

KENWOOD

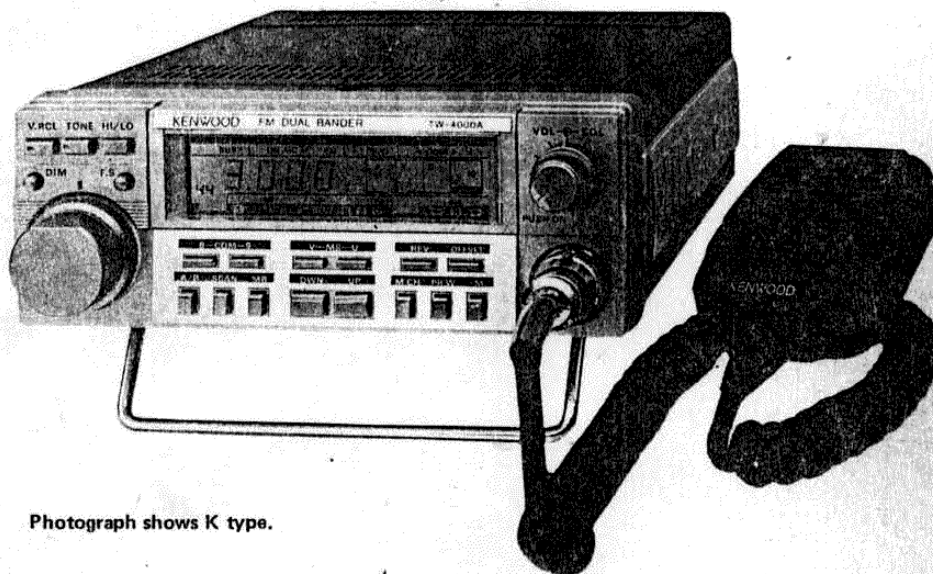
ST

SERVICE MANUAL

TW-4000A TU-4A, TU-4B, TU-4C, VS-1

2m, 70cm FM DUAL BANDER

00157



Photograph shows K type.

CONTENTS

CIRCUIT DESCRIPTION	2	BLOCK DIAGRAM	37
PARTS LIST	16	TU-4A OPTION (TONE UNIT)	38
PC BOARD VIEWS		TU-4B OPTION (TONE UNIT)	38
SWITCH UNIT (X41-1490-XX)	22	TU-4C OPTION (TONE UNIT)	39
PLL UNIT (X50-1930-XX)	22	VS-1 OPTION (VOICE SYNTHESIZER UNIT)	40
TONE UNIT (X52-1250-XX) (T,W type only)	22	PACKING	40
RX-TX UNIT (X44-1520-XX)	23	CIRCUIT DIAGRAM	
430 FINAL UNIT (X45-1300-XX)	24	PLL UNIT (X50-1930-XX)	41
144 FINAL AVR UNIT (X45-1310-XX)	24	CONTROL ASS'Y (W02-03XX-05)	41
CONTROL ASS'Y (W02-03XX-05)	25	SCHEMATIC DIAGRAM (T,W)	42
DISASSEMBLY	26	SCHEMATIC DIAGRAM (K,M1,M2,X)	43
ADJUSTMENT	29	REFERENCE DATA	44
LEVEL DIAGRAM	36	SPECIFICATION	BACK COVER

SPECIFICATIONS

[General]	
Semiconductors	MPU 1 ICs 17 (K, M1, M2, X) 18 (T, W) Transistors 44 FETs 12 Diodes 61 (K, M1) 62 (M2, T, W, X)
Frequency range	VHF 144.0 to 148.0MHz (K, M1, M2, X) VHF 144.0 to 146.0MHz (T, W) UHF 430.0 to 450.0MHz (K, M1) UHF 430.0 to 440.0MHz (M2, T, W, X)
Mode	FM (F3)
Antenna impedance	50 ohms (Both VHF and UHF)
Power requirement	13.8V DC \pm 15%
Grounding	Negative
Operating temperature	-20°C to +50°C
External speaker impedance	8 ohms
Current drain	0.6 V in receive mode with no input signal Max. 7.5 A in HI transmit mode 3.3 A in LOW transmit mode (Approx.) 2 μ A for back up
Dimensions	161 mm (6.3") wide 60 mm (2.7") high 217 mm (8.5") deep (projections not included)
Weight	2.0kg (4.18lbs)
[Transmitter]	
RF output power (at 13.8V DC, 50 Ω load)	HI 25 Watts min. (2 m/70 cm) Low 5 Watts approx. (adjustable up to about 10 W)
Modulation	Reactance
Frequency tolerance (-10°C ~ +50°C)	Less than \pm 15 \times 10 ⁻⁶
Spurious radiation	HI Less than -60 dB LOW Less than -60 dB
Maximum frequency deviation (FM)	\pm 5kHz
Audio distortion	3% max.
[Receiver]	
Circuitry	Double superheterodyne
Intermediate frequency	1st 30.865 MHz 2nd 455 kHz
Receiver sensitivity	SINAD 12 dB less than 0.17 μ V S + N/N more than 30 dB at 0.63 μ V input
Receiver selectivity	More than 14 kHz (-6 dB) Less than 28kHz (-60 dB)
Spurious response	Better than 70dB (without IF/2)
Squelch sensitivity	Less than 0.1 μ V (threshold)
Auto scan stop level	Less than 0.16 μ V (threshold)
Audio output	More than 2.0 watts across 8 ohms 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

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

TRIO-KENWOOD COMMUNICATIONS, GmbH

D-6374 Steinbach TS Industriestrasse 8A West Germany

TRIO-KENWOOD ELECTRONICS, N.V.

Leuvensesteenweg 504, B-1930 Zaventem, Belgium

TRIO-KENWOOD (AUSTRALIA) PTY. LTD.

4E Woodcock Place, Lane Cove N.S.W. 2066, Australia

CIRCUIT DESCRIPTION

144MHz

Destination	Frequency (MHz)	VFO Step (kHz)	TX OFFSET Display	Repeater Shift (kHz)	Tone Circuit
K,M1,M2	142.000-148.995	5(10)	- S +	±600	Option
T	144.000-145.995	25(5)	- S +	±600	1750Hz Tone Burst
W	144.000-145.995	25(5)	D-A S D-B	±600	1750Hz Tone
X	144.000-147.995	25(5)	D-A S D-B	±600	Option

(Note) VFO step () : F. STEP ON

430MHz

Destination	Frequency (MHz)	VFO Step (kHz)	TX OFFSET Display	Repeater Shift (MHz)	Tone Circuit
K,M1	440.000-449.995	25(5)	- S +	±5	Option
M2	430.000-439.995	25(5)	- S +	±5	Option
T	430.000-439.995	25(5)	- S +	±1.6	1750Hz Tone burst
W	430.000-439.995	25(5)	D-A S D-B	-7.6 -1.6	1750Hz Tone
X	430.000-439.995	25(5)	D-A S D-B	-5 -1.6	Option

(Note) VFO step () : F. STEP ON

Table 1 Frequency configuration of destination

	K, M1	M2	T, W, X
VFO-A	146.000	146.000	145.000
VFO-B	443.000	433.000	433.000

Table 2 Reset Frequency

COM	K, M1	M2	T, W, X
8	146.000	146.000	145.000
9	443.000	433.000	433.000

Table 3 COM 8 9 Reset Frequency

TRANSMITTER CIRCUIT CONFIGURATION

The signal from the microphone goes to the RX-TX unit, passes through the mic limiting amplifier which consists of Q21, Q22, IC3 (1/2), and active filter IC3 (1/2).

This directly modulates the output of oscillator Q17 : 2SC460(B) (operating at a frequency of 15.66 MHz) by varicap diode D16 (1S2208).

This signal is then doubled to become the local oscillator signal at 31.32MHz.

The modulated local oscillator signal is mixed with the PLL VCO output (either 14L or 43L) by double balance mixer (DBM) D5 (ND487C1-3R) to become a 144MHz or 430MHz band signal.

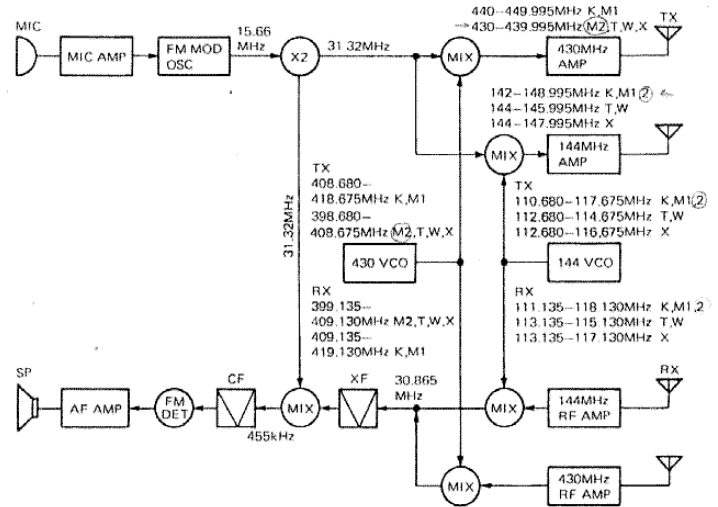


Fig. 1 Frequency-related block diagram

• 144MHz band TX circuit

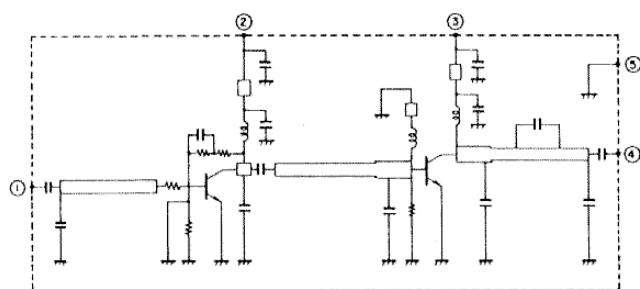
After spurious components are filtered by the 4 section Band Pass Filter (BPF) (L20-23) and amplified by Q14 on the RX-TX unit, the signal, previously amplified by Q10, is amplified by Q15 and Q16 to drive the 144 Final unit. In the 144 Final AVR unit, the signal is power-amplified by power module M57737 and output to the 144 ANT terminal through the LPF.

• 430MHz band TX circuit

After the spurious components are filtered by the 2 section helical resonator and amplified by GaAs FET Q11 : 3SK97 (Q2), the signal, previously amplified by Q10, is further amplified by Q12 and Q13 to drive the 430 Final unit. The signal is power-amplified (in the 430 Final unit) by power module M57729 and then output to the 430 ANT terminal through the LPF.

RF output can be high/low switched by changing the DB voltage applied to the power module through control transistor Q2 : 2SA1012(Y) on the 144 Final AVR unit.

CIRCUIT DESCRIPTION

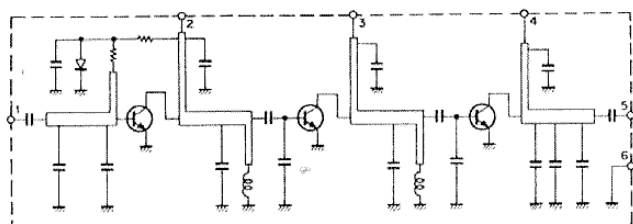


① INPUT ② VCC1 ③ VCC2 ④ OUT ⑤ GND

Fig. 2 Power module M57737 equivalent circuit (144 Final AVR unit Q10)

Item	Symbol	Tc (°C)	Condition	Rating
Operating	Vcc	25		17V
DC current	Icc	25		7A
Operating case temp.	Tc (op)		-30 ~ +110°C	
Storage temp.	Tstg		-40 ~ +110°C	
Power input	Pin	25	Z _g =Z _L =50Ω	0.4W
Power output	Po	25	Z _g =Z _L =50Ω	40W

Table 4 M57737 Max. rating



1: INPUT 2: PRE-DRIVE +B 3: DRIVER +B 4: FINAL +B 5: OUTPUT 6: GND

Fig. 3 Power module M57729 equivalent circuit (430 Final unit Q2)

Item	Symbol	Tc (°C)	Condition	Rating	Unit
Operating	Vcc	25		17	V
DC current	Icc	25		10	A
Power input	Pin(max)	25	Z _G =Z _L =50Ω, V _{CC1} ≤ 12.5V	0.6	W
Power output	Po(max)	25	Z _G =Z _L =50Ω	40	W
Operating case temp.	Tc(op)			-30~ +110	°C
Storage temp.	Tstg			-40~ +110	°C

Table 5 M57729 Max. Rating

RECEIVE CIRCUIT CONFIGURATION

This machine has separate receiver circuits for the 144 MHz band and the 430MHz band from the antenna input to the front end unit. The front end exhibits high sensitivity, using GaAs FET's.

● 144MHz band front end

The 144MHz band antenna input signal controlled through diode switch D1 & D2 in the 144 Final AVR unit enters the RX-TX unit. This front end consists of a GaAs FET Q4 : 3SK97 (Q2) VHF amplifier and 3 pole helical resonator HB(C). The signal is mixed with the PLL output (14L) by the 144MHz Band first MIXER Q5 : 3SK74(L) and becomes the (30.865MHz) first IF signal.

● 430MHz band front end

The 430MHz band antenna input signal, controlled through diode switch D2 & D3 in the 430 Final unit enters the RX-TX unit. This front end consists of a GaAs FET Q1 : 3SK97 (Q2) * J UHF amplifier and 10MHz width band helical resonators HB(A) and HB(B). The signal is mixed with the PLL output (43L) by the 430MHz Band first mixer Q2 : 3SK97 (Q2) to become the (30.865MHz) first IF signal.

The first IF signal passes the 30.865MHz MCF (monolithic crystal filter) XF1 & XF2 to attain both high-sensitivity and good 2-signal characteristics.

The IF signal from the MCF is buffer-amplified by Q7 : 2SK125 (grounded drain) and Q8 : 2SK125 (grounded gate). The signal is then converted to 455kHz by the second mixer Q9, passed through ceramic filter CF1 (CFW455E) and applied to IC1 : KC-1010 (a hybrid IC) where IF amplification, detection, S meter and squelch operations are performed.

The AF signal output from IC1 passes through active LPF Q19 and then through the AF GAIN control into IC2 : MB3712 to be power-amplified to drive the speaker.

CIRCUIT DESCRIPTION

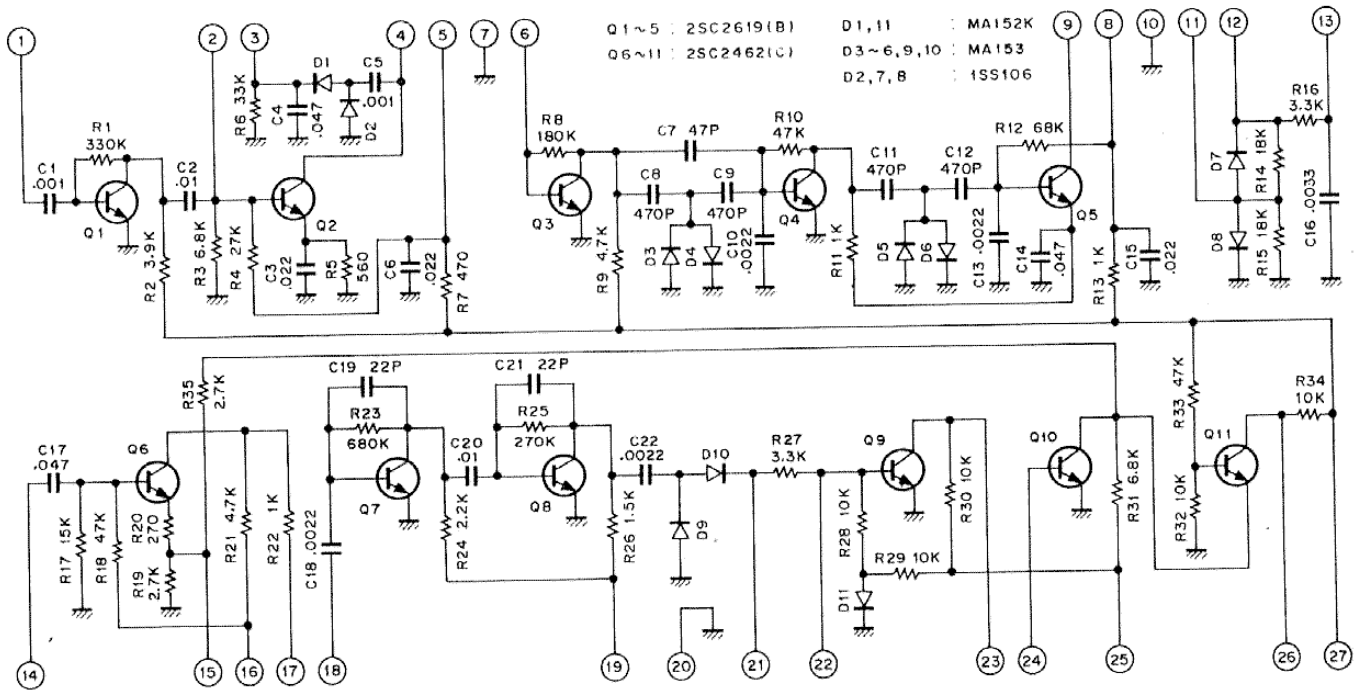


Fig. 4 KC-1010 circuit diagram (RX-TX unit IC1)

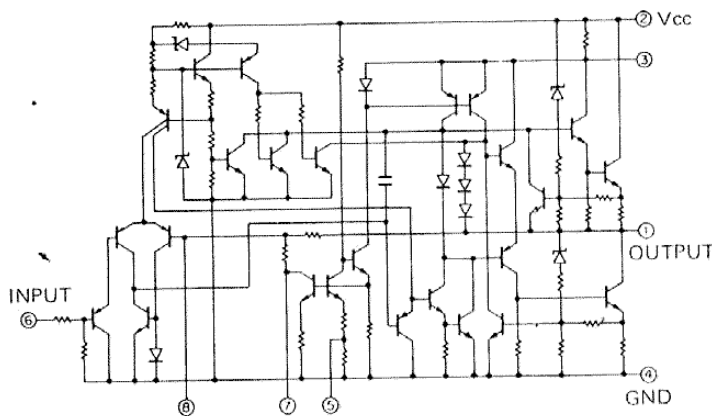


Fig. 5 MB3712 equivalent circuit (RX-TX unit IC2)

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

Table 7 Ceramic filter (L72-0316-05) CFW455E (RX-TX unit CF1)

Item	Rating
Nominal center frequency	30.865MHz
Pass bandwidth	± 7.5 kHz or more at 3dB
Attenuation bandwidth	± 32 kHz or less at 40dB
Ripple	1.5dB or less
Loss	3dB or less
Guaranteed attenuation	6dB or more within ± 1 MHz Spurious level = 40dB or more
Input and output impedance	$1.4k\Omega \pm 10\%$ / $1pF \pm 10\%$

Table 6 MCF (L71-0241-05) (RX-TX unit XF1 and 2)

Item	Rating
Center frequency (f_0) and deviation	455 ± 1 kHz or less
Peak separation	15kHz or more
Voltage sensitivity	15 ± 3 mV/kHz
Hump	No hump in the range ± 5 kHz
Linearity	455 ± 3 kHz or more
Temperature characteristics (-20°C to $+60^\circ\text{C}$)	$\pm 0.3\%$ or less (center frequency)

Table 8 Ceramic discriminator (L79-0446-05) CFY455S (RX-TX unit CF2)

CIRCUIT DESCRIPTION

PLL CIRCUIT

Fig. 6 shows the block diagram of the PLL circuit which consists of two separate VCOs, i.e., the 144VCO and the 430VCO, and one PLL.

Local oscillator circuits

Two independent local oscillator circuits are used for the 144MHz band and the 430MHz band.

For the 144MHz band local oscillator, the 3rd overtone crystal oscillator output is tripled by Q5 to 104.735MHz. For the 430MHz band local oscillator, the 3rd overtone crystal oscillator output is quadrupled by Q11, then tripled by Q10 to 393.735MHz.

144VCO

The 144VCO Q2 : 2SK192A(GR)*N operates from 113.135 - 115.130MHz during reception, and 112.680-114.675MHz (the reception frequency-455kHz) during transmission. This signal is buffer amplified by Q3 and Q4 and is then mixed with the local oscillator signal (104.735 MHz) by a Double Balanced Mixer (D3 : ND487C1-3R) to become the PLL signal within the 8.4-10.395MHz range.

	144MHz band	430MHz band
RX	1280-2679 (K,M1,2) 1680-2079 (T,W) 1680-2479 (X)	1080-3079 (K,M1,2,T,W,X)
TX	1189-2588 (K,M1,2) 1589-1988 (T,W) 1589-2188 (X)	989-2988 (K,M1,2,T,W,X)

Table 9 Frequency dividing ratios

430VCO

The 430 VCO (Q7 : 2SK125) operates from 399.135-409.130MHz during reception, and 398.680-408.675 MHz (reception frequency-455kHz) during transmission. This signal is buffer amplified by Q8 and Q9 and then mixed with the local oscillator signal (393.735MHz) by the double balanced mixer (D3 : ND487C1-3R) to become the PLL IF signal in the 5.4-15.395MHz range.

Switching between the 144 and 430 local oscillator and VCO circuits is done by switching between the 14C power line (8.3V at 144MHz) and the 43C line (8.3V at 430MHz). The PLL IF signal is amplified by Q14 and Q15 is input to IC1 : MC145155P. IC1 contains a 10.24MHz oscillator and divides this by 2048 to obtain a 5kHz reference signal. This is phase-compared with the 5kHz comparison signal obtained by dividing the PLL IF signal using the division data from the microprocessor (Control Assembly IC1). The phase-compared signal is low-pass filtered by Q12 and Q13 to become the VCO control voltage. This is applied to the voltage variable capacitor diode D1 : 1SV50 (144VCO) and D5 : 1SV50 (430VCO) to control the frequency of each VCO.

PLL unit

The unlock signal generated by IC1 (pin 8) controls Q17 and Q16 to obtain the "ULB" voltage which stops the operation of Q1 and Q6 (and Q15 & Q12 on the RX-TX unit) to prevent undesired out-of-band emission.

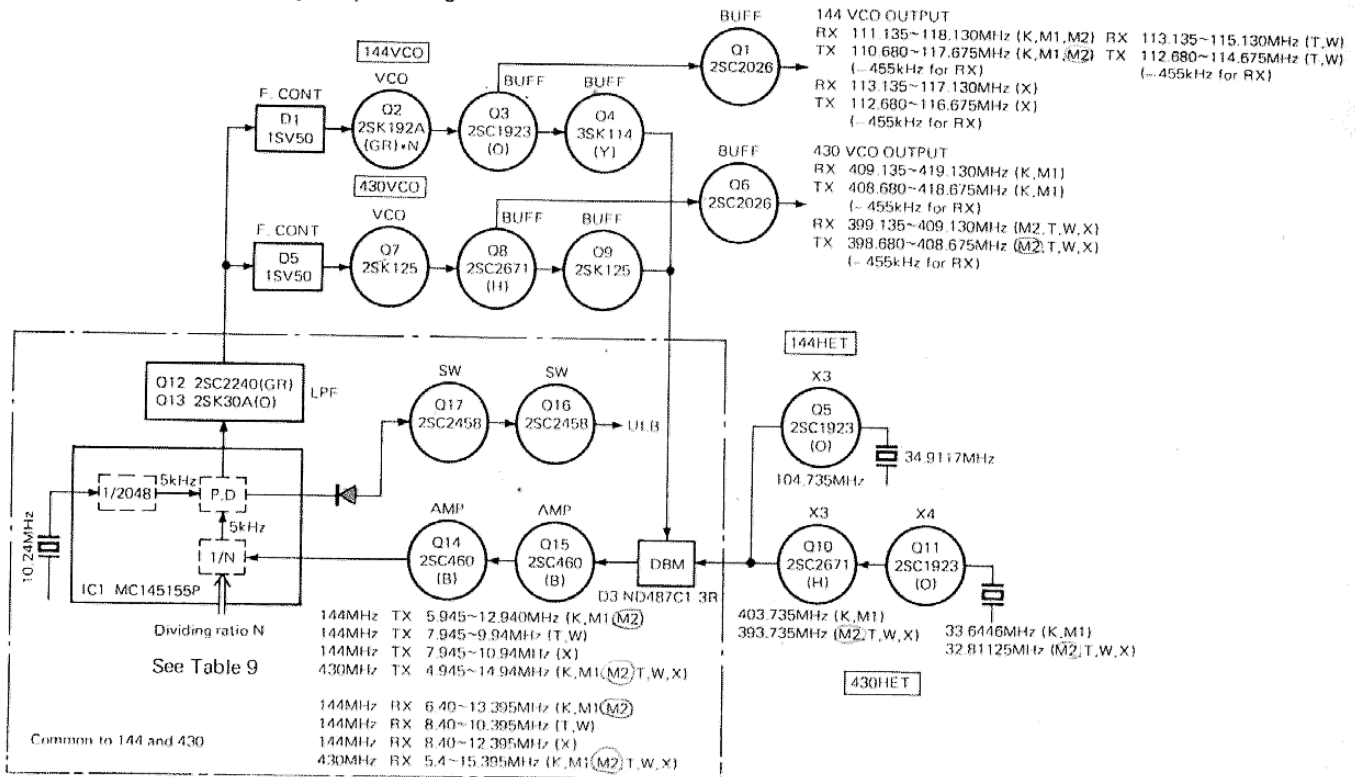


Fig. 6 PLL unit block diagram

CIRCUIT DESCRIPTION

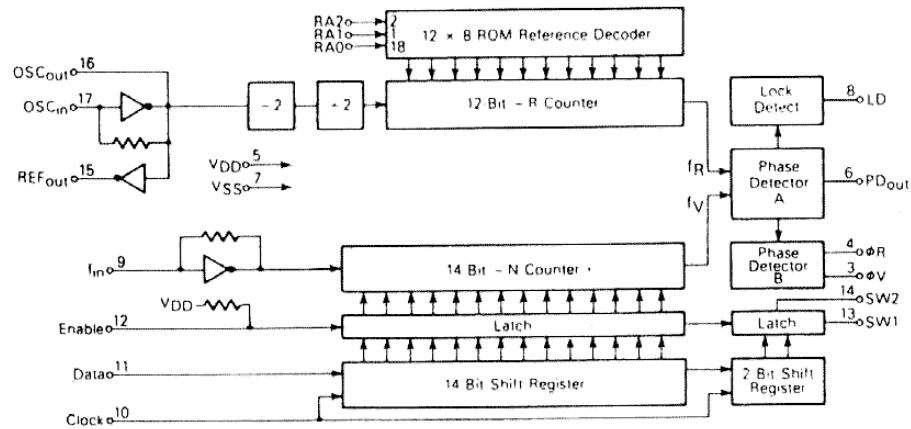


Fig. 7 MC145155P block diagram (PLL unit IC1)

POWER SUPPLY CIRCUIT CONFIGURATION

All regulated power for operation of this machine is supplied by the 144 Final AVR (Automatic Voltage Regulator) unit. Most of the switching circuits are in ICs, such as within hybrid IC IC1 : KC-1020, IC2 and 3 : MB3756, and IC4 : NJM78L06A. This yields a better circuit configuration, and a highly stable regulated power supply.

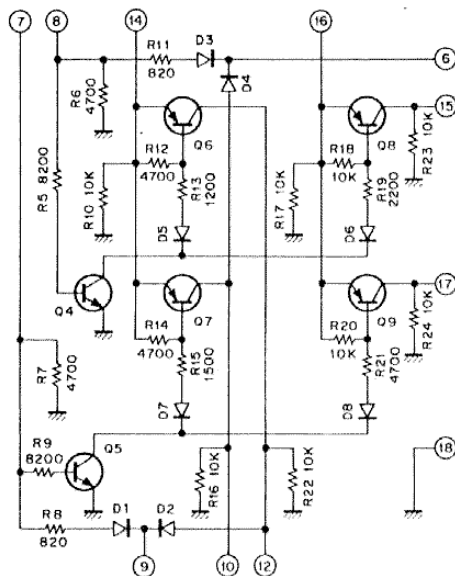
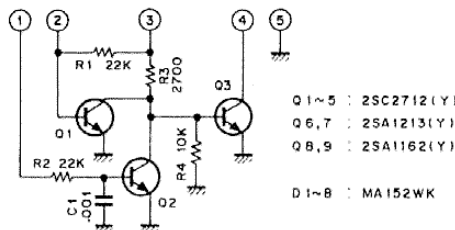


Fig. 8 KC-1020 internal circuit diagram (144 Final AVR unit IC1)

Power supply name	Nominal voltage
CB	Common B+ supply voltage
DB	Drive B+ control voltage
8C1	8.3V constant
8C2	8.3V constant
14C	8.3V constant for 144MHz band operation
43C	8.3V constant for 430MHz band operation
8R	8.3V in receive
8T	8.3V in transmit
14R	8.3V during 144MHz band receive
14T	8.3V during 144MHz band transmit
43R	8.3V during 430MHz band receive
43T	8.3V during 430MHz band transmit
6C	6V constant
5R	5V during receiving
IL	Illumination power supply, 11.2V

	144MHz band		430MHz band	
	RX	TX	RX	TX
14S	0V	7.5V	2.5V	2.5V
43S	2.5V	2.5V	0V	7.5V

Table 10 Power supply types

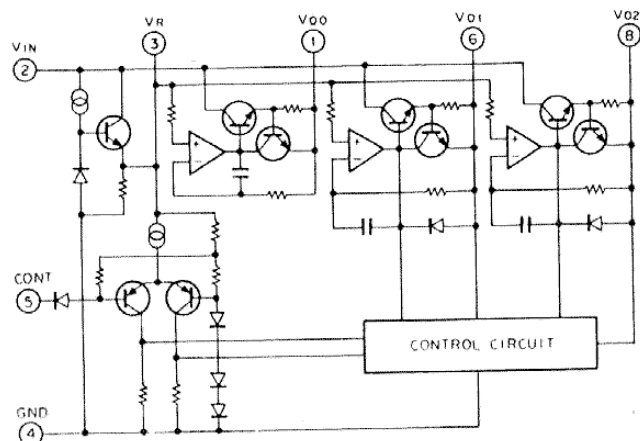


Fig. 9 MB3756 equivalent circuit (144 Final AVR unit IC2 and 3)

CIRCUIT DESCRIPTION

CONTROL ASSEMBLY CIRCUIT

The control assembly is composed of IC1 : CPU (μ PD 7508G-519-00 here abbreviated to CPU), IC2 and 3 : liquid crystal drivers (MSM5829GS and MGM8529GS), and IC4 : level meter IC (IR2429). The CPU system clock oscillates at approximately 200kHz (ports CL1 pin 5 and CL2 pin 9) and is internally divided by two to operate at approximately 10 μ s. PLL and display data are serially output, i.e., PLL data 16 bits (8 bits x 2) and display data 32 bits (8 bits x 4) from the SO port (pin 15) in synchronization with the clock output from the SCK port (pin 12) only when the frequency changes. When the data stream ends, a positive pulse EN(LOAD) is output for approximately 20 μ s.

EN for PLL data is output from P20 (port 20, pin 36), LOAD for MSM5829GS from P21 (pin 37), and LOAD for the MSM5829GS from P22 (pin 38). The clock for the liquid crystal is generated by the MSM5829GS oscillator (time constant R18 and C5) and is supplied to the COM (common) terminal of both the MSM5829GS and IR2429 (both contain on-board clock oscillators which are not used since all timing signal phases must match) and to the liquid crystal. The clock signal is supplied to the IR2429, from the COM port, which has the opposite phase of the COM port.

The liquid crystal static drive supplies a pulse opposite in phase from that of the COM signal when the segment output is ON, and a pulse in phase when the segment output is OFF.

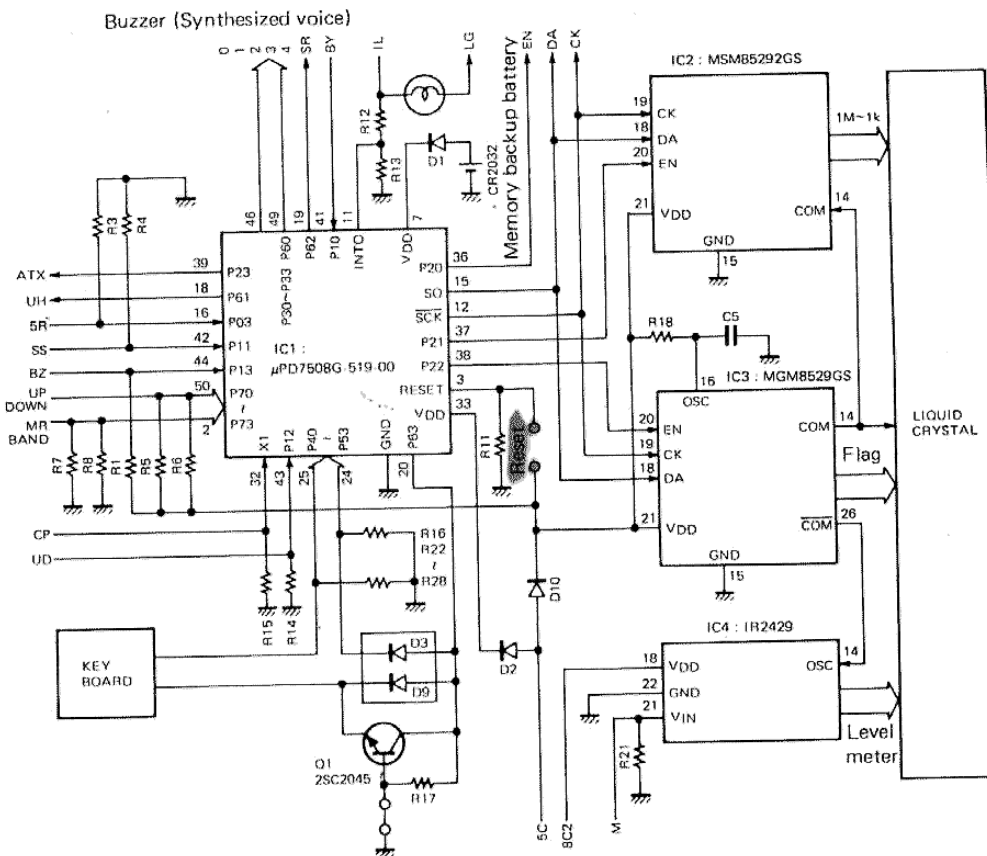


Fig. 10 Control ASS'Y block diagram

- **Reset**

After supplying VDD to pin 33. RESET pin 3 is connected to VDD (2P connector is shorted) for about 0.5 sec.

- **Back up**

Power supplied from the lithium battery (approximately 3V) to VDD (pin 7, which is internally connected to pin 33) via D1. After resetting the system by supplying voltage to VDD (pin 33), connect the battery by soldering the battery terminals. First connect the positive, and then the negative lead.

When a drop in voltage at the INTO (pin 11) is detected, (obtained by dividing the output of connector J5 IL pin [illumination lamp power at about 12V] by R12 and 13), the backup power supply begins operation.

During the backup power condition the system clock oscillator stops and the output port becomes "0", and the input/output port enters the input state. When the INTO voltage rises, the back up state ends. After approximately 0.5 sec. the "normal" state returns and PLL data and other output resumes.

CIRCUIT DESCRIPTION

• PLL Data and Display Data (MSM58292GS and MSM5829GS)

PLL and display data are transmitted serially. SO (pin 15) data is output from the CPU at the leading edge of the SCK pulse (pin 12) which is held until there is a change and the next data is output. The data receiver inputs the SO data at the trailing edge of the SCK output. The PLL data in RX is 0758 (HEX) at 145.00MHz. (Please see the following chart.)

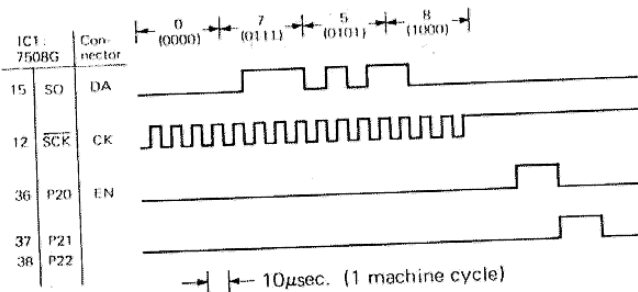


Fig. 11 PLL and display data timing chart

The PLL data length is 16 bits, and the display data (for the MSM58292GS and MSM5829GS) is 32 bits. The display data is transmitted in the same format as the PLL data except that EN is output from P21 or 22 and the data length is different.

PLL data	RX(HEX)	Dividing ratio	TX(HEX)	Dividing ratio
145.00	758	1880	6FD	1789
433.00	690	1680	635	1589

Table 11

• Keyboard signal

When one of the switches is depressed, the corresponding code signal (listed in Table 12) is input to CPU ports 4 and 5.

Switch	Code	Switch	Code	Switch	Code	Switch	Code
REV	11	RPT	21	M	41	PSR	81
COM 8	12	BAND(UP)	22	MS V	42	A/B	82
COM 9	14	BAND(DOWN)	24	MS U	44	SCAN	84
MR	18			M CH	48	FS	88

Table 12 CPU/Switch input code

For example, when the MS V switch is pressed, code "42" is input as shown below.

Port5				Port4				Code
4				2				
0	1	0	0	0	0	1	0	Binary code
P53	P52	P51	P50	P43	P42	P41	P40	

Table 13

Since each code is determined to set one slot of port 5 and one slot of port 4 "H", it is not possible (by pressing two or more switches) to make up a code other than that listed in Table 11.

• Encoder signal

The positive pulse generated in SW unit (A/4) (at each rotary selector click) is applied to X1 (pin 32) of the CPU, counted, and adjusted by the UP/DOWN signal output (P12; pin 43) from the SW unit (A/4). X1 is counted at the leading edge of the clock, and is independent of the pulse width. The UP/DOWN signal is UP when it is high.

• MIC control functions (MR, BAND, V.RCL)

These functions are detected by the code input to CPU P72 (pin 52) and P73 (pin 2). If both MR and BAND are switched ON the MIC's internal hardware sets P72 = 1 and P73 = 0 to obtain the MR state. MR or BAND selection commands are not accepted while V.RCL is ON; otherwise, when V.RCL is OFF, the MIC state corresponds to the switch state.

Priority	State	P72	P73
1	V.RCL ON	1	1
2	MR ON	1	0
3	BAND ON	0	1
4	ALL ON	0	0

Table 14 Priority of MIC control function

• Optional VS-1 voice synthesizer control

Voice synthesization begins when the addresses of the words to be spoken are input to the MN6401-TRA (pin 19-24) (see Table 15) and a start signal is input to the START pin (pin 6). During synthesization, BUSY pin 7 is "H". If a start signal is input during speech output, the next synthesization starts; the address and start signals are output when BUSY is "L" and the CPU voice ON/OFF control port P13 (pin 44) is "H".

However, address and start signals for sound operation are output regardless of the BUSY state (voice ON/OFF); the preceding word is cut off. The start signal is a positive pulse of approximately 20µs, triggered at the leading edge.

A word address is expressed by the BCD representation of addresses PS5 and 4 and PS3-0. Addresses 0-4 are controlled by the microprocessor, and address 5 (switching between Japanese and English) is controlled by the switch on the optional VS-1 unit.

When the tone "beeper" on the 144Final AVR unit is used in place of the VS-1, the tone is generated by using the 0 address and start signals.

CIRCUIT DESCRIPTION

Address	Word	Address	Word	Address	Word	Address	Word
00		10	ZERO	20		30	ZERO
01	MINUS	11	ICHI	21	MINUS	31	ONE
02	SIMPLEX	12	NI	22	SIMPLEX	32	TWO
03		13	SAN	23		33	THREE
04	PLUS	14	YON	24	PLUS	34	FOUR
05		15	GO	25		35	FIVE
06		16	ROKU	26		36	SIX
07		17	NANA	27		37	SEVEN
08		18	HACHI	28		38	EIGHT
09		19	KYU	29		39	NINE
0A	40mS	1A	A(Japanese)	2A	40mS	3A	A(English)
0B	100mS	1B	B(Japanese)	2B	100mS	3B	B(English)
0C	200mS	1C	U(Japanese)	2C	200mS	3C	U(English)
0D	D	1D	V(Japanese)	2D	D	3D	V(English)
0E	POWER ON	1E	TEN	2E	POWER ON	3D	POINT
0F		1F	909Hz, 40mS	2F	OPEN	3F	909Hz, 40mS

Table 15 Voice synthesization addresses

● **Voice ON/OFF control**

When the voice selector is ON, a "H" is applied to CPU P13 (pin 44) and voice output is enabled. When the voice selector is OFF, the input to the pin becomes "H" and voice is not output. However, the tone "beeper" is output regardless of voice being ON or OFF.

When V.RCL (voice recall) is switched ON, the voice synthesization unit detects this and outputs a logic "H" to CPU P13 (pin 44). Therefore, voice is output while V.RCL is ON even if the voice selector is OFF.

● **Switch unit (A/4) encoder operation**

The encoder outputs a positive pulse (CP) at each encoder click and an up/down signal (UD). The encoder checks the level of CK2 at the trailing edge and CK1 at the leading edge and, when the levels differ from each other, outputs a positive pulse (CP) at the CK1 leading edge. UD is output dependent upon CK2 level at the leading edge of CP.

Additional to generating CP, the circuit filters chatter to some extent.

Fig. 12-A illustrates this chatter filtering. The CK2 level is latched by TC4013BP (D flip-flop) at the trailing edge t1 of CK1. The latch output from pin 1 is exclusive OR-ed (EX OR-ed) with CK2 and applied to the following D flip-flop D input (pin 9).

The EX OR output is "H" if CK2's level differs from that at t1. After the EX OR output is applied, the D flip-flop outputs the D-pin level at the trailing edge t3 of CK1; a pulse is output when the EX OR output is "H", i.e., when the logic level of CK2 at the trailing edge of CK1 differs from that of the leading edge of CK1. When CP becomes logic "H", a Clear signal is output from pin 10 to set CP "L" after integration (delay) by C1 and R3.

Thus the CP pulse width is determined.

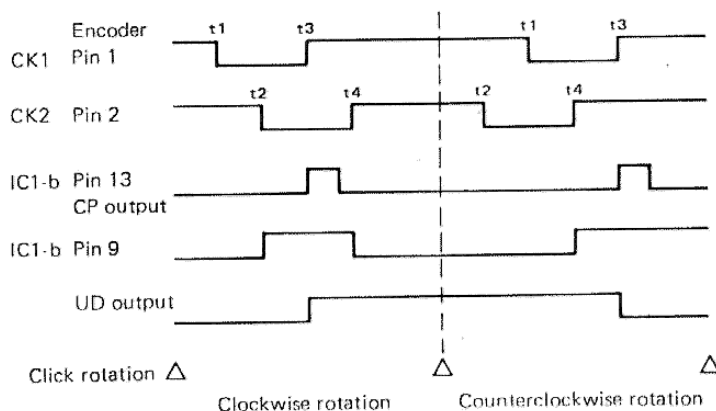


Fig. 12-A Encoder chatter Filtration

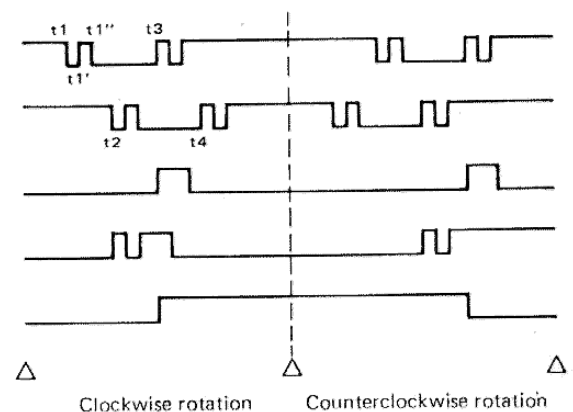


Fig. 12-B Encoder with chatter

CIRCUIT DESCRIPTION

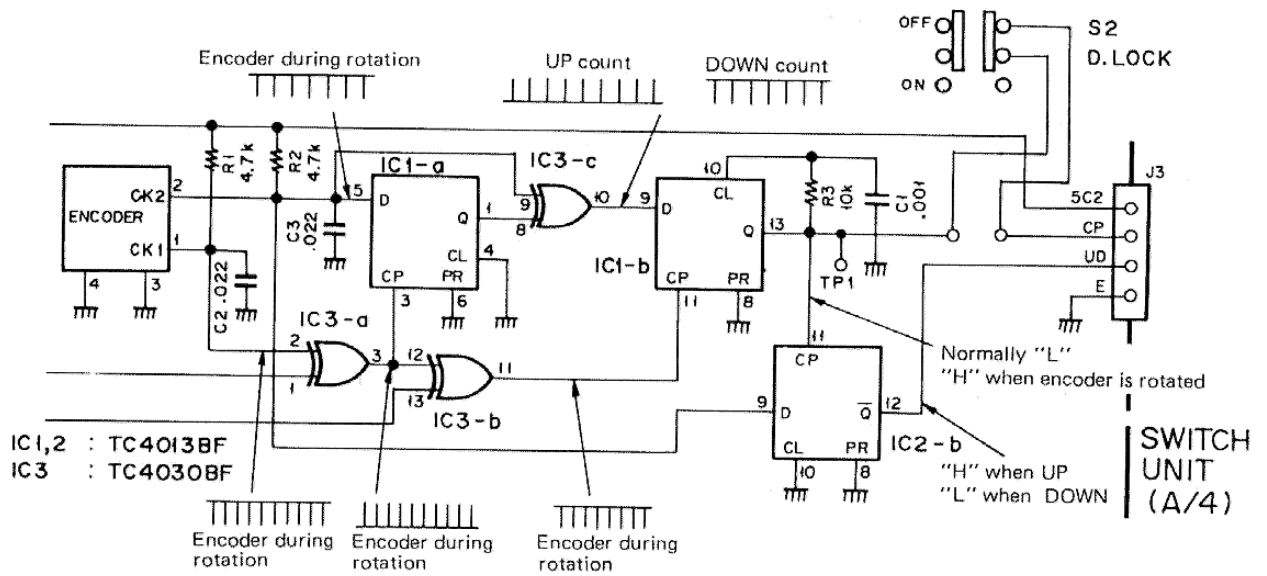


Fig. 13 Encoder pulse generation

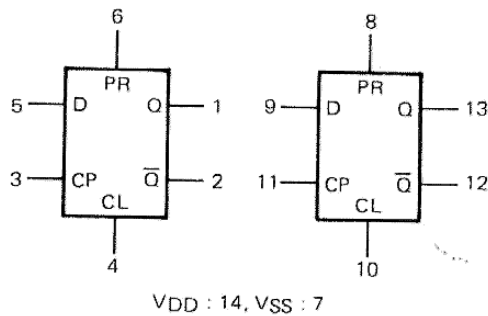


Fig. 14 TC4013BF functional block diagram (Switch unit IC1, 2)

INPUT				OUTPUT	
CL	PR	D	CPΔ	Q _{n+1}	Q _{n+1}
L	H	*	*	H	L
H	L	*	*	L	H
H	H	*	*	L	H
L	L	L	↑	L	H
L	L	H	↑	H	L
L	L	*	↔	Q _n	Q _n

* : Don't Care
Δ : Level Change
• : No Change

Table 16 TC4013 truth table

INPUT		OUTPUT
A	B	X
L	L	L
L	H	H
H	L	H
H	H	L

Table 17 TC4030 truth table (Switch unit IC3)

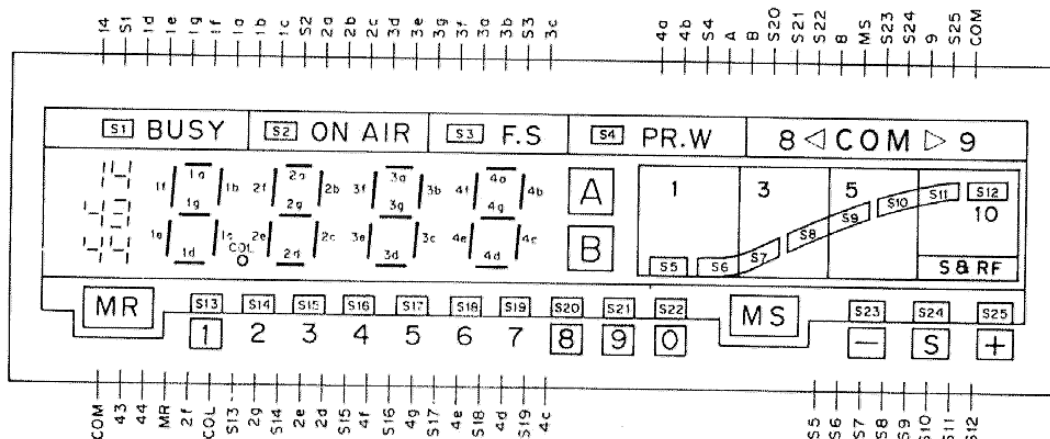


Fig. 15 LCD : FTS-1215

CIRCUIT DESCRIPTION

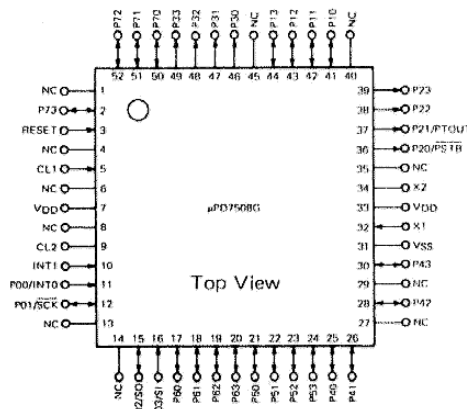


Fig. 16 CPU μPD7508G-519-00 (Control ASS'Y IC1)

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
2	P73	I	D R7	Connector J3		BAND	--	--	ON when MIC BAND is "H".
3	RESET	I	D R11						Normally open. Connected to VDD at reset.
5	CL1	I	--						System clock frequency is determined by C1 and R9.
7	VDD	I	--	Lithium battery					Connected to back up power supply via D1. Pin 7 is internally connected to pin 33.
9	CL2	I	--						See CL1 pin.
10	INT1	I	D R10						Not used.
11	INTO	I	D R13	Connector J5 (R12)		IL	I	--	Detects operating voltage change and determines back up state.
12	SCK	O	--	Connector J1		CK	O	--	PLL data sync clock.
				MSM58292	19	CK	I	--	} Display data sync clock
15	SO	O	--	Connector J1		DA	O	--	
				MSM58292	18	DATA	I	--	} Display serial data
16	P03	I	D R3	Connector J5		5R	I	--	
17	P60	O	--	Connector J2		4	O	--	Outputs voice synthesization address 4.
18	P61	O	--	Connector J5		UH	O	--	Band information. UHF → "H" VHF → "L"
19	P62	O	--	Connector J2		SR	O	--	Voice synthesization start signal output. Positive pulse at 50μs, nominal.
20	P63	O	--	D3-D9			I	--	Outputs positive pulse for reading set information at reset.
21	P50	I	D R16	Keyboard			O	--	REV, COM B, COM 9, and MR code input.
22	P51	I	D R22	Keyboard			O	--	RPT, BAND UP, and BAND DOWN code input.
23	P52	I	D R23	Keyboard			O	--	M, MS V, MS U, and M.CH code input.
24	P53	I	D R24	Keyboard			O	--	PSR, VFO A/B, SCAN, and STEP code input.
25	P40	I	D R25	Keyboard			O	--	REV, RPT, M, and PSR code input.
26	P41	I	D R26	Keyboard			O	--	COM B, BAND UP, MS V, and VFO A/B code input.
28	P42	I	D R27	Keyboard			O	--	COM 9, BAND DOWN, MS U, and SCAN code input.
30	P43	I	D R28	Keyboard			O	--	MR, M.CH, and STEP code input.
31	VSS	--	--	Connector J1		E			GND pin.
32	X1	I	--	Connector J4		CP	I	--	Encoder clock input.
33	VDD	I	--	Connector J1		5C1	I	--	Connected to 5C1 via D2.
34	X2	--	--	Open					Not used.
36	P20	O	--	Connector J1		EN	O	--	PLL data enable output.
37	P21	O	--	MSM58292		LOAD	I	--	} Display data enable output.
38	P22	O	--	MSM5829		LOAD	I	--	
39	P23	O	--	Connector J5		ATX	O	--	TX control output.
41	P10	I	D R2	Connector J2		BY	I	--	Voice synthesization BUSY signal input. "H" during synthesization.
42	P11	I	D R4	Connector J6		SS	I	--	BUSY stop squelch signal input. BUSY stop → "H"
43	P12	I	D R14	Connector J4		UD	I	--	Encoder UP/DOWN signal input. UP → "H"
44	P13	I	U R1	Connector J4		BZ	I	--	Voice synthesization ON/OFF signal input. ON → "H"
46	P30	O	--	Connector J2		0	O	--	} Voice synthesization addresses 0-3
47	P31	O	--		1	O	--		
48	P32	O	--		2	O	--		
49	P33	O	--		3	O	--		
50	P70	I	U R6	Connector J3		UP	I	--	MIC UP SW input. ON → "L"
51	P71	I	U R5			DN	I	--	MIC DOWN SW input. ON → "L"
52	P72	I	D R8			MR	I	--	MIC MR SW input. ON → "H"

Notes: 1. Pins not specified must remain open.
2. Voice synthesization is an optional sub-unit.

Table 18 Function of μPD7508-519-00

CIRCUIT DESCRIPTION

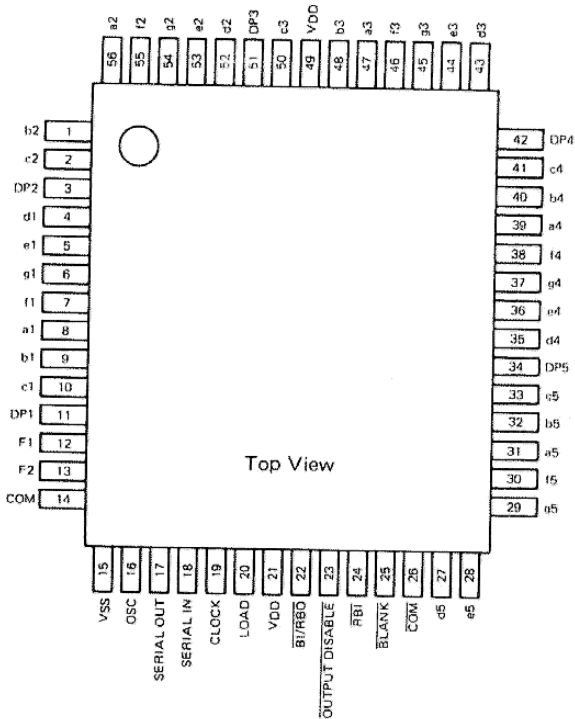


Fig. 17 MSM58292GS (Control ASS'Y IC2)

Hex. No.	RB1	BI/RBO	SEGMENT OUT Note 1							Display
			a	b	c	d	e	f	g	
*	*	L	L	L	L	L	L	L	L	Note 3
0	*	Note 2	L	L	L	L	L	L	L	Note 4
1	*	H	H	H	H	H	H	H	L	0
2	*	H	H	H	L	H	L	L	H	1
3	*	H	H	H	H	H	L	L	H	2
4	*	H	L	H	H	L	L	H	H	3
5	*	H	H	L	H	H	L	H	H	4
6	*	H	H	L	H	H	H	H	H	5
7	*	H	H	H	H	L	L	L	L	6
8	*	H	H	H	H	H	H	H	H	7
9	*	H	H	H	H	H	L	H	H	8
A	*	H	H	H	H	L	H	H	H	9
B	*	H	L	L	H	H	H	H	H	A
C	*	H	H	L	L	H	H	L	L	B
D	*	H	L	H	H	H	H	L	H	C
E	*	H	H	L	L	H	H	H	H	D
F	*	H	H	L	L	L	H	H	H	E

- Notes:
1. H: Display state. The phase of this output is opposite to that of the COM pin output.
L: Nondisplay state. The phase of this output is the same as that of the COM pin output.
 2. BI/RBO is "L" only when RB1 is "L" and all digits are 0 (blank display). When BI/RBO pin is forced to logic "H", 0 is displayed at the least significant digit.
 3. When BI/RBO is forced to logic "L", only the least significant digit blanks.
 4. When RB1 is set to logic "L", the leading zeros are suppressed, i.e., the continuous zeros, if any, at the most significant digit down are blanked.

4. Table 19 MSM58292GS function table

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
1	b2	O	-	LCD	1b	I	-	}	1M segment display
2	c2				1c				
4	d1				3d				
5	e1				3e				
6	g1				3g				
7	f1				3f				
8	a1				3a				
9	b1				3b				
10	c1				3c				
15	VSS				-				
16	OSC	I	-	GND					External clock is used; OSC is grounded.
21	VDD	I	-	Connector J1	5C1	I			Connected to 5C1 via D10.
23	OD	I		GND					COM pin is used for input; OD is grounded.
24	RB1	I		VDD					Leading zero suppression function is not used; RB1 is connected to VDD.
25	BLANK	I		VDD					Displays all digits when display control pin is "H".
35	d4	O	-	LCD	4d	I	-	}	1k segment display
36	e4				4e				
37	g4				4g				
38	f4				4f				
39	a4				4a				
40	b4				4b				
41	c4				4c				
43	d3				2d				
44	e3				2e				
45	g3				2g				
46	f3	2f							
47	a3	2a							
48	b3	2b							
50	c3	2c							
52	d2	1d							
53	e2	1e							
54	g2	1g							
55	f2	1f							
56	a2	1a							
									100k segment display
									1M segment display

Note: Pins not specified must remain open.

Table 20 Function of MSM58292GS

CIRCUIT DESCRIPTION

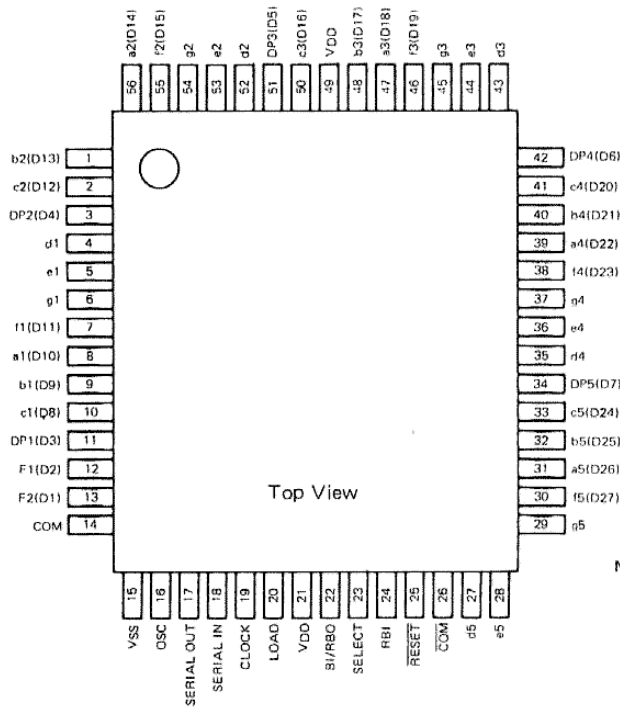


Fig. 18 MSM5829GS (Control ASS'Y IC3)

Hex. No.	RBI	BI/RBO	SEGMENT OUT							Note 1	Display
			a	b	c	d	e	f	g		
.	.	L	L	L	L	L	L	L	L		Note 3
0	.	Note 2	L	L	L	L	L	L	L		Note 4
0	.	H	H	H	H	H	H	H	L		
1	.	H	L	H	H	L	L	L	L		
2	.	H	H	H	L	H	H	L	H		
3	.	H	H	H	H	H	L	L	H		
4	.	H	L	H	H	L	L	H	H		
5	.	H	H	L	H	H	L	H	H		
6	.	H	H	L	H	H	H	H	H		
7	.	H	H	H	H	L	L	L	L		
8	.	H	H	H	H	H	H	H	H		
9	.	H	H	H	H	H	L	H	H		
A	.	H	H	H	H	L	H	H	H		
B	.	H	L	L	H	H	H	H	H		
C	.	H	H	L	L	H	H	H	L		
D	.	H	L	H	H	H	L	H	H		
E	.	H	H	L	L	H	H	H	H		
F	.	H	H	L	L	L	H	H	H		

- Notes: 1. H: Display state. The phase of this output is opposite to that of the COM pin output.
 L: Nondisplay state. The phase of this output is the same as that of the COM pin output.
2. BI/RBO is "L" only when RBI is "L" and all digits are 0 (blank display). When BI/RBO pin is forced to logic "H", 0 is displayed at the least significant digit.
3. When BI/RBO is forced to logic "L", only the least significant digit blanks.
4. When RBI is set to logic "L", the leading zeros are suppressed, i.e., the continuous zeros, if any, at the most significant digit down are blanked.

4. Table 21 MSM5829GS function table

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks				
1	D13	O	-	LCD	B	B	I	-	VFO B display				
2	D12				8	Memory channel 8 display							
3	D4				9	Memory channel 9 display							
7	D11				0	Memory channel 10 display							
8	D10				8	COM channel 8 display							
9	D9				MS	Memory scan state display							
10	D8				-	Repeater shift - (minus) display							
11	D3				SIMP	Repeater shift SIMP (simplex) display							
12	D2				9	COM channel 9 display							
13	D1				+	Repeater shift + (plus) display							
15	VSS				-	GND							GND pin
16	OSC				I								R18 and C5 determine liquid crystal clock frequency.
21	VDD				I								Connected to 5C1 via D10.
23	SELECT	I		GND				Flag ON is selected; SELECT is grounded.					
24	RBI	I		VDD				Suppresses leading zeros in 7-segment display.					
25	RESET	I		VDD				Resets internal shift register for serial data input. Normally "H".					
26	COM	O		IR2429	OSC	I	-	Liquid crystal clock for level meter					
30	D27	O	-	LCD	7	7	I	-	Memory channel 7 display				
31	D26				6	Memory channel 6 display							
32	D25				5	Memory channel 5 display							
33	D24				Decimal point	Decimal point display							
34	D7				1	Memory channel 1 display							
38	D23				44	440MHz display							
39	D22				MR	Memory call state display							
40	D21				2	Memory channel 2 display							
41	D20				3	Memory channel 3 display							
42	D6				4	Memory channel 4 display							
46	D19				43	430MHz display							
47	D18				14	140MHz display							
48	D17				BUSY	BUSY display							
50	D16				ON AIR	ON AIR display							
51	D5				F.STEP	F.STEP display							
55	D15				PSR	Priority level display							
56	D14				Λ	VFO A display							

Note: Pins not specified must remain open.

Table 22 Function of MSM5829GS

CIRCUIT DESCRIPTION

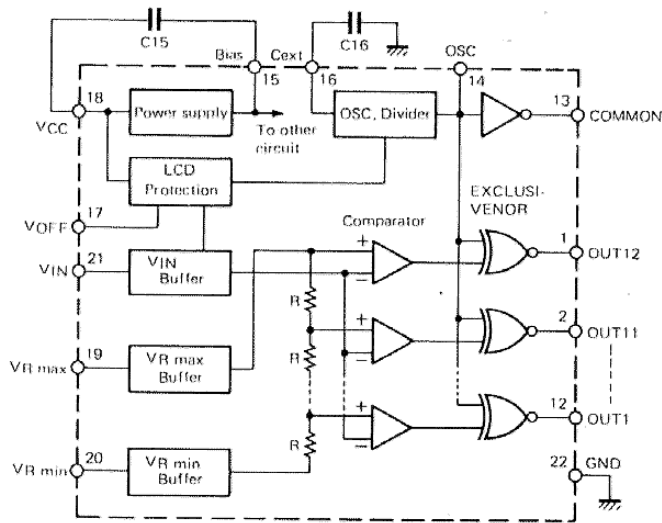


Fig. 19 IR2429 block diagram (Control ASS'Y IC4)

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
3	S10	O	-	LCD	10				Level meter segment output
5	S8				8				
7	S6				6				
8	S5				5				
9	S4				4				
10	S3				3				
11	S2				2				
12	S1	1							
15	BIAS		-						Prevents C12 oscillation
16	C		-	GND					External clock is used; C is grounded.
18	VCC	I	-	Connector J6	8C2	I			8V power supply
19	VREF-MAX								Determines level 10 voltage value.
20	VREF-MIN			GND		I			Determines level 1 voltage value.
21	VIN		D R21	Connector J6	M	I			Meter input (DC)
22	GND		-	GND					GND pin

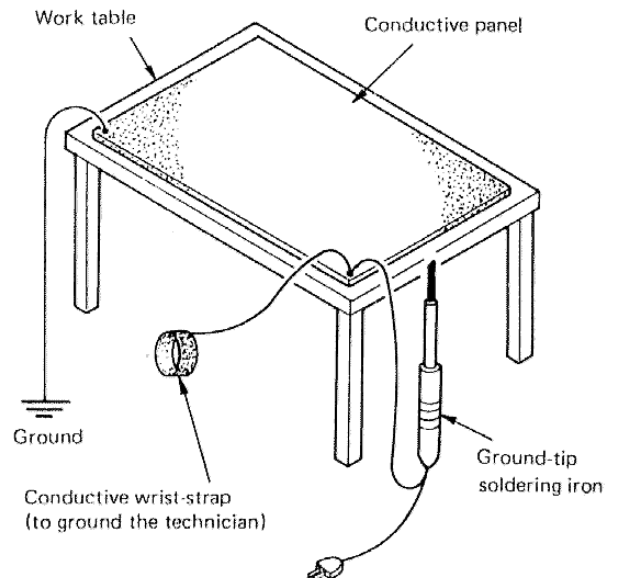
Note: Pins not specified must remain open.

Table 23 Function of IR2429

PRECAUTIONS FOR HANDLING GALLIUM ARSENIDE FET'S

The gallium arsenide FET (3SK97) used in this device is easily damaged by static electricity. Take careful note of the following points when soldering and handling this device.

1. When handling this FET separated from the radio, make sure to first discharge yourself to ground.
2. Use a grounded-tip soldering iron.
3. Ground the FET while soldering-in.
4. Cover the work table with a conductive, grounded panel to insure an adequate static discharge path.



CIRCUIT DESCRIPTION

LITHIUM BATTERY (W09-0323-05)

SPECIFICATIONS

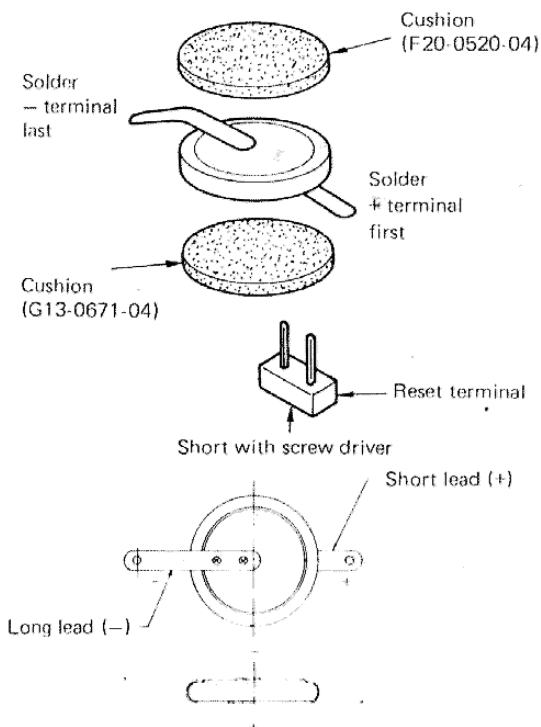
Model and Efficiency

Model	CR2032
Nominal Voltage	3V
Nominal Capacity	170m Ah
Discharge Stop Voltage	2.0V
Dimensions	Diameter 20.2 mm
	High 3.2 mm
Weight	3g

BACKUP BATTERY REPLACEMENT PROCEDURE

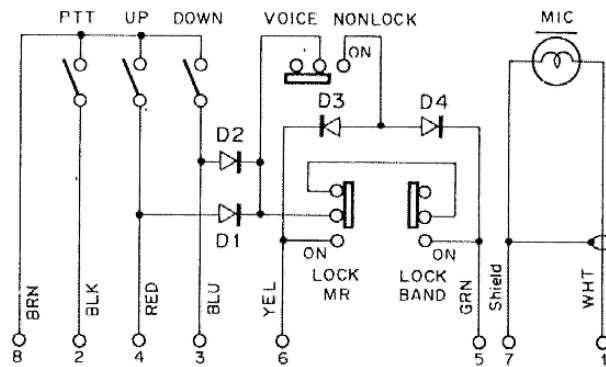
Replace the backup battery as follows:

1. Remove the 3 screws from each side rail. Remove 2 screws holding the front panel to the chassis. Pull the front panel slightly forward (3cm).
2. Disconnect the connector to the Control assembly. Disconnect J1 and J3 on the PLL unit to make disassembly easier.
3. Quickly desolder the battery. Carefully remove the battery so as not to damage the adjacent components or wiring.
4. Check the polarity of the battery. Install a new battery and solder the + (positive) lead first.
5. Reinstall the connector previously unplugged in step 2, then turn the power ON.
6. After resetting, solder the - (negative) battery lead.
7. To reassemble, reverse steps 2 & 1.



ACCESSORY MICROPHONE

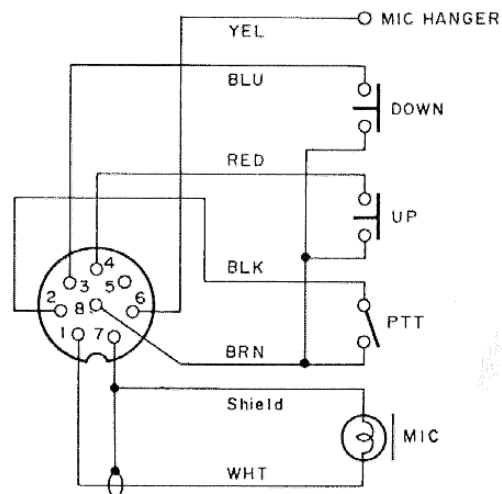
(T91-0327-15) W type



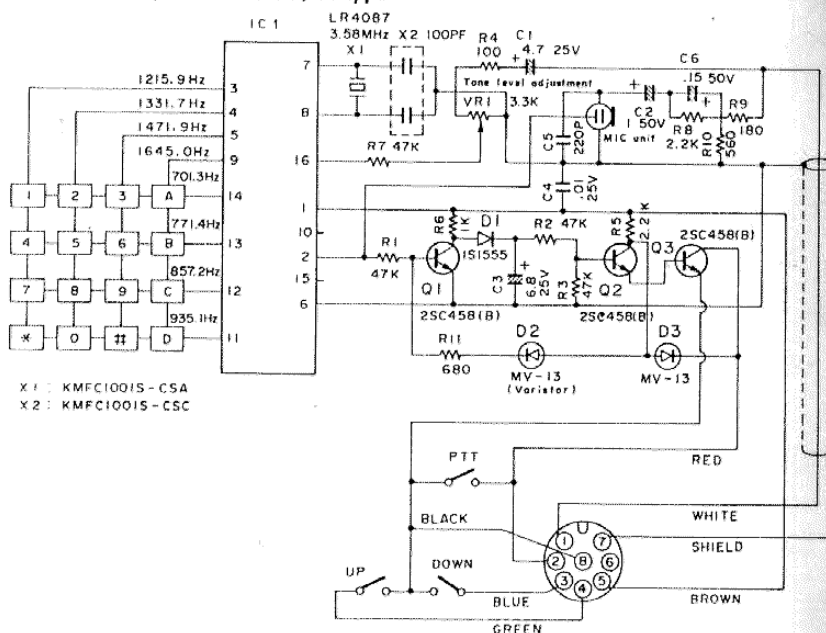
D1~4 : 1S1555

(T91-0331-05) M1, M2, X type

(T91-0333-05) T type



(T91-0332-05) K type



X1 : KMFC1001S - CSA
X2 : KMFC1001S - CSC

PARTS LIST

CAPACITORS

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

- 1 = Type ceramic, electrolytic, etc
- 2 = Shape round, square, etc
- 3 = Temp coefficient
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance

● Temperature coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

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

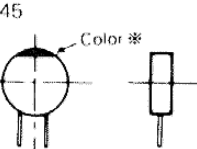
Example CC45TH = -470 ± 60 ppm/°C

● Tolerance

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

Code	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		



● Rating voltage

2nd word \ 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	-
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-

● Capacitor value

- 0 1 0 = 1pF
 - 1 0 0 = 10pF
 - 1 0 1 = 100pF
 - 1 0 2 = 1000pF = 0.001μF
 - 1 0 3 = 0.01μF
 - 2 2 0 = 22pF
- 1st number | Multiplier
2nd number

Symbol	Destination
K	U.S.A.
W	Europe
T	Britain
M	General market

Resistors not listed in this parts list are standard, fixed carbon composition, 1/4W or 1/8W. The resistance values, in ohms, are indicated on the schematic diagram.

SEMICONDUCTOR

N : New parts
 Δ : Please note that parts are sometimes not in stock and it takes much time to deliver.

Name	Re-marks	Part No.	Name	Re-marks	Part No.	Name	Re-marks	Part No.		
Diode		1N60	TR		2SA1012(Y)	LCD	N	FTS-1215B K,M,T		
		1N4448			2SA1015(Y)		N	FTS-1215C W,X		
		1S1555			2SC460(B)		Power module	N	M57729-H K,M1	
		1S1587			2SC496(Y)			N	M57729-L M2,T,W,X	
		1S2588			2SC1775(E)				M57737	
		1SS101			2SC1815(Y)			IC	N	IR2429
		BA244A			1SC1923(O)				N	KC-1010
	N	MA165			2SC1959(Y)				N	KC-1020
	N	MA856			2SC1026					MB3712
		MI301			2SC2240(GR)					MB3756
		MI303			2SC2406TS				N	MC145155P
	N	MI407		N	2SC2406T					MSM5829GS
		ND487C1-3R			2SC2407(1)				MSM58292GS	
		U15B			2SC2458(Y)				NE555P T,W	
					2SC2538-22-A				NJM78L06A	
			2SC2603(E)		TC4013BF					
			2SC2671(H)		TC4030BF					
Vari-cap		1S2208	FET		2SK30A(O)		μPC4558C			
		1SV50			2SK125		μPD7508G-519-00			
		ITT410			2SK192A(GR)*N					
Zener diode		WZ-061			3SK74(L)	N				
		XZ-055 T,W			3SK97(O2)*J	N				
		XZ-064 T,W		3SK92(O2)	N					
		XZ-117		3SK114(Y)	N					

PARTS LIST

Part No.	Re- marks	Description	Ref. No.	Part No.	Re- marks	Description	Ref. No.
TW-4000A GENERAL				G10-0627-04		Cushion B	
A01-0947-02	N	Case (upper)		G13-0671-04	N	Cushion Control ass'y	
A01-0948-02	N	Case (lower)		G13-0681-04	NΔ	Cushion A	
A13-0637-04	NΔ	Sub frame (A) Encoder side		H01-4489-03	NΔ	Packing carton (inside) K,M1,M2,W,X	
A13-0638-04	NΔ	Sub frame (B) MIC side		H01-4490-03	NΔ	Packing carton T	
A13-0639-02	N	Mounting angle ass'y Accessory		H10-2571-02	N	Packing fixture	
A13-0642-05	N	Frame		H12-1325-03	N	Cushion	
B05-0714-04		SP grill cloth		H12-1329-04	N	Cushion	
B05-0725-04	N	Grill cloth (A) x 2		H12-1334-04	NΔ	Cushion	
B05-0726-04	N	Grill cloth (B)		H25-0029-04		Protective bag Plug, Fuse, Seal	
B05-0727-04	N	Grill cloth (C)		H25-0049-03		Accessory bag	
B06-0505-18	NΔ	Key case Control ass'y		H25-0079-04		Protective bag MIC	
B07-0640-03	N	Side escutcheon x 2		H25-0103-04		Protective bag Cord	
B11-0417-08	N	Light guiding plate Control ass'y		H25-0106-04		Protective bag TW-4000A	
B30-0828-05		Lamp with cap x 5 Control ass'y		J02-0022-05		Rubber foot x 2	
B42-1786-04	N	ANT seal x 2 Accessory		J02-0416-04		Foot Accessory	
B46-0058-10		Warranty card K		J19-1374-08	N	LCD holder Control ass'y	
B50-4041-00	N	Instruction manual M1,M2,X		J21-2676-04		Foot mounting hardware x 2	
B50-4042-00	N	Instruction manual T		J21-2717-14	Δ	SP mounting hardware	
B50-4068-00	N	Instruction manual W		J21-2718-04	Δ	Lead holder x 2	
B50-4069-00	N	Instruction manual K		J21-2794-04	NΔ	Capacitor mounting hardware	
CC455L2H040C	C	4P 500V	C03	J25-3164-05		Flexible PC board Control ass'y	
CC455L2H150J	C	15P 500V	C02	J29-0407-04	N	SW guide A x 8	
CK45F1H103Z	C	0.01	C01	J29-0408-04	N	SW guide B x 6	
C91-0112-05		Cap. 0.001 x 6	C04-09	J32-0769-14	N	Round boss x 2	
E04-0109-15		UHF type receptacle x 2 K,M1,M2,X	J1,2	J32-0770-04	N	Round boss x 4	
E04-0109-15		UHF type receptacle x 2 T,W	J1	J32-0771-04	N	Angle boss x 4 Accessory	
E04-0151-05		N type receptacle T,W	J2	J41-0024-15		Cord bushing	
E08-0471-05		4P socket	J3	J61-0401-05		Nylon band x 17	
E08-0771-05	Δ	Mini connector 7P Control ass'y		K21-0770-03	N	Main knob	
E09-0471-05		4P plug Accessory		K23-0758-04	N	Knob (A) AF	
E11-0403-05		Phone jack	J4	K29-0777-14	N	Knob (B) SQL	
E12-0001-15		Phone plug Accessory		N09-0008-04		Round screw x 4 Angle	
E23-0427-05		GND lug.		N09-0256-05		GND screw	
E23-0434-04	N	GND terminal		N09-0632-05		Tapping screw (A) x 4 Angle	
E29-0428-04		Terminal x 3 Control ass'y		N09-0647-08	N	Tapping screw x 8 Control ass'y	
E29-0436-08	N	Inter connector A x 2 Control ass'y		N14-0510-04		Flange nut x 4 Angle	
E29-0437-08	N	Inter connector B Control ass'y		N15-1020-46		Flat washer x 2	
E29-0438-08	N	Inter connector C Control ass'y		N15-1050-46		Flat washer x 4 Angle	
E29-0439-05	N	Relay terminal		N15-1060-46		Flat washer x 4 Angle	
E30-1689-15		DC cord Accessory		N16-0060-46		Spring washer x 4 Angle	
E30-1732-05	N	DC cord ass'y with 8A fuse	J5	N17-1026-46		Tooth washer x 2	
E40-3007-05	Δ	Mini connector 2P Control ass'y		N17-1030-46		Tooth washer x 3	
E40-3008-05	Δ	Mini connector 3P Control ass'y		N32-2004-46		Flat screw x 3 Control ass'y	
E40-3009-05	Δ	Mini connector 4P x 2 Control ass'y		N32-3006-46		Flat screw x 8	
E40-3010-05	Δ	Mini connector 5P Control ass'y		N33-2605-45		Round flat screw x 5	
E40-3013-05	Δ	Mini connector 8P Control ass'y		N33-3006-45		Round flat screw x 6	
F05-8021-05		Fuse 8A Accessory		N33-3008-41		Round flat screw x 6	
F11-0826-04	NΔ	PLL shield cover		N33-4018-41	N	Round flat screw x 4 Angle	
F15-0649-04	N	Shadow mask sheet x 5		N35-2004-46		Bind screw	
F19-0625-04		mask seal		N35-2005-46		Bind screw x 8	
F20-0520-04		Cushion Control ass'y		N35-2604-46		Bind screw x 2	
G02-0505-05		Knob fixed spring		N35-2606-46		Bind screw x 2 T,W	
G02-0520-04		GND spring		N35-2608-45		Bind screw	
G02-0538-04	N	Final GND plate		N35-3005-46		Bind screw	
G10-0610-04		Cushion A x 4		N35-3006-41		Bind screw x 4	
				N35-3006-45		Bind screw x 2	
				N35-3006-46		Bind screw x 10	
				N35-3008-46		Bind screw x 27	
				N87-2006-46		Self tapping screw x 2 Control ass'y	

PARTS LIST

Part No.	Re marks	Description	Ref. No.	Part No.	Re marks	Description	Ref. No.	Q'ty
N87-3006-46		Self tapping screw x 2		E40-0773-05	NA	Mini connector 7P		1
N89-3006-45		Bind tapping screw x 3		R23-9401-05	N	Pot. with SW 10k (A), 50k (B)	VR1,S7	1
N89-3008-45		Bind tapping screw x 2		R92-0150-05		Short jumper		1
S40-2445-05	N	Push switch (lock) x 2 MIC-MR, BAND T,W		S31-1409-05	N	Slide switch BZ	S6	1
S40-2446-05	N	Push switch (nonlock) MIC-VOICE T,W		S40-2443-05	N	Push switch DIM T D.LOCK, TONE, HI/LOW	S1-4	4
S50-1406-05		Tact switch x 2 MIC-UP, DOWN M1,M2,T,W,X		S40-2443-05	N	Push switch K,M1,M2,X DIM, TONE, HI/LOW	S1,3,4	3
S90-0407-18		Rubber switch Control ass'y		S40-2443-05	N	Push switch W DIM, D.LOCK, HI/LOW	S1,2,4	3
T07-0209-15	N	Speaker		S40-2444-05	N	Push switch K,M1,M2,X V.RCL, F.STEP	S2,5	2
T91-0327-15	N	Microphone Accessory W		S40-2444-05	N	Push switch W TONE, F.STEP	S3,5	2
T91-0331-05		Microphone Accessory M1,M2,X		S40-2444-05	N	Push switch F.STEP T	S5	1
T91-0332-05	N	Microphone Accessory K		W02-0332-05	N	Rotary encoder		1
T91-0333-05	N	Microphone Accessory T		PANEL ASS'Y (X41-1500-11,-51,-61) -11 : K,M1,M2,X -51 : T -61 : W				
W02-0336-05	N	Control ass'y K,M1		A20-2479-02	N	Panel ass'y K,M1,M2,X		1
W02-0337-05	N	Control ass'y M2		A20-2480-02	N	Panel ass'y T		1
W02-0338-05	N	Control ass'y T		A20-2481-02	N	Panel ass'y W		1
W02-0339-05	N	Control ass'y W		A21-0751-03	N	Ornamental panel		1
W02-0340-05	N	Control ass'y X		B10-0653-04	N	Front glass		1
W02-0341-05	N	Display Control ass'y K,M1,M2,T		B10-0656-04	N	Display glass		1
W02-0342-05	N	Display Control ass'y W,X		B11-0416-03	N	Light guiding plate (A)		1
W02-0343-05	N	Control Control ass'y K,M1		B43-0692-04	N	Name plate K,M1,M2,W,X		1
W02-0344-05	N	Control Control ass'y M2		B43-0693-04	N	Name plate T		1
W02-0345-05	N	Control Control ass'y T		G01-0818-04	N	Coil spring Knob		5
W02-0346-05	N	Control Control ass'y W		J29-0407-04	N	SW guide A		8
W02-0347-05	N	Control Control ass'y X		J29-0408-04	N	SW guide B		6
W09-0323-05		Lithium battery CR2032 Control ass'y		K27-0436-04	N	Push knob (A) K,M1,M2,X TONE, V.RCL		2
X41-1490-11	N	Switch unit K,M1,M2,X		K27-0436-04	N	Push knob (A) T,W TONE, D.LOCK		2
X41-1490-51	N	Switch unit T		K27-0437-04	N	Push knob (B) HI/LOW		1
X41-1490-61	N	Switch unit W		K27-0438-04	N	Push knob (C) F.STEP, DIM		2
X41-1500-11	N	Panel ass'y K,M1,M2,X		K27-0439-04	N	Push knob (D) UP,DOWN		2
X41-1500-51	N	Panel ass'y T		K27-0440-04	N	Push knob (E) A/B, MR M.CH, PR.W		4
X41-1500-61	N	Panel ass'y W		K27-0441-04	N	Push knob (F) M,SCAN		2
X44-1520-11	N	RX-TX unit K,M1		K27-0442-04	N	Push knob (G) CALL(8.9), MS (V,U),REV,OFFSET		6
X44-1520-21	N	RX-TX unit M2,X		N29-0301-04	N	Stopper ring A Knob φ4		5
X44-1520-51	N	RX-TX unit T,W		SWITCH UNIT (X41-1490-11,-51,-61) -11 : K,M1,M2,X -51 : T -61 : W				
X45-1300-01	N	430 Final unit M2,T,W,X		C91-0475-05		ML 0.022	C2,3	2
X45-1300-11	N	430 Final unit K,M1		C91-0485-05		ML 0.001	C1	1
X45-1310-01	N	144 Final AVR unit T,W		E06-0853-05		8P metal socket MIC		1
X45-1310-11	N	144 Final AVR unit K,M1,M2,X		E40-0274-05	NA	Mini connector		1
X50-1930-00	N	PLL unit M2,T,W,X						
X50-1930-11	N	PLL unit K,M1						
X52-1250-50	N	Tone unit T						
X52-1250-61	N	Tone unit W						

PARTS LIST

Part No.	Remarks	Description	Ref. No.	Q'ty	Part No.	Remarks	Description	Ref. No.	Q'ty
RX-TX UNIT (X44-1520-11,-21,-51)					-11 : K,M1 -21 : M2,X -51 : T,W				
C05-0030-15		Ceramic trimmer 20P	TC7,8	2	CQ92M1H104K		ML 0.1	C166	1
C05-0031-15		Ceramic trimmer 10P	TC5,6	2	CQ92M1H122K		ML 0.0012	C179	1
C05-0067-05		Ceramic trimmer 25P	TC3	1	CQ92M1H182K		ML 0.0018	C161	1
C05-0308-05		Ceramic trimmer 4P	TC1,2,4	3	CQ92M1H222K		ML 0.0022	C151,159	2
CC45CH1H010C		C 1P	C10,33	2	CQ92M1H223K		ML 0.022	C137,140,180,02	4
CC45CH1H030C		C 3P T,W	C25	1	CQ92M1H332K		ML 0.0033	C154	1
CC45CH1H040C		C 4P K,M1,M2,X	C25	1	CQ92M1H333K		ML 0.033	C174	1
CC45CH1H0R5C		C 0.5P	C58,91,92,97,98,134	6	CQ92M1H393K		ML 0.039	C49,52,152	3
CC45CH1H060D		C 6P	C12,44	2	CQ92M1H822K		ML 0.0082	C182	1
CC45CH1H070D		C 7P	C117	1	CS15E1A100M		T 10 10V	C143	1
CC45CH1H080D		C 8P	C35,56,72	3	CS15E1V0R1M		T 0.1 35V	C153,170	2
CC45CH1H100D		C 10P	C15,45	2	CS15E1VR22M		T 0.22 35V	C183	1
CC45CH1H1R5C		C 1.5P	C9,64	2	CS15E1VR47M		T 0.47 35V	C181	1
CC45CH1H180J		C 18P	C34,102,108	3	C90-0820-05		E 470 16V	C164	1
CC45CH1H220J		C 22P	C38,50,65	3	C90-0840-05		E 10 16V	C21	1
CC45CH1H270J		C 27P	C132	1	C91-0116-05		C 0.0022 (SP)	C125	1
CC45CH1H330J		C 33P	C11,24	2	C91-0131-05		C 0.01 (SP)	C14,17,28,29,31,37,41,42,48,51,57,69,83,104,110,112,115,120,131,135,148-150,167,168,184,188,190,191	29
CC45CH1H390J		C 39P	C55	1	C91-0432-05		C 220P	C128	1
CC45RH1H030C		C 3P	C99	1	C91-0457-05		C 0.022	C47,130,133	3
CC45RH1H120J		C 12P	C23	1	C91-0479-05		C 150P	C129	1
CC45RH1H150J		C 15P	C27	1	E04-0154-05		Coax. connector		8
CC45RH1H220J		C 22P	C26	1	E40-0273-05	NA	Mini connector 2P		5
CC45SL1H101J		C 100P	C3,5,8,13,18,61,63,67,71,74,77,79,80,157	14	E40-0373-05	NA	Mini connector 3P		3
CC45TH1H020C		C 2P	C89,95,105	3	E40-0473-05	NA	Mini connector 4P K,M1,M2,X		2
CC45UJ1H040C		C 4P	C127	1	E40-0473-05	NA	Mini connector 4P T,W		1
CC45UJ1H060D		C 6P	C93,96,100,106	4	E40-0573-05	NA	Mini connector 5P		1
CC45UJ1H080D		C 8P	C192	1	E40-0673-05	NA	Mini connector 6P		1
CC45UJ1H120J		C 12P	C126	1	L19-0309-05		DBM coil	L10,11	2
CK73EF1H102Z		Chip cap. 0.001	C2	1	L30-0503-05		IFT 455kHz	L32	1
CK73ESL1H101J		Chip cap. 100P	C1,193	2	L30-0519-05	N	IFT 455kHz	L31	1
CE04W1A101M		E 100 10V	C147,165,172	3	L31-0267-05		ANT coil 144MHz	L3,4	2
CE04W1A470M		E 47 10V	C142,162,176	3	L32-0657-05	N	OSC coil	L27	1
CE04W1C100M		E 10 16V	C40,84,123,158,177	5	L34-0452-05		Coil 3φ6T	L25	1
CE04W1C220M		E 22 16V	C141	1	L34-0692-05		Coil 5φ4T	L26	1
CE04W1H010M		E 1 50V	C156,160	2	L34-0907-05		Coil 4.5φ 2 1/4T	L16	1
CE04W1H2R2M		E 2.2 50V	C178	1	L34-0911-05		Coil 4.5φ 1T	L17	1
CE04W1H3R3M		E 3.3 50V	C144,145	2	L34-1035-05		Coil 3φ 11.5T	L12	1
CE04W1H4R7M		E 4.7 50V	C82,118,146,171	4	L34-1041-05		Coil 4φ 2.5T	L14,15	2
CE04W1HR22M		E 0.22 50V	C01	1	L34-1042-05		Coil 4.5φ 1T	L18	1
CE04W1HR47M		E 0.47 50V	C185	1	L34-1067-05	N	Coil 3φ 2.5T (0.5T)	L2	1
CK45B1H102K		C 0.001	C4,6,7,16,19,20,22,30,32,36,43,46,53,59,60,62,66,68,70,73,75,76,78,81,85-88,90,94,101,103,107,109,111,113,114,116,119,121,122,124,163,169,173,175,187,189	48	L34-1068-05	N	Coil 3φ 3.5T (0.5T)	L1	1
CK45B1H331K		C 330P	C136	1	L34-1069-05	N	Coil 3φ 3.5T (0.5T)	L13	1
CK45B1H471K		C 470P	C54,186	2	L34-1070-05	N	Coil 4.5φ 6T (1 1/4T)	L24	1
CK45F1H103Z		C 0.01	C39	1	L34-1071-05	N	Coil 4φ 4.5T (2T)	L5	1
CQ92M1H102K		ML 0.001	C139	1	L34-2038-05		Tuning coil OSC, IF	L7,28,29	3
CQ92M1H103K		ML 0.01	C155	1	L34-2045-05		Tuning coil IF	L9	1
					L34-2157-05	N	Tuning coil IF	L6	1
					L34-2158-05	N	Tuning coil T : 144	L20-23	4
					L40-1021-12		Ferri-inductor 1mH	L30	1
					L40-1511-14		Ferri-inductor 150μH	L35	1
					L40-2201-14		Ferri-inductor 22μH	L8	1
					L40-3391-14		Ferri-inductor 3.3μH	L19	1
					L40-6825-04		Ferri-inductor 6.8mH	L33	1

PARTS LIST

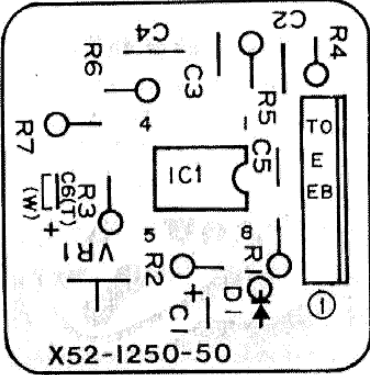
Part No.	Re- marks	Description	Ref. No.	Q'ty	Part No.	Re- marks	Description	Ref. No.	Q'ty	
L71-0241-05	N	MCF	XF1,2	1A	R92-0116-05		Resistor 0.47Ω	R1	1	
L72-0316-05		Ceramic filter CFW455E	CF1	1	R92-0150-05		Short jumper		2	
L77-0987-05	N	Crystal 15.66MHz	X1	1	144 FINAL AVR UNIT (X45-1310-01,-11) -01 : T,W -11 : K,M1,M2,X					
L79-0446-05		Ceramic disc CFY455S	CF2	1						
L79-0468-05		Helical block 144MHz	HB(C) M2,T,W,X	1						
L79-0471-15		Helical block 430MHz	HB(B) M2,T,W,X	1A						
L79-0494-05	N	Helical block 430MHz	HB(A) M2,T,W,X	1A						
L79-0495-05	N	Helical block 430MHz	HB(D) M2,T,W,X	1A						
L79-0496-05	N	Helical block 430MHz	HB(E) M2,T,W,X	1A						
L79-0483-05		Helical block 144MHz	HB(C) K,M1	1A						
L79-0615-05	N	Helical block 440MHz	HB(A) K,M1	1A						
L79-0616-05	N	Helical block 440MHz	HB(B) K,M1	1A						
L79-0617-05	N	Helical block 440MHz	HB(D) K,M1	1A						
L79-0618-05	N	Helical block 440MHz	HB(E) K,M1	1A						
N30-3004-46		Round screw		1						
N87-2606-46		Self tapping screw		8						
R12-2410-05		Trim. pot. 5kΩ (3)	VR2	1	CC45CH1H0R5C	C	0.5P	C16	1	
R12-3434-05		Trim. pot. 10kΩ (3)	VR3	1	CC45CH1H010C	C	1P	C13	1	
R12-4411-05		Trim. pot. 50kΩ (3)	VR1	1	CC45CH1H150J	C	15P	C8	1	
R92-0150-05		Short jumper K,M1,M2,X		3	CC45CH1H330J	C	33P	C9	1	
R92-0150-05		Short jumper T,W		2	CC45SL1H101J	C	100P	C111	1	
430 FINAL UNIT (X45-1300-01,-11) -01 : M2,T,W,X -11 : K,M1					CC45SL1H101D	C	8P	500V	C6	1
					CC45SL2H100D	C	10P	500V	C15	1
					CC45SL2H101J	C	100P	500V	C11	1
					CC45SL2H150J	C	15P	500V	C10	1
					CC45SL2H220J	C	22P	500V	C18	1
					CC45SL2H270J	C	27P	500V	C12	1
					CC45SL2H330J	C	33P	500V	C14	1
					CE04W1C100M	E	10	16V	C1,37,45,47,48, 55,57,59,64,105	10
					CE04W1C101M	E	100	16V	C49,60	2
					CE04W1E100M	E	10	25V	C26	1
					CE04W1E010M	E	10	50V	C106	1
					CE04W1ER10M	E	0.1	50V	C103	1
					CE04W1ER47M	E	0.47	50V	C102	1
					CK45B1H102K	C	0.001		C2,4,7,17,19-21 23-25,28,29, 31-35,38-42, 53,61,62	25
CO92M1H103K	ML	0.01		C104,107-109	4					
C90-0820-05	E	470	16V	C50,67	2					
C90-0860-05	E	10	25V	C3	1					
C90-0861-05	E	22	16V	C27,30	2					
C91-0131-05	C	0.01	(SP)	C5,22,36,43,44, 46,51,52,54,56, 58,63,65,66,101, 110	16					
E23-0046-04		Square terminal			4					
E31-2166-05	N	Connector with cable		1RA	1					
E31-2167-05	N	Cable with terminal		14D	1					
E31-2170-05		Jumper wire			10					
E40-0273-05	Δ	Mini connector 2P			3					
		K,M1,M2,X								
E40-0273-05	Δ	Mini connector 2P		T,W	1					
E40-0373-05	NΔ	Mini connector 3P			1					
		K,M1,M2,X								
E40-0373-05	NΔ	Mini connector 3P		T,W	3					
E40-0473-05	NΔ	Mini connector 4P			3					
E40-0573-05	NΔ	Mini connector 5P			2					
E40-0673-05	NΔ	Mini connector 6P			1					
E40-0873-05	NΔ	Mini connector 8P			1					
F20-0014-05		Shoulder washer		O2	1					
F20-0516-05		Insulating sheet		O2	1					
L15-0016-05		Choke transf.		T1	1					
L33-0025-05		Choke coil		1.3μH	1					
L34-0438-05		Choke coil		0.94μH	1					
CC45CH1H020C	C	2P	C20	1						
CC45CH1H060D	C	6P	C15	1						
CC45CH2H0R5C	C	0.5P 500V	C11	1						
CC45CH2H050C	C	5P 500V	C14	1						
CC45CH2H060D	C	6P 500V	C13	1						
CC45CH2H100D	C	10P 500V	C12	1						
CC45SL1H101J	C	100P	C18,19	2						
CC45SL2H020C	C	2P 500V	C23-25	3						
CC45SL2H030C	C	3P 500V	C8,9	2						
CK45B1H102K	C	0.001	C1,6	2						
C90-0861-05	E	22 16V	C2,4	2						
CK73EF1H102Z		Chip cap. 0.001	C3,5,17,21	4						
CC73ESL1H101J	N	Chip cap. 100P	C16,22	2						
CM73F2H040C		Chip cap. 4P 500V	C7	1						
CM73F2H050C		Chip cap. 5P 500V	C10	1						
E31-2087-05	NΔ	Cable with terminal (B)	43D	1						
E31-2090-05	NΔ	Cable with terminal (A)	4RA	1						
J31-0503-05	NΔ	Beads		8						
L34-0904-05		Coil 3φ9.5T	L1	1						
L34-1061-05	N	Coil 3φ2T	L2	1						
L34-1039-05		Coil 4φ1.5T	L5	1						
L34-1064-05	N	Coil 3φ2T	L7	1						
L34-1072-05	N	Coil 3.5φ2T	L3	1						
L34-1073-05	N	Coil 3.5φ11/4T	L6	1						
L34-1080-05	N	Coil 3φ3T	L4	1						
L40-1092-14		Ferri-inductor 1μH	L8	1						
R12-0422-05		Trim. pot. 100Ω (B)	VR2	1						
R12-5409-05		Trim. pot. 100kΩ (B)	VR1	1						

PARTS LIST

Part No.	Remarks	Description	Ref. No.	Q'ty	Part No.	Remarks	Description	Ref. No.	Q'ty	
L34-0951-05		Coil 4φ2.5T	L1	1	CK45B1H102K		C 0.001	C3,6,8,9,11,26	22	
L34-0953-05		Coil 4φ3.5T	L4,6	2				40,42-44,48,		
L34-1065-05	N	Coil 4φ3.5T	L3	1				56,60,65,67,70,		
L34-1066-05	N	Coil 4φ3.5T	L8	1				71,75,99,102,103,		
L40-1001-14		Ferri-inductor 10μH	L7	1	CO92M1H223K		ML 0.022	112	1	
N30-3004-46		Round screw		2				C92		
N30-3006-46		Round screw		1	CS15E1C2R2M		T 2.2 16V	C90,91	2	
R12-0424-05		Trim. pot. 100Ω(B)2	VR2	1	CS15E1V0R1M		T 0.1 35V	C107	1	
R12-0425-05		Trim. pot. 500Ω(B)2	VR6	1	CS15E1VR22M		T 0.22 35V	C106	1	
R12-1413-05		Trim. pot. 1kΩ(B)2	VR5	1	C91-0131-05		C 0.01 (SP)	C4,5,7,19,23,	19	
R12-1419-05		Trim. pot. 3kΩ(B)3	VR3,4	2				27-29,31,33,73,		
R12-3434-05		Trim. pot. 10kΩ(B)3	VR7,8	2				78,82-85,87,88,		
R12-5410-05		Trim. pot. 100kΩ(B)2	VR1	1				95		
RC05GF2H151J		Solid 150Ω 1/2W	R7	1	C91-0456-05		C 0.047	C46	1	
RS14AB3A010J		MF 1Ω 1W	R19	1	C91-0457-05		C 0.022 (SP)	C94,98,101	3	
RS14AB3A220J		MF 22Ω 1W	R20	1	E31-2168-05	NΔ	Cable with terminal	14L	1	
RS14AB3A5R6J		MF 5.6Ω 1W	R13	1	E31-2169-05	NΔ	Cable with terminal	43L	1	
R92-0150-05		Short jumper		10	E40-0373-05	Δ	Mini connector 3P		1	
					E40-0473-05	Δ	Mini connector 4P		1	
					E40-0673-05	Δ	Mini connector 6P		1	
PLL UNIT (X50-1930-00,-11)										
			-00 : M2, T, W, X -11 : K, M1		L19-0309-05		Wide bandwidth transf.	L8,9	2	
C05-0030-15		Ceramic trimmer 20P	TC1	1	L32-0624-05		OSC coil 144VCO	L4	1	
C05-0031-15		Ceramic trimmer 10P	TC3,5	2	L32-0626-05		OSC coil 430VCO	L15	1	
C05-0062-05		Ceramic trimmer 6P	TC2	1	L34-0904-05		Coil 3φ9.5T	L7	1	
C05-0067-05		Ceramic trimmer 25P	TC4,7,8	3	L34-0908-05		Coil 3φ9.5T	L12,14,16,17	4	
C05-0308-05		Ceramic trimmer 4P	TC6	1	L34-1025-05		Coil 3φ5.5T	L1	1	
CC45CH1H010C	C 1P	M2, T, W, X	C13,22,52,64,111	5	L34-1058-05	N	Coil 3φ2.5T	L13,19	2	
CC45CH1H010C	C 1P	K, M1	C13,22,64,111	4	L34-1059-05	N	Coil 3φ2.5T	L12	1	
CC45CH1H020C	C 2P		C63,113	2	L34-1060-05	N	Coil 3φ3.5T (1/2)	L21	1	
CC45CH1H030C	C 3P	K, M1	C53	1	L34-2155-05	N	Tuning coil	L10,11	2	
CC45CH1H040C	C 4P	M2, T, W, X	C17,21,25,36,53,81	6	L34-2156-05	N	Tuning coil	L24,25	2	
CC45CH1H040C	C 4P	K, M1	C17,21,25,36,81	5	L40-1011-14		Ferri-inductor 100μH	L25-28,32	4	
CC45CH1H050C	C 5P		C69,96	2	L40-1021-12		Ferri-inductor 1mH	L30	1	
CC45CH1H0R5C	C 0.5P	M2, T, W, X	C32,77	2	L40-1092-14		Ferri-inductor 1μH	L5,6,31	3	
CC45CH1H0R5C	C 0.5P	K, M1	C32,52,77	3	L40-4701-14		Ferri-inductor 47μH	L29	1	
CC45CH1H060D	C 6P		C50	1	L40-4782-14		Ferri-inductor 0.47μH	L18,20,22	3	
CC45CH1H070D	C 7P		C16,24,54	3	L40-6891-12		Ferri-inductor 6.8μH	L3	1	
CC45CH1H080D	C 8P		C15,37,38,58	4	L77-0720-05		Crystal 10.24MHz	X1	1	
CC45CH1H150J	C 15P		C18	1	L77-0985-15	N	Crystal 34.9117MHz	X2	1	
CC45CH1H1R5C	C 1.5P		C59	1	L77-0986-15	N	Crystal 32.81125MHz	X3 M2, T, W, X	1	
CC45CH1H220J	C 22P		C51	1	L77-0994-05	N	Crystal 33.6446MHz	X3 K, M1	1	
CC45CH1H270J	C 27P		C14,35,68,100	4	L79-0493-05	N	Helical block M2, T, W, X	L23		
CC45CH1H330J	C 33P		C1,2,34,79,80	5	L79-0622-05	N	Helical block K, M1	L23		
CC45CH1H470J	C 47P		C76	1	TONE UNIT (X52-1250-50,-61) -50 : T -61 : W					
CC45SL1H101J	C 100P		C39,41,45,47,57	10	C90-0478-05		E 10 16V T	C6	1	
CC45SL1H220J	C 22P		61,62,66,72,74	3	C90-0480-05		E 47 10V	C1	1	
CC45SL1H680J	C 68P		C108-110	2	C91-0433-05		Laminated cap. 0.0039	C5	1	
CC45TH1H560J	C 56P		C104,105	2	C91-0473-05		ML 0.033	C4	1	
CE04W1A101M	E 100	10V	C10	1	C91-0484-05		ML 0.01	C2,3	2	
CE04W1A221M	E 220	10V	C20	1	E40-3010-05		Mini connector 5P		1	
CE04W1A470M	E 47	10V	C55	1	R12-3521-05		Trim. pot. 20kΩ	VR1	1	
CE04W1C100M	E 10	16V	C12,49,89,93	4	RN14BK2B9102F		MF 91kΩ 1/8W	R3	1	
CE04W1H4R7M	E 4.7	50V	C30,86	2	R92-0150-05		Short jumper W		1	
			C97	1						

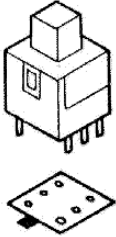
TW-4000A PC BOARD VIEWS

TONE UNIT (X52-1250-XX)
-50 : T -61 : W Component side view

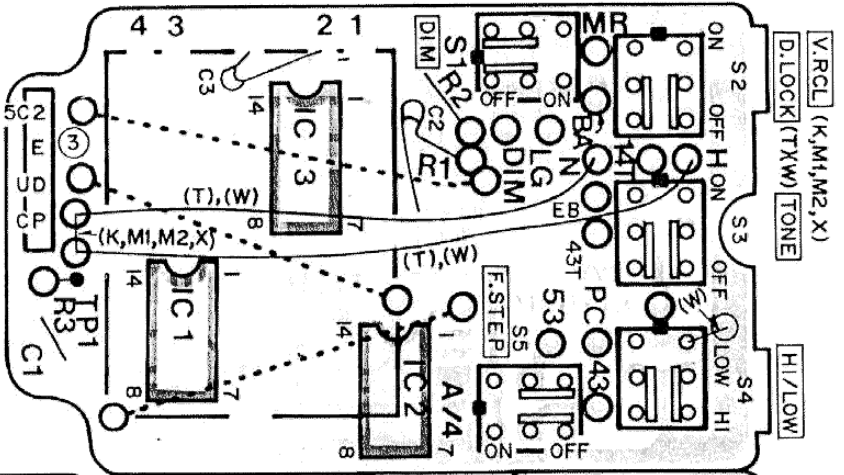


IC1 : NE555P D1 : XZ-055

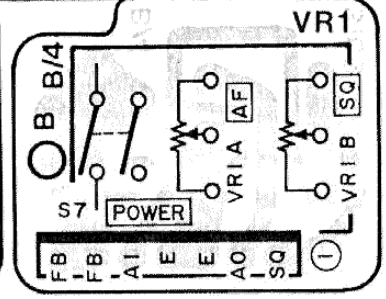
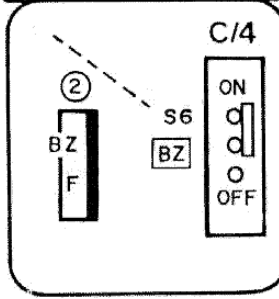
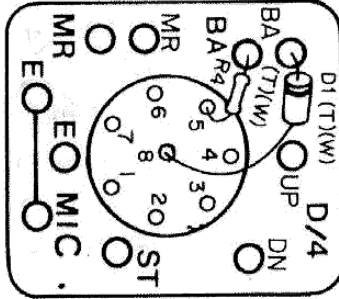
< Attachment direction of S1-5 >



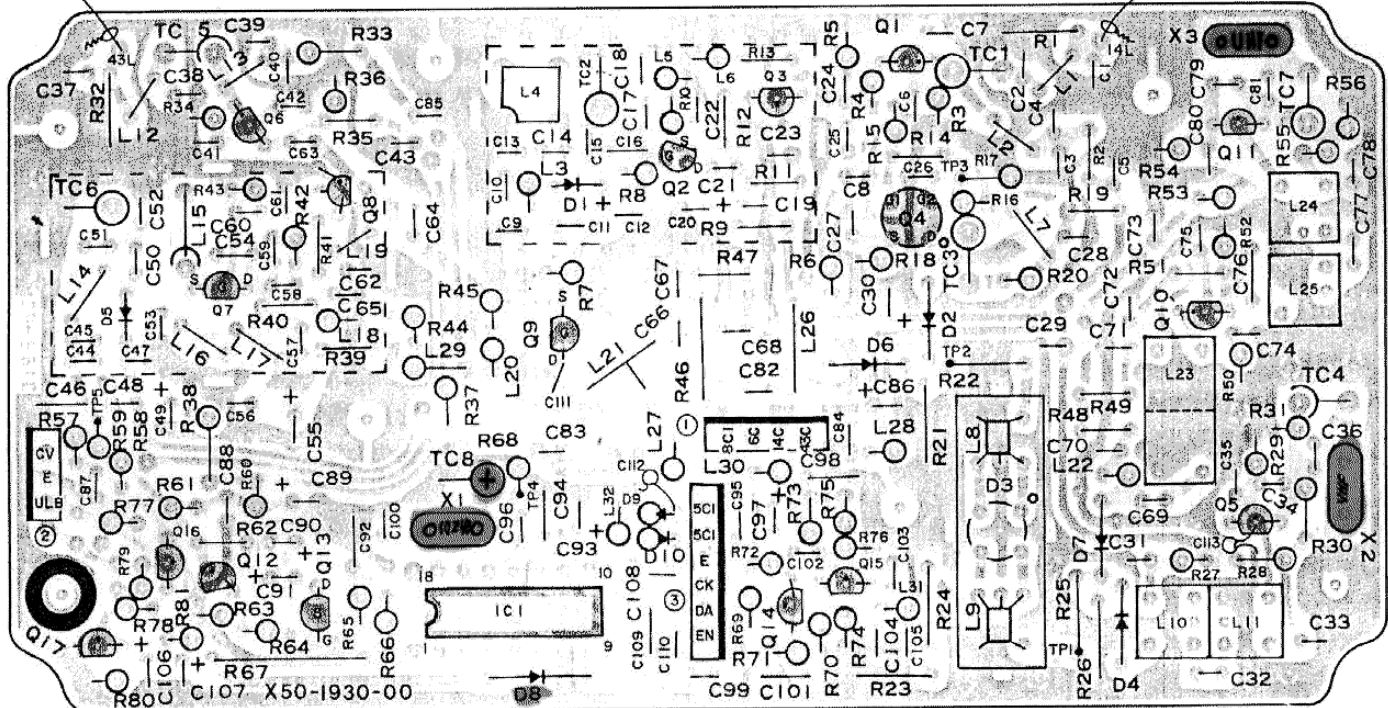
SWITCH UNIT (X41-1490-XX) -11 : K,M1,M2,X -51 : T -61 : W Component side view



IC1,2 : TC4013BF IC3 : TC4030BF



PLL UNIT (X50-1930-XX) -00 : M2,T,W,X -11 : K,M1 Component side view



Q1,6 : 2SC2026 Q2 : 2SK192A(GR)*N Q3,5,11 : 2SC1923(O) Q4 : 3SK114(Y) Q7,9 : 2SK125 Q8,10 : 2SC2671(H)
Q12 : 2SC2240(GR) Q13 : 2SK30A(O) Q14,15 : 2SC460(B) Q16,17 : 2SC2458(Y) or 2SC2603(E)
IC1 : MC145155P* K D1,5 : 1SV50 D2,4,6,7 : MA856 D3 : ND487C1-3R D8 : 1N60 D9,10 : 1S1555

2SC1775
2SC1923
2SC2240

2SC2026
2SC2407
2SC2671

2SC2538

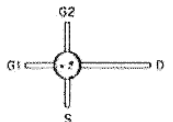
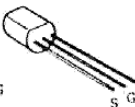
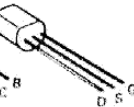
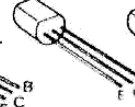
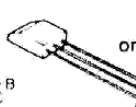
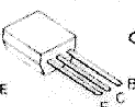
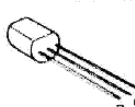
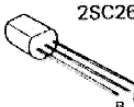
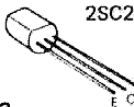
2SC2458
2SC2603

2SC460

2SK192A

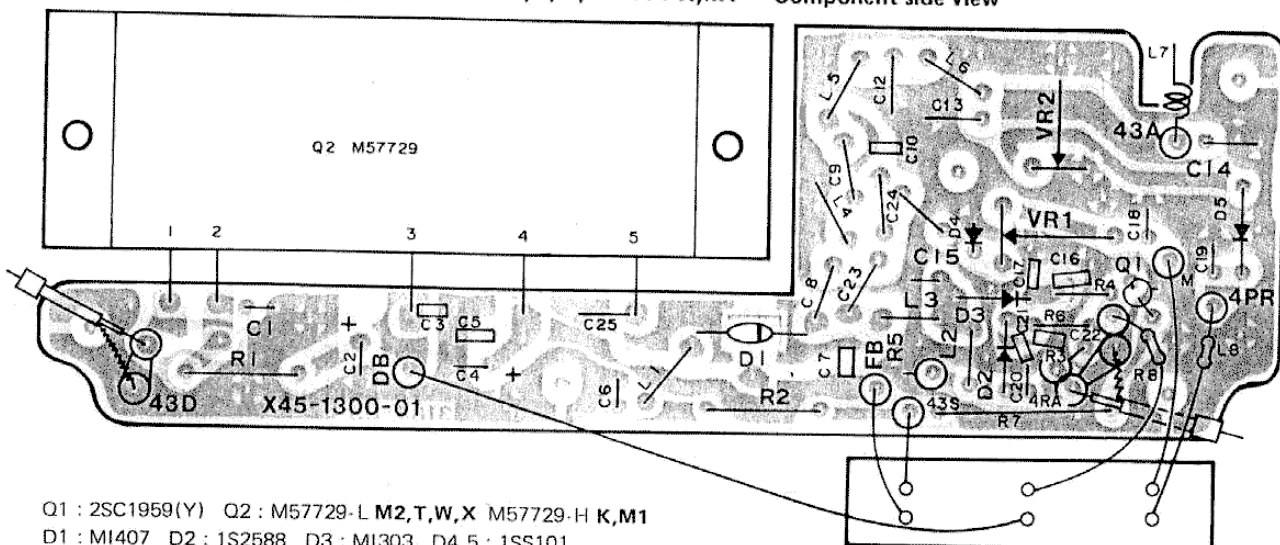
2SK30A
2SK125

3SK74
3SK97
3SK114

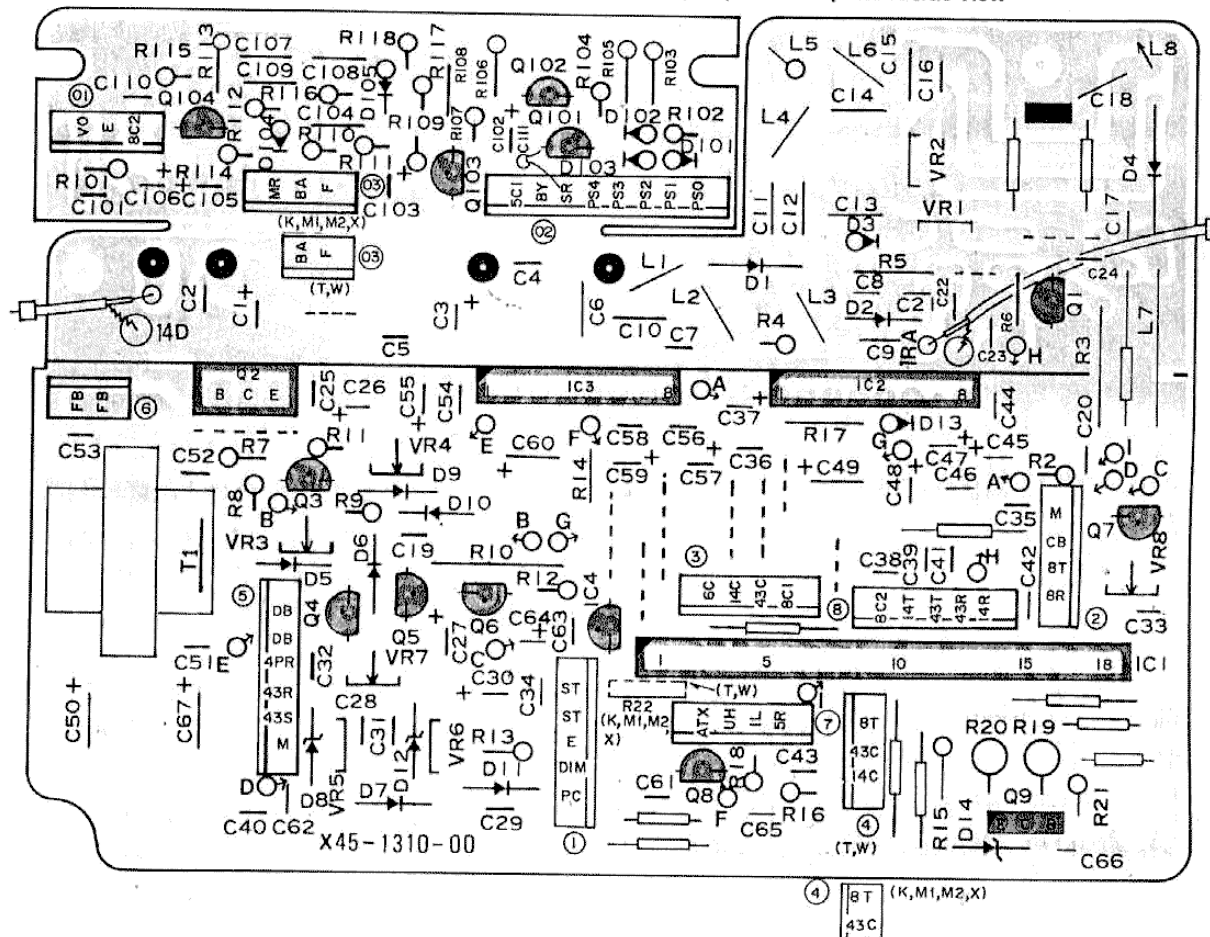


TW-4000A PC BOARD VIEWS

430 FINAL UNIT (X45-1300-XX) -01 : M2,T,W,X -11 : K,M1 **Component side view**

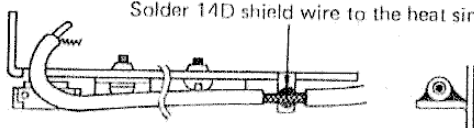


144 FINAL AVR UNIT (X45-1310-XX) -01 : T,W -11 : K,M1,M2,X **Component side view**



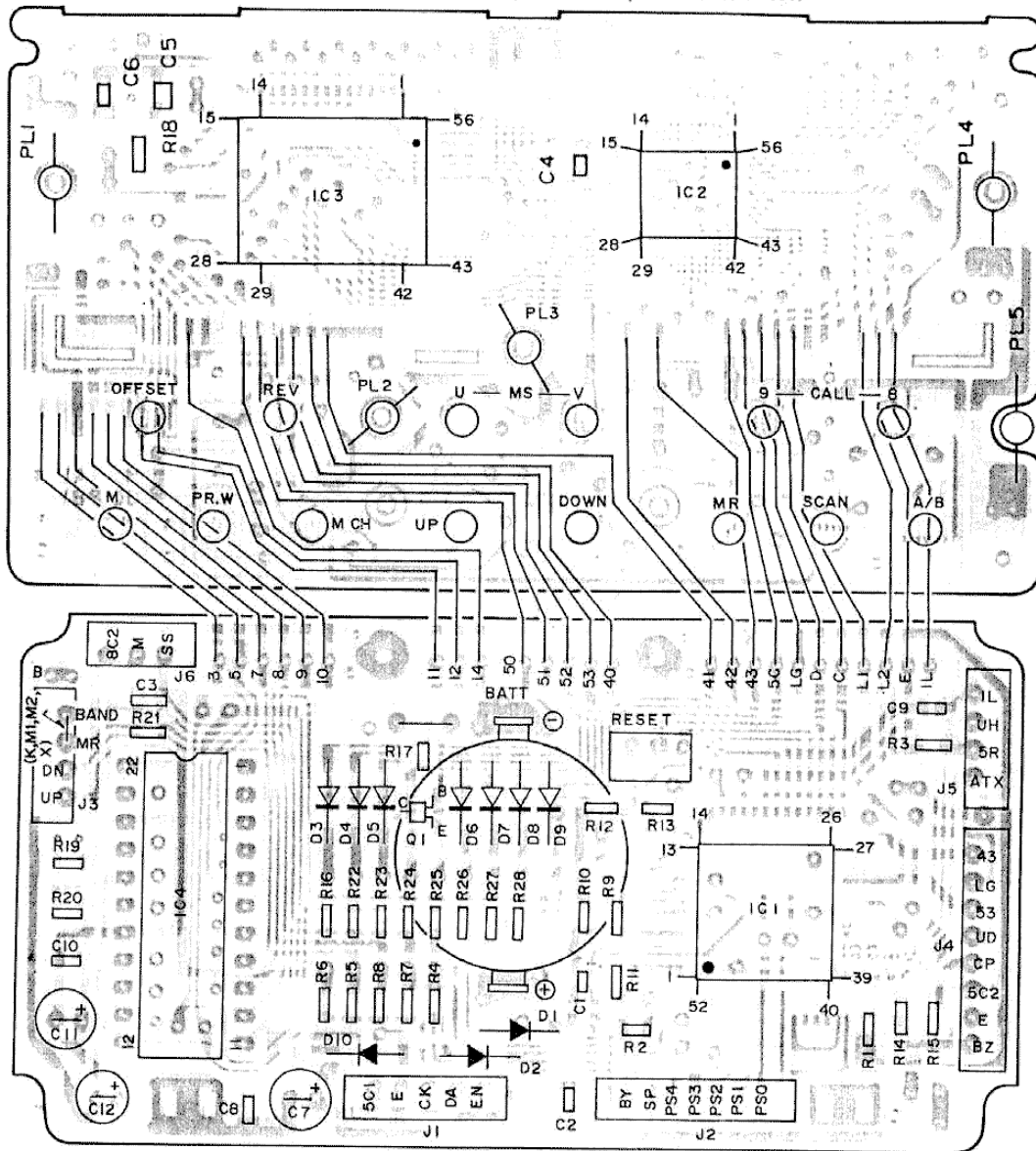
Top View

Solder 14D shield wire to the heat sink.



PC BOARD VIEWS TW-4000A

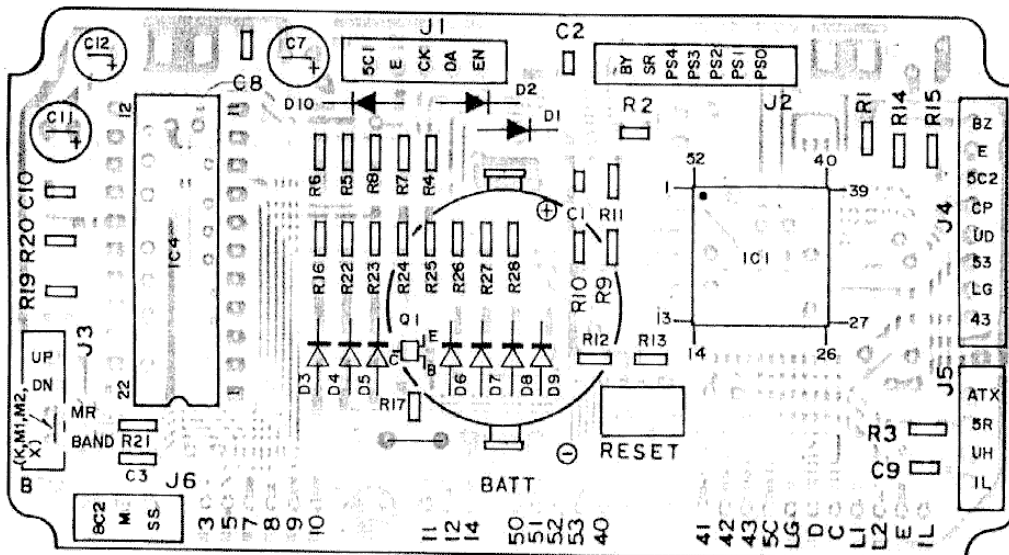
CONTROL ASS'Y (W02-03XX-05) 0336 : K,M1 0337 : M2 0338 : T 0339 : W 0340 : X
 DISPLAY UNIT (W02-034X-05) 0341 : K,M1,M2,T 0342 : W,X Foil side view



- 2SA1015
 - 2SC1815
 - 2SC1959
 - 2SA1012
 - 2SC496
 - 2SC2406TS
 - NJM78L06A
-

CONTROL UNIT (W02-034X-05) 0343 : K,M1 0344 : M2 0345 : T 0346 : W 0347 : X Foil side view

CONTROL UNIT (W02-034X-05) 0343 : K,M1 0344 : M2 0345 : T 0346 : W 0347 : X Component side view



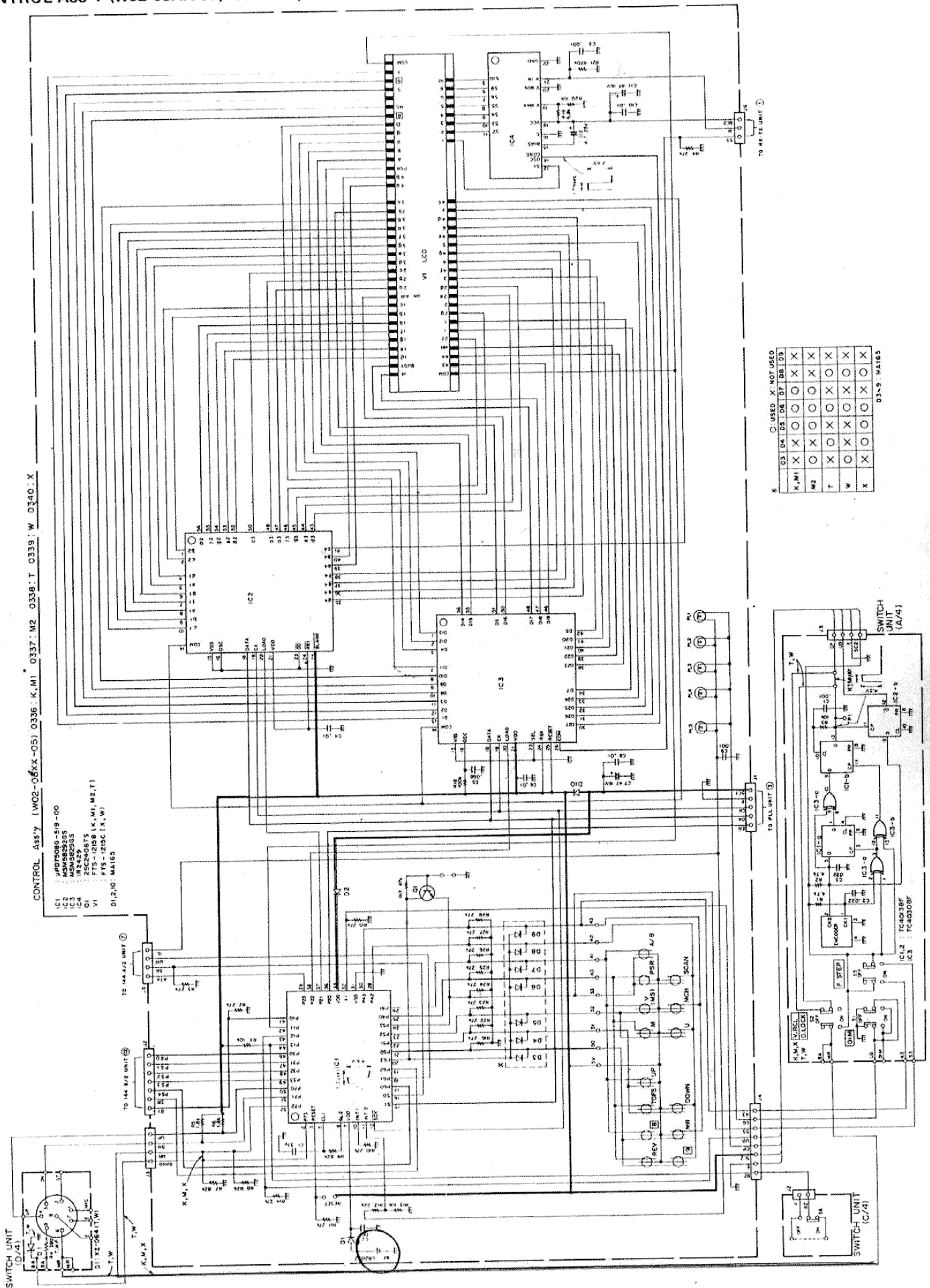
O : USED X : NOT USED

	D3	D4	D5	D6	D7	D8	D9
K, M1	X	X	O	O	O	X	X
M2	O	X	O	O	O	X	X
T	X	O	X	O	X	O	X
W	O	X	X	O	X	O	X
X	X	O	O	O	X	O	X

D3-9 : MA165

Q1 : 2SC2406TS IC1 : μ PD7508G-519-00 IC2 : MSM58292GS IC3 : MSM5829GS IC4 : 1R2429
 V1 : FTS-1215B K,M1,M2,T FTS-1215C W,X D1-10 : MA165

CONTROL ASS'Y (W02-03XX-05) 0336 : K,M1 0337 : M2 0338 : T 0339 : W 0340 : X



CONTROL ASS'Y (W02-03XX-05) 0336 : K,M1 0337 : M2 0338 : T 0339 : W 0340 : X

IC1 : µPD596G-519-00
 IC2 : M5M48255
 IC3 : 75C01
 IC4 : 75C02
 IC5 : 75C03

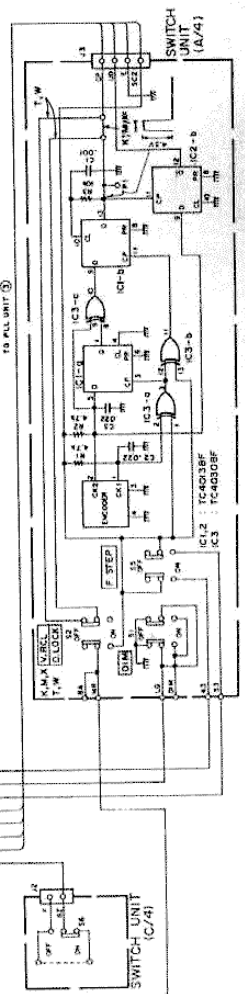
VI : FTS-215C (X,M)

D1,2,10 : MA165

Legend: O USED X NOT USED

	03	04	05	06	07	08	09
K	X	X	X	X	X	X	X
M1	X	X	X	X	X	X	X
M2	X	X	X	X	X	X	X
T	X	X	X	X	X	X	X
W	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X

0336-0339

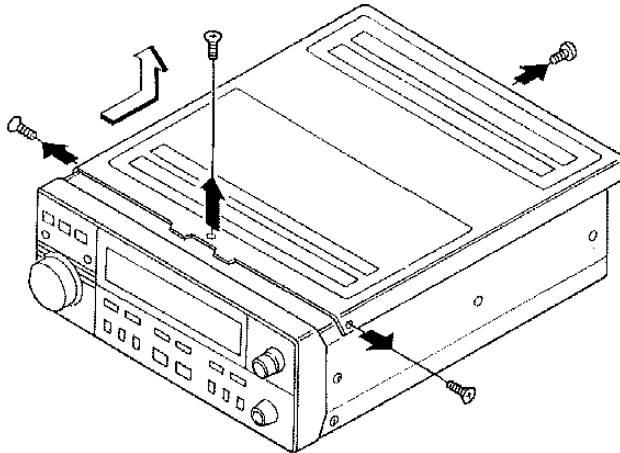


DISASSEMBLY

REMOVING COVERS

Removing top cover

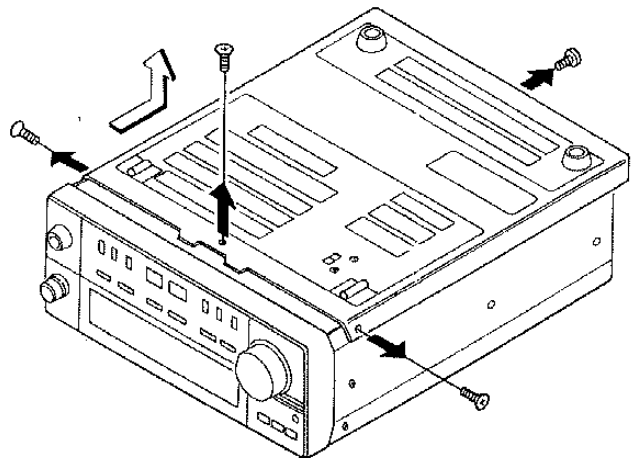
Remove the 4 screws, slide, and lift up.



Note : Before removing the top cover, always remember to disconnect DC cord from the AC outlet.

Removing bottom cover

Remove the 4 screws, slide, and lift up.

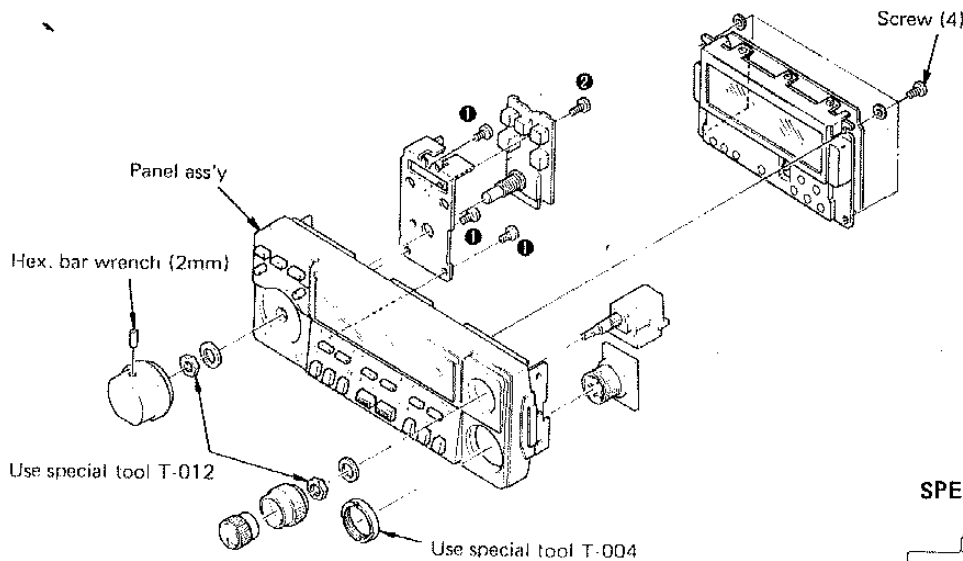


Note : Before removing the bottom cover, always remember to disconnect the DC cord from the AC outlet. When removing the covers, be sure to pull out the speaker connector (2P) and voice ON/OFF switch connector with pointed pliers or similar.

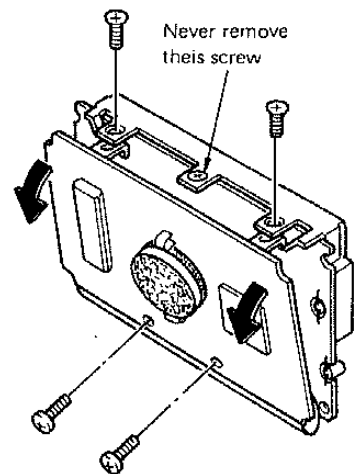
REMOVING SWITCH UNIT AND CONTROL ASS'Y

Removing Switch unit A

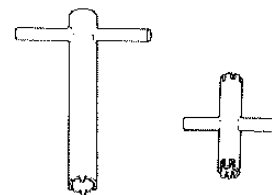
- ① Remove the 3 screws fixing the panel ass'y to the sub frame.
- ② Remove the screw fixing the sub frame to the PCB.



Replace pilot lamp on Control ass'y



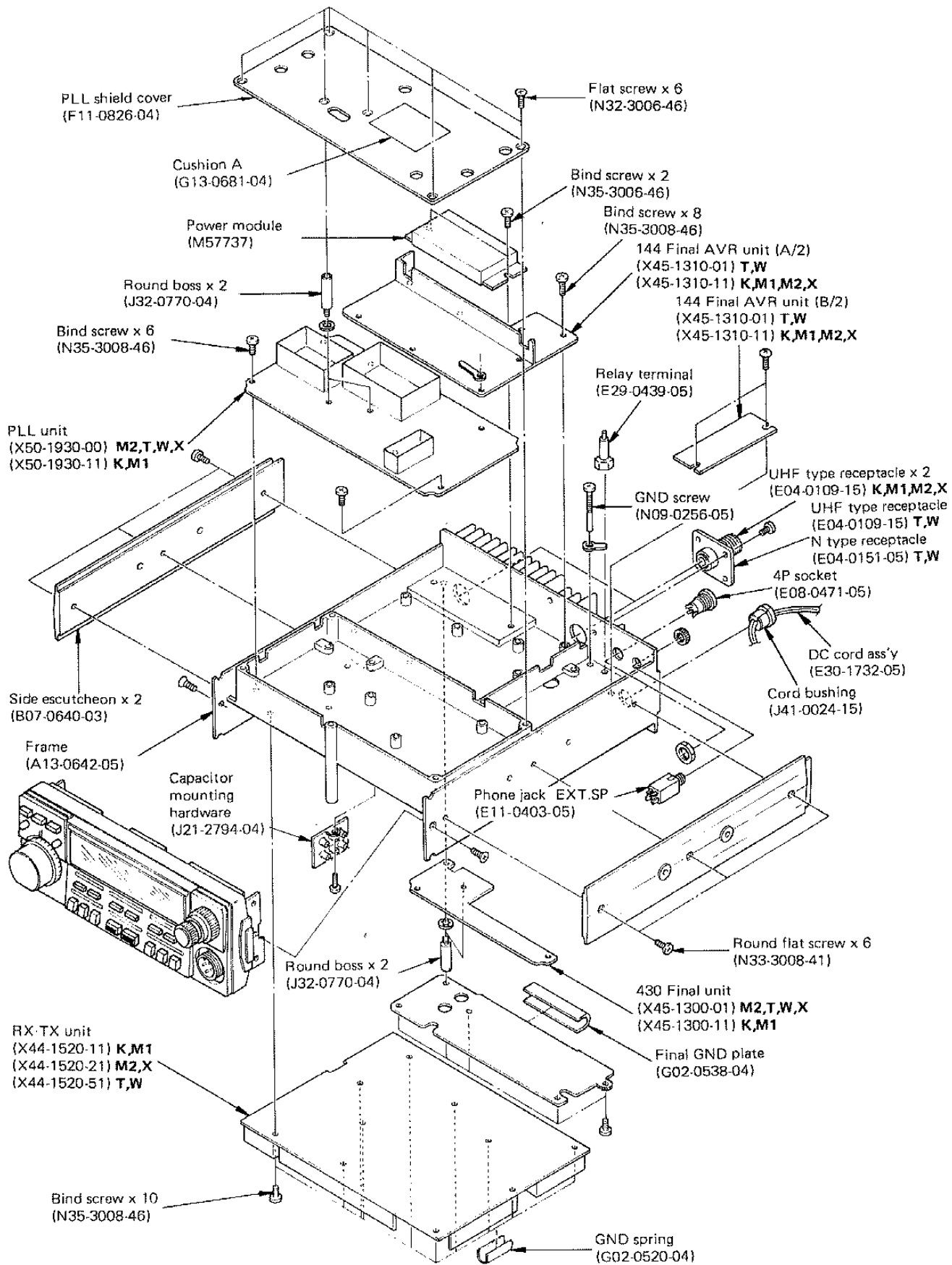
SPECIAL TOOL



T-004
grooved nut wrench

T-012
Hex. nut wrench

DISASSEMBLY



ADJUSTMENT

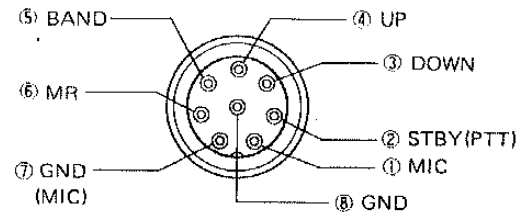
<Preparation>

Unless otherwise specified, set the controls as follows

POWER SW	ON
VOL	MIN
SQL VOL	MIN
D.LOCK SW	OFF
TONE SW	OFF
HI/LOW SW	OFF
DIM SW	OFF

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



MIC terminals (view from front panel side)

TX-RX ADJUSTMENT (COMMON)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reset	1) RESET terminal : Shorted				CONT	RESET terminal	Shorted.	Frequency -145.000(T,W,X) -146.000(K,M1,2) VFO - M.CH - OFFSET - BUSY - BUSY
2. Voltage check	1) POWER SW : ON	DVM	144 FINAL AVR	3-6C				6V±0.2V
				3-8C1				8.2V±0.3V
				8-8C2				8.2V±0.3V
				2-8R				8.2V±0.3V
				7-5R				4.4V±0.2V
				2-8T				0V
	2) Transmit.			2-8T				8.2V±0.3V
	3) Receive.			2-8R				0V
3. Control voltage check	1) DIM SW : ON	DVM	144 FINAL AVR	1-DIM				1.5±0.2V Must be dimmed.
	2) DIM SW : OFF			3-14C				8.2V±0.3V
				3-43C				0V
				8-14R				8.1V±0.3V
				8-43R				0V
				8-43T				0V
				8-14T				0V
				5-43S				2.7V±0.3V
				D1 cathode				2.5V±0.3V
	3) Transmit.			8-14R				0V
				8-43R				0V
				8-43T				0V
				8-14T				8.1V±0.3V
				5-43S				2.5V±0.3V
				4) Frequency : 433.000 (M2, T,W,X) 443.000 (K,M1)	8-14R			
8-43R						0V		
8-43T					8.1V±0.3V			
8-14T					0V			
				5-43S				7.5V±0.3V

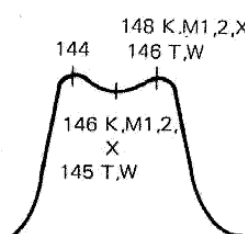
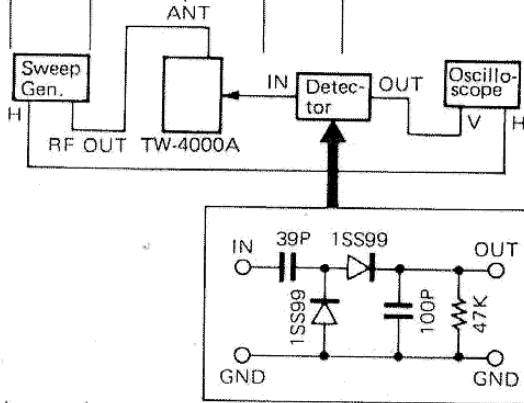
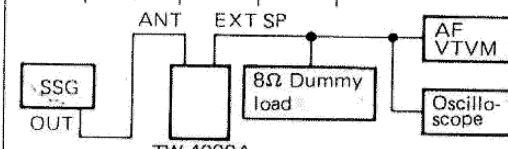
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
	5) Receive	DVM	144 FINAL AVR	3-14C				0V
				3-43C				8.2V±0.3V
				8-14R				0V
				8-43R				8.1V±0.3V
				8-43T				0V
				8-14T				0V
				5-43S				0V
				D1 cathode				0.8V±0.3V
4. PLL adjustment	1) Connect coax. cable 43L & 14L.	f.counter	PLL	TP4 (R68)	PLL	TC8	10.24000MHz	±10Hz
	2) OSC level Frequency : 145.000 T,W,X : 433.000 M2,T,W,X : 443.000 K,M1	RF VTVM		TP1 (R25)		L10, 11	MAX Repeat 2 or 3 times.	(0.21V) (rms) Reference level
						L23, 24,25	MAX Repeat 2 or 3 times.	(0.16V)
	3) Frequency : 145.000 T,W,X : 146.000 K,M1,2 : 435.000 M2,T,W,X : 445.000 K,M1	DVM		TP2 (D6 cathode)		TC3	MAX	(0.3V)
	4) Lock voltage : 2m band Frequency : 144.000 T,W,X : 142.000 K,M1,2 : 145.975 T,W : 147.995 X : 148.995 K,M1,2	DVM		TP5 (R59)		TC2	5.0V	±0.1V
							6.0V	±0.1V
							3.9V	±0.2V
							2.8V	±0.3V
							2.2V	±0.3V
	5) Lock voltage : 70cm band Frequency : 439.975 M2,T,W,X : 449.975 K,M1 : 430.000 M2,T,W,X : 440.000 K,M1	f.counter		TP2		TC6	1.2V	±0.1V
								6.8V or less
6) Frequency adjustment Frequency : 145.000 T,W,X : 146.000 K,M1,2 : 435.000 M2,T,W,X : 445.000 K,M1	f.counter	TP2	TC4	114.1350MHz	±100Hz			
				115.1350MHz	±100Hz			
				404.1350MHz	±100Hz			
				414.1350MHz	±100Hz			
7) UN LOCK voltage (Disconnect TP3 to GND after check).	DVM		ULB ter- minal	Check	5V-5.5V			
				TP3	Shorted to GND.	0.1V or less		
8) PLL OUT level Transmit Frequency : 145.000 T,W : 146.000 K,M1,2,X : 435.000 M2,T,W,X	RF VTVM	14L	TC1	MAX	(0.8V)			
				43L	TC5	MAX	(0.9V)	

RX ADJUSTMENT (2m band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. 2nd OSC	1) Transmit.	RF VTVM	RX-TX	D6 Anode	RX-TX	L28, 29	MAX Repeat 2 or 3 times.	(0.7V)
	2) Receive.	f.counter		D7 Cathode		L27	31320.00kHz	±100Hz

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
2. HET level	1) Frequency : 145.000 T,W,X : 146.000 K,M1,2	RF VTVM	RX-TX	TP4 (R31)	RX-TX	TC3	MAX	(1.2V)
3. RX 144 Helical	1) Disconnect the 14L coax. cable to RX-TX unit. 2) Connect sweep generator to 144 ANT and connect detector to TP3.	Sweep G. Oscilloscope	RX-TX	TP3	RX-TX	L3,4 HB(C)	Adjust L3,4, HB(C) for the response shown.	
								
4. Sensitivity	Connect the 14L coax. cable to RX-TX unit. 1) Frequency : 145.050 SSG output : 60dB (1kHz MOD, 5kHz DEV)	AF VTVM		EXT.SP	RX-TX	L32	AF output maximum.	
								
	2) SSG output : 5dB	DC VTVM	RX-TX	1-M		L6,7,9 TC3	MAX Adjust L6,7,9 (Repeat 2 or 3 times).	
	3) SSG output : -9dBμ (0.36μV).	AF VTVM		EXT.SP				S/N 21dB or more.
5. S meter	1) SSG output : 22dBμ (1kHz MOD, 5kHz DEV) Frequency : 145.050 T,W : 146.050 K,M1,2,X		Display	S meter	RX-TX	VR1	Adjust for 10 LED segments ON.	
	2) SSG output : 0dBμ						Check	S-1 LED segment on.
6. Sensitivity check	1) SSG output : -9dBμ : 144.000 T,W : 145.950 T,W : 144.000 K,M1,2,X : 147.950 K,M1,2,X	AF VTVM		EXT.SP			Check	S/N 20dB or more.
	2) SSG output : 4dBμ : 142.000 K,M1,2 : 148.995 K,M1,2						Check	S/N 20dB or more.

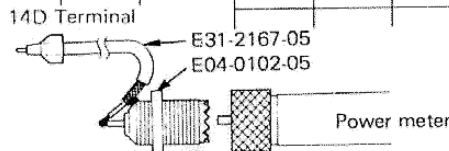
ADJUSTMENT

RX ADJUSTMENT (70cm band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. RX 430 Helical	1) Frequency : 445.000 K,M1 : 435.000 M2,T,W,X 1) Disconnect the 43L coax. cable. 2) Connect sweep generator to ANT. 3) Connect detector to TP1 terminal on RX-TX unit.	Sweep G. Oscilloscope		TP1		HB(A) TC1 HB(B)	Adjust for best gain with correct filter shape response.	
	2) Frequency : 445.000 K,M1 : 435.000 M2,T,W,X SSG output : 5dBμ (1kHz MOD, 5kHz DEV)	RF VTVM	RX-TX	TP2 (R11)	RX-TX	TC2	MAX	
	3)	AF VTVM		EXT.SP			MAX	
	4) Frequency : 435.000 M2,T,W,X : 445.000 K,M1 SSG output : 0dBμ						Check	S-1 LED segment on.
2. S/N check	1) SSG output : -9dBμ Frequency : 430.000 : 439.050 } M2,T,W,X : 440.000 } K,M1 : 449.050 }						Check	20dB or more
3. Internal spurious beat	1) Frequency : 432.315 M2,T,W							NQ 6dB or less

TX ADJUSTMENT (2m band)

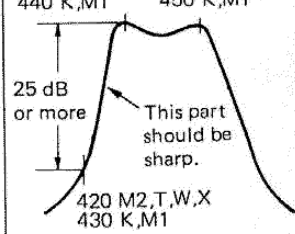
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Drive output	1) Remove 14D coax. cable on RX-TX unit. 2) Connect to 14D coax. cable to 0.6W power meter. Frequency : 145.000 T,W Transmit : 146.000 K,M1,2,X	Power meter (0.6W)	RX-TX	14D	RX-TX	L20-23 TC7,8	MAX Adjust repeat 2 or 3 times.	0.2W/50Ω or more
	3) Check drive output. Frequency : 144.000 or 145.98 T,W : 144.000 K,M1,2,X : 147.975							0.2W or more RF voltmeter may give an inaccurate reading. Use H.P. 432A Power meter or equivalent.
2. 144 output	1) Connect 14D coax. cable. Frequency : 145.000 T,W : 146.000 K,M1,2,X HI/LOW SW : HI Transmit.	Power meter	Rear panel	144 ANT				33W or more
	2) POWER SET				144 FINAL AVR	VR4		30W
		DC A.M	DC cable					6.5A or less



ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
2. 144 output	3) Connect DC voltmeter to TP1.	DVM	144 FINAL AVR	L7	144 FINAL AVR	VR2		Dip point
	4) LOW POWER SET HI/LOW SW : HI	Power meter DC A.M	Rear panel DC cable	144 ANT		VR6		5W 3.4A or less
	5) RF METER HI/LOW SW : HI		CONT	RF METER		VR1	DC : 13.8V RF : 12-13W RF output. Reduce DC for 10W RF output. Adjust VR1 for all LED's on.	All LED's on.
3. Power check	1) Frequency : 144.000 T,W : 145.980 K,M1,2 : 144.000 K,M1,2 : 147.975 X	Power meter	Rear panel	144 ANT				HI 25W or more (LOW) approx. 5W

TX ADJUSTMENT (70cm band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. TX 430 Helical adjustment	1) Frequency : 435.000 M2,T,W,X : 445.000 K,M1 Tracking generator (or sweep) output to TP5 RX-TX unit through directional coupler.	Spect anal. Tracking Gen. Dummy load	RX-TX	43D	RX-TX	TC4 HB(D) HB(E) TC5,6	Adjust for best gain with correct filter shape response.	430 M2,T,W,X 440 K,M1 440 M2,T,W,X 450 K,M1 
2. 430 drive output	1) Connect power meter to 43D coax. cable. Frequency : 435.000 M2,T,W,X : 445.000 K,M1 Transmit.	Power meter (0.6W)	RX-TX	43D	RX-TC RX-TX	TC5,6	Adjust for maximum output with turn less capacitance from peak of TC6	0.25W or more
	2) Check drive output. Frequency : 430.000 or 439.975							0.25W or more
3. 430 output	1) Frequency : 435.000 M2,T,W,X : 445.000 K,M1 HI/LOW SW : HI Transmit.	Power meter	Rear panel	430 ANT				32W or more
	2) POWER SET				144 FINAL AVR	VR3		29W
		DC A.M	DC cable					7.5A or less
	3) Connect DC voltmeter to 4PR terminal.	DVM	430 FINAL	4PR	430 FINAL	VR2		Dip point
	4) LOW POWER SET HI/LOW SW : LOW	Power meter	Rear panel	430 ANT	144 FINAL AVR	VR5		5W
		DC A.M	DC cable					3.6A or less

ADJUSTMENT

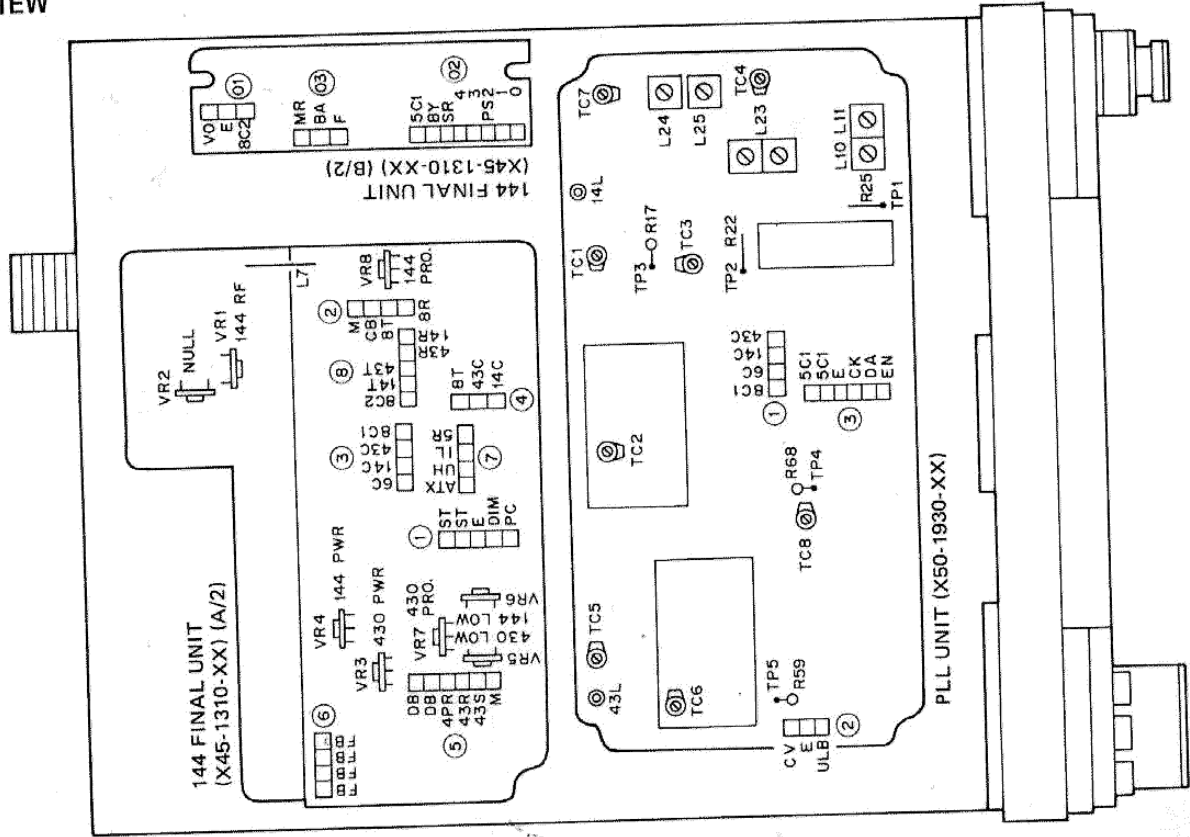
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
	5) RF METER HI/LOW SW : HI		CONT	RF meter	430 FINAL	VR1	DC : 13.8V DC RF : 12-13 W RF output. Reduce DC for 10W RF output. Adjust VR1 for all LED's on.	All LED's on.
4. Output power check	1) Frequency : 430.000, M2,T, : 439.975 W,X : 440.000) K,M1 : 449.975	Power meter	Rear panel	430 ANT				HI 25W or more (LOW) approx. 5W

TX ADJUSTMENT (COMMON)

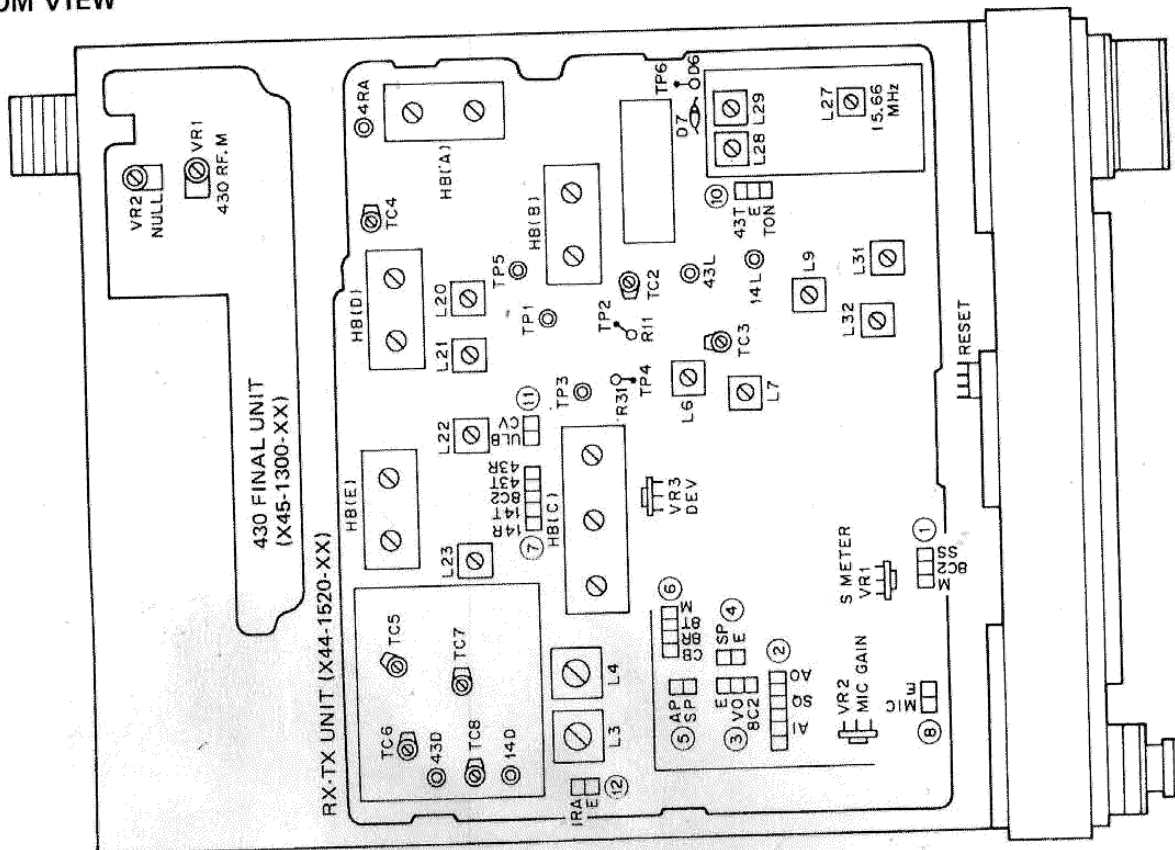
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Protection	1) Frequency : 145.000 or 146.000 HI/LOW SW : HI 144 FINAL AVR VR8 : Full counterclockwise 144 ANT : Shorted Transmit.	DC A.M	DC cable		144 FINAL AVR	VR8		3.2A
	430 FINAL				VR7		3.6A	
2. Modulation	1) Frequency : 145.000 or 146.000 RX-TX unit VR2 : Center MIC input : AG 1kHz, 25mV T,W 44mV K,M1,2,X	Linear detector	Rear panel	144 ANT	RX-TX	VR3	4.5kHz	±0.1kHz
	VR2					3.5kHz	±0.1kHz	
	2) MIC input 20dB DOWN 2.5mV T,W 4.4mV K,M1,2,X							

ADJUSTMENT

TOP VIEW



BOTTOM VIEW

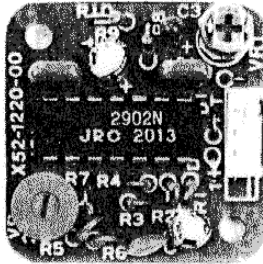


TU-4A/TU-4B/TU-4C (TONE UNIT)

TU-4A SPECIFICATIONS

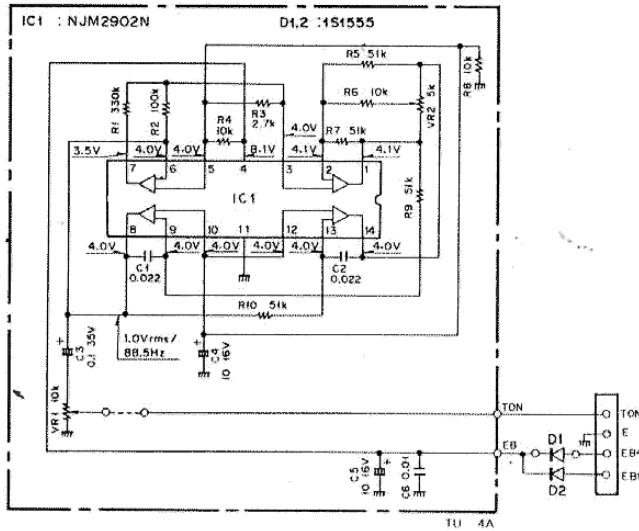
Oscillator frequency 88.5Hz (± 0.2 Hz) at normal temperature
 Frequency adjustment range 60-260Hz

TU-4A OUTSIDE VIEW



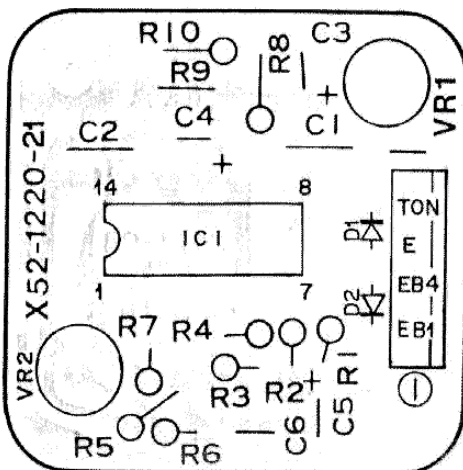
TU-4A SCHEMATIC DIAGRAM

TONE UNIT (X52-1220-21)



TU-4A PC BOARD VIEW

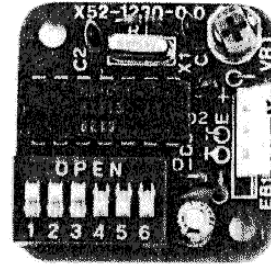
TONE UNIT (X52-1220-21)
Component side view



TU-4B SPECIFICATIONS

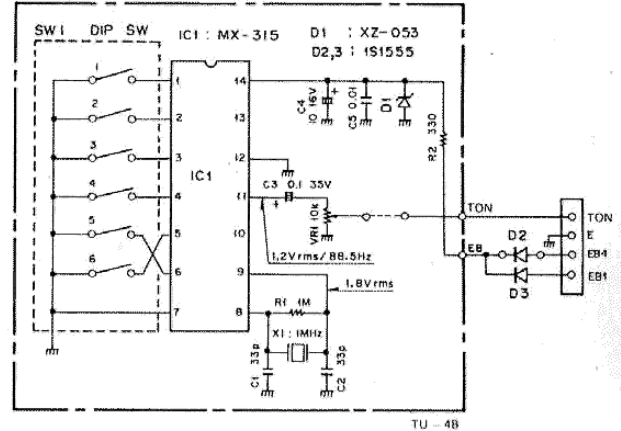
Oscillator frequency 1MHz
 Usable frequency range 37 EIA Specification Group Frequencies

TU-4B OUTSIDE VIEW



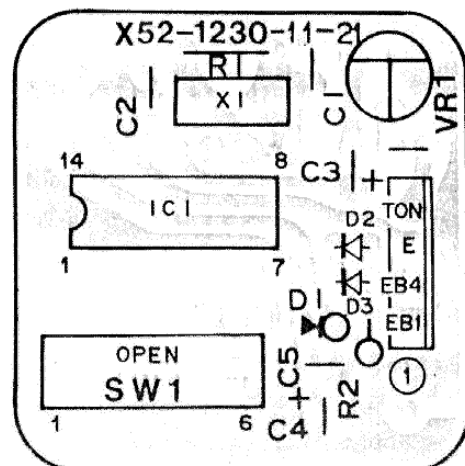
TU-4B SCHEMATIC DIAGRAM

TONE UNIT (X52-1230-11,-21)



TU-4B PC BOARD VIEW

TONE UNIT (X52-1230-11,-21) -11: K -21: M
Component side view



TU-4A/TU-4B/TU-4C (TONE UNIT)

TU-4B PARTS LIST

Part No.	Re- marks	Description	Ref. No.
TU-4B GENERAL			
B40-2649-04	N	Name plate	
B42-1780-04	N	Frequency ID seal	
B50-4036-00	NA	Instruction manual	
H01-4483-03	NA	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
J32-0772-04		Round boss x 2	
N35-2606-46		Bind screw x 2	
X52-1230-11	N	Tone unit	K
X52-1230-21	N	Tone unit	M

TU-4C PARTS LIST

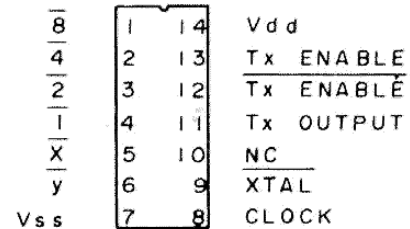
Part No.	Re- marks	Description	Ref. No.
TU-4C GENERAL			
B40-2650-04	N	Name plate	
B42-1780-04		Frequency ID seal	
B50-4036-00	NA	Instruction manual	
H01-4484-03	NA	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
N16-0026-46		Spring washer x 2	
N35-2620-46		Bind screw x 2	
X52-1240-20	N	Tone unit	

Part No.	Re- marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1230-11,-21) -11 : K -21 : M				
CC45CH1H330J		C 33P	C1,2	2
CS15E1V0R1M		T 0.1 35V	C3	1
C90-0840-05		E 10 16V	C4	1
C91-0131-05		C (SP) 0.01	C5	1
E02-0110-05		IC socket 14P	K	1
E40-3009-05	Δ	Mini connector 4P		1
L77-0982-05		Crystal 1MHz	X1	1
R12-3430-05		Trim. pot. 10kΩ (B)	VR1	1
S31-6401-05		DIP switch	S1	1
1S1555		Diode	D2,3	2
XZ-053		Zener diode	D1	1
MX315		IC	M IC1	1

Part No.	Re- marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1240-20)				
CC45CH1H330J		C 33P	C3,4	2
CS15E1V0R1M		T 0.1 35V	C5	1
C90-0840-05		E 10 16V	C6	1
C91-0131-05		C (SP) 0.01	C1,2,7	3
E40-3009-05	Δ	Mini connector 4P		1
J32-0773-04	N	Round boss		2
L77-0982-05		Crystal 1MHz	X1	1
R12-3430-05		Trim. pot. 10kΩ	VR1	1
S31-6401-05		DIP switch	S1,2	2
1S1555		Diode	D1-14	14
XZ-053		Zener diode	D15	1
2SC2458(Y)		TR	Q1,2	2
2SC2603(E)		TR	Q1,2	2
MX315		IC	IC1	1

TU-4B/4C TONE FREQUENCY

#	EIA Specification Group	Hz	Program Lines (ON=1, OFF=0)						#	EIA Specification Group	Hz	Program Lines (ON=1, OFF=0)					
			1	2	3	4	5	6				1	2	3	4	5	6
1	A	67.0	1	1	1	1	1	1	21	A	141.3	1	0	0	0	0	0
2	B	71.9	1	1	1	1	0	1	22	B	146.2	0	1	1	1	0	1
3	C	74.4	1	1	1	0	1	1	23	A	151.4	0	1	1	1	0	1
4	A	77.0	1	1	1	1	0	0	24	B	156.7	0	1	1	0	0	1
5	C	79.7	1	1	0	1	1	1	25	A	162.2	0	1	1	0	0	1
6	B	82.5	1	1	1	0	0	1	26	B	167.9	0	1	0	1	0	1
7	C	85.4	1	1	1	0	0	0	27	A	173.8	0	1	0	1	0	1
8	A	88.5	1	1	1	0	0	0	28	B	179.9	0	1	0	0	0	1
9	C	91.5	1	0	1	1	1	1	29	A	186.2	0	1	0	0	0	1
10	B	94.8	1	1	0	1	0	1	30	B	192.8	0	0	1	1	0	1
11	A	100.0	1	1	0	1	0	0	31	A	203.5	0	0	1	1	0	0
12	B	103.5	1	1	0	0	0	1	32	B	210.7	0	0	1	0	0	1
13	A	107.2	1	1	0	0	0	0	33	A	218.1	0	0	1	0	0	0
14	B	110.9	1	0	1	1	0	1	34	B	225.7	0	0	0	1	0	1
15	A	114.8	1	0	1	1	0	0	35	A	233.6	0	0	0	1	0	0
16	B	118.8	1	0	1	0	0	1	36	B	241.8	0	0	0	0	0	1
17	A	123.0	1	0	1	0	0	0	37	A	250.3	0	0	0	0	0	0
18	B	127.3	1	0	0	1	0	1									
19	A	131.8	1	0	0	1	0	0									
20	B	136.5	1	0	0	0	0	1									



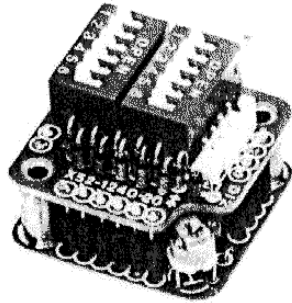
MX315 (TU-4B,C)

TU-4A/TU-4B/TU-4C (TONE UNIT)

TU-4C SPECIFICATIONS

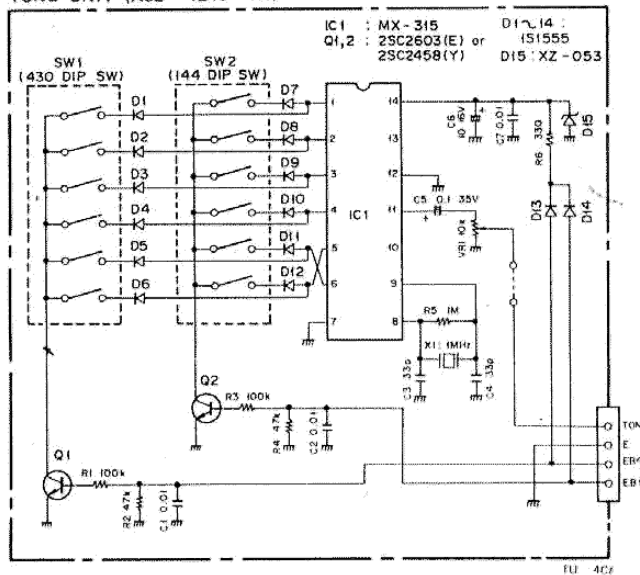
Oscillator frequency 1MHz
 Usable frequency range 37 EIA Specification
 Group Frequencies

TU-4C OUTSIDE VIEW



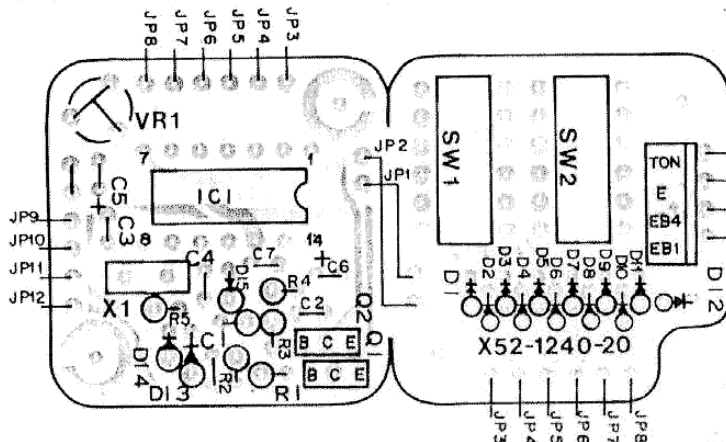
TU-4C SCHEMATIC DIAGRAM

TONE UNIT (X52-1240-20)



TU-4C PC BOARD VIEW

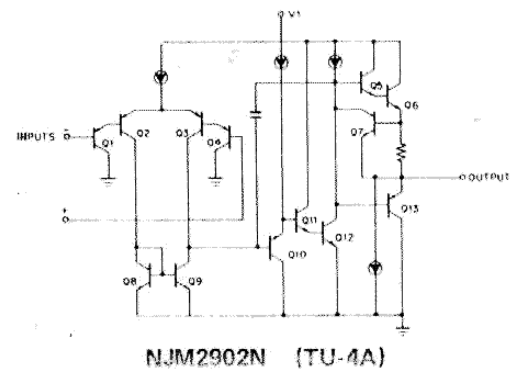
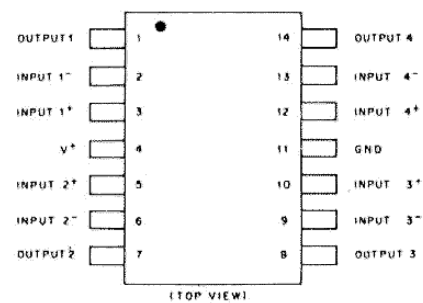
TONE UNIT (X52-1240-20) Component side view



TU-4A PARTS LIST

Part No.	Re-marks	Description	Ref. No.
TU-4A GENERAL			
B40-2648-04	N	Name plate	
B50-4036-00	NΔ	Instruction manual	
H01-4482-03	NΔ	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
J32-0772-04	N	Round boss x 2	
N35-2606-46		Bind screw x 2	
X52-1220-21	N	Tone unit	

Part No.	Re-marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1220-21)				
CS15E1V0R1M		T 0.1 35V	C3	1
C90-0840-05		E 10 16V	C4,5	2
C91-0131-05		C (SP) 0.01	C6	1
C91 1001-05		Laminated cap. 0.022	C1,2	2
E40-3009-05	Δ	Mini connector 4P		1
R12-2412-05		Pot. 5kΩ	VR2	1
R12-3430-05		Trim. pot. 10kΩ(B)	VR1	1
RN14BK2B5102F		MF 51kΩ 1/8W	R5,7,9,10	4
1S1555		Diode	D1,2	2
NJM2902N		IC	IC1	1



TW-4000A

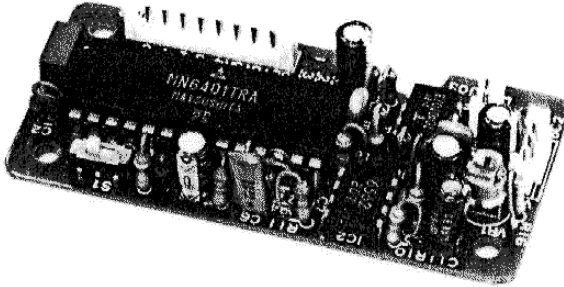
VS-1 (VOICE SYNTHESIZER UNIT)

SPECIFICATIONS

Dimensions: W 70mm
H 15mm
D 35mm

Weight: 20g

OUTSIDE VIEW



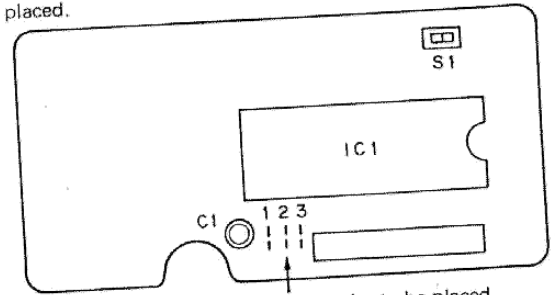
TALK SPEED SELECTION

Speed is factory set at "standard" talk speed. Three different speeds can be selected.

Note: When placing the jumper, solder carefully.

Jumper place	Speed		
	Std. speed	30% more than Std.	60% more than Std.
1	X	X	○
2	X	X	○
3	X	○	X

Symbol ○, denotes the place in which a jumper wire is placed.



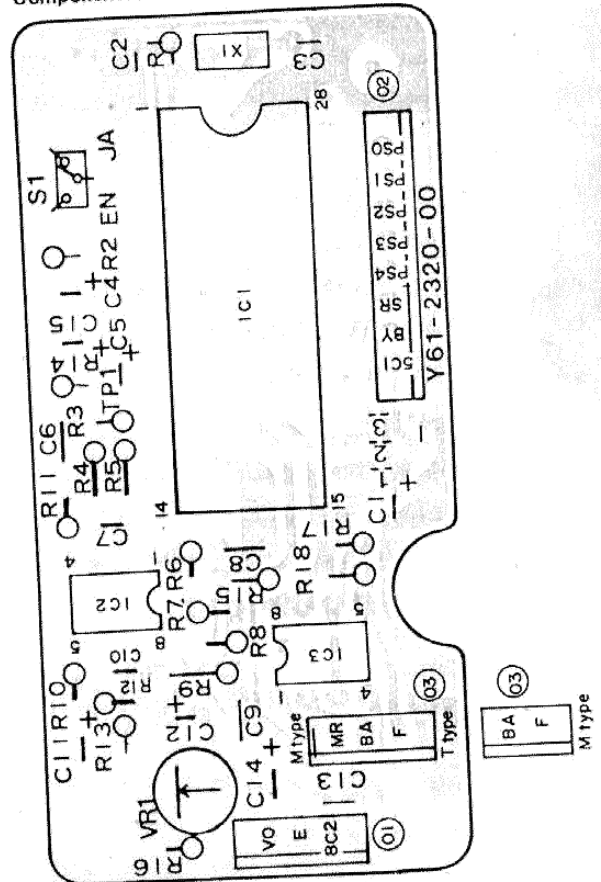
The place which a jumper wire to be placed.

PARTS LIST

Part No.	Re-marks	Description	Ref. No.
B50-4035-00	N	Instruction manual	
CC45SL1H121J	C	120P x 2	C2,3
CE04W1A470M	E	47 10V	C1,14,15
CE04W1C100M	E	10 16V	C11
CE04W1HR22M	E	0.22 50V	C12
CK45B1H221K	C	220P x 2	C7,10
CO92M1H332K	ML	0.0033 x 3	C6,8,9
CS15E1E010M	T	1 25V	C4
CS15E1V0R1M	T	0.1 35V	C5
C91-0131-05	C	0.01 (SP)	C13
E40-0273-05	Δ	Mini connector 2P	M
E40-0373-05	Δ	Mini connector 3P	M
E40-0373-05	Δ	Mini connector x 2 3P	T
E40-0873-05	Δ	Mini connector 8P	
H01-4481-03	NΔ	Packing carton (inside)	M
H01-4501-03	NΔ	Packing carton (inside)	T
H25-0029-04		Protective bag x 2	
L78-0006-05	N	Ceramic OSC	X1
N89-3006-46		Tapping screw x 4	
R12-4408-05		Trim. pot. 50kΩ	VR1
S31-1411-05	N	Slide switch	S1
AN6562	N	IC	IC2
MN6401TRA	N	IC	IC1
TC40107BP	N	IC	IC3

PC BOARD VIEW

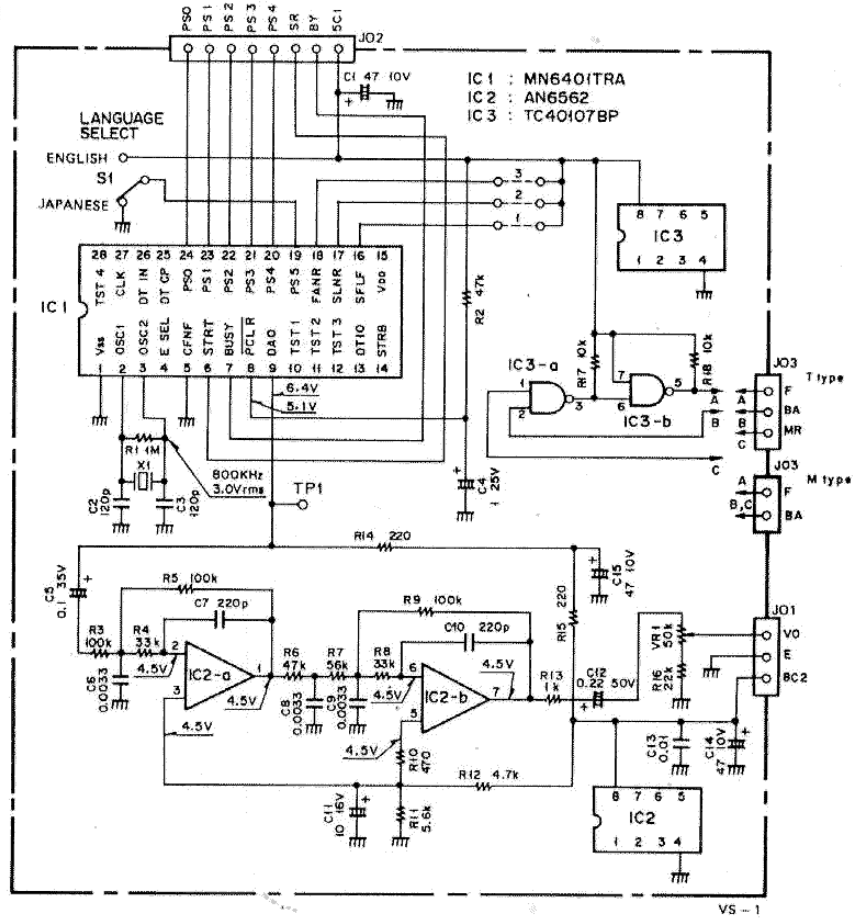
Component side view



J
JI
JI
JI

VS-1/PACKING

SCHEMATIC DIAGRAM



PACKING

★ Protective bag (H25-0103-04)

DC cord (E30-1689-15)

Foot (J02-0416-04)

Protective bag (H25-0029-04)

ANT seal (B42-1786-04)

4P plug (E09-0471-05)

Phone plug (E12-0001-15)

Fuse 8A (F05-8021-05)

Accessory bag (H25-0049-03)

Angle boss x 4 (J32-0771-04)

Round screw x 4 (N09-0008-04)

Tapping screw (A) x 4 (N09-0632-05)

Flange nut x 4 (N14-0510-04)

Flat washer x 4 (N15-1050-46)

Flat washer x 4 (N15-1060-46)

Spring washer x 4 (N16-0060-46)

Round flat screw x 4 (N33-4018-41)

Instruction manual
 (B50-4041-00) M1,M2,X
 (B50-4042-00) T
 (B50-4068-00) W
 (B50-4069-00) K

Warranty card
 (B46-0058-10) K

Cushion
 (H12-1325-03)

Protective bag
 (H25-0106-04)

Cushion
 (H12-1334-04)

Mounting angle ass'y
 (A13-0639-03)

Protective bag (H25-0079-04)

Microphone (T91-0327-15) W

Microphone (T91-0331-05) M1,M2,X

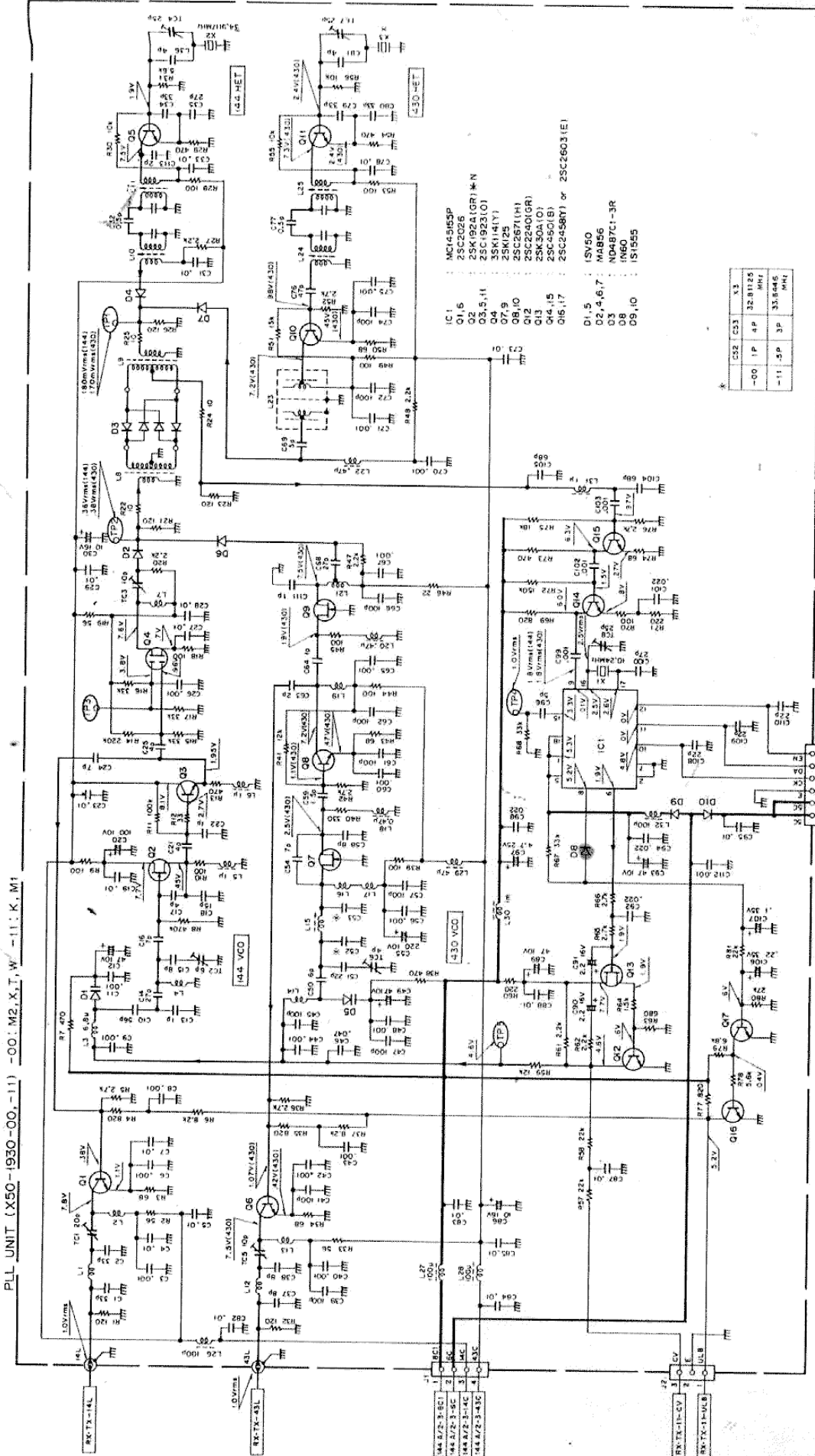
Microphone (T91-0332-05) K

Microphone (T91-0333-05) T

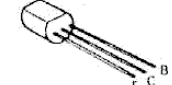
Packing fixture
 (H10-2571-02)

Packing carton (inside)
 (H01-4489-03) K,M1,M2,W,X
 (H01-4490-03) T

Cushion
 (H12-1329-04)



2SA1015 2SC1923
2SC1775 2SC1959
2SC1815 2SC2240



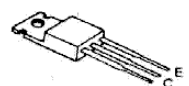
2SC2026
2SC2407
2SC2671



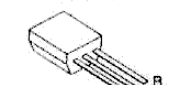
2SC2538



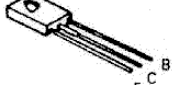
2SA1012



2SC2458
2SC2603



2SC496



2SC460



2SK30A



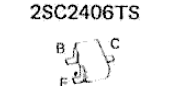
2SK125



2SK192A



2SC2406TS



3SK74



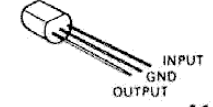
3SK97



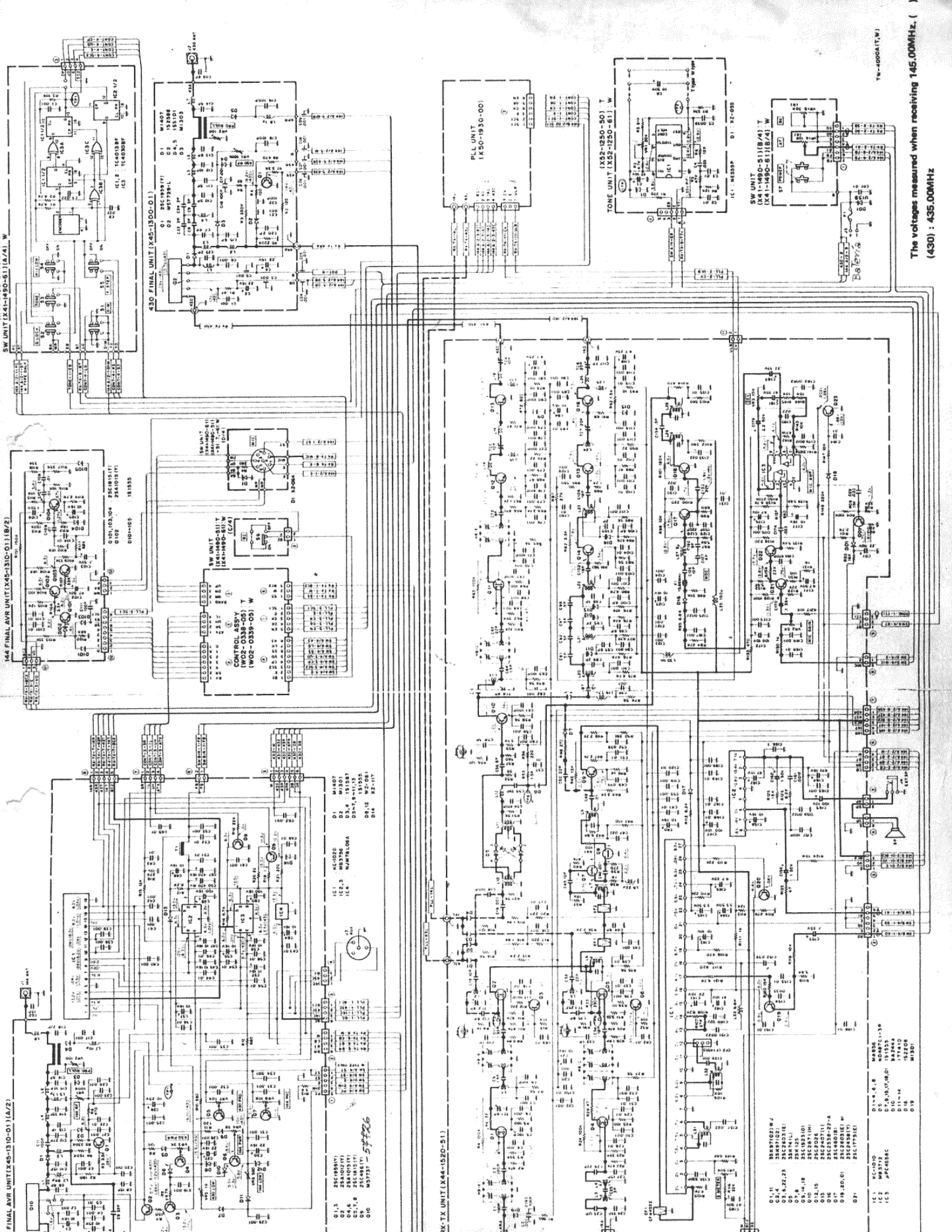
3SK114



NJM78L06A



SCHEMATIC DIAGRAM (T,W)



The voltages measured when receiving 145.00MHz. ()
(430) : 435.00MHz

444 FINAL AVR UNIT (X45-1310-01) (A/2)

444 FINAL AVR UNIT (X45-1310-01) (B/2)

SW UNIT (X41-480-51) (A/A) T

SW UNIT (X41-480-51) (B/A) T

01.3 25C8997Y
04.6 28A031Y
05.7.8 25C028Y
010 M0733T W 54726

IC1 M4020
IC2 M4020
IC3 M4020
IC4 M4020
D1 M4027
D2 M4027
D3 M4027
D4 M4027
D5 M4027
D6 M4027
D7 M4027
D8 M4027
D9 M4027
D10 M4027
D11 M4027
D12 M4027
D13 M4027
D14 M4027
D15 M4027
D16 M4027
D17 M4027
D18 M4027
D19 M4027
D20 M4027
D21 M4027
D22 M4027
D23 M4027
D24 M4027
D25 M4027
D26 M4027
D27 M4027
D28 M4027
D29 M4027
D30 M4027
D31 M4027
D32 M4027
D33 M4027
D34 M4027
D35 M4027
D36 M4027
D37 M4027
D38 M4027
D39 M4027
D40 M4027
D41 M4027
D42 M4027
D43 M4027
D44 M4027
D45 M4027
D46 M4027
D47 M4027
D48 M4027
D49 M4027
D50 M4027
D51 M4027
D52 M4027
D53 M4027
D54 M4027
D55 M4027
D56 M4027
D57 M4027
D58 M4027
D59 M4027
D60 M4027
D61 M4027
D62 M4027
D63 M4027
D64 M4027
D65 M4027
D66 M4027
D67 M4027
D68 M4027
D69 M4027
D70 M4027
D71 M4027
D72 M4027
D73 M4027
D74 M4027
D75 M4027
D76 M4027
D77 M4027
D78 M4027
D79 M4027
D80 M4027
D81 M4027
D82 M4027
D83 M4027
D84 M4027
D85 M4027
D86 M4027
D87 M4027
D88 M4027
D89 M4027
D90 M4027
D91 M4027
D92 M4027
D93 M4027
D94 M4027
D95 M4027
D96 M4027
D97 M4027
D98 M4027
D99 M4027
D100 M4027

01.11 25C8997Y
04.4 28A031Y
05.7.8 25C028Y
010 M0733T W 54726
011 M4027
012 M4027
013 M4027
014 M4027
015 M4027
016 M4027
017 M4027
018 M4027
019 M4027
020 M4027
021 M4027
022 M4027
023 M4027
024 M4027
025 M4027
026 M4027
027 M4027
028 M4027
029 M4027
030 M4027
031 M4027
032 M4027
033 M4027
034 M4027
035 M4027
036 M4027
037 M4027
038 M4027
039 M4027
040 M4027
041 M4027
042 M4027
043 M4027
044 M4027
045 M4027
046 M4027
047 M4027
048 M4027
049 M4027
050 M4027
051 M4027
052 M4027
053 M4027
054 M4027
055 M4027
056 M4027
057 M4027
058 M4027
059 M4027
060 M4027
061 M4027
062 M4027
063 M4027
064 M4027
065 M4027
066 M4027
067 M4027
068 M4027
069 M4027
070 M4027
071 M4027
072 M4027
073 M4027
074 M4027
075 M4027
076 M4027
077 M4027
078 M4027
079 M4027
080 M4027
081 M4027
082 M4027
083 M4027
084 M4027
085 M4027
086 M4027
087 M4027
088 M4027
089 M4027
090 M4027
091 M4027
092 M4027
093 M4027
094 M4027
095 M4027
096 M4027
097 M4027
098 M4027
099 M4027
100 M4027

01.11 M4027
04.4 M4027
05.7.8 M4027
010 M4027
011 M4027
012 M4027
013 M4027
014 M4027
015 M4027
016 M4027
017 M4027
018 M4027
019 M4027
020 M4027
021 M4027
022 M4027
023 M4027
024 M4027
025 M4027
026 M4027
027 M4027
028 M4027
029 M4027
030 M4027
031 M4027
032 M4027
033 M4027
034 M4027
035 M4027
036 M4027
037 M4027
038 M4027
039 M4027
040 M4027
041 M4027
042 M4027
043 M4027
044 M4027
045 M4027
046 M4027
047 M4027
048 M4027
049 M4027
050 M4027
051 M4027
052 M4027
053 M4027
054 M4027
055 M4027
056 M4027
057 M4027
058 M4027
059 M4027
060 M4027
061 M4027
062 M4027
063 M4027
064 M4027
065 M4027
066 M4027
067 M4027
068 M4027
069 M4027
070 M4027
071 M4027
072 M4027
073 M4027
074 M4027
075 M4027
076 M4027
077 M4027
078 M4027
079 M4027
080 M4027
081 M4027
082 M4027
083 M4027
084 M4027
085 M4027
086 M4027
087 M4027
088 M4027
089 M4027
090 M4027
091 M4027
092 M4027
093 M4027
094 M4027
095 M4027
096 M4027
097 M4027
098 M4027
099 M4027
100 M4027

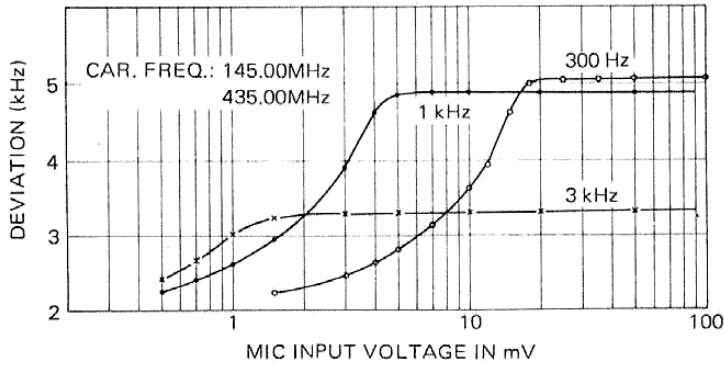
01.11 M4027
04.4 M4027
05.7.8 M4027
010 M4027
011 M4027
012 M4027
013 M4027
014 M4027
015 M4027
016 M4027
017 M4027
018 M4027
019 M4027
020 M4027
021 M4027
022 M4027
023 M4027
024 M4027
025 M4027
026 M4027
027 M4027
028 M4027
029 M4027
030 M4027
031 M4027
032 M4027
033 M4027
034 M4027
035 M4027
036 M4027
037 M4027
038 M4027
039 M4027
040 M4027
041 M4027
042 M4027
043 M4027
044 M4027
045 M4027
046 M4027
047 M4027
048 M4027
049 M4027
050 M4027
051 M4027
052 M4027
053 M4027
054 M4027
055 M4027
056 M4027
057 M4027
058 M4027
059 M4027
060 M4027
061 M4027
062 M4027
063 M4027
064 M4027
065 M4027
066 M4027
067 M4027
068 M4027
069 M4027
070 M4027
071 M4027
072 M4027
073 M4027
074 M4027
075 M4027
076 M4027
077 M4027
078 M4027
079 M4027
080 M4027
081 M4027
082 M4027
083 M4027
084 M4027
085 M4027
086 M4027
087 M4027
088 M4027
089 M4027
090 M4027
091 M4027
092 M4027
093 M4027
094 M4027
095 M4027
096 M4027
097 M4027
098 M4027
099 M4027
100 M4027

01.11 M4027
04.4 M4027
05.7.8 M4027
010 M4027
011 M4027
012 M4027
013 M4027
014 M4027
015 M4027
016 M4027
017 M4027
018 M4027
019 M4027
020 M4027
021 M4027
022 M4027
023 M4027
024 M4027
025 M4027
026 M4027
027 M4027
028 M4027
029 M4027
030 M4027
031 M4027
032 M4027
033 M4027
034 M4027
035 M4027
036 M4027
037 M4027
038 M4027
039 M4027
040 M4027
041 M4027
042 M4027
043 M4027
044 M4027
045 M4027
046 M4027
047 M4027
048 M4027
049 M4027
050 M4027
051 M4027
052 M4027
053 M4027
054 M4027
055 M4027
056 M4027
057 M4027
058 M4027
059 M4027
060 M4027
061 M4027
062 M4027
063 M4027
064 M4027
065 M4027
066 M4027
067 M4027
068 M4027
069 M4027
070 M4027
071 M4027
072 M4027
073 M4027
074 M4027
075 M4027
076 M4027
077 M4027
078 M4027
079 M4027
080 M4027
081 M4027
082 M4027
083 M4027
084 M4027
085 M4027
086 M4027
087 M4027
088 M4027
089 M4027
090 M4027
091 M4027
092 M4027
093 M4027
094 M4027
095 M4027
096 M4027
097 M4027
098 M4027
099 M4027
100 M4027

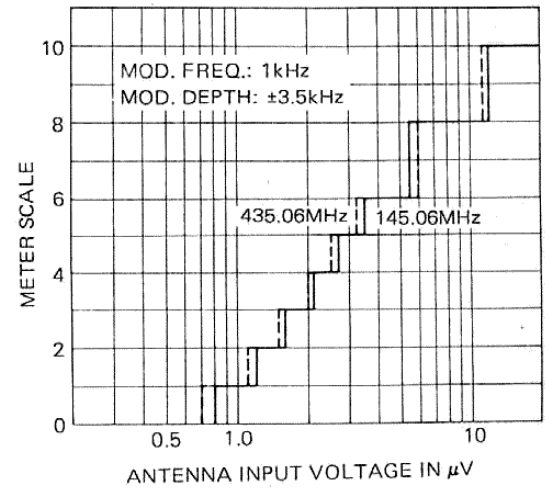
01.11 M4027
04.4 M4027
05.7.8 M4027
010 M4027
011 M4027
012 M4027
013 M4027
014 M4027
015 M4027
016 M4027
017 M4027
018 M4027
019 M4027
020 M4027
021 M4027
022 M4027
023 M4027
024 M4027
025 M4027
026 M4027
027 M4027
028 M4027
029 M4027
030 M4027
031 M4027
032 M4027
033 M4027
034 M4027
035 M4027
036 M4027
037 M4027
038 M4027
039 M4027
040 M4027
041 M4027
042 M4027
043 M4027
044 M4027
045 M4027
046 M4027
047 M4027
048 M4027
049 M4027
050 M4027
051 M4027
052 M4027
053 M4027
054 M4027
055 M4027
056 M4027
057 M4027
058 M4027
059 M4027
060 M4027
061 M4027
062 M4027
063 M4027
064 M4027
065 M4027
066 M4027
067 M4027
068 M4027
069 M4027
070 M4027
071 M4027
072 M4027
073 M4027
074 M4027
075 M4027
076 M4027
077 M4027
078 M4027
079 M4027
080 M4027
081 M4027
082 M4027
083 M4027
084 M4027
085 M4027
086 M4027
087 M4027
088 M4027
089 M4027
090 M4027
091 M4027
092 M4027
093 M4027
094 M4027
095 M4027
096 M4027
097 M4027
098 M4027
099 M4027
100 M4027

REFERENCE DATA

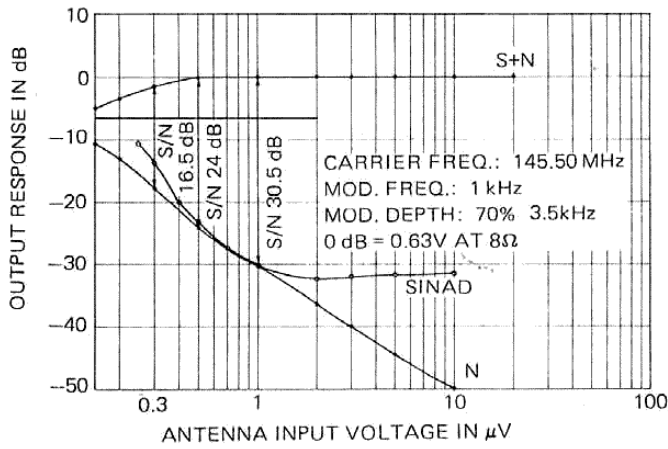
DEVIATION



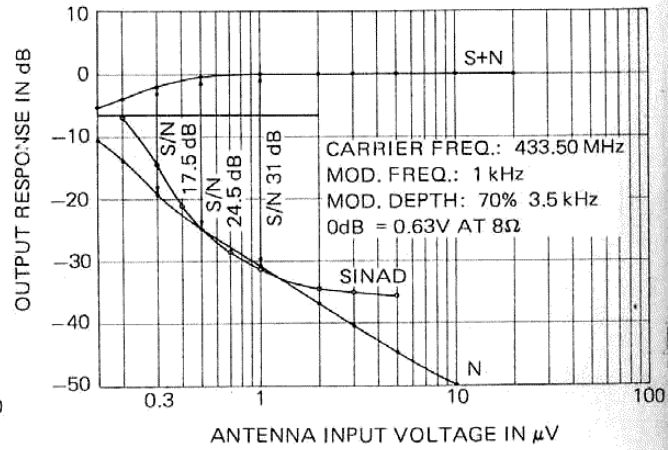
S LEVEL SENSITIVITY



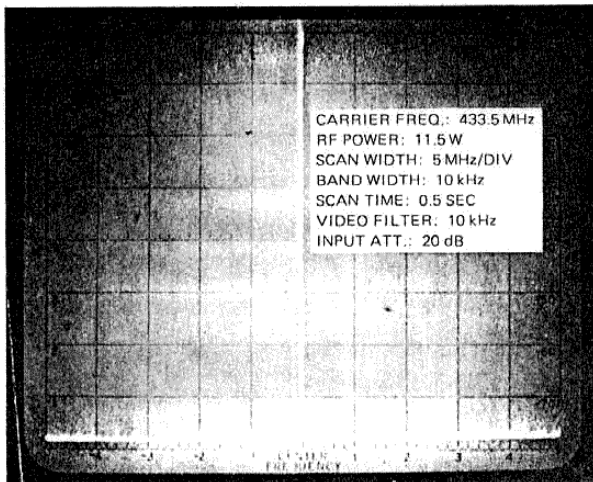
RX SENSITIVITY



RX SENSITIVITY



SPURIOUS RESPONSE



SPURIOUS RESPONSE

