SERVICE MANUAL FOR handic 0012S

Scanning VHF/UHF receiver

handic ab
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CONTENTS

SPECIFICATIONS

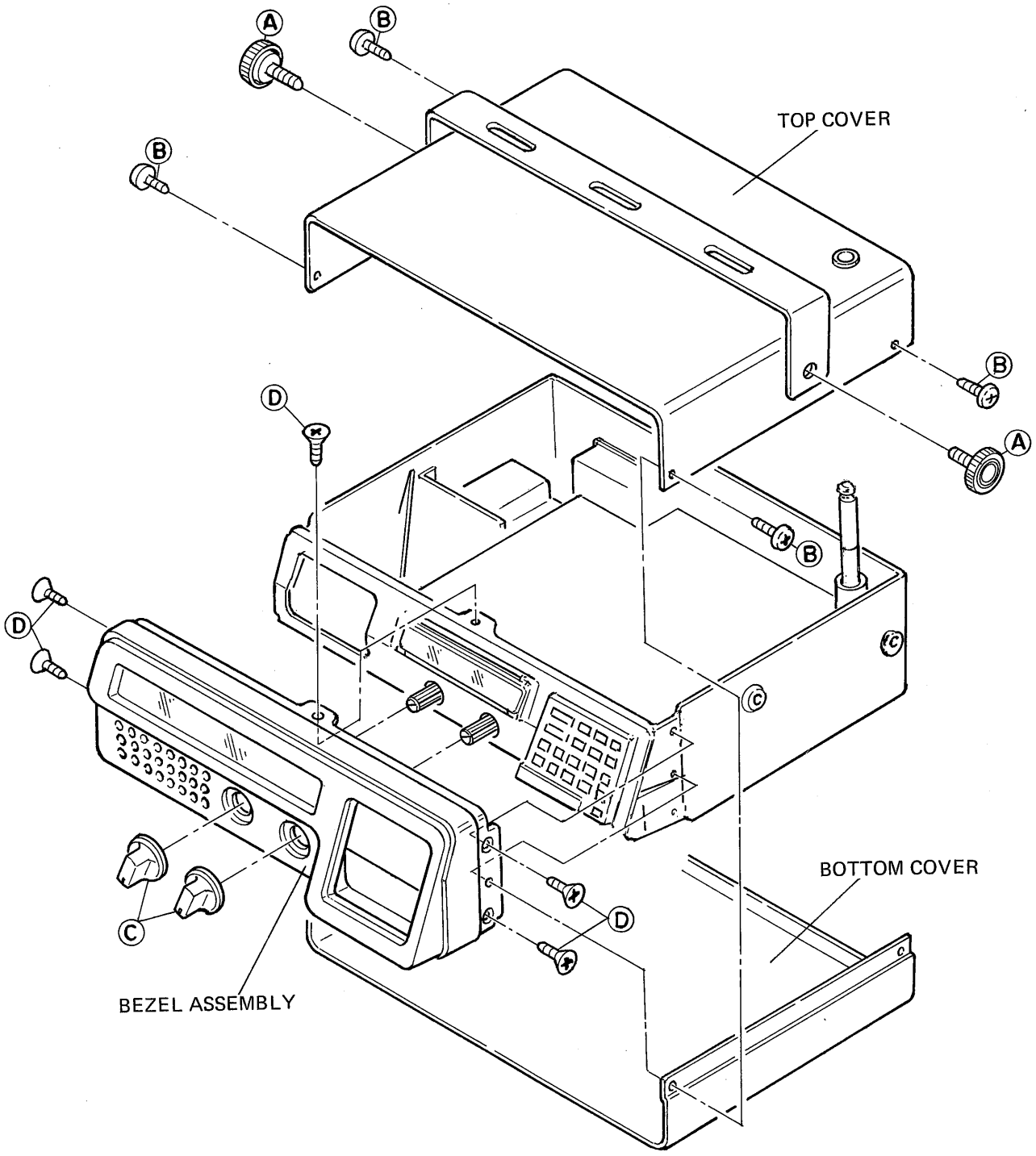
Description	Nominal Spec.	Limit Spec.
Frequency Coverage	68 ~ 88 MHz (5 kHz channel spacing) 144 ~ 174 MHz (5 kHz channel spacing) 410 ~ 512 MHz (12.5 kHz channel spacing)	68 ~ 88 MHz 144 ~ 174 MHz 410 ~ 512 MHz
Scan Rate	10 channels/sec.	7 ~ 13 channels/sec.
Search Rate	10 steps/sec.	7 ~ 13 steps/sec.
Scan Delay Time	2 sec.	1 ~ 3 sec.
Sensitivity (S+N)/N=20 dB		
VHF MID	1 μV	2 μV
VHF HIGH	1 μV	2 μV
UHF	2 μV	4 μV
Selectivity -6 dB	±9 kHz	±10 kHz
-50 dB	±17 kHz	±18 kHz
Spurious Rejection		
at 78 MHz	50 dB	40 dB
at 160 MHz	50 dB	40 dB
at 480 MHz		Not specified
(except primary image)		
Modulation Acceptance	±7 kHz	±5 kHz
Signal to Noise Ratio		
(100 μV 5 kHz Dev. at 1 kHz)		
VHF MID	45 dB	30 dB
VHF HIGH	45 dB	30 dB
UHF	35 dB	25 dB
Residual Noise (Vol. Min.)	3 mV	5 mV
Audio Output Power	1.5 W	1.0 W
(T.H.D. 10%)		

Description	Specification
Program channels	8 channels
Channel display	Fluorescent multi display 1 letter
"PROGRAM" and "DELAY" display	Fluorescent multi display 1 letter
Frequency display	Fluorescent multi display 6 letters
Receiving system	Direct Key entry, digital-controlled synthesizer, superheterodyne.
Speaker	77 mm Dynamic Speaker (8Ω)
Dimensions	Approx. 80(H) x 260(W) x 210(D) m.m
Weight	Approx. 2.4 kg
Power Requirements	AC220 – 240 volts 50 Hz 15 watts Max. DC13.8 volts 8 watts Max.
Accessory	Telescopic antenna (Approx. 63 cm)

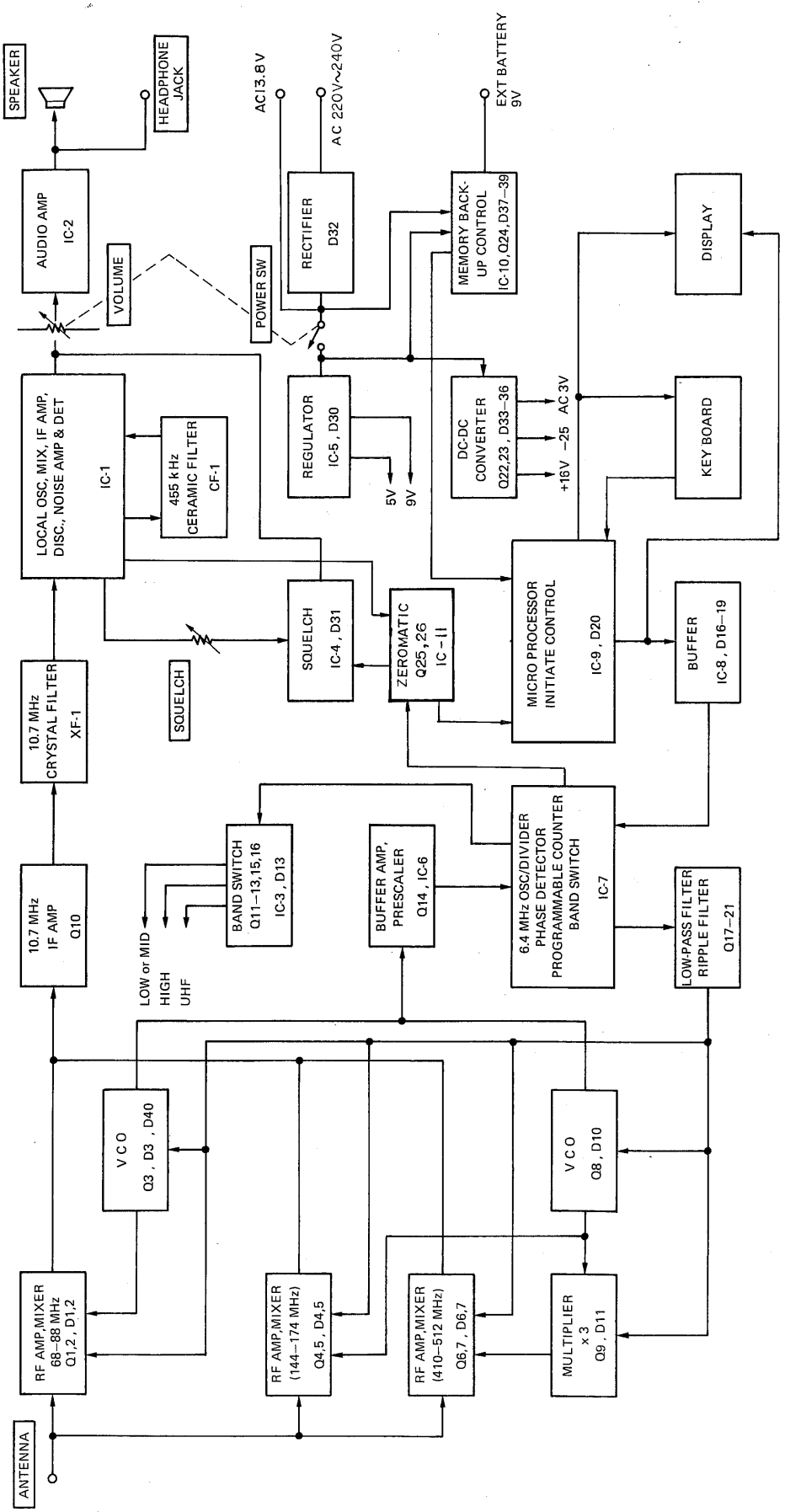
NOTE: *Nominal Specs represent the design specs: all units should be able to approximate these – some will exceed and some may drop slightly below these specs. Limit Specs represent the absolute worst condition which still might be considered acceptable: in no case should a unit perform to less than within any Limit Spec.*

DISASSEMBLY

Step 1: Remove two Mounting Bracket Screws (A) .
Step 2: Remove four screws (B) and detach the Top and Bottom Covers from the Chassis.
Step 3: Pull out two knobs (C) .
Step 4: Remove five screws (D) and separate the Bezel Assembly from the Chassis.



BLOCK DIAGRAM



PRINCIPLES OF OPERATION

The handic 0012S is a PLL Synthesized VHF/UHF Receiver, controlled by a Central Processing Unit (CPU).

The VHF Low Band (30 ~ 50 MHz) or Mid Band (68 ~ 88 MHz) and High Band (144 ~ 174 MHz) are received in 5 kHz increments. The UHF Band (410~512 MHz) is set up for 12.5 kHz increments.

Receiving frequency range, frequency determination, etc., are all functions controlled by the CPU. The CPU is able to do only the assigned functions, and no modification is feasible of the CPU.

The following paragraphs explain the operation of the circuits in terms of the functional blocks:

A variable capacitor diode tuning ("Automatic Tuning System") is employed on all Bands.

Field-effect transistors (FET) are used in the RF/MIX circuits of Low (Mid) and High Bands, to achieve optimum mix-modulation and mutual-modulation characteristics. Q_{10} amplifies 10.7 MHz IF. A 10.7 MHz monolithic Crystal Filter is incorporated for better selectivity.

IC-1 contains Local Oscillator, Mixer, IF Amplifier, Discriminator, Noise Amplifier and Detector. Crystal Oscillator produces 10.245 MHz, which mixed with 10.7 MHz, results in 455 kHz IF. A 455 kHz Ceramic filter is provided to increase selectivity. The 455 kHz IF is amplified in the IF Amp stage, and a Quadrature FM Detector detects it to an audio signal. A portion of the detector output is picked up as a Noise product to control the Squelch signal level. IC-2 is an audio amplifier.

IC-9 is the Central Processing Unit (CPU). The CPU does data processing, calculation, etc. Unstable supply voltage (V_{DD}) to the CPU can produce CPU malfunctions, such as wrong data processing, wrong data transfer, etc. To overcome the malfunctions, D_{20} and C_{111} "initialize" the CPU. In case a Program Backup battery is not connected or is discharged, the CPU may not be initialized by connecting AC cord to line. In such a case, turn Power switch ON and push the Reset Switch on rear panel to initialize the CPU. Figure 1 shows initializing waveform.

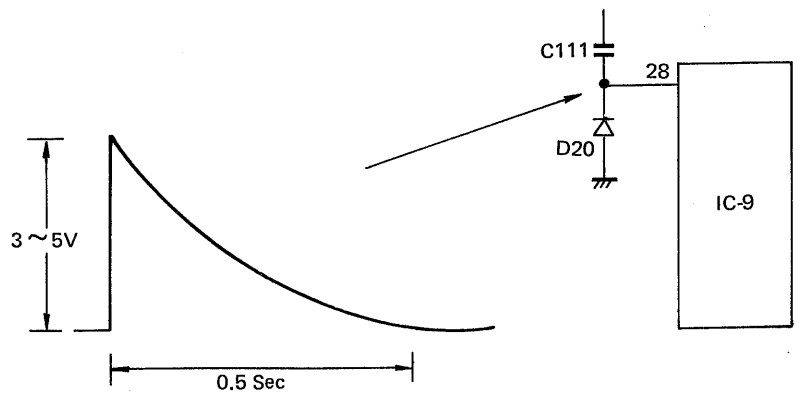


FIGURE 1

The Clock waveform is shown in Figure 2. The CPU incorporates input terminals $R_0 \sim R_9$, output terminals $O_0 \sim O_7$ and HLT terminals. The Input and Output terminals, along with the Key Board, form a coding network or matrix. The Fluorescent Display is driven by the O and R outputs. The O output is connected to the PLL circuit via D_{16-19} and IC-8.

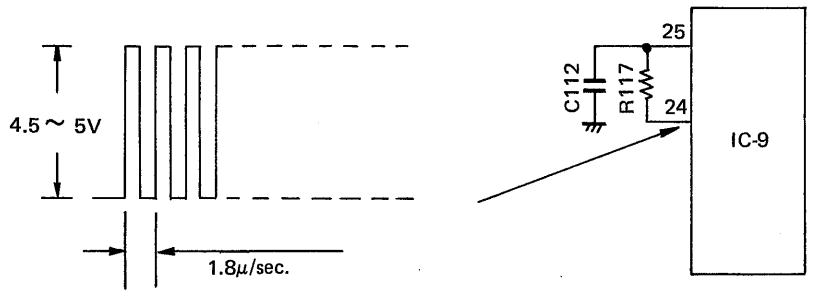


FIGURE 2

IC-7 is a Large-scale Integration (LSI) IC, which makes up a major part of PLL circuit. It contains a 6.4 MHz crystal oscillation circuit, Divider to produce 5 kHz/4.166 kHz for PLL reference frequencies, Phase Detector, Programmable Counter, Band Switch, etc. Output from the Phase Detector controls Voltage Controlled Oscillator (VCO) circuit, via Low-Pass Filter Q_{17-20}.

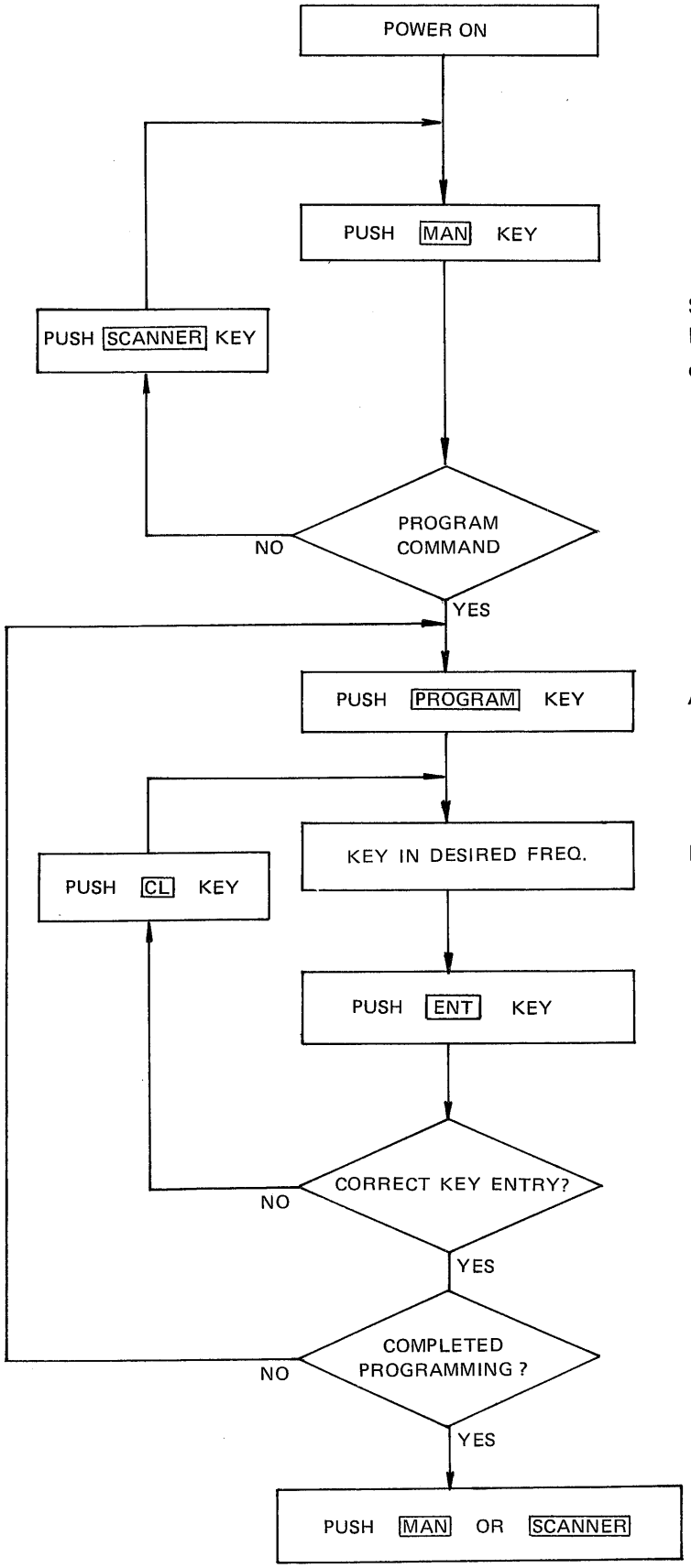
Two VCO circuits for Low Band and Hi/UHF Band are provided. The VCO frequencies are:

Low Band or Mid Band	=	Reception frequency +10.7 MHz
Hi Band	=	Reception frequency −10.7 MHz
UHF Band	=	Reception frequency −10.7 MHz/3

Thus, VHF and UHF are directly converted to 10.7 MHz, to enable reception with minimum spurious interference. And output from each VCO is injected into each Mixer, and a portion of the VCO output is applied to IC-7 (via Buffer Amplifier Prescaler) to compose the PLL circuitry.

DC − DC converter consisting of Q_{22}, Q_{23} and D_{33-36}, generates DC + 16V, −25V and AC 3V and supplies the Low-pass Filter and Display with the respective voltages.

GENERAL OPERATION FLOW CHART



Set to Scanning mode : automatically scans when Squelch is "on".

Shift to Scanning mode : able to select a channel by pushing [MAN] Key, or directly select a channel by pushing [1] ~ [8] Keys.

A push advances one channel frequency.

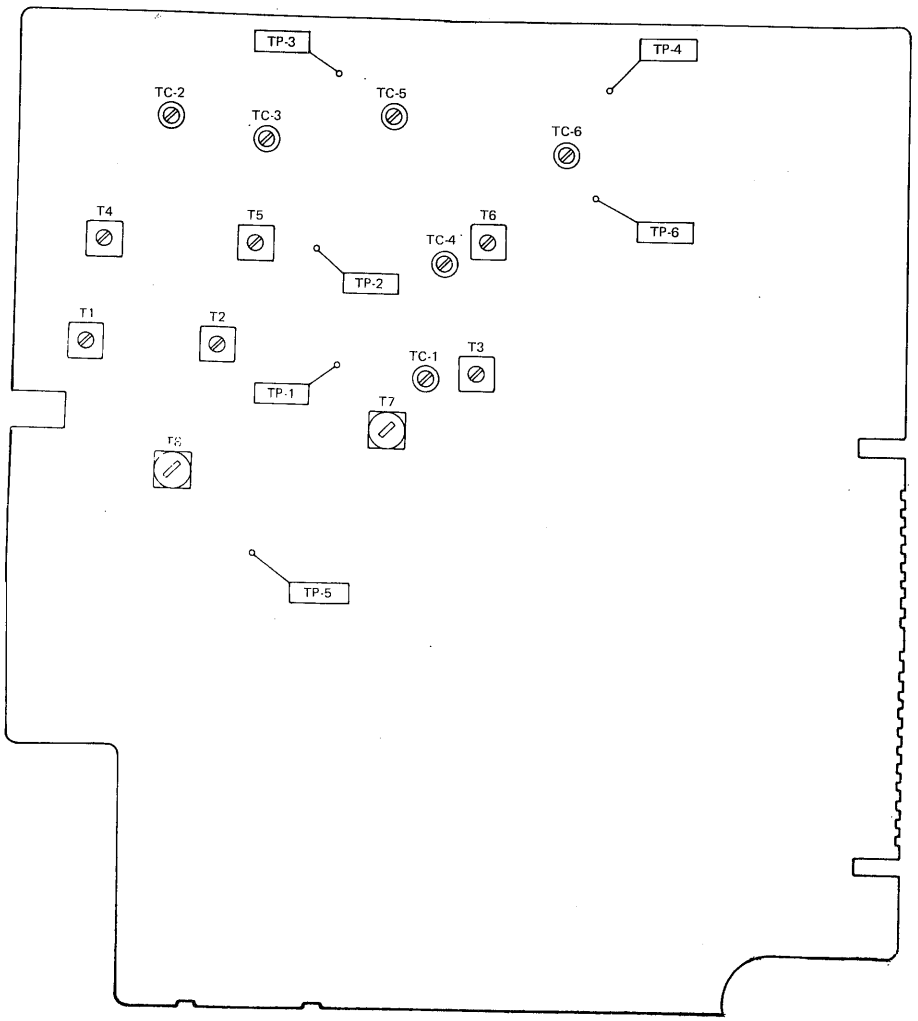
Enter desired reception frequency.

Push [ENT] Key.

Key in correctly?

Change to program command mode.

ALIGNMENT AND TEST POINT POSITIONS



ALIGNMENT PREPARATION

Test equipment required

1. Oscilloscope (0 ~ 500 kHz, 0 ~ 50 MHz)
2. AC VTVM
3. DC VTVM
4. Frequency Counter (60 MHz)
5. 8 ohms dummy load
6. Slow Sweep Generator with variable marker (10.7 MHz)
7. VHF Sweep Generator with variable marker (68 ~ 88 MHz, 144 ~ 174 MHz)
8. UHF Sweep Generator with variable marker (410 ~ 512 MHz)
9. FM Signal Generator (68 ~ 88 MHz, 144 ~ 174 MHz, 410 ~ 512 MHz)

NOTE 1: *Use non-metallic tuning tools.*
The test equipment and Receiver should be warmed up at least 10 minutes before proceeding with alignment.
Input signal from the Generator should be kept as low as possible and still obtain usable output.

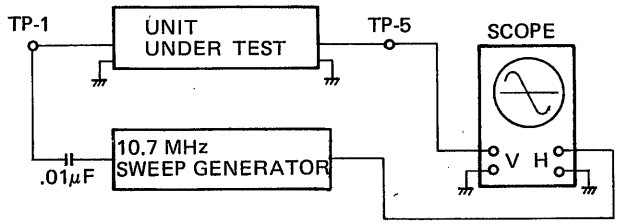
NOTE 2: *A 9-volt battery is required to hold the memory when AC is disconnected. Always be sure the unit is loaded with a fresh 9-volt battery or the pre-pregrammed channels will be lost (and will have to be re-programmed).*

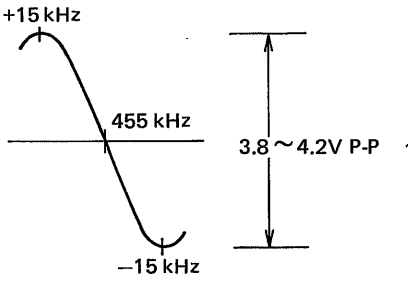
REFERENCE FREQUENCY OSC ALIGNMENT

Step 1: Connect Frequency Counter to TP-6 and ground.
Step 2: Adjust TC-6 so that the frequency is 6.40000 MHz ±10 Hz.

IF SECTION ALIGNMENT

Step 1: Connect instruments as shown below.





INPUT : 100μV

Step 2: Adjust T8 for maximum output so that the 455 kHz marker is in the center of the discriminator curve and for best linearity as shown above.
During Alignment, maintain Sweep Generator output at the lowest level possible to prevent overloading.

VCO ALIGNMENT

VHF MID BAND

Step 1: Connect a DC VTVM to TP-4 and ground.
Step 2: Program CH1, 2 and 3 as follows:
CH1 (68 MHz), CH2 (78 MHz), CH3 (88 MHz)
Step 3: Select Channel 3 (88 MHz) and adjust TC-1 for 8.0V on the DC VTVM.
Step 4: Next, select Channel 1 (68 MHz) and adjust T3 for 1.0V on the DC VTVM.
Step 5: Repeat step 3 and 4 until no further improvement is observed. The DC VTVM should show as below.

68 MHz	Voltage of TP-4	8.0V
78 MHz	Voltage of TP-4	3.5 ± 0.2V
88 MHz	Voltage of TP-4	10.0V

VHF HI BAND, UHF BAND

Step 1: Connect a DC VTVM to TP-4 and ground.
Step 2: Program CH1, 2, 3, 4, 6 and 7 as follows:
CH1 (410 MHz), CH2 (480 MHz), CH3 (512 MHz), CH4 (144 MHz), CH6 (160 MHz), CH7 (174 MHz).
Step 3: Select Channel 3 (512 MHz) and adjust TC-4 for 9.0V.
Step 4: Select Channel 1 (410 MHz) and adjust T6 for 1.0V.
Step 5: Repeat steps 3 and 4. Make sure that the DC VTVM reads as below.

410 MHz	Voltage of TP-4	1.0V
480 MHz	Voltage of TP-4	5.0 ± 0.3V
512 MHz	Voltage of TP-4	9.0V

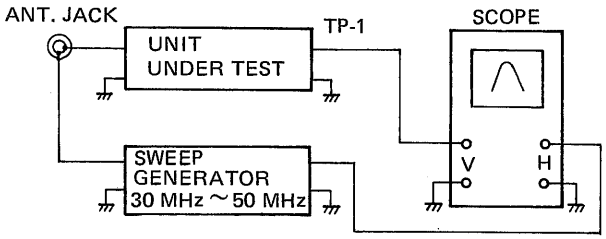
Step 6: After completing alignment at 410 MHz, 480 MHz and 512 MHz, check the voltages at 144 MHz, 160 MHz and 174 MHz.

144 MHz	Voltage of TP-4	approx. 1.0V
160 MHz	Voltage of TP-4	approx. 3.3V
174 MHz	Voltage of TP-4	approx. 7.2V

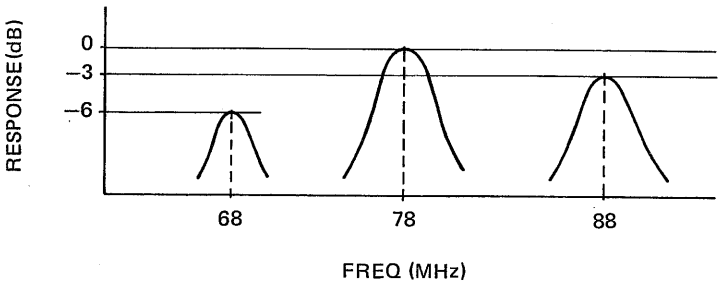
RF AM ALIGNMENT

VHF MID BAND

Step 1: Connect instruments as shown below.



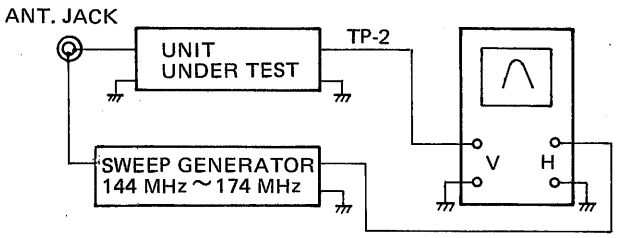
Step 2: Program 68 MHz (CH1), 78 MHz (CH2) and 88 MHz (CH3).
Step 3: Select Channel 3 (88 MHz) and adjust T1 and T2 for maximum RF waveform.
Step 4: Make sure that the output curves at 68 MHz and 88 MHz are similar to Figures below.



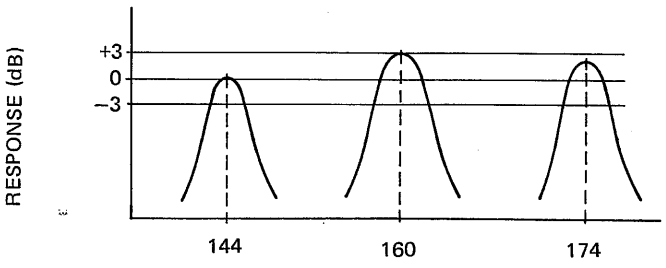
NOTE: *It is difficult to track the peak waveforms of 68 MHz and 88 MHz with marker frequencies; differences of up to –6 dB are acceptable.*

VHF HI BAND

Step 1: Connect instruments as shown below.



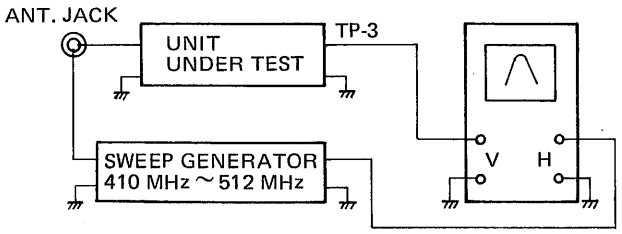
Step 2: Program 144 MHz (CH1), 160 MHz (CH2) and 174 MHz (CH3).
Step 3: Select Channel 1 (144 MHz) and adjust T4 and T5 for maximum RF waveforms.
Step 4: Make sure that the output curves at 160 MHz and 174 MHz are similar to Figures below.



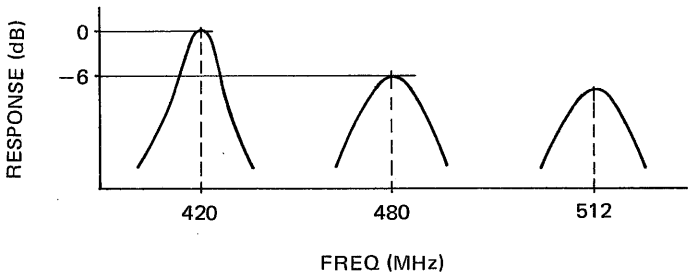
NOTE: *It is difficult to track the peak waveforms of 160 MHz and 174 MHz with marker frequencies; differences of up to –6 dB are acceptable.*

UHF BAND

Step 1: Connect instruments as shown below.

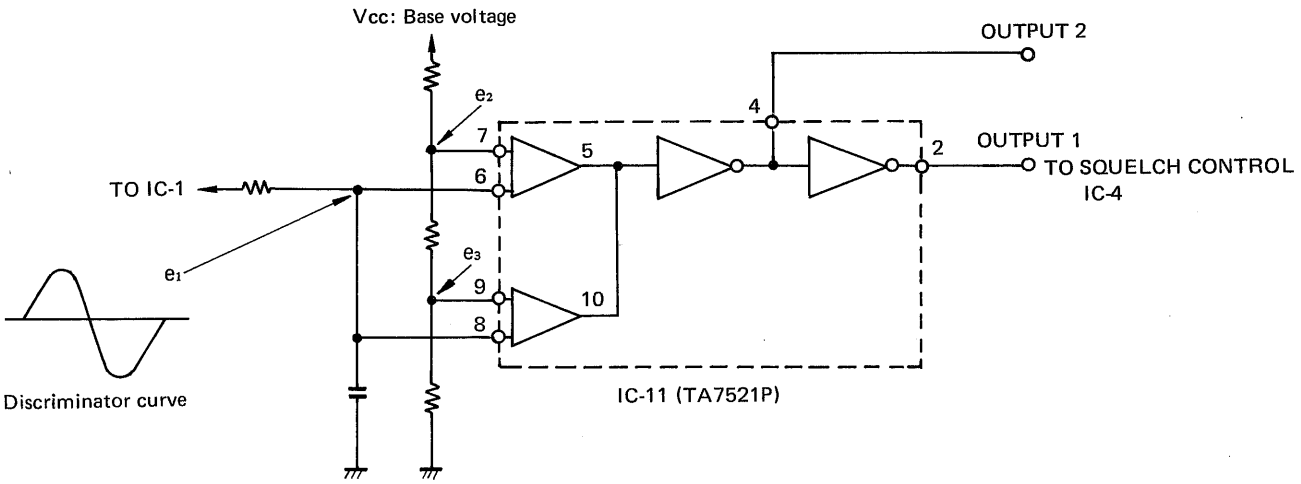


Step 2: Program 420 MHz (CH1), 480 MHz (CH2) and 512 MHz (CH3).
Step 3: Select Channel 1 (420 MHz) and adjust TC-2 and TC-3 for maximum output.
Step 4: Make sure that the output curves at 420 MHz, 480 MHz and 512 MHz are similar to figures below.



NOTE: *It is difficult to track the peak waveforms of 480 MHz and 512 MHz with their marker frequencies; differences of up to −6 dB are acceptable.*

ZEROMATIC FUNCTION AND HOW TO CHECK IT Addition (Page 12)



*Zeromatic functions when OUTPUT 1 is in "H" level.

e_1	$0 < e_1 < e_3$	$e_3 < e_1 < e_2$	$e_2 < e_1 < Vcc$
OUTPUT 1 (Pin No. 2)	L	H	L
OUTPUT 2 (Pin No. 4)	H	L	H

To adjust e_1 voltage, receive signal in Manual mode, and set T-8 to get half supply voltage (IC-1, 4pin). It is convenient to use National Weather Service Signal for the adjustment.
In the event Zeromatic does not function right, refer to "REFERENCE FREQUENCY OSC ALIGINMENT" and check 6.4 MHz, and the adjust T-8 again.

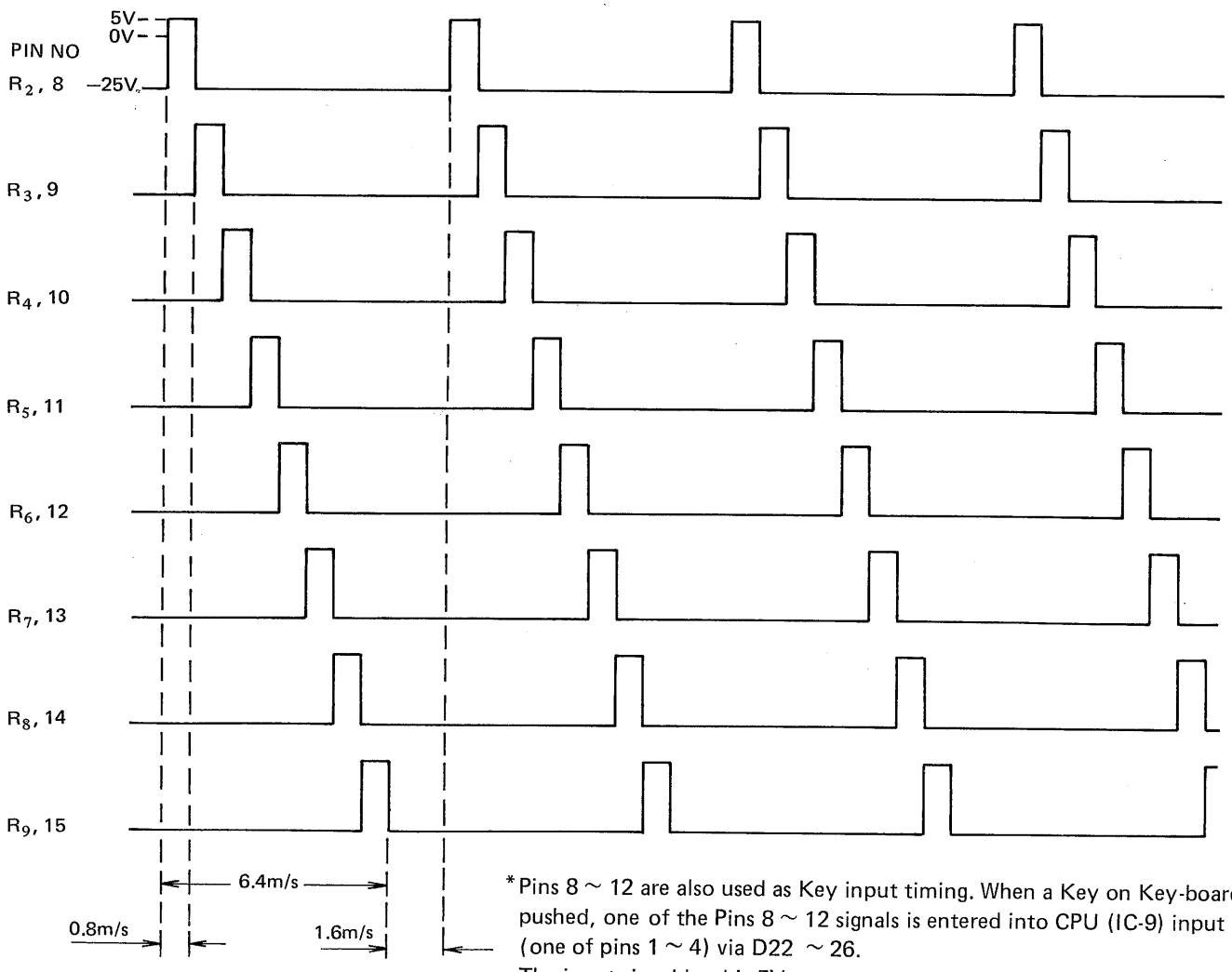
OVERALL ALIGNMENT AND SENSITIVITY MEASUREMENT

Step 1: Connect Signal Generator (SSG) to ANTenna jack and AC VTVM to speaker terminals.
Step 2: Turn SQUELCH fully counterclockwise. Set for reception of the channels noted in the following chart. Set the SSG to the center of each band.

CH	BAND	FREQ.
1	VHF MID	78 MHz
2	VHF HI	160 MHz
3	UHF	470 MHz

Step 3: Set the Signal Generator frequency to 470 MHz (channel 3). Adjust TC-5 and readjust T7 for maximum sensitivity.
Step 4: For each frequency/channel set Signal Generator to each frequency, with 5 kHz deviation, and set VOLUME control for 0 dB (0.775 V) reading on the VTVM.
Step 5: Turn off the modulation and measure the (S+N)/N ratio.

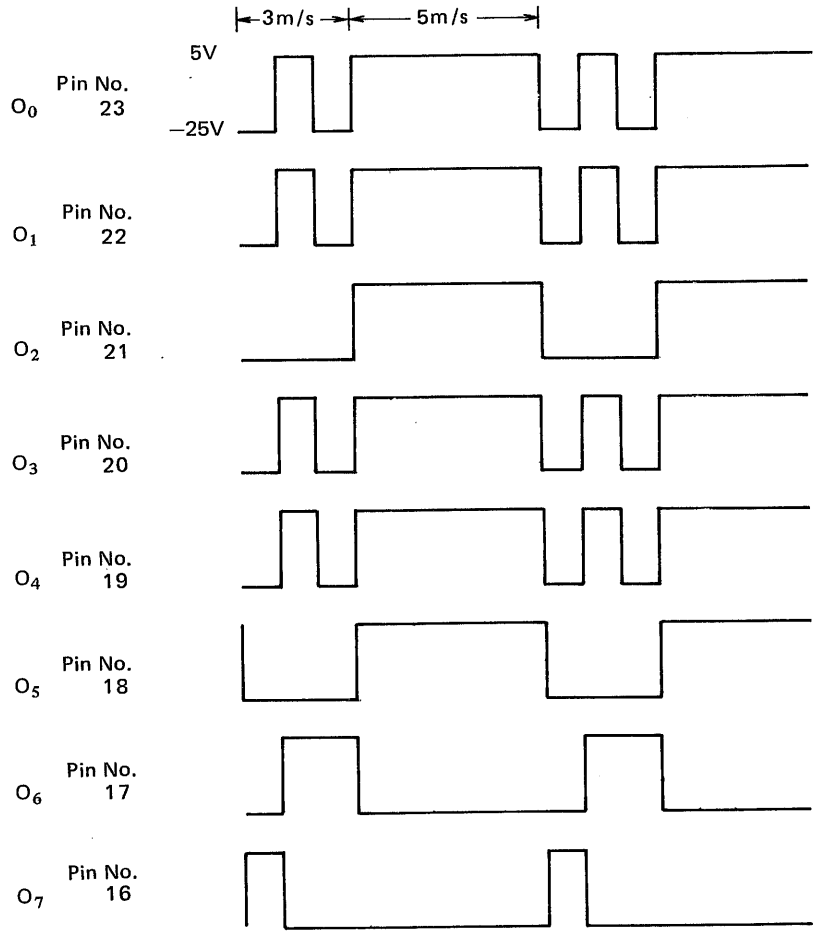
WAVEFORM AT PINS R_2~R_9 OF CPU (IC-9)



* Pins 8 ~ 12 are also used as Key input timing. When a Key on Key-board is pushed, one of the Pins 8 ~ 12 signals is entered into CPU (IC-9) input pin (one of pins 1 ~ 4) via D22 ~ 26.
The input signal level is 5V.

WAVEFORM AT PIN O~O_7 OF CPU (IC-9)

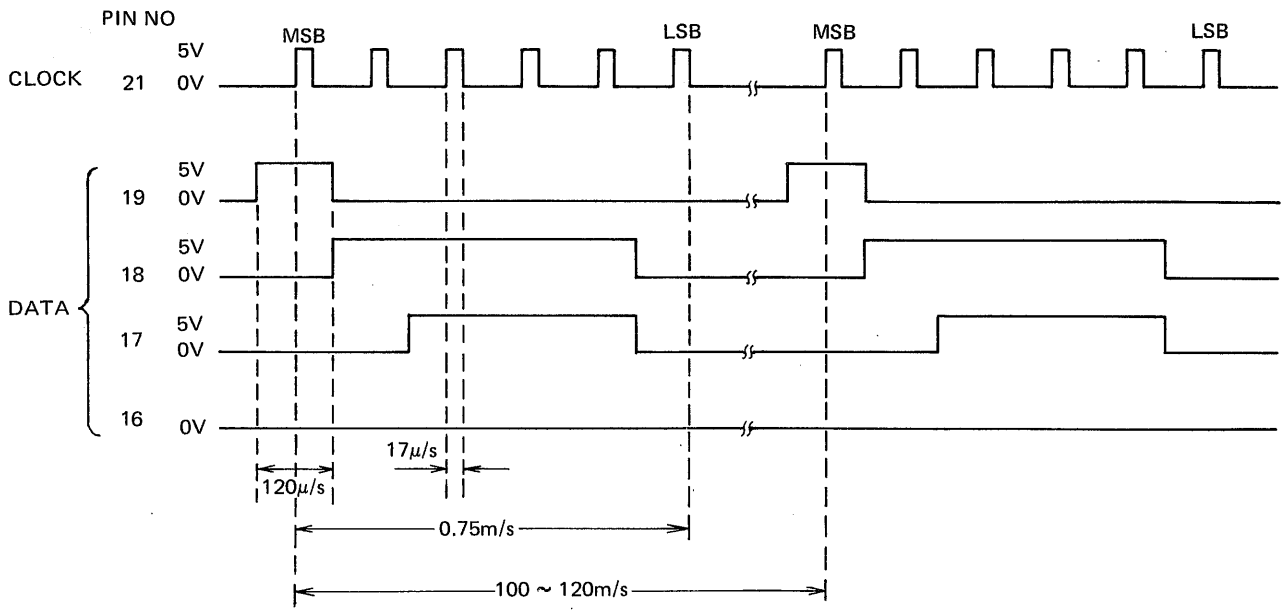
In program mode when display frequencies are all "O".



* Data output from Pins 20 ~ 23 is transfered to PLL via D16 ~ 19.
The signal level to the PLL is 5V.

CLOCK AND DATA INPUT WAVEFORM IN IC-7

(in scanning mode in all channels with 144 MHz input.)



OPERATION CHECK

RECEPTION CHECK

Table-1

FREQ. BAND \ PIN No. IC-7	2	3
LOW or MID	1	1
HIGH	0	1
UHF	0	0

NOTE 1 → 5V
0 → 0V

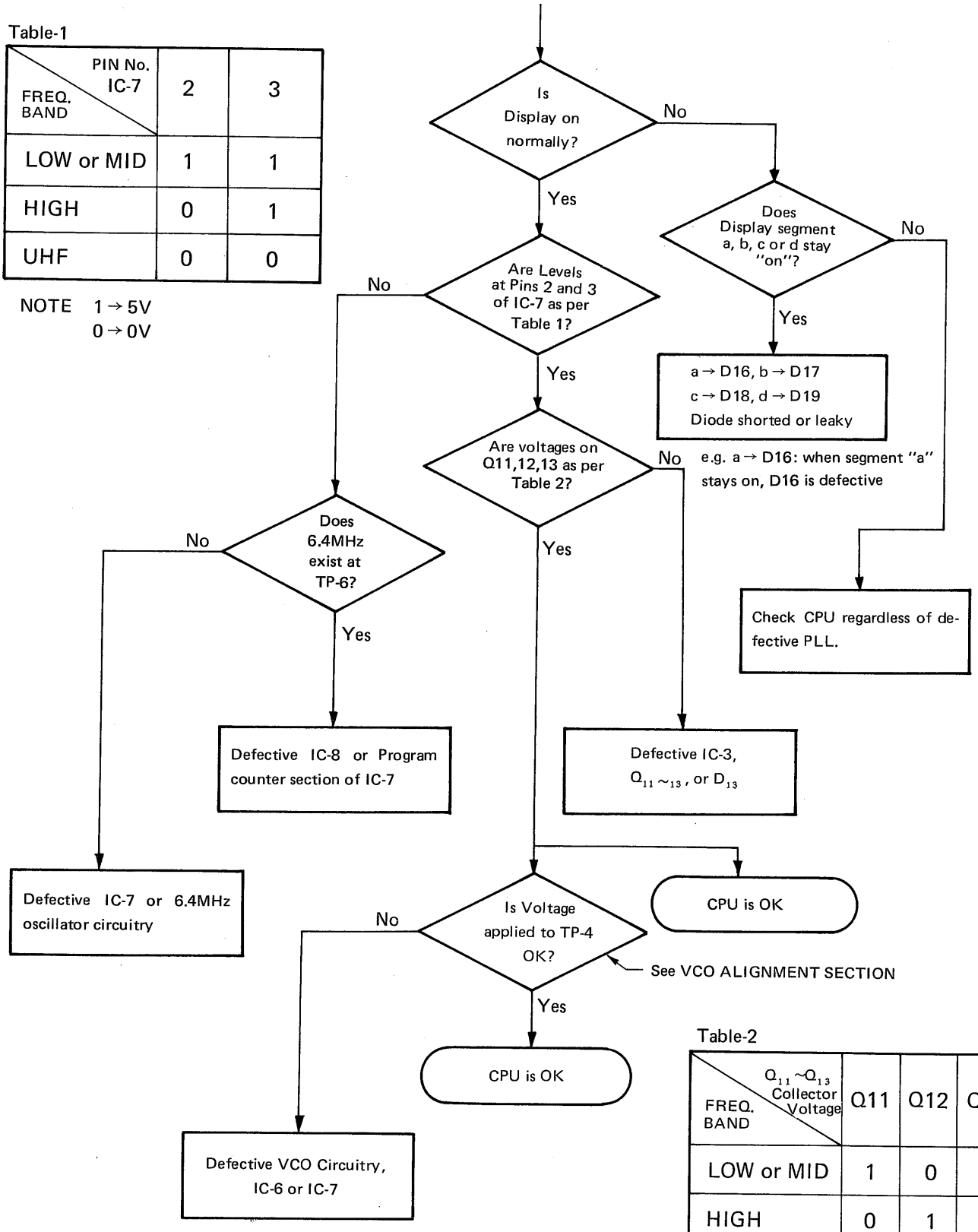
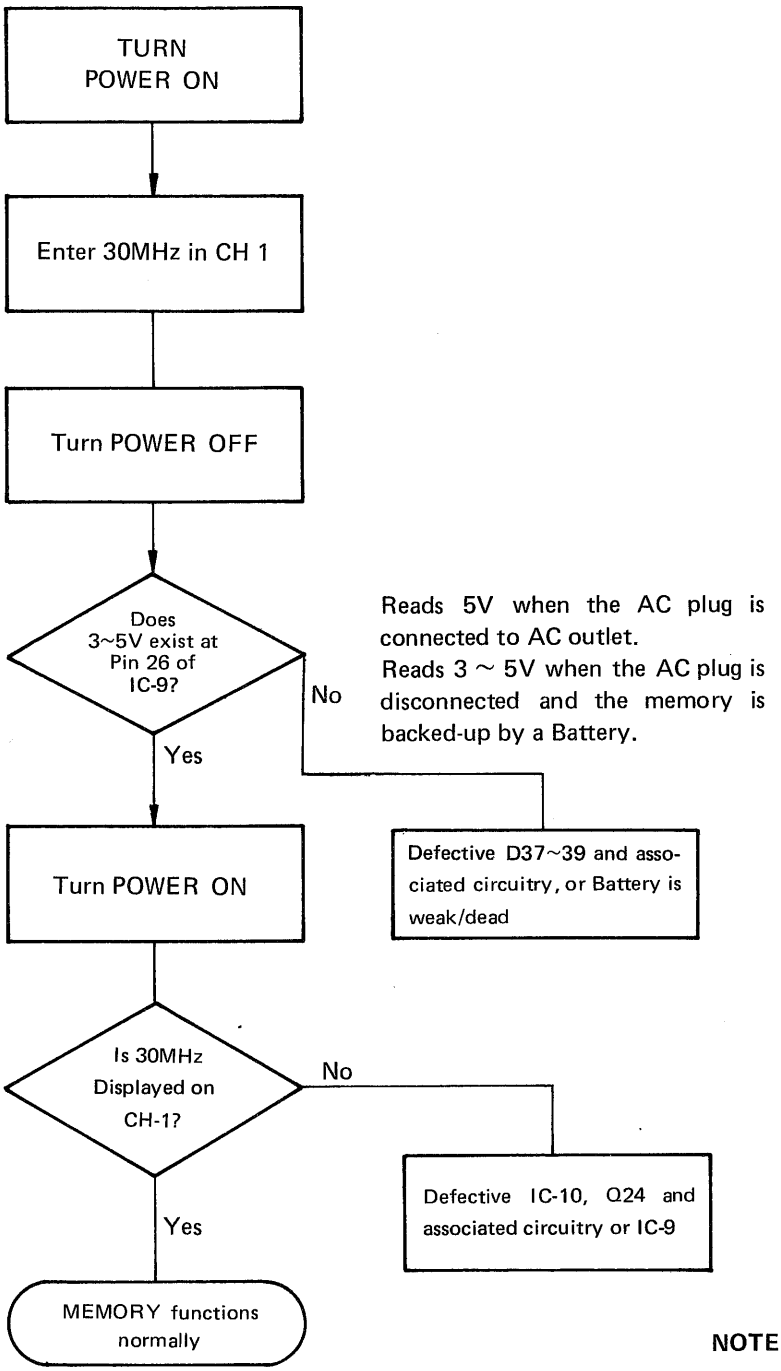


Table-2

FREQ. BAND \ Q11 ~Q13 Collector Voltage	Q11	Q12	Q13
LOW or MID	1	0	0
HIGH	0	1	0
UHF	0	0	1

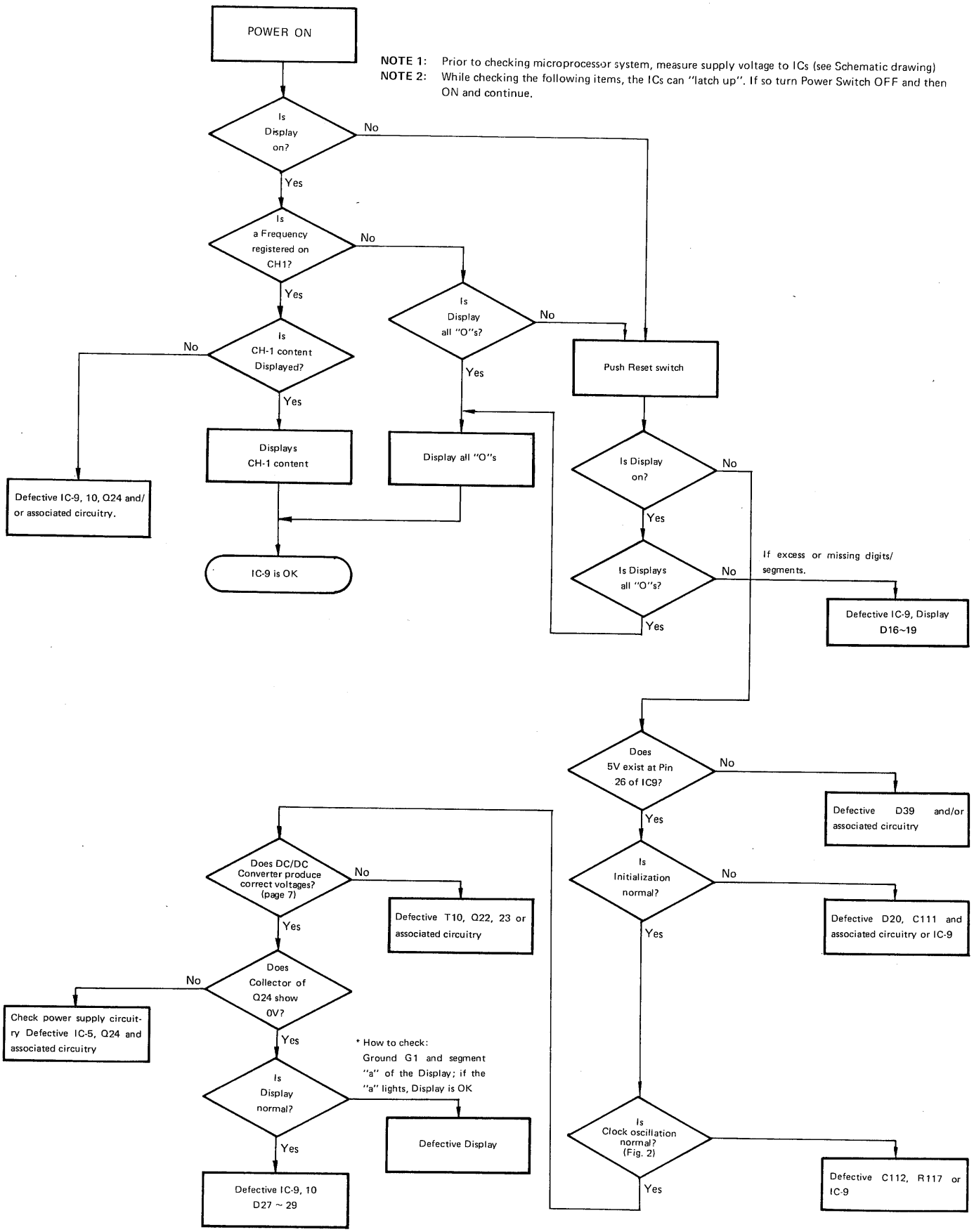
NOTE 1 → 8V
0 → 0V

MEMORY CHECK

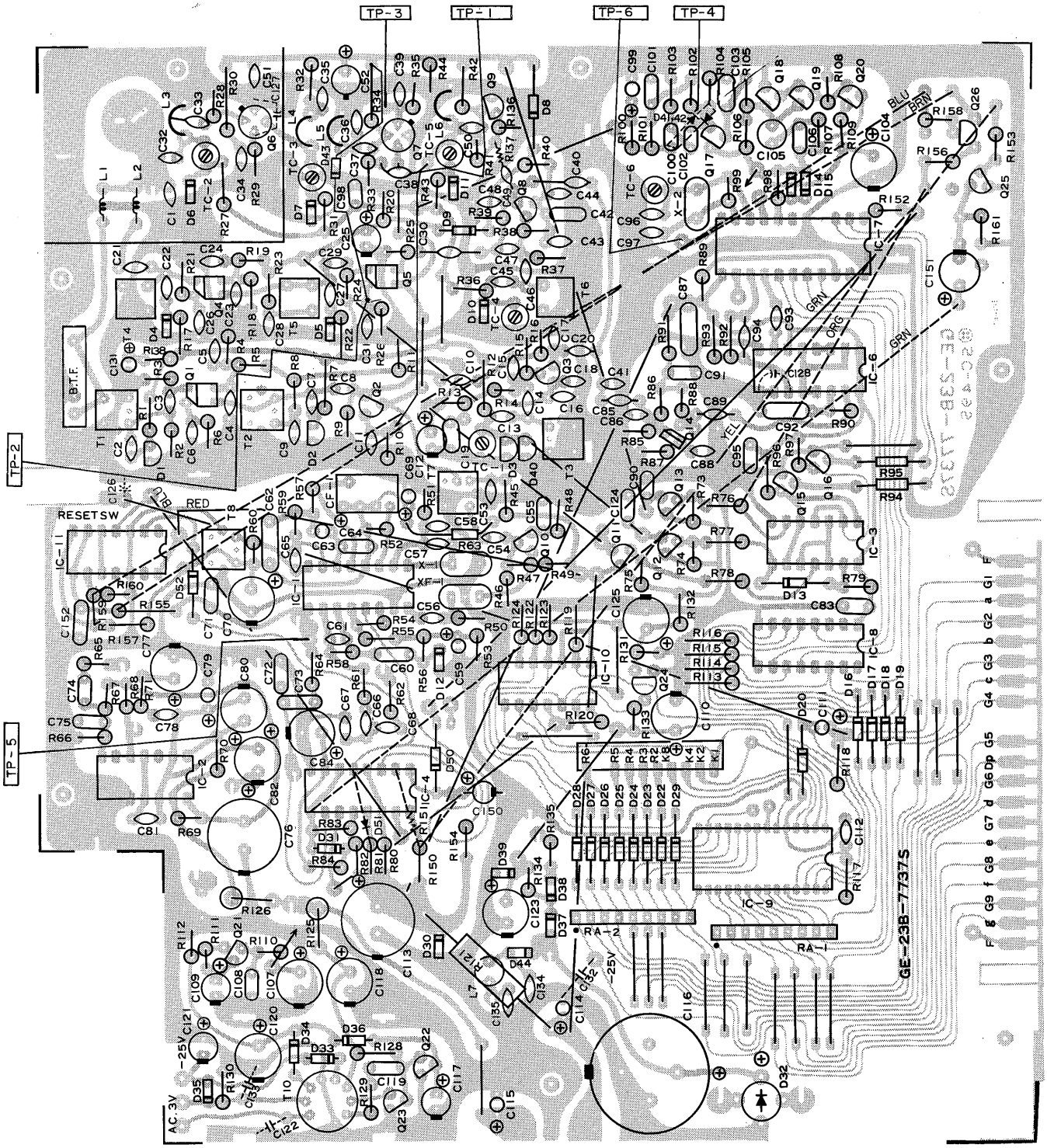


NOTE: H level (5V) exists at collector of Q24 when power is OFF, and L level (0V) exist with Power ON.

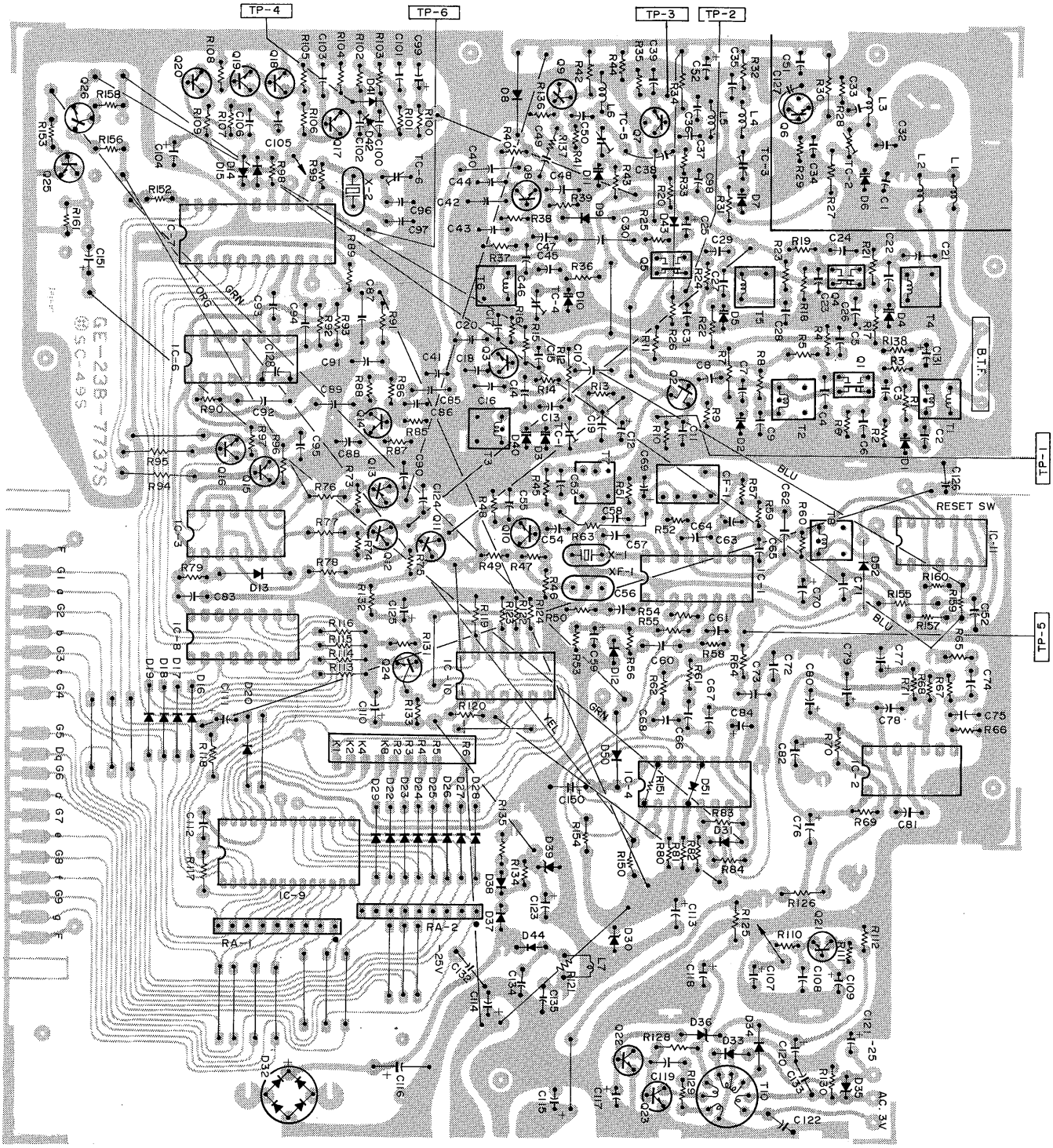
CPU CHECK


POWER ON
NOTE 1: Prior to checking microprocessor system, measure supply voltage to ICs (see Schematic drawing)
NOTE 2: While checking the following items, the ICs can "latch up". If so turn Power Switch OFF and then ON and continue.
Is Display on?
No
Yes
Is a Frequency registered on CH1?
No
Yes
Is Display all "O"s?
No
Yes
Is CH-1 content Displayed?
No
Yes
Push Reset switch
Displays CH-1 content
Display all "O"s
Defective IC-9, 10, Q24 and/or associated circuitry.
IC-9 is OK
Is Display on?
No
Yes
Is Displays all "O"s?
No
Yes
If excess or missing digits/segments.
Defective IC-9, Display D16~19
Does 5V exist at Pin 26 of IC9?
No
Yes
Defective D39 and/or associated circuitry
Is Initialization normal?
No
Yes
Defective D20, C111 and associated circuitry or IC-9
Is Clock oscillation normal? (Fig. 2)
Yes
Defective C112, R117 or IC-9
Does DC/DC Converter produce correct voltages? (page 7)
No
Yes
Defective T10, Q22, 23 or associated circuitry
Does Collector of Q24 show 0V?
No
Yes
Check power supply circuitry Defective IC-5, Q24 and associated circuitry
* How to check:
Ground G1 and segment "a" of the Display; if the "a" lights, Display is OK
Is Display normal?
Yes
Defective Display
Defective IC-9, 10 D27 ~ 29

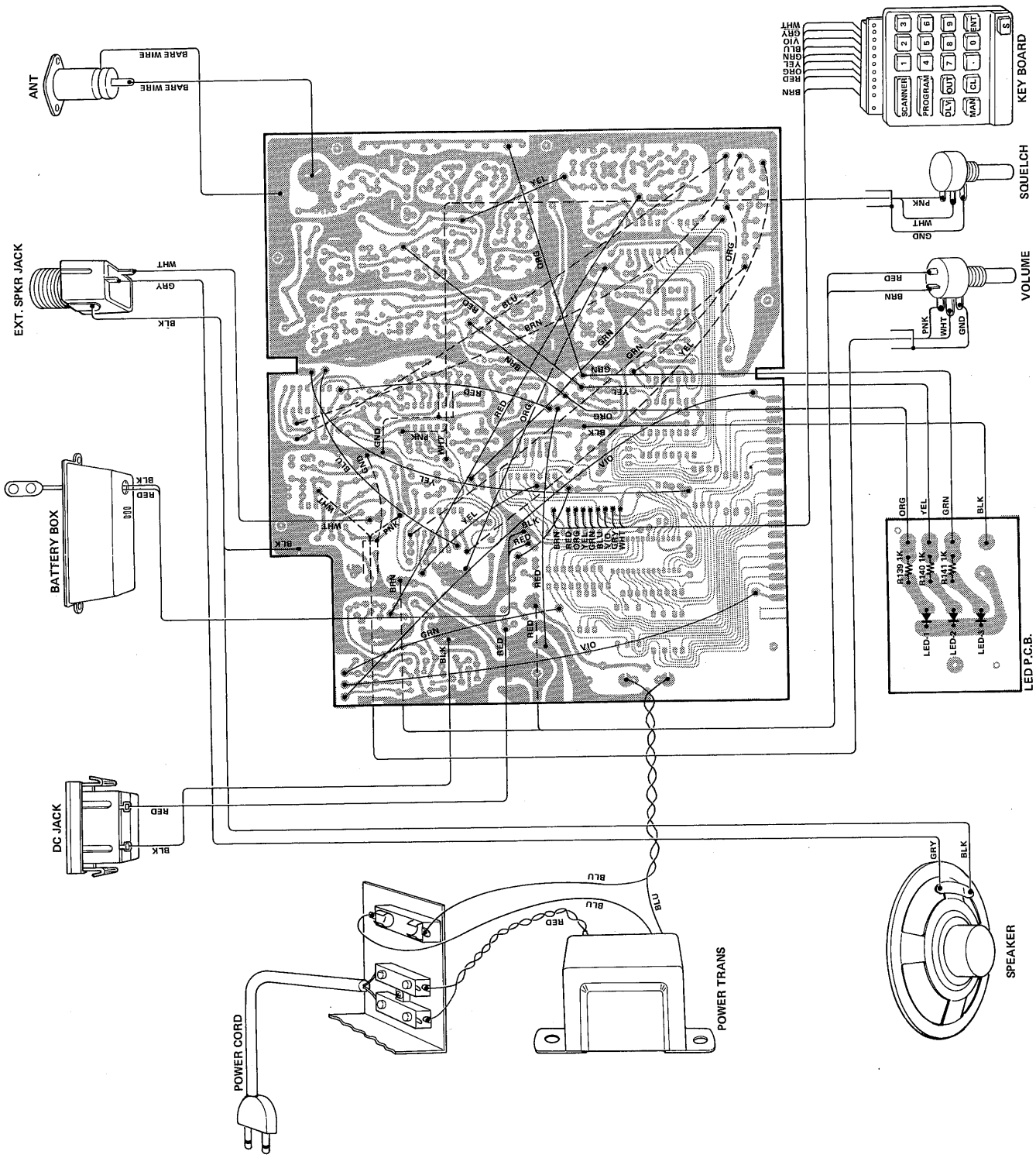
MAIN P.C.BOARD (TOP VIEW)



MAIN P.C.BOARD (BOTTOM VIEW)



WIRING DIAGRAM



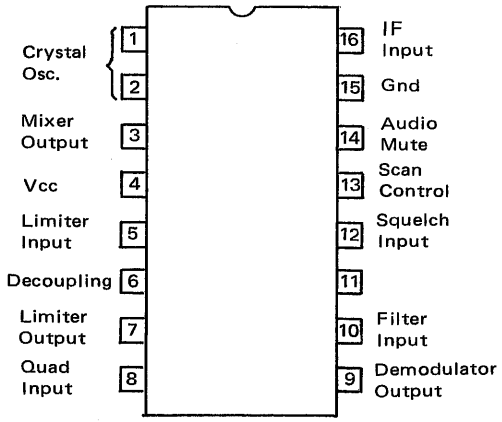
TROUBLESHOOTING GUIDE

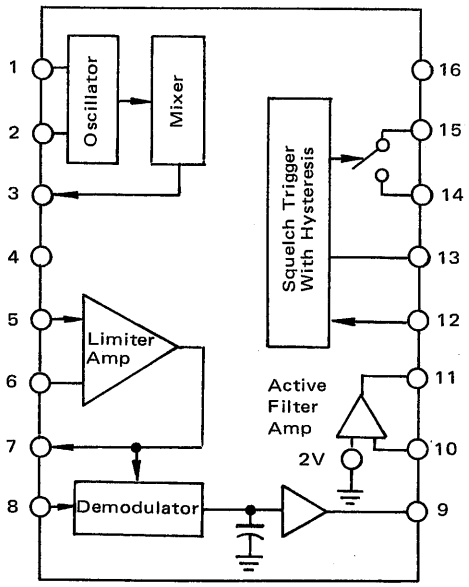
Symptom	Possible Cause
1) Display does not light and no sound when POWER is on. Volume Control: MAX. Squelch Control: Counterclock-wise(CCW)	1) Faulty power cord. 2) Defective power transformer. 3) Defective power switch. 4) Defective rectifier D32. 5) Defective voltage regulator circuit components.
2) Display lights but no sound. Volume Control: MAX. Squelch Control: CCW	1) Defective speaker or headphone jack. 2) Defective audio amplifier IC-2 and/or associated circuit components. 3) Defective IF amplifier IC-1 and/or associated circuit components. 4) Defective functional squelch control IC-4 and/or associated circuit components.
3) Sound but display does not light. Volume Control: MAX. Squelch Control: CCW	1) Activate Reset Switch. 2) Defective initiate control D20 and/or associated circuit components. 3) Defective IC-10, Q24, D37 – 39 and/or associated circuit components. 4) Defective DC – DC converter circuit components. 5) Defective display (fluorescent display tube). 6) Defective CPU IC-9 and/or associated circuit components. 7) Defective IC-5 and/or 8 volts line. 8) Defective C111 and/or D20
4) Does not scan and squelch does not operate.	1) Defective functional squelch control IC-4, D31 and/or associated circuit components. 2) Defective IC-1, 10 and/or associated circuit components. 3) Defective IC-5 and/or associated circuit components.
5) Does not scan but squelch operates.	1) Defective IC-4, 10 and/or associated circuit components. 2) Reset switch operates correctly. 3) Defective initiate control D20 and/or associated circuit components.
6) AUTO scan does not operate but MANUAL selector operates.	1) All channels are skipped (lock-out). 2) Reset switch operates correctly.
7) Display lights but PROGRAM does not operate.	1) Defective Keyboard or connector and/or associated circuit components.
8) Memory operates but after a period the readout memory becomes faulty.	1) Weak 9-volt battery. 2) Defective IC-10, Q24, D37 – 39 and/or associated circuit components.
9) Mid band does not operate but High and UHF operates.	1) Defective Mid band RF amplifier, mixer and/or VCO circuit components. 2) Defective band switch circuit components.

Symptom	Possible Cause
10) High band does not operate but Mid and UHF operate.	1) Defective high band RF amplifier Q4, mixer Q5, switching diode D9 and/or associated circuit components. 2) Defective band switch circuit components.
11) UHF band does not operate but High and Mid operate.	1) Defective UHF band RF amplifier Q6, mixer Q7, multiplier Q9/D11, switching Diode D8 and/or associated circuit components. 2) Defective band switch circuit components.
12) High and UHF band does not operate but Mid operates.	1) Defective VCO circuit Q8, D10 and/or associated circuit components.
13) All bands do not operate but display OK.	Defective PLL circuit Q14 – 21 and IC-6, 7 and/or associated circuit components. IC-7 could malfunction while repairing if badly treated. If so turn power switch on/off.
14) Search does not work, but squelch operates.	1) Defective IC-7.
15) Search but does not halt on the correct frequency.	1) Defective Q26, IC-4,7,11 and/or associated circuit components. 2) 6.4 MHz and T8 out of adjustment.

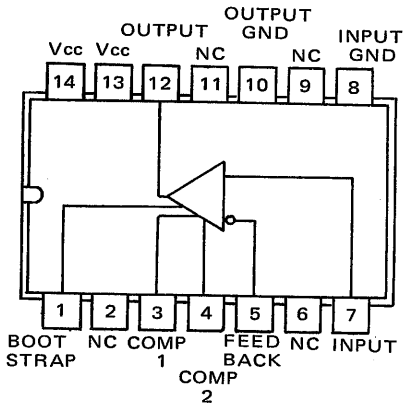
INTEGRATED CIRCUIT LEAD IDENTIFICATIONS

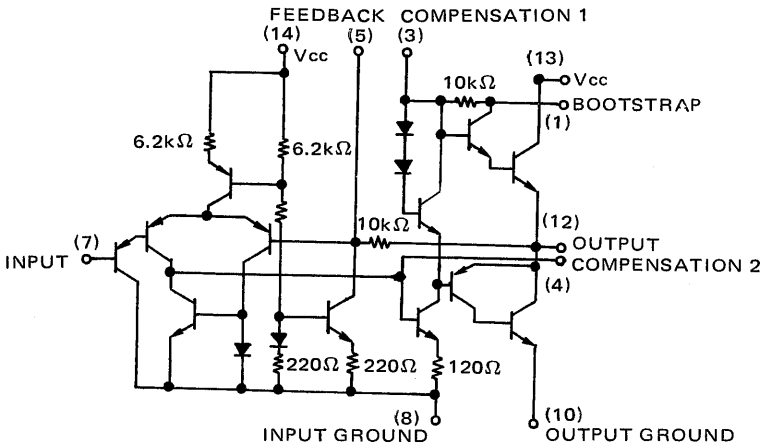
IC-1 MC3357 or MPS5071



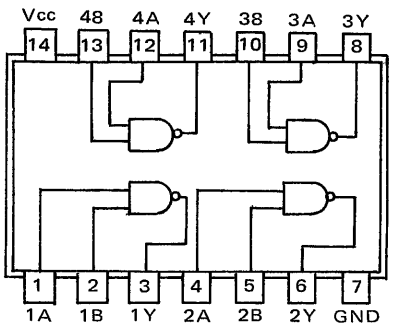


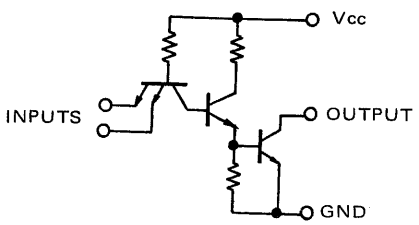
IC-2 SN76007



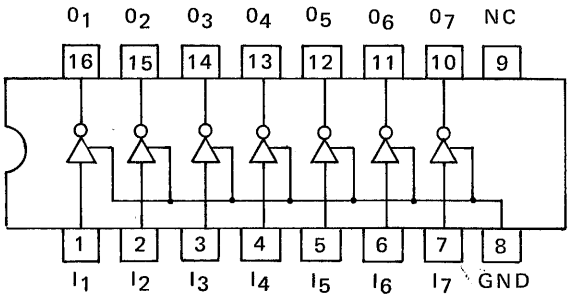


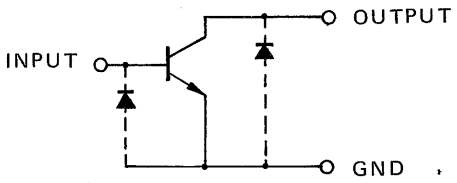
IC-3 SN7426N



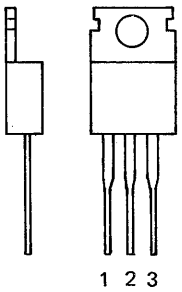


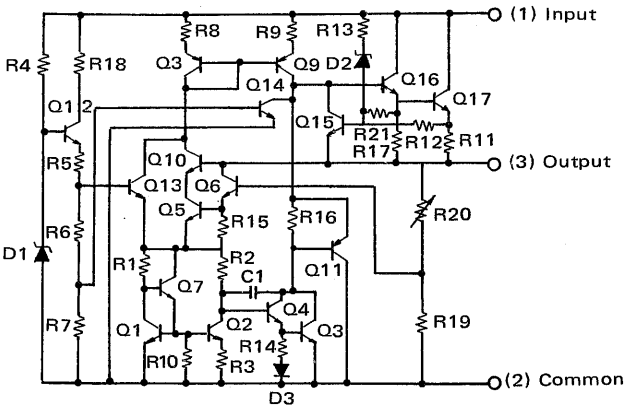
IC-4 TD62501P



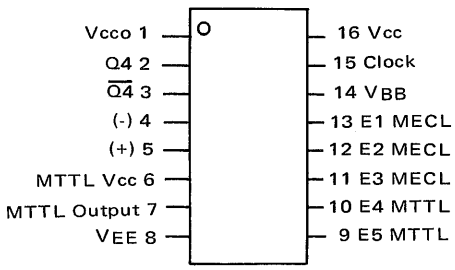


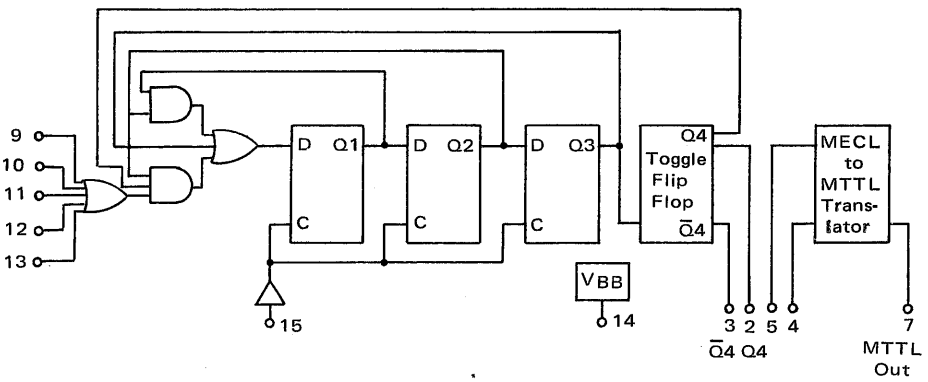
IC-5 HA17808



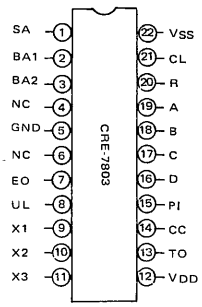


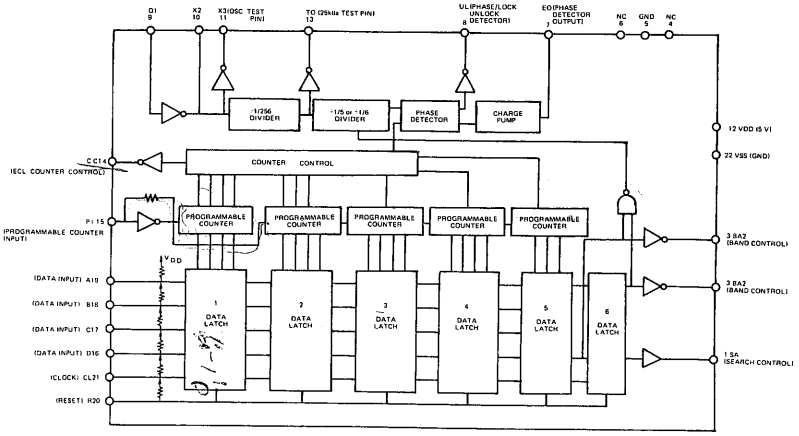
IC-6 MC12013P



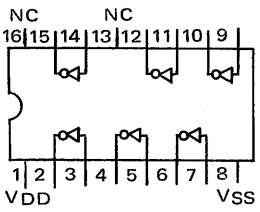


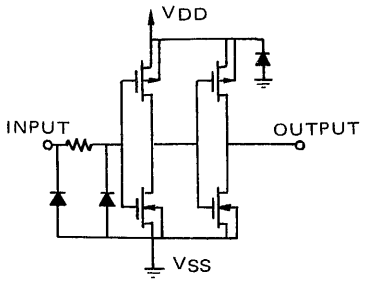
IC-7 GRE-7803A



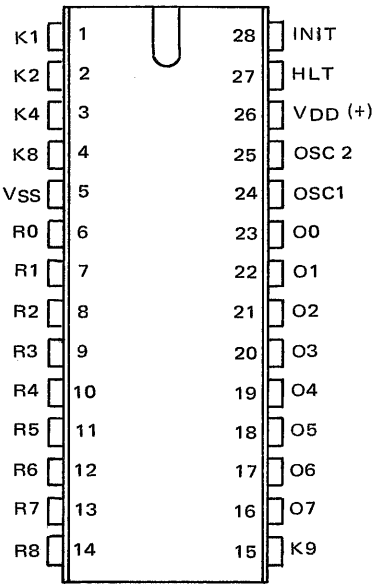


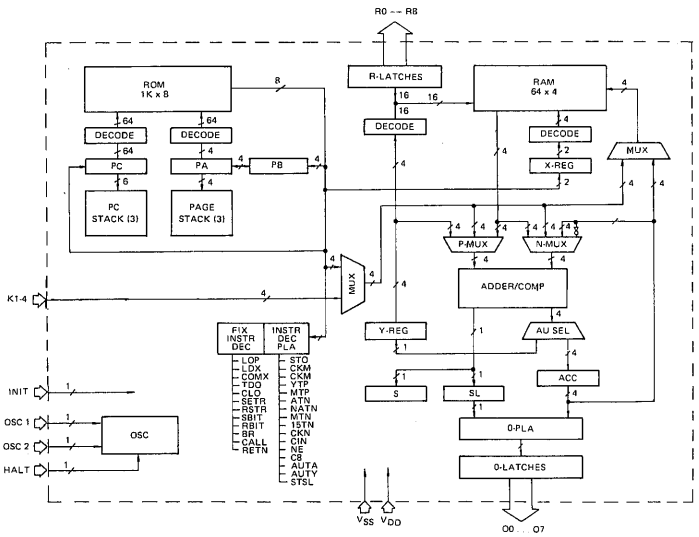
IC-8 TC4050BP



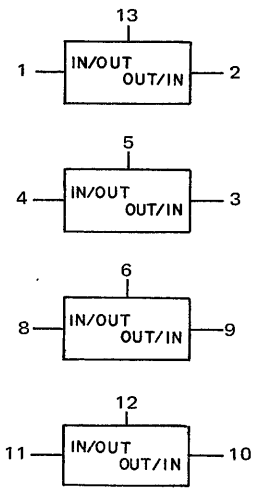


IC-9 GRE-7831

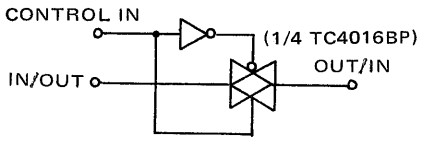




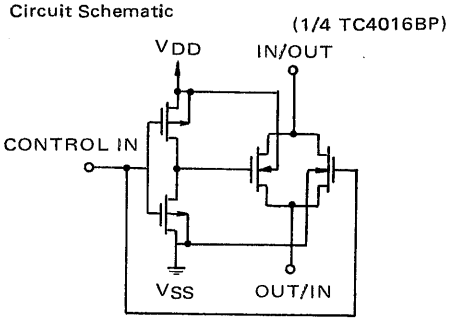
IC-10 TC4016BP



Logic Symbol

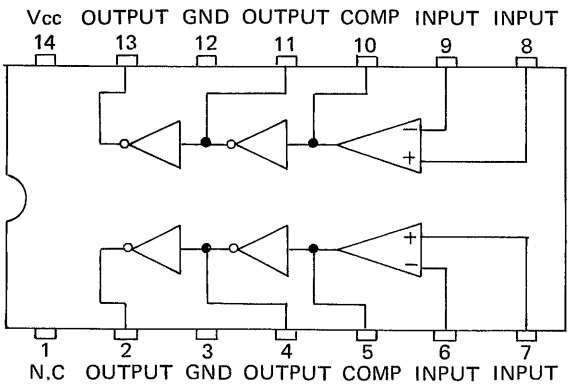


Circuit Schematic



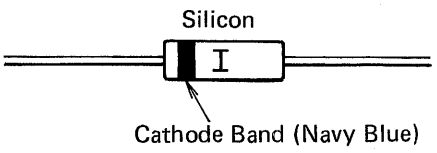
VDD : 14, VSS : 7

IC-11 TA7521P

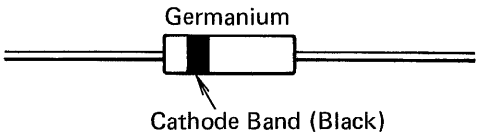


DIODE IDENTIFICATION AND LEAD POLARITY

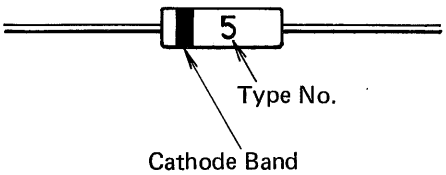
A) 1S2076A



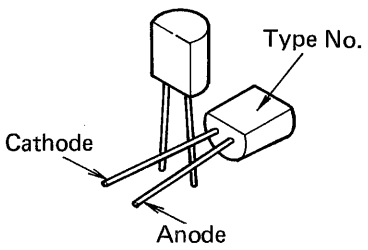
B) 1N60



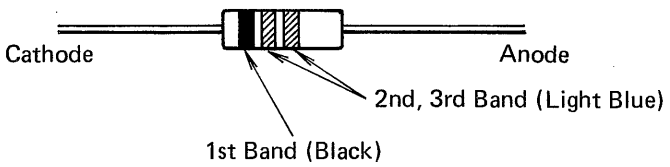
C) HZ 5C-2, HZ 9LC-3, HZ 16LC-1 Zener



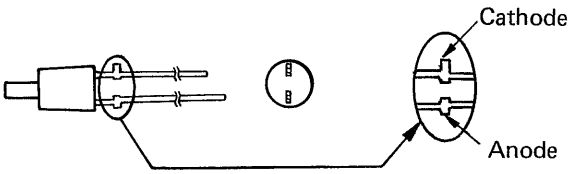
D) FC-53, FC-54 Varactor



E) 1SV89B Varactor



F) TLR206



SEMICONDUCTOR LEAD IDENTIFICATION

A) 3SK77 (GR)

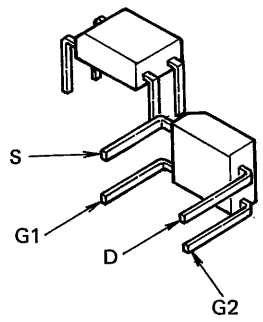
B) 2SK19 (Y)

C) 2SC1923 (O), 2SC1815 (GR), 2SA1015 (O), 2SC2347, 2SC732 (BL), 2SC1384 (R)

D) 2SC535 (B)

E) 2SC1117

Ⓐ



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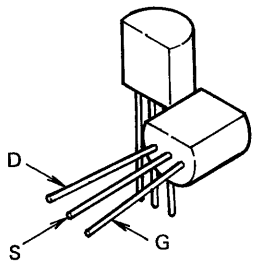

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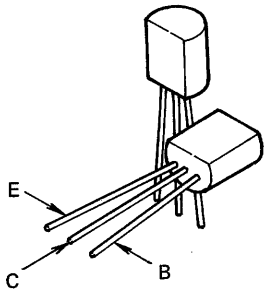

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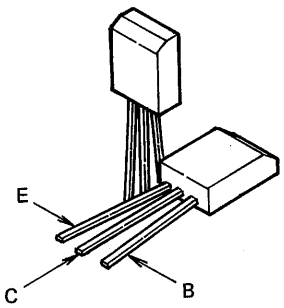

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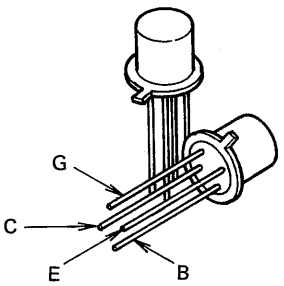
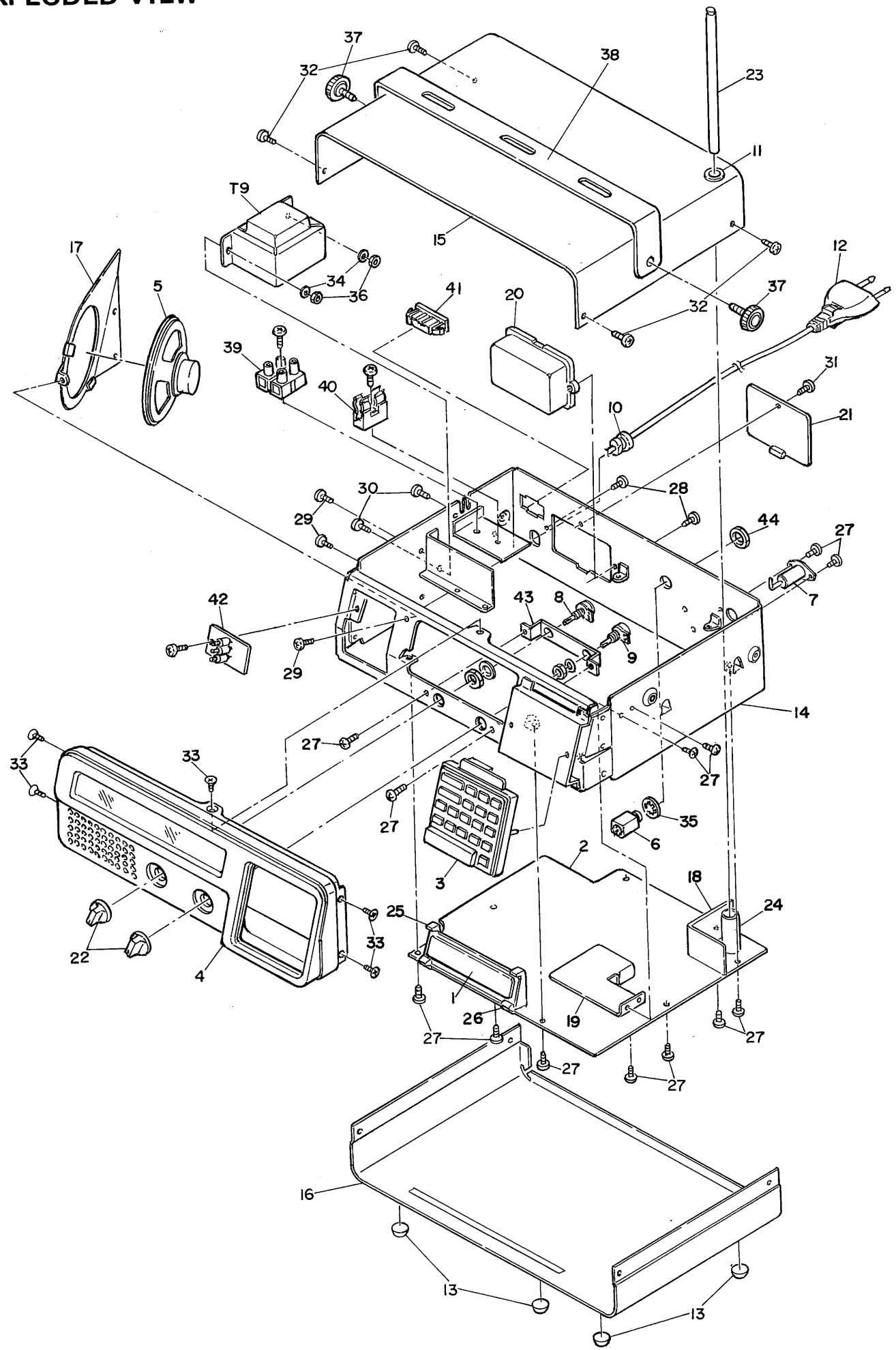


EXPLODED VIEW



PARTS LIST

CAPACITORS

NOTE: Temperature characteristics
(C) NP0
(R) N220
(TH) N470
(U) N750

Ref. No.	Value	Voltage (V)	Tolerance (%)	Material
C1	2pF	50	±0.5pF	Ceramic
C2	33pF	50	±10	Ceramic
C3	100PF	50	±0.5pF	Ceramic
C4	.001μF	50	±10	Ceramic
C5	33pF	50	±10	Ceramic
C6	.001μF	50	±10	Ceramic
C7	33pF	50	±10	Ceramic
C8	33pF	50	±10	Ceramic
C9	.001μF	50	±10	Ceramic
C10	2pF	50	±0.5pF	Ceramic
C11	.001μF	50	±10	Ceramic
C12	10μF	16	−10 +50	Electrolytic
C13	47pF	50	±10	Ceramic
C14	27pF	50	±10	Ceramic
C15	33pF	50	±10	Ceramic
C16	.0047μF	50	±10	Ceramic
C17	5pF	50	±10	Ceramic
C18	100pF	50	±10	Ceramic
C19	.047μF	50	±10	Mylar
C20	5pF	50	±0.5pF	Ceramic
C21	5pF	50	±0.5pF	Ceramic
C22	56pF	50	±10	Ceramic
C23	.001μF	50	±10	Ceramic
C24	100pF	50	±10	Ceramic
C25	10μF	16	−10 +50	Electrolytic
C26	.001μF	50	±10	Ceramic
C27	56pF	50	±10	Ceramic
C28	.001μF	50	±10	Ceramic
C29	33pF	50	±10	Ceramic
C30	10pF	50	±0.5pF	Ceramic
C31	.001μF	50	±10	Ceramic
C32	5pF	50	±0.5pF	Ceramic
C33	10pF	50	±0.5pF	Ceramic
C34	33pF	50	±10	Ceramic
C35	33pF	50	±10	Ceramic
C36	2pF	50	±0.5pF	Ceramic
C37	20pF	50	±10	Ceramic
C38	2pF	50	±0.5pF	Ceramic
C39	.001μF	50	±10	Ceramic
C40	5pF	50	±0.5pF	Ceramic
C41	20pF	50	±10	Ceramic
C42	.047μF	50	±10	Mylar
C43	.0047μF	50	±10	Ceramic
C44	100pF	50	±10	Ceramic
C45	.001μF	50	±10	Ceramic
C46	15pF	50	±10	Ceramic
C47	33pF	50	±10	Ceramic
C48	5pF	50	±0.5pF	Ceramic
C49	5pF	50	±0.5pF	Ceramic
C50	10pF	50	±0.5pF	Ceramic
C51	.001μF	50	±10	Ceramic
C52	10μF	16	−10 +50	Electrolytic
C53	.001μF	50	±10	Ceramic
C54	.001μF	50	±10	Ceramic
C55	.01μF	50	±10	Mylar
C56	.001μF	50	±10	Ceramic
C57	56pF	50	±10	Ceramic
C58	120pF	50	±10	Ceramic
C59	.47μF	35	±20	Tantalum
C60	.01μF	50	±10	Mylar
C61	3pF	50	±0.5pF	Ceramic
C62	.1μF	50	±10	Mylar
C63	.1μF	35	±20	Tantalum
C64	.047μF	50	±10	Mylar
C65	22pF	50	±10	Ceramic
C66	150pF	50	±10	Ceramic
C67	27pF	50	±10	Ceramic
C68	150pF	50	±10	Ceramic
C69	.1μF	35	±20	Tantalum
C70	220μF	10	−10 +50	Electrolytic
C71	.001μF	50	±10	Mylar
C72	.01μF	50	±10	Mylar
C73	.01μF	50	±10	Mylar
C74	.01μF	50	±10	Mylar
C75	.01μF	50	±10	Mylar
C76	470μF	16	−10 +50	Electrolytic
C77	47μF	16	−10 +50	Electrolytic
C78	100pF	50	±10	Ceramic
C79	3.3μF	16	±20	Tantalum
C80	47μF	16	−10 +50	Electrolytic
C81	.001μF	50	±10	Ceramic
C82	47μF	16	−10 +50	Electrolytic
C83	.01μF	50	±10	Mylar
C84	47μF	16	−10 +50	Electrolytic
C85	.001μF	50	±10	Ceramic
C86	10pF	50	±0.5pF	Ceramic
C87	.1μF	50	±10	Mylar
C88	.001μF	50	±10	Ceramic
C89	.001μF	50	±10	Ceramic
C90	.01μF	50	±10	Mylar
C91	.01μF	50	±10	Mylar
C92	.1μF	50	±10	Mylar
C93	.001μF	50	±10	Ceramic
C94	27pF	50	±10	Ceramic
C95	.01μF	50	±10	Mylar
C96	22pF	50	±10	Ceramic
C97	56pF	50	±10	Ceramic
C98	.01μF	50	±10	Mylar
C99	.1μF	35	±20	Tantalum
C100	.01μF	50	±10	Mylar
C101	.022μF	50	±10	Mylar
C102	.01μF	50	±10	Mylar
C103	.1μF	50	±10	Mylar
C104	47μF	16	−10 +50	Electrolytic
C105	1μF	50	±30	Electrolytic (non-polarity)
C106	.01μF	50	±10	Mylar
C107	47μF	16	−10 +50	Electrolytic
C108	.01μF	50	±10	Mylar
C109	10μF	16	−10 +50	Electrolytic
C110	1000μF	10	−10 +50	Electrolytic
C111	.47μF	35	±20	Tantalum

Ref. No.	Value	Voltage (V)	Tolerance (%)	Material
C112	27pF	50	±10	Ceramic
C113	1000μF	10	−10 +30	Electrolytic
C114	.1μF	35	±20	Tantalum
C115	.1μF	35	±20	Tantalum
C116	2200μF	25	−10 +30	Electrolytic
C117	10μF	16	−10 +50	Electrolytic
C118	47μF	16	−10 +50	Electrolytic
C119	.01μF	50	±10	Mylar
C120	47μF	16	−10 +50	Electrolytic
C121	4.7μF	35	−10 +50	Electrolytic
C122	.1μF	50	±10	Mylar
C123	100μF	10	−10 +50	Electrolytic
C124	.01μF	50	±10	Mylar
C125	47μF	16	−10 +50	Electrolytic
C126	.01μF	50	±10	Mylar
C127	33pF	50	±10	Ceramic
C128	5pF	50	±0.5PF	Ceramic
C129	Not used			
C130	Not used			
C131	.1μF	35	±20	Tantulum
C132	.1μF	50	±10	Mylar
C133	100pF	50	±10	Ceramic
C134	.01μF	50	−20 +80	Ceramic
C135	.01μF	50	−20 +80	Ceramic
C136 ~ C149	Not used			
C150	1μF	50	−10 +50	Electrolytic
C151	47μF	16	−10 +50	Electrolytic
C152	.47μF	50	±10	Mylar

RESISTORS

NOTE: Unless otherwise specified all resistors are carbon film, wattage 1/4W, tolerance ±5%

Ref. No.	Value	Handic Part No.	Wattage (W)	Tolerance (%)	Material
R1	47kΩ				
R2	4.7kΩ				
R3	10kΩ				
R4	10kΩ				
R5	47kΩ				
R6	330Ω				
R7	47kΩ				
R8	100Ω				
R9	10kΩ				
R10	2.2kΩ				
R11	2.2kΩ				
R12	4.7kΩ				
R13	1kΩ				
R14	10kΩ				
R15	4.7kΩ				
R16	1kΩ				
R17	47kΩ				
R18	47kΩ				
R19	47kΩ				
R20	2.2kΩ				
R21	330Ω				
R22	47kΩ				
R23	100Ω				
R24	47kΩ				
R25	47kΩ				
R26	2.2kΩ				
R27	47kΩ				
R28	470Ω				
R29	4.7kΩ				
R30	10kΩ				
R31	47kΩ				
R32	100Ω				
R33	3.3kΩ				
R34	33kΩ				
R35	1kΩ				
R36	22kΩ				
R37	4.7kΩ				
R38	8.2kΩ				
R39	1kΩ				
R40	1kΩ				
R41	100kΩ				
R42	1kΩ				
R43	47kΩ				
R44	2.2kΩ				
R45	1kΩ				
R46	10kΩ				
R47	100kΩ				
R48	100Ω				
R49	1kΩ				
R50	4.7kΩ				
R51	100kΩ				
R52	3.3kΩ				
R53	68kΩ				
R54	100kΩ				
R55	2.2kΩ				
R56	4.7kΩ				
R57	3.3kΩ				
R58	1MΩ				
R59	47kΩ				
R60	22kΩ				
R61	22kΩ				
R62	22kΩ				
R63	470Ω				
R64	22kΩ				
R65	10kΩ				
R66	22kΩ				
R67	1.5MΩ				
R68	120kΩ				
R69	470Ω				
R70	100Ω				
R71	82Ω				
R72	Not used				
R73	22kΩ				
R74	22kΩ				
R75	22kΩ				
R76	2.2kΩ				
R77	2.2kΩ				
R78	2.2kΩ				
R79	22kΩ				
R80	22kΩ				
R81	22kΩ				
R82	2.2kΩ				
R83	47kΩ				
R84	3.3kΩ				
R85	18kΩ				
R86	33kΩ				
R87	100Ω				

Ref. No.	Value	Handic Part No.	Watt-age (W)	Toler-ance (%)	Material
R88	470Ω				
R89	2.2kΩ				
R90	1kΩ				
R91	100Ω				
R92	5.6kΩ				
R93	5.6kΩ				
R94	22kΩ				
R95	22kΩ				
R96	22kΩ				
R97	22kΩ				
R98	33kΩ				
R99	100kΩ				
R100	1kΩ				
R101	3.3kΩ				
R102	3.3kΩ				
R103	1.5kΩ				
R104	1kΩ				
R105	470Ω				
R106	2.2kΩ				
R107	3.3kΩ				
R108	1MΩ				
R109	1kΩ				
R110	100Ω				
R111	470Ω				
R112	1.5kΩ				
R113	33kΩ				
R114	33kΩ				
R115	33kΩ				
R116	33kΩ				
R117	47kΩ				
R118	10kΩ				
R119	100kΩ				
R120	47kΩ				
R121	33Ω		5	5	Cement
R122	100kΩ				
R123	100kΩ				
R124	100kΩ				
R125	33Ω		2	5	Metal film
R126	1Ω		1	5	Metal film
R127	Not used				
R128	1.8kΩ				
R129	33Ω				
R130	10kΩ				
R131	2.2kΩ				
R132	22kΩ				
R133	47kΩ				
R134	470Ω				
R135	10kΩ				
R136	10kΩ				
R137	22Ω				
R138	10kΩ				
R139	1kΩ				
R140	1kΩ				
R141	1kΩ				
R142 R149	Not used				
R150	2.2kΩ				
R151	3.3kΩ				
R152	22kΩ				
R153	3.3kΩ				
R154	22kΩ				
R155	100kΩ				

Ref. No.	Value	RS Part No.	Watt-age (W)	Toler-ance (%)	Material
R156	470kΩ				
R157	3.3kΩ				
R158	2.2kΩ				
R159	5.6kΩ				
R160	3.3kΩ				
R161	10kΩ				

TRANSISTORS

Ref. No.	Type No.	Substitute Type No.
Q1	3SK77(GR)	
Q2	2SK19(Y)	
Q3	2SC1923(O)	
Q4,5	3SK77(GR)	
Q6,7	2SC1117	
Q8	2SC1923(O)	
Q9	2SC2347	
Q10	2SC1815(GR)	
Q11 – 13	2SA1015(O)	
Q14	2SC535(B)	
Q15,16	2SC1815(GR)	
Q17 – 20	2SC732(BL)	
Q21,22	2SC1815(GR)	
Q23	2SC1384(R)	
Q24 – 26	2SC1815(GR)	

COILS & TRANSFORMERS

Ref. No.	Description	Handic Part No.	MFR's Part No.
T1	RF Coil		GR-N553
T2	RF Coil		GR-N553
T3	OSC Coil		GR-N544
T4	RF Coil		6.5SNO-097
T5	RF Coil		6.5SNO-097
T6	OSC Coil		6.5SNO-097
T7	IF (10.7 MHz)		119LC-470033N3
T8	Quad. (455 kHz)		7MC-452503N4
T9	Power Transformer		K6862
T10	DC-DC Converter Transformer		GRE-021 or GRE-021A
L1	Choke Coil		4LNC-092
L2	Choke Coil		4LNC-0122
L3~6	UHF Coil		GR-M-545
L7	Choke Coil		3B-037

DIODES

Ref. No.	Description	MFR's Part No.
D1 – 3	Variable Capacitor Diode	FC-54
D4 – 7	Variable Capacitor Diode	1SV89B
D8, 9	Silicon	1S2076A, HV-80, 1S1588
D10, 11	Variable Capacitor Diode	1SV89B
D12	Silicon	1S2076A, HV-80, 1S1588
D13	Germanium	1N60
D14, 15	Silicon	1S2076A, HV-80, 1S1588
D16 – 19	Silicon	1S2076A
D20	Silicon	1S2076A, HV-80, 1S1588
D21	Not used	
D22 – 29	Silicon	1S2076A
D30	Zener Diode	HZ5C-2
D31	Germanium	1N60
D32	Rectifier	1B4B1
D33, 34	Silicon	1S2076A
D35	Zener Diode	HZ9LC-2, HZ9LC-3
D36	Zener Diode	HZ16L-1
D37, 38	Silicon	1S2076A, HV-80, 1S1588
D39	Zener Diode	HZ5C-2
D40	Not used	
D41 – 43	Silicon	1S2076A,HV-80, 1S1588
D44	Silicon	1S1885
D45 – 49	Not used	
D50 – 52	Germanium	1N60
LED1 – 3	Light Emitting Diode	TLR-206

CRYSTALS & CRYSTAL FILTERS

Ref. No.	Description	Handic No.	MFR's Part No.
X1	Crystal (10.245 MHz)		
X2	Crystal (6.4 MHz)		
XF1	Filter (10.7 MHz)		10M15A
CF1	Filter (455 kHz)		LF-H18S
BTF	Trap Filter		20LTR-141

INTEGRATED CIRCUITS

Ref. No.	Type No.	Substitute Type No.
IC1	MC3357P or MPS5071	
IC2	SN76007N	
IC3	SN7426N	
IC4	TD62501P	
IC5	HA17808P	
IC6	MC12013P	
IC7	GRE-7803A	
IC8	TC4050BP	
IC9	GRE-7831	
IC10	TC4016BP	
IC11	TA7521P	

VARIABLE CAPACITORS

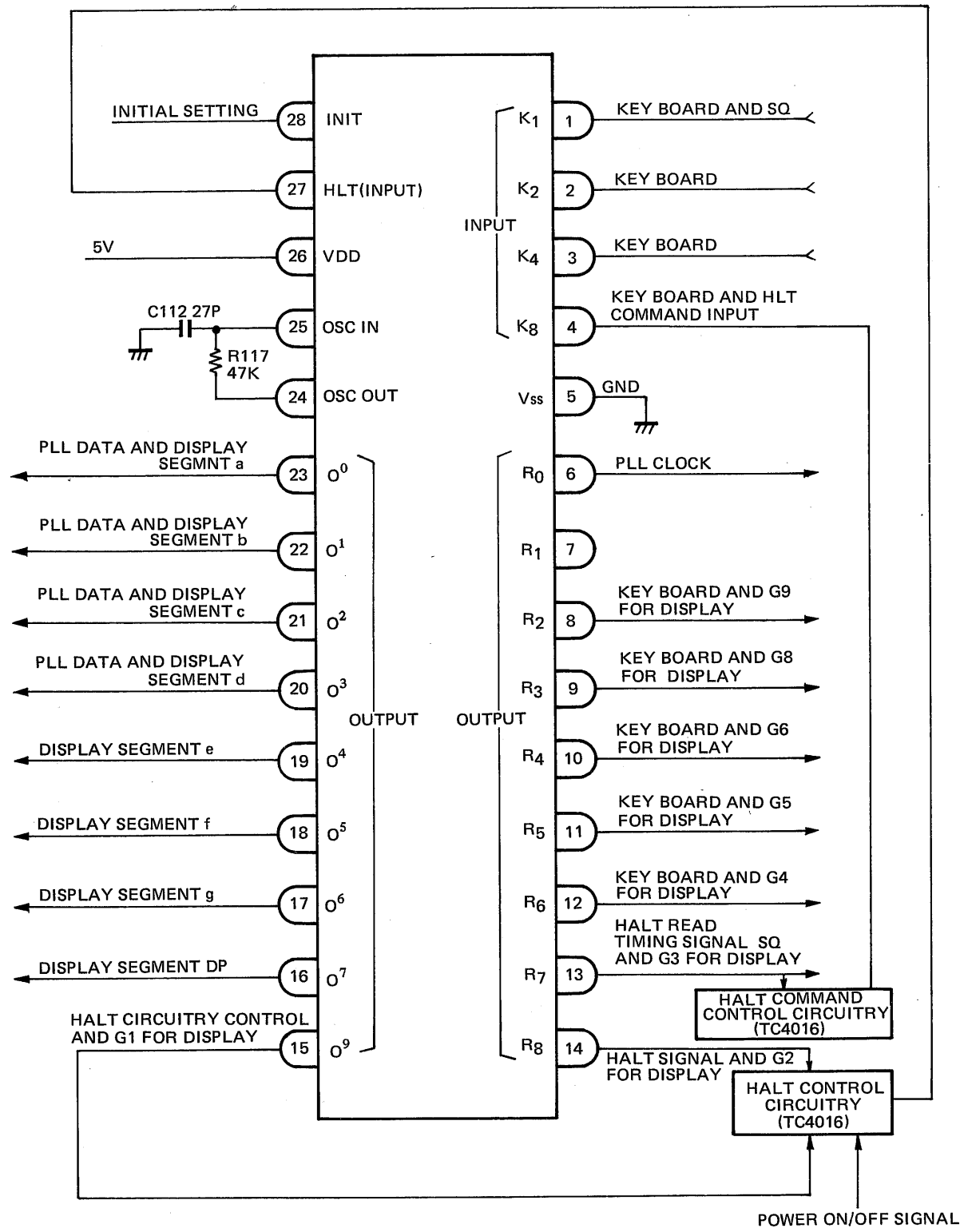
Ref. No.	Description	Handic No.	MFR's Part No.
TC1 – 5	Trimmer (10P)		ECV-1ZW10x53
TC6	Trimmer (20P)		ECV-1ZW20x53

MISCELLANEOUS

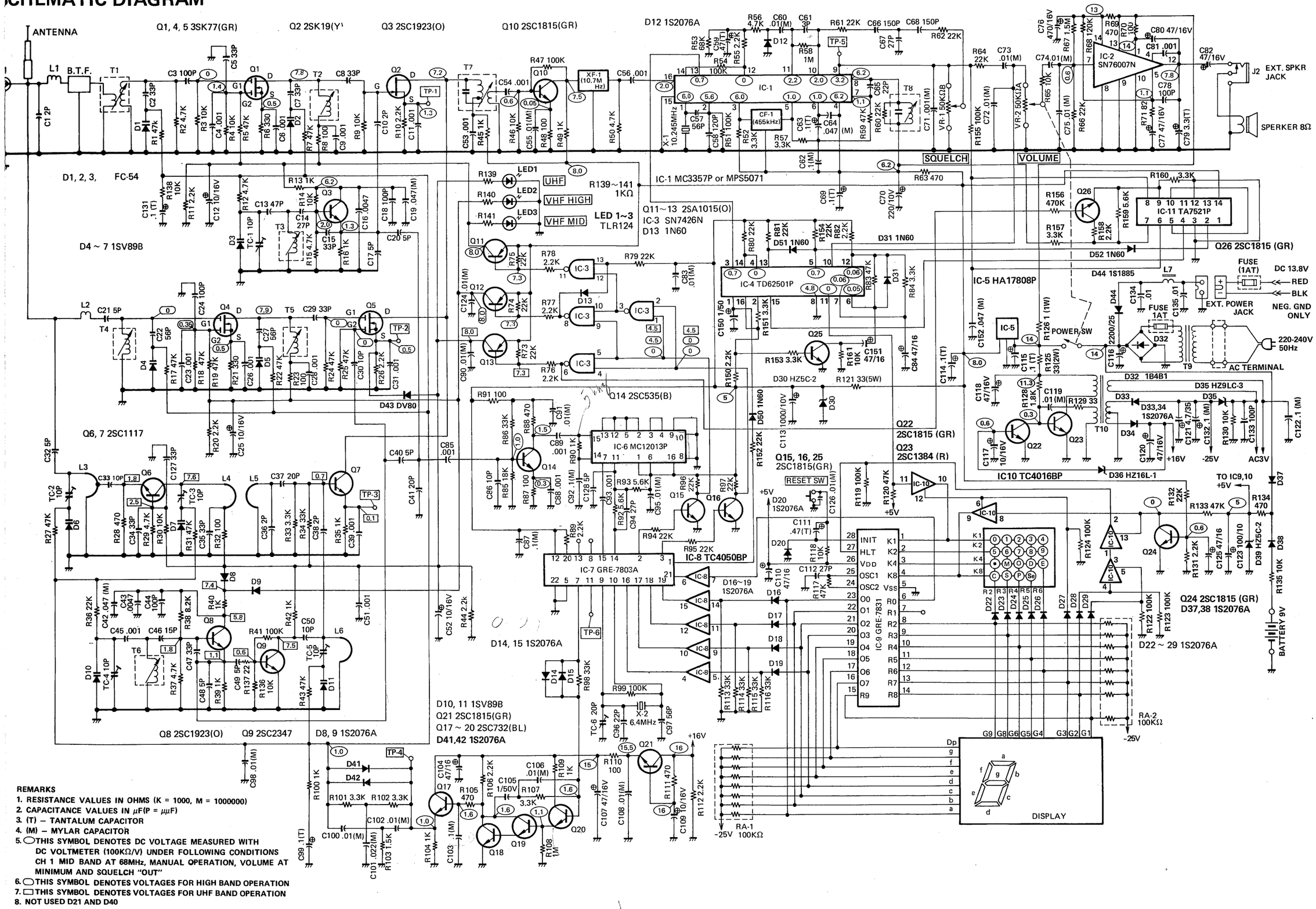
Ref. No.	Description	Handic Part No.	MFR's Part No.
RA – 1, 2	Resistor Array		EXB-P88-100kΩ
	Short Jumper		ERD-14T0A
	Test Pin		CHP-01
	Tight Pipe		ℓ = 20 mm
(1)	Fluorescent Indicator		9-BT-02A
(2)	Main P.C. Board Ass'y		GE-80B-1356
	Main P.C. Board		GE-23B-7737S
(3)	Key Board Ass'y		
	Connector		5048-09A
	Badge		GE-80D-1051
	Key Board		KEA6A045
(4)	Bezel Ass'y		
	Front Escutheon		GE-79A-0676
	L.E.D. Window		GE-79D-0677
(5)	Speaker		C080A20N1313
(6)	EXT. Speaker Jack		S-G7615 #2
(7)	Antenna Jack		JA-C-020
(8)	Volume Control W/SW		VM11A975-5M1411-50KA
(9)	Squelch Control		VM10A-50kΩB-25A
	Reset Switch W/button		KS-R75-0107112-02A
(10)	Line Cord Stain Relief		SR-4N4
(11)	Snap Bushing		SB-437-5
(12)	AC Cord		HAR CLASS-2 (2m)
	Battery Snap		1 type
(13)	Foot		SJ-5027(black)
(14)	Chassis		GE-79A-0674
(15)	Bonnet (Top)		GE-79B-0107
(16)	Bonnet (Bottom)		GE-79B-0108
(17)	Speaker Holder		GE-79C-0109
(18)	RF Shield Plate		GE-79D-0110
	VCO Shield Plate		GE-79D-0348
	VCO Shield Fiber		GE-79D-0349
(19)	PLL Shield Plate (Top)		GE-79D-0455
	PLL Shield Plate (Bottom)		GE-79D-0456
	PLL Shield Fiber		GE-79D-0457
(20)	Battery Box		GE-21D-5728
(21)	Battery Compartment Cover Ass'y		
	Battery Compartment Cover		GE-79D-0113
	Battery Notice Label		GE-80D-0892
	Batterc Cushion		GE-21D-5795
(31)	Battery Compartment Screw		GE-80D-0968
(22)	Volume Knob		GE-20D-5514
(23)	Telescopic Antenna		F2007-113
(24)	Antenna Guide		GE-79D-0118
	AC Cord Bind		No. 5121
	Model Label		GE-80D-1131
	Caution Label		GE-19D-4860

Ref. No.	Description	Handic Part No.	MFR's Part No.
(25)	Display Holder (A)		GE-79D-0451
(26)	Display Holder (B)		GE-79D-0452
(27)	Round-Head Self Tapping Screws		3 x 6 mm
(28)	Round-Head Self Tapping Screws		3 x 8 mm
(29)	Pan-Head Screws		3 x 6 mm
	Pan-Head Screws		3 x 12 mm
(30)	Pan-Head Screws		4 x 8 mm
(32)	Binding-Head Screws (Black)		3 x 8 mm
(33)	Countersunk Head Screws		3 x 6 mm
	Internal Star Lock Washer		3 ϕ
(34)	Internal Star Lock Washer		4 ϕ
(35)	Internal Star Lock Washer		9 ϕ
(36)	Hex Nuts		4 ϕ
(37)	Bracket Screws		GE-23D-7587
(38)	Mounting Bracket		GE-21C-5725
	Mounting Bracket Spacer		GE-19D-4815
(39)	Terminal Block		323-HDS-12P
(40)	Fuse Holder		H-N1150#2
	Miniture Fuse		SEMKO Type 250V/1AT
	AC Terminal Fiber		GE-80D-1184
(41)	DC Jack		GE-22D-6940
	DC Cable Ass'y		GE-22D-6942
	DC Cable Label		GE-79D-0666
(42)	L.E.D. P.C. Board Ass'y		
	L.E.D. P.C. Board		GE-79D-0730
	Light Emitting Diode (LED1–3)		TLR-206
(43)	Volume Bracket		GE-79D-0675
(44)	Hex Nuts		9 ϕ
	Speaker Himeron		GE-79D-0738
	L.E.D. Himeron		GE-79D-0679

MICROPROCESSOR (IC-9) PORT ALLOCATION



SCHEMATIC DIAGRAM



REMARKS

1. RESISTANCE VALUES IN OHMS (K = 1000, M = 1000000)
2. CAPACITANCE VALUES IN μF(P = μμF)
3. (T) – TANTALUM CAPACITOR
4. (M) – MYLAR CAPACITOR
5. ⬭ THIS SYMBOL DENOTES DC VOLTAGE MEASURED WITH DC VOLTMETER (100KΩ/V) UNDER FOLLOWING CONDITIONS CH 1 MID BAND AT 68MHz, MANUAL OPERATION, VOLUME AT MINIMUM AND SQUELCH "OUT"
6. ⬭ THIS SYMBOL DENOTES VOLTAGES FOR HIGH BAND OPERATION
7. ▭ THIS SYMBOL DENOTES VOLTAGES FOR UHF BAND OPERATION
8. NOT USED D21 AND D40