

TECHNICAL MANUAL

OPERATION, MAINTENANCE, INSTALLATION INSTRUCTIONS
AND ILLUSTRATED PARTS BREAKDOWN

MF/HF COMMUNICATIONS RECEIVER

SP-325

(TEN-TEC MODEL NUMBER)

TEN-TEC, INC
N00612-87-C-0098

THIS MANUAL WAS PREPARED IN ACCORDANCE WITH MIL-M-7298C AND APPROVED FOR USE BY THE NAVAL
ELECTRONIC SYSTEMS ENGINEERING CENTER, CHARLESTON, SC

6 OCTOBER 1987

WARNING
HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.

Learn the areas containing high voltage within the equipment.

Be careful not to contact high voltage connections when installing,
operating or maintaining this equipment.

Before working inside the equipment, turn power off
and ground points of high potential before touching them.

RECORD OF CHANGES

CHANGE NO.	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY
1	3/18/88	ADDITION OF RECORD OUTPUT TERMINAL (SEE ADDENDUM TO MANUAL)	NAVELEXCEN CHASN

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INTRODUCTION

This technical manual provides operation and maintenance instructions for the Ten-Tec model SP-325 MF/HF Radio Communications Receiver, along with a detailed Parts Breakdown and Schematic Diagrams. The manual was prepared in accordance with MIL-M-7298C, "Manuals, Technical: Commercial Equipment". The manual is broken down into nine chapters along with a Table of Contents and lists of tables and illustrations.

Chapter 1 presents general information about the Receiver, which includes functional capabilities, performance specifications, and physical dimensions. Chapter 2 provides information concerning the unpacking and initial installation of the Receiver. A general theory of operation is provided in Chapter 3 which describes the functioning of the Receiver and its individual circuit boards. Chapter 4 contains information on operation of the Receiver. This information is designed to acquaint the operator and technician with the unit, and to describe its controls, indicators and operating characteristics. Step by step procedures are also provided for operating the Receiver in various modes.

Chapter 5 provides information on maintenance and troubleshooting measures to be employed at the user's level. Instructions pertaining to the reshipment or long term storage of the unit are provided in Chapter 6. A detailed list of unique single source parts is provided in Chapter 7. In addition, Chapter 7 contains a list of manufacturers for these parts and their addresses. Chapter 8 provides a listing of replaceable modules and parts contained in the Receiver. Chapter 9 contains detailed parts lists for each of the replaceable modules. Chapter 9 also contains schematic diagrams for the electronic circuits of the Receiver.

SP-325



FIGURE 1-1. TEN-TEC MODEL SP-325
MF/HF COMMUNICATIONS RECEIVER

CHAPTER 1

GENERAL INFORMATION

1-1 PURPOSE AND FUNCTION The SP-325 is a microprocessor controlled communications receiver covering the frequency range of 500 kHz to 29.9999 MHz and utilizing Phase Lock Loop technology. The SP-325 features direct frequency entry, 64 memory locations, scratch pad memory, AM, USB, CW, LSB and FSK modes, memory scan, memory tune, vacuum fluorescent display, selection of three bandwidths, and switchable AGC.

1-2 SPECIFICATIONS

Frequency Range: 500 kHz to 29.9999 MHz

Frequency display: 6 digit vacuum fluorescent

Method of tuning: Frequency selection is accomplished in increments of 100 Hz by front panel key pad entry or by knob with 50 Hz increments. An up-down button will increment or decrement the frequency in steps of 1 MHz.

Primary power requirements: 6 watts nominal 105-125 VAC 60 Hz

Modes: AM,USB,CW,LSB,FSK

Audio power output: Line output 100 mw into 600 ohm load with less than 10% distortion. Headphone output 30 mw into 600 ohm load with less than 10% distortion.

Sensitivity: (S+N/N 10 dB) μ v

	CW	AM	USB,LSB,FSK
500 kHz-2 MHz	1.0	3.0	1.0
2 - 29.999 MHz	0.5	2.5	0.5

Gain: Rated sensitivity will produce 1 milliwatt audio output.

RF input: 50 ohms

Selectivity:

Bandwidth	#1	#2	#3
-6 dB	500 Hz min	2.8kHz \pm 0.3	6.0 kHz min
-40 dB		5.0 kHz max	
-50 dB	1.5 kHz max		18 kHz max

Frequency stability: 50 Hz during 1st hour after 5 minute warm-up. \pm 10 Hz during any 60 minute period after the first hour.

Image rejection: Greater than 60 dB

IF rejection: Greater than 60 dB

1-3 Environmental conditions

Operating temperature: 0 to 50 degrees

Humidity: 10% to 95% non-condensing

Elevation: 10,000 feet

1-4 Mechanical

Construction: External metal components use steel. All internal chassis parts are aluminum. External parts finished with semi-gloss black baked enamel with white silkscreen. Mounting kit, with handles provided, to mount unit in a standard 19 inch rack per EIA RS-310-C-77.

Size: (HWD) 3.469 in. X 12.0 in. X 10.5 in.

Weight: 8 lbs. 4 oz.

1-5 EQUIPMENT/PARTS SUPPLIED

1-5.1	RECEIVER MODEL SP-325	QTY 1
1-5.2	BRACKETS FOR RACK MOUNTING	QTY 2
1-5.3	HANDLES	QTY 2
1-5.4	DETACHABLE LINE CORD	QTY 1
1-5.5	RUBBER FEET	QTY 4
1-5.6	SCREWS	QTY 4

1-6 EQUIPMENT/PARTS REQUIRED BUT NOT SUPPLIED

- 1-6.1 HEADPHONES
- 1-6.2 ANTENNA CABLES, CONNECTORS
- 1-6.3 EXTERNAL SPEAKER AND WIRE
- 1-6.4 FSK TERMINAL
- 1-6.5 TEST EQUIPMENT

CHAPTER 2

PREPARATION FOR USE AND INSTALLATION

2-1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking the unit. If the carton is damaged, open the carton in the presence of an agent of the shipping carrier if possible. If the carton is not damaged, retain the carton and packing materials for inspection if damage is found after the unit is unpacked.

Open the carton and remove the foam packing material on top of the unit. Lift the unit free of the carton. No packing materials are required or provided inside the unit. Replace the foam packing material in the carton. The carton may be saved for possible re-shipment if required.

Upon unpacking, inspect the unit for obvious external damage. Pay particular attention to dents or bent sheetmetal. If damage is evident, remove the top and bottom covers of the unit and inspect for further damage such as damaged circuit boards. Do not attempt to operate the unit if such damage is noted until further checks are made.

2-2 MOUNTING The unit is designed for table top or for rack panel mounting. For table top use, four adhesive rubber feet are provided and should be placed on the bottom of the receiver.

Two brackets with handles are supplied for rack mounting. The brackets are symmetrical and may be used on either side. Remove the four 10-24 screws on one side of the receiver that hold the top and bottom cover to the receiver. Place a bracket on the side of the unit, and replace the screws through the bracket and covers into the receiver. Make sure the bracket is flush with the top, bottom and front of the front panel. Tighten the screws securely. Using the same procedure, assemble the other bracket to the receiver.

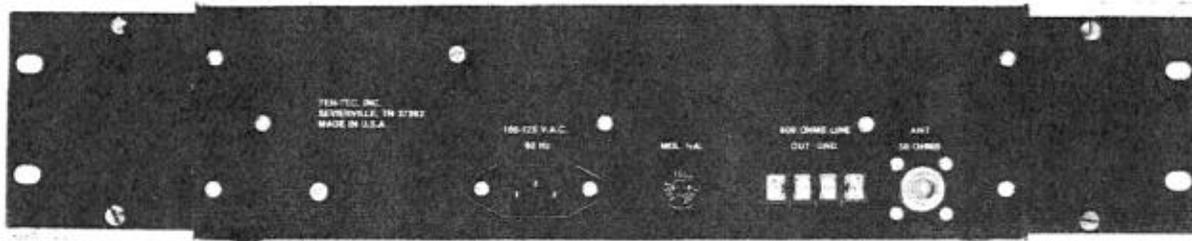


FIGURE 2-1. REAR PANEL CONNECTORS

2-3 POWER The receiver is designed to be powered from 105-125 vac, 60 Hz. A detachable three-conductor power cord is supplied and should be inserted in the receptacle labeled 105-125 V.A.C. 60 Hz. (Shown in Figure 2-1.)

2-4 ANTENNA Connect the antenna to be used to the Type-N antenna receptacle on the rear panel labeled ANT 50 OHMS. (Shown in Figure 2-1.)

2-5 LINE OUTPUT The line output is designed to feed a standard 600 ohm line system. Connect the ground of the line to the GND terminal and the hot lead to the OUT terminal. (Shown in Figure 2-1.)

2-6 HEADPHONES A front panel jack is provided for a standard pair of 600 ohm phones.

CHAPTER 3

GENERAL THEORY OF OPERATION

3-1 INTRODUCTION The SP-325 is a receiver covering the frequency range of 500 kHz to 29.9999 MHz. The received spectrum (500 kHz to 29.9999 MHz) is converted to a first IF of 45 MHz to eliminate images. The spectrum is converted in 10 kHz steps by the phase locked first conversion oscillator. The 45 MHz first IF is converted to a 455 kHz second IF, in steps of 50 Hz, by the phase locked second conversion oscillator. The resultant signal is processed by the appropriate detector and amplified before being made available at the LINE OUTPUT or PHONES jack.

3-2 RF UNIT The signals from the antenna connector are routed to this board. They pass through a low-pass filter to improve the image rejection and through one of six microprocessor selected band-pass filters to the RF amplifier. A high level diode quad mixer converts the signals to an IF of 45 MHz. The signals are amplified and applied to a four pole 45 MHz monolithic filter. The 15 kHz wide 45 MHz filter determines the band of frequencies allowed to pass through the 45 MHz IF.

3-3 IF UNIT The majority of the 455 kHz IF functions are accomplished with one integrated circuit. The integrated circuit contains an RF prestage with AGC, a balanced mixer, separate second conversion buffer, and an IF amplifier with AGC. Because of its internal stabilization, all characteristics are nearly

independent of the supply voltage. Signals from the RF UNIT are applied to the RF prestage in the integrated circuit. They are mixed with the second conversion oscillator, which tunes in 50 Hz steps, and are separated by selection of the appropriate filter. The wanted signal is then amplified and detected in either the AM detector, Q1, or the SSB/CW/FSK detector, D16-D19.

3-4 AF UNIT A single audio power amplifier integrated circuit, IC1, supplies the proper level to the LINE OUTPUT and the PHONES jack. A power transformer and bridge rectifier supply power to a regulator for the main receiver. Power for the ovens is derived from diodes D5 and D6.

3-5 PLL UNIT The PLL UNIT contains both the first conversion oscillator and the second conversion oscillator.

The first conversion oscillator covers the range of 45-75 MHz. The VCO is split into three ranges to cover the 45-75 MHz spectrum. The VCO output is buffered by Q203 and Q208, before being passed to the first mixer. An additional buffer, Q209, isolates the VCO and first mixer from IC201 prescaler. The prescaler output drives the main loop integrated circuit, IC 200. IC 200 develops the reference frequency, accepts information from the microprocessor that determines the output frequency, and outputs a voltage that

drives the loop filter and VCO.

The second conversion oscillator covers the range from 44.540-44.550 MHz. The VCO operates over a range of 139-141 MHz. The buffered VCO output drives a prescaler, IC 207. IC 205, the main loop integrated circuit, develops the reference frequency, accepts information from the microprocessor that determines the output frequency, and outputs a voltage that drives the loop filter and VCO. The output of this loop, 139-141 MHz, is incremented in 10 kHz step. IC 207 and IC 208 divide this output by 200 resulting in a frequency coverage of 695-705 kHz in increments of 50 Hz. Mixer DM200 combines this frequency with the main reference frequency of 10 MHz. The output is filtered in a 10.7 MHz monolithic filter and then combined in mixer DM201 with a 33.845 MHz oscillator to produce the final frequency.

3-6 BFO UNIT This unit contains the crystal oscillators, ovens for the crystals, and a PLL beat frequency oscillator that is used to detect the SSB, CW and FSK signals.

Individual ovens stabilize each of the crystal oscillators. The ovens operate at a temperature of 75 degrees centigrade and are powered from the 13 volt power supply on the AF UNIT. The ovens, cold, require approximately one ampere at 13 volts. After a warm-up of 5 minutes they stabilize and will require approximately 200 milliamperes to maintain the temperature.

The VCO used for the BFO operates at a frequency of 4.533 or 4.567 MHz depending on the mode selected. Buffered VCO output is applied to the main loop integrated circuit, IC 2. IC2 develops the reference frequency, receives information from the microprocessor that will determine the output frequency, and outputs a voltage to control the VCO. The

VCO is divided by 10 in IC3, filtered and output to the IF UNIT.

3-7 LOGIC UNIT Microprocessor, IC4, controls all input and output operations of the SP-325. The rotary encoder signals are sent to IC1 and IC2, which generate tuning pulse and direction information for the microprocessor. IC5 is used to scan the keyboard for key closures. IC8 is a DC-to-DC convertor module that develops supply voltages for the VF display on the DISPLAY/KEYPAD UNIT. Most of the memory related data is stored in IC3, a non-volatile RAM. The microprocessor also outputs the proper code to each of the PLL integrated circuits, selects the correct bandpass filter for the frequency selected and determines the filter and mode requirement from the front panel switches. It also controls the memories, memory tune, and provides the information to the frequency display.

3-8 DISPLAY/KEYPAD UNIT This unit contains a key matrix for information entry into the microprocessor system, annunciator LEDs for filter selection and an LSI driver, IC1, which drives the VF display, DISP1. The driver, IC1, generates multiplexed seven-segment and digit strobe signals for the VF display.

3 - 3 / 3 - 4 blank

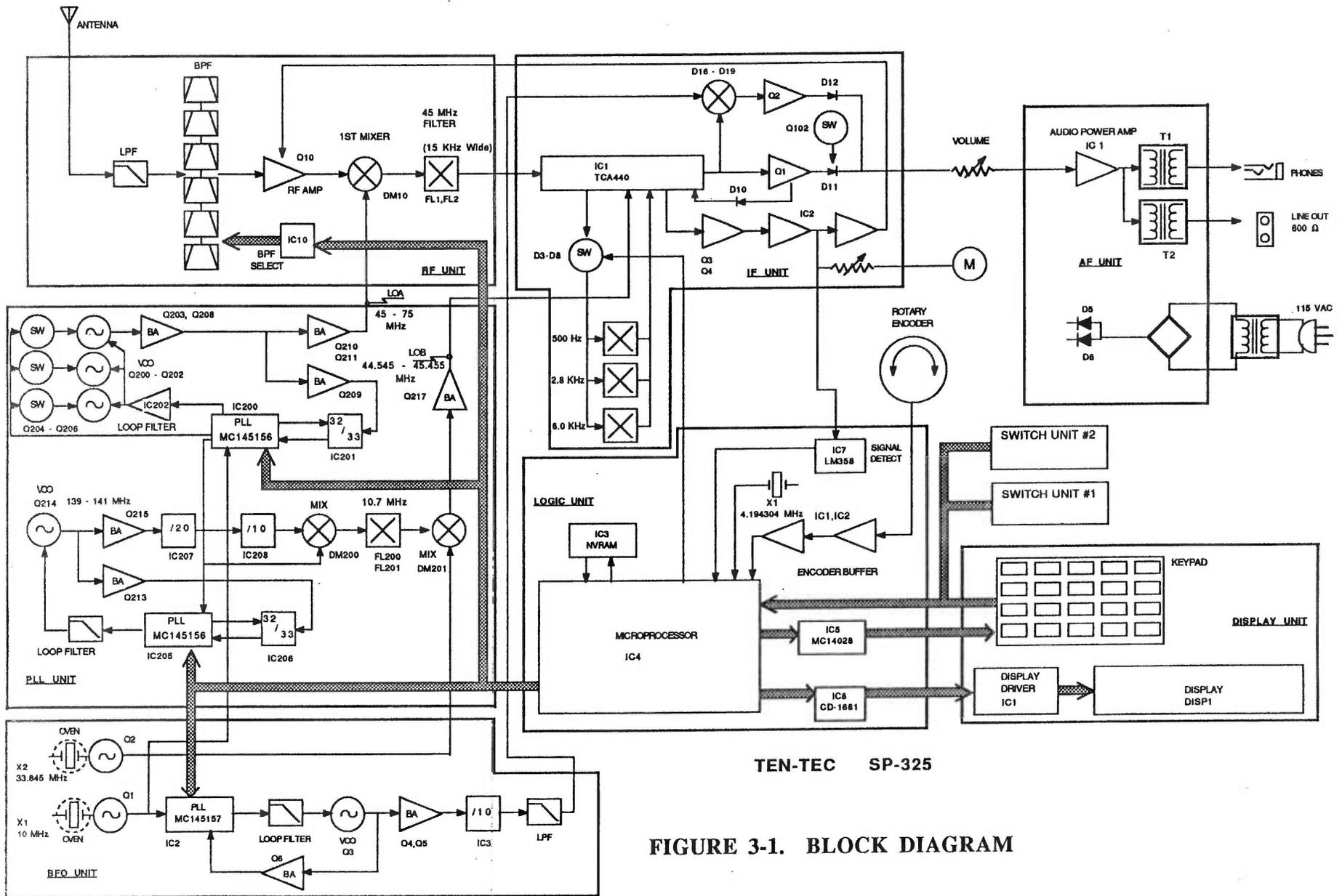


FIGURE 3-1. BLOCK DIAGRAM

CHAPTER 4
DETAILED OPERATING INSTRUCTIONS



FIGURE 4-1. FRONT PANEL CONTROLS AND INDICATORS.

TABLE 4-1
DESCRIPTION OF FRONT PANEL CONTROLS AND INDICATORS.

POWER ON/OFF	Turns SP-325 on by closing the circuit between the line cord and the power transformer.
PHONES	Provides 600 ohm audio output to Headphones.
METER	Indicates relative strength of received signals.
FLUORESCENT DISPLAY	Used to indicate frequency being received, and indication of functions controlled by the keypad.
KEYPAD	Used to enter frequencies, store information, provide scan functions, and select filter bandwidths.
VOLUME	Controls gain of the SP-325 audio system.

TABLE 4-1.
(CONTINUED)

USB/CW	Selects the proper detector for USB/CW reception.
AM	Selects the proper detector for AM reception.
LSB/FSK	Selects the proper detector for LSB/FSK reception.
AGC FAST/SLOW	Selects the proper time constant to provide either fast or slow decay of the AGC line.
MEM	Allows memories to be selected by using the Main Tuning knob.
LOCK	Disconnects the Main Tuning knob from the frequency select function. The Main Tuning knob will not change the frequency when locked.
MHz	Increments or decrements receiver frequency in 1 MHz steps.
MAIN TUNING	Used to select the desired frequency.

4-1 OPERATING MODES The SP-325 can be operated in any of the five modes as described below.

AM OPERATION — Turn POWER switch to ON. Push AM button. Push 6.0 KHz button. Tune desired frequency with the Main Tuning knob or enter the frequency directly as described in section 4-2 KEYPAD.

USB OPERATION — Turn POWER switch to ON. Push USB/CW button. Select desired filter bandwidth, either 2.8 KHz or 6.0 KHz, by pushing the appropriate button. Tune desired frequency with the Main Tuning knob or enter the frequency directly as described in section 4-2 KEYPAD.

CW OPERATION — Turn POWER switch to ON. Push USB/CW button. Select desired filter bandwidth, either 500 Hz or 2.8

KHz, by pushing the appropriate button. Tune desired frequency with the Main Tuning knob or enter the frequency directly as described in section 4-2 KEYPAD.

LSB OPERATION — Turn POWER switch to ON. Push LSB/FSK button. Select desired filter bandwidth, either 2.8 KHz or 6.0 KHz, by pushing the appropriate button. Tune desired frequency with the Main Tuning knob or enter the frequency directly as described in section 4-2 KEYPAD.

FSK OPERATION — Turn POWER switch to ON. Push LSB/FSK button. Select desired filter bandwidth by pushing the appropriate button. *Make sure the bandwidth of the filter selected is greater than the shift used for mark/space.* Tune desired frequency with the Main Tuning knob or enter the frequency directly as described in section 4-2 KEYPAD.

4-2 KEYPAD The keypad is used to enter frequency, select filter bandwidths and to access microprocessor-controlled features. Most of the keys have two functions with the top functions accessed via the Function (shift) **F** key.

When the Function key is pressed an "F" will appear at the right side of the display indicating that the microprocessor is waiting for a shifted function. The display will return to normal upon completion of the command.

The operating frequency may be directly entered by means of the keypad. For example, to enter the frequency of 7.8250 MHz:

press **7** **.** **8** **2** **5** **ENTER**

To enter a frequency of 930 KHz (.9300 MHz.):

press **.** **9** **3** **ENTER**

If you make a mistake when keying in the frequency, simply press the CLR key and re-enter the frequency. The CLR key is also used to exit the Memory Scan modes and to cancel any pending functions.

4-3 MEMORIES The SP-325 contains 64 memory locations (00 to 63) which can store often used frequencies. In addition to storing the frequency, each memory location also stores the mode (AM,USB/CW or LSB/FSK) and the filter bandwidth (.5, 2.8, or 6.0 kHz).

4-3.1 POWER-UP MEMORY When the POWER switch is turned ON, the SP-325 will normally power-up on a frequency of 15.000 MHz. If a special frequency and filter setting is desired upon power-up, place this frequency and operating settings in Memory 00. When next powered on, this memory will be recalled.

4-3.2 MEMORY STORE To enter a frequency into memory, first enter the desired frequency via the keypad or the main tuning dial, then select the desired reception mode

and filter bandwidth. Press the STO key and then enter a two digit number corresponding to the desired memory location. The display will show the location number as it is entered.

For example, to store a displayed frequency into memory location 5:

press **STO** , **0** , **5**

To store a frequency into memory location 15:

press **STO** , **1** , **5**

A memory may also be stored without having to specify the location by using the STO/ENTER method. The SP-325 will store a frequency/mode/filter combination in the next available empty location beginning with memory location "00". To use this function:

press **STO** , **ENTER**

If no more memory locations are available, the display will show "FF" indicating that all memory locations are full.

4-3.3 MEMORY RECALL To recall a frequency from memory press the RCL key and then the desired two digit location number. For example to recall memory location 21:

press **RCL** , **2** , **1**

To recall the last location stored using the STO/ ENTER method:

press **RCL** , **ENTER**

The memory frequency and the memory location number will show in the display and the corresponding reception mode and bandwidth LEDs will light. Moving the main tuning knob or entering another frequency via the keypad will return the SP-325 to the non-memory mode.

4-3.4 SCRATCH PAD MEMORY The scratch pad memory can be used to temporarily store and recall a single frequency without affecting the main memory locations. With the desired frequency in the display, press the STO key twice. The display will show "P" indicating that the displayed frequency is in scratch pad memory. The scratch pad memory may be recalled at any time by pressing the RCL key twice.

To store: press **STO** , **STO**

To recall: press **RCL** , **RCL**

Each time a new frequency is entered into the scratch pad memory, the previous memorized frequency is erased.

4-3.5 MEMORY SCAN To use the memory scan mode:

press **F** , **MS**
STO

The microprocessor will then scan through all of the programmed memories (except those that are locked out) stopping at each location that contains a signal above a pre-set signal strength. It will remain on the memory for approximately 5 seconds, then continue scanning.

To temporarily stop the scan function:

press **ENTER** , then to resume scan:

press **▼ MHz ▲**

The receiver will then resume scanning in the direction chosen by the **▼ MHz ▲** key. To exit the scan mode:

press **CLR** and hold until memory number no longer appears in the display.

NOTE: In order to use memory scan, there must be more than 1 memory location programmed and/or unlocked. If memory scan is

attempted under these conditions the receiver will appear to be malfunctioning as the keypad and main tuning knob will not respond. Pressing the CLR key will return the receiver to normal.

4-3.6 MEMORY LOCKOUT The Memory Lockout function causes selected memory locations to be bypassed during memory scan. The frequency/mode/bandwidth information is retained and may be unlocked at any time.

To lock out a location, recall the location to be locked out and press the Function key followed by the ML key.

For example to lock out memory location #12:

press **RCL** , **1** , **2** , **F** , **ML**
.

If the location to be locked out is already in the display, the recall procedure may be omitted. Then the location may be locked out by just pressing the Function and ML keys.

If the locked out location is recalled or tuned via memory tune, the display will show "L" indicating that the location is locked out.

To unlock an individual location, repeat the above procedure.

4-3.7 LOCK CLEAR The Lock Clear key is used to unlock all of the locked out memory locations. To unlock all locations:

press **F** , **LC**
0

4-3.8 MEMORY SCAN by MODE This feature permits scanning by mode only, for example only USB stations. To use memory scan mode, first select the mode you wish scanned using AM, USB/CW or LSB/FSK then:

press **F** , **MSM**
3

The microprocessor will scan only those

memories of the mode selected. Temporary stop, scan direction, and scan exit are controlled in the same way as memory scan.

4-3.9 MEMORY CLEAR This key will clear all of the memories returning them to their unprogrammed state.

To clear all of the memories:

press , ,

4-3.10 SCAN RATE The scan RATE is used in both the memory scan and programmable scan modes and determines the speed or RATE at which the memory locations or frequencies are scanned. To program the scan rate:

press ,

A number from 0 to 9 will appear in the display indicating the scan rate with a 9 being the fastest. Press the ▼ MHz ▲ key to select the desired rate and then press the ENTER key.

4-4 MEMORY TUNE The memory tune function is used to manually tune through the memories by means of the main tuning knob. When the MEM switch is depressed, turning the main tuning knob clockwise will tune upwards through all of the programmed memories. Turning the knob counter-clockwise will tune down through the memories. Using this method all programmed memories may be accessed, even those that are locked out. A locked out memory location will display an "L" (Locked) in front of the memory number. While in MEMORY TUNE, the MEMORY LOCKOUT, LOCK CLEAR and MEMORY CLEAR functions are also available to lock, unlock or clear the memories.

4-5 PROGRAMMABLE SCAN The programmable scan function is used to scan between any two frequencies at a scan rate determined by the RATE key.

To program the lower frequency, enter the desired lower frequency into the display using the keypad or the main tuning knob, then:

press ,

To program the upper frequency, enter the desired upper frequency into the display and:

press ,

Select the desired mode, filter bandwidth and scan RATE.

To enter the programmable scan mode:

press ,

The receiver will now scan between the selected frequencies. To temporarily stop the scan and/or change the direction of the scan:

press , then to resume scan:

press

To exit the programmable scan mode, press the CLR key.

4-6 DISPLAY TEST This function is used to test all of the segments of the digital display. To use this function:

press , and keep the ENTER key depressed.

All of the display segments will be turned on and the display will return to normal upon release of the ENTER key.

CHAPTER 5

MAINTENANCE INSTRUCTIONS

WARNING HIGH VOLTAGE

is used in the operation of this equipment.
DEATH ON CONTACT

may result if personnel fail to observe safety precautions.
Learn the areas containing high voltage within the equipment.
Be careful not to contact high voltage connections when installing,
operating or maintaining this equipment.
Before working inside the equipment, turn power off
and ground points of high potential before touching them.

5-1 INTRODUCTION To perform maintenance tasks on the SP-325, the technician shall identify faulty modules or subassemblies. The faulty module or subassembly shall be replaced with a known good one.

5-2 CLEANING AND LUBRICATION There are no cleaning or lubrication requirements for the SP-325.

5-3 TROUBLESHOOTING Troubleshooting the SP-325 consists of identifying faulty modules or subassemblies by the symptom of the fault. Table 5-1 lists symptoms and the probable module or modules associated with the fault.

5-4 INSPECTION There are no parts in the SP-325 that are subject to wear. Rear panel connectors should be inspected for damage whenever the unit is moved.

5-5 PERFORMANCE VERIFICATION The following performance verification tests may be performed if there is a suspected failure of the unit. Perform the verification tests in the order listed, as previous tests may contain test set-up procedures required for succeeding tests. The technician will need the following test equipment to perform the verification tests.

- a. RF signal generator, capable of AM modulation, covering the frequency range of 500 kHz to 100 MHz.
- b. AC/DC multimeter
- c. Frequency counter
- d. AC voltmeter
- e. Audio oscillator
- f. Spectrum analyzer covering 500 kHz to 100 MHz

NOTE

The following tests must be performed in the order listed.

Test set-ups and switch positions from one test carry over into the next test.

5-5.1 AF UNIT VERIFICATION Power supply, regulator, and audio power amplifier are contained on the circuit card.

1. Connect the ac power cord to the ac power connector on the rear panel of the unit.
2. Set the front panel POWER ON/OFF switch to the OFF position.
3. Connect the ac power cord to a source of 115 vac.
4. Set the front panel POWER ON/OFF switch to the ON position.
5. Measure the voltage at terminal 20, pin 1. The voltage should be 13 vdc. Measure the voltage at terminal 20, pin 2. The voltage should be 11.5 vdc.
6. Connect an audio oscillator to terminal 1, output to pin 2, ground to pin 1. Adjust the frequency to 1000 Hz and the level to 5 mv. Connect a 600 ohm load to the line output and an AC voltmeter across the load. Adjust the AF GAIN control full clockwise. The AC voltmeter should read 5 volts.
7. Failure to meet any of the above tests would indicate a defective AF UNIT board or associated cables.

5-5.2 BFO UNIT

1. Connect the spectrum analyzer to cable plug 50, ground to pin 1 and hot to pin 2. Output should be 0 dBm minimum.
2. Connect the spectrum analyzer to cable plug 53, ground to pin 2 and hot to pin 1. Output should be 0 dBm minimum.
3. Connect the spectrum analyzer to connector 25. Output should be 0 dBm minimum.

4. Failure to meet any of the above would indicate a defective BFO UNIT or cables.

5-5.3 PLL UNIT

1. Connect the spectrum analyzer to connector 51. Output should be -5 dBm min.
2. Connect the spectrum analyzer to connector 52. Output should be 0 dBm min.
3. Failure to meet any of the above would indicate a defective PLL UNIT or cables.

5-5.4 IF UNIT

1. Set the receiver to 6.0 kHz bandwidth and the mode for AM.
2. Connect the signal generator to the input of the IF UNIT, connector 7. Select a modulation frequency of 1 kHz and set the modulation to 30%. Adjust the output level to 3.5 μ v. Adjust the tuning for maximum indication on the AC voltmeter. Remove the modulation. The difference between modulation and no modulation on the AC voltmeter should be greater than 10 dB.
3. Failure to meet any of the above would indicate a defective IF UNIT or defective cables.

5-5.5 LOGIC UNIT

1. It is difficult to test the LOGIC UNIT as a standalone module without extensive test equipment and digital experience. If the module is suspect, replace it with a known good module to determine if it is defective.

5-5.6 DISPLAY UNIT

1. It is difficult to test the DISPLAY UNIT as a standalone module without extensive test equipment and digital experience. If the LOGIC UNIT is known good and the display does not function, check the cables. If the cables are good, the DISPLAY UNIT is defective.

TABLE 5-1 FAULT ISOLATION	
<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>
1. Main tuning knob will not change frequency.	LOCK switch in lock position. 81394 LOGIC UNIT defective.
2. Keypad will not respond to input and main tuning knob will not change frequency.	*Microprocessor may be in process of a selected function routine. Press the CLR key and try again. *Receiver is in memory scan mode with less than 2 memory locations programmed and/or unlocked. Press CLR key and try again. 81394 LOGIC UNIT defective. 81392 DISPLAY/KEYPAD UNIT defective.
3. Receiver will not operate, no display or meter light.	Check POWER switch, a.c. line cord. 81378 AUDIO UNIT defective.
4. No received signal.	Check ANTENNA connector on rear panel, LINE OUTPUT and PHONES jacks, AF GAIN control. 81393 RF UNIT defective. 81379 IF UNIT defective. 81380 BFO UNIT defective. 81389 PLL UNIT defective. 81378 AUDIO UNIT defective. 81394 LOGIC UNIT defective.
5. S-Meter doesn't read.	81379 IF UNIT defective.
6. Low audio output level.	81378 AUDIO UNIT defective.
7. Unable to select filters.	81379 IF UNIT defective. 81392 DISPLAY/KEYPAD UNIT defective. 81378 AUDIO UNIT defective.
8. MHz button won't work.	81392 DISPLAY/KEYPAD UNIT defective. 81394 LOGIC UNIT defective.
9. USB/CW, AM, LSB/FSK will not select mode.	81391 SWITCH BD. #2 defective. 81394 LOGIC UNIT defective. 81378 AUDIO UNIT defective.

* **NOTE:** If the above procedures do not clear the keypad and/or display, the microprocessor may need to be reset. To reset the processor, turn the POWER ON/OFF switch to the OFF position, wait about 15 seconds then turn the POWER ON/OFF switch back to the ON position.

5-6 DISASSEMBLY, REPAIR, REPLACEMENT, AND REASSEMBLY. To replace a defective module or subassembly perform the following.

1. Set the front panel POWER ON/OFF switch to the OFF position.
2. Disconnect the ac power cable from the rear of the unit.
3. With a phillips head screwdriver, remove the eight screws holding the top and bottom cover to the receiver.
4. Remove the top and bottom covers.
5. If a module is to be replaced, perform the following: Unplug all cables from their respective sockets. With a phillips screwdriver, remove the screws holding the module in the receiver. Remove the module. Replace with a new module. Secure the new module in the receiver with the mounting screws. Replace the cables, matching the number on the plug with the respective number on the socket.
6. To replace the DISPLAY UNIT, remove the four screws in the corner of the front panel and lay the front panel face down. Remove the cables from their respective sockets and remove the screws holding the board to the front panel. Replace with new DISPLAY UNIT and secure with the mounting screws. Replace the cables, matching the number on the plug with the respective number on the socket. Reassemble the front panel to the receiver with the four screws in the corners.
7. Each individual module may be checked by using the procedure outlined in section 5-5.
8. Install the top and bottom covers and secure with the eight screws.
9. Connect the power cable.
10. Set the POWER ON/OFF switch to ON.

CHAPTER 6

PREPARATION FOR RESHIPMENT OR STORAGE

6-1 PREPARATION FOR RESHIPMENT

If the SP-325 ever needs to be packaged for reshipment, it is recommended that the following steps be taken.

1. Remove all cords or cables attached to the unit.
2. Ensure that there is sufficient foam packing material in the shipping carton to protect the unit from any hard impact that may occur during shipment.
3. Place the unit in the center of the shipping carton
4. Place A.C. Line Cord, in protective bag, into the shipping carton.
5. Cover the unit with foam packing material.
6. If using a cardboard packing carton, securely tape the seams of the carton's top cover, bottom cover, and side flaps with reinforced tape.
7. Fasten labels or stamp in indelible ink the word FRAGILE on the top, the bottom, and on all sides of the carton.

6-2 PREPARATION FOR STORAGE

If the SP-325 is not going to be used for a long period of time, it should be stored in its shipping case or some other suitable carton. The unit is rated for storage at temperatures from -30 degrees to +50 degrees C. To prepare the SP-325 for storage perform the following steps.

1. Remove all cords or cables attached to the unit.
2. Ensure that there is sufficient foam packing material in the container.
3. Place the unit in the center of the packing container.
4. Place the A.C. Line Cord, in a protective bag, into the container with the SP-325.
5. Cover the unit with foam packing material
6. If using a cardboard packing container, securely tape the container with reinforced packing tape.
7. Fasten labels or stamp in indelible ink the word FRAGILE on the top, the bottom, and on all sides of the container.
8. Write in large letters on the top of the carton "SP-325 RADIO RECEIVER".

CHAPTER 7

SINGLE SOURCE PARTS LIST

7-1 INTRODUCTION Table 7-1 is a listing of all the parts available from only one unique manufacturer or source. The table lists the Sub-Assembly Number, component ID, Manufacturer PART Number, Manufacturer Code, Part Description and the Ten-Tec PART Number.

TABLE 7-1 SP325 SINGLE SOURCE PARTS LIST

S/A No.	ID.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART #
81378	IC1	TDA1015	SIGNET	IC—TDA1015, LOW VOLTAGE MONOLITHIC INTEGRATED AUDIO AMPLIFIER	25199
81378	T1	81400-1	TT	TRANSFORMER—PRIMARY 8 OHMS WITH BUILT-IN SHUNT, SECONDARY 600 OHMS	81400-1
81378	T2	81400	TT	TRANSFORMER—PRIMARY 8 OHMS SECONDARY 600 OHMS	81400
81379	—	7 MM	AURA	SHIELD CAN-COIL, 7MM NI. PLATED	38131
81379	D10	BAT41	CSF	DIODE—SCHOTTKY, BAT41	28071
81379	FL1	455.95-500-6	NETSCI	FILTER—CRYSTAL, 455.950 KHZ, 500 HZ WIDE	48138
81379	FL2	CFW455KI	MURATA	FILTER—CERAMIC, 455 KHZ, 2.8 KHZ WIDE	48128
81379	FL3	CFW455HI	MURATA	FILTER—CERAMIC, 455 KHZ, 6.0 KHZ WIDE	48129
81379	IC1	TCA440	SIEMENS	IC—TCA440, AM RECEIVER WITH RF PRESTAGE, BALANCED MIXER, LOCAL OSCILLATOR AND IF AMP.	25200
81379	R45	EVN-36CA00B15	PANSC	RESISTOR—VARIABLE, 100K, P.C. MOUNTING	30338

TABLE 7-1 SP325 SINGLE SOURCE PARTS LIST (continued)

S/A No.	ID.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART #
81379	T1	85331-8	TT	COIL—RF, 15 TURNS #30 WIRE, 5 TURNS #30 WIRE ON #91566 FORM	85331-8
81379	T2	421F201	MOUSER	TRANSFORMER—IF, 455 KHZ., PRIMARY 50K OHMS, SECONDARY 500 OHMS, TURNS RATIO 22:1	21093
81379	T3	421F201	MOUSER	TRANSFORMER—IF, 455 KHZ., PRIMARY 50K OHMS, SECONDARY 500 OHMS, TURNS RATIO 22:1	21093
81379	T4	421F201	MOUSER	TRANSFORMER—IF, 455 KHZ., PRIMARY 50K OHMS, SECONDARY 500 OHMS, TURNS RATIO 22:1	21093
81379	T5	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81380	D1	KV3201	FSI	DIODE—VARACTOR, KV3201	28065
81380	IC2	MC145157P	MOT	IC—CMOS SERIAL INPUT PLL FREQUENCY SYNTHESIZER	25213
81380	OV1	PCL1-43-12-	OVENAIR	OVEN—CRYSTAL, HC18/U, 13 VOLT	38174
81380	OV2	PCL1-43-12-	OVENAIR	OVEN—CRYSTAL, HC18/U, 13 VOLT	38174
81389	—	7 MM	AURA	SHIELD CAN-COIL, 7MM NI. PLATED	38131
81389	D200	KV3201	FSI	DIODE—VARACTOR, KV3201	28065
81389	D201	KV3201	FSI	DIODE—VARACTOR, KV3201	28065
81389	D202	KV3201	FSI	DIODE—VARACTOR, KV3201	28065
81389	D203	BA482	AMPEREX	DIODE—PIN, SILICON PLANAR, V.H.F., LOW CAPACITANCE SWITCHING	28056
81389	D204	BA482	AMPEREX	DIODE—PIN, SILICON PLANAR, V.H.F., LOW CAPACITANCE SWITCHING	28056
81389	D205	BA482	AMPEREX	DIODE—PIN, SILICON PLANAR, V.H.F., LOW CAPACITANCE SWITCHING	28056
81389	D206	KV3201	FSI	DIODE—VARACTOR, KV3201	28065

TABLE 7-1 SP325 SINGLE SOURCE PARTS LIST (continued)

S/A No.	ID.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART #
81389	DM200	ND487C1-3R	NEC	DIODE QUAD—MIXER ARRAY	28053
81389	DM201	ND487C1-3R	NEC	DIODE QUAD—MIXER ARRAY	28053
81389	FL200	10M15	TAMA	FILTER—CRYSTAL, 10.7 MHZ, 15 KHZ WIDE	48082
81389	FL201	10M15	TAMA	FILTER—CRYSTAL, 10.7 MHZ, 15 KHZ WIDE	48082
81389	IC200	MC145156P	MOT	IC—CMOS SERIAL INPUT PLL FREQUENCY SYNTHESIZER	25154
81389	IC201	MC12015P	MOT	IC—LOW POWER ECL, DUAL MODULUS, DIVIDE BY 32/33 PRESCALER	25155
81389	IC203	LM2931Z-5	NAT	IC—LOW DROPOUT, LOW CURRENT FIXED 5 VOLT REGULATOR	25156
81389	IC205	MC145156P	MOT	IC—CMOS SERIAL INPUT PLL FREQUENCY SYNTHESIZER	25154
81389	IC206	MC12015P	MOT	IC—LOW POWER ECL, DUAL MODULUS, DIVIDE BY 32/33 PRESCALER	25155
81389	IC207	MC3396P	MOT	IC—200 MHZ FIXED DIVIDE BY 20 PRESCALER	25175
81389	L10	85373	TT	COIL—4 TURNS #30 WIRE ON #98059 PARALYNE COATED BALUN CORE	85373
81389	L201	85331-1	TT	COIL—RF, 12.5 TURNS #24 WIRE ON #91566 FORM	85331-1
81389	L202	85331-2	TT	COIL—RF, 9.5 TURNS #24 WIRE ON #91566 FORM	85331-2
81389	L203	85331-3	TT	COIL—RF, 7.5 TURNS #24 WIRE ON #91566 FORM	85331-3
81389	L204	85331-4	TT	COIL—RF, 5.5 TURNS #24 WIRE ON #91566 FORM	85331-4

TABLE 7-1 SP325 SINGLE SOURCE PARTS LIST (continued)

S/A No.	ID.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART #
81389	L205	85331-5	TT	COIL—RF, 40 TURNS #37 WIRE, 9 TURNS #30 WIRE ON #91566 FORM	85331-5
81389	L206	85331-6	TT	COIL—RF, 10.5 TURNS #28 WIRE ON #91566 FORM	85331-6
81389	L207	85331-6	TT	COIL—RF, 10.5 TURNS #28 WIRE ON #91566 FORM	85331-6
81389	T1	85120	TT	TRANSFORMER—RF, BIFILAR	85120
81389	T2	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81389	T3	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81389	T4	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81389	T5	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81390	—	SPH2 TYPE A	ALPS	SWITCH—DPDT, MICRO LATCHING PUSH BUTTON	32073
81391	—	39-12201	LICON	SWITCH—SPST PUSH BUTTON WITH INTEGRAL LED LAMP	32056
81392	DISP1	FIP9D7	NEC	VACUUM FLUORESCENT DISPLAY 9 DIGITS WITH DECIMAL POINTS	28076
81392	IC1	10951P-50	ROCKWEL	IC—10951P-50 VF NUMERIC DISPLAY DRIVER. SERIAL INPUT, 16 SEGMENT, 16 DIGIT OUTPUTS	25169
81392	KBD1	KHH10902	ALPS	SWITCH—TACTILE P.B., MINIATURE P.C. MOUNTING, LOW CURRENT	32053
81392	LED1	HLMP-1700	HP	LED—RED, T-1 SIZE, LOW CURRENT 2 MA. @ 1.8 VOLTS	28077
81392	LED2	HLMP-1700	HP	LED—RED, T-1 SIZE, LOW CURRENT 2 MA. @ 1.8 VOLTS	28077
81392	LED3	HLMP-1700	HP	LED—RED, T-1 SIZE, LOW CURRENT 2 MA. @ 1.8 VOLTS	28077
81393	—	7 MM	AURA	SHIELD CAN-COIL, 7MM NI. PLATED	38131
81393	D27	5082-3379	HP	DIODE-VHF/UHF ATTENUATOR PIN	28020

TABLE 7-1 SP325 SINGLE SOURCE PARTS LIST (continued)

S/A No.	ID.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART #
81393	DM10	ND487C1-3R	NEC	DIODE QUAD—MIXER ARRAY	28053
81393	FL1	45U20B	TAMA	FILTER—XTAL, 45 MHZ, 20KHZ WIDE	48130
81393	FL2	45U20B	TAMA	FILTER—XTAL, 45 MHZ, 20KHZ WIDE	48130
81393	L32	85331-10	TT	COIL—RF, 9.75 TURNS #30 WIRE ON #91566 FORM	85331-10
81393	L33	85331-9	TT	COIL—RF, 9.5 TURNS #30 WIRE ON #91566 FORM	85331-9
81393	L34	85331-9	TT	COIL—RF, 9.5 TURNS #30 WIRE ON #91566 FORM	85331-9
81393	T11	85366	TT	TRANSFORMER—RF, 17 TURNS #28 WIRE ON (2) #21089 TOROIDS	85366
81393	T12	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81393	T13	85134	TT	TRANSFORMER—RF, TRIFILAR	85134
81394	—	HU-5870-.500-ST	HUDSON	SHIELD CAN—1.062" X 1.39" X .50" TIN PLATED STEEL	38165
81394	IC3	X2404IP	XICOR	IC—X2404IP, 512 X 8 BIT ELECTRICALLY ERASABLE PROM	25248
81394	IC4	98175	TT	IC—HITACHI MICROPROCESSOR HD637A05V0P, CUSTOM PROGRAM	98175
81394	IC8	CD-1681N	TDK	MODULE—DC TO DC CONVERTER INPUT 5 VDC, OUTPUTS 3 VOLTS AC R.M.S. @ 22 MA., -24 VDC @ 7 MA.	25202
81394	L2	85319	TT	COIL—RF, 18 TURNS #26 WIRE ON #21089 CORE	85319
81394	L3	85319	TT	COIL—RF, 18 TURNS #26 WIRE ON #21089 CORE	85319
81394	R30	EVN-36CA00B14	PANSC	RESISTOR—VARIABLE, 10K P.C. MOUNTING	30263

TABLE 7-2 PART MANUFACTURER'S INFORMATION

MFGR'S CODE	MANUFACTURER NAME AND ADDRESS
ALPS	ALPS Electric (USA), Inc., 3553 North First Street, San Jose, CA 95134
AMPEREX	Amperex Electronic Corporation, George Washington Highway, Smithfield, RI 02917
AURA	Aura Mfg. Company, 50 McDermatt Rd., North Haven, CT 06473
CSF	Thompson-CSF Components Corporation, Semiconductor Division, 6660 Variel Avenue, Canoga Park, CA 91303
FSI	Frequency Sources Inc., Semiconductor Division, 16 Maple Rd., Chelmsford, MA 01824
HP	Hewlett Packard Co., P.O. Box 10301, Palo Alto, CA 94303-0890
HUDSON	Hudson Tool and Die, 18 Malvern Street, Newark, NJ 07108
LICON	LICON, 6615 West Irving Park Road, Chicago, IL 60634
MOT	Motorola Semiconductor Products Inc., 3501 Ed Bluestein Blvd., Austin, TX 78721
MOUSER	MOUSER ELECTRONICS, Distribution Center, 2401 Highway 287 North, Mansfield, TX 76063
MURATA	MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Drive, Smyrna, GA 30080
NAT	National Semiconductor Corporation, 2900 Semiconductor Drive, Santa Clara, CA 95051
NEC	NEC Electronics Inc., Corporate Headquarters, 401 Ellis Street, Mountain View, CA 94043
NETSCI	Network Sciences, 3382 West Osborn Rd., Phoenix, AZ 85017
OVENAIR	OVENAIRE, 706 Forrest Street, Charlottesville, VA 22901

TABLE 7-2 PART MANUFACTURER'S INFORMATION (continued)

MFGR'S CODE	MANUFACTURER NAME AND ADDRESS
PANSC	Panasonic Industrial Company, Electronic Components Division, One Panasonic Way, Secaucus, NJ 07094
ROCKWEL	Rockwell International, Semiconductor Products Division, 4311 Jamboree Rd., Newport Beach, CA 92658-8902
SIEMENS	Siemens Corporation, 186 Wood Avenue South, Iselin, NJ 08830
SIGNET	Signetics Corporation, 811 East Arques Avenue, Sunnyvale, CA 94088-3409
TAMA	TAMA Electronics Co., LTD., 3-51-10 Higashi-Oizumi, Nerima-Ku, Tokyo 177, Japan
TDK	TDK Corporation Of America, 4709 Golf Road, Suite 300, Skokie, IL 60076
TT	Ten-Tec, Inc., Highway 411 East, Sevierville, TN 37862
XICOR	XICOR, Inc., 851 Buckeye Court, Milpitas, CA 95035

CHAPTER 8

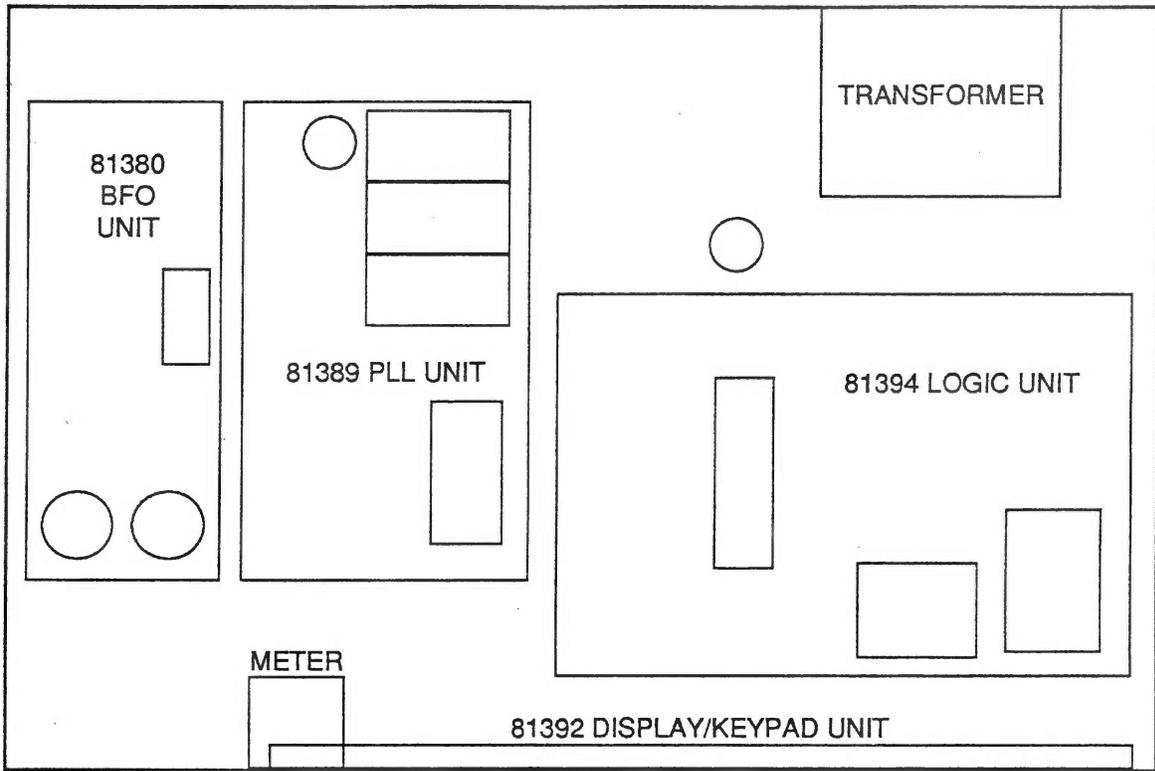
FINAL ASSEMBLY PARTS LIST

8-1 INTRODUCTION Table 8-1 is a listing of all the modules that can be replaced in corrective maintenance procedures. The part numbers listed are assigned by Ten-Tec, Inc. Figure 8-1 illustrates where these modules are located. Table 8-2 is a listing of additional small parts which may need to be replaced if the SP-325 has been damaged.

TABLE 8-1 SP-325 MODULE PARTS LIST

Qty	Description	Part No.
1	AUDIO UNIT	81378
1	IF UNIT	81379
1	BFO UNIT	81380
1	PLL UNIT	81389
1	SWITCH BD. #1	81390
1	SWITCH BD. #2	81391
1	DISPLAY/KEYPAD	81392
1	RF UNIT	81393
1	LOGIC UNIT	81394

TOP VIEW



BOTTOM VIEW

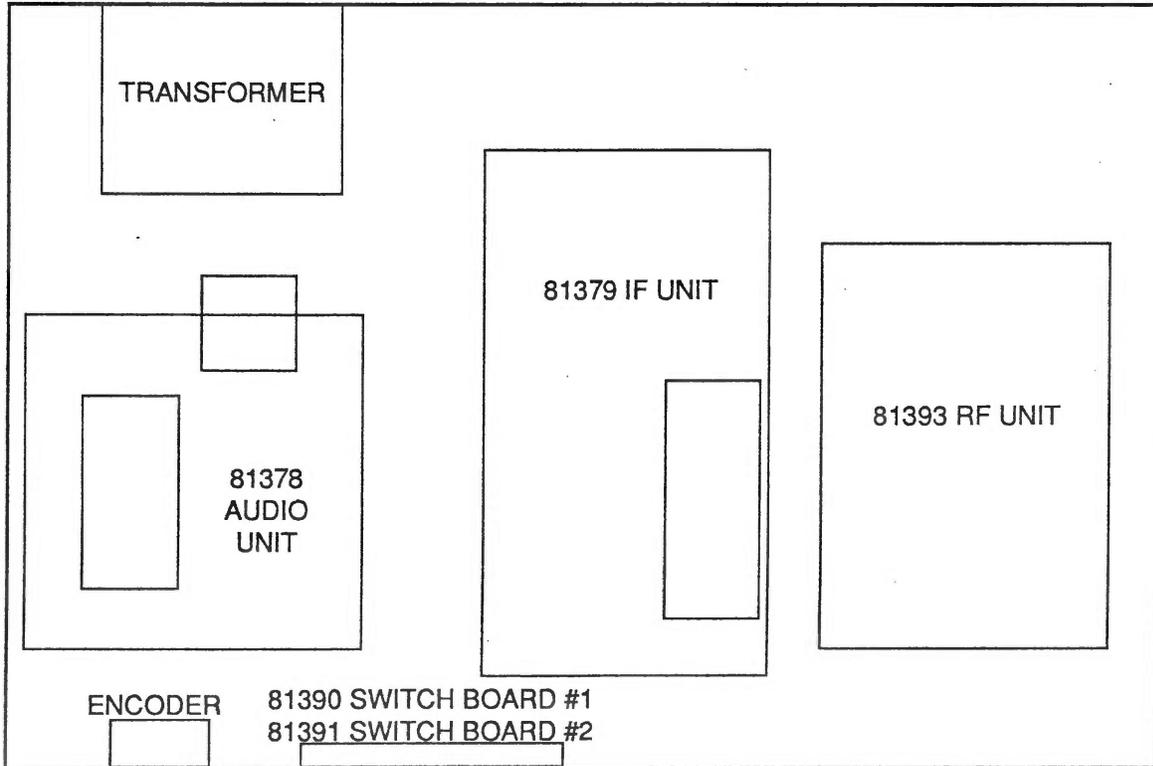


FIGURE 8-1. CIRCUIT BOARD MODULE LOCATION DIAGRAM

TABLE 8-2 FINAL ASSEMBLY REPLACEABLE PARTS

Ten-Tec PART No.	DESCRIPTION	LOCATION
27009 27040	FUSEHOLDER—3AG, PANEL MOUNTING TYPE SURGE PROTECTOR, ANTENNA RF, 100 WATTS	Rear Panel Across ANT. Connector on Rear Panel
27047 32061 35008 35164	FUSE—MDL 1/2A., SLOW BLOW SWITCH—POWER, ROCKER SPDT, 2 AMP. JACK—PHONE, SWITCHCRAFT HI-D #112A BARRIER STRIP, 2 TERMINAL	Rear Panel Rear Panel Front Panel Front Panel
35202 35203 38175	RECEPTACLE—3 CONTACT, AC LINE CORD ANTENNA CONNECTOR—AMPHENOL 82-368 HANDLE—RACK MOUNT	Rear Panel (used for 600Ω LINE OUTPUT) Rear Panel Rack Mount Side Bracket
46138 70096 74184	DETACHABLE 3 WIRE AC LINE CORD SHIPPING CARTON—SP325 MANUAL, SP-325	Packing Kit Packing Kit Packing Kit
81395 81396 81397 81398 92196 92197	METER SUB-ASSEMBLY WITH LAMP ENCODER SUB-ASSEMBLY WITH CABLE MAIN TUNING KNOB WITH SLEEVE AND TRIM RING POWER SUPPLY TRANSFORMER SUB-ASSEMBLY BUTTON—LARGE RUBBER, MHZ UP/DOWN BUTTON—SWITCH, BLACK PLASTIC	Front Panel Front Panel Front Panel ENCODER Inside, Rear Panel Front Panel Front Panel Latching P.B. Switch Assembly
92262 92308 92309-CL 92310-CL1A 92311	KNOB—SMALL, BLACK PLASTIC CHASSIS—MAIN DECK BACK-UP PLATE, FRONT PANEL FRONT PANEL SUB-PANEL	Front Panel VOLUME Control Interior Between Side Panels Behind Front Panel Front Panel Behind Front Panel, Attached to Chassis
92312	SIDE PANEL	Attached to Left and Right Sides of Chassis
92313-CL1A 92318-CL 92319-CL 92325	REAR PANEL TOP AND BOTTOM COVER SIDE BRACKET—RACK MOUNT DIAL-GLASS, BLUE TINTED	Rear Panel Top and Bottom Rack Mount Side Bracket Plastic Bezel in Front of Display
98173	BEZEL SUB-ASSEMBLY WITH KEYPAD & COVER	Attached to Front of Front Panel

CHAPTER 9

ILLUSTRATIONS

9-1 INTRODUCTION This chapter contains the detailed illustrations for the manual. This includes the schematic diagrams, parts lists, component location illustrations and in some cases circuit board trace views.

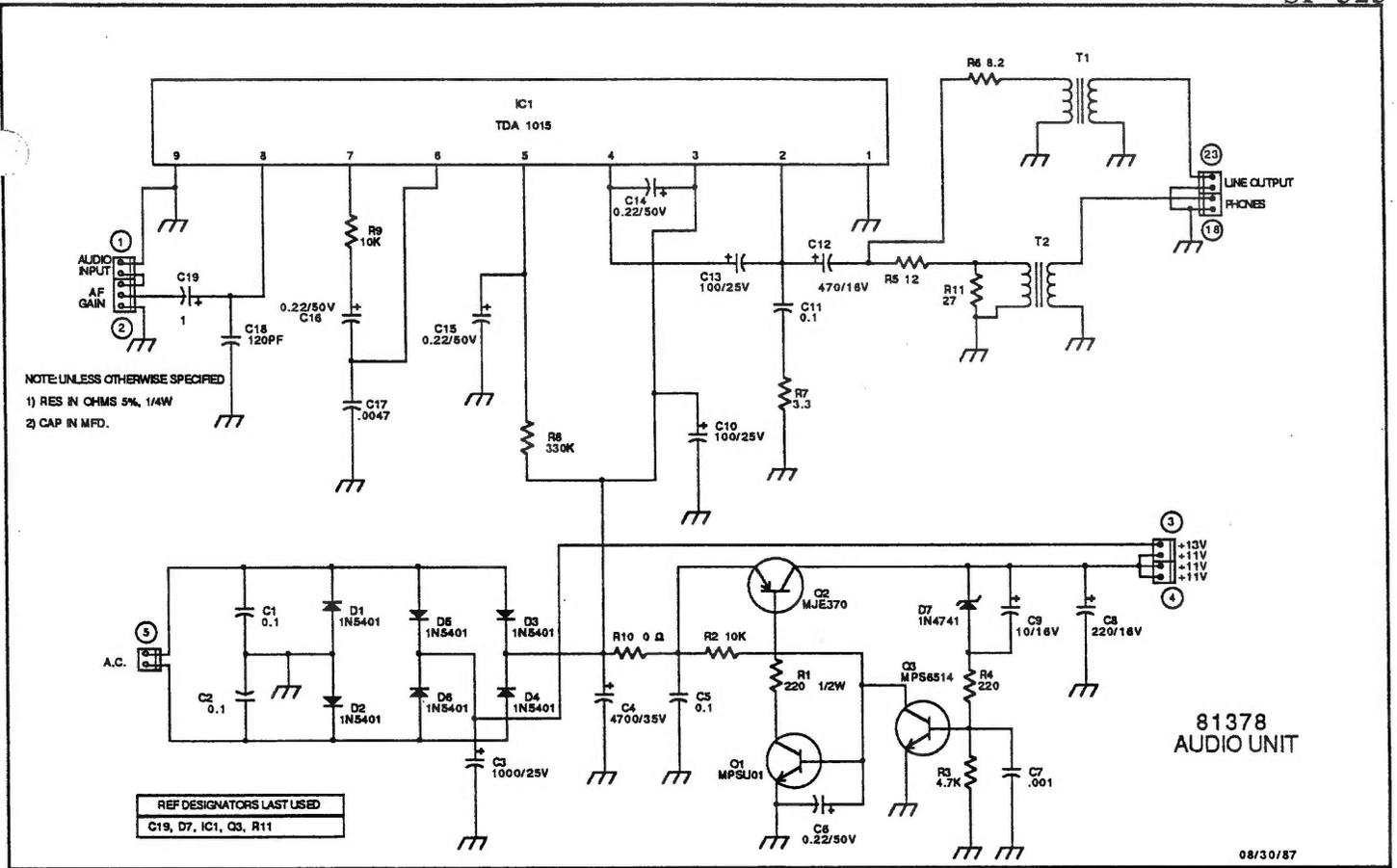


FIGURE 9-1. 81378 AUDIO UNIT SCHEMATIC

ID.	Description	Part No.	ID.	Description	Part No.
C1	0.1	23006	D4	1N5401	28047
C2	0.1	23006	D5	1N5401	28047
C3	1000/25V	23042	D6	1N5401	28047
C4	4700/35V	23191	D7	1N4741	28007
C5	0.1	23006	IC1**	TDA 1015	25199
C6	0.22/50V	23197	Q1	MPSU01	25053
C7	.001	23133	Q2	MJE370	25105
C8	220/16V	23202	Q3	MPS6514	25054
C9	10/16V	23222	R1	220 1/2W	30005
C10	100/25V	23189	R2	10K	30150
C11	0.1	23006	R3	4.7K	30146
C12	470/16V	23228	R4	220	30130
C13	100/25V	23189	R5	12	30116
C14	0.22/50V	23197	R6	8.2	30114
C15	0.22/50V	23197	R7	3.3	30109
C16	0.22/50V	23197	R8	330K	30167
C17	.0047	23293	R9	10K	30150
C18	120PF	23347	R10	0 Ω	30353
C19	1	23264	R11	27	30119
D1	1N5401	28047	T1**	TRANSFORMER	81400
D2	1N5401	28047	T2**	TRANSFORMER	81400-1
D3	1N5401	28047			

NOTE: UNLESS OTHERWISE SPECIFIED
 1) RESISTORS IN OHMS ±5%, 1/4W
 2) CAPACITORS IN MICROFARADS (μF)

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

TABLE 9-1. 81378 AUDIO UNIT PARTS LIST

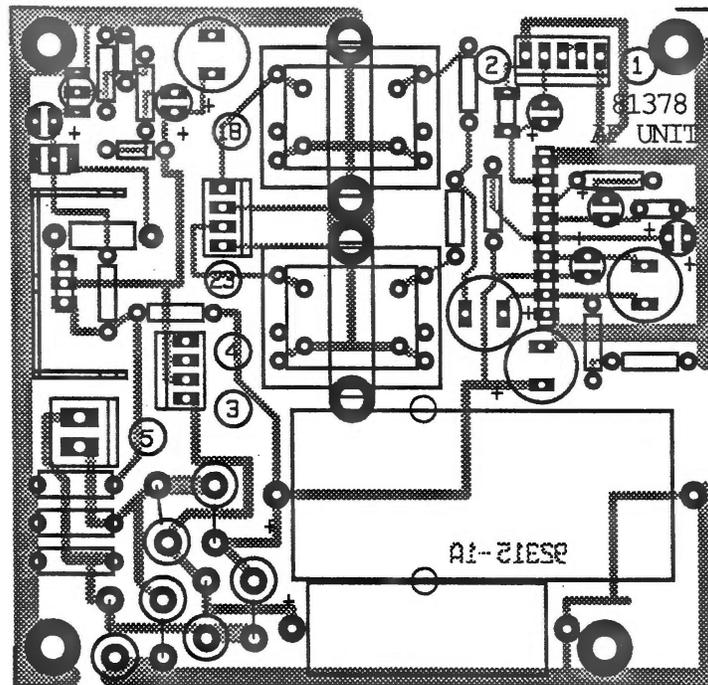


FIGURE 9-2. 81378 AUDIO UNIT CIRCUIT TRACE

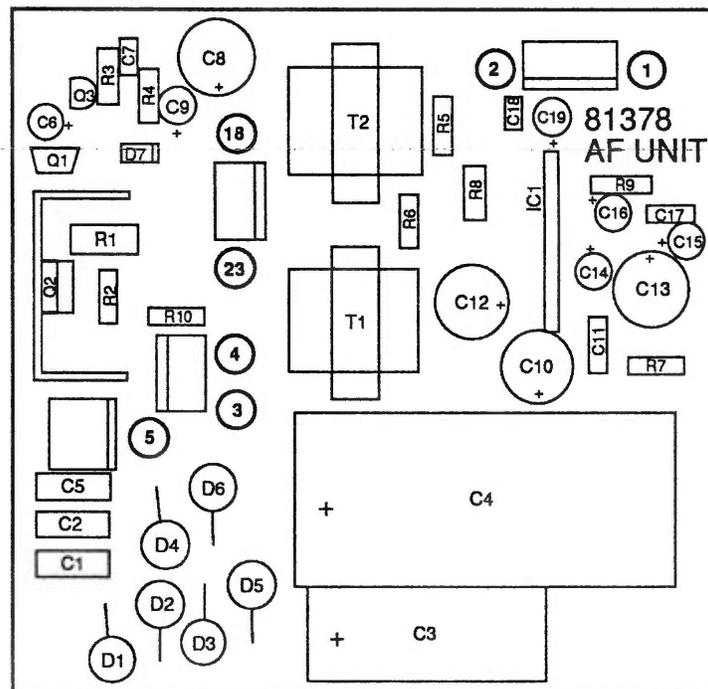


FIGURE 9-3. 81378 AUDIO UNIT COMPONENT LAYOUT

FIGURE 9-4. 81379 IF UNIT SCHEMATIC

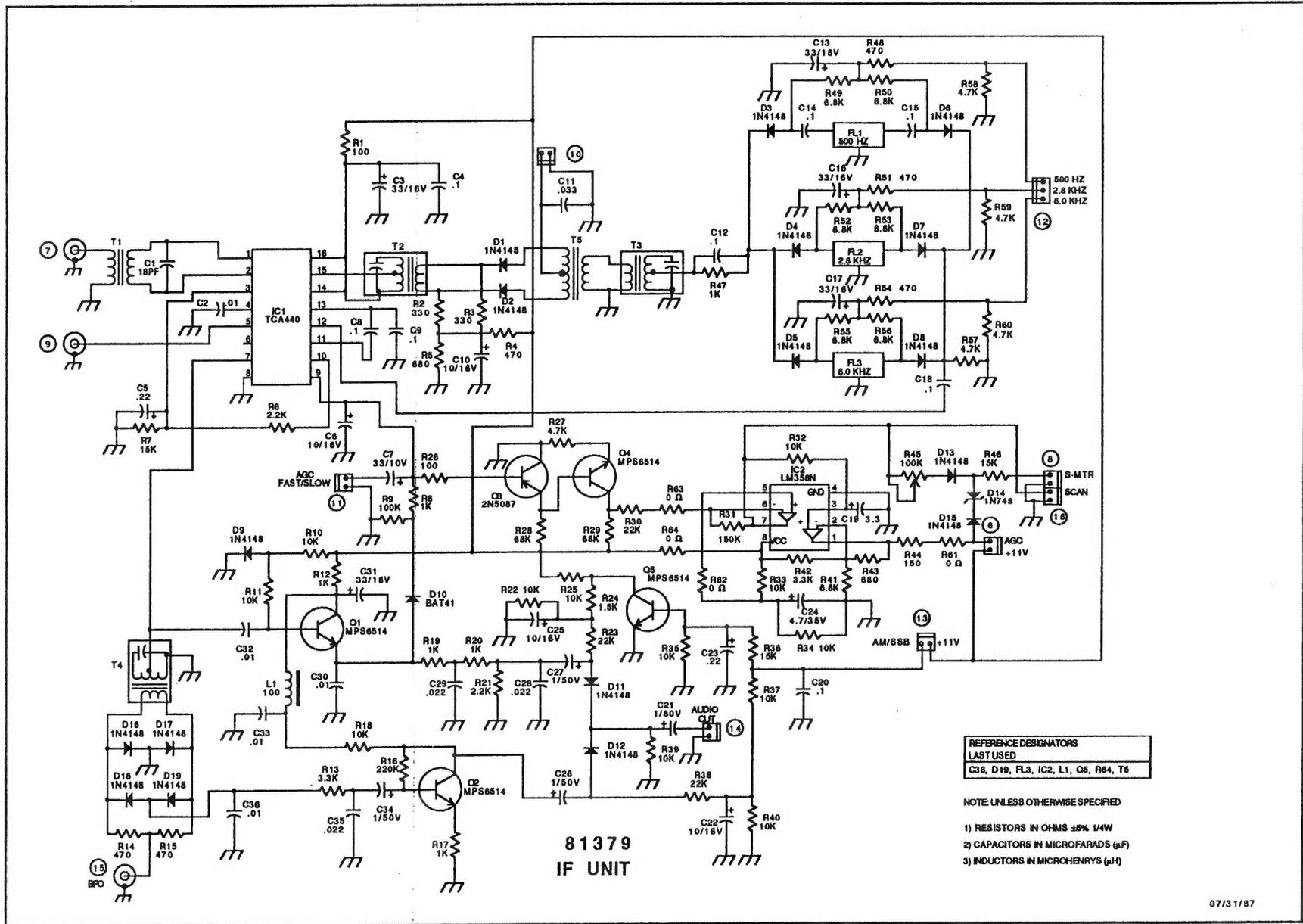


TABLE 9-2. 81379 IF UNIT PARTS LIST

ID.	Description	Part No.	ID.	Description	Part No.
C1	18PF	23302	D16	1N4148	28001
C2	.01	23260	D17	1N4148	28001
C3	33/16V	23182	D18	1N4148	28001
C4	.1	23261	D19	1N4148	28001
C5	.22	23197	FL1**	500 HZ	48138
C6	10/16V	23222	FL2**	2.8 KHZ	48128
C7	33/10V	23308	FL3**	6.0 KHZ	48129
C8	.1	23261	IC1**	TCA440	25200
C9	.1	23261	IC2	LM358N	25117
C10	10/16V	23222	L1	100	21060
C11	.033	23290	Q1	MPS6514	25054
C12	.1	23261	Q2	MPS6514	25054
C13	33/16V	23182	Q3	2N5087	25001
C14	.1	23261	Q4	MPS6514	25054
C15	.1	23261	Q5	MPS6514	25054
C16	33/16V	23182	R1	100	30126
C17	33/16V	23182	R2	330	30132
C18	.1	23261	R3	330	30132
C19	3.3	23265	R4	470	30134
C20	.1	23261	R5	680	30136
C21	1/50V	23264	R6	2.2K	30142
C22	10/16V	23222	R7	15K	30076
C23	.22	23197	R8	1K	30138
C24	4.7/35V	23310	R9	100K	30161
C25	10/16V	23222	R10	10K	30150
C26	1/50V	23264	R11	10K	30150
C27	1/50V	23264	R12	1K	30138
C28	.022	23289	R13	3.3K	30144
C29	.022	23289	R14	470	30134
C30	.01	23260	R15	470	30134
C31	33/16V	23182	R16	220K	30077
C32	.01	23260	R17	1K	30138
C33	.01	23260	R18	10K	30150
C34	1/50V	23264	R19	1K	30138
C35	.022	23289	R20	1K	30138
C36	.01	23260	R21	2.2K	30142
D1	1N4148	28001	R22	10K	30150
D2	1N4148	28001	R23	22K	30154
D3	1N4148	28001	R24	1.5K	30140
D4	1N4148	28001	R25	10K	30150
D5	1N4148	28001	R26	100	30126
D6	1N4148	28001	R27	4.7K	30146
D7	1N4148	28001	R28	68K	30159
D8	1N4148	28001	R29	68K	30159
D9	1N4148	28001	R30	22K	30154
D10**	BAT41	28071	R31	150K	30163
D11	1N4148	28001	R32	10K	30150
D12	1N4148	28001	R33	10K	30150
D13	1N4148	28001	R34	10K	30150
D14	1N748	28021	R35	10K	30150
D15	1N4148	28001	R36	15K	30076

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

TABLE 9-2. 81379 IF UNIT PARTS LIST (CONTINUED)

ID.	Description	Part No.
R37	10K	30150
R38	22K	30154
R39	10K	30150
R40	10K	30150
R41	6.8K	30148
R42	3.3K	30144
R43	680	30136
R44	150	30128
R45**	100K	30338
R46	15K	30076
R47	1K	30138
R48	470	30134
R49	6.8K	30148
R50	6.8K	30148
R51	470	30134
R52	6.8K	30148
R53	6.8K	30148
R54	470	30134
R55	6.8K	30148
R56	6.8K	30148
R57	4.7K	30146
R58	4.7K	30146
R59	4.7K	30146
R60	4.7K	30146
R61	0 Ω	30353
R62	0 Ω	30353
R63	0 Ω	30353
R64	0 Ω	30353
T1**	TRANSFORMER	85331-8
T2**	XFMR-IF,455KHZ	21093
T3**	XFMR-IF,455KHZ	21093
T4**	XFMR-IF,455KHZ	21093
T5**	XFMR-RF	85134

NOTE: UNLESS OTHERWISE SPECIFIED

- 1) RESISTORS IN OHMS $\pm 5\%$ 1/4W
- 2) CAPACITORS IN MICROFARADS (μF)
- 3) INDUCTORS IN MICROHENRYS (μH)

** DENOTES SINGLE SOURCE PART LISTED
IN TABLE 7-1

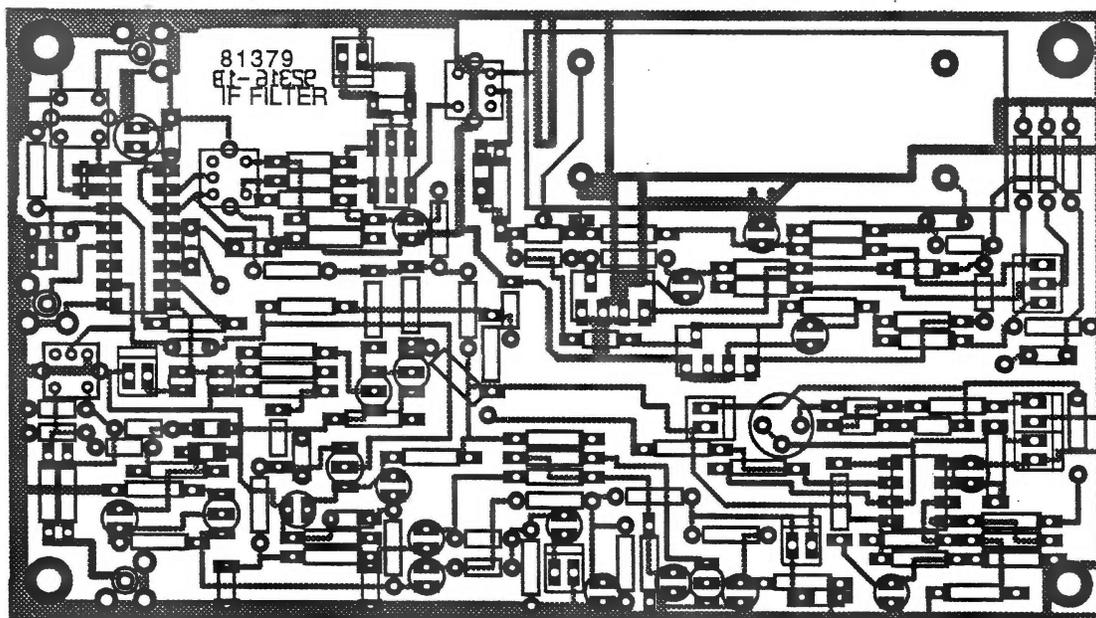


FIGURE 9-5. 81379 CIRCUIT TRACE

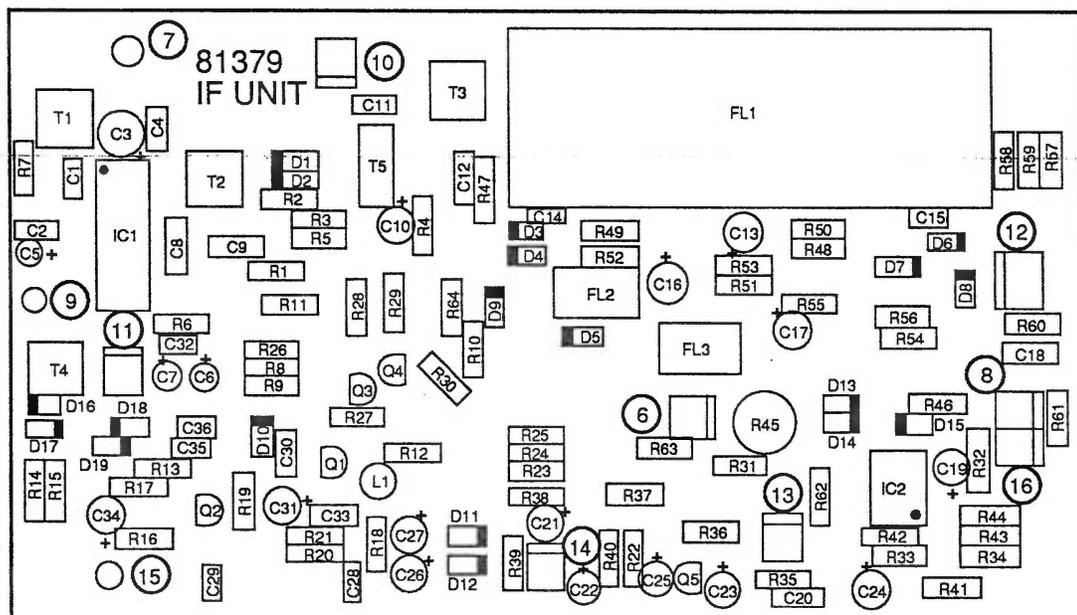
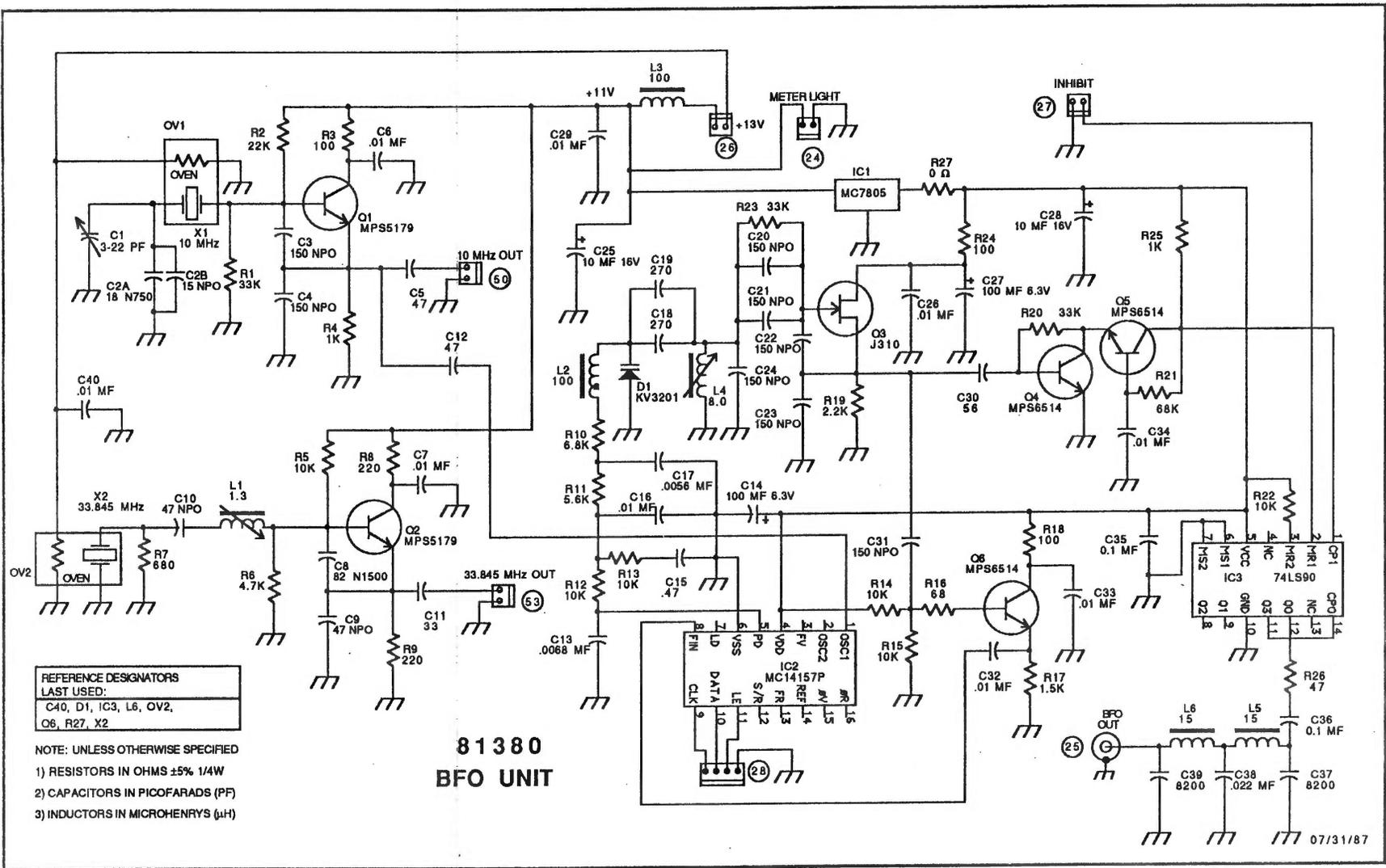


FIGURE 9-6. 81379 IF UNIT COMPONENT LAYOUT

FIGURE 9-7. 81380 BFO SCHEMATIC



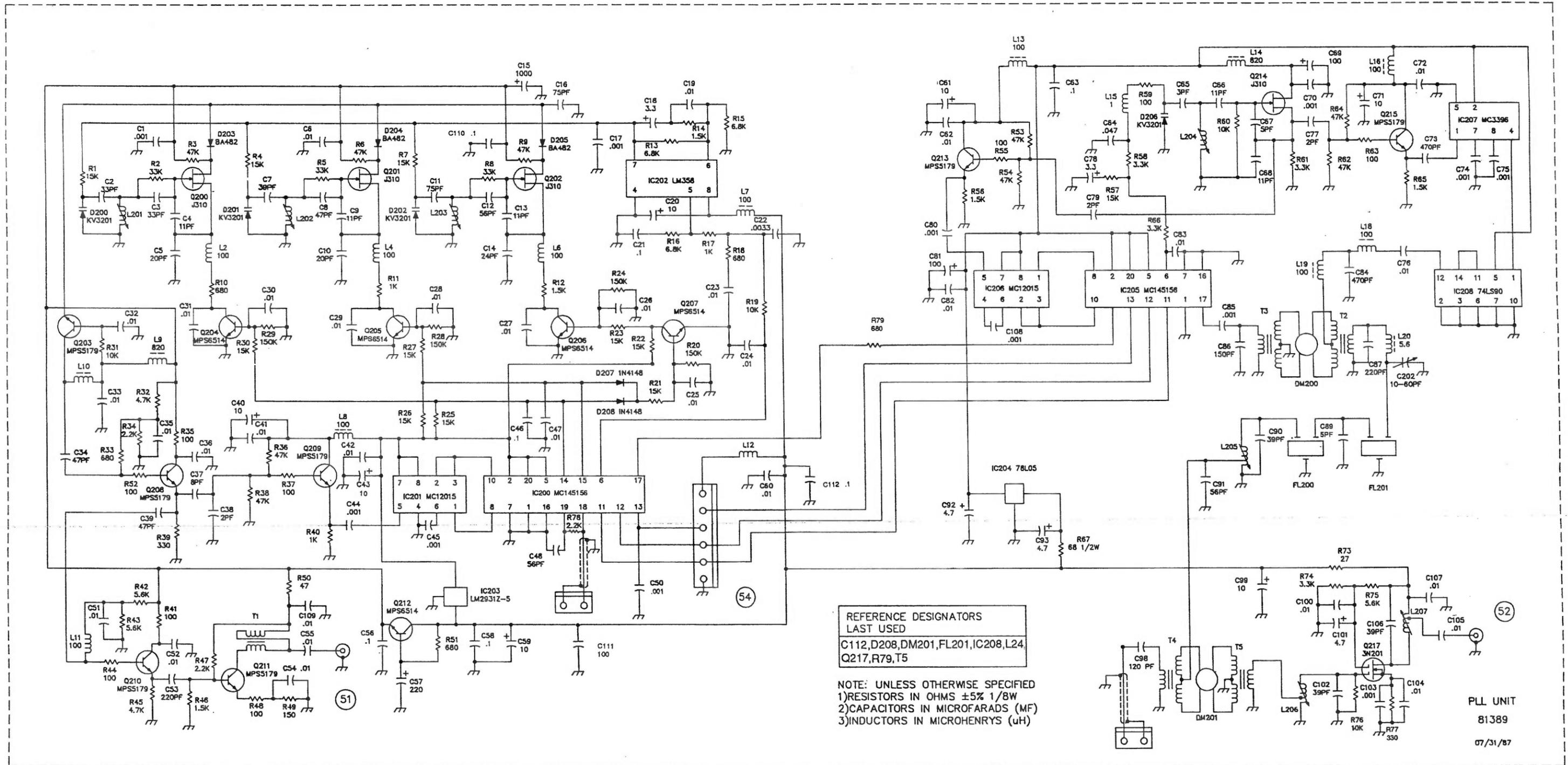


FIGURE 9-10. 81389 PLL UNIT SCHEMATIC

TABLE 9-3. 81380 BFO PARTS LIST

ID.	Description	Part No.	ID.	Description	Part No.
C1	3-22 PF	23168	L4	8.0	21055
C2A	18 N750	23091	L5	15	21126
C2B	15 NPO	23111	L6	15	21126
C3	150 NPO	23225	OV1**	OVEN	38174
C4	150 NPO	23225	OV2**	OVEN	38174
C5	47	23152	Q1	MPS5179	25135
C6	.01 MF	23260	Q2	MPS5179	25135
C7	.01 MF	23260	Q3	J310	25115
C8	82 N1500	23140	Q4	MPS6514	25054
C9	47 NPO	23152	Q5	MPS6514	25054
C10	47 NPO	23152	Q6	MPS6514	25054
C11	33	23246	R1	33K	30155
C12	47	23152	R2	22K	30154
C13	.0068 MF	23338	R3	100	30126
C14	100 MF 6.3V	23267	R4	1K	30138
C15	.47	23330	R5	10K	30150
C16	.01 MF	23005	R6	4.7K	30146
C17	.0056 MF	23337	R7	680	30136
C18	270	23201	R8	220	30130
C19	270	23201	R9	220	30130
C20	150 NPO	23225	R10	6.8K	30148
C21	150 NPO	23225	R11	5.6K	30147
C22	150 NPO	23225	R12	10K	30150
C23	150 NPO	23225	R13	10K	30150
C24	150 NPO	23225	R14	10K	30150
C25	10 MF 16V	23222	R15	10K	30150
C26	.01 MF	23260	R16	68	30124
C27	100 MF 6.3V	23267	R17	1.5K	30140
C28	10 MF 16V	23222	R18	100	30126
C29	.01 MF	23260	R19	2.2K	30142
C30	56	23142	R20	33K	30155
C31	150 NPO	23225	R21	68K	30159
C32	.01 MF	23260	R22	10K	30150
C33	.01 MF	23260	R23	33K	30155
C34	.01 MF	23260	R24	100	30126
C35	0.1 MF	23261	R25	1K	30138
C36	0.1 MF	23261	R26	47	30122
C37	8200	23339	R27	0 Ω	30353
C38	.022 MF	23289	X1	10 MHz	48139
C39	8200	23339	X2	33.845 MHz	48140
C40	.01 MF	23260			
D1**	KV3201	28065			
IC1	MC7805	25095			
IC2**	MC14157P	25213			
IC3	74LS90	25176			
L1	1.3	21058			
L2	100	21060			
L3	100	21060			

NOTE: UNLESS OTHERWISE SPECIFIED

1) RESISTORS IN OHMS $\pm 5\%$ 1/4W

2) CAPACITORS IN PICO FARADS (PF)

3) INDUCTORS IN MICROHENRYS (μ H)

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

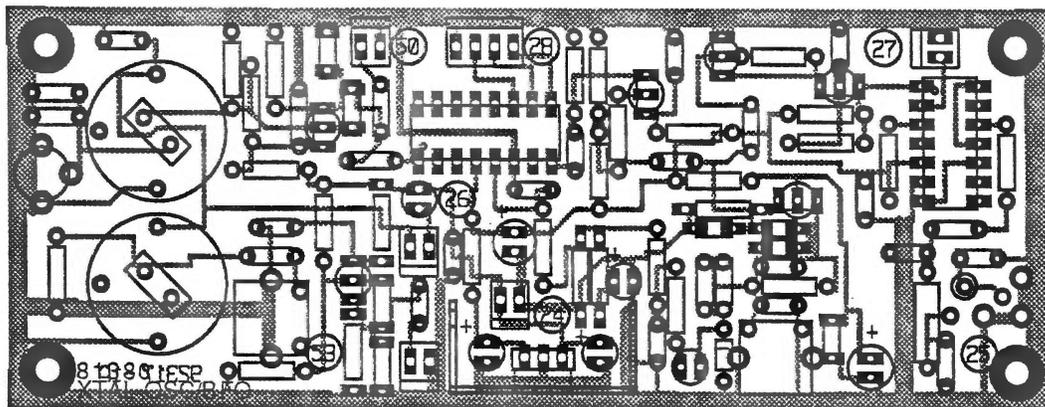


FIGURE 9-8. 81380 BFO UNIT CIRCUIT TRACE

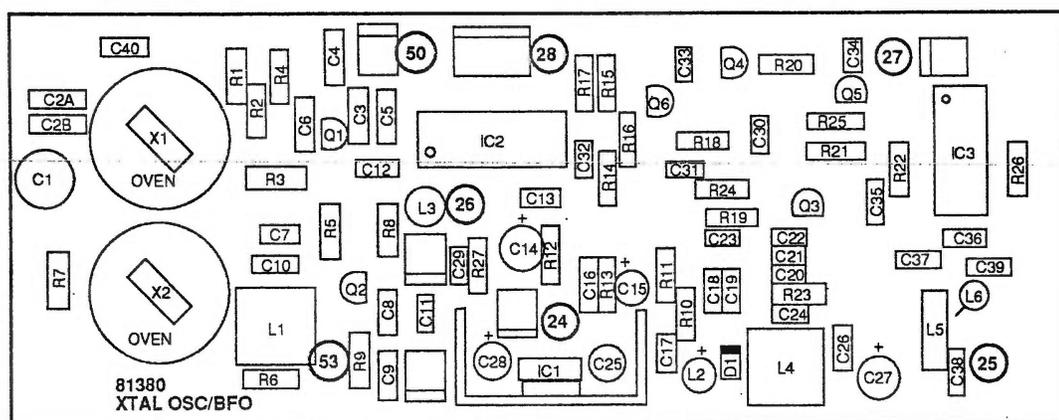


FIGURE 9-9. 81380 BFO UNIT COMPONENT LAYOUT

TABLE 9-4. 81389 PLL UNIT PARTS LIST

ID.	Description	Part No.	ID.	Description	Part No.
C1	.001	23245	C52	.01	23318
C2	33PF	23246	C53	220PF	23322
C3	33PF	23246	C54	.01	23318
C4	11PF	23252	C55	.01	23318
C5	20PF	23254	C56	.1	23261
C6	.01	23318	C57	220/16V	23202
C7	39PF	23304	C58	.1	23261
C8	47PF	23257	C59	10/16V	23266
C9	11PF	23252	C60	.01	23318
C10	20PF	23254	C61	10/16V	23266
C11	75PF	23315	C62	.01	23318
C12	56PF	23305	C63	.1	23261
C13	11PF	23252	C64	.047	23291
C14	24PF	23255	C65	3PF	23248
C15	1000/16V	23200	C66	11PF	23252
C16	75PF	23315	C67	5PF	23249
C17	.001	23282	C68	11PF	23252
C18	3.3	23265	C69	100/6.3V	23267
C19	.01	23318	C70	.001	23245
C20	10/16V	23266	C71	10/16V	23266
C21	.1	23006	C72	.01	23318
C22	.0033	23288	C73	470PF	23259
C23	.01	23318	C74	.001	23245
C24	.01	23005	C75	.001	23245
C25	.01	23318	C76	.01	23318
C26	.01	23318	C77	2PF	23301
C27	.01	23318	C78	3.3	23265
C28	.01	23318	C79	2PF	23301
C29	.01	23318	C80	.001	23245
C30	.01	23318	C81	100/6.3V	23267
C31	.01	23318	C82	.01	23318
C32	.01	23318	C83	.01	23318
C33	.01	23318	C84	470PF	23259
C34	47PF	23257	C85	.001	23245
C35	.01	23318	C86	150PF	23278
C36	.01	23318	C87	220PF	23322
C37	8PF	23250	C88	NOT USED	
C38	2PF	23301	C89	5PF	23249
C39	47PF	23257	C90	39PF	23304
C40	10/16V	23266	C91	56PF	23305
C41	.01	23318	C92	4.7/35V	23310
C42	.01	23318	C93	4.7/35V	23310
C43	10/16V	23266	C94	NOT USED	
C44	.001	23245	C95	NOT USED	
C45	.001	23245	C96	NOT USED	
C46	.1	23261	C97	NOT USED	
C47	.01	23318	C98	120PF	23258
C48	56PF	23305	C99	10/16V	23266
C49	NOT USED		C100	.01	23318
C50	.001	23245	C101	4.7/35V	23310
C51	.01	23318	C102	39PF	23304

TABLE 9-4. 81389 PLL UNIT PARTS LIST (CONTINUED)

ID.	Description	Part No.	ID.	Description	Part No.
C103	.001	23245	L202**	COIL-RF	85331-2
C104	.01	23318	L203**	COIL-RF	85331-3
C105	.01	23318	L204**	COIL-RF	85331-4
C106	39PF	23304	L205**	COIL-RF	85331-5
C107	.01	23318	L206**	COIL-RF	85331-6
C108	.001	23245	L207**	COIL-RF	85331-6
C109	.01	23318	Q200	J310	25115
C202	10-60PF	23268	Q201	J310	25115
D200**	KV3201	28065	Q202	J310	25115
D201**	KV3201	28065	Q203	MPS5179	25135
D202**	KV3201	28065	Q204	MPS6514	25054
D203**	BA482	28056	Q205	MPS6514	25054
D204**	BA482	28056	Q206	MPS6514	25054
D205**	BA482	28056	Q207	MPS6514	25054
D206**	KV3201	28065	Q208	MPS5179	25135
D207	1N4148	28001	Q209	MPS5179	25135
D208	1N4148	28001	Q210	MPS5179	25135
DM200**	QUAD MIXER	28053	Q211	MPS5179	25135
DM201**	QUAD MIXER	28053	Q212	MPS6514	25054
FL200**	10.7MHZ FLTR.	48082	Q213	MPS5179	25135
FL201**	10.7MHZ FLTR.	48082	Q214	J310	25115
IC200**	MC145156	25154	Q215	MPS5179	25135
IC201**	MC12015	25155	Q216	NOT USED	
IC202	LM358N	25117	Q217	3N201	25119
IC203**	LM2931Z-5	25156	R1	15K	30253
IC204	78L05	25072	R2	33K	30255
IC205**	MC145156	25154	R3	47K	30256
IC206**	MC12015	25155	R4	15K	30253
IC207**	MC3396	25175	R5	33K	30255
IC208	74LS90	25176	R6	47K	30300
L1	NOT USED		R7	15K	30253
L2	100	21060	R8	33K	30255
L3	NOT USED		R9	47K	30256
L4	100	21060	R10	680	30292
L5	NOT USED		R11	1K	30333
L6	100	21060	R12	1.5K	30322
L7	100	21060	R13	6.8K	30250
L8	100	21060	R14	1.5K	30245
L9	820	21095	R15	6.8K	30250
L10**	21.5	85373	R16	6.8K	30250
L11	100	21060	R17	1K	30244
L12	CHOKE-RF	85124	R18	680	30243
L13	100	21060	R19	10K	30296
L14	820	21095	R20	150K	30259
L15	1	21112	R21	15K	30253
L16	100	21060	R22	15K	30297
L17	NOT USED		R23	15K	30297
L18	100	21060	R24	150K	30259
L19	100	21060	R25	15K	30297
L20	5.6	21121	R26	15K	30297
L201**	COIL-RF	85331-1	R27	15K	30297

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

TABLE 9-4. PLL UNIT PARTS LIST (CONTINUED)

ID.	Description	Part No.
R28	150K	30259
R29	150K	30259
R30	15K	30297
R31	10K	30252
R32	4.7K	30248
R33	680	30243
R34	2.2K	30246
R35	100	30309
R36	47K	30256
R37	100	30318
R38	47K	30256
R39	330	30241
R40	1K	30333
R41	100	30318
R42	5.6K	30249
R43	5.6K	30249
R44	100	30318
R45	4.7K	30248
R46	1.5K	30245
R47	2.2K	30246
R48	100	30318
R49	150	30239
R50	47	30238
R51	680	30243
R52	100	30309
R53	47K	30256
R54	47K	30256
R55	100	30318
R56	1.5K	30245
R57	15K	30253
R58	3.3K	30247
R59	100	30318
R60	10K	30252
R61	3.3K	30247
R62	47K	30256
R63	100	30309
R64	47K	30300
R65	1.5K	30245
R66	3.3K	30247
R67	68,1/2W	30060
R68	NOT USED	
R69	NOT USED	
R70	NOT USED	
R71	NOT USED	
R72	NOT USED	
R73	27	30236
R74	3.3K	30247
R75	5.6K	30249
R76	3.3K	30247
R77	330	30241
R78	2.2K	30246

ID.	Description	Part No.
R79	680	30292
T1**	XFMR-RF	85120
T2**	XFMR-RF	85134
T3**	XFMR-RF	85134
T4**	XFMR-RF	85134
T5**	XFMR-RF	85134

NOTE: UNLESS OTHERWISE SPECIFIED

1) RESISTORS IN OHMS $\pm 5\%$ 1/8W

2) CAPACITORS IN MICROFARADS (MF)

3) INDUCTORS IN MICROHENRYS (μ H)

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

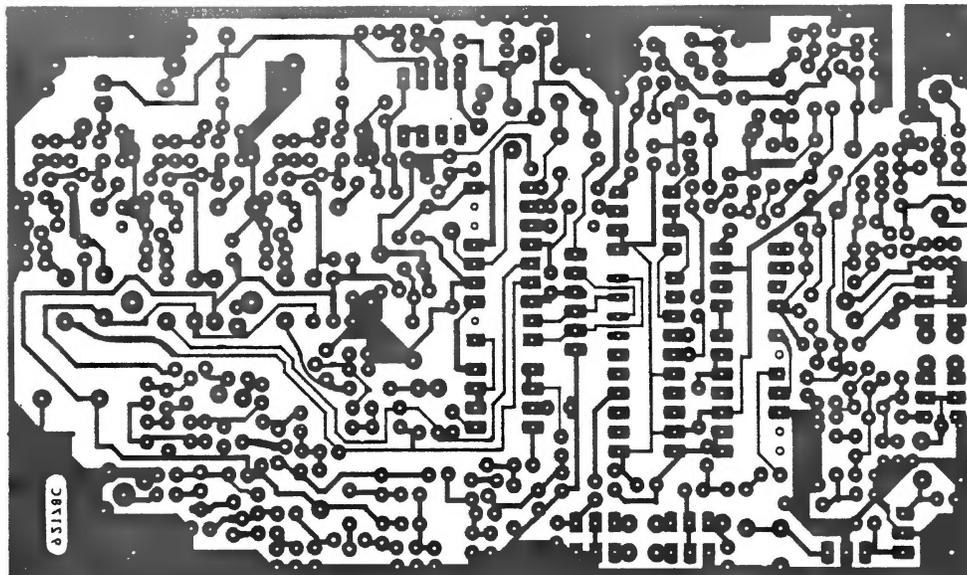


FIGURE 9-11. 81389 PLL UNIT CIRCUIT TRACE

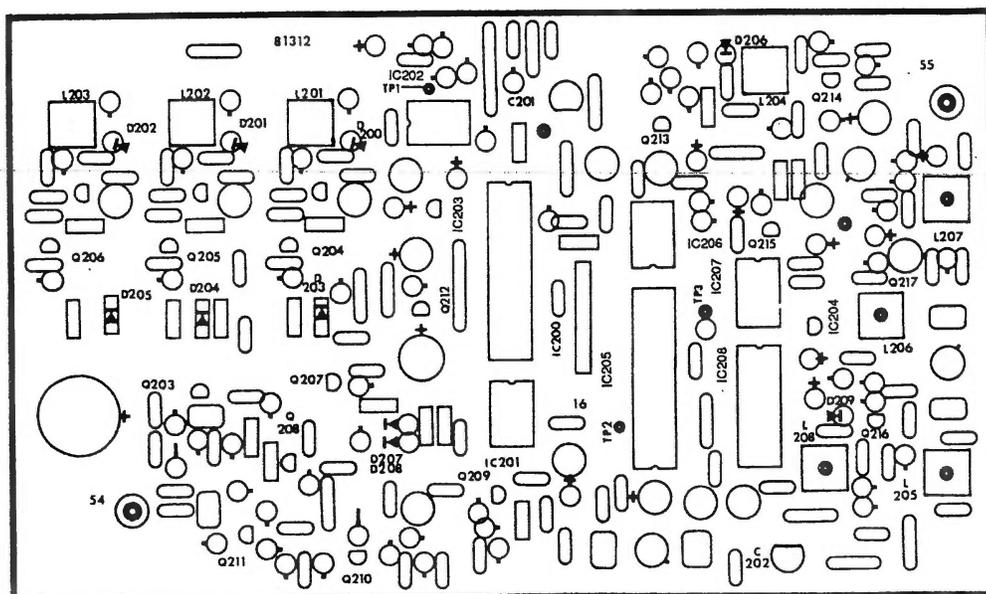


FIGURE 9-12. 81389 PLL UNIT COMPONENT LAYOUT

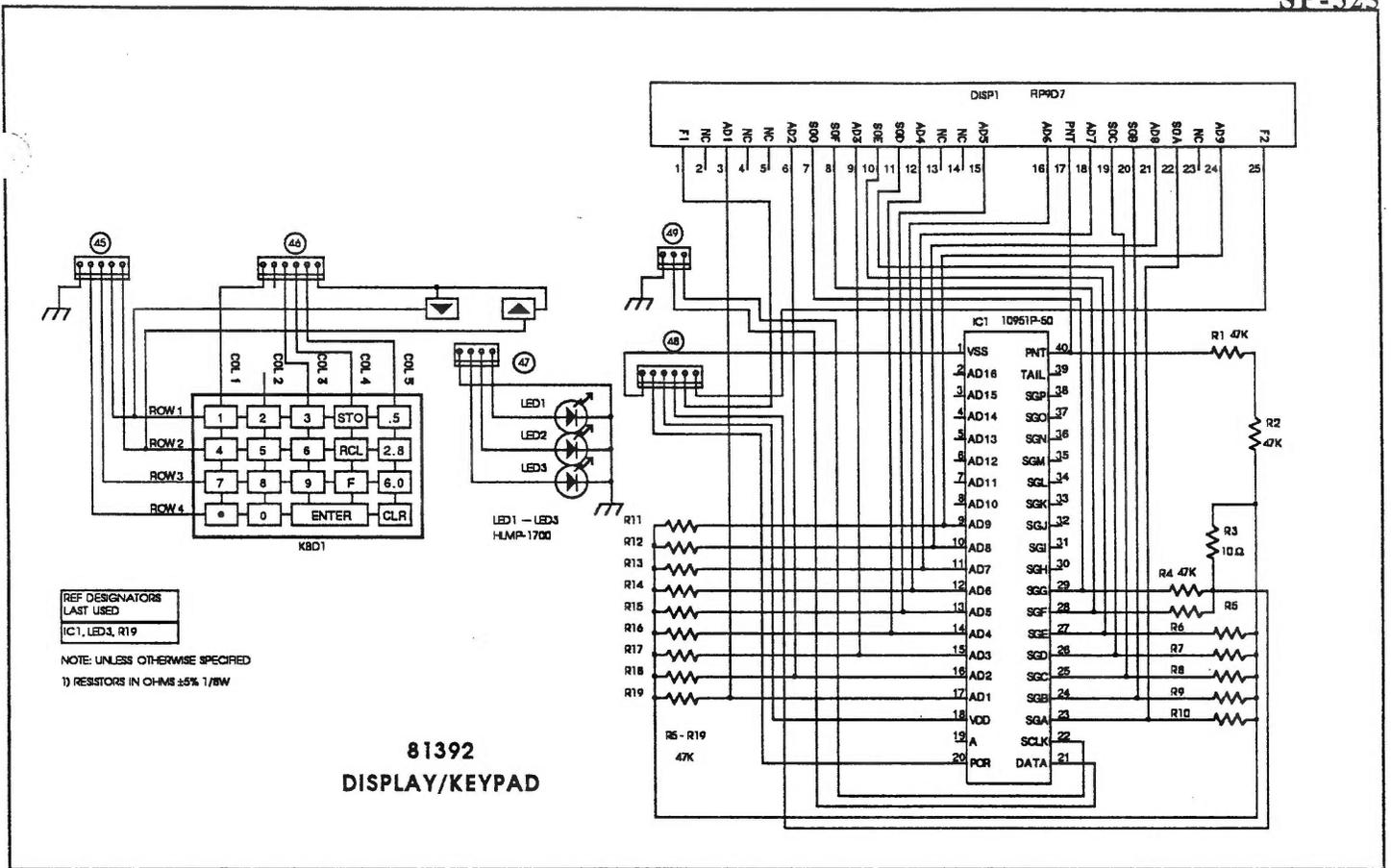


FIGURE 9-13. 81392 DISPLAY/KEYPAD SCHEMATIC

ID.	Description	Part No.
DISP1**	FIP9D7	28076
IC1**	10951P-50	25169
LED1**	HLMP-1700	28077
LED2**	HLMP-1700	28077
LED3**	HLMP-1700	28077
R1	47K	30300
R2	47K	30300
R3	10 Ω	30314
R4	47K	30300
R5	47K	30300
R6	47K	30300
R7	47K	30300
R8	47K	30300
R9	47K	30300
R10	47K	30300
R11	47K	30300
R12	47K	30300

ID.	Description	Part No.
R13	47K	30300
R14	47K	30300
R15	47K	30300
R16	47K	30300
R17	47K	30300
R18	47K	30300
R19	47K	30300

NOTE: UNLESS OTHERWISE SPECIFIED

1) RESISTORS IN OHMS ±5% 1/8W

TABLE 9-5. 81392 DISPLAY/KEYPAD PARTS LIST

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

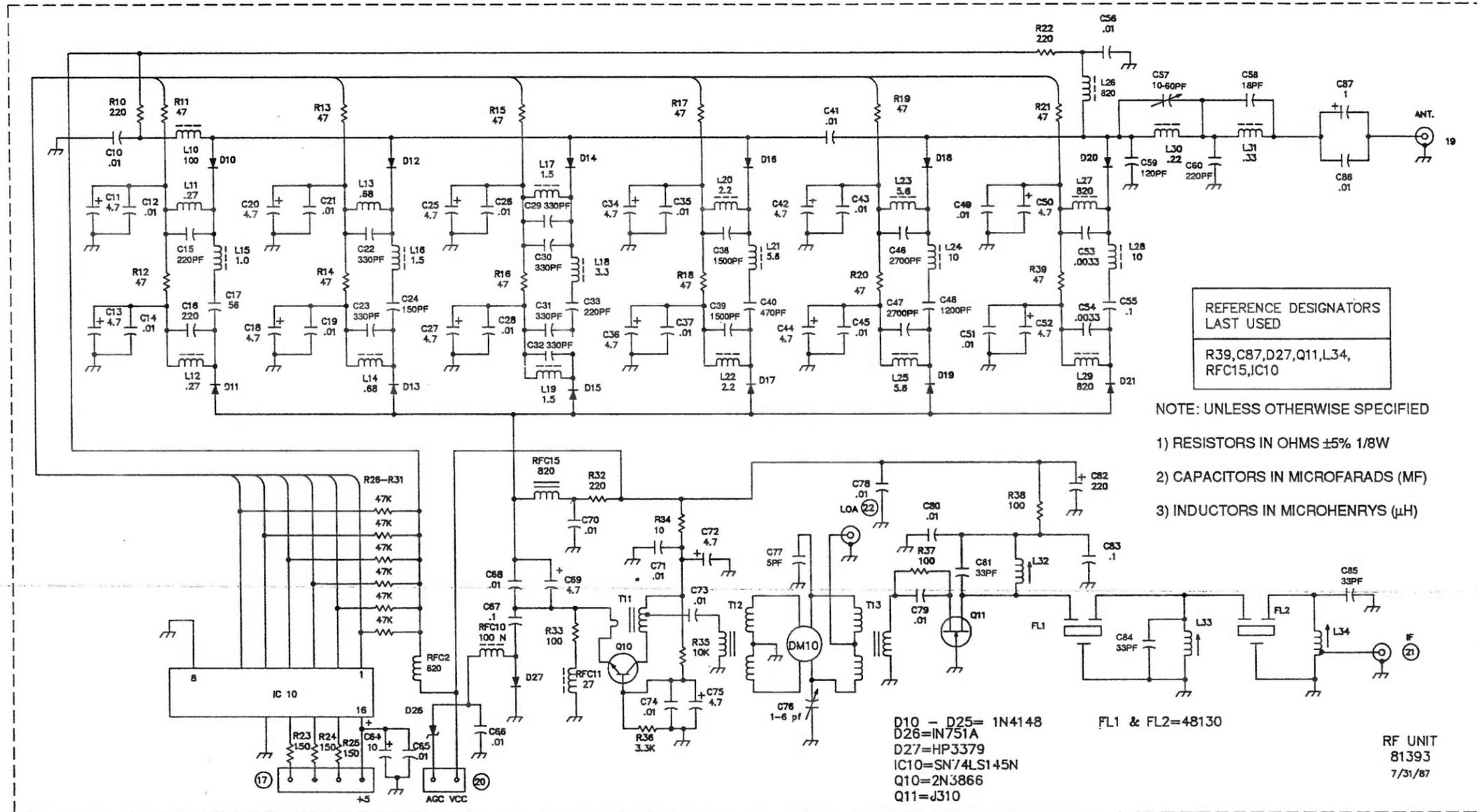


FIGURE 9-14. 81393 RF UNIT SCHEMATIC

TABLE 9-6. 81393 RF UNIT PARTS LIST

ID.	Description	Part No.	ID.	Description	Part No.
C10	.01	23318	C61	NOT USED	
C11	4.7/35V	23310	C62	NOT USED	
C12	.01	23318	C63	NOT USED	
C13	4.7/35V	23310	C64	10/16V	23266
C14	.01	23318	C65	.01	23318
C15	220PF	23322	C66	.01	23318
C16	220PF	23322	C67	.1	23261
C17	56PF	23305	C68	.01	23318
C18	4.7/35V	23310	C69	4.7/35V	23310
C19	.01	23318	C70	.01	23318
C20	4.7/35V	23310	C71	.01	23318
C21	.01	23318	C72	4.7/35V	23310
C22	330PF	23136	C73	.01	23318
C23	330PF	23136	C74	.01	23318
C24	150PF	23278	C75	4.7/35V	23310
C25	4.7/35V	23310	C76	1-6PF	23244
C26	.01	23318	C77	5PF	23249
C27	4.7/35V	23310	C78	.01	23318
C28	.01	23318	C79	.01	23318
C29	330PF	23136	C80	.01	23318
C30	330PF	23136	C81	33PF	23246
C31	330PF	23136	C82	220/16V	23202
C32	330PF	23136	C83	.1	23261
C33	220PF	23322	C84	33PF	23246
C34	4.7/35V	23310	C85	33PF	23246
C35	.01	23318	C86	.01	23318
C36	4.7/35V	23310	C87	1/50V	23264
C37	.01	23318	D10	1N4148	28001
C38	1500PF	23284	D11	1N4148	28001
C39	1500PF	23284	D12	1N4148	28001
C40	470PF	23259	D13	1N4148	28001
C41	.01	23318	D14	1N4148	28001
C42	4.7/35V	23310	D15	1N4148	28001
C43	.01	23318	D16	1N4148	28001
C44	4.7/35V	23310	D17	1N4148	28001
C45	.01	23318	D18	1N4148	28001
C46	2700PF	23287	D19	1N4148	28001
C47	2700PF	23287	D20	1N4148	28001
C48	1200PF	23283	D21	1N4148	28001
C49	.01	23318	D22	NOT USED	
C50	4.7/35V	23310	D23	NOT USED	
C51	.01	23318	D24	NOT USED	
C52	4.7/35V	23310	D25	NOT USED	
C53	.0033	23288	D26	1N751A	28041
C54	.0033	23288	D27**	PIN DIODE	28020
C55	.1	23328	DM10**	QUAD MIXER	28053
C56	.01	23318	FL1**	45MHZ FILTER	48130
C57	10-60PF	23268	FL2**	45MHZ FILTER	48130
C58	18PF	23302	IC10	74LS145N	25203
C59	120PF	23258	L10	100	21060
C60	220PF	23322	L11	.27	21105

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

TABLE 9-6. 81393 RF UNIT PARTS LIST (CONTINUED)

ID.	Description	Part No.
L12	.27	21105
L13	.68	21110
L14	.68	21110
L15	1.0	21112
L16	1.5	21114
L17	1.5	21114
L18	3.3	21118
L19	1.5	21114
L20	2.2	21116
L21	5.6	21121
L22	2.2	21116
L23	5.6	21121
L24	10	21124
L25	5.6	21121
L26	820	21095
L27	820	21095
L28	10	21124
L29	820	21095
L30	.22	21104
L31	.33	21106
L32**	COIL-RF	85331-10
L33**	COIL-RF	85331-9
L34**	COIL-RF	85331-9
Q10	2N3866	25027
Q11	J310	25115
R10	220	30240
R11	47	30289
R12	47	30289
R13	47	30289
R14	47	30289
R15	47	30289
R16	47	30289
R17	47	30289
R18	47	30289
R19	47	30289
R20	47	30289
R21	47	30289
R22	220	30240
R23	150	30239
R24	150	30239
R25	150	30239
R26	47K	30300
R27	47K	30300
R28	47K	30300
R29	47K	30300
R30	47K	30300
R31	47K	30300
R32	220	30240
R33	100	30309
R34	10	30319
R35	10K	30252

ID.	Description	Part No.
R36	3.3K	30247
R37	100	30318
R38	100	30318
R39	47	30289
R40	0 OHM	30353
RFC10	100	21060
RFC11	27	21129
RFC12	820	21095
RFC13	NOT USED	
RFC14	NOT USED	
RFC15	820	21095
T11**	XFMR-RF	85366
T12**	XFMR-RF	85134
T13**	XFMR-RF	85134

NOTE: UNLESS OTHERWISE SPECIFIED

1) RESISTORS IN OHMS $\pm 5\%$ 1/8W

2) CAPACITORS IN MICROFARADS (MF)

3) INDUCTORS IN MICROHENRYS (μ H)

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

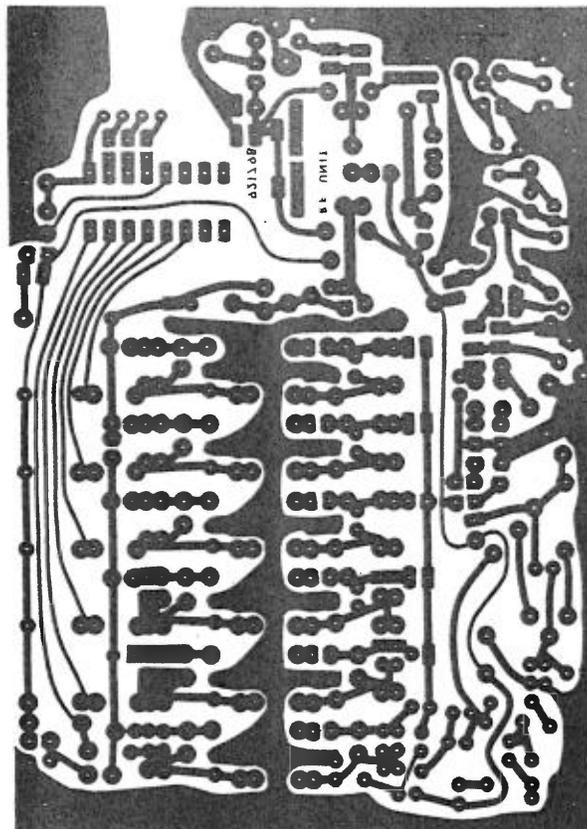


FIGURE 9-15. 81393 RF UNIT CIRCUIT TRACE

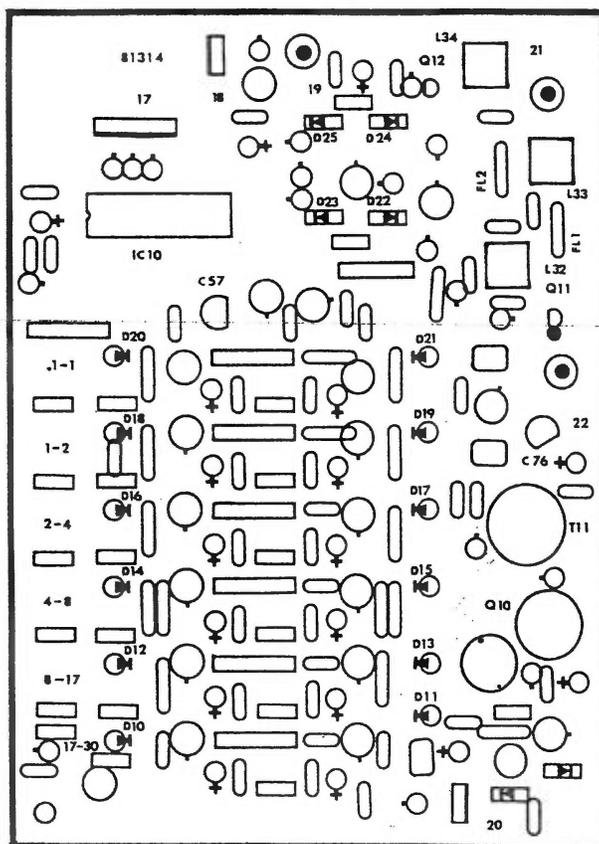
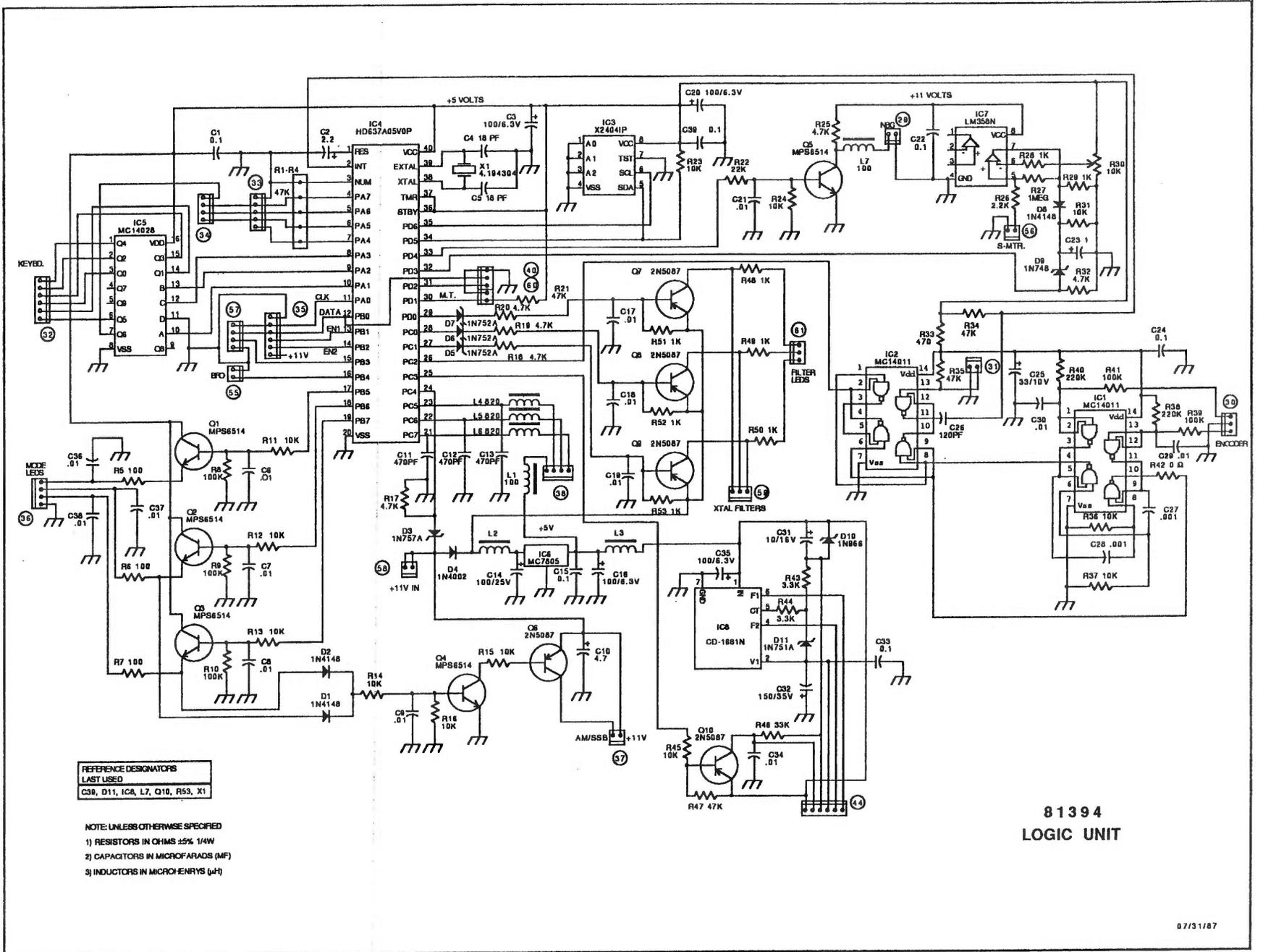


FIGURE 9-16. 81393 RF UNIT COMPONENT LAYOUT

FIGURE 9-17. 81394 LOGIC UNIT SCHEMATIC



81394
LOGIC UNIT

TABLE 9-7. 81394 LOGIC UNIT PARTS LIST

ID.	Description	Part No.	ID.	Description	Part No.
C1	0.1	23261	IC2	MC14011	25091
C2	2.2	23196	IC3**	X2404IP	25248
C3	100/6.3V	23267	IC4**	HD637A05V0P	98175
C4	18 PF	23302	IC5	MC14028	25093
C5	18 PF	23302	IC6	MC7805	25095
C6	.01	23260	IC7	LM358N	25117
C7	.01	23260	IC8**	CD-1681N	25202
C8	.01	23260	L1	100	21060
C9	.01	23260	L2**	CHOKE-RF	85319
C10	4.7	23310	L3**	CHOKE-RF	85319
C11	470PF	23259	L4	820	21095
C12	470PF	23259	L5	820	21095
C13	470PF	23259	L6	820	21095
C14	100/25V	23189	L7	100	21060
C15	0.1	23261	Q1	MPS6514	25054
C16	100/6.3V	23267	Q2	MPS6514	25054
C17	.01	23260	Q3	MPS6514	25054
C18	.01	23260	Q4	MPS6514	25054
C19	.01	23260	Q5	MPS6514	25054
C20	100/6.3V	23267	Q6	2N5087	25001
C21	.01	23260	Q7	2N5087	25001
C22	0.1	23261	Q8	2N5087	25001
C23	1	23264	Q9	2N5087	25001
C24	0.1	23261	Q10	2N5087	25001
C25	33/10V	23308	R1-R4	47K	30265
C26	120PF	23258	R5	100	30126
C27	.001	23245	R6	100	30126
C28	.001	23245	R7	100	30126
C29	.01	23318	R8	100K	30161
C30	.01	23318	R9	100K	30161
C31	10/16V	23266	R10	100K	30161
C32	150/35V	23321	R11	10K	30150
C33	0.1	23006	R12	10K	30150
C34	.01	23260	R13	10K	30150
C35	100/6.3V	23267	R14	10K	30150
C36	.01	23260	R15	10K	30150
C37	.01	23260	R16	10K	30150
C38	.01	23260	R17	4.7K	30146
C39	0.1	23261	R18	4.7K	30146
D1	1N4148	28001	R19	4.7K	30146
D2	1N4148	28001	R20	4.7K	30146
D3	1N757A	28012	R21	47K	30157
D4	1N4002	28000	R22	22K	30154
D5	1N752A	28011	R23	10K	30150
D6	1N752A	28011	R24	10K	30150
D7	1N752A	28011	R25	4.7K	30146
D8	1N4148	28001	R26	2.2K	30142
D9	1N748	28021	R27	1MEG	30173
D10	1N966	28035	R28	1K	30138
D11	1N751A	28041	R29	1K	30138
IC1	MC14011	25091	R30**	10K	30263

** DENOTES SINGLE SOURCE PART LISTED IN TABLE 7-1

TABLE 9-7. 81394 LOGIC UNIT PARTS LIST (CONTINUED)

ID.	Description	Part No.
R31	10K	30150
R32	4.7K	30146
R33	470	30134
R34	47K	30157
R35	47K	30157
R36	10K	30150
R37	10K	30150
R38	220K	30077
R39	100K	30161
R40	220K	30077
R41	100K	30161
R42	0 Ω	30353
R43	3.3K	30144
R44	3.3K	30144
R45	10K	30150
R46	33K	30155
R47	47K	30157
R48	1K	30138
R49	1K	30138
R50	1K	30138
R51	1K	30138
R52	1K	30138
R53	1K	30138
X1	4.194304	48131

NOTE: UNLESS OTHERWISE SPECIFIED

- 1) RESISTORS ON OHMS $\pm 5\%$ 1/4W
- 2) CAPACITORS IN MICROFARADS (MF)
- 3) INDUCTORS IN MICROHENRYS (μH)

FIGURE 9-18. 81394 LOGIC UNIT CIRCUIT TRACE

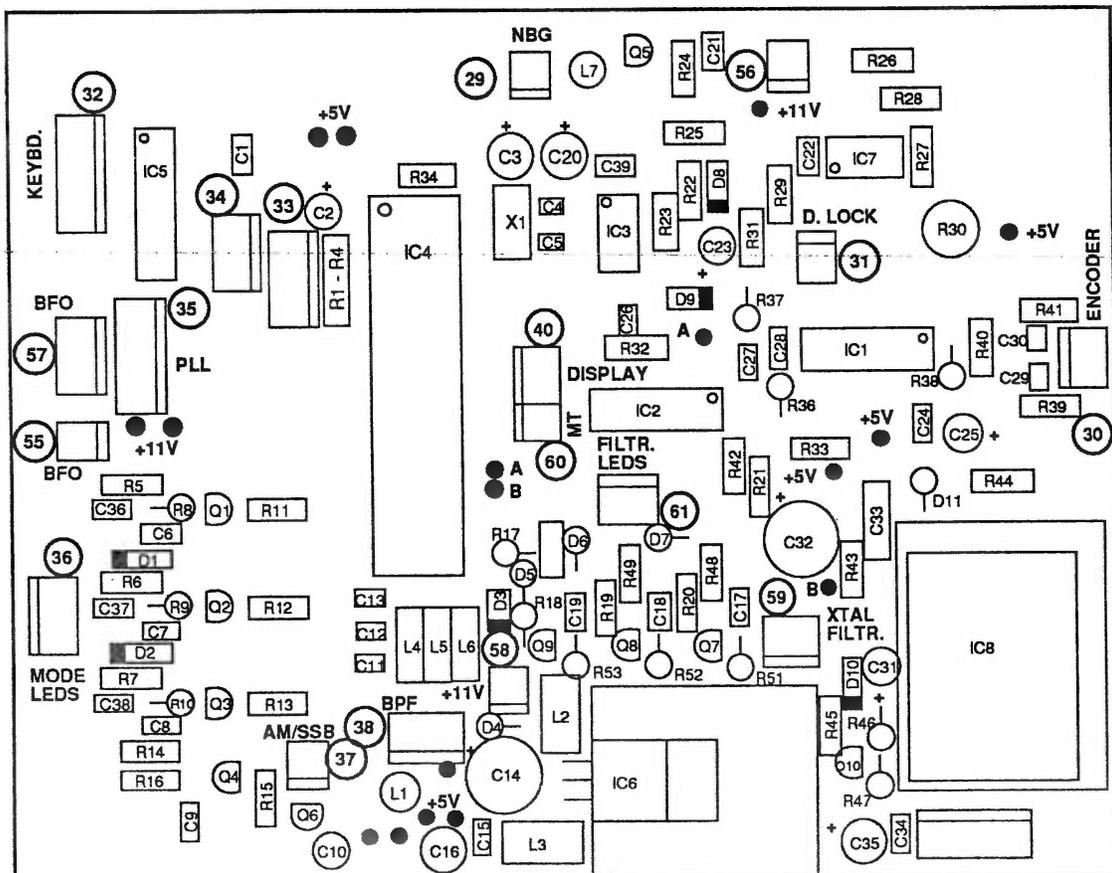
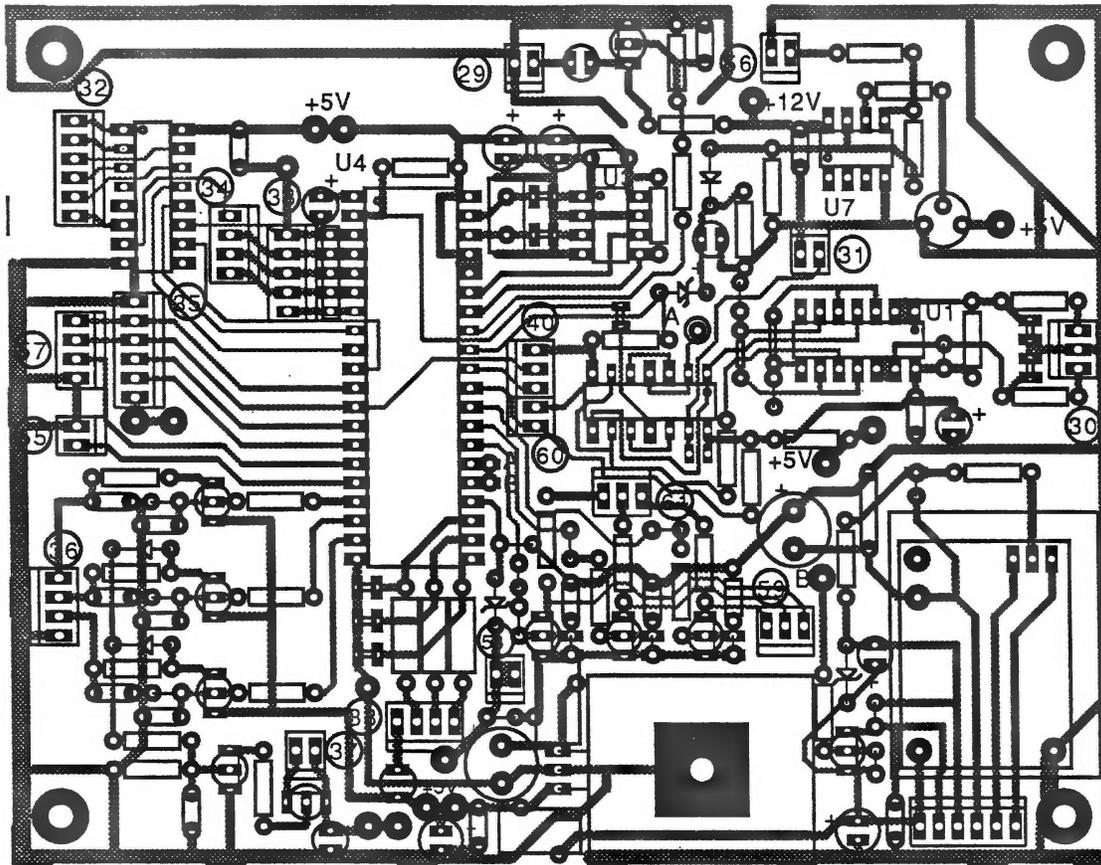


FIGURE 9-19. 81394 LOGIC UNIT COMPONENT LAYOUT

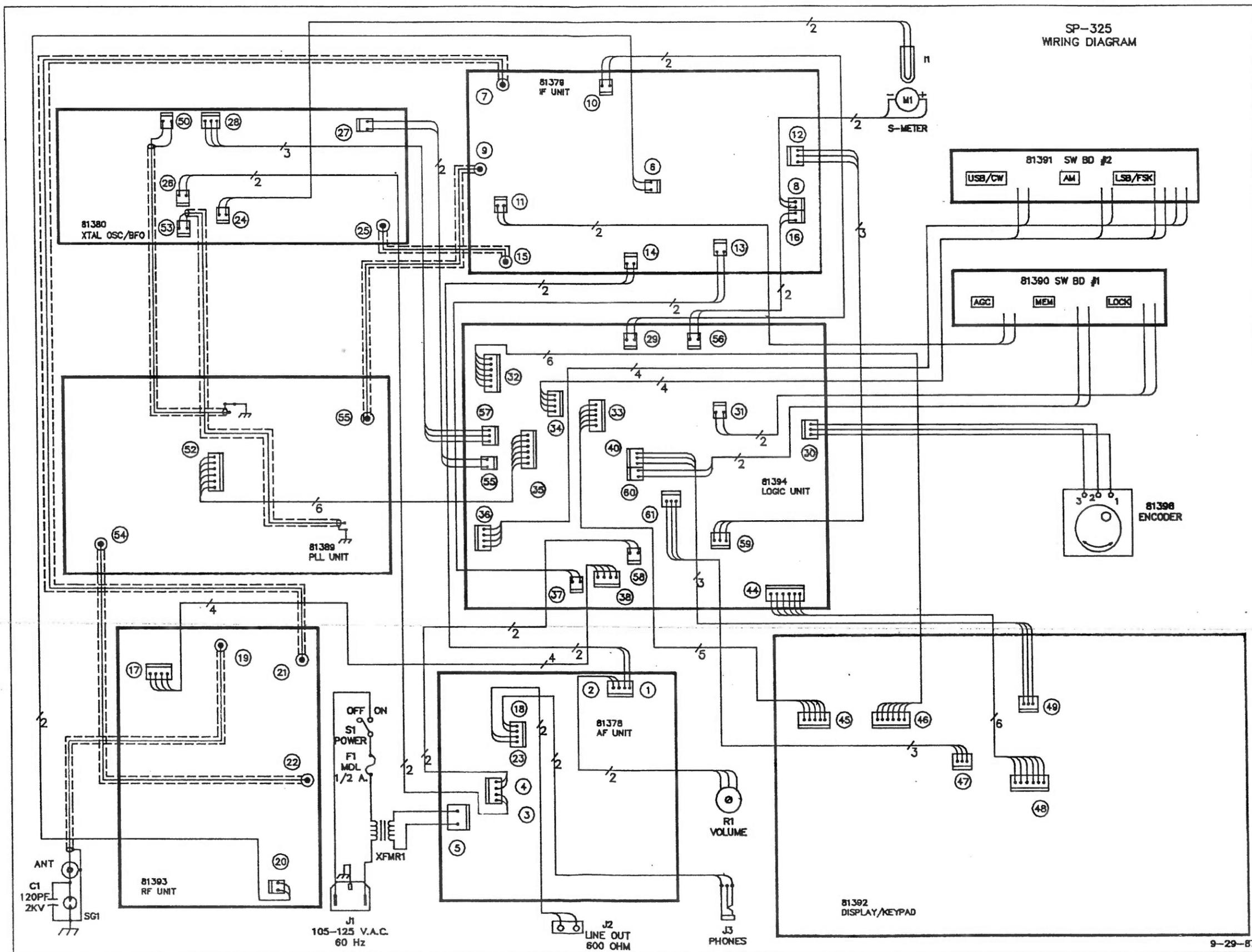
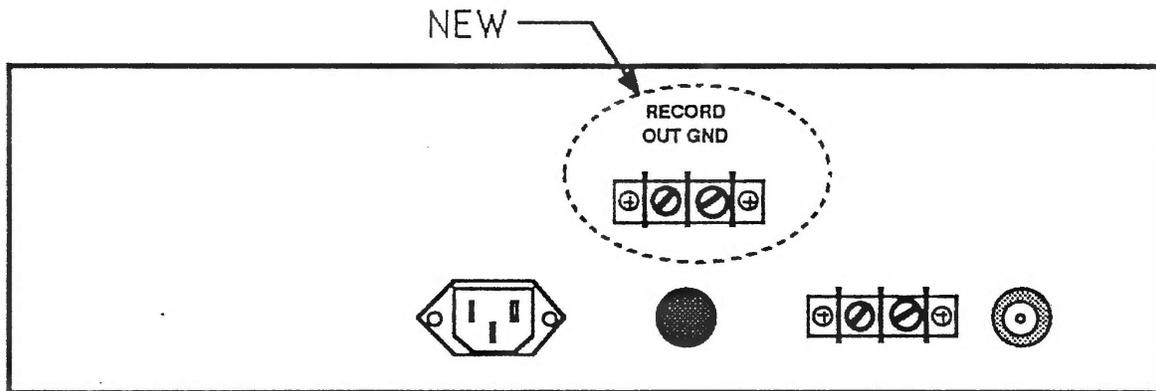


FIGURE 9-20 SP-325 WIRING DIAGRAM

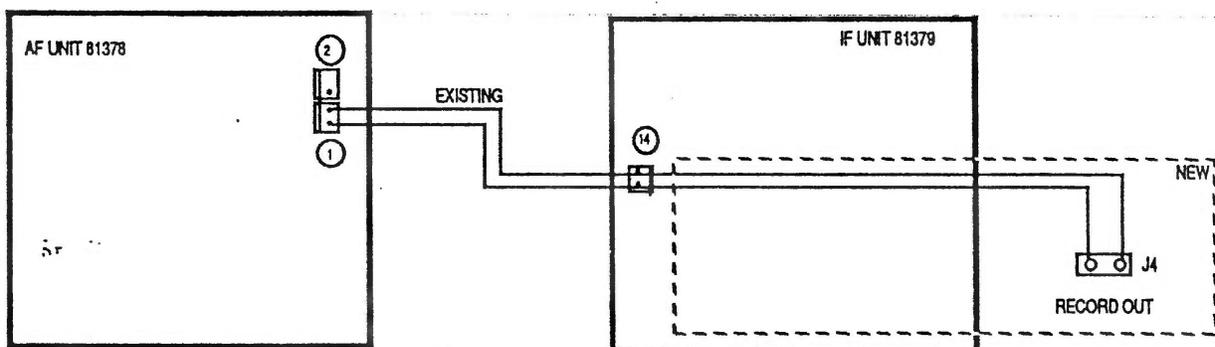
CHANGE NUMBER 1
ADDITION OF RECORD OUTPUT TERMINAL

1. **PURPOSE:** This change provides an additional audio out put which is compatible with AN/TNH-21B Recorder/Reproducers. The additional output (RECORD OUT) is unamplified audio which is not affected by the front panel volume control. (see illustration below)



REAR VIEW OF SP-325 RECEIVER

2. **DESCRIPTION:** The modification consists of picking off the audio signal at the IF circuit card (terminal 14) and routing the signal to a new rear panel terminal to interface with tape recorders which do not require an amplified audio. Figure 9-20 of the Technical manual should be modified to include this minor change to the wiring diagram as follows:



ADDITIONAL WIRING FOR "RECORD OUT" MOD