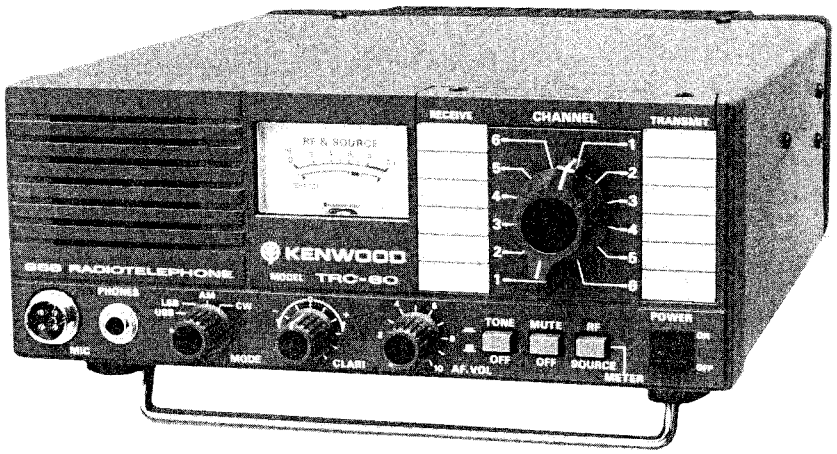
TRC-60

HF BAND
RADIO-TELEPHONE



CONTENTS

SPECIFICATIONS

[General]

Frequency range:	2.0 MHz ~ 18.0 MHz (Up to 6 frequencies can be selected.)
Mode:	A3J (USB), A3H, A1 (CW) A3J (LSB) ..... option
Oscillation system	Crystal oscillator
Transmission system:	Simplex and semi-duplex
Antenna impedance	50Ω
Warm-up time	20 min.
Operating voltage	DC13.8V (−10%, +5%)
Power consumption	Transmission; Approx. 21A Reception; Approx. 2.5A
Dimensions	242.5W × 95.5H × 313.5D mm (Without projections)
Weight	Approx. 5.9 kg
Ground system	Negative
Operating temperature	− 10 to +50°C
Semiconductors	FETs: 11 ICs: 18 Transistors: 134 Diodes: 133

M type:	with oven
M_2 type:	without oven

[Transmitter section]

Transmission output	A3J 85~95W at mic input 30 mV, 1.5 kHz, (at 25°C) A3H 25W
Frequency stability	±50 Hz (−10°C~ +50°C) M type ±1 kHz (−10°C~ +50°C) M2 type
Carrier suppression	Better than 40 dB at 1.5 kHz, 30 mV
Undesired side band output.	Better than 40 dB at 1.5 kHz, 30 mV
Spurious output	Better than −40 dB
Voice frequency band	350 Hz ~ 2700 Hz (±6 dB) 3500 Hz (more than −40 dB)

[Receiver section]

Sensitivity	Less than 3 μV (at 20 dB S/N), A3J Less than 10 μV (at 20 dB S/N), A3H * AF output 0.75W/8Ω 1 kHz * A3H 1 kHz 30% MOD
Voice frequency bandwidth	400 Hz ~ 2600 Hz (±6 dB) 1 kHz standard
Pass band width	2.4~3 kHz (−6 dB)
Selectivity	Less than 3.8 kHz (46 dB) Less than 4.2 kHz (−66 dB)
Image ratio	More than 50 dB at AF 1 kHz
IF interference ratio	More than 50 dB at AF 1 kHz
RX spurious interference ratio	More than 50 dB at AF 1 kHz
Frequency stability	Same as that of the transmitter section
AGC time constant	Approx. 2 SEC on SSB Approx. 0.6 SEC on CW

Others

Mic input impedance	600Ω
Modulation system	Low power balanced modulation
Reception system	Double superheterodyne 1 st IF: 48.455 MHz 2nd IF: 455 kHz
Rated AF output	More than 2W (distortion ratio: 10%) 8Ω
Tone oscillator	Approx. 1.5 kHz

CIRCUIT DESCRIPTION

Outline

The TRC-60 employs a double conversion system which is configured to operate at the first intermediate frequency 48.455 MHz and the second intermediate frequency 455 kHz. At the transmission stage, an SSB signal generated by an SSB generator at a frequency of 455 kHz is mixed with a signal output by the first local oscillator at a frequency of 48 MHz to produce a signal of 48.455 MHz. The produced signal is then mixed with a signal generated by the PLL circuit, the second local generator, at a frequency in the range 50.455 MHz to 66.455 MHz in order to produce a signal having the required transmission frequency. Components incorporated in the configuration are all solid state devices such as two 2SC2509's used in the drive stage and two 2SC2290's used in the final stage.

The configuration also includes a clarifier circuit, oven circuit, mute circuit, tone circuit, alarm circuit, noise blanker circuit, etc which are used to provide auxiliary functions.

Receiver Circuit Configuration

A signal coming from the antenna enters the band pass filter of the RF unit, which is divided into frequency bands shown in Table 5, after flowing through a two-step transmission relay for switching from one filter unit to another.

The signal output by the step amplifier provided for the coil of each band is amplified by Q4, a 3SK74(L) MOS FET. The signal output by Q3, a 2SK19(GR) buffer amplifier, is mixed with a VCO output coming from the PLL circuit by Q1 and Q2, a 3SK74(L) balanced mixer to produce a signal with an intermediate frequency of 48.455 MHz. This signal flows through an MCF (a monolithic filter consisting of L60 and L61) where unnecessary frequency components are eliminated. The filtered signal is mixed with the output of local oscillator having a frequency of 48 MHz by Q7 and Q8, 3SK74(L)'s in the IF unit, to generate a signal with an intermediate frequency of 455 kHz. The signal of 455 kHz is input to a noise blanker gate circuit and a USB or A3H ceramic filter, in order to produce a signal in the prescribed frequency band. Note that the center frequency of the USB filter is 453.5 kHz whereas that of the A3H filter is 455 kHz.

The signal is then amplified by a two-stage IF amplifier Q16 and Q17, and demodulated into an audio signal by a ring detector which is composed of four 1N60's shown as D24 to D27 in the circuit diagram.

The audio signal flows through the AF gain VR after being amplified by Q21, an AM preamplifier. The power of the signal is then amplified by Q1, the TA 7222AP power amplifier of the AF-AVR unit, before being used to drive the speaker.

Item	Rating
Nominal center frequency (fn)	48.455 MHz
1.5 dB pass band width	±8 kHz or more
3 dB pass band width	±10 kHz or more
13 dB attenuation band width	±27 kHz or less
Ripple	0.5 dB or less
Insertion loss	2 dB or less
Guaranteed attenuation	30 dB or more for 1 MHz (except spurious)
Impedance	5 kΩ±10%

Table 1 MCF L71-0231-05 (RF unit L60, 61)

Item	Rating
Nominal center frequency(fn)	453.5 kHz
6 dB band width	±1.20 kHz, or more (from fn)
26 dB band width	±1.70 kHz, or more (from fn)
46 dB band width	±1.90 kHz, or more (from fn)
66 dB band width	±2.10 kHz, or more (from fn)
Guaranteed attenuation	60 dB or greater for 0.1 to 1.0 MHz 40 dB or greater for 600 to 700 kHz
I/O matching impedance	2 kΩ

Table 2 Ceramic filter L72-0329-05 (USB and CW, IF unit L18, 19)

Item	Rating
Nominal center frequency (fn)	455 kHz
6 dB band width	±3 kHz, or more (from fn)
50 dB band width	±9 kHz, or more (from fn)
Guaranteed attenuation	60 dB or greater for frequencies within ±100 kHz
I/O matching impedance	2 kΩ

Table 3 Ceramic filter L72-0319-05 (A3H, IF unit L20)

Item	Rating
Nominal center frequency (fn)	456.5 kHz
Insertion loss (at maximum output)	8 dB or less
6 dB attenuation band width	±1.20 kHz or more (fn)
26 dB attenuating band width	±1.70 kHz or less (fn)
46 dB attenuation band width	±1.90 kHz or less (fn)
66 dB attenuation band width	±2.10 kHz or less (fn)
Ripple within band (within 6 dB band)	5 dB or less
Guaranteed attenuation (within 0.1 ~ 1.0 MHz) for 600 ~ 700 kHz	60 dB or more 40 dB or more
I/O matching impedance	2 kΩ

Table 4 Ceramic filter L72-0330-05 (LSB, IF unit L100, 101) OPTION CFJ455K (906)

Frequency band	Band data	ABCDE data of J7 of the RF unit A	B	C	D	E
2 to 3 MHz	2 MHz	0	1	0	0	0
3 to 4 MHz	3 MHz	1	1	0	0	0
4 to 6 MHz	4 MHz	0	0	1	0	0
	5 MHz	1	0	1	0	0
6 to 8 MHz	6 MHz	0	1	1	0	0
	7 MHz	1	1	1	0	0
8 to 12 MHz	8 MHz	0	0	0	1	0
	9 MHz	1	0	0	1	0
	10 MHz	0	0	0	0	1
	11 MHz	1	0	0	0	1
12 to 18 MHz	12 MHz	0	1	0	0	1
	13 MHz	1	1	0	0	1
	14 MHz	0	0	1	0	1
	15 MHz	1	0	1	0	1
	16 MHz	0	1	1	0	1
	17 MHz	1	1	1	0	1
	18 MHz	0	0	0	1	1

Table 5 Band pass filter data

Transmitter Circuit Configuration

The aural signal coming from the microphone is amplified by Q1 2SC2240 (GR), Q2 2SC1815 (Y) of the CCO unit. This audio signal is compressed by MIC compression circuit Q3: μPC1158H2, and buffered by Q5 before being combined with the carrier by the BM, the μPC1037H balanced modulator, of the IF unit to produce the DSB signal. It then becomes an SSB signal after flowing through a ceramic filter of 453.5 kHz.

The SSB signal is amplified by Q14 and Q15, a 3SK74 (L) two-stage IF amplifier, before being mixed with the output of a local oscillator having a frequency of 48.000 MHz by D20 to D23, a DBM consisting of four 1SS16's to produce a signal with an intermediate frequency of 48.455 MHz. After the signal flows through L60 and L61, an MCF in the RF unit, it is mixed with the output of the VCO local oscillator by D19 to D22, a DBM composed of four 1SS16's to generate a signal having the desired frequency of transmission. The generated signal is amplified by Q9, Q10 and Q11 before being sent to the final unit. After being amplified by a driver which consists of one 2SC2075 and two 2SC2509's, the signal flows through a power amplifier comprising a couple of 2SC2290's so as to gain the required transmission power. This signal is then transmitted to the antenna via the LPF circuit.

Passing frequency band	Filter (used in the final LPF circuit)	
2.0 to 3.2 MHz	FIA/FOA	F1
3.2 to 5.1 MHz	FIB/FOB	F2
5.1 to 7.9 MHz	FIC/FOC	F3
7.9 to 12 MHz	FID/FOD	F4
12 to 18 MHz	FIE/FOE	F5

Table 6. F number table

Note: Use a filter that is appropriate for the passing frequency band.

PLL Circuit

(1) 500 kHz PD comparison signal circuit configuration (digital unit)

The frequency 12 MHz of the output signal of the oven unit reference oscillattor (standard oscillator) is divided by 24 by means of a digital unit consisting of Q11 and Q12 to produce a frequency of 500 kHz.

(2) PLL interpolation frequency generator configuration (VCO unit)

The signal generated by the CCO unit at a frequency in the range 3.545 to 2.545 MHz is mixed with the 24 MHz local oscillator output coming from the IF unit by Q14, an SN16913P, to produce a signal with a frequency in the range 20.455 to 21.455 MHz. It is then mixed with the signal output by the 48 MHz local oscillator in the IF unit by Q15, a 3SK74(M), to generate a signal with a frequency in the range 68.455 to 69.455 MHz.

(3) VCO configuration

The signal having a frequency in the range 50.455 to 66.455 MHz obtained with the PLL circuit locked is made oscillate by Q1 to Q4, four 2SC2668(Y)'s. It is mixed with a signal having a frequency in the range 68.455 to 69.455 MHz coming from the interpolation generator by Q12, an SN16913P, in order to generate a signal having a frequency in the range 3 to 18 MHz. This signal then goes to the digital unit PI terminal.

(4) PLL digital circuit configuration

The signal coming from the PI terminal flows through a buffer amplifier consisting of Q6, a 2SC2347, and Q7, a 2SC2669(Y), and then enters a single stage inverter Q10. Its frequency is divided by two using the Q14 flip-flop. The output frequency is changed to 500 kHz by the decade counter Q15 and Q16 (HD74196P), the frequency division factor of which can be preset to 1/18 to 1/3 corresponding to the band data 2 to 17 MHz. After the 500 kHz signal flows through some timing gates, it is compared to the 500 kHz comparison signal coming from the reference oscillator by Q13, an MC4044P. A DC level proportional to the phase difference between the two signals is thereby generated. After passing through a low-pass filter Q1 to Q3 2SC1775(E), the DC level signal is transmitted to the variable capacitor line of the VCO oscillator in the VCO unit as the PDO voltage in order to control the VCO frequency.

VCO oscillation frequency	(Band data)	Oscillation coil used in PLL circuit	J5 ABCD data A	B	C	D
2 to 5 MHz	(2 to 4)	L1	0	1	1	1
5 to 10 MHz	(5 to 9)	L2	1	0	1	1
10 to 15 MHz	(10 to 14)	L3	1	1	0	1
15 to 18 MHz	(15 to 17)	L4	1	1	1	0

Table 7.

J2					Band	J5			
A	B	C	D	E	data	A	B	C	D
0	1	0	0	0	2	0	1	1	1
1	1	0	0	0	3	0	1	1	1
0	0	1	0	0	4	0	1	1	1
1	0	1	0	0	5	1	0	1	1
0	1	1	0	0	6	1	0	1	1
1	1	1	0	0	7	1	0	1	1
0	0	0	1	0	8	1	0	1	1
1	0	0	1	0	9	1	0	1	1
0	0	0	0	1	10	1	1	0	1
1	0	0	0	1	11	1	1	0	1
0	1	0	0	1	12	1	1	0	1
1	1	0	0	1	13	1	1	0	1
0	0	1	0	1	14	1	1	0	1
1	0	1	0	1	15	1	1	1	0
0	1	1	0	1	16	1	1	1	0
1	1	1	0	1	17	1	1	1	0

Table 8. Comparison between J2 and J5 data of the digital unit

Band data	*	Band data	*
2	N: 18	10	N: 10
3	17	11	9
4	16	12	8
5	15	13	7
6	14	14	6
7	13	15	5
8	12	16	4
9	11	17	3

* Frequency division factor 1/N (digital) of Q15 and Q16

Table 9. Frequency division factor

Features and Configurations of Individual Circuit

(1) CAR oscillator (Carrier unit)

Q20, a TC5048P, is a 17 bit ripple carry binary counter that contains inverters for crystal controlled oscillation.

A crystal oscillator with a frequency of 7.28 MHz is attached to pins 1 and 2 of Q20 which divides the frequency by 16 to produce a frequency of 455 kHz at pin 3. Unnecessary components of the output signal are eliminated by L1 and L2. The filtered signal is then sent to other circuits through Q19, a buffer amplifier. TC1 is a trimmer used to adjust the 455 kHz frequency.

(2) Alarm circuit (Carrier unit)

Q20 (TC5048P) is also provided with a function to divide the 7.28 MHz frequency by 32 and a gate function to intermit its output. Q15 and Q16, a vibrator, are used to generate a train of pulses with a duration of approximately 1.5 seconds. These pulses causes Q17 to switch on and off. On the other hand, the gate function turns pin 14 of Q20 on and off, causing a signal with a frequency of 888 Hz to intermit at intervals of about 1.5 seconds. The signal is sent to the AF circuit, where it generates alarm sound: bich, bich, ... A thermostat which is connected to the collector of Q16 is located in the final section. When the radiator in the final section is overheated to 110°C or more, the collector line goes high, causing an overheated warning to be generated.

(3) Adding an LSB filter

The CFJ455K(906) (L72-0330-05), an LSB ceramic filter, can be used in the TRC-60 as an option. In order to utilize the filter, install it on L100 and L101 of the IF unit. Note that the replacement circuit includes such a filter.

(4) RF attenuation

If there is a large power station such as a broadcast station at the location where the set is operated, pull the IP lead connector attached to the B terminal of the relay unit and plug it into the A terminal. By doing so, the receiving attenuation circuit is reconfigured into an antenna circuit. As a result, the sensitivity and, thus, interference by the nearby station are reduced.

(5) NB circuit

The TRC-60 contains an NB (Noise Blanker) circuit. When the TRC-60 is operated in an area where there is a lot of noise, make the NB circuit effective as follows. Pull the IP lead connector attached to the OFF terminal of the IF unit NBS and plug it into the ON terminal.

(6) Mute circuit

The TRC-60 is equipped with a simple mute circuit for AGC voltage detection. The circuit has been designed to operate for SSG equated ANT inputs of 40 dBμ or greater. However, when the TRC-60 is operated at a location where there is a lot of noise, especialy an A3H, the AGC line oscillates. It is therefore necessary to reduce the sensitivity of the mute circuit by adjusting VR8 when operating the TRC-60 at such a location.

DESCRIPCION DEL CIRCUITO

Introducción

E1 TRC-60 emplea un sistema de conversión doble que está configurado para operar con la primera frecuencia intermedia de 48,455 MHz y la segunda frecuencia intermedia de 455 KHz. En la etapa de transmisión, se genera una señal SSB mediante un generador SSB a una frecuencia de 455 KHz, que se mezcla con una señal de salida, por medio del primer oscilador local a una frecuencia de 48 MHz, para producir una señal de 48,455 MHz.
La señal producida se mezcla entonces con una señal generada por el circuito PLL, el segundo generador local, a una frecuencia entre 50,455 MHz a 66,455 MHz, a fin de producir una señal que tenga la frecuencia de transmisión requerida. Los componentes incorporados en la configuración son dispositivos de estado sólido, como dos 2SC2509 empleados en la etapa de excitación y otros dos 2SC2290 aplicados en la etapa final.
La configuración también incluye un circuito clarificador, circuito de curado, circuito de silenciar, circuito de tono, circuito de alarma, circuito de borrado, etc. que se emplean para obtener funciones auxiliares.

● Configuración del circuito receptor

La señal procedente de la antena entra en el filtro de paso de banda de la unidad RF, que se divide en las bandas de frecuencia que se muestran en el tabla 5, luego de pasar por un relé de transmisión de dos pasos para cambiar de una unidad de filtro a otra.
La señal emitida por el amplificador de paso, provisto por la bobina de cada banda, es amplificada por Q4, un MOS FET 3SK74 (L). La señal emitida por Q3, un amplificador intermedio 2SK19 (GR), se mezcla con una salida VCO procedente del circuito PLL mediante Q1 y Q2, un mezclador compensado 3SK74 (L), para producir una señal con frecuencia intermedia de 48,455 MHz. Esta señal fluye por MCF (un filtro monolítico compuesto de L60 y L61) en donde se eliminan los componentes de frecuencia innecesarios.
La señal filtrada se mezcla con la salida del oscilador local que tiene una frecuencia de 48 MHz mediante Q7 y Q8, de S6K74 (L), de la unidad IF, para generar una señal con una frecuencia intermedia de 455 KHz.
La señal de 455 KHz se introduce a un circuito de puerta borrador de ruido y a USB, o a un filtro de cerámica A3H, a fin de producir una señal en la banda de frecuencia prescripta.
Advertir que la frecuencia central del filtro USB es de 453,5 KHz mientras que el filtro A3H es de 455 KHz.
La señal se amplifica entonces por medio del amplificador de FI de dos etapas, Q16 y Q17, y se demodula en una señal audio por medio de un detector de anillo compuesto de cuatro 1N60, como se muestra con D24 y D27, en el diagrama del circuito.
La señal audio fluye a través de VR de ganancia AF después de amplificarse por medio de Q21, un amplificador AM. La potencia de la señal se amplifica entonces mediante Q1, el amplificador de potencia TA7222AP de la unidad AF AVR, previamente a usarse para excitar el altavoz.

Ver la Tabla 1～5 que se encuentra en la página 2-1～2-2

● Configuración del circuito del transmisor

La señal airal procedente del micrófono es amplificada por Q1 2SC2240(GR), Q2 2SC1815(Y) de la uniad CCO. Fluye luego por un circuito limitador compuesto de D1 y D2 (1S155) y filtros de paso bajo y paso de banda (Q4 y Q5) antes de combinarse con la portadora por medio de BM, el modulador compensado μPC 1037H, de la unidad IF para producir la señal DSB. Con lo cual resulta una señal SSB luego de pasar a través de un filtro de cerámica de 453,5 KHz.
La señal SSB se amplifica por medio de Q14 y Q15, un amplificador de FI de dos etapas 3SK74 (L), antes de mezclarse con la salida de un oscilador local que tiene una frecuencia de 48.000 MHz y formado por D20 a D23, un DBM que consiste de cuatro 1SS16, para producir una señal con una frecuencia intermedia de 48,455 MHz.
Luego de que la señal pasa por L60 y L61, un MCF de la unidad RF, se mezcla con la salida del oscilador local VCO mediante D19 a D22, un DB, compuesto de cuatro 1SS16, para generar una señal que tiene la frecuencia deseada de la transmisión. La señal generada se amplifica mediante Q9, Q10 y Q11, antes de enviarse a la unidad final.
Después de amplificarse mediante un excitador que consiste de un 2SC2075 y dos 2SC2509, la señal pasa a través de un amplificador que incorpora un par de 2SC2290, a fin de ganar la potencia de transmisión requerida. Esta señal se transmite luego a la antena vía el circuito LPF.

Ver la Tabla 6 que se encuentra en la pagina 2-2

Nota:
Usar un filtro que sea apropiado para la frecuencia de banda pasante.

Circuito PLL

(1)
Configuración del circuito de comparación de señal de 500KHz PD (Unidad digital)
La frecuencia de 12 MHz de la señal de salida del oscilador de referencia de la unidad de curar se divide por 24 mediante una unidad digital que consiste de Q11 y Q12, a fin de producir una frecuencia de 500 KHz.

(2) Configuranción del generador de interpolación de frecuencia PLL (Unidad VCO)
La señal generada por la unidad CCO a una frecuencia comprendida entre 2,545 a 3,545 MHz, se mezcla con la salida del oscilador local de 24 MHz procedente de la unidad de FI mediante Q14, SN16913P, para producir una señal con una frecuencia comprendida entre 20,455 a 21,455 MHz. Luego se mezcla con la salida de señal mediante el oscilador local de 48 MHz en la

unidad de FI con Q15, un 3SK74 (M), para generar una señal con una frecuencia comprendida entre 68,455 a 69,455 MHz.

(3) Configuración VCO
La señal que tiene una frecuencia comprendida entre 50,455 a 66,455 MHz, obtenido con el circuito PLL enganchado, se hace oscilar mediante Q1 a Q4, cuatro 2SC2668(Y).
Luego se mezcla con una señal que tiene una frecuencia comprendida en 68,455 a 69,455 MHz procedente del generador de interpolación mediante Q12, un SN16913P, a fin de generar una señal que tenga una frecuencia en la etapa de 3 a 18 MHz. Esta señal se transmite luego a la unidad digital (PI).

(4) Configuración del circuito digital PLL
La señal procedente del terminal PI pasa a través de un amplificador intermedio que consiste de Q6, un 2SC2347, y Q7, un 2SC2669(Y), y luego entra en un inversor de etapa única Q10. Su frecuencia se divide por dos usando el flip-flop Q14. La frecuencia de salida se cambia a 500 KHz mediante el contador de décadas Q15 y Q16 (HD74196P), cuyo factor de división de frecuencia puede preajustarse de 1/18 a 1/3 correspondientes a la banda 2 de 17 MHz.
Luego de que la señal de 500 KHz pasa por algunas puertas temporizadoras, se la compara con la señal de comparación procedente del oscilador de referencia mediante Q13, un MC4044P. Se genera entonces un nivel CC proporcional a la diferencia de fase entre las dos señales generadas. Luego de pasar por el filtro de paso bajo Q1 a Q3 (2SC17755 (E)), la señal de nivel CC se transmite a la línea de capacitor variable del oscilador VCO en dicha unidad, como el voltaje PDO, a fin de controlar la frecuencia VCO.

Ver la Tabla 7~9 que se encuentra en la página 2-2~2-3

Características y configuraciones individuales

(1) Oscilador CAR (Unidad portadora)
Q20, un TC5048P, es un contador binario de portadora con ondulación de 17 bitios que contiene inversores para control de oscilación por cristal.
Se coloca un oscilador de cristal con una frecuencia de 7,28 MHz a las clavijas 1 y 2 de Q20, que divide la frecuencia por16 para producir una frecuencia de 455 KHz en la clavija 3. Los componentes innecesarios de la señal de salida se eliminan mediante L1 y L2. La señal filtrada se envía luego a otros circuitos a través de Q19, un amplificador intermedio. TC1 es un trimer usado para ajustar la frecuencia 455 KHz.

(2) Circuito de alarma (Unidad portadora)
Q20 (TC5048P) cuenta también con una función para dividir la frecuencia de &, 28 MHz mediante 32 y se dispone una función de puerta para hacer efecto intermitente la salida.
Q15 y Q16, vibradores, se emplean para generar un tren de impulsos con una duración de aproximadamente 1,5 segundos. Estos impulsos causan la activación y desactivación de Q17. Por otra parte, la función de compuerta activa y desactiva la clavija 14 de Q20, produciendo una señal con 88 Hz de frecuencia para presentarse con intermitencia a intervalos de unos 1,5 segundos. La señal se envía entonces al circuito AF, en donde genera un sonido de alarma: "bip, bip"... Se conecta un termostato al colector de Q16, que se ubica en la sección final. Cuando se sobrecalienta el radiador de la sección final a 110°C ó más, se recalienta la línea del colector, provocando una señal de advertencia de recalentamiento.

(3) Agregado de un filtro LSB
El CFJ455K(906) (L72-0330-05) es un filtro de cerámica LSB, que puede usarse en TRC-60 como opción. A fin de utilizar un filtro, hay que instalarlo en L100 y L101 de la unidad FI. Advertir que el circuito de recambio incluye tal filtro.

(4) Atenuación SR
Si hubiera una central de alta potencia, como una emisora de radio, en el sitio en que se ha de usar el equipo, conviene tirar del conector de conductor IP puesto en el terminal B de la unidad de relé y enchufarlo en el terminal A. Al hacerlo, el circuito de atenuación de recepción se reconfigura a un circuito de antena. Como resultado, se regula la sensibilidad y, con ello, la interferencia de la central cercana.

(5) Circuito NB
TRC-60 contiene un circuito NB (Borrador de ruido). Cuando se opera TRC-60 en una zona en donde hay mucho ruido, se pone en efectividad el circuito NB del modo siguiente. Tirar del conector conductor IP puesto en el terminal OFF de la unidad de FI NBS y enchufarlo en el terminal ON.

(6) Circuito de silenciar
El TRC-60 se equipa con un circuito de silenciar simple para detección de la tensión AGC. El circuito se ha diseñado para operar las entradas ANT tratadas SSG de 40 dBμ o mayores. Sin embargo, cuando TRC-60 es operado en un sitio en donde hay mucho ruido, especialmente un tipo de ubicación A3H, la línea AGC oscila marcadamente. Por ello, es necesario reducir la sensibilidad del circuito de silenciar ajustando VR8, cuando se usa TRC-60 en tales lugares.

FREQUENCY ADJUSTMENT

Frequency Adjustment

Make the following adjustment when setting frequencies. Basic adjustments are made at the factory so that all units will be fully operational after the following procedures are performed.

A. Contents

1. Confirming parts used and points to be modified and adjusted.
2. SMP — DUP — DUP2 setting
3. Crystal installation
4. Matrix unit (Band setting)
5. Jumper unit (Filter selecting)
6. Frequency adjustment
7. Power output adjustment
8. Performance check
9. Marking frequencies on the indicator plate
10. Crystal specifications sheet

B; Procedures

1. The points to be modified and adjusted are shown in Fig. 1

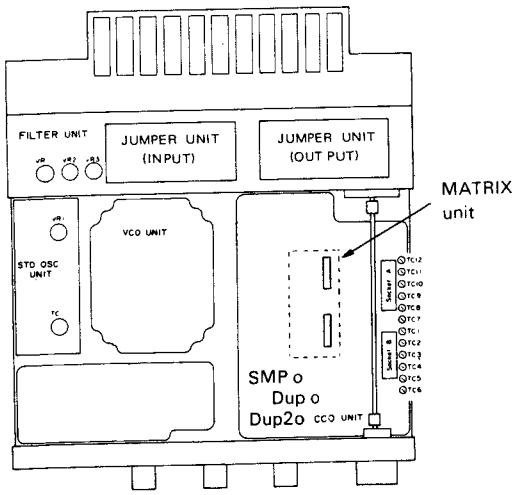


Fig. 1 Top View

The parts to be used are as follows.

- Matrix unit
  (Included in the accessory package).
- Crystals
  Only crystals which conform to the crystal specifications should be used. See item 10.

2. SMP — DUP — DUP2 setting

Insert the 1P connector whose lead is connected to the SMP terminal of the CCO unit into DUP or DUP2, depending on the frequency configuration to be employed.

(1) SMP
The connector has been inserted in this position at the factory. This position is used when the transmission frequency is to be the same as the reception frequency.

(2) DUP
This position is used when the transmission frequency is different from the reception frequency.

(3) DUP2
This position is used when the transmission frequency and reception frequency are to be the same on channel 1 and different on other channels.

3. Crystal installation

(1) SMP:
Each crystal is used for both transmission and reception. Insert crystals in sockets CH1 to CH6 of group B.

(2) DUP;

Crystals for reception:	Sockets CH1 to CH6 of group B
Crystals for transmission;	Sockets CH1 to CH6 of group A

(3) DUP 2:
Crystal for both transmission and reception:

	Socket CH1 of group B
Crystals for reception:	Socket CH2 to CH6 of group B
Crystals for transmission:	Socket CH2 to CH6 of group A

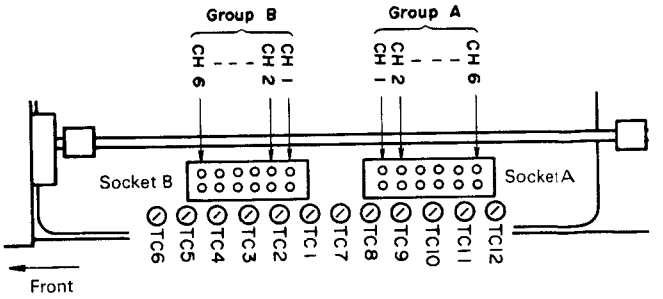


Fig. 2

4. Matrix unit (Band setting)

This unit generates band data corresponding to the crystal frequencies. There are two groups of diodes on the unit: one consisting of D1 to D30 and the other of D31 to D60. Remove diodes according to the crystal the channels in which crystals are not installed as they are.

Band	A	B	C	D	E	Band	A	B	C	D	E
2 MHz	0	1	0	0	0	10 MHz	0	0	0	0	1
3	1	1	0	0	0	11	1	0	0	0	1
4	0	0	1	0	0	12	0	1	0	0	1
5	1	0	1	0	0	13	1	1	0	0	1
6	0	1	1	0	0	14	0	0	1	0	1
7	1	1	1	0	0	15	1	0	1	0	1
8	0	0	0	1	0	16	0	1	1	0	1
9	1	0	0	1	0	17	1	1	1	0	1

Table 10 Band data table 1: Remove

(1) Diode groups to be modified

SMP:		D1 to D30
DUP:	Reception:	D1 to D30
	Transmission:	D31 to D60
DUP2:	Common channel:	D1 to D5
	Reception:	D6 to D30
	Transmission:	D36 to D60

(2) Example 1.
When a 5,182 MHz crystal used for both transmission and reception is installed in CH1.

1 Find the band data corresponding to the 5 MHz band from the band data table 10.
5.182 MHz → 5 MHz Band

	A	B	C	D	E
5 MHz band data →	1	0	1	0	0

2 Remove the diodes corresponding to A and C

	A	B	C	D	E
5 MHz band data →	1	0	1	0	0
Diodes for CH1 →	(D1)	D2	(D3)	D4	D5

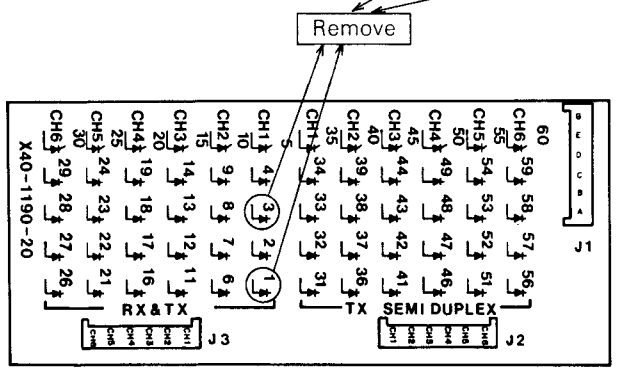


Fig. 3 Matrix unit

(3) Example 2.
When a 10.256 MHz crystal in installed in CH2
10.256 MHz → Band: 10 MHz

	A	B	C	D	E
10 MHz band data →	0	0	0	0	1
Diodes for CH2 →	D6	D7	D8	D9	(D10)

Remove

Remove diodes of other channels in the same manner.

(4) Installed the Matrix unit into the CCO unit.

5. Jumper unit (filter selecting)

The filters to be used are selected by adding jumpers from the two jumper unit located on the upper side of the final units. These two jumper units must be modified in the same manner.

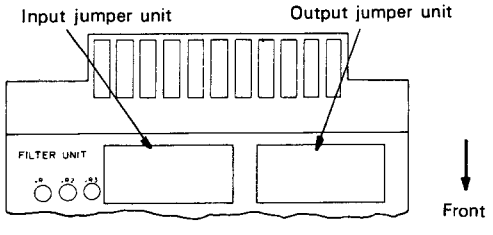


Fig. 4 Location of Jumper unit

The modification procedures are as follows.

(1) Remove the 4 screws to remove the jumper unit cover.

(2) Select the F number corresponding to each channel according to the F number table below.

Pass band	Filter used in Final LPF	Filter number
2.0 — 3.2 MHz	FIA/FOA	F1
3.2 — 5.1 MHz	FIB/FOB	F2
5.1 — 7.9 MHz	FIC/FOC	F3
7.9 — 12 MHz	FID/FOD	F4
12 — 18 MHz	FIE/FOE	F5

Table 11 F number table

Example)

CH1	5.182 MHz	→	Use F3 filter
CH2	10.256 MHz	→	Use F4 filter

(3) Add a jumper wire which corresponds to the F number obtained.

Example)

CH1	5.182 MHz	→	F3 ..... ①
CH2	10.256 MHz	→	F4 ..... ②

Add and solder a jumper wire those circled.

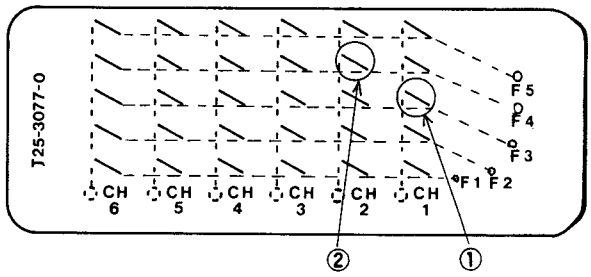


Fig. 5 Jumper unit

Note:
Make sure that only one jumper is add for each channel.

6. Frequency adjustment

Connect a frequency counter to the VCO terminal (J4) in the RF unit. Adjust the trimmer of each channel so that the frequency counter reads the following frequency (fx).
fx = 48.455 MHz + frequency indicated on crysal

Example)

CH1	5.182 MHz	→	fx = 48.455 + 5.182 = 53.637000 MHz
CH2	10.256 MHz	→	fx = 48.455 + 10.256 = 58.711000 MHz

7. Power output adjustment

Make sure that steps 1 through 6 have been performed correctly, then turn the power on and perform the following fine adjustment.

(a) SSB:
There are 6 potentiometers for adjusting power output on the crystal control unit (CCO unit): VR4 (CH1), VR5 (CH2), VR6 (CH3), VR7 (CH4), VR8 (CH5) and VR9 (CH6). Adjust them so that 80 ± 5W of transmission power is obtained when the microphone input is 3 mV at 600Ω.

(b) A3H:
Adjust VR4 through VR9 so that about 25W of transmission power is obtained when the microphone input is off.

8. Check

Confirm that the unit's performance meets specifications.

9. Marking frequencies on the indicator plate

(1) Remove the two screws located at the upper part of the panel to remove the indicator plate retainer.
(2) Remove the indicator plate and write the frequencies of the crystals installed on it.
(3) Mount the indicator plate in its original position and fasten it with the retainer.

10. Crystal specifications sheet

(1) Model number:	HC-42/U (Undercut type)
(2) Degree of oscillation:	3'rd overtone
(3) Oscillation frequency:	25.450 to 35.450 MHz
(4) Indication frequency:	Indicates the nominal frequency (Order a crystal by specifying its nominal frequency)
(5) Part number:	L77-0960-05
(6) Permissible frequency deviation:	$\pm 10 \times 10^{-6}$ (at 25°C)
(7) Frequency stability with temperature:	$\pm 5 \times 10^{-6}$ (In the range −10 to 50°C with room temperature taken as reference)

(8) Relation between indication (nominal) frequency and oscillation frequency:

Oscillation frequency (fosc)
= 10 × {23.545 − N − indication (nominal) frequency f_D}

N = 20 − The value of f_D, the indication (nominal) frequency, in terms of MHz's with the decimal part truncated

For the CW mode, produce the crystal oscillation frequency 1.5 kHz lower than nominal frequency, and indicate nominal frequency on the crystal.

Example)
$f_D = 13.555$ MHz
$N = 20 - 13 = 7$
$f_{OSC} = 10 \times (23.545 - 7 - 13.555) = 29.900$ (MHz)

(9) Crystal oscillator circuit
See Fig. 6.

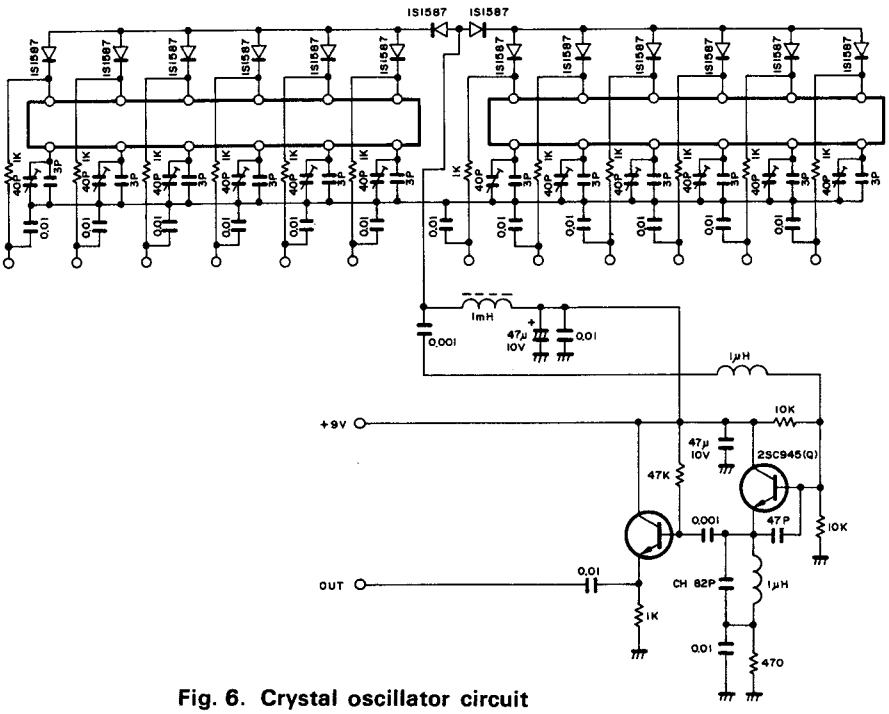


Fig. 6. Crystal oscillator circuit

The following functions are available with the TRC-60

1. Receiver RF attenuator

The RF attenuator switching terminals are provided on the relay unit located in the top side of the set as shown in the Fig. 4. The RF attenuator is set to OFF in the factory. If interference by strong signals is remarkable, set it to ON.

Terminal A..... ON
Terminal B..... OFF

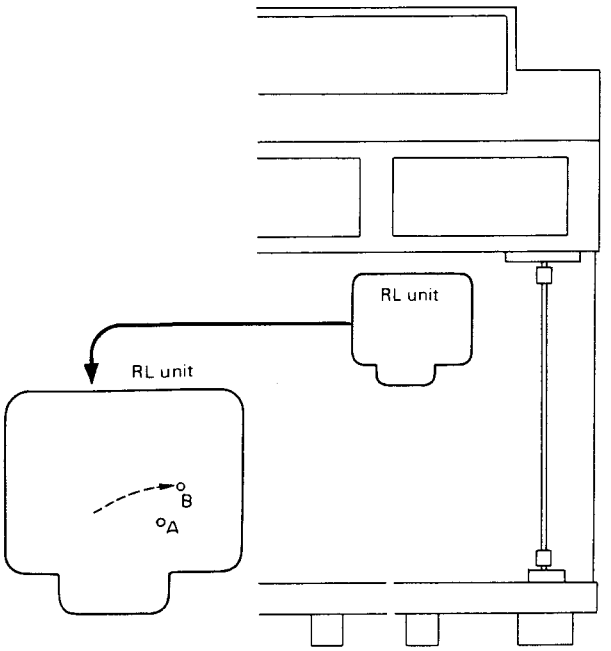


Fig. 7 Top side of the set

2. Noise blanker

The noise blanker ON-OFF terminals are provided on the IF unit located in the bottom side of the set. Turn the noise blanker on if necessary.

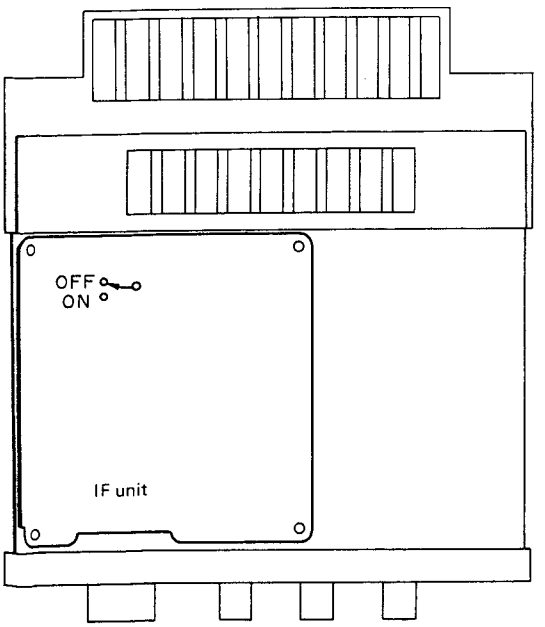


Fig. 8 Bottom side of the set

3. Optional LSB filters

Optional LSB filter installation procedures are as follows.

1. Remove 5 screws which fasten the IF unit and lift the left side of the IF unit.

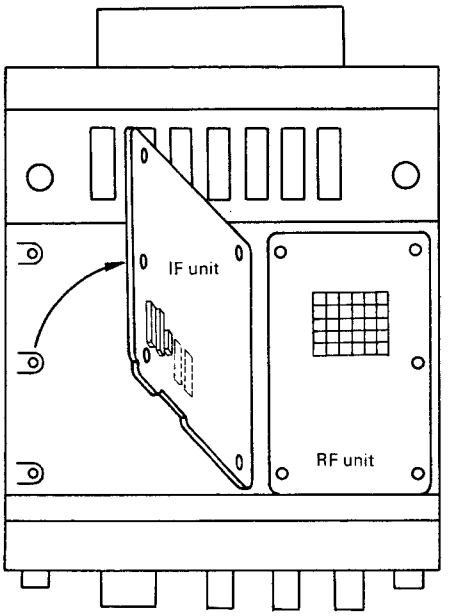


Fig. 9 Bottom view of the chassis

2. Install the filters in the locations of L100 and L101.
3. Solder the filter terminals.
4. Fasten the IF unit with the 5 screws.

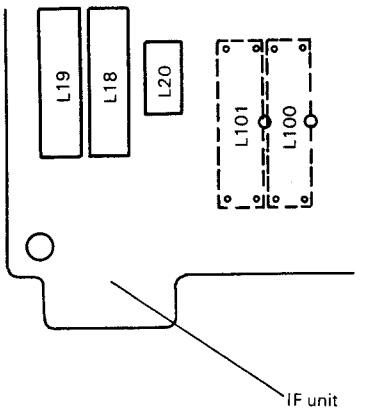


Fig. 10 Top view of the IF unit

ADJUST DE FRECUENCIA

Ajuste de frecuencia

Efectuar los ajustes que se mencionan a continuación cuando se ajusten las frecuencias.
Los ajustes básicos se efectúan enfábrica de forma que todas las unidades funcionarán perfectamente después de efectuar los procedimientos siguientes.

A. Contenidos

1. Confirmación de las piezas utilizadas y puntos a modificar y ajustar
2. Ajuste SMP — DUP — DUP2
3. Instalacion del cristal
4. Band setting de la unidad matriz (Ajuste de bando).
5. Filter selecting de la unidad puente (Selección de filtro)
6. Ajuste de frecuencia
7. Ajuste de la potencia de salida
8. Comprobación del funcionamiento
9. Anotación de frecuencias en la placa indicadora
10. Hoja de especificacion les del cristal

B. Procedimientos

1. Los puntos a ser modificado y ajustados se muestran en la figure 1.

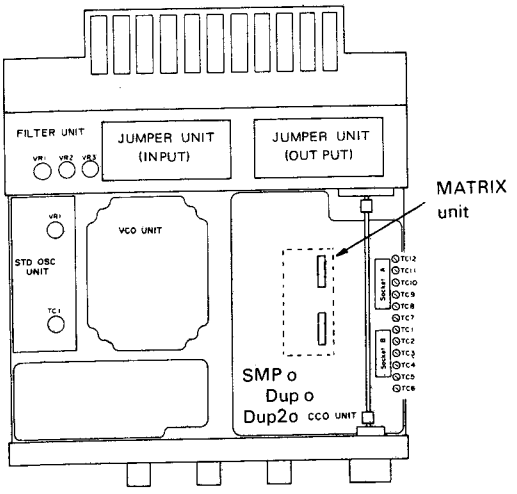


Fig. 1

Las piezas a ser utilizadas son las siguientes:
Unidad matriz
(Incluida en el paquete de accesorios).

- Cristales
  Deberán utilizarse solamente cristales que cumplan con las especificaciones para ellos preparadas.

Ver la página 3-7, articuls 10.

2. Ajuste SMP — DUP — DUP2

Insertar el conector de un polo cuyo cable está conectado al terminal SMP de la unidad CCO en DUP o DUP2, dependiendo de la configuración de la frecuencia que vaya a utilizarse.

(1) SMP
El conector ha sido insertado en esta posición en la fábrica. Esta posición se utiliza cuando la frecuencia de transmisión vaya a ser la misma que la frecuencia de recepción.

(2) DUP
Esta posición se utiliza cuando la frecuencia de transmisión es diferente de la frecuencia de recepción.

(3) DUP2
Esta posición se utiliza cuando la frecuencia de transmisión y la frecuencia de recepción vayan a ser las mismas en el canal 1 y diferentes en otros canales.

3. Instalación del cristal

(1) SMP:
Cada cristal se utiliza para transmisión y recepción.
Insertar los cristales en los receptáculos CH1 a CH6 del grupo B.

(2) DUP:

Cristales para recepción:	Receptáculos CH1 a CH6 del grupo B
Cristales para transmisión:	Receptáculo CH1 a CH6 del grupo A

(3) DUP2:
Cristal para transmisión y recepción:
Receptáculo CH1 del grupo B

Cristales para recepción:	Receptáculos CH2 a CH6 del grupo B
Cristales para transmisión:	Receptáculos CH2 a CH6 del grupo A

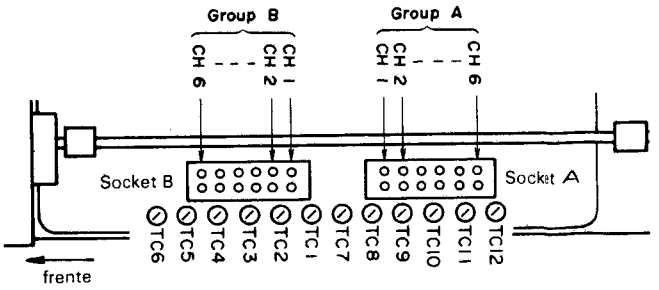


Fig. 2

4. Unidad matriz (ajuste de banda)

Esta unidad genera los datos de banda correspondientes a las frecuencias de cristal. Existen dos grupos de diodos en la unidad: uno consistente de D1 a D30 y otros de D31 a D60. Quitar los diodos de acuerdo a las frecuencias del cristal y refiriendose a la tabla siguiente. Dejar los diodos de los canales en los cuales no se han instalado cristales tal y como están.

Band	A	B	C	D	E	Band	A	B	C	D	E
2 MHz	0	1	0	0	0	10 MHz	0	0	0	0	1
3	1	1	0	0	0	11	1	0	0	0	1
4	0	0	1	0	0	12	0	1	0	0	1
5	1	0	1	0	0	13	1	1	0	0	1
6	0	1	1	0	0	14	0	0	1	0	1
7	1	1	1	0	0	15	1	0	1	0	1
8	0	0	0	1	0	16	0	1	1	0	1
9	1	0	0	1	0	17	1	1	1	0	1

Tabla 10 Tabla de datos de bandas 1 : Quitar

(1) Grupos de diodos a ser modificados

SMP:		D1 a D30
DUP:	Recepción:	Dá a D30
	Transmisión:	D31 a D60
DUP2:	Canal comun:	D1 a D5
	Recepción:	D6 a D30
	Transmisión:	D36 a D60

(2) Ejemplos:

Cuando un cristal de 5,182 MHz utilizado para transmisión y recepción se instalae en el CH1.

1 Buscar los datos de banda correspondientes a la banda de 5 MHz en la tabla de datos de banda.

5,182 Mhz → 5 MHz banda

	A	B	C	D	E
5 MHz banda datos →	1	0	1	0	0

2 Quitar los diodos correspondientes a A y C

	A	B	C	D	E
5 MHz banda datos →	1	0	1	0	0
Diodos CH1 →	(D1)	D2	(D3)	D4	D5

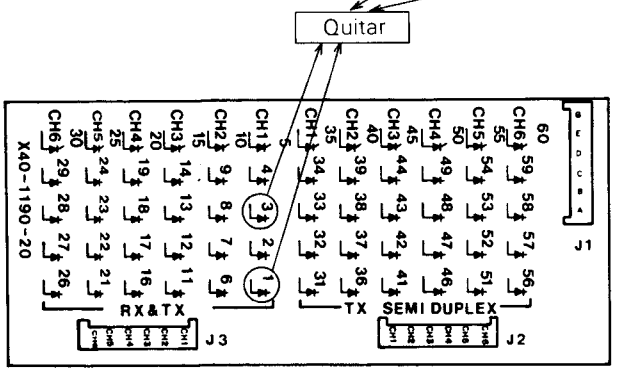


Fig. 3 Unidad de matriz

(3) Ejemplos 2

Cuando se instale un cristal de 10,256 MHz en CH2.

10,256 MHz → Banda 10 MHz

	A	B	C	D	E
10 MHz banda datos →	0	0	0	0	1
Diiodos CH2 →	D6	D7	D8	D9	(D10)

Quitar

Quitar los diodos de otros canales de la misma manera.

5. Unidad de puente (selección de filtro)

Los filtros a ser utilizados se seleccionan quitando los puentes de las unidades de puente situadas en el lado superior de las unidades finales. Estas dos unidades de puente deben modificarse de la misma manera.

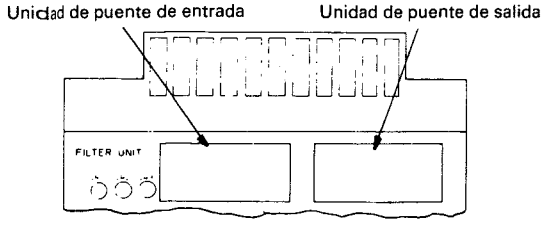


Fig. 4

Los procedimientos de modificación son los siguientes:

1) Quitar los cuatro tornillos para extraer la cubierta de la unidad de puente.
2) Seleccionar el número F correspondiente a cada canal de acuerdo a la tabla de números F mostrada a continuación.

Frecuencia de banda pasante	Filtro usado en el circuito LPF final	Numeros filter
2.0 — 3.2 MHz	FIA/FOA	F1
3.2 — 5.1 MHz	FIB/FOB	F2
5.1 — 7.9 MHz	FIC/FOC	F3
7.9 — 12 MHz	FID/FOD	F4
12 — 18 MHz	FIE/FOE	F5

Tabla 11 Tabla de números F

Ejemplo)

CH1 5,182 MHz → user F3 filter

CH2 10,256 MHz → user F14 filter

3) Agregar una conexión en puente que corresponda al número F obtenido.

Ejemplo)

CH1 5.182 MHz → F3..... ①

CH2 10.256 MHz → F4..... ②

Y soldar las conexiones en puente que se encuentran marcadas con un cirqulo.

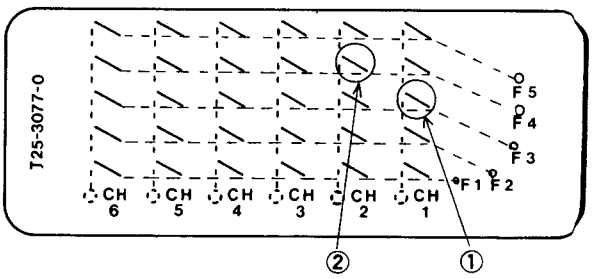


Fig. 5 Unidad de puente

Nota:

Cerciorarse de que solamente quede un puente para cada canal.

6. Ajuste de frecuencia

Conectar un contador de frecuencia al terminal del oscilador controlado por tensión (VCO) (J4) en la unidad DE RF. Ajustar el compensador de sintonía de cada canal de forma que el contador de frecuencia indique la frecuencia siguiente (fx) ± 5 Hz.

fx = 48,455 MHz + la frecuencia indicada en el crisal

Ejemplo)

CH1 5,182 MHz → fx = 48,455 + 5,182
= 53,637000 MHz

CH2 10,256 MHz → fx = 48,455 + 10,256
= 58,711000 MHz

7. Ajuste de la potencia de salida

Cerciorarse de que hayan sido ejecutados correctamente los pasos del 1 al 6. Luego, encender la unidad y efectuar los ajustes finos siguientes.

(a) SSB:
Hay 6 potenciómetros para ajustar la potencia de salida en la unidad de control de cristal (unidad CCO): VR4 (CH1), VR5 (CH2), VR6 (CH3), VR7 (CH4), VR8 (CH5) y VR9 (CH6).
Adjustarlos de forma que se obtengan 80 ± 5W de potencia de transmisión cuando la entrada del micrófono sea de 3 mV a 600Ω.

(b) A3H:
Ajustas desde VR4 a VR9 de forma que se obtengan aproximadamente 25W de potencia de transmisión cuando la entrada del micrófono esté desconectada.

8. Comprobación

Confirmar que el funcionamiento de la unidad cumpla con las especificaciones.

9. Anotación de frecuencias en la placa de indicación

1) Quitar los dos tornillos situados en la parte superior del panel para poder quitar el retenedor de la placa indicadora.
2) Quitar la placa indicadora y anotar las frecuencias de los cristales instalados en ella.
3) Montar la placa indicadora en su posición original y apretarla con el retenedor.

10. Usar los cristales especificados en las especificaciones

(1) Número de modelo: HC-42/U (Incluyendo corte inferior)
(2) Grado de oscilación: 3 veces de sobretono
(3) Frecuencia de oscilación: 25,450 a 35,450 MHz
(4) Frecuencia de presentación: Presenta la frecuencia nominal (Al solicitar un cristal hay que especificar su frecuencia nominal)
(5) Número de pieza: L77-0960-05
(6) Desviación de frecuencia permisible: $\pm 10 \times 10^{-6}$ (a 25°C) (En el equipo puede establecerse a cero)
(7) Cambio de frecuencia con temperatura: $\pm 5 \times 10^{-6}$ (En el rango de −10 a 50°C con la temperatura ambiente de referencia)
(8) Relación entre la de presentación (nominal) y la de oscilación:
Frecuencia de oscilación (fosc)
= 10 × {23,545 − N − Frecuencia de presentación (nominal) f_D}
N = 20 − el valor de f_D, frecuencia de presentación (nominal), en términos de MHz con la parte decimal quitada.
(9) Vista inferior del chasis.

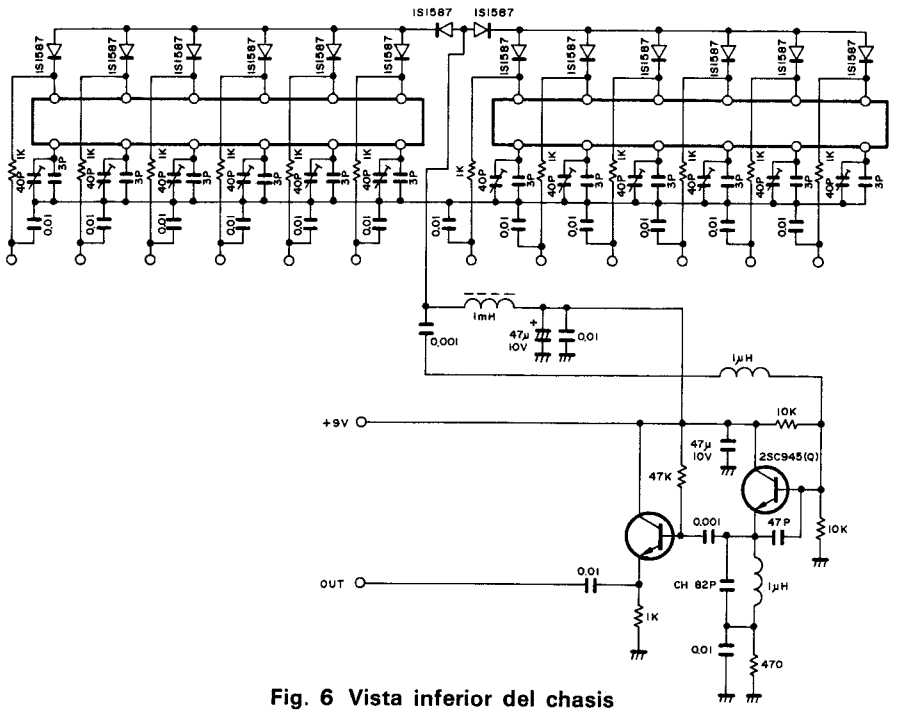


Fig. 6 Vista inferior del chasis

Con el TRC-60 se dispone de las functiones siguientes

1. Atenuador de RF del receptor

Los terminales de conmutación del atenuador de RF están en la unidad de relés situada en la parte superior del aparato como se muestra en la Fig. 4. El atenuador se a puesto en la posición de desactivado (OFF) en la fábrica. Si la interferencia de señales intensas fuese muy notable, poner el aparato en la posición de activado (ON).

Terminal A ..... activado (ON)
Terminal B ..... desactivado (OFF)

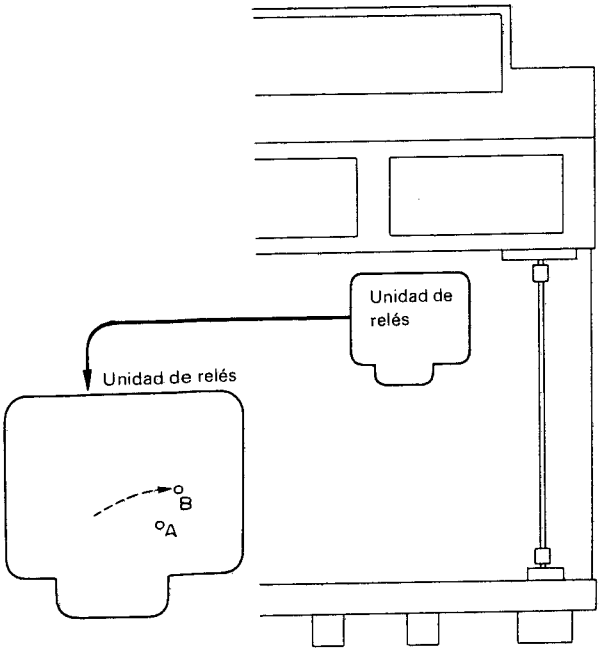


Fig. 7

2. Supresor de ruidos

Los terminales de activado/desactivado (ON-OFF) del reductor de ruidos están en la unidad de FI situada en la parte inferior del aparato. Activar el supresor de ruidos si fuese necesario.

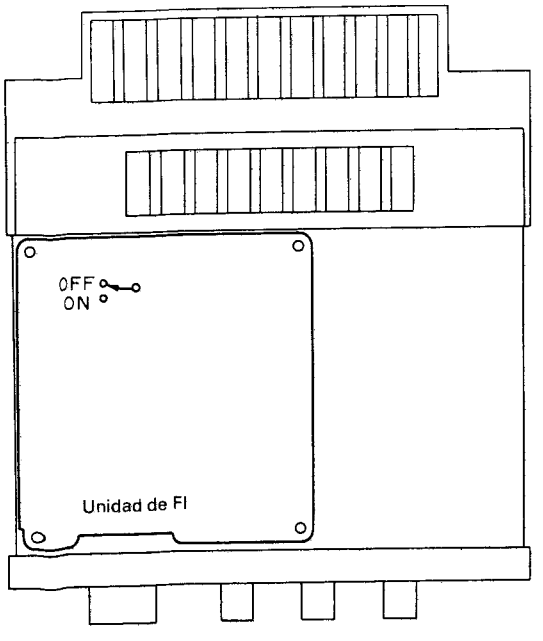


Fig. 8

3. Filtros LSB (banda lateral inferior) opcionales

Los procedimientos de instalación del filtro LSB opcional son los siguientes:

1. Quitar los 5 tornillos que sujetan la unidad de FI y levantar el lado izquierdo de esta unidad.

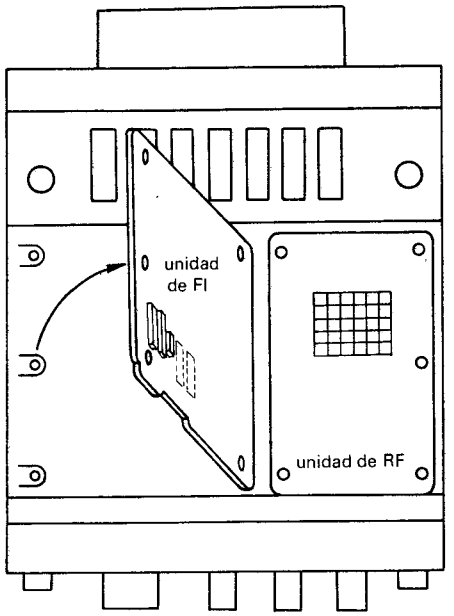


Fig. 9 Vista inferior del chasis

2. Instalar los filtoros in las ubicaciones de L100 y L101.
3. Soldar los terminales de los filtoros.
4. Atear la unidad IF con 5 tor nillos.

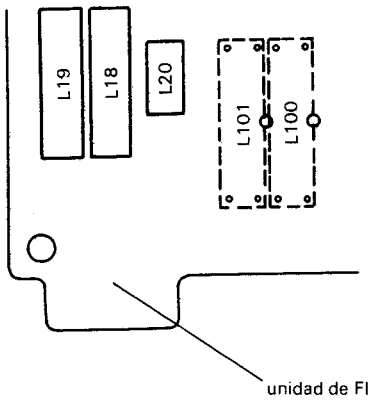


Fig. 10

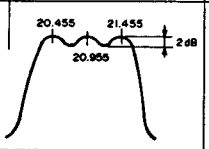
TEST EQUIPMENT REQUIRED

1. **DC Volt meter (DC V.M)**
   1) Input resistance: More than 1 MΩ
   2) Voltage range: 1.5 to 1000V AC/DC
   NOTE:
   A high-precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.
2. **DC Am meter**
   1) Current range: 100 mA, 200 mA, 2A, 10A. High-precision current meter may be used.
3. **RF Volt meter (RF V.M)**
   1) Input impedance: 1 MΩ and less than 3 pF, min.
   2) Voltage range: 10 mV to 300V
   3) Frequency range: 50 MHz or greater
4. **AF Volt meter (AF V.M)**
   1) Frequency range: 50 Hz to 10 kHz
   2) Input resistance: 1 MΩ or greater
   3) Voltage range: 10 mV to 30V
5. **AF Generator (AG)**
   1) Frequency range: 200 Hz to 5 kHz
   2) Output: 2 mV~1V, low distortion
6. **AF Dummy load**
   1) Impedance: 8Ω
   2) Dissipation: 3W or greater
7. **RF Dummy load**
   1) Impedance: 50Ω, 150Ω
   2) Dissipation: 100W continuous or greater
   3) Frequency limits: 1.8 to 30 MHz
8. **Oscilloscope**
   Requires high sensitivity, and extternal synchronization capability.
9. **Tracking generator**
   Frequency range: 48.455 MHz
10. **Standard signal generator (SSG)**
    1) Frequency range: 1.8 to 30 MHz
    2) Output: −20 dB/0.1μV~120 dB/1V
    NOTE:
    Generator must be frequency stable.
11. **Frequency counter**
    1) Minimum input voltage: 50 mV
    2) Frequency range: Greater than 30 MHz
12. **Noise generator**
    Must generate ignition noise containing harmonics beyond 30 MHz
13. **Spectrum analyzer**
    1) Frequency range: 100K to 110 MHz
    2) Bandwidth: 1 kHz to 3 MHz
14. **Distortion meter**
15. **Power meter**
    1) Impedance: 50Ω
    2) Dissipation: 100W continuous or greater
    3) Frequency limits: 30 MHz or greater
16. **Directional coupler**

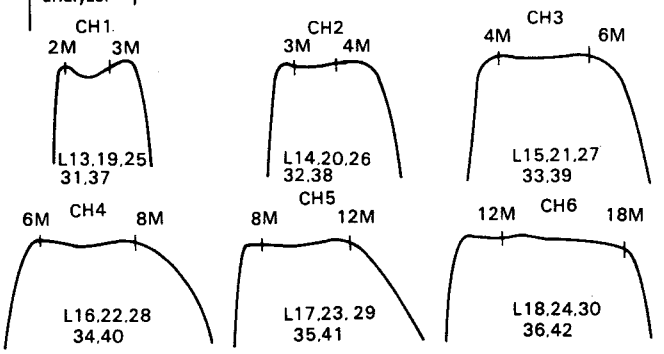
Notes on Adjustment:
The TRC-60 is designed for full operation on any frequency between 2 and 18 MHz without adjusting anything except the frequency adjustment shown on page 3-1.
No all of the adjustment points shown below always require adjustment. Determine the points to be adjusted according to the frequency used.

Notas sobre el ajuste:
El TRC-60 ha sido diseñado para funcionar perfectamente entre frecuencias de 2 a 18 MHz sin tener que ajustar nada excepto los puntos de ajuste mostrados en la página 3-5. No todos los puntos mostrados más abajo requieren ser ajustados siempre. Determinar los puntos que han de ajustarse refiriéndose a la frecuencia usada.

ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification
		Test equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	Unless otherwise specified, set the controls as follows. DC: 13.8V, J2 of RF unit; open, Mode: USB, CLARI VOL: centered, TONE: OFF, RF/SOURSE: SOURSE							
2. Voltage check	1) Power SW: ON							Power relay activates. Current should be 2.5A or less. Pilot lamp should be lit.
		DC V.M	CCO	RB(J14)	CCO	VR3	0.8V	
	2) IF unit: VR6 MAX to CW		IF	D34	IF	VR7	3.0V	
3. Sourse voltage	Power SW: ON				RL	VR3	The meter reads "7" on RF scale	
4. C11 voltage	Transmit	DC V.M	RL	C11(J9)	RL	VR2	11.0V	±0.1V
5. Base current	Transmit	DC A.M	FINAL	14 (Gray wire)	FINAL	VR1	150 mA	
				14A (White wire)		VR2	100 mA	
6. FAN Operation	Transmit		FINAL	TH1			Warm up with a dryer and confirm that the fan operates correctly.	
7. CAR	1) Receive	RF V.M	CAR	TP1	CAR	L1,2	MAX	0.4V or more
	2) MODE: AM							No output
	3) MODE: USB	Counter			CAR	TC1	455.000 kHz	±1 Hz
8. Standard oscillator This item should be done 20 minute after the power on	1) CLARI Control centered	Counter RF V.M	IF	12(J4)	STD	TC1	12.000 MHz	±1 Hz 0.8V
	2) Transmit	Counter			STD	VR1	12.000 MHz	±1 Hz
	3) Receive						Control the CLARI VOL.	±250 Hz or more
9. HET	Receive	RF V.M	IF	24(J3)	IF	L32,39	MAX	0.04V
				48 (J3)		L38,40	MAX	0.058V
				D38		L28,30	MAX	1.0V
10. PLL	1) Matrix PCB jig (unit equipped with 2 MHz, 5 MHz, 10 MHz and 15 MHz band data jumper wire CH: 1 Socket A CH1: 31.000 MHz	Counter	VCO	CCO(J1)	CCO	TC1	3.100 MHz	±1 Hz
		RF V.M						0.2V or more
		Spectrum-analyzer		TP-1, TP-2	VCO	L8~10		
		Sync'ed scope		Pin 2 of Q12		L5~7	MAX	0.01V or more
		DC V.M		TP3		L1	2.0V	
		Counter		VCO(J4)			50.900 MHz	
	2) • CH:2 • Socket A CH2: 31.000 MHz	DC V.M.		TP3	VCO	L2	2.0V	
		Counter		VCO(J4)				53.900 MHz
	3) • CH:3 • socket A CH3: 31.000 MHz	DC V.M.		TP3	VCO	L3	2.0V	
		Counter		VCO(J4)				58.900 MHz
	4) • CH:4 • Socket A CH4: 31.000 MHz	DC V.M.		TP3	VCO	L4	2.0V	
		Counter		VCO(J4)				63.900 MHz

Item	Condition	Measurement			Adjustment			Specification
		Test equipment	Unit	Terminal	Unit	Parts	Method	
11. SIMP-DUP-DUP2	1) • Connect the 1p plug on the CCO unit into DUP. • Select CH1 to CH6 with the CH rotary SW and insert a 31.000 MHz crystal unit into Socket B in the order from CH1 to CH6. • Transmit.	Counter	VCO	VCO (J4)			CH1: 50.900 MHz CH2: 53.900 MHz CH3: 58.900 MHz CH4: 63.900 MHz CH5: 63.900 MHz CH6: 63.900 MHz	Confirm that the following frequencies can be obtained at each CH.
	2) • Connect the 1p plug on the CCO unit into DUP2. • Select CH2 to CH6 with the CH rotary SW and insert a 31.0 MHz crystal unit into Socket B in the order from CH2 to CH6.						CH2: 53.900 MHz CH3: 58.900 MHz CH4: 63.900 MHz CH5: 63.900 MHz CH6: 63.900 MHz	Confirm that the following frequencies can be obtained at each CH.
	3) CH: 1 Socket A CH1: 31.000 MHz						Confirm that a freququency of 50.900 MHz is obtained in both TX and Rx modes.	
12. TBL Voltage	Transmit	DC V.M	CCO	TBL (J14)	CCO	VR2	2.0V	
13-A B.P.F	1) Install matrix jig (BPF)	Spectrum analyzer	RF	R22	RF			



13-B. MCF	1) Connect a tracking generator to R6 in RF unit.. Connect a spectrum analyzer to R19 in IF unit.	Spectrum analyzer Tracking generator			RF IF	L9, 59 62,73 L4		Notes: 1. The frequencies of the left and right shoulders of the waveform shown at left are not necessarily those which will result 2. The output level must be flat within 5 kHz above and below 48.455 MHz. 3. It is not necessary for the center frequency to be 48.455 MHz. 4. The output level at 48.455 MHz±5 kHz should be set as high as possible without distoring the wavebrm.
	2) Connect a tracking generator to R82 in IF unit. Connect spectrum analyzer to D18, in RF unit Transmit.				IF	L26	Adjust L26 so that the output level is maximized at 8.455 MHz observing the waveform	
14. TONE	TONE: ON	Counter AF V.M	IF	TO (J6)	IF	VR9	1.5 kHz	±2 Hz 0.1V or more
15. Alarm	1) Relay unit: Disconnect the J8 connector MODE: USB							• The tone sounds • A3H
	2) AF VOL: MIN	AF.V.M						0.8V or more (AF output 8Ω 2)

Item	Condition	Measurement			Adjustment			Specification
		Test equipment	Unit	Ter-minal	Unit	Parts	Method	
16. GAIN	Install matrix jig. IF unit VR1: Centered TC1: Centered CH: 1 Socket A CH1: 31.000 MHz SSG output: 0 dBμ Frequency: 2.445 MHz	SSG Oscillo-scope AF V.M			RF	L9, 59 62, 73	MAX	S/N 10 dB or more
					IF	L4, 5 9,8,29 33		
17. A3H GAIN	MODE: A 3H SSG output: 14 dBμ (MOD/1 kHz, DEV/30%) frequency: 2.445 MHz	SSG Oscillo-scope AF V.M						S/N 10 dB or more
18. NB	1) MODE: USB SSG output: 30 dBμ	DC V.M	IF	TP1	IF	L2,3	MIN	
	2) ANT: connect the N.G IF unit: Connect the 1p plug to ON terminal. (After adjustment, always return to OFF terminal.)	Noise generator				VR1 L9	Adjust to non-signal point.	
19. MUTE	1) SSG output: 30 dBμ MUTE: ON	SSG Oscillo-scope			IF	VR8	Adjust to point.	
	2) SSG output: 40 dBμ	AF V.M						The signal should appeared
20. 48M Trap	SSG frequency: 48.455 MHz SSG output: 60 dBμ	Oscillo-scope SSG AF V.M			RF	L11	Minimum the AF output	
21. Output and distortion	SSG output: 40 dBμ AF VOL: Adjust so that the AF V.M reads 3.47V/8Ω	Distortion meter						Distortion 10% or less
22. AGC	SSG output: 80 dBμ	Oscillo-scope AF V.M SSG					Time until the AGC voltage returns to that of 80%.	A3H, USB: approx. 2 SEC CW: approx. 0.6 SEC
23. RF.ATT	SSG output: 10 dBμ	SSG AF V.M					Reconnect the 1p plug of relay unit from A to B and measure the attenuation.	20 dB±3 dB or more
24. Residual noise	AF VOL: MIN SSG output: OFF	AF V.M						1 mV or less
25. ALP	1) MODE: USB CH: 1 Transmit	DC V.M	CCO	ALP (J14)	CCO	VR4	3.0V±0.1V	
	2) CH: 2					VR5		
	3) CH: 3					VR6		
	4) CH: 4					VR7		
	5) CH: 5					VR8		
	6) CH: 6					VR9		
26. MIC Sensitivity	1) MODE: USB MIC Input: 30 mV/1.5 kHz Transmit	AF V.M AG	CCO	AFO (J14)				45 mV~65 mV
	2) MIC Input: 3 mV/1.5 kHz Transmit				CCO	VR11	Adjust so that 80% of the above value is obtained.	
27. DRIVE	1) RF unit: Connect a cord (50Ω load) to J2. IF unit: VR2: MIN VR5: Centered Install matrix jig. Socket a CH1: 35.450 MHz MIC input: 30 mV/1.5 kHz Transmit	RF V.M AG	IF	Cathode of D41			Approx. 0.07V (check)	
	2) MIC Input: 3 mV/1.5 kHz Transmit		RF	J2 (50Ω load at both ends)	RF	L59, 62 73	0.7V or more	
					IF	L22, 23 26		

Item	Condition	Measurement			Adjustment			Specification
		Test equipment	Unit	Ter-minal	Unit	Parts	Method	
28. POWER	1) RF unit: Connect J2 connector ANT: Power Meter	Power meter, AG						110W or more
	2) MIC input: 3 mV/1.5 kHz				CCO	VR4	80W	
	3) CH: 2 Socket ACH2: Install 34.450 MHz crystal Band data: 3					VR5		
	4) CH: 3 Socket ACH2: Install 34.450 MHz crystal Band data: 5					VR6		
	5) CH: 4 Socket ACH3: Install 35.450 MHz crystal Band data: 8					VR7		
	6) CH: 5 Socket ACH5: Install 35.450 MHz crystal Band data: 12					VR8		
	7) CH: 6 Socket ACH6: Install 34.450 MHz crystal Band data: 18					VR9		
	8) CH: 1 Socket ACH1: Install 35.450 MHz crystal MIC input: 30 mV/1.5 kHz				FILTER	VR2	90W	
29. RF Meter	Connect J2 connector ANT: Power meter				FILTER	VR3	The meter reads "7" on RF scale	
30. Carrier suppretion	MIC input: OFF MODE: USB Frequency: 10 MHz	Spectrum analyzer			IF	VR5	Minimize the carrier level.	—40 dB or less
31. A3H Output power	1) MODE: A3H MIC input: OFF	Power meter			IF	VR4	25W	
	2) MIC input: 30 mV/1.5 kHz	Spectrum analyzer				VR2	Adjust so that the value of —6 dB for carrier level is obtained.	
32. Protection	Band data: 14 ANT: 150Ω 100W Power meter	150Ω 100W Dummy load			FILTER	VR1	40W ANT open or short	The current consumption should be lower than that measured with a 50Ω dummy load.
33. KEY	MODE: CW KEY Jack: Key	AF V.M	CCO	AFO	CCO	VR1	Adjust so that the value in 26.1) is obtained.	

ADJUSTMENT POINTS

▼ TOP VIEW

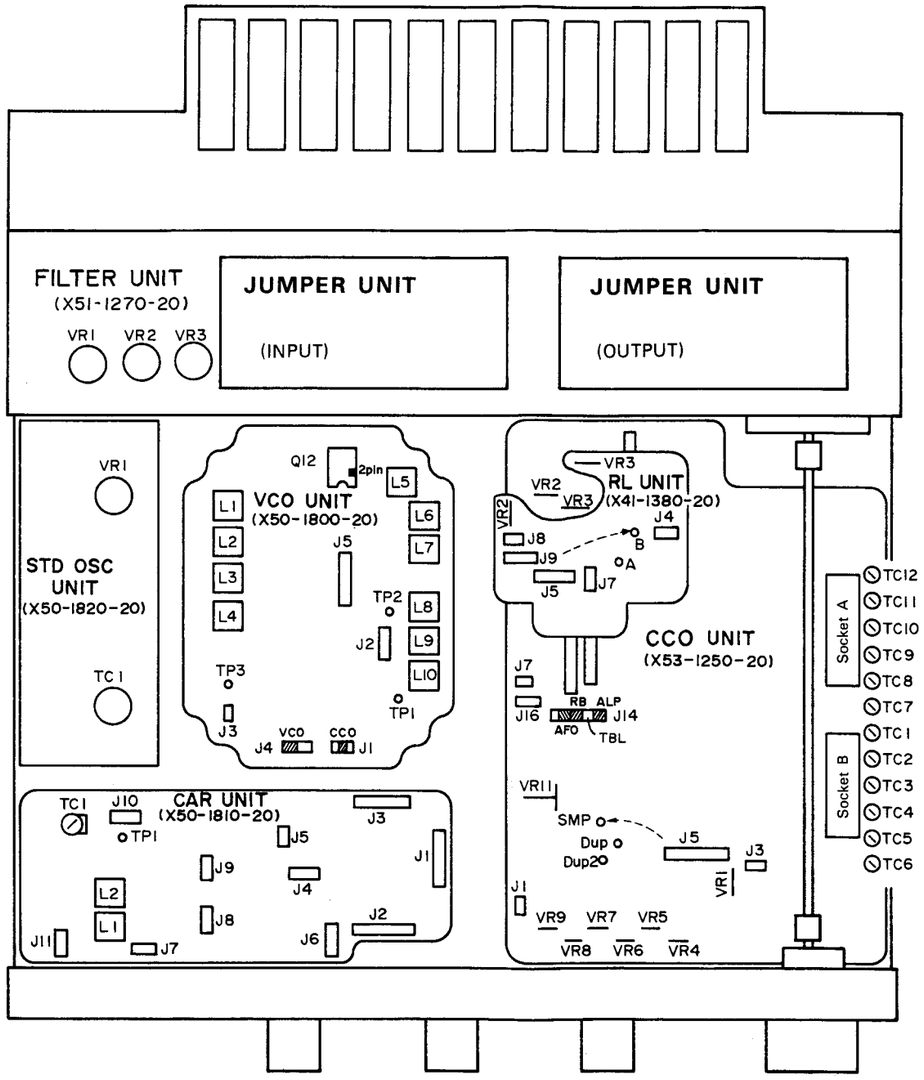


Fig. 8

NOTE :
Adjustment points in the diagram are color shaded.

– MEMO –

▼ BOTTOM VIEW

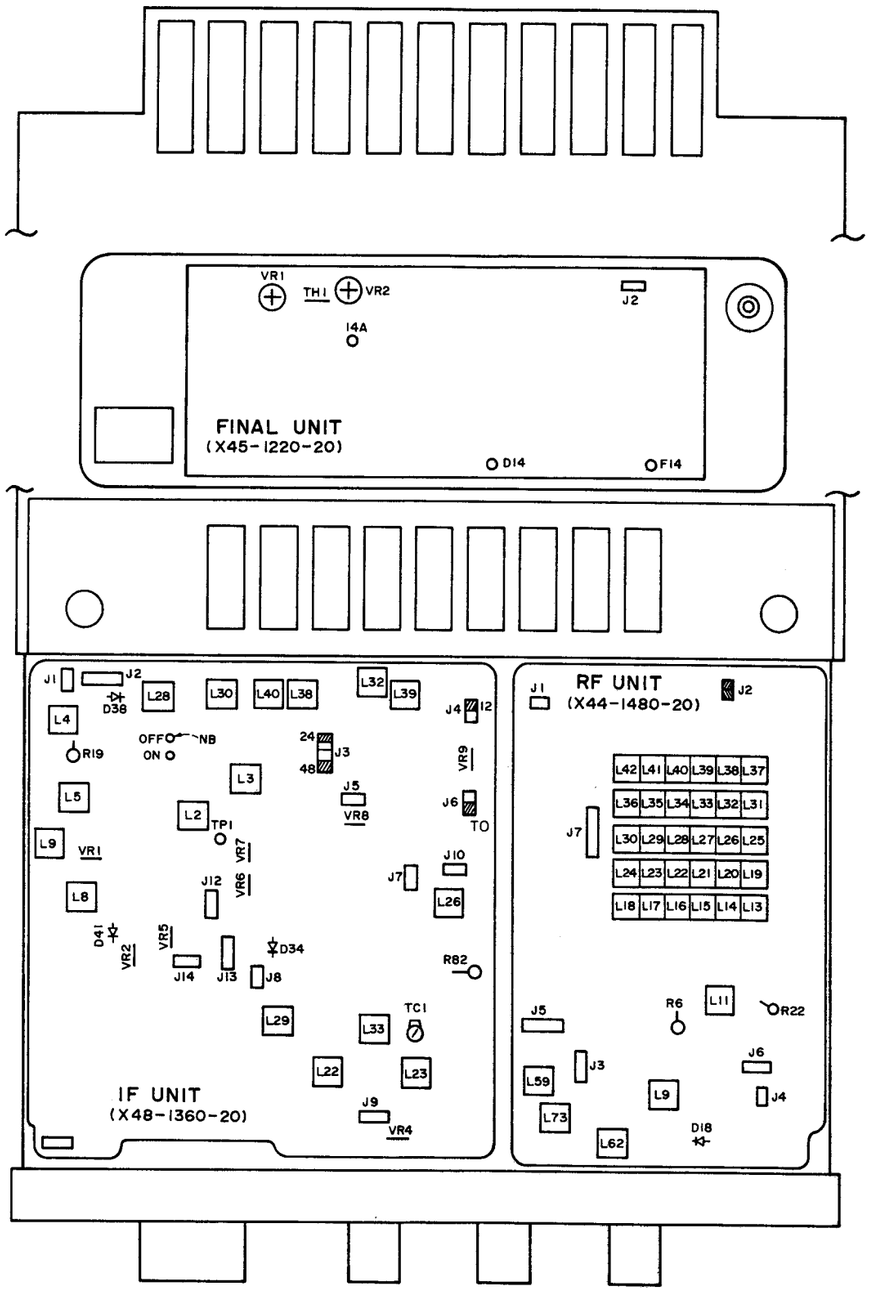
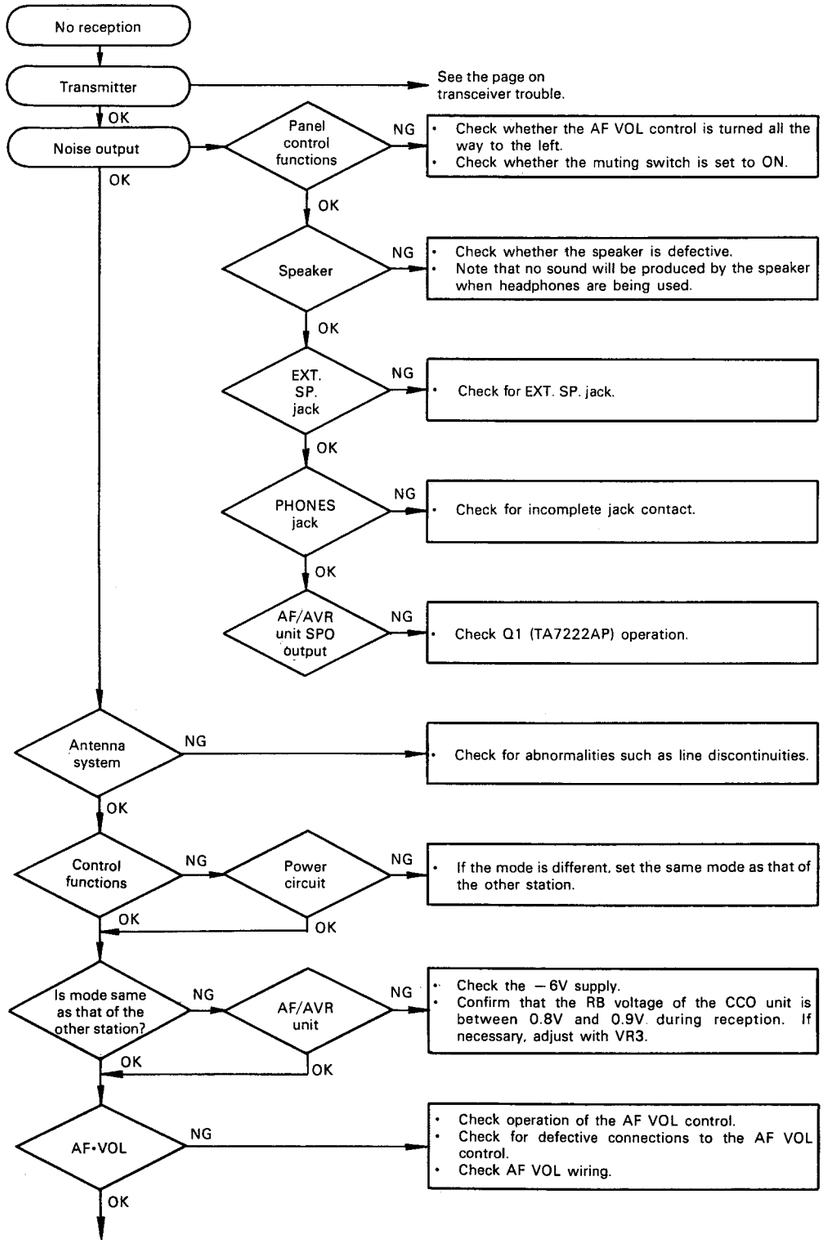
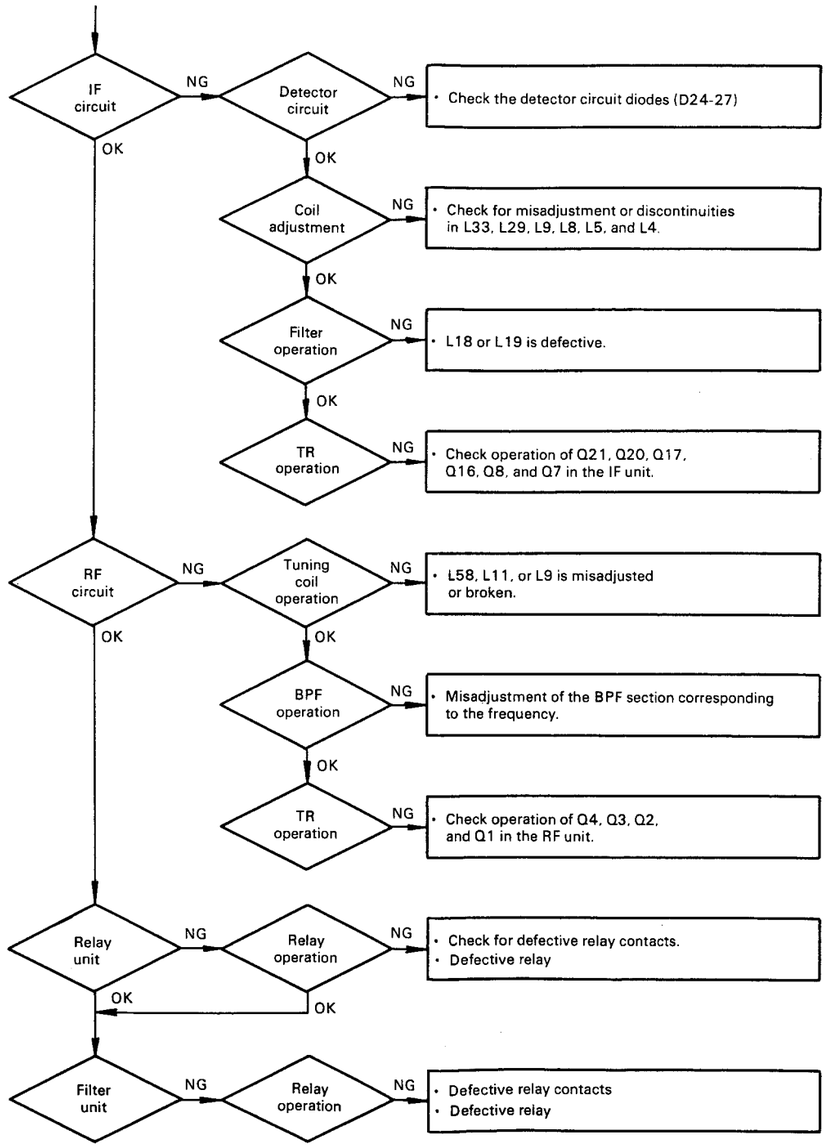


Fig. 9

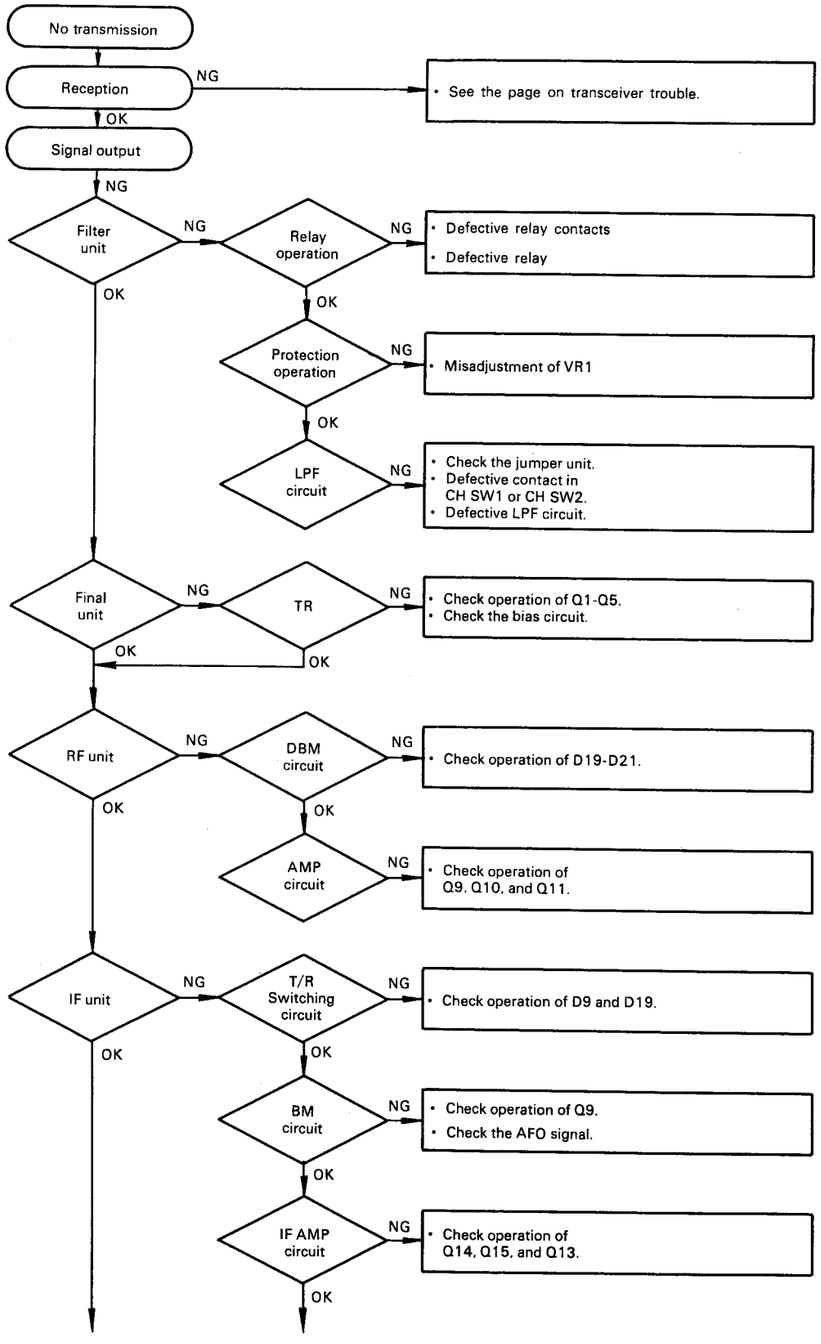
TROUBLE SHOOTING

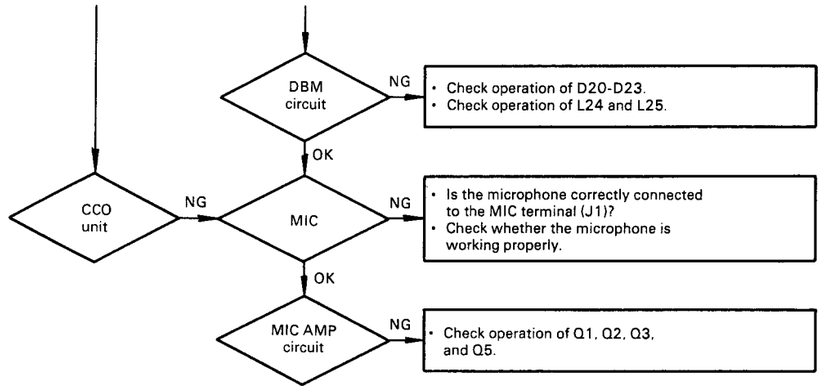
<Receiver Section>





<Transmitter Section>

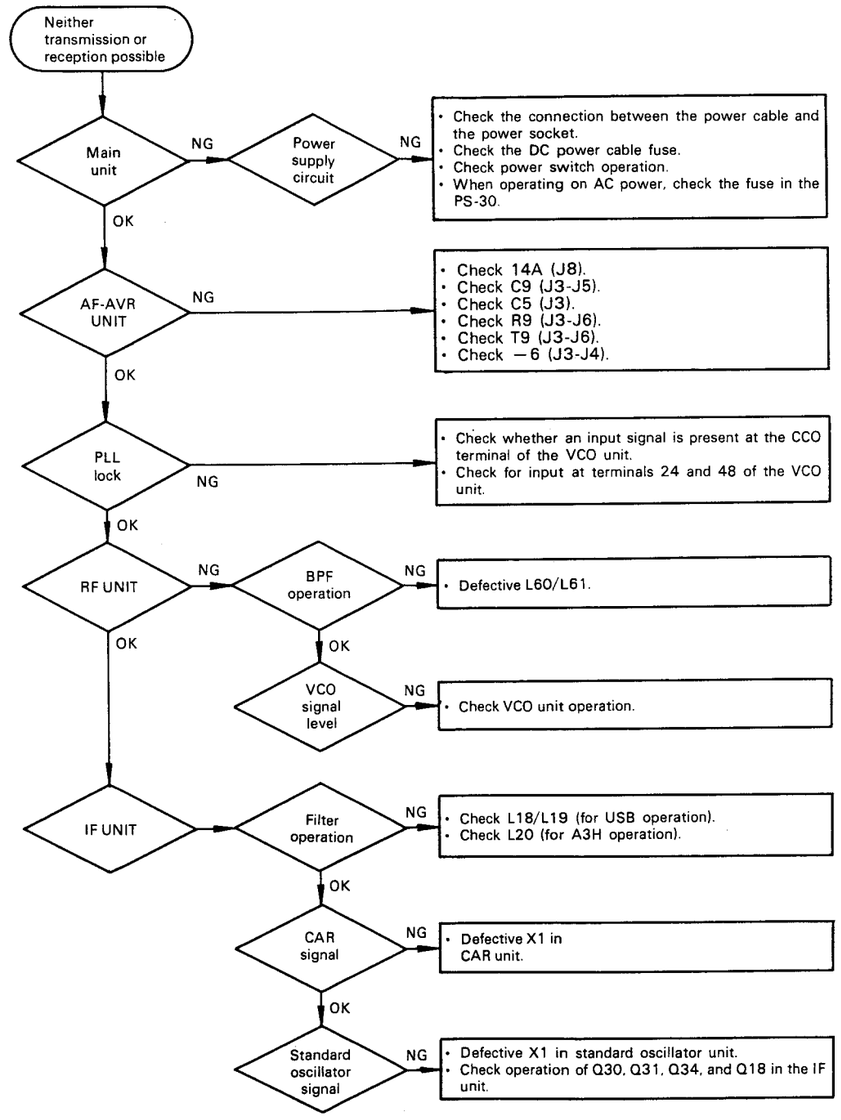




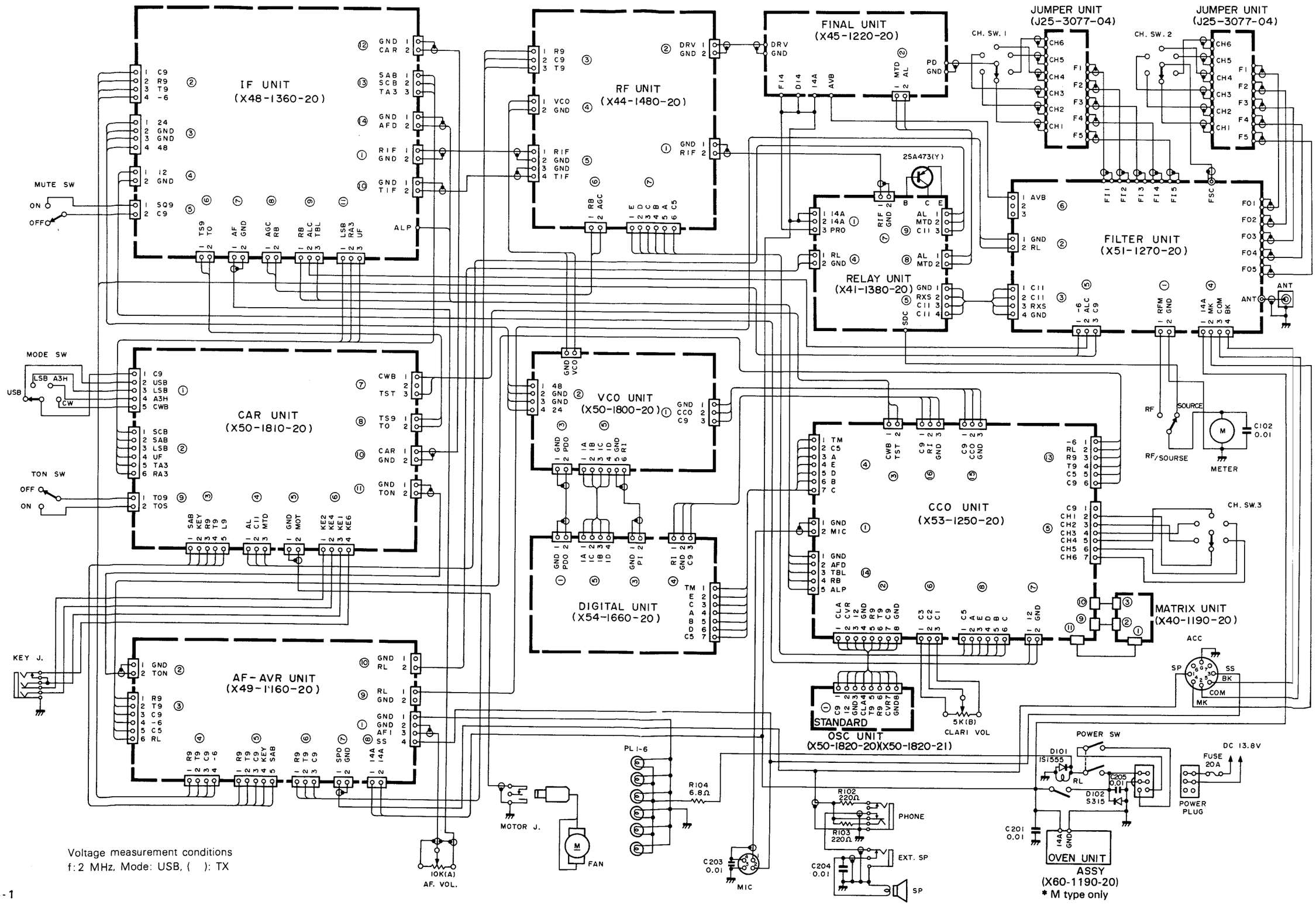
A3H power varies on different channels.	• Readjust power for each channel (to obtain an 80W output with a 1.5 kHz AF input level of 3 mV).
A3H modulation is either to high or too low.	• Adjust modulation to specifications with VR2 of the IF unit.
Distortion is included in the transmission signal.	• Incorrect idling current adjustment (drive and final circuits) • The following measure must be taken when cross modulation or spurious emissions are produced. Mutually offset the 12 MHz standard signal frequency and the frequency of the interpolation oscillator in the CCO unit so that distortion is reduced (or eliminated).
Fan does not turn.	• Check whether the jack from the fan is fully inserted into the fan terminal on the back panel. • The fan is set to begin turning when the temperature in the vicinity of the final exceeds 70C.

<Other check items>

1. TBL voltage check	Confirm that the TBL voltage is 2.0V during transmission.
2. Crystal position check	Since different crystal connectors are used in the CCO unit for operation in the SMP, DUP, and DUP2 modes, check operation in these modes and the positions in which crystals are inserted.
3. Power variations on different channels	Power for the different channels is adjsuted by means of corresponding potentiometers inside the CCO unit (VR4, VR5, VR6, VR7, VR8, and VR9). Make sure that these potentiometers are correctly adjusted.
4. When protection is on	If operation is normal when a 50 ohm power meter and load are connected to the ANT terminal, it is likely that the SWR of the antenna is too large (greater than VSWR2). In this case, the antenna must be adjusted. However, if operation is not normal, protection readjustment is necessary.
5. When the alarm sounds	When the alarm sounds, stop transmission immediately and switch to the receive mode. The alarm sounds when the final becomes too hot, and will go off when the temperature drops again.



SCHEMATIC DIAGRAM



Voltage measurement conditions
f: 2 MHz, Mode: USB, ( ): TX

BLOCK DIAGRAM

TX signal line
RX signal line

CCO UNIT (X53-1250-20)

MIC 600Ω
MIC AMP Q1 2SC2240GR
MIC AMP Q2 2SC1815(Y)
MIC Q3 μPC1158HZ
AF FILTER Q5 2SC945(Q)
AFO
35.450~25.450MHz
X1~X12
OSC Q14 2SC945(Q)
BUFFER AMP Q15 Q49 Q16 2SC945(Q)x2 Q16:2SC2347
1/10 DIVIDER Q43 HD74196P
BUFFER AMP Q17 2SC945(Q)
CCO (3.545~2.545MHz)
SMP. DUP. DUP2
CLARI VR C3 C2 C1 +V
MATRIX UNIT (X40-1190-20)
BUFFER AMP Q50 2SC945(Q)
I2
CLA I2M RI

STANDARD OSC UNIT (X50-1820-20,21)

X1 12MHz
OSC Q1 2SC945(Q)
BUFFER AMP Q2 2SC945(Q)
12M (12MHz)
20: M Type
21: M2 Type
D2
T9 T9
CLA

CAR UNIT (X50-1810-20)

OSC & DIVIDER Q20 TC5048P
455KHz
BUFFER AMP Q19 2SC945(Q)
CAR (455KHz)
X1 7.28MHz

AF-AVR UNIT (X49-1160-20)

AFI
AF AMP (PA) Q1 TA7222AP
SPO
SP 8Ω
C9 9V AVR
C5 5V AVR
R9 9V AVR
T9 9V AVR
-6 -6V AVR

IF UNIT (X48-1360-20)

I2
Q30 (24MHz) 2SC945(Q)
Q31 (48MHz) 2SC945(Q)
BUFFER AMP Q34 2SC945(Q)
24 (24MHz) BUFFER AMP Q32 2SC945(Q)
48 (48MHz) BUFFER AMP Q33 2SC945(Q)
BUFFER AMP Q18 2SC945(Q) (48MHz)
A3H CAR. ADJ. VR4
BUFFER AMP Q12 2SC945(Q)
L18, L19 CFJ455(U)
IF AMP Q14 3SK74(L)
IF AMP Q15 3SK74(L)
ALC
DBM D20~23 ISS16 x 4
L20 CFW455HT
IF AMP Q16 3SK74(L)
IF AMP Q17 3SK74(L)
D24 D25 D27 D26 IN60 x 4
IF AMP Q13 2SC945(Q)
TIF
L100, L101 CFJ455(L)
AFO
BUFFER AMP Q27 2SC945(Q)
BM Q9 μPC1037H
BUFFER AMP Q10 2SC945(Q)
BUFFER AMP Q11 2SC945(Q)
CAR (455KHz)
RIF
MIX Q7 3SK74(L)
MIX Q1 3SK74(L)
NB SW GATE D4,5 1S1587
MUTE CONTROL Q26 μPC4558C
AGC DC AMP Q25 2SK19(GR)
AGC
AGC CONTROL Q23 2SC945(Q)
AGC AMP Q19 2SC945(Q)
AM DET IN60
AF AMP Q20 2SC945(Q)
NOISE AMP Q1 2SK19(GR)
NOISE AMP Q2,3 2SC945(Q) x2
NOISE AMP Q4 2SC945(Q)
SW Q6 2SC945(Q)
AGC Q5 2SC745(Q)
DC SW Q36 Q37 Q22
Q22 : 2SC945(Q)
Q36,37 : 2SA1015(Y)
MUTE SIGNAL
AF AMP Q21 2SC945(Q)
AF
AF VR

VCO UNIT (X50-1800-20)

Q1 Q2 Q3 Q4 2SC2668(Y)
BUFFER AMP Q10 2SC2668(Y)
AMP Q11 2SC2668(Y)
(50.455~66.455MHz) VCO
BUFFER AMP Q16 2SC2668(Y)
68.455~69.455 MHz MIX Q15 3SK74(M)
20.455~21.455 MHz MIX Q14 SN16913P
CCO
24
48
(OSC)
2~5M 10~15M 5~10M 15~18M
BUFFER AMP Q9 2SC2668(Y)
MIX Q12 SN16913P
BUFFER AMP Q13 2SC2669(Y)
(18MHz~3MHz)
PDO
P1
BUFFER AMP Q6 2SC2347
BUFFER AMP Q7 2SC2668(Y)
Q10 SN74S00N 1/4
1/2 DIVIDER Q14 SN74LS74N
1/N N: 18~3
MD74196P Q15
HD74196P Q16
DIVIDER SN74S00N Q10
ABCD E
1/4 Q10 SN74S00N
GATE (F-F) Q14 SN74LS74N
(500KHz)
PHASE DETECTOR Q13 MC4044P
LPF Q1~3 2SC1775(E)
UP LOCK DETECTOR Q10
TM TM
(500KHz)
1/2 DIVIDER Q12 SN74LS90AN
1/2 DIVIDER Q11 SN74LS92N
(12MHz) RI

RF UNIT (X44-1480-20)

TIF
DBM D19~21 1SS16 x 4
AMP Q9 2SC945(Q)
AMP Q10 2SC945(Q)
AMP Q11 2SC2086
DRV
VCO
BPF MCF L60, L61
RIF
MIX Q1 3SK74(L)
MIX Q2 3SK74(L)
AMP Q3 2SK19(GR)
AGC
RF AMP Q4 3SK74(L)
BPF 2~3, 3~4 4~6, 6~8 8~12, 12~18 MHz
RFI
BPF SELECT

FINAL UNIT (X45-1220-20)

DRV
AMP Q1 2SC2075
AMP Q2 Q3 2SC2509 x2
AMP(PA) Q4 Q5 2SC2290 x2
FO

FILTER UNIT (X51-1270-20)

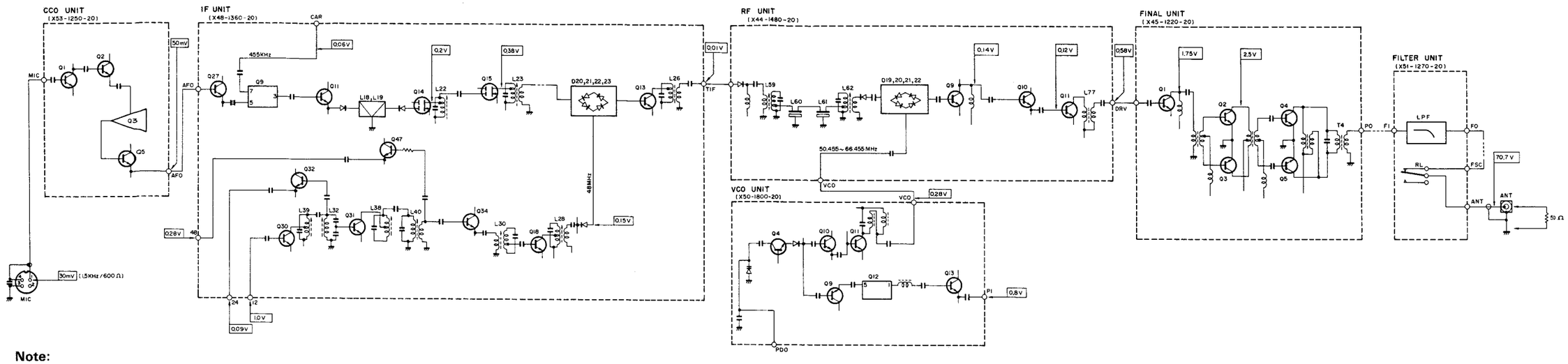
LPF
T
R
ALC
R x S
ANT

RELAY UNIT (X41-1380-20)

R
RFI
TO 11VAVR C

LEVEL DIAGRAM

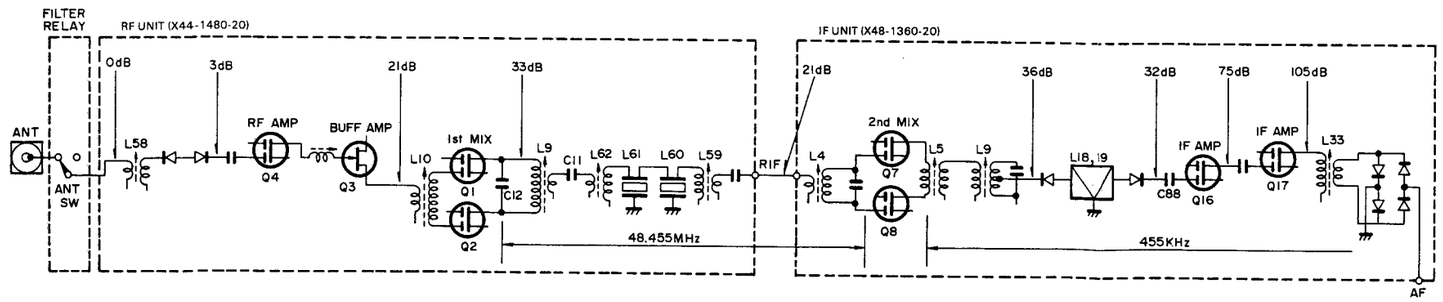
[Transmitter Section]



Note:

* Transmitting frequency: 2 MHz USB
Output power: 100W
ALC: OFF
Test equipment: RF VOLTMETER

[Receiver Section]

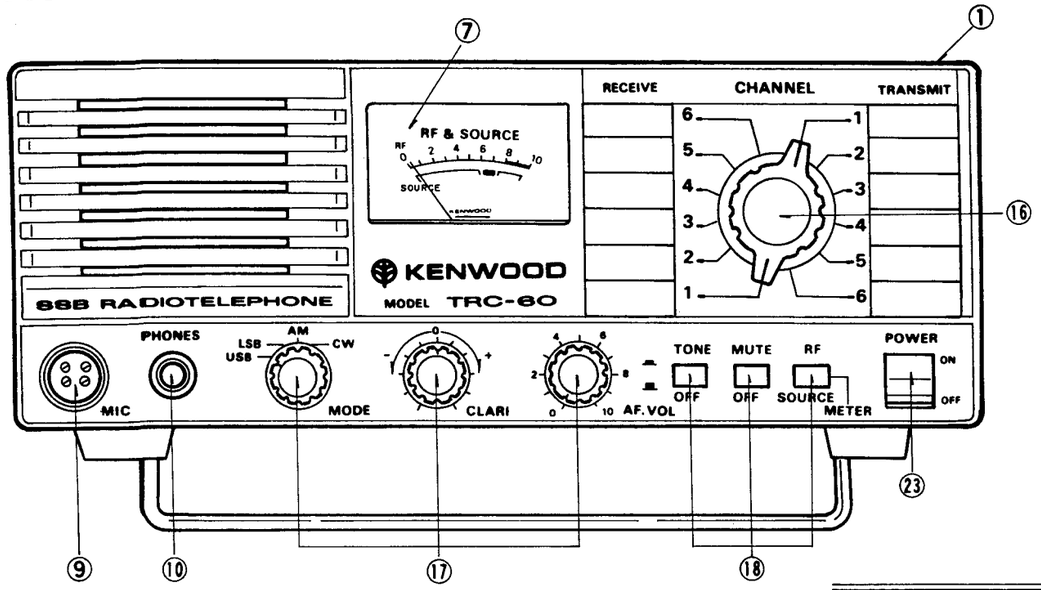


Notes:

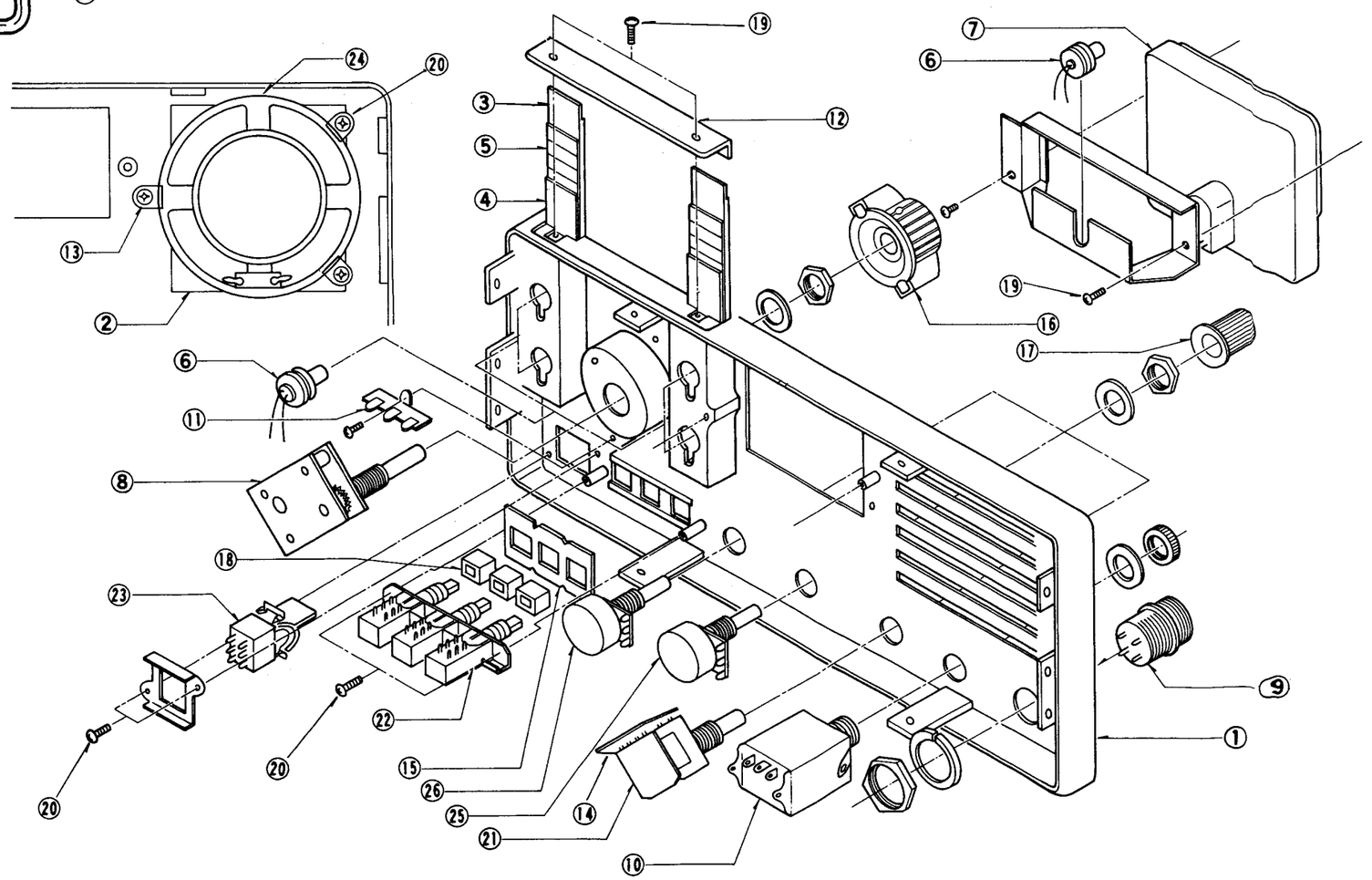
* A SSG signal of 2 MHz, 0 dB is applied to the ANT terminal (50Ω) and the AF GAIN control is adjusted to obtain an audio of 0.63V/8Ω. The SSG signal levels shown in the figure are to obtain the constant audio output when the AF GAIN control is fixed.

* Always connect the SSG output to the ANT terminal via a titanium capacitor of 0.047 μF.

PARTS LIST AND DISASSEMBLY



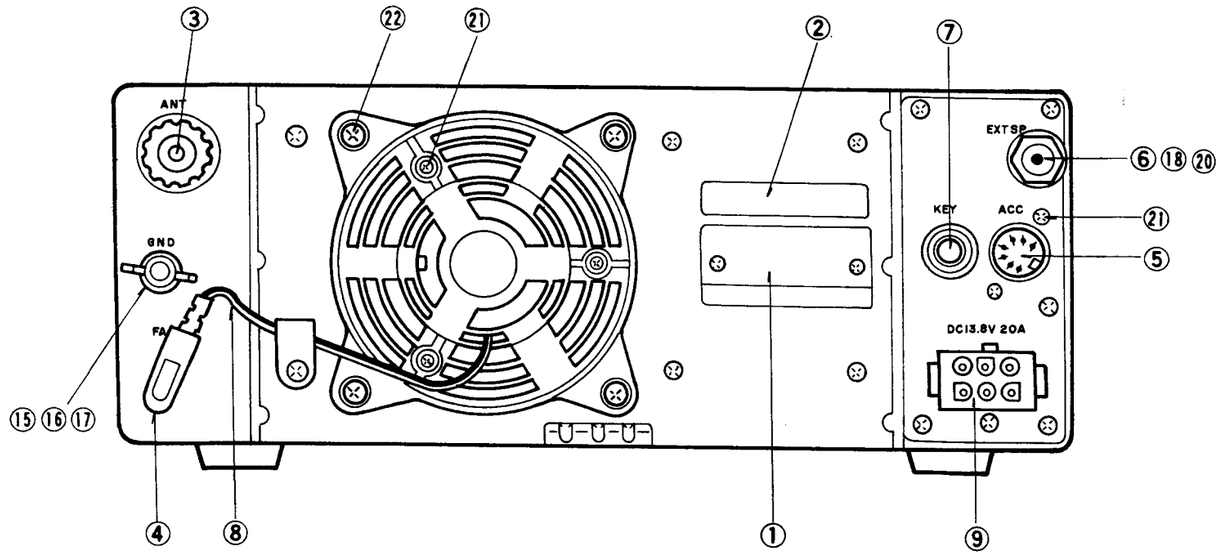
Ⓐ FRONT PANEL DISASSEMBLY

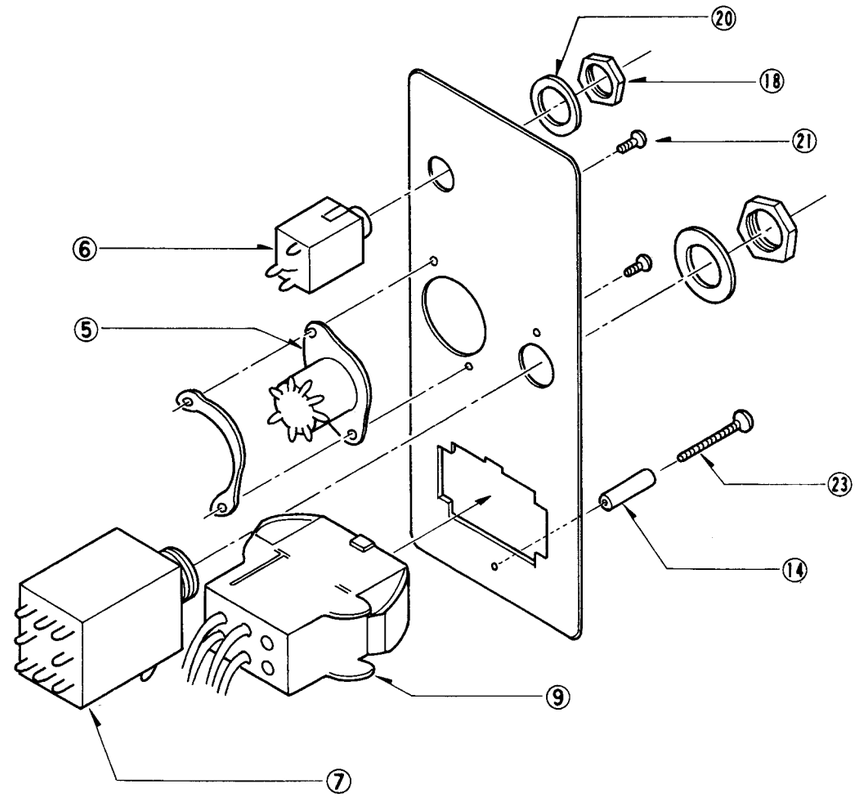


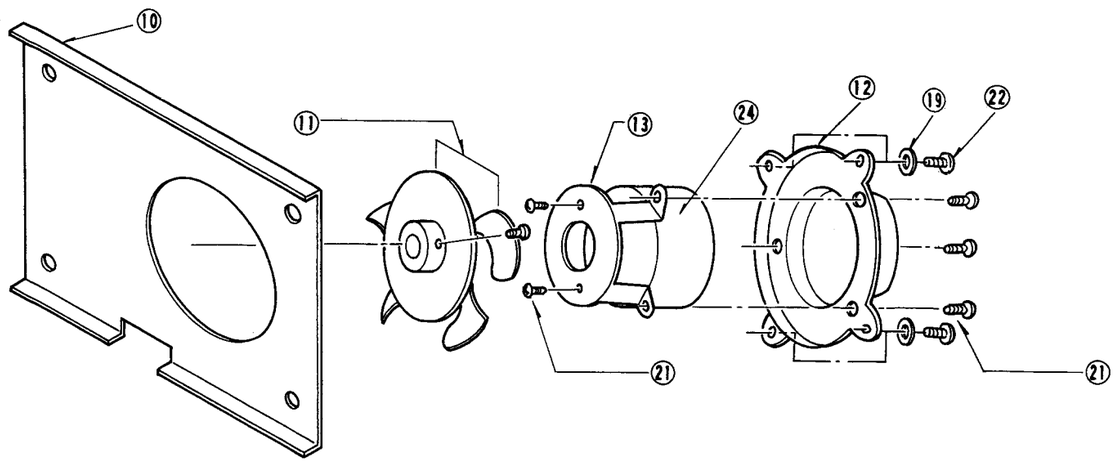
Ⓐ FRONT PANEL PARTS LIST

Ref. No.	Part No.	Description
A-1	A20-2436-25	Panel
A-2	B05-0719-04	Speaker grill cloth
A-3	B10-0646-04	Display glass x 2
A-4	B11-0410-04	Filter
A-5	B19-0605-04	Display film x 2 2pcs are accessoried.
A-6	B30-0818-05	Pilot lamp x 5
A-7	B31-0634-05	Meter
A-8	D40-0617-04	Gear assy
A-9	E06-0403-05	4P Mic socket
A-10	E11-0404-05	3P Phone jack
A-11	E22-0207-05	Connecting terminal (3P) Panel
A-12	J19-1356-04	Bracket, Glass
A-13	J21-2524-04	SP Bracket x 3
A-14	J25-2715-04	PC board MODE SW
A-15	J42-0427-04	Bush, Knob
A-16	K21-0758-04	Knob, Channel
A-17	K21-0759-04	Knob x 3, MODE, CLARI, AF.VOL
A-18	K29-0709-04	Push knob x 3, TONE, MUTE, METER
A-19	N33-3008-45	Round flat screw
A-20	N87-3006-46	Taptight screw
A-21	S01-2432-05	Rotary switch MODE, S2
A-22	S42-3404-05	Push switch, TONE, MUTE, METER, S3
A-23	S44-1404-05	Paddle switch, Power, S4
A-24	T07-0220-05	Speaker
A-25	R01-2409-05	Pot CLARI (5 kΩ B) VR101
A-26	R01-3420-05	Pot AF VOL (10Ω A) VR102

Ⓑ REAR PANEL DISASSEMBLY



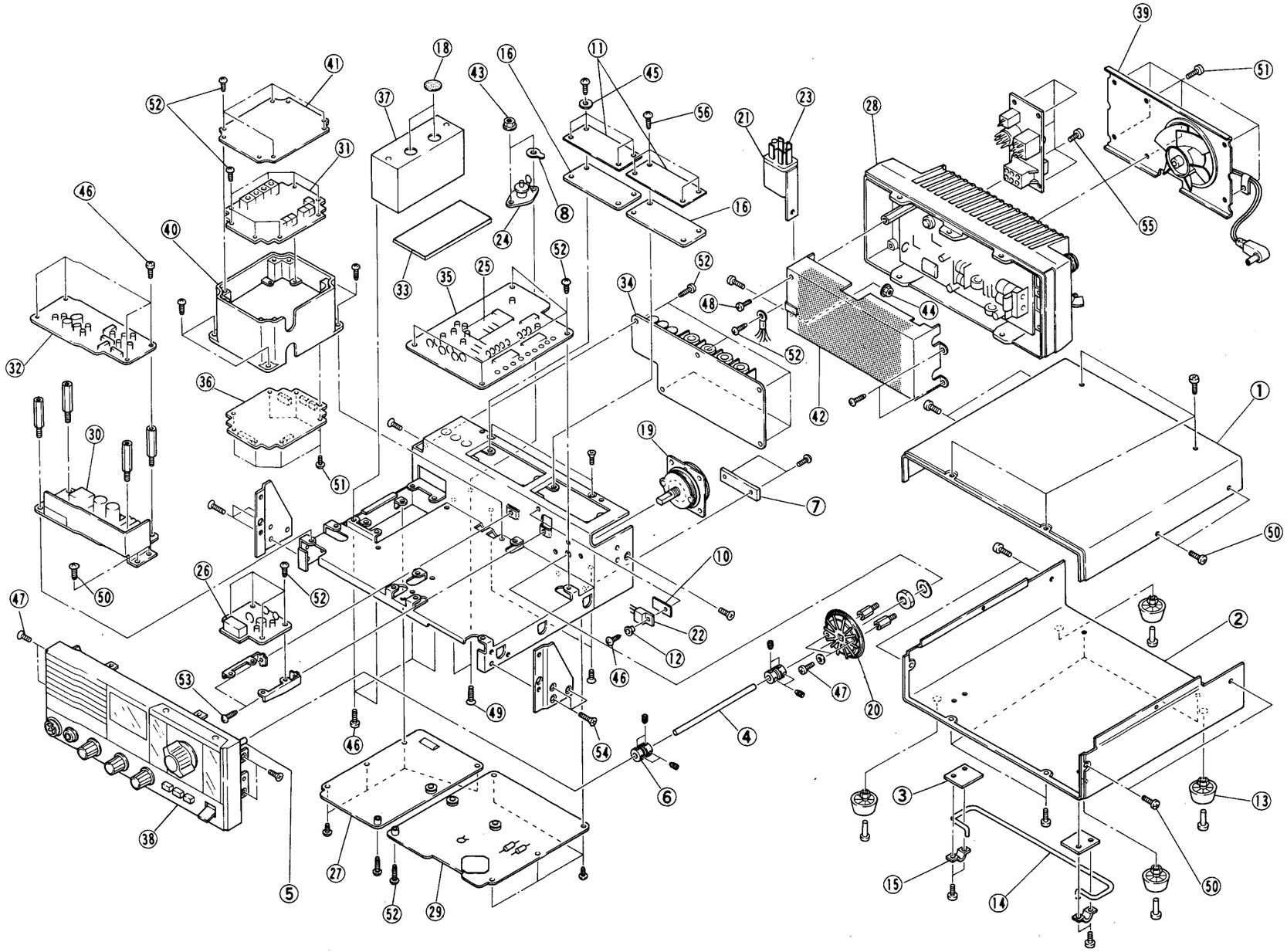




Ⓑ REAR PANEL PARTS LIST

Ref. No.	Part No.	Description
B-1	B40-2585-04	Name plate
B-2	B42-1709-04	Lavel
B-3	E04-0152-05	UHF type receptacle ANT.
B-4	E08-0271-05	DC socket
B-5	E06-0751-05	7P DIN socket, ACC
B-6	E11-0402-15	US jack, Ext sp.
B-7	E11-0404-05	3P Phone jack, Key
B-8	E30-1632-05	Cord with DC plug, Fan
B-9	E31-2110-00	Connector with cord
B-10	F07-0826-03	Heat sink cover
B-11	F09-0405-24	Fan
B-12	F29-0406-03	Fan motor housing
B-13	J21-2632-04	Motor mounting
B-14	J31-0116-04	Collar
B-15	N10-2020-46	Nut x 2
B-16	N14-0115-05	Flange nut
B-17	N14-0509-05	Nut
B-18	N10-2080-46	Nut
B-19	N15-1030-46	Washer x 4, Motor housing
B-20	N15-1080-46	Washer, Ext sp.
B-21	N30-2604-46	Round screw x 7, 7P Din socket, motor
B-22	N87-3008-46	Taptight screw x 4
B-23	N87-3012-46	Taptight screw
B-24	T42-0301-05	Fan motor

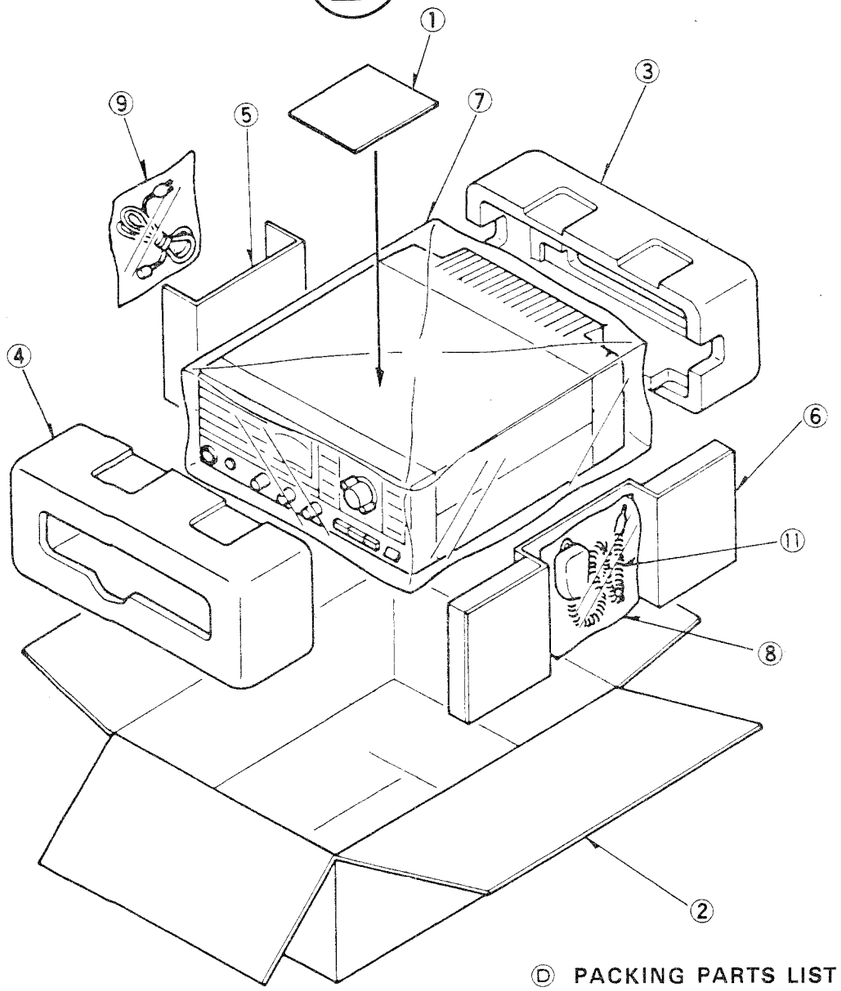
© GENERAL DISASSEMBLY



© GENERAL PARTS LIST

Ref. No.	Part No.	Description
C-1	A01-0911-02	Case (Upper)
C-2	A01-0912-02	Case (Lower)
C-3	B39-0407-04	Spacer x 2, Foot
C	B58-0627-00	Caution, English
C	CK45FIH103Z	C, 0.01 μF, C201 ~ 205
C-4	D21-0819-04	Band shaft (A), L = 106
C-5	D21-0820-04	Band shaft (B), L = 27
C-6	D22-0402-05	Universal joint x 2, Band
C-7	E20-0315-05	Terminal mount, 3P, Chassis
C-8	E23-0015-04	GND. lug
C-10	F20-0516-05	Insulating sheet, Relay unit, TR
C-11	F20-0519-04	Insulating board, Jumper unit
C-12	F29-0014-05	Shoulder washer
C-13	J02-0323-05	Foot x 4
C-14	J02-0407-04	Assistant foot
C	J19-1313-05	Nylon lead holder
C-15	J21-2573-04	Bracket x 2, Foot
C-16	J25-3077-04	P.C. board, Jumper x 2
C-18	J42-0038-04	Hole bush x 2
C	J61-0401-05	Nylon band x 40
C	R92-0619-05	Cement resister, R101
C	RC05GF2H101J	Solid 100Ω, R102, 103
C	RS14AB3D6R8J	Metal film 6.8Ω, R104
C-19	S01-2433-05	Rotary switch, BAND S1-1
C-20	S29-1422-05	Rotary wafer, S1-3
C-21	S51-1411-05	Relay, RL1
C-22	V01-0473-06	Transistor, 2SA473(Y), Q100
C-23	V11-0076-05	Diode, 1S1555, D1
C-24	V11-2163-86	Diode, S31C, D2
C-25	X40-1190-20	Matrix unit
C-26	X41-1380-20	Relay unit
C-27	X44-1480-20	RF unit
C-28	X45-1220-20	Final unit
C-29	X48-1360-20	IF unit
C-30	X49-1160-20	AF. AVR unit
C-31	X50-1800-20	VCO unit
C-32	X50-1810-20	Carrier unit
C-33	X50-1820-21	Standard OSC unit (M2 type only)
C-34	X51-1270-20	Filter unit
C-35	X53-1250-20	CCO unit
C-36	X54-1660-20	Digital unit
C-37	X60-1190-20	Crystal oven unit ass'y (M type only)
C-38		Front panel
C-39		Rear Panel
C-40		VCO case
C-41		VCO cover
C-42		Final shield cover
C-43	N14-0404-04	Flange nut
C-44	N14-0510-04	Flange nut
C-45	N19-0628-04	washer
C-46	N30-3006-46	Pan head screw
C-47	N30-3008-46	Pan head screw
C-48	N30-6008-46	Pan head screw
C-49	N32-3010-46	Flat screw
C-50	N35-3006-45	Bind screw
C-51	N87-3006-45	Self tapping screw
C-52	N87-3006-46	Self tapping screw
C-53	N87-4006-46	Self tapping screw
C-54	N88-3006-46	Flat tapping screw
C-55	N89-3006-45	Bind tapping screw
C-56	N89-3006-46	Bind tapping screw

Ⓓ PACKING

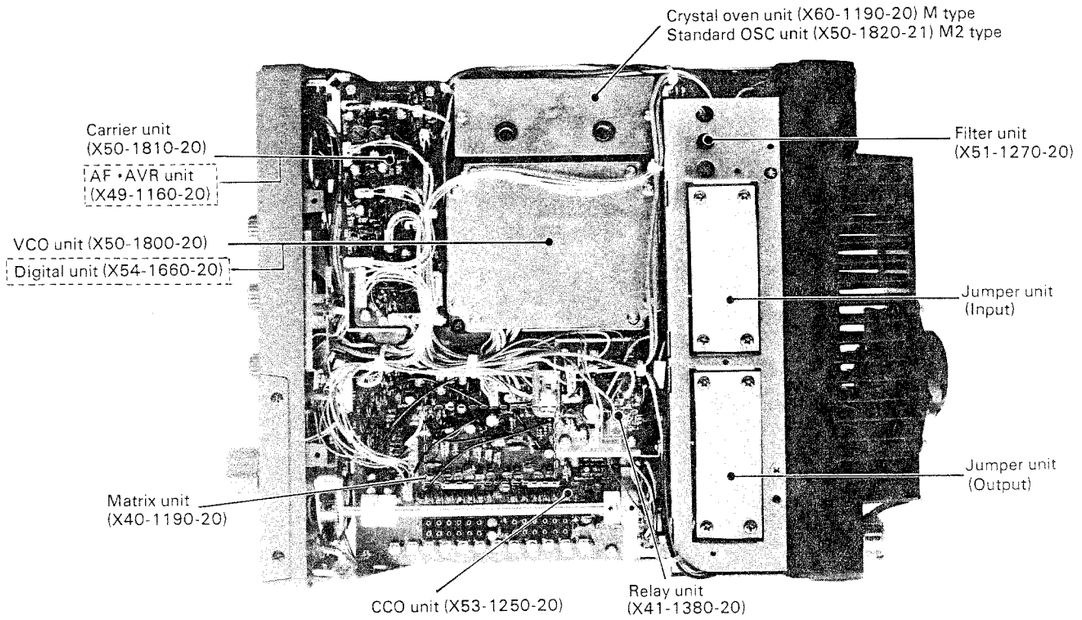


Ⓓ PACKING PARTS LIST

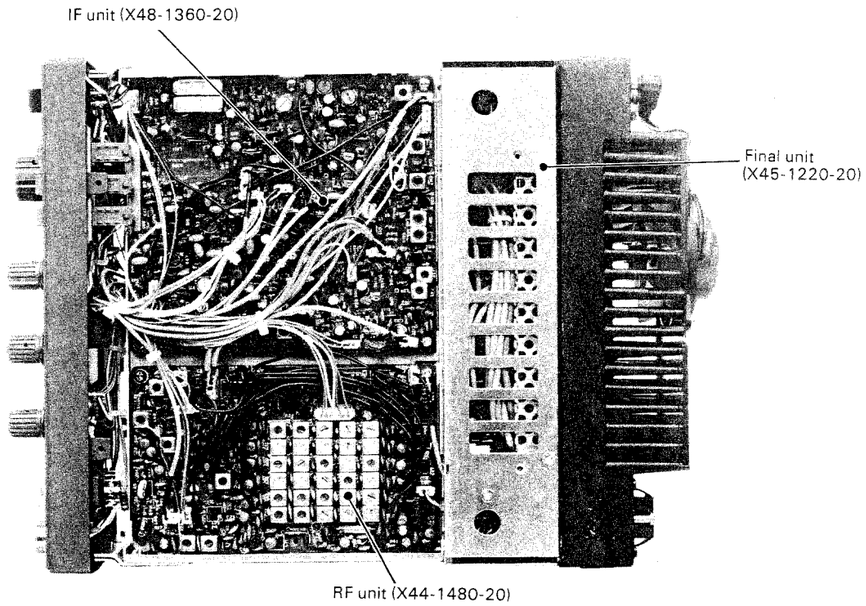
Ref. No.	Part No.	Description
D-1	B50-3925-00	Instruction manual
D	E30-1638-05	DC cord
D	F05-2034-05	Fuse 20A, accessory
D-2	H01-2777-04	Packing carton(inside)
D-3	H10-2520-02	Packing fixture (R)
D-4	H10-2554-02	Packing fixture (L)
D-5	H12-0462-04	Packing fixture
D-6	H12-0486-04	Packing fixture
D-7	H20-1410-03	Protective cover
D-8	H25-0079-04	Protective bag, MIC
D-9	H25-0112-04	Protective bag, DC cable
D-10	H25-0116-04	Protective bag
D-11	T91-0322-05	Microphone
D	W01-0404-05	Hexagonal wrench, for M3, accessory
D	W01-0405-04	Hexagonal wrench, for M4, accessory

INSIDE VIEWS

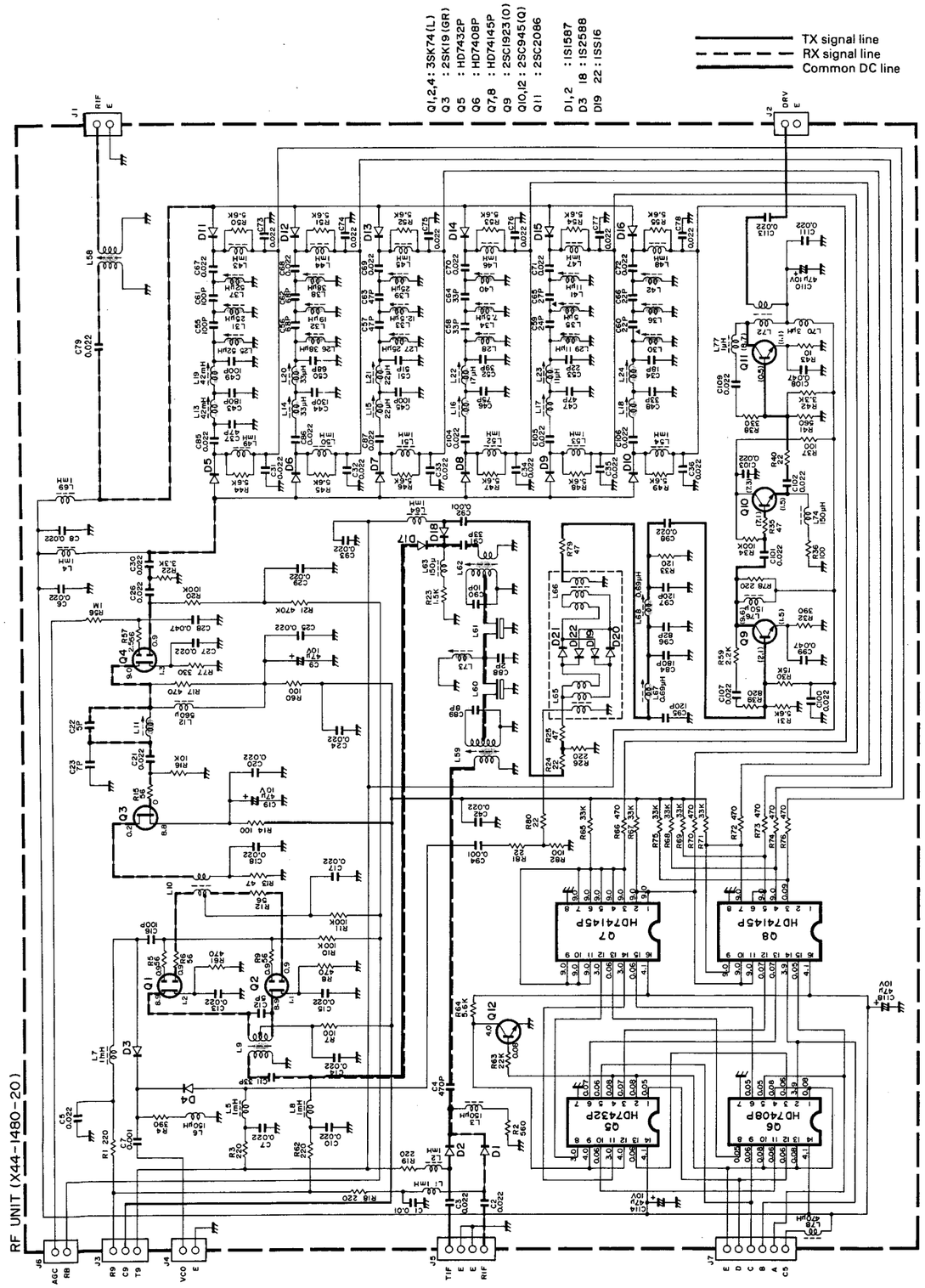
TOP VIEW



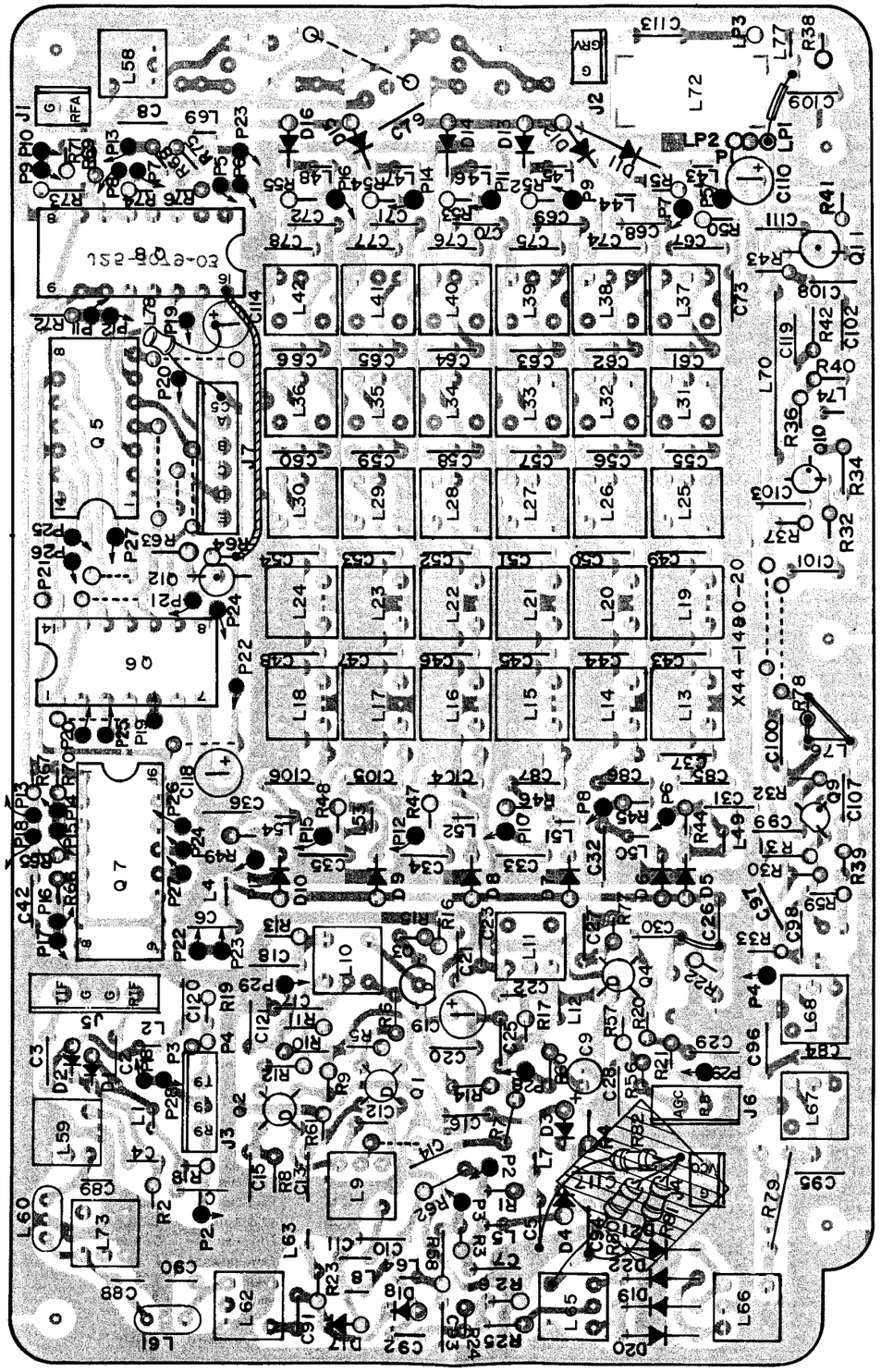
BOTTOM VIEW

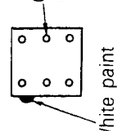


▼RF UNIT (X44-1480-20) CIRCUIT DIAGRAM



▼RF UNIT (X44-1480-20) PCB VIEW [Component Side View]





Note:
1. Cut the leg of L58 as shown in the figure below before installing it.

RF UNIT (X44-1480-20) PARTS LIST

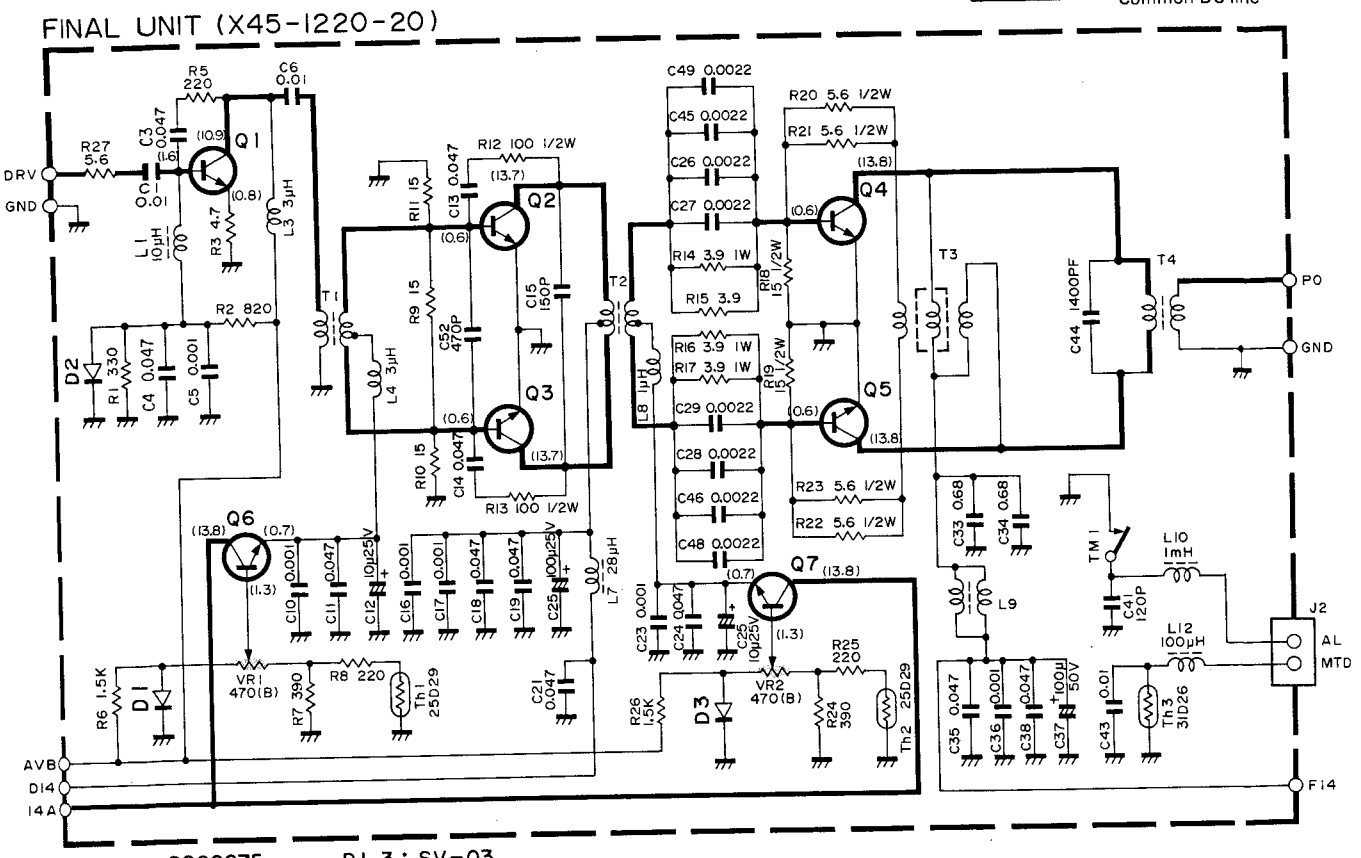
Ref. No.	Part No.	Description		
C1	CK45F1H103Z	C	0.01μF	
C2,3	C90-0254-05	C	0.022μF	
C4	CC45SL1H471J	C	470pF	
C5~8	C90-0254-05	C	0.022μF	
C9	CE04W1A470M	E	47μF	
C10	C90-0254-05	C	0.022μF	
C11	CC45CH1H330J	C	33pF	
C12	CC45RH1H050C	C	5pF	±0.25pF
C13~15	C90-0254-05	C	0.022μF	
C16	CC45SL1H101J	C	10pF	
C17,18	C90-0254-05	C	0.022μF	
C19	CE04W1A470M	E	47μF	
C20,21	C90-0254-05	C	0.022μF	
C22	CC45CH1H050C	C	5pF	±0.25pF
C23	CC45CH1H070C	C	7pF	±0.25pF
C25~27	C90-0254-05	C	0.022μF	
C28	CQ92M1H473K	ML	0.047μF	
C29~36	C90-0254-05	C	0.022μF	
C37	CC45RH1H470J	C	47pF	
C42	C90-0254-05	C	0.022μF	
C43	CC45RH1H181J	C	180pF	
C44	CC45RH1H131J	C	130pF	
C45	CC45RH1H101J	C	100pF	
C46	CC45RH1H750J	C	75pF	
C47	CC45RH1H470J	C	47pF	
C48	CC45RH1H330J	C	33pF	
C49	CC45RH1H101J	C	100pF	
C50	CC45RH1H680J	C	68pF	
C51	CC45RH1H510J	C	51pF	
C52	CC45RH1H390J	C	39pF	
C53	CC45RH1H220J	C	22pF	
C54	CC45RH1H180J	C	18pF	
C55	CC45RH1H101J	C	100pF	
C56	CC45RH1H680J	C	68pF	
C57	CC45RH1H470J	C	47pF	
C58	CC45RH1H330J	C	33pF	
C59	CC45RH1H240J	C	24pF	
C60	CC45RH1H100D	C	10pF	±0.5pF
C61	CC45RH1H101J	C	100pF	
C62	CC45RH1H680J	C	68pF	
C63	CC45RH1H470J	C	47pF	
C64	CC45RH1H330J	C	33pF	
C65	CC45RH1H270J	C	27pF	
C66	CC45RH1H150J	C	15pF	
C67~79	C90-0254-05	C	0.022μF	
C84	CC45RH1H181J	C	180pF	
C85~87	C91-0457-05	C	0.022μF	
C88	CC45RH1H040C	C	4pF	±0.25pF
C89	CC45RH1H080D	C	8pF	±0.5pF
C90	CC45RH1H100D	C	10pF	±0.5pF
C91	CC45CH1H330J	C	33pF	
C92	CK45B1H102K	C	0.001μF	
C93	C90-0254-05	C	0.022μF	
C94	CK45B1H102K	C	0.001μF	
C95	CC45RH1H121J	C	120pF	
C96	CC45RH1H820J	C	82pF	
C97	CC45RH1H121J	C	120pF	
C98	C90-0254-05	C	0.022μF	
C99	C91-0456-05	C	0.047μF	
C100~107	C90-0254-05	C	0.022μF	
C108	C91-0456-05	C	0.047μF	
C109	C91-0457-05	C	0.022μF	
C110	CE04W1A470M	E	10μF	
C111,113	C91-0457-05	C	0.022μF	
C114	CE04W1A470M	E	47μF	

Ref. No.	Part No.	Description	
C117	CK45B1H102K	C	0.001μF
C118	CE04W1A470M	E	47μF
C119~121	C91-0457-05	C	0.022μF
D1,2	V11-0370-05	Diode	1S1587
D3~18	V11-0414-05	Diode	1S2588
D19~22	V11-0374-05	Diode	1SS16
J1,2	E40-0273-05	Mini-connector	2P
J3	E40-0373-05	Mini-connector	3P
J4	E40-0273-05	Mini-connector	2P
J5	E40-0473-05	Mini-connector	4P
J6	E40-0273-05	Mini-connector	2P
J7	E40-0673-05	Mini-connector	6P
L1,2	L40-1021-03	Ferri-inductor	1 mH
L4,5	L40-1021-03	Ferri-inductor	1 mH
L7,8	L40-1021-03	Ferri-inductor	1 mH
L9	L34-0858-05	Tuning coil	
L10	L19-0324-05	Wide band transf. DBM, RX	
L11	L32-0195-05	Tuning coil	
L12	L40-5611-03	Ferri-inductor	560μH
L13	L34-3021-05	Filter coil	42μH
L14	L34-0878-05	Filter coil	33μH
L15	L34-0877-05	Filter coil	22μH
L16	L34-3016-05	Filter coil	17μH
L17	L34-3017-05	Filter coil	11μH
L18	L34-0874-05	Filter coil	
L19	L34-3021-05	Filter coil	42μH
L20	L34-0878-05	Filter coil	33μH
L21	L34-0877-05	Filter coil	22μH
L22	L34-3016-05	Filter coil	17μH
L23	L34-3017-05	Filter coil	11μH
L24	L34-0874-05	Filter coil	
L25	L34-3019-05	Filter coil	52μH
L26	L34-3009-05	Filter coil	38μH
L27	L34-3020-05	Filter coil	25μH
L28	L34-0875-05	Filter coil	12.5μH
L29	L34-3017-05	Filter coil	11μH
L30	L34-3011-05	Filter coil	6.9μH
L31	L34-3020-05	Filter coil	25μH
L32	L34-3010-05	Filter coil	19μH
L33	L34-0875-05	Filter coil	12.5μH
L34	L34-3018-05	Filter coil	7.5μH
L35	L34-3012-05	Filter coil	5μH
L36	L34-3011-05	Filter coil	6.9μH
L37	L34-3019-05	Filter coil	52μH
L38	L34-3009-05	Filter coil	38μH
L39	L34-3020-05	Filter coil	25μH
L40	L34-0875-05	Filter coil	12.5μH
L41	L34-3017-05	Filter coil	11μH
L42	L34-0873-05	Filter coil	
L43~54	L40-1021-03	Ferri-inductor	1 mH
L58	L19-0332-05	Input transf.	
L59	L32-0634-05	Tuning coil	
L60,61	L71-0231-05	MCF	
L62	L34-0859-05	Tuning coil	
L63	L40-1511-03	Ferri-inductor	150μH
L64	L40-1021-03	Ferri-Inductor	1 mH
L65,66	L19-0324-05	Wide band transf. DBM, RX	
L67,68	L34-3015-05	Filter coil	0.69μH
L69	L40-1021-03	Ferri-Inductor	1 mH
L70	L33-0032-05	Choke coil	3μH
L72	L19-0330-05	Wide band transf. PA	
L73	L34-0627-05	Tuning coil	
L74,76	L40-1511-03	Ferri-inductor	150μH

Ref. No.	Part No.	Description	
L77	L40-1092-04		1μH
L78	L40-4711-03		470μH
Q1,2	V09-1002-56	FET	3SK74 (L)
Q3	V09-0012-05	FET	2SK19 (GR)
Q4	V09-1002-56	FET	3SK74 (L)
Q5	V03-1009-76	IC	HD7432P
Q6	V30-1009-66	IC	HD7408P
Q7,8	V30-1009-86	IC	HD74145P
Q9	V03-1923-06	Transistor	2SC1923 (O)
Q10	V03-0293-05	Transistor	2SC945 (Q)
Q11	V03-2086-06	Transistor	2SC2086
Q12	V03-0293-05	Transistor	2SC945 (Q)
Q80,81	RD14BB2B220J	Resistor	22Ω 1/8W
Q87	RD14BB2B101J	Resistor	100Ω 1/8W

▼ FINAL UNIT (X45-1220-20) CIRCUIT DIAGRAM

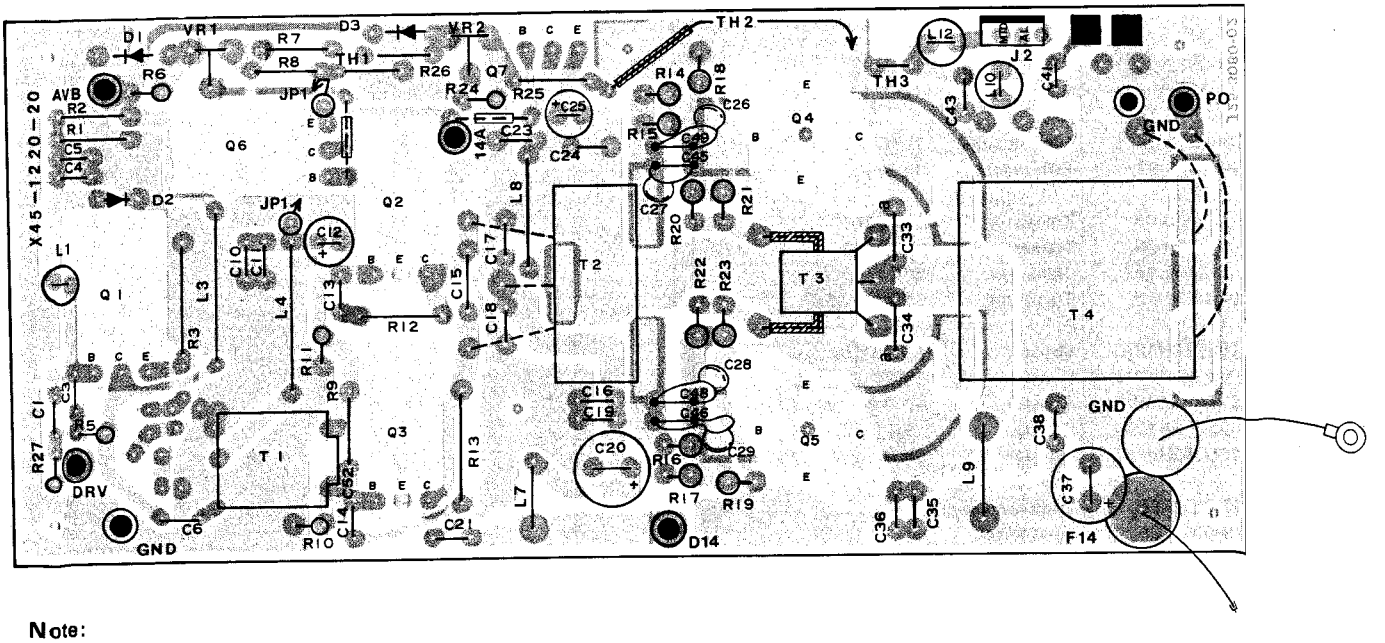
TX signal line
Common DC line



Q1 : 2SC2075
Q2,3 : 2SC2509
Q4,5 : 2SC2290※J
Q6,7 : 2SD880(Y)

D1,3 : SV-03
D2 : SV-4A
D4,5 : IN60

▼ FINAL UNIT (X45-1220-20) PCB VIEW [Component Side View]



Note:

1. The leads of C26~C29 should be kept as short as possible, and care should be taken to prevent them from coming in contact with the heat sink.
2. Install T3 so that its bottim is separated from the p.c. board by about 2mm.
3. Install TH3 so that its bottom is separated from the p.c. board by 6mm.
4. Install C33 and C34 after shaping them to ma spacing of the holes in the p.c. board as shown figure below.

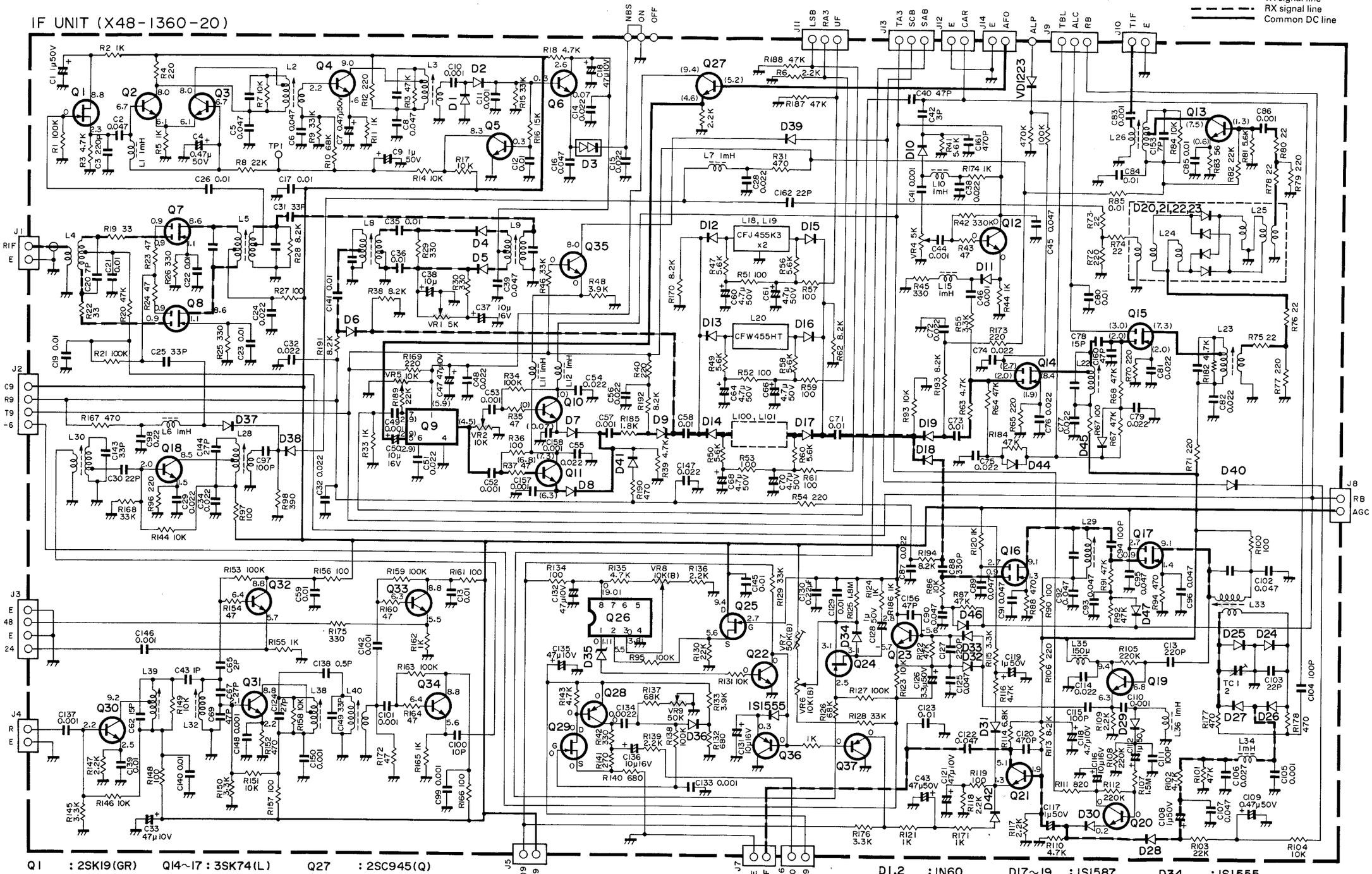
Connect the formed sections to the "a" side of the p.c. board.

FINAL UNIT (X45-1220-20) PARTS LIST

Ref. No.	Part No.	Description
C1	C91-0455-05	C 0.01μF
C3,4	C91-0456-05	C 0.047μF
C5	CK45B1H102K	C 0.001μF
C6	C91-0455-05	C 0.01μF
C10	CK45B1H102K	C 0.001μF
C11	C91-0456-05	C 0.047μF
C12	CE04W1E100	E 10μF
C13,14	C91-0456-05	C 0.047μF
C15	CM93D2H151J	MC 150pF
C16,17	CK45B1H102K	C 0.001μF
C18,19	C91-0456-05	C 0.047μF
C20	CE04W1E101	E 100μF
C21	C91-0456-05	C 0.047μF
C23	CK45B1H102K	C 0.001μF
C24	C91-0456-05	C 0.047μF
C25	CE04W1E100	E 10μF
C26~29	CK45B1H222KMU	C 0.0022μF
C33,34	C91-0448-05	Layer-built condenser 0.68μF
C35	C91-0456-05	C 0.047μF
C36	CK45B1H102K	C 0.001μF
C37	CE04W1H101M	E 100μF
C38	C91-0456-05	C 0.047μF
C39	CM73F2H142J	MC 0.0014μF
C41	CC45SL1H121J	C 120pF
C43	C91-0455-05	C 0.01μF
C45,46 48,49	CK45B1H222KMU	C 0.0022μF
C52	CC45SL1H471J	C 470pF
D1	V21-0007-05	Varistor SV-03
D2	V11-3379-26	Varistor MV-5T
D3	V21-0007-05	Varistor SV-03
J2	E40-0273-05	Mini-connector 2P
L1	L40-1001-03	Ferri-inductor 10μH
L3,4	L33-0032-05	RFC 3μH
L7	L33-0617-05	RFC 28μH
L8	L33-0025-05	RFC 1μH
L9	L33-0625-15	RFC
L10	L40-1025-04	Ferri-inductor 1mH
L12	L40-1011-04	Ferri-inductor 100μH
Q1	V03-2075-06	Transistor 2SC2075
Q2,3	V03-2509-06	Transistor 2SC2509
Q4,5	V03-2209-16	Transistor 2SC2290*J
Q6,7	V04-0880-16	Transistor 2SD880 (Y)
R3	RC05GF2H4R7J	Resistor 4.7Ω 1/2W
R12,13	RC05GF2H101J	Resistor 100Ω 1/2W
R14~17	RS14AB3A3R9J	Resistor MF 3.9Ω 1W
R18,19	RC05GF2H150J	Resistor 15Ω 1/2W
R20~23	RC05GF2H5R6J	Resistor 5.6Ω 1/2W
T1	L19-0315-25	Wide band transf.
T2	L19-0311-05	Input transf.
T3	L19-0313-15	NF transf.
T4	L19-0312-05	Output transf.
TH1,2	V11-3360-16	Thermister 25D29
TH3	V11-7762-16	Thermister 31D26
TM1	S59-1404-05	Thermostat
VR1,2	R12-0058-05	Trim, pot 470Ω (B)

Ref. No.	Part No.	Description
	E04-0152-05	UHF type receptacle, ANT
	E08-0271-05	DC socket
	E23-0043-04	Earth lug, ANT
	E23-0046-04	Square terminal
	E23-0401-05	Round terminal
	E23-0420-05	Earth lug
	E31-2112-05	Terminal with wire
	E31-2137-05	Terminal with wire
	F01-0735-05	Heat sink
	F20-0516-05	Insulating sheet
	F29-0014-05	Insulating washer
	J31-0503-05	Bead
	J32-0730-04	Hex. boss
	N10-2020-46	Nut
	N14-0115-05	Frange nut (GND) terminal
	N14-0509-46	Nut
	N15-1040-46	Washer
	N19-0611-04	Washer
	N30-2012-46	Round screw
	N30-3006-46	Round screw
	N30-3080-46	Round screw
	N30-4020-46	Round screw
	N87-3006-46	Tapping screw
	R92-0150-05	Jumper wire

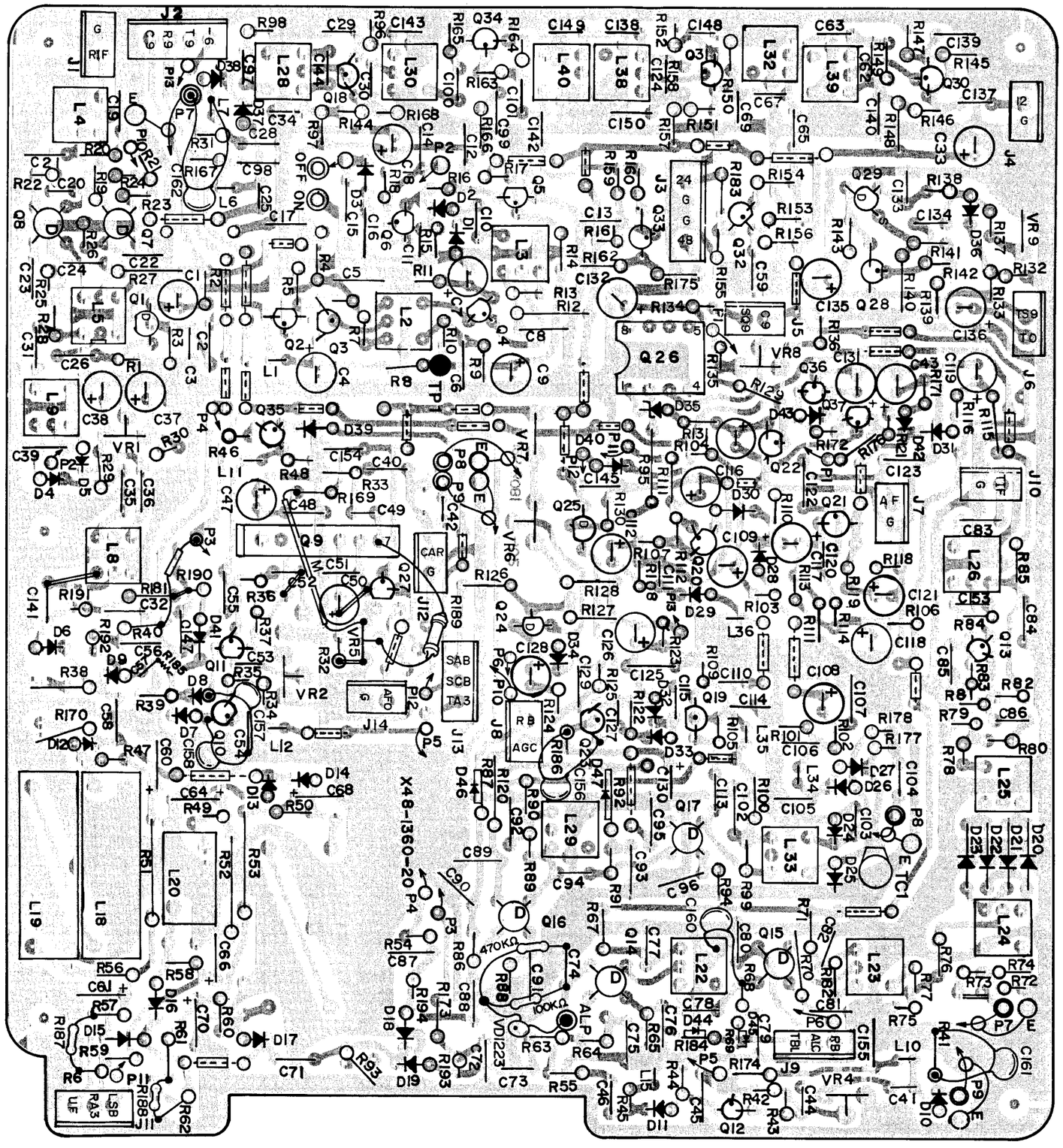
▼ IF UNIT (X48-1360-20) CIRCUIT DIAGRAM



Q1 : 2SKI9(GR)
Q2~6 : 2SC945(Q)
Q7,8 : 3SK74(L)
Q9 : μPCI037H
QI0~I3: 2SC945(Q)
QI4~I7 : 3SK74(L)
QI8~23: 2SC945(Q)
Q24 : 2SK30A
Q25 : 2SKI4(GR)
Q26 : μPC4558C
Q27 : 2SC945(Q)
Q28 : 2SAI0I5(Y)
Q29 : 2SK30A(O)
Q30~35: 2SC945(Q)
Q36,37 : 2SAI0I5(Y)

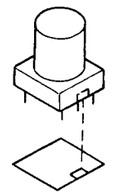
D1,2 : IN60
D3 : MV-13
D4~9 : ISI587
DI0,II : ISI555
DI2,I4,I5: ISI587
DI3,I6 : ISI007
DI7~I9 : ISI587
D20~23 : ISSI6
D24~27 : IN60
D28,30,3I: ISI555
D29 : WZ-060
D32,33 : IN60
D34 : ISI555
D35 : WZ-061
D36~38: ISI587
D39~42: ISI555
D44~47: ISI555

▼ IF UNIT (X48-1360-20) PCB VIEW [Component Side View]

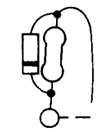


1. Use the 905A as the L19 and use the 905B as the L18.
2. Procedure for installing VR7 and VR9.

3. Procedure for installing L5 and L8.



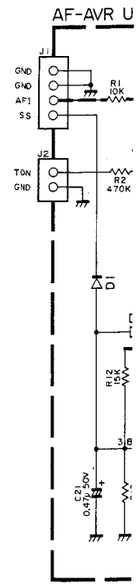
4. The following should be combined for installation: D44～D47, R184, R69, R92 and R87.



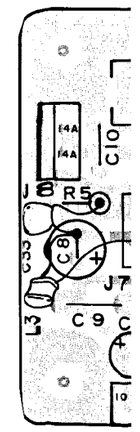
IF UNIT (X48-1360-20) PARTS LIST

Ref. No.	Part No.	Description		
C1	CE04W1H010M	E	1μF	
C2	CQ92M1H473K	S	0.047μF	
C3	CC45SL1H221J	C	220pF	
C4	CE04W1HR47M	E	0.47μF	
C5,6	CQ92M1H473K	S	0.047μF	
C7	CE04W1HR47M	E	0.47μF	
C8	CQ92M1H473K	S	0.047μF	
C9	CE04W1H010M	E	1μF	
C10,11	CQ92M1H102K	S	0.001μF	
C12,13	CK45F1H103Z	C	0.01μF	
C14,15	C91-0457-05	C	0.022μF	
C16	CQ92M1H473K	S	0.047μF	
C17	CK45F1H103Z	C	0.01μF	
C18	CE04W1A470M	E	47μF	
C19	CK45F1H103Z	C	0.01μF	
C20	CC45RH1H070D	C	7pF	±0.5pF
C21～23	CK45F1H103Z	C	0.01μF	
C24	C91-0457-05	C	0.022μF	
C25	CC45CH1H330J	C	33pF	
C26	CK45F1H103Z	C	0.01μF	
C28,29	C91-0457-05	C	0.022μF	
C30	CC45CH1H220J	C	22pF	
C31	CC45CH1H330J	C	33pF	
C32	C91-0457-05	C	0.022μF	
C33	CE04W1A470M	E	47μF	
C34	C91-0457-05	C	0.022μF	
C35,36	CK45F1H103Z	C	0.01μF	
C37,38	CE04W1C100M	E	10μF	
C39	CQ92M1H473K	S	0.047μF	
C40	CC45SL1H470J	C	47pF	
C41	CK45B1H102K	C	0.001μF	
C42	CC45CH1H030C	C	3pF	±0.25pF
C43	CE04W1H4R7M	E	4.7μF	
C44	CK45B1H102K	C	0.001μF	
C45	CQ92M1H473K	S	0.047μF	
C46	CK45B1H102K	C	0.001μF	
C47	CE04W1A470M	E	47μF	
C48	C91-0457-05	C	0.022μF	
C49	CK45B1H102K	C	0.001μF	
C50	CE04W1C100M	E	10μF	
C51	C91-0457-05	C	0.022μF	
C52,53	CK45B1H102K	C	0.001μF	
C54～56	C91-0457-05	C	0.022μF	
C57,58	CK45B1H102K	C	0.001μF	
C59	CK45F1H103Z	C	0.01μF	
C60,61	CQ92M1H4R7M	S	4.7μF	
C62	CC45RH1H150J	C	15pF	
C63	CC45CH1H010C	C	1pF	±0.25pF
C64	CQ92M1H4R7M	S	4.7μF	
C65	CC45CH1H020C	C	2pF	±0.25pF
C66	CQ92M1H4R7M	S	4.7μF	
C67	CC45RH1H270J	C	27pF	
C68	CQ92M1H4R7M	S	4.7μF	
C69	CC45RH1H470J	C	47pF	
C70	CQ92M1H4R7M	S	4.7μF	
C71	CK45B1H102K	C	0.001μF	
C72	C91-0457-05	C	0.022μF	
C73	CK45F1H103Z	C	0.01μF	
C74～77	C91-0457-05	C	0.022μF	
C78	CC45CH1H150J	C	15pF	
C79	C91-0457-05	C	0.022μF	
C80	CQ92M1H473K	S	0.01μF	
C81,82	C91-0457-05	C	0.022μF	
C83	CK45B1H102K	C	0.001μF	
C84,85	CK45F1H103Z	C	0.01μF	
C86	CK45B1H102Z	C	0.001μF	1N60
C87	C91-0457-05	C	0.022μF	
C88	CK45B1H331K	C	330pF	
C89～93	CQ92M1H473K	S	0.047μF	
C94	CC45SL1H101J	C	100pF	
C95,96	CQ92M1H473K	S	0.047μF	
C97	CC45SL1H101J	C	100pF	
C98	C91-0457-05	C	0.022μF	
C99	CK45B1H102K	C	0.001μF	
C100	CC45CH1H100D	C	10pF	±0.5pF
C101	CK45B1H102K	C	0.001μF	
C102	CQ92M1H473K	S	0.047μF	
C103	CC45CH1H220J	C	22pF	
C104	CK45B1H331K	C	330pF	
C105	CK45B1H102K	C	0.001μF	
C106	CQ92M1H273K	S	0.027μF	
C107	CQ92M1H473K	S	0.047μF	
C108	CE04W1H010M	E	1μF	
C109	CE04W1HR47M	E	0.47μF	
C110	CK45B1H102K	C	0.001μF	
C111	CC45SL1H101J	C	100pF	
C112	CE04W1H010M	E	1μF	
C113	CC45SL1H221J	C	220pF	
C114	C91-0457-05	C	0.022μF	
C115	CC45SL1H101J	C	100pF	
C116	CE04W1C100M	E	10μF	
C117	CE04W1H010M	E	1μF	
C118	CE04W1A470M	E	47μF	
C119	CE04W1C100M	E	10μF	
C120	CC45SL1H471J	C	470pF	
C121	CE04W1A470M	E	47μF	
C122	CQ92M1H473K	S	0.047μF	
C123	CQ92M1H103K	S	0.01μF	
C124	CC45RH1H270J	C	27pF	
C125	CQ92M1H473K	S	0.047μF	
C126	CE04W1H3R3M	E	3.3μF	
C127	CC45SL1H221J	C	220pF	
C128	CE04W1H010M	E	1μF	
C129	CK45F1H103Z	C	0.01μF	
C130	CE04W1HR22M	E	0.22μF	
C131	CE04W1C100M	E	10μF	
C132	CE04W1H470M	E	47μF	
C133	CQ92M1H102K	S	0.001μF	
C134	CQ92M1H222K	S	0.0022μF	
C135	CE04W1H470M	E	47μF	
C136	CE04W1C100M	E	10μF	
C137	CK45B1H102K	C	0.001μF	
C138	CC45CH1H0R5C	C	0.5pF	±0.25pF
C139,140	CK45F1H103Z	C	0.01μF	
C141	CK45B1H331K	C	330pF	
C142	CK45B1H102K	C	0.001μF	
C143	CC45RH1H330J	C	33pF	
C144	CC45RH1H270J	C	27pF	
C145	CK45F1H103Z	C	0.01μF	
C147	C91-0457-05	C	0.022μF	
C148	CK45B1H102K	C	0.001μF	
C149	CC45RH1H330J	C	33pF	
C150	CK45B1H102K	C	0.001μF	
C153	CC45CH1H070D	C	7pF	±0.5pF
C154	CK45F1H103Z	C	0.01μF	
C155	C91-0457-05	C	0.022μF	
C156	CC45SL1H470J	C	47pF	
C157,158	CC45SL1H101J	C	100pF	
C160	CC45CH1H470J	C	47pF	
C161	CK45B1H471K	C	470pF	
C162	CC45CH1H100D	C	10pF	±0.5pF
D1,2	V11-0051-05	Diode		
D3	V21-0004-05	Diode	MV13	
D4～9	V11-0370-05	Diode	1S1587	
D10,11	V11-0076-05	Diode	1S1555	
D12	V11-0370-05	Diode	1S1587	
D13	V11-4160-66	Diode	1S1007	
D14,15	V11-0370-05	Diode	1S1587	
D16	V11-4160-66	Diode	1S1007	
D17～19	V11-0370-05	Diode	1S1587	
D20～23	V11-0374-05	Diode	1SS16	
D24～27	V11-0051-05	Diode	1N60	
D28	V11-0076-05	Diode	1S1555	
D29	V11-0051-05	Diode	1N60	
D30,31	V11-0076-05	Diode	1S1555	
D32,33	V11-0051-05	Diode	1N60	
D34	V11-0076-05	Diode	1S1555	
D35	V11-0243-05	Zener diode	WZ061	
D36～38	V11-0370-05	Diode	1S1587	
D39～44	V11-0076-05	Diode	1S1555	
J1	E40-0273-05	Mini-connector	2P	
J2,3	E40-0473-05	Mini-connector	4P	
J4～8	E40-0273-05	Mini-connector	2P	
J9	E40-0373-05	Mini-connector	3P	
J10	E40-0273-05	Mini-connector	2P	
J11	E40-0373-05	Mini-connector	3P	
J12	E40-0273-05	Mini-connector	2P	
J13	E40-0373-05	Mini-connector	3P	
J14	E40-0273-05	Mini-connector	2P	
L1	L40-1021-03	Ferri-inductor	1 mH	
L2	L34-0540-05	Tuning coil		
L3	L34-0863-05	Tuning coil		
L4	L34-0862-05	Tuning coil		
L5	L34-0864-05	Tuning coil		
L6,7	L40-1021-03	Ferri-inductor	1 mH	
L8	L34-0866-15	Tuning coil		
L9	L34-0865-15	Tuning coil		
L10～12	L40-1021-03	Ferri-inductor	1 mH	
L15	L40-1021-03	Ferri-inductor	1 mH	
L18,19	L72-0329-05	Ceramic filter		
L20	L72-0319-03	Ceramic filter	CFW455HT	
L22,23	L34-0540-05	Tuning coil		
L24,25	L19-0324-05	Wide band transf.		
L26	L34-0858-05	Tuning coil		
L28	L34-0507-05	Tuning coil		
L29	L34-0540-05	Tuning coil		
L30	L34-0507-05	Tuning coil		
L32	L34-0505-05	Tuning coil		
L33	L34-0868-05	Tuning coil		
L34	L40-1021-03	Ferri-inductor	1 mH	
L35	L40-1511-03	Ferri-inductor	150μH	
L36	L40-1021-03	Ferri-inductor	1 mH	
L38	L34-0507-05	Tuning coil		
L39	L34-0505-05	Tuning coil		
L40	L34-0507-05	Tuning coil		
L100,101	L72-0330-05	Ceramic filter (LSB) OPTION		
Q1	V09-0012-05	FET	2SK19 (GR)	
Q2～6	V03-0293-05	Transistor	2SC945 (Q)	
Q7,8	V09-1002-56	FET	3SK74 (L)	
Q9	V30-0177-16	IC	μPC1037H	
Q10～13	V03-0293-05	Transistor	2SC945 (Q)	
Q14～17	V09-1002-56	FET	3SK74 (L)	
Q18～23	V03-0293-05	Transistor	2SC945 (Q)	
Q24	V09-0056-05	FET	2SK30A (O)	
Q25	V09-0012-05	FET	2SK19 (GR)	
Q26	V30-0349-10	IC	μPC4558C	
Q27	V03-0293-05	Transistor	2SC945 (Q)	
Q28	V01-1015-06	Transistor	2SA1015 (Y)	
Q29	V09-0056-05	FET	2SK30A (O)	
Q30～35	V03-0293-05	Transistor	2SC945 (Q)	
Q36,37	V01-1015-06	Transistor	2SA1015 (Y)	
R187,188	RD14BB2B473J	Resistor	4.7 kΩ	1/8W
TC1	C05-0030-15	Ceramic trimmer	20pF	
VR1	R12-2410-05	Trim, pot	5 kΩ (B)	
VR2	R12-3434-05	Trim, pot	10 kΩ (B)	
VR4	R12-2410-05	Trim, pot	5 kΩ (B)	
	R12-1418-05	Trim, pot	1 kΩ (B)	
VR5,6	R12-3434-05	Trim, pot	10 kΩ (B)	
VR7	R12-4410-05	Trim, pot	50 kΩ (B)	
VR8	R12-3434-05	Trim, pot	10 kΩ (B)	
VR9	R12-4410-05	Trim, pot	50 kΩ (B)	
	E23-0512-05	Round terminal × 3		
	E31-2136-05	Terminal with wire		
	J31-0502-04	PCB coller		
	J42-0428-05	PCB bush		

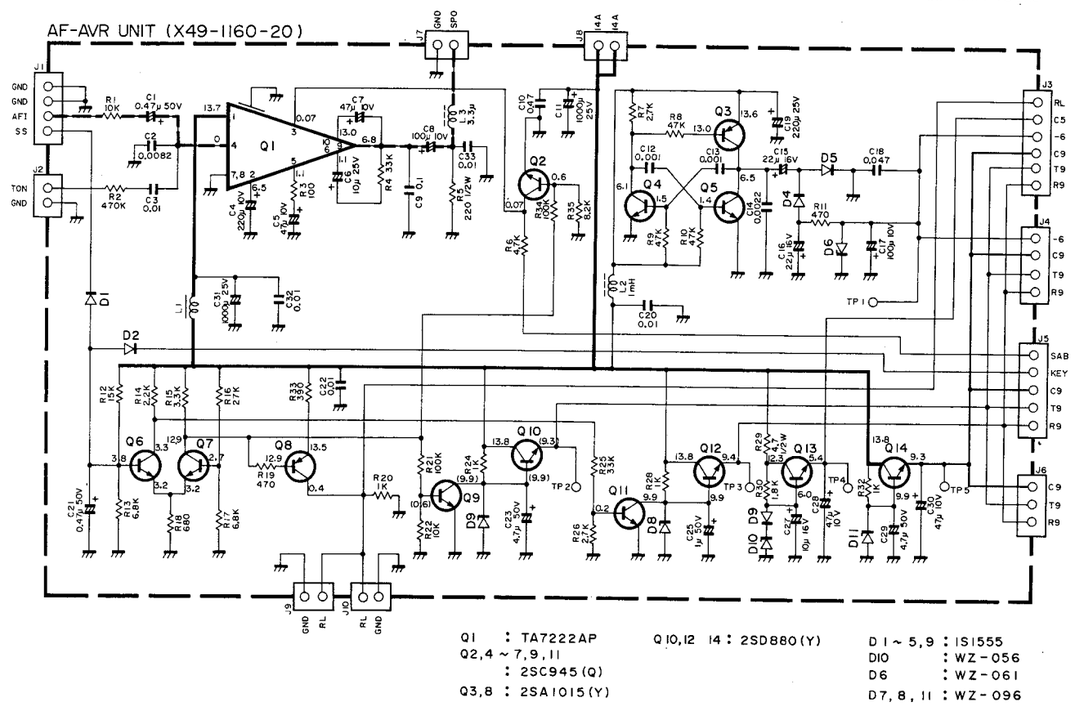
▼ AF AVR



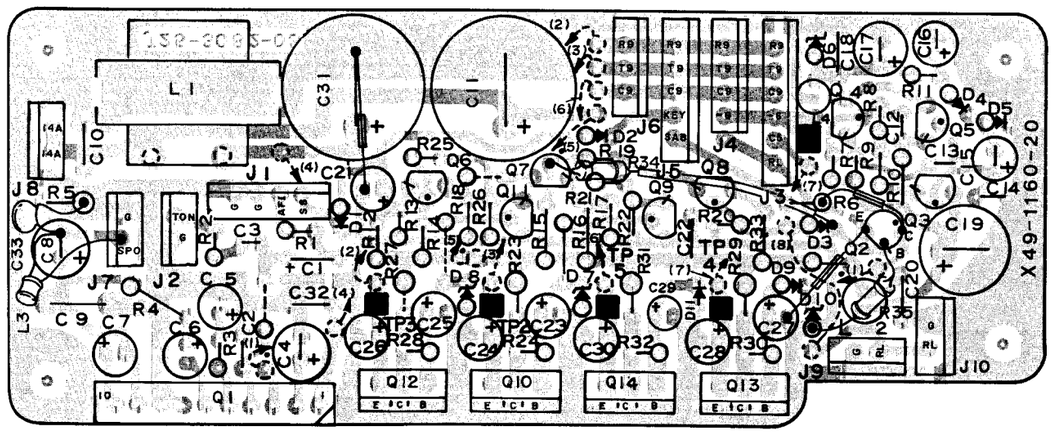
▼AF AVR



▼ AF AVR UNIT (X49-1160-20) CIRCUIT DIAGRAM



▼ AF AVR UNIT (X49-1160-20) PCB VIEW [Component Side View]

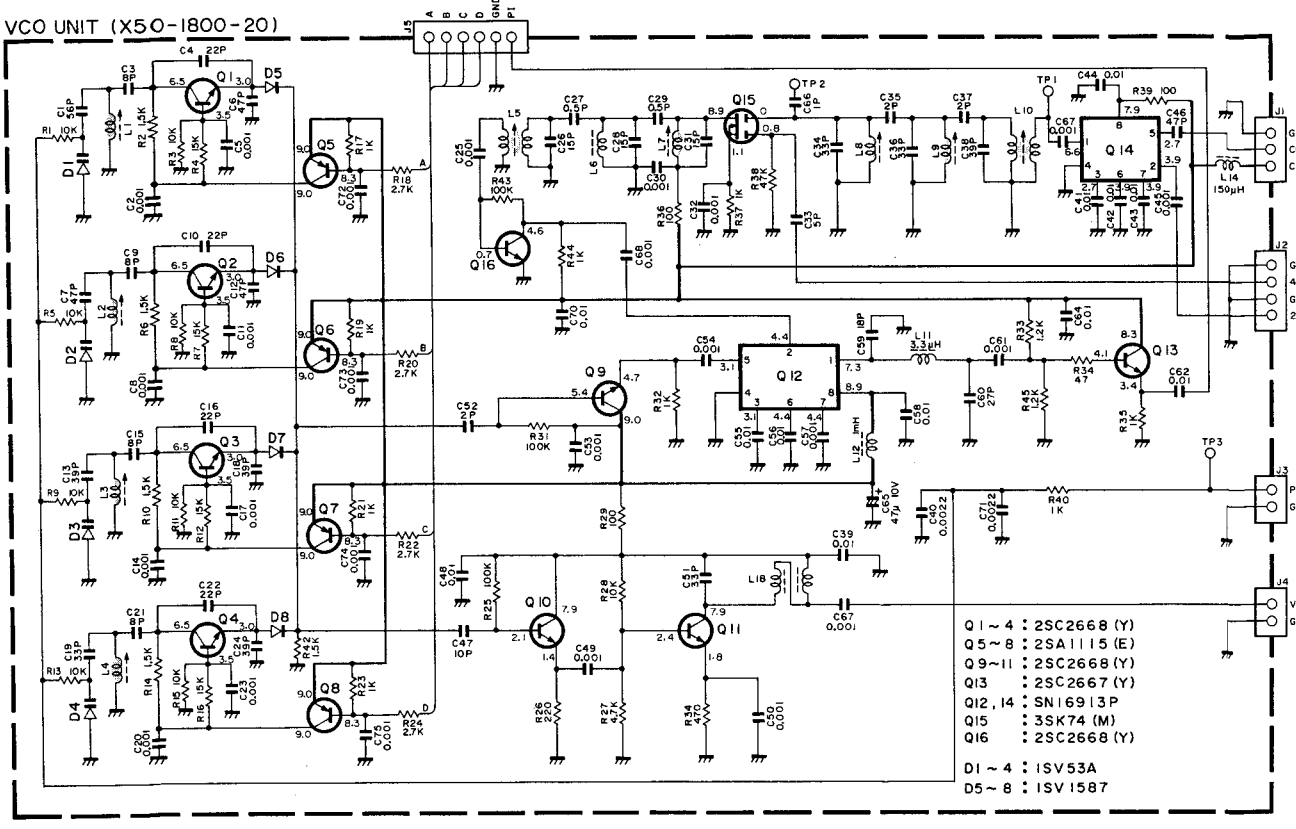


AF AVR UNIT (X49-1160-20) PARTS LIST

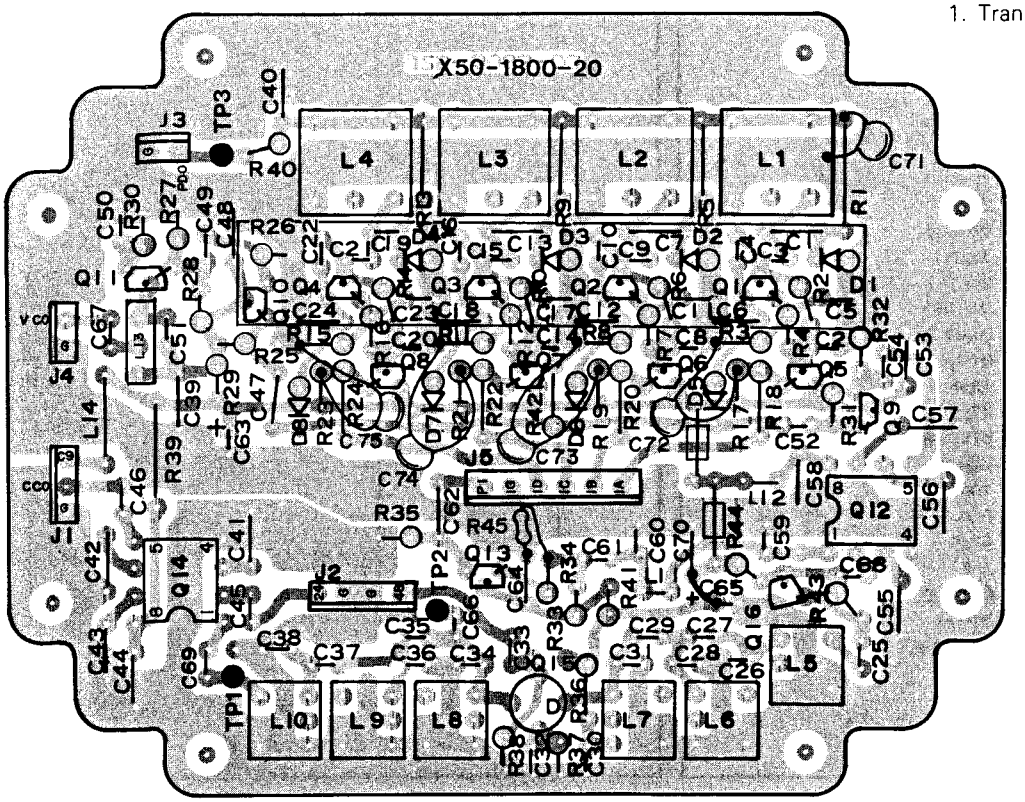
Ref. No.	Part No.	Description
C1	CE04W1HR47M	E 0.47μF
C2	CQ92M1H822K	S 0.0082μF
C3	CQ92M1H103K	S 0.01μF
C4	CE04W1A221M	E 220μF
C5	CE04W1A470M	E 47μF
C6	CE04W1E100M	E 10μF
C7	CE04W1A470M	E 47μF
C8	CE04W1A101M	E 10μF
C9	CQ92M1H104K	S 0.1μF
C10	C91-0456-05	C 0.047μF
C11	C90-0855-05	Cap. 1000μF 25V
C12,13	CQ92M1H102K	S 0.001μF
C15,16	CE04W1C220M	E 22μF
C17	CE04W1A101M	E 100μF
C18	C91-0456-05	Cap. 0.047μF
C19	CE04W1E221M	E 220μF
C20	CK45F1H103Z	C 0.01μF
C21	CE04W1HR47M	E 0.47μF
C22	CK45F1H103Z	C 0.01μF
C23	CE04W1HR47M	E 0.47μF
C25	CE04W1H010M	E 1μF
C27	CE04W1C100M	E 10μF
C28	CE04W1A470M	E 47μF
C29	CE04W1HR47M	E 0.47μF
C30	CE04W1A470M	E 47μF
C31	C90-0855-05	Cap. 1000μF 25V
C32,33	CK45F1H103Z	C 0.01μF
D1,2,4,5	V11-0076-05	Diode 1S1555
D6	V11-0243-05	Zener diode WZ-061
D7,8	V11-4175-36	Zener diode WZ-096
D9	V11-0076-05	Diode 1S1555
D10	V11-4175-26	Zener diode WZ-056
D11	V11-4175-36	Zener diode WZ-096
J1	E40-0473-05	Mini-connector 4P
J2	E40-0273-05	Mini-connector 2P
J3	E40-0673-05	Mini-connector 6P
J4	E40-0473-05	Mini-connector 4P
J5	E40-0573-05	Mini-connector 5P
J6	E40-0373-05	Mini-connector 3P
J7 ~ 10	E40-0273-05	Mini-connector 2P
L1	L15-0016-05	Low frequency choke
L2	L40-1021-03	Ferri-inductor 1 mH
L3	L40-3392-02	Ferri-inductor 3.3μH
L4	L40-1511-03	Ferri-inductor 150μH
Q1	V30-1184-16	IC TA7222AP
Q2	V03-0293-05	Transistor 2SC945 (Q)
Q3	V01-1015-06	Transistor 2SA1015 (Y)
Q4 ~ 7	V03-0293-05	Transistor 2SC945 (Q)
Q8	V01-1015-06	Transistor 2SA1015 (Y)
Q9	V03-0293-05	Transistor 2SC945 (Q)
Q10	V04-0880-16	Transistor 2SD880 (Y)
Q11	V03-0293-05	Transistor 2SC945 (Q)
Q12 ~ 14	V04-0880-16	Transistor 2SD880 (Y)
R5	RC05GF2H221J	Resistor 220Ω 1/2W
R29	RC05GF2H4R7J	Resistor 4.7Ω 1/2W
	E23-0046-04	Square terminal
	F01-0770-04	Heat sink
	F20-0516-05	Insulating, sheet
	F29-0014-05	Insulating washer

▼ VCO UNIT (X50-1800-20) CIRCUIT DIAGRAM

Common DC line

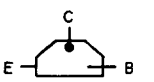


▼ VCO UNIT (X50-1800-20) PCB VIEW [Component Side View]



Note:

1. Transistor installation procedure.



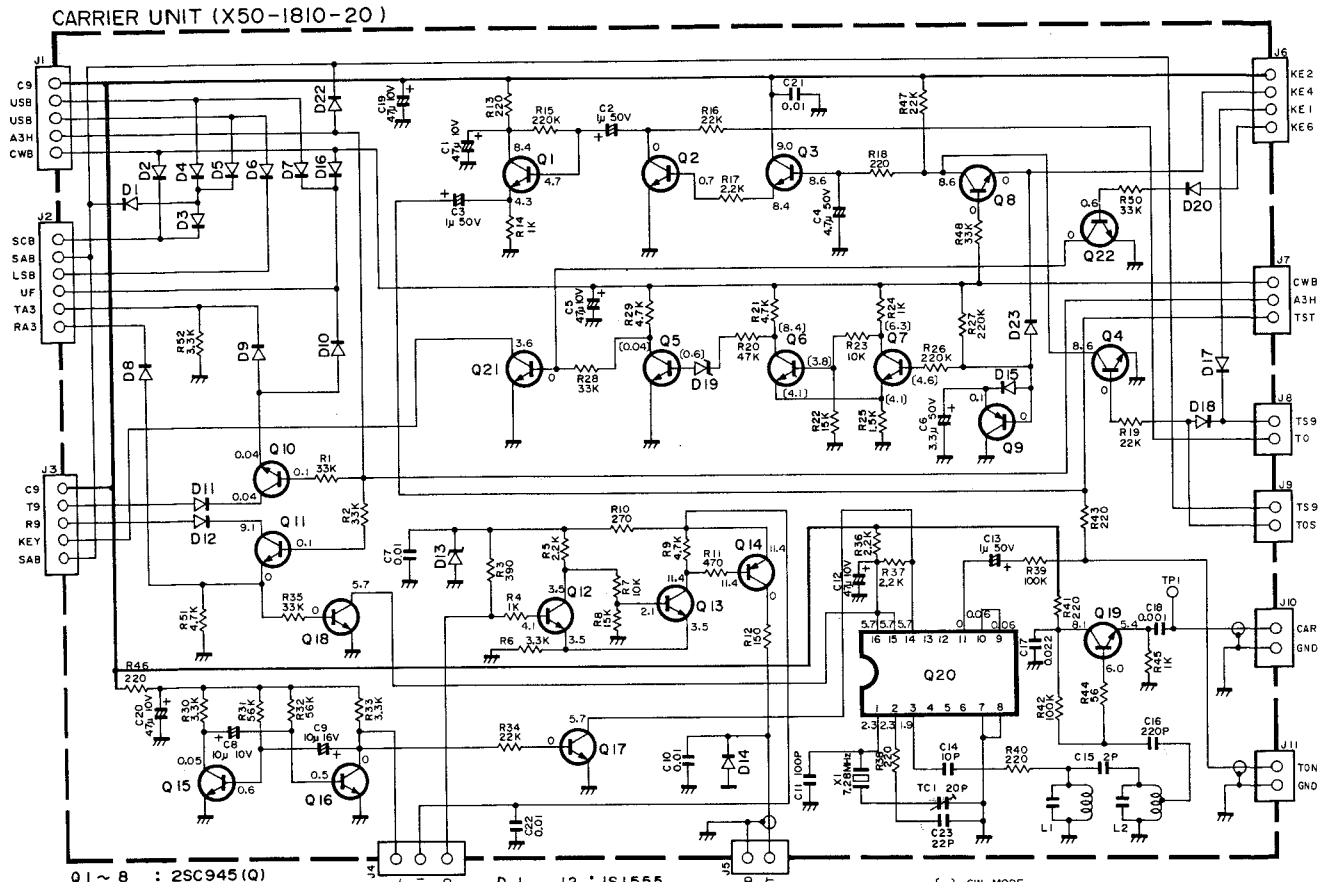
VCO Unit (X-50-1800-20) PARTS LIST

Ref. No.	Part No.	Description		
C1	CC45TH1H560J	C	56pF	
C2	CK45B1H102K	C	0.001μF	
C3	CC45TH1H080D	C	8pF	±0.5pF
C4	CC45TH1H220J	C	22pF	
C5	CK45B1H102K	C	0.001μF	
C6,7	CC45TH1H470J	C	47pF	
C8	CK45B1H102K	C	0.001μF	
C9	CC45TH1H080D	C	8pF	±0.5pF
C10	CC45TH1H220J	C	22pF	
C11	CK45B1H102K	C	0.001μF	
C12	CC45TH1H470J	C	47pF	
C13	CC45TH1H390J	C	39pF	
C14	CK45B1H102K	C	0.001μF	
C15	CC45TH1H080D	C	8pF	±0.5pF
C16	CC45TH1H220J	C	22pF	
C17	CK45B1H102K	C	0.001μF	
C18	CC45TH1H390J	C	39pF	
C19	CC45TH1H330J	C	33pF	
C20	CK45B1H102K	C	0.001μF	
C21	CC45TH1H080D	C	8pF	±0.5pF
C22	CC45TH1H220J	C	22pF	
C23	CK45B1H102K	C	0.001μF	
C24	CC45TH1H390J	C	39pF	
C25	CK45B1H102K	C	0.001μF	
C26	CC45RH1H150J	C	15pF	
C27	CC45CH1H0R5C	C	0.5pF	±0.25pF
C28	CC45RH1H150J	C	15pF	
C29	CC45CH1H0R5C	C	0.5pF	±0.25pF
C30	CK45B1H102K	C	0.001μF	
C31	CC45RH1H150J	C	15pF	
C32	CK45B1H102K	C	0.001μF	
C33	CC45CH1H050C	C	5pF	±0.25pF
C34	CC45RH1H330J	C	33pF	
C35	CC45CH1H020C	C	2pF	±0.25pF
C36	CC45RH1H330J	C	33pF	
C37	CC45CH1H020C	C	2pF	±0.25pF
C38	CC45RH1H390J	C	39pF	
C39	CK45F1H103Z	C	0.01μF	
C40	CK45B1H222K	C	0.0022μF	
C41~44	CK45F1H103Z	C	0.01μF	
C45	CK45B1H102K	C	0.001μF	
C46	CC45SL1H470J	C	47pF	
C47	CC45CH1H100D	C	10pF	±0.5pF
C48	CK45F1H103Z	C	0.01μF	
C49,50	CK45B1H102K	C	0.001μF	
C51	CC45CH1H330J	C	33pF	
C52	CC45CH1H020C	C	2pF	±0.25pF
C53	CK45F1H103Z	C	0.01μF	
C54	CK45B1H102K	C	0.001μF	
C55~58	CK45F1H103Z	C	0.01μF	
C59	CC45CH1H180J	C	18pF	
C60	CC45CH1H270J	C	27pF	
C61	CK45B1H102K	C	0.001μF	
C62	CK45F1H103Z	C	0.01μF	
C63	CE04W1A101M	E	100μF	
C64	CK45F1H103Z	C	0.01μF	
C65	CE04W1A470M	E	47μF	
C66	CC45CH1H010C	C	1pF	±0.25pF
C67~69	CK45B1H102K	C	0.001μF	
C70	CK45F1H103Z	C	0.01μF	
C71	CK45B1H222K	C	0.0022μF	
C72~75	CK45B1H102K	C	0.01μF	
D1~4	V11-4161-36	Diode	1SV53A	
D5~8	V11-0370-05	Diode	1S1587	

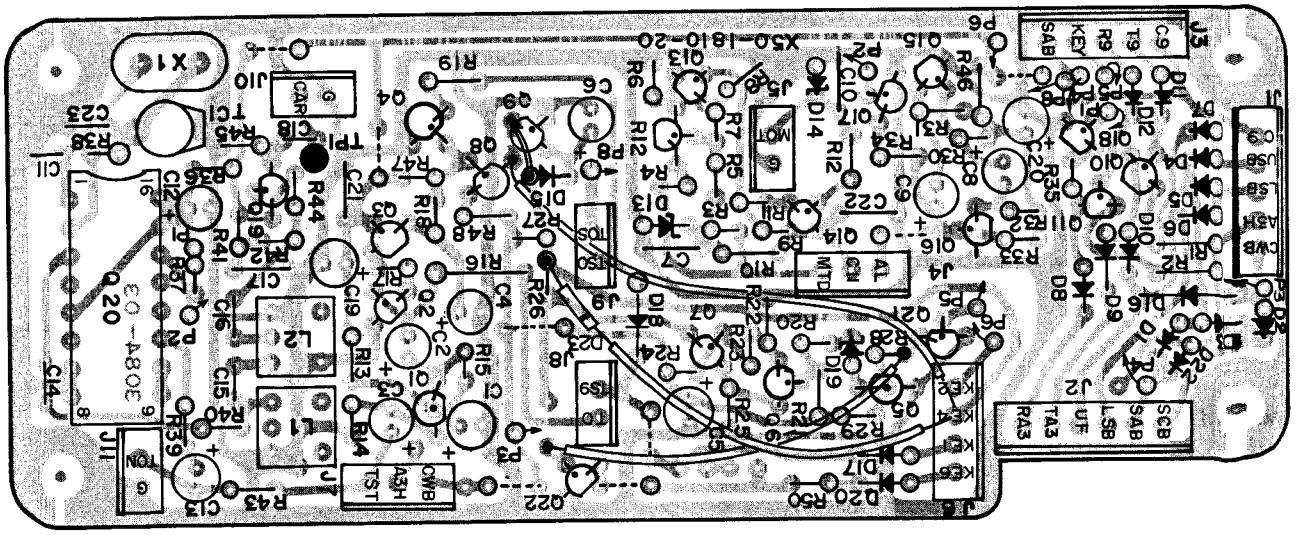
Ref. No.	Part No.	Description	
J1	E40-0373-05	Mini-connector	3P
J2	E40-0473-05	Mini-connector	4P
J3,4	E40-0273-05	Mini-connector	2P
J5	E40-0673-05	Mini-connector	6P
L1	L34-0853-05	Oscillating coil	
L2	L34-0852-055	Oscillating coil	
L3,4	L34-0855-05	Oscillating coil	
L5~7	L34-0507-05	Tuning coil	
L8~10	L34-0627-05	Tuning coil	
L11	L40-3391-03	Ferri-inductor	3.3μH
L12	L40-1021-03	Ferri-inductor	1 mH
L13	L19-0321-05	Wide band transf.	
L14	L40-1511-03	Ferri-inductor	150μH
Q1~4	V03-2668-16	Transistor	2SC2668 (Y)
Q5~8	V01-1115-16	Transistor	2SA1115 (E)
Q9,10,11	V03-2668-16	Transistor	2SC2668 (Y)
Q12	V30-1048-06	IC	SN16913P
Q13	V03-2669-16	Transistor	2SC2669 (Y)
Q14	V30-1048-06	IC	SN16913P
Q15	V09-1013-06	FET	3SK74 (M)
R1,5,9,13	RD14BB2B103J	Resistor	1 kΩ 1/8W
R39	RD14BB3E101J	Resistor	100Ω 2.5W
	R92-0150-05	Jumper wire	

▼ CARRIER UNIT (X50-1810-20) CIRCUIT DIAGRAM

Common DC line



▼ CARRIER UNIT (X50-1810-20) PCB VIEW [Component Side View]

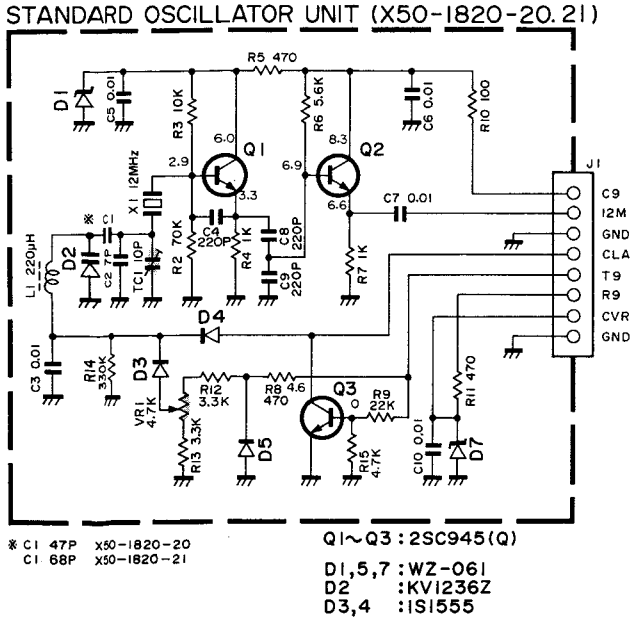


CARRIER UNIT (X50-1810-20) PARTS LIST

Ref. No.	Part No.	Description		
C1	CE04W1A470M	E	47μF	
C2,3	CE04W1H010M	E	1μF	
C4	CE04W1H4R7M	E	4.7μF	
C5	CE04W1A470M	E	47μF	
C6	CE04W1H3R3M	E	3.3μF	
C7	CK45F1H103Z	C	0.01μF	
C8,9	CE04W1C100M	E	10μF	
C10	CK45F1H103Z	C	0.01μF	
C11	CC45SL1H101J	C	100pF	
C12	CE04W1A470M	E	47μF	
C13	CE04W1H010M	E	1μF	
C14	CC45CH1H100D	C	10pF	±0.5%
C15	CC45CH1H020C	C	2pF	±0.25%
C16	CC45SL1H221J	C	220pF	
C17	C91-0457-05	C	0.022μF	
C18	CK45B1H102K	C	1000pF	
C19,20	CE04W1A470M	E	47μF	
C21,22	CK45F1H103Z	C	0.01μF	
C23	CC45CH1H220J	C	22pF	
D1~12	V11-0076-05	Diode	1S1555	
D13	V11-0243-05	Zener diode	WZ-061	
D14~18	V11-0076-05	Diode	1S1555	
D19	V11-4175-16	Zener diode	WZ-052	
D20,22,23	V11-0076-05	Diode	1S1555	

Ref. No.	Part No.	Description	
J1	E40-0573-05	Mini-connector	5P
J2	E40-0673-05	Mini-connector	6P
J3	E40-0573-05	Mini-connector	5P
J4	E40-0473-05	Mini-connector	3P
J5	E40-0273-05	Mini-connector	2P
J6	E40-0473-05	Mini-connector	4P
J7	E40-0373-05	Mini-connector	3P
J8~11	E40-0273-05	Mini-connector	2P
L1,2	L34-0540-05	Tuning coil	
Q1~8	V03-0293-05	Transistor	2SC945 (Q)
Q9	V01-1015-06	Transistor	2SA1015 (Y)
Q10~13	V03-0293-05	Transistor	2SC945 (Q)
Q14	V01-1015-06	Transistor	2SA1015 (Y)
Q15~19	V03-0293-05	Transistor	2SC954 (Q)
Q20	V30-1092-06	IC	TC5048P
Q21,22	V03-0293-05	Transistor	2SC954 (Q)
R12	RC05GF2H151J	Resistor	150Ω 1/2W
R52	RD14BB2B332J	Resistor	3.3kΩ 1/8W
TC1	C05-0030-15	Ceramic trimmer	20pF
X1	L77-0959-05	Crystal	7.280 MHz

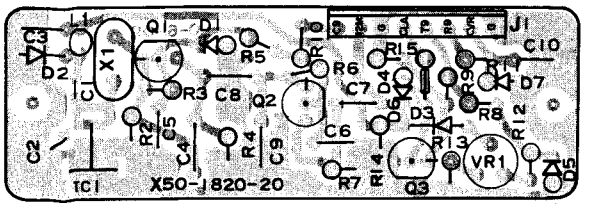
▼STANDARD OSCILLATOR UNIT (X50-1820-20,21) CIRCUIT DIAGRAM



STANDARD OSCILLATOR UNIT (X50-1820-20,21) PARTS LIST

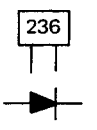
Ref. No.	Part No.	Description		
C1	CC45CH1H470J	C	47pF	(M type)
C1	CC45CH1H680J	C	68pF	(M2 type)
C2	CC45CH1H070J	C	7pF	
C3	C90-0246-05	C	0.01μF	
C4	CM93D2H221J	MC	220pF	
C5~7	C90-0246-05	C	0.01μF	
C8,9	CM93D2H221J	MC	220pF	
C10	C90-0246-05	C	0.01μF	
L1	L40-2211-03		220μH	
D1	V11-0243-05	Zener diode	WZ-061	
D2	V11-3178-76	Diode	KV1236X	
D3,4	V11-0076-05	Diode	1S1555	
D5,7	V11-0243-05	Zener diode	WZ-061	
J1	E40-0873-05	Mini-connector	8P	
Q1~3	V03-0293-05	Transistor	2SC945 (Q)	
TC1	C05-0010-15	Ceramic trimmer	10pF	
VR1	R12-1409-05	Trim pot	4.7 kΩ B	
X1	L77-0961-05	Crystal	12 MHz	
	R92-0150-05	Jumper wire		

▼STANDARD OSCILLATOR UNIT (X50-1820-20,21) PCB VIEW [Component Side View]



Note:

1. Procedure installing D2

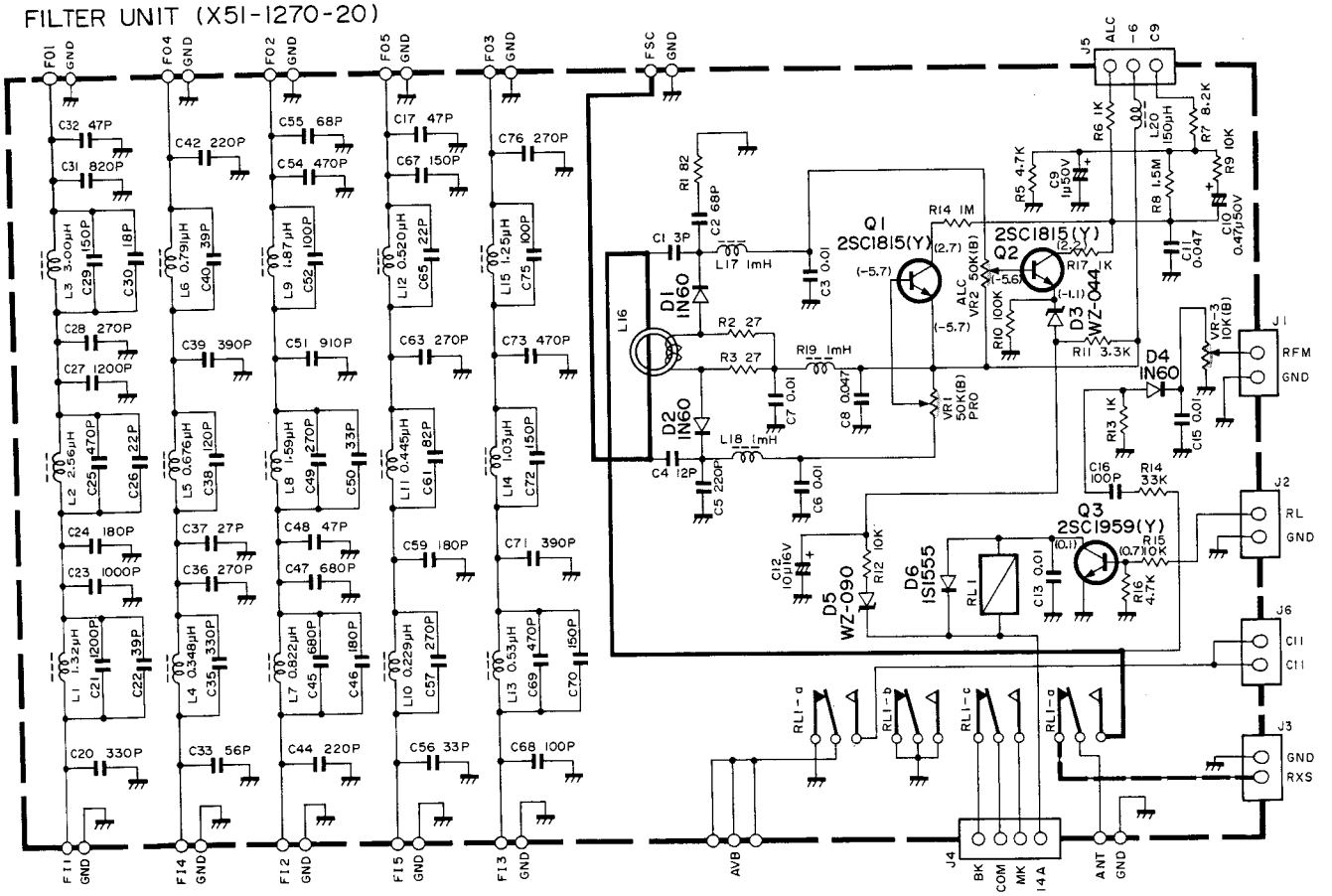


Side with the printed characters

▼ FILTER UNIT (X51-1270-20) CIRCUIT DIAGRAM

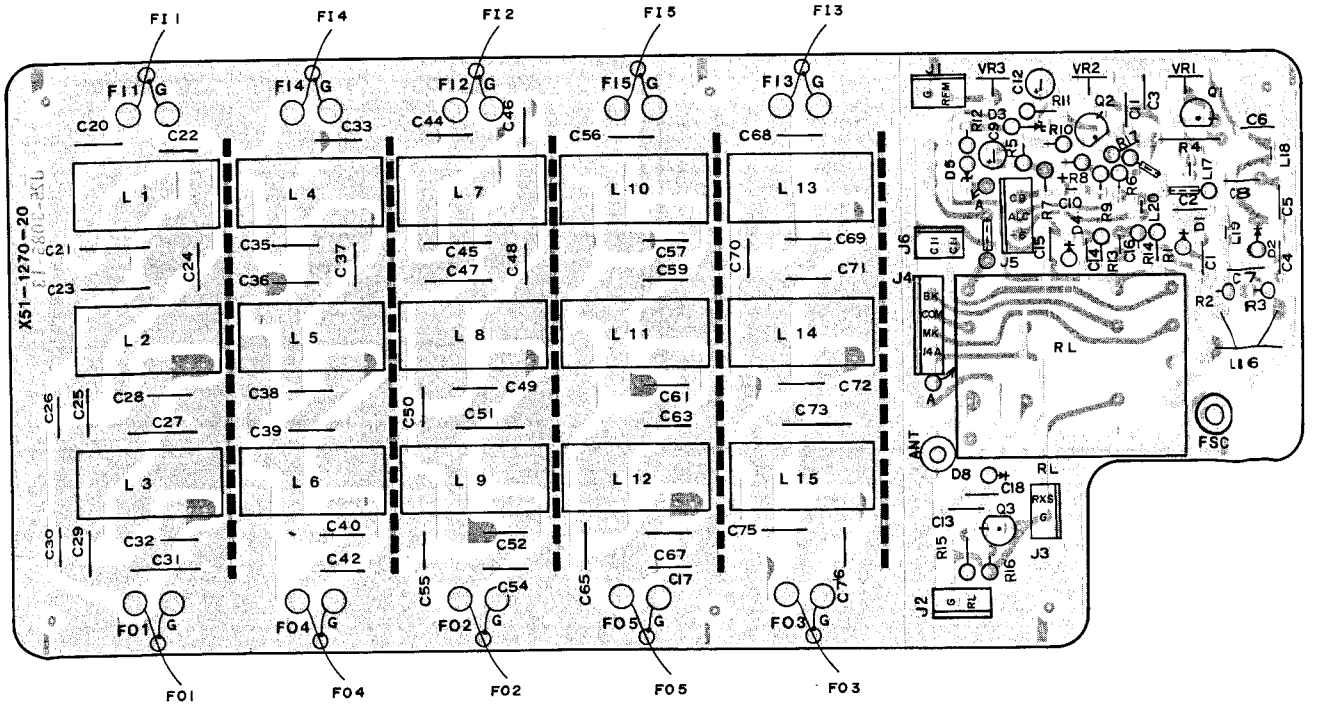
TX signal line

FILTER UNIT (X51-1270-20)



▼ FILTER UNIT (X51-1270-20) PCB VIEW

[Component Side View]

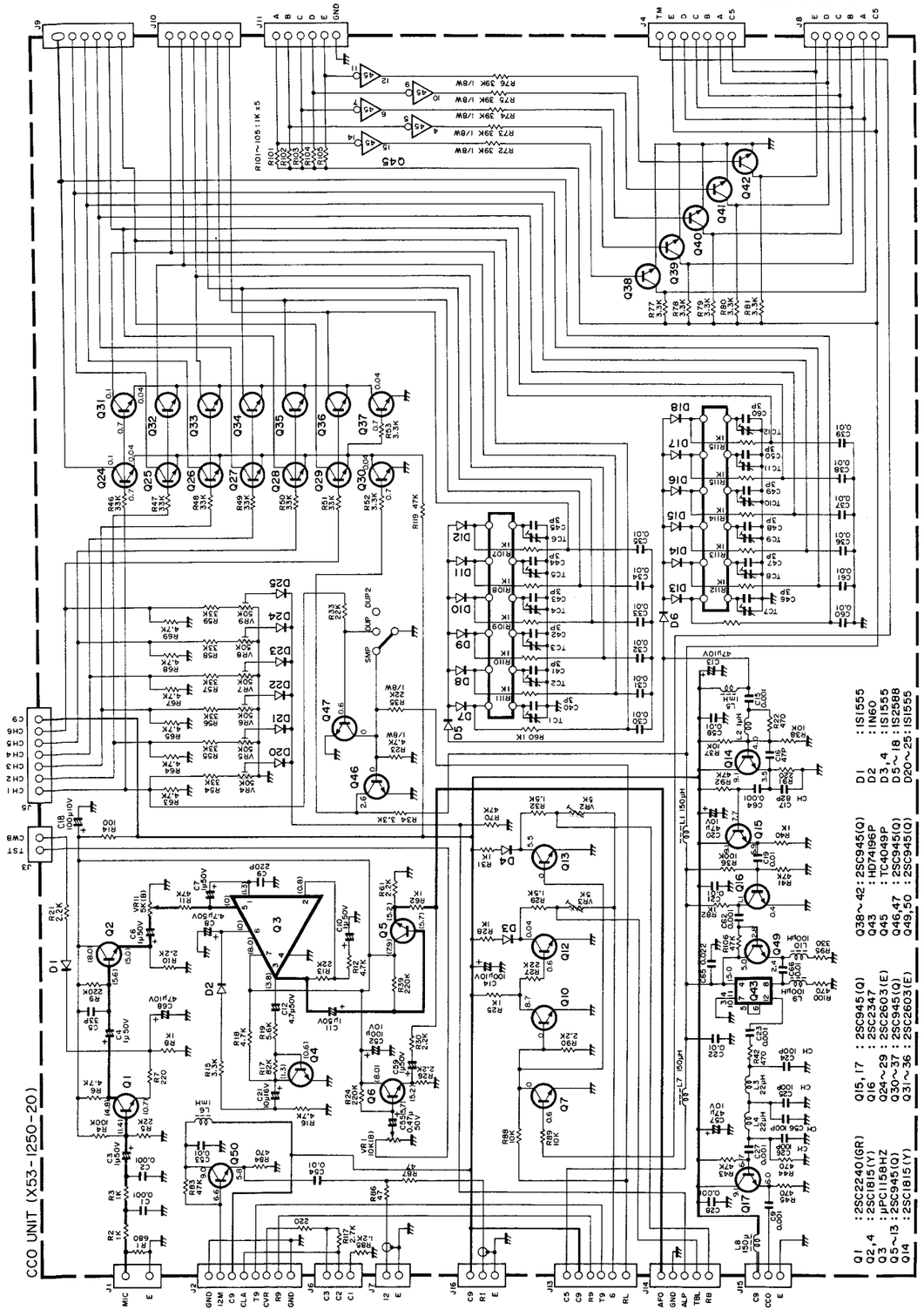


FILTER UNIT (X51-1270-20) PARTS LIST

Ref. No.	Part No.	Description		
C1	CC45CH2H030C	C	3pF	±0.25pF
C2	CC45CH2H680J	C	68pF	
C3	CK45F1H103Z	C	0.01μF	
C4	CC45CH1H120J	C	12pF	
C5	CC45SL2H221J	C	220pF	
C6,7	CK45F1H103Z	C	0.01μF	
C8	CK45F1H473Z	C	0.047μF	
C9	CE04W1H010M	E	1μF	
C10	CE04W1HR47M	E	0.47μF	
C11	CK45F1H473Z	C	0.047μF	
C12	CE04W1C100M	E	10μF	
C13,15	CK45F1H103Z	C	0.01μF	
C16	CC45SL1H101J	C	100pF	
C17	CM93D2H470J	ML	47pF	
C20	CM93D2H331J	ML	330pF	
C21	CM93D2H122J	ML	0.0012μF	
C22	CC45CH2H390J	C	39pF	
C23	CM93D2H102J	ML	0.001μF	
C24	CM93D2H181J	ML	180pF	
C25	CM93D2H471J	ML	470pF	
C26	CC45CH2H220J	C	22pF	
C27	CM93D2H122J	ML	0.0012μF	
C28	CM93D2H271J	ML	270pF	
C29	CM93D2H151J	ML	150pF	
C30	CC45CH2H180J	C	18pF	
C31	CM93D2H821J	ML	820pF	
C32	CC45CH2H470J	C	47pF	
C33	CM93D2H560J	ML	56pF	
C35	CM93D2H331J	ML	330pF	
C36	CM93D2H271J	ML	270pF	
C37	CC45CH2H270J	C	27pF	
C38	CM93D2H121J	ML	120pF	
C39	CM93D2H391J	ML	390pF	
C40	CM93D2H390J	ML	39pF	
C42,44	CM93D2H221J	ML	220pF	
C45	CM93D2H681J	ML	680pF	
C46	CC45CH1H181J	C	180pF	
C47	CM93D2H681J	ML	680pF	
C48	CC45CH2H270J	C	27pF	
C49	CM93D2H271J	ML	270pF	
C50	CC45CH2H330J	C	33pF	
C51	CM93D2H911J	ML	910pF	
C52	CM93D2H101J	ML	100pF	
C54	CM93D2H471J	ML	470pF	
C55	CM93D2H680J	ML	68pF	
C56	CM93D2H330J	ML	33pF	
C57	CM93D2H271J	ML	270pF	
C59	CM93D2H181J	ML	180pF	
C61	CM93D2H820J	ML	82pF	
C63	CM93D2H271J	ML	270pF	
C65	CM93D2H220J	ML	22pF	
C67	CM93D2H151J	ML	150pF	
C68	CM93D2H101J	ML	100pF	
C69	CM93D2H471J	ML	470pF	
C70	CM93D2H151J	ML	150pF	
C71	CM93D2H391J	ML	390pF	
C72	CM93D2H151J	ML	150pF	
C73	CM93D2H471J	ML	470pF	
C75	CM93D2H101J	ML	100pF	
C76	CM93D2H271J	ML	270pF	
D1,2	V11-0051-05	Diode	1N60	
D3	V11-4161-06	Zener diode	WZ-044	
D4	V11-0051-05	Diode	1N60	
D5	V11-0240-05	Zener diode	WZ-090	
D8	V11-0076-05	Diode	1S1555	
J1~3	E40-0273-05	Mini-connector	2P	
J4	E40-0473-05	Mini-connector	4P	
J5	E40-0373-05	Mini-connector	3P	
J6	E40-0273-05	Mini-connector	2P	
L1	L34-3022-05	Filter coil	1.32μH	
L2	L34-3023-05	Filter coil	2.56μH	
L3	L34-3024-05	Filter coil	3.00μH	
L4	L34-3031-05	Filter coil	0.348μH	
L5	L34-3032-05	Filter coil	0.676μH	
L6	L34-3033-05	Filter coil	0.791μH	
L7	L34-3025-05	Filter coil	0.822μH	
L8	L34-3026-05	Filter coil	1.59μH	
L9	L34-3027-05	Filter coil	1.87μH	
L10	L34-3034-05	Filter coil	0.229μH	
L11	L34-3035-05	Filter coil	0.445μH	
L12	L34-3036-05	Filter coil	0.520μH	
L13	L34-3028-05	Filter coil	0.531μH	
L14	L34-3029-05	Filter coil	1.03μH	
L15	L34-3030-05	Filter coil	1.25μH	
L16	L39-0406-05	Filter coil		
L17~19	L40-1021-03	Filter coil		
L20	L40-1511-03	Filter coil		
Q1,2	V03-1815-06	Transistor	2SC1815 (Y)	
Q3	V03-1959-06	Transistor	2SC1959 (Y)	
RL1	S51-4402-05	Relay		
VR1,2	R12-4411-05	Trim, pot	50 kΩ B	
VR3	R12-3434-04	Trim, pot	10 kΩ B	
	E04-0154-05	Coax. connector		
	E23-0046-04	Square terminal		
	E23-0512-05	Round, terminal x 3		
	E31-2136-05	Terminal with wire		

▼ CCO UNIT (X53-1250-20) CIRCUIT DIAGRAM

TX signal line
Common DC line

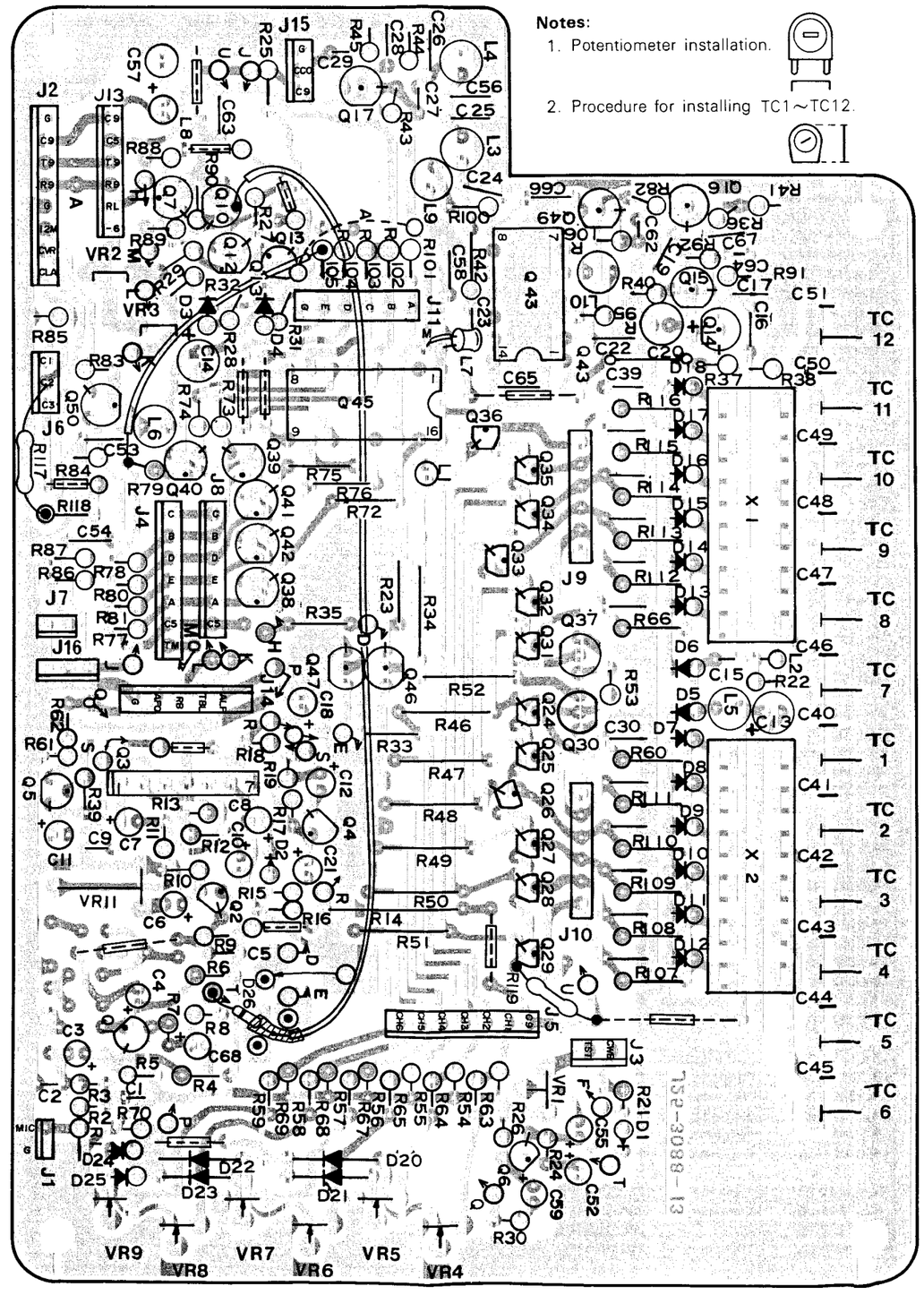


▼ CCO UNIT (X53-1250-20) PCB VIEW

[Component Side View]

Notes:

1. Potentiometer installation.
2. Procedure for installing TC1～TC12.



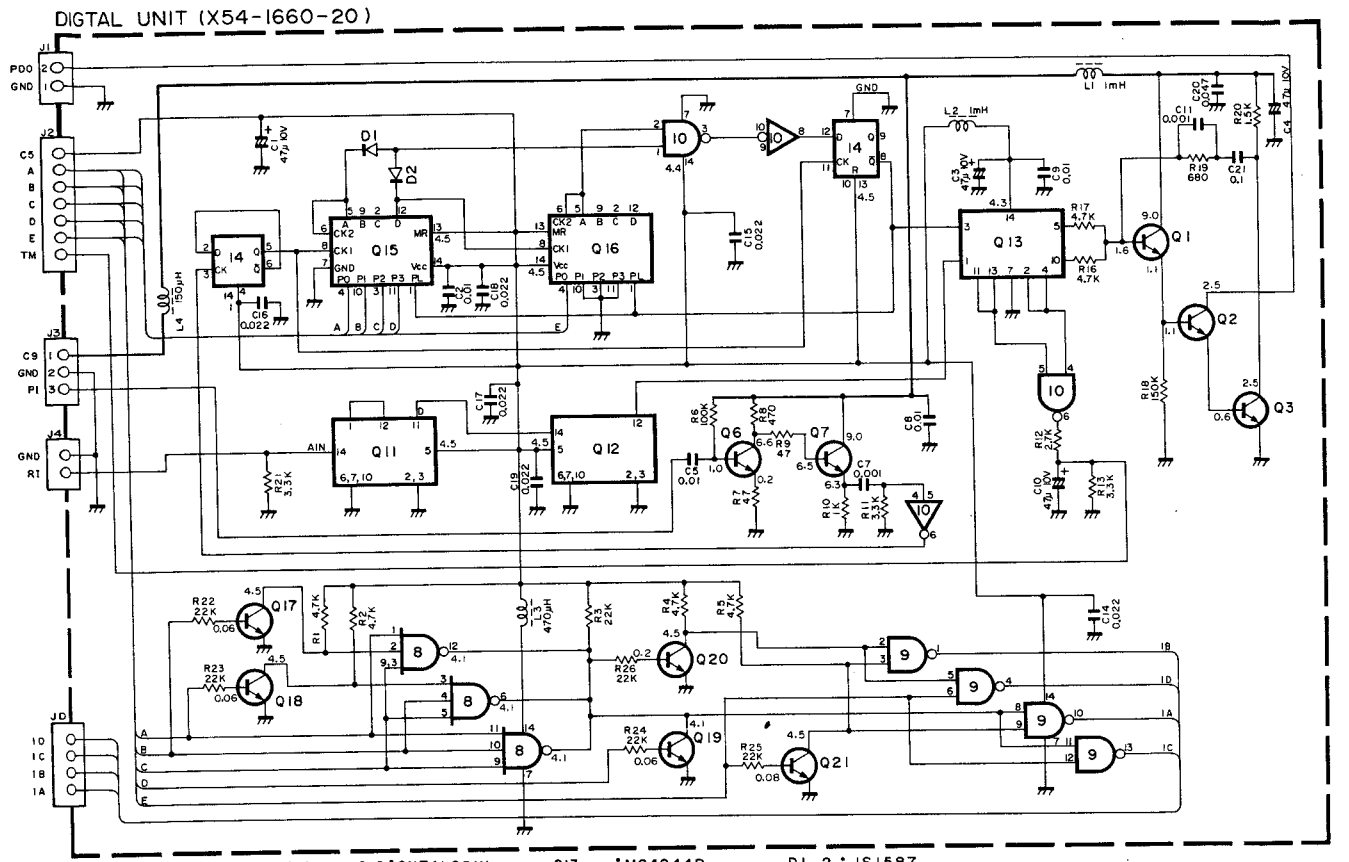
CCO UNIT (X53-1250-20) PARTS LIST

Ref. No.	Part No.	Description		
C1,2	CK45B1H102K	C	0.001μF	
C3,4	CE04W1H010M	E	1μF	
C5	CC45CH1H330J	C	33pF	
C6,7	CE04W1H010M	E	1μF	
C8	CE04W1H4R7M	E	4.7μF	
C9	CK45B1H221K	C	220pF	
C10,11	CE04W1H010M	E	1μF	
C12	CE04W1H4R7M	E	4.7μF	
C13	CE04W1A470M	E	47μF	
C14	CE04W1A101M	E	100μF	
C15	CK45B1H102K	C	0.001μF	
C16	CC45CH1H470J	C	47pF	
C17	CC45CH1H820J	C	82pF	
C18	CE04W1A101M	E	100μF	
C19	CK45F1H103Z	C	0.01μF	
C20	CE04W1A470M	E	47μF	
C21	CE04W1C100M	E	10μF	
C22	CK45F1H103Z	C	0.01μF	
C23,27	CK45B1H102K	C	0.001μF	
C28	CK45F1H103Z	C	0.01μF	
C29	CK45B1H102K	C	0.001μF	
C30~39	CK45F1H103Z	C	0.01μF	
C40~51	CC45CH1H030C	C	3pF	±0.25pF
C52	CE04W1A101M	E	100μF	
C53,54	CK45F1H103Z	C	0.001μF	
C55	CE04W1HR47M	E	0.47μF	
C57	CE04W1A470M	E	47μF	10V
C58	CK45B1H102K	C	0.001μF	
C59	CE04W1H010M	E	1μF	
C60,61	CK45F1H103Z	C	0.01μF	
C62,64	CK45B1H102K	C	0.001μF	
C65	C91-0457-05	C	0.022μF	
C66,67	CK45F1H103Z	C	0.01μF	
C68	CE04W1A470M	E	47μF	
D1	V11-0076-05	Diode		1S1555
D2	V11-0051-05	Diode		1N60
D3,4	V11-0076-05	Diode		1S1555
D5~18	V11-0414-05	Diode		1S2588
D20~26	V11-0076-05	Diode		1S1555
J1	E40-0273-05	Mini-connector		2P
J2	E40-0873-05	Mini-connector		8P
J3	E40-0273-05	Mini-connector		2P
J4,5	E40-0773-05	Mini-connector		7P
J6	E40-0373-05	Mini-connector		3P
J7	E40-0273-05	Mini-connector		2P
J8	E40-0673-05	Mini-connector		6P
J9~11	E40-0611-05	Mini-connector		6P
J13	E40-0673-05	Mini-connector		6P
J14	E40-0573-05	Mini-connector		5P
J15,16	E40-0373-05	Mini-connector		3P
L1	L40-1511-03	Ferri-inductor		150μH
L2	L33-0633-05	Choke coil		1μH
L3,4	L40-2201-03	Ferri-inductor		22μH
L5,6	L40-1021-03	Ferri-inductor		1 mH
L7,8	L40-1511-03	Ferri-inductor		150μH
L9,10	L40-1011-03	Ferri-inductor		100μH
Q1	V03-2240-06	Transistor		2SC2240 (GR)
Q2	V03-1815-06	Transistor		2SC1815 (Y)
Q3	V11-1177-26	IC		μPC1158H2
Q4	V03-1815-06	Transistor		2SC1815 (Y)

Ref. No.	Part No.	Description	
Q5~7, 10,12, 13	V03-0945-06	Transistor	2SC945 (Q)
Q14	V03-1815-06	Transistor	2SC1815 (Y)
Q15	V03-0945-06	Transistor	2SC945 (Q)
Q16	V03-2347-06	Transistor	2SC2347
Q17	V03-0945-06	Transistor	2SC945 (Q)
Q24~29	V03-2603-06	Transistor	2SC2603 (E)
Q30	V03-0945-06	Transistor	2SC945 (Q)
Q31~36	V03-2603-06	Transistor	2SC2603 (E)
Q37~42	V03-0945-06	Transistor	2SC945 (Q)
Q43	V30-1078-06	IC	HD74196P
Q45	V30-1009-26	IC	TC4049BP
Q46,47, 49,50	V03-0945-06	Transistor	2SC945 (Q)
TC1~12	C05-0315-05	Ceramic trimmer	40 pF
VR1	R12-3434-05	Trim, pot	10kΩB
VR2,3	R12-2411-05	Trim, pot	5kΩB
VR4~9	R12-4411-05	Trim, pot	50kΩB
VR11	R12-2401-05	Trim, pot	5kΩB
X1,2	E18-0601-05	Crystal socket	

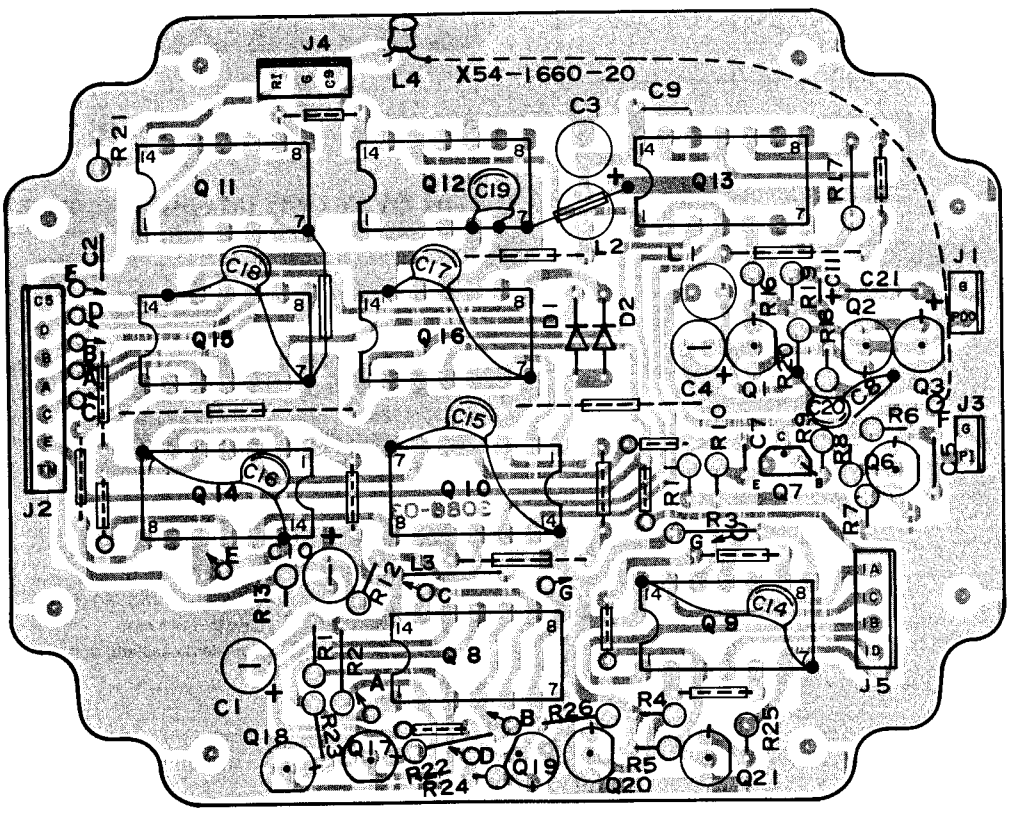
▼ DIGITAL UNIT (X54-1660-20) CIRCUIT DIAGRAM

Common DC line



Q1~3: 2SC1775 (E)
Q6 : 2SC2347
Q7 : 2SC2669 (Y)
Q8 : 2N74LS12N
Q9 :SN74LS01N
Q10:SN74S00N
Q11:SN74LS92N
Q12:SN74LS90AN
Q13 :MC4044P
Q14 :SN74LS74N
Q15,16 :HD74196P
Q17 21:2SC945(Q)
D1,2 : 1S1587

▼ DIGITAL UNIT (X54-1660-20) PCB VIEW [Component Side View]

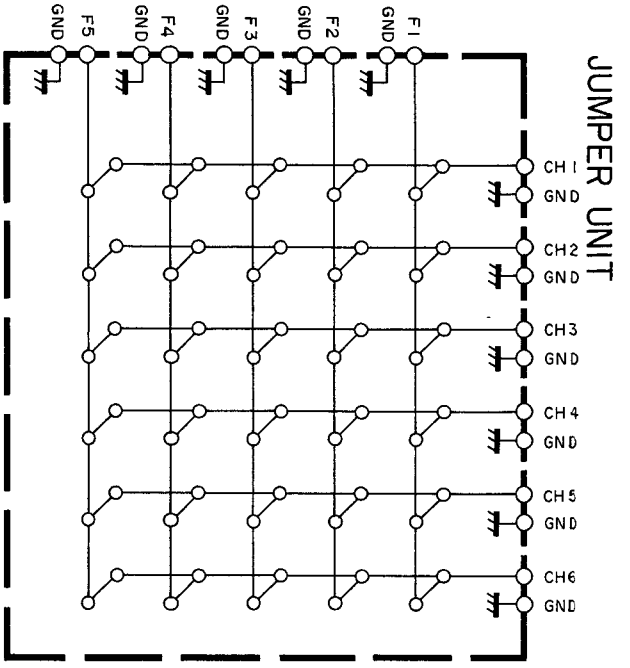


DIGITAL UNIT (X54-1660-20) PARTS LIST

Ref. No.	Part No.	Description	
C1	CE04W1A470M	E	47μF
C2	CK45F1H103Z	C	0.01μF
C3,4	CE04W1A470M	E	47μF
C5	CK45F1H103Z	C	0.01μF
C7	CK45B1H102K	C	0.001μF
C8,9	CK45F1H103Z	C	0.01μF
C10	CE04W1A470M	E	47μF
C11	CQ92M1H102K	ML	0.001μF
C14~19	C91-0457-05	C	0.022μF
C20	C91-0456-05	C	0.047μF
C21	CQ92M1H104K	ML	0.1μF
D1,2	V11-0370-05	Diode	1S1587
J1	E40-0273-05	Mini-connector	2P
J2	E40-0773-05	Mini-connector	7P
J3	E40-0273-05	Mini-connector	2P
J4	E40-0373-05	Mini-connector	3P
J5	E40-0473-05	Mini-connector	4P
L1,2	L40-1021-03	Ferri-inductor	1 mH
L3	L40-4711-03	Ferri-inductor	470μH
L4	L40-1511-03	Ferri-inductor	150μH
Q1~3	V03-1775-06	Transistor	2SC1775 (E)
Q6	V03-2347-06	Transistor	2SC2347
Q7	V03-2669-16	Transistor	2SC2669 (Y)
Q8	V30-1193-26	IC	SN74LS12N
Q9	V30-1041-16	IC	SN74LS01N
Q10	V30-0181-05	IC	SN74S00N
Q11	V30-1151-06	IC	SN74LS92N
Q12	V30-1005-26	IC	SN74LS90N
Q13	V30-0173-05	IC	MC4044P
Q14	V30-1005-86	IC	SN74LS74N
Q15,16	V30-1078-06	IC	HD74196P
Q17~21	V03-0293-05	Transistor	2SC945 (Q)
	R92-0150-05	Jumper wire	

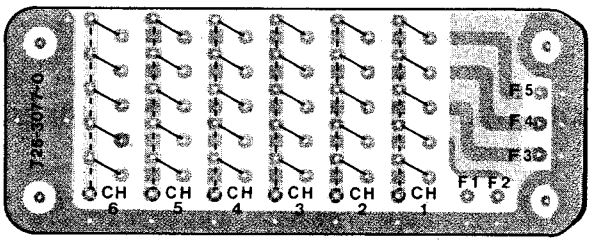
JUMPER UNIT (J25-3077-00)

▼CIRCUIT DIAGRAM



JUMPER UNIT (J25-3077-00)

▼PCB VIEW



CRYSTAL OVEN UNIT (M type only) PARTS LIST

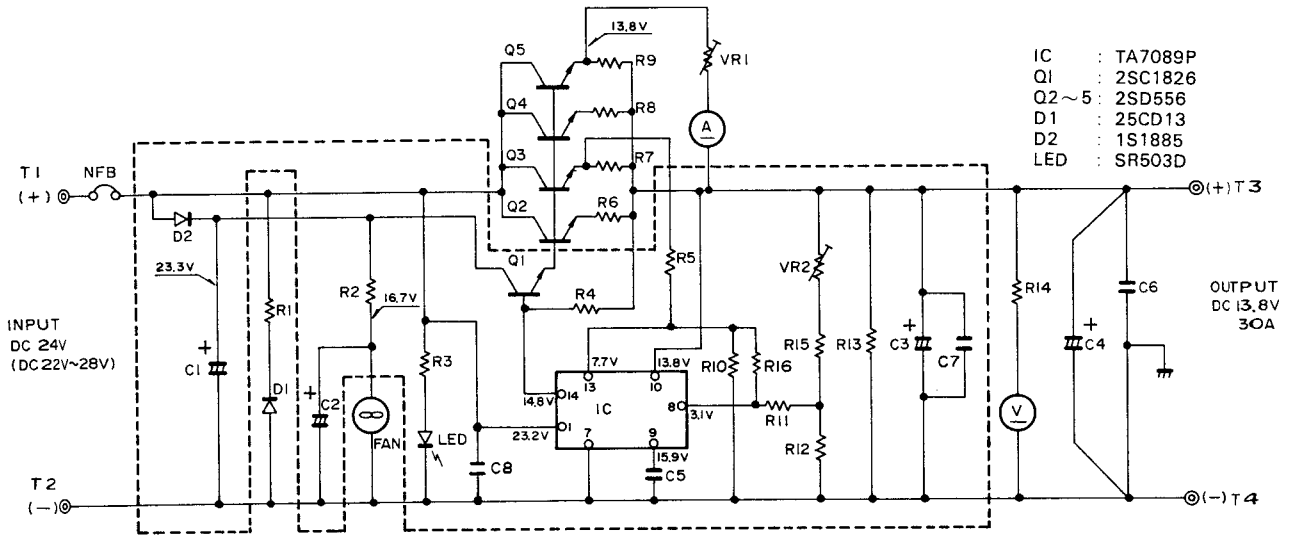
Ref. No.	Part No.	Description	
	E31-2110-05	Connector with wire	
	RN14BK2E3900F	Resistor (Metal film)	390Ω
	RN14BK2E1001F	Resistor (Metal film)	1 kΩ
	RN14BK2E2001F	Resistor (Metal film)	2 kΩ
	RN14BK2E4301F	Resistor (Metal film)	4.3 kΩ
	RN14BK2E6202F	Resistor (Metal film)	62 kΩ
	V11-4101-50	Zener diode, XZ-062	
	V11-4172-86	Zener diode, WZ-036	
	V30-1237-26	IC, μPC151C	
	V04-0880-16	Transistor, 2SD880 (Y)	
	W02-0323-05	Crystal oven assy	
	X50-1820-20	Standard oscillator unit	

DS-24 DC-DC CONVERTER (OPTION)

SPECIFICATIONS

Input voltage: 22 — 28V DC
Output voltage: 13.8V DC
Output current: 30A
Dimensions: 201 (H) × 183 (W) × 283 (L)
Weight: Approx. 4.5 kg
Accessories: Instruction manual

SCHEMATIC DIAGRAM



VR1: Am meter caribration
VR2: Setting the output voltage
DC Voltage measurement condition
Output terminal: open

DS-24 PARTS LIST

Ref. No.	Part No.	Description		
AM	B31-0638-08	Am meter 0～30A		
C1	CE02W1H221	Electrolytic	220μF	50V
C2	CE02W1H470	Electrolytic	47μF	50V
C3	CE04W1E101M	Electrolytic	100μF	25V
C4	CE02W1E222	Electrolytic	2200μF	25V
C5	CK45B1H102K	Ceramic	1000pF	50V
C6	CQ92M1H472K	Styren	0.0047μF	50V
C7,8	CQ92M1H104K	Styren	0.1μF	50V
D1		Diode	25CD13	
D2	V11-9988-00	Diode	1S1885	
FAN	F09-0408-08	Fan motor	DC24V	
IC		IC	TA7089P	
LED		LED	SR503D	
NFB	S59-2401-08	NF Breaker		
Q1		Transistor	2SC1826	

Ref. No.	Part No.	Description		
Q2～5	V04-0556-00	Transistor	2SD556	
R1	R92-0661-08	Enamel resistor	0.1Ω	30W
R2	RW98A3H330J	Cement resistor	33Ω	5W
R3	RD14BY2H302	Resistor	3kΩ	1/2W
R4,5	RD14BY2H151	Resistor	150Ω	1/2W
R6～9	R92-0662-08	Cement resistor	0.4Ω	30W
R10	RD14BY2H182	Resistor	1.8kΩ	1/2W
R11	RD14BY2H102	Resistor	1kΩ	1/2W
R12	RD14BY2H561	Resistor	560Ω	1/2W
R13	RD14BY2H751	Resistor	750Ω	1/2W
R14	RD14BY2H563	Resistor	56KΩ	1/2W
R15	RD14BY2H152	Resistor	1.5kΩ	1/2W
VM	B31-0637-08	Volt meter	0～20V	
VR1	R12-2015-05	Trim Pot	5kΩ	
VR2	R01-1402-08	Trim Pot	1kΩ	
	B50-3935-00	Instruction manual		
	E21-0457-08	Terminal (Red)	16φ × 2	
	E21-0458-08	Terminal (Black)	16φ × 2	

PS-30C DC POWER SUPPLY (OPTION)

SPECIFICATIONS

Power Supply Section

Input voltage ..... DC POWER SUPPLY
AC 120V/220V/240V
±10% 50/60 Hz

Output voltage ..... DC 13.8V (standard voltage)

Output current ..... 20A (intermittent load 25% duty cycle)

Countinuous load current 15A max.

Output voltage fluctuation Within ±0.7V at AC 120V, 220V, 240V±10% (Load current: 15A)
Within 0.7V at 2～15A of load current (No-load output voltage: Less than 16V at AC 120V, 220V, 240V)

Ripple voltage ..... Less than 20 mV (rms). output current 15A

Power consumption ..... Approx. 470W at AC 120V, 220V, 240V. (Load current: 20A)

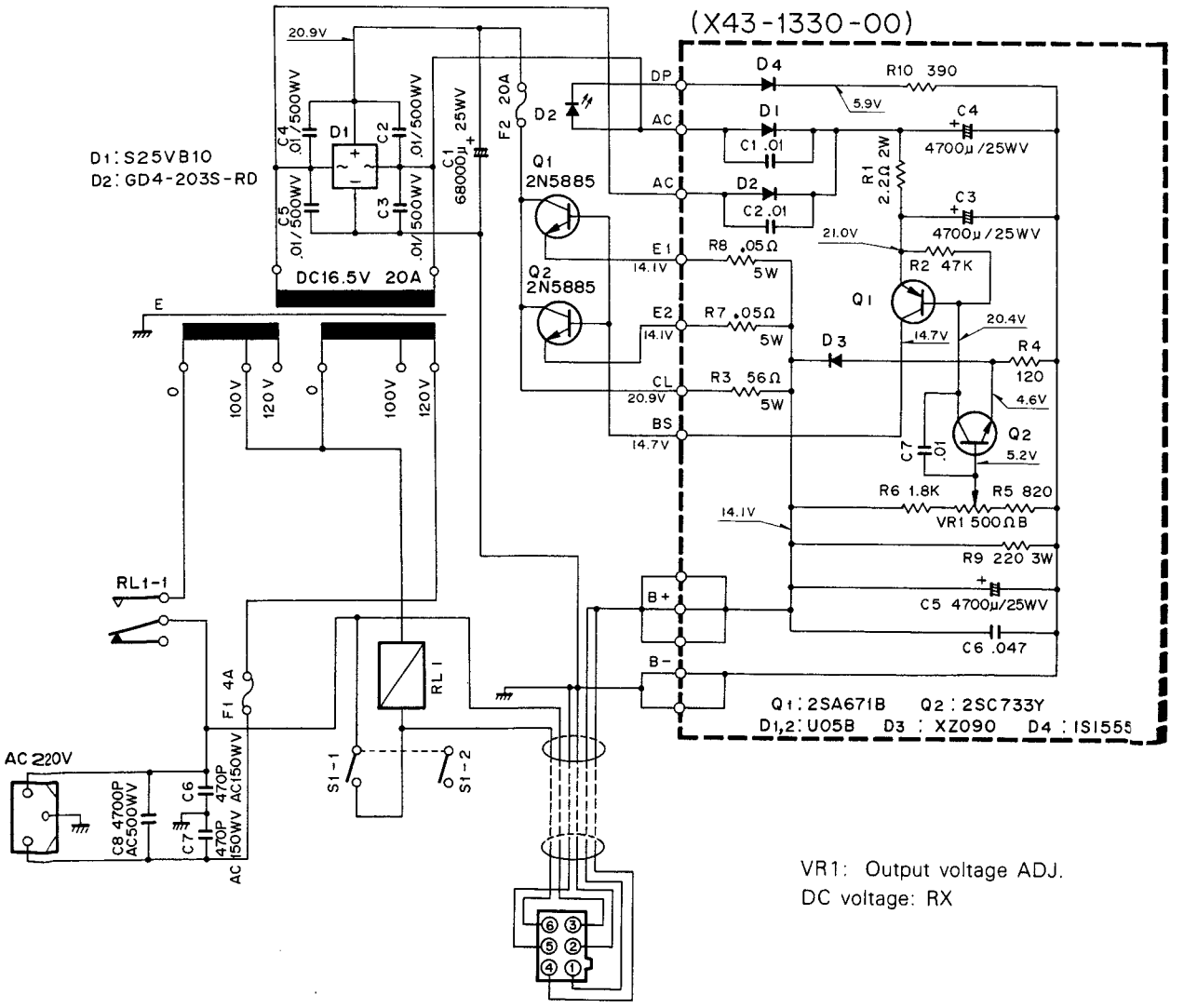
General

Dimensions ..... 180 (7″—1/16) W × 133 (5″—1/4) H × 287 (11″—5/16) D mm (inch)

Weight ..... Approx. 8.9kg (19.6 lbs.)

Note: The circuit and ratings may change without notice due to developments in technology.

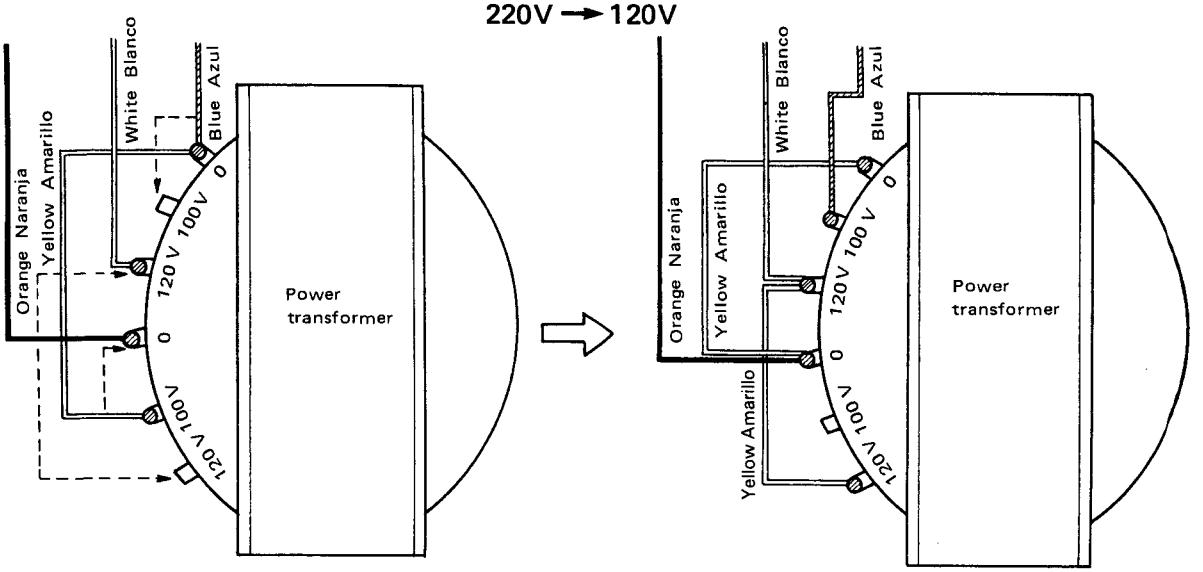
SCHEMATIC DIAGRAM



When this unit is to be operated on 120V and 240V, connect the lead as shown below.

Cuando esta unidad vaya a ser utilizada con 120V, 240V connectar el cable como se muestra debajo.

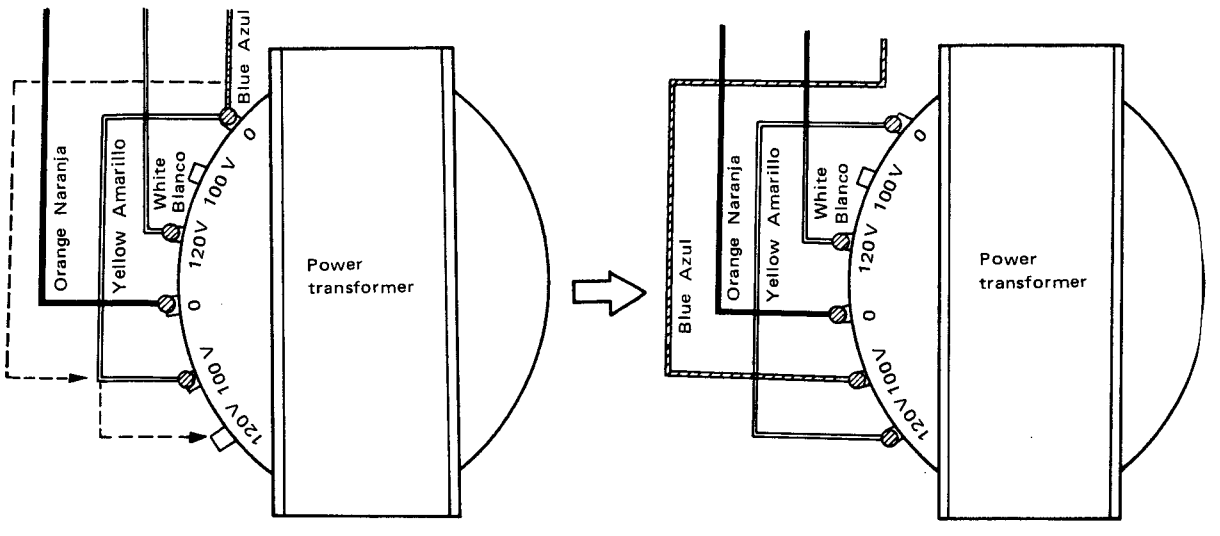
220V → 120V



Fuse (F1) 4A

Fuse (F1) 4A → 6A

220V → 240V



Fuse (F1) 4A

Fuse (F1) 4A

PS-30C GENERAL PARTS LIST

Ref. No.	Part No.	Description
C1	C90-0813-05	E 68000μF, 25WV
C2～5	CK45E2H103P	C 0.01μF
C6,7	C90-0300-05	C 470pF, AC150WP
C8	C91-0412-05	C 4700pF, AC500WV
D1	V11-1365-06	Diode, S25VB10
D2		LED GD4-203S-RD
Q1,2	V08-1012-06	Transistor, 2N5885 or MJ802

Ref. No.	Part No.	Description
RL1	S51-1406-05	Relay
S1-1	S36-2402-05	See-saw switch, power
	A01-0913-02	Case (upper)
	A01-0914-02	Case (lower)
	A20-2356-05	Main panel
	A20-2437-03	Panel, KENWOOD
	A23-1463-03	Rear panel

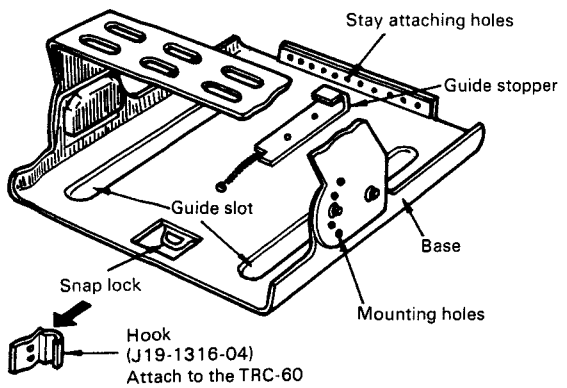
Ref. No.	Part No.	Description
	B40-2586-04	Name plate
	B42-1710-04	Label, name plate
	B50-3926-00	Instruction manual
	E18-0351-05	3P Inlet
	E22-0206-05	Connecting terminal 3P
	E22-0207-05	Connecting terminal 3P
	E30-1643-15	AC cord ass'y
	E30-1644-15	AC cord ass'y
	E31-0500-05	Cable with plug
	F01-0738-03	Heat sink
	F05-2035-15	Fuse (20A)
	F05-4022-05	Fuse (4A)
	F05-6021-05	Fuse (6A)
	F07-0827-04	Heat sink cover
	H01-2780-04	Packing carton (inside)
	H03-2023-04	Packing carton (outside)
	H10-2523-02	Packing fixture (F)
	H10-2524-02	Packing fixture (R)
	H12-0455-04	Packing fixture
	H20-1413-03	Protective cover
	H25-0029-04	Packing bag
	J02-0049-14	Foot x 4
	J13-0033-15	Fuse holder
	J19-0509-04	LED holder
	J42-0403-05	Cord bush
	J61-0019-05	Vinyle tie
	J61-0402-05	Free-up belt
	L01-8066-15	Power transformer
	N10-2030-46	Nut x 6
	N14-0115-05	Frange nut, transf.
	N14-0404-05	Frange nut, relay
	N15-1030-41	Washer
	N15-1040-41	Washer
	N15-1060-41	Washer
	N30-2604-45	Round screw, see-saw switch
	N30-3006-41	Round screw, terminal plate
	N30-3008-41	Round screw, relay
	N30-3010-45	Round screw, heat sink
	N30-3020-45	Round screw
	N30-4012-41	Round screw, transf. front foot
	N33-3008-45	Flat screw, AC inlet
	N35-3006-45	Bind screw, case, panel, rearpanel
	N35-3014-41	Bind screw, transistor
	N87-3006-41	Self tapping screw
	N87-4012-41	Self tapping, rear foot
	N89-3005-45	Self tapping screw
	X43-1330-00	AVR unit

AVR UNIT (X43-1330-00) PARTS LIST

Ref. No.	Part No.	Description
C1,2	CK45F1H103Z	C 0.01μF +80%,-20%
C3~5	C90-0814-05	E 4700μF 25WV
C6	CK45F1H473Z	C 0.047μF +80%,-20%
C7	CK45F1H103Z	C 0.01μF +80%,-20%
R1	RS14GB3D2R2J	Resistor (Metal film) 22Ω ±5% 2W
R3	R92-0622-05	Resistor (cement) 56Ω 5W
R7,8	R92-0619-05	Resistor (cement) 0.05Ω 5W
R9	RS14GB3F221J	Resistor (Metal film) 220Ω ±5% 3W
Q1		Transistor 2SB512P
Q2	V03-0183-05	Transistor 2SC733 (Y)
D1,2	V11-0270-05	Diode U05B
D3	V11-4167-06	Zener diode XZ-090
D4	V11-0076-05	Diode 1S1555
VR1	R12-0042-05	Trim Pot 500Ω (B)

MB-100 MOBILE MOUNT (OPTION)

OUTSIDE VIEW



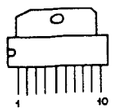
PARTS LIST

Ref. No.	Part No.	Description
	H01-2604-04	Carton case (Inside)
	H12-0450-03	Cushion
	H20-1409-03	Protective cover
	H19-1316-04	Hook
	H21-2633-04	Guide stopper
	H51-0006-15	Snap lock
	H54-0401-14	Stay x 2
	H90-0401-04	Guide stopper (V)
	N09-0008-04	6 mm Hex. screw x 6
	N14-0008-04	6 mm Nut x 6
	N15-1060-46	Flat washer
	N16-0040-46	Lock washer x 2
	N16-0060-46	Lock washer x 6
	N19-0609-04	Nylon washer
	N30-4008-46	Round screw
	N32-3006-46	Flat screw
	N87-3006-46	Self tapping screw x 2
	N88-3006-46	Flat tapping screw x 2
	N99-0304-04	Hex. head screw x 6
	W01-0401-04	Allen key

SEMICONDOCTORS

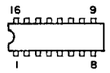
μPC1037H
μPC1158H2

μPC4558C
SN16913P

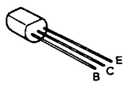


TA7222AP

HD7408P
HD74196P
HD7432P
MC4044P
SN74LS01N
SN74LS12N
SN74LS74AN
SN74LS90N
SN74LS92N
SN74S00N
TA7089P



TC5048P
TC4049BP
HD74145P



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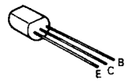
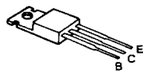
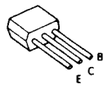


2SA1015(Y),
2SC945(Q),
2SC1775(E)
2SC1923(O),
2SC2347,

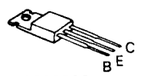


2SC2075,
2SD880(Y)

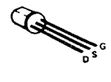


2SA1115(E),
2SC2603(E),
2SC2668(Y),
2SC2669(Y),

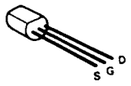
2SC2290*J



2SC2509,



2SK19(GR),

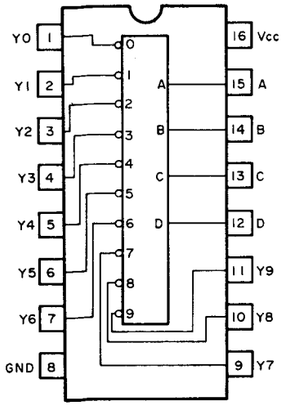


2SK30A(O)

TOP VIEW
3SK74(L,M)

RF (X44-1480-20)

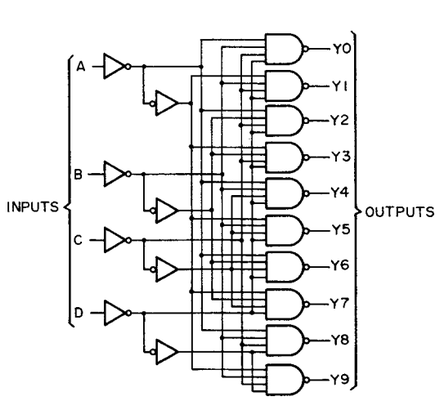
HD74145P (Q7, 8)



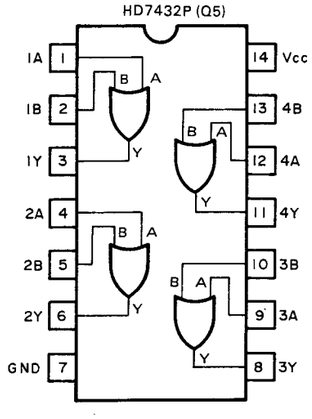
HD74145P (Q7, 8)

	INPUTS				OUTPUTS									
	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L
INVALID	H	L	H	L	H	H	H	H	H	H	H	H	H	H
	H	L	H	H	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H	H	H
	H	H	H	L	H	H	H	H	H	H	H	H	H	H
	H	H	H	H	H	H	H	H	H	H	H	H	H	H

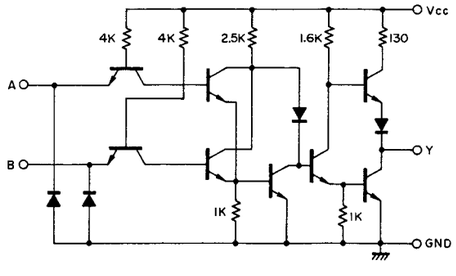
HD74145P



HD7432P (Q5)

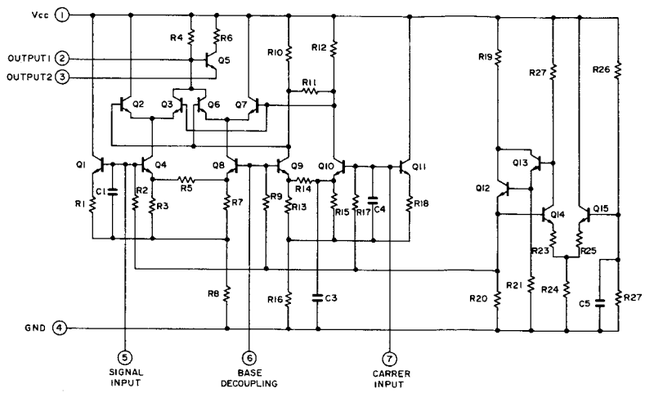


HD7432P (Q5),

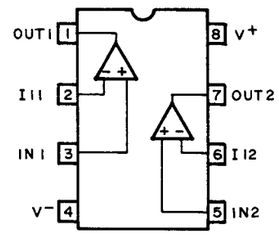


IF (X48-1360-20)

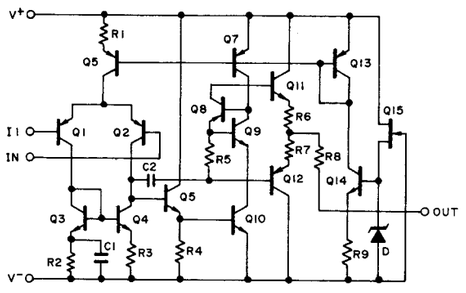
μPC1637H (Q9)



μPC4558C (Q26),

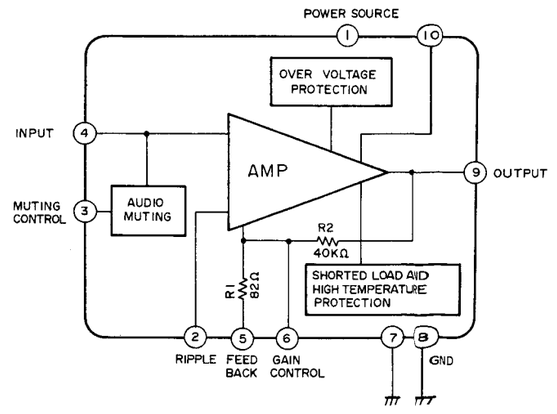


μPC4558C (1/2 circuit)



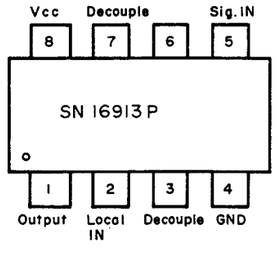
AF-AVR (X49-1160-20)

TA7222AP (Q1)



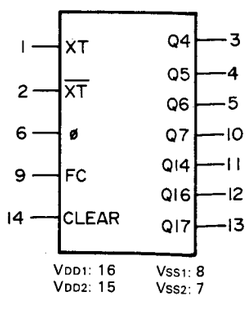
VCO (X50-1800-20)

SN16913P (Q12, 14)

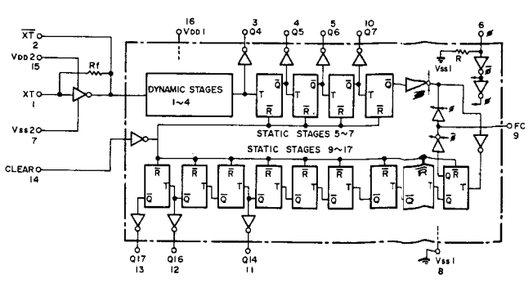


CAR (X50-1810-20)

TC5048P (Q20)



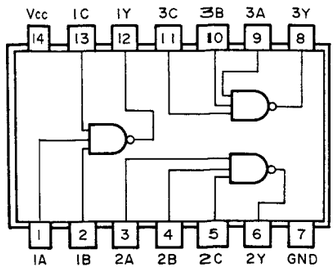
TC5048P (Q20)



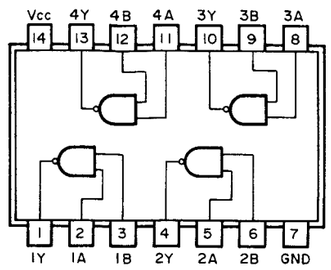
TRC-60

Digital (X54-1660-20)

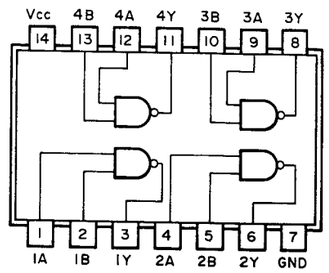
SN74LS12N (Q8),



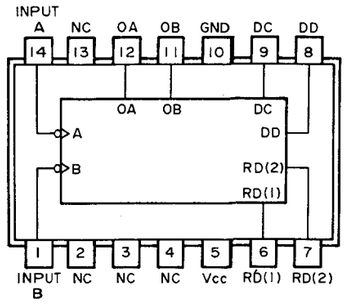
SN74LS01N (Q9),



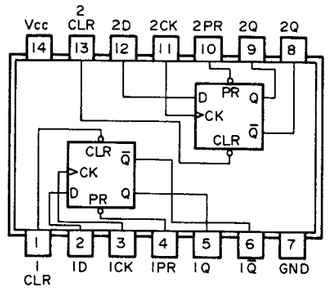
SN74S00N (Q10)



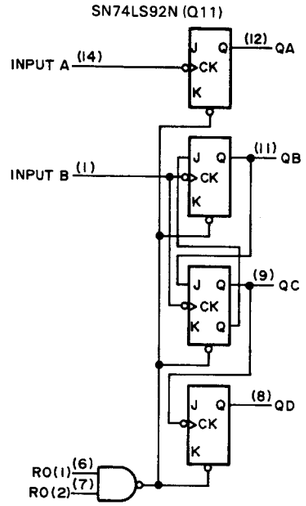
SN74LS92N (Q1 1),



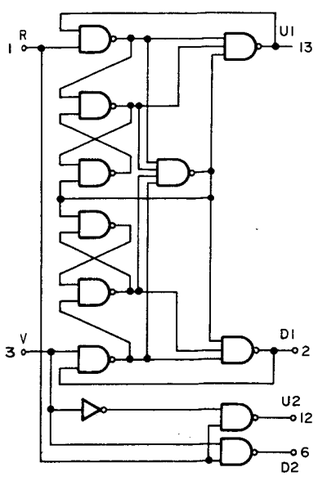
SN74LS74AN (Q14),



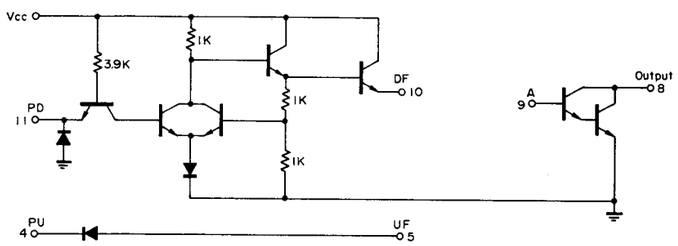
SN74LS92N (Q11)



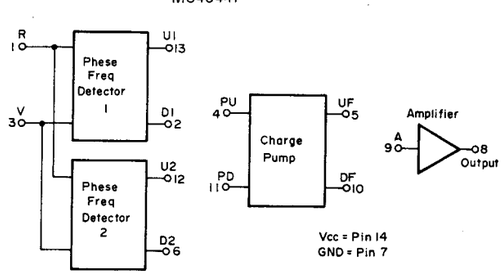
MC4044P (Q13)



MC4044P

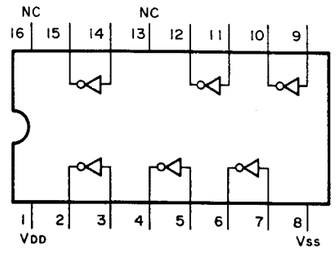


MC4044P

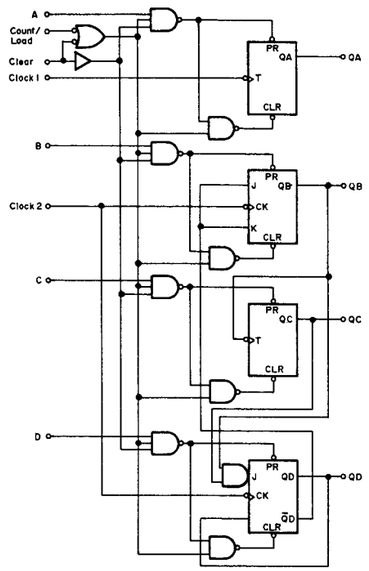


CCO (X53-1250-20)

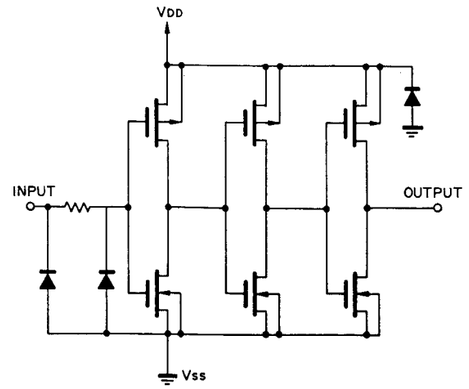
TC-4049BP (Q45),



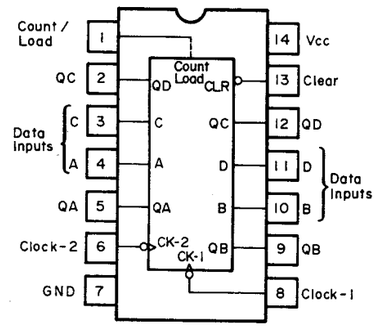
HD74196P (Q43)



TC4049BP (1/6 circuit)



HD74196P

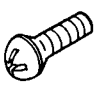


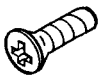
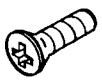
SCREWS

Ref. No.	Parts Name	Part No.	Description
1	Nut	N10-2080-46	EXT. SP
2	Washer	N15-1080-46	EXT. SP
2	Washer	N15-1030-46	Motor housing
3	Nut	N14-0115-05	Grand terminal
3	Flange nut	N14-0404-04	M3, S31C
3	Flange nut	N14-0510-04	
4	Washer	N19-0609-04	MB-100
4	Washer	N19-0628-04	Jumper unit
5	Pan head screw	N30-2604-46	ACC, Motor
5	Pan head screw	N30-3006-46	Carrier unit, oven
5	Pan head screw	N30-3008-46	Rotary Wafer
5	Pan head screw	N30-6008-46	Relay
6	Flat screw	N32-3006-46	Heat sink
6	Flat screw	N32-3008-46	Panel
6	Flat screw	N32-3010-46	Panel, S31C
7	Round flat screw	N33-3008-45	Bracket, glass

Ref. No.	Parts Name	Part No.	Description
8	Bind screw	N35-3006-45	Case
9	Flat tap tight screw	N85-3006-46	Chassis
10	Self tap tight screw	N87-3006-41	Name plate, Foot
10	Self tap tight screw	N87-3006-46	P.C. Board, F cover
10	Self tap tight screw	N87-3008-46	T type terminal, VCO case housing
10	Self tap tight screw	N87-3012-46	Rear panel
10	Self tap tight screw	N87-3014-46	P.C. Board, collar
10	Self tap tight screw	N87-4006-46	Bracket, Unit
11	Flat tap tight screw	N88-3006-46	MB-100
12	Bind tap tight screw	N89-3005-46	Filter, P.C. board
12	Bind tap tight screw	N89-3006-45	Rear panel

Ref No.	Parts Name	Contents of Parts Numbers	Remarks
1	Hexagon nut 	N10-2□□□-4□ Treatment — 6 Chromate Nominal diameter of nut — 080 M8.0 mm	
2	Flat washer 	N15-1□□□-4□ Treatment — 6 Chromate Nominal diameter of washer — 030 M3.0 mm 080 M8.0 mm (Ex.) Flat washer for M3.0 fasteners → N15-1030-46	
3	Flange nut 	N14-0115-05 N14-0404-04 N14-0509-05 N14-0510-04	Requires no washer.
4	Nylon washer 	N19-0609-04 N19-0628-04	

Ref No.	Parts Name	Contents of Parts Numbers	Remarks
5	Pan head machine Screw of cross recessed. 	N30-□□□□-4□ (ISO Standard) Treatment — 6 — Chromate Screw length — 04 — 4 mm 06 — 6 mm 08 — 8 mm Nominal diameter — 26 — M2.6 30 — M3 60 — M6 (Ex.) M3 × 6 mm pan head screw → N30-3006-46	
6	Flat head machine screw of cross recessed. 	N32-□□□□-4□ (ISO Standard) Treatment — 6 — Chromate Screw length — 06 — 6 mm 08 — 8 mm 10 — 10 mm Nominal diameter — 30 — M3 (Ex.) M3 × 8 mm flat head screw → N32-3008-46	
7	Oval countersunk head machine screw of cross recessed. (Oval countersunk head machine screw) 	N33-□□□□-4□ Treatment — 5 — Black cromate Screw length — 08 — 8 mm Nominal diameter — 30 — M3 (Ex.) M3 × 8 mm oval countersunk head machine screw → N33-3008-46	
8	Binding head machine screw of cross recessed. 	N35-□□□□-4□ Treatment — 5 — Black chromate Screw length — 06 — 6 mm Nominal diameter — 30 — M3 (Ex.) M3 × 8 mm black binding head screw → N35-3008-45	

Ref No.	Parts Name	Contents of Parts Numbers	Remarks
9	Second flat head tap tight screw. 	N85-□□□□-4□ Treatment — 6 — Chromate Screw length Nominal diameter — 30 — M3	
10	Second brazier tap tigh screw 	N87-□□□□-4□ Treatment — 1 — Nickel 6 — Chromate Screw length — 06 — 6 mm 08 — 8 mm Nominal diameter — 30 — M3 — 12 — 12 mm 40 — M4 — 14 — 14 mm	
11	Flat tap tight screw 	N88-3006-46	
12	Second binding head tap tight screw. 	N89-□□□□-4□ Treatment — 5 — Black chromate Screw length — 05 — 5 mm 06 — 6 mm Screw diameter — 30 — M3 (Ex.) M3 × 8 mm chromate binding head tap tight screw → N89-3008-46	