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SERVICE MANUAL

**Model TS-120S
VFO-120 SP-120
PS-30 AT-120**

TS-120V

INCLUDES SCHEMATIC ONLY FOR
THIS VERSION OF THE TS-120S



HF SSB TRANSCEIVER

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SPECIFICATIONS/SPECIAL COMPONENTS DATA

Frequency Range:

| | |
|-------------|-------------------------|
| 80 m band | 3.5~4.0 MHz |
| 40 m band | 7.0~7.3 MHz |
| 20 m band | 14.0 ~ 14.35 MHz |
| 15 m band | 21.0 ~ 21.45 MHz |
| 10 m band A | 28.0 ~ 28.5 MHz |
| 10 m band B | 28.5 ~ 29.0 MHz |
| 10 m band C | 29.0 ~ 29.5 MHz |
| 10 m band D | 29.5 ~ 29.7 MHz |
| WWV | 15.0 MHz (receive only) |

Mode: SSB (A3J), CW (A1)

Power Requirements:

| | |
|-----------|---|
| 80 m ~ | |
| 15 m band | 200W PEP for SSB operation 160W DC for CW operation |
| 10 m band | 160W PEP for SSB operation 140W PEP for CW operation |

Antenna Impedance: 50Ω

Carrier Suppression: Carrier better than 40 dB down from the output signal.

Sideband Suppression: Unwanted sideband is better than 50 dB down from the output signal.

Mic. Impedance: 500Ω ~ 50kΩ

Audio Frequency

Response: 400 ~ 2600 Hz (-6 dB)

Harmonic Radiation: Better than 40 dB down from output signal.

Receiver Sensitivity: 0.25μV for S/N 10 dB or better

Image Ratio: Image frequency better than 50 dB down from the output signal.

IF Rejection: IF frequency is .70 dB or more down from the output signal.

Frequency Stability: Within 100 Hz during any 30 minute period after warm up.

Within ±1 kHz during the first hour after 1 minute of warm up.

Selectivity: SSB, CW 2.4 kHz (-6 dB)
4.2 kHz (-60 dB)

AF Output: More than 1.5W (8Ω load, 10% distortion)

AF Load Impedance: 4 ~ 16Ω for both speaker and headphone.

Power Supply: 12 ~ 16V DC (13.8V)

Power Consumption: Less than 18A in transmit (less than 1:5 SWR ratio)

(at DC 13.8V): Less than 0.7A in receive.

Semiconductors and Tube:

| | |
|--------------|-----|
| IC's | 26 |
| FET's | 16 |
| Transistors | 90 |
| Diodes | 142 |
| Display Tube | 1 |

Dimensions: W 241(241) × H 94(108)
× D 235(281) mm
(With Projection)

Weight: Approx. 5.6 kg (12.3 lbs)

NOTE:

The circuit and ratings may change without notice due to development in technology.

SPECIAL COMPONENTS DATA

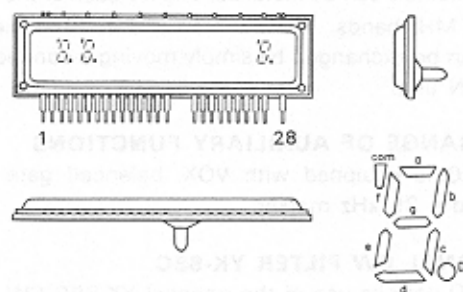
- Application
2SC2290 (HF power amplifier) (V03-2290-06)
NPN Epitaxial planar transistor Si
- Absolute maximum ratings

| Item | Pc | V _{CEO} | V _{CES} | V _{ESD} | I _C | I _E | T _{stg} |
|-------|-----------------------------------|------------------|------------------|------------------|----------------|----------------|------------------|
| Value | 175 (W) (T _C =25°C) | 45 (V) | 45 (V) | 4.0(V) | 20 (A) | -20 (A) | -65~175 (°C) |

- Application
2SC2509 (HF power amplifier) (V03-2509-06)
NPN Epitaxial planar transistor Si
- Absolute maximum ratings

| Item | Pc | V _{CEO} | V _{CES} | V _{ESD} | I _C | I _E | T _{stg} |
|-------|---------------------------------|------------------|------------------|------------------|----------------|----------------|------------------|
| Value | 20(W) (T _C =25°C) | 40(V) | 40(V) | 18(V) | 4(V) | 5(A) | -55~150(°C) |

- Indicating tube 9-BT-12 (V40-7760-86)



| PIN NO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|------------|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|
| CONNECTION | F | Nc | Gq | Nc | Nc | Gg | q | f | Gr | e | d | Gc | Nc | Nc |
| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | Gs | Np | Np | G4 | Dp | G3 | c | b | G2 | a | com | Gr | Np | F |

FEATURES/GENERAL INFORMATION/YK-88C

FEATURES

1. SINGLE CONVERSION SYSTEM USING PLL CIRCUITRY

The single conversion system, with a unique PLL Phase Locked Loop circuit, FET balanced mixers and MOS FET'S assures excellent spurious and intermodulation characteristics.

2. BUILT-IN DIGITAL DISPLAY

The digital display affords easy reading of operating frequency to an accuracy of 100 Hz, on any band and any mode.

3. BUILT-IN SHIFT CIRCUIT (Passband Tuning)

An IF SHIFT system is built in to the transceiver to allow shifting of the IF passband, thereby eliminating adjacent channel interference.

4. 3.5~29.7 MHz AND WWV BANDS

The transceiver is designed to operate on LSB/USB/CW in the 3.5~29.7 MHz bands. WWV (14.5~15 MHz) is also built in to the transceiver to permit accurate frequency calibration.

5. COMPACT, LIGHT-WEIGHT DESIGN

The TS-120 has many advanced features, yet it is compact and light-weight and suitable for mobile and field operation as well as fixed station operation.

6. EASY OPERATION

All controls and switches are carefully arranged for ease of operation, ensuring convenience and versatility.

7. ALL SOLID-STATE DESIGN

The all solid-state, compact unit features a wide band final stage, eliminating the need for peaking controls.

8. FOUR FIXED CHANNELS

Four FIX channels can be installed, one for each of the 7, 14, 21 and 28 MHz bands. The 3.5 MHz and 28 MHz fixed xtal position can be exchanged by simply moving a connector on the AF-GEN unit.

9. FULL RANGE OF AUXILIARY FUNCTIONS

The TS-120 is equipped with VOX, balanced gate noise blanker and a 25 kHz marker.

10. OPTIONAL CW FILTER YK-88C

The TS-120 permits use of the optional YK-88C CW filter. CW semi-break-in operation is provided using the built-in VOX and CW side tone circuits.

11. WIDE VARIETY OF OPTIONAL ACCESSORIES

The following optional accessories are available: Regulated Power Supply (PS-30), Mobile Mount (MB-100), CW Filter (YK-88C), External VFO (VFO-120), External Speaker (SP-120), and antenna tuner AT-120.

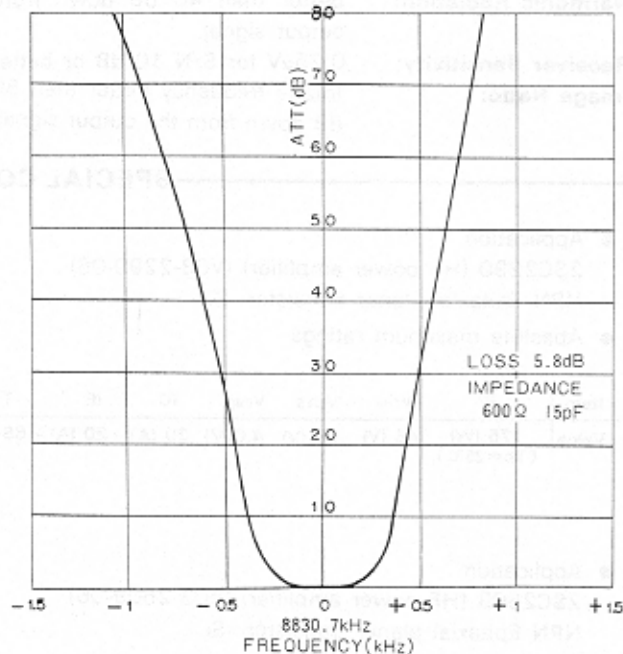
GENERAL INFORMATION

Page 49 shows a block diagram of the TS-120 HF Amateur transceiver. It employs a single-conversion system with PLL circuitry. The IF is 8.83 MHz.

The TS-120 features a number of unique circuits and overall high performance. It is designed so the PLL lock frequency of each band, the CAL marker signal, and the counter clock circuit use a single reference frequency crystal instead of individual crystals as found in the TS-820 series transceiver. Circuits include IF SHIFT, VOX (with semi-break-in CW), side tone, noise blanker (NB), and crystal calibrator (CAL) for convenient and versatile transceiver operation.

YK-88C SPECIFICATIONS

| | |
|-----------------------------|---|
| Center frequency: | 8830.7 kHz |
| Center frequency deviation: | Less than ± 150 Hz (6 dB) |
| Passband width: | 500 Hz -6 dB |
| Attenuation band width: | 1.5 kHz (-60 dB) |
| Ripple: | Less than 2 dB |
| Minimum loss: | 6 dB ± 2 dB |
| Guaranteed attenuation: | Less than ± 2 kHz $\sim \pm 1$ MHz More than 80 dB |
| Terminal impedance: | 600 Ω $\pm 5\%$, 15pF $\pm 5\%$ |



YK-88C filter attenuation characteristic

CIRCUIT DESCRIPTION

RECEIVING CIRCUIT

The signal from the antenna is fed to the 8.83 MHz IF trap circuit. This signal is stepped up about 10 dB and impedance-converted by a wide-band transformer before it is applied to the bandpass filter (BPF). The BPF is common to transmission and reception, eliminates the need for a preselector, and makes the RF section compact in design. The signal from the BPF is fed to the dual-gate MOS FET wideband RF amplifiers consisting of a 3SK74 (Q1) and a 2SC1815 (Q2), where the 2 MHz to 35 MHz signal is amplified about 20 dB.

The RF amplifier output passes through a wide-band transformer to the input balanced transformer of the balanced mixer (two 3SK74s, Q3 and Q4), where it is mixed with the VCO output from the PLL and converted to the 8.83 MHz IF. This signal is applied to the IF unit, through the ceramic filters, NB gate circuit and the crystal filter. The NB circuit is controlled by the NB switch on the front panel.

The signal, passing through the crystal filter, is amplified about 90 dB by the three-stage 3SK74 MOS FET IF amplifier (Q1, Q2, and Q3) and is demodulated into audio by the four-diode ring detector.

From the final IF stage, the signal also passes through a buffer amplifier and is fed to the AGC circuit where it is detected and amplified. Receiver gain is controlled by this AGC voltage applied to the second gates of the RF and IF amplifiers, with the time constant determined by R38 (2.2M Ω) and C40 (1 μ F). Input levels of 2 dB and 34 dB are indicated as S1 and S9 on the S-meter. The AF signal is amplified by Q1, a 2SC2240 (GR), gain controlled, and further amplified by an HA1366W (Q7), the power-amplifier IC, to drive the speaker. This signal, which is transistor-coupled with Q14, a 2SC1815(Y), and Q15, a 2SA1015(Y), is sampled for ANTI-VOX control, so the VOX circuit is not tripped by the speaker output. This new system is a departure from the conventional transformer-coupled sampling systems.

TRANSMITTING CIRCUIT

The microphone signal is amplified by transistors Q18, a 2SC2240(GR), Q10, and Q11, each a 2SC1815(Y), and is fed to the four-diode balanced modulator (BM) circuit. Microphone impedance is 500 Ω to 50k Ω .

The 8.83 MHz DSB signal from the BM is amplified about 10 dB by Q12, a 2SK19 FET, and is fed to the IF unit where the unwanted sideband is removed by the crystal filter to produce an SSB signal. The gate of Q12 is also controlled by the protection voltage which is developed when the transmitter output looks into an incorrect load, continuously reducing output power. The SSB signal from the crystal filter is amplified about 30 dB by the 3SK74 IF amplifier (Q1), and is fed to the transmit 3SK74 MOS FET balanced mixer (Q5 and Q6), where it is mixed with the VCO output and converted to the final transmit frequency.

Unwanted spurious components are eliminated by the transmit/receive BPF circuit, and the signal is wideband-amplified by Q7, Q8 (2SC1815), and Q9 (2SC2086).

In the final unit, the signal is amplified by the 2SC2075 driver (Q1), and by the 2SC2509 push-pull power amplifiers (Q2 and Q3). Then the signal is amplified by the 2SC2290 push-pull power amplifiers (Q4, 5). The signal then passes through an RF filter and is fed to the antenna.

Antenna output is toroid-sampled to detect the forward and reflected power. The forward power is used for ALC and the reflected power for protection. Forward power is fed to the second gate of the 3SK74 transmit/receive IF amplifier (Q1), with a time constant determined by R4 (1.5 M Ω) and C25 (0.47 μ F). For CW operation, block bias keying controls the base circuit of the 2SA1015 switching transistor (Q10) in the RF circuit. Q10 controls the first and second gate voltages of the transmit mixer (Q5 and Q6) and the base voltage of the predriver (Q9).



FUNCTIONAL DESCRIPTION

TS-120S FREQUENCY SYSTEM

The TS-120S employs single conversion with a unique PLL circuit, as shown in Fig. 1.

The frequency system is basically that of the TS-820 with the exception of the PLL circuit.

PLL CIRCUIT

VCO output is obtained by synthesizing the 10 MHz and 500 kHz reference, from the counter, and the VFO and CAR instead of a separate HET crystal circuit for each band the TS-120 uses the counter reference oscillator, and a programmable divider circuit contained in the PLL. This simplifies circuit design and eliminates changes in transmit/receive frequency due to HET crystal frequency differences. Fig. 2 shows PLL circuit construction and Table 1 shows the frequency in each circuit.

Referring to Fig. 1, MIX (3) combines CAR and VFO signals and is operated straight through to mixer (1) on 3.5 and 7 MHz. MIX (2) operates at 14 MHz and above with the output of MIX (3) to provide mixer (1) input, as shown in

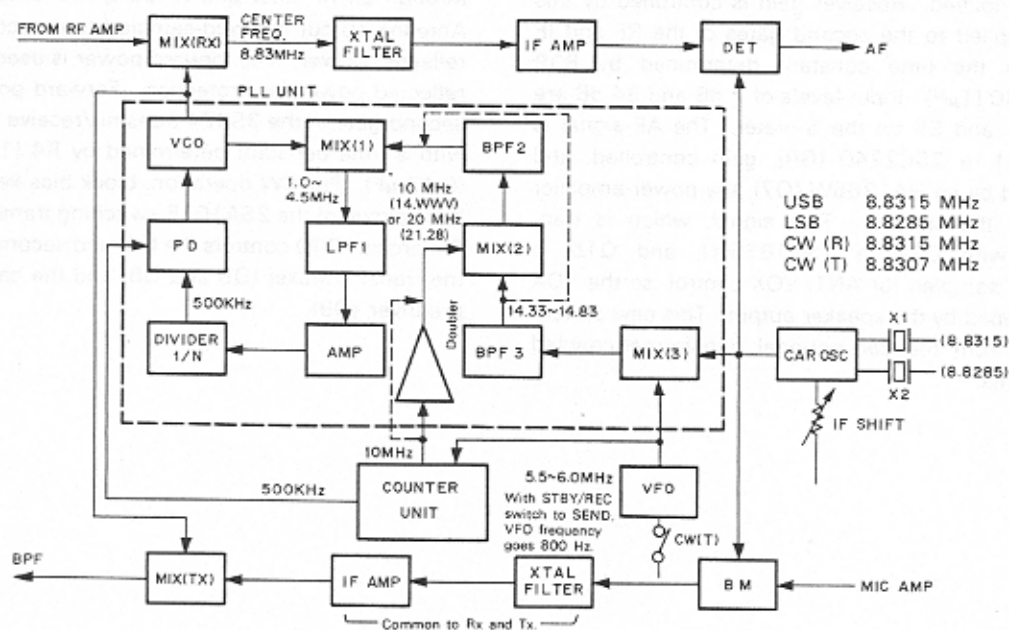
Table 1. MIX (1) output is filtered, amplified, shaped and divided by the programmable divider to obtain 500 kHz output.

The programmable divider converts the information from the band switch into a BCD signal in the counter. By presetting, the signal is divided at the ratio shown in Table 1. The phase comparator is a Motorola MC4044P. The loop filter amplifier, component transistors, minimizes unwanted spurious signal. If output of the phase comparator unlocks for any reason, VCO output is switched off to prevent out of band emission and, simultaneously the digital display blanks.

CAR OSCILLATOR

The CAR oscillator contains one oscillator and two crystals for LSB, USB, and CW operation. The oscillator frequency in each mode is listed in Fig. 1.

Oscillator frequency can be varied by the IF SHIFT control during reception.



| | |
|--------|------------|
| USB | 8.8315 MHz |
| LSB | 8.8285 MHz |
| CW (R) | 8.8315 MHz |
| CW (T) | 8.8307 MHz |

Fig. 1 TS-120 Frequency configuration

FUNCTIONAL DESCRIPTION

| Band | RX, TX Frequency | VCO | MIX(1) Input | MIX(1) Output | Divider | D | C | B | A |
|------|------------------|-----------------|-----------------|---------------|---------|---|---|---|---|
| WWV | 14.5 ~15.0 | 23.33 ~23.83 | 24.33 ~24.83 | 1.0 | 1/2 | 1 | 1 | 1 | 0 |
| 3.5 | 3.5 ~4.0 | 12.33 ~12.83 | 14.33 ~14.83 | 2.0 | 1/4 | 1 | 1 | 0 | 0 |
| 7 | 7.0 ~7.5 | 15.83 ~16.33 | 14.33 ~14.83 | 1.5 | 1/3 | 1 | 1 | 0 | 1 |
| 14 | 14.0 ~14.5 | 22.83 ~23.33 | 24.33 ~24.83 | 1.5 | 1/3 | 1 | 1 | 0 | 1 |
| 21 | 21.0 ~21.5 | 29.83 ~30.33 | 34.33 ~34.83 | 4.5 | 1/9 | 0 | 1 | 1 | 1 |
| 28 | 28.0 ~28.5 | 36.83 ~37.33 | 34.33 ~34.83 | 2.5 | 1/5 | 1 | 0 | 1 | 1 |
| 28.5 | 28.5 ~29.0 | 37.33 ~37.83 | 34.33 ~34.83 | 3.0 | 1/6 | 1 | 0 | 1 | 0 |
| 29 | 29.0 ~29.5 | 37.83 ~38.33 | 34.33 ~34.83 | 3.5 | 1/7 | 1 | 0 | 0 | 1 |
| 29.5 | 29.5 ~30.0 | 38.33 ~38.83 | 34.33 ~34.83 | 4.0 | 1/8 | 1 | 0 | 0 | 0 |

Table 1 The frequency chart

VFO OSCILLATOR

The TS-120 VFO oscillator has been developed on the basis of the TS-820 and TS-520 VFO. It is physically smaller, and its operating frequency has been raised to cover 5.5 to 6.0 MHz.

During CW operation, transmit frequency is shifted approx. 800 Hz above the receive frequency. CW shift is also digitally displayed.

The main tuning dial covers 25 kHz per revolution and is calibrated at 1 kHz intervals. A 10 kHz subscale is also provided. The operating frequency can be read easily from either the analog or digital display.

DIGITAL COUNTER

The TS-120 digital counter employs a VFO frequency counting system as shown in Fig. 3.

The VFO frequency is mixed with a 5 MHz signal obtained from the reference oscillator chain by a 3SK73 (Q7) and is converted to a 1 MHz signal. This signal passes through the LPF, is amplified, buffered and shaped into a square wave, passes through the 0.1 second gate circuit and is applied to the four-digit counter. The signal is counted from 10 Hz to 100 kHz and fed to the preset counter deriving the carrier output.

The 100 kHz order digit presets "5" or "0" to display the operating frequency.

The 1 MHz and 10 MHz order digits are composed by diode matrix operating on bandswitch information.

The counter outputs are switched by the multiplexer and are converted from BCD to seven-segment information by the decoder to light the fluorescent display tube.

The 10 MHz signal from the time-base reference oscillator is divided to produce gate, latch, and reset pulses which are fed to the counter. The 10 MHz and 500 kHz signals are fed to the PLL circuit.

The marker circuit produces a 100 kHz signal which synchronizes the 25 kHz multivibrator to obtain a marker signal as accurate as the reference frequency. The analog dial can be accurately calibrated to the marker signal.

The 1/10 division at the first-stage count-down chain uses low-power Schottky TTL, while the remaining divisions are made by a CMOS IC for low power consumption and minimum spurious emission.

Because of the IF SHIFT circuit, the CAR frequency is independent of the transmit/receive frequency. Once the VFO

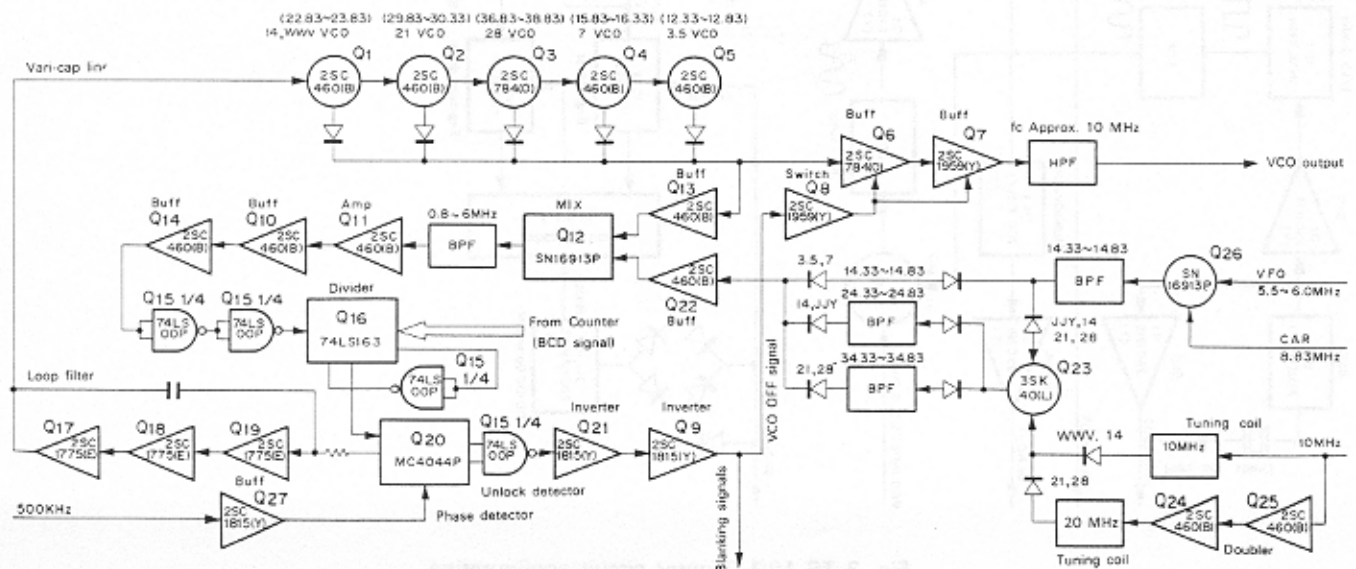


Fig. 2 TS-120 PLL circuit configuration

FUNCTIONAL DESCRIPTION

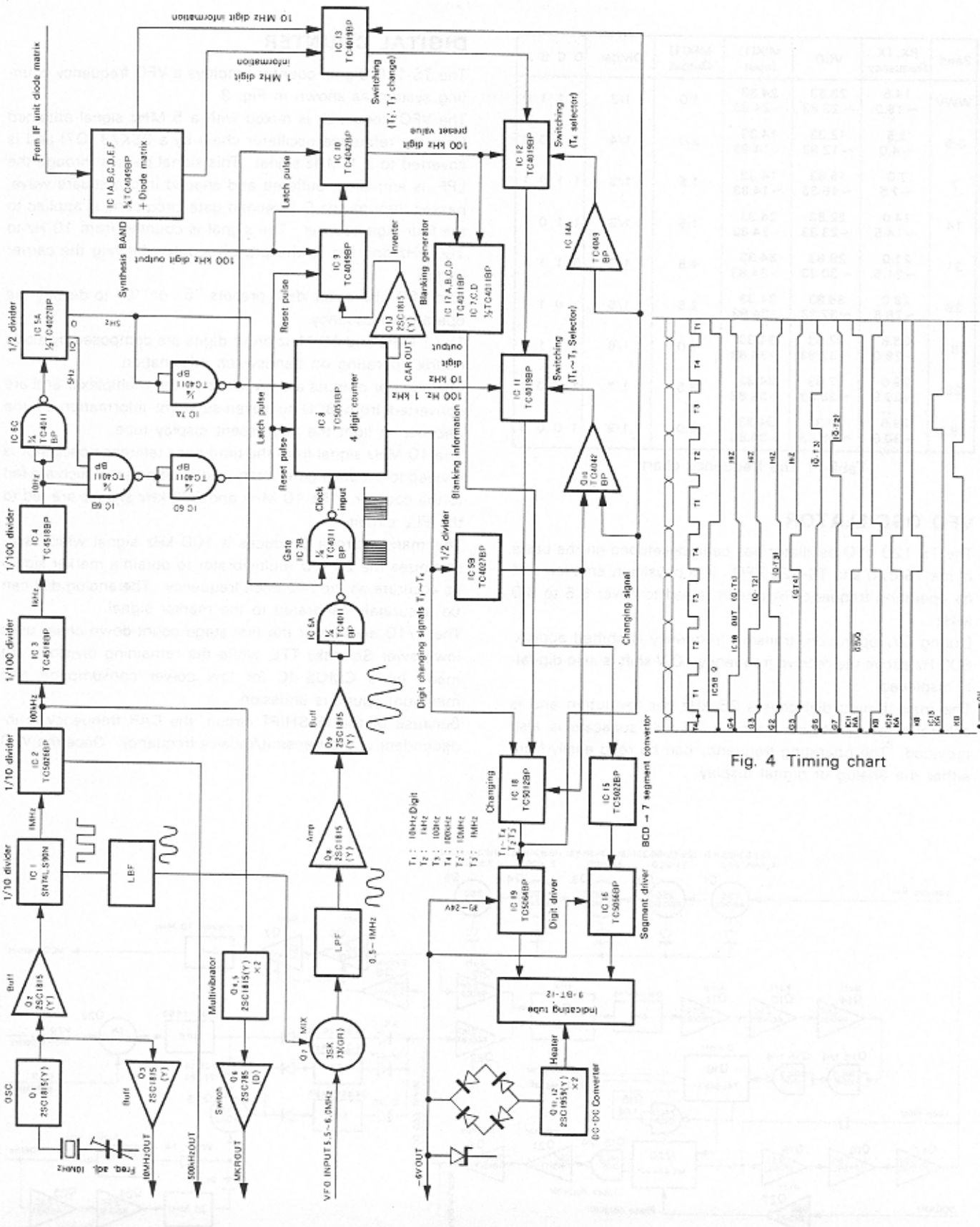


Fig. 4 Timing chart

Fig. 3 TS-120 Counter circuit configuration

FUNCTIONAL DESCRIPTION

frequency is counted, the operating frequency is indicated as accurately as the 10 MHz reference oscillator frequency is calibrated to WWV. Operating frequency is indicated accurate to the 100 Hz order, regardless of the band or mode. If the VFO output varies (beyond the band edge the 1 and 10 MHz digits disappear and a blanking signal is developed.

| Operating band | Blanking frequencies |
|----------------|------------------------|
| 3.5 MHz | more than 4,000.0 MHz |
| 7.0 MHz | less than 7,000.0 MHz |
| 14.0 MHz | less than 14,000.0 MHz |
| 21.0 MHz | less than 21,000.0 MHz |
| 28.0 MHz | less than 28,000.0 MHz |
| 28.5 MHz | more than 29,000.0 MHz |
| 29.0 MHz | less than 29,000.0 MHz |
| 29.5 MHz | more than 30,000.0 MHz |

PROTECTION CIRCUIT

Fig. 5 shows the TS-120 protection circuit. When the transmit output load varies, the toroid in the final circuit samples reflected power. It is then rectified and amplified, producing a protection voltage to control the 2SK19 (Q12) on the AF-GEN unit, so transmitter output is continuously reduced.

FILTER UNIT

1. ALC: Protection circuit (VSWR)

The protection voltage picked up by L18 in the filter unit is amplified by Q1 (2SC1815), then applied to the ALC line to control the output voltage.

The ALC voltage is amplified by Q3 (2SC1815). For the 28 MHz band, the output power is lowered to 50W by applying BAND information to the B terminal so that Q2 controls the emitter voltage of Q3. For mobile operation, the power output is lowered to 50W in all bands by grounding the PO terminal of the filter unit so that the power down circuit for 28 MHz band is operated.

2. Fan drive circuit

The output of the thermistor detecting the temperature of the final unit is applied to Q6 (2SA562) via Q7 and Q8, so that Q6 is switched to operate the fan. The fan starts to rotate at about 45°C although the operating range shown in specification is 30~60°C. It stops when the temperature drops to a level 5~15°C lower the start temperature. This circuit operates regardless of transmission or reception because it detects the temperature of the heat sink.

3. AVR circuit

The 11V AVR consists of Q4, Q5 and Q6. The regulated voltage is supplied to every unit except for the fan drive circuit during transmission. The fan drive circuit is always supplied with the regulated voltage regardless of transmission or reception.

4. Filter circuit

The filter is a 2-stage constant K filter (3-stage for 3.5 MHz band).

FINAL UNIT

1. Temperature protection

- Core temperature protection operates when the output transformer temperature exceeds 120°C.
 - Operates when the heat sink temperature exceeds 90°C because of some defect.
- When either of the above protection systems operate, the RL circuit in the AF GEN unit is turned OFF and the unit is forcibly placed in the reception mode and transmission is inhibited. The protection circuit automatically recovers when the temperature drops to the normal level (i.e., the temperature drops by about 40°C).

2. Temperature detection by the fan drive circuit

The heat sink temperature is detected by the thermistor TH3 to control fan operation.

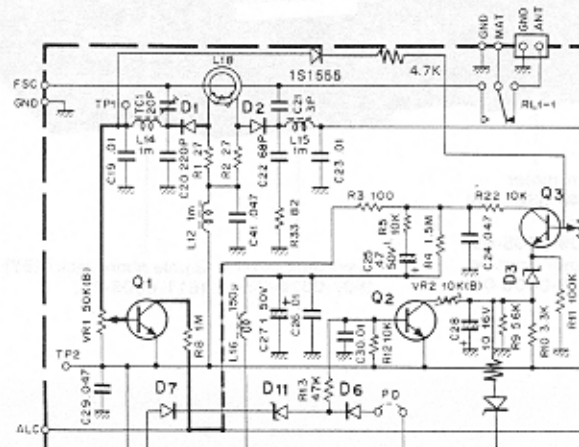
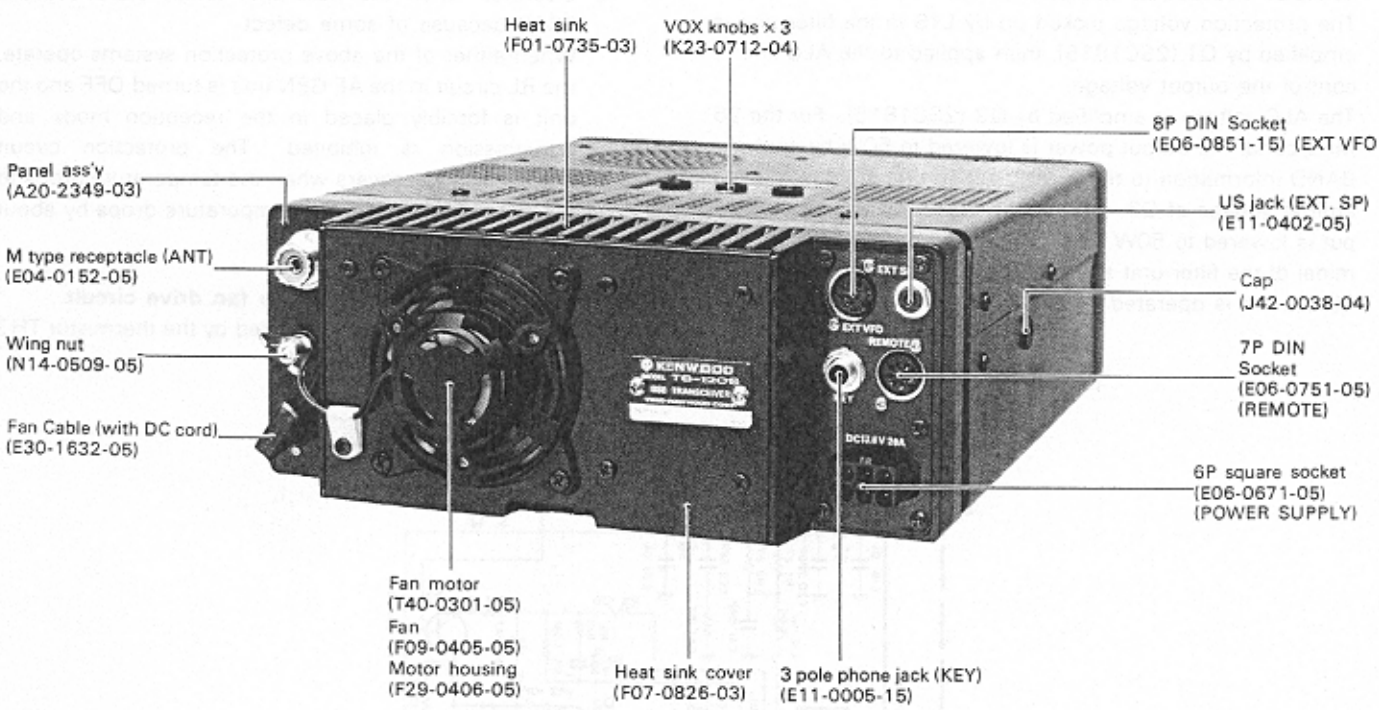
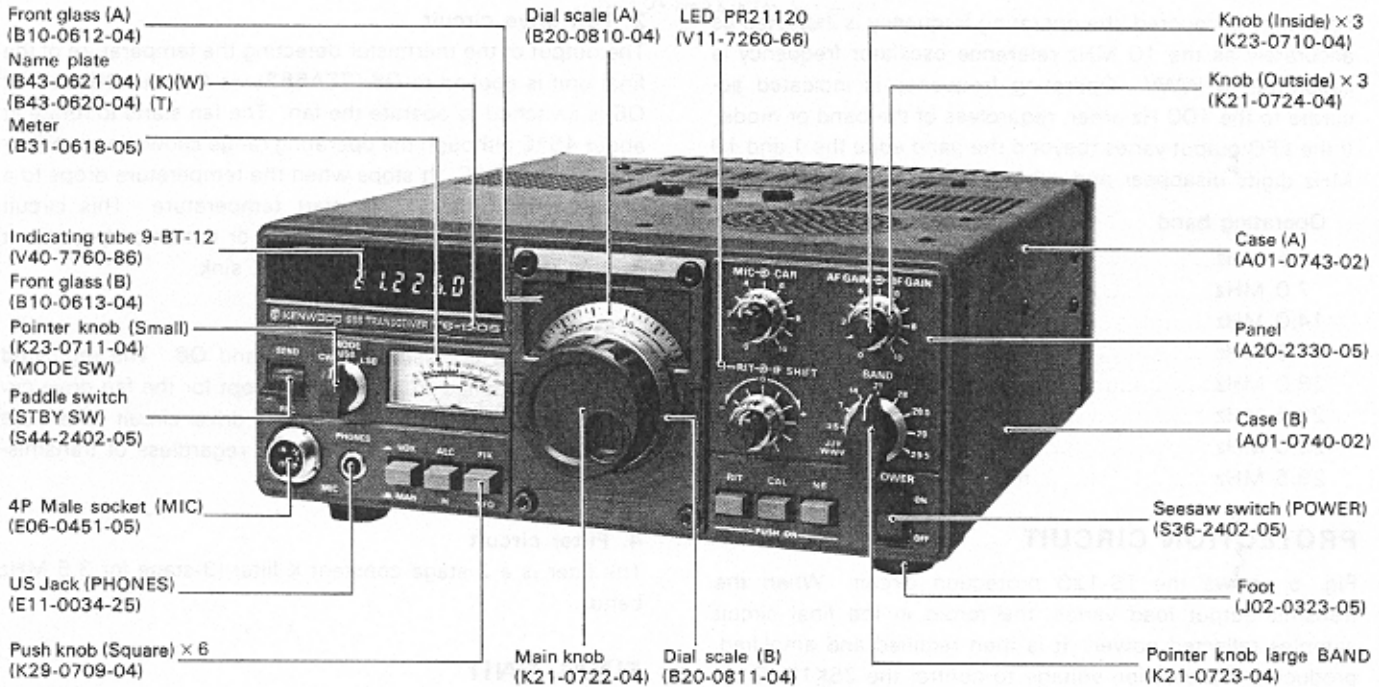


Fig. 5 TS120 Protection circuit

OUTSIDE VIEWS

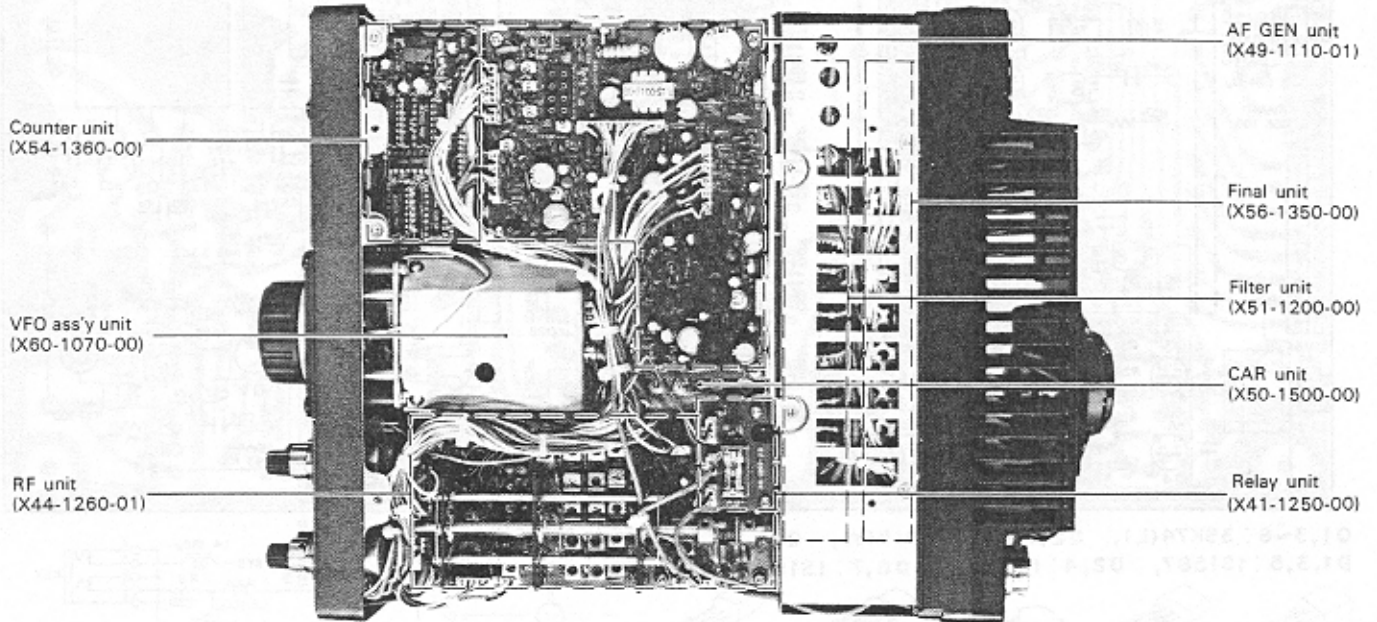
FUNCTIONAL DESCRIPTION



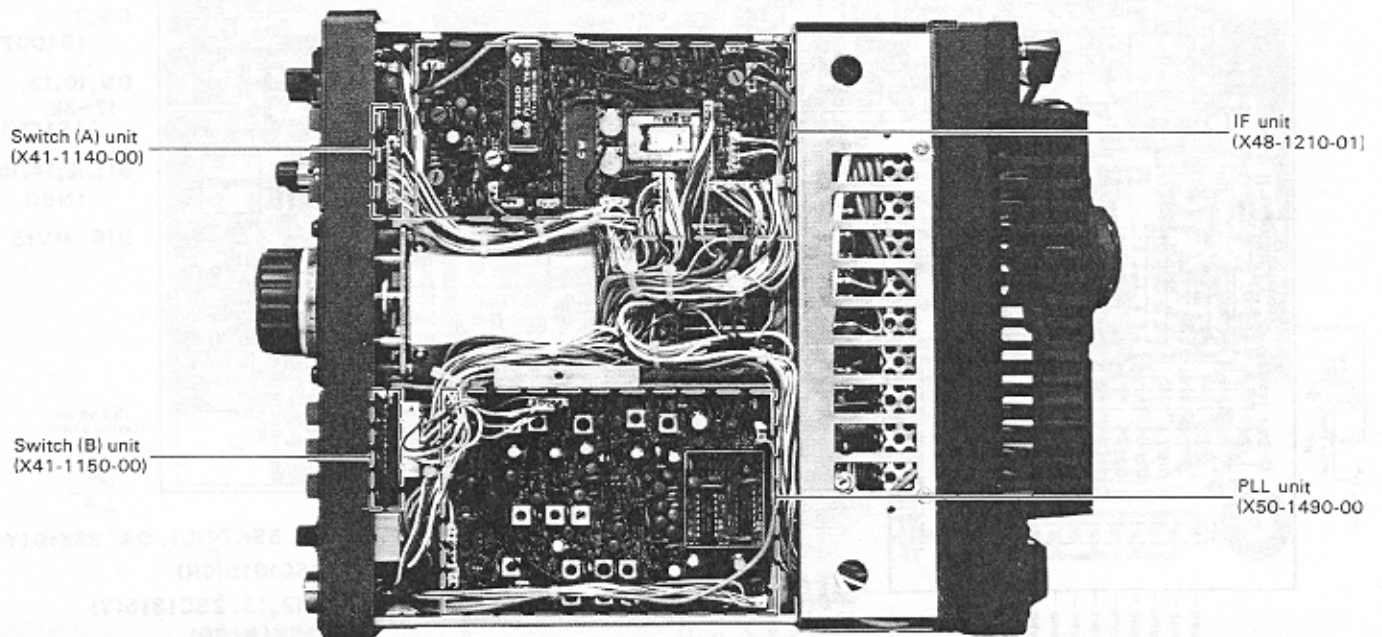
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INSIDE VIEWS

TOP VIEW

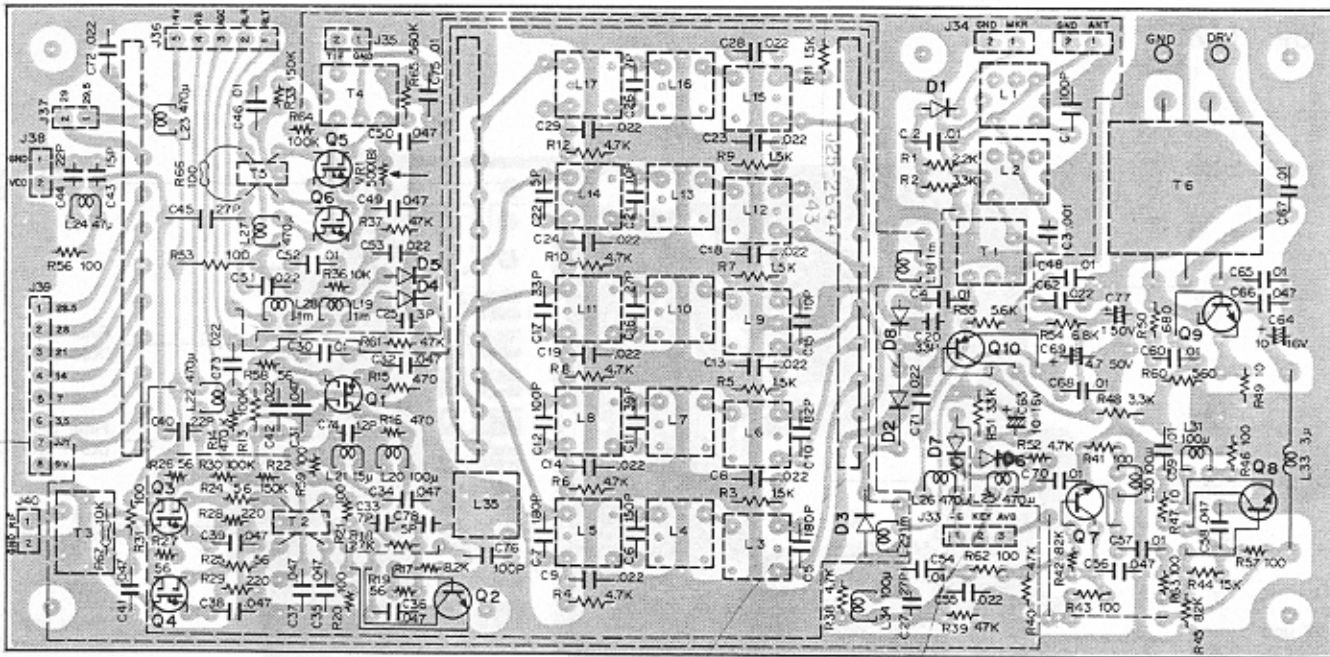


BOTTOM VIEW



PC BOARD VIEWS

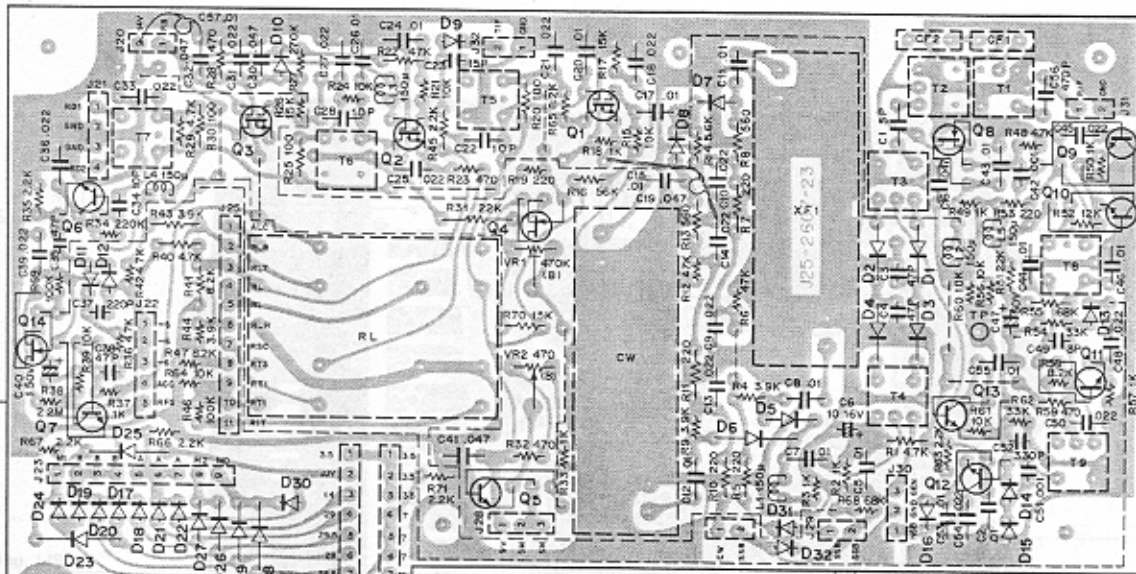
▼ RF UNIT (X44-1260-01)



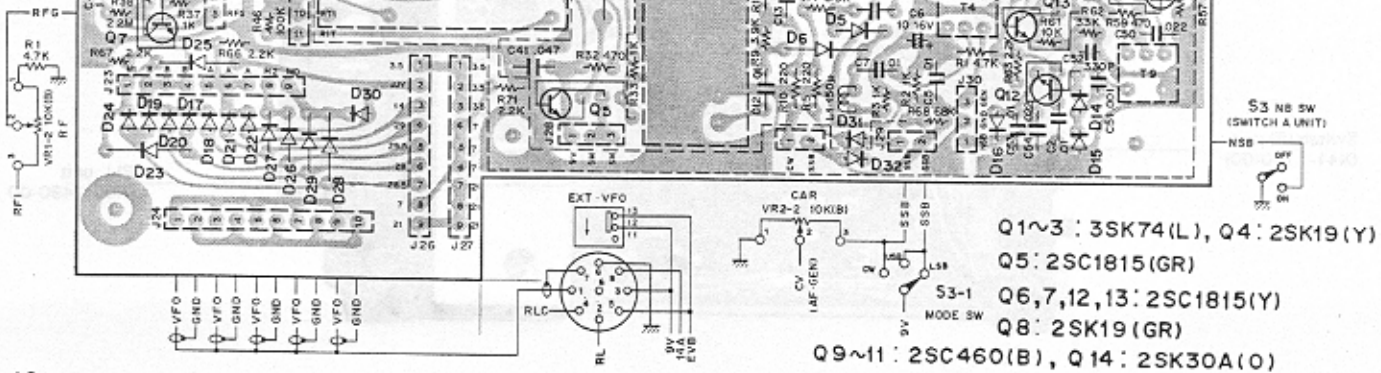
Q1,3~6: 3SK74(L), Q2,7,8: 2SC1815(Y), Q9: 2SC2086, Q10: 2SA1015(Y)
 D1,3,5: 1S1587, D2,4: 1S2588, D6,7: 1S1555



▼ IF UNIT (X48-1210-01)

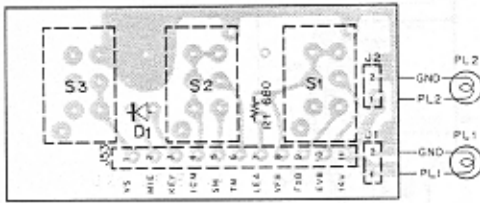


D1~4,6,8 : 1S1587
 D5,7 : 1S1007
 D9,10,13,17~32 : 1S1555
 D11,12,14,15 : 1N60
 D16: MV13

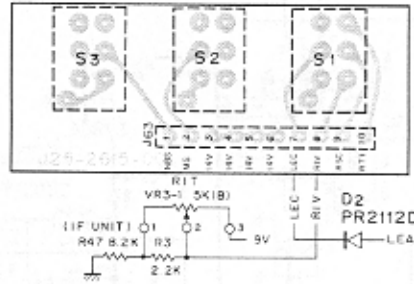


PC BOARD VIEWS

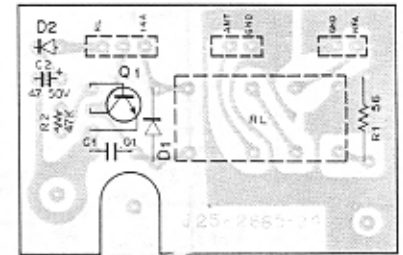
▼ SWITCH (B) UNIT (X41-1150-00)



▼ SWITCH (A) UNIT (X41-1140-00)

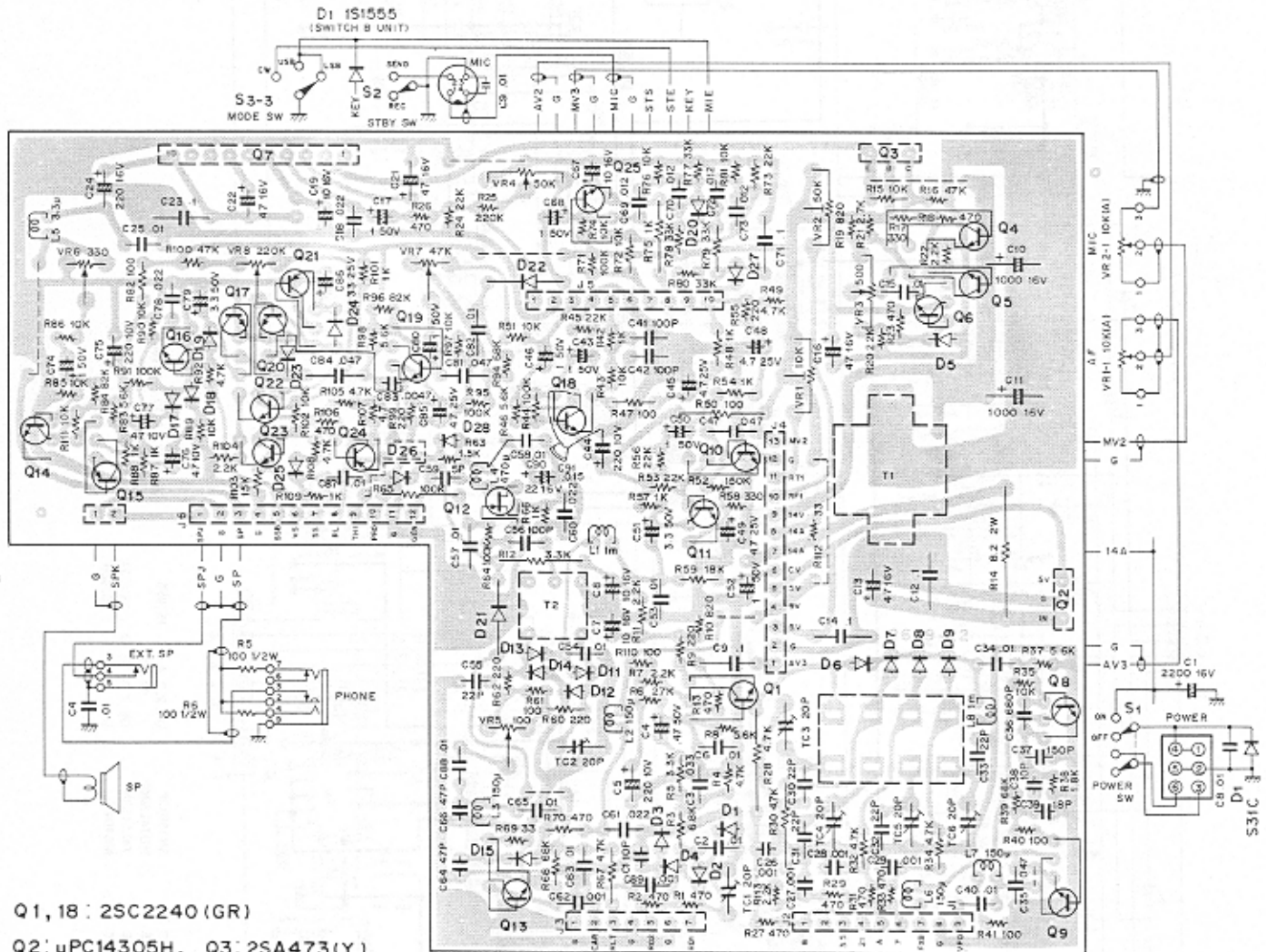


RELAY UNIT (X41-1250-00)



Q1: 2SC1959(Y) D1,2: 1S1555

▼ AF, GEN UNIT (X49-1110-00)



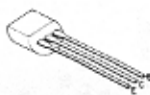
Q1, 18 : 2SC2240 (GR)

Q2: μ PC14305H, Q3: 2SA473(Y)

Q4~6, 10, 11, 14, 16, 17, 19, 20, 23, 25 : 2SC1815(Y), Q7: HA1366W, Q8, 13: 2SC460(B), Q9 : 2SC1959(Y)

Q12 : 2SK19(GR), Q15, 21 : 2SA1015 (Y), Q22 : 2SC1815 (GR), Q24 : 2SA562(Y)

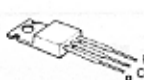
D1~4, 11~14, 23, 24, 26 : 1N60, D5 : WZ-061, D6~9 : 1S2588, D15 : 1S1587, D17~22, 25, 27, 28 : 1S1555



2SA1015(Y) 2SC1959(Y)
2SC1815 (Y) 2SC2240(GR)
2SC1815 (GR)



2SK19(GR)



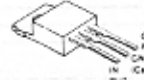
2SA473(Y)



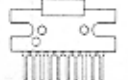
2SA562(Y)



2SC460 (B)



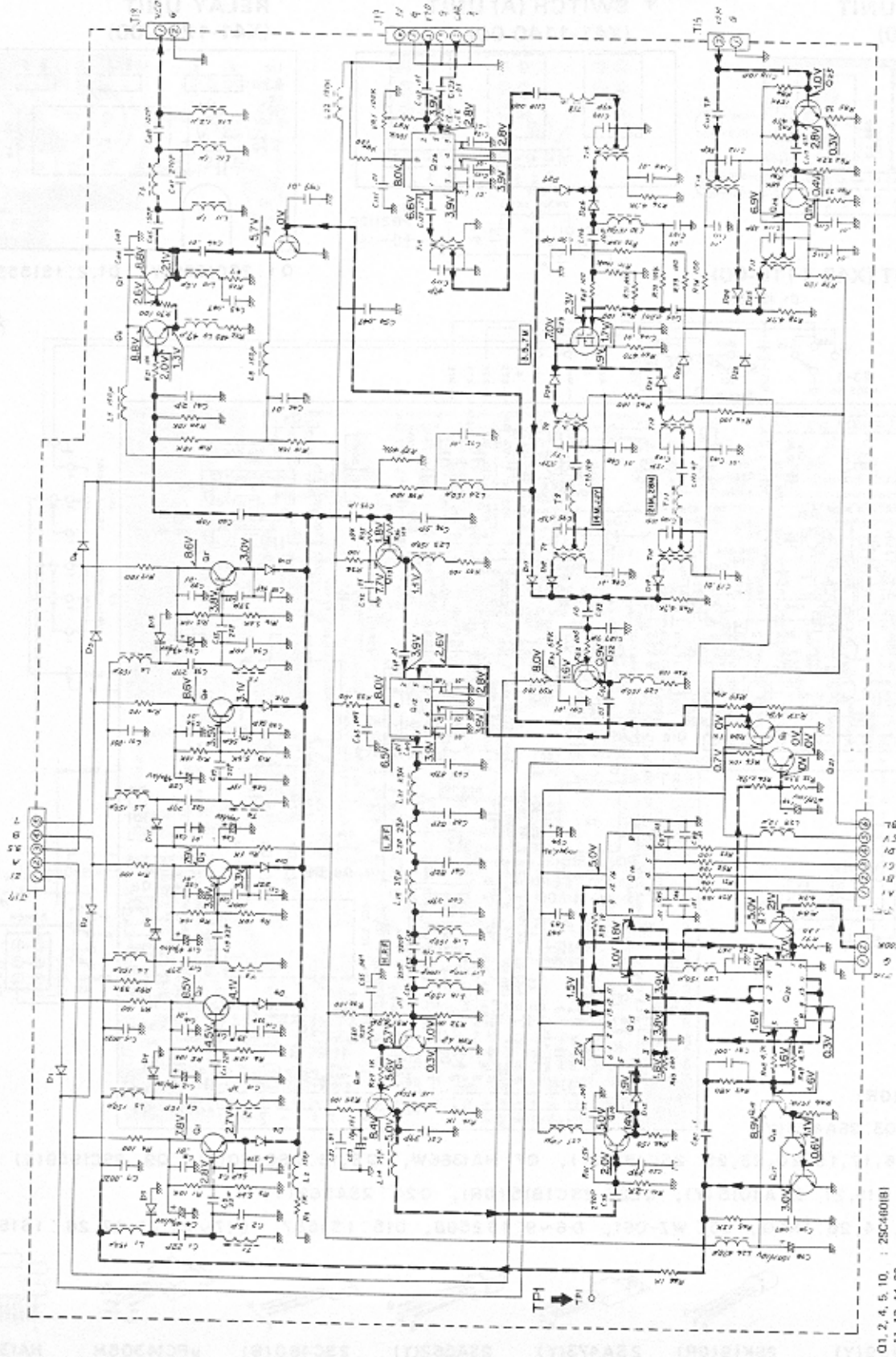
μ PC14305H



HA1366W

CIRCUIT DIAGRAM

▼ PLL UNIT (X50-1490-00)



06, 8, 12, 14, 17, 18, 19, 20, 21, 24, 25, 26, 27, 15

D1, 2, 3, 4, 22, 23
D5, 7, 9, 11, 13
D10

5A16913P
HD74LS00P
74LS163N
MC404P

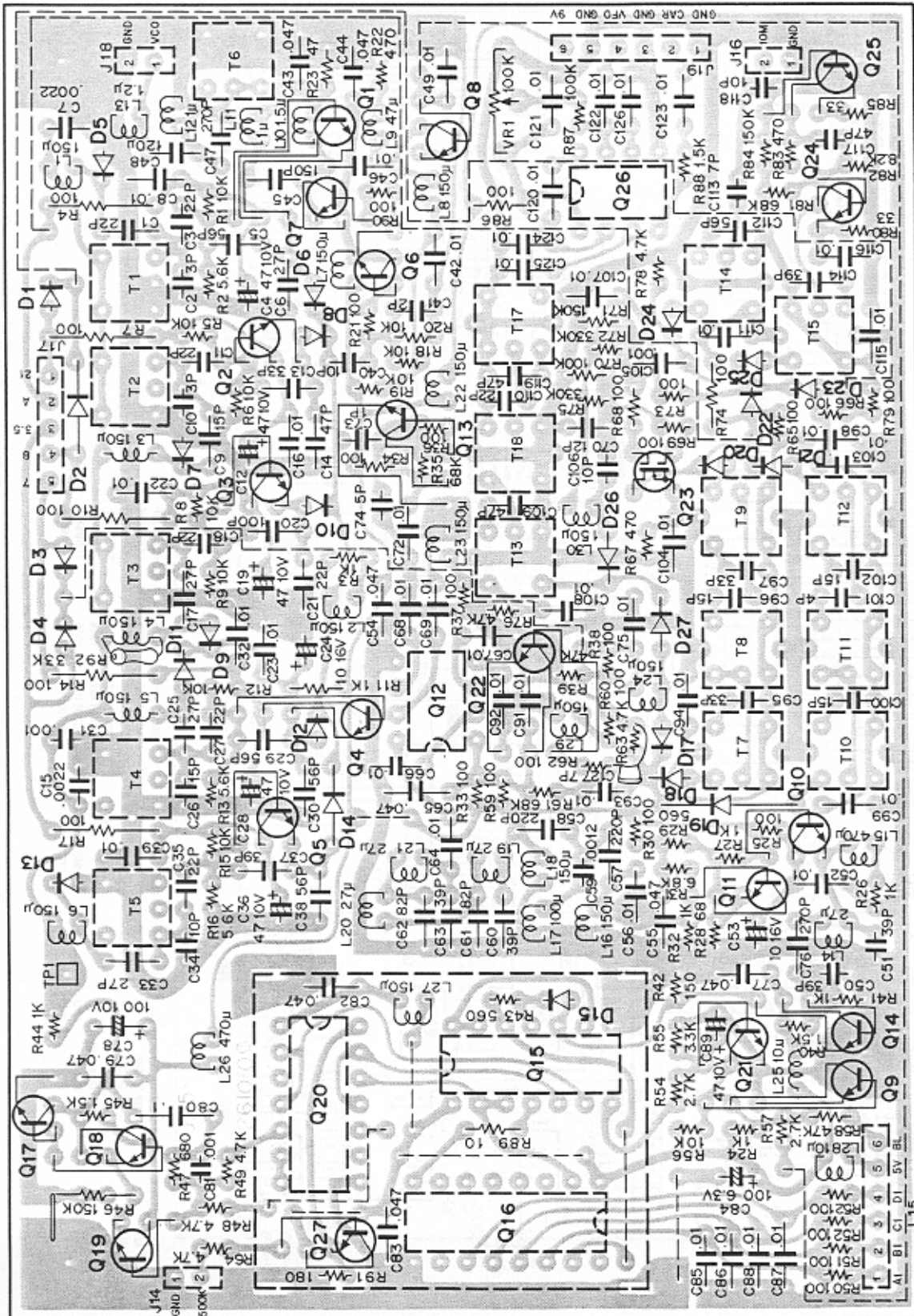
Q12, 26
Q15
Q16
Q20

25C4001B1
25C19591Y1
25C18151Y1
25C1775(E)
35K40(L)
25C78(A)(O)

Q1, 2, 4, 5, 10, 11, 13, 14, 22, 24, 25
Q7, 8
Q9, 21, 27
Q17, 18, 19
Q23
Q3, 6

PC BOARD VIEWS

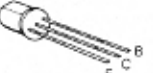
▼ PLL UNIT (X50-1490-00)



25C460(B)



25A562(Y)
25C784(O)



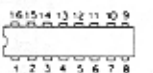
35K40(L)



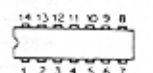
25C1775(E)
25C1815(Y)
25C1959(Y)



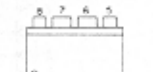
HD74LS163N



HD74LS00P
MC4044P



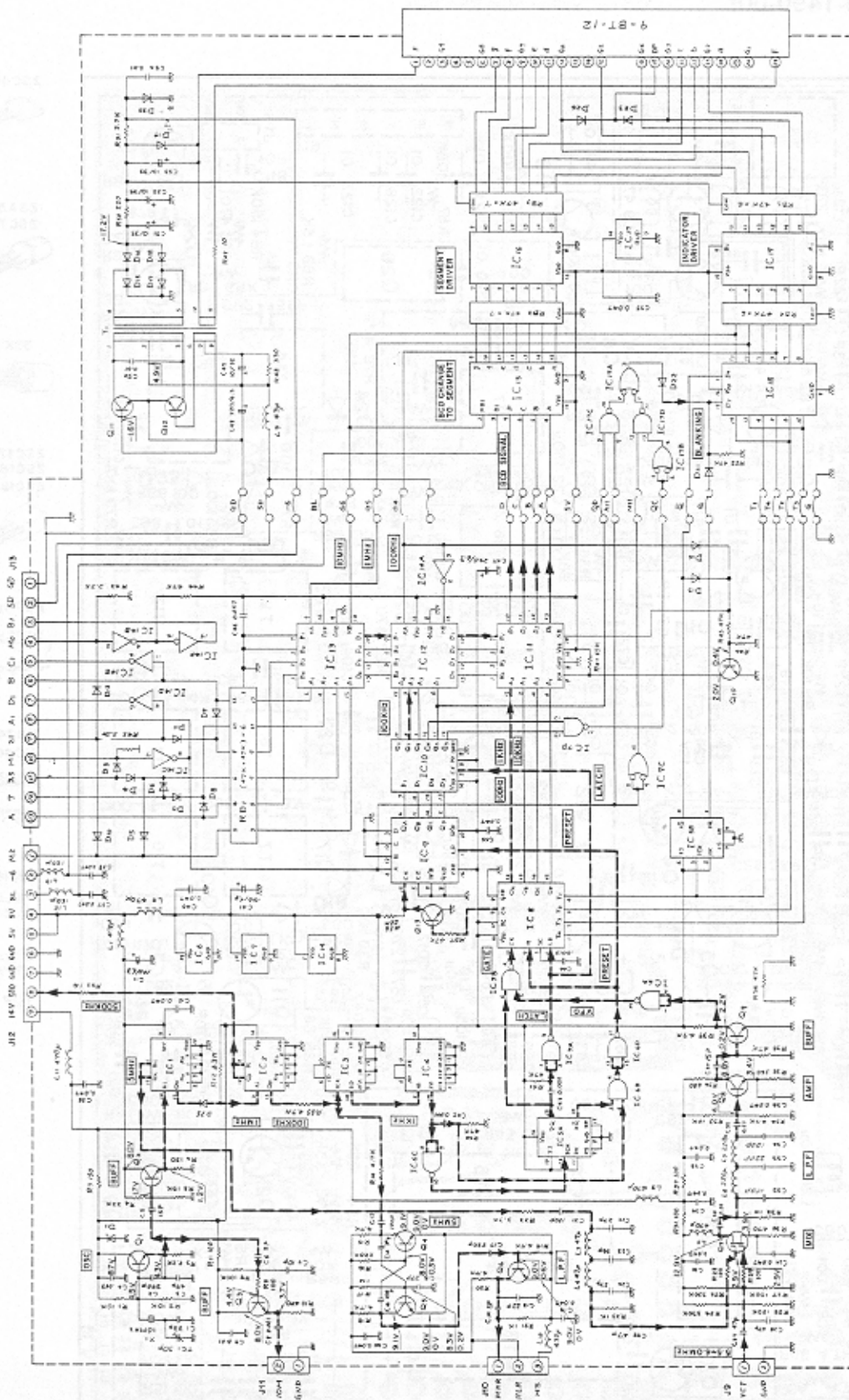
SN16913P



TOP VIEWS

CIRCUIT DIAGRAM

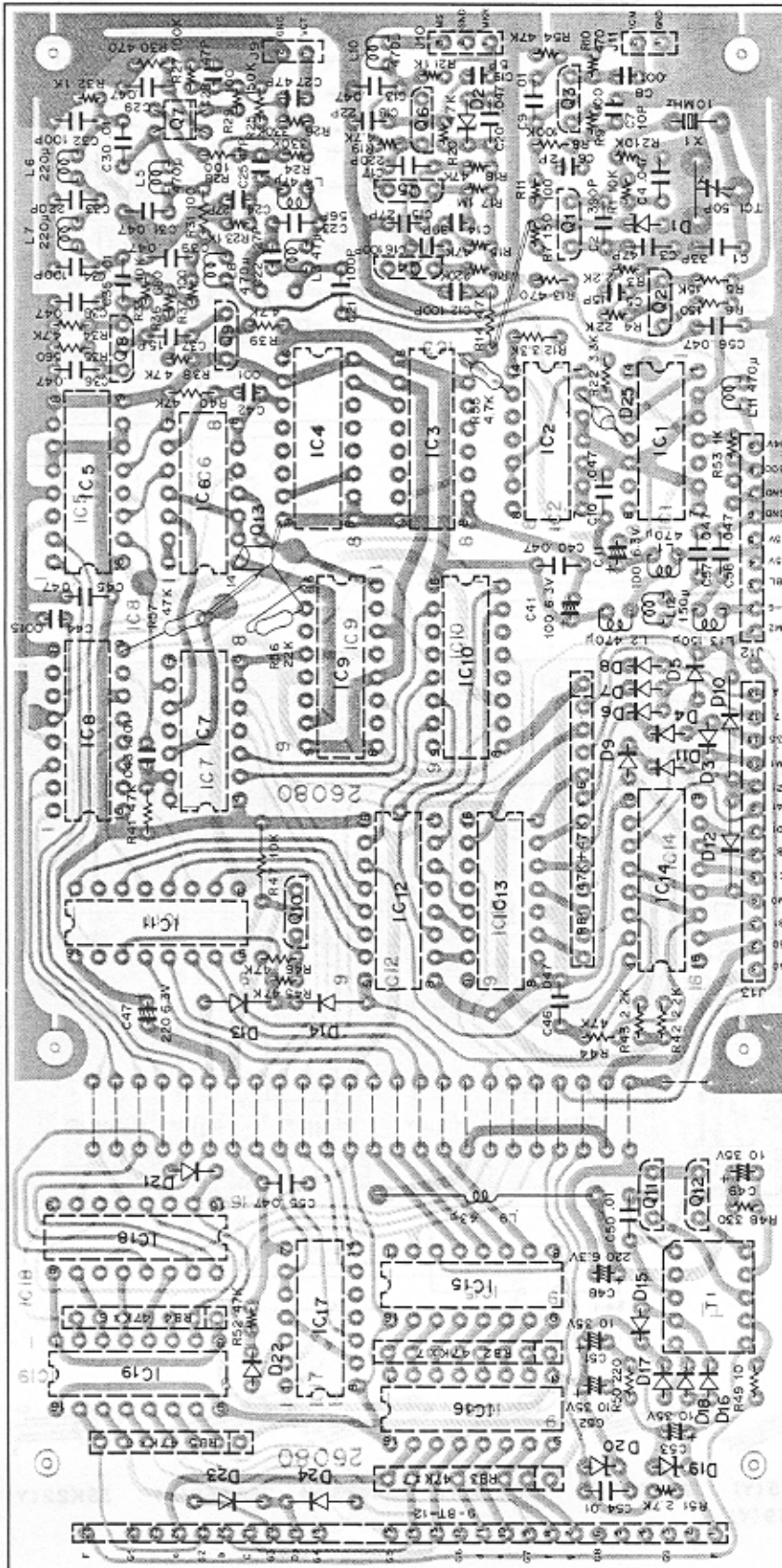
▼ COUNTER UNIT (X54-1360-00)



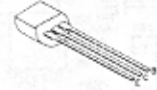
- Q1, 2, 3, 4, 8, 9, 10, 13 : 2SC1815(Y)
- Q7 : 3SK73(GR)
- O11, 12 : 2SC1959(Y)
- O6 : 2SC785(O)
- Q5 : 2SC1815(GR)
- D1, 19 : WZ-080
- D3, 4, 5, 6, 7, 8, 9, 10 : 1S1565
- IC1 : SN74LS00N
- IC2 : TC5028P
- IC3, 4 : TC4518BP
- IC5 : TC4027BP
- IC6, 7, 17 : TC4011BP
- IC8 : TC5051BP
- IC9 : TC4129BP
- IC10 : SN74LS00N
- IC11, 12, 13 : TC4019BP
- IC14 : TC4518BP
- IC15 : TC5022BP
- IC16 : TC5068BP
- IC18 : TC5012BP
- IC19 : TC5064BP

PC BOARD VIEWS

▼ COUNTER UNIT (X54-1360-00)



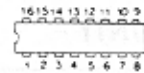
2SC7B5(O) 2SC1815(GR)
2SC1815(Y) 2SC1959(Y)



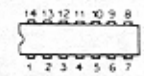
2SK73 (GR)



TC40198P TC5012BP
TC4027BP TC5022BP
TC4029BP TC5051BP
TC4042BP TC5064BP
TC4049BP TC5066BP
TC4518BP



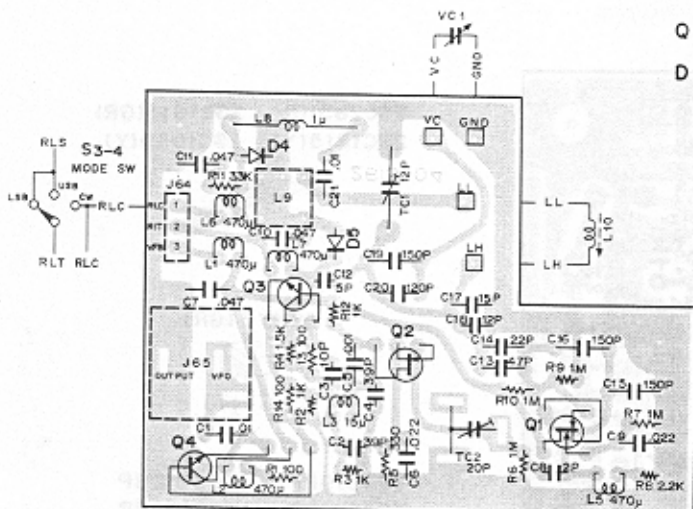
SN74LS90N TC50268P
TC4011BP



TOP VIEWS

PC BOARD VIEWS

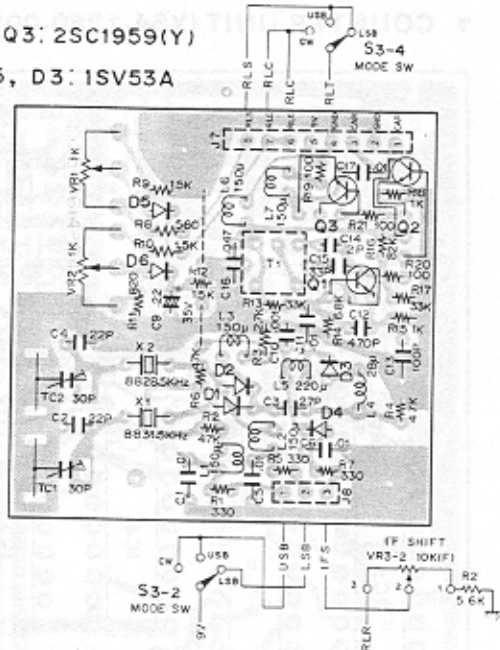
▼ VFO UNIT (X40-1130-00)



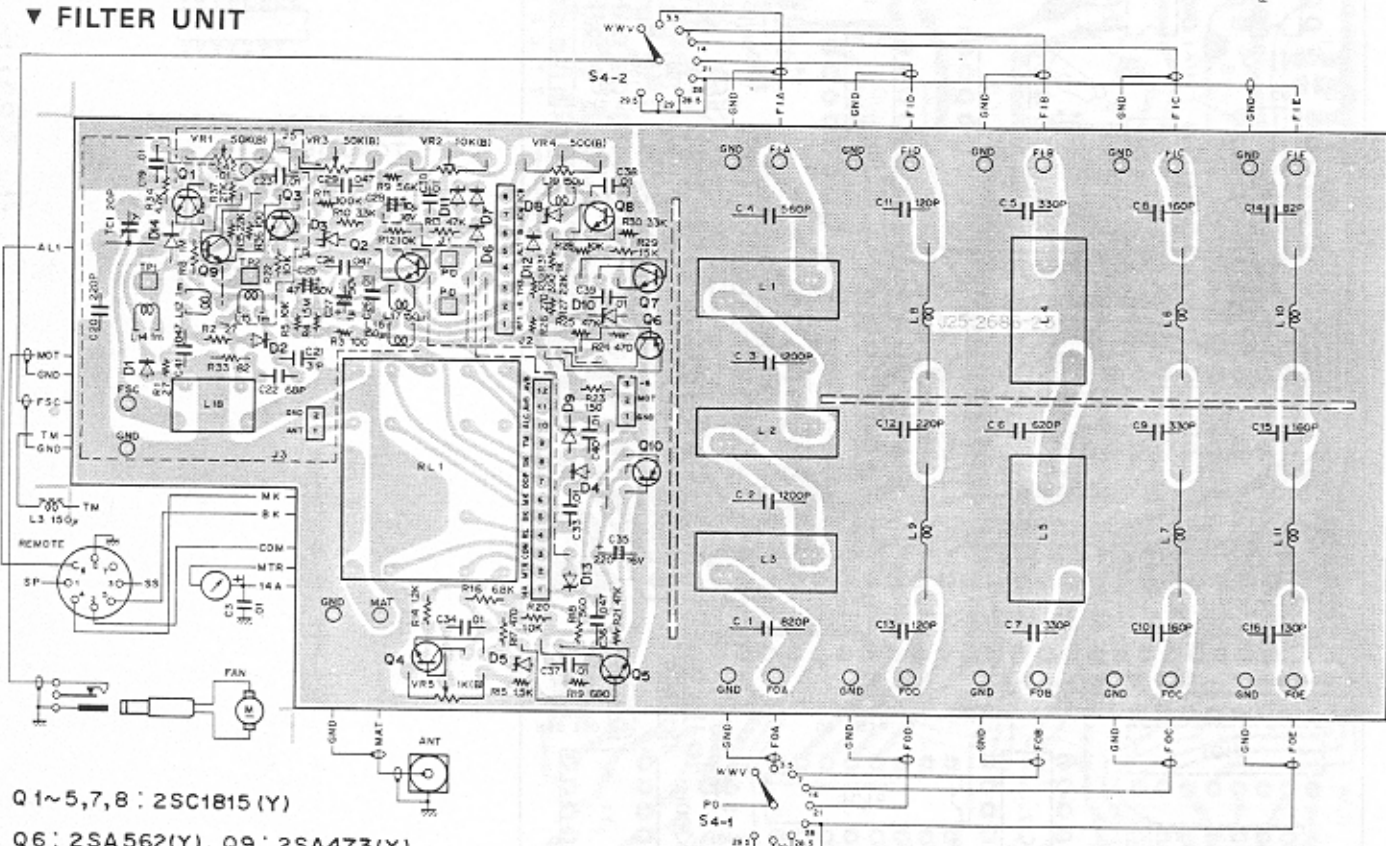
Q1: 3SK22(Y), Q2: 2SK19(Y), Q3: 2SC460(B)
 Q4: 2SC1959(Y), D4: 1S2588, D5: 1SV53A

▼ CARRIER UNIT (X50-1500-00)

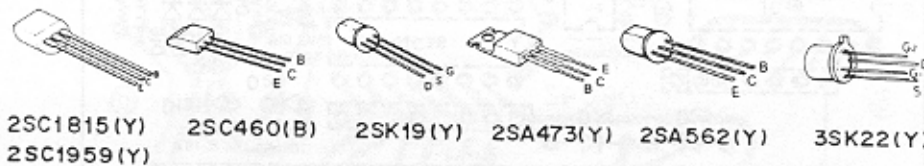
Q1,2: 2SC460(B), Q3: 2SC1959(Y)
 D1,2,4~6: 1S1555, D3: 1SV53A



▼ FILTER UNIT

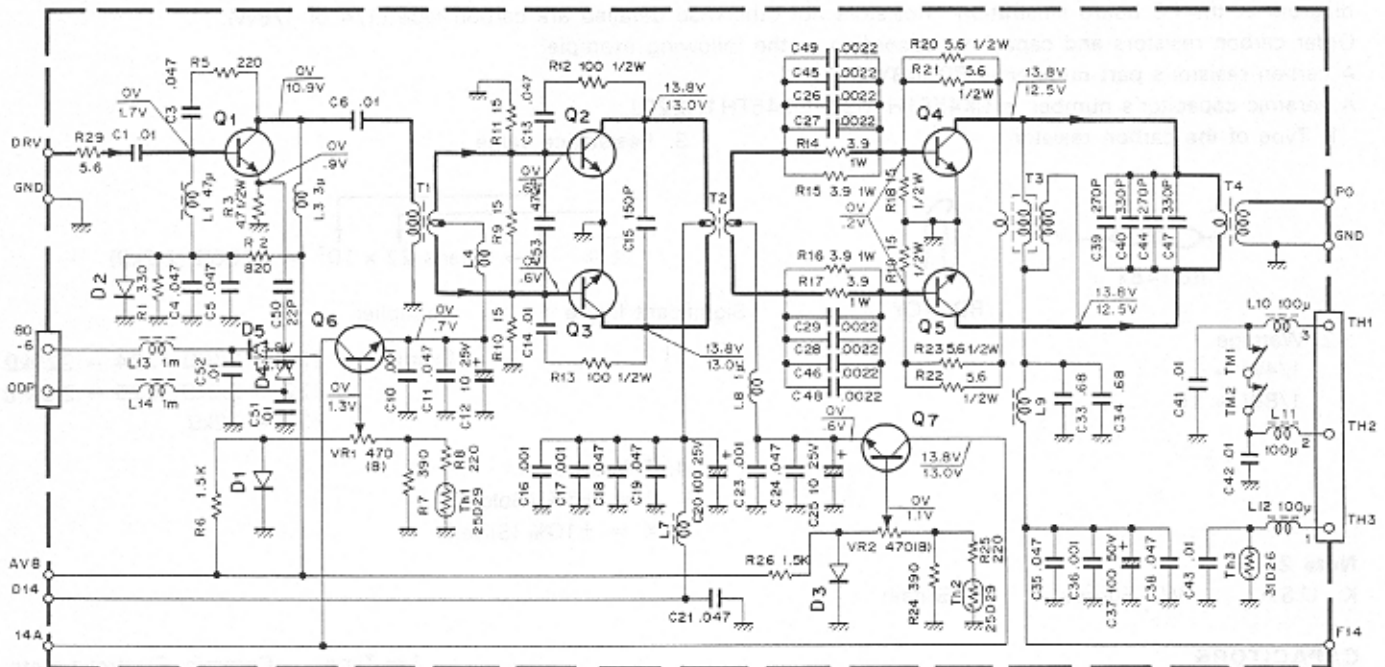


Q1~5,7,8: 2SC1815(Y)
 Q6: 2SA562(Y), Q9: 2SA473(Y)
 D1,2: 1N60, D3: WZ-044
 D4,6,7,9,12: 1S1555
 D5,10: WZ-061, D8,11,13: WZ-090

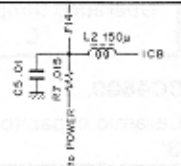
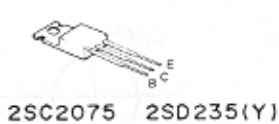
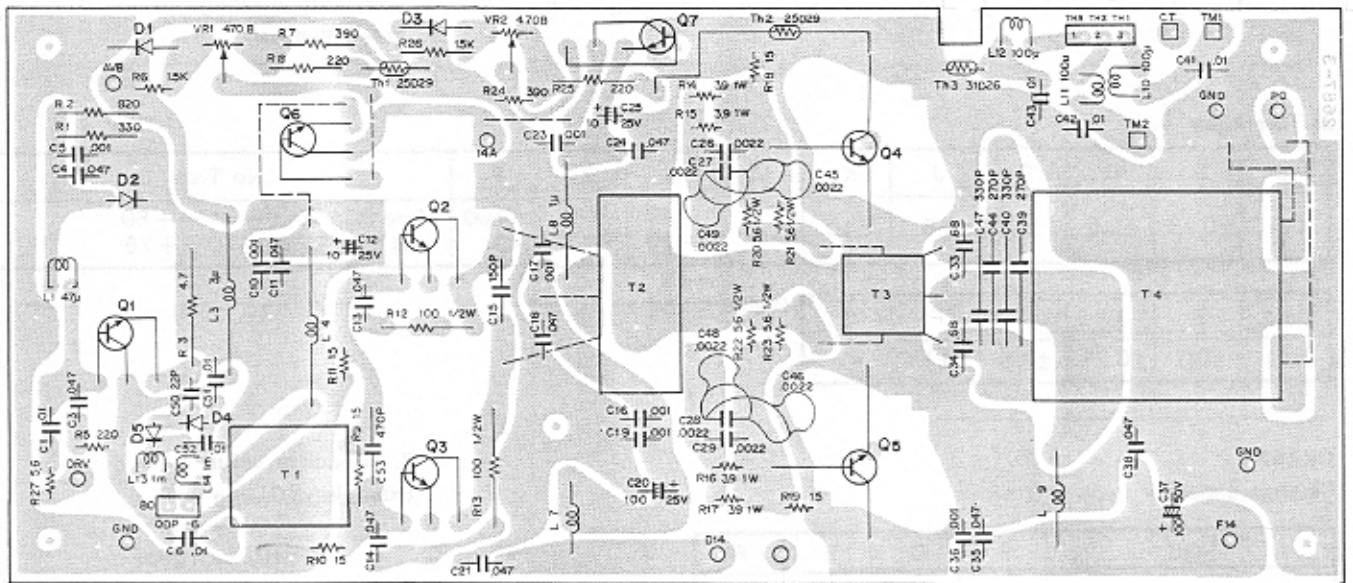


PC BOARD VIEWS/CIRCUIT DIAGRAM

▼ FINAL UNIT (X56-1350-00)



- | | | |
|----------------|------------------|--------------|
| Q1 : 2SC2075 | Q4,5 : 2SC2290 | D1,3 : SV-03 |
| Q2,3 : 2SC2509 | Q6,7 : 2SD235(Y) | D2 : SV-4A |
| | | D4,5 : 1N60 |



PARTS LIST

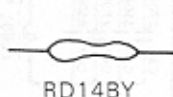
Note 1:
Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components refer to the schematic diagram or the PC board illustration. Resistors not otherwise detailed are carbon type (1/4 or 1/8W).

Order carbon resistors and capacitors according to the following example:

A carbon resistor's part number is RD14BY 2E222J.

A ceramic capacitor's number is CK45F1H103Z, CC45TH1H220J.

1. Type of the carbon resistor



3. Resistance value



Significant figure

Multiplier

Example: 221 → 220Ω 224 → 220kΩ
222 → 2.2kΩ 225 → 2.2MΩ
223 → 22kΩ

4. Tolerance

J = ±5% (Gold)

K = ±10% (Silver)

Note 2:

K: U.S.A. W: Europe T: Britain

CAPACITORS

Type I

CK 45 F 1H 103 Z
1 2 3 4 5 6

Type II

CC 45 TH 1H 220 J
1' 2 3' 4 5 6

- 1 = Type Ceramic, Electrolytic etc.
- 2 = Shape Round, Square etc.
- 3 = Temp range
- 3' = Temp coeff
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance

6. Tolerance

| Type | C | D | G | J | K | M | X | Z | P | No Type |
|------|-------|------|----|----|-----|-----|------------|------------|------------|---|
| (%) | ±0.25 | ±0.5 | ±2 | ±5 | ±10 | ±20 | +40 -20 | +80 -20 | +100 -0 | More than 10μF -10~+50 Less than 4.7μF -10~+75 |

| Cord | B | C | D | F | G |
|------|------|-------|------|----|----|
| (pF) | ±0.1 | ±0.25 | ±0.5 | ±1 | ±2 |

(Value less than 10 pF)

CK45F

Ceramic capacitor (type I) 3

| Cord | B | D | E | F |
|--------------------------|------------|------------|------------|------------|
| Operating temperature °C | -30 +85 | -30 +85 | -30 +85 | -10 +70 |

5. Capacitor value

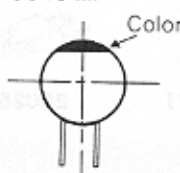
Example: 010 → 1pF
100 → 10pF
101 → 100pF
102 → 1000pF = 0.001μF
103 → 0.01μF

CC4500....

Ceramic capacitor (type II) temperature coeff. capacitor 1' 3'

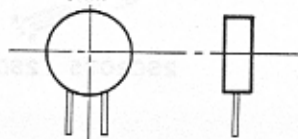
| Color | CH (Black) | LH (Red) | PH (Orange) | RH (Yellow) | SL (Green) | TH (Blue) | UH (Violet) |
|--------|---------------|-------------|----------------|----------------|---------------|--------------|----------------|
| ppm/°C | 0 | -80 | -150 | -220 | -330 | -470 | -750 |

CC45



Type II

CK45



Type I

PARTS LIST

☆ New parts

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|--------------|--|--------------|
| GENERAL | | | |
| CAPACITOR | | | |
| C1 | C90-0806-05 | Electrolytic 2200 μ F 16WV | |
| C3~9 | CK45F1H103Z | Ceramic 0.01 μ F +80% -20% | |
| RESISTOR | | | |
| R1~3 | RD148B2E000J | Carbon resistor 000 Ω \pm 5% 1/4W | |
| R5,6 | RC05GF2H101J | Solid resistor 100 Ω \pm 5% 1/2W | |
| R7 | R92-0620-00 | Cement resistor 15 m Ω | |
| SEMICONDUCTOR | | | |
| D1 | V11-2163-05 | Diode S31C | |
| D2 | V11-7260-66 | LED PR212D | |
| D3 | V11-0240-05 | Zener diode WZ-090 | |
| POTENTIOMETER | | | |
| VR1 | R06-9402-05 | 10k Ω (A) AF 10k Ω (B) RF | |
| VR2 | R06-9402-05 | 10k Ω (A) MIC 10k Ω (B) CAR | |
| VR3 | R06-9403-05 | 5k Ω (B) RIT 10k Ω (F) IF SHIFT | |
| MISCELLANEOUS | | | |
| S1 | S36-2402-05 | See saw switch POWER | |
| S2 | S44-2402-05 | Paddle switch STBY | |
| S3 | S01-2417-05 | Rotary switch MODE | |
| S4 | S01-2417-15 | Rotary switch BAND | |
| L2~5 | L40-1511-03 | Ferri-inductor 150 μ H | |
| - | A01-0743-02 | Case (A) upper | ☆ |
| - | A01-0744-02 | Case (B) Lower | ☆ |
| - | A20-2349-03 | Panel ass'y | ☆ |
| - | B05-0701-04 | Speaker grill cloth | |
| - | B10-0613-04 | Front glass (B) | |
| - | B20-0811-04 | Dial scale (B) | |
| PL1,2 | B30-0808-05 | Pilot lamp \times 2 | |
| - | B31-0618-05 | Meter | |
| - | B39-0407-04 | Spacer \times 2 for leg | |
| - | B42-1644-00 | Indicating plate (VOX) | |
| - | B42-1659-14 | Indicating plate (ADJUSTMENT) | |
| - | B43-0620-04 | Name plate (T) | ☆ |
| - | B43-0621-04 | Name plate (W)(K) | ☆ |
| - | B50-2643-00 | Operating manual (W)(K) | ☆ |
| - | B50-2644-00 | Operating manual (T) | ☆ |
| - | B51-0877-00 | Service manual (K)(W)(T) | ☆ |
| - | D21-0807-05 | Band shaft | |
| - | D22-0404-05 | Universal joint | |
| - | D40-0603-04 | Gear Ass'y | |
| - | E04-0152-05 | M type receptacle ANT | |
| - | E06-0252-05 | 2P metal socket (Power supply) | |
| - | E06-0451-05 | 4P metal socket MIC | |
| - | E06-0751-05 | 7P DIN socket REMOTE (ACSY) | |
| - | E06-0851-05 | 8P DIN socket EXT. VFO SW | |
| - | E07-0751-05 | 7P DIN plug REMOTE | |
| - | E11-0005-15 | 3 pole phone jack KEY | |
| - | E11-0034-25 | PHONES jack | |
| - | E11-0402-05 | EXT.SP jack | |
| - | E12-0001-05 | Phone plug EXT.SP (ACSY) | |
| - | E22-0207-05 | Lug plate 101B | |
| - | E22-0405-05 | Lug plate \times 3 202B | |
| - | E29-0407-05 | Bridge connector | |

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|-----------------------------------|--------------|
| - | E30-1632-05 | Fan Cable (with DC cord) | |
| - | E30-1638-05 | PC Cord Ass'y (ACSY) | ☆ |
| - | F05-2034-05 | Fuse 20A | |
| - | F07-0826-05 | Heat sink cover | ☆ |
| - | F09-0405-05 | Fan | |
| - | G02-0505-05 | Knob D spring \times 3 | |
| - | H01-2619-04 | Carton (inside) (W)(K) | |
| - | H01-2620-04 | Carton (inside) (T) | ☆ |
| - | H03-1706-04 | Carton (outside) (K) | |
| - | H03-1707-04 | Carton (outside) (W) | ☆ |
| - | H03-1708-04 | Carton (outside) (T) | ☆ |
| - | H01-2574-04 | Case cover | |
| - | H10-2509-02 | Front packing fixture | ☆ |
| - | H10-2510-02 | Rear packing fixture | |
| - | H12-0441-04 | Accessory box | |
| - | H20-1405-03 | Protective cover | |
| - | H21-0701-04 | Protection sheet for VOX CONTROLS | |
| - | J02-0323-05 | Foot \times 4 | |
| - | J02-0407-04 | Tilt bracket | |
| - | J21-2504-04 | Mounting stopper (SP) | ☆ |
| - | J31-0141-04 | Spacer ring for mic | |
| - | J42-0038-04 | Hole plug | |
| - | J42-0407-04 | Knob bush \times 2 | |
| - | J61-0019-05 | Vinyle tie \times 10 | |
| - | J61-0210-05 | Vinyle tie | |
| - | J61-0401-05 | Nylon cable tie \times 4 | |
| - | K21-0722-04 | Main knob VFO | |
| - | K21-0723-04 | Pointer knob large | |
| - | K21-0724-04 | Knob (outside) \times 3 | |
| - | K23-0710-04 | Knob (inside) \times 3 | |
| - | K23-0711-04 | Pointer knob (small) | |
| - | K23-0712-04 | VOX knob \times 3 | |
| - | K29-0709-04 | Push knob (square) \times 6 | |
| - | N14-0508-04 | Spanner Nut | |
| - | N14-0509-05 | Wing nut | |
| - | N19-0607-04 | Nylon panel washer | |
| - | N99-0303-05 | Hex. head screw (VFO) | |
| - | T03-0027-15 | Speaker | |
| - | T10-0301-05 | Fan motor | ☆ |
| - | B46-0058-00 | Warranty Card (K) | |

SWITCH (A) UNIT (X41-1140-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|---------------------|--------------|
| S1~3 | S40-2404-05 | Push switch SPJ222H | |

SWITCH (B) UNIT (X41-1150-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------|--------------|--|--------------|
| R1 | RD14CB2E681J | Carbon resistor 680 Ω \pm 5% 1/4W | |
| D1 | V11-0076-05 | Diode 1S1555 | |
| S1~3 | S40-2405-05 | Push switch SPJ222E | |
| C1 | CK45F1H103Z | Ceramic 0.01 μ F +80% -20% | |

PARTS LIST

RELAY UNIT (X41-1250-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------------|--------------|--|--------------|
| CAPACITOR | | | |
| C1 | CK45F1H103Z | Ceramic 0.01 μ F +80% -20% | |
| C2 | CE04W1HR47 | Electrolytic 0.47 μ F 50WV | |
| RESISTOR | | | |
| R1,2 | RD14BB2E000J | Carbon resistor $\infty\infty\infty\Omega$ \pm 5% 1/4W | |
| SEMICONDUCTOR/RELAY | | | |
| Q1 | V03-1959-06 | Transistor 2SC1959 (Y) | |
| D1,D2 | V11-0076-05 | Diode 1S1555 | |
| | S51-2408-05 | Relay G2V2 | |

DC CABLE ASS'Y (E30-1638-05)

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|-----------------|--------------|
| - | E30-1637-05 | Cable | |
| - | F05-2034-05 | Fuse (20A) | |
| - | J13-0404-05 | Fuse holder | |
| - | J61-0201-05 | Vinyle tie x 10 | |

RF UNIT (X-1260-01)

| Ref. No. | Parts No. | Description | Re- marks |
|------------------|--------------|------------------------------|--------------|
| CAPACITOR | | | |
| C1 | CC45RH1H101J | Ceramic 100pF \pm 5% | |
| C3 | CQ09S1H102J | Styrene 1000pF \pm 5% | |
| C5 | CC45RH1H221J | Ceramic 220pF \pm 5% | |
| C6 | CC45RH1H151J | Ceramic 150pF \pm 5% | |
| C7 | CC45RH1H221J | Ceramic 220pF \pm 5% | |
| C10 | CC45RH1H820J | Ceramic 82pF \pm 5% | |
| C11 | CC45RH1H390J | Ceramic 39pF \pm 5% | |
| C12 | CC45RH1H101J | Ceramic 100pF \pm 5% | |
| C15 | CC45RH1H100D | Ceramic 10pF \pm 0.5pF | |
| C16 | CC45RH1H270J | Ceramic 27pF \pm 5% | |
| C17 | CC45RH1H330J | Ceramic 33pF \pm 5% | |
| C20 | CC45RH1H330J | Ceramic 33pF \pm 5% | |
| C21 | CC45RH1H100D | Ceramic 10pF \pm 0.5pF | |
| C22 | CC45RH1H050C | Ceramic 5pF \pm 0.25pF | |
| C25 | CC45RH1H030C | Ceramic 3pF \pm 0.25pF | |
| C26 | CC45RH1H070C | Ceramic 7pF \pm 0.25pF | |
| C27 | CC45RH1H270J | Ceramic 27pF \pm 5% | |
| C31,32 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C33 | CC45SL1H070C | Ceramic 7pF \pm 0.25pF | |
| C35 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C37~39 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C40 | CC45SL1H220J | Ceramic 22pF \pm 0.5pF | |
| C41 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C43 | CC45SL1H150J | Ceramic 15pF \pm 5% | |
| C44 | CC45SL1H220J | Ceramic 22pF \pm 5% | |
| C45 | CC45SL1H270J | Ceramic 27pF \pm 5% | |
| C46,47 | C91-0455-05 | Ceramic 0.01 μ F | |
| C49,50 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C56 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C58 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C61 | CC45SL1H221J | Ceramic 220pF \pm 5% | |
| C63 | CE04W1C100 | Electrolytic 10 μ F 16WV | |
| C64 | CE04W1C100 | Ceramic 10 μ F 16WV | |

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------------------|--------------|--|--------------|
| C66 | C91-0456-05 | Ceramic 0.047 μ F 25WV | |
| C69 | CE04W1H4R7 | Electrolytic 4.7 μ F 50WV | |
| C74 | CC45RH1H120J | Ceramic 12pF \pm 0.25pF | |
| C76 | CC45RH1H101J | Ceramic 100pF \pm 5% | |
| C78 | CC45SL1H050C | Ceramic 5pF \pm 0.25pF | |
| RESISTOR | | | |
| R1~66 | RD14CB2E000J | Carbon Resistor $\infty\infty\infty\Omega$ \pm 5% 1/4W | |
| R22,32 | NOT USED | | |
| SEMICONDUCTOR | | | |
| Q1 | V09-1002-56 | FET 3SK74(L) | |
| Q2 | V03-1815-06 | Transistor 2SC1815(Y) | |
| Q3~6 | V09-1002-56 | FET 3SK74(L) | |
| Q7,8 | V03-1815-06 | Transistor 2SC1815(Y) | |
| Q9 | V03-2086-06 | Transistor 2SC2086 | |
| Q10 | V01-1015-06 | Transistor 2SA1015(Y) | |
| D1 | V11-0370-05 | Diode 1S1587 | |
| D2 | V11-0414-05 | Diode 1S2588 | |
| D3 | V11-0370-05 | Diode 1S1587 | |
| D4 | V11-0414-05 | Diode 1S2588 | |
| D5 | V11-0370-05 | Diode 1S1587 | |
| D6 | V11-0076-05 | Diode 1S1555 | |
| D7 | V11-0061-05 | Diode 1N60 | |
| D8 | V11-3172-76 | Diode 1S1585 | |
| COIL/INDUCTOR/TRANSFORMER | | | |
| L1 | L34-0559-05 | Trap coil 8.83 MHz | |
| L2 | L34-0558-05 | Trap coil 8.83 MHz | |
| L3 | L34-0698-05 | BPF coil 3.5 MHz | |
| L4 | L34-0699-05 | BPF coil 3.5 MHz | |
| L5 | L34-0698-05 | BPF coil 3.5 MHz | |
| L6 | L34-0700-05 | BPF coil 7 MHz | |
| L7 | L34-0701-05 | BPF coil 7 MHz | |
| L8 | L34-0700-05 | BPF coil 7 MHz | |
| L9 | L34-0702-05 | BPF coil 14 MHz, WWV | |
| L10 | L34-0703-05 | BPF coil 14 MHz, WWV | |
| L11 | L34-0702-05 | BPF coil 14 MHz, WWV | |
| L12 | L34-0704-05 | BPF coil 21 MHz | |
| L13 | L34-0705-15 | BPF coil 21 MHz | |
| L14 | L34-0706-05 | BPF coil 21 MHz | |
| L15 | L34-0707-05 | BPF coil 28 MHz | |
| L16 | L34-0737-05 | BPF coil 28 MHz | |
| L17 | L34-0738-05 | BPF coil 28 MHz | |
| L18,19 | L40-1021-03 | Ferri inductor 1 mH | |
| L20 | L40-1011-03 | Ferri inductor 100 μ H | |
| L21 | L40-1592-02 | Ferri inductor 1.5 μ H | |
| L22,23 | L40-4711-03 | Ferri inductor 470 μ H | |
| L24 | L40-4782-02 | Ferri inductor 0.47 μ H | |
| L25~27 | L40-4711-03 | Ferri inductor 470 μ H | |
| L28,29 | L40-1021-03 | Ferri inductor 1 mH | |
| L30,31 | L40-1011-03 | Ferri inductor 100 μ H | |
| L32 | L40-4791-02 | Ferri inductor 4.7 μ H | |
| L33 | L33-0032-05 | Choke coil 3 μ H | |
| L34 | L40-1011-03 | Ferri inductor 100 μ H | |
| L35 | L34-0559-05 | Trap coil 8.83 MHz | |
| T1 | L34-0696-35 | Input coil ANT | |
| T2 | L19-0303-05 | Wide range transformer | |
| T3,4 | L34-0697-05 | Output coil | |
| T5 | L19-0303-05 | Wide band transformer | |
| T6 | L19-0302-05 | Wide band transformer P.DRV | |
| MISCELLANEOUS | | | |
| - | S29-3404-15 | Rotary wafer ass'y | |

PARTS LIST

IF UNIT (X48-1210-01)

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|--------------|--------------------------------------|--------------|
| CAPACITOR | | | |
| C1 | CC45SL1H050C | Ceramic 5pF ±0.25pF | |
| C3.4 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C6 | CE04W1C100 | Electrolytic 10μF 16WV | |
| C22 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C23 | CC45SL1H150J | Ceramic 15pF ±5% | |
| C28 | CC45SL1H070D | Ceramic 7pF ±0.5pF | |
| C34 | CC45SH1H100D | Ceramic 10pF ±0.5pF | |
| C35 | CC45SH1H470J | Ceramic 47pF ±5% | |
| C38 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C40 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C47 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C49 | CC45SL1H030C | Ceramic 3pF ±0.25pF | |
| C56 | CC34SL1H470K | Ceramic 470pF ±10% | |
| RESISTORS | | | |
| R1~67 | RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| SEMICONDUCTOR | | | |
| Q1~3 | V09-1002-56 | FET 3SK74(L) | |
| Q4 | V09-0012-05 | FET 2SK19(IGR) | |
| Q5 | V01-1015-06 | Transistor 2SA1015(Y) | |
| Q6.7 | V03-1815-06 | Transistor 2SC1815(Y) | |
| Q8 | V09-0012-05 | FET 2SK19(IGR) | |
| Q9~11 | V03-0079-05 | Transistor 2SC460(B) | |
| Q12.13 | V03-1815-06 | Transistor 2SC1815(Y) | |
| D1~4 | V11-0370-05 | Diode 1S1587 | |
| D5 | V11-4160-66 | Diode 1S1007 | |
| D6 | V11-0370-05 | Diode 1S1587 | |
| D7 | V11-4160-66 | Diode 1S1007 | |
| D8 | V11-0370-05 | Diode 1S1587 | |
| D9.10 | V11-0076-05 | Diode 1S1555 | |
| D11.12 | V11-0051-05 | Diode 1N60 | |
| D13 | V11-0076-05 | Diode 1S1555 | |
| D14.15 | V11-0051-06 | Diode 1N60 | |
| D16 | V21-0004-05 | Varistor MV13 | |
| D17~32 | V11-0076-05 | Diode 1S1555 | |
| POTENTIOMETER | | | |
| VR1 | R12-3045-05 | 10kΩ (B) | |
| VR2 | R12-6401-05 | 470kΩ (B) | |
| INDUCTOR/COIL | | | |
| L1~5 | L40-1511-03 | Ferri-inductor 150μF | ☆ |
| T1.2 | L34-0708-05 | Tuning coil | |
| T3 | L34-0537-05 | Tuning coil | |
| T4 | L34-0538-05 | Tuning coil | |
| T5.6 | L34-0535-05 | Tuning coil | |
| T7 | L34-0536-05 | Tuning coil | |
| T8 | L34-0535-05 | Tuning coil | |
| T9 | L34-0536-05 | Tuning coil | |
| MISCELLANEOUS | | | |
| XF1 | L71-0208-05 | Cristal filter 4 element, monolithic | ☆ |
| CF1.2 | L72-0310-05 | Ceramic filter for NB | ☆ |
| — | E23-0046-04 | Terminal (Square) | |
| — | S51-4401-05 | Relay LZN-4 | |

AF·GEN UNIT (X49-1110-00)

| Ref. No. | Parts No. | Description | Re- marks |
|------------------|------------------------------|--------------------------|--------------|
| CAPACITOR | | | |
| C1 | CC45CH1H100D | Ceramic 10pF ±0.5pF | |
| C3 | CQ92M1H333K | Mylar 0.033μF ±10% | |
| C4 | CE04W1HR47 | Electrolytic 0.47μF 50WV | |
| C5 | CE04W1A221 | Electrolytic 220μF 10WV | |
| C7.8 | CE04W1C100 | Electrolytic 10μF 16WV | |
| C9 | CQ92M1H104K | Mylar 0.1μF ±10% | |
| C10.11 | CE04W1C102Q | Electrolytic 1000μF 16WV | |
| C12 | CQ92M1H104K | Mylar 0.1μF ±10% | |
| C13 | CE04W1C470 | Electrolytic 47μF 16WV | |
| C14 | CQ92M1H104K | Mylar 0.1μF ±10% | |
| C16 | CE04W1C470 | Electrolytic 47μF 16WV | |
| C17 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C18 | CQ92M1H223K | Mylar 0.022μF ±10% | |
| C19 | CE04W1C100 | Electrolytic 10μF 16WV | |
| C20 | VACANT | | |
| C21.22 | CE04W1C470 | Electrolytic 47μF 16WV | |
| C23 | CQ92M1H104K | Mylar 0.1μF ±10% | |
| C24 | CE04W1C221 | Electrolytic 220μF 16WV | |
| C30~33 | CC45CH1H220J | Ceramic 22pF ±5% | |
| C37 | CC45SL1H151J | Ceramic 150pF ±5% | |
| C38 | CC45CH1H100D | Ceramic 10pF ±0.5pF | |
| C39 | CC45SL1H180J | Ceramic 18pF ±5% | |
| C41.42 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C43 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C44 | CE04W1A221 | Electrolytic 220μF 10WV | |
| C45 | CE04W1E4R7 | Electrolytic 4.7μF 25WV | |
| C46 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C47 | CQ92M1H473K | Mylar 0.047μF ±10% | |
| C48.49 | CE04W1E4R7 | Electrolytic 4.7μF 25WV | |
| C50 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C51 | CE04W1H3R3 | Electrolytic 3.3μF 50WV | |
| C52 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C55 | CC45UJ1H220J | Ceramic 22pF ±5% | |
| C56 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C59 | CC45CH1H050C | Ceramic 5pF ±0.25pF | |
| C64 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C66 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C67 | CE04W1C100 | Electrolytic 10μF 16WV | |
| C68 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C69.70 | CQ92M1H123K | Mylar 0.012μF ±10% | |
| C71 | CQ921H104K | Mylar 0.1μF ±10% | |
| C72.73 | CQ92M1H123K | Mylar 0.012μF ±10% | |
| C74 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C75 | CE04W1A221 | Electrolytic 220μF 10WV | |
| C76.77 | CE04W1A470 | Electrolytic 47μF 10WV | |
| C78 | CQ92M1H223K | Mylar 0.022μF ±10% | |
| C79 | CE04W1H3R3 | Electrolytic 3.3μF 50WV | |
| C80 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C81 | CQ92M1H473K | Mylar 0.047μF ±10% | |
| C83 | CQ92M1H102K | Mylar 1000pF ±10% | |
| C84 | CQ92M1H473K | Mylar 0.047μF ±10% | |
| C85.86 | CE04W1E4R7 | Electrolytic 4.7μF 25WV | |
| C86 | CE04W1E3R3 | Electrolytic 3.3μF 25WV | |
| C89 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C90 | CE04W1C220 | Electrolytic 22μF 16WV | |
| RESISTOR | | | |
| R1~113 | RD14CB2E000J RD14BB2E000J | Carbon 000Ω ±5% 1/4W | |
| R14 | RS14GB3D8R2J | Metal film 8.2Ω ±5% 2W | |
| R36.80.93 | NOT USED | | |

PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|------------------------------|-------------|----------------------------|--------------|
| SEMICONDUCTOR | | | |
| Q1 | V03-2240-06 | Transistor 2SC2240 (GR) | |
| Q2 | V30-1029-36 | IC μ PC14305H | |
| Q3 | V01-0473-06 | Transistor 2SA473 (Y) | |
| Q4~6 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q7 | V30-1045-06 | IC HA1366W | |
| Q8 | V03-0079-05 | Transistor 2SC460 (B) | |
| Q9 | V03-1959-06 | Transistor 2SC1959 (Y) | |
| Q10,11 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q12 | V09-0012-05 | FET 2SK19 (GR) | |
| Q13 | V03-0079-05 | Transistor 2SC460 (B) | |
| Q14 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q15 | V01-1015-06 | Transistor 2SA1015 (Y) | |
| Q16,17 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q18 | V03-2240-06 | Transistor 2SC2240 (GR) | |
| Q19,20 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q21 | V01-1015-06 | Transistor 2SA1015 (Y) | |
| Q22 | V01-1815-16 | Transistor 2SC1815 (GR) | |
| Q22,23 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q24 | V01-0032-05 | Transistor 2SA562 (Y) | |
| Q25 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| D~4 | V11-0051-05 | Diode 1N60 | |
| D5 | V11-0243-05 | Zener diode WZ-061 | |
| D6~9 | V11-0414-05 | Diode 1S2588 | |
| D10 | NOT USED | | |
| D11~14 | V11-0051-05 | Diode 1N60 | |
| D15 | V11-0370-05 | Diode 1S1587 | |
| D16 | VACANT | | |
| D17~22 | V11-0076-05 | Diode 1S1555 | |
| D23,24 | V11-0051-05 | Diode 1N60 | |
| D25 | V11-0076-05 | Diode 1S1555 | |
| D26 | V11-0051-05 | Diode 1N60 | |
| D27,28 | V11-0076-05 | Diode 1S1555 | |
| POTENTIOMETER | | | |
| VR1 | R12-3025-05 | 10k Ω (B) RIT | |
| VR2 | R12-4016-05 | 50k Ω RF | |
| VR3 | R12-0042-05 | 50 Ω (B) 9V | |
| VR4 | R12-4016-05 | 50k Ω SIDE TONE | |
| VR5 | R12-0401-05 | 100 Ω BM | |
| VR6 | R12-0405-05 | 330 Ω (B) ANTI VOX | |
| VR7 | R12-3408-05 | 47k Ω VOX GAIN | |
| VR8 | R12-5402-05 | 220k Ω DELAY | |
| TRIMMER/COIL/INDUCTOR | | | |
| TC1~6 | C05-0030-15 | Ceramic trimmer 20pF | |
| L1 | L40-1021-03 | Ferri-inductor 1 mH | |
| L2,3 | L40-1511-03 | Ferri-inductor 150 μ H | |
| L4 | L40-4771-03 | Ferri-inductor 470 μ H | |
| L5 | L40-3392-03 | Ferri-inductor 3.3 μ H | |
| L6,7 | L40-1511-03 | Ferri-inductor 150 μ H | |
| L8 | L40-1021-03 | Ferri-inductor 1 mH | |
| T1 | L15-0016-05 | Filter choke | |
| T2 | L34-0567-05 | Tuning coil | |
| MISCELLANEOUS | | | |
| - | E18-0401-05 | Crystal socket 4P | |
| - | F20-0078-05 | Insulating mica | |
| - | F29-0014-05 | Shoulder washer | |

PLL UNIT (X50-1490-00)

| Ref. No. | Parts No. | Description | Re- marks |
|------------------|--------------|--------------------------------|--------------|
| CAPACITOR | | | |
| C1 | CC45TH1H220J | Ceramic 22pF \pm 5% | |
| C2 | CC45TH1H030C | Ceramic 3pF \pm 0.25pF | |
| C3 | CC45TH1H220J | Ceramic 22pF \pm 5% | |
| C4 | CE0W1A470 | Electrolytic 47 μ F 10WV | |
| C5 | CC45UJ1H560J | Ceramic 56pF \pm 5% | |
| C6 | CC45UJ1H270J | Ceramic 27pF \pm 5% | |
| C9 | CC45TH1H150J | Ceramic 15pF \pm 5% | |
| C10 | CC45TH1H030C | Ceramic 3pF \pm 0.25pF | |
| C11 | CC45TH1H220J | Ceramic 22pF \pm 5% | |
| C12 | CE04W1A470 | Electrolytic 47 μ F 10WV | |
| C13 | CC45TH1H330J | Ceramic 33pF \pm 5% | |
| C14 | CC45TH1H470J | Ceramic 47pF \pm 5% | |
| C17 | CC45TH1H270J | Ceramic 27pF \pm 5% | |
| C18 | CC45UJ1H220J | Ceramic 22pF \pm 5% | |
| C19 | CE04W1A470 | Electrolytic 47 μ F 10WV | |
| C20 | CC45UJ1H101J | Ceramic 100pF \pm 5% | |
| C21 | CC45UJ1H220J | Ceramic 22pF \pm 5% | |
| C24 | CE04W1C100 | Electrolytic 10 μ F 16WV | |
| C25 | CC45TH1H270J | Ceramic 27pF \pm 5% | |
| C26 | CC45TH1H150J | Ceramic 15pF \pm 5% | |
| C27 | CC45TH1H220J | Ceramic 22pF \pm 5% | |
| C28 | CE04W1A470 | Electrolytic 47 μ F 10WV | |
| C29,30 | CC45UJ1H560J | Ceramic 56pF \pm 5% | |
| C33 | CC45TH1H270J | Ceramic 27pF \pm 5% | |
| C34 | CC45TH1H100D | Ceramic 10pF \pm 0.5pF | |
| C35 | CC45TH1H220J | Ceramic 22pF \pm 5% | |
| C36 | CE04W1A470 | Electrolytic 47 μ F 10WV | |
| C37 | CC45RH1H390J | Ceramic 39pF \pm 5% | |
| C38 | CC45SH1H560J | Ceramic 56pF \pm 5% | |
| C40 | CC45CH1H100D | Ceramic 10pF \pm 0.5pF | |
| C41 | CC45CH1H020C | Ceramic 2pF \pm 0.25pF | |
| C43,44 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C45 | CC45SL1H151J | Ceramic 150pF \pm 5% | |
| C47 | CC45SL1H271J | Ceramic 270pF \pm 5% | |
| C48 | CC45SL1H121J | Ceramic 120pF \pm 5% | |
| C50,51 | CC45SL1H390J | Ceramic 39pF \pm 5% | |
| C53 | CE04W1C100 | Electrolytic 10 μ F 16WV | |
| C54,55 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C57,58 | CC45SL1H221J | Ceramic 220pF \pm 5% | |
| C59 | CQ92M1H122K | Mylar 1200pF \pm 10% | |
| C60 | CC45SL1H390J | Ceramic 39pF \pm 5% | |
| C61,62 | CC45SL1H820J | Ceramic 82pF \pm 5% | |
| C63 | CC45SL1H390J | Ceramic 39pF \pm 5% | |
| C65 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C70 | CC45SL1H120J | Ceramic 12pF \pm 5% | |
| C71 | VACANT | | |
| C73 | CC45CH1H010C | Ceramic 1pF \pm 0.25pF | |
| C74 | CC45CH1H050C | Ceramic 5pF \pm 0.25pF | |
| C76 | CC45SL1H271J | Ceramic 270pF \pm 5% | |
| C77 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C78 | CE04W1A101 | Electrolytic 100 μ F 10WV | |
| C79 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C80 | CQ92M1H104K | Mylar 0.1 μ F \pm 10% | |
| C81 | CQ92M1H102K | Mylar 1000pF \pm 10% | |
| C82,83 | C90-0262-05 | Ceramic 0.047 μ F 25WV | |
| C84 | CE04W0J101 | Electrolytic 100 μ F 6.3WV | |
| C89 | CE04W1A470 | Electrolytic 47 μ F 10WV | |
| C90 | VACANT | | |
| C95 | CC45RH1H330J | Ceramic 33pF \pm 5% | |

PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|----------|------------------------------|---------------------|--------------|
| C96 | CC45RH1H150D | Ceramic 15pF ±0.5pF | |
| C97 | CC45RH1H330J | Ceramic 33pF ±5% | |
| C100 | CC45RH1H150D | Ceramic 15pF ±0.5% | |
| C101 | CC45RH1H040C | Ceramic 4pF ±0.25pF | |
| C102 | CC45RH1H150D | Ceramic 15pF ±0.5pF | |
| C106 | CC45CH1H100D | Ceramic 10pF ±0.5pF | |
| C109 | CC45RH1H470J | Ceramic 47pF ±5% | |
| C110 | CC45RH1H220J | Ceramic 22pF ±5% | |
| C112 | CC45RH1H560J | Ceramic 56pF ±5% | |
| C113 | CC45SL1H070D | Ceramic 7pF ±0.5pF | |
| C114 | CC45RH1H390J | Ceramic 39pF ±5% | |
| C117 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C118 | CC45CH1H100D | Ceramic 10pF ±0.5pF | |
| C119 | CC45RH1H470J | Ceramic 47pF ±5% | |
| C127 | CC45RH1H070D | Ceramic 7pF ±0.5% | |
| R1~92 | RD14CB2E000J RD14BB2E000J | | |
| R77 | NOT USED | | |

SEMICONDUCTOR

| | | | |
|--------|-------------|------------|-------------|
| Q1.2 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q3 | V03-0368-05 | Transistor | 2SC784 (O) |
| Q4.5 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q6 | V03-0368-05 | Transistor | 2SC784 (O) |
| Q7.8 | V03-1959-06 | Transistor | 2SC1959 (Y) |
| Q9 | V03-1815-06 | Transistor | 2SC1815 (Y) |
| Q10.11 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q12 | V30-1048-06 | IC | SN16913P |
| Q13.14 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q15 | V30-1046-06 | IC | HD74LS00P |
| Q16 | V30-1037-06 | IC | HD74LS163N |
| Q17~19 | V03-1775-06 | Transistor | 2SC1775 (E) |
| Q20 | V30-0173-05 | IC | MC4044P |
| Q21 | V03-1815-06 | Transistor | 2SC1815 (Y) |
| Q22 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q23 | V09-0079-05 | FET | 3SK40 (L) |
| Q24.25 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q26 | V30-1048-06 | IC | SN16913P |
| Q27 | V03-1815-06 | Transistor | 2SC1815 (Y) |
| D1~4 | V11-0076-05 | Diode | 1S1555 |
| D5 | V11-4161-36 | Diode | 1SV53A |
| D6 | V11-0370-05 | Diode | 1S1587 |
| D7 | V11-4161-36 | Varicap | 1SV53A |
| D8 | V11-0370-05 | Diode | 1S1587 |
| D9 | V11-4161-36 | Varicap | 1SV53A |
| D10 | V11-0414-05 | Diode | 1S2588 |
| D11 | V11-4161-36 | Varicap | 1SV53A |
| D12 | V11-0370-05 | Diode | 1S1587 |
| D13 | V11-4161-36 | Varicap | 1SV53A |
| D14 | V11-0370-05 | Diode | 1S1587 |
| D15 | V11-0370-05 | Diode | 1S1587 |
| D16 | NOT USED | | |
| D17~21 | V11-0370-05 | Diode | 1S1587 |
| D22.23 | V11-0076-05 | Diode | 1S1555 |
| D24~27 | V11-0370-05 | Diode | 1S1587 |

POTENTIOMETER

| | | | |
|-----|-------------|-------|----------|
| VR1 | R12-5014-05 | 100kΩ | Spurious |
|-----|-------------|-------|----------|

INDUCTOR/COIL

| | | | |
|--------|-------------|----------------|-------|
| L1~8 | L40-1511-03 | Ferri-inductor | 150μH |
| L9 | L40-4701-03 | Ferri-inductor | 47μH |
| L10 | L40-1592-02 | Ferri-inductor | 1.5μH |
| L11.12 | L40-1092-02 | Ferri-inductor | 1μH |

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|-------------|-------------------|--------------|
| L13 | L40-1292-02 | Ferri-inductor | 1.2μH |
| L14 | L40-2701-03 | Ferri-inductor | 27μH |
| L15 | L40-4711-03 | Ferri-inductor | 470μH |
| L16 | L40-1511-03 | Ferri-inductor | 150μH |
| L17 | L40-1011-03 | Ferri-inductor | 100μH |
| L18 | L40-1511-03 | Ferri-inductor | 150μH |
| L19~21 | L40-2701-03 | Ferri-inductor | 27μH |
| L22~24 | L40-1511-03 | Ferri-inductor | 150μH |
| L25 | L40-1001-03 | Ferri-inductor | 10μH |
| L26 | L40-4711-03 | Ferri-inductor | 470μH |
| L27 | L40-1511-03 | Ferri-inductor | 150μH |
| L28 | L40-1001-03 | Ferri-inductor | 10μH |
| L29.30 | L40-1511-03 | Ferri-inductor | 150μH |
| T1 | L32-0199-05 | OSC coil | 14 MHz |
| T2 | L32-0197-05 | OSC coil | 21 MHz |
| T3 | L32-0198-05 | OSC coil | 28 MHz |
| T4 | L32-0195-05 | OSC coil | 7 MHz |
| T5 | L32-0193-05 | OSC coil | 3.5 MHz |
| T6 | L34-0529-05 | Trap coil | 8.83 MHz |
| T7 | L34-0714-05 | Tuning coil | |
| T8 | L34-0715-05 | Tuning coil | |
| T9 | L34-0716-05 | Tuning coil | |
| T10 | L34-0717-05 | Tuning coil | |
| T11 | L34-0718-05 | Tuning coil | |
| T12 | L34-0757-05 | Tuning coil | |
| T13 | L34-0711-05 | Tuning coil | |
| T14 | L34-0709-05 | Tuning coil | 10 MHz |
| T15 | L34-0710-05 | Tuning coil | 20 MHz |
| T17 | L34-0712-05 | Tuning coil | |
| T18 | L34-0713-05 | Tuning coil | |
| MISCELLANEOUS | | | |
| - | E23-0046-04 | Terminal (square) | |

CAR UNIT (X50-1500-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|--------------|-------------------------------|--------------|
| CAPACITOR | | | |
| C2 | CC45UJ1H220J | Ceramic 22pF ±5% | |
| C3 | CC45UJ1H270J | Ceramic 27pF ±5% | |
| C4 | CC45UJ1H220J | Ceramic 22pF ±5% | |
| C7.8 | VACANT | | |
| C9 | CS15E1VR22M | Tantalum 0.22μF 35WV | |
| C13 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C14 | CC45CH1H020C | Ceramic 2pF ±0.25pF | |
| C15 | CC45CH1H330J | Ceramic 33pF ±5% | |
| C16 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| RESISTOR | | | |
| R1~21 | RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| SEMICONDUCTOR | | | |
| Q1.2 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q3 | V03-1959-06 | Transistor | 2SC1959 (Y) |
| D1.2 | V11-0076-05 | Diode | 1S1555 |
| D3 | V11-4161-36 | Varicap | 1SV53A |
| D4~6 | V11-0076-05 | Diode | 1S1555 |
| POTENTIOMETER | | | |
| VR1.2 | R12-1012-05 | 1kΩ (B) | |

PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|-------------|---------------------------|--------------|
| MISCELLANEOUS | | | |
| TC1,2 | C05-0056-05 | Ceramic trimmer 30pF | |
| X1 | L77-0485-05 | Quartz crystal 8831.5 kHz | |
| X2 | L77-0486-05 | Quartz crystal 8828.5 kHz | |
| L1~3 | L40-1511-03 | Ferri-inductor 150μH | |
| L4 | L33-0266-05 | Choke coil 28μH | |
| L5~7 | L40-1511-03 | Ferri-inductor 150μH | |
| T1 | L32-0201-05 | OSC coil | |

FILTER UNIT (X51-1200-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------|--------------|-------------------------------|--------------|
| C1 | CM93D2H821J | Mica 820pF ±5% | |
| C2,3 | CM93D2H122J | Mica 1200pF ±5% | |
| C4 | CM93D2H561J | Mica 560pF ±5% | |
| C5 | CM93D2H331J | Mica 330pF ±5% | |
| C6 | CM93D2H621J | Mica 620pF ±5% | |
| C7 | CM93D2H331J | Mica 330pF ±5% | |
| C8 | CM93D2H271J | Mica 160pF ±5% | |
| C9 | CM93D2H331J | Mica 330pF ±5% | |
| C10 | CM93D2H161J | Mica 160pF ±5% | |
| C11 | CM93D2H121J | Mica 120pF ±5% | |
| C12 | CM93D2H221J | Mica 220pF ±5% | |
| C13 | CM93D2H121J | Mica 120pF ±5% | |
| C14 | CM93D2H820J | Mica 82pF ±5% | |
| C15 | CM93D2H161J | Mica 160pF ±5% | |
| C16 | CM93D2H131J | Mica 130pF ±5% | |
| C17,18 | NOT USED | | |
| C20 | CC45SL2H221J | Ceramic 220pF ±5% | |
| C21 | CC45CH2H030J | Ceramic 3pF ±0.25 pF | |
| C22 | CC45CH1H680J | Ceramic 68pF ±5% | |
| C24 | C91-0456-05 | Ceramic 0.047μF 25 WV | |
| C25 | CE04W1HR47 | Electrolytic 0.47μF 50WV | |
| C27 | CE04W1H010 | Electrolytic 1μF 50WV | |
| C28 | CE04W1C100 | Electrolytic 10μF 16WV | |
| C29 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C31,32 | NOT USED | | |
| C35 | CE04W1C221 | Electrolytic 220μF 16WV | |
| C36 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C38 | NOT USED | | |
| C41 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C42 | CM93D2H101J | Mica 100pF ±5% | |
| R~33 | RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| R6,7 | NOT USED | | |
| R23 | RC05GF2H151J | Solid resistor 150Ω ±5% 1/2W | |
| R33 | RD14BB2E820J | Carbon resistor 82Ω ±5% 1/4W | |
| Q1~5 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q6 | V01-0032-05 | Transistor 2SA562 (Y) | |
| Q7,8,9 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q10 | V01-0473-06 | Transistor 2SA473 (Y) | |
| D1,2 | V11-0051-05 | Diode 1N60 | |
| D3 | V11-4161-06 | Zener diode WZ-044 | |
| D4 | V11-0076-05 | Diode 1S1555 | |
| D5 | V11-0243-05 | Zener diode WZ-061 | |
| D6,7 | V11-0076-05 | Diode 1S1555 | |
| D8 | V11-0240-05 | Zener diode WZ-090 | |
| D9 | V11-0076-05 | Diode 1S1555 | |
| D10 | V11-0243-05 | Zener diode WZ-061 | |

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|-------------------------|--------------|
| D11 | V11-0240-05 | Zener diode WZ-090 | |
| D12 | V11-0076-05 | Diode 1S1555 | |
| D13 | V11-0240-05 | Zener Diode WZ-090 | |
| D14 | V11-0076-05 | Diode 1S1555 | |
| VR1 | R12-4016-05 | Potentiometer 50kΩ (B) | |
| VR2 | R12-3025-05 | Potentiometer 10kΩ (B) | |
| VR3 | R12-4016-05 | Potentiometer 50kΩ (B) | |
| VR4 | R12-0042-05 | Potentiometer 500Ω (B) | |
| VR5 | R12-1020-05 | Potentiometer 1kΩ (B) | |
| TC1 | C05-0043-05 | Ceramic trimmer 20pF | |
| RL1 | S51-4402-05 | Relay | |
| L1~3 | L34-0826-05 | Filter coil (A) | ☆ |
| L4,5 | L34-0827-05 | Filter Coil (B) | ☆ |
| L6,7 | L34-0828-05 | Filter coil (C) | ☆ |
| L8,9 | L34-0829-05 | Filter coil (D) | ☆ |
| L10,11 | L34-0830-05 | Filter coil (E) | ☆ |
| L12 | L40-1021-03 | Ferri-inductor 1mH | |
| L13 | | | |
| L14,15 | L40-1021-03 | Ferri-inductor 1mH | |
| L16,17 | L40-1511-03 | Ferri-inductor 150μH | |
| L18 | L39-0406-05 | Detector coil | ☆ |
| L19 | L40-1511-03 | Ferri-inductor 150μH | |
| - | E23-0046-04 | Terminal (square) × 4 | |
| - | E23-0401-05 | Terminal (circle) × 24 | |
| - | F20-0078-05 | Insulating mica | |
| - | F29-0014-05 | Shoulder washer | |
| - | J31-0502-04 | Board stand (color) × 6 | |
| - | J42-0404-05 | Board stand (bush) × 6 | |

COUNTER UNIT (X54-1360-00)

| Ref. No. | Parts No. | Description | Re- marks |
|------------------|--------------|--------------------------|--------------|
| CAPACITOR | | | |
| C1 | CC45CH1H330J | Ceramic 33pF ±5% | |
| C2 | CC45SL1H391J | Ceramic 390pF ±5% | |
| C3 | CC45CH1H470J | Ceramic 47pF ±5% | |
| C4 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C5 | CC45SL1H150J | Ceramic 15pF ±5% | |
| C6 | CC45SL1H020C | Ceramic 2pF ±0.25pF | |
| C7 | CC45SL1H100D | Ceramic 10pF ±0.5pF | |
| C10 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C11 | CE04W0J101Q | Electrolytic 100μF 6.3WV | |
| C12 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C13 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C14 | CC45SL1H390J | Ceramic 39pF ±5% | |
| C15 | CC45SL1H330J | Ceramic 33pF ±5% | |
| C16 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C17 | CC45SL1H221J | Ceramic 220pF ±5% | |
| C18 | CC45SL1H220J | Ceramic 22pF ±5% | |
| C19 | CC45SL1H050C | Ceramic 5pF ±0.25pF | |
| C20 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C21 | CC45SL1H101J | Ceramic 100pF ±5% | |
| C22 | CC45SL1H270J | Ceramic 27pF ±5% | |
| C23 | CC45SL1H560J | Ceramic 56pF ±5% | |

PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|--------------|-------------------------------|--------------|
| C24 | CC45SL1H270J | Ceramic 27pF ±5% | |
| C25 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C26 | NOT USED | | |
| C27,28 | CC45SL1H470J | Ceramic 47pF ±5% | |
| C29 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C31 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C32 | CC45SL1H121J | Ceramic 120pF ±5% | |
| C33 | CC45SL1H271J | Ceramic 270pF ±5% | |
| C34 | CC45SL1H121J | Ceramic 120pF ±5% | |
| C36 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C38~40 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C41 | CE04W0J101Q | Electrolytic 100μF 6.3WV | |
| C44 | CQ92M1H152K | Mylar 1500pF ±10% | |
| C45,56 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C47,48 | CE04W0J221Q | Electrolytic 220μF 6.3WV | |
| C49 | CE04W1V100Q | Electrolytic 10μF 35WV | |
| C51~53 | CE04W1V100Q | Electrolytic 10μF 35WV | |
| C55~58 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| RESISTOR | | | |
| R1~57 | RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| R13 | NOT USED | | |
| RB1 | R90-0506-05 | (47kΩ + 47kΩ) × 6 | |
| RB2,3 | R90-0521-05 | 47kΩ × 7 | |
| RB4,5 | R90-0522-05 | 47kΩ × 6 | |
| SEMICONDUCTOR | | | |
| Q1~5 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q6 | V03-0473-05 | Transistor 2SC785 (O) | |
| Q7 | V09-1002-46 | FET 3SK73 (GR) | |
| Q8~10 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| Q11,12 | V03-1959-06 | Transistor 2SC1959 (Y) | |
| Q13 | V03-1815-06 | Transistor 2SC1815 (Y) | |
| IC1 | V30-1005-26 | IC SN74LS90N | |
| IC2 | V30-1040-06 | IC TC5026BP | |
| IC3,4 | V30-1039-06 | IC TC4518BP | |
| IC5 | V30-1050-06 | IC TC4027BP | |
| IC6,7 | V30-1030-06 | IC TC4011BP | |
| IC8 | V30-1055-06 | IC TC5051BP | |
| IC9 | V30-1051-06 | IC TC4029BP | |
| IC10 | V30-1052-06 | IC TC4042BP | |
| IC11~13 | V30-1049-06 | IC TC4019BP | |
| IC14 | V30-1009-26 | IC TC4049BP | |
| IC15 | V30-1054-06 | IC TC5022BP | |
| IC16 | V30-1057-06 | IC TC5066BP | |
| IC18 | V30-1053-06 | IC TC5012BP | |
| IC19 | V30-1056-06 | IC TC5064BP | |
| D1 | V11-0240-05 | Zener diode WZ-090 | |
| D2 | VACANT | | |
| D3~18 | V11-0076-05 | Diode 1S1555 | |
| D19 | V11-4160-86 | Zener diode WZ-071 | |
| D20 | V11-4162-66 | Zener diode XZ-060 | |
| D21~24 | V11-0076-05 | Diode 1S1555 | |
| D25 | V21-0004-05 | Varistor MV-13 | |
| MISCELLANEOUS | | | |
| — | V40-7760-05 | Indicating tube 9-BT-12 | ☆ |
| TC1 | C05-0035-05 | Ceramic trimmer 50pF | |
| L1,2 | L40-4711-03 | Ferri-inductor 470μH | |
| L3,4 | L40-4701-03 | Ferri-inductor 47μH | |
| L5 | L40-4711-03 | Ferri-inductor 470μH | |
| L6,7 | L40-2711-03 | Ferri-inductor 270μH | |
| L8 | L40-4711-03 | Ferri-inductor 470μH | |
| L9 | L33-0616-05 | Choke coil 43μH | ☆ |

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|------------------------|--------------|
| L10,11 | L40-4711-03 | Ferri-inductor 470μH | |
| L12,13 | L40-1511-03 | Ferri-inductor 150μH | |
| T1 | L19-0305-05 | Oscillator transformer | ☆ |
| X2 | L77-0482-05 | Quartz crystal 10 MHz | |
| — | E31-0430-15 | Ribbon conductor | |

FINAL UNIT (X56-1350-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------|------------------------------|-------------------------------|--------------|
| C1 | C91-0455-05 | Ceramic 0.01μF 25WV | |
| C3 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C4 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C5 | CK45B1H102K | Ceramic 0.001μF ±10% | |
| C6 | C91-0455-05 | Ceramic 0.01μF 25WV | |
| C7 | NOT USED | | |
| C10 | CK45B1H102K | Ceramic 0.001μF ±10% | |
| C11 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C12 | CE04W1E100 | Electrolytic 10μF 25WV | |
| C13,14 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C15 | CM93AD2H151J | Mica 150pF ±5% | |
| C16,17 | CK45B1H102K | Ceramic 0.001μF ±10% | |
| C18,19 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C20 | CE04W1E101 | Electrolytic 100μF 25WV | |
| C21 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C22 | NOT USED | | |
| C23 | CK45B1H102K | Ceramic 0.001μF ±10% | |
| C24 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C25 | CE04W1E100 | Electrolytic 10μF 25WV | |
| C26~29 | CK45B1H222KMU | Ceramic 0.0022μF ±10% | |
| C30~32 | NOT USED | | |
| C33,34 | C91-0448-05 | Ceramic 0.68μF | |
| C35 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C36 | CK45B1H102K | Ceramic 0.001μF ±10% | |
| C37 | CE04W1H101Q | Electrolytic 100μF 50WV | |
| C38 | C91-0456-05 | Ceramic 0.047μF 25WV | |
| C39 | CM93AD2H271J | Mica 270pF ±5% | |
| C40 | CM93AD2H331J | Mica 330pF ±5% | |
| C41~43 | C91-0455-05 | Ceramic 0.01μF 25WV | |
| C44 | CM93AD2H271J | Mica 270pF ±5% | |
| C45,46 | CK45B1H222KNU | Ceramic 0.0022μF ±10% | |
| C47 | CM93AD2H331J | Mica 330pF ±5% | |
| C48,49 | CK45B1H222KMU | Ceramic 0.0022μF ±10% | |
| C50 | CC45SL1H220J | Ceramic 22pF ±5% | |
| C51,52 | C90-0455-05 | Ceramic 0.01μF 25WV | |
| C53 | CM93AD2H471T | Mica 470pF ±5% | |
| R1~27 | RD14BB2E000J RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| R3 | RC5GF2H4R7J | Solid resistor 4.7Ω ±5% 1/2W | |
| R12,13 | RC05GF2H101J | Solid resistor 100Ω ±5% 1/2W | |
| R14~17 | RS14AB3A3R9J | Metal film 3.9Ω ±5% 1W | |
| R18~23 | RC05CF2H5R6J | Solid resistor 5.6Ω ±5% 1/2W | |
| Q1 | V03-2075-06 | Transistor 2SC2075 | |
| Q2,3 | V03-2509-06 | Transistor 2SC2509 | |
| Q4,5 | V03-2290-16 | Transistor 2SC2290J | ☆ |
| Q6,7 | V04-0046-05 | Transistor 2SD235 (Y) | |
| D1 | V22-0031-05 | Varistor SV-03 | |
| D2 | V11-4363-36 | Varistor SV-4A | |
| D3 | V22-0031-05 | Varistor SV-03 | |
| D4,5 | V11-0051-05 | Diode 1N60 | |

PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|----------|-------------|------------------------|--------------|
| Th1,2 | V11-3360-16 | Thermistor 25D29 | ☆ |
| Th3 | V11-7762-16 | Thermistor 31D26 | |
| VR1,2 | R12-0058-05 | Potentiometer 470Ω (B) | |
| TM1 | S59-1404-05 | | ☆ |
| TM2 | S59-1403-05 | | ☆ |
| L1 | L40-4701-03 | Ferri-inductor 47μH | |
| L2 | L33-0025-05 | RFC | |
| L3,4 | L33-0032-05 | RFC | |
| L5,6 | NOT USED | | |
| L7 | L33-0617-05 | RFC | |
| L8 | L33-0025-05 | RFC | |
| L9 | L33-0625-05 | RFC | |
| L10~12 | L40-1011-04 | Ferri-inductor 100μH | |
| L13,14 | L40-1021-04 | Ferri-inductor 1mH | |
| T1 | L19-0317-05 | Wide band transformer | ☆ |
| T2 | L19-0311-05 | Input transformer | ☆ |
| T3 | L19-0313-05 | NF Transformer | ☆ |
| T4 | L19-0312-05 | Output transformer | ☆ |
| — | E04-0152-05 | M type receptacle ANT | |
| — | E08-0271-05 | DC socket | |
| — | E23-0043-04 | | |
| — | E23-0046-04 | Terminal (square) × 4 | |
| — | E23-0401-05 | Terminal (circle) × 8 | |
| — | F01-0735-05 | | |
| — | F20-0078-05 | Insulating mica × 3 | |
| — | F29-0014-05 | Shoulder washer × 3 | |
| — | J31-0503-05 | Beads × 4 | |
| — | J32-0730-04 | Hex boss | ☆ |
| — | N14-0509-05 | Wing nut | |

VFO ASS'Y UNIT (X60-1070-00)

| Ref. No. | Parts No. | Description | Re- marks |
|----------------|-------------|-----------------|--------------|
| GENERAL | | | |
| — | B01-0615-05 | Dial escutcheon | |
| — | B10-0612-04 | Front glass (A) | |
| — | B20-0810-04 | Dial scale (A) | |
| — | G01-0804-04 | Coil spring | |
| — | K21-0722-04 | Main knob | |
| — | N19-0608-04 | Washer × 2 | |
| — | X40-1130-00 | VFO unit | |

VFO UNIT (X40-1130-00)

| Ref. No. | Parts No. | Description | Re- marks |
|------------------|--------------|----------------------|--------------|
| CAPACITOR | | | |
| C2 | CC45SL1H390J | Ceramic 39pF ±5% | |
| C3 | CC45CH1H100D | Ceramic 10pF ±0.5pF | |
| C4 | CC45SL1H390J | Ceramic 39pF ±5% | |
| C7 | C90-0262-05 | Ceramic 0.047μF 25WV | |

| Ref. No. | Parts No. | Description | Re- marks |
|----------------------|--------------|-------------------------------|--------------|
| C8 | CC45CH1H020C | Ceramic 2pF ±0.25pF | |
| C10,11 | C90-0262-05 | Ceramic 0.047μF 25WV | |
| C12 | CC45SG1H050C | Ceramic 5pF ±0.25pF | |
| C13 | CC45LG1H470J | Ceramic 47pF ±5% | |
| C14 | CC45LG1H220J | Ceramic 22pF ±5% | |
| C15,16 | CC45LG1H151J | Ceramic 150pF ±5% | |
| C17 | CC45SG1H150J | Ceramic 15pF ±5% | |
| C18 | CC45RG1H120J | Ceramic 12pF ±5% | |
| C19 | CC45LG1H151J | Ceramic 150pF ±5% | |
| C20 | CC45CG1H121J | Ceramic 120pF ±5% | |
| RESISTOR | | | |
| R~14 | RD14CB2E000J | Carbon resistor 000Ω ±5% 1/4W | |
| SEMICONDUCTOR | | | |
| Q1 | V09-0020-05 | FET 3SK22 (Y) | |
| Q2 | V09-0011-05 | FET 2SK19 (Y) | |
| Q3 | V03-0079-05 | Transistor 2SC460 (B) | |
| Q4 | V03-1959-06 | Transistor 2SC1959 (Y) | |
| D4 | V11-0414-05 | Diode 1S2588 | |
| D5 | V1104161-36 | Diode 1SV53A | |
| TRIMMER/VC | | | |
| TC1 | C05-0305-05 | Ceramic trimmer 12pF | |
| TC2 | C05-0013-15 | Ceramic trimmer 20pF | |
| — | C02-0010-05 | Variable capacitor | |
| INDUCTOR/COIL | | | |
| L1,2 | L40-4711-03 | Ferri-inductor 470μH | |
| L3 | L40-1501-03 | Ferri-inductor 15μH | |
| L5~7 | L40-4711-03 | Ferri-inductor 470μH | |
| L8 | L33-0025-05 | Choke coil 1μH | |
| L9 | L32-0609-05 | Oscillator coil B | |
| L10 | L32-0608-05 | Oscillator coil A | |
| MISCELLANEOUS | | | |
| — | B42-1645-04 | Indication tape | |
| — | D22-0405-04 | Coupling | |
| — | D40-0604-05 | Dial mechanism | |
| — | E13-0163-05 | 1P Pin jack | |
| — | E23-0046-04 | Terminal (square) × 4 | |

EXPLODED VIEW/DISASSEMBLY

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RadioAmateur.EU

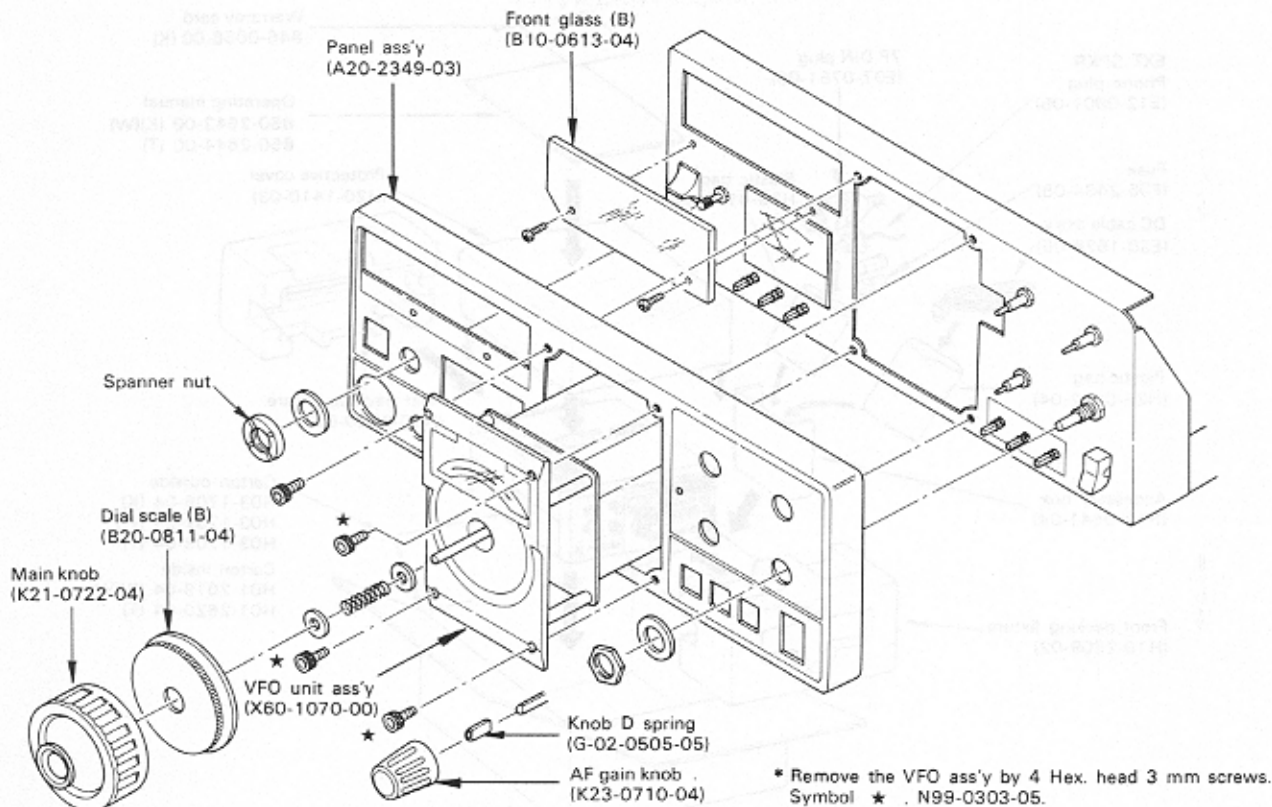


Fig. 7 Front panel exploded view/removing the VFO ass'y

| No. | Description | Parts No. | Remarks |
|-----|-----------------|-------------|--------------|
| 1 | Subpanel | A22-0714-13 | |
| 2 | GND screw | N09-0258-05 | |
| 3 | Rotary switch | S01-1410-05 | MODE |
| 4 | Phone Jack | E11-0034-05 | PHONE |
| 5 | 4P Mic socket | E06-0451-05 | MIC |
| 6 | Paddle switch | S44-2402-05 | STBY |
| 7 | Switch unit (B) | X41-1150-00 | |
| 8 | Meter | B31-0618-05 | |
| 9 | Meter housing | F29-0404-05 | |
| 10 | Potentiometer | R06-9402-05 | MIC CAR |
| 11 | Potentiometer | R06-9402-05 | RF, AF |
| 12 | Potentiometer | R06-9403-05 | RIT IF SHIFT |
| 13 | Gear ass'y | D40-0603-05 | |
| 14 | Seesaw switch | S36-2402-05 | POWER |
| 15 | Switch unit (A) | X41-1140-00 | |
| 16 | Screw | N30-2604-48 | |
| 17 | Screw | N34-3004-48 | |

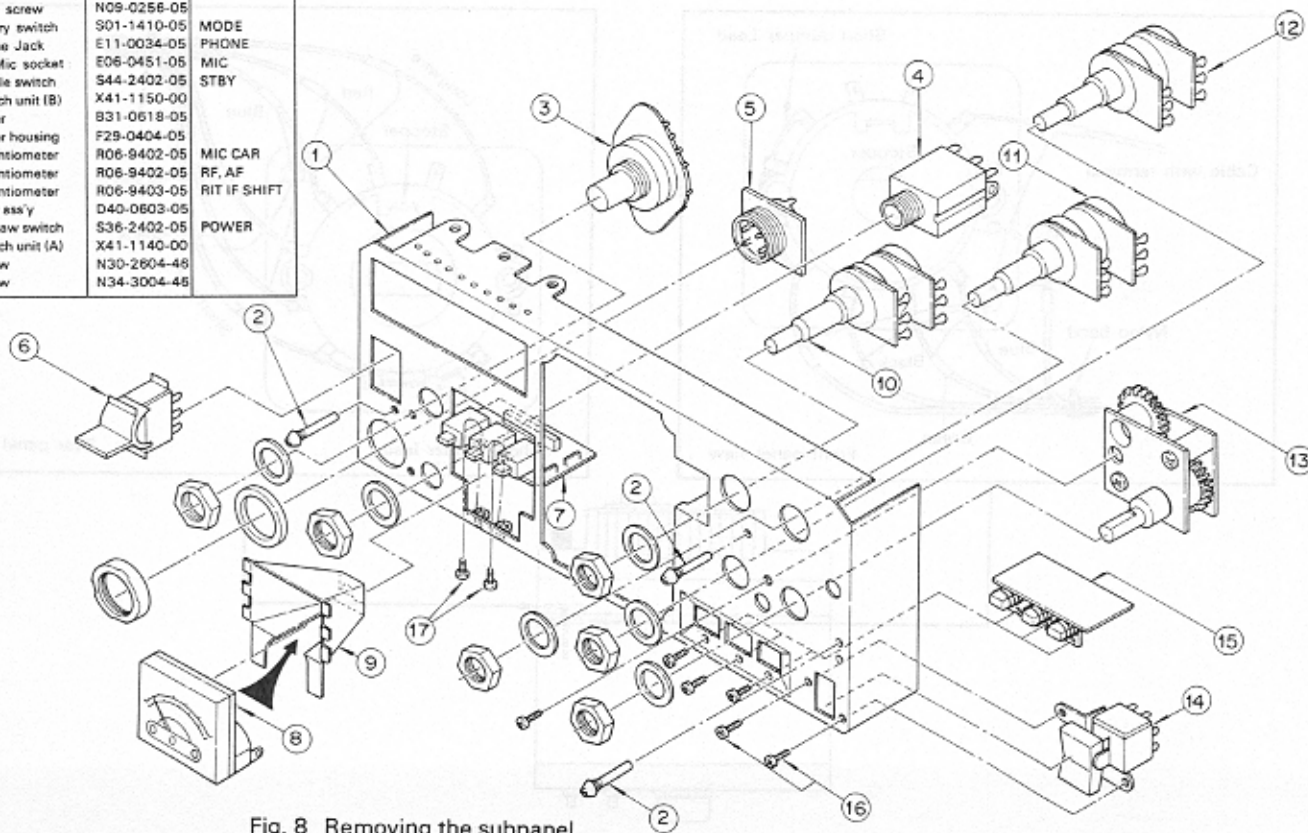


Fig. 8 Removing the subpanel

PACKING / DISASSEMBLY

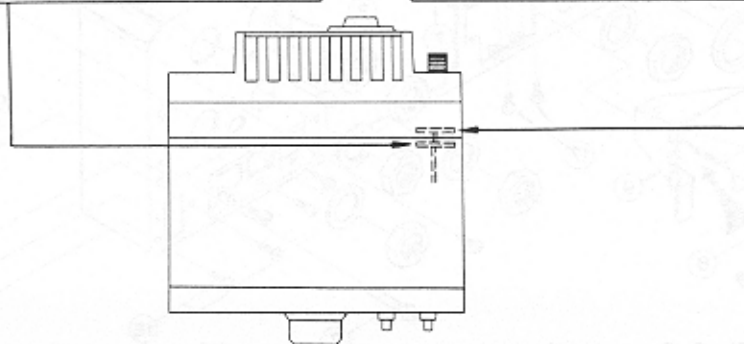
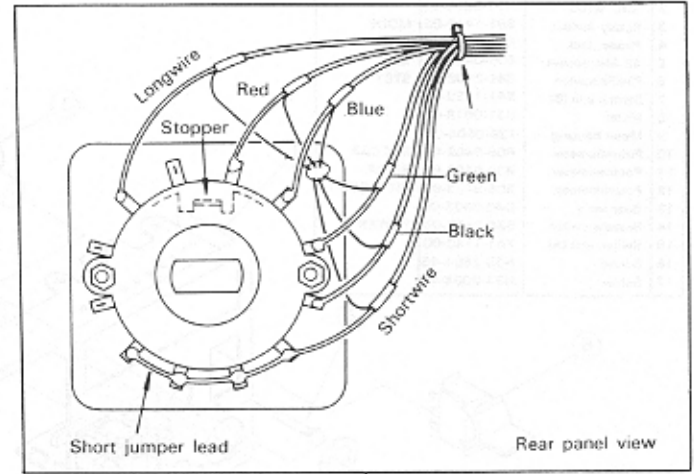
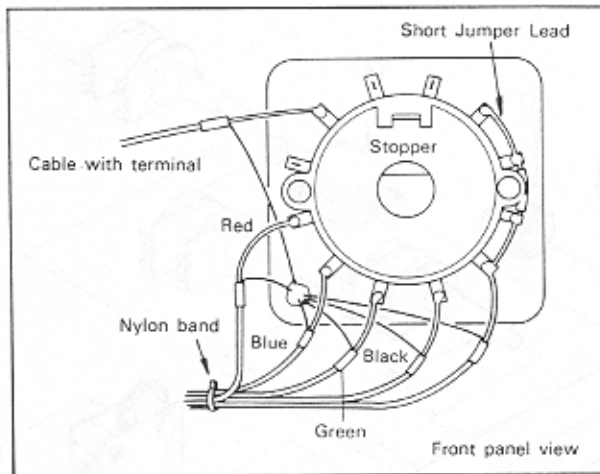
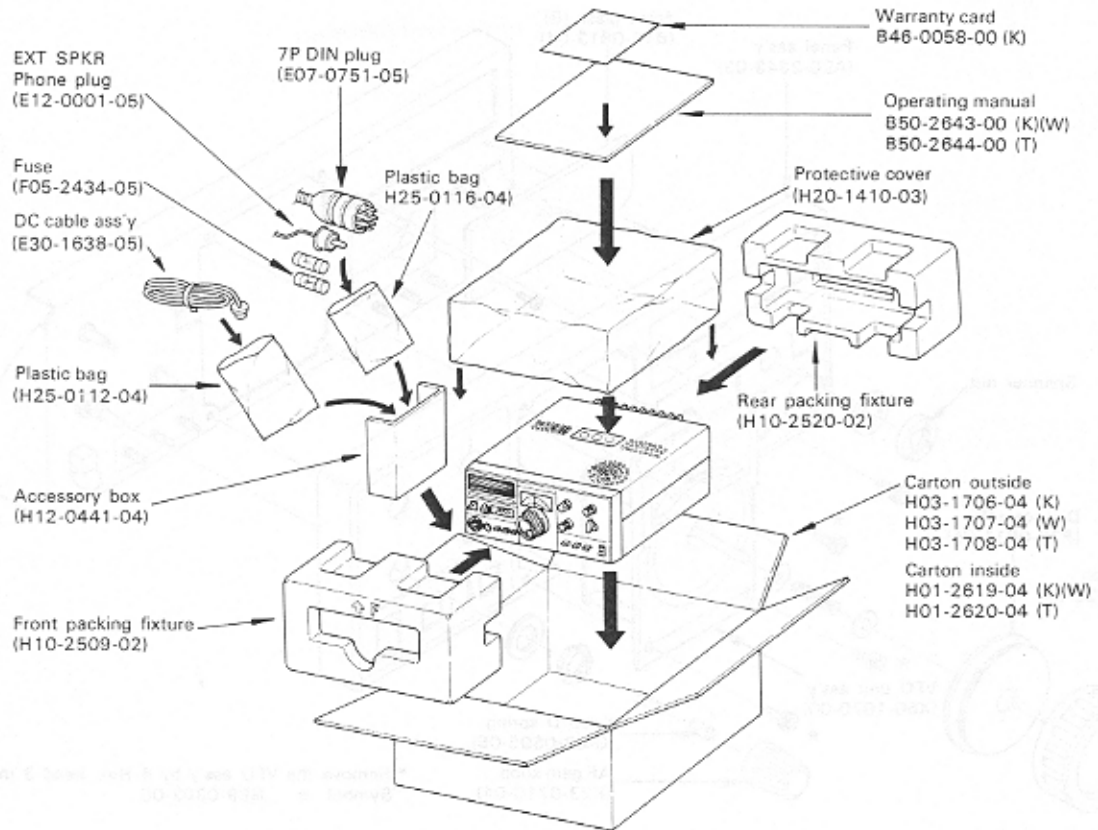


Fig. 6 BAND rotary switch (S01-2417-05) wiring.

DISASSEMBLY

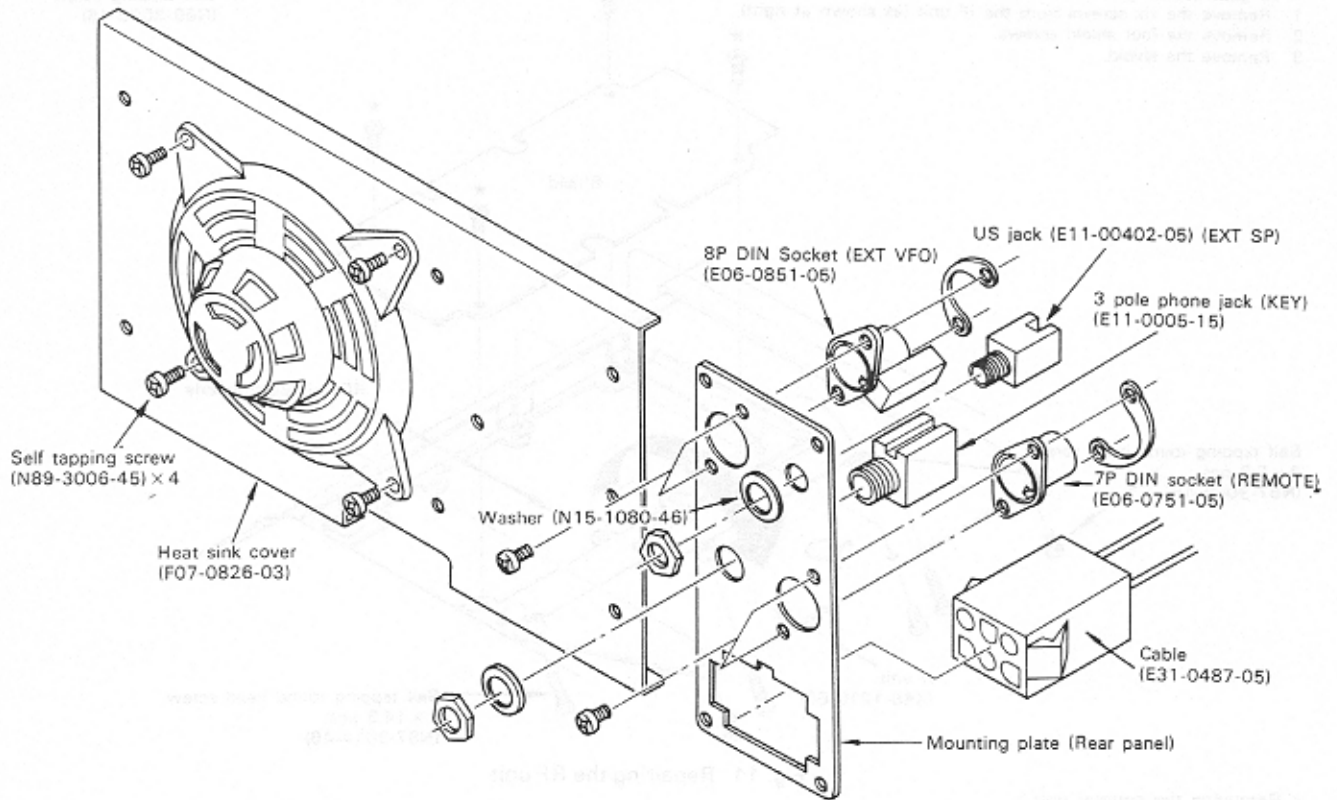


Fig. 9 Heat sink cover and Rear panel disassembly

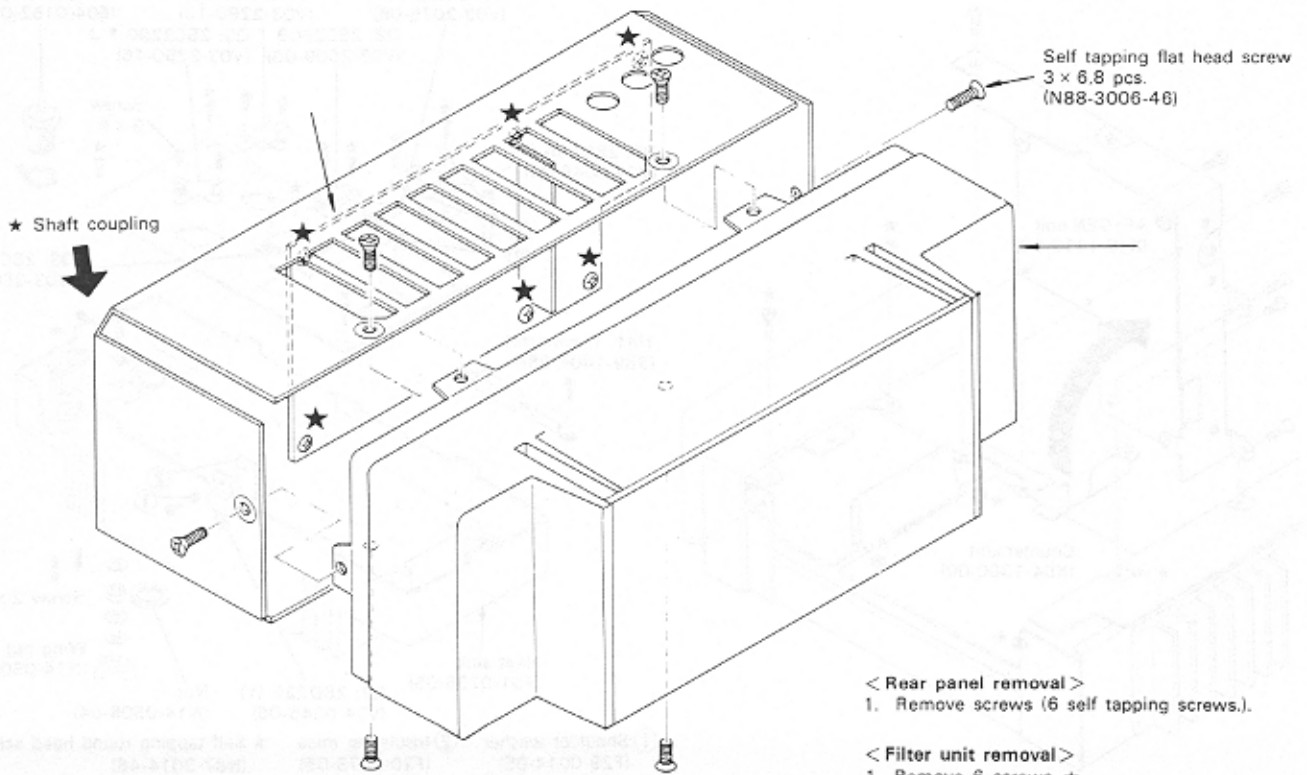


Fig. 10 Rear panel/filter unit removal

DISASSEMBLY

<To gain access to the RF unit>

1. Remove the six screws from the IF unit (as shown at right).
2. Remove the four shield screws.
3. Remove the shield.

★ Self tapping screw
(N89-3005-46)

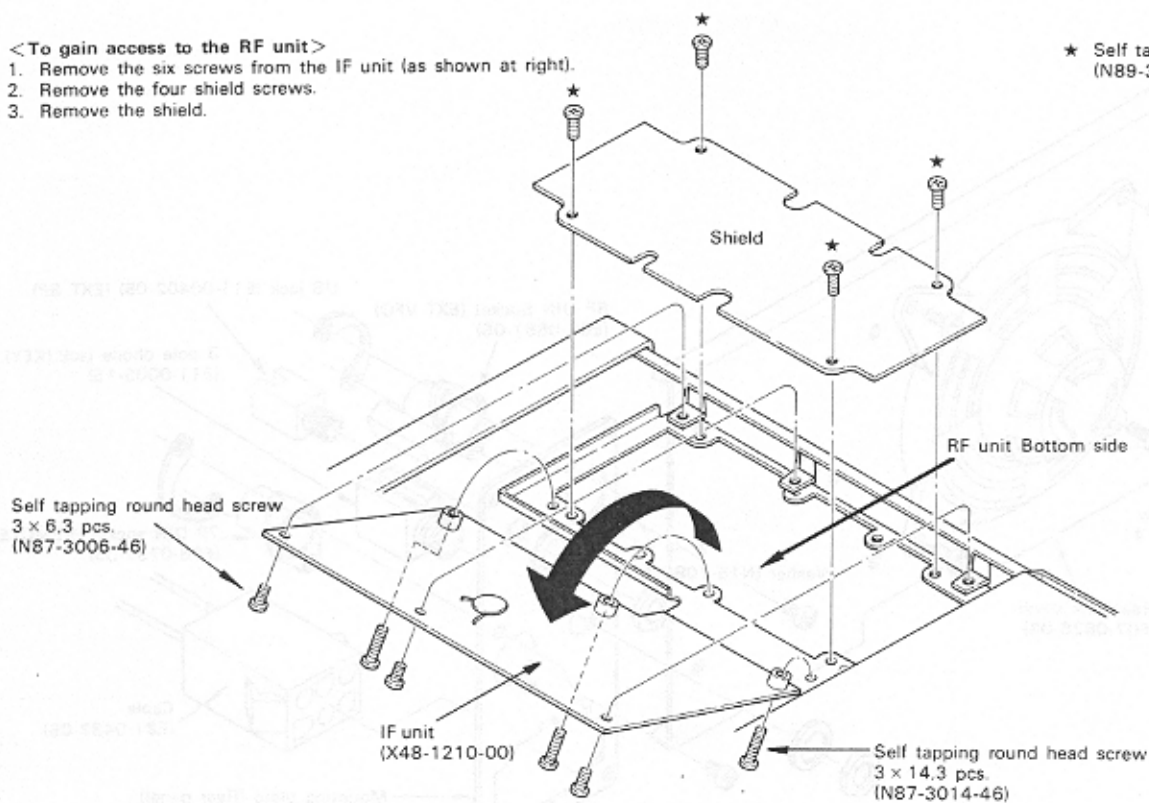


Fig. 11 Repairing the RF unit

<Removing the counter unit>

1. Remove the six screws from the AF-GEN unit (X49-1110-00) (as shown at bottom).
2. Remove screws (★) from the counter unit.

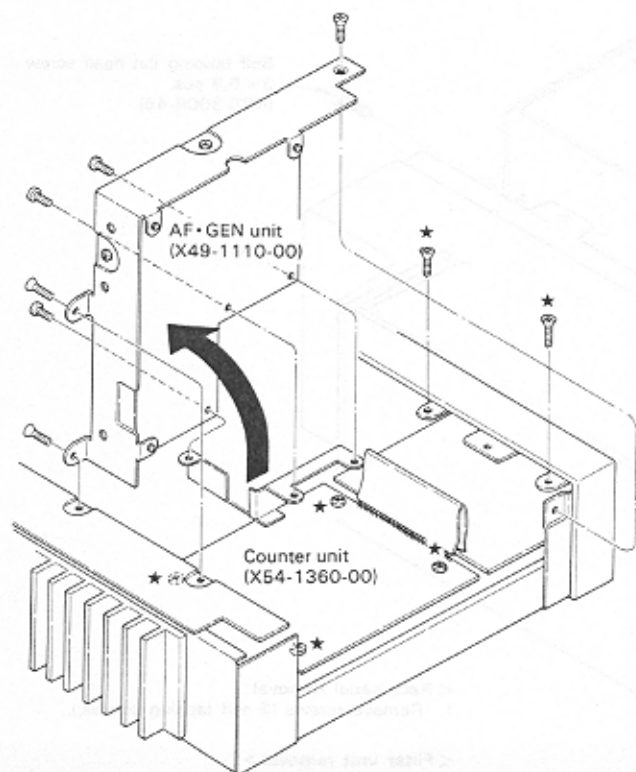


Fig. 12 Removing the counter unit

REMOVING THE FINAL UNIT

Remove Nine screws (★)

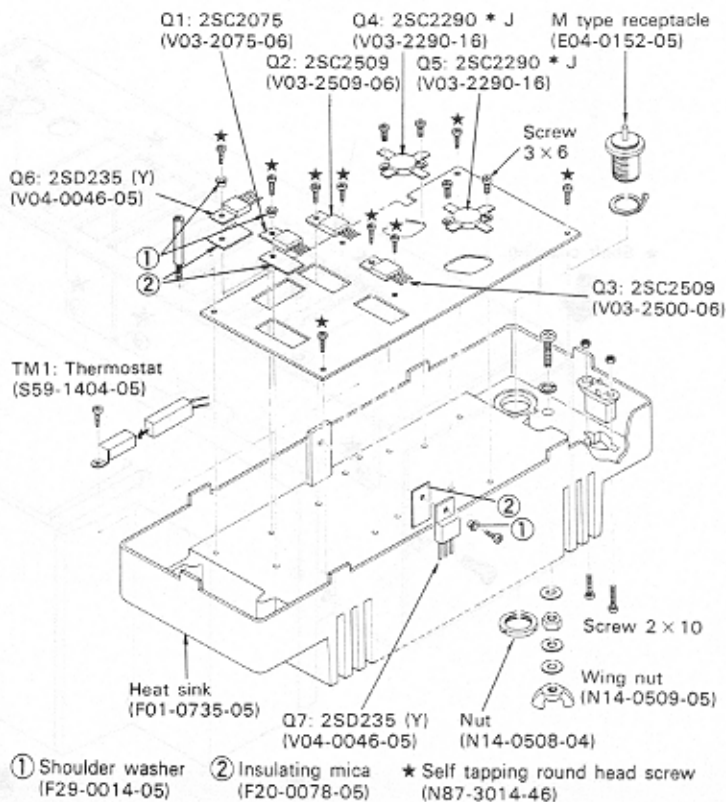
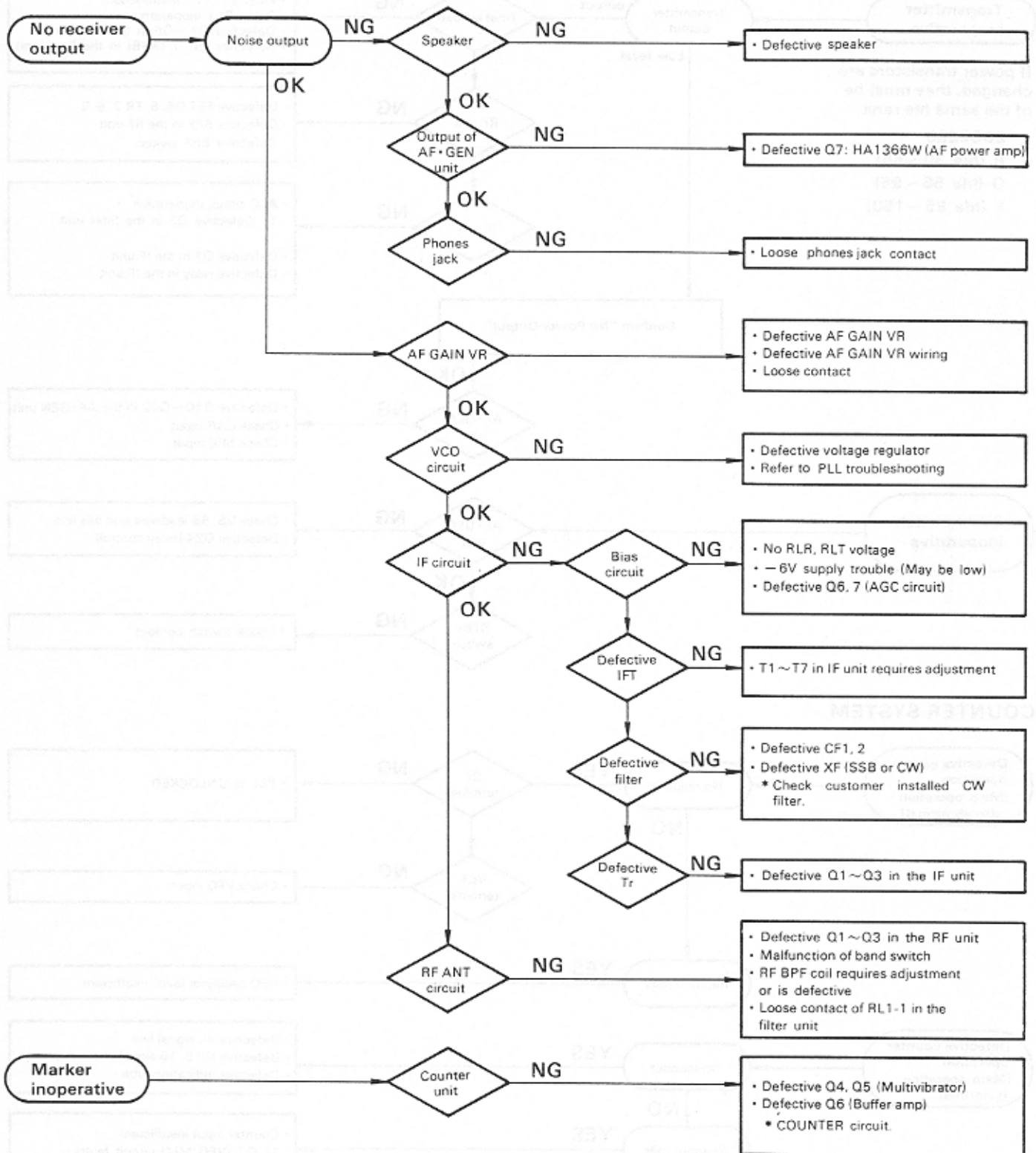


Fig. 13 Final unit disassembly

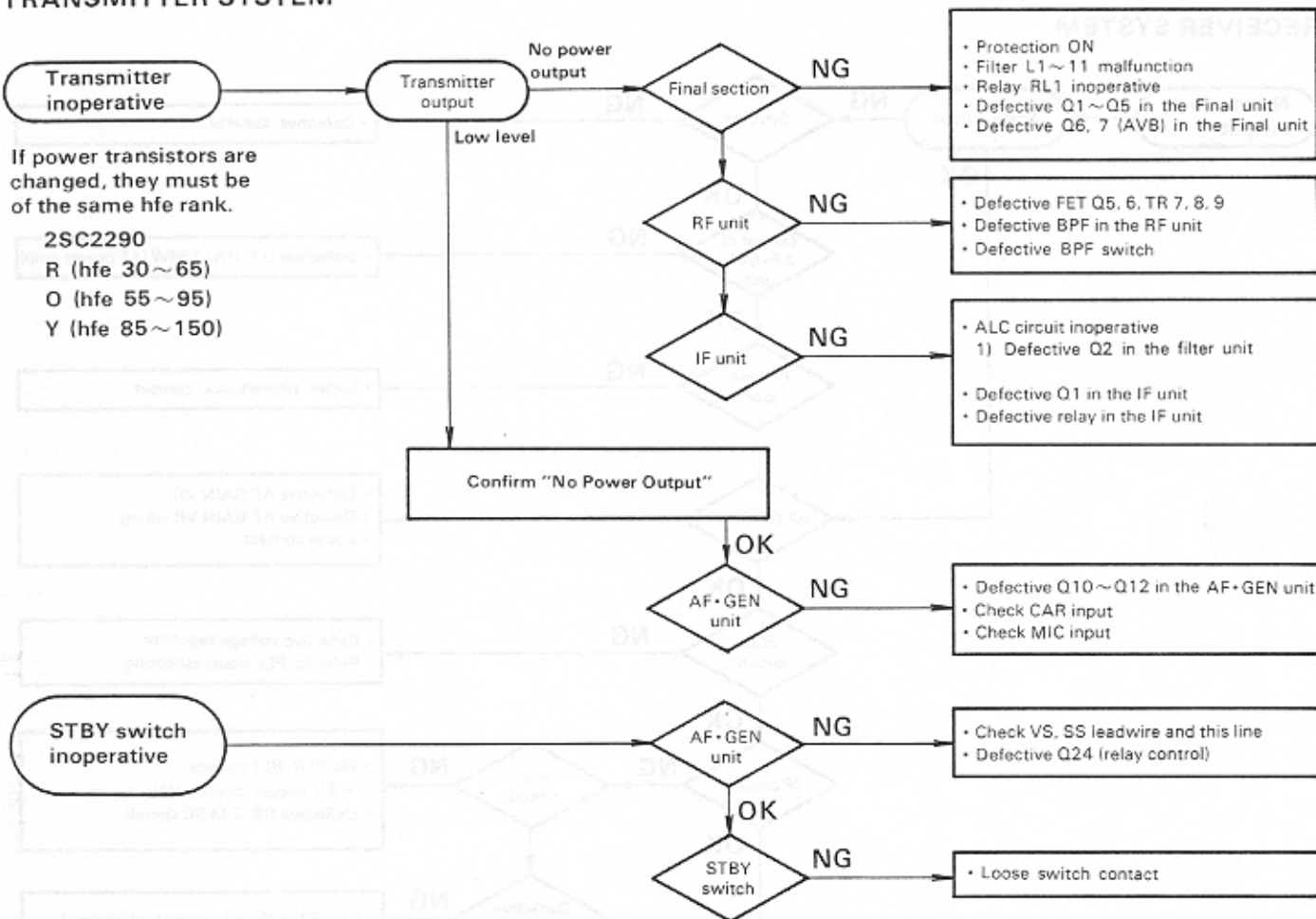
TROUBLE SHOOTING

RECEIVER SYSTEM

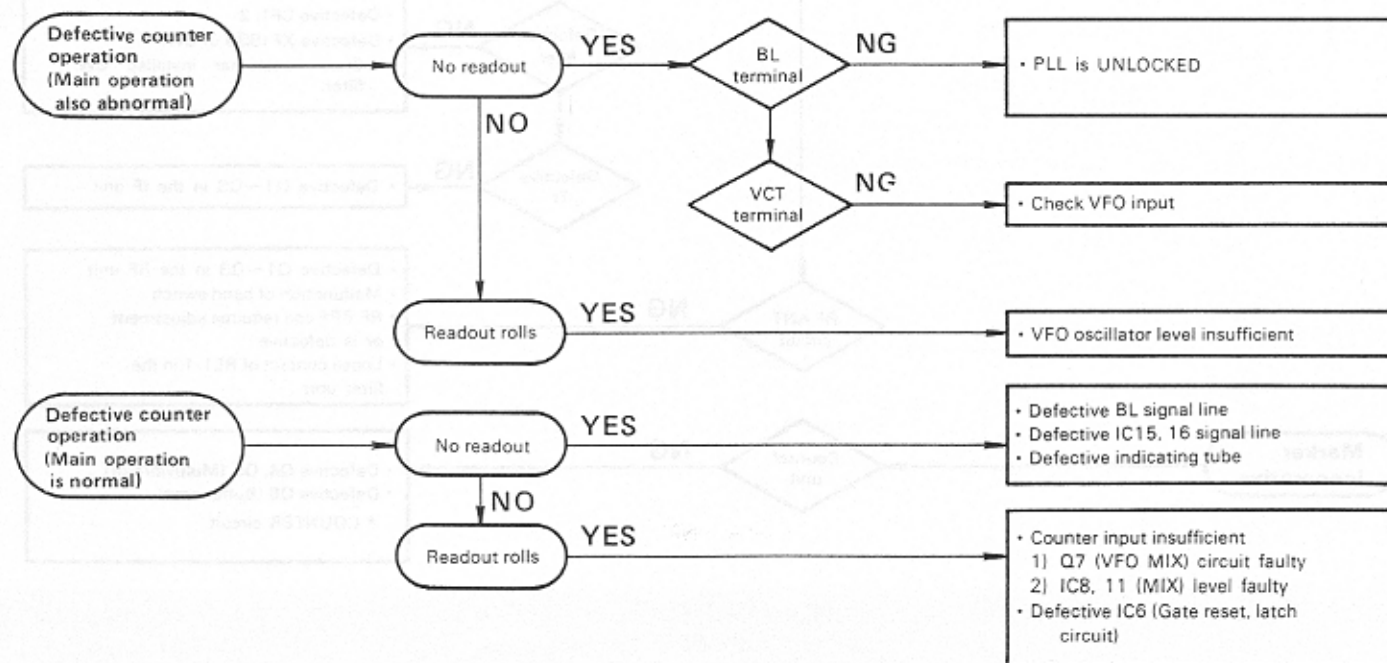


TROUBLE SHOOTING

TRANSMITTER SYSTEM

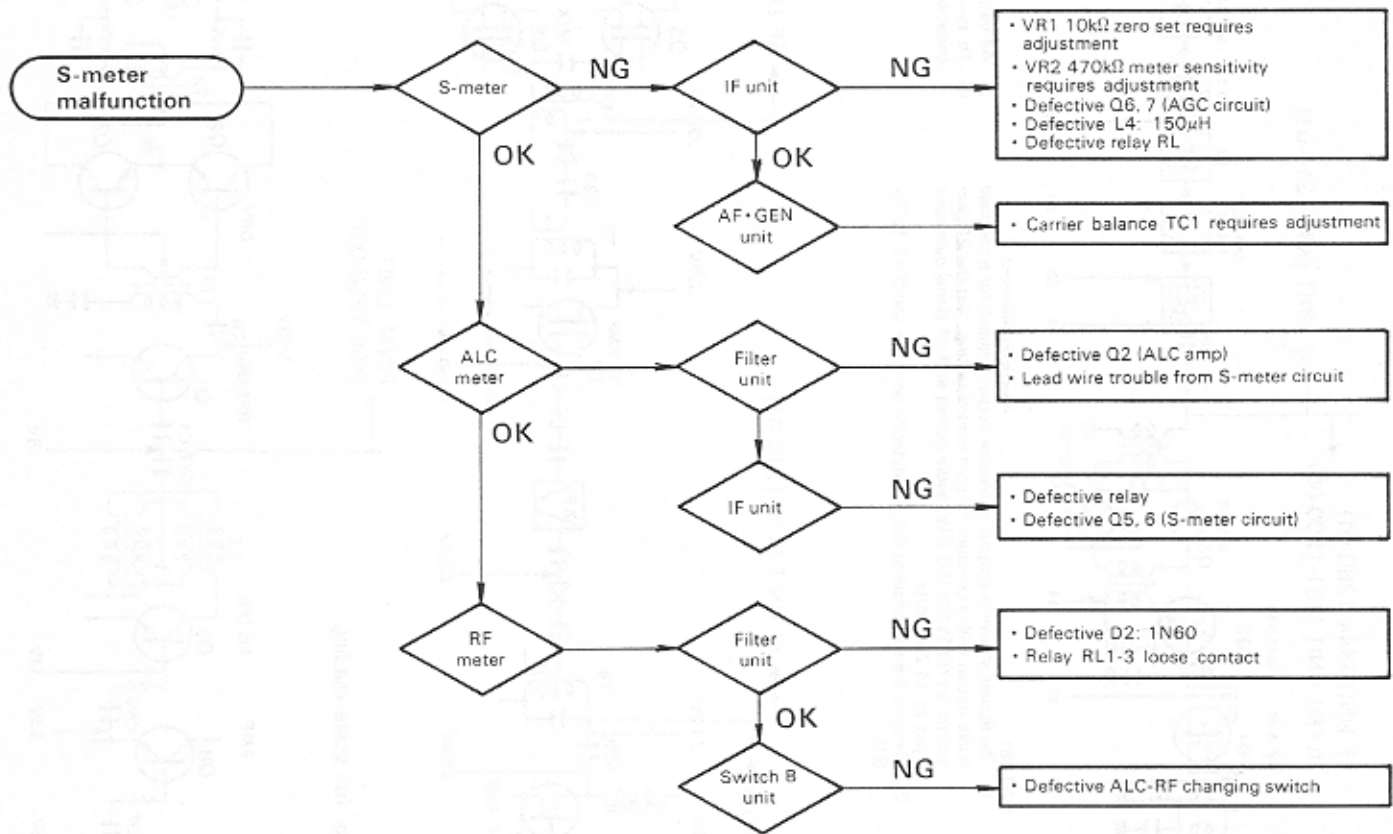
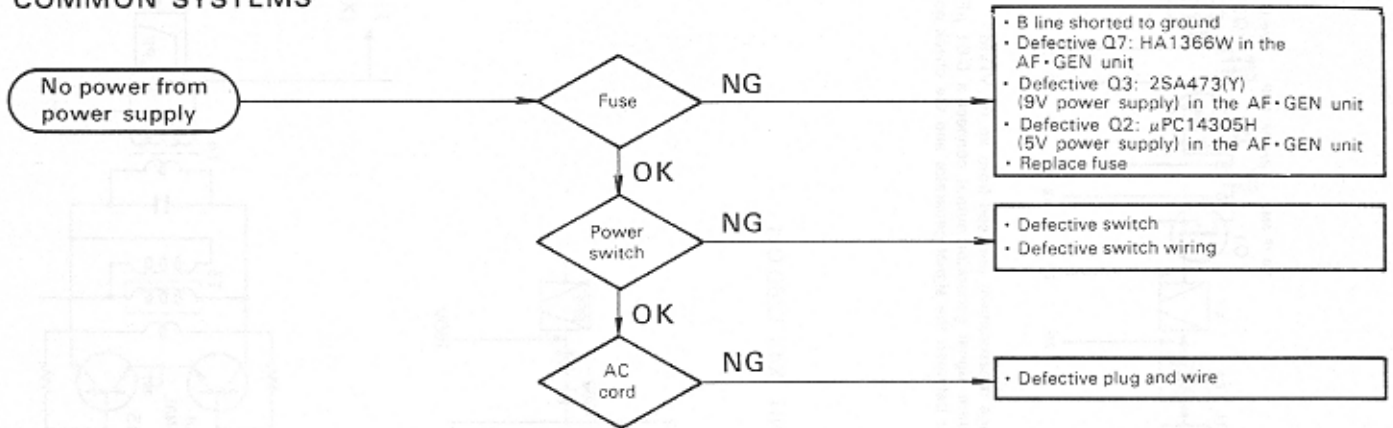


COUNTER SYSTEM

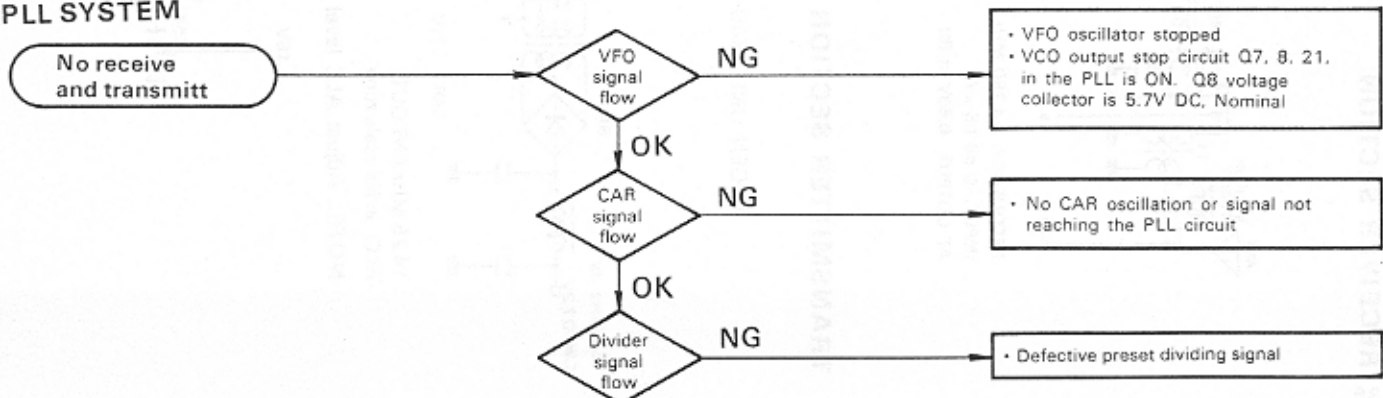


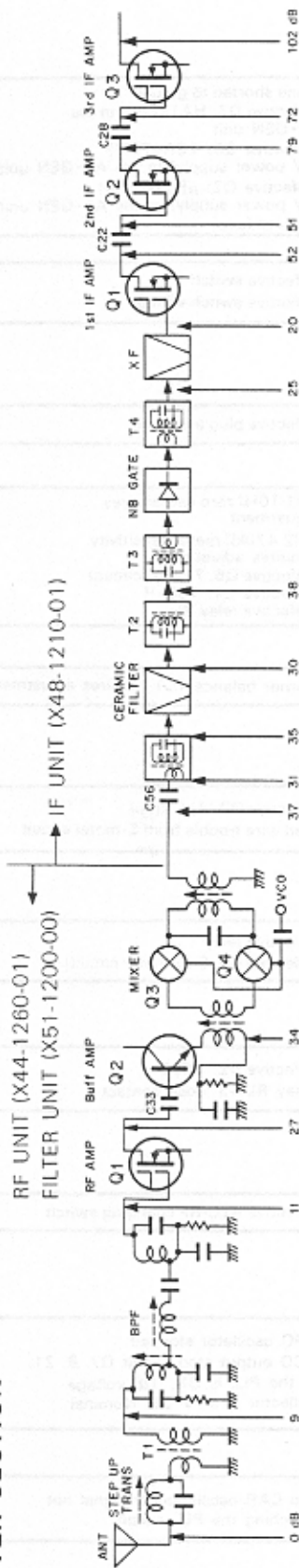
TROUBLE SHOOTING

COMMON SYSTEMS



PLL SYSTEM



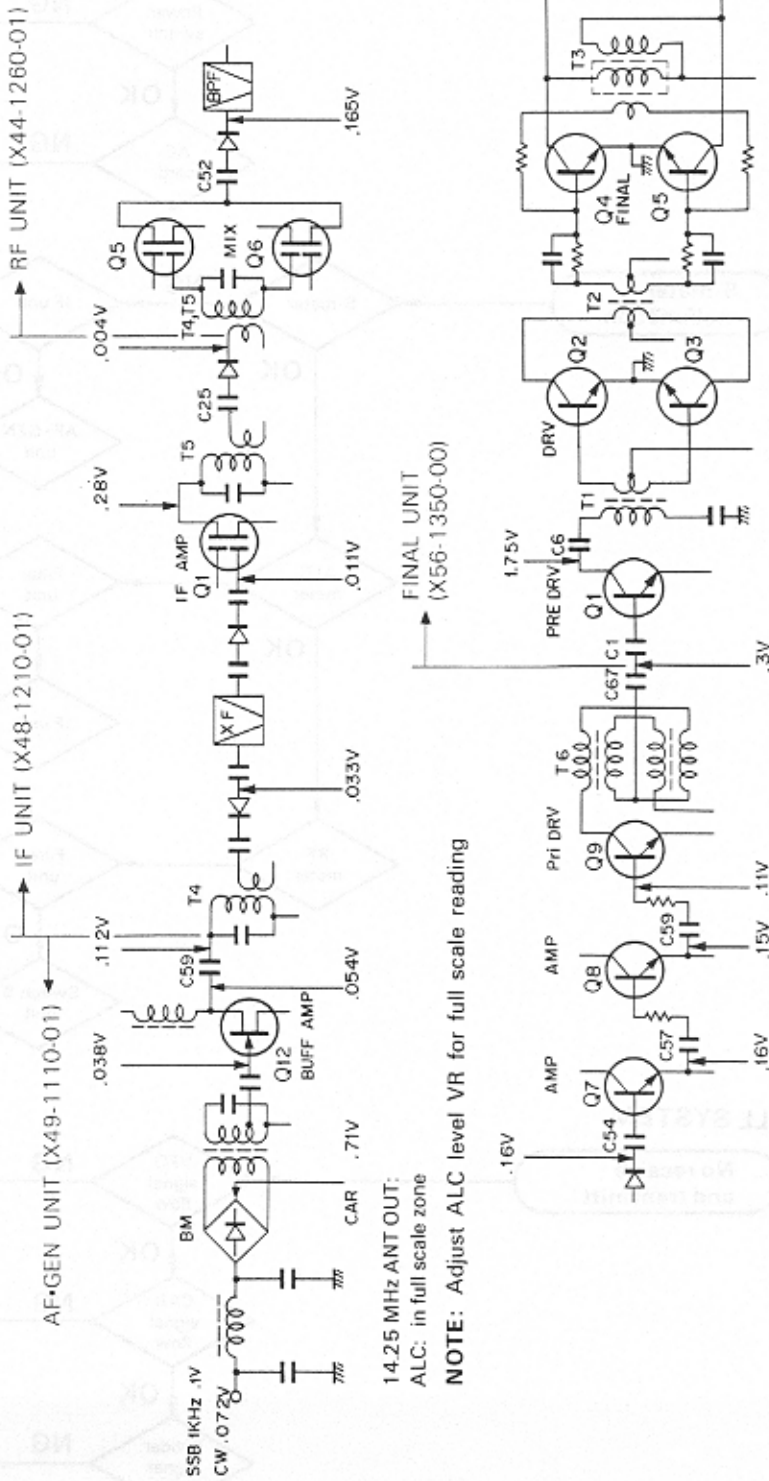


FREQUENCY: 14.250 MHz
 INPUT: 0 dB (5 μV)
 AF OUTPUT: 0.63V at 8Ω

NOTES:

- The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for 0.63V/8Ω (50 mW) audio output at 0 dB signal generator input at 14.250 MHz.
- Measure the AF output at the ring detector on the IF unit (X48-1210-01).
- All voltage measurements are read from an RF VTVM.
- To measure signal generator output connect a 0.01 μF 500 WV capacitor between the signal generator and the check point.

TRANSMITTER SECTION



NOTE: Adjust ALC level VR for full scale reading

ADJUSTMENTS

GENERAL

Adjustment procedures for this transceiver are classified into formal adjustments requiring a full service bench and simplified adjustment using a VTVM, AF and RF VTVM, AG, and AF and RF dummy load.

Complete adjustment also requires a frequency counter, SSG, sweep generator, etc.

(TX BPF, RX BPF, IF trap)

TEST EQUIPMENT REQUIRED

1. VTVM or DVM

- 1) Input resistance: More than 1 M Ω
- 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. RF VTVM

- 1) Input impedance: 1 M Ω and less than 3 pF, min.
- 2) Voltage range: 10 mV to 300 V
- 3) Frequency range: 50 MHz or greater

NOTE:

During adjustment special accuracy is not required (such as input level or PLL circuit carrier oscillator output), a VTVM or VOM may substitute for an RF VTVM by measuring through the output of a detector as shown in item 12.

3. AF VTVM

- 1) Frequency range: 50 Hz to 10 kHz
- 2) Input resistance: 1 M Ω or greater
- 3) Voltage range: 10 mV to 30 V

4. AF GENERATOR (AG)

- 1) Frequency range: 200 Hz to 5 kHz
- 2) Output: 2 mV~1 V, low distortion

5. AF DUMMY LOAD

- 1) Impedance: 8 Ω
- 2) Dissipation: 3 W or greater

6. RF DUMMY LOAD

- 1) Impedance: 50 to 75 Ω , 150 Ω
- 2) Dissipation: 100W continuous or greater
- 3) Frequency limits: 1.8 to 30 MHz

The above-mentioned instruments may be used for simplified adjustment. For complete, precise adjustment, the following instruments are also necessary.

7. OSCILLOSCOPE

Requires high sensitivity, and external synchronization capability.

8. SWEEP GENERATOR

- 1) Center frequency: 8.83 MHz
- 2) Frequency deviation: Maximum ± 5 kHz
- 3) Output voltage: More than 0.1V
- 4) Sweep rate: At least 0.5 sec/cm

9. Standard Signal Generator

- 1) Frequency range: 1.8 to 30 MHz
- 2) Output: -6 dB~120 dB (0.25 μ V~0.5V)

NOTE:

Generator must be frequency stable.

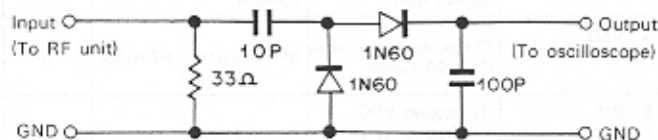
10. FREQUENCY COUNTER

- 1) Minimum input voltage: 50 mV
- 2) Frequency range: Greater than 40 MHz

11. NOISE GENERATOR

Must generate ignition noise containing harmonics beyond 30 MHz.

12. DETECTOR (TX B.P.F.)



REFERENCE

| Japanese "SSG" | American "SG" |
|----------------|---------------|
| -6dB | 0.25 μ V |
| 0 dB | 0.5 μ V |
| 6 dB | 1 μ V |
| 12 dB | 2 μ V |
| 24 dB | 8 μ V |
| 30 dB | 15.8 μ V |
| 40 dB | 50 μ V |
| 50 dB | 158 μ V |
| 60dB | 500 μ V |
| 70 dB | 1.58 mV |
| 80 dB | 5 mV |
| 90 dB | 15.8 mV |
| 100 dB | 50 mV |
| 120 dB | 0.5 V |

ADJUSTMENTS

PREPARATORY WORK

- Remove the upper and lower cases as shown in figure 14, below.

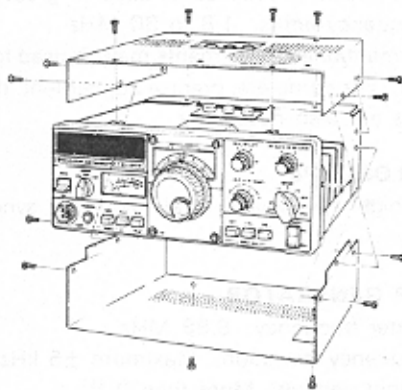


Fig. 14 Case disassembly

- Unless otherwise specified, set the controls as follows.

| | |
|-----------|------------------|
| AF GAIN | COUNTERCLOCKWISE |
| RF GAIN | FULL CLOCKWISE |
| MIC GAIN | CENTERED |
| CAR LEVEL | CENTERED |
| RIT | CENTERED |
| IF SHIFT | CENTERED |
| MODE | LSB |
| SEND/REC | REC |
| NB | OFF |
| CAL | OFF |
| RIT | OFF |
| FIX/VFO | VFO |
| ALC/RF | RF |
| VOX/MAN | MAN |
| POWER | ON |

| Item | Condition | Measuring point | | | Adjust | | | Specifications/Remarks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---------------------|---------------------|----------|--------|----------------------------|--|---|-------|-----|-------|-------|-----|---------------------|-----------|-----------|-------|-----------|---------------------|-----------|-------|-----------|---------------------|-----------|--------|-----------|-----------|---------------------|--------|-----------|---------------------|-----------|--------|-----------|-----------|-----------|--------|-----------|-----------|---------------------|--------|---------------------|-----------|-----------|--------|-----------|-----------|-----------|
| | | Test equipment | Unit | Terminal | Unit | Part | Reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Power Supply Voltage 1) 9V set 2) 2.8V 3) AVB 11V | STBYSW → SEND | DC VTVM | AF-GEN | J4, 4P | AF-GEN | VR-3 | 9V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | J4, 10P | AF-GEN | VR-2 | 2.8V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | FILTER | AVB | FILTER | VR-4 | | 11.0V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. CAR 1) CAR output 2) Freq. RX 3) Freq. RX | 1) IF SHIFT centered 2) LSB MODE 3) USB MODE CW MODE | RF VTVM | AF-GEN | J3, 2P | CAR | T1 | 0.3Vrms | 0.3V ± 1 dB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Frequency counter | AF-GEN | J3, 2P | CAR | TC2 TC1 | 8.82850 MHz 8.83150 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Frequency counter | AF-GEN | J3, 2P | CAR | VR2 | 8.83070 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. IF SHIFT | Alternate SEND/REC | Frequency counter | AF-GEN | J3, 2P | CAR | VR-1 | RX and TX frequency no change | LSB: 8.82850 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. VFO | Check output across 0~500 range | RF voltmeter | AF-GEN | J1, 6P | VFO | TC2 | 0.2Vrms | 0.2V ± 1 dB rms at VFO scale 250 0.2V ± 2 dB rms in FIX CH output | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. RIT | 1) Adjust VFO frequency to 5.5 MHz 2) RIT control centered | Frequency counter | AF-GEN | J1, 6P | AF-GEN | VR1 | Alternate RIT ON and OFF | 1) No frequency change between RIT ON and OFF 2) More than ±1.5 kHz variable RIT range | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. VCO | | DC VTVM | PLL | TP1 | PLL | T1 T2 T3 T4 T5 | WWV → 3.5V (VFO: 00) 14 MHz → 3.5V (VFO: 500) 21 MHz → 3.5V (VFO: 250) 28.0 → 5.0V (VFO: 500) or 29.0 → 5.0V (VFO: 0) 7 MHz → 5.5V (VFO: 250) 3.5 MHz → 3.5V (VFO: 250) | Oscillator level 1V ± 2 dB <table border="1"> <thead> <tr> <th></th> <th>"0"</th> <th>"250"</th> <th>"500"</th> </tr> </thead> <tbody> <tr> <td>WWV</td> <td>(3.5V) 23.33 MHz</td> <td>23.58 MHz</td> <td>23.83 MHz</td> </tr> <tr> <td>3.5 M</td> <td>12.33 MHz</td> <td>(3.5V) 12.58 MHz</td> <td>12.83 MHz</td> </tr> <tr> <td>7.0 M</td> <td>15.83 MHz</td> <td>(5.5V) 16.08 MHz</td> <td>16.33 MHz</td> </tr> <tr> <td>14.0 M</td> <td>22.83 MHz</td> <td>23.08 MHz</td> <td>(3.5V) 23.33 MHz</td> </tr> <tr> <td>21.0 M</td> <td>29.83 MHz</td> <td>(3.5V) 30.08 MHz</td> <td>30.33 MHz</td> </tr> <tr> <td>28.0 M</td> <td>36.83 MHz</td> <td>37.08 MHz</td> <td>37.33 MHz</td> </tr> <tr> <td>28.5 M</td> <td>37.33 MHz</td> <td>37.58 MHz</td> <td>(5.0V) 37.33 MHz</td> </tr> <tr> <td>29.0 M</td> <td>(5.0V) 37.83 MHz</td> <td>38.08 MHz</td> <td>38.33 MHz</td> </tr> <tr> <td>29.5 M</td> <td>38.33 MHz</td> <td>38.58 MHz</td> <td>38.83 MHz</td> </tr> </tbody> </table> | | "0" | "250" | "500" | WWV | (3.5V) 23.33 MHz | 23.58 MHz | 23.83 MHz | 3.5 M | 12.33 MHz | (3.5V) 12.58 MHz | 12.83 MHz | 7.0 M | 15.83 MHz | (5.5V) 16.08 MHz | 16.33 MHz | 14.0 M | 22.83 MHz | 23.08 MHz | (3.5V) 23.33 MHz | 21.0 M | 29.83 MHz | (3.5V) 30.08 MHz | 30.33 MHz | 28.0 M | 36.83 MHz | 37.08 MHz | 37.33 MHz | 28.5 M | 37.33 MHz | 37.58 MHz | (5.0V) 37.33 MHz | 29.0 M | (5.0V) 37.83 MHz | 38.08 MHz | 38.33 MHz | 29.5 M | 38.33 MHz | 38.58 MHz | 38.83 MHz |
| | "0" | "250" | "500" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WWV | (3.5V) 23.33 MHz | 23.58 MHz | 23.83 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 M | 12.33 MHz | (3.5V) 12.58 MHz | 12.83 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.0 M | 15.83 MHz | (5.5V) 16.08 MHz | 16.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14.0 M | 22.83 MHz | 23.08 MHz | (3.5V) 23.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21.0 M | 29.83 MHz | (3.5V) 30.08 MHz | 30.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28.0 M | 36.83 MHz | 37.08 MHz | 37.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28.5 M | 37.33 MHz | 37.58 MHz | (5.0V) 37.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29.0 M | (5.0V) 37.83 MHz | 38.08 MHz | 38.33 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29.5 M | 38.33 MHz | 38.58 MHz | 38.83 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note () control voltage

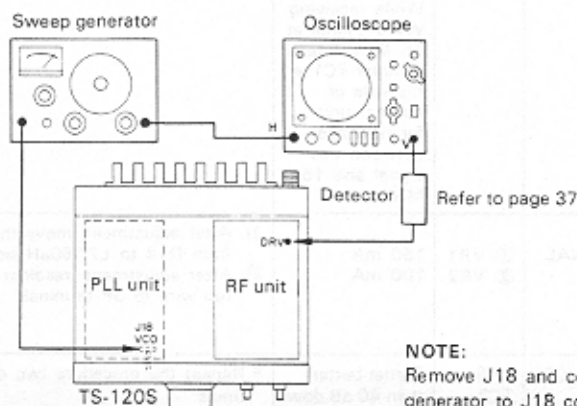
ADJUSTMENTS

| Item | Condition | Measuring point | | | Adjust | | | Specifications/Remarks |
|---------------------------------|---|---|----------------------|--|-----------------|---------------------------|--|--|
| | | Instruments | Unit | Terminal | Unit | Parts | Reference | |
| 7. TX BPF | Maintain adjustment order 3.5 MHz, 7.5 MHz, 14 MHz, 21 MHz, 28 MHz | Sweep generator Oscilloscope Detector | RF PLL | DRV VCO | RF | L3~17 | Adjust coils for waveform as shown at right (Fig. 15) | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>3.5 MHz L3, 4, 5</p> </div> <div style="text-align: center;"> <p>7 MHz L6, 7, 8</p> </div> </div> <p>Ripple ratio less than 5 dB Ripple ratio less than 2 dB</p> |
| 8. RX BPF | This adjustment requires a spectrum analyzer and tracking generator. Otherwise adjust as in item 7. | Tracking generator Spectrum analyzer | Rear panel RF | ANT Q2, E | RF | L3~17 | Same as above (Fig. 16) | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> </div> <p>Ripple ratio less than 2 dB Ripple ratio less than 1 dB</p> |
| 9. IF AMP | 1) VFO: 250 BAND: 14 MHz MODE: USB | SSG Oscilloscope AF VTVM 8Ω dummy or speaker | | SP | RF IF | T3 T1~17 | 1) Adjust for a maximum output 2) Apply SSG output at (25 μV) -6 dB to the antenna terminal signal to noise ratio approx. 15 dB | <div style="text-align: center;"> </div> <p>Ripple ratio less than 2 dB</p> |
| 10. IF trap | 1) BAND: 7 MHz 2) BAND: 14 MHz | SSG AF VTVM | | SP | RF | L1, 2 L35 | Adjust for minimum S-meter reading and AF output level. repeat the procedure two or three times. | Check for 80 dB attenuation of 8.83 MHz signal. (Fig. 17) |
| 11. NB | Connect the noise generator to ANT terminal. S-meter reading S5~7. | Noise generator Oscilloscope | IF | D14(K) (cathode) | RF IF | T3 T1 | Adjust for a wave form as shown at right. repeat the procedure two or three times | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Before adjustment</p> </div> <div style="text-align: center;"> <p>After adjustment</p> </div> </div> |
| 12. Counter standard Oscillator | BAND: WWV VFO: 500 (15,000 MHz) CAL ON | ANT | | | Freq. count. | TC1 | Set the BAND switch to WWV dial scale: 500] connect an antenna to the set. While receiving WWV Signal at 15 MHz, adjust trimmer TC1 at the side of counter unit for zero beat between this signal and 15 MHz | Set for zero beat between WWV and CAL |
| 13. Base current | MODE: LSB MIC: Counter-clockwise BAND: 14 MHz SEND position | RF power meter Current meter | FINAL | ① D14terminal to⊕ L7 150μH side to⊖ ② F14-3P | FINAL | ① VR1 ② VR2 | 150 mA 100 mA | 1) After adjustment, move the wire from D14 to L7 150μH side. 2) After adjustment, resolder red wire to 3P terminal. |
| 14. Carrier suppression | Adjust at 14 MHz for RF full CW power. Switch to SSB position. No input | Power meter Oscilloscope Direction coupler | | ANT | AF-GEN | VR5 TC2 (Min.) * | Carrier better than 40 dB down from output signal | * Repeat the procedure two or three times |

ADJUSTMENTS/TEST SET UP

| Item | Condition | Measuring point | | | Adjusting point | | | Specifications/Remarks |
|-------------------|---|---|--------------------------------------|------------|-------------------------|---------------------------|--|---|
| | | Instruments | Unit | Terminal | Unit | Parts | Reference | |
| 15. Carrier point | 1) Connect AG to MIC terminal and apply an input of 1500 Hz at 7 mV 2) Adjust MIC GAIN until output becomes 5W | RF power meter Oscilloscope AG AF VTVM | | ANT | CAR | USB → TC1 LSB → TC2 | Shift the AF signal between 300 Hz and 2700 Hz adjust TC1 (in USB) and TC2 (in LSB) so RF output reading is equal high and low level. | 400 Hz, 2600 Hz (−6 dB down) 1500 Hz: Centered Check carrier suppression if carrier point is adjusted. Adjust TC1 (in USB) and TC2 (in LSB) so RF reading is the same. |
| 16. Side tone | AF GAIN: 12 o'clock MODE: CW Install KEY and KEY down | KEY AF VTVM | | | AF-GEN | VR4 | 0.63V/8Ω | |
| 17. Ic meter | MODE SW: CW STBY SW: SEND Same as item 13 | Power meter DC current meter | | | FILTER | VR4 | 11A | When same as item 13-②. Adjust CAR level. IC meter reading to 11A. |
| 18. ALC | BAND: 14 MHz VFO: 200 MODE: CW VR2 in the filter Unit: counter-clockwise STBY: SEND | RF power meter, AG, AF VTVM | | | FILTER | VR3 VR2 | 95W 75W (28.5 MHz) | Check that RF output power is the same level input. SSB position at 7 mV (1500 Hz) input. |
| 19. Protection | VR1 in the filter Unit: Full clock-wise Same as above Refer to 42 page | RF VTVM DC volt meter, coaxial cable (50Ω), "BIRD" Watt meter, 150Ω, 100W dummy. | FILTER TP1 and TP2 as shown at right | FILTER TC1 | MIN. (Approx. 0.2~0.4V) | | | |
| 19. S-meter | Adjust 14, 175 MHz in receive position | SSG | | | 1) IF 2) IF 3) IF | 1) VR1 2) T6 3) VR2 | 1) 100 dB to the antenna from SSG → S9 + 60 dB. 2) 8 dB to the antenna from SSG → S1 3) 40 dB (50 μV) to the antenna from SSG → S9 | 2) Less than 8 dB ± 4 dB 3) Less than 40 dB ± 6 dB |

TEST AND ALIGNMENT SET-UP



NOTE:
Remove J18 and connect the sweep generator to J18 connector (pin 1).

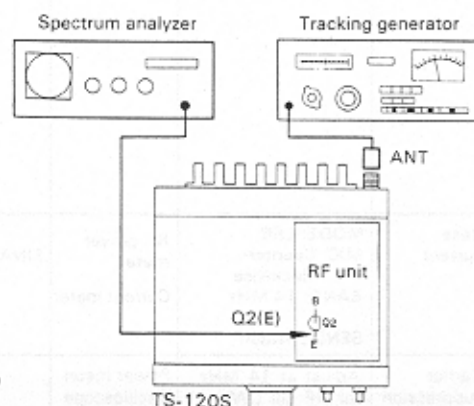


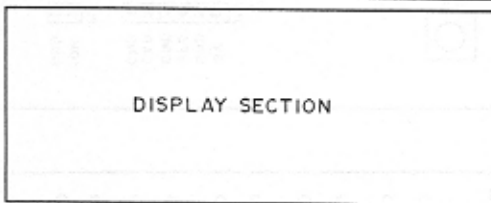
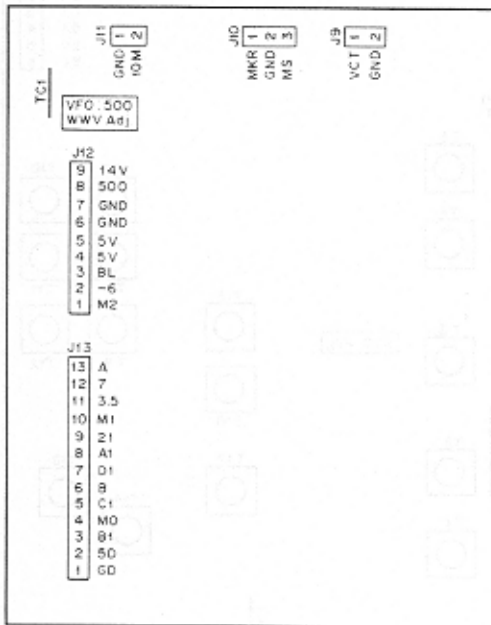
Fig. 15 Test equipment connection/Item 7 TX BPF

Fig. 16 Test equipment connection/Item 8 RX BPF

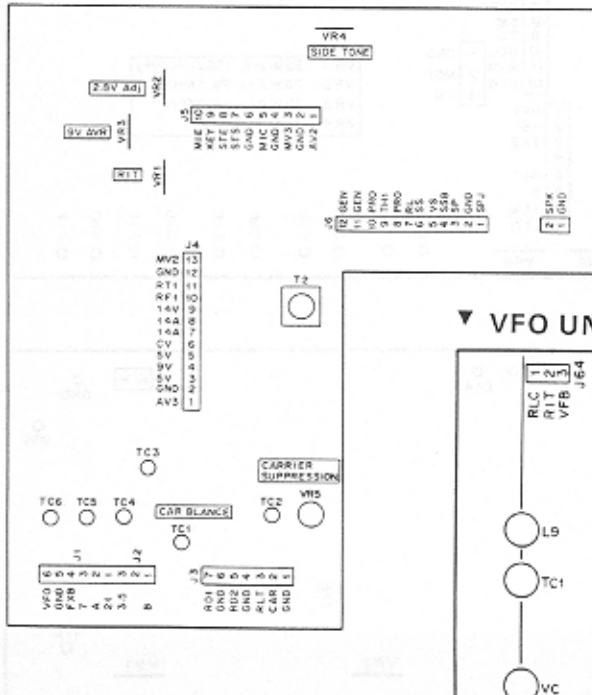
TEST AND ALIGNMENT SET-UP

PC BOARD ALIGNMENT

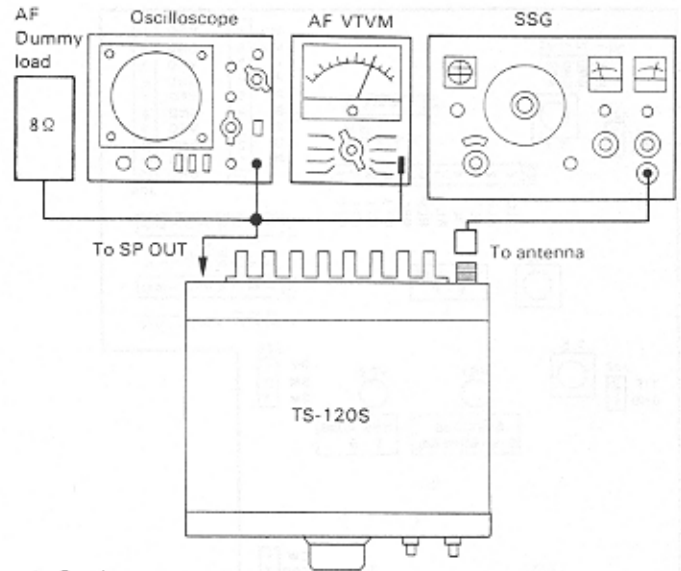
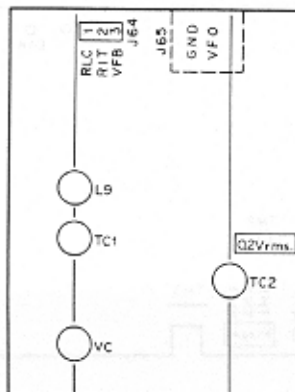
▼ COUNTER UNIT (X54-1360-00)



▼ AF-GEN UNIT (X49-1110-01)



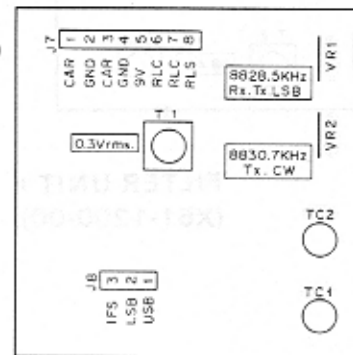
▼ VFO UNIT (X40-1130-00)



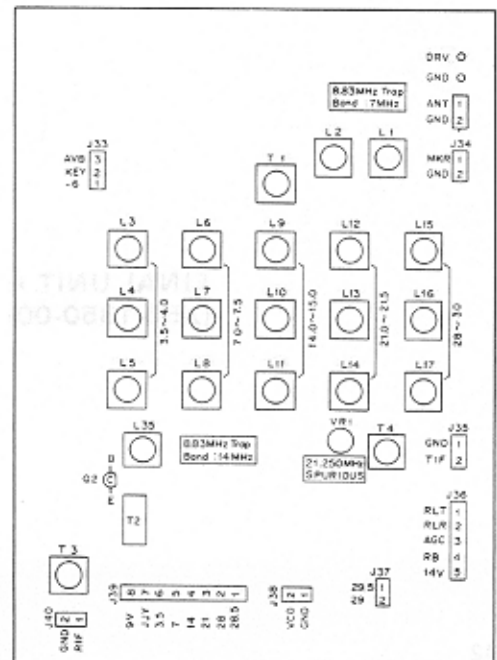
★ Caution:
NEVER TRANSMIT with SSG at antenna terminal.

Fig. 17 Test equipment connection/Item
9 IF AMP, Item 10 IF TRAP

CAR UNIT ▶ (X50-1500-00)

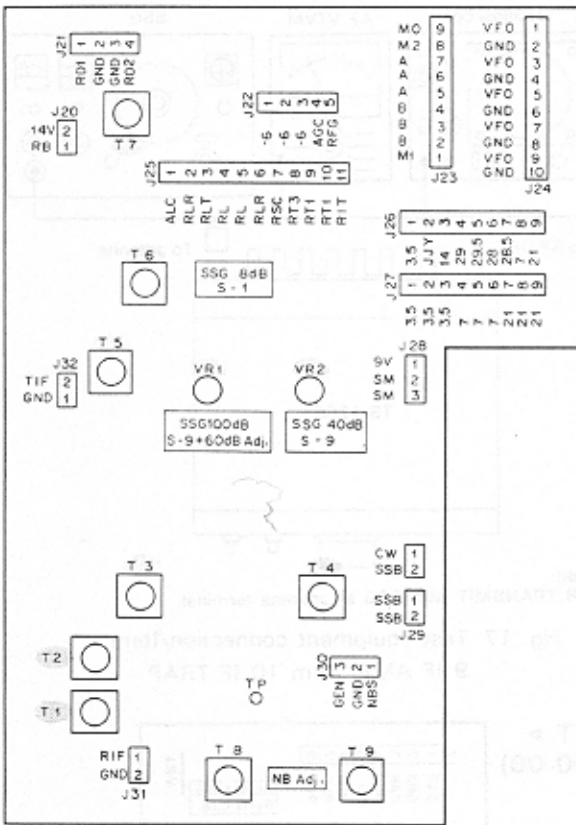


RF UNIT ▶ (X44-1260-01)

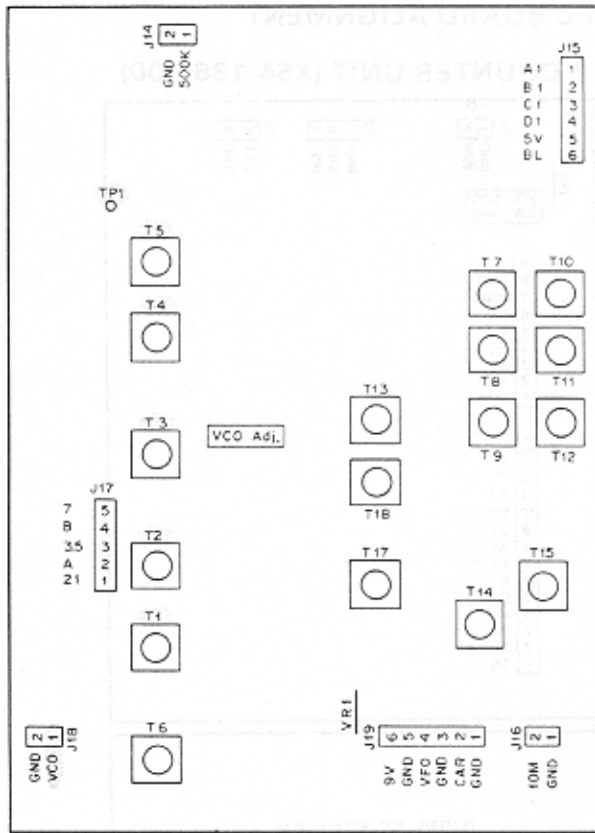


PC BOARD ALIGNMENT

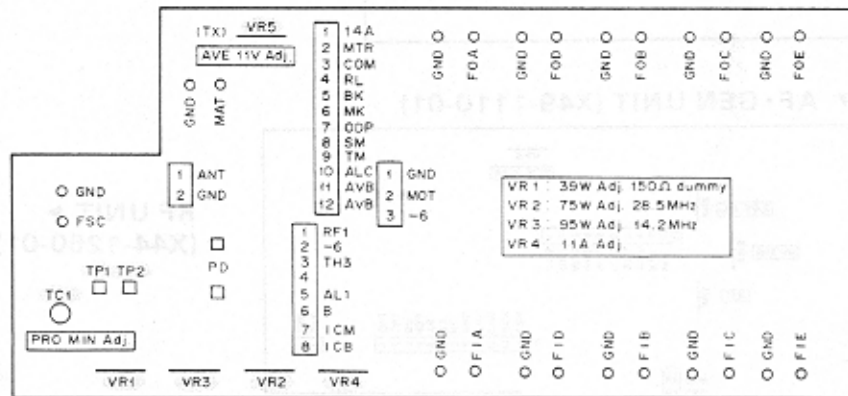
▼ IF UNIT (X48-1210-01)



PLL UNIT (X50-1490-00)

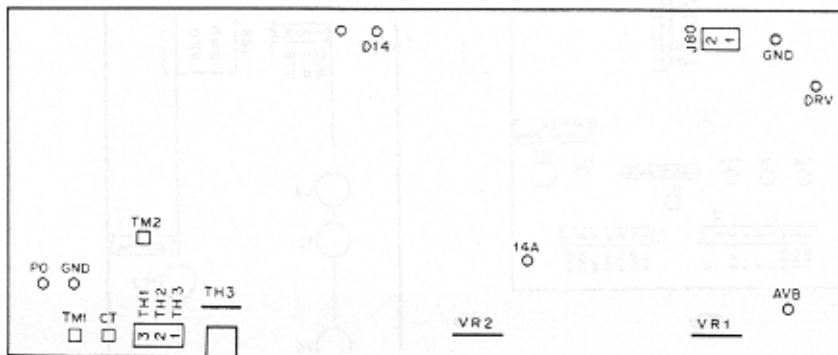


FILTER UNIT ► (X51-1200-00)



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FINAL UNIT ► (X56-1350-00)



PS-30

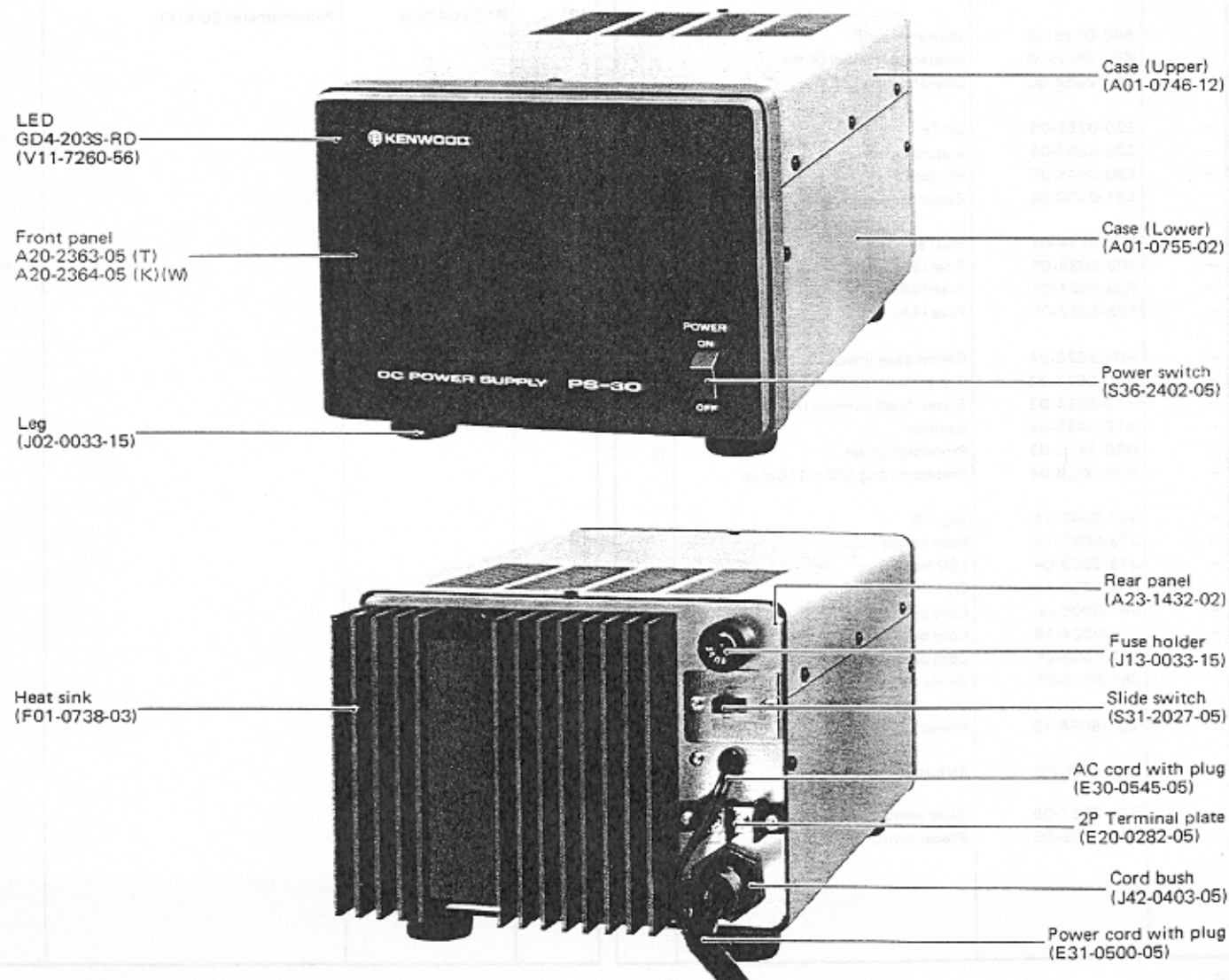
SPECIFICATION

[Power Supply Section]

| | |
|-----------------------------|--|
| Input voltage: | AC 120V/220V or 220V/240V \pm 10%. 50/60 Hz |
| Output voltage: | DC 13.8V (standard voltage) |
| Output current: | 20A (intermittent load 50% duty cycle) |
| Continuous load current: | 15A max. (inclusive of external output terminal) |
| Output voltage fluctuation: | Within \pm 0.7V at AC 120V, 220V, 240V \pm 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 x 133 (5"—1/4)H x 287 (11"—5/16)D mm (inch) |
| Weight: | Approx. 8.9 kg (19.6 lbs.) |

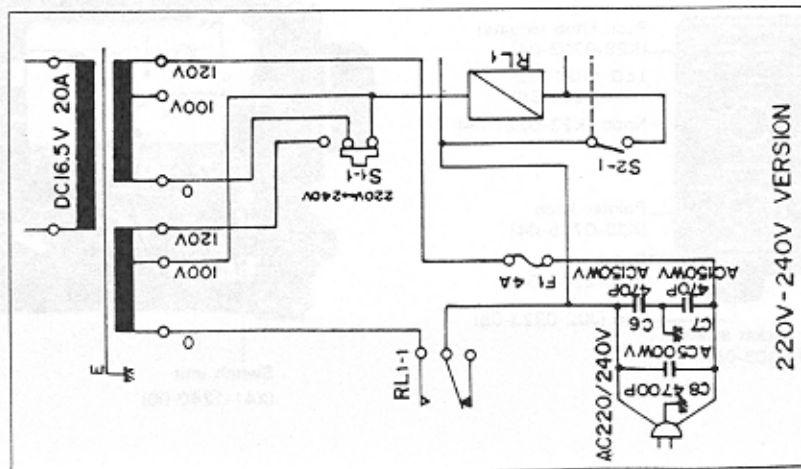
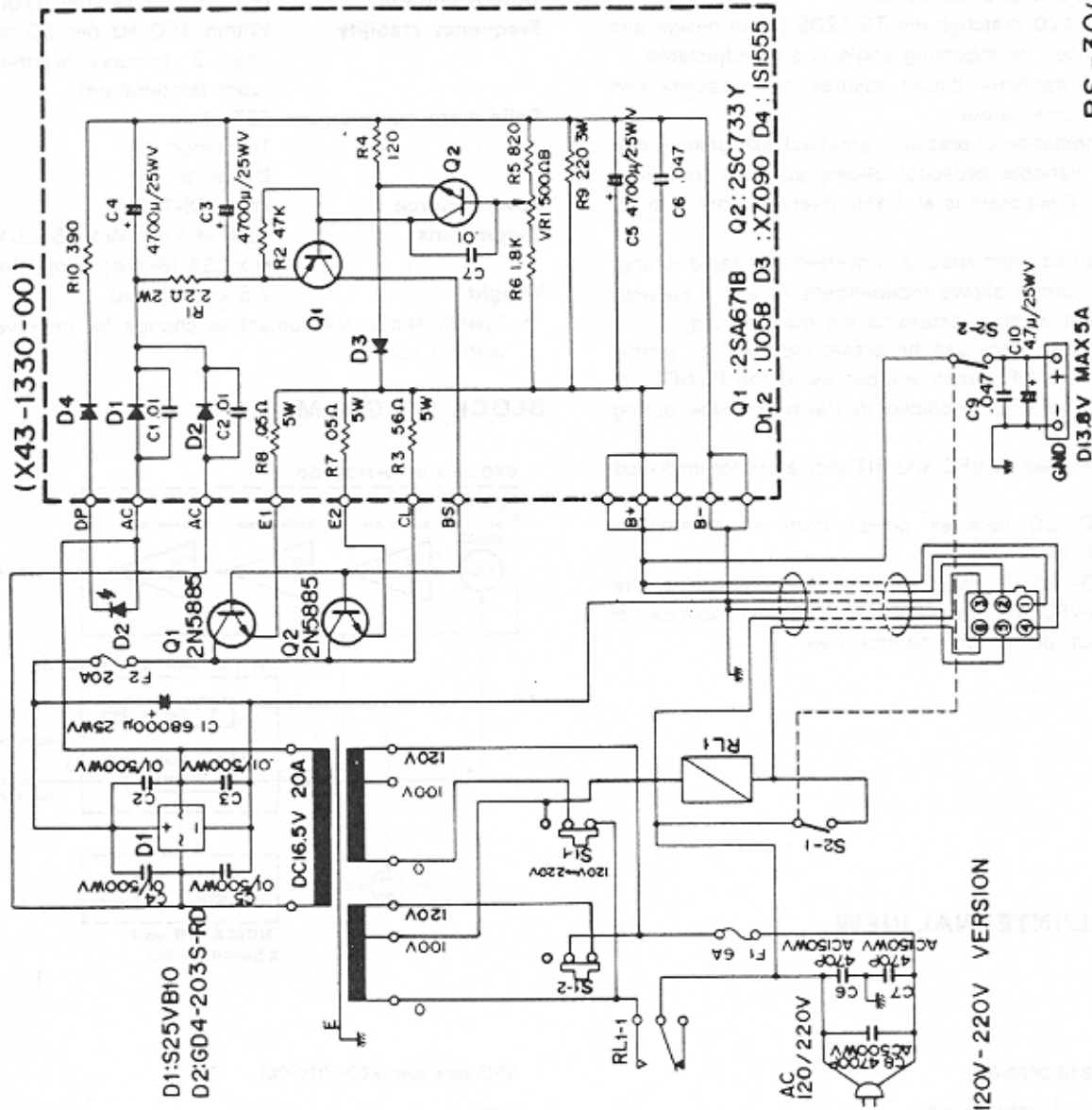


PS-30

< PS-30 PARTS LIST >

| Ref. No. | Parts No. | Description | Re- marks | Ref. No. | Parts No. | Description | Re- marks |
|----------------|-------------|------------------------------------|--------------|-------------------------------|--------------|--|--------------|
| GENERAL | | | | AVR UNIT (X43-1330-00) | | | |
| C1 | C90-0813-05 | Electrolytic 6800 μ F 25WV | ☆ | C1.2 | CK45F1H103Z | Ceramic 0.01 μ F +80% -20% | |
| C2~5 | CK45E2H103P | Ceramic 0.01 μ F +100, -0% | | C3~5 | C90-0814-05 | Electrolytic 4700 μ F 25WV | ☆ |
| C6.7 | C90-0300-05 | Ceramic 470pF AC150WV | | C6 | CK45F1H473Z | Ceramic 0.047 μ F +80% -20% | |
| C8 | C91-0412-05 | Ceramic 470pF AC500WV | | C7 | CK45F1H103Z | Ceramic 0.01 μ F +80% -20% | |
| C9 | CK45F1H473Z | Ceramic 0.047 μ F +80% -20% | | R2~10 | RD14882E000J | Carbon resistor 000 Ω \pm 5% 1/4W | |
| C10 | CE04W1E4R7 | Electrolytic 4.7 μ F 25WV | | R1 | RS14GB3D2R2J | Resistor (Metal film) 2.2 Ω \pm 5% 2W | |
| Q1.2 | V08-1012-06 | Transistor 2N5885 | ☆ | R3 | R92-0622-05 | Resistor (cement) 56 Ω 5W | |
| D1 | V11-1365-06 | Diode S25VB10 | ☆ | R7.8 | R92-0619-05 | Resistor (cement) 50m Ω 5W | |
| - | V11-7260-56 | LED GD4-203S-RD | ☆ | R9 | RS14GB3F221J | Resistor (metal film) 220 Ω \pm 5% 3W | |
| RL1 | S51-1406-05 | Relay | ☆ | Q1 | V01-0139-05 | Transistor 2SA671TDB | |
| - | A01-0746-12 | Case (upper) | ☆ | Q2 | V03-0183-05 | Transistor 2SC733 (Y) | |
| - | A01-0755-02 | Case (Lower) | ☆ | D1.2 | V11-0270-05 | Diode U05B | |
| - | A20-2363-03 | Front panel (T) | ☆ | D3 | V11-4167-06 | Zener diode XZ-090 | |
| - | A20-2364-03 | Front panel (K.W) | | D4 | V11-0076-05 | Diode 1S1555 | |
| - | A23-1432-02 | Rear panel (K) | ☆ | VR1 | R12-0042-05 | Potentiometer 500 Ω (B) | |
| - | A23-1433-02 | Rear panel (W.T) | | | | | |
| - | B46-0058-00 | Warranty card | | | | | |
| - | B50-2652-00 | Operating manual (K,W) | ☆ | | | | |
| - | B50-2656-00 | Operating manual (T) | | | | | |
| - | E20-0282-05 | 2P Terminal plate | | | | | |
| - | E22-0207-05 | Lug plate \times 3 | | | | | |
| - | E30-0545-05 | AC cord with plug | | | | | |
| - | E31-0500-05 | Power cord with plug | ☆ | | | | |
| - | F01-0738-03 | Heat sink | ☆ | | | | |
| - | F05-2035-05 | Fuse (2A) | ☆ | | | | |
| - | F05-6021-05 | Fuse (6A) \times 2 (K) | | | | | |
| - | F05-4022-05 | Fuse (4A) (W.T) | | | | | |
| - | H01-2623-04 | Carton case (inside) | ☆ | | | | |
| - | H10-2523-02 | Styren foam cushion (F) | ☆ | | | | |
| - | H10-2524-02 | Styren foam cushion (R) | ☆ | | | | |
| - | H12-0455-04 | Cushion | ☆ | | | | |
| - | H20-1413-03 | Protection cover | ☆ | | | | |
| - | H25-0029-04 | Protection bag (60 \times 110mm) | | | | | |
| - | J02-0049-14 | Leg \times 6 | | | | | |
| - | J13-0033-15 | Fuse holder | | | | | |
| - | J19-0509-04 | LED holder | | | | | |
| - | J32-1030-14 | 00000 \times 2 | | | | | |
| - | J41-0006--5 | Cord bush (K) | | | | | |
| - | J41-0024-15 | Cord bush (W.T) | | | | | |
| - | J42-0403-05 | Cord bush | | | | | |
| - | J61-0019-05 | Vinyle tie \times 7 | | | | | |
| - | L01-8066-15 | Power transformer | ☆ | | | | |
| - | X43-1330-00 | AVR Unit | ☆ | | | | |
| - | S31-2027-05 | Slide switch | | | | | |
| - | S36-2402-05 | Power switch | ☆ | | | | |

PS-30



PS-30(K).(W)

VFO-120 FEATURES/BLOCK DIAGRAM/SPECIFICATIONS/EXTERNAL VIEW/INTERNAL VIEW

FEATURES

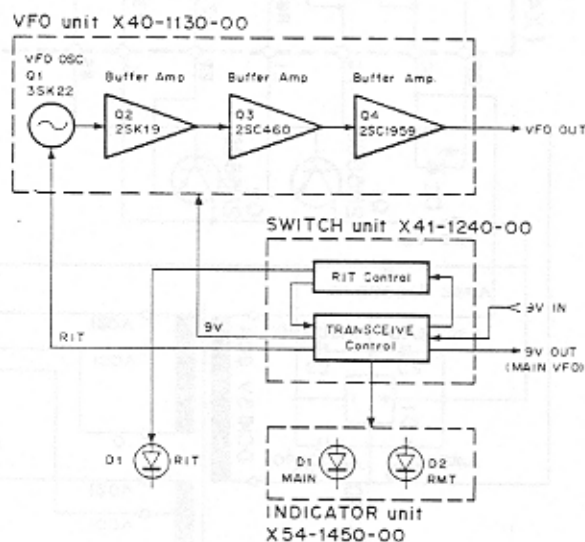
1. The model VFO-120 is a remote VFO designed for use with the TS-120S (V) SSB transceiver, permitting cross-channel transceive operation.
2. The VFO-120 matches the TS-120S (V) in design and appearance. Its mounting angle is also adjustable.
3. The FET oscillator circuit assures high stability and distortion-free output.
4. The combination of precision anti-backlash gearing and a linear variable capacitor allows accurate frequency reading. Calibration is at 1 kHz intervals from 0 to 25 kHz. The indented main knob is convenient for rapid tuning.
5. The RIT circuit allows independent receive frequency adjustment without disturbing the main tuning.
6. Transmit frequency can be preset (spotted) by simply pressing the T-F switch without using the FUNCTION switch. The VFO is placed in transmit mode during reception.
7. LED's are used as VFO and RIT indicators for error-free operation.
8. The VFO-120 receives power from its companion TS-120S (V).
9. The VFO-120 is installed by simply connecting the supplied VFO and ground cables. The VFO cable carries the output, power, and control lines.

SPECIFICATIONS

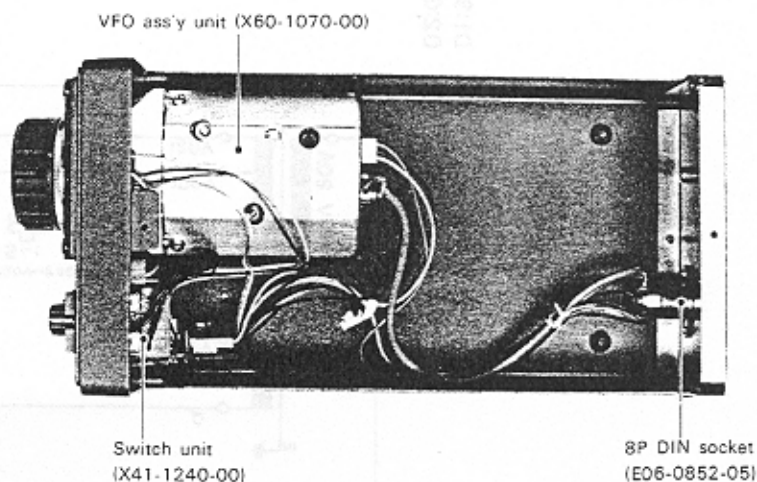
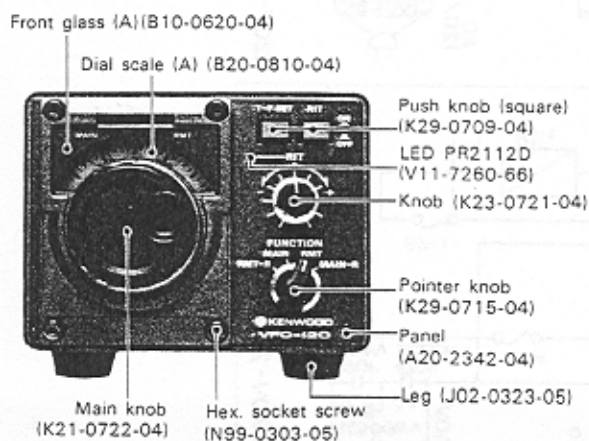
| | |
|-------------------------------|---|
| Oscillator frequency | 5.50~6.00 MHz |
| Oscillator circuit | Clapp |
| Output voltage | 0.2 V \pm 1 dB (across 470 Ω load) |
| Frequency stability | Within 100 Hz per 30 minutes after 3 minutes warm-up (at room temperature). |
| Solid-state complement | FET: 2 Transistor: 2 Diode: 6 |
| Power source | From TS-120V |
| Dimensions | 123 (4-7/8) W x 96 (3-13/16) H x 235 (9-1/4) D mm (inch) |
| Weight | 2.5 kg (3.5 lbs) |

* Specifications are subject to change for improvement without notice.

BLOCK DIAGRAM



EXTERNAL/INTERNAL VIEW



☆ Mark denotes New Part

VFO-120 PARTS LIST

| Ref. No. | Parts No. | Description | Re- marks |
|-------------------------------------|-------------|-------------------------------------|--------------|
| General | | | |
| - | A01-0739-03 | Case (A) upper | ☆ |
| - | A01-0740-03 | Case (B) lower | ☆ |
| - | A20-2341-04 | Panel | ☆ |
| - | A23-1430-04 | Rear panel | ☆ |
| - | B39-0407-04 | Spacer × 2 for leg | |
| - | B46-0058-00 | Warranty card | (K) ☆ |
| - | B50-2633-00 | Operating manual | (K), (W) ☆ |
| - | B50-2634-00 | Operating manual | (T) ☆ |
| - | E02-0107-05 | Diode socket | ☆ |
| - | E06-0852-05 | 8P DIN socket | ☆ |
| - | E30-1628-05 | VFO cable | ☆ |
| - | H01-2609-04 | Carton | (K), (W) ☆ |
| - | H01-2610-02 | Carton | (T) ☆ |
| - | H10-2513-02 | Front packing fixture | |
| - | H10-2514-02 | Rear packing fixture | |
| - | H12-0445-04 | Cushion | |
| - | H20-1407-03 | Protective cover | |
| - | H25-0117-04 | Polyethylene bag 80 × 250 | |
| - | J02-0323-05 | Leg × 4 | |
| - | J02-0409-04 | Assistance leg | |
| - | J42-0412-04 | Knob bush | ☆ |
| - | J61-0019-05 | Vinyle tie × 5 | |
| - | K23-0721-04 | Knob (RIT) | ☆ |
| - | K29-0715-04 | Pointer knob (FUNCTION) | ☆ |
| - | K29-0709-04 | Push knob (square) | |
| - | N99-0303-05 | Hex. socket screw × 4 (VFO M4 × 10) | |
| D1 | V11-7260-66 | LED PR2112D | |
| - | X41-1240-00 | Switch unit | ☆ |
| - | X60-1070-01 | VFO ass'y unit | ☆ |
| SWITCH UNIT (X41-1240-00) | | | |
| CAPACITOR | | | |
| C1 | CH45F1H103Z | Ceramic | |
| POTENTIOMETER/SWITCH | | | |
| VR1 | R01-2404-05 | 5kΩ (B) (RIT) | |
| VR2 | R12-3025-05 | 10kΩ (B) | |
| S1 | S29-1410-05 | Slide rotary switch SRG-R4 | ☆ |
| S2 | S40-2409-15 | Push switch T. F SET SW | |
| S3 | S40-2404-05 | Push switch RIT SW | ☆ |
| RELAY/SEMICONDUCTOR | | | |
| RL1 | S51-2408-05 | Relay G2V-2 | |
| D1 | V11-0219-05 | Diode V06B | |
| VFO ASS'Y UNIT (X60-1070-00) | | | |
| GENERAL | | | |
| - | B01-0621-05 | Dial escutcheon | ☆ |
| - | B10-0620-04 | Front glass (A) | ☆ |
| - | B20-0810-04 | Dial scale (A) | ☆ |
| - | B20-0811-04 | Dial scale (B) | ☆ |
| - | B30-0808-05 | Pilot lamp | |
| - | K21-0722-04 | Main knob | ☆ |
| - | N19-0608-04 | Washer × 2 | ☆ |

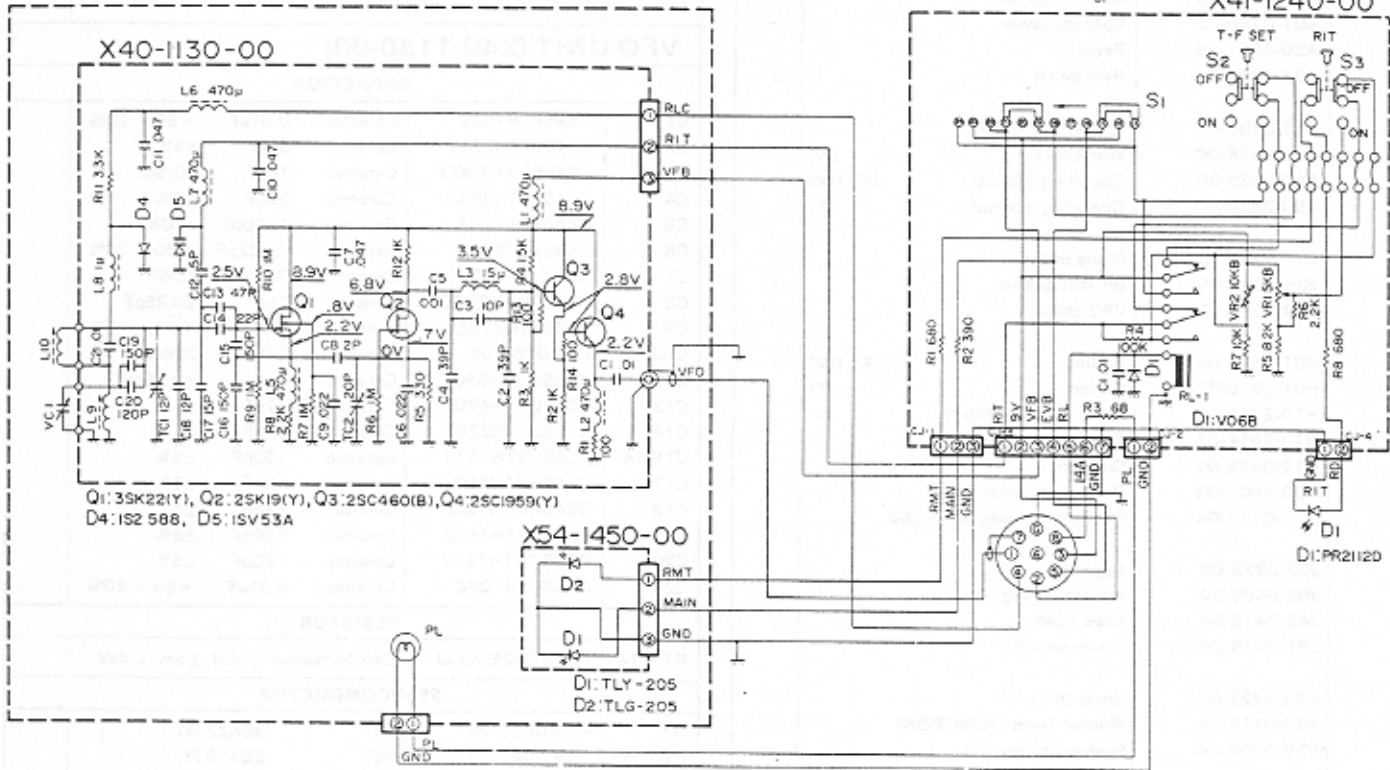
| Ref. No. | Parts No. | Description | Re- marks |
|-------------------------------------|--------------|-----------------------|--------------|
| - | X40-1130-00 | VFO unit | ☆ |
| - | X54-1450-00 | Indicator unit | ☆ |
| VFO UNIT (X40-1130-00) | | | |
| CAPACITOR | | | |
| C1 | CK45F1H103Z | Ceramic 0.01μF | +80. -20% |
| C2 | CC45SL1H390J | Ceramic 39pF | ±5% |
| C3 | CC45CH1H100D | Ceramic 10pF | ±0.5pF |
| C4 | CC45SL1H390J | Ceramic 39pF | ±5% |
| C5 | CK45B1H102K | Ceramic 1000pF | ±10% |
| C6 | CK45F1H223Z | Ceramic 0.022μF | +80. -20% |
| C7 | C90-0262-05 | Ceramic 0.047μF | 25WV |
| C8 | CC45CH1H020C | Ceramic 2pF | ±0.25pF |
| C9 | CK45F1H223Z | Ceramic 0.022μF | +80. -20% |
| C10.11 | C90-0262-05 | Ceramic 0.047μF | 25WV |
| C12 | CC45SG1H050C | Ceramic 5pF | ±0.25pF |
| C13 | CC45LG1H470J | Ceramic 47pF | ±5% |
| C14 | CC45LG1H220J | Ceramic 22pF | ±5% |
| C15.16 | CC45LG1H151J | Ceramic 150pF | ±5% |
| C17 | CC45SG1H150J | Ceramic 15pF | ±5% |
| C18 | CC45RG1H120J | Ceramic 12pF | ±5% |
| C19 | CC45LG1H151J | Ceramic 150pF | ±5% |
| C20 | CC45CG1H121J | Ceramic 120pF | ±5% |
| C21 | CK45F1H103Z | Ceramic 0.01μF | +80. -20% |
| RESISTOR | | | |
| R1 ~ 14 | RD14CB2E000J | Carbon resistor | ±5% 1/4W |
| SEMICONDUCTOR | | | |
| Q1 | V09-0020-05 | FET | 3SK22 (Y) |
| Q2 | V09-0011-05 | FET | 2SK19 (Y) |
| Q3 | V03-0079-05 | Transistor | 2SC460 (B) |
| Q4 | V03-1959-06 | Transistor | 2SC1959 (Y) |
| D4 | V11-0414-05 | Diode | 1S2588 |
| D5 | V11-4161-36 | Varicap diode | 1SV53A |
| TRIMMER/VC/INDUCTOR/COIL | | | |
| TC1 | C05-0305-05 | Ceramic trimmer | 12pF |
| TC2 | C05-0013-15 | Ceramic trimmer | 20pF |
| - | C02-0010-05 | Variable capacitor | ☆ |
| L1.2 | L40-4711-03 | Ferri inductor | 470μH |
| L3 | L40-1501-03 | Ferri inductor | 15μF |
| L5~7 | L40-4711-03 | Ferri inductor | 470μH |
| L8 | L33-0025-05 | Choke coil | 1μH |
| L9 | L32-0609-05 | Oscillator coil B | ☆ |
| L10 | L32-0608-05 | Oscillator coil A | ☆ |
| MISCELLANEOUS | | | |
| - | B42-1645-04 | Indication tape | ☆ |
| - | D22-0405-04 | Coupling | ☆ |
| - | D40-0604-05 | Dial mechanism | ☆ |
| - | E13-0163-05 | 1P Pin jack | |
| - | E23-0046-04 | Terminal (square) × 4 | |
| INDICATOR UNIT (X54-1450-00) | | | |
| SEMICONDUCTOR | | | |
| D1 | V11-3163-16 | LED | TLY-205 |
| D2 | V11-3162-86 | LED | TLG-205 |

SCHEMATIC DIAGRAM/SPECIFICATIONS/PARTS LIST

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

VFO-120 SCHEMATIC DIAGRAM

X60-1070-01



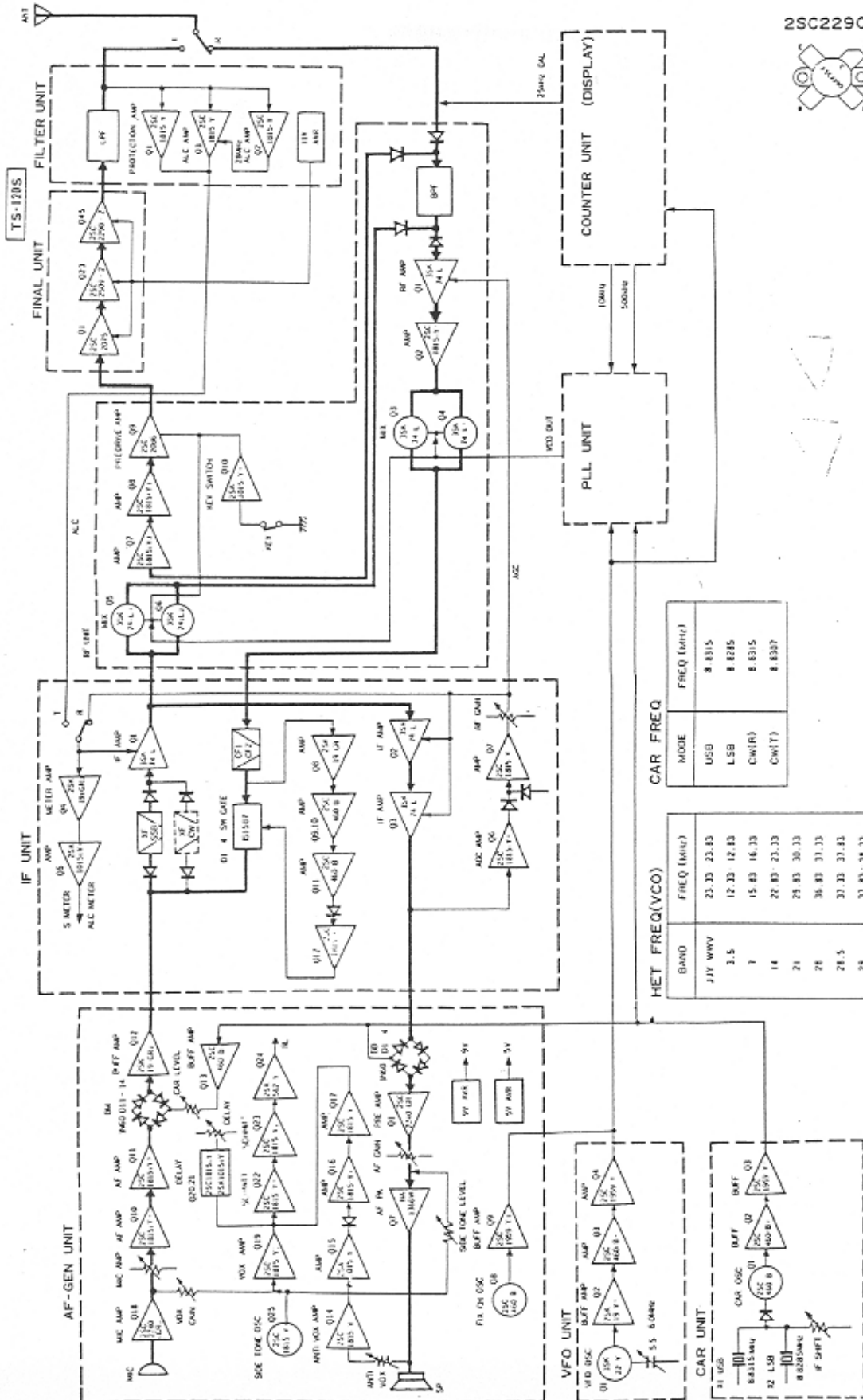
VFO-120 SPECIFICATIONS

- Speaker size: 3"
- Rated input: 1.0 watts
- Impedance: 8 ohms
- Frequency response: 300 Hz to 5 kHz
- Dimensions: 4-7/8" wide X 3-3/4" high X 9-1/3" deep (excluding feet)
- Weight: 3.1 lbs.

SP-120 PARTS LIST

| Ref. No. | Parts No. | Description | Remarks |
|----------|-------------|-------------------------------|------------|
| - | A01-0739-03 | Case (A) | ☆ |
| - | A01-0740-03 | Case (B) | ☆ |
| - | A20-2343-03 | Panel | ☆ |
| - | A23-1431-04 | Rear panel | ☆ |
| - | B04-0401-04 | SP grill | ☆ |
| - | B07-0613-04 | SP ring | ☆ |
| - | B39-0407-04 | Spacer x 2 | ☆ |
| - | B50-2636-00 | Operating manual | (K), (W) ☆ |
| - | B50-2637-00 | Operating manual | (T) ☆ |
| - | E20-0208-04 | Terminal plate | ☆ |
| - | G53-0507-04 | Packing x 4 | ☆ |
| - | H01-2611-04 | Carton | ☆ |
| - | H10-2513-02 | Front packing fixture | ☆ |
| - | H10-2514-02 | Rear packing fixture | ☆ |
| - | H12-0445-04 | Cushion | ☆ |
| - | H20-1407-03 | Protective cover | ☆ |
| - | H25-0077-03 | Polyethylene bag | ☆ |
| - | J02-0323-05 | Leg x 4 | ☆ |
| - | J02-0409-04 | Assistance leg | ☆ |
| - | J21-1144-14 | Speaker mounting hardware x 2 | ☆ |
| - | J61-0019-05 | Vinyle tie | ☆ |
| - | T07-0204-05 | Speaker | ☆ |

BLOCK DIAGRAM



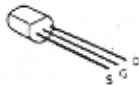
2SC2290



2SC2086



2SK30A(O)



2SK19(Y)
2SK19(GR)



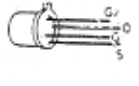
2SC460(B)



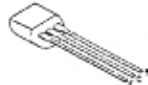
3SK40(L)



3SK22(Y)



2SA1015(Y) 2SC1815(GR)
2SC785(O) 2SC1959(Y)
2SC1775(E) 2SC2240(GR)
2SC1815(Y)



2SA473(Y)



2SC2075



2SD235(Y)



2SC2509



2SA562(Y)



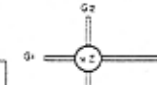
2SC784(O)



μPC14305H



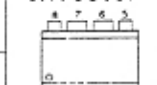
3SK74(L)



3SK73(GR)



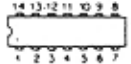
SN16913P



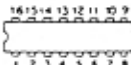
HA1366W



HD74LS00P MC4044P
SN74LS90N TC5026BP
TC4011BP



TC40198P TC50228P
TC40278P TC50518P
TC40298P TC50648P
TC40428P TC50668P
TC40498P TC45188P
TC50128P 74LS163N



VFO-120 FEATURES/BLOCK DIAGRAM/EXTERNAL VIEW/INTERNAL VIEW/CIRCUIT DESCRIPTION

FEATURES

1. The AT-120 is a high performance HF antenna tuner and is a modification of the popular AT-200 antenna tuner. The AT-120 is small and light, and is suitable not only for operation in your HAM shack but also for mobile or field operation.
2. The AT-120 is designed to be used on all Amateur bands meter, and an antenna switch.
3. The AT-120 is designed to be used on the Amateur bands between 3.5 MHz and 30 MHz.
4. Antenna MATCHING or THROUGH operation is BAND-switch selected.
5. The SWR meter operates in both THROUGH and MATCHING modes.
6. A mounting bracket is included for mobile operation.
7. The panel meter can be illuminated by an external power source.
8. The antenna matching circuit is effective in reducing TVI since it acts as a band-pass filter.

CIRCUIT DESCRIPTION

Directional Coupler

The directional coupler samples forward and reflected power from the transceiver to the load.

Meter Circuit

The forward and reflected power sampled by the directional coupler is used for SWR measurement. Forward power is calibrated with the CAL control so the meter reads reflectance as SWR.

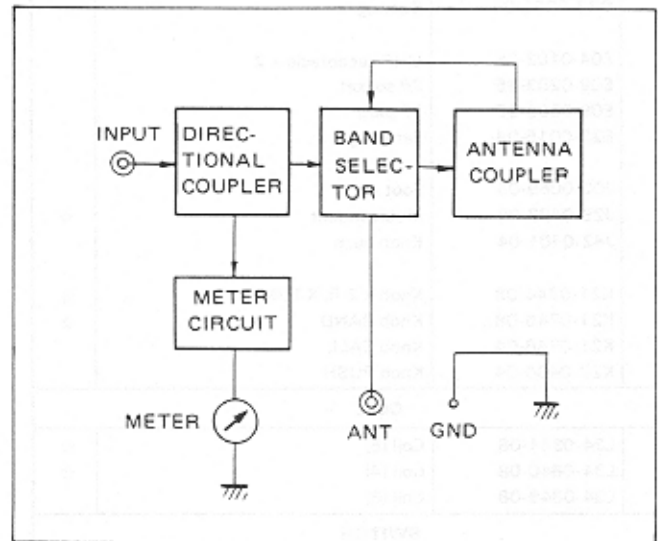
Band Selector Switch

This selects the band to which the matching circuit is tuned. In the "THROUGH" position, the antenna is connected directly to the transceiver, by passing the coupler, while still allowing SWR measurement.

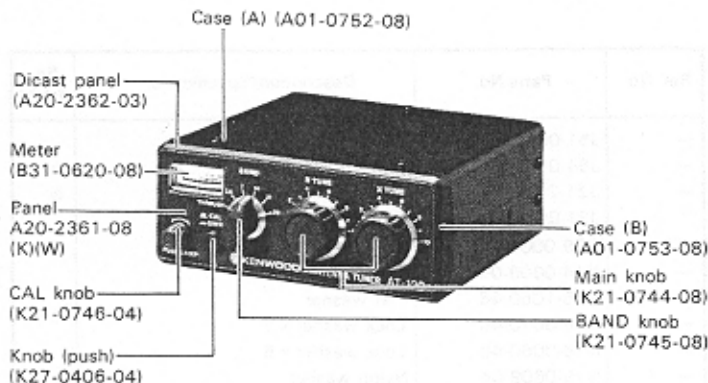
Antenna Coupler

The universal matching circuit is capable of matching 20 to 300Ω loads to the 50Ω input impedance.

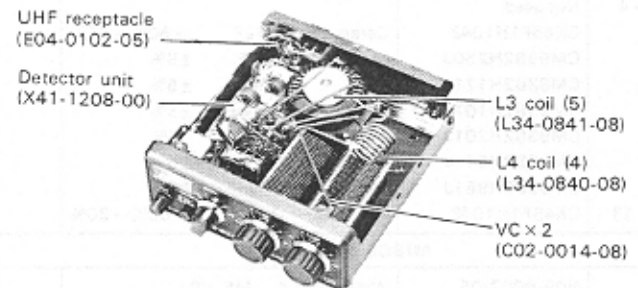
BLOCK DIAGRAM



EXTERNAL VIEW/INTERNAL VIEW



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AT-120 PARTS LIST/MB-100

Mark: New Parts

| Ref. No. | Parts No. | Description | Re- marks |
|-------------------------|-------------|----------------------------------|--------------|
| GENERAL | | | |
| | A01-0752-08 | Case (A) | ☆ |
| | A01-0753-08 | Case (B) | ☆ |
| | A20-2360-08 | Panel (T) | ☆ |
| | A20-2361-08 | Panel (K) (W) | ☆ |
| | A20-2362-03 | Dicasting panel | ☆ |
| | B31-0620-08 | Meter | ☆ |
| | B31-0058-00 | Warranty card (K) | |
| | B50-2667-08 | Operating manual (K) (W) (T) | ☆ |
| | B51-0875-00 | Service manual (K) (W) (T) | ☆ |
| | D23-0061-04 | Bearing | |
| | E04-0102-05 | UHF receptacle × 2 | |
| | E08-0203-25 | 2P socket | |
| | E09-0203-25 | 2P plug | |
| | E23-0015-04 | Earth lug × 3 | |
| | J02-0069-05 | Foot | |
| | J29-0402-08 | Mobile maunt | ☆ |
| | J42-0401-04 | Knob bush | |
| | K21-0744-08 | Knob × 2 R, X TUNE | ☆ |
| | K21-0745-08 | Knob BAND | ☆ |
| | K21-0746-04 | Knob CALL | |
| | K27-0406-04 | Knob PUSH | |
| COIL | | | |
| 3 | L34-0841-08 | Coil (5) | ☆ |
| 4 | L34-0840-08 | Coil (4) | ☆ |
| 5 | L34-0849-08 | Coil (6) | |
| SWITCH | | | |
| | S01-3404-08 | Rotary switch | ☆ |
| | S40-2403-05 | Push Switch | |
| VC/POTENTIOMETER | | | |
| C1,2 | C02-0014-08 | Variable capacitor × 2 250pF 1KV | ☆ |
| | R05-3406-08 | Variable resistor 20 kΩ (B) | ☆ |
| CAPACITOR | | | |
| 1~4 | Not used | | |
| 5 | CK45F1H104Z | Ceramic 0.1μF +80% -20% | |
| 6 | CM93B2H250J | Mica 25pF ±5% | |
| 7 | CM93B2H171J | Mica 170pF ±5% | |
| 8 | CM93B2H101J | Mica 100pF ±5% | |
| 9 | CM93B2H201J | Mica 200pF ±5% | |
| 10 | CM93B2H341J | Mica 340pF ±5% | |
| 11 | CM93B2H951J | Mica 950pF ±5% | |
| 12,13 | CK45F1H104Z | Ceramic 0.1μF +80% -20% | |
| MISCELLANEOUS | | | |
| | N09-0007-05 | Wing volt × 4 M5 × 8 | |
| | N14-0509-05 | Wing nut | |
| | X41-1208-00 | Detector Unit | ☆ |
| | H01-2633-08 | Carton (T) | ☆ |
| | H01-2634-08 | Carton (K) (W) | ☆ |
| | H12-0461-08 | Cushion | ☆ |

DETECTOR UNIT (X41-1208-00)

| Ref No | Parts No. | Description | Re- marks |
|--------|--------------|------------------------------|--------------|
| C1.2 | CM93B2H150J | Mica 15pF ±5% | |
| C3.4 | CK45F1H104Z | Ceramic 0.1μF +80% -20% | |
| R1.2 | PD148B2E510J | Carbon resistor 51Ω ±5% 1/4W | |
| L1.2 | L39-0403-08 | Detector coil | ☆ |

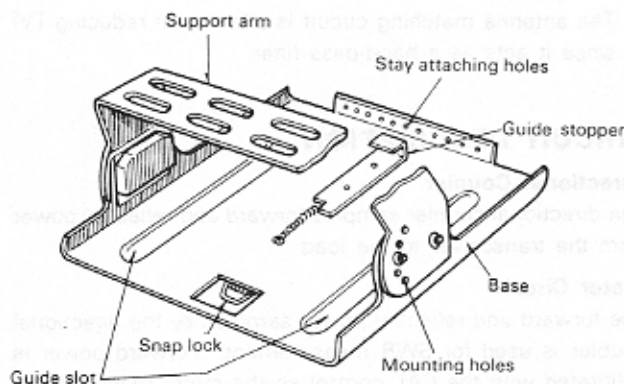


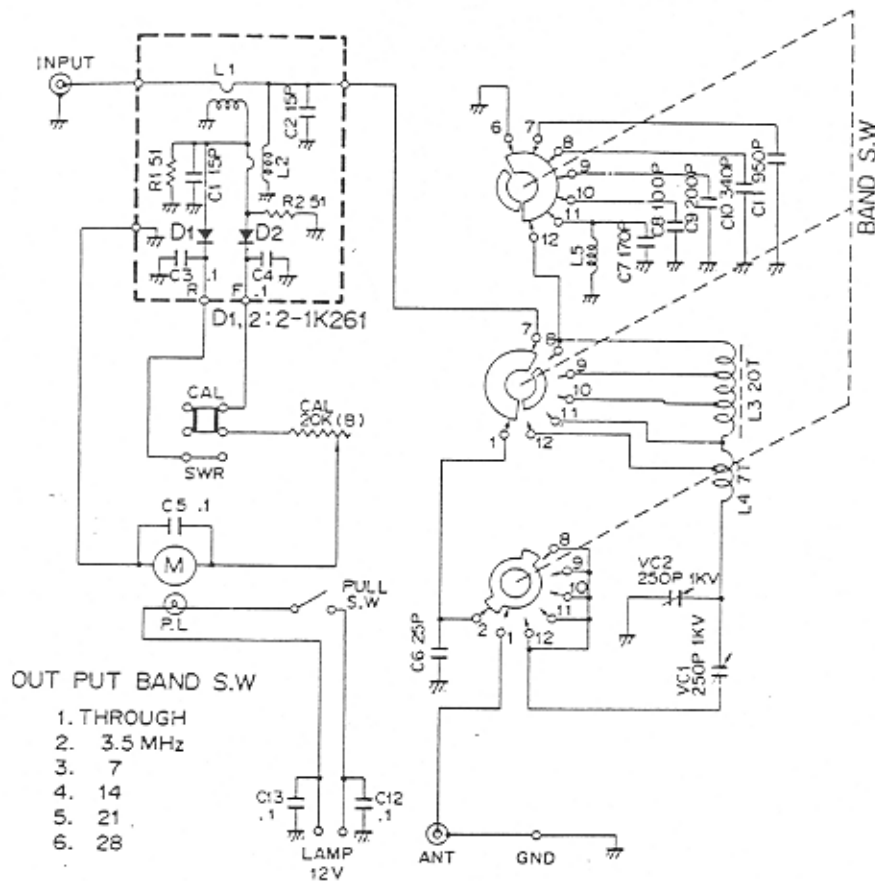
Fig. 21 MB-100 Installation location

| Ref. No. | Parts No. | Description/Specification | Re- marks |
|----------|-------------|--|--------------|
| - | J51-0006-15 | Snap lock | |
| - | J54-0401-14 | Stay × 2 | ☆ |
| - | J21-2633-04 | Guide stopper | ☆ |
| - | J21-0401-04 | Guide stopper (V) | |
| - | N09-0008-04 | 6mm Hex. Screw × 6 | |
| - | N14-0009-04 | 6mm Nut × 6 | |
| - | N15-1060-46 | Flat washer | |
| - | N16-0040-46 | Lock washer × 2 | |
| - | N16-0060-46 | Lock washer × 6 | |
| - | N19-0609-04 | Nylon washer | ☆ |
| - | N30-4008-46 | Screw | |
| - | N32-3006-46 | Flat head screw | |
| - | N87-3006-46 | Round head phillips self tapping screw × 2 | |
| - | N88-3006-46 | Flat tap light tight screw × 2 | |
| - | N99-0304-04 | Hex. head screw × 6 | |
| - | W01-0401-04 | Hex. wrench | |

AT-120 SCHEMATIC DIAGRAM/SPECIFICATIONS

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

SCHEMATIC DIAGRAM



SPECIFICATIONS

1. Antenna Coupler

| | |
|-------------------|--------------------------------------|
| Frequency range: | 5 amateur bands from 3.5 to 29.7 MHz |
| Input impedance: | 50Ω |
| Output impedance: | 20 to 300Ω, unbalanced. |
| Through power: | 150 W max. (3.5 MHz band, 120 W) |
| Insertion loss: | Less than 0.5 dB at optimum match. |

2. SWR Meter

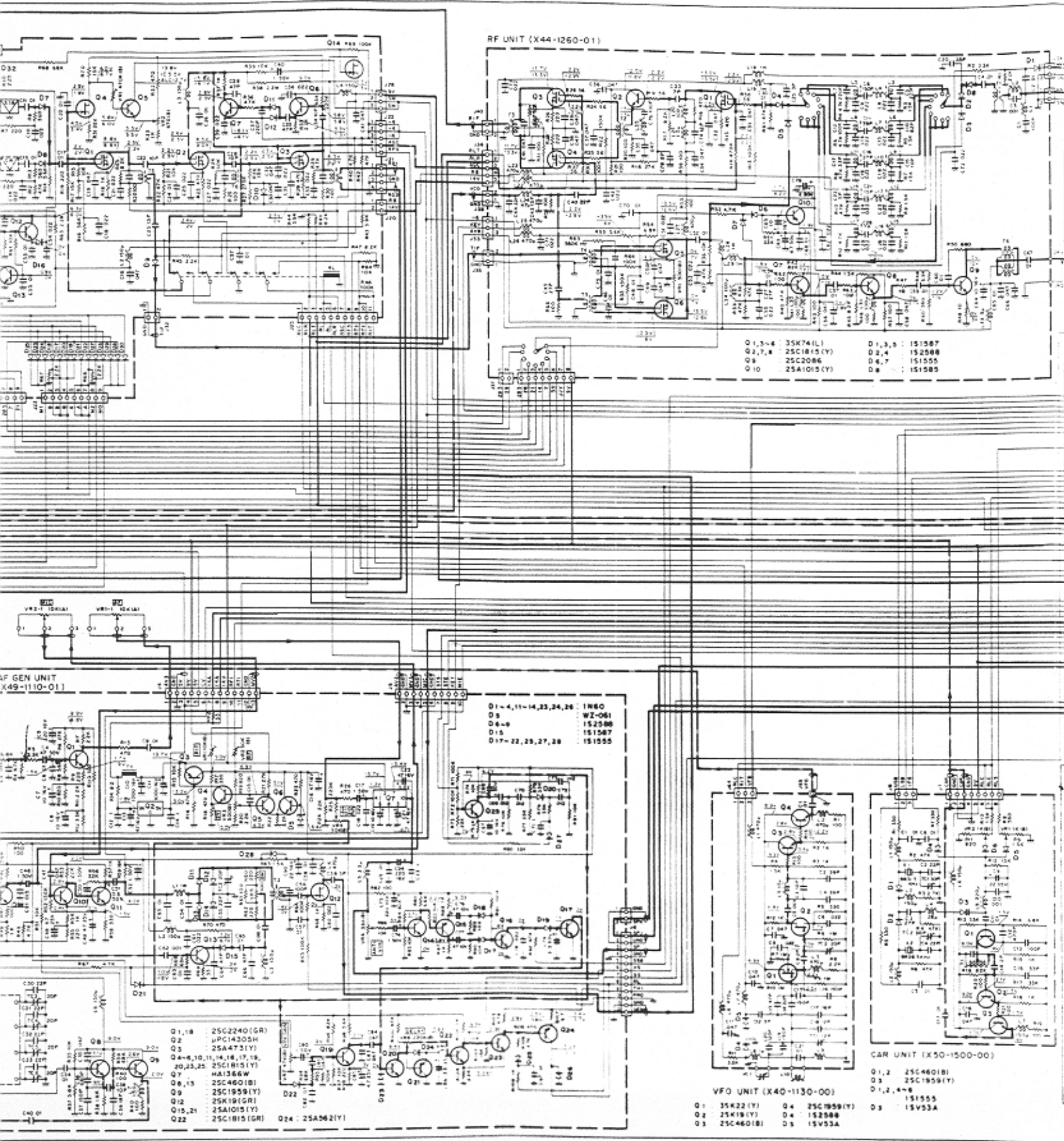
| | |
|----------------------|-----------------|
| Frequency range: | 3.5 to 29.7 MHz |
| Max. power: | 150 W |
| Measurable range: | 1.0:1 to 10:1 |
| Min. power required: | 2 W |

3. General

| | |
|------------------|--|
| INPUT Connector: | UHF type (50Ω) |
| ANT Connector: | UHF type (50Ω) |
| GND: | Wing nut and STUD. |
| Dimensions: | 152 (6) W × 60 (20-3/8) H × 159 (6-1/4) D mm. (inch) |
| Weight: | 1.6 kg (3.5 lbs) approx. |

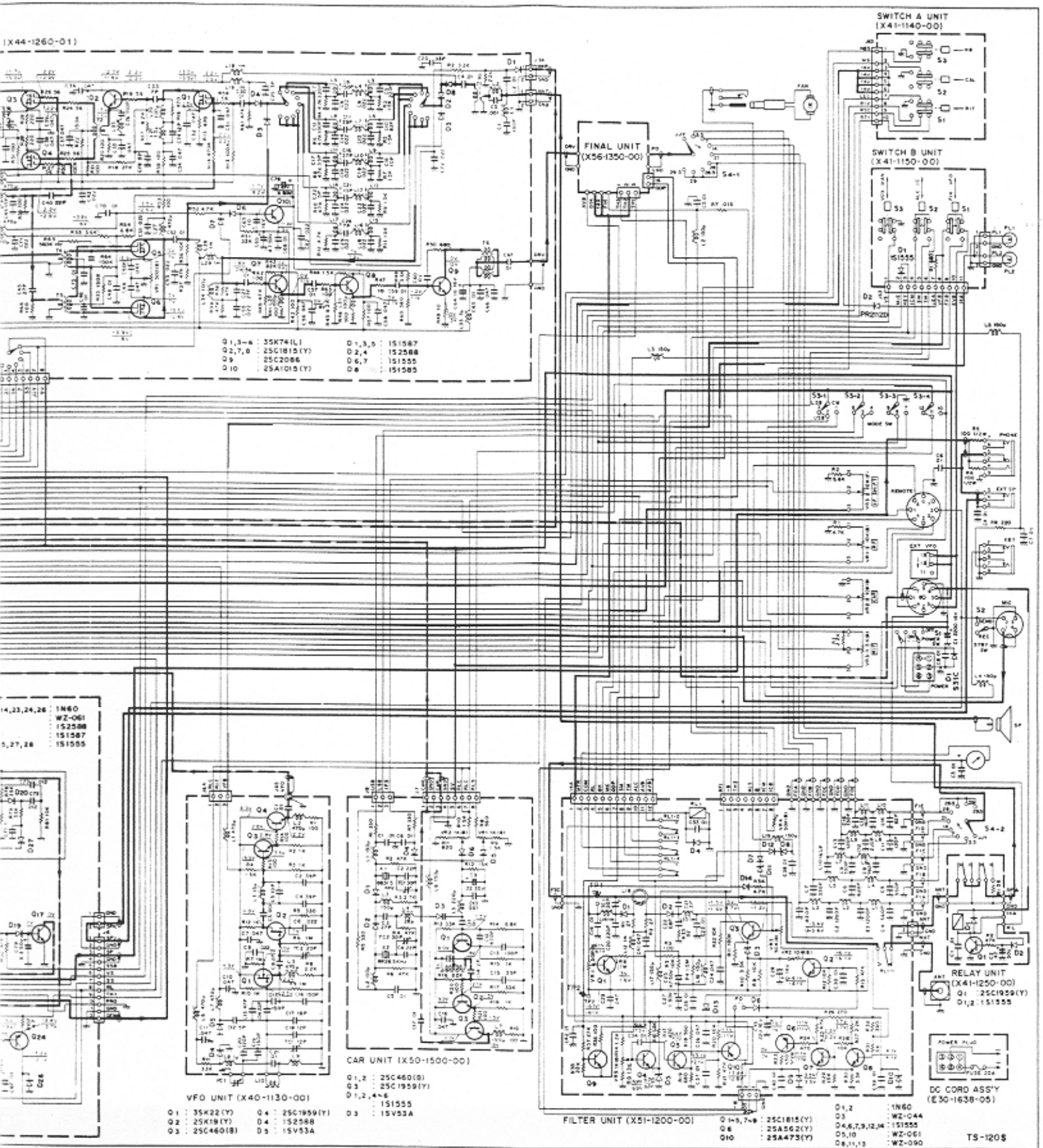
SCHEMATIC DIAGRAM

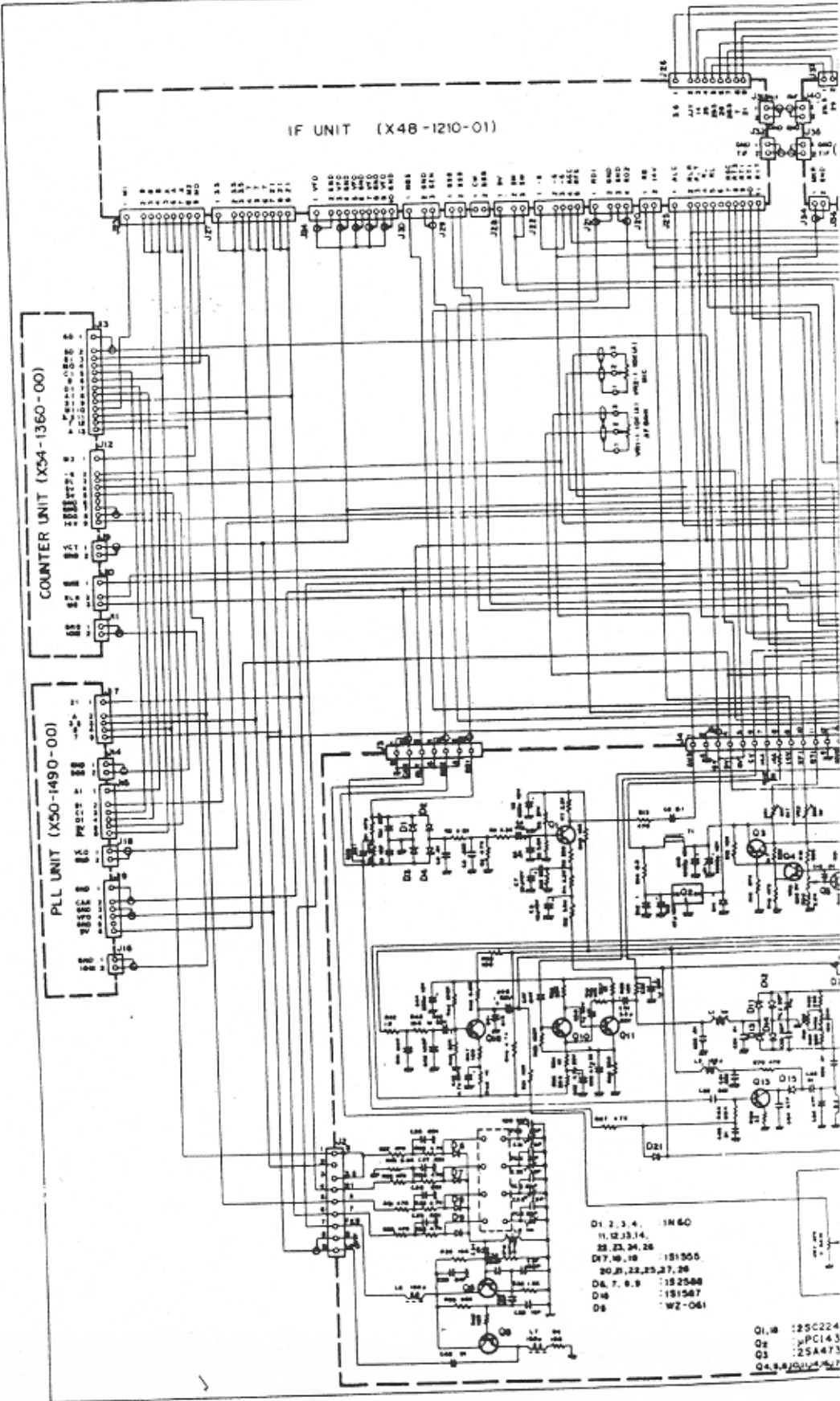
TS-120-S



MATIC DIAGRAM

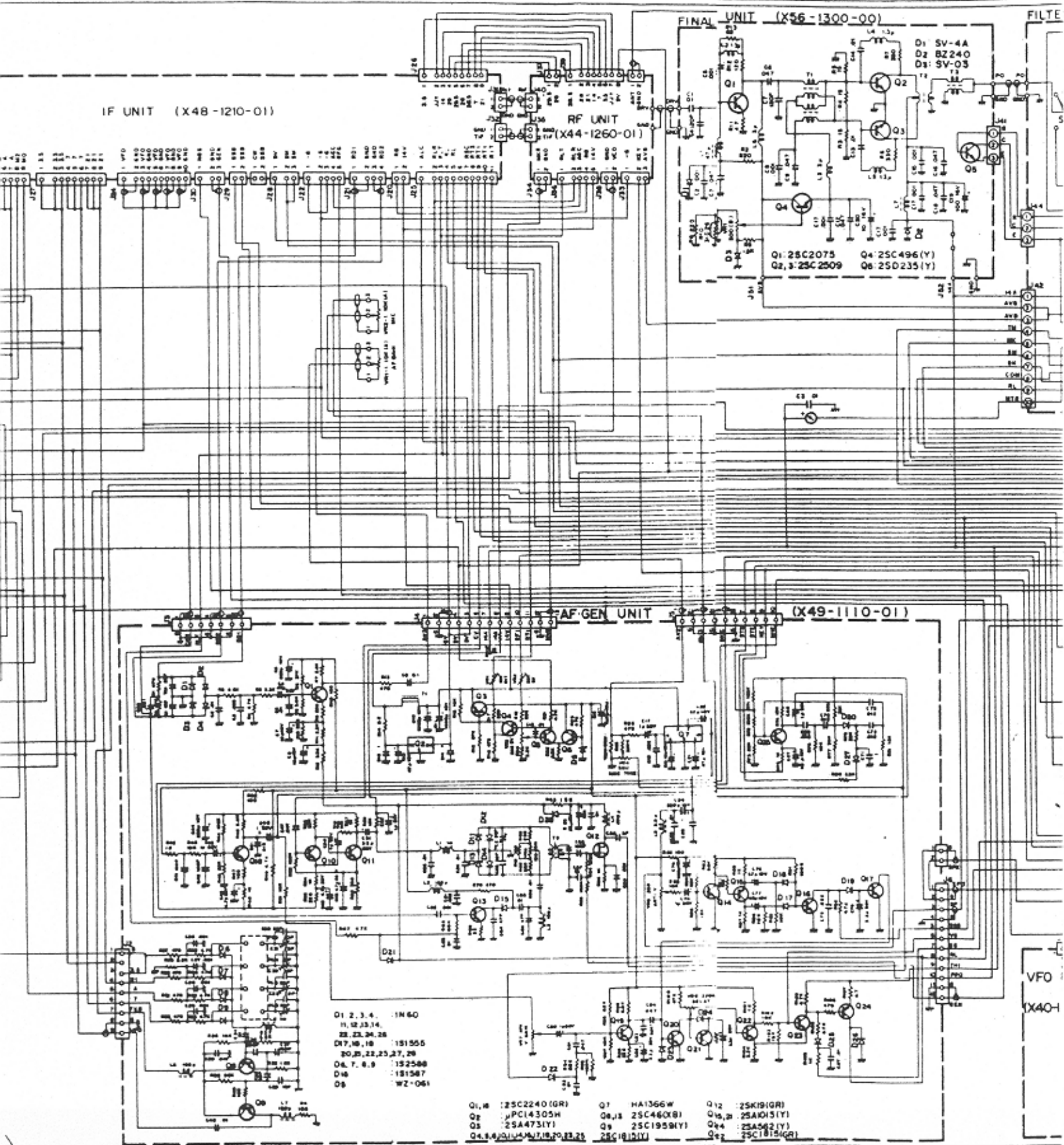
TS-120-S





TS-12C ✓

TS-120V SCHEMATIC DIAGRAM



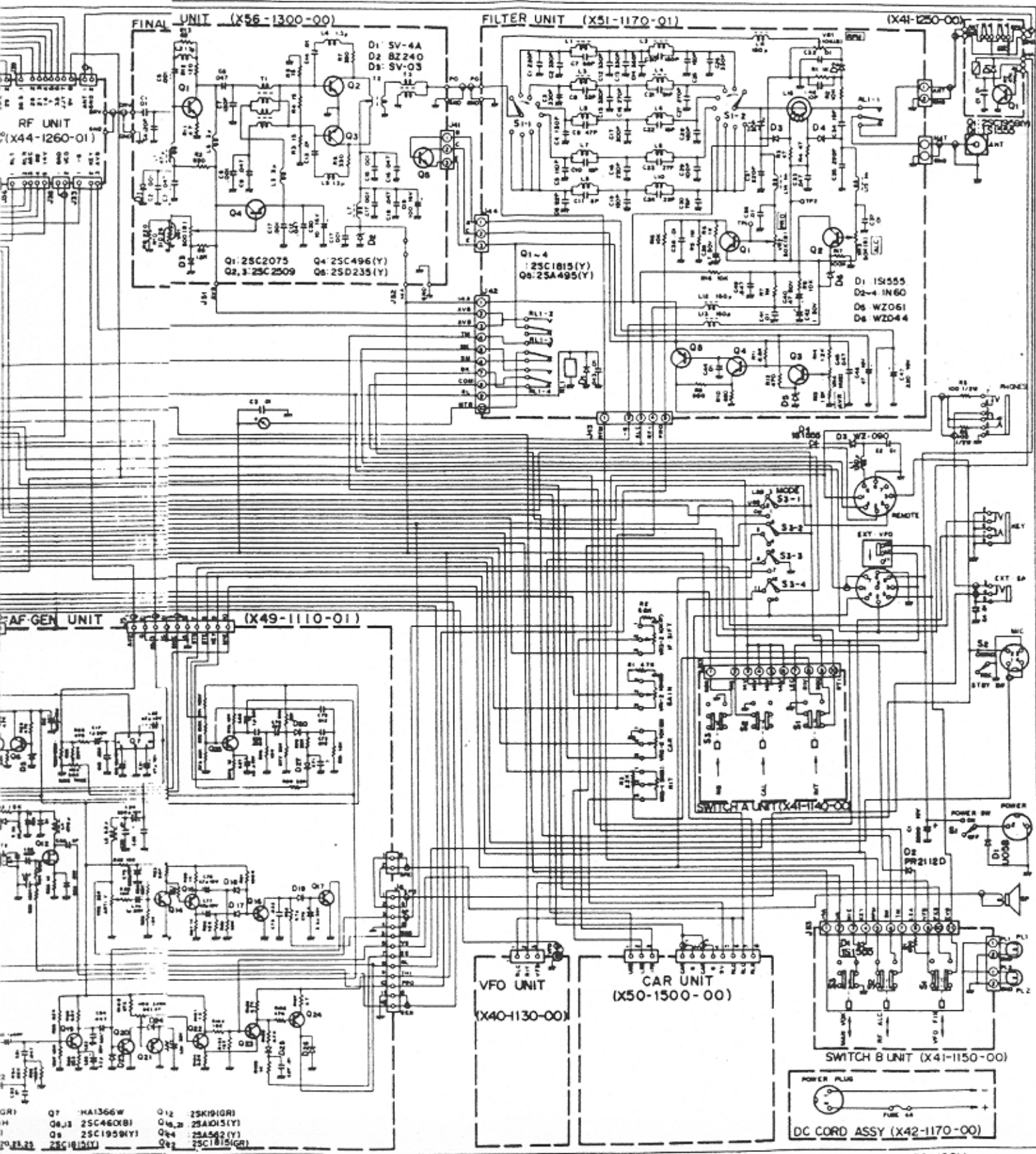
O1 2, 3, 4, 1N60
 11, 12, 13, 14
 22, 23, 24, 28
 O7 16, 18 151555
 20, 21, 22, 25, 27, 29
 O8 7, 8, 9 152588
 O9 151587
 O9 W2-061

Q1, 6 25C224010R1 Q7 HA1366W Q12 25K1910R1
 Q2 PC14305H Q8, 13 25C460XB1 Q13, 14 25AK151Y1
 Q3 25A4731Y1 Q9 25C1959Y1 Q14 25AK121Y1
 Q4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

TS-120V

0V SCHEMATIC DIAGRAM

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