

MAINTENANCE SERVICE MANUAL FRG-7700

For Service Manuals Contact
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THIS MANUAL IS
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Amateur Radio Directory

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PREFACE

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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SECTION 1—GENERAL

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ALL MODE COMMUNICATIONS RECEIVER

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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 minutes 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

ICs:		SN74LS293		Diodes:	
HD10551P	2	TA7061AP	1	1N60	10
MB8718	1			1S188FM	4
MB84040B	1	FETs:		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	Transistors:		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
μPB553C	1	2SC1317R	1	S2VB10F	1
μPC575C2F	1	2SC1384R	3		
μPD5101LC	6	2SC1393L	2	LEDs:	
μPC78L05A	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

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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 (R3054620) 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.

FRV-7700 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 Dev.

Size:

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

Weight:

Approximately 800 g.

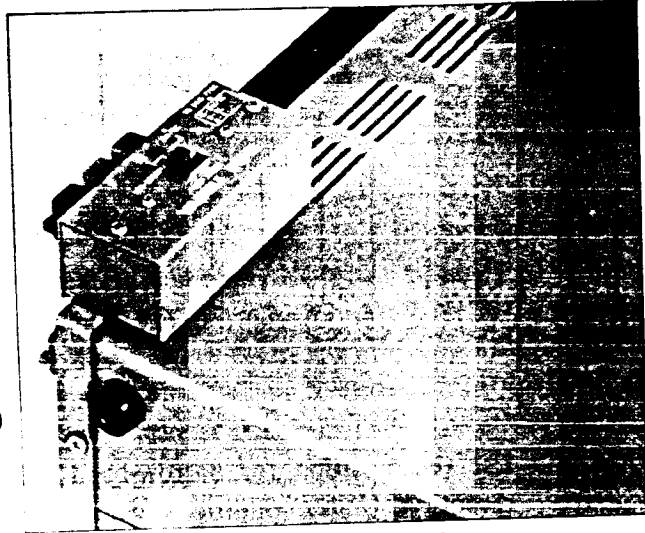


FRV-7700



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

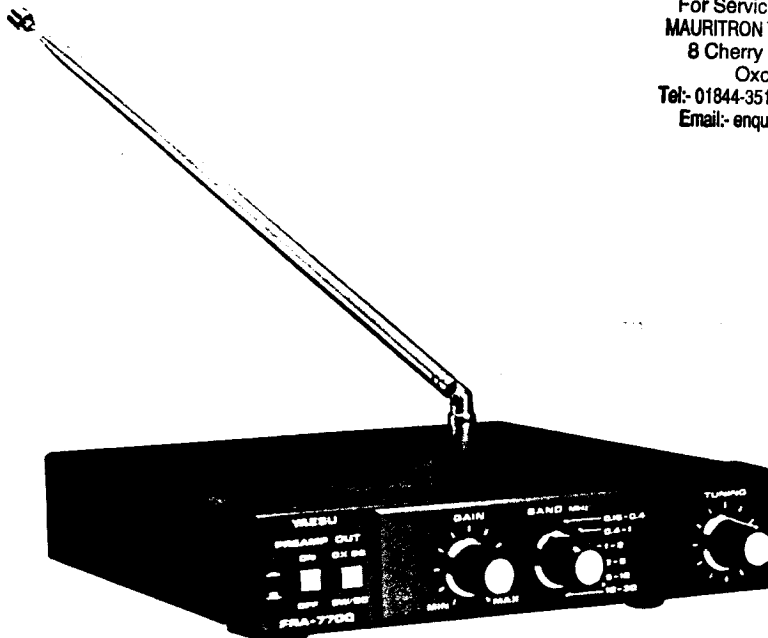


YH-77

FRA-7700 ACTIVE ANTENNA

This active antenna unit is designed for use with the FRG-7700 general coverage receiver, allowing good quality reception of signals while using only the attached 1.2 meter telescoping antenna. The active antenna unit includes an RF preamplifier

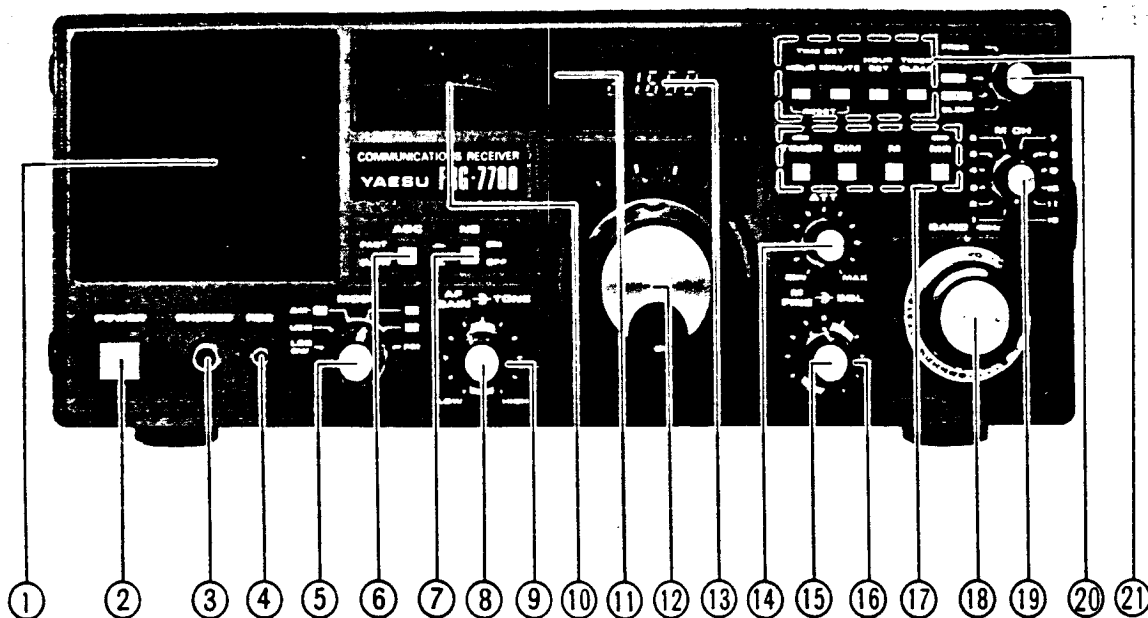
useful over the entire 150 kHz to 30 MHz range of the FRG-7700. Its gain is adjustable from the front panel allowing precise setting for optimum performance under a wide variety of reception situations.



FRA-7700

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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 blander 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

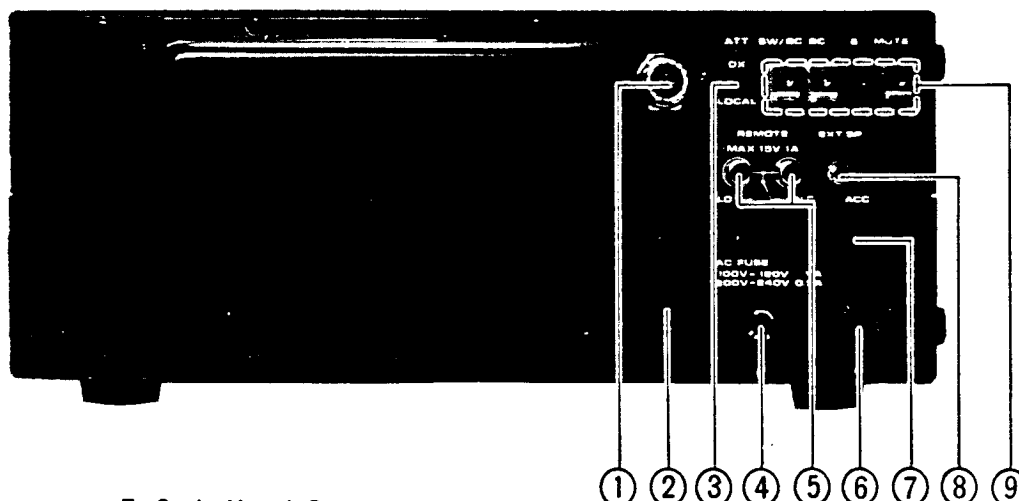
MINUTE This switch is used for setting minutes. The setting procedure is identical to that for setting hours.

HOURL 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.



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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.

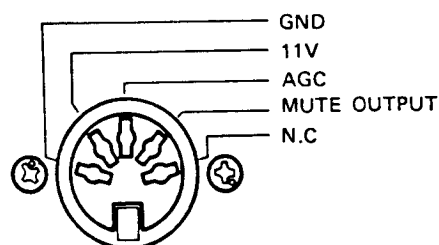
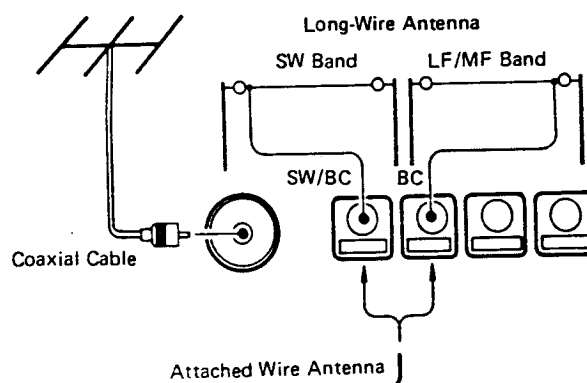
(9) SW/BC, BC, E, MUTE

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.

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.

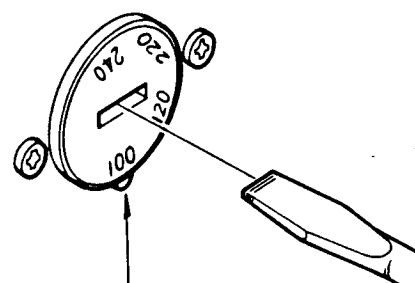
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CAUTION

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.



POINTER

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.

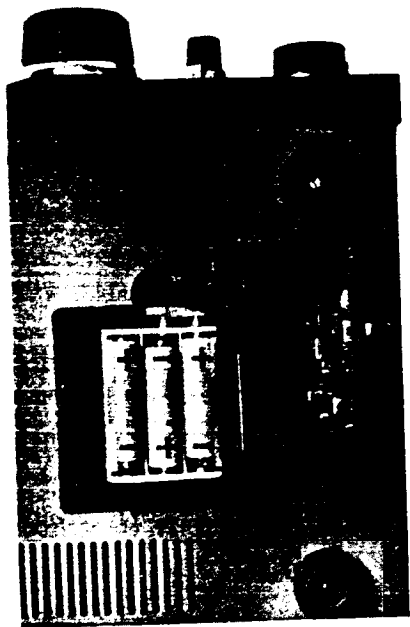


Figure 1

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-

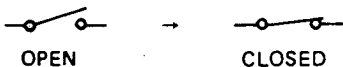
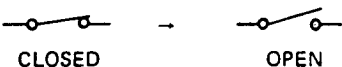

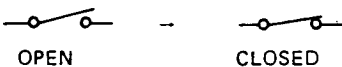


nection to be made between center pin and ground until the relay is activated; the relay will then open the connection.

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

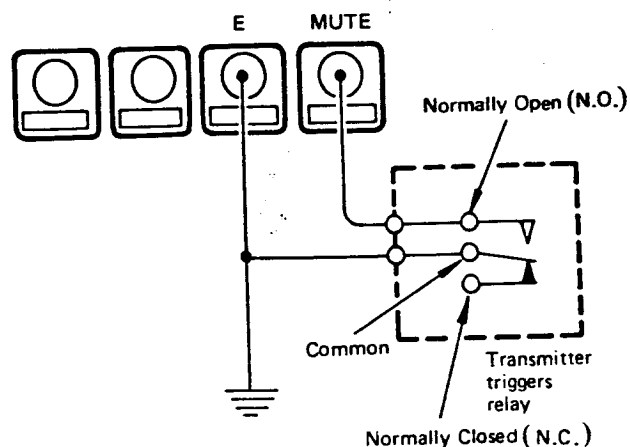
When the FRG-7700 is used in conjunction with a transmitter, the MUTE terminal on the rear panel may be used to silence the receiver when transmitting. Do not forget to use a relay for external antenna switching between the receiver and transmitter. Shorting the MUTE terminal to ground will cause the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



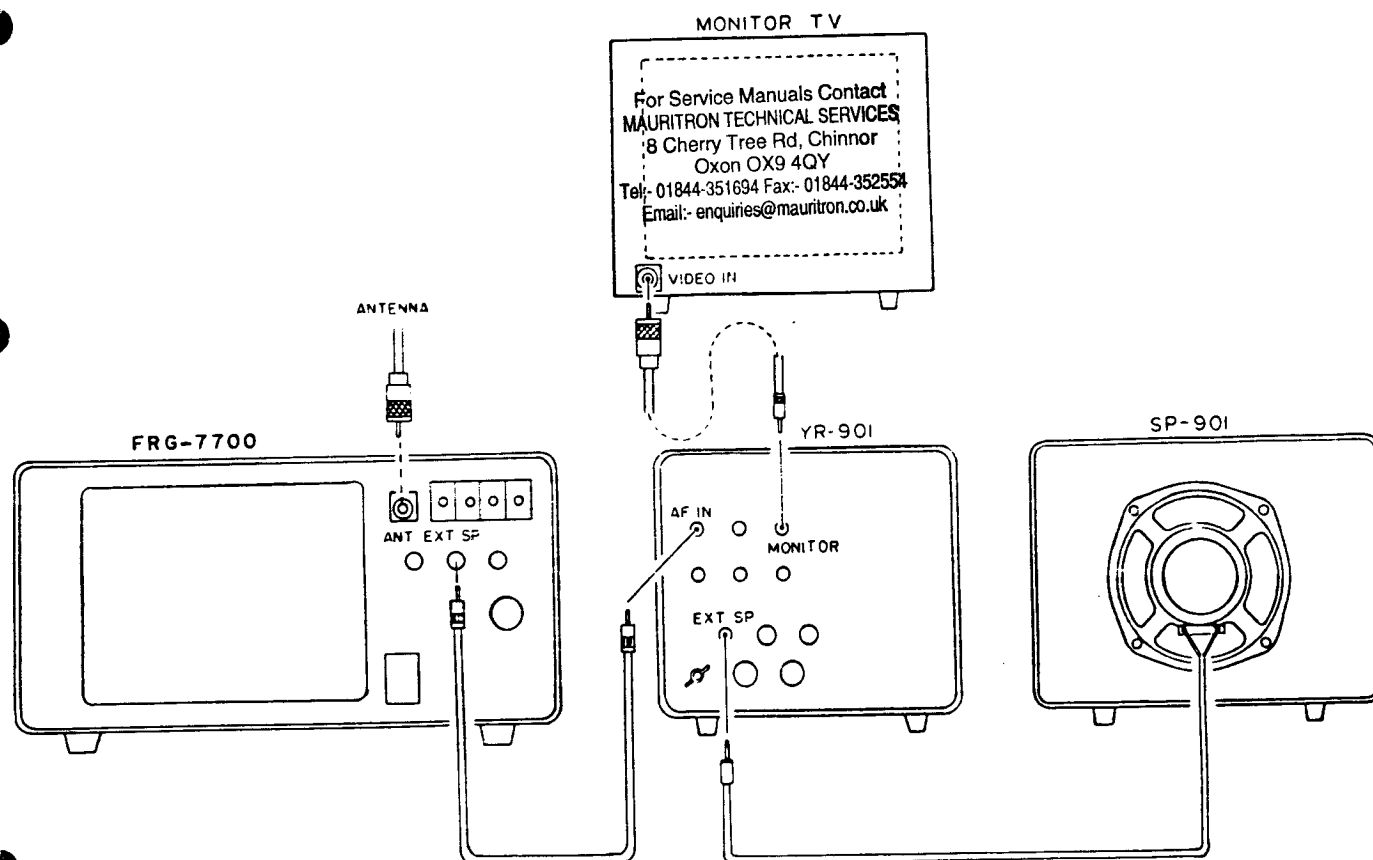
The YR-901 is a high-performance computerized translator which will allow display on a video monitor of incoming Morse Code and/or teletype (RTTY) signals. The YR-901 and YVM-1 Video Monitor are options available from your Yaesu dealer.

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

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.

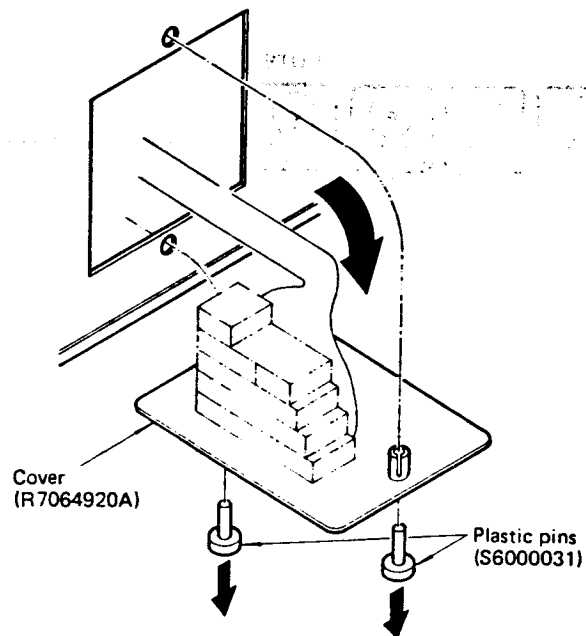


Figure 2

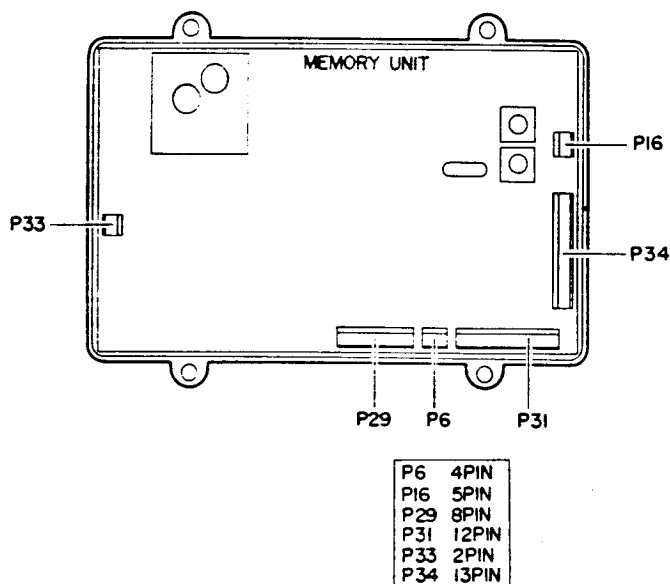


Figure 3

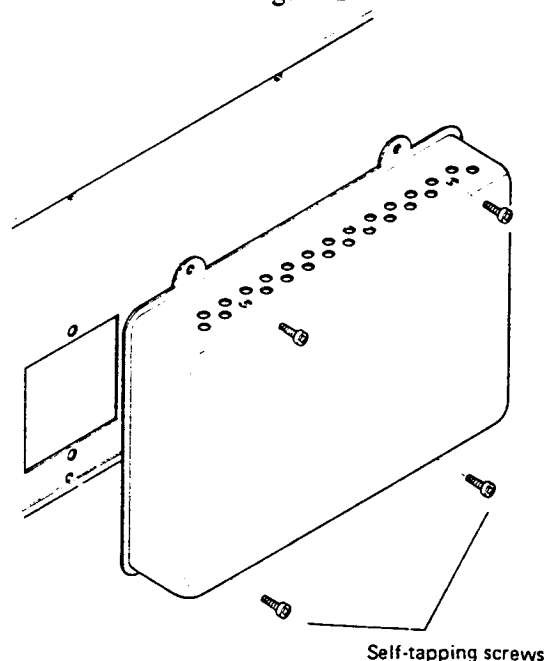


Figure 4

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.

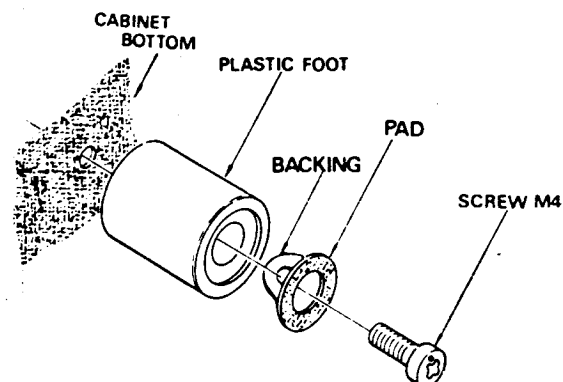
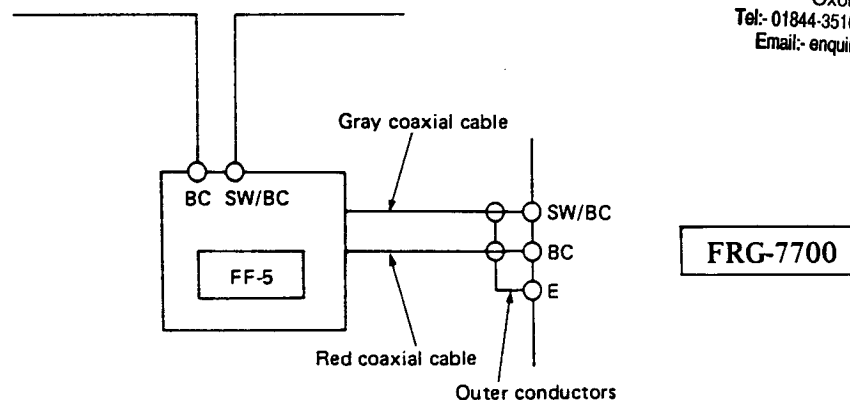


Figure 5

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.

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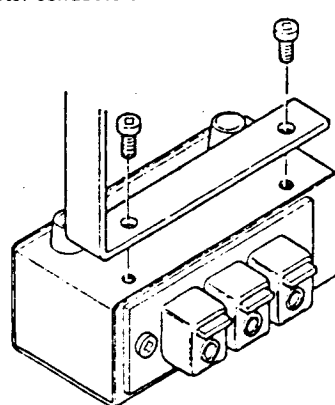


Fig. 1

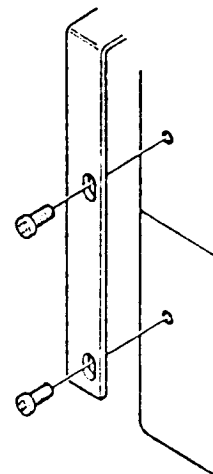


Fig. 2

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.

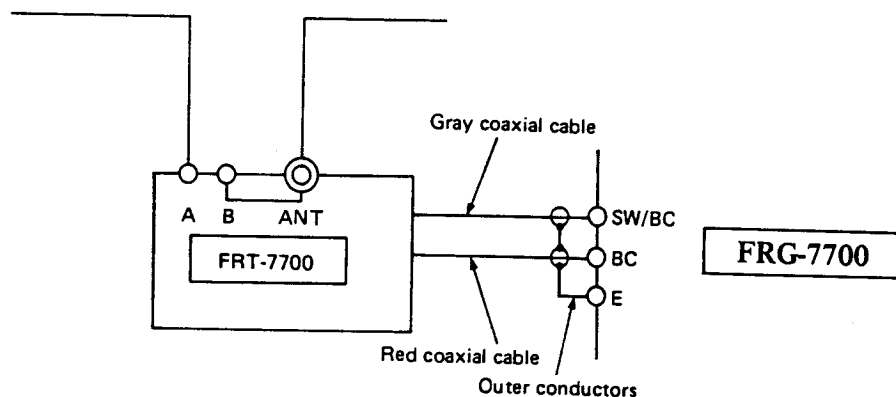
The coaxial receptacle (SO-239) is connected parallel to the ANT B terminal in the FRT-7700. If your antenna feeder has a coax plug, it should be connected to the coaxial receptacle.

OPERATION

1. Set your FRG-7700 for normal operation on the frequency you desire.
2. Preset the controls and switches as follows:

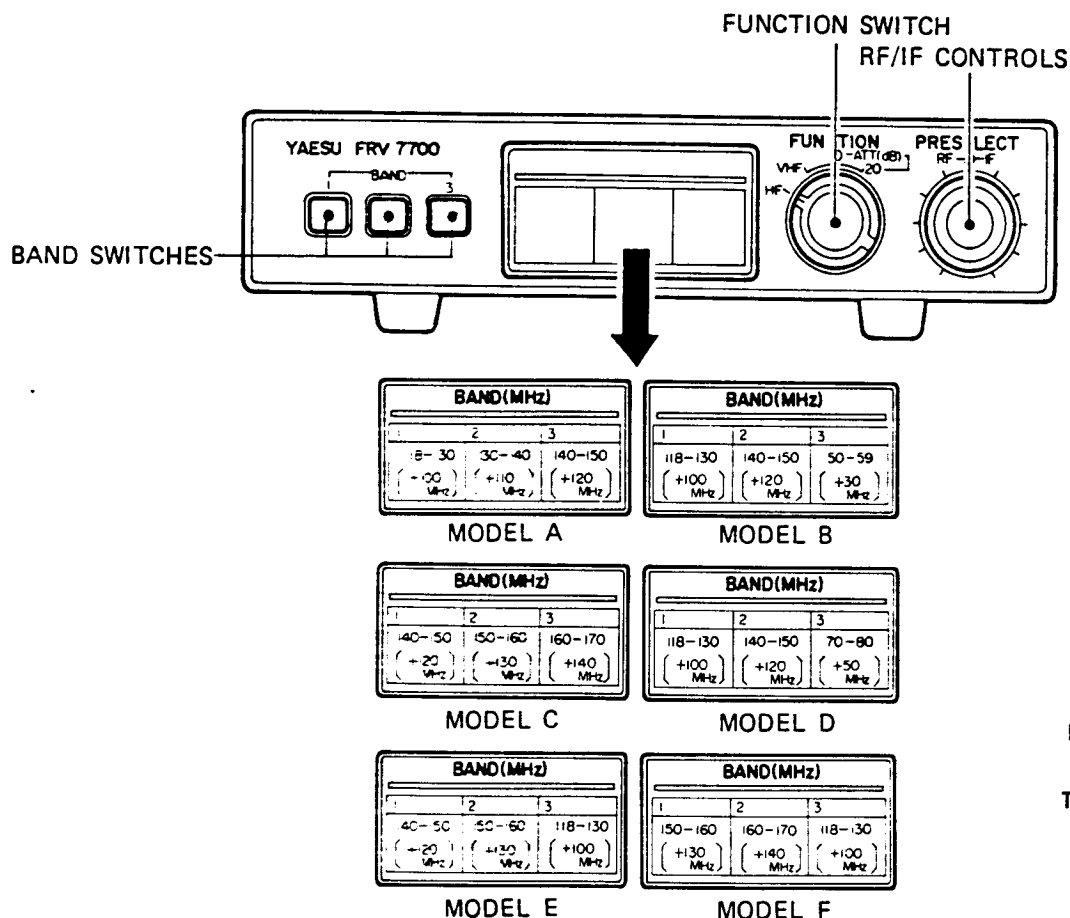
TUNER	— OFF
ATT	— 0 (dB)
BAND	— Desired band
MATCHING	— 3

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



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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.

REAR PANEL CONNECTIONS

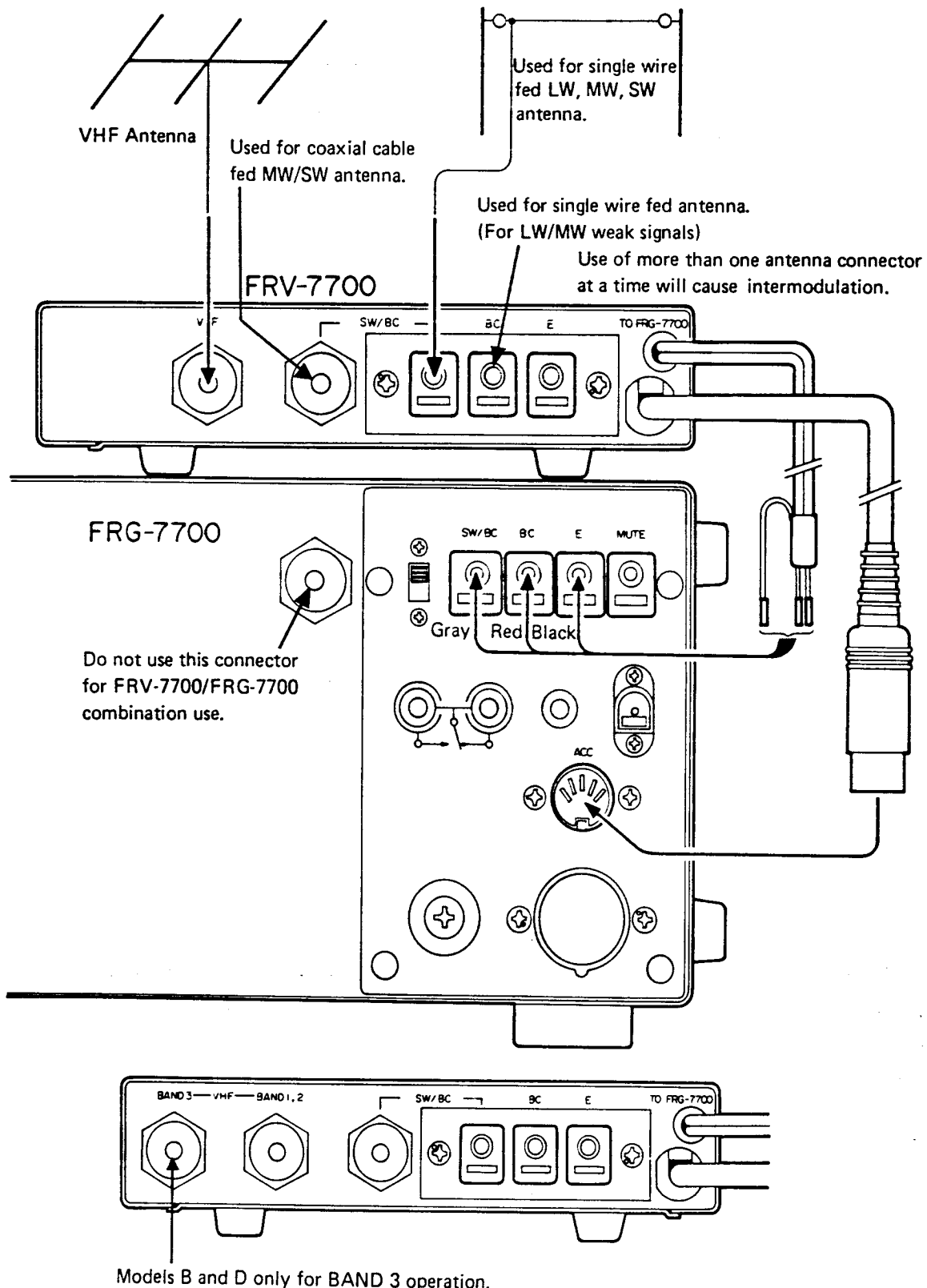
VHF

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).

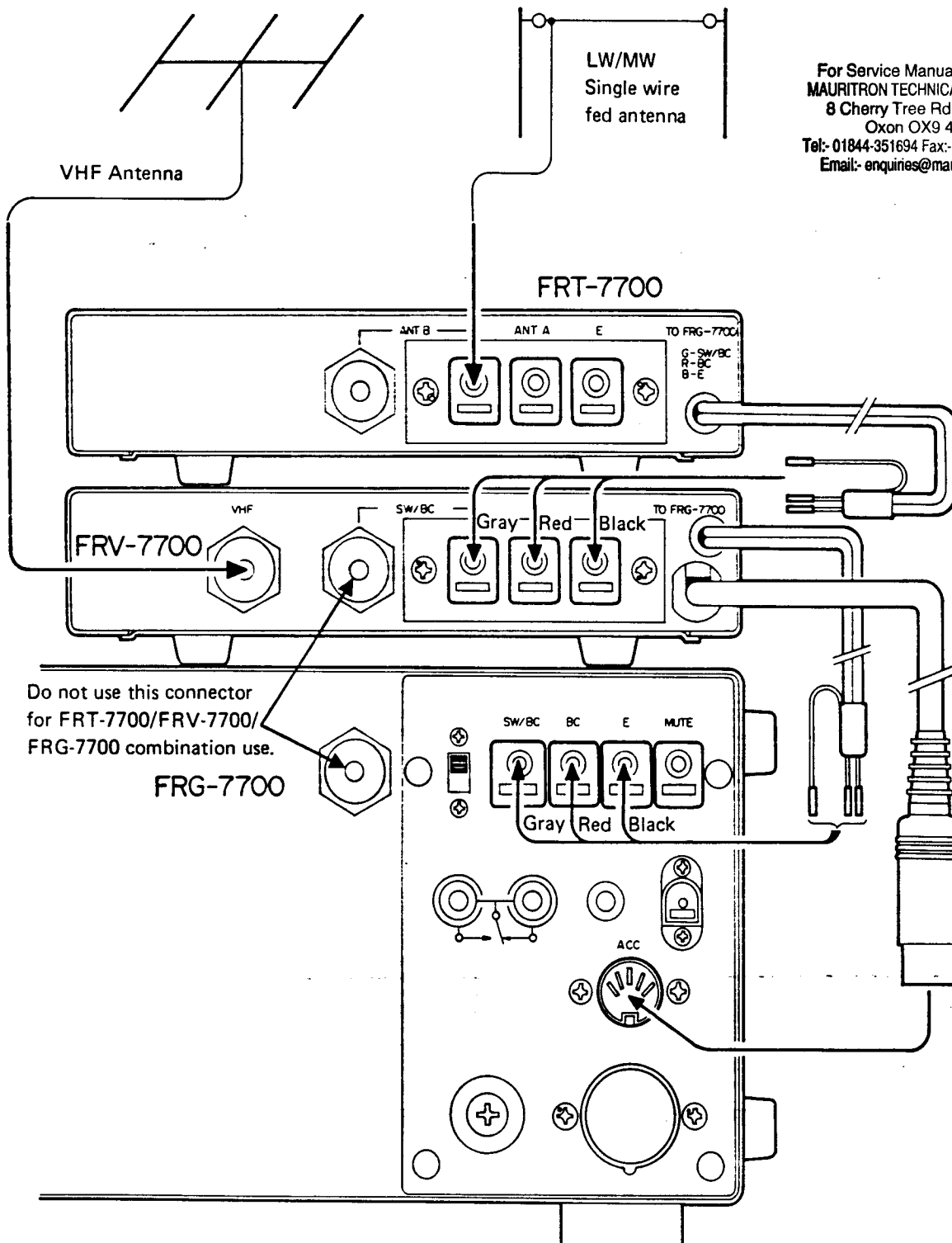


FRV-7700/FRG-7700 INTERCONNECTIONS

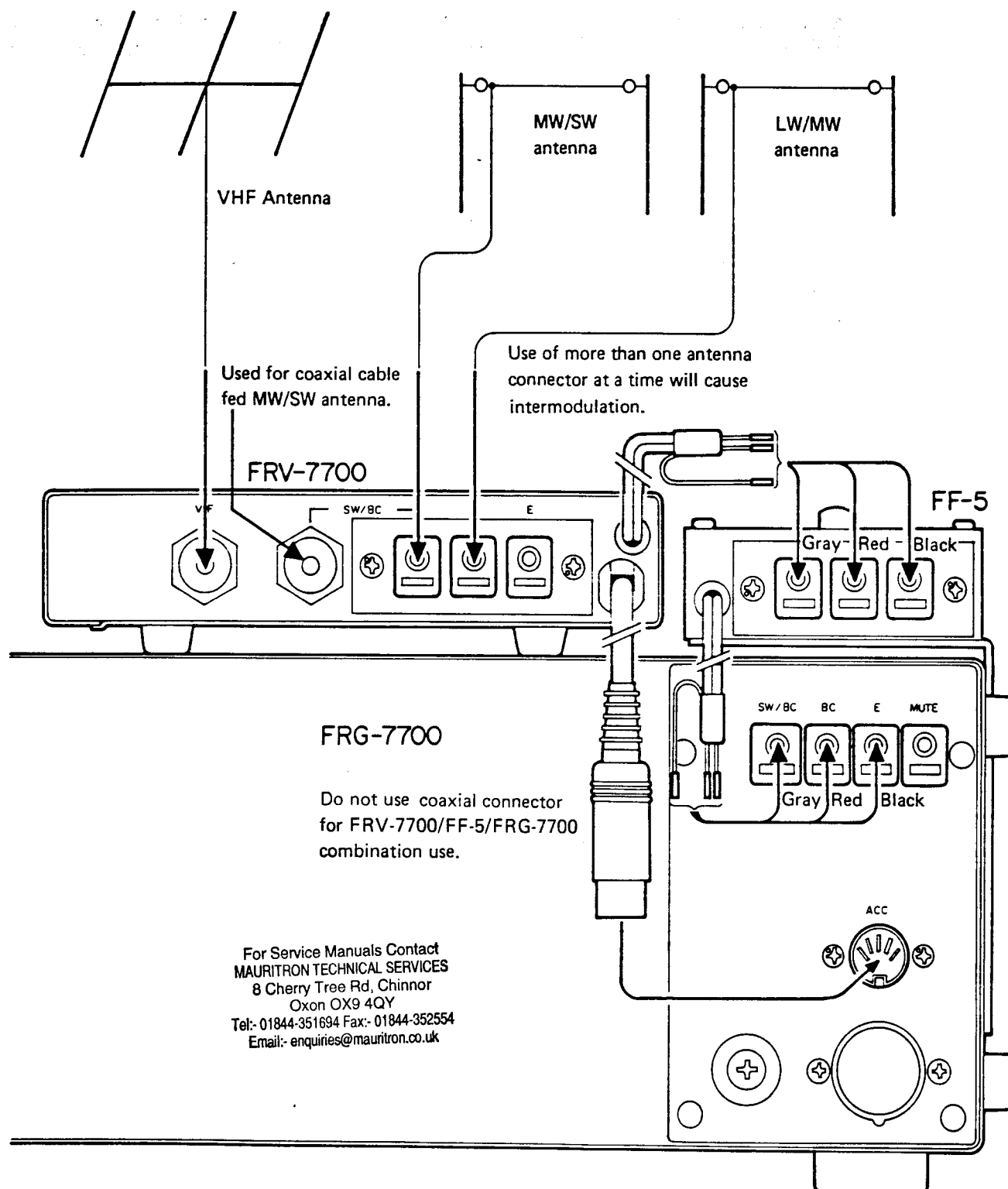
Connect the GRAY wire to the SW/BC terminal on the FRG-7700, the RED wire to the BC terminal and the BLACK wire to the E terminal.

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.

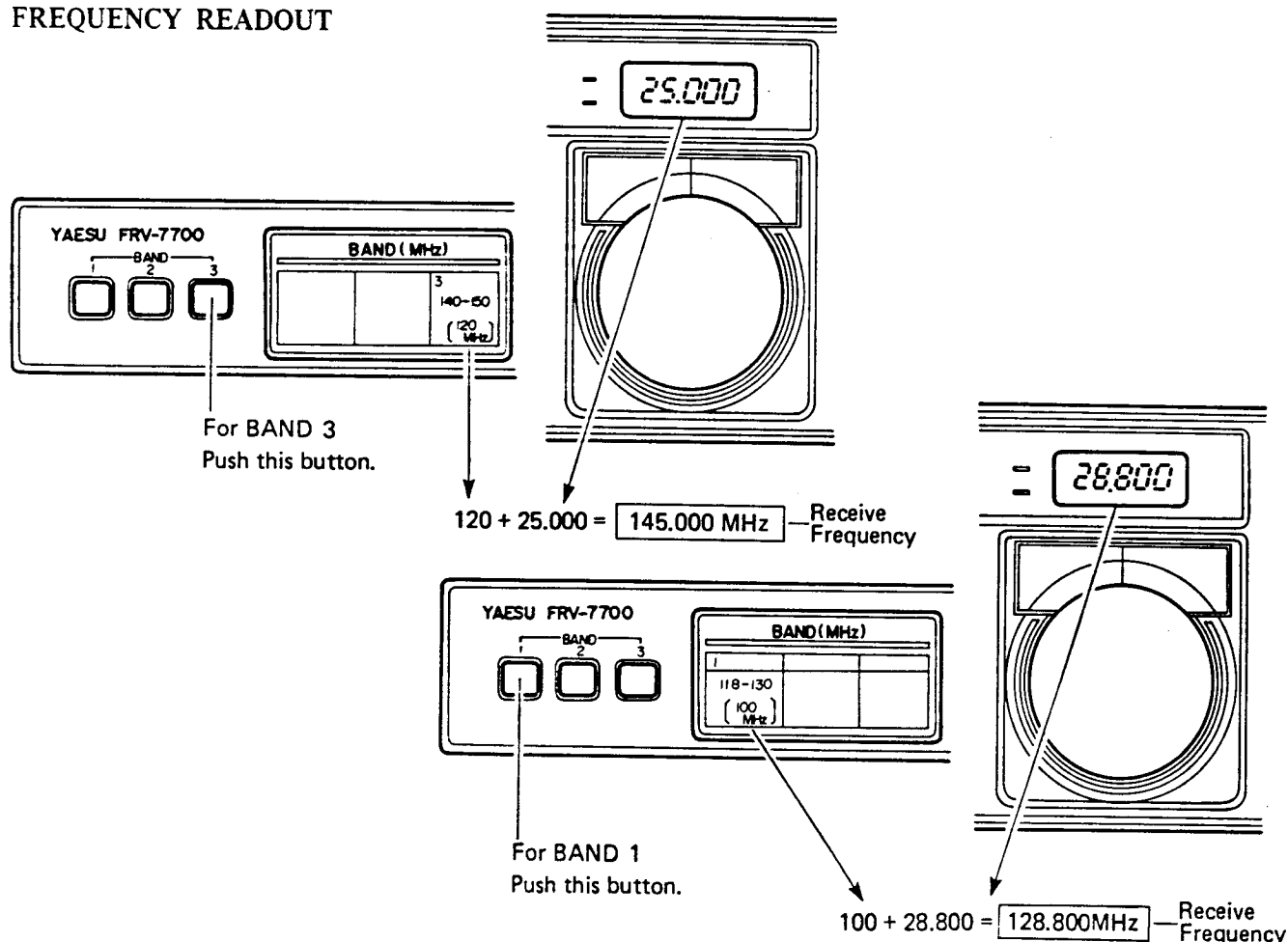
Taking another example, push the BAND 1 switch to engage a +100 MHz conversion. Tune the FRG-7700 to 28.800 MHz, and the resultant frequency received will be 128.800 MHz.

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



FRA-7700

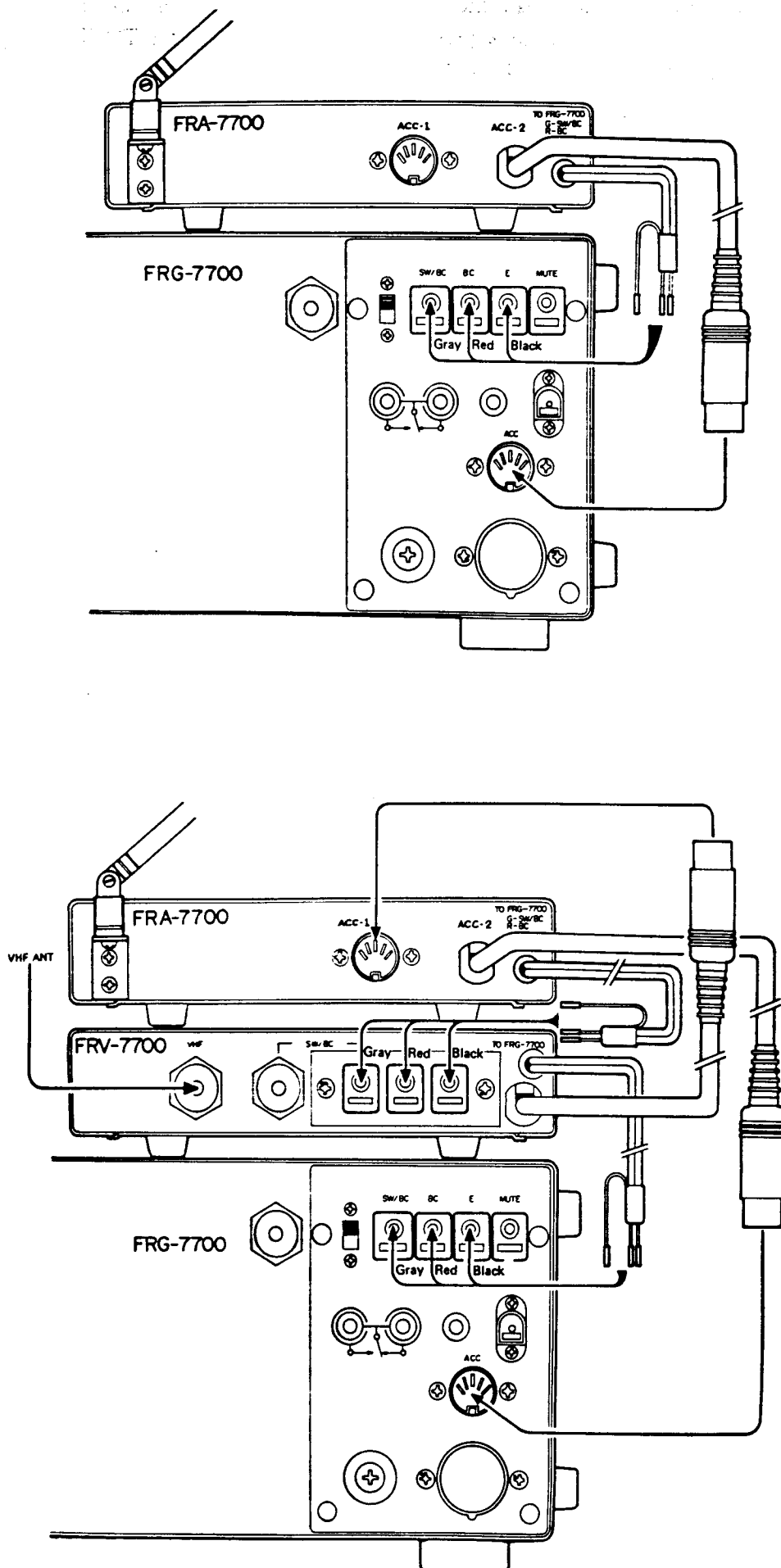
INSTALLATION AND OPERATION

1. On the end of the cable from the FRA-7700 connect the wire with the grey tab to the SW/BC terminal on the FRG-7700, and the wire with the red tab to the BC terminal. Similarly, connect the wire with the black tab to the E terminal on the FRG-7700. Connect the DIN plug from the FRA-7700 to the ACC jack.
2. Preset the controls and switches on the FRA-7700 as follows:
PREAMP ON
OUT SW/BC position
GAIN fully clockwise
BAND as desired
3. Fully extend the telescoping antenna on the FRA-7700.
4. Set the FRG-7700 to receive the desired frequency (as in step 2).
5. Adjust the TUNING control on the FRA-7700 for a peak in the signal on the receiver. If this peak occurs at either the fully clockwise or counterclockwise positions of the TUNING control, set the BAND switch to an adjacent position and tune again for a peak.
6. Adjust the angle and position of the telescoping antenna for maximum signal.
7. If a strong signal on a nearby frequency interferes with your desired signal, reduce the GAIN control setting to minimize the interference.
8. When you attempt to receive very weak signals on frequencies below 2 MHz, set the OUT switch to the DX BC position.

Note:

If you have the FRA-7700 connected to the receiver and switched OFF, such as when listening to strong local signals or through another antenna, you may need to set the BAND switch and TUNING control on the FRA-7700 to peak the received signal (even though the FRA-7700 is switched off).

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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.

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AM BROADCAST RECEPTION

- (1) Virtually all 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. If several stations are stored in the various memory channels, simply rotate the M CH switch to the desired channel.
- (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.

- (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.

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) Place the FUNCTION switch in the CLOCK position, then push and hold the HOUR SET button. The minutes and seconds will reset to zero. Tune in WWV at 10 MHz (or another international time standard) on the receiver. 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.
- (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.

To set the timer for on/off automatic control of the FRG-7700, proceed as follows (example—on time 10:30 AM, off time 11:30 AM)

- (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.

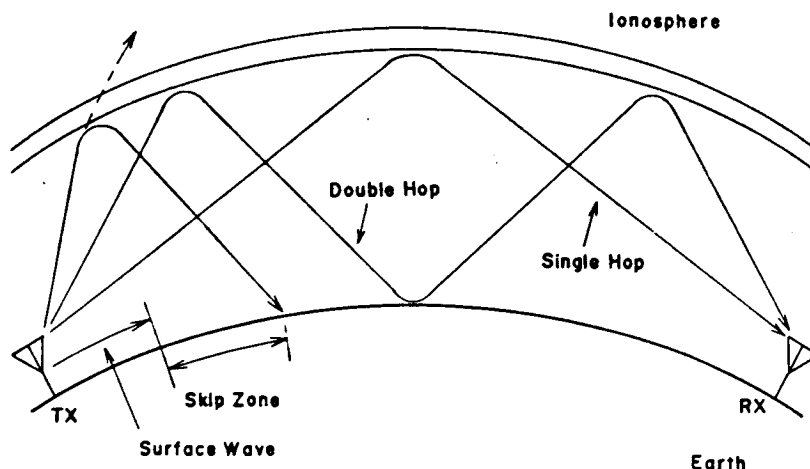
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NOTES REGARDING PROPAGATION OF SHORTWAVE SIGNALS

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.



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 nighttime 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 of the Tokyo schedule, 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 nighttime 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 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 above) as your main daylight bands. Secondly, use the lower frequencies (below 15 MHz) as your prime nighttime 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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[illegible]

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 a 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.

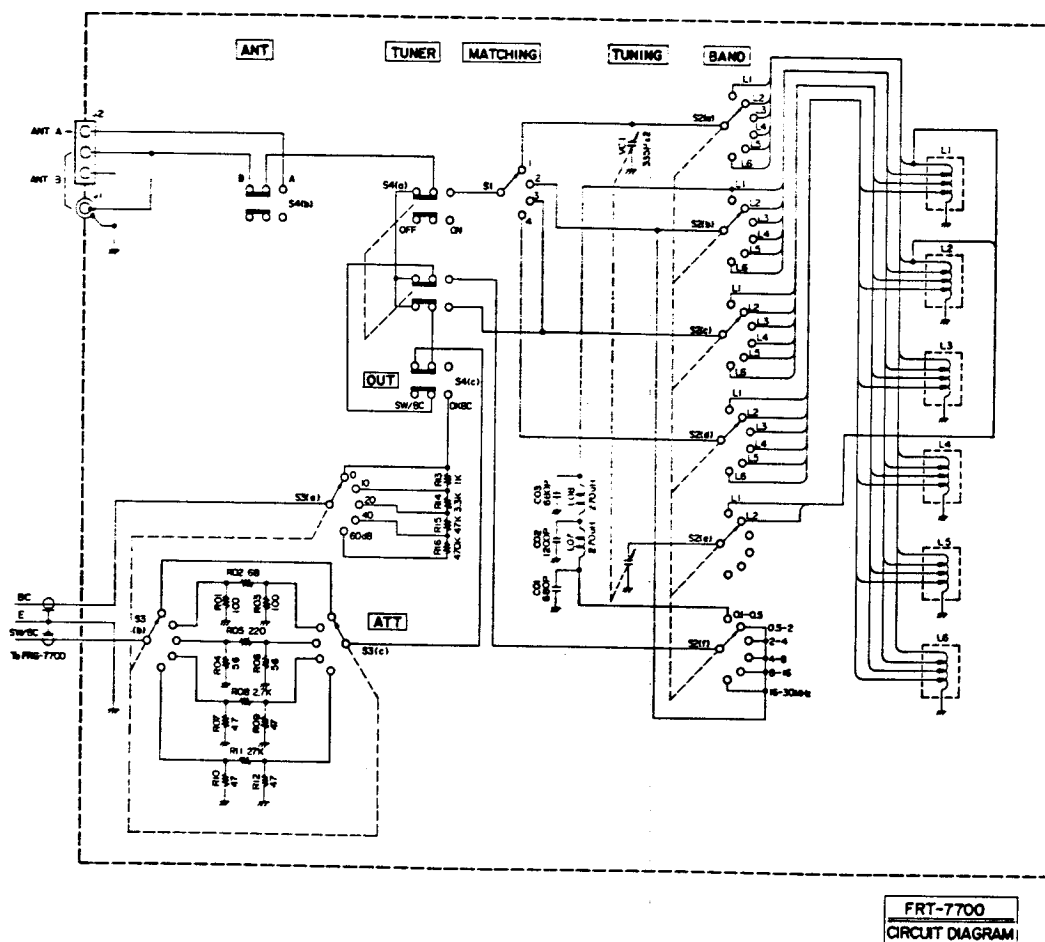
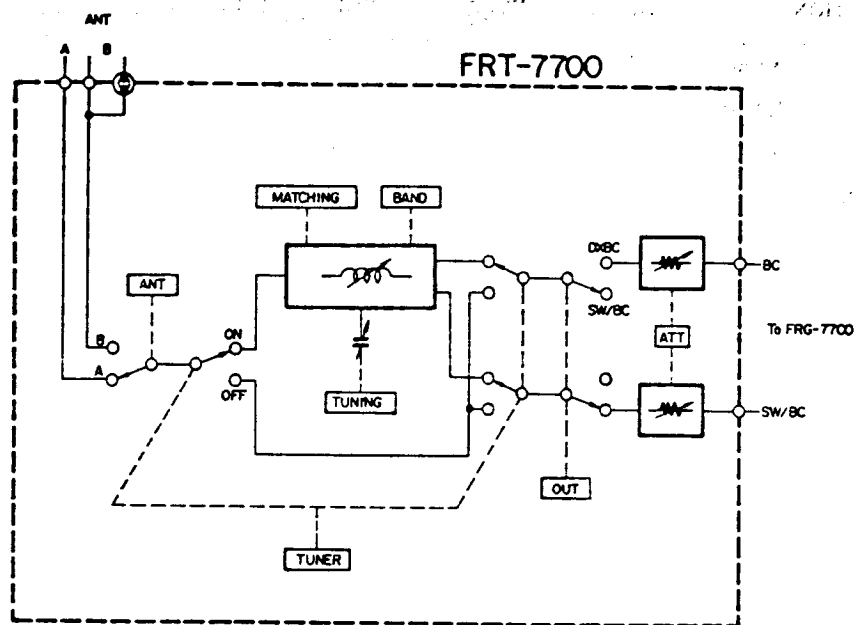
CRYSTAL DATA

TECHNICAL NOTES

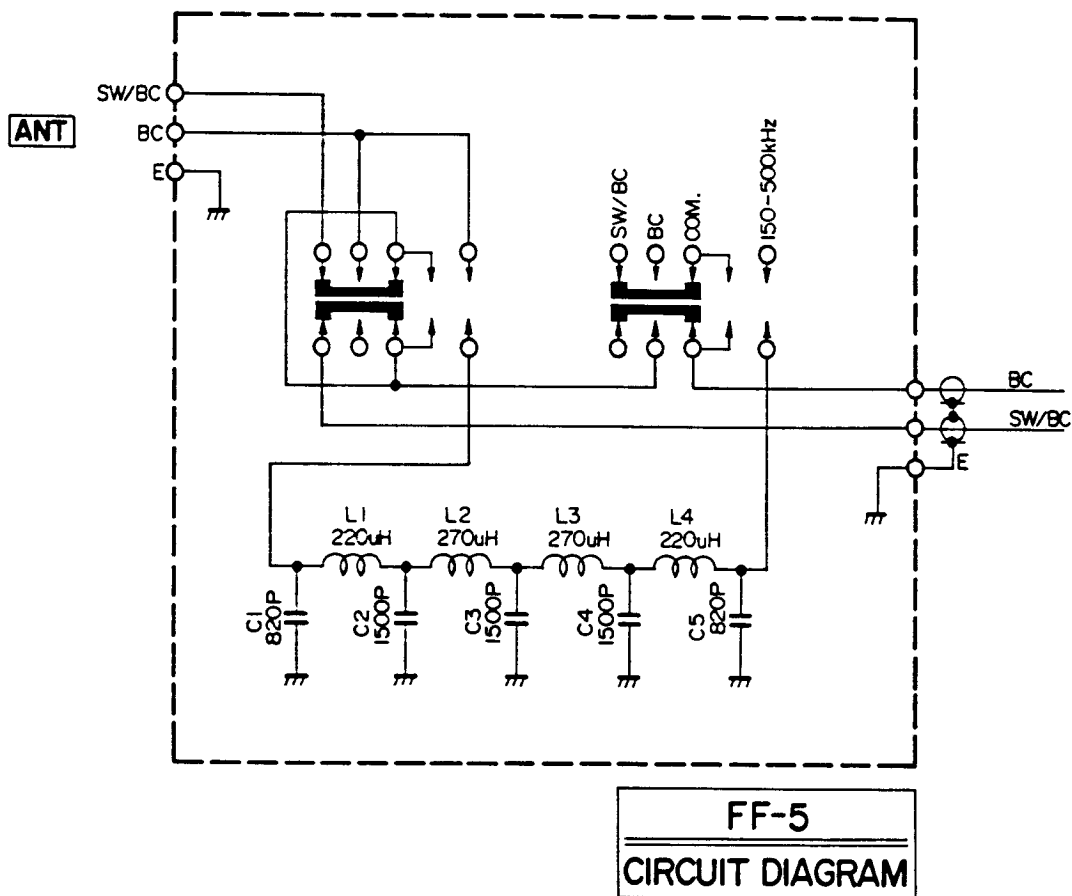
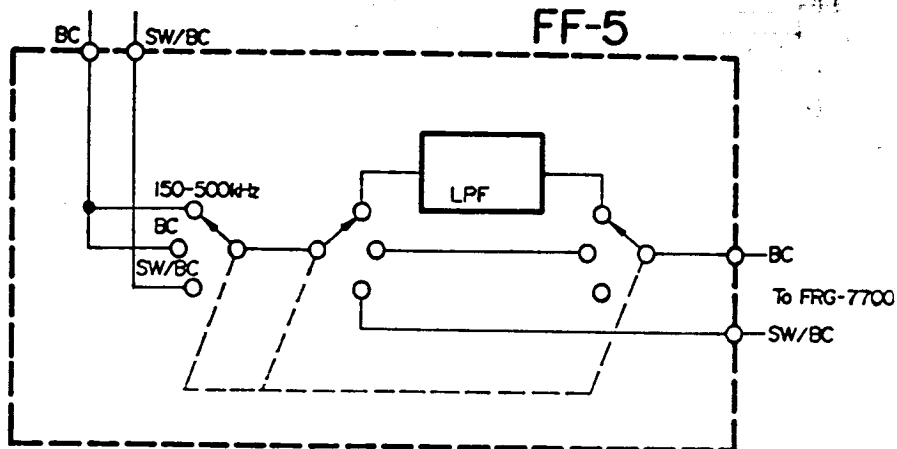
FUNCTION		HOLDER	RANGE (MHz)	MODE	LOAD C	EFFECTIVE RESISTANCE	DRIVE LEVEL
MAIN UNIT	X1001	HC-18/U	3.2768	Fundamental	30pF	150Ω	3mW
PLL UNIT	X2001	HC-18/U	47.6	3rd Overtone	20pF	25Ω	2mW
PLL UNIT	X2002	HC-18/U	6.4	Fundamental	30pF	30Ω	3mW
MEMORY UNIT	X6001	HC-18/U3P	16.434	Fundamental	30pF	15Ω	3mW

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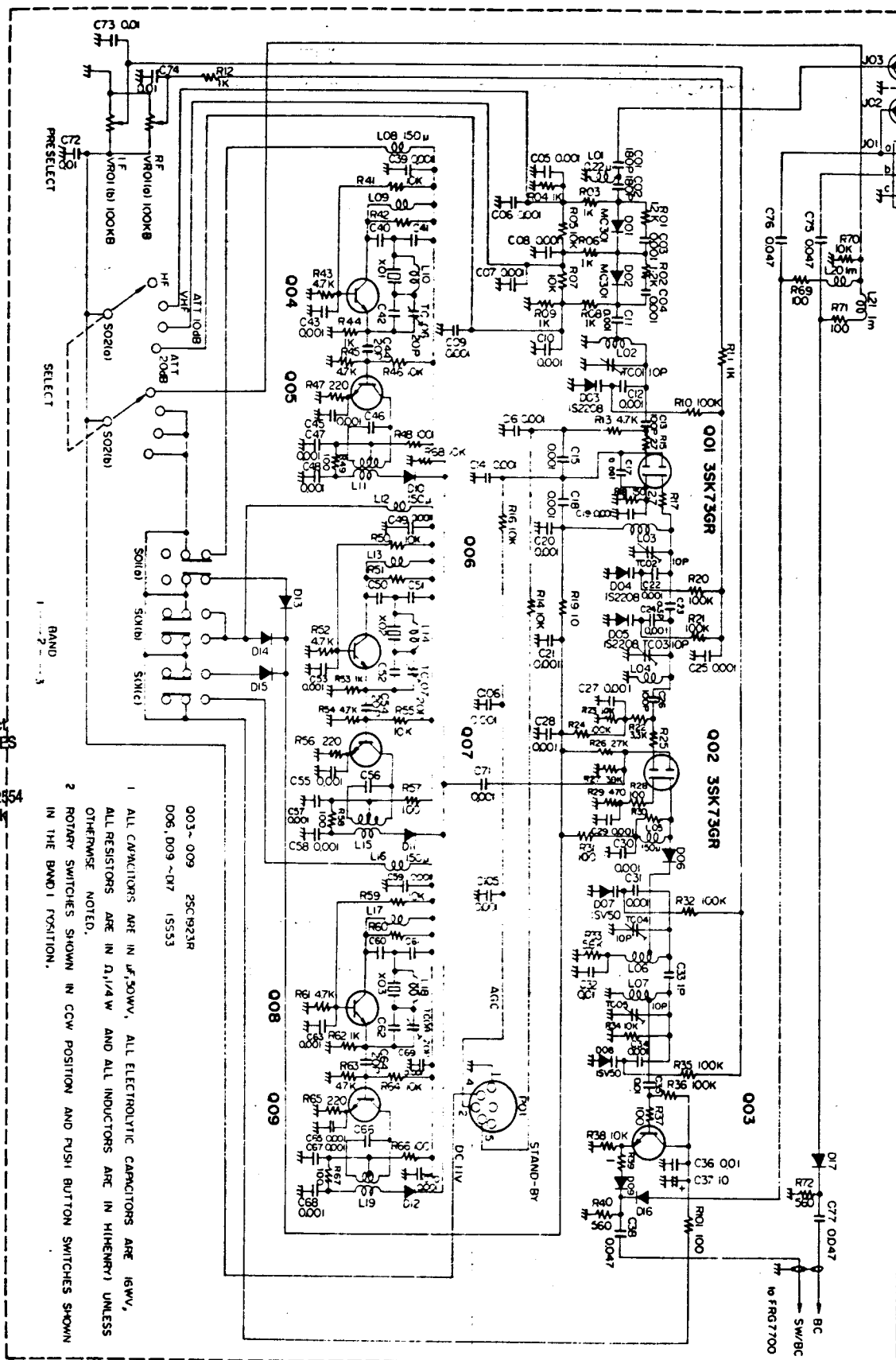
FRT-7700



FRT-7700
CIRCUIT DIAGRAM



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- 2 ROTARY SWITCHES SHOWN IN CCW POSITION AND PUSH BUTTON SWITCHES SHOWN IN THE BAND 1 POSITION.

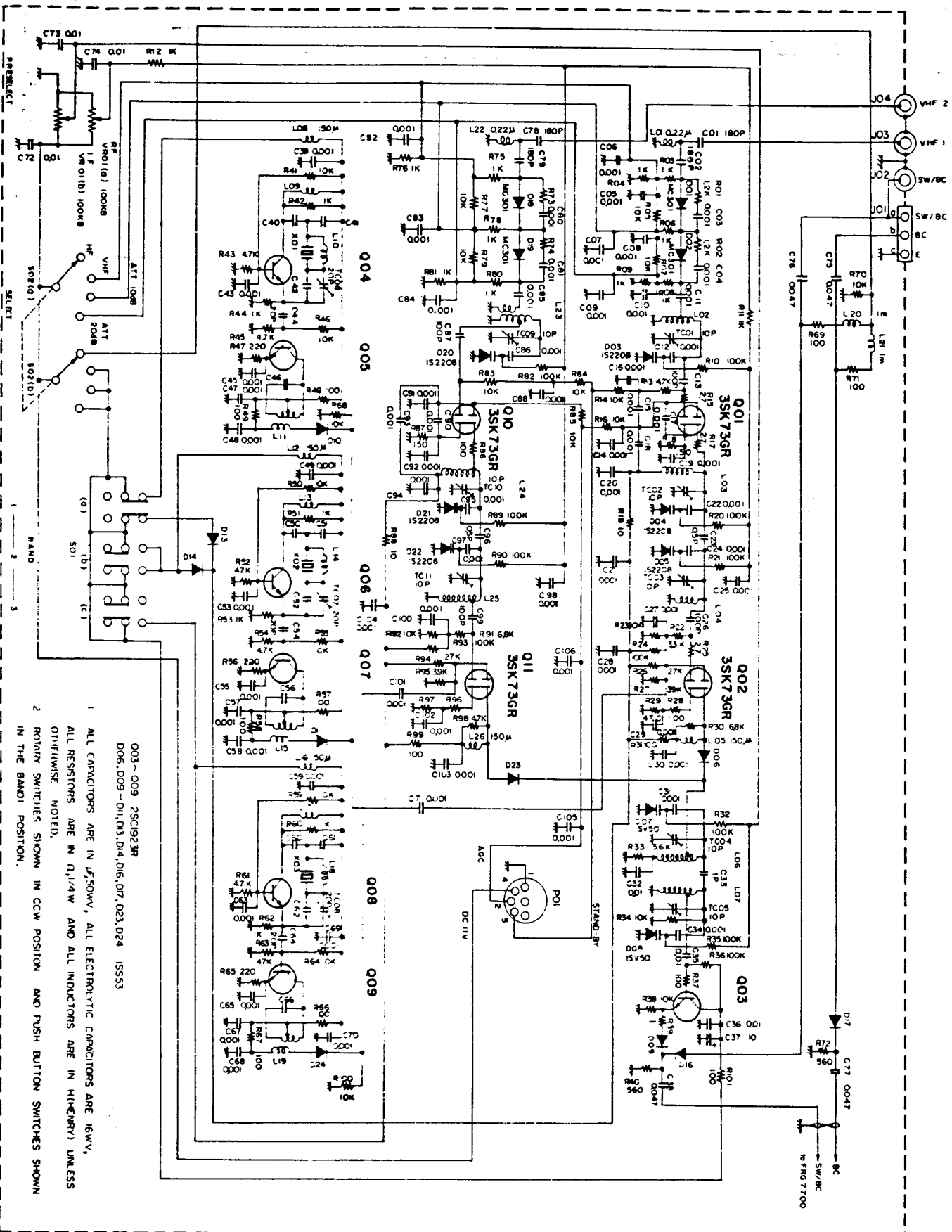
003-009 25C1923R
006, 009 ~ 017 15553

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FRV-7700
CIRCUIT DIAGRAM

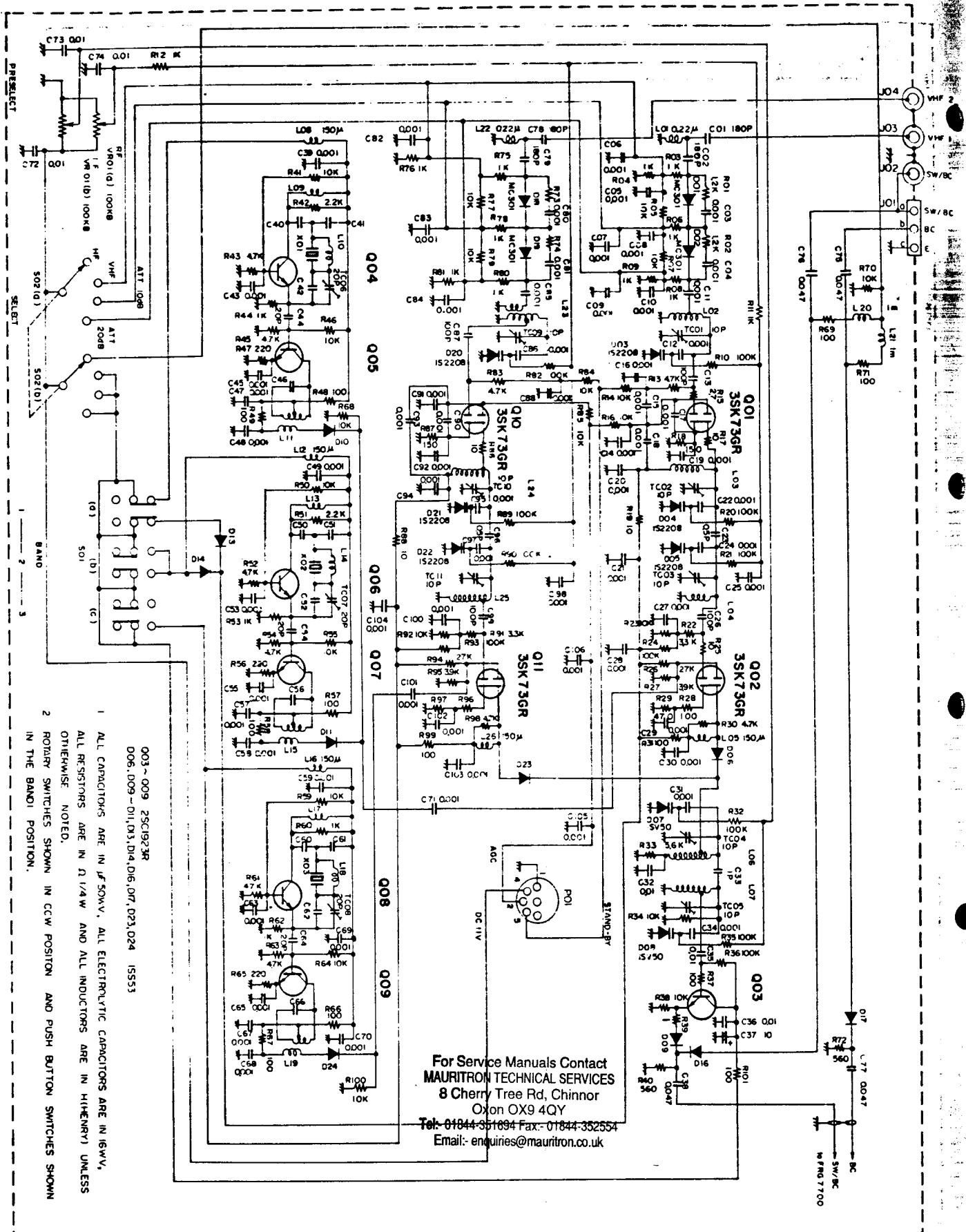
TYPE	A	C
X.TAL		
X 01	100MHZ	120MHZ
X 02	110MHZ	130MHZ
X 03	120MHZ	140MHZ
RESISTOR		
R25	27	10
R30	68K	47K
R32	1K	2.2K
R51	1K	2.2K
R63	1K	2.2K
CAPACITOR		
C 40	36P	24P
C 41	36P	24P
C 42	20P	20P
C 46	24P	16P
C 50	27P	16P
C 51	27P	16P
C 52	20P	20P
C 56	20P	13P
C 60	24P	15P
C 61	24P	15P
C 62	20P	20P
C 66	16P	10P
INDUCTOR		
L 10	0.33u	0.33u
L 14	0.33u	0.22u
L 18	0.33u	0.22u

FRV-7700(B.D)



TYPE	B	D
X01	100MHZ	100MHZ
X02	120MHZ	120MHZ
X03	30MHZ	50MHZ
R73	220	330
R74	220	1K
R96	390	220
R97	180	330
CAPACITOR		
C40	36P	36P
C41	36P	36P
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	36P	12P
INDUCTOR		
L10	0.33 μ	0.33 μ
L14	0.33 μ	0.33 μ
L18	4.7 μ	1.8 μ

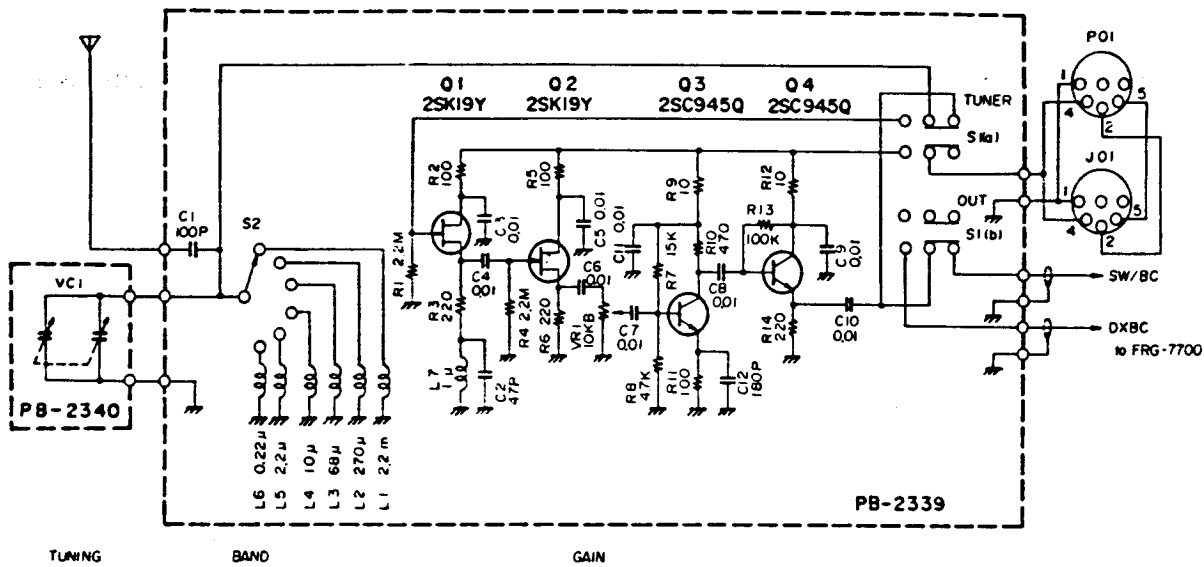
FRV-7700(E.F)



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
R75	100	100
R76	470	470
CAPACITOR		
C40	24P	16P
C41	24P	16P
C42	20P	20P
C43	16P	13P
C44	16P	15P
C45	16P	15P
C46	20P	20P
C47	13P	10P
C48	36P	36P
C49	36P	36P
C50	20P	20P
C51	24P	24P
C52	24P	24P
C53	24P	24P
C54	24P	24P
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C189	24P	24P
C190	24P	24P
C191	24P	24P
C192	24P	24P
C193	24P	24P
C194	24P	24P
C195	24P	24P
C196	24P	24P
C197	24P	24P
C198	24P	24P
C199	24P	24P
C200	24P	24P

FRV-7700
 CIRCUIT DIAGRAM

FRA-7700



1. ALL CAPACITORS ARE IN μF 50WV, ALL RESISTORS ARE IN Ω /1/4W, ALL INDUCTORS ARE IN MHENRY, UNLESS OTHERWISE NOTED.
2. ROTARY SWITCH IS SHOWN IN CCW POSITION AND PUSH BUTTON SWITCHES ARE SHOWN IN THE RELEASED POSITION.

FRA - 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.

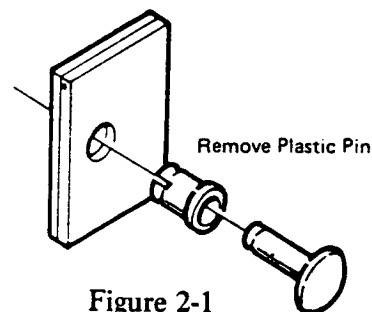


Figure 2-1

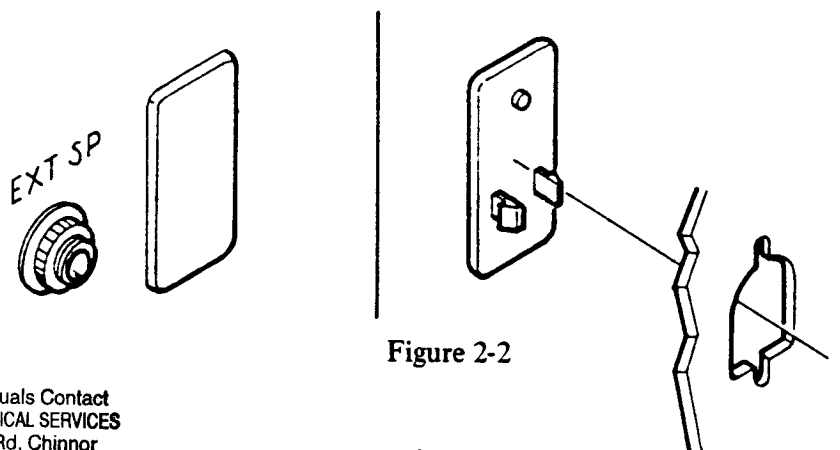


Figure 2-2

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8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

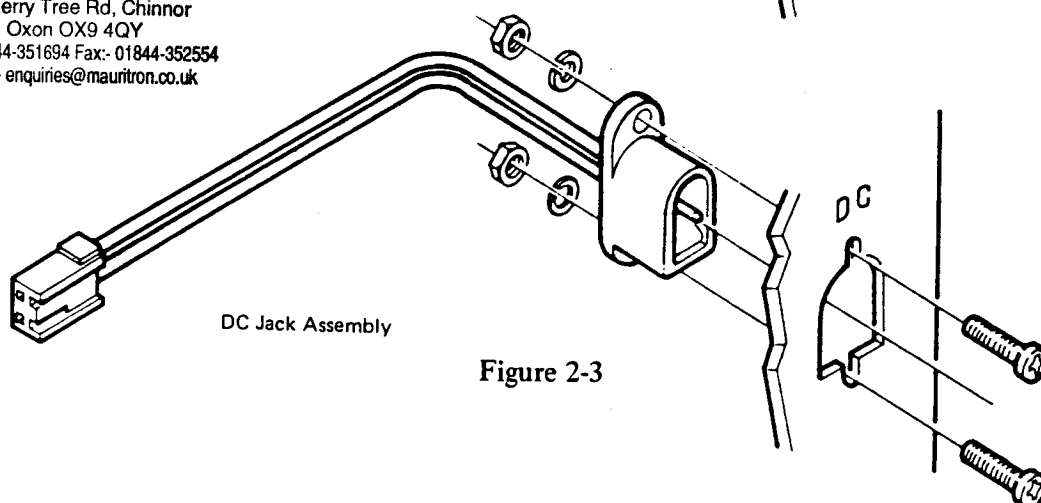


Figure 2-3

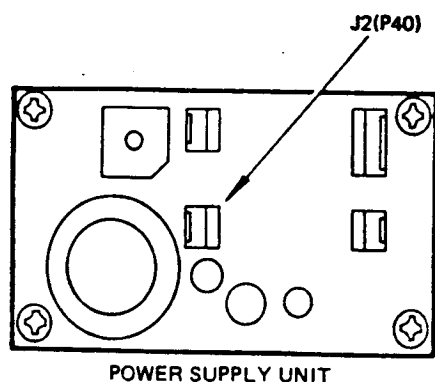


Figure 2-4

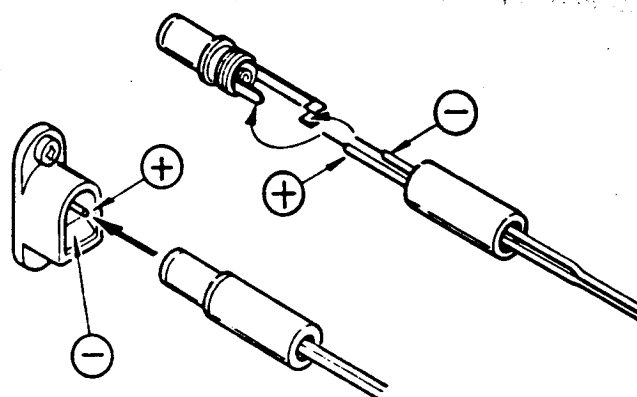


Figure 2-5

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 2-6.
2. Install and solder the two 1N60 diodes and the 3.3 Kohm resistor as shown in Figure 2-6.

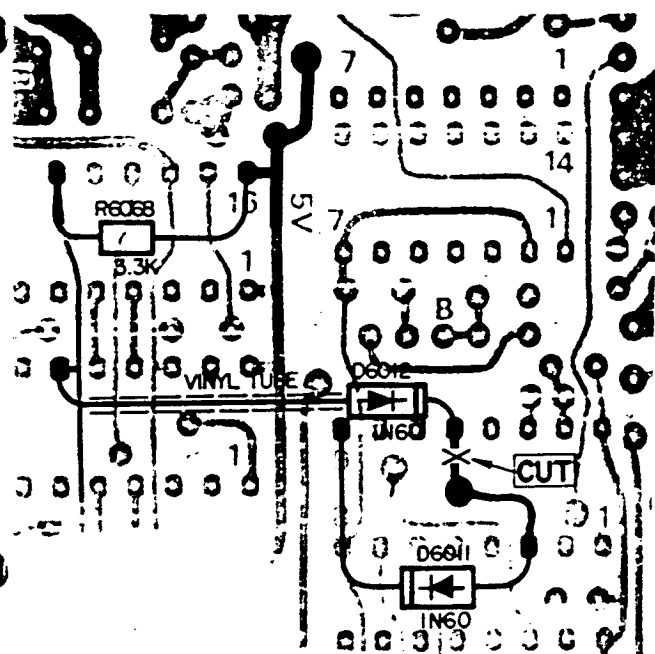


Fig. 2-6

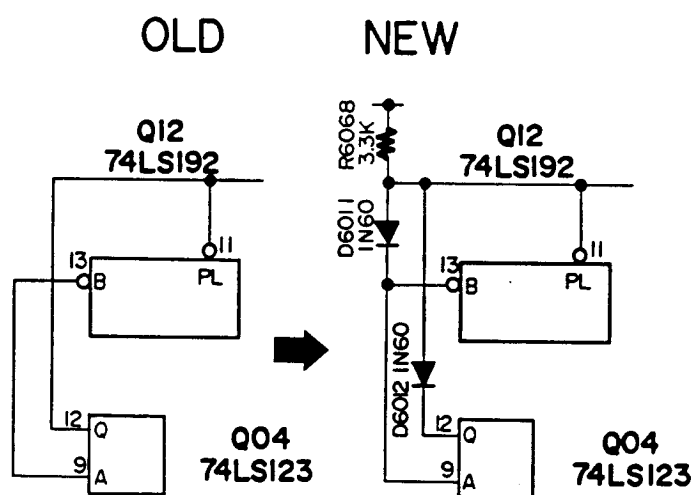


Fig. 2-7

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. 2-8) 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. 2-9.
- 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.

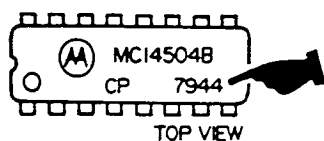


Figure 2-8

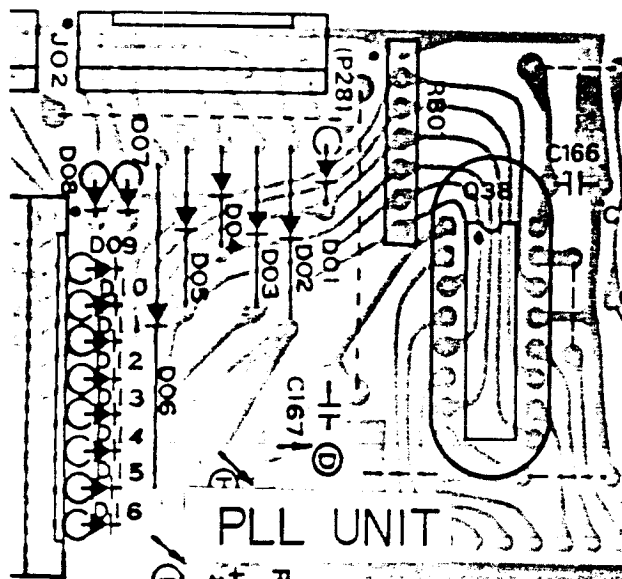


Figure 2-9

- 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. 2-10.
- 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. 2-11.
- 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.

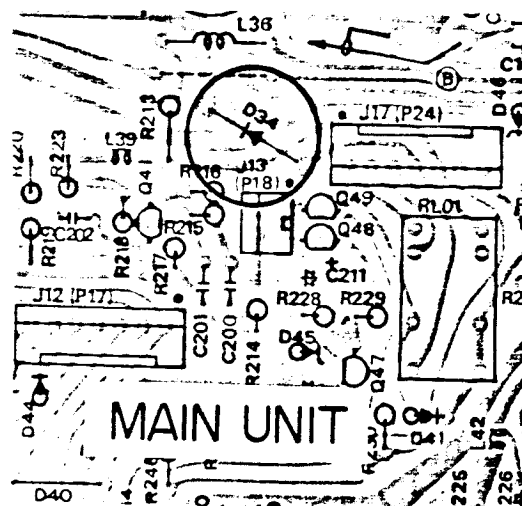


Figure 2-10

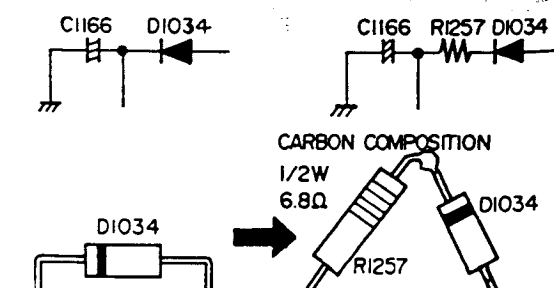


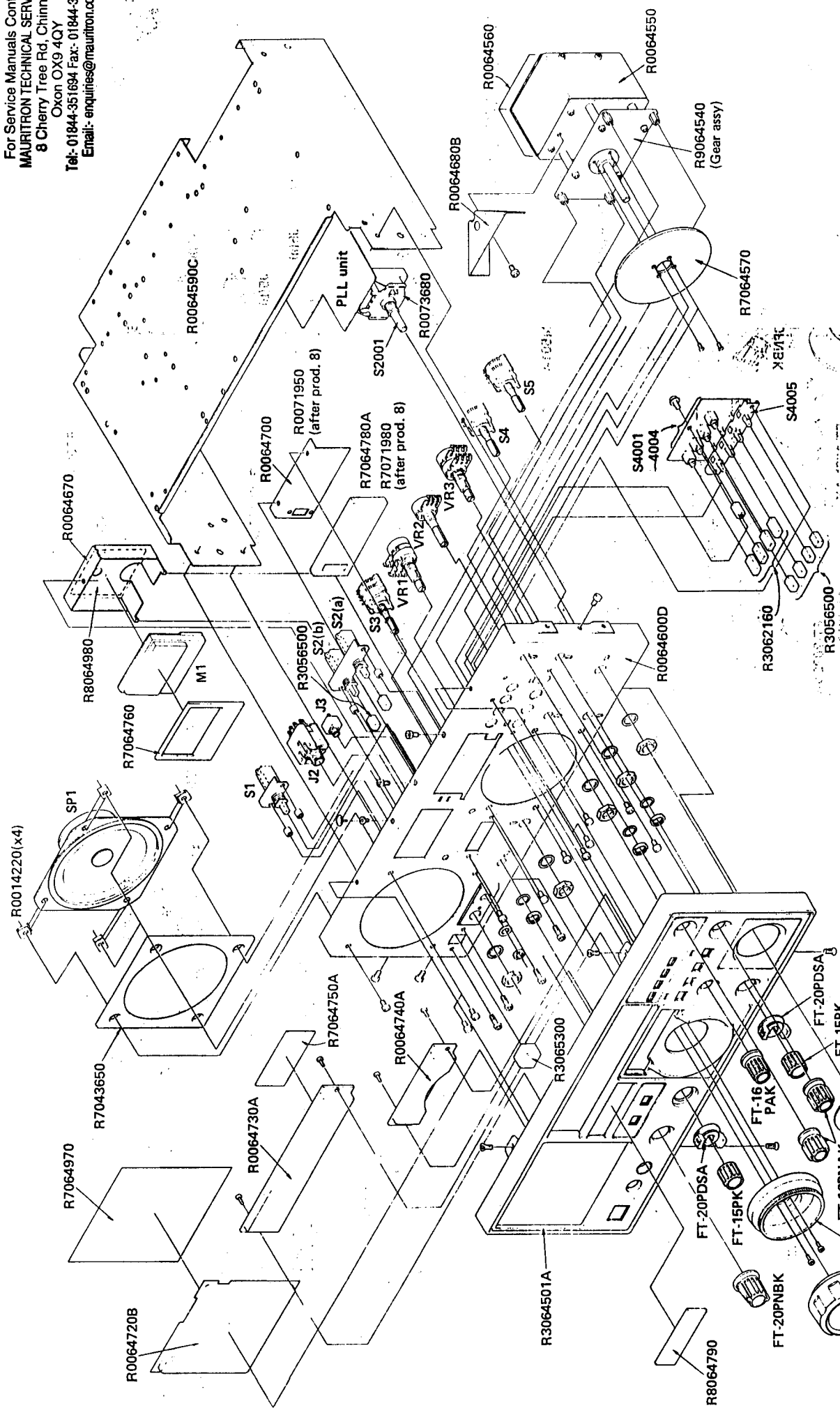
Figure 2-11

SECTION 3—SERVICING

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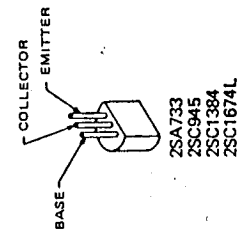
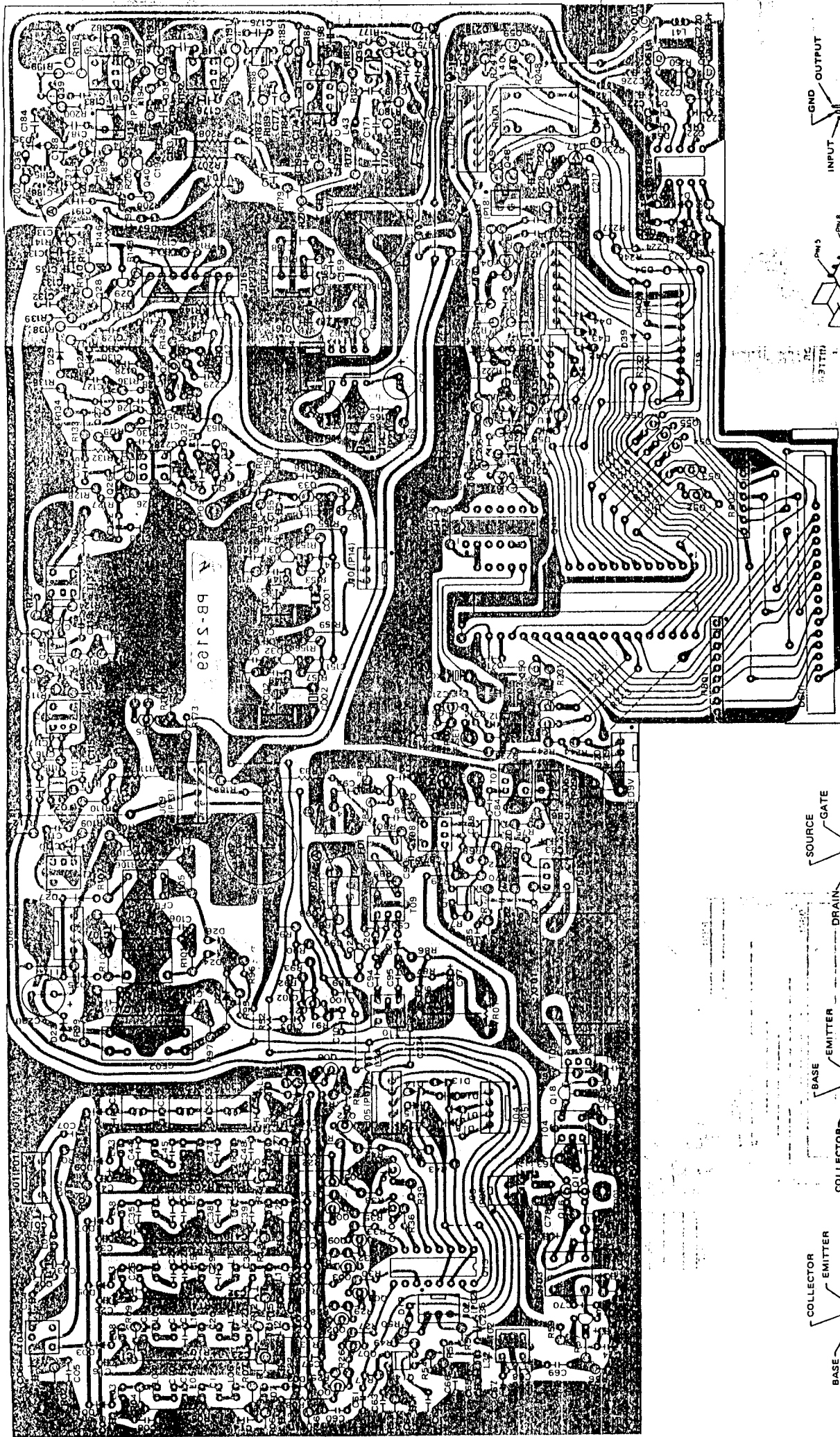
FRONT PANEL REMOVAL

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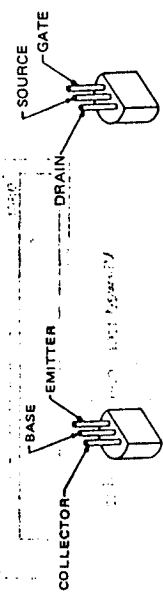


Knob Parts code number
 FT-15PK ... R3065250
 FT-16PAK ... R3065260
 FT-16PNAK ... R3065270
 FT-20PDSB ... R3065280

TS4-13

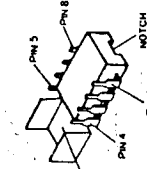


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2SC945
2SC1384
2SC1674L

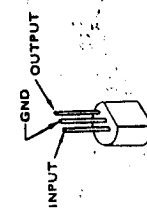


MPS-A13

2SK125



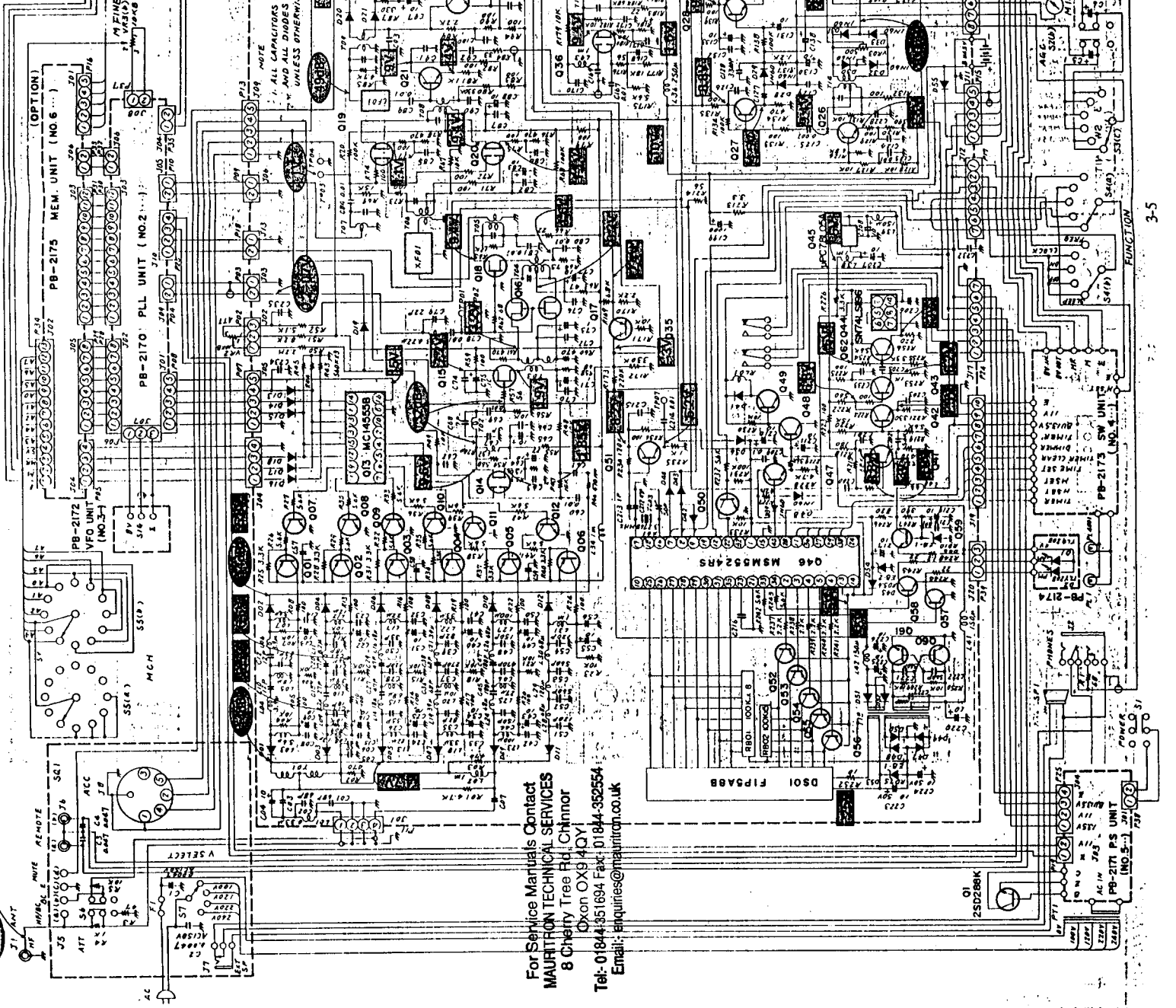
μPC575C2



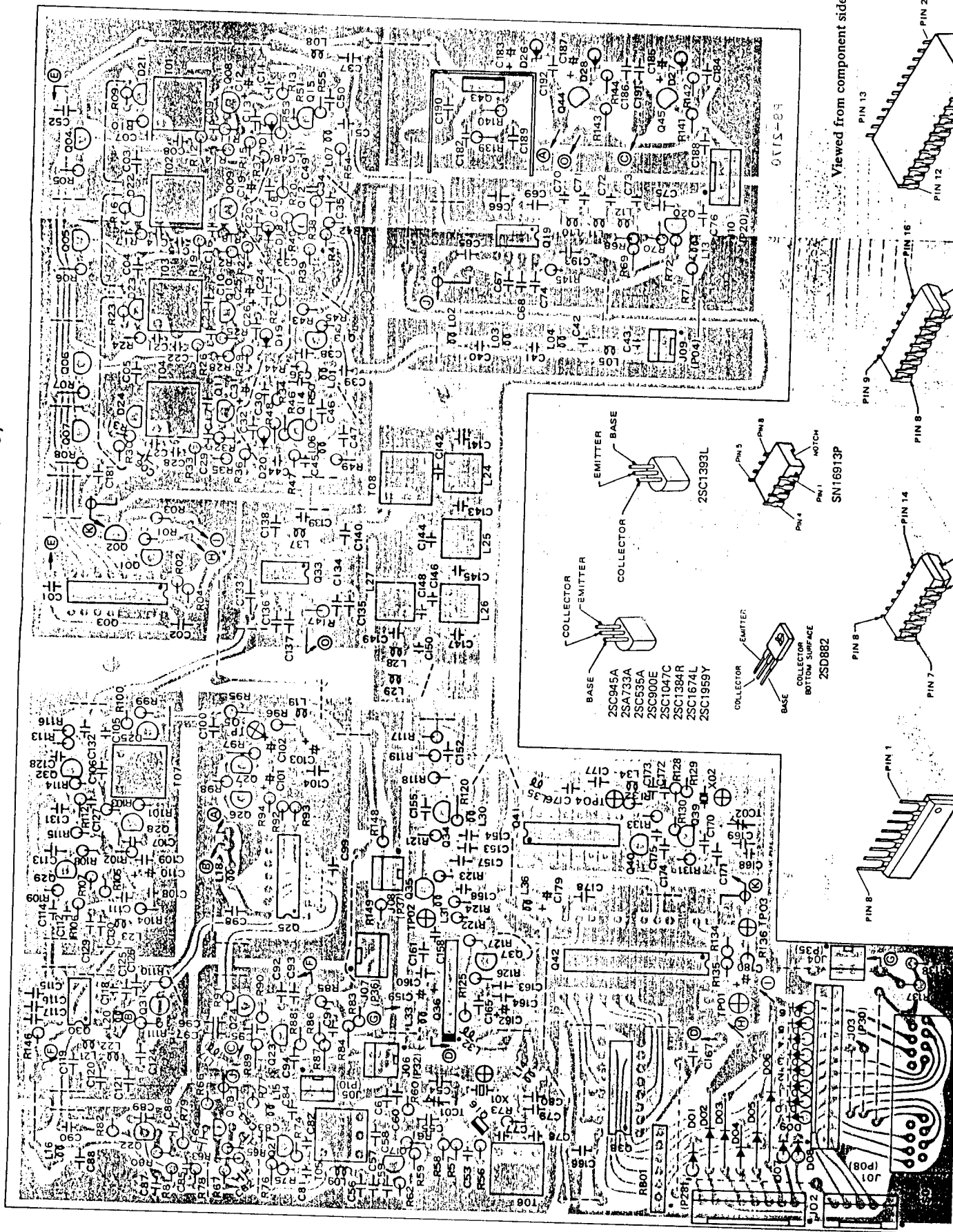
78L05/08

Viewed from component side

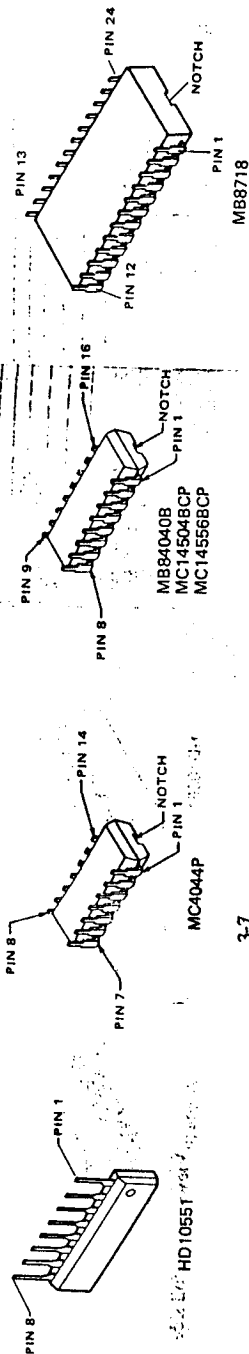
ALL CAPACITORS ARE IN μF UNLESS OTHERWISE NOTED.
ALL RESISTORS ARE IN Ω UNLESS OTHERWISE NOTED.
ALL ROTARY SWITCHES SHOWN IN CW POSITION WITHOUT MCH SWITCH AND ALL PUSH BUTTON SWITCHES SHOWN IN THE RELEASED POSITION.



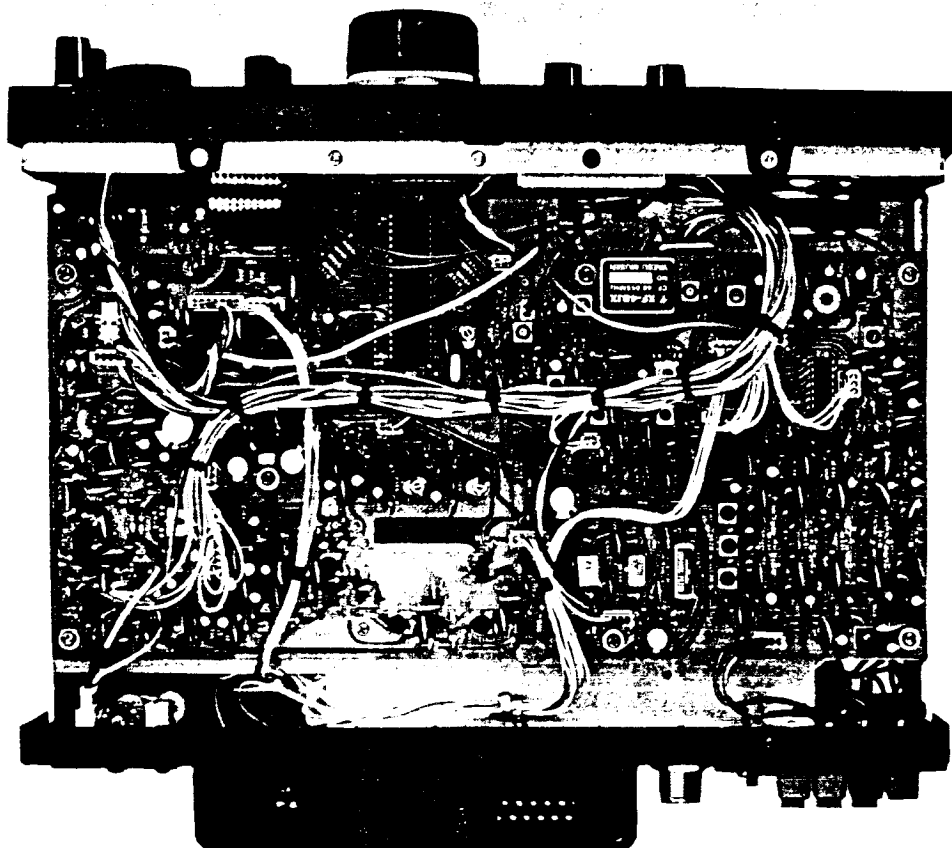
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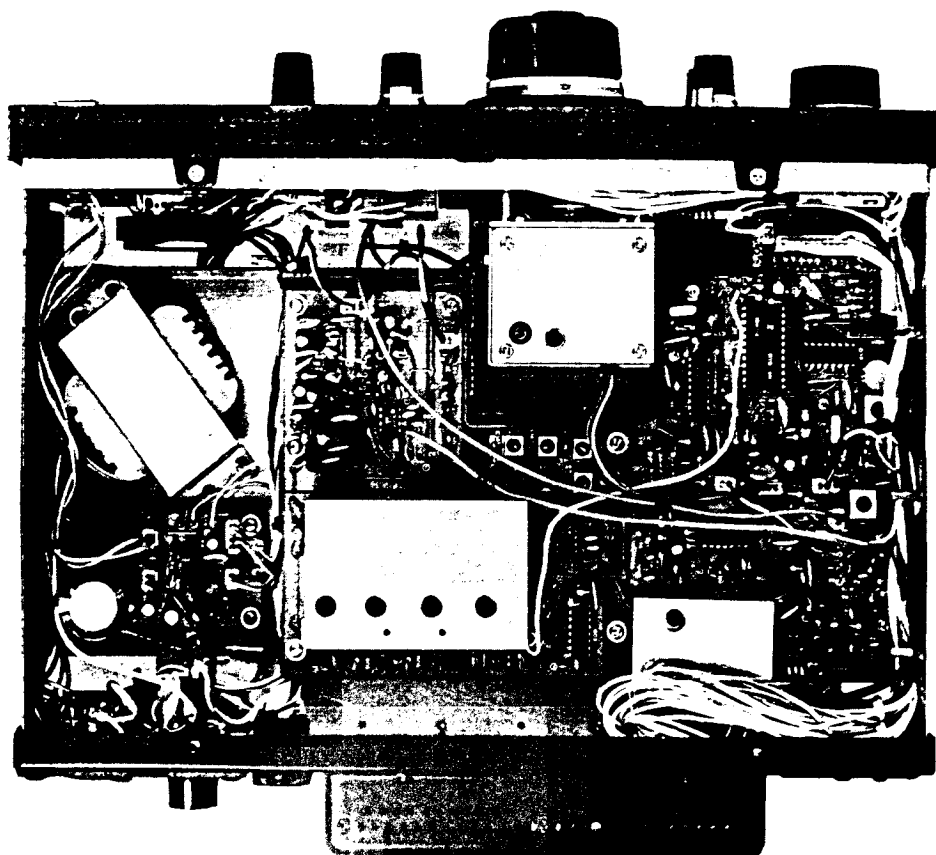
VIEWED FROM COMPONENT SIDE.



BOARD LAYOUT

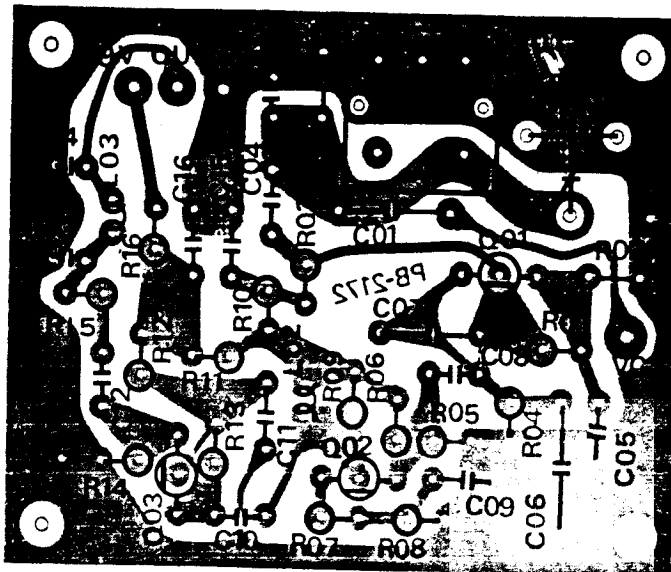


Top View

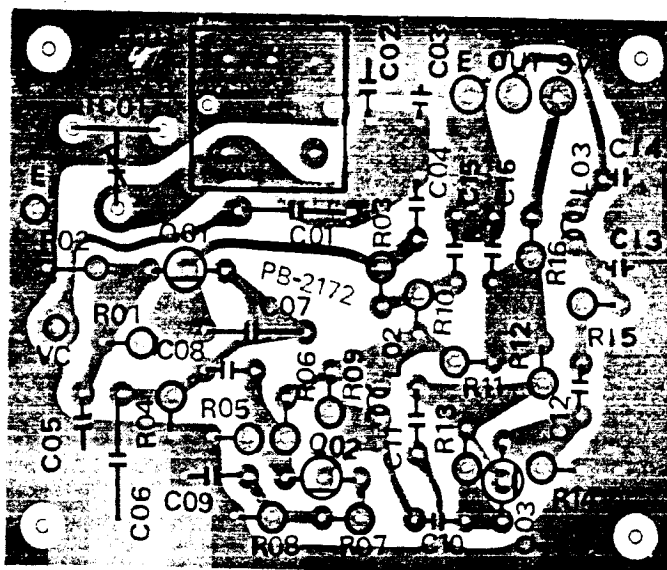


Bottom View

VFO UNIT PARTS LAYOUT

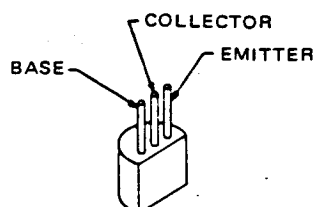


Viewed from component side

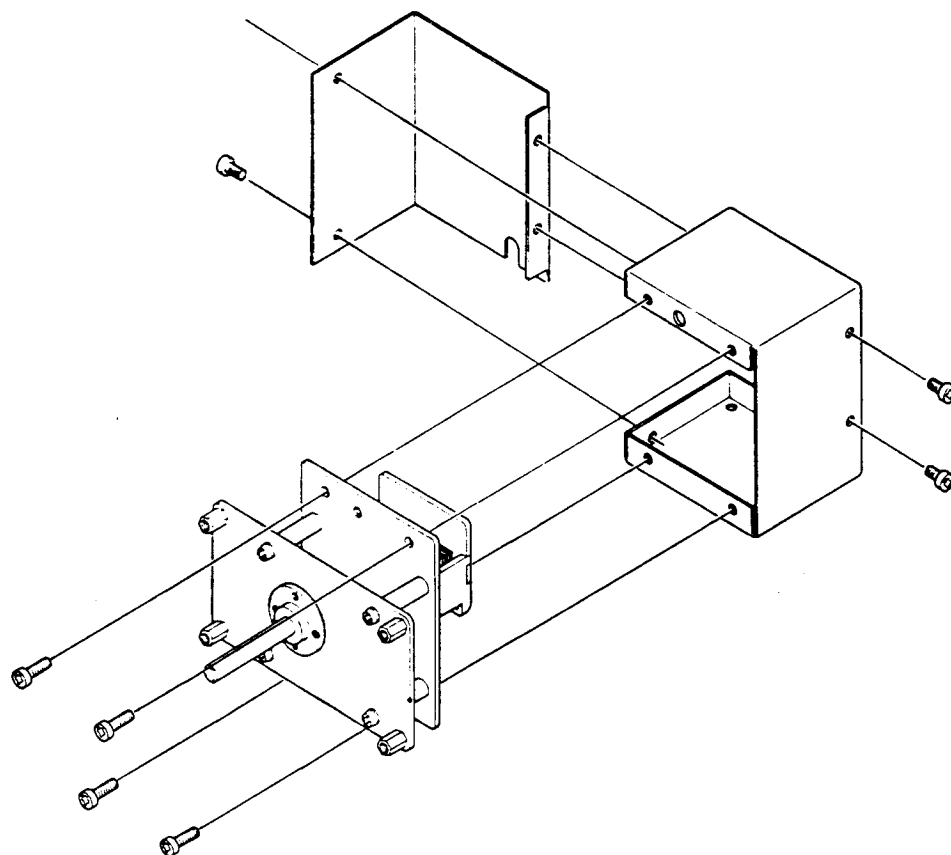
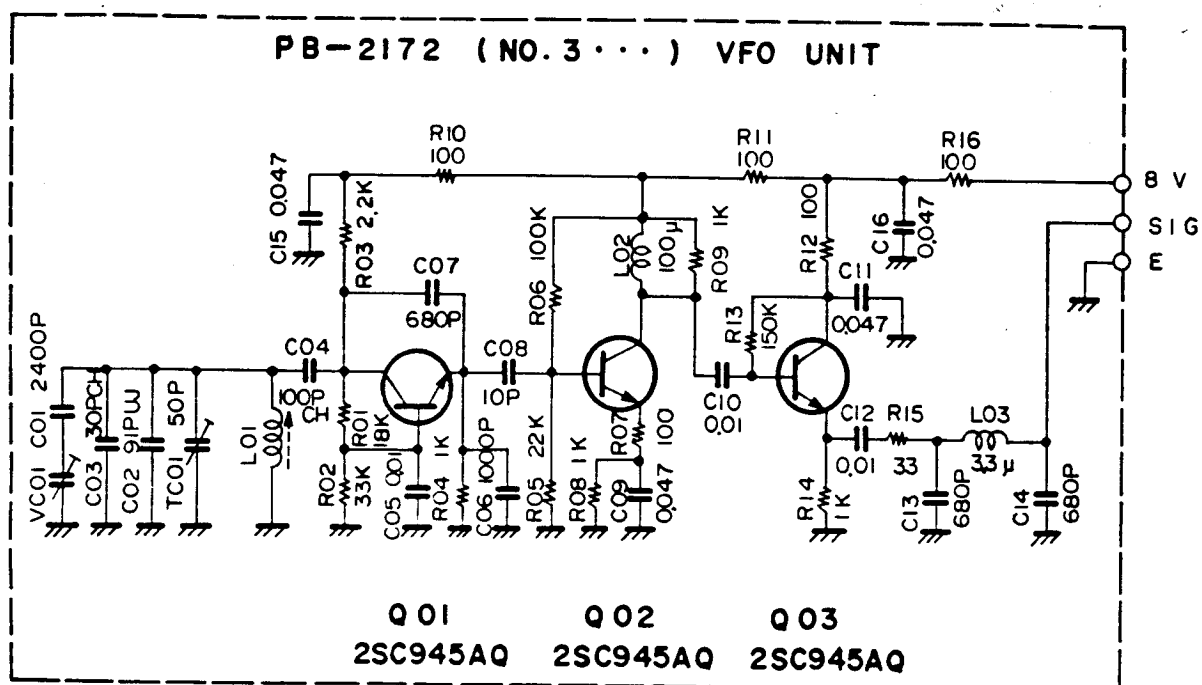


Viewed from solder side

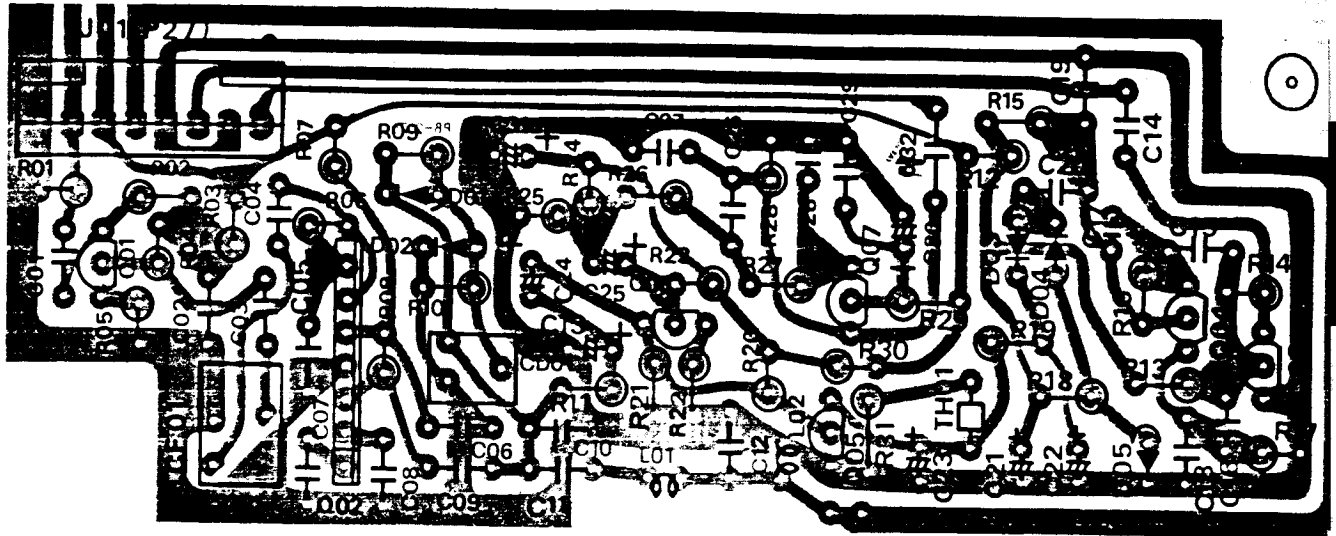
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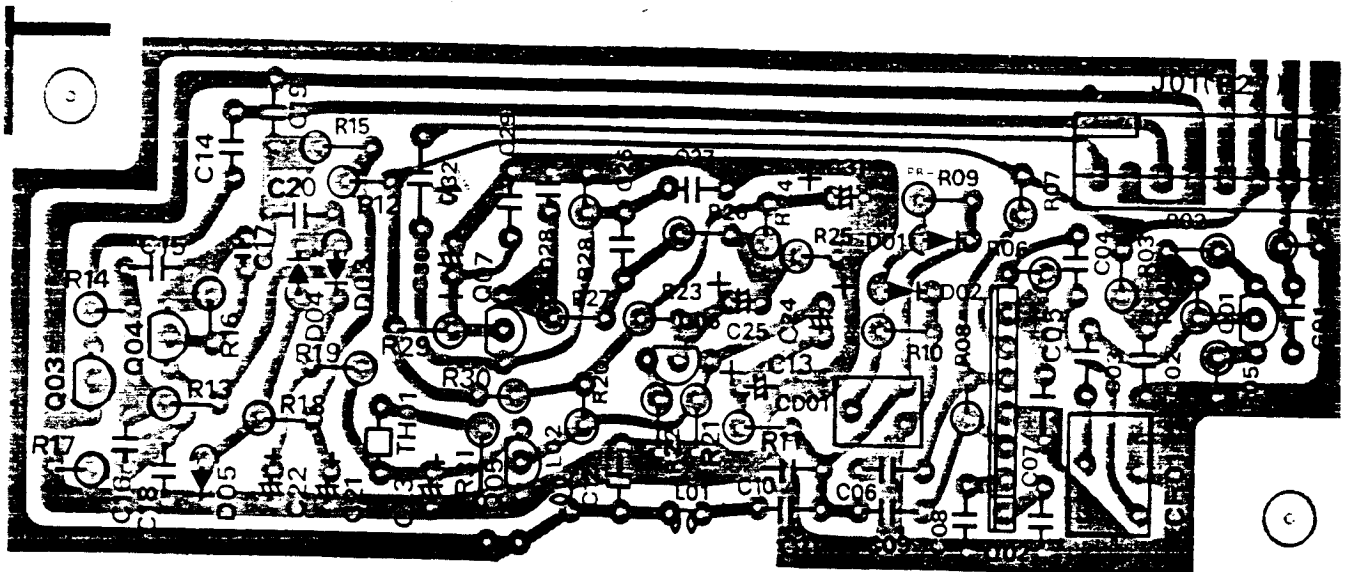
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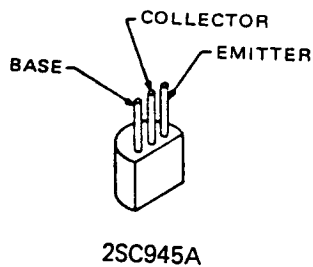
FM UNIT PARTS LAYOUT



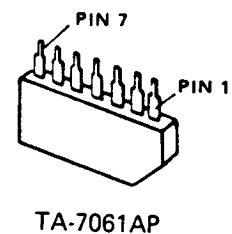
Viewed from component side

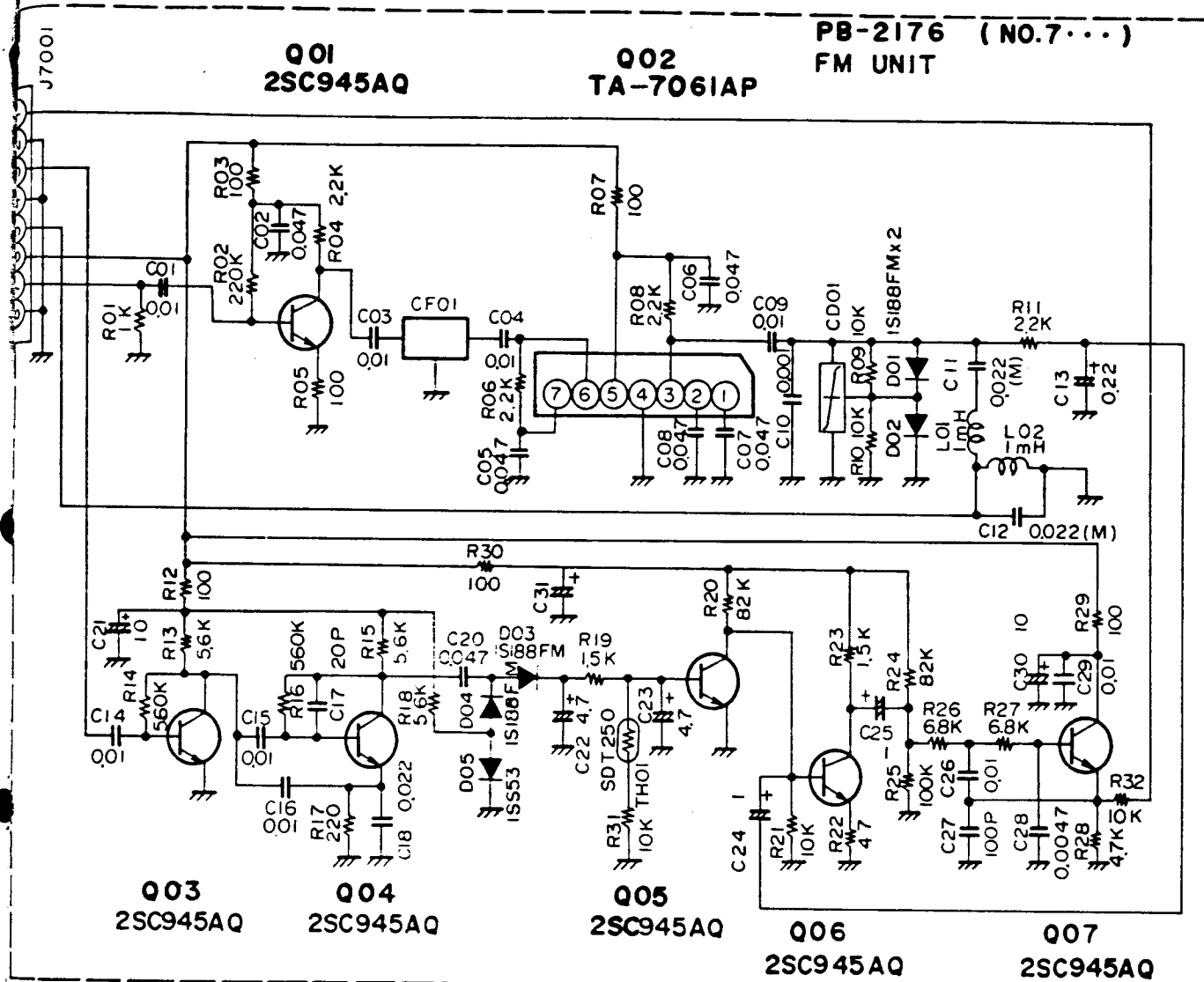


Viewed from foil side

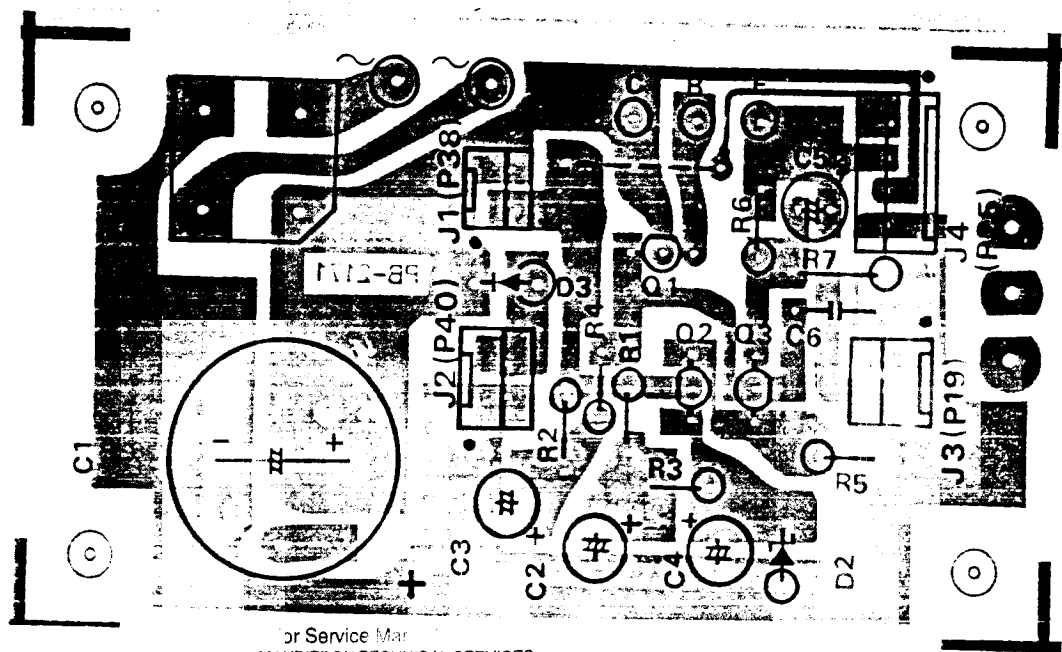


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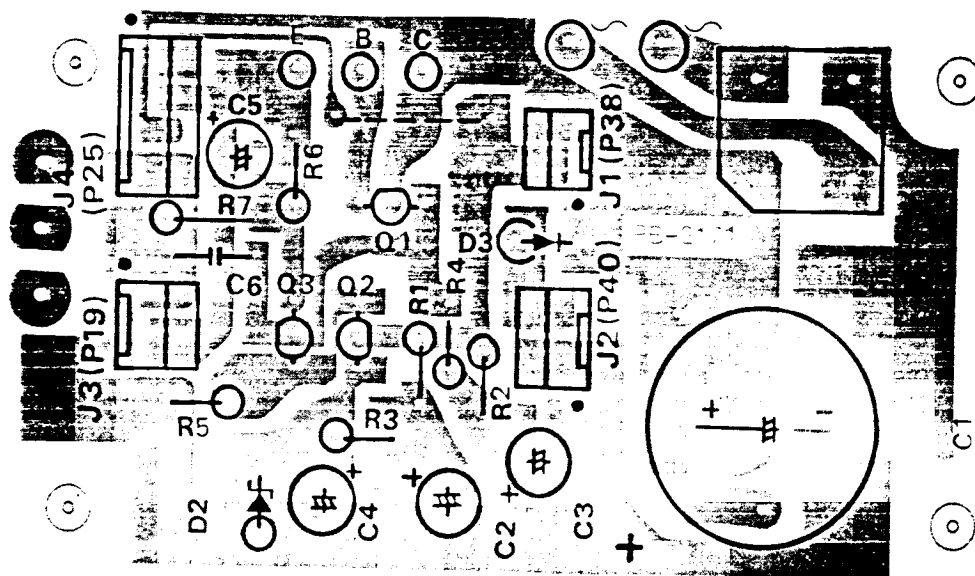


POWER SUPPLY UNIT PARTS LAYOUT

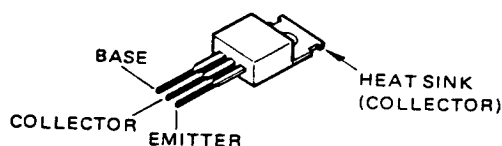


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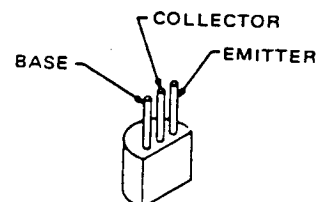
Viewed from component side



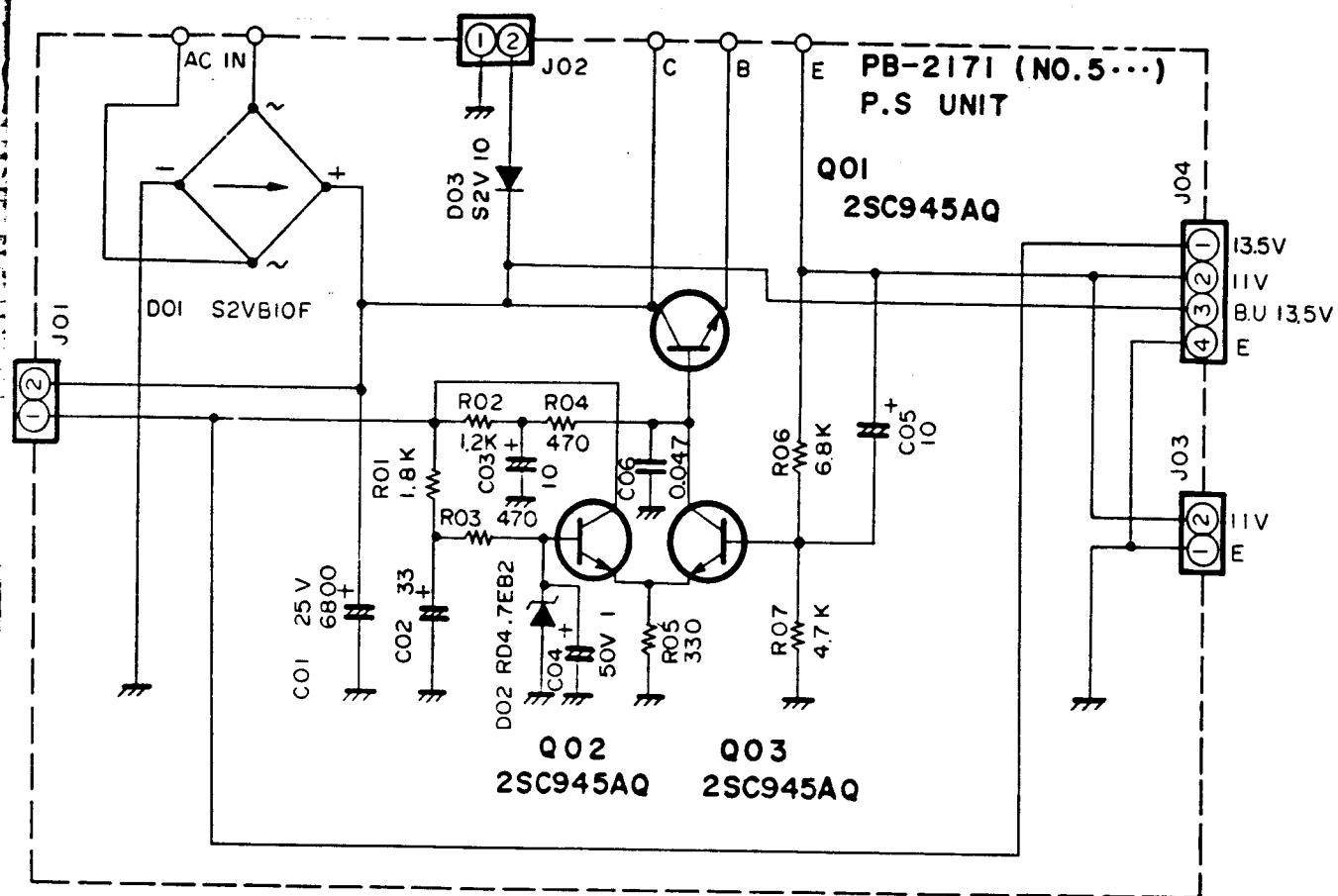
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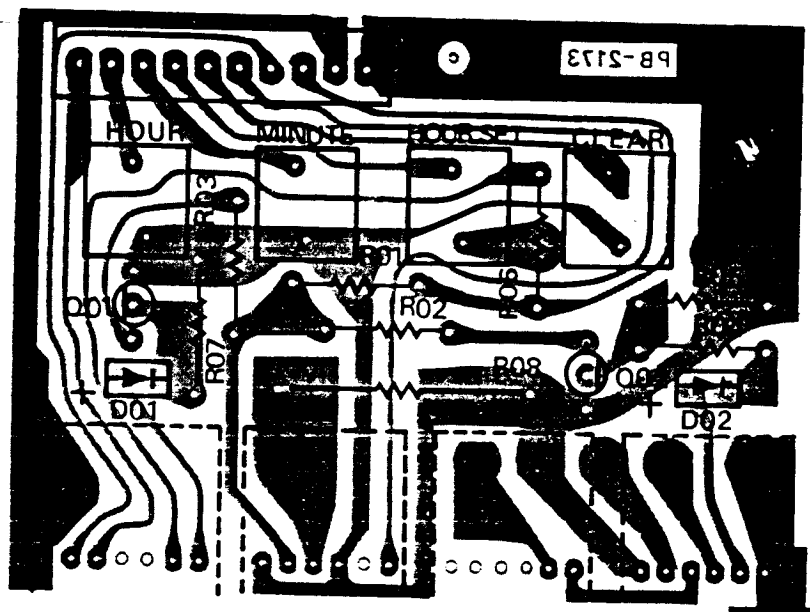
2SD288K



2SC945A

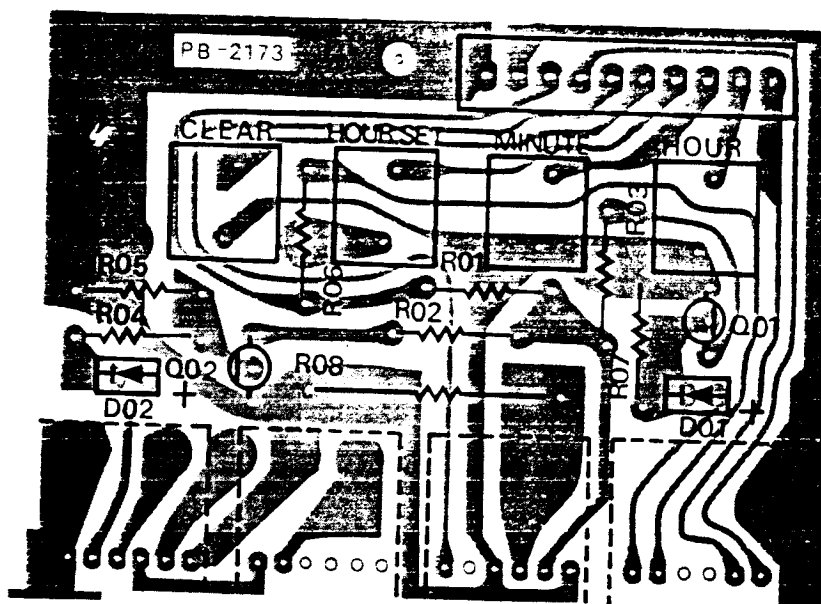


SWITCH UNIT PARTS LAYOUT

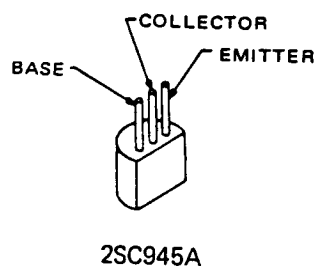
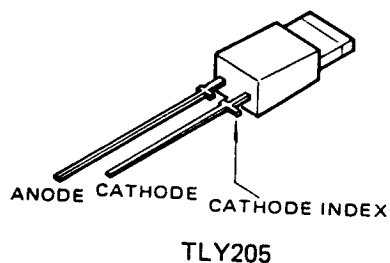


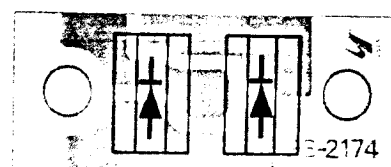
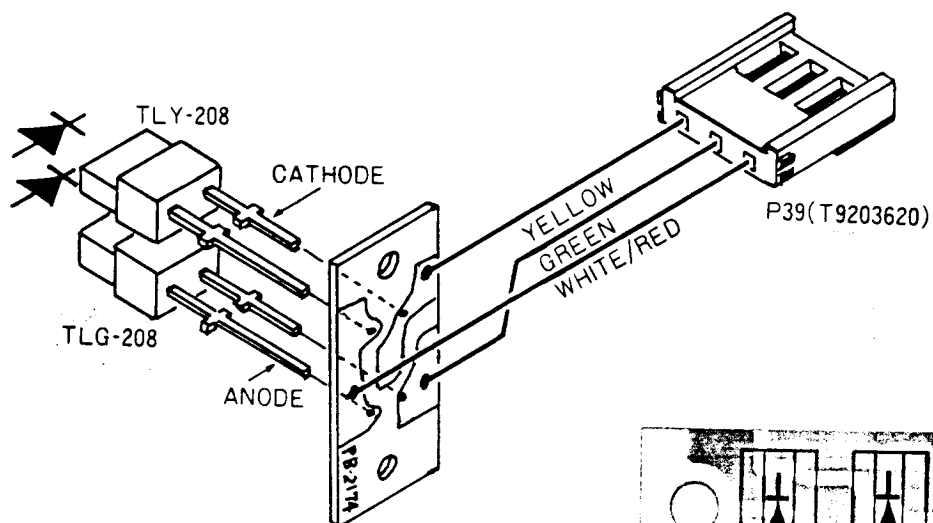
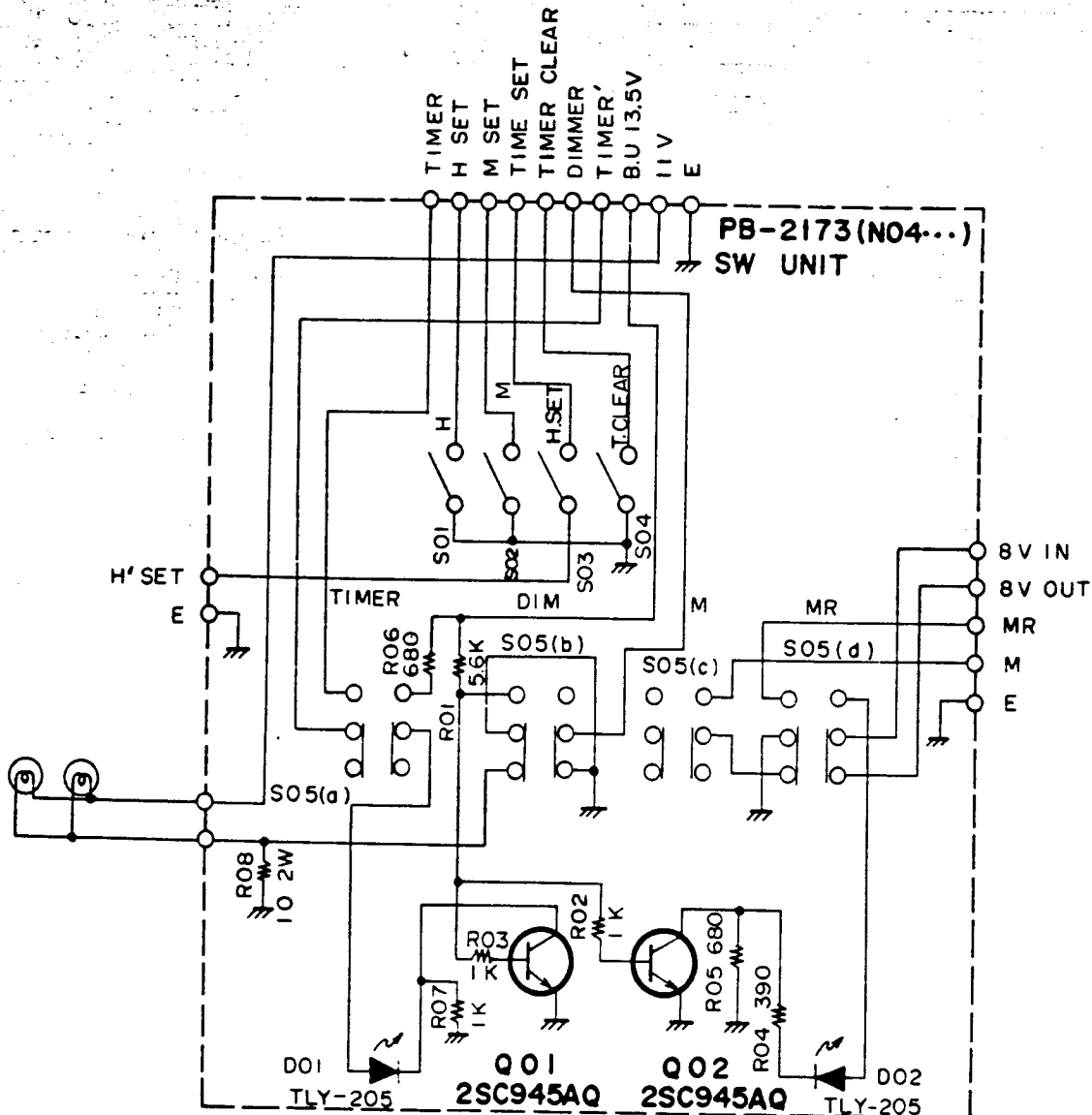
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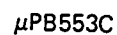
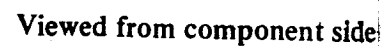
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Viewed from foil side

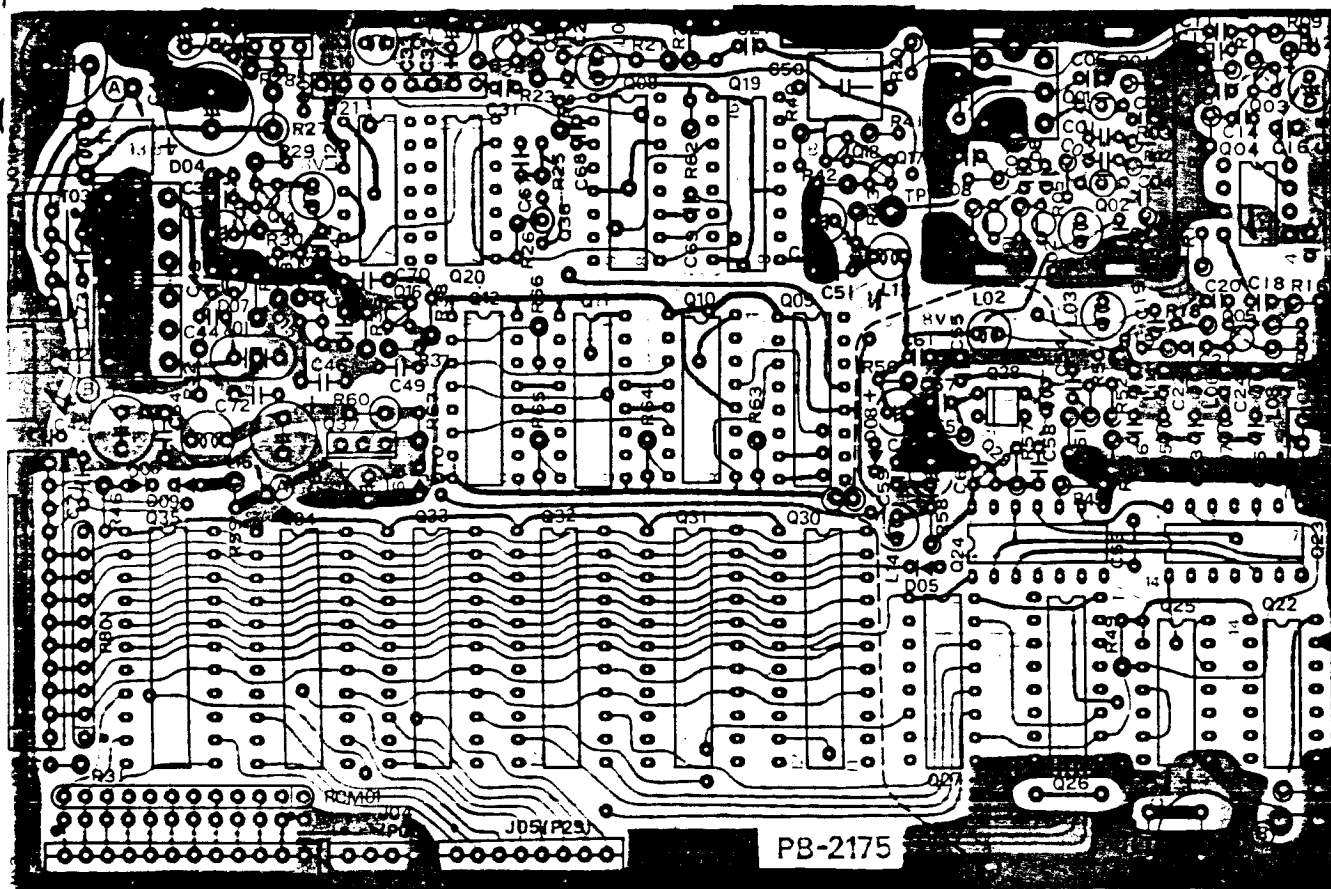




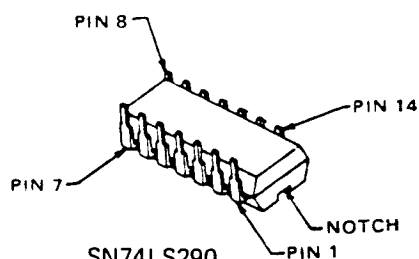


PARTS LAYOUT MEMORY UNIT(PB-2175)

SERVICE NO2

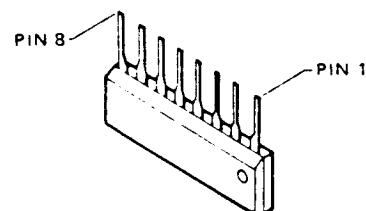


Viewed from foil side

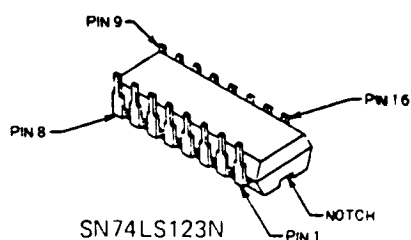


SN74LS290
SN74LS293
MC14024BCP
MC14069UBCP
MSM4023RS

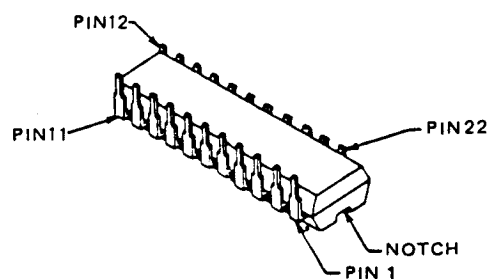
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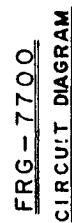
HD10551



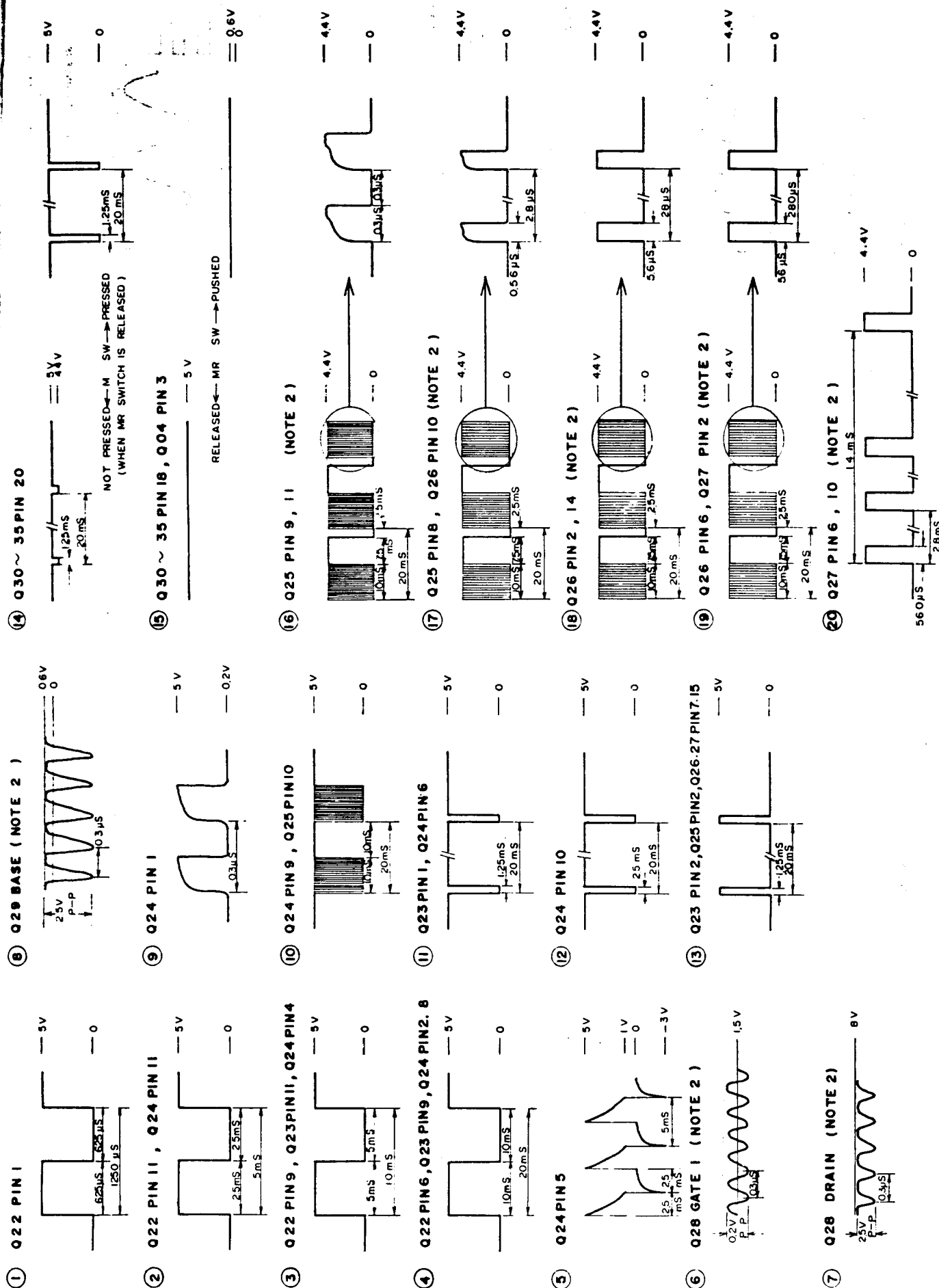
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SN74LS192N
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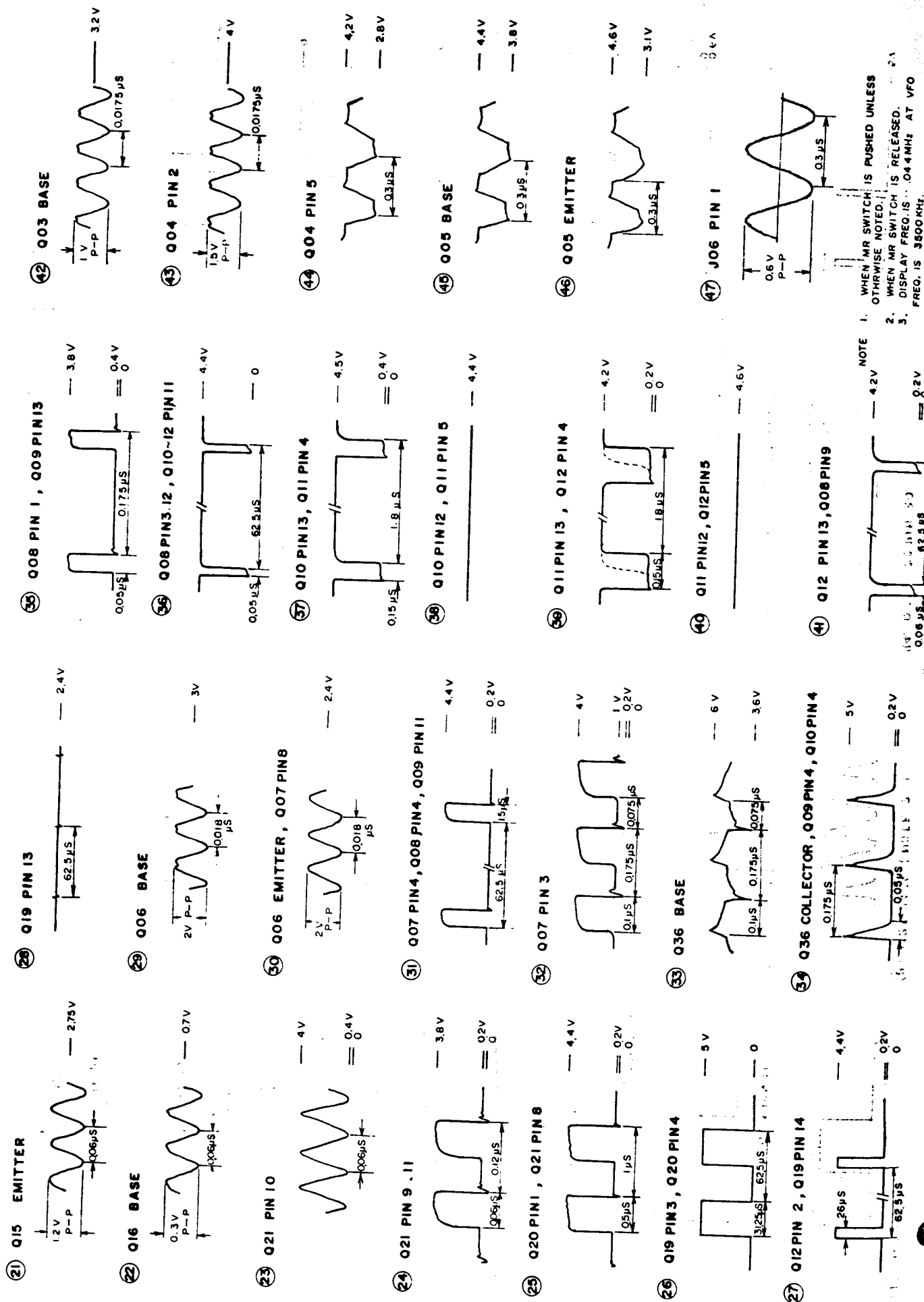


μPD5101

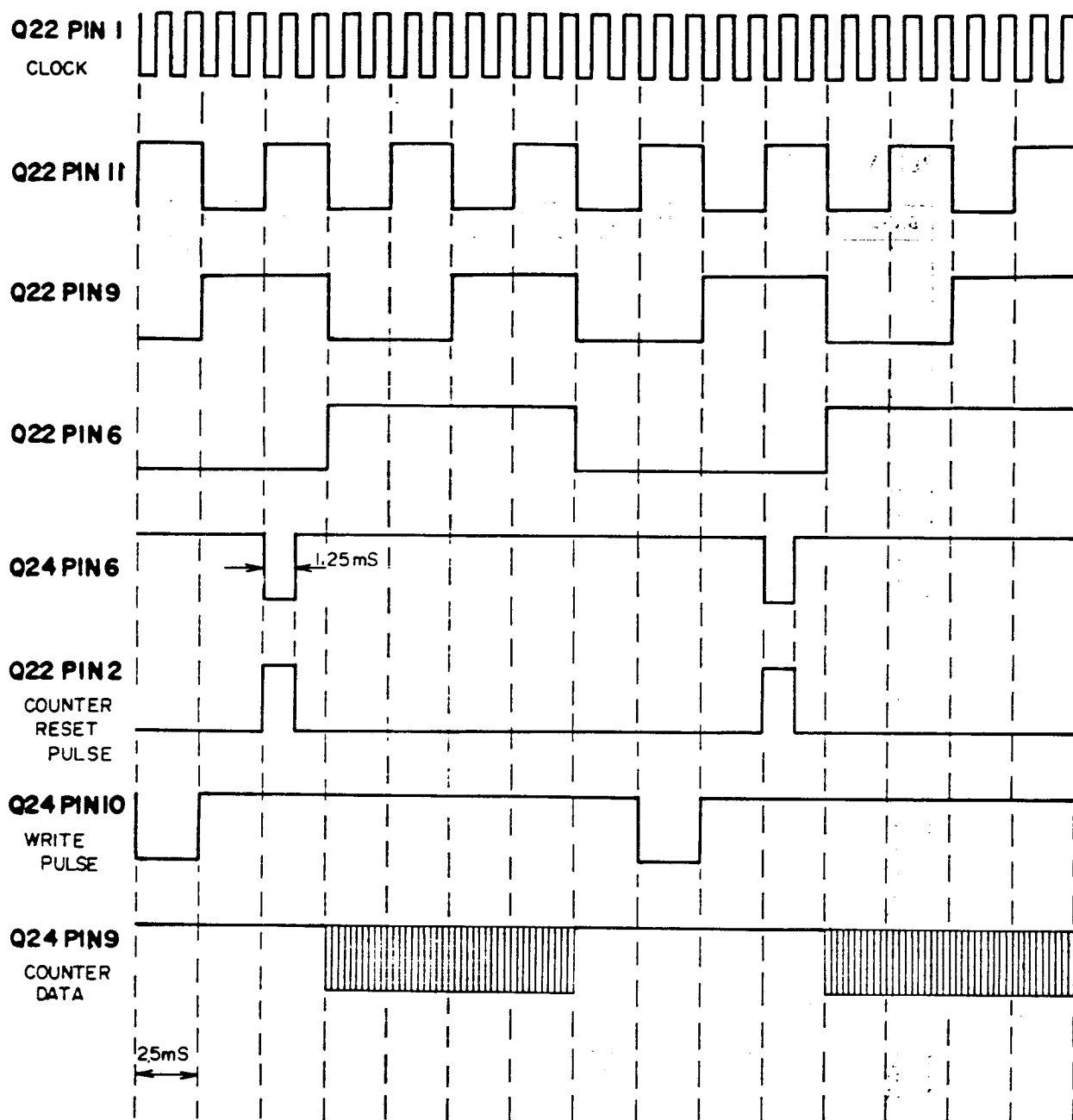


WAVE FORM CHART





TIMING CHART



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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

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Email:- enquiries@mauritron.co.uk

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	-	-	-	-	-

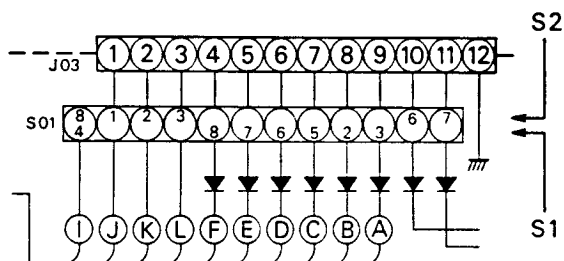
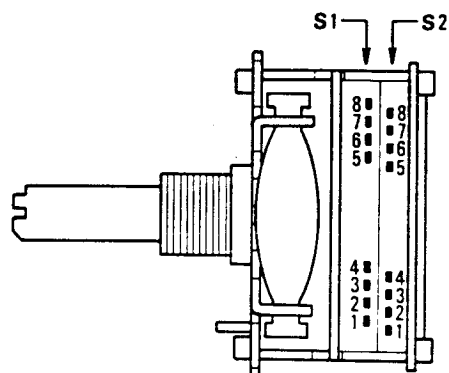
1 - HI LEVEL ON - ON
0 - LOW LEVEL - - OFF

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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
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



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 not cause 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 sponge specially designed for CMOS components.

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.

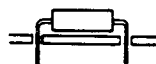
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INSERTION OF PARTS ON CIRCUIT BOARDS

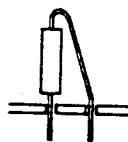
All of the below are acceptable ways of inserting components into circuit board mounting holes.



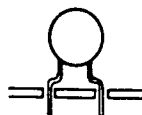
(a) Bend leads slightly



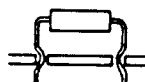
(b) Straight-in mounting



(c) Vertical mounting



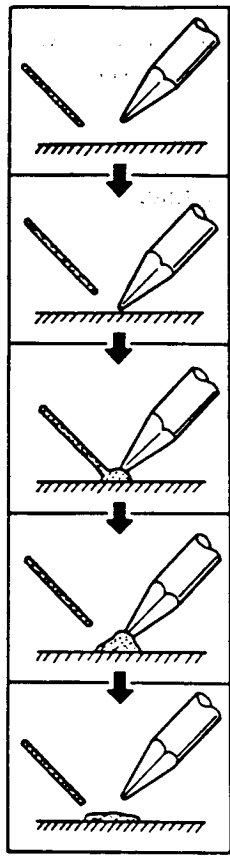
(d) Preformed disc ceramic capacitor



(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE

EXAMPLES OF POOR SOLDERING PRACTICE



(1) Prepare soldering iron and solder.

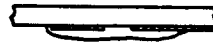
(2) Apply soldering iron to surface to be soldered.

(3) Apply solder to heated surface.

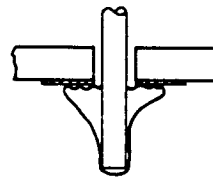
(4) When enough solder is applied, remove solder. Continue to apply heat until solder flows cleanly.

(5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

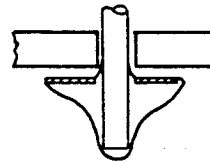
Solder bridge (caused by use of too much solder)



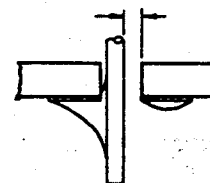
"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)



Lifted trace (caused by too much heat on circuit board foil)

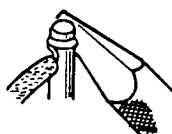
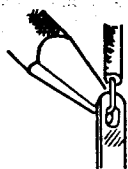
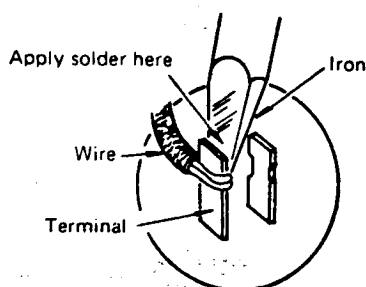


Unstable joint (caused by insufficient heat or solder)



Soldering to terminal posts:

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



GENERAL

MAIN UNIT

3-31

(3) First and Second IF Adjustment

Set the MODE switch to LSB/CW, the ATT switch to DX, and rotate the ATT control fully counter-clockwise. Connect a signal generator to the antenna jack, J_1 , 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 T_{1004} - T_{1008} and T_{1011} - T_{1014} for maximum S-meter reading.

(4) S-Meter Sensitivity and Full Scale Adjustment

- Preset the controls, switches, and dial frequency as in step 3. Set the signal generator output level to 8 dB (ref: 0 dB = $1\mu V$). Adjust VR_{1002} so that the S-meter just begins to move off the left-hand peg on its scale.
- Set the signal generator output level to 90 dB.

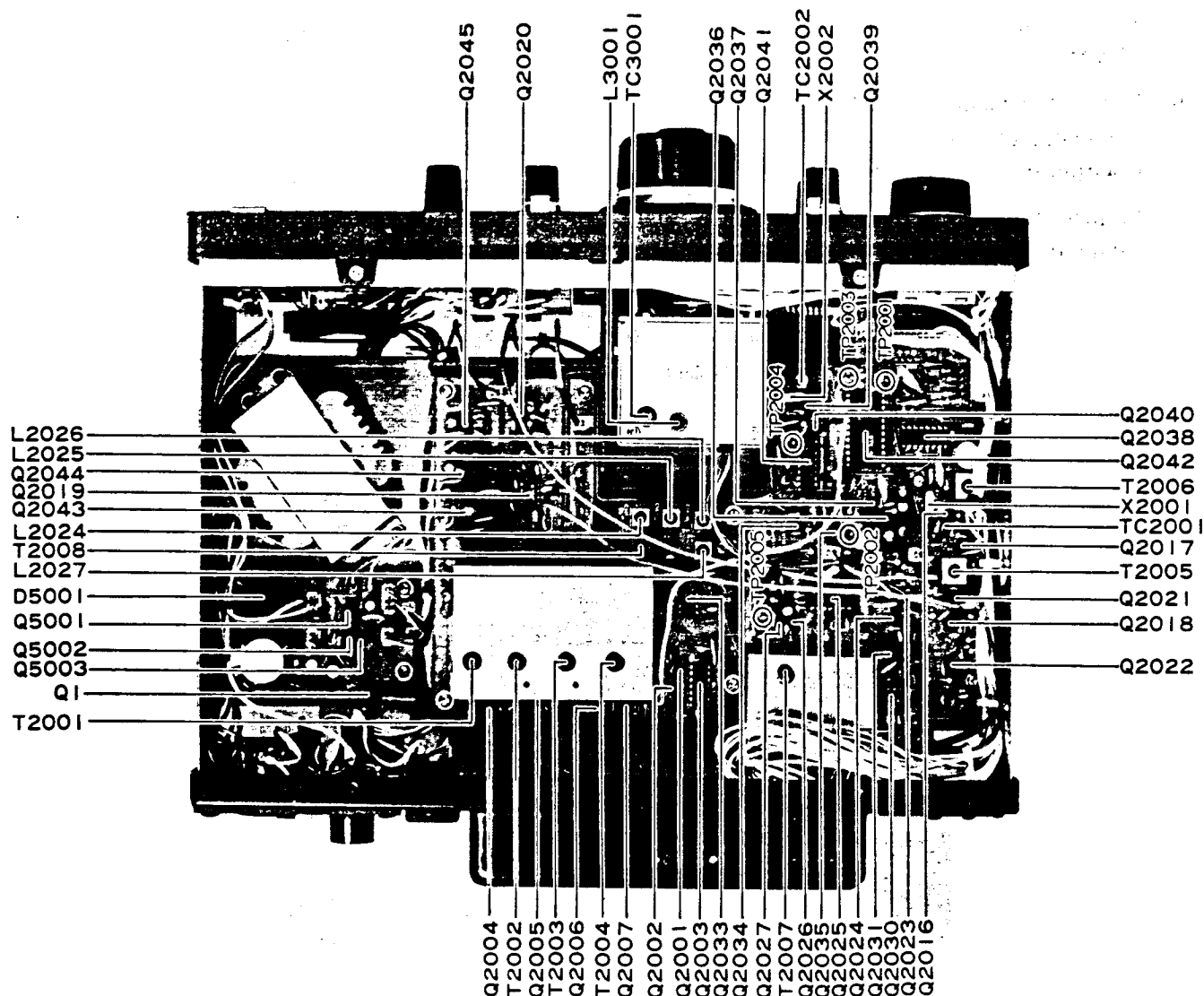
Adjust VR_{1004} for a full scale reading on the S-meter.

(5) NB Adjustment

- Connect a VTVM to the source of Q_{1037} , and a signal generator to antenna jack J_1 . Set the signal generator output level to 20 dB, output frequency to 8.01 MHz, and adjust T_{1015} - T_{1017} for a minimum reading on the VTVM.
- Connect a noise generator to antenna jack J_1 , and press the NB switch. Adjust VR_{1001} for a minimum noise level from the speaker.

(6) Trap Adjustment

Connect a signal generator to antenna jack J_1 , 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 T_{1002} for a minimum reading on the S-meter.



BOTTOM VIEW

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

- 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).
- 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

- 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.
- 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.
- 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.

- Change the BAND switch to the 12, 20, and 29 MHz band positions, and adjust VCO coil T₂₀₀₃, T₂₀₀₂, T₂₀₀₁, respectively, to obtain readings of 7.4 volts on the VTVM.
- Set the BAND switch to the 21, 13 and 1 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.

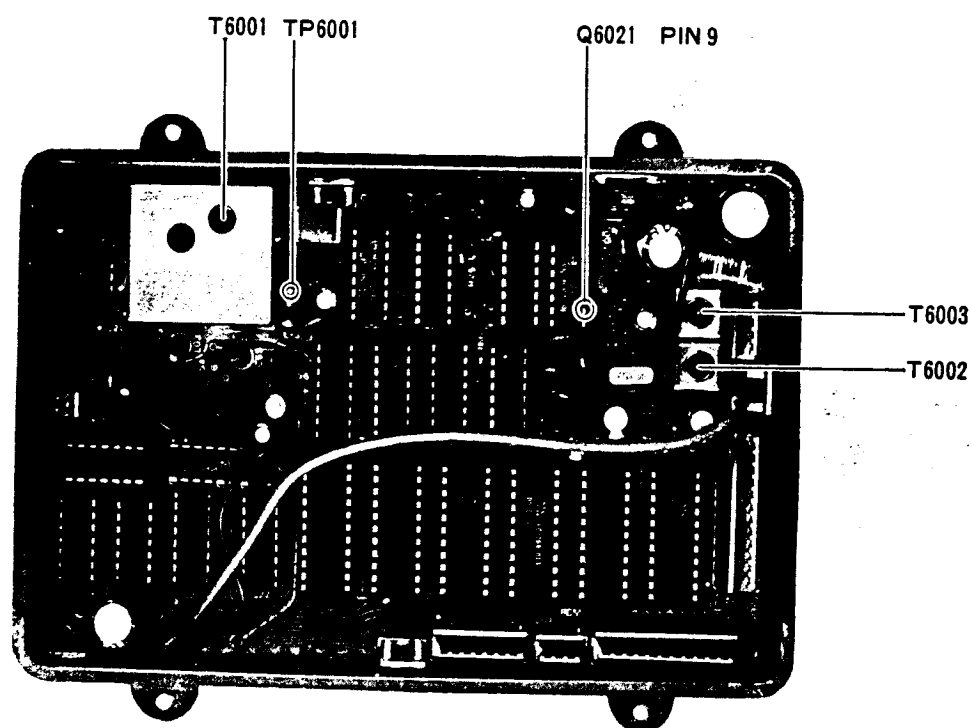
MEMORY UNIT

(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.

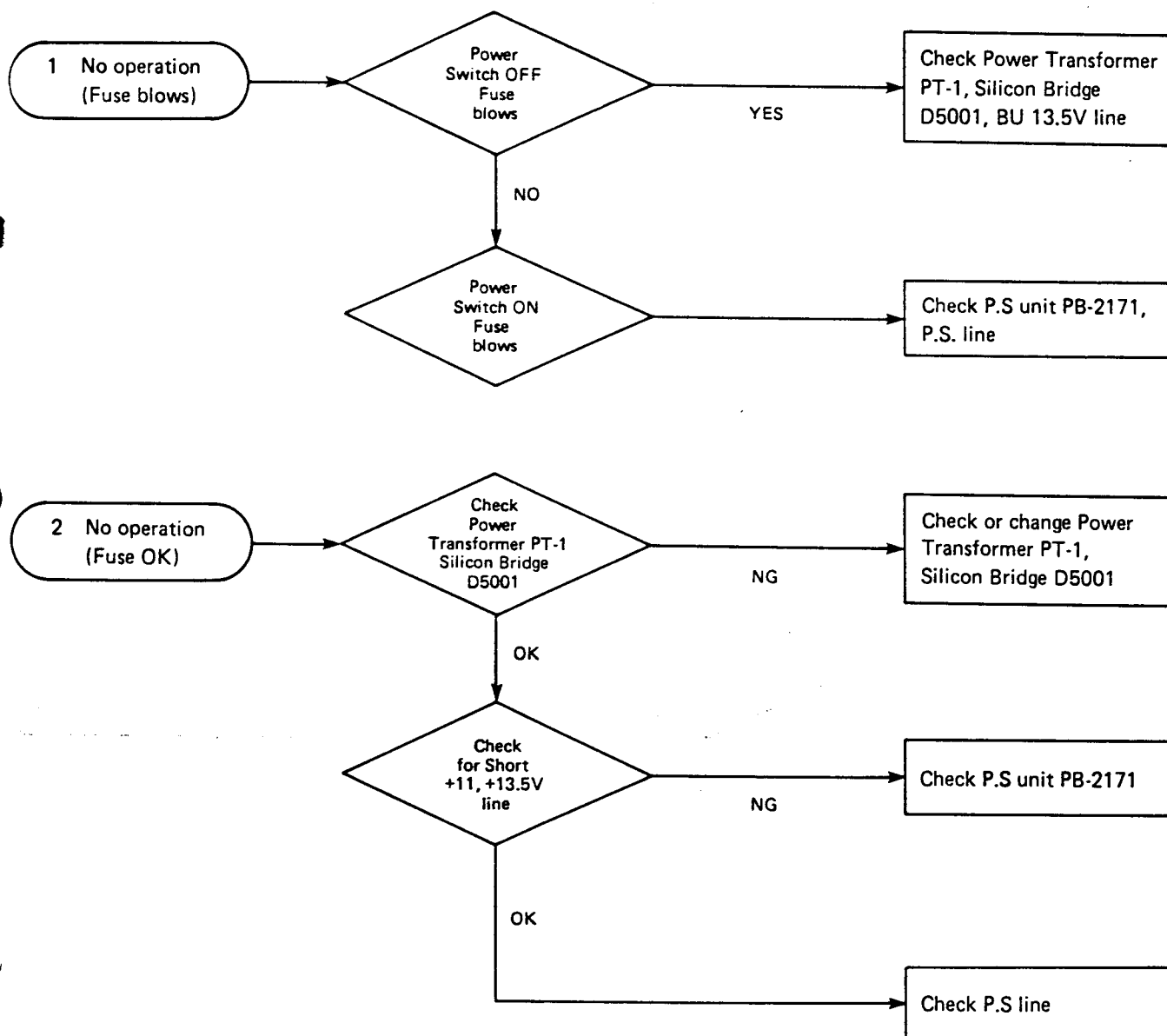


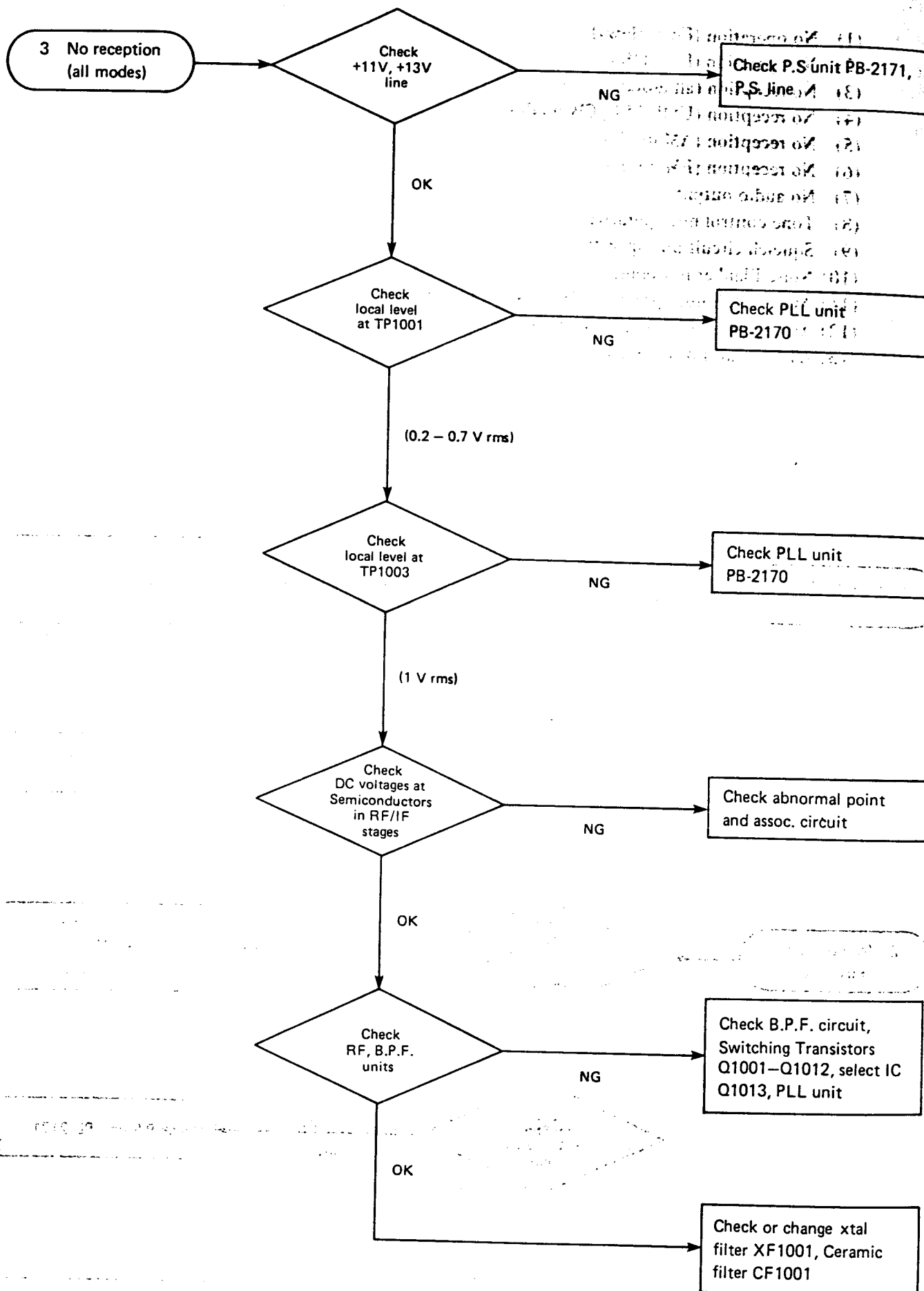
MEMORY UNIT

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

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4 No reception
(LSB, USB, CW mode)

Check
DC voltages at
semiconductors
in IF stage

NG

Check abnormal point
and assoc. circuit

OK

Check
carrier level at
TP1005

NG

Check carrier osc circuit

(700 mV rms)

Check ceramic filter
CF1002 and assoc. circuit

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5 No reception
(AM mode)

Check
DC voltages at
semiconductors
in IF stage

NG

Check abnormal point
and assoc. circuit

OK

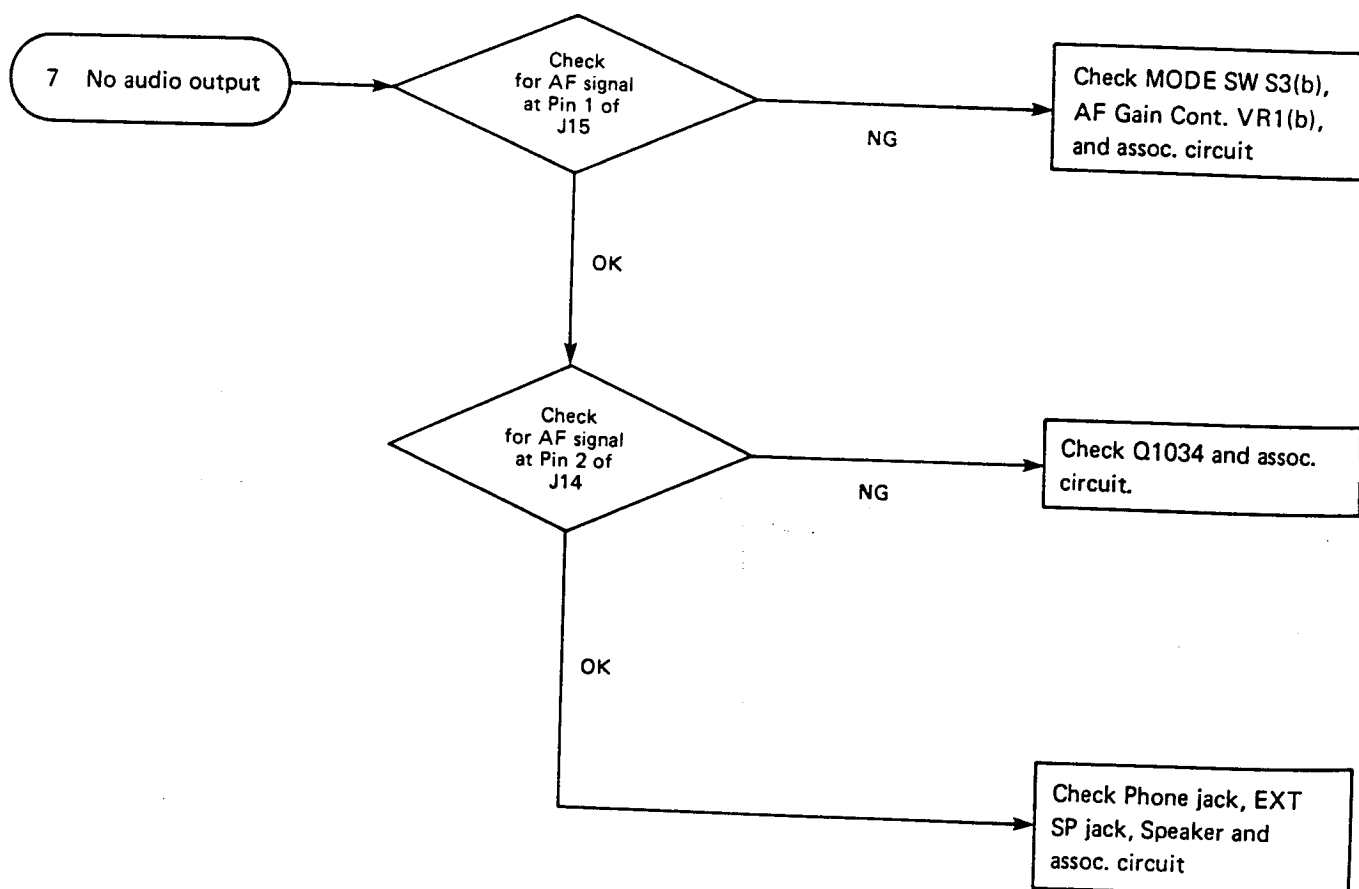
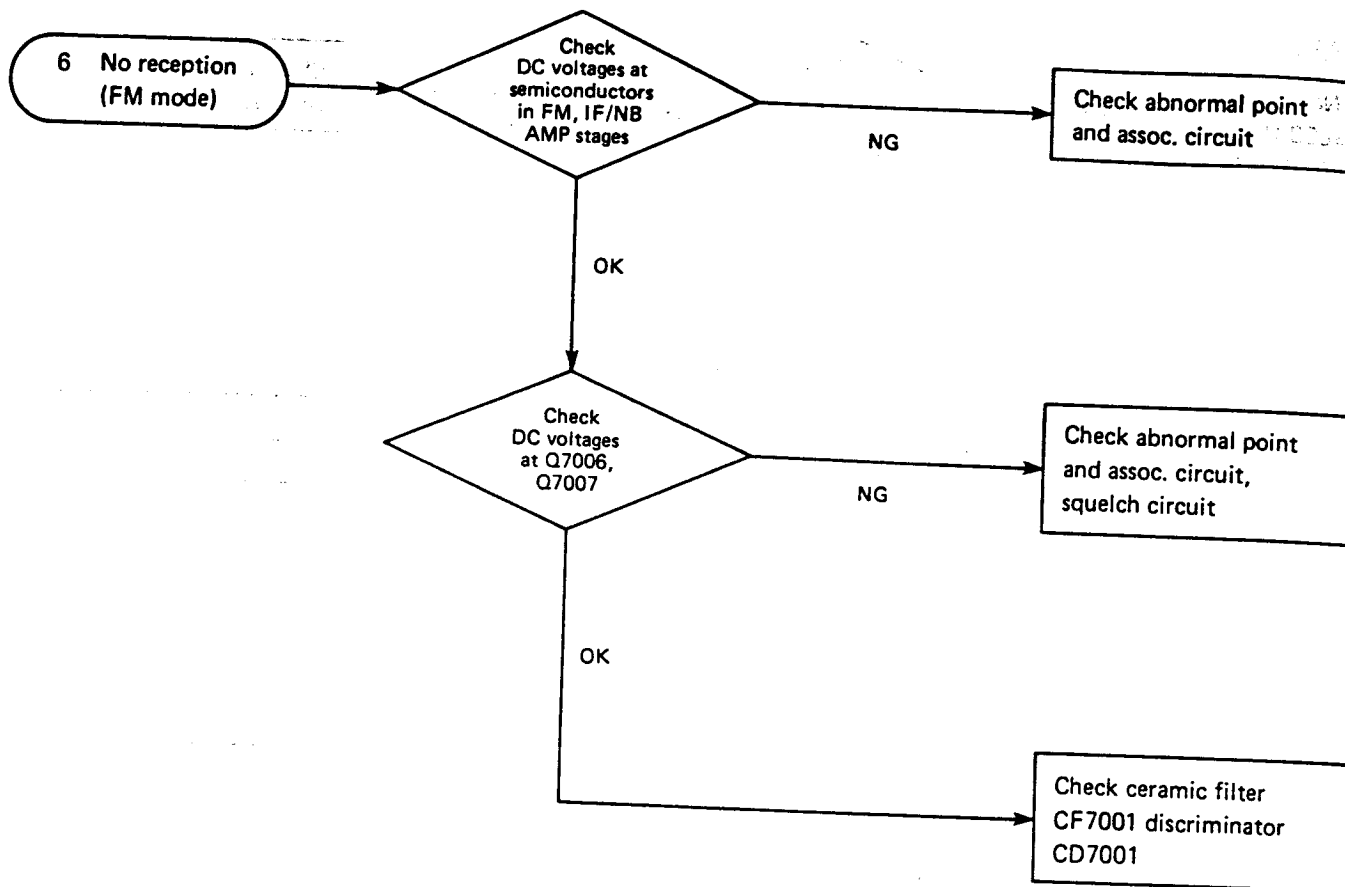
Check
AGC voltage
at Pin 6 of
J1006

NG

Check Q1028, Q1029,
AGC circuit

4V

Check ceramic filter
CF1003, CF1004 and
assoc. circuit



8 Tone control not operative

Check or change
Tone control VR1(a),
C1058

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9 Squelch circuit not operative

Check
noise level
at Pin 5 of
J7001

NG

Check or replace C7011,
C7012, L7001, L7002

(10 mV)

Check
noise level
at Pin 3 of
J7001

NG

Check or change squelch
control VR3(a)

(0–10 mV)

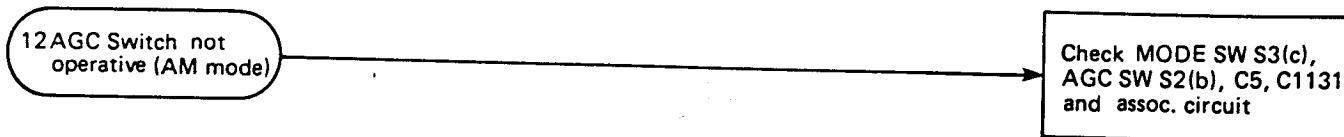
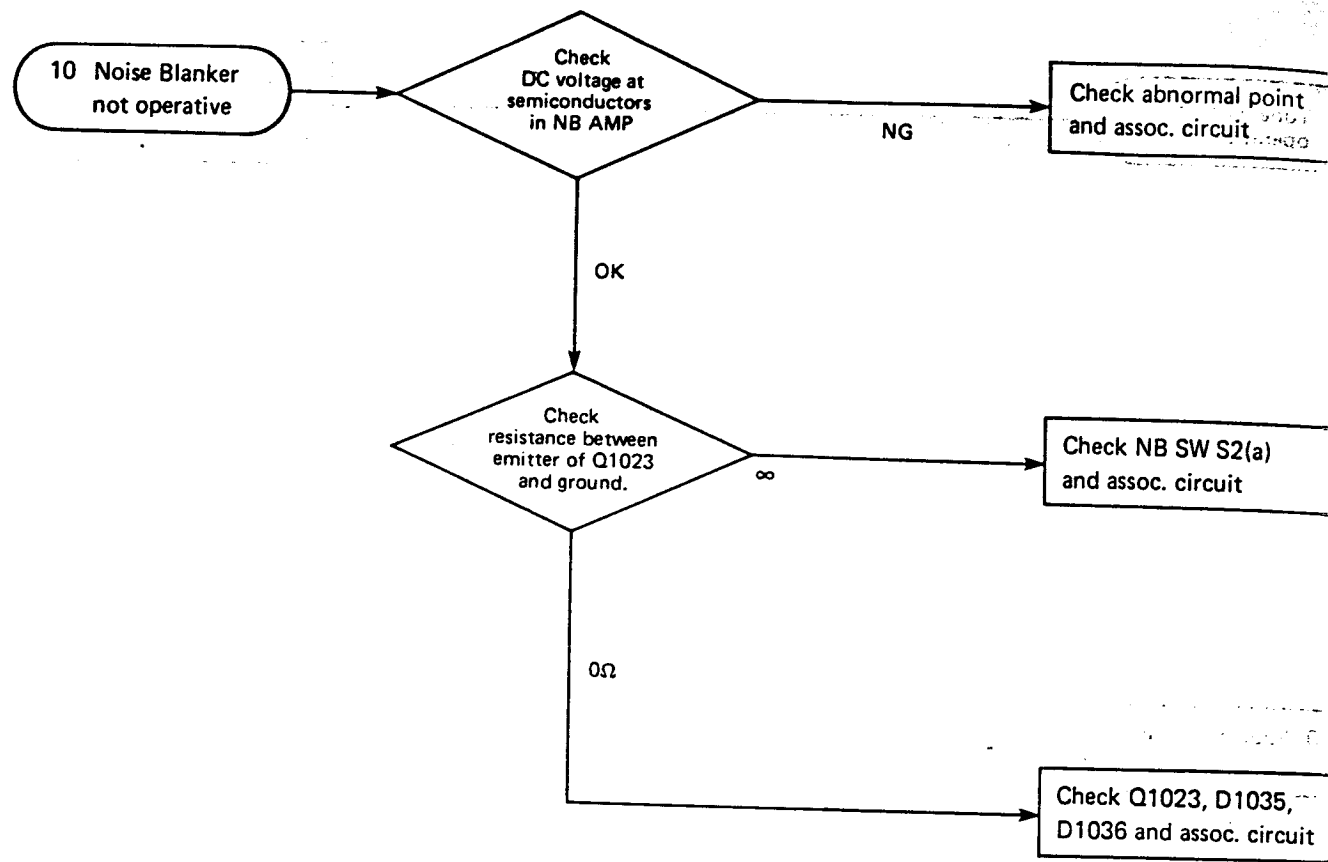
Check
DC voltage
at base of
Q7005

NG

Check Q7003, Q7004,
D7003–D7005 and
assoc. circuit

(0.44–0.64V)
(Threshold 0.56V)

Check Q7005 and
assoc. circuit



13 ATT circuit
not operative

Check
DC voltage
at Pin 2 of
J1002

NG

Check R1051,
+11V line

(4.1V to -1.7V)

Check
DC voltage
at Pin 3 of
J1002

NG

Check R1052,
-5V line

(-1.7V)

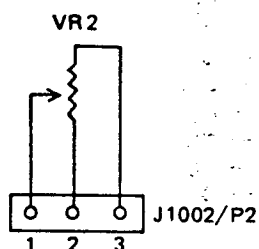
Check
DC voltage
at Pin 1 of
J1002

NG

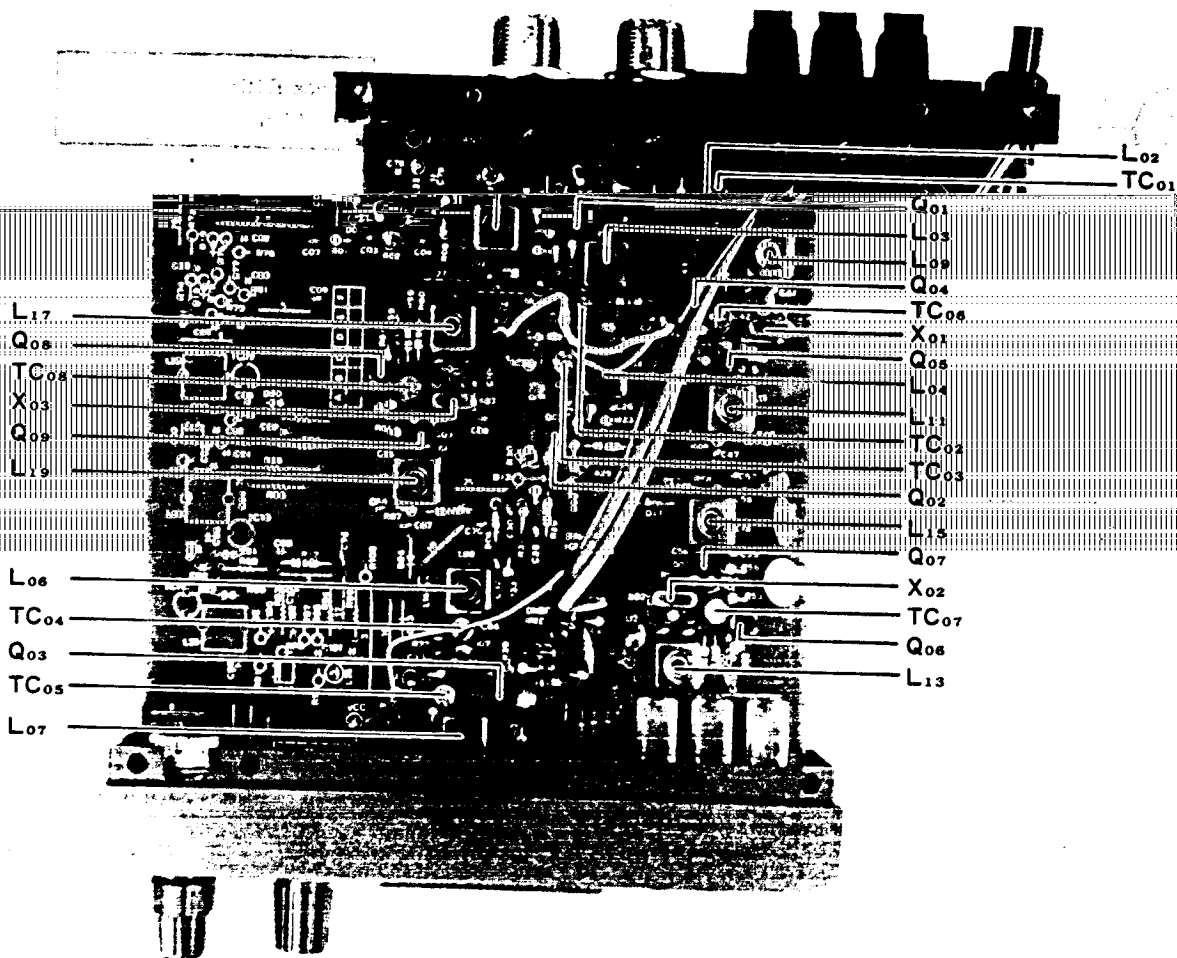
Check ATT Cont. VR2
and assoc. circuit

(4.1V)

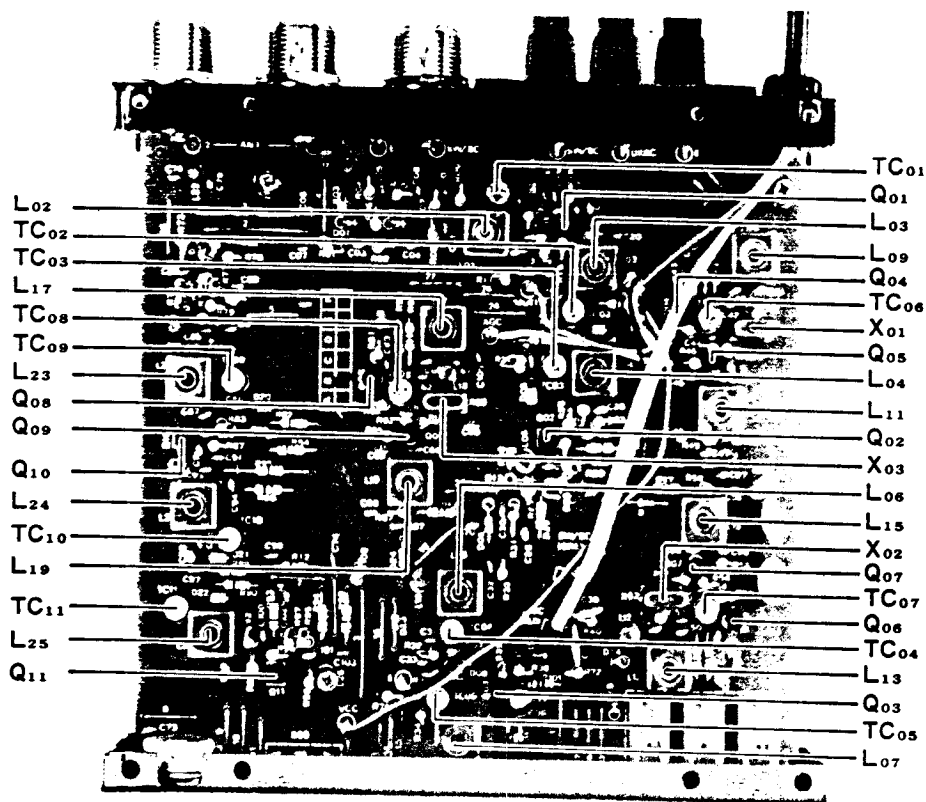
Check R1050, Q1014
and assoc. circuit



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FRV-7700 (Model: A, C)



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

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 — P.O. Box 49, 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:
(Print or Type)

Name: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Country: _____

YAESU MUSEN COMPANY, LTD. – C.P.O. BOX 1500, TOKYO, JAPAN
 YAESU ELECTRONICS CORPORATION – P.O. Box 49, Paramount, CA 90723
 YAESU ELECTRONICS CORPORATION – 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

ORDER BLANK

QUANTITY	RECEIVER IDENTIFICATION	LOCATION	PART NUMBER	CIRCUIT DESIGNATION

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QUANTITY	RECEIVER IDENTIFICATION	LOCATION	PART NUMBER	CIRCUIT DESIGNATION

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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
		DIODE	P7,8,13,15,16	P1090154	PI051-05F
D1	G2090147	LED TLG208	P17,24	P1090156	PI051-07F
D2	G2090151	TLY208	P23,27-29	P1090157	PI051-08F
		RESISTOR	P30,31	P1090161	PI051-12F
			P34	P1090162	PI051-13F
R3	J01245470	Carbon film 1/4W TJ 47Ω		P2000018	BATTERY SOCKET S1(006P)
R1	J01245680	" " " " 68Ω		Q9000096	BATTERY CASE C4
R4	J02245102	" " " " SJ 1kΩ	MAIN UNIT		
R5	J02245103	" " " " 10kΩ	Symbol No.	Part No.	Description
R2	J02245223	" " " " 22kΩ	PB-2169A	F0002169A	Printed Circuit Board
		POTENTIOMETER		C0021690	P.C.B. with Components
VR1	J62800049	DM10A638A-10kΩ-10kA			TRANSISTOR, FET & IC
VR2	J60800071	VM10A610E-10kC	Q1001-1006,1035, 1052-1056	G3107331Q	TR 2SA733A-Q
VR3	J62800050	DM10A638A-10kΩx2			
		CAPACITOR	Q1007-1012,1021, 1022,1026-1033, 1038-1041,1043, 1047-1051,1057, 1058,1060-1062	G3309451Q	" 2SC945A-Q
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		"
PT1	L3030085		Q1034	G1090073	IC μPC575C2
		METER	Q1045	G1090084	" μPC78L05A
M1	M0290021	AP-170	Q1044	G1090033	" SN74LS196
		SPEAKER	Q1046	G1090310	" MSM5524
SP1	M4090044	SE92BYM-2 8Ω 2W	Q1013	G1090309	" MC14555BCP
		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			
S4	N0190074	SRN-1025N DISP	D1045	G2090156	Zener RD5.6EB-2
S5	N0190075	SRN-202CN MEM.CH	D1053	G2090154	Zener RD7.5EB-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
		TERMINAL BOARD	X1001	H0102336	HC-18/U 3.2768MHz
	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

T011 278A5

CF1002	H3900041	CFM-455J1	R1219,1229,1254	J02245562	Carbon film 1/4W SJ 5.6kΩ
CF1003	H3900240	CFG455H	R1232,1242,1243	J01245562	" " " TJ 5.6kΩ
CF1004	H3900220	LF-H12	R1090,1126,1141,1169,1198	J02245682	" " " SJ 6.8kΩ
		RESISTOR			
R1213	J10276339	Carbon composition 1/2W GK 3.3Ω	R1051	J02245822	" " " " 8.2kΩ
R1257	J10276689	" " 1/2W GK 6.8Ω	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	J02245103	" " " " 10kΩ
R1163,1248,1252	J00245100	Carbon film 1/4W VJ 10Ω			
R1055,1066,1071,1116,1125,1145,1183,1191,1244,1245	J00245220	" " " " 22Ω			
R1066	J02245220	" " " TJ 22Ω			
R1084	J02245330	" " " SJ 33Ω			
R1063,1114,1123,1181,1189,1258	J02245470	" " " " 47Ω			
R1057,1162,1176,1214	J02245560	" " " " 56Ω	R1048,1111,1187,1207	J01245103	" " " TJ 10kΩ
R1058,1062	J02245680	" " " " 68Ω	R1065,1149	J02245123	" " " SJ 12kΩ
R1064	J02245750	" " " " 75Ω	R1069,1220	J02245153	" " " " 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	J02245101	" " " " 100Ω	R1177	J02245183	" " " " 18kΩ
			R1088,1193	J02245223	" " " " 22kΩ
			R1165,1204,1227	J02245473	" " " " 47kΩ
			R1118,1160,1184,1215	J02245683	" " " " 68kΩ
			R1068,1070,1119,1120,1134,1138,1185,1186,1231	J02245104	" " " " 100kΩ
			R1167,1234	J02245124	" " " " 120kΩ
R1005,1008,1010,1013,1014,1016,1017,1019,1020,1022,1083,1098,1102,1106,1132	J01245101	" " " TJ 100Ω	R1166	J02245154	" " " " 150kΩ
			R1142,1173,1199	J02245224	" " " " 220kΩ
			R1208	J01245224	" " " TJ 220kΩ
			R1080,1091,1152,1156,1172	J02245334	" " " SJ 330kΩ
R1053	J02245151	" " " SJ 150Ω			
R1161,1168,1256	J02245221	" " " " 220Ω	R1147	J02245394	" " " " 390kΩ
R1086,1087,1221	J02245331	" " " " 330Ω	R1043-1045	J02245564	" " " " 560kΩ
R1130,1195,1247	J02245391	" " " " 390Ω	R1050	J02245225	" " " " 2.2MΩ
R1002,1003,1046,1060,1061,1076,1078,1136,1217	J02245471	" " " " 470Ω			
					BLOCK RESISTOR
			RB1001	J40900019	RA1/16K8R-100kΩ 100kΩx8
			RB1002	J40900020	RA1/16K5R-100kΩ 100kΩx5
					POTENTIOMETER
R1054,1222	J02245561	" " " " 560Ω	VR1003	J51740501	EVNB3AA00B52 500Ω
R1109	J02245681	" " " " 680Ω	VR1002	J50702202	EVLS0A00B23 2kΩ
R1246	J02245821	" " " " 820Ω	VR1001	J51721502	EVLS3A00B53 5kΩ
R1081,1092,1143,1200,1206,1235,1253	J02245102	" " " " 1kΩ	VR1004	J51721203	EVLS3A00B24 20kΩ
R1144	J01245102	" " " TJ 1kΩ			
R1137	J02245122	" " " SJ 1.2kΩ			
R1095	J02245152	" " " " 1.5kΩ			
R1089,1148,1151,1154,1158,1164,1170,1205	J02245222	" " " " 2.2kΩ			CAPACITOR
			C1213	K00172010	DD104SL010C50V02 50WV SL 1pF
			C1067	K00172030	DD104SL030C50V02 " " 3pF
R1237-1241	J01245222	" " " TJ 2.2kΩ			
R1025,1028,1031,1034,1037,1040,1226,1251,1255	J02245332	" " " SJ 3.3kΩ	C1068	K00173070	DD104SL070D50V02 " " 7pF
			C1010,1012	K00175120	DD104SL120J50V02 " " 12pF
R1001,1085,1099,1103,1107,1110,1202,1228	J02245472	" " " " 4.7kΩ	C1017,1021	K00175180	DD104SL180J50V02 " " 18pF
R1146	J01245472	" " " TJ 4.7kΩ			
R1052	J01245512	" " " " 5.1kΩ	C1079	K00175220	DD104SL220J50V02 " " 22pF
R1026,1027,1029,1030,1032,1033,1035,1036,1038,1039,1041,1042,1097,1101,1105,1175,1192,1196	J02245562	" " " SJ 5.6kΩ			
			C1011,1018,1020	K00175270	DD104SL270J50V02 " " 27pF
			C1026,1030,1147,1151	K00175330	DD104SL330J50V02 " " 33pF

C1027,1029,1212	K00175470	DD104SL470J50V02 50WV SL 47pF	C1013,1016,1022, 1025,1031,1034, 1040,1043,1049, 1055,1064,1065, 1075,1077,1083, 1088,1096,1097, 1130,1131,1133, 1135,1139,1155, 1157,1192,1195, 1197,1198,1207, 1208,1210,1211, 1217,1219,1220, 1225,1226	K40120106	16RL10	16W	10μF
C1019	K00175560	DD104SL560J50V02 " " 56pF					
C1001,1002,1036, 1038	K00175680	DD104SL680J50V02 " " 68pF					
C1035,1039	K00175820	DD104SL820J50V02 " " 82pF					
C1162	K10176101	DD104YB101K50V02 " 100pF					
C1028,1044,1048, 1051,1054,1056	K00175121	DD105SL121J50V02 " SL 120pF	C1223,1224	K40179014	50RE10	50WV	10μF
C1153	K00175151	DD104SL151J50V02 " " 150pF	C1137,1163,1239	K40129002	16RE47	16WV	47μF
C1045,1047	K00175181	DD104SL181J50V02 " " 180pF	C1230	K40120107	16RL100	"	100μF
C1146,1150	K00175221	DD107SL221J50V02 " " 220pF	C1161	K40149010	25RE330	25WV	330μF
			C1164	K40120477	16RL470	16WV	470μF
			C1166	K40149005	25RE1000	25WV	1000μF
			C1199	K40120108	16RL1000	16WV	1000μF
C1037,1145,1149	K00175271	DD107SL271J50V02 " " 270pF			TRIMMER CAPACITOR		
C1046,1098	K10176471	DD104YB471K50V02 " 470pF	TC1001-1003	K91000016	ECV-1ZW50x32		50pF
C1052,1053,1221, 1222	K10176561	DD104YB561K50V02 " 560pF			INDUCTOR		
C1185,1186,1227	K10176102	DD104YB102K50V02 " 0.001μF	L1033	L1190113	FL3H R22M		0.22μH
C1141	K50177222	50F2U222M " 0.0022μF	L1001	L1190109	FL3H R33M		0.33μH
C1128	K10176332	DD107YB332K50V02 " 3300pF	L1005	L1190007	FL4H 1R8M		1.8μH
			L1004,1006,1010	L1190010	FL4H 3R9K		3.9μH
			L1003,1007	L1190111	FL4H 5R6K		5.6μH
			L1015	L1190013	FL4H 6R8K		6.8μH
			L1009,1011	L1190070	FL4H 8R2K		8.2μH
			L1020	L1190014	FL4H 100K		10μH
C1060,1069,1078, 1080,1081,1084, 1089,1094,1095, 1101,1111-1113, 1117,1118,1122, 1123,1125,1143, 1167,1173,1176, 1179,1182,1184, 1187-1189,1193, 1200,1202,1205, 1214,1218,1233	K13170103	DD201YF103Z5L5 " 0.01μF	L1008,1012	L1190112	FL4H 120K		12μH
			L1014,1016	L1190021	FL5H 180K		18μH
			L1013,1017	L1190023	FL5H 220K		22μH
			L1025	L1190073	FL5H 270K		27μH
			L1018,1022	L1190025	FL5H 330K		33μH
			L1019,1021	L1190027	FL5H 390K		39μH
			L1024,1026,1028, 1030	L1190031	FL5H 680K		68μH
			L1023,1027	L1190016	FL5H 101K		100μH
C1229	K50177223	50F2U223M " 0.022μF	L1029	L1190018	FL5H 121K		120μH
C1003,1005,1007, 1008,1014,1015, 1023,1024,1032, 1033,1041,1042, 1050,1056-1059, 1061-1063,1066, 1070,1072,1074, 1076,1082, 1085-1087, 1090-1093,1099, 1100,1102-1110, 1114-1116, 1119-1121,1124, 1126,1127,1129, 1132,1134,1136, 1140,1154,1156, 1168-1172,1174, 1175,1177,1178, 1180,1181,1183, 1191,1196,1201, 1203,1206,1215, 1216,1228, 1232,1234,1235	K13170473	DB207YF473Z5L5 " 0.047μF	L1039-1042	L1190020	FL5H 151K		150μH
			L1036	L1190001	EL0710 251K		250μH
			L1032	L1190114	FL5H 821K		820μH
			L1002,1034,1035, 1038,1043,1044	L1190017	FL5H 102K		1mH
			L1031	L1190040	S4 1mH		1mH
				L9190016	Shield Case (7mm)		
					TRANSFORMER		
			T1001	L0020789A			
			T1002	L0020863			
			T1003	L0020883			
			T1004,1007	L0020858			
			T1005	L0020857			
			T1006	L0020858			
C1144,1159	K50177473	50F2U473M " 0.047μF	T1008	L0020860			
C1209	K23170003	RPE112F104V50V " 0.1μF	T1009,1010	L0020861			
C1158,1165	K50177104	50F2U104M " 0.1μF	T1011-1017	L0190002	7MC-312162NO		
C1071,1073,1138, 1142,1148,1152	K40170105	50RL1 " 1μF	T1018	L3030086	DC-DC CONV.		
C1190	K40170225	50RL2R2 " 2.2μF					
C1160	K40140475	25RL4R7 25W 4.7μF			RELAY		
C1004,1006,1009	K40120106	16RL10 16W 10μF	RL1001	M1190006	FBR221AD012		

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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	J02245101	Carbon film 1/4W SJ 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	J02245151	" " " " 150Ω
J1016	P0090136	PI051-08M	R2117	J02245181	" " " " 180Ω
J1019	P1090196	FJ-10-001	R2062, 2124	J02245221	" " " " 220Ω
			R2089,2142,2144	J02245331	" " " " 330Ω
	Q5000011	Wrapping Terminal C	R2041,2049,2054, 2066,2071,2082, 2095,2109,2116	J02245391	" " " " 390Ω
			R2013,2020,2027, 2034,2104,2136	J02245471	" " " " 470Ω
			R2094,2122	J02245561	" " " " 560Ω
			R2015,2022,2029, 2036,2037,2039, 2058,2110,2119, 2126,2131,2132	J02245102	" " " " 1kΩ
PLL UNIT					
Symbol No.	Part No.	Description			
PB-2170A	F0002170A	Printed Circuit Board			
	C0021700	P.C.B with Components			
			R2091,2137	J02245152	" " " " 1.5kΩ
		TRANSISTOR, IC			
Q2004-2007	G3107331Q	TR 2SA733A-Q	R2005-2008,2038, 2073,2096,2118, 2125,2134	J02245222	" " " " 2.2kΩ
Q2016	G3305351	" 2SC535A			
Q2026,2027	G3309000E	" 2SC900E	R2138,2148,2149	J02245272	" " " " 2.7kΩ
Q2001,2002, 2008-2011,2014, 2015,2018, 2020-2024,2028, 2029,2031,2032, 2037,2039,2040	G3309451Q	" 2SC945A-Q	R2057,2060,2092 2093,2097	J02245472	" " " " 4.7kΩ
			R2011,2018,2025, 2032,2046,2069, 2079,2103,2105, 2112,2129	J02245103	" " " " 10kΩ
Q2012	G3310473	" 2SC1047C			
Q2044,2045	G3313840R	" 2SC1384R	R2012,2019,2026, 2033,2047,2056, 2059,2068,2078, 2101,2106,2113, 2128	J02245223	" " " " 22kΩ
Q2017,2035	G3313930L	" 2SC1393L			
Q2034	G3316740L	" 2SC1674L			
Q2013	G3319590Y	" 2SC1959Y			
Q2043	G3408820Q	" 2SD882Q			
Q2042	G1090153	IC MB8718	R2002,2004 2086,2087	J02245473	" " " " 47kΩ
Q2041	G1090311	" MB84040B			
Q2036	G1090296	" HD10551	R2074	J02245683	" " " " 68kΩ
Q2025	G1090087	" MC4044P	R2001,2003,2009, 2010,2016,2017, 2023,2024,2030, 2031,2051,2065, 2090,2099,2100, 2111,2133	J02245104	" " " " 100kΩ
Q2038	G1090312	" MC14504BCP			
Q2003	G1090128	" MC14556BCP			
Q2019,2030,2033	G1090012	" SN16913P			
			R2127	J02245154	" " " " 150kΩ
		DIODE			
D2001-2020	G2090027	Si 1SS53			
D2021-2025	G2090043	Varactor MV-104	RB2001	J40900017	BLOCK RESISTOR RA1/16-6R1MΩ 1/16W 1MΩx6
D2027,2028	G2090156	Zener RD5.6EB2			
D2026	G2090155	Zener RD9.1EB2			
					CAPACITOR
			C2048,2062	K00179001	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	J02245100	Carbon film 1/4W SJ 10Ω	C2070,2073,2081, 2112,2139	K00172050	DD104SL050C50V02 " " 5pF
R2083-2085	J02245150	" " " " 15Ω			
R2040,2043	J02245330	" " " " 33Ω	C2010,2017,2168	K06172050	DD104UJ050C50V02 " UJ 5pF
R2044	J02245560	" " " " 56Ω			
R2121	J02245820	" " " " 82Ω	C2049,2086	K00173060	DD104SL060D50V02 " SL 6pF
R2014,2021,2028, 2035,2042,2045	J02245101	" " " " 100Ω			

REPAIR PARTS

[illegible]

FM UNIT			INDUCTOR		
Symbol No.	Part No.	Description	L7001,7002	L1190017	FLSH 102K 1mH
PB-2176	F0002176	Printed Circuit Board			
	C0021760	P.C.B with Components			
			J7001	P0090167	CONNECTOR PI011-08M 8P
		TRANSISTOR & IC			
Q7001,7003-7007	G3309451Q	TR 2SC945A-Q			
Q7002	G1090059	IC TA-7061AP			
		DIODE			
D7001-7004	G2001880F	Ge 1S188FM			
D7005	G2090027	Si 1SS53			
			VFO UNIT		
			Symbol No.	Part No.	Description
			PB-2172	F0002172	Printed Circuit Board
				C0021720	P.C.B with Components
TH7001	G9090001	SDT-250			
					TRANSISTOR
		CERAMIC FILTER	Q3001-3003	G3309451Q	2SC945A-Q
CF7001	H3900030	LFB-15			
					RESISTOR
		CERAMIC DISCRIMINATOR	R3015	J02245330	Carbon film 1/4W SJ 33Ω
CD7001	H7900010	455D	R3007,3010-3012,3016	J02245101	" " " " 100Ω
		RESISTOR	R3004,3008,3009,3014	J02245102	" " " " 1kΩ
R7022	J02245470	Carbon film 1/4W SJ 47Ω	R3003	J02245222	" " " " 2.2kΩ
R7003,7005,7007,7012,7029,7030	J02245101	" " " " 100Ω	R3001	J02245183	" " " " 18kΩ
R7017	J02245221	" " " " 220Ω	R3005	J02245223	" " " " 22kΩ
R7001	J02245102	" " " " 1kΩ	R3002	J02245333	" " " " 33kΩ
R7019,7023	J02245152	" " " " 1.5kΩ	R3006	J02245104	" " " " 100kΩ
R7004,7006,7008,7011	J02245222	" " " " 2.2kΩ	R3013	J02245154	" " " " 150kΩ
R7028	J02245472	" " " " 4.7kΩ			CAPACITOR
R7013,7015,7018	J02245562	" " " " 5.6kΩ	C3008	K02173100	DD104CH100D50V02 50WV CH10pF
R7026,7027	J02245682	" " " " 6.8kΩ			
R7009,7010,7021,7031,7032	J02245103	" " " " 10kΩ	C3003	K06179009	DD105UJ560J50V02 " " 56pF
R7020,7024	J02245823	" " " " 82kΩ	C3004	K02175101	DD107CH101J50V02 " " 100pF
R7025	J02245104	" " " " 100kΩ			
R7002	J02245224	" " " " 220kΩ	C3002	K02179019	DD107CH910J50V02 " CH 91pF
R7014,7016	J02245564	" " " " 560kΩ	C3007	K30176681	LCQ18681K05 " 680pF
			C3013,3014	K10176681	DD104B681K50V02 " 680pF
		CAPACITOR	C3006	K30209001	DM19D102K1 100WV 1000pF
C7017	K00179005	DD104SL200J50V02 50WV SL 20pF	C3001	K30209006	DM19D242K1 " 2400pF
C7027	K00175101	DD105SL101J50V02 " " 100pF	C3005,3010,3012	K13170103	DB201YF103Z5L5 50WV 0.01μF
C7010,7016	K12171102	DD105E102P50V02 " 0.001μF	C3009,3011,3015,3016	K13170473	DB207YF473Z5L5 " 0.047μF
C7028	K13170472	DB201YF472Z5L5 " 0.0047μF			VARIABLE CAPACITOR
C7001,7003,7004,7009,7014,7015,7019,7026,7029	K13170103	DB201YF103Z5L5 " 0.01μF	VC3001	K90000034	C-613A132
C7018	K13170223	DD109F223Z50V02 " 0.022μF			TRIMMER CAPACITOR
C7011,7012	K50177223	50F2U223M " 0.022μF	TC3001	K91000013	ECV-1ZW20x32 50pF
C7002,7005-7008,7020	K13170473	DB207YF473Z5L5 " 0.047μF			INDUCTOR
C7013	K70167224	CS15E1VR22M 35WV 0.22μF	L3001	L0020062	R12-5775
C7024,7025	K40170105	50RL1 50WV 1μF	L3003	L1190009	FL4H 3R3M 3.3μH
C7022,7023	K40140475	25RL4.7 25WV 4.7μF	L3002	L1190016	FL5H 101K 100μH
C7021,7030,7031	K40120106	16RL10 16WV 10μF	PL3001	Q1000043A	K0298-4-0 12V, 100mA
					TERMINAL
			Q5000020		MS-60121

SWITCH UNIT			MEMORY UNIT (OPTION)		
Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
PB-2173	F0002173	Printed Circuit Board	PB-2175A	F0002175A	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
		SWITCH	Q6007	G1090296	" HD10551
S4001-4004	N5090003	KEF-10901	Q6008	G1090100	" SN74LS123
S4005	N4090039	SUT-42A	Q6009-6012	G1090019	" SN74LS192
			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			
PB-2171A	F0002171A	Printed Circuit Board	D6001,6002	G2090073	Varactor FC-52M
	C0021710	P.C.B with Components	D6007	G2090040	Varactor FC-63
			D6003,6010	G2090156	Zener RD5.6EB2
			D6004	G2090153	Zener RD10EB1
		TRANSISTOR	D6005,6006,6008,6009	G2090027	Si 1SS53
Q5001-5003	G3309451Q	2SC945A-Q	D6011,6012	G2090029	Ge 1N60
		DIODE			CRYSTAL
D5001	G2090157	Si S2VB10F	X6001	H0102339	HC-18/U, 3P 16.384MHz
D5002	G2090158	Zener RD4.7EB2			RESISTOR
D5003	G2090159	Si S2V10	R6027	J20306100	Metallic film 1W 10Ω
		RESISTOR	R6029	J02245100	Carbon film 1/4W SJ 10Ω
R5005	J02245331	Carbon film 1/4W SJ 330Ω	R6019	J02245270	" " " " 27Ω
R5003,5004	J02245471	" " " " 470Ω	R6060	J20306330	Metallic film 1W 33Ω
R5002	J02245122	" " " " 1.2kΩ	R6005,6011,6012,6017,6020,6023,6030,6035,6042,6055,6056	J02245100	Carbon film 1/4W SJ 100Ω
R5001	J02245182	" " " " 1.8kΩ			
R5007	J02245472	" " " " 4.7kΩ	R6001,6004,6025,6026,6028	J02245221	" " " " 220Ω
R5006	J02245682	" " " " 6.8kΩ	R6013,6024	J02245391	" " " " 390Ω
		CAPACITOR	R6018	J02245471	" " " " 470Ω
C5006	K13170473	DB207YF473Z5L5 50WV 0.047μF	R6067	J02245561	" " " " 560Ω
C5004	K40170105	50RL1 " 1μF	R6036,6038,6058,6062	J02245102	" " " " 1kΩ
C5003,5005	K40120106	16RL10 16WV 10μF	R6041	J02245182	" " " " 1.8kΩ
C5002	K40120336	16RL33 " 33μF	R6014,6043	J02245222	" " " " 2.2kΩ
C5001	K40149013	RPE-25V682M 25WV 6800μF	R6063-6066	J02245272	" " " " 2.7kΩ
		CONNECTOR	R6068	J10246332	" composition " GK 3.3kΩ
J5001-5003	P0090120	PI051-02M	R6040	J02245562	" film " SJ 5.6kΩ
J5004	P0090132	PI051-04M	R6034,6046,6049,6053,6059	J02245103	" " " " 10kΩ
			R6010,6015,6022	J02245183	" " " " 18kΩ
	Q5000011	Wrapping terminal C	R6009,6016,6021,6031,6033,6051	J02245223	" " " " 22kΩ
			R6050	J02245333	" " " " 33kΩ

R6052	J02245393	Carbon film 1/4W SJ 39kΩ			INDUCTOR
R6002,6003,6006,6007	J02245473	" " " " 47kΩ	L6006	L1190005	FL4H IR0M 1μH
R6008,6032,6044	J02245104	" " " " 100kΩ	L6004,6008	L1190009	FL4H 3R3M 3.3μH
R6037	J02245124	" " " " 120kΩ	L6005,6007	L1190111	FL4H 5R6K 5.6μH
R6045	J02245154	" " " " 150kΩ	L6001,6002,6009,6012,6014	L1190020	FL5H 151K 150μH
R6057	J02245184	" " " " 180kΩ	L6003,6010,6016	L1190017	FL5H 102K 1mH
R6061	J02245224	" " " " 220kΩ	L6011	L2030067B	S/N COIL 3mH
			L6013,6015	L1190035	FL7H 392J 3.9mH
		BLOCK RESISTOR			
RB6001	J40900018	RA1/16K9R100kΩ 1/16W 100kΩx9			TRANSFORMER
			T6001	L0020110	R12-4797A
			T6002	L0020864	VCO COIL
		CAPACITOR	T6003	L0020865	"
C6044	K06173060	DD104UJ060D50V02 50WV UJ 6pF			CONNECTOR
C6001,6002	K02173070	DD104CH070D50V02 " CH 7pF	J6006	P0090120	PI051-02M 2P
C6011,6027,6069	K00175120	DD104SL120J50V02 " SL 12pF	J6004	P0090132	PI051-04M 4P
C6012	K00175270	DD104SL270J50V02 " " 27pF	J6001	P0090133	PI051-05M 5P
C6043	K06175330	DD104UJ330J50V02 " UJ 33pF	J6005	P0090136	PI051-08M 8P
C6067	K00175560	D104SL560J50V02 " SL 56pF	J6003	P0090140	PI051-12M 12P
C6049	K02175560	DD106CH560J50V02 " CH 56pF	J6002	P0090141	PI051-13M 13P
C6045	K06179009	DD105UJ560J50V02 " UJ 56pF		Q5000011	Wrapping terminal C
C6046	K02175151	DD109CH151J50V02 " " 150pF			
C6023,6025	K10176561	DD104B561K50V02 " 560pF			
C6022,6026	K10176821	DD104B821K50V02 " 820pF		R3054620	FOOT H-30
C6003,6004,6006,6007,6008,6010,6013,6014,6030,6031,6068	K12171102	DD105E102P50V02 " 0.001μF		Q0000002	Fuse 1A (AC100-120V)
C6024	K10179022	2222-660-02272 " 2700μF		Q0000001	0.5A (AC200-240V)
C6009,6016-6021,6029,6033,6034,6038,6042,6047,6048,6054-6059,6061	K14179002	RD204YM0.01μF " 0.01μF			AC POWER CORD
C6053	K50177103	50F2U103M " 0.01μF		T9013280	2 wire, 2 prong plug DC-546-007
C6005,6036,6051,6070-6073	K13170473	DB207YF473Z5L5 " 0.047μF		T9013282	3 wire, 3 prong plug (UL) UC-904-016
C6064	K23170003	RPE112F104Z50V " 0.1μF		T9013284	3 wire, 2 prong EU plug EC-407-007
C6050	K54200001	B32561-A1105J 100WV 1μF		T9013283	3 wire, 3 prong Australian plug SC-411-001
C6015,6032,6035,6039,6060,6066	K40120106	16RL10 16WV 10μF		S3000023	Mini Belt C
C6052,6062	K40120226	16RL22 16WV 22μF			
C6063,2065	K40149003	25RE100 25WV 100μF			
C6041	K40120227	16RL220 16WV 220μF			
C6040	K40129031	16RC470 " 470μF			
C6037	K40089004	6.3RE1000 6.3WV 1000μF			
		MODULE			
RCM6001	Q80000005	RK1/16R-11R100kΩ/103Z50 (1/16W 100kx11, 50WV 0.01μFx11)			

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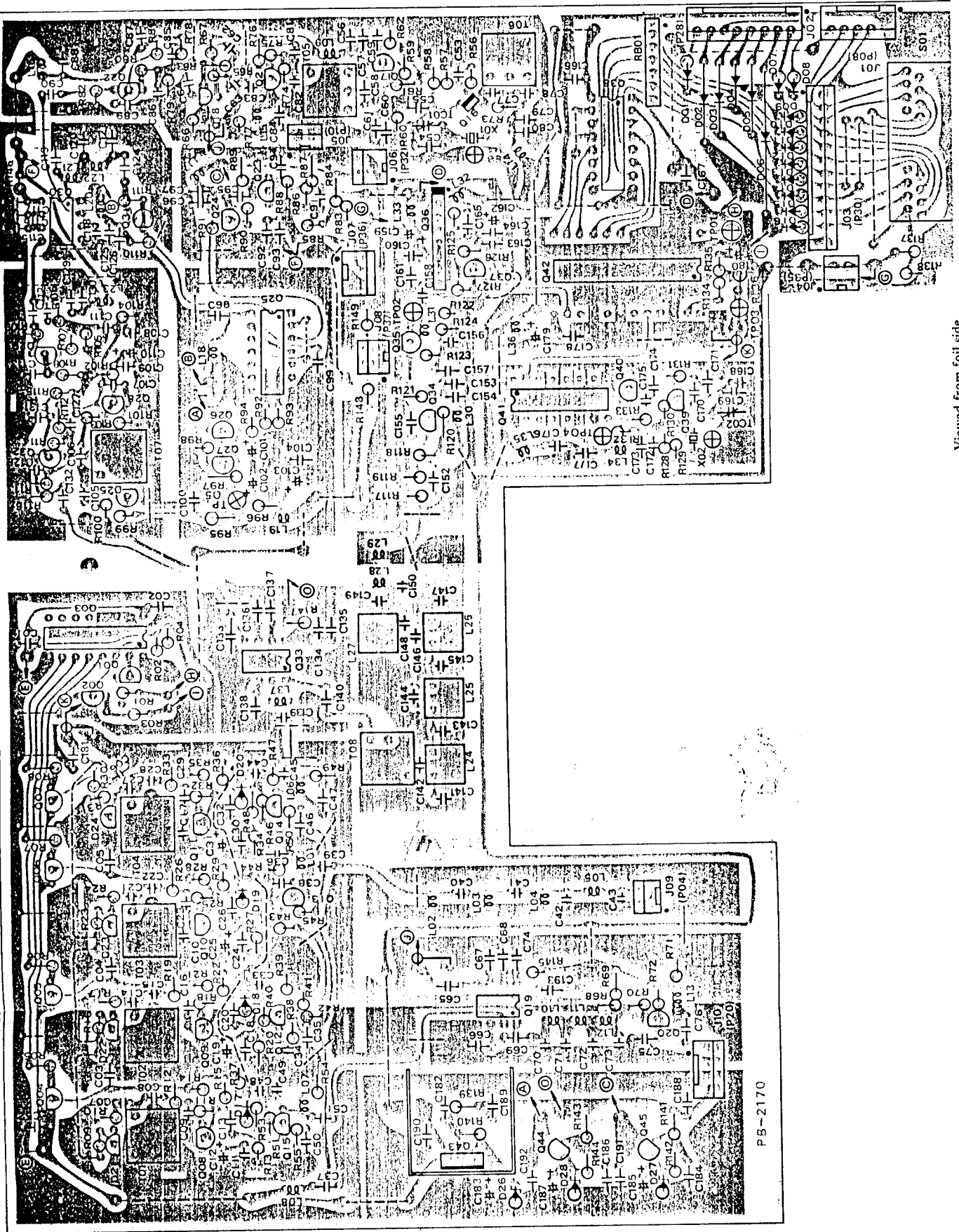
● MODEL A, ▲ MODEL B, ■ MODEL C, ★ MODEL D, ○ MODEL E, □ MODEL F

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	" " " 0.001 μ F (DD104-B102K50V02)
		RESISTOR				
R39	J02245010	Carbon film	1/4W SJ 1 Ω	(MODEL B [▲] ,D [★] , E [□] ,F [□])		
R15,17,25,86 [*]	J02245279	" "	" " 2.7 Ω	C80-86,88, 90-95,97,98, 100-104)		
R19,88 ^{▲*□□}	J01245100	" "	" TJ 10 Ω	C107 ^{□□} ,108 ^{□□}		
R17 ^{□□} ,25 ^{□□} ,86 ^{□□}	J02245100	" "	" SJ 10 Ω	C32,35,36,72-74	K14180103	" " 63WV 0.01 μ F (RD871-1FZ103Z63V)
R28,31,37,49,58, 67,86 [▲] ,96 ^{□□}	J02245101	" "	" " 100 Ω	C38,75-77	K13170473	" " 50WV 0.047 μ F (DB207YF473Z5L5)
R48,57,66,69,71, 99 ^{▲*□□} ,101	J01245101	" "	" TJ 100 Ω	C37	K40129004	Electrolytic 16WV 10 μ F (RL16V10)
R18,87 ^{▲*□□}	J02245151	" "	" SJ 150 Ω			
R97 [▲]	J02245181	" "	" " 180 Ω			
R47,56,65,73 [▲] , 74 [▲] ,96 [*]	J02245221	" "	" " 220 Ω			
R97 [*] ,73 [*]	J02245331	" "	" " 330 Ω			
R96 [▲]	J02245391	" "	" " 390 Ω			
R29,97 ^{□□}	J02245471	" "	" " 470 Ω			
R40,72	J02245561	" "	" " 560 Ω			
R3,4,6,8,9,11,44, 53,62,74 [*] , 75 ^{▲*□□} ,76 ^{▲*□□} , 78 ^{▲*□□} ,80 ^{▲*□□} , 81 ^{▲*□□}	J02245102	" "	" " 1k Ω	TUNING CAPACITOR		
R12,42,51 ^{▲*▲} , 60 ^{▲*▲*□□}	J01245102	" "	" TJ 1k Ω	● MODEL A		
R1,2,73 ^{□□} ,74 ^{□□}	J02245122	" "	" SJ 1.2k Ω	C66	K00179004	Cermic disc 50WV 16pF (DD104SL160K50V02)
R51 ^{□□} ,60 ^{□□} ,42 ^{□□}	J01245222	" "	" TJ 2.2k Ω	C42,52,56,62	K00179005	" " " 20pF (DD104SL200K50V02)
R22,91 ^{□□}	J02245332	" "	" SJ 3.3k Ω	C46,60,61	K00179006	" " " 24pF (DD104SL240K50V02)
R27,95 ^{▲*□□} ,98 [*]	J02245392	" "	" " 3.9k Ω	C50,51	K00175270	" " " 27pF (DD104SL270K50V02)
R13,30 ^{□□} ,43,45, 52,54,61,63, 98 ^{▲*□□} ,83 ^{□□}	J02245472	" "	" " 4.7k Ω	C40,41	K00179008	" " " 36pF (DD104SL360K50V02)
R33	J02245562	" "	" " 5.6k Ω			
R30 ^{▲*▲} ,91 ^{▲*}	J02245682	" "	" " 6.8k Ω	▲ MODEL B		
R5,7,14,16,23,34, 38,46,55,64,68, 70,79 ^{▲*□□} ,83 ^{▲*} , 77 ^{□□} ,92 ^{□□} , 100 ^{□□}	J02245103	" "	" SJ 10k Ω	C56	K00179004	Ceramic disc 50WV 16pF (DD104SL160K50V02)
R41,50,59, 84 ^{▲*□□} ,85 ^{▲*□□} , 92 ^{▲*} ,100 ^{▲*}	J01245103	" "	" TJ 10k Ω	C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)
R26,94 ^{▲*□□}	J01245273	" "	" TJ 27k Ω	C46,50,51	K00179006	" " " 24pF (DD104SL240K50V02)
R20,24,82 ^{▲*□□} , 89 ^{▲*□□} ,90 ^{▲*□□} , 93 ^{▲*□□}	J01245104	" "	" " 100k Ω	C40,41,66	K00179008	" " " 36pF (DD104SL360K50V02)
R10,21,32,35,36	J02245104	" "	" SJ 100k Ω	C60,61	K00179012	" " " 75pF (DD104SL750K50V02)
		POTENTIOMETER		■ MODEL C		
VR1	J62800060	K16BA0058-100KBx2 100K Ω Bx2		C66	K00173100	Ceramic disc 50WV 10pF (DD104SL101K50V02)
				C56	K00179003	" " " 13pF (DD104SL130K50V02)
				C60,61	K00175150	" " " 15pF (DD104SL150K50V02)
				C46,50,51	K00179004	" " " 16pF (DD104SL160K50V02)
		CAPACITOR		C42,52	K00179005	" " " 20pF (DD104SL200K50V02)
C23,96 ^{▲*□}	K00179001	Ceramic disc 50WV 0.5pF (DD104SL0R5C50V02)		C40,41	K00179006	" " " 24pF (DD104SL240K50V02)
C33	K00172010	" " " 1pF (DD104SL010C50V02)				

● 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					CONNECTOR
C56	K00179003	Ceramic disc 50WV 13pF (DD104SL130K50V02)	J1	Q9000122	UG0033
C46,50,51	K00179004	" " " 16pF (DD104SL160K50V02)	J2,3,4 ^{▲▲□□}	P1090194	MBR06B
C42,52,62	K00179005	" " " 20pF (DD104SL200K50V02)			CONNECTION CABLE
C40,41,66	K00179006	" " " 24pF (DD104SL240K50V02)	P1 (with wire)	T9204284	(5P DIN PLUG)
C60,61	K00179008	" " " 36pF (DD104SL360K50V02)			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				

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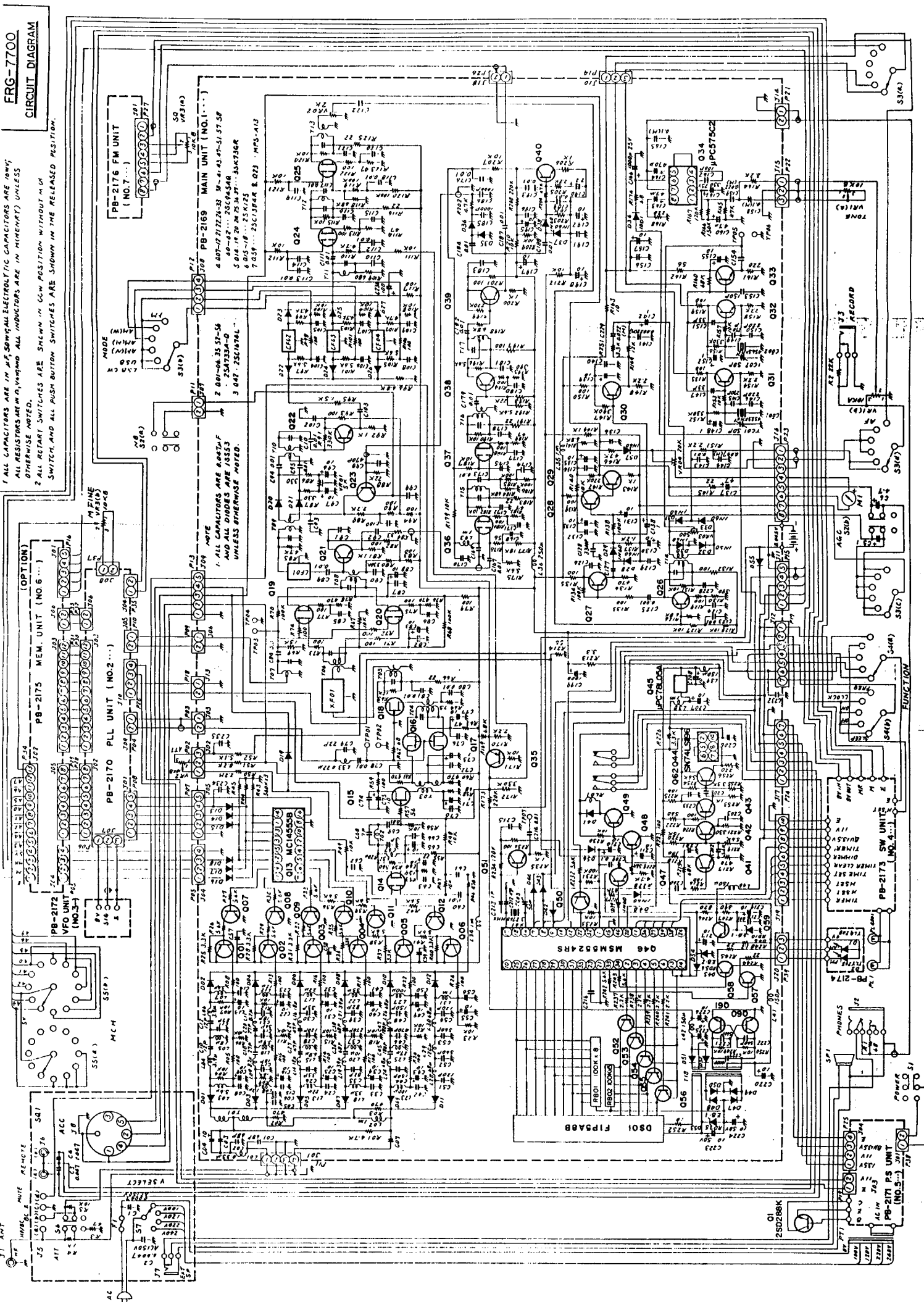


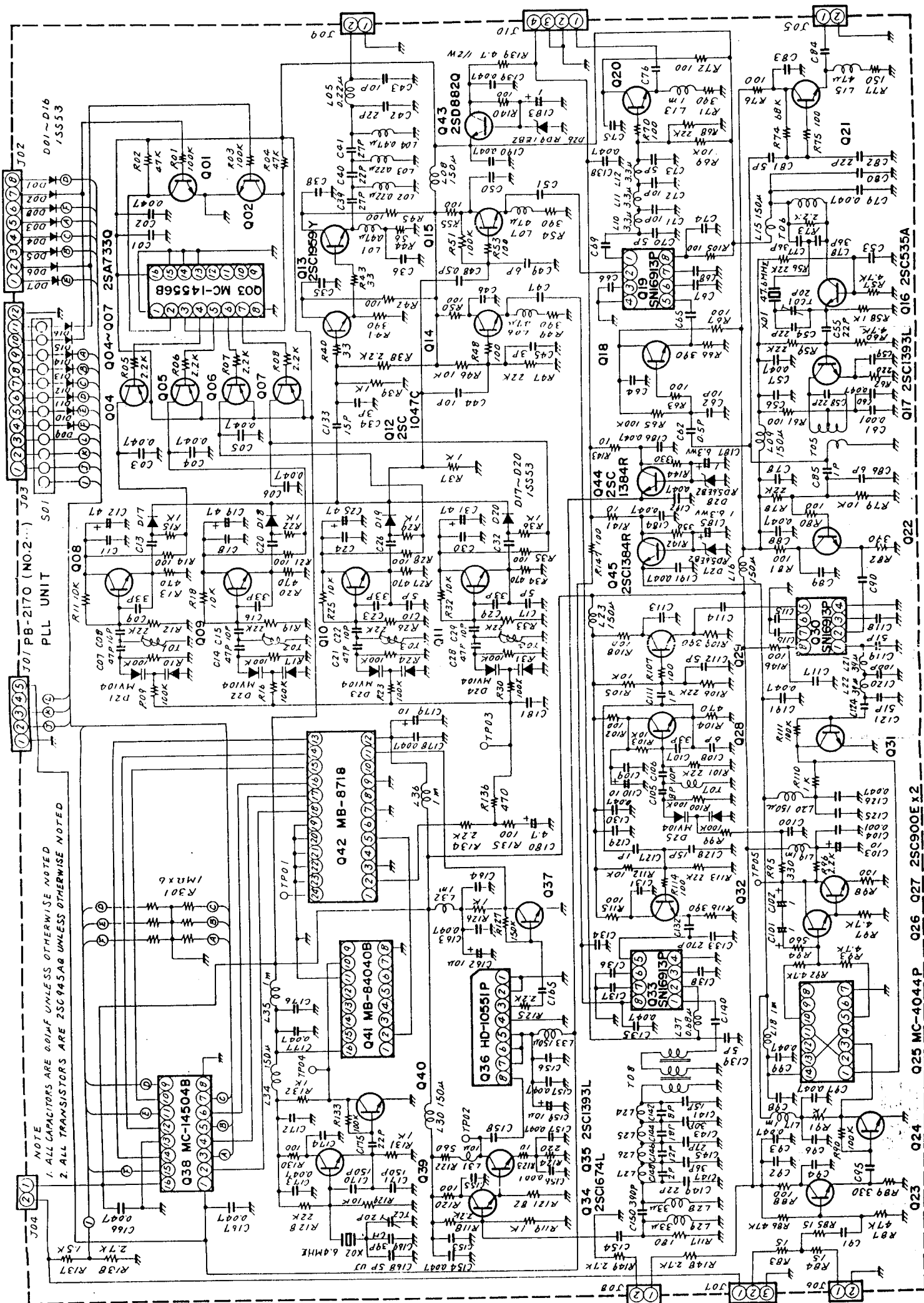
Viewed from foil side

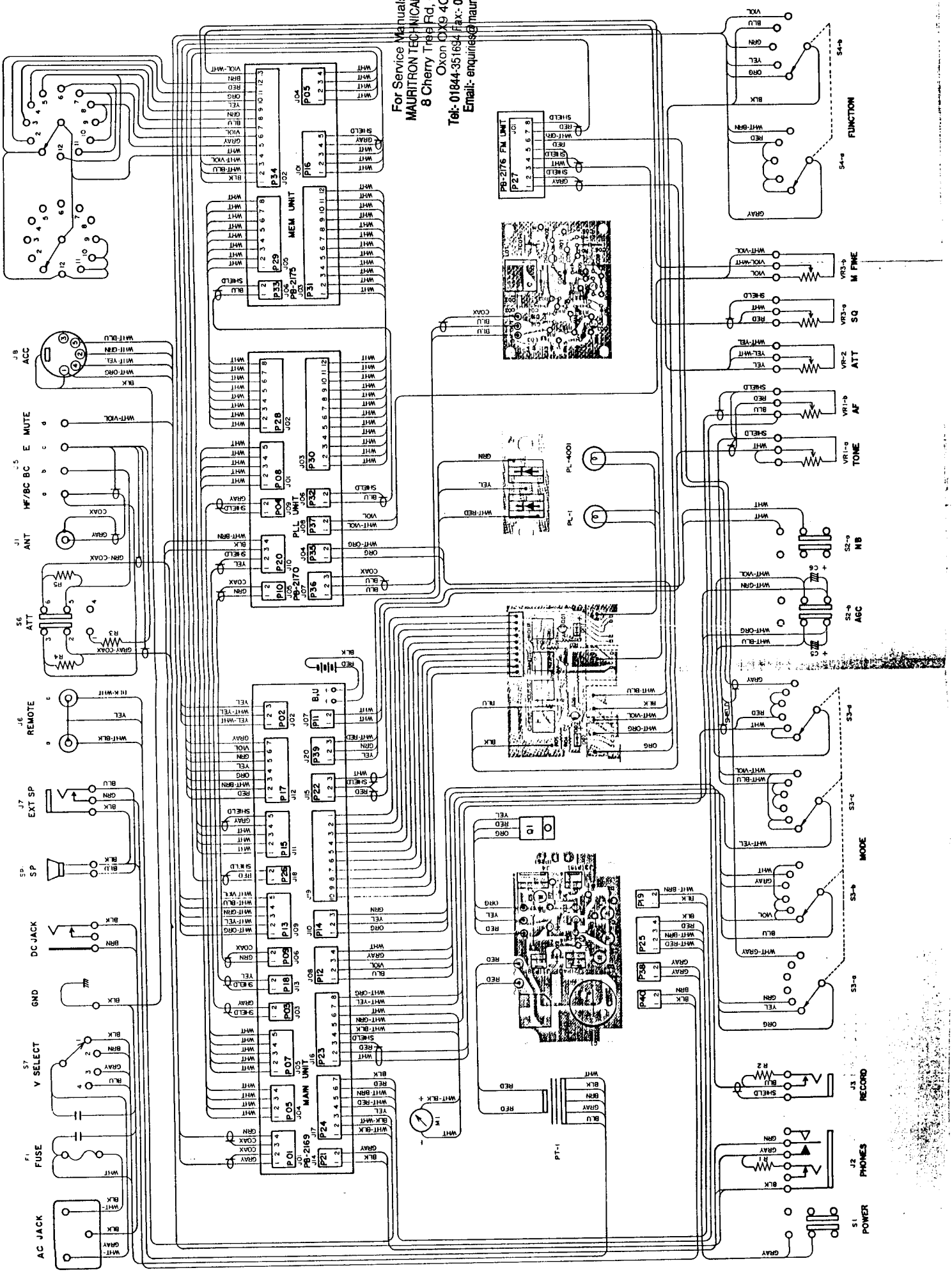
ERG-7700

CIRCUIT DIAGRAM

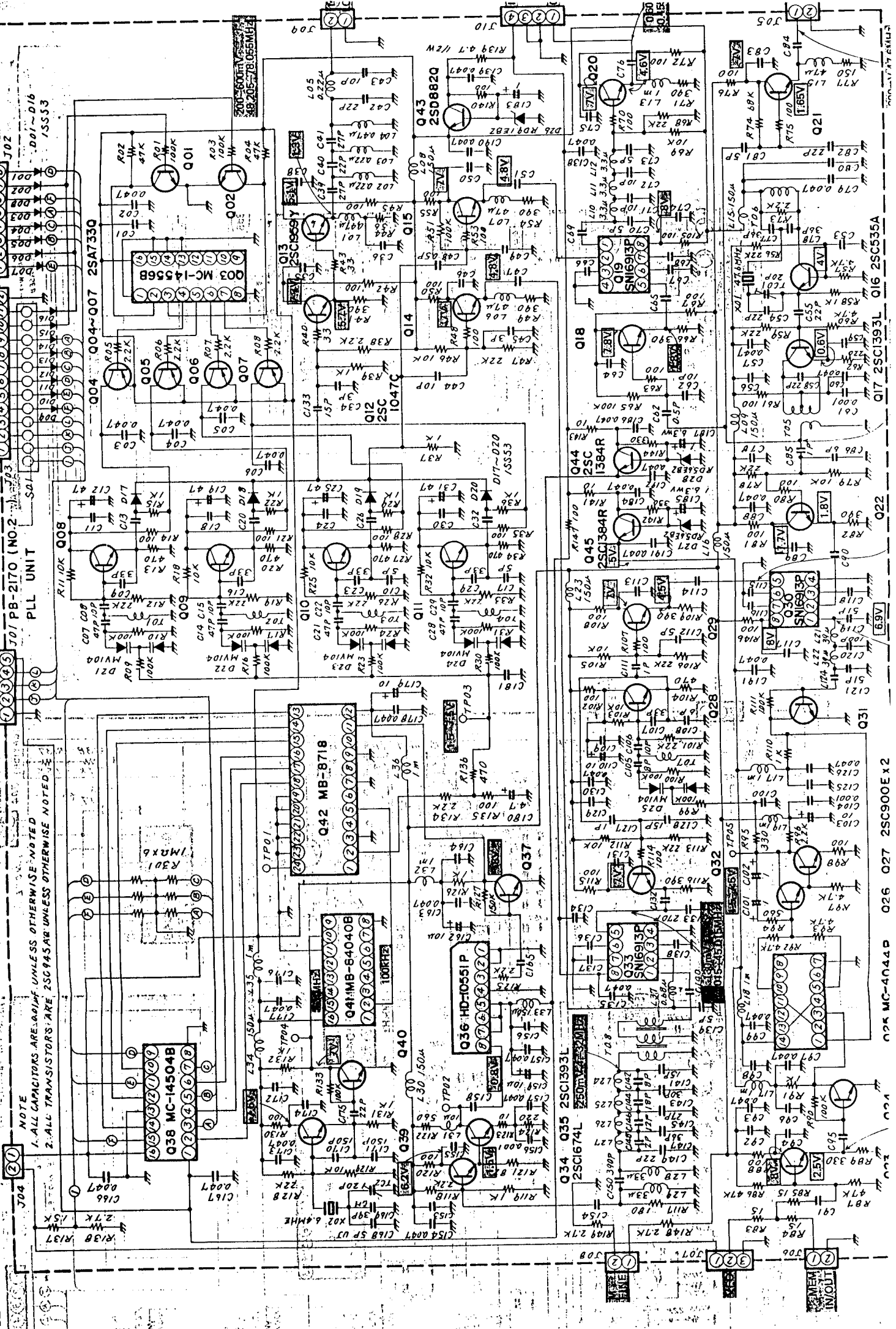
1 ALL CAPACITORS ARE IN μ F, SEMI-CONDUCTOR CAPACITORS ARE IN μ F, UNLESS OTHERWISE NOTED.
 2 ALL RETARY SWITCHES ARE SHOWN IN LOW POSITION WITHOUT MCH
 SWITCH, AND ALL PUSH BUTTON SWITCHES ARE SHOWN IN THE RELEASED POSITION.

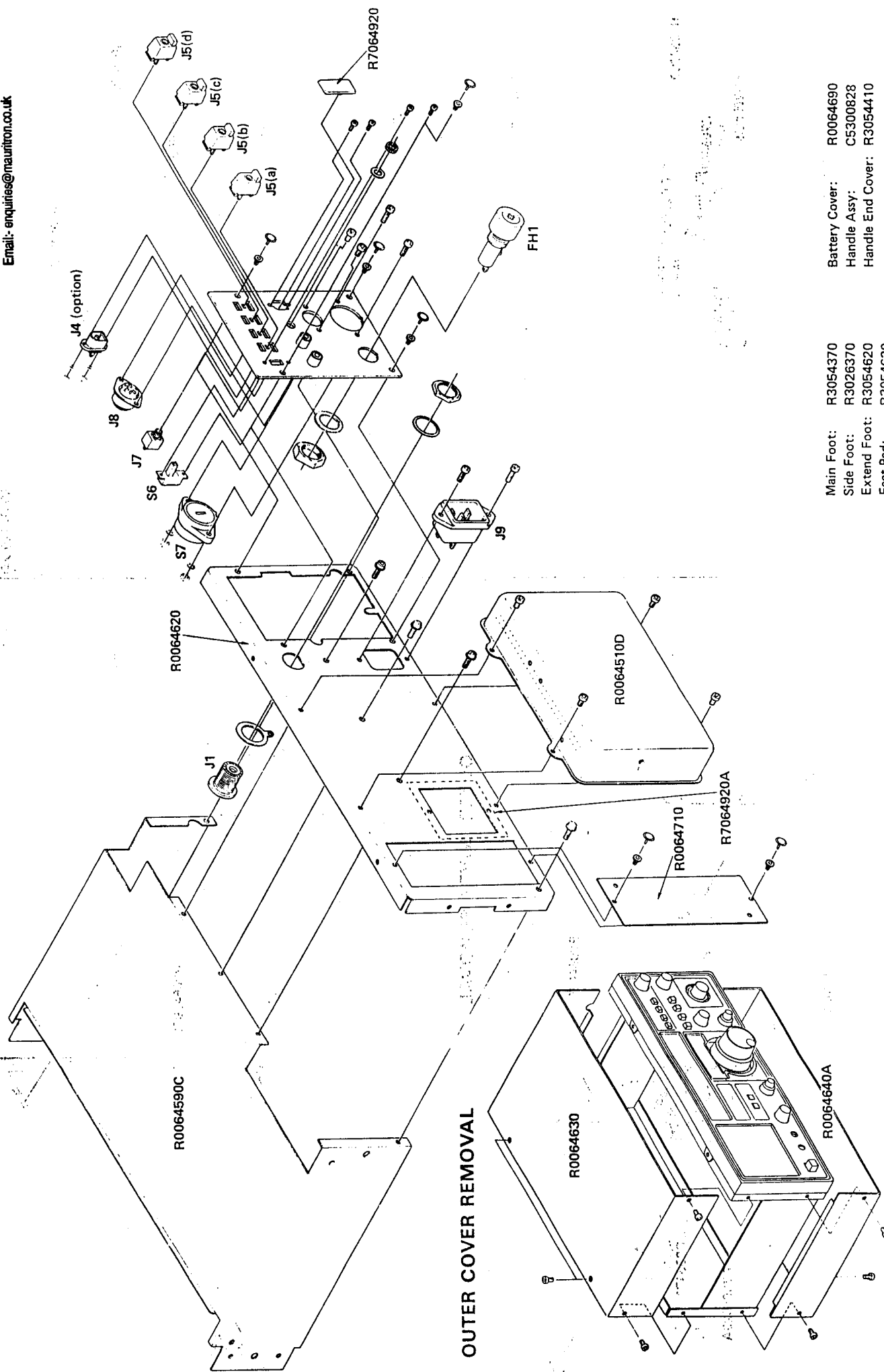






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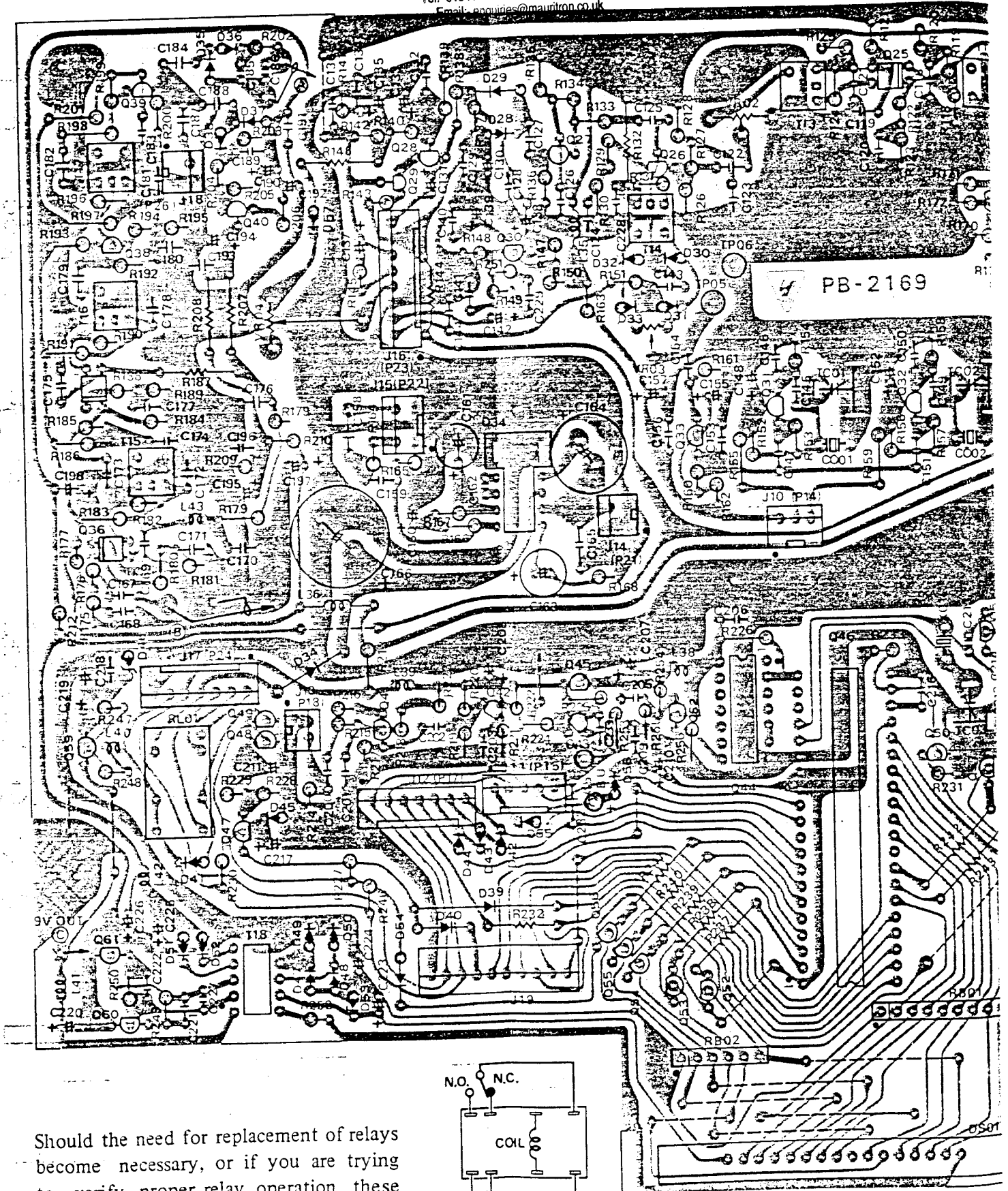




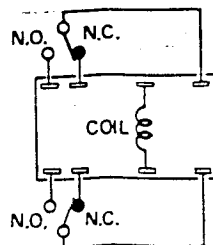
Main Foot: R3054370
 Side Foot: R3026370
 Extend Foot: R3054620
 Feet Pad: R3054630

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

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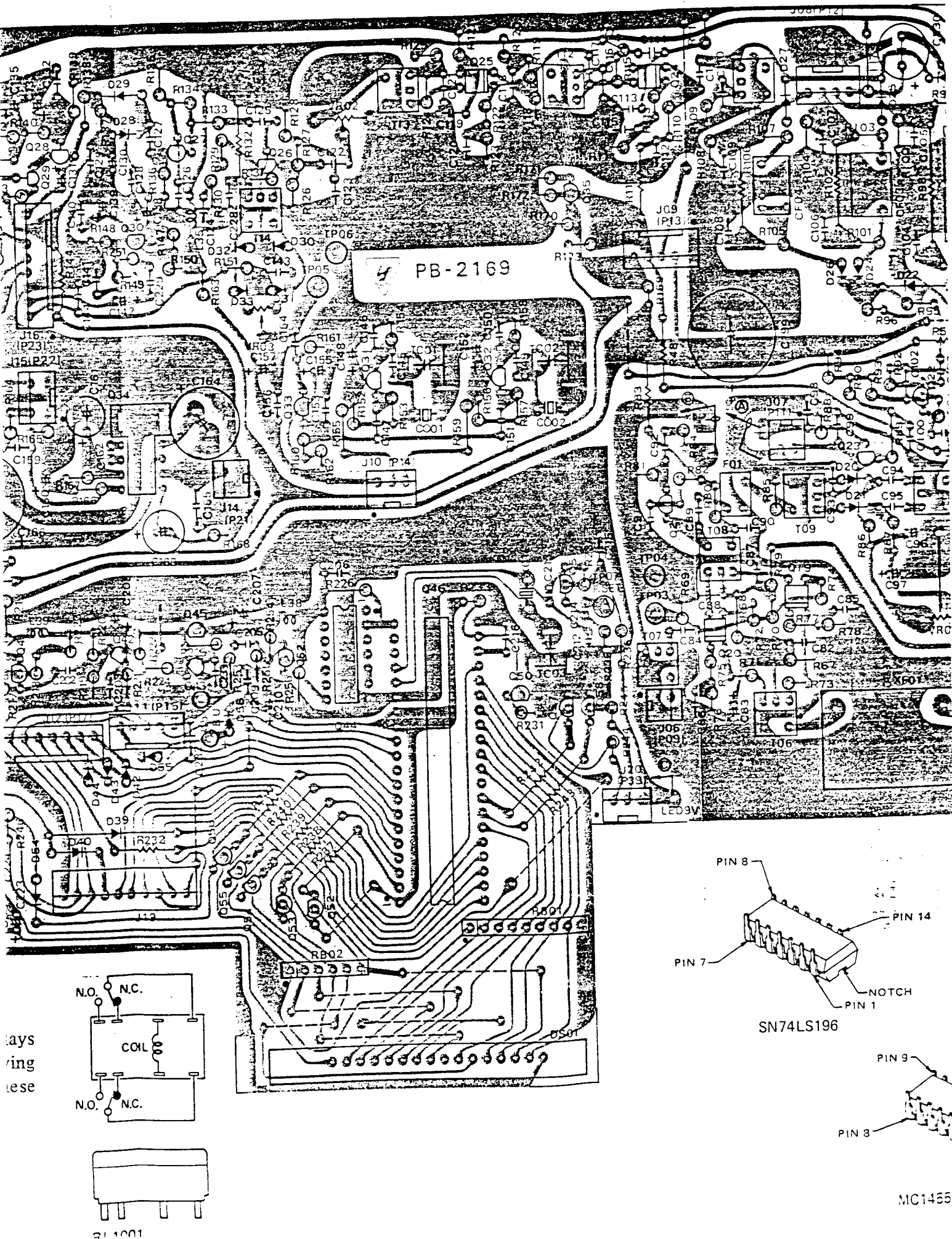


Should the need for replacement of relays become necessary, or if you are trying to verify proper relay operation, these diagrams should help you.

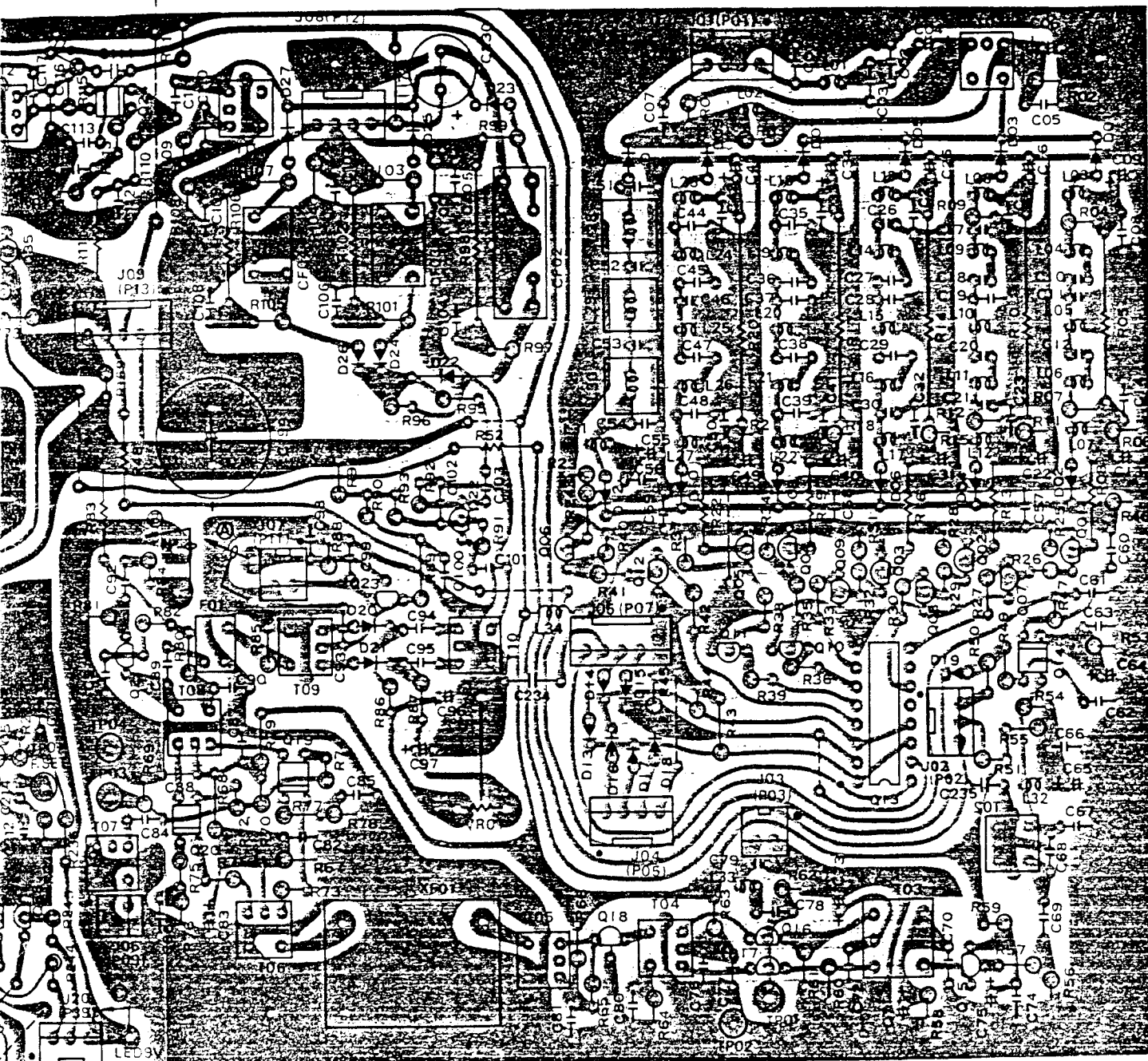


R1 1001

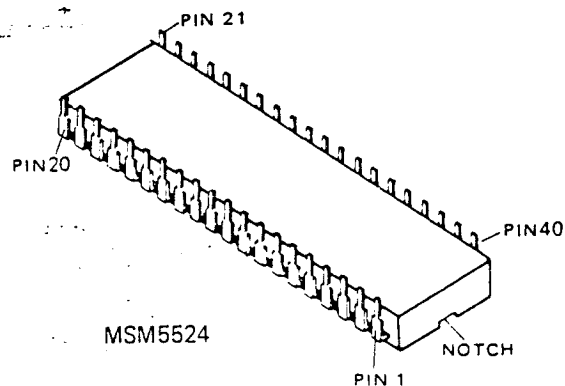
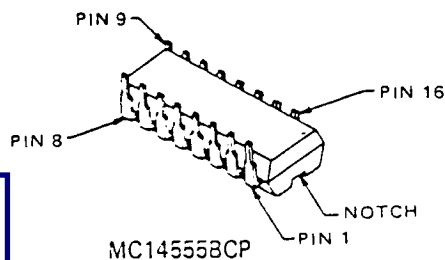
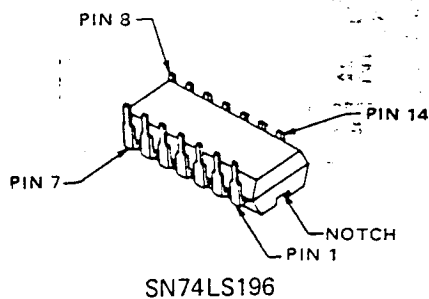
PARTS LAYOUT MAIN UNIT(PB-2169)



MAIN UNIT(PB-2169)



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