KENWOOD

SERVICE MANUAL

Model TS-180S

VFO-180 PS-30 SP-180 AT-180



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HF SSB TRANSCEIVER

SPECIFICATIONS

GENERAL

Frequency Range:

160 meter band .... 1.80 to 2.00 MHz
80 meter band ..... 3.50 to 4.00 MHz
40 meter band ..... 7.00 to 7.30 MHz
20 meter band ..... 14.00 to 14.35 MHz
15 meter band ..... 21.00 to 21.45 MHz
10 meter band ..... 28.00 to 29.70 MHz
WWV ..... 10.0 MHz (receive only)
AUX 2BAND ..... A: 2.0 to 15.0 MHz each 500 kHz band
B: 18.0 to 18.5 MHz
C: 25.0 to 25.5 MHz

Mode: SSB(A3J), CW(A1), FSK(F1)

Voltage Requirements: 11.0VDC to 16.0VDC (13.8VDC nominal)

Power Consumption (at 13.8 VDC VSWR less than 1.5:1):

	TS-180 (TS-180S)	TS-180S (with D.F.C)
Receive	1.2 A	1.6 A
Transmit	19.6 A	20 A

Semiconductor Complement:

	TS-180 (TS-180S)	TS-180S (with D.F.C)
Transistors	143	177
FETS	21	26
ICS	33	53
Diodes	203	240

Dimensions: (Projections not included)

325(12-13/16")wide × 133(5-1/4")high × 287(11-5/16")deep

Weight:

TS-180 (TS-180S)	TS-180S (with D.F.C)
11.0 kg (24.2 lbs)	11.5 kg (25.3 lbs)

TRANSMITTER SECTION

Input Power:

160 to 15 meters band	10 meters band
SSB 200 Watts PEP	160 Watts PEP
CW 160 Watts PEP	140 Watts DC
FSK 100 Watts DC	50 Watts DC

Antenna Impedance: 50 Ohms

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

Unwanted Sideband Suppression: Unwanted sideband is better than 60 dB down from the output signal

Harmonic Radiation: Better than 40 dB down from output signal

Spurious Radiation: Better than 50 dB down from output signal

Microphone Impedance: 500Ω to 50 kΩ

Transmitter AF response: 400 to 2600 kHz

RECEIVER SECTION

Receiver Sensitivity: 0.25μV S+N/N 0 dB or more

Image Rejection: Image frequency better than 60 dB down from the output signal

IF Rejection: IF frequency is 80 dB or more down from output signal

Frequency Stability: Within ±1 kHz during the first hour after 1 minute of warmup
Within 100 Hz during any 30 minute period after warmup

Receiver Selectivity: SSB, CW WIDE
2.4 kHz (−6 dB)
4.2 kHz(−60 dB)
CW NAR, FSK (With optional filter YK-88C)
0.5 kHz (−6 dB)
1.8 kHz(−60 dB)

Audio Output: More than 2 watts (with less than 10% distortion) into an 4 ohm load.

AF Output Impedance: 4 to 16 ohms (speaker or headphones)

FEATURES

1. DFC (Digital Frequency Control), with four tunable memories.

- Memories are usable in transmit and or receive modes. Split-frequency operation is possible with TS-180S VFO and any one of the memories, with TS-180S VFO and optional VFO-180 external VFO, and with a DFC memory and VFO-180.
- Memories can store frequencies from the TS-180S VFO, FIX CH, and VFO-180. Also, frequencies can be transferred between memories.
- Memory-shift paddle switches allow any of the memory frequencies to be tuned in 20-Hz steps up or down, slow or fast, with recall of the original stored frequency.

2. High-performance solid-state final.

- No dipping or loading. Just dial up the frequency, peak the drive, and operate.
- High power...200 W PEP/160 W DC input on 160~15 meters, and 160 W PEP/140 W DC on 10 meters.
- Highly reliable, with large heatsink.
- Final transistors (two SFR1714s, each with PC=250 W) are manufactured by Motorola to Kenwood's specifications.
- Double protection circuits. If the VSWR is more than 10:1, transmit power is automatically reduced to about 1/10 of normal. Also, if the temperature of the care of the transmit output coil rises abnormally, transmit power is reduced to about 1/10 of normal.

3. Covers 160~10 meters, with provisions for WARC allocations.

- Transceives on 160, 80/75, 40, 20, 15, and all of 10 meters.
- Receives WWV on 10 MHz
- Adaptable, by installing additional parts to three new bands, if they should be made available at the World Administrative Radio Conference. AUX 1 and AUX 2 as well as the WWV positions are provided on the BAND switch for this purpose.
- The TS-180S VFO covers more than 50 kHz above and below each band, for MARS and other applications, an thus will accommodate shifts and expausions of existing bands that might be made at WARC.

4. Built-in microprocessor-controlled large digital display.

- Shows actual VFO frequency.
- Digital display memory and display of frequency difference. With DSP/M switch turned on when the DSP/DIFF switch is depressed, the frequency that was displayed is memorized and shown at the left side of the digital display, and the difference between the

FEATURES/CIRCUIT DESCRIPTION

memorized frequency and the VFO frequency is shown at the right side, continuously changing as the main tuning is changed.
- Blinking decimal points indicate "out of band"
- Monoscale dial also provided.

5. Improved dynamic range, with optimum cross-modulation rejection.
- RF AGC, using a pin diode between the antenna input and RF amplifier-Attenuating is accomplished by the mixer's AGC output, due to superior characteristics of forward bias current versus high-frequency resistance. Thus, the RF-amplifier bias voltage is set automatically for optimum cross-modulation rejection.
- RF attenuator, with fixed AGC voltage for about 20 dB of attenuation.

6. Single-conversion system with highly advanced PLL circuit.
- Uses only one crystal.
- Improved stability and spurious characteristics.

7. Easy-to-use MODE switch.
Automatic selection of upper and lower sideband with BAND switch. SSB NORMAL and REVERSE positions on MODE switch.
- CW NARROW and WIDE positions, allowing narrowband operation on CW with the optional YK-88CW filter — a low-pass audio filter is inserted in the WIDE position.
- FSK position for RTTY operation, providing a 170-Hz frequency shift.

8. RF speech processor.
- Increases average audio level and average transmit power by maintaining constant IF amplifier output independent of the microphone output.
- Selectable SLOW and FAST time constants. SLOW (long) time constant provides more natural audio, whereas FAST (short) increases talk power.

9. Dual SSB IF crystal filter system
- Second filter (YK-88S) is optional. IF circuits are common for both transmission and reception.
- Improves signal-to-noise ratio and increases selectivity.
- Provides excellent audio compression when transmitting, while preventing sideband expansion (splatter).

10. Tunable noise blanker (adjustable noise-sampling frequency.)

11. Dual RIT (receiver incremental tuning). Operates on VFO and FIX/MEMORY positions, with separate concentric controls.

12. Variable-pitch CW sidetone (internal adjustment).

13. IF SHIFT moves passband away from interfering signals.

14. Fixed channel (for net and similar applications), when crystal is added.

15. Built-in VOX circuit.
- Automatic transmission by voice. VOX GAIN and DELAY controls on front panel.
- Semiautomatic keying on CW. Time constant automatically 2/3 shorter than on SSB.

16. Variety of rear-panel provisions:

IF OUT 1, IF OUT 2	for observing waveforms
XVTR terminal	for transverters
ACSY terminal	for linear amplifier and other optional accessories
EXT VFO terminal	for external VFO
RF ANT	for separate antenna for receive only
KEY terminal	for CW key
RTTY terminal	for radioteletype operation
SP terminal	for external speaker
ANTI VOX control	for antitrip of transmit from receiver audio during VOX operation

17. Full line of matching accessories.
- PS-30 base-station power supply.
- SP-180 external speaker with selectable audio-filters.
- VFO-180 remote VFO
- AT-180 antenna tuner/SWR and power meter/antenna switch
- DF-180 Digital Frequency Control (if TS-180S is purchased without DFC)
- YK-88C CW filter
- YK-88S SSB filter

CIRCUIT DESCRIPTION

Receiver Section

The receiver section of the TS-180S is fundamentally of a single-conversion type with an IF of 8.83 MHz (only the NB circuit has a double-conversion system).

The input signal from the ANT or RX ANT is first applied to the RF ATT circuit consisting of PIN diodes D1 and D2 (BA379 × 2), then applied to the antenna coil via the IF trap. The input signal level is stepped up by the antenna coil, and then amplified by RF AMP Q3 (3SK73). The amplified signal is applied to the balanced mixer consisting of junction-type FETs Q7 and Q8 (2SK125 × 2), via the source follower Q6 (2SK125), where the VCO output is mixed with the input signal and the 8.83 MHz IF signal is generated. The IF signal is divided and sent to two circuits in the IF unit, where one half is amplified by Q3 (2SA1015) and diode detected. It is then amplified and used to control the RF ATT circuit. The other half is applied to the buffer amplifier, then divided again and sent to the ceramic filter assembly and the NB mixer, Q6, (2SK19). The signal through the ceramic filter is amplified by the FET amplifier Q2 (2SK19), then applied to the NB gate consisting of four 1S1587s diodes. The signal applied to Q6 is mixed with the local-oscillator signal (9285 ± about 74 kHz variable) and the 455 kHz signal is generated. The 455 kHz signal is amplified by Q7, Q8, and Q9 (2SC460 × 3) and then detected. The detected signal is applied to the three-stage amplifier to switch the NB gate. The NB gate output is applied to the three-stage amplifier, Q15, Q16, and Q17 (3SK73 × 3), via the SSB (or CW) crystal filter, then applied to the buffer amplifier, Q35 (2SC460), via the (optional) SSB crystal filter. This buffered signal is heterodyned with the CAR oscillator output at the product detector consisting of two 1N60 diodes to produce the audio signal. The audio signal is amplified by the buffer amplifier, Q29 and Q30 (2SC1000 × 2), then applied to the AF amplifier AN315 via the AF GAIN control, and the AF amplifier drives the speaker.

Transmitter Section

The voice signal from the microphone is amplified by the MIC amplifier, Q32 (2SC1000), then applied to the MIC amplifier Q33 (TA 7140) via the MIC GAIN control. The MIC input matches a microphone of 500 Ω ~ 50 kΩ. A 20 dB attenuator is available if the microphone output level is too high (by a pin jumper on the IF unit). The MIC amplifier output is applied to the balanced modulator (IN60 × 4) where the signal is switched by the CAR, and a DSB signal is generated. The DSB signal is buffered by Q35, then filtered by the crystal filter to produce the SSB signal. The SSB signal is amplified by

CIRCUIT DESCRIPTION

the three-stage IF amplifier (which is shared with the receiver section). This amplifier is also used as the processor compression amplifier. The compression amplifier always operates, and turning the processor ON and OFF is performed by switching the compression-amplifier ALC time constant. The amplified SSB signal is applied to the optional SSB crystal filter which filters the sideband widened by the processor. (If the optional filter is not used, turn the switches on the IF unit to the ATT position). Even if the optional filter is not used, effectiveness of the processor will not be decreased. The filtered signal is then applied to IF amplifier Q22 (3SK73), where RF POWER and ALC functions (external, internal ALC, and XVTR ALC) are applied.The amplified SSB signal is then mixed with the VCO output by the balanced mixer Q4 and Q5 (3SK73 × 2) in the RF unit, and the SSB signal of the desired frequency is obtained. The mixer output is applied to the amplifier Q1 (3SK73) via a tuned circuit in the Coil Pack unit. At this stage, the gain compensation for each band and power decrease at protection are carried out. The signal amplified by Q1 is filtered by the BPF and amplified by the wide-band amplifier Q2 and Q3 (2SC1519 and 2SC741). This amplifier drives the 10 W Driver stage. In the 10 W Driver stage, the drive output is amplified by Q1 (2SC2075), then amplified by the push-pull amplifier Q2 and Q3 (2SC2509 × 2), and 10 W output is obtained. The 10 W stage drives the final push-pull amplifier consisting of two SRF-1714s. The final output is fed to the antenna via the LPF and the antenna relay. In the 100 W final stage, the temperature of the output transformer is detected and in the LPF unit, the ALC signal is detected. For CW operation, the switching transistor Q10 (2SC734) in the RF unit controls the balanced mixer Q4 and Q5 (3SK73 × 2) in the RF unit and the amplifier Q4 (3SK73) in the Coil Pack unit. Positive (+) keying is used in TS-180S. Transmission and reception are switched by four relays (nine circuits).

Noise Blanker

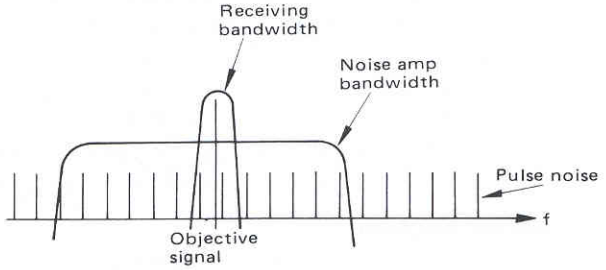


Fig. 1 Noise detecting band width of former noise blanker

In former circuits, the passband of the noise amplifier was fixed to ±10~20 kHz of the receiving frequency. If a strong signal existed near the received signal, noise separation usually deteriorated. This disadvantage could not be avoided with such a circuit. In the TS-180S, a local oscillator and mixer are provided for the noise amplifier and the signal is converted to 455 kHz, and then noise components are separated. The passband of the noise amplifier is determined by BPF, and the passband center can be shifted to an optimum frequency within a range of about ±100 kHz off the receiving frequency. Therefore, a strong interfering signal can be avoided and noise separation can be done efficiently.

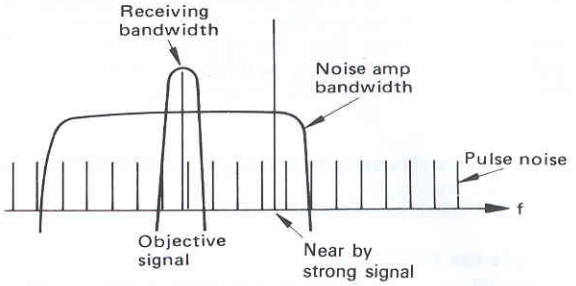


Fig. 2 Formal noise blanker

If a strong signal is within the passband of the noise amplifier, a noise-amplifier AGC voltage is generated by the strong signal and noise detection function is blocked. In the Amateur bands, there is every likelihood of a strong signal existing (a local ham station, a BC station, etc.) within the passband of the noise amplifier Fig. 2.

If the passband center of the noise amplifier is shiftable, interference from other stations can be avoided with stable detection of the noise component only. And, there is scarcely any difference in the waveform of the noise within the receiving range and that within the passband of the noise amplifier because frequency shift is very small Fig. 3.

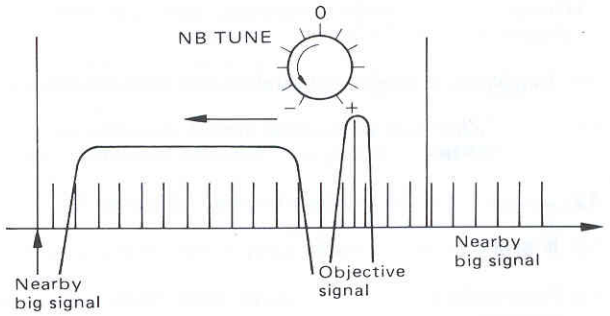


Fig. 3 TS-180 Noise blanker

Speech Processor

In the TS-180S, the receiver IF amplifier is also used as the compression amplifier for transmission. As the gain of the IF amplifier is too high, it is decreased during transmission by increasing the source resistors of the second and third amplifier stages. An individual AGC system is provided for transmission. The processor always operates during transmission. Two selectable time constants are provided; when SLOW is selected, the time constant is sufficiently long and natural and voice tone is not lost. When FAST is selected, the time constant is short and talk power of the transmitted signal is increased. In either case, compression-amplifier peak level is kept constant, so no further adjustment is required when the

CIRCUIT DESCRIPTION

time constant is changed. Normally, the compression level reading is about 10 dB on the COMP meter. When the optional SSB filter is installed, the compression level can be increased up to 20 dB with the selector at FAST because the widened sideband is filtered.

In former transceivers such as the TS-520, only the crystal filters, the first stage of the IF amplifier, and the mixer coils were shared by the transmitter and the receiver. However, as the receiver AGC loop operates on the same principle as the RF compressor, the IF amplifier of the receiver is also used as the speech processor for transmission in the TS-180S.

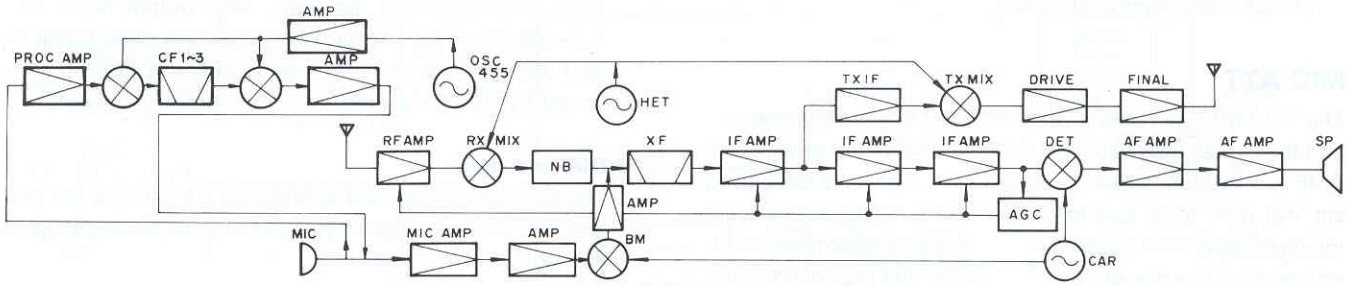


Fig. 4 TS-820 RF Speech processor

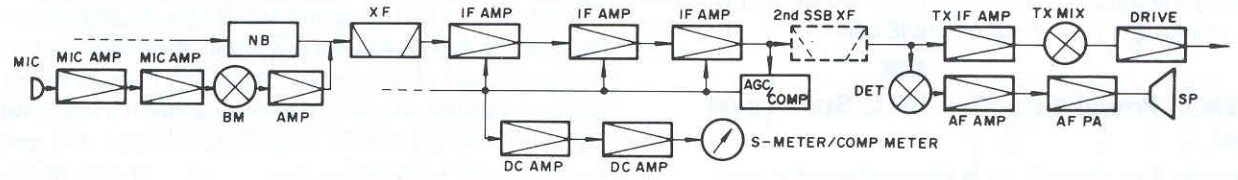


Fig. 5 TS-180 RF Speech processor

RF Power Control

RF power level can be changed by adjusting the RF POWER control on the front panel. The RF POWER control decreases the ALC time-constant reference voltage (normally 3.6 V), which decreases the transmitter IF amplifier gain. Thus, the drive level is decreased, and with it the RF power. The circuit operates in the same way as the variable-threshold receiver RF GAIN control.

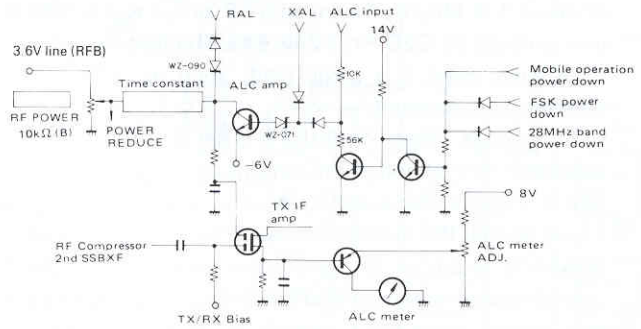


Fig. 6 RF POWER CONTROL RF POWER SWITCHING

IF Double Filters

The following advantages are obtained by adding the SSB crystal filter to the IF-amplifier output. 1) improvement of S/N ratio, 2) improvement of selectivity for a single signal on reception, and 3) a deeper compression level. Each advantage is amplified below.

1) External noise and noise generated in the RF or MIXER stage can be reduced by the IF-amplifier input filter used in existing transceiver circuits. However, for noise generated in the IF amplifier, only the filtering function of the succeeding AF stage is effective. For example, when the AF frequency range is 200 Hz ~ 3 kHz and the carrier frequency is 8331.5 kHz (USB), noise existing within the range of 8831.7 ~ 8834.5 kHz and 8831.3 ~ 8828.5 kHz is output from the AF stage of a receiver using an input IF filter only. However, if a crystal filter of 8830.0 ± 1.2 kHz (e.g. YK-88S) is added between the IF amplifier and the detector, only the IF noise existing within 8831.2 ~ 8828.2 kHz is output. As a result, the IF noise is decreased by about 3 dB when viewed from the AF output. The overall S/N ratio is not decreased by 3 dB because it is determined by not only the IF noise but also by the noise generated in the previous RF stages. In the TS-180S, however, when the IF SHIFT is varied to a large extent, the IF noise has a greater influence on S/N ratio than usual and the additional filter is useful. Even if the IF SHIFT is centered, the additional filter sharply cuts off the AF signal high-frequency component and so decreases audibility of the output noise.
2) An ordinary crystal filter is included in the AGC loop, so that, when the tuning frequency is shifted up and down while a strong signal is received, the apparent selectivity for a single signal viewed from the output is deteriorated by the AGC. As the additional filter is not in the AGC loop, the apparent selectivity viewed from the output is just the selectivity of the filter regardless of the level of the received signal. Thus, the high-frequency beat heard at off-tuning can be avoided.
3) The RF compressor speech processor used in the TS-180S

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eliminates splatter normally generated by compression. Expansion of the sideband on compression is usually negligible. However, if the compression level is increased to 30 dB during FAST time-constant operation, sideband expansion is somewhat critical. With the additional filter, the sideband signal is again filtered and a high-quality SSB signal of high talk power is obtained.

MIC ATT

The TS-180S includes a maximum 30 dB of compression, and the overall gain between the MIC AMP and transmitter IF AMP is very high. When the gain is too high, it is difficult to set the gain to a low level, especially when a high-gain microphone is used. Therefore, a 20 dB attenuator is provided between the microphone connector and the microphone amplifier so that the compression amplifier gain can be easily set. Switching the attenuation level (0 dB — 20 dB) is performed by changing a jumper pin on the IF unit.

Transmission Power Selection (ALC Start Level Selection)

The ALC voltage from the LPF unit is resistor-divided in the IF unit, then applied to the ALC amplifier. By changing the dividing ratio the ALC start level (i.e., the transmission power which is controlled by the ALC) is varied. The dividing ratio is transistor-switched, which is controlled by the diode matrix to which signals from MODE SW and BAND SW are applied.

Frequency Divider Unit (X54-1420-00)

This unit divides the 8 MHz reference signal from the PLL unit and generates the GAT, RST, and LTH signals for the display unit and the memory assembly. Q1 and Q2: 8 MHz input amplifier; Q3: 1/16 divider; Q4: 1/100 divider; Q6: buffer (between C-MOS and TTL); Q7: 1/10 divider; Q8 and Q9: timing generator; Q10: output buffer.

Display Unit (X54-1430-00)

1. Outline of unit

The unit consists of the counter, display driver, tone signal circuit, 5 V and −24 V power supply and the interface to the external switches. These are all controlled by the microprocessor Q20.

1 Counter

Four-digit data (4 bits × 4) of 100 Hz ~ 100 kHZ counted by Q12 ~ Q14 are divided into two groups of 4 bits × 2 by the data selector and input to the microprocessor two digits by two digits. The data selector is controlled by the output of Q20, Pin 25 (R3). The data are input to Q20, Pins 26 ~ 29 (R4 ~ R7) and 34 ~ 37 (R12 ~ R15) and stored in the microprocessor RAM, at the trailing edge of the GATE signal (input to Pin 4: IRQ).

2 Display

B0 ~ B3 data are generated by the PLL and input to Pins 33 ~ 41 (KØ ~ K3). These data are for MHz and tens of MHz digits for each Amateur band and are combined with the stored four-digit data of 100 Hz ~ 100 kHz. Then, digit data is converted to 8-bit data to drive the corresponding seven-segment indicator, and output from Pins 13 ~ 20 ($Ø_0$ ~ $Ø_7$). At the same time, the drive signal for each digit (4 bits) is output and is BCD-to-DECIMAL converted by Q23 to operate the corresponding indicator.

3 DIFF indication

The DIF signal is applied to Q20 Pin 31 (R9) via the gate and FF. The indication is switched by the trailing edge of this signal.

4 Memory indication

The signal from DIS is applied to Q20 Pin 30 (R8) via the latch. At the trailing edge of this signal, the frequency currently indicated is memorized. When the memory operation is completed, the microprocessor issues the tone drive signal from Pin 23 (R4) to drive the tone circuit. The tone circuit can be inhibited by shorting the terminals on the tone unit. The tone signal sounds at 2.8 kHz for 30 ms. The frequency and time are determined by C9 and R18, and C8 and R16, respectively.

5 Off-band indication

When the indicated frequency is out of an amateur band, two decimal points, which are lighted continuously regardless of NOR or DIFF indication, flash to notify the operator that the frequency is out of band.

6 Other Circuits

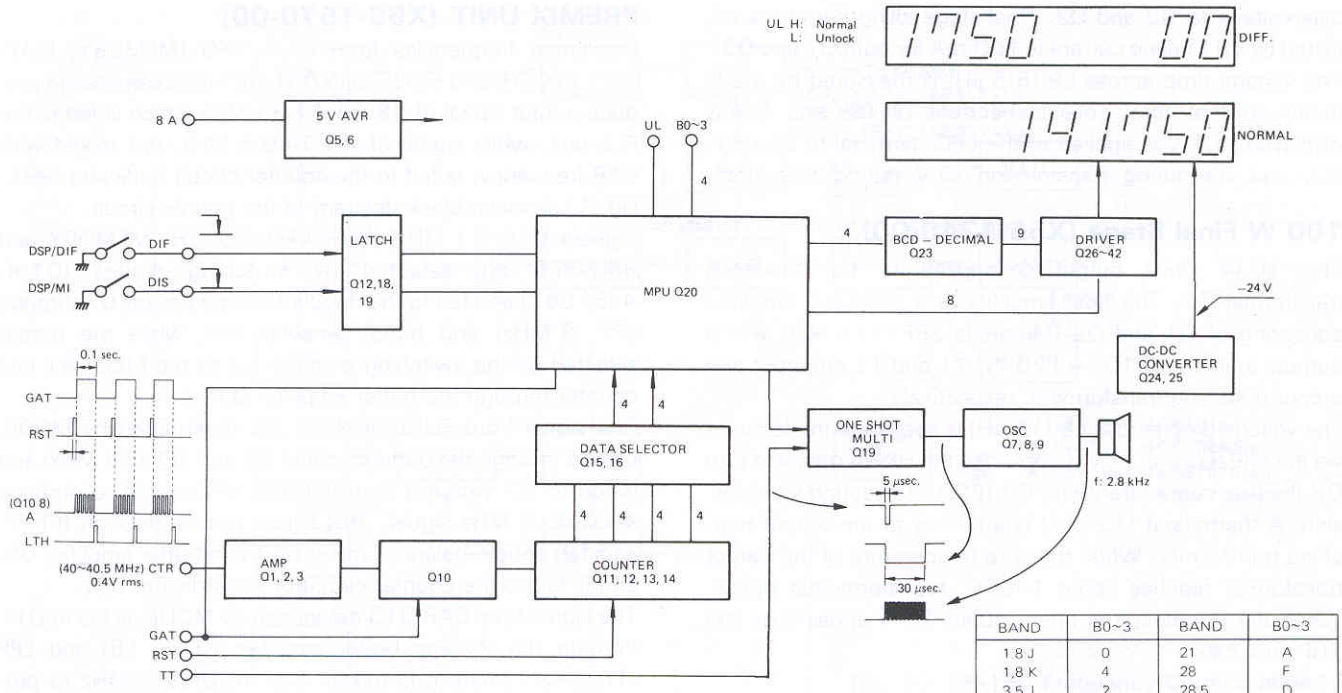
Clock generator for the microprocessor: Generates a clock of about 1.4 MHz by means of a CR circuit (C7 and R14) and outputs to Q20 Pin 12 (X.EX). The frequency varies extensively even if a small load, such as a frequency counter, is connected.

RESET circuit: When Pin 3 (RST) is set to "L", the microprocessor is reset and all the outputs are initialized to "H". The 5 V line is connected to Pin 3 via a CR time-constant circuit so that the microprocessor is automatically reset at power-on. A circuit to prevent the microprocessor from operating erroneously is also connected to Pin 3. This circuit consists of Q4, Q21, and D1. It compares the 5 V line voltage with the reference voltage (4 V) across D1 and resets the microprocessor if the 5 V line voltage is below 3.4 V.

10 W Driver Stage (X56-1330-00)

In the 10 W Driver stage Q1 (2SC2075) amplifies the input signal to drive the push-pull amplifier consisting of Q2 and Q3 (2SC2509 × 2). The circuit configuration is almost the same as that used in the TS-120S. Q4 (2SC496 (Y)) supplies the

CIRCUIT DESCRIPTION



BAND	B0~3	BAND	B0~3
1.8 J	0	21	A
1,8 K	4	28	F
3.5 J	2	28.5	D
3.5 K	3	29	E
3.5 W	6	29.5	C
7 J	5	WWV	B
7 K	7	AUX A	9
14	8	AUX B	1

Fig. 7 Display unit block diagram

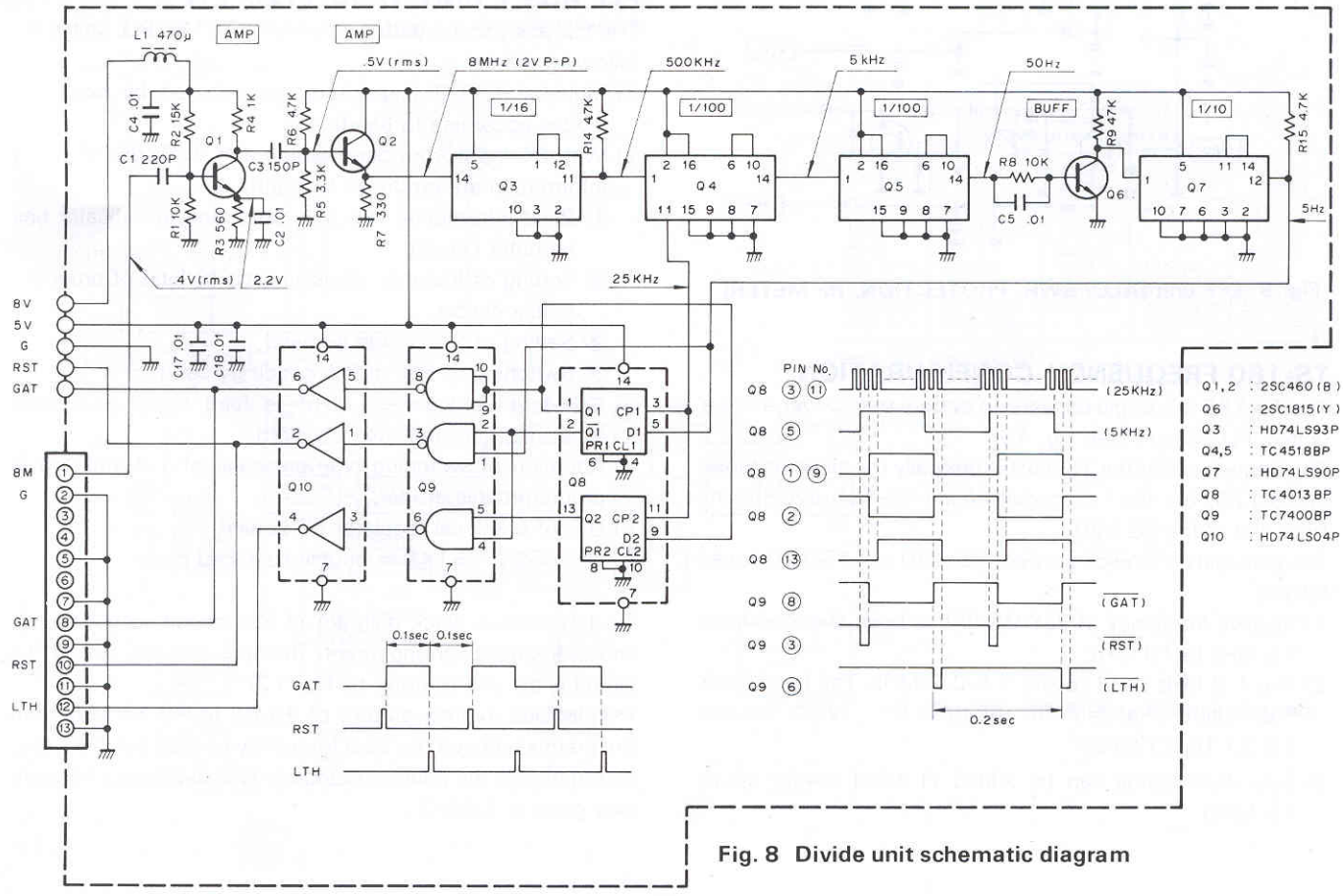


Fig. 8 Divide unit schematic diagram

CIRCUIT DESCRIPTION

bias voltage to Q2 and Q3. Final-stage idling current is adjusted by VR1 (idling current is 100 mA for both Q2 and Q3). The voltage drop across L9 (6.6 μH) is measured by the Ic meter so that total collector current of Q2 and Q3 is displayed. 5.1 V is applied to the LPC terminal to bias Q1, Q2, and Q3 during transmission (0 V during reception).

100 W Final Stage (X56-1340-00)

The 10 W Drive output is applied to the matching transformer T1. The final amplifier is a push-pull amplifier consisting of Q1 and Q2 (Motorolla SRF1714 ×2) which outputs a power of 100 ~ 120 W. T1 and T2 are input and output matching transformers, respectively.

The voltage drop across L8 (15 μH) is applied to the Ic meter via the MIP terminal. 5 V is applied to the HPC terminal to turn ON the bias control transistor Q3 (2SD235) during transmission. A thermostat (120°C) is attached to the output matching transformer. When the core temperature of the output transformer reaches about 140°C, the thermostat opens. When the thermostat is open, about 13 V appears on the THP terminal.

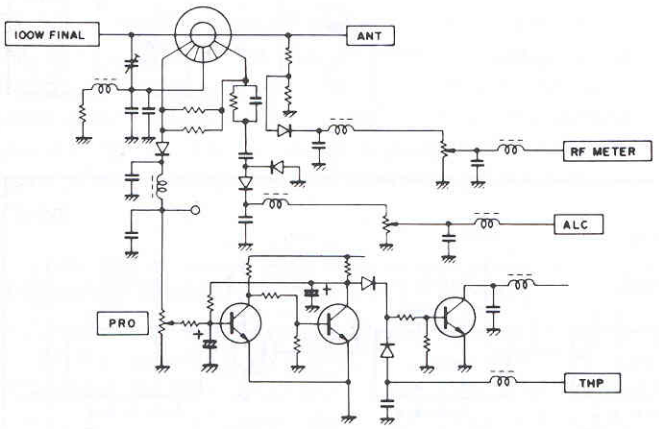


Fig. 9 LPF unit (ALC, SWR, PROTECTION, RF METER)

TS-180 FREQUENCY CONFIGURATION

The TS-180 is a single conversion system transceiver using a unique PLL circuit (see Fig. 10).

The frequencies of the TS-180 is basically the same as those of TS-120, but the PLL circuit of the TS-180 is defferent from that of the TS-120.

The principal defference between TS-180 and TS-120 are as follows:

1) Receive frequency of JJY/WWV has been changed from 15 MHz to 10 MHz.
2) The 1.8 MHz band covers 1.5-2.0 MHz. The band mark has been changed to read "1.5". (VCO covers 10.33-10.83 MHz)
3) Two AUX bands can be added (1 band covers up to 15 MHz).

PREMIX UNIT (X50-1570-00)

Oscillation frequencies form CAR, VFO (MEMORY, RMT-VFO, FIX-CH) and FUNCTION/RIT are mixed together to produce output signal of 48.83-49.33 MHz which is fed to the PLL unit, while signal of 40.0-40.5 MHz, not mixed with CAR frequency, is fed to the counter circuit (indicator unit). Fig. 11 shows a block diagram of the premix circuit.

Signals (6.6-6.1 MHz) from VFO, FIX-CH, MEMORY and RMT-VFO are selected by switching diodes (D1-4, 4-IS1587) and fed to the double-balanced mixer Q7 through LPF (8 MHz) and buffer amplifier Q4, while the output selected by the switching diodesis fed to the MEMORY unit counter through the buffer amplifier Q3.

The signal from FUNCTION/RIT Q5 determined by MODE, passes through the bufferamplifier Q6 and LPF (50 MHz) and is fed to Q7 where it is mixed with VFO signal to produce 40.0-40.5 MHz signal. This signal passes through IFT T1 and T2, double-balanced mixer Q11 and buffer amplifier Q9, and is fed to the counter circuit of the indicator unit.

The signal from CAR Q13 detemined by MODE, is fed to Q11 through the 2-stage buffer amplifier (Q14, 15) and LPF (10 MHz), where it is mixed with 40.0-40.5 MHz to produce 48.83-49.33 MHz. This signal is fed as a premix output to the PLL unit through IFT (T3, T4) and the buffer amplifier Q12.

PLL ASS'Y UNIT (X60-1120-11)

The PLL ass'y unit is defferent from the TS120 PLL unit in the following points:

1) Multi-band VCO (capacitors are selected by switching diodes according to band).
2) With DC input from band switch and VCO, the following information are produced by matrix unit.
   ① Band information (4bits) is outputted to indicator unit (counter circuit).
   ② Setting of freqency devision ratio (8 bits) of programmable divider.
   ③ Setting of SSB mode by band.
   ④ Switching of BPF of PLL circuit by band.
3) Standard oscillator (8 MHz) to feed signal to outside (indicator unit and memory unit).
4) Adoption of switching type prescaler of 1/4 and 1/5 in programmable divider.
5) Use of 5 V local regulator (IC power).
6) Use of SN76514N in double-balanced mixer.

Fig.12 shows a block diagram of PLL circuit, and Table 1 shows frequency arrangement. The operating principle of PLL circuit is as follows (refer to Fig. 12):

Frequencies (premix output) of 48.83 to 49.33 MHz from the premix unit and the VCO frequency of each band are mixed together in the double-balanced mixer to produce frequencies given in Table 2.

CIRCUIT DESCRIPTION

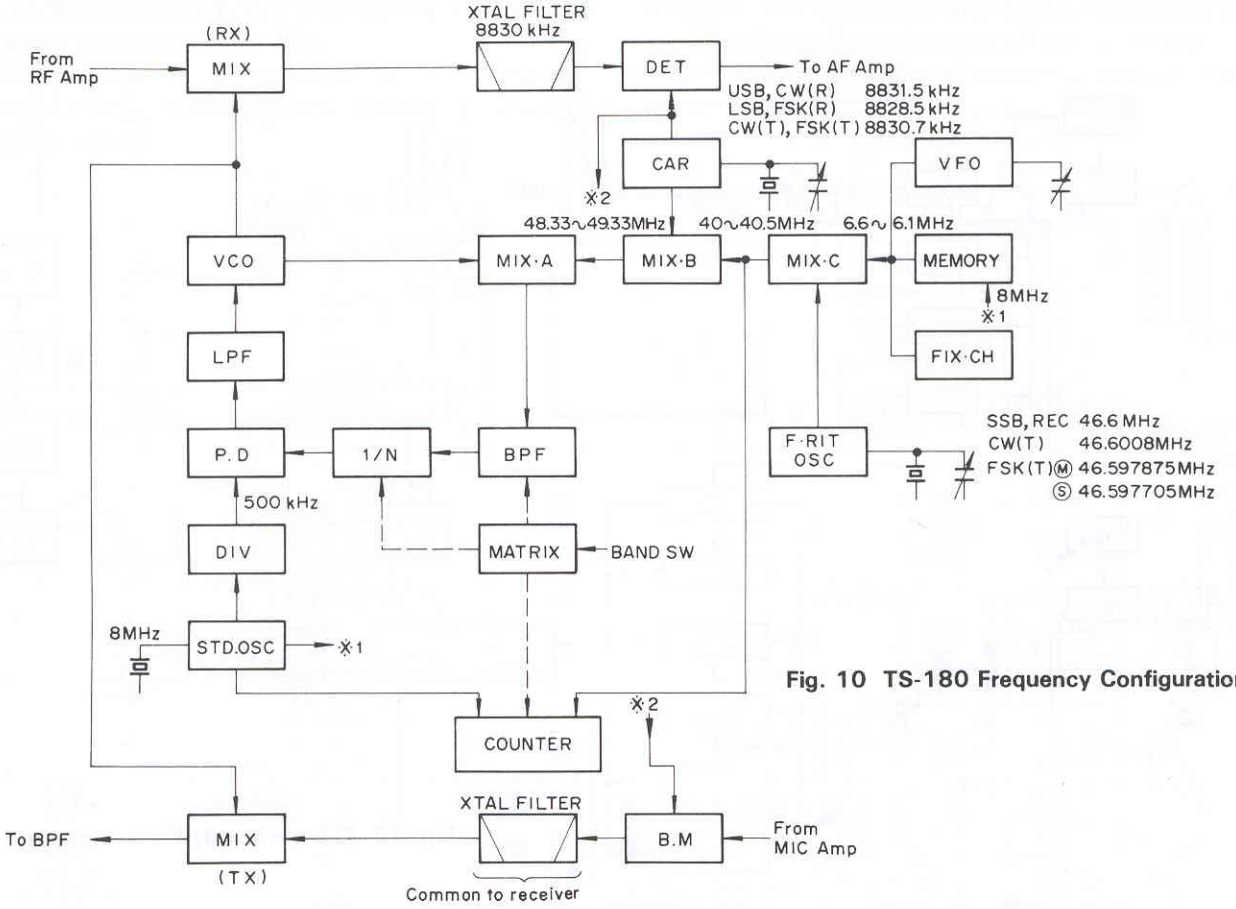
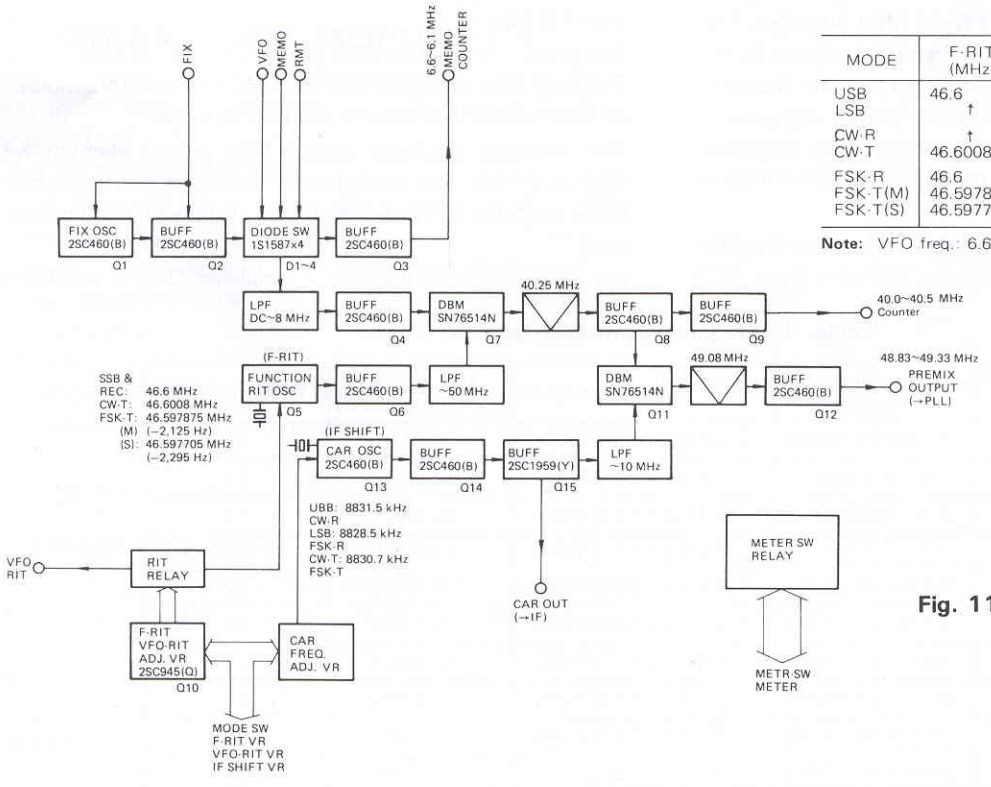


Fig. 10 TS-180 Frequency Configuration



FREQUENCY CHART

MODE	F·RIT (MHz)	CAR (kHz)	MIX 1 (MHz)	MIX 2 (MHz)
USB	46.6	8831.5	40.0	48.8315
LSB	↑	8828.5	↑	48.8285
CW·R	↑	8831.5	↑	48.8315
CW·T	46.6008	8830.7	40.0008	↑
FSK·R	46.6	8828.5	40.0	48.8285
FSK·T(M)	46.597875	8830.7	39.997875	48.828575
FSK·T(S)	46.597705	↑	39.997705	48.828405

Note: VFO freq.: 6.6 MHz

Fig. 11 PREMIX unit block diagram

CIRCUIT DESCRIPTION

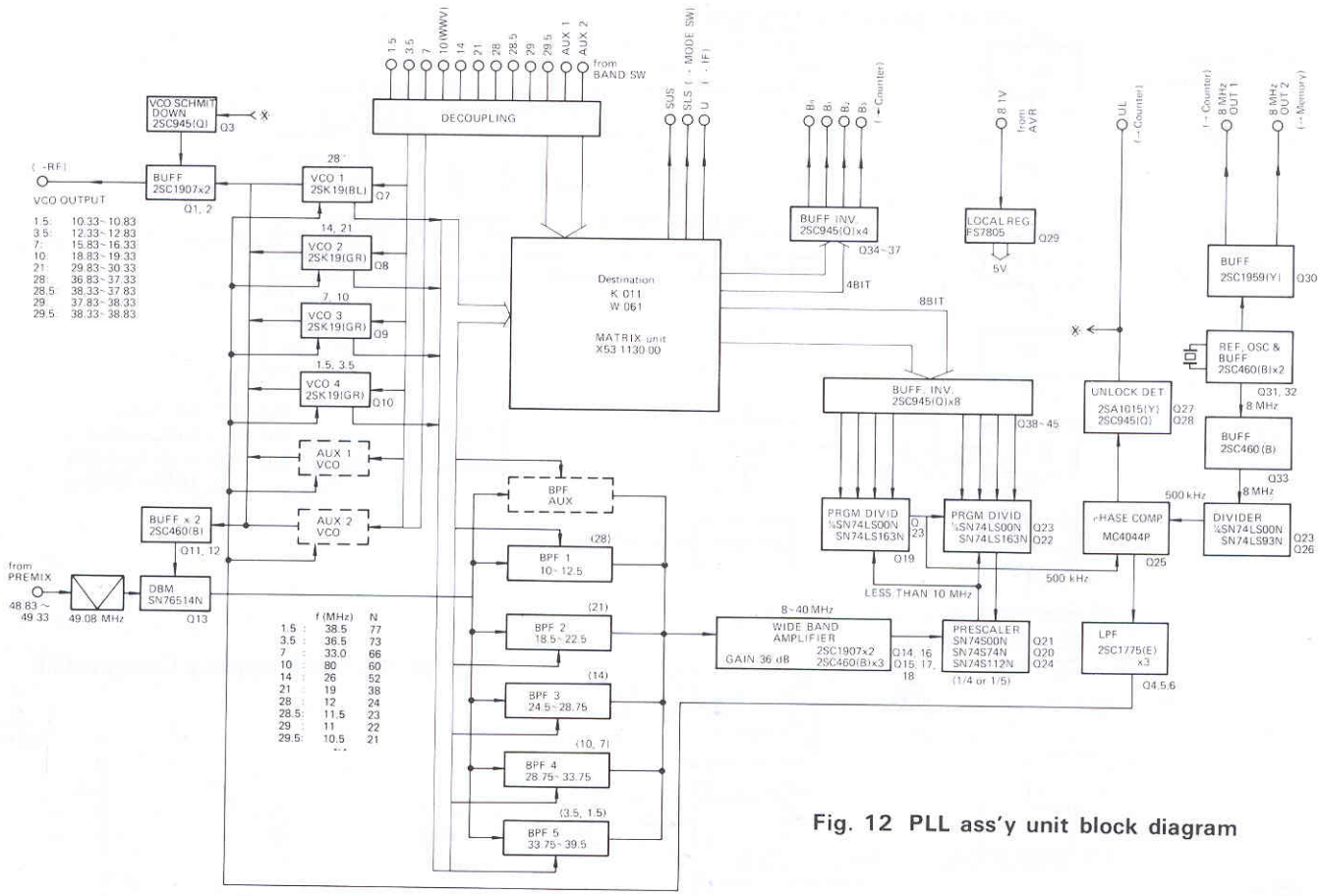


Fig. 12 PLL ass'y unit block diagram

The frequency obtained is fed to BPF1-BPF5 (and AUX) and is amplilfied to about 36 dB by the 8-40 MHz amplifier. This frequency is shaped into a digital wave and is divided by the prescaler and the programmable divider to obtain 500 kHz output. The information from the band switch and VCO is converted into 8-bit BCD signal by the matrix unit. By presetting this signal, the frequency is divided at the ratio given in Table

Band information is fed from the matrix unit to the indicator unit (counter circuit). The information includes 4-bit BCD signal, LSB signal (less than 7 MHz) and USB signal (more than 10 MHz).

The phase comparator Q25 uses MC4044P of Motolora Co. The loop filter amplifier is composed of transistors mounted on the outside to minimize spurious radiation.

The reference oscillator uses 8 MHz crystal element with Q32 2SC460. The oscillation frequency is fed through the buffer amplifier to the external units (display unit and memory unit).

the frequency from the buffer amplilfier Q33 is divided by

Table 1 Frequencies of each unit

Band	Transmit/receive frequency	VCO frequency	MIX A (Q13) output frequency	Frequency division (N)
WWV/JJY	10.0~10.5 MHz	18.83*19.33 MHz	30.0 MHz	60
1.5	1.5~2.0 MHz	10.33~10.83 MHz	38.5 MHz	77
3.5	3.5~4.0 MHz	12.33~12.83 MHz	36.5 MHz	73
7	7.0~7.5 MHz	15.83~16.33 MHz	33.0 MHz	66
14	14.0~14.5 MHz	22.83~23.33 MHz	26.0 MHz	52
21	21.0~21.5 MHz	29.73~30.00 MHz	19.0 MHz	38
28	28.0~28.5 MHz	36.83~37.33 MHz	12.0 MHz	24
28.5	28.5~29.0 MHz	37.33~37.83 MHz	11.5 MHz	23
29	29.0~29.5 MHz	37.83~38.33 MHz	11.0 MHz	22
29.5	29.5~30.0 MHz	38.33~38.83 MHz	10.5 MHz	21

CIRCUIT DESCRIPTION

Q23 and Q26 to produce 500 kHz comparison signal which is fed to the phase comparator Q25.
The VCO oscillator is composed of 6 VCOs covering 3.5 MHz, 10 MHz, 14 MHz, 21 MHz, 28 MHz bands and 2 AUX bands (option).

If the oscillator is locked for any reason, it is detected by the phase comparator output to shut off the VCO output.
This prevents the radiation of unwanted signals and blanks the digital display.

Table 2 Matrix unit programmable code

Band	Destination	Indicating unit B_3	B_2	B_1	B_0	Frequency division (N) *	DIVID 2 Np	D	C	B	A	DIVID 1 Nm	D	C	B	A
JJY /WWV	Common	1	0	1	1	60	12	0	0	1	1	8	0	1	1	1
1.5	J	0	0	0	0	77	15	0	0	0	0	13	0	0	1	0
	K	0	1	0	0											
3.5	J	0	0	1	0	73	14	0	0	0	1	13	0	0	1	0
	K	0	0	1	1											
X	W	0	1	1	0											
7 X	J.W	0	1	0	1	66	14	0	0	0	1	6	1	0	0	1
	K	0	1	1	1											
14	Common	1	0	0	0	52	10	0	1	0	1	8	0	1	1	1
21	Common	1	0	1	0	38	8	0	1	1	1	2	1	1	0	1
28	Common	1	1	1	1	24	4	1	0	1	1	4	1	0	1	1
28.5	Common	1	1	0	1	23	4	1	0	1	1	3	1	1	0	0
29	Common	1	1	1	0	22	4	1	0	1	1	2	1	1	0	1
29.5	Common	1	1	0	0	21	4	1	0	1	1	1	1	1	1	0
						25	4	1	0	1	1	5	1	0	1	0
						26	4	1	0	1	1	6	1	0	0	1

* Frequency division (N) = 4 (Np + 1) + Nm
Destination: J = JAPAN K = USA W = EUROPE

MEMORY ASS'Y UNIT (X60-1090-00)

The memory ass'y consists of Control and VCO units. These units in combination constitute as a presettable up-down digital VFO.
It has the following features :

1) The heart of the memory ass'y consists of a 4-bit microprocessor and a dual PLL circuit.
2) Up to 4 channels of VFO frequencies are presettable.
3) The memory shift (M. SHIFT) feature provides the digital VFO function. The oscillator covers a variable frequency range of approx. 700 kHz. Digital frequency control is possible over this frequency range at 20 Hz interval.
4) A memory back-up battery, which maintains the contents of memories M, M', and M'' intact even when the power to the unit is turned off, is accommodatable.

1. Control Unit (X53-1100-00)

The control unit consists of a counter, data selector, astable multivibrator, RS flip-flop, external RAM, 5V-AVR, and interface with external switches. All the data to and from these circuits are controlled by microprocessor Q23 (TMC 1010) and transfered to the VCO unit.
The block diagram of the control unit is shown in Fig. 13.

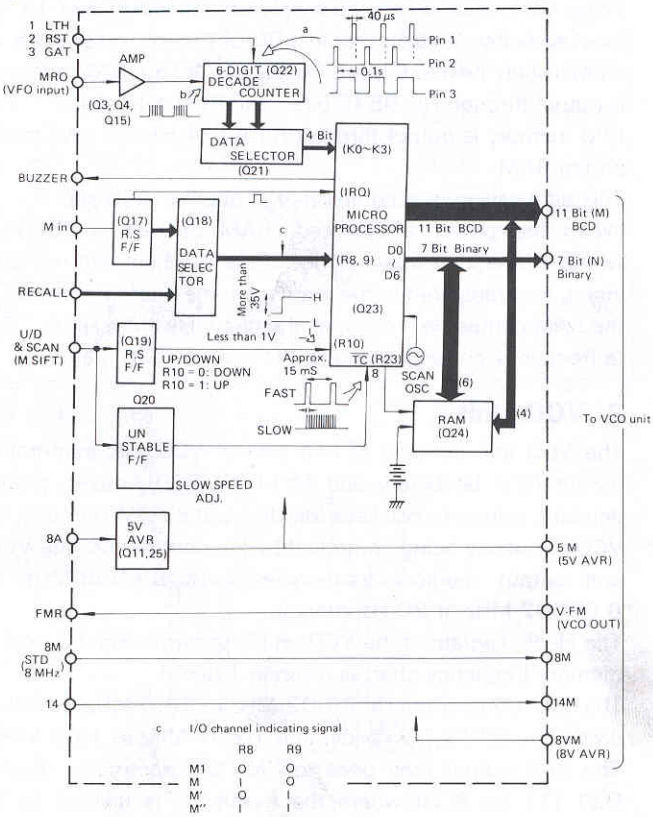


Fig. 13 CONTROL unit block diagram

CIRCUIT DESCRIPTION

Microprocessor Operation:

1) Counter control

The signal (6.1 to 6.6 MHz) from MRO terminal goes to data selector Q21 together with the 5 digit data (10 Hz to 600 kHz) converted into 4 bit BCD code. The data selector is controlled by the output of pin-25 (R3) of Q23.

The digit-serial BCD output is coupled to pins 38 to 41 (K0 to K3) of Q23 and stored in a RAM within the microprocessor. This sequence is activated at the trailing edge of the gate signal (IRQ: pin 4) on MEMORY INPUT operation.

2) Memory operation

A positive pulse generated by MEMORY IN operation goes to data selector Q18 via RS flip-flop Q17. (The output of the f.f. also goes to pin 4 (IRQ) of Q23 as a GATE signal.)

The MEMORY OUT operation goes to data selector Q18 in accordance with read command from the selector circuit. The selected data goes to pins 30 and 31 of Q23.

3) UP/DOWN and SCAN operations

When the UP mode is selected, an H level signal goes to RS flip-flop Q19, and when the DOWN mode is selected, an L level signal couples to pin 32 (R10) of Q23.

The scanning circuit consists of astable multivibrator Q20 and 1/N divider. The dividing ratio is controlable over 1/N + 50% with VR1. In the SLOW SCAN mode, all the sections of Q20 operate and its output goes to pin 8 (TC) of Q23 via buffer Q19.

In the FAST SCAN mode, the 1/N divider in Q20 stops operation. The microprocessor operation is illustrated in Fig. 14.

4) Memory back-up feature

When Q5 and Q6 detect the supply voltage (normally + 14 V) lowered below 9 volts, terminal R0 of the microprocessor is compulsorily held to L level. Consequently, the RAM address is output through 00 05 (6 bits), and BCD data stored in the CPU memory is output through R4 R7 (4 bits) to save them on the RAM.

This data saving is accomplished in approx. 600 sec.

When the power is restored, RAM content is checked whether it remains intact or not. If the RAM content remains intact, it is transfered to the memory in the microprocessor. If the RAM content is broken, all the channels are reset to "0" (a frequency corresponding to "0" on the VFO dial).

2. VCO Unit

The VCO unit consists of two sets of VCO, programmable divider (N:7 bit binary and M:11 bit BCD), mixer, phase detector, reference oscillator/divider, and 8V-AVR circuits. Its VCO frequency being controlled by the control unit, the VCO unit output memory frequencies from 6.6998 MHz to 6.00002 MHz at 20 Hz interval.

The block diagram of the VCO unit is shown in Fig.15, and a memory frequency chart is given in Table 3.

The 1st VCO oscillates at 20.02 MHz to 30.0 MHz, which is divided by Q28's 1/2 divider into 10.01 MHz to 15.0 MHz. The VCO output then goes to "M" programmable divider Q31 (11 bit BCD) where the frequency is divided by M

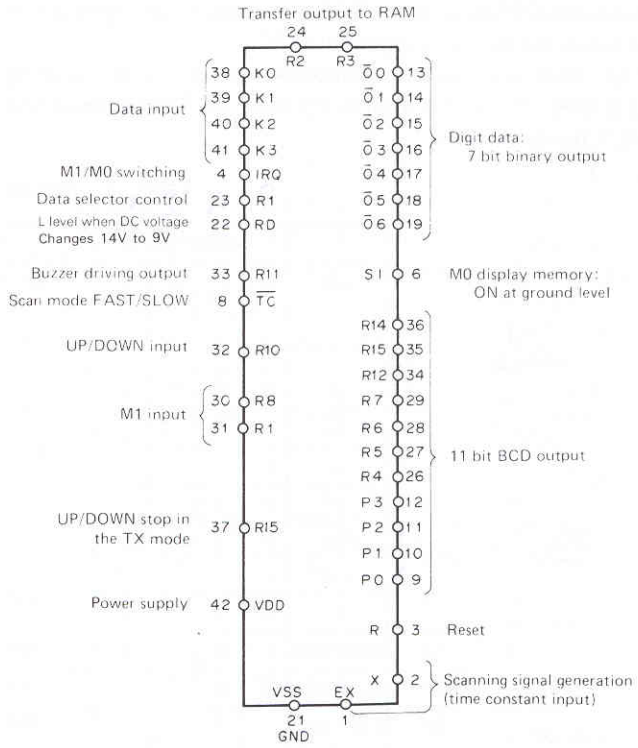


Fig. 14 Microprocessor explanation

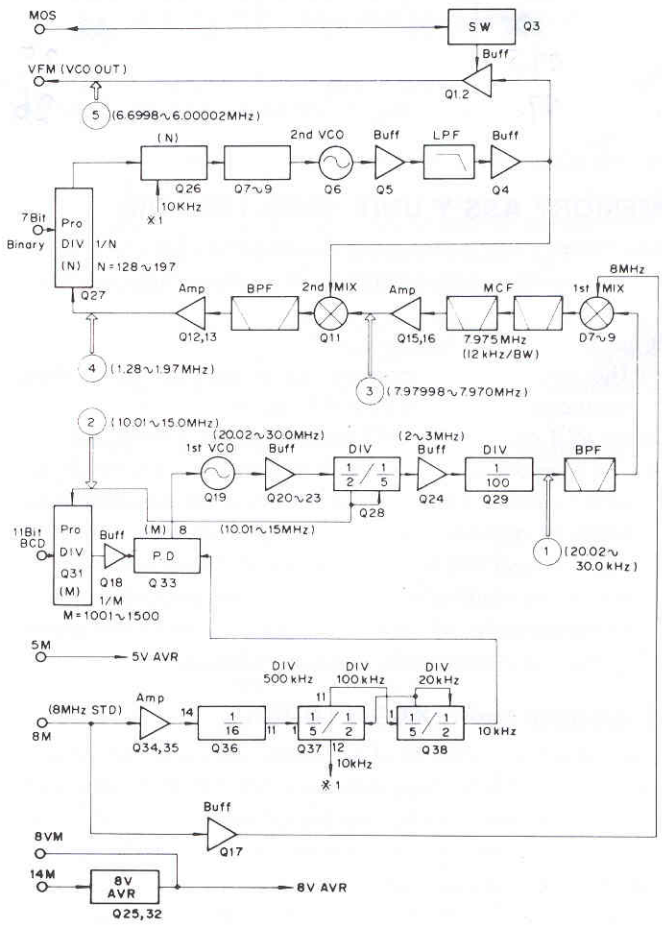


Fig. 15 VCO unit block diagram

CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

(M = 1001 to 1500) into 10 kHz, and converted into the 1st VCO voltage by phase detector Q33.
The 1/2 divided 1st VCO output of 10.01 to 15.0 MHz also goes to 1/5 and 1/100 divider, then to the 1st mixer (D7 to D9) where it is mixed with the reference oscillator frequency of 8 MHz and converted into 7.97998 MHz to 7.970 MHz. These frequencies, after filtered through the MCF and amplified, go to the 2nd mixer (Q11). In the 2nd mixer, the signal is mixed with the 2nd VCO frequency to be converted into 1.28 to 1.97 MHz. It then goes to "N" programmable divider Q27 (7 bit binary code) where it is divided by N into 10 kHz, then converted into the 2nd VCO voltage by phase detector Q26.
The reference frequency for phase detectors Q23 and Q33 is created by first amplifying the 8 MHz reference frequency by Q34 and Q35, then dividing it into 10 kHz by divider Q36 to Q38. The 2nd VCO oscillates frequencies from 6.00002 MHz to 6.6998 MHz. These frequencies are coupled to the memory output via buffers Q1 and Q2.
These memory frequencies turn on/off Q1 and Q2 with the MEMORY operation switch.

Table 3 F memory frequency table:

Operating frequency (MHz) *1	Memory output frequency (MHz) ⑤	Mixer input frequency (MHz) ③	N input frequency (MHz) ④	N	1/500 output frequency (kHz) ①	M input frequency (MHz) ②	M
13.900.00	6.699.98	7.979.98	1.280	128	20.02	10.01	1001
13.900.18	6.699.82	7.979.82	1.280	128	20.18	10.09	1009
13.999.98	6.600.02	7.970.02	1.370	137	29.98	14.99	1499
14.000.00	6.600.00	7.970.00	1.370	137	30.00	15.00	1500
14.000.02	6.599.98	7.979.98	1.380	138	20.02	10.01	1001
14.000.10	6.599.90	7.979.90	1.380	138	20.10	10.05	1005
14.000.20	6.599.80	7.969.80	1.380	138	20.20	10.10	1010
14.001.00	6.599.00	7.979.00	1.380	138	21.00	10.50	1050
14.002.00	6.598.00	7.979.00	1.380	138	22.00	11.00	1100
14.009.98	6.590.02	7.960.02	1.380	138	29.98	14.99	1499
14.010.00	6.590.00	7.970.00	1.380	138	30.00	15.00	1500
14.050.00	6.550.00	7.970.00	1.420	142	30.00	15.00	1500
14.100.00	6.500.00	7.970.00	1.470	147	30.00	15.00	1500
14.200.00	6.400.00	7.970.00	1.570	157	30.00	15.00	1500
14.300.00	6.300.00	7.970.00	1.670	167	30.00	15.00	1500
14.400.00	6.200.00	7.970.00	1.770	177	30.00	15.00	1500
14.500.00	6.100.00	7.970.00	1.870	187	30.00	15.00	1500
14.599.80	6.000.20	7.970.20	1.970	197	29.80	14.90	1490
14.600.00	6.000.00	7.970.00	1.970	197	30.00	15.00	1500

Operation frequency range
Display

*Note 1. MHz order is different to BAND. This above tabe indicated on the 14 MHz band.
2. ① ~ ⑤ mark shows each frequency of block diagram on the VCO unit Fig. 15.

2SC1907 (Q1, 2, 14, 16 on the PLL Unit)

Si NPN Epitaxial Planer Transistor

Abusolute Maximum Rating (TA = 25°C)

Item	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_E	P_C	T_j	T_{stg}
Value	30V	19V	2V	50mA	−50mA	300mW	125°C	−55~+125°C

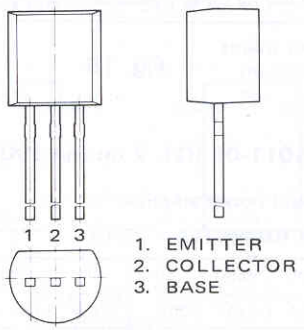


Fig. 16

SEMICONDUCTOR DATA

2SK125 (Q7, 8 on the RF Unit)

Application: RF Band Mixer (N Channel Si J-FET)

Absolute Maximum Rating (TA = 25°C)

Item	VGDO	VGSO	ID	IG	PC	TC	Tstg
Value	−25V	−25V	100mA	10mA	500mW	120°C	−50~+125°C

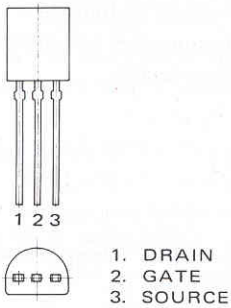


Fig. 17

BA379 (D1, 2 on the RF Unit)

Application: RF Attenuator (Pin diode)

Absolute Maximum Ratings TA mb < 60°C

Item	VR	IF	Tstg
Value	30V	20mA	−55 ~ +100°C

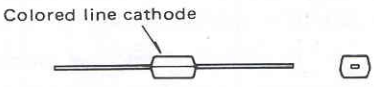
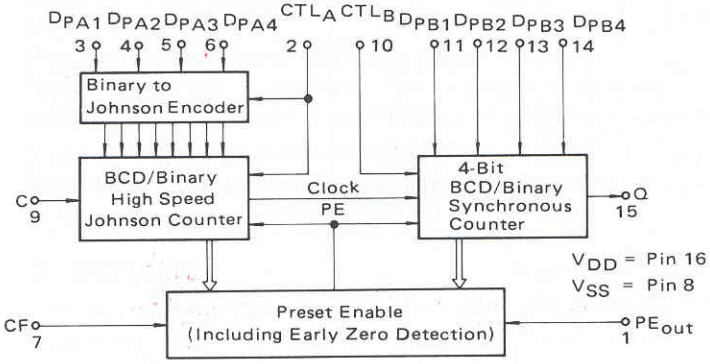


Fig. 18

MC14569B (Q27 on the MEMORY Unit)
DUAL 4-BIT BCD/BINARY COUNTER



CTL = "0" for Binary Count
CTL = "1" for BCD Count

Fig. 19

SRF 1714 V08-1011-06 (Q1, 2 on the 100W Final Unit)

Application: RF band power amplifier

Absolute Maximum Ratings (TA = 25°C)

Item	VCEO	VCBO	VEBO	IC	PD	Tstg	RθJC
Value	25V	45V	4.0V	20A	250W	−65~+200°C	0.7°C/W

SRF 1714

Color	hFE Minimum	hFE Maximum
Red	20	32
Orange	28	42
Yellow	38	52
Green	48	63
Blue	57	78
Violet	72	93
Black	87	108
Brown	100	120

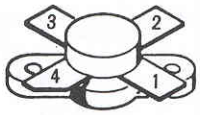


Fig. 20

HD74196 (Q11 on the DISPLAY unit)
PRESETTABLE DECADE COUNTER/LATCH

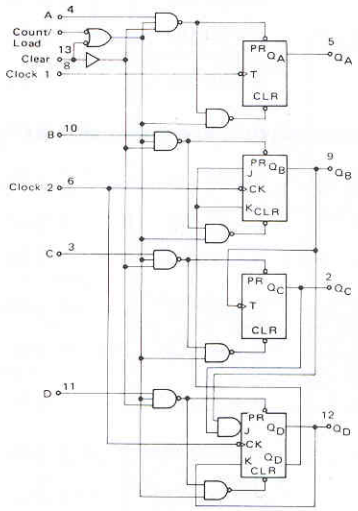


Fig. 21

HD74LS90P (Q7 on the DIVID Unit)
DECADE COUNTER

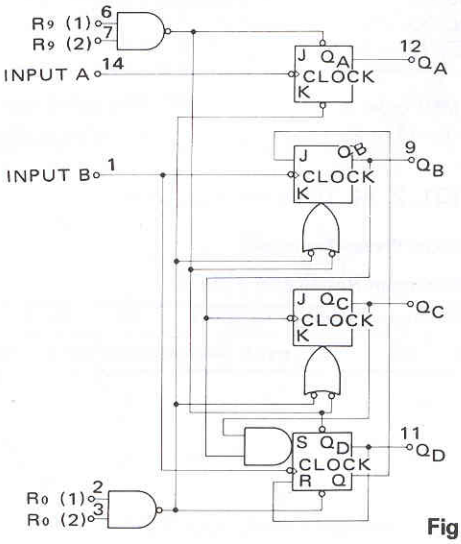


Fig. 22

SEMICONDUCTOR DATA

HD74LS93P (Q3 on the DIVID unit)
4-BIT BINARY COUNTER

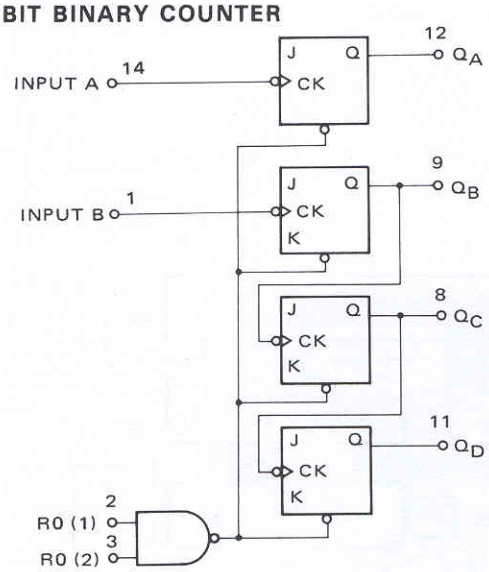


Fig. 23

TMC1000/TMC1010
Q20 on the DISPLAY unit
Q23 on the MEMORY ASS'Y unit

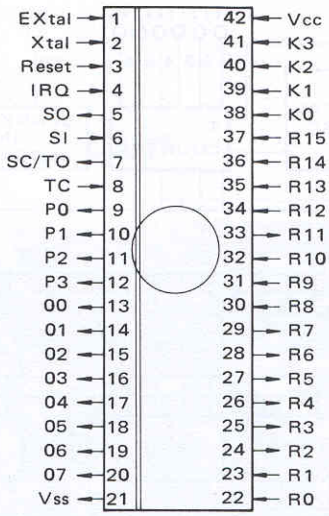


Fig. 24

SN74LS90N (Q37 on the MEMORY ASS'Y Unit)
DECADE COUNTER

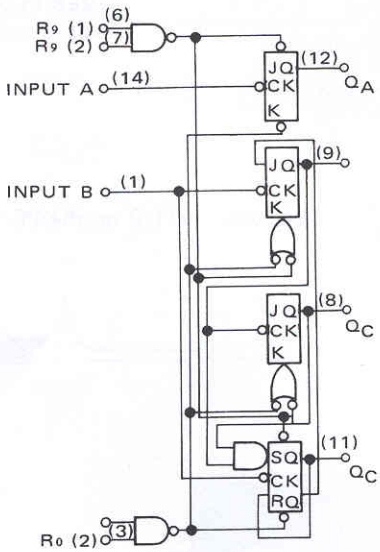


Fig. 25

TC5501P-1 (Q24 on the MEMORY ASS'Y unit)
256 WORDS × 4-BIT C MOS RAM

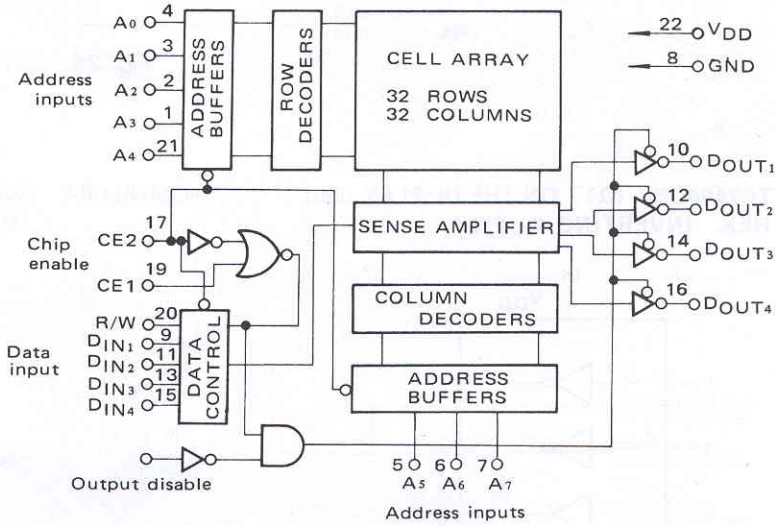


Fig. 26

TC7400BP (Q19 on the Display Unit)
INPUT POSITIVE NAND GATE

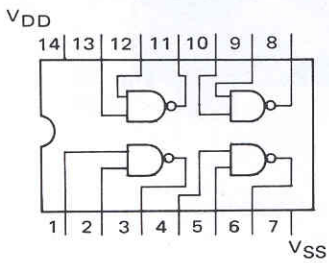
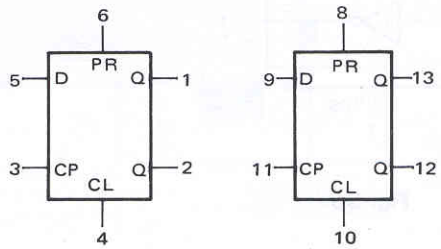


Fig. 27

TC4013BP (Q8 on the Divid Unit)
DUAL D-TYPE FLIP FLOP



V_{DD}: 14, V_{SS}: 7

Fig. 28

SEMICONDUCTOR DATA

TC5032P (Q22 on the MEMORY ASS'Y Unit)
6-DIGIT DECADE COUNTER

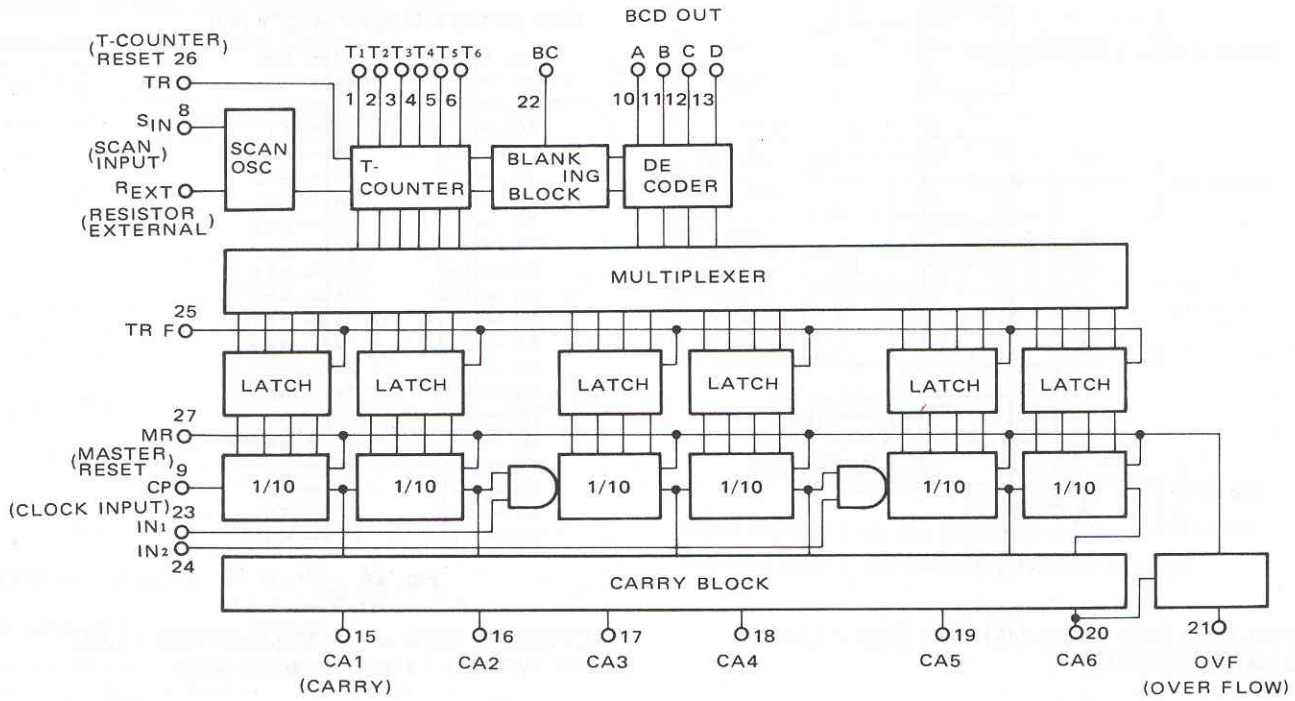


Fig. 29

TC7404UBP (Q17 ON THE DISPLAY unit)
HEX. INVERTING BUFFER

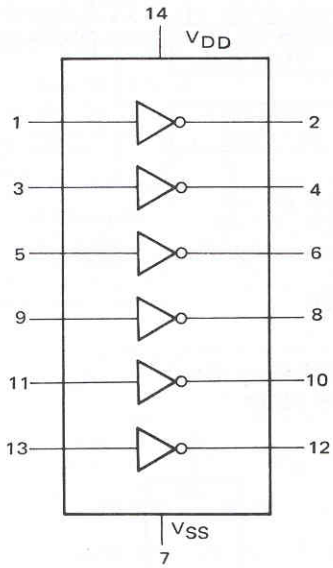
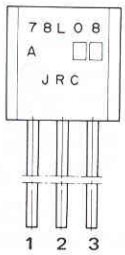


Fig. 30

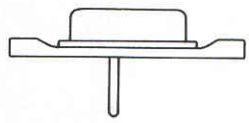
NJM78L08A (Q32 on the MEMORY unit)

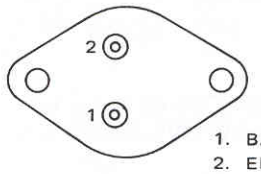


1. Output
2. Ground
3. Input

Fig. 31

2N5885 (Q1,2 on the PS-30)



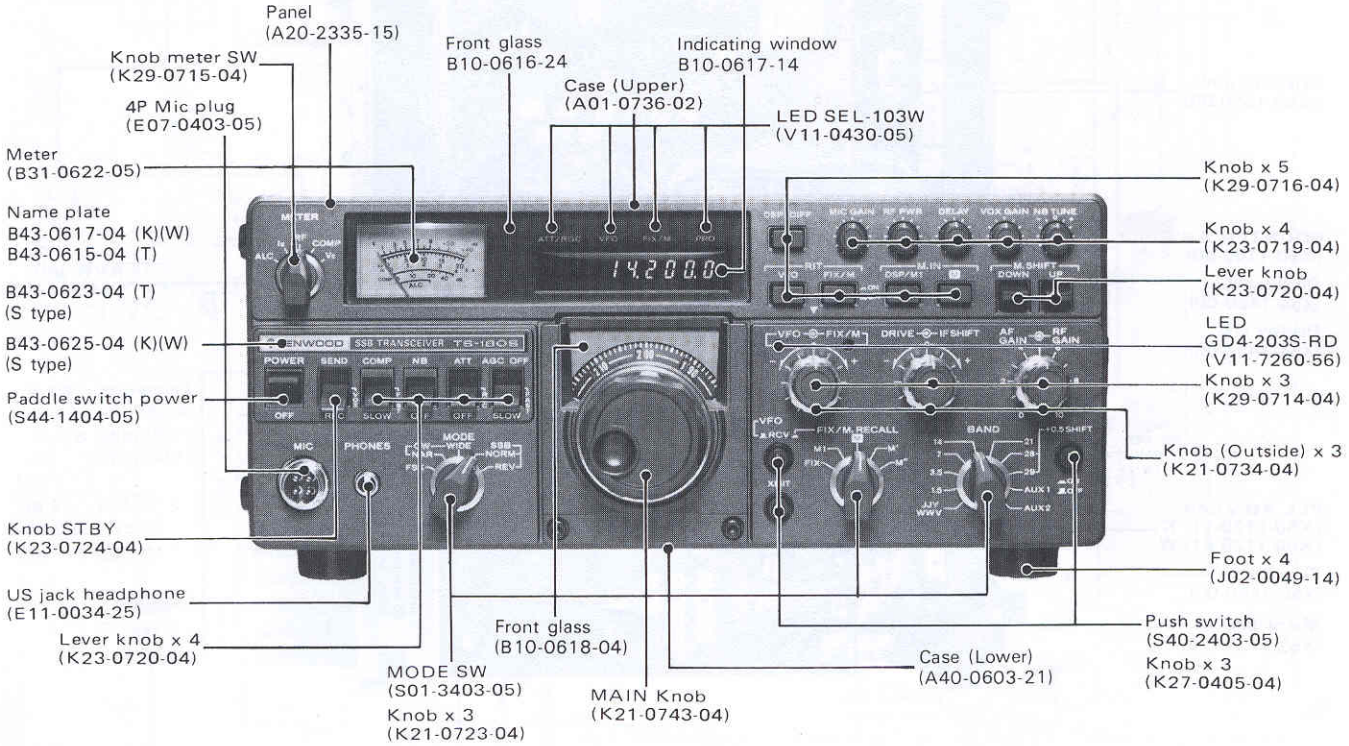


1. BASE
2. EMITTER

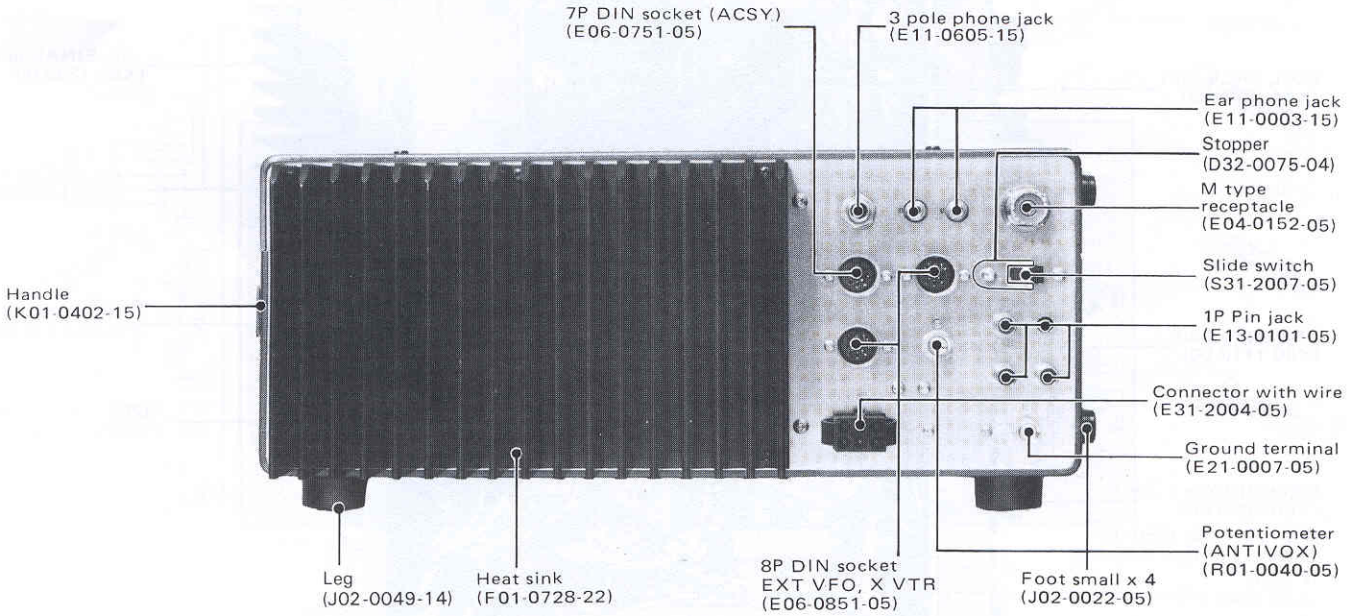
Fig. 32

OUTSIDE VIEWS

FRONT PANEL

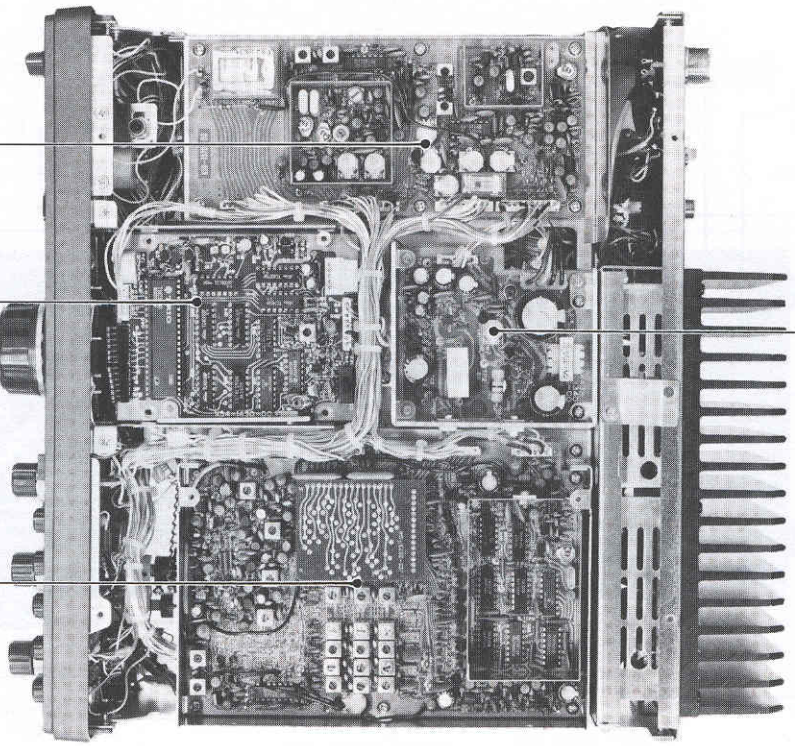


REAR PANEL

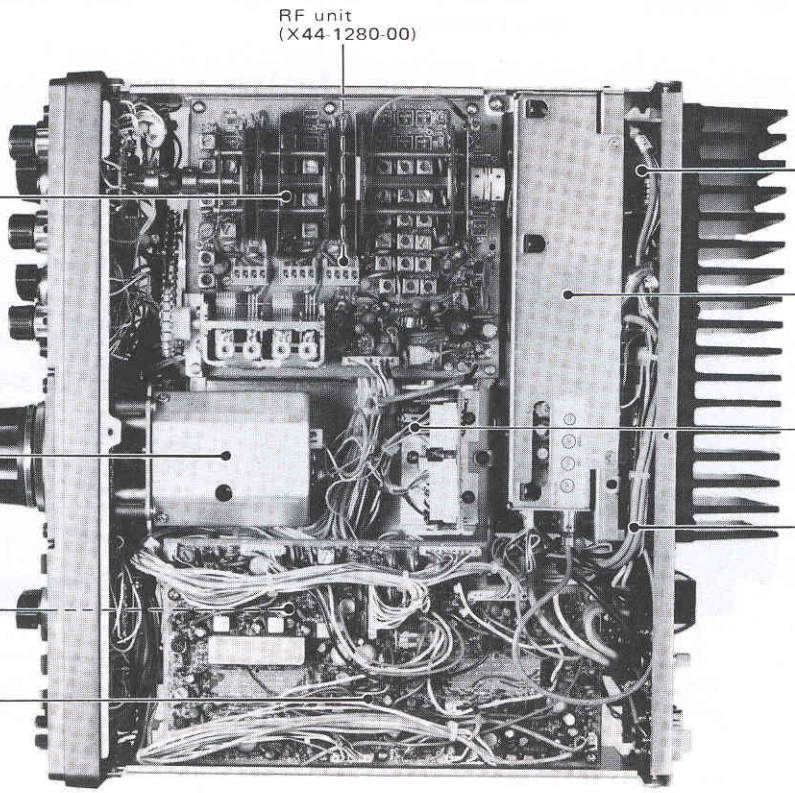


INSIDE VIEWS

TOP VIEWS

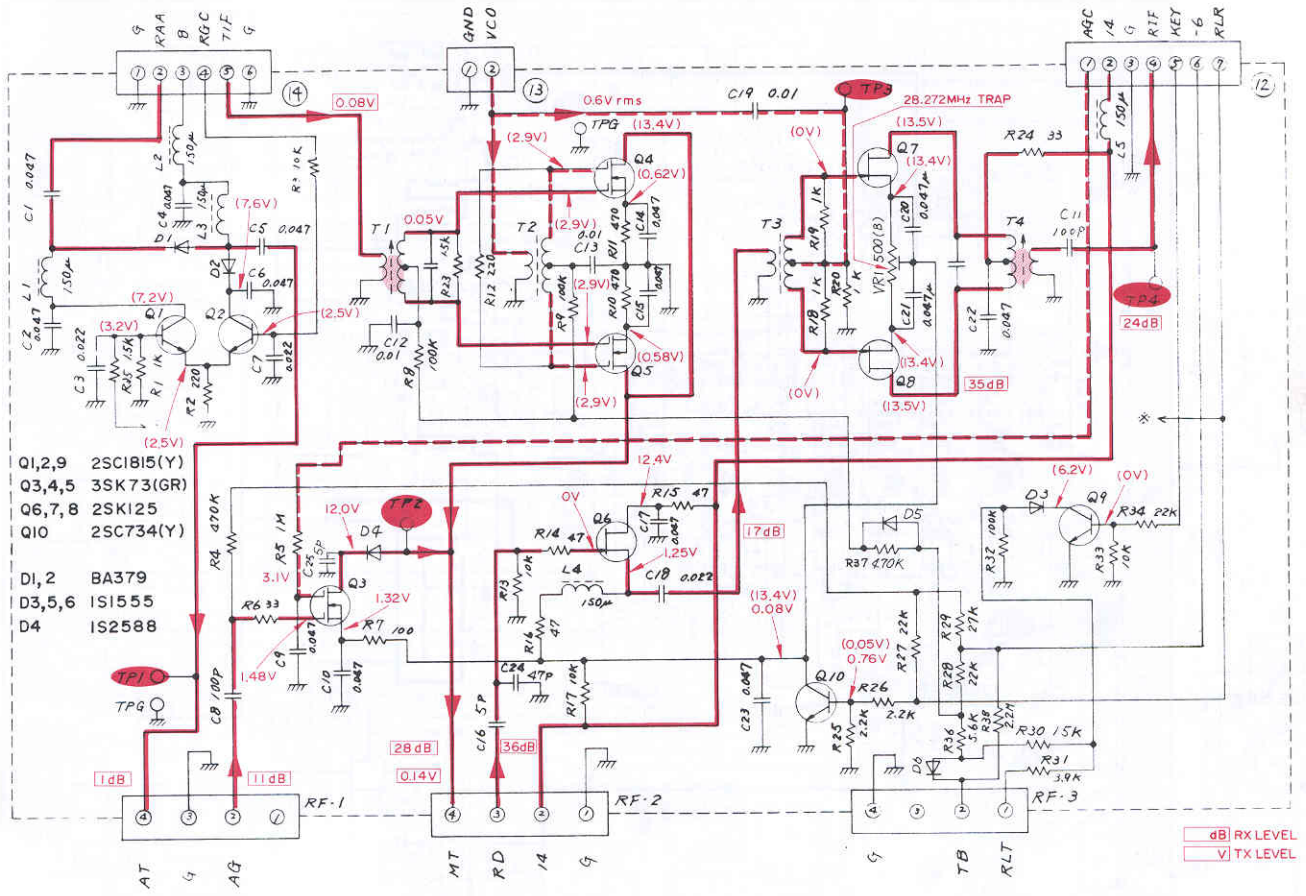


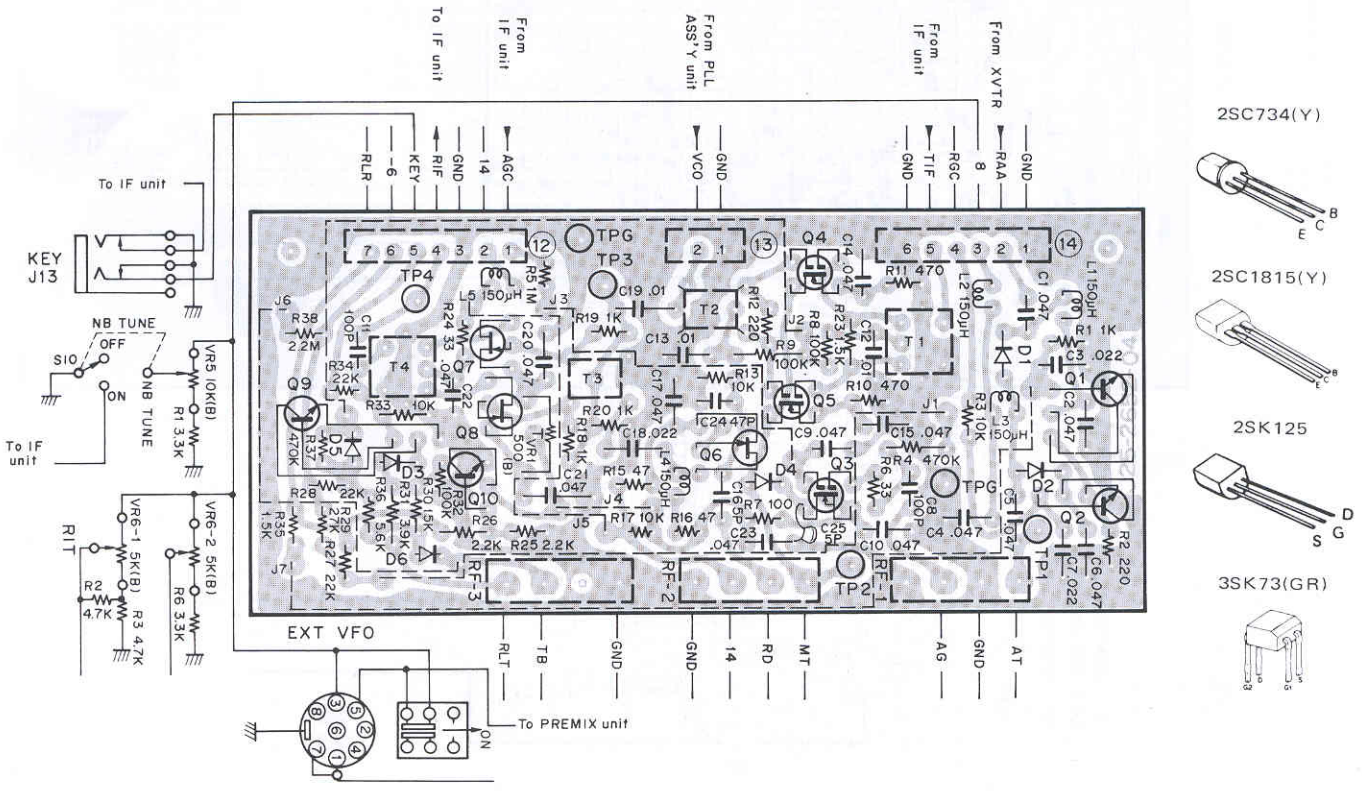
BOTTOM VIEWS



PC BOARD/CIRCUIT DIAGRAM

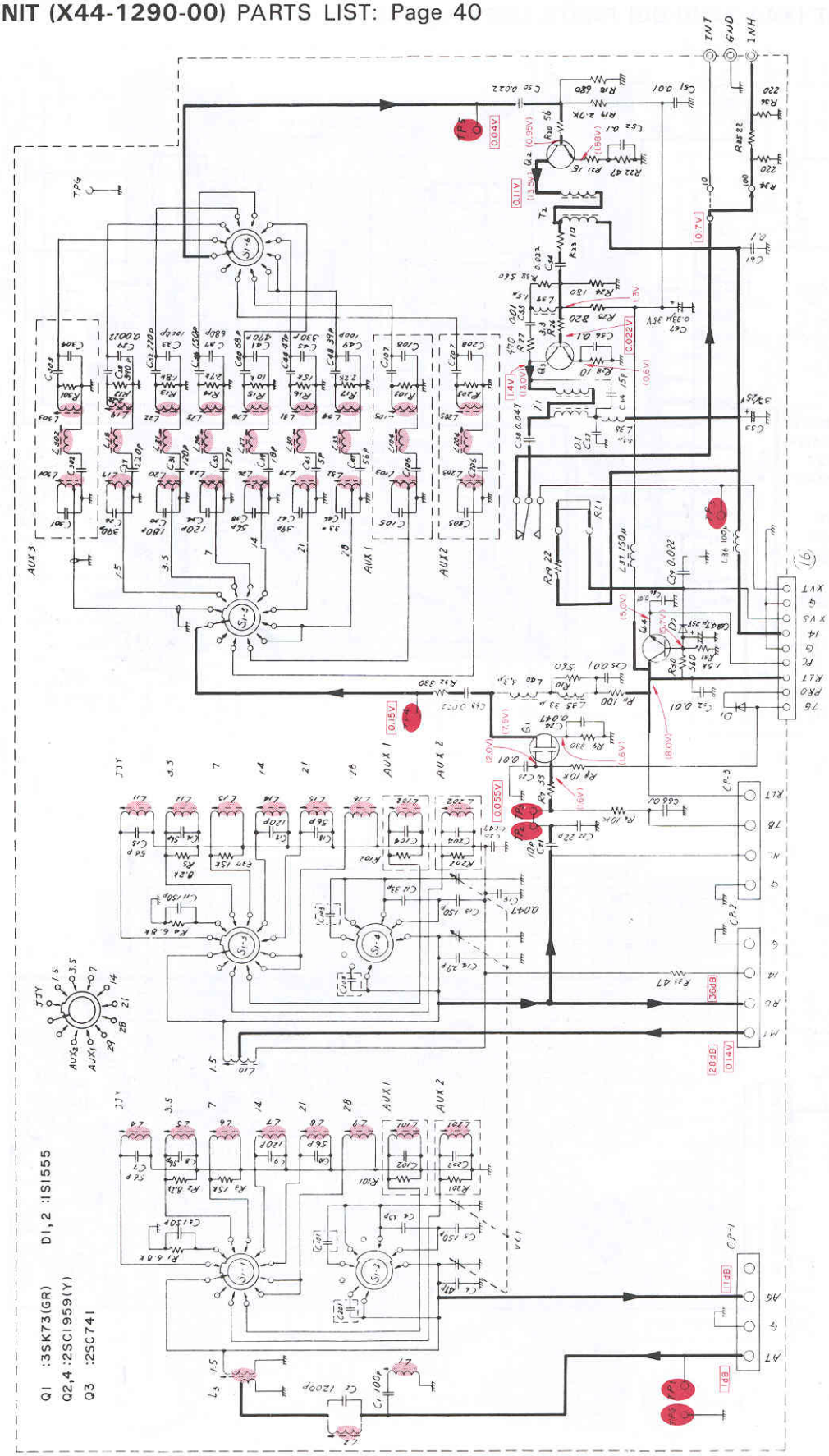
▼ RF UNIT (X44-1280-00) PARTS LIST: Page 40





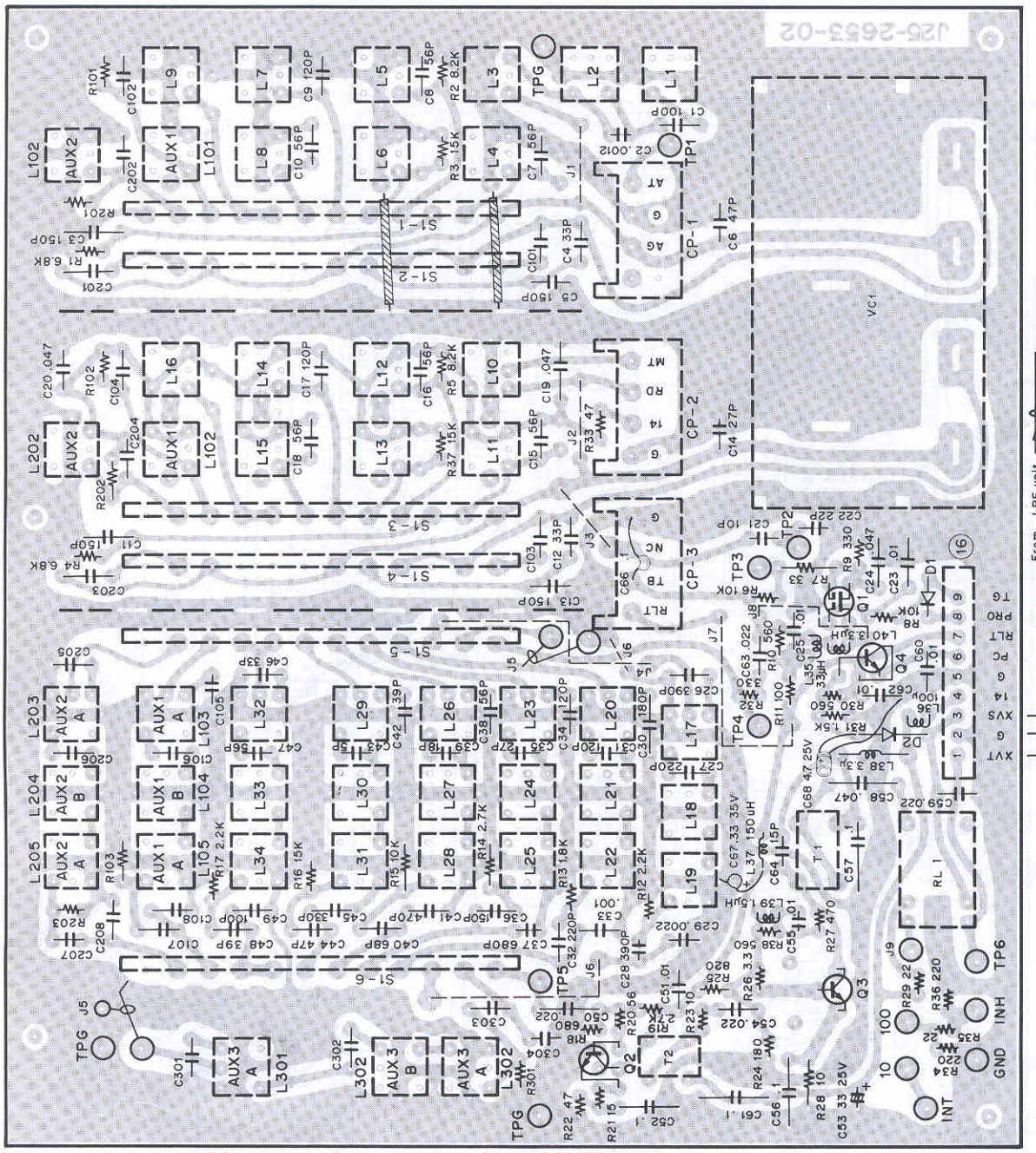
PC BOARD/CIRCUIT DIAGRAM

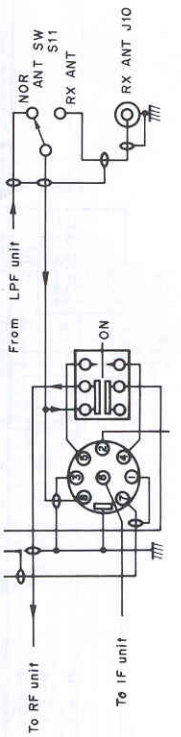
▼ COILPACK UNIT (X44-1290-00) PARTS LIST: Page 40



PC BOARD/CIRCUIT DIAGRAM

▼ COILPACK UNIT (X44-1290-00)

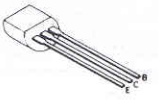




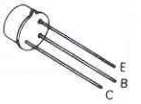
3SK73(GR)



2SC1959(Y)

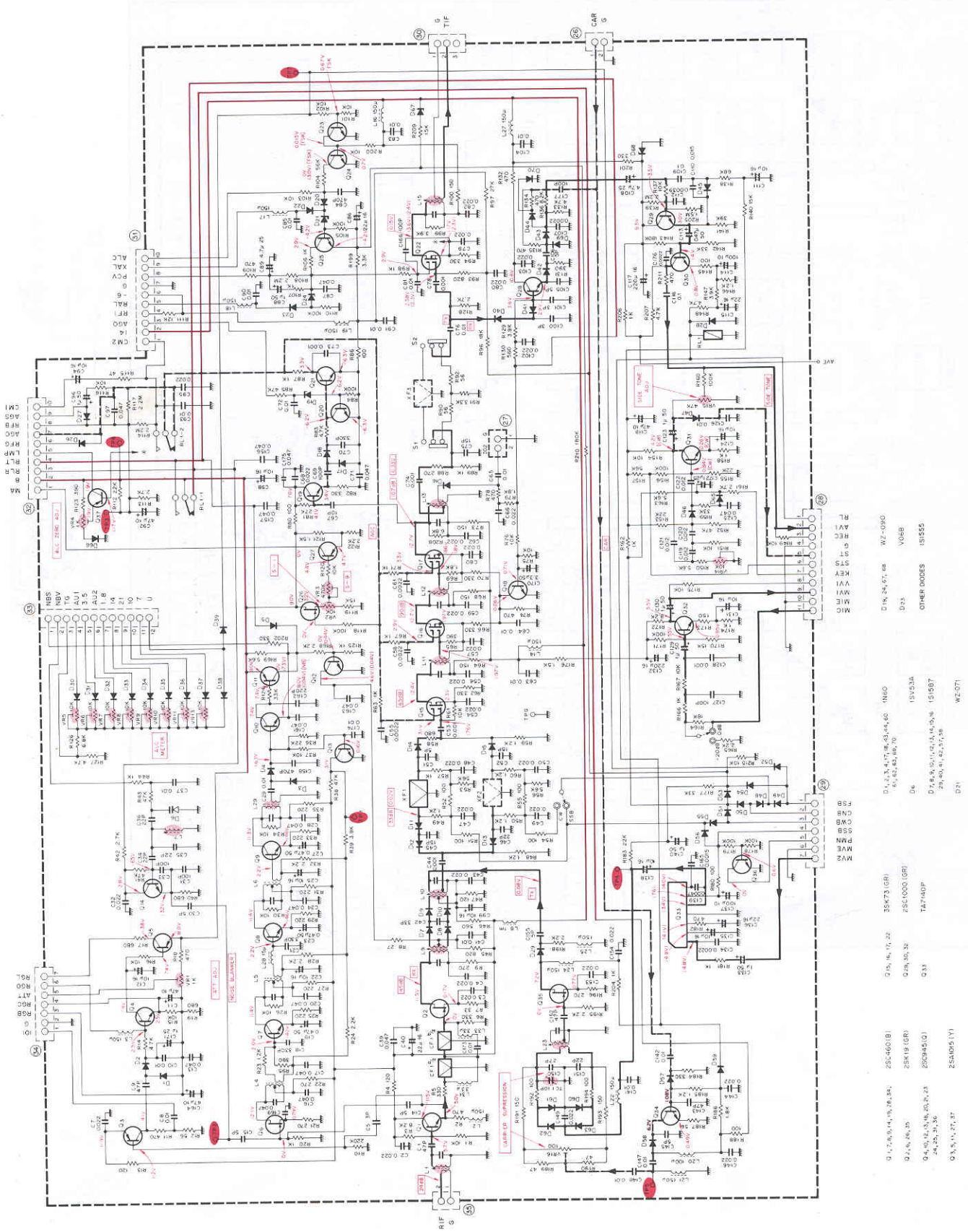


2SC741



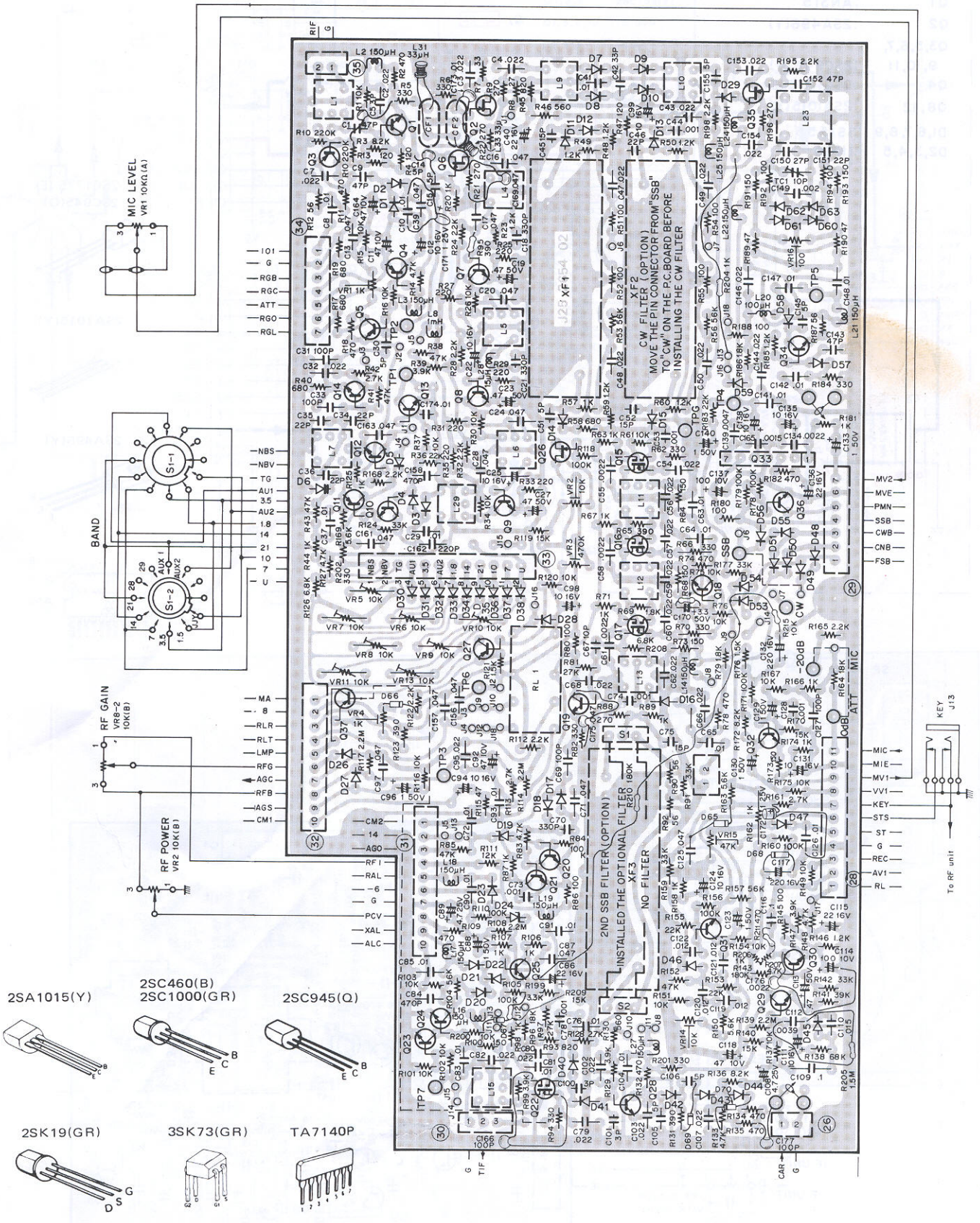
PC BOARD/CIRCUIT DIAGRAM

▼ IF UNIT (X48-1240-11) PARTS LIST: Page 41



PC BOARD/CIRCUIT DIAGRAM

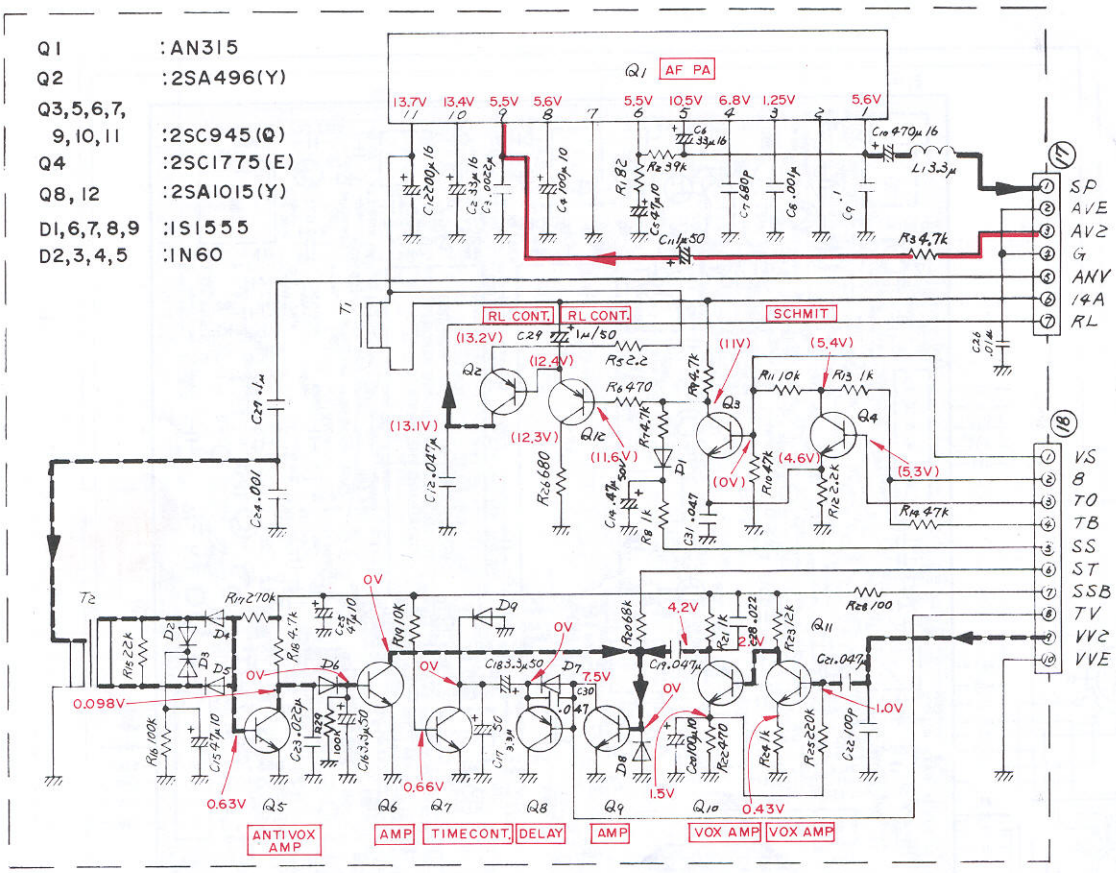
▼ **IF UNIT (X48-1240-11)** PARTS LIST: Page 41



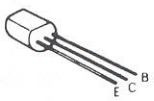
PC BOARD/CIRCUIT DIAGRAM

▼ AF VOX UNIT (X49-1130-00) PARTS LIST: Page 42

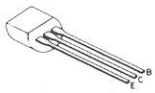
Q1	:AN315
Q2	:2SA496(Y)
Q3,5,6,7, 9,10,11	:2SC945(Q)
Q4	:2SC1775(E)
Q8,12	:2SA1015(Y)
D1,6,7,8,9	:IS1555
D2,3,4,5	:IN60



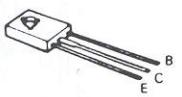
2SC1775 (E)
2SC945(Q)

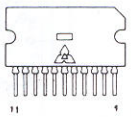


2SA1015(Y)

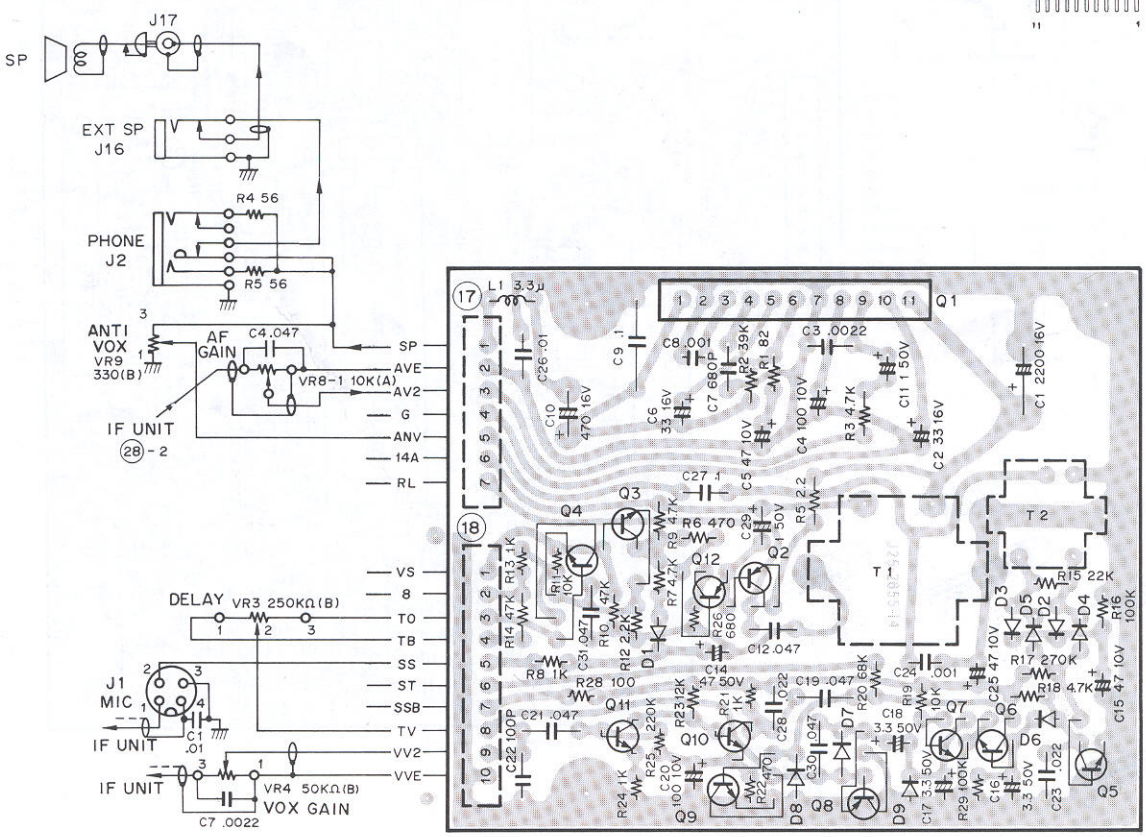


2SA496(Y)



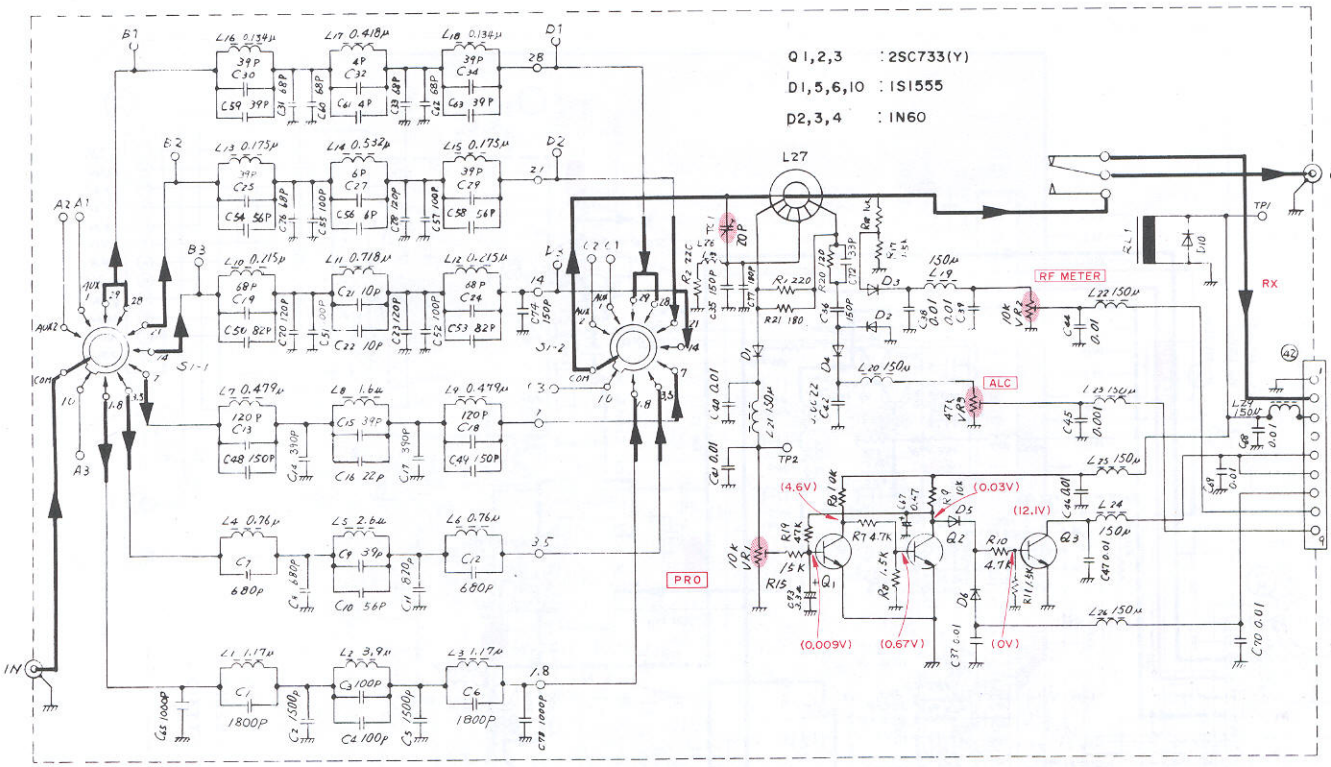


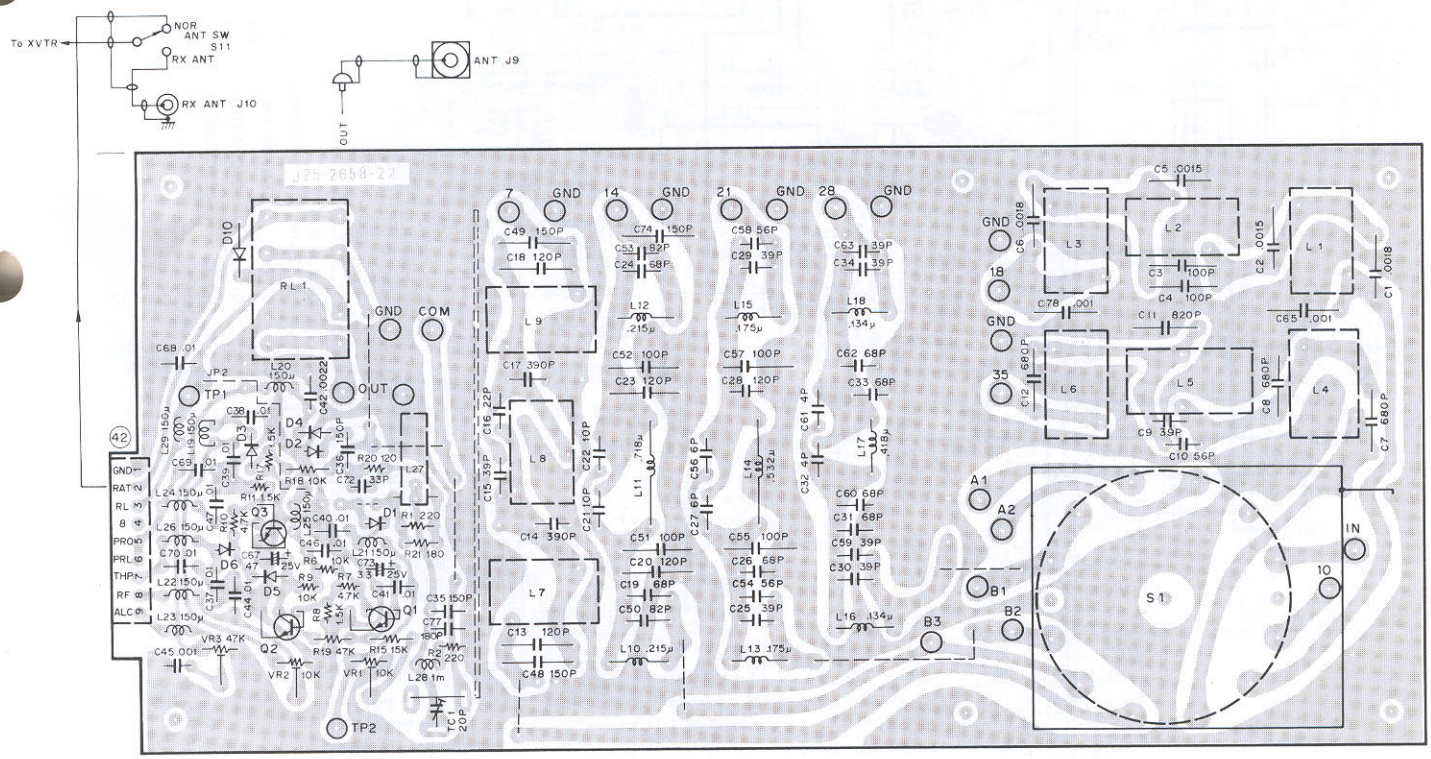
AN315



PC BOARD/CIRCUIT DIAGRAM

▼ LPF UNIT (X51-1180-00) PARTS LIST: Page 44



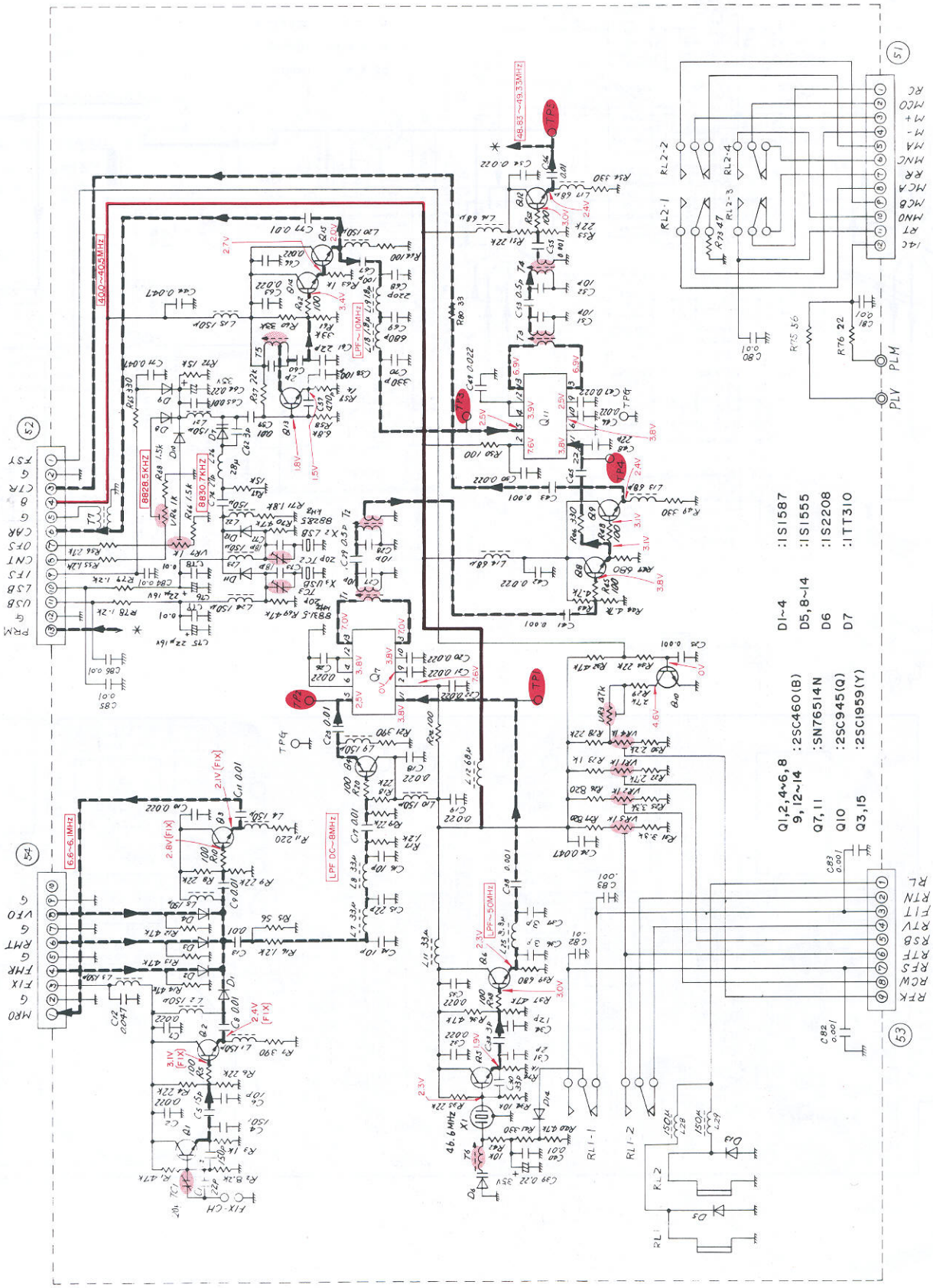


2SC733(Y)



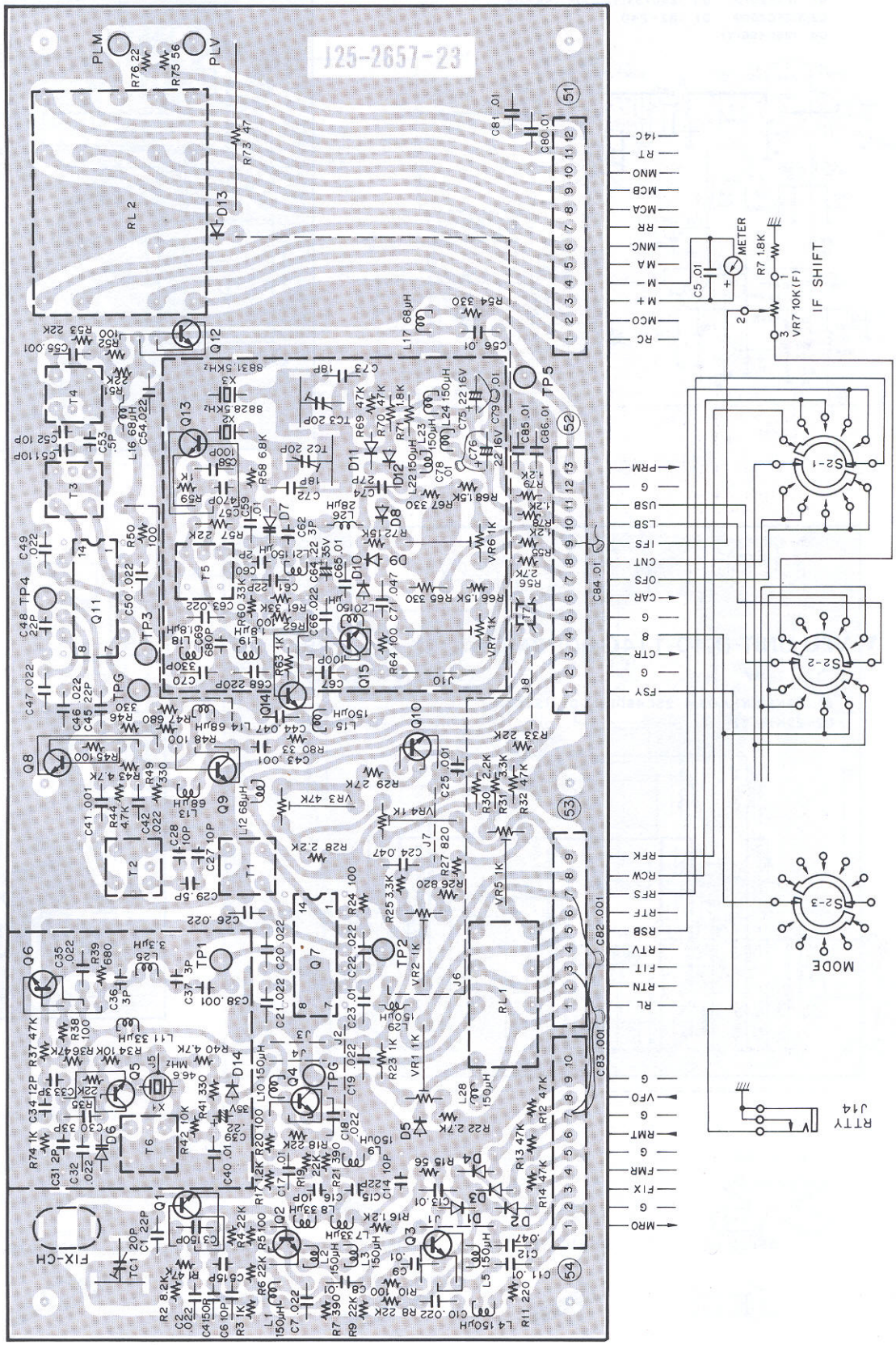
PC BOARD/CIRCUIT DIAGRAM

▼ PREMIX UNIT (X50-1570-00) PARTS LIST: Page 43



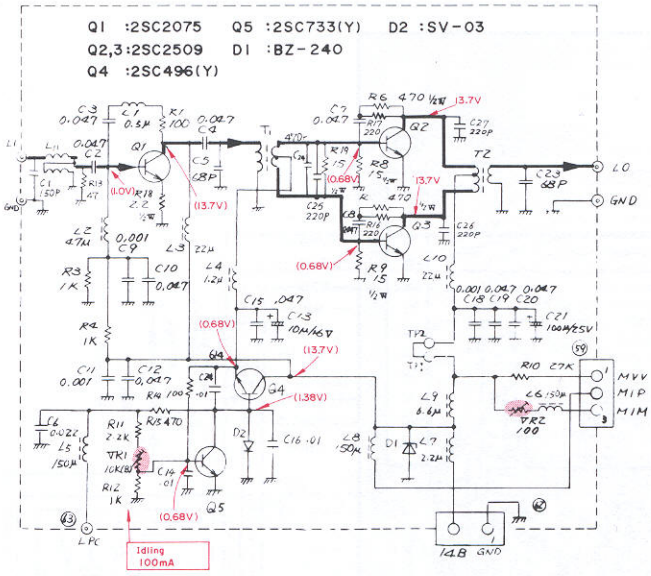
PC BOARD/CIRCUIT DIAGRAM

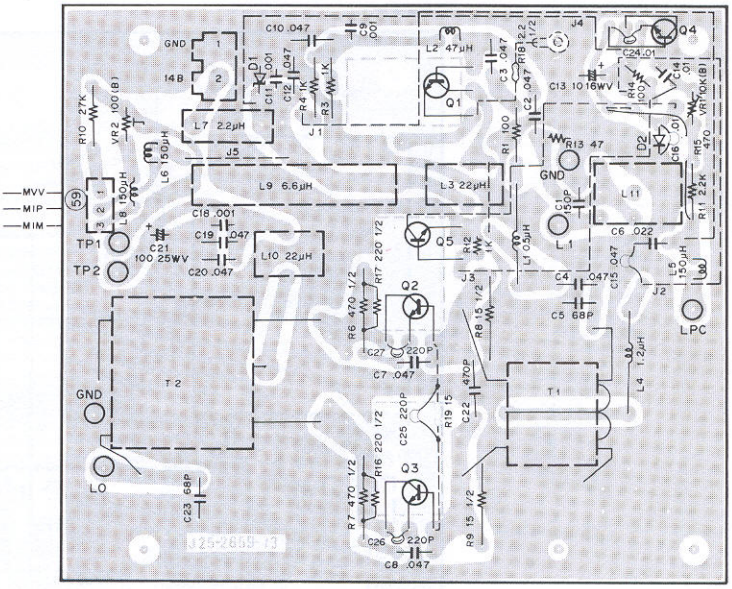
▼ PREMIX UNIT (X50-1570-00)



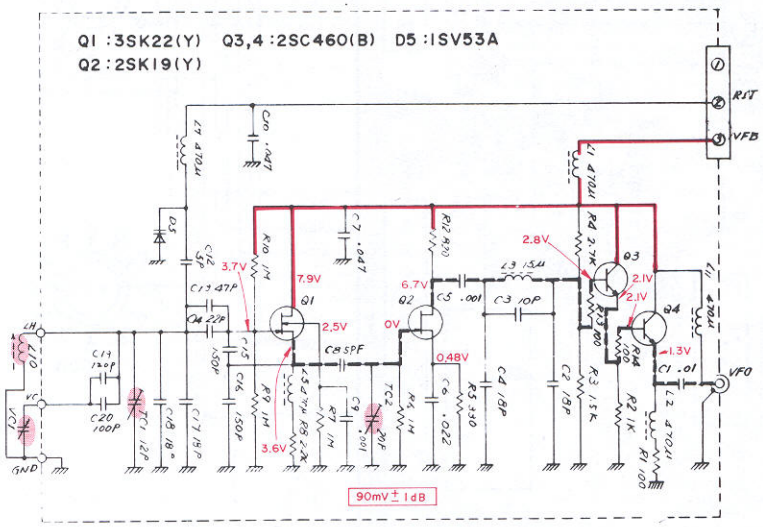
PC BOARD/CIRCUIT DIAGRAM

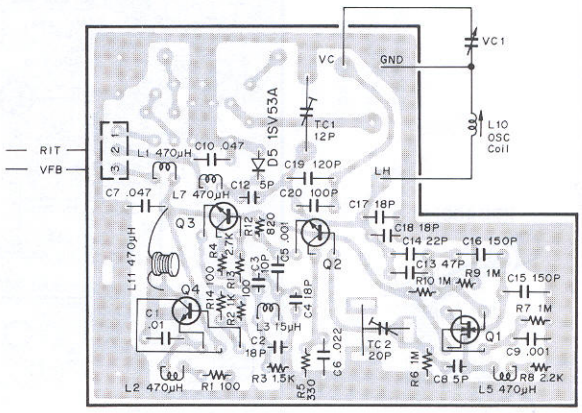
▼ 10 W FINAL UNIT (X56-1330-00) PARTS LIST: Page 45





▼ VFO UNIT (X40-1140-00) PARTS LIST: Page 46



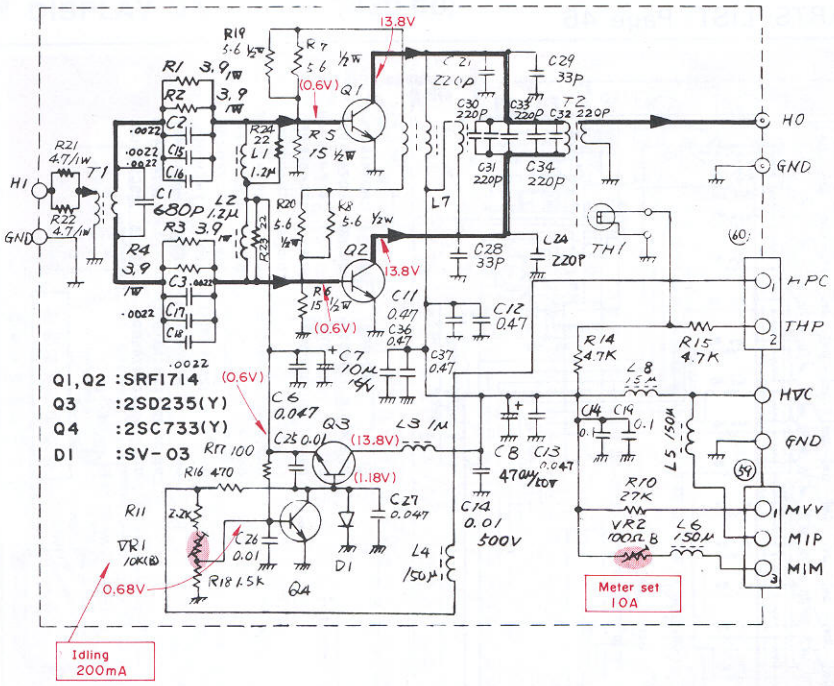


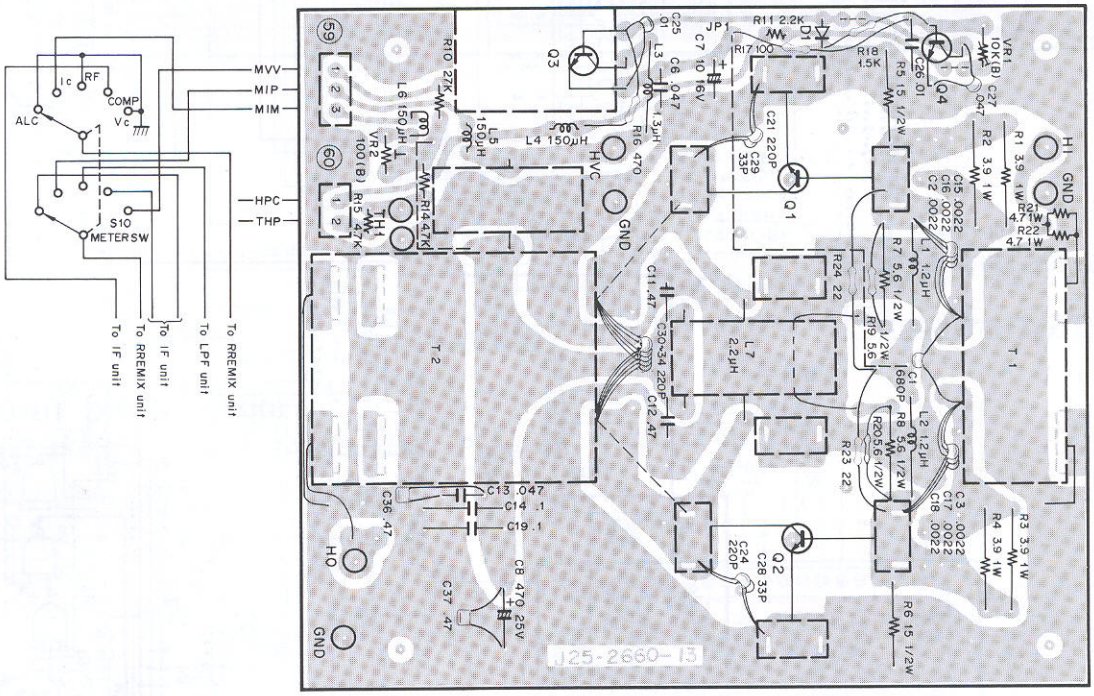
3SK22 (Y) 2SK19 (Y) 2SC496(Y) 2SC733(Y) 2SC2075 2SC2509



PC BOARD/CIRCUIT DIAGRAM

▼ 100 W FINAL UNIT (X56-1340-00) PARTS LIST: Page 45





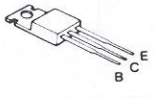
NOTE:

1. Apply the heat sink compound to Q1, Q2 and both sides of the insulating mica film.
2. Solder C30 ~ C34 to the terminal pipe of the transformer with their lead lengths as short as possible. Solder the 1ϕ wire to the terminal pipe of the transformer. Twist 5 leads from C30 ~ C34 before soldering.
3. Twist the leads from C3, C17 and C18 and solder them keeping them as short as possible, and do the same with the leads from C2, C15 and C16.

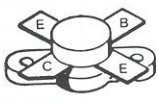
2SC733(Y)



2SD235(Y)



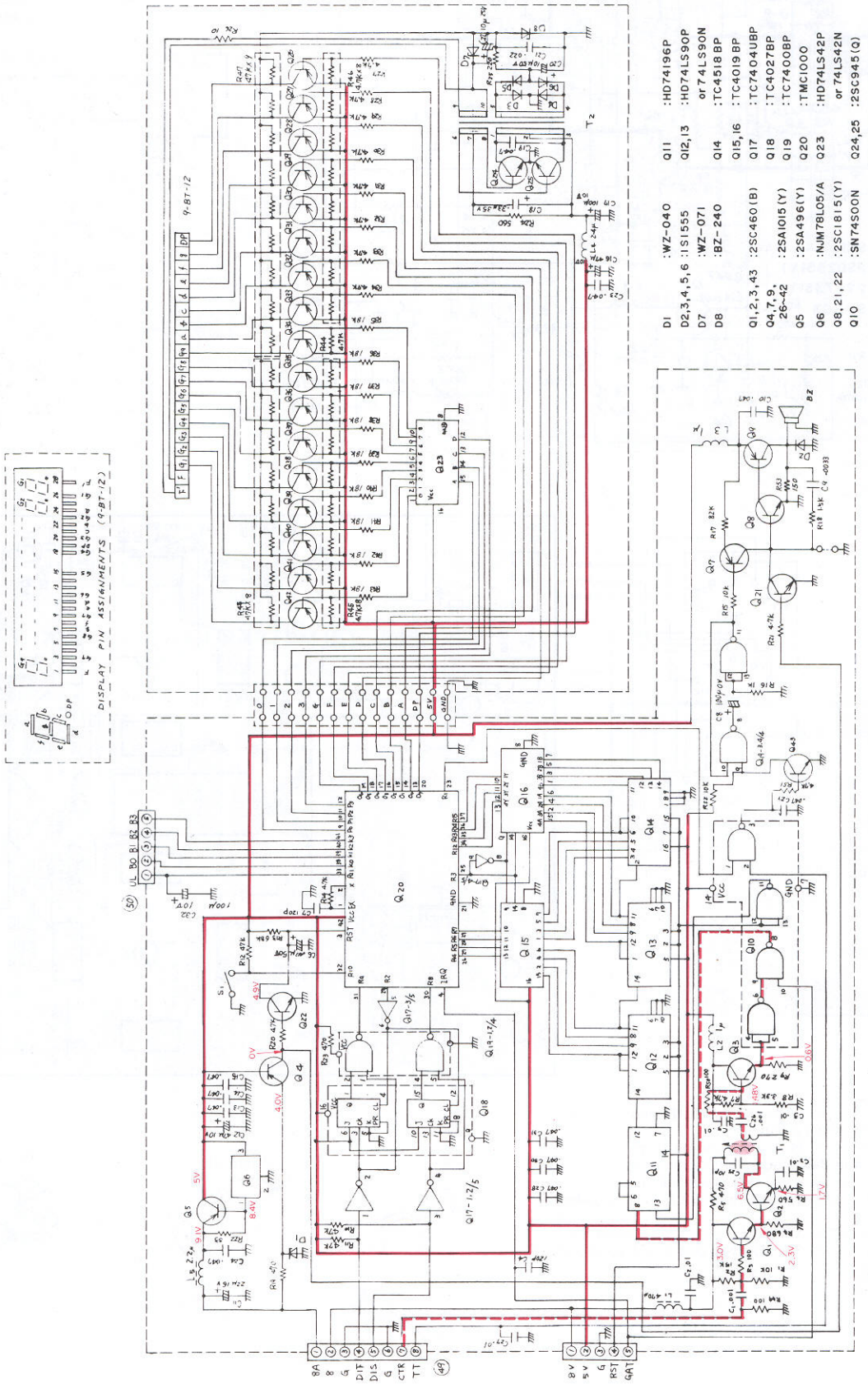
SRF1714



PC BOARD/CIRCUIT DIAGRAM

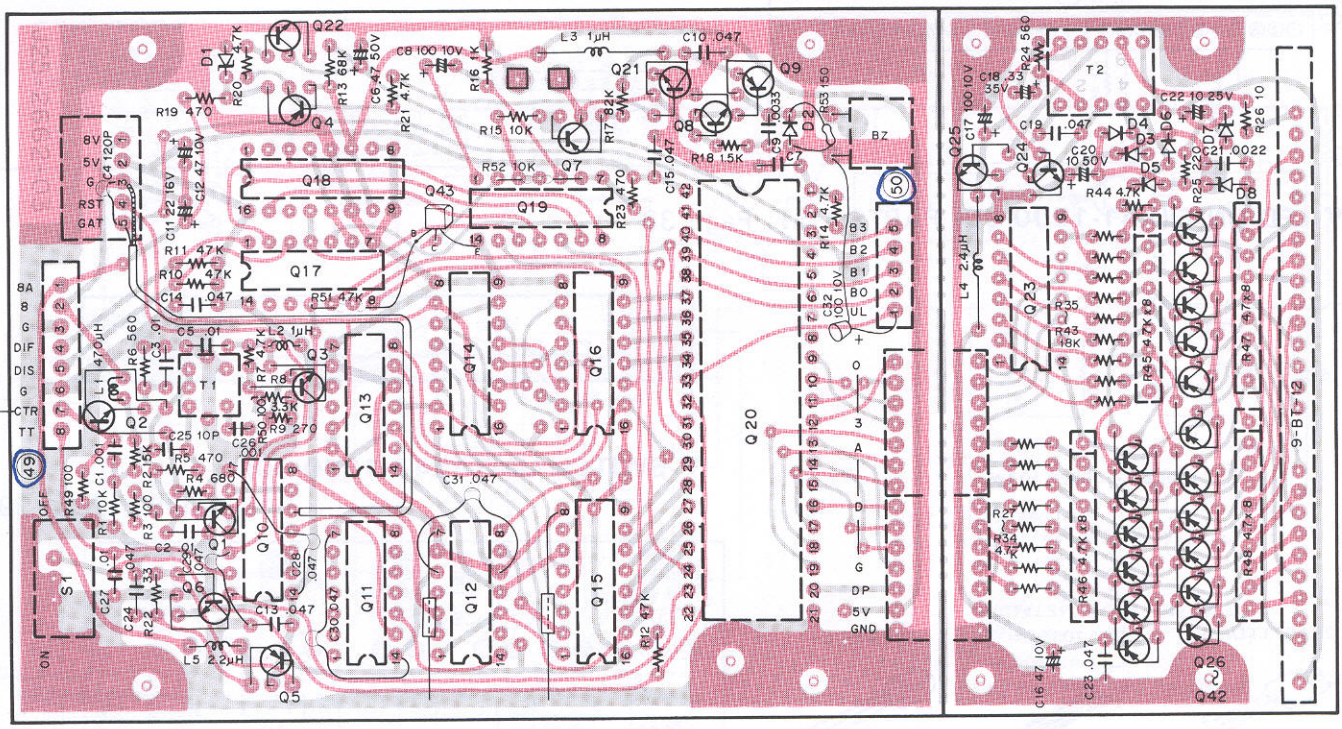
▼ **COUNTER ASS'Y UNIT (X60-1100-00)**

▼ **DISPLAY UNIT (X54-1430-00)** PARTS LIST: Page 46

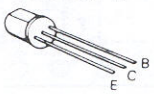


PC BOARD/CIRCUIT DIAGRAM

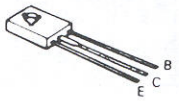
▼ COUNTER ASS'Y UNIT (X60-1100-00)
▼ DISPLAY UNIT (X54-1430-00)



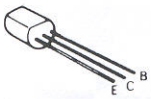
2SC460(B)
2SC733(Y)



2SA496(Y)



2SC945(Q)



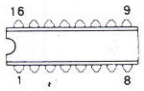
2SC1815(Y)
2SA1015(Y)



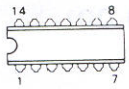
NJM78L05/A



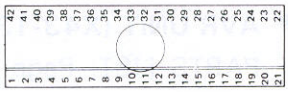
HD74LS42P
TC4019BP
TC4027BP
TC4518BP



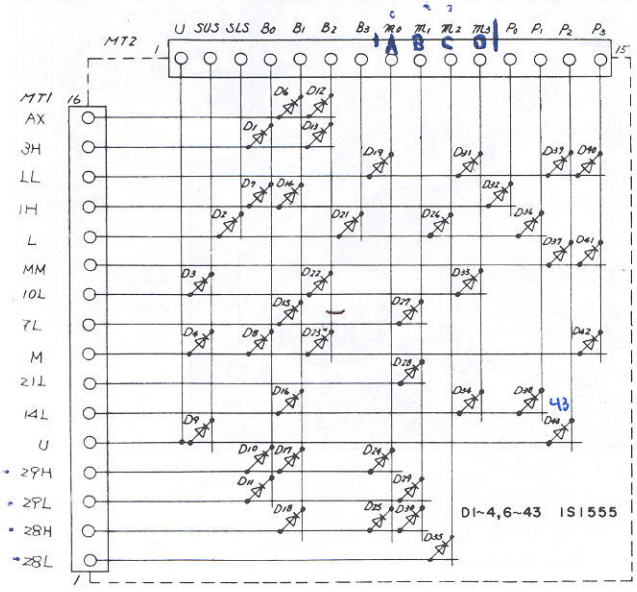
SN74S00N
HD74196P
HD74LS90P
TC7400BP
TC7404UBP

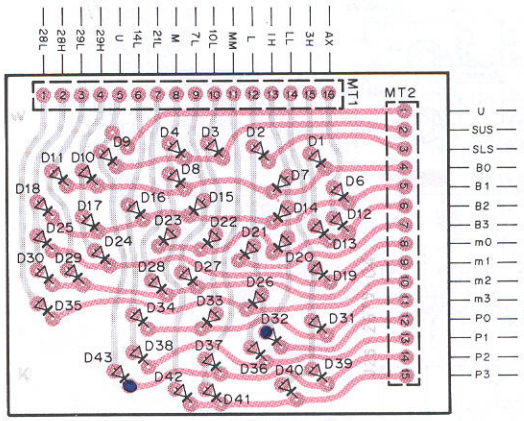


TMC1000



▼ PLL ASS'Y UNIT (X60-1120-00)
▼ MATRIX UNIT (X53-1130-00) PARTS LIST: Page 48

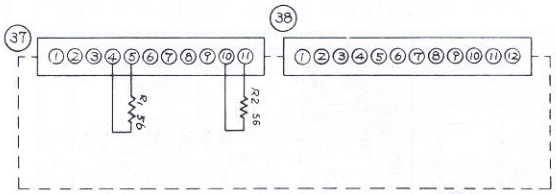


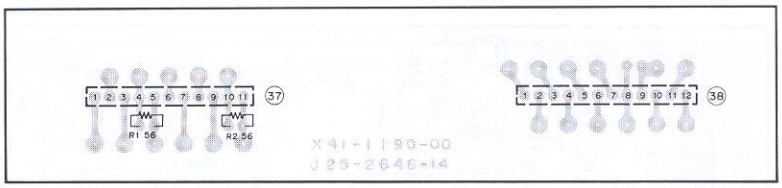


Not used D1, 15, 20 (K) type
Not used D13, 20 (W)(T)(X) type

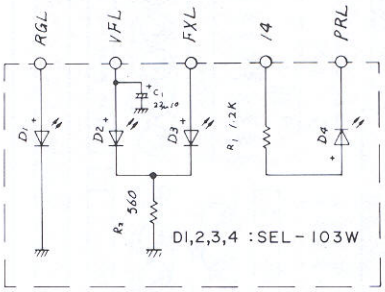
PC BOARD/CIRCUIT DIAGRAM

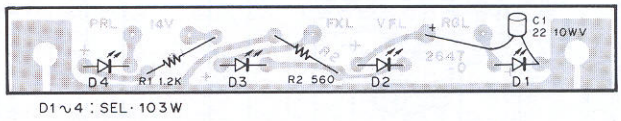
▼ CONNECTOR UNIT (X41-1190-00) PARTS LIST: Page 39





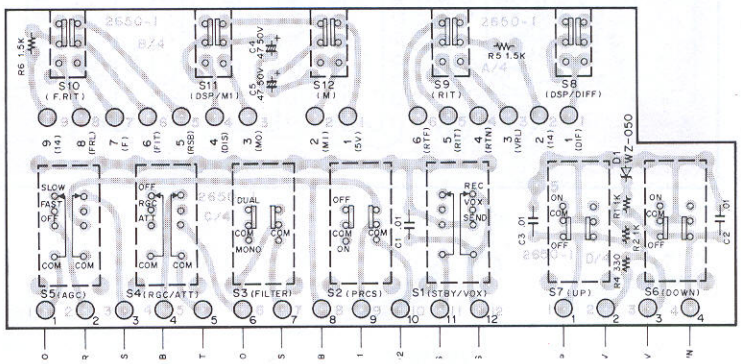
▼ LED UNIT (X41-1200-00) PARTS LIST: Page 39



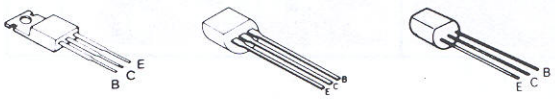


▼ SWITCH UNIT (X41-1230-00)

PARTS LIST: Page 39

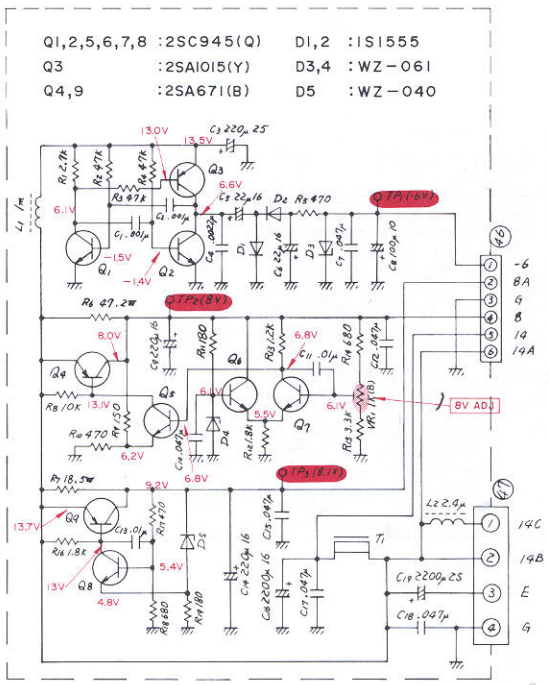


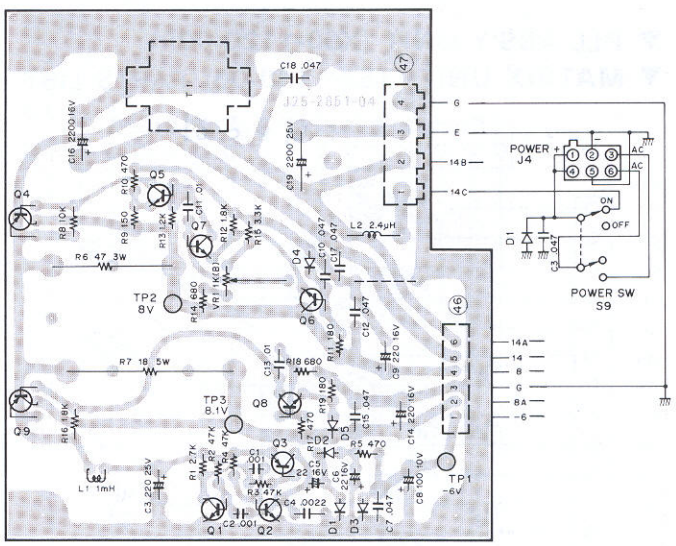
2SA671TD(B) 2SA1015(Y) 2SC945(Q)



▼ AVR UNIT (X43-1340-00)

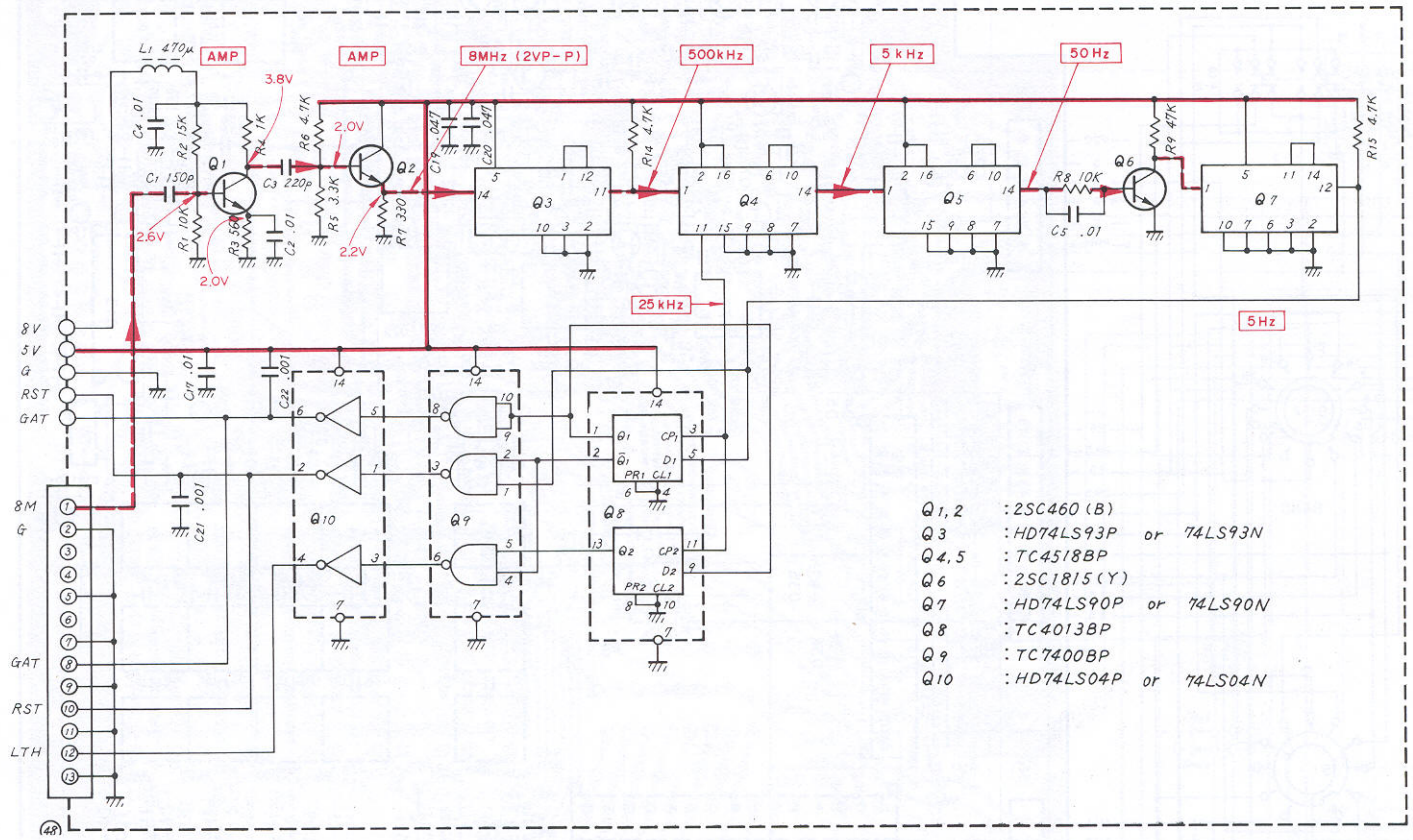
PARTS LIST: Page 40

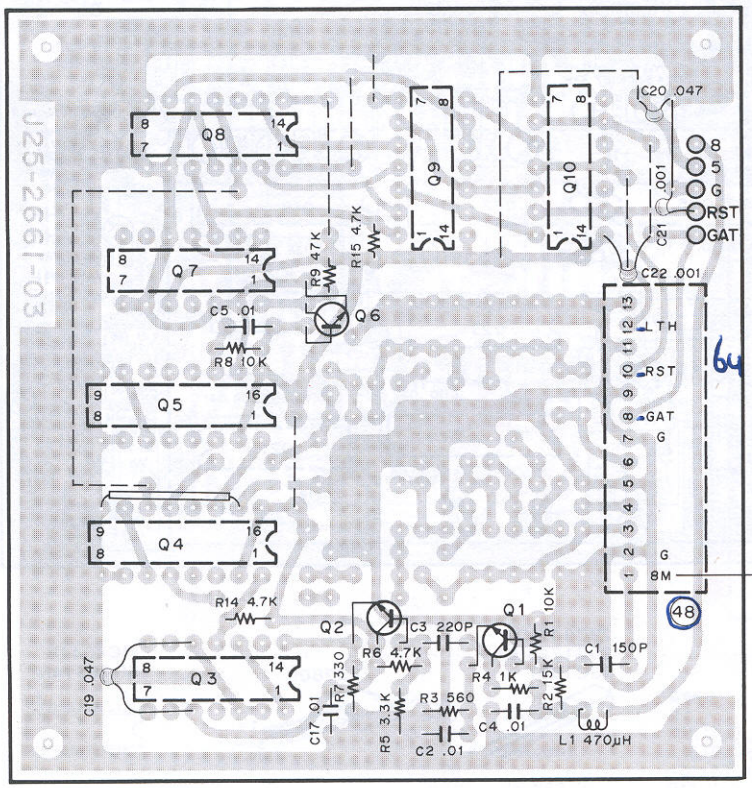




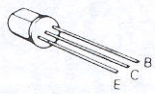
PC BOARD/CIRCUIT DIAGRAM

▼ **COUNTER ASS'Y UNIT (X60-1100-00)**
▼ **DIVIDE UNIT (X54-1420-00)** PARTS LIST: Page 46

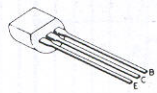




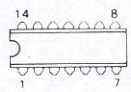
2SC460(B)



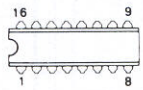
2SC1815(Y)



HD74LS93P
HD74LS04P
HD74LS90P
TC7400BP
TC4013BP

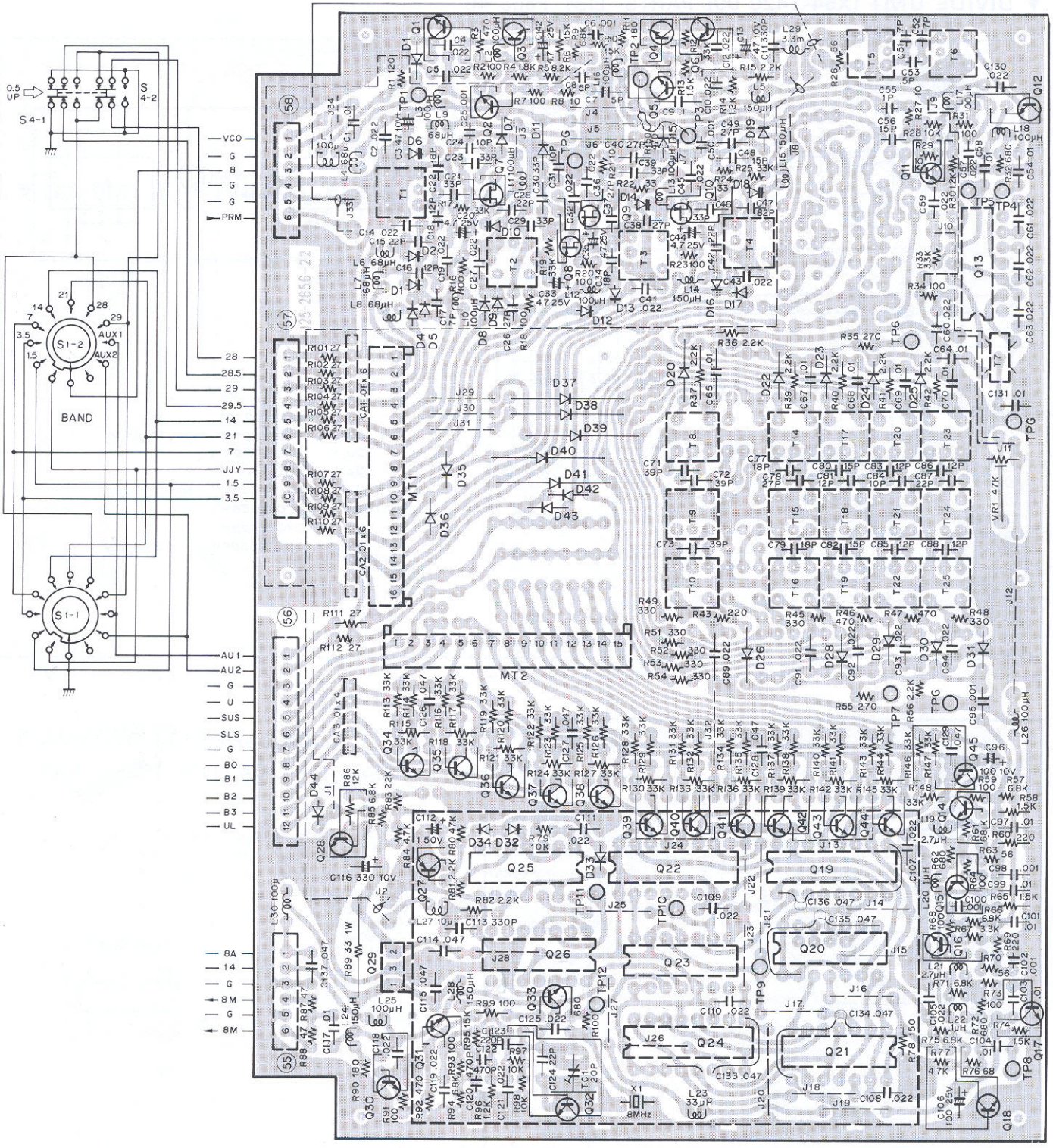


TC4518BP

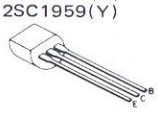


PC BOARD/CIRCUIT DIAGRAM

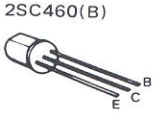
▼ PLL UNIT (X50-1560-00)



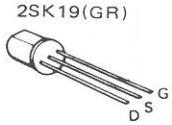
2SA1015(Y)
2SC1959(Y)



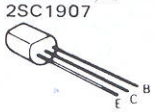
2SC460(B)



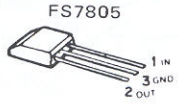
2SK19(GR)



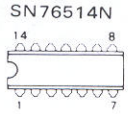
2SC945(Q)
2SC1775(E)
2SC1907

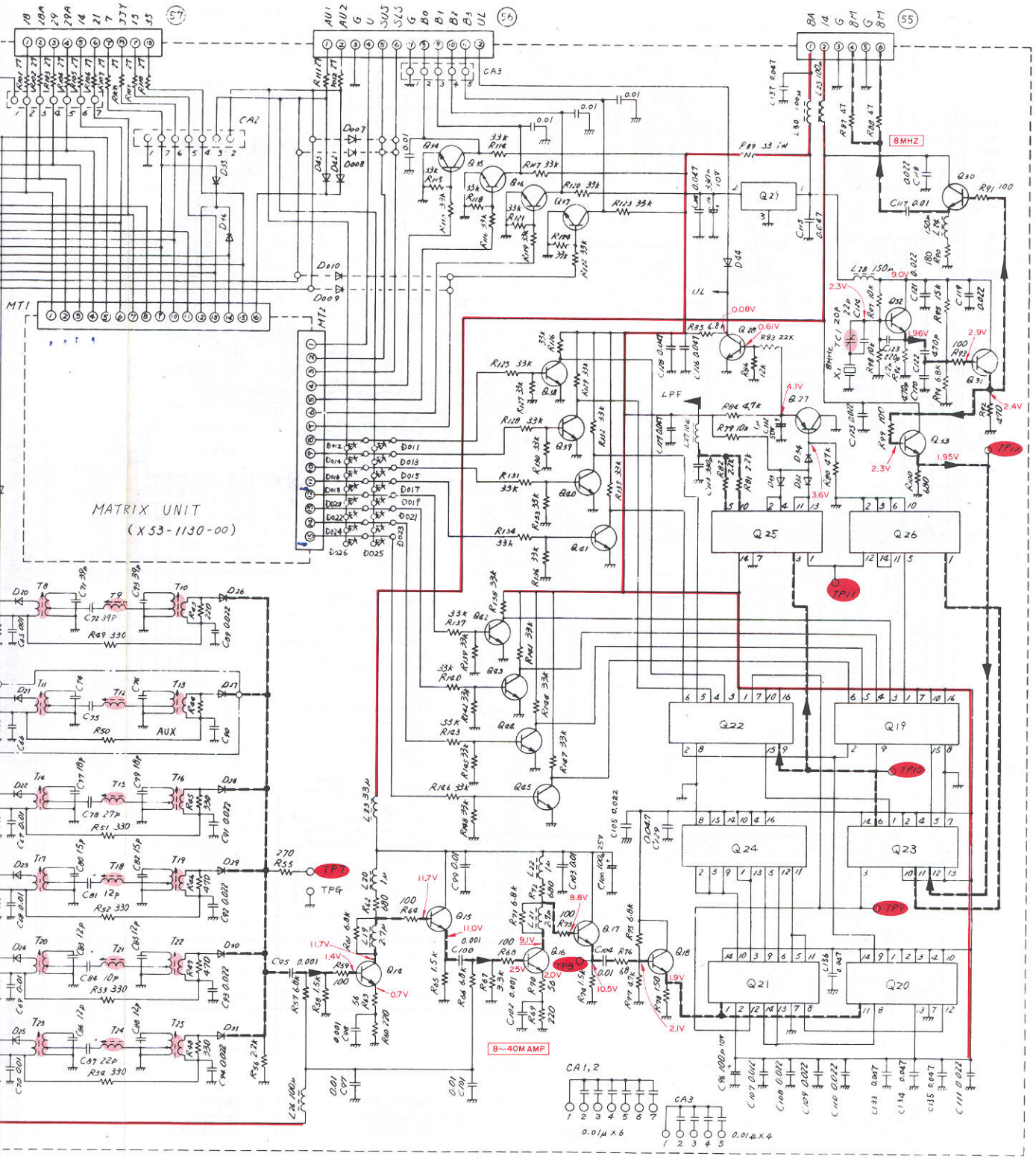


FS7805



MC4044P
SN76514N





P or 74LSI63N

or 74LS00N

Q26 :SN74LS93N or HD74LS93P or 74LS93N
Q27 :2SA1015(Y)
Q29 :FS7805
Q30 :2SC1959(Y)

D1~3, 5, 9, 13, 16 :1S2588

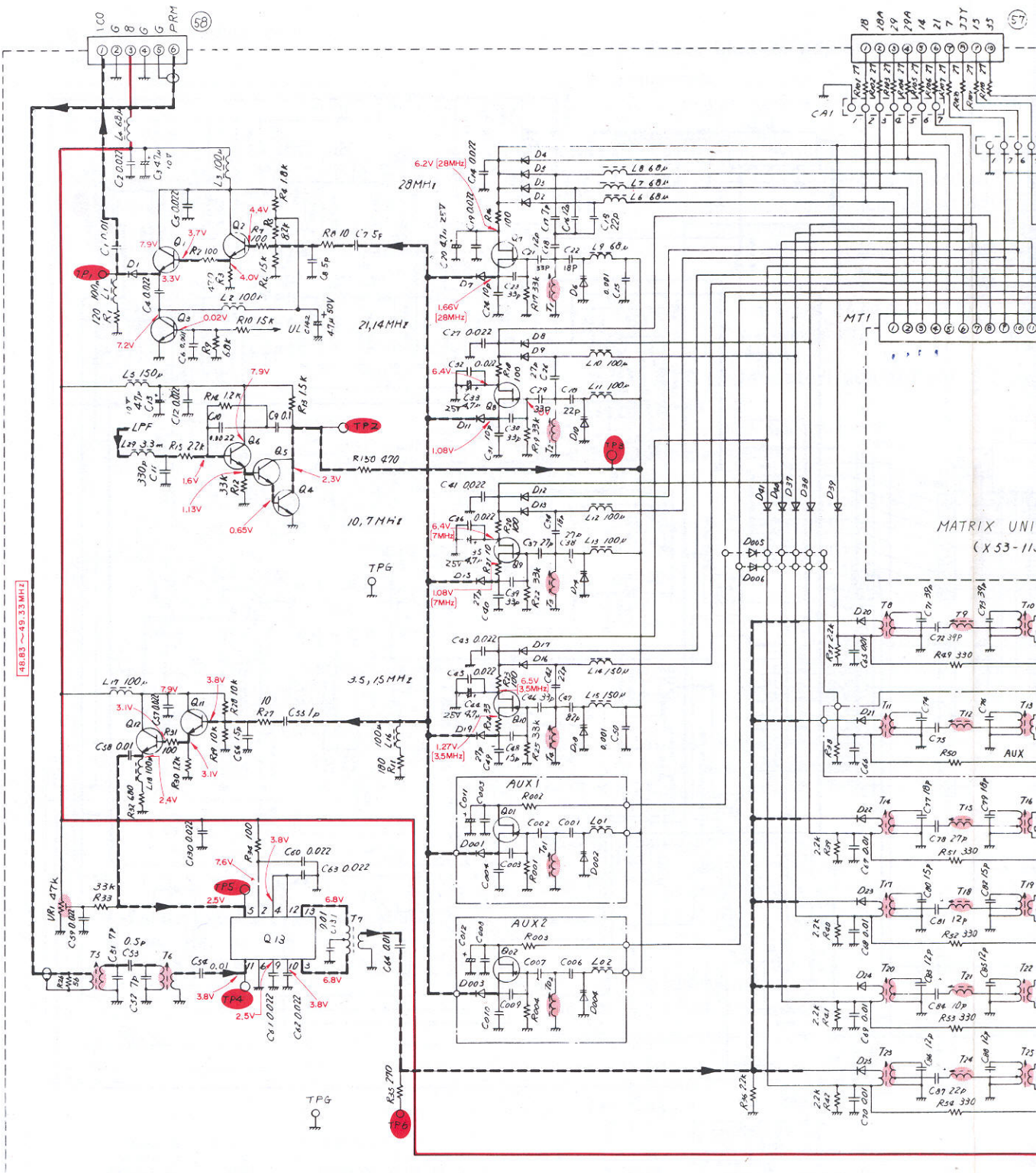
D4, 7, 8, 11, 12, 15, 17, 19, 32~44, 001, 003, 005~026 :1S1555

D6, 10, 14, 18, 002, 004 :1SV53A

D20, 22~26, 28~31 :1S1587

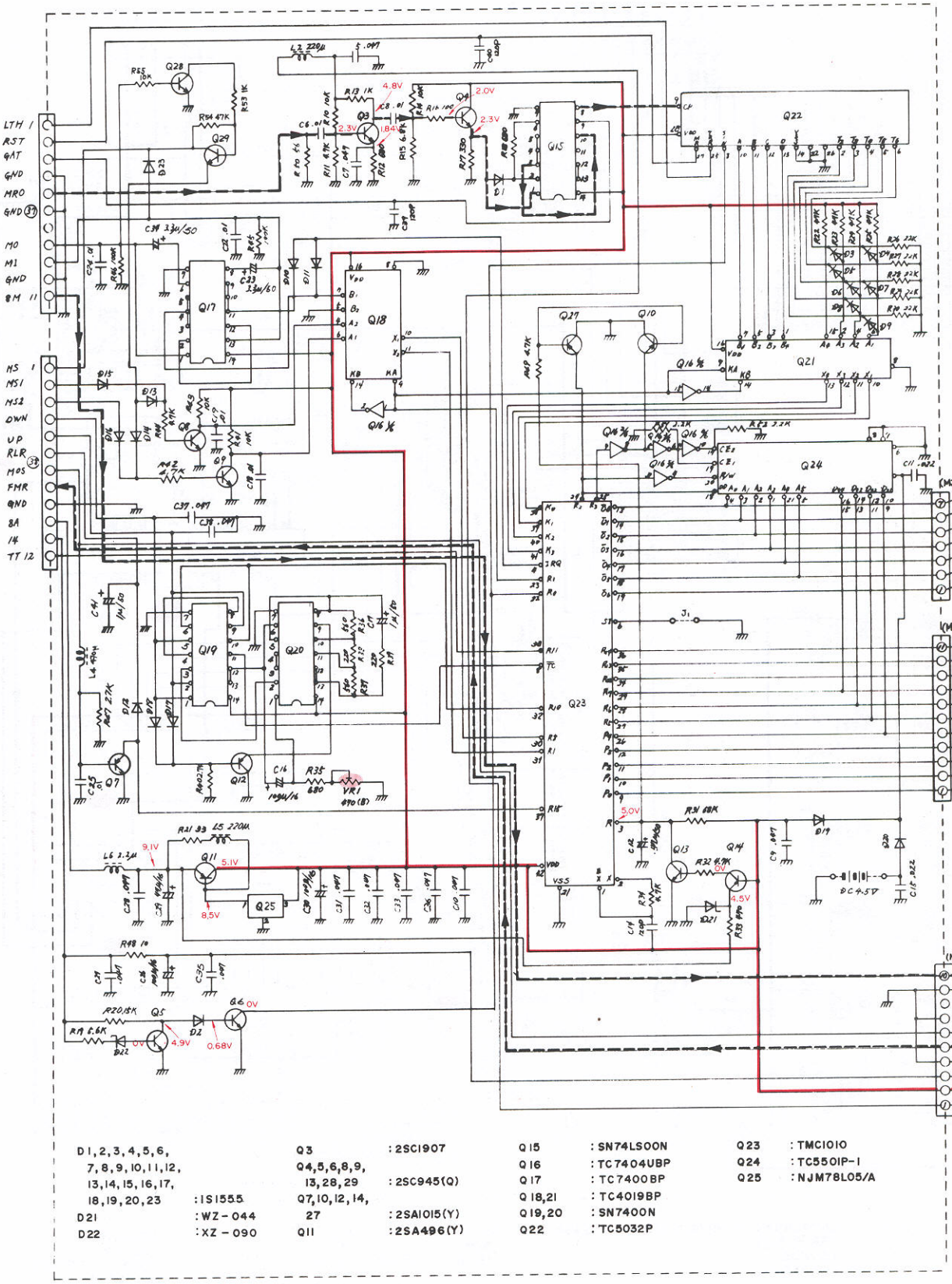
▼ PLL ASS'Y UNIT (X60-1120-00)

▼ PLL UNIT (X50-1560-00) PARTS LIST: Page 47



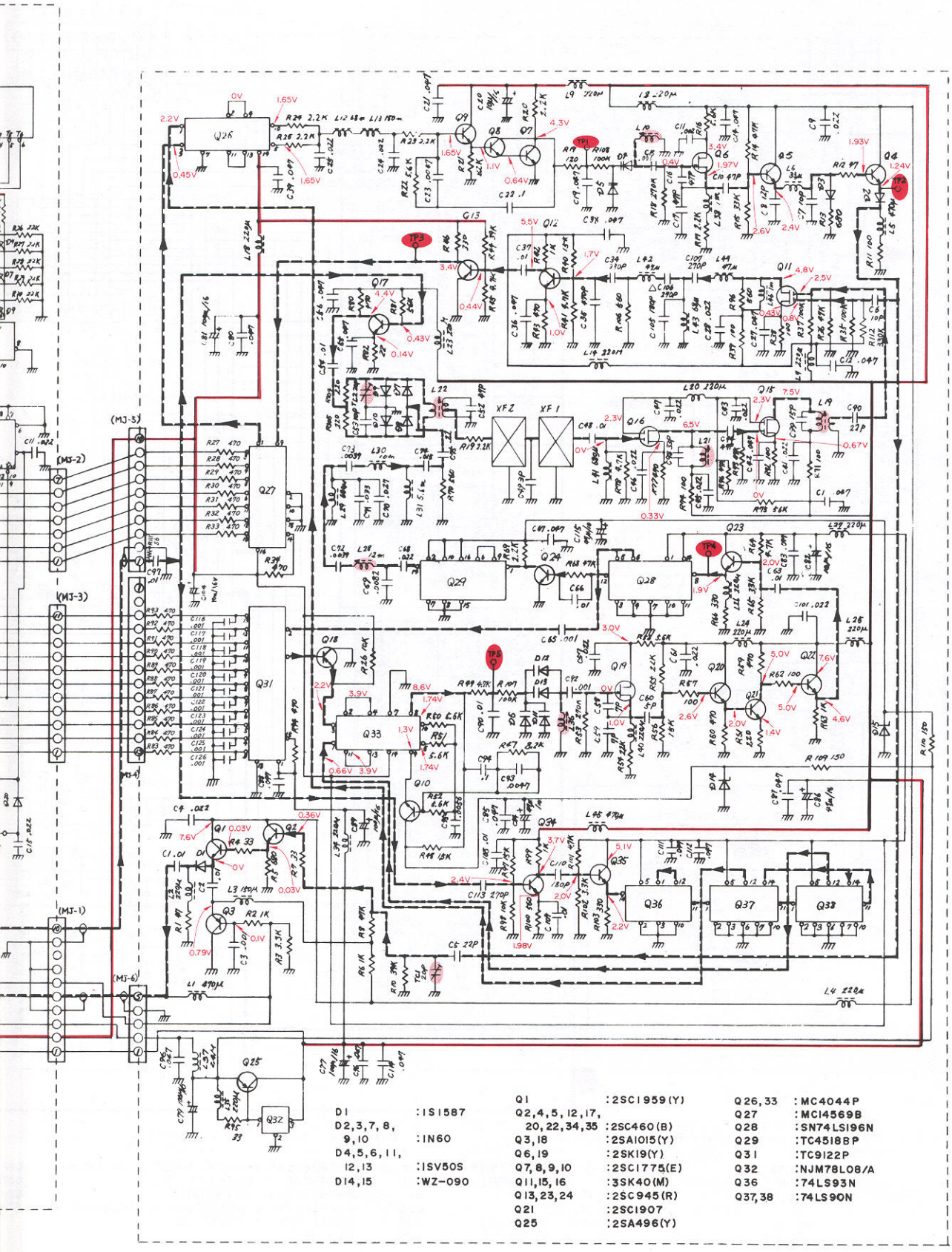
Q01, 02, 8~10	:2SK19(GR)	Q4~6	:2SC1775(E)	Q19, 22	:SN74LS163N or HD74LS163P or 74LS163N	Q26	
Q1, 2, 14, 16	:2SC1907	Q7	:2SK19(BL)	Q20	:SN74S74N or HD74S74	Q27	
Q3, 28 34~45	:2SC945(Q)	Q11, 12, 15, 17, 18, 31~33	:2SC460(B)	Q21	:SN74S00N or HD74S00	Q29	
		Q13	:SN76514N	Q23	:SN74LS00N or HD74LS00P or 74LS00N	Q30	
				Q24	:SN74S112N or HD74S112		
				Q25	:MC4044P		

▼ MEMORY ASS'Y UNIT (X60-1090-00)
▼ CONTROL UNIT (X53-1100-00) PARTS LIST: Page 50



D1,2,3,4,5,6, 7,8,9,10,11,12, 13,14,15,16,17, 18,19,20,23	:1S1555	Q3	:2SC1907	Q15	:SN74LS00N	Q23	:TMC1010
D21	:WZ-044	Q4,5,6,8,9, 13,28,29	:2SC945(Q)	Q16	:TC7404UBP	Q24	:TC5501P-1
D22	:XZ-090	Q7,10,12,14, 27	:2SA1015(Y)	Q17	:TC7400BP	Q25	:NJM78L05/A
		Q11	:2SA496(Y)	Q18,21	:TC4019BP		
				Q19,20	:SN7400N		
				Q22	:TC5032P		

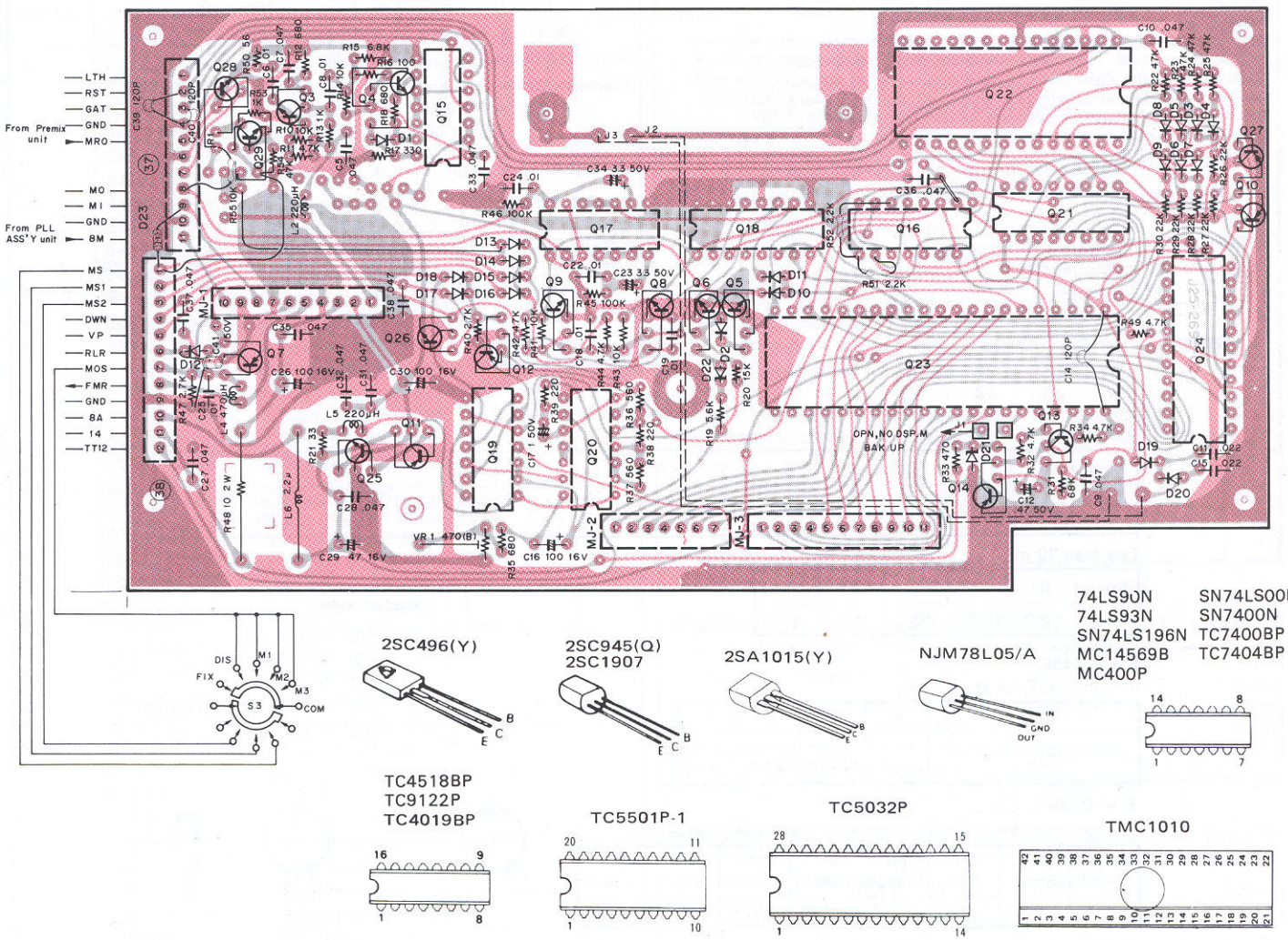
▼ VCO UNIT (X50-1550-00) PARTS LIST: Page 49



D1	:1S1587	Q1	:2SC1959(Y)	Q26,33	:MC4044P
D2,3,7,8, 9,10	:1N60	Q2,4,5,12,17, 20,22,34,35	:2SC460(B)	Q27	:MC14569B
D4,5,6,11, 12,13	:1SV50S	Q3,18	:2SA1015(Y)	Q28	:SN74LS196N
D14,15	:WZ-090	Q6,19	:2SK19(Y)	Q29	:TC4518BP
		Q7,8,9,10	:2SC1775(E)	Q31	:TC9122P
		Q11,15,16	:3SK40(M)	Q32	:NJM78L08/A
		Q13,23,24	:2SC945(R)	Q36	:74LS93N
		Q21	:2SC1907	Q37,38	:74LS90N
		Q25	:2SA496(Y)		

PC BOARD/CIRCUIT DIAGRAM

▼ CONTROL UNIT (X53-1100-00)



74LS90N SN74LS00N
74LS93N SN7400N
SN74LS196N TC7400BP
MC14569B TC7404BP
MC400P

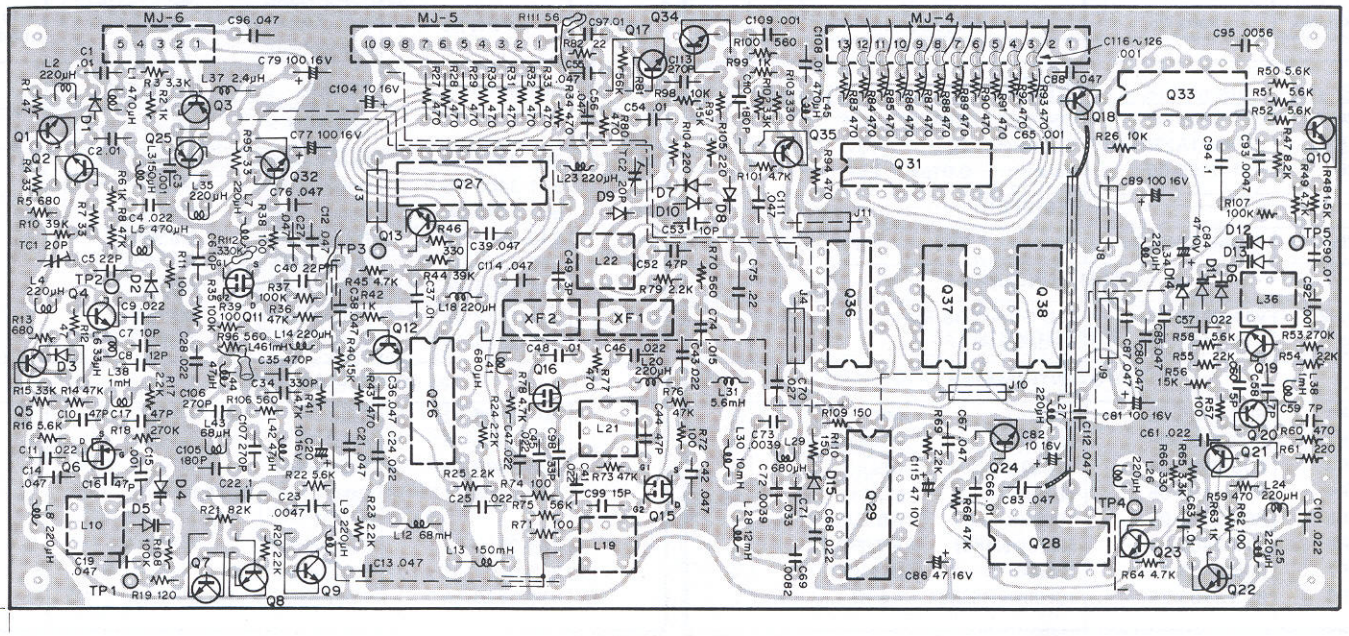
TC4518BP
TC9122P
TC4019BP

TC5501P-1

TC5032P

TMC1010

▼ VCO UNIT (X50-1550-00)



PARTS LIST

Note 1:
K: U.S.A. T: Britian W: Europe X: Australia

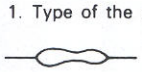
Note 2:
Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the P.C. board illustration. Resistors not otherwise detailed are carbon type (1/4W 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.

RESISTOR

1. Type of the carbon resistor



RD14BY
RD14BB (small size)

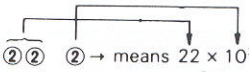


RD14CY
RD14CB (small size)

2. Wattage

1W → 3A 3W → 3F 5W → 3H
2W → 3D 4W → 3G

3. Resistance value



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

4. Tolerance

J = ±5% (Gold) K = ±10% (Silver)

CAPACITORS

Type I

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

1 = Type ..... ceramic, electrolytic, etc.
2 = Shape ..... round, square, etc.
3 = Temp. range
3' = Temp. coefficient

Type II

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

4 = Voltage rating
5 = Value
6 = Tolerance

6 = Tolerance

Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±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

Less than 10 pF

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

5 = Capacitor value

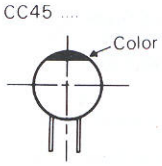
Example: 010 → 1 pF
100 → 10 pF
101 → 100 pF
102 → 1000 pF = 0.001 μF
103 → 0.01 μF

3 = CK45F
Ceramic capacitor (type I) 3

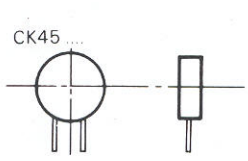
Cord	B	D	E	F
Operating temperature °C	−30 +85	−30 +85	−30 +85	−10 +70

3' = CC45 ○○ ....
Ceramic capacitor (type II) temperature coeff. capacitor .1' 3'.

1st word (Color)	CH (Black)	LH (Red)	PH (Orange)	RH (Yellow)	SH (Green)	TH (Blue)	UJ (Violet)
ppm/°C	0	−80	−150	−220	−330	−470	−750



Type II



Type I

GENERAL Schematic: Page 72

☆: New Parts

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C4	C91-0456-05	Ceramic 0.047μF 25V	
C6	CE04W1A220	Electrolytic 22μF 10V	
C8	C91-0455-05	Ceramic 0.01μF 25V	
		RESISTOR	
R8,9	RC05GF2H560J	Solid 56Ω ±5% 1/2W	
		SEMICONDUCTOR	
D1,2	V11-7260-56	LED GD4-203S-RD	
D3	V11-2163-86	Diode S31C	
		POTENTIOMETER	
VR1	R05-3405-05	10kΩ(A) MIC	☆
VR2	R05-3402-05	10kΩ(B) RF POWER	☆
VR3	R05-6401-05	250kΩ (B) DELAY	☆
VR4	R05-4403-05	50kΩ(B) VOX	☆
VR5	R05-3408-05	10kΩ (B) NB TUNE	☆
VR6	R19-2401-25	5kΩ(B)/5kΩ(B) RIT/F•RIT	☆
VR7	R05-3403-25	10kΩ(F) IF•SHIFT	☆
VR8	R19-3403-25	10kΩ(A)/10kΩ(B) AF/RF	☆
VR9	R01-0040-05	300Ω(B) ANTI VOX	
		SWITCH	
S1	S01-2414-05	Rotary switch BAND	☆
S2	S01-3403-05	Rotary switch MODE	☆
S3	S01-1415-05	Rotary switch FIX/M	☆
S4	S40-4401-05	Push switch 0.5 SHIFT	☆
S5,6	S40-2403-05	Push switch × 2 RX/TX	
S9	S44-1404-05	Paddle switch POWER	
S10	S01-1412-05	Rotary switch METER	☆
S11	S31-2007-05	Slide switch ANT	
		MISCELLANEOUS	
—	A01-0736-02	Case TOP	☆
—	A20-2335-15	Panel	☆
—	A23-1428-03	Rear panel	☆
—	A40-0603-21	Case BOTTOM	☆
—	B03-0510-04	Switch mask	☆
—	B05-0201-04	Speaker grill cloth	
—	B10-0616-24	Front glass	☆

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
—	B10-0617-14	Front glass (Indicating window)	☆
—	B30-0106-15	Pilot lamp × 2 (meter) 12V 40mA	☆
—	B31-0622-05	Meter 750μA	☆
—	B42-1666-04	Indicating plate (SIDE TONE)	☆
—	B42-1667-04	Indicating plate (RF)	☆
—	B43-0615-04	Name plate (T)	☆
—	B43-0617-04	Name plate (K),(W)	☆
—	B43-0623-04	Name plate S type (T)	☆
—	B43-0625-04	Name plate S type (K),(W)	☆
—	B46-0058-00	Warranty card (K)	
—	B50-2612-00	Instruction manual (K),(W)	☆
—	B50-2613-00	Instruction manual (T)	☆
—	B58-0612-00	Warning paper (Transmitter section)	☆
—	D21-0809-05	Band shaft	
—	D22-0402-05	Universal coupling × 2	
—	D22-0404-05	Universal joint	
—	D32-0075-04	Switch stopper	
—	E02-0104-15	Diode socket × 2	☆
—	E04-0152-05	M type receptacle (ANT)	
—	E06-0451-15	4P metal socket (MIC)	
—	E06-0751-05	7P DIN socket (ACSY)	
—	E06-0851-05	8P DIN socket × 2 (EXT VFO, XVTR)	
—	E07-0403-05	4P Mic plug	
—	E07-0751-05	7P DIN plug	
—	E09-0671-05	6P square plug	
—	E11-0003-15	Earphone jack × 2 (EXT-SP, FSK-KEY)	
—	E11-0005-15	3 pole phone jack (KEY)	
—	E11-0034-25	US jack (headphone)	
—	E13-0101-05	1P pinjack × 4	
—	E14-0101-05	1P pinplug (Speaker)	
—	E21-0007-05	Screw terminal (GND)	
—	E23-0043-04	Earth lug (ANT)	
—	E23-0418-05	Terminal × 6	
—	E29-0407-05	Bridge connector × 29	☆
—	E29-0409-04	Earth plate	☆
—	E31-2004-05	Square connector (POWER 6P)	☆
—	F10-1249-04	Silicon steel plate	☆
—	F15-0601-04	Shadow mask	
—	F15-0625-04	Shadow mask	☆
—	G01-0809-04	Spring (GND)	☆
—	G09-0405-05	Knob spring	
—	G09-0410-05	Knob spring × 3	
—	G13-0621-04	Cushion	☆
—	H01-2596-04	Carton (INSIDE) (K),(W)	☆
—	H01-2597-04	Carton (INSIDE) (T)	☆
—	H01-2642-04	Carton (INSIDE) (K),(W) S type	☆
—	H01-2643-04	Carton (INSIDE) (T) S type	☆
—	H03-1684-04	Carton (OUTSIDE) (K)	☆
—	H03-1685-04	Carton (OUTSIDE) (T)	☆
—	H03-1686-04	Carton (OUTSIDE) (W)	☆
—	H03-1722-04	Carton (OUTSIDE) (K) S type	☆
—	H03-1723-04	Carton (OUTSIDE) (W) S type	☆
—	H03-1724-04	Carton (OUTSIDE) (T) S type	☆
—	H10-2515-02	Front packing fixture	☆
—	H10-2516-02	Rear packing fixture	☆
—	H12-0446-04	Cusion	☆
—	H20-1414-03	Protective cover	☆
—	H25-0029-04	Protective bag	
—	H25-0120-04	Protective bag	

Ref. No.	Parts No.	Description	Re-marks
—	J02-0022-05	Foot × 4 (small)	
—	J02-0049-14	Foot × 6 (large)	
—	J32-0724-04	Hex. boss × 2 (coilpack)	☆
—	J32-1030-14	Boss × 2	
—	J42-0401-04	Knob bushing × 3	
—	J61-0019-05	Vinyle tie × 5	
—	K01-0402-05	Handle	
—	K21-0723-04	Pointer knob × 3 (BAND)	
—	K21-0734-04	Knob × 3	☆
—	K23-0719-04	Knob × 5 (MIC GAIN)	☆
—	K23-0720-04	Switch paddle × 6	☆
—	K23-0724-04	Switch paddle (STBY)	☆
—	K27-0405-04	Knob × 3	
—	K29-0714-03	Knob × 3	☆
—	K29-0715-04	Pointer knob (METER SW)	☆
—	K29-0716-04	Knob × 5 (RIT SW)	☆
—	N99-0303-05	Hex. head screw × 2 (VFO)	
—	T03-0027-15	Speaker	

CONNECTOR UNIT (X41-1190-00) Schematic: Page 32

Ref. No.	Parts No.	Description	Re-marks
		RESISTOR	
R1	RD14CB2E560J	Carbon 56Ω ±5% 1/4W	

LED UNIT (X41-1200-00) Schematic: Page 32

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CE04W1A220	Electrolytic 22μF 10V	
		SEMICONDUCTOR	
D1 ~ 4	V11-0430-05	LED SEL-103W	

SWITCH UNIT (X41-1230-00) Schematic: Page 32

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C4,5	CE04W1HR47	Electrolytic 0.47μF 50V	
		RESISTOR	
R1 ~ 6	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
D1	V11-0394-05	Zener diode WZ-050	
S1	S33-2402-05	Lever switch	☆
S2,3	S36-2026-15	Lever switch	
S4,5	S33-2402-05	Lever switch	☆
S6,7	S36-2029-05	Lever switch	
S8	S40-2409-15	Push switch	
S9,10	S40-2404-05	Push switch	
S11	S40-2409-15	Push switch	
S12	S40-2404-05	Push switch	

PARTS LIST

AVR UNIT (X43-1340-00)

Schematic: Page 32

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C3	CE04W1E221	Electrolytic 220μF 25V	
C5,6	CE04W1C220	Electrolytic 22μF 16V	
C8	CE04W1A101	Electrolytic 100μF 10V	
C9,14	CE04W1C221	Electrolytic 220μF 16V	
C16	CE04W1C222Q	Electrolytic 2200μF 16V	
C19	C90-0807-05	Electrolytic 2200μF 25V	☆
RESISTOR			
R6	RS14GB3D470J	Metal film 47Ω ±5% 2W	
R7	R92-0621-05	Cement resistor 18Ω ±10% 5W	☆
R1~5, 8~19	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
POTENTIOMETER			
VR1	R12-1405-05	1kΩ(B)	
SEMICONDUCTOR			
Q1,2	V03-0945-06	Transistor 2SC945(Q)	
Q3	V01-1015-06	Transistor 2SA1015(Y)	
Q4	V01-0139-05	Transistor 2SA671TD(B)	
Q5~8	V03-0945-06	Transistor 2SC945(Q)	
Q9	V01-0139-05	Transistor 2SA671TD(B)	
D1,2	V11-0076-05	Diode 1S1555	
D3,4	V11-0243-05	Zener diode WZ-061	
D5	V11-4161-56	Zener diode WZ-040	
COIL/CHOKE TRANSFORMER			
T1	L15-0016-05	Choke transformer	
L1	L40-1021-03	Ferri-inductor 1mH	
L2	L33-0624-05	Choke coil 2.4μH	☆

RF UNIT (X44-1280-00)

Schematic: Page 19

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C8	CC45SL1H101J	Ceramic 100pF ±5%	
C9,10	C91-0456-05	Ceramic 0.047μF 25V	
C11	CC45SL1H101J	Ceramic 100pF ±5%	
C16	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C17,20,21	C91-0456-05	Ceramic 0.047μF 25V	
C24	CC45SL1H470J	Ceramic 47pF ±5%	
C25	CC45SL1H050D	Ceramic 5pF ±0.5pF	
RESISTOR			
R1~36	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R35	RC05GF2H152J	Solid 1.5kΩ ±5% 1/2W	
SEMICONDUCTOR			
Q1,2	V03-1815-06	Transistor 2SC1815(Y)	
Q3~5	V09-1002-46	FET 3SK73(GR)	
Q6~8	V09-1004-26	FET 2SK125	☆
Q9	V03-1815-06	Transistor 2SC1815(Y)	
Q10	V03-0126-05	Transistor 2SC734(Y)	
D1,2	V11-1263-06	Diode BA379	☆
D3	V11-0076-05	Diode 1S1555	
D4	V11-0414-05	Diode 1S2588	
D5,6	V11-0076-05	Diode 1S1555	
COIL/TRANSFORMER			
T1	L30-0506-05	IFT	☆
T2,3	L19-0303-05	Wide band transformer	
T4	L30-0506-05	IFT	☆
L1~5	L40-1511-03	Ferri-inductor 150μH	

COILPACK UNIT (X44-1290-00)

Schematic: Page 20

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45RH1H101J	Ceramic 100pF ±5%	
C2	CQ09S1H122J	Styrene 1200pF ±5%	
C3	CC45RH1H151J	Ceramic 150pF ±5%	
C4	CC45RH1H330J	Ceramic 33pF ±5%	
C5	CC45RH1H151J	Ceramic 150pF ±5%	
C6	CC45RH1H470J	Ceramic 47pF ±5%	
C7,8	CC45RH1H560J	Ceramic 56pF ±5%	
C9	CC45RH1H121J	Ceramic 120pF ±5%	
C10	CC45RH1H560J	Ceramic 56pF ±5%	
C11	CC45RH1H151J	Ceramic 150pF ±5%	
C12	CC45RH1H330J	Ceramic 33pF ±5%	
C13	CC45RH1H151J	Ceramic 150pF ±5%	
C14	CC45RH1H270J	Ceramic 27pF ±5%	
C15,16	CC45RH1H560J	Ceramic 56pF ±5%	
C17	CC45RH1H121J	Ceramic 120pF ±5%	
C18	CC45RH1H560J	Ceramic 56pF ±5%	
C20	C90-0456-05	Ceramic 0.047μF 50V	
C21	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C22	CC45SL1H220J	Ceramic 22pF ±5%	
C26	CQ09S1H391J	Styrene 390pF ±5%	
C27	CC45RH1H221J	Ceramic 220pF ±5%	
C28	CQ09S1H391J	Styrene 390pF ±5%	
C29	CQ92M1H222K	Mylar 0.0022μF ±10%	
C30	CC45RH1H181J	Ceramic 180pF ±5%	
C31	CC45RH1H121J	Ceramic 120pF ±5%	
C32	CC45RH1H221J	Ceramic 220pF ±5%	
C33	CQ09S1H102J	Styrene 1000pF ±5%	
C34	CC45RH1H121J	Ceramic 120pF ±5%	
C35	CC45RH1H270J	Ceramic 27pF ±5%	
C36	CC45RH1H151J	Ceramic 150pF ±5%	
C37	CQ09S1H681J	Styrene 680pF ±5%	
C38	CC45RH1H560J	Ceramic 56pF ±5%	
C39	CC45RH1H180J	Ceramic 18pF ±5%	
C40	CC45RH1H680J	Ceramic 68pF ±5%	
C41	CC45SL1H471J	Ceramic 470pF ±5%	
C42	CC45RH1H390J	Ceramic 39pF ±5%	
C43	CC45RH1H050C	Ceramic 5pF ±0.25p	
C44	CC45RH1H470J	Ceramic 47pF ±5%	
C45	CC45SL1H331J	Ceramic 330pF ±5%	
C46	CC45RH1H330J	Ceramic 33pF ±5%	
C47	CC45RH1H560J	Ceramic 56pF ±5%	
C48	CC45RH1H390J	Ceramic 39pF ±5%	
C49	CC45RH1H101J	Ceramic 100pF ±5%	
C53	CE04W1E330	Electrolytic 33μF 25V	
C55	C90-0272-05	Ceramic 0.01μF 50V	
C64	CC45RH1H150J	Ceramic 15pF ±5%	
C66	CQ92M1H104K	Mylar 0.1μF ±10%	
C67	CS15E1VR33M	Tantalum 0.33μF 35V	
C68	CE04W1E4R7	Electrolytic 4.7μF 25V	
RESISTOR			
R1~38	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
SEMICONDUCTOR			
Q1	V09-1002-46	FET 3SK73(GR)	
Q2	V03-1959-06	Transistor 2SC1959(Y)	
Q3	V03-0283-05	Transistor 2SC741	
Q4	V03-1959-06	Transistor 2SC1959(Y)	
D1,2	V11-0076-05	Diode 1S1555	
TRANSFORMER/COIL/VARIABLE CAPACITOR			
T1	L19-0310-05	RF transformer	☆
T2	L19-0314-05	RF transformer	
L1	L34-0559-05	Trap coil	
L2	L34-0558-05	Trap coil (red)	
L3	L34-0759-05	Tuning coil 1.5MHz (brown)	☆

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
L4	L34-0765-05	Tuning coil 10MHz (orange)	☆
L5	L34-0760-05	Tuning coil 3.5MHz (red)	☆
L6	L34-0761-05	Tuning coil 7MHz (yellow)	☆
L7	L34-0762-05	Tuning coil 14MHz (green)	☆
L8	L34-0763-05	Tuning coil 21MHz (white)	☆
L9	L34-0764-05	Tuning coil 28MHz (blue)	☆
L10	L34-0759-05	Tuning coil 1.5MHz (brown)	☆
L11	L34-0765-05	Tuning coil 10MHz (orange)	☆
L12	L34-0760-05	Tuning coil 3.5MHz (red)	☆
L13	L34-0761-05	Tuning coil 7MHz (yellow)	☆
L14	L34-0762-05	Tuning coil 14MHz (green)	☆
L15	L34-0763-05	Tuning coil 21MHz (white)	☆
L16	L34-0764-05	Tuning coil 28MHz (blue)	☆
L17	L34-0766-05	BPF coil 1.5A (brown)	☆
L18	L34-0767-05	BPF coil 1.5B (black)	☆
L19	L34-0766-05	BPF coil 1.5A (brown)	☆
L20	L34-0768-05	BPF coil 3.5A (red)	☆
L21	L34-0769-05	BPF coil 3.5B (black)	☆
L22	L34-0768-05	BPF coil 3.5A (red)	☆
L23	L34-0770-05	BPF coil 7A (yellow)	☆
L24	L34-0771-05	BPF coil 7B (black)	☆
L25	L34-0770-05	BPF coil 7A (yellow)	☆
L26	L34-0772-05	BPF coil 14A (green)	☆
L27	L34-0773-05	BPF coil 14B (black)	☆
L28	L34-0772-05	BPF coil 14A (green)	☆
L29	L34-0774-05	BPF coil 21A (white)	☆
L30	L34-0775-05	BPF coil 21B (black)	☆
L31	L34-0774-05	BPF coil 21A (white)	☆
L32	L34-0776-06	BPF coil 28A (blue)	☆
L33	L34-0777-05	BPF coil 28B (black)	☆
L34	L34-0776-05	BPF coil 28A (black)	☆
L35	L40-3301-03	Ferri-inductor 33μH	
L36	L40-1011-04	Ferri-inductor 100μH	
L37	L40-1511-03	Ferri-inductor 150μH	
L38	L33-0032-05	Choke coil 3.3μH	
L39	L40-1592-02	Ferri-inductor 1.5μH	
L40	L40-3391-03	Ferri-inductor 3.3μH	
VC1	C02-0013-05	Variable capacitor	☆
MISCELLANEOUS			
S1	S29-6402-05	Rotary wafer ass'y	☆
RL1	S51-1404-05	Relay G2E	
—	D13-0401-04	Sproket	
—	D13-0402-04	Sproket	
—	D16-0402-04	Chain ass'y	

IF UNIT (X48-1240-11)

Schematic: Page 22

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45SL1H470J	Ceramic 47pF ±5%	
C2～4	C91-0457-05	Ceramic 0.022μF 25V	
C5	CC45SL1H030C	Ceramic 3pF ±0.25pF	
C7	C91-0457-05	Ceramic 0.022μF 25V	
C9	CC45SL1H470J	Ceramic 47pF ±5%	
C11	CE04W1A470	Electrolytic 47μF 10V	
C12	CE04W1C100	Electrolytic 10μF 16V	
C14,15	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C16,17	C91-0456-05	Ceramic 0.047μF 25V	
C19	CE04W1HR47	Electrolytic 0.47μF 50V	
C20	C91-0456-05	Ceramic 0.047μF 25V	
C22	CE04W1C100	Electrolytic 10μF 16V	
C23	CE04W1HR47	Electrolytic 0.47μF 50V	
C24	C91-0456-05	Ceramic 0.047μF 25V	
C25	CE04W1C100	Electrolytic 10μF 16V	
C27	CE04W1HR47	Electrolytic 0.47μF 50V	
C28	C91-0456-05	Ceramic 0.047μF 25V	
C30	CC45CH1H050C	Ceramic 5pF ±0.25pF	
C31	CC45RH1H101J	Ceramic 100pF ±5%	
C32	C91-0457-05	Ceramic 0.022μF 25V	
C33	CC45RH1H101J	Ceramic 100pF ±5%	
C34～36	CC45RH1H220J	Ceramic 22pF ±5%	
C40	CE04W1C220	Electrolytic 22μF 16V	
C42	CC45CH1H330J	Ceramic 33pF ±5%	
C43	C91-0457-05	Ceramic 0.022μF 25V	
C45	CC45SL1H150J	Ceramic 15 pF ±5%	
C46	CC45SL1H220J	Ceramic 22pF ±5%	
C47～50	C91-0457-05	Ceramic 0.022μF 25V	
C51	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C52	CC45SL1H150J	Ceramic 15pF ±5%	
C54,56,	C91-0457-05	Ceramic 0.022μF 25V	
C57	C91-0457-05	Ceramic 0.022μF 25V	
C59,60	C91-0457-05	Ceramic 0.022μF 25V	
C62	C91-0457-05	Ceramic 0.022μF 25V	
C66	C91-0457-05	Ceramic 0.022μF 25V	
C67	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C68	C91-0457-05	Ceramic 0.022μF 25V	
C69	CC45SL1H101J	Ceramic 100pF ±5%	
C75	CC45SL1H150J	Ceramic 15pF ±5%	
C79,80	C91-0457-05	Ceramic 0.022μF 25V	
C82	C91-0457-05	Ceramic 0.022μF 25V	
C86	CE04W1C220	Electrolytic 22μF 16V	
C87	C91-0456-05	Ceramic 0.047μF 25V	
C88	CE04W1H010	Electrolytic 1μF 50V	
C89	CE04W1E4R7	Electrolytic 4.7μF 25V	
C92	CE04W1A470	Electrolytic 47μF 10V	
C93	C90-0272-05	Ceramic 0.01μF 50V	
C94	CE04W1C100	Electrolytic 10μF 16V	
C95	C91-0457-05	Ceramic 0.022μF 25V	
C96	CE04W1H010	Electrolytic 1μF 50V	
C97	C91-0456-05	Ceramic 0.047μF 25V	
C98,99	CE04W1C100	Electrolytic 10μF 16V	
C100,101	CC45SL1H030C	Ceramic 3pF ±0.25pF	
C102,103	C91-0457-05	Ceramic 0.022μF 25V	
C105,106	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C108	CE04W1E4R7	Electrolytic 4.7μF 25V	
C109	CQ92M1H104K	Mylar 0.1μF ±10%	
C110	CQ92M1H153K	Mylar 0.015μF ±10%	
C111	CE04W1C100	Electrolytic 10μF 16V	
C112	CQ92M1H392K	Mylar 0.0039μF ±10%	
C113	CE04W1HR47	Electrolytic 0.47μF 50V	
C114	CE04W1A101Q	Electrolytic 100μF 10V	
C115	CE04W1C220	Electrolytic 22μF 16V	
C116	CQ92M1H104K	Mylar 0.1μF ±10%	
C117	CE04W1C221	Electrolytic 220μF 16V	
C118	CE04W1A470	Electrolytic 47μF 10V	
C119～122	CQ92M1H123K	Mylar 0.012μF ±10%	
C123	CE04W1H010	Electrolytic 1μF 50V	
C124	CE04W1C100	Electrolytic 10μF 16V	
C125	C91-0456-05	Ceramic 0.047μF 25V	
C127	CC45SL1H101J	Ceramic 100pF ±5%	
C129,130	CE04W1H010	Electrolytic 1μF 50V	
C131	CE04W1C100	Electrolytic 10μF 16V	
C132	CE04W1C221	Electrolytic 220μF 16V	
C133	CE04W1C010	Electrolytic 1μF 16V	
C135	CE04W1C100	Electrolytic 10μF 16V	
C136	CE04W1C220	Electrolytic 22μF 16V	
C137	CE04W1A101	Electrolytic 100μF 10V	
C138	CE04W1C100	Electrolytic 10μF 16V	

PARTS LIST

Ref. No.	Parts No.	Description		Remarks
C139	CQ92M1H472K	Mylar	0.0047μF ±10%	
C140	CE04W1H010	Electrolytic	1μF 50V	
C143	CC45SL1H470J	Ceramic	47pF ±5%	
C144	C91-0457-05	Ceramic	0.022μF 25V	
C145	CC45SL1H050C	Ceramic	5pF ±0.25pF	
C146,149	C91-0457-05	Ceramic	0.022μF 25V	
C150	CC45UJ1H270J	Ceramic	27pF ±5%	
C151	CC45UJ1H220J	Ceramic	22pF ±5%	
C152	CC45SL1H470J	Ceramic	47pF ±5%	
C153,154	C91-0457-05	Ceramic	0.022μF 25V	
C155	CC45CH1H050C	Ceramic	5pF ±0.25pF	
C162	CC45SL1H221J	Ceramic	220pF ±5%	
C163	C91-0456-05	Ceramic	0.047μF 25V	
C164	CE04W1A470	Electrolytic	47μF 10V	
C165	CQ92M1H152K	Mylar	0.0015μF ±10%	
C166	CC45SL1H101J	Ceramic	100pF ±5%	
C169	C91-0456-05	Ceramic	0.047μF 25V	
C170	CE04W1H3R3	Electrolytic	3.3μF 50V	
C171,172	CS15E1E010M	Tantalum	1μF 25V	
C174	CQ92M1H103K	Mylar	0.01μF ±10%	
C177	CC45SL1H101J	Ceramic	100pF ±5%	
C6, 38, 77, 113, 159, 160		Not used		
RESISTOR				
R72, 197		Not used		
R1～204	RD14CB2E○○○J	Carbon	○○○Ω ±5% 1/4W	
SEMICONDUCTOR				
Q1	V03-0079-05	Transistor	2SC460(B)	
Q2	V09-0012-05	FET	2SK19(GR)	
Q3	V01-1015-06	Transistor	2SA1015(Y)	
Q4	V03-0945-06	Transistor	2SC945(Q)	
Q5	V01-1015-06	Transistor	2SA1015(Y)	
Q6	V09-0012-05	FET	2SK19(GR)	
Q7～9	V03-0079-05	Transistor	2SC460(B)	
Q10	V03-0945-06	Transistor	2SC945(Q)	
Q11	V01-1015-06	Transistor	2SA1015(Y)	
Q12,13	V03-0945-06	Transistor	2SC945(Q)	
Q14	V03-0079-05	Transistor	2SC460(B)	
Q15～17	V09-1002-48	FET	3SK73(GR)	
Q18	V03-0945-06	Transistor	2SC945(Q)	
Q19	V03-0079-05	Transistor	2SC460(B)	
Q20,21	V03-0945-06	Transistor	2SC945(Q)	
Q22	V09-1002-48	FET	3SK73(GR)	
Q23～25	V03-0945-06	Transistor	2SC945(Q)	
Q26	V09-0012-05	FET	2SK19(GR)	
Q27	V01-1015-06	Transistor	2SA1015(Y)	
Q28	V03-0079-05	Transistor	2SC460(B)	
Q29,30	V03-0355-05	Transistor	2SC1000(GR)	
Q31	V03-0945-06	Transistor	2SC945(Q)	
Q32	V03-0355-05	Transistor	2SC1000(GR)	
Q33	V30-1073-06	IC	TA7140P	☆
Q34	V03-0079-05	Transistor	2SC460(B)	
Q35	V09-0012-05	FET	2SK19(GR)	
Q36	V03-0945-06	Transistor	2SC945(Q)	
Q37	V01-1015-06	Transistor	2SA1015(Y)	
D1～4	V11-0051-05	Diode	1N60	
D5	V11-0076-05	Diode	1S1555	
D6	V11-4161-36	Varicap-diode	ISV53A	
D7～16	V11-0370-05	Diode	1S1587	
D17,18	V11-0051-05	Diode	1N60	
D19	V11-0240-05	Zener diode	WZ-090	
D20	V11-0076-05	Diode	1S1555	
D21	V11-4160-86	Zener diode	WZ-071	
D22	V11-0076-05	Diode	1S1555	
D23	V11-0219-05	Diode	V06B	
D24	V11-0240-05	Zener diode	WZ-090	

Ref. No.	Parts No.	Description		Remarks
D26～28	V11-0076-05	Diode	1S1555	
D29	V11-0370-05	Diode	1S1587	
D30～38	V11-0076-05	Diode	1S1555	
D40～42	V11-0370-05	Diode	1S1587	
D43,44	V11-0051-05	Diode	1N60	
D45～56	V11-0076-05	Diode	1S1555	
D57,58	V11-0370-05	Diode	1S1587	
D59	V11-0076-05	Diode	1S1555	
D60～63	V11-0051-05	Diode	1N60	
D65,66	V11-0076-05	Diode	1S1555	
D67,68	V11-0240-05	Zener diode	WZ-090	
D69,70	V11-0051-05	Diode	1N60	
D25, 64		Not used		
POTENTIOMETER				
VR1	R12-1002-05	Semi-fixed resistor	1kΩ	
VR2	R12-3002-05	Semi-fixed resistor	10kΩ	
VR3	R12-6402-05	Semi-fixed resistor	470kΩ	☆
VR4	R12-1002-05	Semi-fixed resistor	1kΩ	
VR5～11,13	R12-3036-05	Semi-fixed resistor	10kΩ	
VR12		Not used		
VR14	R12-3412-05	Semi-fixed resistor	10kΩ	
VR15	R12-3408-05	Semi-fixed resistor	47kΩ	
VR16	R12-0401-05	Semi-fixed resistor	100Ω	
TRIMMER/COIL/IFT/FILTER				
TC1	C05-0031-15	Trimmer	10pF	
L1	L34-0781-05	Tuning coil	(red)	☆
L2,3	L40-1511-03	Ferri-inductor	150μF	
L4～6	L34-0782-05	Tuning coil	455kHz	☆
L7	L32-0613-05	Oscillator coil	(white)	☆
L8	L40-1021-03	Ferri-inductor	1mH	
L9	L34-0537-05	Tuning coil	(black)	
L10	L34-0831-05	Tuning coil	(yellow)	☆
L11,12	L34-0780-05	Tuning coil	(blue)	☆
L13	L34-0781-05	Tuning coil	(red)	☆
L14	L40-1511-03	Ferri-inductor	150μH	
L15	L34-0781-05	Tuning coil	(red)	☆
L16～19	L40-1511-03	Ferri-inductor	150μH	
L20	L40-1011-25	Ferri-inductor	100μH	
L21,22	L40-1511-03	Ferri-inductor	150μH	
L23	L34-0567-05	Tuning coil	(orange)	
L24,25,27	L40-1511-03	Ferri-inductor	150μH	
L28	L40-1501-03	Ferri-inductor	15μH	
L29	L30-0504-05	IFT	455kHz	
L31	L40-3301-03	Ferri-inductor	33μH	
L26,30,32	Not used			
XF1	L71-0208-05	Crystal filter	8.83MHz(SSB)	
CF1	L72-0310-05	Ceramic filter	8.83MHz	
S1,2	S31-1403-05	Slide switch		
RL1	S51-2408-05	Relay	G2V-2	
—	J31-0502-04	PC board collar	×4	
—	J42-0404-05	PC board bush	×4	

AF VOX UNIT (X49-1130-00)

Schematic: Page 24

Ref. No.	Parts No.	Description		Remarks
CAPACITOR				
C1	CE04W1C222Q	Electrolytic	2200μF 16V	
C2	CE04W1C330	Electrolytic	33μF 16V	
C4	CE04W1A101	Electrolytic	100μF 10V	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
C5	CE04W1A470	Electrolytic 47μF 10V	
C6	CE04W1C330	Electrolytic 33μF 16V	
C10	CE04W1C471	Electrolytic 470μF 16V	
C11	CE04W1H010	Electrolytic 1μF 50V	
C12	C91-0456-05	Ceramic 0.047μF 25V	
C14	CE04W1HR47	Electrolytic 0.47μF 50V	
C15	CE04W1A470	Electrolytic 47μF 10V	
C16～18	CE04W1H3R3	Electrolytic 3.3μF 50V	
C19	C91-0456-05	Ceramic 0.047μF 25V	
C20	CE04W1A101	Electrolytic 100μF 10V	
C21	C91-0456-05	Ceramic 0.047μF 25V	
C22	CC45SL1H101J	Ceramic 100pF ±5%	
C23	C91-0457-05	Ceramic 0.022μF 25V	
C25	CE04W1A470	Electrolytic 47μF 10V	
C27	CQ92M1H104K	Mylar 0.1μF ±10%	
C28	C91-0457-05	Ceramic 0.022μF 25V	
C29	CE04W1H010	Electrolytic 1μF 50V	
C30,31	C91-0456-05	Ceramic 0.047μF 25V	
C13		Not used	
RESISTOR			
R1～28	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R27		Not used	
SEMICONDUCTOR			
Q1	V30-0208-05	IC AN315	
Q2	V01-0113-05	Transistor 2SA496(Y)	
Q3	V03-0945-06	Transistor 2SC945(Q)	
Q4	V03-1775-06	Transistor 2SC1775(E)	
Q5～7	V03-0945-06	Transistor 2SC945(Q)	
Q8	V01-1015-06	Transistor 2SA1015(Y)	
Q9～11	V03-0945-06	Transistor 2SC945(Q)	
Q12	V01-1015-06	Transistor 2SA1015(Y)	
D1	V11-0076-05	Diode 1S1555	
D2～5	V11-0051-05	Diode 1N60	
D6～9	V11-0076-05	Diode 1S1555	
TRANSFORMER/COIL			
T1	L15-0016-05	Choke transformer	
T2	L13-0001-05	Input transformer	
L1	L33-0032-05	Choke coil 3.3μH	

PREMIX UNIT (X50-1570-00)

Schematic: Page 26

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45CH1H220J	Ceramic 22pF ±5%	
C2	C91-0457-05	Ceramic 0.022μF 25V	
C3,4	CC45SL1H151J	Ceramic 150pF ±5%	
C5	CC45CH1H150J	Ceramic 15pF ±5%	
C6	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C7,10	C91-0457-05	Ceramic 0.022μF 25V	
C14	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C15	CC45CH1H220J	Ceramic 22pF ±5%	
C16	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C18	C91-0457-05	Ceramic 0.022μF 25V	
C27,28	CC45RH1H100D	Ceramic 10pF ±0.5pF	
C29	CC45CH1H0R5C	Ceramic 0.5pF ±0.25pF	
C30	CC45TH1H330J	Ceramic 33pF ±5%	
C31	CC45TH1H020C	Ceramic 2pF ±0.25pF	
C32	C91-0457-05	Ceramic 0.022μF 25V	
C33	CC45TH1H030C	Ceramic 3pF ±0.25pF	
C34	CC45TH1H120J	Ceramic 12pF ±5%	
C35	C91-0457-05	Ceramic 0.022μF 25V	
C36,37	CC45CH1H030C	Ceramic 3pF ±0.25pF	
C39	CS15E1VR22M	Tantalum 0.22μF 35V	
C40,42	C90-0272-05	Ceramic 0.01μF 50V	
C45,48	CC45CH1H220J	Ceramic 22pF ±5%	
C51,52	CC45RH1H100D	Ceramic 10pF ±0.5pF	
C53	CC45CH1H0R5C	Ceramic 0.5pF ±0.25pF	
C54	C90-0272-05	Ceramic 0.01μF 50V	
C58	CC45SL1H101J	Ceramic 100pF ±5%	
C59	C90-0272-05	Ceramic 0.01μF 50V	
C60	CC45CH1H020C	Ceramic 2pF ±0.25pF	
C61	CC45CH1H220J	Ceramic 22pF ±5%	
C62	CC45TH1H030C	Ceramic 3pF ±0.25pF	
C63	C91-0457-05	Ceramic 0.022μF 25V	
C64	CS15E1VR22M	Tantalum 0.22μF 35V	
C65	C90-0272-05	Ceramic 0.01μF 50V	
C66	C91-0457-05	Ceramic 0.022μF 25V	
C67	CC45SL1H101J	Ceramic 100pF ±5%	
C68	CC45SL1H221J	Ceramic 220pF ±5%	
C70	CC45SL1H331J	Ceramic 330pF ±5%	
C72,73	CC45UJ1H180J	Ceramic 18pF ±5%	
C74	CC45UJ1H270J	Ceramic 27pF ±5%	
C75,76	CE04W1C220	Electrolytic 22μF 16V	
REGISTOR			
R1～80	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R77		Not used	
SEMICONDUCTOR			
Q1,2	V03-0079-05	Transistor 2SC460(B)	
Q3	V03-1959-06	Transistor 2SC1959(Y)	
Q4～6	V03-0079-05	Transistor 2SC460(B)	
Q7	V30-0153-05	IC SN76514N	
Q8,9	V03-0079-05	Transistor 2SC460(B)	
Q10	V03-0945-06	Transistor 2SC945(Q)	
Q11	V30-0153-05	IC SN76514N	
Q12～14	V03-0079-05	Transistor 2SC460(B)	
Q15	V03-1959-06	Transistor 2SC1959(Y)	
D1～4	V11-0370-05	Diode 1S1587	
D5	V11-0076-05	Diode 1S1555	
D6	V11-0317-05	Varicap-diode 1S2208	
D7	V11-0432-05	Varicap-diode ITT310	
D8～14	V11-0076-05	Diode 1S1555	
POTENTIOMETER			
VR1,2	R12-1405-05	Semi-fixed resister 1kΩ	
VR3	R12-3411-05	Semi-fixed resister 47kΩ	
VR4～7	R12-1405-05	Semi-fixed resister 1kΩ	
TRIMMER/COIL/CRYSTAL			
TC1～3	C05-0013-15	Ceramic trimmer 20pF	
T1,2	L34-0794-05	Tuning coil 40MHz	☆
T3,4	L34-0795-05	Tuning coil 49MHz	☆
T5	L32-0201-05	Oscillator coil 8.83MHz	
T6	L32-0619-15	Oscillator coil 46.6MHz	☆
T7	L19-0314-05	RF trans	
L1～5	L40-1511-03	Ferri-inductor 150μH	
L7,8	L40-3301-03	Ferri-inductor 33μH	
L9,10	L40-1511-03	Ferri-inductor 150μH	
L11	L40-3301-03	Ferri-inductor 33μH	
L12～14	L40-6801-03	Ferri-inductor 68μH	
L15	L40-1511-03	Ferri-inductor 150μH	
L16,17	L40-6801-03	Ferri-inductor 68μH	
L18,19	L40-1892-02	Ferri-inductor 1.8μH	
L20～24	L40-1511-03	Ferri-inductor 150μH	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
L25	L40-3391-03	Ferri-inductor 3.3μH	
L26	L33-0266-05	Choke coil 28μH	
L28,29	L40-1511-03	Ferri-inductor 150μH	
L6,27		Not used	
X1	L77-0831-05	Quartz crystal 46.603MHz(F.RIT)	☆
X2	L77-0486-05	Quartz crystal 8828.5kHz(LSB)	
X3	L77-0485-05	Quartz crystal 8831.5kHz(USB)	
MISCELLANEOUS			
RL1	S51-2408-05	Relay G2V-2(DC12V)	
RL2	S51-4401-05	Relay LZN4(DC12V)	
—	E18-0201-05	Crystal socket	
—	J31-0502-04	PC board collar × 6	
—	J42-0404-05	PC board bush ×6	

LPF UNIT (X51-1180-00)

Schematic: Page 25

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CM93D2H182J	Mica 1800pF ±5%	
C2	CM93D2H152J	Mica 1500pF ±5%	
C3, 4	CC45CH2H101J	Ceramic 100pF ±5%	
C5	CM93D2H152J	Mica 1500pF ±5%	
C6	CM93D2H182J	Mica 1800pF ±5%	
C7	CM93D2H681J	Mica 680pF ±5%	
C8	CM93D2H821J	Mica 820pF ±5%	
C9	CC45CH2H390J	Ceramic 39pF ±5%	
C10	CC45CH2H680J	Ceramic 68pF ±5%	
C11	CM93D2H821J	Mica 820pF ±5%	
C12	CM93D2H681J	Mica 680pF ±5%	
C13	CC45CH2H121J	Ceramic 120pF ±5%	
C14	CM93D2H391J	Mica 390pF ±5%	
C15,16	CC45CH2H220J	Ceramic 22pF ±5%	
C17	CM93D2H391J	Mica 390pF ±5%	
C18	CC45CH2H121J	Ceramic 120pF ±5%	
C19	CC45CH2H680J	Ceramic 68pF ±5%	
C20	CC45CH2H121J	Ceramic 120pF ±5%	
C21,22	CC45CH2H100D	Ceramic 10pF ±0.5pF	
C23	CC45CH2H121J	Ceramic 120pF ±5%	
C24	CC45CH2H680J	Ceramic 68pF ±5%	
C25	CC45CH2H270J	Ceramic 27pF ±5%	
C26	CC45CH2H820J	Ceramic 82pF ±5%	
C27	CC45CH2H060D	Ceramic 6pF ±0.5pF	
C28	CC45CH2H820J	Ceramic 82pF ±5%	
C29	CC45CH2H270J	Ceramic 27pF ±5%	
C30	CC45CH2H390J	Ceramic 39pF ±5%	
C31	CC45CH2H680J	Ceramic 68pF ±5%	
C32	CC45CH2H040C	Ceramic 4pF ±0.25pF	
C33	CC45CH2H680J	Ceramic 68pF ±5%	
C34	CC45CH2H390J	Ceramic 39pF ±5%	
C35	CC45SL1H331J	Ceramic 330pF ±5%	
C36	CC45SL1H151J	Ceramic 150pF ±5%	
C48,49	CC45CH2H151J	Ceramic 150pF ±5%	
C50	CC45CH2H820J	Ceramic 82pF ±5pF	
C51,52	CC45CH2H101J	Ceramic 100pF ±5%	
C53	CC45CH2H820J	Ceramic 82pF ±5%	
C54	CC45CH2H560J	Ceramic 56pF ±5%	
C55	CC45CH2H101J	Ceramic 100pF ±5%	
C56	CC45CH2H060D	Ceramic 6pF ±0.5pF	
C57	CC45CH2H101J	Ceramic 100pF ±5%	
C58	CC45CH2H560J	Ceramic 56pF ±5%	
C59	CC45CH2H390J	Ceramic 39pF ±5%	
C60	CC45CH2H680J	Ceramic 68pF ±5%	
C61	CC45CH2H040C	Ceramic 4pF ±0.25pF	
C62	CC45CH2H680J	Ceramic 68pF ±5%	
C63	CC45CH2H390J	Ceramic 39pF ±5%	
C65	CM93D2H102J	Mica 1000pF ±5%	
C67	CS15E1ER47M	Tantalum 0.47μF 25V	
C72	CC45SL1H330J	Ceramic 33pF ±5%	
C73	CS15E1E3R3M	Tantalum 3.3μF 25V	
C74	CC45CH2H101J	Ceramic 100pF ±5%	
C75	CC45SL2H330J	Ceramic 33pF ±5%	
C43,64		Not used	
C66,71		Not used	
RESISTOR			
R1～20	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R3～5		Not used	
R12～14		Not used	
SEMICONDUCTOR			
Q1～3	V03-0183-05	Transistor 2SC733(Y)	
D1	V11-0076-05	Diode 1S1555	
D2,3,4	V11-0051-05	Diode 1N60	
D5,6,10	V11-0076-05	Diode 1S1555	
D7, 8, 9		Not used	
POTENTIOMETER			
VR1,2	R12-3410-05	Semi-fixed resister 10kΩ(B)	☆
VR3	R12-3035-05	Semi-fixed resister 47kΩ(B)	
TRIMMER/COIL			
TC1	C05-0043-05	Ceramic trimmer 20pF	
L1	L34-0796-05	Filter coil A 1.8MHz	☆
L2	L34-0797-05	Filter coil B 1.8MHz	☆
L3	L34-0796-05	Filter coil A 1.8MHz	☆
L4	L34-0798-05	Filter coil C 3.5MHz	☆
L5	L34-0799-05	Filter coil D 3.5MHz	☆
L6	L34-0798-05	Filter coil C 3.5MHz	☆
L7	L34-0800-05	Filter coil E 7MHz	☆
L8	L34-0801-05	Filter coil F 7MHz	☆
L9	L34-0800-05	Filter coil E 7MHz	☆
L10	L34-0802-15	Filter coil G 14MHz	☆
L11	L34-0803-15	Filter coil H 14MHz	☆
L12	L34-0802-15	Filter coil G 14MHz	☆
L13	L34-0804-15	Filter coil I 21MHz	☆
L14	L34-0805-15	Filter coil J 21MHz	☆
L15	L34-0804-15	Filter coil I 21MHz	☆
L16	L34-0806-15	Filter coil K 28MHz	☆
L17	L34-0807-15	Filter coil L 28MHz	☆
L18	L34-0806-15	Filter coil K 28MHz	☆
L19～26	L40-1511-03	Ferri-inductor 150μH	
L27	L19-0310-05	RF transformer	
L28	L40-1021-03	Ferri-inductor 1mH	
L29	L40-1511-03	Ferri-inductor 150μH	
MISCELLANEOUS			
S1	S01-2416-05	Rotary switch	☆
RL1	S51-2407-05	Relay	☆
—	E13-0101-05	Pin jack ×2	
—	J61-0019-05	Vinyle tie	

PARTS LIST

FINAL ASS'Y UNIT (X60-1130-00)

Ref. No.	Parts No.	Description	Remarks
—	X56-1330-00	10W Final unit	☆
—	X56-1340-00	100W Final unit	☆

10W FINAL UNIT (X56-1330-00) Schematic: Page 28

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45CH1H151J	Ceramic 150pF ±5%	
C2~4	C91-0456-05	Ceramic 0.047μF 25V	
C5	CC45CH1H680J	Ceramic 68pF ±5%	
C6	C91-0457-05	Ceramic 0.022μF 25V	
C7,8	C91-0456-05	Ceramic 0.047μF 25V	
C10,12	C91-0546-05	Ceramic 0.047μF 25V	
C13	CE04W1C100	Electrolytic 10μF 16V	
C15,19	C91-0456-05	Ceramic 0.047μF 25V	
C17		Not used	
C20	C91-0456-05	Ceramic 0.047μF 25V	
C21	CE04W1E101	Electrolytic 100μF 25V	
C22	CC45SL1H471J	Ceramic 470pF ±5%	
C23	CC45CH2H680J	Ceramic 68pF ±5%	
C25	CC45SL1H221J	Ceramic 220pF ±5%	
C26,27	CC45SL1H151J	Ceramic 150pF ±5%	
RESISTOR			
R2,5		Not used	
R6,7	RC05GF2H471J	Solid 470Ω ±5% 1/2W	
R8,9	RC05GF2H150J	Solid 15Ω ±5% 1/2W	
R16,17	RC05GF2H221J	Solid 220Ω ±5% 1/2W	
R18	RC05GF2H2R2J	Solid 2.2Ω ±5% 1/2W	
R19	RC05GF2H150J	Solid 15Ω ±5% 1/2W	
R1~15	RD14BB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
SEMICONDUCTOR			
Q1	V03-2075-06	Transistor 2SC2075	
Q2,3	V03-2509-06	Transistor 2SC2509	
Q4	V03-0336-05	Transistor 2SC496(Y)	
Q5	V03-0183-05	Transistor 2SC733(Y)	
D1	V11-4160-06	Diode BZ-240	
D2	V22-0031-05	Varistor SV-03	
POTENTIOMETER			
VR1	R12-3025-05	Semi-fixed resistor 10kΩ(B)	
VR2	R12-0408-05	Semi-fixed resistor 100Ω(B)	
TRANSFORMER/COIL			
T1	L13-0303-15	Input matching transformer	☆
T2	L13-0302-05	Output matching transformer	☆
L1	L33-0628-05	Choke coil 0.5μH	☆
L2	L40-4701-03	Ferri-inductor 47μH	
L3	L33-0617-05	RFC (wide band) 22μH	
L4	L33-0629-05	Choke coil 1.2μH	☆
L5,6	L40-1511-03	Ferri-inductor 150μH	
L7	L33-0601-05	Choke coil 2.2μH	
L8	L40-1511-03	Ferri-inductor 150μH	
L9	L39-0407-05	Detecting coil 6.6μH	☆
L10	L33-0617-05	RFC (wide band) 22μH	
L11	L19-0310-05	RF transformer	
MISCELLANEOUS			
—	F20-0078-05	Insulating plate ×2	
—	F29-0014-05	Insulating washer	

Ref. No.	Parts No.	Description	Remarks
—	J31-0502-04	PC board collar ×4	
—	J42-0404-05	PC board bush ×4	

100W FINAL UNIT (X56-1340-00) Schematic: Page 29

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CM93D2H681J	Mica 680pF ±5%	
C2,3	CK45D2H222M	Ceramic 0.0022μF ±10%	
C6	C91-0456-05	Ceramic 0.047μF 25V	
C7	CE04W1C100	Electrolytic 10μF 16V	
C8	CE04W1H471Q	Electrolytic 470μF 25V	
C11,12	C91-0458-05	Laminated capacitor 0.47μF	☆
C13	C91-0456-05	Ceramic 0.047μF 25V	
C14	CK45F1H104Z	Ceramic 0.1μF +80%,−20%	
C15~18	CK45D2H222M	Ceramic 0.0022μF ±10%	
C19	CK45F1H104Z	Ceramic 0.1μF +80%,−20%	
C21,24	CM93D2H221J	Mica 220pF ±5%	
C25, 26	CK45F1H103Z	Ceramic 0.01μF +80%,−20%	
C27	C91-0456-05	Ceramic 0.047μF 25V	
C28,29	CM93D2H330J	Mica 33pF ±5%	
C30~34	CC45SL2H221J	Ceramic 220μF ±5%	☆
C36,37	C91-0458-05	Laminated capacitor 0.47μF	
C4,5,9,10,20,22,23,35		Not used	
RESISTOR			
R1~4	RS14AB3A3R9J	Metal film 3.9Ω ±5% 1W	
R5,6	RC05GF2H150J	Solid 15Ω ±5% 1/2W	
R7,8	RC05GF2H5R6J	Solid 5.6Ω ±5% 1/2W	
R19,20	RC05GF2H5R6J	Solid 5.6Ω ±5% 1/2W	
R21,22	RS14AB3A4R7J	Metal film 2.7Ω ±5% 1W	
R23,24	RC05GF2H220J	Solid 22Ω ±5% 1/2W	
R9~18	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R9,12,13		Not used	
SEMICONDUCTOR			
Q1,2	V08-1011-06	Transistor SRF1714	☆
Q3	V04-0046-05	Transistor 2SD235(Y)	
Q4	V03-0183-05	Transistor 2SC733(Y)	
D1	V22-0031-05	Varistor SV-03	
POTENTIOMETER			
VR1	R12-3025-05	Semi fixed resister 10kΩ(B)	
VR2	R12-0408-05	Semi fixed resister 100Ω(B)	☆
TRANSFORMER/COIL			
T1	L13-0305-05	Input matching transformer	☆
T2	L19-0316-05	Output matching transformer	☆
L1,2	L33-0629-05	Choke coil 1.3μH	☆
L3	L33-0025-05	Choke coil 1.3μH	
L4~6	L40-1511-03	Ferri-inductor 150μH	
L7	L33-0621-15	Choke coil A	☆
L8	L33-0622-15	Choke coil B 15μH	☆
MISCELLANEOUS			
TH1	S59-1403-05	Thermostat (insulating type 120°C)	
—	F01-0728-22	Heat sink	
—	F20-0078-05	Insulating mica	
—	F29-0014-05	Insulating washer	

COUNTER ASS'Y (60-1100-00) Schematic: Page 30,33

Ref. No.	Parts No.	Description	Remarks
—	X54-1420-00	Divide unit	☆
—	X54-1430-00	Display unit	☆

PARTS LIST

DIVIDE UNIT (X54-1420-00)

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Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45SL1H151J	Ceramic 150pF ±5%	
C3	CC45SL1H221J	Ceramic 220pF ±5%	
C6~16		Not used	
RESISTOR			
R1~15	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R10~13		Not used	
SEMICONDUCTOR			
Q1,2	V03-0079-05	Transistor 2SC460(B)	
Q3	V30-1082-06	IC HD74LS93P	☆
or	V30-1103-06	IC 74LS93N	
Q4,5	V30-1039-06	IC TC4518BP	
Q6	V03-1815-06	Transistor 2SC1815(Y)	
Q7	V30-1083-06	IC HD74LS90P	☆
or	V30-1106-06	IC 74LS90N	☆
Q8	V30-1084-06	IC TC4013BP	☆
Q9	V30-1079-06	IC TC7400BP	
Q10	V30-1007-56	IC HD74LS04P	
or	V30-1104-06	IC 74LS04N	
COIL			
L1	L40-4711-03	Ferri-inductor 470μH	

DISPLAY UNIT (X54-1430-00)

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Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C4	CC45SL1H121J	Ceramic 120pF ±5%	
C6	CE04W1HR47	Electrolytic 0.47μF 50V	
C7	CC45SL1H121J	Ceramic 120pF ±5%	
C8	CE04W1A101	Electrolytic 100μF 10V	
C9	CQ92M1H332K	Mylar 0.0033μF ±10%	
C10	C91-0456-05	Ceramic 0.047μF 25V	
C11	CE04W1C220	Electrolytic 22μF 16V	
C12	CE04W1A470	Electrolytic 47μF 10V	
C13~15	C91-0456-05	Ceramic 0.047μF 25V	
C16	CE04W1A470	Electrolytic 47μF 10V	
C17	CE04W1A101	Electrolytic 100μF 10V	
C18	CS15E1VR33M	Tantalum 0.33μF 35V	
C19	CQ92M1H473K	Mylar 0.047μF ±10%	
C20	CE04W1H100	Electrolytic 10μF 50V	
C21	CQ92M1H223K	Mylar 0.022μF ±10%	
C22	CE04W1E100	Electrolytic 10μF 25V	
C23,24	C91-0456-05	Ceramic 0.047μF 25V	
C25	CC45RH1H100[illegible]	Ceramic 10pF ±0.5pF	
C32	CE04W1A101	Electrolytic 100μF 10V	
RESISTOR			
R1~44	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R45,46	R90-0510-05	Composite resistor 4.7kΩ ×8	
R47	R90-0518-05	Composite resistor 47kΩ ×9	☆
R48	R90-0511-05	Composite resistor 47kΩ ×8	
R49~52	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
SEMICONDUCTOR			
Q1~3	V03-0079-05	Transistor 2SC460(B)	
Q4	V01-1015-06	Transistor 2SA1015(Y)	
Q5	V01-0113-05	Transistor 2SA496(Y)	
Q6	V30-1020-16	IC NJM78L05/A	
Q7	V01-1015-06	Transistor 2SA1015(Y)	
Q8	V03-1815-06	Transistor 2SC1815(Y)	
Q9	V01-1015-06	Transistor 2SA1015(Y)	

Ref. No.	Parts No.	Description	Remarks
Q10	V30-0181-05	IC SN74S00N	
Q11	V30-1078-06	IC HD74196P	☆
Q12,13	V30-1083-06	IC HD74LS90P	
or	V30-1106-06	IC 74LS90N	
Q14	V30-1039-06	IC TC4518BP	
Q15,16	V30-1049-06	IC TC4019BP	
Q17	V30-1028-06	IC TC7404UBP	☆
Q18	V30-1050-06	IC TC4027BP	
Q19	V30-1079-06	IC TC7400BP	☆
Q20	V30-1081-06	MPU TMC1000	☆
Q21,22	V03-1815-06	Transistor 2SC1815(Y)	
Q23	V30-1010-26	IC HD74LS42P	
or	V30-1105-06	IC 74LS42N	
Q24,25	V03-0945-06	Transistor 2SC945(Q)	
Q26~42	V01-1015-06	Transistor 2SA1015(Y)	
Q43	V03-0079-05	Transistor 2SC460(B)	
D1	V11-4161-56	Zener diode WZ-040	
D2~6	V11-0076-05	Diode 1S1555	
D7	V11-4160-86	Zener diode WZ-071	
D8	V11-4160-96	Zener diode BZ-240	
TRANSFORMER/COIL			
T1	L34-0794-05	Tuning coil 40MHz	
T2	L19-0305-05	Oscillating transformer	
L1	L40-4711-03	Ferri-inductor 470μH	
L2,3	L33-0025-05	Choke coil 1μH	
L4	L33-0220-05	Choke coil 2.4μH	
L5	L33-0624-05	Choke coil 2.2μH	
MISCELLANEOUS			
—	E02-0106-05	IC socket	
—	F20-0078-05	Insulating mica	
—	J31-0503-05	Bead × 5	
—	S31-1401-05	Slide switch	
—	T95-0052-05	Piezo-electric buzzer	☆
—	V40-7760-86	Indicating tube 9-BT-12	

VFO ASS'Y UNIT (X60-1110-00)

Ref. No.	Parts No.	Description	Remarks
MISCELLANEOUS			
—	B01-0618-15	Dial escutcheon	☆
—	B10-0618-04	Front glass	☆
—	B20-0812-04	Dial scale A	☆
—	B20-0813-14	Dial scale B	☆
—	B30-0809-05	Pilot lamp 12V, 40mA	☆
—	B42-1671-04	Seal	☆
—	D21-0811-24	Dial shaft	☆
—	K21-0743-04	Main knob	☆
—	K29-0720-04	Calibration knob	☆
—	X40-1140-00	VFO unit	☆

VFO UNIT (X40-1140-00)

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Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CK45F1H103Z	Ceramic 0.01μF +80%−20%	

PARTS LIST

Ref. No.	Parts No.	Description			Remarks
C2	CC45SL1H180J	Ceramic	18pF	±5%	
C3	CC45CH1H100D	Ceramic	10pF	±0.5pF	
C4	CC45SL1H180J	Ceramic	18pF	±5%	
C5	CK45B1H102K	Ceramic	0.001μF	±10%	
C6	CK45F1H223Z	Ceramic	0.022μF	+80%, −20%	
C7	C91-0456-05	Ceramic	0.047μF	25V	
C8	CC45CH1H050C	Ceramic	5pF	±0.25pF	
C9	CK45B1H102K	Ceramic	0.001μF	±10%	
C10	C91-0456-05	Ceramic	0.047μF	25V	
C12	CC45RG1H050C	Ceramic	5pF	±0.25pF	
C13	CC45LG1H470J	Ceramic	47pF	±5%	
C14	CC45LG1H220J	Ceramic	22pF	±5%	
C15,16	CC45LG1H151J	Ceramic	150pF	±5%	
C17	CC45PG1H180J	Ceramic	18pF	±5%	
C18	CC45RG1H180J	Ceramic	18pF	±5%	
C19	CC45LG1H121J	Ceramic	120pF	±5%	
C20	CC45CG1H101J	Ceramic	100pF	±5%	
C11		Not used			
RESISTOR					
R1 ~ 14	RD14CB2E○○○J	Carbon	○○○Ω	±5% 1/4W	
SEMICONDUCTOR					
Q1	V09-0020-05	FET	3SK22(Y)		
Q2	V09-0011-05	FET	2SK19(Y)		
Q3,4	V03-0079-05	Transistor	2SC460(B)		
D5	V11-4161-36	Vari-cap diode	1SV53A		
D1,2,3,4		Not used			
VC/TRIMMER/COIL					
VC1	C02-0017-05	Variable capacitor			☆
TC1	C05-0305-05	Trimmer	12pF		
TC2	C05-0013-15	Trimmer	20pF		
L1,2	L40-4711-03	Ferri-inductor	470μH		
L3	L40-1501-03	Ferri-inductor	15μH		
L5,7	L40-4711-03	Ferri-inductor	470μH		
L10	L32-0612-05	Oscillating coil			☆
L11	L40-4711-03	Ferri-inductor	470μH		
L4,6,8,9		Not used			
MISCELLANEOUS					
—	B42-1645-04	Indicating plate			
—	D22-0405-05	Coupling			
—	D40-0607-05	Dial mechanism			☆
—	E13-0163-05	1P pin jack			
—	J32-0732-04	Spacer			

PLL ASS'Y UNIT (X60-1120-11) (W type 61)

Ref. No.	Parts No.	Description	Remarks
—	X50-1560-00	PLL unit	☆
—	X53-1130-11	MATRIX unit (K)	☆
—	X53-1130-61	MATRIX unit (W)	☆

PLL UNIT (X50-1560-00)

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Ref. No.	Parts No.	Description			Remarks
CAPACITOR					
C3	CE04W1A470Q	Electrolytic	47μF	10V	

Ref. No.	Parts No.	Description			Remarks
C4,5	C91-0457-05	Ceramic	0.022μF	25V	
C7,8	CC45CH1H050C	Ceramic	5pF	±0.25pF	
C9	CQ92M1H104K	Mylar	0.1μF	±10%	
C11	CC45SL1H331J	Ceramic	330pF	±5%	
C12	C91-0457-05	Ceramic	0.022μF	25V	
C13	CE04W1A470Q	Electrolytic	47μF	10V	
C14	C91-0457-05	Ceramic	0.022μF	25V	
C15	CC45RH1H220J	Ceramic	22pF	±5%	
C16	CC45RH1H220J	Ceramic	12pF	±5%	
C17	CC45RH1H070D	Ceramic	7pF	±0.5pF	
C18	CC45UJ1H120J	Ceramic	12pF	±5%	
C19	C91-0457-05	Ceramic	0.022μF	25V	
C20	CE04W1E4R7	Electrolytic	4.7μF	25V	
C21	CC45UJ1H330J	Ceramic	33pF	±5%	
C22	CC45UJ1H180J	Ceramic	18pF	±5%	
C23	CC45UJ1H330J	Ceramic	33pF	±5%	
C24	CC45UJ1H100D	Ceramic	10pF	±0.5pF	
C26	CC45UJ1H270J	Ceramic	27pF	±5%	
C27	C91-0457-05	Ceramic	0.022μF	25V	
C28	CC45UJ1H220J	Ceramic	22pF	±5%	
C29	CC45RH1H330J	Ceramic	33pF	±5%	
C30	CC45UJ1H330J	Ceramic	33pF	±5%	
C31	CC45UJ1H100D	Ceramic	10pF	±0.5pF	
C32	C91-0457-05	Ceramic	0.022μF	25V	
C33	CE04W1E4R7	Electrolytic	4.7μF	25V	
C34	CC45RH1H180J	Ceramic	18pF	±5%	
C35	CE04W1E4R7	Electrolytic	4.7μF	25V	
C36	C91-0457-05	Ceramic	0.022μF	25V	
C37	CC45RH1H270J	Ceramic	27pF	±5%	
C38	CC45TH1H270J	Ceramic	27pF	±5%	
C39	CC45RH1H330J	Ceramic	33pF	±5%	
C40	CC45RH1H270J	Ceramic	27pF	±5%	
C41	C91-0457-05	Ceramic	0.022μF	25V	
C42	CC45RH1H220J	Ceramic	22pF	±5%	
C43	C91-0457-05	Ceramic	0.022μF	25V	
C44	CE04W1E4R7	Electrolytic	4.7μF	25V	
C45	C91-0457-05	Ceramic	0.022μF	25V	
C46	CC45RH1H330J	Ceramic	33pF	±5%	
C47	CC45TH1H820J	Ceramic	82pF	±5%	
C48	CC45RH1H150J	Ceramic	15pF	±5%	
C49	CC45RH1H270J	Ceramic	27pF	±5%	
C51,52	CC45RH1H070D	Ceramic	7pF	±0.5pF	
C53	CC45CH1H0R5C	Ceramic	0.5pF	±0.25pF	
C55	CC45CH1H010C	Ceramic	1pF	±0.25pF	
C56	CC45CH1H150J	Ceramic	15pF	±5%	
C57	C91-0457-05	Ceramic	0.022μF	25V	
C71 ~ 73	CC45RH1H390J	Ceramic	39pF	±5%	
C77	CC45RH1H180J	Ceramic	18pF	±5%	
C78	CC45RH1H270J	Ceramic	27pF	±5%	
C79	CC45RH1H180J	Ceramic	18pF	±5%	
C80	CC45RH1H150J	Ceramic	15pF	±5%	
C81	CC45RH1H120J	Ceramic	12pF	±5%	
C82	CC45RH1H150J	Ceramic	15pF	±5%	
C83	CC45RH1H120J	Ceramic	12pF	±5%	
C84	CC45RH1H100D	Ceramic	10pF	±0.5pF	
C85,86	CC45RH1H120J	Ceramic	12pF	±5%	
C87	CC45RH1H220J	Ceramic	22pF	±5%	
C88	CC45RH1H120J	Ceramic	12pF	±5%	
C96	CE04W1A101Q	Electrolytic	100μF	10V	
C97,99, 101,103	C90-0272-05	Ceramic	0.01μF	25V	
C105	C91-0457-05	Ceramic	0.022μF	25V	
C106	CE04W1E101Q	Electrolytic	100μF	25V	
C112	CE04W1H010	Electrolytic	1μF	50V	
C113	CC45SL1H331J	Ceramic	330pF	±5%	
C116	CE04W1A331Q	Electrolytic	330μF	10V	
C118, 119,121	C91-0457-05	Ceramic	0.022μF	25V	
C123	CC45SL1H221J	Ceramic	220pF	±5%	
C124	CC45CH1H220J	Ceramic	22pF	±5%	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
C125,130	C91-0457-05	Ceramic 0.022μF 25V	
C131	C90-0272-05	Ceramic 0.01μF 25V	
CA1,2	C91-0451-05	Capacitor (array type) 0.01μF × 6	
	C91-0463-05	Capacitor (array taype) 0.01μF × 4	
C66,74,75,76,90		Not used	
RESISTOR			
R1～150	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R89	RS14AB3A330J	Metal film 33Ω ±5% 1W	
SEMICONDUCTOR			
Q1,2	V03-1907-06	Transistor 2SC1907	
Q3	V03-0945-06	Transistor 2SC945(Q)	
Q4～6	V03-1775-06	Transistor 2SC1775(E)	
Q7	V09-0111-05	FET 2SK19 (BL)	
Q8～10	V09-0011-05	FET 2SK19(GR)	
Q11,12	V03-0079-05	Transistor 2SC460(B)	
Q13	V30-0153-05	IC SN76514N	
Q14	V03-1907-06	Transistor 2SC1907	☆
Q15	V03-0079-05	Transistor 2SC460(B)	
Q16	V03-1907-06	Transistor 2SC1907	☆
Q17,18	V03-0079-05	Transistor 2SC460(B)	
Q19	V30-1047-06	IC HD74LS163P	
or	V30-1037-06	IC 74LS163N	☆
Q20	V30-1076-06	IC HD74S74P	☆
or	V30-1112-06	IC SN74S74N	☆
Q21	V-30-1075-06	IC HD74S00P	☆
or	V30-0181-05	IC SN74S00N	☆
Q22	V30-1047-06	IC HD74LS163P	
or	V30-1037-06	IC 74LS163N	☆
Q23	V30-1046-06	IC HD74LS00P	
or	V30-1005-06	IC SN74LS00N	
or	V30-1111-06	IC 74LS00N	☆
Q24	V30-1077-06	IC HD74S112P	☆
or	V30-0185-05	IC SN74S112N	☆
Q25	V30-0173-05	IC MC4044P	
Q26	V30-1082-06	IC HD74LS93P	
or	V30-1113-06	IC SN74LS93N	
or	V30-1103-06	IC 74LS93N	
Q27	V01-1015-06	Transistor 2SA1015(Y)	
Q28	V03-0945-06	Transistor 2SC945(Q)	
Q29	V30-0158-05	IC FS7805	
Q30	V03-1959-06	Transistor 2SC1959(Y)	
Q31～33	V03-0079-05	Transistor 2SC460(B)	
Q34～45	V03-0945-06	Transistor 2SC945(Q)	
D1～3	V11-0414-05	Diode 1S2588	
D4	V11-0076-05	Diode 1S1555	
D5	V11-0414-05	Diode 1S2588	
D6	V11-4161-36	Vari-cap diode 1SV53A	
D7,8	V11-0076-05	Diode 1S1555	
D9	V11-0414-05	Diode 1S2588	
D10	V11-4161-36	Vari-cap diode 1SV53A	
D11,12	V11-0076-05	Diode 1S1555	
D13	V11-0414-05	Diode 1S2588	
D14	V11-4161-36	Vari-cap diode 1SV53A	
D15	V11-0076-05	Diode 1S1555	
D16	V11-0414-05	Diode 1S2588	
D17	V11-0076-05	Diode 1S1555	
D18	V11-4161-36	Vari-cap diode 1SV53A	
D19	V11-0076-05	Diode 1S1555	
D20	V11-0370-05	Diode 1S1587	
D22～26, 28～31	V11-0370-05	Diode 1S1587	
D32～44	V11-0076-05	Diode 1S1555	
D21,27		Not used	
POTENTIOMETER			
VR1	R12-3411-05	Semi fixed resister 47kΩ	

Ref. No.	Parts No.	Description	Remarks
TRIMMER/TRANSFORMER/COIL/CRYSTAL			
TC1	C05-0013-15	Ceramic trimmer 20pF	
T1	L32-0614-15	Oscillating coil 28MHz	☆
T2	L32-0615-05	Oscillating coil 14,21MHz	☆
T3	L32-0616-05	Oscillating coil 7,10MHz	☆
T4	L32-0617-05	Oscillating coil 1.5,3.5MHz	☆
T5,6	L34-0795-05	Tuning coil 49MHz	
T7	L19-0303-05	Wide band transformer	
T8	L34-0783-15	Tuning coil	☆
T9	L34-0784-15	Tuning coil	☆
T10	L34-0783-15	Tuning coil	☆
T14	L34-0785-05	Tuning coil	☆
T15	L34-0786-05	Tuning coil	☆
T16	L34-0785-05	Tuning coil	☆
T17	L34-0787-05	Tuning coil	☆
T18	L34-0788-05	Tuning coil	☆
T19	L34-0787-05	Tuning coil	☆
T20	L34-0789-05	Tuning coil	☆
T21	L34-0790-05	Tuning coil	☆
T22	L34-0789-05	Tuning coil	☆
T23	L34-0791-05	Tuning coil	☆
T24	L34-0792-05	Tuning coil	☆
T25	L34-0791-05	Tuning coil	☆
T11～13		Not used	
L1～3	L40-1011-03	Ferri-inductor 100μH	
L4	L40-6801-03	Ferri-inductor 68μH	
L5	L40-1511-03	Ferri-inductor 150μH	
L6～9	L40-6801-03	Ferri-inductor 68μH	
L10～13	L40-1011-03	Ferri-inductor 100μH	
L14,15	L40-1511-03	Ferri-inductor 150μH	
L16～18	L40-1011-03	Ferri-inductor 100μH	
L19	L40-2792-02	Ferri-inductor 2.7μH	
L20	L40-1092-02	Ferri-inductor 1mH	
L21	L40-2792-02	Ferri-inductor 2.7μH	
L22	L40-1092-02	Ferri-inductor 1mH	
L23	L40-3301-03	Ferri-inductor 33μH	
L24	L40-1511-03	Ferri-inductor 150μH	
L25,26	L40-1011-03	Ferri-inductor 100μH	
L27	L40-1001-03	Ferri-inductor 10μH	
L28	L40-1511-03	Ferri-inductor 150μH	
L29	L40-3325-04	Ferri-inductor 3.3mH	
L30	L40-1011-04	Ferri-inductor 100μH	
X1	L77-0837-05	Quartz crystal 8MHz	☆

MATRIX UNIT (X53-1130-00)

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Ref. No.	Parts No.	Description	Remarks
SEMICONDUCTOR			
D2～43	V11-0076-05	Diode 1S1555	
D1,15,20		Not used (K)	
D13,20		Not used (W)(T)(X)	

MEMORY ASS'Y UNIT (X60-1090-00)

Schematic: Page 36

Ref. No.	Parts No.	Description	Remarks
MISCELLANEOUS			
—	B42-1670-04	Indicating plate	
—	J31-0502-04	PC board collar	
—	J42-0404-05	PC board bush	
—	J61-0401-05	Nylon band	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
	X50-1550-00	VCO unit	☆
	X53-1100-00	CONTROL unit	☆

VCO UNIT (X50-1550-00)

Schematic: Page 36

Ref. No.	Parts No.	Description			Remarks
CAPACITOR					
C4	C91-0457-05	Ceramic	0.022μF	25V	
C5	CC45RH1H220J	Ceramic	22pF	±5%	
C6,7	CC45CH1H100D	Ceramic	10pF	±0.5pF	
C8	CC45CH1H120J	Ceramic	12pF	±5%	
C9	C91-0457-05	Ceramic	0.022μF	25V	
C10	CC45CH1H470J	Ceramic	47pF	±5%	
C11	C91-0457-05	Ceramic	0.022μF	25V	
C12~14	C91-0456-05	Ceramic	0.047μF	25V	
C16,17	CC45RH1H470J	Ceramic	47pF	±5%	
C19	CQ92M1H473K	Mylar	0.047μF	±10%	
C20	CE04W1C100	Electrolytic	10μF	16V	
C21	C91-0456-05	Ceramic	0.047μF	25V	
C22	CQ92M1H104K	Mylar	0.1μF	±10%	
C23	CQ92M1H472K	Mylar	0.0047μF	±10%	
C24,25	CQ92M1H223K	Mylar	0.022μF	±10%	
C27	C91-0456-05	Ceramic	0.047μF	25V	
C28	C91-0457-05	Ceramic	0.022μF	25V	
C34	CC45SL1H331J	Ceramic	330pF	±5%	
C35	CC45SL1H471J	Ceramic	470pF	±5%	
C36,38,39	C91-0456-05	Ceramic	0.047μF	25V	
C40	CC45RH1H220J	Ceramic	22pF	±5%	
C41	C91-0457-05	Ceramic	0.022μF	25V	
C42	C91-0456-05	Ceramic	0.047μF	25V	
C43	C91-0457-05	Ceramic	0.022μF	25V	
C44	CC45RH1H470J	Ceramic	47pF	±5%	
C45~47	C91-0457-05	Ceramic	0.022μF	25V	
C49	CC45CH1H030C	Ceramic	3pF	±0.25pF	
C52	CC45RH1H470J	Ceramic	47pF	±5%	
C53	CC45CH1H100D	Ceramic	10pF	±0.5pF	
C55,56	C91-0456-05	Ceramic	0.047μF	25V	
C57	C91-0457-05	Ceramic	0.022μF	25V	
C58,59	CC45RH1H070C	Ceramic	7pF	±0.25pF	
C60	CC45SL1H050C	Ceramic	5pF	±0.25pF	
C61	C91-0457-05	Ceramic	0.022μF	25V	
C65	CC45B1H102K	Ceramic	0.001μF	±10%	
C67	C91-0456-05	Ceramic	0.047μF	25V	
C68	CQ92M1H223K	Mylar	0.022μF	±10%	
C69	CQ92M1H822K	Mylar	0.0082μF	±10%	
C70	CQ92M1H273K	Mylar	0.027μF	±10%	
C71	CQ92M1H333K	Mylar	0.033μF	±10%	
C72,73	CQ92M1H392K	Mylar	0.0039μF	±10%	
C74	CQ92M1H153K	Mylar	0.015μF	±10%	
C75	CQ92M1H224K	Mylar	0.22μF	±10%	
C76	C91-0456-05	Ceramic	0.047μF	25V	
C77,79	CE04W1C101	Electrolytic	100μF	16V	
C80	C91-0456-05	Ceramic	0.047μF	25V	
C81	CE04W1C101	Electrolytic	100μF	16V	
C82	CE04W1C100	Electrolytic	10μF	16V	
C83	C91-0456-05	Ceramic	0.047μF	25V	
C84	CE04W1A470Q	Electrolytic	47μF	10V	
C85	C91-0456-05	Ceramic	0.047μF	25V	
C86	CE04W1C470	Electrolytic	47μF	16V	
C87,88	C91-0456-05	Ceramic	0.047μF	25V	
C89	CE04W1C101	Electrolytic	100μF	16V	
C90	CQ92M1H102K	Mylar	0.001μF	±10%	
C92	CC45B1H102K	Ceramic	0.001μF	±10%	
C93	CQ92M1H472K	Mylar	0.0047μF	±10%	
C94	CQ92M1H104K	Mylar	0.1μF	±10%	
C95	CQ92M1H562K	Mylar	0.0056μF	±10%	
C96	C91-0456-05	Ceramic	0.047μF	25V	
C98	CC45RH1H330J	Ceramic	33pF	±5%	
C99	CC45RH1H150J	Ceramic	15pF	±5%	
C101	C91-0457-05	Ceramic	0.022μF	25V	
C104	CE04W1C100	Electrolytic	10μF	16V	
C105	CC45SL1H181J	Ceramic	180pF	±5%	
C106,107	CC45SL1H271J	Ceramic	270pF	±5%	
C110	CC45SL1H181J	Ceramic	180pF	±5%	
C111	C91-0456-05	Ceramic	0.047μF	25V	
C112	CQ92M1H473K	Ceramic	0.047μF	±10%	
C113	CC45SL1H271J	Ceramic	270pF	±5%	
C114	C91-0456-05	Ceramic	0.047μF	25V	
C115	CE04W1A470Q	Electrolytic	47μF	10V	
C116~126	CC45B1H102K	Ceramic	0.001μF	±10%	
C18,26,29,30,31,32,33,50 51,62,64,78 91,100,102,103	NOT USED				
RESISTOR					
R1~110	RD14CB2E○○○J	Carbon	○○○Ω	±5% 1/4W	
R9,67		Not used			
SEMICONDUCTOR					
Q1	V03-1959-06	Transistor	2SC1959(Y)		
Q2	V03-0079-05	Transistor	2SC460(B)		
Q3	V01-1015-06	Transistor	2SA1015(Y)		
Q4,5	V03-0079-05	Transistor	2SC460(B)		
Q6	V09-0011-05	FET	2SK19(Y)		
Q7~10	V03-1775-06	Transistor	2SC1775(E)		
Q11	V09-0082-05	FET	3SK40(M)		
Q12	V03-0079-05	Transistor	2SC460(B)		
Q13	V03-0316-05	Transistor	2SC945(R)		
Q15,16	V09-0082-05	FET	3SK40(M)		
Q17	V03-0079-05	Transistor	2SC460(B)		
Q18	V01-1015-06	Transistor	2SA1015(Y)		
Q19	V09-0011-05	FET	2SK19(Y)		
Q20	V03-0079-05	Transistor	2SC460(B)		
Q21	V03-1907-06	Transistor	2SC1907		
Q22	V03-0079-05	Transistor	2SC460(B)		
Q23,24	V03-0316-05	Transistor	2SC945(R)		
Q25	V01-0113-05	Transistor	2SA496(Y)		
Q26	V30-0173-05	IC	MC4044P		
Q27	V30-1100-06	IC	MC14569B		☆
Q28	V30-1102-06	IC	SN74LS196N		☆
Q29	V30-1039-06	IC	TC4518BP		
Q31	V30-1036-16	IC	TC9122P		
Q32	V30-1101-06	IC	NJM78L08/A		☆
Q33	V30-0173-05	IC	MC4044P		
Q34,35	V03-0079-05	Transistor	2SC460(B)		
Q36	V30-1103-06	IC	74LS93N		☆
Q37,38	V30-1106-06	IC	74LS90N		☆
Q14,30		Not used			
D1	V11-0370-05	Diode	1S1587		
D2,3	V11-0051-05	Diode	1N60		
D4~6	V11-1260-36	Vari-cap diode	1SV50S		
D7~10	V11-0051-05	Diode	1N60		
D11~13	V11-1260-36	Vari-cap diode	1SV50S		
D14,15	V11-0240-05	Zener diode	WZ-090		
TRIMMER/COIL/FILTER					
TC1,2	C05-0030-15	Ceramic trimmer	20pF		
L1	L40-4711-03	Ferri-inductor	470μH		
L2	L40-2211-03	Ferri-inductor	220μH		
L3	L40-1511-03	Ferri-inductor	150μH		
L4	L40-2211-03	Ferri-inductor	220μH		
L5	L40-4711-03	Ferri-inductor	470μH		
L6	L40-3301-03	Ferri-inductor	33μH		
L7~9	L40-2211-03	Ferri-inductor	220μH		
L10	L32-0620-05	Oscillating coil	6MHz		☆

PARTS LIST/PACKING

Ref. No.	Parts No.	Description	Remarks
L12	L40-6831-21	Ferri-inductor 68mH	
L13	L40-1541-27	Ferri-inductor 150mH	
L14,18	L40-2211-03	Ferri-inductor 220μH	
L19	L34-0845-05	Tuning coil 8MHz	☆
L20	L40-2211-03	Ferri-inductor 220μH	
L21	L34-0846-05	Tuning coil 8MHz	☆
L22	L34-0847-05	BM coil 8MHz	☆
L23~27	L40-2211-03	Ferri-inductor 220μH	
L28	L33-0626-05	Choke coil 12mH	☆
L29	L40-6811-03	Ferri-inductor 680μH	
L30	L40-1035-05	Ferri-inductor 10mH	
L31	L33-0627-05	Choke coil 5.6mH	☆
L34,35	L40-2211-03	Ferri-inductor 220μH	
L36	L32-0621-05	Oscillating coil 25MHz	☆
L37	L33-0624-05	Choke coil 2.4μH	
L38	L40-1021-03	Ferri-inductor 1mH	
L40	L40-2211-03	Ferri-inductor 220μH	
L41	L40-6811-03	Ferri-inductor 680μH	
L42	L40-4701-03	Ferri-inductor 47μH	
L43	L40-6801-03	Ferri-inductor 68μH	
L44	L40-4701-03	Ferri-inductor 47μH	
L45	L40-4711-03	Ferri-inductor 470μH	
L46	L40-1021-03	Ferri-inductor 1mH	
L11,15,16,17,32,33,39		Not used	
XF1,2	L71-0213-05	MCF 7975kHz	

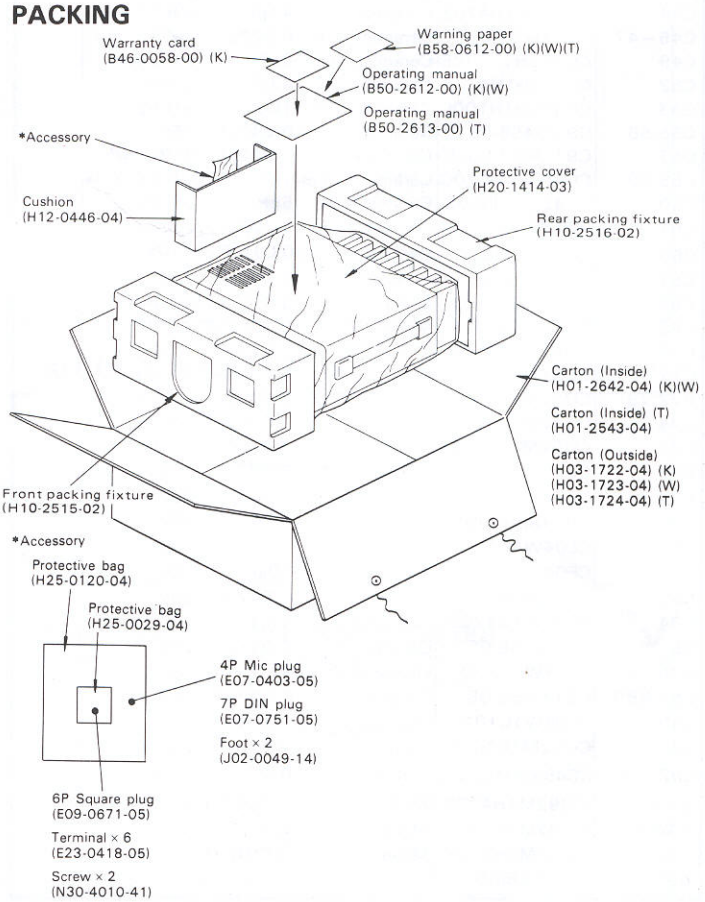
CONTROL UNIT (X53-1100-00)

Schematic: Page 36

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C5,7,9,10	C91-0456-05	Ceramic 0.047μF 25V	
C11	CQ92M1H223K	Mylar 0.022μF ±10%	
C12	CE04W1HR47	Electrolytic 0.47μF 50V	
C14	CC45SL1H121J	Ceramic 120pF ±5%	
C15	CQ92M1H223K	Mylar 0.022μF ±10%	
C16	CE04W1C101	Electrolytic 100μF 16V	
C17	CE04W1H010	Electrolytic 1μF 50V	
C23	CE04W1H3R3	Electrolytic 3.3μF 50V	
C26	CE04W1C101	Electrolytic 100μF 16V	
C27,28	C91-0456-05	Ceramic 0.047μF 25V	
C29	CE04W1C470	Electrolytic 47μF 16V	
C30	CE04W1C101	Electrolytic 100μF 16V	
C31~33	CQ92M1H473K	Mylar 0.047μF ±10%	
C34	CE04W1H3R3	Electrolytic 3.3μF 50V	
C35,36	CQ92M1H473K	Mylar 0.047μF ±10%	
C37,38	C91-0456-05	Ceramic 0.047μF 25V	
C39,40	CC45SL1H121J	Ceramic 120pF ±5%	
C41	CE04W1H010	Electrolytic 1μF 50V	
C1~4,13,20,21		Not used	
RESISTOR			
R1~55	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R48	RS14GB3D100J	Metal film 10Ω ±5% 2W	
R1~9 NOT USED			
SEMICONDUCTOR			
Q3	V03-1907-06	Transistor 2SC1907	
Q4~6	V03-0945-06	Transistor 2SC945(Q)	
Q7	V01-1015-06	Transistor 2SA1015(Y)	
Q8,9	V03-0945-06	Transistor 2SC945(Q)	
Q10	V01-1015-06	Transistor 2SA1015(Y)	
Q11	V01-0113-05	Transistor 2SA496(Y)	
Q12	V01-1015-06	Transistor 2SA1015(Y)	
Q13	V03-0945-06	Transistor 2SC945(Q)	
Q14	V01-1015-06	Transistor 2SA1015(Y)	
Q15	V30-1005-66	IC SN74LS00N	
Q16	V30-1028-06	IC TC7404UBP	

Ref. No.	Parts No.	Description	Remarks
Q17	V30-1079-06	IC TC7400BP	
Q18	V30-1049-06	IC TC4019BP	
Q19,20	V30-0198-05	IC SN7400N	
Q21	V30-1049-06	IC TC4019BP	
Q22	V30-1091-06	IC TC5032P	☆
Q23	V30-1090-06	MPU TMC1010	☆
Q24	V30-1094-06	IC TC5501P-1	☆
Q25	V30-1020-16	IC NJM78L05/A	
Q27	V01-1015-06	Transistor 2SA1015(Y)	
Q28,29	V03-0945-06	Transistor 2SC945(Q)	
D1~20	V11-0076-05	Diode 1S1555	
D21	V11-4161-06	Zener diode WZ044	
D22	V11-4167-06	Zener diode XZ090	
D23	V11-0076-05	Diode 1S1555	
Q1,2,26		Not used	
POTENTIOMETER			
VR1	R12-0413-05	Semi fixed resister 470Ω(B)	
COIL			
L2	L40-2211-03	Ferri-inductor 220μH	
L4	L40-4711-03	Ferri-inductor 470μH	
L5	L40-2211-03	Ferri-inductor 220μH	
L6	L33-0601-05	Choke coil 2.2μH	
L1,3		Not used	
MISCELLANEOUS			
—	E02-0106-05	IC socket 42P	
—	E02-0109-05	IC socket 22P	☆
—	J13-0041-05	Fuse holder ×2	

PACKING



EXPLODED VIEW/DISASSEMBLY

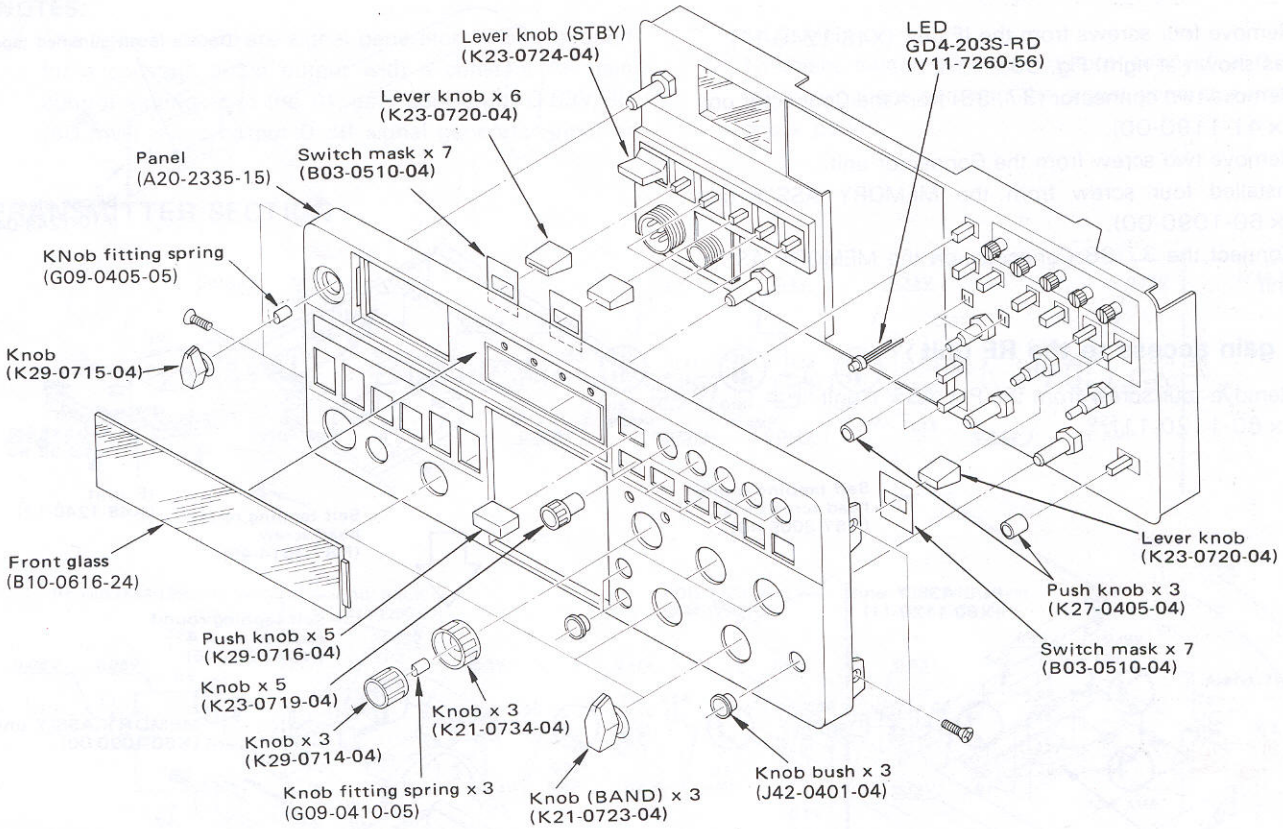


Fig. 32 Front panel exploded view

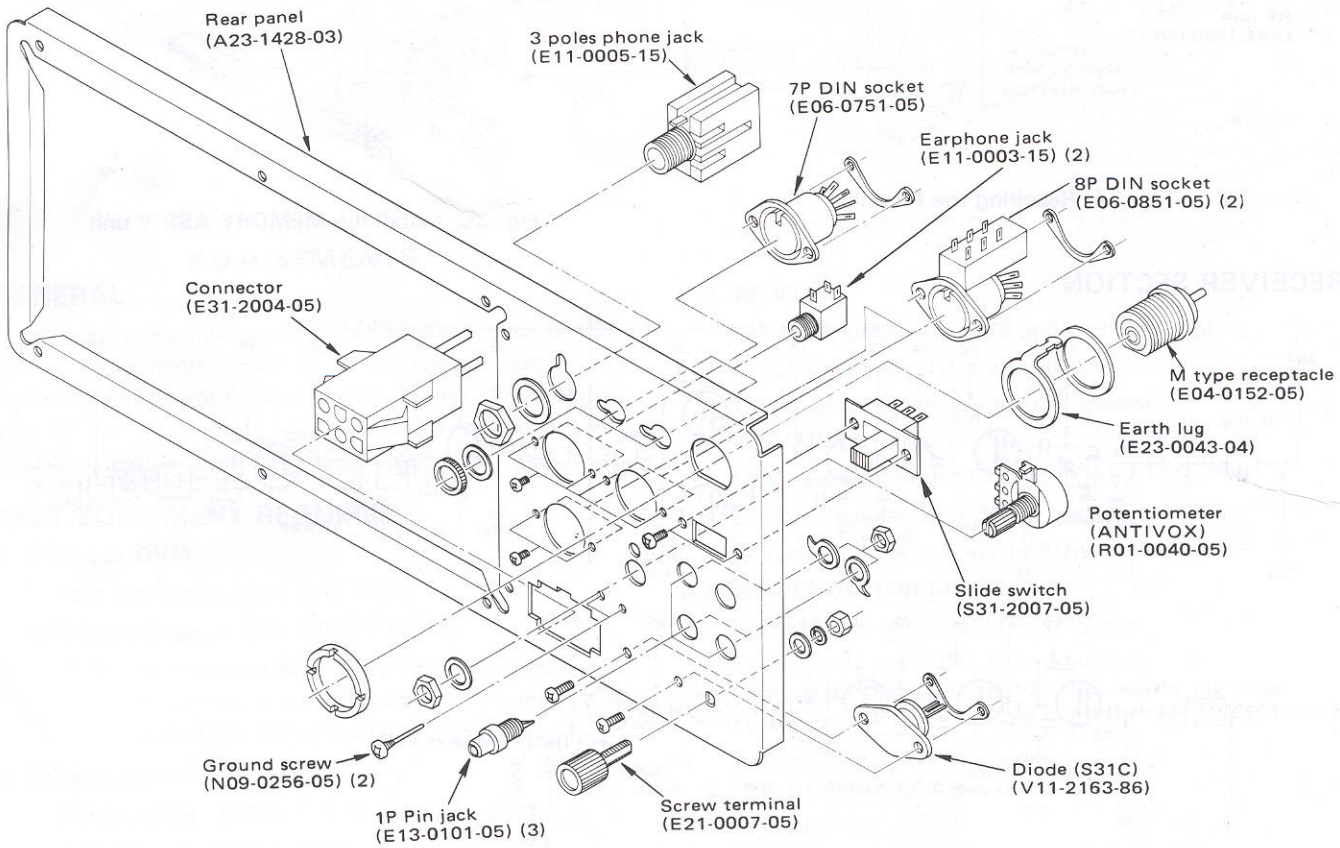


Fig. 33 Rear panel disassembly

DISASSEMBLY / LEVEL DIAGRAM

〈How to install the MEMORY ASS'Y unit〉

(1) Remove four screws from the IF unit (X48-1240-11). (as shown at right) Fig. 35.
(2) Remove two connector (37, 38) from the Connector unit (×41-1190-00).
(3) Remove two screw from the Connector unit.
(4) Installed four screw from the MEMORY ASS'Y unit (×60-1090-00).
(5) Connect the 37 38 Conecctor on the MEMORY ASS'Y unit.

〈To gain access to the RF unit〉

(1) Remove four screw from the PLL ASS'Y unit (×60-1120-11).

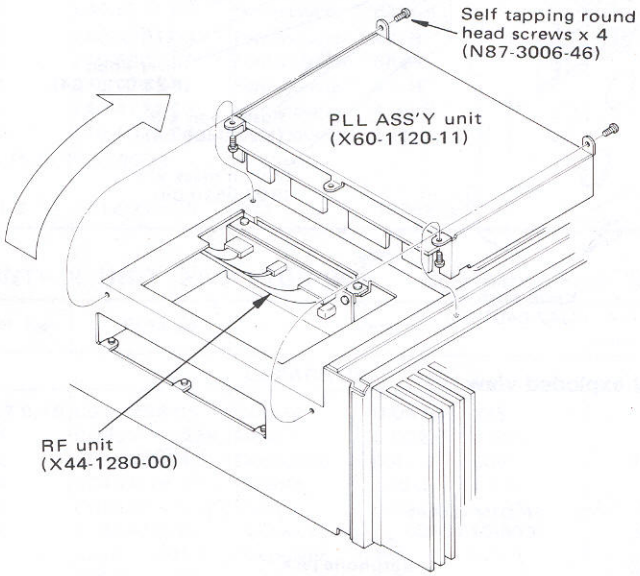


Fig. 34 Repairing the RF unit

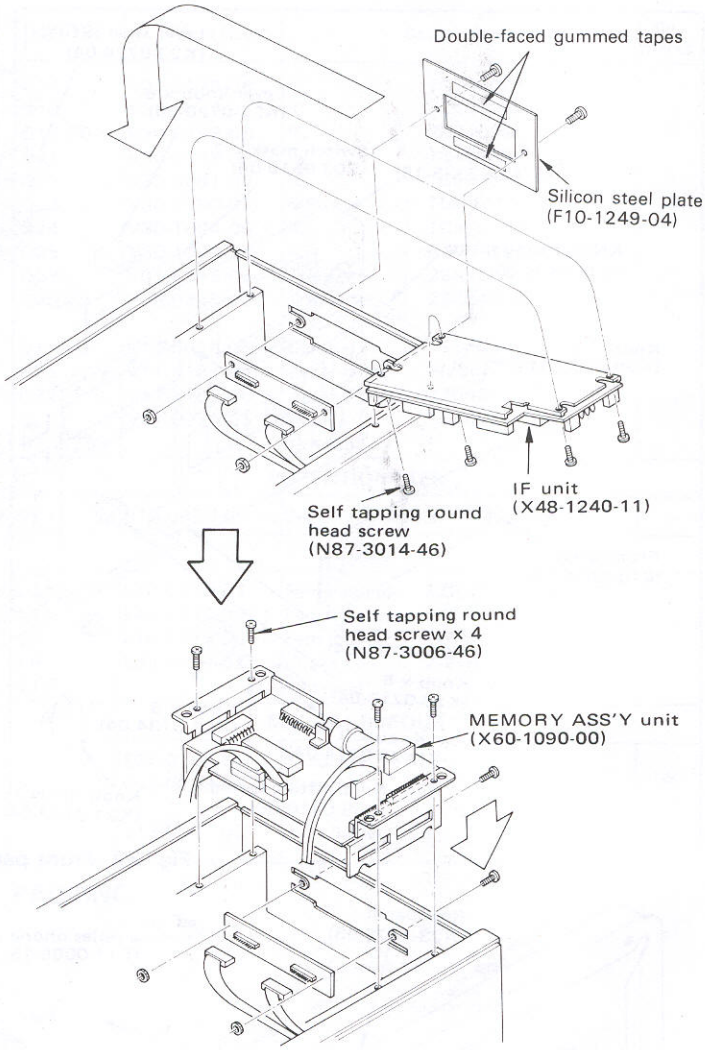
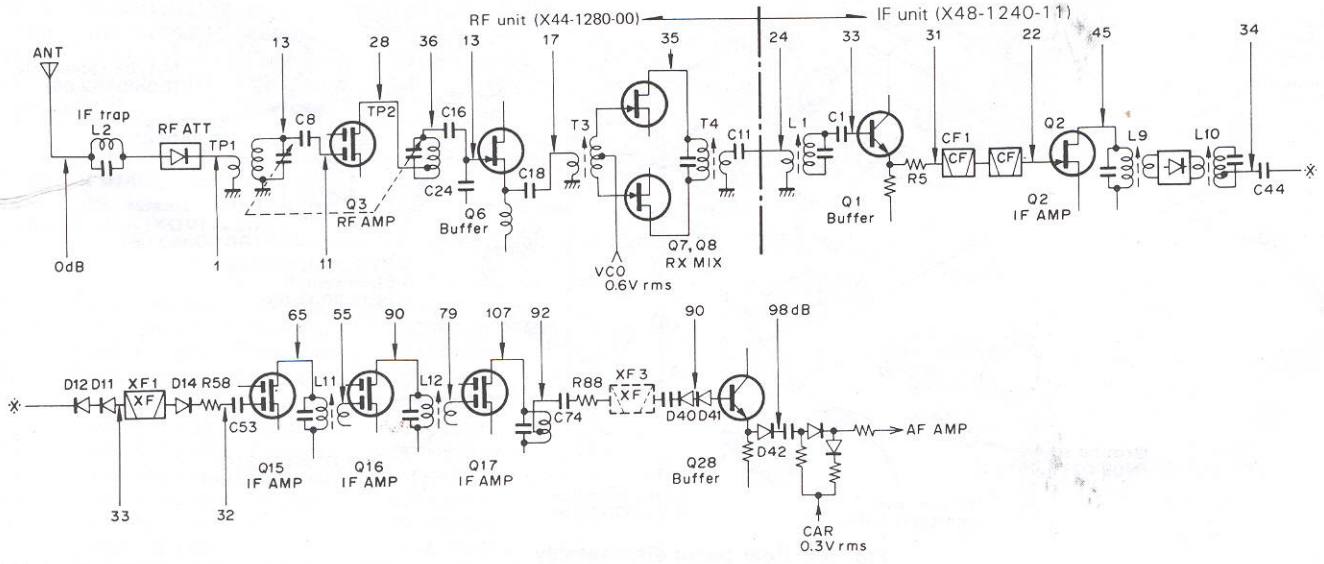


Fig. 35 Install the MEMORY ASS'Y unit

RECEIVER SECTION

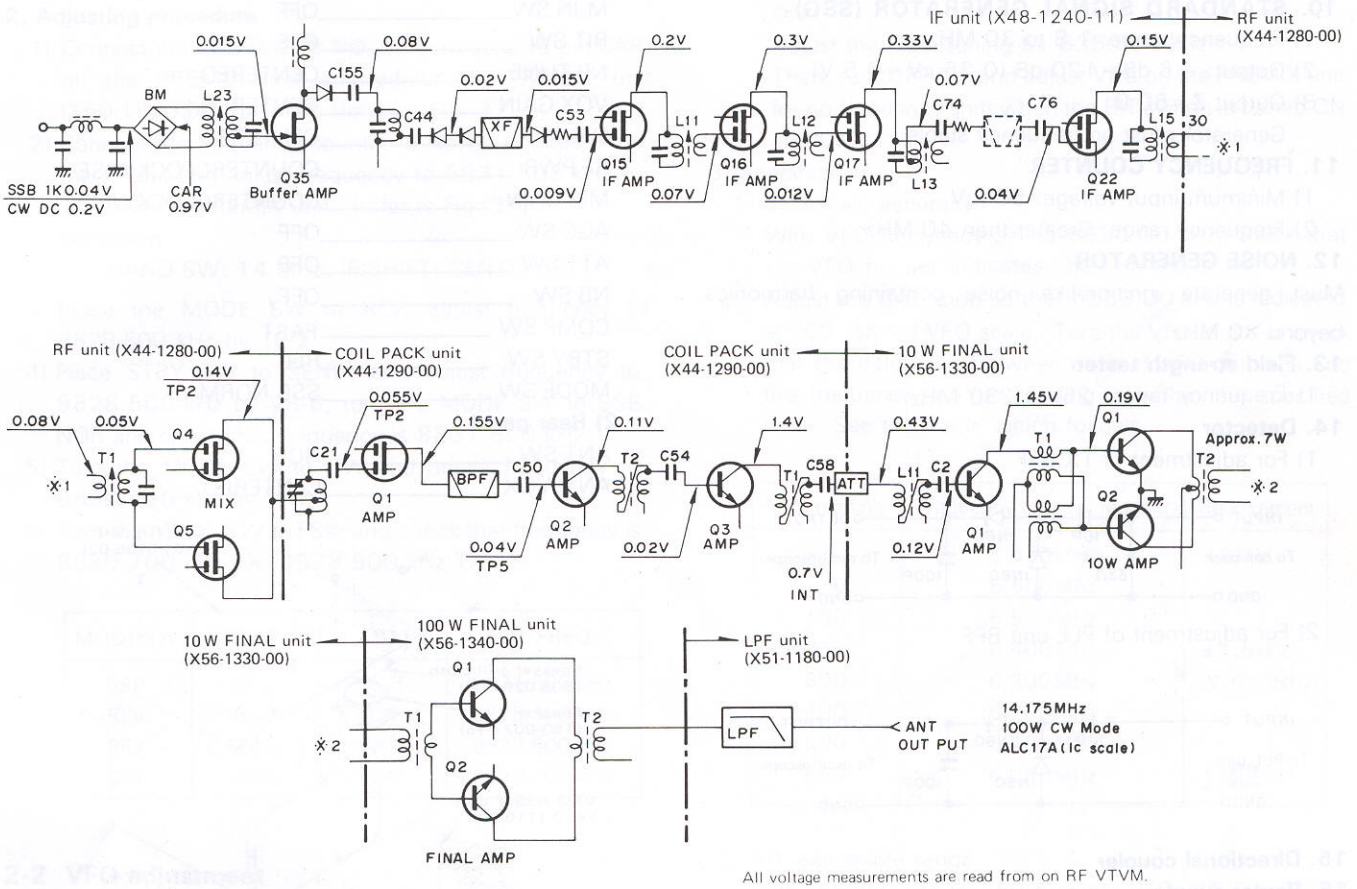


LEVEL DIAGRAM / ADJUSTMENTS

NOTES:

1. 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 0 dB signal generator input at 14.2 MHz.
2. To inject signal generator output connect a 0.01μF 500V capacitor between the signal generator and the check point.

TRANSMITTER SECTION



All voltage measurements are read from on RF VTVM.

ADJUSTMENTS

GENERAL

Adjustment procedures for this tranceiver 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 and etc.

TEST EQUIPMENT REQUIRED

1. VTVM or DVM

1) Input resistance: More than 1 MΩ
2) Voltage range: 1.5 to 1000 V AC/DC

NOTE: A high-precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. DC current meter

1) Current range: 100 mA, 200 mA, 2A, 10A.
High-precision current meter may be used.

3. RF VTVM

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

4. AF VTVM

1) Frequency range: 50 Hz to 10 kHz
2) Input impedance: 1 MΩ or greater
3) Voltage range: 10 mV to 30 V

5. AF GENERATOR (AG)

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

6. AF DUMMY LOAD

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

7. RF DUMMY LOAD

1) Impedance: 50 Ω.
2) Dissipation: 100 W continuous or greater

ADJUSTMENTS

3) Frequency limit: 1.8 to 30 MHz

8. OSCILLOSCOPE

Requires high sensitivity and external synchronization capability.

9. SWEEP GENERATOR

1) Center frequency: 8 to 40 MHz
2) Sweep bandwidth: Maximum ±16 MHz
3) Output voltage: More than 0.1 V

10. STANDARD SIGNAL GENERATOR (SSG)

1) Frequency range: 1.8 to 30 MHz
2) Output: −6 dB~120 dB (0.25 μV~0.5 V)
3) Output Z=50 Ω
   Generator must be frequency stable.

11. FREQUENCY COUNTER

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

12. NOISE GENERATOR

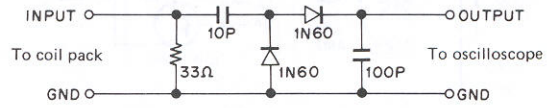
Must generate ignition-like noise containing harmonics beyond 30 MHz.

13. Field strength tester

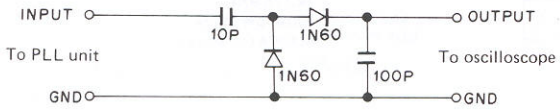
1) Frequency range: 25 ~ 230 MHz

14. Detector

1) For adjustment of TX.BPF



2) For adjustment of PLL unit BPF



15. Directional coupler

16. Power supply

1) 100 W type: 13.8 V, 20 A min. PS-30 or higher class

17. FIX-CH adjusting crystal element

1) 6,350 kHz (center: 250 kHz)
2) 6,600 kHz (lower band edge: 000 kHz)
3) 6,100 kHz (upper band edge: 500 kHz)

NOTE: Crystal elements in 2 and 3 are used for confirmation of frequencies.

PREPARATION

1. Remove the upper and lower cases as shown at right (Figure 36).
2. Unless otherwise specified, set the controls as follows.

1) Front panel

POWER SW _____ OFF
BAND SW _____ 1.5 MHz
SHIFT SW _____ ON
RF GAIN _____ FULL CLOCKWISE
AF GAIN _____ COUNTERCLOCKWISE
DRIVE _____ CENTERED
IF SHIFT _____ CENTERED
VFO RIT _____ CENTERED
FIX RIT _____ CENTERED
RCV. SW _____ VFO
XMIT SW _____ OFF
RECALL SW _____ M
METER SW _____ RF
M.IN SW _____ OFF
RIT SW _____ OFF
NB TUNE _____ CENTERED
VOX GAIN _____ CENTERED
DELAY _____ CENTERED
RF PWR _____ COUNTERCLOCKWISE
MIC GAIN _____ COUNTERCLOCKWISE
AGC SW _____ OFF
ATT SW _____ OFF
NB SW _____ OFF
COMP SW _____ FAST
STBY SW _____ REC
MODE SW _____ SSB NORM

2) Rear panel

ANT SW _____ NOR
ANTI VOX _____ CENTERED

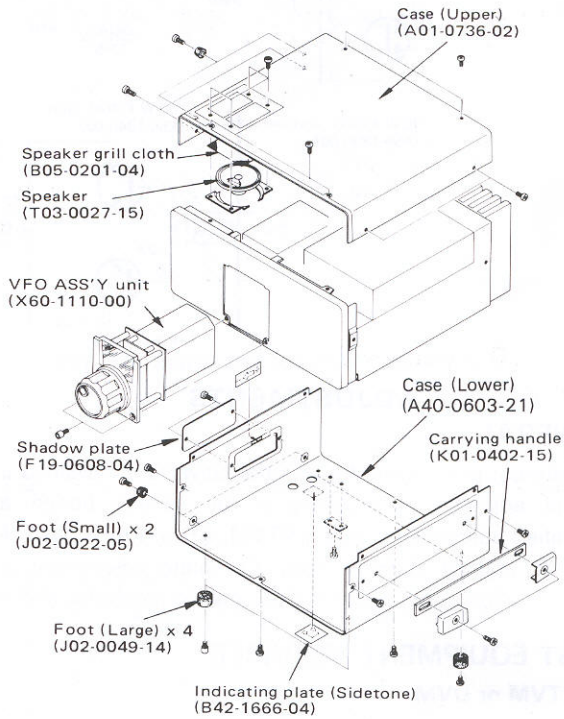


Fig. 36 Case disassembly

1. Power Supply Adjustment

1-1 8 V adjustment

1. Instrument

1) DC VTVM

2. Adjusting procedure

Connect the voltmeter between TP-2 and chassis on the AVR

ADJUSTMENTS

unit (X43-1340-00) and adjust VR1 on the AVR for 8 V. (refer to Fig. 37 Page 57)

2. RX Adjustment

2-1 Carrier unit adjustment

1. Instruments

1) RF VTVM
2) Frequency counter

2. Adjusting procedure

1) Connect the RF VTVM to NO. 52 connector (6 pin CAR) on the PREMIX unit and adjust T5, PREMIX unit (X50-1570-00) for max. (refer to Fig. 37)
2) Connect the frequency counter to No.26 connector on the IF unit and adjust frequency to 8831.500 kHz by TC-3 on the PREMIX unit. (refer to Fig. 37)
   condition
   BAND SW: 14 MHz, IF SHIFT: CENTERED.
3) Place the MODE SW to REV, adjust frequency to 8828.500 kHz by TC-2.
4) Place STBY SW to SEND, and adjust frequency to 8828.500 kHz by VR-6, turn the MODE SW to SSB NOR and check that frequency is 8831.500 kHz.
5) Turn the MODE SW to CW and adjust frequency to 8830.700 kHz by VR7.
6) Turn the MODE SW to FSK, and check that frequency is 8830.700 kHz RX, 8828.500 kHz TX.

MODE SW	STBY SW	ADJ.	ADJ. FREQ.
SSB	REC	TC-3	8831.500 kHz
REV	REC	TC-2	8828.500 kHz
REV	SEND	VR-6	8828.500 kHz
CW	SEND	VR-7	8830.700 kHz

2-2 VFO adjustment

1. Instruments

1) RF VTVM
2) Frequency counter

2. Adjusting procedure

1) Frequency adjustment.
   Set the RCV push switch to OFF and connect the frequency counter to TP-2 on the PREMIX unit (X50-1500-00).
   Set the VFO to the 50 kHz position and check that the oscillator frequency is 6550.00 kHz. Then, set the VFO to "500" and check that the oscillator frequency is 6100.00 kHz.
   If the frequency is not 6550.00 kHz, correct by TC1 in the VFO ASSY unit. If the frequency is not 6100.00 kHz, correct by L1 in the VFO ASSY unit.
   Since TC1 and L1 adjustments interact repeat these adjustments three or four times.
2) Output voltage
   Set the VFO to "250".
   Connect the RF VTVM to TP-2 on the PREMIX unit and adjust trimmer TC2 in the VFO ASSY unit for 90 mV (±1 dB) output voltage.
   NOTE: When adjusting output voltage, do not simultaneously connect a frequency counter to TP-2 on the PREMIX unit.
3) VFO RIT adjustment (Receiver Incremental Tuning)
   Connect the frequency to TP-2 on the PREMIX unit.
   Set the RIT control to 0 (center) and turn the RIT switch ON.
   Adjust the main tuning for 6350.00 kHz.
   Then, turn OFF RIT and adjust VR5 on the PREMIX unit for no frequency shift when the RIT switch is turned ON and OFF.

3. Specifications

1) VFO scale accuracy
   With VFO frequency set to 6550.00 kHz, check that the VFO pointer indicates "50" on the scale.
   Adjust the CAL knob so that 6550.00 kHz is indicated at "50" on the VFO scale. Turn the VFO dial and check that the difference between each of VFO readings and the frequency counter reading is within the specified limit. See the Table which follows.

VFO reading	Frequency counter reading	Requirement
−50	6,650 MHz	±3 kHz
0	6,600 MHz	
100	6,500 MHz	
200	6,400 MHz	±1,5 kHz
300	6,300 MHz	(Width 3 kHz)
400	6,200 MHz	
500	6,100 MHz	
550	6,050 MHz	+9 kHz −2 kHz

2) RIT adjustable range
   With the VFO set to 250 turn the VFO RIT SW ON; Adjust the VFO RIT control to confirm that the frequency varies more than ±2 kHz. Turn the VFO RIT SW OFF.

2-3 FIX/R, RIT adjustment

1. Instruments

1) Quartz crystal 6.350 MHz (FIX CH)
2) RF VTVM
3) Frequency counter

2. Adjusting procedure

1) Install a 6.350 MHz quartz crystl in the PREMIX unit (X50-1570-00).
   Adjust the RF POWER control full counterclockwise.
   Turn the FIX RIT SW ON, turn the RCV SW, XMIT, SW and RECALL SW ON, and the FIX RIT control centered.
   Set the MODE SW to SSB NORM position.
   Connect the frequency counter to the 1P terminal (No. 54) on the PREMIX unit, and adjust frequency to 6350.000 kHz by TC 1. (refer to Fig. 37)

ADJUSTMENTS

2) Connect the RF VTVM to TP-2, and check that RF output is 90 mV ±3 dB.
3) Connect the frequency counter to the 3P terminal (No. 52) on the PREMIX unit, and adjust frequency to 40250.000 kHz by T6.
Place the STBY SW to SEND and adjust frequency to 40250.000 kHz by VR-1. Turn the MODE SW to CW position and adjust frequency to 40250.000 kHz by VR-2.
4) With the STBY SW set to REC, depress DSP/M1 and DSP/DIFF SWs in that order while observing the frequency counter, and confirm that 0.0 appears on the right side of the counter.
Turn the FIX RIT VR to "+" and "−" and check that the frequency varies more than ±1.5 kHz. Set the control back to the original position.

2-4 VCO voltage adjustment

1. Instruments

1) Frequency counter
2) DC volt meter
3) RF VTVM

2. Adjusting procedure

1) Connect the frequency counter between terminal TP-1, PLL unit (X60-1120-00/11/61) and the GND terminal.
Connect the voltmeter between terminal TP-3 and the GND terminal. (refer to Fig. 37)
Connect an RF VTVM between terminal TP-1 and the GND terminal. After connecting, measure and adjust at the following points:
2) Frequency check

Band/VFO scale	0	250	500
WWV,JJY	18.83 MHz	19.08 MHz	19.33 MHz
1.5 MHz	10.33 MHz	10.58 MHz	10.83 MHz
3.5 MHz	12.33 MHz	12.58 MHz	12.83 MHz
7.0 MHz	15.83 MHz	16.08 MHz	16.33 MHz
14.0 MHz	22.83 MHz	23.08 MHz	23.33 MHz
21.0 MHz	29.83 MHz	30.08 MHz	30.33 MHz
28.0 MHz	36.83 MHz	37.08 MHz	37.33 MHz
28.5 MHz	37.33 MHz	37.58 MHz	37.83 Mhz
29.0 MHz	37.83 MHz	38.08 MHz	38.33 MHz
29.5 MHz	38.33 MHz	38.58 MHz	38.83 MHz

3) Disconnect the freq. counter. With the VFO set to 0 kHz, check that the RF VTVM indicates 0.6 V ±2 dB at each frequency band.
4) Set VFO scale to "0" and adjust VCO voltage listed below.

Band	Coil	VCO Voltage
1.5 MHz, 3.5 MHz	T4	2V
WWV BAND, 7 MHz	T3	
14 MHz, 21 MHz	T2	1.8V
28 ~ 29.5 MHz	T1	2V

2-5 Standard oscillator frequency adjustment

1. Instruments

1) Frequency counter

2. Adjusting procedure

1) Connect the frequency counter to TP-8 on the PLL ASS'Y unit, on the 1.5 MHz BAND, adjust frequency to 38.500000 MHz ± 10 Hz by TC-1. (refer to Fig. 37)
NOTE: When the frequency counter is connected to TP-8, the digital display may read intermittent and incorrectly. Use a high impedance probe (HP 1121A).

2-6 ANTENNA and MIX coil adjustment

1. Instrument

1) SSG (Standard Signal Generator)

2. Adjusting procedure

1) Since the resonant point may deviate due to a shift in antenna impedance, be sure the antenna is terminated at 50 ohms.
Set the AGC SW to FAST.
DRIVE: Centered (12 o'clock position)
2) Apply SSG output at 60 dB (500 μV) to the antenna terminal and adjust the COILPACK unit (X44-1290-00) in the order listed for maximum AF output and sensitivity. Reduce the SSG output as sensitivity increases (refer to Fig. 38 Table 3).

Table 3

SSG OUTPUT	BAND	VFO SCALE	COILPACK	
10.250 MHz	WWV	250	L4	L11
1.900 MHz	1.5 MHz	400	L3	L10
3.750 MHz	3.5 MHz	250	L5	L12
7.150 MHz	7.0 MHz	150	L6	L13
14.175 MHz	14.0 MHz	175	L7	L14
21.225 MHz	21.0 MHz	225	L8	L15
28.880 MHz	28.5 MHz	300	L9	L16

NOTE: If the 1.5 MHz BAND is readjusted, then complete coilpack alignment must be repeated.

2-7 IFT adjustment

1. Instrument

1) SSG (Standard Signal Generator)

2. Adjusting procedure

1) Set AGC SW to FAST and the VFO dial scale to 400.
2) Apply a signal of 1.900 MHz at 40 dB to the antenna termilnal.
3) Adjust T4 on the RF unit (X44-1280-00), L1, L9 to L13 on the IF unit (X48-1240-11) and L3, L10 on the COILPACK unit (X44-1290-00) for maximum S meter reading. After adjustment, turn the L9 core counterclockwise 180° from oscillation starting point. (refer to Fig. 38)

ADJUSTMENTS

TOP VIEW

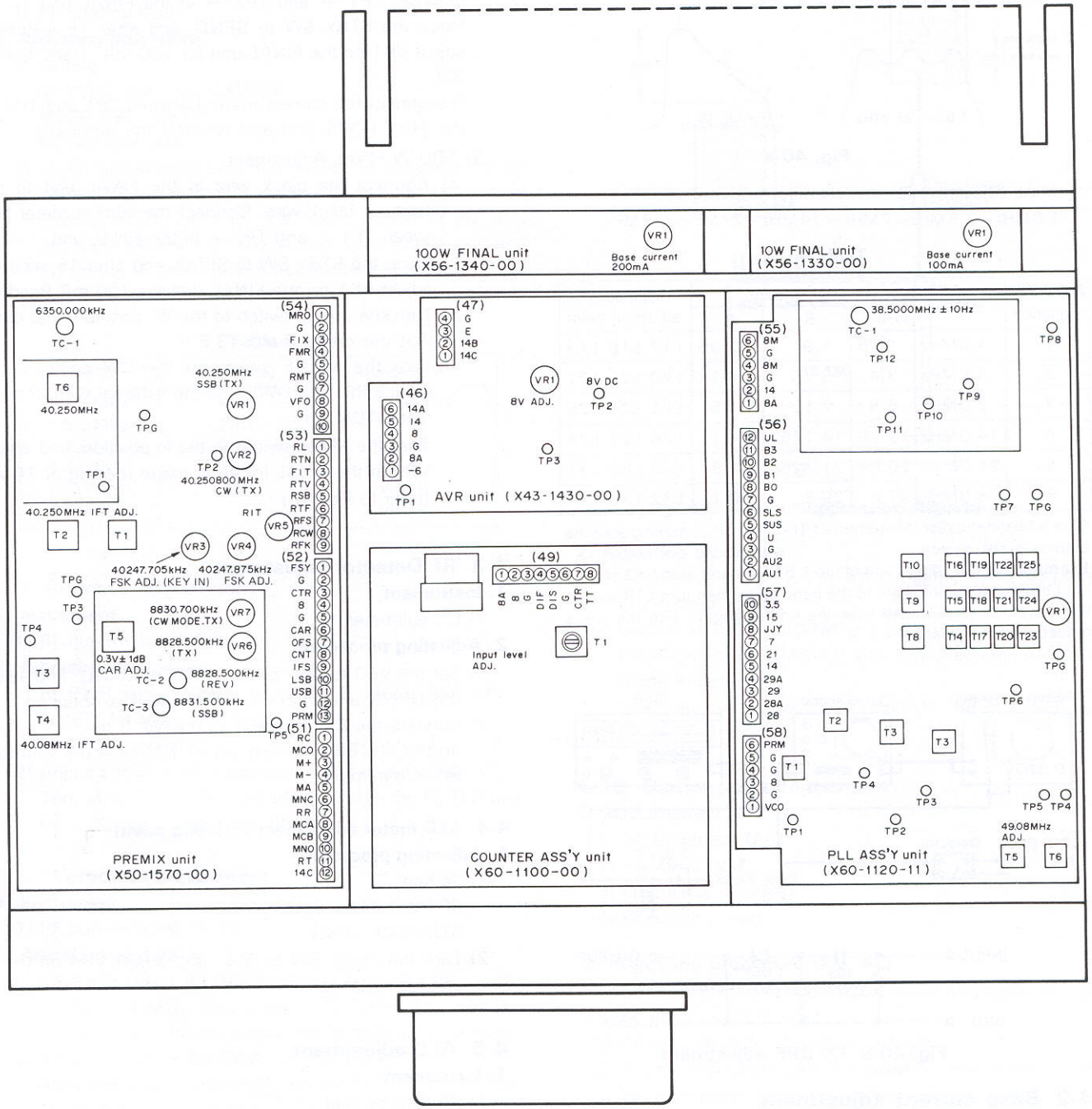


Fig. 37 TS-180 Top view

ADJUSTMENTS

BOTTOM VIEW

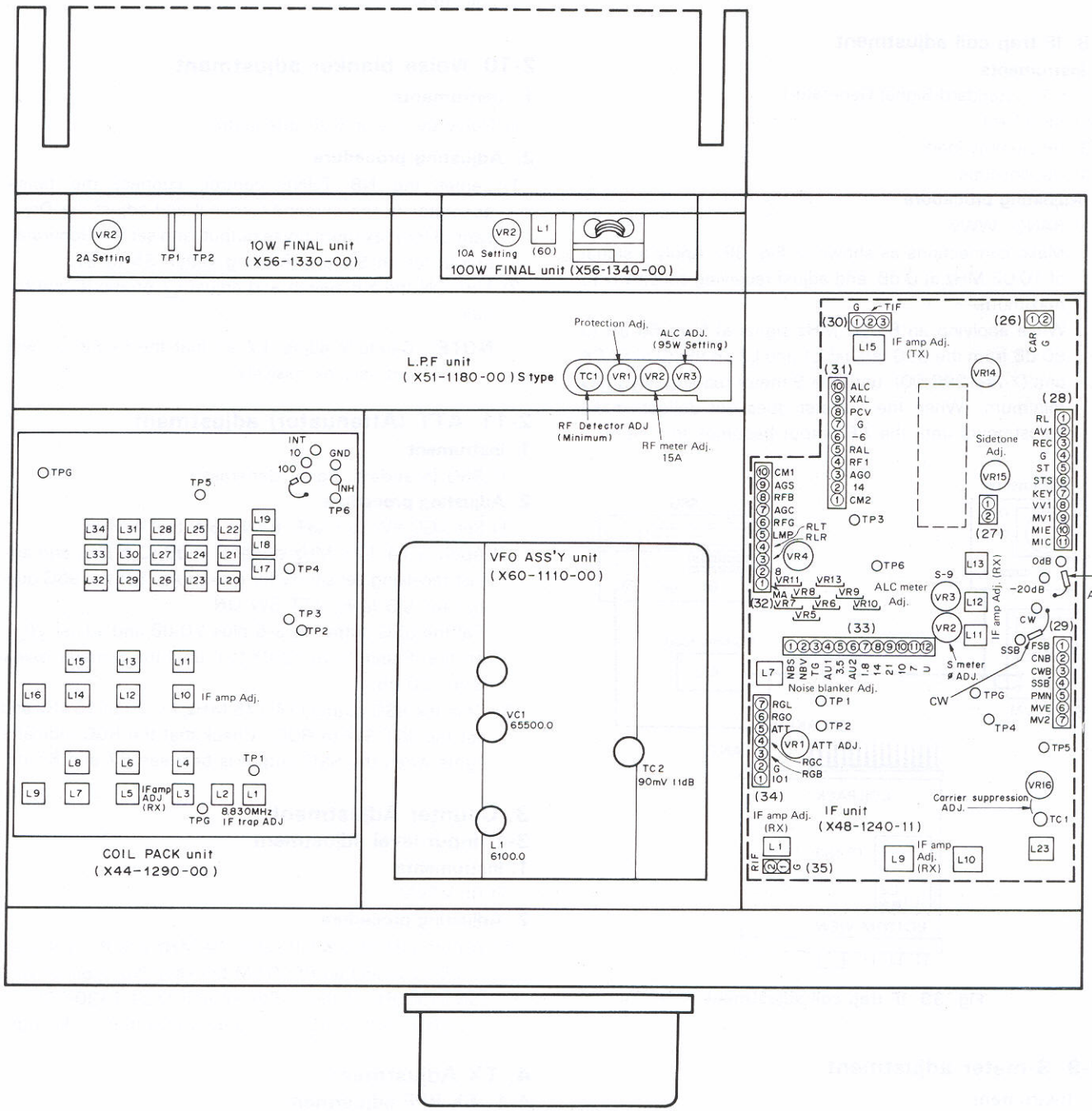


Fig. 38 TS-180 Bottom view

ADJUSTMENTS

4) 28.272 MHz, adjust VR-1 on the RF unit for minimum internal signal at 28.722 MHz.

2-8 IF trap coil adjustment

1. Instruments

1) SSG (Standard Signal Generator)
2) AF VTVM
3) AF Dummy load
4) Oscilloscope

2. Adjusting procedure

1) BAND: WWV.
Make connections as shown in Fig. 39. Apply a signal of 10.02 MHz at 0 dB, and adjust receiving sensitivity to maximum.
While applying an 8.830 MHz signal at from 60 dB to 80 dB from the SSG, adjust L1 and L2 on the COILPACK unit (X44-1290-00), until the S-meter reading becomes minimum. When the S-meter does not deflect, make adjustments until the AF output becomes minimum.

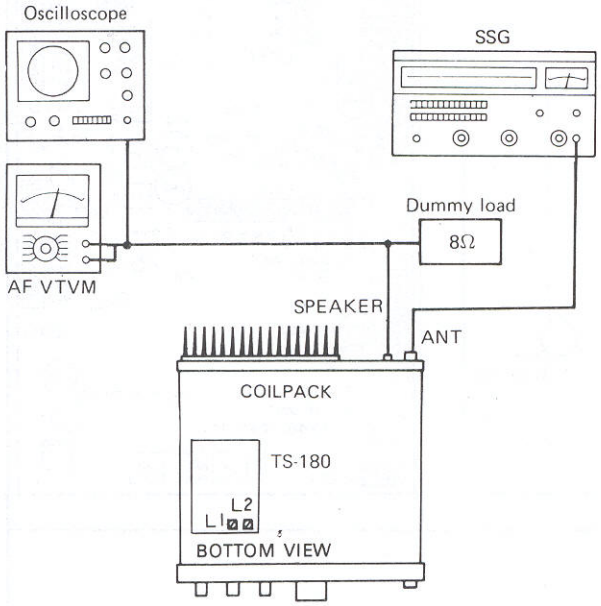


Fig. 39 IF trap coil adjustment

2-9 S-meter adjustment

1. Instrument

1) SSG (Standard Signal Generator).

2. Adjusting procedure

1) After adjusting each section until sensitivity becomes maximum, set the AGC SW to FAST. Apply a signal at 14.175 MHz, −6 dB (0.25 μV) to the antenna terminal. Adjust the AF GAIN control fullyclockwise, and adjust L12 on the IF unit for a voltmeter reading of 2V/8Ω.
2) Apply a signal at 14.175 MHz, 6 dB (1 μV) to the antenna terminal. Adjust VR2 on the IF unit (X48-1240-11) for an S-1 reading.
3) Set the SSG output to 40 dB (50 μV) and adjust VR3 on the IF unit for an S-9 reading.
4) Repeat steps 2 and 3 two or three times for optimum adjustment.

2-10 Noise blanker adjustment

1. Instruments

1) Noise generator with attenuator.

2. Adjusting procedure

1) Center the NB TUNE control, connect the noise generator to the antenna terminal and adjust the Drive control for maximum noise output, and set the Generator output for an S-meter reading within S5 to S7.
2) Turn ON the NB switch and adjust L7 on the IF unit for null.

NOTE: Carefully adjust L7 so that the frequency will not vary excessively.

2-11 ATT (Attenuator) adjustment

1. Instrument

1) SSG (Standard Signal Generator)

2. Adjusting procedure

1) Set AGC SW to FAST, BAND SW to 14 MHz
2) Apply a 14.175 MHz signal at 0 dB (0.5 μV), and adjust receiving sensitivity for maximum. Set the SSG output for S-5 level, ATT SW ON.
Set the SSG output to S-5 plus 20 dB and adjust VR-1 on the IF unit (X48-1240-11) until the S-meter reads S-9 + 20 dB.
3) Shift the SSG output (14.175 MHz) by about 15 kHz and set the ATT SW to RGC. Check that the RGC indicator lights when the SSG output is between 67 and 87 dB.

3. Counter Adjustment

3-1 Input level adjustment

1. Instruments

1) RF VTVM

2. Adjusting procedure

1) With the BAND switch set to 14 MHz and the dial scale to 250 connect an RF VTVM between No. 5 pin of Q10 (SN74S00N) of the DISPLAY unit (X54-1430-00) and the GND. Adjust T1 in the unit for maximum deflection.

4. TX Adjustment

4-1 TX BPF adjustment

1. Instruments

1) Sweep Generator
2) Oscilloscope
3) Detector

2. Adjusting procedure

1) Remove the short jumper wire between TP2 and TP3 in the COILPACK unit (X44-1290-00).
Connect the Slow Sweep Generator to the RF OUT terminal (TP3).
Connect the Detector to the INH terminal on the COILPACK unit (X44-1290-00).

ADJUSTMENTS

2) Place the STBY SW to SEND.
Adjust L17 ~ L34 in the COILPACK unit for the output wave form as shown in Fig. 40.

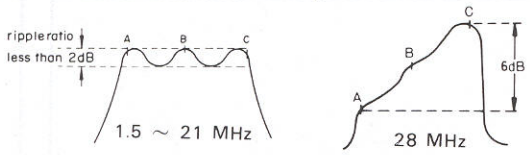


Fig. 40-a

Make adjustments in the following sequence:
1.5 MHz→3.5 MHz→7 MHz→14 MHz→21 MHz→28 MHz

Table 4

Adjusting sequence	BAND	Marker point			Coil pack adjusting point
		A	B	C	
1	1.5 MHz	1.75	1.9	2.05	L17 L18 L19
2	3.5 MHz	3.4	3.75	4.1	L20 L21 L22
3	7.0 MHz	6.8	7.15	7.5	L23 L24 L25
4	14.0 MHz	13.65	14.175	14.1	L26 L27 L28
5	21.0 MHz	20.65	21.225	21.8	L29 L30 L31
6	28.0 MHz	27.6	28.8	30.1	L32 L33 L34

After adjustment, resolder terminals TP-2 and TP-3, making sure the pattern is not altered.

Example: In the adjustment of the 1.5 MHz band, turn L19 and 17 until the marker point is set to the band edge, then turn L18 so that the waveform is balanced over the entire length. Use the same procedure for all bands.

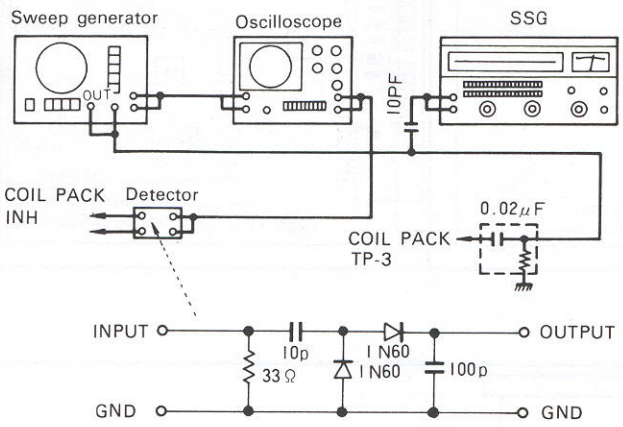


Fig. 40-b TX BPF adjustment

4-2 Base current adjustment

1. Instruments

1) RF Dummy load
2) DC Current meter

2. Adjusting procedure

1) Set VR-8, 6, 9, 10 and 13 on the IF unit full counterclockwise.
Set VR-1 in the 10 W FINAL and 100 W FINAL unit full counterclockwise. Set VR1, 3 on the FILTER unit full counterclockwise, and VR2 at 9 o'clock. Connect the RF dummy load to the ANT terminal.

2) 10 W FINAL Adjustment
Remove the jumper, and connect the current meter between TP1 + and TP2 − in the FINAL unit.
Place the STBY SW to SEND, and after 15 sedonds, adjust VR1 on the FINAL unit for 100 mA. (refer to Fig. 37).
Disconnect the current meter between TP1 and TP2 in the 10W FINAL unit and resolder the terminals.

3) 100 W FINAL Adjustment.
a) Connect the black wire in the FINAL unit to the harness black wire. Connect the current meter between TP1 + and TP2 − in the FINAL unit.
Place the STBY SW to SEND, and after 15 seconds, adjust VR1 on the FINAL unit for 200 mA Reading.
b) Turn the meter switch to the VC position, and check that the meter reads 13.8 V.
c) Turn the MODE switch to the CW position, and reduce the RF POWER so the external current meter reads 10A.
Turn the Meter switch to the Ic position, and adjust VR2 in the FINAL for an Ic meter reading of 10 A. (refer to Fig. 38)

4-3 RF Detector adjustment

1. Instrument

1) DC voltmeter

2. Adjusting procedure

1) Set the VFO to 400 on the 1.5 MHz BAND, and adjust the DRIVE until maximum TX output is obtained.
2) Connect the DC voltmeter to the No. 3 terminal of VR1 on the FILTER unit, and adjust TC1 until the voltmeter reads minimum.

4-4 ALC meter adjustment (Starting point)

1. Adjusting procedure

1) Setting
RF PWR: FULL CLOCKWISE
STBY SW: SEND
2) Turn the meter SW to ALC, and adjust VR4 on the IF unit for meter zero.

4-5 ALC adjustment

1. Instrument

1) RF dummy load

2. Adjusting procedure

1) Setting
RF PWR: FULL CLOCKWISE, MODE SW: CW
BAND: 14 MHz, VFO: "200"
STBY SW: SEND
Set VR9 to 12 o'clock.
2) Adjust the DRIVE control until maximum output is obtained.
Adjust VR3 on the FILTER unit until the RF POWER meter reads 95 W.

ADJUSTMENTS

4-6 ALC meter adjustment

1. Instrument

1) RF dummy load

2. Adjusting procedure

1) Setting
   RF PWR: FULL CLOCKWISE
   MODE SW: CW
   METER SW: ALC
2) Make adjustment until full power is obtained on all bands. Adjust each VR on the IF unit for an Ic scale reading of 8A, but with the meter switch in the ALC position. On the 1.5 MHz, Adjust T_1 on the RF unit and L_{15} on the IF unit until the ALC meter reads max. Make adjustments as listed below.

Table 5

BAND	VFO Scale	Adjusting VR
1.5MHz	400	VR-8
3.5MHz	250	VR-6
7.0MHz	250	VR-13
14.0MHz	250	VR-9
21.0 MHz	250	VR-10
29.0 MHz	250	VR-11

4-7 RF meter adjustment

1. Instrument

1) RF dummy load (50Ω)

2. Adjusting procedure

1) RF PWR setting: FULL CLOCKWISE, MODE SW: CW
   BAND: 14 MHz, Dial scale: "200"
   STBY SW to SEND
2) Adjust DRIVE until maximum output is obtained.
   Turn Meter SW to RF and adjust VR2 in the FILTER unit for an Ic scale reading of 15 A.

4-8 Protection adjustment

1. Instrument

1) RF dummy load (50Ω)

2. Adjusting procedure

1) RF PWR: FULL CLOCKWISE, MODE SW: CW
   BAND: 14 MHz, Dial scale: 200, STBY SW: SEND
2) Adjust for maximum output into a 50Ω dummy load.
3) Adjust RF PWR for 24W. Disconnect the load (open ANT) and quickly adjust VR1 on the FILTER unit for PRO On threshold in transmit.
4) Short the ANT terminal and quickly verify protection in TX.

   NOTE: This check is not required for the TS-180V. Protection circuit adjustment should be made after adjustment of detector balance (section 4-3), otherwise the circuit will not function properly.

4-9 Carrier suppression adjustment

1. Instruments

1) RF VTVM, RF dummy load
2) Directional coupler

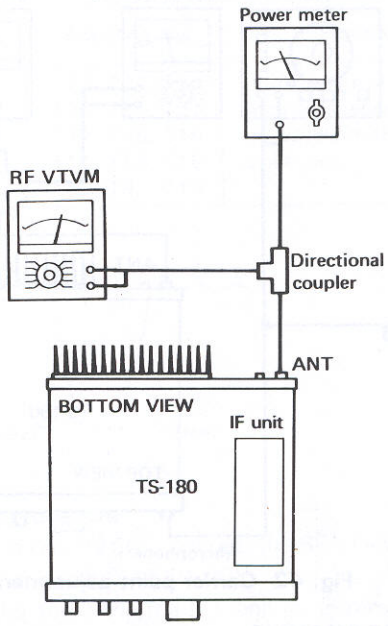


Fig. 41 Carrier Suppression Adjustment

2. Adjusting procedure

1) Connect as shown in Fig. 41 and adjust at 14,200 MHz CW for full power.
2) Switch MODE to NORM and adjust VR16 and TC1 on the IF unit (X48-1240-11) alternately until the RF VTVM reads minimum.
   Make this adjustment so the NORM and REV levels are equal.

4-10 Carrier point adjustment

1. Instruments

1) AF Generator (AG)
2) AF, RF VTVM
3) Frequency counter
4) RF dummy load

2. Adjusting procedure (Fig. 42)

1) Connect the AG to the MIC terminal and apply an input of 1500 Hz at 2 mV.
2) Adjust DRIVE for maximun output.
3) Adjust MIC GAIN until the COMP meter reads 10 dB.
4) Shift the signal frequency between 300 Hz and 2700 Hz and adjust TC2 (in NORM) and TC3 (in REV) on the PREMIX unit for equal output reading between the high and low frequencies. (refer to Fig. 37)
5) After adjustment, check carrier suppression.
6) Connect the frequency counter to No. 26 connector on the IF unit (X48-1240-11).
7) MODE SW: CW, STBY SW: SEND
   Adjust VR7 on the PREMIX unit for 8830.700 KHz.

4-11 FSK adjustment

1. Instrument

1) Frequency counter

ADJUSTMENTS

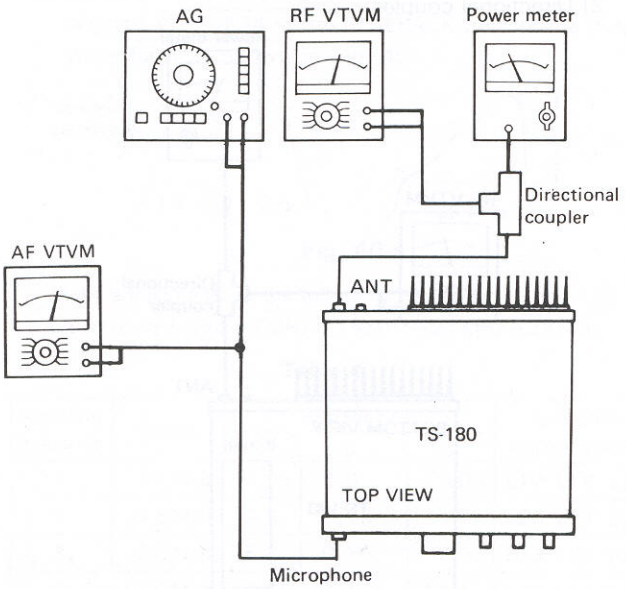


Fig. 42 Carrier point adjustment

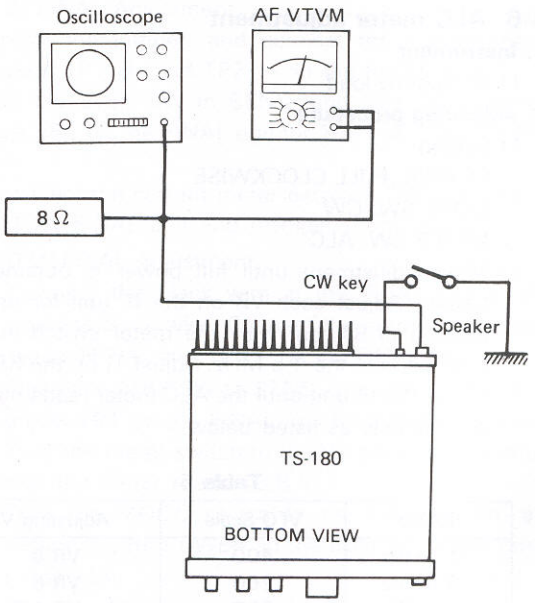


Fig. 43 Side tone adjustment

2. Adjusting procedure

1) MODE SW: FSK
Connect the frequency counter to the 3P terminal (No. 52) on the PREMIX unit (X50-1570-00) and adjust the VFO for 40250.00 kHz. (VFO 250)

2) RF PWR: FULL COUNTERCLOCKWISE, STBY SW: SEND.
Adjust VR4 on the PREMIX unit for 40247.875 kHz-±10 Hz. Then, install a blank plug into the FSK Jack and adjust VR3 on the PREMIX unit for 40247.705 kHz ±10 Hz.

4-12 Side tone adjustment

1. Instruments

1) AF VTVM
2) Oscilloscope
3) AF dummy load
4) Key (Shorting lead also usable)

2. Adjusting procedure

1) MODE SW: CW, AF VR: 12 o'clock position
Adjust VR15 on the IF unit (X48-1240-11) for AF output of 0.63V/8Ω (50 mW) with the key down. (refer to Fig. 38)

5. PREMIX adjustment

5-1 40.25 MHz IFT adjustment

1. Instrument

1) RF VTVM

2. Adjusting procedure

Set the VFO to "250" and connect the RF VTVM to TP-4 on the PREMIX unit (× 50-1570-00). Adjust T1 and T2 on the PREMIX unit for maximum.

5-2 49.08 MHz IFT adjustment

1. Instrument

1) RF VTVM

2. Adjusting procedure

1) Set the VFO scale to "250". Connect the RF VTVM to TP-5 on the PREMIX unit (X50-1570-00). Adjust T3 and T4 on the PREMIX unit for maximum.
(refer to Fig. 37)

6. PLL adjustment

6-1 BPF adjustment

1. Instruments

1) Sweep Generator
2) Oscilloscope
3) Frequency counter
4) RF dummy load

2. Adjusting procedure

1) Disconnect the No. 52 connector from the PREMIX unit (X50-1570-00).
Connect the detector to TP-8 in the PLL unit (X50-1560-00) and connect the oscilloscope to it's output. (refer to Fig. 44)

Table 7

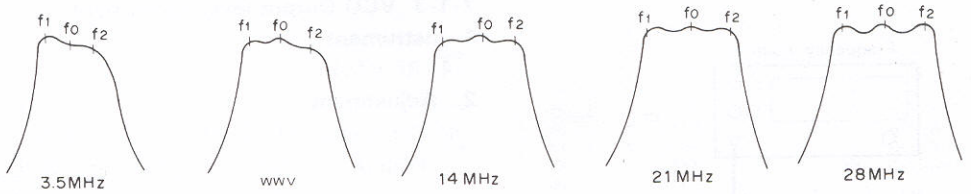
BAND \ VFO SCALE	0	250	500
WWV, JJY	18.83 MHz	19.08 MHz	19.33 MHz
1.5 MHz	10.33 MHz	10.58 MHz	10.83 MHz
3.5 MHz	12.33 MHz	12.58 MHz	12.83 MHz
7.0 MHz	15.83 MHz	16.08 MHz	16.33 MHz
14.0 MHz	22.83 MHz	23.08 MHz	23.33 MHz
21.0 MHz	29.83 MHz	30.08 MHz	30.33 MHz
28.0 MHz	36.83 MHz	37.08 MHz	37.33 MHz
28.5 MHz	37.33 MHz	37.58 MHz	37.83 MHz
29.0 MHz	37.83 MHz	38.08 MHz	38.33 MHz
29.5 MHz	38.33 MHz	38.58 MHz	38.83 MHz

Connect the Sweep Generator output to TP-6 on the PLL unit. Output waveform should be as shown with Table 6.

ADJUSTMENTS

Table 6

BAND	f1	Marker frequency f0	f2	Adjusting coil	Procedure
3.5 MHz	33.75 MHz	36.625 MHz	39.5 MHz	T23, T24, T25	Turn the core of each of the three coils repeatedly until the waveform shown below is obtained.
WWV	28.75 MHz	31.25 MHz	33.75 MHz	T20, T21, T22	
14 MHz	24.5 MHz	26.625 MHz	28.75 MHz	T17, T18, T19	
21 MHz	18.5 MHz	20.5 MHz	22.5 MHz	T14, T15, T16	
28 MHz	10.0 MHz	11.6 MHz	13.5 MHz	T8, T9, T10	



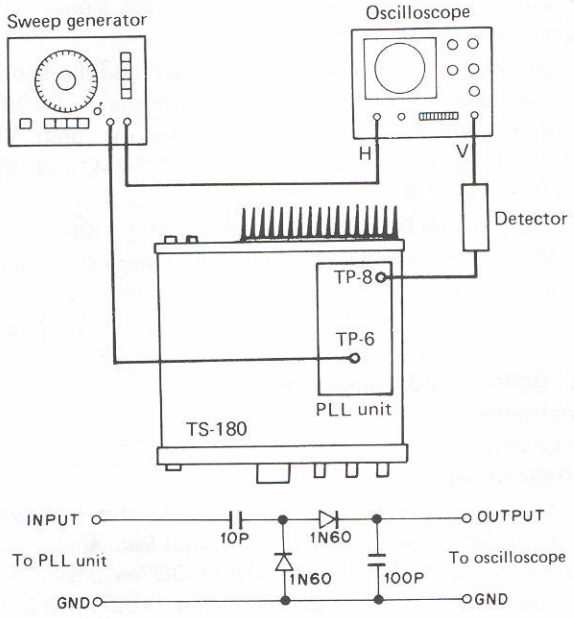


Fig. 44 PLL adjustment

2) Adjust as item 1, Connect the No. 52 connector on the PREMIX unit and connect the frequency counter to TP-1 in the PLL unit. Check that frequency reads as shown in Table 6.
3) After checking item 2, Table 7:
   a) Remove the frequency counter from TP-1 in the PLL unit.
   b) Connect the voltmeter to TP-1 in the PLL unit.
   c) Set the VFO to "0" and verify the voltage for each band is 0.6V ±2 dB.

NOTE: If the sweep generator output impedance is far greater than 50 ohms, reduce it to 50 ohms by inserting a resistor or pad.

6-2 49.08 MHz tuning circuit adjustment

1. Instruments

1) RF VTVM

2. Adjusting procedure

1) Set the VFO to "250", connect the RF VTVM to TP-4 in the PLL unit (×50-1560-00).
2) Adjust T5 and T6 in the PLL unit for maximum.

6-3 MIXER balance adjustment

1. Instruments

1) Field strength meter or Spectrum analyzer

2. Adjusting procedure

1) Band: 28.5 MHz; Set the VFO to "250", Connect the spectrum analyzer to TP6 in the PLL unit (X50-1560-00).
2) Set the spectrum analyzer to 49.08 MHz (PREMIXER signal), and adjust VR-1 in the PLL unit for minimum. (refer to Fig. 37)

7. Memory adjustment

7-1 VCO adjustment

7-1-1 1st VCO adjustment

1. Instruments

1) Frequency counter
2) Digital voltmeter
3) High impedance probe.

NOTE: This adjustment can be disregarded if the frequency counter input impedance is sufficiently high and the input cable capacity is low.

2. Adjusting procedure

1) Connect the frequency counter through a high impedance probe (HEWLETT PACKARD 1121) to TP4 in the VCO unit (X50-1550-00). Connect the digital voltmeter to TP5 in the VCO unit (X50-1550-00).
2) Turn the RCV switch to the FIX/M RECALL position, the FIX/M OUT SW to the "M1" or "M" position. Turn the Power SW ON, and check that the frequency reads 30.000 MHz. If the frequency is not 30.000 MHz, correct it by the M. SHIFT SW. Adjust L36 in the VCO unit (x50-1550-00) for a voltmeter 8.6V ± 0.02V reading.
3) After item 2 adjustment, touch the M. SHIFT switches

ADJUSTMENTS

UP or DOWN and check that frequency reads 20.020 MHz, and the digital voltmeter reads approx. 1V.

7-1-2 2nd VCO adjustment

1. Instrumets

1) RF VTVM
2) Digital voltmeter
3) Frequency counter
4) High impedance probe

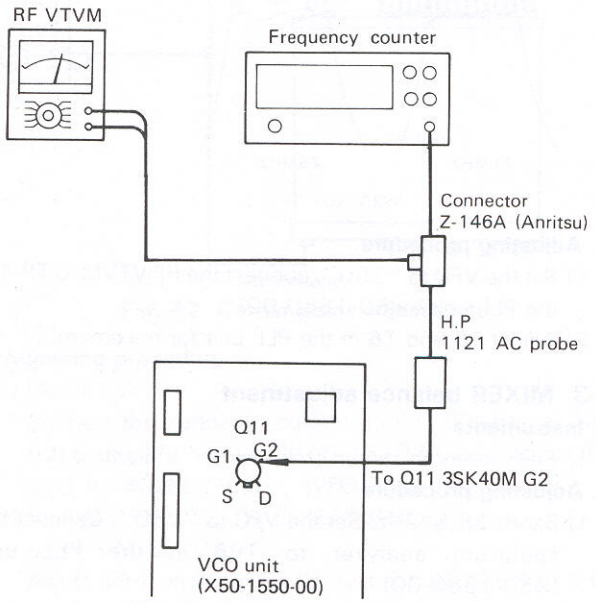


Fig. 45 2nd VCO adjustment

2. Adjusting procedure

1) Connect the frequency counter and RF VTVM to the 2nd gate of Q11 3SK40 (M) in the VCO unit (X50-1550-00).
2) Turn the RCV switch to the VFO position, and check that the frequency reads 7.9700 MHz. Then, adjust L19, L21, L22 in the VCO unit (X50-1550-00) for maximum RF VTVM reading.
3) Connect the frequency counter to the MJ6 terminal in the VCO unit. Connect the digital voltmeter to TP1 in the VCO unit.
4) Turn the RCV switch to the FIX/M RECALL, the FIX/M OUT SW to M1 or "M", and set frequency to read 6.69000 MHz by the M. SHIFT SW (UP or DOWN). Adjust L10 in the VCO unit for a 5.0 V±0.02 V digital voltmeter reading.
5) Set frequency to read 6.000 MHz by the M. SHIFT UP (or DOWN) and check that the voltmeter reads approx. 1.5 V.

7-1-3 VCO Output level adjustment

1. Instrument

1) RF VTVM

2. Adjustment

1) Connect an RF VTVM between the TP-2 terminal on the Premix unit (X50-1570-00) and GND. Set the RCV switch to VFO. With the dial scale set to "250", store the signal in the memory at M.IN. Similarly, set the dial scale to "0" and "500" and store the signal in the memory at each setting.
2) Set the RCV switch to FIX/M RECALL and the knob to "M", then check that the display indicates 250.0. Next, adjust TC1 of the memory unit VCO (X50-1550-00) until the RF VTVM indicates 90 mV± 1 dB.
   Then, set the FIX/M RECALL knob to M' (000.0) and M (500.0) in turn to confirm that there is no output difference.

7-2 Scan speed adjustment

1. Instrument

Not required.

2. Adjustment

1) Store any frequency in the memory. Set the RCV switch to FIX/M RECALL to recall the stored frequency.
2) Set the M. SHIFT lever to UP or DOWN position, and adjust VR1 in the CONTROL unit (X53-1100-00) to obtain the desired speed.

NOTE: The FAST speed is not adjustable. The SLOW speed is factory adjusted to 1/10 of the FAST speed.

WIREHARNESS

Symbol color

BLU: Blue GRY: Gray WHT: White
BRN: Brown ORA: Orange YLW: Yellow
GRN: Green VLT: Violet

Connector No.	Terminal No.	Color	Destination: Connector	Destination: Terminal	Remarks
1	1	GRY/WHT	33	9	10
	2	VLT/WHT	33	8	21
	3	BLU/WHT	33	8	7
	4	GREEN	33	5	3.5
	5	YLW/WHT	33	7	1.8
	6	ORA/WHT	33	10	10
	7	BRN/WHT	101		
	8	RED/WHT	33	6	AU2
	9	WHT	33	4	AU1
	10	GRY	57	6	21
	11	VLT	57	5	14
	12	BLU	57	7	7
	13	GRN/WHT	57	10	3.5
	14	YLW	57	9	1.5
	15	ORA	57	8	10
	16	RED	56	1	AV1
	17	BRN	56	2	AV2
2	1	YLW/WHT	53	4	RTV
	2	RED	7	3	Front panel
3	1	BRN	52	9	IFS
	2	WHT	103		
4	1	WHT	17	2	AF GAIN
	2		17	5	
	3	RED	28		
	4		28	2	
	5	GRN/WHT	31	4	RF GAIN
	6	BLU/WHT	32	6	
	7	VLT	22	11	
	8	BLU	8	16	
5	1	BRN/WHT	57	4	29.5
	2	RED/WHT	57	3	29
	3	ORA/WHT	57	2	28.5
	4	YLW/WHT	57	1	28
6	1	RED	33	2	NBV
	2	BRN	18	10	VOX GAIN
	3		18	9	
	4	GRY	28		
	5		28	8	
7	1	ORA	38	5	UP
	2	GRN	38	4	DWN
	3	RED	3	2	
8	1	ORA	37	9	MI
	2	YLW	37	8	MO
	3	VLT	49	5	DIS
	4	BRN/WHT	53	3	FIF
	5	GRN	100		
	6	BRN	18	3	TO
	7	GRY	18	4	TB
	8	WHT	18	8	TV
	9	RED	31	8	PCV
	10	BLU	29	6	MVE
	11		29	7	MV2
	12	GRN	28		
	13		28	9	MV1
9	1	YLW	106		
	2	GRY	53	2	RTN
	3	VLT	19	2	RIT
	4	GRY/WHT	53	6	RTF
	5	GRN	49	4	DIF
10	1	ORA/WHT	11	8	FXL
	2	YLW	34	7	RGL
	3	VLT/WHT	19	3	VFB
	4	VLT/WHT	11	9	USB
	5	BLU	42	6	PRL
11	1	BRN/WHT	38	7	Function SW
	2	RED/WHT	54	3	
	3	BLU	38	1	
	4	YLW/WHT	38	3	
	5	GRN/WHT	38	2	
	6	BLU/WHT	51	6	RX-SW
	7	GRY/WHT	51	10	TX-SW
	8	ORA/WHT	10	1	Function SW
	9	VLT/WHT	10	4	RX-SW
	10	BLK/WHT	8	14	RX-SW
	11	GRN	8	15	RX-SW
12	1	GRN/WHT	32	7	AGC
	2	YLW	106		14
	3	Coax. cable	35	1	GND
	4		35	2	RIF
	5	GRY/WHT	107		KEY
	6	BLU/WHT	109		−6
	7	WHT	103		RLR
13	1	Coax. cable	58	2	GND
	2		58	1	VCO
14	1	Coax. cable	43	3	GND
	2		43	2	RAA
	3	BRN/WHT	101		8
	4	ORA	34	4	RGC
	5	Coax. cable	30	2	TIF
	6		30	1	GND
15	1	Coax. cable	64	1	INT
	2		64	2	GND
16	1	Coax. cable	43	5	XVT
	2		43	6	GND
	3	GRN	43	1	XVS
	4	YLW	106		14
	5				GND
	6	VLT	111		PC
	7	RED/WHT	21	11	RLT
	8	YLW/WHT	42	5	PRO
	9	BRN	33	3	TG
17	1	RED	23	1	SP
	2	WHT	5	1	AVE
	3		5	2	AV2
	4				GND
	5	ORA	43	9	ANN
	6	BLU	46	6	14A
	7	BLU/WHT	108		RL
18	1	ORA/WHT	22	1	VS
	2	BRN/WHT	101		8
	3	BRN	8	6	TO
	4	GRY	8	7	TB
	5	RED/WHT	102		SS
	6	GRN	28	5	ST
	7	BLU/WHT	21	15	SSB
	8	WHT	8	8	TV
	9	BRN	6	3	VV2
	10		6	2	VVE
19	1				
	2	VLT	9	3	RIT
	3	VLT/WHT	10	3	VFB
20	1	Coax. cable	54	8	OUT
	2		54	9	GND
21	1	BRN	32	4	RLT
	2	RED	52	8	CNT
	3	ORA	52	7	OFS
	4	YLW	53	7	RFS
	5	GRN	102		
	6	BLU	53	8	RCW
	7	VLT	53	9	RFK
	8	GRY	52	11	USB
	9	WHT	56	6	SLS
	10	BRN/WHT	101		
	11	RED/WHT	16	7	RLT
	12	ORA/WHT	52	10	LSB
	13	YLW/WHT	56	5	SVS
	14	GRN/WHT	29	4	SSB
	15	BLU/WHT	18	7	SSB
	16	VLT/WHT	29	3	CWB
	17	GRY/WHT	29	2	CNB
	18	BLK/WHT	29	1	FSB
22	1	ORA/WHT	18	1	VS
	2	RED/WHT	102		
	3	BRN/WHT	31	1	CM2
	4	YLW/WHT	32	10	CM1
	5	GRN/WHT	33	1	NBS
	6	BLU/WHT	34	3	RGB
	7	VLT/WHT	34	5	ATT
	8	GRY/WHT	34	6	AGO
	9	WHT	103		
	10	GRY	31	3	AGO
	11	VLT	5	1	
	12	BLU	32	9	AGS
	13	VLT	32	8	RFB
23	1	RED	17	1	PHONE
	2	BRN	45	9	
	3	RED	43	8	
	4	ORA	28	11	MIC JACK
	5		28	10	
24	1				
	2	GRY	29	5	PMN
	3	WHT	51	1	MCB
	4	RED	51	2	MIP
	5	ORA	42	8	RF
	6	YLW	32	5	LMP
	7	GRN	104		
	8	BLU	59	3	MVV
	9	VLT/WHT	51	8	MCA
	10	GRY/WHT	59	1	MIM
	11	RED/WHT	51	3	M+
	12	ORA/WHT	51	4	M−
	13	YLW	45	7	EXT
	14		45	8	SP
25	1	WHT	41	1	DIODE
	2	BLU	47	1	
	3	RED	40	2	MCB
	4	YLW	40	1	MIP
	5	BLU	51	12	14C
26	1	Coax. cable	52	6	CAR
	2		52	5	GND
27	1	Coax. cable	45	1	GND
	2		45	2	I02
28	1	BLU/WHT	108		RL
	2	RED	5	4	AV1
	3	WHT	44	1	REC
	4		44	2	GND
	5	GRN	18	6	ST
	6	BRN	44	13	STS
	7	GRY/WHT	107		KEY
	8	GRY	6	5	VV1
	9	GRN	8	13	MV1
	10	ORA	23	5	MIE
	11		23	4	MIC
29	1	BLK/WHT	21	18	FSB
	2	GRY/WHT	21	17	CNB
	3	VLT/WHT	21	16	CWB
	4	GRN/WHT	21	14	SSB
	5	GRY	25	2	PMN
	6	BLU	8	10	MVE
	7		8	11	MV2
30	1	Coax. cable	14	6	GND
	2		14	5	TIF
	3				
31	1	BRN/WHT	22	3	CM2
	2	YLW	106		14
	3	GRY	22	10	AGO
	4	GRN/WHT	5	5	RF1
	5	GRN	47	7	RAL
	6	BLU/WHT	109		−6
	7				GND
	8	RED	8	9	PCV
	9	YLW/WHT	43	7	XAL
	10	BRN	42	9	ALC
32	1	GRN	104		MA
	2	BRN/WHT	101		8
	3	WHT	103		RLR
	4	BRN	21	1	RLT
	5	YLW	25	6	LMP
	6	BLU/WHT	5	6	RFG
	7	GRN/WHT	12	1	AGC
	8	VLT	22	13	RFB
	9	BLU	22	12	AGS
	10	YLW/WHT	22	4	CMI
33	1	GRN/WHT	22	5	NBS
	2	RED	6	1	NBV
	3	BRN	16	9	TG

Connector No.	PC Board and Parts Name
1	BAND SWITCH
2	VFO, FIX RIT
3	IF SHIFT VR
4	AF·RF GAIN VR
5	0.5 SHIFT VR
6	VOX GAIN, NB TUNE

Connector No.	PC Board and Parts Name
7	SWITCH UNIT D (X41-1230-00)
8	Relay VR, RF POWER VR, MIC GAIN VR
9	SWITCH UNIT A (X41-1230-00)
10	LED UNIT (X41-1200-00)
11	FIX, MEMORY Rotary SW
12~14	RF UNIT (X44-1280-00)

Connector No.	PC Board and Parts Name
15, 16	COIL PACK UNIT (X44-1290-00)
17, 18	AF·VOX UNIT (X49-1130-00)
19, 20	VFO ASS'Y UNIT (X60-1110-00)
21	MODE SWITCH
22	SWITCH UNIT C (X41-1230-00)

WIREHARNESS

Connector No.	Terminal	Color	Destination: Connector	Destination: Terminal	Remarks
	4	WHT	1	9	AV1
	5	GRN	1	4	3.5
	6	RED/WHT	1	8	AV2
	7	YLW/WHT	1	5	1.8
	8	VLT/WHT	1	2	14
	9	GRY/WHT	1	1	21
	10	ORA/WHT	1	6	10
	11	BLU/WHT	1	3	7
	12	YLW	56	4	U
34	1	Coaxial cable	45	5	L01
	2		45	6	GND
	3	BLU/WHT	22	6	RGB
	4	ORA	14	4	RGO
	5	VLT/WHT	22	7	ATT
	6	GRY/WHT	22	8	AGO
	7	YLW	10	2	RGL
35	1, 2	Coax. cable	12	3, 4	GND, RIF
37	1	VLT	48	12	LTH
	2	BLU	48	10	RST
	3	GRN	48	8	GAT
	4, 5	Coax. cable	54	2, 1	GND, MRO
	6				
	7				
	8	YLW	8	2	M0
	9	ORA	8	1	M1
	10, 11	Coax. cable	55	5, 6	GND, 8M
38	1	BLU	11	3	MS
	2	GRN/WHT	11	5	MS1
	3	YLW/WHT	11	4	MS2
	4	GRN	7	2	DWN
	5	ORA	7	1	UP
	6	WHT	103		RLR
	7	BRN/WHT	11	1	MOS
	8, 9	Coax. cable	54	4, 5	FMR, GND
	10	RED	110		8A
	11	YLW	106		14
	12	BRN	49	8	TT
40	1	YLW	24	4	MIP
	2	RED	24	3	MCB
41	1	WHT	24	1	+
	2	RED	61	1	+
	3	BLK	47	3	GND
	4	BLK	61	2	
	5	BLK	47	4	
	6	BLK	62	2	
42	1, 2	Coax. cable	45	4, 3	GND, RAT
	3	BLU/WHT	108		RL
	4	BRN/WHT	101		8
	5	YLW/WHT	16	8	PRO
	6	BLU	10	1	PRL
	7	YLW	60	1	TAP
	8	ORA	25	5	RF
	9	BRN	31	10	ALC
43	1, 2	Coax. cable	27	1, 2	GND, I02
	3, 4	Coax. cable	42	2, 1	RAT, GND
	5, 6	Coax. cable	34	1, 2	L01, GND
	7, 8	YLW	25	13	
			25	14	
	9	BRN	23	2	
	10	VLT	52	1	FSY
44	1, 2	WHT	28	3, 4	REC, GND
	3	RED/WHT	102		
	4	ORA	51	7	RR
	5	GRY	51	1	RC
	6	VLT	51	11	RT
	7	GRN	31	5	RAL
	8	YLW/WHT	51	2	MCO

Connector No.	Terminal No.	Color	Destination: Connector	Destination: Terminal	Remarks
	9	BRN/WHT	101		
	10	YLW	106		
	11, 12	Coax. cable	54	6, 7	RMT, GND
	13	BRN	28	6	STS
	14	GRY/WHT	107		
45	1	GRN	16	3	XVS
	2, 3	Coax. cable	14	2, 1	RAA, GND
	4	BLU/WHT	108		
	5, 6	Coax. cable	16	1, 2	XVT, GND
	7	YLW/WHT	31	9	XAL
	8	RED	23	3	PHONE
	9	ORA	17	5	ANN
46	1	BLU/WHT	109		−6
	2	RED	110		8A
	3				GND
	4	BRN/WHT	107		8
	5	YLW	106		14
	6	BLU	17	6	14A
47	1	BLU	24	2	14C
	2	RED	62	1	14B
	3	VLT	41	3	E
	4	BLK	41	5	GND
48	1, 2	Coax. cable	55	4, 3	8M, GND
	3				
49	1	RED	110		8A
	2	BRN/WHT	101		8
	3				GND
	4	GRN	9	5	DIF
	5	VLT	8	3	DIS
	6, 7	Coax. cable	52	3, 2	GND, CTR
	8	BRN	38	12	TT
50	1	BRN/WHT	56	12	UL
	2	BLU/WHT	56	8	B0
	3	GRN/WHT	56	9	B1
	4	VLT/WHT	56	10	B2
	5	RED/WHT	56	11	B3
51	1	GRY	44	5	RC
	2	YLW/WHT	44	8	MC0
	3	RED/WHT	25	11	M+
	4	ORA/WHT	25	12	M−
	5	GRN	104		MA
	6	BLU/WHT	11	6	MNC
	7	ORA	44	4	RR
	8	VLT/WHT	25	9	MCA
	9	WHT	25	3	MCB
	10	GRY/WHT	11	7	MNO
	11	VLT	44	6	RT
	12	BLU	24	5	14C
52	1	VLT	45	10	FSY
	2, 3	Coax. cable	49	7, 6	GND, CTR
	4	BRN/WHT	101		8
	5, 6	Coax. cable	26	2, 1	GND, CAR
	7	ORA	21	3	OFS
	8	RED	21	2	CNT
	9	BRN	4	1	IFS
	10	ORA/WHT	21	12	LSB
	11	GRY	21	8	USB
	12, 13	Coax. cable	58	5, 6	GND, PRM
53	1	BLU/WHT	108		RL
	2	GRY	9	2	RTN
	3	BRN/WHT	8	4	FIT
	4	YLW/WHT	3	1	RTV
	5	GRN	100		RSB
	6	GRY/WHT	9	4	RTF
	7	YLW	21	4	RFS
	8	BLU	21	6	RCW
	9	VLT	21	7	RFK

Connector No.	Terminal No.	Color	Destination: Connector	Destination: Terminal	Remarks
54	1, 2	Coax. cable	37	5, 4	MRO, GND
	3	RED/WHT	11	2	FIX
	4, 5	Coax. cable	38	8, 9	FMR, GND
	6, 7	Coax. cable	44	11, 12	RMT, GND
	8, 9	Coax. cable	20	1, 2	VFO, GND
	10				
55	1	RED	110		8A
	2	YLW	106		14
	3, 4	Coax. cable	48	2, 1	GND, 8M
	5, 6	Coax. cable	37	10, 11	GND, 8M
56	1	RED	1	16	AV1
	2	BRN	1	17	AV2
	3				GND
	4	YLW	33	12	U
	5	YLW/WHT	21	13	SVS
	6	WHT	21	9	SLS
	7				GND
	8	BLU/WHT	50	2	B0
	9	GRN/WHT	50	3	B1
	10	VLT/WHT	50	4	B2
	11	RED/WHT	50	5	B3
	12	BRN/WHT	50	1	UL
57	1	YLW/WHT	2	4	28
	2	ORA/WHT	2	3	28.5
	3	RED/WHT	2	2	29
	4	BRN/WHT	2	1	29.5
	5	VLT	1	11	14
	6	GRY	1	10	21
	7	BLU	1	12	7
	8	ORA	1	15	10
	9	YLW	1	14	1.5
	10	GRN/WHT	1	13	3.5
58	1, 2	Coax. cable	13	2, 1	VCO, GND
	3	BRN/WHT	101		8
	4				GND
	5, 6	Coax. cable	52	12, 13	PRM, GND
59	1	GRY/WHT	25	10	MIM
	2	RED	25	4	MIP
	3	BLU	25	8	MVV
60	1	YLW	42	7	THP
	2	VLT	111		PC
61	1	RED	41	2	HVC
	2	BLK	41	4	GND
62	1	RED	47	2	14B
	2	BLK	41	6	GND
63	1	VLT	111		PC
	1, 2	Coax. cable	15	1, 2	INT, GND
64	1	GRN	37	3	CAT
	2	–	–	–	–
	3	BLU	37	2	RST
	4	–	–	–	–
	5	VLT	37	1	LTH
	6	–	–	–	–

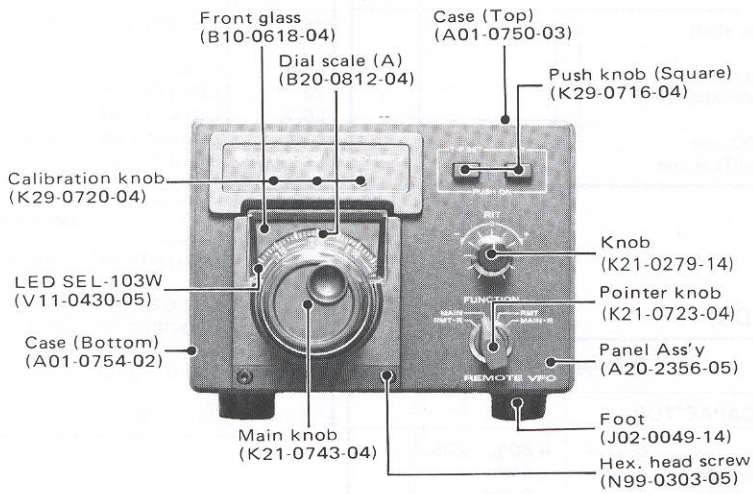
Connector No.	PC Board and Parts Name
23	PHONE, MIC Jack
24	METER SW, METER, SP OUT
25	POWER SW
26~35	IF UNIT (X48-1240-11)
36	NOT USED

Connector No.	PC Board and Parts Name
37, 38	MEMORY ASS'Y UNIT (X60-1090-00)
39	Protection diode
40, 41	POWER Jack
42	LPF UNIT (X51-1180-00)
43~45	Rear panel

Connector No.	PC Board and Parts Name
46, 47	AVR UNIT (X43-1340-00)
48~50	COUNTER ASS'Y UNIT (X60-1100-00)
51~54	PREMIX UNIT (X50-1570-00)
55~58	PLL ASS'Y UNIT (X60-1120-00)
59~63	FINAL ASS'Y UNIT (X60-1130-00)

VFO-180 PARTS LIST

EXTERNAL VIEW

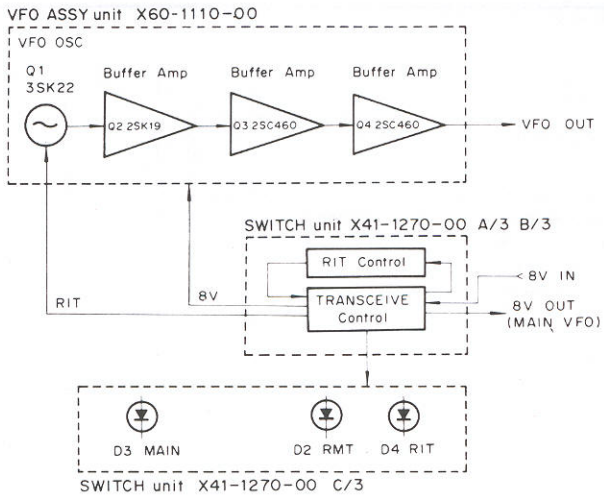


SPECIFICATIONS

Oscillator frequency ..... 6.65 ~ 6.05 MHz
Oscillator circuit ..... Clapp
Output voltage ..... 0.3 V ± 1 dB (across 50-ohm 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: 5
Power source ..... From TS-180S
Dimensions ..... 180(7-1/8)W × 133(5-1/4)H × 287(11-5/16)D mm(inch)
Weight ..... 2.9 kg (6.4 lbs)

* Specifications are subject to change for improvement without notice.

BLOCK DIAGRAM



TOTAL

☆: New Parts

Ref. No.	Parts No.	Description	Remarks
–	A01-0750-03	Case (Top)	
–	A01-0754-02	Case (BOTTOM)	☆
–	A20-2356-05	Panel ass'y	☆
–	A20-2357-03	Panel	☆
–	A23-1435-03	Rear panel	☆
–	B07-0614-03	Indicator grill (T)	☆
–	B07-0619-03	Indicator grill (K) (W)	☆
–	B46-0058-00	Warranty card (K)	
–	B50-2661-00	Operating manual (K) (W)	☆
–	B51-2662-00	Operating manual (T)	☆
–	E06-0852-05	8P DIN socket	
–	E21-0007-05	Screw terminal	
–	E31-2016-05	1P Cable	☆
–	J02-0049-14	Foot × 6	☆
–	J32-1030-14	Round boss × 2	
–	J61-0019-05	Vinyle tie	
–	K21-0279-14	Knob	
–	K21-0723-04	Pointer knob	
–	K29-0716-04	Push knob × 2	
–	H01-2636-04	Carton case (K) (W)	☆
–	H01-2637-04	Carton case (T)	☆
–	H10-2523-02	Front packing fixture	
–	H10-2525-02	Rear packing fixture	☆
–	H20-0276-03	Protective cover	
–	H25-0117-04	Plastic bag 80 × 250	
–	N09-0608-05	Self tapping flat head screw × 2	☆
–	N99-0303-05	Hex. head screw × 2 (M4 × 10)	
–	X41-1270-00	SWITCH unit	☆
–	X60-1110-00	VFO ASS'Y unit	☆

VFO ASS'Y unit (X60-1110-00)

Ref. No.	Parts No.	Description	Remarks
–	B01-0618-15	Dial escutcheon	☆
–	B10-0618-04	Front glass	☆
–	B20-0812-04	Dial scale A	☆
–	B20-0813-14	Dial scale B	☆
–	B30-0809-05	Pilot lamp 12V 40 mA	☆

VFO-180 PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
—	D21-0811-24	Dial shaft	☆
—	K21-0743-04	Main knob	☆
—	K29-0720-04	Calibration knob	☆
—	X40-1140-00	VFO unit	☆
—	X41-1270-00	SWITCH unit	☆

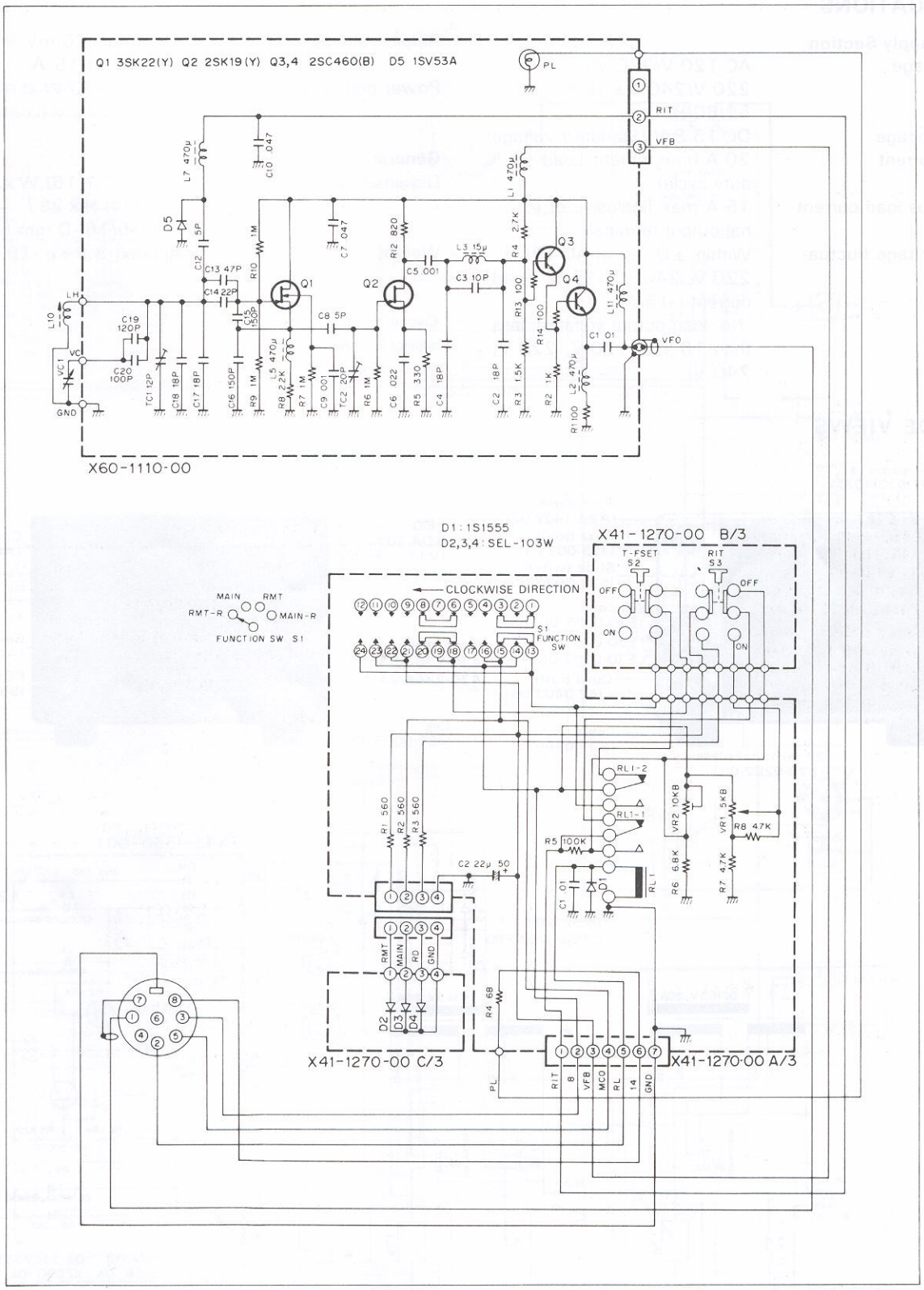
VFO UNIT (X40-1140-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%,−20%	
C2	CC45SL1H180J	Ceramic 18pF ±5%	
C3	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C4	CC45SL1H180J	Ceramic 18pF ±5%	
C5	CK45B1H102K	Ceramic 0.001μF ±10%	
C6	CK45F1H223Z	Ceramic 0.022μF +80%,−20%	
C7	C91-0456-05	Ceramic 0.047μF 25V	
C8	CC45CH1H050C	Ceramic 5pF ±0.25pF	
C9	CK45B1H102K	Ceramic 0.001μF ±10%	
C10	C91-0456-05	Ceramic 0.047μF 25V	
C12	CC45RG1H050C	Ceramic 5pF ±0.25pF	
C13	CC45LG1H470J	Ceramic 47pF ±5%	
C14	CC45LG1H220J	Ceramic 22pF ±5%	
C15,16	CC45LG1H151J	Ceramic 150pF ±5%	
C17	CC45PG1H180J	Ceramic 18pF ±5%	
C18	CC45RG1H180J	Ceramic 18pF ±5%	
C19	CC45LG1H121J	Ceramic 120pF ±5%	
C20	CC45CG1H101J	Ceramic 100pF ±5%	
C11 NOT USED			
		RESISTOR	
R1～14	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
Q1	V09-0020-05	FET 3SK22 (Y)	
Q2	V09-0011-05	FET 2SK19 (Y)	
Q3,4	V03-0079-05	Transistor 2SC460 (B)	
D5	V11-4161-36	Vari-cap diode 1SV53A	
D1～4		Not used	
		VC/TRIMMER/COIL	
VC1	C02-0017-05	Variable capacitor	☆
TC1	C05-0305-05	Trimmmer 12pF	
TC2	C05-0013-15	Trimmer 20pF	
L1,2	L40-4711-03	Ferri-inductor 470μH	
L3	L40-1501-03	Ferri-inductor 15μH	
L5,7,	L40-4711-03	Ferri-inductor 470μH	
L10	L32-0612-05	Oscillating coil	☆
L11,101	L40-4711-03	Ferri-inductor 470μH	
L4,6,8,9 NOT USED			
		MISCELLANEOUS	
—	B42-1645-04	Indicating plate	
—	D22-0405-05	Coupling	
—	D40-0607-05	Dial mechanism	☆
—	E13-0163-05	1P pin jack	
—	J32-0732-04	Spacer	

SWITCH UNIT (X41-1270-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%, −20%	
C2	CE04W1A220	Electrolytic 22μF 10V	
		RESISTOR	
R1～8	RD14CB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
D1	V11-0370-05	Diode 1S1555	
D2～4	V11-0430-05	LED SEL-103W	
		POTENTIOMETER	
VR1	R01-2404-05	5kΩ (B) RIT	
VR2	R12-3025-05	10kΩ (B)	
		SWITCH	
S1	S29-1410-05	Slide rotary switch	
S2	S40-2409-15	Push switch T.F. set	
S3	S40-2404-05	Push switch RIT	
		MISCELLANEOUS	
RL1	S51-2408-05	Relay	

VFO-180 SCHEMATIC DIAGRAM



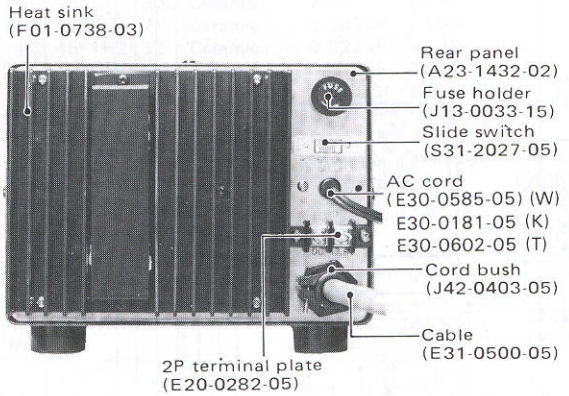
PS-30

SPECIFICATIONS

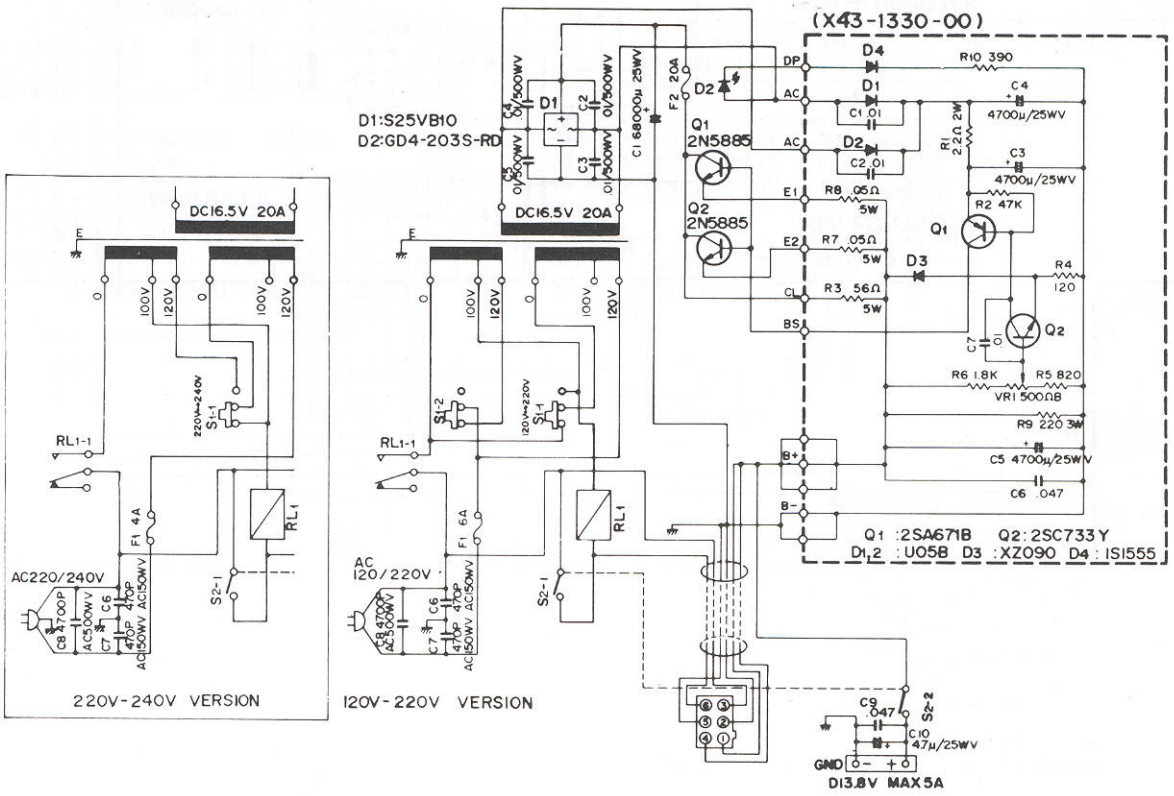
Power Supply Section	
Input voltage	AC 120 V/220 V or 220 V/240 V ± 10 %, 50/60 Hz
Output voltage	DC 13.8 V (Standard voltage)
Output current	20 A (intermittent Load 50 % duty cycle)
Continuous load current	15 A max (inclusive of external output terminal)
Output voltage fluctuation	Within ± 0.7 V at AC 120 V, 220 V, 240 V ± 10 % (Load current : 15 A) (No. load output voltage : less than 16 V at 120 V, 220 V, 240 V)
Ripple voltage	Less than 20 mV (rms), output current 15 A
Power consumption	Approx. 470 W at AC 120 V, 220 V, 240 V (Load current : 20 A)
General	
Dimensions	180 (7''-1/16) W × 133 (5''-1/4) H × 287 (11''-5/16) D mm (inch)
Weight	Approx. 8.9 Kg (19.6 lbs)

Curcuit design and ratings are subject to change for improvement without notice.

OUTSIDE VIEWS







PS-30/SP-180 PARTS LIST

GENERAL

PS-30

Ref. No.	Part No.	Description	Remarks
		GENERAL	
C1	C90-0813-05	Electrolytic 68000μF 25V	☆
C2~5	CK45E2H103P	Ceramic 0.01μF +100%−0%	
C6,7	C90-0300-05	Ceramic 470pF AC150V	
C8	C90-0412-05	Ceramic 4700pF AC500V	
C9	CK45F1H473Z	Ceramic 0.047μF +80%−20%	
C10	CE04W1E4R7	Electrolytic 4.7μF 25V	
Q1,2	V08-1012-06	Transistor 2N5885	☆
D1	V11-1365-06	Diode S25VB10	☆
—	V11-7260-56	LED GD4-203S-RD	
—	S31-2027-05	Slide switch	
—	S36-2402-05	Seesaw switch Power	
RL1	S51-1406-05	Releay	☆
—	A01-0746-12	Case (upper)	☆
—	A01-0755-02	Case (lower)	☆
—	A20-2363-03	Front panel (T)	☆
—	A20-2364-03	Front panel (K)(W)	
—	A23-1432-02	Rear panel (K)	☆
—	A23-1433-02	Rear panel (W)(T)	
—	B46-0058-00	Warranty card (K)	
—	B50-2652-10	Operating manual (K)(W)	☆
—	B50-2656-00	Operating manual (T)	☆
—	E20-0282-05	2P Terminal plate	
—	E22-0207-05	Lug plate	
—	E30-0181-05	AC cord with plug (K)	
—	E30-0585-05	AC cord with plug (W)	
—	E30-0602-05	AC cord (T)	
—	E31-0500-05	Power cord with plug	☆
—	F01-0738-03	Heat sink	☆
—	F05-2035-15	Fuse (20A)	☆
—	F05-6021-05	Fuse (6A) × 2 (K)	
—	F05-4022-05	Fuse (4A) × 2 (W)(T)	
—	H01-2624-04	Carton case (inside) (K)(W)	☆
—	H01-2625-04	Carton case (inside) (T)	☆
—	H03-1711-04	Carton case (outside) (T)	☆
—	H03-1712-04	Carton case (outside) (K)	☆
—	H03-1726-04	Carton case (outside) (W)	☆
—	H10-2523-02	styren foam cushion (F)	☆
—	H10-2524-02	Styren foam cushion (R)	☆
—	H12-0455-04	Cushion	☆
—	H20-0413-03	Protective cover	☆
—	H25-0029-04	Protective bag 60 × 110	
—	J02-0049-14	Leg × 6	
—	J13-0033-15	Fuse holder	
—	J19-0509-04	LED holder	
—	J32-1030-14	Round boss × 2	
—	J41-0006-05	Cord bush (K)	
—	J41-0024-15	Cord bush (W)(T)	
—	J42-0403-05	Cord bush (W)(T)(K)	
—	J61-0019-05	Vinyle tie	
—	L01-8066-15	Power transformer	☆
—	X43-1330-00	AVR unit	☆

AVR Unit (X43-1330-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1,2	CK45F1H103Z	Ceramic 0.01μF +80,−20%	
C3~5	C90-0814-05	Electrolytic 4700μF 25V	☆
C6	CK45F1H473Z	Ceramic 0.047μF +80,−20%	
C7	CK45F1H103Z	Ceramic 0.01μF +80,−20%	
R2~10	RD14BB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
R1	RS14GB3D2R2J	Metal film 2.2Ω ±5% 2W	
R3	R92-0622-05	Cement 56Ω 5W	☆
R7,8	R92-0619-05	Cement 50mΩ 5W	☆
R9	RS14GB3F221J	Metal film 220Ω ±5% 3W	
VR1	R12-0042-05	Semi fixed resistor 500Ω(B)	
		SEMICONDUCTOR	
Q1	V01-0139-05	Transistor 2SA671TDB	
Q2	V03-0183-05	Transistor 2SC733(Y)	
D1,2	V11-0270-05	Diode U05B	
D3	V11-4167-06	Zener diode XZ-090	
D4	V11-0076-05	Diode 1S1555	

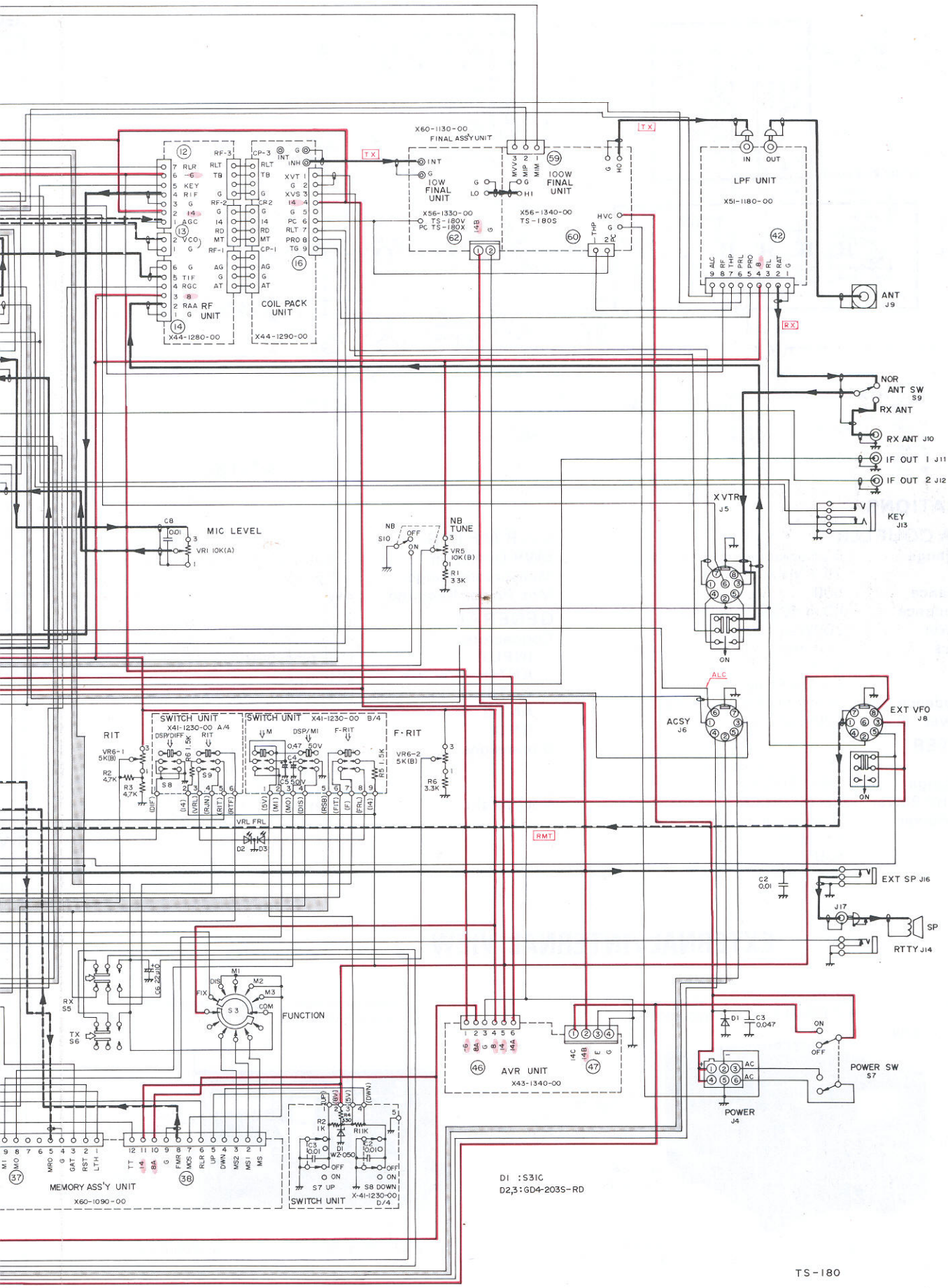
SP-180

TOTAL

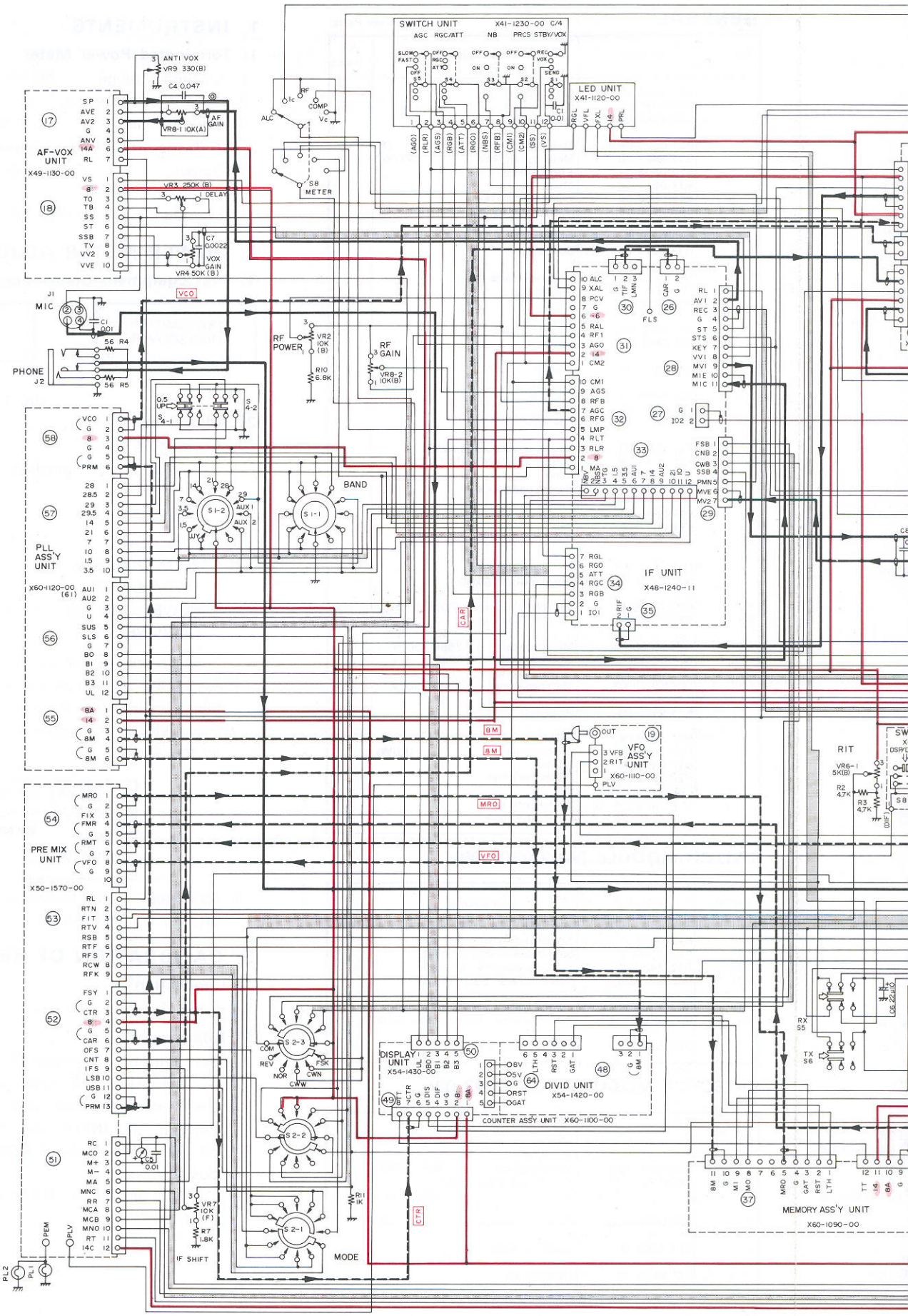
☆: New Parts

		RESISTOR	
R1	RS14AB3D8R2J	Solid 8.2Ω ±5% 2W	
R2	RD14BB2E101J	Carbon 100Ω ±5% 1/4W	
		FILTER/SWITCH	
L1	L79-0443-25	Filter	
S1	S42-3401-05	Push switch	☆
S2	S40-2414-05	Push switch	☆
		MISCELLANEOUS	
—	A01-0750-03	Case (TOP)	☆
—	A01-0751-02	Case (BOTTOM)	☆
—	A20-2358-05	Panel (T)	☆
—	A20-2359-15	Panel (K) (W)	☆
—	B46-0058-00	Warranty card (K)	
—	B50-2664-00	Operating manual (K) (W)	☆
—	B50-2665-00	Operating manual (T)	☆
—	E11-0404-05	Headphone jack	☆
—	E12-0001-05	Phone plug	
—	E13-0361-05	3P pin jack	
—	E14-0101-05	1P pin plug × 2	
—	G53-0509-04	Packing × 6	
—	G53-0502-04	Packing × 2	
—	H01-2630-04	Carton case (K)(W)	☆
—	H01-2631-04	Carton case (T)	☆
—	H10-2523-02	Front packing fixture	
—	H10-2525-02	Rear packing fixture	
—	H20-0276-03	Protective cover	
—	H25-0049-03	Plastic bag	
—	K29-0716-04	Push knob × 4	
—	T06-0011-05	Speaker	

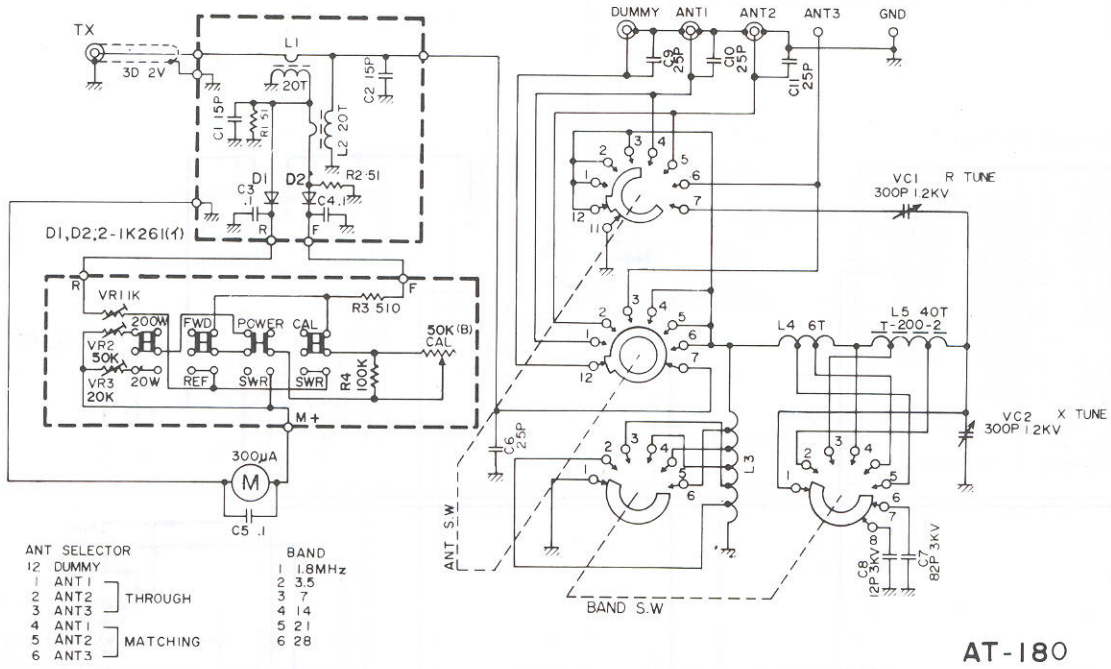
EMATIC DIAGRAM



SCHEMATIC DIAG



AT-180/SCHEMATIC DIAGRAM/SPECIFICATIONS



AT-180

SPECIFICATIONS

ANTENNA COUPLER

Frequency Range ..... 6 amateur bands from 1.8 to 29.7 MHz
Input Impedance 50Ω
Output Impedance ..... 50 to 500Ω, unbalanced
Through Power ..... 200W at max.
Insertion Loss ..... Less than 0.5 dB in matched state
PL ..... 1.8 MHz only
Output Impedance ..... 20 to 500Ω, unbalanced
Through Power ..... 100W at max.

WATTMETER

Type ..... Through-line wattmeter
Frequency Range ..... 1.8 to 30 MHz
Measurable RF Power ... Up to 20/200W, switched
Kinds of RF Power ..... Forward or reflected power, switched.
Impedance 50Ω
Accuracy ..... Better than ±10% of full scale

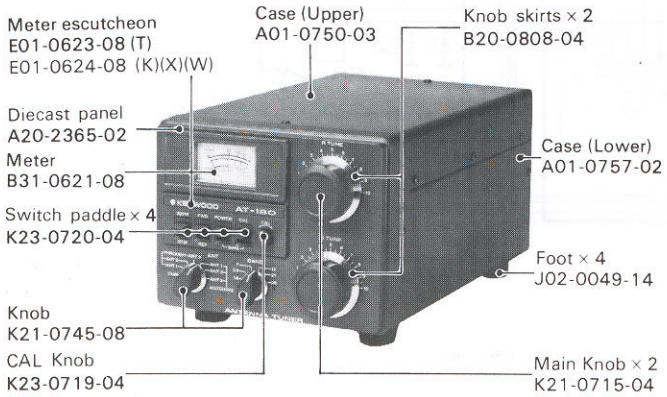
SWR METER

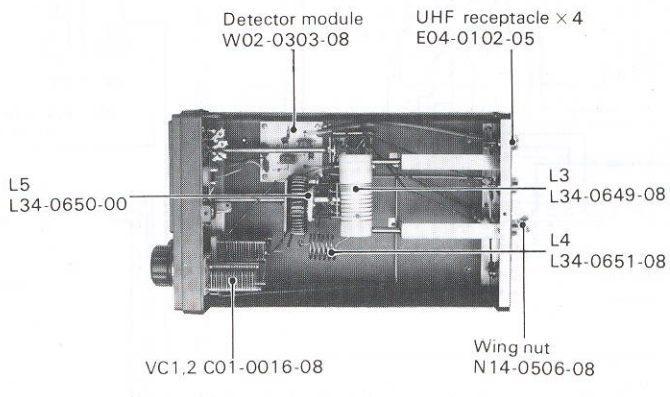
SWR Detection ..... Toroid core direction coupler
Measurable Range ..... 1.1 to 10
Min. Power Required 4W

GENERAL

Connectors
INPUT ..... UHF type, 50Ω
ANT-1 ..... UHF type
ANT-2 ..... UHF type
ANT-3 ..... Stud and wing nut
GND
Dimensions ..... W 166 mm (6-17/32")
H 153 mm (6")
D 190 mm (7-1/2")
Net Weight ..... 2.8 kg (6.2 lbs.) approx.

EXTERNAL/INTERNAL VIEW





PARTS LIST ADJUSTMENT

GENERAL

☆ : New Parts

Ref. No.	Parts No.	Description	Re-marks
	A01-0750-03	Case (Upper)	☆
	A01-0757-02	Case (Lower)	☆
	A20-2365-02	Diecast panel	☆
	B01-0623-08	Meter escutcheon (T)	☆
	B01-0624-08	Meter escutcheon (K) (W)	☆
	B20-0808-04	Knob skirts	
	B31-0621-08	Meter	☆
	B46-0058-00	Warranty card (K)	
	B50-2678-08	Operating manual	☆
	D23-0061-04	Bearing × 2	
	D32-0018-04	Shaft stopper	
	E04-0102-05	UHF receptacle × 4	
	E23-0015-04	Ground lug	
	E23-0408-05	Terminal × 2	
	F09-0402-05	Insulating cover	
	F29-0402-05	Insulator	
	G13-0621-04	Cushion	
	J02-0049-14	Foot × 6	
	J32-1034-04	Round boss × 2	
	J32-0714-04	Hex. boss × 2	
	K21-0715-04	Main knob × 2 R.X. TUNE	
	K21-0745-08	Knob × 2 BAND. ANT	
	K23-0719-04	Knob CAL	
	K23-0720-04	Switch paddle × 4	
L3	L34-0649-08	Coil	
L4	L34-0651-08	Coil	
L5	L34-0650-08	Coil	
	S01-2418-08	Rotary switch ANT	☆
	S01-2419-08	Rotary switch BAND	☆
VC1,2	C02-0016-08	Variable capacitor 300pF 1.2kV	☆
C5	CK45F1H104Z	Ceramic capacitor 0.1μF +80%, −20%	
C6	FM05ZC250J5	Mica capacitor 25pF 500V	
C7	C91-0419-05	Ceramic capacitor 82pF 3kV	
C8	C91-0420-05	Ceramic capacitor 12pF 3kV	
C9 ~ 11	FM05ZC250J5	Mica capacitor 25pF 500V	
	N14-0506-08	Wing nut × 2	
	H01-2648-08	Packing case (T)	
	H01-2649-08	Packing case (K)(W)	
	H12-0464-08	Cushion	
	H20-0372-04	Protective cover	
	W02-0302-08	Switch module	☆
	W02-0303-08	Detector module	☆

SWITCH MODULE (W02-0302-08)

Ref. No.	Parts No.	Description	Re-marks
VR1	R12-1024-05	Semi-fixed resistor 1kΩ (B)	
VR2	R12-4020-05	Semi-fixed resistor 50kΩ (B)	
VR3	R12-3420-08	Semi-fixed resistor 20kΩ (B)	
VR4	R05-3407-08	Potentiometer 50kΩ (B) CAL	
R3	RD14BB2E511J	Carbon resistor 510Ω ±5% 1/4W	
R4	RD14BB2E104J	Carbon resistor 100kΩ ±5% 1/4W	
	S36-2026-15	Paddle switch × 4	

DETECTOR MODULE (W02-0303-08)

Ref. No.	Parts No.	Description	Re-marks
C1,2	FM05ZC150J5	Mica capacitor 15pF 500V	
C3,4	CK45F1H104Z	Ceramic capacitor 0.1μF +80%, −20%	
R1,2	RD14BB2E510J	Carbon resistor 51Ω ±5% 1/4W	
D1,2	V11-7763-26	Diode 2-1k261 × 2	
L1,2	L39-0403-08	Detector coil	

1. INSTRUMENTS

1) Terminated Power Meter

1. Frequency range: 50 MHz or more
2. Input impedance: 50Ω
3. Power range: 20W and 200W

2) HF Transmitter or Transceiver

1. Output: 100W CW
   Variable to 10W.
   Example: TS-180, TS-820S

2. POWER METER ADJUSTMENT

1) Test Equipment Connection

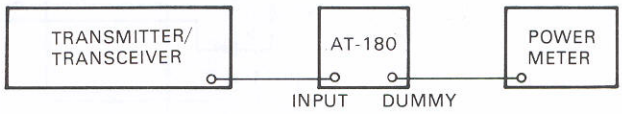


Fig. 1

2) Adjustment

1. Connect as in Fig. 1.
2. Unless otherwise specified, controls should be set as follows:

ANT SW	DUMMY
BAND SW	14
200W/20W SW	200W
FWD/REF SW	FWD
POWER/SWR SW	POWER
CAL/SWR SW	SWR

   Tune up the transceiver at 14.175 MHz.
3. Adjust the transceiver for 100W output at the power meter (adjusted by the carrier level control).
   Adjust VR2 on the switch unit for a meter reading of 100 on the AT-180.

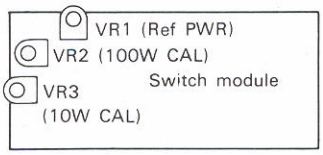


Fig. 2

4. As in step 3, lower transceiver output to 10W and adjust VR3 for a meter indication of 10 on the 20W scale.

3. CALIBRATION OF REF POWER

1) Connection

As in Fig. 1.

2) Adjustment

1. Set controls as described in 2.2.
   Confirm 100W CW output reading.
2. Unkey the transceiver and reverse the coaxial cables between the INPUT and DUMMY terminals on the AT-180. Move the FWD/REF switch to the REF position.
3. Transmit and adjust VR1 for previously confirmed 100W reading.

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