

MAINTENANCE SERVICE MANUAL FRG-7700



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FOREWORD

The purpose of this manual is to provide the reader with information critical to the operation and maintenance of the FRG-7700 general coverage communications receiver. 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 FRG-7700 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.

Yaesu Musen Company, Ltd.
Tokyo, Japan

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ALL MODE COMMUNICATIONS RECEIVER FRG-7700



GENERAL DESCRIPTION

The FRG-7700 is a revolutionary communications receiver for the most demanding shortwave listener. Using an advanced frequency synthesizer, the FRG-7700 provides reception over the range 150 kHz – 29.9 MHz, with provision for reception of AM, SSB, CW, and FM stations. In the AM mode, three bandwidths are available, allowing the operator to select the IF bandwidth most appropriate for the interference level and fidelity requirements of each listening period.

Available as an option for the FRG-7700 is Yaesu's exciting memory feature, which allows the storage and recall of up to twelve discrete frequencies. This allows the operator to watch several stations with pushbutton ease, thus eliminating the considerable effort involved in tuning manually for each of several stations one wants to watch. A memory backup feature is provided for the memory unit to preserve memories when power is removed (three penlight cells required, batteries not supplied).

The FRG-7700 features high sensitivity, excellent selectivity, digital plus analog display of the operating frequency, and a built-in digital quartz clock that can be programmed to turn the receiver on and off. A snooze timer is included in the clock feature. The timer may also be used to control peripheral equipment such as a tape recorder, for unattended recording of programs you might otherwise miss because you must be away from your station.

Top performance features include a highly effective noise blanker, selectable fast/slow AGC (Automatic Gain Control) circuit, an audio filter which may be adjusted to improve interference rejection, an easy-to-read S-meter, and two RF attenuators (one fixed, one continuously adjustable) for operation under very strong signal conditions. For FM operation, a squelch control will silence the receiver until a signal is received. Convenient interface jacks for tape recorder control, audio output to an external speaker or tape recorder, receiver muting, and for listening via headphones make the FRG-7700 truly the most versatile receiver to be made available to the shortwave listeners of the world.

We recommend that this manual be read carefully prior to operating the FRG-7700. With proper care in installation and operation, this receiver will provide you with many years of trouble-free operation.

GENERAL

SPECIFICATIONS

Frequency Range:

150 kHz – 29.999 MHz (30 bands)

Modes:

AM, SSB (USB, LSB), CW, FM

Sensitivity:

	AM	SSB/CW	FM
0.15MHz–0.3MHz	30 μ V/500 Ω	3 μ V/500 Ω	–
0.3MHz–2MHz	25 μ V/500 Ω	2 μ V/500 Ω	–
2MHz–29.999MHz	5 μ V/50 Ω	0.5 μ V/50 Ω	1 μ V/50 Ω

Selectivity:

AM W (Wide)	12 kHz (–6 dB)	25 kHz (–50 dB)
AM M (Medium)	6 kHz (–6 dB)	15 kHz (–50 dB)
AM N (Narrow)	2.7 kHz (–6 dB)	8 kHz (–50 dB)
SSB/CW	2.7 kHz (–6 dB)	8 kHz (–50 dB)
FM	15 kHz (–6 dB)	30 kHz (–40 dB)

Stability:

Less than ± 1 kHz from 1 to 30 minutes after power ON.

Less than ± 300 Hz after 30 minut warm-up.

Antenna Impedance:

0.15 MHz – 2 MHz BC 500 ohms
(unbalanced)

2 MHz – 29.999 MHz, SW/BC 50 ohms
(unbalanced)

Audio Output:

1.5 Watts (8 ohms, 10% THD)

Speaker Impedance:

8 ohms

4-16 ohms for external speaker or headphone

Power Requirement:

100/120/220/240 volts, AC 50/60 Hz

Power Consumption:

	With Memory Unit
Standby: AC 10 VA	AC 10 VA
ON: AC 33 VA	AC 39 VA

Size:

334(W) x 129(H) x 225(D) mm

Weight:

Approx. 6 kg

6.5 kg (with Memory Unit)

SEMICONDUCTOR COMPLEMENT*

IC:		SN74LS293	1	Diode:	
HD10551P	2	TA7061AP	1	1N60	10
MB8718	1			1S188FM	4
MB84040B	1	FET:		1SS53	64
MC4044P	1	2SK107-3	2	10D1	1
MC14024BCP	2	2SK125	4	FC52M	2
MC14046BCP	1	3SK73GR	8	FC63	1
MC14069UBCP	1			MV104	5
MC14504BCP	1	Transistor:		RD4.7EB2	1
MC14518BCP	2	2SA733AQ	17	RD5.6EB2	4
MC14555BCP	1	2SC535A	1	RD7.5EB1	1
MC14556BCP	1	2SC900E	4	RD9.1EB2	1
MSM4023RS	1	2SC945AQ	70	RD10EB1	1
MSM5524RS	1	2SC1047C	1	S2V10	1
μ PB553C	1	2SC1317R	1	S2VB10F	1
μ PC575C2F	1	2SC1384R	3		
μ PD5101LC	6	2SC1393L	2	LED:	
μ PC78L05A	1	2SC1674L	4	TLG-208	1
SN16913P	3	2SC1959Y	1	TLY-205	2
SN74LS123	1	2SD288K	1	TLY-208	1
SN74LS192	4	2SD882Q	3		
SN74LS196	1	MPS-A13	1		
SN74LS290	1				

* Including Memory Unit

Specifications subject to change without notice or obligation

ACCESSORIES

The following accessories are packaged along with the FRG-7700:

- (1) AC Power Cable (T9013280) 1 ea.
- (2) Extra fuses 100-120V 1A (Q0000002)
220-240V 0.5A (Q0000001) 2 ea.
- (3) Wire for antenna (Q3000004) 10 m.
- (4) Extender feet with pads (R3054630) 2 ea.

AVAILABLE OPTIONS

- (1) Memory Unit
- (2) Memory/Clock Backup Batteries (AA Size)

NOTE

In this manual, discussion of the memory feature will omit repetitive use of the word "option," in the interest of brevity. The standard FRG-7700 does not include the memory unit, which is available as an extra-cost option from your Yaesu dealer. The AA size penlight cells required to activate the memory backup feature are not supplied with the memory unit.

RECOMMENDED ACCESSORIES

The FRV-7700 is a high-performance crystal controlled VHF frequency converter, designed to match the FRG-7700 general coverage communications receiver. The three 10 MHz ranges on the VHF band are converted into 20^{*}(18) – 30 MHz, allowing you to receive these frequencies with your FRG-7700.

The tunable high-Q resonators in both RF and IF sections eliminate most intermodulation and cross modulation problems, providing excellent receiver performance when working with weak signals.

The FRT-7700 is an ultra-compact antenna tuner for the FRG-7700 receiver. Designed for operation from 150 kHz to 30 MHz, the FRT-7700 will provide the proper impedance for the receiver, thus rejecting unwanted signals. A built-in attenuator, 60 dB maximum, prevents intermodulation and cross-modulation from occurring when strong signals are being carried to your receiver. Also, a two-section lowpass filter aids in the rejection of interference from strong signals above 2 MHz, when you are listening to bands in the 150 kHz to 500 kHz range.

SPECIFICATIONS

Frequency coverage:

- Model A – ^{*}118 – 130 MHz; 130 – 140 MHz;
140 – 150 MHz
- Model B – ^{*}118 – 130 MHz; 140 – 150 MHz;
50 – 59 MHz
- Model C – 140 – 150 MHz; 150 – 160 MHz;
160 – 170 MHz
- Model D – ^{*}118 – 130 MHz; 140 – 150 MHz;
70 – 80 MHz
- Model E – 140 – 150 MHz; 150 – 160 MHz;
^{*}118 – 130 MHz
- Model F – 150 – 160 MHz; 160 – 170 MHz;
^{*}118 – 130 MHz

Sensitivity: (measured w/FRG-7700)

- AM (M) – 2.5 μ V for 10 dB S/N @ 1 kHz
30% MOD
- AM (N) – 2.0 μ V for 10 dB S/N @ 1 kHz
30% MOD
- SSB/CW – 0.5 μ V for 10 dB S/N
- FM – 0.5 μ V for 10 dB S/N @ 3.5 kHz
DIV

Size:

32(H) x 167(W) x 170(D) mm

Weight:

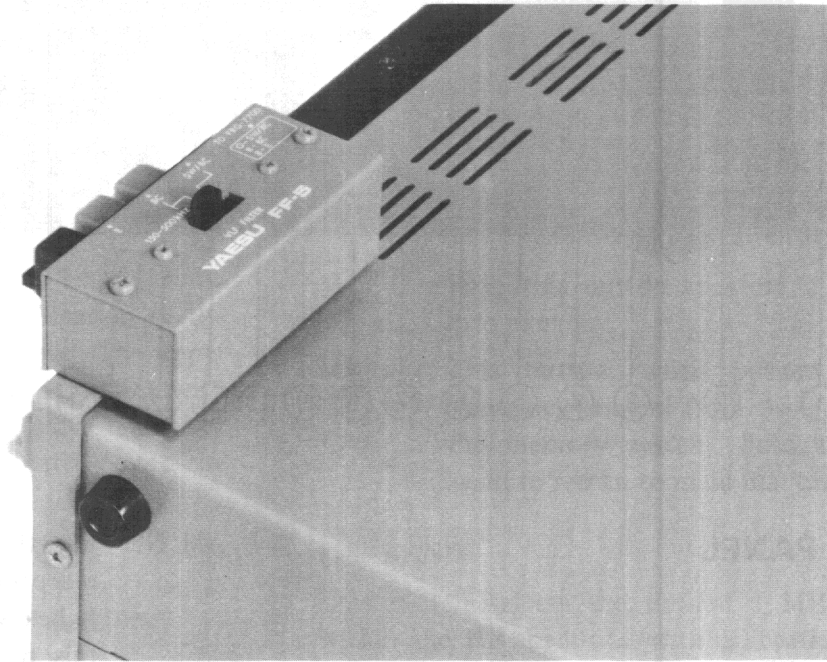
Approximately 800 g.



FRT-7700

The FF-5 LF Filter can reject signals above 500 kHz, thus preventing cross-modulation and inter-modulation caused by strong broadcasting stations

above 500 kHz. The installation of this filter onto your FRG-7700 can be done using the mounting bracket supplied.



LF FILTER FF-5

The YH-55 and YH-77 headphones are light in weight, and an extra-soft cushion makes for many hours of comfort. The audio response is shaped to match that of your receiver.

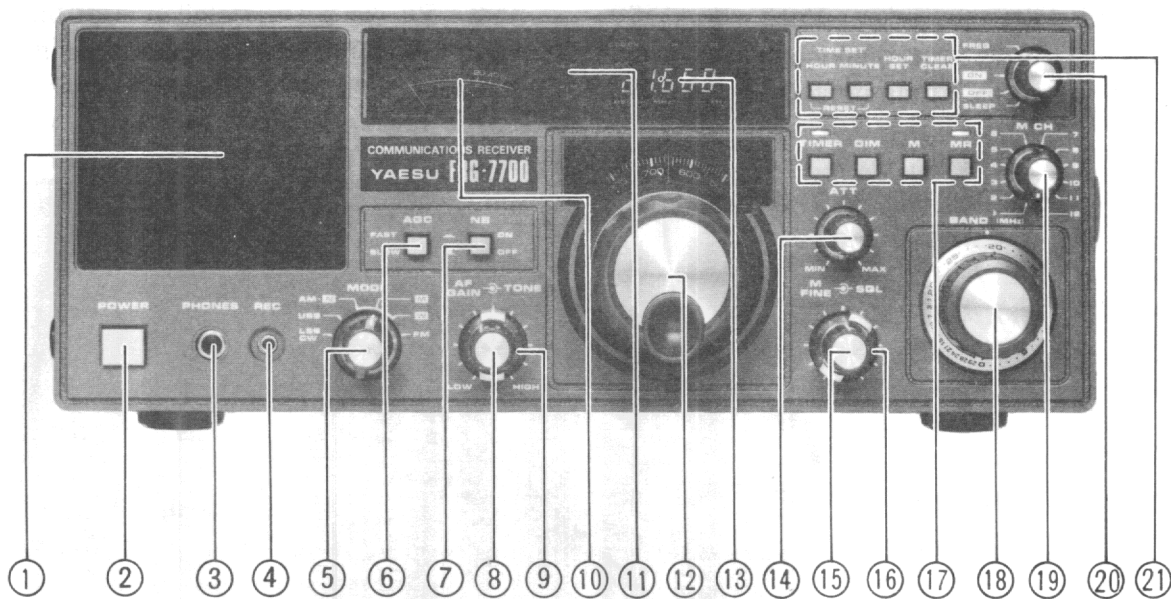


YH-55



YH-77

CONTROLS AND SWITCHES



FRONT PANEL

(1) SPEAKER

Internal speaker

(2) POWER

This is the main ON/OFF switch for the receiver. When the POWER switch is in the OFF position, on/off control may be exercised by the clock timer. See the "Operation" section for details.

(3) PHONES

This is a standard 1/4" headphone jack. When the headphone plug is inserted into this jack, the internal speaker is automatically cut off. The audio output impedance is 8 ohms.

(4) REC

This miniature phone jack is for recording purposes. The output level is approximately 100 mV (fixed), irrespective of the setting of the AF GAIN control.

(5) MODE

This control chooses the desired mode:

LSB/CW Use this position for lower sideband (LSB) and Morse Code (CW) reception.

USB Use this position for upper sideband (USB) reception. This position may also be used for CW reception, if desired.

AM N Use this position for narrow-band AM reception. Under conditions of extremely heavy adjacent frequency interference, this position of the mode switch may allow AM reception where a wider mode would be unusable. There will be some degradation in fidelity in the AM N position, however.

AM M For all-around AM reception, the AM M position of the mode switch may be used. Because of the wider bandwidth, the fidelity on the incoming signal is much better than with the AM N filter.

AM W Under clear band conditions, the AM W provides the widest bandwidth and best fidelity.

FM This position selects reception of FM signals.

(6) AGC

This switch allows selection of the optimum AGC (Automatic Gain Control) decay time. The SLOW position is normally used for AM reception, while the FAST position is normally chosen for Morse Code (CW) reception. For SSB reception, the optimum position is determined by band conditions and the adjacent-frequency interference level.

(7) NB

This switch, when pressed, activates the noise blanker for reduction in the level of interfering pulse-type noise.

(8) AF GAIN

The AF GAIN control varies the volume level from the speaker. Clockwise rotation increases the volume level.

(9) TONE

This control varies the high-frequency audio response. The variation in audio fidelity provided by the TONE control is highly useful in minimizing interference from heterodynes and other high-pitched noises that might ruin reception.

(10) S-METER

The S-meter provides a relative indication of the signal strength on the incoming signal. The upper scale is calibrated in S-units from S1 to S9, with stronger signals indicated in dB over S9. The lower scale is calibrated in S-units compatible with the SINPO code, as shown in Table 1.

(11) AM, PM

These are AM and PM indicators for the clock.

(12) MAIN DIAL

The main dial determines the operating frequency of the FRG-7700, in conjunction with the setting of the BAND switch.

(13) DIGITAL DISPLAY

The digital display indicates the operating frequency as well as the time. Selection of display of the frequency or time is made via the FUNCTION switch.

(14) ATT

The ATT (Attenuator) control, when rotated in a clockwise direction, reduces the gain of the receiver preamplifier, thus minimizing overloading of the receiver during conditions of extremely strong adjacent-frequency interference. Maximum receiver sensitivity occurs when the ATT control is rotated to the fully counterclockwise position.

(15) M FINE

This control allows fine tuning during memory operation. A frequency excursion of up to 1 kHz may be achieved using this control.

(16) SQL

The SQL (Squelch) control will silence the receiver until a signal is received. The SQL control is usable

ONLY in the FM mode.

**(17) CONTROL SWITCHES
(TIMER, DIM, M, MR)**

TIMER Once the desired on/off timers are programmed into the clock, push this switch to activate the power control timer. In this mode, the digital clock timer will turn the receiver on and off.

DIM This button, when pushed, will allow dimming of the meter lamp, the dial lamps, and the display intensity.

M Push this button to store a frequency into memory.

MR This button, when pushed, transfers frequency control from the main dial to the memory system. Push the button again to return to main dial tuning.

(18) BAND

This switch selects the desired 1 MHz segment within the HF spectrum, with calibrations from 0 MHz to 29 MHz. Also provided are preset marks for the HF amateur radio (ham) bands.

(19) M CH

This switch selects the desired memory channel.

(20) FUNCTION

This switch selects the Digital Display functions.

FREQ All digits of the operating frequency are displayed with resolution to 1 kHz.

CLOCK Time is displayed in a 12-hour format.

ON The ON time, at which the receiver will be turned on, is displayed.

OFF The OFF time, at which the receiver will be turned off, is displayed.

SLEEP The remaining time of the sleep timer is displayed.

(Up to 59 minutes can be set for the sleep timer.)

(21) CLOCK SETTING SWITCHES

HOUR This switch is used for setting hours on the clock and timer. Pressing this switch once will advance the reading by one hour. If this switch is held for more than two seconds, the hour reading will advance continuously.

GENERAL

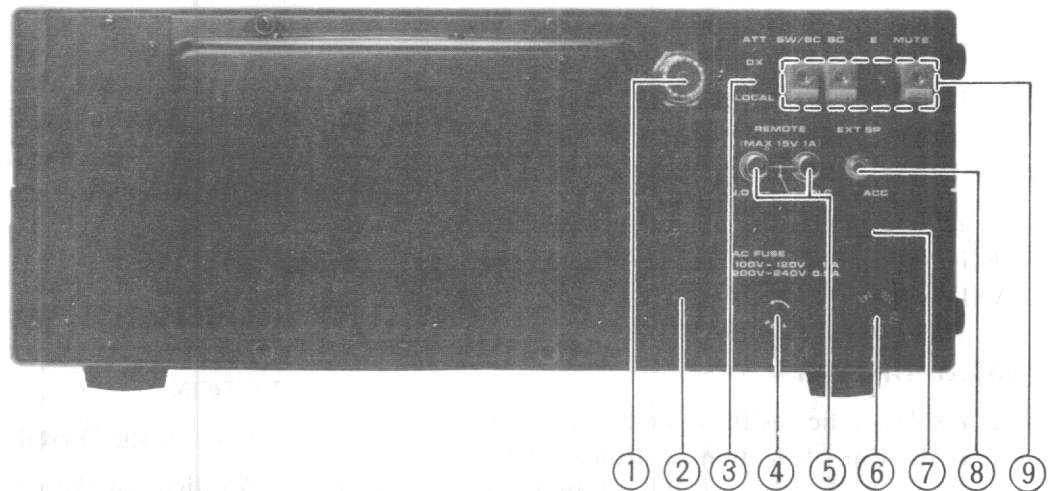
MINUTE This switch is used for setting minutes. The setting procedure is identical to that for setting hours.

HOUR SET

This switch, when pressed, resets the minute and second digits of the clock to zero. For example, if more than 30 minutes are displayed on the clock, pressing the HOUR SET button will advance the clock to the next hour. If less than 30 minutes have elapsed in the hour, pressing the HOUR SET button will zero the minutes and seconds, but leave the hour reading unchanged. This feature facilitates easy time setting.

TIMER CLEAR

This switch, when pressed, clears the remaining time before the programmed off time. After the timer turns the receiver on in the TIMER mode, you may push the TIMER CLEAR button to turn the receiver off. The following day, the receiver will turn ON again at the programmed time. In the sleep timer mode, pushing this switch will cause the remaining time to be zero, and the receiver will turn off.



REAR PANEL

(1) COAX ANT

This is a standard UHF type coaxial connector for shortwave and standard broadcast listening. This connector is wired in parallel with the SW/BC terminals.

(2) AC

The AC power cable should be connected at this point.

(3) ATT

The ATT (Attenuator) switch activates an attenuator in the incoming signal path when the LOCAL position is selected. For best receiver sensitivity, this switch should be placed in the DX position.

(4) AC LINE FUSE

For 100/120 volt operation, a 1 amp fuse should be installed here. For 200/240 volt operation, a 1/2 amp fuse should be installed here. When replacing fuses, be absolutely certain to use a fuse of the proper rating, as our warranty does not cover damage caused by use of an improper fuse.

(5) REMOTE (N.O./N.C.)

These RCA type jacks may be used for control of peripheral equipment such as tape recorders, etc. When the TIMER switch is activated, and the ON time is reached, the internal switching relay is activated. When the OFF time is reached, the relay returns to its normal condition. The normally open and normally closed jacks on the rear panel may then be used, according to the control requirements of your station equipment. See the "Operation" section for details.

(6) AC VOLTAGE SELECTOR

This is for selection of the proper input AC voltage. Set this selector for your local line voltage. If you have any question about your local line voltage, consult your local Yaesu dealer before attempting operation of this equipment.

(7) ACC

This is a 5 pin DIN accessory jack which affords access to AGC voltage, an 11 volt DC line, and the mute line.

(8) EXT SP

An external speaker may be connected via this jack. The audio output impedance is 4-16 ohms. Insertion of a plug into this jack automatically cuts off the internal speaker.

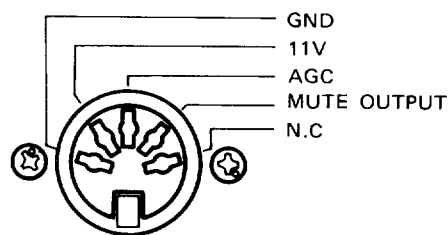
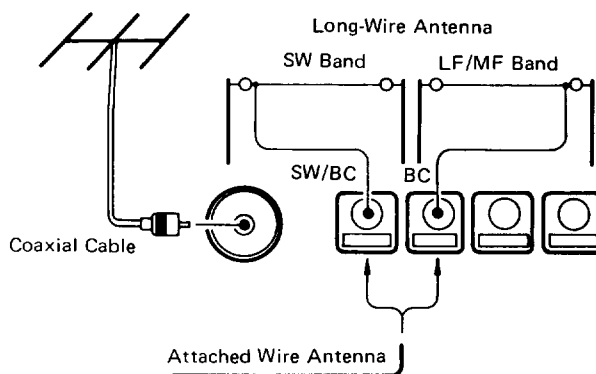
(9) SW/BC, BC, E, MUTE

SW/BC is for connection to a long wire antenna for both shortwave and broadcast listening.

BC is for connection to a long wire antenna for broadcast band listening.

E is a ground connection.

MUTE provides a means of muting the FRG-7700 (an external standby switch). Shorting the MUTE terminal to ground will mute the receiver.



ACC CONNECTIONS

SINPO CODE

	Signal Strength	Degrading Effect of			Overall Rating
	S	Interference I	Noise N	Propagation Disturbance P	O
5	Excellent * (60dB)	Nil ● (-40dB)	Nil (-40dB)	Nil ○ (0dB)	Excellent
4	Good (45dB)	Slight (-30dB)	Slight (-30dB)	Slight (10dB)	Good
3	Fair (30dB)	Moderate (-20dB)	Moderate (-20dB)	Moderate (20dB)	Fair
2	Poor (15dB)	Severe (-10dB)	Severe (-10dB)	Severe (30dB)	Poor
1	Barely Audible (0dB)	Extreme (0dB)	Extreme (0dB)	Extreme (40dB)	Unusable

Table 1

* RECEIVER INPUT LEVEL
● RATIO TO SIGNAL
○ DEPTH OF FADING, ECHO, ETC.

INSTALLATION

Best performance from this equipment can only be obtained if proper care is observed during installation. While the setup procedure for the FRG-7700 is extremely straightforward, permanent damage to the set can occur if improper voltage is applied to the unit or if external connections are improperly made. Before attempting operation of your FRG-7700, be certain to read the following sections carefully.

UNPACKING AND INITIAL INSPECTION

Carefully remove the FRG-7700 from its carton, and inspect it for any signs of physical damage. Rotate the knobs and push the switches, checking each for normal freedom of action. Should any damage be observed, document it carefully, and notify the shipping company immediately. Save the carton and foam packing material for possible use at a later date.

AC VOLTAGE SELECTION

Your FRG-7700 is supplied with a power transformer capable of operation from 100, 120, 220, or 240 volts, as these voltages are the ones most commonly used throughout the world. Your Yaesu dealer has taken care to make sure that your radio is set up for the voltage used in your area. However, in some parts of the world, more than one voltage is available for use. It is extremely important that the FRG-7700 not be subjected to an improper supply voltage.

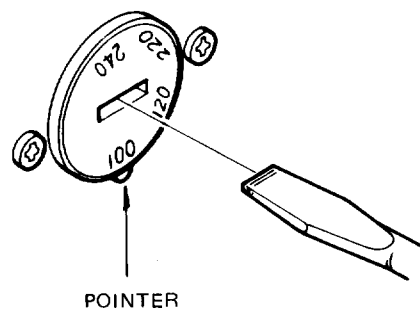
Therefore, before connecting the power cord to the radio, make absolutely certain that the voltage specification marked on the rear panel of your receiver (lower right-hand corner) matches your local supply voltage. At the same time, check to make certain that a fuse of the proper rating is installed. For 100/120 volt operation, use a 1 amp fuse. For 220/240 volt operation, use a 1/2 amp fuse. The fuse holder is located on the rear panel. NEVER remove the fuse holder when the power cord is plugged into the wall outlet.

CAUTION

Be certain to observe the above precautions regarding power connections and fuses. Our warranty does not cover damage caused by improper supply voltage nor damage caused by use of an improper fuse.

To set the radio up for operation on a different voltage (as, for example, should you move from Europe to the United States), proceed as follows:

- (1) Disconnect the power cord from the rear of the FRG-7700.
- (2) Remove the label covering the voltage selector control on the rear panel of the receiver.
- (3) Insert a screwdriver into the slot on the voltage selector. Rotate the selector until the proper voltage is at the very bottom of the selector, in line with the pointer.
- (4) If a change is made from 100/120 volts to 220/240 volts, or vice versa, be certain that you install a fuse of the proper rating. For 100/120 volts, use a 1 amp fuse, and for 220/240 volts, use a 1/2 amp fuse.
- (5) Make a small label to indicate the new voltage specification for the receiver, and secure it over the voltage selector.
- (6) Connect the power cord to the rear panel "AC" jack, and plug the power plug into your wall outlet.
- (7) If you have any doubt about your local supply voltage, ask your Yaesu dealer. Improper supply voltage must not be applied to this instrument.



AC VOLTAGE SELECTOR

BACKUP BATTERY INSTALLATION

Memory-equipped FRG-7700 receivers include a backup feature which will hold the memory even when the unit is unplugged from the supply voltage. The backup feature requires three AA size penlight cells (not supplied), which should be installed as shown in Figure 1. Be absolutely certain to observe the proper polarity of the batteries during installation.

Battery consumption is extremely low, but we recommend that the backup batteries be replaced once per year. If you have not used the FRG-7700 for a long time, we recommend that you inspect the penlight cells to ensure that no leakage from the batteries has occurred. Damage caused by battery leakage or improper battery polarity is not covered by our warranty.

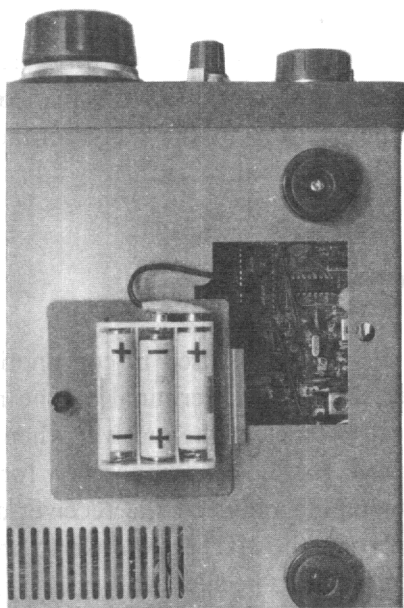


Figure 1

GROUND CONNECTION

For best performance and safety, the FRG-7700 should be connected to a good earth ground. The ground lead should be a heavy-gauge braided cable or wire, and should be connected to the terminal marked "E" on the rear panel of the receiver.

ANTENNA INSTALLATION

The antenna is an important part of your station installation. Without a good antenna system, it will be difficult for you to take full advantage of your FRG-7700 receiver's many high-performance features. For best reception, please follow the guidelines presented below regarding antenna installation.

(1) Low Frequency (LF) and Medium Frequency (MF) Reception (Below 2 MHz Exclusively)

Good all-around reception will occur if a single long wire is connected to the BC terminal on the rear of the receiver. Insulate the wire at the far end, and at the point where it enters your house; ceramic insulators suitable for antenna installations are available from your Yaesu dealer. The wire itself may be either bare or insulated (plastic or vinyl covering on the wire), with the constraint that bare wire should not come in contact with trees or other obstructions.

In general, the antenna wire should be as long, high, and in the clear as possible. If these simple recommendations are followed, good reception will be easy to obtain.

(2) Shortwave (SW) Reception (Above 2 MHz Exclusively)

Maximum performance is secured in the shortwave bands through the use of a resonant antenna having an impedance of 50 ohms at the design frequency. A center-fed "dipole" antenna cut for the most-listened-to frequency will easily satisfy this requirement. Dipole antennas should be fed with coaxial cable, and suitable antenna kits are available from your Yaesu dealer.

However, the shortwave bands are quite wide, and no dipole antenna will be resonant throughout this entire frequency range. The best course of action, then, is to cut the legs of the dipole antenna to the longest (equal) lengths that your installation area will allow. This will provide an excellent listening system for your shortwave station.

Should you wish to cut your dipole antenna for optimum performance on a particular shortwave band, the formulas of interest are:

$$\text{Length (feet)} = 468/\text{frequency (MHz)}$$

$$\text{Length (meters)} = 142.5/\text{frequency (MHz)}$$

GENERAL

Notes Regarding Antenna Installations

For general reception (listening on both the LF/MF and shortwave bands), the antenna connection should be made to the SW/BC connector or to the coaxial antenna connector on the rear panel. If your primary interest is only on the LF/MF bands, then connect your antenna wire to the BC terminal. Do not connect one antenna to the SW/BC terminal (or coax connector) and another antenna to the BC connector at the same time; if you do, overloading or intermodulation distortion may be created, degrading receiver performance.

Use extreme caution when installing your antenna system. Every year, several people are electrocuted because their antenna touched a high-voltage wire providing their normal house current. It is extremely important that your shortwave antenna be located such that it cannot possibly come in contact with electric wires even in a disastrous windstorm.

REMOTE TERMINAL CONNECTIONS

The REMOTE terminals are connected to a relay, which is an electronically controlled switch. In the case of the FRG-7700, the switching relay is controlled by the clock timer, allowing you to control the operation of a tape recorder or other equipment simply by the proper setting of your FRG-7700 clock controls. The "N.O." terminal is "normally open," which means that the relay will cause no connection to be made from the center pin to ground until the timer activates the relay. The "N.C." terminal is "normally closed," which means that the relay contacts will cause a con-



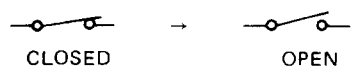


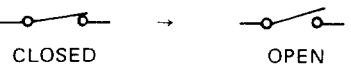
nection to be made between center pin and ground until the relay is activated; the relay will then open the connection.

Most tape recorders have a "footswitch" connection which allows external control. In some cases, this external on/off control line is incorporated into the microphone cord. Closing an external switch then allows the tape recorder to be turned on. To use this kind of tape recorder with the FRG-7700, connect a shielded cable from the tape recorder footswitch jack to the FRG-7700 "N.O." jack, and connect a shielded cable from the FRG-7700 "REC" jack on the front panel to the tape recorder "LINE IN" or "MIC" jack, depending on the levels accepted by your tape recorder. Remember that the REC jack on the FRG-7700 is not controlled by the AF GAIN control, but the EXT SP jack is; you may want to connect your audio input line differently for your particular requirements.

Details of the operation of the timer are included in the "Operation" section of this manual. Table 2 indicates the position of the relay contacts tied to the REMOTE terminal.

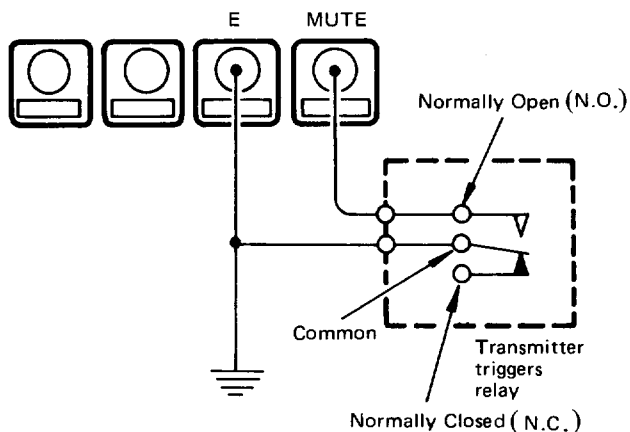
MUTE CONNECTION

When the FRG-7700 is used in conjunction with a transmitter, the MUTE terminal on the rear panel may be used to silence the receiver when transmitting. Do not forget to use a relay for external antenna switching between the receiver and transmitter. Shorting the MUTE terminal to ground will cause the receiver to be silenced.

TIMER FUNCTION	N.O. Terminal	N.C. Terminal	FRG-7700 (with POWER SW OFF)
ON TIMER	 OPEN → CLOSED	 CLOSED → OPEN	ON at the programmed time
OFF TIMER	 CLOSED → OPEN	 OPEN → CLOSED	OFF at the programmed time
SLEEP TIMER	 OPEN → CLOSED	 CLOSED → OPEN	OFF after the programmed period of time

→ When the timer is activated

Table 2



INTERCONNECTION WITH YR-901 MORSE CODE/TELETYPE READER

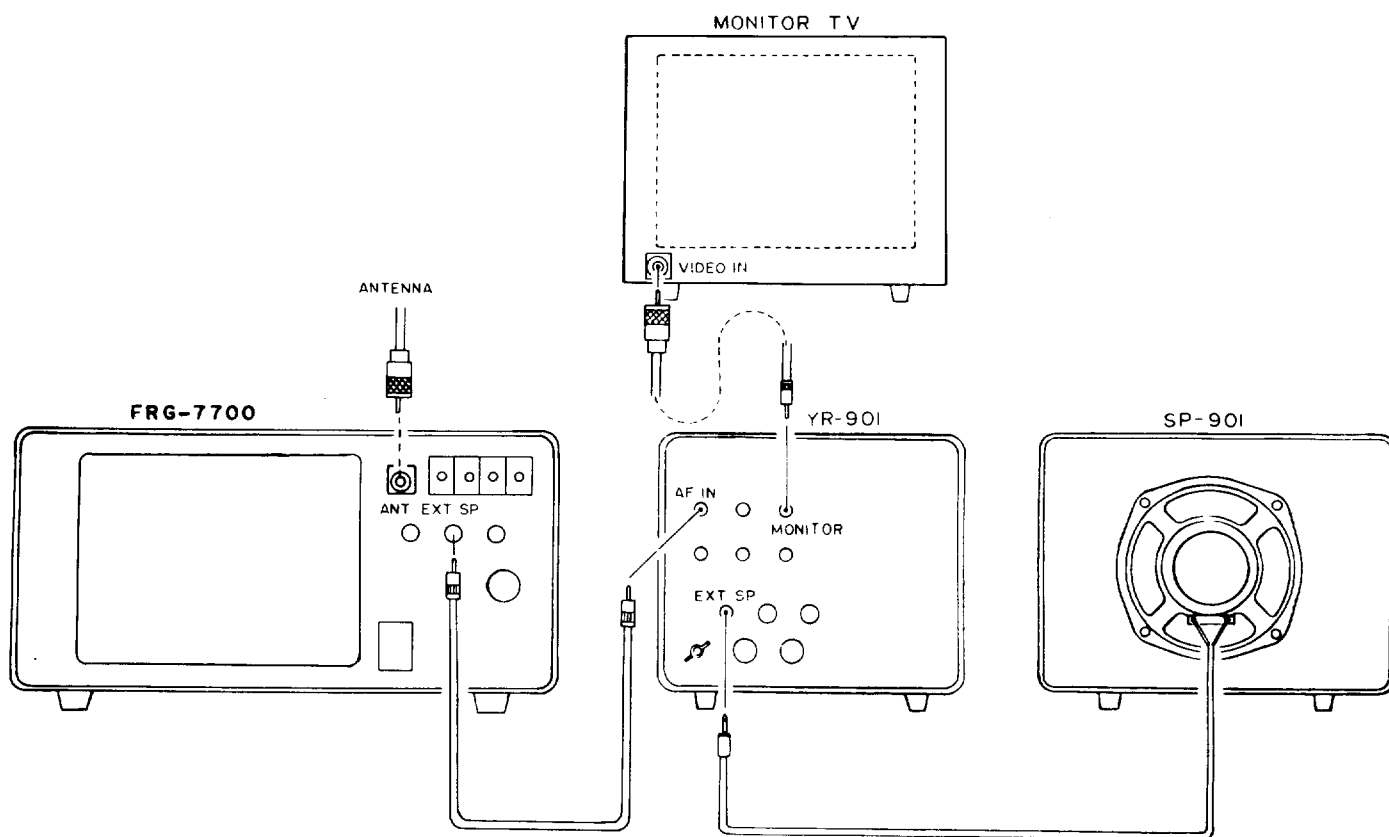
The YR-901 is a high-performance computerized translator which will allow display on a video monitor of incoming Morse Code and/or teletype (RTTY) signals. The YR-901 and YVM-1 Video Monitor are options available from your Yaesu dealer.

Complete operation instructions are included with the YR-901. Please refer to the drawing below for details of the extremely simple interconnections required. Please note that the SP-901 speaker is not mandatory for use with the YR-901, as the latter includes a built-in speaker.

PHYSICAL LOCATION OF THE FRG-7700

The FRG-7700 will perform well in any location that allows free passage of air around the cabinet. Solid state equipment such as the FRG-7700 should not, however, be used in extremely hot environments unless some provision is made (external fan, etc.) for keeping the station temperature less than 40°C.

The YR-901 will allow you to see for yourself late-breaking teletype news as it comes from abroad on circuits used by the international news services. Amateur radio Morse Code and teletype communications, and a host of other exotic transmissions will unfold before you on the video screen. See your Yaesu dealer for details.



FRG-7700/YR-901/YVM-1/SP-901

GENERAL

MEMORY UNIT INSTALLATION

The optional Memory Unit is easily installed in a matter of minutes. Please follow the below instructions carefully, in order to make the proper connections.

- (1) Remove the small cover from the rear panel of the receiver, as shown in Fig. 2.
- (2) Connect the six plugs which are fastened to the cover to the appropriate jacks on the Memory Unit, as shown in Fig. 3.
- (3) Mount the Memory Unit with the supplied self-tapping screws (4 pcs), as shown in Fig. 4, being sure that no wires from inside the unit are protruding.

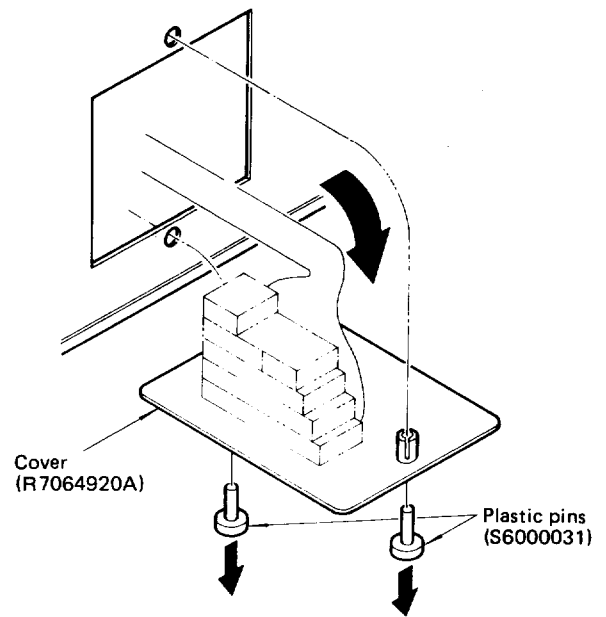


Figure 2

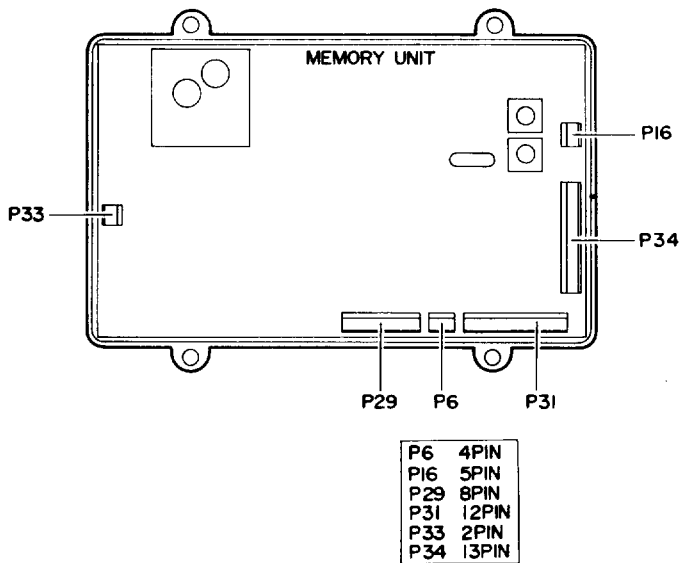


Figure 3

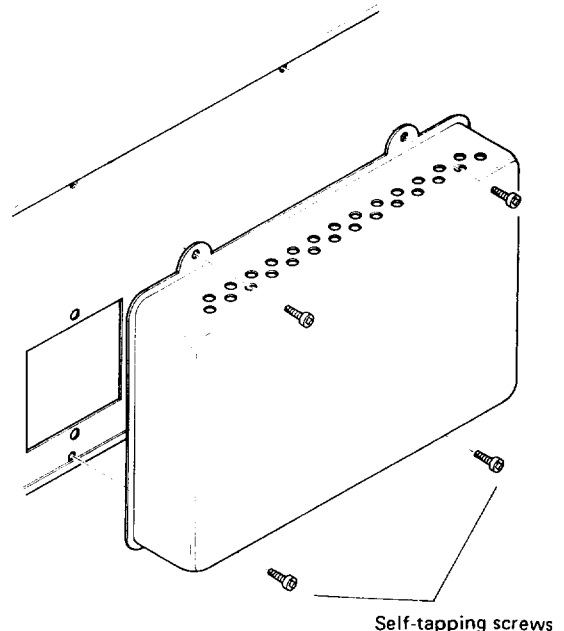


Figure 4

BOTTOM PANEL FEET

The feet on the bottom of the receiver may be changed, should you desire to change the viewing angle for the FRG-7700. The extender feet, packed in the accessory kit for the receiver, may be installed at the front or back, depending on the viewing angle desired. When repacking the receiver for shipping, be certain to replace the original feet. Refer to Figure 5 for mounting details for the bottom panel feet.

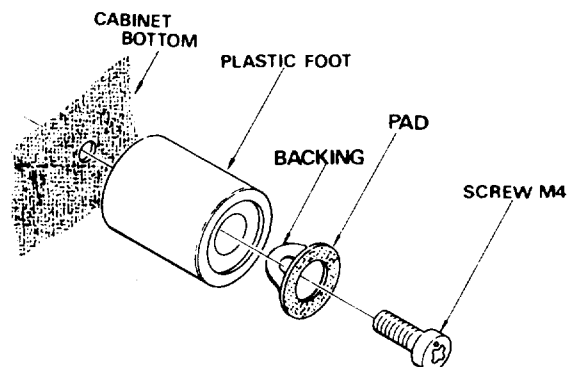
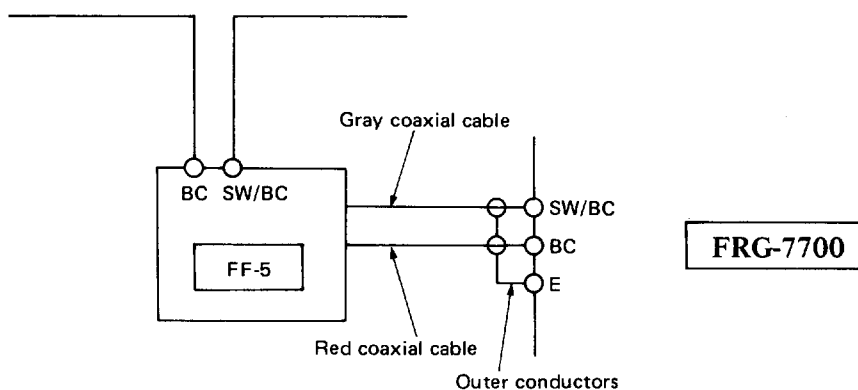


Figure 5

FF-5 INSTALLATION PROCEDURE

When connecting the FF-5 to your FRG-7700, proceed using the following installation procedure.

1. Remove the two feet mounted on the connector side of the FF-5.
2. Referring to Figure 1, fix the supplied mounting bracket to the FF-5 with the screws removed in Step 1.
3. Remove the two screws on the left, rear side of the cabinet, and secure the mounting bracket of the FF-5 in place, as shown in Figure 2.
4. Connect center conductor of the gray coaxial cable from the FF-5 to the SW/BC terminal on the rear panel of the FRG-7700.
5. Connect the center conductor of the red coaxial cable to the BC terminal on the rear panel of the FRG-7700.
6. Connect both outer conductors of the gray and red coaxial cables to Terminal E of the FRG-7700.



CONNECTIONS

BC Terminal

This terminal can be used to receive weak signals below 2 MHz. However, when receiving local stations, your antenna should be connected to the SW/BC terminal.

SW/BC Terminal

This connector will accept the connection of both antennas to receive above and below 2 MHz. Normally, an antenna is connected to this terminal.

OPERATION OF THE SWITCH

SW/BC Position

When you receive signals above 2 MHz, or strong signals below 2 MHz, the switch should be placed in this position. While set in this position, your antenna should be connected to the SW/BC terminal.

BC Position

Set the switch to the BC position when receiving weak signals below 2 MHz. If the signal is receiving interference from strong stations on other frequencies, use the ATT switch on the rear panel of the FRG-7700 to help reduce the interference.

While the switch is in the BC position, your antenna connection should be made to the BC terminal.

150 – 500 kHz Position

When you receive weak signals in the range of 150 – 500 kHz, set the switch to this position and connect your antenna to the BC terminal. Signals which may cause interference in this range will be rejected.

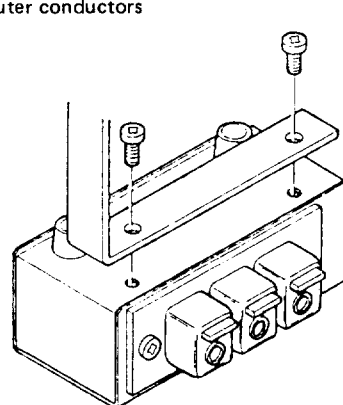


Fig. 1

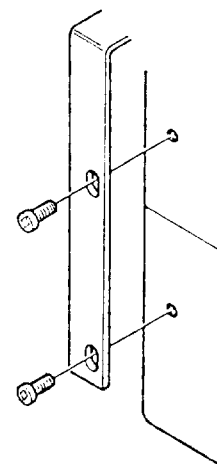


Fig. 2

GENERAL

FRT-7700 INSTALLATION PROCEDURE

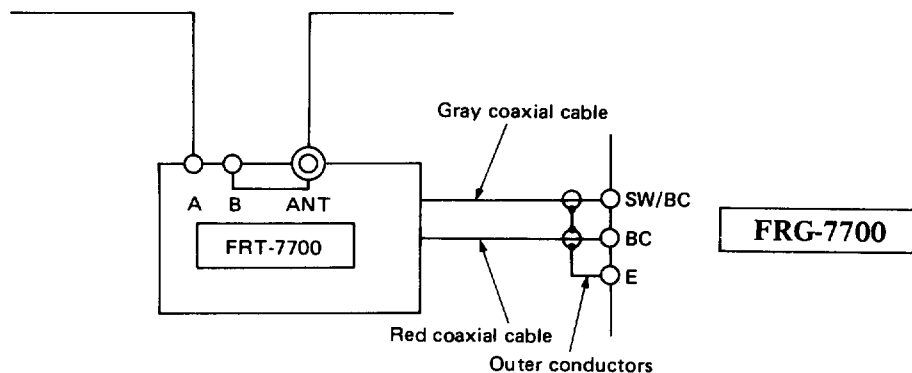
1. Connect the center conductor of the gray coaxial cable coming from the rear panel of the FRT-7700 to the SW/BC terminal on the rear panel of the FRG-7700. Connect the center conductor of the red coaxial cable to the BC terminal. Both outer conductors of the coaxial cables should be connected to terminal E.
2. Your antenna should be connected to the ANT B terminal for normal operation. This terminal accepts incoming signals from 150 kHz to 30 MHz. However, the ANT B terminal is best utilized when you are interested in receiving weak signals in the range of 150 kHz to 500 kHz.

The coaxial receptacle (SO-239) is connected parallel to the ANT B terminal in the FRT-7700. If your antenna feeder has a coax plug, it should be connected to the coaxial receptacle.

OPERATION

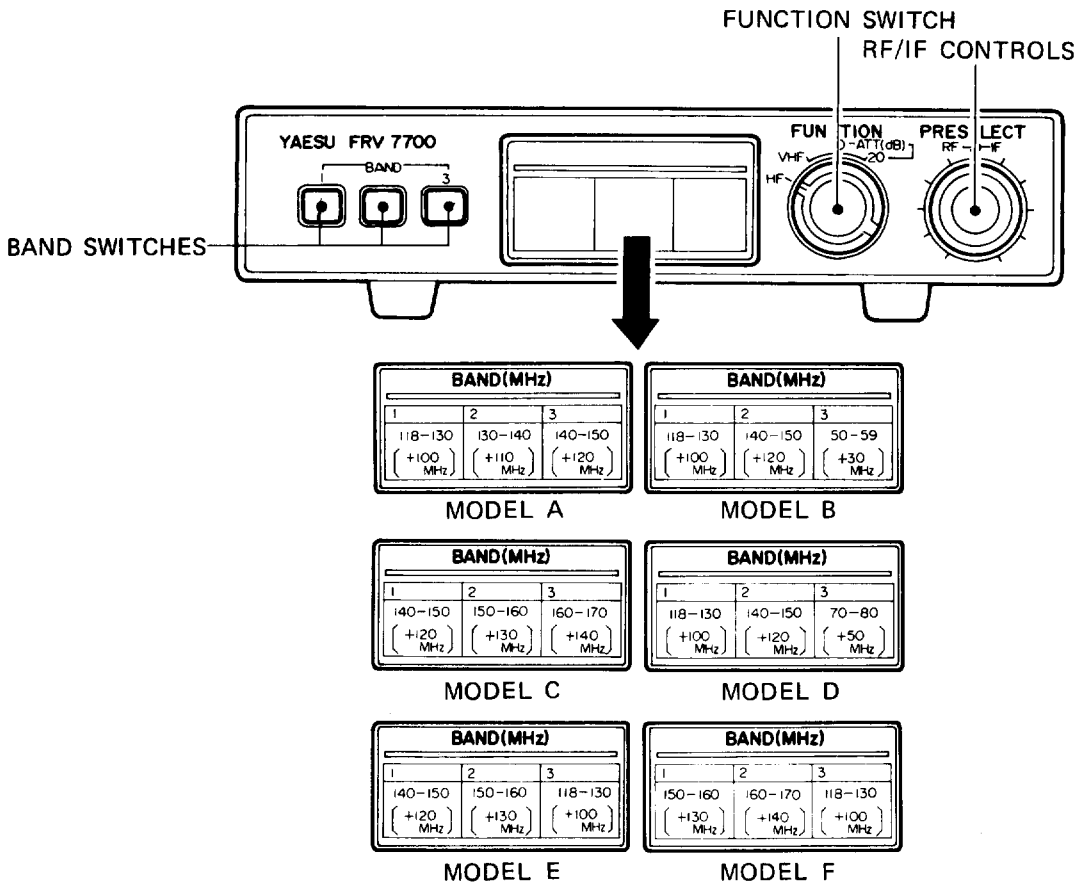
1. Set your FRG-7700 for normal operation on the frequency you desire.
2. Preset the controls and switches as follows:
TUNER – OFF
ATT – 0 (dB)
BAND – Desired band
MATCHING – 3

3. Tune the FRG-7700 to your desired signal.
4. Push the TUNER switch on, and adjust the TUNING control for maximum deflection on the S-meter.
5. Change the position of the MATCHING selector to the point where the S-meter reaches maximum deflection.
6. Repeat the adjustments in Steps 4 and 5 until a maximum S-meter reading is obtained. In some cases, the best sensitivity is obtained at either one range above or below the specified coverage of the BAND switch, a trick you might try when you are unable to obtain sufficient sensitivity.
7. When your receiving station receives interference from strong signals, try reducing all incoming signals by adjusting the ATT control, until you find a position where you can receive the signals clearly.
8. When weak signal reception below 2 MHz is desired, push the OUT switch to DXBC, and the weak signals will be clearly received.



FRV-7700 INSTALLATION PROCEDURE

FRONT PANEL SWITCHES AND CONTROLS



BAND Switches

These three switches select the desired coverage, shown on the front panel.

FUNCTION Switch

This switch activates the FRV-7700, and in the 10 or 20 dB ATT position the receive signal is attenuated. When this switch is placed in the HF position, the FRV-7700 is switched off and the HF antenna is connected through the FRV-7700.

RF and IF Controls

These controls tune the RF and IF resonators exactly to your receive frequency, providing maximum sensitivity and rejection of unwanted signals. During operation, adjust these controls for a maximum S-meter reading on each frequency.

GENERAL

REAR PANEL CONNECTIONS

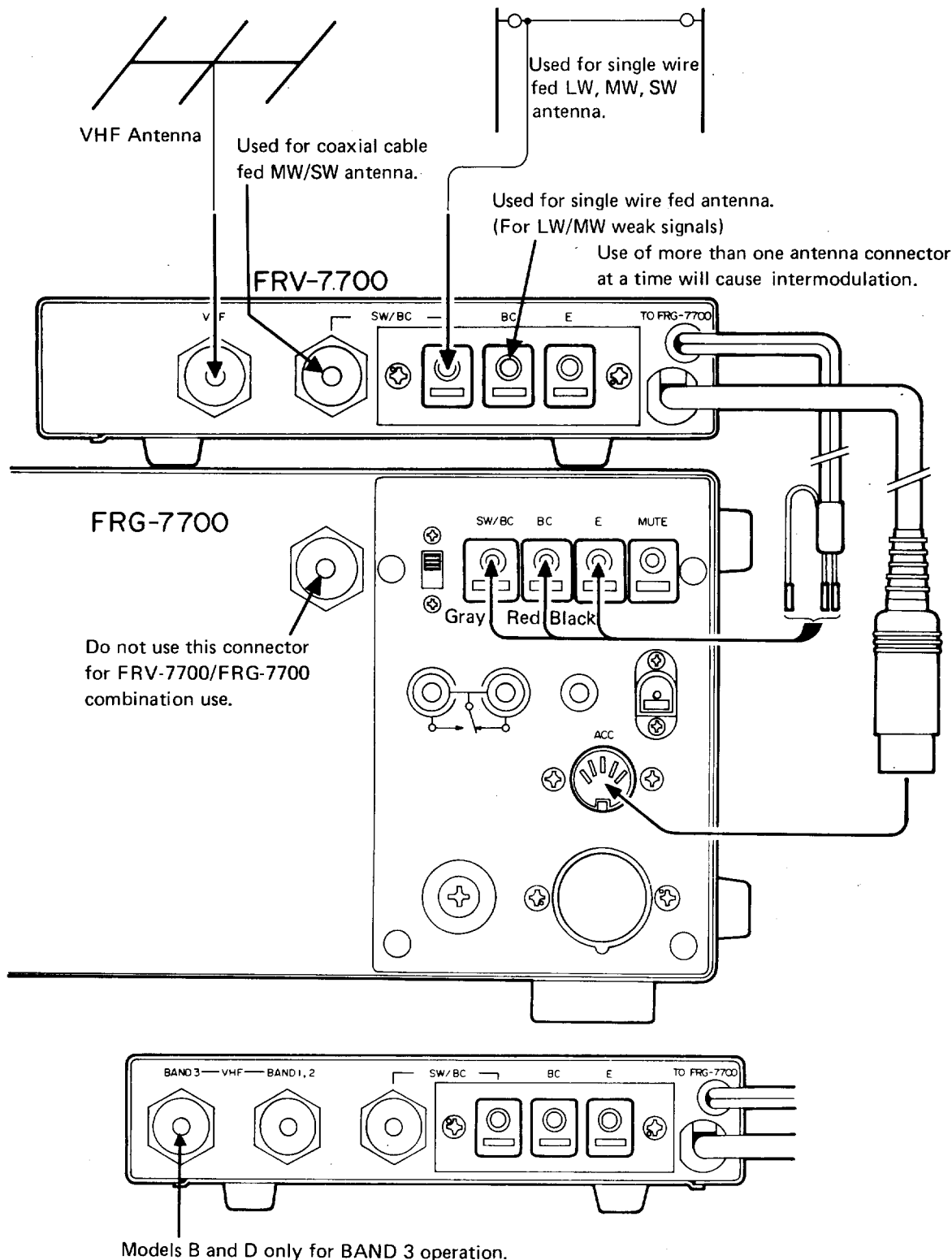
VHF

This jack accommodates the antenna for the VHF band.

SW/BC, BC, E

These terminals accommodate antennas for BC and

HF bands. When the FUNCTION switch is in the HF position, the signal from the antenna connected to these terminals is fed through the FRV-7700 to the FRG-7700. Antenna connection should be done in the same manner as that of the FRG-7700 (refer to the FRG-7700 Instruction Manual).

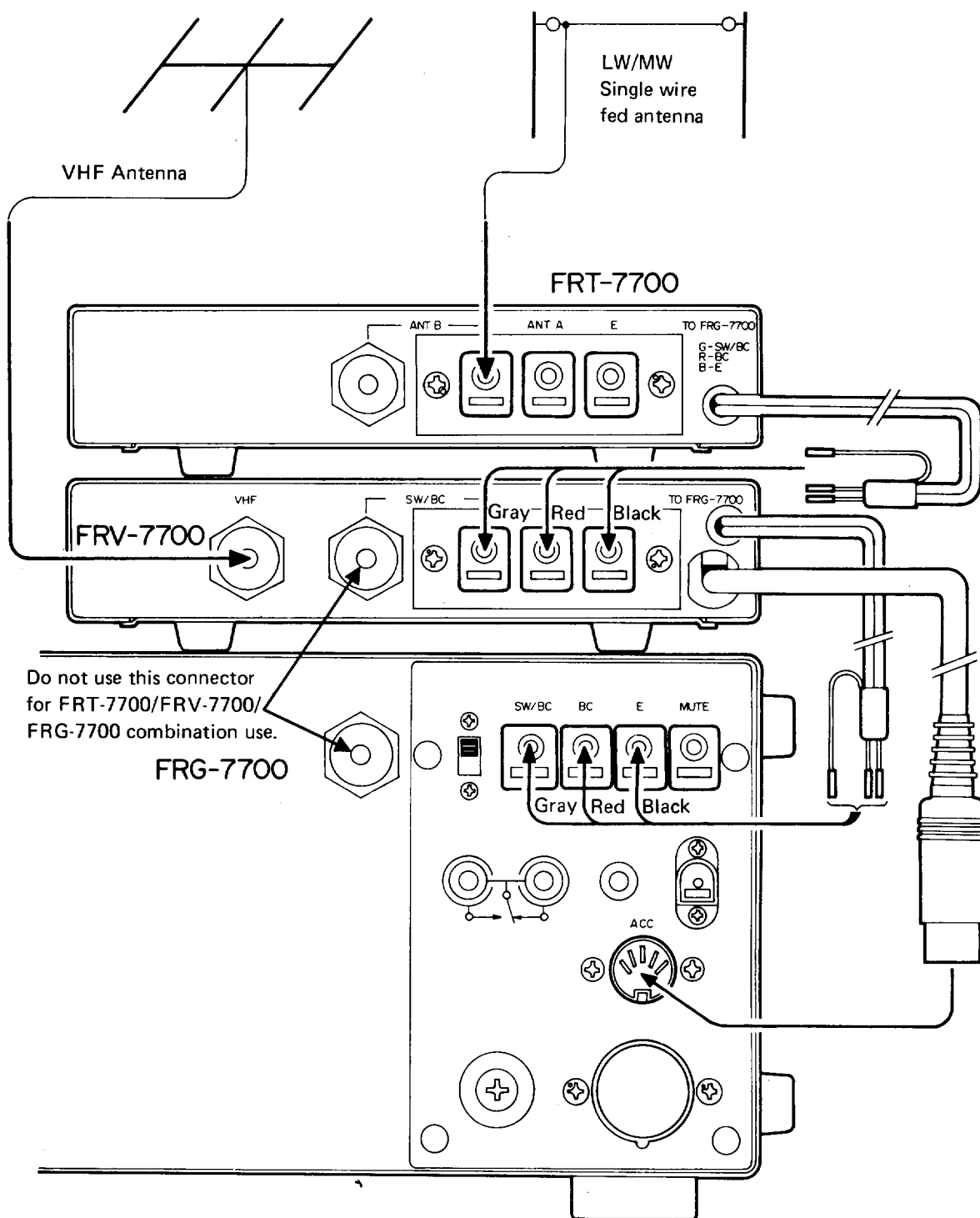


FRV-7700/FRG-7700 INTERCONNECTIONS

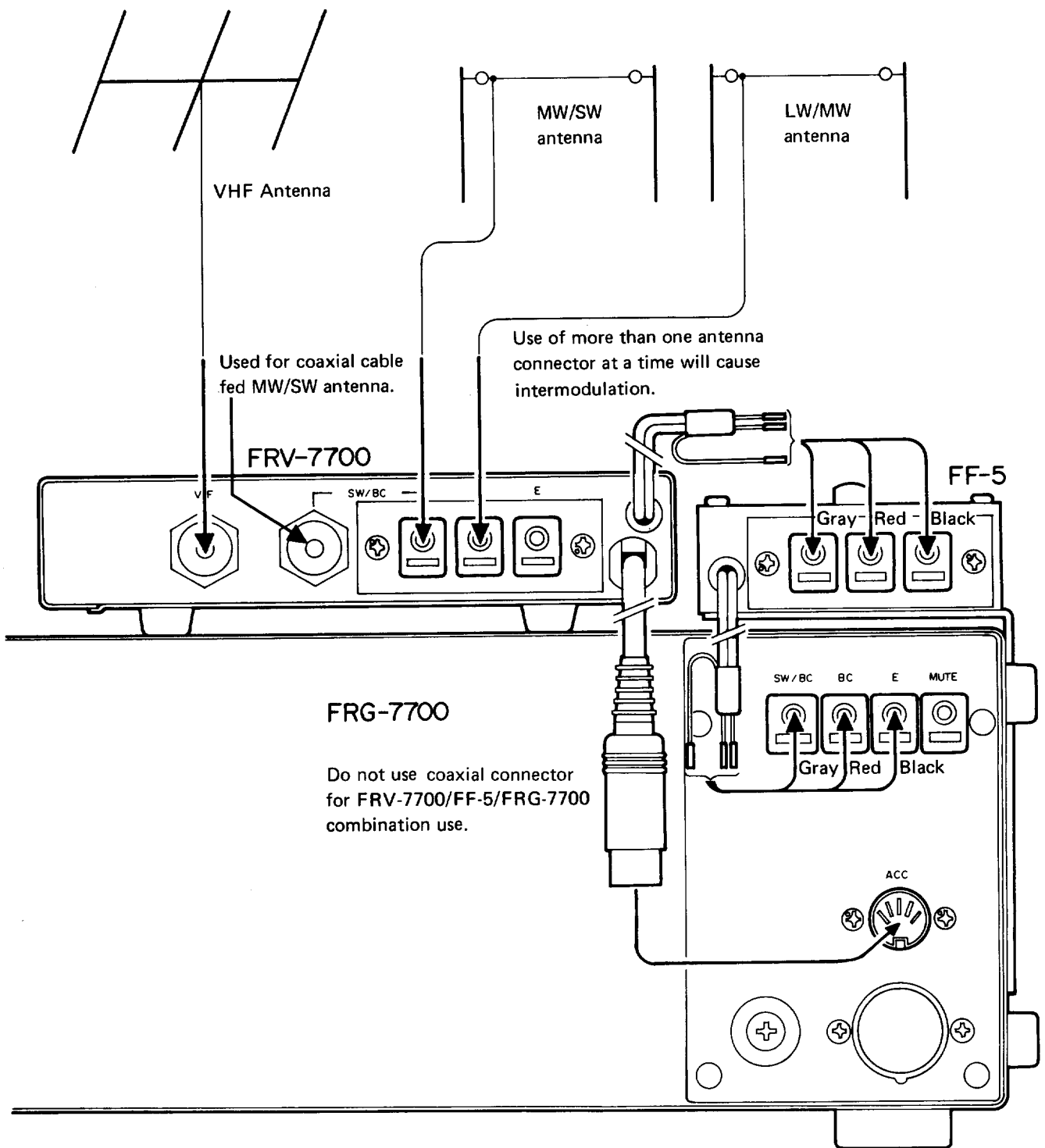
Connect the GRAY wire to the SW/BC terminal on the FRG-7700, the RED wire to the BC terminal and the BLACK wire to the E terminal.

Connect the DIN plug to the ACC jack on the FRG-7700 rear panel, which provides AGC voltage,

the source voltage of the FRV-7700. When the FRV-7700 is used with the FRG-7700, make no antenna connections to this jack, so as to avoid any signal feeding directly from this jack to the receiver.



FRT-7700/FRV-7700/FRG-7700 INTERCONNECTIONS



FRV-7700/FF-5/FRG-7700 INTERCONNECTIONS

OPERATION

The frequency conversion provided by the FRV-7700 is shown on the front panel. The FRV-7700 uses the 18–30 MHz portion of your FRG-7700 as its tuning range, transforming it up to the VHF frequency by shifting it the amount shown in parentheses in the BAND table.

For example, on Model A, Band 2 provides a frequency shift of +110 MHz. Thus, when tuning 20–30 MHz on your FRG-7700, the converted frequency is 130–140 MHz. Likewise, on Model A, Band 3 causes a conversion of +120 MHz, producing a tuning range of 140–150 MHz when you tune 20–30 MHz on your FRG-7700.

Look at the examples below. Push Band 3 to select 140–150 MHz. Now tune the FRG-7700 to 25.000 MHz. The resulting frequency will be 145.000 MHz, in the middle of the 2 Meter Amateur Radio band.

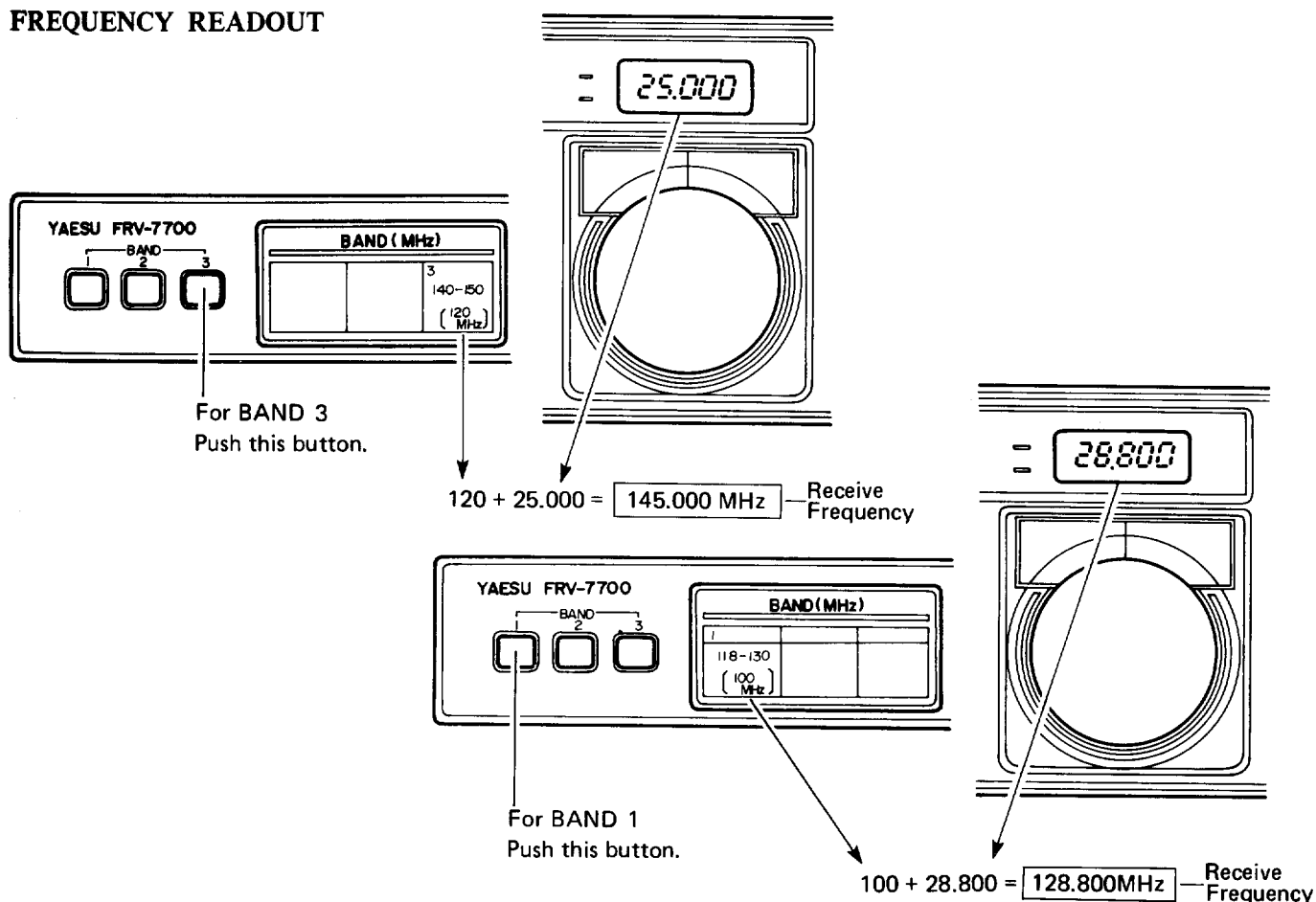
Taking another example, push the BAND 1 switch to engage a +100 MHz conversion. Tune the FRG-7700 to 28.800 MHz, and the resultant frequency received will be 128.800 MHz.

For normal operation, set the FUNCTION switch to VHF, and set the FRG-7700 BAND switch as needed to produce the desired frequency in accordance with the BAND switch engaged on the FRV-7700. Turn the FRG-7700 POWER switch ON.

Adjust the FRV-7700 RF GAIN and IF GAIN controls for maximum deflection on the FRG-7700 S-meter while listening to an incoming signal. This peaking of these controls will ensure maximum sensitivity and rejection of out-of-band signals.

When extremely strong signals are present, you may want to activate the 10 dB or 20 dB attenuator to reduce cross-modulation or intermodulation products which may be hampering reception. These signals are characterized by occasional squealing, unintelligible signal quality. Set the FUNCTION switch to either the 10 dB or 20 dB position, as necessary, to reduce the interference level.

FREQUENCY READOUT



OPERATION

Operation of the FRG-7700 is extremely straightforward. However, the owner should read these pages carefully so as to derive maximum performance from this equipment. Before attempting operation, make certain that all power, antenna, and ground connections have been made correctly.

FREQUENCY SELECTION

The operating frequency is read directly from the digital display. All digits of the operating frequency are displayed, with resolution to 1 kHz. The BAND switch is calibrated in 1 MHz steps, from 0 MHz through 29 MHz, with an additional 10 steps being provided for instant presetting to the bands containing the amateur radio (ham) bands.

To select a frequency, first set the BAND switch to the desired 1 MHz segment, then rotate the main dial to select the last three digits of the frequency. A coarse frequency determination may also be made through the main dial window, which is calibrated every 10 kHz.

AM BROADCAST RECEPTION

- (1) Most commercial broadcast stations in the MF and HF bands use the AM (Amplitude Modulation) mode of operation. To begin, turn the power switch on, and set the mode switch to AM M (AM mode, medium bandwidth).
- (2) Tune in an AM station to the point where the S-meter reading reaches a maximum.
- (3) If there is very heavy interference, you may wish to set the mode switch to the AM N (AM mode, narrow bandwidth) position. This will provide maximum rejection of adjacent-frequency interference, although the narrower bandwidth will cause some loss of fidelity. Conversely, if there is very little interference, you may switch to the AM W (AM mode, wide bandwidth) position. This will provide maximum fidelity.
- (4) The TONE control on the front panel may be used to vary the audio response characteristics

of the receiver. For example, if you are troubled by a high-pitched "heterodyne" signal, rotate the TONE control in a counter-clockwise direction to reduce this interference.

- (5) When extremely strong signals are encountered, the operator may want to reduce the level of these signals. Rotate the ATT (Attenuator) control on the front panel clockwise to reduce the strength of the incoming signals. Should you desire to activate the fixed 20 dB attenuator, set the rear panel ATT switch to LOCAL. For most listening, though, leave this switch set to the DX position.
- (6) For reduction in impulse-type noise (automobile ignition, etc.), push the NB (Noise Blanker) switch. This circuit is highly effective in minimizing this type of interference.
- (7) An Automatic Gain Control (AGC) circuit is included in your FRG-7700. This feature keeps signal strengths adjusted to a constant level under conditions of fading. When rapid fading conditions are encountered, you may want to set the AGC switch to FAST, as the use of the SLOW position might cause a weak signal to be obliterated by an adjacent-frequency station which is much stronger. With some experience, the operator will soon learn the proper settings of the MODE and AGC switches for operation under a variety of conditions.

AMATEUR RADIO (HAM) BAND RECEPTION

Amateur radio operators use a variety of operating modes on the HF bands. However, your FRG-7700 is well equipped to receive the various types of ham signals encountered in day-to-day operation.

SSB Voice Signals

- (1) Amateur radio operators use lower sideband (LSB) on the bands below 10 MHz, and upper sideband (USB) above 10 MHz. Set the mode switch accordingly.

- (2) Turn the power switch on. The meter lamp and digital display will become illuminated.
- (3) Rotate the ATT control fully counterclockwise, and adjust the AF GAIN control for a comfortable listening level.
- (4) Now rotate the main tuning dial until a voice signal is found. Careful adjustment of the main tuning dial will result in excellent clarity on the incoming SSB signal. Under conditions of rapid fading, set the AGC switch to FAST.
- (5) When pulse-type ignition noise is encountered, push the NB switch.
- (6) Adjacent frequency interference may be reduced substantially by counterclockwise rotation of the TONE knob. Also, advancing the ATT knob in a clockwise direction may result in some reduction of interference from a strong adjacent station; such a station may be so strong that the AGC control may cause the receiver to be "pumped," and reduction of the receiver front end gain will reduce this effect.
- (7) Note that the bandswitch contains nine bands which correspond to the amateur radio allocations. This allows simplified band changing when listening to amateurs. The 10, 18, and 24 MHz bands, newly assigned to the amateur service, are not yet approved for amateur operation in most countries, and no amateur operations will be heard until action is taken by the governments involved.

Morse Code (CW) Reception

Morse Code transmissions may be received by placing the mode switch in either the USB or LSB/CW position. The operator may find that adjacent-frequency interference conditions are better in one or the other of the above modes, and that position should be used until conditions change. The main tuning dial should be rotated until a comfortable listening pitch is obtained.

Frequency Modulation (FM) Reception

Frequency modulation operation is becoming more popular on the 29 MHz amateur band. Also, the operator may wish to use the FRG-7700 with a VHF/UHF converter, for listening to FM repeater operation on the VHF and/or UHF bands. Set the mode switch to FM, and rotate the main tuning dial until the best fidelity on the incoming signal is obtained.

For FM operation, the front panel squelch (SQL) control should be advanced to the point where the receiver is just silenced when no signal (only noise) is being received. This will allow silent monitoring during long periods when no stations are active.

MEMORY OPERATION

The memory feature provides a means of storing frequencies you may want to recall at a later time. Up to twelve stations may be stored in memory. Here is the simple procedure for memory storage and recall:

- (1) Set the M FINE control to the 12 o'clock position. Rotate the M CH switch to memory channel 1.
- (2) Tune the receiver to the desired station, being careful to tune for best clarity and fidelity. Press the M (Memory) button. The station is now stored. Continue tuning for additional stations, if desired, and store them in the other memory channels.
- (3) To recall a station previously stored, rotate the M CH switch to the appropriate channel, and press the MR (Memory Recall) button.
- (4) To return control to the main tuning dial, simply push the MR button again. The MR lamp will turn off, and normal tuning will again be possible. The stations stored in memory will not be lost if you release the MR switch; just press it again to return to the memory.

GENERAL

- (5) Note that stations on different bands may be stored in memory. Once stored, they may be recalled without the need to rotate the band switch to the appropriate band. In other words, you may store stations in the 11 MHz, 15 MHz, and 21 MHz bands as you tune them in using the band switch and main tuning dial; once you press the MR button, you only need to rotate the M CH switch to recall these stations, with no change in the position of the bandswitch required.
 - (6) The M FINE control may be used to provide fine tuning of ± 1 kHz from a memorized frequency. This may be necessary should the memorized station begin to drift, or should propagation conditions cause new interference to appear on frequency. Judicious use of the AM N position of the mode switch, along with the M FINE control, will provide solid copy on many stations that might otherwise be obliterated by interference.
- (3) Push the MINUTE button to advance the minute digit to 25. When the MINUTE button is pressed and held, the digits will advance rapidly, in the same manner as the hour digit.
 - (4) The clock should be accurate within 15 seconds per month. When setting the clock, be certain that the appropriate AM/PM digit is illuminated.

TIMER OPERATION

Four timer functions are available. They are:

ON Timer

In this mode, the receiver is turned on at a pre-programmed time.

OFF Timer

In this mode, the receiver is turned off at a pre-programmed time.

ON/OFF Timer

In this mode, both the on and off times are preset for power control of the receiver.

SLEEP Timer

In this mode, you may set a listening time of up to 59 minutes, after which the receiver will turn off.

DIGITAL CLOCK OPERATION

The built-in digital quartz clock is a highly accurate timepiece which adds convenience and flexibility to your FRG-7700 station. The clock will operate so long as the receiver is plugged in, and it will also operate off of the memory backup batteries. When the receiver is initially plugged in, the clock will indicate AM 1:00 and will begin counting. Setting the time is a simple procedure, as shown below.

Example: set the clock to 5:25:00 PM

- (1) Tune in WWV at 5, 10, or 15 MHz (or another international time standard) on the receiver. Place the FUNCTION switch in the CLOCK position, then push and hold the HOUR SET button. The minutes and seconds will reset to zero. When the time standard ticks off the start of a new minute, release the HOUR SET button. This will align the count of the seconds to the international time standard.
 - (2) Push the HOUR button to advance the hour digit to 5:00. If the HOUR button is held for more than two seconds, the hour digits will advance rapidly until the HOUR button is released.
- (1) Set the POWER switch to OFF, and set the function switch to the ON position.
 - (2) Set the display to 10:30 AM by pushing the HOUR and MINUTE buttons, in the same way as you did when you preset the clock earlier.
 - (3) Set the function switch to OFF. Set the display to 11:30 AM by pushing the HOUR and MINUTE buttons.
 - (4) Push the TIMER switch to activate the timer. The FRG-7700 will turn on at 10:30 AM, and turn off at 11:30 AM. Be certain to observe the AM or PM lamps when programming the on and off times.

- (5) If you want to turn the receiver off before the programmed off time, push the **TIMER CLEAR** button.

To set the sleep timer, proceed as follows:

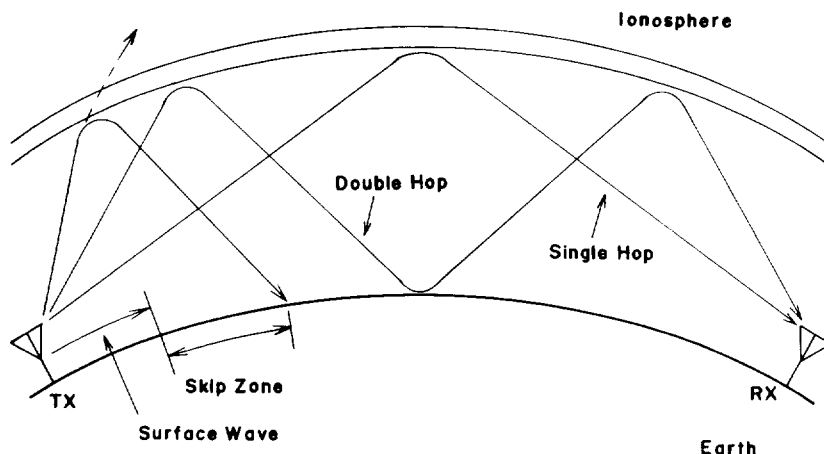
- (1) Turn the **POWER** switch **OFF**, and set the function switch to the **SLEEP** position.
- (2) Push the **MINUTE** switch once. This will cause the sleep time to count back from the 59 minute mark by one minute. Holding the **MINUTE** button down will cause the time to change rapidly, in the same manner as described earlier. If you set the display to 40, the receiver will stay on for 40 minutes, then shut off.
- (3) If you want to turn the receiver off before the programmed off time, push the **TIMER CLEAR** button.

NOTES REGARDING PROPAGATION OF SHORTWAVE SIGNALS

While a complete discussion of the physics of shortwave radio signal propagation is well beyond the scope of this manual, some guidelines are presented below to help you to choose the optimum listening frequency for the time of day and the time of year in which you are operating. This discussion will also help you when you are reading the schedules of overseas broadcast stations; you will soon be able to know instantly why you cannot expect to hear Tokyo on 3.9 MHz at 1:00 in the afternoon.

Shortwave signals are transmitted by huge stations running many thousands of watts of power. Their antenna systems are elaborate and expensive. But all of this equipment would be useless were it not for a property of the ionosphere (a layer of the atmosphere high above the earth) which causes signals to be reflected back to earth when they strike the ionosphere.

Depending on several factors, including the time of day, the time of year, and the current state of solar activity (determined primarily by "sunspots"), the optimum frequency for reflection over a particular distance will change. Another aspect that can be noted is that, for a particular frequency on which you are operating, the distance over which signals will be propagated will change. Thus, in order to hear stations 12,000 km away over a long period of time on a particular day, you will likely have to change your operating frequency (consistent with the broadcast station schedules!) in order to take advantage of changing propagation conditions.



GENERAL

As a general rule, daytime propagation conditions will be best on frequencies from about 12-14 MHz and higher. Propagation at night will generally be best on the 2-15 MHz bands. These general rules often have exceptions, of course; during periods of high solar activity, the 21 MHz band may, for example, be excellent for long-distance propagation well into the night. However, it would be highly unusual for the bands below about 8 MHz to support transoceanic propagation throughout the daytime period.

When reading broadcast station schedules, one must consider not only the time of day at one's own location, but also the time of day at the transmitter location. Let us examine the example of two broadcast stations, one in Tokyo and one in Moscow, both operating on 6 MHz at 6:00 PM local time (for our example, let us say that you live in New York City, USA). Because there are night-time conditions across most, if not all, of the North Atlantic path that a signal would follow on its way from Moscow to New York, one would normally have a good chance of receiving the broadcast from Moscow. However, the path from Tokyo to New York is largely a daylight path, and our rule of thumb discussed earlier would tell us that it would be difficult, if not impossible, to hear Tokyo at that time on that frequency.

However, if one reads further down the schedule for Tokyo, a broadcast on 15 MHz at the same time may be found. The 15 MHz region (± 5 MHz) is a middle ground which often supports round-the-clock propagation. You would have a much better chance of hearing Tokyo on 15 MHz, because the path is largely over daylight.

Broadcast station managers are well aware of this phenomenon, and this is the reason why their schedules indicate "North American Service" or "Programming Beamed at Southeast Asia." They take propagation conditions into consideration, and aim their antennas carefully, so as to have the best chance of reaching their target area at a time when people will be at home to listen.

The time of year is important for several reasons. For example, at 4:00 PM in New York in June, the sun is still high in the sky. But at 4:00 PM in December, twilight is fast approaching, and night-time conditions are taking over on the North Atlantic path. Broadcast station managers adjust their schedules so as to use the lower frequencies (below 10 MHz) more heavily in the winter months, because of the increased distance covered by darkness during the winter.

Signals do not always follow the shortest distance from point A to point B (called the "Great Circle" path). They sometimes follow a bent path, or one exactly the opposite of the great circle. This is why it is sometimes possible to hear Tokyo from New York on 7 MHz late in the afternoon in the winter, even though the Great Circle path is in daylight; the signals are traveling along a darkness path around the world. The fact that many stations are louder, and that the transmitting antenna may not be beamed on the optimum path at that time, makes reception extremely difficult. But this is the excitement of shortwave listening—hearing the unexpected. Under tough conditions such as this, the AM-N (narrow bandwidth) position of the mode switch will prove itself to be a highly useful feature.

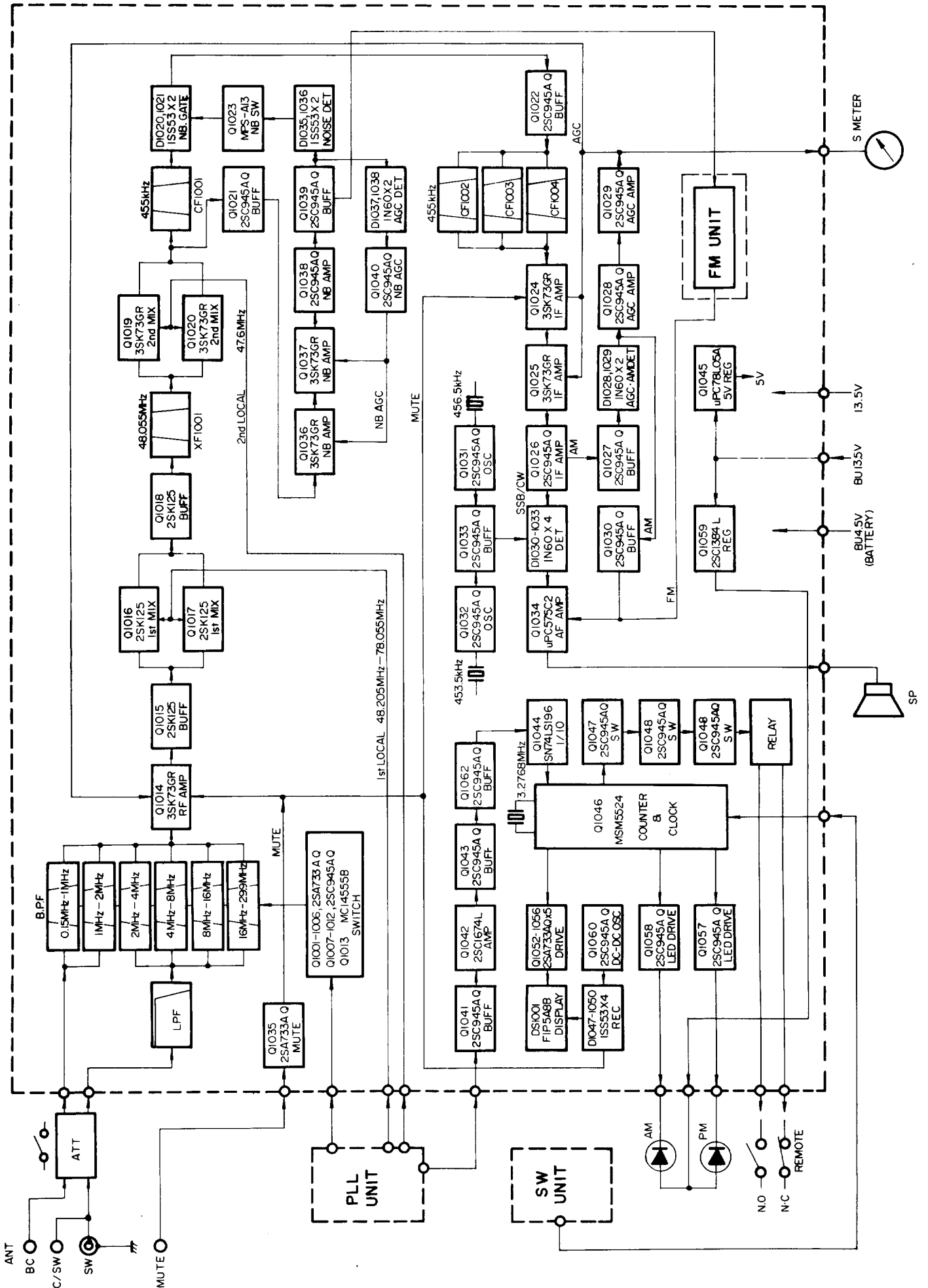
To conclude our discussion on propagation conditions, we would stress the following general rules. First, use the higher frequencies (15 MHz and up) as your main daylight bands. Secondly, use the low frequencies (below 15 MHz) as your prime night-time bands. Thirdly, look for peaks in propagation when there is sunrise or sunset at one end or another of a propagation path. For example, look for a peak in 26 MHz propagation towards the East for the hour or so after your sunrise, and toward the West around your sunset.

Careful planning of your operating times, proper choice of listening frequencies, and diligent study of schedules from overseas broadcast stations will pay rich dividends in entries in your log book. We hope that this section will have helped you understand the fascinating world of shortwave radio propagation better.

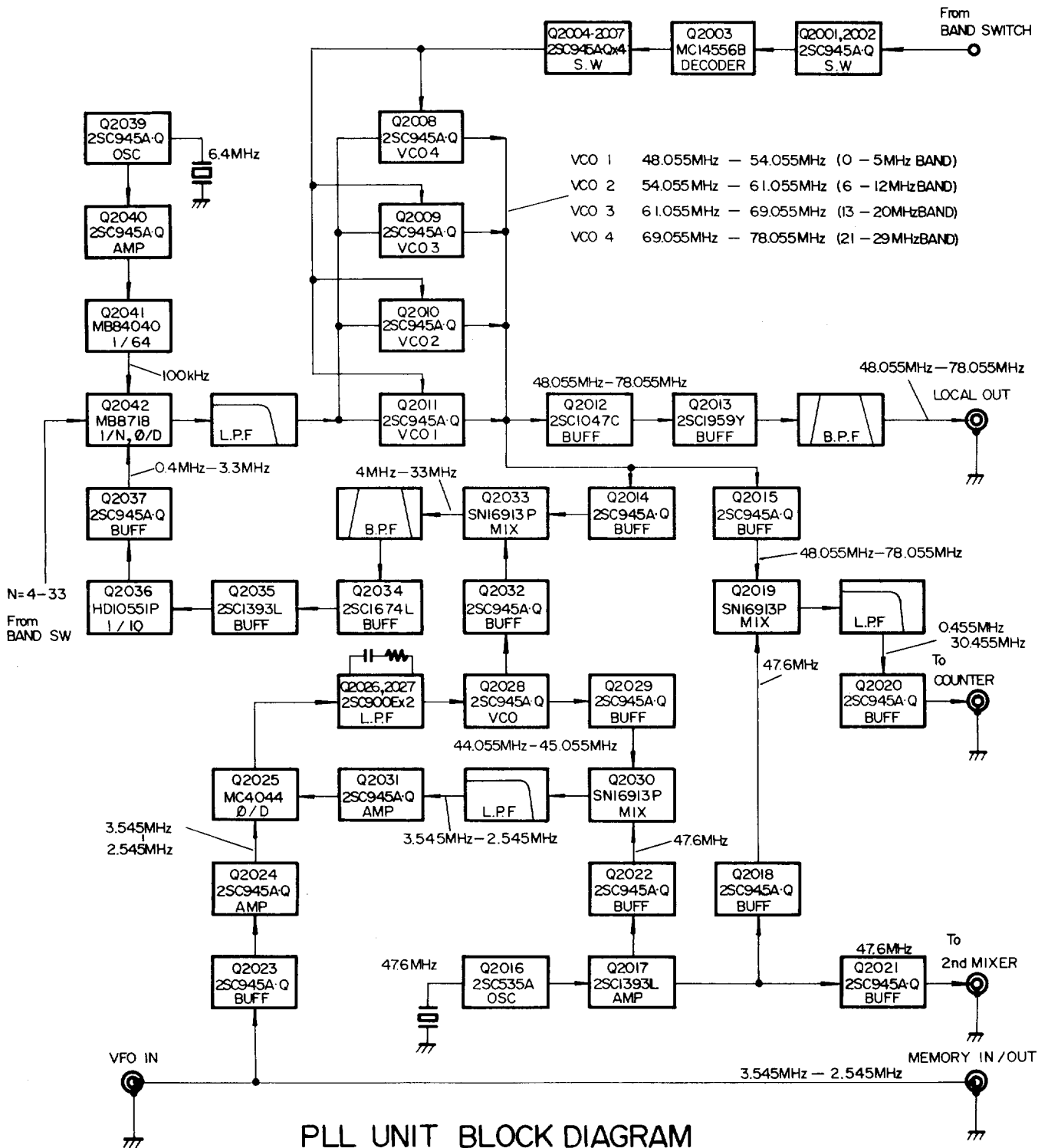
SECTION 2—TECHNICAL NOTES

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BLOCK DIAGRAM



TECHNICAL NOTES



CIRCUIT DESCRIPTION

Reference to the block diagram and the following circuit description will provide you with a better understanding of the design of this receiver. The FRG-7700 is a superheterodyne receiver using up-conversion to a first IF (Intermediate Frequency) of 48 MHz. Synthesized local oscillators are used for both the first and second mixers, providing a high degree of frequency stability.

RECEIVER SIGNAL FLOW

The RF (Radio Frequency) signal from the antenna is fed through the defeatable RF attenuator to the MAIN Unit. The signal is passed through a low-pass filter ($f_c = 30$ MHz), consisting of L_{1001} , C_{1001} , C_{1002} , and then through bandpass filters for the following ranges: 150 kHz – 1 MHz, 1 – 2 MHz, 2 – 4 MHz, 4 – 8 MHz, 8 – 16 MHz, and 16 – 30 MHz. Selection of the filter to be used is provided by diode switches $D_{1001} - D_{1012}$ (1SS53), which are driven by Q_{1013} (MC14555), $Q_{1001} - Q_{1006}$ (2SA733), and $Q_{1007} - Q_{1012}$ (2SA945A-Q), according to the setting of the band switch.

The signal is then amplified by RF amplifier Q_{1014} (3SK73GR), a dual-gate MOS FET with superior linearity and low noise figure. The amplified signal is then fed through buffer Q_{1015} (2SK125) to the first mixer, where the RF signal is mixed with the first local oscillator signal (48.055 – 78.055 MHz) delivered from the PLL Unit, resulting in a 48.055 MHz first IF. This up-conversion technique provides superior image rejection characteristics when compared with conventional designs.

The first IF signal is amplified by Q_{1018} (2SK125) and fed through crystal filter XF_{1001} , which has a 20 kHz bandwidth at –6 dB, providing protection from in-band intermodulation distortion while allowing sufficient bandwidth for effective noise blanking. The signal is then delivered to the second mixer, where the 48.055 MHz first IF signal is mixed with a 47.6 MHz local oscillator signal from the PLL Unit, producing a 455 kHz second IF signal.

The 455 kHz signal is passed through a ceramic filter, CF_{1001} (20 kHz/–6 dB) and noise blanker gate diodes D_{1020}/D_{1021} (1SS53) to the main IF filters: CF_{1002} (SSB/AM-N), CF_{1003} (AM-M), and CF_{1004} (AM-W), with filter selection made via the

mode switch. The filtered IF signal is then delivered to the main IF amplifier chain, consisting of Q_{1024} , Q_{1025} (3SK73GR), and Q_{1026} (2SC945A-Q).

In the SSB and CW modes, the IF signal is coupled to the product detector, a diode ring demodulator consisting of $D_{1030} - D_{1033}$ (1N60), which converts the IF signal into audio using the carrier signal delivered from Q_{1033} (2SC945A-Q). The audio signal is fed to the audio amplifier, Q_{1034} (μ PC575C2), which delivers 1.5 watts of audio power to the speaker.

In the AM mode, the IF signal is coupled from Q_{1026} via C_{125} to buffer amplifier Q_{1027} (2SC945A-Q). The signal is then detected at D_{1028}/D_{1029} (1N60), and the resulting audio signal is fed to the audio amplifier via buffer amplifier Q_{1030} (2SC945A-Q).

NOISE BLANKER CIRCUIT

A portion of the output from the second mixer is fed through buffer Q_{1021} (2SC945A-Q) to amplifiers Q_{1036} , Q_{1037} (3SK73GR) and Q_{1038} , Q_{1039} (2SC945A-Q). When a carrier or noise-free modulated signal is received, the IF signal is rectified by D_{1037} and D_{1038} (1N60), producing a DC voltage. The DC voltage is amplified by Q_{1040} (2SC945A-Q) and fed to gate 2 of Q_{1036} and Q_{1037} , controlling the gain of those stages.

When pulse noise is received, D_{1035} and D_{1036} (1SS53) rectify the IF signal, producing a DC voltage which controls the noise blanker switching diodes (D_{1020}/D_{1021}). Noise pulses have a very short duration, but extremely high amplitude. Because of the very slow time constant of the AGC circuit feeding back to Q_{1036} and Q_{1037} , these short duration pulses will not induce AGC action, and those stages will operate at full gain. When a pulse is received, however, Q_{1023} biases D_{1020} and D_{1021} to block the signal path momentarily.

When a noise pulse and a desired signal are received simultaneously, the blanking action is not impaired, because the relative amplitude difference between the desired signal and the noise pulse is high.

AGC CIRCUIT

A portion of the output from the AM detector is fed to DC amplifiers Q_{1028} and Q_{1029} (2SC945A-Q). This amplified DC voltage is applied to gate 2 of the RF and IF amplifiers, controlling the gain of those stages.

MUTE CIRCUIT

Q_{1035} is normally in the "ON" state, providing normal bias voltage to gate 1 of Q_{1014} and Q_{1024} . When the MUTE terminal is shorted to ground, Q_{1035} turns off, removing the bias voltage from the above transistors, thus silencing the receiver.

CLOCK AND DIGITAL DISPLAY CIRCUIT

A Large Scale Integration (LSI) chip, Q_{1046} (MSM5524), controls both the display of the operating frequency and the time. An 0.455 – 30.455 MHz signal from the PLL Unit is amplified by Q_{1041} , Q_{1042} , and Q_{1043} (2SC1674L), then fed through divider (1/10) Q_{1044} (SN74LS196) to the LSI chip. The output from Q_{1046} is fed to the fluorescent display tube, (DS1001), through segment drivers Q_{1052} – Q_{1058} (2SA733A-Q). Q_{1060} and Q_{1061} act as a DC-DC converter, providing –25 volts DC for the display tube.

The timer control output from the LSI activates relay RL_{1001} , which controls the receiver main power supply ON/OFF function. RL_{1001} also is connected to the REMOTE terminals on the rear panel of the receiver, for control of peripheral station equipment.

PLL CIRCUIT

The first and second local signals (48.055 – 78.055 MHz and 47.6 MHz, respectively) are generated by the dual-loop PLL (Phase Locked Loop) circuit.

A 44.055 – 45.055 MHz signal is generated by VCO (Voltage Controlled Oscillator) Q_{2028} (2SC945A-Q) in PLL Loop 1. This signal feeds mixer Q_{2030} (SN16913P), where the VCO signal is mixed with a 47.6 MHz signal generated by crystal oscillator Q_{2016} (2SC535A), producing a 3.545 –

2.545 MHz signal which is fed to phase detector Q_{2025} (MC4044P). The phase detector compares the phase of the input signal with that of the VFO signal delivered via Q_{2024} (2SC945A-Q); any phase difference is converted to a DC control voltage, which is fed to varactor diodes in the VCO circuit, in order to correct the phase difference and lock the input signal with the VFO signal.

In PLL Loop 2, there are four VCO circuits which are selected by the bandswitch, with the net result being an output signal of 48.055 – 78.055 MHz. This signal is fed to mixer Q_{2033} (SN16913P), where the input signal is mixed with the 44.055 – 45.055 MHz signal delivered from PLL Loop 1, producing a 4 – 33 MHz signal. This signal is fed through divider (1/10) Q_{2036} (HD10551P) to phase detector Q_{2042} (MB8718), which also contains programmable divider.

Phase detector Q_{2042} compares the phase of the signal from the onboard programmable divider and that of the 100 kHz reference signal generated by Q_{2039} , Q_{2040} (2SC945A-Q), and Q_{2041} (MB84040), producing an error-correcting DC voltage. The dividing ratio of the programmable divider is selected by the bandswitch. The error-correction voltage is fed to varactor diodes in VCO/1 – VCO/4, thus locking a highly stable 48.055 – 78.055 MHz signal, which will be used as the first local signal. The VCO output is fed through buffers Q_{2012} (2SC1047C) and Q_{2013} (2SC1959Y) prior to delivery to the first mixer.

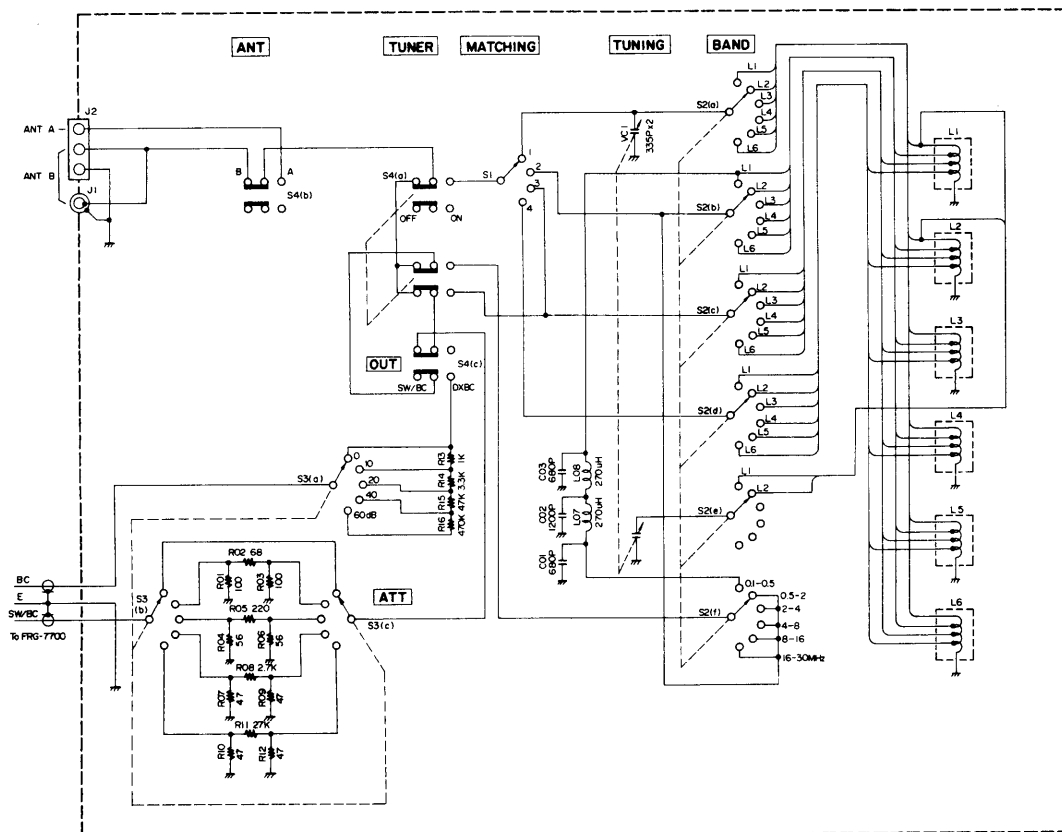
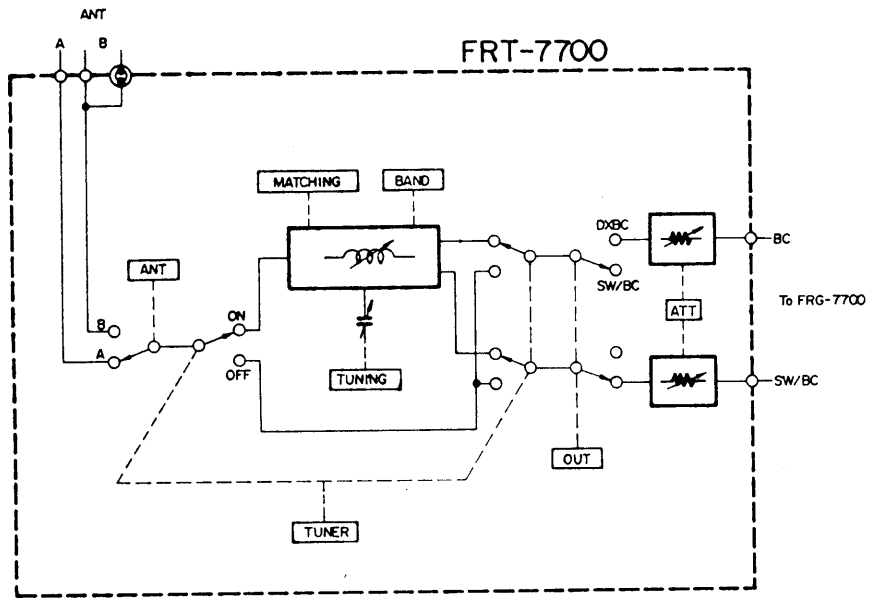
The second local signal (47.6 MHz) is generated by Q_{2016} , then amplified by Q_{2017} (2SC1393L) and fed through buffer Q_{2021} (2SC945A-Q) prior to delivery to the second mixer.

A portion of the first local signal is fed to mixer Q_{2019} (SN16913P), where the signal is mixed with the 47.6 MHz second local signal, producing a signal at 0.455 – 30.455 MHz which is fed to the LSI chip in the counter for display of the operating frequency.

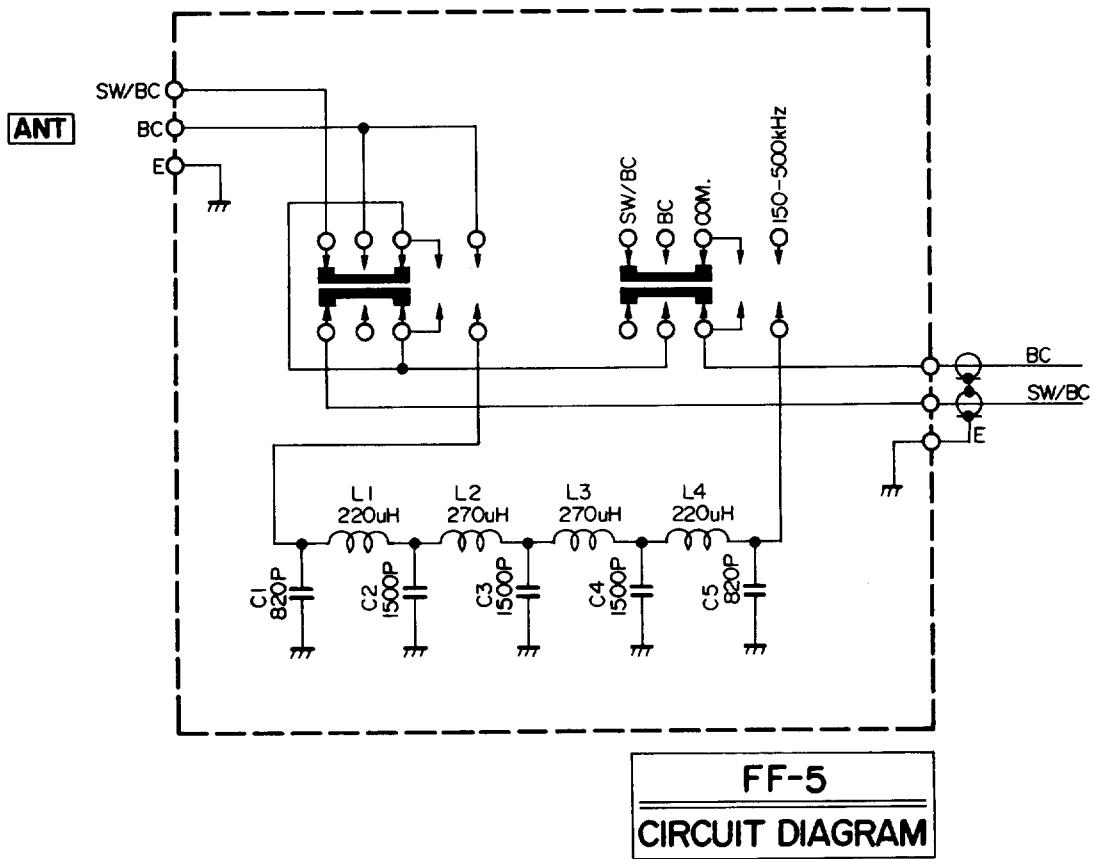
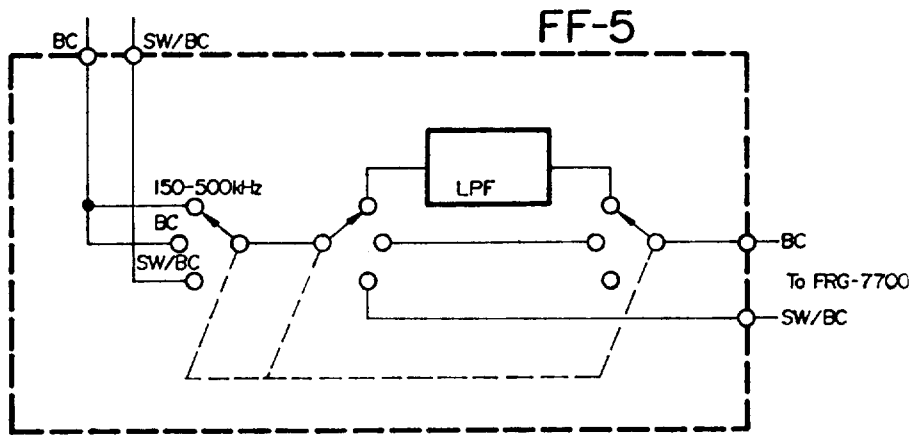
CRYSTAL DATA

FUNCTION		HOLDER	RANGE (MHz)	MODE	LOAD C	EFFECTIVE RESISTANCE	DRIVE LEVEL
MAIN UNIT	X1001	HC-18/U	3.2768	Fundamental	30pF	150 Ω	3mW
PLL UNIT	X2001	HC-18/U	47.6	3rd Overtone	20pF	25 Ω	2mW
PLL UNIT	X2002	HC-18/U	6.4	Fundamental	30pF	30 Ω	3mW
MEMORY UNIT	X6001	HC-18/U3P	16.434	Fundamental	30pF	15 Ω	3mW

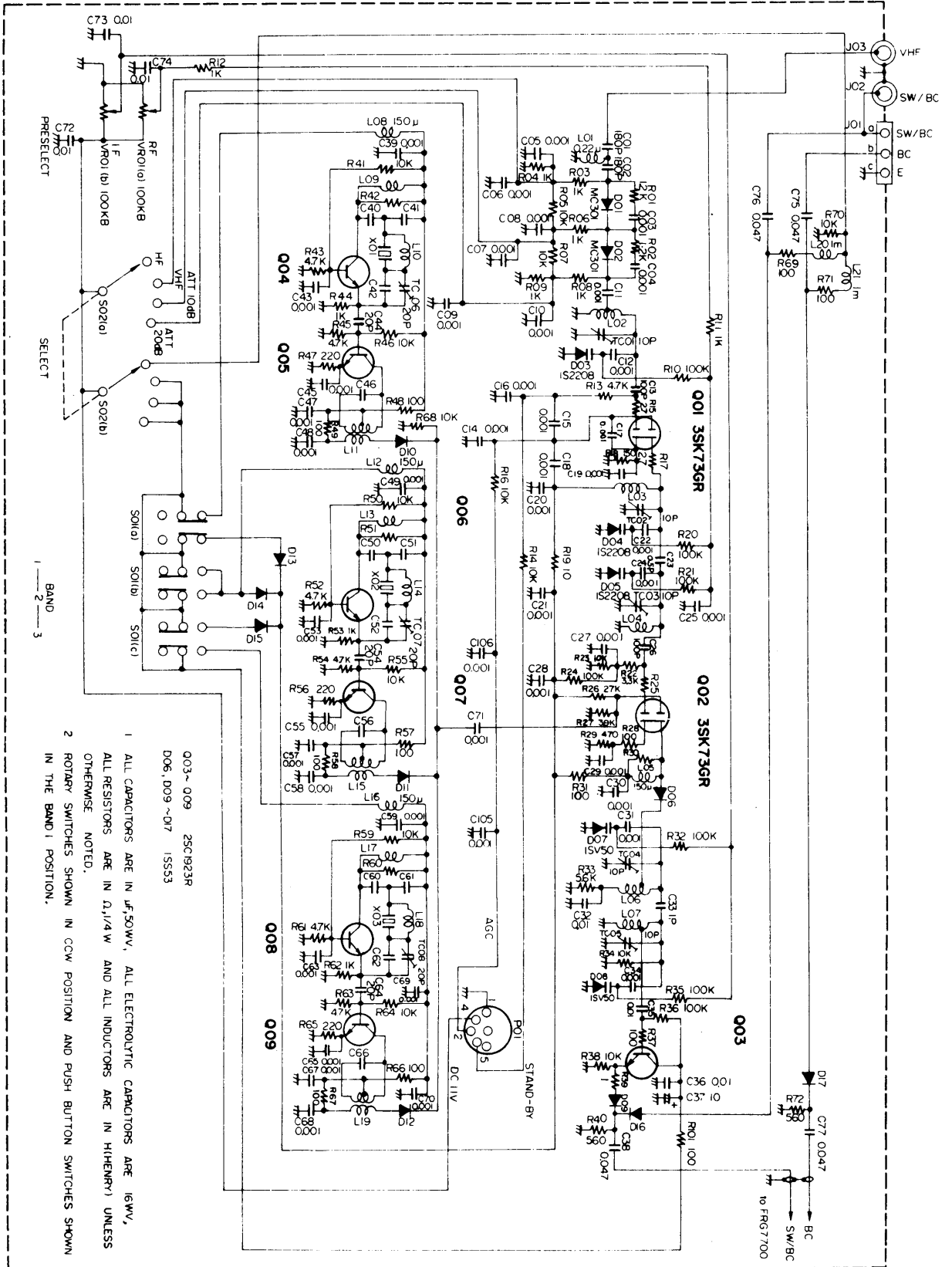
FRT-7700



FRT-7700
CIRCUIT DIAGRAM



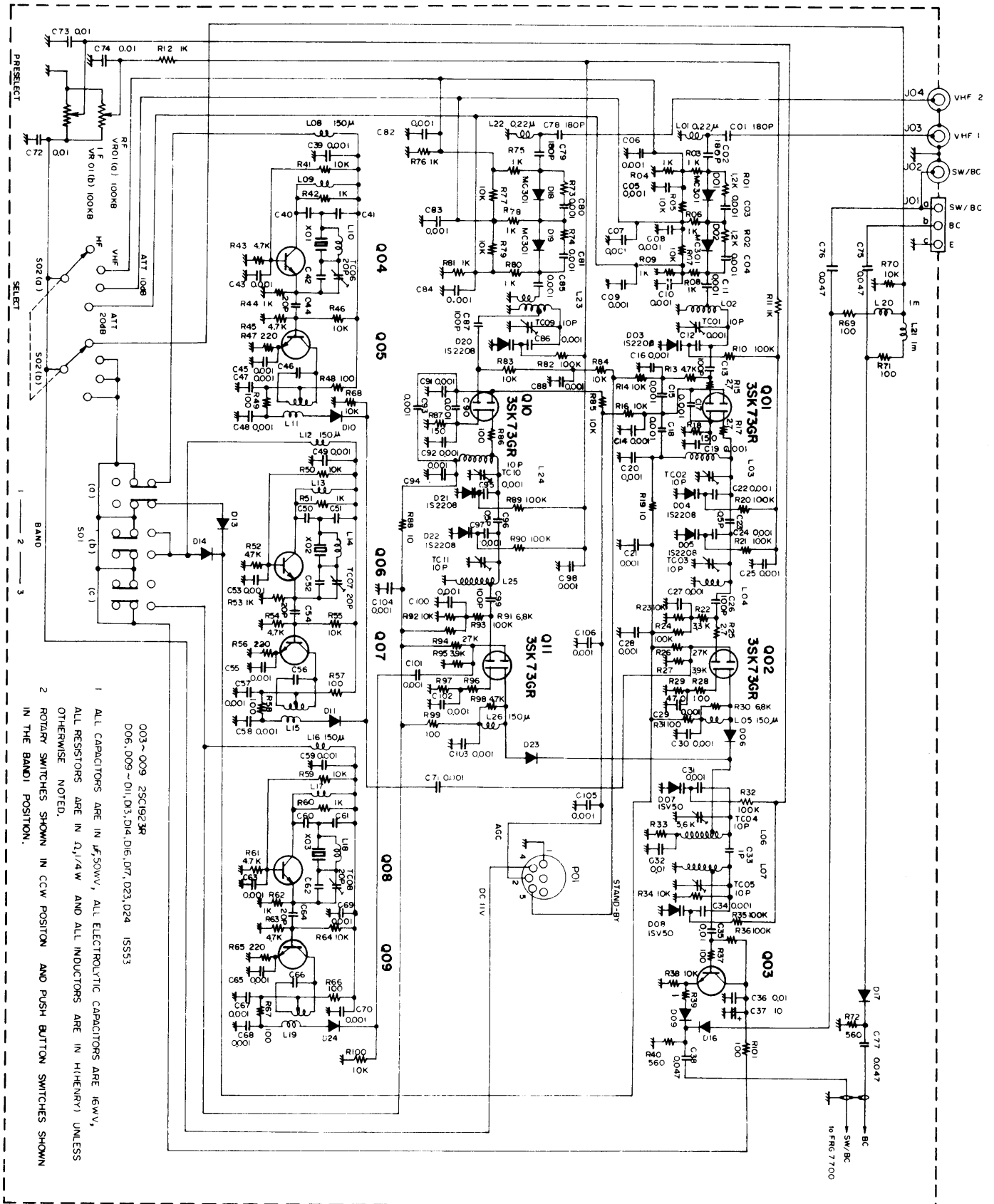
FRV-7700(A.C)



TYPE	VALUE	UNIT
X 01	100MHZ	XTAL
X 02	110MHZ	130MHZ
X 03	120MHZ	140MHZ
R 25	27	10
R 30	68K	4.7K
R 31	1K	2.2K
R 32	1K	2.2K
R 33	1K	2.2K
R 34	1K	2.2K
R 35	1K	2.2K
R 36	1K	2.2K
R 37	1K	2.2K
R 38	1K	2.2K
R 39	1K	2.2K
R 40	1K	2.2K
R 41	1K	2.2K
R 42	1K	2.2K
R 43	1K	2.2K
R 44	1K	2.2K
R 45	1K	2.2K
R 46	1K	2.2K
R 47	1K	2.2K
R 48	1K	2.2K
R 49	1K	2.2K
R 50	1K	2.2K
R 51	1K	2.2K
R 52	1K	2.2K
R 53	1K	2.2K
R 54	1K	2.2K
R 55	1K	2.2K
R 56	1K	2.2K
R 57	1K	2.2K
R 58	1K	2.2K
R 59	1K	2.2K
C 40	36P	24P
C 41	36P	24P
C 42	20P	20P
C 43	20P	20P
C 44	20P	20P
C 45	24P	16P
C 46	24P	16P
C 47	24P	16P
C 48	24P	16P
C 49	24P	16P
C 50	27P	16P
C 51	27P	16P
C 52	20P	20P
C 53	20P	20P
C 54	20P	20P
C 55	20P	20P
C 56	20P	20P
C 57	20P	20P
C 58	20P	20P
C 59	20P	20P
C 60	24P	15P
C 61	24P	15P
C 62	20P	20P
C 63	20P	20P
C 64	20P	20P
C 65	16P	10P
C 66	16P	10P
L 10	0.33 μ	0.33 μ
L 11	0.33 μ	0.22 μ
L 12	0.33 μ	0.22 μ
L 13	0.33 μ	0.22 μ
L 14	0.33 μ	0.22 μ
L 15	0.33 μ	0.22 μ
L 16	0.33 μ	0.22 μ
L 17	0.33 μ	0.22 μ
L 18	0.33 μ	0.22 μ

FRV-7700
CIRCUIT DIAGRAM

FRV-7700(B.D)



003~009 250C1923R
 006,009 ~D11,D13,D14,D16,D17,D23,D24 1S553

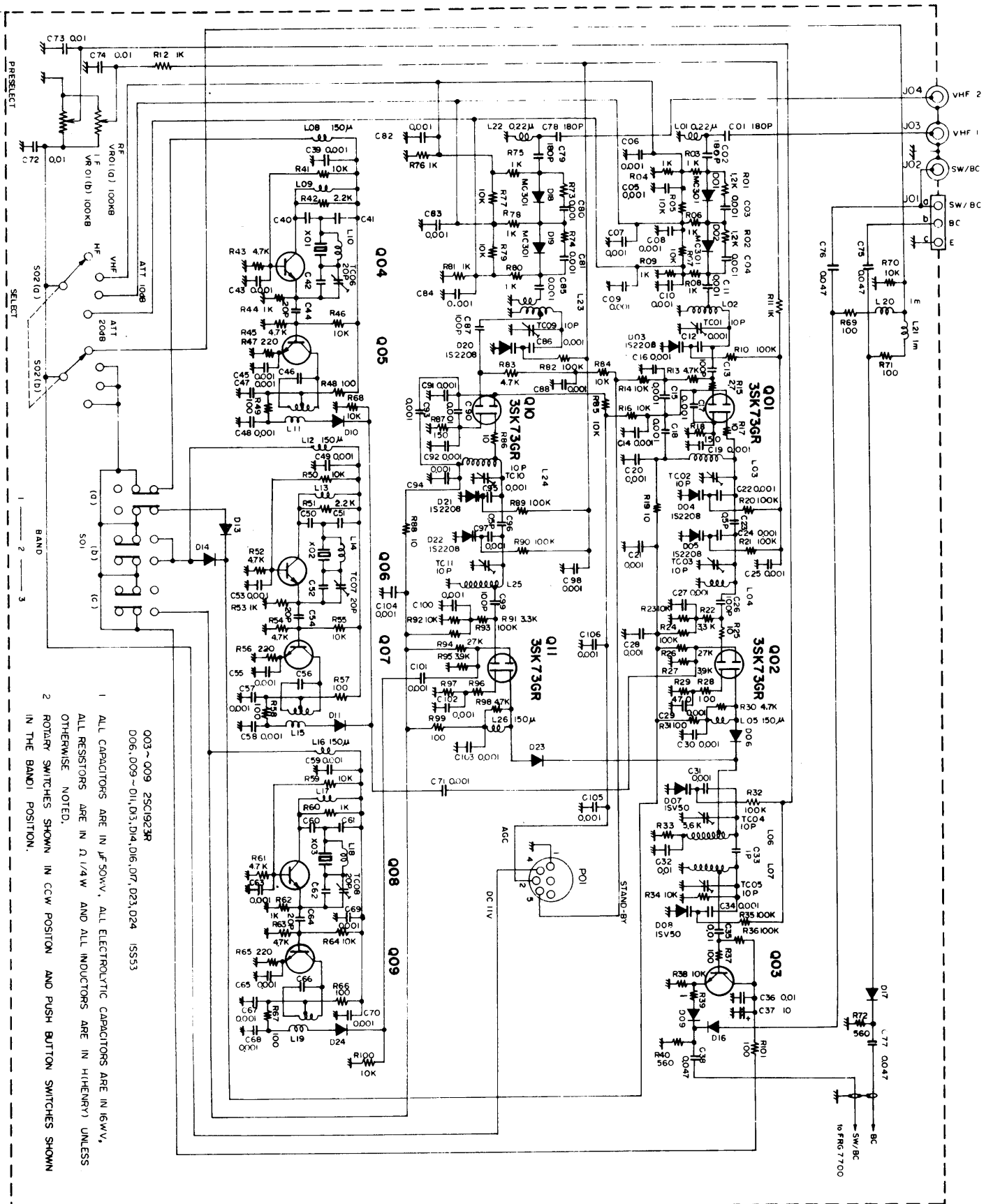
1 ALL CAPACITORS ARE IN μ F,50WV, ALL ELECTROLYTIC CAPACITORS ARE 16WV, ALL RESISTORS ARE IN Ω ,1/4W, AND ALL INDUCTORS ARE IN HI-ENERGY UNLESS OTHERWISE NOTED.

2 ROTARY SWITCHES SHOWN IN CCW POSITION AND PUSH BUTTON SWITCHES SHOWN IN THE BAND1 POSITION.

TYPE	B	D
X-TAL		
X01	100MHZ	100MHZ
X02	120 MHZ	120MHZ
X03	30MHZ	50MHZ
RESISTOR		
R73	220	330
R74	2.20	1K
R96	3.90	220
R97	180	330
CAPACITOR		
C40	3.6P	3.6P
C41	3.6P	3.6P
C42	20P	20P
C46	24P	24P
C50	24P	24P
C51	24P	24P
C52	20P	20P
C56	16P	16P
C60	75P	15P
C61	75P	15P
C62	20P	20P
C66	3.6P	12P
INDUCTOR		
L10	0.3 μ	0.3 μ
L14	0.3 μ	0.3 μ
L18	4.7 μ	1.8 μ

FRV-7700
 CIRCUIT DIAGRAM

FRV-7700(E.F)



003 ~ 009 25C1923R
 006, 009 - 011, D13, D14, D16, D17, D23, D24 1S553

1 ALL CAPACITORS ARE IN μ F 50WV, ALL ELECTROLYTIC CAPACITORS ARE IN 16WV, ALL RESISTORS ARE IN Ω , 1/4W AND ALL INDUCTORS ARE IN HI(HENRY) UNLESS OTHERWISE NOTED.

2 ROTARY SWITCHES SHOWN IN CCW POSITION AND PUSH BUTTON SWITCHES SHOWN IN THE BAND1 POSITION.

TYPE	E	F
X-TAL		
X01	120MHZ	150MHZ
X02	130MHZ	140MHZ
X03	100MHZ	100MHZ
RESISTOR		
R73	1.2K	1.2K
R74	1.2K	1.2K
R96	100	100
R97	470	470
CAPACITOR		
C40	24 P	16 P
C41	24 P	16 P
C42	20 P	20 P
C46	16 P	13 P
C50	16 P	15 P
C51	16 P	15 P
C52	20 P	20 P
C56	13 P	10 P
C60	36 P	36 P
C61	36 P	36 P
C62	20 P	20 P
C66	24 P	24 P
INDUCTOR		
L10	0.22 μ	0.22 μ
L14	0.22 μ	0.22 μ
L18	0.33 μ	0.33 μ

FRV-7700
 CIRCUIT DIAGRAM

MODIFICATIONS

DC POWER SUPPLY OPERATION (DC KIT INSTALLATION)

A. Required Parts (included w/kit)

1 pc.	C5300842	DC Jack Assembly
1 pc.	P1090139	DC Plug
2 pcs.	U00107007	Screws
2 pcs.	U60001001	Nut
2 pcs.	U71050001	Spring Washer

B. Modification Procedure

1. Remove the handle mounted on the right side of the cabinet.
2. Remove the six screws retaining the bottom cover and carefully set the panel to one side.
3. Disconnect the battery clip connected to the backup battery case.
4. Remove the four plastic pins that are fastened to the rear panel terminal board, as shown in Figure 2-1.
5. Grasp the terminal board and remove the small plastic cover to expose the DC Jack cutout, as shown in Figure 2-2.
6. Install the DC Jack assembly as shown in Figure 2-3.
7. Re-install the terminal board with the four plastic pins.
8. Insert plug P₄₀ into Jack J₂ as shown in Figure 2-4.
9. Reconnect the battery clip to the backup battery case, and replace the bottom cover, re-installing the six screws removed in Step 2.
10. The DC power cord may now be wired as shown in Figure 2-5. A supply capable of providing 13.5 volts DC at 1.2 amp (min.) is required.

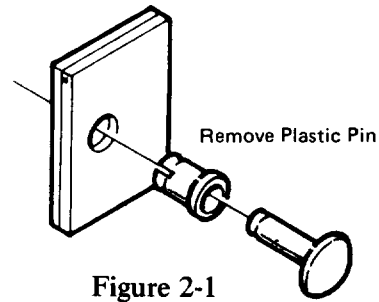


Figure 2-1

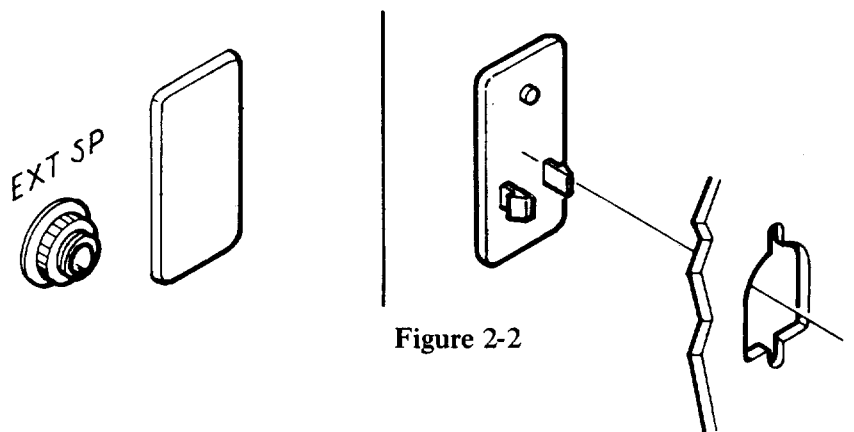


Figure 2-2

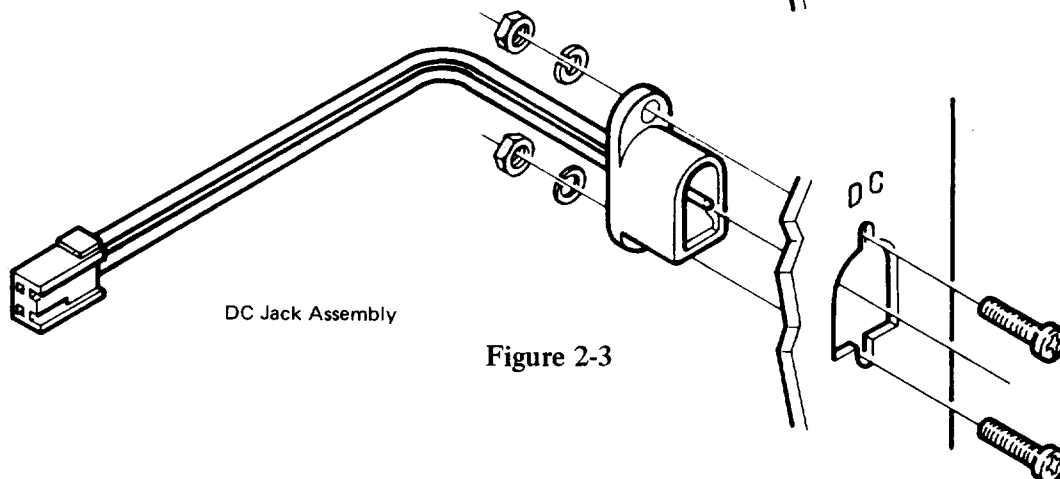


Figure 2-3

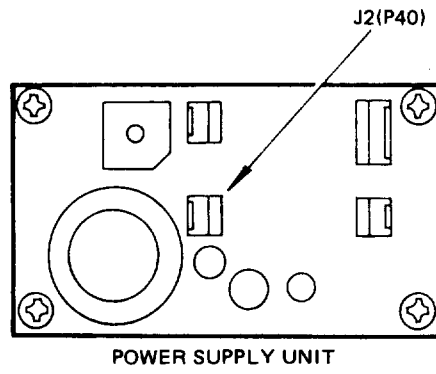


Figure 2-4

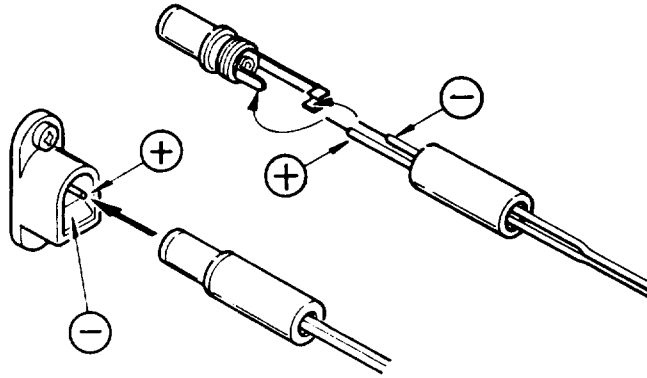


Figure 2-5

PERFORMANCE IMPROVEMENT FOR EARLY MODEL

This modification will provide additional power switch protection against rush current that occurs when the power switch is turned on. Please be advised that the IC MC 14504 (lot number "7944", Fig. 2-6) has been reported by the supplier as defective, and must be replaced.

MODIFICATION PROCEDURE

- 1) Remove the carrying handle on the left side of the receiver, then the top cover, and finally the bottom cover.
- 2) Remove all connectors on the PLL unit.
- 3) Remove the band switch knob and unscrew the nut securing the band switch, from the outside of the receiver.
- 4) Remove the eight screws on the PLL unit, and take the PLL unit out of its chassis.
- 5) Cut all the pins of Q₂₀₃₈ from the component side, and unsolder the pins, as shown in Fig. 2-7.
- 6) Install the new MC 14504 in the correct position, and solder its pins.
- 7) Replace the PLL unit in its chassis with the eight screws previously removed. Secure the band switch and the band switch knob into place.
- 8) Reconnect all connectors removed from the PLL unit in step 2.



Figure 2-6

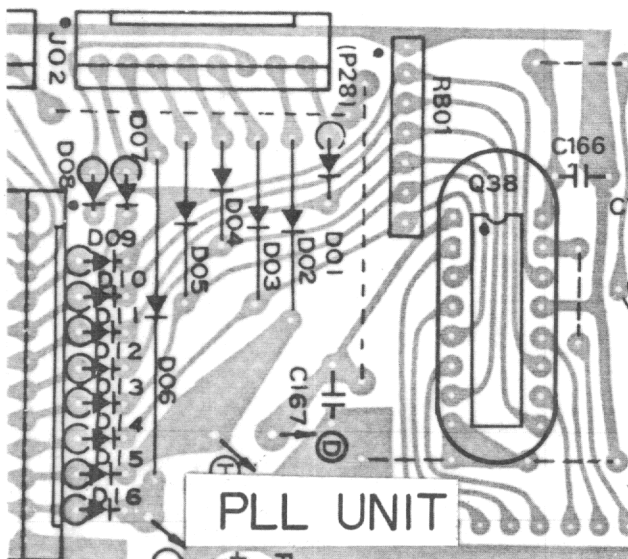


Figure 2-7

- 9) Disconnect P₀₁, P₀₅, P₁₃ and P₁₅ on the main unit from their jacks, and remove the eight screws from the main unit.
- 10) Tilt the main unit toward the front panel, in order to expose the solder side of the board.
- 11) Unsolder the cathode of D₁₀₃₄ from the pattern, and pull the lead from the component side, as shown in Fig. 2-8.
- 12) Insert through the hole and solder one lead of a 1/2 W, 6.8 (or 5.6) ohm resistor to the point where the cathode of D₁₀₃₄ was removed.
- 13) Solder the other lead of the resistor to the cathode lead of D₁₀₃₄ on the component side, as shown in Fig. 2-9.
- 14) Replace all connectors previously removed from the main unit.
- 15) Secure the main unit back on to the chassis with the eight screws.
- 16) Close the receiver by replacing the top cover, bottom cover, and then the carrying handle.

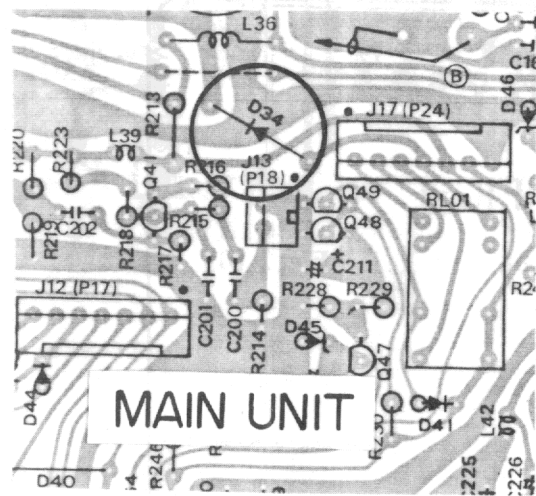


Figure 2-8

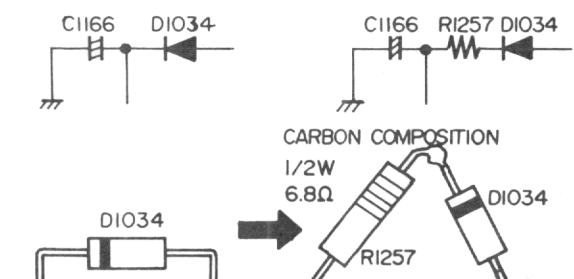


Figure 2-9

TECHNOCAL NOTES

MEMORY FREQUENCY 1kHz ERROR

The following modification will correct the 1 kHz error in frequencies recalled from the memory function. It will also eliminate the audible beat occurring during memory operation.

Parts Needed

1N60 germanium diode	2 pcs.
1/4 watt 3.3Kohms resistor	1 pce.

Modification Procedure

1. Cut the upper pattern on PB-2175, as shown in Figure 2-10.
2. Install and solder the two 1N60 diodes and the 3.3 Kohm resistor as shown in Figure 2-10.

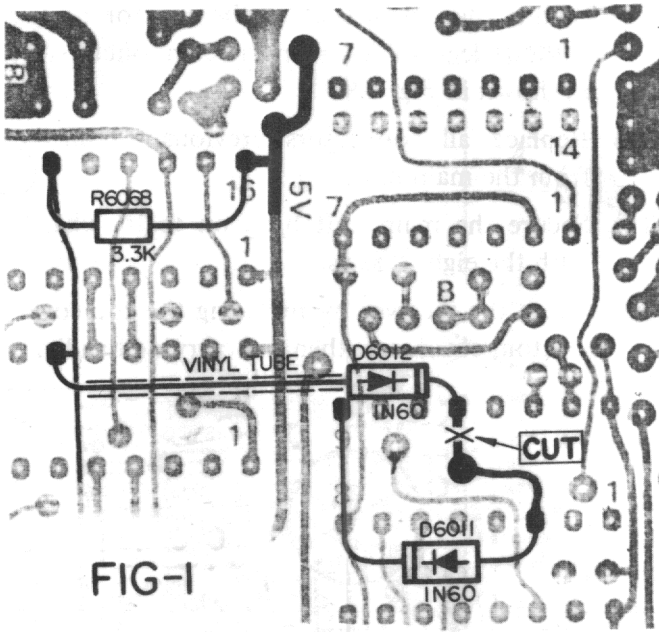


Fig. 2-10

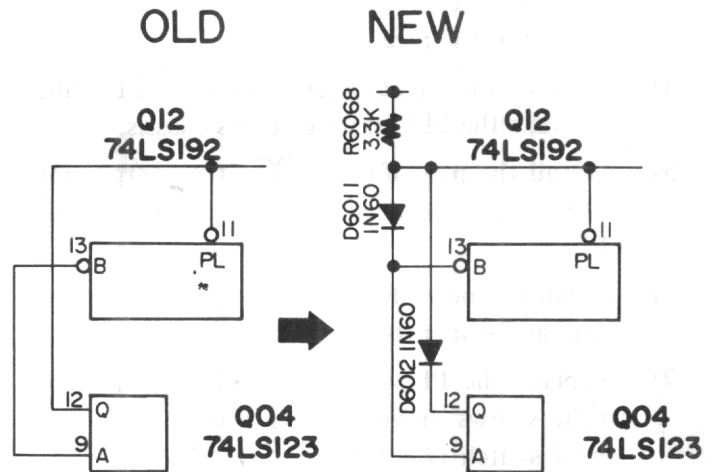


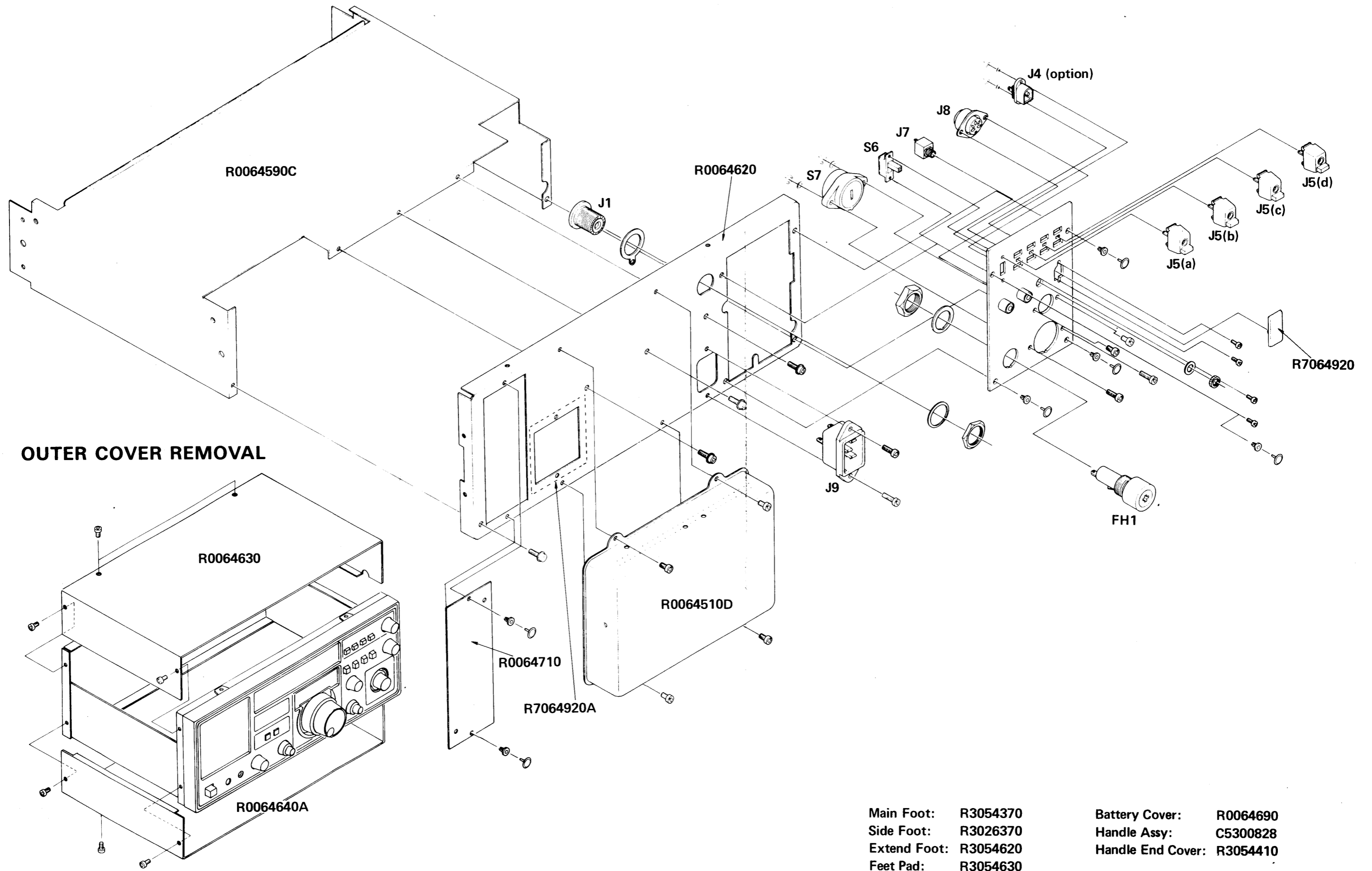
FIG-2

Fig. 2-11

SECTION 3—SERVICING

FRONT PANEL REMOVAL	3-1
REAR PANEL REMOVAL	3-2
OUTER COVER REMOVAL	3-2
PARTS LAYOUT AND CIRCUIT DIAGRAM	
MAIN UNIT (PB-2169)	3-3
PLL UNIT (PB-2170)	3-7
VFO UNIT (PB-2172).....	3-10
FM UNIT (PB-2176)	3-12
POWER SUPPLY UNIT (PB-2171)	3-14
SWITCH UNIT (PB-2173).....	3-16
MEMORY UNIT (PB-2175)	3-18
MEMORY UNIT CHECK POINTS	3-20
MEMORY UNIT WAVE FORM CHART	3-22
MEMORY UNIT TIMING CHART	3-24
PLL VCO SELECTION	3-25
PLL DIVIDING RATIO	3-26
MAIN UNIT BPF SELECTION	3-27
BAND SWITCH CONTACT POSITION	3-28
SOLDERING AND DESOLDERING TECHNIQUE	3-29
MAINTENANCE AND ALIGNMENT	3-31
TROUBLESHOOTING	3-34

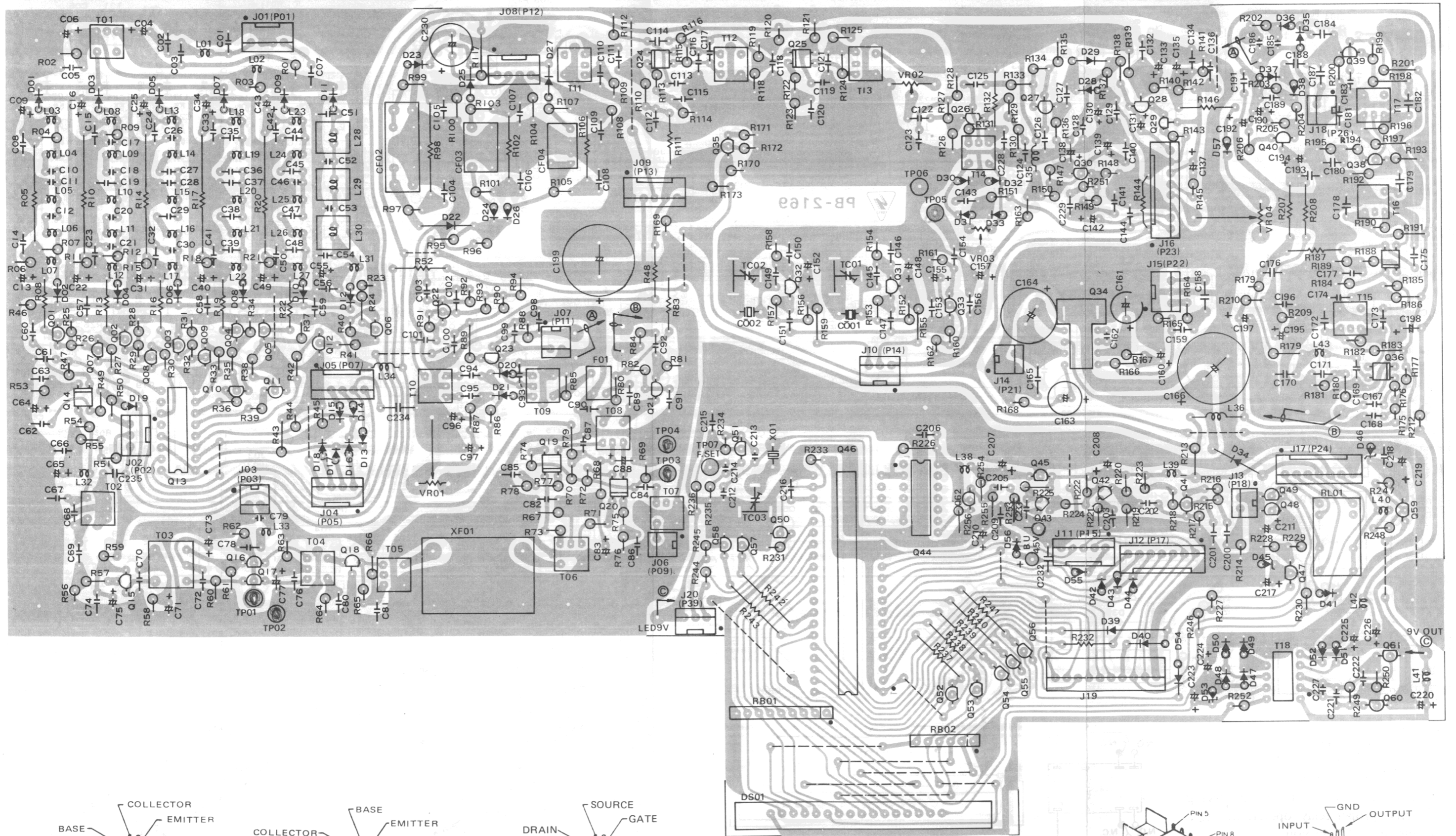
REAR PANEL REMOVAL



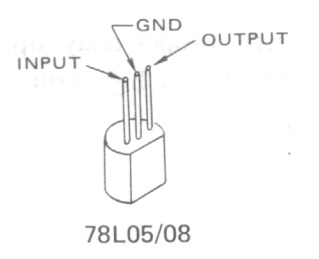
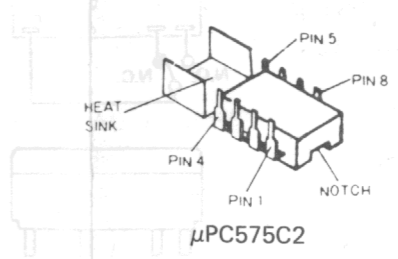
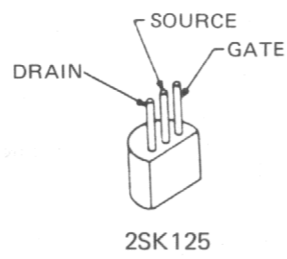
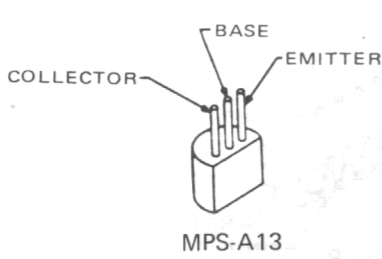
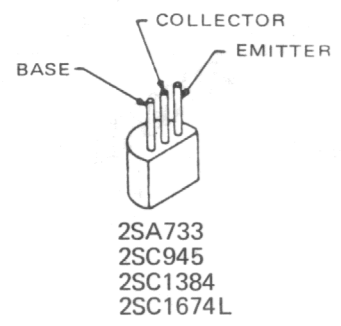
Main Foot: R3054370
 Side Foot: R3026370
 Extend Foot: R3054620
 Feet Pad: R3054630

Battery Cover: R0064690
 Handle Assy: C5300828
 Handle End Cover: R3054410

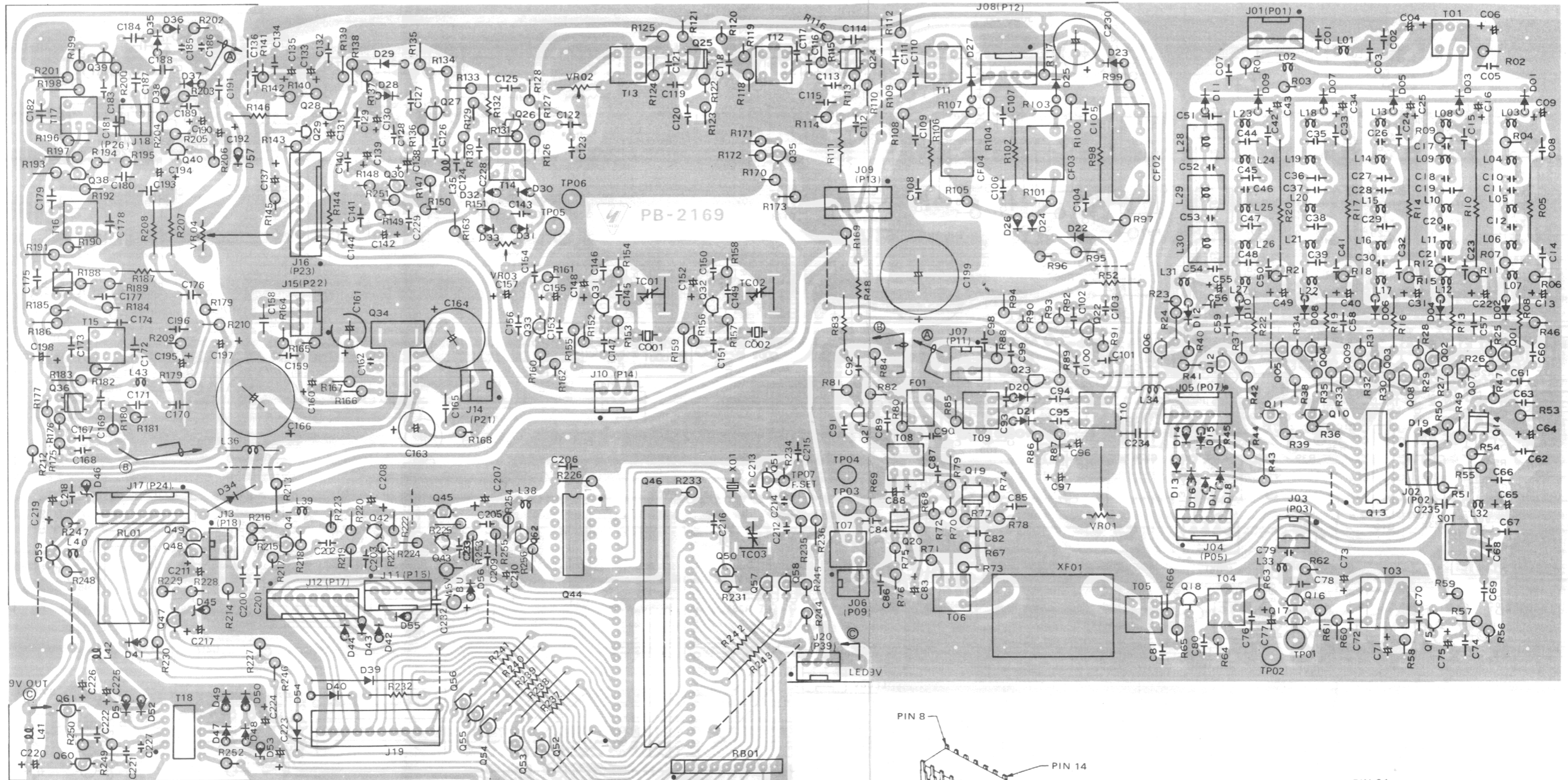
PARTS LAYOUT MAIN UNIT(PB-2169)



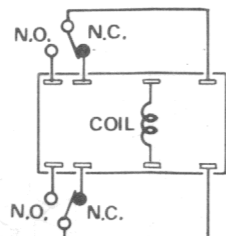
Viewed from component side



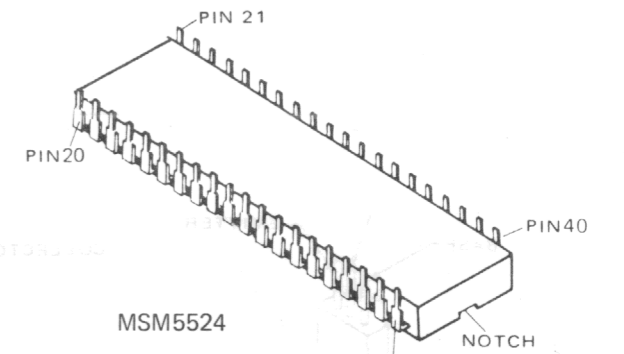
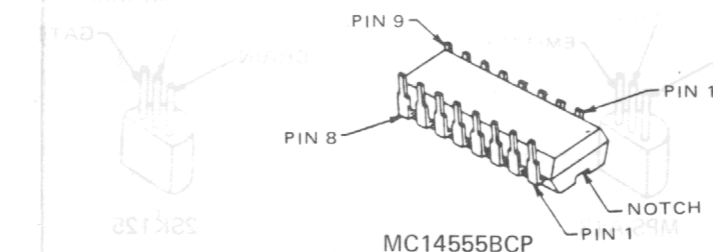
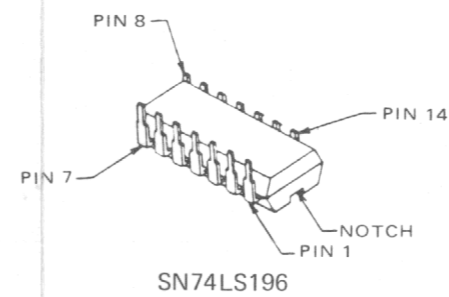
PARTS LAYOUT MAIN UNIT(PB-2169)



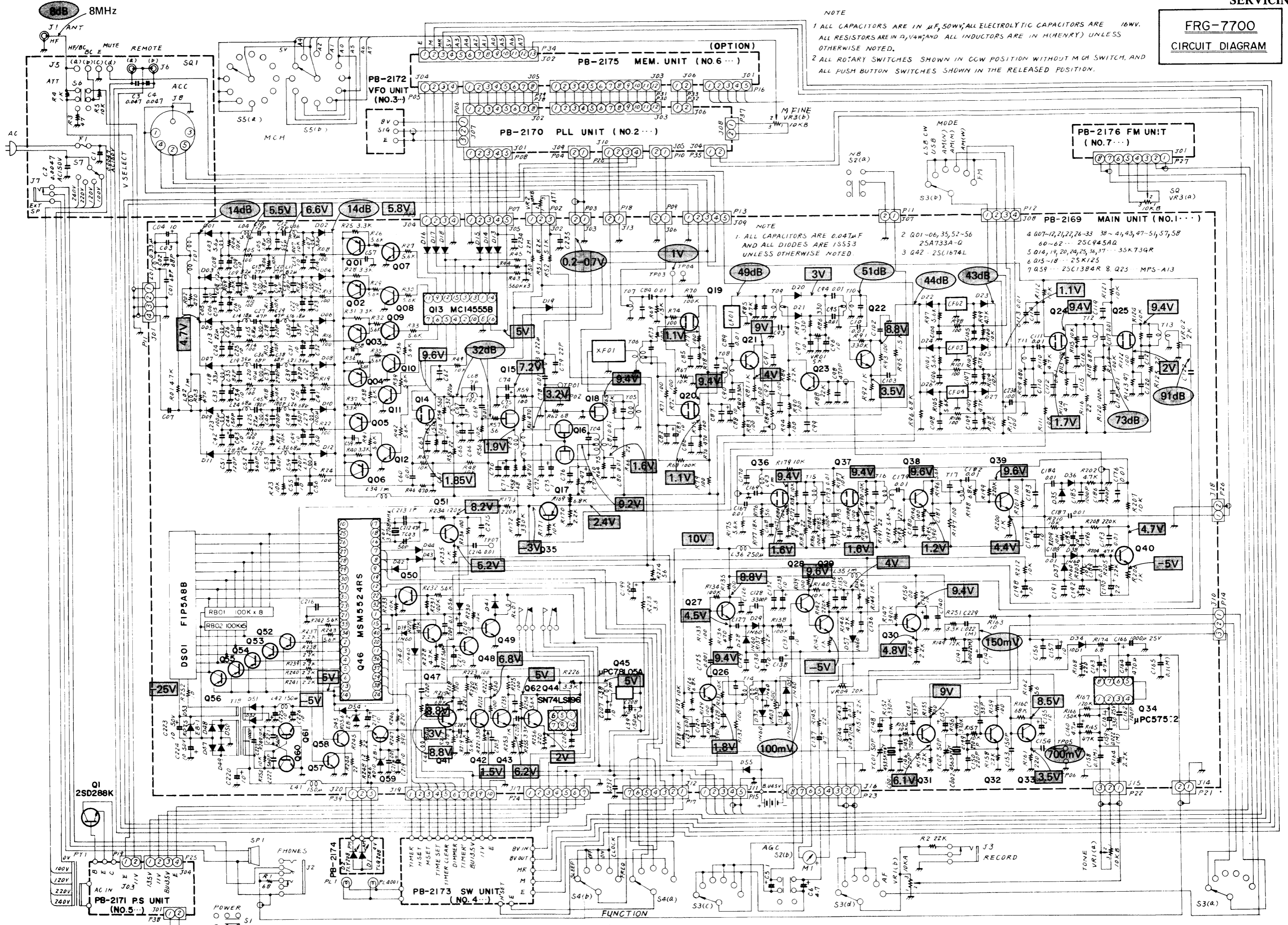
Should the need for replacement of relays become necessary, or if you are trying to verify proper relay operation, these diagrams should help you.



RL1001
FBR221AD012-M



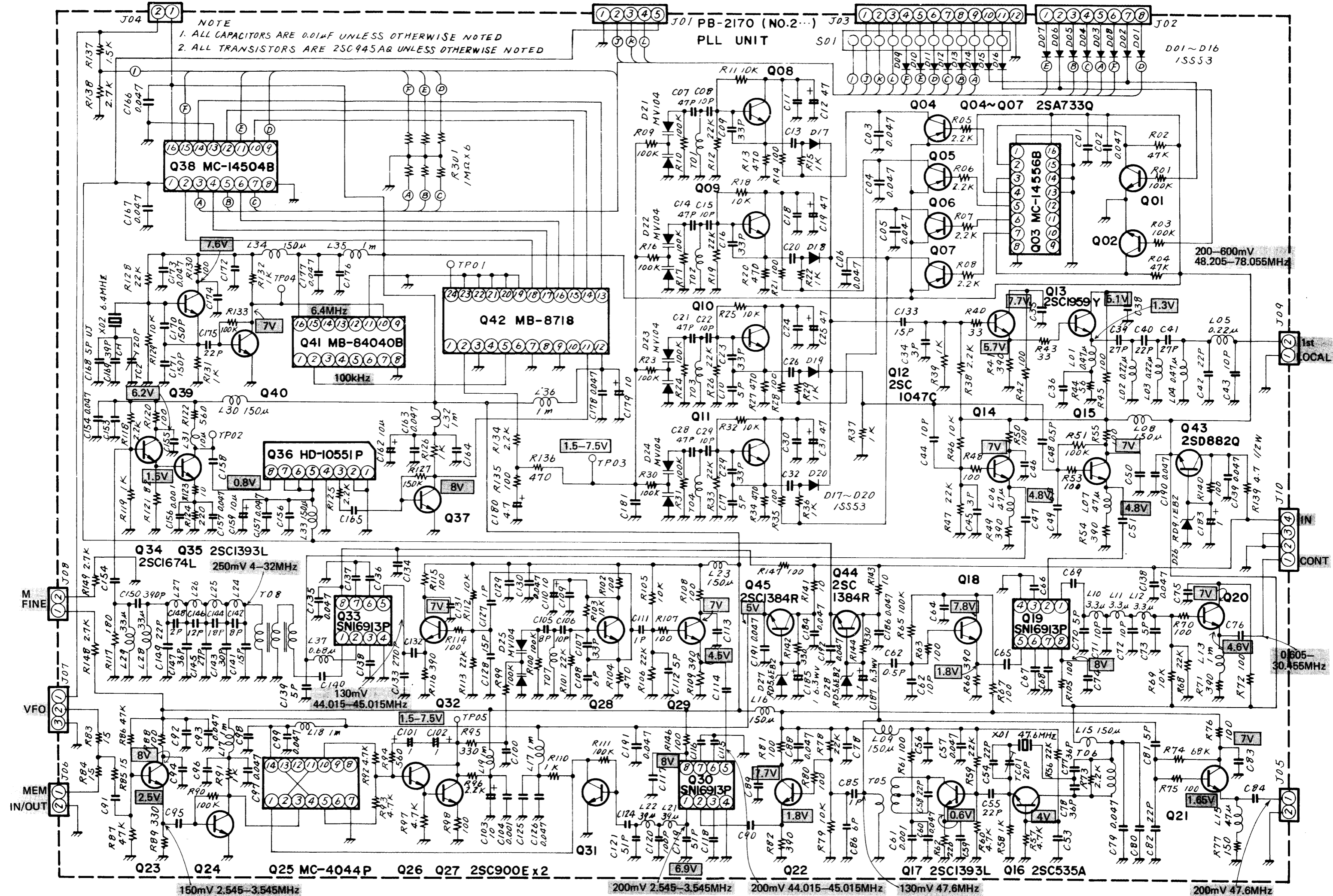
FRG-7700
CIRCUIT DIAGRAM



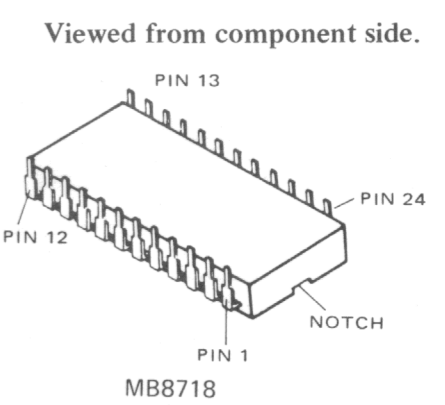
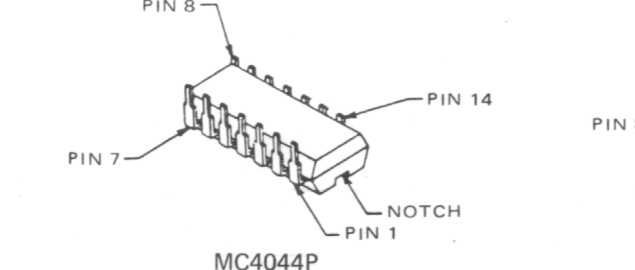
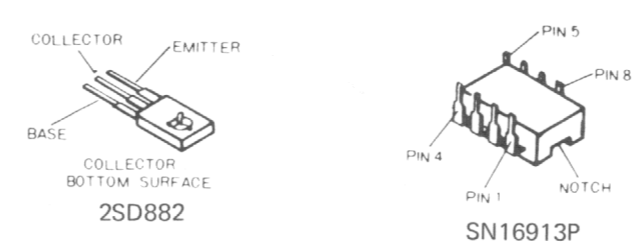
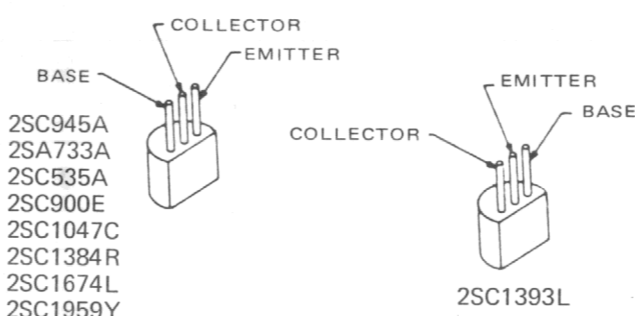
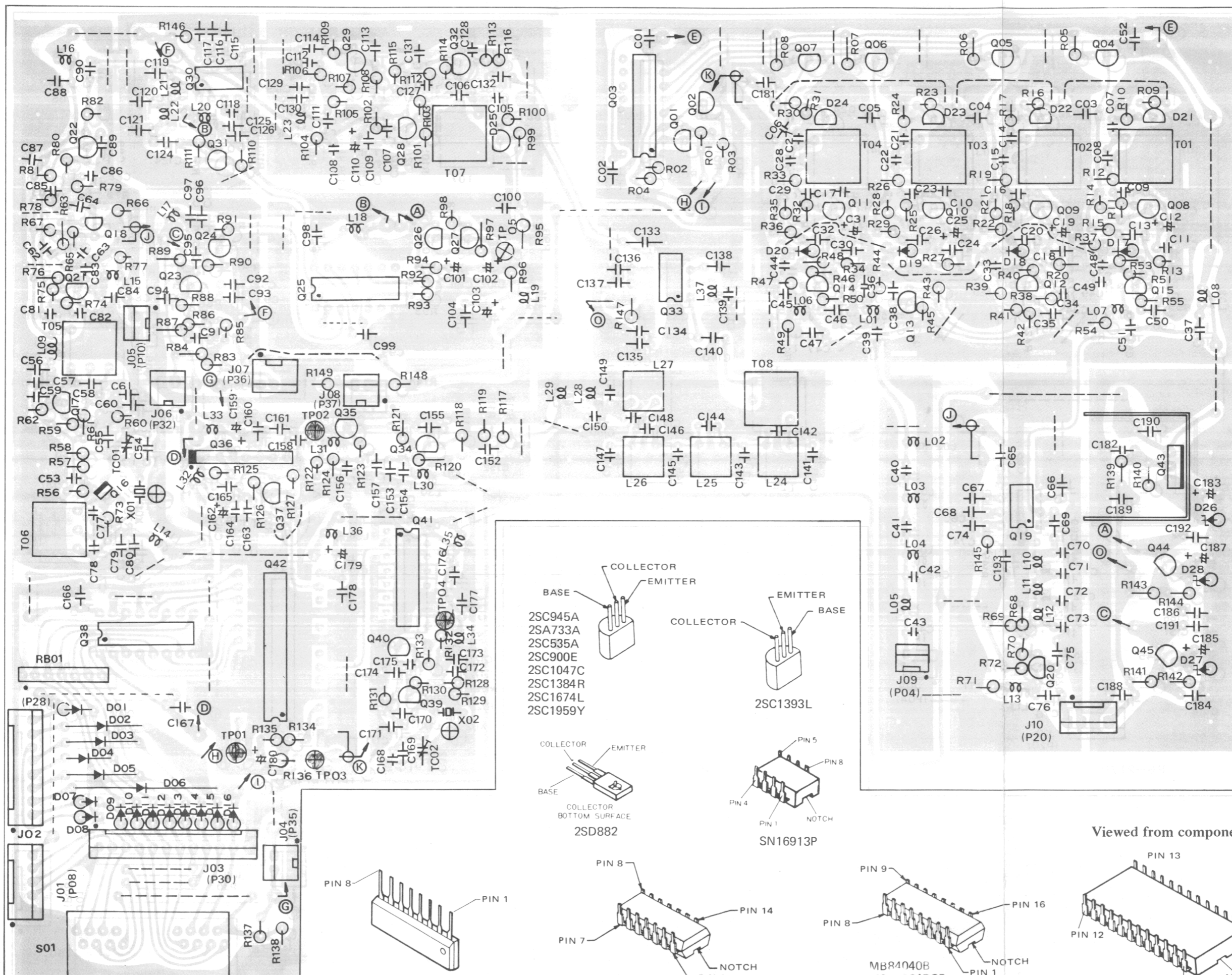
NOTE
 1 ALL CAPACITORS ARE IN μ F, 50WV; ALL ELECTROLYTIC CAPACITORS ARE 16WV.
 ALL RESISTORS ARE IN Ω , Ω , Ω AND ALL INDUCTORS ARE IN MH (HENRY) UNLESS OTHERWISE NOTED.
 2 ALL ROTARY SWITCHES SHOWN IN CCW POSITION WITHOUT MCH SWITCH, AND ALL PUSH BUTTON SWITCHES SHOWN IN THE RELEASED POSITION.

NOTE
 1 ALL CAPACITORS ARE 0.047 μ F AND ALL DIODES ARE 1SS53 UNLESS OTHERWISE NOTED
 2 Q01-06, 35, 52-56 2SA733A-G
 3 Q42 - 2SC1674L

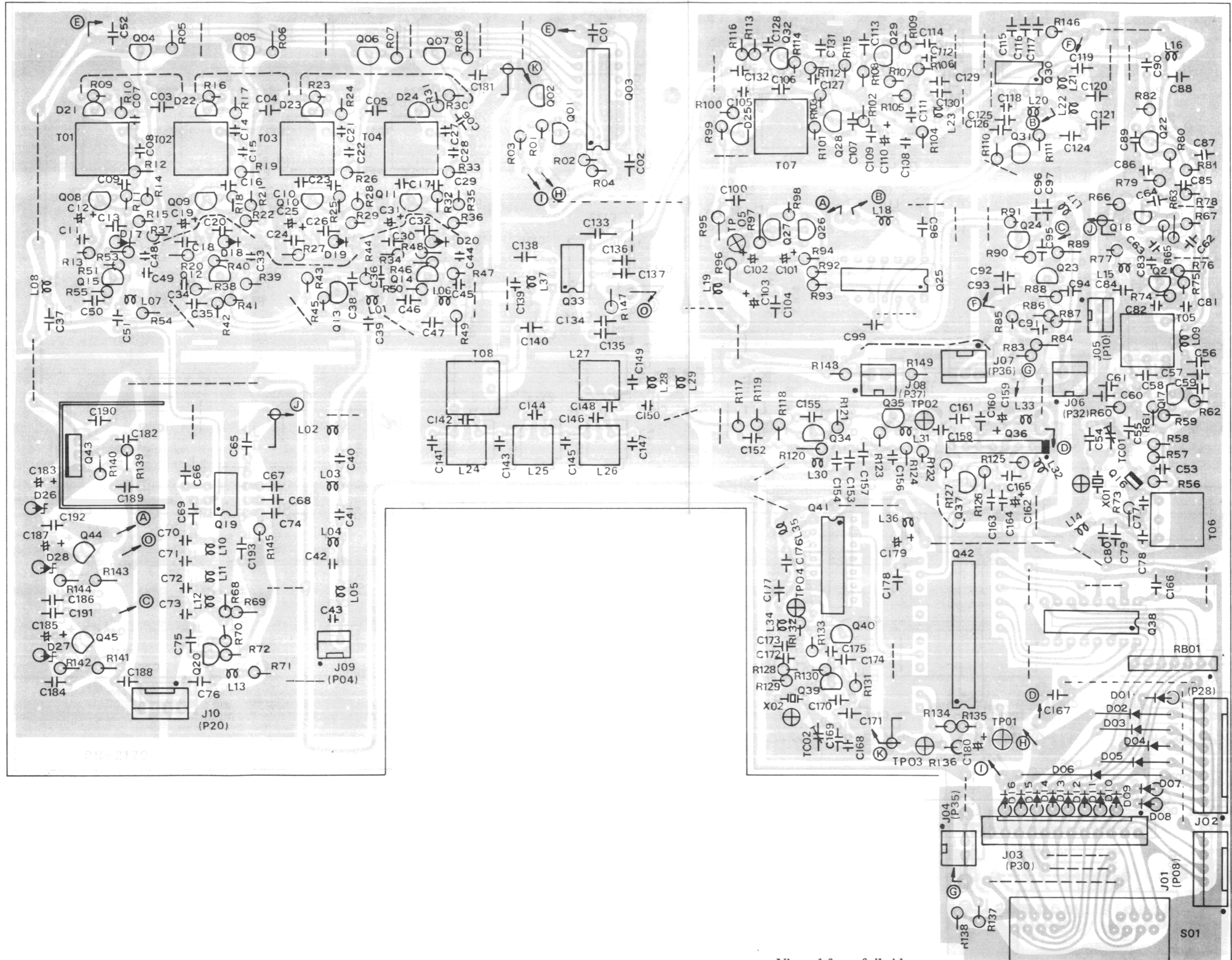
4 Q07-12, 21, 22, 26-33 3B-41, 43, 47-51, 57, 58 60-62... 2SC945A-Q
 5 Q14, 19, 20, 24, 25, 36, 37... 3SK73GR
 6 Q15-18... 2SK125
 7 Q59... 2SC138AR 8. Q23 MPS-A13



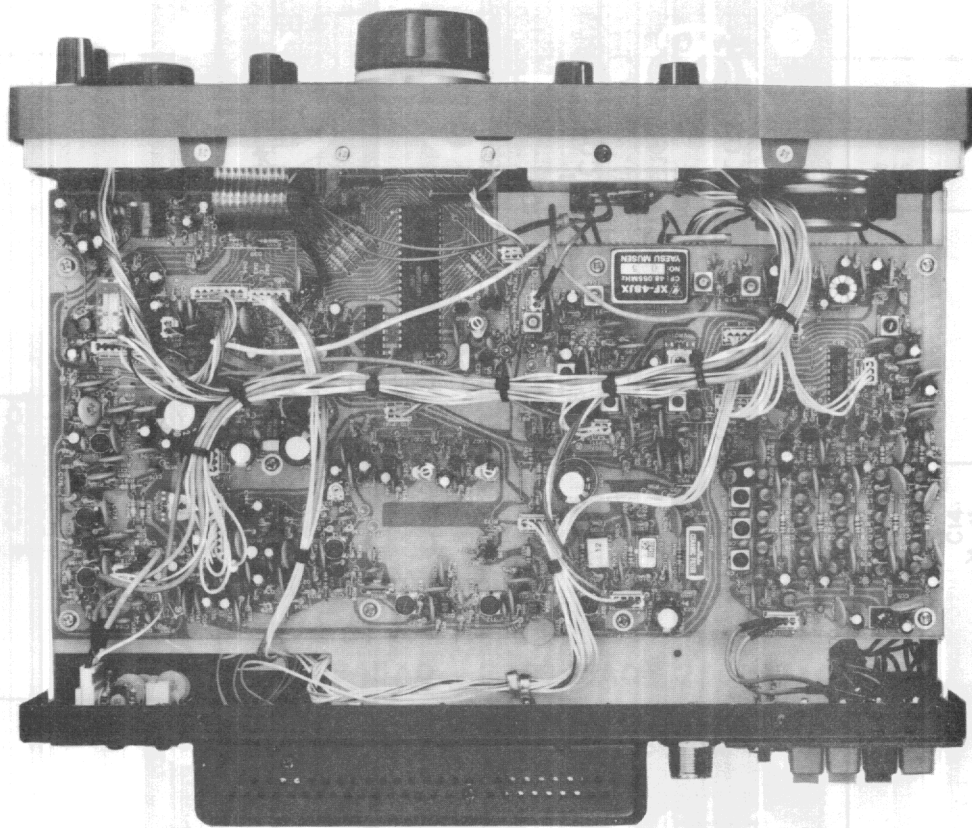
PARTS LAYOUT PLL UNIT(PB-2170)



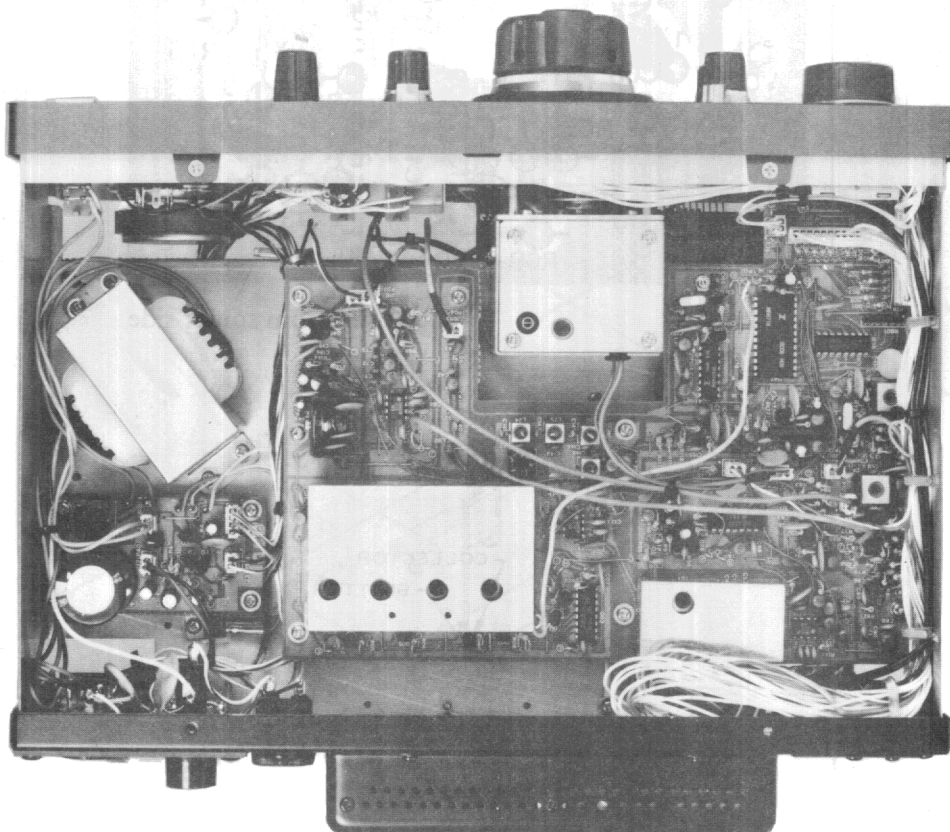
PARTS LAYOUT PLL UNIT(PB-2170)



VFO TUNING BOARD LAYOUT

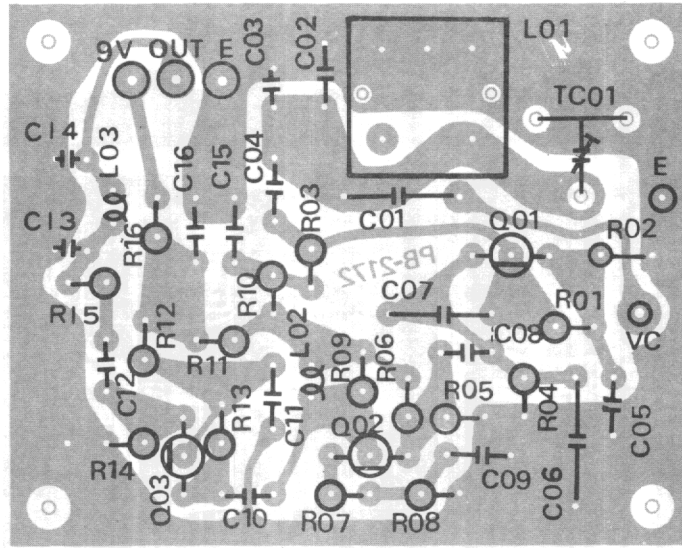


Top View

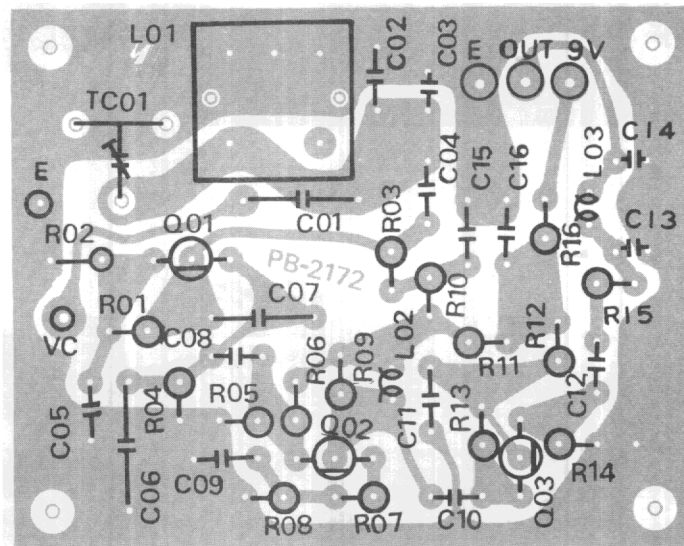


Bottom View

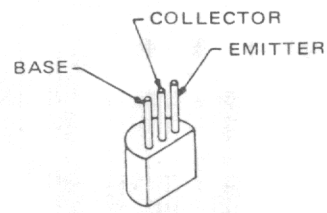
VFO UNIT PARTS LAYOUT



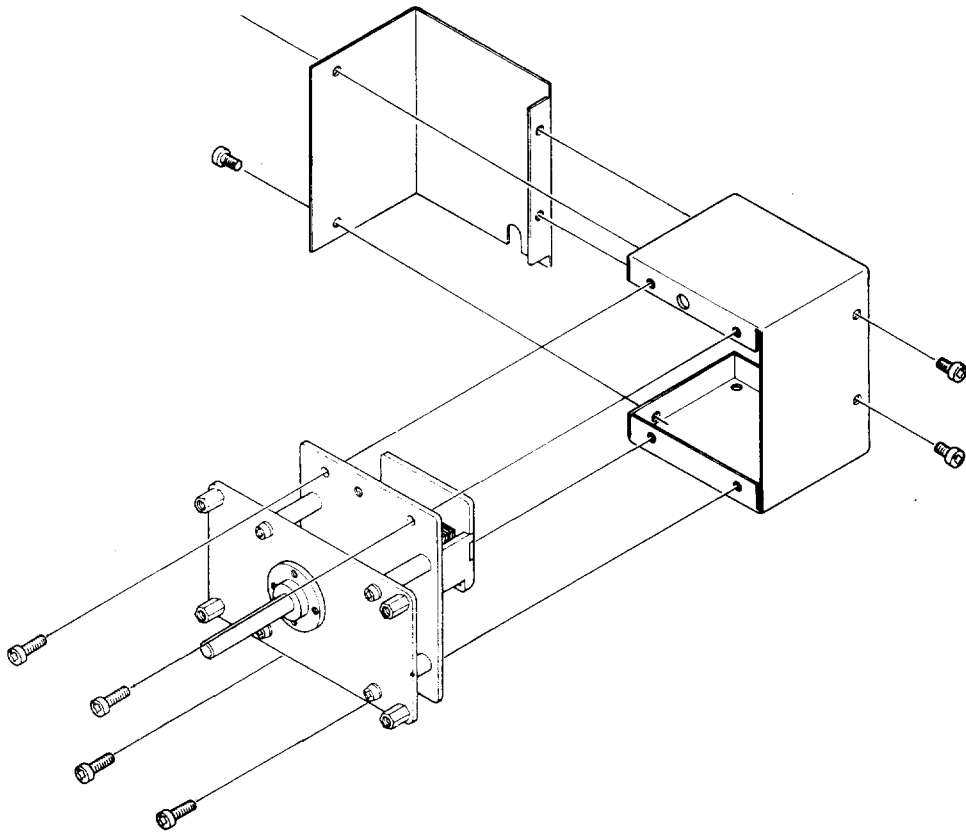
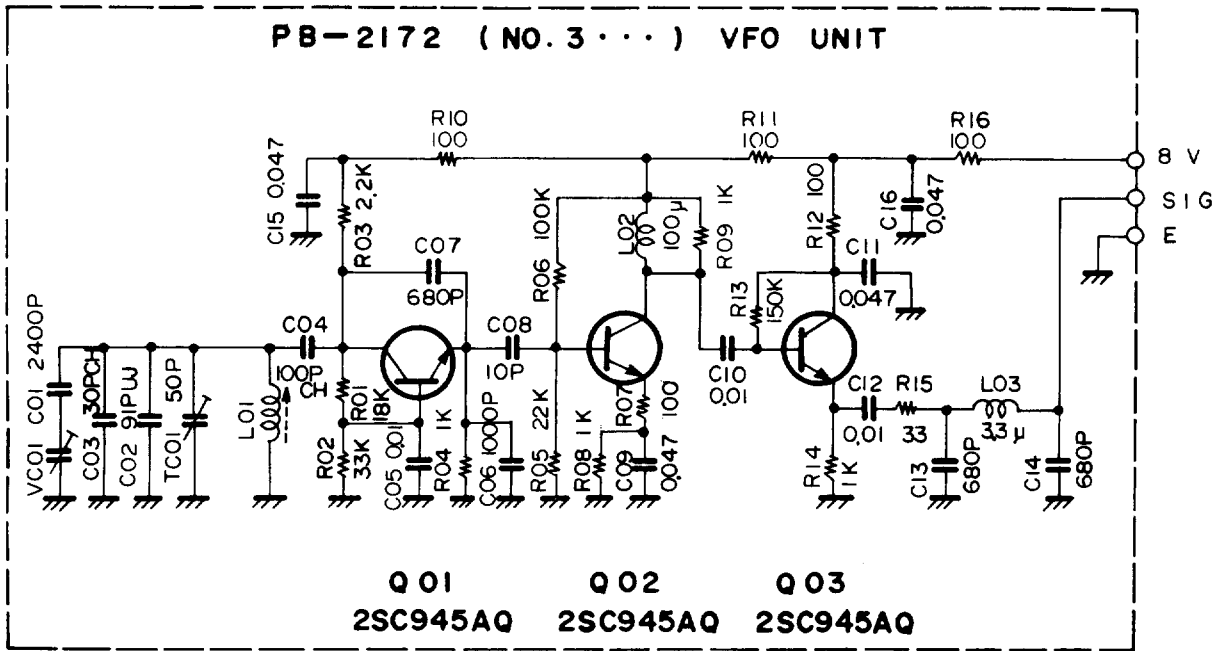
Viewed from component side



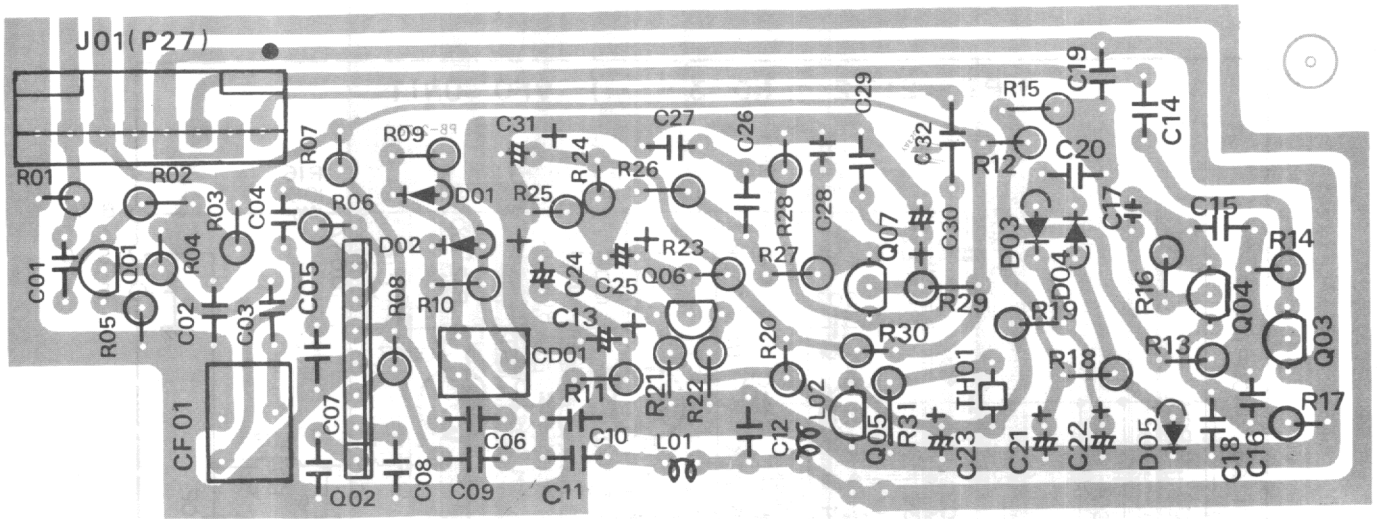
Viewed from solder side



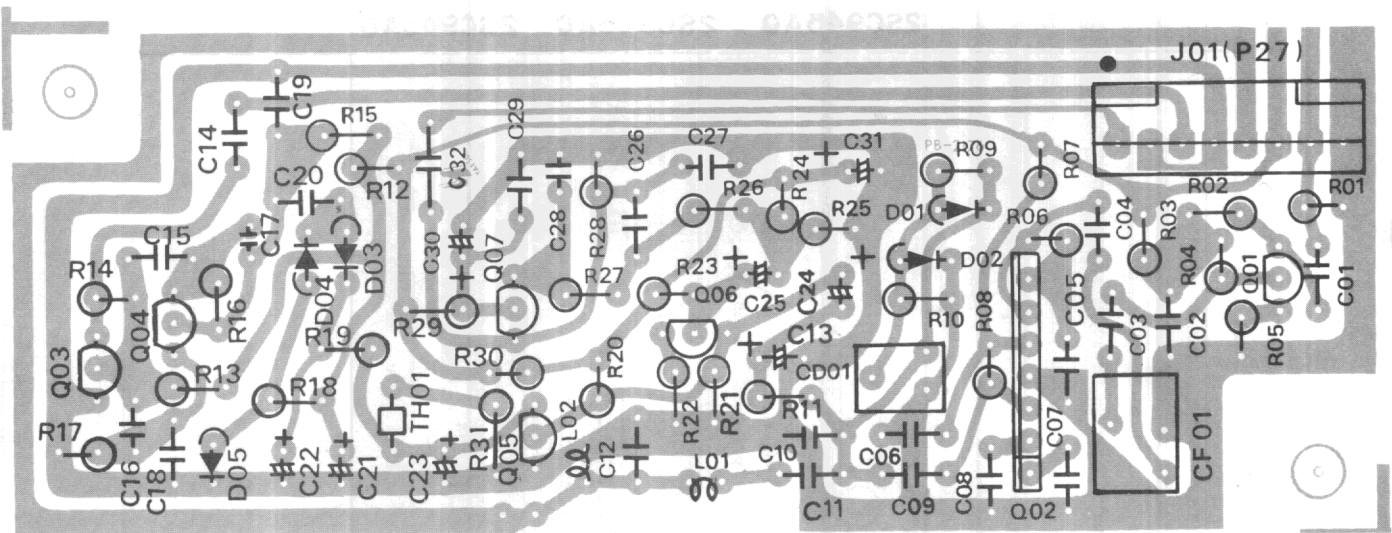
2SC945A



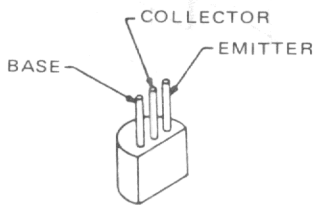
FM UNIT PARTS LAYOUT



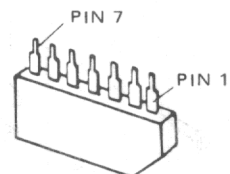
Viewed from component side



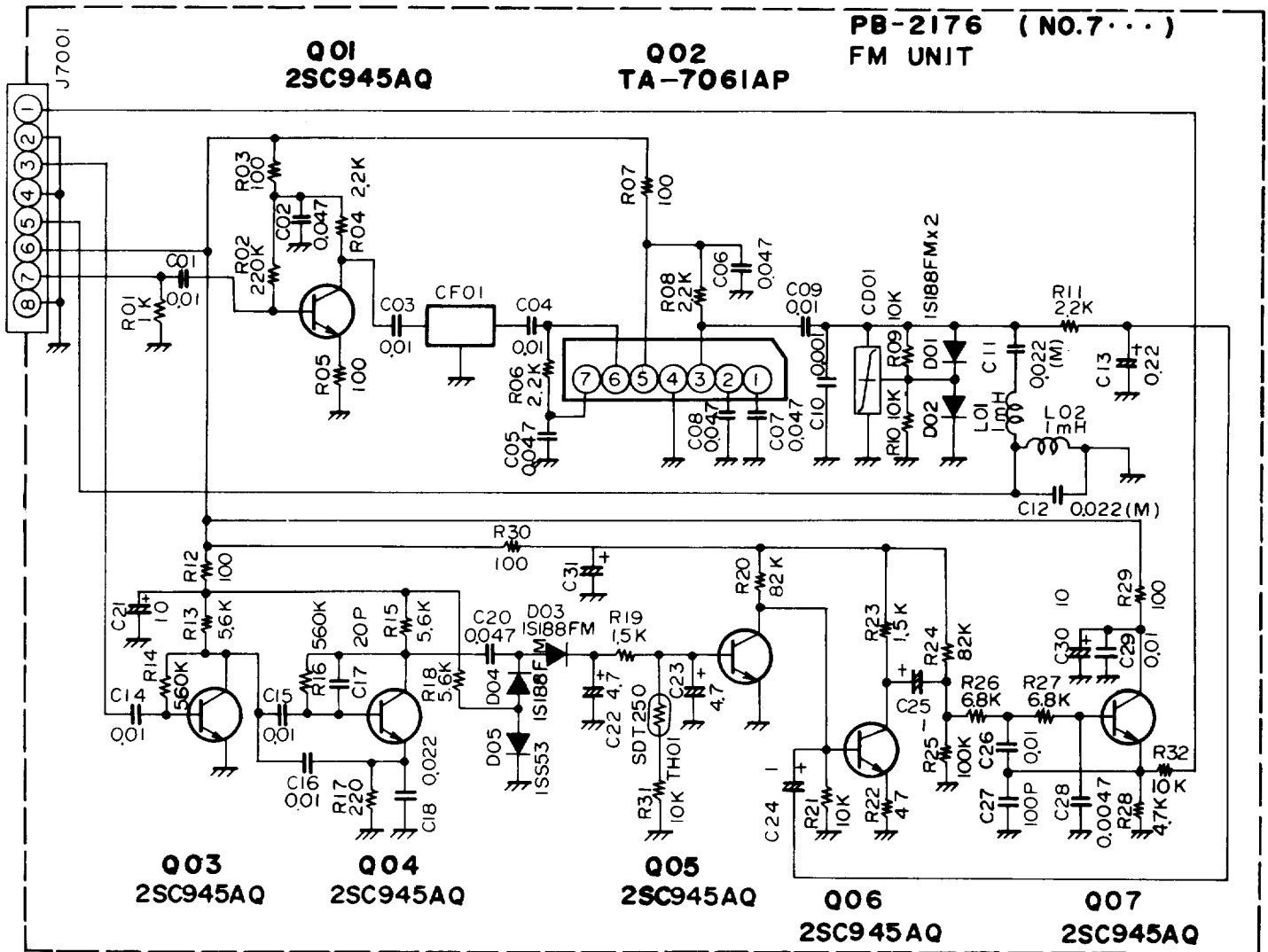
Viewed from foil side



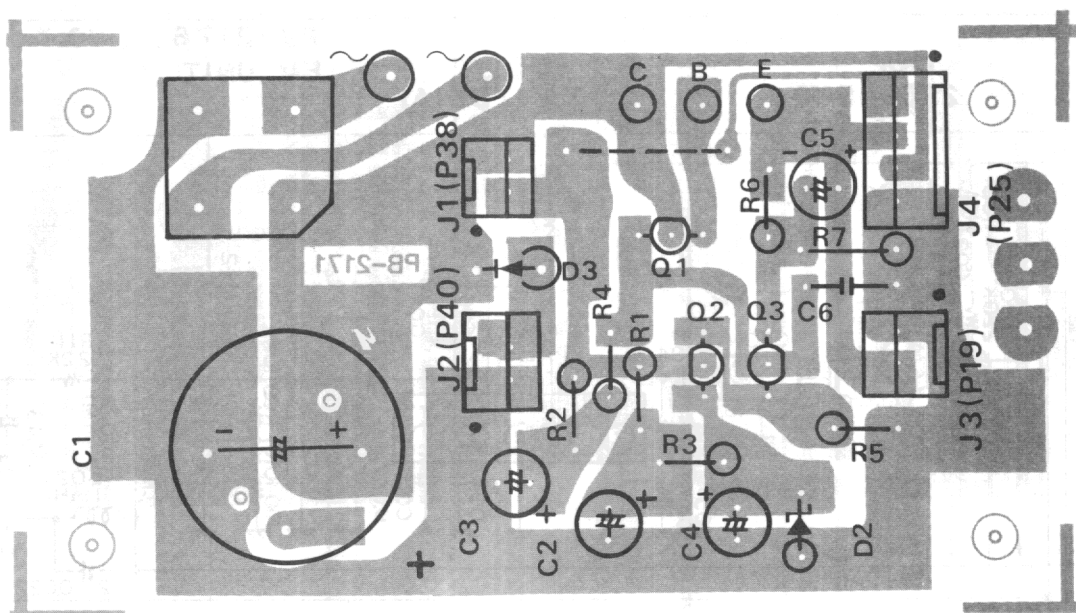
2SC945A



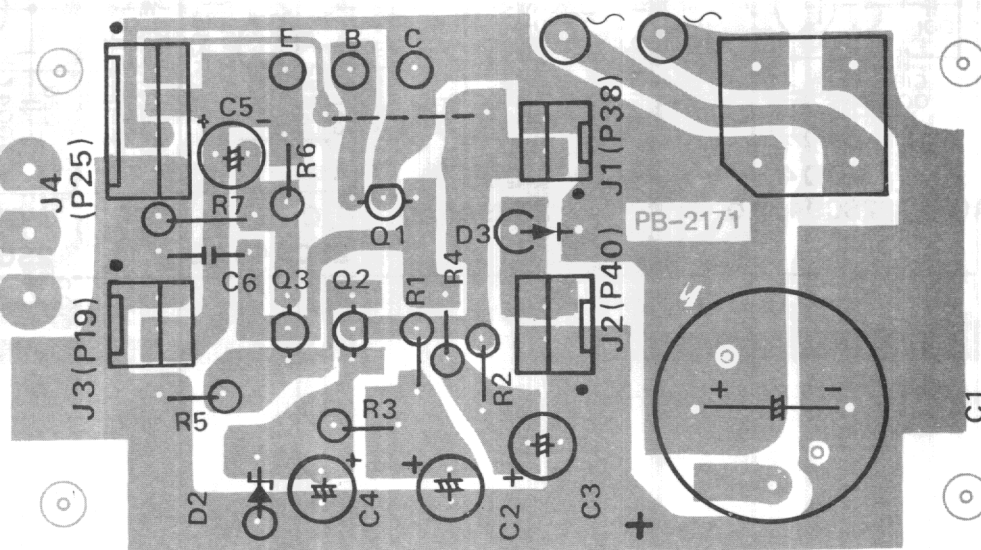
TA-7061AP



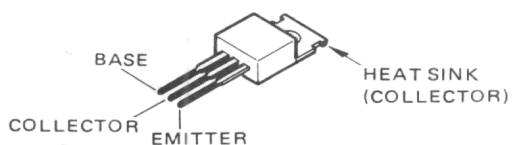
POWER SUPPLY UNIT PARTS LAYOUT



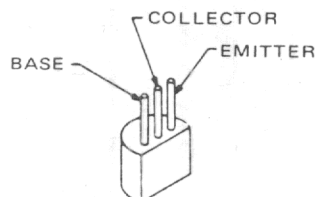
Viewed from component side



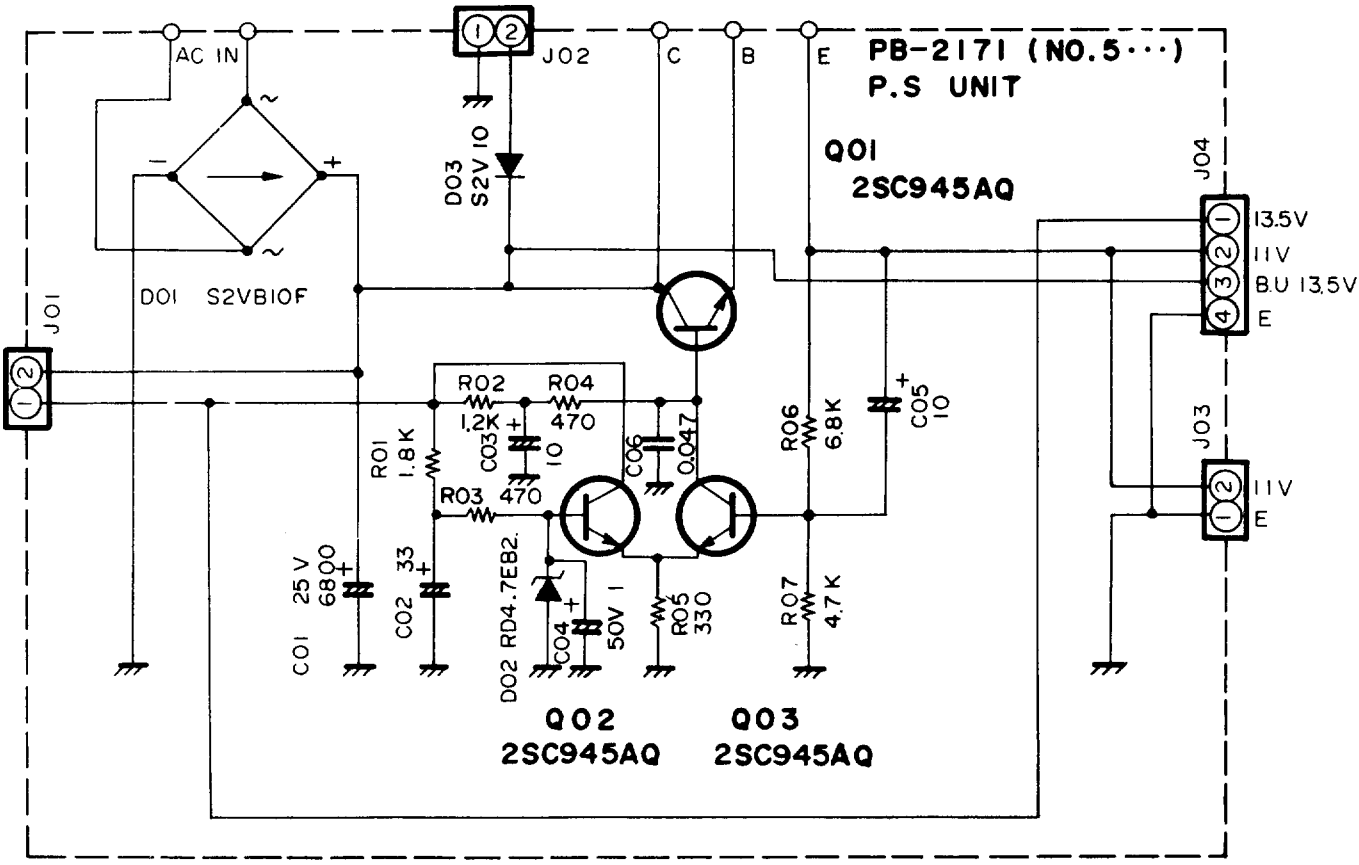
Viewed from foil side



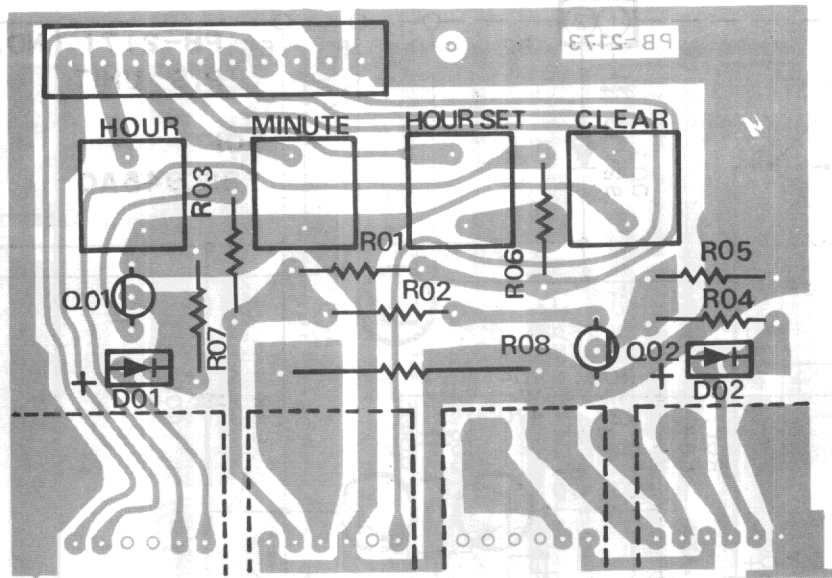
2SD288K



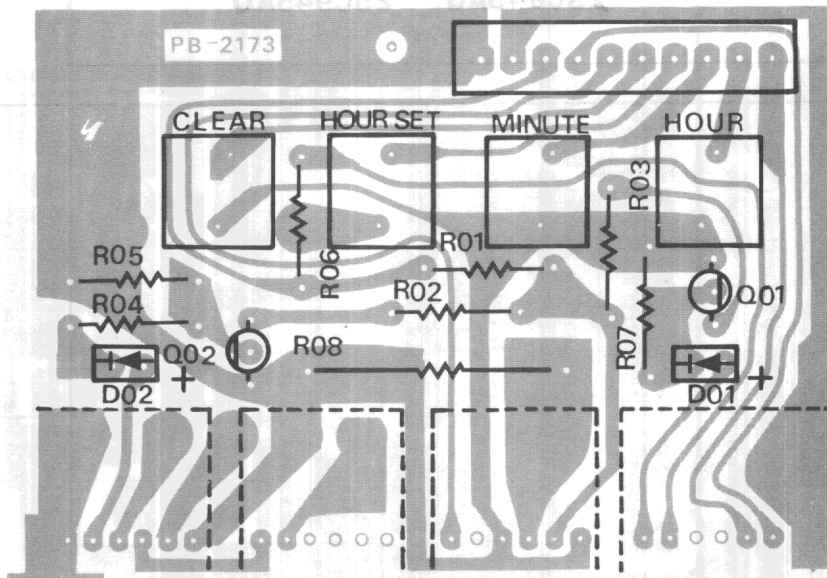
2SC945A



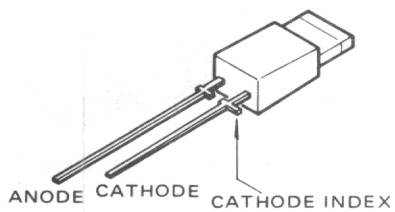
SWITCH UNIT PARTS LAYOUT



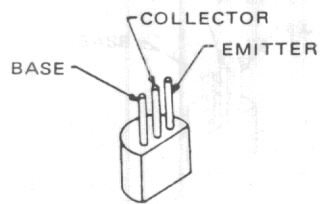
Viewed from component side



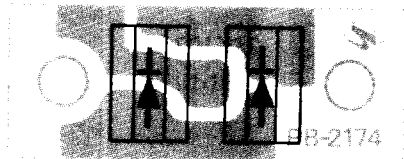
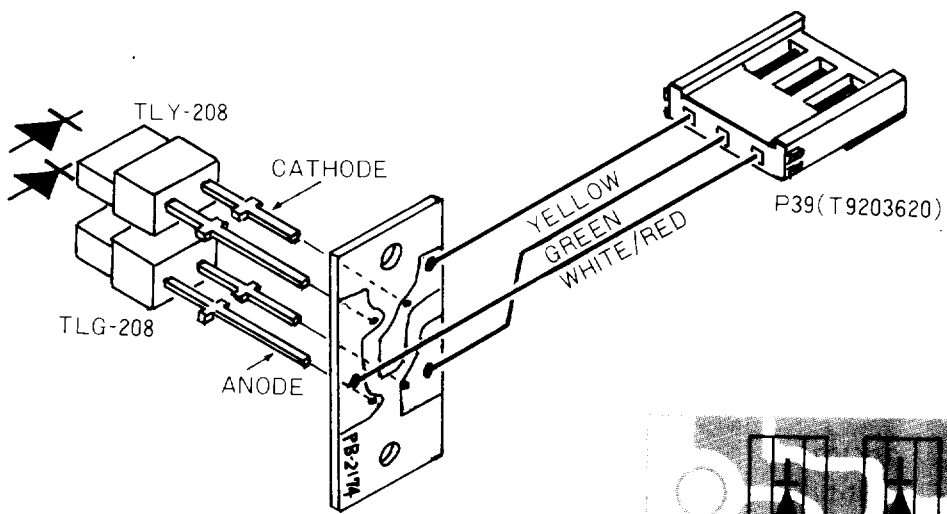
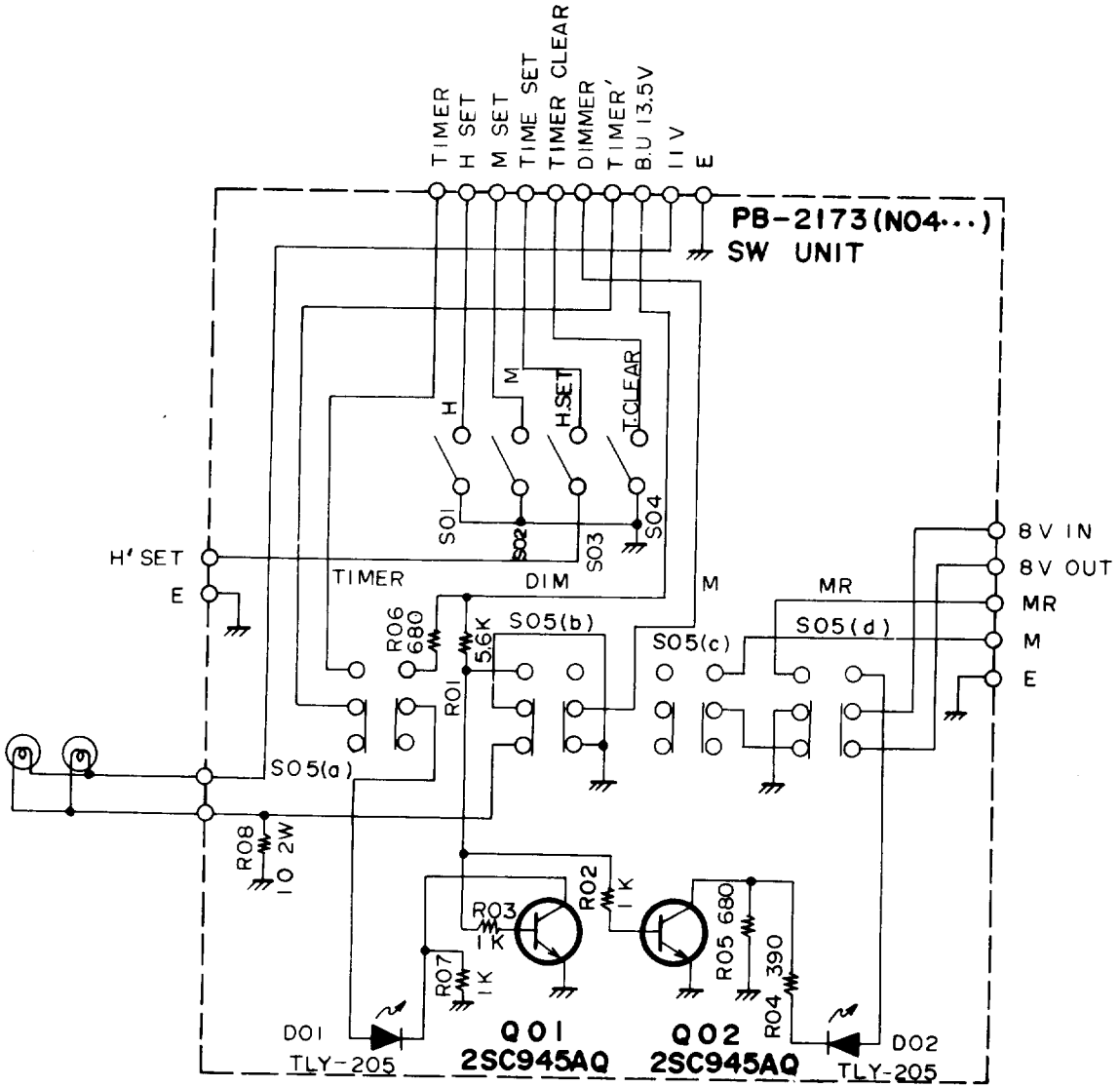
Viewed from foil side



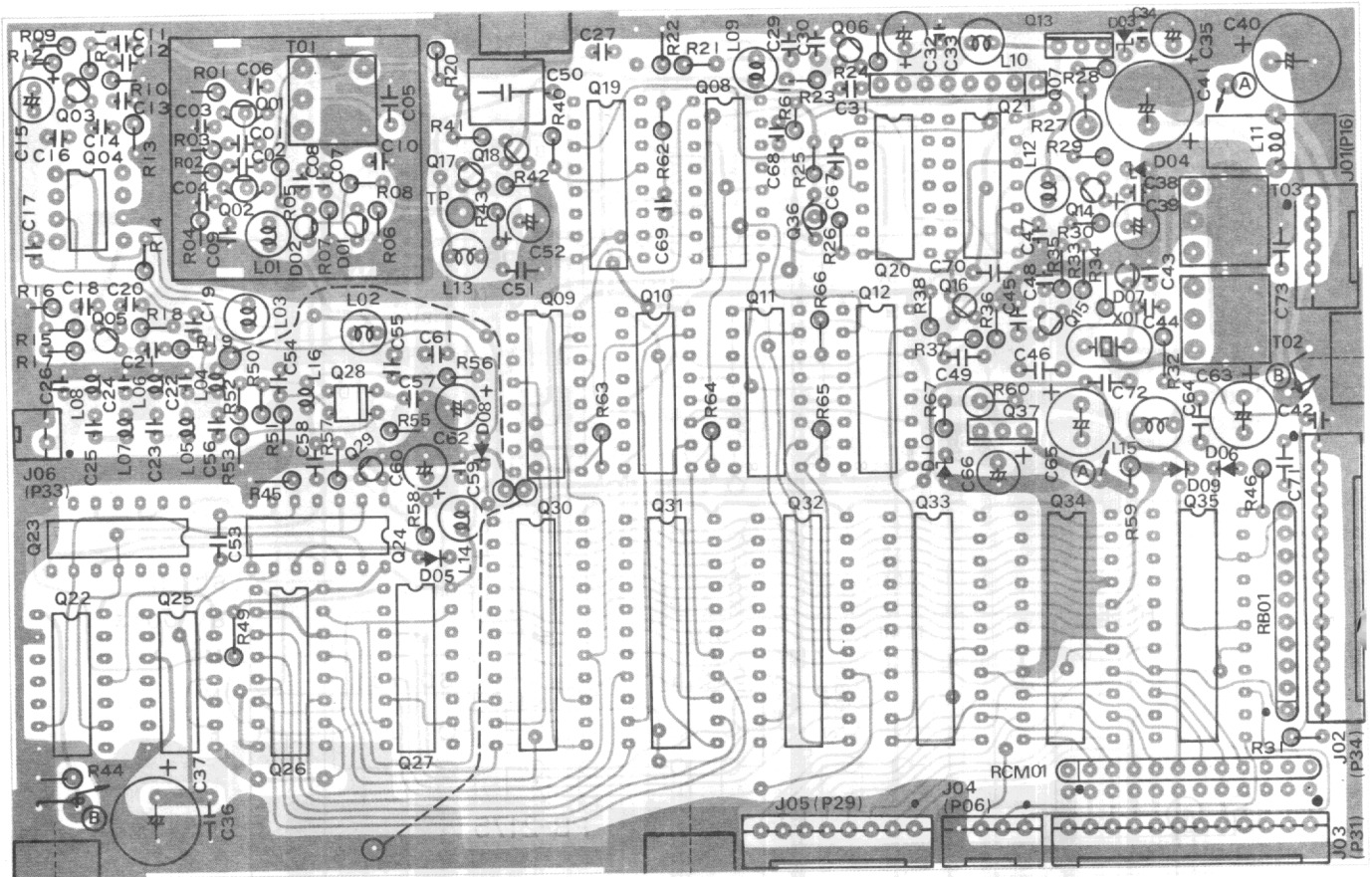
TLY205



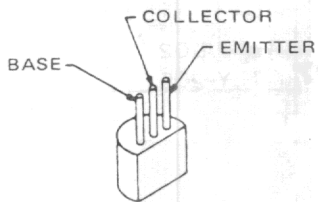
2SC945A



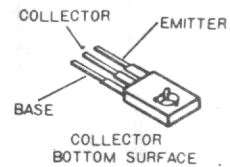
PARTS LAYOUT MEMORY UNIT(PB-2175)



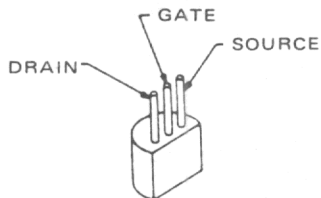
Viewed from component side



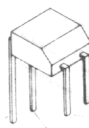
- 2SC900E
- 2SC1317R
- 2SC1674L
- 2SC945A
- 2SA733A



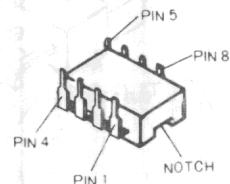
2SD822Q



2SK107-3

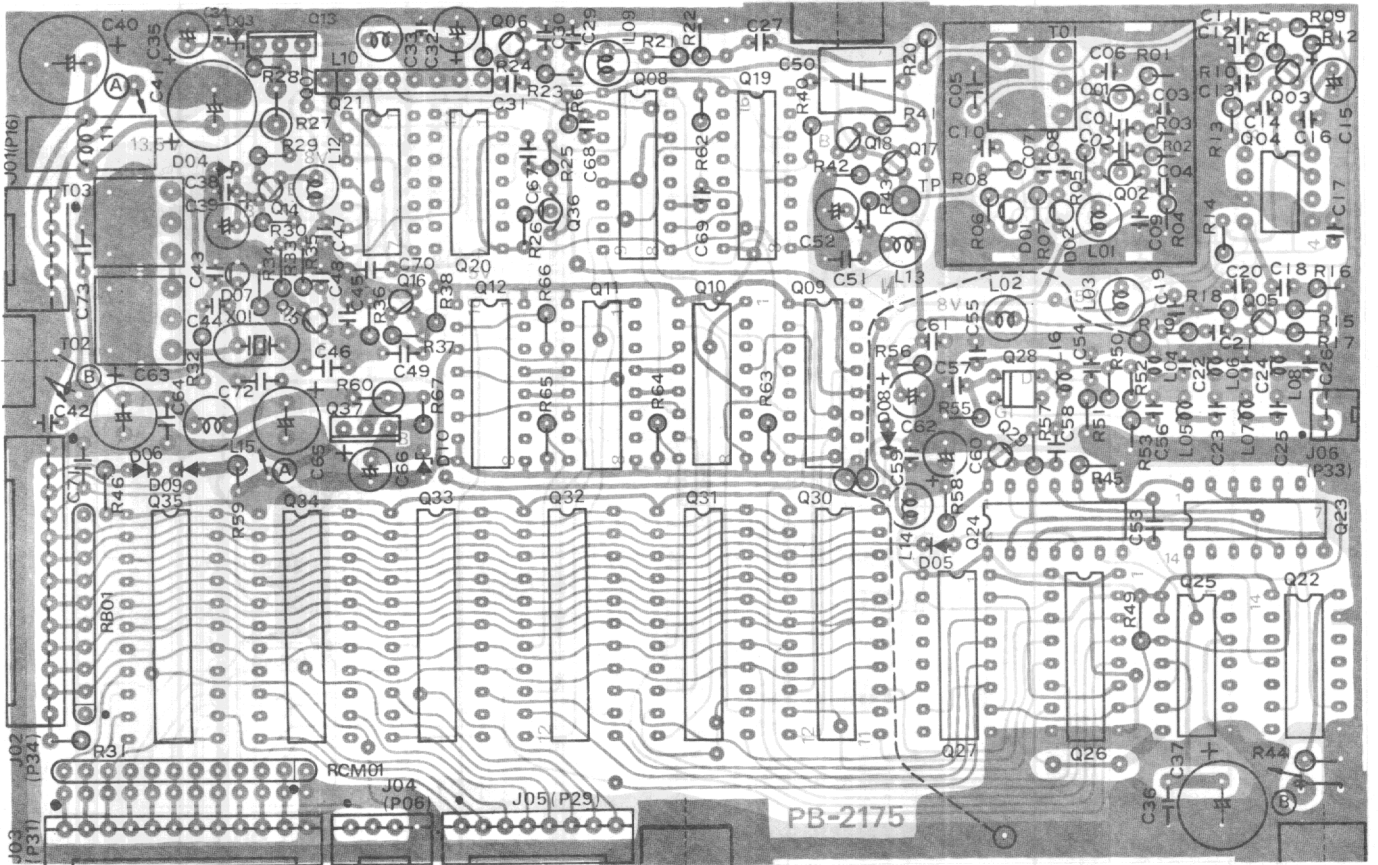


3SK73

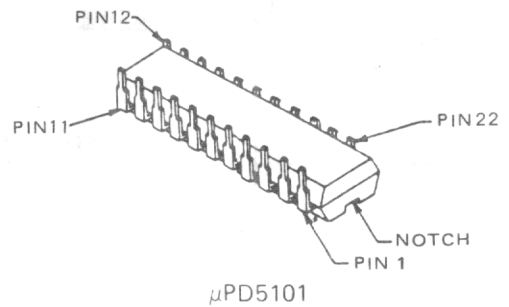
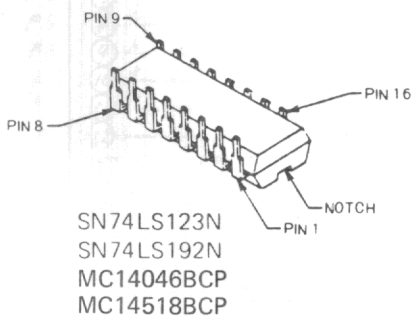
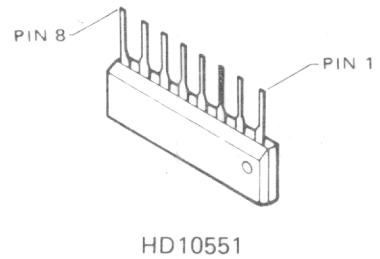
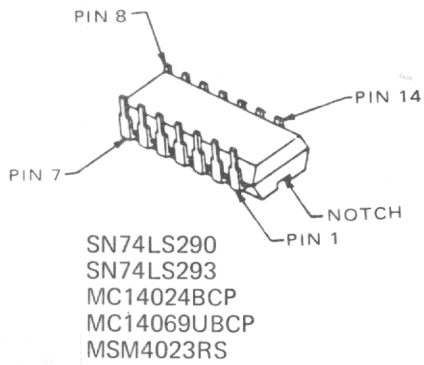


μPB553C

PARTS LAYOUT MEMORY UNIT(PB-2175)

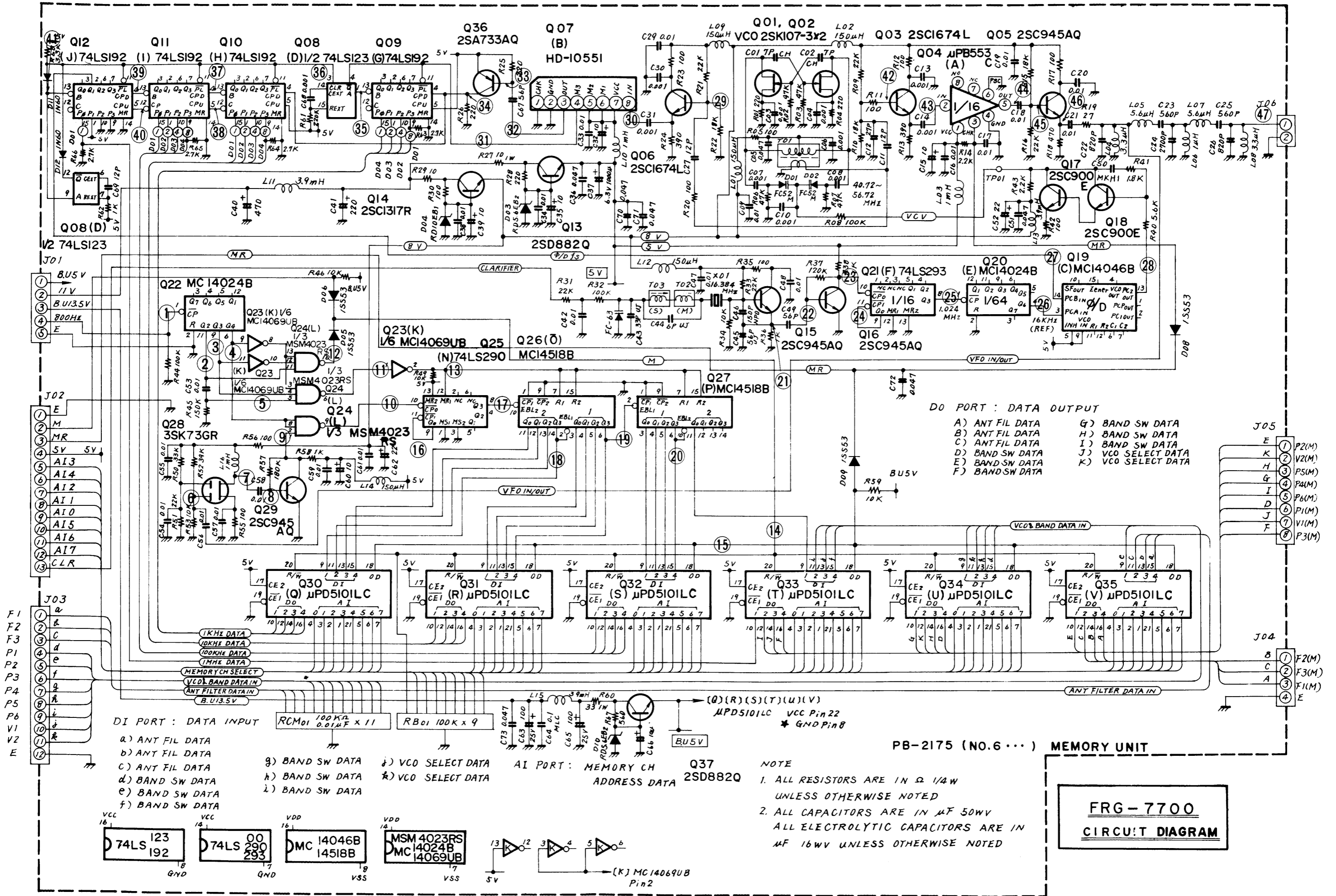


Viewed from foil side

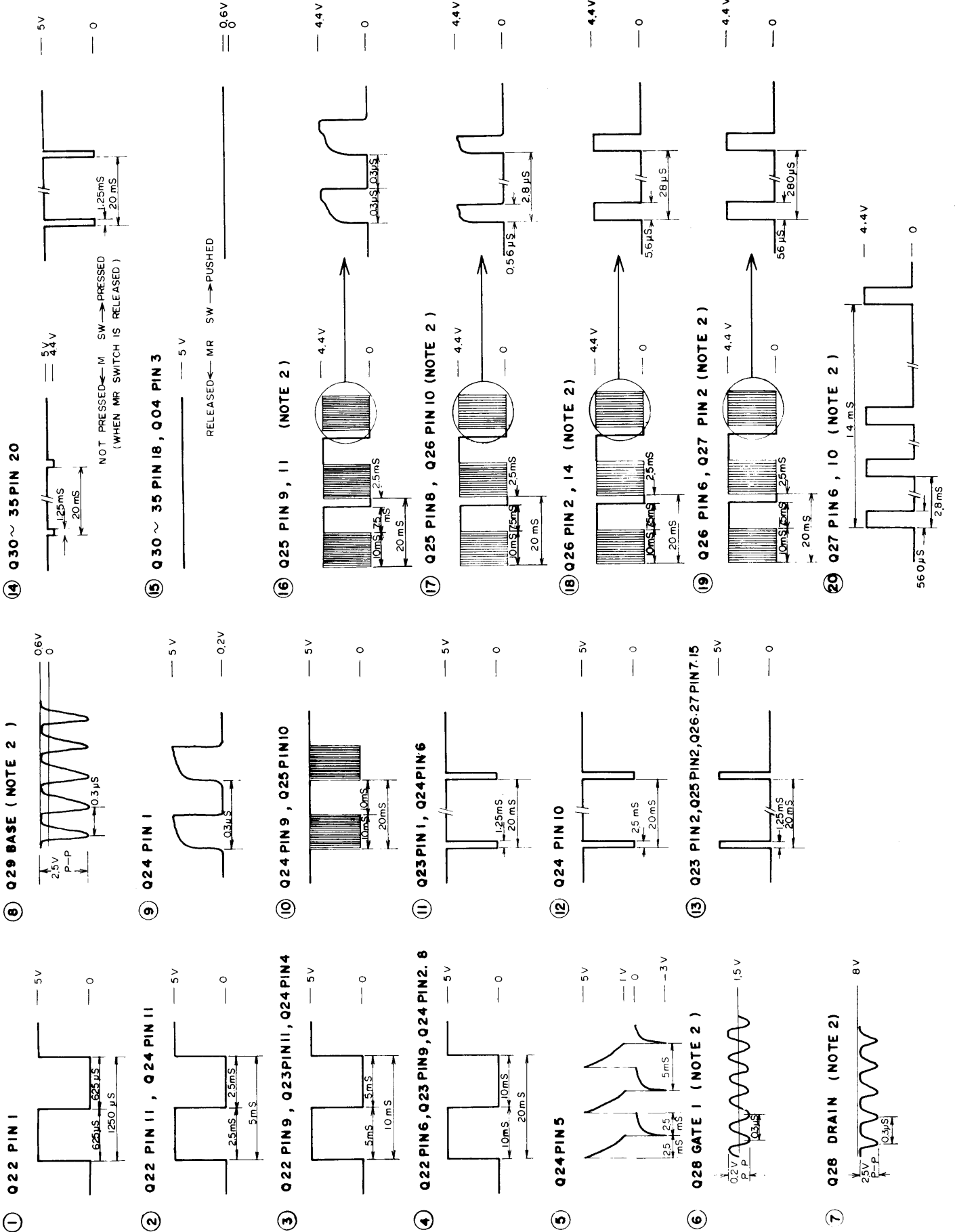


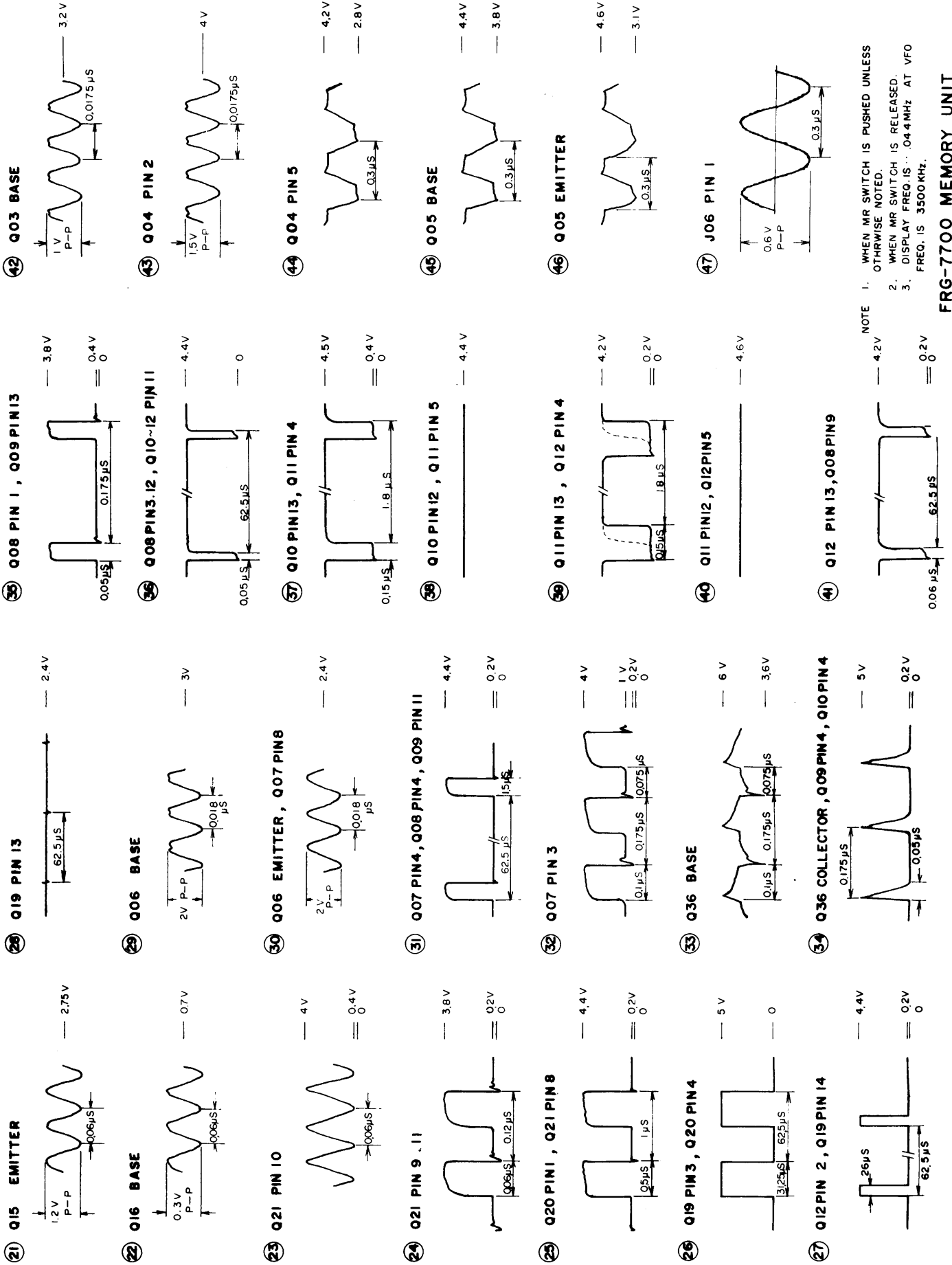
Viewed from foil side

MEMORY UNIT CHECK POINT



WAVE FORM CHART

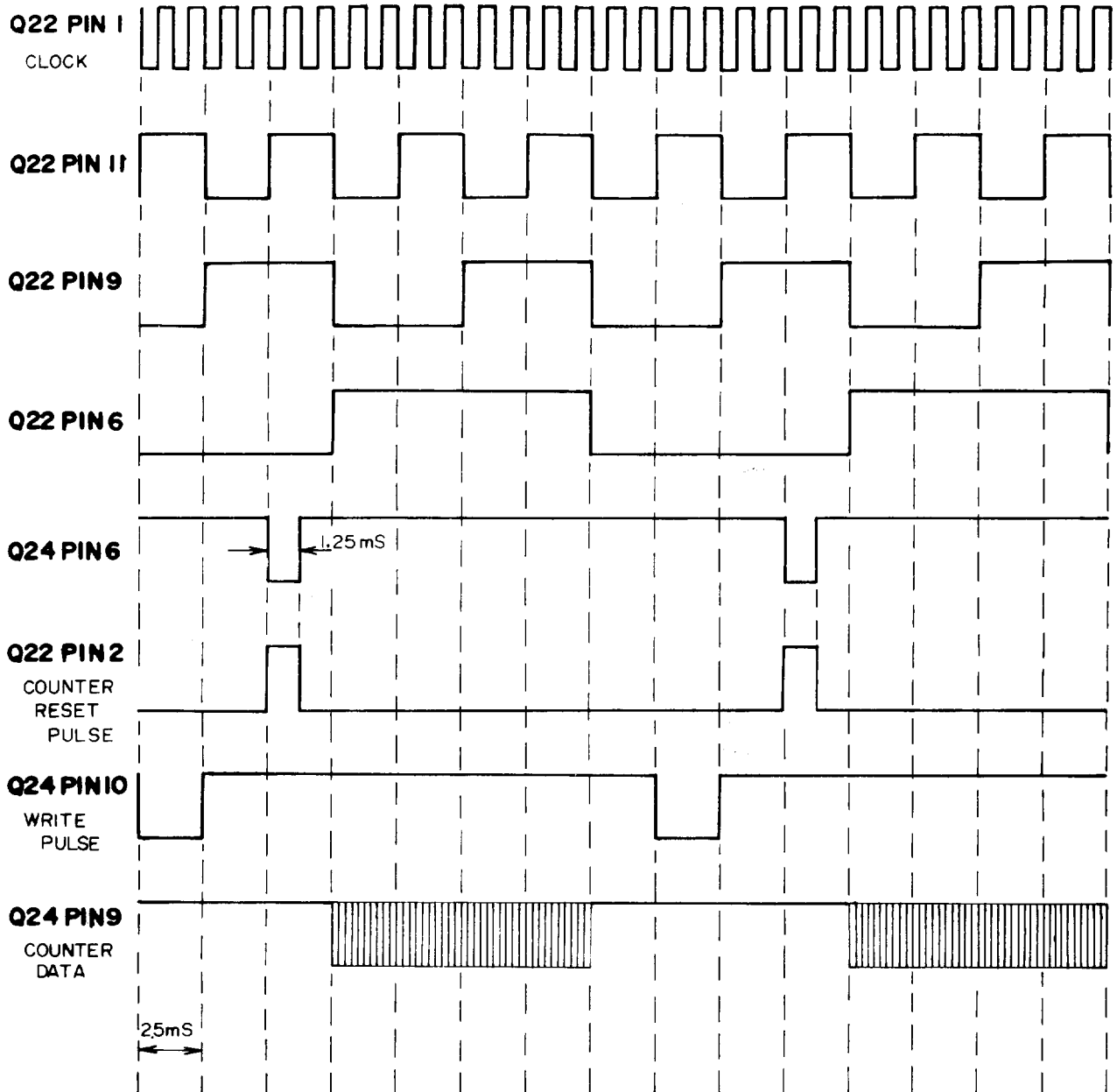




NOTE 1. WHEN MR SWITCH IS PUSHED UNLESS OTHERWISE NOTED.
 2. WHEN MR SWITCH IS RELEASED.
 3. DISPLAY FREQ. IS ... 0.4 MHz AT VFO FREQ. IS 3500 kHz.

FRG-7700 MEMORY UNIT

TIMING CHART



FRG - 7700
MEMORY UNIT

PLL VCO SELECTION

BAND	Q2001	Q2002	Q2004	Q2005	Q2006	Q2007	Q2008	Q2009	Q2010	Q2011
0	-	-	-	-	-	ON	-	-	-	ON
1	-	-	-	-	-	ON	-	-	-	ON
2	-	-	-	-	-	ON	-	-	-	ON
3	-	-	-	-	-	ON	-	-	-	ON
4	-	-	-	-	-	ON	-	-	-	ON
5	-	-	-	-	-	ON	-	-	-	ON
6	ON	-	-	-	ON	-	-	-	ON	-
7	ON	-	-	-	ON	-	-	-	ON	-
8	ON	-	-	-	ON	-	-	-	ON	-
9	ON	-	-	-	ON	-	-	-	ON	-
10	ON	-	-	-	ON	-	-	-	ON	-
11	ON	-	-	-	ON	-	-	-	ON	-
12	ON	-	-	-	ON	-	-	-	ON	-
13	-	ON	-	ON	-	-	-	ON	-	-
14	-	ON	-	ON	-	-	-	ON	-	-
15	-	ON	-	ON	-	-	-	ON	-	-
16	-	ON	-	ON	-	-	-	ON	-	-
17	-	ON	-	ON	-	-	-	ON	-	-
18	-	ON	-	ON	-	-	-	ON	-	-
19	-	ON	-	ON	-	-	-	ON	-	-
20	-	ON	-	ON	-	-	-	ON	-	-
21	ON	ON	ON	-	-	-	ON	-	-	-
22	ON	ON	ON	-	-	-	ON	-	-	-
23	ON	ON	ON	-	-	-	ON	-	-	-
24	ON	ON	ON	-	-	-	ON	-	-	-
25	ON	ON	ON	-	-	-	ON	-	-	-
26	ON	ON	ON	-	-	-	ON	-	-	-
27	ON	ON	ON	-	-	-	ON	-	-	-
28	ON	ON	ON	-	-	-	ON	-	-	-
29	ON	ON	ON	-	-	-	ON	-	-	-
1	-	-	-	-	-	ON	-	-	-	ON
3	-	-	-	-	-	ON	-	-	-	ON
7	ON	-	-	-	ON	-	-	-	ON	-
10	ON	-	-	-	ON	-	-	-	ON	-
14	-	ON	-	ON	-	-	-	ON	-	-
18	-	ON	-	ON	-	-	-	ON	-	-
21	ON	ON	ON	-	-	-	ON	-	-	-
24	ON	ON	ON	-	-	-	ON	-	-	-
28	ON	ON	ON	-	-	-	ON	-	-	-
29	ON	ON	ON	-	-	-	ON	-	-	-

ON - ON
 - - OFF

PLL DIVIDING RATIO

BAND	Q2042 DIVIDING RATIO	Q2042 (MB-8718) PIN No.					
		13	14	15	16	17	18
0	1/4	0	0	1	0	0	0
1	1/5	1	0	1	0	0	0
2	1/6	0	1	1	0	0	0
3	1/7	1	1	1	0	0	0
4	1/8	0	0	0	1	0	0
5	1/9	1	0	0	1	0	0
6	1/10	0	0	0	0	1	0
7	1/11	1	0	0	0	1	0
8	1/12	0	1	0	0	1	0
9	1/13	1	1	0	0	1	0
10	1/14	0	0	1	0	1	0
11	1/15	1	0	1	0	1	0
12	1/16	0	1	1	0	1	0
13	1/17	1	1	1	0	1	0
14	1/18	0	0	0	1	1	0
15	1/19	1	0	0	1	1	0
16	1/20	0	0	0	0	0	1
17	1/21	1	0	0	0	0	1
18	1/22	0	1	0	0	0	1
19	1/23	1	1	0	0	0	1
20	1/24	0	0	1	0	0	1
21	1/25	1	0	1	0	0	1
22	1/26	0	1	1	0	0	1
23	1/27	1	1	1	0	0	1
24	1/28	0	0	0	1	0	1
25	1/29	1	0	0	1	0	1
26	1/30	0	0	0	0	1	1
27	1/31	1	0	0	0	1	1
28	1/32	0	1	0	0	1	1
29	1/33	1	1	0	0	1	1
1	1/5	1	0	1	0	0	0
3	1/7	1	1	1	0	0	0
7	1/11	1	0	0	0	1	0
10	1/14	0	0	1	0	1	0
14	1/18	0	0	0	1	1	0
18	1/22	0	1	0	0	0	1
21	1/26	1	0	1	0	0	1
24	1/28	0	0	0	1	0	1
28	1/32	0	1	0	0	1	1
29	1/33	1	1	0	0	1	1

1 - HI LEVEL
0 - LOW LEVEL

MAIN UNIT BPF SELECTION

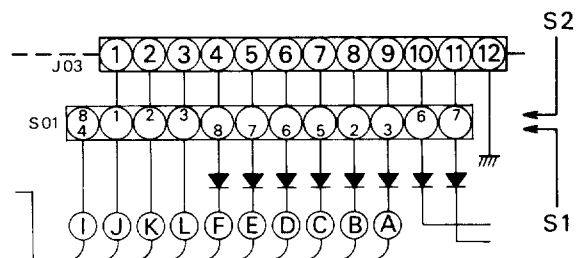
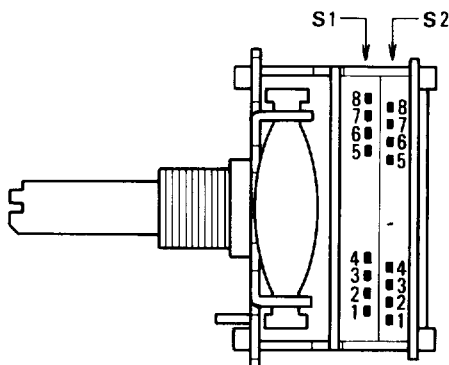
BAND	J1005 PIN No.			Q1007	Q1008	Q1009	Q1010	Q1011	Q1012
	2	3	4						
0	0	0	0	-	-	-	-	-	ON
1	1	0	0	-	-	-	-	ON	-
2	0	1	0	-	-	-	ON	-	-
3	0	1	0	-	-	-	ON	-	-
4	1	1	0	-	-	ON	-	-	-
5	1	1	0	-	-	ON	-	-	-
6	1	1	0	-	-	ON	-	-	-
7	1	1	0	-	-	ON	-	-	-
8	0	0	1	-	ON	-	-	-	-
9	0	0	1	-	ON	-	-	-	-
10	0	0	1	-	ON	-	-	-	-
11	0	0	1	-	ON	-	-	-	-
12	0	0	1	-	ON	-	-	-	-
13	0	0	1	-	ON	-	-	-	-
14	0	0	1	-	ON	-	-	-	-
15	0	0	1	-	ON	-	-	-	-
16	0	1	1	ON	-	-	-	-	-
17	0	1	1	ON	-	-	-	-	-
18	0	1	1	ON	-	-	-	-	-
19	0	1	1	ON	-	-	-	-	-
20	0	1	1	ON	-	-	-	-	-
21	0	1	1	ON	-	-	-	-	-
22	0	1	1	ON	-	-	-	-	-
23	0	1	1	ON	-	-	-	-	-
24	0	1	1	ON	-	-	-	-	-
25	0	1	1	ON	-	-	-	-	-
26	0	1	1	ON	-	-	-	-	-
27	0	1	1	ON	-	-	-	-	-
28	0	1	1	ON	-	-	-	-	-
29	0	1	1	ON	-	-	-	-	-
1	1	0	0	-	-	-	ON	-	-
3	0	1	0	-	-	-	ON	-	-
7	1	1	0	-	-	ON	-	-	-
10	0	0	1	-	ON	-	-	-	-
14	0	0	1	-	ON	-	-	-	-
18	0	1	1	ON	-	-	-	-	-
21	0	1	1	ON	-	-	-	-	-
24	0	1	1	ON	-	-	-	-	-
28	0	1	1	ON	-	-	-	-	-
29	0	1	1	ON	-	-	-	-	-

1 - HI LEVEL ON - ON
 0 - LOW LEVEL - - OFF

BAND SWITCH CONTACT POSITION

BAND	BAND SWITCH (S2001)										
	S1						S2				
	PIN No. (common No. 4)						PIN No. (common No. 8)				
	8	7	6	5	2	3	1	2	3	6	7
0	-	-	ON	-	-	-	-	-	-	-	-
1	ON	-	ON	-	-	-	ON	-	-	-	-
2	-	ON	ON	-	-	-	-	ON	-	-	-
3	ON	ON	ON	-	-	-	-	ON	-	-	-
4	-	-	-	ON	-	-	ON	ON	-	-	-
5	ON	-	-	ON	-	-	ON	ON	-	-	-
6	-	-	-	-	ON	-	ON	ON	-	ON	-
7	ON	-	-	-	ON	-	ON	ON	-	ON	-
8	-	ON	-	-	ON	-	-	-	ON	ON	-
9	ON	ON	-	-	ON	-	-	-	ON	ON	-
10	-	-	ON	-	ON	-	-	-	ON	ON	-
11	ON	-	ON	-	ON	-	-	-	ON	ON	-
12	-	ON	ON	-	ON	-	-	-	ON	ON	-
13	ON	ON	ON	-	ON	-	-	-	ON	-	ON
14	-	-	-	ON	ON	-	-	-	ON	-	ON
15	ON	-	-	ON	ON	-	-	ON	ON	-	ON
16	-	-	-	-	-	ON	-	ON	ON	-	ON
17	ON	-	-	-	-	ON	-	ON	ON	-	ON
18	-	ON	-	-	-	ON	-	ON	ON	-	ON
19	ON	ON	-	-	-	ON	-	ON	ON	-	ON
20	-	-	ON	-	-	ON	-	ON	ON	-	ON
21	ON	-	ON	-	-	ON	-	ON	ON	ON	ON
22	-	ON	ON	-	-	ON	-	ON	ON	ON	ON
23	ON	ON	ON	-	-	ON	-	ON	ON	ON	ON
24	-	-	-	ON	-	ON	-	ON	ON	ON	ON
25	ON	-	-	ON	-	ON	-	ON	ON	ON	ON
26	-	-	-	-	ON	ON	-	ON	ON	ON	ON
27	ON	-	-	-	ON	ON	-	ON	ON	ON	ON
28	-	ON	-	-	ON	ON	-	ON	ON	ON	ON
29	ON	ON	-	-	ON	ON	-	ON	ON	ON	ON
1	ON	-	ON	-	-	-	ON	-	-	-	-
3	ON	ON	ON	-	-	-	-	ON	-	-	-
7	ON	-	-	-	ON	-	ON	ON	-	ON	-
10	-	-	ON	-	ON	-	-	-	ON	ON	-
14	-	-	-	ON	ON	-	-	-	ON	-	ON
18	-	ON	-	-	-	ON	-	ON	ON	-	ON
21	ON	-	ON	-	-	ON	-	ON	ON	ON	ON
24	-	-	-	ON	-	ON	-	ON	ON	ON	ON
28	-	ON	-	-	ON	ON	-	ON	ON	ON	ON
29	ON	ON	-	-	ON	ON	-	ON	ON	ON	ON

ON - ON
 - - OFF



SERVICING

SOLDERING AND DESOLDERING TECHNIQUE ON PRINTED CIRCUIT BOARDS

The FRG-7700 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.

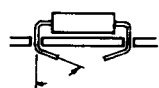
In storage, use only a non-inductive sponge.

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 potential 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

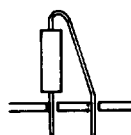
All of the below are acceptable ways of inserting components into circuit board mounting holes.



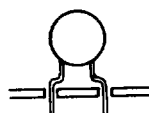
(a) Bend leads slightly



(b) Straight-in mounting



(c) Vertical mounting



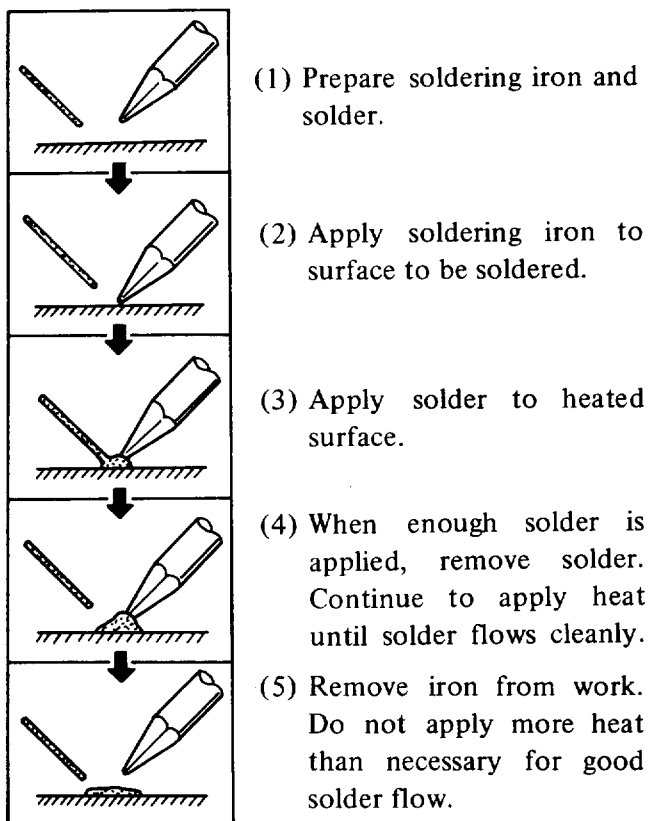
(d) Preformed disc ceramic capacitor



(e) Preformed resistor, diode, etc.

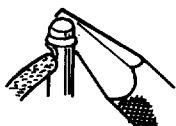
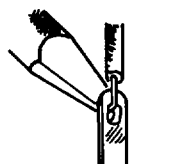
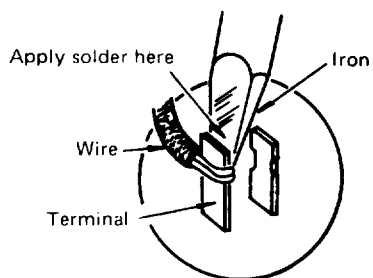
BASIC SOLDERING PRACTICE

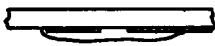
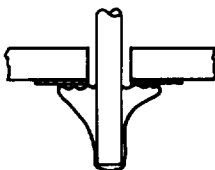
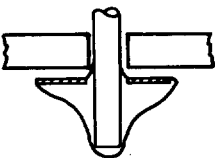
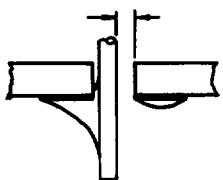
EXAMPLES OF POOR SOLDERING PRACTICE



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> 

(3) First and Second IF Adjustment

Set the MODE switch to LSB/CW, the ATT switch to DX, and rotate the ATT control fully counterclockwise. Connect a signal generator to the antenna jack, J₁, and set its frequency to 8.01 MHz. Tune the receiver to 8.01 MHz, set the signal generator output to a level sufficient to obtain deflection of the S-meter, and adjust T₁₀₀₄ - T₁₀₀₈ and T₁₀₁₁ - T₁₀₁₄ for maximum S-meter reading.

(4) S-Meter Sensitivity and Full Scale Adjustment

- a. Preset the controls, switches, and dial frequency as in step 3. Set the signal generator output level to 8 dB (ref: 0 dB = 1μV). Adjust VR₁₀₀₂ so that the S-meter just begins to move off the left-hand peg on its scale.
- b. Set the signal generator output level to 90 dB.

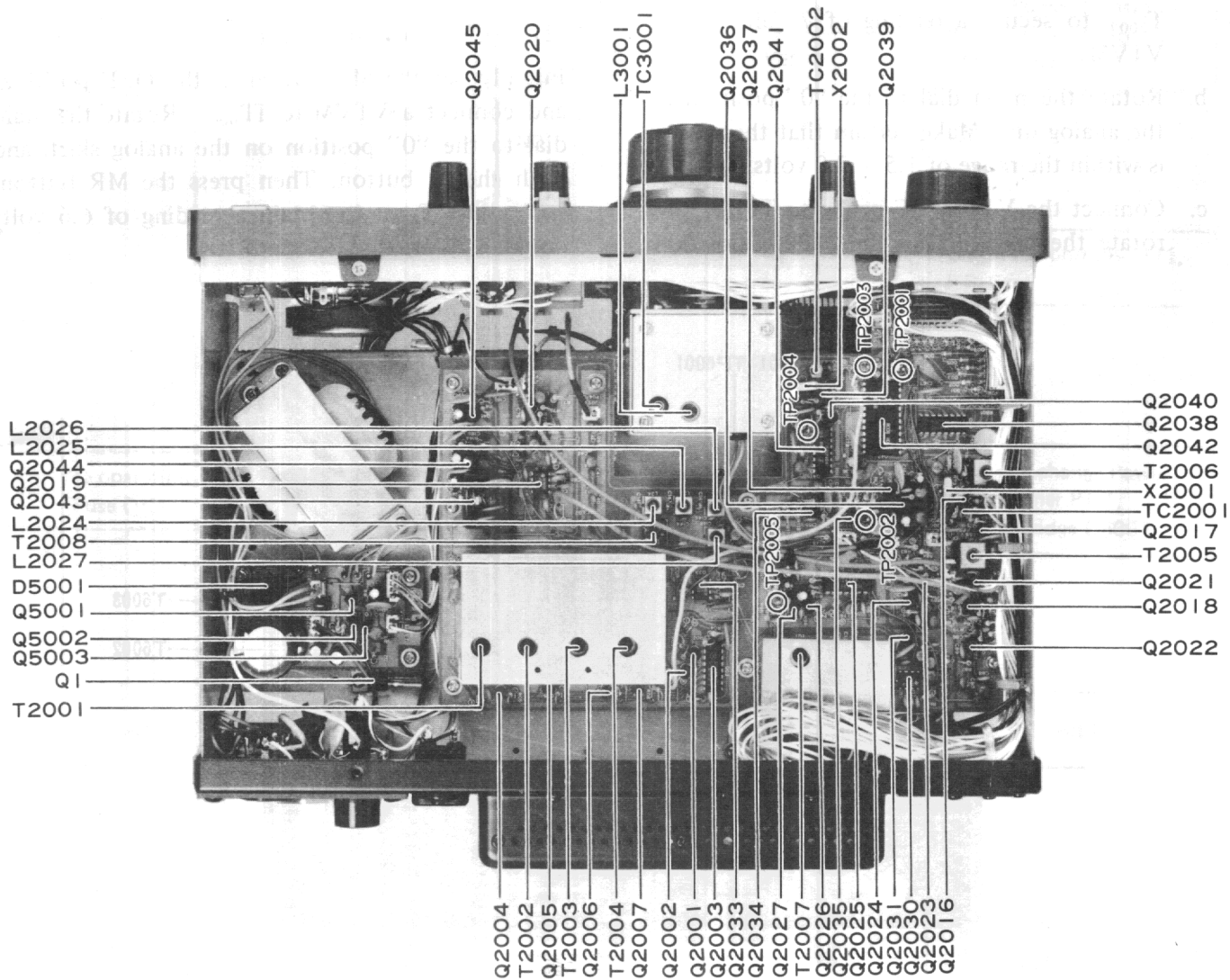
Adjust VR₁₀₀₄ for a full scale reading on the S-meter.

(5) NB Adjustment

- a. Connect a VTVM to the source of Q₁₀₃₇, and a signal generator to antenna jack J₁. Set the signal generator output level to 20 dB, output frequency to 8.01 MHz, and adjust T₁₀₁₅ - T₁₀₁₇ for a minimum reading on the VTVM.
- b. Connect a noise generator to antenna jack J₁, and press the NB switch. Adjust VR₁₀₀₁ for a minimum noise level from the speaker.

(6) Trap Adjustment

Connect a signal generator to antenna jack J₁, and set its frequency to the first IF frequency, 48.055 MHz. Set the signal generator output level to a level sufficient to obtain deflection on the S-meter, then T₁₀₀₂ for a minimum reading on the S-meter.



BOTTOM VIEW

SERVICING

PLL UNIT

(1) PLL Reference Oscillator Adjustment

Set the MR switch to off, and connect a frequency counter to pin 9 of Q₂₀₄₁. Adjust TC₂₀₀₂ for a reading of exactly 3.2 MHz on the counter.

(2) PLL Local Alignment

- a. Connect the RF probe of a VTVM to pin 1 of J₂₀₀₅. Adjust T₂₀₀₅ and T₂₀₀₆ for a maximum meter reading on the VTVM (typical value: 100-200 mV RMS).
- b. Connect a frequency counter to pin 1 of J₂₀₀₅. Adjust TC₂₀₀₁ for a reading of exactly 47.6 MHz on the counter.

(3) VCV Line Adjustment

- a. Connect the DC probe of a VTVM to TP₂₀₀₅ (PLL Unit), and rotate the main dial to the "1000" position on the analog dial. Adjust T₂₀₀₇ to secure a reading of 7 volts on the VTVM.
- b. Rotate the main dial to the "0" position on the analog dial. Make certain that the voltage is within the range of 1.5 – 2.0 volts.
- c. Connect the VTVM DC probe to TP₂₀₀₃, and rotate the main dial to the "1000" position.

Set the BAND switch to the 5 MHz band, and adjust T₂₀₀₄ to obtain a reading of 7.4 volts on the VTVM.

- d. Change the BAND switch to the 12, 20, and 29 MHz band positions, and adjust VCO coils T₂₀₀₃, T₂₀₀₂, T₂₀₀₁, respectively, to obtain readings of 7.4 volts on the VTVM.
- e. Set the BAND switch to the 21, 13 and 0 MHz band positions, and rotate the main dial to the "0" position on the analog dial. Make certain that the voltages at TP₂₀₀₃ are within the range of 1.5 – 2.0 volts.

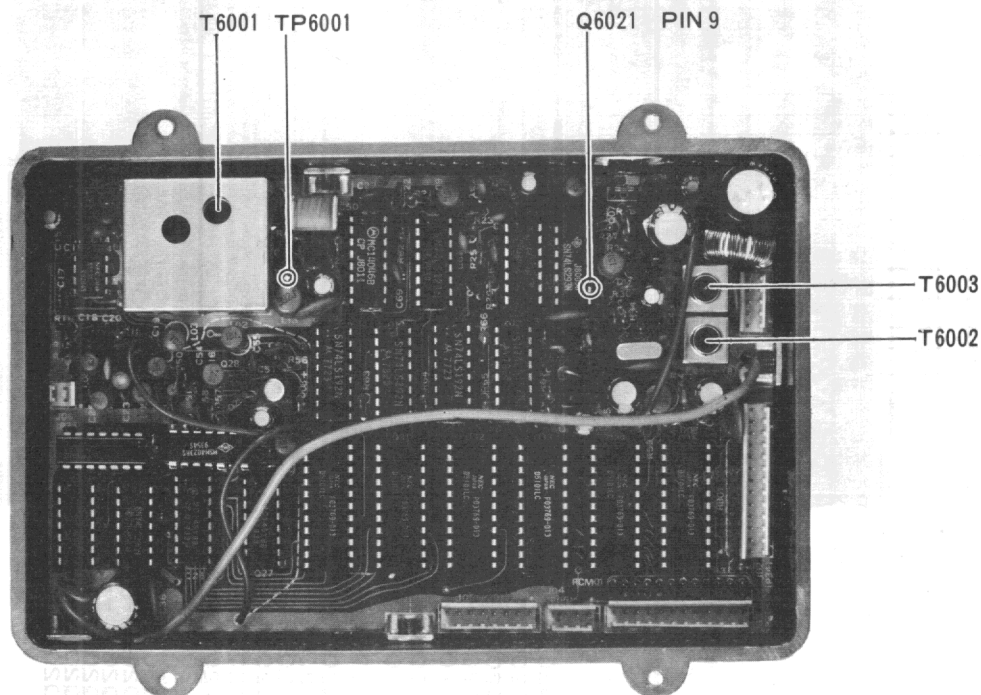
MEMORY UNIT

(1) M FINE Adjustment

Set the M FINE control to the 12 o'clock position, and connect a frequency counter to pin 9 of Q₆₀₂₁. Adjust T₆₀₀₃ for a reading of 8.192 MHz on the counter.

(2) VCV Line Adjustment

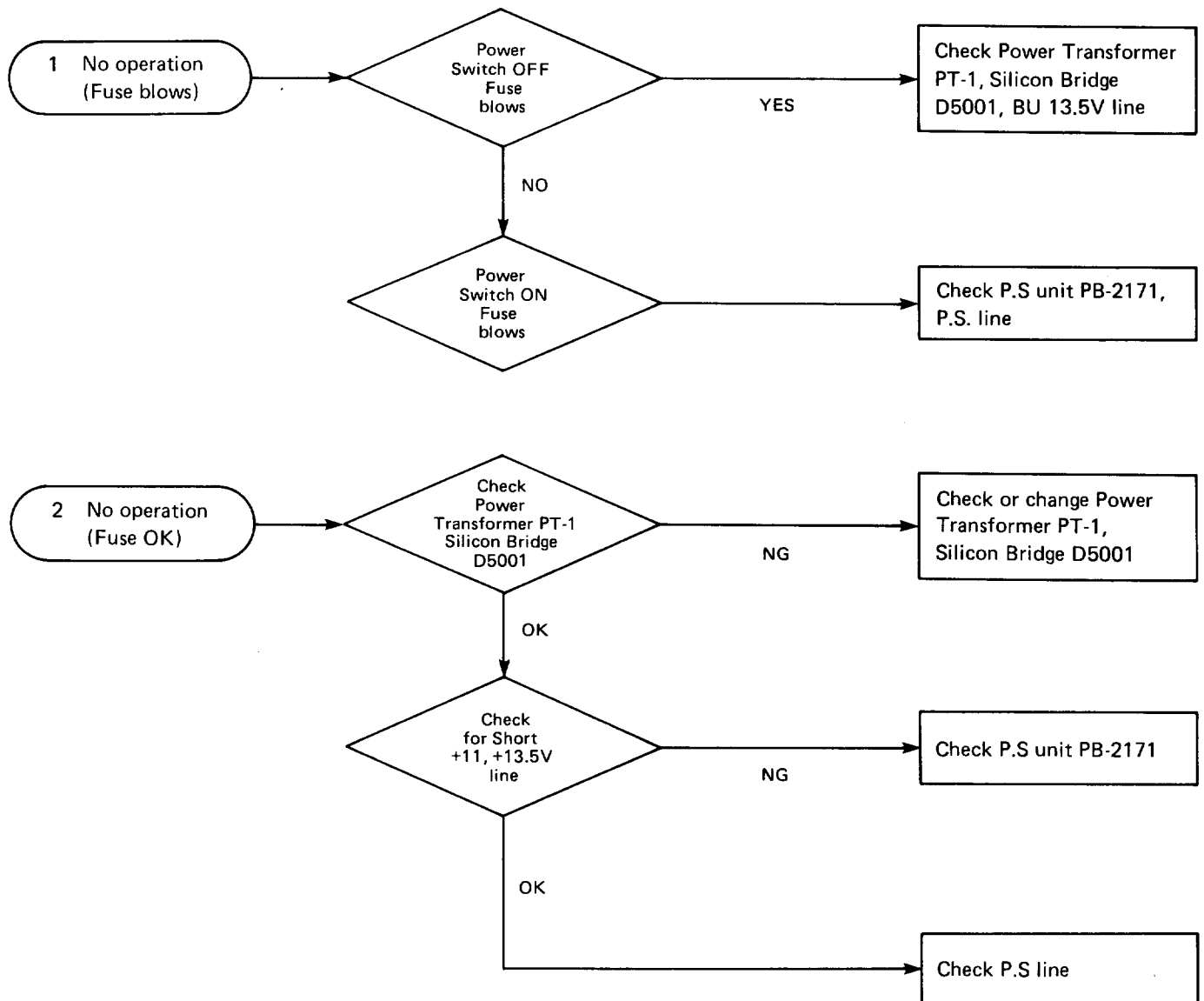
Initially set the MR switch in the OFF position, and connect a VTVM to TP₆₀₀₁. Rotate the main dial to the "0" position on the analog skirt, and push the M button. Then press the MR button, and adjust T₆₀₀₁ to obtain a reading of 6.6 volts on the VTVM.



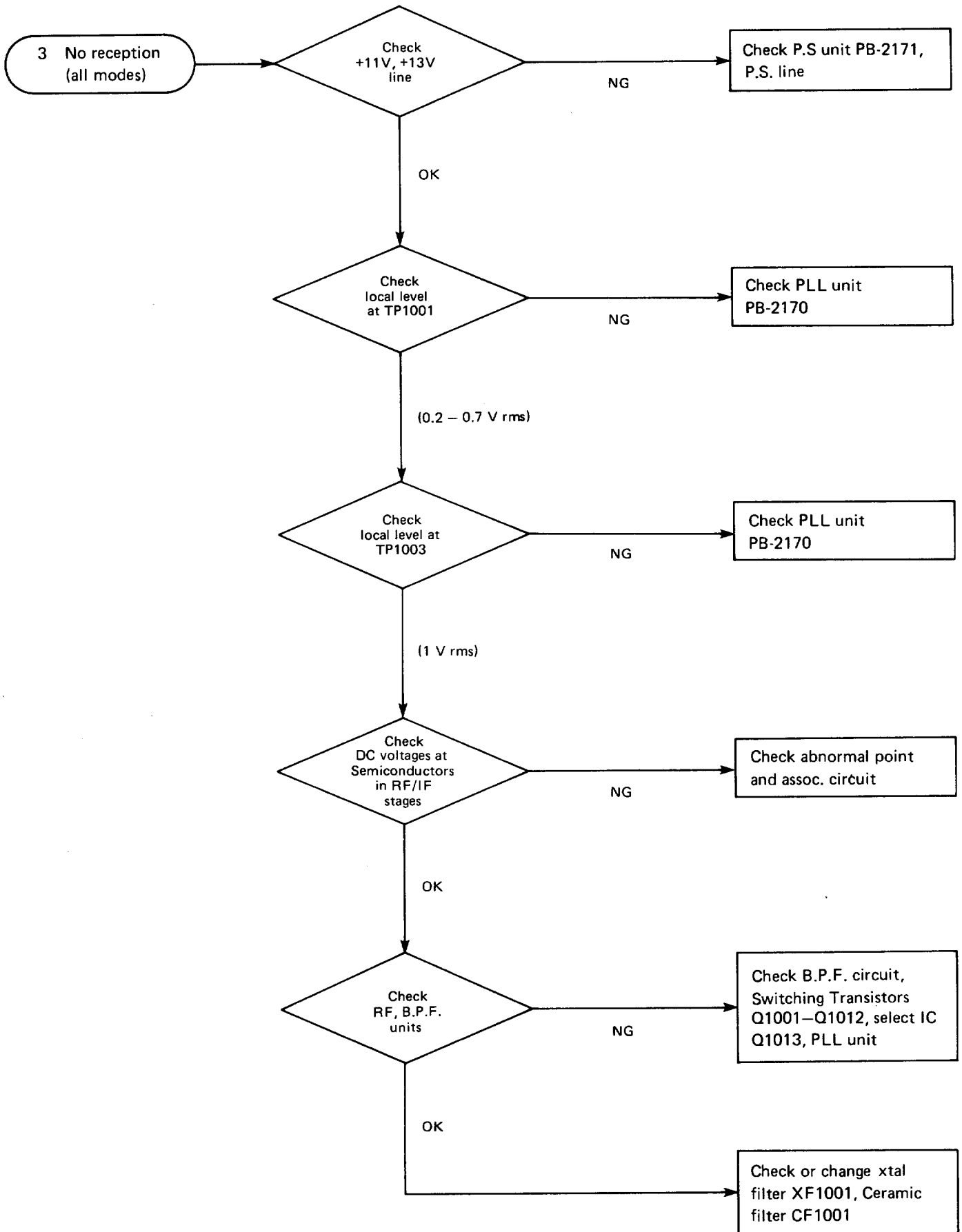
MEMORY UNIT

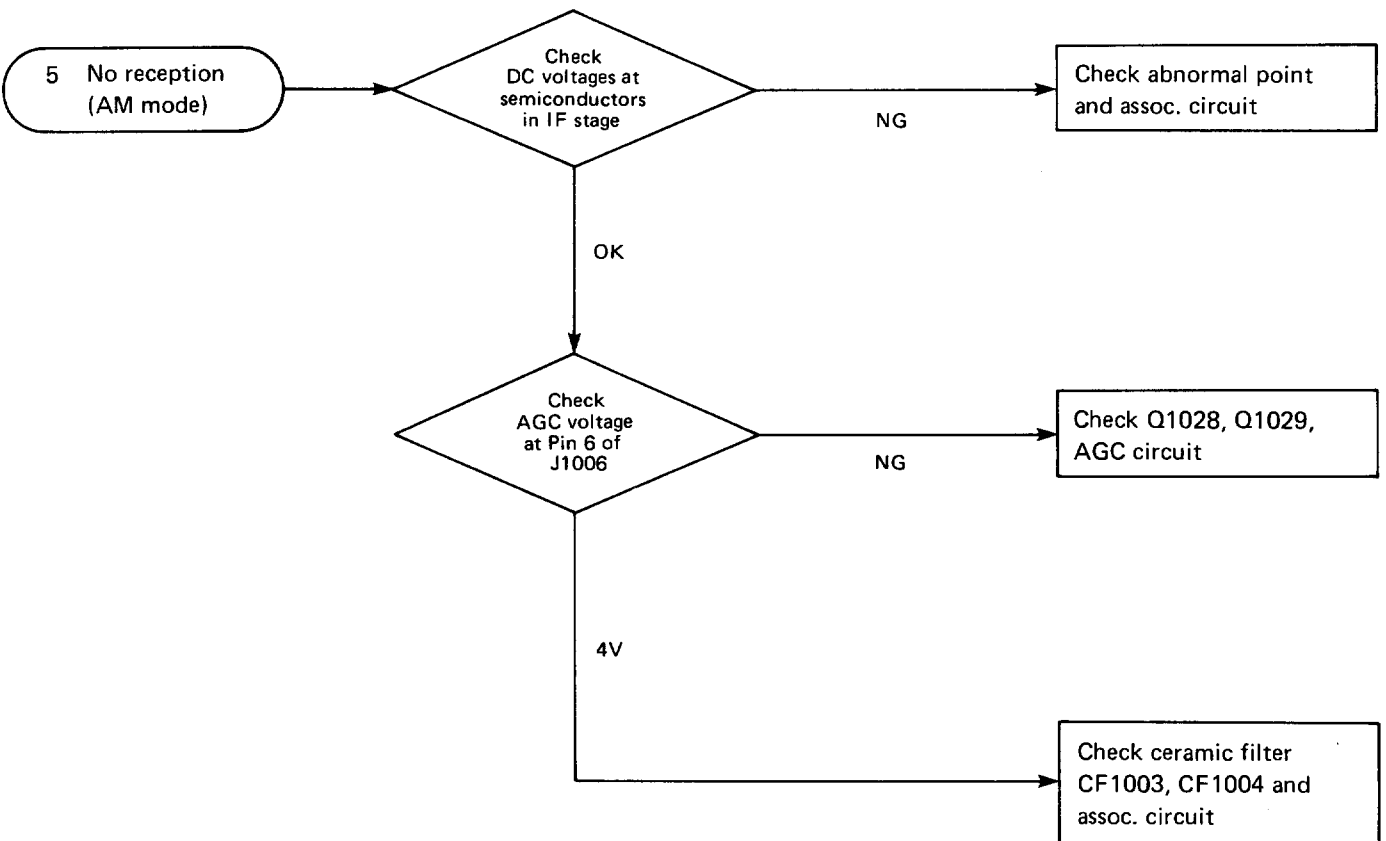
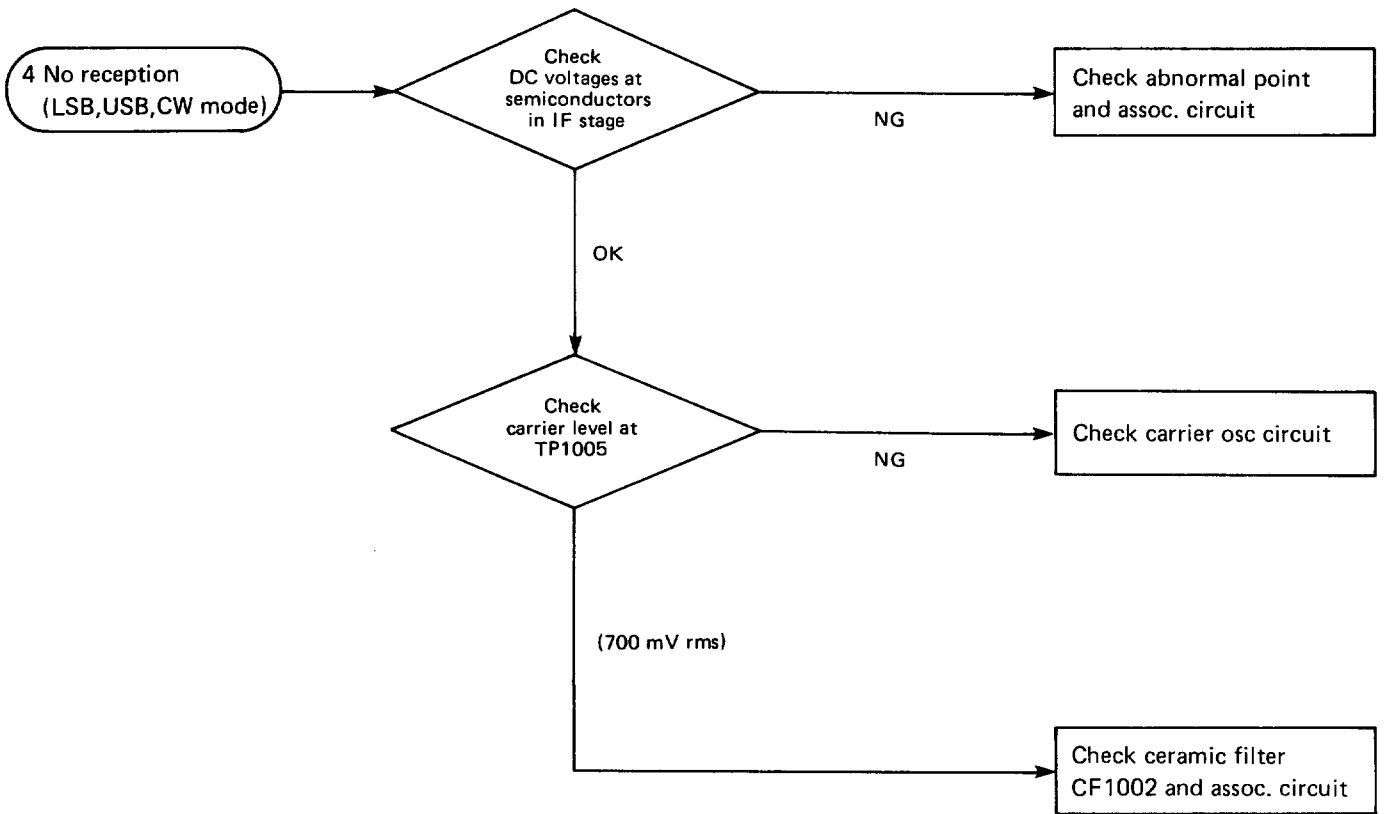
TROUBLESHOOTING

- (1) No operation (Fuse blows)
- (2) No operation (Fuse OK)
- (3) No reception (all mode)
- (4) No reception (USB, LSB, CW mode)
- (5) No reception (AM mode)
- (6) No reception (FM mode)
- (7) No audio output
- (8) Tone control not operative
- (9) Squelch circuit not operative
- (10) Noise Blanker not operative
- (11) AGC switch not operative (SSB, CW, FM mode)
- (12) AGC switch not operative (AM mode)
- (13) ATT circuit not operative

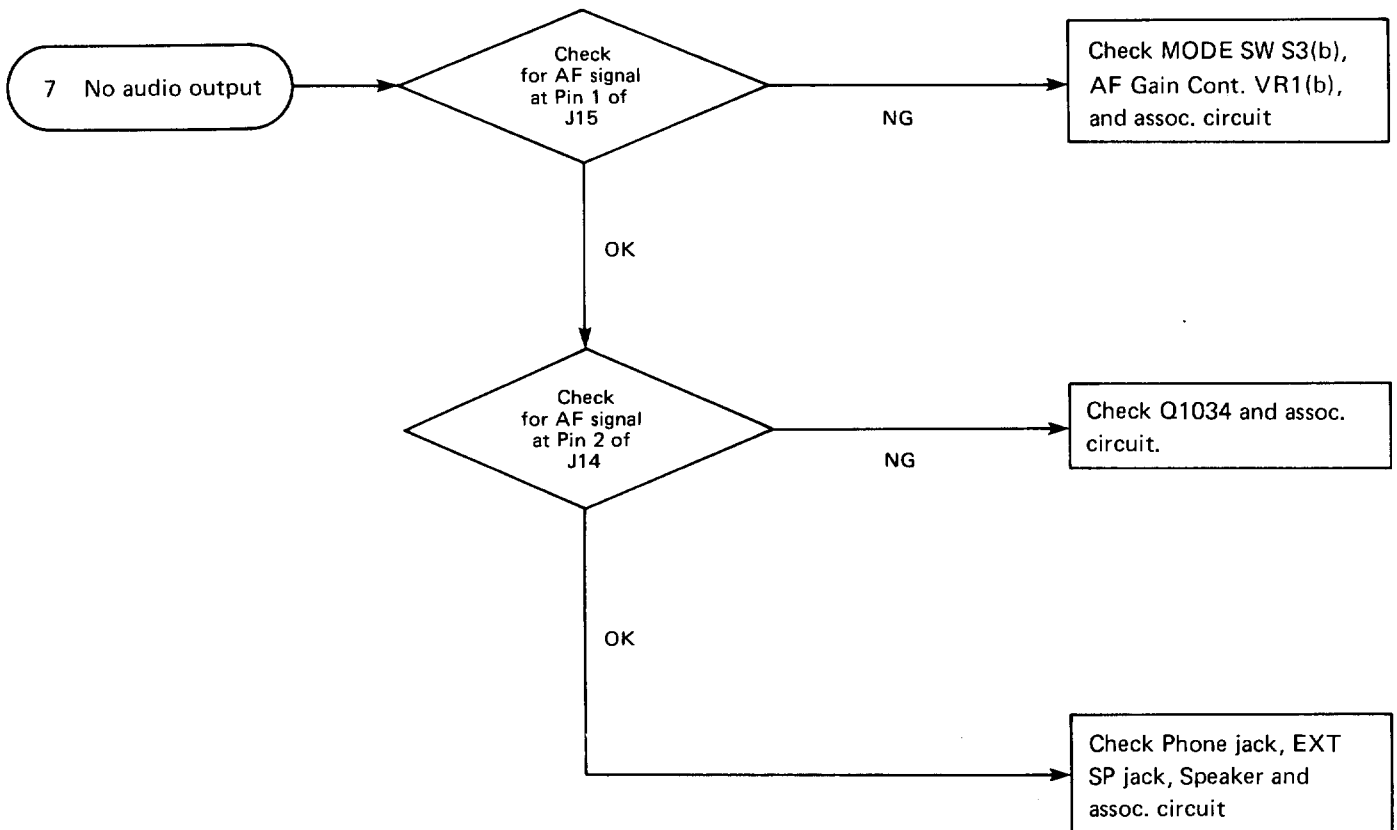
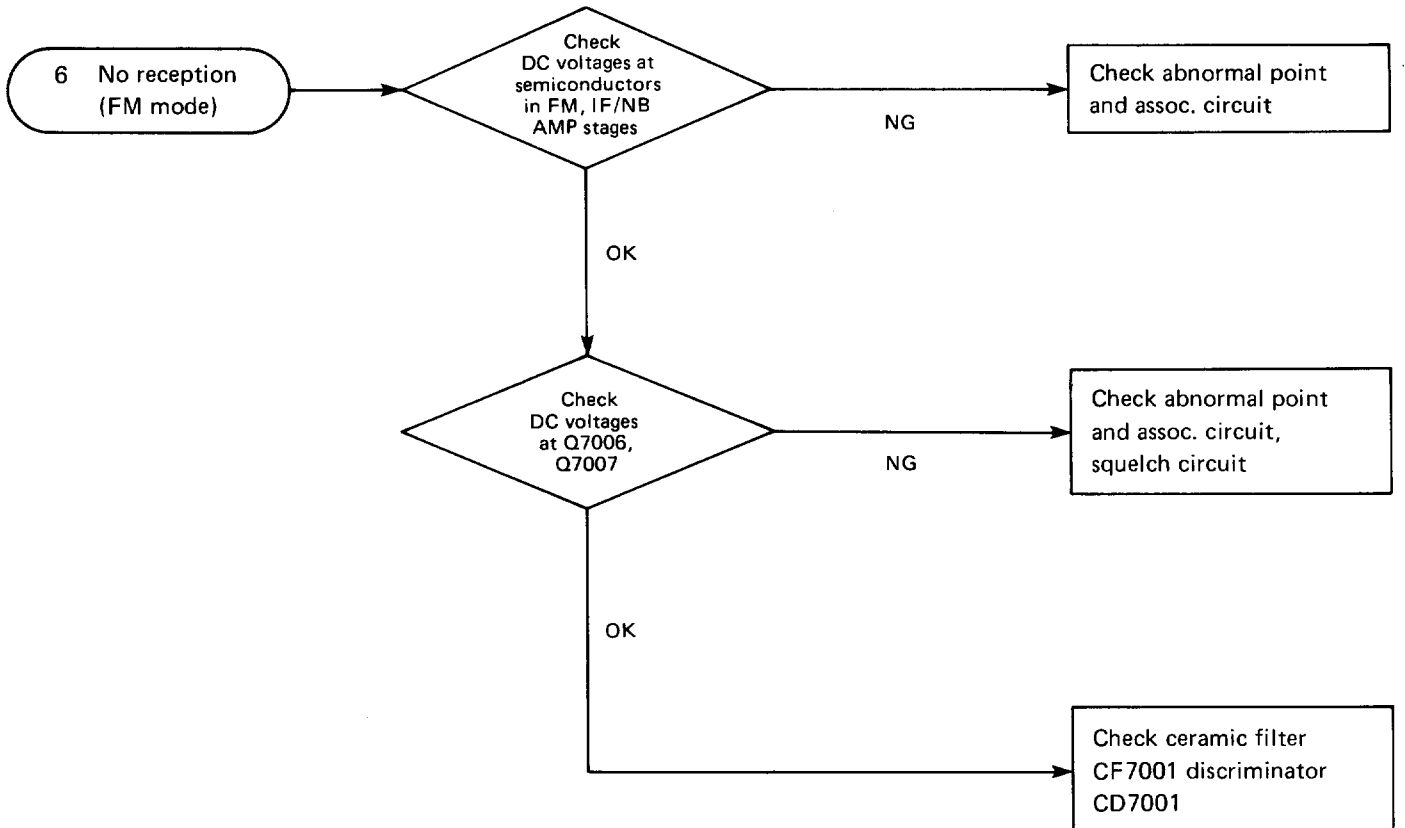


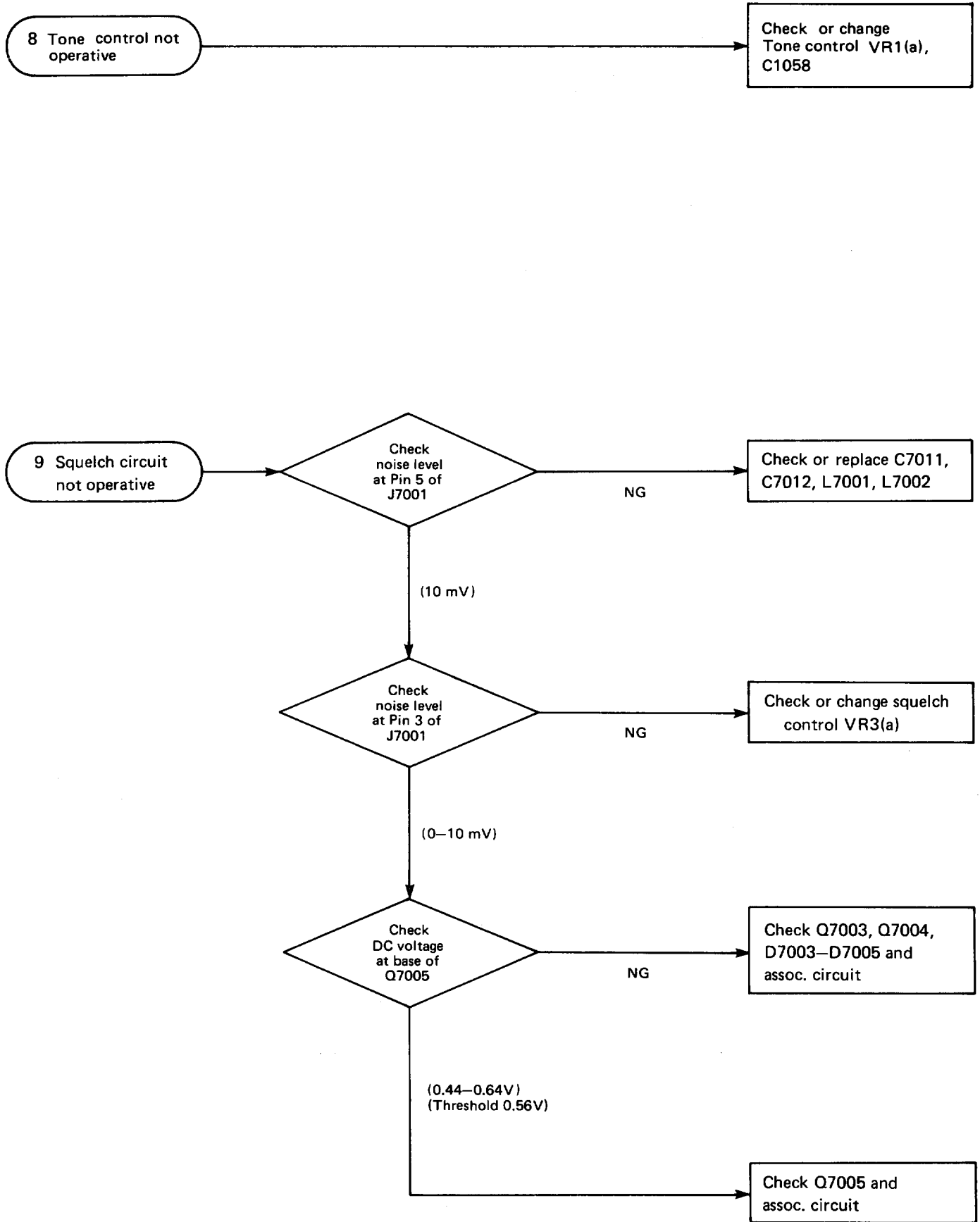
SERVICING



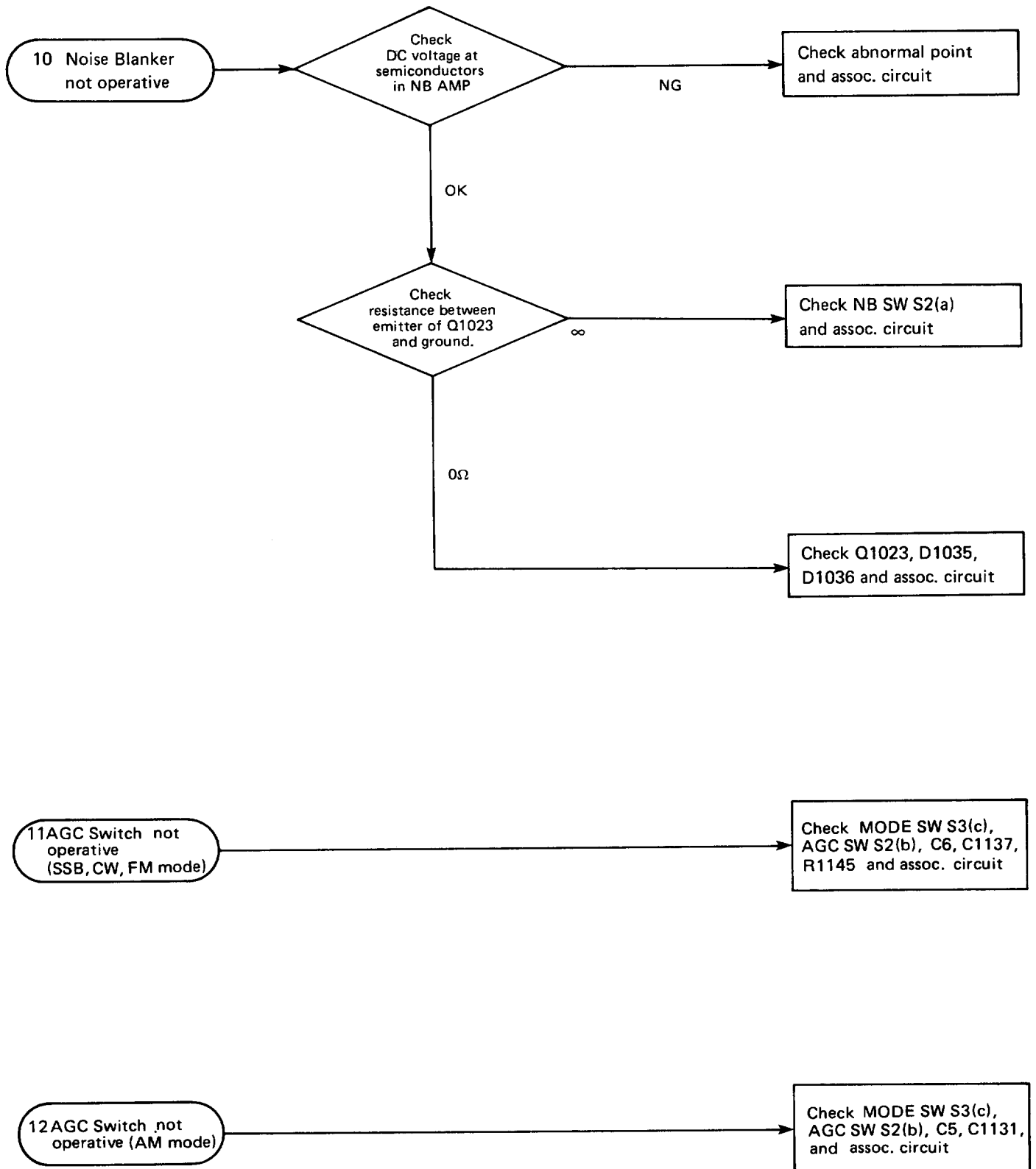


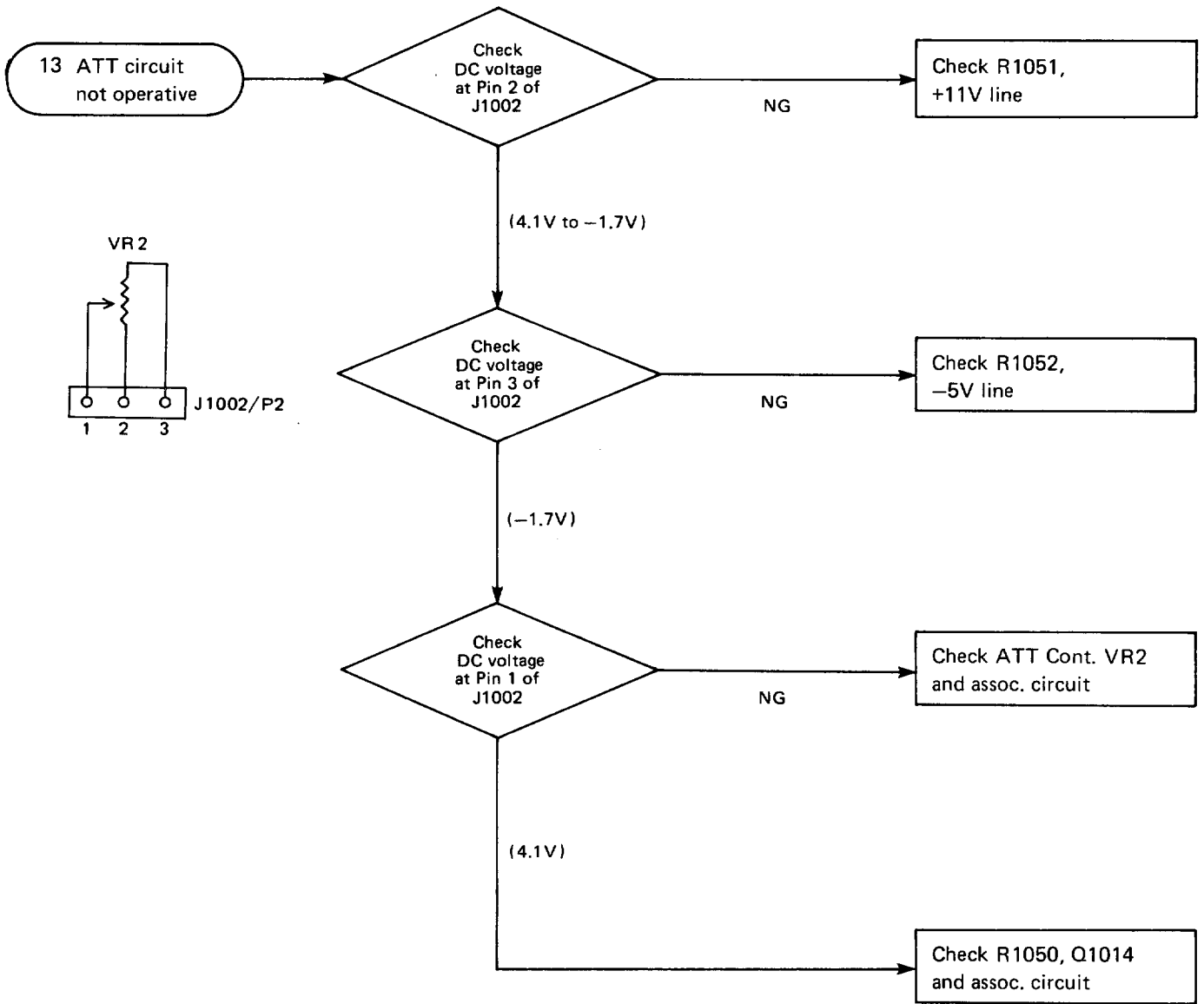
SERVICING

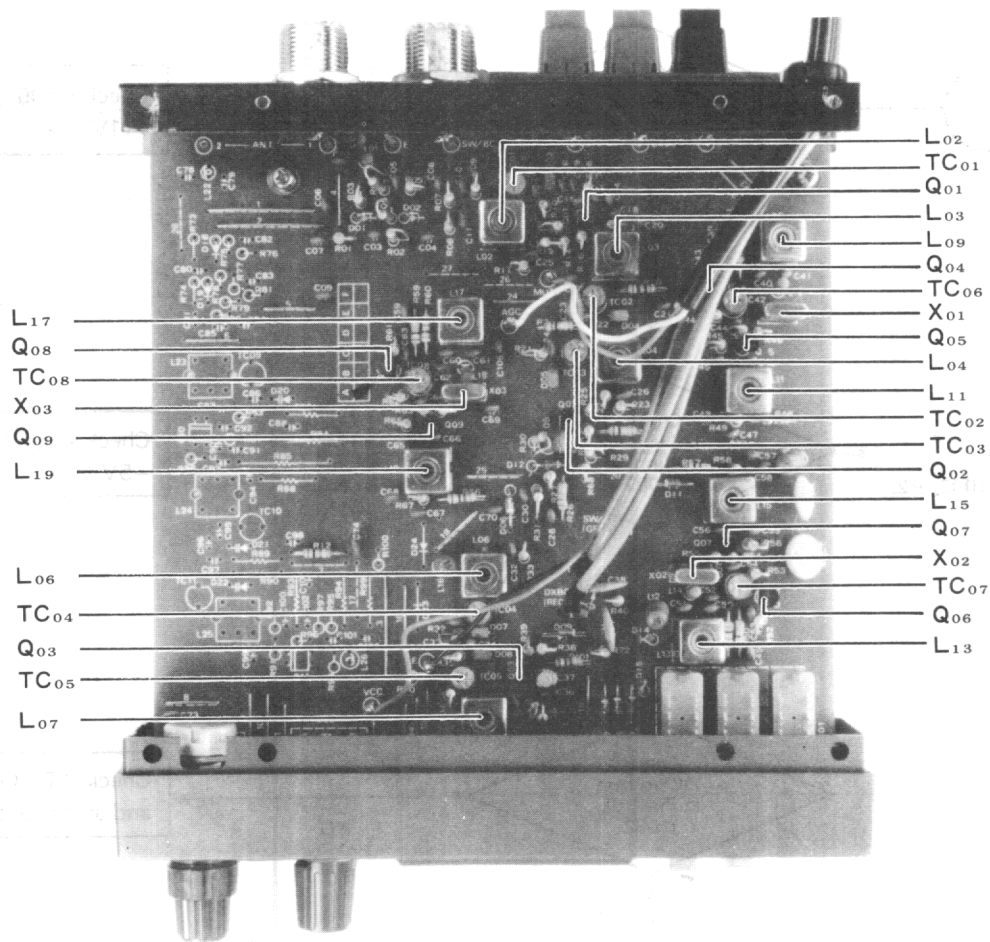




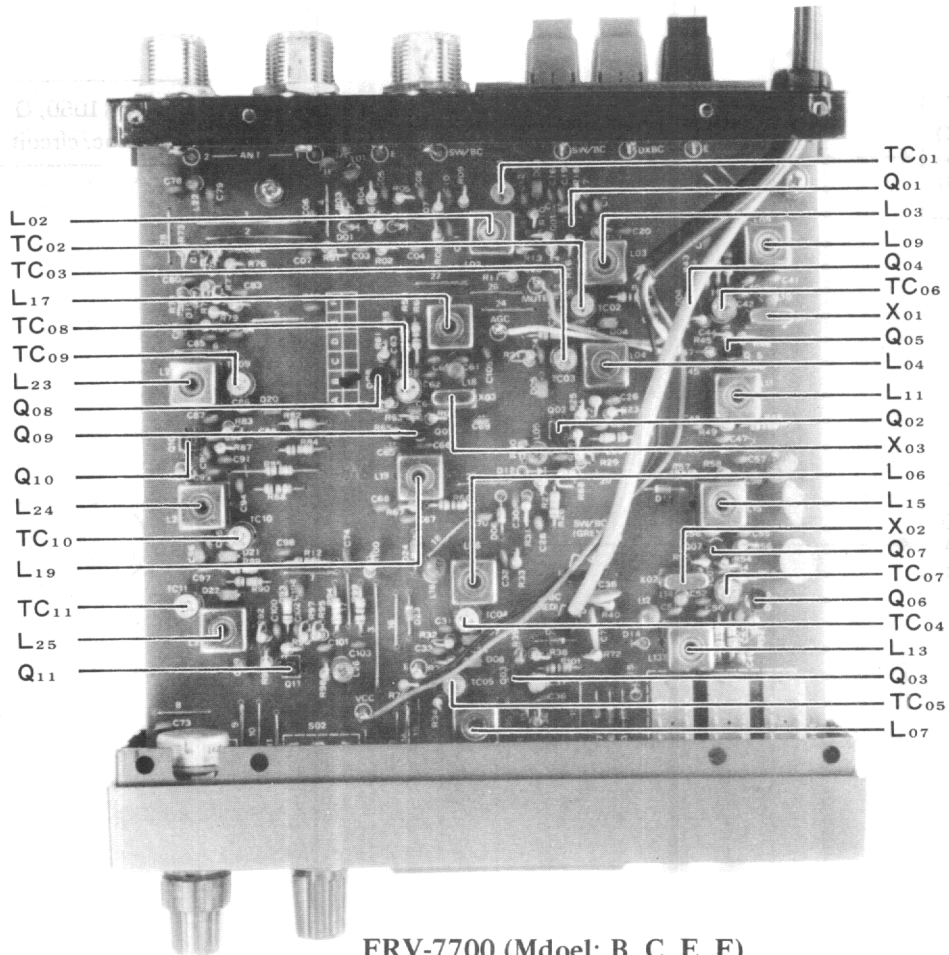
SERVICING







FRV-7700 (Model: A, C)



FRV-7700 (Model: B, C, E, F)

SECTION 4—REPAIR PARTS

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

PARTS LIST AND ORDERING FORMS

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.

PARTS ORDER EXAMPLE

QUANTITY	RECEIVER IDENTIFICATION	LOCATION	*PART NUMBER	CIRCUIT DESIGNATION
1	FRG-7700.	PB-2169	G3801250	Q ₁₀₁₅ (2SK125)

.....
(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	RECEIVER 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: _____

YAESU MUSEN COMPANY, LTD. - C.P.O. BOX 1500, TOKYO, JAPAN
YAESU ELECTRONICS CORPORATION - 6851 Walthall Way, Paramount, CA 90723
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(cut here)

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QUANTITY	RECEIVER 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

MAIN CHASSIS						PLUG	
Symbol No.	Part No.	Description					
	F0002174	Printed Circuit Board		P3,4,9-11,18,19, 21,26,32,33,35, 37,38,40	P1090187	PI051-02F	
		TRANSISTOR		P2,14,22,39	P1090188	PI051-03F	
Q1	G3402880K	2SD288K		P1,5,6,12,20,25	P1090153	PI051-04F	
				P7,8,13,15,16	P1090154	PI051-05F	
		DIODE		P17,24	P1090156	PI051-07F	
D1	G2090147	LED	TLG208	P23,27-29	P1090157	PI051-08F	
D2	G2090151		TLY208	P30,31	P1090161	PI051-12F	
				P34	P1090162	PI051-13F	
		RESISTOR			P2000018	BATTERY SOCKET S1(006P)	
R3	J01245470	Carbon film	1/4W TJ 47Ω		Q9000096	BATTERY CASE C4	
R1	J01245680	" "	" " 68Ω				
R4	J00245102	" "	" VJ 1kΩ				
R5	J00245103	" "	" " 10kΩ				
R2	J00245223	" "	" " 22kΩ				
		POTENTIOMETER					
VR1	J62800049	DM10A638A-10kB-10kA				TRANSISTOR, FET & IC	
VR2	J60800071	VM10A610E-10kC		Q1001-1006,1035, 1052-1056	G3107331Q	TR	2SA733A-Q
VR3	J62800050	DM10A638A-10kBX2		Q1007-1012,1021, 1022,1026-1033, 1038-1041,1043, 1047-1051,1057, 1058,1060-1062	G3309451Q	"	2SC945A-Q
		CAPACITOR					
C1,2	K12329002	ECKDAL472PE	150VAC 0.0047μF	Q1059	G3313840R	"	2SC1384R
C3,4	K13170473	DB207YF473Z5L5	50WV 0.047μF	Q1042	G3316740L	"	2SC1674L
C5	K40170105	50RL	" 1μF	Q1023	G3090005	"	MPS-A13
C6	K40140475	25RL4R7	25WV 4.7μF	Q1015-1018	G3801250	FET	2SK125
		POWER TRANSFORMER		Q1014,1019,1020, 1024,1025,1036, 1037			3 SK 73 SR
PT1	L3030085			Q1034	G1090073	IC	μPC575C2
		METER		Q1045	G1090084	"	μPC78L05A
M1	M0290021	AP-170		Q1044	G1090033	"	SN74LS196
				Q1046	G1090310	"	MSM5524
		SPEAKER		Q1013	G1090309	"	MC14555BCP
SP1	M4090044	SE92BYM-2	8Ω 2W				
		LAMP				DIODE	
PL1	Q1000045	12V 150mA	K0298-4-0	D1001-1027,1035, 1036,1041-1044, 1047-1052, 1054-1056	G2090027	Si	1SS53
		SWITCH					
S1	N4090037	SUF-12	POWER	D1034	G2090001	Si	10D1
S2	N4090038	SUF-24	AGC/NB	D1028-1033, 1037-1040,1057	G2090029	Ge	1N60
S3	N0190076	SRN-2046N	MODE			Zener	RD5.6EB-2
S4	N0190074	SRN-1025N	DISP	D1045	G2090156	Zener	RD7.5EB-1
S5	N0190075	SRN-202CN	MEM.CH	D1053	G2090154	Zener	RD10EB-1
		RECEPTACLE		D1046	G2090153	Zener	RD10EB-1
J1	P1090028	MBR-06D				FLUORESCENT TUBE	
J2	P1090004	SG-7814		DS1001	G6090020	FIP5A8B	
J3	P1090201	UK-0002					
J9	P0090094	PA-125				CRYSTAL	
				X1001	H0102336	HC-18/U	3.2768MHz
		TERMINAL BOARD					
	Q9000089	TERMINAL BOARD ASS'Y				CERAMIC OSCILLATOR	
J5a,b,c	P1090205	UG-0015 #2 (RED)		CO1001	H7900090	CSB453.5A2	453.5kHz
J5d	P1090211	UG-0015 #1 (Black)		CO1002	H7900100	CSB456.5A2	456.5kHz
J7	P1090201	UK-0002					
J8	P1090206	UC-0007-02				CRYSTAL FILTER	
S6	N6090020	OS-22-09S		XF1001	H1102023	XF-48JX	48.055MHz
S7	N0190077	JR-1002-06				CERAMIC FILTER	
FH1	P2000019	FH-032-C		CF1001	H3900230	CFU455C2	

REPAIR PARTS

CF1002	H3900040	CFM-455J1	R1219,1229,1254	J00245562	Carbon film	1/4W VJ	5.6kΩ
CF1003	H3900240	CFG455H	R1232,1242,1243	J01245562	" "	" TJ	5.6kΩ
CF1004	H3900220	LF-H12	R1090,1126,1141, 1169,1198	J00245682	" "	" VJ	6.8kΩ
		RESISTOR	R1051	J00245822	" "	" "	8.2kΩ
R1213	J10276339	Carbon composition 1/2W GK 3.3Ω	R1004,1006,1007, 1009,1011,1012, 1015,1018,1021, 1023,1047,1049, 1056,1067,1100, 1104,1108,1112, 1115,1121,1124, 1127,1128,1131, 1140,1153,1157, 1171,1179,1182, 1190,1203,1209, 1210,1212,1230, 1233,1249,1250	J00245103	" "	" "	10kΩ
R1163,1248,1252	J00245100	Carbon film 1/4W VJ 10Ω					
R1055,1066,1071, 1116,1125,1145, 1183,1191,1244, 1245	J00245220	" " " " 22Ω					
R1084	J00245330	" " " " 33Ω					
R1063,1114,1123, 1181,1189	J00245470	" " " " 47Ω					
R1057,1162,1176, 1214	J00245560	" " " " 56Ω	R1048,1111,1187, 1207	J01245103	" "	" TJ	10kΩ
R1058,1062	J00245680	" " " " 68Ω	R1065,1149	J00245123	" "	" VJ	12kΩ
R1064	J00245750	" " " " 75Ω	R1069,1220	J00245153	" "	" "	15kΩ
R1024,1059, 1072-1075,1077, 1079,1082,1090, 1093,1094,1113, 1117,1122,1129, 1133,1135,1139, 1150,1155,1159, 1180,1188,1194, 1197,1201,1216, 1218,1223,1224, 1225,1236	J00245101	" " " " 100Ω	R1177	J00245183	" "	" "	18kΩ
			R1088,1193	J00245223	" "	" "	22kΩ
			R1165,1204,1227	J00245473	" "	" "	47kΩ
			R1118,1160,1184, 1215	J00245683	" "	" "	68kΩ
			R1068,1070,1119, 1120,1134,1138, 1185,1186,1231	J00245104	" "	" "	100kΩ
			R1167,1234	J00245124	" "	" "	120kΩ
R1005,1008,1010, 1013,1014,1016, 1017,1019,1020, 1022,1083,1098, 1102,1106,1132	J01245101	" " " TJ 100Ω	R1166	J00245154	" "	" "	150kΩ
			R1142,1173,1199	J00245224	" "	" "	220kΩ
			R1208	J01245224	" "	" TJ	220kΩ
			R1080,1091,1152, 1156,1172	J00245334	" "	" VJ	330kΩ
R1053	J00245151	" " " VJ 150Ω	R1147	J00245394	" "	" "	390kΩ
R1161,1168,1256	J00245221	" " " " 220Ω	R1043-1045	J00245564	" "	" "	560kΩ
R1086,1087,1221	J00245331	" " " " 330Ω	R1050	J00245225	" "	" "	2.2MΩ
R1130,1195,1247	J00245391	" " " " 390Ω					
R1002,1003,1046, 1060,1061,1076, 1078,1136,1217	J00245471	" " " " 470Ω					
							BLOCK RESISTOR
			RB1001	J40900019	RA1/16K8R-100kΩ	100kΩx8	
R1054,1222	J00245561	" " " " 560Ω	RB1002	J40900020	RA1/16K5R-100kΩ	100kΩx5	
R1109	J00245681	" " " " 680Ω					
R1246	J00245821	" " " " 820Ω					POTENTIOMETER
R1081,1092,1143, 1200,1206,1235, 1253	J00245102	" " " " 1kΩ	VR1003	J51740501	EVNB3AA00B52	500Ω	
			VR1002	J50702202	EVLS0A00B23	2kΩ	
			VR1001	J51721502	EVLS3A00B53	5kΩ	
R1144	J01245102	" " " TJ 1kΩ	VR1004	J51721203	EVLS3A00B24	20kΩ	
R1137	J00245122	" " " VJ 1.2kΩ					
R1095	J00245152	" " " " 1.5kΩ					CAPACITOR
R1089,1148,1151, 1154,1158,1164, 1170,1205	J00245222	" " " " 2.2kΩ	C1213	K00172010	DD104SL010C50V02	50WV SL 1pF	
R1237-1241	J01245222	" " " TJ 2.2kΩ	C1067	K00172030	DD104SL030C50V02	" " 3pF	
R1025,1028,1031, 1034,1037,1040, 1226,1251,1255	J00245332	" " " VJ 3.3kΩ	C1068	K00173070	DD104SL070D50V02	" " 7pF	
			C1010,1012	K00175120	DD104SL120J50V02	" " 12pF	
R1001,1085,1099, 1103,1107,1110, 1202,1228	J00245472	" " " " 4.7kΩ	C1017,1021	K00175180	DD104SL180J50V02	" " 18pF	
R1146	J01245472	" " " TJ 4.7kΩ	C1079	K00175220	DD104SL220J50V02	" " 22pF	
R1052	J01245512	" " " " 5.1kΩ	C1011,1018,1020	K00175270	DD104SL270J50V02	" " 27pF	
R1026,1027,1029, 1030,1032,1033, 1035,1036,1038, 1039,1041,1042, 1097,1101,1105, 1175,1192,1196	J00245562	" " " VJ 5.6kΩ	C1026,1030,1147, 1151	K00175330	DD104SL330J50V02	" " 33pF	

REPAIR PARTS

J1003,1006,1007,1013,1014,1018	P0090120	CONNECTOR PI051-02M		R2048,2050,2053,2055,2061,2063,2067,2070,2072,2075,2076,2080,2081,2088,2098,2102,2107,2108,2114,2115,2120,2130,2135,2140,2145-2147	J00245101	Carbon film	1/4W VJ	100Ω
J1002,1010,1015,1020	P0090121	PI051-03M						
J1001,1004,1008	P0090132	PI051-04M						
J1005,1009,1011	P0090133	PI051-05M						
J1012,1017	P0090135	PI051-07M		R2077	J00245151	" "	" "	150Ω
J1016	P0090136	PI051-08M		R2117	J00245181	" "	" "	180Ω
J1019	P1090196	FJ-10-001		R2062, 2124	J00245221	" "	" "	220Ω
				R2089,2142,2144	J00245331	" "	" "	330Ω
	Q5000011	Wrapping Terminal C		R2041,2049,2054,2066,2071,2082,2095,2109,2116	J00245391	" "	" "	390Ω
				R2013,2020,2027,2034,2104,2136	J00245471	" "	" "	470Ω
				R2094,2122	J00245561	" "	" "	560Ω
PLL UNIT				R2015,2022,2029,2036,2037,2039,2058,2110,2119,2126,2131,2132	J00245102	" "	" "	1kΩ
Symbol No.	Part No.	Description						
	F0002170	Printed Circuit Board						
	C0021700	P.C.B with Components						
				R2091,2137	J00245152	" "	" "	1.5kΩ
		TRANSISTOR, IC		R2005-2008,2038,2073,2096,2118,2125,2134	J00245222	" "	" "	2.2kΩ
Q2004-2007	G3107331Q	TR	2SA733A-Q					
Q2016	G3305351	"	2SC535A					
Q2026,2027	G3309000E	"	2SC900E	R2138,2148,2149	J00245272	" "	" "	2.7kΩ
Q2001,2002,2008-2011,2014,2015,2018,2020-2024,2028,2029,2031,2032,2037,2039,2040	G3309451Q	"	2SC945A-Q	R2060,2092,2093,2097	J00245472	" "	" "	4.7kΩ
				R2011,2018,2025,2032,2046,2069,2079,2103,2105,2112,2129	J00245103	" "	" "	10kΩ
Q2012	G3310473	"	2SC1047C					
Q2044,2045	G3313840R	"	2SC1384R	R2012,2019,2026,2033,2047,2056,2059,2068,2078,2101,2106,2113,2128	J00245223	" "	" "	22kΩ
Q2017,2035	G3313930L	"	2SC1393L					
Q2034	G3316740L	"	2SC1674L					
Q2013	G3319590Y	"	2SC1959Y					
Q2043	G3408820Q	"	2SD882Q	R2002,2004,2057,2086,2087	J00245473	" "	" "	47kΩ
Q2042	G1090153	IC	MB8718					
Q2041	G1090311	"	MB84040B	R2074	J00245683	" "	" "	68kΩ
Q2036	G1090296	"	HD10551	R2001,2003,2009,2010,2016,2017,2023,2024,2030,2031,2051,2065,2090,2099,2100,2111,2133	J00245104	" "	" "	100kΩ
Q2025	G1090087	"	MC4044P					
Q2038	G1090312	"	MC14504BCP					
Q2003	G1090128	"	MC14556BCP					
Q2019,2030,2033	G1090012	"	SN16913P					
				R2127	J00245154	" "	" "	150kΩ
		DIODE						
D2001-2020	G2090027	Si	1SS53			BLOCK RESISTOR		
D2021-2025	G2090043	Varactor	MV-104	RB2001	J40900017	RA1/16-6R1MΩ 1/16W 1MΩx6		
D2027,2028	G2090156	Zener	RD5.6EB2					
D2026	G2090155	Zener	RD9.1EB2					
				C2048,2062	K00179001	CAPACITOR DD104SL0R5C50V02 50WV SL 0.5pF		
		CRYSTAL						
X2001	H0102337	HC-18/U	47.6MHz	C2085,2111,2127	K00172010	DD104SL010C50V02 " " 1pF		
X2002	H0102338	"	6.4MHz					
				C2148	K00172020	DD104SL020C50V02 " " 2pF		
		RESISTOR						
R2139	J10276479	Carbon composition 1/2W TJ 4.7Ω		C2034,2045	K00172030	D104SL030C50V02 " " 3pF		
R2123,2141,2143	J00245100	Carbon film 1/4W VJ 10Ω		C2070,2073,2081,2112,2139	K00172050	DD104SL050C50V02 " " 5pF		
R2083-2085	J00245150	" "	" " 15Ω					
R2040,2043	J00245330	" "	" " 33Ω	C2010,2017,2168	K06172050	DD104UJ050C50V02 " UJ 5pF		
R2044	J00245560	" "	" " 56Ω					
R2121	J00245820	" "	" " 82Ω	C2049,2086	K00173060	DD104SL060D50V02 " SL 6pF		
R2014,2021,2028,2035,2042,2045	J00245101	" "	" " 100Ω					

C2108	K06173060	DD104UJ060D50V02 50WV UJ 6pF	C2163,2166,2167, 2173,2177,2178, 2182,2184,2186, 2188-2192	K13170473	DB207YF473Z5L5 50WV 0.047μF
C2142	K00173080	DD104SL080D50V02 " SL 8pF			
C2105	K06173080	DD104UJ080D50V02 " UJ 8pF	C2101,2102,2183, 2185,2187	K40170105	50RL1 " 1μF.
C2043,2044,2063, 2071,2072	K00173100	DD104SL100D50V02 " SL 10pF	C2180	K40140475	25RL4R7 25WV 4.7μF
C2008,2015,2022, 2028,2106	K06173100	DD104UJ100D50V02 " UJ 10pF	C2103,2110,2159, 2162,2179	K40129004	16RE10 16WV 10μF
C2146	K00175120	DD104SL120J50V02 " SL 12pF	C2012,2019,2025, 2031	K40109002	10RE47 10WV 47μF
C2033,2128,2141	K00175150	DD104SL150J50V02 " " 15pF			TRIMMER CAPACITOR
C2144	K00175180	DD104SL180J50V02 " " 18pF	TC2001,2002	K91000029	ECV1ZW20x53 20pF
C2040,2042,2055, 2058,2082,2149, 2175	K00175220	DD104SL220J50V02 " " 22pF	L2002,2003,2005	L1190113	FL-3H R22M 0.22μH
			L2001,2004	L1190011	FL-4H R47M 0.47μH
			L2037	L1190013	FL-4H R68M 0.68μH
C2054	K06175220	DD104UJ220J50V02 " UJ 22pF	L2010-2012	L1190009	FL-4H 3R3M 3.3μH
C2039,2041,2145	K00175270	DD104SL270J50V02 " SL 27pF	L2031	L1190014	FL-5H 100K 10μH
C2143	K00179007	DD104SL300J50V02 " " 30pF	L2028,2029	L1190025	FL-5H 330K 33μH
			L2021,2022	L1190027	FL-5H 390K 39μH
C2009,2016,2023, 2029,2107	K06175330	DD104UJ330J50V02 " UJ 33pF	L2006,2007,2015	L1190029	FL-5H 470K 47μH
C2147	K00179008	DD104SL360J50V02 " SL 36pF	L2008,2009,2014, 2016,2020,2023, 2030,2033,2035	L1190020	FL-5H 151K 150μH
C2077,2078	K02179014	DD106CH360J50V02 " CH 36pF	L2013,2017-2019, 2032,2034,2036	L1190017	FL-5H 102K 1mH
C2169	K06175390	DD104UJ390J50V02 " UJ 39pF	L2024,2026	L0020882	L.P.F
			L2025	L0020871	L.P.F
C2007,2014,2021, 2027	K06175470	DD104UJ470J50V02 " " 47pF	L2027	L0020873	L.P.F
C2119,2121	K00179510	DD104SL510J50V02 " SL 51pF			TRANSFORMER
C2120	K00175101	DD105SL101J50V02 " " 100pF	T2001	L0020869	
C2170,2171	K02175151	DD109CH151J50V02 " CH 150pF	T2002	L0020868	
C2133	K30176271	Z17D271K05 " 270pF	T2003	L0020867	
C2150	K10176391	DD104YB391K50V02 " 390pF	T2004	L0020866	
C2061,2156	K12171102	DD105E102P50V02 " 0.001μF	T2005	L0020110	R12-4797
			T2006	L0020127	R12-4094A
C2001,2011,2013, 2018,2020,2024, 2026,2030,2032, 2035-2038,2046, 2047,2050-2053, 2056,2059, 2064-2069, 2074-2076,2080, 2083,2084, 2081-2091, 2093-2096,2098, 2100,2109, 2113-2118,2124, 2125,2129,2131, 2132,2134, 2136-2138,2140, 2152,2153,2155, 2158,2160,2164, 2165,2172,2174, 2176,2181,2193	K13170103	DB201YF103Z5L5 " 0.01μF	T2007	L0020862	
			T2008	L0020209	
C2002-2006,2057, 2060,2079,2092, 2097,2099,2104, 2126,2130,2135, 2154,2157,2161	K13170473	DB207YF473Z5L5 " 0.047μF			SWITCH
			S2001	N0190072	CB-1-2-40
					CONNECTOR
			J2004-2006,2008, 2009	P0090120	PI051-02M
			J2007	P0090121	PI051-03M
			J2010	P0090132	PI051-04M
			J2001	P0090133	PI051-05M
			J2002	P0090136	PI051-08M
			J2003	P0090140	PI051-12M
				Q5000011	Wrapping terminal C

REPAIR PARTS

FM UNIT					INDUCTOR	
Symbol No.	Part No.	Description	L7001,7002	L1190017	FL5H 102K	1mH
	F0002176	Printed Circuit Board				
	C0021760	P.C.B with Components			CONNECTOR	
			J7001	P0090167	PI011-08M	8P
		TRANSISTOR & IC				
Q7001,7003-7007	G3309451Q	TR 2SC945A-Q				
Q7002	G1090059	IC TA-7061AP				
		DIODE				
D7001-7004	G2001880F	Ge 1S188FM	VFO UNIT			
D7005	G2090027	Si 1SS53	Symbol No.	Part No.	Description	
				F0002172	Printed Circuit Board	
				C0021720	P.C.B with Components	
		THERMISTOR				
TH7001	G9090001	SDT-250				
		CERAMIC FILTER				
CF7001	H3900030	LFB-15	Q3001-3003	G3309451Q	2SC945A-Q	
		CERAMIC DISCRIMINATOR				
CD7001	H7900010	455D	R3015	J00245330	Carbon film 1/4W VJ 33Ω	
			R3007,3010-3012,3016	J00245101	" " " " 100Ω	
			R3004,3008,3009,3014	J00245102	" " " " 1kΩ	
R7022	J00245470	Carbon film 1/4W VJ 47Ω	R3003	J00245222	" " " " 2.2kΩ	
R7003,7005,7007,7012,7029,7030	J00245101	" " " " 100Ω	R3001	J00245183	" " " " 18kΩ	
R7017	J00245221	" " " " 220Ω	R3005	J00245223	" " " " 22kΩ	
R7001	J00245102	" " " " 1kΩ	R3002	J00245333	" " " " 33kΩ	
R7019,7023	J00245152	" " " " 1.5kΩ	R3006	J00245104	" " " " 100kΩ	
R7004,7006,7008,7011	J00245222	" " " " 2.2kΩ	R3013	J00245154	" " " " 150kΩ	
					CAPACITOR	
R7028	J00245472	" " " " 4.7kΩ	C3008	K02173100	DD104CH100D50V02 50WV CH10pF	
R7013,7015,7018	J00245562	" " " " 5.6kΩ	C3003	K02179012	DD105CH300D50V02 " " 30pF	
R7026,7027	J00245682	" " " " 6.8kΩ	C3002	K06179012	DD106UJ910J50V02 " " 91pF	
R7009,7010,7021,7031,7032	J00245103	" " " " 10kΩ	C3004	K02175101	DD107CH101J50V02 " " 100pF	
R7020,7024	J00245823	" " " " 82kΩ	C3007	K30176681	LCQ18681K05 " 680pF	
R7025	J00245104	" " " " 100kΩ	C3013,3014	K10176681	DD104B681K50V02 " 680pF	
R7002	J00245224	" " " " 220kΩ	C3006	K30209001	DM19D102K1 100WV 1000pF	
R7014,7016	J00245564	" " " " 560kΩ	C3001	K30209006	DM19D242K1 " 2400pF	
			C3005,3010,3012	K13170103	DB201YF103Z5L5 50WV 0.01μF	
			C3009,3011,3015,3016	K13170473	DB207YF473Z5L5 " 0.047μF	
					VARIABLE CAPACITOR	
C7017	K00179005	DD104SL200J50V02 50WV SL 20pF	VC3001	K90000034	C-613A132	
C7027	K00175101	DD105SL101J50V02 " " 100pF			TRIMMER CAPACITOR	
C7010,7016	K12171102	DD105E102P50V02 " 0.001μF	TC3001	K91000016	ECV-1ZW50x32 50pF	
C7028	K13170472	DB201YF472Z5L5 " 0.0047μF			INDUCTOR	
C7001,7003,7004,7009,7014,7015,7019,7026,7029	K13170103	DB201YF103Z5L5 " 0.01μF	L3001	L0020062	R12-5775	
C7018	K13170223	DD109F223Z50V02 " 0.022μF	L3003	L1190009	FL4H 3R3M 3.3μH	
C7011,7012	K50177223	50F2U223M " 0.022μF	L3002	L1190016	FL5H 101K 100μH	
C7002,7005-7008,7020	K13170473	DB207YF473Z5L5 " 0.047μF			LAMP	
C7013	K70167224	CS15E1VR22M 35WV 0.22μF	PL3001	Q1000043	K0298-4-0 12V, 100mA	
C7024,7025	K40170105	50RL1 50WV 1μF				
C7022,7023	K40140475	25RL4.7 25WV 4.7μF				
C7021,7030,7031	K40120106	16RL10 16WV 10μF				

SWITCH UNIT			MEMORY UNIT (OPTION)		
Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	F0002173	Printed Circuit Board		F0002175	Printed Circuit Board
	C0021730	P.C.B with Components		C0021750	P.C.B with Components
		TRANSISTOR			TRANSISTOR, FET & IC
Q4001,4002	G3309451Q	2SC945A-Q	Q6036	G3107331Q	TR 2SA733A-Q
			Q6017,6018	G3309000E	" 2SC900E
		DIODE	Q6005,6015,6016, 6029	G3309451Q	" 2SC945A-Q
D4001,4002	G2090134	LED TLY-205	Q6014	G3313170R	" 2SC1317R
		RESISTOR	Q6003,6006	G3316740L	" 2SC1674L
R4008	J20336100	Metallic film 2W 10Ω	Q6013,6037	G3408820Q	" 2SD882Q
R4004	J01245391	Carbon film 1/4W TJ 390Ω	Q6001,6002	G3801070C	FET 2SK107-3
R4005,4006	J01245681	" " " " 680Ω	Q6028	G4800730G	" 3SK73GR
R4002,4003,4007	J01245102	" " " " 1kΩ	Q6004	G1090313	IC μPB553C
R4001	J01245562	" " " " 5.6kΩ	Q6030-6035	G1090227	" μPD5101LC
			Q6007	G1090296	" HD10551
		SWITCH	Q6008	G1090100	" SN74LS123
S4001-4004	N5090003	KEF-10901	Q6009-6012	G1090019	" SN74LS192
S4005	N4090039	SUT-42A	Q6025	G1090317	" SN74LS290
			Q6021	G1090315	" SN74LS293
	T9203650	FLAT CABLE	Q6020,6022	G1090165	" MC14024BCP
			Q6019	G1090314	" MC14046BCP
			Q6023	G1090126	" MC14069UBCP
			Q6026,6027	G1090108	" MC14518BCP
			Q6024	G1090316	" MSM4023RS
		POWER SUPPLY UNIT			DIODE
Symbol No.	Part No.	Description	D6001,6002	G2090073	Varactor FC-52M
	F0002171	Printed Circuit Board	D6007	G2090040	Varactor FC-63
	C0021710	P.C.B with Components	D6003,6010	G2090156	Zener RD5.6EB2
			D6004	G2090153	Zener RD10EB1
		TRANSISTOR	D6005,6006,6008, 6009	G2090027	Si 1SS53
Q5001-5003	G3309451Q	2SC945A-Q			
		DIODE			CRYSTAL
D5001	G2090157	Si S2VB10F	X6001	H0102339	HC-18/U, 3P 16.384MHz
D5002	G2090158	Zener RD4.7EB2			
D5003	G2090159	Si S2V10			RESISTOR
			R6027	J20306100	Metallic film 1W 10Ω
		RESISTOR	R6029	J00245100	Carbon film 1/4W VJ 10Ω
R5005	J00245331	Carbon film 1/4W VJ 330Ω	R6019	J00245270	" " " " 27Ω
R5003,5004	J00245471	" " " " 470Ω	R6060	J20306330	Metallic film 1W 33Ω
R5002	J00245122	" " " " 1.2kΩ	R6005,6011,6012, 6017,6020,6023, 6030,6035,6042, 6055,6056	J00245101	Carbon film 1/4W VJ 100Ω
R5001	J00245182	" " " " 1.8kΩ			
R5007	J00245472	" " " " 4.7kΩ	R6001,6004,6025, 6026,6028	J00245221	" " " " 220Ω
R5006	J00245682	" " " " 6.8kΩ	R6013,6024	J00245391	" " " " 390Ω
		CAPACITOR	R6018	J00245471	" " " " 470Ω
C5006	K13170473	DB207YF473Z5L5 50WV 0.047μF	R6067	J00245561	" " " " 560Ω
C5004	K40170105	50RL1 " 1μF	R6036,6038,6058, 6062	J00245102	" " " " 1kΩ
C5003,5005	K40120106	16RL10 16WV 10μF	R6041	J00245182	" " " " 1.8kΩ
C5002	K40120336	16RL33 " 33μF	R6014,6043	J00245222	" " " " 2.2kΩ
C5001	K40149013	RPE-25V682M 25WV 6800μF	R6063-6066	J00245272	" " " " 2.7kΩ
			R6040	J00245562	" " " " 5.6kΩ
		CONNECTOR	R6034,6046,6049, 6053,6059	J00245103	" " " " 10kΩ
J5001-5003	P0090120	PI051-02M	R6010,6015,6022	J00245183	" " " " 18kΩ
J5004	P0090132	PI051-04M	R6009,6016,6021, 6031,6033,6051	J00245223	" " " " 22kΩ
	Q5000011	Wrapping terminal C	R6050	J00245333	" " " " 33kΩ

REPAIR PARTS

R6052	J00245393	Carbon film	1/4W VJ	39kΩ				INDUCTOR
R6002,6003,6006,6007	J00245473	" "	" "	47kΩ	L6006	L1190005	FL4H IR0M	1μH
					L6004,6008	L1190009	FL4H 3R3M	3.3μH
R6008,6032,6044	J00245104	" "	" "	100kΩ	L6005,6007	L1190111	FL4H 5R6K	5.6μH
R6037	J00245124	" "	" "	120kΩ	L6001,6002,6009,6012,6014	L1190020	FL5H 151K	150μH
R6045	J00245154	" "	" "	150kΩ				
R6057	J00245184	" "	" "	180kΩ	L6003,6010,6016	L1190017	FL5H 102K	1mH
R6061	J00245224	" "	" "	220kΩ	L6011	L2030067A	S/N COIL	3mH
					L6013,6015	L1190035	FL7H 392J	3.9mH
		BLOCK RESISTOR						
RB6001	J40900018	RA1/16K9R	100kΩ				TRANSFORMER	
		1/16W	100kΩx9		T6001	L0020110	R12-4797A	
					T6002	L0020864	VCO COIL	
					T6003	L0020865	"	
		CAPACITOR						
C6044	K06173060	DD104UJ060D50V02						CONNECTOR
		50WV UJ	6pF					
C6001,6002	K02173070	DD104CH070D50V02			J6006	P0090120	PI051-02M	2P
		"	CH 7pF		J6004	P0090132	PI051-04M	4P
C6011,6027,6069	K00175120	DD104SL120J50V02			J6001	P0090133	PI051-05M	5P
		"	SL 12pF		J6005	P0090136	PI051-08M	8P
C6012	K00175270	DD104SL270J50V02			J6003	P0090140	PI051-12M	12P
		"	" 27pF		J6002	P0090141	PI051-13M	13P
C6043	K06175330	DD104UJ330J50V02						
		"	UJ 33pF			Q5000011	Wrapping terminal C	
C6067	K00175560	D104SL560J50V02						
		"	SL 56pF					
C6049	K02175560	DD106CH560J50V02						
		"	CH 56pF					
C6045	K06179009	DD105UJ560J50V02						
		"	UJ 56pF					
C6046	K02175151	DD109CH151J50V02						
		"	" 150pF		Symbol No.	Part No.	Description	
C6023,6025	K10176561	DD104B561K50V02				Q3000004	Wire Antenna	
		"	560pF			R3054620	FOOT H-30	
C6022,6026	K10176821	DD104B821K50V02				Q0000002	Fuse 1A (AC100-120V)	
		"	820pF			Q0000001	0.5A (AC200-240V)	
C6003,6004,6006,6007,6008,6010,6013,6014,6030,6031,6068	K12171102	DD105E102P50V02					AC POWER CORD	
		"	0.001μF			T9013280	2 wire, 2 prong plug DC-546-007	
C6024	K10179022	2222-660-02272				T9013282	3 wire, 3 prong plug (UL) UC-904-016	
		"	2700μF			T9013284	3 wire, 2 prong EU plug EC-407-007	
C6009,6016-6021,6029,6033,6034,6038,6042,6047,6048,6054-6059,6061	K14179002	RD204YM0.01μF				T9013283	3 wire, 3 prong Australian plug SC-411-001	
		"	0.01μF					
C6053	K50177103	50F2U103M						
		"	0.01μF					
C6005,6036,6051,6070-6073	K13170473	DB207YF473Z5L5				S3000023	Mini Belt C	
		"	0.047μF					
C6064	K23170003	RPE112F104Z50V						
		"	0.1μF					
C6050	K54200001	B32561-A1105J						
		100WV	1μF					
C6015,6032,6035,6039,6060,6066	K40120106	16RL10	16WV	10μF				
C6052,6062	K40120226	16RL22	16WV	22μF				
C6063,2065	K40149003	25RE100	25WV	100μF				
C6041	K40120227	16RL220	16WV	220μF				
C6040	K40129006	16RE470	"	470μF				
C6037	K40089004	6.3RE1000	6.3WV	1000μF				
		MODULE						
RCM6001	Q80000005	RK1/16R-11R	100kΩ/103Z50					
		(1/16W 100kx11,						
		50WV 0.01μFx11)						

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
PB-2246	F0002246	Printed Circuit Board	PB-2215A	F0002215A	Printed Circuit Board
	C0022460	PCB with components		C0022150	PCB with components
		RESISTOR			CAPACITOR
R7,9,10,12	J02245470	Carbon film 1/4W SJ 47Ω	C1,5	K10176821	Ceramic disc 50WV 820pF (DD104-B821K)
R4,6	J02245560	" " " " 56Ω			
R2	J02245680	" " " " 68Ω	C2,3,4	K10176152	" " " 150pF (DD105-B152K)
R1,3	J02245101	" " " " 100Ω			
R5	J02245221	" " " " 220Ω			
R13	J02245102	" " " " 1kΩ			
R8	J02245272	" " " " 2.7kΩ			INDUCTOR
R14	J02245332	" " " " 3.3kΩ	L1,3	L1190024	FL5H-221K 220μH
R11	J02245273	" " " " 27kΩ	L2,4	L1190038	FL5H-271K 270μH
R15	J02245473	" " " " 47kΩ			
R16	J02245474	" " " " 470kΩ			CONNECTOR
			J1	Q9000121	UG0013
		CAPACITOR			
C1,3	K10176681	Ceramic disc 50WV 680pF (DD104-B681K)			
C2	K10176122	" " " 1200pF (DD105-B122K)			
		VARIABLE CAPACITOR	Symbol No.	Part No.	Description
VC1	K90000037	CB21G112	PB-2298	F0002298	Printed Circuit Board
PB-2247	F0002247	VC1 Mounting Board		C0022981	● PCB with components (Model A)
				C0022982	▲ " (Model B)
				C0022983	■ " (Model C)
				C0022984	★ " (Model D)
		INDUCTOR		C0022985	○ " (Model E)
L1	L0020988			C0022986	□ " (Model F)
L2	L0020989				
L3	L0020990				
L4	L0020991				FET
L5	L0020992		Q1,2▲,10*○□, 11▲*○□	G4800730G	3SK73GR
L6	L0020993				
L7,8	L1190038	FL5H-271K 270μH			TRANSISTOR
			Q3-9	G3319230R	2SC1923R
		SWITCH			
S1	N0190086	SBU1024N			
S2	N0190087	SRZW66S			DIODE
S3	N0190088	SRZW45S	D1,2,18▲*○□, 19▲*○□	G2090044	Si MC301
S4	N4090043	SUF31			
			D6,9-11,13,14, 16,17,12●■, 15●■,23▲*○□, 24▲*○□	G2090027	" 1SS53
		CONNECTOR			
J1	P1090194	MBR06B	D3-5, 20▲*○□-22▲*○□	G2022080	Varactor 1S2208
J2	Q9000122	UG0033			
			D7,8	G2090023	" 1SV50
		KNOB			
	R3065270	FT-16PNAK ATT, BAND, MATCHING			CRYSTAL
	R3065260	FT-16PAK TUNING	X1●▲★	H0102423	HC-18/U 100MHz
	R3056500	PUSH KNOB A	(Model A,B,D)		
			X1□(Model C,E)	H0102425	" 120MHz
			X1□(Model F)	H0102426	" 130MHz
			X2●(Model A)	H0102424	" 110MHz
			X2▲★(Model B,D)	H0102425	" 120MHz
			X2□(Model C,E)	H0102426	" 130MHz

● MODEL A, ▲ MODEL B, ■ MODEL C, ★ MODEL D, ○ MODEL E, □ MODEL F

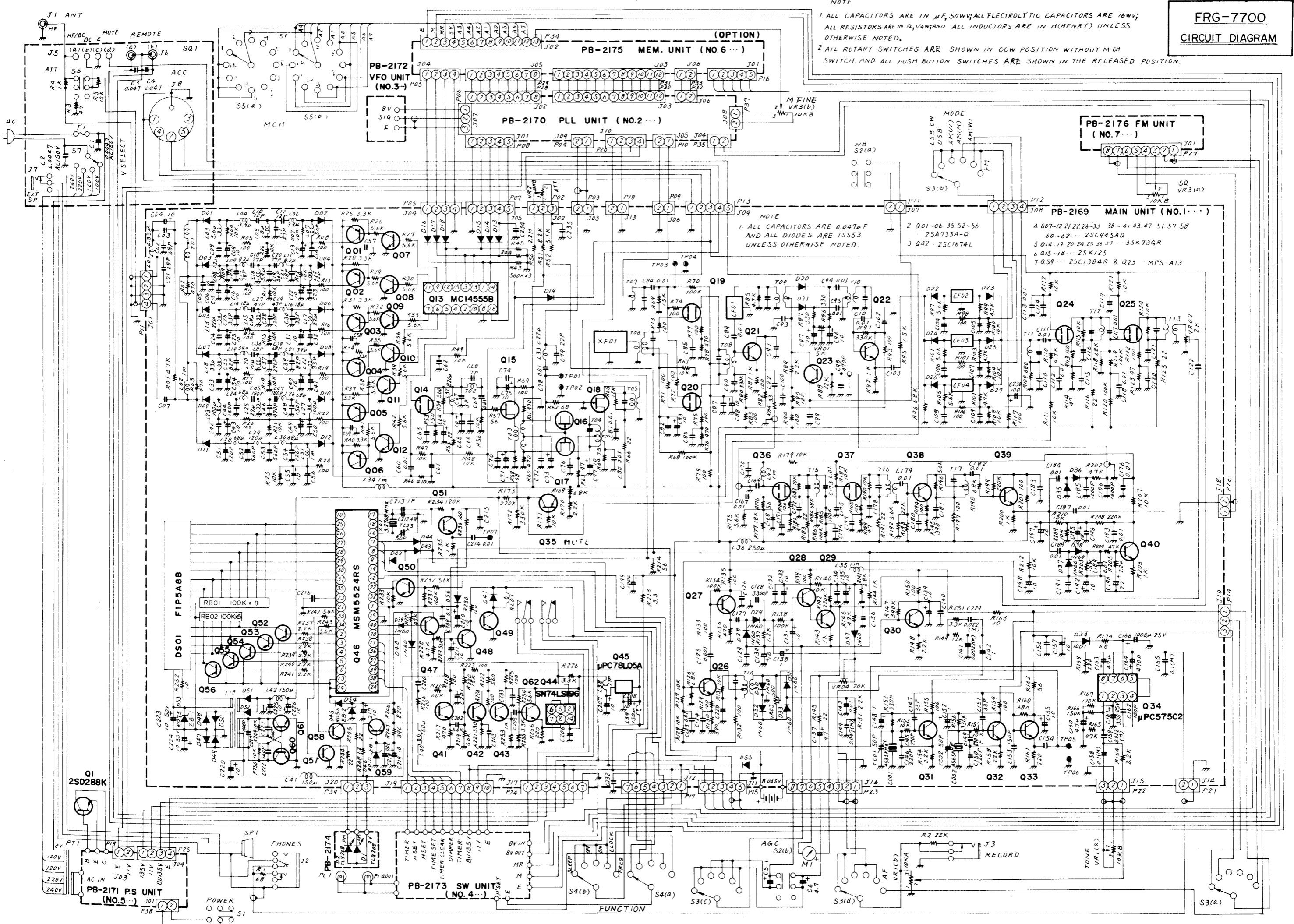
X2□(Model F)	H0102427	HC-18/U	140MHz	C44,54,64	K00179005	Ceramic disc 50WV 20pF (DD104SL200J50V02)
X3●(Model A)	H0102425	"	120MHz			
X3▲(Model B)	H0102421	"	30MHz	C13,26,87▲★○, 99▲★○	K10176101	" " " 100pF (DD104-B101K50V02)
X3■(Model C)	H0102427	"	140MHz			
X3★(Model D)	H0102422	"	50MHz	C1,2,78▲★○□, 79▲★○□	K10176181	" " " 180pF (DD104-B181K50V02)
X3□(Model E,F)	H0102423	"	100MHz			
				C3-12,15-22,24, 25,27-31,34,39, 43,45,47-49,53, 55,57-59,63,65, 67-71,105,106, 107●	K10176102	" " " 0.001μF (DD104-B102K50V02)
		RESISTOR				
R39	J02245010	Carbon film	1/4W SJ 1Ω			
R15,17,25,86★	J02245279	" "	" " 2.7Ω			
R19,88▲★○□	J01245100	" "	" TJ 10Ω	(MODEL B▲,D★, E○,F□)		
R17□□,25□□,86□□	J02245100	" "	" SJ 10Ω	C80-86,88, 90-95,97,98, 100-104)		
R28,31,37,49,58, 67,86▲,96□□	J02245101	" "	" " 100Ω			
R48,57,66,69,71, 99▲★○□,101	J01245101	" "	" TJ 100Ω	C107□□,108□□		
R18,87▲★○□	J02245151	" "	" SJ 150Ω	C32,35,36,72-74	K14180103	" " 63WV 0.01μF (RD871-1FZ103Z63V)
R97▲	J02245181	" "	" " 180Ω	C38,75-77	K13170473	" " 50WV 0.047μF (DB207YF473Z5L5)
R47,56,65,73▲, 74▲,96★	J02245221	" "	" " 220Ω	C37	K40129004	Electrolytic 16WV 10μF (RL16V10)
R97★,73★	J02245331	" "	" " 330Ω			
R96▲	J02245391	" "	" " 390Ω			
R29,97□□	J02245471	" "	" " 470Ω			
R40,72	J02245561	" "	" " 560Ω			TUNING CAPACITOR
R3,4,6,8,9,11,44, 53,62,74★, 75▲★○□,76▲★○□, 78▲★○□,80▲★○□, 81▲★○□	J02245102	" "	" " 1kΩ	● MODEL A		
R12,42,51●▲★, 60●▲★○□	J01245102	" "	" TJ 1kΩ	C66	K00179004	Cermic disc 50WV 16pF (DD104SL160K50V02)
R1,2,73□□,74□□	J02245122	" "	" SJ 1.2kΩ	C42,52,56,62	K00179005	" " " 20pF (DD104SL200K50V02)
R51■□□,60■,42□□	J01245222	" "	" TJ 2.2kΩ	C46,60,61	K00179006	" " " 24pF (DD104SL240K50V02)
R22,91□□	J02245332	" "	" SJ 3.3kΩ	C50,51	K00175270	" " " 27pF (DD104SL270K50V02)
R27,95▲★○□,98★	J02245392	" "	" " 3.9kΩ	C40,41	K00179008	" " " 36pF (DD104SL360K50V02)
R13,30■□□,43,45, 52,54,61,63, 98★○□,83□□	J02245472	" "	" " 4.7kΩ			
R33	J02245562	" "	" " 5.6kΩ	▲ MODEL B		
R30●▲★,91▲★	J02245682	" "	" " 6.8kΩ	C56	K00179004	Ceramic disc 50WV 16pF (DD104SL160K50V02)
R5,7,14,16,23,34, 38,46,55,64,68, 70,79▲★○□,83▲★, 77□□,92□□, 100□□	J02245103	" "	" SJ 10kΩ	C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)
R41,50,59, 84▲★○□,85▲★○□, 92★,100▲★	J01245103	" "	" TJ 10kΩ	C46,50,51	K00179006	" " " 24pF (DD104SL240K50V02)
R26,94▲★○□	J01245273	" "	" TJ 27kΩ	C40,41,66	K00179008	" " " 36pF (DD104SL360K50V02)
R20,24,82▲★○□, 89▲★○□,90▲★○□, 93▲★○□	J01245104	" "	" " 100kΩ	C60,61	K00179012	" " " 75pF (DD104SL750K50V02)
R10,21,32,35,36	J02245104	" "	" SJ 100kΩ			
		POTENTIOMETER				
VR1	J62800060	K16BA0058-100KBx2	100KΩBx2	C66	K00173100	Ceramic disc 50WV 10pF (DD104SL101K50V02)
				C56	K00179003	" " " 13pF (DD104SL130K50V02)
				C60,61	K00175150	" " " 15pF (DD104SL150K50V02)
				C46,50,51	K00179004	" " " 16pF (DD104SL160K50V02)
		CAPACITOR				
C23,96▲★○	K00179001	Ceramic disc	50WV 0.5pF (DD104SL0R5C50V02)	C42,52	K00179005	" " " 20pF (DD104SL200K50V02)
C33	K00172010	" "	" 1pF (DD104SL010C50V02)	C40,41	K00179006	" " " 24pF (DD104SL240K50V02)

● MODEL A, ▲ MODEL B, ■ MODEL C, ★ MODEL D, ○ MODEL E, □ MODEL F

* MODEL D				L11 ^{□□,15□□} , 19 ^{●■□□}	L0021072	
C66	K00175120	Ceramic disc 50WV 12pF (DD104SL120K50V02)		L19 ^{▲▲}	L0021078	
C60,61	K00175150	" " " 15pF (DD104SL150K50V02)		L23 [▲]	L0021073	
C56	K00179004	" " " 16pF (DD104SL160K50V02)		L23 [★]	L0021075	
C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)		L24 ^{▲,25▲}	L0021074	
C46,50,51	K00179006	" " " 24pF (DD104SL240K50V02)		L24 ^{★,25★}	L0021076	
C40,41	K00179008	" " " 36pF (DD104SL360K50V02)		L23 ^{□□}	L0021146	
				L24 ^{□□,25□□}	L0021147	
						SWITCH
			S1	N4090048		SUF31
			S2	N0190086		SUB1024N
○ MODEL E						
C56	K00179003	Ceramic disc 50WV 13pF (DD104SL130K50V02)				CONNECTOR
C46,50,51	K00179004	" " " 16pF (DD104SL160K50V02)	J1	Q9000122		UG0033
C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)	J2,3,4 ^{▲▲□□}	P1090194		MBR06B
C40,41,66	K00179006	" " " 24pF (DD104SL240K50V02)				CONNECTION CABLE
C60,61	K00179008	" " " 36pF (DD104SL360K50V02)	P1 (with wire)	T9204284		(5P DIN PLUG)
						KNOB
				R3065270		FT-16PNAK (FUNCTION)
				R3068620		FT-16PK (RF)
				R3071750		FT-16PDSB (IF)
				R3056500		PUSH KNOB
□ MODEL F						
C56	K00173100	Ceramic disc 50WV 10pF (DD104SL100K50V02)				
C46	K00179003	" " " 13pF (DD104SL130K50V02)				
C50,51	K00175150	" " " 15pF (DD104SL150K50V02)				
C40,41	K00179004	" " " 16pF (DD104SL160K50V02)				
C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)				
C60,61	K00179008	" " " 36pF (DD104SL360K50V02)				
		TRIMMER CAPACITOR				
TC1-5,9 ^{▲▲□□} , 10 ^{▲▲□□,11▲▲□□}	K91000085	CTZ51C122	10pF			
TC6-8	K91000086	CTZ51E117	20pF			
		INDUCTOR				
L1,14 ^{■□□,18■} , 22 ^{▲▲□□,10□□}	L1190113	FL3H-R22M	0.22μH			
L10,14 ^{●▲▲,18●□□}	L1190109	FL3H-R33M	0.33μH			
L5,8,12,16, 26 ^{▲▲□□}	L1190020	FL5H-151K	150μH			
L20,21	L1190017	FL5H-102K	1mH			
L18 [▲]	L1190011	FL4H-4R7K	4.7μH			
L18	L1190007	FL4H-1R8	1.8μH			
L2 ^{□□}	L0021067					
L3 ^{●▲▲,4□□}	L0021068					
L3 ^{■□□}	L0021083					
L6 ^{●▲▲,7●▲▲}	L0021079A					
L6 ^{■□□,7■□□}	L0021145					
L9 ^{□□,13□□,17●■□□}	L0021071					
L17 ^{▲▲}	L0021077					

● MODEL A, ▲ MODEL B, ■ MODEL C, ★ MODEL D, ○ MODEL E, □ MODEL F

FRG-7700
CIRCUIT DIAGRAM



NOTE
 1 ALL CAPACITORS ARE IN μ F, 50WV; ALL ELECTROLYTIC CAPACITORS ARE 16WV;
 ALL RESISTORS ARE IN Ω , μ W, AND ALL INDUCTORS ARE IN H (HENRY) UNLESS OTHERWISE NOTED.
 2 ALL ROTARY SWITCHES ARE SHOWN IN CCW POSITION WITHOUT MCH SWITCH, AND ALL PUSH BUTTON SWITCHES ARE SHOWN IN THE RELEASED POSITION.

NOTE
 1 ALL CAPACITORS ARE 0.047 μ F
 AND ALL DIODES ARE 1SS53
 UNLESS OTHERWISE NOTED.

- 2 Q01-06 35 52-56 2SA1733A-Q
- 3 Q42 25C1674L
- 4 Q07-12 21 22 26-33 38-41 43 47-51 57 58 60-62 25C945A-Q
- 5 D14 19 20 24 25 36 37 35K739R
- 6 Q15-18 25K125
- 7 Q59 25C1384R 8 Q23 MPS-A13

PB-2171 PS UNIT (NO. 5)

PB-2173 SW UNIT (NO. 4)

PB-2170 PLL UNIT (NO. 2)

PB-2175 MEM. UNIT (NO. 6)

PB-2172 VFO UNIT (NO. 3)

PB-2176 FM UNIT (NO. 7)

PB-2169 MAIN UNIT (NO. 1)

Q1 25D288K

FUNCTION

Q34 μ PC575C2

Q45 UPC78L05A

Q46 MSM5524RS

Q48 SN74LS06

Q49 SN74LS06

Q50 DS01 FIP58B

Q51 DS01 FIP58B

Q52 DS01 FIP58B

Q53 DS01 FIP58B

Q54 DS01 FIP58B

Q55 DS01 FIP58B

Q56 DS01 FIP58B

Q57 DS01 FIP58B

Q58 DS01 FIP58B

Q59 DS01 FIP58B

Q60 DS01 FIP58B

Q61 DS01 FIP58B

Q62 DS01 FIP58B

Q63 DS01 FIP58B

Q64 DS01 FIP58B

Q65 DS01 FIP58B

Q66 DS01 FIP58B

Q67 DS01 FIP58B

Q68 DS01 FIP58B

Q69 DS01 FIP58B

Q70 DS01 FIP58B

Q71 DS01 FIP58B

Q72 DS01 FIP58B

Q73 DS01 FIP58B

Q74 DS01 FIP58B

Q75 DS01 FIP58B

Q76 DS01 FIP58B

Q77 DS01 FIP58B

Q78 DS01 FIP58B

Q79 DS01 FIP58B

Q80 DS01 FIP58B

Q81 DS01 FIP58B

Q82 DS01 FIP58B

Q83 DS01 FIP58B

Q84 DS01 FIP58B

Q85 DS01 FIP58B

Q86 DS01 FIP58B

Q87 DS01 FIP58B

Q88 DS01 FIP58B

Q89 DS01 FIP58B

Q90 DS01 FIP58B

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Q92 DS01 FIP58B

Q93 DS01 FIP58B

Q94 DS01 FIP58B

Q95 DS01 FIP58B

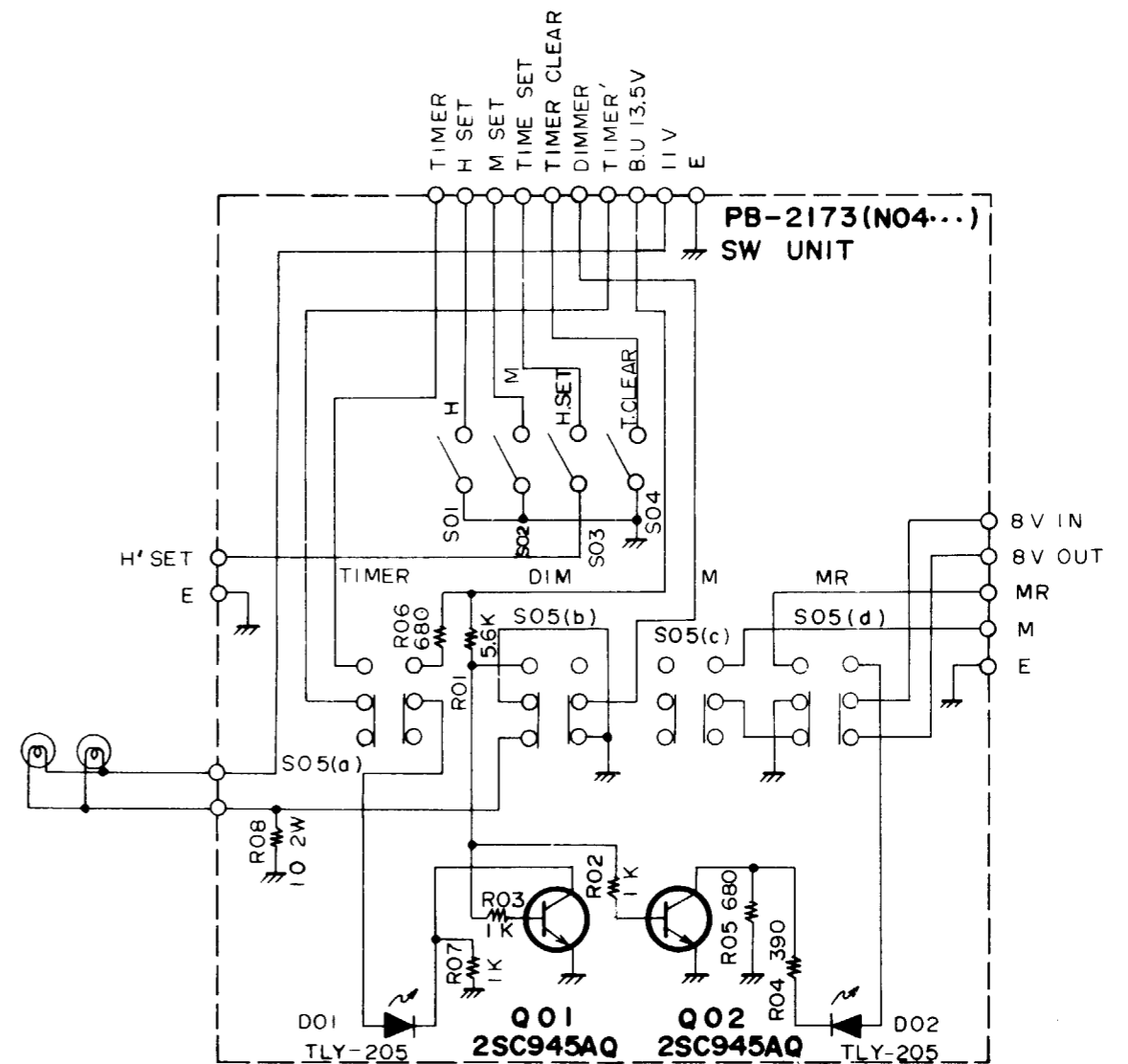
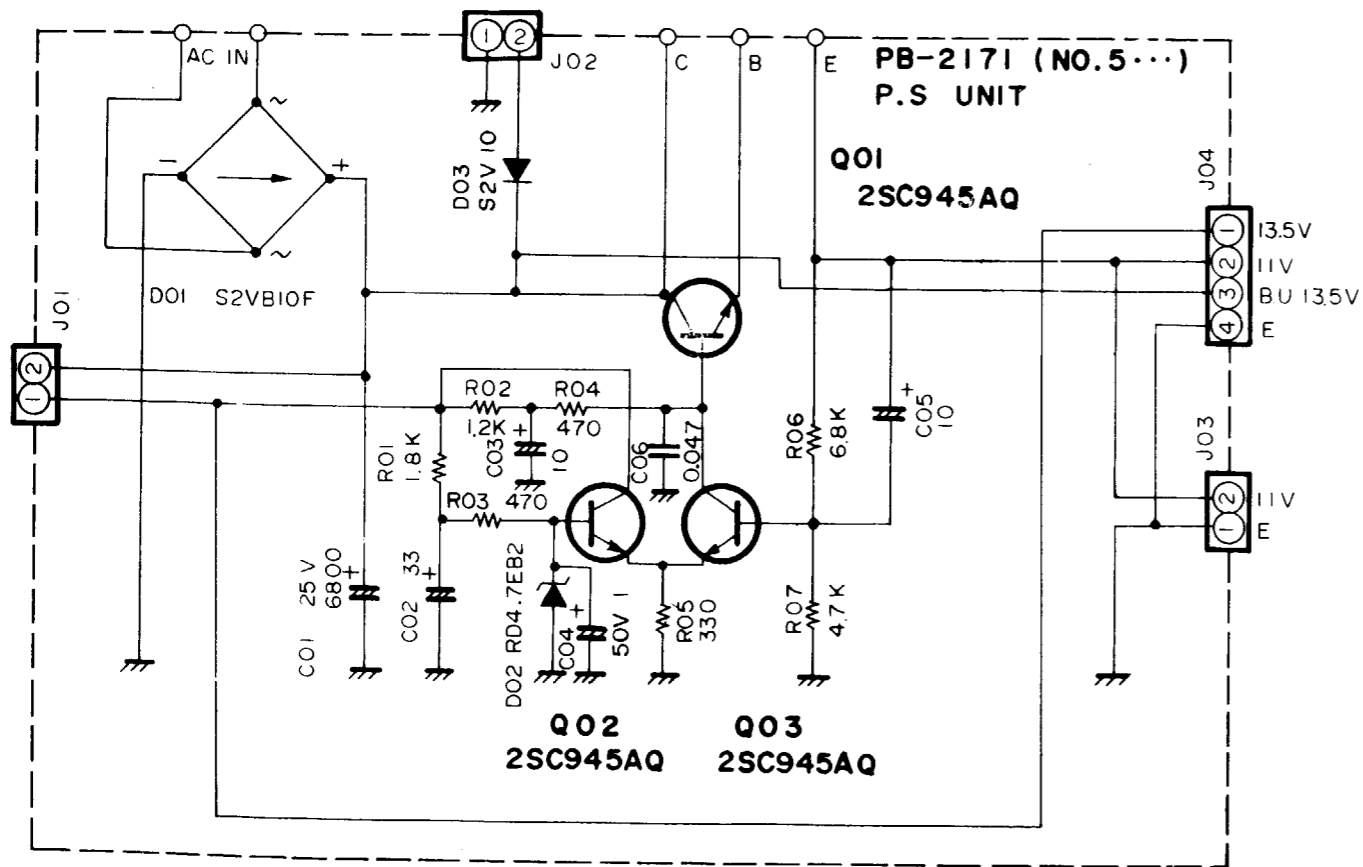
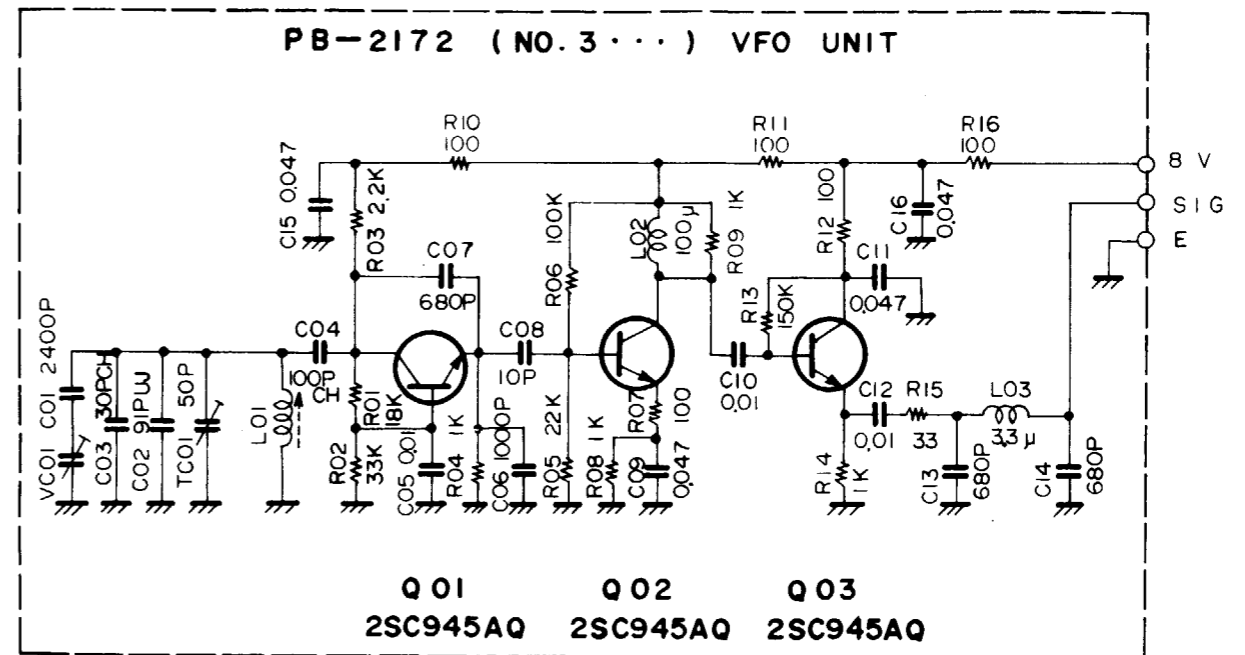
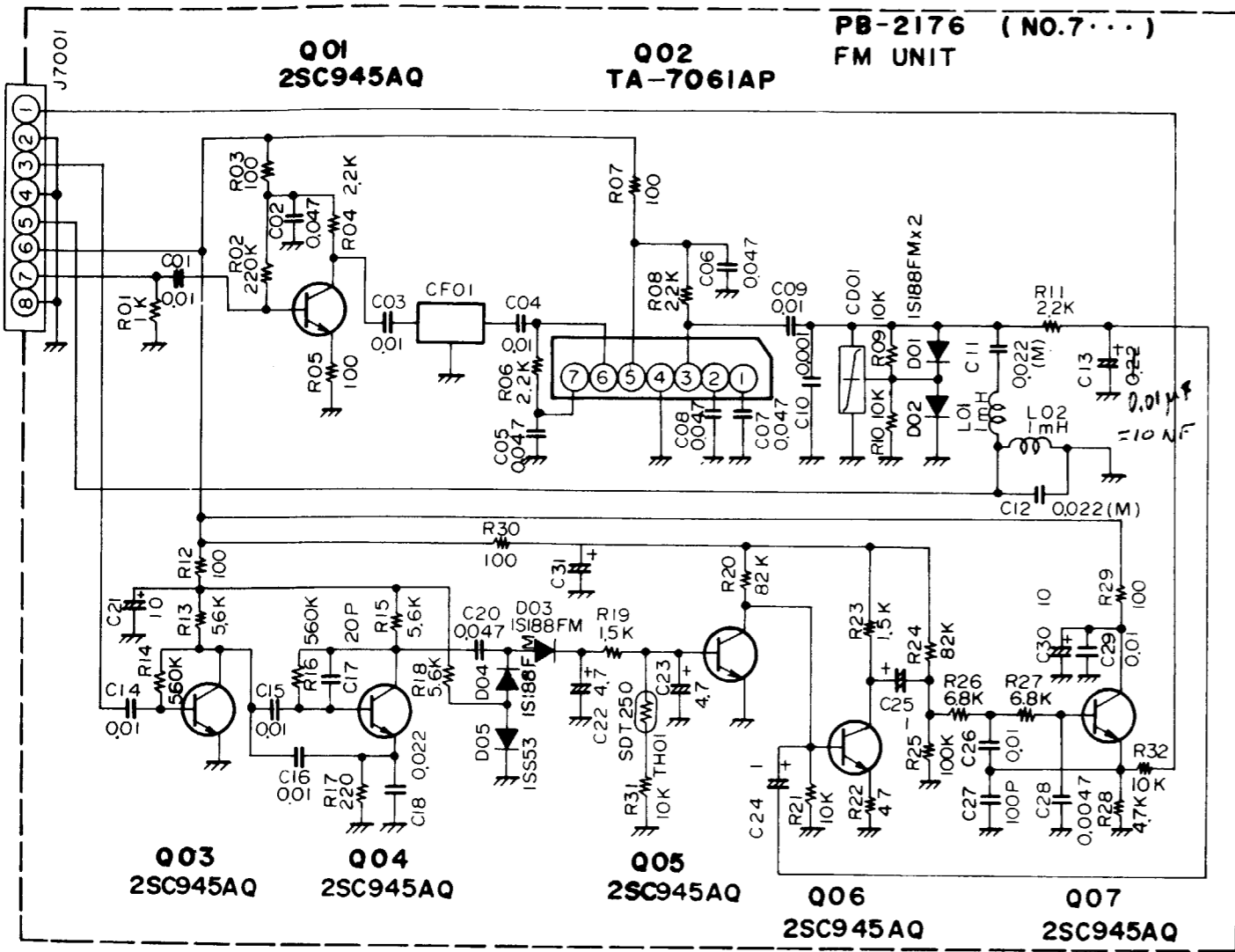
Q96 DS01 FIP58B

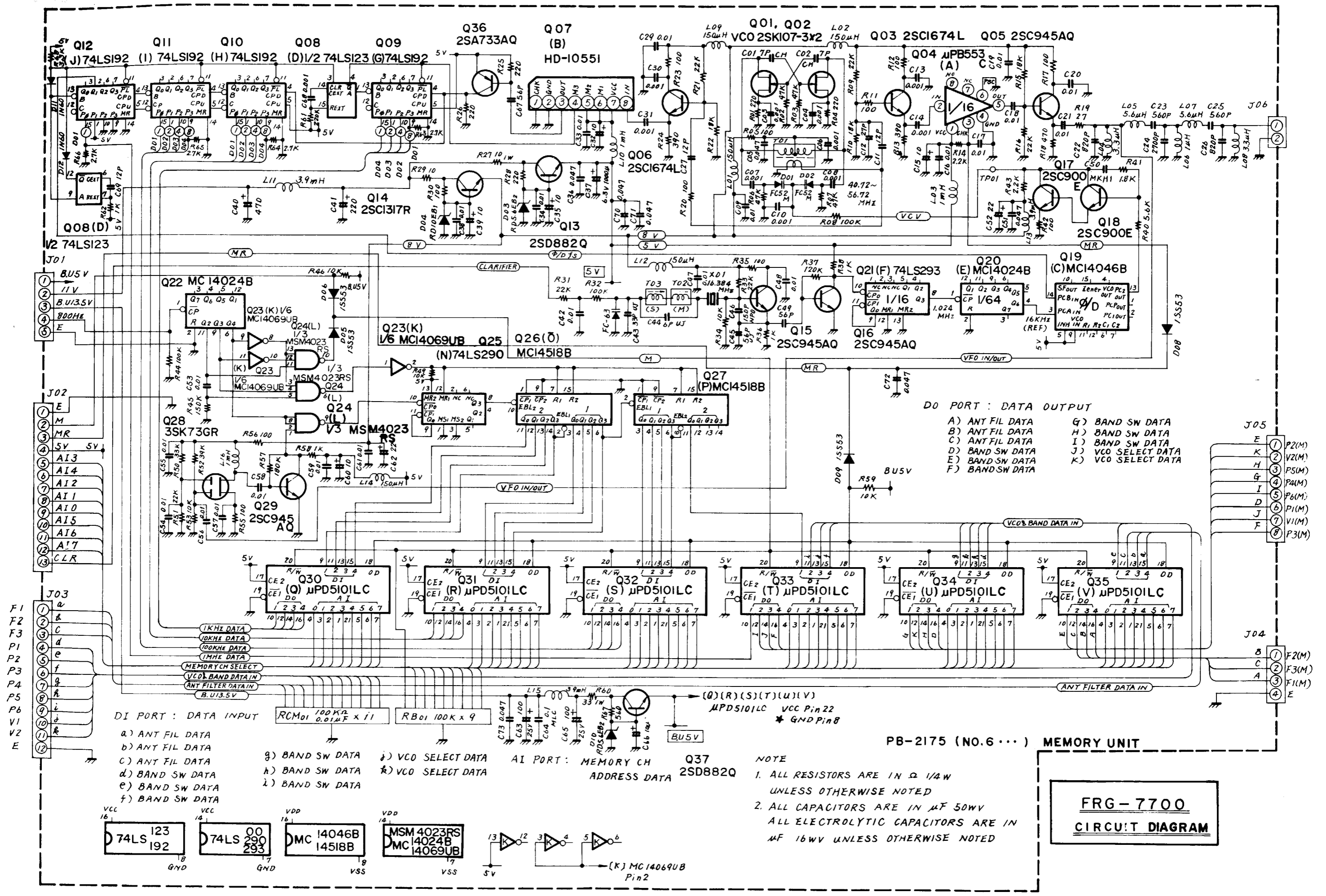
Q97 DS01 FIP58B

Q98 DS01 FIP58B

Q99 DS01 FIP58B

Q100 DS01 FIP58B





DO PORT : DATA OUTPUT
 A) ANT FIL DATA G) BAND SW DATA
 B) ANT FIL DATA H) BAND SW DATA
 C) ANT FIL DATA I) BAND SW DATA
 D) BAND SW DATA J) VCO SELECT DATA
 E) BAND SW DATA K) VCO SELECT DATA
 F) BAND SW DATA

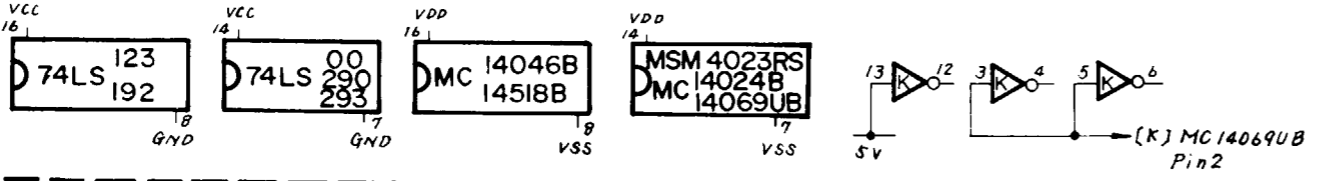
DI PORT : DATA INPUT
 a) ANT FIL DATA g) BAND SW DATA j) VCO SELECT DATA
 b) ANT FIL DATA h) BAND SW DATA k) VCO SELECT DATA
 c) ANT FIL DATA i) BAND SW DATA
 d) BAND SW DATA
 e) BAND SW DATA
 f) BAND SW DATA

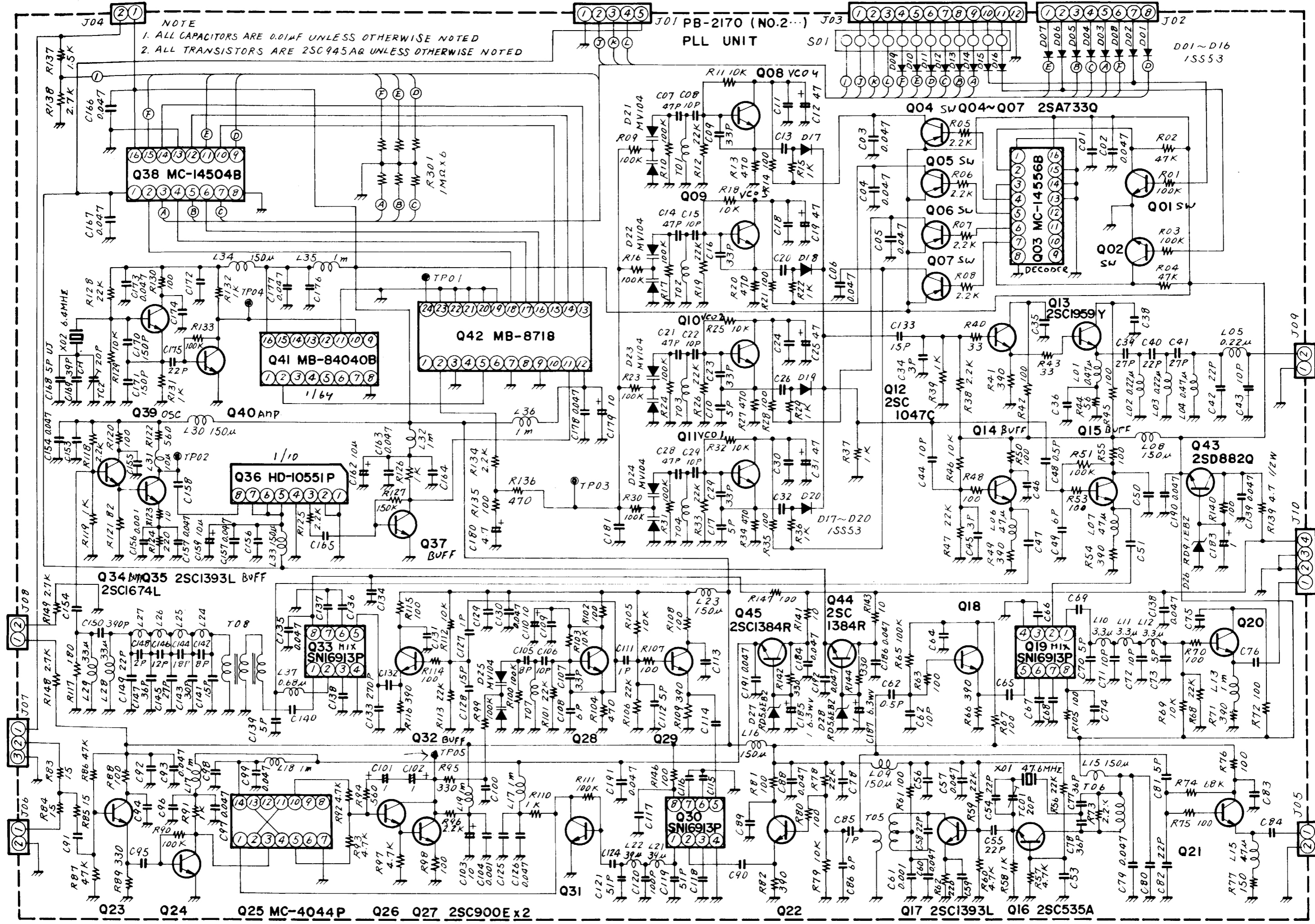
AI PORT : MEMORY CH ADDRESS DATA
 Q37 2SD882Q

PB-2175 (NO.6...) MEMORY UNIT

NOTE
 1. ALL RESISTORS ARE IN Ω 1/4W UNLESS OTHERWISE NOTED
 2. ALL CAPACITORS ARE IN μF 50V ALL ELECTROLYTIC CAPACITORS ARE IN μF 16V UNLESS OTHERWISE NOTED

FRG-7700
CIRCUIT DIAGRAM





NOTE
 1. ALL CAPACITORS ARE 0.01μF UNLESS OTHERWISE NOTED
 2. ALL TRANSISTORS ARE 2SC945AR UNLESS OTHERWISE NOTED

PLL UNIT

D01~D16
 1SS53

Q38 MC-14504B

Q42 MB-8718

Q41 MB-84040B

Q36 HD-10551P

Q34 2SC1393L BUFF
 Q35 2SC1674L

Q33 MIX
 SN6913P

Q32 BUFF

Q30 MIX
 SN6913P

Q23 Q24

Q25 MC-4044P

Q26 Q27 2SC900E x2

Q22

Q17 2SC1393L

Q16 2SC535A

Q21

Q04 SW Q04~Q07 2SA7330

Q03 MC-14556B

Q01 SW

Q02 SW

Q12 2SC1047C

Q13 2SC1959Y

Q14 BUFF

Q15 BUFF

Q43 2SD8820

Q44 2SC1384R

Q45 2SC1384R

Q18

Q19 MIX
 SN6913P

Q20

WIRING DIAGRAM

