of unit. d. Replace top cover of unit.		

4. ALIGNMENT/ADJUSTMENT

Refer to table 1, test 2 for adjustment of R7 (+5.2-V dc regulator).

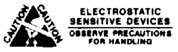
5. REPAIR

Repair of the synthesizer voltage regulator is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

> **Caution**
>
> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.



This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change.

Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

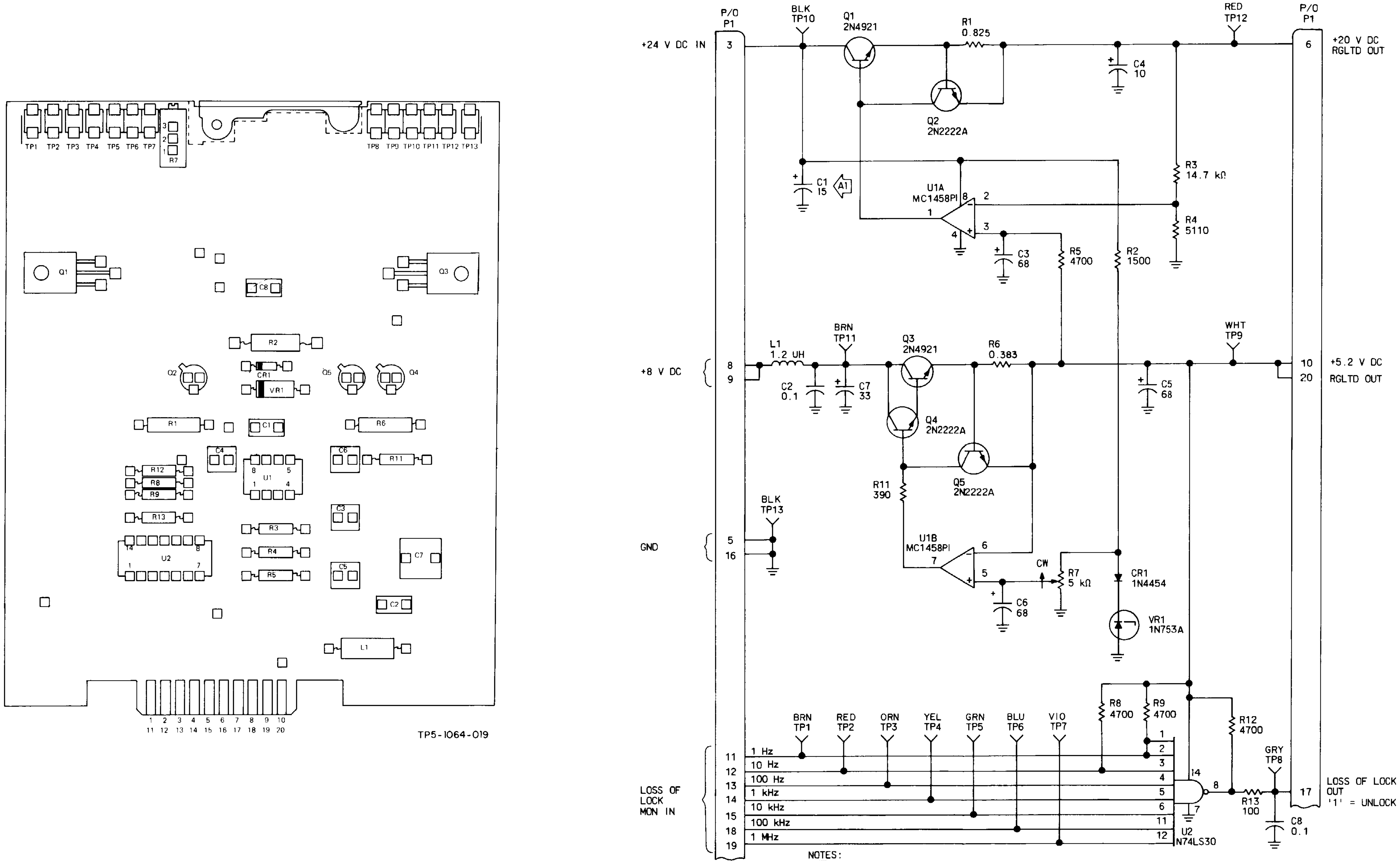
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
03058	General Electric Co. Semi-Conductor Products Dept. W. Genesee St. Auburn, NY 13021
04713	Motorola, Inc. Semiconductor Products Group 5005 E. McDowell Rd. Phoenix, AZ 85008
07263	Fairchild Camera and Instrument Corp. Semiconductor Div. 464 Ellis St. Mountain View, CA 94042
16545	U.S. Capacitor Corp/Centralab Electronics Div. 4561 Colorado Los Angeles, CA 90039
18324	Signetics Corp. 811 E. Arques Ave. Sunnyvale, CA 94086
56289	Sprague Electric Co. North Adams, MA 01247
74970	Johnson, E. F., Co. 299 10th Ave SW Waseca, MN 56093
81349	Military Specifications
81483	Internationsl Rectifier PO Box 2321 Terminal Annex 9220 Sunset Blvd. Los Angeles, CA 90069
96906	Military Standards

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer voltage regulator	635-0656-001	REV C



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

635-0427
TP4-6926-014

Synthesizer Voltage Regulator, Schematic Diagram
Figure 3 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTH VOLTAGE REGULATOR	635-0656-001			
CR1	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V (A1)	913-3279-200		16546	CY30C104M
C1	CAPACITOR,FXD ELCTLT, 15UF, 20%, 35V	184-9102-420		56289	199D1013
C2	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C3	CAPACITOR,FXD ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C4	CAPACITOR,FXD ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C5,C6	CAPACITOR,FXD ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C7	CAPACITOR,FXD ELCTLT, 33UF, 20%, 25V	184-9102-260		56289	199D1009
C8	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
L1	COIL,RF 1.20UH	240-2715-140		96906	MS75058-2
Q1	TRANSISTOR	352-0782-010		04713	2N4921
Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3	TRANSISTOR	352-0782-010		04713	2N4921
Q4,Q5	TRANSISTOR	352-0661-020		07263	2N2222A
R1	RESISTOR,FXD 0.825 OHMS, 1%, 1W	747-1499-340		81349	RW70UR825F
R2	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/2W	745-1359-000		81349	RCR20G152KS
R3	RESISTOR,FXD FILM, 14.7K, 1%, 1/8W	705-1052-000		81349	RN55D1472F
R4	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R5	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R6	RESISTOR,FXD 0.383 OHMS, 1%, 1W	747-1499-270		81349	RW70UR383F
R7	RESISTOR,VAR WW, 5K, PCRM5%, 3/4W	381-1721-390		81349	RT22C2X502
R8,R9	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R10	NOT USED				
R11	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R12	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R13	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-001
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-001
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-001
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-001
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-001
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-001
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-001
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-001
TP9	JACK,TIP WHT	360-0484-010		74970	105-1101-001
TP10	JACK,TIP BLK	360-0484-030		74970	105-1103-001
TP11	JACK,TIP BRN	360-0484-070		74970	105-1108-001
TP12	JACK,TIP RED	360-0484-020		74970	105-1102-001
TP13	JACK,TIP BLK	360-0484-030		74970	105-1103-001
U1	INTEGRATED CIRCUIT	351-1071-070		04713	MC1458P1
U2	INTEGRATED CIRCUIT	351-1523-140		18324	N74LS30N
VR1	SEMICOND DEVICE	353-2714-000		81483	1N753A

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed C1 from 0.1μF to 15μF.	REV C and above

Synthesizer Voltage Regulator, Schematic Diagram
Figure 3 (Sheet 2)

Synthesizer Subcarrier Generator (638-6962-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

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1. DESCRIPTION

Synthesizer Subcarrier Generator 638-6962-001, shown in figure 1, is a 3-layer planar card with a 20-pin edge-on connector.

The synthesizer subcarrier generator uses three phase-locked loops to produce output frequencies of 456.29 kHz and 443.71 kHz. These frequencies are used in a receiver-exciter when using UUSB (channel A2, upper-upper sideband) and LLSB (channel B2, lower-lower sideband) modes of operation.

2. PRINCIPLES OF OPERATION

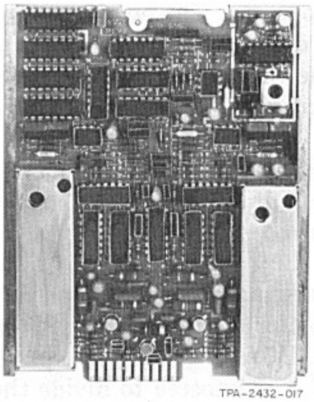
2.1 General (Refer to figure 2.)

The synthesizer subcarrier generator receives input reference signals of 450 kHz and 100 kHz and a 450-kHz enable signal from an external source. In addition to the rf input signals, +20-V dc and +5-V dc voltages are required. The output signals are 456.29 kHz (channel A2), 443.71 kHz (channel B2), and a subcarrier generator status signal.

The three phase-locked loops are identified in figure 2 as follows:

a. The 456.29 kHz phase-locked loop consists of loop mixer (Q5), squaring amplifier (U6D, E, F), phase/frequency detector (U1, U2, U3), integrator-filter (U4A, B) and vco-buffer (Q1, Q2, Q3).

b. The 443.71 kHz phase-locked loop consists of loop mixer (Q7), squaring amplifier (U6A, B, C), phase/frequency detector (U17, U18, U19), integrator-filter (U20A, B), and vco-buffer (Q8, Q9, Q10).



Synthesizer Subcarrier Generator
Figure 1

c. The 6.29-kHz, phase-locked loop consists of divide-by-100 circuits (U7, U13), phase/frequency detector (U8, U9, U10), divide-by-629 circuit (U15, U16), integrator-filter (U11A), 629-kHz vco (U12) and logic converter (Q4).

A 100-kHz reference signal from an external source is divided by 100 and routed as a 1-kHz signal to a phase/frequency detector. A 629-kHz vco signal is also routed through a divide-by-629 circuit to the phase/frequency detector. The phase/frequency detector provides two outputs to the integrator-filter. When the input signals are in phase, the two outputs are high. When the input signals are out of phase, one output signal is high and the other is low. The output signals from the phase/frequency detector are filtered by an RC circuit in the integrator-filter. A dual-input integrator responds to the relative difference of potential of the inputs. The output remains constant if both inputs are at the same voltage level. However, when the voltage level of the inputs are different, the integrator output will vary at a rate and magnitude determined by the voltage difference of the inputs. The output of the integrator is applied to the vco. The vco output frequency is controlled by this closed loop. The output (629 kHz) of the vco is also routed through a logic converter to a divide-by-100 circuit. This circuit provides a 6.29-kHz reference signal for both output phase-locked loops.

A 450-kHz reference signal from an external source is amplified, buffered, and routed to the two output phase-locked loops. The 450-kHz reference signal is mixed with a voltage-controlled oscillator signal in a loop mixer. The resultant signal (6.29 kHz) is routed through a squaring amplifier to a phase/frequency detector. The phase of the 6.29-kHz reference signal is compared with the phase of the 6.29-kHz, phase-locked loop signal. The output voltages of the phase/frequency detector are routed through an integrator-filter to the vco as previously explained. The vco output frequency is controlled by this closed loop.

2.2 6.29-kHz, Phase-Locked Loop (Refer to figure 2 and figure 3, the schematic diagram.)

A 100-kHz signal from an external source is routed from connector P1-14 to the divide-by-100 integrated circuit U7. U7 is a high-speed, programmable down counter. It is connected to divide the input signal of 100 kHz by a factor of 100 and to produce an output signal of 1 kHz. This signal is applied to a NAND gate (U8A) in the phase/frequency detector.

The other input to the phase/frequency detector originates in the 629-kHz vco (U12). The output of vco is routed to logic converter Q4. This circuit converts the vco output logic from emitter-coupled logic to transistor-to-transistor logic. The reference vco output frequency (629 kHz) is routed to a divide-by-629 circuit (U15 and U16). The output of 1 kHz from this circuit is routed to the phase/frequency detector.

The phase/frequency detector (U8A, B, C, U9A, B, C, and U10) receives two input signals and provides two outputs to the integrator-filter. A reference input signal of 1 kHz is provided by the divide-by-100 circuit (U7). A variable input signal of 1 kHz is provided by the divide-by-629 circuit (U15 and U16). When the reference and variable input signals are in phase, the output signals of the phase/frequency detector are both high. When the input signals are out of phase, one output is high and the other is low.

The phase/frequency discriminator is triggered by the negative edge of the reference and variable input signals. The two output signals are both high if the reference and variable input signals are in phase. If the variable input signal leads the reference input signal, one output (variable) will be low for the time interval between the variable and reference input pulses. If the variable input signal lags the reference signal, one output (reference) will be low for the time interval between the variable and reference input pulses. The output voltages are routed to the integrator-filter.

The integrator-filter consists of operational amplifier U11A and the associated circuit. The filter bandwidth is narrow enough to reduce spurious levels and wide enough to minimize lock time and allow the natural tendency of the phase-lock loop to track the desired signal. This signal is routed to varicap CR5 in the vco. As the capacitance of the varicap varies, the frequency of the vco changes.

The reference vco output frequency (629 kHz) is also routed to a divide-by-100 circuit U13. The output of this circuit (6.29 kHz) is applied to the phase/frequency detectors in the 456.29 kHz and 443.71 kHz phase-locked output loops.

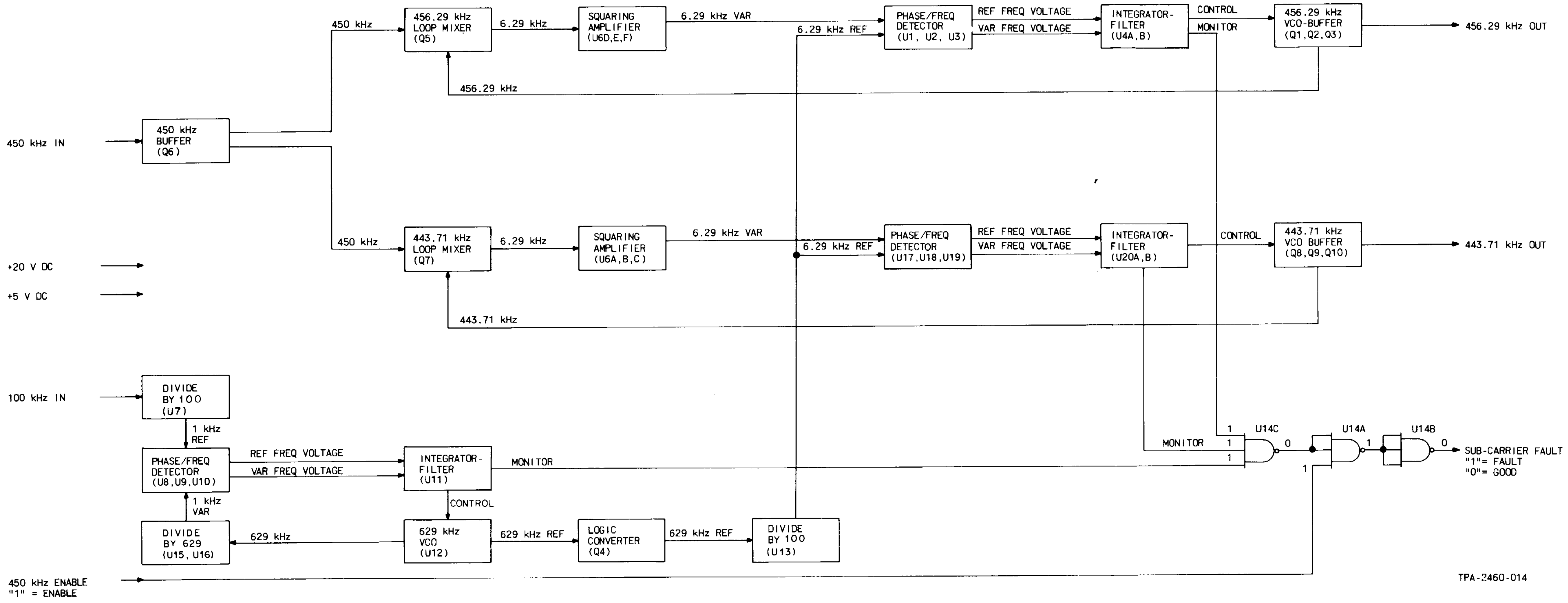
2.3 456.29-kHz Phase-Locked Loop (Refer to figure 2 and figure 3, the schematic diagram.)

A 450-kHz signal from an external source is routed from connector P1-16 to the 450-kHz buffer (Q6). The buffer circuit provides amplification and isolation. The buffer provides input signal for the loop mixers of both the 456.29-kHz and 443.71-kHz, phase-locked loops.

The loop mixer (Q5) is a dual gate MOSFET. The 450-kHz reference signal from the buffer is applied to gate 2, and the vco output frequency (456.29 kHz) is applied to gate 1. The mixer action produces an output signal of 6.29 kHz. This signal is routed through a low-pass filter to the squaring amplifier.

The squaring amplifier (U6D, E, F) is a three-stage amplifier-inverter. The squaring amplifier converts the sine-wave input into a square-wave output which is compatible with transistor-to-transistor logic. The 6.29-kHz input signal is amplified and buffered and routed to the phase/frequency detector.

The phase/frequency detector (U1, U2, U3) receives two input signals and provides two outputs to the



Synthesizer Subcarrier Generator, Block Diagram
Figure 2

integrator-filter. A 6.29-kHz variable signal is provided by the squaring amplifier (U6D, E, F). A 6.29-kHz reference signal is provided by the 6.29-kHz, phase-locked loop. When the reference and variable input signals are in phase, the output signals of the phase/frequency detector are both high. When the input signals are out of phase, one output is high and the other is low.

The phase/frequency discriminator is triggered by the negative edge of the reference and variable input signals. The two output signals are both high if the reference and variable input signals are in phase. If the variable input signal leads the reference input signal, one output (variable) will be low for the time interval between the variable and reference input pulses. If the variable input signal lags the reference signal, one output (reference) will be low for the time interval between the variable and reference input pulses. The output voltages are routed to the integrator-filter.

The integrator-filter consists of two operational amplifiers (U4A, B) and RC filters. The output signals from the phase/frequency detector is applied to RC filters (R1-R4 and C1-C2). The RC filters act to smooth the signal. These signals are then applied to the dual inputs of integrator U4B. The integrator output remains constant if both inputs are at the same voltage level. If the input voltage levels are not equal, the integrator output will change at a rate and direction determined by the magnitude and polarity of the input voltage difference. The output signal from integrator U4B is routed to operational amplifier U4A. Operational amplifier U4A is an active filter. The output signal from operational amplifier U4A is applied to a voltage-variable capacitor in the vco-buffer. This signal controls the frequency of the vco.

The frequency of the voltage-controlled oscillator (Q1) is controlled by the input signal from the integrator-filter. This signal is applied to varicap CR2. As the input signal varies, the capacitance of varicap CR2 varies. This changes the frequency of the vco. The output of the vco is amplified and buffered by transistor amplifiers Q2 and Q3. The output signal (456.29 kHz) is routed to external circuits and to the 456.29-kHz loop mixer Q5.

2.4 443.71-kHz, Phase-Locked Loop (Refer to figure 2 and figure 3, the schematic diagram.)

With the exception of the output frequency, the operation of the 443.71-kHz, phase-locked loop and the 456.29-kHz, phase-locked loop are identical. Refer to paragraph 2.3 for the theory of operation of the 456.29-kHz, phase-locked loop.

2.5 Synthesizer Subcarrier Generator Status (Refer to figure 2 and figure 3, the schematic diagram.)

The synthesizer subcarrier generator status circuit consists of NAND gates U14A, B, and C. When the three phase-locked loops are in a locked status, a logic 1 signal is provided from lock detector diodes CR4, CR12; CR9, CR10; CR6, CR11; and associated circuits. With a logic 1 input to all terminals, NAND gate U14C produces a logic 0 output. This logic 0 is applied to U14A. If the other input (450-kHz enable) signal to U14A is logic 1, the output is a logic 1. NAND gate U14B acts as an inverter for these signals. If all conditions are normal, a logic 0 signal is available for monitoring by external circuits. If a fault occurs or a signal is lost, a fault signal (logic 1) is produced.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer subcarrier generator are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check the total performance of the synthesizer subcarrier generator. These procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic diagram (figure 3) to trace the source of the fault.

4. ALIGNMENT/ADJUSTMENT

Refer to table 1 for the following adjustments.

a. 443.71-kHz output level, test 3
b. 456.29-kHz output level, test 5
c. 629-kHz loop control level, test 7
d. 456.29-kHz loop control voltage, test 10
e. 443.71-kHz loop control voltage, test 14

Table 1. Synthesizer Subcarrier Generator, Testing and Troubleshooting.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing the synthesizer subcarrier generator that is to be tested. b. Remove synthesizer subcarrier generator. Install it on an extender card, place it in the unit, and connect the extender coaxial cables. c. Set unit LINE SELECTOR switch to 115 V. d. Connect unit to 115 V ac power source and set power on. Initiate frequency change to clear unit fault.		
2. 443.71-kHz output level	Connect rf voltmeter to P1-11. Measure the output level.	300 ±15 mV rms. If normal, proceed to test 4.	Proceed to test 3.
3. 443.71-kHz output level adjustment	a. Connect the rf voltmeter to P1-11. b. Refer to figure 3. Adjust R69 for an output level of 300 mV rms.	300 ±15 mV rms.	Proceed to test 18, and troubleshoot the 443.71-kHz, phase-locked loop.
4. 456.29-kHz output level	Connect rf voltmeter to P1-20. Measure the output level.	300 +15 mV rms. If normal, proceed to test 6.	Proceed to test 5.
5. 456.29-kHz output level adjustment	a. Connect rf voltmeter to P1-20. b. Refer to figure 3. Adjust R16 for an output level of 300 mV rms.	300 ±15 mV rms.	Proceed to test 18, and troubleshoot the 456.29-kHz, phase-locked loop.
6. 629-kHz loop control voltage measurement	Connect digital voltmeter (dvm) to test point E2 (figure 3). Measure the control voltage.	11.0 ±0.2 V dc. If normal, proceed to test 8.	Proceed to test 7.
7. 629-kHz loop control voltage adjustment	a. Connect dvm as in test 6. b. Using a nonmetallic tuning tool, adjust inductor L5 (figure 3) for an indication of 11.0 V dc on the dvm. Note Suggested setting for oscilloscope controls for ripple content measurements. Horizontal scale-1 ms/cm. Vertical channel coupling-ac. Vertical scale-as required. Triggering-internal.	11.0 ±0.2 V dc.	Proceed to test 18.e, and troubleshoot the 629-kHz, phase-locked loop.

Table 1. Synthesizer Subcarrier Generator, Testing and Troubleshooting (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. 629-kHz loop ripple content	Connect oscilloscope to test point E2 (figure 3). Measure the ripple content.	0.2 V p-p maximum.	Proceed to test 18.e, and troubleshoot the 629-kHz, phase-locked loop.
9. 456.29-kHz loop control voltage measurement	Connect dvm to test point E1 (figure 3). Measure the control voltage.	11.5 ±0.2 V dc. If normal, proceed to test 11.	Proceed to test 10.
10. 456.29-kHz loop control voltage adjustment	a. Connect dvm as in test 9.		
	b. Using a nonmetallic tuning tool, adjust inductor L1 for an indication of 11.5 V dc on the dvm.	11.5 +0.2 V dc.	Proceed to test 10.c.
	c. Repeat test 5.	Same as test 5.	Same as test 5.
11. 456.29-kHz loop ripple content	Connect oscilloscope to test point E1 (figure 3). Measure the ripple content. Refer to test 8 for suggested oscilloscope control settings.	20 mV p-p maximum.	Proceed to test 18, and troubleshoot the 456.29-kHz, phase-locked loop.
12. 456.29-kHz frequency	Connect frequency counter to test point E1 (figure 3). Measure the frequency.	456.29 ±0.005 kHz.	Proceed to test 18, and troubleshoot the 456.29-kHz, phase-locked loop.
13. 443.71-kHz loop control voltage measurement	Connect dvm to test point E3 (figure 3). Measure the control voltage.	11.5 ±0.2 V dc. If normal, proceed to test 15.	Proceed to test 14.
14. 443.71-kHz loop control voltage adjustment	a. Connect dvm as in test 13.		
	b. Using a nonmetallic tuning tool, adjust inductor L8 for an indication of 11.5 V dc on the dvm.	11.5 ±0.2 V dc.	Proceed to test 14.c.
	c. Repeat test 3.	Same as test 3.	Same as test 3.
15. 443.71-kHz loop ripple content	Connect oscilloscope to test point E3 (figure 3). Measure the ripple content. Refer to test 8 for suggested oscilloscope control settings.	20 mV p-p maximum.	Proceed to test 18, and troubleshoot the 443.71-kHz, phase-locked loop.
16. 443.71-kHz frequency	Connect frequency counter to test point E3 (figure 3). Measure the frequency.	443.71 ±0.005 kHz.	Proceed to test 18, and troubleshoot the 443.71-kHz, phase-locked loop.
17. Fault detection circuit (Cont)	Connect dvm across TP2(+) and TP1(-). Refer to figure 3. Measure the voltage.	Logic 0.	1. Check 450-kHz enable signal at P1-13. 2. Check U14 and associated circuit.

Table 1. Synthesizer Subcarrier Generator, Testing and Troubleshooting (Cont).

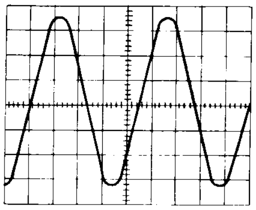
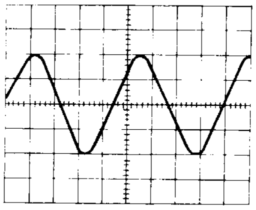
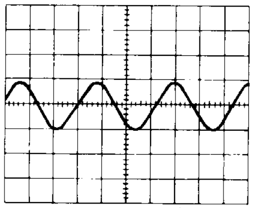
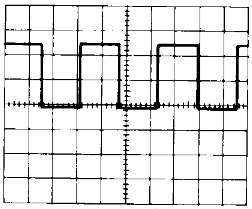
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. (Cont)	**Note** If normal indications were obtained in the preceding tests, the synthesizer subcarrier generator is operational. The following tests are used to isolate a fault to a component or circuit.		
18. Trouble-shooting	a. Connect oscilloscope to gate 2 of Q5 or Q7. Observe waveform. **Note** In the troubleshooting procedures, refer to the parts location diagram for physical location of parts. Refer to the schematic diagram for circuit connections.	 Vert - 1 V/div Horz - 0.5 μs/div	1. Check 450-kHz input signal at P1-16. 2. Check +20 V dc at P1-7. 3. Check Q6 and associated circuit. 4. Check input circuit of Q5 or Q7.
	b. Connect oscilloscope to gate 1 of Q5 or Q7. Observe waveform.	 Vert - 0.1 V/div Horz - 0.5 μs/div	1. Check 456.29-kHz vco-buffer (Q1, Q2, Q3) or 443.71-kHz vco-buffer (Q8, Q9, Q10). 2. Check input circuit.
	c. Connect oscilloscope to U6 pins 9/7. Observe waveform.	 Vert - 0.5 V/div Horz - 50 μs/div	1. Check Q5 or Q7 and associated circuit. 2. Check +5 V dc at P1-8.
(Cont)	d. Connect oscilloscope to U6 pins 2/15. Observe waveform.	 Vert - 2 V/div Horz - 50 μs/div	Check U6 and associated circuit.

Table 1. Synthesizer Subcarrier Generator, Testing and Troubleshooting (Cont).

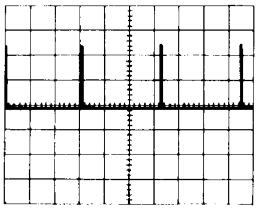
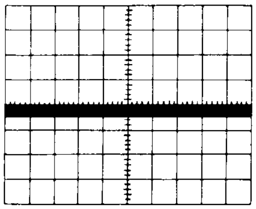
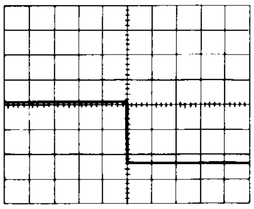
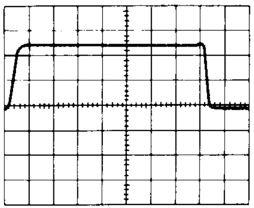
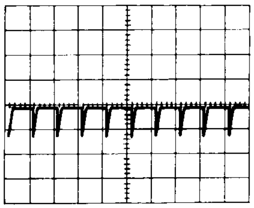
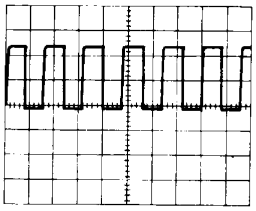
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
18. (Cont)	e. Connect oscilloscope to U13 pin 1. Observe waveform.	 Vert - 2 V/div Horz - 50 μs/div	1. Check U13 and associated circuit. 2. Proceed to test 18.g.
	f. Connect oscilloscope to test point E1/E3. Observe waveform. Typically all that is seen at these test points is low-level, high-frequency noise. **Note** Unless a fault exists in the 629-kHz loop circuit, the synthesizer subcarrier generator is operational.	 Vert - 10 mV/div Horz - 1 ms/div	Check U4 or U20 and associated circuit.
	g. Connect oscilloscope to U7 - pin 1. Observe waveform.	 Vert - 2 V/div Horz - 2 μs/div	1. Check 100-kHz input signal at P1-14. 2. Check U7 and associated circuit.
	h. Connect oscilloscope to U16 - pin 1. Observe waveform.	 Vert - 2 V/div Horz - 0.2 μs/div	Check U16, U15, and associated circuits.
	i. Connect oscilloscope to test point E2. Observe waveform. The amplitude and polarity of this waveform may vary greatly.	 Vert - 20 mV/div Horz - 1 ms/div	Check U8, U9, U10, U11, and associated circuit.
(Cont)			

Table 1. Synthesizer Subcarrier Generator, Testing and Troubleshooting (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
18. (Cont)	j. Connect oscilloscope to collector of Q4. Observe waveform.	 Vert - 2 V/div Horz - 1 µs/div	1. Check Q4 and associated circuit. 2. Check U12 and associated circuit.

5. REPAIR

Repair of the synthesizer subcarrier generator is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change.

Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

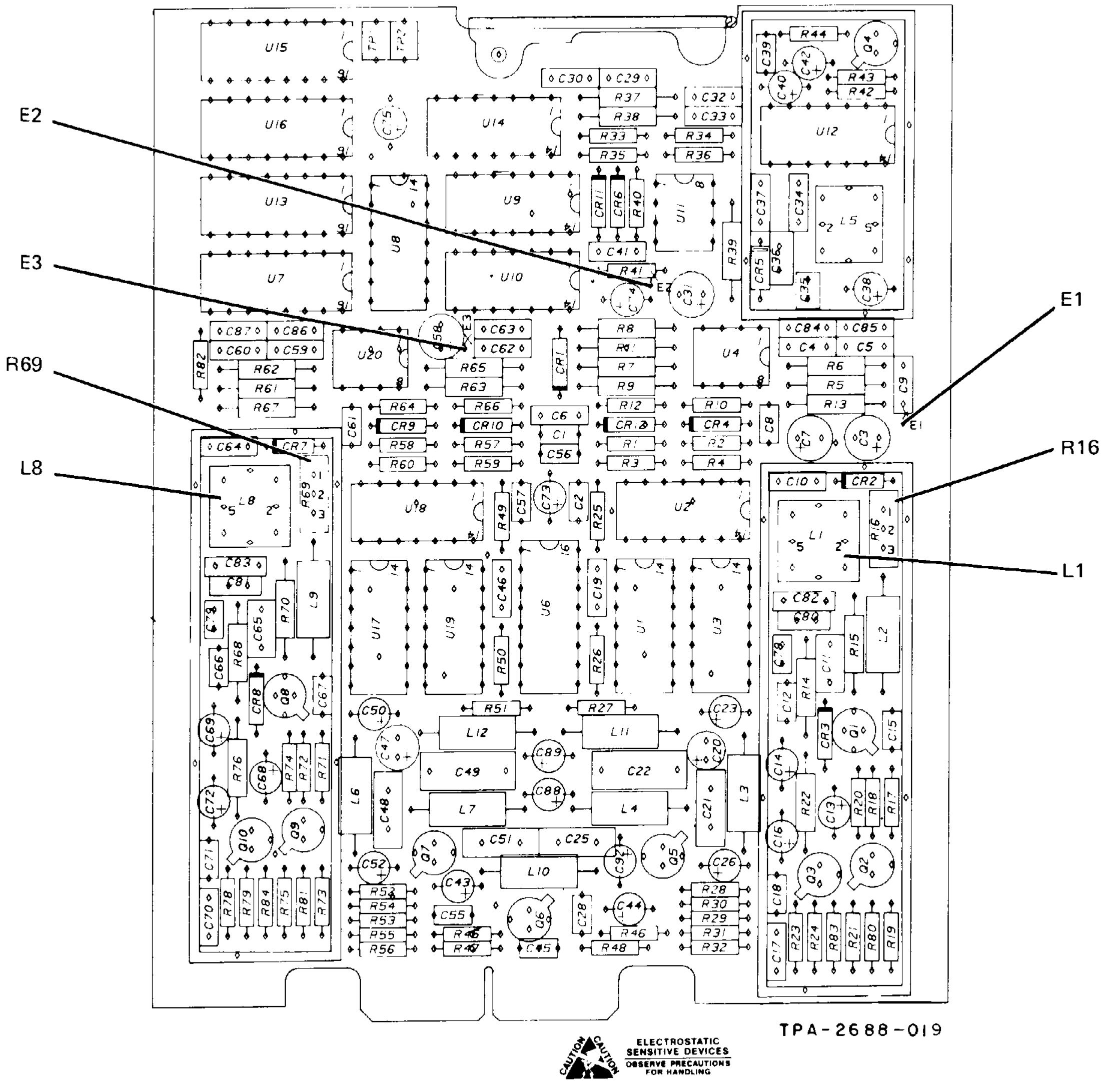
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801
25088	SIEMENS CORP 186 WOOD AVE S ISELIN NJ 08830
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
93958	REPUBLIC ELECTRONICS CORP 176 E 7TH ST PATERSON NJ 07524
96906	MILITARY STANDARD

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer Subcarrier Generator	638-6962-001	REV D



Synthesizer Subcarrier Generator, Schematic Diagram
Figure 3 (Sheet 1 of 3)

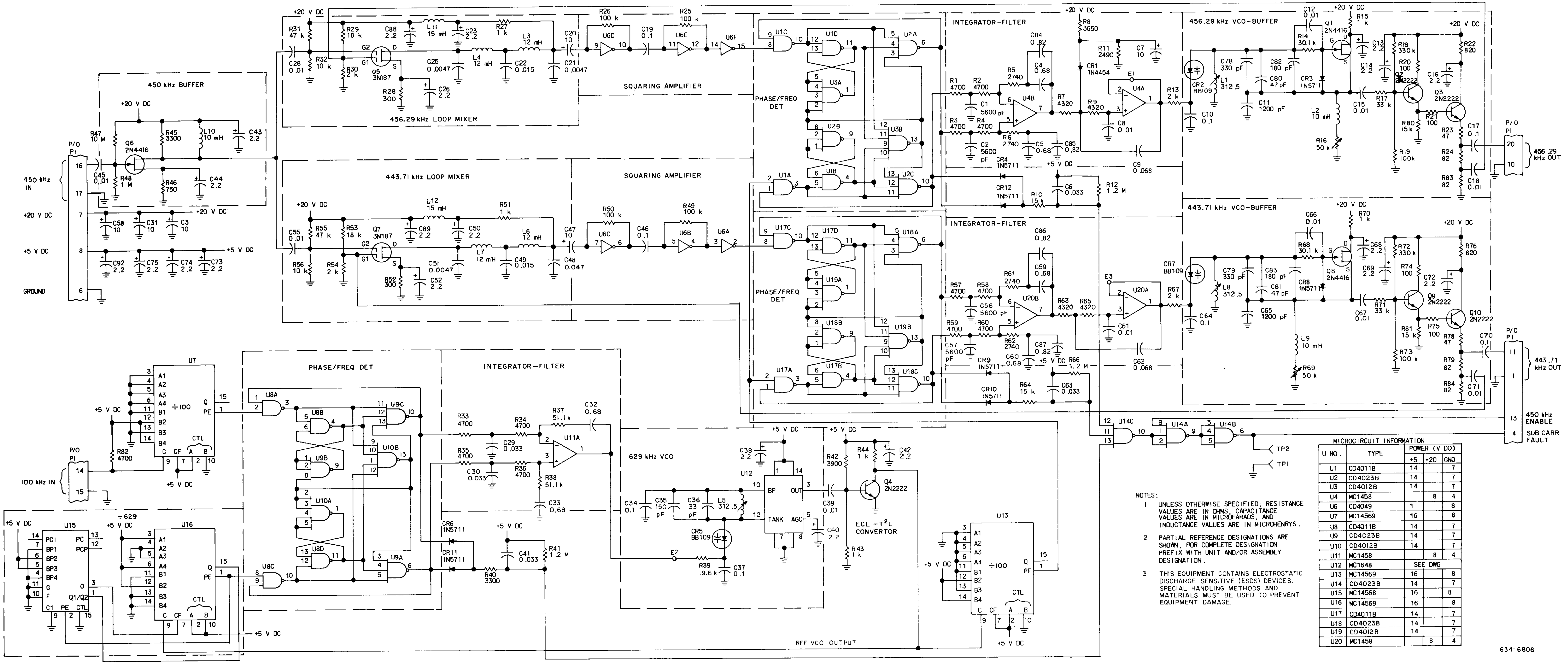
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTHESIZER SUBCARRIER GENERATOR (ESDS)	638-6962-001			
CR1	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR2	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR3,CR4	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR5	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR6	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR7	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR8-CR12	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
C1,C2	CAPACITOR,FXD CER DIEL, 5600PF, PORM10%, 100V	913-5019-170		81349	CK05BX562K
C3	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C4,C5	CAPACITOR,FXD CER DIEL, 0.68UF, PORM10%, 50V	913-5019-540		81349	CK06BX684K
C6	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-380		81349	CK06BX333K
C7	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C8	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C9	CAPACITOR,FXD CER DIEL, 0.068UF, PORM10%, 100V	913-5019-420		81349	CK06BX683K
C10	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C11	CAPACITOR,FXD CER DIEL, 1200PF, PORM5%, 100V	913-3281-290		18796	8131-100C0G122J
C12	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C13,C14	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C15	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C16	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C17	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C18	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C19	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C20	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C21	CAPACITOR,FXD CER DIEL, 4700PF, PORM5%, 100V	913-3281-370		18796	8141M100C0G472J
C22	CAPACITOR,FXD CER DIEL, 0.015UF, PORM10%, 100V	913-3281-230		18796	8151-100C0G153K
C23	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C24	NOT USED				
C25	CAPACITOR,FXD CER DIEL, 4700PF, PORM5%, 100V	913-3281-370		18796	8141M100C0G472J
C26	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C27	NOT USED				
C28	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C29,C30	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-380		81349	CK06BX333K
C31	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C32,C33	CAPACITOR,FXD CER DIEL, 0.68UF, PORM10%, 50V	913-5019-540		81349	CK06BX684K
C34	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C35	CAPACITOR,FXD CER DIEL, 0.00015UF, 5%, 100V	913-3117-050		56289	1CC0G151X5100C4
C36	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		93790	CD5EY330J0
C37	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C38	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C39	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C40	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C41	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-380		81349	CK06BX333K
C42	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C43,C44	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C45	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C46	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C47	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C48	CAPACITOR,FXD CER DIEL, 4700PF, PORM5%, 100V	913-3281-370		18796	8141M100C0G472J
C49	CAPACITOR,FXD CER DIEL, 0.015UF, PORM10%, 100V	913-3281-230		18796	8151-100C0G153K
C50	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C51	CAPACITOR,FXD CER DIEL, 4700PF, PORM5%, 100V	913-3281-370		18796	8141M100C0G472J
C52	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C53,C54	NOT USED				
C55	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C56,C57	CAPACITOR,FXD CER DIEL, 5600PF, PORM10%, 100V	913-5019-170		81349	CK05BX562K
C58	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C59,C60	CAPACITOR,FXD CER DIEL, 0.68UF, PORM10%, 50V	913-5019-540		81349	CK06BX684K
C61	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C62	CAPACITOR,FXD CER DIEL, 0.068UF, PORM10%, 100V	913-5019-420		81349	CK06BX683K
C63	CAPACITOR,FXD CER DIEL, 0.033UF, PORM10%, 100V	913-5019-380		81349	CK06BX333K
C64	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C65	CAPACITOR,FXD CER DIEL, 1200PF, PORM5%, 100V	913-3281-290		18796	8131-100C0G122J
C66,C67	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C68,C69	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C70	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C71	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C72-C75	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C76,C77	NOT USED				
C78,C79	CAPACITOR,FXD CER DIEL, 0.00033UF, 5%, 100V	913-3117-070		56289	1CC0X381X5100C4
C80,C81	CAPACITOR,FXD CER DIEL, 47PF, 10%, 75V	913-1098-020		72982	8111A075C0G0-470 K
C82,C83	CAPACITOR,FXD CER DIEL, 180PF, 2%, 75V	913-3872-000		93958	44696-9
C84-C87	CAPACITOR,FXD CER DIEL, 0.82UF, PORM10%, 50V	913-5019-550		81349	CK06BX824K
C88,C89	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
C90,C91	NOT USED				
C92	CAPACITOR,FXD TNTLM ELCTLT, 2.2UF, 20%, 25V	184-9102-660		56289	199D225X0025BE3
L1	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L2	COIL,RF 10000UH	240-2715-610		96906	MS75089-35
L3,L4	COIL,RF 12000UH	240-2715-620		96906	MS75089-36
L5	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L6,L7	COIL,RF 12000UH	240-2715-620		96906	MS75089-36
L8	INDUCTOR,RF	242-0441-010		02113	242-0441-010
L9,L10	COIL,RF 10000UH	240-2715-610		96906	MS75089-35
L11,L12	COIL,RF 15000UH	240-2715-630		96906	MS75089-37
Q1	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q2-Q4	TRANSISTOR	352-0661-020		07263	2N2222A
Q5	TRANSISTOR (ESDS)	352-1093-010		02735	3N187
Q6	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q7	TRANSISTOR (ESDS)	352-1093-010		02735	3N187

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
Q8	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q9,Q10	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R4	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R5,R6	RESISTOR,FXD FILM, 2.74K, 1%, 1/8W	705-1017-000		81349	RN55D2741F
R7	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R8	RESISTOR,FXD FILM, 3.65K, 1%, 1/8W	705-1023-000		81349	RN55D3651F
R9	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R10	RESISTOR,FXD CMPSN, 15K, 10%, 1/8W	745-2383-000		81349	RCR05G153KS
R11	RESISTOR,FXD FILM, 2.49K, 1%, 1/8W	705-1015-000		81349	RN55D2491F
R12	RESISTOR,FXD CMPSN, 1.2MEGO, 5%, 1/8W	745-1864-270		81349	RCR05G125JS
R13	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R14	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R15	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R16	RESISTOR,VAR 50K, 5%, 1/2W	381-1770-000		80294	3290W1-503
R17	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R18	RESISTOR,FXD CMPSN, 330K, 10%, 1/8W	745-2431-000		81349	RCR05G334KS
R19	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R20,R21	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R22	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R23	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/8W	745-2292-000		81349	RCR05G470KS
R24	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/8W	745-2301-000		81349	RCR05G820KS
R25,R26	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R27	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R28	RESISTOR,FXD CMPSN, 300 OHMS, 5%, 1/8W	745-1863-360		81349	RCR05G301JS
R29	RESISTOR,FXD CMPSN, 18K, 10%, 1/8W	745-2386-000		81349	RCR05G183KS
R30	RESISTOR,FXD CMPSN, 2K, 5%, 1/8W	745-1863-560		81349	RCR05G202JS
R31	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R32	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R33-R36	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R37,R38	RESISTOR,FXD FILM, 51.1K, 1%, 1/8W	705-1078-000		81349	RN55D5112F
R39	RESISTOR,FXD FILM, 19.6K, 1%, 1/8W	705-1058-000		81349	RN55D1962F
R40	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R41	RESISTOR,FXD CMPSN, 1.2MEGO, 5%, 1/8W	745-1864-270		81349	RCR05G125JS
R42	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/8W	745-2362-000		81349	RCR05G392KS
R43,R44	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R45	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/8W	745-2359-000		81349	RCR05G332KS
R46	RESISTOR,FXD CMPSN, 750 OHMS, 5%, 1/8W	745-1863-460		81349	RCR05G751JS
R47	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/8W	745-1864-850		81349	RCR05G106KS
R48	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R49,R50	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R51	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R52	RESISTOR,FXD CMPSN, 300 OHMS, 5%, 1/8W	745-1863-360		81349	RCR05G301JS
R53	RESISTOR,FXD CMPSN, 18K, 10%, 1/8W	745-2386-000		81349	RCR05G183KS
R54	RESISTOR,FXD CMPSN, 2K, 5%, 1/8W	745-1863-560		81349	RCR05G202JS
R55	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R56	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R57-R60	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R61,R62	RESISTOR,FXD FILM, 2.74K, 1%, 1/8W	705-1017-000		81349	RN55D2741F
R63	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R64	RESISTOR,FXD CMPSN, 15K, 10%, 1/8W	745-2383-000		81349	RCR05G153KS
R65	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R66	RESISTOR,FXD CMPSN, 1.2MEGO, 5%, 1/8W	745-1864-270		81349	RCR05G125JS
R67	RESISTOR,FXD FILM, 2K, 1%, 1/8W	705-3605-140		81349	RN55D2001F
R68	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R69	RESISTOR,VAR 50K, 5%, 1/2W	381-1770-000		80294	3290W1-503
R70	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R71	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R72	RESISTOR,FXD CMPSN, 330K, 10%, 1/8W	745-2431-000		81349	RCR05G334KS
R73	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W	745-2413-000		81349	RCR05G104KS
R74,R75	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R76	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R77	NOT USED				
R78	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/8W	745-2292-000		81349	RCR05G470KS
R79	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/8W	745-2301-000		81349	RCR05G820KS
R80,R81	RESISTOR,FXD CMPSN, 15K, 10%, 1/8W	745-2383-000		81349	RCR05G153KS
R82	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R83,R84	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/8W	745-2301-000		81349	RCR05G820KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
U1	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U2	INTEGRATED CIRCUIT (ESDS)	351-8159-360		07263	4023BPC
U3	INTEGRATED CIRCUIT (ESDS)	351-8159-350		07263	4012BPC
U4	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC
U5	NOT USED				
U6	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U7	MICROCIRCUIT (ESDS)	351-8882-010		04713	MC14569BCP
U8	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U9	INTEGRATED CIRCUIT (ESDS)	351-8159-360		07263	4023BPC
U10	INTEGRATED CIRCUIT (ESDS)	351-8159-350		07263	4012BPC
U11	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC
U12	INTEGRATED CIRCUIT	351-7768-010		04713	MC1648P
U13	MICROCIRCUIT (ESDS)	351-8882-010		04713	MC14569BCP
U14	INTEGRATED CIRCUIT (ESDS)	351-8159-360		07263	4023BPC
U15	INTEGRATED CKT (ESDS)	351-8883-010		04713	MC14568BCP
U16	MICROCIRCUIT (ESDS)	351-8882-010		04713	MC14569BCP
U17	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U18	INTEGRATED CIRCUIT (ESDS)	351-8159-360		07263	4023BPC
U19	INTEGRATED CIRCUIT (ESDS)	351-8159-350		07263	4012BPC
U20	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC

Synthesizer Subcarrier Generator, Schematic Diagram
Figure 3 (Sheet 2)



NOTES:

1 UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.

2 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

3 THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

U NO.	TYPE	POWER (V DC)		
		+5	+20	GND
U1	CD4011B	14		7
U2	CD4023B	14		7
U3	CD4012B	14		7
U4	MC1458		8	4
U6	CD4049	1		8
U7	MC14569	16		8
U8	CD4011B	14		7
U9	CD4023B	14		7
U10	CD4012B	14		7
U11	MC1458		8	4
U12	MC1648	SEE DWG		
U13	MC14569	16		8
U14	CD4023B	14		7
U15	MC14568	16		8
U16	MC14569	16		8
U17	CD4011B	14		7
U18	CD4023B	14		7
U19	CD4012B	14		7
U20	MC1458		8	4

Synthesizer Subcarrier Generator, Schematic Diagram
Figure 3 (Sheet 3)

Synthesizer Reference (642-2451-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

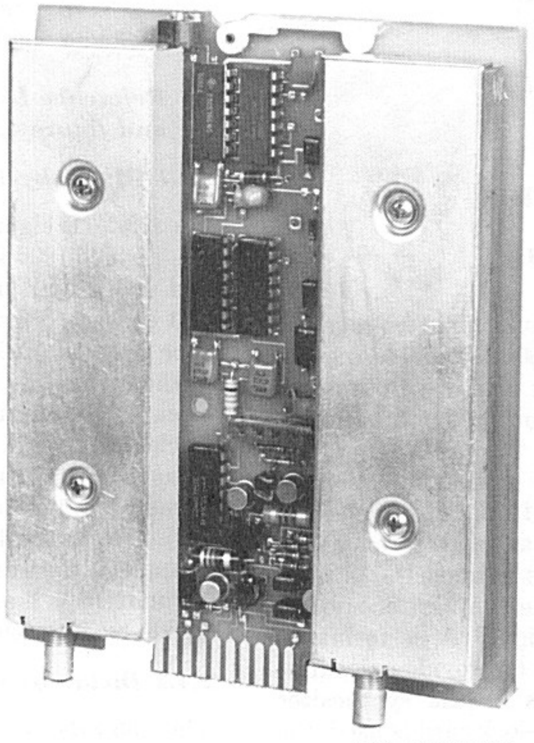
Printed in USA

523-0770715-001211
1 January 1981

1. DESCRIPTION

Synthesizer Reference 642-2451-001, shown in figure 1, contains a 3-layer planar card and two rf secure compartments (metal box construction) that contain two printed circuit cards. It has provisions for mounting an external phase-lock card that is used with an external frequency standard. The 3-layer planar card has a 20-pin edge-on connector.

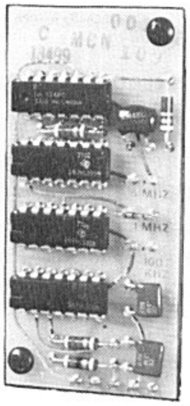
The synthesizer reference consists of temperature-compensated crystal oscillator (tcxo) A1, times 12 (x 12) multiplier A2, and reference divider A3. Provisions are provided for using an optional external phase-lock circuit card.



Synthesizer Reference
Figure 1

External Phase Lock 635-0655-001, shown in figure 2, is an optional printed circuit board that mounts to the synthesizer reference and allows an external frequency standard to be used. The external phase-lock card is a 2-layer circuit card that uses a 5-pin connector to mate with the synthesizer reference.

The external phase-lock card consists of a squaring amplifier, a divide-by-10 circuit, a divide-by-5 circuit, and a phase discriminator. Provisions are provided for using a 100-kHz, 1-MHz, or 5-MHz external frequency standard.


TP5-3193-017

External Phase Lock
Figure 2

2. PRINCIPLES OF OPERATION

2.1 General (Refer to figure 3.)

The synthesizer reference receives input voltages of +20 V dc and +5 V dc and a 450-kHz enable/disable signal. It generates a 9.9-MHz sine-wave output, a 118.8-MHz output, a 450-kHz output, and two 100-kHz reference signal outputs. The 9.9-MHz, 118.8-MHz, and 450-kHz outputs are used as injection inputs to the rf translator and if amplifiers, and the 100-kHz outputs are used as a reference for generating the variable injection frequencies. In addition, the 450-kHz is used by the synthesizer subcarrier generator as a reference signal. A performance monitor signal is also supplied to provide an indication of the operational status of the synthesizer reference. If the external phase-lock card is used, the synthesizer reference outputs are phase-locked to an external 100-kHz, 1-MHz, or 5-MHz frequency standard.

2.2 TCXO A1 (Refer to figure 3 and figure 4, the schematic diagram.)

The tcxo (Y1, Q1, Q2) is a voltage-controlled, temperature-compensated crystal oscillator. When used with its internal compensation circuit, RT1 through RT3 provide a temperature-compensated voltage control signal to the crystal oscillator. The crystal oscillator supplies a 9.9-MHz signal through one output amplifier (Q4) to the rf translator for fixed 9.9-MHz signal injection. The 9.9-MHz output signal is also routed to the performance monitor circuit. The crystal oscillator supplies the 9.9-MHz signal through a second output amplifier (Q3) to an inverter (U4C).

The 9.9-MHz signal is received by divide-by-11 circuit reference divider A3 and through a second inverter (U4D) to the times 12 multiplier A2.

2.3 Times 12 Multiplier (Refer to figure 3 and figure 4, the schematic diagram.)

The 9.9-MHz-signal is received by the times 12 multiplier, multiplied and applied to crystal filter Y1 (118.8 MHz), and produces an output 12 times the frequency of the applied input. The 118.8-MHz output is supplied to the rf translator for fixed 118.8-MHz signal injection. The 118.8-MHz signal is also amplified by amplifier Q11 and Q12 and routed to the performance monitor circuit.

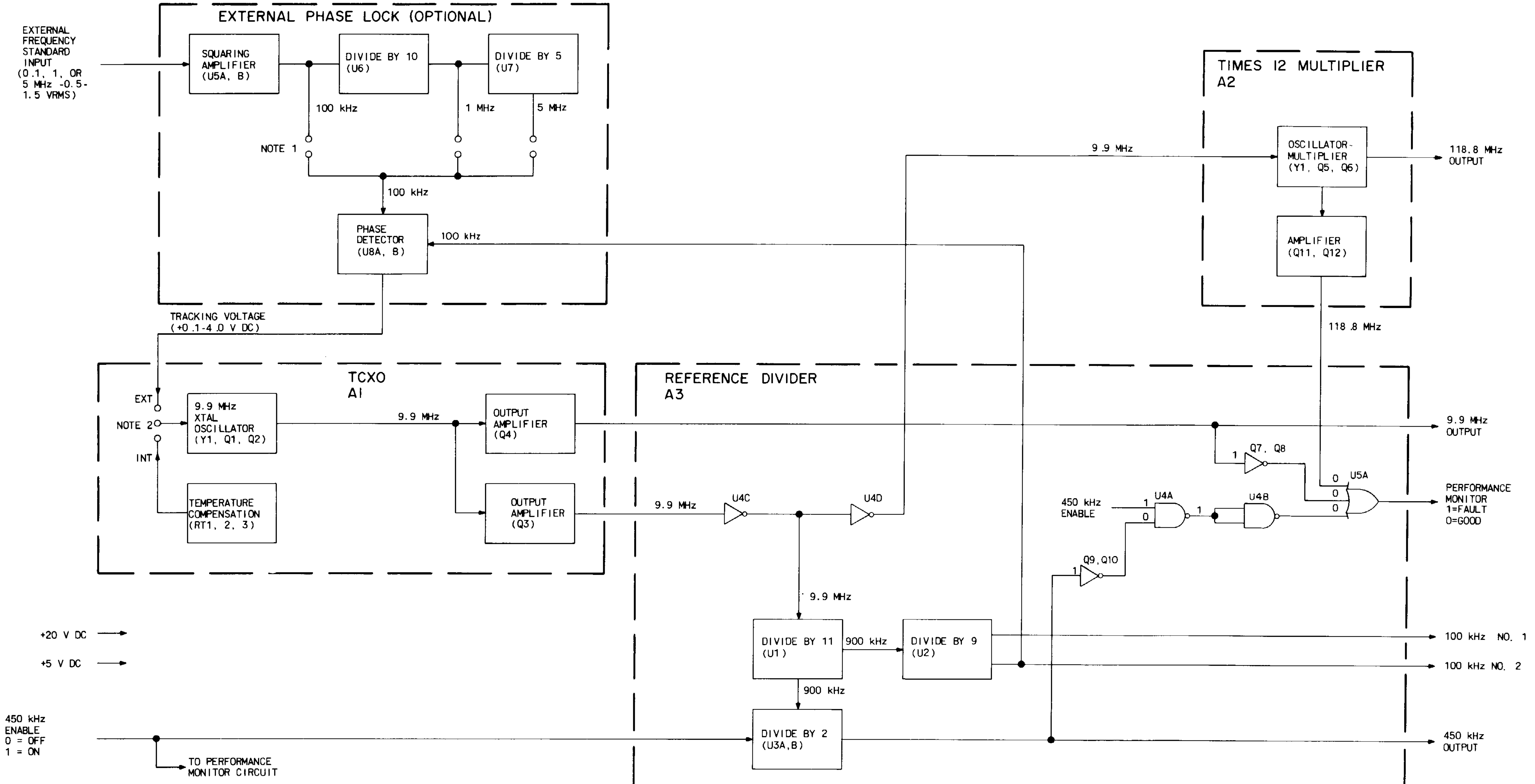
2.4 Reference Dividers (Refer to figure 3 and figure 4, the schematic diagram.)

2.4.1 Divide-by-11

The 9.9-MHz signal is received by divide-by-11 circuit U1, divided (900 kHz), and applied to divide-by-9 U2 and divide-by-2 circuit U3A, B. The divide-by-11 circuit consists of an up/down decade counter and a D-type flip-flop. Refer to table 1 for the logic truth table of the divide-by-11 circuit. Note that when the ripple clock (RC) output resets the D-type flip-flop, it latches the reset condition until the ripple clock is removed (after the next clock input). This causes the decade counter to be loaded at counter 0 for the last half of clock 9, all of clock 10, and until after clock 11 is applied; then the load (L) logic 0 is removed. Clock 12 and clock 1 are one and the same, producing a divide-by-11 circuit.

2.4.2 Divide-by-9

The 900-kHz signal from divide-by-11 circuit U1 is received by divide-by-9 circuit U2, divided (100 kHz), and applied as two 100-kHz reference signals to the unit under control and to the external phase lock (if



NOTES:
1. CONNECT STRAP ACCORDING TO EXTERNAL FREQUENCY INPUT.
2. CONNECT STRAP TO EXT IF EXTERNAL FREQUENCY STANDARD IS USED. CONNECT STRAP TO INT FOR INTERNAL TEMPERATURE COMPENSATION.

TPA-2499-014

Synthesizer Reference, Block Diagram
Figure 3

Table 1. Divide-by-11 Logic Truth Table.

CLOCK INPUT	U1						U3A				
	OUTPUTS						INPUTS			OUTPUTS	
	QA	QB	QC	QD	RC	COUNT	C	D	R	Q	$\overline{Q}$
1	1	0	0	0	1	1	1	1	1	1	0
2	0	1	0	0	1	2	2	1	1	1	0
3	1	1	0	0	1	3	3	1	1	1	0
4	0	0	1	0	1	4	4	1	1	1	0
5	1	0	1	0	1	5	5	1	1	1	0
6	0	1	1	0	1	6	6	1	1	1	0
7	1	1	1	0	1	7	7	1	1	1	0
8	0	0	0	1	1	8	8	1	1	1	0
9	1	0	0	1	1	9	9	1	1	1	0
9.5	0	0	0	0	*0	0	9.5	0	1	0	1
10	0	0	0	0	1	0	10	1	1	0	1
11	0	0	0	0	1	0	11	1	1	1	0
12/1	1	0	0	0	1	1	12/1	1	1	1	0

*RC logic 0 appears only for one-half clock cycle time and returns to logic 1 (U1 is reset to start count at 1).

used). The divide-by-9 circuit consists of an up/down decade counter. Refer to table 2 for a logic truth table of the divide-by-9 circuit. Note that the ripple clock (RC) output loads the decade counter to count 0 during the last half of clock 9 and allows the counter to count 1 at clock 10. Clock 10 and clock 1 are one and the same, producing a divide-by-9 circuit.

2.4.3 Divide-by-2

The 900-kHz signal from divide-by-11 circuit U1 is received by divide-by-2 circuit U3A, B, divided (450 kHz), and applied as a 450-kHz carrier reinsertion signal to the unit under control. The 450-kHz output signal is also routed to the performance monitor circuit and the synthesizer subcarrier. The divide-by-2 circuit consists of a D-type flip-flop. The 450-kHz enable signal is applied to pin 10 of U3A. This signal is also routed to the performance monitor circuit. Refer to table 3 for a logic truth table of the divide-by-2 circuit. Note that a logic 0 on the set input disables the divide-by-2 circuit (latches it in the set condition).

Table 2. Divide-by-9 Logic Truth Table.

CLOCK	U2					
	OUTPUTS					
	QA	QB	QC	QD	RC	COUNT
1	1	0	0	0	1	1
2	0	1	0	0	1	2
3	1	1	0	0	1	3
4	0	0	1	0	1	4
5	1	0	1	0	1	5
6	0	1	1	0	1	6
7	1	1	1	0	1	7
8	0	0	0	1	1	8
9	1	0	0	1	1	9
9.5	0	0	0	0	*0	0
10/1	1	0	0	0	1	1

*RC logic 0 appears only for one-half clock cycle time and returns to logic 1 (U1 is reset to start count at 1).

Table 3. Divide-by-2 Logic Truth Table.

INPUTS			OUTPUTS	
Clock	D	S	Q	$\overline{Q}$
→1	0	1	0	1
No change	1	1	No change	
→1	1	1	1	0
No change	0	1	No change	
→1	0	1	0	1
X	X	0	1	0

→1 = change from logic 0 to logic 1
1 = logic 1
0 = logic 0
X = no effect

2.5 *Performance Monitor Circuit (Refer to figure 3 and figure 4, the schematic diagram.)*

The performance monitor circuit is located on reference divider A3. It consists of transistor amplifiers Q7 through Q10, NAND gates U4A and U4B, and OR gate U5A. This circuit monitors the presence of the 118.8 MHz-, 9.9 MHz-, and 450-kHz output signals, and the 450 kHz-enable signal.

The 450-kHz output and 450-kHz enable signal are applied to NAND gate U4A. If both signals are present, the NAND gate produces a logic 1 output. This is inverted and appears as a logic 0 at one input of OR gate U5A.

The 9.9 MHz-output signal is amplified and inverted by amplifiers Q7 and Q8. If this signal is present, a logic 0 signal is routed to one input of OR gate U5A.

The 118.8-MHz output signal is routed to one input of OR gate U5A. If this signal is present, a logic 0 is applied.

When all input signals are present, a logic 0 is applied to all inputs of OR gate U5A. Under these conditions, the output signal is a logic 0. This indicates a good synthesizer reference circuit card. If any one of the input signals are not present, the output of OR gate U5A is a logic 1. This indicates a fault in the synthesizer reference.

2.6 *External Phase Lock (Refer to figure 3 and figure 4, the schematic diagram.)*

The external phase lock receives an external frequency standard signal (5 MHz, 1 MHz, or 100 kHz) and a tcxo 100-kHz reference signal for use in generation of a tracking voltage output for control of the synthesizer reference tcxo. The external phase lock must be internally strapped for the appropriate external frequency standard.

2.6.1 *100-kHz External Standard*

When a 100-kHz external standard is used, it is supplied through squaring amplifier U5A, B to phase detector U8A, B. A 100-kHz internal reference standard is also applied to the phase detector. The 100-kHz signals are phase compared and a resultant tcxo dc input signal is supplied by the external phase lock.

2.6.2 *1-MHz External Standard*

When a 1-MHz external standard is used, it is supplied through squaring amplifier U5A, B to divide-by-10 circuit U6. The 100-kHz output of the divide-by-10 circuit is supplied as a 100-kHz external standard to the phase detector. Refer to paragraph 2.6.1 for operating using the 100-kHz external standard.

2.6.3 *5-MHz External Standard*

When a 5-MHz external standard is used, it is supplied through squaring amplifier U5A, B to divide-by-10 circuit U6. The 500-kHz output of the divide-by-10 circuit is supplied to divide-by-5 circuit U7, and the 100-kHz output of the divide-by-5 circuit is supplied as a 100-kHz external standard to the phase detector. Refer to paragraph 2.6.1 for operation using the 100-kHz external standard.

3. TESTING AND TROUBLESHOOTING

3.1 *Test Equipment and Power Requirements*

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer reference are listed in the maintenance section of this instruction book.

3.2 *Testing*

The test procedures in table 4 check the total performance of the synthesizer reference. The test procedures in table 5 check the total performance of the external phase lock. These procedures permit isolation of a fault to a specific component or circuit when the results are used with the appropriate schematic diagram to trace the source of the fault.

Table 4. Synthesizer Reference Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test Setup	a. Remove top cover of the unit containing the synthesizer reference that is to be tested. b. Remove cover from the synthesizer section of the unit. c. Remove synthesizer reference and install it on an extender card and place it in the unit. d. Set LINE SELECTOR switch to 115 V. e. Connect unit to 115-V ac power source and set power on. Note Refer to the parts location diagram for location of test points and adjustments.		
	f. Measure dc voltage from J1-14 and J1-4 to J1-9 (ground).	+5.2 ±0.2 V dc.	Check unit synthesizer voltage regulator.
	g. Measure dc voltage from J1-12 to J1-9 (ground).	NLT +19.5 V dc, NMT +20.8 V dc.	Check unit synthesizer voltage regulator.
	h. Set unit MODE switch to ISB.		
2. 9.9-MHz output	a. Using an rf voltmeter with a 50-ohm adapter, measure the output at P53.	300 ±75 mV rms.	Adjust A1R20 for 300-mV rms output. Check that tcxo is strapped to INT. If the above does not correct the results, replace tcxo A1.
3. 100-kHz reference outputs	a. Using a frequency counter, measure the output between J1-17 and J1-18 (ground).	100 ±0.1 kHz.	Check A3U4C, A3U3A, B, A3U1 and A3U2.
	b. Using an oscilloscope, check the square-wave outputs of J1-17 and J1-18 (ground).	Negative swing (logic 0) is NMT 0.5 V dc. Positive swing (logic 1) is NLT +3.0 V dc.	Same as test 3.a.
	c. Using a frequency counter, measure the output between J1-15 and J1-18 (ground).	100 ±0.1 kHz.	Same as test 3.a.
	d. Using an oscilloscope, check the square-wave outputs at J1-15 and J1-18 (ground).	Negative swing (logic 0) is NMT 0.5 V dc. Positive swing (logic 1) is NLT +3.0 V dc.	Same as test 3.a.

Table 4. Synthesizer Reference Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. 450-kHz output	a. Using an rf voltmeter with a 50-ohm adapter, measure the output between J1-6 and J1-7 (ground).	300 ±15 mV rms.	If indication is near normal limit, change value of A3R29.
	b. Set unit MODE switch to AM.		Check A3U3A, A3U3B, and associated circuit.
	c. Note the output between J1-6 and J1-7 (ground).	≅ 0 mV rms.	Check A3U3B, A3U3A, and unit 450-kHz disable circuit.
	d. Set MODE switch to ISB.		
	e. Using a frequency counter, measure the output between J1-6 and J1-7 (ground).	450 ±0.5 kHz.	Check A3U3A, A3U3B, and associated circuit.
5. 118.8-MHz output	a. Remove shield that covers crystal A2Y1.		
	b. Using an rf voltmeter with an unloaded probe tip, measure the rf voltage at A2Y1 output.	Note output.	Check A2Q5, A2Y1, and associated circuit.
	c. Adjust A2C24 and A2C28 for maximum output.		
	d. Using an rf voltmeter with a 50-ohm adapter, measure the output at P52.		
	e. Adjust A2C32, A2C24, and A2C28 for maximum output.	500 ±100 mV rms.	Check A2Q6, and associated circuit.
6. 118.8-MHz performance monitor	a. Using a 50-ohm adapter, connect rf voltmeter to P52. Measure and note output level.	500 ±100 mV.	Proceed to test 6.b.
	b. Connect an oscilloscope to J1-20.		
	c. Adjust A2C32 until a logic 1 is indicated on the oscilloscope.	Logic 1.	Check A2Q11, A2Q12, A3U5A, and associated circuit.
	d. Note the output level on rf voltmeter.	75 - 250 mV.	Same as test 6.c.
	e. Readjust A2C32 for proper output level.	500 ±100 mV.	Change x 12 multiplier A2.
7. 9.9-MHz performance monitor	a. Using a 50-ohm adapter, connect rf voltmeter to P53. Measure and note output level.	300 ±75 mV.	Proceed to test 7.b.
	b. Connect oscilloscope to J1-20.		
(Cont)	c. Adjust A1R20 until a logic 1 is indicated on the oscilloscope.	Logic 1.	Check A1Q4, A3Q7, A3Q8, and associated circuit.

Table 4. Synthesizer Reference Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	d. Note the output level on rf voltmeter.	50 - 150 mV.	Same as test 7.c.
	e. Readjust A1R20 for proper output level.	300 ±75 mV.	Replace tcxo A1.
8. 450-kHz performance monitor	a. Connect rf voltmeter across J1-6 (+) and J1-7 (-). Measure and note output level.	300 ±15 mV.	Proceed to test 8.b.
	b. Connect oscilloscope to J1-20.		
	c. Set unit MODE switch to AM. Note waveform on oscilloscope.	Logic 1.	Check A3U4A-B, A3Q9, A3Q10, and associated circuit.
	d. Note output level on rf voltmeter.	Approximately 0 mV.	Same as test 7.c.
	e. Set unit MODE switch to ISB. Note output level on rf voltmeter.	300 ±15 mV.	Replace reference divider A3.

Table 5. External Phase Lock, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test Setup	a. Remove top cover of the unit containing the external phase lock that is to be tested.		
	b. Remove cover from the synthesizer section of the unit.		
	c. Remove synthesizer reference (with external phase lock) and install it on an extender card and place it in the unit.		
	d. Set unit LINE SELECTOR switch to 115 V.		
	e. Connect unit to 115-V ac power source and set power on.		
	f. Measure dc voltage from external phase lock P1-4 to P1-2 (ground).	+5.2 ±0.2 V dc.	Check unit synthesizer voltage regulator and associated synthesizer reference.
	Note Clip inside tcxo must be in the external position (refer to figure 5).		
2. 5-MHz external reference	a. Set clip on the external phase lock to the 5-MHz position.		
	b. Connect 5-MHz external standard (0.5 to 1.5 V rms) to EXT STD jack on unit.		
	c. Connect an oscilloscope to U8-8 and observe square wave.	Steady duty ratio, indicating locked condition.	Check U5, U6, U7, and U8.
	d. Ground P1-5 and observe square wave at U8-8.	Unsteady square wave.	Check U8.
	e. Remove P1-5 ground and observe square wave at U8-8.	Steady duty ratio, indicating locked condition.	Check U5, U6, U7, and U8.
3. 1-MHz external reference	a. Set clip on the external phase lock to the 1-MHz position.		
	b. Connect 1-MHz external standard (0.5 to 1.5 V rms to EXT STD jack on unit.		
	c. Connect an oscilloscope to U8-8 and observe square wave.	Steady duty ratio, indicating locked condition.	Check U5, U6, and U8.
	d. Ground P1-5 and observe square wave at U8-8.	Unsteady square wave.	Check U8.
	e. Remove P1-5 ground and observe square wave at U8-8.	Steady duty ratio, indicating locked condition.	Check U5, U6, and U8.

Table 5. External Phase Lock, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. 100-kHz external reference	a. Set clip on the external phase lock to the 100-kHz position.		
	b. Connect 100-kHz external standard (0.5 to 1.5 V rms to EXT STD jack on unit.		
	c. Connect an oscilloscope to U8-8 and observe square wave.	Steady duty ratio, indicating locked condition.	Check U5 and U8.
	d. Ground P1-5 and observe square wave at U8-8.	Unsteady square wave.	Check U8.
	e. Remove P1-5 ground and observe square wave at U8-8.	Steady duty ratio, indicating locked condition.	Check U5 and U8.

4. REPAIR

Repair of the synthesizer reference and external phase lock is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

> **Caution**
>
> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figures 4 and 5). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

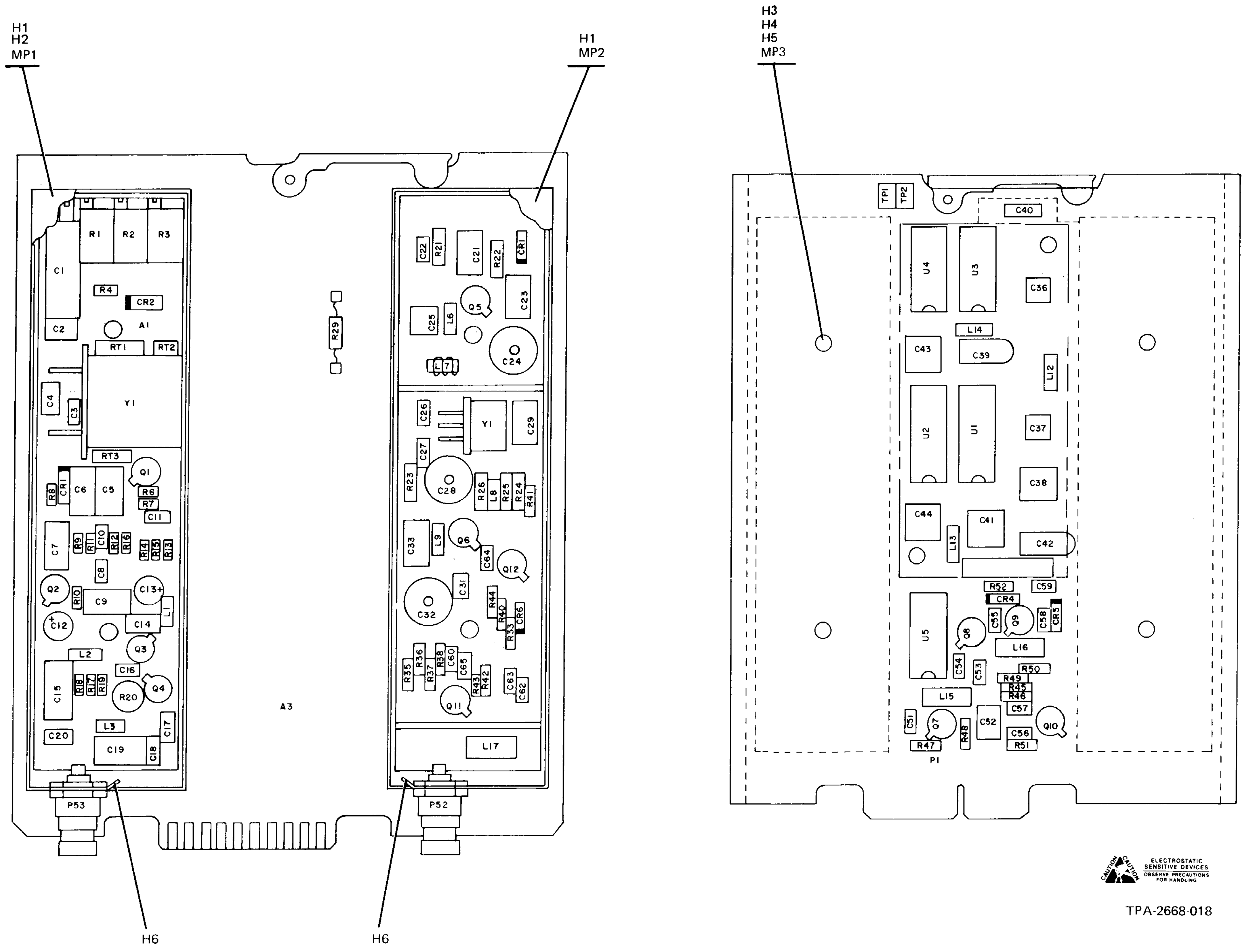
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
07910	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV PO BOX 728 855 35TH STREET NE CEDAR RAPIDS IA 52406
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
73899	JFD ELECTRONICS COMPONENTS CORP 15TH AVENUE AND 62ND ST BROOKLYN NY 11219
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
90634	GULTON INDUSTRIES INC GULTON ST METUCHEN NJ 08840
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
93958	REPUBLIC ELECTRONICS CORP 176 E 7TH ST PATERSON NJ 07524
96341	MICROWAVE ASSOCIATES INC NORTHWEST INDUSTRIAL PARK SOUTH AVE BURLINGTON MA 01803
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer reference	642-2451-001	REV B
Tcxo A1	635-0653-001	REV H
Times 12 multiplier A2	638-6594-001	REV A
Reference divider A3	635-6599-001	REV B
External Phase lock	635-0655-001	REV J



Synthesizer Reference, Schematic Diagram
Figure 4 (Sheet 1 of 3)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTHESIZER REFERENCE (ESDS)	642-2451-001			
A1	TCXO BOARD	635-0653-001			
A2	X12 MULTIPLEXER BOARD	638-6594-001			
A3	REFERENCE DIVIDER BOARD (ESDS)	638-6599-001			
H1	SCREW,MACH STL, 4-40 X 1/4 (QTY 4)	343-0133-000		96906	MS51957-13
H2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 4)	310-0279-000		96906	MS35338-135
H3	NUT,PLAIN,HEX SST, 4-40 (QTY 4)	313-0043-000		96906	MS35649-244
H4	WASHER,LOCK SST, 0.123 ID X 0.260 OD (QTY 4)	373-8010-000		96906	MS35335-57
H5	SCREW,MACH STL, 4-40 X 3/8 (QTY 4)	343-0135-000		96906	MS51957-15
H6	TERMINAL,LUG (QTY 4)	304-0220-000		77147	4028HT
MP1	COVER,BOX	635-4947-001			
MP2	COVER, BOX	635-4947-001			
MP3	POST,ELEC-MECH (QTY 4)	540-9036-003			540-9036-003
P52,P53	CONNECTOR,RCPT ELEC	357-7207-090		98291	52-044-0000
	RESISTOR, TEST SELECT R29	635-8926-001			
R29	RESISTOR,FXD CMPSN, 56 OHMS, 5%, 1/4W	745-0703-000		81349	RCR07G560JS
R29	RESISTOR,FXD CMPSN, 62 OHMS, 5%, 1/4W	745-0705-000		81349	RCR07G620JS
R29	RESISTOR,FXD CMPSN, 68 OHMS, 5%, 1/4W	745-0706-000		81349	RCR07G680JS
R29	RESISTOR,FXD CMPSN, 75 OHMS, 5%, 1/4W	745-0708-000		81349	RCR07G750JS
R29	RESISTOR,FXD CMPSN, 82 OHMS, 5%, 1/4W	745-0709-000		81349	RCR07G820JS
R29	RESISTOR,FXD CMPSN, 91 OHMS, 5%, 1/4W	745-0711-000		81349	RCR07G910JS
R29	RESISTOR,FXD CMPSN, 100 OHMS, 5%, 1/4W	745-0712-000		81349	RCR07G101JS
R29	RESISTOR,FXD CMPSN, 110 OHMS, 5%, 1/4W	745-0714-000		81349	RCR07G111JS
R29	RESISTOR,FXD CMPSN, 120 OHMS, 5%, 1/4W	745-0715-000		81349	RCR07G121JS
R29	RESISTOR,FXD CMPSN, 130 OHMS, 5%, 1/4W	745-0717-000		81349	RCR07G131JS
R29	RESISTOR,FXD CMPSN, 150 OHMS, 5%, 1/4W	745-0718-000		81349	RCR07G151JS
R29	RESISTOR,FXD CMPSN, 160 OHMS, 5%, 1/4W	745-0720-000		81349	RCR07G161JS
R29	RESISTOR,FXD CMPSN, 180 OHMS, 5%, 1/4W	745-0721-000		81349	RCR07G181JS
	TCXO BOARD A1	635-0653-001			
CR1	SEMICOND DEVICE	353-3157-000		81483	1N935A
CR2	SEMICOND DEVICE	922-6095-160		96341	1N5146A
C1	CAPACITOR,VAR GL DIEL, 0.8 TO 12PF, 750V	922-0487-000		73899	VC31GWY
C2	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
	CAPACITOR, TEST SELECT C3	601-3486-001			
C3	CAPACITOR,FXD CER DIEL, 0.47PF, PORM 0.25PF, 75V	913-1098-320		72982	8111B090C0K0-478C
C3	CAPACITOR,FXD CER DIEL, 0.56PF, PORM 0.25PF, 75V	913-1098-310		72982	8111B090C0K0-568C
C3	CAPACITOR,FXD CER DIEL, 0.68PF, PORM 0.25PF, 75V	913-1098-300		72982	8111B090C0K0-688C
C3	CAPACITOR,FXD CER DIEL, 0.82PF, PORM 0.25PF, 75V	913-1098-290		72982	8111B090C0K0828C
C3	CAPACITOR,FXD CER DIEL, 1PF, PORM 0.25PF, 150V	913-1098-330		72982	8101B212C0K0-109C
C3	CAPACITOR,FXD CER DIEL, 1.2PF, PORM 0.25PF, 75V	913-1098-280		72982	8101A075C0K0-129C
C3	CAPACITOR,FXD CER DIEL, 1.8PF, PORM 0.25PF, 75V	913-1098-260		72982	8101A075C0K0-189C
C3	CAPACITOR,FXD CER DIEL, 2.7PF, PORM 0.25PF, 75V	913-1098-240		72982	8101B077C0G0-279C
C3	CAPACITOR,FXD CER DIEL, 3.9PF, PORM 0.25PF, 75V	913-1098-220		72982	8101A075C0J0-399C
C3	CAPACITOR,FXD CER DIEL, 4.7PF, PORM 0.25PF, 75V	913-1098-210		72982	8101A075C0H0-479C
C3	CAPACITOR,FXD CER DIEL, 6.8PF, PORM 0.5PF, 75V	913-1098-140		72982	8101A075C0H0-689D
C3	CAPACITOR,FXD CER DIEL, 8.2PF, PORM 0.5PF, 75V	913-1098-160		72982	8101A075C0H0-829D
C3	CAPACITOR,FXD CER DIEL, 10PF, 5%, 75V	913-1098-010		72982	8101A075C0G0-100J
	CAPACITOR, TEST SELECT C4	601-3485-001			
C4	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 50V	912-4141-350		93790	CD5EY820J0
C4	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 50V	912-4141-360		93790	CD5FY910J0
C4	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 50V	912-4141-050		93790	CD5FY101J0
C4	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 50V	912-4141-370		93790	CD5FY111J0
C4	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 50V	912-4141-380		93790	CD5FY121J0
C4	CAPACITOR,FXD MICA DIEL, 130PF, 5%, 50V	912-4141-390		93790	CD5FY131J0
C4	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C4	CAPACITOR,FXD MICA DIEL, 160PF, 5%, 50V	912-4141-410		93790	CD5FY161J0
C4	CAPACITOR,FXD MICA DIEL, 170PF, 5%, 50V	912-4141-420		93790	CD5FY171J0
C4	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C4	CAPACITOR,FXD MICA DIEL, 200PF, 5%, 50V	912-4141-440		93790	CD5FY201J0
C4	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C4	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 50V	912-4141-470		93790	CD5FY271J0
C4	CAPACITOR,FXD MICA DIEL, 300PF, 5%, 50V	912-4141-480		93790	CD5FY301J0
C4	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C4	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 50V	912-4141-500		93790	CD5FY361J0
C4	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 50V	912-4141-510		72136	DM5F391J050WV
C4	CAPACITOR,FXD MICA DIEL, 400PF, 5%, 50V	912-4141-520		72136	DM5F401J050WV
C4	CAPACITOR,FXD CER DIEL, 0.00047UF, 5%, 100V	913-3117-080		56289	1CC0G471X5100C4
C4	CAPACITOR,FXD CER DIEL, 0.00068UF, 5%, 100V	913-3117-090		56289	2CC0G681X5100C4
C5,C6	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-3903-000		81349	CM04FD221J03
C7	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C8	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C9	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C10,C11	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-0(0		81349	CK05BX102K
C12	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C13	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C14	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C15	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C16	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C17,C18	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C19	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-3861-000		81349	CM04ED560J03
C20	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
L1	COIL,RF 560UH	240-2723-050		96906	MS75085-16
L2	COIL,RF 1UH	240-2023-000		96906	MS75083-13
L3	COIL,RF 0.56UH	240-2020-000		96906	MS75083-10
Q1-Q3	TRANSISTOR	352-0596-030		14433	2N2369A
Q4	TRANSISTOR	352-0440-000		07910	2N918
RT1	RESISTOR,THRM 100K, 10%, 4MW	714-1138-010		90634	51TD49
RT2	RESISTOR,THRM 1K, 10%, 2.6MW	714-1138-060		90634	31TD43
RT3	RESISTOR,THRM 1MEGO, 5%, 5.3MW	714-2853-000		90634	61TM49-5PCT
R1	RESISTOR,VAR	380-9086-030		80294	3292X50K
R2	RESISTOR,VAR	380-9086-040		80294	3292X500K
R3	RESISTOR,VAR	380-9086-030		80294	3292X50K
R4	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R5	NOT USED				
R6,R7	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R8	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R9,R10	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R11	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R12	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/8W	745-2347-000		81349	RCR05G152KS
R13,R14	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R15	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/8W	745-2332-000		81349	RCR05G561KS
R16	RESISTOR,FXD 383 OHMS, 1%, 1W	747-2183-570		81349	RWR81S3830FR
R17	RESISTOR,FXD CMPSN, 12K, 10%, 1/8W	745-2380-000		81349	RCR05G123KS
R18	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R19	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R20	RESISTOR,VAR 200 OHMS, 10%, 0.5W	382-0027-050		80294	3329HCT1-201
Y1	CRYSTAL UNIT,QTZ 9.900000MHZ	289-7271-010		00136	289-7271-010
	X12 MULTIPLEXER BOARD A2	638-6594-001			
CR1	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR2-CR5	NOT USED				
CR6	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1-C20	NOT USED				
C21	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 500V	912-3844-000		81349	CM04ED270J03
C22	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C23	CAPACITOR,FXD CER DIEL, 120PF, 2%, 75V	913-3879-000		93958	44696-16
C24	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R
C25	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C26,C27	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C28	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R
C29	CAPACITOR,FXD MICA DIEL, 24PF, 5%, 500V	912-3843-000		81349	CM04ED240J03
C30	NOT USED				
C31	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C32	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R
C33	CAPACITOR,FXD MICA DIEL, 30PF, 5%, 500V	912-3846-000		81349	CM04ED300J03
C34-C59	NOT USED				
C60	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C61	NOT USED				
C62-C65	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
L1-L5	NOT USED				
L6	COIL,RF 27UH	240-2040-000		96906	MS75084-17
L7	TRANSFORMER,RF	637-1783-001			
L8	COIL,RF 0.27UH	240-2016-000		96906	MS75083-06
L9	COIL,RF 0.22UH	240-2015-000		96906	MS75083-05
L10-L16	NOT USED				
L17	COIL,RF 0.15UH	240-2715-030		96906	MS75087-3
Q1-Q4	NOT USED				
Q5	TRANSISTOR	352-0959-020		27014	2N4208
Q6	TRANSISTOR	352-0792-020		02735	2N5179
Q7-Q10	NOT USED				
Q11	TRANSISTOR	352-0792-020		02735	2N5179
Q12	TRANSISTOR	352-0440-000		07910	2N918
R1-R20	NOT USED				
R21	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R22	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R23	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R24	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R25	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W	745-0782-000		81349	RCR07G822KS
R26	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R27-R34	NOT USED				
R35	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R36	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W	745-2277-000		81349	RCR05G180KS
R37	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W	745-2320-000		81349	RCR05G271KS
R38	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/8W	745-2332-000		81349	RCR05G561KS
R39	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/8W	745-2374-000		81349	RCR05G822KS
R40	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/8W	745-2353-000		81349	RCR05G222KS
R41	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R42	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/8W	745-2301-000		81349	RCR05G820KS
R43	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/8W	745-2323-000		81349	RCR05G331KS
R44	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
Y1	FILTER,XTAL,BP	293-1315-010		00136	2Q38
	REFERENCE DIVIDER BOARD A3 (ESDS)	638-6599-001			
CR1-CR3	NOT USED				
CR4,CR5	SEMICOND DEVICE	353-3644-010		03508	1N4454GE

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C1-C35	NOT USED				
C36,C37	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C38	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C39	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C40,C41	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C42	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C43,C44	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C45-C50	NOT USED				
C51	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C52	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 50V	912-4141-510		72136	DM5F391J050WV
C53	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C54-C59	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
L1-L11	NOT USED				
L12,L13	COIL,RF 27UH	240-2040-000		96906	MS75084-17
L14	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L15	COIL,RF 0.68UH	240-2715-110		96906	MS75087-11
L16	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
Q1-Q6	NOT USED				
Q7	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q8	TRANSISTOR	352-0440-000		07910	2N918
Q9	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q10	TRANSISTOR	352-0440-000		07910	2N918
R1-R44	NOT USED				
R45	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R46	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R47	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R48	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R49	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R50	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/6W	745-2338-000		81349	RCR05G821KS
R51	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R52	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
U1,U2	INTEGRATED CIRCUIT COUNTER	351-1527-040		34335	SN74LS190N
U3	INTEGRATED CIRCUIT FLIP FLOP	351-1525-040		04713	SN74LS74AN
U4	INTEGRATED CIRCUIT LOGIC GATE	351-7629-010		07263	7400PC
U5	INTEGRATED CIRCUIT MOS GATE (ESDS)	351-8287-050		02735	CD4075BE

Synthesizer Reference, Schematic Diagram
Figure 4 (Sheet 2)

NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.

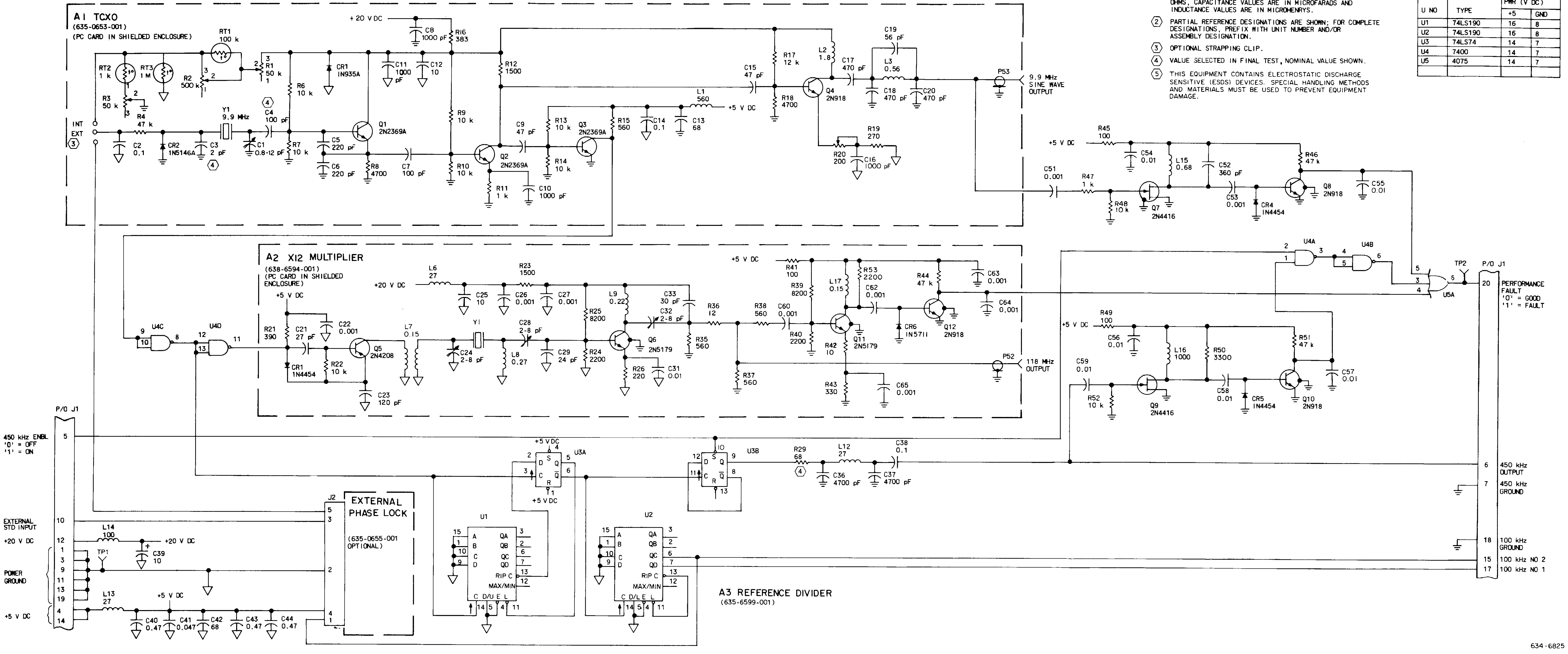
③ OPTIONAL STRAPPING CLIP.

④ VALUE SELECTED IN FINAL TEST, NOMINAL VALUE SHOWN.

⑤ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

U NO	TYPE	PWR (V DC)	
		+5	GND
U1	74LS190	16	8
U2	74LS190	16	8
U3	74LS74	14	7
U4	7400	14	7
U5	4075	14	7



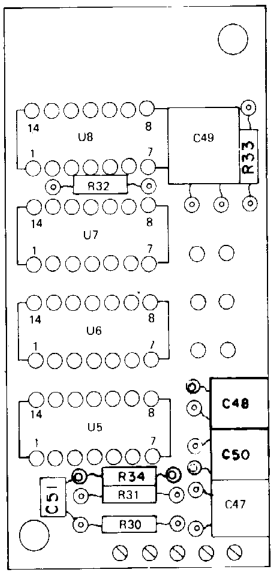
Synthesizer Reference, Schematic Diagram
Figure 4 (Sheet 3)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	EXTERNAL PHASE LOCK (OPTION)	635-0655-001			
C1-C46	NOT USED				
C47,C48	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C49	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C50	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V (A1)	913-3279-200		16546	CY30C104M
C51	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (B1)	912-4141-400		72136	DM5F151J050WV
R1-R29	NOT USED				
R30	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R31	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W (A1)	745-0773-000		81349	RCR07G472KS
R31	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W (B2)	745-0761-000		81349	RCR07G222KS
R31	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R32	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R33	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R34	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W (A1)(B2)	745-0761-000		81349	RCR07G222KS
R34	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
U1-U4	NOT USED				
U5	INTEGRATED CIRCUIT N74LS00A	351-1523-110		18324	N74LS00N
U6,U7	INTEGRATED CIRCUIT SN74LS90N	351-1636-010		01295	SN74LS90N
U8	INTEGRATED CIRCUIT SN74LS74N	351-1525-040		18324	N74LS74N883C

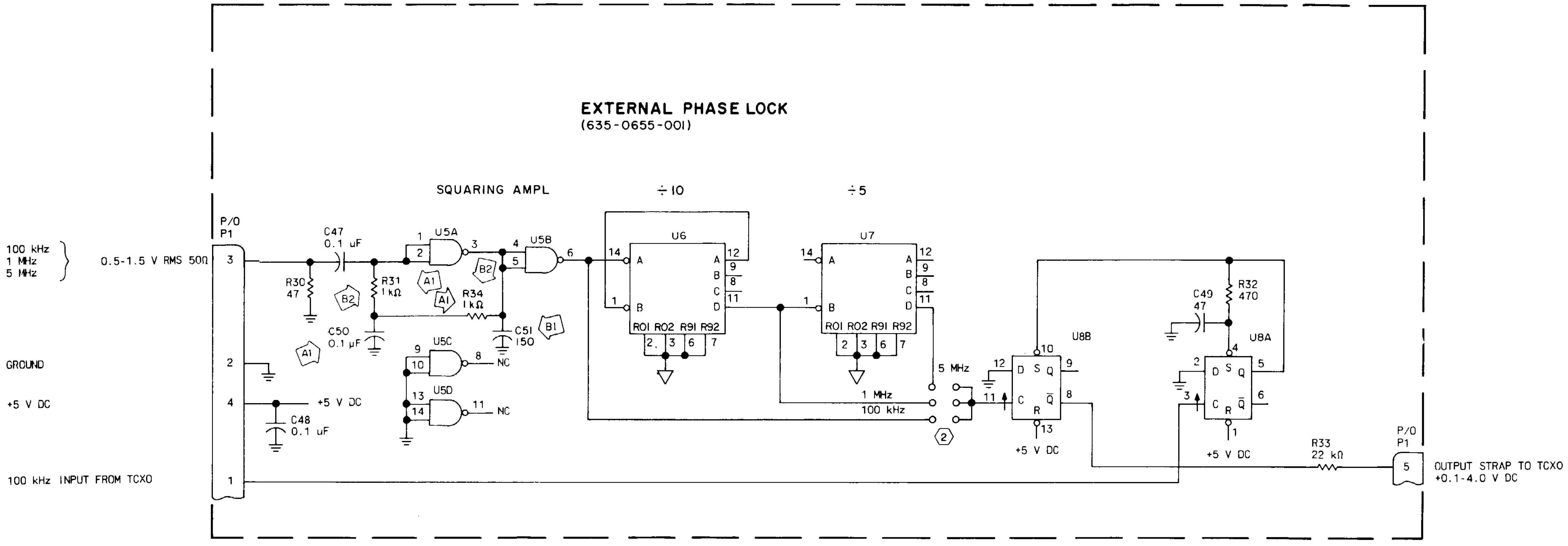
MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	EXTERNAL PHASE-LOCK 635-0655-001	
A1	Added C50, 0.1μF. Added R34, 2200Ω. Changed R31 from 4700Ω to 2200Ω.	REV C and above
B1	Added C51, 150 pF.	REV G and above
B2	Changed R31 and R34 from 2200 Ω to 1 kΩ.	REV J and above



TP5-1212-019

External Phase Lock, Schematic Diagram
Figure 5 (Sheet 1 of 2)



POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)	
		+5	GND
U5	N74LS00A	14	7
U6, U7	SN74LS90N	5	10
U8	SN74LS74N	14	7

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN PICOFARADS.

② OPTIONAL STRAPPING CLIP.

③ PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

④ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

635-0430 SH 2

External Phase Lock, Schematic Diagram
Figure 5 (Sheet 2)

Synthesizer End Decade (635-0657-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767973-002211
2nd Edition, 1 October 1980

1. DESCRIPTION

Synthesizer End Decade 635-0657-001, shown in figure 1, is a 2-layer planar card with a 20-pin edge-on connector (2-layers, 10 pins each).

The synthesizer end decade consists of a logic circuit, a low-pass filter circuit, a vco circuit, a loss-of-lock (LOL) monitor circuit, and a divide-by-10 output circuit.

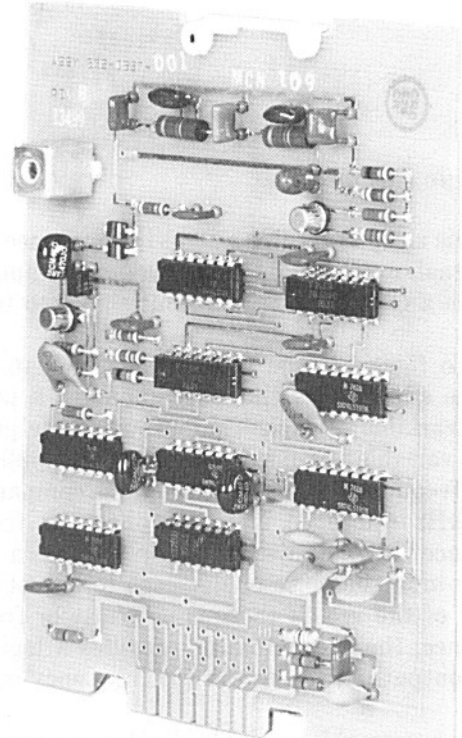
2. PRINCIPLES OF OPERATION

2.1 General (Refer to figure 2.)

The synthesizer end decade receives 100/10/1-Hz bcd frequency control signals and a 100-kHz reference signal, and generates a 600- to 510-kHz variable frequency output and a lock signal output (logic 1 for lock).

The logic circuits receive a 100-kHz reference input and a bcd frequency input. The bcd frequency input is used to program a variable frequency divider (divide-by-60 to divide-by-51). The programmed variable divider output (100 kHz) and the 100-kHz reference input are supplied to a phase/frequency discriminator that provides a control voltage proportional to the phase/frequency difference between its inputs.

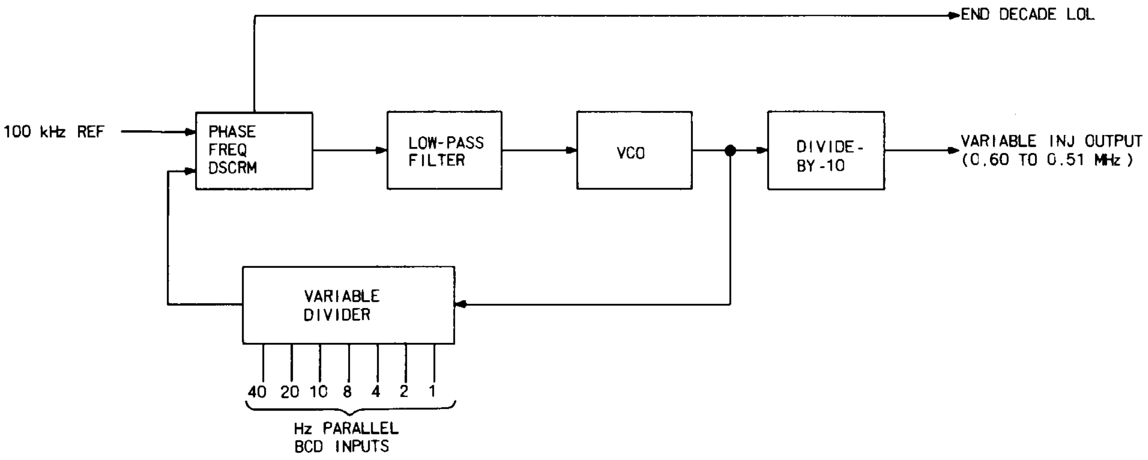
The vco circuit receives the control voltage signal from the logic circuits and is driven to and locked at the variable frequency as programmed by the variable divider bcd inputs to the logic circuits. The vco output (6.0 to 5.1 MHz) is supplied to the logic circuits for clocking and lock signal generation. The vco output (6.0 to 5.1 MHz) is supplied through a divide-by-10 circuit to rf circuits for additional frequency mixing and generation.



TP5-2335-017

Synthesizer End Decade
Figure 1

NOTICE: This section replaces first edition dated 1 June 1977.



TP5-2362-013

Block Diagram
Figure 2

2.2 Logic Circuits

The logic circuits receive a 100-kHz reference input, a vco signal output, and bcd frequency inputs, and supplies a control voltage output signal to the vco.

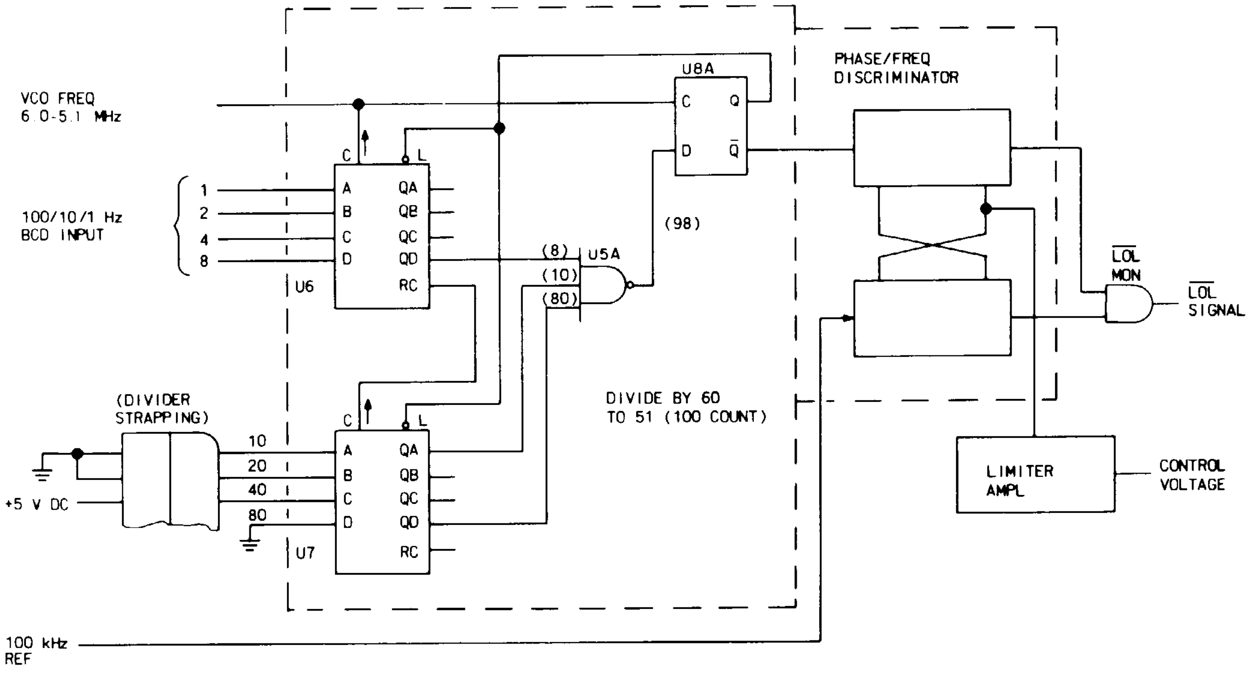
Refer to figure 3. The vco signal output (6.0 to 5.1 MHz) is supplied as the clock input to a programmable variable divider. The output of the programmable variable divider (100 kHz) is supplied to a phase/frequency discriminator and is compared with a 100-kHz reference input. A phase or frequency difference in the discriminator causes a control voltage input increase or decrease to adjust the frequency of the vco. If there is no phase or frequency difference, the discriminator provides a logic 1 lock signal output indicating the vco frequency is locked.

The programmable variable divider is programmed by the bcd frequency inputs. For example, if a bcd input of 0 is applied, the up/down decade counter is programmed to load the count 40 at any time a load signal (logic 0) is applied. Refer to table 1. This programs the variable divider to count from 40 (first count 41) to 100 (last count 100/40).

This causes the output of the variable divider to be 1/60th of the clock input or a divide-by-60 with a bcd input of 0. Note as the bcd input goes up 1, 2, 3, etc, the division ratio goes down -59, -58, -57, etc. Also note, that for the divide-by-circuit to operate as a constant, the last clock 100 must also be the loaded count (in the case of bcd 0, count 40). To do this, prerecognition of count 100 is required. Look-ahead circuit U5A performs this function. At clock 58 (count 98) gate U5A is NANDed and supplies a logic 0 input to U8A-D. With a logic 0 at U8A-D, clock 59 (count 99) causes U8A-Q to go to logic 1 and loads decade counter to bcd input (NANDed output of U5A is removed). At clock 59, U8A-$\overline{Q}$ supplies a pulse to phase/frequency discriminator. Clock 60 (count 40) causes U8A-Q to go to logic 0 and enables decade counter to count on the next clock. Next clock is one above the bcd programmed input. Note that count 99 initiates the output from the divider and count 100 appears only as the bcd programmed input. Refer to figure 4. A 500-Hz programmed input is shown, the same principles apply to any other programmed bcd input.

2.3 VCO Circuits

The vco circuits receive a control voltage from the logic circuits. The control voltage drives the vco to the required vco frequency. The vco signal output is supplied through one buffer amplifier to the logic circuits and through a fixed divide-by-10 output circuit to the unit under control for additional frequency mixing and generation.



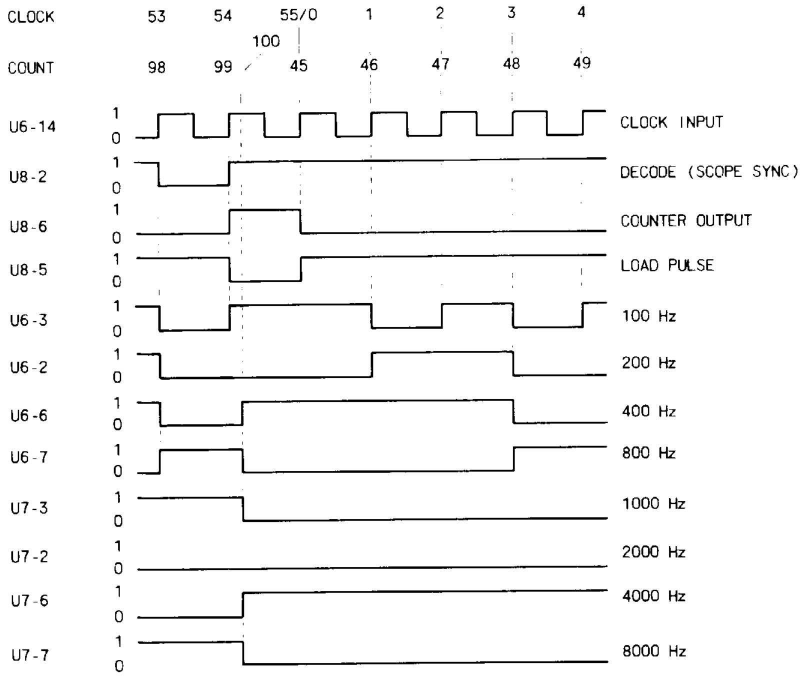
TP5-2363-013

Logic Circuit
Figure 3

Table 1. Variable Divider, Logic Truth Table.

BCD INPUT (100/10/1 Hz)	DIVIDER INPUTS								OUTPUT COUNT	DIVIDE BY	LOOP FREQ (MHz)
	U6				U7						
	A	B	C	D	**A	**B	[1]C	*D			
0	0	0	0	0	0	0	1	0	40	60	6.0
1	1	0	0	0	0	0	1	0	41	59	5.9
2	0	1	0	0	0	0	1	0	42	58	5.8
3	1	1	0	0	0	0	1	0	43	57	5.7
4	0	0	1	0	0	0	1	0	44	56	5.6
5	1	0	1	0	0	0	1	0	45	55	5.5
6	0	1	1	0	0	0	1	0	46	54	5.4
7	1	1	1	0	0	0	1	0	47	53	5.3
8	0	0	0	1	0	0	1	0	48	52	5.2
9	1	0	0	1	0	0	1	0	49	51	5.1

*Internally strapped for logic 0 (ground).
**Externally strapped for logic 0 (ground) at pins 7 and 17.
[1] Externally strapped for logic 1 (+5.2 V dc) at pin 16.



PROGRAMMED BCD INPUTS		
MHz	PIN NO.	LOGIC LEVEL
1	U6-15	1
2	U6-1	0
4	U6-10	1
8	U6-9	0
10	U7-15	FXD 0
20	U7-1	FXD 0
40	U7-10	FXD 1
80	U7-9	FXD 0

NOTE: EXAMPLE SHOWN IS FOR 500 Hz.

TP5-2366-013

Variable Divider, Inputs and Outputs
Figure 4

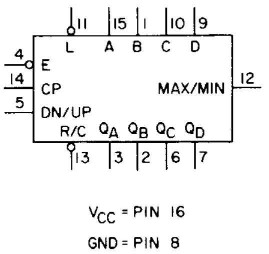
2.4 Up/Down Decade Counter 351-1527-040 (Refer to table 2.)

The 351-1527-040 up/down decade counter is a 4-bit decade counter. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when input conditions are met.

A high at the enable input inhibits counting. A low at the enable input and a low-to-high clock transistion triggers the four master/slave flip-flops. The enable input should be changed only when the clock is high. The down/up input determines the direction of the count. When low, the count goes up; when high, the count goes down.

These counters are programmable. The outputs may be preset to any state by placing a low on the load input and entering the desired data at the data inputs. The output changes to agree with the data inputs independently of the state of the clock input. This allows the counters to be used as modulo-N dividers by modifying the count length with the preset inputs.

Two outputs are available to perform the cascading function: ripple clock and maximum/minimum count. The latter output produces a high level output pulse with a duration approximately equal to one complete cycle of the clock when the counter overflows or underflows. The ripple clock output produces a low level output pulse equal in width to the low level portion of the clock input when an overflow or underflow condition exists. The counters are cascaded by feeding the ripple clock output to the enable input of the succeeding counter if parallel clocking is used or to the clock input if parallel enabling is used. The maximum/minimum count output can be used to accomplish look-ahead for high-speed operation.



TP5-2325-013

Up/Down Decade Counter 351-1527-040
Figure 5

Table 2. Up/Down Decade Counter 351-1527-040, Logic Truth Table.

PROGRAMMABLE INPUTS				COUNT	BCD OUTPUTS			
A	B	C	D		QA	QB	QC	QD
0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0
0	1	0	0	2	0	1	0	0
1	1	0	0	3	1	1	0	0
0	0	1	0	4	0	0	1	0
1	0	1	0	5	1	0	1	0
0	1	1	0	6	0	1	1	0
1	1	1	0	7	1	1	1	0
0	0	0	1	8	0	0	0	1
1	0	0	1	9	1	0	0	1

E (enable): logic 0 enables counter; logic 1 inhibits counter.

L (load): logic 0 programs the bcd output count to be set at the bcd count of the programmable inputs; the next clock pulse counts one higher/lower (up/down).

DU (down/up): logic 0 counts up; logic 1 counts down.

CP (clock pulse): logic 0-to-logic 1 transition advances counter.

RC (ripple clock): logic 0 pulse equal to 1/2 clock cycle when an overflow occurs.

MM (maximum/minimum count): logic 1 pulse equal to full clock cycle when an overflow or underflow occurs.

2.5 *Decade Counter 351-1636-010 (Refer to table 3.)*

The 351-1636-010 decade counter is a high-speed, monolithic decade counter consisting of four dual-rank, master-slave flip-flops internally interconnected to provide a divide-by-2 counter and a divide-by-5 counter. Gated direct reset lines are provided to inhibit count inputs and return all outputs to a logical 0 or to a binary coded decimal (bcd) count of 9. As the output from flip-flop A is not internally connected to the succeeding stages, the count may be separated in three independent count modes:

a. When used as a binary coded decimal decade counter, the BD input must be externally connected to the A output. The A input receives the incoming count, and a count sequence is obtained in accordance with the bcd count sequence truth table shown above. In addition to a conventional 0 reset, inputs are provided to reset a bcd 9 count for 9's complement decimal applications.

b. If a symmetrical divide-by-10 count is desired for frequency synthesizers or other applications requiring division of a binary count by a power of 10, the D output must be externally connected to the A input. The input count is then applied at the BD input and a divide-by-10 square wave is obtained at output A.

c. For operation as a divide-by-2 counter and divide-by-5 counter, no external interconnections are required. Flip-flop A is used as a binary element for the divide-by-2 function. The BD input is used to obtain binary divide-by-5 operation at the B, C, and D outputs. In this mode, the two counters operate independently; however, all four flip-flops are reset simultaneously.

Table 3. Decade Counter 351-1636-010, Logic Truth Table.

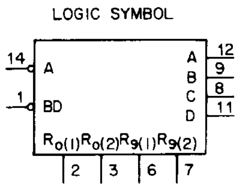
*BCD COUNT SEQUENCE

COUNT	OUTPUT			
	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

**RESET/COUNT

RESET INPUTS				OUTPUT			
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	D	C	B	A
1	1	0	X	0	0	0	0
1	1	X	0	0	0	0	0
X	X	1	1	1	0	0	1
X	0	X	0	Count			
0	X	0	X	Count			
0	X	X	0	Count			
X	0	0	X	Count			

*Output A connected to input BD for BCD count.
**X indicates that either a logical 1 or a logical 0 may be present.



TP5-2326-012

Decade Counter 351-1636-010
Figure 6

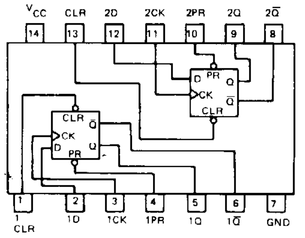
2.6 Dual D-Type Flip-Flop With Preset and Clear 351-1525-040 (Refer to table 4.)

The 351-1525-040 consists of dual, high-speed, D-type flip-flops. Information on the D input is transferred to the Q output on the positive going edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive going pulse. When the clock input is at either high or low level, the D-input signal has no effect.

Table 4. Dual D-Type Flip-Flop With Preset and Clear 351-1525-040, Logic Truth Table.

INPUTS				OUTPUTS	
PRESET	CLEAR	CLOCK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	*H	*H
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q_0}$

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
* This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.



TP5-2327-011

Dual D-Type Flip-Flop With Preset and Clear 351-1525-040
Figure 7

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer end decade are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 5 check total performance of the synthesizer end decade. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

Table 5. Synthesizer End Decade, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup (Cont)	a. Remove top cover of the unit containing the synthesizer end decade that is to be tested. b. Remove cover from the synthesizer section of the unit. c. Remove synthesizer end decade, install it on an extender card, and place it in the unit. d. Set unit LINE SELECTOR switch to 115 V. e. Connect unit to 115-V ac power source and set power on.		

Table 5. Synthesizer End Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. (Cont)	f. Measure dc voltage from P1-20 and P1-2 to P1-6 (ground).	+5.2 ±0.2 V dc.	Check unit synthesizer voltage regulator.
	g. Measure dc voltage from P1-10 to P1-6 (ground).	NLT +19.5 V dc, NMT +20.8 V dc.	Check unit synthesizer voltage regulator.
2. Test procedures	a. Set the end frequency control to 9.		
	b. Measure dc voltage at cathode end of CR1-CR2. (Refer to figure 8 for CR1-CR2 cathode location.) **Note** Prior to REV C voltage at CR1-CR2 should be at 9.5 ±0.2 V dc.	7.0 ±0.2 V dc. (see note)	Adjust L6 for 9.5 ±0.1 V dc. If L6 adjustment does not correct the problem, check Q1, Q2, and associated circuit.
	c. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	510 ±0.5 kHz.	Adjust L6 for 510 kHz with 7.0 ±0.2 V dc at cathode end of CR1-CR2. If L6 adjustment does not correct the problem, check Q1, Q2, and associated circuit.
	d. Note the frequency counter reading while moving the frequency control from 9 down to 0 (Refer to chart.) **Note** Prior to REV C voltage at CR1-CR2 should be 9.5 ±0.2 V dc and increase in 0.5 V dc steps.	Note that the frequency reading increases by 10 kHz with each step of the frequency control. Reading should be 600 ±0.5 kHz with frequency control at 0.	Check U6, U7, U8, and associated circuits.
	e. Measure the dc voltage at P1-12.	NLT +3.5 V dc. **Note** RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that result of step f. is satisfactory.	Check U3, U4, and U5.
(Cont)	f. Ground P1-5 while noting the voltage of P1-12.	NMT 0.5 V dc.	Check U1, U2, U3, U4, and U5.

Table 5. Synthesizer End Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	g. Remove P1-5 ground.		

LOW END FREQ DIGIT	CR1-CR2 DC VOLTAGE	FREQ OUTPUT P1-1 (kHz)
9	7.0 ±0.2	510 ±0.5
8	7.5 ±0.2	520 ±0.5
7	8.0 ±0.2	530 ±0.5
6	8.5 ±0.2	540 ±0.5
5	9.0 ±0.2	550 ±0.5
4	9.5 ±0.2	560 ±0.5
3	10.0 ±0.2	570 ±0.5
2	10.5 ±0.2	580 ±0.5
1	11.0 ±0.2	590 ±0.5
0	11.5 ±0.2	600 ±0.5

4. ALIGNMENT/ADJUSTMENT

Refer to table 5 for adjustment of L6. Perform test 2, steps a through c.

5. REPAIR

Repair of the synthesizer end decade is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

> **Caution**
>
> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 8). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change.

Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applied to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

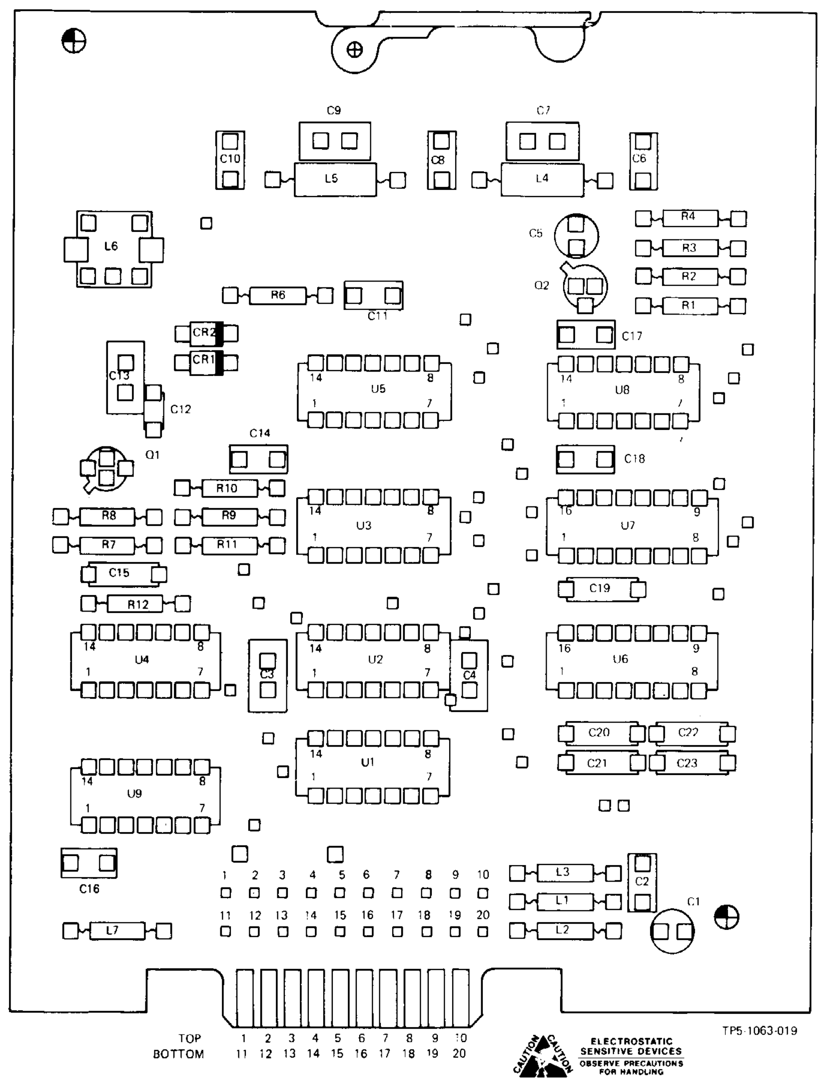
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

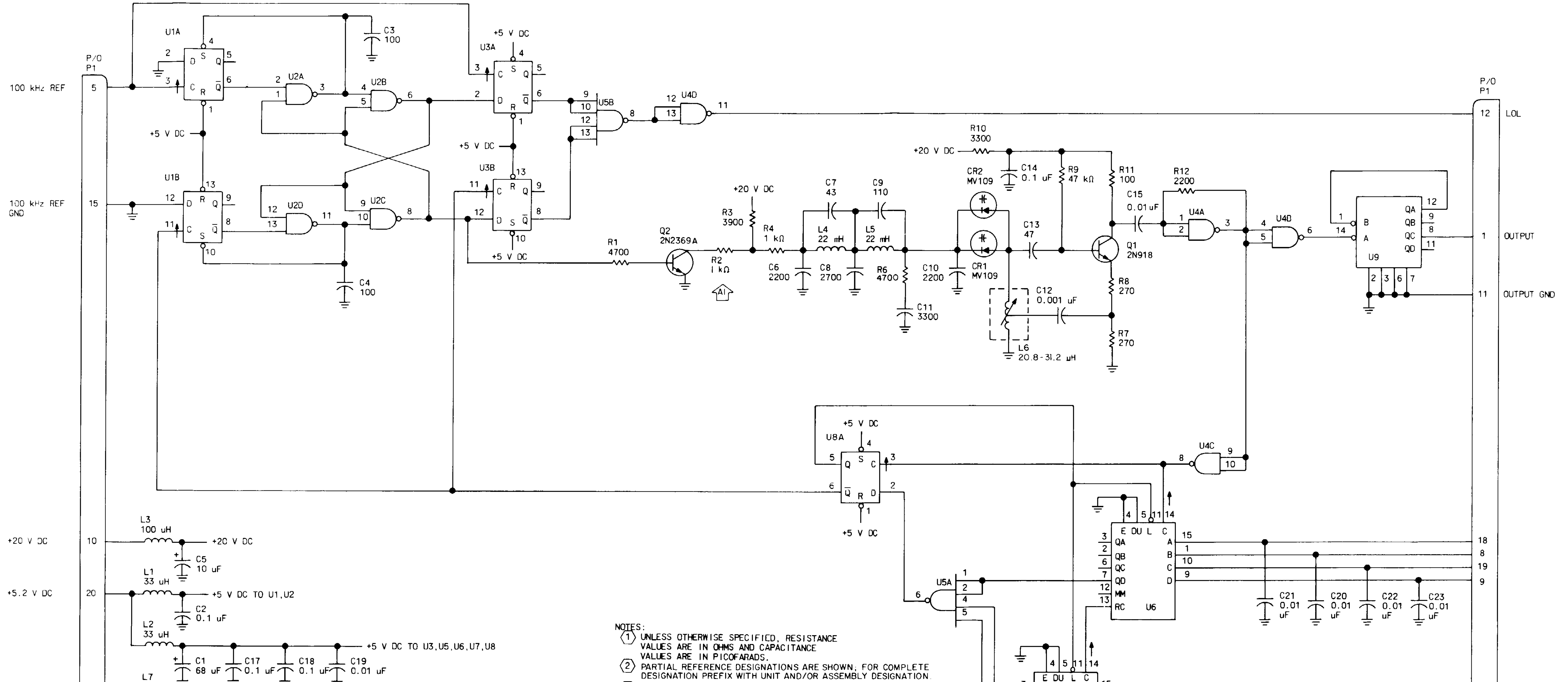
CODE	MANUFACTURER'S NAME AND ADDRESS
01295	Texas Instruments, Inc. U.S. Semiconductor Group P.O. Box 5012 13500 N. Central Expressway Dallas, TX 75222
04713	Motorola, Inc. Semiconductor Products Group 5005 E. McDowell Rd. Phoenix, AZ 85008
07910	Teledyne Semiconductor 1300 Terra Bella Ave. Mountain View, CA 94043
12294	Erie Technological Products of Canada, Ltd. 5 Fraser Ave. Tenton, Ont., Can. K8V 5S1
14433	ITT Semiconductors P.O. Box 3049 3301 Electronics Way West Palm Beach, FL 33402
16546	U.S. Capacitor Corp/Centralab Electronics Div. 4561 Colorado Los Angeles, CA 90039
18324	Signetics Corp. 811 E. Arques Ave. Sunnyvale, CA 94086
18796	Erie Technological Products, Inc State College Div. 1900 W. College Ave. State College, PA 16801
20462	PREM Enterprises, Inc. 3519 N. Chapel Hill McHenry, IL 60050
34335	Advanced Micro Devices 901 Thompson Pl. Sunnyvale, CA 94086
56289	Sprague Electric Co. North Adams, MA 01247
81349	Military Specifications
96906	Military Standards

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer end decade	635-0657-001	REV C





POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)	
		+5 V	GND
U1,U3,U8	SN74LS74N	14	7
U2,U4	N74LS00N	14	7
U5	N74LS20N	14	7
U6,U7	SN74LS190N	16	8
U9	SN74LS90N	5	10

NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN PICOFARADS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

635-0428
TP4-6927-014

Synthesizer End Decade, Schematic Diagram
Figure 8 (Sheet 1 of 2)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTH END DECADE (ESDS)	635-0657-001			
CR1,CR2	SEMICOND DEVICE GL DIEL, 0.8 TO 8.5PF, 1000V	922-6124-040		04713	SMV1276
C1	CAPACITOR,FXD ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C2	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C3,C4	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C5	CAPACITOR,FXD ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C6	CAPACITOR,FXD CER DIEL, 2200PF, PORM5%, 100V	913-3281-300		18796	8131-100C0G222J
C7	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-3854-000		81349	CM04ED430J03
C8	CAPACITOR,FXD CER DIEL, 0.0027UF, 5%, 100V	913-3117-130		81349	CCR06CG272J
C9	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 500V	912-3882-000		81349	CM04FD111J03
C10	CAPACITOR,FXD CER DIEL, 2200PF, PORM5%, 100V	913-3281-300		18796	8131-100C0G222J
C11	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K
C12	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C13	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C14	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C15	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 100V	913-3680-000		12294	805-014X5V0103Z
C16-C18	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C19-C23	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 100V	913-3680-000		12294	805-014X5V0103Z
L1,L2	COIL,RF 33UH	240-2041-000		96906	MS75085-01
L3	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L4,L5	COIL,RF 22000UH	240-2715-650		96906	MS75089-39
L6	INDUCTOR,RF	242-0441-050		20462	242-0441-050
L7	COIL,RF 33UH	240-2041-000		96906	MS75085-01
Q1	TRANSISTOR	352-0440-000		07910	2N918
Q2	TRANSISTOR	352-0596-030		14433	2N2369A
R1	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R2	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W (A1)	745-0761-000		81349	RCR07G222KS
R2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R3	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R4	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R5	NOT USED				
R6	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R7,R8	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R9	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R10	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R11	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R12	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
U1	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U2	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U3	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U4	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U5	INTEGRATED CIRCUIT	351-1523-130		18324	N74LS20N
U6,U7	INTEGRATED CIRCUIT (ESDS)	351-1527-040		34335	SN74LS190N
U8	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U9	INTEGRATED CIRCUIT	351-1636-010		01295	SN74LS90N

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed R2 from 2200Ω to 1kΩ.	REV C and above

Synthesizer End Decade, Schematic Diagram
Figure 8 (Sheet 2)

Synthesizer Decade (623-2080-001, -002, -003, -004)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767972-301211
1 June 1977
3rd Revision, 1 October 1980

1. DESCRIPTION.

Synthesizer Decades 623-2080-001, -002, -003, -004, shown in figure 1 and listed in table 1, are 2-layer planar cards with 20-pin edge-on connectors (2 layers, 10 pins each). The modules differ only in strapping and frequency control/output, as indicated on the schematic, figure 14.

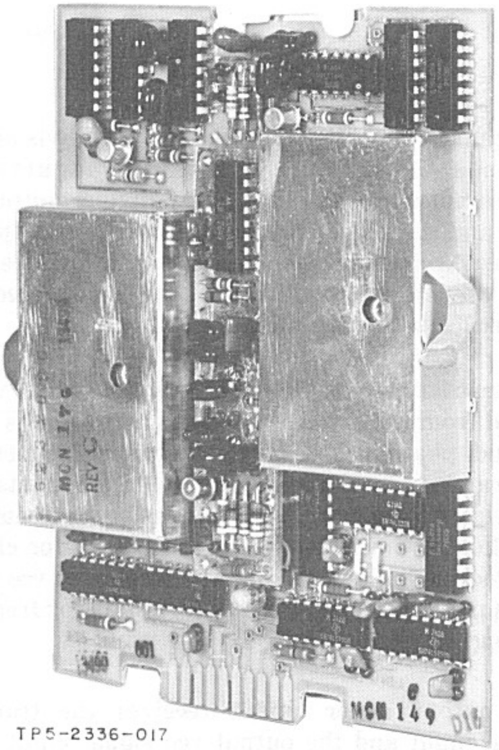
Table 1. Cards Covered by These Instructions.

CARD TYPE	COLLINS PART NO
100-kHz synthesizer decade	623-2080-001
10-kHz synthesizer decade	623-2080-002
1-kHz synthesizer decade	623-2080-003
100/10-Hz synthesizer decade	623-2080-004

The synthesizer decade module consists of translator logic, translator vco, output mixer, output logic, output vco, low-pass filter circuits, a divide-by-10 output circuit, and a loss-of-lock (LOL) monitor circuit.

2. PRINCIPLES OF OPERATION

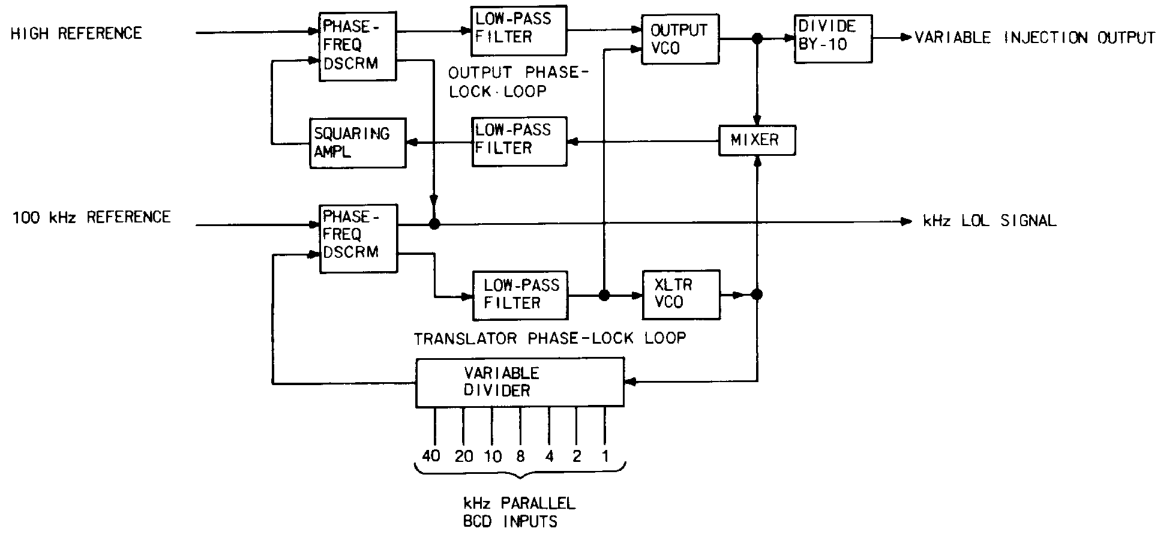
2.1 General (Refer to figure 2.)



Synthesizer Decade
Figure 1

The synthesizer decade module receives bcd frequency control signals, a 100-kHz reference signal, and a high-reference signal, and generates a variable injection signal output and a lock signal output (logic 1 for lock). The variable injection signal output is used as the high-reference signal in the next frequency step in the generation of a 79.35001- to 109.35-MHz variable injection signal output.

The translator logic circuits receive a 100-kHz reference input, a translator vco signal, and a bcd frequency input. The bcd frequency input is used to



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Synthesizer Decade, Block Diagram
Figure 2

program a variable frequency divider (division ratio depends on strapping and bcd inputs). The programmed variable frequency divider output (100 kHz) and the 100-kHz reference input are supplied to a phase/frequency discriminator that provides a control voltage proportional to the phase/frequency difference between its inputs.

The translator vco circuit receives the control voltage signal from the translator logic circuits and is driven to and phase-locked at the variable frequency as programmed by the variable divider bcd inputs to the translator logic circuits. The translator vco output is supplied to the translator logic circuits for clocking and lock signal generation. The translator vco output is supplied to the output mixer circuits for frequency mixing.

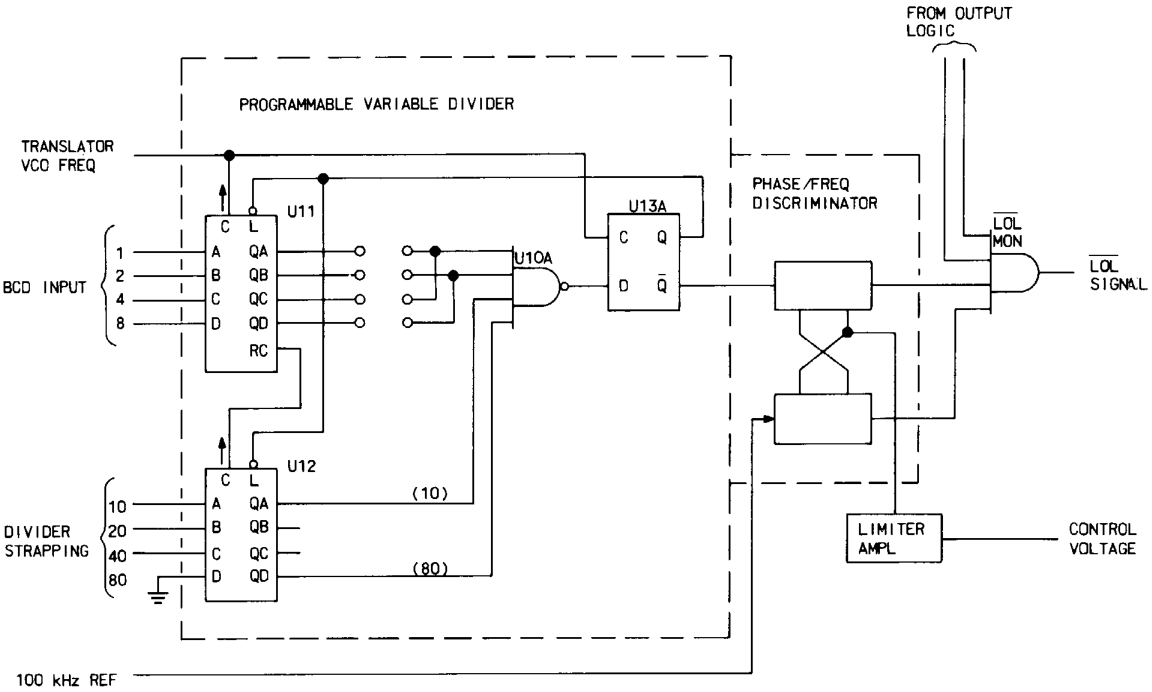
The output mixer circuit receives the translator signal input and the output vco signal input, mixes them, and supplies a reference input to the phase/frequency discriminator. In the phase/frequency discriminator the mixer reference input is compared with the high-reference input and produces an output control voltage.

The output vco circuit receives the output control voltage signal from the output logic circuits and the translator tracking voltage from the translator vco circuits. The translator tracking voltage provides a reference voltage for the output vco, and the output control voltage drives the output vco until it is locked at the variable injection frequency. The output vco output is supplied to a fixed divide-by-10 output circuit. The fixed divide-by-10 circuit output is supplied as a reference to the following decade or output module.

2.2 *Translator Logic Circuits*

The translator logic circuits receive a 100-kHz reference input, a translator vco signal output, and bcd frequency inputs, and supplies a control voltage output signal to the translator vco.

Refer to figure 3. The translator vco signal output (table 2) is supplied as the clock input to a programmable variable divider. The output of the programmable variable divider (100 kHz) is supplied to a phase/frequency discriminator and is compared with a 100-kHz reference input. A phase or frequency difference in the discriminator causes a control voltage input increase or decrease to adjust the frequency of the vco. If there is no phase or frequency difference, the discriminator provides a logic 1 lock signal output indicating the vco frequency is locked.



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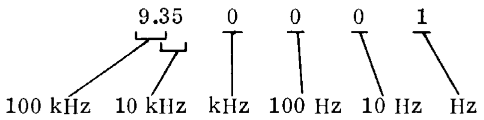
Translator Logic Circuits
Figure 3

Table 2. Decade Versus VCO Inputs/Outputs.

DECADE	TRANSLATOR VCO FREQ (MHz)	HIGH REF INPUT FREQ TO OUTPUT VCO (MHz)	OUTPUT VCO FREQ BEFORE DIVIDER (MHz)
100 kHz	9.5 to 8.6	0.85 to 0.750001	10.35 to 9.350001
10 kHz	7.8 to 6.9	0.70 to 0.60001	8.50 to 7.50001
1 kHz	6.4 to 5.5	0.60 to 0.5001	7.00 to 6.0001
100 Hz	5.4 to 4.5	0.60 to 0.501	6.00 to 5.001
10 Hz	5.4 to 4.5	0.60 to 0.51	6.00 to 5.01

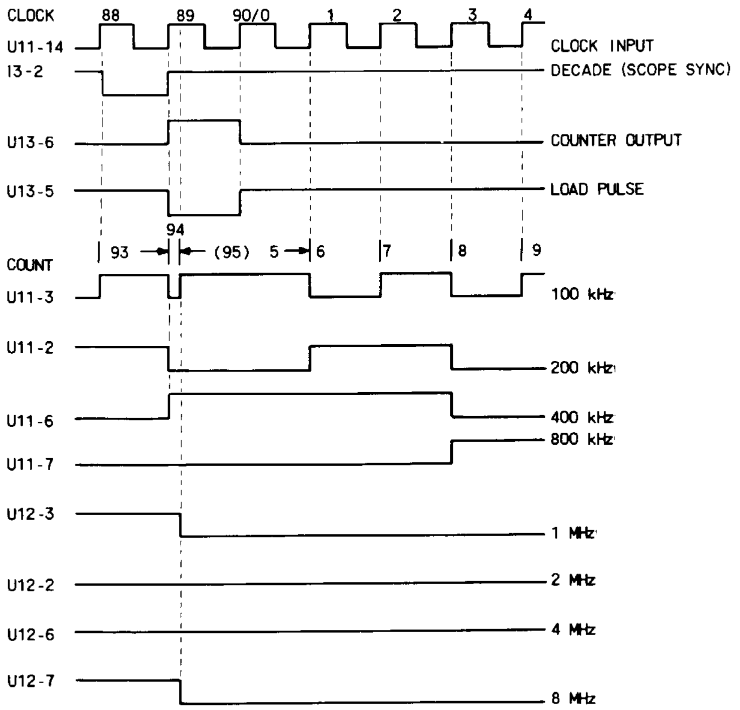
Note

The above high-reference inputs are shown as they would be in a 1-Hz tuned synthesizer. In a 10-Hz tuned synthesizer, there would be no 10-Hz decade and the 100-Hz high-reference input would be 0.60 to 0.51 MHz, the 1-kHz high-reference input would be 0.60 to 0.501 MHz, etc. In a 100-Hz tuned synthesizer, there would be no 100-Hz decade and the 1-kHz high reference would be 0.60 to 0.51 MHz, the 10-kHz high reference would be 0.70 to 0.601 MHz, etc. Output vco frequency at 100-kHz output has the following tuning characteristics.



The programmable variable divider is programmed by the bcd frequency inputs. Refer to table 3. For example, if a bcd input of 0 is applied, the up/down decade counter is programmed to load the count 0 at any time a load signal (logic 0) is applied. This programs the variable divider to count from 0 (first count 1) to 95 (last count 95/0). This causes the output of the variable divider to be 1/95th of the clock input or a divide-by-95 with a bcd input of 0. Note that, as the bcd input goes up 1, 2, 3, etc, the division ratio goes down -94, -93, -92, etc. Also note that, for the divide-by circuit to operate as a constant, the last count 95 also must be the loaded count (in the case of bcd 0, count 0). To do this, prerecognition of count 95 is required. Look-ahead circuit of U10A performs this function. At clock 93 (count 93), gate U10A is ANDed and supplies a logic 0 input to U13A-D. With a logic 0 at U13A-D, clock 94 (count 94) causes U13A-$\overline{Q}$ to go to logic 0 and loads decade counter to bcd input (ANDed output U10A is removed). At clock 94, U13A-Q supplies a pulse to the phase/frequency discriminator. Clock 95 (count 00) causes U13A-Q to go to logic 1 and enables decade counter to count on the next clock. Next clock is one above the bcd programmed input. Note that count 94 initiates the output from the divider and count 95 appears only as the bcd programmed input. Refer to figure 4. A 500-kHz programmed input is shown; the same principles apply to any other programmed bcd input.

The preceding discussion pertained to the 100-kHz decade card. Differences between the cards can be seen in figures 5 through 8 and tables 3 through 6. Note that the internal strapping changes and the external input divider strapping changes cause a change in the programmable variable divider.



PROGRAMMED BCD INPUTS		
100 kHz	PIN NO.	LOGIC LEVEL
1	U11-15	1
2	U11-1	0
4	U11-10	1
8	U11-9	0
10	U12-15	FXD 0
20	U12-1	FXD 0
40	U12-10	FXD 0
80	U12-9	FXD 0

NOTE:
EXAMPLE SHOWN IS FOR 500 kHz.

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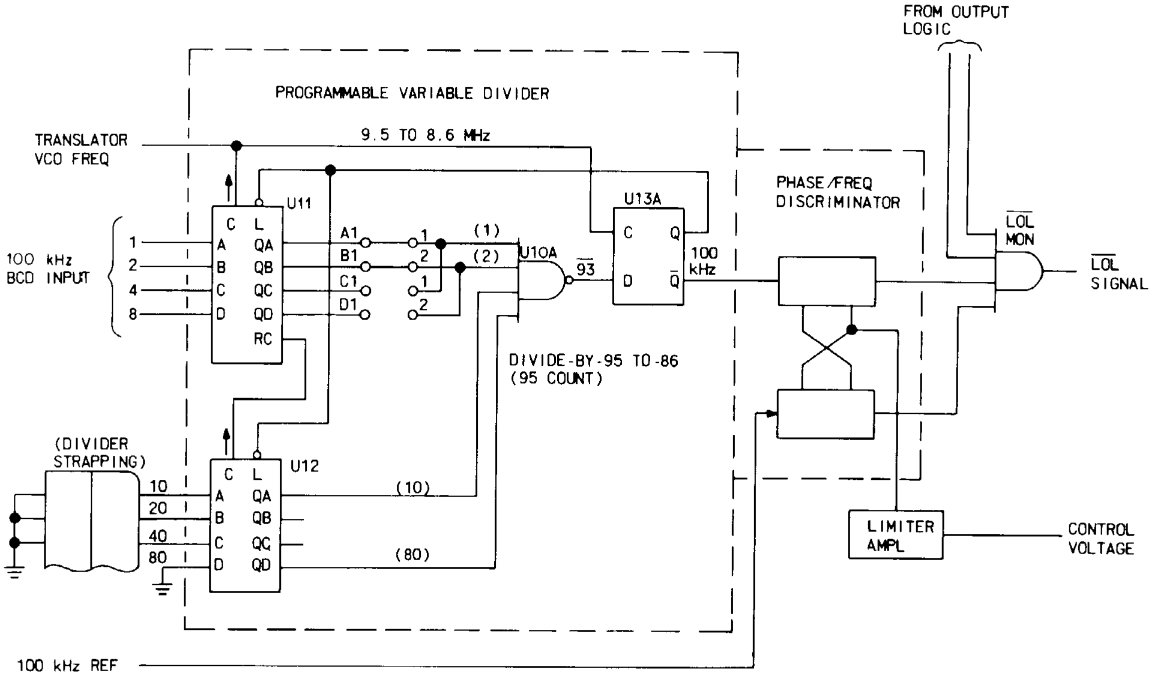
Variable Divider, Inputs and Outputs
Figure 4

Table 3. 100-kHz Decade, Logic Truth Table.

BCD INPUT (100 kHz)	DIVIDER INPUTS								OUTPUT COUNT	DIVIDE-BY	LOOP FREQ (MHz)
	U11				U12						
	A	B	C	D	**A	**B	**C	*D			
0	0	0	0	0	0	0	0	0	0	95	9.5
1	1	0	0	0	0	0	0	0	1	94	9.4
2	0	1	0	0	0	0	0	0	2	93	9.3
3	1	1	0	0	0	0	0	0	3	92	9.2
4	0	0	1	0	0	0	0	0	4	91	9.1
5	1	0	1	0	0	0	0	0	5	90	9.0
6	0	1	1	0	0	0	0	0	6	89	8.9
7	1	1	1	0	0	0	0	0	7	88	8.8
8	0	0	0	1	0	0	0	0	8	87	8.7
9	1	0	0	1	0	0	0	0	9	86	8.6

*Internally strapped for logic 0 (ground).
**Externally strapped for logic 0 (ground) at pins 7, 16, and 17.



100-kHz Decade Translator, Logic Circuit
Figure 5

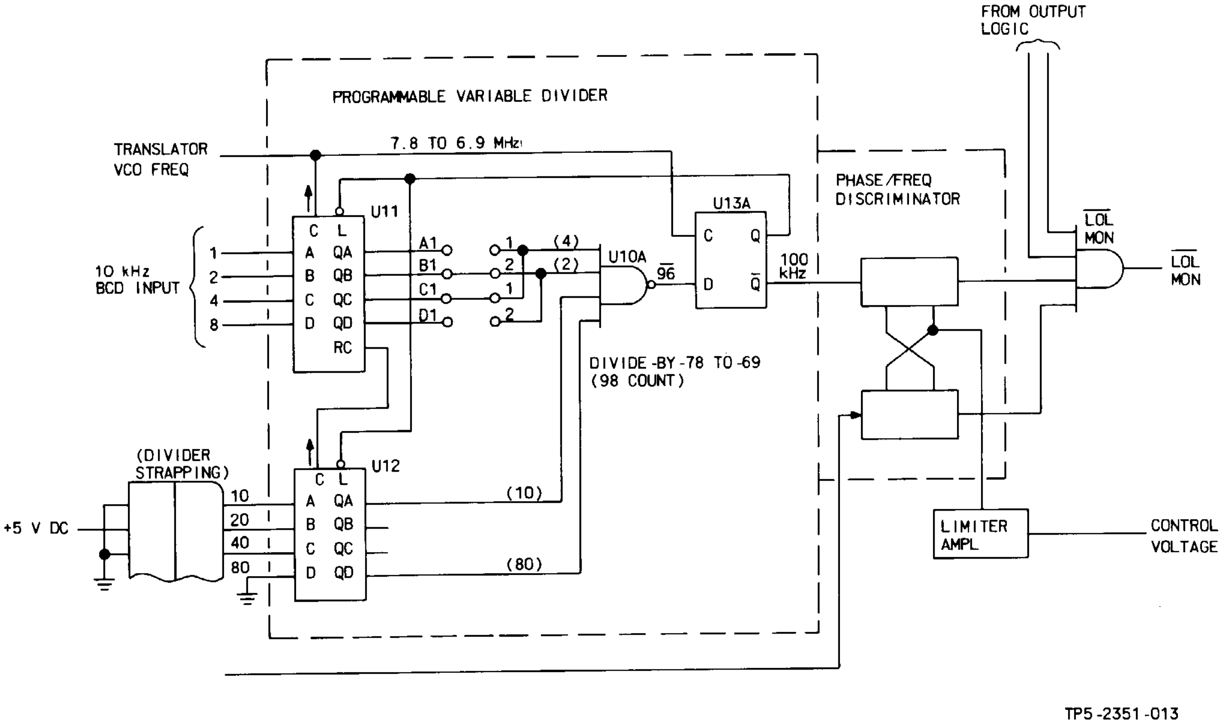
Table 4. 10-kHz Decade, Logic Truth Table.

BCD INPUT (10 kHz)	DIVIDER INPUTS								OUTPUT COUNT	DIVIDE-BY	LOOP FREQ (MHz)
	U11				U12						
	A	B	C	D	**A	[1]B	**C	*D			
0	0	0	0	0	0	1	0	0	20	78	7.8
1	1	0	0	0	0	1	0	0	21	77	7.7
2	0	1	0	0	0	1	0	0	22	76	7.6
3	1	1	0	0	0	1	0	0	23	75	7.5
4	0	0	1	0	0	1	0	0	24	74	7.4
5	1	0	1	0	0	1	0	0	25	73	7.3
6	0	1	1	0	0	1	0	0	26	72	7.2
7	1	1	1	0	0	1	0	0	27	71	7.1
8	0	0	0	1	0	1	0	0	28	70	7.0
9	1	0	0	1	0	1	0	0	29	69	6.9

*Internally strapped for logic 0 (ground).

**Externally strapped for logic 0 (ground) at pins 7 and 16.

[1] Externally strapped for logic 1 (+5.2 V dc) at pin 17.

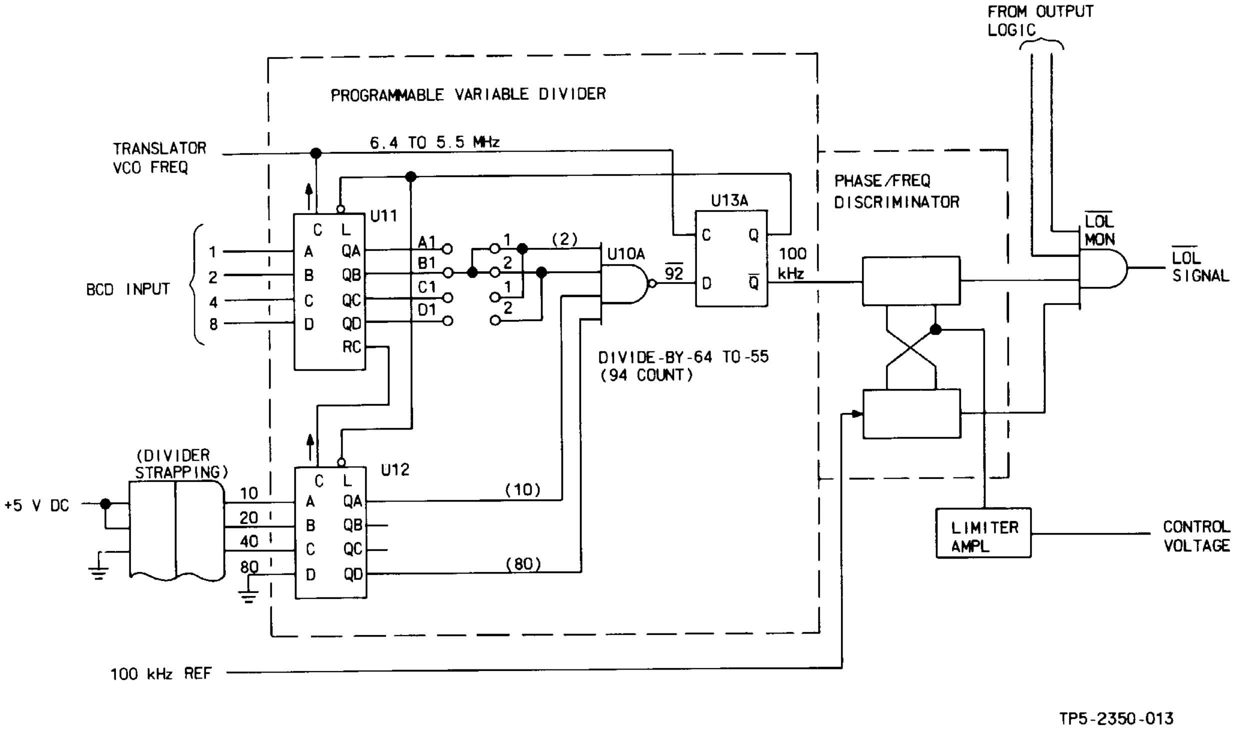


10-kHz Decade Translator, Logic Circuit
Figure 6

Table 5. 1-kHz Decade, Logic Truth Table.

BCD INPUT (1 kHz)	DIVIDER INPUTS								OUTPUT COUNT	DIVIDE-BY	LOOP FREQ (MHz)
	U11				U12						
	A	B	C	D	^{1}A	^{1}B	**C	*D			
0	0	0	0	0	1	1	0	0	30	64	6.4
1	1	0	0	0	1	1	0	0	31	63	6.3
2	0	1	0	0	1	1	0	0	32	62	6.2
3	1	1	0	0	1	1	0	0	33	61	6.1
4	0	0	1	0	1	1	0	0	34	60	6.0
5	1	0	1	0	1	1	0	0	35	59	5.9
6	0	1	1	0	1	1	0	0	36	58	5.8
7	1	1	1	0	1	1	0	0	37	57	5.7
8	0	0	0	1	1	1	0	0	38	56	5.6
9	1	0	0	1	1	1	0	0	39	55	5.5

*Internally strapped for logic 0 (ground).
**Externally strapped for logic 0 (ground) at pin 16.
^{1}Externally strapped for logic 1 (+5.2 V dc) at pins 7 and 17.

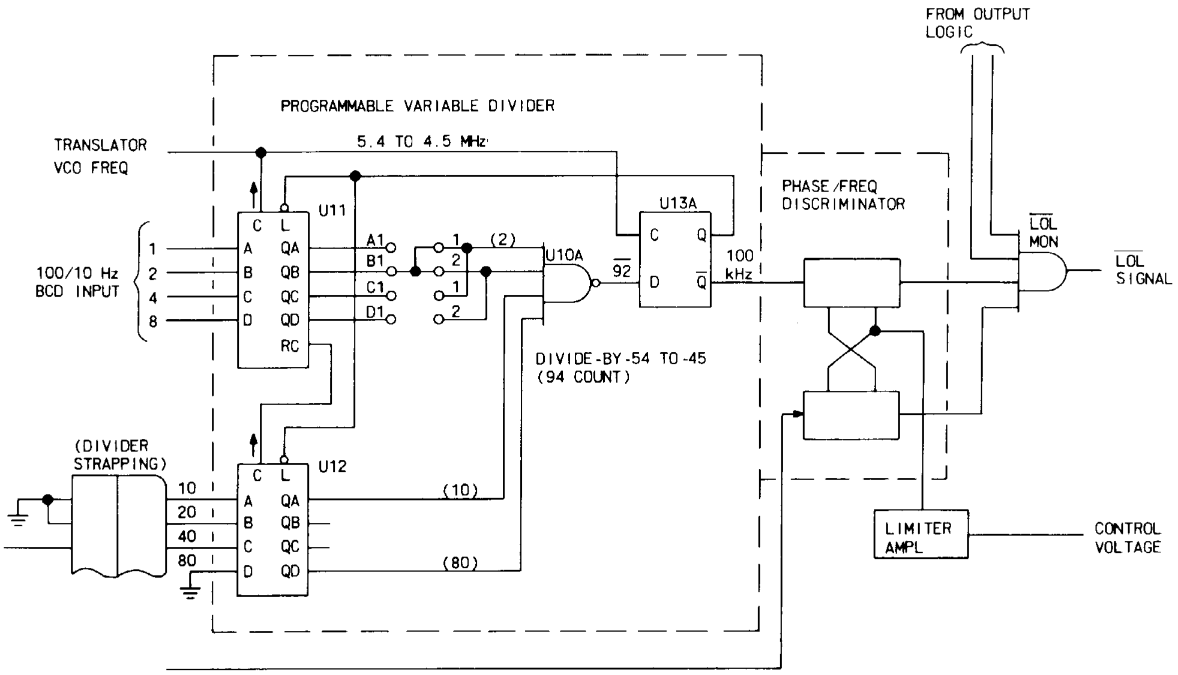


1-kHz Decade Translator, Logic Circuit
Figure 7

Table 6. 100/10-Hz Decade, Logic Truth Table.

BCD INPUT (100/10 Hz)	DIVIDER INPUTS								OUTPUT COUNT	DIVIDE-BY	LOOP FREQ (MHz)
	U11				U12						
	A	B	C	D	**A	**B	¹C	*D			
0	0	0	0	0	0	0	1	0	40	54	5.4
1	1	0	0	0	0	0	1	0	41	53	5.3
2	0	1	0	0	0	0	1	0	42	52	5.2
3	1	1	0	0	0	0	1	0	43	51	5.1
4	0	0	1	0	0	0	1	0	44	50	5.0
5	1	0	1	0	0	0	1	0	45	49	4.9
6	0	1	1	0	0	0	1	0	46	48	4.8
7	1	1	1	0	0	0	1	0	47	47	4.7
8	0	0	0	1	0	0	1	0	48	46	4.6
9	1	0	0	1	0	0	1	0	49	45	4.5

*Internally strapped for logic 0 (ground).
**Externally strapped for logic 0 (ground) at pins 7 and 17.
¹Externally strapped for logic 1 (+5.2 V dc) at pin 16.



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100/10-Hz Decade Translator, Logic Circuit
Figure 8

2.3 Translator VCO Circuits

The translator vco circuits receive a control voltage from the translator logic circuits. The control voltage drives the vco to the required translator frequency. The translator signal output is supplied through one buffer amplifier to the output mixer circuits and the translator logic circuits.

2.4 Output Mixer Circuits

The output mixer circuits receive a translator signal input (table 2) from the translator vco. The translator vco signal is mixed with the output vco frequency (table 2) and a resulting difference frequency (table 2, same as high-reference input) is supplied to the output logic circuits.

2.5 Output Logic Circuits

The output logic circuits receive the output mixer difference frequency and a high-reference input signal (table 2), and supply a control voltage output signal to operate the output vco.

Refer to figure 9. The output mixer difference frequency is supplied through a squaring amplifier to a phase/frequency discriminator. This frequency is compared with the high-reference input signal. A phase or frequency difference in the discriminator causes the control voltage to increase or decrease to adjust the frequency of the vco. If there is no phase or frequency difference, the discriminator provides a logic 1 lock signal output and the vco frequency locks.

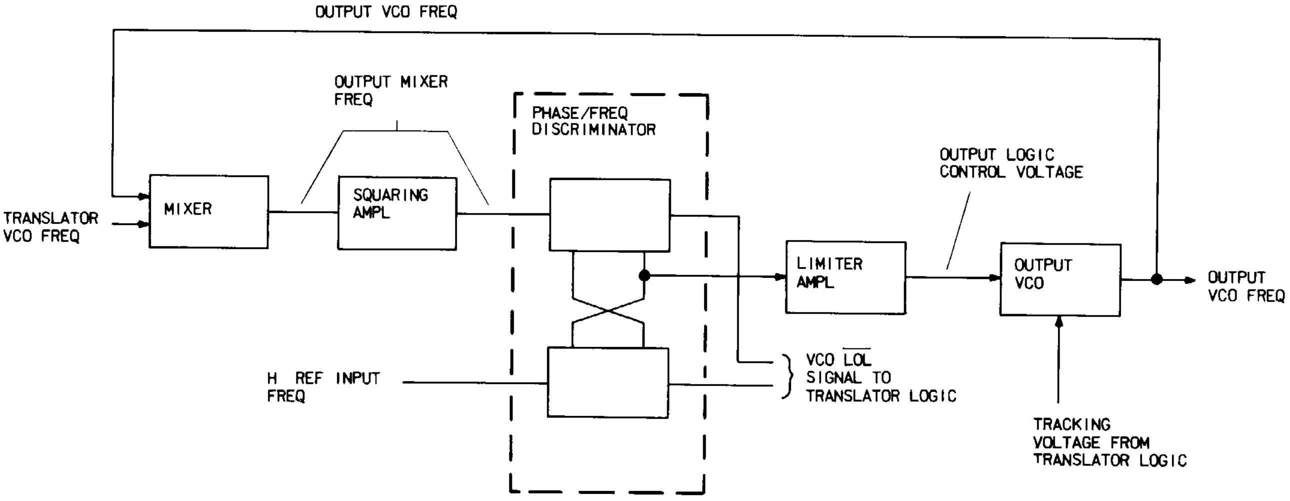
2.6 Output VCO Circuits

The output vco circuits receive a control voltage from the output logic circuits and a tracking voltage from the translator logic circuits. The tracking voltage from the translator logic circuits provides a reference for the output vco, and the control voltage from the output logic circuits drives the output vco to the required output vco frequency. The output vco frequency is supplied through a fixed divide-by-10 circuit and provides a reference frequency to the unit under control for additional frequency mixing and generation. Note that the tracking voltage from the translator logic circuits is used as a reference for the output vco, thus summing the translator frequency information and the output vco frequency information.

2.7 Up/Down Decade Counter 351-1527-040 (Refer to table 7)

The 351-1527-040 up/down decade counter is a 4-bit decade counter. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincidently with each other when input conditions are met.

A high at the enable input inhibits counting. A LOC at the enable input and a low-to-high clock transition triggers the four master/slave flip-flops. The enable input should be changed only when the clock is high. The down/up input determines the direction of the count. When low, the count goes up; when high, the count goes down.



Output Logic Circuits
Figure 9

Table 7. Up/Down Decade Counter 351-1527-040, Logic Truth Table.

PROGRAMMABLE INPUTS				COUNT	BCD OUTPUTS			
A	B	C	D		QA	QB	QC	QD
0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0
0	1	0	0	2	0	1	0	0
1	1	0	0	3	1	1	0	0
0	0	1	0	4	0	0	1	0
1	0	1	0	5	1	0	1	0
0	1	1	0	6	0	1	1	0
1	1	1	0	7	1	1	1	0
0	0	0	1	8	0	0	0	1
1	0	0	1	9	1	0	0	1

E (enable): logic 0 enables counter; logic 1 inhibits counter.

L (load): logic 0 programs the bcd output count to be set at the bcd count of the programmable inputs; the next clock pulse counts one higher/lower (up/down).

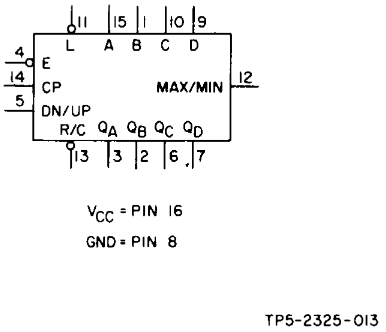
DU (down/up): logic 0 counts up; logic 1 counts down.

CP (clock pulse): logic 0-to-logic 1 transition advances counter.

RC (ripple clock): logic 0 pulse equal to 1/2 clock cycle when an overflow occurs.

MM (maximum/minimum count): logic 1 pulse equal to full clock cycle when an overflow or underflow occurs.

These counters are programmable. The outputs may be preset to any state by placing a low on the load input and entering the desired data at the data inputs. The output changes to agree with the data inputs independently of the state of the clock input. This allows the counters to be used as modulo-N dividers by modifying the count length with the preset inputs.



Up/Down Decade Counter 351-1527-040
Figure 10

Two outputs are available to perform the cascading function: ripple clock and maximum/minimum count. The latter output produces a high level output pulse with a duration approximately equal to one complete cycle of the clock when the counter overflows or underflows. The ripple clock output produces a low-level output pulse equal in width to the low-level portion of the clock input when an overflow or underflow condition exists. The counters are cascaded by feeding the ripple clock output to the enable input of the succeeding counter if parallel clocking is used, or to the clock input if parallel enabling is used. The maximum/minimum count output can be used to accomplish look-ahead for high-speed operation.

2.8 Decade Counter 351-1636-010 (Refer to table 8.)

The 351-1636-010 decade counter is a high-speed, monolithic decade counter consisting of four dual-rack, master-slave flip-flops internally interconnected to provide a divide-by-2 counter and a divide-by-5 counter. Gated direct reset lines are provided to inhibit count inputs and return all outputs to a logical 0 or to a binary coded decimal (bcd) count of 9. As the output from flip-flop A is not internally connected to the succeeding stages, the count may be separated in three independent count modes.

a. When used as a binary coded decimal decade counter, the BD input must be externally connected to the A output. The A input receives the incoming count, and a count sequence is obtained in accordance with the bcd count sequence in table 8. In addition to a conventional 0 reset, inputs are provided to reset a bcd 9 count for nine's complement decimal applications.
b. If a symmetrical divide-by-10 count is desired for frequency synthesizers or other applications requiring division of a binary count by a power of 10, the D output must be externally connected to the A input. The input count is then applied at the BD input and a divide-by-10 square wave is obtained at output A.
c. For operation as a divide-by-2 counter and divide-by-5 counter, no external interconnections are required. Flip-flop A is used as a binary element for the divide-by-2 function. The BD input is used to obtain binary divide-by-5 operation at the B, C, and D outputs. In this mode, the two counters operate independently; however, all four flip-flops are reset simultaneously.

Table 8. Decade Counter 351-1636-010, Logic Truth Table.

*BCD COUNT SEQUENCE				
COUNT	OUTPUT			
	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

**RESET/COUNT							
RESET INPUTS				OUTPUT			
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	D	C	B	A
1	1	0	X	0	0	0	0
1	1	X	0	0	0	0	0
X	X	1	1	1	0	0	1
X	0	X	0	Count			
0	X	0	X	Count			
0	X	X	0	Count			
X	0	0	X	Count			

*Output A connected to input BD for BCD count.
**X indicates that either a logical 1 or a logical 0 may be present.

2.9 Dual D-Type Flip-Flop With Preset and Clear 351-1525-040 (Refer to table 9)

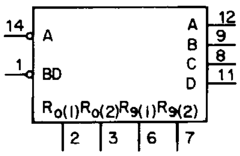
The 351-1525-040 consists of dual high-speed D-type flip-flops. Information on the D input is transferred to the Q output on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. When the clock input is at either high or low level, the D-input signal has no effect.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer decade are listed in the maintenance section of this instruction book.

LOGIC SYMBOL

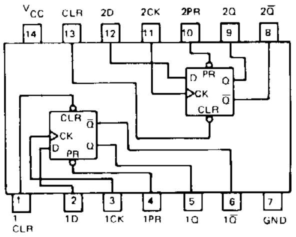


TP5-2326-012

Decade Counter 351-1636-010
Figure 11

3.2 Testing

The test procedures in table 10 check total performance of the synthesizer decade. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



TP5-2327-011

Dual D-Type Flip-Flop With Preset and Clear 351-1525-040
Figure 12

Table 9. Dual D-Type Flip-Flop With Preset and Clear 351-1525-040, Logic Truth Table.

INPUTS				OUTPUTS	
PRESET	CLEAR	CLOCK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	*H	*H
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q_0}$

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
* This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of the unit containing the synthesizer decade that is to be tested.		
	b. Remove cover from the synthesizer section of the unit.		
	c. Remove synthesizer decade and install it on an extender card and place it in the unit.		
	d. Set unit LINE SELECTOR switch to 115 V.		
	e. Connect unit to 115-V ac power source and set power on.		
	f. Measure dc voltage from P1-20 and P1-2 to P1-6 (ground).	+5.2 ±0.2 V dc.	Check unit synthesizer voltage regulator.
	g. Measure dc voltage from P1-10 to P1-6 (ground).	NLT +19.5 V dc, NMT +20.8 V dc.	Check unit synthesizer voltage regulator.
2. 100-kHz decade 623-2080-001	**Note** CR1, CR2, CR3, and CR4 are located under metal can shields. These shields must be in place during testing and adjustments. Refer to figure 13 for test point locations on the rear of the synthesizer decade.		
	a. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	800 ±50 kHz. Note actual frequency.	Check unit 10-kHz decade.
	b. Set FREQUENCY KHZ control on front panel to 09900.00 (or 09900.0).		
	c. Measure the dc voltage at the cathode end of CR3-CR4. (Refer to note and chart at end of test 2 for voltages and output frequencies at different 100-kHz settings.)	10.0 ±0.1 V dc.	Adjust L9 for 10.0 ±0.1 V dc. If L9 adjustment does not correct the problem, check Q4, Q5, and associated circuit.
	d. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	940 ±5 kHz. (Actual should equal 935 kHz plus one-tenth of the difference between 850 kHz and the actual frequency in step a.)	Adjust L7 for actual frequency required with 1.5 V dc at anode end of CR1-CR2. If L7 adjustment does not correct the problem, check Q1, Q2, and associated circuits.
(Cont)			

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	e. Measure the dc voltage at the anode end of CR1-CR2.	1.5 ±0.5 V dc.	Same as step d.
	f. Note the dc voltage at the anode end of the anode end of CR1-CR2 while moving the 100-kHz frequency control from 9 down to 0.	NLT 1.0 V dc and NMT 2.0 V dc at any frequency control setting.	Adjust L7 so that all settings fall into the 1.0- to 2.0-V dc reading.
	g. Set FREQUENCY KHZ control on front panel to 09000.00 (or 09000.0).		
	h. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	850 ±0.5 kHz.	Check unit 10-kHz decade.
	i. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	1035 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	j. Set FREQUENCY KHZ control on front panel to 09900.00 (or 09900.0).		
	k. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	945 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	l. Measure the dc voltage at P1-12 to ground.	NLT +3.5 V dc.	Check U3, U8, U9, and U10.
		Note RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that result of step m is satisfactory.	
	m. Ground P1-5 while noting the voltage at P1-12.	NMT 0.5 V dc.	Check U6, U7, U8, U9, and U10.
	n. Remove P1-5 ground.		
	o. Set front-panel PWR switch off.		
	p. Remove 10-kHz decade from unit under test.		
	q. Set front-panel PWR switch on.		
	r. Measure the dc voltage at P1-12 to ground.	NMT 0.5 V dc.	Check U1, U2,U3, and U10.
(Cont)	s. Set front-panel PWR switch off.		

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	t. Replace 10-kHz decade in unit under test.		

Note

The following chart is shown with an input frequency of 850 ±5 kHz. The actual output frequency with any input frequency can be determined using the following formula.

$$AF = LF - 10\text{ kHz} + \frac{850\text{ kHz} - IF}{10}$$

AF = actual output frequency at P1-1.

LF = output frequency listed in chart for associated 100-kHz frequency digit.

IF = actual input frequency.

100-kHz FREQ DIGIT	CR3-CR4 DC VOLTAGE	FREQ OUTPUT P1-1 (kHz)
9	10.00 ±0.1	945 ±0.5
8	*10.30	955 ±0.5
7	*10.55	965 ±0.5
6	*10.85	975 ±0.5
5	*11.15	985 ±0.5
4	*11.40	995 ±0.5
3	*11.70	1005 ±0.5
2	*11.95	1015 ±0.5
1	*12.25	1025 ±0.5
0	*12.50	1035 ±0.5

Note

Table shown with an input frequency of 850 ±5 kHz [front-panel FREQUENCY KHZ setting of 09X00.00 (or 09X00.0)].

*Reference voltage only. Voltages will vary from board to board.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. 10-kHz decade 623-2080-002	**Note** CR1, CR2, CR3, and CR4 are located under metal can shields. These shields must be in place during testing and adjustments. Refer to figure 13 for test point locations on the rear of the synthesizer decade.		
	a. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	650 ±50 kHz. Note actual frequency.	Check unit 1-kHz decade.
(Cont)	b. Set FREQUENCY KHZ control on front panel to 09990.00 (or 09990.0).		

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	c. Measure the dc voltage at the cathode end of CR3-CR4 (refer to note and chart at end of test 3 for voltages and output frequencies at different 10-kHz settings).	10.45 ±0.1 V dc.	Adjust L9 for 10.00 ±0.1 V dc. If L9 adjustment does not correct the problem, check Q4, Q5, and associated circuit.
	d. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	755 ±5 kHz. (Actual should equal 750 kHz plus one-tenth of the difference between 700 kHz and the actual frequency in step a.)	Adjust L7 for actual frequency required with 1.5 V dc at anode end of CR1-CR2. If L7 adjustment does not correct the problem, check Q1, Q2, and associated circuits.
	e. Measure the dc voltage at the anode end of CR1-CR2.	1.5 ±0.5 V dc.	Same as step d.
	f. Note the dc voltage of the anode end of CR1-CR2 while moving the 10-kHz frequency control from 9 down to 0.	NLT 1.0 V dc and NMT 2.0 V dc at any frequency control setting.	Adjust L7 so that all settings fall into the 1.0- to 2.0-V dc reading.
	g. Set FREQUENCY KHZ control on front panel to 09900.00 (or 09900.0).		
	h. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	700 ±0.5 kHz.	Check unit 1-kHz decade.
	i. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	850 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	j. Set FREQUENCY KHZ control on front panel to 09990.00 (or 09990.0).		
	k. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	760 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	l. Measure the dc voltage at P1-12 to ground.	NLT +3.5 V dc. **Note** RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that result of step m is satisfactory.	Check U3, U8, U9, and U10.
(Cont)	m. Ground P1-5 while noting the voltage at P1-12.	NMT 0.5 V dc.	Check U6, U7, U8, U9, and U10.

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	n. Remove P1-5 ground.		
	o. Set front-panel PWR switch off.		
	p. Remove 1-kHz decade from unit under test.		
	q. Set front-panel PWR switch on.		
	r. Measure the dc voltage at P1-12 to ground.	NMT 0.5 V dc.	Check U1, U2, U3, and U10.
	s. Set front-panel PWR switch off.		
	t. Replace 1-KHZ decade in unit under test.		

Note

The following chart is shown with an input frequency of 700 ±5 kHz. The actual output frequency with any input frequency can be determined using the following formula.

$$AF = LF - 10\text{ kHz} + \frac{700\text{ kHz} - IF}{10}.$$

AF = actual output frequency at P1-1.

LF = output frequency listed in chart for associated 10-kHz frequency digit.

IF = actual input frequency.

10-kHz FREQ DIGIT	CR3-CR4 DC VOLTAGE	FREQ OUTPUT P1-1 (kHz)
9	10.00 ±0.1	760 ±0.5
8	*10.30	770 ±0.5
7	*10.55	780 ±0.5
6	*10.85	790 ±0.5
5	*11.10	800 ±0.5
4	*11.40	810 ±0.5
3	*11.75	820 ±0.5
2	*12.00	830 ±0.5
1	*12.35	840 ±0.5
0	*12.65	850 ±0.5

Note

Table shown with an input frequency of 700 ±5 kHz [front-panel FREQUENCY KHZ setting of 099X0.00 (or 099X0.0)].

*Reference voltage only. Voltages will vary from board to board.

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. 1-kHz decade 623-2080-003	**Note** CR1, CR2, CR3, and CR4 are located under metal can shields. These shields must be in place during testing and adjustments. Refer to figure 13 for test point locations on the rear of the synthesizer decade.		
	a. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	550 ±50 kHz. Note actual frequency.	Check unit 100-kHz decade.
	b. Set FREQUENCY KHZ control on front panel to 09999.00 (or 09999.0).		
	c. Measure the dc voltage at the cathode end of CR3-CR4 (refer to note and chart at end of test 4 for voltages and output frequencies at different 1-kHz settings).	10.0 ±0.1 V dc.	Adjust L9 for 10.0 ±0.1 V dc. If L9 adjustment does not correct the problem, check Q4, Q5, and associated circuit.
	d. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	605 ±5 kHz. (Actual should equal 600 kHz plus one-tenth of the difference between 610 kHz and the actual frequency in step a.)	Adjust L7 for actual frequency required with 1.5 V dc at anode end of CR1-CR2. If L7 adjustment does not correct the problem, check Q1, Q2, and associated circuits.
	e. Measure the dc voltage at the anode end of CR1-CR2.	1.5 ±0.5 V dc.	Same as step d.
	f. Note the dc voltage at the anode end of CR1-CR2 while moving the 1-kHz frequency control from 9 down to 0.	NLT 1.0 V dc and NMT 2.0 V dc at any frequency control setting.	Adjust L7 so that all settings fall into the 1.0- to 2.0-V reading.
	g. Set FREQUENCY KHZ control on front panel to 09990.00 (or 09990.0).		
	h. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	600 ±0.5 kHz.	Check unit 100-kHz decade.
	i. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	700 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
(Cont)	j. Set FREQUENCY KHZ control on front panel to 09999.00 (or 09999.0).		

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	k. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	610 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	l. Measure the dc voltage at P1-12 to ground.	NLT +3.5 V dc.	Check U3, U8, U9, and U10.
		Note RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that result of step m is satisfactory.	
	m. Ground P1-5 while noting the voltage at P1-12.	NMT 0.5 V dc.	Check U6, U7, U8, U9, and U10.
	n. Remove P1-5 ground.		
	o. Set front-panel PWR switch off.		
	p. Remove decade in 100-Hz slot (A18) from unit under test.		
	q. Set front-panel PWR switch on.		
	r. Measure the dc voltage at P1-12 to ground.	NMT 0.5 V dc.	Check U1, U2, U3, and U10.
	s. Set front-panel PWR switch off.		
	t. Replace decade in 100-Hz slot (A18) in unit under test.		
(Cont)	**Note** The following chart is shown with an input frequency of 600 ±5 kHz. The actual output frequency with any input frequency can be determined using the following formula. $AF = LF - 10\ \text{kHz} + \frac{600\ \text{kHz} - IF}{10}$. AF = actual output frequency at P1-1. LF = output frequency listed in chart for associated 1-kHz frequency digit. IF = actual input frequency.		

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>4. (Cont)</td><td colspan="3">
<table>
<tr><th>1-kHz FREQ DIGIT</th><th>CR3-CR4 DC VOLTAGE</th><th>FREQ OUTPUT P1-1 (kHz)</th></tr>
<tr><td>9</td><td>10.00 ±0.1</td><td>610 ±0.5</td></tr>
<tr><td>8</td><td>*10.40</td><td>620 ±0.5</td></tr>
<tr><td>7</td><td>*10.85</td><td>630 ±0.5</td></tr>
<tr><td>6</td><td>*11.25</td><td>640 ±0.5</td></tr>
<tr><td>5</td><td>*11.70</td><td>650 ±0.5</td></tr>
<tr><td>4</td><td>*12.10</td><td>660 ±0.5</td></tr>
<tr><td>3</td><td>*12.55</td><td>670 ±0.5</td></tr>
<tr><td>2</td><td>*12.95</td><td>680 ±0.5</td></tr>
<tr><td>1</td><td>*13.40</td><td>690 ±0.5</td></tr>
<tr><td>0</td><td>*13.80</td><td>700 ±0.5</td></tr>
<tr><td colspan="3">Note
Table shown with an input frequency of 600 ±5 kHz [front-panel FREQUENCY KHZ setting of 0999X.00 (or 0999X.0)].
*Reference voltage only. Voltages will vary from board to board.</td></tr>
</table>
</td></tr>
<tr><td>5. 100/10-Hz decade 623-2080-004</td><td>Note
CR1, CR2, CR3, and CR4 are located under metal can shields. These shields must be in place during testing and adjustments. Refer to figure 13 for test-point locations on the rear of the synthesizer decade.</td><td></td><td></td></tr>
<tr><td></td><td>a. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).</td><td>550 ±50 kHz. Note actual frequency.</td><td>Check unit 10-Hz decade or end decade.</td></tr>
<tr><td></td><td>b. If decade installed in 100-Hz slot (A18), set FREQUENCY KHZ control to 09999.90 (or 09999.9).
If decade installed in 10-Hz slot (A17), set FREQUENCY KHZ control to 09999.99.</td><td></td><td></td></tr>
<tr><td>(Cont)</td><td>c. Measure the dc voltage at the cathode end of CR3-CR4 (refer to note and chart at end of test 5 for voltages and output frequencies at different 100- or 10-Hz settings).</td><td>9.5 ±0.1 V dc.</td><td>Adjust L9 for 9.5 ±0.1 V dc. If L9 adjustment does not correct the problem, check Q4, Q5, and associated circuit.</td></tr>
</table>

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	d. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	515 ±5 kHz. (Actual should equal 510 kHz plus one-tenth of the difference between 600 kHz and the actual frequency in step a.)	Adjust L7 for actual frequency required with 1.5 V dc at anode end of CR1-CR2. If L7 adjustment does not correct the problem, check Q1, Q2, and associated circuits.
	e. Measure the dc voltage at the anode end of CR1-CR2.	1.5 ±0.5 V dc.	Same as step d.
	f. Note the dc voltage at the anode end of CR1-CR2 while moving the 100- or 10-Hz frequency control from 9 down to 0 (Change 100-Hz control if installed as 100-Hz decade or 10-Hz control if installed as 10-Hz decade).	NLT 1.0 V dc and NMT 2.0 V dc at any frequency control setting.	Adjust L7 so that all settings fall into the 1.0- to 2.0-V dc reading.
	g. If decade installed in 100-Hz slot (A18), set FREQUENCY KHZ control on front panel to 09999.00 (or 09999.0). If decade installed in 10-Hz slot, set FREQUENCY KHZ control on front panel to 09999.90.		
	h. Using a frequency counter, measure the high reference input between P1-14 and P1-4 (ground).	600 ±0.5 kHz.	Check unit 10-Hz decade or end decade.
	i. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	600 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	j. If decade installed in 100-Hz slot (A18), set FREQUENCY KHZ control on front panel to 09999.90 (or 09999.9). If decade installed in 10-Hz slot (A18), set FREQUENCY KHZ control on front panel to 09999.99.		
	k. Using a frequency counter, measure the output between P1-1 and P1-11 (ground).	510 ±0.5 kHz.	Check U11, U12, U13, and associated circuits.
	l. Measure the dc voltage at P1-12 to ground.	NLT +3.5 V dc. **Note** RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that result of step m is satisfactory.	Check U3, U8, U9, and U10.
(Cont)	m. Ground P1-5 while noting the voltage at P1-12.	NMT 0.5 V dc.	Check U6, U7, U8, U9, and U10.

Table 10. Synthesizer Decade, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	n. Remove P1-5 ground.		
	o. Set front-panel PWR switch off.		
	p. If testing decade installed in 100-Hz slot (A18), remove decade in 10-Hz (A17) slot from unit under test. If testing decade installed in 10-Hz slot (A17), remove end decade from unit under test.		
	q. Set front-panel PWR switch on.		
	r. Measure the dc voltage at P1-12 to ground.	NMT 0.5 V dc.	Check U1, U2, U3, and U10.
	s. Set front-panel PWR switch off.		
	t. Replace decade that was removed in step p.		

The following chart is shown with an input frequency of 600 ±5 kHz. The actual output frequency with any input frequency can be determined using the following formula.

$$AF = LF - 10\ \text{kHz} + \frac{600\ \text{kHz} - IF}{10}.$$

AF = actual output frequency at P1-1.

LF = output frequency listed in chart for associated 100- or 10-Hz frequency digit.

IF = actual input frequency.

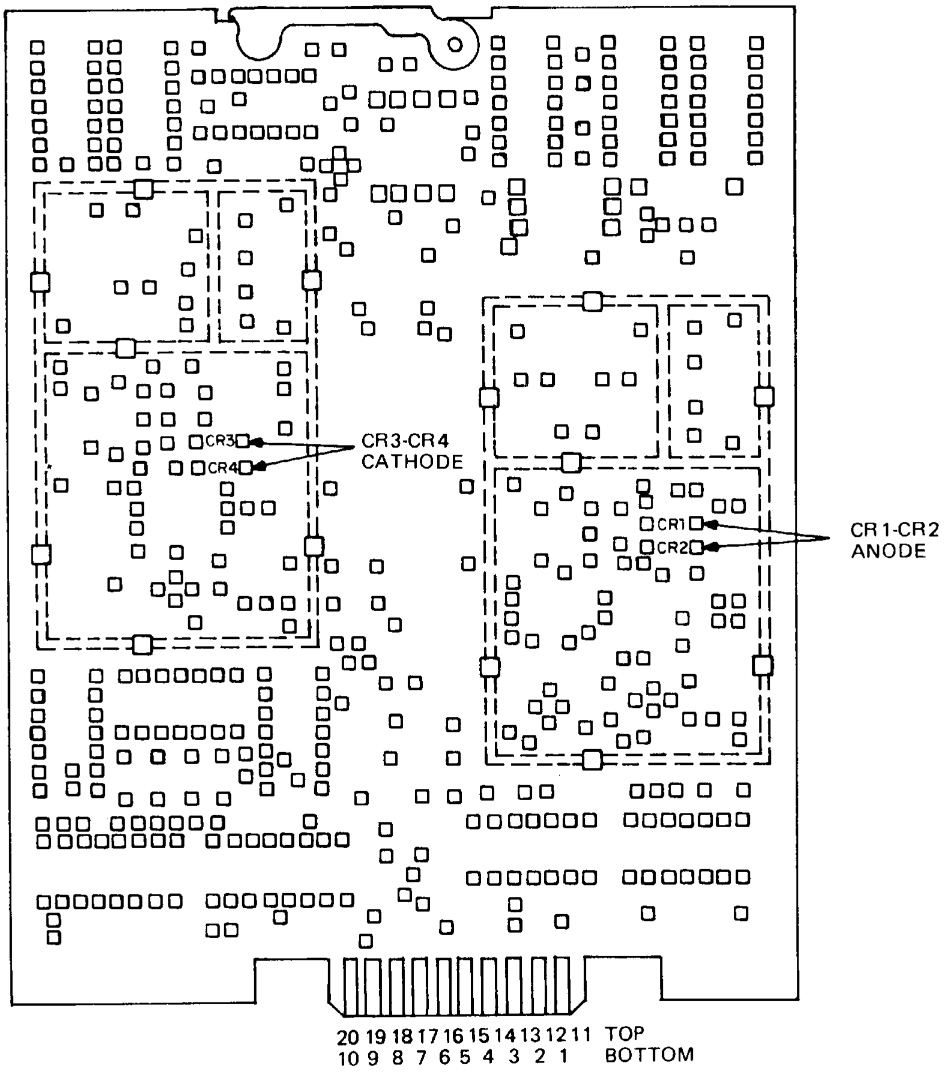
*100/10-Hz FREQ DIGIT	CR3-CR4 DC VOLTAGE	FREQ OUTPUT P1-1 (kHz)
9	10.0 ±0.1	510 ±0.5
8	**10.5	520 ±0.5
7	**11.0	530 ±0.5
6	**11.5	540 ±0.5
5	**12.0	550 ±0.5
4	**12.5	560 ±0.5
3	**13.0	570 ±0.5
2	**13.5	580 ±0.5
1	**14.0	590 ±0.5
0	**14.5	600 ±0.5

*If decade installed in 100-Hz (A18) slot, 100-Hz frequency digit position. If decade installed in 10-Hz (A17) slot, 10-Hz frequency digit position.

**Reference voltage only. Voltages will vary from board to board.

Note

Table shown with an input frequency of 600 ±5 kHz.



TP5-3056-011

Synthesizer Decade, Rear View
Figure 13

4. ALIGNMENT/ADJUSTMENT

4.1 L7 and L9 Selection, and Decade Strapping

Note

> L7 and L9 can be replaced only by removing the metal cans that cover them. In emergency repairs L7, L9, and strapping can be changed on any synthesizer decade 623-2080-( ) to make the required decade (100 kHz, 10 kHz, 1 kHz, or 100/10 Hz). When L7, L9, and straps are installed as follows the indicated decade is constructed. Testing and adjustments must be made to ensure proper operation.

4.1.1 100-kHz Decade 623-2080-001

a. Install L7, 6.75 to 11.25 μH, (242-0441-030).
b. Install L9, 6.75 to 11.25 μH, (242-0441-030).
c. Strap A to 1 and B to 2.

4.1.2 10-kHz Decade 623-2080-002

a. Install L7, 6.75 to 11.25 μH, (242-0441-030).
b. Install L9, 12.0 to 18.0 μH, (242-0441-040).
c. Strap B to 2 and C to 1.

4.1.3 1-kHz Decade 623-2080-003

a. Install L7, 12.0 to 18.0 μH, (242-0441-040).
b. Install L9, 20.8 to 31.2 μH, (242-0441-050).
c. Strap B to 2 and 1 to 2.

4.1.4 100/10-Hz Decade 623-2080-004

a. Install L7, 20.8 to 31.2 μH, (242-0441-050).
b. Install L9, 20.8 to 31.2 μH, (242-0441-050).
c. Strap B to 2 and 1 to 2.

4.2 Adjustment of L7 and L9

Note

> If either L7 or L9 is replaced, both must be adjusted. Metal can shields must be installed before making these adjustments.

Refer to table 8. Perform the test procedures applicable to the associated decade.

a. For L7 and L9 adjustment in 100-kHz decade, perform test 2, steps a through d.
b. For L7 and L9 adjustment in 10-kHz decade, perform test 3, steps a through d.
c. For L7 and L9 adjustment in 1-kHz decade, perform test 4, steps a through d.
d. For L7 and L9 adjustment in 100/10-Hz decade, perform test 5, steps a through d.

5. REPAIR

Repair of the synthesizer decade is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

ELECTROSTATIC
SENSITIVE DEVICES
OBSERVE PRECAUTIONS
FOR HANDLING

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 14). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference disignators of each part/subassembly are listed in alphanumeric sequence.These are the reference designators shown on the parts' location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

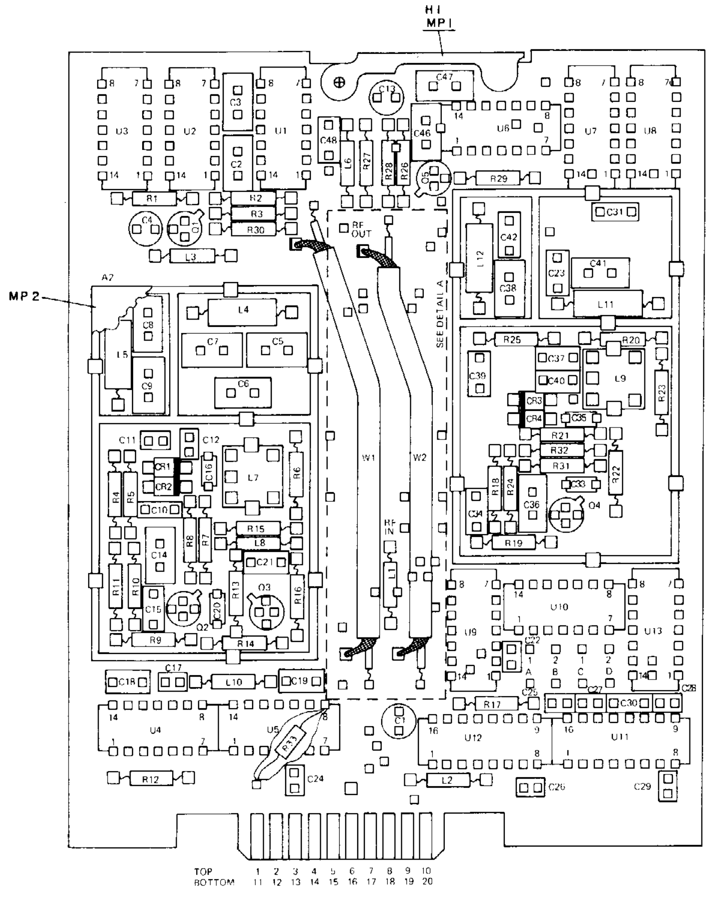
CODE	MANUFACTURER'S NAME AND ADDRESS
01295	Texas Instruments, Inc. US Semiconductor Group PO Box 5012 13500 N. Central Expressway Dallas, TX 75222
02735	RCA Corp. Solid State Div. Route 202 Somerville, NJ 08876
04713	Motorola, Inc. Semiconductor Products Group 5005 E. McDowell Rd. Phoenix, AZ 85008

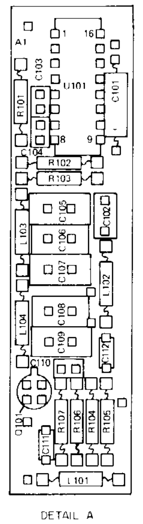
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
07263	Fairchild Camera and Instrument Corp. Semiconductor Div. 464 Ellis St. Mountain View, CA 94042
07910	Teledyne Semiconductor 1300 Terra Bella Ave. Mountain View, CA 94043
14433	ITT Semiconductors PO Box 3049 3301 Electronics Way West Palm Beach, FL 33402
16546	U.S. Capacitor Corp/Centralab Electronics Div 4561 Colorado Los Angeles, CA 90039
18324	Signetics Corp. 811 E. Arques Ave. Sunnyvale, CA 94086
18796	Erie Technological Products, Inc. State College Div. 1900 W. College Ave. State College, PA 16801
20462	PREM Enterprises, Inc. 3519 N. Chapel Hill McHenry, IL 60050
34335	Advanced Micro Devices 901 Thompson Pl. Sunnyvale, CA 94086
56289	Sprague Electric Co. North Adams, MA 01247
81349	Military Specifications
96906	Military Standards

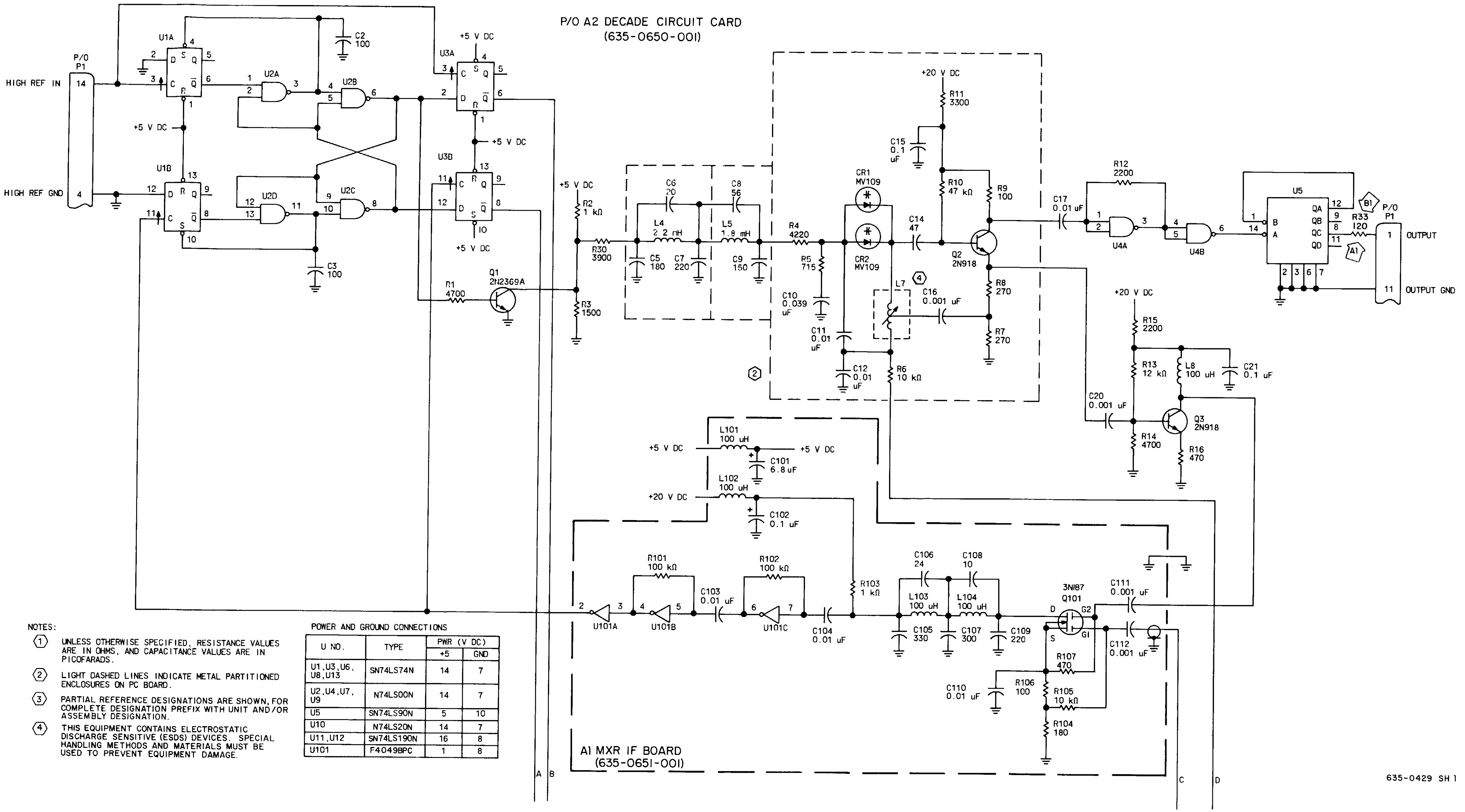
6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
100-kHz synthesizer decade	623-2080-001	REV E
10-kHz synthesizer decade	623-2080-002	REV E
1-kHz synthesizer decade	623-2080-003	REV E
100/10-Hz synthesizer decade	623-2080-004	REV E
Decade circuit card	635-0650-001	REV P
Mixer if board	635-0651-001	REV A







NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, AND CAPACITANCE VALUES ARE IN PICOFARADS.

② LIGHT DASHED LINES INDICATE METAL PARTITIONED ENCLOSURES ON PC BOARD.

③ PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

④ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

POWER AND GROUND CONNECTIONS

U NO.	TYPE	PWR (V DC)	
		+5	GND
U1,U3,U6, U8,U13	SN74LS74N	14	7
U2,U4,U7, U9	N74LS00N	14	7
U5	SN74LS90N	5	10
U10	N74LS20N	14	7
U11,U12	SN74LS190N	16	8
U101	F4049BPC	1	8

Synthesizer Decade, Schematic Diagram
Figure 14 (Sheet 1 of 3)

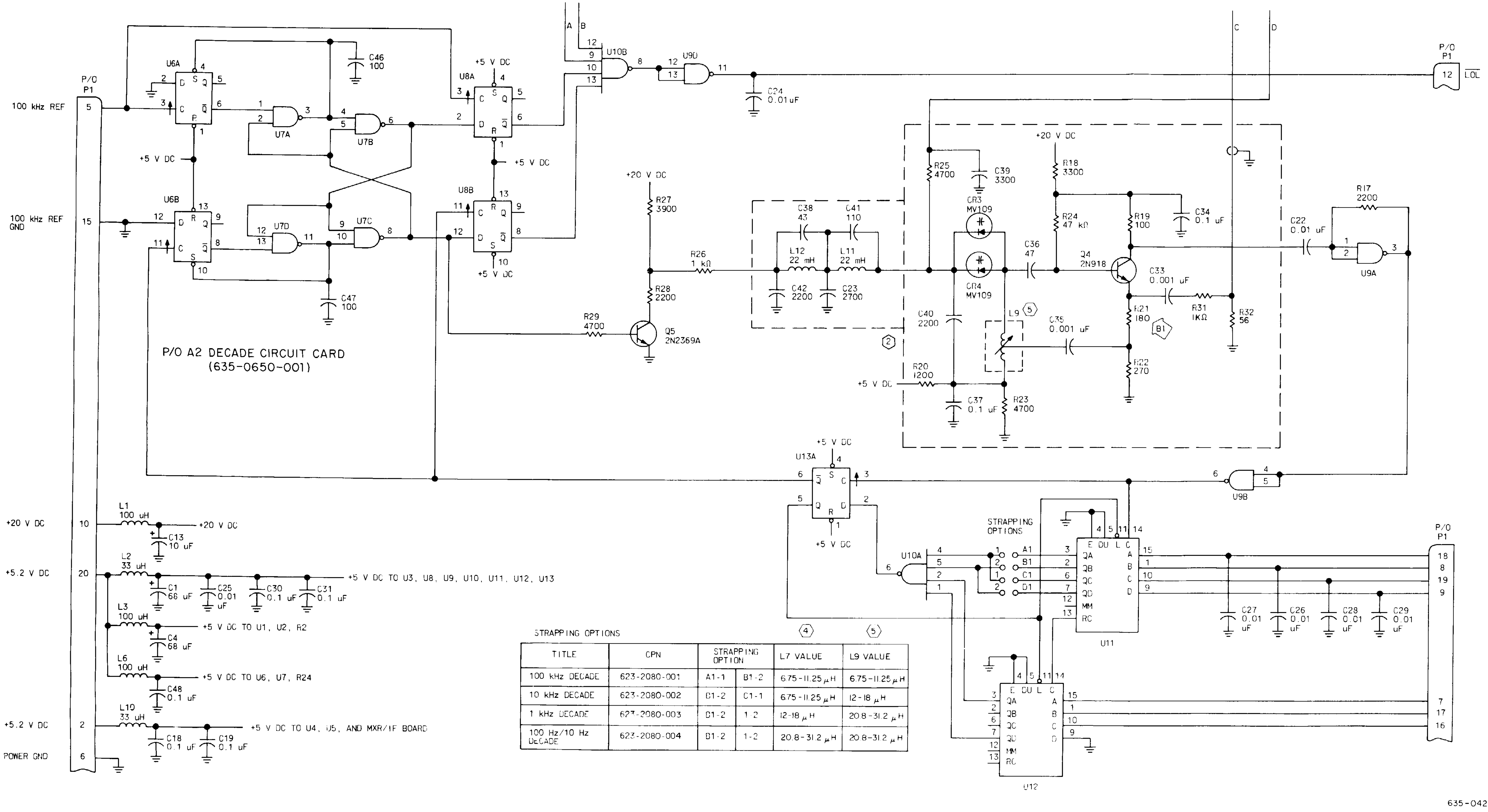
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTH 100-KHZ DECADE	623-2080-001	A		
	SYNTH 10-KHZ DECADE	623-2080-002	B		
	SYNTH 1-KHZ DECADE	623-2080-003	C		
	SYNTH 100/10-HZ DECADE	623-2080-004	D		
A1	MIXER/IF BOARD (ESDS)	635-0651-001			
A2	DECADE BOARD (ESDS)	635-0650-001			
L1-L6	NOT USED				
L7	INDUCTOR,RF	242-0441-030	A,B	20462	242-0441-030
L7	INDUCTOR,RF	242-0441-040	C	20462	242-0441-040
L7	INDUCTOR,RF	242-0441-050	D	20462	242-0441-050
L8	NOT USED				
L9	INDUCTOR,RF	242-0441-030	A	20462	242-0441-030
L9	INDUCTOR,RF	242-0441-040	B	20462	242-0441-040
L9	INDUCTOR,RF	242-0441-050	C,D	20462	242-0441-050
	MIXER/IF BOARD A1 (ESDS)	635-0651-001			
C1-C100	NOT USED				
C101	CAPACITOR,FXD ELCTLT, 6.8UF, 10%, 6V	184-9086-020		81349	M39003-01-2242
C102	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C103, C104	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C105	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 100V	912-3915-000		81349	CM04FA331J03
C106	CAPACITOR,FXD MICA DIEL, 24PF, 5%, 500V	912-3843-000		81349	CM04ED240J03
C107	CAPACITOR,FXD MICA DIEL, 300 PF, 5%, 300V	912-3912-000		81349	CM04FC301J03
C108	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C109	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-3903-000		81349	CM04FD221J03
C110	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C111, C112	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
L1-L100	NOT USED				
L101- L104	COIL,RF 100UH	240-2047-000		96906	MS75085-07
Q1-Q100	NOT USED				
Q101	TRANSISTOR (ESDS)	352-1093-010		02735	3N187
R1-R100	NOT USED				
R101, R102	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R103	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R104	RESISTCR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R105	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R106	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R107	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
U1-U100	NOT USED				
U101	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
	DECADE BOARD A2 (ESDS)	635-0650-001			
CR1-CR4	SEMICOND DEVICE GL DIEL, 0.8 TO 8.5PF, 1000V	922-6124-040		04713	SMV1276
C1	CAPACITOR,FXD ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C2,C3	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C4	CAPACITOR,FXD ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C5	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-3897-000		81349	CM04FD181J03
C6	CAPACITOR,FXD MICA DIEL, 20PF, 5%, 500V	912-3841-000		81349	CM04ED200J03
C7	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-3903-000		81349	CM04FD221J03
C8	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-3861-000		81349	CM04ED560J03
C9	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-3891-000		81349	CM04FD151J03
C10	CAPACITOR,FXD CER DIEL, 0.039UF, PORM10%, 100V	913-5019-390		81349	CK06BX393K
C11,C12	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C13	CAPACITOR,FXD ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C14	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C15	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C16	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C17	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C18,C19	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C20	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C21	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C22	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C23	CAPACITOR,FXD CER DIEL, 0.0027UF, 5%, 100V	913-3117-130		81349	CCR06CG272J
C24-C29	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C30,C31	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C32	NOT USED				
C33	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C34	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C35	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C36	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C37	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C38	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-3854-000		81349	CM04ED430J03
C39	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100COG332K
C40	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-3281-160		18796	8131-100COG222K
C41	CAPACITOR,FXD MICA DIEL, 110PF, 5%, 500V	912-3882-000		81349	CM04FD111J03
C42	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-3281-160		18796	8131-100COG222K
C43-C45	NOT USED				
C46,C47	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C48	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
L1	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L2	COIL,RF 33UH	240-2041-000		96906	MS75085-01
L3	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L4	COIL,RF 2200UH	240-2715-530		96906	MS75089-27
L5	COIL,RF 1800UH	240-2715-520		96906	MS75089-26
L6	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L7	NOT USED				
L8	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L9	NOT USED				
L10	COIL,RF 33UH	240-2041-000		96906	MS75085-01
L11,L12	COIL,RF 22000UH	240-2715-650		96906	MS75089-39
L13	COIL,RF 1.50UH (A1)(B1)	240-2025-000		96906	MS75084-02
Q1	TRANSISTOR	352-0596-030		14433	2N2369A
Q2-Q4	TRANSISTOR	352-0440-000		07910	2N918
Q5	TRANSISTCR	352-0596-030		14433	2N2369A
R1	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R3	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R4	RESISTOR,FXD FILM, 4.22K, 1%, 1/8W	705-1026-000		81349	RN55D4221F
R5	RESISTOR,FXD FILM, 715 OHMS, 1%, 1/8W	705-0989-000		81349	RN55D7150F
R6	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R7,R8	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R9	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R10	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R11	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R12	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R13	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R14	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R15	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R16	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R17	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R18	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R19	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R20	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R21	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (B1)	745-0728-000		81349	RCR07G271KS
R21	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R22	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R23	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R24	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R25	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R26	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R27	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R28	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R29	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R30	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R31	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R32	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R33	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/4W (B1)	745-0716-000		81349	RCR07G121KS
U1	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U2	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U3	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U4	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U5	INTEGRATED CIRCUIT	351-1636-010		01295	SN74LS90N
U6	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U7	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U8	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C
U9	INTEGRATED CIRCUIT	351-1523-110		18324	N74LS00N
U10	INTEGRATED CIRCUIT	351-1523-130		18324	N74LS20N
U11,U12	INTEGRATED CIRCUIT (ESDS)	351-1527-040		34335	SN74LS190N
U13	INTEGRATED CIRCUIT	351-1525-040		18324	N74LS74N883C

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Added A2L13, 1.5μH	635-0650-001 REV K and above
B1	Deleted A2L13, 1.5μH. Added A2R33, 120Ω in same place as A2L13 was removed. Changed A2R21 from 270 to 180Ω.	635-0650-001 REV M and above.

Synthesizer Decade, Schematic Diagram
Figure 14 (Sheet 2)



STRAPPING OPTIONS

TITLE	CPN	STRAPPING OPTION		L7 VALUE ④	L9 VALUE ⑤
100 kHz DECADE	623-2080-001	A1-1	B1-2	6.75-11.25 μH	6.75-11.25 μH
10 kHz DECADE	623-2080-002	B1-2	C1-1	6.75-11.25 μH	12-18 μH
1 kHz DECADE	623-2080-003	B1-2	1 2	12-18 μH	20.8-31.2 μH
100 Hz/10 Hz DECADE	623-2080-004	B1-2	1-2	20.8-31.2 μH	20.8-31.2 μH

Synthesizer Decade, Schematic Diagram
Figure 14 (Sheet 3)

Synthesizer Output (635-4930-001, -002)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767971-102211
2nd Edition, 1 October 1980
1st Revision, 1 January 1981

1. DESCRIPTION

Synthesizer Output 635-4930-001, -002, shown in figure 1, is a module that contains a base 2-layer planar card, four rf secure compartments (metal box construction), and five printed wiring boards. The base 2-layer planar card contains a 20-pin edge-on connector (2 layers, 10 pins each).

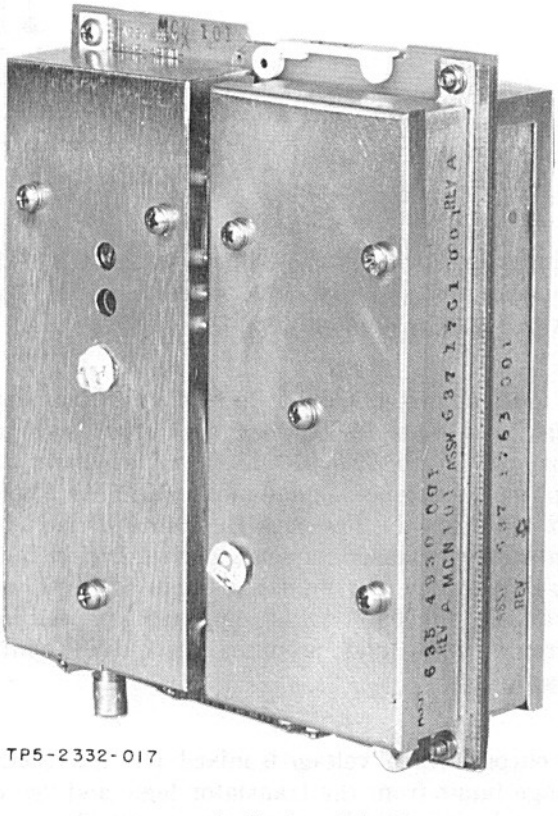
The synthesizer output module consists of translator logic, translator vco, output mixer, output logic, output vco, low-pass filter circuits, and a loss-of-lock (lol) monitor circuit.

2. PRINCIPLES OF OPERATION

2.1 General (Refer to figure 2.)

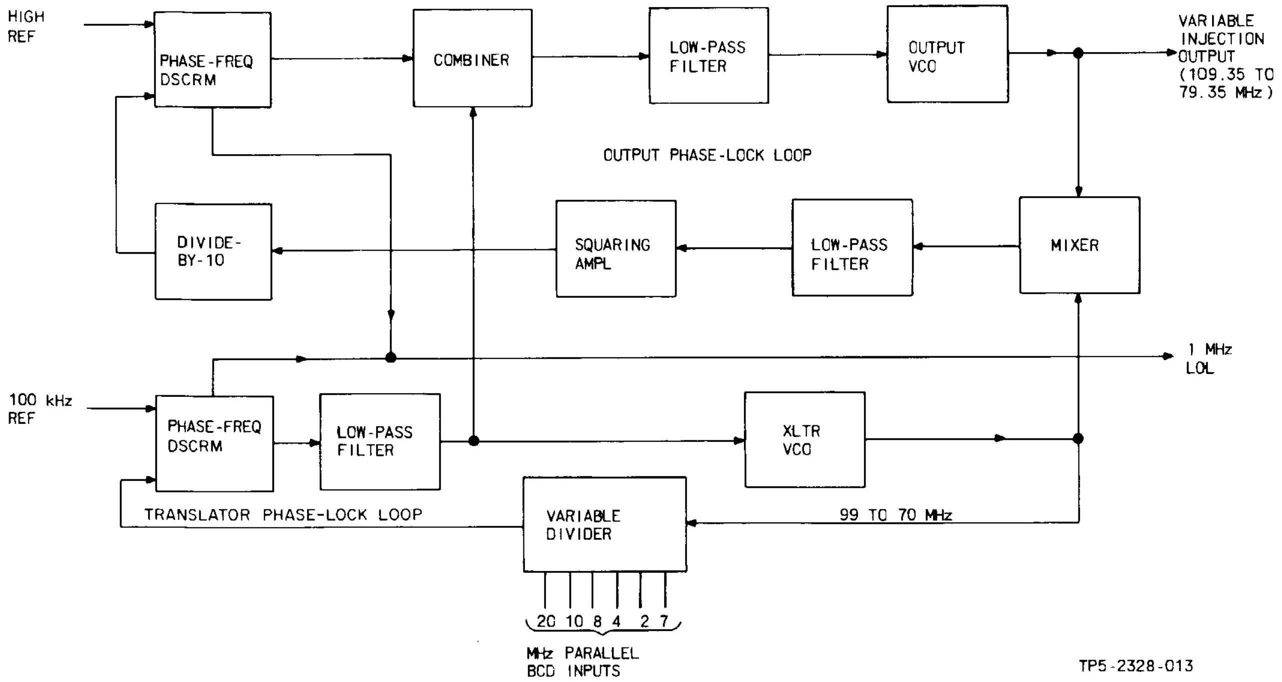
The synthesizer output module receives MHz bcd frequency control signals, a 100-kHz reference signal and a high-reference signal (1.035 to 0.935001 MHz), and generates a 109.35- to 79.35001-MHz variable injection signal output and a 1-MHz lock signal output (logic 1 for lock).

The translator logic circuits receive a 100-kHz reference input, a translator vco signal, and a bcd frequency input. The bcd frequency input is used to program a variable frequency divider (divide-by-99 to 70). The programmed variable frequency divider output (100 kHz) and the 100-kHz reference input are supplied to a phase/frequency discriminator that, with a low-pass filter, provides a control voltage proportional to the phase/frequency difference between its inputs. This control voltage is also supplied as a tracking voltage to the output phase-lock loop.



Synthesizer Output
Figure 1

The translator vco circuit receives the control voltage signal from translator logic circuits and is driven to and phase-locked at the variable frequency as programmed by variable divider bcd inputs to translator logic circuits. The translator vco output (99 to 70 MHz) is supplied to translator logic circuits for



Synthesizer Output, Block Diagram
Figure 2

clocking and lock signal generation. The translator vco output (99 to 70 MHz) is supplied to output mixer circuits for frequency mixing.

The output mixer circuit receives the translator signal input (99 to 70 MHz) and the output vco signal input (109.35 to 79.3501 MHz), mixes them and supplies a reference signal input (10.35 to 9.35001 MHz) through the low-pass filter and divide-by-10 counter to the phase/frequency discriminator. In the phase/frequency discriminator, the divide-by-10 output (1.035 to 0.935 MHz) is compared with the high reference input and produces an output control voltage.

The output control voltage is mixed with the tracking voltage input from the translator logic and vco circuits and applied to the output vco circuit. The output vco circuit receives the output control voltage signal from the output logic circuits and is driven to and locked at the variable injection frequency (109.35 to 79.3501 MHz).

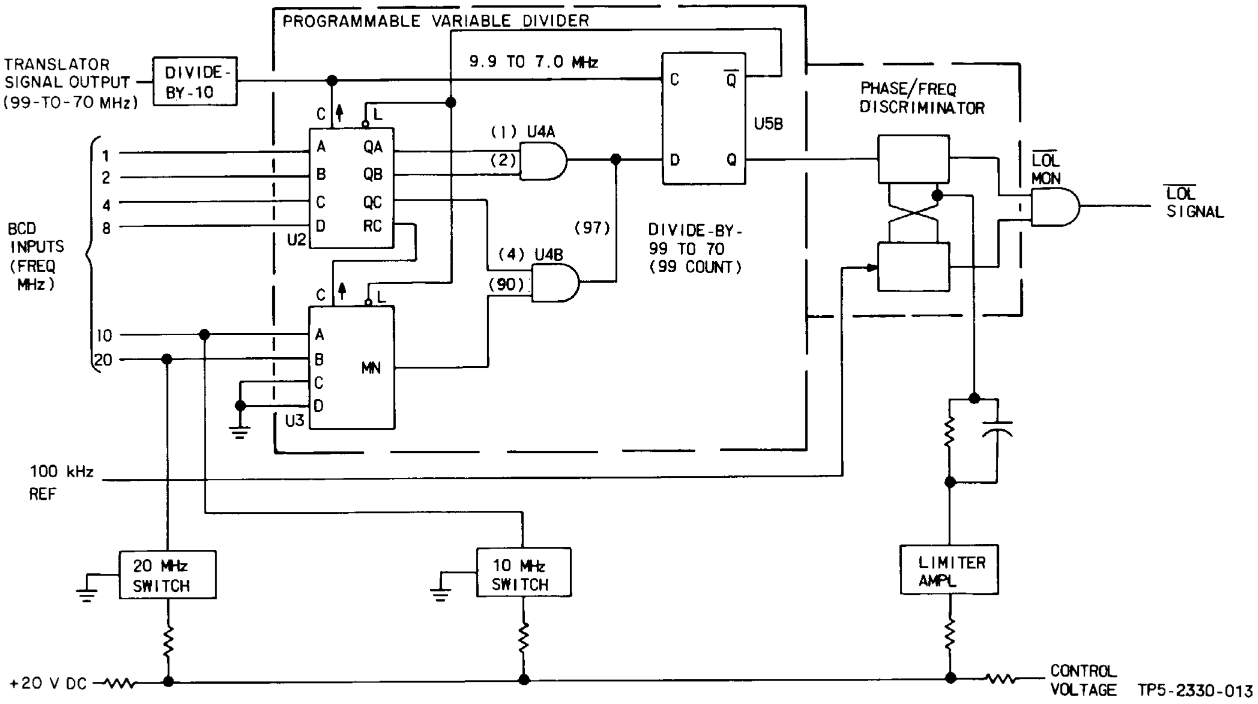
The output vco circuit is phase-locked to the high reference input and through the translator phase-lock loop to the 100-kHz reference input.

The output vco output (109.35 to 79.3501 MHz) is supplied as the variable injection to associated rf circuits.

2.2 Translator Logic Circuits

The translator logic circuits receive a 100-kHz reference input, a translator vco signal output, and bcd frequency inputs for 0, 1, 2, 4, 8, 10, and 20 MHz; it also supplies a control voltage output signal to the translator vco.

Refer to figure 3. The translator vco signal output (99 to 70 MHz) is supplied through a fixed divide-by-10 network (9.9 to 7.0 MHz) and applied as the clock input to a programmable variable divider. The output of the programmable variable divider (100 kHz) is supplied to a phase/frequency discriminator and is compared with a 100-kHz reference input. A phase or frequency difference in the discriminator causes a control voltage input increase or decrease to adjust the frequency of the vco. If there is no phase or frequency difference, the discriminator provides a logic 1 lock signal output indicating the vco frequency is locked. Note that a 10- or 20-MHz bcd input enables switches that change the limiter amplifier voltage divider ratio to equalize the loop gain over the frequency range.



Translator Logic Circuits
Figure 3

The programmable variable divider is programmed by bcd frequency inputs. For example, if a bcd input of 00 MHz is applied, the up/down decade counter is programmed to load the count 0 at any time a load signal (logic 0) is applied. Refer to table 1. This programs the variable divider to count from 0 (first count 1) to 99 (last count 99/0), causing the output of the variable divider to be 1/99th of the clock input, or divide-by-99 with a bcd input of 00. Note that as the bcd input goes up 1, 2, 3 etc, the division ratio goes down 98, 97, 96, etc. Also note that for the divide-by circuit to operate as a constant, the last count 99 must also be the loaded count (in the case of bcd 00, count 0). To do this, prerecognition of count 99 is required. Look-ahead circuit of U4A and U4B performs this function. At clock 97 (count 97) gates U4A and U4B are ANDed and supply a logic 1 input to U5B-D. With a logic 1 at U5B-D, clock 98 (count 98) causes U5B-$\overline{Q}$ to go to logic 0 and loads decade counter to bcd input (ANDed outputs of U4A and U4B are removed). At clock 98, U5B-Q supplies a pulse to phase/frequency discriminator. Clock 99 (count 00) causes U5B-$\overline{Q}$ to go to logic 1 and enables decade counter to count on the next clock. Next clock is one above the bcd programmed input. Note that count 98 initiates the output from the divider and count 99 appears only as the bcd programmed input. Refer to figure 4. A 15-MHz programmed input is shown; the same principles apply to any other programmed bcd input.

2.3 *Translator VCO Circuits*

The translator vco circuits receive a control voltage from the translator logic circuits. The control voltage drives the vco to the required translator frequency. The translator signal output is supplied through one buffer amplifier to the output mixer circuits and through a second buffer amplifier to the translator logic circuits.

2.4 *Output Mixer Circuits*

The output mixer circuits receive a translator signal input (99 to 70 MHz) from the translator vco. The translator vco signal is mixed with the output vco frequency (109.35 to 79.35001 MHz) and a resulting difference frequency (10.35 to 9.35001 MHz) is supplied through a low-pass filter to the output logic circuits.

2.5 *Output Logic Circuits*

The output logic circuits receive the output mixer difference frequency (10.35 to 9.35001 MHz), a tracking voltage from the translator vco, and a high reference input signal (1.035 to 0.935001 MHz), and supply a control voltage output signal to operate the output vco.

Table 1. Variable Divider, Logic Truth Table.

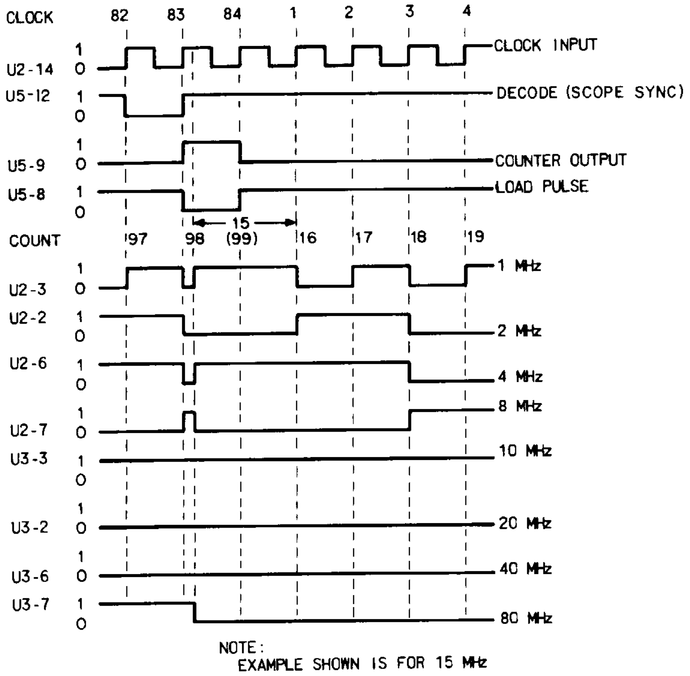
FREQUENCY CONTROL (MHz)	PROGRAMMABLE INPUTS								OUTPUT COUNT	DIVIDE-BY	LOOP FREQUENCY (MHz)
	U2				U3						
	A	B	C	D	A	B	*C	*D			
0	0	0	0	0	0	0	0	0	0	99	99
1	1	0	0	0	0	0	0	0	1	98	98
2	0	1	0	0	0	0	0	0	2	97	97
3	1	1	0	0	0	0	0	0	3	96	96
4	0	0	1	0	0	0	0	0	4	95	95
5	1	0	1	0	0	0	0	0	5	94	94
6	0	1	1	0	0	0	0	0	6	93	93
7	1	1	1	0	0	0	0	0	7	92	92
8	0	0	0	1	0	0	0	0	8	91	91
9	1	0	0	1	0	0	0	0	9	90	90
10	0	0	0	0	1	0	0	0	10	89	89
11	1	0	0	0	1	0	0	0	11	88	88
12	0	1	0	0	1	0	0	0	12	87	87
13	1	1	0	0	1	0	0	0	13	86	86
14	0	0	1	0	1	0	0	0	14	85	85
15	1	0	1	0	1	0	0	0	15	84	84
16	0	1	1	0	1	0	0	0	16	83	83
17	1	1	1	0	1	0	0	0	17	82	82
18	0	0	0	1	1	0	0	0	18	81	81
19	1	0	0	1	1	0	0	0	19	80	80
20	0	0	0	0	0	1	0	0	20	79	79
21	1	0	0	0	0	1	0	0	21	78	78
22	0	1	0	0	0	1	0	0	22	77	77
23	1	1	0	0	0	1	0	0	23	76	76
24	0	0	1	0	0	1	0	0	24	75	75
25	1	0	1	0	0	1	0	0	25	74	74
26	0	0	1	0	0	1	0	0	26	73	73
27	1	1	1	0	0	1	0	0	27	72	72
28	0	0	0	1	0	1	0	0	28	71	71
29	1	0	0	1	0	1	0	0	29	70	70

*Grounded inputs (fixed logic 0)

Refer to figure 5. The output mixer difference frequency (10.35 to 9.35001 MHz) is supplied through a squaring amplifier and a fixed divide-by-10 network (1.035 to 0.935001 MHz), to a phase/frequency discriminator. This frequency from the divide-by-10 network is compared with the high reference input signal (1.035 to 0.935001 MHz). A phase or frequency difference in the discriminator causes the control voltage to increase or decrease to adjust the frequency of the vco. If there is no phase or frequency difference, the discriminator provides a logic 1 lock signal output and the vco frequency locks. Note that the translator tracking voltage is summed with the output logic circuits' control voltage to provide control voltage for the total variable injection frequency output (109.35 to 79.35001 MHz).

2.6 Output VCO Circuits

The output vco circuits receive a control voltage from the output logic circuits. The control voltage drives the vco to the required output variable injection frequency. The output variable injection frequency is supplied through one output amplifier to the unit under control and through a second output amplifier to the output mixer circuits.



NOTE:
EXAMPLE SHOWN IS FOR 15 MHz

	PROGRAMMED BCD INPUTS	
MHz	PIN NO.	LOGIC LEVEL
1	U2-15	1
2	U2-1	0
4	U2-10	1
8	U2-9	0
10	U3-15	1
20	U3-1	0
40	U3-10	FXD 0
80	U3-9	FXD 0

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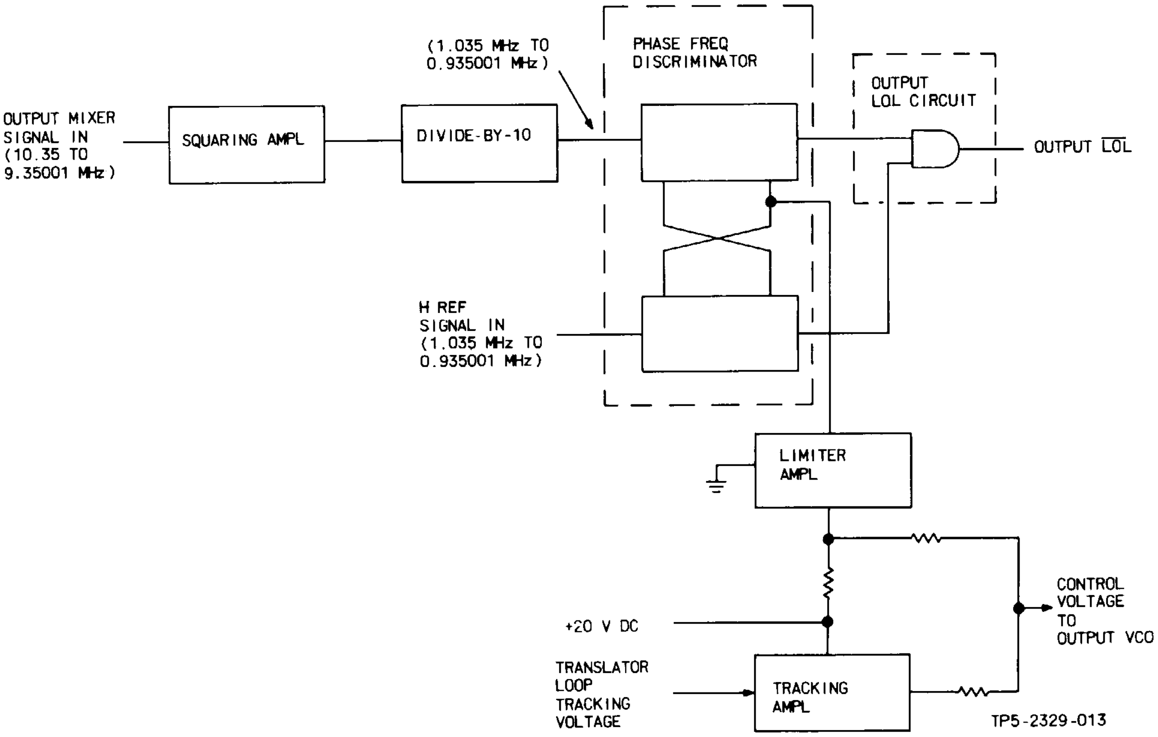
Variable Divider, Inputs and Outputs
Figure 4



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Output Logic Circuits
Figure 5

2.7 Up/Down Decade Counter 351-1527-040 (Refer to table 2 and figure 6.)

The 351-1527-040 up/down decade counter is a 4-bit decade counter. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when input conditions are met.

A high at the enable input inhibits counting. A low at the enable input and a low-to-high clock transition triggers the four master/slave flip-flops. The enable input should be changed only when the clock is high. The down/up input determines the direction of the count. When low, the count goes up; when high, the count goes down.

These counters are programmable. The outputs may be preset to any state by placing a low on the load input and entering the desired data at the data inputs. The output changes to agree with the data inputs independently of the state of the clock input. This allows the counters to be used as modulo N dividers by modifying the count length with the preset inputs.

Two outputs are available to perform the cascading function: ripple clock and maximum/minimum count. The latter output produces a high level output pulse with a duration approximately equal to one complete cycle of the clock when the counter overflows or underflows. The ripple clock output produces a low level output pulse equal in width to the low level portion of the clock input when an overflow or underflow condition exists. The counters are cascaded by feeding the ripple clock output to the enable input of the succeeding counter if parallel clocking is used, or to the clock input if parallel enabling is used. The maximum/minimum count output can be used to accomplish look-ahead for high-speed operation.

Table 2. Up/Down Decade Counter 351-1527-040, Logic Truth Table.

PROGRAMMABLE INPUTS				COUNT	BCD OUTPUTS			
A	B	C	D		QA	QB	QC	QD
0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0
0	1	0	0	2	0	1	0	0
1	1	0	0	3	1	1	0	0
0	0	1	0	4	0	0	1	0
1	0	1	0	5	1	0	1	0
0	1	1	0	6	0	1	1	0
1	1	1	0	7	1	1	1	0
0	0	0	1	8	0	0	0	1
1	0	0	1	9	1	0	0	1

E (enable): logic 0 enables counter; logic 1 inhibits counter.

L (load): logic 0 programs the bcd output count to be set at the bcd count of the programmable inputs; the next clock pulse counts one higher/lower (up/down).

DU (down/up): logic 0 counts up; logic 1 counts down.

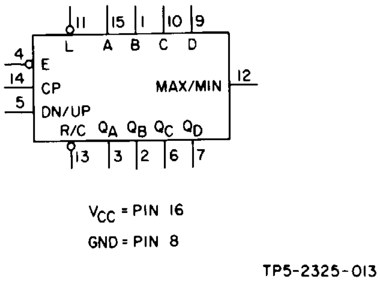
CP (clock pulse): logic 0-to-logic 1 transition advances counter.

RC (ripple clock): logic 0 pulse equal to 1/2 clock cycle when an overflow occurs.

MM (maximum/minimum count): logic 1 pulse equal to full clock cycle when an overflow or underflow occurs.

2.8 Decade Counter 351-1636-010 (Refer to table 3 and figure 7.)

The 351-1636-010 decade counter is a high-speed, monolithic decade counter consisting of four dual-rank, master-slave flip-flops internally interconnected to provide a divide-by-2 counter and a divide-by-5 counter. Gated direct reset lines are provided to inhibit count inputs and return all outputs to a logic 0 or to a binary coded decimal (bcd) count of 9. As the output from flip-flop A is not internally connected to the succeeding stages, the count may be separated into the three following independent count modes:

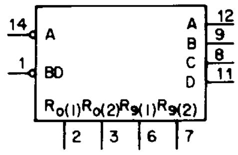


Up/Down Decade Counter 351-1527-040
Figure 6

a. When used as a binary coded decimal decade counter, the BD input must be externally connected to the A output. The A input receives the incoming count, and a count sequence is obtained in accordance with the bcd count sequence truth table shown above. In addition to a conventional 0 reset, inputs are provided to reset a bcd 9-count for 9's complement decimal applications.

b. If a symmetrical divide-by-10 count is desired for frequency synthesizers or other applications requiring division of a binary count by a power of 10, the D output must be externally connected to the A input. The input count is then applied at the BD input and a divide-by-10 square wave is obtained at output A.

LOGIC SYMBOL



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Decade Counter 351-1636-010
Figure 7

c. For operation as a divide-by-2 counter and divide-by-5 counter, no external interconnections are required. Flip-flop A is used as a binary element for the divide-by-2 function. The BD input is used to obtain binary divide-by-5 operation at the B, C, and D outputs. In this mode, the two counters operate independently; however, all four flip-flops are reset simultaneously.

2.9 Dual D-Type Flip-Flop With Preset and Clear 351-1525-040 (Refer to table 4 and figure 8.)

The 351-1525-040 consists of dual high-speed, D-type flip-flops. Information on the D input is transferred to the Q output on the positive going edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive going pulse. When the clock input is at either high or low level, the D input signal has no effect.

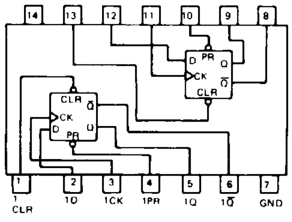
3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer output module are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 5 check total performance of the synthesizer output module. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



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Dual D-Type Flip-Flop With Preset and Clear 351-1525-040
Figure 8

Table 3. Decade Counter 351-1636-010, Logic Truth Table.

*BCD COUNT SEQUENCE				
COUNT	OUTPUT			
	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

**RESET/COUNT							
RESET INPUTS				OUTPUT			
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	D	C	B	A
1	1	0	X	0	0	0	0
1	1	X	0	0	0	0	0
X	X	1	1	1	0	0	1
X	0	X	0	Count			
0	X	0	X	Count			
0	X	X	0	Count			
X	0	0	X	Count			

*Output A connected to input BD for BCD count.
**X indicates that either a logical 1 or a logical 0 may be present.

Table 4. Dual D-Type Flip-Flop With Preset And Clear 351-1525-040, Logic Truth Table.

INPUTS				OUTPUTS	
PRESET	CLEAR	CLOCK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	*H	*H
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q_0}$

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
*This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

Table 5. Synthesizer Output, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of the unit containing the synthesizer output that is to be tested.		
	b. Remove cover from the synthesizer section of the unit.		
	c. Remove synthesizer output and install it on an extender card and place it in the unit.		
	d. Set unit LINE SELECTOR switch to 115 V.		
	e. Connect unit to 115-V ac power source and set power on.		
	f. Measure dc voltage from J1-19 to J1-17 (ground).	+5.2 ±0.2 V dc.	Check unit synthesizer voltage regulator.
	g. Measure dc voltage from J1-7 to J1-17 (ground).	NLT +19.5 V dc. NMT +20.8 V dc.	Check unit synthesizer voltage regulator.
	h. Measure dc voltage from J1-20 to J1-17 (ground).	+8.0 ±0.5 V dc.	Check unit power supply.
	i. Set unit MODE switch to ISB.		
2. Synthesizer output	a. Set FREQUENCY KHZ control on front panel to 29555.55 (or 29555.5).		
	b. Using a frequency counter (or oscilloscope), measure the high reference input between P1-1 and P1-2 (ground).	979 ±1 kHz. Note actual frequency	Check unit decades one at a time.
	c. Measure the dc voltage at A3E110. (Refer to note and chart at end of test 2 for voltages and frequencies at different 10 and 1 MHz settings.)	4.90 ±0.1 V dc.	Adjust L2 for 4.90 ±0.1 V dc. If L2 adjustment does not correct the problem check Q4, Q5, and associated circuit.
	d. Using a frequency counter, measure the output at P2.	79.79 ±0.005 MHz. (Actual should equal 79.35 MHz plus the difference between 1035 kHz and the actual frequency in step a.)	Adjust L3 for actual frequency with required V dc at A1E100. If L3 adjustment does not correct the problem check A1A1Q1, A1A1Q2, A1A103, and associated circuits.
	e. Measure the dc voltage at A1E100.	4.80 ±0.1 V dc.	Same as step d.
(Cont)	f. Note the dc voltage at A1E100 while moving the 10 and 1 MHz frequency controls from 9 down to 0.	Refer to chart at end of test 2. (Voltage goes up as frequency controls go down.)	Adjust L3 so that all settings fall into the limits shown in chart.

Table 5. Synthesizer Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	g. Set FREQUENCY KHZ control on front panel to 00000.00 (or 00000.0).		
	h. Using a frequency counter, measure the high reference input between P1-1 and P1-2 (ground).	1035 ±0.5 kHz.	Check unit 100-kHz decade.
	i. Using a frequency counter, measure the output at P2.	109.350 MHz ±0.5 kHz.	Check A4A1U1 thru A4A1U5 and associated circuits.
	j. Set FREQUENCY KHZ control on front panel to 29999.99 (or 29999.9).		
	k. Using a frequency counter, measure the output at P2.	79.350 MHz ±0.5 kHz.	Same as step i.
	l. Measure the dc voltage at P1-8 to ground.	NLT +3.5 V dc. **Note** RCV FAULT, EXCTR FAULT, or R/E FAULT indicator lighting indicates that results of step m are satisfactory.	Check A4A1U4 and A4A1U6 thru A4A1U8.
	m. Ground P1-10 while noting the voltage at P1-8.	NMT 0.5 V dc.	Same as step l.
	n. Remove P1-10 ground.		
	o. Set front-panel PWR switch off.		
	p. Remove 100-kHz decade from unit under test.		
	q. Set front-panel PWR switch on.		
	r. Measure the dc voltage at P1-8 to ground.	NMT 0.5 V dc.	Check A2A1U3 thru A2A1U5.
	s. Set front-panel PWR switch off.		
(Cont)	t. Replace 100-kHz decade in unit under test.		

Table 5. Synthesizer Output, Testing and Troubleshooting Procedures (Cont).

TEST	PROCECURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)			

Note

The following chart is shown with an input frequency of 1035 ±5 kHz. The actual output frequency with an input frequency can be determined using the following formula:

AF = LF - 100 kHz + 1035 kHz - IF.

AF = actual output frequency at P2.

LF = output frequency listed in chart for associated MHz frequency digits.

IF = actual input frequency.

10-MHz FREQ DIGIT	1-MHz FREQ DIGIT	A3E110 DC VOLTAGE	XLTR FREQ A3A1E9 (MHz)	A1E100 DC VOLTAGE	OUTPUT FREQ P2 (MHz)
2	9	4.90	70.000	4.80	80.350
	8	5.20	71.000	5.05	81.350
	7	5.50	72.000	5.30	82.350
	6	5.80	73.000	5.60	83.350
	5	6.10	74.000	5.85	84.350
	4	6.40	75.000	6.15	85.350
	3	6.70	76.000	6.40	86.350
	2	7.05	77.000	6.70	87.350
	1	7.35	78.000	7.00	88.350
	0	7.70	79.000	7.25	89.350
1	9	8.00	80.000	7.55	90.350
	8	8.35	81.000	7.85	91.350
	7	8.70	82.000	8.15	92.350
	6	9.00	83.000	8.45	93.350
	5	9.35	84.000	8.80	94.350
	4	9.70	85.000	9.10	95.350
	3	10.10	86.000	9.40	96.350
	2	10.45	87.000	9.75	97.350
	1	10.85	88.000	10.05	98.350
	0	11.20	89.000	10.40	99.350
0	9	11.60	90.000	10.75	100.350
	8	12.00	91.000	11.10	101.350
	7	12.40	92.000	11.50	102.350
	6	12.85	93.000	11.90	103.350
	5	13.30	94.000	12.30	104.350
	4	13.75	95.000	12.75	105.350
	3	14.20	96.000	13.25	106.350
	2	14.70	97.000	13.75	107.350
	1	15.25	98.000	14.30	108.350
	0	15.80	99.000	14.90	109.350

Note

Table shown with an input frequency of 1035 ±5 kHz (front-panel FREQUENCY KHZ setting of XX000.00 (or XX000.0)). Frequencies shown ±0.0005 MHz, voltages shown ±0.1 V dc.

4. ALIGNMENT/ADJUSTMENT

Note

Perform these adjustments only if repairs have been made and test procedures in table 5 cannot meet the normal indications.

4.1 Translator VCO Tracking

Note

Translator VCO must be in an open-loop condition. To perform this adjustment disconnect wire from A3A1E5 and check that continuity is broken between A3A1E5 and A4A1E8. When adjustment is complete, reconnect A3A1E3.

a. Perform setup of table 5, test 1.
b. Adjust the slug in oscillator coil A3A1L2 to approximately 1.6 mm (1/16 in) below coil form.
c. Adjust the plates in oscillator capacitor A3A1C7 two turns below the top of capacitor form.
d. Set front-panel FREQUENCY KHZ to 29000.00 (or 29000.0).
e. Connect a frequency counter between P1-1 and P1-2 (ground). Must equal 1035 ±0.5 kHz.
f. Connect a frequency counter between P1-10 and P1-9 (ground). Must equal 100 ±0.01 kHz.
g. Connect a frequency counter at A3A1E5 to A3A1E4 (ground).
h. Adjust the slug in oscillator coil A3A1L2 for 70.000 MHz ±20 kHz.
i. Set front-panel FREQUENCY KHZ to 00000.00 (or 00000.0).
j. Adjust the plates in oscillator capacitor A3A1C7 for 99.000 MHz ±20 kHz.

Note

Adjust capacitor A3A1C7 for an error opposite the error of coil A3A1L2. Example, if A3A1L2 is adjusted at 70.000 MHz minus 20 kHz, adjust A3A1C7 for 99.000 MHz plus 20 kHz.

k. Repeat steps f through j until low and high frequencies are within 10 kHz of the correct frequency.

4.2 Output VCO Tracking

a. Perform setup of table 5, test 1.
b. Adjust the slug in oscillator coil A1A1L3 to approximately 1.6 mm (1/16 in) below coil form.
c. Adjust the plates in oscillator capacitor A1A1C2 two turns below the top of capacitor form.
d. Set front-panel FREQUENCY KHZ to 29000.00 (or 29000.0).
e. Connect a frequency counter between P1-1 and P1-2 (ground). Must equal 1035 ±0.5 kHz.
f. Connect a frequency counter between P1-10 and P1-9 (ground). Must equal 100 ±0.01 kHz.
g. Connect a frequency counter with 50-Ω load at P2.
h. Adjust the slug in oscillator coil A1A1L3 for 80.350 MHz ±20 kHz.
i. Set front-panel FREQUENCY KHZ to 00000.00 (or 00000.0).
j. Adjust the plates in oscillator capacitor A1A1C2 for 109.350 MHz ±20 kHz.

Note

Adjust capacitor A1A1C2 for an error opposite the error of coil A1A1L3. Example, if A1A1L3 is adjusted at 80.350 MHz minus 20 kHz, adjust A1A1C2 for 109.350 MHz plus 20 kHz.

k. Repeat steps f through j until low and high frequencies are within 10 kHz of the correct frequency.

4.3 Output VCO Level Adjustment

a. Perform setup of table 5, test 1.
b. Connect an rf voltmeter with 50-Ω load to P2.
c. Set front-panel FREQUENCY KHZ to 16000.00 (or 16000.0).
d. Adjust A1A1R4 for +7 dB mW on rf voltmeter.

Note

A1A1R10 may be replaced with a selected resistor (50 through 720 Ω) to meet this adjustment.

4.4 Output VCO Final Tuning

a. Perform setup of table 5, test 1.
b. Connect a high-impedance scope probe to A2A1U4-6.

Note

A steady rectangular waveform should be seen. The object of this adjustment is to make the rectangular waveform as near a square wave as possible throughout the synthesizer output tuning range.

c. Set front-panel FREQUENCY KHZ controls to 29 555.55 kHz.
d. Adjust A1A1L3 for a 42-percent duty ratio (square wave, 42-percent logic 1, 58-percent logic 0).
e. Set front-panel FREQUENCY KHZ controls to 00 555.55 kHz.
f. Adjust A1A1C2 for duty ratio, opposite that indicated. For example, if a 30-percent duty ratio is indicated, adjust for a 70-percent duty ratio.
g. Repeat steps c through f until the duty ratio at both end frequencies is between 45 and 55 percent.

5. REPAIR

Repair of the synthesizer output module is accomplished using standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 9). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

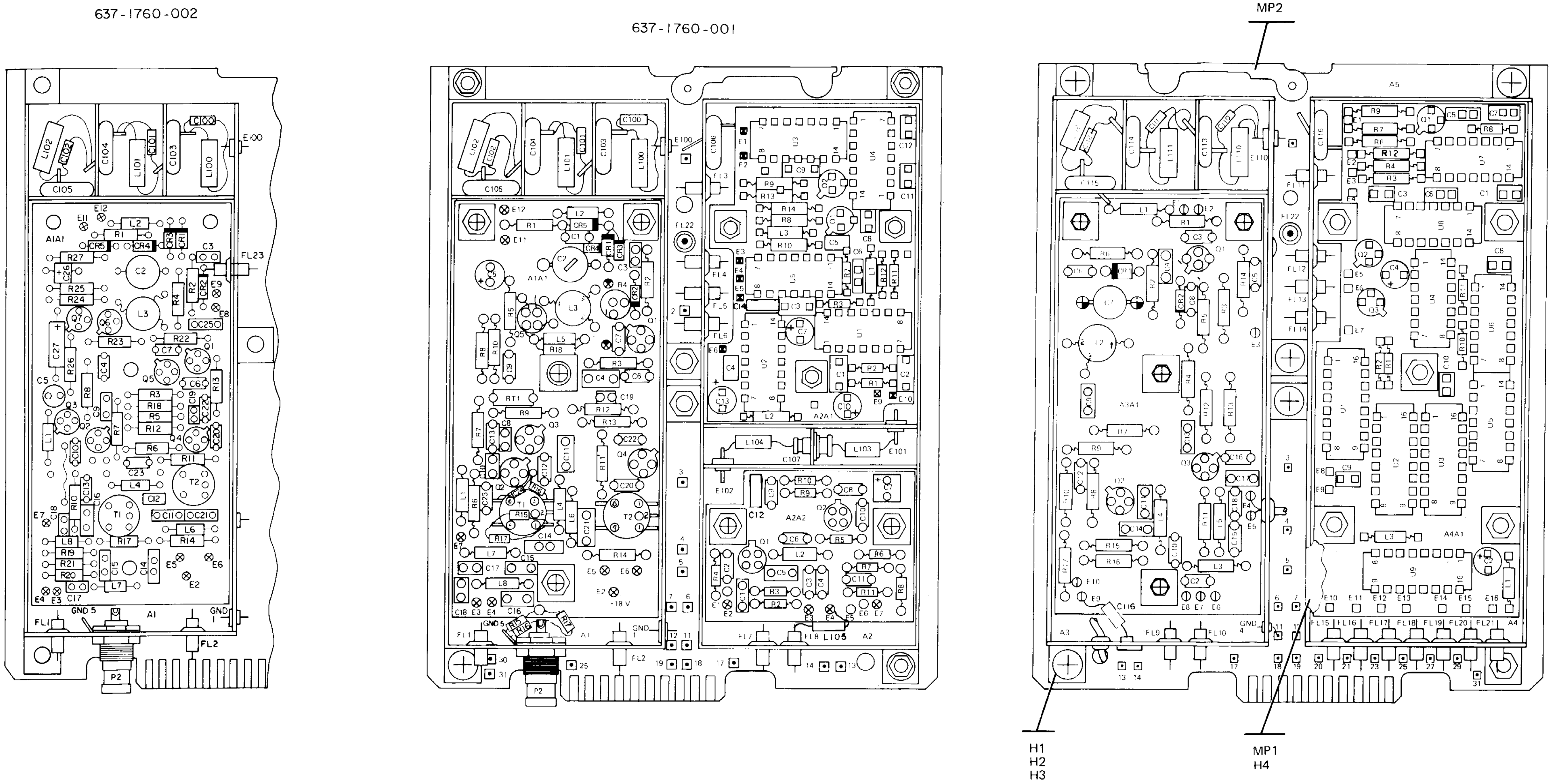
CODE	MANUFACTURER'S NAME AND ADDRESS
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876

CODE	MANUFACTURER'S NAME AND ADDRESS
03550	VANGUARD ELECTRONICS CO INC 930 W HYDE PARK BLVD INGLEWOOD CA 90302
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
07910	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
10646	CARBORUNDUM CO THE P O BOX 337 NIAGARA FALLS NY 14302
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP SAN DIEGO OPERS 8808 BALBOA AVE SAN DIEGO CA 92123
25088	SIEMENS CORP 186 WOOD AVE S ISELIN NJ 08830
28480	HEWLETT-PACKARD CO CORPORATE HQ 1501 PAGE MILL RD PALO ALTO CA 94304
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
77250	PHEOLL MFG CO DIV OF ALLIED PRODUCTS CORP 5700 W ROOSEVELT RD CHICAGO IL 60650
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
91293	JOHANSON MFG CO P O BOX 329 BOONTON NJ 07005
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer output	635-4930-001	REV G
Output vco assy A1	637-1760-001	REV J
Output vco board A1A1	635-0890-002	REV J
Output mixer-logic assy A2	637-1761-001	REV H
Output logic board A2A1	635-0836-001	REV E
Output mixer board A2A2	635-0837-001	REV D
Translator vco assy A3	637-1763-001	REV G
Translator vco board A3A1	635-0846-001	REF F
Translator logic assy A4	637-1762-001	REV F
Translator logic board A4A1	635-0646-001	REV E
Synthesizer output	635-4930-002	REV G
Output vco assy A1	637-1760-002	REV J
Output vco board A1A1	638-6520-001	REV B



CAUTION ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

TP5-1230-018

Synthesizer Output, Schematic Diagram
Figure 9 (Sheet 1 of 6)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTH OUTPUT	635-4930-001	A		
	SYNTH OUTPUT	635-4930-002	B		
A1	OUTPUT VCO (ESDS)	637-1760-001	A		
A1	OUTPUT VCO (ESDS)	637-1760-002	B		
A2	OUTPUT MIXER/LOGIC (ESDS)	637-1761-001			
A3	TRANSLATOR VCO (ESDS)	637-1763-001			
A4	TRASLATOR LOGIC (ESDS)	637-1762-001			
A5	CONNECTOR BOARD	635-0998-001			
FL1-FL21	NOT USED				
FL22	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
H1	NUT,PLAIN,HEX NP BRS, 4-40 (QTY 6)	313-0051-000		77250	P313-0051-000
H2	WASHER,SPRING CD PL BRZ, 0.115 ID X 0.209 OD (QTY 16)	310-0095-000		96906	MS35338-97
H3	SCREW,MACH NP BRS, 4-40 X 5/16 (QTY 6)	343-0286-000		77250	P343-0286-000
H4	SCREW,MACH NP BRS, 4-40 X 1/4 (QTY 10)	343-0285-000		77250	P343-0285-000
H5	PIN,SPR SST, 0.078 DIA X 1/4 (QTY 1)	311-0355-000		96906	MS16562-199
MP1	COVER, BOX (QTY 2)	635-4802-001			
MP2	HANDLE (QTY 1)	637-2559-001			
	OUTPUT VCO A1 (ESDS)	637-1760-001	A		
	OUTPUT VCO A1 (ESDS)	637-1760-002	B		
A1	OUTPUT VCO BOARD (ESDS)	635-0890-002	A		
A1	OUTPUT VCO BOARD (ESDS)	638-6520-001	B		
C1-C99	NOT USED				
C100	CAPACITOR,FXD CER DIEL, 18PF, 10%, 75V	913-1098-030		72982	8101A075C0G0-180K
C101	CAPACITOR,FXD CER DIEL, 0.00015UF, 5%, 100V	913-3117-050		56289	1CC0G151X5100C4
C102	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 50V	912-4141-330		72136	DM5E680J050WV
C103, C104	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V	912-4114-370		81349	CB11RE152J
C105	CAPACITOR,FXD MICA DIEL, 750PF, 5%, 500V (A8)	912-4114-350		81349	CB11RE751J
C105	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V	912-4114-370		81349	CB11RE152J
FL1,FL2	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
FL23	FILTER,RAD INTR 1750PF	241-5006-010	B	81349	FL38GW1ED3-0001
L1-L99	NOT USED				
L100-L102	COIL,RF 15000UH	240-2715-630		96906	MS75089-37
P1	NOT USED				
P2	CONNECTOR,RCPT ELEC	357-7207-090		98291	52-044-0000
R1-R14	NOT USED				
R15,R16	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A7)	745-2320-000	A	81349	RCR05G271KS
R17	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A7)	745-2277-000	A	81349	RCR05G180KS
	OUTPUT VCO BOARD A1A1 (ESDS)	635-0890-002	A		
CR1	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR2	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR3-CR5	SEMICOND DEVICE (A6)	922-6131-010		25088	BB109-6131-010
C1	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (A6)	913-4018-000		81349	CK05BX102K
C2	CAPACITOR,VAR AIR DIEL, 1 TO 10PF, 200V	922-0583-230		91293	5268
C3	CAPACITOR,FXD CER DIEL, 18PF, 10%, 75V	913-1098-030		72982	8101A075C0G0-180K
C4	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C5	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D105X0025CB1
C6	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (A6)	913-4018-000		81349	CK05BX102K
C6	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C7	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C8	CAPACITOR,FXD CER DIEL, 15PF, 5%, 75V (A6)	913-1098-180		72982	8101A075C0G0-150J
C9	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V (A6)	913-4018-000		81349	CK05BX102K
C9	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V	912-4141-180		72136	DM5E270J050WV
C10	CAPACITOR,FXD CER DIEL, 0.00047UF, 5%, 100V	913-3117-080		56289	1CC0G471X5100C4
C11	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C12,C13	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C14	CAPACITOR,FXD CER DIEL, 47PF, PORM 0.25PF, 150V	913-1098-370		72982	8111B203C0G0470F
C15	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		72136	DM5E330J050WV
C16	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300		72136	DM5E510J050WV
C17	CAPACITOR,FXD CER DIEL, 0.00068UF, 5%, 100V	913-3117-090		56289	2CC0G681X5100C4
C18	CAPACITOR,FXD CER DIEL, 270PF, 5%, 100V	913-1098-470		72982	8121M101C0G0-271J
C19	CAPACITOR,FXD CER DIEL, 3PF, 0.25PF, 150V	913-1098-340		72982	8101B212C0J0309C
C20	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C21	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C22	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C23	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C24	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V (A6)	912-4141-110		72136	DM5C080D300WV
L1	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L2	COIL,RF 2.70UH (A6)	240-2028-000		96906	MS75084-05
L2	COIL,RF 15UH	240-2037-000		96906	MS75084-14
L3	COIL,ADJUSTABLE	637-4502-001			
L4	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L5	COIL,RF 1UH (A4)	240-2023-000		96906	MS75083-13
L6	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L7,L8	COIL,RF 0.100UH	240-2723-140		96906	MS75083-1
Q1	TRANSISTOR (ESDS)	352-0756-050		17856	FN1905
Q2	TRANSISTOR	352-0440-000		07910	2N918
Q3,Q4	TRANSISTOR	352-0792-020		02735	2N5179
Q5	TRANSISTOR (ESDS)	352-0756-050		17856	FN1905

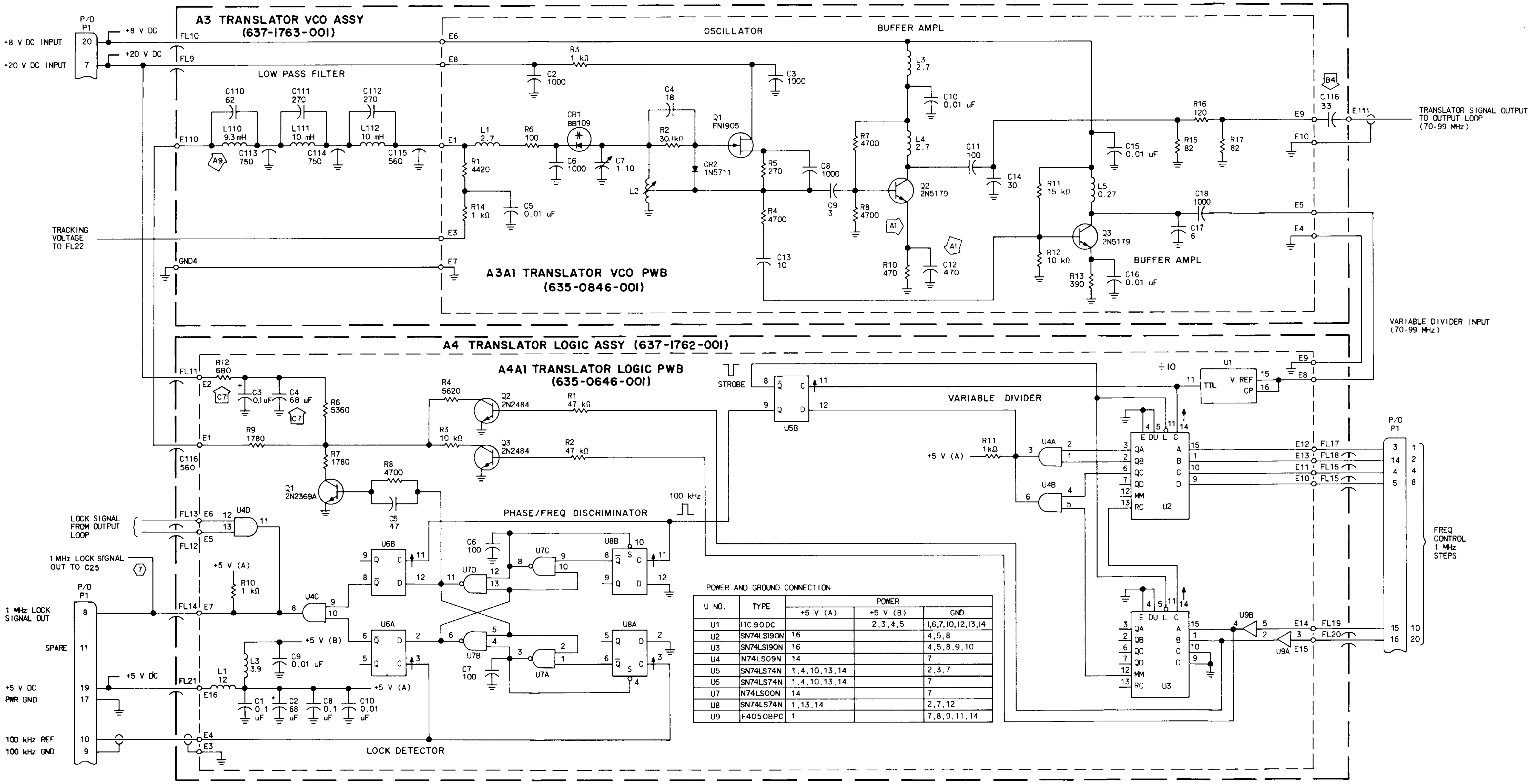
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R1	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R2	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W (A6)	705-1067-000		81349	RN55D3012F
R2	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R3	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (A6)	745-0749-000		81349	RCR07G102KS
R3	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R4	RESISTOR,VAR 1K, 10%, 0.5W (A11)	382-0027-070		80294	3329H1-102
	RESISTOR,TEST SELECT R4	638-6457-001			
R4	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R4	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R4	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R4	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R4	RESISTOR,FXD CMPSN, 390 OHMS, 5%, 1/4W	745-0733-000		81349	RCR07G391JS
R4	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R4	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R5	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R6	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R7	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R8	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R9	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W (A5)	745-0707-000		81349	RCR07G680KS
R9	RESISTOR,FXD CMPSN, 22 OHMS, 10%, 1/4W	745-0689-000		81349	RCR07G220KS
R10	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W (A2)	745-0713-000		81349	RCR07G101KS
R10	RESISTOR,FXD,CMPSN, 100 THRU 390 OHMS, 10%, 1/4W (A5)	638-1088-001			
R10	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R11	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R12	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W (A2)	745-0743-000		81349	RCR07G681KS
R12	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R13	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R14	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R15	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W (A3)(A4)	745-2304-000		81349	RCR05G101KS
	OR				
R15	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/8W (A3)(A4)	745-2311-000		81349	RCR05G151KS
R16	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/8W (A6)	745-2292-000		81349	RCR05G470KS
R17	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/8W (A6)	745-2323-000		81349	RCR05G331KS
R18	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/8W (A6)	745-2338-000		81349	RCR05G821KS
RT1	RESISTOR,THRM 220 OHMS, 10%, 1/2W	714-1721-000		10646	0325F5-015
T1	TRANSFORMER,RF (A5)	278-0430-200		03550	22488
T1	TRANSFORMER,RF	278-0430-290		03550	22511
T2	TRANSFORMER,RF	278-0430-200		03550	22488
	OUTPUT VCO BOARD A1A1 (ESDS)	638-6520-001	B		
CR1	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR2	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR3-CR5	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
C1	NOT USED				
C2	CAPACITOR,VAR AIR DIEL, 1 TO 10PF, 200V	922-0583-230		91293	5268
C3	CAPACITOR,FXD CER DIEL, 18PF, 10%, 75V	913-1098-030		72982	8101A075C0G0-180K
C4	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C5	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C6	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C7	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C8	NOT USED				
C9	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 50V	912-4141-180		72136	DM5E270J050WV
C10	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C11	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C12,C13	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C14	CAPACITOR,FXD CER DIEL, 47PF, PORM 0.25PF, 150V	913-1098-370		72982	8111B203C0G0470F
C15	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		72136	DM5E330J050WV
C16	CAPACITOR,FXD MICA DIEL, 51PF, 5%, 50V	912-4141-300		72136	DM5E510J050WV
C17	CAPACITOR,FXD CER DIEL, 0.00068UF, 5%, 100V	913-3117-090		56289	2CC0G681X5100C4
C18	CAPACITOR,FXD CER DIEL, 270PF, 5%, 100V	913-1098-470		72982	8121M101C0G0-271J
C19	CAPACITOR,FXD CER DIEL, 3PF, 0.25PF, 150V	913-1098-340		72982	8101B212C0J0309C
C20	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C21	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C22	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C23	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C24	NOT USED				
C25	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C26	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-940		56289	199D474X9035AE3
C27	CAPACITOR,FXD ELCTLT, 2.2UF, 10%, 20V	184-9086-430		81349	M39003-01-2283
L1	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L2	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L3	COIL,ADJUSTABLE	637-4502-001			
L4	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L5	NOT USED				
L6	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L7,L8	COIL,RF 0.100UH	240-2723-140		96906	MS75083-1
Q1	TRANSISTOR (ESDS)	352-0756-170		17856	FN1905
Q2	TRANSISTOR	352-0440-000		07910	2N918
Q3,Q4	TRANSISTOR	352-0792-020		02735	2N5179
Q5	TRANSISTOR (ESDS)	352-0756-170		17856	FN1905
Q6	TRANSISTOR	352-0551-010		15818	2N2907A
Q7	TRANSISTOR	352-0915-030		22229	2N5116
R1	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R2	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R3	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	RESISTOR TEST SELECT R4	638-6457-001			
R4	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R4	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R4	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R4	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R4	RESISTOR,FXD CMPSN, 390 OHMS, 5%, 1/4W	745-0733-000		81349	RCR07G391JS
R4	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R4	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R5	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R6	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W (C6)	745-0764-000		81349	RCR07G272KS
R6	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R7	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R8	RESISTOR,FXD CMPSN, 1.8K, 10%, 1/4W	745-0758-000		81349	RCR07G182KS
R9	NOT USED				
R10	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W (C6)	745-0707-000		81349	RCR07G680KS
R10	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/4W	745-0716-000		81349	RCR07G121KS
R11	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R12	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R13	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R14	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R15,R16	NOT USED				
R17	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R18	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R19,R20	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R21	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/4W	745-0686-000		81349	RCR07G180KS
R22	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R23	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R24	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W	745-0869-000		81349	RCR07G225KS
R25	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R26	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R27	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
T1	TRANSFORMER,RF (C6)	278-0430-290		03550	22511
T1	TRANSFORMER,RF	278-0444-100			
T2	TRANSFORMER,RF	278-0430-290		03550	22511
	OUTPUT MIXER/LOGIC A2 (ESDS)	637-1761-001			
A1	OUTPUT LOGIC BOARD	635-0836-001			
A2	OUTPUT MIXER BOARD (ESDS)	635-0837-001			
C1-C105	NOT USED				
C106	CAPACITOR,FXD MICA DIEL, 750PF, 5%, 500V	912-4114-350		81349	CB11RE751J
C107	CAPACITOR,FXD CER DIEL, 15PF, 20%, 500V	913-3111-050		72982	2404-014-15PF10
FL1,FL2	NOT USED				
FL3-FL8	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
L1-L102	NOT USED				
L103	COIL,RF 10UH (C3)	240-2715-250		96906	MS75088-13
L103	COIL,RF 12UH	240-2715-260		96906	MS75088-14
L104	COIL,RF 10UH (C3)	240-2715-250		96906	MS75088-13
L104	COIL,RF 22UH	240-2715-290		96906	MS75089-3
L105	COIL,RF 100UH	240-2047-000		96906	MS75085-07
	OUTPUT LOGIC BOARD A2A1	635-0836-001			
C1-C3	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C4	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C5	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C6	CAPACITOR,FXD CER DIEL, 47PF, 10%, 75V	913-1098-020		72982	8111A075C0G0-470K
C7	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-680		56289	199D106X0025CE3
C8	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C9	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-200		16546	CY30C104M
C10	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C11,C12	CAPACITOR,FXD CER DIEL, 100PF, PORM5%, 100V	913-3281-280		81349	CCR19CG101J
C13	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C14	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V (B2)	912-4141-400		72136	DM5F151J050WV
L1,L2	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L3	COIL,RF 4.70UH (B2)	240-2031-000		96906	MS75084-08
L3	COIL,RF 100UH	240-2047-000		96906	MS75085-07
Q1	TRANSISTOR	352-0517-010		01295	2N930
Q2	TRANSISTOR	352-0596-030		14433	2N2369A
R1	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/8W (C1)	745-2329-000		81349	RCR05G471KS
R1	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W (C4)	745-0755-000		81349	RCR07G152KS
R1	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/8W	745-2347-000		81349	RCR05G152KS
R2	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/8W (C1)	745-2329-000		81349	RCR05G471KS
R2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (C4)	745-0749-000		81349	RCR07G102KS
R2	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R3	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R4-R6	NOT USED				
R7	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R8	RESISTOR,FXD FILM, 33.2K, 1%, 1/8W (A10)	705-1069-000		81349	RN55D3322F
R8	RESISTOR,FXD FILM, 21K, 1%, 1/8W	705-3605-630		81349	RN55D2102F
R9	RESISTOR,FXD FILM, 3.48K, 1%, 1/8W	705-1022-000		81349	RN55D3481F
R10	RESISTOR,FXD FILM, 3.83K, 1%, 1/8W	705-1024-000		81349	RN55D3831F
R11	RESISTOR,FXD FILM, 10K, 1%, 1/20W	705-3163-120		81349	RN50C1002F
R12	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R13	RESISTOR,FXD FILM, 4.64K, 1%, 1/8W	705-1028-000		81349	RN55D4641F
R14	RESISTOR,FXD FILM, 464 OHMS, 1%, 1/8W	705-0980-000		81349	RN55D4640F
U1	INTEGRATED CIRCUIT LOGIC GATE	351-1523-090		18324	N74LS04N
U2	INTEGRATED CIRCUIT	351-1636-010		01295	SN74LS90N
U3	INTEGRATED CIRCUIT FLIP FLOP	351-1525-040		04713	SN74LS74AN
U4	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U5	INTEGRATED CIRCUIT FLIP FLOP	351-1525-040		04713	SN74LS74AN

Synthesizer Output, Schematic Diagram
Figure 9 (Sheet 2)



POWER AND GROUND CONNECTION

U NO.	TYPE	POWER		
		+5 V (A)	+5 V (B)	GND
U1	11C90DC		2,3,4,5	1,6,7,10,12,13,14
U2	SN74LS190N	16		4,5,8
U3	SN74LS190N	16		4,5,8,9,10
U4	N74LS09N	14		7
U5	SN74LS74N	1,4,10,13,14		2,3,7
U6	SN74LS74N	1,4,10,13,14		7
U7	N74LS00N	14		7
U8	SN74LS74N	1,13,14		2,7,12
U9	F4050BPC	1		7,8,9,11,14

NOTES:

⟨1⟩ UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

⟨2⟩ PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

⟨3⟩ P1 IS ON CONNECTOR CARD 635-0998-001.

⟨4⟩ ALL UNMARKED SET AND RESET PINS ARE CONNECTED TO INACTIVE STATE AS SHOWN IN TABLES.

⟨5⟩ TEST SELECT:
A11 A1A1R4 FROM 150Ω TO 560Ω A2 A5 A3 A4

⟨6⟩ APPLICABLE TO SYNTH OUTPUT MODULE 635-4930-001 ONLY.

⟨7⟩ APPLICABLE TO SYNTH OUTPUT MODULE 635-4930-002 ONLY.

⟨8⟩ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

635-0426 SH 1

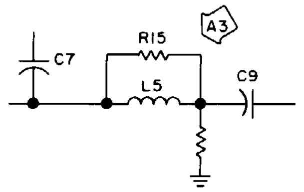
Synthesizer Output, Schematic Diagram
Figure 9 (Sheet 3)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	OUTPUT MIXER BOARD A2A2 (ESDS)	635-0837-001			
C1	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 300V	912-4141-020		72136	DM5C100D300WV
C2,C3	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C4	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 50V	913-5019-320		81349	CK05BX104K
C5	CAPACITOR,FXD MICA DIEL, 5PF, PORM 0.5PF, 300V	912-4141-010		72136	DM5C050D300WV
C6	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C7	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V	184-9102-240		56289	199D106X0025CB1
C8-C10	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C11	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C12	CAPACITOR,FXD MICA DIEL, 22PF, PORM 0.5PF, 300V (B1)(C2)	912-4141-030		72136	DM5E220D300WV
C12	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110		72136	DM5C080D300WV
L1	NOT USED				
L2	COIL,RF 0.18UH	240-2014-000		96906	MS75083-04
Q1	TRANSISTOR	352-0792-020		02735	2N5179
Q2	TRANSISTOR (ESDS)	352-1093-010		02735	3N187
R1	NOT USED				
R2	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/8W	745-2356-000		81349	RCR05G272KS
R3	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/8W	745-2335-000		81349	RCR05G681KS
R4	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R5	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R6	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R7	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R8	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/8W	745-2314-000		81349	RCR05G181KS
R9	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R10	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W (C2)	745-2341-000		81349	RCR05G102KS
R10	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W (C5)	745-0755-000		81349	RCR07G152KS
R10	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/8W	745-2347-000		81349	RCR05G152KS
R11	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/8W	745-2295-000		81349	RCR05G560KS
	TRANSLATOR VCO A3 (ESDS)	637-1763-001			
A1	TRANSLATOR VCO BOARD (ESDS)	635-0846-001			
C1-C109	NOT USED				
C110	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 50V	912-4141-320		72136	DM5E620J050WV
C111, C112	CAPACITOR,FXD CER DIEL, 270PF, 5%, 100V	913-1098-470		72982	8121M101C0G0-271J
C113, C114	CAPACITOR,FXD MICA DIEL, 750PF, 5%, 500V	912-4114-350		81349	CB11RE751J
C115	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-4114-320		81349	CB11RE561J
C116	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V (B4)	912-4141-220		72136	DM5E330J050WV
FL1-FL8	NOT USED				
FL9,FL10	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
L1-L109	NOT USED				
L110	COIL,RF 10000UH (A9)	240-2715-610		96906	MS75089-35
L110	COIL,WW,.0093H	634-5339-001			
L111, L112	COIL,RF 10000UH	240-2715-610		96906	MS75089-35
	TRANSLATOR VCO BOARD A3A1 (ESDS)	635-0846-001			
CR1	SEMICOND DEVICE	922-6131-010		25088	BB109-6131-010
CR2	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
C1	NOT USED				
C2,C3	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C4	CAPACITOR,FXD CER DIEL, 18PF, 10%, 75V	913-1098-030		72982	8101A075C0G0-180K
C5	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C6	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C7	CAPACITOR,VAR AIR DIEL, 1 TO 10PF, 200V	922-0583-230		91293	5268
C8	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C9	CAPACITOR,FXD MICA DIEL, 3PF, PORM 0.5PF, 300V	912-4141-070		72136	DM5C030D300WV
C10	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C11	CAPACITOR,FXD CER DIEL, 100PF, PORM5%, 100V	913-3281-280		81349	CCR19CG101J
C12	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V (A1)	913-5019-200		81349	CK05BX103K
C12	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C13	CAPACITOR,FXD CER DIEL, 10PF, 5%, 75V	913-1098-010		72982	8101A075C0G0-100J
C14	CAPACITOR,FXD MICA DIEL, 30PF, 5%, 50V	912-4141-200		72136	DM5E300J050WV
C15,C16	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C17	CAPACITOR,FXD MICA DIEL, 6PF, PORM 0.5PF, 300V	912-4141-090		72136	DM5C060D300WV
C18	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
L1	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L2	COIL,ADJUSTABLE	635-9660-001			
L3,L4	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L5	COIL,RF 0.27UH	240-2016-000		96906	MS75083-06
Q1	TRANSISTOR (ESDS)	352-0756-050		17856	FN1905
Q2,Q3	TRANSISTOR	352-0792-020		02735	2N5179
R1	RESISTOR,FXD FILM, 4.42K, 1%, 1/8W	705-1027-000		81349	RN55D4421F
R2	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R3	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R4	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R5	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R6	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R7,R8	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R9	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W (A1)	745-0713-000		81349	RCR07G101KS
R10	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R11	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R12	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R13	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R14	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R15	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G82CKS
R16	RESISTOR,FXD CMPSN, 120 OHMS, 10%, 1/4W	745-0716-000		81349	RCR07G121KS
R17	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
	TRANSLATOR LOGIC A4 (ESDS)	637-1762-001			
A1	TRANSLATOR LOGIC BOARD (ESDS)	635-0646-001			
C1-C115	NOT USED				
C116	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-4114-320		81349	CB11RE561J
FL1-FL10	NOT USED				
FL11-FL21	FILTER,RAD INTR 1750PF	241-5006-010		81349	FL38GW1ED3-0001
	TRANSLATOR LOGIC BOARD A4A1 (ESDS)	635-0646-001			
C1	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-180		16546	CY20C104M
C2	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C3	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-180		16546	CY20C104M
C4	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 25V (C7)	184-9102-240		56289	199D106X0025CB1
C4	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 25V	184-9102-280		56289	199D1011
C5	CAPACITOR,FXD CER DIEL, 47PF, 10%, 75V	913-1098-020		72982	8111A075C0G0-470K
C6,C7	CAPACITOR,FXD CER DIEL, 100PF, PORM5%, 100V	913-3281-280		81349	CCR19CG101J
C8	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-180		16546	CY20C104M
C9,C10	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
L1	COIL,RF 12UH	240-2036-000		96906	MS75084-13
L2	COIL,RF 33UH (C7)	240-2041-000		96906	MS75085-01
L3	COIL,RF 3.90UH	240-2030-000		96906	MS75084-07
Q1	TRANSISTOR	352-0596-030		14433	2N2369A
Q2,Q3	TRANSISTOR	352-0549-000		07263	2N2484
R1,R2	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R3	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R4	RESISTOR,FXD FILM, 5.62K, 1%, 1/8W	705-1032-000		81349	RN55D5621F
R5	NOT USED				
R6	RESISTOR,FXD FILM, 5.36K, 1%, 1/8W	705-1031-000		81349	RN55D5361F
R7	RESISTOR,FXD FILM, 1.78K, 1%, 1/8W	705-1008-000		81349	RN55D1781F
R8	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R9	RESISTOR,FXD FILM, 1.78K, 1%, 1/8W	705-1008-000		81349	RN55D1781F
R10,R11	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R12	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W (C7)	745-0743-000		81349	RCR07G681KS
U1	INTEGRATED CIRCUIT	351-1653-020		07263	11C90DC
U2,U3	INTEGRATED CIRCUIT (ESDS)	351-1527-040		34335	SN74LS190N
U4	INTEGRATED CIRCUIT LOGIC GATE	351-1523-210		18324	N74LS09N
U5,U6	INTEGRATED CIRCUIT FLIP FLOP	351-1525-040		04713	SN74LS74AN
U7	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U8	INTEGRATED CIRCUIT FLIP FLOP	351-1525-040		04713	SN74LS74AN
U9	INTEGRATED CIRCUIT (ESDS)	351-8159-220		07263	4050BPC

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Removed A3A1R9, 100Ω from in series with A3A1Q2-E and junction of A3A1R10-A3A1C12. Changed A3A1C12 from 0.01μF to 470pF.	635-0846-001, REV B and above.
A2	Changed: A1A1R12 from 680Ω to 560Ω. A1A1R10 from 100Ω to test select of 100Ω to 390Ω.	635-0890-002, REV A and above.
A3	Added A1A1R15, test select of 100Ω or 150Ω.	635-0890-002, REV C and above.
A4	Removed A1A1L5, 1μH and A1A1R15, test select of 100Ω or 150Ω from circuit as shown below.	635-0890-002, REV E and above.



REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A5	Added A1A1Q5, FN1905 Changed: A1A1R9 from 68Ω to 22Ω A1A1R10 from test select of 100Ω to 390Ω; to 180Ω fixed. A1A1T1 changed from 278-0430-200 to 278-0430-290.	635-0890-002, REV E and above.

A6	Removed A1A1C1, 1000pF from A1A1CR1 cathode to ground.
	Removed A1A1C8, 15pF from A1A1Q3-B to ground.
	Changed:
	A1A1C6 from 1000pF to 470pF
	A1A1C9 from 1000pF to 27pF
	A1A1L2 from 2.7μH to 15μH
	A1A1R2 from 30.1kΩ to 68.1kΩ
	A1A1R3 from 1kΩ to 560Ω.
	Added A1A1CR3, BB109
	Added A1A1CR4, BB109
	Added A1A1CR5 BB109
	Added A1A1C24, 8pF
	Added A1A1R16, 47Ω
	Added A1A1R17, 330Ω
	Added A1A1R18, 820Ω
		635-0890-002, REV F and above.

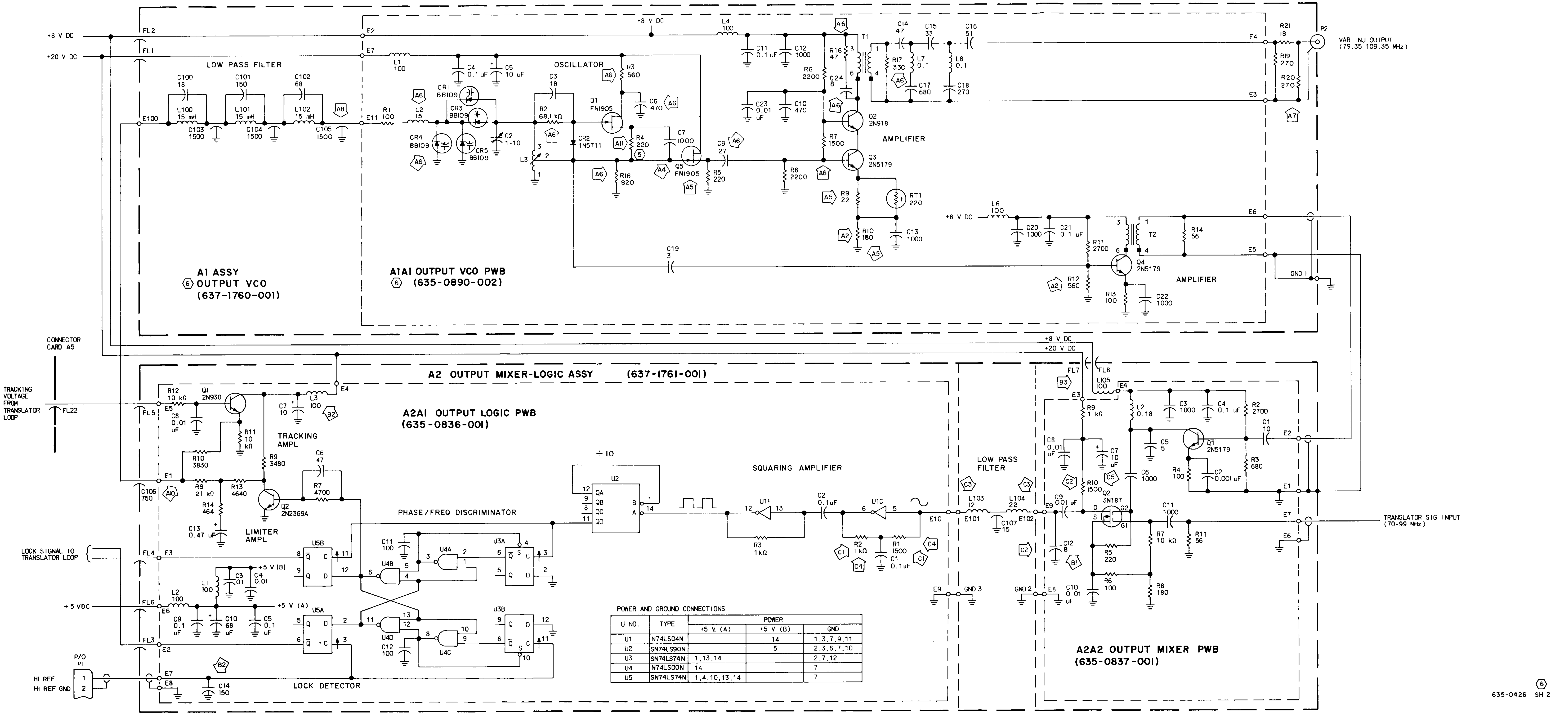
A7	Added A1R15, 270Ω
	Added A1R16, 270Ω
	Added A1R17, 18Ω
		635-1760-001, REV D and above.

A8	Changed A1C105 from 750pF to 1500pF.	637-1760-001, REV E and above.
A9	Changed A3L110 from 10mH to 9.3mH	637-1763-001, REV D and above.
A10	Changed A2A1R8 from 33.2kΩ to 21kΩ.	635-0836-001, REV B and above.

MODIFICATION HISTORY (Cont)

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A11	Changed A1A1R4 from 1kΩ variable to test select of 150Ω to 560Ω.	635-0890-002 REV G and above.
B1	Added A2A2C12, 22pF.	635-0837-001 REV B and above.
B2	Added A2A1C14, 150pF. Changed A2A1L3 from 4.7μH and 100μH.	635-0836-001 REV C and above.
B3	Added A2L105, 100μH.	637-1761-001 REV E and above.
B4	Added A3C116, 33pF.	637-1763-001 REV F and above.
C1	Changed: A2A1R1 from 470Ω to 1500Ω. A2A1R2 from 470Ω to 1kΩ.	635-0836-001 REV D and above.
C2	Changed: A2A2C12 from 22pF to 8pF. A2A2R10 from 1kΩ to 1500Ω.	635-0837-001, REV C and above.
C3	Changed: A2L103 from 10μH to 12μH. A2L104 from 10μh to 22μH.	637-1761-001, REV H and above.
C4	Changed: A2A1R1 from 1500Ω, 1/4 W to 1500Ω, 1/8 W. A2A1R2 from 1kΩ, 1/4 W to 1kΩ, 1/8 W.	635-0836-001, REV E and above.
C5	Changed A2A2R10 from 1500Ω, 1/4 W to 1500Ω, 1/8 W.	635-0837-001, REV D and above.
C6	Changed: A1A1R6 from 2700Ω to 1500Ω A1A1R10 from 68Ω to 120Ω A1A1T1 from 278-0430-290 to 278-0444-001.	638-6520-001, REV C and above.
C7	Changed: A4A1L2 from 33μH to A4A1R12, 680Ω. A4A1C4 from 10μF to 68μF.	635-0646-001 REV E and above. (SB 53)

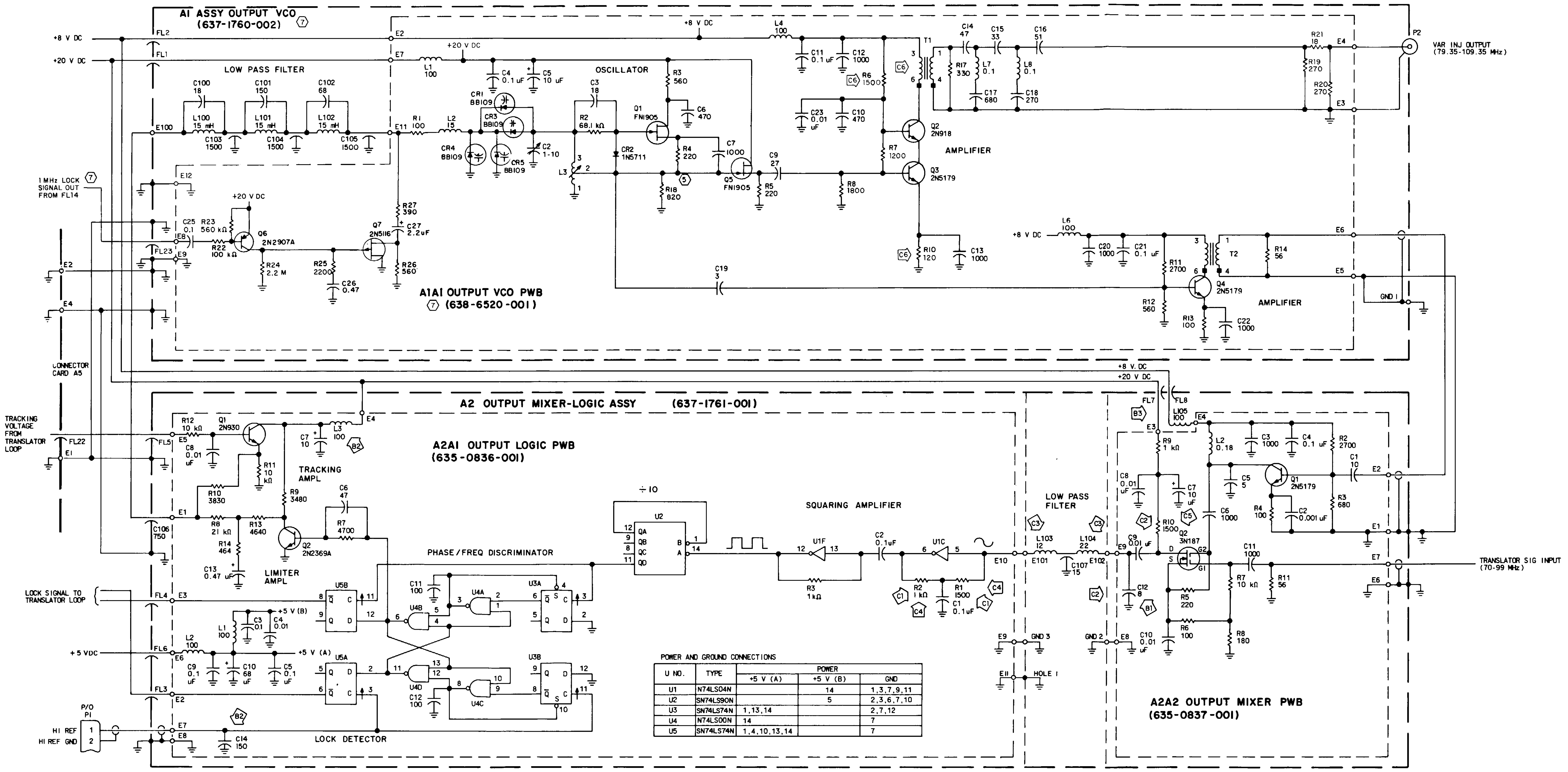
Synthesizer Output, Schematic Diagram
Figure 9 (Sheet 4)



POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER		
		+5 V (A)	+5 V (B)	GND
U1	N74LS04N		14	1,3,7,9,11
U2	SN74LS90N		5	2,3,6,7,10
U3	SN74LS74N	1,13,14		2,7,12
U4	N74LS00N	14		7
U5	SN74LS74N	1,4,10,13,14		7

Synthesizer Output (635-4930-001 only), Schematic Diagram
Figure 9 (Sheet 5)



POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER		
		+5 V (A)	+5 V (B)	GND
U1	N74LS04N		14	1,3,7,9,11
U2	SN74LS90N		5	2,3,6,7,10
U3	SN74LS74N	1,13,14		2,7,12
U4	N74LS00N	14		7
U5	SN74LS74N	1,4,10,13,14		7

Synthesizer Output (635-4930-002 only), Schematic Diagram
Figure 9 (Sheet 6)

Receive Audio (635-0748-( ))

Rockwell International

instructions

Collins Telecommunications Products Division

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1. DESCRIPTION

Receive Audio 635-0748-001, shown in figure 1, is a 2-layer planar card with a 56-pin edge-on connector (2 layers, 28 pins each).

The receive audio card consists of audio input switching circuits, channel A line audio amplifier, channel B line audio amplifier, headphone audio amplifier, speaker audio amplifier, and squelch control circuits.

2. PRINCIPLES OF OPERATION

2.1 General

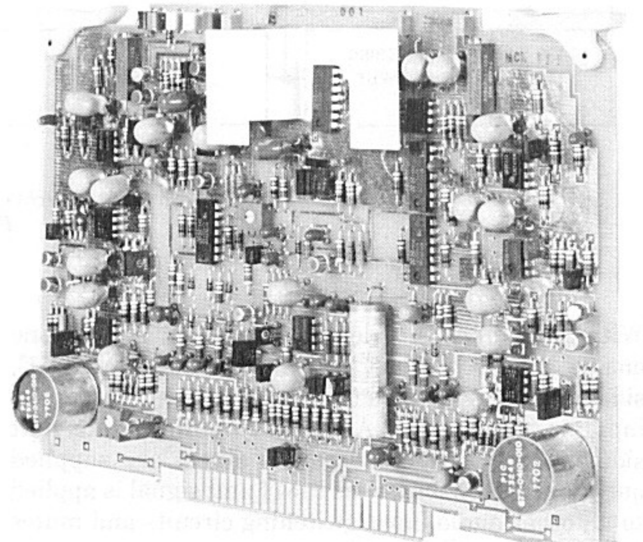
The receive audio card receives audio inputs from AM audio, FM audio, SSB audio, ISB audio, or sidetone audio circuits. These inputs are switched to common line audio amplifiers and supplied through output audio circuits to other audio circuits, speakers, headphones, and performance monitors.

The receive audio card also receives a level controlled speaker audio input and supplies a squelch/mute controlled speaker audio output.

2.2 Audio Input Switching
(Refer to figure 2.)

Since the audio input switching circuits are identical for all modes, the following discussion centers on the AM af (audio) input switching.

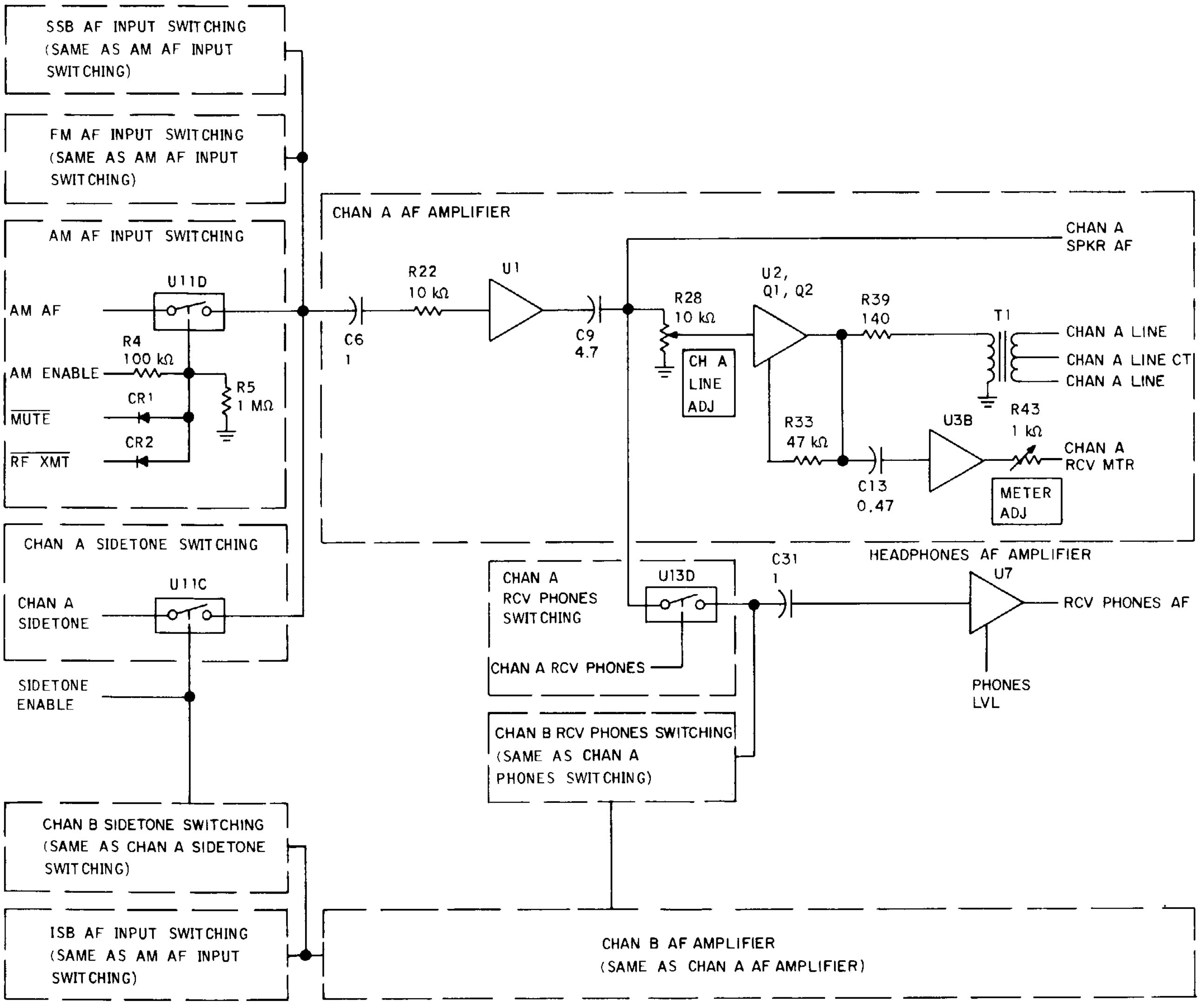
With an AM audio signal and an AM enable signal applied to bilateral switch U11D, AM audio is supplied through closed switch U11D to the input of the channel A audio amplifier. With a mute or rf xmt signal applied, the AM enable signal is removed. Switch U11D cannot be closed, and the AM audio signal is muted from the input of the channel A audio amplifier.



TP5-2342-017

Receive Audio
Figure 1

NOTICE: This section replaces second edition dated 1 June 1978 and revision.



TP4-9028-013

Audio Input Switching and Associated Amplifiers
Figure 2

With a channel A sidetone signal and a sidetone enable signal applied to bilateral switch U11C, sidetone is applied through closed switch U11C to the input of the channel A audio amplifier. Note that sidetone and a sidetone enable signal are supplied only during transmit; thus the rf xmt signal is applied to all other audio input switching circuits and mutes these other audio signals.

2.3 Line Audio Amplifiers (Refer to figure 2.)

The line audio amplifiers consist of a channel A audio amplifier and a channel B audio amplifier. These two line audio amplifiers are identical in operation; thus the following paragraphs discuss only the channel A audio amplifier.

An audio input to the channel A audio amplifier is amplified by U1 and supplied as three audio outputs: input to the speaker audio amplifier, input to the headphones audio amplifier, and input to the channel A line audio amplifier.

The input to the channel A line audio amplifier is level controlled by the CH A LINE ADJ potentiometer and amplified by amplifiers U2, Q1, and Q2. The output of these amplifiers is supplied to performance monitor U3B and audio output transformer

T1. Audio output transformer T1 provides a balanced 600-ohm audio output for external use. U3B provides an adjustable (METER ADJ potentiometer) dc level output to the channel A receive level meter to allow constant monitoring of the channel A audio output level.

2.4 Headphones Audio Amplifier (Refer to figure 2.)

With an audio signal from the channel A input audio amplifier and a channel A receive phones enable signal applied, audio is supplied through closed bilateral switch U13D to headphones amplifier U7. The output of U7 is level controlled externally and supplies audio for an external headphone set.

The channel B headphone audio circuit is identical to the channel A circuit.

2.5 Speaker Audio Amplifier (Refer to figure 3.)

With a speaker audio input signal applied to transistor switch Q9 and the squelch signal removed from Q9, audio is supplied through a closed switch to speaker amplifier U8.

When a squelch signal is applied to Q9, Q9 is opened and speaker audio is squelched.

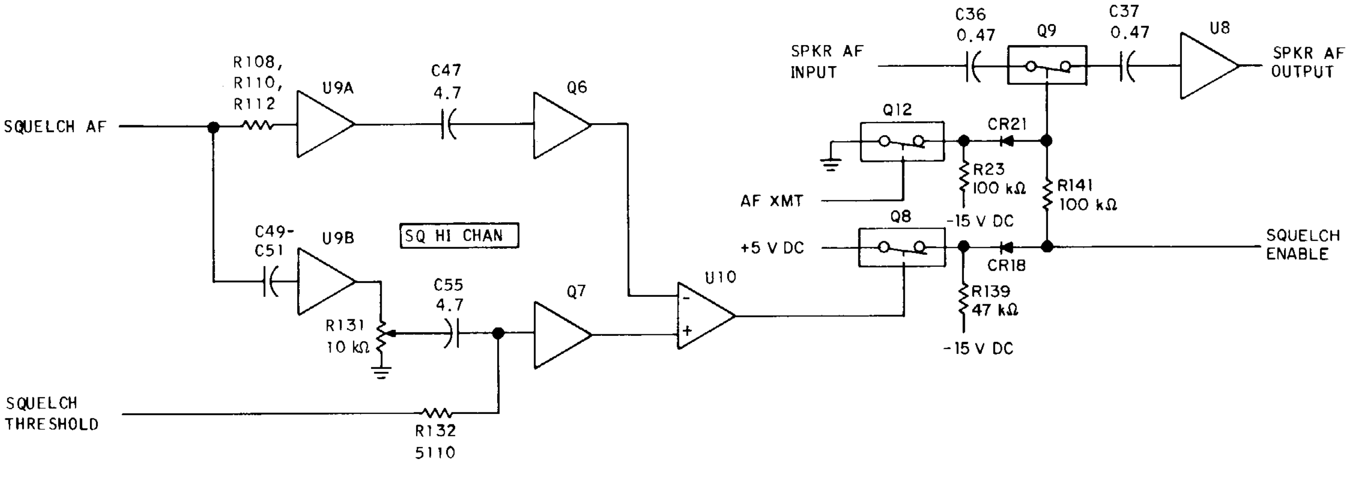
A speaker squelch signal can be applied from one of three sources; squelch enable input, af xmt input, or squelch control circuit.

2.6 Squelch Control Circuit (Refer to figure 3.)

Squelch audio (or noise) signals are supplied at squelch low channel input amplifier U9A and squelch high channel input amplifier U9B. The squelch low-channel signal is level detected by Q6 and applied to the inverting input of U10. The squelch high channel signal is level detected by R131 and Q7 and applied to the noninverting input of U10. When the output of Q7 is lower than the output of Q6, a negative signal is applied from U10 to Q8. Q8 is closed and the squelch signal is removed from Q9. When the output of Q7 exceeds the output of Q6, a positive signal is applied from U10 to Q8. Q8 is opened and the squelch signal is applied to Q9 (noise only or squelched audio condition).

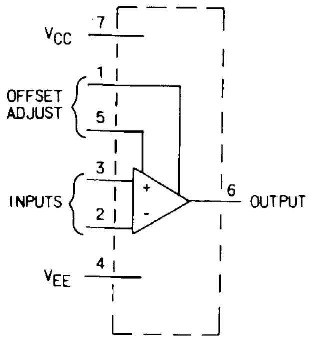
2.7 Operational Amplifier 351-1110-020 (Refer to figure 4.)

The 351-1110-020 is an operational amplifier designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.



TP4-9027-013

Speaker Amplifier and Squelch Control Circuit
Figure 3



CHARACTERISTICS

SUPPLY VOLTAGE: V_{CC} +22 V DC MAX
V_{EE} -22 V DC MAX
INPUT DIFF VOLTAGE: ±30 V MAX
INPUT COMMON MODE VOLTAGE:
±15 V MAX ①
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ②
INPUT RESISTANCE: 300 kΩ MIN, 2.0 MΩ MAX
OUTPUT RESISTANCE: 75Ω TYPICAL
VOLTAGE GAIN: 25 MIN

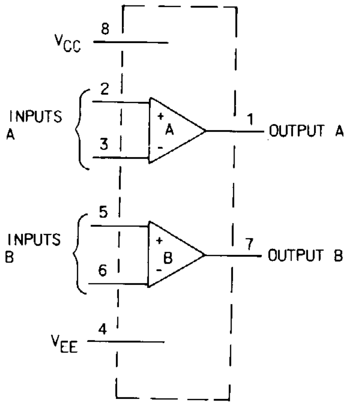
NOTES:

① FOR SUPPLY VOLTAGE LESS THAN ±15.0 V, MAX INPUT VOLTAGE EQUAL TO SUPPLY VOLTAGE.

② SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2286-013

Operational Amplifier 351-1110-020
Figure 4



CHARACTERISTICS
SUPPLY VOLTAGE: V_{CC} +18 V DC MAX
V_{EE} -18 V DC MAX
INPUT DIFF VOLTAGE: ±30 V MAX
INPUT COMMON MODE VOLTAGE:
±15 V MAX ①
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ②
INPUT RESISTANCE: 300 kΩ MIN, 2.0 MΩ MAX
OUTPUT RESISTANCE: 75Ω TYPICAL
VOLTAGE GAIN: 15 MIN

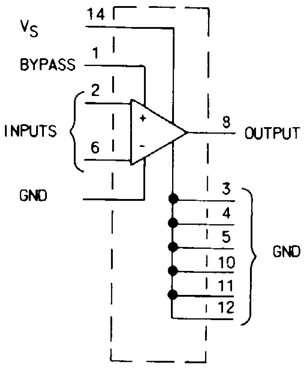
NOTES:

① FOR SUPPLY VOLTAGE LESS THAN ±15.0 V, MAX INPUT VOLTAGE EQUAL TO SUPPLY VOLTAGE.

② SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

TP5-2285-013

Dual Operational Amplifier 351-1071-070
Figure 5



CHARACTERISTICS

SUPPLY VOLTAGE: +22 V DC MAX
INPUT DIFF VOLTAGE: ±0.5 V MAX
BANDWIDTH: 100 kHz TYPICAL
INPUT RESISTANCE: 150 kΩ TYPICAL
OUTPUT RESISTANCE: 8Ω TYPICAL
VOLTAGE GAIN: 40 MIN, 60 MAX
OUTPUT VOLTAGE SWING: 14 V p-p TYPICAL
OUTPUT POWER: 2.5 W MIN

TP5-2284-013

Audio Power Amplifier 351-1118-010
Figure 6

2.8 Dual Operational Amplifier 351-1071-070 (Refer to figure 5.)

The 351-1071-070 consists of two operational amplifiers in one package designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components.

2.9 Audio Power Amplifier 351-1118-010 (Refer to figure 6.)

The 351-1118-010 is an audio power amplifier with an internal fixed gain of 34 dB.

2.10 COS/MOS Quad Bilateral Switch 351-8252-010 (Refer to figure 7.)

The 351-8252-010 consists of four bilateral switches in one package. The 351-8252-010 bilateral switches exhibit a low closed-switch impedance (60 to 360 Ω typical) and relative constant impedance (±5 Ω) over the full input signal range.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the receive audio card are listed in the maintenance section of this instruction book.

3.2 Testing

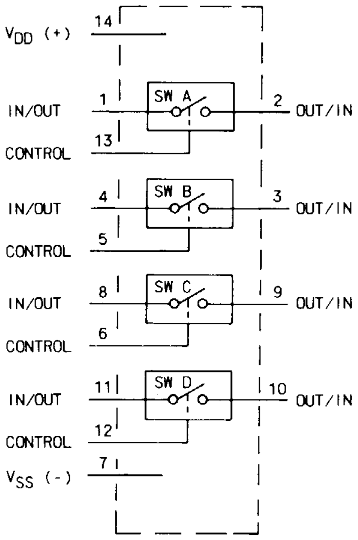
The test procedures in table 1 check the total performance of the receive audio card. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

4. ALIGNMENT/ADJUSTMENT

4.1 Channel A Receive Line Amplifier Adjustment

Adjustment of CH A RCV LINE ADJ (R28) is as follows:

a. Perform test setup of table 1, test 1.
b. Set front-panel MODE switch to AM.
c. Connect an audio oscillator to P1-35.
d. Set the audio oscillator to 1000 Hz at 10-mV rms output.
e. Connect a 600-Ω load across CH A AUD OUT terminals.
f. Connect an audio voltmeter across 600-Ω load.
g. Adjust CH A LINE ADJ (R28) for a 0-dB mW (+775-mV rms) reading on audio voltmeter.



TYPICAL CHARACTERISTICS

V_{DD} TO V_{SS} VOLTS	CONTROL VOLTS	CLOSED-SWITCH IMPEDANCE		TYPICAL OPEN-SWITCH IMPEDANCE
		TYPICAL	MAX	
15	15	60-145Ω	220-320Ω	10 kΩ
10	10	89-190Ω	400-550Ω	10 kΩ
5	5	160-360Ω	3000-5500Ω	10 kΩ

NOTE: CONTROL VOLTAGE MUST EQUAL V_{DD} TO CLOSE SWITCH.
CONTROL VOLTAGE MUST EQUAL V_{SS} TO OPEN SWITCH.

TP5-2283-013

COS/MOS Quad Bilateral Switch 351-8252-010
Figure 7

Table 1. Receive Audio, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of unit containing the receive audio that is to be tested.		
	b. Remove receive audio card. Install it on an extender card and place it in the unit.		
	c. Set unit LINE SELECTOR switch to 115 V.		
	d. Connect unit to 115-V ac power source and set power on.		
	e. Measure dc voltages between the following pins and ground (TP1, brown):		
	P1-23	+15 ±1.0 V dc.	Check associated power supply.
	P1-27	+5 ±0.5 V dc.	
	P1-6	-15 ±1.0 V dc.	
	P1-18	+18 ±1.0 V dc.	
2. Channel A, line amplifier gain	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Adjust audio oscillator for 1000 Hz at 10 mV rms.		
	d. Connect a 600-Ω load across CH A AUD OUT terminals.		
	e. Connect an oscilloscope across the 600-Ω load.		
	f. Adjust R28 for maximum output with no visible distortion.		
	g. Connect audio voltmeter across 600-Ω load. Note output level.	NLT +15 dB mW.	Check Q1, Q2, U1, U2, and associated circuits.
	h. Adjust R28 for +10-dB mW output.	Reference.	
	i. Set front-panel MODE switch to SSB/CW.		
	j. Connect the audio oscillator to P1-34.		
	k. Set audio oscillator for 1000 Hz at 10 mV rms.		
	l. Note output level.	+10 ±1 dB mW.	If too high check U11D and associated circuit. If too low check U11A and associated circuit.
(Cont)	**Note** Steps m thru p are applicable only if receiver has FM MODE switch position.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	m. Connect the audio oscillator to P1-7.		
	n. Set front-panel MODE switch to FM.		
	o. Set audio oscillator for 1000 Hz at 10 mV rms.		
	p. Note output level.	+10 ±1 dB mW.	Check U11B and associated circuit.
	q. Connect an 800-Ω load between P1-5 and ground.		
	r. Connect the audio oscillator to P1-5.		
	s. Apply +5-V dc signal to P1-38.		
	t. Set audio oscillator for 1000 Hz at 10 mV rms.		
	u. Note output level.	+10 ±1 dB mW.	Check U11C and associated circuit.
	v. Remove +5 V dc from P1-38.		
	w. Set front-panel MODE switch to AM.		
	x. Connect the audio oscillator to P1-35.		
	y. Adjust audio oscillator for 1000 Hz at 10 mV rms.		
	z. Adjust R28 for 0-dB mW output level.		
3. Channel A, frequency response	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect a 600-Ω load across CH A AUD OUT terminals.		
	d. Connect an audio voltmeter across 600-Ω load.		
	e. Adjust audio oscillator from 0 to 10 000 Hz with a constant 10-mV rms output.		
	f. Note maximum level and frequencies at point 1 dB below maximum level.	Upper 1 dB frequency NLT 8000 Hz, NMT 12 kHz. Lower 1 dB frequency, NMT 250 Hz.	Check Q1, Q2, U1, U2, and associated circuits.
4. Channel A, total harmonic distortion	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
(Cont)	c. Connect a 600-Ω load across CH A AUD OUT terminals.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	d. Connect distortion analyzer across 600-Ω load.		
	e. Adjust audio oscillator to 300 Hz at 10-mV rms output.		
	f. Measure total harmonic distortion using distortion analyzer.	NMT 3%.	Check bypass and dc blocking capacitors.
	g. Repeat step f with audio oscillator set at:		
	1000 Hz 6000 Hz	NMT 0.5%. NMT 0.5%.	Same as step f.
5. Channel B, line amplifier gain (with ISB only)	a. Set front-panel MODE switch to ISB.		
	b. Connect an audio oscillator to P1-50.		
	c. Adjust audio oscillator for 1000 Hz at 10 mV rms.		
	d. Connect a 600-Ω load across CH B AUD OUT terminals.		
	e. Connect an oscilloscope across the 600-Ω load.		
	f. Adjust R65 for maximum output with no visible distortion.		
	g. Note output level.	NLT 15 dB mW.	Check Q4, Q5, U4, U5, and associated circuits.
	h. Adjust R65 for +10-dB mW output.		
	i. Connect an 800-Ω load between P1-22 and ground.		
	j. Connect the audio oscillator to P1-22.		
	k. Apply +5-V dc signal to P1-38.		
	l. Set audio oscillator for 1000 Hz at 10 mV rms.		
	m. Note output level.	+10 ±1 dB mW.	If too high check U12B and associated circuits. If too low check U12C and associated circuits.
	n. Remove +5 V dc from P1-38.		
(Cont)	o. Connect the audio oscillator to P1-50.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	p. Adjust audio oscillator for 1000 Hz at 10 mV rms.		
	q. Adjust R65 for 0-dB mW output level.		
6. Channel B, frequency response (with ISB only)	a. Set front-panel MODE switch to ISB.		
	b. Connect an audio oscillator to P1-50.		
	c. Connect a 600-Ω load across CH B AUD OUT terminals.		
	d. Connect an audio voltmeter across 600-Ω load.		
	e. Adjust audio oscillator from 0 to 10 000 Hz with a constant 10-mV rms output.		
	f. Note maximum level and frequencies at point 1 dB below maximum level.	Upper 1 dB frequency NLT 8000 Hz, NMT 12 kHz. Lower 1 dB frequency, NMT 250 Hz.	Check Q4, Q5, U4, U5, and associated circuit.
7. Channel B, total harmonic distortion (with ISB only)	a. Set front-panel MODE switch to ISB.		
	b. Connect an audio oscillator to P1-50.		
	c. Connect a 600-Ω load across CH B AUD OUT terminals.		
	d. Connect a distortion analyzer across 600-Ω load.		
	e. Adjust audio oscillator to 300 Hz at 10-mV rms output.		
	f. Measure total harmonic distortion using distortion analyzer.	NMT 3%.	Check bypass and dc blocking capacitors.
	g. Repeat step f with audio oscillator set at:		
	1000 Hz	NMT 0.5%.	Same as step f.
	6000 Hz	NMT 0.5%.	
8. Headphone amplifier, gain	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect a distortion analyzer to P1-12.		
	d. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		
(Cont)	e. Set front panel PHONES level control to minimum.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	f. Set front-panel PHONES switch to CH A.		
	g. Note that a negligible audio output is present on the audio voltmeter.	NLT 30 dB below level of step i.	
	h. Set front-panel PHONES level control to maximum.		
	i. Note level on the audio voltmeter.	NLT +15 dB mW.	Check U13D, U7, and associated circuits.
	Note Steps 8.j through 8.n with ISB only.		
	j. Set front-panel MODE switch to ISB.		
	k. Connect the audio oscillator to P1-50.		
	l. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		
	m. Set front-panel PHONES switch to CH B.		
	n. Note level on the audio voltmeter.	NLT +15 dB mW.	Check U13B and associated circuits.
9. Headphone amplifier, frequency response	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect an audio voltmeter to P1-12.		
	d. Set front-panel PHONES level control to midrange.		
	e. Set front-panel PHONES switch to CH A.		
	f. Adjust audio oscillator from 0 to 10 000 Hz with a constant 10-mV rms output.		
	g. Note maximum output level and frequencies at point 1 dB below maximum level.	Upper 1-dB frequency NLT 6000 Hz. Lower 1-dB frequency, NLT 250 Hz.	Check U7 and associated circuits.
10. Headphone amplifier, total harmonic distortion	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect a distortion analyzer to P1-12.		
	d. Set front-panel PHONES switch to CH A.		
(Cont)	e. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	f. Adjust front-panel PHONES level control for 0 ±1 dB mW at P1-12.		
	g. Measure total harmonic distortion using distortion analyzer.	NMT 0.5%.	Check bypass and dc blocking capacitors.
11. Speaker amplifier, gain	a. Set front-panel MODE switch to AM.		
	b. Set front-panel SPKR switch to CH A.		
	c. Connect an audio oscillator to P1-35.		
	d. Connect an audio voltmeter between P1-19 and P1-17.		
	e. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		
	f. Set SQUELCH control to off (fully ccw).		
	g. Increase front-panel AF GAIN control until distortion analyzer indicates 4 V rms.		
	h. Measure distortion using the distortion analyzer.	NMT 3%.	Check U8 and associated circuits.
	Note Steps 11.i through 11.m with ISB only.		
	i. Set front-panel MODE switch to ISB.		
	j. Set front-panel SPKR switch to CH B.		
	k. Connect an audio oscillator to P1-50.		
	l. Adjust AF GAIN control until distortion analyzer indicates 4 V rms.		
	m. Measure distortion using the distortion analyzer.	NMT 3%.	Same as step h.
12. Speaker amplifier, frequency response	a. Set front-panel MODE switch to AM.		
	b. Set front-panel SPKR switch to CH A.		
	c. Connect an audio oscillator to P1-35.		
	d. Connect an audio voltmeter between P1-19 and P1-17.		
	e. Set SQUELCH control to off (fully ccw).		
	f. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		
	g. Adjust AF GAIN control for 0.5 V rms as indicated on audio voltmeter.		
(Cont)	h. Adjust audio oscillator from 0 to 10 000 Hz.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)	i. Note maximum output level and frequencies at point 1 dB below maximum level.	Upper 1 dB frequency, NLT 6000 Hz. Lower 1 dB frequency, NMT 250 Hz.	Check Q9, U8, and associated circuit.
13. Speaker amplifier, total harmonic distortion	a. Set front-panel MODE switch to AM.		
	b. Set front-panel SPKR switch to CH A.		
	c. Connect an audio oscillator to P1-35.		
	d. Connect a distortion analyzer between P1-19 and P1-17.		
	e. Set SQUELCH control to off (fully ccw).		
	f. Adjust audio oscillator to 1000 Hz at 10-mV rms outputs.		
	g. Adjust front-panel AF GAIN control until distortion analyzer indicates 4 V rms.		
	h. Measure total harmonic distortion using distortion analyzer.	NMT 3%.	Check bypass and dc blocking capacitors.
14. Squelch	a. Set front-panel MODE switch to AM.		
	b. Set front-panel SPKR switch to CH A.		
	c. Connect audio oscillator to P1-35.		
	d. Connect an audio voltmeter between P1-19 and P1-17.		
	e. Set front-panel SQUELCH control on (away from fully ccw).		
	f. Adjust the squelch threshold for minimum resistance (SQUELCH control near full ccw).		
	g. Set audio oscillator to 500 Hz at 10-mV rms output.		
	h. Set AF GAIN control for 0.5 V rms as indicated by audio voltmeter.		
	i. Slowly increase audio oscillator frequency until audio output is squelched. Note frequency.	Between 600 and 2500 Hz.	If too low, check Q7, U9B, and associated circuit. If too high, check Q6, U9A, and associated circuit.
(Cont)			

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
14. (Cont)	j. Return audio oscillator to 500 Hz and note that audio output returns.		
	k. Quickly switch from 500 to 3000 Hz audio and note time required for audio to squelch.	NMT 3 seconds.	Check Q7, U9B, U10, Q8, and associated circuit.
15. Channel A, performance monitor	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect a dvm to P1-2.		
	d. Set audio oscillator to 1000 Hz at 10-mV rms output.		
	e. Note dvm reading.	NMT 0.5 V dc.	Check U3A, Q10, and associated circuits.
	f. Decrease audio oscillator output by 10 dB.		
	g. Note dvm reading.	NLT +3.0 V dc.	Same as step e.
16. Channel B, performance monitor (with ISB only)	a. Set front-panel MODE switch to ISB.		
	b. Connect an audio oscillator to P1-50.		
	c. Connect a dvm to P1-51.		
	d. Set audio oscillator to 1000 Hz at 10-mV rms output		
	e. Note dvm reading.	NMT 0.5 V dc.	Check U6B, Q11, and associated circuits.
	f. Decrease audio oscillator output by 10 dB.		
	g. Note dvm reading.	NLT +3.0 V dc.	Same as step e.
17. Channel A receive meter	a. Set front panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Connect a 600-Ω load between CH A AUD OUT terminals.		
	d. Set front-panel METER switch to CH A AF (+3FS).		
	e. Set audio oscillator to 1000 Hz at 10-mV rms output.		
(Cont)	f. Note front-panel meter reading.	≅ 0 dB mW.	Adjust per paragraph 4.3. Check U3B and associated circuit.

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
17. (Cont)	g. Decrease audio oscillator output by 10 dB.		
	h. Note front-panel meter reading.	≅ -10 dB mW.	Same as step e.
18. Channel B, receive meter (with ISB only)	a. Set front-panel MODE switch to ISB.		
	b. Connect an audio oscillator to P1-50.		
	c. Connect a 600-Ω load between CH B AUD OUT terminals.		
	d. Set front-panel METER switch to CH B AF (+3FS).		
	e. Set audio oscillator to 1000 Hz at 10-mV rms output.		
	f. Note front-panel meter reading.	≅ 0 dB mW.	Adjust per paragraph 4.4. Check U6A and associated circuit.
	g. Decrease audio oscillator output by 10 dB.		
	h. Note front-panel meter reading.	≅ -10 dB mW.	Same as step e.
19. Rf transmit	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Set front-panel METER switch to CH A AF (+3FS).		
	d. Set audio oscillator to 1000 Hz at 10-mV rms output.		
	e. Reference front-panel meter reading.	Reference.	
	f. Apply a +5-V dc signal at P1-41.		
	g. Note front-panel meter reading.	No deflection.	Check Q3, CR2, U11D, and associated circuit.
	h. Remove +5 V dc from P1-41.		
	i. Note front-panel meter reading.	Step e reference.	
	j. Set front-panel MODE switch to SSB/CW (receiver) or USB (receiver-exciter).		
	k. Remove audio oscillator from P1-35 and connect it to P1-34 (same 10-mV output).		
(Cont)	l. Reference front-panel meter reading.	Reference.	

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
19. (Cont)	m. Apply a +5-V dc signal at P1-41.		
	n. Note front-panel meter reading.	No deflection.	Check CR4, U11A, and associated circuit.
	o. Remove +5 V dc from P1-41.		
	p. Note front-panel meter reading.	Step l reference.	
	q. Apply +5-V dc signal at P1-10.		
	r. Remove audio oscillator from P1-34 and connect it to P1-7 (same 10-mV output).		
	s. Reference front-panel meter reading.	Reference.	
	t. Apply a +5-V dc signal at P1-41.		
	u. Note front-panel meter reading.	No deflection.	Check CR6, U11B, and associated circuit.
	v. Remove +5 V dc from P1-41.		
	w. Note front-panel meter reading.	Step s reference.	
	x. Remove +5 V dc from P1-10.		
	y. Apply +5 V dc from P1-38.		
	z. Remove audio oscillator from P1-7 and connect it to P1-5 (same 10-mV output).		
	aa. Reference front-panel meter reading.	Reference.	
	ab. Apply a +5-V dc signal at P1-41.		
	ac. Note front-panel meter reading.	Step aa reference.	Check for shorts or unauthorized modification.
	ad. Remove +5 V dc from P1-41.		
	ae. Note front-panel meter reading.	Step aa reference.	
	af. Remove +5 V dc from P1-38.		
	Note Steps 19.ag through 19.at with ISB only.		
	ag. Set front-panel MODE switch to ISB.		
	ah. Remove audio oscillator from P1-5 and connect it to P1-50 (same 10-mV output).		
	ai. Reference front-panel meter reading.	Reference.	
(Cont)	aj. Apply a +5-V dc signal at P1-41.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
19. (Cont)	ak. Note front-panel meter reading.	No deflection.	Check CR12, U12B, and associated circuit.
	al. Remove +5 V dc from P1-41.		
	am. Note front-panel meter reading.	Step ai reference.	
	an. Apply +5-V dc signal to P1-38.		
	ao. Remove audio oscillator from P1-50 and connect it to P1-22 (same 10-mV output).		
	ap. Reference front-panel meter reading.	Reference.	
	aq. Apply a +5 V dc signal at P1-41.		
	ar. Note front-panel meter reading.	Step ap reference.	Same as step ac.
	as. Remove +5 V dc from P1-41.		
	at. Note front-panel meter reading.	Step ap reference.	
20. Mute	a. Set front-panel MODE switch to AM.		
	b. Connect an audio oscillator to P1-35.		
	c. Set front-panel METER switch to CH A AF (+3FS).		
	d. Set audio oscillator to 1000 Hz at 10-mV rms output.		
	e. Reference front-panel meter reading.	Reference.	
	f. Apply a ground signal at P1-13.		
	g. Note front-panel meter reading.	No deflection.	Check CR1 and associated circuit.
	h. Remove ground from P1-13.		
	i. Note front-panel meter reading.	Step e reference.	
	j. Set front-panel MODE switch to SSB/CW (receiver) or USB (receiver-exciter).		
	k. Remove audio oscillator from P1-35 and connect it to P1-34 (same 10-mV output).		
	l. Reference front-panel meter reading.	Reference.	
	m. Apply a ground signal at P1-13.		
(Cont)	n. Note front-panel meter reading.	No deflection.	Check CR3 and associated circuit.

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
20. (Cont)	o. Remove ground from P1-13.		
	p. Note front-panel meter reading.	Step l reference.	
	q. Apply +5-V dc signal at P1-10.		
	r. Remove audio oscillator from P1-34 and connect it to P1-7 (same 10-mV output).		
	s. Reference front-panel meter reading.	Reference.	
	t. Apply a ground signal at P1-13.		
	u. Note front-panel meter reading.	No deflection.	Check CR5 and associated circuit.
	v. Remove ground from P1-13.		
	w. Note front-panel meter reading.	Step s reference.	
	x. Remove +5 V dc from P1-10.		
	y. Apply +5-V dc signal to P1-38.		
	z. Remove audio oscillator from P1-7 and connect it to P1-5 (same 10-mV output).		
	aa. Reference front panel meter reading.	Reference.	
	ab. Apply a ground signal at P1-13.		
	ac. Note front-panel meter reading.	Step aa reference.	Check for shorts or unauthorized modifications.
	ad. Remove ground from P1-13.		
	ae. Note front-panel meter reading.	Step aa reference.	
	af. Remove +5 V dc from P1-38.		
	Note Steps 20.ag through 20.at with ISB only.		
	ag. Set front-panel MODE switch to ISB.		
	ah. Remove audio oscillator from P1-5 and connect it to P1-50 (same 10-mV output).		
	ai. Reference front-panel meter reading.	Reference.	
	aj. Apply a ground signal to P1-13.		
	ak. Note front-panel meter reading.	No deflection.	Check CR11 and associated circuit.
	al. Remove ground from P1-13.		
	am. Note front-panel meter reading.	Step ai reference.	
(Cont)	an. Apply +5-V dc signal to P1-38.		

Table 1. Receive Audio, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
20. (Cont)	ao. Remove audio oscillator from P1-50 and connect it to P1-22 (same 10-mV output).		
	ap. Reference front-panel meter reading.	Reference.	
	aq. Apply a ground signal at P1-13.		
	ar. Note front-panel meter reading.	Step ap reference.	Check for shorts or unauthorized modifications.
	as. Remove ground from P1-13.		
	at. Note front-panel meter reading.	Step ap reference.	
21. Af transmit	a. Set front-panel MODE switch to AM.		
	b. Set front-panel SPKR switch to CH A.		
	c. Connect an audio oscillator to P1-35.		
	d. Connect an audio voltmeter between P1-19 and P1-17.		
	e. Adjust audio oscillator to 1000 Hz at 10-mV rms output.		
	f. Set SQUELCH control to off (fully ccw).		
	g. Adjust front-panel AF GAIN control until audio voltmeter indicates 0.5 V rms.		
	h. Apply +5-V dc signal to P1-4.		
	i. Note audio voltmeter reading.	0.0 V rms.	Check Q12, Q9, CR21, and associated circuit.
	j. Remove +5 V dc from P1-4.		
	k. Note audio voltmeter reading.	0.5 V rms.	Same as step i.

4.2 Channel B Receive Line Amplifier Adjustment

Adjustment of CH B RCV LINE ADJ (R65) is as follows:

a. Perform test setup of table 1, test 1.
b. Set front-panel MODE switch to ISB.
c. Connect an audio oscillator to P1-50.
d. Set the audio oscillator to 1000 Hz at 10-mV rms output.
e. Connect a 600-Ω load across CH B AUD OUT terminals.
f. Connect an audio voltmeter across 600-Ω load.
g. Adjust CH B LINE ADJ (R65) for a 0-dB mW (+775-mV rms) reading on audio voltmeter.

4.3 Channel A Meter Adjustment

Adjustment of METER ADJ (R43) is as follows:

a. Perform channel A line amplifier adjustment per paragraph 4.1.
b. Perform test setup of table 1, test 1.
c. Set front-panel MODE switch to AM.
d. Connect an audio oscillator to P1-35.
e. Set front-panel METER switch to RCV-CH A AF (+3FS).
f. Set the audio oscillator to 1000 Hz at 10-mV rms output.
g. Adjust METER ADJ (R43) for a 0-dB mW reading on the front-panel meter.

4.4 Channel B Meter Adjustment

Adjustment of METER ADJ (R80) is as follows:

a. Perform channel B line amplifier adjustment per paragraph 4.2.
b. Perform test setup of table 1, test 1.
c. Set front-panel MODE switch to ISB.
d. Connect an audio oscillator to P1-50.
e. Set the audio oscillator to 1000 Hz at 10-mV rms output.
f. Set front-panel METER switch to RCV-CH B AF (+3FS).
g. Adjust METER ADJ (R80) for a 0-dB mW reading on the front-panel meter.

4.5 Squelch Adjustment

Perform squelch high-channel adjust (R131) as follows:

a. Perform test setup of table 1, test 1.
b. Set front-panel MODE switch to AM.
c. Set front-panel SPKR switch to CH A.
d. Connect an audio oscillator to P1-35.
e. Connect audio voltmeter to TP5 (green), voltmeter common to TP1 (brown).
f. Adjust audio oscillator (10-mV rms output) from 0 through 10 000 Hz and note maximum indication on audio voltmeter (frequency should be 600 ±100 Hz). Note amplitude.
g. Connect audio voltmeter to TP4 (yellow), voltmeter common to TP1 (brown).
h. Adjust audio oscillator (10-mV rms output) from 0 through 10 000 Hz and note maximum indication on audio voltmeter (frequency should be 2400 ±400 Hz).
i. Set audio oscillator to frequency (10-mV rms output) that gave the maximum indication in step h.
j. Adjust R131 to produce a level at TP4 (yellow), 12 dB below the amplitude noted in step f.

5. REPAIR

Repair of the receive audio card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

> This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).
>
> All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 8). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column - Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column - Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column - Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column - Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column - Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column - Lists the manufacturer's part number for the selected parts.

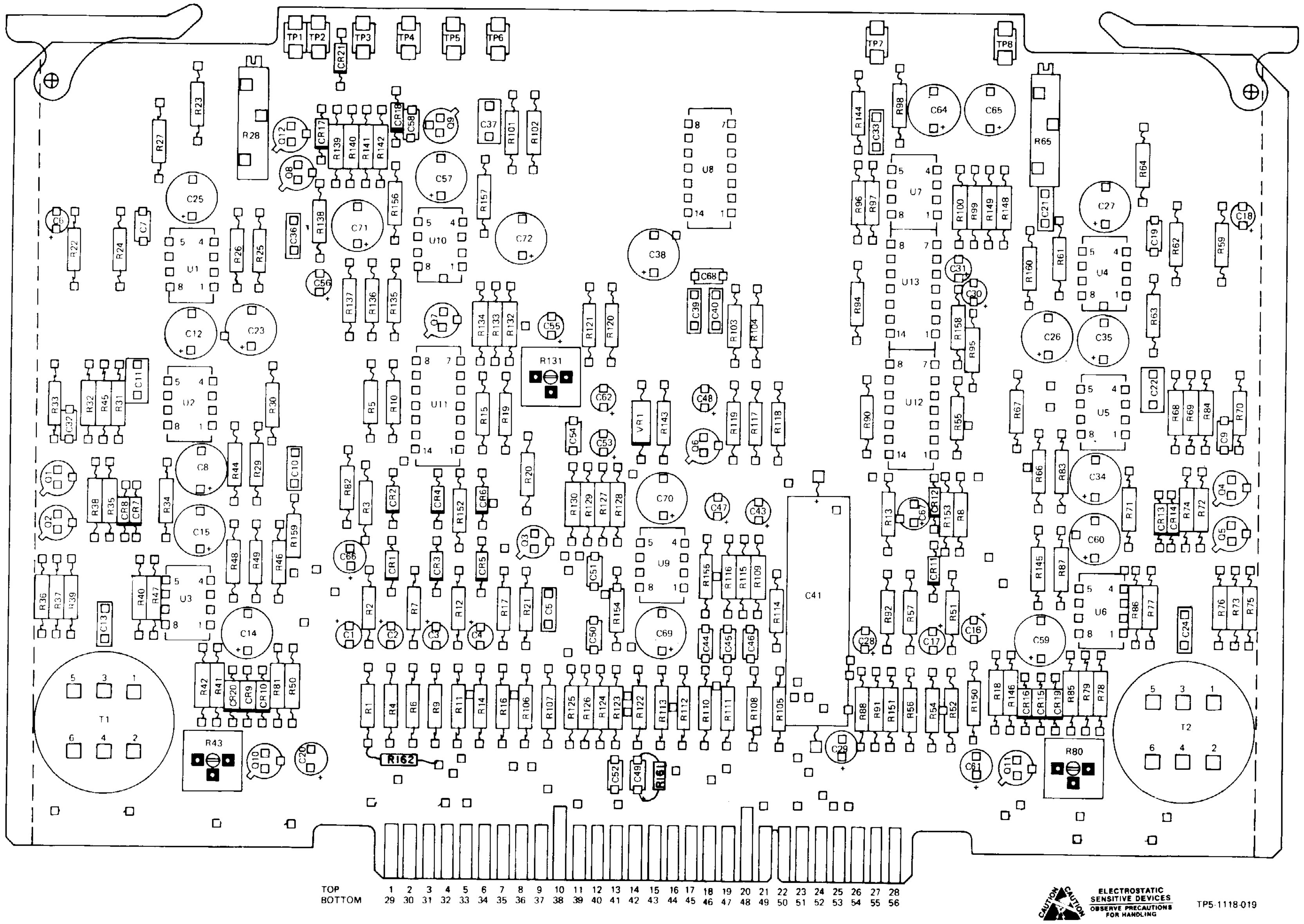
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
00872	TELEDYNE SYSTEMS CO MICROELECTRONICS DIV 12964 PANAMA ST LOS ANGELES CA 90066
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP SAN DIEGO OPERS 8808 BALBOA AVE SAN DIEGO CA 92123
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
73386	FREED TRANSFORMER CO INC 1736 WEIRFIELD ST BROOKLYN NY 11227
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
80294	BOURNS INC INSTRUMENT DIV 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATION
98330	POLYPHASE INSTRUMENT CO E FOURTH ST BRIDGEPORT PA 19405

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Receive audio	635-0748-001	REV N
Receive audio	635-0748-002	REV N



Receive Audio, Schematic Diagram
Figure 8 (Sheet 1 of 5)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	RECEIVE AUDIO (ESDS)	635-0748-001	A		
	RECEIVE AUDIO (ESDS)	635-0748-002	B		
CR1-CR21	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1-C4	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C5	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C6	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C7	CAPACITOR,FXD CER DIEL, 56PF, 10%, 200V (A2)	913-4003-000		81349	CK05BX560K
C7	CAPACITOR,FXD CER DIEL, 18PF, PORM10%, 200V (B2)	913-5019-040		81349	CK05BX180K
C7	CAPACITOR,FXD MICA DIEL, 24PF, PORM 0.5PF, 50V	912-4141-160		72136	DM5E240D050WV
C8	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C9	CAPACITOR,FXD CER DIEL, 56PF, 10%, 200V (A2)	913-4003-000		81349	CK05BX560K
C9	CAPACITOR,FXD CER DIEL, 47PF, 10%, 200V	913-4002-000		81349	CK05BX470K
C10	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V (B1)	913-5019-440		81349	CK06BX104K
C10	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C11	CAPACITOR,FXD CER DIEL, 1UF, 20%, 50V	913-3279-270		16546	CY30C105M
C12	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C13	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V (B1)	913-5019-440		81349	CK06BX104K
C13	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C14,C15	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C16-C18	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C19	CAPACITOR,FXD CER DIEL, 56PF, 10%, 200V (A2)	913-4003-000		81349	CK05BX560K
C19	CAPACITOR,FXD CER DIEL, 18PF, PORM10%, 200V (B2)	913-5019-040		81349	CK05BX180K
C19	CAPACITOR,FXD MICA DIEL, 24PF, PORM 0.5PF, 50V	912-4141-160		72136	DM5E240D050WV
C20	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C21	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V (B1)	913-5019-440		81349	CK06BX104K
C21	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C22	CAPACITOR,FXD CER DIEL, 1UF, 20%, 50V	913-3279-270		16546	CY30C105M
C23	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C24	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V (B1)	913-5019-440		81349	CK06BX104K
C24	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C25-C27	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C28	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C29	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C30,C31	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C32	CAPACITOR,FXD CER DIEL, 56PF, 10%, 200V (A2)	913-4003-000		81349	CK05BX560K
C32	CAPACITOR,FXD CER DIEL, 47PF, 10%, 200V	913-4002-000		81349	CK05BX470K
C33	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C34,C35	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C36	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C37	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C38	CAPACITOR,FXD ELCTLT, 33UF, 20%, 25V	184-9102-260		56289	199D1009
C39,C40	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C41	CAPACITOR,FXD ELCTLT, 220UF, M10%P75%, 20V	183-1277-200		56289	600D227G020DG5
C42	NOT USED				
C43	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C44	CAPACITOR,FXD CER DIEL, 0.022UF, PORM10%, 50V	913-5019-240		81349	CK05BX223K
C45,C46	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C47,C48	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C49	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V (A2)	913-5019-200		81349	CK05BX103K
C50,C51	CAPACITOR,FXD CER DIEL, 330PF, 10%, 200V	913-4012-000		81349	CK05BX331K
C52	CAPACITOR,FXD CER DIEL, 680PF, 10%, 200V	913-4016-000		81349	CK05BX681K
C53	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C54	CAPACITOR,FXD CER DIEL, 0.01UF, PORM10%, 100V	913-5019-200		81349	CK05BX103K
C55,C56	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C57	CAPACITOR,FXD ELCTLT, 33UF, 20%, 25V	184-9102-260		56289	199D1009
C58	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-5019-140		81349	CK05BX332K
C59,C60	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C61	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C62	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 10V	184-9102-070		56289	199D475X0010BB1
C63	NOT USED				
C64,C65	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C66,C67	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C68	CAPACITOR,FXD CER DIEL, 100PF, 10%, 200V	913-4006-000		81349	CK05BX101K
C69-C72	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
Q1	TRANSISTOR	352-0661-020		07263	2N2222A
Q2	TRANSISTOR	352-0551-010		04713	2N2907A
Q3,Q4	TRANSISTOR	352-0661-020		07263	2N2222A
Q5	TRANSISTOR	352-0551-010		04713	2N2907A
Q6,Q7	TRANSISTOR	352-0661-020		07263	2N2222A
Q8	TRANSISTOR	352-0551-010		04713	2N2907A
Q9	TRANSISTOR (ESDS)	352-0759-020		00872	2N4092
Q10,Q11	TRANSISTOR	352-0661-020		07263	2N2222A
Q12	TRANSISTOR (ESDS)	352-0605-010		22229	2N2608
R1	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R2	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R3	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R4	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R5	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R6	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R7	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R8	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R9	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R10	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R11	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R12	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS

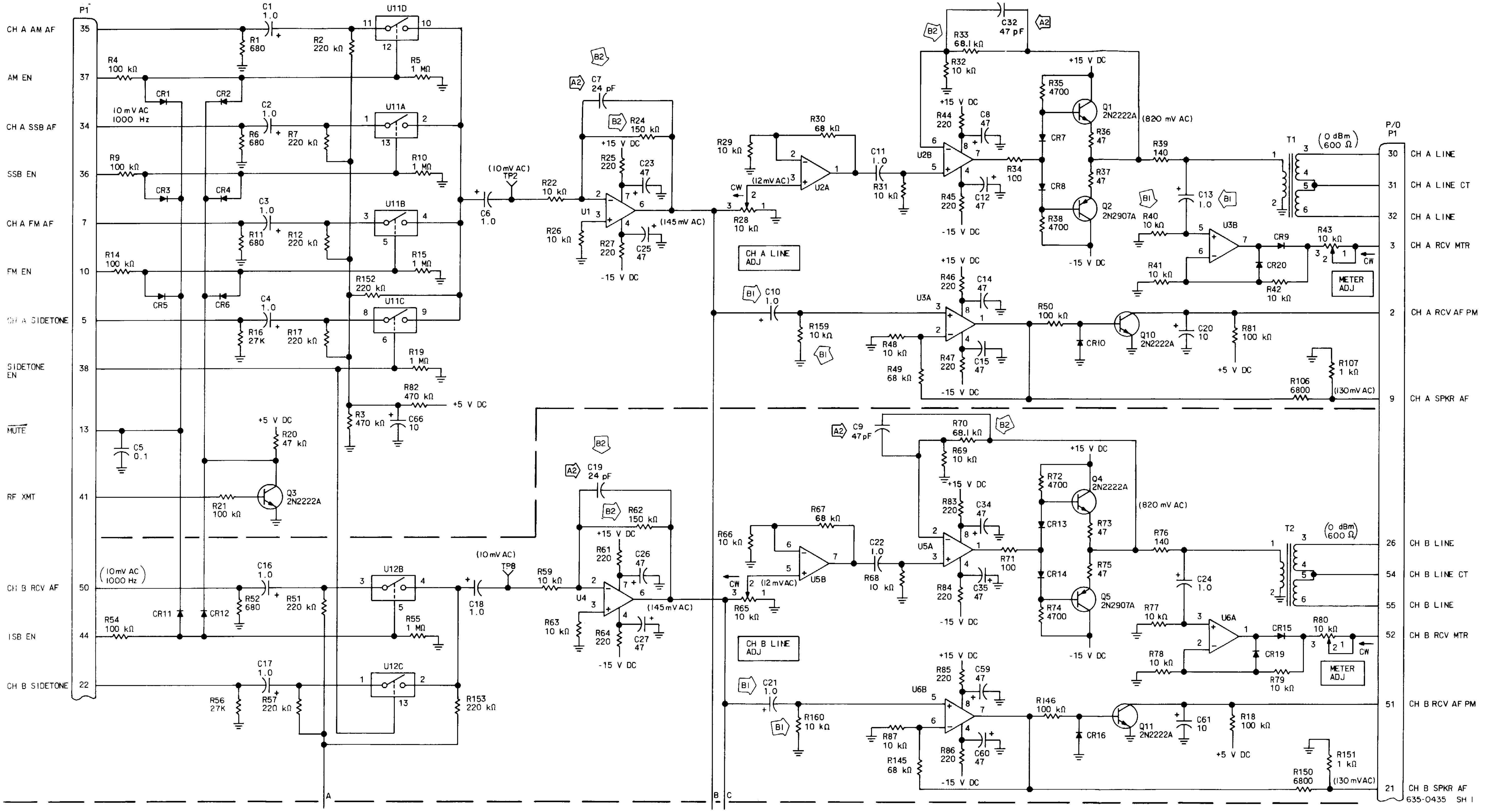
PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R13	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R14	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R15	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R16	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R17	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R18	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R19	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R20	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R21	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R22	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R23	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R24	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W (B2)	745-0827-000		81349	RCR07G154KS
R24	RESISTOR,FXD FILM, 150K, 1%, 1/8W	705-3604-090		81349	RN55D1503F
R25	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R26	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R27	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R28	RESISTOR,VAR 10K, 10%, 3/4W	382-0012-290		80294	3006P1-103
R29	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R30	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R31,R32	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R33	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W (B2)	745-0815-000		81349	RCR07G683KS
R33	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R34	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R35	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R36,R37	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R38	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R39	RESISTOR,FXD FILM, 140 OHMS, 1%, 1/8W	705-0955-000		81349	RN55D1400F
R40	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (B1)	745-0821-000		81349	RCR07G104KS
R40	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R41,R42	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R43	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-070		80294	3386P1-103
R44-R47	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R48	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R49	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R50	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R51	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R52	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R53	NOT USED				
R54	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R55	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R56	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R57	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R58	NOT USED				
R59	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R60	NOT USED				
R61	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R62	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W (B2)	745-0827-000		81349	RCR07G154KS
R62	RESISTOR,FXD FILM, 150K, 1%, 1/8W	705-3604-090		81349	RN55D1503F
R63	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R64	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R65	RESISTOR,VAR 10K, 10%, 3/4W	382-0012-290		80294	3006P1-103
R66	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R67	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R68,R69	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R70	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W (B2)	745-0815-000		81349	RCR07G683KS
R70	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R71	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R72	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R73	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R74	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R75	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R76	RESISTOR,FXD FILM, 140 OHMS, 1%, 1/8W	705-0955-000		81349	RN55D1400F
R77	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (B1)	745-0821-000		81349	RCR07G104KS
R77	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R78,R79	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R80	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-070		80294	3386P1-103
R81	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R82	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R83-R86	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R87	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R88	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R89	NOT USED				
R90	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R91	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R92	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R93	NOT USED				
R94	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R95,R96	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R97	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W (A2)	745-0815-000		81349	RCR07G683KS
R97	RESISTOR,FXD FILM, 56.2K, 1%, 1/8W	705-1080-000		81349	RN55D5622F
R98	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R99	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R100	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W (A2)	745-0827-000		81349	RCR07G154KS
R100	RESISTOR,FXD FILM, 287K, 1%, 1/8W	705-1114-000		81349	RN55D2873F
R101	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R102, R103	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R104	RESISTOR,FXD CMPSN, 2.7 OHMS, 5%, 1/4W	745-4377-000		81349	RCR07G2R7JS
R105	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R106	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R107	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R108	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W (A1)	745-0779-000		81349	RCR07G682KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R108	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R109	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
R110	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R111	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R112	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R113	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
R114	RESISTOR,FXD CMPSN, 13K, 5%, 1/4W	745-0789-000		81349	RCR07G133JS
R115	RESISTOR,FXD CMPSN, 51K, 5%, 1/4W (A2)	745-0810-000		81349	RCR07G513JS
R115	RESISTOR,FXD FILM, 51.1K, 1%, 1/8W	705-1078-000		81349	RN55D5112F
R116	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W (A2)	745-0812-000		81349	RCR07G563KS
R116	RESISTOR,FXD FILM, 56.2K, 1%, 1/8W	705-1080-000		81349	RN55D5622F
R117	RESISTOR,FXD FILM, 31.6K, 1%, 1/8W	705-1068-000		81349	RN55D3162F
R118	RESISTOR,FXD FILM, 5.76K, 1%, 1/8W	705-3605-360		81349	RN55D5761F
R119	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R120	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R121	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R122	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R123	RESISTOR,FXD CMPSN, 75K, 5%, 1/4W	745-0816-000		81349	RCR07G753JS
R124	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R125	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
R126	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R127	RESISTOR,FXD CMPSN, 56K, 10%, 1/4W (A2)	745-0812-000		81349	RCR07G563KS
R127	RESISTOR,FXD FILM, 56.2K, 1%, 1/8W	705-1080-000		81349	RN55D5622F
R128	RESISTOR,FXD CMPSN, 51K, 5%, 1/4W (A2)	745-0810-000		81349	RCR07G513JS
R128	RESISTOR,FXD CMPSN, 680 OHMS, 5%, 1/2W	745-1078-000		81349	RC20BF681J
R129	RESISTOR,FXD CMPSN, 510 OHMS, 5%, 1/4W	745-0738-000		81349	RCR07G511JS
R130	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R131	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-070		80294	3386P1-103
R132	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R133	RESISTOR,FXD FILM, 31.6K, 1%, 1/8W	705-1068-000		81349	RN55D3162F
R134	RESISTOR,FXD FILM, 56.2K, 1%, 1/8W (A1)	705-1080-000		81349	RN55D5622F
R134	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000		81349	RN55D2492F
R135	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R136	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R137	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R138	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R139	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R140	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R141	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R142	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R143	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R144	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W (A2)	745-0773-000		81349	RCR07G472KS
R144	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W	745-0800-000		81349	RCR07G273KS
R145	RESISTOR,FXD CMPSN, 68K, 10%, 1/4W	745-0815-000		81349	RCR07G683KS
R146	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R147	NOT USED				
R148, R149	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R150	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R151	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R152, R153	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R154-R157	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R158	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R159, R160	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (B1)	745-0821-000		81349	RCR07G104KS
R159, R160	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R161	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W (A2)	745-0803-000		81349	RCR07G333KS
R162	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W (A3)	745-0857-000		81349	RCR07G105KS
T1,T2	TRANSFORMER,AUD	677-0410-010	A	73386	41712
T1,T2	TRANSFORMER, AUD	667-0327-010	B	98330	T4465
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-001
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-001
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-001
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-001
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-001
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-001
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-001
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-001
U1	INTEGRATED CIRCUIT	351-1110-020		07263	UA741TC
U2,U3	INTEGRATED CIRCUIT	351-1071-070		04713	MC1458P1
U4	INTEGRATED CIRCUIT	351-1110-020		07263	UA741TC
U5-U7	INTEGRATED CIRCUIT	351-1071-070		04713	MC1458P1
U8	INTEGRATED CIRCUIT	351-1118-010		27014	LM380N
U9	INTEGRATED CIRCUIT	351-1071-070		04713	MC1458P1
U10	INTEGRATED CIRCUIT	351-1110-020		07263	UA741TC
U11-U13	INTEGRATED CIRCUIT (ESDS)	351-8252-010		04713	MC14066BCP
VR1	SEMICOND DEVICE	353-2710-000		12954	1N751A

Receive Audio, Schematic Diagram
Figure 8 (Sheet 2)



Receive Audio, Schematic Diagram
Figure 8 (Sheet 3)

MODIFICATION HISTORY

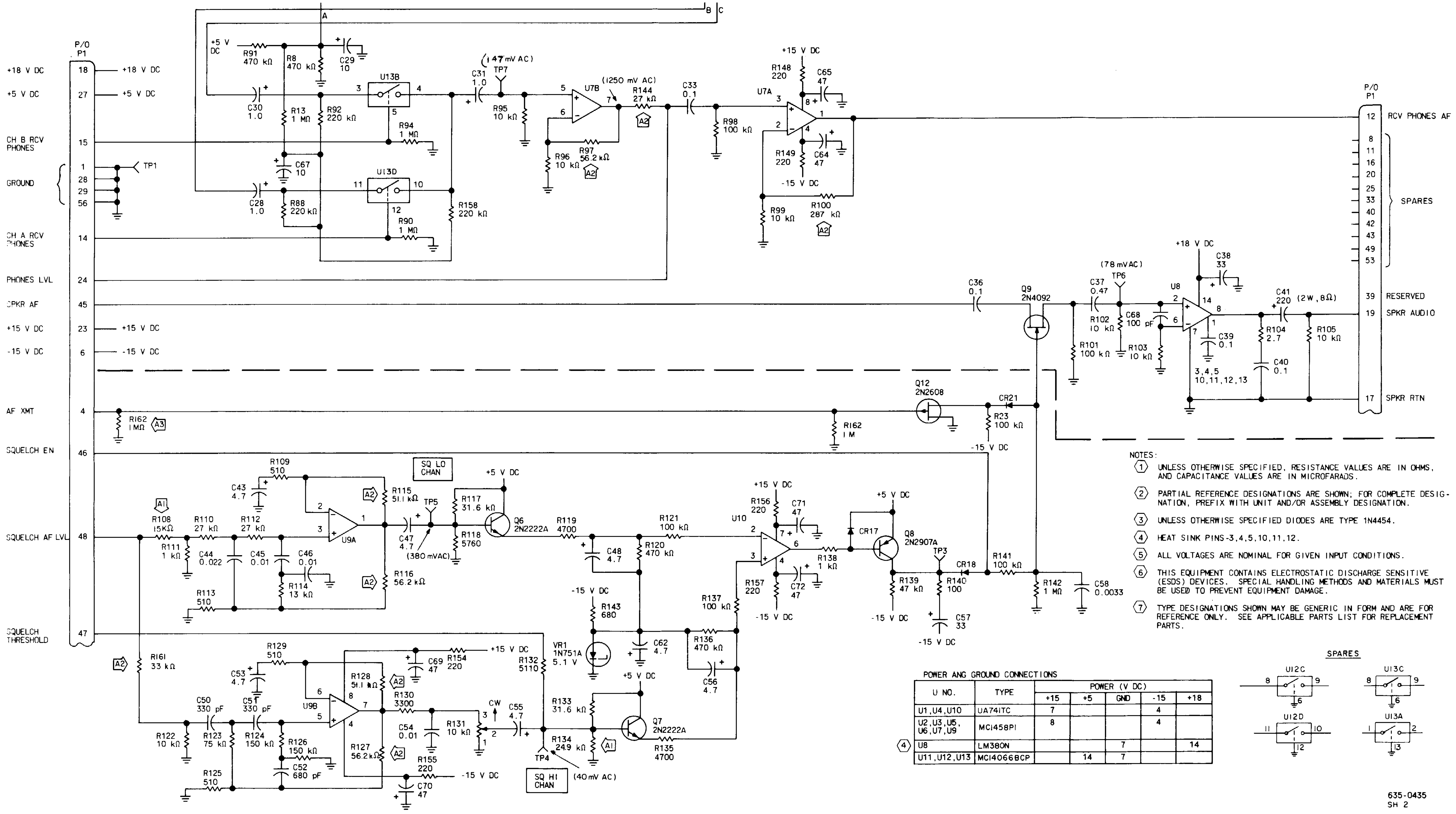
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed: R108 from 6800Ω to 15kΩ. R134 from 56.2kΩ to 24.9kΩ.	REV E and above
A2	Removed C49, 0.01 μF. Added R161, 33kΩ, in same location as C49 was removed. Changed: C7 from 56 pF to 18 pF C9 from 56 pF to 47 pF C19 from 56 pF to 18 pF C32 from 56 pF to 47 pF R97 from 68kΩ to 56.2kΩ R100 from 150kΩ to 287kΩ R115 from 51kΩ, 5% to 51.1kΩ, 1% R116 from 56kΩ, 10% to 56.2kΩ, 1% R127 from 56kΩ, 10%, to 56.2kΩ, 1% R128 from 51kΩ, 5% to 51.1kΩ, 1% R144 from 4700Ω to 27kΩ Added R161, 33kΩ	REV F and above
A3	Added R162, 1MΩ	REV H and above
B1	Changed: C10 from 0.1 μF to 1.0 μF C13 from 0.1 μF to 1.0 μF C21 from 0.1 μF to 1.0 μF C24 from 0.1 μ to 1.0 μF R40 from 100 kΩ to 10 kΩ R77 from 100 kΩ to 10 kΩ R159 from 100 kΩ to 10 kΩ R160 from 100 kΩ to 10 kΩ	REV K and above

Note

Modification history through REV K has been included in all 635-0748-002 receive audio cards.

B2	Changed: C7 from 18 pF to 24 pF C19 from 18 pF to 24 pF R24 from 150 kΩ, 10% to 150 kΩ, 1% R33 from 68 kΩ, 10% to 68.1 kΩ, 1% R62 from 150 kΩ, 10% to 150 kΩ, 1% R70 from 68 kΩ, 10% to 68.1 kΩ, 1%	REV N and above

Receive Audio, Schematic Diagram
Figure 8 (Sheet 4)



NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, AND CAPACITANCE VALUES ARE IN MICROFARADS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ UNLESS OTHERWISE SPECIFIED DIODES ARE TYPE 1N4454.

④ HEAT SINK PINS-3,4,5,10,11,12.

⑤ ALL VOLTAGES ARE NOMINAL FOR GIVEN INPUT CONDITIONS.

⑥ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

⑦ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

POWER ANG GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)				
		+15	+5	GND	-15	+18
U1,U4,U10	UA741TC	7			4	
U2,U3,U5, U6,U7,U9	MC1458PI	8			4	
④ U8	LM380N			7		14
U11,U12,U13	MC14066BCP		14	7		

635-0435
SH 2

Receive Audio, Schematic Diagram
Figure 8 (Sheet 5)

Frequency Standard Switch (646-6558-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0770716-001211
1 January 1981

1. DESCRIPTION

Frequency standard switch 646-6558-001, shown in figure 1, consists of a chassis, a 2-layer planar card, and four coaxial connections.

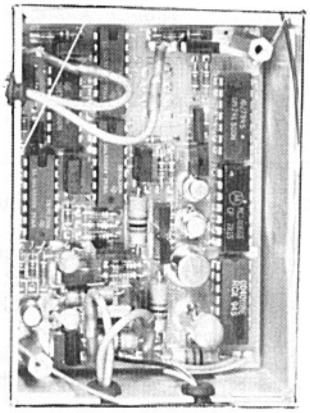
2. PRINCIPLES OF OPERATION (Refer to the schematic diagram.)

2.1 General

The frequency standard switch provides two separate 100-kHz outputs. In addition, a performance monitor signal is provided to external circuits. Operating power of +5 ±0.1 V dc, 100 mA, is required from an external source. Two rf input signals are required. The external standard rf input may be 5 MHz, 1 MHz, or 100 kHz. The oven standard rf input is 1 MHz.

2.2 External Standard Input

Switch S1 must be set to the frequency of the external standard input signal applied to J23. When switch S1 is set to the 100-kHz position, the input signal is routed through NAND gates U1A, U1B, and U1C, switch S1, and applied as a 100-kHz signal to amplifier Q1. When switch S1 is set to the 1-MHz position, the input signal is routed through NAND gates U1A and U1B to frequency divider U2. Frequency divider U2 divides the input frequency (1 MHz) by ten. This signal (100 kHz) is routed through switch S1 to amplifier Q1. When switch S1 is set to the 5-MHz position, the input signal is routed through NAND gates U1A and U1B and frequency dividers U2 (divide by 10) and U3 (divide by 5). This signal (100 kHz) is routed through switch S1 to amplifier Q1.



Frequency Standard Switch
Figure 1

When an external standard signal is applied and the NAND gates (U1A, U1B, and U1C) and frequency dividers (U2 and U3) are operational, a logic 0 signal is produced at the input to NAND gate U5B. This produces a logic 1 signal at the output of NAND gate U5B. A logic 1 energizes electronic switch U4A. The closed contacts of switch U4A connect the 100-kHz signal from switch S1 to the input of NAND gate U5A. This signal is amplified by FET Q2. Transistors Q3 and Q4 are frequency splitters that provide separate 100-kHz output frequencies.

2.3 Oven Standard Input

The oven standard rf input of 1 MHz is routed through NAND gates U6A and U6B to frequency divider U7. The 1-MHz signal is divided by ten and routed as a 100-kHz signal to electronic switch U4B.

If the external standard input signal is not applied or the circuit malfunctions, switch U4B is closed. The 100-kHz signal is routed through NAND gate U5A to transistors Q2, Q3, and Q4. This signal is amplified by FET Q2. Transistors, Q3 and Q4 are frequency splitters that provide separate 100-kHz output frequencies.

2.4 Performance Monitor

A performance monitor signal is provided to external circuits from the output of NAND gate U5D. When the external standard input signal is active, a logic 1 signal is provided on the performance monitor output line.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the frequency standard switch are listed in the maintenance section of this instruction book.

3.2 Testing and Troubleshooting

The test procedures in table 1 check the total performance of the frequency standard switch. The procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic diagram to trace the source of the fault.

Table 1. Frequency Standard Switch, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Set dc power supply for +5-V dc output.		
	b. Connect a ground lead from the dc power supply to black lead on the frequency standard switch.		
	c. Connect +5 V dc to red lead on frequency standard switch.		
	d. Connect a 50-ohm load to J1 and J56.		
2. Oven standard input	a. Connect the rf signal generator to P1. Set the rf signal generator frequency to 1 MHz. Adjust the output level for 0.1 V rms.		
	b. Measure the rf output level and frequency at J1.	Output level: 0.4 to 1.5 V rms Frequency: 100 kHz	Check U6, U7, U4B, U5A, Q2, Q4, and associated circuits.
	c. Measure the rf output level and frequency at J56.	Output level: 1.5 to 2.5 V rms Frequency: 100 kHz	Check U6, U7, U4B, U5A, Q3, and associated circuits.
	d. Set the rf signal generator output level to 2.0 V rms.		
	e. Measure the output levels at J1 and J56.	Same as tests 2b and 2c	Same as tests 2b and 2c.
	f. Change rf signal generator frequency by 1000 Hz.		
	g. Measure the output frequency at J1 and J56.	Frequency changes by 100 Hz from 100 kHz reference	Same as tests 2b and 2c.

Table 1. Frequency Standard Switch, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. External standard input	a. Connect rf signal generator to J23 (external standard input). Set the rf signal generator frequency to 5 MHz. Adjust the output level for 0.5 V rms.		
	b. Set switch S1 on the frequency standard switch to 5 MHz.		
	c. Measure the rf output level and frequency at J1.	Output level: 0.4 to 1.5 V rms Frequency: 100 kHz	Check U1A, B U2, S1, U3, U4A and associated circuits.
	d. Measure the rf output level and frequency at J56.	Output level: 1.5 to 2.5 V rms Frequency: 100 kHz	Same as test 3c.
	e. Change rf signal generator frequency by 5000 Hz.		
	f. Measure the output frequency at J1 and J56.	Frequency changes by 100 Hz from 100-kHz reference	Same as tests 3c and 3d.
	g. Set the rf signal generator frequency to 1 MHz. Adjust the output level for 0.5 V rms.		
	h. Set switch S1 on the frequency standard switch to 1 MHz.		
	i. Measure the rf output level and frequency at J1.	Output level: 0.4 to 1.5 V rms Frequency: 100 kHz	Check U1A, U1B, U2, S1, and associated circuits.
	j. Measure the rf output level and frequency at J56.	Output level: 1.5 to 2.5 V rms Frequency: 100 kHz	Same as test 3i.
	k. Change rf signal generator frequency by 1000 Hz.		
	l. Measure the output frequency at J1 and J56.	Frequency changes by 100 Hz from 100-kHz reference	Same as test 3i.
	m. Set the rf signal generator frequency to 100 kHz. Adjust the output level for 0.5 V rms.		
	n. Set switch S1 on the frequency standard switch to 100 kHz.		
	o. Measure the rf output level and frequency at J1.	Output level: 0.4 to 1.5 V rms Frequency: 100 kHz	Check U1A, B, C, S1, and associated circuit.
(Cont)	p. Measure the rf output level and frequency at J56.	Output level: 1.5 to 2.5 V rms Frequency: 100 kHz	Same as test 3o.

Table 1. Frequency Standard Switch, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	q. Change rf signal generator frequency by 100 Hz.		
	r. Measure the output frequency at J1 and J56.	Frequency changes by 100 Hz from 100-kHz reference	Same as test 3o.
4. Performance monitor	a. Connect one rf signal generator to P1 and another rf signal generator to J3.		
	b. Set both rf signal generators for 1 MHz. Adjust the output levels for 0.5 V rms.		
	c. Set switch S1 on the frequency standard switch to 1 MHz.		
	d. Connect frequency counter to J2.		
	e. Change frequency of rf signal generator connected to P1 (oven standard input) by 1 kHz.		
	f. Measure logic level on performance monitor output (blue lead).	Logic 1	Check U5D and associated circuit.
	g. Measure frequency at J56.	100 kHz	Same as test 4f.
	h. Disconnect rf signal generator from J23 (external standard input).		
	i. Measure logic level on performance monitor output (blue lead).	Logic 0	Check U5D and associated circuit.
	j. Measure frequency at J56.	Frequency changes by 100 Hz from the 100 kHz observed in test 4g	Same as test 4i.

4. REPAIR

Repair of the frequency standard switch is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

CAUTION CAUTION
ELECTROSTATIC
SENSITIVE DEVICES
OBSERVE PRECAUTIONS
FOR HANDLING

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 2). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

CODE	MANUFACTURER'S NAME AND ADDRESS
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
81349	MILITARY SPECIFICATION
94375	AUTOMATIC CONNECTOR INC 400 MORELAND RD COMMACK NY 11725
95146	ALCO ELECTRONIC PRODUCTS INC P O BOX 1348 LAWRENCE MA 01842
96906	MILITARY STANDARD

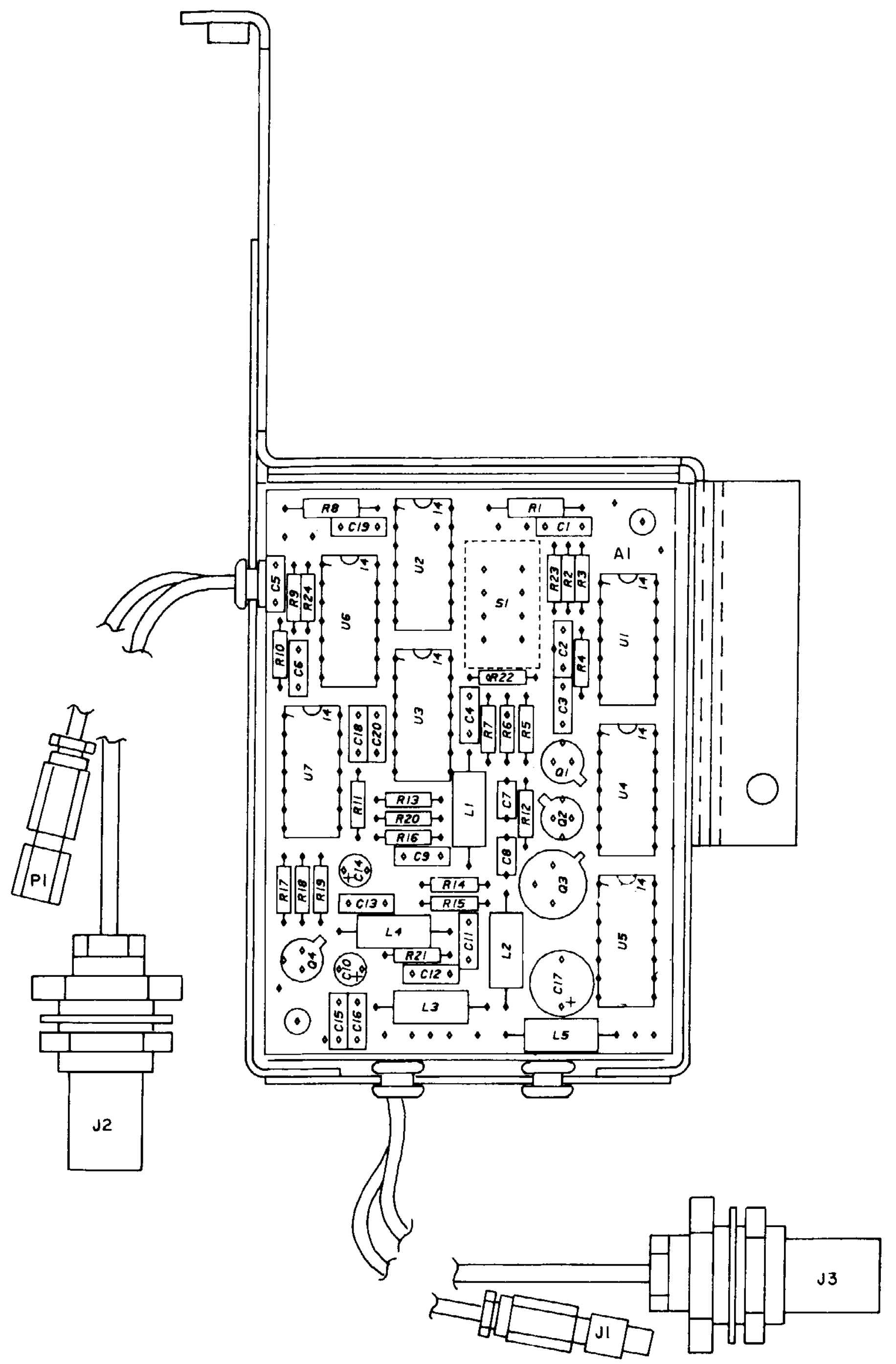
5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Frequency Standard Switch	646-6558-001	REV —

PARTS LIST

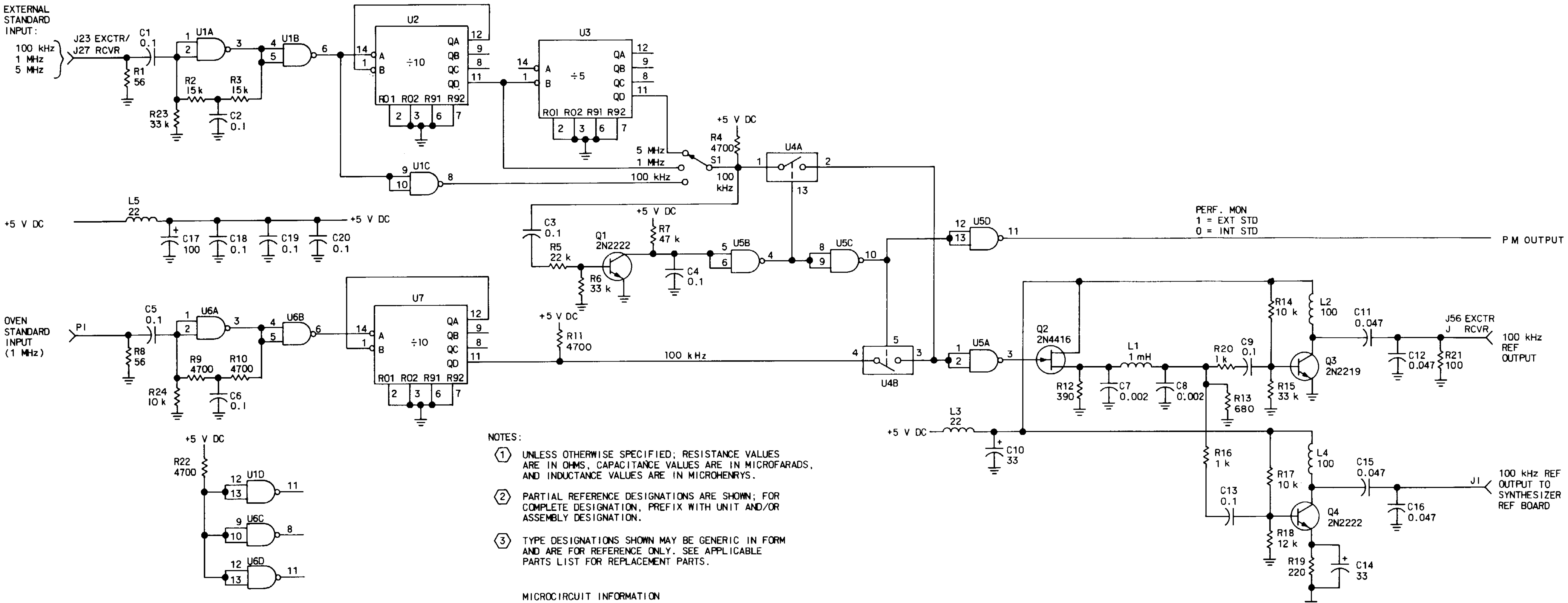
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	FREQUENCY STANDARD SWITCH	646-6558-001			
A1	AUTO SWITCH-OVER	642-3570-001			
J1	CONNECTOR,PLUG ELEC	357-7115-000		81349	M39012-74-0004
J2,J3	CONNECTOR,RCPT ELEC	357-7129-010		94375	801-B3800B75
P1	CONNECTOR,PLUG ELEC	357-9600-000		81349	M39012-73-0003
	AUTO SWITCH-OVER A1 (ESDS)	642-3570-001			
C1-C6	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C7,C8	CAPACITOR,FXD CER DIEL, 2200PF, PORM10%, 100V	913-5019-120		81349	CK05BX222K
C9	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C10	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V	184-9102-090		56289	199D336X0010DB1
C11,C12	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 100V	913-5019-400		81349	CK06BX473K
C13	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C14	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V	184-9102-090		56289	199D336X0010DB1
C15,C16	CAPACITOR,FXD CER DIEL, 0.047UF, PORM10%, 100V	913-5019-400		81349	CK06BX473K
C17	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
C18-C20	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
L1	COIL,RF 1000UH	240-2715-490		96906	MS75089-23
L2	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L3	COIL,RF 22UH	240-2715-290		96906	MS75089-3
L4	COIL,RF 100UH	240-2715-370		96906	MS75089-11
L5	COIL,RF 22UH	240-2715-290		96906	MS75089-3
Q1	TRANSISTOR	352-0661-020		07263	2N2222A
Q2	TRANSISTOR (ESDS)	352-0756-010		17856	2N4416
Q3	TRANSISTOR	352-0661-010		07263	2N2219A
Q4	TRANSISTOR	352-0661-020		07263	2N2222A
R1	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R2,R3	RESISTOR,FXD CMPSN, 15K, 10%, 1/8W	745-2383-000		81349	RCR05G153KS
R4	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R5	RESISTOR,FXD CMPSN, 22K, 10%, 1/8W	745-2389-000		81349	RCR05G223KS
R6	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R7	RESISTOR,FXD CMPSN, 47K, 10%, 1/8W	745-2401-000		81349	RCR05G473KS
R8	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R9-R11	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R12	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/8W	745-2326-000		81349	RCR05G391KS
R13	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/8W	745-2335-000		81349	RCR05G681KS
R14	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R15	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R16	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R17	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W	745-2377-000		81349	RCR05G103KS
R18	RESISTOR,FXD CMPSN, 12K, 10%, 1/8W	745-2380-000		81349	RCR05G123KS
R19	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/8W	745-2317-000		81349	RCR05G221KS
R20	RESISTOR,FXD CMPSN, 1K, 10%, 1/8W	745-2341-000		81349	RCR05G102KS
R21	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/8W	745-2304-000		81349	RCR05G101KS
R22	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/8W	745-2365-000		81349	RCR05G472KS
R23	RESISTOR,FXD CMPSN, 33K, 10%, 1/8W	745-2395-000		81349	RCR05G333KS
R24	RESISTOR,FXD CMPSN, 10K, 10%, 1/6W	745-2377-000		81349	RCR05G103KS
S1	SWITCH, MINIATURE SLIDE 250MA	266-0253-060		95146	SLS-230PC
U1	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U2,U3	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N
U4	INTEGRATED CIRCUIT (ESDS)	351-8252-010		02735	CD4066BE
U5	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-340		07263	4011BPC
U6	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U7	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N



CAUTION CAUTION ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

TPA-2796-019

Frequency Standard Switch, Schematic Diagram
Figure 2 (Sheet 1 of 2)



NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE OR COLLINS PN	PWR (VDC)		SPARE SECTIONS
		+5	GND	
U1	74LS00	14	7	
U2	74LS90	5	10	
U3	74LS90	5	10	
U4	4066	14	7	C, D
U5	4011	14	7	
U6	74LS00	14	7	
U7	74LS90	5	10	

634-6885

Frequency Standard Switch, Schematic Diagram
Figure 2 (Sheet 2)

TS-8010 Card Extender Kit (622-3431-001, -002)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0767968-003211
3rd Edition, 1 January 1981

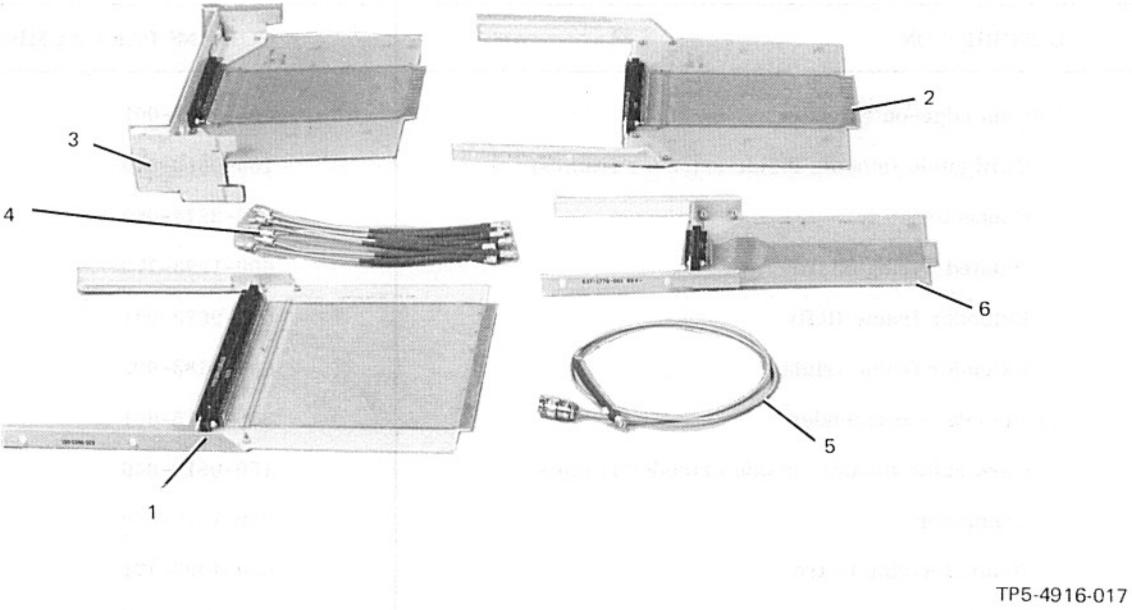
1. DESCRIPTION

The TS-8010 Card Extender Kit 622-3431-001, -002 contains all cables and extender cards necessary for extending cards and modules in the HF-80 series receivers, exciters, and controls. These extenders enable testing and troubleshooting of individual circuit cards in hot mockup or in on-line situations without the need of sophisticated test fixtures or test equipment.

The TS-8010 622-3431-001 contains all cables and extenders necessary for testing and troubleshooting the HF-80 series receivers, exciters, receiver-exciters, and controls; and the 851S-( ) series receivers.

The TS-8010 622-3431-002 contains only those extenders necessary for testing and troubleshooting the HF-80 series controls.

Refer to figure 1 and table 1 for the complement of these card extender kits.



TS-8010 Card Extender Kit
Figure 1

NOTICE: This section replaces second edition dated 1 June 1978.

Table 1. TS-8010 Card Extender Kit Complement.

ITEM NO	COLLINS PART NUMBER	DESCRIPTION	622-3431-	
			001	002
1	635-0913-001	130-pin edge-on extender	X	X
2	635-0915-001	56-pin edge-on extender	X	X
3	635-0915-002	Rf module extender	X	
4	635-9686-001	Subminiax coax extender	7	
5	635-9686-002	Subminiax coax/BNC extender	X	
6	637-2843-001	Synthesizer extender	X	

2. REPAIR

Repair of the TS-8010 Card Extender Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

3. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and in maintenance of the equipment. The Collins part number and description for each nonstandard replacement part are listed in table 2.

All pins and shields of the extenders are one-to-one connections; therefore a schematic diagram of the extenders is not shown.

Table 2. TS-8010 Card Extender Kit Parts List.

DESCRIPTION	COLLINS PART NUMBER
130-pin edge-on extender	635-0913-001
Card guide (mounts inside extender frames)	150-0810-040
Connector	372-2274-060
Printed wiring board	600-1993-770
Extender frame (left)	635-9683-001
Extender frame (right)	635-9683-002
56-pin edge-on extender	635-0915-001
Card guide (mounts inside extender frames)	150-0810-040
Connector	372-7515-040
Printed wiring board	600-1993-771
Extender frame (left)	635-9685-001
Extender frame (right)	635-9685-002

Table 2. TS-8010 Card Extender Kit Parts List (Cont).

DESCRIPTION	COLLINS PART NUMBER
Rf module extender	635-0915-002
Connector	372-7515-040
Printed wiring board	600-1993-771
Extender frame	635-9681-001
Subminiax coax extender	635-9686-001
Rf connector	357-7207-010
Rf connector	357-7207-020
Coaxial cable, RG-316/U	425-0146-010
Subminiax coax/BNC extender	635-9686-002
Rf connector	357-7207-010
Rf connector, BNC	357-7279-010
Coaxial cable, RG-316/U	425-0146-010
Synthesizer extender	637-2843-001
Card guide (mounts inside extender brackets)	150-0810-030
Connector	372-7515-050
Printed wiring board	600-1993-050
Extender bracket (left)	637-1775-001
Extender bracket (right)	637-1776-001

AC-8012 Oven Standard Kit (622-3460-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0768671-002211
2nd Edition, 1 January 1981

1. DESCRIPTION

AC-8012 Oven Standard Kit 622-3460-001 contains an rf oscillator, an external phase-lock card, and all the cables and hardware necessary to install them in the units listed in table 1. When installed, the oven standard provides a high-stability crystal oscillator mounted inside a proportionally controlled oven.

Table 1. AC-8012 Oven Standard Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
HF-8010 Exciter	622-3389-( )
HF-8010A Exciter	622-3395-( )
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )
HF-8070 Receiver-Exciter	622-3387-( )
HF-8070A Receiver-Exciter	622-3394-( )
851S-1 Receiver	622-4272-( )

Note

This kit is factory installed on some configurations of these units.

The AC-8012 rf oscillator provides a 1-MHz sine-wave frequency output at a level of 0.40 volt rms into 50 ohms. Accuracy of the rf oscillator exceeds that of the tcxo built into the used-on equipments and uses a proportionally controlled oven instead of the temperature-compensating network to improve accuracy over the controlled temperature range, -20 to +70 °C (-4 to +158 °F).

The AC-8012 rf oscillator has two frequency adjustments: a coarse adjustment (FREQ ADJ - COARSE) to adjust the output frequency to ±1.5 x 10^{-6} of the nominal frequency with ±5 x 10^{-9} or better resolution, and a fine adjustment (FREQ ADJ - FINE) to adjust the output frequency to 2.0 x 10^{-8} minimum to 4.0 x 10^{-8} maximum with minimum resolution of ±2 x 10^{-10}.

The AC-8012 rf oscillator requires +18.0 ±0.9 V dc, 8.0 watts maximum during warmup; 2.5 watts nominal after warmup; and +5.0 ±0.25 V dc, 20 mA maximum.

2. INSTALLATION (Refer to figure 1.)

Installation of AC-8012 Oven Standard Kit (622-3460-001) consists of installation of external phase-lock on the synthesizer reference (REF STD) and installation of oscillator assembly Y1 (637-9135-001).

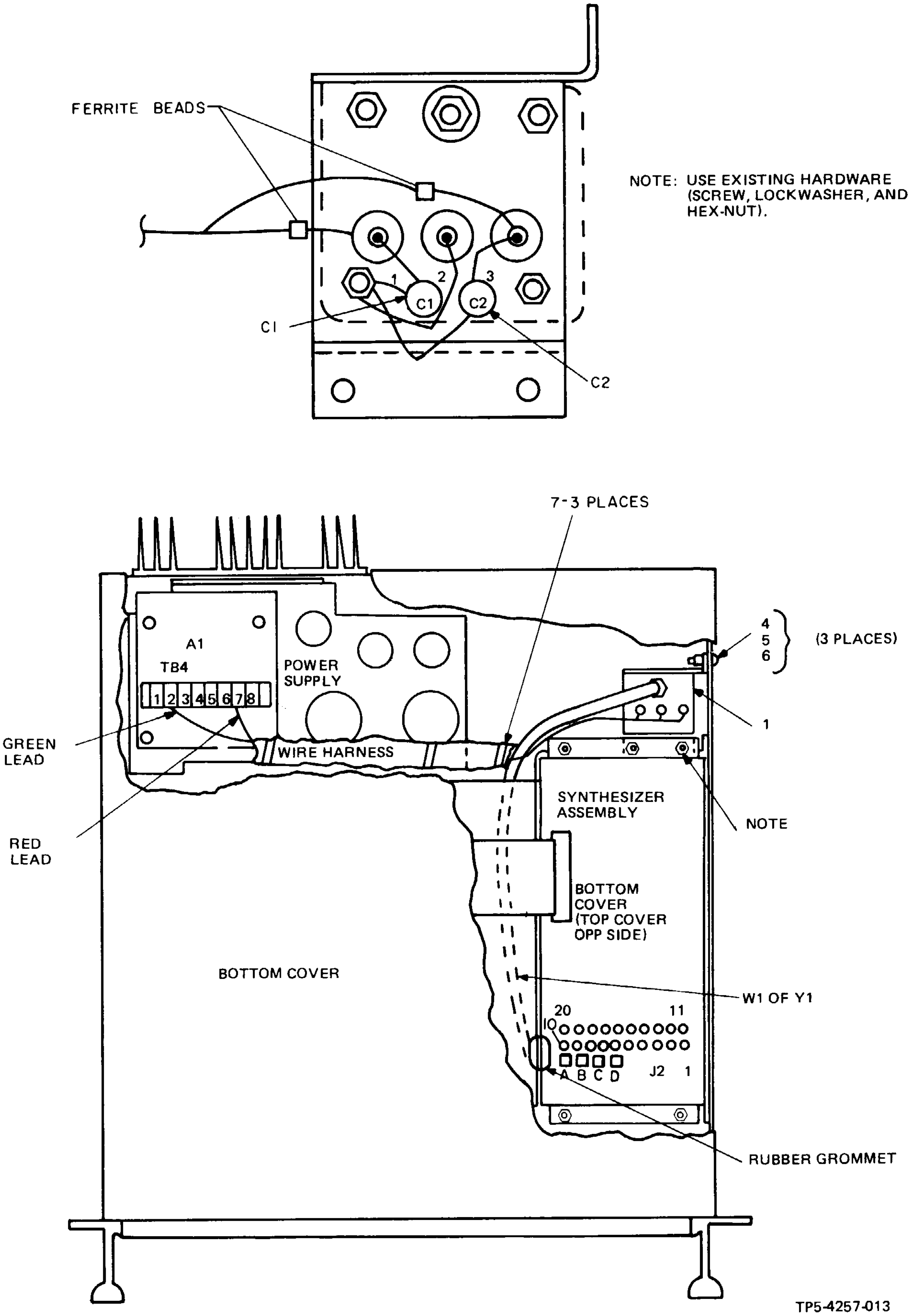
Note

Refer to maintenance section of this instruction book for planar card component replacement procedures.

2.1 External Phase-Lock (635-0655-001) Installation

a. Remove top cover from unit.
b. Remove top cover from synthesizer assembly.
c. Remove REF STD from synthesizer assembly.
d. Remove cover from left side rf compartment on REF STD, and move jumper clip from INT to EXT position (strap for external operation).

NOTICE: This section replaces first edition dated 1 June 1978.



AC-8012 Oven Standard Kit Installation
Figure 1

e. Reinstall left side rf compartment cover on REF STD.
f. Mount external phase-lock (table 2, item 2) to REF STD with two lockscrews (table 2, item 3).
g. Set jumper clip on external phase-lock to 1-MHz position.
h. Insert REF STD in its original position in synthesizer assembly.
i. Reinstall synthesizer assembly top cover.
j. Reinstall unit top cover.

2.2 Oscillator Assembly (637-9135-001) Installation

a. Remove bottom cover from unit.
b. Remove attaching hardware referred to in note on figure 1.
c. Install oscillator assembly (table 2, item 1) to chassis using three screws (table 2, item 4), three lockwashers (table 2, item 5), three hexnuts (table 2, item 6), and attaching hardware removed in step b above.
d. Install the two wires from oscillator assembly (table 2, item 1) to power supply A1 (green wire to A1TB4-2 and red wire to A1TB4-7).
e. Using three cable ties (table 2, item 7), tie the two wires that connect the oscillator assembly to power supply A1.
f. Remove bottom cover of synthesizer assembly and install oscillator assembly cable W1 (table 2, P/O item 1) to synthesizer sideboard as follows:
   1. Thread cable W1 through rubber grommet as shown in figure 1.

Note

Some configurations of the synthesizer assembly do not contain a rubber grommet. In configurations not having a rubber grommet, place W1 in one of the cutouts for wiring, using care not to pinch wires when reinstalling synthesizer assembly bottom cover.

Note

Some configurations of the synthesizer sideboard contain posts on the J2 pad and some only contain solder holes. In the configurations containing solder holes, do not insert leads more than 0.508 cm (0.20 in) into sideboard when soldering.

   2. Solder center conductor of W1 (insulated) to J2-A post or pad of synthesizer sideboard.
   3. Solder shield top of W1 (uninsulated) to J2-B post or pad of synthesizer sideboard.
g. Reinstall synthesizer assembly bottom cover.
h. Reinstall unit bottom cover.

3. REPAIR

Repair of the AC-8012 Oven Standard Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

Table 2. AC-8012 Oven Standard Kit Parts List.

ITEM	DESCRIPTION	COLLINS PART NUMBER	QUANTITY
1	Oscillator assembly	637-9135-001	1
	Radio frequency oscillator	277-0472-010	1
	Capacitor, 0.1 μF	913-3681-000	2
	Ferrite bead	288-0915-030	2
2	External phase-lock	635-0655-001	1
3	Lockscrew - 0.112 x 40 x 0.187	330-1716-130	2
4	Machined screw - 0.138 x 32 x 0.375	343-0169-000	3
5	Lockwasher - 0.138	310-0096-000	3
6	Hexnut - 0.138 x 32	313-0045-000	3
7	Cable tie	435-1169-200	3
8	Drawing envelope	520-8360-132	1
	Installation kit, oven oscillator -- AC-8012	622-3460-001	1

4. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and in installation/maintenance of the equipment. The Collins part number and description of each nonstandard replacement part are listed in table 2.

Radio Frequency Oscillator 277-0472-010 is a nonrepairable assembly and should be returned to factory if defective.

External Phase-Lock 635-0655-001 is repairable and is covered in Synthesizer Reference (623-2085-001) instructions (Collins part number 523-0767970) included in this instruction book.

AC-8013 External Standard Kit (622-3461-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0768672-003211
3rd Edition, 1 January 1981

1. DESCRIPTION

The AC-8013 External Standard Kit 622-3461-001 contains an external phase-lock card, a cable assembly, and the hardware necessary to install them in the units listed in table 1. When installed, the external standard kit allows for an external high-stability frequency source to be connected to the synthesizer reference.

The external phase-lock card (P/O AC-8013 kit), when installed, allows an external reference frequency of 5 MHz, 1 MHz, or 100 kHz to be supplied to the units listed. The external reference signal must be 0.5 to 1.5 volts rms sine wave into 50 ohms with accuracy depending on the accuracy of the signal source.

2. INSTALLATION (Refer to figure 1.)

Installation of AC-8013 External Standard Kit (622-3461-001), consists of installation of external phase-lock on the synthesizer reference (REF STD) and installation of cable assembly W1 (637-9136-001).

Note

Refer to maintenance section of this instruction book for planar card component replacement procedures.

2.1 External Phase-Lock (635-0655-001) Installation

a. Remove top cover from unit.
b. Remove top cover from synthesizer assembly.
c. Remove REF STD from synthesizer assembly.

Table 1. AC-8013 External Standard Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
HF-8010 Exciter	622-3389-( )
HF-8010A Exciter	622-3395-( )
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )
HF-8070 Receiver-Exciter	622-3387-( )
HF-8070A Receiver-Exciter	622-3394-( )
851S-1 Receiver	622-4272-( )

Note

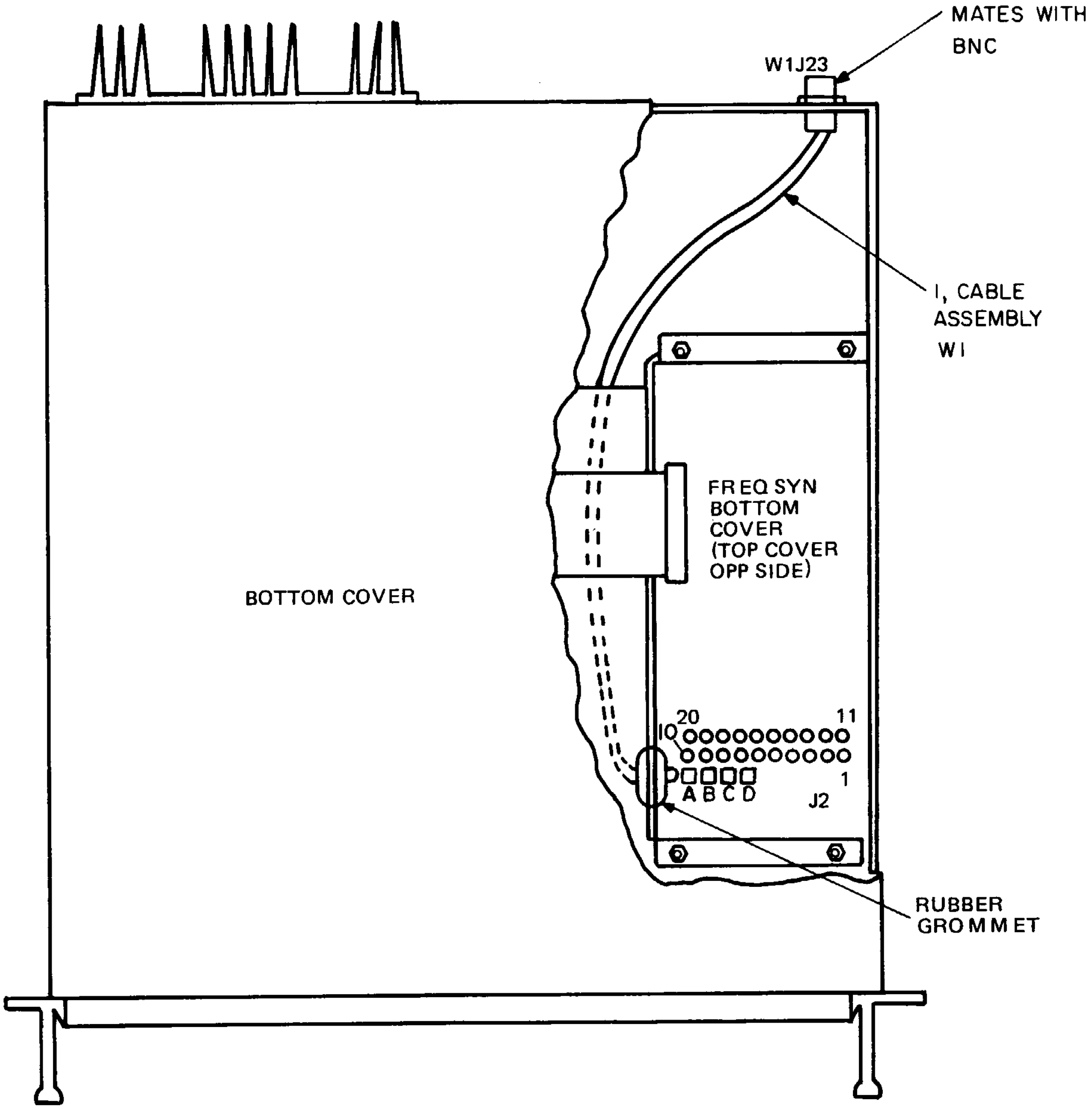
If an oven standard kit is installed, the oven standard must first be removed before the external standard kit is installed.

d. Remove cover from left side rf compartment on REF STD, and move jumper clip from INT to EXT position (strap for external operation).
e. Reinstall left side rf compartment cover on REF STD.
f. Mount external phase-lock (table 2, item 2) to REF STD with two lockscrews (table 2, item 3).
g. Set jumper clip on external phase-lock to 1-MHz position.
h. Insert REF STD in its original position in synthesizer assembly.
i. Reinstall synthesizer assembly top cover.
j. Reinstall unit top cover.

2.2 Cable Assembly W1 (637-9136-001) Installation

a. Remove bottom cover from unit.
b. Remove bottom cover from synthesizer assembly.

NOTICE: This section replaces second edition dated 1 October 1980.



TP5-4258-013

AC-8013 External Standard Kit Installation
Figure 1

c. Secure cable assembly W1 (table 2, item 1) to J23 position of rear panel and thread cable through rubber grommet to synthesizer assembly as shown in figure 1.

Note

Some configurations of the synthesizer assembly do not contain a rubber grommet. In configurations not having a rubber grommet, place W1 in one of the cutouts for wiring using care not to pinch wires when reinstalling synthesizer assembly bottom cover.

Some configurations of the synthesizer sideboard contain posts in the J2 pads and some only contain solder holes. In the configurations containing solder holes, do not insert leads more than 0.508 cm (0.20 in) into sideboard when soldering.

d. Solder center conductor of W1 (insulated) to J2-A post or pad of synthesizer sideboard.

e. Solder shield top of W1 (uninsulated) to J2-B post or pad of synthesizer sideboard.

f. Reinstall synthesizer assembly bottom cover.

g. Reinstall unit bottom cover.

3. REPAIR

Repair of the AC-8013 External Standard Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and installation/maintenance of the equipment. The Collins part number and description for each nonstandard replacement part are listed in table 2.

External Phase-Lock 635-0655-001 is covered in Synthesizer Reference (623-2085-001) instructions (Collins part number 523-0767970) included in this instruction book.

Table 2. AC-8013 External Standard Kit, Parts List.

ITEM	DESCRIPTION	COLLINS PART NUMBER	QUANTITY
1	Cable assembly W1	637-9136-001	1
2	External phase-lock	635-0655-001	1
3	Lockscrew - 0.112 x 40 x 0.187	330-1716-130	2
4	Drawing envelope	520-8360-133	1
	Installation kit-external reference standard, AC-8013	622-3461-001	1

AC-8014 Frequency Display Kit (622-3470-001, -002)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0770521-001211
1 October 1980

1. DESCRIPTION

AC-8014 Frequency Display Kit 622-3470-( ) contains a frequency display and all cables and hardware necessary to install it in the units listed in table 1. When installed, the frequency display kit provides an LED display of the unit's selected frequency.

The AC-8014 frequency display provides a lighted display in 100- or 10-Hz increments. The AC-8014 Frequency Display Kit 622-3470-001 will modify one unit with 10-Hz tuning; the 622-3470-002 will modify one unit with 100-Hz tuning.

2. INSTALLATION

Installation of AC-8014 Frequency Display Kit consists of installation of A2A5 Frequency Display 637-1787-006 or 637-1787-007.

Note

Refer to maintenance section of this instruction book for planar card component replacement procedures.

2.1 *Preparation of Unit*

a. Remove unit top and bottom covers.
b. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

Table 1. AC-8014 Frequency Display Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
HF-8010 Exciter	622-3389-( )
HF-8010A Exciter	622-3395-( )
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )
HF-8070 Receiver-Exciter	622-3387-( )
HF-8070A Receiver-Exciter	622-3394-( )

c. Remove upper overlay panel from front panel as follows:
   1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.
   4. Carefully remove upper overlay panel.
d. Remove cover plate on back of front panel by removing five Phillips-head screws and attaching hardware (screwheads on front of front panel).
e. Disconnect ribbon cable from A2J4 (frequency switchboard).

2.2 Sideboard Rework

Note

Sideboard rework is required for all sideboards 635-0749-001 through REV G (REV H and later do not require rework).

a. Remove all plug-in cards and modules from sideboard assembly (A3 through A13).

b. Tag and disconnect all plug-on ribbon cables from bottom of sideboard assembly (use cabling, connector layout, and pin numbering figure in the diagrams section to assist you).

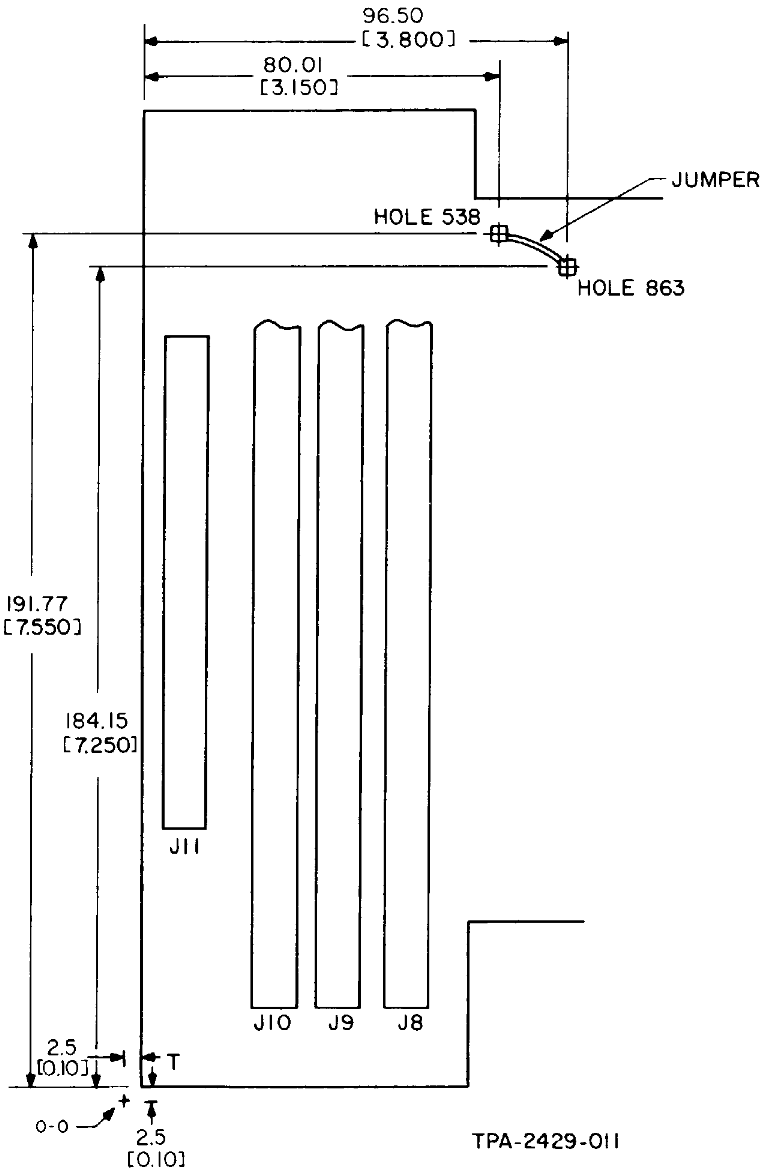
c. Remove sideboard 635-0749-001 from bottom of chassis.

d. Add a jumper wire on bottom of sideboard between hole 538 (X = 3.2500, Y = 7.6500) and hole 863 (X = 3.900, Y = 7.3500). X and Y locations originate at board master 0-0 (A13 end of sideboard, front side, X = left to right, Y = front to back, 0-0 = 0.10 inch front and left of sideboard corner). Refer to figure 1.

e. When sideboard modification is complete, stamp RWK H following the part number and REV letter, 637-1530-002 (REV ( ).

f. Reinstall sideboard to bottom of chassis.

g. Reinstall all ribbon cables that were removed from bottom of chassis in step b.



NOTE:
DIMENSIONS ARE IN MILLIMETERS [INCHES].

Hole 538-Hole 863 Jumper Wire Location
Figure 1

2.3 *Installation of Frequency Display*

a. Install new cover plate (supplied in kit) to back of front panel, using four Phillips-head screws (supplied in kit) and attaching hardware (screwheads on front of front panel).
b. Mount panel support (middle bar on front panel) to front panel by using four Phillips-head screws and lockwashers.

Caution

> Upper overlay panel (plexiglass) is brittle; exercise care when installing upper overlay panel.

c. Carefully install upper overlay panel into slot of middle bar on front panel.
d. Carefully slide frequency display in place in front panel.
e. Connect plug P8 of new wire harness (supplied in kit) to jack A2J5 on frequency display.
f. Secure frequency display using four Phillips-head screws and attaching hardware.
g. Connect plug P2 of new wire harness to jack A2J4 on frequency switchboard.
h. Connect plug P2 of old wire harness to pendant connect on new wire harness.
i. Install top and bottom covers of unit.

3. REPAIR

Repair of the AC-8014 Frequency Display Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and installation/maintenance of the equipment. The Collins part number and description for each replacement part are listed in table 2.

Frequency Display 637-1781-006, -007 is covered in Frequency Display (637-1781-( )) instructions (Collins part number 523-0767975) included in this instruction book.

Table 2. AC-8014 Frequency Display Kit Parts List.

DESCRIPTION	COLLINS PART NUMBER	QUANTITY 622-3470-( )	
		-001	-002
Frequency display (10 Hz)	637-1781-007	1	
Frequency display (100 Hz)	637-1781-006		1
Screw 0.086-56 x 0.25	343-0072-000	8	8
Lockwasher 0.086	310-0275-000	8	8
Circuit card bracket	637-1546-001	2	2
Wire harness	634-8289-001	1	1
Cover plate	634-8273-001	1	1
Screw 0.086-56 x 0.375	343-0674-000	4	4
Nut 0.086-56	313-0037-000	4	4
Washer 0.086	310-6320-000	4	4
Wire, 30 AWG	428-0282-050	0.1 ft	0.1 ft

AC-8015 Frequency Standard Switch Kit (622-3499-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0770717-001211
1 January 1981

1. DESCRIPTION

AC-8015 Frequency Standard Switch Kit 622-3499-001 contains a frequency standard switch assembly, an installation drawing, and cable tie. The frequency standard switch kit may be installed in the units listed in table 1.

The frequency standard switch assembly provides two separate 100-kHz outputs. With an input signal of 1 kHz, the two 100-kHz output levels are 0.4 to 1.5 V rms and 1.5 to 2.5 V rms.

The frequency standard switch assembly requires +5 ±0.1 V dc, 100 mA as operating voltage.

Table 1. Related Equipment.

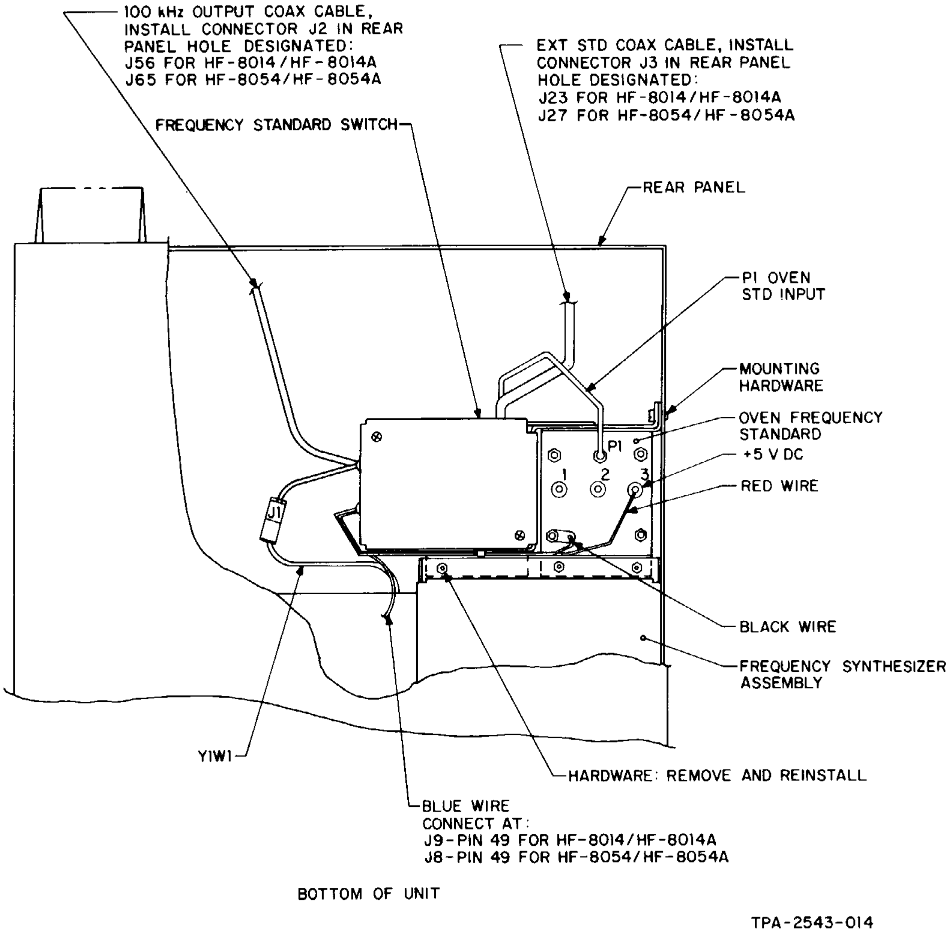
EQUIPMENT	COLLINS PART NUMBER
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )

2. INSTALLATION (Refer to figure 1)

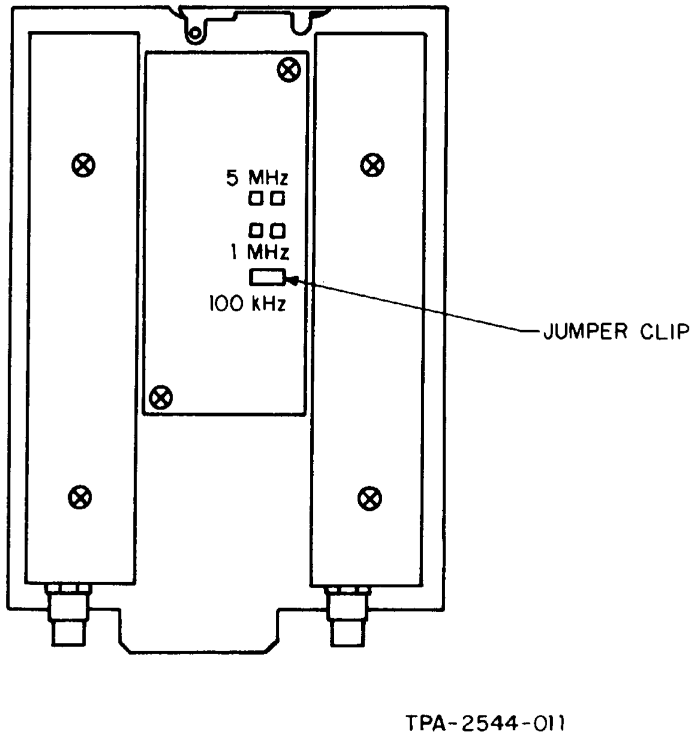
The AC-8012 Oven Standard Kit (622-3460-001) must be installed before installing the AC-8015 Frequency Standard Switch Kit. Refer to the AC-8012 instructions (523-0768671) for installation instructions.

To install the AC-8015 Frequency Standard Switch Kit, proceed as follows:

a. Install AC-8012 Oven Standard Kit.
b. Remove top cover of unit.
c. Remove top cover of frequency synthesizer assembly.
d. Remove frequency reference subassembly shown in figure 2.
e. Refer to figure 2. Move the jumper clip on the external phase-lock card of the frequency reference subassembly to the 100-kHz position as shown in figure 2.
f. Replace frequency reference subassembly into frequency synthesizer assembly.
g. Replace top cover of frequency synthesizer.
h. Turn unit over. Remove bottom cover of unit.
i. Install frequency standard switch assembly to chassis as shown in figure 1. Remove and reinstall hardware as noted.
j. Install coaxial cables to rear panel as shown in figure 1.
k. Disconnect coaxial cable connection (Y1W1) at oven frequency standard and reconnect to J1 of frequency standard switch assembly.
l. Connect coaxial connector P1 of the frequency standard switch to the oven frequency standard as shown in figure 1.
m. Connect the three wires (red, black, and blue) as shown in figure 1.
n. Tie wires as required.
o. On the frequency standard switch assembly, set switch S1 to the frequency (5 MHz, 1 MHz, or 100 kHz) of the external standard input.
p. Replace bottom and top covers of unit.



AC-8015 Frequency Standard Switch Kit Installation
Figure 1



Frequency Reference Card Strapping
Figure 2

3. REPAIR

Repair of the AC-8015 Frequency Standard Switch Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

Table 2 lists the Collins part number and description of the parts of the AC-8015.

The schematic diagram for the frequency standard switch assembly is included in a separate instruction (523-0770737).

Table 2. AC-8015 Frequency Standard Switch Kit Parts List.

ITEM	DESCRIPTION	COLLINS PART NUMBER	QUANTITY
1	Frequency standard switch	646-6558-001	1
2	Cable tie	435-1169-200	0.91 m (3 ft)
3	Drawing envelope (contains installation drawing)	520-8360-261	1

AC-8017/8017A 100-Hz to 10-Hz Conversion Kit (622-3453-001, -002)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0768676-002211
2nd Edition, 1 January 1981

1. DESCRIPTION

AC-8017 100-Hz to 10-Hz Conversion Kit 622-3453-001 contains a 10-Hz frequency switchboard assembly and a synthesizer decade card. When installed, the AC-8017 100-Hz to 10-Hz conversion kit provides 10-Hz tuning on all applicable units listed in table 1.

Note

If 100-Hz frequency display has been installed in unit it should be replaced with a 10-Hz display during installation of this kit.

Table 1. AC-8017/8017A 100-Hz to 10-Hz Conversion Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
AC-8017 100-Hz TO 10-Hz CONVERSION KIT 622-3453-001	
HF-8010 Exciter	622-3389-( )
HF-8010A Exciter	622-3395-( )
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )
HF-8070 Receiver-Exciter	622-3387-( )
HF-8070A Receiver-Exciter	622-3394-( )
AC-8017A 100-Hz TO 10-Hz CONVERSION KIT 622-3453-002	
HF-8090 Exciter Control	622-3390-( )
HF-8091 Receiver Control	622-3391-( )
HF-8092 Receiver-Exciter Control	622-3392-( )
HF-8093 Exciter Control	622-3476-( )
HF-8094 Receiver Control	622-3477-( )

NOTICE: This section replaces first edition dated 1 June 1978.

The AC-8017A 100-Hz to 10-Hz Conversion Kit 622-3453-002 contains a 10-Hz frequency switchboard assembly and a 10-Hz to 29-MHz frequency display. When installed, the AC-8017A 100-Hz to 10-Hz conversion kit provides 10-Hz tuning and a 10-Hz display on all applicable units listed in table 1.

2. INSTALLATION

Installation instructions for the AC-8017/8017A are divided into two procedures; instructions for installation of 622-3453-001 and instructions for installation of 622-3453-002.

Installation of AC-8017 100-Hz to 10-Hz Conversion Kit 622-3453-001 consists of replacing the existing frequency switchboard assembly with one from the kit, and configuring the synthesizer assembly for 10-Hz operation using the 100/10-Hz decade card supplied with the kit.

Installation of AC-8017A 100-Hz to 10-Hz Conversion Kit 622-3453-002 consists of replacing the existing frequency switchboard and frequency display assemblies using the assemblies supplied with the kit.

2.1 AC-8017 100-Hz to 10-Hz Conversion Kit 622-3453-001 Installation

a. Frequency Switchboard Replacement

Note

Retain hardware removed during disassembly for use in reassembly. Refer to unit parts list as an aid in disassembly and assembly.

1. Remove unit top cover.
2. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

3. Remove upper overlay panel from front panel as follows:
   (a) Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   (b) Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   (c) Lift upper edge bar from front panel.
   (d) Carefully remove upper overlay panel.
4. Remove cover plate on back of front panel by removing five Phillips-head screws and attaching hardware (screws on front of front panel).
5. Disconnect plug P2 from frequency switchboard jack A2J4.
6. Remove frequency switchboard 635-0830-001 by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).
7. Secure frequency switchboard 635-0830-002 supplied in kit to front panel using four Phillips-head screws and attaching hardware (screwheads on front of front panel).
8. Connect plug P2 to jack A2J4 on frequency switchboard.
9. Secure cover plate to back of front panel with five Phillips-head screws and attaching hardware (screwheads on front side of front panel).

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during replacement of upper overlay panel.

10. Insert upper overlay panel into slot on panel support (middle bar on front panel).
11. Replace edge bar on top of front panel ensuring upper overlay panel fits properly.
12. Secure upper overlay panel to front panel with eight Phillips-head screws and lockwashers.
13. Secure front panel to unit with four hexhead screws and attaching hardware.

b. Configuring Synthesizer Assembly 635-9697-001 for 10-Hz Operation

1. Remove synthesizer assembly top cover.
2. Remove END DECADE from A18 slot and install into A17 slot.
3. Install decade card 623-2080-004 into the A18 slot.
4. Reinstall synthesizer assembly top cover.
5. Reinstall unit top cover.

c. Configuring Synthesizer Assembly 634-8201-001 for 10-Hz Operation

1. Remove synthesizer assembly top cover.
2. Remove END DECADE from A19 slot and install into A18 slot.

3. Install decade card 623-2080-004 into the A19 slot.
4. Reinstall synthesizer assembly top cover.
5. Reinstall unit top cover.

2.2 AC-8017A 100-Hz to 10-Hz Conversion Kit 622-3452-002 Installation

Note

Retain hardware removed during disassembly for reassembly. Refer to unit parts list as an aid in disassembly and assembly.

a. Remove unit top cover.
b. Remove frequency display as follows:
   1. Remove four Phillips-head screws and attaching hardware.
   2. Disconnect plug P8 from jack A2J5 on frequency display.
c. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

d. Remove upper overlay panel from front panel as follows:
   1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.
   4. Carefully remove upper overlay panel.
e. Disconnect plug P2 from frequency switchboard jack A2J4.
f. Remove frequency switchboard 635-0830-001 by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).
g. Secure frequency switchboard 635-0830-002 supplied in kit to front panel using four Phillips-head screws and attaching hardware (screwheads on front of front panel).
h. Connect plug P2 to jack A2J4 on frequency switchboard.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during replacement of upper overlay panel.

i. Insert upper overlay panel into slot on panel support (middle bar on front panel).
j. Replace edge bar on top of front panel ensuring upper overlay panel fits properly.
k. Secure upper overlay panel to front panel with eight Phillips-head screws and attaching hardware.
l. Secure front panel to unit with four hexhead screws and attaching hardware.
m. Install frequency display 637-1781-002 as follows:
   1. Connecting plug P8 to jack A2J5 on frequency display.
   2. Securing frequency display to mounts with four Phillips-head screws and attaching hardware.
n. Reinstall unit top cover.

3. REPAIR

Repair of the AC-8017/8017A 100-Hz to 10-Hz Conversion Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and in maintenance of the equipment. The Collins part number and description for each nonstandard replacement part are listed in table 2.

These cards are covered in the following instructions which are included in the associated instruction book.

a. Frequency display (637-1781-001, -002) instructions (Collins part number 523-0767975).
b. Frequency switchboard (635-0830-001, -002) instructions (Collins part number 523-0767947).
c. Synthesizer decade (623-2080-001, -002, -003, -004) instructions (Collins part number 523-0767972).

Table 2. AC-8017/8017A 100-Hz to 10-Hz Conversion Kit Parts List.

DESCRIPTION	COLLINS PART NUMBER
AC-8017	622-3453-001
Frequency switchboard	635-0830-002
Synthesizer decade	623-2080-004
AC-8017A	622-3453-002
Frequency switchboard	635-0830-002
Frequency display	637-1781-002

AC-8018 10-Hz to 1-Hz Conversion Kit (622-3454-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0768673-002211
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1. DESCRIPTION

AC-8018 10-Hz to 1-Hz Conversion Kit 622-3454-001 contains a single synthesizer decade card. When installed, the 10-Hz to 1-Hz conversion kit provides remote tuning in 1-Hz increments (in remotely controlled units). Refer to table 1 for equipment this kit is used on.

2. INSTALLATION

Installation of the AC-8018 10-Hz to 1-Hz Conversion Kit consists of configuring the synthesizer assembly for 1-Hz operation using decade card (100/10-Hz decade) supplied with the kit.

a. Remove the unit top cover.
b. Remove synthesizer assembly top cover.

Table 1. AC-8018 10-Hz to 1-Hz Conversion Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
*HF-8010 Exciter	622-3389-( )
**HF-8010A Exciter	622-3395-( )
*HF-8014 Exciter	622-3472-( )
**HF-8014A Exciter	622-3473-( )
*HF-8050 Receiver	622-3385-( )
**HF-8050A Receiver	622-3393-( )
*HF-8054 Receiver	622-3474-( )
**HF-8054A Receiver	622-3475-( )
*HF-8070 Receiver-Exciter	622-3387-( )
**HF-8070A Receiver-Exciter	622-3394-( )
[1]851S-1 Receiver	622-4272-( )

*With 10-Hz tuning, either factory installed or installed using AC-8017 100-Hz to 10-Hz Conversion Kit 622-3453-001; and with AC-8090 Remote Control Kit 622-3462-001 installed.

**With 10-Hz tuning, either factory installed or installed using AC-8017 100-Hz to 10-Hz Conversion Kit 622-3453-001.

[1] Remotely controlled, either factory installed or installed using AC-8090 Remote Control Kit 622-3462-001.

NOTICE: This section replaces first edition dated 1 June 1978.

c. Remove synthesizer 100/10-kHz decade from A17 slot and install in A16 slot.
d. Install synthesizer 100/10-kHz decade from kit in A17 slot.
e. Reinstall synthesizer assembly top cover.
f. Reinstall unit top cover.

3. REPAIR

Repair of the AC-8018 10-Hz to 1-Hz Conversion Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

Synthesizer Decade 623-2080-004 is the only part in this kit.

Synthesizer Decade 623-2080-004 is covered in Synthesizer Decade (623-2080-001, -002, -003, -004) instructions (Collins part number 523-0767972) which are included in this instruction book.

AC-8019 100-Hz to 1-Hz Conversion Kit (622-3455-001)

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

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1. DESCRIPTION

AC-8019 100-Hz to 1-Hz Conversion Kit 622-3455-001 contains a 10-Hz frequency switchboard assembly and two synthesizer decade cards. When installed, the 100-Hz to 1-Hz conversion kit provides local tuning in 10-Hz increments (in all units) and remote tuning in 1-Hz increments (in remotely controlled units). Refer to table 1 for equipment this kit is used on.

Note

If 100-Hz Frequency Display has been installed in unit it should be replaced with a 10-Hz display when installing this kit.

Table 1. AC-8019 100-Hz to 1-Hz Conversion Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
HF-8010 Exciter	622-3389-( )
HF-8010A Exciter	622-3395-( )
HF-8014 Exciter	622-3472-( )
HF-8014A Exciter	622-3473-( )
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )
HF-8070 Receiver-Exciter	622-3387-( )
HF-8070A Receiver-Exciter	622-3394-( )

Note

Some configurations of these units have factory-installed 10-Hz tuning. To convert these units to 1-Hz tuning use AC-8018 10-Hz to 1-Hz Conversion Kit 622-3454-001.

2. INSTALLATION

Installation of AC-8019 100-Hz to 1-Hz Conversion Kit 622-3455-001 consists of replacing the existing frequency switchboard assembly with one from the kit, and configuring the synthesizer assembly for 1-Hz operation using two decade cards (100/10-Hz decades) supplied with the kit.

2.1 Frequency Switchboard Replacement

Note

Retain hardware removed during disassembly for use in reassembly. Refer to unit parts list as an aid in disassembly and assembly.

a. Remove unit top cover.

b. Remove front panel from unit by removing four hexhead screws and attaching hardware.

Caution

Upper overlay panel (plexiglass) is brittle; exercise care during removal of upper overlay panel.

c. Remove upper overlay panel from front panel as follows:
   1. Remove four Phillips-head screws and lockwashers that secure back of front panel to upper edge bar.
   2. Remove four Phillips-head screws and lockwashers that secure back of front panel to panel support (middle bar on front panel).
   3. Lift upper edge bar from front panel.

NOTICE: This section replaces first edition dated 1 June 1978.

4. Carefully remove upper overlay panel.

d. Remove cover plate on back of front panel by removing five Phillips-head screws and attaching hardware (screwheads on front of front panel).
e. Disconnect plug P2 from frequency switchboard jack A2J4.
f. Remove frequency switchboard 635-0830-001 by removing four Phillips-head screws and attaching hardware (screwheads on front of front panel).
g. Secure frequency switchboard 635-0830-002 supplied in kit to front panel using four Phillips-head screws and attaching hardware (screwheads on front of front panel).
h. Connect plug P2 to jack A2J4 on frequency switchboard.
i. Secure cover plate to back of front panel with five Phillips-head screws and attaching hardware (screwheads on front side of front panel).

Caution

> Upper overlay panel (plexiglass) is brittle; exercise care during replacement of upper overlay panel.

j. Insert upper overlay panel into slot on panel support (middle bar on front panel).
k. Replace edge bar on top of front panel ensuring upper overlay panel fits properly.
l. Secure upper overlay panel to front panel with eight Phillips-head screws and lockwashers.
m. Secure front panel to unit with four hexhead screws and attaching hardware.

2.2 Configuring Synthesizer

2.2.1 Configuring Synthesizer Assembly 635-9697-001 for 1-Hz Operation

a. Remove synthesizer assembly top cover.
b. Remove END DECADE from A18 slot and install into the A16 slot.
c. Install one decade card 623-2080-004 in the A17 slot and a second one in the A18 slot.
d. Reinstall synthesizer assembly top cover.
e. Reinstall unit top cover.

2.2.2 Configuring Synthesizer Assembly 634-8201-001 for 1-Hz Operation

a. Remove synthesizer assembly top cover.
b. Remove END DECADE from A19 slot and install into the A17 slot.
c. Install one decade card 623-2080-004 in the A19 slot and a second one in the A18 slot.
d. Reinstall synthesizer assembly top cover.
e. Reinstall unit top cover.

3. REPAIR

Repair of the AC-8019 100-Hz to 1-Hz Conversion Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

This paragraph assists in the identification, requisition, and issuance of parts, and in maintenance of the equipment. The Collins part number and description for each nonstandard replacement part are listed in table 2. These cards are covered in the following instructions which are included in this instruction book.

a. Frequency switchboard (635-0830-001, -002) instructions (Collins part number 523-0767947).
b. Synthesizer decade (623-2080-001, -002, -003, -004) instructions (Collins part number 523-0767972).

Table 2. AC-8019 100-Hz to 1-Hz Conversion Kit Parts List.

DESCRIPTION	COLLINS PART NUMBER	QUANTITY
Frequency switchboard	635-0830-002	1
Synthesizer decade	623-2080-004	2

AC-8055 IF Filters Kit
(622-3452-( ))

Rockwell
International

instructions

Collins Telecommunications Products Division

Printed in USA

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1. DESCRIPTION

AC-8055 IF Filters Kit 622-3452-( ) contains an if filter card and two sets of decals to mark the front-panel BANDWIDTH switch. When installed, the AC-8055 IF Filters Kit allows selection of one of eight filters using the front-panel MODE switch and BANDWIDTH switch. Normally, selection of specific filters is made in SSB/CW or AM modes. The if filter card is installed in the local unit and one set of decals is used to appropriately mark the front-panel BANDWIDTH switch of the local unit. The second set of decals is used to mark the front-panel BANDWIDTH switch on the associated control unit (if applicable). Refer to table 1 for equipment this kit is used on.

2. INSTALLATION

Installation of AC-8055 IF Filters Kit 622-3452-( ) consists of installing an if filter card and front-panel decals.

2.1 Filter 637-2515-( ) Installation

a. Remove top cover from unit.
b. Remove A8 CHAN A IF from the unit.
c. Plug filter into A8 CHAN A IF.
d. Insert A8 CHAN A IF in its original position in unit.
e. Reinstall unit top cover.

2.2 Decal Installation

Note

Extra decals in kit to be installed on associated control unit (if applicable).

Table 1. AC-8055 IF Filters Kit, Equipment Used On.

EQUIPMENT	COLLINS PART NUMBER
HF-8050 Receiver	622-3385-( )
HF-8050A Receiver	622-3393-( )
HF-8054 Receiver	622-3474-( )
HF-8054A Receiver	622-3475-( )

Install adhesive-backed decals in front-panel recess at BANDWIDTH switch positions as shown in table 2.

3. REPAIR

Repair of the AC-8055 IF Filters Kit is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

4. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts, and in maintenance of the equipment. The Collins part number and description for each nonstandard replacement part are listed in table 3.

Filter 637-2515-( ) is covered in Filter 637-2515-( ) instructions (Collins part number 523-0767967) included in this instruction book.

NOTICE: This section replaces first edition dated 1 June 1978.

Table 2. Decal Installation.

BANDWIDTH SWITCH POSITION	DECALS INSTALLED							
	KIT 622-3452-( )							
	-001	-002	-003	-004	-005	-006	-007	-008
A	6	6	6	6	6	-	6	0.25U
B	3	-	3	3	3	-	-	0.7U
C	1	-	1	1	1	-	1	0.7L
D	0.5	-	0.5	0.5	0.5	-	-	0.25L
E	0.2	0.2	0.2	0.2	0.1	-	0.2	5.0

Table 3. AC-8055 IF Filters Kit Parts List.

PART DESCRIPTION	COLLINS PART NUMBER	QUANTITY USED ON							
		AC-8055 IF FILTERS KIT 622-3452-( )							
		-001	-002	-003	-004	-005	-006	-007	-008
Filter	637-2515-001	1							
Filter	637-2515-002		1						
Filter	637-2515-003			1					
Filter	637-2515-005				1				
Filter	637-2515-006					1			
Filter	637-2515-010						1		
Filter	637-2515-011							1	
Filter	637-2515-013								1
Decal, 0.1	635-9700-001					2			
Decal, 0.2	635-9700-002	2	2	2	2			2	
Decal, 0.5	635-9700-003	2		2	2	2			
Decal, 1	635-9700-004	2		2	2	2		2	
Decal, 3	635-9700-005	2		2	2	2			
Decal, 6	635-9700-006	2	2	2	2	2		2	
Decal, 0.25U	646-6912-001								2
Decal, 0.25L	646-6912-002								2
Decal, 0.7U	646-6912-003								2
Decal, 0.7L	646-6912-004								2
Decal, 5.0	646-6912-005								2
Drawing envelope	520-8360-134	1	1	1	1	1	1	1	1
Installation Kit-IF Filters, AC-8055	622-3452-( )	1	1	1	1	1	1	1	1