



FOX TANGO INTERNATIONAL

MAINTENANCE SERVICE MANUAL CPU-2500R

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INDEX

FOREWORD	(Page) i
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SECTION 1 – GENERAL

GENERAL DESCRIPTION	I-1
SPECIFICATIONS	I-2
SEMICONDUCTOR COMPLEMENT AND ACCESSORIES	I-3
CONTROLS AND SWITCHES	I-4
REAR APRON CONNECTIONS	I-6
INSTALLATION	I-7
OPERATION	I-8
MICROPHONE CONNECTIONS	I-10

SECTION 2 – TECHNICAL NOTES

BLOCK DIAGRAM	2-1
CIRCUIT THEORY	2-3
CRYSTAL DATA	2-6

SECTION 3 – SERVICING

REMOVAL OF CABINET AND FRONT PANEL	3-1
MODIFICATIONS	
POWER SOCKET	3-4
REVERSED CAPACITOR CHECK	3-5
MODULATOR CHANGE	3-6
TONE SQUELCH MODIFICATION	3-8
FREQUENCY RANGE MODIFICATION	3-9
LEVEL DIAGRAM	3-12
RX/RESONATOR UNIT PARTS LAYOUT	3-14
RX UNIT CIRCUIT DIAGRAM	3-16
TX UNIT PARTS LAYOUT	3-18
BOOSTER UNIT PARTS LAYOUT	3-21
PLL/VCO UNIT PARTS LAYOUT	3-22
PLL/VCO CIRCUIT DIAGRAM	3-24
PLL CONTROL UNIT PARTS LAYOUT	3-26
CPU/TONE ENCODER LOGIC CHART	3-27
PROGRAMABLE DIVIDER LOGIC CHART	3-28
SCAN CONTROL CIRCUIT TIMING CHART	3-30
DRIVE/DISPLAY UNIT PARTS LAYOUT	3-32
DRIVE/DISPLAY UNIT CIRCUIT DIAGRAM	3-34
PHOTO UNIT PARTS LAYOUT	3-35
SW UNIT/MONITOR UNIT PARTS LAYOUT	3-36
TONE SQUELCH UNIT PARTS LAYOUT	3-37

SOLDERING AND DESOLDERING TECHNIQUE	3-38
CIRCUIT TRACE REPAIR	3-40
RELAY CONNECTION INFORMATION	3-42
MAINTENANCE AND ALIGNMENT	3-43
TROUBLESHOOTING	3-50

SECTION 4 – REPAIR PARTS

PARTS LIST AND ORDERING DATA	4-1
PARTS LIST	4-5

FOREWORD

The purpose of this manual is to provide the reader with information critical to the operation and maintenance of the CPU-2500R transceiver. Technical details are geared for maximum comprehension by the technician or owner, rather than the design engineer. To this end, the descriptions have been kept brief, while photographs and drawings are utilized liberally.

Use of this manual is entirely at the owner's risk. While we believe the material presented herein to be correct and factual, we assume no liability for damage which may occur when this manual is used as a reference.

The CPU-2500R has had an enviable service record, and we trust that you will seldom have recourse to this manual. Should reference be necessary, though, we hope and trust that the information presented will be sufficient for your service needs.

The author wishes to express his gratitude to the engineering and service staffs of Yaesu Musen Company and Yaesu Electronics Corporation, whose skills and insights have contributed significantly to the completion of this manual.

73,



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CPU-2500R 2 METER FM TRANSCEIVER WITH CENTRAL PROCESSING UNIT



GENERAL DESCRIPTION

The CPU-2500R is a revolutionary, ultimate performance transceiver for the most demanding 2 meter FM operator. Controlled by a central processing unit, the CPU-2500R features full PLL synthesis in 5 kHz steps, thus producing 800 channels between 144 and 148 MHz. An optical coupling frequency selection system utilizes photo-interrupters, eliminating ordinary rotary switches which can become oxidized and noisy.

The central processing unit allows never-before-possible operating flexibility. As many as four memory channels may be programmed for simplex or repeater operation, and an additional channel may be programmed for split operation on any frequency. The CPU-2500R PLL scanner will sweep up or down the band, and will also scan only the four memory channels, per your instructions.

Two microphones are available for use with the CPU-2500R. The standard microphone features the normal PTT switch plus up/down scanning controls. A versatile keyboard microphone allows

remote input of memory or dial frequencies, up/down scanning control, auxiliary repeater split selection of up to 4 MHz, and two-tone input for autopatch or control link purposes.

Among the other exciting features of the CPU-2500R are automatic or manual tone burst/tone call operation, selectable power output of 25W/3W, and a memory backup feature for holding memorized frequencies when the transceiver is turned off. A fully adjustable subaudible tone guarded squelch (TGS) is available as an option.

Famous Yaesu design features include automatic final protection for the output transistors, as well as reversed polarity protection for the supply input. The CPU-2500R is supplied complete with all mounting hardware, cables, and accessories required for mobile use, as well as a stand for base station use. The solid state devices used in the space-age CPU-2500R assure you of many years of trouble-free operation.

SPECIFICATIONS

Frequency range:

144 – 148 MHz*
144.000 – 147.995 MHz receive
144.010 – 147.995 MHz transmit

*Factory modified to 144 – 146 MHz,
if required by local regulations.

Synthesizer steps:

10 kHz, with 5 UP switch for intermediate
steps.

Emission type:

F3 variable reactance frequency modulation.

Deviation:

± 5 kHz factory preset, ± 16 kHz maximum

Power output:

25 watts (HI), 3 watts (LOW) @ 13.6 VDC
into 50 ohm load.

Spurious emissions:

Better than 60 dB down.

Antenna impedance:

50 ohms nominal.

Microphone impedance:

600 ohms

Tone burst frequency:

1800 Hz (USA model),
1750 Hz (Europe, etc.)

Receiver type:

Double conversion superheterodyne.

Receiver sensitivity:

0.3 μ V for 20 dB QS

Selectivity:

±6 kHz at 6 dB down, ±12 kHz at 60 dB
down.

First IF:

10.7 MHz

Second IF:

455 kHz

Audio output:

1.5 watts @ 10% THD.

Audio output impedance:

8 ohms.

Voltage requirement:

13.6 volts ± 10%

Current consumption:

0.5 A receive
6.0 A transmit (HIGH), 2.5 A (LOW)

Case dimensions:

180 (W) x 72 (H) x 270 (D) mm.

Weight:

3.2 kg.

SEMICONDUCTOR COMPLEMENT

GENERAL

Integrated Circuits		Field-Effect Transistors		Photo-Interrupter	
MN9003 (CPU)	1	2SK19BL	1	ON1105	2
MC14011B	5	2SK19GR	3		
MC14042B	1	2SK30AY	1	Germanium Diodes	
MC14069B	1	3SK40M	3	1S188FM	11
MC14410	1	3SK51	3		
MC14556B	1			Silicon Diodes	
MSM5576	1	Transistors		1S1555	28
TA7060P	1	2SA496Y	1	V05B	1
TC5081P	1	2SA564Q	9		
μ PC575C2	1	2SA719P	4	Varactor Diodes	
μ PC577H	1	2SC373	1	1S2209	5
μ PC14305	1	2SC535A	3	1SV50	1
μ PC14308	2	2SC741	1		
μ PD857C	1	2SC1000GR	1	Varistor Diode	
78L05	2	2SC1815Y	32	MV103	1
VP-20A	1	2SD235-O	1		
				LED Display	
				5082-7740	7

Specifications subject to change without notice or obligation.

ACCESSORIES

1. MICROPHONE 1 ea.

The standard microphone comes with a flexible, coiled cord and 6 pin connector for insertion into the front panel microphone jack. The microphone includes a PTT switch and UP/DOWN scanner controls. The keyboard microphone includes a tone pad and remote programming controls.

2. MICROPHONE HANGER 1 ea.

The hanger may be installed wherever convenient for easy access to the microphone.

3. POWER CORD 1 ea.

The power cord comes equipped with a 10 ampere fuse in the DC line.

4. SPARE FUSES 1 ea.

These fuses are for replacement if the line fuse blows. When replacing fuses, be absolutely certain to use a replacement fuse of 10 amps rating.

WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.

5. MOBILE MOUNTING BRACKET 1 ea.

For mobile installations, a universal mounting bracket is supplied.

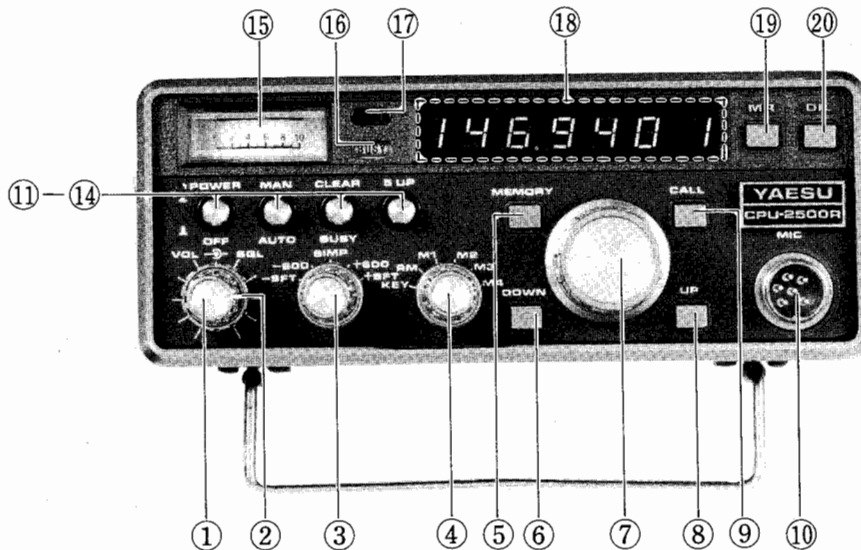
6. STAND 1 ea.

For easy viewing in base station use.

7. MINIATURE PHONE PLUG 1 ea.

For use of headphones or an external speaker.

FRONT PANEL CONTROLS AND SWITCHES

**(1) VOL**

This is the AF gain (volume) control for the transceiver. Clockwise rotation increases the audio output.

(2) SQL

This is the squelch threshold adjustment control. With no signal present, it should be adjusted to the point where receiver noise just disappears, to provide silent listening.

(3) TX OFFSET SELECTOR

SIMP – This position chooses simplex operation on the main dial frequency or memory frequencies M1–M4.

+600, –600 – These positions select the normal plus or minus 600 kHz repeater offset on the dial or M1–M4 frequencies.

+SFT, –SFT – When the keyboard microphone is used, these switch positions select remotely programmed auxiliary offset frequencies for transmit. In this way, unusual repeat splits may be accommodated.

(4) MEMORY CHANNEL SELECTOR

This six-position switch allows selection of the memorized frequencies as desired by the operator.

KEY – When the keyboard microphone is used, placing the switch in the KEY position allows programming and recall of memory frequencies from the keyboard.

RM (RECEIVE MEMORY) – When this position is selected, split operation throughout the range of the transceiver is possible. Memory position RM is used for reception, while transmission is on the dial frequency. Refer to the “Operation” section for details.

M1–M4 – These are the four main memory channels which may be programmed and recalled.

(5) MEMORY

This switch is used for programming a frequency into memory.

(6) DOWN

This button activates the CPU scanner for scanning lower in frequency. When the lower band edge is reached, the scanner’s next step will be to 147.990 MHz (145.990 MHz on the European model), thus assuring in-band operation at all times.

(7) CHANNEL SELECTOR

This is the main tuning dial for the transceiver. It is activated when the DIL button is pushed. Each tuning step is 10 kHz, with the intermediate 5 kHz steps being provided via the 5 UP switch. When the transceiver is initially turned on, the display will indicate 147.000 MHz (145.000 on the European model), and the dial may be tuned from that point to the desired operating frequency. Tuning is via an optical coupling photo-interrupter circuit.

(8) UP

This button activates the CPU scanner for scanning higher in frequency. When the upper band edge is reached, the scanner's next step will be to 144.000 MHz.

(9) CALL

When pushed, this button activates the tone burst and PTT circuit for as long as it remains depressed. In this way, a number of differing repeater access requirements may be accommodated.

(10) MIC

This is the microphone receptacle for the standard microphone. Microphone impedance is 600 ohms.

(11) POWER

Pushing this switch supplies power to all transceiver circuits.

(12) SCAN STOP

When this switch is pressed (MANUAL scan mode), the scanning feature of the CPU-2500R will scan continuously until the microphone PTT switch or the front panel CALL switch is pressed.

When this switch is not pushed (AUTO mode), the scanner will hold on a busy or clear channel, according to the position of the SCAN STOP MODE switch.

(13) SCAN STOP MODE

When using the AUTO scanner, pressing this switch (CLEAR position) will cause the scanner to halt when a clear channel is found. This is very useful when searching for an unused frequency for simplex operation, etc.

In the BUSY position, (switch not pushed), the scanner will stop and hold on an occupied channel. This feature is useful for checking a number of channels for activity.

(14) 5 UP

This switch, when pressed, shifts the operating frequency 5 kHz up from the normal 10 kHz channel spacing.

(15) METER

On receive, signal strength is displayed, and on transmit, relative power output is displayed.

(16) BUSY

This lamp lights when the squelch is tripped by an incoming signal, thus indicating that the frequency is occupied.

(17) ON AIR

This lamp lights up during transmission.

(18) DISPLAY

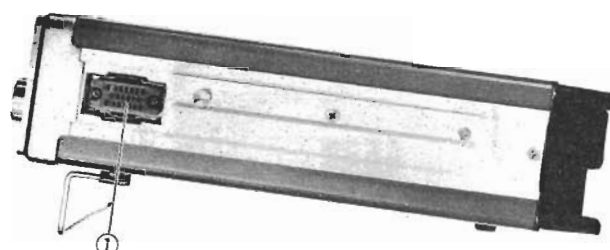
Full frequency readout is provided by the digital display. As well, the memory channel selected is displayed at the right-hand side.

(19) MR (MEMORY RECALL)

This button transfers control from the main dial to the memory channels.

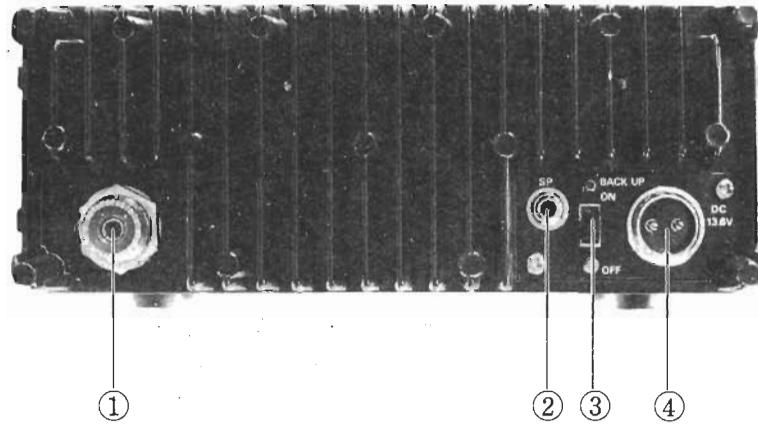
(20) DIL (DIAL)

This switch, when pressed, transfers control from the memory channels to the main tuning dial.

CABINET RIGHT SIDE**(1) KEYBOARD MIC JACK**

When the keyboard microphone is used, its input is through this jack.

REAR APRON CONNECTIONS AND SWITCH

**(1) ANT**

This is the main antenna connector.

(2) EXT SP

This is a miniature phone jack for accommodation of an external speaker. Audio output impedance is 8 ohms, and the internal speaker will be cut off when an external speaker is used via this jack.

(3) BACKUP switch

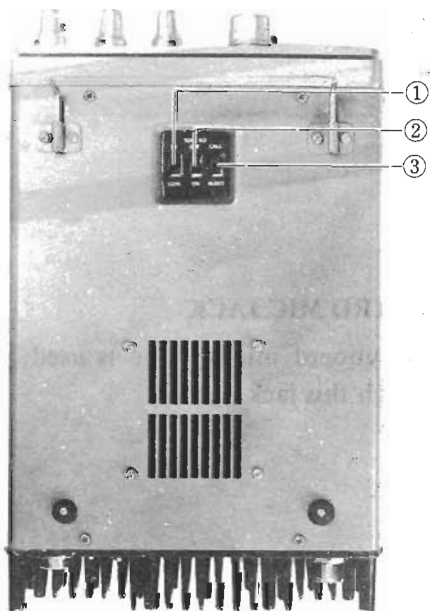
When this switch is placed in the ON position, and DC power is still connected to the POWER

connector, the memory circuits will still be held in operating condition. If DC power is removed, though, the memorized frequencies will be lost.

(4) POWER

This receptacle accommodates the power cord. A fuse is located in the power cord, rated at 10 amps. **WHEN REPLACING FUSES, BE CERTAIN TO USE A FUSE OF 10 AMPS RATING. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.**

UNDERSIDE CABINET SWITCHES

**(1) LOW POWER SWITCH**

In the LOW position, power output will be approximately 3 watts, and in the HIGH position, power output will be approximately 25 watts.

(2) TONE SQ

When the optional tone squelch unit is installed, placing this switch in the ON position will activate the subaudible encoder/decoder.

(3) BURST/CALL

When this switch is placed in the BURST position, a 1/2 second tone burst will be generated whenever the PTT switch is activated. In the CALL position, pressing the PTT switch will not cause a tone to be sent. The front panel CALL button will send a tone and activate the PTT circuit for as long as the switch is pushed, regardless of the position of the BURST/CALL switch.

INSTALLATION

MOBILE INSTALLATION

For mobile service, the CPU-2500R should be installed where the digital display, controls, and microphone are easily accessible for operation. The transceiver may be installed in any position without loss of performance. A suitable location would be atop the transmission tunnel. A universal bracket is supplied with your transceiver for mobile installation. Refer to Fig. 1 for mounting details.

1. Use the universal mounting bracket as a template for positioning the mounting holes. Use a 3/16" diameter bit for drilling these holes, allowing clearance for the transceiver, its cables and microphone, and its controls. Secure the mounting bracket with the screws, washers, and nuts supplied, as shown in the drawing.
2. Ease the transceiver into the guide rail, and slide it into the desired position. Tighten the knobs on the outside of the universal bracket to secure the transceiver.
3. The microphone hanger may be installed wherever convenient for access to the microphone.

Power connections should be made directly to the automobile battery. Routing through the cigarette lighter may cause the lighter fuse to blow if the fuse is not of sufficient rating. As well, connection directly to the battery allows the memory circuits to remain activated when the ignition is turned off, using the BACK UP switch.

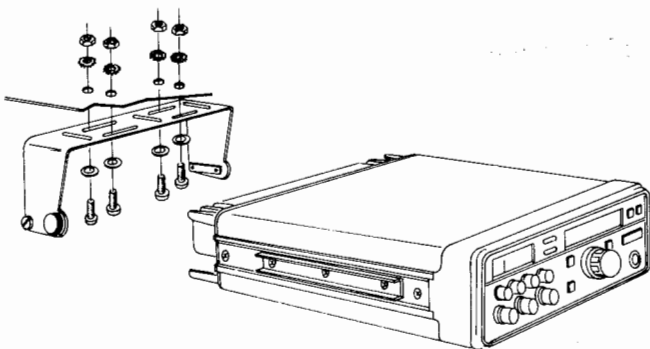


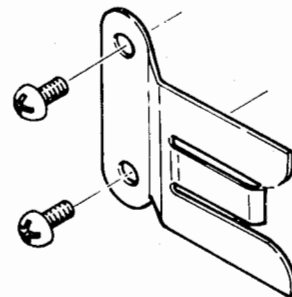
Figure 1

Connect the RED lead of the power cord to the POSITIVE (+) battery terminal, and connect the BLACK lead to the NEGATIVE (-) terminal. If it is necessary to extend the power cable, use #16 AWG insulated copper wire, and use the minimum length practicable to reduce voltage drop.

CAUTION

BEFORE CONNECTING THE POWER CABLE TO THE TRANSCEIVER, CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING (BATTERY CHARGING). IF THE VOLTAGE EXCEEDS 15 VOLTS DC, THE REGULATOR SHOULD BE READJUSTED SO THAT THE HIGHEST CHARGING RATE DOES NOT EXCEED 15 VOLTS. ALSO, BE ABSOLUTELY CERTAIN THAT THE CORRECT BATTERY POLARITY IS OBSERVED WHEN MAKING CONNECTIONS. REVERSED POLARITY WILL NOT DAMAGE THE CPU-2500R BECAUSE OF THE PROTECTIVE CIRCUITRY INCORPORATED IN DESIGN. HOWEVER, THE CPU-2500R WILL NOT OPERATE UNDER CONDITIONS OF REVERSED SUPPLY POLARITY.

Connect the power cable to the POWER receptacle on the rear apron, connect the coaxial cable from the antenna to the rear apron ANT receptacle, and connect the microphone to the jack appropriate for the microphone in use. An external speaker may be connected to the rear apron SP jack, if desired. Use the speaker plug supplied with the transceiver. Insertion of a plug into this jack automatically cuts off the internal speaker.



OPERATION

Operation instructions for the keyboard are adequately described in the Instruction Manual for the CPU-2500R, and they will not be repeated here. A summary of keyboard microphone and repeater operation is found below.

KEYBOARD MICROPHONE OPERATION

- (1) To enter a frequency from the keyboard, enter the last three digits of the operating frequency, and press ENT/DIL. An example for entry of 146.940 MHz is shown. See Example 1.

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Now program 146.940 MHz.
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly entered.

Example 1

- (2) To enter a frequency into memory, complete the above entry procedure, then press the desired memory channel number key (1 through 4), then press M. See Example 2.

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Now program 146.940 MHz.
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly entered.
1	14 . 10	Enter 146.940 into memory position 1.
M	146.940	Correctly stored in M1.

Example 2

- (3) To recall a frequency from memory, press the desired memory channel number key, then press MR. See Example 3.
- (4) To return to the main dial frequency after completing memory operation, simply press ENT/DIL.

Press	Display	Comments
	146.520	Original frequency.
1	14 . 10	Recall 146.940 stored in memory position 1.
MR	146.940	Correctly recalled.

Example 3

- (5) To transmit and receive on different frequencies (using the memory instead of the standard repeater shift), enter a frequency into memory channel 0 (zero). Dial in the desired transmit frequency on the keyboard, then press MR. See Example 4.

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Program 146.940 into Receive Memory (M0).
9	14 .690	
4	146.940	
ENT/DIL	146.940	Frequency now entered.
0	14 . 00	Store frequency in M0.
M	146.940	Frequency now stored correctly.
6	14 . 60	Program 146.240 as transmit frequency.
2	14 .620	
4	146.240	
ENT/DIL	146.240	Transmit frequency entered.
MR	146.940	SELECT sw. to RM. RX on 146.940.
PTT sw.	146.240	On the air, TX on 146.240.

Example 4

REPEATER OPERATION

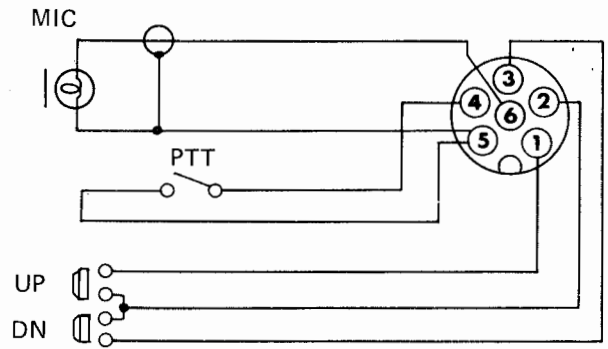
- (1) Set the TX OFFSET control to +600 or -600 to select automatic repeater shift of +600 kHz or -600 kHz, respectively.
- (2) To select automatic repeater shift of other than 600 kHz, you may use the keyboard microphone. Enter the first two digits of the desired split, push SET, then set the TX OFFSET control to + or -, to select repeater shift in that direction. See Example 5.
- (3) To program unusual splits when the keyboard microphone is not used, you must use the RM (Receive Memory) feature; the auxiliary shift feature cannot be programmed manually from the main dial.

Press	Display	Comments
	146.940	Original frequency.
7	14 . 70	Set automatic shift of 700 kHz.
0	14 .700	TX OFFSET SELECTOR TO -SFT.
SET	146.940	Shift of -700 kHz now programmed.
PTT sw.	146.240	On the air, TX on 146.240.

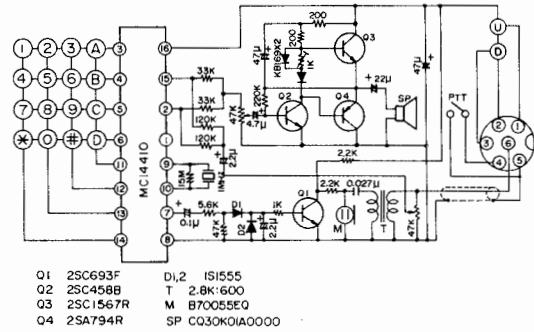
Place TX OFFSET SELECTOR to +SFT for +700 kHz shift.

Example 5

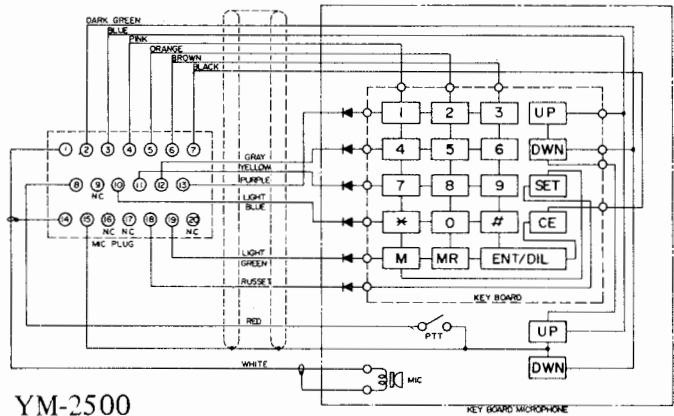
MICROPHONE CONNECTIONS



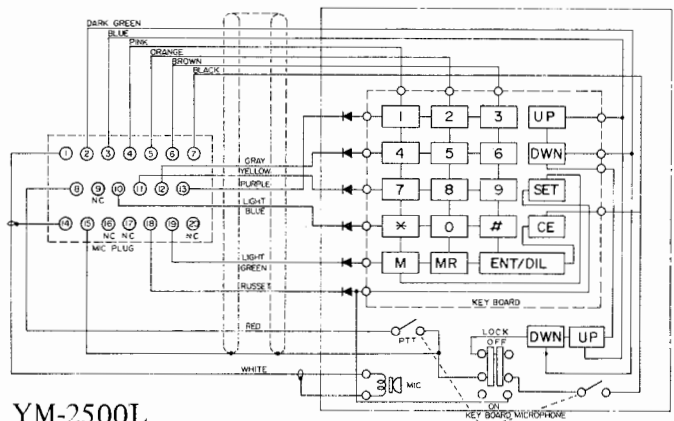
SCANNING MICROPHONE YE-17



KEYBOARD (TONE PAD) MICROPHONE YM-22



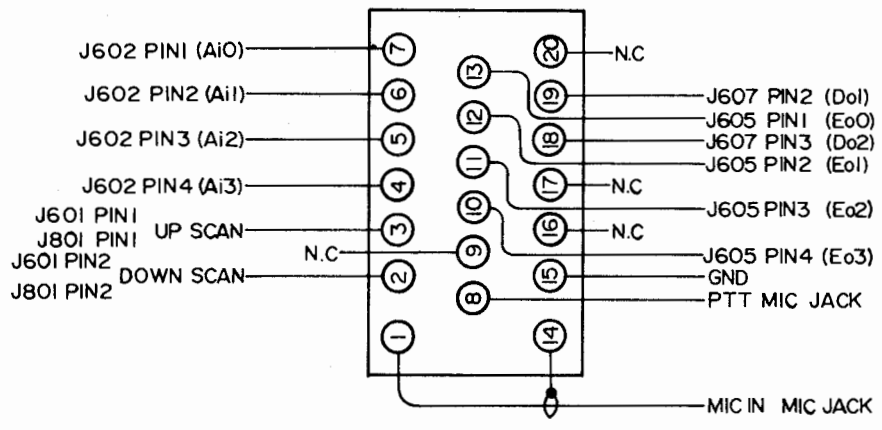
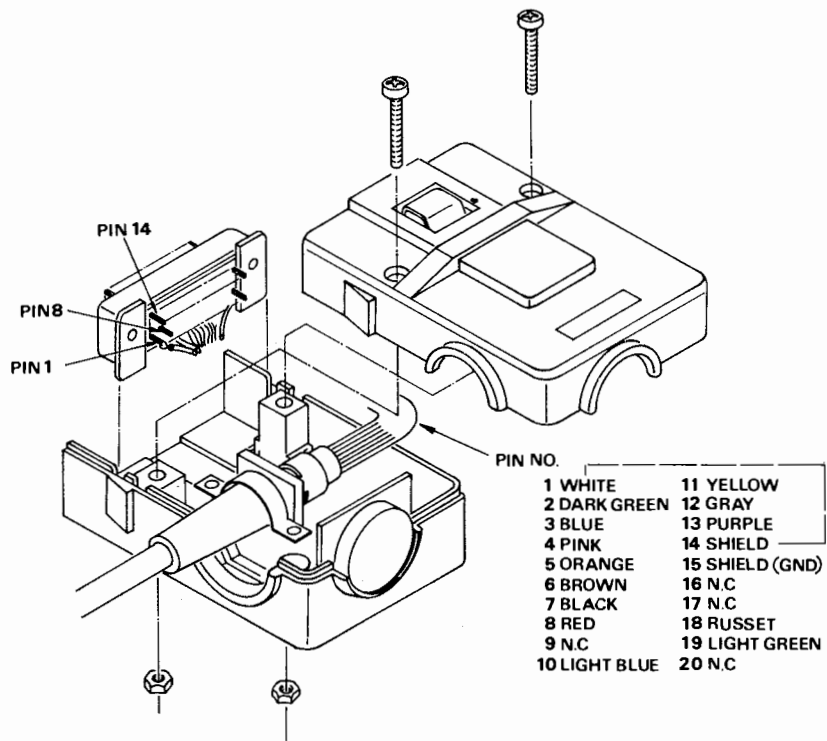
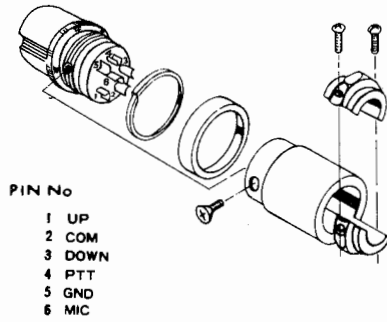
YM-2500



YM-2500L

KEYBOARD (TONE PAD AND REMOTE PROGRAMMING CONTROL) MICROPHONE YM-2500

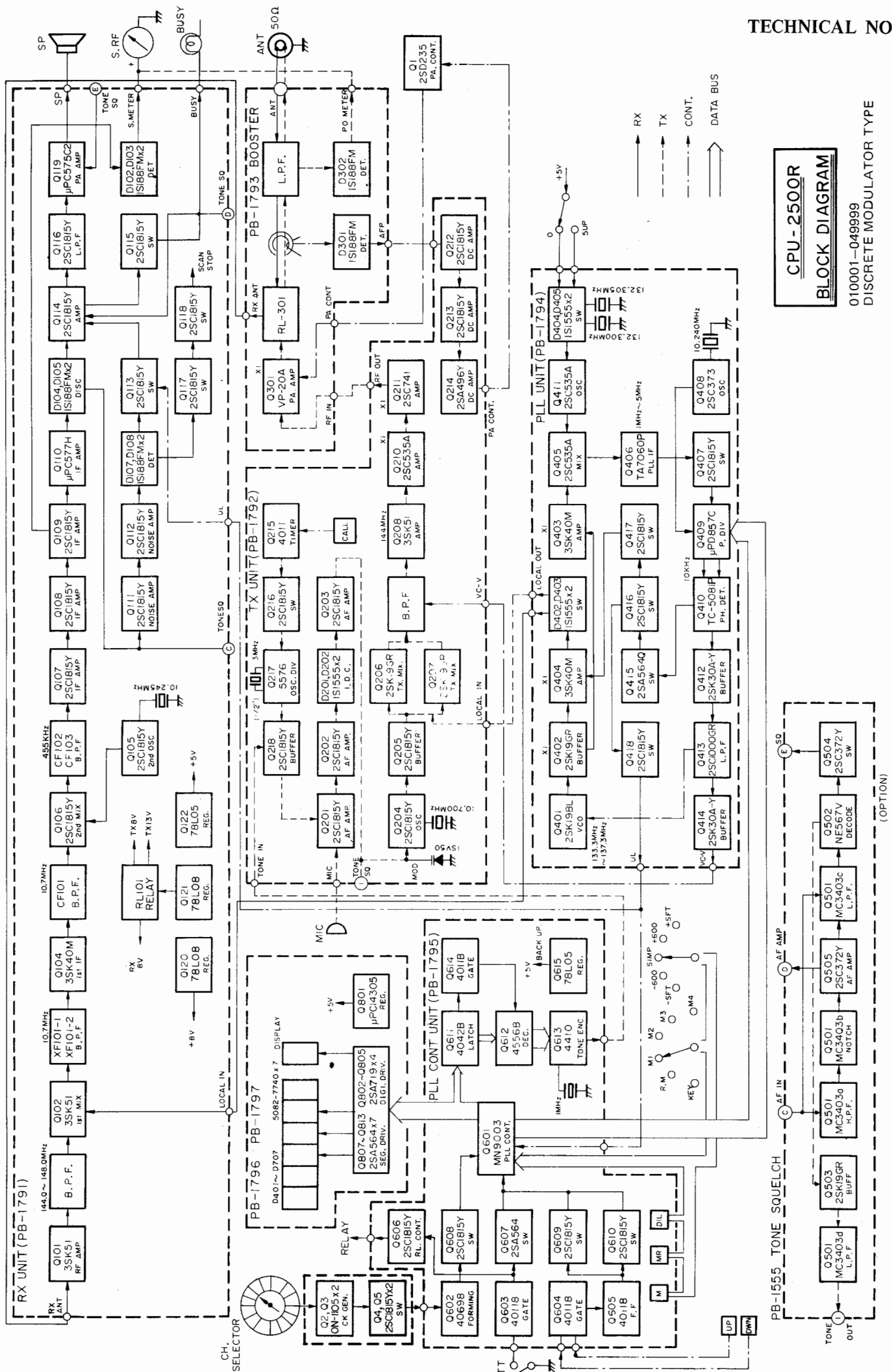
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MEMO

SECTION 2-TECHNICAL NOTES

BLOCK DIAGRAM	2-1
CIRCUIT THEORY	2-3
CRYSTAL DATA	2-6

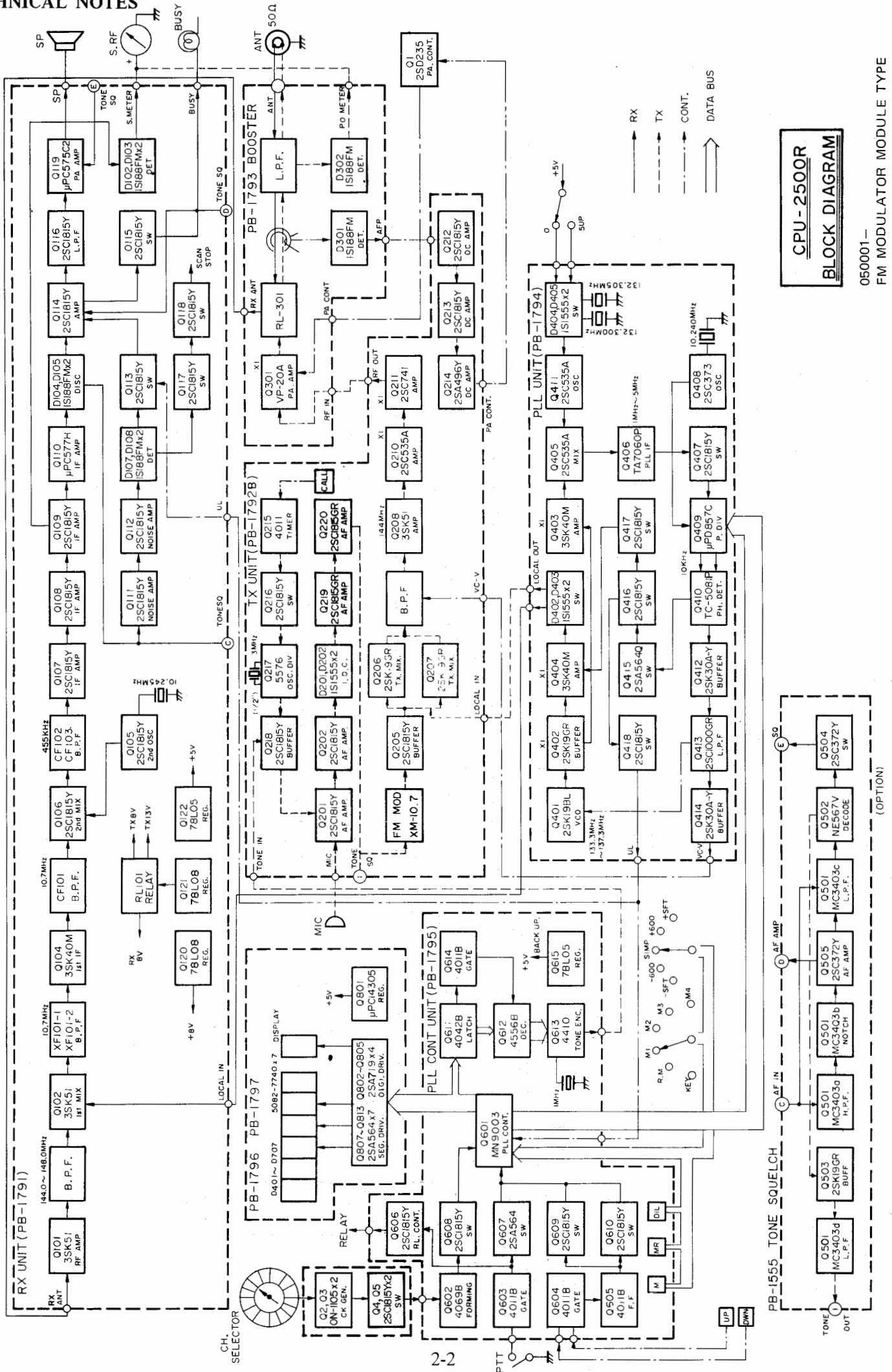


CPU - 2500R
BLOCK DIAGRAM

010001-049999
DISCRETE MODULATOR TYPE

(OPTION)

TECHNICAL NOTES



CPU-2500R
BLOCK DIAGRAM

050001-
FM MODULATOR MODULE TYPE

(OPTION)

The block diagram and circuit description to follow will provide you with a better understanding of this transceiver. Refer to the schematic diagram for specific component details.

The CPU-2500R consists of a transmitter and a double-conversion superheterodyne receiver. A phase lock loop synthesizer provides channel selection over the entire 144–148 MHz band, in conjunction with the optical coupling system. The frequency range may be limited at the factory to 144–146 MHz or 144–148 MHz, to conform to local regulations. Solid state circuitry is employed throughout the CPU-2500R, which is designed for operation from a 13.6 VDC \pm 10% negative ground power source.

TRANSMITTER

The transmitter produces a frequency modulated signal. The audio signal from the microphone is set to a proper level by VR₂₀₁, and is amplified by Q₂₀₁, Q₂₀₂, and Q₂₀₃ (2SC1815Y). The audio output from Q₂₀₂ is coupled to the instantaneous deviation control (IDC), where both positive and negative peaks are clipped by diodes D₁₀₁ and D₁₀₂ (1S1555). The output from Q₂₀₃ is fed through a low-pass filter consisting of C₂₁₃, L₂₀₁, and C₂₁₄, thus eliminating harmonics above the speech range caused by clipping. The deviation level is set by VR₂₀₂, and it is adjusted at the factory for a nominal deviation of \pm 5 kHz.

The speech signal is then applied to a phase modulator varactor diode, D₂₀₃ (1SV50), which varies the frequency of the 10.7 MHz crystal controlled oscillator, Q₂₀₄ (2SC1815Y). The frequency modulated 10.7 MHz signal is then amplified by buffer amplifier Q₂₀₅ (2SC1815Y) and fed to a balanced mixer consisting of Q₂₀₆ and Q₂₀₇ (2SK19GR). Here the signal is converted up to 144–148 MHz by mixing with the 133.3–137.3 MHz signal supplied from the VCO (voltage controlled oscillator) on the PLL UNIT. The output from the balanced mixer is fed through a bandpass filter consisting of T₂₀₃–T₂₀₆ to amplifiers Q₂₀₈ (3SK51), Q₂₀₉ (2SC535A), and Q₂₁₀ (2SC741), providing 200 mW of drive to the RF POWER UNIT. T₂₀₃–T₂₀₆ are tuned to the transmitting frequency by varactor diodes D₂₀₅–D₂₀₈ (1S2209). PA amplifier module Q₃₀₁ (VP-20A)

provides 25 watts of RF energy through a diode switch and low-pass filter into a 50 ohm load.

A small portion of the RF output is rectified by diode D₃₀₂ (1S188FM); the resulting DC voltage is fed to the front panel meter for an indication of the relative power output from the transmitter. VR₃₀₃ allows setting of the relative power output meter deflection range. The DC output from D₃₀₂ is also fed to the control unit for activation of the ON AIR lamp while transmitting.

If the transmitter is activated without an antenna being connected, or if a high VSWR is present at the antenna receptacle, the reflected power is detected through T₃₀₁ and D₃₀₁ (1S188FM), producing a DC voltage. Q₂₁₂ (2SC1815Y) conducts with the application of DC voltage through VR₃₀₂, causing a decrease in the collector current of Q₂₁₃ (2SC1815Y). As a result, the collector voltage of Q₂₁₄ (2SA496Y) drops, causing Q₂₁₂ to decrease current and supply voltage to the PA transistor, thus protecting that component. The threshold level is set by VR₃₀₂. This circuit is also used to switch the power output down to 3 watts when the HIGH/LOW switch is placed in the LOW position. The amount of power reduction is set by VR₂₀₄.

The tone burst circuit consists of a timing generator and a gated multivibrator. With the BURST/CALL switch in the BURST position, a DC voltage is applied to trigger Q₂₁₅ (4011), which generates a pulse of 0.5–1 second duration. The pulse switches Q₂₁₆ (2SC1815Y) to supply DC voltage to Q₂₁₇ (MSM5576), where the clock signal is divided by 1024, 2048, or 4096, producing an accurate tone burst signal. The burst signal is fed to the base of microphone amplifier Q₂₀₁. The front panel CALL button provides a manual switch for actuation of the audio tone, as well as the transceiver PTT. The tone level is set by VR₂₀₆, while the burst length is set by VR₂₀₅.

RECEIVER

The input signal from the antenna is fed through a low-pass filter consisting of L₁, L₃₀₁, C₂, C₃₀₁–C₃₀₃, and C₃₁₃, and T/R relay RL₃₀₁, to RF amplifier Q₁₀₁ (3SK51), a dual-gate FET. The amplified signal is then fed through a four-stage high-Q coaxial resonator to the first mixer, Q₁₀₂ (3SK51).

This front end configuration provides high immunity from cross modulation and other spurious responses, while providing a low system noise figure.

The 144–148 MHz signal is heterodyned with the first local oscillator, producing a 10.7 MHz first IF signal. The first local oscillator signal is delivered from the PLL VCO circuit. The first IF signal is fed through crystal filter XF-101, which has a passband of ± 15 kHz, and amplified by IF amplifier Q₁₀₄ (3SK51). The amplified IF signal is fed through CF-101, and then delivered to the second mixer, Q₁₀₆ (2SC1815Y), where the heterodyne signal of 10.245 MHz from Q₁₀₅ (2SC1815Y) is injected; the result is a 455 kHz second IF signal. CF-101, with a bandwidth of ± 200 kHz, prevents image responses (produced by mixing) from degrading receiver performance.

Cascaded ceramic filters CF₁₀₂ and CF₁₀₃ provide a ± 7.5 kHz bandwidth for the receiver. IF amplifiers Q₁₀₇–Q₁₀₉ (2SC1815Y) deliver the 455 kHz IF signal to Q₁₁₀ (μ PC577H), where any amplitude variation is eliminated. The signal is then delivered to ceramic discriminator CD₁₀₁ and diodes D₁₀₄ and D₁₀₅ (1S188FM).

The discriminator produces an audio output in response to a corresponding frequency shift in the IF signal. The audio output signal is amplified by Q₁₁₄ and Q₁₁₆ (2SC1815Y) for application across the VOLUME control VR_{1a} to the input of Q₁₁₉ (μ PC575C2), which delivers 1.5 watts of audio to the loudspeaker. The audio response is shaped by the low pass filter at Q₁₁₆.

A portion of the 455 kHz IF signal is rectified by D₁₀₂ and D₁₀₃ (1S188FM) for S-meter indication. VR₁₀₁ provides calibration of the S-meter deflection level.

When no carrier is present in the 455 kHz IF, the high frequency noise at the discriminator output is amplified by Q₁₁₁ and Q₁₁₂ (2SC1815Y) and detected by D₁₀₇ and D₁₀₈ (1S188FM), producing a DC voltage. This voltage activates switch Q₁₁₃ (2SC1815Y). As Q₁₁₃ conducts, the base of Q₁₁₄ is grounded, thus disabling the audio amplifier. When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator output; the audio amplifier then returns to normal operation.

When the squelch circuit opens (Q₁₁₄ conducting), lamp driver Q₁₁₅ (2SC1815Y) draws current, causing the BUSY lamp to light up. The squelch is preset by VR₁₀₂, and VR_{1b} is the front panel SQL control.

HETERODYNE OSCILLATOR

The heterodyne signal is generated by the PLL (phase lock loop) circuit consisting of a voltage controlled oscillator (VCO), a reference crystal oscillator, a programmable divider, and a phase comparator.

VCO oscillator Q₄₀₁ (2SK19GR) generates a 133.3–137.3 MHz signal. The oscillator frequency is controlled by varactor diode D₄₀₁ (1S2209), which varies the capacitance of a tuned circuit consisting of L₄₀₁, TC₄₀₁, and C₄₀₄, C₄₀₆ in accordance with a DC voltage supplied from phase comparator Q₄₀₁ (TC5081).

The output signal from Q₄₀₁ is amplified by buffer amplifiers Q₄₀₂ (2SK19GR) and Q₄₀₄ (3SK40M) and fed through diode switch D₄₀₂/D₄₀₃ (1S1555) to the receiver or transmitter mixers.

A portion of the output from Q₄₀₄ is fed through buffer amplifier Q₄₀₃ (3SK40M) to a PLL mixer Q₄₀₅ (2SC535A), producing a 1–5 MHz PLL IF signal through mixing with the PLL heterodyne signal.

The PLL heterodyne signal is generated by an overtone-crystal-controlled oscillator, Q₄₁₁ (2SC535A).

Diode switches D₄₀₄ and D₄₀₅ (1S1555) select the appropriate crystal in accordance with the TX OFFSET SELECTOR switch and the 5 UP switch. The output from Q₄₁₁ is fed to the PLL mixer Q₄₀₅.

Crystal oscillator Q₃₁₂ (2SC373) generates a 10.24 MHz signal, and its output is fed to scaler/divider Q₄₀₉ (μ PD857C), where a 10 kHz reference signal is produced.

Digital phase comparator Q₄₀₁ (TC5081P) compares the phase of the PLL IF signal with that of the reference signal, and any phase difference is converted into an error correcting voltage. This

error correcting voltage is fed through buffer Q₄₁₂ (2SK30AY) and amplifier Q₄₁₃ (2SC1000-GR) to varactor diode D₄₀₁, which changes the output signal phase to lock with that of the reference signal.

When the VCO is locked, the constant voltage at pin 4 of Q₄₁₀ is applied to Q₄₁₅ (2SA564Q), causing it to conduct; in turn, Q₄₁₆ (2SC1815Y) cuts off. The "H" voltage at the collector of Q₄₁₆ turns Q₄₁₇ (2SC1815Y) ON, supplying DC voltage to the earlier exciter stages, Q₄₀₂ and Q₄₀₄. When the VCO is unlocked, the DC voltage at the emitter of Q₄₁₇ drops, preventing normal operation of Q₄₀₂ and Q₄₀₄.

The output voltage from Q₄₁₆ is reversed in polarity by Q₄₁₇ (2SC1815Y) and applied to Q₄₁₈ (2SC1815Y), keeping the collector of Q₄₁₈ "H" in order to drive the digital display. The voltage is also applied to Q₁₁₃ (2SC1815Y), which supplies DC voltage to audio amplifier Q₁₁₄.

When the VCO is unlocked, the collector DC voltage drops, causing the LED's to turn off; simultaneously, audio amplifier Q₁₁₄ is muted, silencing the receiver. The receiver remains muted until VCO lock is achieved.

DISPLAY

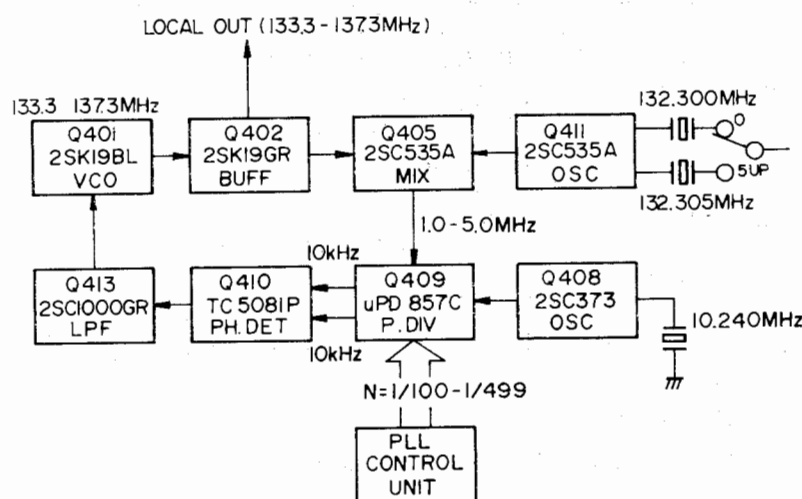
The digital display consists of 7 seven-segment light emitting diode display digits, D₇₀₁–D₇₀₇ (5082–7740). Drivers Q₈₀₂–Q₈₀₅ (2SA719) and segment drivers Q₈₀₇–Q₈₁₃ (2SA564) provide the necessary input to drive the display correctly.

POWER SUPPLY

A DC 13.6 VDC is required for operation of the transceiver. DC 13.6 VDC is used for audio PA Q₁₁₉, relay RL₃₀₁, and the lamps. The supply voltage to the driver and transmitter PA is fed through voltage regulator Q₁ (2SD235), which is controlled by the HIGH/LOW switch and the automatic final protection circuit.

Voltage regulator Q₈₀₁ (μ PC14305) regulates the supply voltage at 5 VDC to supply the memory backup circuit, thus holding the memorized frequencies when the transceiver is turned off. Q₁₂₀ (2SC496Y) provides a regulated 8 VDC for the control circuitry. Q₁₂₁ (2SC496Y) provides 8 volts for the receiver strip and the transmitter low level circuits. Q₁₂₂ provides 5 VDC for the logic circuits.

PLL CIRCUIT FREQUENCY RELATIONSHIPS



OPTIONAL TONE SQUELCH CIRCUIT

The tone squelch circuitry permits selective calling and listening on otherwise busy channels. The encoder transmits a subaudible low-frequency tone, and the decoder mutes the receiver until a similar subaudible tone is received on an incoming signal. The tone signal can be set to any frequency within the range of 70–250 Hz.

The tone signal is generated by Q₅₀₂ (NE567); its frequency is set by R₅₁₆, VR₅₀₂, and C₅₁₆. The level of the tone signal is set by VR₅₀₄ and fed through buffer amplifier Q₅₀₃ (2SK19GR) to a low-pass filter consisting of the “d” unit of operational amplifier Q₅₀₁ (MC3403). The tone signal is then superimposed on the speech signal. The constants for setting the frequency are obtained from Table 1.

The audio output from the receiver discriminator is fed to unit “a” of Q₅₀₁. Unit “a” forms a high-pass filter, while unit “b” forms a T-notch filter. Both filters remove the tone signal from the audio signal which subsequently is fed through audio amplifier Q₅₀₅ (2SC372Y) to the receiver audio amplifier Q₁₁₄.

The tone signal passes through a low-pass filter at unit “c” of Q₅₀₁, and is fed to Q₅₀₂. When the tone frequency on the incoming signal matches that of the transmitted signal from the CPU-2500R, the voltage at pin 8 of Q₅₀₂ becomes low, causing Q₅₀₄ (2SC372Y) to switch off. In turn, proper bias is applied to Q₁₁₉ for normal operation.

Without a proper tone signal, Q₅₀₄ conducts, removing bias from Q₁₁₉, and hence disabling the audio circuit.

As the conventional squelch circuit is operative when the tone squelch is switched in, the BUSY lamp will light up when the channel is occupied, indicating that no transmission should be made out of courtesy to the other operators.

CRYSTAL DATA

FUNCTION	HOLDER	RANGE (MHz)	MODE	LOAD C	SERIES R	DRIVE LEVEL
REFERENCE (X ₄₀₁)	HC-18/U	10.240	Fundamental	30 pF	25 Ω	2 mW
2nd Local (X ₁₀₁)	HC-18/U	10.245	Fundamental	30 pF	25 Ω	2 mW
Carrier (X ₂₀₂)	*HC-18/U	*10.700	Fundamental	30 pF	20 Ω	2 mW
PLL Local (X ₄₀₂) (X ₄₀₃)	HC-18/U	44.100 44.10166	3rd overtone	20 pF	40 Ω	2 mW
1800 Hz Tone (X ₂₀₁)	HC-25/U	3.6864	Fundamental	30 pF	100 Ω	3 mW
1750 Hz Tone (X ₂₀₁)	HC-25/U	3.584				
Tone encoder (X ₆₀₁)	HC-43/UT	1.000	Fundamental	Series resonance	5k Ω	0.5 mW

* ACTUAL FREQUENCY: 10.740 MHz

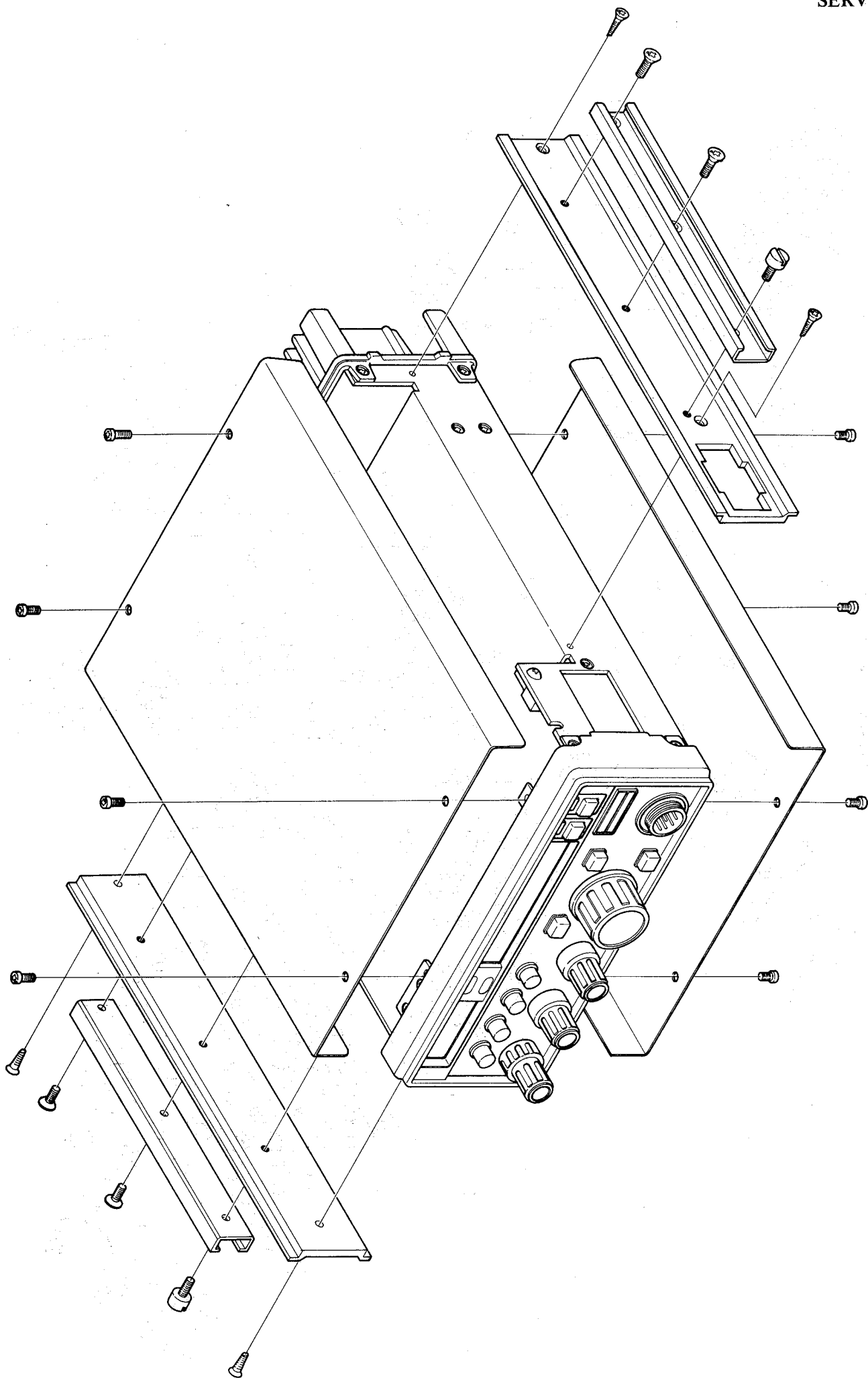
Load Capacitor: 30 pF, 40 kHz UP (Decided by circuit)

** Grounded case

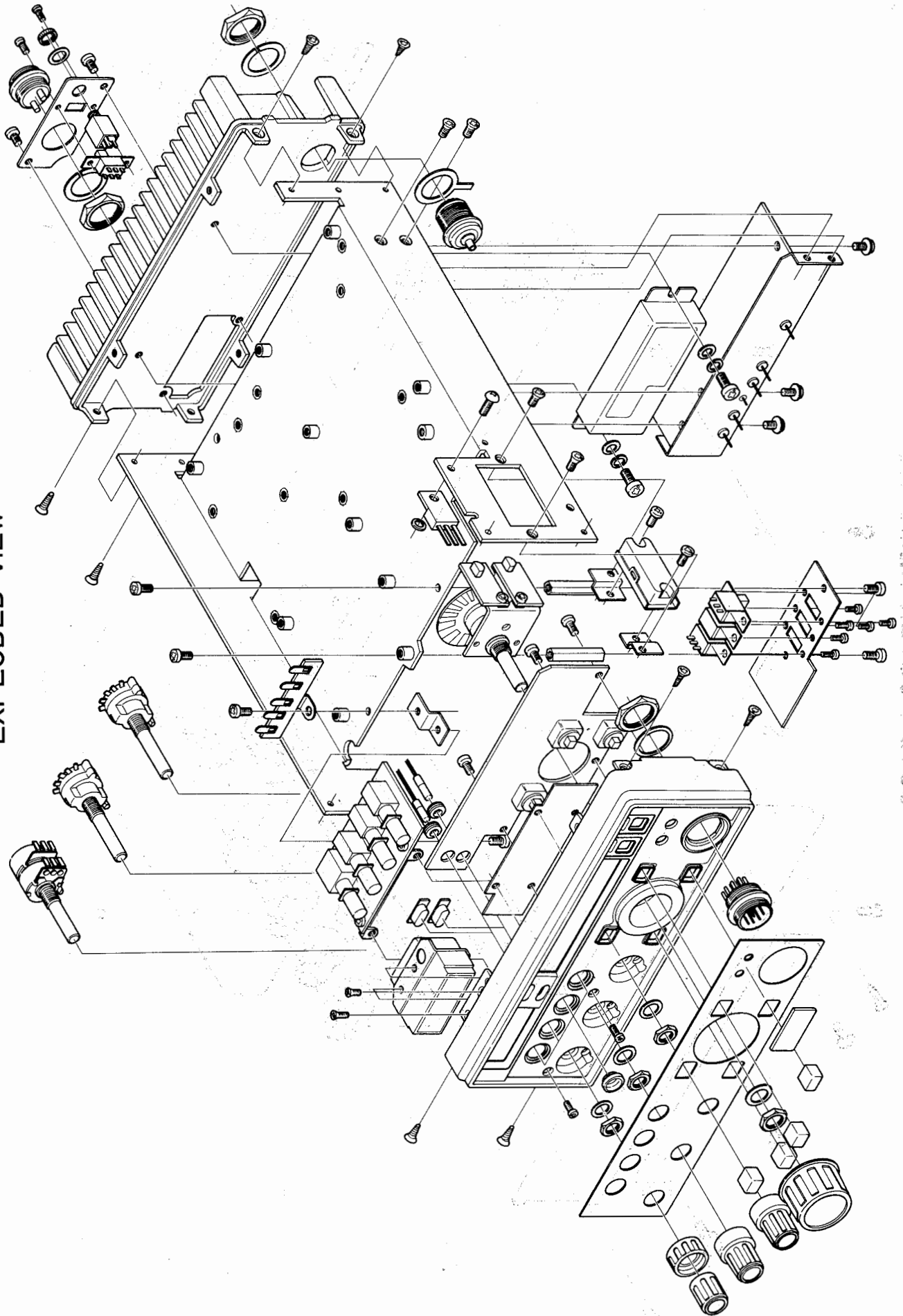
SECTION 3-SERVICING

REMOVAL OF CABINET AND FRONT PANEL	3-1
MODIFICATIONS	
POWER SOCKET	3-4
REVERSED CAPACITOR CHECK	3-5
MODULATOR CHANGE	3-6
TONE SQUELCH MODIFICATION	3-8
FREQUENCY CHANGE MODIFICATION	3-9
LEVEL DIAGRAM	3-12
RX/RESONATOR UNIT PARTS LAYOUT	3-14
RX UNIT CIRCUIT DIAGRAM	3-16
TX UNIT PARTS LAYOUT	3-18
BOOSTER UNIT PARTS LAYOUT	3-21
PLL/VCO UNIT PARTS LAYOUT	3-22
PLL/VCO CIRCUIT DIAGRAM	3-24
PLL CONTROL UNIT PARTS LAYOUT	3-26
CPU/TONE ENCODER LOGIC CHART	3-27
PROGRAMABLE DIVIDER LOGIC CHART	3-28
SCAN CONTROL CIRCUIT TIMING CHART	3-30
DRIVE/DISPLAY UNIT PARTS LAYOUT	3-32
DRIVE/DISPLAY UNIT CIRCUIT DIAGRAM	3-34
PHOTO UNIT PARTS LAYOUT	3-35
SW UNIT/MONITOR UNIT PARTS LAYOUT	3-36
TONE SQUELCH UNIT PARTS LAYOUT	3-37
SOLDERING AND DESOLDERING TECHNIQUE	3-38
CIRCUIT TRACE REPAIR	3-40
RELAY CONNECTION INFORMATION	3-42
MAINTENANCE AND ALIGNMENT	3-43
TROUBLESHOOTING	3-50

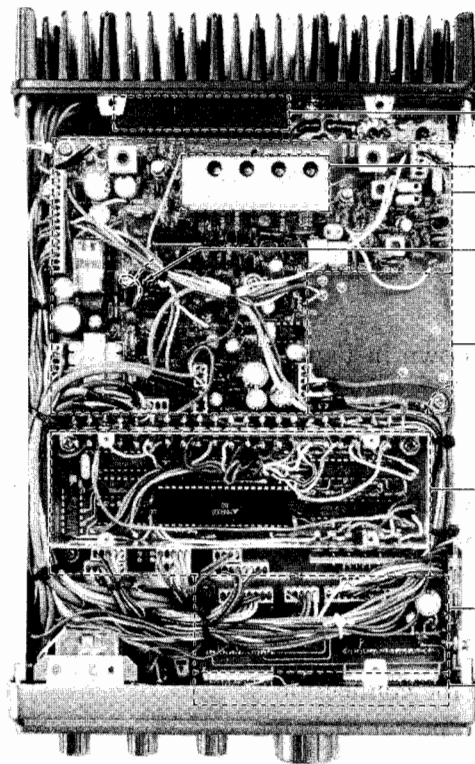
OUTER COVER REMOVAL



EXPLODED VIEW

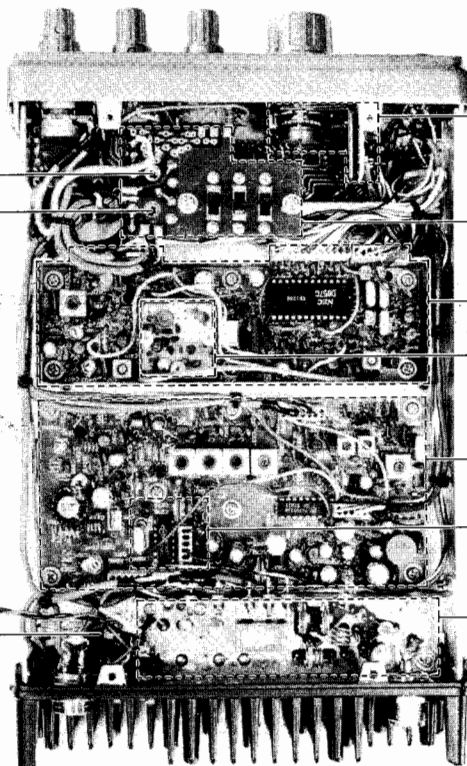


ORDER BOOK REF: 07



- Q₃₀₁
(RF POWER MODULE)
- RESONATOR UNIT(PB-1800)
- RECEIVER UNIT(PB-1791)
- RED WIRE MUST BE CUT
WHEN TONE SQUELCH UNIT
IS INSTALLED
- TONE SQUELCH UNIT
(WHEN INSTALLED)
- PLL CONTROL UNIT
(PB-1795)
- LED DRIVER UNIT
(PB-1797)
- DISPLAY UNIT
(PB-1796)

TOP VIEW



- VR₉₀₁
(MONITOR LEVEL)
- VR₉₀₂
(TONE LEVEL)

- PHOTO INTERRUPTER
UNIT(PB-1848/1849)
- MONITOR UNIT
(PB-1897)
- PLL UNIT(PB-1794)
- VCO UNIT(PB-1830A)
- TRANSMITTER UNIT
(PB-1792)
- TONE BURST SECTION
- BOOSTER UNIT
(PB-1793)

Q₁

BOTTOM VIEW

MODIFICATION TO POWER SOCKET

In some CPU-2500R sets bearing serial numbers 039999 and down, high current across the ground lead at J₁₀₃ would cause the Molex connector to overheat. The small modification below, made to the power socket, will cure the problem.

MODIFICATION PROCEDURE

- (1) Locate the power socket, as shown in Figure 2.
2. Locate the negative lead. The drawing is a bottom view.
- (2) Install a 1 mm diameter wire from the negative terminal of the power socket to the shield plate on the BOOSTER Unit, as shown in the drawing.
- (3) Be certain that you have made the connection to the negative terminal of the power socket, and close up the transceiver.

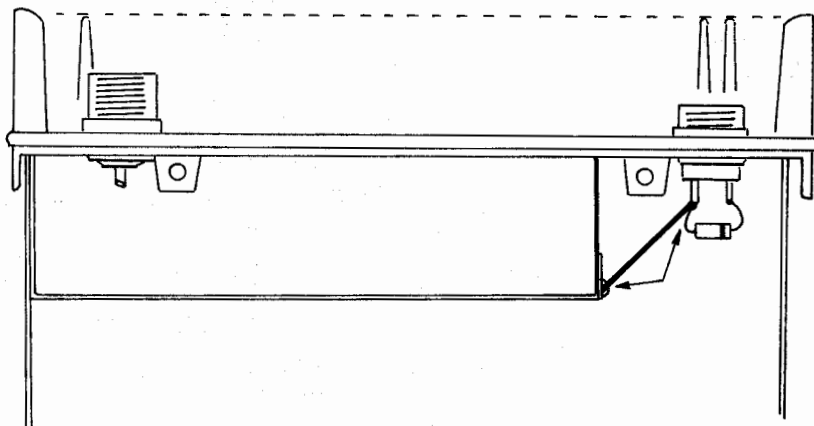


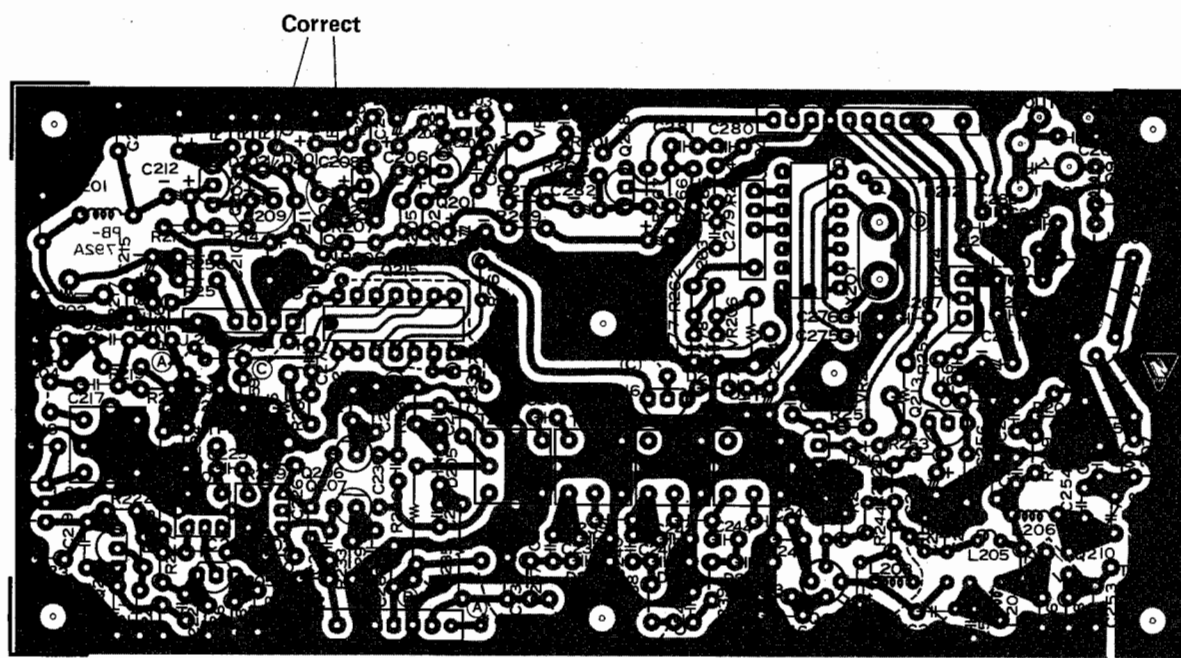
Figure 2

REVERSED CAPACITOR CHECK

Early in the production of the CPU-2500R, a mistake was found in the printing on a circuit board. The effect of this mistake was to cause C₂₀₈ and C₂₀₉ to be reversed upon installation, because there were two slots marked C₂₀₈.

C₂₀₈ should be rated 1 μ F at 50 WV, while C₂₀₉ should be rated 10 μ F at 16 WV.

The correct drawing of the parts layout is shown in Figure 3. All transceivers with the capacitors reversed should be modified accordingly. This error should not be found in sets bearing serial numbers 030001 and up.



Viewed from component side

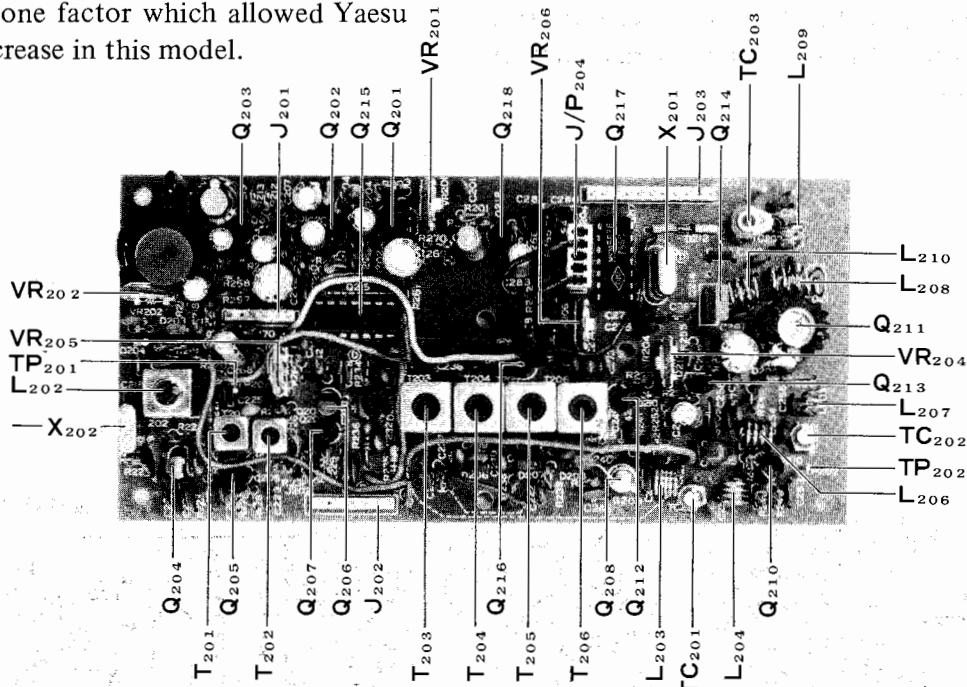
Figure 3

MODULATOR CHANGE

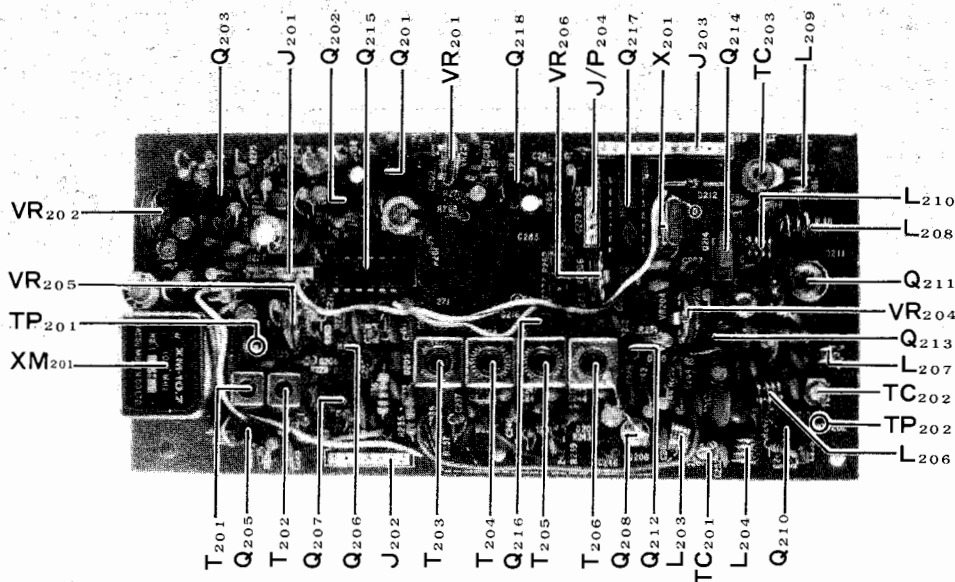
CPU-2500R transceivers bearing serial numbers 050001 and up used a modulator board different from that used in earlier production runs. The early models bear the nomenclature MOD Circuit (PB-1792, 1792A), while the new boards are called the TX Unit (PB-1792B, C . . .).

The schematic diagrams for the circuits in question are shown below. There is no reason to retrofit early models with the new modulator board.

This change was not brought about because of any deficiency in the early circuitry. Rather, some new modular circuitry became available which reduced the parts required to do the same task. The consolidation was one factor which allowed Yaesu to avoid a price increase in this model.



Early Model (Discrete FM Modulator)



After Prod. 5 (FM Modulator Module)

INSTALLATION OF OPTIONAL TONE SQUELCH CIRCUIT

PARTS REQUIRED:

1. Tone Squelch Unit (PB-1555A) completed and tested (1 pce)
2. RC Kit for Frequency Selection (1 set)

- (4) Locate a jumper wire on the printed board as illustrated in Fig. 5. Cut this jumper wire.

INSTALLATION:

- (1) Remove screws on the side of the transceiver and lift up the top cover.
- (2) Locate the space for PB-1555A and place it in such a way so that the pins on the receiver printed board come through the holes in the PB-1555A as illustrated in Fig. 4.
- (3) Solder the pins on PB-1555A and the receiver printed board as illustrated in Fig. 4.

ALIGNMENT:

The tone frequency should coincide with that of the transmitting station to open the squelch circuit. The frequency of the kit is set to 77 Hz at the factory and can be set anywhere between 70 Hz to 160 Hz by VR₅₀₂.

The tone frequency can be changed to 160 Hz through 250 Hz by selecting the components as illustrated in Table 1.

TONE FREQ	C516	R516	R513	R514	R524
70-160 Hz	0.15 μF	39 Kohm	15 Kohm	470 Kohm	15 Kohm
160-250 Hz	0.1 μF	33 Kohm	8.2 Kohm	270 Kohm	8.2 Kohm

Table 1

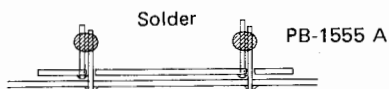
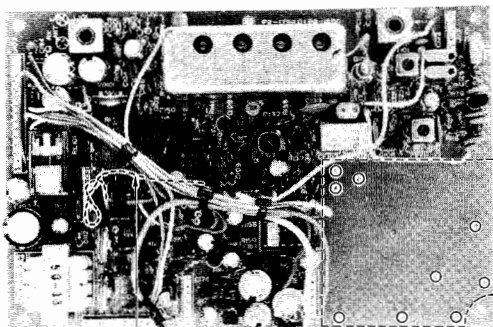


Figure 4

- A RECEIVER BOARD
- B TONE SQUELCH UNIT
- C RED WIRE MUST BE CUT WHEN TONE SQUELCH UNIT IS INSTALLED.



RED WIRE MUST BE CUT WHEN TONE SQUELCH UNIT INSTALLED.

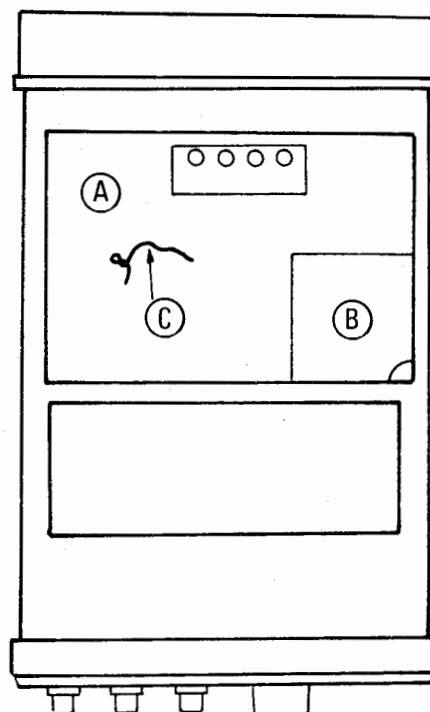


Figure 5

FREQUENCY RANGE MODIFICATIONS

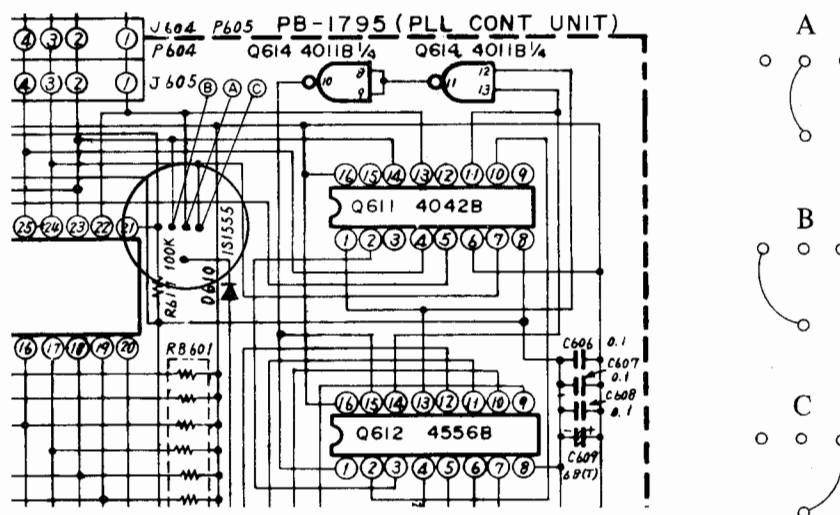
FREQUENCY RANGE MODIFICATION INFORMATION

Several modifications are available for changing the frequency range and/or the preset frequency of the CPU-2500R.

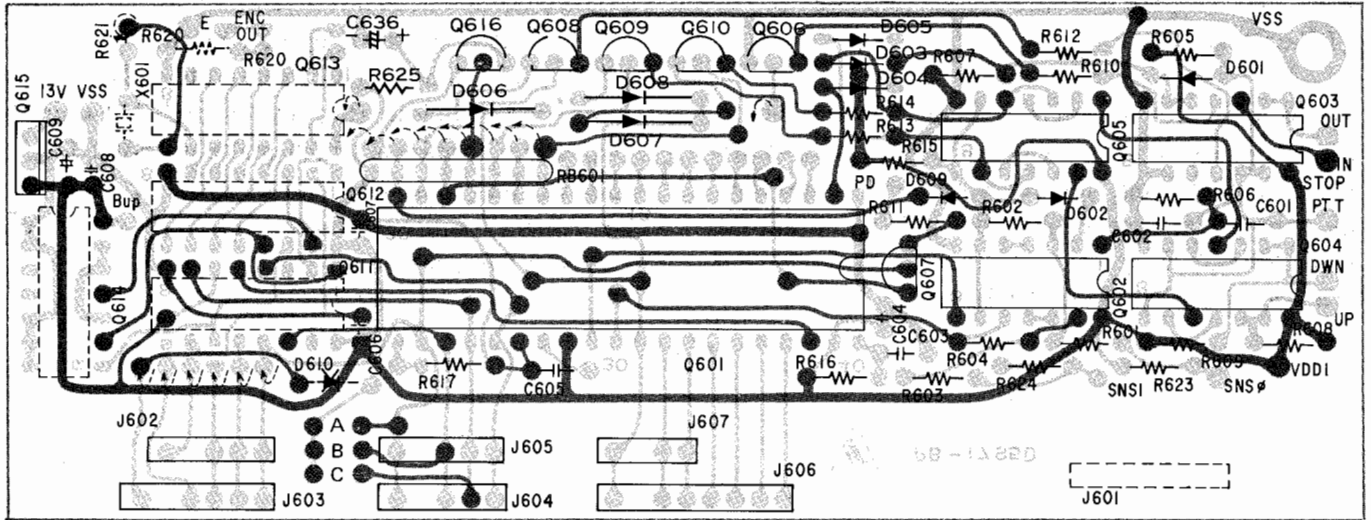
Please refer to the chart, schematic, and board layouts provided in this section. In order to modify the frequency range, jumper wires must be installed or removed at points (A), (B), and (C) as shown, while diode D₆₀₁ controls the preset frequency (145.000 MHz or 147.000 MHz).

Please note that when a jumper is to be installed at point (A), this does not mean that the jumper is to be connected between point (A) and some other point (for example, (A) to (B), etc.). The correct jumpering technique is to install a wire between the two solder terminals which make up point (A), or the two that form (B), and so forth. If D₆₀₁ is to be "open," simply remove the diode or lift one end of it from the board.

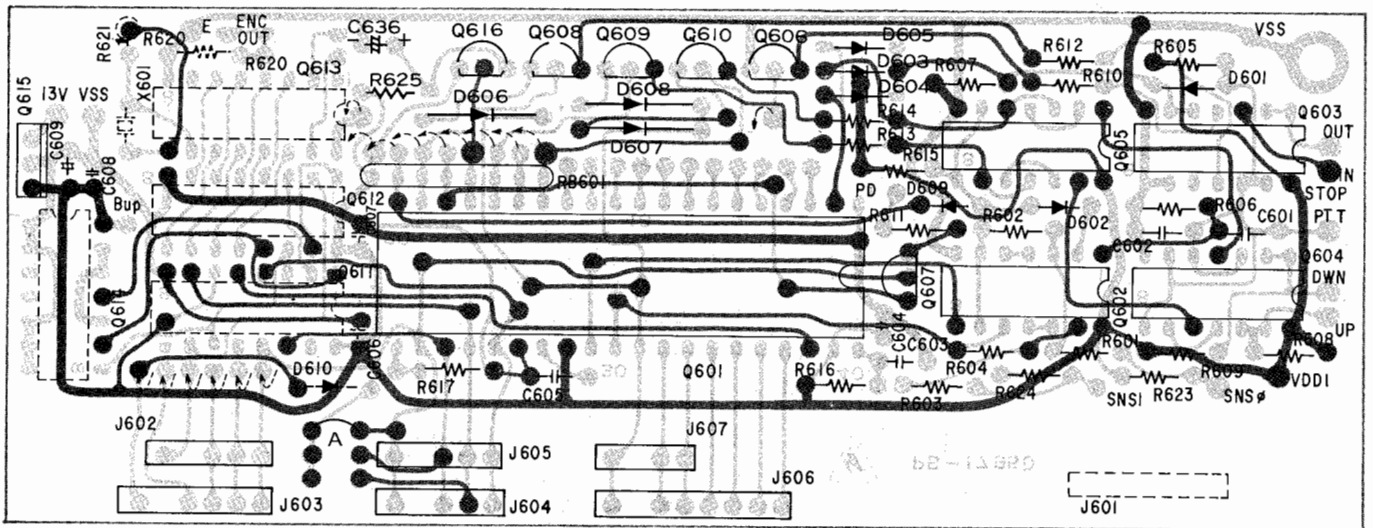
BAND	JUMPER	D610	RX FREQ.	TX FREQ.
144-146	A	○	144.00-145.99	144.01-145.99
144-148	OPEN	OPEN	144.00-147.99	144.01-147.99
144-148	B	○	144.00-147.99	144.01-145.99
144-149	C	○	144.00-148.99	144.01-145.99



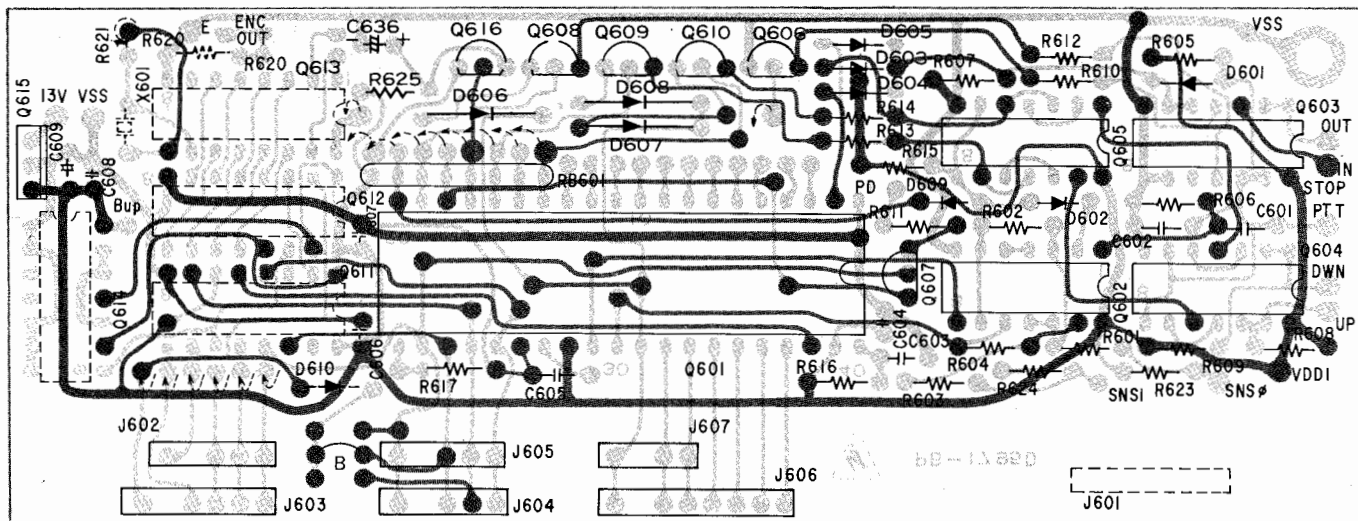
FREQUENCY RANGE RX 144.00–147.99 MHz, TX 144.01–147.99 MHz, PRESET 147 MHz



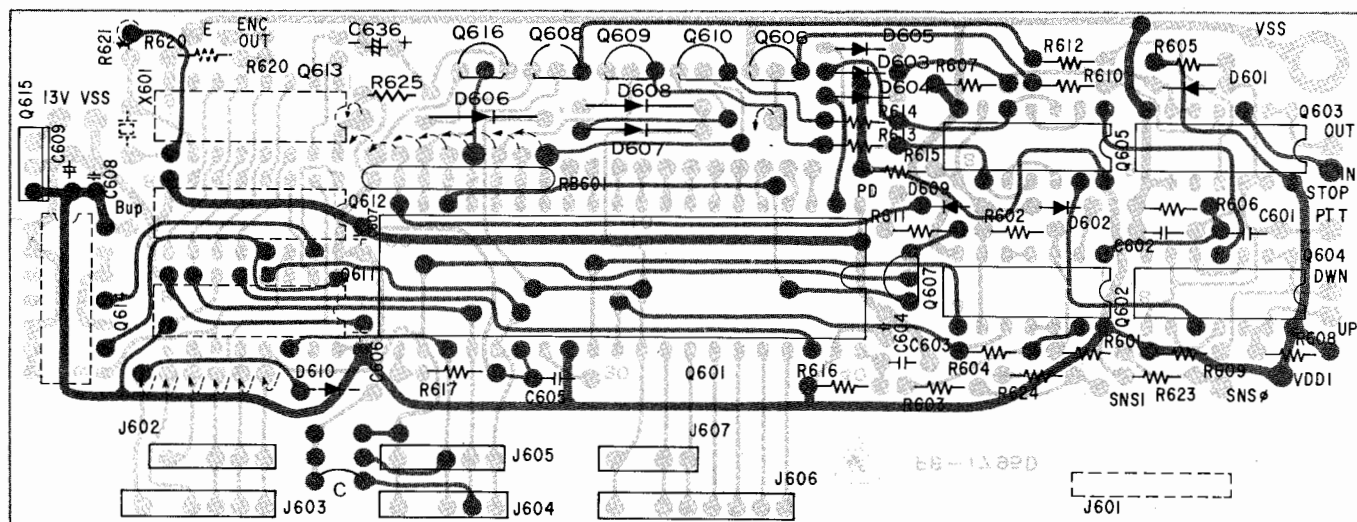
FREQUENCY RANGE RX 144.00–145.99 MHz, TX 144.01–145.99 MHz, PRESET 145 MHz



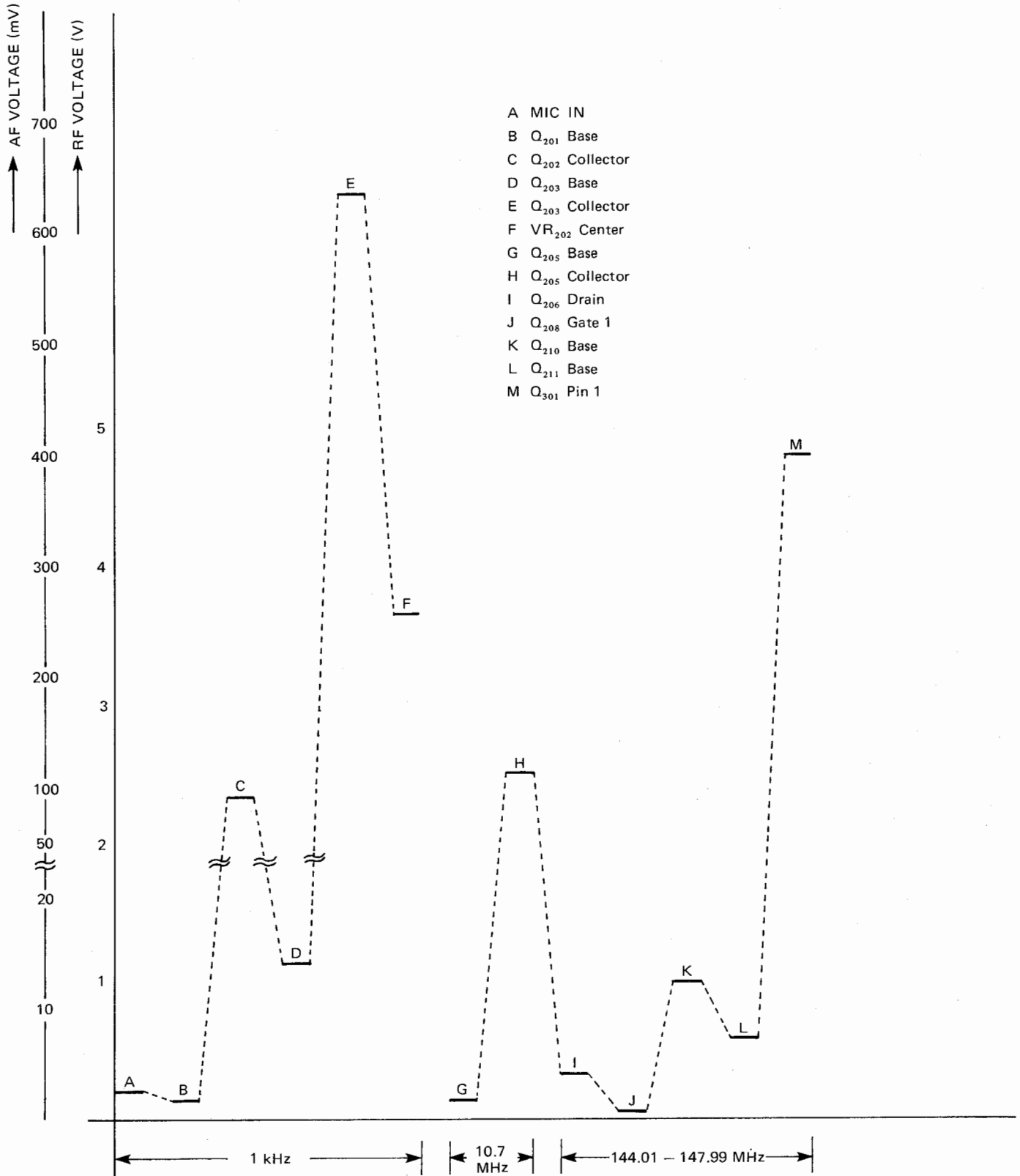
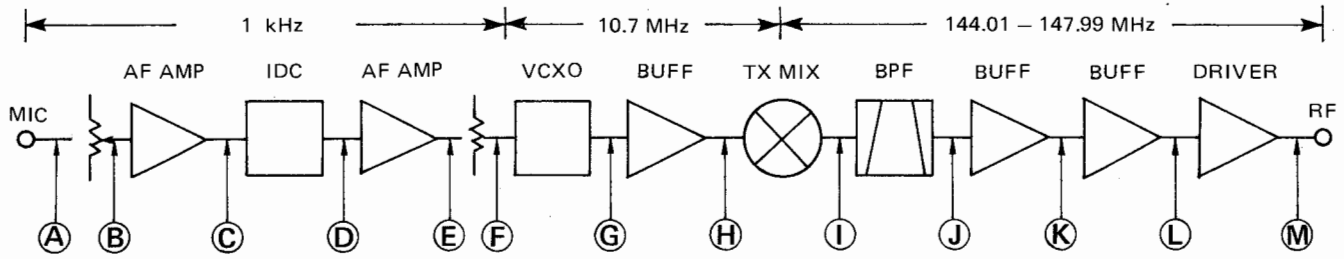
FREQUENCY RANGE RX 144.00–147.99 MHz, TX 144.01–145.99 MHz, PRESET 145 MHz



FREQUENCY RANGE RX 144.00–148.99 MHz, TX 144.01–145.99 MHz, PRESET 145 MHz

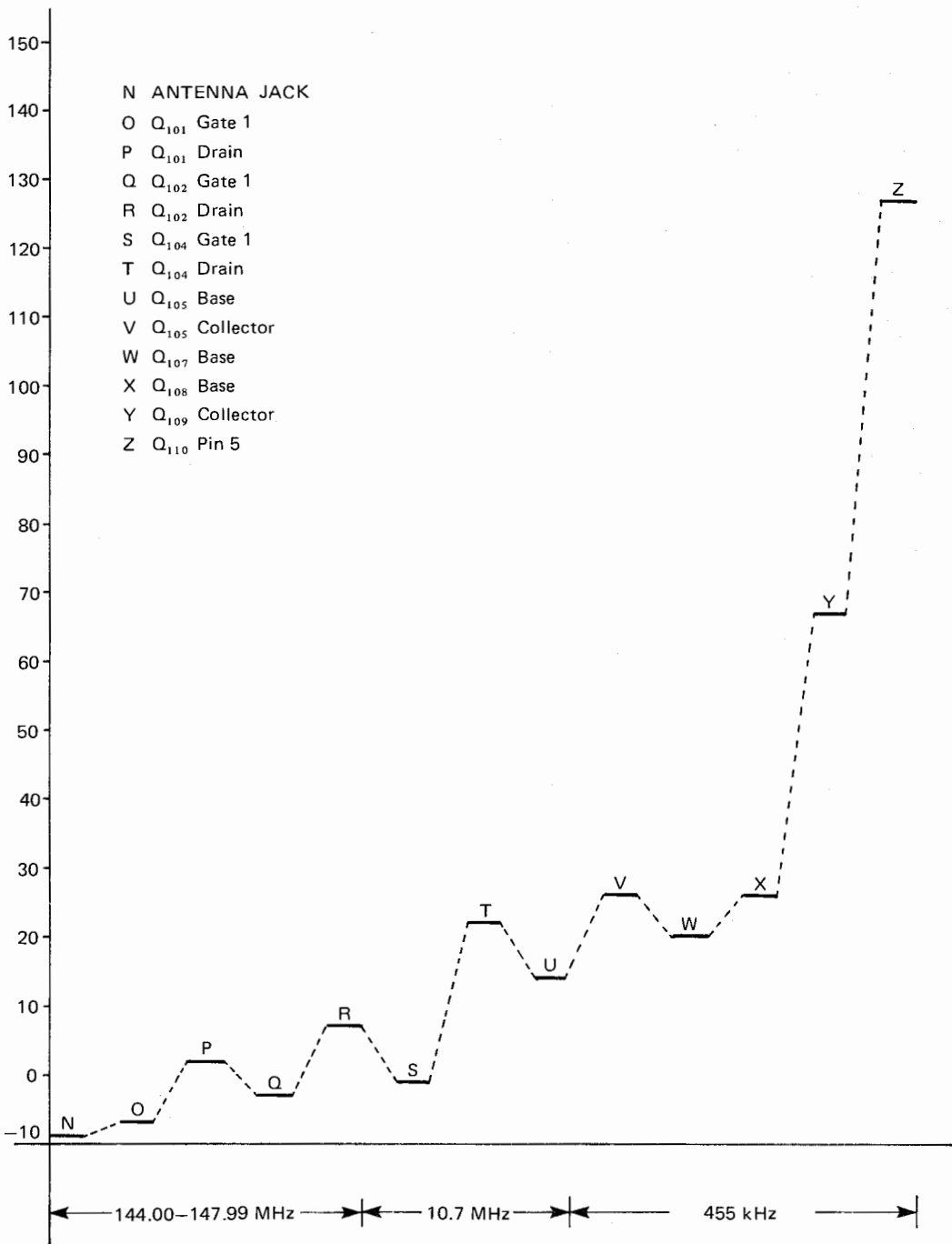
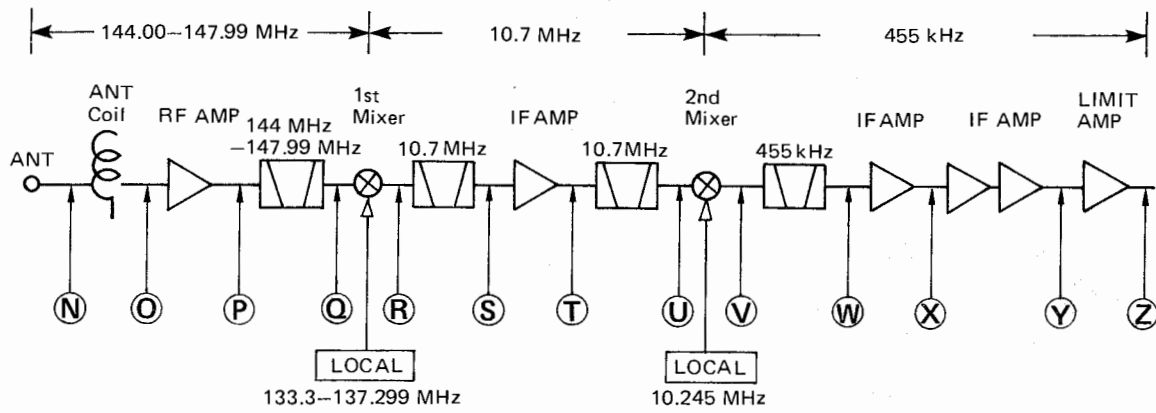


LEVEL DIAGRAM TRANSMITTER SECTION

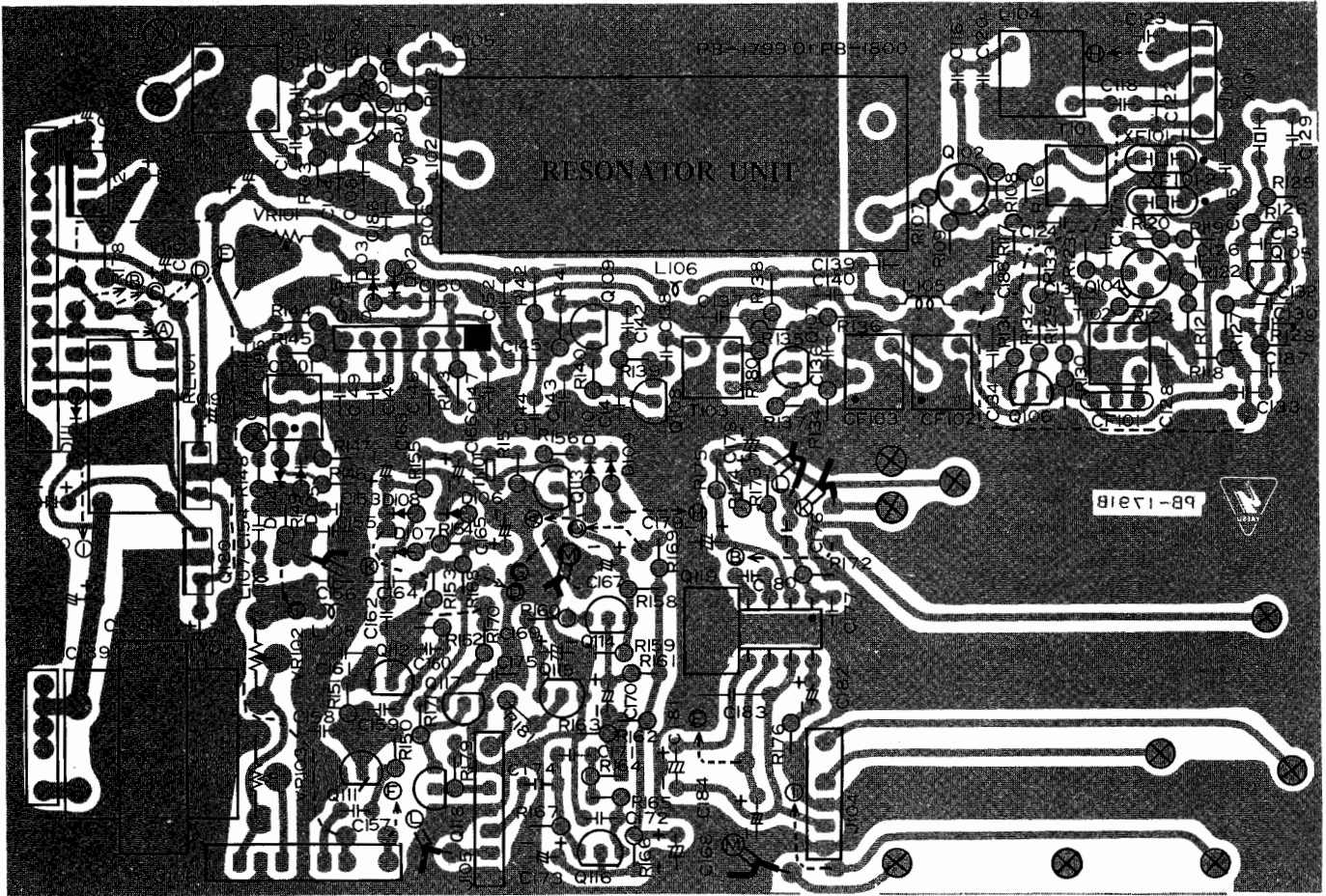
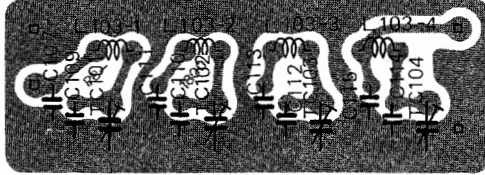


LEVEL DIAGRAM

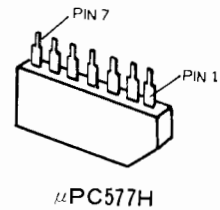
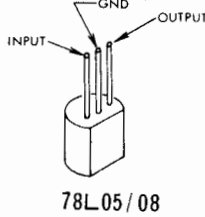
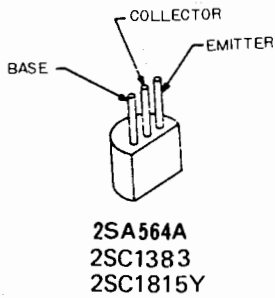
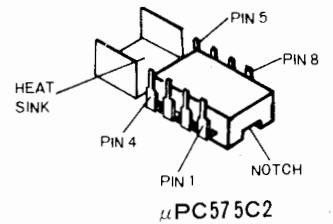
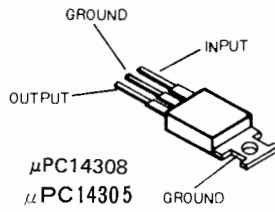
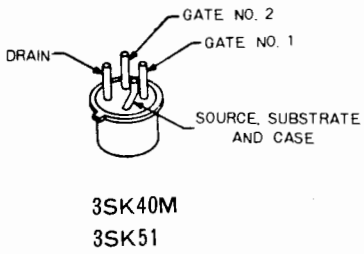
RECEIVER SECTION

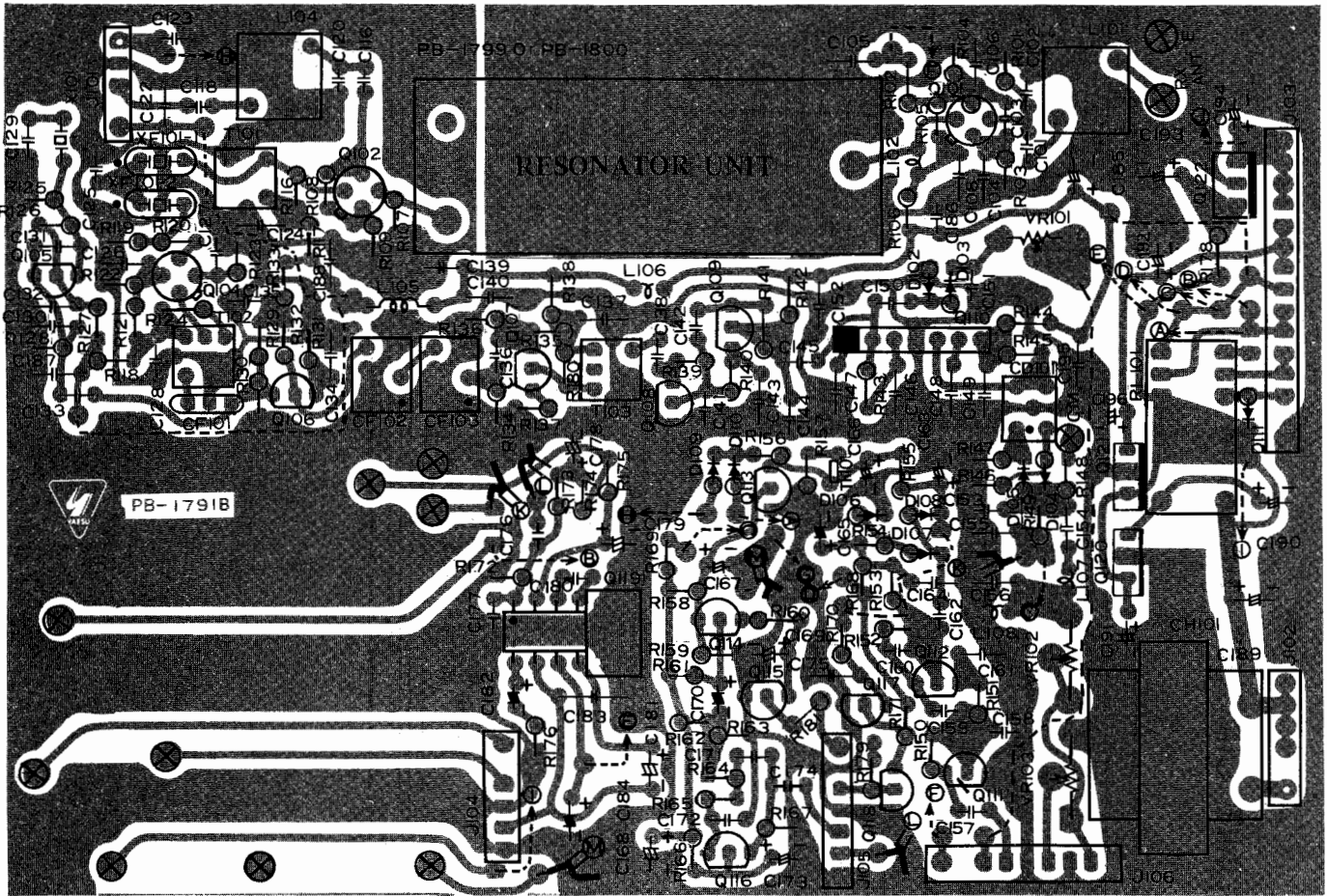
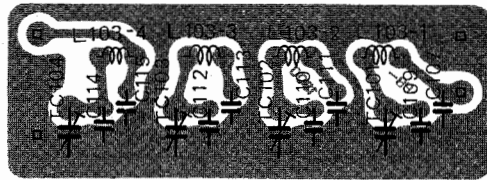


PARTS LAYOUT (RECEIVER/RESONATOR UNIT)



Viewed from component side





VOLTAGE CHART
(DC VOLTS)

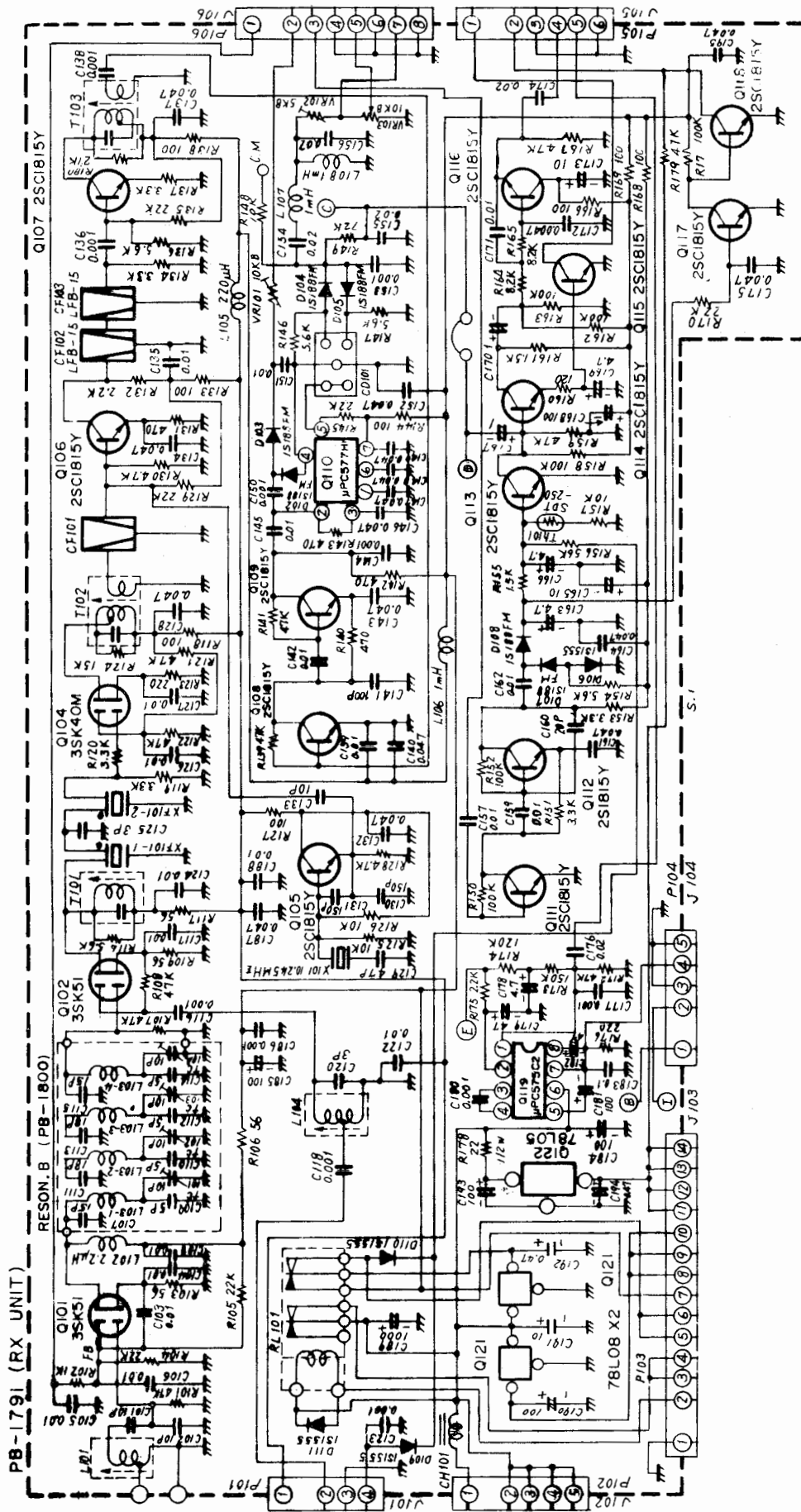
Viewed from solder side

	E(S)	C(D)	B(G ₁)	G ₂
Q ₁₀₁	0.35	7.0	0	3.5
Q ₁₀₂	0.15	7.0	0	0.15
Q ₁₀₄	0.4	7.0	0	3.5
Q ₁₀₅	3.4	7.0	3.5	—
Q ₁₀₆	0.6	4.3	1.2	—
Q ₁₀₇	0.8	7.2	1.5	—
Q ₁₀₈	E	1.6	0.7	—
Q ₁₀₉	3.5	5.5	4.2	—
Q ₁₁₁	E	1.6	0.7	—

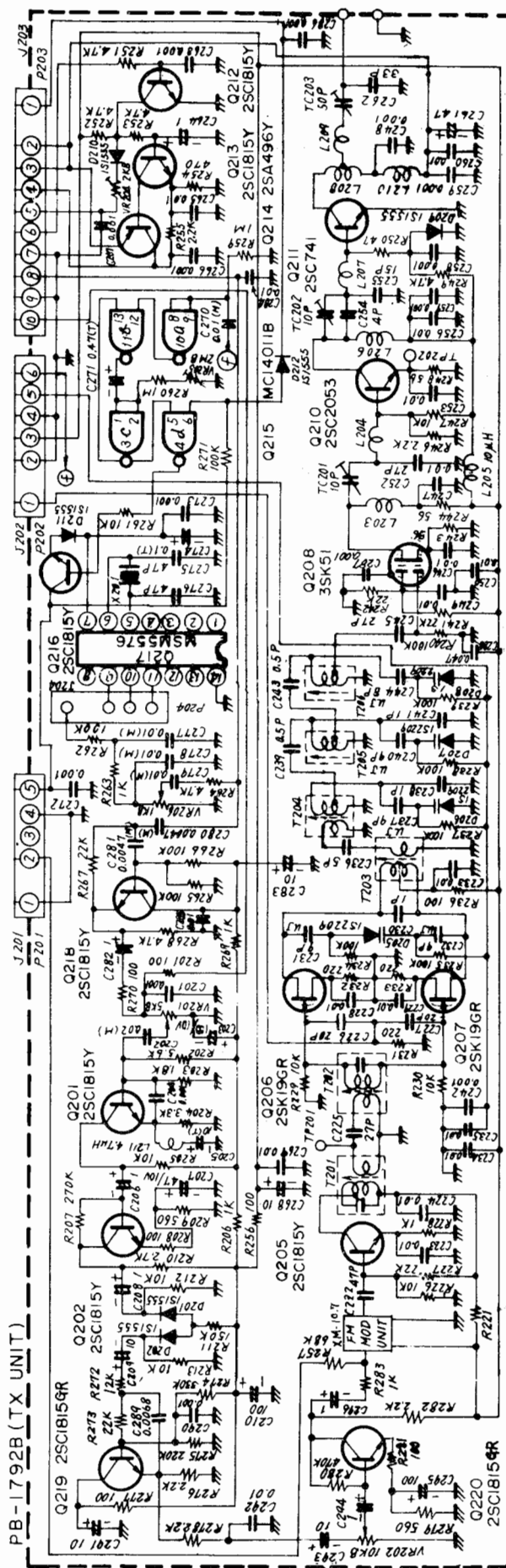
	E(S)	C(D)	B(G ₁)	G ₂	
Q ₁₁₂	3.5	4.7	4.1	—	
Q ₁₁₃	E	1.9/0	0.35/0.6	—	R/T (SQ ON/OFF)
Q ₁₁₄	1.3	3.8	1.9	—	
Q ₁₁₅	E	0.1/13.5	0.8/0	—	R/T (SQ ON/OFF)
Q ₁₁₆	7	2.7	3.3	—	
Q ₁₁₇	E	0.6/0	0.4/0.5	—	R/T (SQ ON/OFF)
Q ₁₁₈	E	0.6/0	0/4.5	—	

	1	2	3	4	5	6	7	8
Q ₁₁₀	5.0	5.0	3.5	E	2.5	2.0	6.0	—
Q ₁₁₉	1.7	13.5	13.0	7.6	6.4	13.6	0.25	1.8
Q ₁₂₀	13.6	0	8.0	—	—	—	—	—
Q ₁₂₁	13.6	0	8.0	—	—	—	—	—
Q ₁₂₂	12.4	0	5.0	—	—	—	—	—

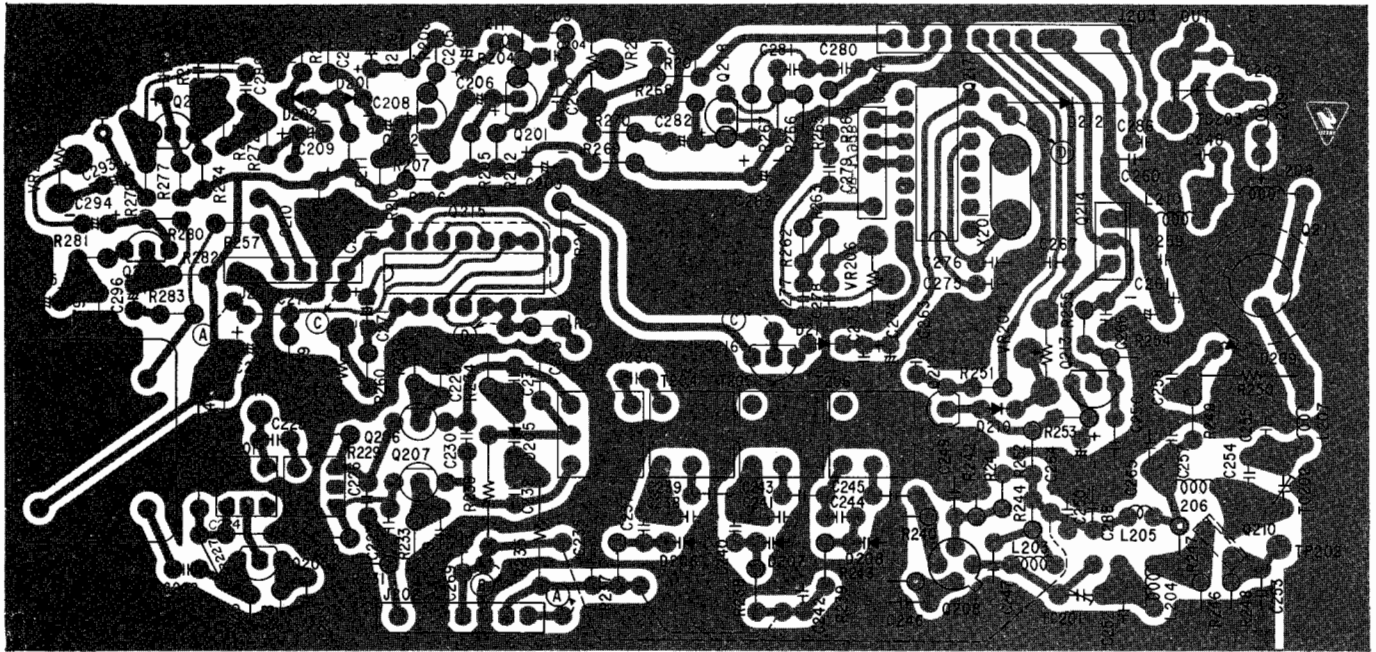
RX UNIT CIRCUIT DIAGRAM



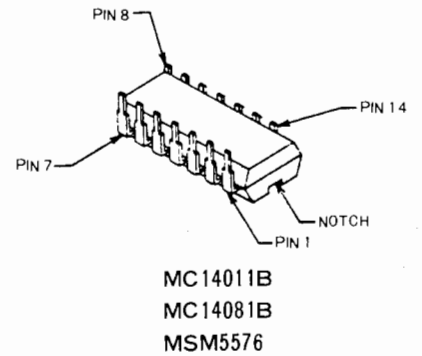
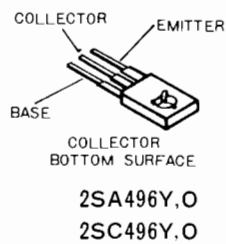
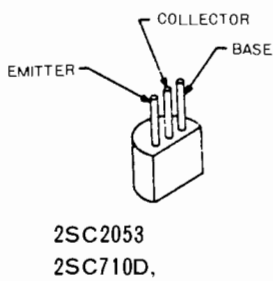
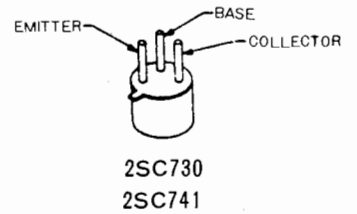
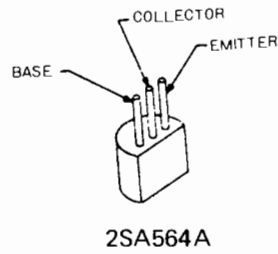
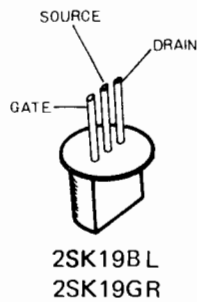
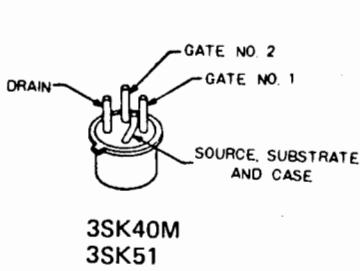
TX UNIT CIRCUIT DIAGRAM

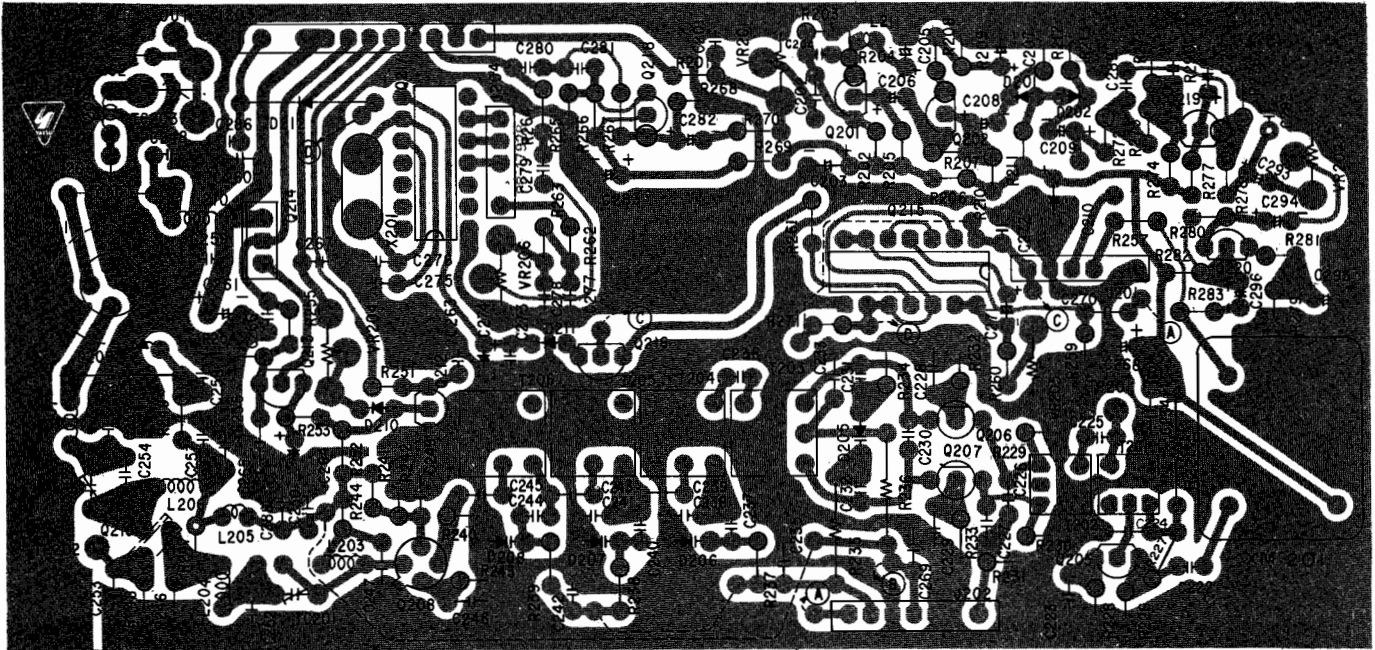


PARTS LAYOUT (TX UNIT)



Viewed from component side



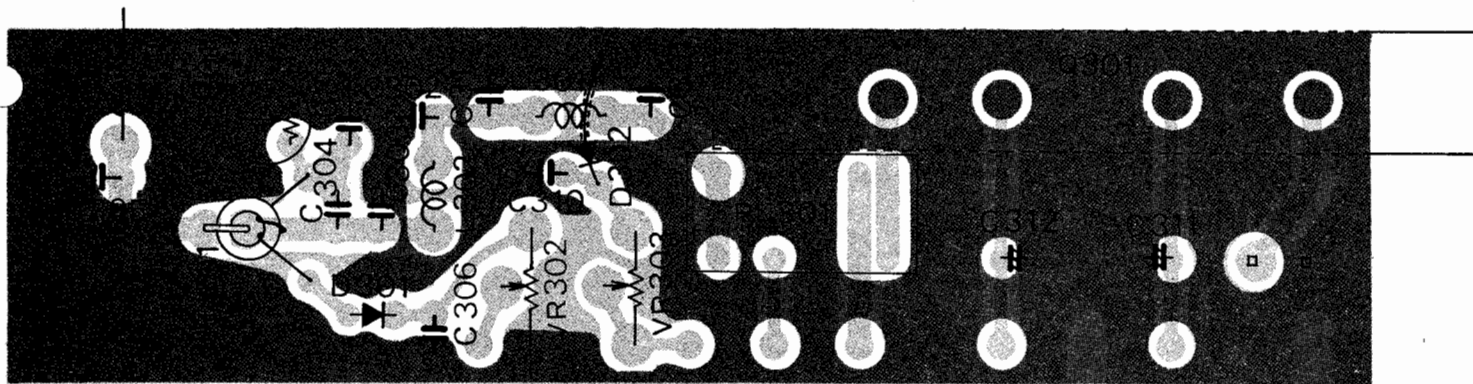


Viewed from solder side

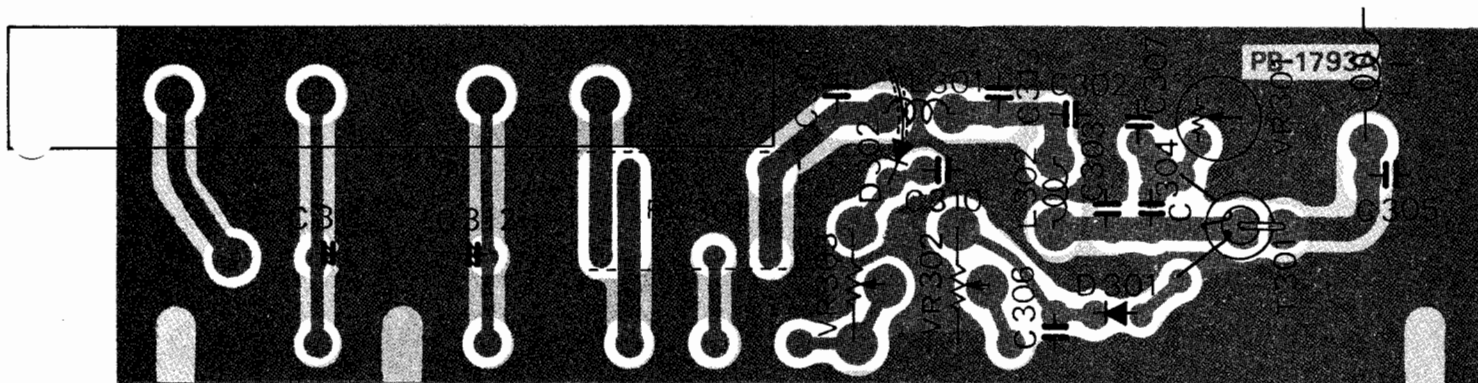
VOLTAGE CHART
(DC VOLTS)

	E(S)	C(D)	B(G ₁)	G ₂	
Q ₂₀₁	0.7	3.2	1.3	—	
Q ₂₀₂	0.7	3.7	1.4	—	
Q ₂₀₃	0.6	3.9	1.3	—	
Q ₂₀₄	1.3	2.0	6.5	—	
Q ₂₀₅	1.3	2.0	6.5	—	
Q ₂₀₆	0.8	6.5	-0.15	—	
Q ₂₀₇	0.8	6.5	-0.15		
Q ₂₀₈	0.3	7	0	3.6	
Q ₂₁₀	0.55	7.4	0.9	—	
Q ₂₁₁	E	13.5	0.9	—	
Q ₂₁₂	E	7.0/1.0	0.4/0.05	—	H/L
Q ₂₁₃	6.5/0.65	12.5	7.0/1.0	—	H/L
Q ₂₁₄	13.5	13.0/3.0	12.5	—	H/L
Q ₂₁₆	6.5	7.3	7.3	—	BURST: ON
Q ₂₁₈	1.7	5.0	2.4	—	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q ₂₁₇	0	0	0	0	2.6	2.5	6.0	0	3.0	3.0	3.0	3.0	3.0	0

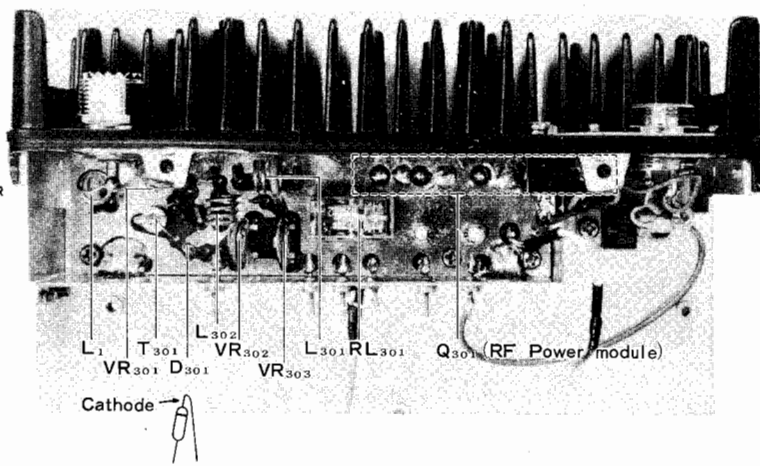
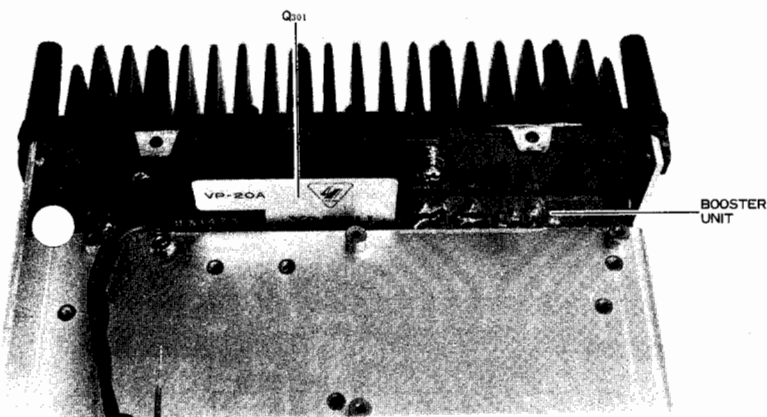


Viewed from component side

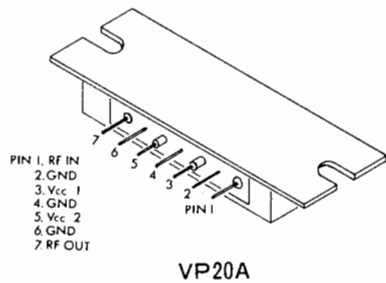


Viewed from power module side

MOUNTING DETAIL

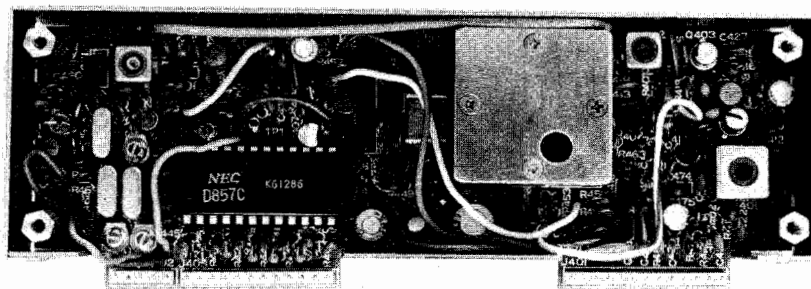


BOOSTER UNIT(PB-1793)



VOLTAGE CHART
(DC VOLTS)

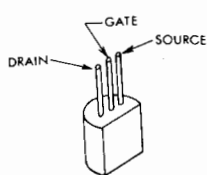
	1	2	3	4	5	6	7	
Q ₃₀₁	0	0	12.5/2.5	0	13.6	0	0	H/L



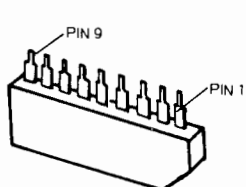
VOLTAGE CHART
(DC VOLTS)

	E(S)	C(D)	B(G)	G ₂	
Q ₄₀₁	0.8	7.0	-1.5	—	
Q ₄₀₂	4.2	7.0	3.7	—	
Q ₄₀₃	0.2	7.0	0	3.7	
Q ₄₀₄	0.2	7.0	0	3.7	
Q ₄₀₅	1.0	7.0	1.6	—	
Q ₄₀₇	E	2.5	0.6	—	
Q ₄₀₈	4.5	7.0	4.6	—	
Q ₄₁₁	0.7	7.0	1.35	—	
Q ₄₁₂	2.0	7.0	2.4	—	
Q ₄₁₃	E	3.2	0.65	—	
Q ₄₁₄	3.0	7.0	3.5	—	
Q ₄₁₅	6.0	0	5.0	—	} PLL: LOCK
Q ₄₁₆	E	4.2	0	—	
Q ₄₁₇	E	0.2	0.7	—	
Q ₄₁₈	E	0	0.7	—	

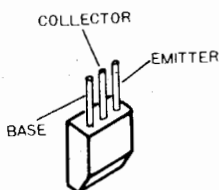
	1	2	3	4	5	6	7	8	9	
Q ₄₀₆	1.5	1.5	0	6.5	7.5	—	—	—	—	
Q ₄₁₀	5.0	0	2.0	5.0	5.0	0	2.5	0	0	PLL LOCK



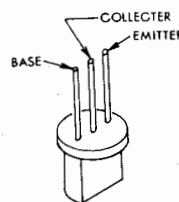
2SK30Y



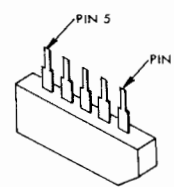
TC5081P



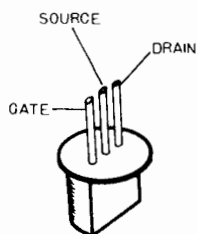
2SC535A



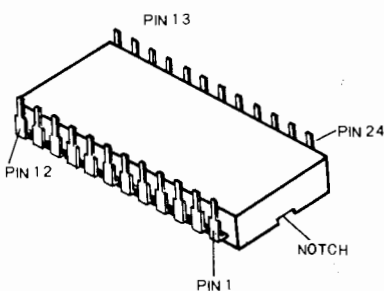
2SC373
2SC1000GR



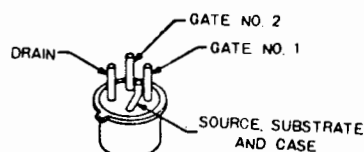
TA7060P



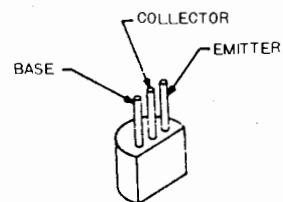
2SK198L
2SK19GR



μPD857C

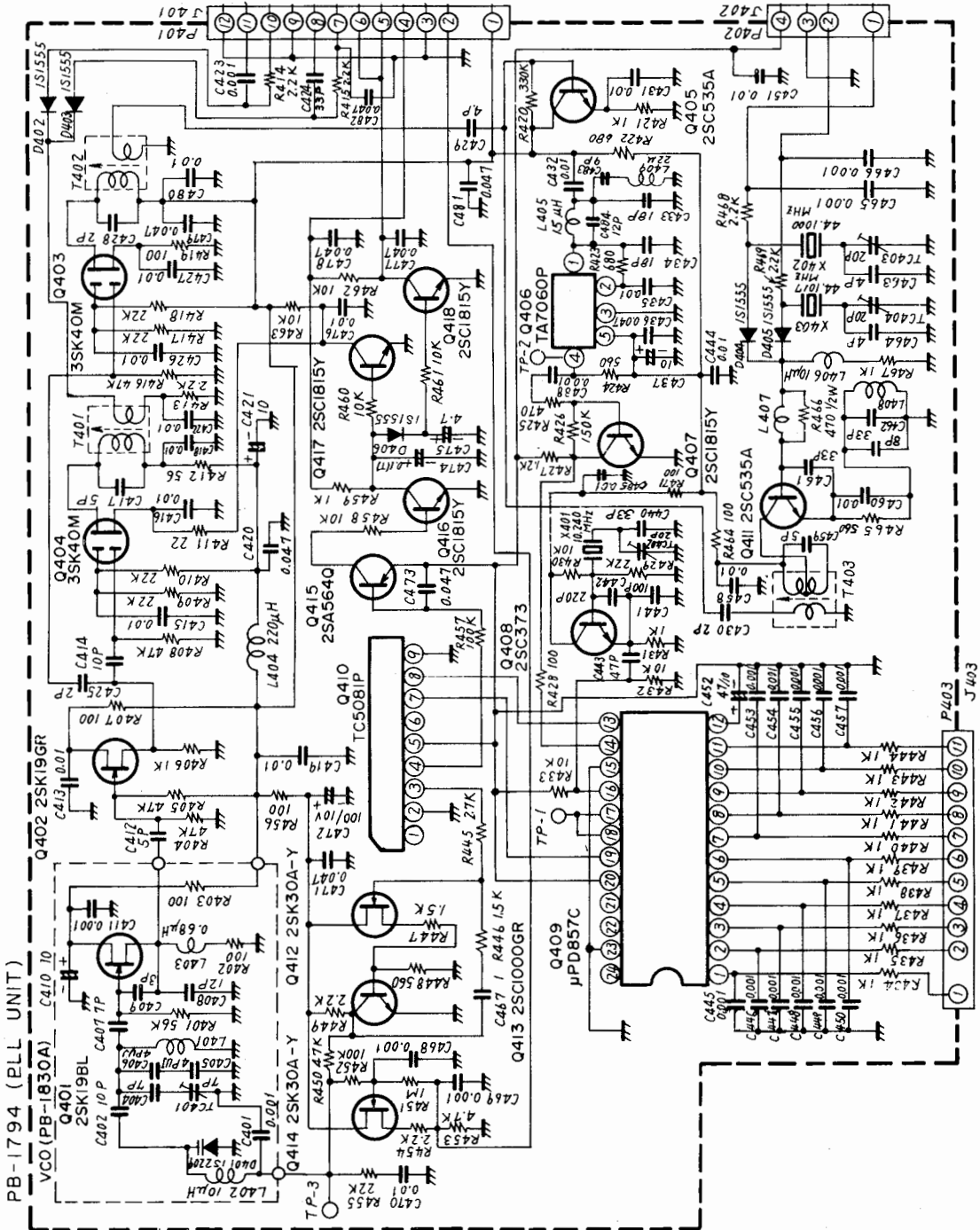


3SK40M
3SK51-03

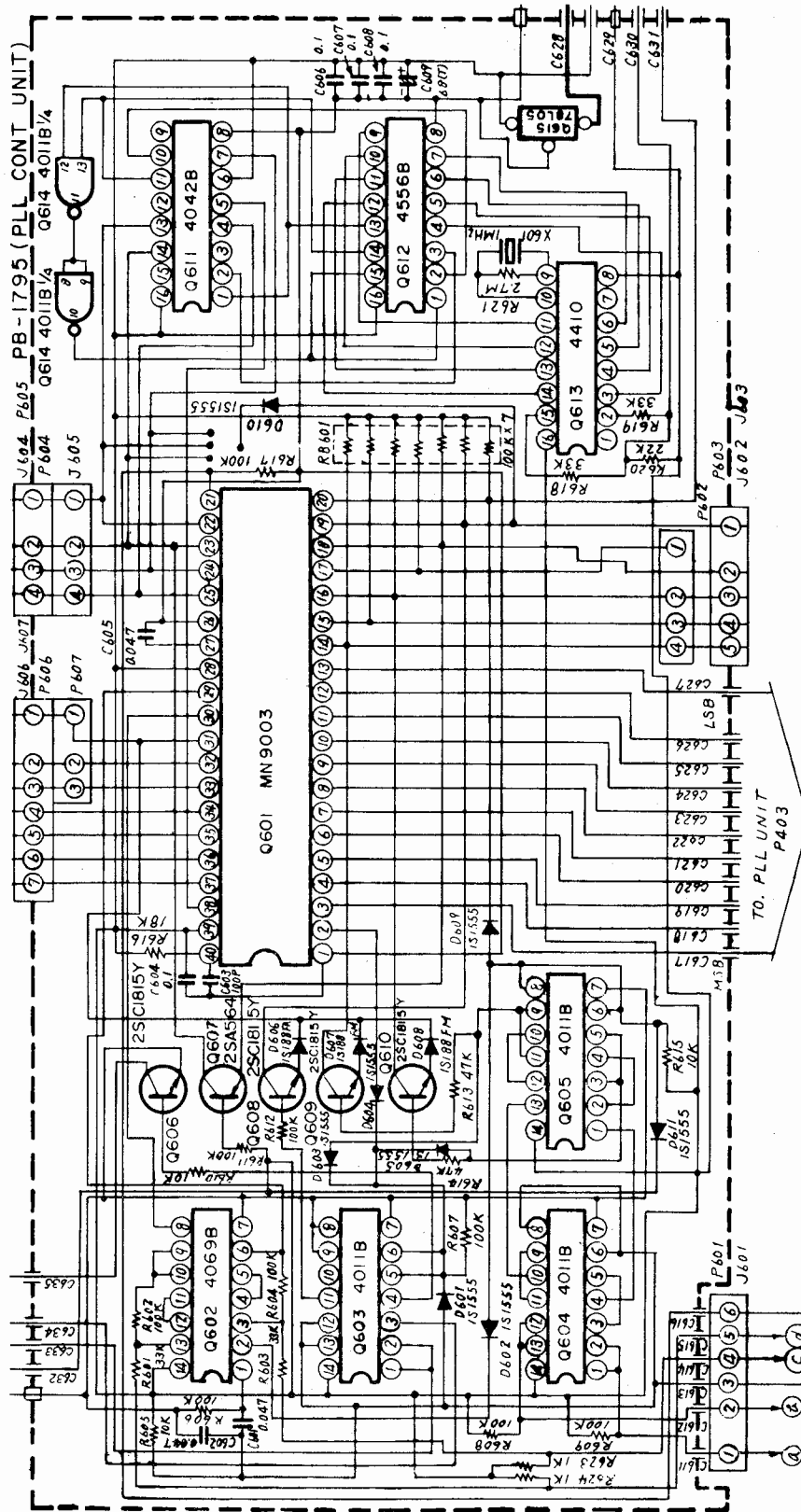


2SA564A
2SC1383
2SC1815Y

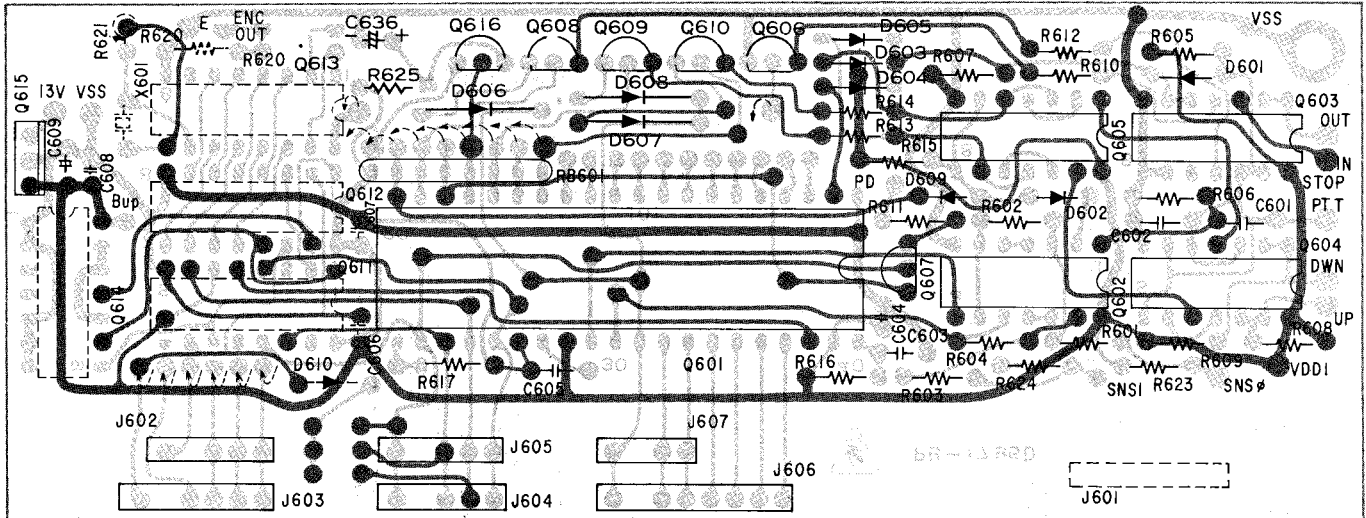
PLL/VCO UNIT DIAGRAM



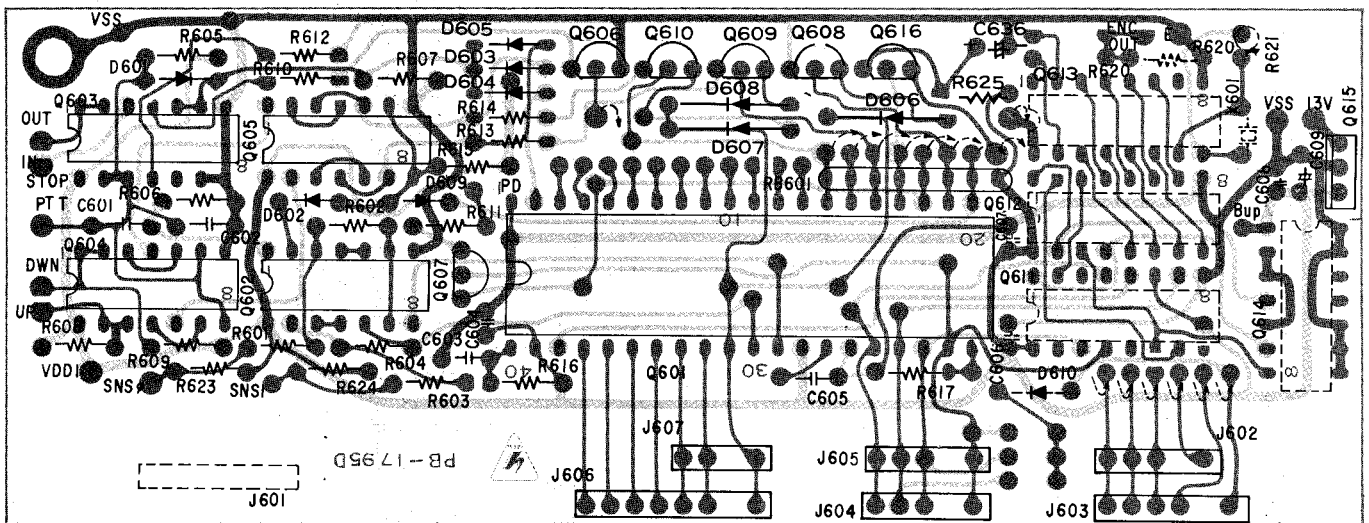
PLL CONTROL UNIT CIRCUIT DIAGRAM



PARTS LAYOUT (PLL CONTROL UNIT)

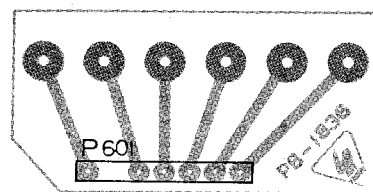
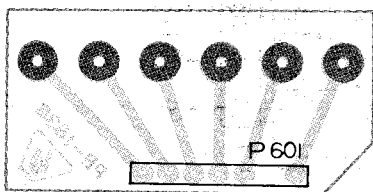


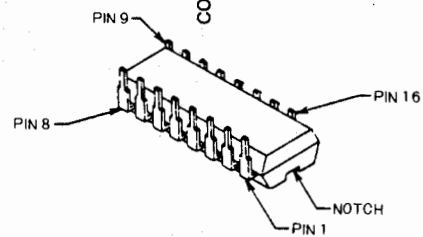
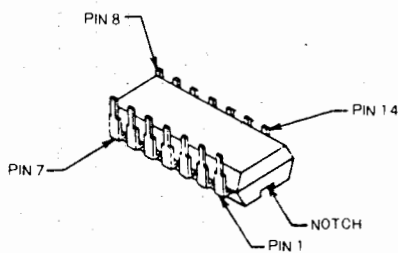
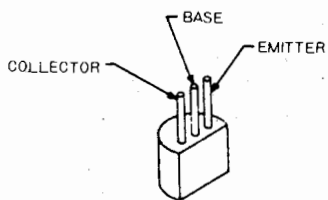
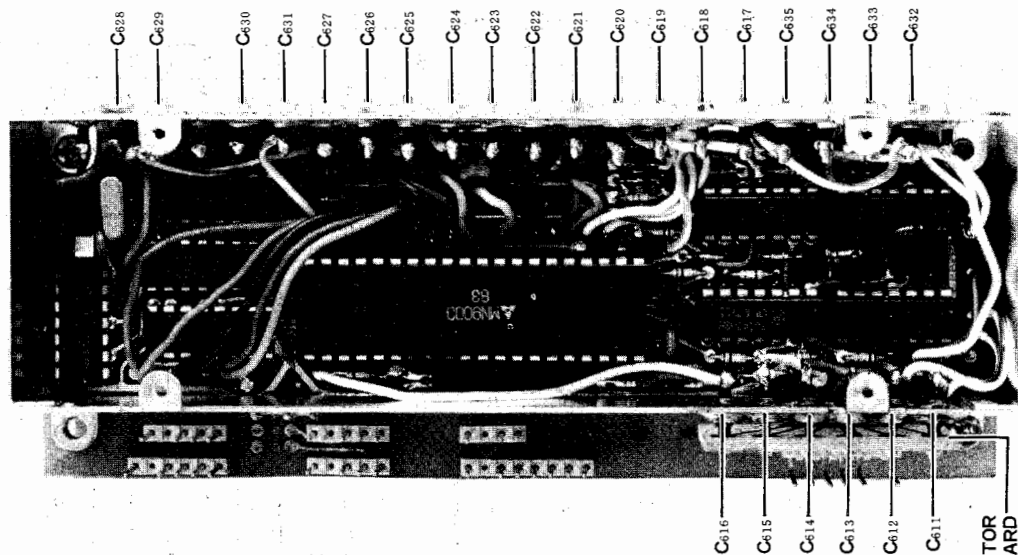
Viewed from component side



Viewed from solder side

J601 CONNECTOR BOARD PARTS LAYOUT





- MSM561 MC14049B
- MC14008B MC14510B
- MC14028B MC14511B
- MC14042B MC14519B

YM-2500 KEY-BOARD	Q ₆₀₁ MN9003				Q ₆₁₃ MC14410							
	PIN 25	PIN 24	PIN 23	PIN 22	PIN 6	PIN 5	PIN 4	PIN 3	PIN 11	PIN 12	PIN 13	PIN 14
1	L	L	L	L	H	H	H	L	H	H	H	L
2	L	L	L	H	H	H	H	L	H	H	L	H
3	L	L	H	L	H	H	H	L	H	L	H	H
4	L	H	L	L	H	H	L	H	H	H	H	L
5	L	H	L	H	H	H	L	H	H	H	L	H
6	L	H	H	L	H	H	L	H	H	L	H	H
7	H	L	L	L	H	L	H	H	H	H	H	L
8	H	L	L	H	H	L	H	H	H	H	L	H
9	H	L	H	L	H	L	H	H	H	L	H	H
*	H	H	L	L	L	H	H	H	H	H	H	L
0	H	H	L	H	L	H	H	H	H	H	L	H
#	H	H	H	L	L	H	H	H	H	L	H	H

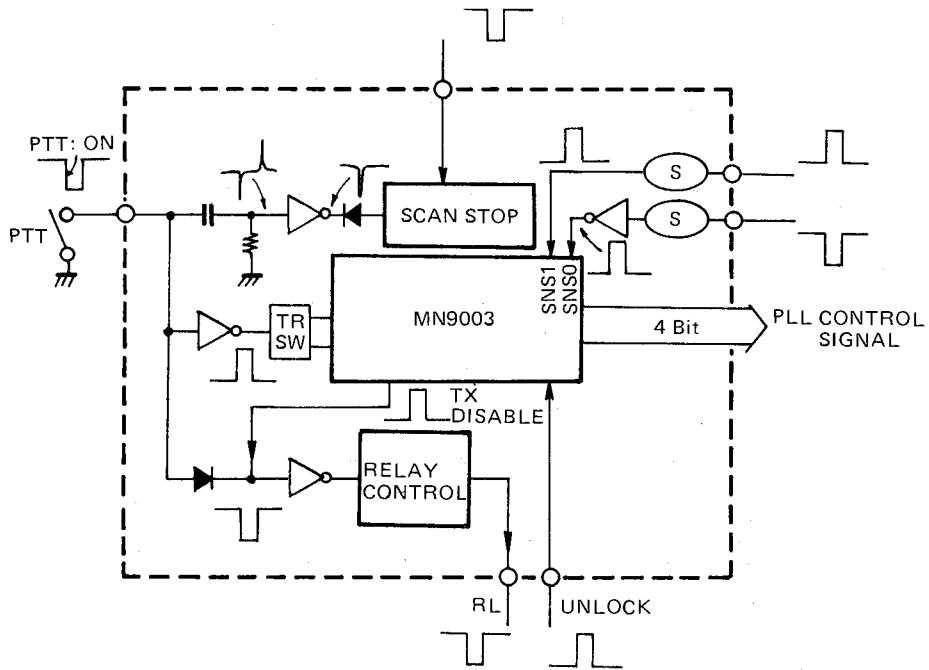
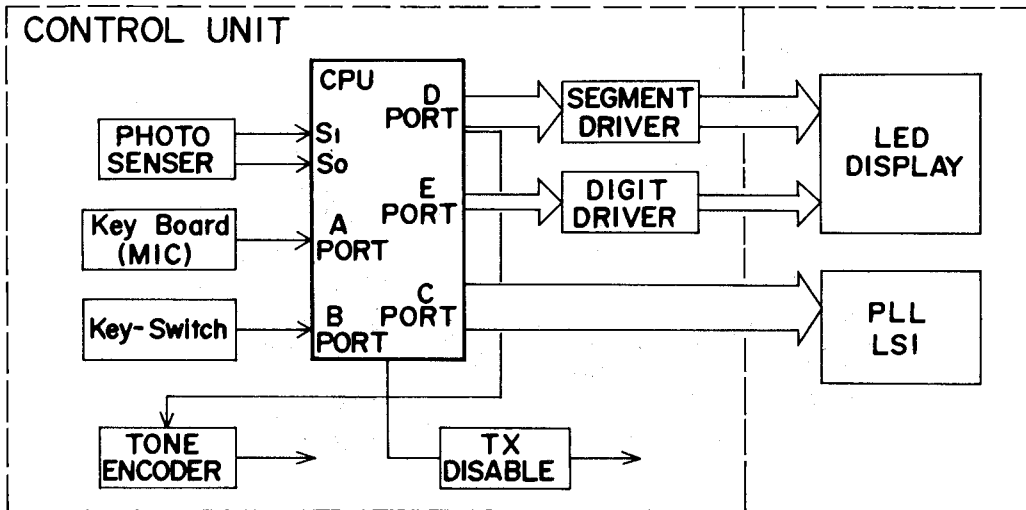
		HIGH TONE		
		1209Hz	1336Hz	1477Hz
LOW TONE	697Hz	1	2	3
	770Hz	4	5	6
	852Hz	7	8	9
	941Hz	*	0	#

CPU MN9003 and TONE ENCODER MC14410 LOGIC CHART

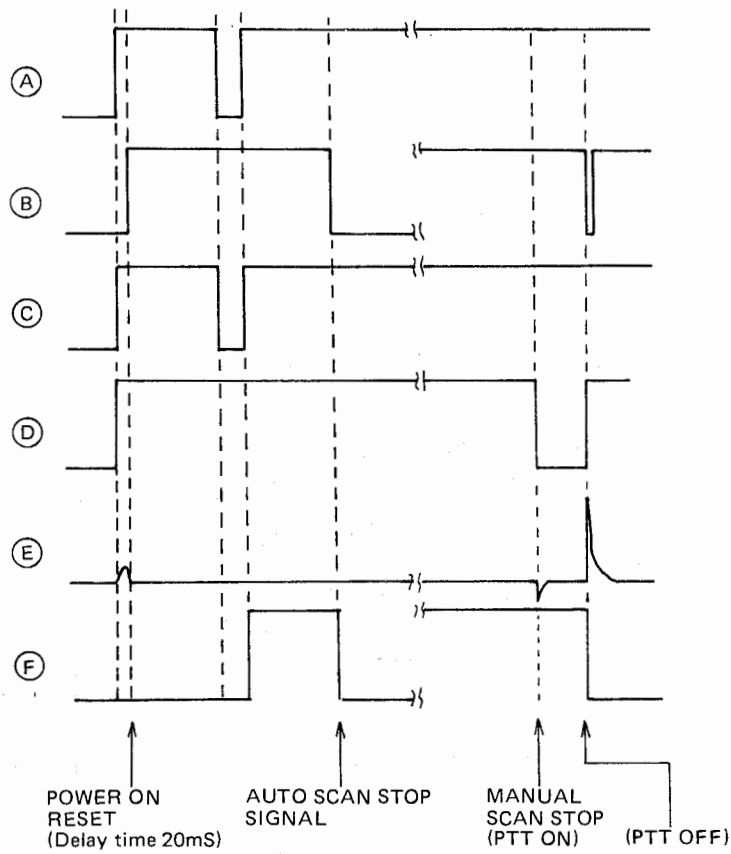
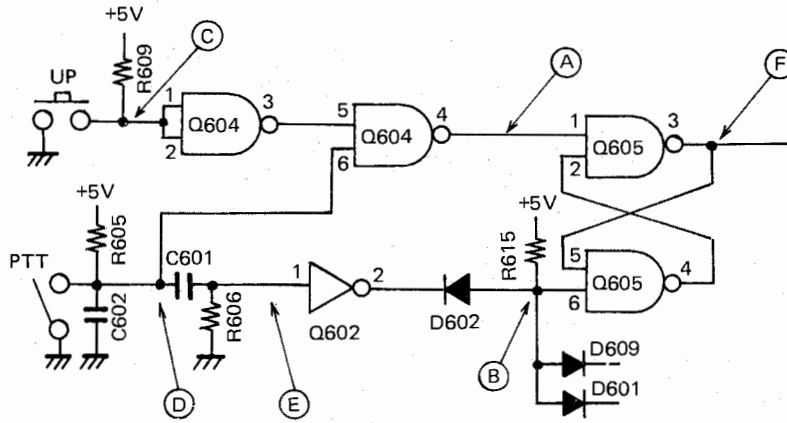
Q409 (μ PD857C) PROGRAMMABLE DIVIDER CODE

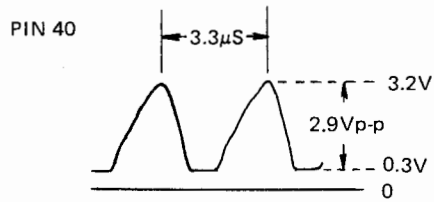
Q 409 PIN NUMBER →	1	2	3	4	5	6	7	8	9	10	11	
P/J403 →	1	2	3	4	5	6	7	8	9	10	11	
DIAL DISPLAY ↓	PROGRAMMABLE DIVIDER RATIO ↓	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇	P ₈	P ₉	P ₁₀	P ₁₁
144.000	1/100	0	0	0	0	0	0	0	0	1	0	0
4.010	1/101	1	0	0	0	0	0	0	0	1	0	0
4.020	1/102	0	1	0	0	0	0	0	0	1	0	0
4.030	1/103	1	1	0	0	0	0	0	0	1	0	0
4.040	1/104	0	0	1	0	0	0	0	0	1	0	0
4.050	1/105	1	0	1	0	0	0	0	0	1	0	0
4.060	1/106	0	1	1	0	0	0	0	0	1	0	0
4.070	1/107	1	1	1	0	0	0	0	0	1	0	0
4.080	1/108	0	0	0	1	0	0	0	0	1	0	0
4.090	1/109	1	0	0	1	0	0	0	0	1	0	0
144.100	1/110	0	0	0	0	1	0	0	0	1	0	0
4.110	1/111	1	0	0	0	1	0	0	0	1	0	0
4.120	1/112	0	1	0	0	1	0	0	0	1	0	0
4.130	1/113	1	1	0	0	1	0	0	0	1	0	0
4.140	1/114	0	0	1	0	1	0	0	0	1	0	0
4.150	1/115	1	0	1	0	1	0	0	0	1	0	0
4.160	1/116	0	1	1	0	1	0	0	0	1	0	0
4.170	1/117	1	1	1	0	1	0	0	0	1	0	0
4.180	1/118	0	0	0	1	1	0	0	0	1	0	0
4.190	1/119	1	0	0	1	1	0	0	0	1	0	0
144.200	1/120	0	0	0	0	0	1	0	0	1	0	0
4.300	1/130	0	0	0	0	1	1	0	0	1	0	0
4.400	1/140	0	0	0	0	0	0	1	0	1	0	0
4.500	1/150	0	0	0	0	1	0	1	0	1	0	0
4.600	1/160	0	0	0	0	0	1	1	0	1	0	0
4.700	1/170	0	0	0	0	1	1	1	0	1	0	0
4.800	1/180	0	0	0	0	0	0	0	1	1	0	0
4.900	1/190	0	0	0	0	1	0	0	1	1	0	0
145.000	1/200	0	0	0	0	0	0	0	0	0	1	0
5.010	1/201	1	0	0	0	0	0	0	0	0	1	0
5.020	1/202	0	1	0	0	0	0	0	0	0	1	0
5.030	1/203	1	1	0	0	0	0	0	0	0	1	0
5.040	1/204	0	0	1	0	0	0	0	0	0	1	0
5.050	1/205	1	0	1	0	0	0	0	0	0	1	0
5.060	1/206	0	1	1	0	0	0	0	0	0	1	0
5.070	1/207	1	1	1	0	0	0	0	0	0	1	0
5.080	1/208	0	0	0	1	0	0	0	0	0	1	0
5.090	1/209	1	0	0	1	0	0	0	0	0	1	0
145.100	1/210	0	0	0	0	1	0	0	0	0	1	0
5.200	1/220	0	0	0	0	0	1	0	0	0	1	0
5.300	1/230	0	0	0	0	1	1	0	0	0	1	0
5.400	1/240	0	0	0	0	0	0	1	0	0	1	0
5.500	1/250	0	0	0	0	1	0	1	0	0	1	0
5.600	1/260	0	0	0	0	0	1	1	0	0	1	0
5.700	1/270	0	0	0	0	1	1	1	0	0	1	0
5.800	1/280	0	0	0	0	0	0	0	1	0	1	0
5.900	1/290	0	0	0	0	1	0	0	1	0	1	0
146.000	1/300	0	0	0	0	0	0	0	0	1	1	0
147.000	1/400	0	0	0	0	0	0	0	0	0	0	1
147.990	1/499	1	0	0	1	1	0	0	1	0	0	1

*1 HIGH LEVEL (5V)
*0 LOW LEVEL (0V)

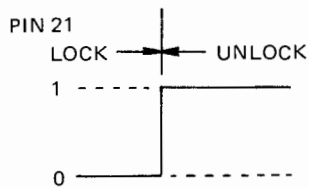


SCAN CONTROL CIRCUIT TIMING CHART (UP SCAN)

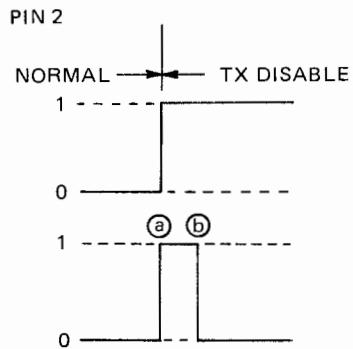




CPU CLOCK OSCILLATOR



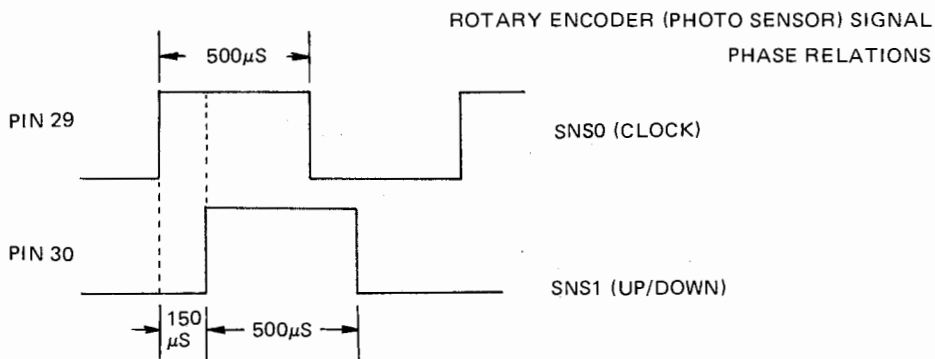
LOCK LOW (TX, RX ENABLE)
UNLOCK HIGH (TX, RX DISABLE)



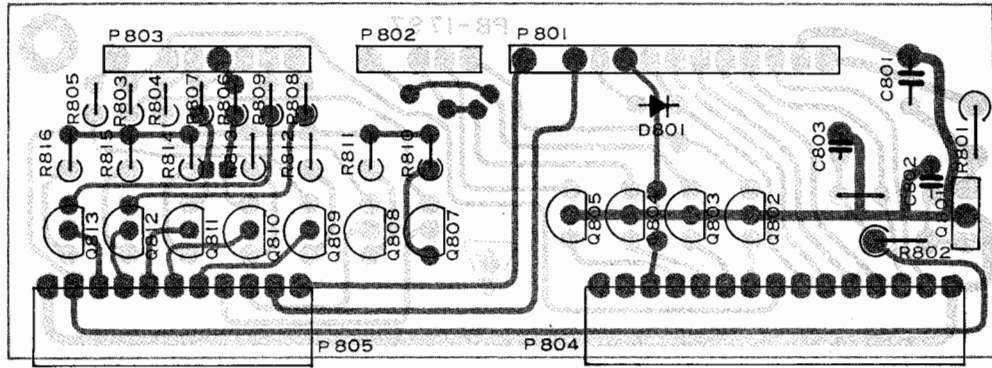
NORMAL LOW (TX, RX ENABLE)
OFFBAND } HIGH (TX, RX DISABLE)
UNLOCK }

PTT (MANUAL) SCAN STOP

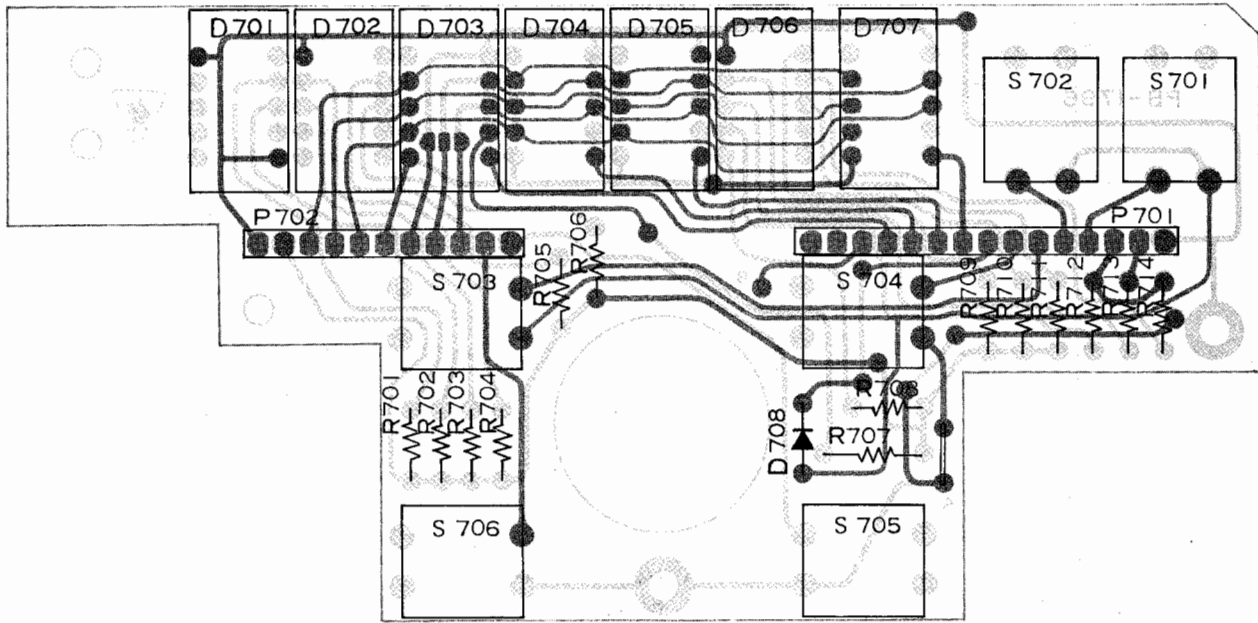
- (a) Press HIGH (SCAN STOP ONLY, NOT TRANSMIT)
- (b) Release LOW (NORMAL)



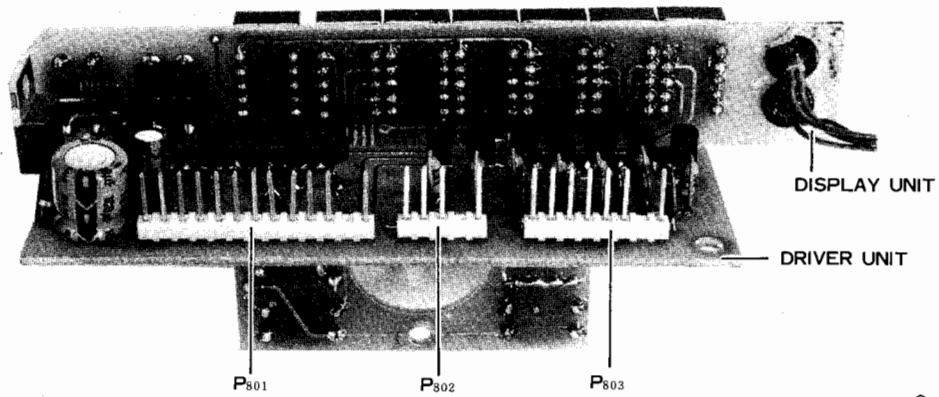
PARTS LAYOUT (DRIVER/DISPLAY UNIT)



Viewed from component side



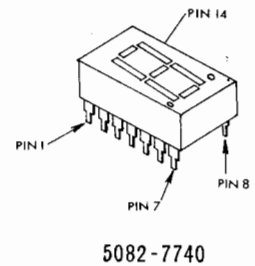
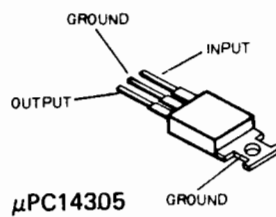
Viewed from component side

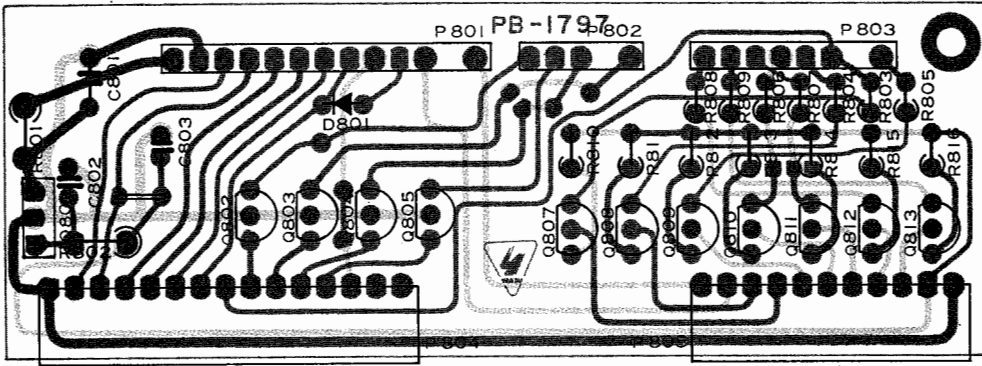


VOLTAGE CHART
(DC VOLTS)

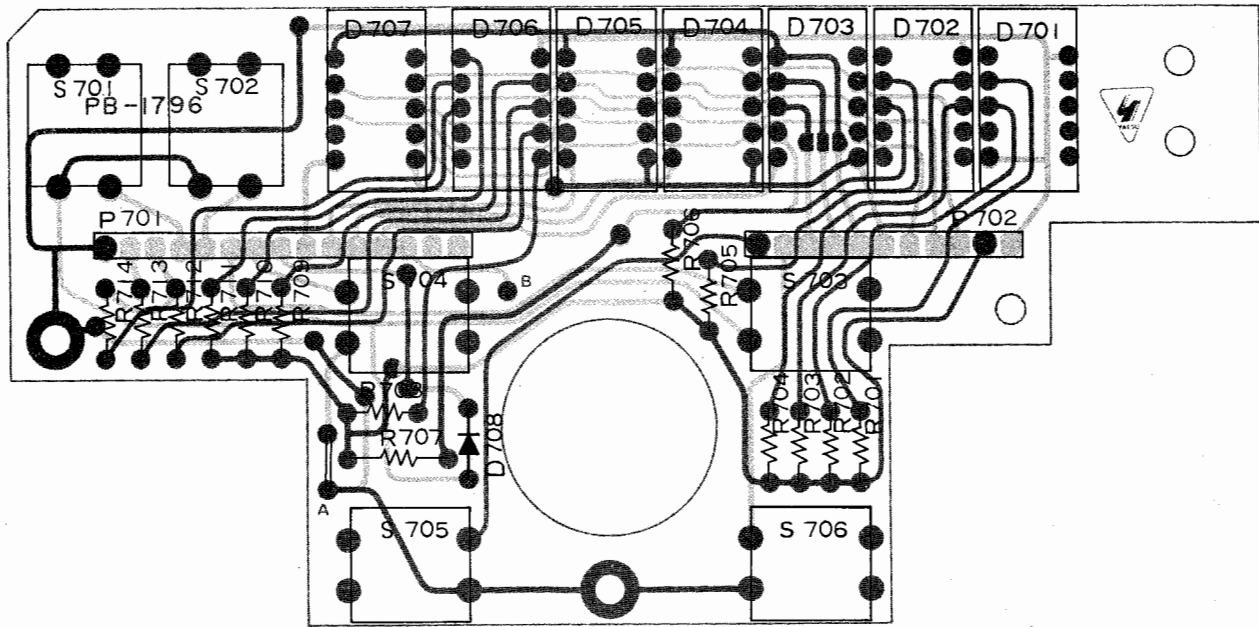
	E	C	B
Q ₈₀₂₋₈₀₅	2.4	0	4.2
Q ₈₀₇₋₈₁₃	4.5	3.1	4.3

	IN	E	OUT
Q ₈₀₁	10.5	0	5.0

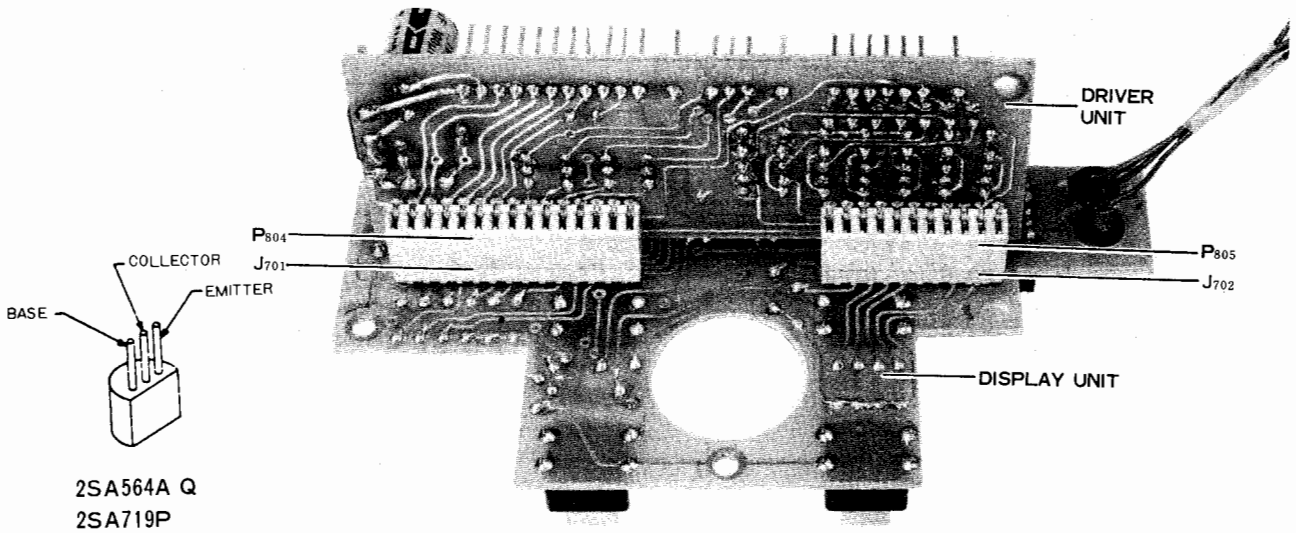




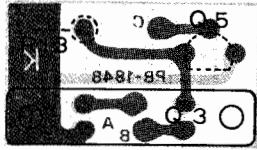
Viewed from solder side



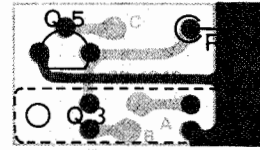
Viewed from solder side



PARTS LAYOUT (PHOTO UNIT)

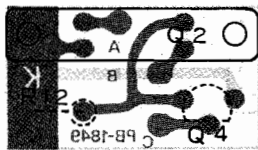


Viewed from component side

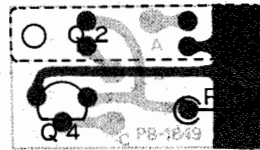


Viewed from solder side

PB-1848

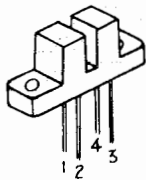


Viewed from component side

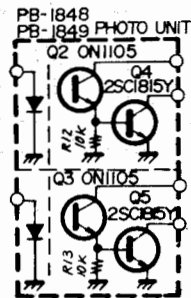
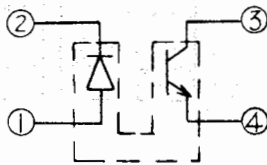


Viewed from solder side

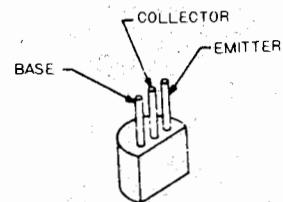
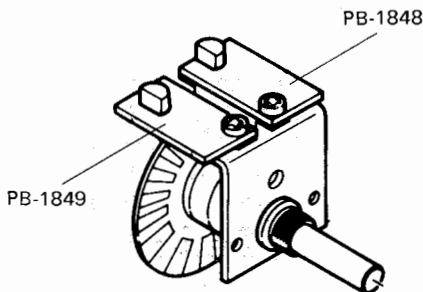
PB-1849



ON1105

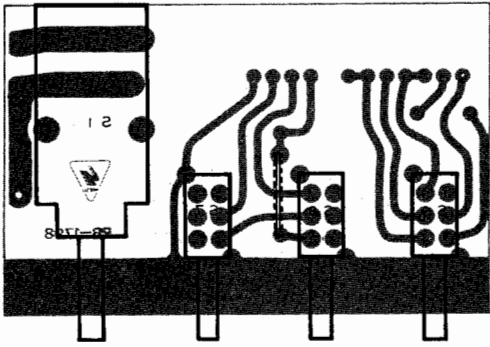


MOUNTING DETAILS

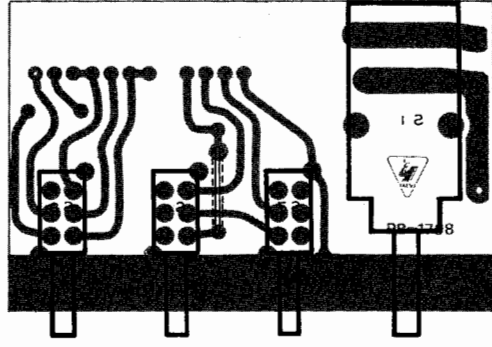


2SC1815Y

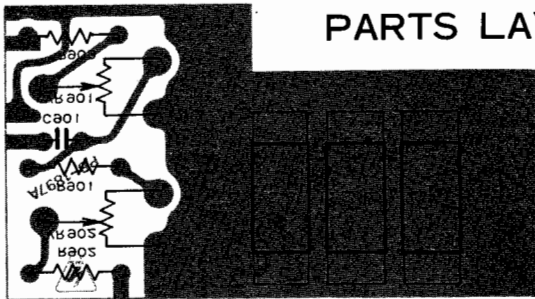
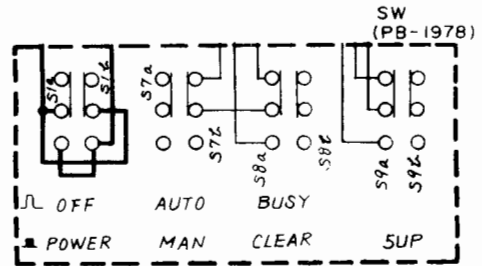
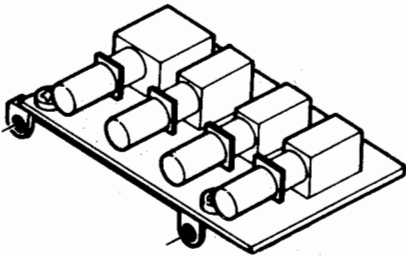
PARTS LAYOUT (SW UNIT)



Viewed from component side

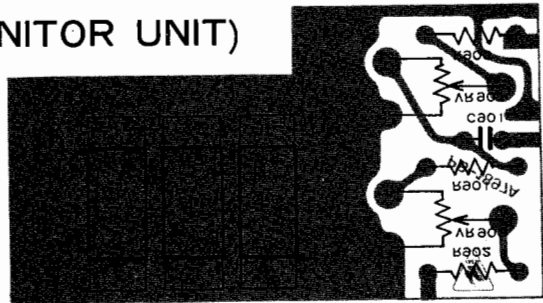


Viewed from solder side

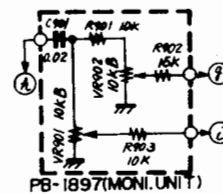
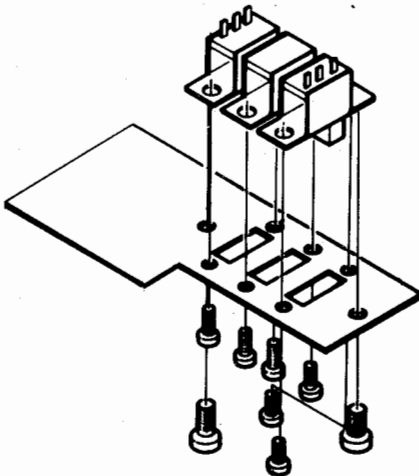


Viewed from component side

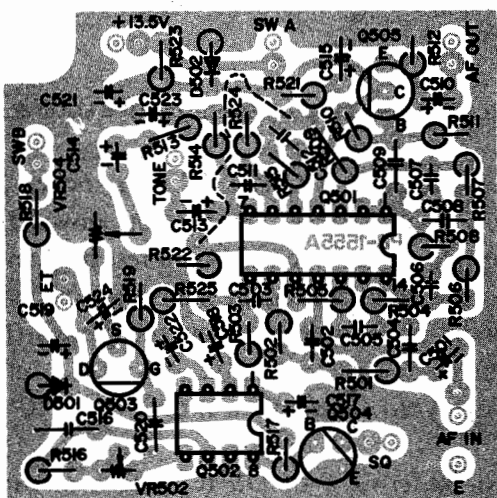
PARTS LAYOUT (MONITOR UNIT)



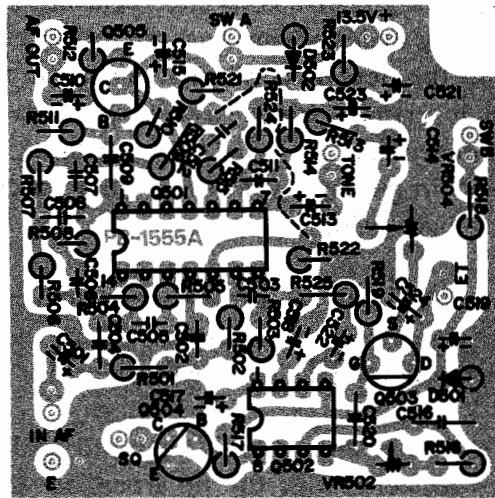
Viewed from solder side



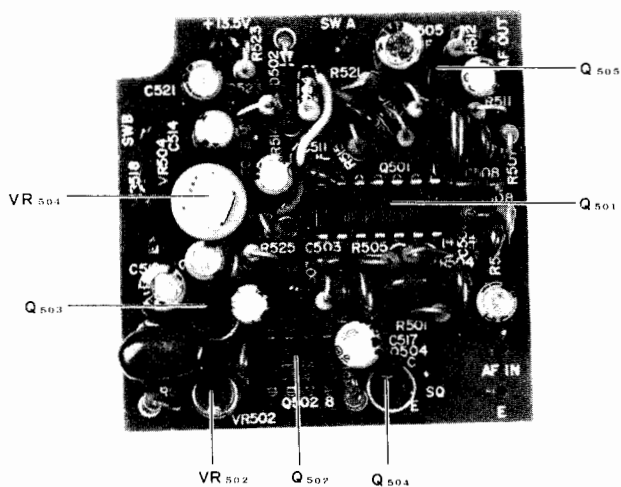
PARTS LAYOUT (TONE SQUELCH UNIT)



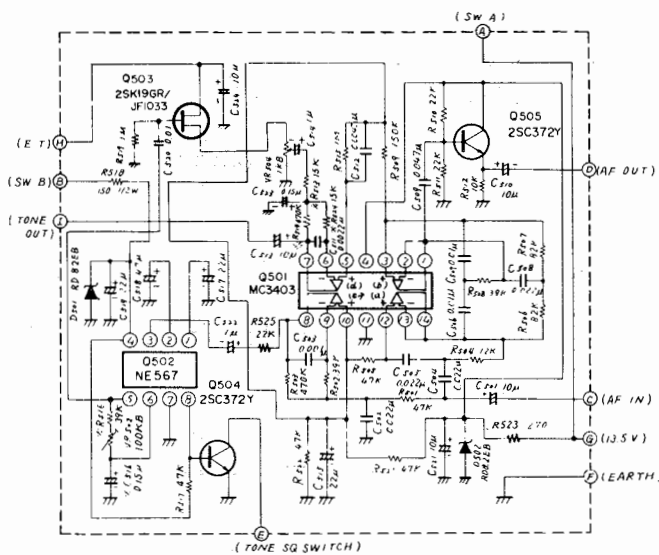
Viewed from component side



Viewed from solder side



	C 516 *	R 516 *	R 513 *	R 514 *	R 524 *
70Hz 160Hz	0.15μF	39KΩ	15KΩ	470KΩ	15KΩ
160Hz 250Hz	0.1μF	33KΩ	8.2KΩ	270KΩ	8.2KΩ



TONE SQUELCH (PB-1555A) OPTION

**SOLDERING AND DESOLDERING TECHNIQUE
ON PRINTED CIRCUIT BOARDS**

The CPU-2500R circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift." While this does no permanent damage to the board, much servicing trouble can result, because of the tendency for this lifted trace to break. A few simple precautions will keep your circuit boards in A-1 condition.

1. Use only a 12 to 30 watt chisel-tip soldering iron. Yes, some "repairmen" have been known to use small blowtorches on cards.
2. Use only a soldering iron equipped with a three-wire cord, with the tip grounded. Also acceptable is a soldering iron isolated through a transformer. An old soldering iron or gun may have 117 volts on the tip, and will certainly cause more damage than it repairs!
3. **USE ONLY 60/40 ROSIN CORE SOLDER.** Acid core solder should be thrown away if you find it in your radio shop!
4. Use a solder sucker and solder tape to ensure a professional repair job.
5. If you **do** lift a trace, don't worry! Read on to find out how to repair traces like a pro.

NOTES ON USE OF CMOS IC's:

As CMOS devices are extremely sensitive to damage from static electricity, special precautions must be observed.

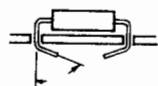
In storage, use only a non-inductive sponge.

When installing a CMOS IC in a socket, or on a circuit board, be certain that the power is off. In addition, the technician should rest his hand on the chassis as the component is inserted, so as to place his hand at the same level as the chassis (better to discharge small amounts of static electricity through your fingers than through a \$5 IC!).

When soldering a CMOS IC onto a circuit board, use a low wattage iron, and be sure to ground the tip with a clip lead, if the tip is not grounded through a three-wire power cord.

INSERTION OF PARTS ON CIRCUIT BOARDS

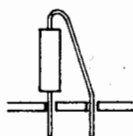
All of the below are acceptable ways of inserting components into circuit board mounting holes.



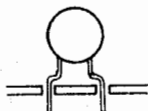
(a) Bend leads slightly



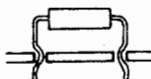
(b) Straight-in mounting



(c) Vertical mounting



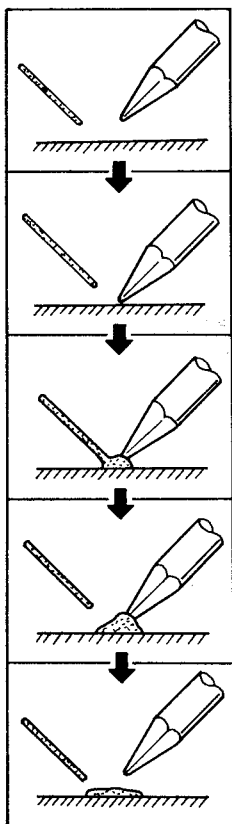
(d) Preformed disc ceramic capacitor



(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE

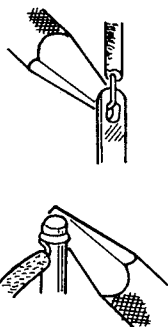
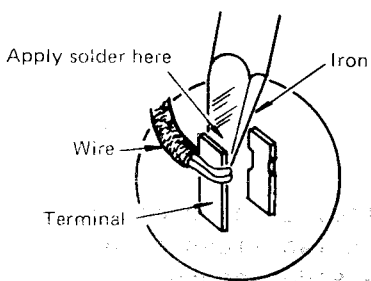
EXAMPLES OF POOR SOLDERING PRACTICE

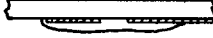
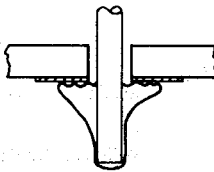
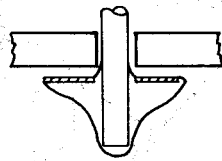
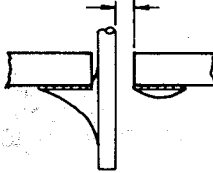


- (1) Prepare soldering iron and solder.
- (2) Apply soldering iron to surface to be soldered.
- (3) Apply solder to heated surface.
- (4) When enough solder is applied, remove solder. Continue to apply heat until solder flows cleanly.
- (5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

Soldering to terminal posts:

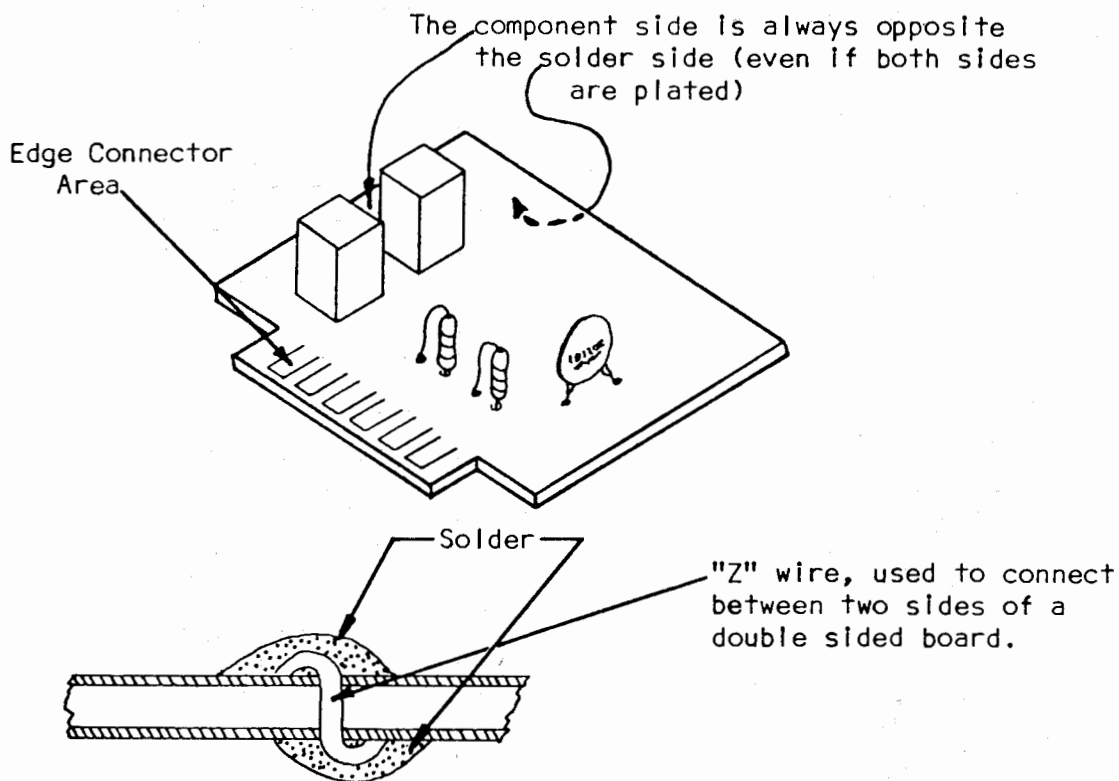
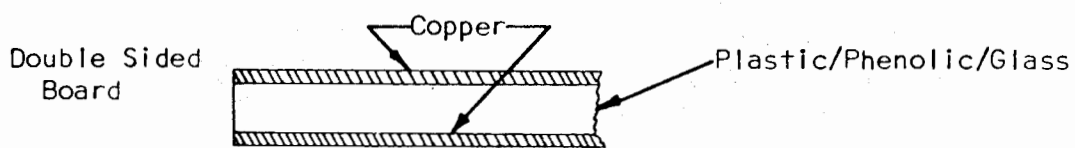
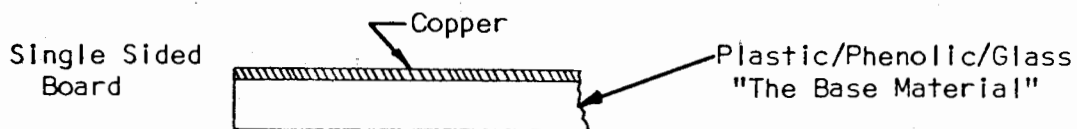
(Be certain to apply heat to both post and wire.)



<p>Solder bridge (caused by use of too much solder)</p> 
<p>"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)</p> 
<p>Lifted trace (caused by too much heat on circuit board foil)</p> 
<p>Unstable joint (caused by insufficient heat or solder)</p> 

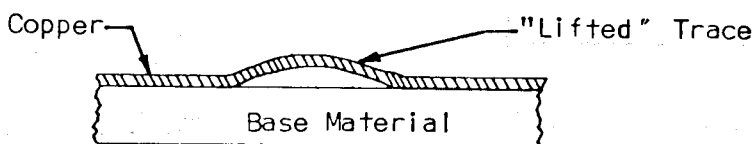
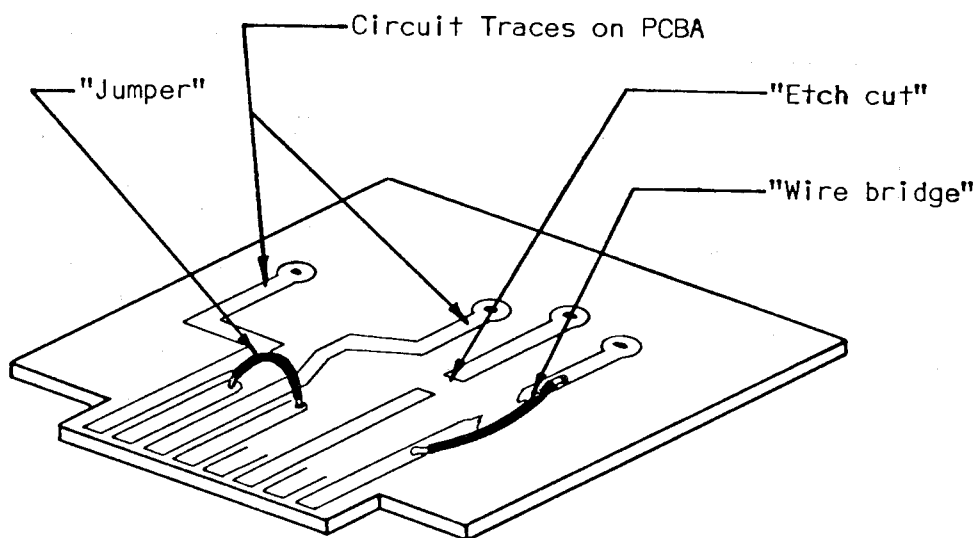
CIRCUIT TRACE REPAIR

Most of the printed circuit boards used in the CPU-2500R are single sided boards. However, occasionally a double-sided board is used in situations where high shielding is required. A comparison of the two types is shown below.

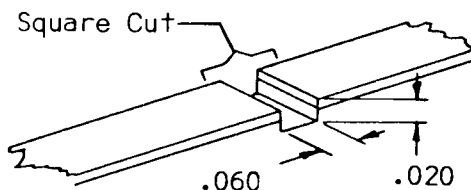


Sometimes, after the design and drafting of a board are completed, a board is produced with an error in it. Though non-technical managers sometimes suffer a stroke at hearing of this situation, it is not unheard of in engineering circles. Thus, should you encounter etch cuts and jumpers on a board, be assured that the modifications were made in the interest of securing optimum performance. Unless you consider your expertise to be superior to that of the design engineer, please leave these mods in place.

However, in service work the occasion does arise when a trace must be cut. Proceed as follows.



If you have previously lifted a trace, make an etch cut on each side of the lifted trace, and install a wire bridge as shown in the drawing.

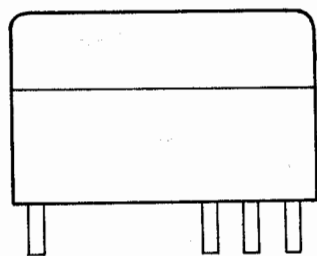


Coat Cut Area With Eastman 910

RELAY CONNECTION INFORMATION

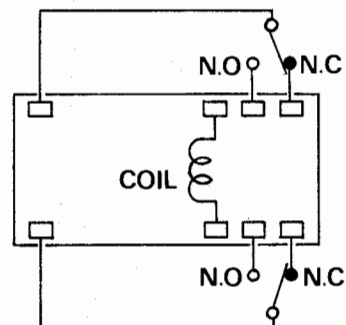
Should the need for replacement of relays become necessary, or if you are trying to verify proper relay operation, the diagrams below should help you.

RL-101



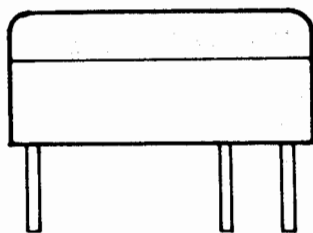
SIDE VIEW

AW6221-DC12V



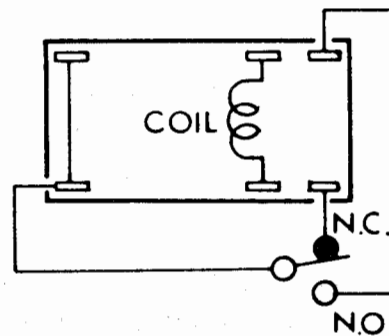
BOTTOM VIEW

RL-301



SIDE VIEW

FBR221D012



BOTTOM VIEW

MAINTENANCE & ALIGNMENT

GENERAL

The CPU-2500R has been carefully aligned and tested at the factory prior to shipment. The reliability of the solid-state devices used in the CPU-2500R should provide years of trouble-free service if the transceiver is not abused, and if normal, routine maintenance is carried out.

THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED IN ORDER TO PREVENT DAMAGE TO THE TRANSCEIVER:

- (1) Do not exceed 15 volts DC at the power receptacle. When operating mobile, check the battery voltage under load (transmitter keyed) with the engine running fast enough that the ammeter shows a charge. As well, do not operate the CPU-2500R if the battery voltage is below 12 VDC.
- (2) Avoid prolonged exposure to direct sunshine, and do not expose the transceiver directly to water.

ROUTINE MAINTENANCE

Routine maintenance should be limited to keeping the transceiver clean, and making periodic checks of the transmitter power output and the receiver sensitivity.

Cleaning:

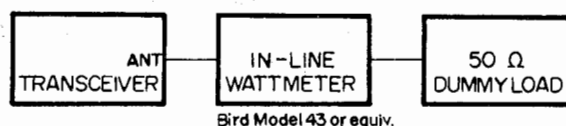
When the transceiver has been used in a dusty or sandy area, the interior may require periodic cleaning. A vacuum cleaner may be used for loose dirt, while caked or otherwise accumulated dirt may be removed with a soft brush. Check the interior to make sure that it is completely dry before replacing the case and operating the transceiver. The exterior may be wiped with a damp cloth as often as needed.

PERFORMANCE CHECKS

Make all performance checks at 13.6 VDC under load.

Check the transmitter output as follows:

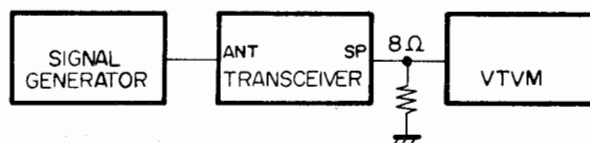
- (a) Connect a suitable dummy load/RF wattmeter to the ANT receptacle.
- (b) Set the channel selector to any channel and key the transmitter. Observe the RF power output, which should be approximately 25 watts (HIGH). The S-meter should indicate between 6 and 8 on the relative output scale at full power.



PO Test Setup

Check the receiver sensitivity as follows:

- (a) Connect an AC voltmeter to the SP receptacle, and set the SQUELCH control fully counterclockwise.
- (b) Connect the RF output of a precision VHF signal generator to the ANT receptacle. Note the VTVM reading with no signal generator input. Adjust the VOLUME control and the VTVM range, as required, to obtain approximately a full scale reading on the VTVM. Do NOT change the VOLUME control setting after this adjustment is made.
- (c) Set the signal generator to the receiving frequency of the transceiver, and adjust the output amplitude of the signal generator until the VTVM reads 20 dB decrease (1/10 voltage) of the reading in step (b). The signal generator output voltage at this point is the 20 dB quieting sensitivity, and the level should be approximately 0.3 μ V.



RX Sensitivity Test Setup

SERVICING

If the above performance checks indicate the need for realignment, it is recommended that the unit be returned to your dealer for servicing. The sophisticated CPU and control circuitry, in particular, are so critical that they should not be touched by other than an experienced technician. Attempts to realign the transceiver tuned circuits without the proper test equipment may result in degraded transceiver performance.

ALIGNMENT

SOME OF THE FOLLOWING ALIGNMENT PROCEDURES REQUIRE SPECIALIZED TEST EQUIPMENT AND TECHNIQUES, AND SHOULD ONLY BE PERFORMED BY AN EXPERIENCED TECHNICIAN.

RECEIVER

(1) RF Amplifier

- Connect a calibrated VHF signal generator to the antenna receptacle, and set the channel selector to 147.000 MHz.
- Tune the signal generator to the receive frequency, and peak L_{101} , L_{104} , TC_{101} – TC_{104} , T_{101} , and T_{102} for a maximum S-meter reading.

(2) First IF Amplifier

- Connect a sweep generator to the second gate of Q_{102} . Connect an oscilloscope through a detector to the drain of Q_{103} .
- Set the frequency of the sweep generator to 10.7 MHz, and apply output from the generator. Adjust T_{101} until the scope pattern illustrated in Figure 6 is obtained.
- Disconnect the sweep generator and scope. Measure the RF injection voltage to the second gate of Q_{105} . A nominal value is 1 volt RMS.

(3) S-Meter Sensitivity

- Apply the output from the signal generator to the antenna receptacle. Peak T_{103} for a maximum S-meter reading on the generator signal.
- Set the output level of the signal generator to 20 dB, and adjust VR_{101} for a full-scale deflection of the S-meter.

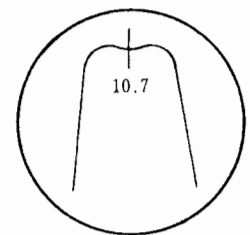
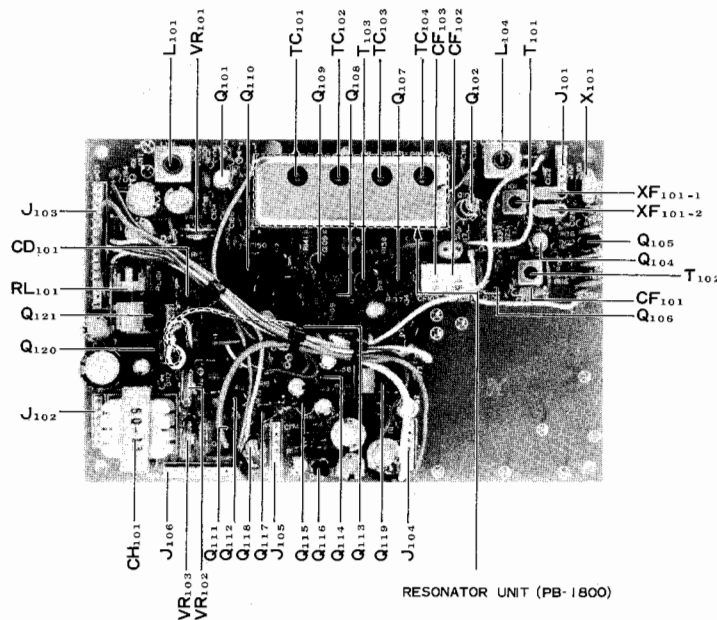


Fig. 6

(4) Noise Squelch Threshold

- a) Apply a 0 dB signal from the signal generator at 147.000 MHz.
- b) Set the front panel SQL switch to the fully clockwise position. Adjust VR₁₀₂ until the squelch just opens. Do not advance VR₁₀₂ past the threshold point.
- c) Place the TONE SQ switch in the ON position. Set the signal generator output to -10 dB.
- d) Adjust VR₁₀₃ until the squelch threshold is found. Do not vary VR₁₀₃ away from the threshold point.
- e) Turn off the signal generator.
- f) Rotate the front panel SQL control until the squelch threshold is found. Back off on the SQL control very slightly so that the receiver is just muted. Now apply output from the signal generator. A signal of approximately -12 dB should be required to trip the squelch.

alignment, the final transistor may be damaged.

(1) 10.7 MHz TX Alignment

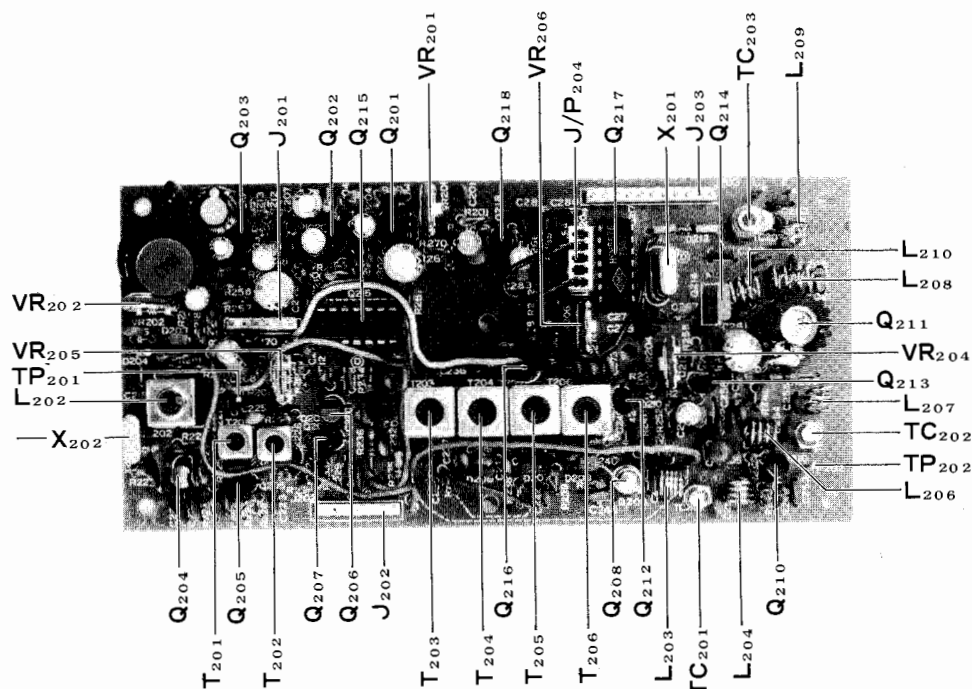
- a) Connect the RF probe of a VTVM to TP₂₀₁.
- b) Adjust T₂₀₁ for a maximum indication on the VTVM. A nominal value is 550 mV RMS.
- c) Connect a frequency counter to TP₂₀₁, and adjust L₂₀₂ for a reading of 10.700 MHz ± 100 Hz on the counter.

(2) Mixer/Interstage Alignment

- a) Connect a dummy load/wattmeter to the antenna jack.
- b) Connect the RF probe of a VTVM to gate 1 of Q₂₀₈.
- c) Close the microphone PTT switch, and adjust T₂₀₁-T₂₀₆ for a maximum VTVM indication. A nominal reading is 100 mV RMS.
- d) Connect a DC voltmeter to TP₂₀₂, and adjust T₂₀₁-T₂₀₆ and TC₂₀₁ for a maximum reading on the DC voltmeter.
- e) Remove the DC voltmeter, and adjust T₂₀₁-T₂₀₆ and TC₂₀₁-TC₂₀₃ for maximum power output as indicated on the wattmeter.

TRANSMITTER ALIGNMENT (Align at 146.000 MHz)

Note: When making the automatic final protection (AFP) circuit adjustment, be certain to follow the instructions regarding connection of the dummy load explicitly. If no load is connected when the AFP is out of



TRANSMITTER UNIT (PB-1792)

(3) Modulator Alignment

- a) Set up the test equipment as specified in Figure 7.
- b) As shown in Figure 8, set VR₂₀₁ and VR₂₀₂ to the center of their ranges. Apply a signal of 1 kHz at 25 mV from an audio oscillator connected to the microphone jack.
- c) Short the PTT connection at pin 4 of the mic jack to ground. Adjust VR₂₀₂ for an indication of ± 4.5 kHz on the deviation meter.
- d) Set the audio generator for an output of 2.5 mV. Adjust VR₂₀₁ for a deviation of ± 3.5 kHz as indicated on the deviation meter.

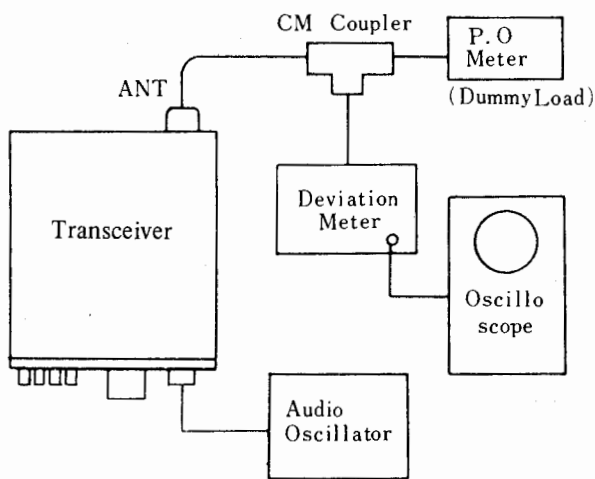


Fig. 7

(4) Tone Burst

- a) Push the front panel CALL switch.
- b) Connect an oscilloscope to the center pin of VR₂₀₂, and confirm that oscillation of the circuit is taking place.
- c) Connect a frequency counter to the center pin of VR₂₀₆, and confirm that the burst signal is of the proper frequency (1800 Hz for the USA model, etc.). Release the CALL switch.
- d) Return to step a) of section 3, "Modulator Alignment". Adjust VR₂₀₆ while pressing the CALL switch to establish that the FM deviation is ± 3.5 kHz with application of the burst signal. Release the CALL button after this alignment.
- e) While listening on a monitor receiver, place the BURST/CALL switch in the BURST position, and close the microphone PTT switch. Confirm that the burst signal is of the desired duration (factory set at 0.5 second). VR₂₀₅ provides adjustment of the burst length.

(5) AFP Circuit, PO Meter, and Local Output

- a) Connect a dummy load/wattmeter to the antenna receptacle.
- b) Connect a DC voltmeter (+) lead to the cathode of D₃₀₁, and the (-) lead to ground. Adjust VR₃₀₁ for minimum cathode voltage.

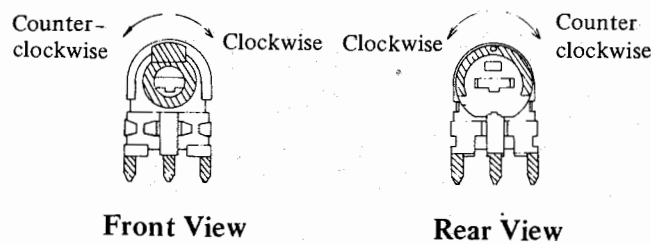
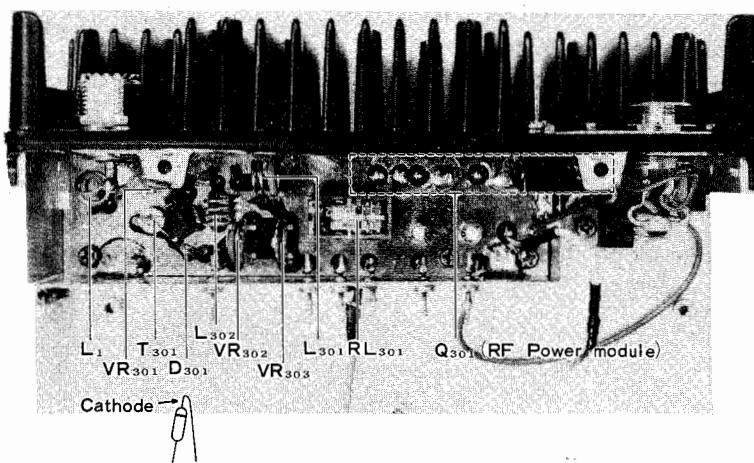
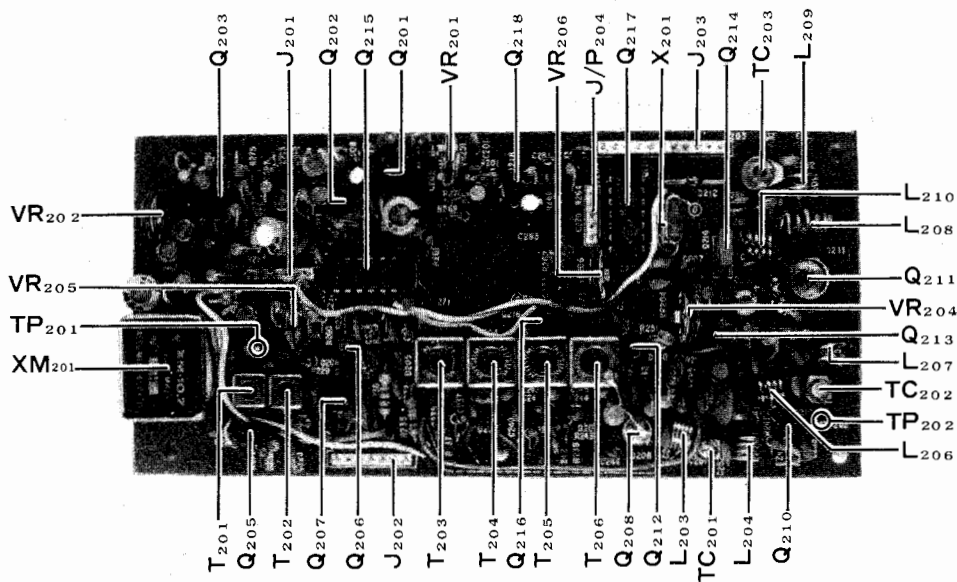


Fig. 8

- c) Remove the dummy load/wattmeter from the antenna receptacle.
- d) Connect a DC ammeter with a 10 ampere full scale capability to the (+) lead of the power cord.
- e) While transmitting, adjust VR₃₀₂ for a reading of 2 amps on the DC ammeter.
- f) Reconnect the dummy load/wattmeter to the antenna receptacle. Adjust VR₃₀₃ for a reading of 8 on the front panel meter. This calibrates the relative output meter.
- g) To set the low power mode output power, set the power switch to the LOW position. Adjust VR₂₀₄ while transmitting for a reading of 3 watts output on the wattmeter.



BOOSTER UNIT (PB-1793)



TX UNIT (PB-1792B)

PLL ALIGNMENT

(1) 10.240 MHz Oscillator Alignment

- a) Connect the RF probe of a VTVM to the emitter of Q₄₀₈. Confirm that oscillation is taking place at a level of approximately 1.1 V RMS.
- b) Connect a frequency counter to TP₁, located on the PLL Unit. Adjust TC₄₀₂ for a reading of exactly 5.1200 MHz.

(2) PLL Local, Multiplier Stages

- a) In the receive mode, connect the RF probe of a VTVM to the emitter of Q₁₁₁. Confirm that the stage is oscillating at a level of approximately 180 mV RMS.
- b) Connect a DC voltmeter using a 10 volt scale to TP3. Adjust TC₄₀₁ to secure a voltage of 3.3 volts.
- c) Connect an oscilloscope to TP₂, and

adjust T₄₀₂ and T₄₀₃ for a maximum deflection on the scope.

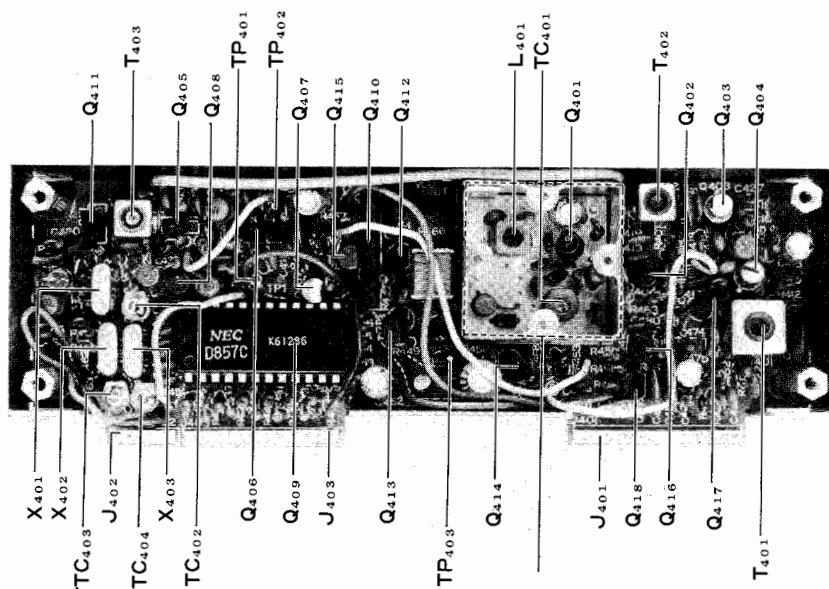
- d) Connect the RF probe of a VTVM to the cathodes of D₄₀₂/D₄₀₃. Adjust T₄₀₁ for a maximum reading on the VTVM. A nominal reading is 540 mV RMS.

(3) PLL Local Frequency

- a) Connect a frequency counter to the cathodes of D₄₀₂/D₄₀₃.
- b) Adjust TC₄₀₃ for a reading of 135.300 MHz ± 100 Hz on the counter.
- c) Press the front panel 5 UP button, and adjust TC₄₀₄ for a reading of 135.305 MHz ± 100 Hz on the counter.

(4) UNLOCK Circuit

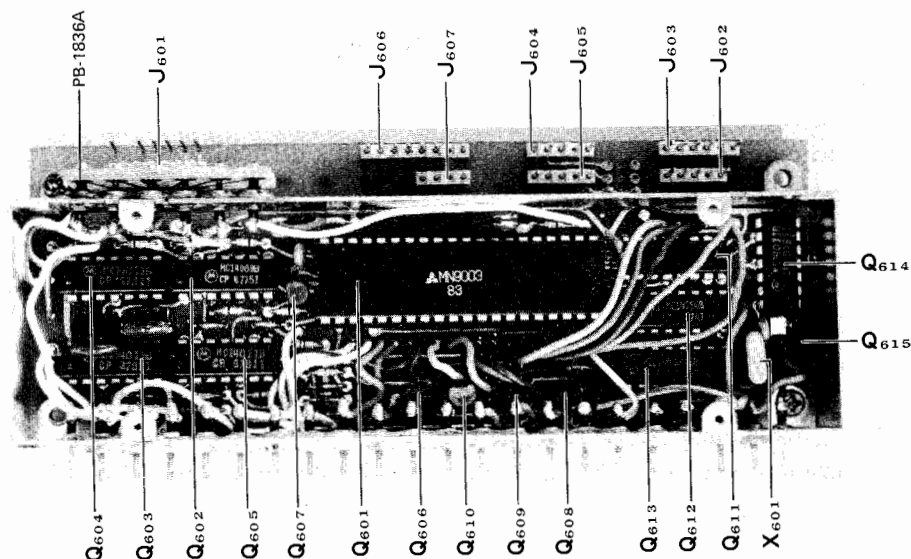
- a) Short TP2 to ground. Digits 3, 4, and 5 of the display should be blanked to indicate PLL unlock.



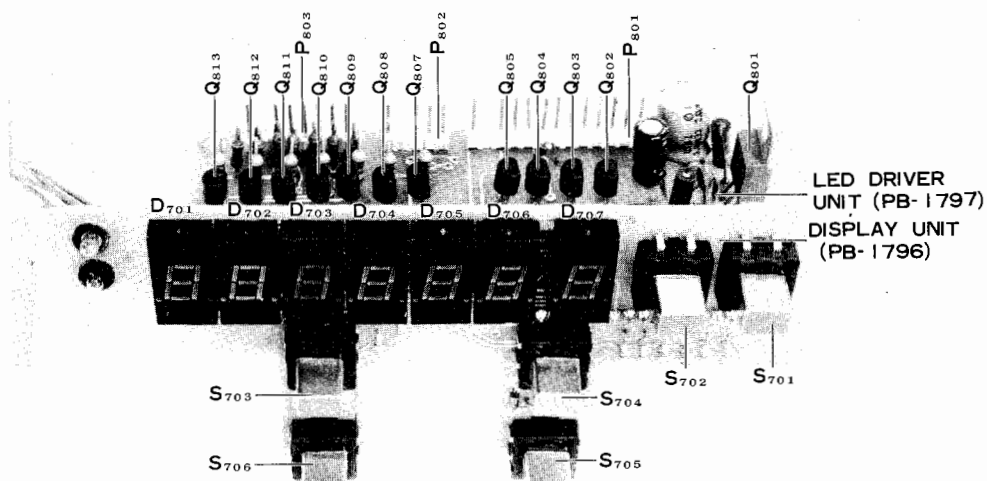
PLL UNIT (PB-1794) VCO UNIT (PB-1830A)

PLL CONTROL, DISPLAY UNITS

The CMOS circuitry used in these units is extremely critical in its adjustment. Under no circumstances should this circuitry be touched for alignment purposes.



PLL CONTROL UNIT (PB-1795)



A FUNDAMENTAL ANALYSIS OF THE TROUBLE

The failure may be caused by one of the following:

- 1) Mechanical defect
- 2) Electrical defect
- 3) Others (Murphy's Law, etc.)

1. MECHANICAL DEFECTS

Typical mechanical defects encountered by the technician are:

- a) Damage from shock during transportation (remember the unit was probably subjected both to sea and truck shipment).
- b) Damage caused by vibration in service.
- c) Damage caused by forcing stubborn knobs or switches. This difficulty is usually preceded by one of the above two defects.

2. ELECTRICAL DEFECTS

Typical electrical defects encountered are:

- a) Part(s) failure(s) caused by aging.
- b) Failures caused by improper application of supply voltage, or by voltage spikes. An improper fuse in use could cause extensive damage to be sustained.
- c) Improper operation (e.g. transistors without load – this usually points to failure elsewhere, in addition to the damaged transistor or IC).
- d) Loose connections at the power connector or elsewhere caused by cold solder joints, etc.

3. OTHERS

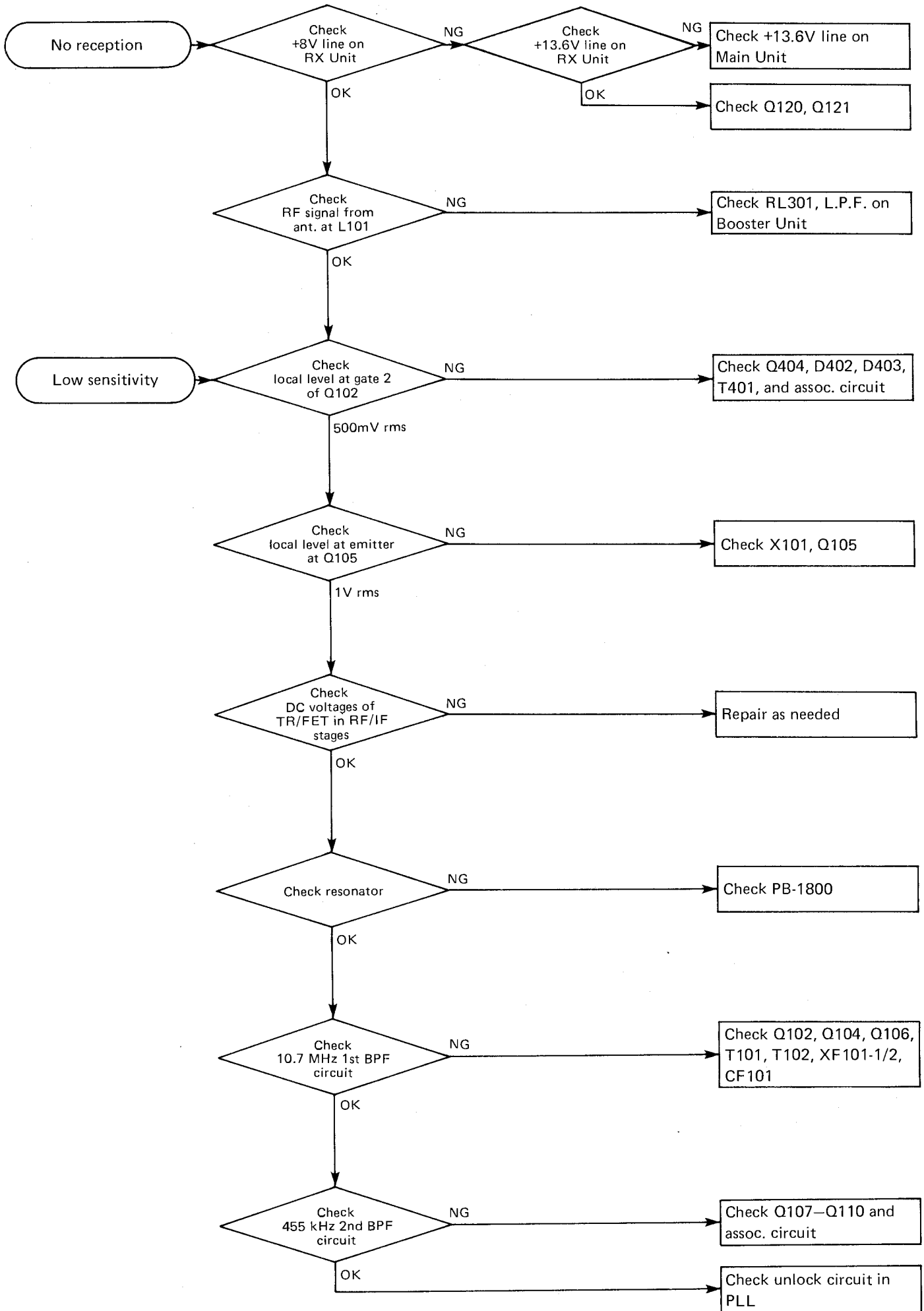
Among the miscellaneous types of failures or difficulties encountered are:

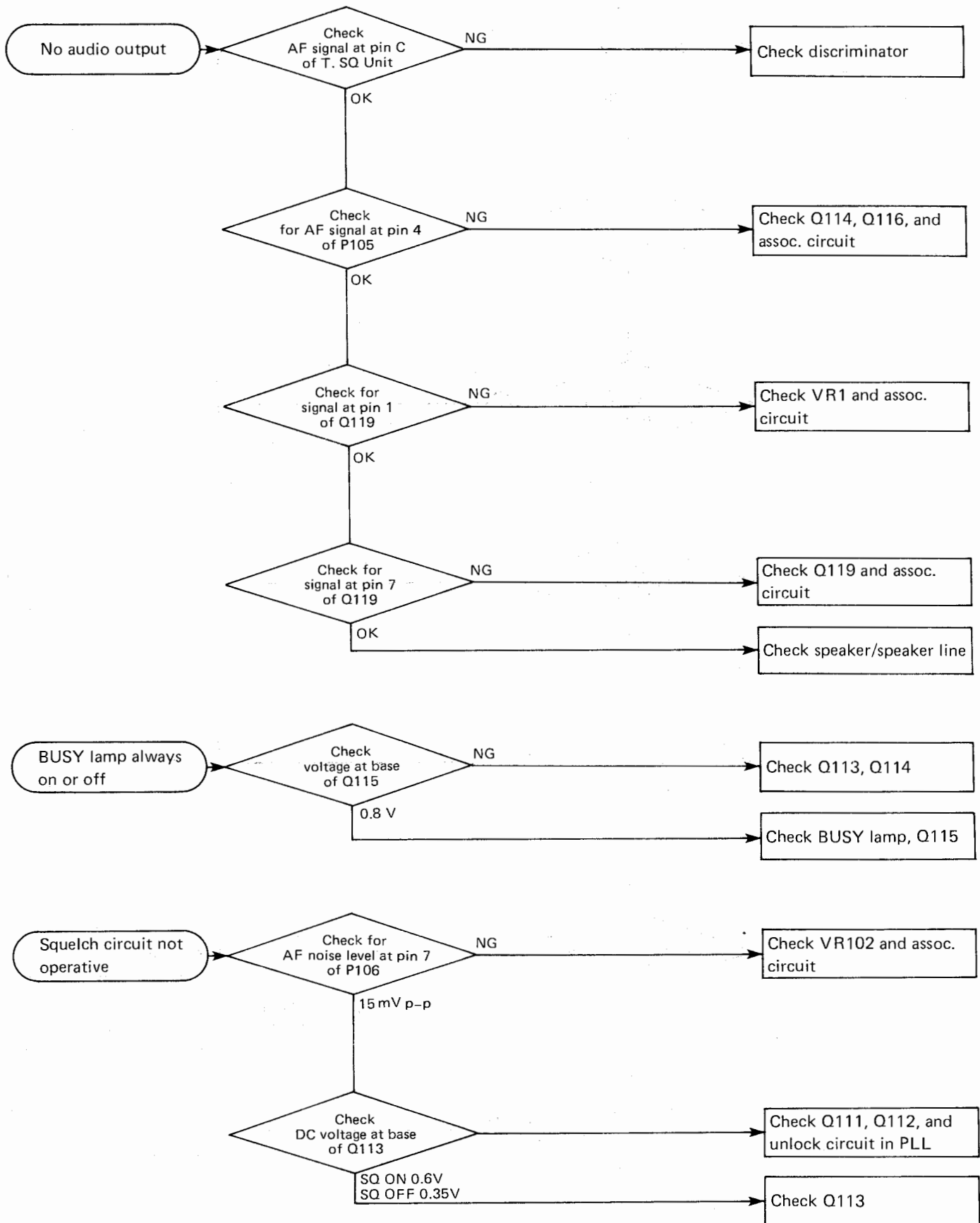
- a) Antenna troubles – poor connectors, use of cheap coax not made to withstand weather, and sabotage by neighbors (nail driven through coax, etc.).
- b) "Cockpit error:" including mislabeled coax lines to coax switch, or attempt to use transceiver on frequencies other than those it was designed for.
- c) Murphy's Law: use of a non-Yaesu microphone with different connections, for example (See page 1-10)

TYPICAL PART FAILURES, CAUSES, AND SYMPTOMS

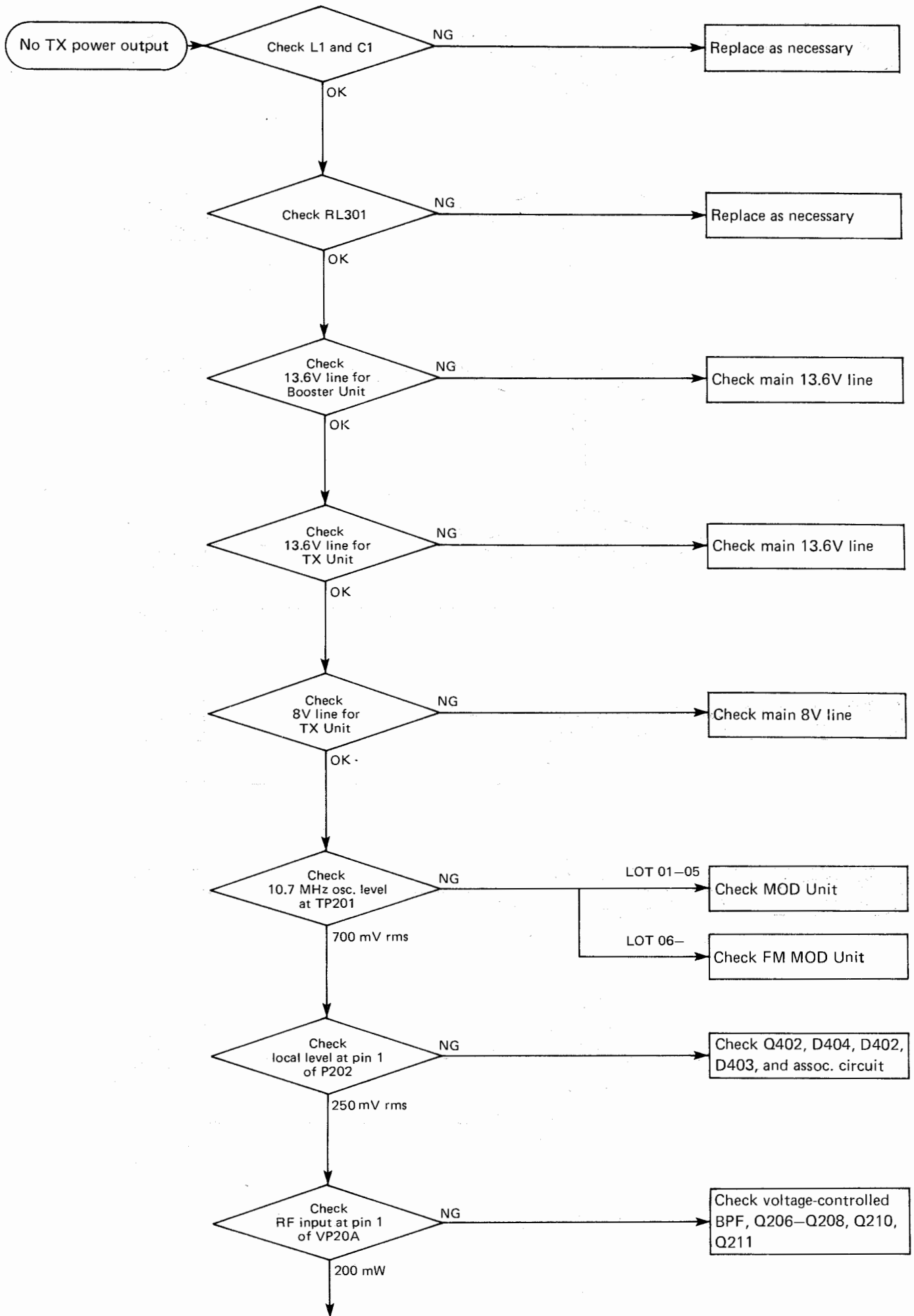
PARTS	CAUSE OF TROUBLE	SYMPTOMS
Semiconductors (IC, FET, TR)	High supply voltage Open circuit Excessive drive High temperature	Short or open circuit Output decreases to 1/2 at 80°C Internal noise Instability
MOS FET MOS IC	Static electricity	Total failure
Crystal Crystal filter	Shock High temperature	Crystal destroyed Frequency drift Filter bandpass change
Resistor	Excessive power Aging High temperature	Component burned Value changed Open circuit
Potentiometer	Excessive power Shock	Component burned Open circuit Noise Unsmooth rotation
Capacitor	Excess voltage High temperature Excess power	Shorted Leakage Open/decreased capacitance
Variable capacitor Trimmer capacitor	Ratings exceeded Dust between plates Shock, forced rotation	Shorted Leakage Unsmooth rotation
Coils	Ratings exceeded Variation	Open or short circuit Leakage or shorted turns Detuned
Switch	Ratings exceeded Aging	Poor contact Unsmooth operation Open circuit
Relay	Ratings exceeded Humidity	Poor contact Noise Coil open

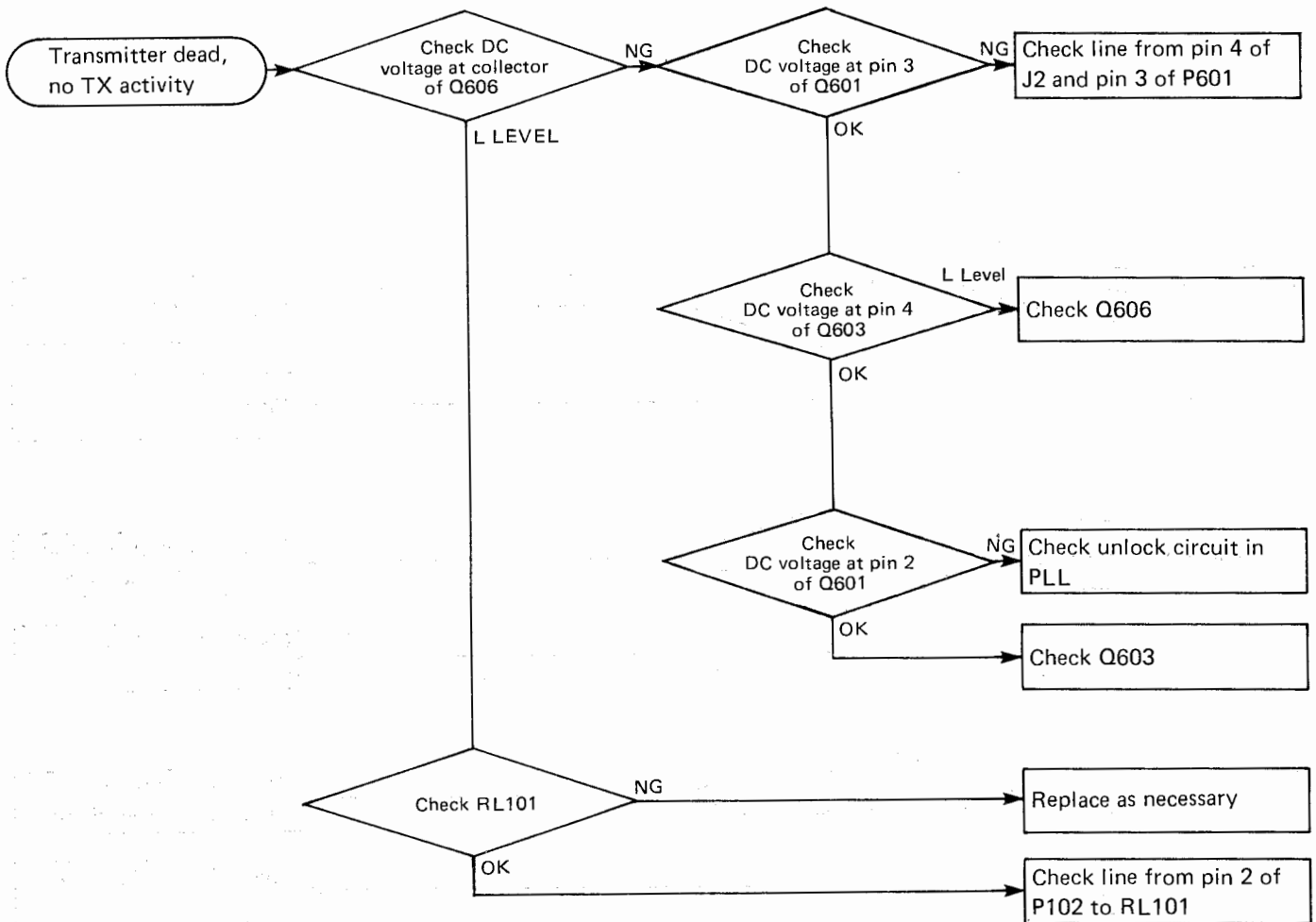
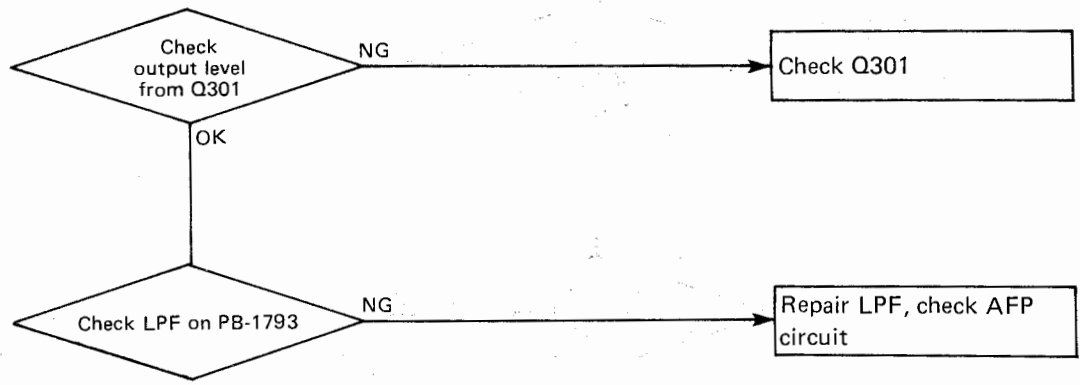
FAULT TREE



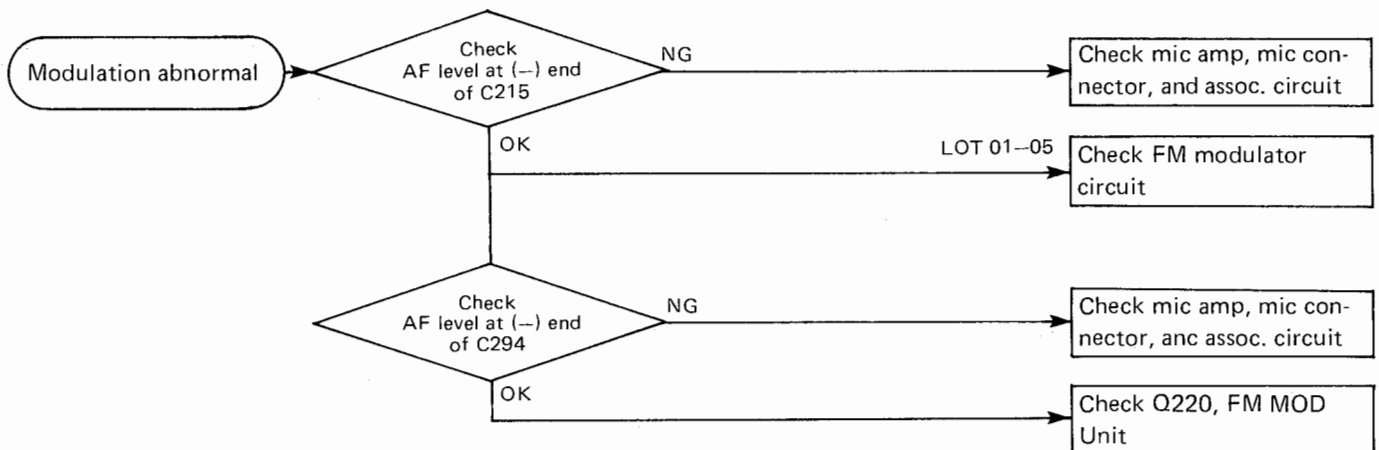
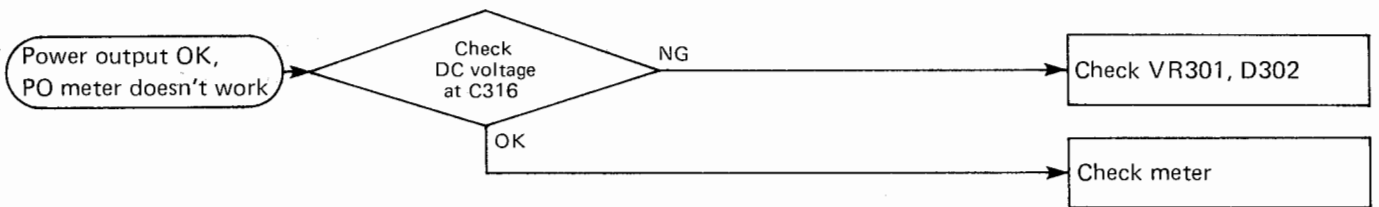
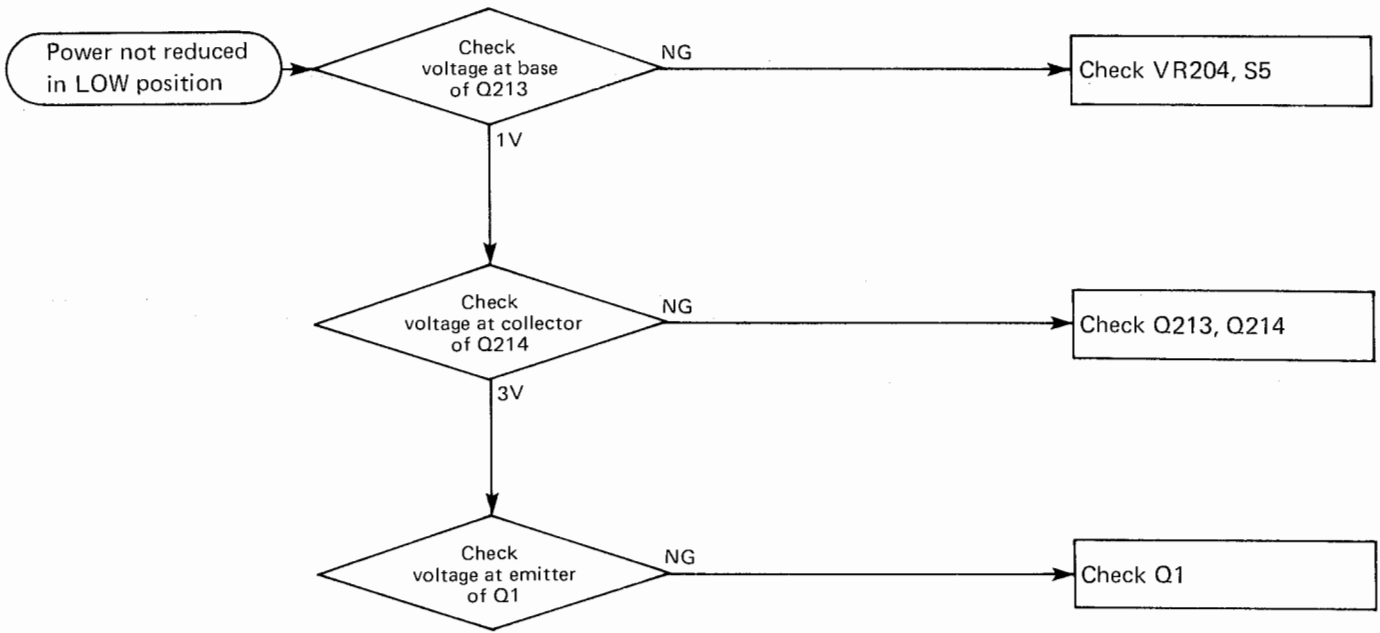


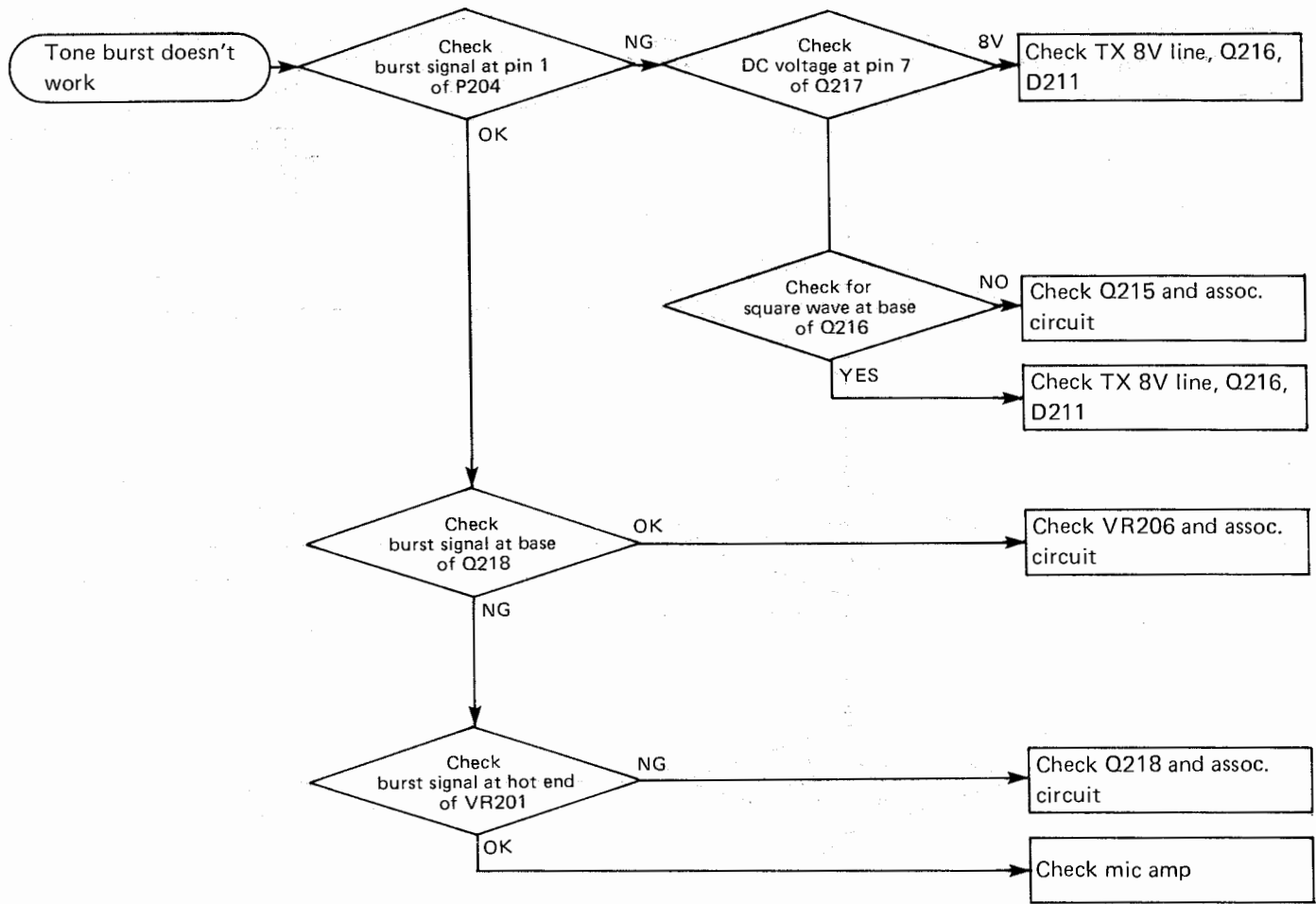
SERVICING



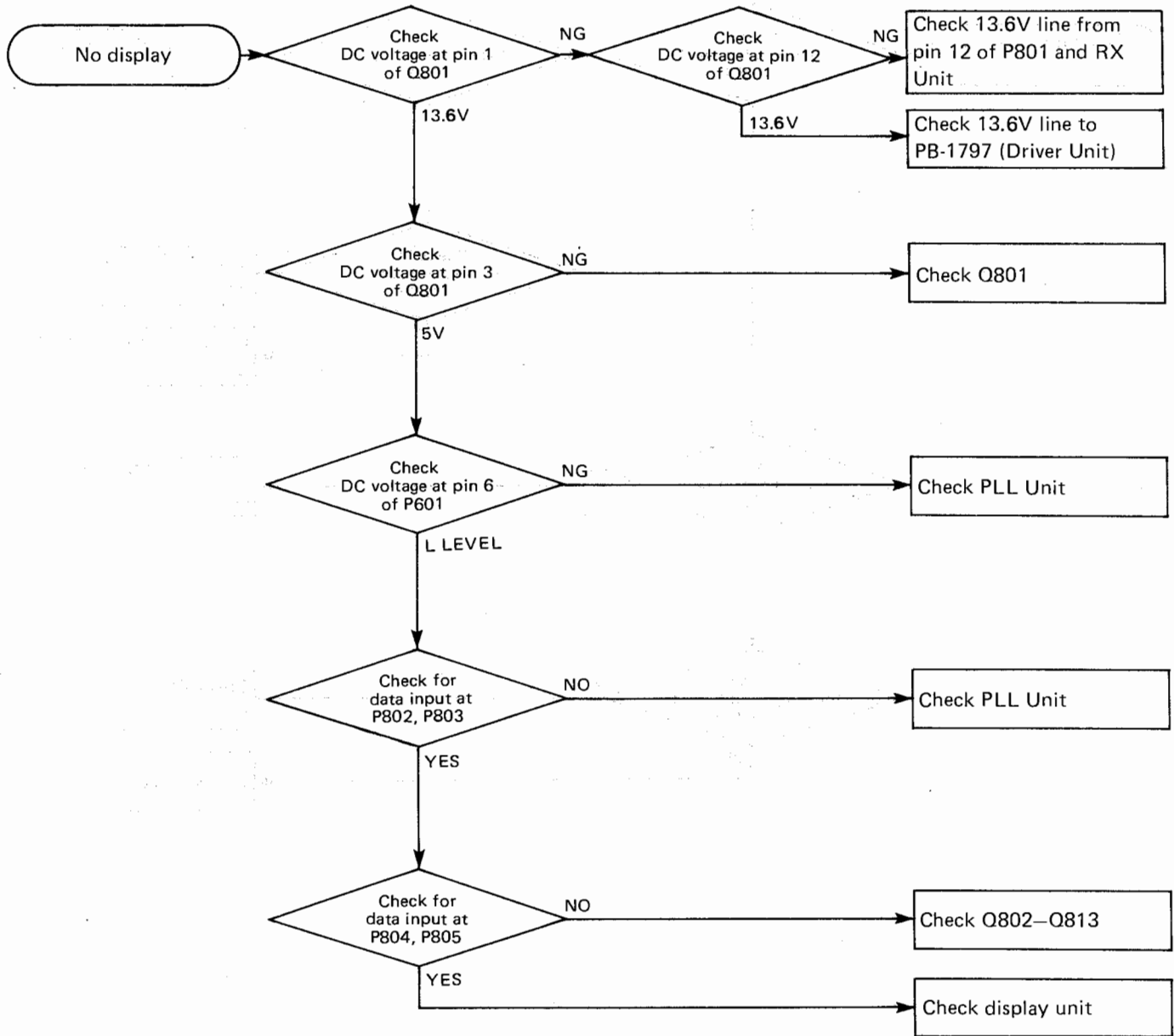


SERVICING





SERVICING



SECTION4-REPAIR PARTS

PARTS LIST AND ORDERING DATA	4-1
PARTS LIST	4-5

PARTS LIST AND ORDERING DATA

If you live in the United States, you may order parts from Yaesu Electronics Corporation. In other countries, you should order parts from the Yaesu agent for your country. In countries where Yaesu is not currently represented, you may order spare parts directly from Yaesu Musen Company, Ltd. in Tokyo.

When ordering, please specify the exact model number of the transceiver that the part is for. Many parts are standard, such as resistors and disc ceramic capacitors, but you should use particular care when ordering such items as electrolytics, tantalum capacitors, and the like.

The parts list to follow identifies the board that the parts belong to, as well as the circuit designation and part description. A "Part Number" is also specified, and this number will allow immediate identification by our parts department of the item you require. (**See note below.)

Shipment of parts from Yaesu USA is usually made by UPS, COD. Allow at least a week for the parts department to process your order. You will receive prompt notification that your order has been received, and if parts are back ordered, or if additional information is required, you will be so informed.

PARTS ORDER EXAMPLE

QUANTITY	TRANSCIVER IDENTIFICATION	LOCATION	**PART NUMBER	CIRCUIT DESIGNATION
1	CPU-2500R	PB-1791	G4800510C	Q ₁₀₁ (3SK51-03)

**Note: In earlier transceivers, no part numbering system was used in the manual. For this reason, the nomenclature "3SK51" will suffice for the part number. All CPU-2500R transceivers have a part number for each component.

(cut here)

YAESU MUSEN COMPANY, LTD. – C.P.O. BOX 1500, TOKYO, JAPAN
 YAESU ELECTRONICS CORPORATION – 6851 Walthall Way, Paramount, CA 90723
 YAESU ELECTRONICS CORPORATION – 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

ORDER BLANK

QUANTITY	TRANSCIVER IDENTIFICATION	LOCATION	PART NUMBER	CIRCUIT DESIGNATION

I authorize shipment via: Best Way Parcel Post
 UPS Other

Ship To: Name: _____
 (Print or Type) Address: _____
 City: _____ State: _____ Zip: _____
 Country: _____

PARTS LIST

REPAIR PARTS

MAIN CHASSIS					
Symbol No.	Parts No.	Description			
			J403	T9200960A	5047-11 with wire
			J601	T9200950A	5047-06 "
		TRANSISTOR	J602	T9200940A	5047-04 "
Q1	G34023500	Silicon Transistor 2SD235(O)	J603	T9200920A	5047-05 } "
			J801		5047-12 } "
			J604	T9201030A	5047-04 } "
		DIODE	J802		5047-04 } "
D1	G2090034	Silicon Diode U05B	J605	T9200930A	5047-04 "
D2,3,4	G2015550	" " 1S1555	J606	T9200900A	5047-07 "
			J607	T9200910B	5047-03 "
			J803	T9200890A	5047-07 "
		RESISTOR			
R6	J10276100	Carbon Composition 1/2W GK 10 Ω			PILOT LAMP
R7	J10276101	" " " " 100 Ω	PL1,2	Q1000024	BQ034-22528A
R2,3	J10276181	" " " " 180 Ω			
R4,5	J01245221	Carbon Film 1/4W TJ 220 Ω			
					TERMINAL BOARD
			TB1	Q6000011	1L4PS2-0-2
		POTENTIOMETER	TB2	Q6000014	1L5PS3-0-2
VR1	J62800030	DM10A637A 10k Ω B/10k Ω A	TB3	Q6000007	1L3PS2-0-1
		CAPACITOR	RX UNIT		
C2	K00175150	Ceramic disc 50WV SL 15pF	Symbol No.	Parts No.	Description
C4,5	K12171102	" " " " 0.001 μ F		C0017910	RX UNIT and RESONATOR
C1	K40120226	Electrolytic 16WV R 22 μ F			UNIT with components
C3	K40120476	" " " R 47 μ F	PB-1791B	F0001791B	Printed Circuit Board
		INDUCTOR			IC, FET & TRANSISTOR
L1	L0020132	Lowpass Coil	Q122	G1090084	IC μ PC78L05A
			Q120 ,121	G1090080	" μ PC78L08
			Q119	G1090073	" μ PC575C2
		METER	Q110	G1090072	" μ PC577H
M1(with PL3)	M0290012	AP-120 200 μ A	Q104	G4800400M	FET 3SK40M
			Q101,102	G4800510C	" 3SK51-03
			Q105-109, 111-118	G3318150Y	Transistor 2SC1815Y
		SPEAKER			
SP1	M4090032	SM-77K-Y 8 Ω 1W			
		SWITCH			DIODE
S2,5,6,10	N6090004	SSF-22-08B	D102-105, 107,108	G2001880F	Germanium Diode 1S188FM
S3	N0050023	SRN1026N			
S4	N0190004	SRN1025N	D106,109-111	G2015550	Silicon Diode 1S1555
		CONNECTOR			
J1	P0090010	FM-142S			CRYSTAL
J2	P0090012	FM-146S	X101	H0100720A	HC-18/U, 10.245MHz
J3	P1090005	SG-8050			
J4	P1090028	M-BR-06D			
J5	P1090048	S-1620A-ST			MONOLITHIC FILTER
J101	T9201050B	5047-04	XF101	H1101960	10M2B2
J103		5047-14			
J202		5047-06			
J401		5047-12	with wire		
J102	T9201010B	5047-05 "	CF101	H3900130	RVF10.7MF-BR
J104	T9201040B	5047-05	CF102,103	H3900030	LFB-15
J201		5047-05			
J105	T9201000A	5047-06 "			
J106	T9200990A	5047-08 "			CERAMIC DISCRIMINATOR
J203	T9200980B	5047-10 "	CD101	H7900060	SFD455S4
J402	T9200970A	5047-04 "			

Q217	G1090103	IC	MSM5576	R220,234,	J00245104	" " " " 100kΩ
Q206,207	G3800190G	FET	2SK19GR	237-240,262,		
Q208	G4800510C	"	3SK51-3	265,266,271		
Q214	G3104960Y	Transistor	2SA496Y	R211,214	J00245154	" " " " VJ 150kΩ
Q210	G3320530	"	2SC2053	R275	J00245224	" " " " 220kΩ
Q211	G3307410	"	2SC741	R207	J00245274	" " " " 270kΩ
Q201-205,212,	G3318150Y	"	2SC1815Y	R274	J00245334	" " " " 330kΩ
213,216,218				R280	J00245474	" " " " 470kΩ
Q210*	G3305350A	"	2SC535A	R259,260	J00245105	" " " " 1MΩ
Q219,220	G3318150G	"	2SC1815GR			
						POTENTIOMETER
		DIODE		VR202,206	J50701102	TR-11R300 1kΩB
D201,202,	G2015550	Silicon Diode	1S1555	VR204	J50701202	" " " " 2kΩB
209-212				VR201	J50701502	" " " " 5kΩB
D204	G2090041	Varistor	MV-103	VR205	J50701205	" " " " 2MΩB
D203	G2090023	Varactor	1SV50			
D205-208	G2022090	"	1S2209			
						CAPACITOR
				C239,243	K00179001	Ceramic disc 50WV 0.5pF
				C238,241	K02179001	" " " " CH 1pF
		CRYSTAL		C230	K02172020	" " " " 2pF
X201	H0100601	HC-25/U	(1800Hz Tone) 3.6864MHz	C218	K06172040	" " " " UJ 4pF
				C254	K00172040	" " " " SL 4pF
X201	H0100602	"	(1750Hz Tone) 3.584MHz	C236	K00172050	" " " " CH 5pF
				C244	K06173080	" " " " UJ 8pF
X202	H0100490	HC-18/U	10.74MHz	C231,232,237,	K06173090	" " " " 9pF
				240		
				C255	K00175150	" " " " SL 15pF
		MODULATOR MODULE		C226,227	K02179008	" " " " CH 20pF
XM201	H9500320	XM-10.7		C225,245,252	K00175270	" " " " SL 27pF
				C262	K00175330	" " " " 33pF
				C275,276	K02175470	" " " " CH 47pF
		RESISTOR		C222	K00175470	" " " " SL 47pF
R250	J01245470	Carbon Film	1/4W TJ 47Ω	C219,220	K02175101	" " " " CH 100pF
R243,244,248	J00245560	" " "	VJ 56Ω	C217	K06175101	" " " " UJ 100pF
R236	J01245101	" " "	TJ 100Ω	C201,204,216,	K12171102	" " " " 0.001μF
R201,208,225,	J00245101	" " "	VJ 100Ω	242,248,		
256,270,277,				257-259,263,		
281				266,267,272,		
R221	J01245221	" " "	TJ 220Ω	273,286,287,		
R215,231-233	J00245221	" " "	VJ 220Ω	290		
R254	J00245471	" " "	470Ω	C221,223,224,	K14170103	" " " " 0.01μF
R209,279	J00245561	" " "	560Ω	228,229,		
R206,216,224,	J00245102	" " "	1kΩ	233-235,246,		
228,263,269,				247,249,250,		
283				253,256,260,		
R203	J00245182	" " "	1.8kΩ	265,269		
R246,255,276,	J00245222	" " "	2.2kΩ	C288	K14170473	" " " " 0.047μF
282				C284,285	K23140001	Ceramic Chip 25WV 0.01μF
R210,278	J00245272	" " "	2.7kΩ	C280,281	K50177472	Mylar Film 50WV 0.0047μF
R204	J00245332	" " "	3.3kΩ	C289	K50177682	Mylar 50WV 0.0068μF
R249,251,253,	J00245472	" " "	4.7kΩ	C270,277-279,	K50177103	" " " " 0.01μF
257,264,268				292		
R202,219	J00245562	" " "	5.6kΩ	C202	K50177223	" " " " 0.022μF
R205,212,213,	J00245103	" " "	10kΩ	C213,214	K50177473	" " " " 0.047μF
226,229,230,				C274	K70127104	Tantalum 35WV 0.1μF
247,258,261				C271	K70127474	" " " " 0.47μF
R272	J00245123	" " "	12kΩ	C205	K70127106	" " " " 16WV 10μF
R252	J00245153	" " "	15kΩ	C206,208,215,	K40170105	Electrolytic 50WV R 1μF
R217,223,227,	J00245223	" " "	22kΩ	264,282,294,		
241,242,267,				296		
273				C209,212,268,	K40120106	" " " " 16WV R 10μF
R218	J00245333	" " "	33kΩ	283,291,293		
R222	J00245473	" " "	47kΩ	C207	K40100476	" " " " 10WV R 47μF
R235	J01245104	Carbon Film	1/4W TJ 100kΩ	C261	K40120476	" " " " 16WV R 47μF

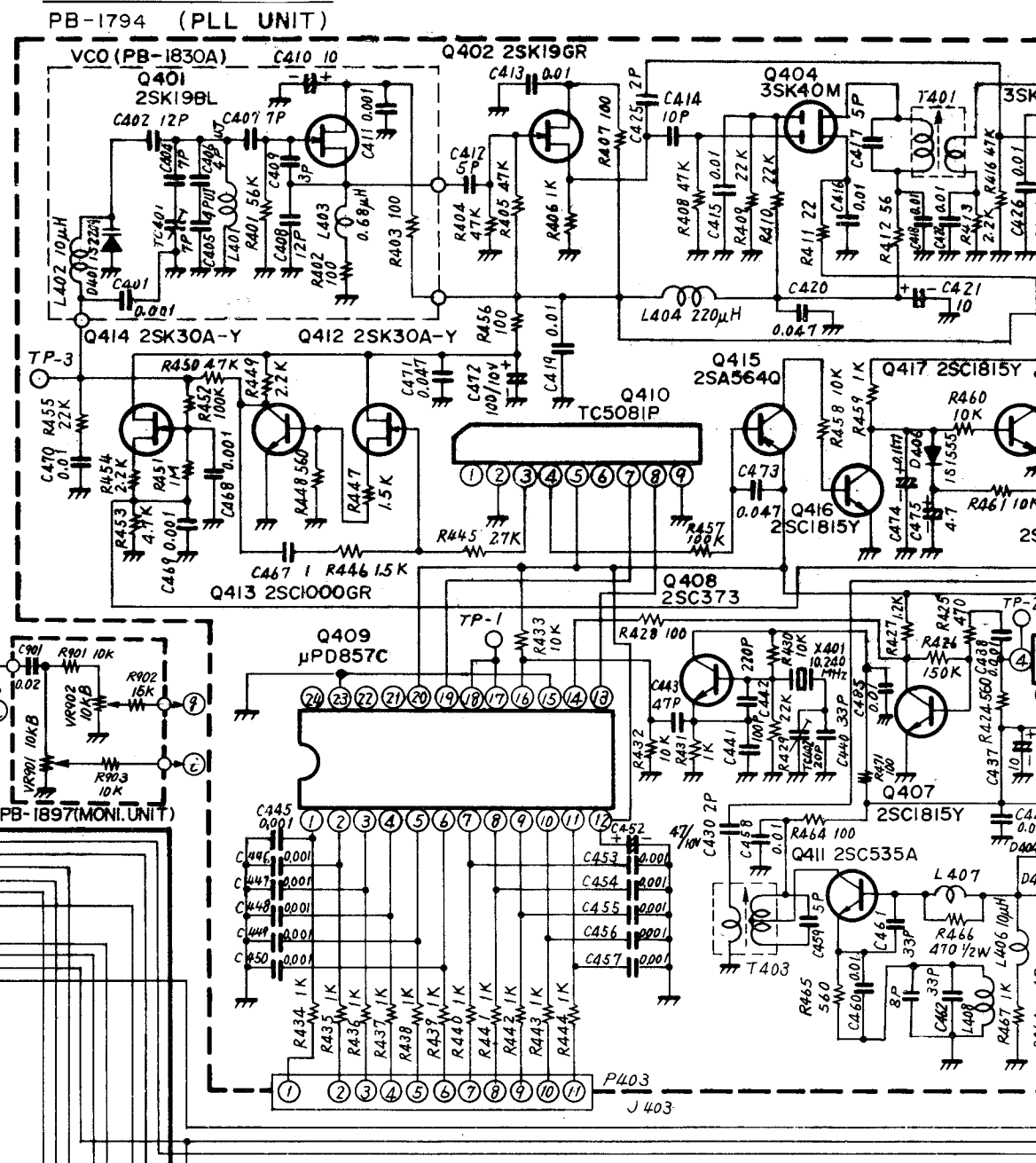
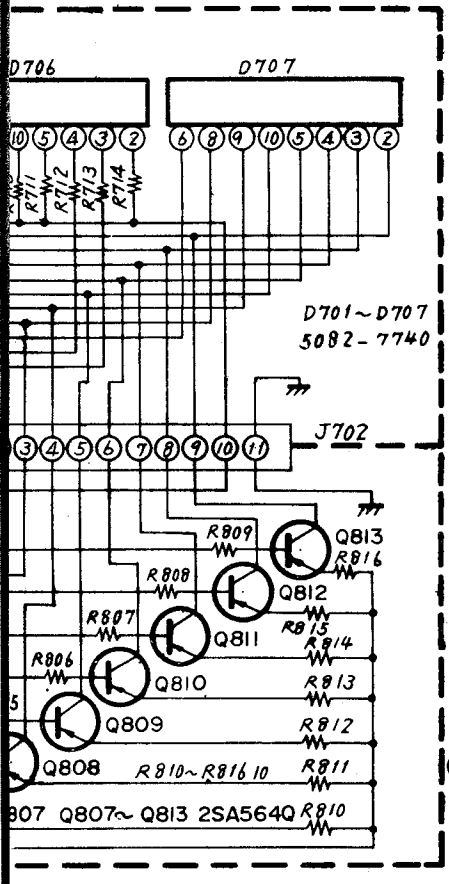
REPAIR PARTS

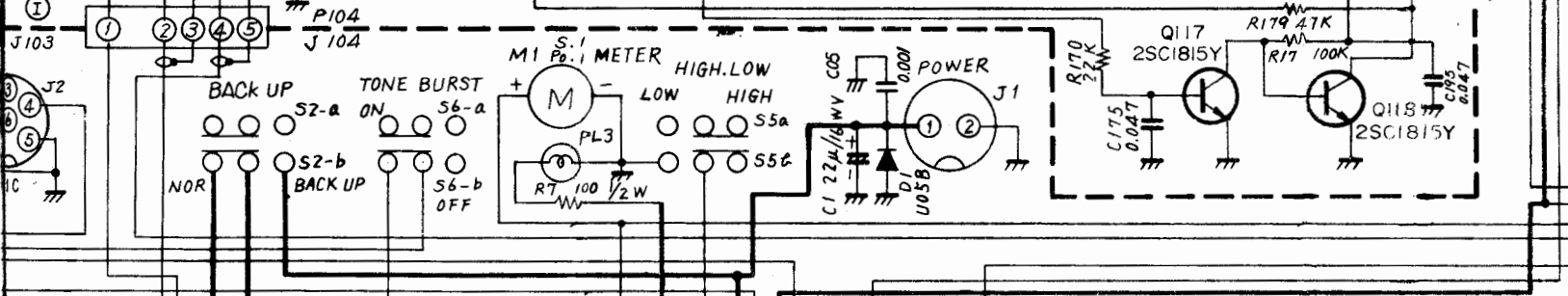
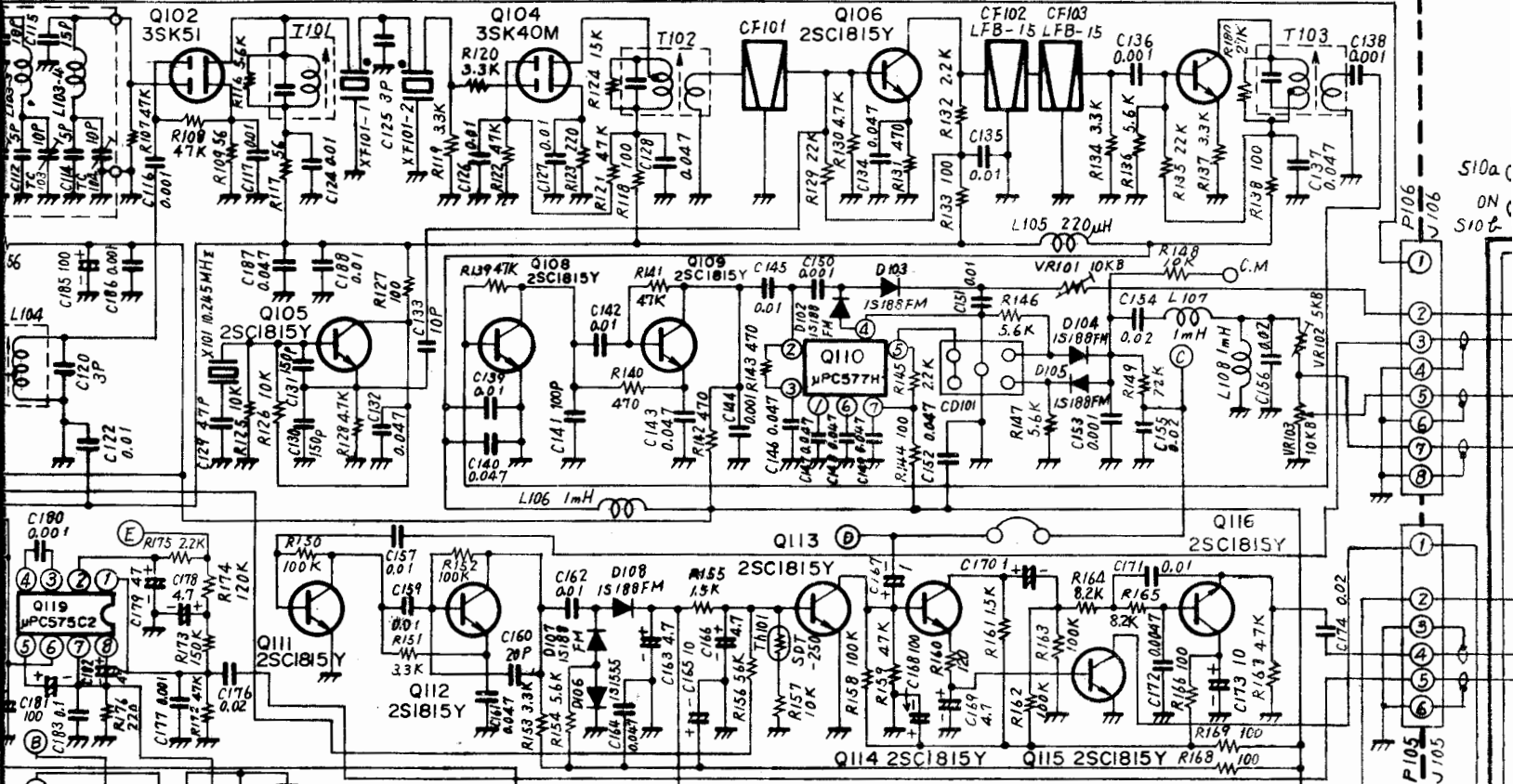
C203,210,295	K40100107	Electrolytic 10WV R 100 μ F	VR302	J50701103	TR-11R300	10k Ω B
C211	K40100227	" 10WV R 220 μ F	VR303	J50701204	TR-11R300	200k Ω B
						CAPACITOR
			C304	K00179001	Ceramic disc 50WV	0.5pF
			C307	K00172030	" " "	SL 3pF
		TRIMMER CAPACITOR	C301-303,305,313	K00175150	" " "	SL 15pF
TC201,202	K91000028	ECV-1ZW 10x53 10pF	C306,310	K12171102	" " "	0.001 μ F
TC203	K91000016	ECV-1ZW 50x32 50pF	C308,309,314-316	K20170102	Feed Thru "	0.001 μ F
		INDUCTOR	C311,312	K40120106	Electrolytic 16WV R	10 μ F
L207,209	L0020193					
L203	L0020195					
L204,206,210	L0020196					RELAY
L202	L0020319		RL301	M1190006	FBR221D012	DC 12V
L208	L0020380					
L201	L1190075	L10-104J 100mH				
L205	L1190014	FL-4H 100M 10 μ H				INDUCTOR
L211	L1190011	FL-4H 4R7M 4.7 μ H	L301,302	L0020430	LPF Coil	
		TRANSFORMER				TRANSFORMER
T201,202	L0020187	3005	T301	L0020335	CM Coupler	
T203-206	L0020111	R12-4102				
				Q5000011	Wrapping Terminal C	
				Q4000001	Seal Terminal A102	
XS201	P3090002	S2-101P-00				
						PLL UNIT
		MINI CONNECTOR	Symbol No.	Parts No.	Description	
P204	P0090050	5048-04A		C0017940	PLL UNIT and VCO BOARD with components	
P201	P0090042	5048-05A				
P202	P0090051	5048-06A	PB-1794A	F0001794A	Printed Circuit Board	
P203	P0090052	5048-10A				
						IC, FET & TRANSISTOR
J204	T9201020A	5047-04 with Jumper wire	Q409	G1090047	IC	μ PD857C
			Q410	G1090048	"	TC-5081P
			Q406	G1090063	"	TA-7060P
	Q5000011	Wrapping Terminal C	Q402	G3800190G	FET	2SK19GR
	R5047912B	Heat Sink TO-5	Q412,414	G3800301Y	"	2SK30A-Y
	L9190001	Ferrite Beads 4A-R1 3x3-1	Q403,404	G4800400M	"	3SK40M
			Q415	G3105640Q	Transistor	2SA564Q
			Q408	G3303730	"	2SC373
			Q405,411	G3305350A	"	2SC535A
			Q413	G3310000G	"	2SC1000GR
			Q407,416-418	G3318150Y	"	2SC1815Y
						DIODE
			D402-406	G2015550	Silicon Diode	1S1555
						RF POWER MODULE
Q301	G1090245	VP-20A-1				
						CRYSTAL
			X401	H0100350	HC-18/U	10.240MHz
			X402	H0100841	"	44.100MHz
D301,302	G2001880F	Germanium Diode 1S188FM	X403	H0100844	"	44.10166MHz
	G2090001	Silicon 10D1				
						RESISTOR
			R411	J00245220	Carbon Film 1/4W VJ	22 Ω
VR301	J51723221	SR19R 220 Ω B	R412	J00245560	" " " "	56 Ω

REPAIR PARTS

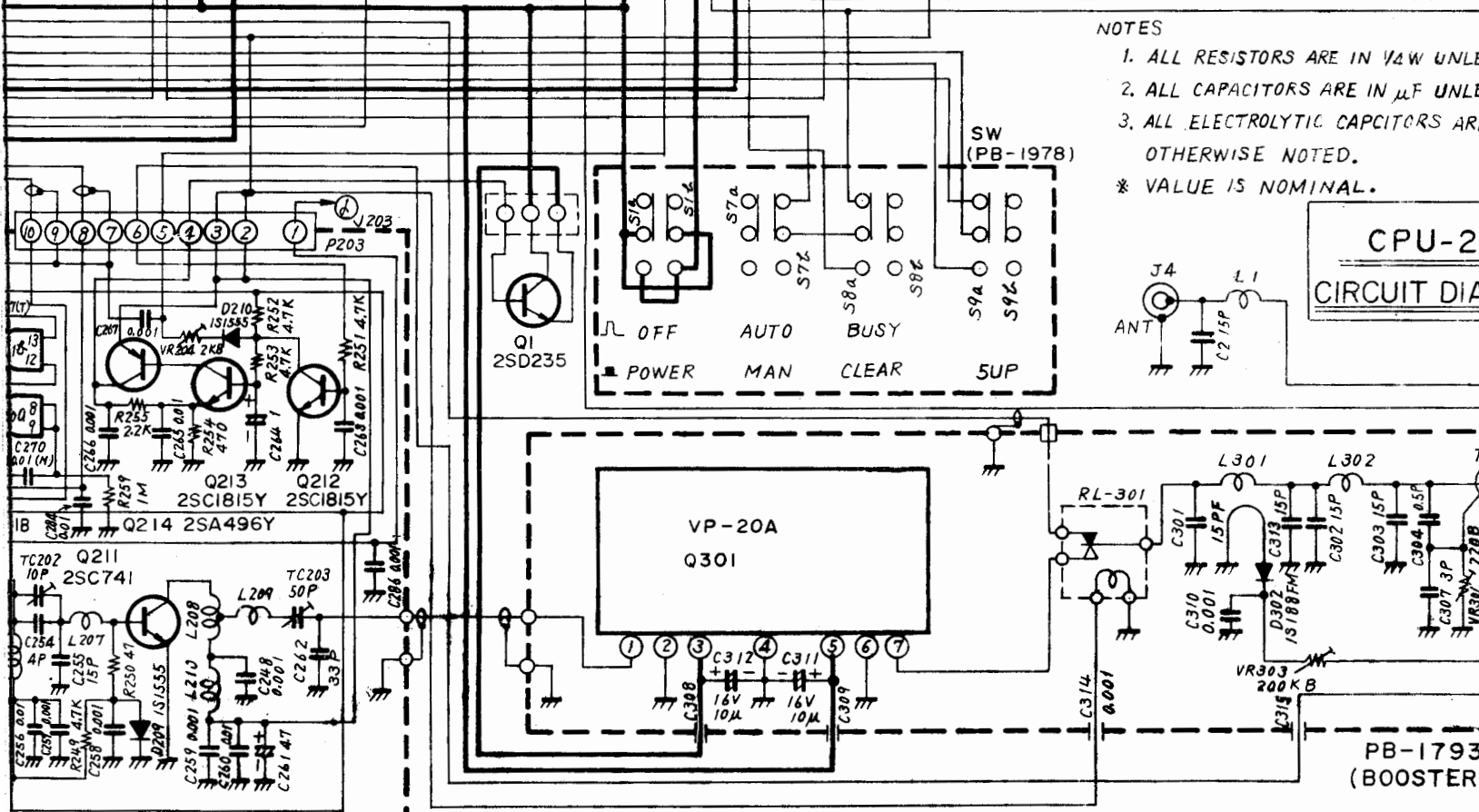
C402	K02173100	Ceramic disc	50WV CH10pF	R621	J10246275	Carbon Composition
C408	K02175120	" "	" CH12pF			1/4W GK 2.7MΩ
C401,411	K12171102	" "	" 0.001μF			
C410	K40120106	Electrolytic	16WV R 10μF			
						BLOCK RESISTOR
				RB601	J40900003	7x100kΩ RA-7R
						TRIMMER CAPACITOR
TC401	K91000056	TZ03Z070A	7pF			
						CAPACITOR
				C603	K02175101	Ceramic 50WV CH100pF
						INDUCTOR
L401	L0020359A	S6-B		C604,606-608	K23170003	Ceramic RPE112F104Z50V 0.1μF
L403	L1190004	Micro Inductor	0.68μH	C601,602,605	K50177473	Mylar Film 50WV 0.047μF
L402	L1190014	" "	10μH	C609	K71137685	Tantalum 20WV 6.8μF
				C611-635	K21170002	Feedthru 50WV 1000pF
				C636	K70127106	" 10WV 10μF
	R0041040B	VCO Case				
	R0041050B	VCO Cover				MINI CONNECTOR
	Q5000011	Wrapping Terminal C		P607	P0090048	5048-03A
				P602,604,605	P0090050	5048-04A
				P603	P0090042	5048-05A
				P601	P0090095	5049-06A
				P606	P0090054	5048-07A
PLL CONT UNIT						
Symbol No.	Parts No.	Description				
PB-1795D	F0001795D	Printed Circuit Board				
	C0017950	P.C.B with components				
						IC SOCKET
				QS601	P3090040	SE-OC8340-02 (116-40-40-114)
PB-1836	F1001836	Connector Board				
					Q4000001	Seal Terminal A102
						IC, FET & TRANSISTOR
Q601	G1090142	CPU	MN-9003			
Q603-605,614	G1090068	IC	MC-14011B			DISPLAY UNIT
Q611	G1090051	"	MC-14042B	Symbol No.	Parts No.	Description
Q602	G1090126	"	MC-14069B	PB-1796	F0001796	Printed Circuit Board
Q613	G1090127	"	MC-14410		C0017960	P.C.B with components
Q612	G1090128	"	MC-14556B			
Q615	G1090084	"	μPC78L05A			
Q607,616	G3105640Q	Transistor	2SA564Q			DIODE
Q606,608-610	G3318150Y	"	2SC1815Y	D701-707	G2090059	LED 5082-7740
				D708	G2015550	Silicon Diode 1S1555
						DIODE
D601-604,609,610-612	G2015550	Silicon Diode	1S1555			RESISTOR
D606-608	G2001880F	Germanium Diode	1S188FM	R707	J10246101	Carbon Composition 1/4W GK 100Ω
				R701-706,708-714	J01215471	Carbon Film 1/8W TJ 470Ω
						CRYSTAL
X601	H0100710	HC-43/U	1MHz			
						PUSH SWITCH
				S701-706	N7090001	AKC-8N
						RESISTOR
R623,624	J01215102	Carbon Film	1/8W TJ 1kΩ			
R605,610	J01215103	" "	" " 10kΩ			MINI CONNECTOR
R616	J01215183	" "	" " 18kΩ	P702	P0090059	3022-11A
R620	J01215223	" "	" " 22kΩ	P701	P0090058	3022-15A
R601,603,618,619	J01215333	" "	" " 33kΩ			
R613,614	J01215473	" "	" " 47kΩ			DRIVER UNIT
R602,604,606,607-609,611,612,615,617	J01215104	" "	" " 100kΩ	Symbol No.	Parts No.	Description
				PB-1797	F0001797	Printed Circuit Board
					C0017970	P.C.B with components
R606,625	J01215224	" "	" " 220kΩ			

IC & TRANSISTOR			PHOTO B BOARD		
Symbol No.	Parts No.	Description	Symbol No.	Parts No.	Description
Q801	G1090065	IC μ PC14305			
Q807-813	G3105640Q	Transistor 2SA564Q	PB-1849	F0001849	Printed Circuit Board
Q802-805	G3107190P	" 2SA719-P		C0018490	PCB with components
DIODE			PHOTO INTERRUPTER		
D801	G2015550	1S1555	Q2	G0090001	ON-1105
RESISTOR			TRANSISTOR		
R802	J10276229	Carbon Composition 1/2W GK 2.2 Ω	Q4	G3318150Y	2SC1815Y
R801	J10276220	" " " " 22 Ω			
R810-816	J00245100	Carbon Film 1/4W VJ 10 Ω			RESISTOR
R803-809	J00245472	" " " " 4.7k Ω	R12	J00245103	Carbon Film 1/4W VJ 10k Ω
CAPACITOR			RESONATOR BOARD (P/O RX UNIT)		
C802	K70167474	Tantalum 35WV 0.47 μ F	Symbol No.	Parts No.	Description
C803	K40120226	Electrolytic 16WV R 22 μ F	PB-1800	F0001800	Printed Circuit Board
C801	K40120107	" " 100 μ F		C0018000	RESONATOR BOARD with components
MINI CONNECTOR			CAPACITOR		
P802	P0090050	5048-04A			
P803	P0090054	5048-07A	C109,110,112, 114	K02172050	Ceramic 50WV CH5pF
P801	P0090038	5048-12A			
			C107,115	K02175150	" " " 15pF
			C111,113	K02175180	" " " 18pF
J805	P1090047	3024-11A			
J804	P1090046	3024-15A			
					CERAMIC TRIMMER
			TC101-104	K91000028	ECV-1ZW 10x53 10pF
SW UNIT					
Symbol No.	Parts No.	Description			
PB-1798	F0001798	Printed Circuit Board			INDUCTOR
	C0017980	P.C.B with components	L103	L0020409	
		PUSH SWITCH		R5044940A	Resonator Case
S1	N4090003	MP0001AA2060		Q5000011	Wrapping Terminal C
S7,8,9	N4090012	SPJ2-22-A01			
PHOTO A BOARD			MONITOR UNIT		
Symbol No.	Parts No.	Description	Symbol No.	Parts No.	Description
PB-1848	F0001848	Printed Circuit Board	PB-1897A	F0001897A	Printed Circuit Board
	C0018480	PCB with components		C0018970	P.C.B with components
					RESISTOR
		PHOTO INTERRUPTER	R901,903	J10246103	Carbon Composition
Q3	G0090001	ON-1105			1/4W GK 10k Ω
			R902	J10246153	" " " " 15k Ω
		TRANSISTOR			POTENTIOMETER
Q5	G3318150Y	2SC1815Y	VR901,902	J51721203	EVL-S3AA 00B24 20k Ω B
		RESISTOR			CAPACITOR
R13	J00245103	Carbon Film 1/4W VJ 10k Ω	C901	K50177223	Mylar Film 50WV 0.022 μ F





- NOTES
1. ALL RESISTORS ARE IN Ω UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS ARE IN μ F UNLESS OTHERWISE NOTED.
 3. ALL ELECTROLYTIC CAPACITORS ARE OTHERWISE NOTED.
- * VALUE IS NOMINAL.





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