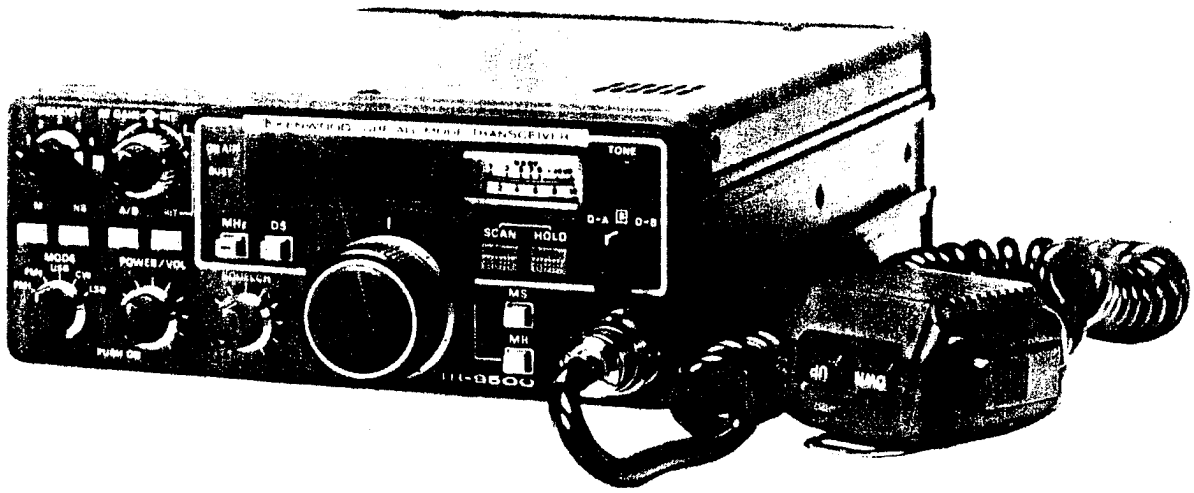
KENWOOD®

SERVICE MANUAL

TR-9500



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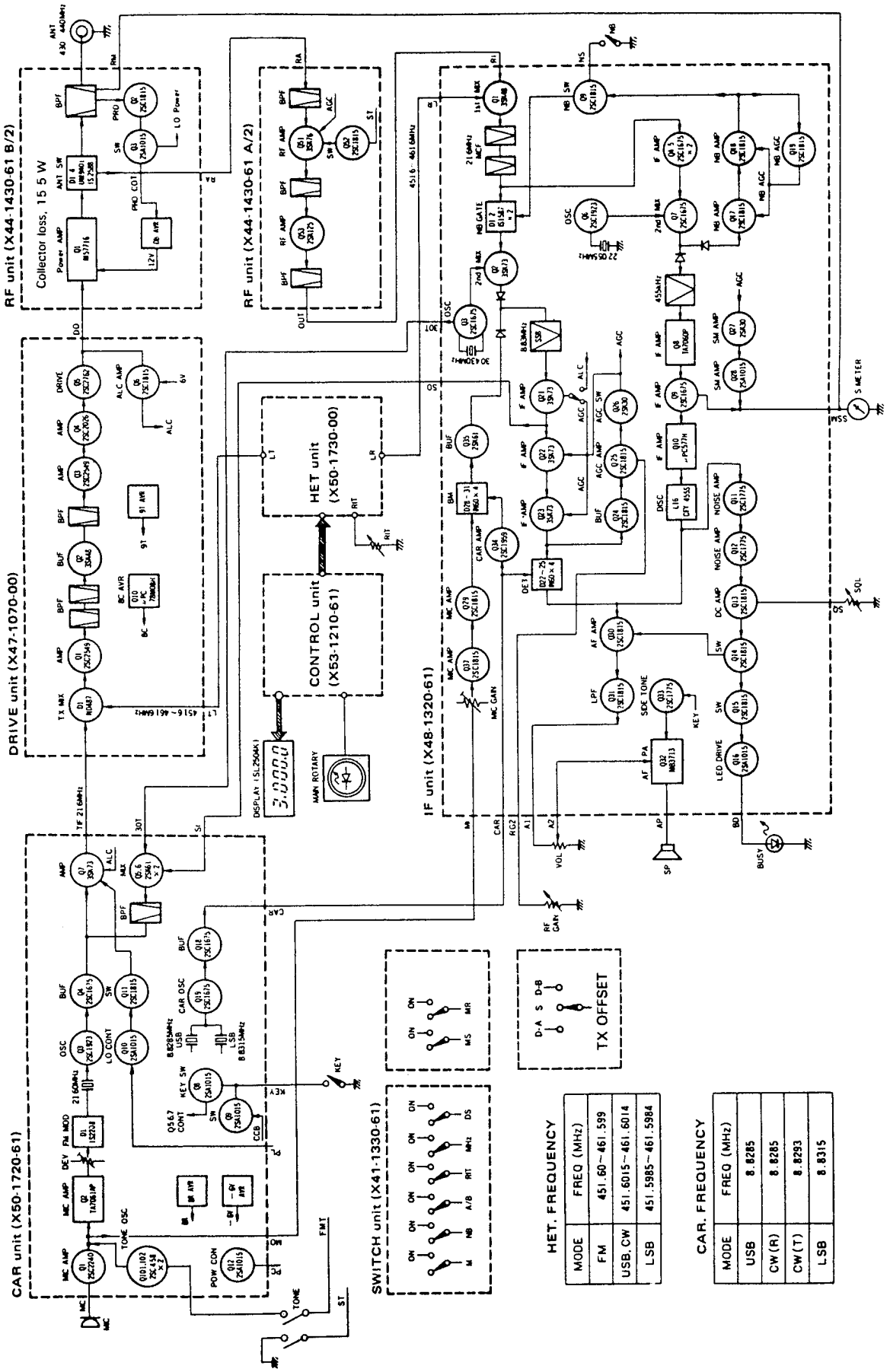
UHF ALL MODE TRANSCEIVER

BLOCK DIAGRAM(W)



CIRCUIT DESCRIPTION

RECEIVER CIRCUIT

The antenna signal is input to the front end (RF unit A/2) through the diode switch in the final unit (RF unit B/2). The front end is comprised of a two-stage RF amplifier consisting of a dual gate MOS FET (Q51 : 3SK76), a junction FET (Q53 : 2SK125) and a helical resonator with a bandwidth of 10 MHz.

The signal amplified in the front end is then applied to the IF unit. The IF unit has a first mixer (Q1 : 3SK48) followed by a two-stage monolithic filter (MCF), providing high sensitivity and superior two signal characteristics.

The first 21.6 MHz IF signal output from the MCF is applied to both the SSB circuit and the FM circuit.

In the SSB circuit, the SSB signal, after passing through the NB gate, is converted to 8.83 MHz with 2nd mixer Q2, then applied to the crystal filter (YK-88S). The signal is then amplified with IF amplifier Q21 (which is also used for transmission) and IF amplifiers Q22 and Q23 and is demodulated into an audio signal with a ring demodulator.

In the NB circuit, the noise signal is converted into a 455 kHz signal with 2nd mixer Q7, then amplified with the 2-stage amplifier consisting of Q17 and Q18 (2SC1815(Y)) to switch the NB gate.

The signal is picked up from the last stage of the IF amplifier (Q23), then detected and amplified to generate the AGC voltage. The AGC time constant is automatically set according to the mode : FAST for CW; SLOW for SSB. The AGC voltage is applied to IF amplifiers Q21, Q22 and Q23 (3SK73(GR)) and RF amplifier Q51. It is also used to drive the S meter.

In the FM circuit, the FM signal is converted into a 455 kHz IF signal with 2nd mixer Q7, then applied to the IF amplifier through the ceramic filter (CFW 455C). The IF signal is amplified with Q8 (TA7060P), Q9 (2SC1675(L)) and Q10 (μPC577H), then is demodulated.

In the squelch circuit, the noise signal is amplified with Q11 and Q12 (2SC1775(E)) and then rectified with D9 and D10 to switch Q13 thru Q16 ON and OFF so that AF amplifier Q30 and the BUSY indicator are switched ON and OFF. The Q16 output signal is also fed to the control unit (X53-1210-XX) as the scan stop siganl (SS). The scan stop signal (SS) is applied to pin 4 of microprocessor Q12 in the control unit.

In every mode, the demodulated AF signal is amplified with AF amplifier Q30 (2SC1815(Y)), filtered with active L.P.F. Q31 (2SC1815(Y)) and applied to power amplifier Q32 (MB3713) through the AF gain control to drive the speaker.

Item	Rating
Nominal center frequency (*fo*)	21.6 MHz
3 dB bandwidth	*fo* ±7.5 kHz or more
Attenuation bandwidth	*fo* ±25 KHz or less at 40 dB *fo* ±45 kHz or less at 60 dB
Guaranteed attenuation	70 dB or more within *fo* ±1 MHz 80 dB or more within *fo* ±(910 kHz ±20 kHz)
Spurious	35 dB or more within *fo* to *fo* + 500 kHz
Ripple	1.0 dB or less
Loss	2.0 dB or less
Input and output impedance	1 kΩ//1pF

Table 1 MCF (L71-0227-05) XF1 (A), (B)

Item	Rating
Center frequency (*fo*)	8830 kHz
Center frequency deviation	Within ±150 Hz at 6 dB
Pass bandwidth	±1.2 kHz or more at 6 dB
Attenuation bandwidth	±1.5 kHz or less at 20 dB ±2.2 kHz or less at 60 dB ±3 kHz or less at 80 dB
Ripple	2 dB or less
Loss	6 dB or less
Guaranteed attenuation	80 dB or more within *fo* ±1 MHz
Input and output impedance	600Ω//15pF

Table 2 Crystal filter (L71-0208-05) XF2 YK-88S

Item	Rating
Nominal center frequency	455 kHz
6 dB bandwidth	±7.5 kHz or more
50 dB bandwidth	±15 kHz or less
Ripple (within 455 ±5 kHz)	3 dB or less
Loss	6 dB or less
Guaranteed attenuation (within 455 ±100 kHz)	35 dB or more
Input and output impedance	1.5 kΩ

Table 3 Ceramic filter (L72-0316-05) CF1, CWF455E

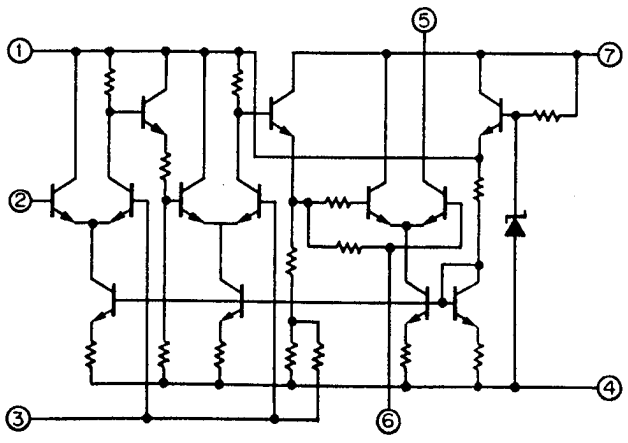


Fig. 1 μPC577H Equivalent circuit

CIRCUIT DESCRIPTION

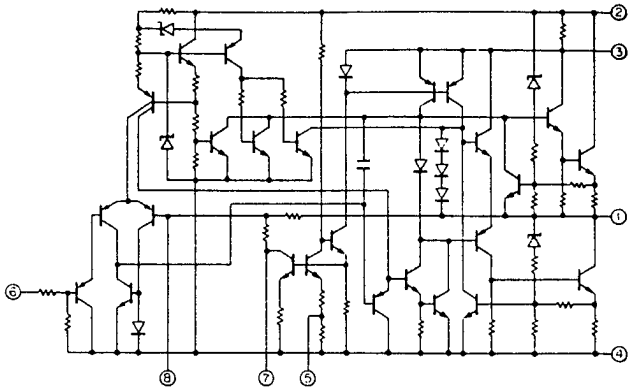


Fig. 2 MB3713 Equivalent circuit

TRANSMITTER CIRCUIT

The microphone signal is amplified with microphone amplifier Q1 (2SC2240(GR)), which is commonly used for both SSB and FM transmission modes and is incorporated in the carrier unit (X50-1720-XX). The amplified signal is then fed to both the SSB and FM circuits.

The microphone signal for SSB transmission is applied to microphone amplifiers Q37 and Q29 (2SC1815(Y)) through MIC GAIN control VR6 in the IF unit (X48-1320-61). Then, the microphone signal is applied to the balanced modulator (BM) along with the carrier (8.83 MHz). The resultant DSB signal is bufferred by buffer amplifier Q35 (2SK61(GR)) then filtered by crystal filter XF2 to generate the SSB signal. The SSB signal is amplified with Q21 (3SK73(GR)) and applied through terminal SO to the transmitter balanced mixer consisting of Q5 and Q6 (2SK61(GR)) in the carrier unit to obtain the 21.6 MHz SSB signal. Unnecessary spurious signals accompanying the SSB signal are reduced by the 4-stage BPF, then the SSB signal is amplified with Q7 (this amplifier is used for all modes).

The microphone signal for FM transmission is applied to limiting amplifier Q2 (TA7061AP) in the carrier unit. Then, the signal directly frequency modulates the 21.60 MHz signal generated by oscillator Q3 (2SC1923(O)) through D1 (1S2208). The 21.6 MHz FM signal is amplified by buffer amplifier Q4 (2SC1675(L)), then amplified by Q7 (3SK73(GR)) which is also used for amplifying the SSB signal.

The signal amplified by Q7 is fed to the drive unit (X47-1070-00) through terminal TIF. In the drive unit, the 21.6 MHz signal is mixed with the signal supplied from the HET unit (through terminal LT) to generate the 430 MHz signal. The 430 MHz signal is amplified by Q1 (2SC2549) and Q2 (2SK48) with accompanying spurious signals reduced by the 2-pole, 3-stage helical resonator, then is amplified by Q3 (2SC2549), Q4 (2SC2026) and Q5 (2SC 2762) and fed to the final unit (RF unit B/2) (X44-1430-61) through terminal DO.

In the final unit, the signal is first amplified by power module Q1 (M57716), then fed to the antenna through the B.P.F. M57716 provides stable performance, since its power idle current, intermodulation-distortion-product (IMD) and frequency response are appropriately designed. The drive unit output signal is also applied to Q6 (2SC 1815(Y)) to generate the ALC voltage. The ALC voltage is supplied to the 2nd gates of IF amplifiers Q21 in the IF unit and Q7 in the carrier unit through the ALC terminals.

Protective operation and HI/LOW switching for FM and CW modes are achieved by varying the source voltage of IF amplifier Q7 in the carrier unit and the voltage applied to terminal 3 of the power module. For CW keying, the B+ line connected to the transmitter balanced mixer consisting of Q5 and Q6 and IF amplifier Q7 in the carrier unit is switched with Q8 (2SA1015(Y)).

Item	Symbol	Tc (°C)	Rating
Operating voltage	V_{CC}	25	17V
Base bias voltage	V_{BB}	25	10V
DC current	I_{CC}	25	6A
Operating case temperature	Tc (op)	–	−30~+110°C
Storage temperature	T_{stg}	–	−40~+110°C

Table 4 Power module M57716 Max Rating

Item	Symbol	Tc (°C)	Condition	Rating MIN	Rating TYP
Output power	Po	25	V_{CC1} = V_{CC2} = 12.5 V, V_{BB} = 9 V	18.5 W	19 W
Total efficiency	ηT	25	f = 430~440 MHz, Pin = 0.2 W	40 %	42 %
Power gain linearity	Gp	25	V_{CC1} = V_{CC2} = 12.5 V, V_{BB} = 9 V f = 430~440 MHz, Pin = 10 dBm	21 dB	

Table 5 Power module M57716

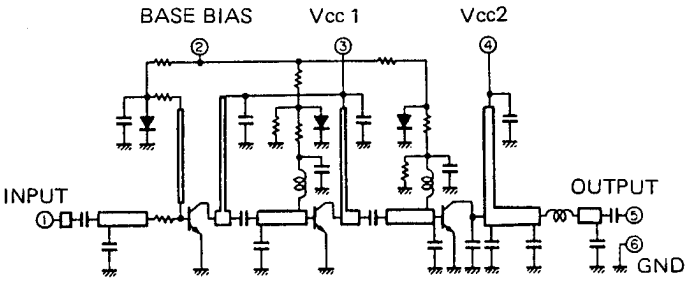


Fig. 3 Power module M57716 Equivalent circuit

CIRCUIT DESCRIPTION

HET CIRCUIT (X50-1730-00)

The 122-127 MHz signal generated by the VCO formed of Q12 (2SK19(GR)) is buffered and amplified by Q13 (2SC1923(O)) and Q17 (3SK73(GR)), then mixed with the 116.5 MHz signal by Q22 (2SC1923(O)) to generate the 5.5-10.49 MHz signal. The 116.5 MHz signal is generated by multiplying the 12.9444 MHz signal output by Q23 (2SC 1675(L)) by 9 with D7 (1SS99). The 5.5-10.49 MHz signal is amplified with Q21, Q20 (2SC1675(L) x 2) and Q19 (2SC2603(E)), then applied to pin 9 of Q18 (TC9125P), which divides the frequency into 10 kHz according to the frequency dividing data applied to pins 4-8 through terminals PL through PD from the control unit and phase-compares the 10 kHz signal obtained with the reference frequency to generate the VCO control signal. The VCO control signal output from pin 14 of Q18 is applied to the low pass filter consisting of Q10 and Q11 (2SC2240(GR) x 2), then is applied to vari-cap diode D6 (1SV50S) to control the VCO frequency.

The DC signal level which is generated in the control unit (X53-1210-XX) and is applied to vari-cap diode D8 (1SV 50S) through terminal HCV to vary the frequency output by Q23 within a range of 0-9.9 kHz.

The RIT control voltage is also applied to D8 to vary the frequency.

The signal supplied from the control unit through terminal HL is used to select either the high band or low band crystal. The signal oscillated by Q1 (2SC1923) is tripled by Q2 (2SC1675(L)) then tripled again by Q5 (2SC1923(O)) to obtain the 330 MHz signal. The 330 MHz signal is amplified by Q6 (2SC2549) and mixed with the 120 MHz signal from the PLL by D3 (ND487) to generate a 450 MHz signal.

The 450 MHz signal is amplified by Q7, Q8 (2SC2026 x 2) and Q9 (2SC2549) and spurious elements are reduced by the 2-stage helical resonator. The resultant frequency range is 451.6 MHz~461.6 MHz, and is output through terminals LR and LT.

CONTROL CIRCUIT (X53-1210-XX)

Indicator

A 5-digit LED display is used as the indicator. BCD code data appearing at the D port (pins 8 thru 11) of microprocessor Q12 is converted into drive signals by 7-segment driver Q11 (SN74LS247N) to drive Q13 through Q19 (2SA1115). The digit signals output from ports E and F (pins 12~16) of Q12 turn Q22 through Q26 (2SC1959(Y)) ON in order to light each LED digit.

The signals output from ports C3 (pin 5) and F2 (pin 18) of Q12 drive Q21 and Q27 (2SC1815(Y)), then Q20 and Q28 (2SC1015(Y)) to turn the 100 Hz and MHz digit dots ON and OFF.

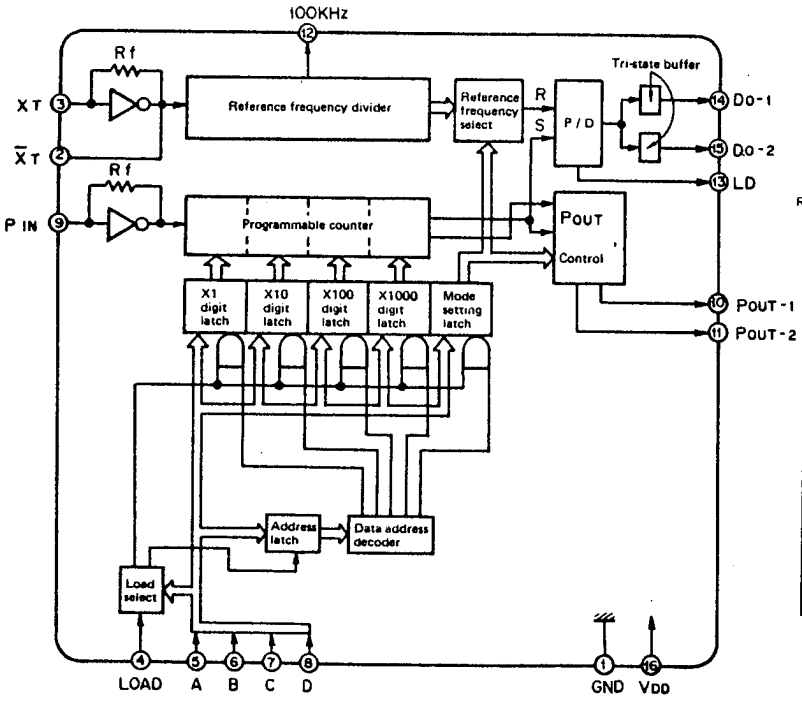


Fig. 4 TC9125P Block diagram

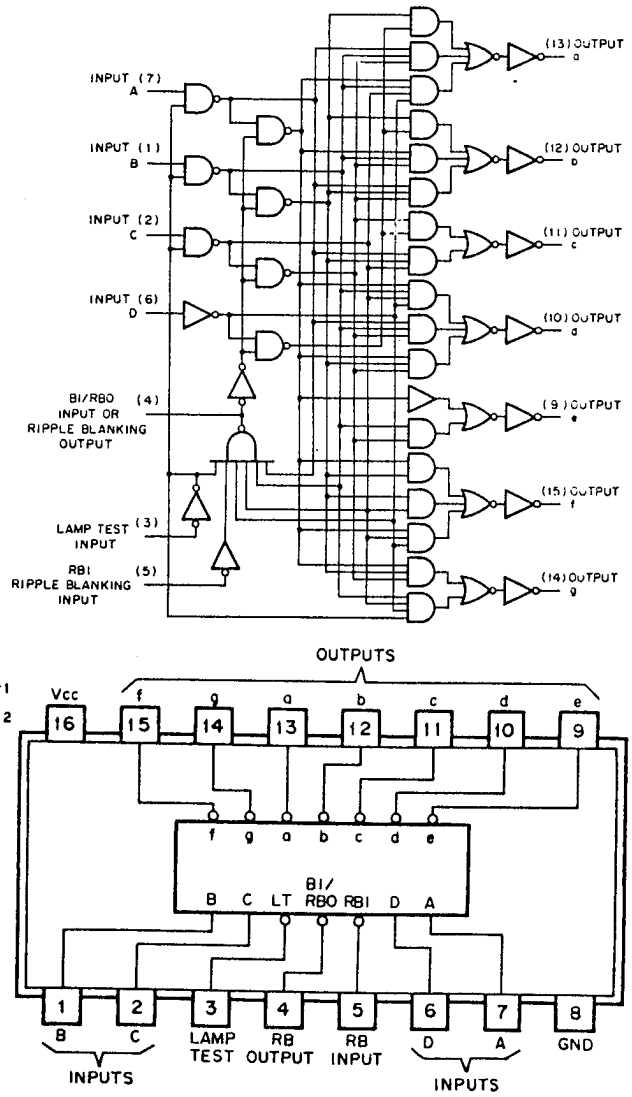
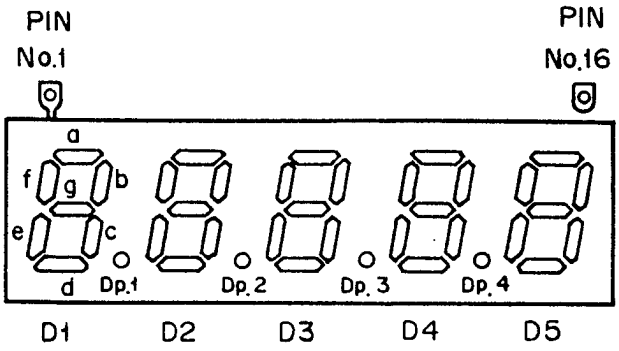


Fig. 5 SN74LS247N

CIRCUIT DESCRIPTION



Pin No.	Address	Pin No.	Address
1	D5 Cathode	9	g Anode
2	D4, Dp4 Cathode	10	b Anode
3	D3, Dp3 Cathode	11	a Anode
4	D2, Dp2 Cathode	12	f Anode
5	D1, Dp1 Cathode	13	Dp4 Anode
6	e Anode	14	Dp3 Anode
7	d Anode	15	Dp2 Anode
8	c Anode	16	Dp1 Anode

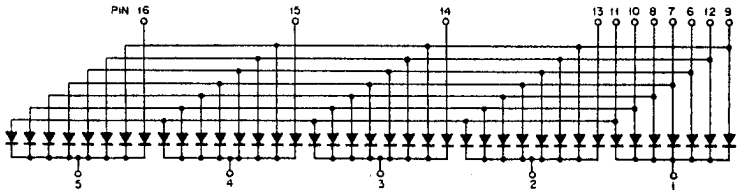


Fig. 6 5 digit LED SL-2504K

Symbol	Terminal name	Explanation
IN1~IN4	Input terminal	Input terminals for 4 bit data
AO1~AO4	Output terminal	Outputs data latched by clock pulse CKA
BO1~BO4	Output terminal	Outputs data latched by clock pulse CKB
CKA	Clock A terminal	Clock signal for latching 4-bit input signal in 4-bit flip flop A. Input signal is latched at the rising of clock signal.
CKB	Clock B terminal	Clock signal for latching 4-bit input signal in 4-bit flip flop B. Input signal is latched at the rising of clock signal.

Table 6 Functions of MN1201A

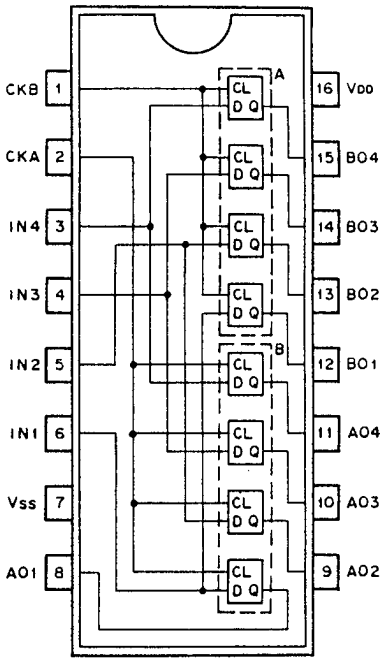


Fig. 7 MN1201A Block diagram

Data for HET circuit

Data output to the HET circuit is the frequency dividing data (output through terminals PL~PD), the 100 Hz and 1 kHz data (the DC signal output through terminal HCV) and the crystal selection data (output through terminal HL). The 100 Hz and 1 kHz data output from G port (pins 22~25) of microprocessor Q12 are latched in dual latch Q10 (MN1201A). The latch output data are converted into a DC signal by the D/A converter consisting of resistors R49 through R57, and the DC voltage is output to the HET circuit through terminal HCV.

The frequency dividing data is 550 when 0.00 is displayed in the FM mode and 1040 when 4.90 is displayed in the FM mode. This data is output only when the frequency varies.

Shifting the frequency for the USB and LSB modes is performed by the microprocessor so that the following relationships are kept.

$f_{USB} = f_{FM} + 1.5\,kHz$ $\quad f_{LSB} = f_{FM} - 1.5\,kHz$

Reset circuit

Lambda diode D7 (MA522(Q)) is used to detect the power supply voltage : when the power supply voltage exceeds the valley voltage (about 3.5 V) of the lambda diode, the diode is OFF and Q6 (2SA1015(Y)) is ON so that an "L" level signal is applied to the reset terminal (pin 7) of the microprocessor to reset it.

CIRCUIT DESCRIPTION

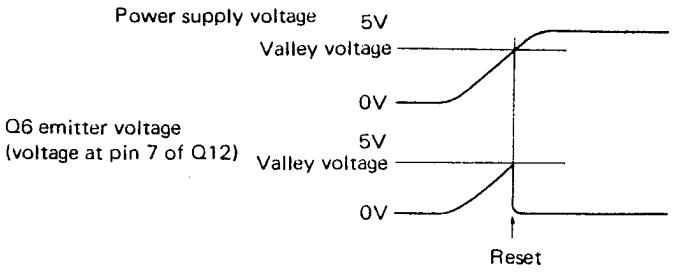


Fig. 8-A Reset timing

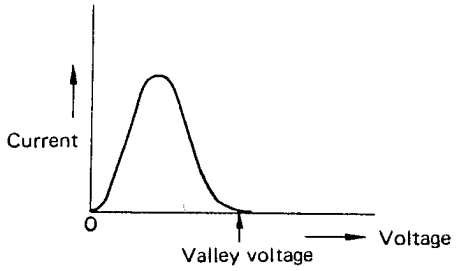


Fig. 8-B Lambda diode characteristics

Switching circuit

Switches are scanned using the signals output from ports E and F (pins 12 through 16) of the microprocessor and the input terminals (B port : pins 37 through 40) to determine if the switch circuit is ON ; various functions are performed according to the scanning result.

The E and F port output signals are kept from being output by Q29 through Q33 (2SA1115(Y)) during transmission to improve the S/N ratio of the transmitted signal. Many diodes (1S1555) are used to prevent the control pulse signals from entering the wrong circuits.

Power supply for the control circuit

There are three power supply circuits incorporated in the control unit : one for the LED display (5V), consisting of Q9 (μPC78M05H) ; one for back-up, consisting of Q1 (2SC1815(Y)) ; and one for the microprocessor, consisting of Q5 (2SC496(Y)).

When power is fed to the power connector with the power switch OFF, the back-up power supply operates to maintain the microprocessor memory. At this time, all ports are at the "L" level and the power consumption is minimum. When the power switch is ON, the other power supply circuits operate and the back-up power supply is turned off by the control signal from the microprocessor.

Encoder and UP/DOWN inputs

Fig. 9 shows the output signal from the encoder (50 steps per rotation). This signal is used to discriminate UP and DOWN counts within the microprocessor. The UP counts starts when U/D is H level at the down edge of the clock signal, and the DOWN count when U/D is L level.

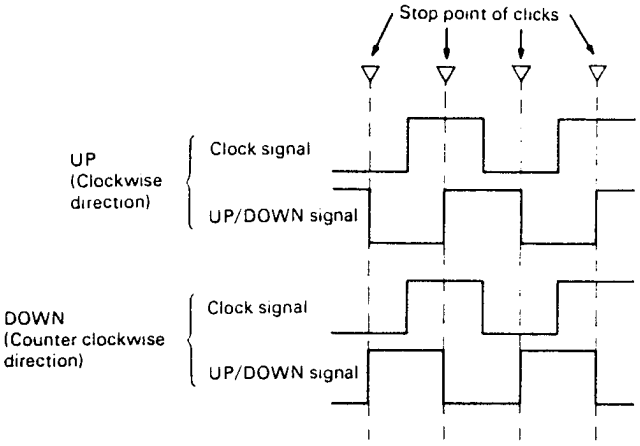


Fig. 9

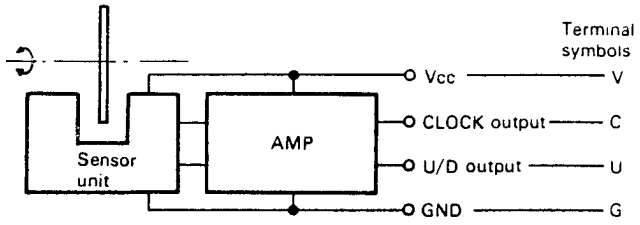


Fig. 10 Rotary encoder

Tone oscillator circuit

When the output for the microprocessor tone oscillator is H level, Q7 (2SC1815(Y)) is energized, allowing a current to flow into the piezo-electric buzzer oscillator, Q8 (2SC1815(Y)), producing a tone.

Repeater shift and tone circuit

Type	Shift SW markings	Shifted freq.	Tone circuit
W	D–A	–7.6 MHz	1750 Hz tone circuit
	D–B	–1.6 MHz	
T	⊕	+1.6 MHz	1750 Hz tone Burst circuit
	⊖	–1.6 MHz	
X	D–A	–5 MHz	None
	D–B	–1.6 MHz	

Table 7 Repeater shift and tone circuit

CIRCUIT DESCRIPTION/OPTION (LSB CRYSTAL)

Pin No.	Terminal name	Input signal	Output signal	Description	Pulse
1	CL1			Clock signal, 400 kHz	
2	PC0	O		L during reception and H during transmission in the FM1 and FM2 modes	
3	PC1	O		BACK UP detection, normally H ; L during back-up operation	
4	PC2	O		Squelch signal : normally L ; H when squelch is open in the FM1 and FM2 modes	
5	PC3		O	100 Hz digit dot signal : L in modes FM1 and FM2 and H in the USB, CW and LSB modes	
6	$\overline{INT}$	O		Normally H	
7	RES	O		Normally L ; the microprocessor is reset when the level changes from H to L.	
8	PD0		O	BCD data output signals for display	O
9	PD1		O		O
10	PD2		O		O
11	PD3		O		O
12	PE0		O	1 MHz digit signal for display — Matrix scanning signal output terminals; used in conjunction with PB terminals	O
13	PE1		O	100 kHz digit signal for display	O
14	PE2		O	10 kHz digit signal for display	O
15	PE3		O	1 kHz digit signal for display	O
16	PF0		O	100 Hz digit signal for display	O
17	PF1		O	Normally H ;L during back-up operation	

Pin No.	Terminal name	Input signal	Output signal	Description	Pulse
18	PF2		O	1 MHz digit dot signal : normally H	
19	PF3		O	Tone oscillator signal output	O
20	TEST	O		Normally 5V	
21	Vcc			5 V DC	
22	PG0		O	BCD data output for MN1201 (D/A converter)	O
23	PG1		O		O
24	PG2		O		O
25	PG3		O		O
26	PH0		O	Data output for TC9125P in the HET unit (normally L ; a pulsed signal is output when the frequency is changed).	O
27	PH1		O		O
28	PH2		O		O
29	PH3		O		O
30	PI0		O		O
31	PI1		O	HET unit L33 and L34 switching signal (L33 is selected at L and L34 at H.)	
32	PI2		O	Normally L ; H during transmission in the FM1 and FM2 modes	
33	PA0	O		Rotary encoder clock signal input	
34	PA1	O		Rotary encoder UP/DOWN signal input	
35	PA2	O		Normally L ; H when the MIC UP SW is pressed	
36	PA3	O		Normally L ; H when the MIC DOWN SW is pressed	
37	PB0	O		Matrix scanning signal input terminals : used in conjunction with the PE terminals	O
38	PB1	O			O
39	PB2	O			O
40	PB3	O			O
41	Vss			Grounded	
42	CL0			Clock signal, 400 kHz	

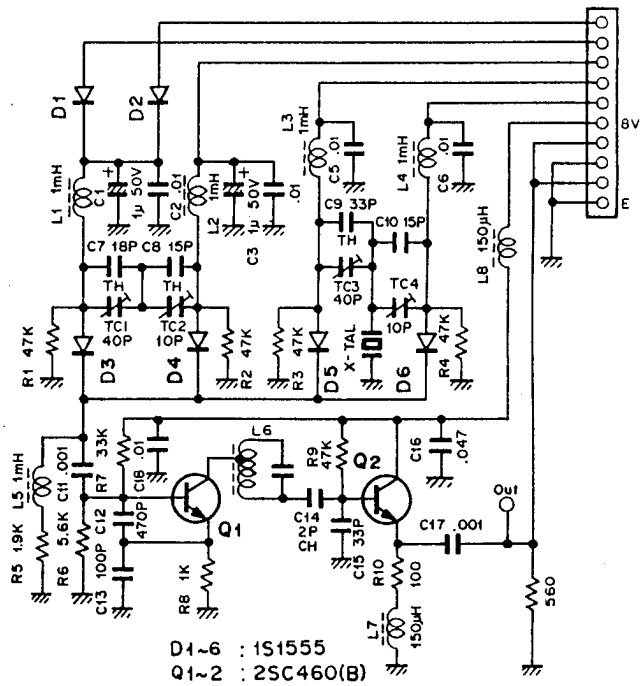
Table 8 μPC650C-093 Terminal function

LSB Crystal Specifications

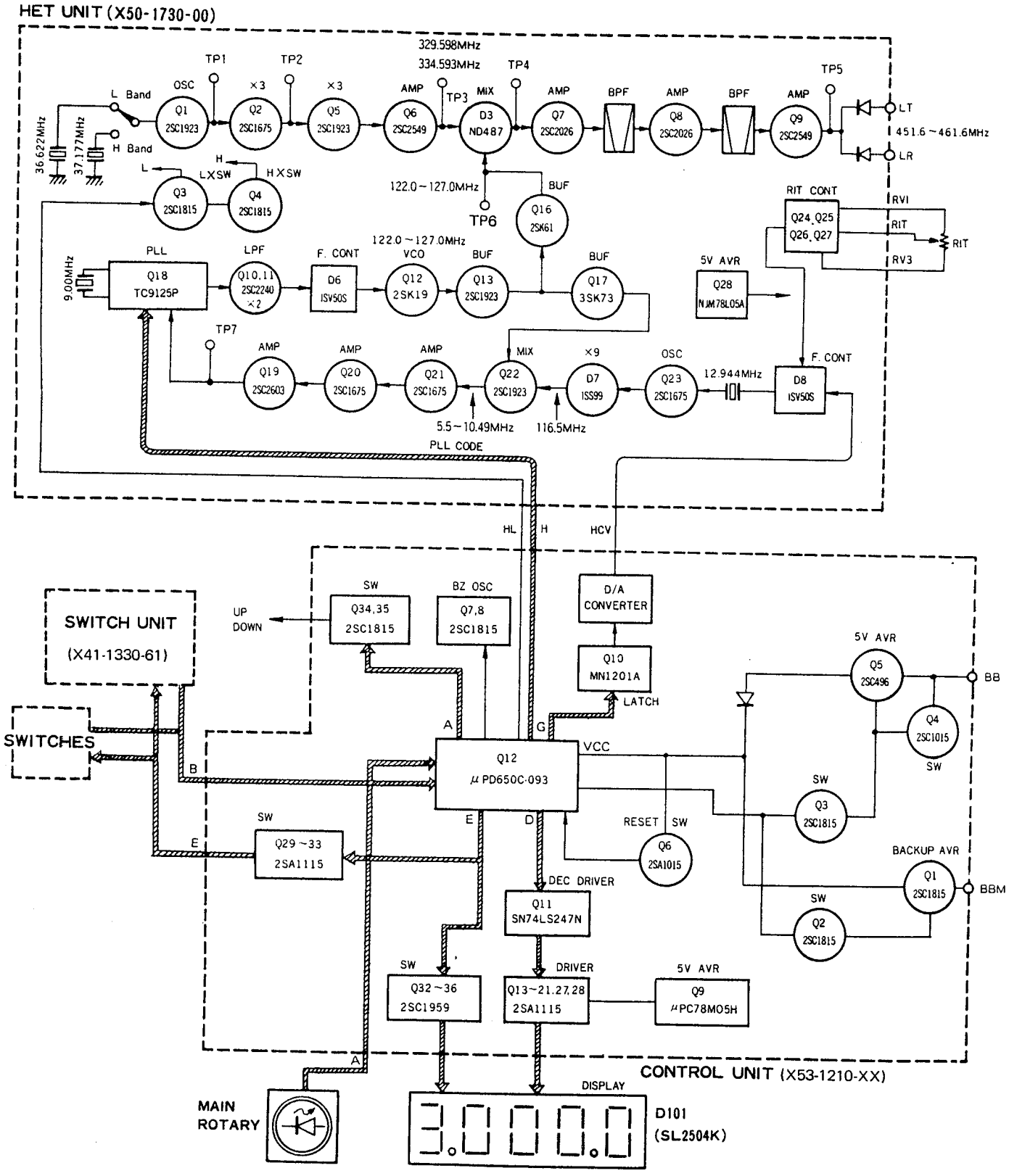
1. Type — HC-18/T (lead length 20 m/m)
2. Oscillation — Fundamental
3. Frequency & Part No.

Frequency	Part No.
8.8293 MHz	L77-0932-05

4. Frequency Stability — Within ±2 x 10^{-6} at 25°C
5. Output Voltage — 0.4 Vrms
6. Oscillator Circuit — Shown at right



PLL BLOCK DIAGRAM



PARTS LIST

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

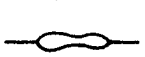
Note 2:
Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the P.C. board illustration. Resistors 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



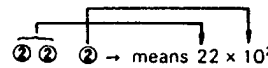
RD14BY
RD14BB (small size)

RD14CY
RD14CB (small size)

2. Wattage

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

3. Resistance value



② ② ② → means 22 × 10^2 = 2200Ω (2.2 kΩ)

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

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

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

Type II

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

4 = Voltage rating
5 = Value
6 = Tolerance

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

1st word (Color)	C (Black)	L (Red)	P (Orange)	R (Yellow)	S (Green)	T (Blue)	U (Violet)
ppm/°C	0	−80	−150	−220	−330	−470	−750

Ex. **CC45TH** = −470 ±60 ppm/°C

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

3 = CK45 ○
Ceramic capacitor (type II) 3

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

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

6 = Tolerance

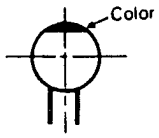
Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 −20	+80 −20	+100 −0	More than 10 μF −10 ~ +50 Less than 4.7 μF −10 ~ +75

Less than 10 pF

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

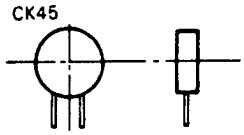
Abbreviation		Abbreviation	
Cap.	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

CC45



Type I

CK45



Type II

TR-9500 SEMICONDUCTOR

☆: New parts

Item	Name	Parts No.	Remarks
Diode	1N60	V11-0051-05	
	1S1555	V11-0076-05	
	1S1587	V11-0370-05	
	1S2588	V11-0414-05	
	1SS99	V11-1277-86	☆
	MA522(Q)	V11-1173-46	
	ND487C1-3R	V11-1277-96	☆
	U05B	V11-0270-05	
	UM9401	V11-7778-16	☆
	V06B	V11-0219-05	
Vari-cap diode	1S2208	V11-0317-05	
	1SV50S	V11-1260-36	

Item	Name	Parts No.	Remarks
Zener diode	WZ-032	V11-4172-26	
	XZ-057	V11-4176-76	
	XZ-060	V11-4101-20	
	XZ-070	V11-4161-96	
	XZ-090	V11-4167-06	
Varistor	1S1212	V11-1262-06	
	MV-13	V21-0004-05	
	VD1223	V11-1262-46	
Thermistor	D33A	V11-3161-86	

PARTS LIST

Item	Name	Parts No.	Re-marks
LED	PR5532K	V11-7272-36	
	PY5532K	V11-7272-46	
	SL-2504 K	V11-6178-36	☆
	SLP144B	V11-6172-56	
	SLP244B	V11-6172-66	
TR	2SA1012(O)	V01-1012-16	☆
	2SA1012(Y)	V01-1012-26	☆
	2SA1015(Y)	V01-1015-06	
	2SA1115(D)	V01-1115-26	
	2SA1115(E)	V01-1115-16	
	2SC458(B)	V03-0093-05	
	2SC460(B)	V03-0079-05	
	2SC496(Y)	V03-0336-05	
	2SC1675(L)	V03-1675-10	
	2SC1775(E)	V03-1775-06	
	2SC1815(Y)	V03-1815-06	
	2SC1923(O)	V03-1923-06	
	2SC1959(Y)	V03-1959-06	
	2SC2026	V03-2026-06	
	2SC2240(GR)	V03-2240-06	
	2SC2549	V03-2549-06	
	2SC2603(D)	V03-2603-26	
	2SC2603(E)	V03-2603-06	
	2SC2762	V03-2762-06	☆
Power module	M57716	V30-1235-16	☆
FET	2SK19(GR)-TRIO5	V09-1001-16	
	2SL30A(GR)	V09-0060-05	
	2SK30A(O)	V09-0056-05	
	2SK61(GR)	V09-1014-06	
	2SK125	V09-0136-10	
	3SK48	V09-1003-16	
	3SK73(GR)	V09-1002-46	
	3SK76-O	V09-1012-16	☆
IC	MB3713	V30-1233-16	☆
	MN1201A	V30-1008-66	
	NJM78L05A	V30-1149-06	
	SN74LS247N	V30-1030-56	
	TA7060P	V30-0087-05	
	TA7061AP	V30-0039-05	
	TC9125P	V30-1232-16	☆
	μPC577H	V30-0177-05	
	μPC78M05H	V30-1223-16	
	μPC78M08H	V30-1222-16	
Micro-processor	μPD650C-093	V30-1234-16	☆

Ref. No.	Parts No.	Description	Re-marks
	TR-9500 GENERAL		
	A01-0798-03	Case (upper)	☆
	A01-0799-02	Case (lower)	☆
	A13-0612-02	Angle ass'y (right)	
	A13-0613-02	Angle ass'y (left)	
	A13-0614-04	Angle (top)	
	A20-2424-03	Panel	☆
	B01-0636-02	Panel escutcheon T	☆
	B01-0637-02	Panel escutcheon W	☆
	B01-0638-02	Panel escutcheon X	☆
	B03-0513-14	Switch mask (B) x 4 13 x 13mm	
	B03-0518-04	Switch mask x 4 7 x 10mm	
	B05-0712-14	Grill cloth Case (lower) 30 x 148mm	
	B05-0713-04	Grill cloth Case (upper) 32 x 32 mm	
	B05-0714-04	SP grill cloth 64 x 80 mm	
	B07-0635-03	Side escutcheon x 2	☆
	B10-0640-04	Front glass	☆
	B30-0821-05	Pilot lamp 8 V, 70mA	☆
	B31-0631-05	Meter	☆
	B50-2795-00	Operating manual W	☆
	B50-2796-00	Operating manual T	☆
	B50-2797-00	Operating manual X	☆
	E06-0651-05	6P male socket MIC	
	E07-0651-05	6P metal plug MIC	
	E12-0001-05	Phone plug (accessary)	
	E12-0401-05	STBY plug (accessary)	
	E23-0015-04	Lug terminal x 2 (LED)	
	E29-0412-05	1P connector (male)	
	E29-0413-05	1P connector (female)	
	E30-1649-05	DC cord ass'y with 5A fuse	
	E31-0456-05	Connector with lead (SP)	
	E31-2088-05	Cable with terminal	☆
	E40-0773-05	Mini connect wafer 7P	
	F05-5022-05	Fuse 5A	
	F15-0622-04	Shadow mask Meter	
	F15-0627-04	Shadow mask LED	
	F15-0635-04	Cushion (meter)	☆
	F20-0078-05	Insulating sheet Q101	
	F29-0014-05	Shoulder washer Q101	
	G02-0505-05	Knob spring RIT	
	G09-0417-04	Gnd spring (A) HET	☆
	G13-0608-04	Cushion (A) Case (upper) 85 x 138mm	
	G13-0644-04	Cushion	☆
	G53-0510-04	Packing Case (lower) 10 x 184mm	
	H01-2745-03	Carton case (inside) T	☆
	H01-2746-03	Carton case (inside) W, X	☆
	H10-2501-03	Packing fixture	
	H10-2528-22	Packing fixture	
	H25-0049-03	Accessary bag	
	H25-0079-04	Protective bag MIC	
	H25-0103-04	Protective bag Cord	
	H25-0106-04	Protective bag	

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
	J02-0069-05	Foot x 2	
	J02-0416-04	Foot (accessary)	
	J25-2714-14	PC board MODE	
	J25-2716-24	PC board SCAN	
	J25-2744-04	PC board TX OFFSET	
	J25-3023-04	PC board M ch, MS	☆
	J31-0514-04	Spacer collar HI/LOW	
	J32-0198-14	Hex. boss x 7 L=17 mm	
	J32-0753-04	Hex. boss L=28 mm	☆
	J42-0409-04	Knob bushing	
	J61-0019-05	Vinyle tie	
	K21-0749-03	Main knob	
	K21-0750-04	Knob (C) RF GAIN	
	K23-0727-04	Knob (A) x 2 MODE, M.CH	
	K23-0728-04	Knob (B) SQL	
	K23-0729-04	Knob (D) RIT	
	K23-0733-04	Knob (E) TX OFFSET	
	K23-0742-04	Knob VOL	
	K27-0408-04	Push knob (A) x 4 M, NB, A/B, RIT	
	K27-0409-04	Push knob (B) x 2 SCAN, HOLD	
	K27-0416-05	Knob x 3 DS, MR, MS	
	K27-0425-05	Push knob (F) MHz	☆
	K29-0733-04	Push knob (C) TONE, H/L	
	N09-0008-04	Ornamental screw Angle	
	N09-0256-05	Gnd screw	
	N13-0307-04	Ornamental nut AF GAIN	☆
	N14-0510-04	Flange nut x 4 Angle	
	N14-0512-05	Speed nut x 4	
	N15-1040-46	Flat washer x 4 Angle	
	N15-1060-46	Flat washer x 4 Angle	
	N16-0060-46	Spring washer x 4 Angle	
	N30-2004-46	Round screw MS	
	N30-2604-46	Round screw x 11	
	N30-3004-46	Round screw x 6	
	N30-3005-46	Flat screw x 10	
	N30-3006-46	Round screw Tr	
	N33-2606-45	Round flat screw x 4 SP	
	N33-3006-45	Round flat screw x 16	
	N35-3004-46	Bind screw x 13	
	N35-3006-46	Bind screw x 13	
	N87-3006-46	Self tapping screw x 13	
	N89-3005-46	Bind tapping screw x 2 Lug terminal	
	N99-0304-04	Hex. head screw x 4 Angle	
R103	RS14AB3A121J	Metal film 120Ω 1W	
VR101	R05-3412-05	Pot. 10kΩ(K) AF GAIN (with SW)	☆
VR102	R01-4409-05	Pot. 50kΩ(B) SQL	☆
VR103,104	R19-3406-05	Pot. 10kΩ(B) x 2 RF GAIN, RIT	
	S01-1421-05	Rotary switch TX OFFSET	
	S01-2421-05	Rotary switch MODE	
	S01-2430-15	Rotary switch M. CH	☆
	S40-1401-05	Push switch MS	
	S40-2403-05	Push switch TONE T	
	S40-2403-05	Push switch H/L X	
	S40-2406-05	Push switch TONE W	
	S40-2417-05	Push switch MR	

Ref. No.	Parts No.	Description	Re-marks
	S50-1406-05	Tact switch x 2 MIC	
	S59-1405-05	Key board switch x 2 SCAN, HOLD	
	T07-0216-05	Speaker	☆
	T91-0311-05	Microphone T	
	T91-0313-05	Microphone W, X	
	W01-0401-04	Allen key Angle	
	W02-0308-05	Rotary encoder	
	X41-1330-61	Switch unit	☆
	X44-1430-61	RF unit	☆
	X47-1070-00	Drive unit	☆
	X48-1320-61	IF unit	☆
	X50-1720-00	CAR unit X	☆
	X50-1720-51	CAR unit T	☆
	X50-1720-61	CAR unit W	☆
	X50-1730-00	HET unit	☆
	X53-1210-51	Control unit T	☆
	X53-1210-61	Control unit W	☆
	X53-1210-71	Control unit X	☆

SWITCH UNIT (X41-1330-61)

	E23-0046-04	Square terminal	
	E40-0373-05	Mini connect wafer 3P	
	E40-0573-05	Mini connect wafer 5P	
	E40-0673-05	Mini connect wafer 6P	
	E40-0773-05	Mini connect wafer 7P	
	E40-1273-05	Mini connect wafer 12P	
	N30-2604-46	Round screw	
	R92-0150-05	Short jumper	
S1	S40-2409-15	Push switch M	
S2	S40-2405-05	Push switch NB	
S3,4	S40-2404-05	Push switch X2 A/B, RIT	
S5,6	S40-1401-05	Push switch X2 MHz, DS	

RF UNIT (X44-1430-61)

C1	CC45SL2H030C	C	3pF	±0.25pF	500V
C2	CC45SL2H010C	C	1pF	±0.25pF	500V
C3	CC45SL2H030C	C	3pF	±0.25pF	500V
C4	CC45SL1H020C	C	2pF	±0.25pF	
C5,6	CC45SL2H030C	C	3pF	±0.25pF	500V
C7	CC45SL2H080D	C	8pF	±0.5pF	500V
C8	CC45SL2H120J	C	12pF		500V
C9	CC45SL2H030C	C	3pF	±0.25pF	500V
C10	CC45SL2H020C	C	2pF	±0.25pF	500V
C14	CS15E1C010M	T	1μF	16V	
C19	CS15E1V0R1M	T	0.1μF	35V	
C21	C90-0817-05	E	1000μF	16V	
C23	CE04W1C220M	E	22μF	16V	
C25	CE04W1C220M	E	22μF	16V	
C27	CE04W1C220M	E	22μF	16V	
C30	CC45SL1H101J	C	100pF		
C31	CC45SL2H020C	C	2pF	±0.25pF	500V

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
C51	CC45SL1H330J	C 33pF	
C52	CC45SL1H220J	C 22pF	
C55	C91-0456-05	C 0.047μF	
C56	CC45SL1H101J	C 100pF	
C58	CC45SL1H101J	C 100pF	
C59	CC45SL1H470J	C 47pF	
C62	CC45SL1H101J	C 100pF	
	E04-0154-05	Coax connector X2	
	E04-0156-05	N type connector	☆
	E08-0203-25	2P connector	
	E08-0304-05	Power jack (back up)	
	E11-0405-05	Key Jack	
	E11-0406-05	Stand-by Jack	
	E11-0409-05	Earphone Jack	
	E23-0046-04	Square terminal	
	E23-0401-05	Round terminal	
	E31-2089-05	Cable with terminal	☆
	E40-0373-05	Mini connect wafer 3P	
	E40-0473-05	Mini connect wafer 4P	
	F01-0744-15	Heat sink	
L1	L34-1018-05	Coil 3φ 1.5T	☆
L2	L34-0908-05	Coil	
L3	L34-1018-05	Coil 3φ 1.5T	☆
L4	L34-1017-05	Coil 3φ 3T	☆
L5,6	L34-1018-05	Coil 3φ 1.5T	☆
L7	L33-0026-05	Choke coil 1μH	
L51	L79-0479-05	Helical block (I)	☆
L52	L79-0480-05	Helical block (J)	☆
L53	L79-0481-05	Helical block (K)	☆
L54	L33-0026-05	Choke coil 1μH	
L55	L34-0908-05	Coil	
	N09-0256-05	GND screw	
	N30-2606-45	Round screw X2 (Back Up)	
	N30-3006-46	Round screw X8	
	N35-3006-46	Bind screw X2 (Pow module)	
	N87-2606-46	Self tapping screw X6	
R1	RC05GF2H221J	Solid 220Ω 1/2W	
	R92-0150-05	Short jumper	
VR1	R12-4020-05	Trim. pot 50kΩ (2 pole)	
VR2	R12-4016-05	Trim. pot 50kΩ	
VR3	R12-0417-05	Trim. pot 100Ω (2 pole)	☆

DRIVE UNIT (X47-1070-00)

C3	CC45CH1H050C	C 5pF ±0.25pF	
C5	CC45SL1H101J	C 100pF	
C7	CC45CH1H070D	C 7pF ±0.5pF	
C10	CC45CH1H100D	C 10pF ±0.5pF	
C12	CC45SL1H101J	C 100pF	
C13,14	C90-0804-05	Cap. 0.001μF	
C15	C91-0131-05	C 0.01μF	
C17	CC45SL1H101J	C 100pF	
C18	CQ92M1H103K	ML 0.001μF	
C19	C91-0131-05	C 0.01μF	

Ref. No.	Parts No.	Description	Re-marks
C20	C90-0804-05	Cap. 0.001μF	
C21	CE04W1A470M	E 47μF 10V	
C23	CC45CH1H010C	C 1pF ±0.25pF	
C25	C90-0804-05	Cap. 0.001μF	
C26	CC45SL1H101J	C 100pF	
C27	CC45CH1H010C	C 1pF ±0.25pF	
C28	CC45CH1H020C	C 2pF ±0.25pF	
C31	CS15E1VR47M	T 0.47μF 35V	
C33	CE04W1C101M	E 100μF 16V	
C35	C90-0820-05	E 470μF 16V	
C37	C91-0457-05	C 0.022μF	
C39	CE04W1A470M	E 47μF 10V	
C41	CE04W1A470M	E 47μF 10V	
TC1,2	C05-0062-05	Ceramic trimmer 6P	
TC3	C05-0030-15	Ceramic trimmer 20P	
	E04-0154-05	Coax connector X3	
	E23-0401-05	Round terminal X2	
	E40-0273-05	Mini connector wafer 2P	
	E40-0373-05	Mini connector wafer X2 3P	
	E40-0573-05	Mini connector wafer 5P	
	E40-0673-05	Mini connector wafer 6P	
	F20-0078-05	Insulating sheet (Q7)	
	F29-0014-05	Shoulder washer (Q7)	
L1	L34-0908-05	Coil	
L2,3	L19-0309-05	Wide band width trans	
L4	L79-0476-05	Helical block (F)	☆
L5	L79-0477-05	Helical block (G)	☆
L6	L79-0478-05	Helical block (H)	☆
L7,8	L34-0824-05	Coil 3.5φ 3T	
L9	L34-1018-05	Coil 3φ 2T	
L10,11	L34-1019-05	Coil 3φ 3T	☆
L12	L33-0026-05	Choke coil 1μH	
L13	L40-1011-03	Ferri-inductor 100μH	
L14	L15-0016-05	Low frequency choke	
L15	L40-1011-03	Ferri-inductor 100μH	
	N30-3004-46	Round screw (Q10)	
	N30-3006-46	Round screw (Q7)	
	N87-2606-46	Self tapping screw x 6	
R31	RC05GF2H2R2J	Solid 2.2Ω 1/2W	
VR1	R12-3416-05	Trim. pot 47kΩ	
VR2	R12-1020-05	Trim. pot 1kΩ	
VR3	R12-3027-05	Trim. pot 30kΩ	
VR4	R12-0417-05	Trim. pot 100Ω 2 pole	
	R92-0150-05	Short jumper x 3	

PARTS LIST

Ref. No.	Parts No.	Description			Remarks
IF UNIT (X48-1320-61)					
C1	CC45SL1H470J	C	47pF		
C2	CC45CH1H0R5C	C	0.5pF	±0.25pF	
C3	CC45CH1H100D	C	10pF	±0.5pF	
C4	CC45CH1H010C	C	1pF	±0.25pF	
C5	CC45SL1H101J	C	100pF		
C6	C91-0131-05	C	0.01μF		
C7	CC45CH1H100D	C	10pF	±0.5pF	
C8	CC45CH1H010C	C	1pF	±0.25pF	
C9	C91-0456-05	C	0.047μF		
C10	CC45SL1H470J	C	47pF		
C11	CE04W1C100M	E	10μF	16V	
C12	C91-0131-05	C	0.01μF		
C13	CC45SL1H101J	C	100pF		
C14,15	C91-0457-05	C	0.022μF		
C16	CC45SL1H101J	C	100pF		
C17	CC45CH1H070D	C	7pF	±0.5pF	
C18	CC45SL1H151J	C	150pF		
C19	C91-0131-05	C	0.01μF		
C20	CC45RH1H150J	C	15pF		
C21	C91-0131-05	C	0.01μF		
C22	CC45SL1H101J	C	100pF		
C23,24	C91-0131-05	C	0.01μF		
C25	CC45CH1H120J	C	12pF		
C26	CC45SL1H221J	C	220pF		
C27	C91-0131-05	C	0.01μF		
C28	CC45CH1H050C	C	5pF	±0.25pF	
C30	C91-0456-05	C	0.047μF		
C32	CE04W1A470M	E	47μF	10V	
C33,34	C91-0456-05	C	0.047μF		
C36	C91-0456-05	C	0.047μF		
C37	CQ92M1H103K	ML	0.01μF		
C38	CE04W1H010M	E	1μF	50V	
C39,40	C91-0456-05	C	0.047μF		
C42	C91-0131-05	C	0.01μF		
C43~47	C91-0456-05	C	0.047μF		
C48,49	CQ92M1H102K	ML	0.001μF		
C50	CQ92M1H183K	ML	0.018μF		
C51	CQ92M1H222K	ML	0.0022μF		
C52	CQ92M1H393K	ML	0.039μF		
C53	CQ92M1H222K	ML	0.0022μF		
C54	CC45SL1H220J	C	22pF		
C55	CQ92M1H103K	ML	0.01μF		
C56	CC45SL1H330J	C	33pF		
C57	CE04W1A470M	E	47μF	10V	
C58	CQ92M1H222K	ML	0.0022μF		
C59,60	CE04W1H3R3M	E	3.3μF	50V	
C61	CE04W1H4R7M	E	4.7μF	50V	
C63	CE04W1A101M	E	100μF	10V	
C64	C91-0456-05	C	0.047μF		
C67,68	C91-0456-05	C	0.047μF		
C70,71	C91-0456-05	C	0.047μF		
C74	C91-0131-05	C	0.01μF		
C75	CE04W1H010M	E	1μF	50V	
C76	C91-0456-05	C	0.047μF		
C80	CC45CH1H080D	C	8pF	±0.5pF	
C81~84	C91-0457-05	C	0.022μF		
C85	CC45CH1H470J	C	47pF		
C86	C91-0131-05	C	0.01μF		
C87~89	C91-0457-05	C	0.022μF		
C90	CC45CH1H470J	C	47pF		
C91	C91-0131-05	C	0.01μF		
C92~94	C91-0457-05	C	0.022μF		

Ref. No.	Parts No.	Description			Remarks
C95	CC45CH1H100D	C	10pF	±0.5pF	
C96	C91-0457-05	C	0.022μF		
C97	CC45SL1H470J	C	47pF		
C99	C91-0457-05	C	0.022μF		
C100	CC45SL1H470J	C	47pF		
C101	C91-0457-05	C	0.022μF		
C102	CS15E1E010M	T	1μF	25V	
C103	CE04W1H010M	E	1μF	50V	
C106	C91-0456-05	C	0.047μF		
C111	CC45SL1H101J	C	100pF		
C112	CC45CH1H220J	C	22pF		
C113	CC45CH1H150J	C	15pF		
C114	C91-0131-05	C	0.01μF		
C115	CQ92M1H103K	ML	0.01μF		
C116	CQ92M1H104K	ML	0.1μF		
C118	CE04W1H3R3M	E	3.3μF	50V	
C119	CE04W1A470M	E	47μF	10V	
C121	CQ92M1H104K	ML	0.1μF		
C122	CE04W1C100M	E	10μF	16V	
C123	CQ92M1H332K	ML	0.0033μF		
C124	CQ92M1H103K	ML	0.01μF		
C125	CS15E1V0R1M	T	0.1μF	35V	
C126	CE04W1C220M	E	22μF	16V	
C127	CE04W1H010M	E	1μF	50V	
C129	CE04W1A101M	E	100μF	10V	
C130	CC45SL1H101J	C	100pF		
C131	CE04W1H010M	E	1μF	50V	
C132	CE04W1A470M	E	47μF	10V	
C133	C90-0834-05	Cap.	0.1μF		
C134	CE04W1A101M	E	100μF	10V	
C135	C90-0820-05	E	470μF	16V	
C137	CS15E1V0R1M	T	0.1μF	35V	
C138,139	CQ92M1H103K	ML	0.01μF		
C140,141	CQ92M1H123K	ML	0.012μF		
C142	CS15E1C4R7M	T	4.7μF	16V	
C143	CE04W1H010M	E	1μF	50V	
C144	CE04W1C100M	E	10μF	16V	
C147	CC45CH1H100D	C	10pF	±0.5pF	
C148	C91-0457-05	C	0.022μF		
C150	C91-0457-05	C	0.022μF		
C151	CC45CH1H330J	C	33pF		
C152	CC45CH1H270J	C	27pF		
C153	CC45CH1H030C	C	3pF	±0.25pF	
C154,155	C91-0457-05	C	0.022μF		
C156	CC45CH1H030C	C	3pF	±0.25pF	
C158	CE04W1H3R3M	E	3.3μF	50V	
C161	CQ92M1H473K	ML	0.047μF		
C162	CC45SL1H101J	C	100pF		
C163	CE04W1H4R7M	E	4.7μF	50V	
C164	CE04W1H010M	E	1μF	50V	
TC1	C05-0067-05	Ceramic trimmer 25pF			
TC2	C05-0031-15	Ceramic trimmer 10pF			
	E04-0154-05	Coax connector			
	E23-0046-04	Square terminal X5			
	E31-2090-05	Cable with terminal			☆
	E40-0273-05	Mini connect wafer 2P			
	E40-0373-05	Mini connect wafer 3P			
	E40-0573-05	Mini connect wafer 5P			
	E40-0973-05	Mini connect wafer 9P			
	E40-1173-05	Mini connect wafer 11P			

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
L1,2	L34-0909-05	Coil	
L3	L34-0908-05	Coil	
L4~7	L30-0508-05	IFT 21.6MHz	
L8,9	L34-0781-05	Tuning coil 8.83MHz	
L10	L34-0505-05	Tuning coil	
L11	L30-0508-05	IFT 21.6MHz	
L12	L40-1511-03	Ferri-inductor 150μH	
L13	L40-4711-03	Ferri-inductor 470μH	
L14	L30-0504-05	IFT 455kHz	
L15	L30-0503-05	IFT 455kHz	
L16	L79-0446-05	Ceramic discri CFY455S	
L17	L40-6825-04	Ferri-inductor 6.8mH	
L18	L34-0536-05	Tuning coil 8.83MHz	
L19	L30-0503-05	IFT 455kHz	
L20	L40-1501-03	Ferri-inductor 15μH	
L21	L30-0503-05	IFT 455kHz	
L22	L30-0504-05	IFT 455kHz	
L23	L40-1021-03	Ferri-inductor 1mH	
L24	L34-0536-05	Tuning coil 8.83MHz	
L25	L34-0781-05	Tuning coil 8.83MHz	
L26	L34-0536-05	Tuning coil 8.83MHz	
L27	L40-1511-03	Ferri-inductor 150μH	
L28	L40-1011-03	Ferri-inductor 100μH	
L29	L40-1511-03	Ferri-inductor 150μH	
L30	L40-1021-03	Ferri-inductor 1mH	
CF1	L72-0316-05	Ceramic filter CFW455E	
XF1(A),(B)	L71-0227-05	MCF 21.6MHz ±7.5kHz	
XF2	L71-0208-05	MCF YK-88S	
X1	L77-0938-05	Crystal 30.43MHz	☆
X2	L77-0870-05	Crystal 22.055MHz	
	N30-3004-46	Round screw	
VR1	R12-4016-05	Trim. pot 50kΩ	
VR2	R12-7402-05	Trim. pot 500kΩ	☆
VR3	R12-1016-05	Trim. pot 3kΩ	
VR4	R12-4015-05	Trim. pot 50kΩ	
VR5	R12-0421-05	Trim. pot 100Ω	☆
VR6	R12-3027-05	Trim. pot 30kΩ	
VR7	R12-3025-05	Trim. pot 10kΩ	
	R92-0150-05	Short jumper x 9	
RL1	S51-1407-05	Relay	

CAR UNIT (X50-1720-00, -51, -61)

-00 : X, -51 : T
-61 : W

C3	C90-0824-05	E	1μF	50V	
C4	C90-0832-05	E	47μF	10V	
C5	C90-0482-05	E	4.7μF	25V	
C7	C90-0824-05	E	1μF	50V	
C8	C90-0832-05	E	47μF	10V	
C10	CC45SL1H101J	C	100pF		
C11	CQ92M1H332K	ML	0.0033μF		
C12	C90-0832-05	E	47μF	10V	
C13	C90-0482-05	E	4.7μF	25V	
C14	C90-0832-05	E	47μF	10V	
C15	C90-0824-05	E	1μF	50V	
C16	CQ92M1H103K	ML	0.01μF		
C17	CQ92M1H333K	M	0.033μF		
C18	C90-0824-05	E	1μF	50V	
C20	CC45UJ1H030C	C	3pF	±0.25pF	
C21	CC45TH1H100D	C	10pF	±0.5pF	
C23	CC45SL1H221J	C	220pF		
C24	CC45CH1H101J	C	100pF		
C25	CC45CH1H100D	C	10pF	±0.5pF	
C27	CE04W1C220M	E	22μF	16V	
C29	CC45RH1H560J	C	56pF		
C30,31	CC45SL1H330J	C	33pF		
C32,33	C91-0131-05	C	0.01μF		
C37	CS15E1A3R3M	T	3.3μF	10V	
C38	CE04W1C100M	E	10μF	16V	
C39	CC45CH1H150J	C	15pF		
C40,41	CC45CH1H010C	C	1pF	±0.25pF	
C42	CC45CH1H470J	C	47pF		
C43	CC45CH1H100D	C	10pF	±0.5pF	
C44,45	C91-0457-05	C	0.022μF		
C49	C91-0131-05	C	0.01μF		
C55	CE04W1C100M	E	10μF	16V	
C56	CR04W1A470M	E	47μF	10V	
C61	CE04W1C101M	E	100μF	16V	
C62	CE04W1C470M	E	47μF	16V	
C63	CE04W1C101M	E	100μF	16V	
C64	C91-0457-05	C	0.022μF		
C65	C91-0456-05	C	0.047μF		
C66	CC45CH1H220J	C	22pF		
C72	CC45SL1H221J	C	220pF		
C75	CC45CH1H020J	C	2pF	±0.25pF	
C76	CC45SL1H270J	C	27pF		
C78	CC45SL1H221J	C	220pF		
C79	C91-0131-05	C	0.01μF		
C80	CC45CH1H120J	C	12pF		
C81	CC45CH1H070D	C	7pF	±0.5pF	
C103	CE04W1C220M	E	22μF	16V	W, T
C104	CS15E1A150K	T	15μF	10V	T
C105	CE04W1C220M	E	22μF	16V	W, T
C106	CE04W1H010M	E	1μF	50V	W, T
C107~109	C91-0433-05	Laminated cap. 0.0039μF			W, T
C110	CQ92M1H472K	ML	0.0047μF		W, T
C111	CS15E1A150K	T	15μF	10V	T
TC1	C05-0062-05	Ceramic trimmer 6pF			
TC2~4	C05-0067-05	Ceramic trimmer 25pF			
	E23-0046-04	Square terminal			
	E40-0273-05	Mini connect wafer 2P			
	E40-0373-05	Mini connect wafer 3P			
	E40-0773-05	Mini connect wafer 7P			
	E40-0873-05	Mini connect wafer 8P			
	E40-0973-05	Mini connect wafer 9P			
L1	L40-1541-27	Ferri-inductor 150mH			
L2	L77-0931-05	Crystal 21.60MHz			☆
L3	L33-0638-05	Choke coil 3.3μH			☆
L4	L40-1021-03	Ferri-inductor 1mH			
L5	L40-4711-03	Ferri-inductor 470μH			
L6	L31-0313-05	Tuning coil			
L7	L34-0755-05	Tuning coil			
L8~11	L34-0749-05	Tuning coil			
L12	L40-6825-04	Ferri-inductor 6.8mH			
L13,14	L40-1511-03	Ferri-inductor 150μH			
L15	L32-0201-05	Oscillating coil			

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
L16~18	L40-1021-03	Ferri-inductor 1mH	
L19	L77-0932-05	Crystal 8.8293MHz	☆
L20	L77-0933-05	Crystal 8.8315 MHz W, T	☆
	N30-3004-46	Round screw	
R102	R92-0616-05	Metal film 10kΩ W, T	
R103	RN14BK2E4703F	Metal film 470kΩ ±1% 1/4W W, T	
R107	R92-0616-05	Metal film 10kΩ W, T	
R108	R92-0617-05	Metal film 7.5kΩ W, T	
VR1	R12-1004-05	Trim. pot 4.7kΩ	
VR2	R12-3004-05	Trim. pot 47kΩ X	
VR101	R12-3041-05	Trim. pot 10kΩ W, T	
VR102	R12-3004-05	Trim. pot 47kΩ T	
	R92-0150-05	Short jumper	

HET UNIT (X50-1730-00)

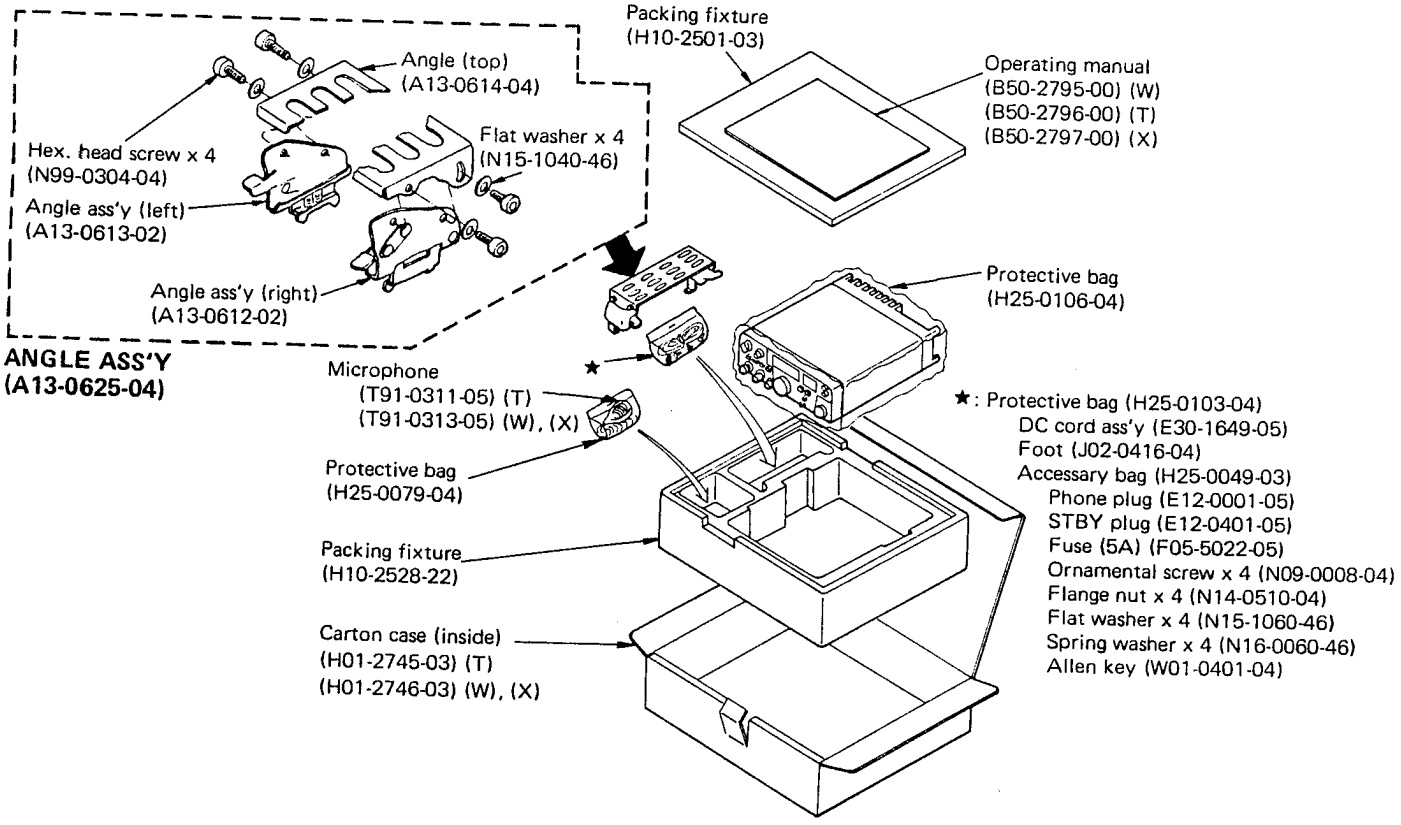
C2	CC45CH1H100D	C	10pF	±0.5pF	
C3	CC45RH1H560J	C	56pF		
C6	CC45SL1H470J	C	47pF		
C9	CC45CH1H010C	C	1pF	±0.25pF	
C13	CC45CH1H220J	C	22pF		
C17	CE04W1A470M	E	47μF	10V	
C18	CC45CH1H100D	C	10pF	±0.5pF	
C20	CC45SL1H101J	C	100pF		
C22	CC45CH1H220J	C	22pF		
C23	CC45CH1H050C	C	5pF	±0.25pF	
C25	CC45SL1H101J	C	100pF		
C27	CC45CH1H030C	C	3pF	±0.25pF	
C29	CC45SL1H101J	C	100pF		
C31	CC45CH1H100D	C	10pF	±0.5pF	
C32	C90-0804-05	C	0.001μF		
C33,34	CC45SL1H101J	C	100pF		
C38	CQ92M1H223K	ML	0.022μF		
C39,40	CS15E1C2R2M	T	2.2μF	16V	
C41	CE04W1H010M	E	1μF	50V	
C42	C91-0457-05	C	0.022μF		
C44	CQ92M1H473K	ML	0.047μF		
C45	CC45PG1H100D	C	10pF	±0.5pF	
C46	CC45CH1H080D	C	8pF	±0.5pF	
C47	CC45CH1HOR5C	C	0.5pF	±0.25pF	
C48	CC45CH1H060D	C	6pF	±0.5pF	
C49	CC45CH1H150J	C	15pF		
C50	CC45CH1H030C	C	3pF	±0.25pF	
C52	CE04W1A101M	E	100μF	10V	
C53	CC45CH1H040C	C	4pF	±0.25pF	
C54	CC45UJ1H100D	C	10pF	±0.5pF	
C56	CE04W1H4R7M	E	4.7μF	50V	
C57	CE04W1C100M	E	10μF	16V	
C60	CC45CH1H010C	C	1pF	±0.25pF	
C62	CC45CH1H330J	C	33pF		
C63	CC45CH1H050C	C	5pF	±0.25pF	
C67	CE04W1A470M	E	47μF	10V	
C68	C91-0457-05	C	0.022μF		
C69,70	CC45CH1H330J	C	33pF		
C71	CC45SL1H101J	C	100pF		
C72	CQ92M1H223K	ML	0.022μF		
C73	CC45SL1H101J	C	100pF		
C74	CC45CH1H100D	C	10pF	±0.5pF	
C75	CC45CH1H080D	C	8pF	±0.5pF	
C76	C91-0457-05	C	0.022μF		
C77	CE04W1C100M	E	10μF	16V	
C78	CC45CH1H100D	C	10pF	±0.5pF	
C79	CC45CH1H040C	C	4pF	±0.25pF	
C80,81	CC45CH1HOR5C	C	0.5pF	±0.25pF	
C82	CC45CH1H220J	C	22pF		
C83	CE04W1A470M	E	47μF	10V	
C85,86	CC45CH1H101J	C	100pF		
C87	CC45UJ1H680J	C	68pF		
C88	CC45UJ1H330J	C	33pF		
C90	CS15E1VR47M	T	0.47μF	35V	
C92	CS15E1VR47M	T	0.47μF	35V	
C93	CE04W1A470M	E	47μF	10V	
C96	CC45SL1H101J	C	100pF		
C97	CC45SL1H470J	C	47pF		
C98	CC45CH1HOR5C	C	0.5pF	±0.25pF	
C99	CC45CH1H050C	C	5pF	±0.25pF	
TC1,2	C05-0067-05	Ceramic trimmer 25pF			
TC3,4	C05-0308-05	Ceramic trimmer 4pF			
TC5,6	C05-0062-05	Ceramic trimmer 6pF			
TC7	C05-0030-15	Ceramic trimmer 20pF			
	E04-0154-05	Coax connector X2			
	E23-0046-04	Square terminal			
	E40-0673-05	Mini connect wafer 6P			
	E40-0873-05	Mini connect wafer 8P			
L1,2	L40-1511-03	Ferri-inductor 150μH			
L4	L32-0638-05	Oscillating coil 36MHz			☆
L5	L40-4711-03	Ferri-inductor 470μH			
L6,7	L34-2016-05	Turning coil			☆
L8	L34-1015-05	Coil 3φ 4.5T			☆
L9	L34-1016-05	Coil 3φ 4.5T			☆
L10	L40-1511-03	Ferri-inductor 150μH			
L11,12	L19-0309-05	Wide bandwidth trans			
L13	L40-4711-03	Ferri-inductor 470μH			
L14	L40-1021-03	Ferri-inductor 1mH			
L15	L34-0824-05	Coil 3.5φ 2.5T			
L16	L33-0026-05	Choke coil 1μH			
L17	L40-3391-03	Ferri-inductor 3.3μH			
L18	L32-0624-05	Oscillating coil VCO			
L19	L40-3391-03	Ferri-inductor 3.3μH			
L20	L34-0820-05	Tuning coil			
L21	L34-2015-05	Tuning coil			☆
L22	L34-0683-05	Tuning coil			
L23	L40-4711-03	Ferri-inductor 470μH			
L24	L40-1021-03	Ferri-inductor 1mH			
L25	L40-1501-03	Ferri-inductor 15μH			
L26	L40-1021-03	Ferri-inductor 1mH			
L27,28	L34-2014-05	Tuning coil			☆
L29	L33-0631-05	Choke coil 4.7μH ±0.5%			
L30	L40-1021-03	Ferri-inductor 1mH			
L31	L77-0934-05	Crystal 9MHz			☆
L32	L77-0935-05	Crystal 12.9444 MHz			☆
L33	L77-0936-05	Crystal 36.6222 MHz			☆
L34	L77-0937-05	Crystal 37.1777 MHz			☆
L35	L79-0473-05	Helical block 332.1 MHz			☆
L36	L79-0474-05	Helical block(D) 456.6 MHz			☆
L37	L79-0475-05	Helical block(E) 456.6 MHz			☆

PARTS LIST/PACKING

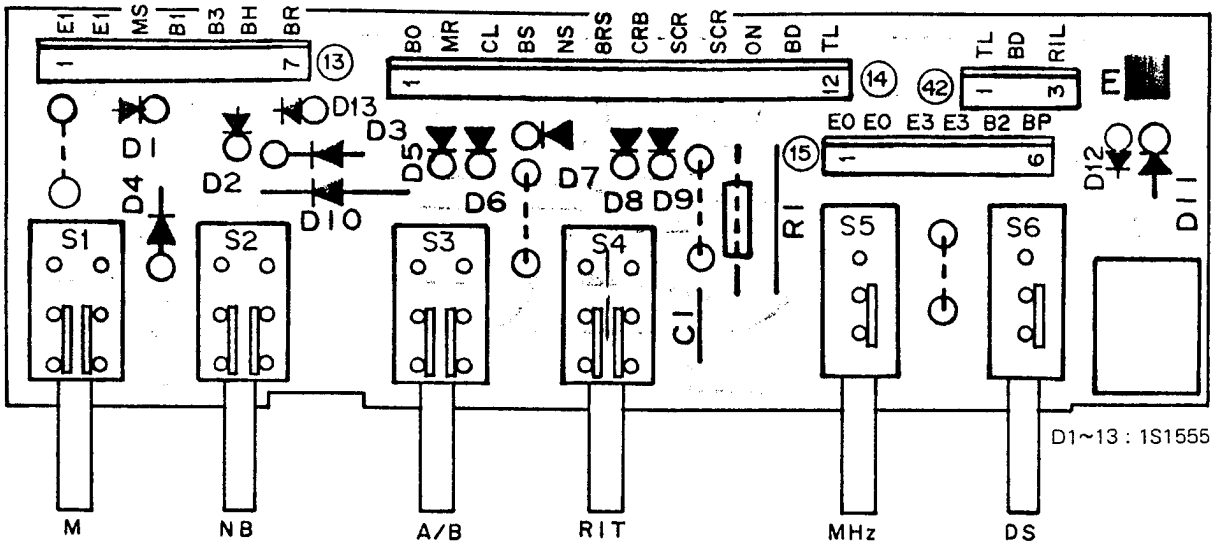
Ref. No.	Parts No.	Description	Re-marks
	N87-2606-46	Self tapping screw	
VR1	R12-6403-05	Trim. pot 470kΩ	
VR2	R12-3416-05	Trim. pot 47kΩ	
	R92-0150-05	Short jumper	
	420-0009-05	Silicone (PLL, VCO)	
CONTROL UNIT (X53-1210-51, -61, -71)			
		-51 : T, -61 : W, -71 : X	
C1	CE04W1C331M	E 330μF 16V	
C2	CE04W1A221M	E 220μF 10V	
C3	CE04W1A470M	E 47μF 10V	
C4	CE04W1C470M	E 47μF 16V	
C6	CE04W1C470M	E 47μF 16V	
C7	CE04W1A470M	E 47μF 10V	
C8	CE04W1A471M	E 470μF 10V	
C9,10	CE04W1A221M	E 220μF 10V	
C11	CQ92M1H223K	ML 0.022μF 50V	
C12	CE04W1A101M	E 100μF 10V	
C14	CE04W1A221M	E 220μF 10V	
	E23-0046-04	Square terminal	
	E40-0373-05	Mini connect wafer 3P	
	E40-0573-05	Mini connect wafer 5P	
	E40-0673-05	Mini connect wafer 6P	
	E40-0873-05	Mini connect wafer 8P	
	E40-0973-05	Mini connect wafer 9P	

Ref. No.	Parts No.	Description	Re-marks
	G11-0605-04	Cushion for BZ-1	
	J29-0403-04	Transducer plate	
L1	L30-0503-05	IFT	
	N30-3006-46	Round screw	
	N35-3006-46	Bind screw	
R1	RS14GB3D150J	Metal film 15Ω 2W	
R2	RC05GF2H330J	Solid 33Ω 1/2W	
R49	RN14BK2E1003F	Metal film 100kΩ ±1% 1/4W	
R50	RN14BK2E2003F	Metal film 200kΩ ±1% 1/4W	
R51	RN14BK2E4023F	Metal film 402kΩ ±1% 1/4W	
R52	RN14BK2E8063F	Metal film 806kΩ ±1% 1/4W	
R53	RN14BK2E1003F	Metal film 100kΩ ±1% 1/4W	
R54	RN14BK2E4703F	Metal film 470kΩ ±1% 1/4W	
R55	RN14BK2E2003F	Metal film 200kΩ ±1% 1/4W	
R56	RN14BK2E4023F	Metal film 402kΩ ±1% 1/4W	
R57	RN14BK2E8063F	Metal film 806kΩ ±1% 1/4W	
R58	R90-0530-05	Resistor block 2.7kΩ X4	
R59,60	R90-0526-05	Resistor block 27kΩ X4	
R61	R90-0532-05	Resistor block 27kΩ X5	☆
VR1	R12-1413-05	Trim. pot 1kΩ	☆
BZ-1	T95-0051-05	Transducer	

PACKING

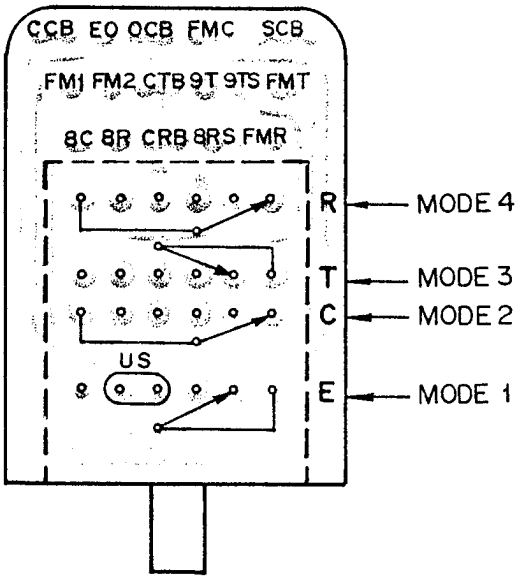


▼ SWITCH UNIT (X41-1330-61) Components side view



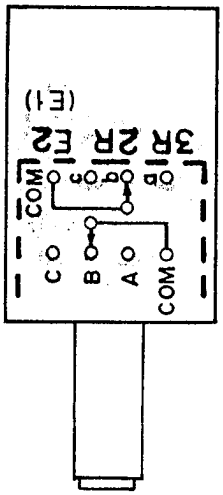
▼ MODE BOARD (J25-2714-14)

Components side view



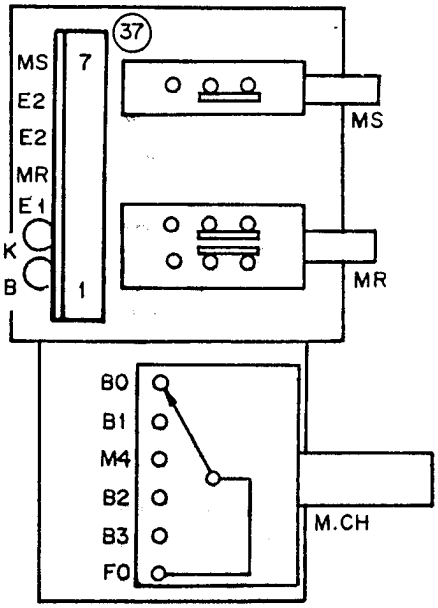
▼ TX OFFSET BOARD (J25-2744-04)

Components side view



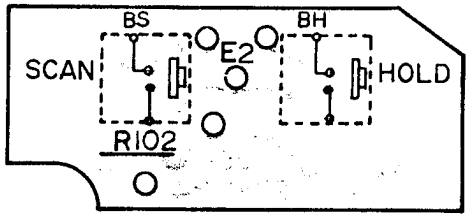
▼ M. CH, MS, MR BOARD (J25-3023-04)

Components side view



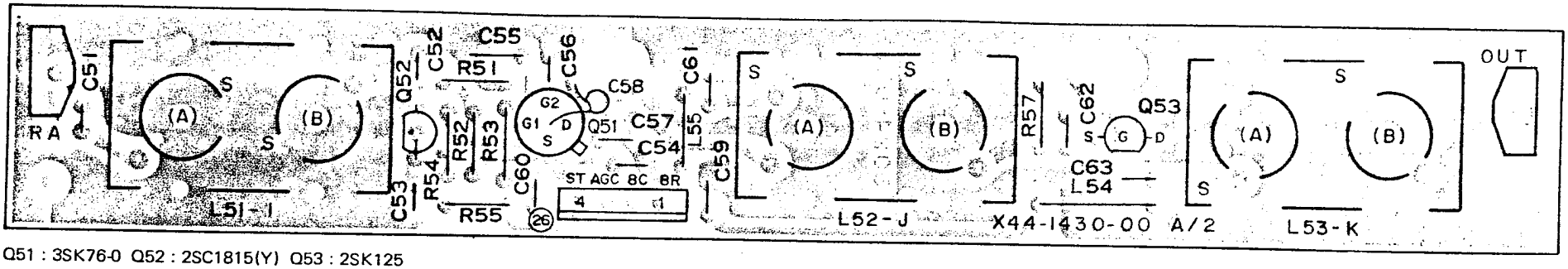
▼ SCAN, HOLD BOARD (J25-2716-24)

Components side view



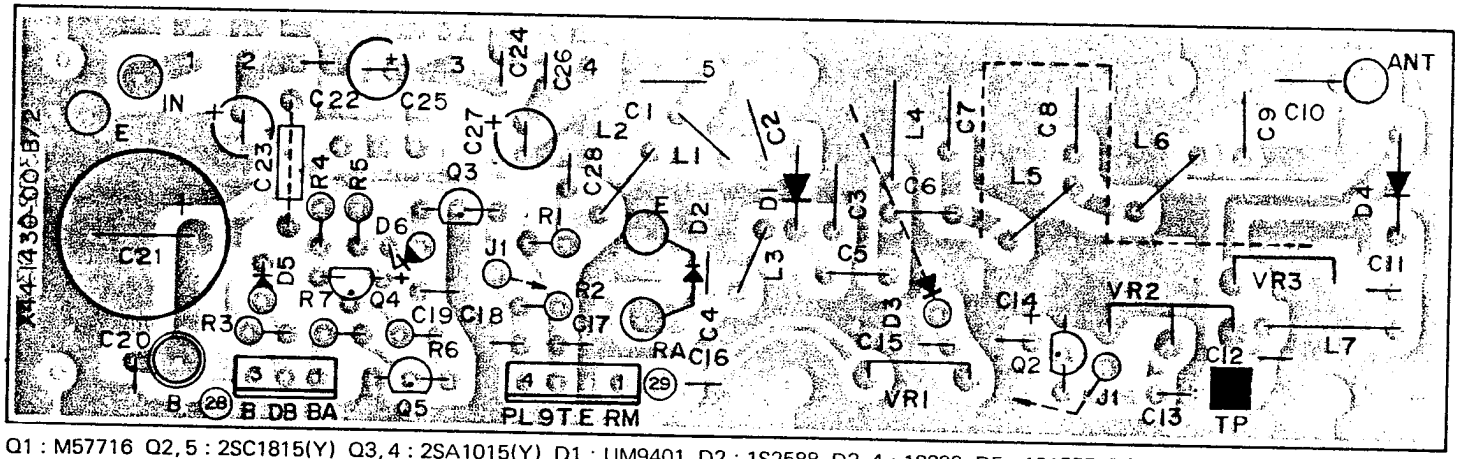
Abbreviation			Terminal name		Wire
BLK	:	BLACK	CCB	:	BRNX2
BLU	:	BLUE	EO	:	WHT/BLK
BRN	:	BROWN	OCB	:	WHT/BLU
GRN	:	GREEN	FMC	:	WHT/REDX2
GRY	:	GRAY	SCB	:	BLU
ORA	:	ORANGE	FM1	:	YLW
RED	:	RED	FM2	:	GRN
WHT	:	WHITE	CTB	:	WHT/ORAX2
YLW	:	YELLOW	9T	:	ORA
			9TS	:	BLK
			FMT	:	WHT/YLW
			8C	:	WHT
			8R	:	GRY
			CRB	:	WHT/GRNX2
			8RS	:	WHT/BRN
			FMR	:	WHT/GRY
			US	:	RED

▼ RF UNIT (X44-1430-61) (A/2) Components side view



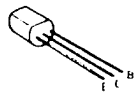
Q51 : 3SK76-0 Q52 : 2SC1815(Y) Q53 : 2SK125

▼ RF UNIT (X44-1430-61) (B/2) Components side view

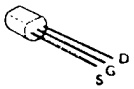


Q1 : M57716 Q2, 5 : 2SC1815(Y) Q3, 4 : 2SA1015(Y) D1 : UM9401 D2 : 1S2588 D3, 4 : 1SS99 D5 : 1S1555 D6 : WZ-032

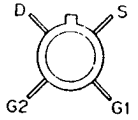
2SA1015
2SC1815



2SK125

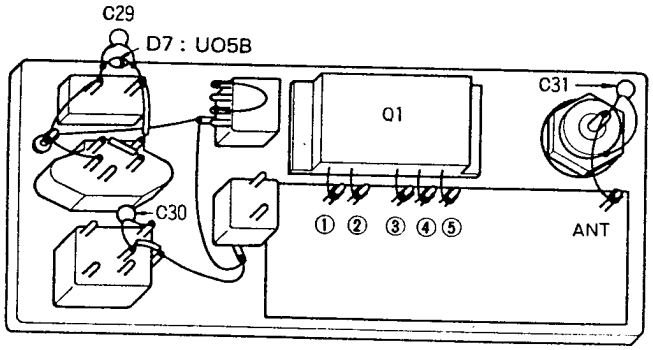


3SK76-0

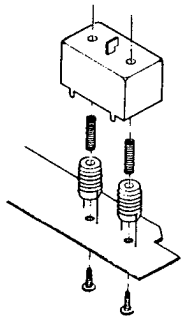


TOP VIEW

< Wiring on the Heat Sink >



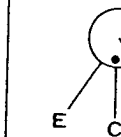
< Helical block assembly >



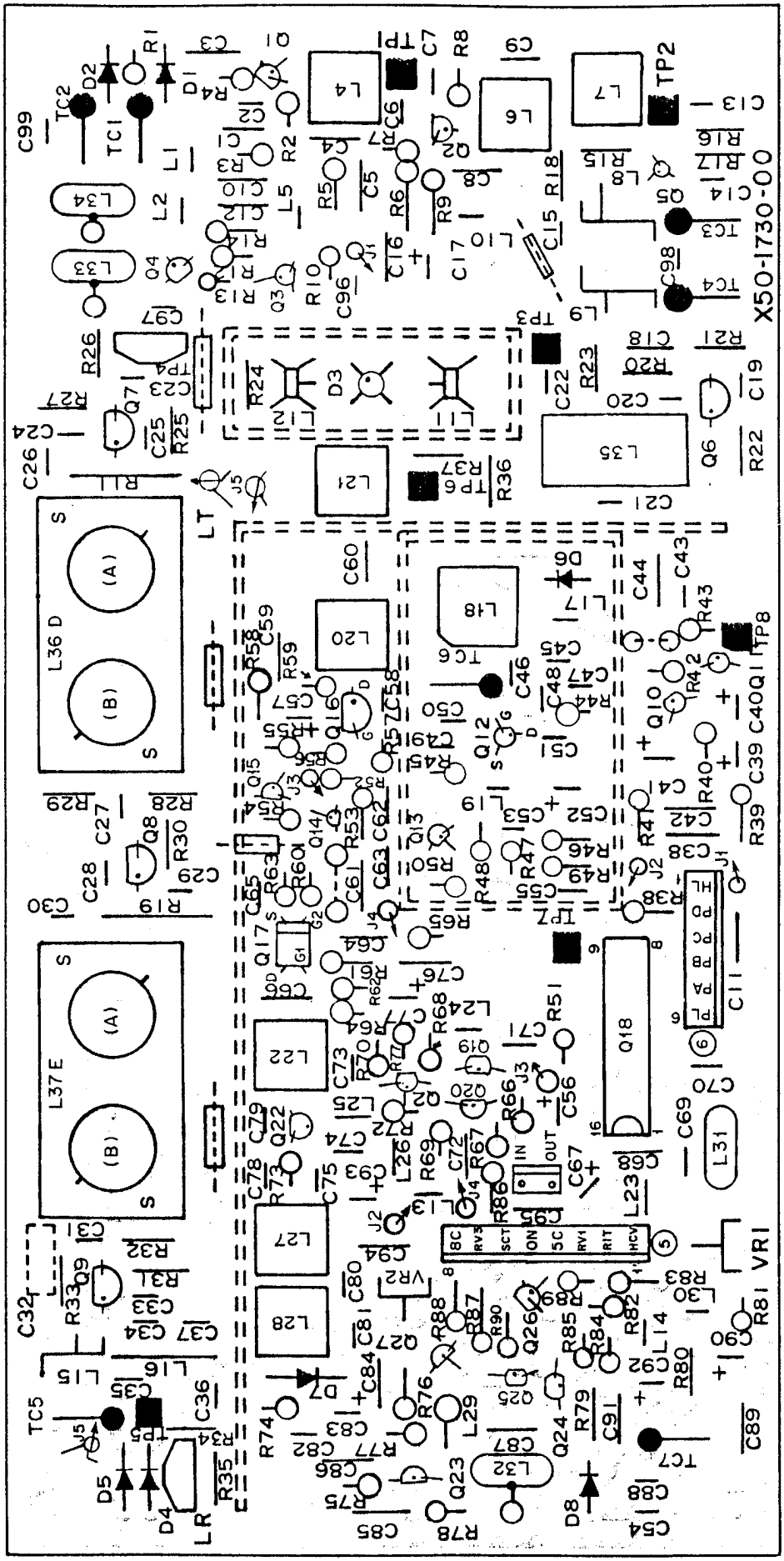
L51 (A) : Red
(B) : Blue
L52 (A) : Black
(B) : Red
L53 (A) : White
(B) : Yellow

* Helical coils are identified by bobbin color.
* L51 (A) and L52 (B) are of the same type.

Transistor terminal indication

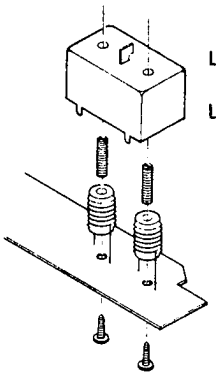


PC BOARD VIEW TR-950



▼ HET UNIT (X50-1730-00) Components side view

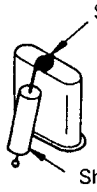
< Helical block assembly >



L36 (A) : Green
(B) : Green
L37 (A) : Blue
(B) : Green

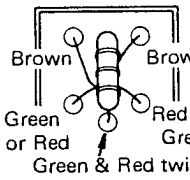
* Helical coils are identified by bobbin color.
* L36 (A), (B) and L37 (B) are of the same type.

< Attachment method of L33, 34 >



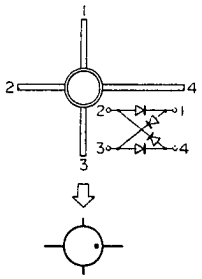
* Solder as quickly as possible.

< Attachment direction of L11, 12 >

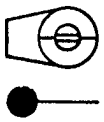


L11 and L12 should be installed parallel to the surface of the shield case.

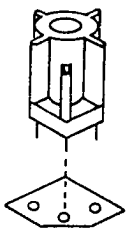
< Attachment direction of D3 >



< Attachment direction of TC1~7>

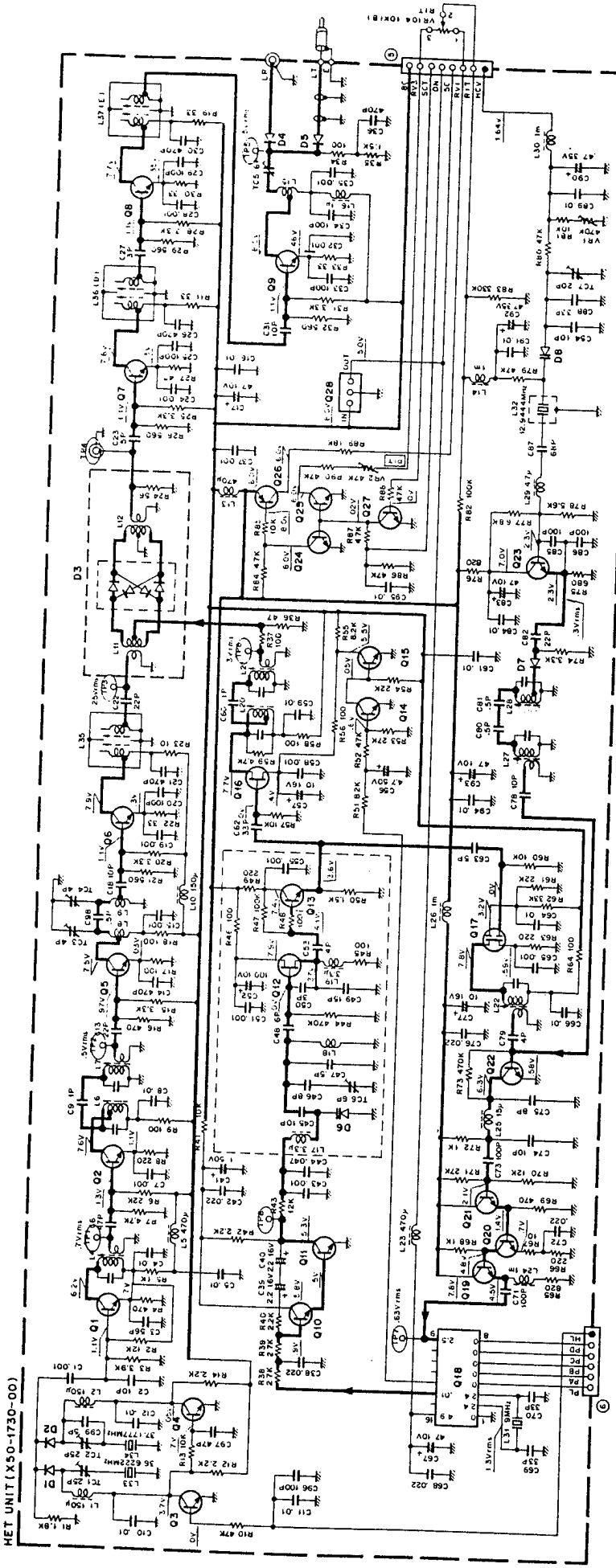


< Attachment direction of L18 >



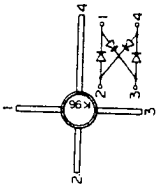
▼ HET UNIT (X50-1730-00)

HET UNIT (X50-1730-00)

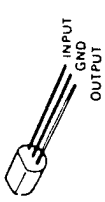


Q1,5,13,22	: 2SC1923(O)	Q7,8	: 2SC2026	Q18	: TC9125P	D1,2	: 1S1555
Q2,20,21,23	: 2SC1675(L) or 2SC460(B)	Q10,11	: 2SC2240(GR)	Q19,24,25	: 2SC2603(E)or(D)	D3	: ND487C1-3R
Q3,4,15,27	: 2SC1815(Y)	Q12	: 2SK19(GR) TRIO-5	Q26	: 2SA1015(Y)	D4,5,7	: 1SS99
Q6,9	: 2SC2549	Q16	: 2SK61(GR)	Q28	: NJM78L05A	D6,8	: 1SV50S
		Q17	: 3SK73(GR)	Q14	: 2SC1775(E)		

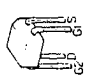
ND487C1-3R



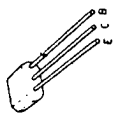
NJM78L05A



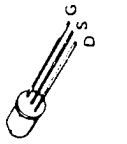
3SK73



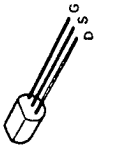
2SC2603



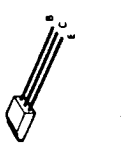
2SK19



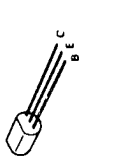
2SK61



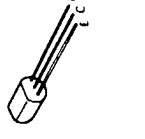
2SC460

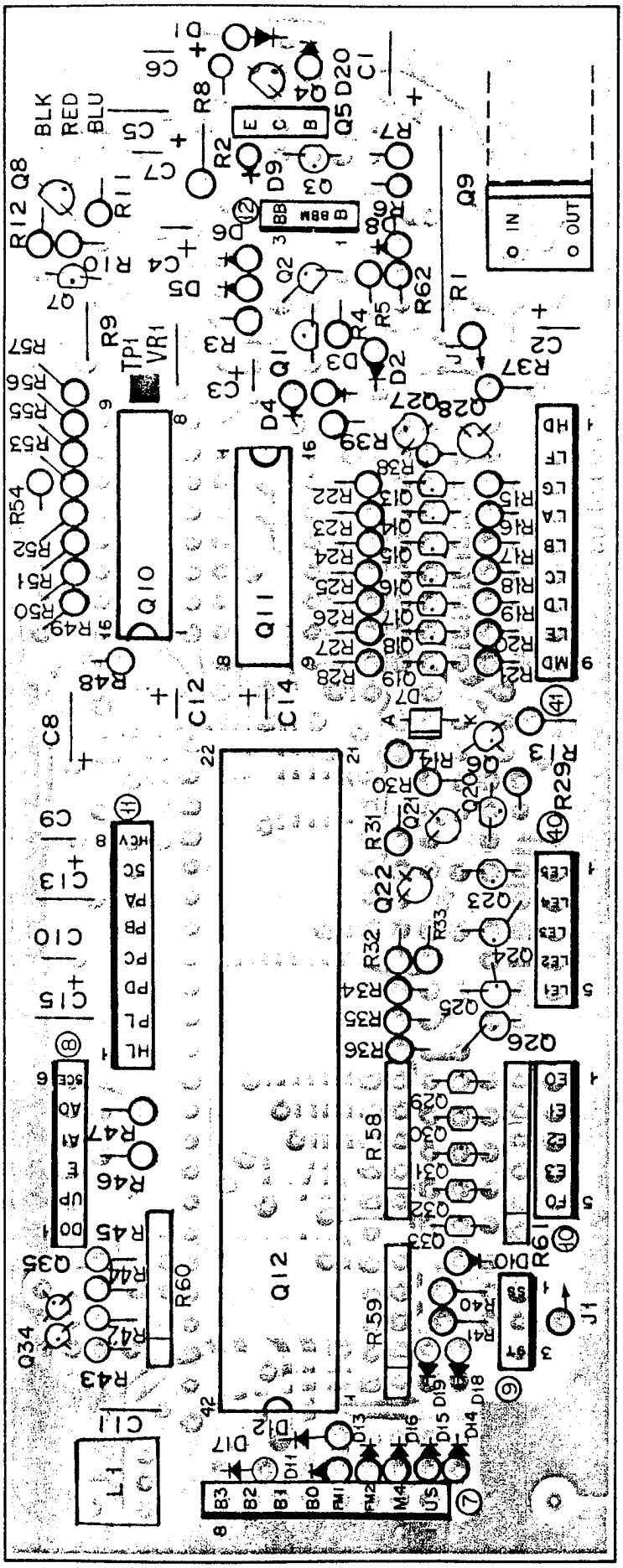


2SC2026
2SC2549



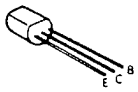
2SA1015
2SC1675
2SC1775
2SC1815
2SC1923
2SC2240



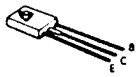


▼ CONTROL UNIT (X53-1210-51,-61,-71) -51 : T, -61 : W, -71 : X Components side view

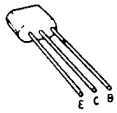
2SA1015
2SC1815
2SC1959



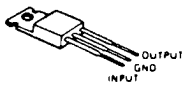
2SC496



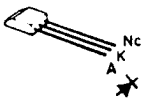
2SA1115



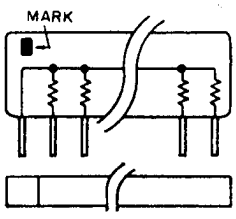
μPC78M05H



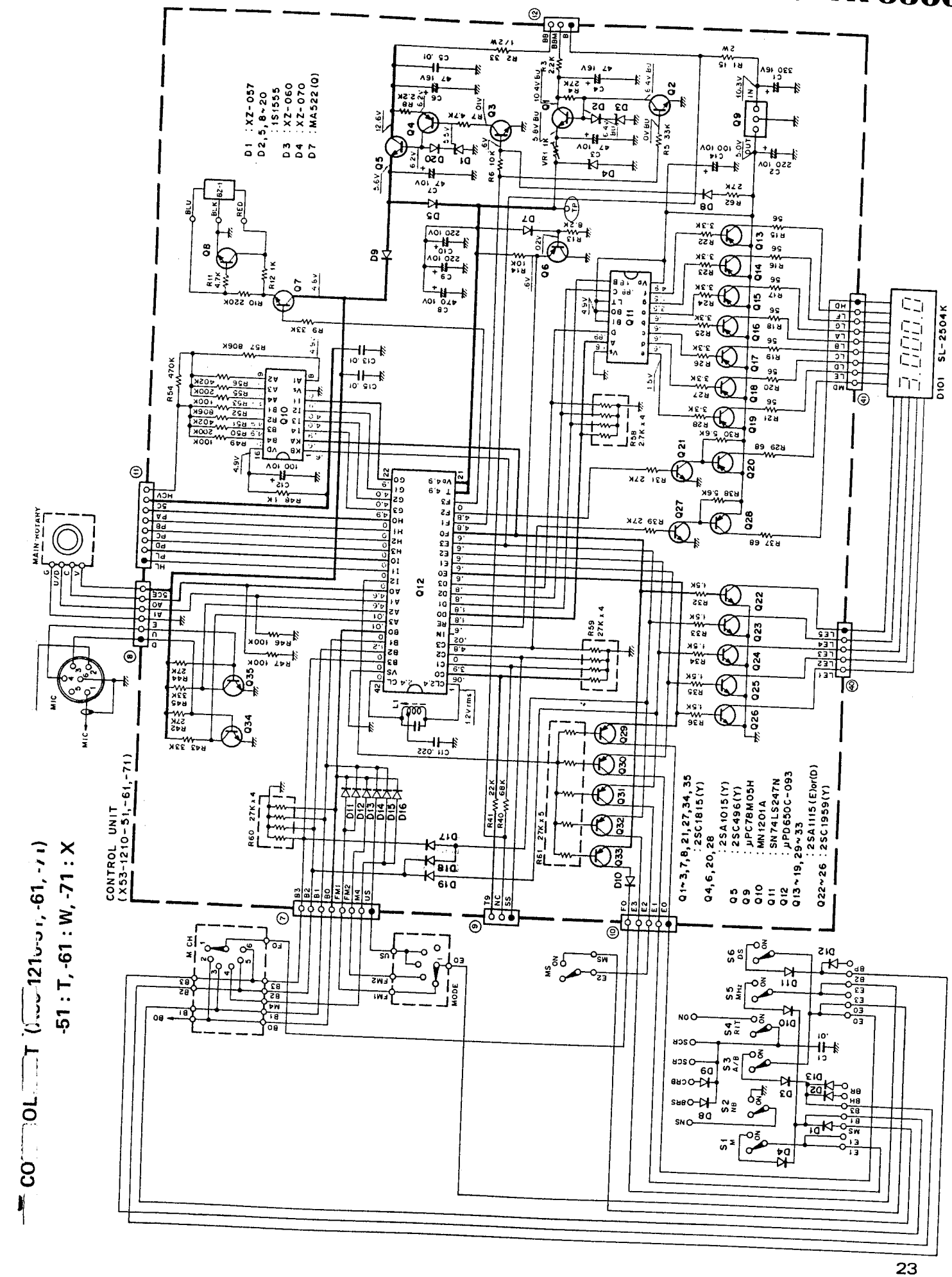
MA522



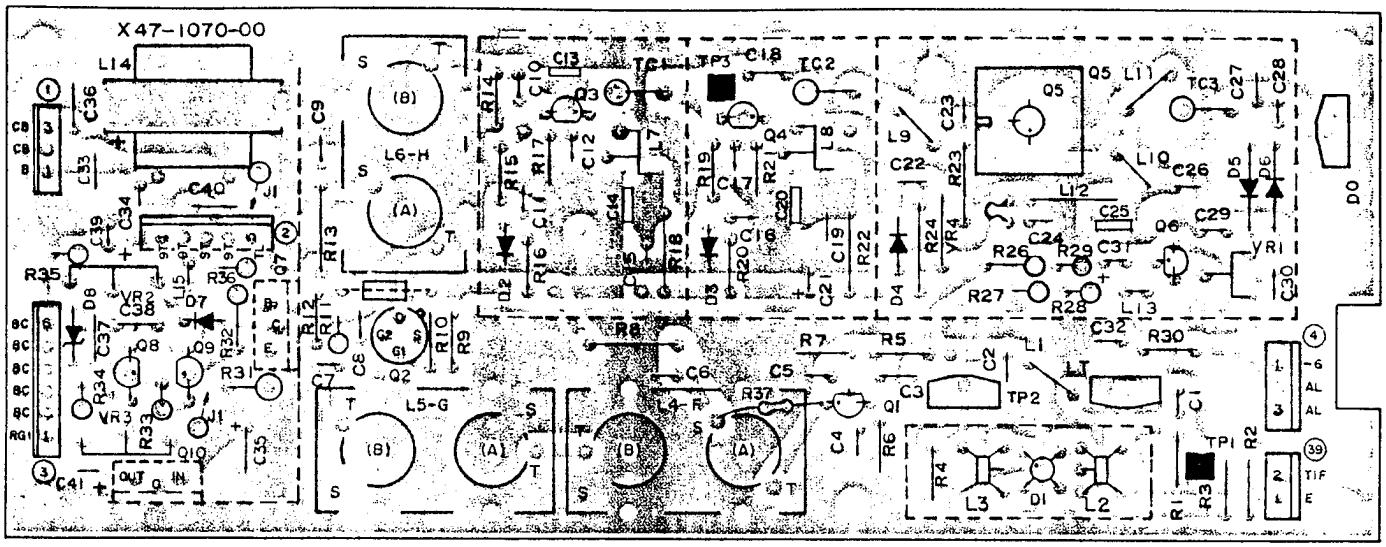
	T	W	X
D17	Not used	Used	Not used
D18	Not used	Not used	Used



R58~61

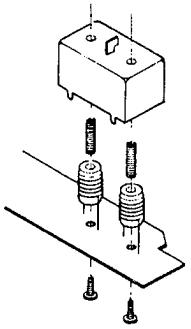

CONTROL UNIT
(X53-1210-51,-61,-71)
-51 : T, -61 : W, -71 : X
D1 : XZ-057
D2, 5, 8~20 : 1S1555
D3 : XZ-060
D4 : XZ-070
D7 : MA522 (Q)
Q1~3, 7, 8, 21, 27, 34, 35 : 2SC1815 (Y)
Q4, 6, 20, 28 : 2SA1015 (Y)
Q5 : 2SC496 (Y)
Q9 : μPC78M05H
Q10 : MN1201A
Q11 : SN74LS247N
Q12 : μPD650C-093
Q13~19, 29~33 : 2SA1115 (E) or (D)
Q22~26 : 2SC1959 (Y)
D101 SL-2504K
MAIN ROTARY
MIC
M CH
MODE
S1 M
S2 NB
S3 A/B
S4 RIT
S5 MHz
S6 DS

▼ DRIVE UNIT (X47-1070-00) Components side view



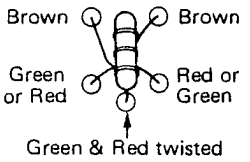
Q1, 3 : 2SC2549 Q2 : 3SK48 Q4 : 2SC2026 Q5 : 2SC2762 Q6, 9 : 2SC1815(Y) Q7 : 2SA1012(Yor O) Q8 : 2SA1015(Y)
Q10 : μPC78M08H D1 : ND487C1-3R D2, 3 : MV-13 D4 : 1S1555 D5, 6 : 1N60 D7 : VD1223 D8 : XZ-060

< Helical block assembly >



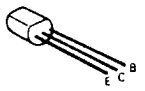
L4 (A) : Blue
(B) : Pink
L5 (A) : Pink
(B) : Gray
L6 (A) : Brown
(B) : Gray

< Attachment direction of L2, 3 >

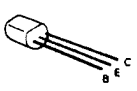


L2 and L3 should be installed parallel to the surface of the shield case.

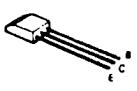
2SA1015 2SC1815
2SC458 2SC1923
2SC1675 2SC1959
2SC1775 2SC2240



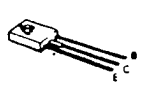
2SC2026
2SC2549



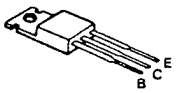
2SC460



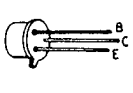
2SC496



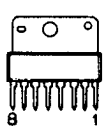
2SA1012



2SC2762



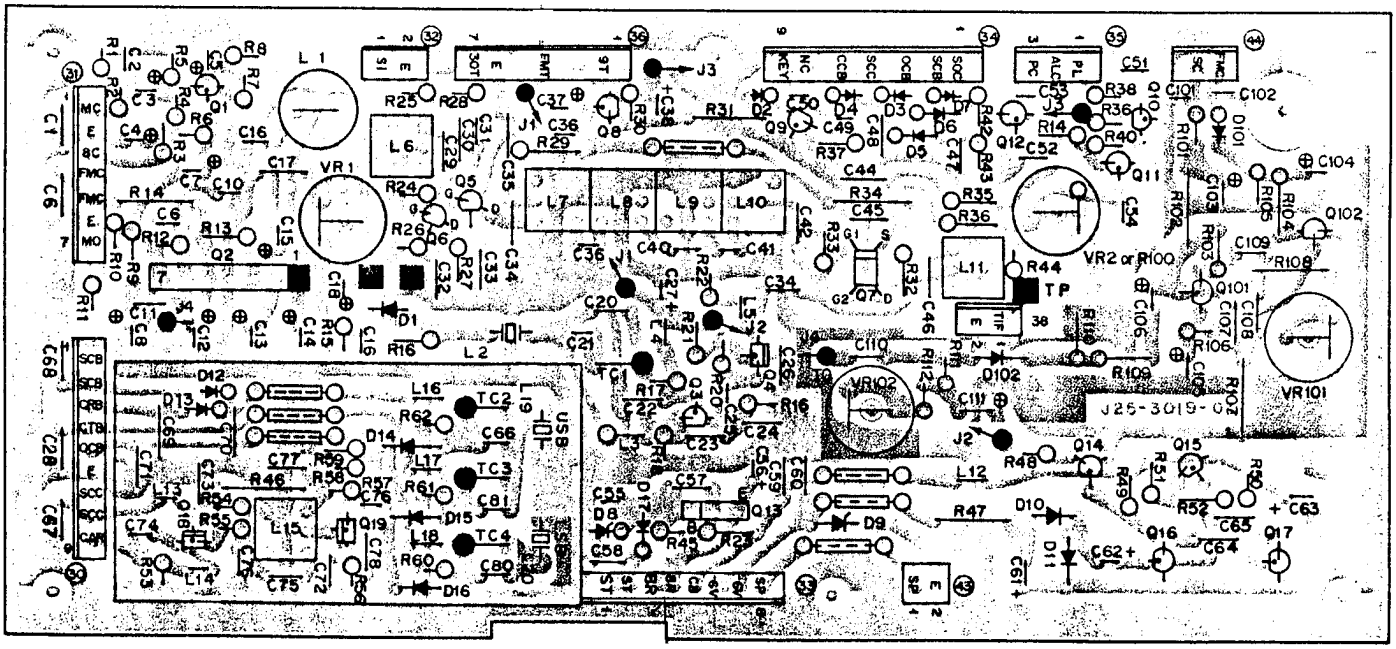
MB3713



TA7060P

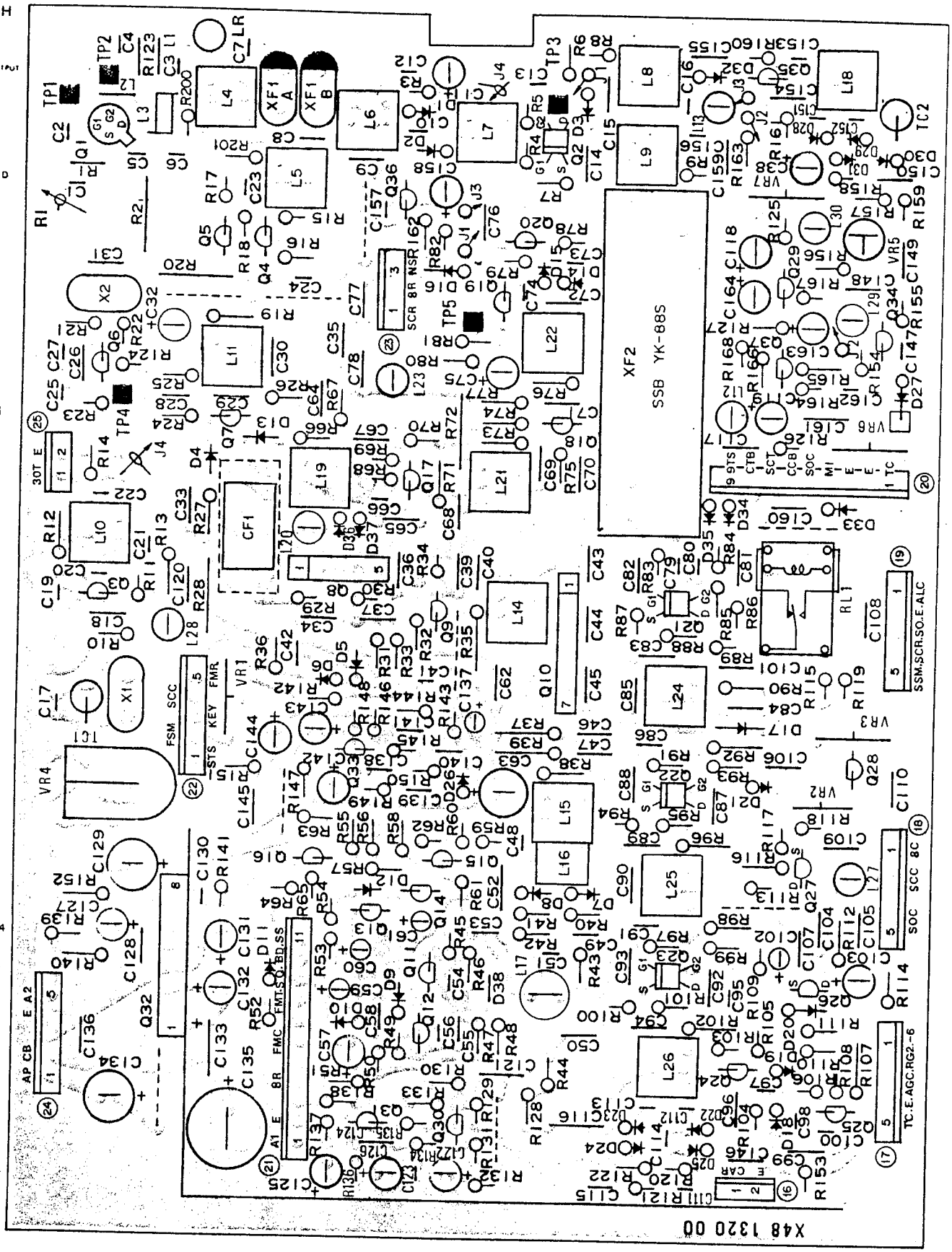
* Helical coils are identified by bobbin color.
* L4 (B), L5 (A) and L5 (B), L6 (B) are of the same type.

▼ CAR UNIT (X50-1720-00, -51, -61) -00 : X, -51 : T, -61 : W Foil side view

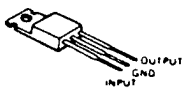


Q1 : 2SC2240(GR) Q2 : TA7061AP Q3 : 2SC1923(O) Q4, 18 : 2SC460(B) or 2SC1675(L) Q5, 6 : 2SK61(GR) Q7 : 3SK73(GR)
Q8~10, 12, 15 : 2SA1015(Y) Q11, 14, 16, 17 : 2SC1815(Y) Q13 : 2SC496(Y) Q19 : 2SC1675(L) Q101, 102 : 2SC458(B)
D1 : 1S2208 D2~7, 10~16, 101, 102 : 1S1555 D8 : XZ-090 D9 : XZ-060 D17 : V06B

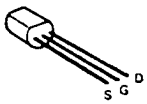
▼ IF UNIT (X48-1320-61) Components side view



μPC78M08H

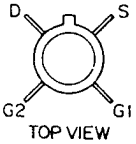


2SK30A



3SK73

3SK48

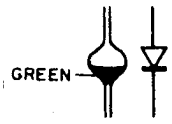


TOP VIEW

TA7061AP
μPC577H

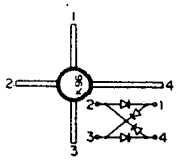
VD1223

MV-13



GREEN

ND487C1-3R



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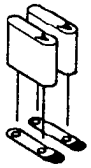
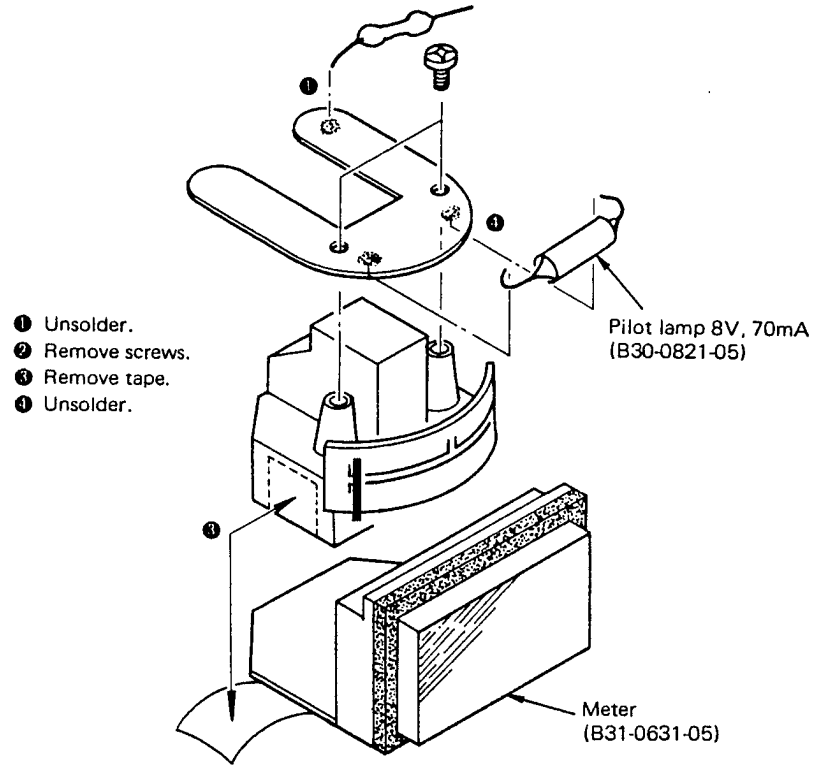
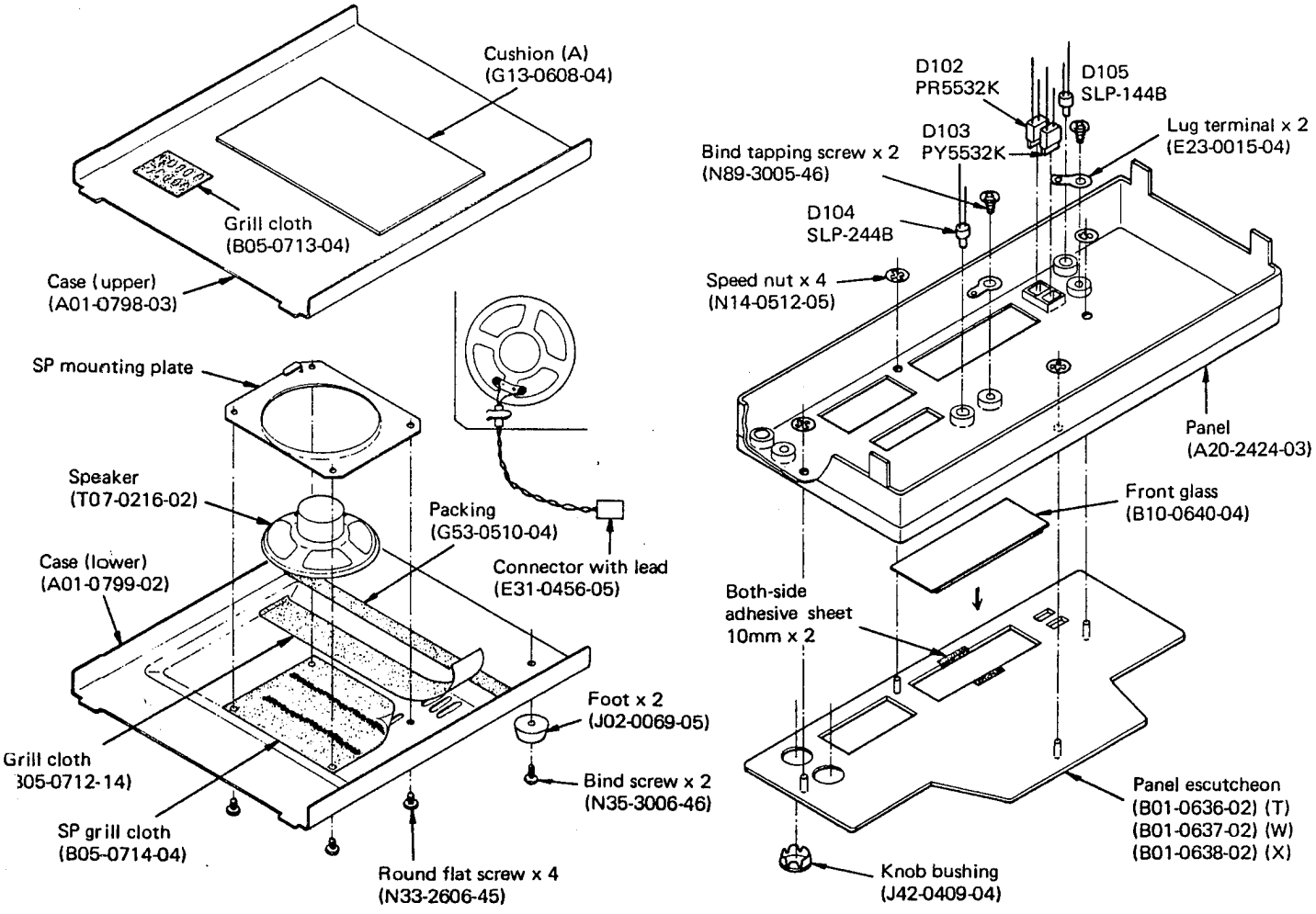


Q1 : 3SK48 Q2, 21~23 : 3SK73(GR) Q3~5, 7, 9 : 2SC460(B) or 2SC1675(L) Q6 : 2SC1923(O) Q8 : TA7060P
Q10 : μPC577H Q11, 12, 33 : 2SC1775(E) Q13~15, 17~20, 24, 25, 29~31, 36, 37 : 2SC1815(Y) Q16, 28 : 2SA1015(Y)
Q26 : 2SK30A(GR) Q27 : 2SK30A(O) Q32 : MB3713 Q34 : 2SC1959(Y) Q35 : 2SK61(GR)
D1~3, 17, 27, 32 : 1S1587 D4, 11, 13, 20, 21, 26, 33~35 : 1S1555 D5~10, 14, 15, 18, 19, 22~25, 28~31, 36, 37 : 1N60
D12 : 1S1212 D16 : MV13 D38 : D33A

DISASSEMBLY





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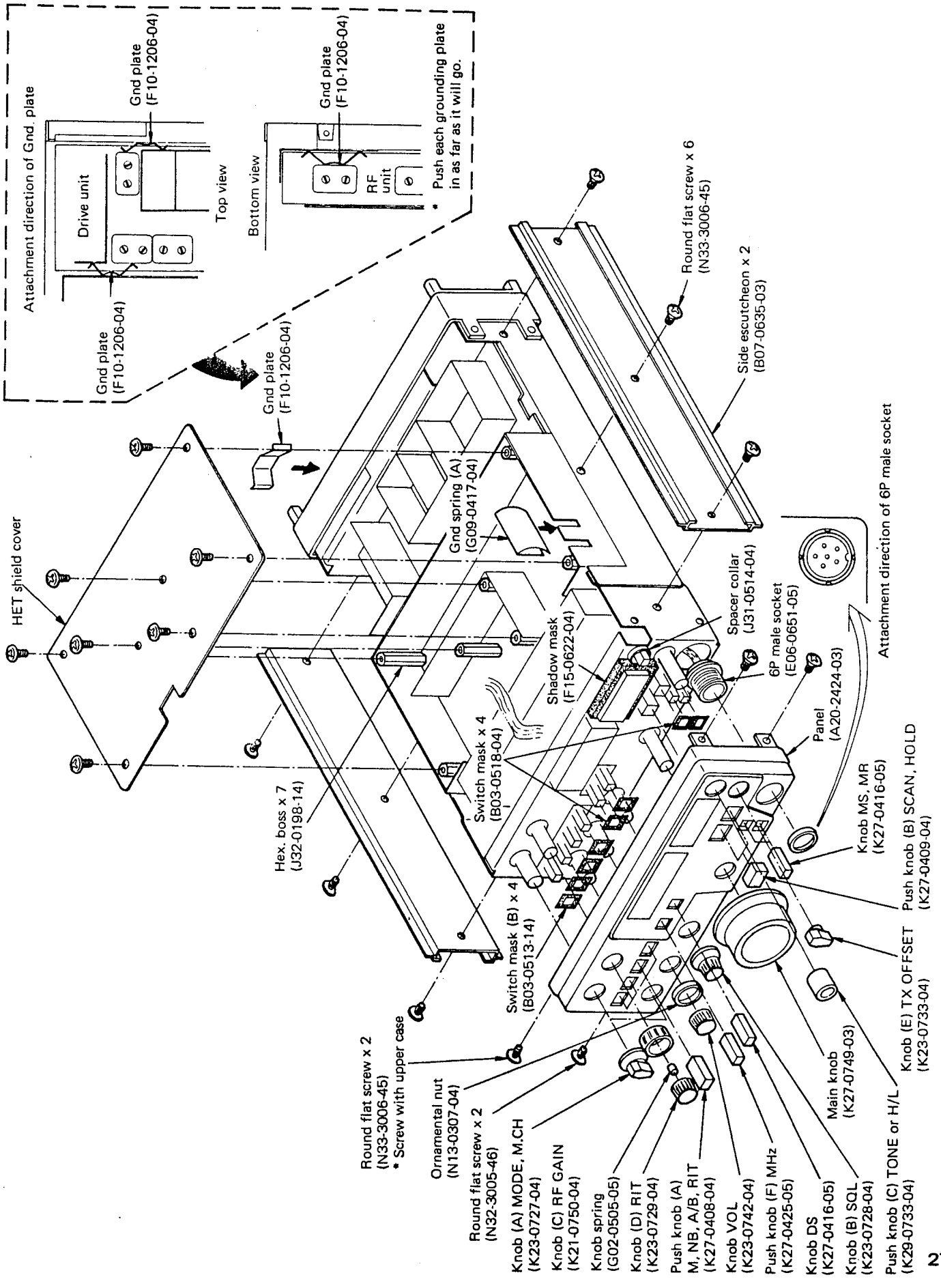

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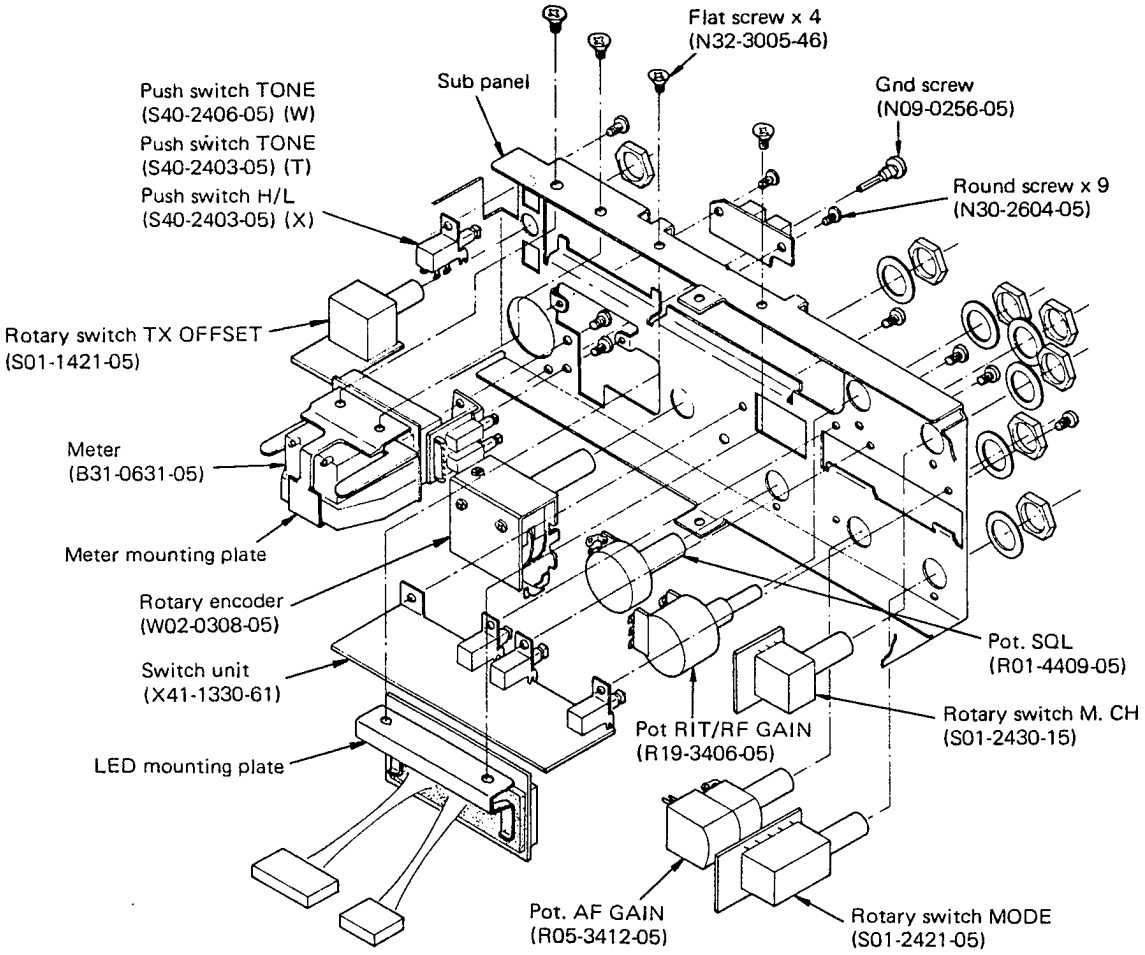
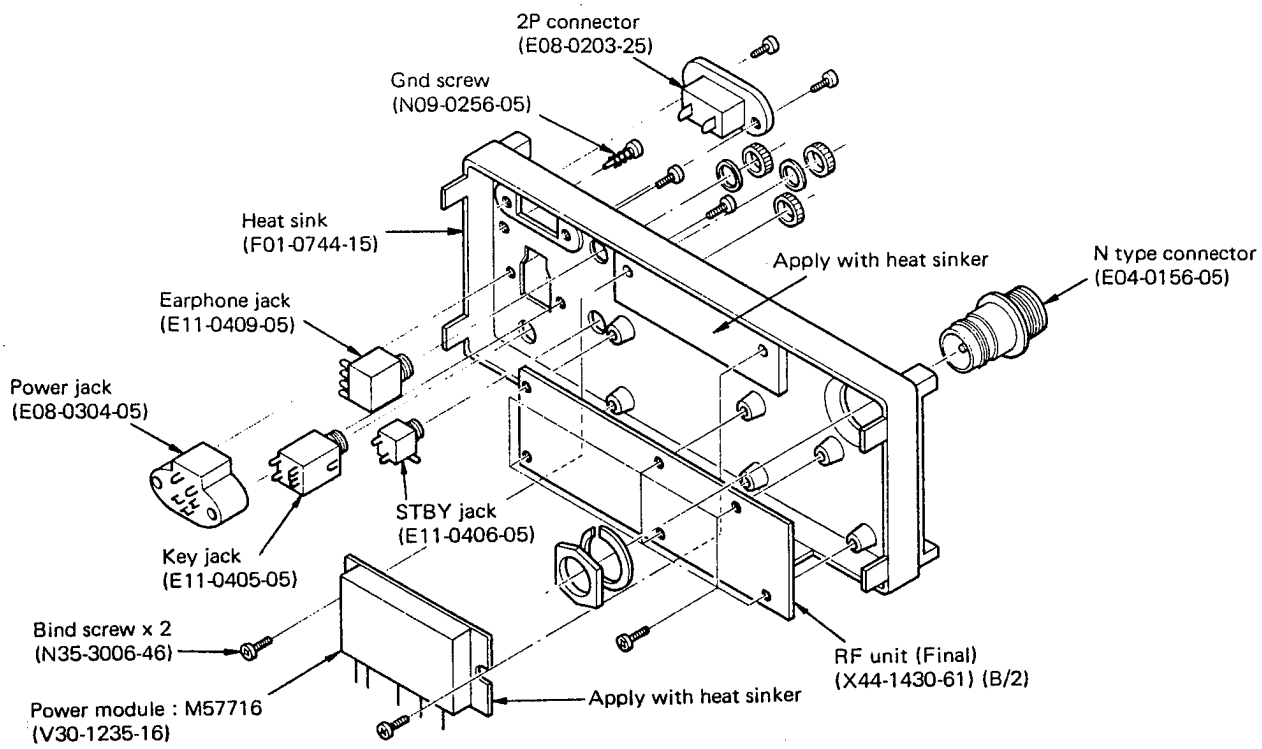
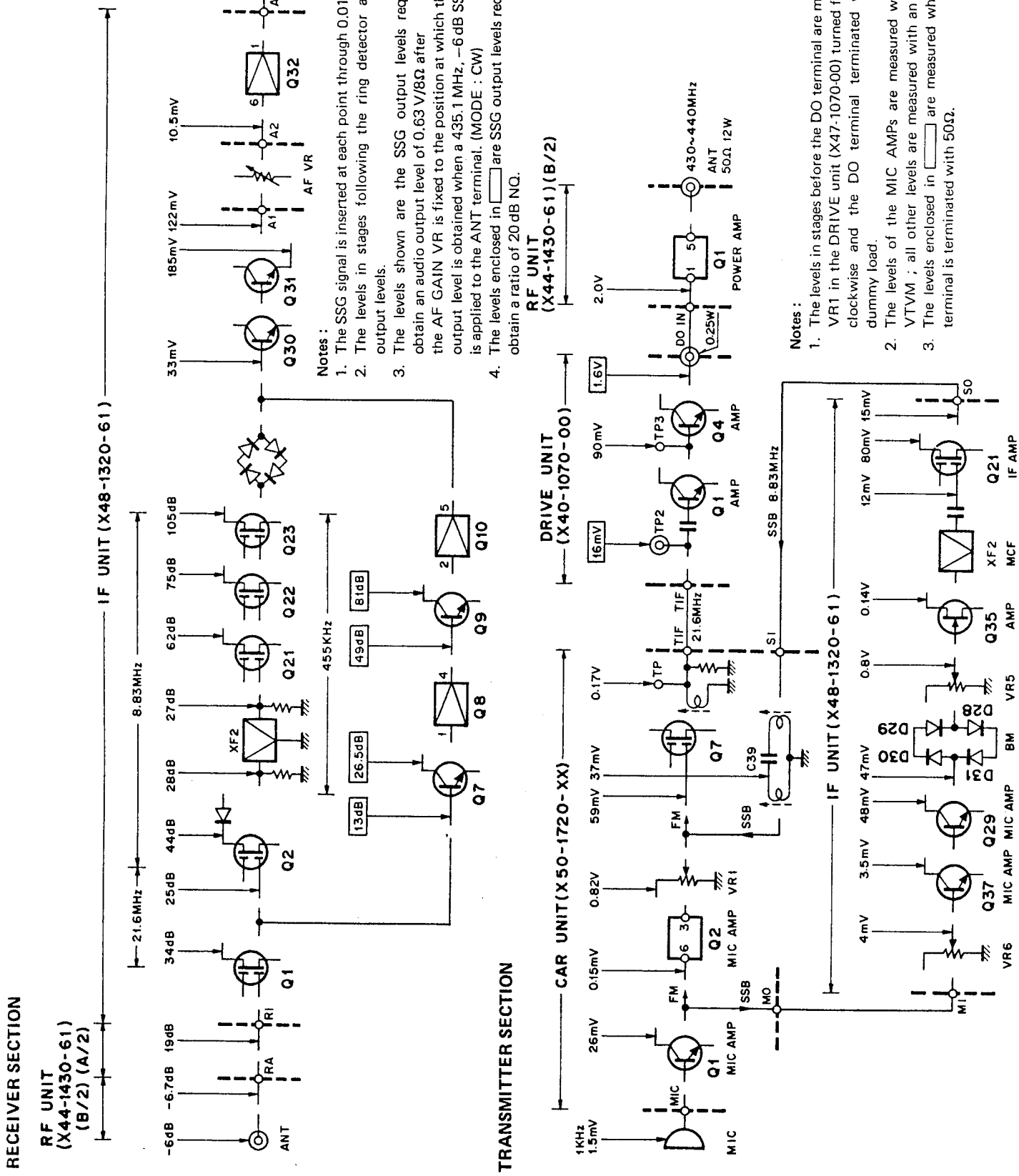




LEVEL DIAGRAMS



ADJUSTMENTS

<Test Equipment>

1. Tester
   - Input: Sufficient
2. RF VTVM (RF V.M.)
   - Input impedance: 1 MΩ and less than 2 pF
   - Voltage range: F.S. = 10 mV to 300V
   - Frequency range: 450 MHz or greater
3. Frequency counter (F count)
   - Minimum input voltage: 50 mV
   - Frequency range: 450 MHz or greater
4. DC power supply
   - Voltage 10V to 17V variable
   - Current: 6A min.
5. RF Power Meter
   - Dissipation: 3W, 20W
   - Impedance: 50Ω
   - Frequency range: 450 MHz
6. AF VTVM (AF V.M.)
   - Input impedance: 1 MΩ or greater
   - Voltage range: F.S = 1 mV to 30V
   - Frequency range: 50 Hz to 10 kHz
7. AF Generator (AG)
   - Frequency range: 100 Hz to 10 kHz
   - Output: 0.5 mV to 1V
8. Linear detector
   - Frequency range: 450 MHz
9. Directional coupler
10. Oscilloscope
    - With horizontal input and high sensitivity
11. Standard signal generator (SSG)
    - Frequency range: 450 MHz
    - Modulation: amplitude and frequency modulation
    - Output: −20 dB ~ 100 dB
12. AF Dummy load
    - 8Ω, 5W (approx.)
13. Sweep generator
    - Frequency range: 450 MHz
14. Field Strength Meter
    - Frequency range: 450 MHz

<Preparation>

Unless otherwise specified, set the controls as follows.

POWER/VOL SW	ON
SEND/REC	REC
RF GAIN VOL	MAX (fully counterclockwise)
SQUELCH VOL	MIN
MODE SW	USB
VFO A/B SW	A
TONE SW	OFF
TX OFFSET SW	S
RIT VOL	Centered
RIT SW	OFF
NB SW	OFF
SCAN SW	OFF
D.STEP/SEARCH	OFF
MR	OFF
MS	OFF
MHz	OFF

Table 9

Notes:

- When adjusting the trimmers or coils, use a non-induced adjusting rod of bakelite, etc.
- When adjusting the RX section never transmit to prevent SSG damage.
- Connect MIC connector as shown in Fig 11.

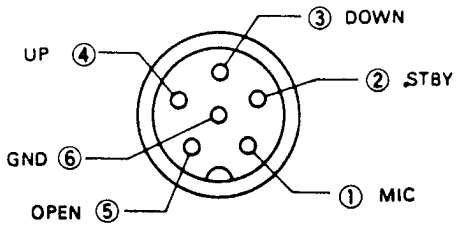


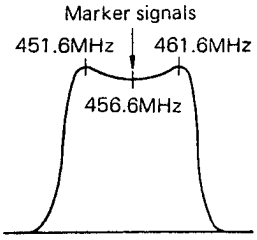
Fig. 11 MIC terminals (view from front panel side)

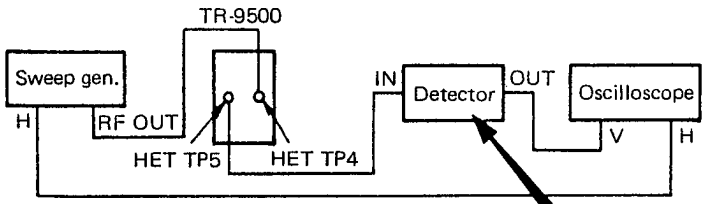
- The output level of SSG is indicated as SSG's open circut.

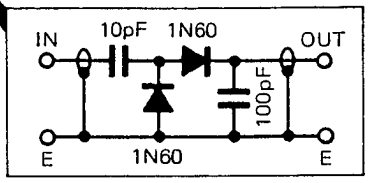
ADJUSTMENTS

TX/RX SECTION (COMMON)

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. Voltage check in RX mode	1) 8C	DC V.M	DRIVE	③ 8C				7.7~8.3V	Check
	2) 9T		DRIVE	② 9T				Less than 0.1V	
	3) 5C		HET	⑤ 5C				4.7~5.3V	Check
	4) 8R		CAR	㉝ 8R				8.0~8.6V	
	5) –6		CAR	㉝ –6				–5.8~–6.2V	
2. Voltage check in TX mode	1) –6 MODE : FM1, 2 Transmission mode	DC V.M	CAR	㉝ –6				0V	Check
	2) 8R		CAR	㉝ 8R				Less than 0.5V	
	3) 9T MODE : USB		DRIVE	② 9T	DRIVE	VR2	9.1V	+0.1V, –0V	
	4) Bias current	DC A.M	DRIVE	Shorting jumper	DRIVE	VR4	25mA	±2mA	
	5) DB	DC V.M	RF (B/2)	㉘ DB				11.7~12.1V	Check
3. Back-up voltage check	1) RX mode POWER : OFF	DC V.M	Control	TP	Control	VR1	5.0V	±0.1V	
	2) POWER : ON								
4. PLL	1) MODE : USB MHz : ON f : 434.00 MHz	RF V.M	HET	TP1	HET	L4	Turn the core counterclockwise until the oscillating signal level becomes 0.5dB lower than its peak value.	(0.85V)	All parenthesized figures below are reference values.
				TP2	HET	L6, 7	MAX	(0.85V)	
	2) f : 435.00 MHz	RF V.M	HET	TP2	HET	L7	Adjust the core so that the same level is obtained as at 434.00 MHz.	(0.65V)	
	3) f : 434.00 MHz	RF V.M	HET	TP3	HET	TC3,4 L35	MAX	(0.25V)	
				TP7	HET	L22,27,28	MAX Repeat adjustment	(0.65V)	
		DC V.M	HET	TP8	HET	TC6	6V	±0.1V	
		RF V.M	HET	TP7	HET	L22,27,28	MAX	More than 0.5V	
	4) f : 432.00 MHz	RF V.M	HET	TP6	HET	L20,21	MAX	(0.4V)	
	5) f : 435.00 MHz The sweep generator is connected to TP4 of the HET unit (Input : 30~35 dBμ) The detector is connected to TP5 and TP7 is grounded with the clip. TC5 : Maximum position (see the figure below).	Oscilloscope	HET		HET	L36,37	Adjust the four cores of the helical block so that the waveform shown at right is obtained.		





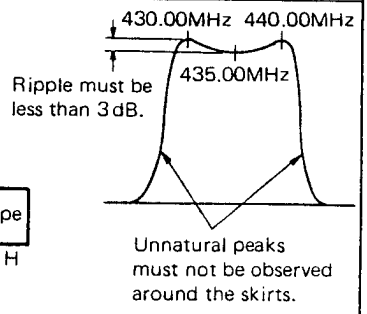
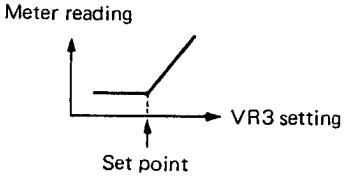


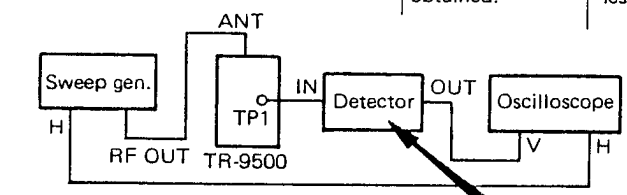
ADJUSTMENTS

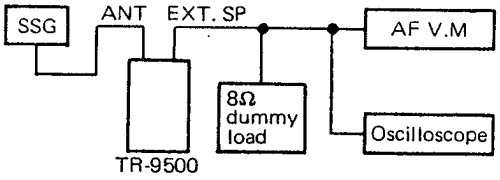
Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	6) Disconnect the test equipment and the grounding wire.	RF V.M	HET	TP5	HET	TC5	MAX	(0.5V)	
	7) Install the HET shielding cover.								
5. HET frequency adjustment	1) f : 435.00 MHz	F counter	HET	TP2	HET	TC2	111.53333 MHz	±10 Hz	
	2) f : 433.00 MHz			TP2	HET	TC1	109.86666 MHz	±10 Hz	
	3) MODE : USB MHz : OFF f : 432.9999 MHz			TP6	HET	TC7	124.99840 MHz	±10 Hz	
	4) f : 433.00 MHz MODE : LSB			TP6	HET	VR1	124.99850 MHz	±10 Hz	
	5) RIT VOL : Centered RIT SW : ON			TP6	HET	VR2	124.99850 MHz	±10 Hz	
	6) RIT VOL : fully clockwise (+direction) fully counter-clockwise (– direction)			TP6	HET			124.99980 MHz or higher 124.99770 MHz or lower	Check
	7) RIT SW : OFF RIT VOL : Centered MODE : USB								
6. SSB 2nd local oscillator	Set knobs as shown in Table 9.	RF V.M	IF	TP3	IF	L10	Turn the core a half turn out from the maximum.	(0.4V)	
	2)	F counter	IF	TP3	IF	TC1	30.4300 MHz	±10 Hz	
7. CAR	1) MODE : USB	RF V.M	IF	D27 cathode	CAR	L15	Turn the core a little to the left of the maximum reading position.	0.3V±0.02V	
	2)	F counter	IF	D27 cathode	CAR	TC2	8.8285 MHz	±50 Hz	
	3) MODE : CW							The same frequency as in paragraph 2) above	Check
	4) Transmission mode				CAR	TC3	8.8293 MHz	±50 Hz	
	5) Reception mode							The same frequency as in paragraph 2) above	Check
	6) MODE : LSB				CAR	TC4	8.8315 MHz	±50 Hz	
	7) MODE : USB								

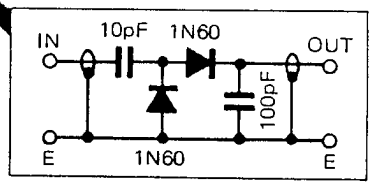
ADJUSTMENTS

RX SECTION

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. RG1 voltage	1) RG1 voltage	DC V.M	DRIVE	③RG1	DRIVE	VR3	4.0V	±0.1V	
2. Helical	1) Connect the sweep generator to the ANT terminal on the rear panel with its output level set to 30~40 dBμ.	Oscilloscope, Sweep generator	IF	TP1	RF (A/2)	L51~53	Adjust the 6 helical block cores so that the waveform shown at right is obtained.		
3. Sensitivity adjustment	1) Connect the AF VTVM to the EXT SP terminal on the rear panel with an 8Ω load connected. Connect the SSG to the ANT terminal on the rear panel.	SSG, Oscilloscope, AF V.M, 8Ω dummy load							
	2) Tune to the SSG signal (435.025 MHz, 6 dBμ) so that a beat signal of about 1.5 kHz is output.	AF V.M, S-meter		EXT.SP	IF	L4~9 L24~26	MAX Repeat adjustment		
	3) MODE : FM SSG : MOD 1 kHz DEV 3.5 kHz	S-meter			IF	L11	MAX Repeat adjustment		
	4) SSG output : 50 dBμ	AF V.M		EXT.SP	IF	L15	MAX		
	5) SSG output : 100 dBμ	AF V.M		EXT.SP				Normal output should be obtained.	Check
	6) SSG output : −6 dBμ	AF V.M, Oscilloscope		EXT.SP	RF (A/2)	L51	Fine adjust the core so that the optimum waveform is obtained.	S/N must be more than 20 dB.	S/N measurement for FM mode
4. S-meter reading in FM mode	1) SSG output : 26 dBμ	S-meter			IF	VR1	Adjust VR1 for a meter reading of "10" on a scale of 1−10.		
5. S-meter reading in the USB mode	1) MODE : USB SSG output : OFF	S-meter			IF	VR3	Turn VR3 counterclockwise so that the meter needle does not swing.		





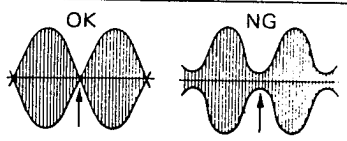
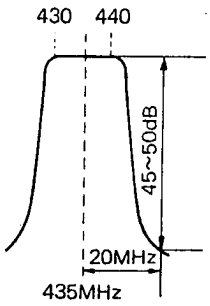


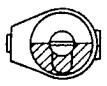
ADJUSTMENTS

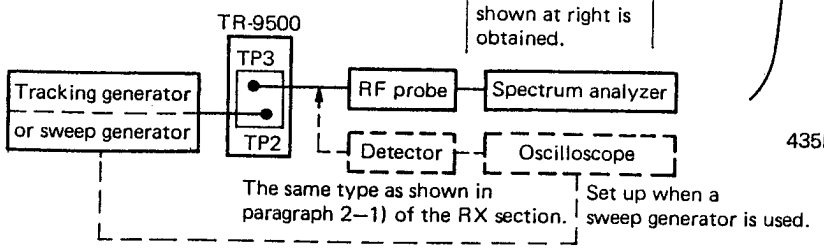
Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	2) SSG output : ON 0 dBμ Adjust the frequency so that the S-meter reading is maximized.	S-meter			IF	L25	Adjust the core for the maximum meter reading, then turn it counterclockwise until the meter reads "1" on a scale of 1–9.		
	3) SSG output : 20 dBμ				IF	VR2	Adjust VR2 so that the S-meter reads "9" on a scale of 1–9.		
6. SSB sensitivity adjustment	1) SSG output : –6 dBμ	AF V.M		EXT.SP				S/N must be more than 14 dB.	Check
	2) Set the VFO dial to 430.00 and 439.975 and perform measurements described in paragraphs 3–6) and 6–1) at each point.							FM S/N must be more than 20 dB. SSB S/N must be more than 14 dB.	Check
7. NB	1) SSG output : 10 dBμ	DC V.M	IF	TP5	IF	L19, 21	MIN Repeat adjustment		
	2) Pulsed noise is input.							Pulsed noise should be reduced.	
8. Side tone	1) MODE : CW Connect a key to the KEY terminal on the rear panel. AF VOL : Centered	AF V.M		EXT.SP	IF	VR4	0.5V/8Ω		
9. Squelch	1) MODE : FM SQ VOL : Threshold							The SQ VOL position should be at 9~12 o'clock position.	Check
	2) SQ VOL : Threshold Tune to the SSG signal (any frequency within the band, –10 dBμ).	SSG						Squelch should open.	

ADJUSTMENTS

TX SECTION

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. FM carrier	1) Pull out the TIF ㊳ connector of the CAR unit. MODE : FM1 Transmit.	RF V.M	CAR	TP	CAR	L10,11	MAX	(1.2V)	
		F counter	CAR	TP	CAR	TC1	21.6000 MHz	±200 Hz	
2. CW carrier level	1) MODE : CW Transmit.	RF V.M	CAR	TP	IF	L18	MAX		
					CAR	L6	MAX		
					CAR	L7~10	MAX Repeat adjustment		
					IF	VR7	Adjust VR7 for 1.2V reading.	±0.05V	
3. Carrier point	1) MODE : USB Transmit.	Oscillo-scope, RF V.M	CAR	TP	IF	TC2 VR5	MIN Repeat adjustment		
	2) Apply a two-tone signal (300 Hz, 1 mV and 2700 Hz, 1 mV) to the MIC terminal.	Oscillo-scope			IF	VR6	Set VR6 to the 11 o'clock position.		
	3) Ditto				CAR	TC2	The waveform should be as shown at right.		
	4) MODE : LSB				CAR	TC4	Perform the same adjustment as in paragraph 3–3).		
3. Simplified carrier point adjustment	1) MODE : USB Adjust the AG output level so that a transmission power of 5W is obtained.	Power meter							
	2) AG : 300 Hz or 2700 Hz	Power meter			CAR	TC2	Alternate 300 Hz and 2700 Hz.	The output power should be the same at both frequencies.	
	3) MODE : LSB	Power meter			CAR	TC4	Alternate 300 Hz and 2700 Hz.	The output level should be the same at both frequencies.	
4. Helical	1) Drive unit VR1 : all the way to the left TC2 : Centered (see the figure below). Connect a tracking generator or sweep generator to TP2 of the drive unit and connect the RF probe to TP3.	Oscillo-scope spectrum analyzer	DRIVE	TP3	DRIVE	TC1	Adjust TC1 so that the maximum level is obtained at 435.00 MHz.		
						L4~6	Adjust the 6 helical block cores so that the waveform shown at right is obtained.		
	2) Disconnect the test equipment. Connect the TIF ㊳ connector of the CAR unit.								





ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
5. Drive adjustment	1) f : 435.00MHz MODE : FM1 Disconnect the DO cable from the drive unit and connect a 3W power meter to the DO terminal. Transmit.	3W power meter (RM V.M)	DRIVE	DO	DRIVE	TC1~3	MAX Repeat adjustment	More than 0.25W (more than 3 Vrms)	
	2) f : 430.00 MHz 439.975 MHz							More than 0.25 W (more than 3 Vrms)	Check
6. Power/RF meter adjustment	1) MODE : CW Disconnect the 3W power meter and connect the DO cable to the DO terminal. f : 430.00, 435.00, 439.975 MHz	20W power meter		ANT				More than 15W	Check
	2) f : 435.00 MHz	DC V.M	FINAL	TP	FINAL	VR3	MIN		
	3) f : 430.00 MHz	Power meter		ANT	DRIVE	VR1	Adjust VR1 for a reading of 11 W.		
	4) Current consumption	DC A.M						The total current consumption should be less than 3.8A.	Check
	5) RF meter	RF meter			FINAL	VR1	Adjust the VR1 for a meter reading of "8" on a scale of 0–10.		
	6) f : 439.975 MHz	Power meter, DC A.M						More than 11 W, Less than 3.8A	Check
	7) If the specifications were not satisfied on adjustment in paragraphs 6–4) and 6), widen the pitch of L5 in the final unit and perform power adjustment again.								
7. Low power adjustment	1) MODE : FM1 f : 435 MHz HI/LOW : LOW Transmit.	Power meter		ANT	Carrier	VR2	Adjust VR2 for a reading of 1.2W.		
	2) MODE : FM, CW f : 431 MHz Transmit.							Less than 3W	Check
	3) f : 439 MHz Transmit.							Less than 3W	
8. Protection	1) MODE : FM1 f : 435 MHz AMT terminal : open Transmit.				FINAL	VR2	Set VR2 to the 7 o'clock position as viewed from the front.		
		DC A.M						Less than 2A	Check
	2) Transmit when the meter reading is greater than 2A.				FINAL	VR2	Adjust VR2 for a reading of 2A.		
	3) Connect the power meter.							Normal output should be obtained.	Check

ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
9. FM deviation	1)Connect the AG (1 kHz, 30 mV) to the MIC terminal, then transmit.	Linear detector			CAR	VR1	Adjust the VR1 for 5 kHz deviation.		
	2) Adjust the AG level so that the linear detector reading becomes 3.5 kHz.	Linear detector, AG		MIC terminal				The AG output level must be less than 5 mV.	Check
10. SSB MIC gain	1) MODE : USB f : 432 MHz Connect the AG (1.5 kHz, 1 mV) to the MIC terminal. Transmit.	Power meter		ANT	IF	VR6	5 W	±0.5 W	
	2) HI/LOW : HI→LOW →HI							The output power should not vary.	
	3) Set the AG output to 1.5 kHz,10 mV.						12.5 W	±2.5 W	Check
11. Carrier suppression	1) MODE : USB Transmit.	Field strength meter			IF	TC2 VR5	MIN Repeat adjustment	More than 50 dB (less than −10 dBm)	
12. Tone (W, T type)	1) TONE : ON Transmit.	Connect a F counter to the linear detector output.			CAR	VR101	1750 Hz	±10 Hz	
							DEV : more than 2.5 kHz		
	2) T type only Transmit.				CAR	VR102	Adjust the tone burst interval to about 0.5 sec.		

Micro-processor operational check

Item	Condition	Specification
1. Reset check	1) Pull the power connector out and reinsert it.	Display 3.000.0
	2) VFO A/B : B	Display 0.000.0
	3) VFO A/B : A MR : ON MEMORY : 1	Display 3.000.0
	4) MEMORY : 2~6	Display 0.000.0
	5) MR : OFF	Display 3.000.0
2. Dial step and number of digits displayed	1) A/B : A MODE : USB, CW, LSB Turn the VFO knob clockwise one click at a time until the display becomes 3.001.0, then turn it counterclockwise until 2.999.0 is displayed.	The display should vary in 100 Hz steps. (5 digit display)
	2) MODE : FM2	The display should vary in 1 kHz steps. (4 digit display)
	3) D.S : ON Turn the VFO knob clockwise one click at a time until 3.10 is displayed, then turn it counterclockwise until 2.90 is displayed.	The display should vary in 5 kHz steps. (3 digit display)
	4) MODE : FM1 VFO A/B : B Turn the VFO knob clockwise one click at a time until the display which starts at 0.000 reaches 0.100, turn it counterclockwise until the display becomes 9.900 (0.100→0.000→9.900), then turn it clockwise until 0.000 is displayed.	The display should vary in 25 kHz steps. (4 digit display)
	5) D.S : OFF Perform the same operation as in paragraph 2—4).	The display should vary in 25 kHz steps. (4 digit display)

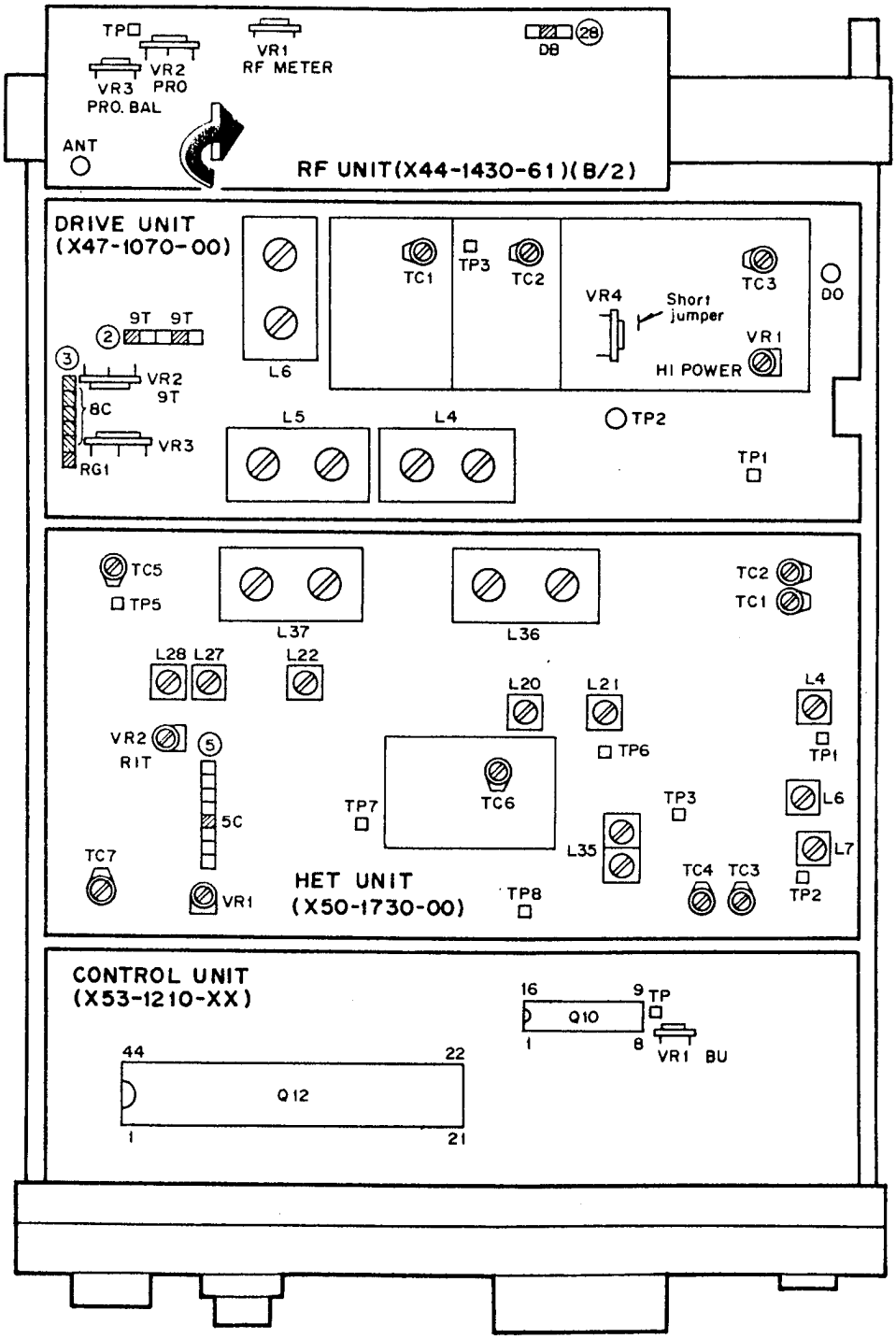
ADJUSTMENTS

Item	Condition	Specification
Search operation check	1) MODE : USB D.S : ON	The frequency range from 0 to 9.9 kHz must be searched in 100 Hz steps.
	2) VFO A/B : A Turn the MAIN knob.	The frequency should vary in 10 kHz steps.
	3) Transmit.	The ON AIR indicator (red) lights to indicate transmission.
	4) Receive. D.S : OFF	
4. MHz indication check	1) MHz : ON MODE : FM1 Turn the MAIN knob in both directions.	The display should vary in 1 MHz steps. The tone sounds everytime the display changes.
5. Memory write	1) f : 1.00 MEMORY : 1 M : ON	The tone sounds.
	2) f : 2.00 MEMORY : 2 M : ON	The tone sounds.
	3) f : 3.00 MEMORY : 3 M : ON	The tone sounds.
	4) f : 4.00 MEMORY : 4 M : ON	The tone sounds.
	5) f : 5.00 MEMORY : 5 M : ON	The tone sounds.
	6) f : 6.00 MEMORY : 6 M : ON	The intermittent tone sounds continuously.
	7) f : 7.00 M : ON	The intermittent tone stops.
Memory call	1) MR : ON	Display 5.000.0
	2) Transmit.	Display 7.000.0
	3) Receive.	Display 5.000.0
	4) MEMORY : 5 : 4 : 3 : 2 : 1	Display 5.000.0 4.000.0 3.000.0 2.000.0 1.000.0
	5) MR : OFF	Display 7.00
7. MEMORY SCAN check	1) SQL : all the way to the right	Display 1.000.0 ~ 6.000.0 The frequency changes repeatedly from 1.000.0 to 6.000.0. The MHz dot flickers.
	2) SQL : all the way to the left	The display stops. The dot flickers. The BUSY indicator lights.
	3) SCAN : ON	The next memory channel is displayed.

Item	Condition	Specification
	4) Turn SQL clockwise.	Scan starts. The BUSY indicator goes off.
	5) HOLD : ON	The display stops changing. The dot flickers.
	6) SCAN : ON	Scan starts.
	7) Transmit.	Scan stops.
	8) Receive.	The dot flickers.
	9) MS : OFF	The dot lights continuously.
8. SCAN check	1) SQL : all the way to the right SCAN : ON	The display frequency increases. The dot flickers.
	2) SQL : all the way to the left	The display stops changing. The BUSY indicator lights. The MHz dot flickers.
	3) Turn SQL clockwise.	The display frequency increases. The BUSY indicator goes off.
	4) HOLD : ON	The display stops changing. The MHz dot lights continuously.
	5) SCAN : ON	The display frequency increases. The MHz dot flickers.
	6) Transmit.	The display stops changing. The MHz dot lights continuously.
	7) Receive.	Scan stops.
9. UP/DOWN check	1) MODE : USB MHz : OFF Set the MAIN dial to 7.000.0.	Display 7.000.0
	2) Press the MIC UP switch once.	The tone sounds. Display 7.000.1
	3) MHz : ON Press the MIC UP switch once.	The tone sounds. Display 8.000.1
	4) Hold down the MIC UP switch.	The intermittent tone sounds. The display frequency increases.
	5) Press the MIC DOWN switch once.	The tone sounds. The display frequency decreases 1 MHz.
	6) MHz : OFF Press the MIC DOWN switch once.	The tone sounds. The display frequency decreases 100 Hz.
	7) Hold down the MIC DOWN switch.	The intermittent tone sounds. The display frequency decreases.
10. RIT	1)RIT : ON	The RIT indicator (red) lights.
	2) MODE : FM1, FM2	The RIT indicator (red) goes out.
	3) Transmit.	The RIT indicator (red) goes out. The ON AIR indicator (red) lights.
	4) Receive.	The RIT indicator (red) lights.

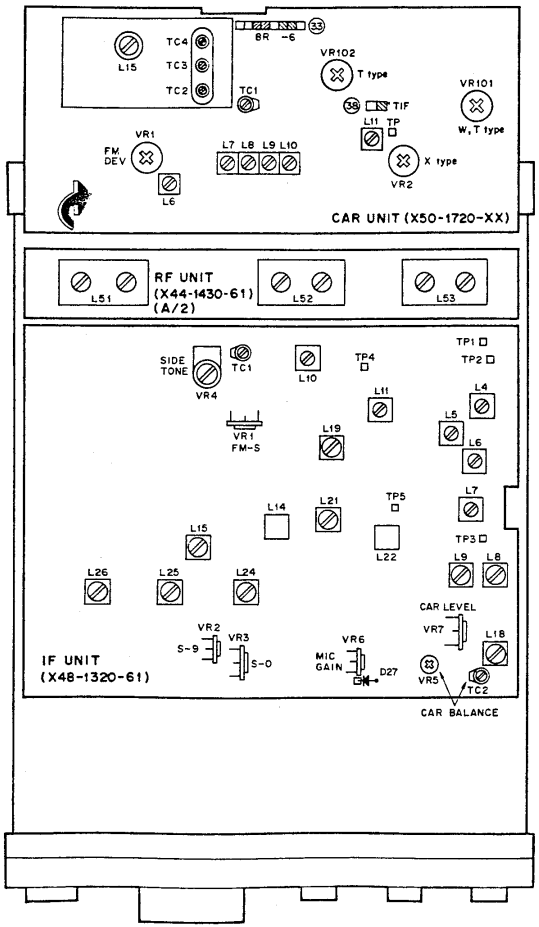
ADJUSTMENTS

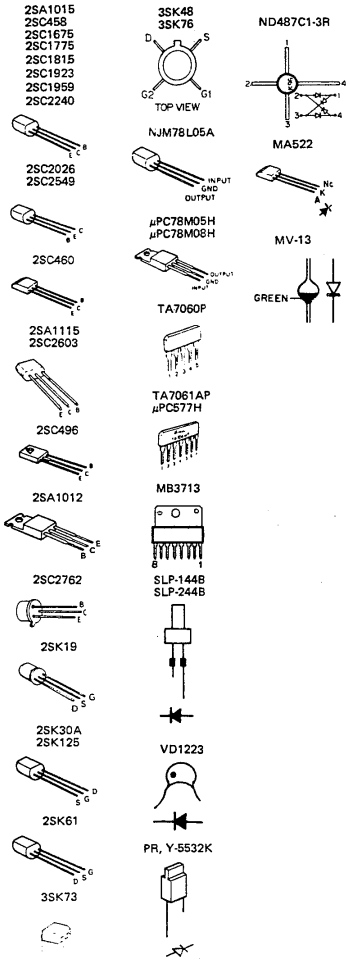
TOP VIEW



ADJUSTMENTS

BOTTOM VIEW





SCHEMATIC ABBREVIATION (W) TYPE TR-9500

Connector No.	Terminal No.	Terminal	Remarks	Destination: Unit/Switch	Destination: Connector No.	Destination: Terminal No.	Destination: Terminal
DRIVE UNIT (X47-1070-00)							
①	1	B	Switched B + 13.8 V	S/RF meter			B
				POW. SW			B
	2	CB	Common B + 13.8 V	CAR UNIT	㊸	5	CB
	3	CB		IF UNIT	㉔	2	CB
②	1	9T	+9 V in TX	CAR UNIT	㊱	2	9T
	2	9T					
	3	ST	Stand by	MIC terminal		2	ST
	4	9T	+9 V in TX	MODE SW. 3			9T
	5	TL	On air light B +	SW UNIT	⑭	12	TL
⑧	1	RG1	RF GAIN control Top	RF GAIN VR		1	RG1
	2	8C	+8 V common	IF UNIT	⑯	1	8C
	3	8C		RF UNIT	㉖	2	8C
	4	8C		HET UNIT	⑤	8	8C
	5	8C		MODE SW. 2			8C
	6	8C		CAR UNIT	㊶	3	8C
④	1	−6	−6 V in RX and SSB TX	CAR UNIT	㊵	6	−6
	2	ALC	ALC	CAR UNIT	㊷	2	ALC
	3	ALC		IF UNIT	⑮	1	ALC
㊽	1	E	GND				
	2	TIF	IF signal for TX	CAR UNIT	㊽	1	TIF
		DO	Drive output to final	RF UNIT B/2			IN
		LT	TX reference signal	HET UNIT			LT
IF UNIT (X48-1320-61)							
⑯	1	CAR	Carrier	CAR UNIT	㉚	9	CAR
	2	E	GND				
⑰	1	−6	−6 in RX and SSB TX	CAR UNIT	㉝	7	−6
	2	RG2	RF GAIN CONTROL Arm	RF GAIN		2	RG2
	3	AGC	AGC	RF UNIT	㉖	3	AGC
	4	E	GND				
	5	TC	Carrier for TX	IF UNIT	⑳	1	TC
⑱	1	8C	+8 V common	DRIVE UNIT	③	2	8C
	2	SCC	+8 V common in SSB, CW	CAR UNIT	㉚	8	SCC
	3	SCC		IF UNIT	㉒	4	SCC
	4	SOC	+8 V common in SSB	IF UNIT	⑳	5	SOC
	5	SOC		CAR UNIT	㉞	1	SOC
⑬	1	ALC	ALC	DRIVE UNIT	④	3	ALC
	2	E					
	3	SO	1st IF output in SSB, CW TX	CAR UNIT	㉜	1	SI
	4	SCR	+8 V in SSB, CW RX	SW UNIT	⑭	8	SCR
	5	SSM	S-Meter in SSB, CW	S/RF meter			SSM
㉘	1	TC	Carrier for TX	IF UNIT	⑰	5	TC
	2	E	GND				
	3	E					
	4	MI	SSB MIC input from carrier unit	CAR UNIT	㉛	7	MO
	5	SOC	+8 V common in SSB	IF UNIT	⑮	4	SOC
	6	CCB	+8 V common in CW	MODE SW 2			CCB
	7	SCT	+9 V in SSB, CW TX	HET UNIT	⑤	6	SCT
	8	CTB	+9 V in CW TX	MODE SW 3			CTB
	9	9TS	+9 V in SSB TX	MODE SW 3			9TS
㉑	1	A1	AF GAIN CONTROL Top	AF GAIN VR		1	
	2	E	GND				
	3	8R	+8 V in RX	RF UNIT	㉖	1	8R
	4	8R		MODE SW. 4			8R
	5	8R		CAR UNIT	㊷	3	8R
	6	FMC	+8 V common in FM	MODE SW. 2			FMC
	7	NC	Not connected	−			
	8	FMT	+9 V in FM TX	CAR UNIT	㊱	4	FMT
	9	SO	SOL	SOL VR Arm			
	10	BD	BUSY light	SW UNIT	⑭	11	BD
	11	SS	SCAN Stop	CONTROL UNIT	⑨	1	SS
㉓	1	STS	SIDE TONE SW	KEY			STS
	2	FSM	FM S-Meter	S/RF meter			SSM
	3	KEY	KEY	KEY			KEY
	4	SCC	+8 V common in SSB, CW	IF UNIT	⑯	3	SCC
	5	FMR	+8 V in FM RX	MODE SW. 4			FMR

TR-9500 SCHEMATIC ABBREVIATION (W) TYPE

Connector No.	Terminal No.	Terminal	Remarks	Destination: Unit/Switch	Destination: Connector No.	Destination: Terminal No.	Destination: Terminal
㉒	1	SCR	+8 V in SSB, CW RX	SW UNIT	⑭	9	SCR
	2	8R	+8 V in RX	CAR UNIT	㊸	4	8R
	3	NS	Noise blanker SW	SW UNIT	⑭	5	NS
㉔	1	AP	Audio output	EXT. SP			AP
	2	CB	Common B + 13.8 V	DRIVE UNIT	①	3	CB
	3	NC		–			
	4	E	GND				
	5	A2	AF GAIN CONTROL Arm	AF GAIN VR		2	
㉕	1	30T	30.43 MHz for TX	CAR UNIT	㊱	7	30T
	2	E	GND				
		LR	RX reference signal	HET UNIT			LR
		RI	RF signal input	RF UNIT (A/2)			OUT
HET UNIT (X50-1730-00)							
③	1	HCV	HET control voltage	CONTROL UNIT	⑪	8	HCV
	2	RIT	RIT control Arm	RIT VR		2	
	3	RV1	RIT control Top	RIT VR		1	
	4	5C	+5 V common	CONTROL	⑪	7	5C
	5	ON	RIT SW	SW UNIT	⑭	10	ON
	6	SCT	+9 V in SSB, SW TX	IF UNIT	㉘	7	SCT
	7	RV3	RIT control	RIT VR		3	
	8	8C	+8C common	DRIVE UNIT	③	4	8C
⑥	1	HL	High/Low Band	CONTROL UNIT	⑪	1	HL
	2	PD	PLL IC data		⑪	3	PD
	3	PC			⑪	4	PC
	4	PB			⑪	5	PB
	5	PA			⑪	6	PA
	6	PL	PLL IC load pulse		⑪	2	PL
		LR	RX reference signal	IF UNIT			LR
		LT	TX reference signal	DRIVE UNIT			LT
		E	GND				
CONTROL UNIT (X53-1210-61)							
⑦	1	US	USB	MODE SW. 1			US
	2	M4	Memory channel M4	M. CH SW			M4
	3	FM2	FM2 mode	MODE SW. 1			FM2
	4	FM1	FM1 mode	MODE SW. 1			FM1
	5	B0	μ-proc. B-input port	M. CH SW			B0
	6	B1		M. CH SW			B1
	7	B2		M. CH SW			B2
	8	B3		M. CH SW			B3
⑧	1	DO	MIC down switch	MIC terminal		3	
	2	UP	MIC up switch			4	
	3	E		Main rotary			G
	4	A1	Encoder Up/Down input				U/D
	5	A0	Encoder clock input				C
	6	5CE	+5 V common to encoder				V
⑨	1	SS	SCAN stop	IF UNIT	㉑	11	SS
	2	NC					
	3	9T	+9 V in TX	MODE SW. 3			FMT
⑩	1	E0	μ-proc. E-output port	SW UNIT	⑬	1	E0
	2	E1		SW UNIT	⑬	1	E1
	3	E2		MS SW	㊲	5	E2
	4	E3		SW UNIT	⑬	4	E3
	5	F0	μ-proc. F-output port	M. CH SW			F0
⑪	1	HL	High/Low Band	HET UNIT	⑥	1	HL
	2	PL	PLL IC load pulse		⑥	6	PL
	3	PD	PLL IC Data		⑥	2	PD
	4	PC			⑥	3	PC
	5	PB			⑥	4	PB
	6	PA			⑥	5	PA
	7	5C	+5 V common		⑤	4	5C
	8	HCV	HET control voltage		⑤	1	HCV
⑫	1	B	Switched B + 13.8 V	POW. SW			B
	2	BBM	INT. or EXT. Back up voltage B + 13.8 V	BACK UP terminal			BBM
	3	BB	Unswitched B + 13.8 V	POW. SW			BB

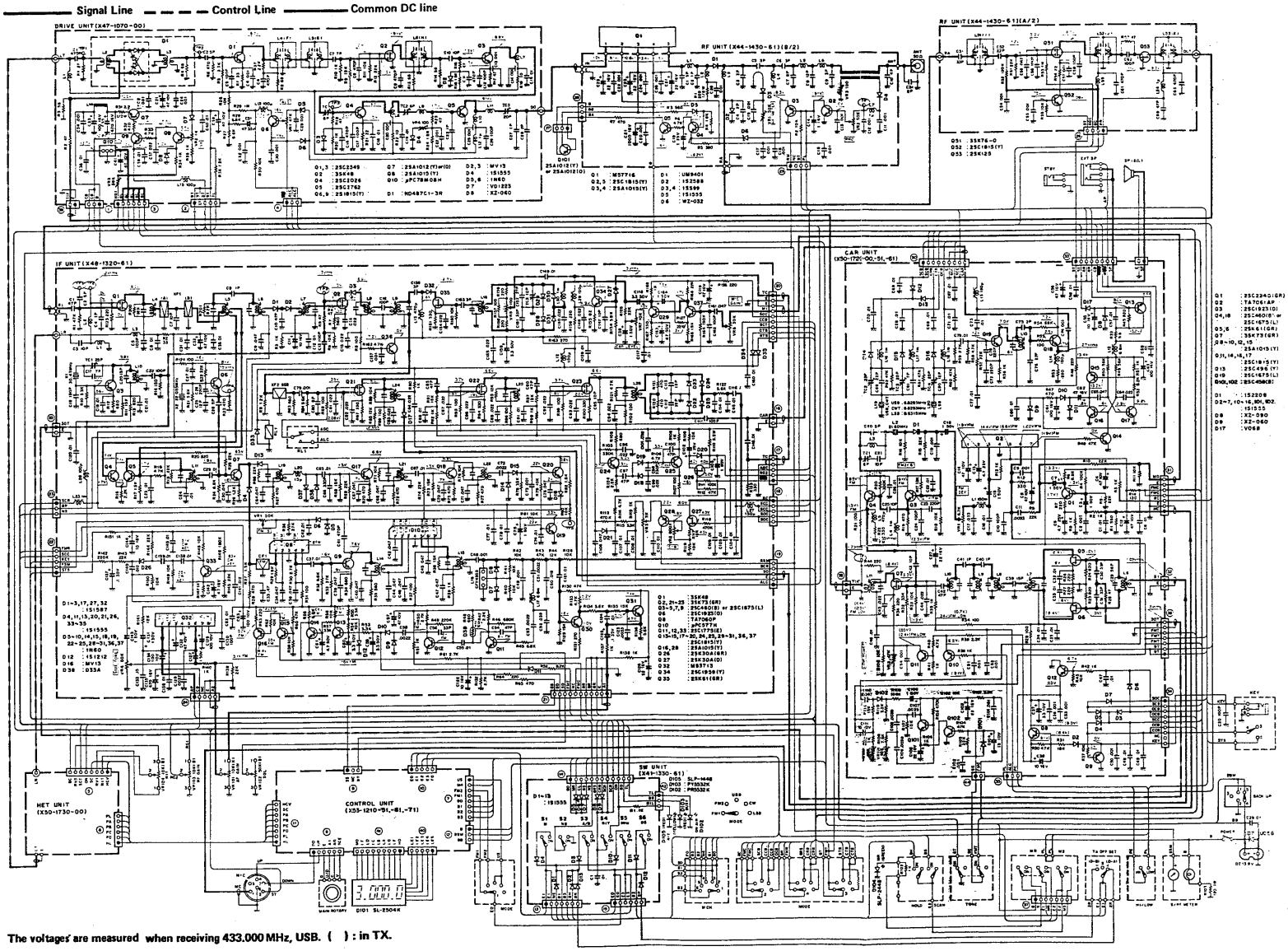
Connector No.	Terminal No.	Terminal	Remarks	Destination: Unit/Switch	Destination: Connector No.	Destination: Terminal No.	Destination: Terminal
㊵	1	LE5	5 digit LED pin No. 1	D101 SL2504K		1	
	2	LE4	5 digit LED pin No. 2			2	
	3	LE3	5 digit LED pin No. 3			3	
	4	LE2	5 digit LED pin No. 4			4	
	5	LE1	5 digit LED pin No. 5			5	
㊶	1	HD	5 digit LED pin No. 13	D101 SL2504K		13	
	2	LF	5 digit LED pin No. 12			12	
	3	LG	5 digit LED pin No. 9			9	
	4	LA	5 digit LED pin No. 11			11	
	5	LB	5 digit LED pin No. 10			10	
	6	LC	5 digit LED pin No. 8			8	
	7	LD	5 digit LED pin No. 7			7	
	8	LE	5 digit LED pin No. 6			6	
	9	MD	5 digit LED pin No. 16			16	
SWITCH UNIT (X41-1330-61)							
⑬	1	E1	μ-proc. E-output port M	CONTROL UNIT	⑩	2	E1
	2	E1		TX OFFSET			E1
	3	MS	Memory scan	MS SW	㊲	7	MS
	4	B1	μ-proc. B-input port M, MHz, MS	M. CH SW			B1
	5	B3	μ-proc. B-input port A/B, HOLD	M. CH SW			B3
	6	BH	Hold SW	HOLD SW			BH
	7	BR	Repeater SW	TX OFFSET SW			2R
⑭	1	B0	μ-proc. B-input port	M. CH SW			B0
	2	MR	Memory read	MR SW	㊲	4	MR
	3	CL	Call	–			
	4	BS	Scan	SCAN SW			BS
	5	NS	Noise Blanker SW	IF UNIT	㉘	3	NS
	6	8RS	+8 V in SSB RX	MODE SW. 4			8RS
	7	CRB	+8 V in CW RX	MODE SW. 4			CRB
	8	SCR	+8 V in SSB, CW RX	IF UNIT	⑬	4	SCR
	9	SCR		IF UNIT	㉘	1	SCR
	10	ON	RIT ON	HET UNIT	⑤	5	ON
	11	BD	Busy light	IF UNIT	⑳	10	BD
	12	TL	On air light	DRIVE UNIT	②	5	TL
⑮	1	E0	μ-proc. E-output port	CONTROL UNIT	⑩	1	E0
	2	E0		MODE SW. 1			E0
	3	E3		–			
	4	E3		CONTROL UNIT	⑩	4	E3
	5	B2	μ-proc. B-input port	M. CH SW			B2
	6	BP	Repeater SW	TX OFFSET SW			3R
㊷	1	TL	On air light	D102			
	2	BD	Busy light	D103			
	3	RIL	RIT light	D105			
RF UNIT (X44-1430-61) (B/2)							
㉗	1	BA	Q101 Base	Q101 BASE			
	2	DB	Q101 Collector	Q101 Collector			
	3	B	Q101 Emitter	Q101 Emitter			
㉘	1	BA	Q101 Base	Q101 BASE			
	2	DB	Q101 Collector	Q101 Collector			
	3	B	Q101 Emitter	Q101 Emitter			
㉙	1	RM	RF METER	S/RF Meter			SSM
	2	NC	Not connected	–			
	3	9T	+9 V in TX	CAR UNIT	㉕	1	9T
	4	PL	Low power control	MR/MS SW			PL
		IN	Drive input	DRIVE UNIT			DO
		E	GND				
		RA	RX ANT	RF UNIT (A/2)			RA
		ANT	Antenna	Antenna			
		B	Switched B + 13.8 V	S/RF meter			B
				POW. SW			B

Connector No.	Terminal No.	Terminal	Remarks
RF UNIT (X44-1430-61) (A			
㉓	1	8R	+8 V in RX
	2	8C	+8 V common
	3	AGC	AGC
	4	ST	STAND BY
		RA	RX ANT
		OUT	RF AMP OUT
CAR UNIT (X50-1720-6			
㉚	1	SCB	+8 V common in USB
	2	SCB	
	3	CRB	+8 V in CW RX
	4	CTB	+8 V in CW TX
	5	OCB	+8 V common in LSB
	6	E	GND
	7	SCC	+8 V common in SSB, CW
	8	SCC	
	9	CAR	Carrier
㉛	1	MC	MIC input
	2	E	GND
	3	8C	+8 V common
	4	FMC	+8 V common in FM
	5	FMC	
	6	E	GND
	7	MO	MIC Amp output
㉜	1	SI	1st IF signal in SSB, CW TX
	2	E	GND
㉝	1	ST	STAND BY
	2	ST	
	3	8R	+8 V in RX
	4	8R	
	5	CB	Common B + 13.8 V
	6	–6	–6 V in RX and SSB TX
	7	–6	
	8	SP	Speaker
㉞	1	SOC	+8 V common in SSB
	2	SCB	+8 V common in USB
	3	OCB	+8 V common in LSB
	4	OCB	
	5	SCC	+8 V common in SSB, CW
	6	CCB	+8 V common in CW
	7	CCB	
	8	NC	Not connected
	9	KEY	KEY
㉟	1	PL	Low Power control
	2	ALC	ALC
	3	PC	Power control
㊱	1	9T	+9 V in TX
	2	9T	
	3	FMT	+9 V in FM TX
	4	FMT	
	5	FMT	
	6	E	GND
	7	30T	30.43 MHz for TX
㊳	1	TIF	TX IF signal
	2	E	GND
㊹	1	SC	
	2	FMC	
S/RF METER			
		SSM	S-Meter in SSB, CW
			FM S-Meter
		B	Switched B + 13.8 V

Con-nector No.	Termi-nal	Remarks	Destination			
			Unit/Switch	Con-nector No.	Termi-nal No.	Termi-nal
	LE5	5 digit LED pin No. 1	D101 SL2504K		1	
	LE4	5 digit LED pin No. 2			2	
	LE3	5 digit LED pin No. 3			3	
	LE2	5 digit LED pin No. 4			4	
	LE1	5 digit LED pin No. 5			5	
	HD	5 digit LED pin No. 13	D101 SL2504K		13	
	LF	5 digit LED pin No. 12			12	
	LG	5 digit LED pin No. 9			9	
	LA	5 digit LED pin No. 11			11	
	LB	5 digit LED pin No. 10			10	
	LC	5 digit LED pin No. 8			8	
	LD	5 digit LED pin No. 7			7	
	LE	5 digit LED pin No. 6			6	
	MD	5 digit LED pin No. 16			16	
SWITCH UNIT (X41-1330-61)						
	E1	μ-proc. E-output port M	CONTROL UNIT	⑯	2	E1
	E1		TX OFFSET			E1
	MS	Memory scan	MS SW	㉗	7	MS
	B1	μ-proc. B-input port M, MHz, MS	M. CH SW			B1
	B3	μ-proc. B-input port A/B, HOLD	M. CH SW			B3
	BH	Hold SW	HOLD SW			BH
	BR	Repeater SW	TX OFFSET SW			2R
	B0	μ-proc. B-input port	M. CH SW			B0
	MR	Memory read	MR SW	㉗	4	MR
	CL	Call	–			
	BS	Scan	SCAN SW			BS
	NS	Noise Blanker SW	IF UNIT	㉓	3	NS
	8RS	+8 V in SSB RX	MODE SW. 4			8RS
	CRB	+8 V in CW RX	MODE SW. 4			CRB
	SCR	+8 V in SSB, CW RX	IF UNIT	⑱	4	SCR
	SCR		IF UNIT	㉓	1	SCR
	ON	RIT ON	HET UNIT	⑤	5	ON
	BD	Busy light	IF UNIT	㉑	10	BD
	TL	On air light	DRIVE UNIT	②	5	TL
	E0	μ-proc. E-output port	CONTROL UNIT	⑯	1	E0
	E0		MODE SW. 1			E0
	E3		–			
	E3		CONTROL UNIT	⑬	4	E3
	B2	μ-proc. B-input port	M. CH SW			B2
	BP	Repeater SW	TX OFFSET SW			3R
	TL	On air light	D102			
	BD	Busy light	D103			
	RIL	RIT light	D105			
RF UNIT (X44-1430-61) (B/2)						
	BA	Q101 Base	Q101 BASE			
	DB	Q101 Collector	Q101 Collector			
	B	Q101 Emitter	Q101 Emitter			
	BA	Q101 Base	Q101 BASE			
	DB	Q101 Collector	Q101 Collector			
	B	Q101 Emitter	Q101 Emitter			
	RM	RF METER	S/RF Meter			SSM
	NC	Not connected	–			
	9T	+9 V in TX	CAR UNIT	㉕	1	9T
	PL	Low power control	MR/MS SW			PL
	IN	Drive input	DRIVE UNIT			DO
	E	GND				
	RA	RX ANT	RF UNIT (A/2)			RA
	ANT	Antenna	Antenna			
	B	Switched B + 13.8 V	S/RF meter			B
			POW. SW			B

Con-nector No.	Termi-nal No.	Termi-nal	Remarks	Destination			
				Unit/Switch	Con-nector No.	Termi-nal No.	Termi-nal
RF UNIT (X44-1430-61) (A/2)							
㉖	1	8R	+8 V in RX	IF UNIT	㉑	3	8R
	2	8C	+8 V common	DRIVE UNIT	③	3	8C
	3	AGC	AGC	IF UNIT	⑰	3	AGC
	4	ST	STAND BY	STBY jack			
		RA	RX ANT	RF UNIT (B/2)			RA
		OUT	RF AMP OUT	IF UNIT			RI
CAR UNIT (X50-1720-61)							
㉘	1	SCB	+8 V common in USB	CAR UNIT	㉔	2	SCB
	2	SCB		MODE SW. 2			SCB
	3	CRB	+8 V in CW RX	MODE SW. 4			CRB
	4	CTB	+8 V in CW TX	MODE SW. 3			CTB
	5	OCB	+8 V common in LSB	CAR UNIT	㉔	3	OCB
	6	E	GND				
	7	SCC	+8 V common in SSB, CW	CAR UNIT	㉔	5	SCC
	8	SCC		IF UNIT	⑯	2	SCC
	9	CAR	Carrier	IF UNIT	⑯	1	CAR
㉛	1	MC	MIC input	MIC terminal		1	MC
	2	E	GND				
	3	8C	+8 V common	DRIVE UNIT	③	6	8C
	4	FMC	+8 V common in FM	MODE SW. 2			FMC
	5	FMC		CAR UNIT	㊹	2	FMC
	6	E	GND				
	7	MO	MIC Amp output	IF UNIT	㉒	4	MI
㉜	1	SI	1st IF signal in SSB, CW TX	IF UNIT	⑮	3	SO
	2	E	GND				
㉝	1	ST	STAND BY	STBY jack			
	2	ST		MIC terminal		2	ST
	3	8R	+8 V in RX	IF UNIT	㉑	5	8R
	4	8R		IF UNIT	㉓	2	8R
	5	CB	Common B + 13.8 V	DRIVE UNIT	①	2	CB
	6	–6	–6 V in RX and SSB TX	DRIVE UNIT	④	1	–6
	7	–6		IF UNIT	⑰	1	–6
	8	SP	Speaker	EXT. SP jack			
㉞	1	SOC	+8 V common in SSB	IF UNIT	⑱	5	SOC
	2	SCB	+8 V common in USB	CAR UNIT	㉘	1	SCB
	3	OCB	+8 V common in LSB	CAR UNIT	㉘	5	OCB
	4	OCB		MODE SW. 2			OCB
	5	SCC	+8 V common in SSB, CW	CAR UNIT	㉘	7	SCC
	6	CCB	+8 V common in CW	MODE SW. 2			CCB
	7	CCB		KEY			
	8	NC	Not connected	–			
	9	KEY	KEY	KEY			KEY
㉟	1	PL	Low Power control	MR/MS SW			PL
	2	ALC	ALC	DRIVE UNIT	④	2	ALC
	3	PC	Power control	–			
㊱	1	9T	+9 V in TX	RF UNIT (B/2)	㉖	3	9T
	2	9T		DRIVE UNIT	②	1	9T
	3	FMT	+9 V in FM TX	TONE SW			FMT
	4	FMT		IF UNIT	㉑	8	FMT
	5	FMT		MODE SW. 3			FMT
	6	E	GND				
	7	30T	30.43 MHz for TX	IF UNIT	㉕	1	30T
㊳	1	TIF	TX IF signal	DRIVE UNIT	㉙	2	TIF
	2	E	GND				
㊹	1	SC		TONE SW			SC
	2	FMC		CAR UNIT	㉛	5	FMC
S/RF METER							
		SSM	S-Meter in SSB, CW	IF UNIT	⑮	5	SSM
			FM S-Meter	IF UNIT	㉒	2	FSM
				RF UNIT (B/2)	㉖	1	RM
		B	Switched B + 13.8 V	POW. SW			B
				MR/MS SW	㉗	1	B

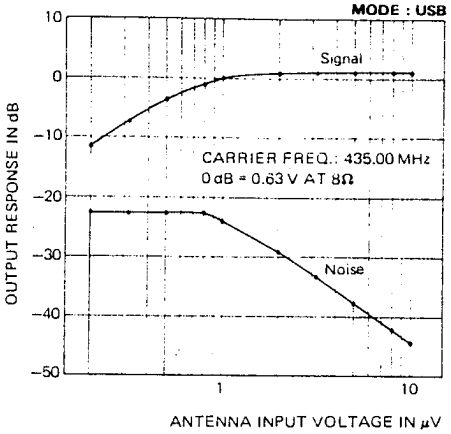
Con-nector No.	Termi-nal No.	Termi-nal	Remarks	Destination			
				Unit/Switch	Con-nector No.	Termi-nal No.	Termi-nal
M. CH SW							
		M4	Memory channel M4	CONTROL UNIT	⑦	2	M4
		B0	μ-proc. B-input port	CONTROL UNIT	⑦	5	B0
		B0		SW UNIT	⑭	1	B0
		B1		CONTROL UNIT	⑦	6	B1
		B1		SW UNIT	⑬	4	B1
		B2		CONTROL UNIT	⑦	7	B2
		B2		SW UNIT	⑬	5	B2
		B3		SW UNIT	⑬	5	B3
		B3		CONTROL UNIT	⑦	8	B3
		F0	μ-proc. F-input port	CONTROL UNIT	⑲	5	F0
MODE SW. 2							
		8C	+8 V common	DRIVE UNIT	③	5	8C
		FMC	+8 V common in FM	CAR UNIT	㊺	4	FMC
		FMC		IF UNIT	㉑	6	FMC
		SCB	+8 V common in USB	CAR UNIT	㉘	2	SCB
		CCB	+8 V common in CW	IF UNIT	⑳	6	CCB
		CCB		CAR UNIT	㉔	6	CCB
		OCB	+8 V common in LSB	CAR UNIT	㉔	4	OCB
MODE SW. 3							
		9T	+9 V in TX	DRIVE UNIT	②	4	9T
		FMT	+9 V in FM TX	CAR UNIT	㉘	5	FMT
		9TS	+9 V in SSB TX	IF UNIT	⑳	9	9TS
		CTB	+9 V in CW TX	IF UNIT	⑳	8	CTB
		CTB		CAR UNIT	㉚	4	CTB
MODE SW. 4							
		8R	+8 V in RX	IF UNIT	㉑	4	8R
		FMR	+8 V in FM RX	IF UNIT	㉒	5	FMR
		8RS	+8 V in SSB RX	SW UNIT	⑭	6	8RS
		CRB	+8 V in CW RX	SW UNIT	⑭	7	CRB
		CRB		CAR UNIT	㉚	3	CRB
HOLD/SCAN SW							
		BH	Hold SW	SW UNIT	⑬	6	BH
		BS	Scan	SW UNIT	⑭	4	BS
		E2	μ-proc. E-output port	MR/MS SW	㉗	6	E2
MR/MS SW							
㉗	1	B	Switched B + 13.8 V	POW. SW			B
			–	S/RF meter			B
	2	K	–	HOLD/SCAN SW			
	3	E1	μ-proc. E-output port M	SW UNIT	⑬	2	E1
	4	MR	Memory read	SW UNIT	⑭	2	MR
	5	E2	μ-proc. E-output port	CONTROL UNIT	⑯	3	E2
	6	E2		SCAN SW			E2
	7	MS	Memory scan	SW UNIT	⑬	3	MS
		PL	Low power control	RF UNIT (B/2)	㉖	4	PL
		PL		CAR UNIT	㊺	1	PL
BACK UP TERMINAL							
		BBM	INT. or EXT. Back-up voltage B + 13.8 V	CONTROL UNIT	⑫	2	BBM
KEY							
		KEY	KEY	IF UNIT	㉒	3	KEY
				CAR UNIT	㉔	9	KEY
		STS	SIDE TONE SW	IF UNIT	㉒	1	STS
TONE SW							
		ST	Stand by	MIC terminal		2	ST
		FMT	+9 V in FM TX	CAR UNIT	㉘	3	FMT
		SC		CAR UNIT	㊹	1	SC
TX OFFSET SW							
		2R	Repeater SW	SW UNIT	⑬	7	BR
		3R	Repeater SW	SW UNIT	⑬	6	BP
		E1	μ-proc. E-output port	SW UNIT	⑬	2	E1
		E1		MR/MS SW	㉗	3	E1



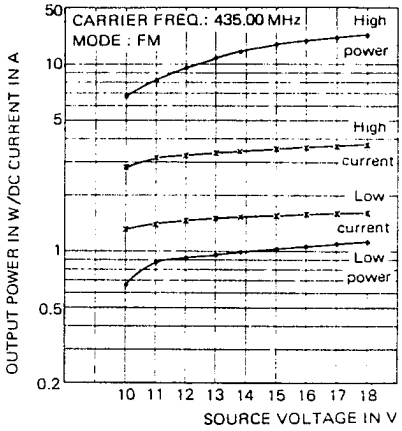
The voltages are measured when receiving 433.000 MHz, USB. ( ) : in TX.

REFERENCE DATA

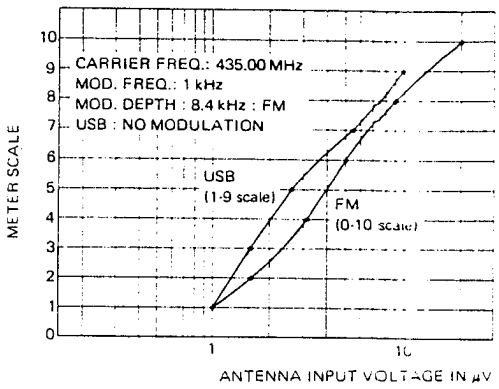
RX SENSITIVITY



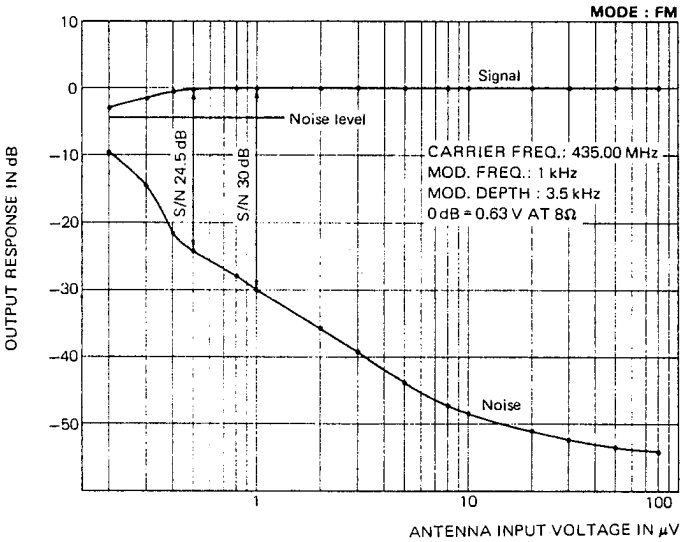
OUTPUT POWER/CURRENT



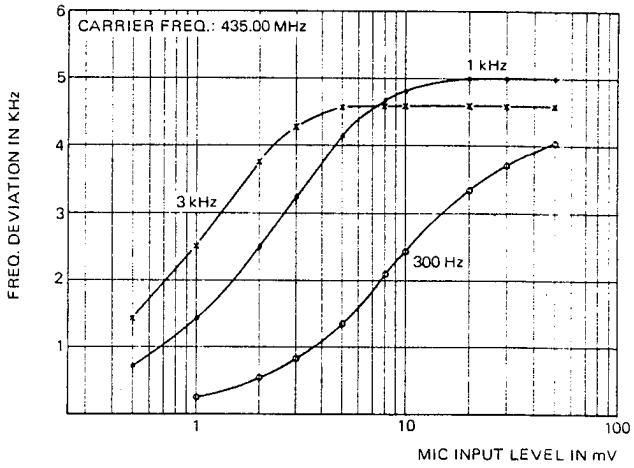
S LEVEL SENSITIVITY



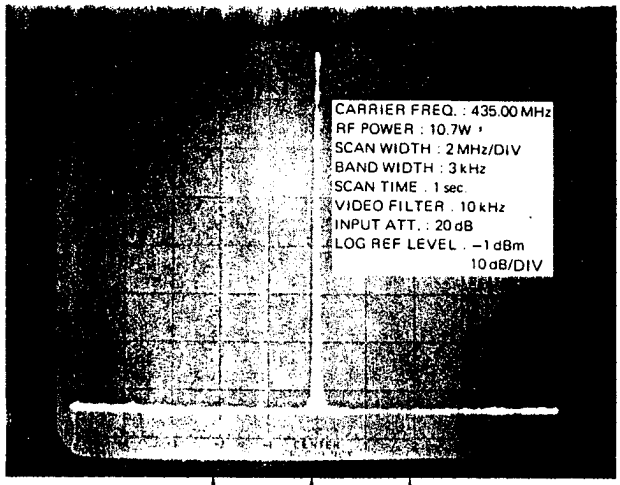
RX SENSITIVITY



DEVIATION



NEAR SPURIOUS RESPONSE

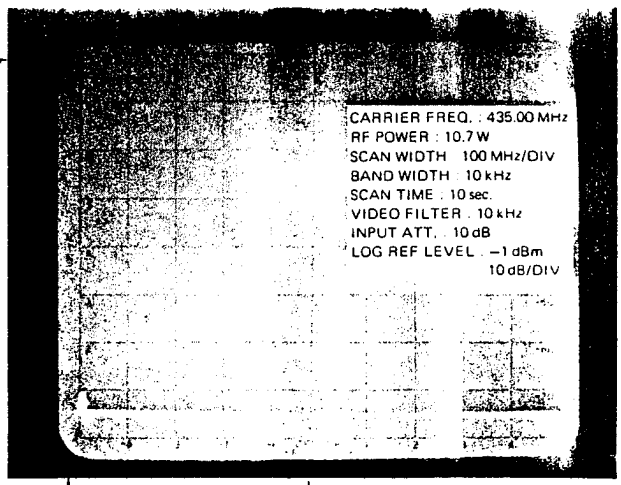


431 MHz　439 MHz

435 MHz Fundamental

HARMONICS SPURIOUS RESPONSE

Fundamental level



435 MHz Fundamental　935 MHz

* The fundamental has been reduced in amplitude by the H.P.F.

SPECIFICATIONS

General

Semiconductors	ICs	12
	FETs	17
	Transistors	111 (W, T), 109 (X)
	Diodes	115 (W, T), 114 (X)
Frequency range	430.000.0 to 439.999.9 MHz	
Frequency synthesizer	Digital control, phase locked VCO	
Mode	SSB (A3J), FM (F3), CW (A1)	
Antenna impedance	50 ohms	
RPT. Tone Frequency	1,750 Hz	
Power requirement	13.8 V DC ± 15%	
Grounding	Negative	
Operating temperature	−20°C to + 50°C	
Current drain	0.7A in receive mode with no input signal	
	3.8A in transmit mode (Approx.)	
	2.0 mA for memory back up	
Dimensions	170 mm (6-11/16") wide	
	68 mm (2-11/16") high	
	241 mm (9-1/2") deep	
Weight	2.7 kg (5.94 lbs)	

Transmitter Section

RF output power (at 13.8 V DC, 50Ω load)	10 W	
Modulation	FM	Variable reactance direct shift
	SSB	Balanced modulation
Frequency tolerance	Less than $\pm 10 \times 10^{-6}$	
Spurious radiation	Less than −60 dB	
Carrier suppression	Better than 40 dB	
Unwanted side band suppression	Better than 40 dB	
Maximum frequency deviation (FM)	±5 kHz	
Microphone	Dynamic microphone with PTT switch, 500Ω	

Receiver Section

Circuitry	Double conversion superheterodyne	
Intermediate frequency	1st IF	21.6 MHz
	2nd IF	(FM) 455 kHz, (SSB/CW) 8.83 MHz
Receiver sensitivity	FM	Better than 0.5μV for 35 dB S/N
		Better than 0.25μV for 12 dB SINAD
	SSB, CW	Better than 0.5μV for 20 dB S/N
Receiver selectivity	FM	More than 14 kHz (−6 dB)
		Less than 20 kHz (−60 dB)
	SSB, CW	More than 2.4 kHz (−6 dB)
		Less than 4.8 kHz (−60 dB)
Spurious interference	Better than 60 dB	
Squelch sensitivity	0.2μV (Threshold)	
Auto scan stop level	Less than 0.2μV (Threshold)	
Audio output	More than 2.0 watts across 8 ohm load (10% dist.)	

Note : Circuit and ratings are subject to change without notice due to developments in technology.

A product of

TRIO-KENWOOD CORPORATION

17-5, 2-chome, Shibuya, Shibuya-ku, Tokyo 150, Japan

TRIO-KENWOOD COMMUNICATIONS, INC.

1111. West Walnut Street. Compton. California. 90220. U.S.A.

TRIO-KENWOOD COMMUNICATIONS, GmbH

D-6374 Steinbach TS. Industriestrasse 8A. West Germany

TRIO-KENWOOD(AUSTRALIA)PTY. LTD.

30 Whiting Street. Artarmon. Sydney N.S.W. Australia 2064