CHERICO, F. P
Field Service

apelco

Clipper 82
VHF-FM Radiotelephone
Instruction Manual

PURPOSE

THIS MANUAL CONTAINS IMPORTANT INFORMATION ON THE INSTALLATION, OPERATION AND MAINTENANCE OF YOUR EQUIPMENT.

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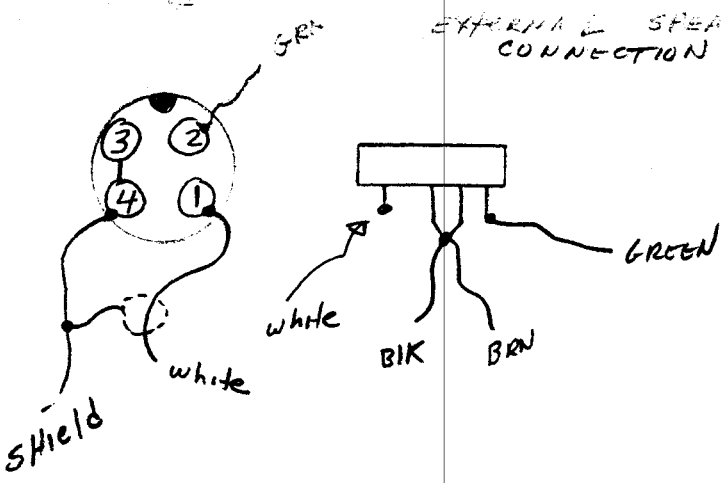


SECTION 1

INTRODUCTION

1.1 GENERAL

This CLIPPER 82 VHF-FM marine radiotelephone provides reliable simplex and one half duplex (two frequency simplex) mode communications between ships and from ships at sea to public or private shore stations. The one half duplex mode is referred to as duplex mode in this instruction manual. The CLIPPER 82 provides two-way communications on the USA and International channels, reception on the four separate weather channels, and two-way commuinications on the international calling and safety channel (16). Installation requires attaching the mounting yoke and the microphone bracket and connection to a 13.6VDC power source and an approved antenna.

This manual describes the physical and functional characteristics of the radiotelephone. Complete operational data, installation, theory of operation, and maintenance sections are provided including schematics,parts location drawings, and replaceable parts lists.

1.2 EQUIPMENT FEATURES

The CLIPPER 82 is designed and manufactured to provide ease of installation and operation with excellent reliability. The important built-in features of the equipment are listed below:

- All solid state circuitry for low current drain, minimum heat dissipation, and maximum reliability.
- A high-performance receiver with great selectivity for operation in "noisy" or "busy" areas.
- 54 channel transmit and 82 channel receive capability within the assigned VHF FM maritime band. All U.S. channels and International channels are included.
- Four watts audio output power to the speaker provides adequate volume even in a noisy environment.
- Exclusive circuit that automatically selects channel 16 and 25 watts output power when OFF/VOLUME Control is turned clockwise.
- Exclusive circuit that automatically monitors channel 16 and a selected channel when MON pushbutton switch is depressed
- Phase-locked loop frequency synthesizer generates channel frequencies to eliminate the need for conventional crystals on each channel.
- Microcomputer-controlled channel frequencies and characteristics.
- Selected channel indicated on bright LED digital display.

- Keyboard entries for distress channel 16, and weather channels W1, W2, W3 and W4 (capable of receiving all three U.S. weather channels and one Canadian weather channel).

- Full 25 watts output power to the antenna connector with protective circuitry to prevent damage when operating into faulty antenna systems.

1.3 EQUIPMENT SUPPLIED

Figure 1-1 shows the CLIPPER 82 VHF-FM Radiotelephone with detachable microphone and mounting yoke attached. Table 1-1 provides a complete list of the equipment supplied, the part numbers, and the quantity of equipment supplied.

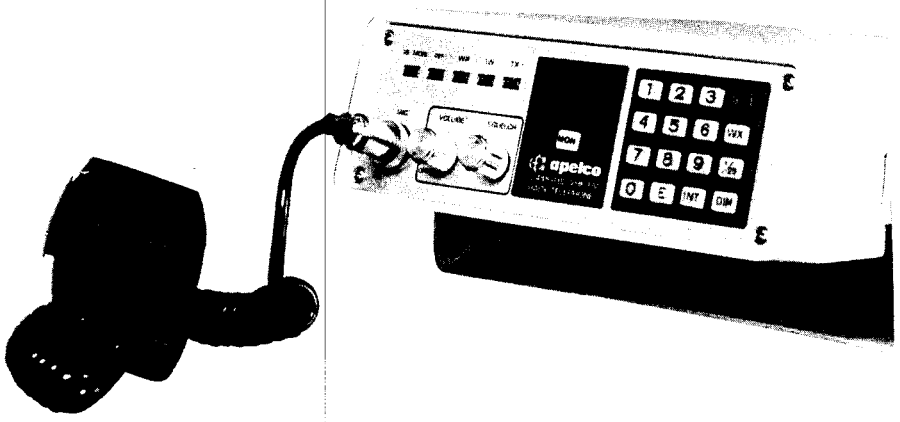


Figure 1-1 CLIPPER 82 VHF-FM Radiotelephone

Table 1-1
Equipment Supplied

Equipment Name	Part No.	Quantity
Radiotelephone	M56452	1
Microphone	1032698-106	1
Microphone Bracket w/ Attaching Hdwe.	217-7180P1	1
Power Connector and Cord	1032698-34	1
Mounting Yoke	1032698-49	1

Table 1-1
Equipment Supplied (cont'd)

Equipment Name	Part No.	Quantity
Spare Bulb(s) & Fuse(s) Kit		1
Manual	984887	1
FCC Data Sheet		1
FCC Registration Form		1
Warranty Certificate	981224	1
Warranty Registration Forms	983893	1

1.4 SPECIFICATIONS

Transmitter

Channels	54
Frequency stability	±10 PPM (0.001%) (-20°C to +50°C)
Frequency range	156.025 to 161.175 MHz
Channel Spacing	25 kHz increments
Power output	25 watts switchable to 1 watt into 50 ohms at 13.6 VDC (+0%, -25%) input
Modulation	Frequency modulated 16F3 (±5.0 kHz deviation for 100% modulation at 1000 Hz).
Audio distortion	Less than 10% at 1000 Hz for ±3 kHz deviation
Audio roll-off filter	Exceeds FCC requirements of 18 dB per octave beyond 3000 Hz
Spurious & harmonic radiated outputs	At least 70 dB below rated carrier power

Receiver

Channels	82 channels
Frequency range	156.050 to 162.025 MHz 25 kHz increments plus 162.550 MHz (W1) 162.400 MHz (W2) 162.475 MHz (W3) 161.650 MHz (W4)

1.4 SPECIFICATIONS (cont'd)

Frequency stability	±0.001% from -20°C to +50°C
Adjacent channel rejection	-70 dB
IF frequencies	1st IF = 16.9 MHz 2nd IF = 455 KHz
Sensitivity (20 dB quieting)	0.5 uV.
Usable Sensitivity 12 dB (SINAD)	0.35 uV at 1.0 watt
Audio response	+2, -8 dB from a standard 6 dB/octave de-emphasis characteristics from 300 to 3000 Hz referenced at 1000 Hz.
Modulation acceptance	±7.0 kHz bandwidth
Intermodulation rejection	-60dB
Squelch sensitivity threshold	0.3uV or better
Tight squelch sensitivity	0.5uV to 2.0uV
Audio output	4.0 watts or more at 10% or less distortion into 3.12-ohm load.
Spurious and image rejection	70 dB or more
<u>Operating Power Requirements</u>	
Input voltage	13.6 VDC ±15% (nominal), negative ground only
Operating range	11.6 to 15.6 volts dc
Input current	
Transmit	5.5 amps max at 25 watts
Receiving (squelched)	0.4 amps max
<u>Operating Temperature</u>	
Transmit and receive modes	-20°C to +50°C
<u>Radio Dimensions</u>	
Height	80 mm (including bracket) 3.1 inches
Width	240 mm (9.4 inches)

1.4 SPECIFICATIONS (cont'd)

Depth	245 mm (9.6 inches)
Weight	Approximately 3.4 Kg (7 lbs)

NOTE

The Model CLIPPER 82 VHF-FM Radiotelephone meets all applicable sections of FCC Parts 2, 15 and 83 and DOC RSS182.

1.5 COMMUNICATION RANGE

VHF communication range is dependent on the gain and height of the antenna as well as transmitter power and received signal strength. Refer to Figure 1-2, Range Nomograph, to determine the operating range of the installed system.

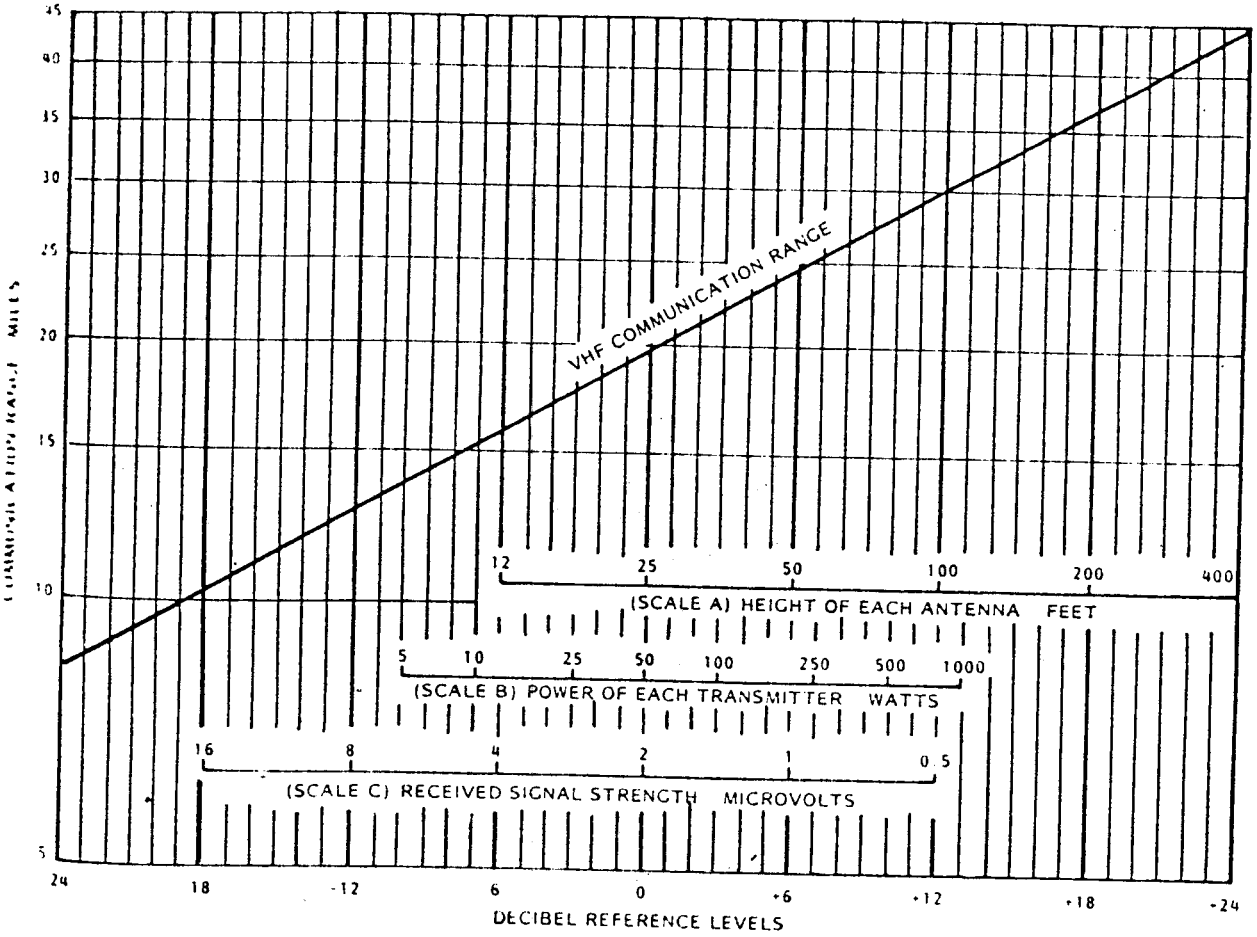


Figure 1-2 Marine VHF Communication Range Nomograph

EXAMPLE

What is the operating range, assuming a minimum required signal strength of 1.0 uV, between a base station using a 50 watt transmitter, a 50 foot tower, with a 6.0 dB antenna and a ship using a 25 watt transmitter with a 3 dB antenna mounted on a 15 foot mast?

Base station power (50 watts)	0 dB
Ship station power (25 watts)	-3 dB
Base station antenna height (50 feet)	+6 dB
Ship antenna height (15 feet)	-4.5 dB
Base station antenna gain	+6 dB
Ship station antenna gain	+3 dB
Signal strength required (1.0 uV)	+6 dB
Base station coax cable loss (RG-8/U)	-6 dB
Ship station coax cable loss (RG-58C/U)	-3 dB
TOTAL	+4.5 dB

Range equals 23 miles for +4.5 dB reference level.

Note: Coax cable loss
RG-58C/U = 6 dB/100 feet
RG-8/U = 3 dB/100 feet

SECTION 2

INSTALLATION

2.1 GENERAL

Select the most appropriate mounting location to eliminate the possibility of damage from spray or rain. The mounting location for the radiotelephone and the antenna is determined by the size of the vessel, available space, operator convenience, and proximity to the power source and grounding point. The exterior of the radio is treated with several coats of epoxy paint, but must not be installed where it will be exposed to direct spray or sunlight.

2.2 MOUNTING THE RADIO

This radio is designed so that the mounting bracket can be secured to a horizontal shelf, the overhead or to a bulkhead as shown in Figure 2-1. Install the radio by positioning it in the mounting bracket and securing the two plastic clamps. Either the top or the bottom of the radio will fit into the bracket if the clamp blocks on the sides of the radio are inverted.

Remove the radio from the mounting bracket when access to the chassis is desired. The cover may be detached by removing the four screws from the rear.

The front panel of the radio is designed to be mounted at two different angles from the vertical. (See Figure 2-2.) This enables an operator to observe the panel when it is mounted on a horizontal shelf or to an overhead. First remove the four screws from the rear panel and slide the chassis forward from the case. Next remove the four screws (two from each side of the front panel) and pull the front panel forward. Remove the four screws (two on each side of the front of the case securing it to both angle brackets). Position the front of the case (by rotating it) to the desired mounting angle and secure it to the two angle mounted brackets with the four screws. Secure the front panel to the front of the case with the four screws.

2.3 ANTENNA

Any of the marine VHF antennas listed and described in Table 2-1 are suitable for use with this radiotelephone. Refer to Appendix C for detailed specifications.

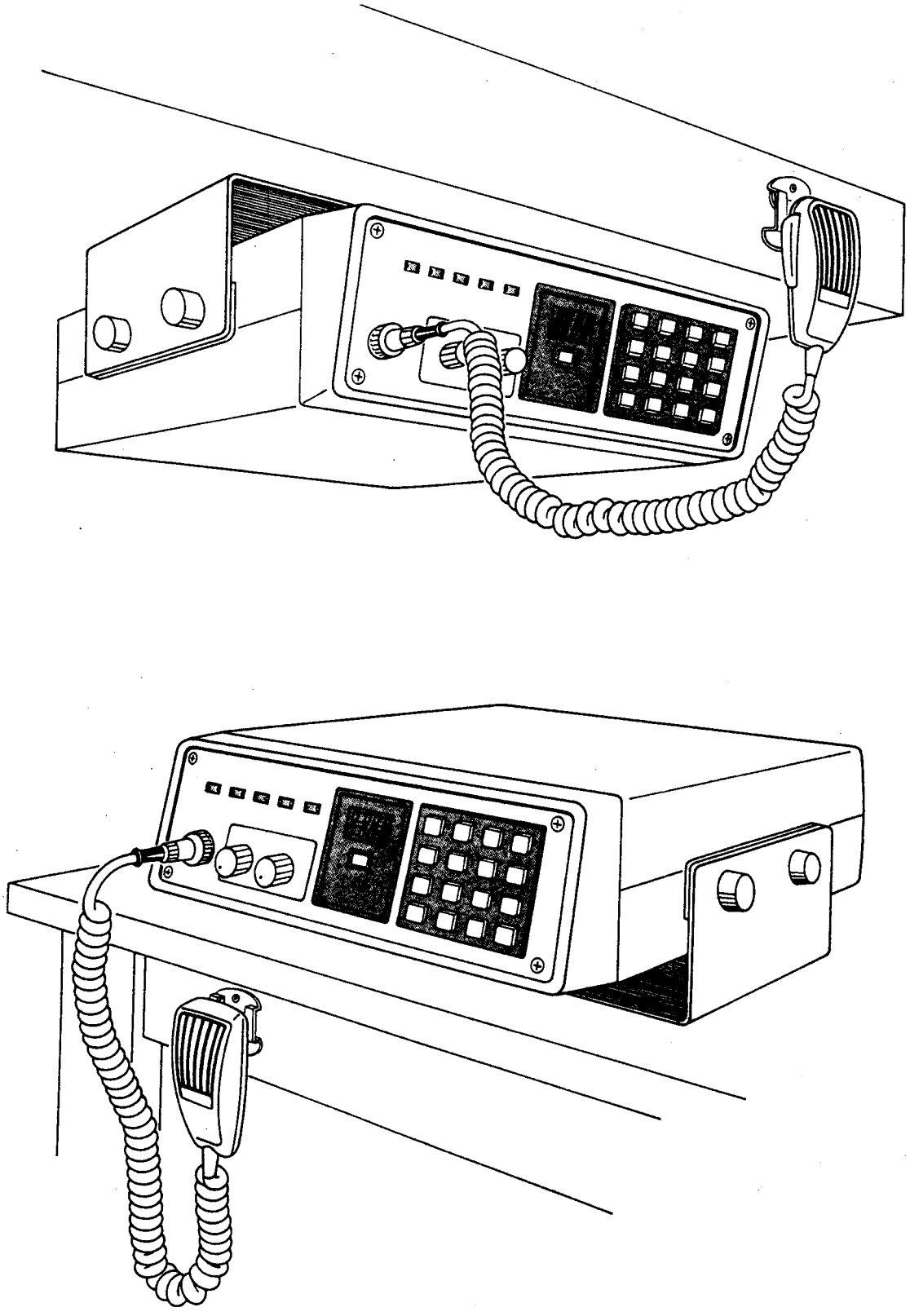


Figure 2-1 Typical Installations

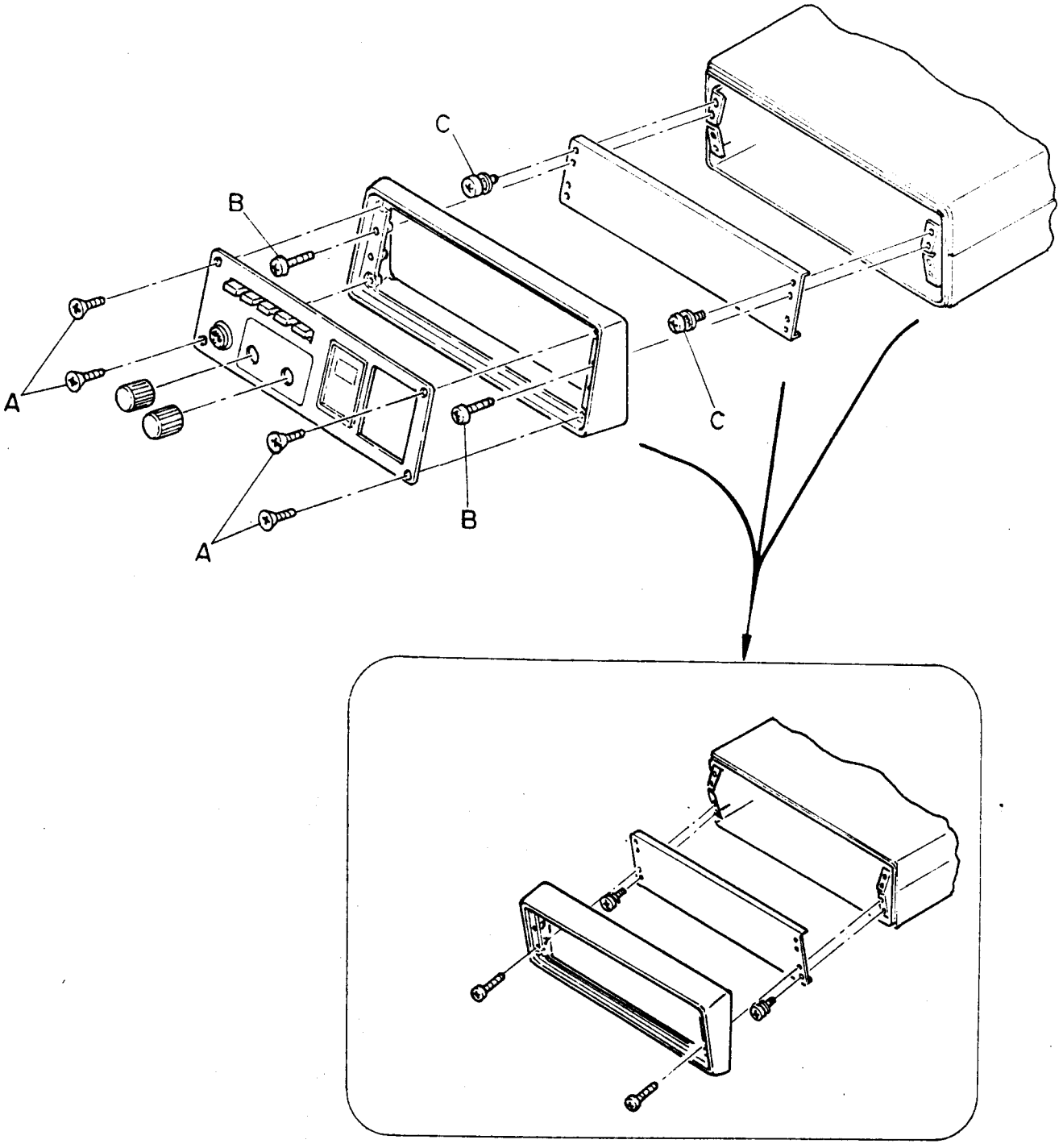


Figure 2-2 Front Panel Reversal

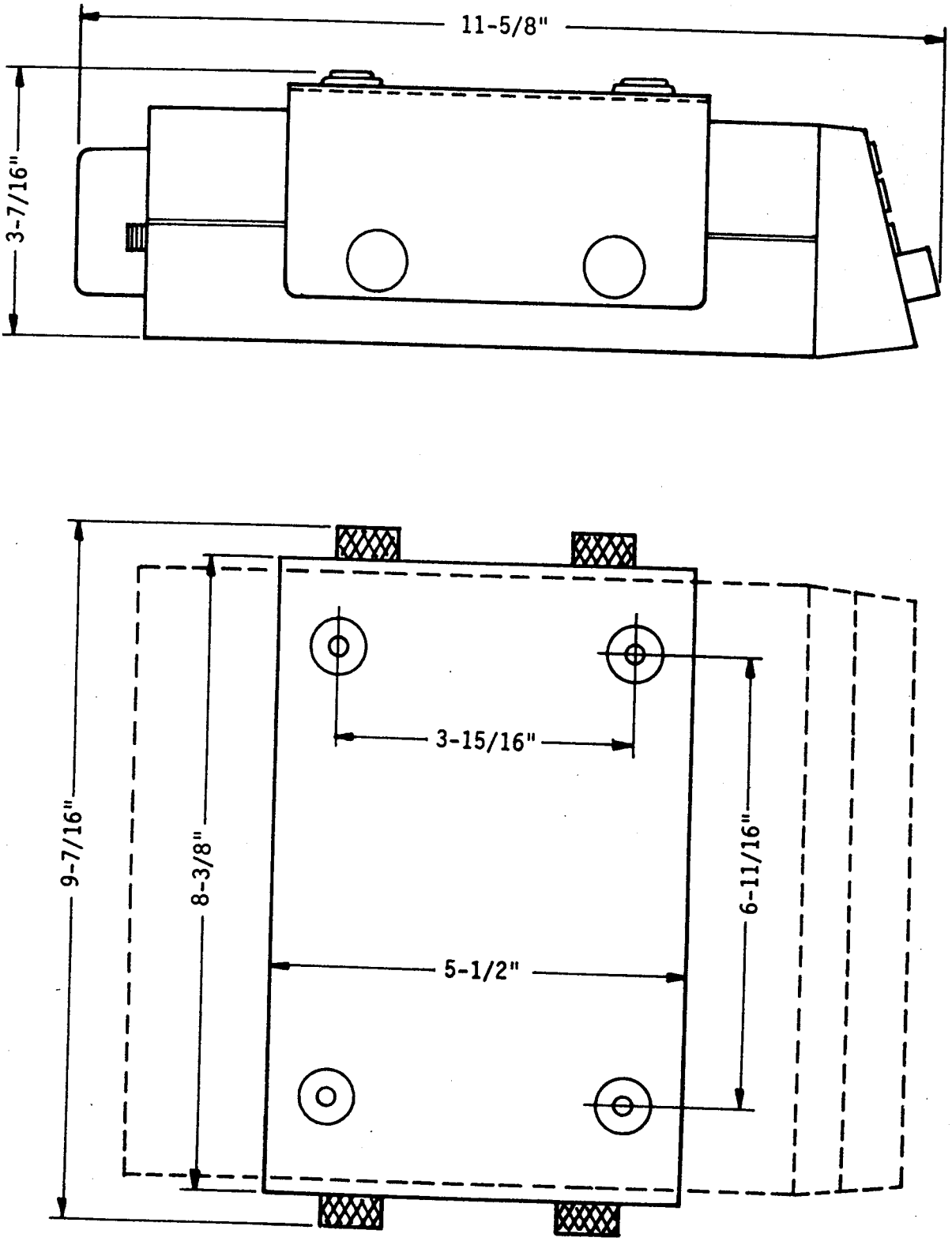


Figure 2-3 Outline and Mounting Dimensions

Table 2-1
Approved Marine VHF Antennas

Antenna Model	Product Code	Antenna Length	Gain (Industry Std.)	Coax Length Feet
M68W	M68109	6 ft.	3 dB	20 ft. RG-58C/U
M70	M68416	21 ft. 2 sections	9 dB	20 ft. "
M74	M68451	9 ft. 7 in. 2 sections	6 dB	20 ft. "
M73 Sailboat	M68452	39.5 in.	Unity	Not supplied, (RG-8/U coax should be used)

The transmitting or receiving range may be extended by either or both of the following:

1. Increase the mounting height of the antenna. (M76 mast extension)

2. Use an antenna with a higher gain.

These recommendations can substantially increase range. The dealer from whom the radiotelephone was purchased can advise as to the best antenna/mounting configuration for a particular application (Figure 2-3).

Mounting instructions are furnished with the antenna and also may be found in Appendix C. If the cable length required is greater than that supplied, it is recommended that RG-8/U cable be used for as much of the distance as feasible. If the mounting surface selected (deck or cabin top) does not have sufficient strength to support the antenna during heavy weather, it may be reinforced with a backing plate.

When additional lengths of RG-8/U antenna cable must be added, the cable supplied with the VHF antenna should be shortened to a convenient length and the PL-259 plug installed. The additional cable does not require any retuning of the radio (Figure 2-3). All intermediate antenna cable connections must be weatherproofed upon final installation.

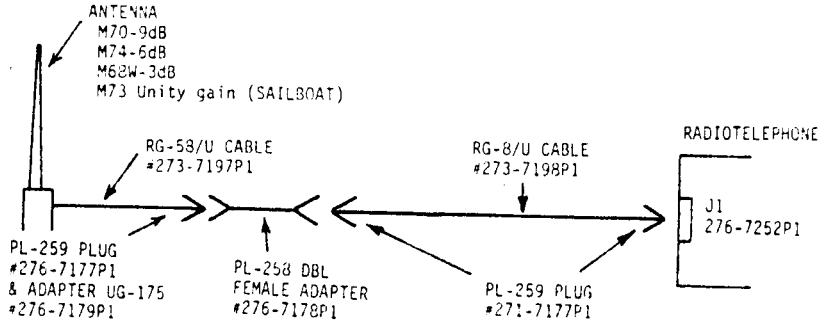


Figure 2-4 Antenna Cable Connections

2.4 BONDING OF METALWORK

Unbonded metalwork in the vicinity of the antenna, such as hand rails, steering cable, permanent halyards, windshield frame, or plumbing, may affect the performance of the radio. It is good practice to bond these together and ground to the engine with a copper strap and suitable clamps. In some cases this bonding will be essential, since any unbonded metalwork may act as a parasitic absorber or reradiator of the antenna transmit signal. These parasitic elements may severely distort an otherwise excellent antenna pattern. BOND ALL METALWORK.

2.5 ELECTRICAL CONNECTIONS

2.5.1 DC Power Connection

A special two-pin connector is furnished for connecting the 13.6 vdc power to the radio. The power cable from the 13.6 volt power source to the radio should be number 14 stranded wire for a run of less than 10 feet. Longer cable runs require larger wire to minimize the voltage drop (Figure 2-4). Connections should be made directly to the battery. Check that all connections are clean and bright. The (+) battery wire must be connected to pin 2 of the connector and the (-) battery wire (ground) to pin 1 of the connector.

Should the power connections be inadvertently reversed, protective fuse F1 (7A), located on the rear panel, will blow. Check the input power leads for correct polarity with a VOM, reconnect the leads observing correct polarity and replace the fuse.

CAUTION

Do not install this radio on any vessel with a positive ground battery system.

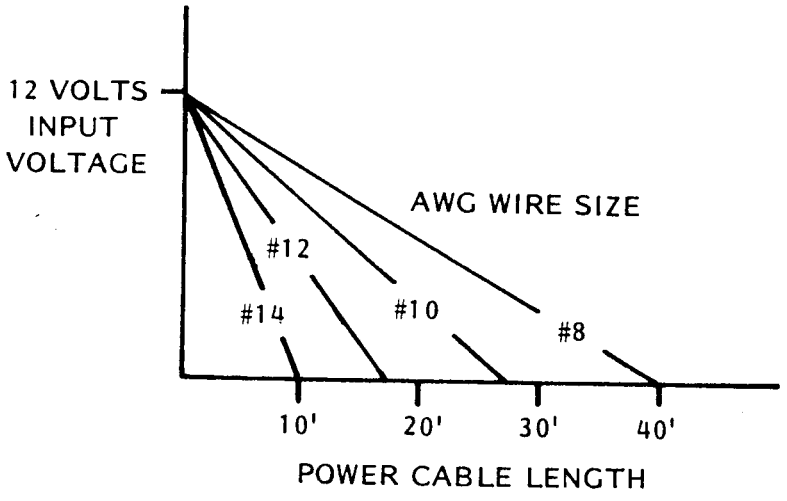


Figure 2-5 Power Cable Size Versus Length

2.5.2 External Speaker Connection

The CLIPPER 82 radiotelephone has an external speaker jack (EXT-SP J104) mounted on the rear panel. This jack provides the user with the option of connecting an external 3.12 to 4.0 ohm speaker to the radiotelephone. The speaker is not provided with the radiotelephone package and must be obtained separately. When an external 3.12-ohm speaker is plugged into J104 it automatically disconnects the radiotelephone 3.12-ohm internal speaker.

2.6 GROUNDING

No special grounding is necessary for the radiotelephone installation. However, when the radiotelephone is mounted on a non-grounded surface a ground wire should be attached to the mounting yoke.

SECTION 3

OPERATION

3.1 AVAILABLE CHANNELS

The CLIPPER 82 transmits on 54 and receives on 82 Marine VHF radiotelephone channels. There are channels that are FCC approved but may be used only by authorized stations for specific purposes, depending on the type of vessel (commercial or non-commercial). Because of this, caution is urged. Table 3-1 lists all of the marine VHF frequency channel designations for International and U.S. radiotelephone use. Full familiarization with this table is essential. The international frequencies were agreed upon by the attending countries at the 1968 International Telecommunication Union meeting in Geneva. These frequencies are in active use around the world. The U.S. channels are those channels authorized for use in the U.S. by the FCC.

3.2 CONTROLS AND INDICATORS

Refer to Figure 3-1 for familiarization with the following controls and indicators.

1) 16 MON Indicator (1, Fig. 3-1)
When illuminated, indicates that the MON pushbutton switch (14, Fig. 3-1) has been pressed. When the MON pushbutton switch has been pressed, the receiver scans between safety and calling channel 16 and the indicated channel at a one second rate until a signal great enough to break squelch is received (the transmitter is locked out in the 16 MON mode).

2) INT Indicator (2, Fig. 3-1)
When keyboard INT pushbutton switch (12, Fig. 3-1) is pressed, the INT lamp illuminates, indicating the synthesizer will program only international frequency assignments. When INTis not illuminated, the synthesizer programs only U.S. frequency assignments.

3) WX Indicator (3, Fig. 3-1)
Illuminates when WX key (10, Fig. 3-1) has been pressed, to indicate that one of the weather channels is to be monitored.

4) 1 W Indicator (4, Fig. 3-1)
The 1W indicator goes on when the 1/25 keyboard pushbutton (11, Fig. 3-1) is pressed. When 1 W is not illuminated, the transmitter is set for 25 watts output.

5) TX Indicator (5, Fig. 3-1)
The TX indicator lights when the microphone push-to-talk switch has been pressed, applying B+ to the transmitter circuits and RF is present at the output of the antenna matching circuitry.

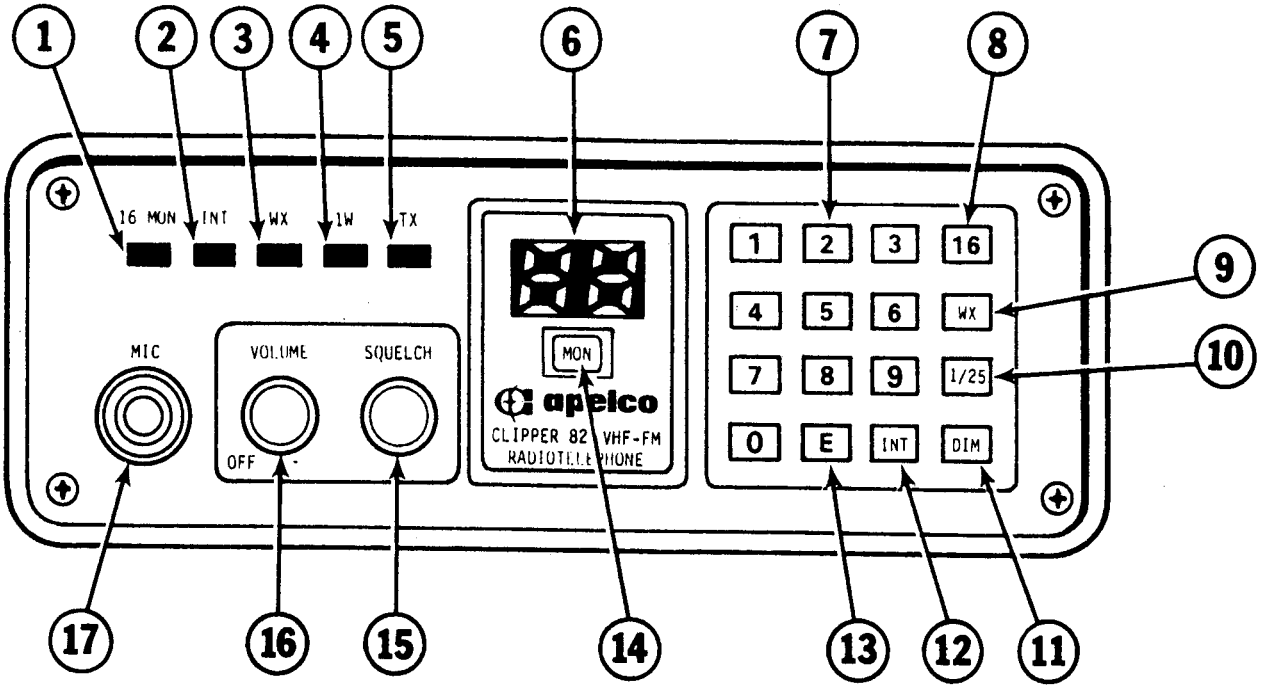


Figure 3-1 CLIPPER 82 Front Panel Controls, Indicators and Jack

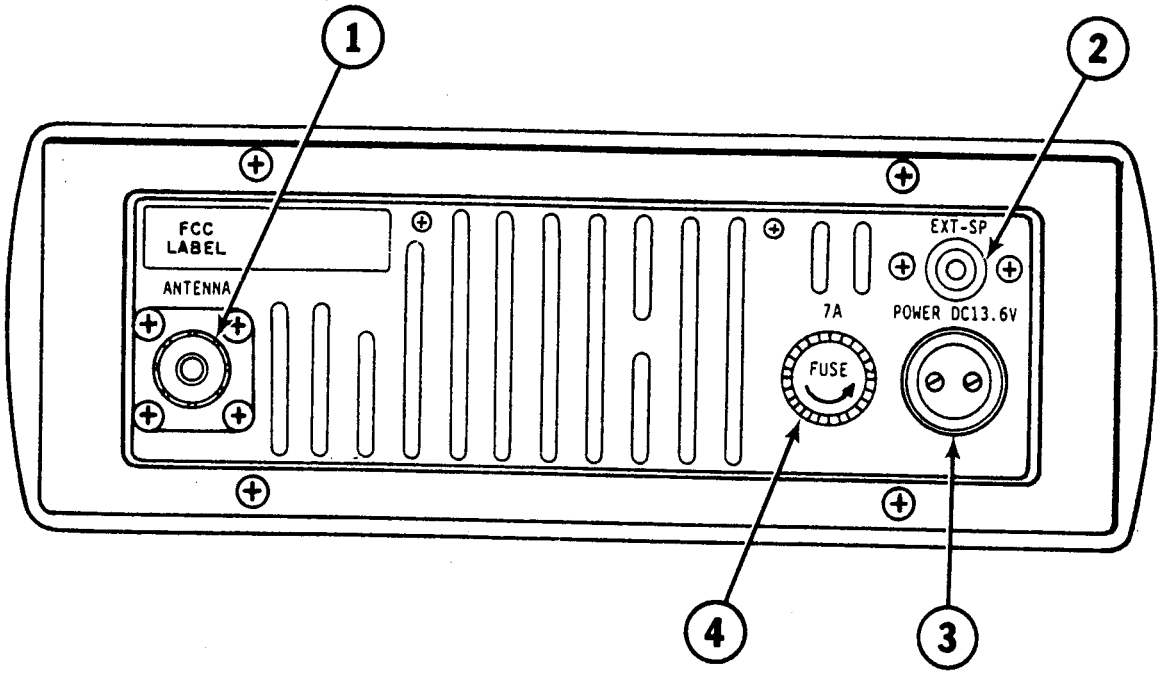
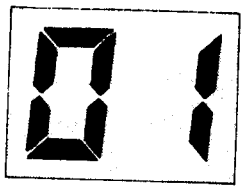


Figure 3-2 CLIPPER 82 Rear Panel Connectors and Fuse

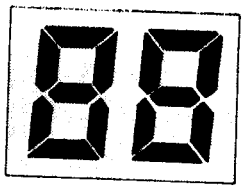
6) Channel No. Indicator LEDS (6, Fig. 3-1)
Illuminate when the communication, distress and weather channels are selected on the keyboard as shown below:

Channels 1 through 88 are displayed as follows:

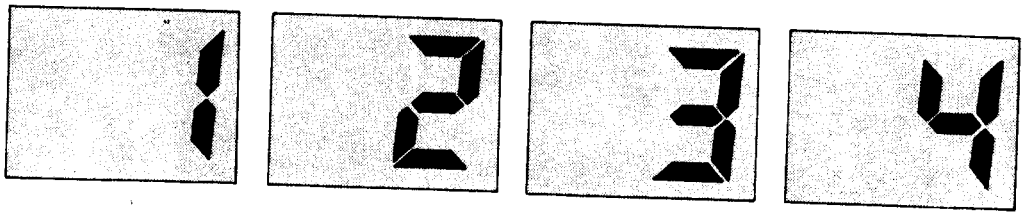
Ch 01 - 09



Ch 10 - 88



Weather Channels W1 to W4 are displayed on the LEDs as follows:



7) Keyboard
Consists of 16 keys with rear illumination.

8) 0-9 Key Pushbuttons (7, Fig. 3-1)
Used to select communication channels when followed by pressing E (entry) key (14, Fig. 3-1).

9) 16 Key Pushbutton (8, Fig. 3-1)
Selects (safety and calling) Channel 16 immediately when pressed. Entry key is not required.

10) WX Key Pushbutton (9, Fig. 3-1)
If followed by depressing the desired weather channel key (1, 2, 3 or 4), causes the synthesizer to program the correct receiver frequency. (The transmitter is locked out when receiving these channels).

11) 1/25 Key Pushbutton (10, Fig. 3-1)
Selects either one watt or 25 watts power output to the antenna. When 1W indicator (4, Fig. 3-1) is illuminated, approximately one watt of power is applied to the antenna. When the 1W indicator (4, Fig. 3-1) is not illuminated, full transmitter power is applied to the antenna.

12) DIM Key Pushbutton (11, Fig. 3-1)
When pressed, decreases the illumination of the Channel No. Indicator LEDs, the keyboard back lighting lamp and the mode indicator lamps by approximately fifty percent.

13) INT Key Pushbutton (12, Fig. 3-1)
When pressed, causes the synthesizer to program only international channel frequencies and illuminates the INT indicator (2, Fig. 3-1). Pressing again will return to U.S. operation.

14) E Key Pushbutton (13, Fig. 3-1)
The E key (entry)# is pressed following the selection of a channel number on keyboard to cause the synthesizer to program the correct channel frequency.

15) MON Pushbutton Switch (14, Fig. 3-1)
When pressed, illuminates the 16 MON indicator (1, Fig. 3-1) and causes the synthesizer to scan the distress channel 16 and a previously selected channel at a one second rate. The scanning stops when a signal is great enough to exceed the squelch level. If that channel is the selected one, reception will be interrupted every three seconds to check channel 16 (priority channel) for a signal. (The transmitter is inhibited during this mode.)

16) SQUELCH Control (15, Fig. 3-1)
Provides an adjustable input signal threshold to eliminate random RF background noise during "no signal" conditions. This control sets the signal-to-noise ratio at which a signal will become audible.

17) OFF/VOLUME Control (16, Fig. 3-1)
Switches DC power on and off and also controls the volume of the audio output at the radiotelephone's built-in speaker.

18) MIC Connector (17, Fig. 3-1)
Input connector for the microphone and push-to-talk switch.

3.3 REAR PANEL CONNECTORS AND FUSE

See Figure 3-2 for the location of the unit rear panel connectors and fuse.

1) EXT-SP Connector J104 (2, Fig. 3-2)
Provides the connection for an optional,external speaker which can be located remotely from the unit. Connecting an external speaker automatically disconnects the unit's internal speaker.

2) POWER DC 13.6V Connector J103 (1, Fig. 3-2)
A keyed, two-pin male connector used to connect the 13.6 VDC input battery connector. The plus (+) terminal of the battery is connected to pin 2 with the red wire and the minus terminal is connected to pin 1 with the black wire.

3) 7A FUSE (4, Fig. 3-2)
A 7 ampere protective fuse is connected between pin 2 of the power connector and choke coil L24.

4) ANTENNA Connector J101 (1, Fig. 3-2)
Provides the input coaxial connection for the antenna cable with a PL-259 or equivalent connector.

3.4 OPERATING PROCEDURES

Specific operating procedures are presented below. General information on radiotelephone usage may be found in the appendices. (Refer to Table 3-1)

3.4.1 Transmit/Receive

1. Connect antenna to ANTENNA Jack J101 (1, Fig. 3-2), microphone to MIC Jack J102 (17, Fig. 3-1) and DC power cable to POWER DC 13.6V Jack J103 (3, Fig. 3-2).

2. Turn OFF/VOLUME control (16, Fig. 3-1) half a turn clockwise to turn radio on.

NOTE
When the OFF/VOLUME is turned clockwise to ON, the synthesizer automatically programs for USA channel frequencies and distress channel 16.

3. Rotate SQUELCH control (15, Fig. 3-1) until speaker noise is audible.

4. Adjust OFF/VOLUME control for a comfortable level

5. Rotate squelch control clockwise until noise just ceases.

NOTE
Do not turn past this point as receiver will cut out weak signals that should normally be audible.

6. Set transmitter power (10, Fig. 3-1) to either the 1W or 25W position (illuminated is 1W) depending on the distance the message is to be transmitted and transmitting conditions. In U.S. harbors, the FCC requires power be limited to one watt.

7. To transmit and receive on channel 16, depress the 16 key (8, Fig. 3-1) and refer to Appendix A for remaining procedures. Channel 16 communications can also be established by depressing key pushbutton switches 1, then 6 and then E. If 16 key is pressed again, radiotelephone will return to last channel entered before pressing 16 key.

NOTE

Initial communication contacts usually are made over channel 16 as all ships and shore stations monitor this channel.

8. To transmit and/or receive on channels other than distress channel 16, refer first to table 3-1 to select the appropriate channel, depress the desired channel number keys using "0" before channels 1 through 9 and then the E key. Transmit using the microphone push-to-talk switch.

9. To receive weather information, refer to table 3-1 for the appropriate channel. Depress WX key pushbutton (9, Fig. 3-1) and 1, 2, 3 or 4 key pushbutton. It is not necessary to press E key to receive weather channels. Transmitter is locked out in this mode.

10. To transmit and receive over international frequencies on the selected channel, depress INT key pushbutton (12, Fig. 3-1), observe INT indicator (2, Fig. 3-1) illuminates and transmit using the microphone push-to-talk switch. Weather channels are disabled if INT indicator is on.

11. To monitor channel 16 and one communication channel, depress the communication channel key(s), E key and then the MON pushbutton switch (14, Fig. 3-1). The 16 MON indicator (1, Fig. 3-1) illuminates.

In the monitor mode, the Clipper 82 will automatically lock on the selected channel and remain there for approximately three seconds. It will then look at channel 16 to see if a signal is present. If none is present, it immediately returns to the selected channel and the scan cycle starts over. If one is present on channel 16, it will stop scanning and stay there as it is the priority channel in the scan mode.

NOTE

YOU CANNOT TRANSMIT IN MONITOR MODE!

If a Channel 16 signal is present, the receiver will stop scanning and lockto that signal. Channel 16 is a priority channel and will override any other communications or weather channel.

CAUTION

The squelch control must be set at or near the RF noise threshold for optimum operation of priority circuitry. (See step 5.)

When the Channel 16 signal is no longer present, the receiver will revert to the scan mode with the previously-selected channel frequency. If the "16" key is depressed to lock in Channel 16, for example to transmit an answer, the receiver can be returned to monitoring the original channel being monitored by depressing "16" or "E" again, then "MON". (If only "MON"is pressed, scan will be Channel 16 only.)

12. To transmit distress calls ("MAYDAY, MAYDAY, MAYDAY"):

    a. Depress Channel 16 key (8, Fig. 3-1).

    b. Depress microphone PTT switch and speaking slowly transmit the phrase "MAYDAY, MAYDAY, MAYDAY", followed by the name and call sign and the calling vessel repeated three times. Continue with the distress message as follows, speaking slowly and distinctly:

        1. The name of calling vessel.

        2. Last known position.

        3. The nature of the emergency.

        4. A description of the calling vessel (type, color, length, number of persons aboard, etc.).

        5. Indicate end of message by saying, "Over".

NOTE

Because the primary purpose of the distress frequency is to summon help, it is likely that an immediate response will be received. If there is no reply after several transmissions, transmit on any other available frequency until contact is made.

3.5 STATION LOG BOOK PROCEDURE

A station log must be maintained during the hours of service of ship stations using the radiotelephone. Pages of the log shall be numbered in sequence, and each page shall include the name of the vessel and the radio call sign of the station. All entries which show transmitter operation shall be made and signed by the LICENSED operator. Watch entries, and signature of each person keeping the required watch, shall be so related that they constitute a certification by each such person of when the watch began and ended. The date and time of each occurrence or incident required to be in the log should be Greenwich Mean Time opposite the entry, and the time shown (in GMT) when the ship is engaged on international voyages. Vessels operating on the Great Lakes are subject to the Great Lakes agreement and use Eastern Standard Time (EST): other stations may use GMT or local standard time. The log book should show the appropriate symbol as the head of the column in which the time is entered (symbols such as GMT, EST, CST, or PST).

Table 3-1

Marine VHF Radiotelephone Channels

Channel	Ship Transmit	Ship Receive	Mode S/D	Intl Only	U.S. Only	Function: Ship to Ship	Function: Ship to Shore	Type of Operation
1	156.050	160.650	D	yes		no	yes	Public Correspondence, Port Operation
1A	156.050	156.050	S		yes	yes	yes	Public Correspondence, Port Operation
2	156.100	160.700	D	yes		no	yes	Public Correspondence, Port Operation
3	156.150	160.750	D	yes		no	yes	Public Correspondence, Port Operation
4	156.200	160.800	D	yes		no	yes	Public Correspondence, Port Operation
5	156.250	160.850	D	yes		no	yes	Public Correspondence, Port Operation
5A	156.250	156.250	S		yes	yes	yes	Public Correspondence, Port Operation
6	156.300	156.300	S			yes	no	Safety
7	156.350	160.950	D	yes		no	yes	Public Correspondence, Port Operation
7A	156.350	156.350	S		yes	yes	yes	Port Operation
8	156.400	156.400	S			yes	no	Intership
9	156.450	156.450	S			yes	yes	Port Operation
10	156.500	156.500	S			yes	yes	Port Operation
11	156.550	156.550	S			yes	yes	Port Operation
12	156.600	156.600	S			yes	yes	Port Operation
13	156.650	156.650	S			yes	yes	Bridge to Bridge, (1W) Navigational
14	156.700	156.700	S			yes	yes	Port Operation
15	-------	156.750	S	yes		Rcv	Rcv	Recv Only - Coast to Ship
16	156.800	156.800	S			yes	yes	Calling & Safety
17	156.850	156.850	S			no	yes	State Controlled - Ship to Coast (1W)
18	156.900	161.500	D	yes		no	yes	Port Operation
18A	156.900	156.900	S		yes	yes	yes	Port Operation
19	156.950	161.550	D	yes		no	yes	Port Operation
19A	156.950	156.950	S		yes	yes	yes	Port Operation
20	157.000	161.600	D			no	yes	Port Operation
21	157.050	161.650	D	yes		no	yes	Port Operation
21A	157.050	157.050	S		yes	yes	yes	Port Operation (USCG only)
22	157.100	161.700	D	yes		no	yes	Port Operation
22A	157.100	157.100	S		yes	yes	yes	Port Operation (USCG only)
23	157.150	161.750	D	yes		no	yes	Public Correspondence
23A	157.150	157.150	S		yes	no	yes	Port Operation (USCG only)
24	157.200	161.800	D			no	yes	Public Correspondence
25	157.250	161.850	D			no	yes	Public Correspondence
26	157.300	161.900	D			no	yes	Public Correspondence
27	157.350	161.950	D			no	yes	Public Correspondence
28	157.400	162.000	D			no	yes	Public Correspondence
60	156.025	160.625	D	yes		no	yes	Public Correspondence, Port Operation
61	156.075	160.675	D	yes		no	yes	Public Correspondence, Port Operation
62	156.125	160.725	D	yes		no	yes	Public Correspondence, Port Operation
63	156.175	160.775	D	yes		no	yes	Public Correspondence, Port Operation
63A	156.175	156.175	D		yes	yes	yes	Public Correspondence, Port Operation
64	156.225	160.825	D	yes		no	yes	Public Correspondence, Port Operation
65	156.275	160.875	D	yes		no	yes	Public Correspondence, Port Operation
65A	156.275	156.275	S		yes	yes	yes	Port Operation
66	156.325	160.925	D	yes		no	yes	Public Correspondence, Port Operation
66A	156.325	156.325	S		yes	yes	yes	Port Operation
67	156.375	156.375	S			yes	no	Port Operation
68	156.425	156.425	S			yes	yes	Port Operation
69	156.475	156.475	S			no	yes	Port Operation
70	156.525	156.525	S			yes	no	Intership
71	156.575	156.575	S			no	yes	Intership, Port Operation
72	156.625	156.625	S			yes	no	Intership
73	156.675	156.675	S			yes	yes	Port Operation
74	156.725	156.725	S			yes	yes	Port Operation
75	-------	156.775	-			---	---	Guard Band (156.775) (Recv only)
76	-------	156.825	-			---	---	Guard Band (156.825) (Recv only)
77	156.875	156.875	S			yes	no	Intership
78	156.925	161.525	D	yes		no	no	Port Operation
78A	156.925	156.925	S		yes	no	yes	Port Operation
79	156.975	161.575	D	yes		no	yes	Port Operation
79A	156.975	156.975	S		yes	yes	yes	Port Operation
80	157.025	161.625	D	yes		no	yes	Port Operation
80A	157.025	157.025	S		yes	yes	yes	Port Operation
81	157.075	161.675	D	yes		no	yes	Port Operation
81A	157.075	157.075	S		yes	yes	yes	Port Operation (USCG only)
82	157.125	161.725	D	yes		no	yes	Port Operation, Public Correspondence
82A	157.125	157.125	S		yes	yes	yes	Port Operation, (USCG only)
83	157.175	161.775	D	yes		no	yes	Public Correspondence
83A	157.175	157.175	S		yes	no	yes	Intership, Port Operation (USCG only)
84	157.225	161.825	D			no	yes	Port Operation, Public Correspondence
85	157.275	161.875	D			no	yes	Public Correspondence
86	157.325	161.925	D			no	yes	Public Correspondence
87	157.375	161.975	D			no	yes	Public Correspondence
88	157.425	162.025	D	yes		no	yes	Public Correspondence
88A	157.425	157.425	S		yes	yes	no	Intership
W1	-------	162.550				Rcv	Rcv	NOAA Weather (Recv only)
W2	-------	162.400				Rcv	Rcv	NOAA Weather (Recv only)
W3	-------	162.475				Rcv	Rcv	NOAA Weather (Recv only)
W4	-------	161.650				Rcv	Rcv	Canada Weather (Recv only)

SECTION 4

THEORY OF OPERATION

4.1 BLOCK DIAGRAM DISCUSSION

The CLIPPER 82 is a keyboard selectable, microprocessor-controlled, multi-channel VHF transmitter-receiver. Standard maritime channel numbers entered in the front panel keyboard control a frequency synthesizer, which automatically locks on to correct frequencies for transmit and receive with a phase-locked loop stabilized oscillator. Refer to block diagrams (Figs. 4-1 and 4-2) and schematics (Figs. 6-1 and 6-2).

4.1.1 Frequency Synthesizer

The frequency synthesizer is shown in functional block diagram form in Figure 4-1. A channel number entered on the keyboard activates the microprocessor, which is programmed in ROM to output three codes, two to drive the LED display of the selected channel number and the other a multiplexed nine-digit binary code (See Table 4-1) which controls a VHF voltage-controlled oscillator in a phase-locked loop.

The code is applied to a programmable divider in IC6 which supplies a signal representative of the VCO output frequency to the phase detector. The reference signal for the phase detector is 5 KHz, generated by dividing the output of a 10.240 MHz crystal oscillator by 2048.

The output of the phase detector goes through a low-pass filter and is applied to the VCO as a control voltage, which determines the VCO's output frequency (139.150 to 145.650 MHz). Part of the output drives a buffer amplifier which supplies signal to the receiver and transmitter sections. Another part is buffered and used as a sample for phase comparison in the phase-locked loop.

The loop sample is buffered (Q21) and divided by five before being applied to a mixer circuit (IC8). The other signal at the mixer is the 10.240 MHz oscillator output after being divided by two in the PLL control circuit (IC6) and then multiplied by five in Q22 to 25.600 MHz.

The output of the mixer (2.230 to 3.530 MHz) is low-pass filtered and processed through a limiting amplifier (IC8). It then goes to the programmable divider in the PLL control circuit, where it is divided by an amount determined by the nine-bit code from the microprocessor. The divider output is then fed to the phase detector and compared with the reference signal.

A phase error is detected as a control voltage which is low pass filtered and used to change the VCO frequency in a direction to correct the error. When the frequency is correct, the control voltage becomes stable and holds the VCO on frequency.

Any drift in VCO frequency will be corrected by the loop, thus holding the accuracy to that of the crystal oscillator, or ±10 parts per million.

When the loop is not phase locked, an error signal from the phase detector is applied to Q14, which inhibits the transmitter section and prevents transmitting the wrong frequency.

4.1.2 Transmitter Circuitry

The VCO output is buffered (Q-12) and applied to a mixer (Q3). The other input to the mixer is 16.900 MHz, modulated by audio input from the microphone.

The microphone audio is applied to a preamp (IC3), a pre-emphasizer and then a limiting amplifier (IC2) which prevents the signal from overmodulating the RF. The audio is then applied to a variable capacitance diode in the 16.900 MHz oscillator tuned tank circuit, causing the oscillator signal to be frequency modulated. This signal is buffered (Q4) and applied to mixer Q3.

The output of mixer (Q3) is a frequency modulated RF signal of (VCO + 16.900) MHz. This RF is fed through a bandpass filter to a two-stage amplifier (Q1 and Q2) and used to drive the RF Power Module (IC1).

The RF Power Module is a controlled gain amplifier which can produce 30 watts output from 100 MW input. The high power RF is applied through a double-pi network to the antenna.

When RF is present at the output of the power module, Q23 is turned on and grounds diode D10, forming a shorted, 1/4-wave transmission line at the receiver section input, preventing transmitter RF from entering the receiver.

The RF power also is detected and used in a DC amplifier chain (IC4, Q9 and Q10) to generate a control voltage to apply to the power module to control its power output.

4.1.3 Receiver Circuitry

The input RF from the antenna is fed to an FET RF Amplifier Q24. (Note that when Q23 is off D10 is open and there is no shorted 1/4-wave line at the receiver input.) The amplified signal is fed through a bandpass filter to the receiver first mixer.

The first mixer output is single-tuned to produce a 16.9 MHz intermediate frequency using the VCO output as the second input. The output signal is passed through a dual crystal filter and applied to IC9 which also contains the second IF converter, amplifier, detector and audio amplifier.

The 1st IF signal is mixed with 17.355 MHz to produce a 455 KC second IF signal. This is passed through a dual ceramic filter, amplified, limited and detected.

The detected audio passes through a de-emphasis filter to the volume control (VR101) and enters the audio power amplifier (IC10).

DISPLAY	USA RX 9	8	7	6	5	4	3	2	1	USA TX 9	8	7	6	5	4	3	2	1	TX 1	INTERNATIONAL RX 9	8	7	6	5	4	3	2	1	INTERNATIONAL TX 9	8	7	6	5	4	3	2	1	TX 1
1	0	1	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1																			
2	0	1	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	1																			
3	0	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1																			
4	0	1	0	0	1	1	1	1	0	0	1	0	0	1	1	1	1	0	1																			
01	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	0	0	0	1	1	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	0	0
02	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0
03	1	1	1	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	1	0	0
04	1	1	1	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	1	0	0	0
05	1	1	1	0	0	0	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	0
06	1	1	1	0	0	1	0	0	0	1	1	1	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0
07	1	1	1	0	0	1	0	1	0	1	1	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	0	0
08	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	0	0	0	1	1	1	0	0	1	1	0	0	1	1	1	1	0	0	1	1	0	0	0	0
09	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	1	1	1	1	0	0	1	1	1	0	0	0
10	1	1	1	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
11	1	1	1	0	1	0	0	1	0	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1	0	1	0	0	1	0	0	0
12	1	1	1	0	1	0	1	0	0	1	1	1	0	1	0	1	0	0	0	1	1	1	0	1	0	1	0	0	1	1	1	1	0	1	0	1	0	0	0	0
13	1	1	1	0	1	0	1	1	0	1	1	1	0	1	0	1	1	0	0	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	1	0	0	0
14	1	1	1	0	1	1	0	0	0	1	1	1	0	1	1	0	0	0	0	1	1	1	0	1	1	0	0	0	1	1	1	1	0	1	1	0	0	0	0	0
15	1	1	1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1	1	0	1	0	1	1
16	1	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	1	1	0	0	0	0
17	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0
18	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
19	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	1	1	1	1	0	0	0	1	0	0	0	0
20	0	1	0	0	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0
21	1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	0	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	0	0	0
22	1	1	1	1	0	1	0	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0	0	0	0	0
23	1	1	1	1	0	1	0	1	0	1	1	1	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	0	1	0	0	0
24	0	1	0	1	0	0	1	0	0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	0	0	1	0	0	1	1	1	1	0	1	1	0	0	0	0	0
25	0	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0
26	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	1	1	1	1	0
27	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	0	0	1	0	0	0
28	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	0	0
60	0	0	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	0	0	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	0
61	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0
62	0	0	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1	0
63	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	0	0	0	0	1	1	0
64	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	0	1	0
65	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	1	0
66	1	1	1	0	0	1	0	0	1	1	1	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	1	0
67	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	0	1	1	1	0	0	1	0	1	0	1	1	1	0	0	1	0	1	1	1	0	0	1	0	1	1	0
68	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	0	1	0	0	0	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	0	1	0	1	0
69	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0
70	1	1	1	0	1	0	0	0	1	1	1	1	0	1	0	0	0	1	0	0	0	1	1	1	0	1	0	0	0	1	1	1	1	0	1	0	0	0	1	0	1	0
71	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1	0	0	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0
72	1	1	1	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1	0	1	0
73	1	1	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0
74	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	0	0	1	0	0	0	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	0	0	1	0	1	0
75	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1
76	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1
77	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
78	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	1	0	1	0	1	0
79	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	0	0	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0	0	1	1	0	1	1	0
80	1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0	1	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	1	0	1	0	0
81	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	0	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	1	0
82	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1	1	0	1	0	0	1	0	1	0
83	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1	0	0	1	0	1	0	1	0	0	0	0	1	1	1	1	1	0	1	0	1	1	0	1	0
84	0	1	0	1	0	0	1	0	1	1	1	1	1	0	1	1	0	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	1	1	0	1	1	0	1	0	1	0
85	0	1	0	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0
86	0	1	0	1	0	1	0	0	1	1	1	1	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	0	0	0	1	0	1	0	1	0
87	0	1	0	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	0	0	1	1	0	1	0	1	0
88	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	0	1	0	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	0	1	0	1	0	1	0

Figure 4-1 PLL Codes for Clipper 82

SECTION 5

MAINTENANCE

5.1 GENERAL

The purpose of this section is to provide servicing instructions to the service engineer. The equipment is designed to provide long periods of trouble-free operation. However, it is recognized that environmental and other factors will result in a need for occasional service.

5.2 PERIODIC MAINTENANCE

The procedures listed below should be performed at monthly intervals to minimize the possibility of an equipment failure and assure optimum performance.

1. Inspect the antenna system. Pay particular attention to the cleanliness of the antenna insulator (s), condition of soldered connections, etc.

2. Fuse ferrules are subject to corrosion which increases circuit resistance. Fuses should be removed from their holders, inspected, and cleaned of any accumulation of dirt or corrosion.

3. Plastic surfaces should be cleaned with lens tissue or a soft non-abrasive cloth. Care should be exercised when cleaning any plastic surface to prevent scratching. Mild soap and water may be used in stubborn cases.

CAUTION

Do not use solvents.

5.3 POST-INSTALLATION SERVICE

This radiotelephone is completely aligned at the factory and should not require any adjustments at installation. However, it is considered good practice to verify that none of the adjustments has changed or been disturbed before or during installation. The test equipment listed below (5.3.1) is used for the test setup shown in Figure 5-1. This test setup is used either in part or total during the following adjustments.

5.3.1 Test Equipment

1.	DC power supply (13.6 VDC)	20V	10A	
2.	RF power meter	50 ohms	40W	150-200 MHz

3.	Signal Generator (Measurements Corp 800 or equivalent)	50 ohm termination	150-200 MHz
4.	FM linear detector (FMLD) (Measurements Corp 902 or equivalent)		150-200 MHz
5.	Frequency counter (HP 5245L or equivalent)		1-500 MHz
6.	Digital Voltmeter		
7.	Oscilloscope (any oscilloscope accurate for audio signal tracing)		
8.	SINADDER (Trademark of Helper Instrument Co.)		
9.	Distortion Meter		
10.	Toggle Switch (for use as a PTT switch)		
11.	Toggle Switch with RG-58c/u and 2 BNC connectors for TX/RX switching.		

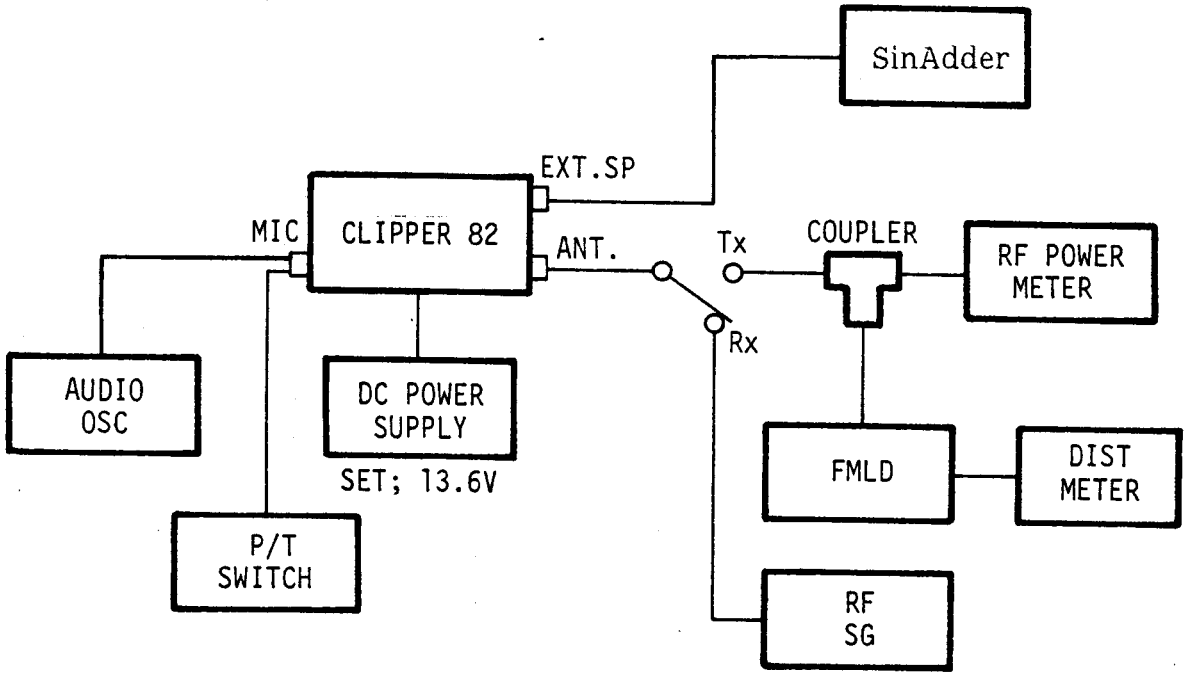


Figure 5-1 Test Equipment Interconnection

5.3.2 Crystal Frequency Adjustments

1) 10.24 MHz frequency adjustment

a. Connect the frequency counter to TP-2 (pin 6 of IC-6).
b. Turn OFF/VOLUME control (17, Fig. 3-1) CW to apply 13.6 Vdc to the radiotelephone.
c. Adjust trimmer capacitor TC-1 for a reading of 10.24 MHz on the frequency counter.

2) 16.9 MHz frequency adjustment

a. Connect frequency counter to the collector of Q4.
b. Depress 16 key pushbutton switch (9, Fig. 3-1) and observe an indication of 16 on channel No. indicator LED-1 (6, Fig. 3-1).
c. Set PTT toggle switch to TX (do not apply any modulation from the audio oscillator) and adjust L10 for an indication of 16.9 MHz on the frequency counter.

3) 17.355 MHz (RX second local freq.) adjustment

a. Depress 1 and 9 key pushbuttons (8, Fig. 3-1) and E key pushbutton (14, Fig. 3-1) for an indication of 19 (center frequency channel) on channel No. indicator LED-1 (6, Fig. 3-1)
b. Set PTT toggle switch to RX position.
c. Connect the high gain frequency counter through a series 5pF capacitor to pin 2 of IC-9.
d. Adjust trimmer capacitor TC-2 for an indication 17.355 MHz on the frequency counter.

5.3.3 PLL Adjustments

NOTE
Do not perform this procedure until the 10.24 MHz frequency adjustment has been completed.

1) 25.6 MHz frequency adjustment

a. Connect the frequency counter to pin 1 of IC-8.
b. Adjust L18 for maximum indication of 25.6 MHz on the oscilloscope. Use a counter to be certain the frequency is correct.

2) PLL lock and maximum output adjustments

a. Connect the high input impedance voltmeter to the plus (+) side of capacitor C74.
b. Depress the 0 then the 1 key pushbuttons (8, Fig. 3-1) and E key pushbutton (14, Fig. 3-1) for an indication of 01 on channel No. indicator LED-1 (6, Fig. 3-1).
c. Adjust L16 for approximately 5 volts on the high input impedance voltmeter.

d. Depress WX and 1 key pushbutton switches (10, 8, Fig. 3-1) and observe that the voltage indicated on the high input impedance voltmeter is approximately 7 volts.

e. After the PLL has locked, adjust L15 for a maximum output on the high input impedance voltmeter.

5.3.4 TX Bandpass Filter Adjustment

1) Depress 1, 9 and E key pushbutton switches (8, 14, Fig. 3-1) and observe an indication of 19 (center frequency channel) on channel No. indicator LED-1 (6, Fig. 3-1).

2) Connect the RF voltmeter to Pin 1 of IC-1.

3) Adjust L4, L5, L6 and L7 to obtain a maximum reading on the RF voltmeter.

4) Connect the RF power meter to the ANTENNA Jack J101 and re-adjust L4, L5, L6 and L7 for maximum RF output power.

5) Depress first the 1 and E key pushbutton switches (8 and 14, Fig. 3-1) and then the 1 and WX key pushbutton switches (8 and 10 Fig. 3-1) while fine tuning L4, L5, L6 and L7 for approximately the same RF power output for both extreme frequency channels (01 and W1).

5.3.5 Modulation Limiting

1) Connect the FM Linear Detector (FMLD) to the ANTENNA Jack J101 and tune to 156.800 MHz (distress channel 16 frequency).

2) Depress 16 key pushbutton switch (9, Fig. 3-1) and observe an indication of 16 on channel No. indicator LED-1 (6, Fig. 3-1).

3) Connect audio oscillator and PTT toggle switch to microphone Jack J102 as shown in Figure 5-1.

4) Set audio oscillator to 2.5 kHz and 50% modulation +16 dB.

5) Adjust VR-1 (Simplex) to fall in the range of 4.5 to 5.0 kHz deviation.

5.3.6 RF Output Power Control Adjustment

1) Depress 1W/25W key pushbutton switch (11, Fig. 3-1) (1W position) and adjust VR-3 for an indication of 1 watt on the RF power meter.

2) Release 1W/25W key pushbutton switch (11, Fig. 3-1) (25W position) and adjust VR-4 for an indication of just under 25 watts on the RF power meter.

NOTE

Use caution when adjusting VR-4 to insure that the RF power meter reading does not exceed 25 watts.

5.3.7 RX Sensitivity Adjustment

1) Connect the SINADDER to the EXT-SP Jack J104 (1, Fig. 3-2).

2) Depress 1, 9, and E key pushbutton switches (8, 14 Fig. 3-1) and observe an indication of 19 (center frequency channel) on channel No. indicator LED-1 (6, Fig. 3-1).

3) Adjust coils L19, 20, 21, 22 and transformer T1 for maximum sensitivity (dip) on the SINADDER at the center frequency of channel 19.

4) Adjust transformer T2 for optimum SINAD on the SINADDER.

5) Check the sensitivity at the highest frequency channel W1 and the lowest frequency channel 01 on the SINADDER.

6) If necessary, fine tune coils L20, 21 and 22 to obtain the same sensitivity on high frequency channel USA W1 as on low frequency channel USA 01.

5.4 TROUBLESHOOTING

5.4.1 Unit does not turn on

1) Check input line voltage and fuse for open circuit.
2) If fuse blows, check V1, D24, IC1, 5, 10 for short and Q10, 16,17 for insulation breakdown.

5.4.2 No sound from speaker

1) No sound when a signal applied to Pin 4 of IC10.

- Check bias voltage of IC10.
- Check Q30 for short or malfunction.

2) No sound when a signal applied to volume control

- Check Q28, 29.

5.4.3 No signals received

1) If no B+, check Q17, 19, 20 or IC5.
2) Check X4 17.355 MHz oscillator frequency and level.
3) Check bias voltage of IC9.
4) Check 1st L.O. frequency.
5) Check XF1, 2 and CF1, 2.
6) Check CPU IC101.

5.4.4 Low sensitivity of receiver

1) Check IC9, Q24, 25, 26.
2) Check 1st L.O. frequency and level.
3) Check D11, 12, Q23, D1 for short.
4) Check antenna, cable and connector.

5.4.5 Squelch inoperative

1) Check VR102 and VR5.
2) Check circuitry around Q27, D19 and IC5.

5.4.6 No transmitter ouput

1) If no TX B+, check Q20, 18, and Q3. If no B+ for Oscillator circuit, check Q11, 14.
2) Check RF input to Mixer Q3:

   ° Check VCO level. If no output, check PLL.
   ° Check Level of 16 MHz, and if no good check Q4 and L8. If no oscillation, check Q5, X1, D2 and L10.

3) Check bias voltage of Q1, 2.
4) Check IC1. (See Figure 5-2)
5) Check TX Inhibit for malfunction.

5.4.7 Low Power

1) Check RF input level to IC1. If low, check input level to Mixer Q3 and gain of Q1, 2. If normal, check IC1 and Antenna SW circuit. (See Figure 5-2)

5.4.8 No or poor Modulation

1) Check microphone.
2) Check IC2, 3. L12 and VR2.

5.4.9 Excessive frequency deviation of transmitter

1) Check VCO frequency, and if wrong, check PLL.
2) Check 16.9 MHz frequency. If wrong, check L10, D2 and X1. (Also, check bias voltage of D2.)
3) Check IC101.

5.4.10 PLL will not lock

1) Check frequency deviation. Check 10.24 MHz oscillator.
2) Check output level of VCO and if low, check bias voltage of Q12.

5.4.11 Display does not work

1) Check RA 1, 2, IC103, 104.
2) Check LED.
3) Check PLL Output Code. (See Figure 4-3)
4) Check IC101, 102.

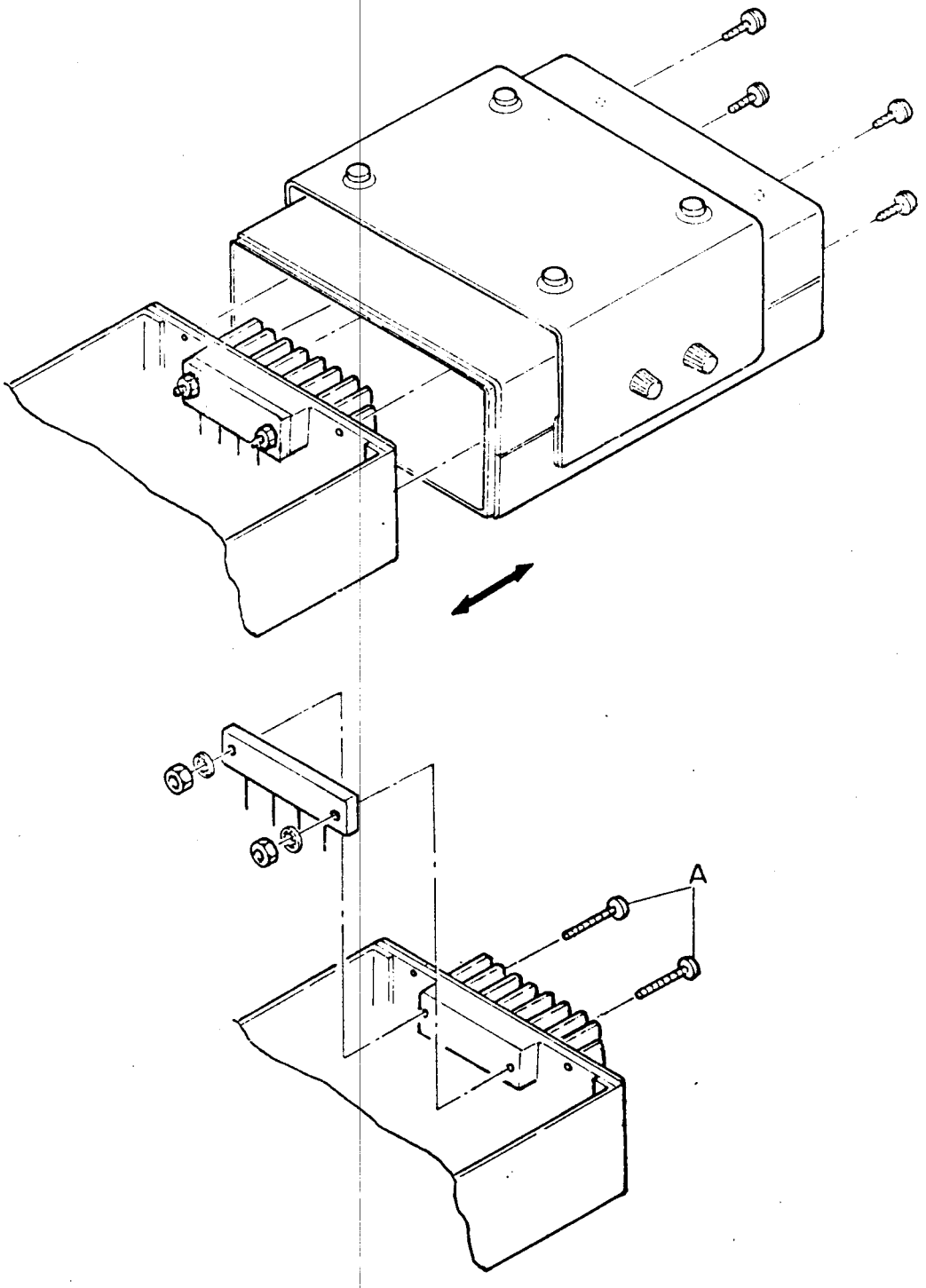


Figure 5-2 Power Module (IC1) Replacement

SECTION 6

DRAWINGS AND PARTS LIST

Section 6 contains the parts list, schematic diagrams and assembly drawings for the Clipper 82 Radiotelephone.

PARTS LIST CLIPPER 82 RADIOTELEPHONE

Description	Qty	Symbol	Part No.
Capacitors			
Ceramic, 10pF (NPO), 500 V	2	C5,6	1032698-108
Ceramic, 15pF (NPO), 500 V	1	C1	1032698-109
Ceramic, 22pF (NPO), 500 V	1	C2	1032698-110
Ceramic, 1.5pF (NPO)	1	C3	1032698-111
Ceramic, 2pF (NPO)	2	C67,68	1032698-112
Ceramic, 4pF (NPO)	5	C12,15,99,102-104	1032698-113
Ceramic, 5pF (NPO)	5	C18,20,72,103, 105	1032698-114
Ceramic, 10pF (NPO)	4	C88,93,121,107	1032698-115
Ceramic, 12pF (NPO)	1	C71	1032698-116
Ceramic, 15pF (NPO)	3	C89,90,96	1032698-117
Ceramic, 22pF (NPO)	2	C111,122	1032698-118
Ceramic, 33pF (NPO)	1	C17	1032698-120
Ceramic, 39pF (NPO)	1	C29	1032698-121
Ceramic, 47pF (NPO)	1	C11	1032698-119
Ceramic, 56pF (NPO)	2	C83,84	1032698-122
Ceramic, 68pF (NPO)	4	C14,25,91,113,	1032698-123
Ceramic, 82pF (NPO)	1	C24	1032698-124
Ceramic, 100pF (NPO)	2	C26,32,	1032698-125
Ceramic, 150pF (NPO)	1	C33	1032698-126
Ceramic, 10pF (N220)	1	C64	1032698-127
Ceramic, 22pF (N220)	2	C63,87	1032698-128
Ceramic, 68pF (N220)	1	C85	1032698-129
Ceramic, 22pF (N1000)	1	C35	1032698-130
Ceramic, 47pF (SL)	1	C134	1032698-132
Ceramic, 100pF (SL)	8	C19,49,50,52,61,108, 110,147	1032698-133
Ceramic, 220pF (SL)	2	C123,128	1032698-134
Ceramic, 470pF (SL)	5	C4,136,139,140,145	1032698-135
Ceramic, 0.001uF	11	C7,9,13,16,55,57,94,95, 100,101,151	1032698-136
Ceramic, 0.01uF	29	C21,22,28,37,38,56,58,65, 66,69,70,77-82,92,106,148 150,152,154,158,159,160, 162,163	1032698-137
Tantalum, 0.1uF, 35 WV	4	C53,118,119,116	1032698-138
Tantalum, 0.47uF, 35WV	1	C74,	1032698-139
Tantalum, 2.2uF, 16WV	3	C41,44,47	1032698-140
Tantalum, 3.3uF, 16WV	1	C73	1032698-141
Tantalum, 33uF, 10WV	1	C149	1032698-142

Description	Qty	Symbol	Part No.
Capacitors (cont'd)			
Electrolytic, 1.0uF, 50WV	3	C60,76,131	1032698-143
Electrolytic, 3.3uF, 25WV	1	C135	1032698-144
Electrolytic, 10uF, 16WV	7	C48,112,130,137,138 153,156	1032698-145
Electrolytic, 33uF, 10WV	1	C45	1032698-146
Electrolytic, 47uF, 10WV	1	C141	1032698-147
Electrolytic, 47uF, 16WV	4	C10,40,62,143	1032698-148
Electrolytic, 47uF, 25WV	1	C8	1032698-149
Electrolytic, 220uF, 16WV	2	C97,98	1032698-150
Electrolytic, 470uF, 16WV	1	C146	1032698-151
Electrolytic, 1000uF, 25WV	1	C142	1032698-152
Bipolar Electrolytic, 10uF, 16WV	1	C125	1032698-153
Mylar, 0.001uF, 50WV	2	C126,127	1032698-154
Mylar, 0.0015uF, 50WV	1	C133	1032698-155
Mylar, 0.0068uF, 50WV	1	C129	1032698-156
Mylar, 0.01uF, 50WV	9	C27,54,109,114,117,124 132,157,161	1032698-157
Mylar, 0.022uF, 50WV	4	C42,43,51,75	1032698-158
Mylar, 0.033uF, 50WV	1	C46	1032698-159
Mylar, 0.047uF, 50WV	3	C59,115,120	1032698-160
Mylar, 0.22uF, 50WV	1	C144	1032698-161
Coils & Transformers			
Coil	1	L3	1032698-6
Coil	1	L1	1032698-4
Coil	2	L2,14	1032698-5
Coil	1	L12	1032698-7
Coil	1	L7	1032698-12
Coil	1	L20	1032698-8
Coil	2	L6,21	1032698-9
Coil	1	L10	1032698-15
Coil	3	L4,5,19	1032698-10
Coil	1	L22	1032698-11
Coil	2	L15,16	1032698-16
Coil	1	L18	1032698-17
Transformer	1	T1	1032698-208
Transformer	1	T2	1032698-13
Coil, Choke	1	L24	1032698-22
Coil, Choke	1	L25	1032698-23
Inductor, 1.0uH	1	L26	1032698-26
Inductor, 2.2uH	1	L13	1032698-18
Inductor, 2.7uH	1	L8	1032698-19
Inductor, 10.0uH	1	L9	1032698-21
Inductor, 56.0uH	1	L17	1032698-25
Inductor, 2.2mH	1	L23	1032698-20
Bead, Ferrite (FBH-2.6/1.3/3.0-40L)	2	L27,28	

Resistors

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

Description	Qty	Symbol	Part No.
18 ohms	1	R7	585108-164
22 ohms	1	R4	585108-168
47 ohms	2	R10,12	
56 ohms	1	R83	585108-2
100 ohms	3	R49,53,112	585108-8
150 ohms	1	R85	585108-64
220 ohms	3	R50,69,81	585108-72
330 ohms	2	R58,71	585108-80
470 ohms	5	R15,16,34,74,76	585108-88
560 ohms	1	R88	585108-92
680 ohms	3	R41,65,75	585108-96
820 ohms	2	R84,R94	585108-100
1k ohms	9	R2,57,59,60,62,66, 67,114,115	585108-12
1.5K ohms	2	R11,89	585108-20
1.8K ohms	1	R5	585108-24
2.2K ohms	12	R2,36,47,93,98,100,101, 110,120,124,125,129	585108-28
2.7K ohms	1	R122	585108-32
3.3K ohms	1	R128	585108-36
4.7K ohms	2	R17,48	585108-44
6.8K ohms	2	R3,13	585108-48
8.2K ohms	1	R86	585108-56
10K ohms	11	R31,51,63,68,72,77, 104,107,111,113,117	585108-60
12K ohms	3	R6,18,20,39	585108-106
15K ohms	5	R45,96,103,118,119	585108-110
18K ohms	1	R26	585108-114
22K ohms	3	R19,52,78	585108-118
33K ohms	3	R55,56,73	585108-126
39K ohms	1	R105	585108-28
47K ohms	8	R23,25,29,40,61,64,82, 87,108	585108-134
56K ohms	1	R121	585108-138
68K ohms	9	R8,9,14,38,54,79,80,91,106	585108-142
82K ohms	1	R43	585108-146
100K ohms	5	R37,42,46,90,102	585108-150
220K ohms	1	R116	585108-180
330K ohms	1	R92	
470K ohms	1	R97	
680K ohms	2	R32,35	585108-182
1M ohms	1	R95	
10 ohms, 1W, ±5% Metal	1	R126	1032698-196
33 ohms, 1W, ±5% Metal	1	R70	167059-44
270 ohms, 1W, ±5% Metal	1	R44	167059-88

Semiconductors

Description	Qty	Symbol	Part No.
I.C. RAY-GRE-AV6	1	IC1	1032698-85
I.C. TA7060P	1	IC2	1032698-86
I.C. TA7063P	1	IC3	1032698-87
I.C. TA7310P	1	IC8	1032698-88
I.C. LM307 or 741	1	IC4	1032698-89
I.C. MM55110	1	IC6	1032698-90
I.C. SP8622B	1	IC7	1032698-91
I.C. HA1366W	1	IC10	1032698-92
I.C. MC3357P	1	IC9	1032698-93
Regulator TA78L009P	1	IC5	1032698-94
Transistor 2SA496(Y)	1	Q19	1032698-95
Transistor 2SA1015(Y)	2	Q14,22	1032698-96
Transistor 2SC496(Y)	1	Q18	1032698-97
Transistor 2SC982	1	Q8	1032698-98
Transistor 2SC1173(Y)	3	Q10,16,17	1032698-99
Transistor 2SC1815(Y)	4	Q4,26,28,29	1032698-100
Transistor 2SC1815(GR)	7	Q9,11,15,20,23,27,30	1032698-101
Transistor 2SC1923(O)	4	Q2,5,12,21	1032698-102
Transistor2SC2053	1	Q1	1032698-103
F.E.T.3SK63(GR)	4	Q3,13,24,25	1032698-104
Diode 1N6O	3	D5,6,19	1032698-197
Diode I51555	14	D7,8,9,11,12,15,16,17,18, 20,21,22,23,27	1032698-64
Diode MI-402	2	D1,10	1032698-62
Diode ERC-01-02	1	D24	1032698-66
Varactor Diode ITT310	1	D2	1032698-63
Varactor MV-201	2	D13,14	1032698-65
Zener Diode HZ5C1	1	D26	1032698-69
Zener Diode H29C1	1	D25	1032698-68
Varistor TNR15G220K	1	V1	1032698-67

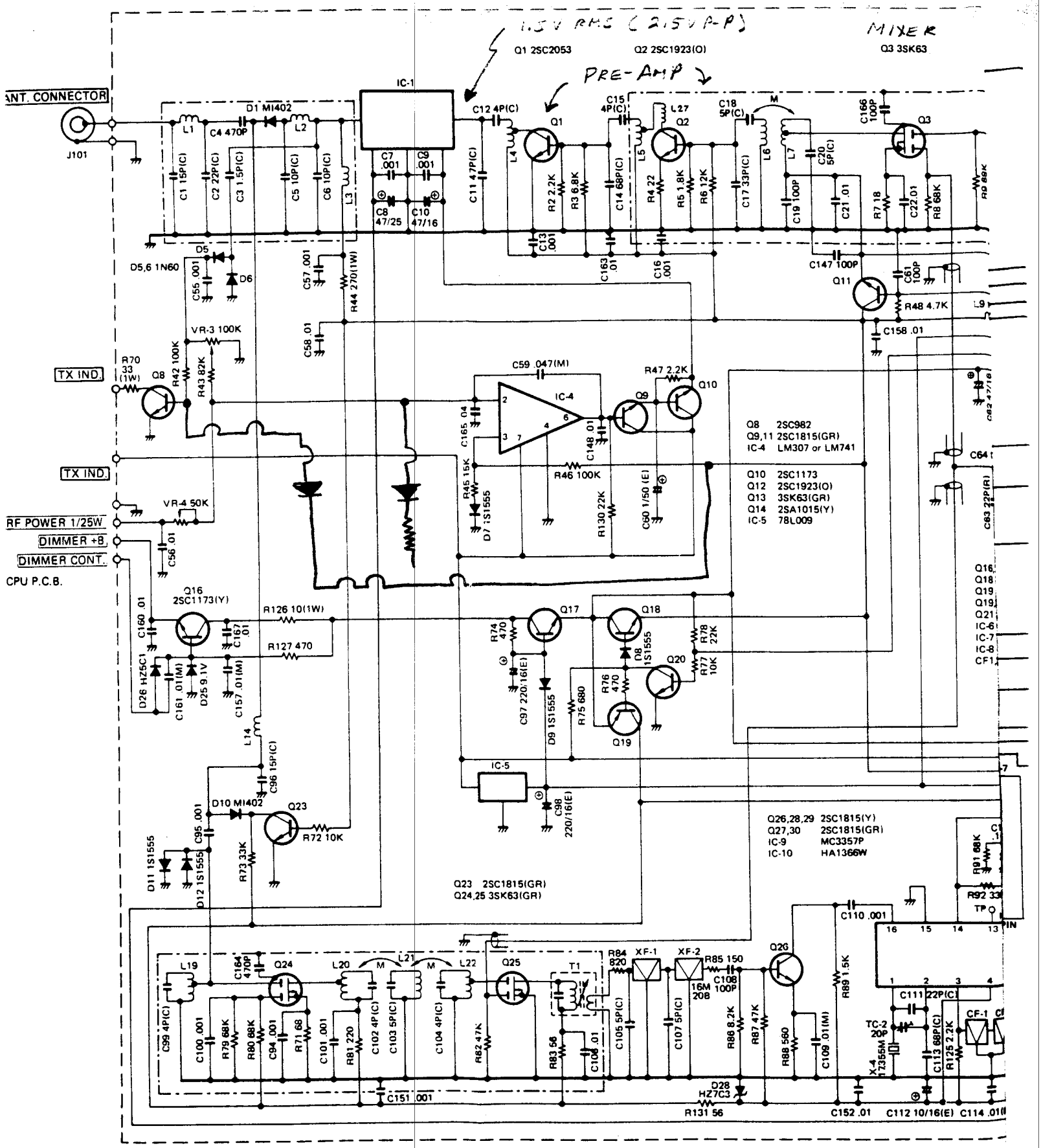
Miscellaneous

Crystal (10.240MHz)	1	X3	1032698-70
Crystal (16.908MHz)	1	X1	1032698-72
Crystal (17.355MHz)	1	X4	1032698-73
Crystal Filter (16.9 MHz)	1 Kit	XF1,2	1032698-74
Ceramic Filter (445 kHz)	2	CF1,2	1032698-75
Ceramic Trimmer (20pF)	2	TC1,2	1032698-76
Semi-Fixed Resistor(4.7k ohms)	1	VR1	1032698-77
Semi-Fixed Resistor(22k ohms)	1	VR5	1032698-212
Semi-Fixed Resistor(47k ohms)	1	VR4	1032698-80
Semi-Fixed Resistor (100k ohms)	1	VR3	1032698-79
Connector (2P:male)	3		1032698-81
Connector (3P:male)	1		1032698-82
Connector (4P:male)	2		1032698-83
Connector (13P:male)	1		1032698-84
P.C. Board Main	1		1032698-192

CPU P.C.B. Assembly

Description	Qty	Symbol	Part No.
P.C. Board Assy (CPU)	1		1032698-209
I.C. (GRE-7914)	1	IC101	1032698-170
I.C. (TMS-1025N2LL)	1	IC102	1032698-171
I.C. (TD62104)	2	IC103,104	1032698-172
I.C. (TC4066)	2	IC105,106	1032698-173
Diode (IS1555)	7	D101-105,107,108	1032698-64
Zener Diode (HZ-6)	1	D106	1032698-198
Transistor (2SA1015-Y)	1	Q101	1032698-96
Transistor (2SC1815-GR)	7	Q102-108	1032698-101
Lamp (BPZ-10V)	4	PL5,6,7,8	1032698-186
Carbon Film Resistor, 470 ohms	2	R101,103	
Carbon Film Resistor, 3.3k ohms	3	R117,124,125	
Carbon Film Resistor, 3.9k ohms	1	R104	
Carbon Film Resistor, 6.8k ohms	2	R121,127	
Carbon Film Resistor, 10k ohms	12	R102,126,128,129,130,132, 133,134,135,136,137,138	
Carbon Film Resistor, 12k ohms	1	R112	
Carbon Film Resistor, 15k ohms	2	R118,120	
Carbon Film Resistor, 33k ohms	4	R111,113,114,119	
Carbon Film Resistor, 47k ohms	7	R105,109,110,115,116, 131,139	
Carbon Film Resistor, 68k ohms	2	R106,108	
Carbon Film Resistor, 100k ohms	1	R107	
Carbon Film Resistor, 680k ohms	2	R122,123	
Ceramic Capacitor, 47pF (NPO)	1	C105	1032698-119
Mylar Capacitor, 0.0056uF, 50WV	3	C114,115,116	1032698-222
Mylar Capacitor, 0.01uF, 50WV	2	C102,106	1032698-157
Mylar Capacitor,10uF, 16WV	1	C101	1032698-145
Tantalum Capacitor, 0.1uF, 35WV	1	C109	1032698-138
Tantalum Capacitor, 0.47uF, 35V	3	C104,110,117	1032698-139
Tantalum Capacitor, 2.2uF, 16WV	2	C103,118	1032698-140
Tantalum Capacitor, 10uF, 10WV	2	C107,108	1032698-223

Description	Qty	Symbol	Part No.
Resistor Array, 33k ohms x 9	1	RA4	1032698-224
Resistor Array, 33k ohms x 12	1	RA1	1032698-225
Resistor Array, 560 ohms x 7	2	RA2,3	1032698-226
Connector (2P:male)	1		1032698-81
Connector (4P:male)	1		1032698-83
Connector (7P:male)	1		1032698-162
Connector (8P:male)	1		1032698-163
Socket, IC, 40 Pin	1		1032698-227
Socket, IC, 28 Pin	1		1032698-228
LED PCB Assembly			
P.C. Board (L.E.D.)	1		1032698-210
L.E.D. (MAN 6610)	1		983574-1
Pilot Lamp (L50D-14V-50MA)	1	PL9	1032698-186
Switch, Pushbutton (KS-R11-010811-01)	1		1032698-221
Chassis Assembly			
Res, Var, 50k, with switch		VR101	1032698-27
Res, Var, 50k		VR102	1032698-28
Jack, Antenna		J101	1032698-29
Jack, Power		J103	1032698-180
Jack, Microphone		J102	1032698-32
Jack, Ext. Spkr.		J104	1032698-181
Microphone		MK-1	1032698-106
Clip, Microphone			217-7180P1
Speaker		SPK-1	1032698-33
Cable, Power			1032698-200
Holder, Fuse			1032698-168
Fuse, 7 AMP		F1	
Chassis, Front			1032698-178
Chassis, Right Side			1032698-36
Chassis, Left Side			1032698-37
Bracket, Speaker			1032698-38
Holder, Speaker			1032698-39
Gasket, Speaker			1032698-58
Shield Case, PLL			1032698-40
Shield Case, RCVR			1032698-41
Shield Case, XMTR			1032698-42
Shield Case, Filter			1032698-43
Cover, Shield Case, Top			1032698-44
Cover, Shield Case, BTM			1032698-45
Yoke	1		1032698-213
Grommet, Yoke	2		1032698-214
Spacer, Yoke	2		1032698-215
Screws, Thumb	2		1032698-59
Heat Sink	1		1032698-46
Gasket, Heat Sink	1		1032698-57


1.5V RMS (2.15V P-P)
MIXER
Q1 2SC2053
Q2 2SC1923(O)
Q3 3SK63
PRE-AMP
ANT. CONNECTOR
J101
IC-1
D1 MI402
C4 470P
C12 4P(C)
C15 4P(C)
C18 5P(C)
C166 100P
Q1
Q2
Q3
L1
L2
L3
L4
L5
L6
L7
L27
C1 15P(C)
C2 22P(C)
C3 1.5P(C)
C5 10P(C)
C6 10P(C)
C7 .001
C8 .001
C8 47/25
C10 47/16
C11 47P(C)
C13 .001
C14 68P(C)
C16 .001
C19 100P
C20 5P(C)
C21 .01
C22 .01
C147 100P
C163 .01
R2 2.2K
R3 6.8K
R4 22
R5 1.8K
R6 12K
R7 18
R8 68K
R9 68K
D5
D5,6 1N60
D6
C55 .001
C57 .001
R44 270(1W)
C58 .01
VR-3 100K
R42 100K
R43 82K
R70 33 (1W)
Q8
TX IND.
C59 .047(M)
IC-4
R47 2.2K
Q9
Q10
C165 .04
C148 .01
R45 15K
D7 1S1555
R46 100K
R130 22K
C60 1/50 (E)
Q11
C61 100P
R48 4.7K
L9
C158 .01
C64
C82 47/16
C83 22P(R)
Q8 2SC982
Q9,11 2SC1815(GR)
IC-4 LM307 or LM741
Q10 2SC1173
Q12 2SC1923(O)
Q13 3SK63(GR)
Q14 2SA1015(Y)
IC-5 78L009
TX IND.
VR-4 50K
RF POWER 1/25W
DIMMER +8
DIMMER CONT.
CPU P.C.B.
C56 .01
Q16
2SC1173(Y)
C160 .01
C162 .01
R126 10(1W)
R127 470
D26 HZ5C1
D25 9.1V
C161 .01(M)
C157 .01(M)
Q17
Q18
Q19
Q20
R74 470
R76 470
R75 680
R77 10K
R78 22K
D8 1S1555
D9 1S1555
C97 220/16(E)
L14
C96 15P(C)
IC-5
C98 220/16(E)
D10 MI402
Q23
R72 10K
C95 .001
D11 1S1555
D12 1S1555
R73 33K
Q23 2SC1815(GR)
Q24,25 3SK63(GR)
Q26,28,29 2SC1815(Y)
Q27,30 2SC1815(GR)
IC-9 MC3357P
IC-10 HA1366W
R91 68K
R92 33
TP
PIN
C110 .001
L19
C164 470P
Q24
L20
L21
L22
Q25
T1
R84 820
XF-1
XF-2
R85 150
C108 100P
16M 208
Q26
R89 1.5K
C99 4P(C)
C100 .001
R79 68K
R80 68K
C94 .001
R71 68
C101 .001
R81 220
C102 4P(C)
C103 5P(C)
C104 4P(C)
R82 47K
R83 56
C106 .01
C105 5P(C)
C107 5P(C)
R86 8.2K
R87 47K
R88 560
C109 .01(M)
C111 22P(C)
TC-2 20P
X-4 17355M
C113 68P(C)
R125 2.2K
CF-1
C151 .001
D28 HZ7C3
R131 56
C152 .01
C112 10/16(E)
C114 .01

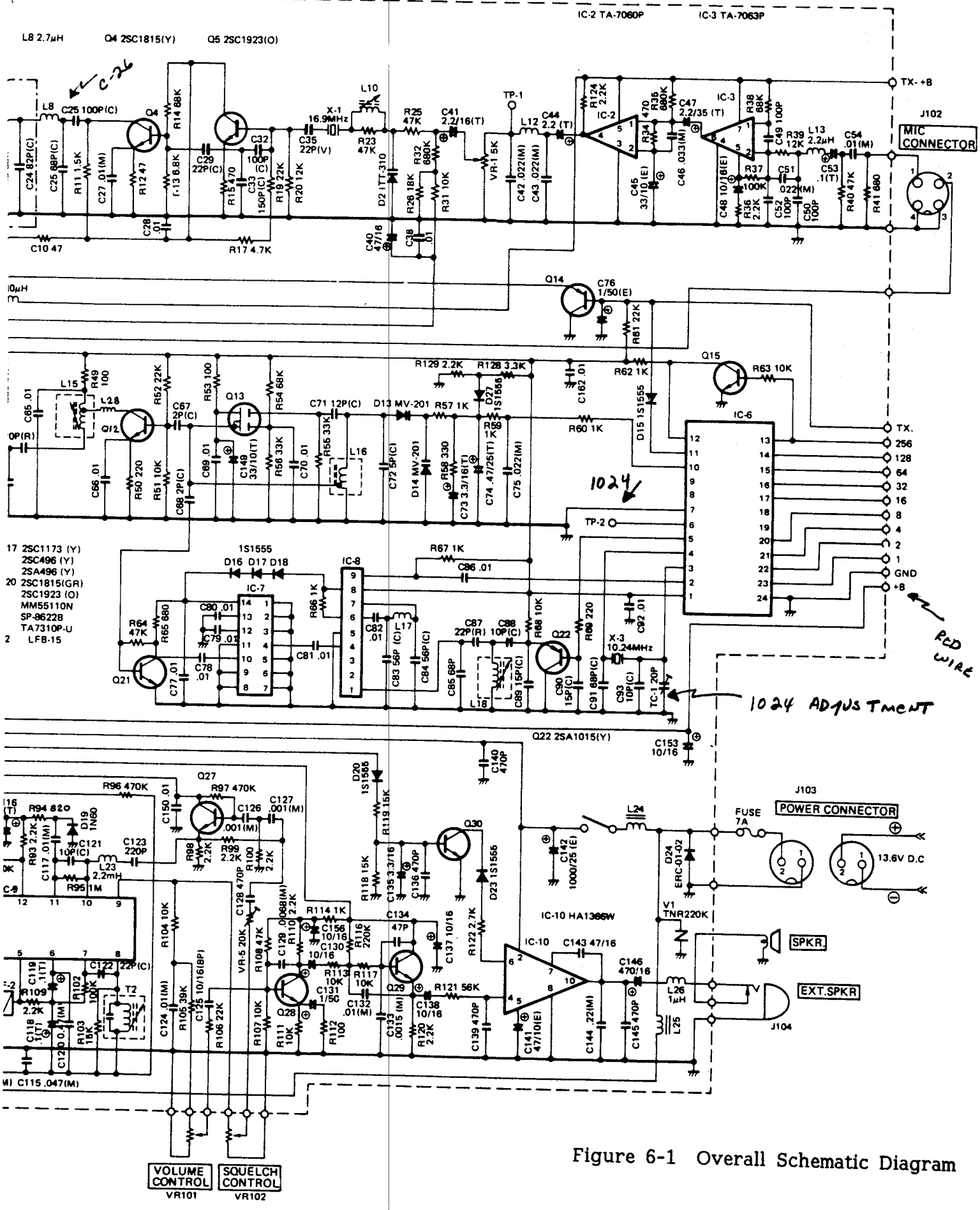
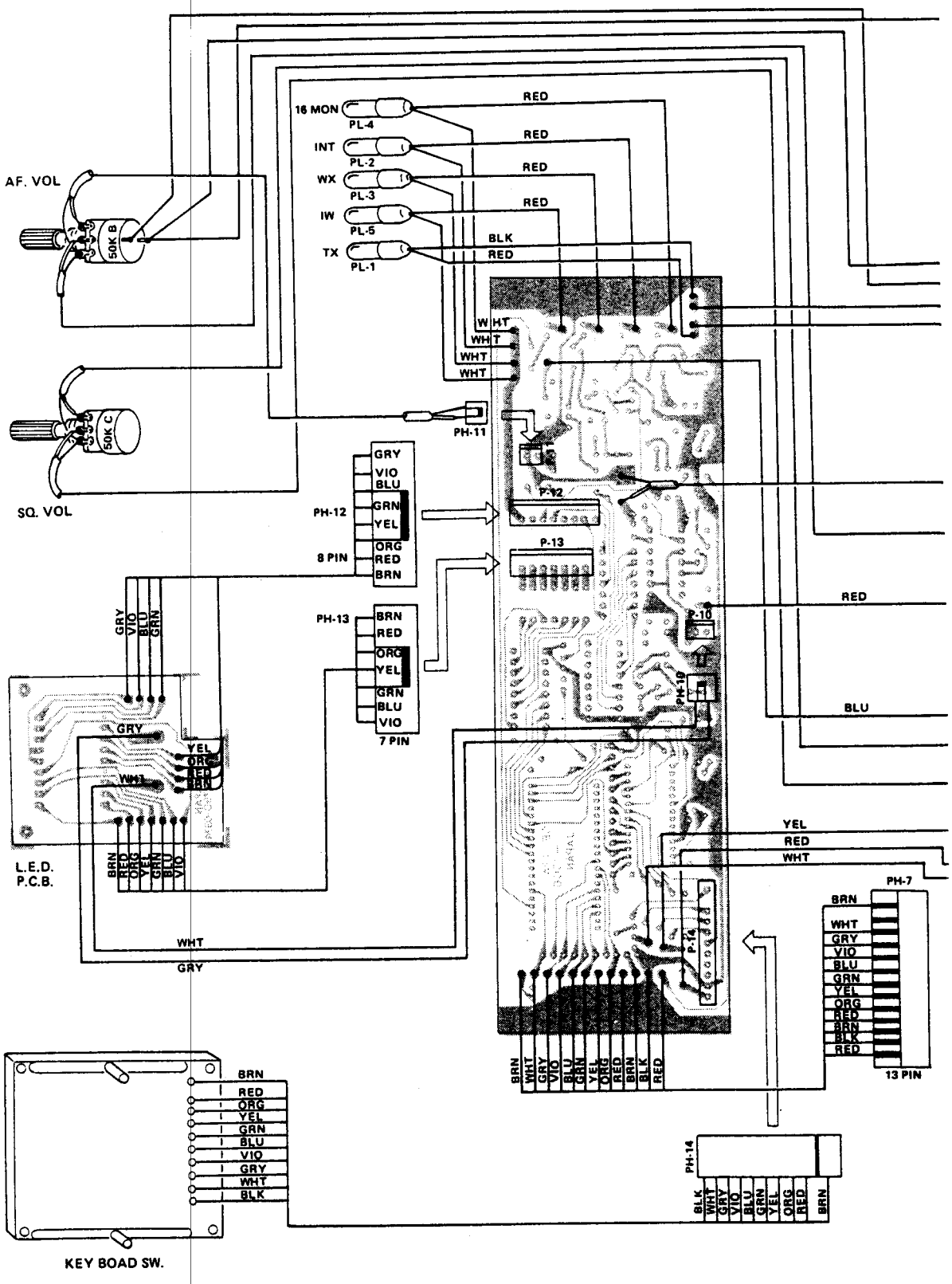


Figure 6-1 Overall Schematic Diagram


AF. VOL
50K B
SQ. VOL
50K C
16 MON
PL-4
INT
PL-2
WX
PL-3
IW
PL-5
TX
PL-1
RED
RED
RED
RED
BLK
RED
WHT
WHT
WHT
WHT
PH-11
P-12
P-13
PH-12
8 PIN
GRY
VIO
BLU
GRN
YEL
ORG
RED
BRN
PH-13
7 PIN
BRN
RED
ORG
YEL
GRN
BLU
VIO
P-10
PH-10
RED
BLU
YEL
RED
WHT
PH-7
13 PIN
L.E.D.
P.C.B.
WHT
GRY
KEY BOAD SW.
PH-14

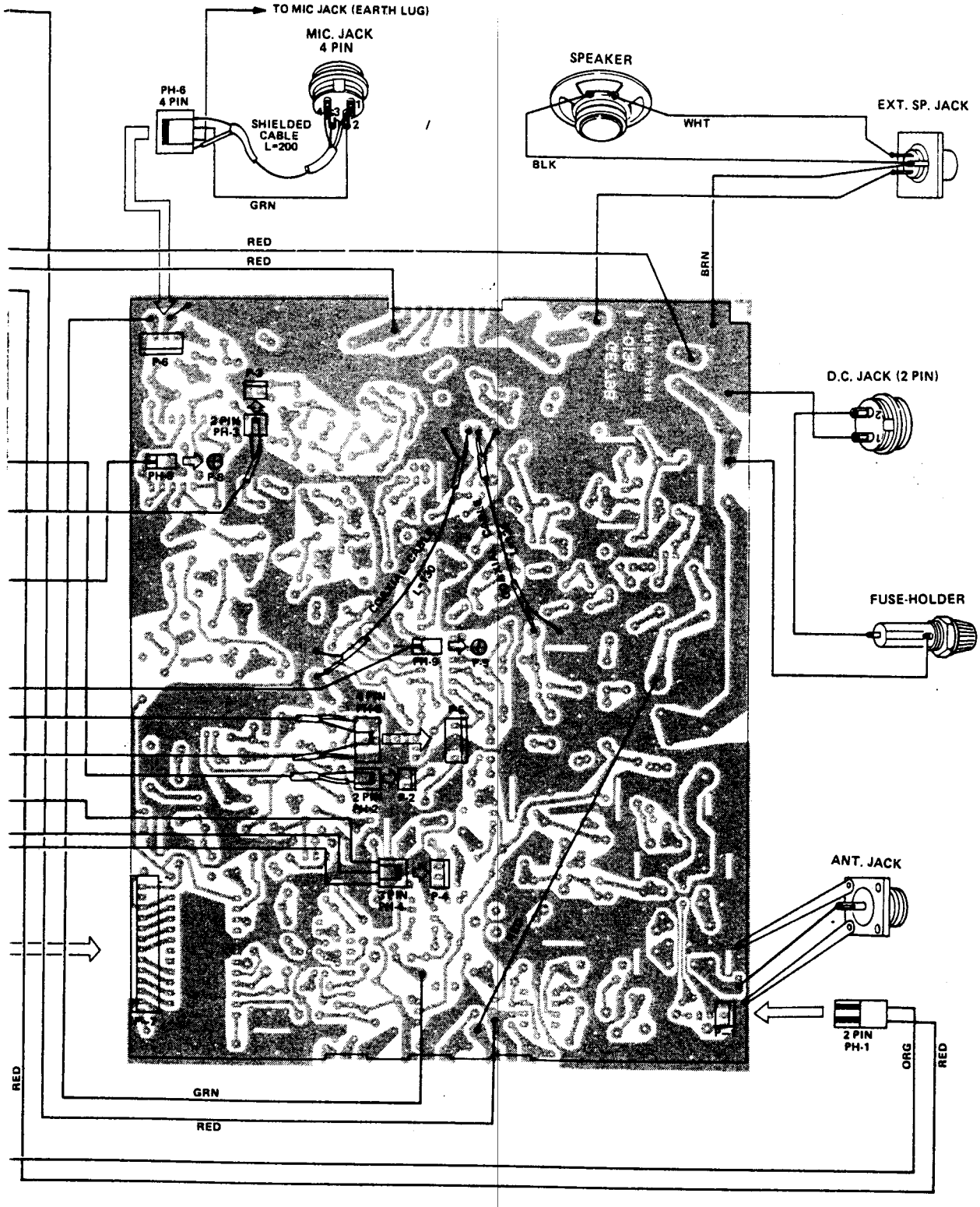


Figure 6-3 Interconnection Diagram

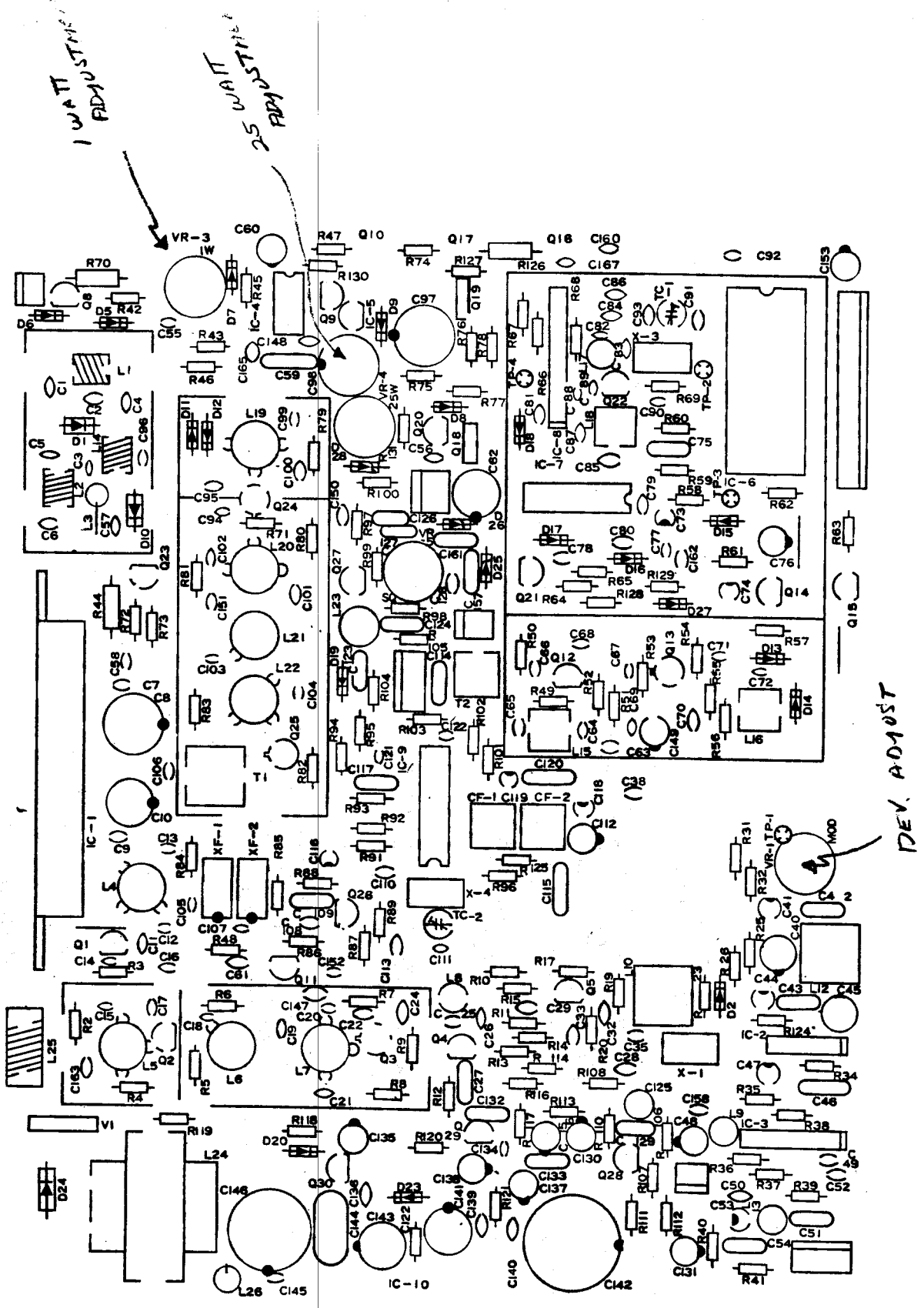


Figure 6-4 Component Locations

APPENDIX A

RADIOTELEPHONE SERVICES

A.1 BASIC RADIOTELEPHONE SERVICE

Radiotelephone communication capability provides important benefits of safety and convenience. It is possible to call, or be called by, the Coast Guard or other vessels within range.

With the addition of channels for Maritime Radiotelephone Service, a far greater range of communication is possible. Range is no longer limited to the relatively short range of the transmitter. The ability to contact the Marine operator provides communication with virtually any other telephone anywhere in the world, on land or sea.

A.2 GETTING ON THE AIR

Before a vessel can lawfully transmit any message, with or without the assistance of a Marine Telephone Operator, the FCC requires that the following be on board:

1. A valid ship's radiotelephone station license.
2. A licensed radiotelephone operator.
3. A radiotelephone station log book.

FCC regulations prohibit the use of profane language, and establish other reasonable controls. All persons aboard a vessel who will be using its communications equipment should be familiar with these and with approved operating procedures. Frequencies are shared with other boatmen. Contacts should be kept brief so that all may have an equal opportunity to transmit and receive messages.

A.3 TECHNICAL REQUIREMENTS

The Telephone Company (or independent common carrier) operates the shore-based radio stations. It does not rent, lease or sell radio telephone equipment for use aboard ship. Such equipment is owned and maintained by the boat owner or, in some cases, by a maritime radio operating company. The selection, installation, and maintenance of a shipboard radio station is highly technical and should be entrusted only to a licensed, reliable marine radio service concern.

The owner's service requirements aboard ship and the operating area will determine the type of marine telephone service and the specific installation needed. Transmitters must meet the requirements set forth in the International Regulations applicable in the country in which the ship is registered. Vessels of United States registry must conform to the regulations of the FCC.

A.4 REGISTER WITH THE COAST STATION

If regular use of Public Marine Radiotelephone Service is planned, it is important to register with the owner of the coast station serving the primary area of operation. Registration with Bell System stations is free. It provides the coast station with billing information for calls, and saves the air time necessary to transmit this information on each call. Ship stations equipped for selective signaling must register in order to obtain assignment of a radiotelephone or ringer number. In areas serviced by the Bell System the operator may register by calling "collect" any of the contact numbers.

There is no monthly charge for maintaining an account. Billing is made for each marine call and for any long distance or overseas charges when they apply. Information on these charges is available in advance from the Marine Operator.

On all three Bell System marine services, messages (to U.S.) to or from any boat may be placed prepaid, collect, or as credit card calls.

NOTES

Keep the Telephone Company informed of any changes that affect your registration.

A.5 MARINE RADIOTELEPHONE

The Bell System and numerous independent Common Carriers maintain a network of marine radio stations strategically located along the coastal waters and major inland waterways of the 48 contiguous states of the U.S. Stations are generally operated 24 hours a day.

A.5.1. VHF Service

1. Public Class III-B Coast Stations

This Service offers reliable operation with good transmission quality over distances of 20 to 50 miles, using FM with channels in the 156-162 MHz range. Antenna height and equipment quality are the primary factors that determine communication distance. The locations of VHF stations in the continental U.S. are shown on Figure A-1.

NOTE

Under FCC rules now in effect, a licensed VHF radiotelephone must be aboard before medium requency (MF) equipment can be licensed. VHF must be used in preference to MF when within range of a VHF shore station.

2. VHF Channels

There are 29 non-commercial VHF channels available in the United States. They are grouped into categories for specific uses so that maximum utilization with minimum interference can be attained. A listing by category may be found in Table 3-1.

Channels for use only by commercial vessels are: 7, 8, 10, 11, 18, 19, 67, 77, 79, 80, and 88. Channels for International use only are: 1, 2, 3, 4, 5, and 78.

3. How to Place Calls on VHF/Ship to Shore

a. Listen to verify channel to desired station is not busy.

b. When channel is clear, put transmitter on air for 15 to 20 seconds - repeat if no answer.

c. When the Marine Operator answers, say: "This is (Ship Call Signal) the telephone billing number is...". If there is no telephone billing number, state caller's name, ship's name and address in city of registry.

d. Finish up with the city and telephone number being called. Proceed thereafter as directed.

e. At the end of the conversation, repeat ship's name and call sign and sign off with "clear" or "out".

4. Shore-to-Ship

a. Call the local telephone operator and ask for the Marine Operator.

b. Give the Marine Operator the name of the ship being called, its call sign, location, and selective signaling code number (if known). Proceed thereafter as directed.

5. Receiving Shore-to-Ship Calls

To receive public coast station calls, a receiver must be in operation on the proper channel.

When calling on VHF, Bell System coast stations will call on channel 16 (156.8 MHz) when requested to do so by the calling party.

Since it is mandatory for commercial operators to maintain a watch on channel 16 (156.8 MHz), many commercial operators carry an additional receiver tuned to a working frequency of their area coast station. This enables them to receive a high percentage of calls on the first attempt. Selective ringing requires a second receiver.

When you hear your boat called, answer as follows: (Name of coast station that called) "This is (Name of your vessel and call sign), Over". Proceed thereafter as directed.

6. Ship-to-Ship Direct

To directly contact another vessel, compatible equipment must be available. (If the other vessel is out of range, make contact through the Marine Operator.)

Most direct ship-to-ship contacts are originated on the distress calling and safety frequency - Channel 16 (156.8 MHz).

a. On a nonbusy channel give the name of the vessel being called, and the name and call sign of the calling vessel.

b. When the called vessel answers, it should suggest an intership frequency on which to complete the conversation. Calls must be limited to 3 minutes except in emergencies.

c. When the call is complete, sign off with vessel name and call sign. You may not call the same boat again for at least 10 minutes.

A.6 DISTRESS, URGENCY AND SAFETY MESSAGES

If the radio is turned on, and not in use, it should be monitoring the calling and safety frequency (channel 16). This channel is monitored 24 hours a day by the Coast Guard and most commercial shore stations. If help is needed, it can be on its way in moments from the Coast Guard and other vessels in the area.

Distress, urgency and safety messages are identified by the use of a code word at the beginning of each message. This word indicates the priority of the message.

A.6.1 Distress Signal: MAYDAY

Used if there is an immediate danger of loss of life or property. MAYDAY has priority over all other communications.

1. If A MAYDAY is heard

Immediately discontinue any transmission. Note the details of the message in the radio log right away. A call to relay information or render assistance may be received. Having the facts may make it possible to help save a vessel or a life.

Unless assistance is possible, do not make any transmissions on this channel until the MAYDAY condition is lifted by the Coast Guard.

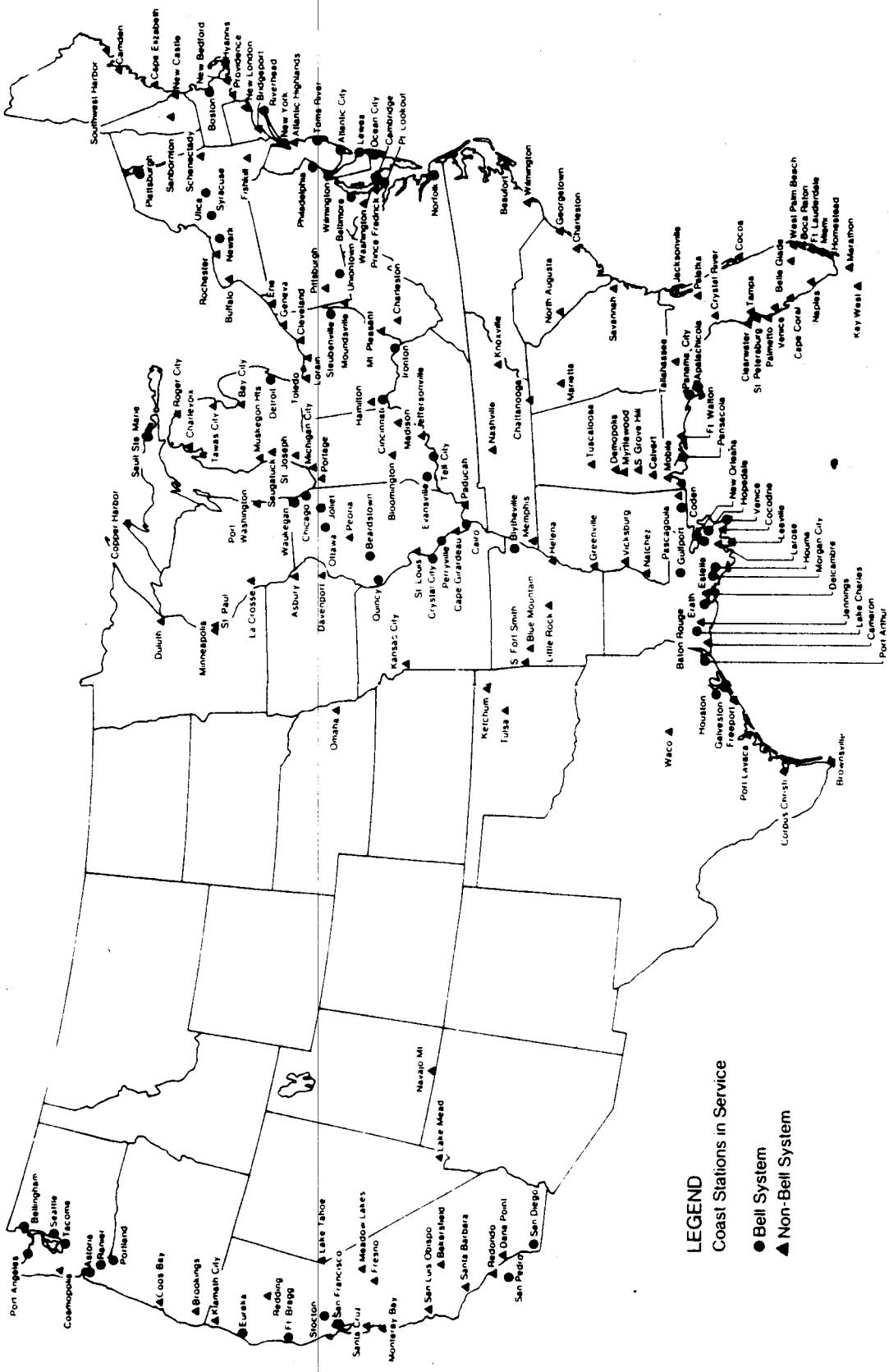


Figure A-1 Public Class III B Coast Stations
(VHF Maritime Radiotelephone Service)

A.6.1 Distress Signal: MAYDAY (cont'd)

2. To Make a MAYDAY Call

a. Switch to channel 16.

NOTE

Because the primary purpose of the channel is to summon help, it is likely that an immediate response will be heard. If not, repeat the message. If still no reply, transmit on any other available frequency until contact is made.

b. Speaking slowly and distinctly, say "MAYDAY, MAYDAY, MAYDAY. This is ....." giving the name of vessel and call sign three times. Then continue with the distress message, as follows, still speaking slowly and distinctly.

c. The name of calling vessel.

d. Position.

e. The assistance needed.

f. A description of vessel (type, color, length, number of persons aboard, etc.).

g. Indicate end of message by saying, "Over".

A.6.2 Urgency Signal: PAN

Used when the safety of the vessel or person is in jeopardy. "Man overboard" messages are sent with this urgency signal. PAN has priority over all other communications with the exception of distress traffic.

A.6.3 Safety Signal: SECURITY

Used for messages concerning the safety of navigation or giving important meteorological warnings.

A.7 WEATHER BROADCASTS

Coast Guard stations transmit weather information in many areas. Local frequencies and schedules may be obtained from the nearest U.S.C.G. or NOAA office. The U.S. Weather Bureau broadcasts current weather on channels W1 (162.550 MHz) and W2 (162.400 MHz) and W3 (162.475 MHz). Canada weather is on W4 (161.650).

At some shore stations, the Marine Operator broadcasts weather information. The Marine Operator may be consulted for channels used and time schedule of broadcasts. Commercial broadcasting stations generally broadcast weather reports and forecasts as part of their news coverage.

NOTE

No prudent boatman ventures out of port without the best available knowledge of weather conditions and possible changes. Your radiotelephone can help you obtain this important information.

A.8 KEEPING THE LOG BOOK

NOTE

Radio logs must be retained for at least one year, and for three years if they contain entries concerning marine disaster or distress signals. This period may be longer if an investigation is underway or pending.

The FCC requires the following entries in a radiotelephone log each day underway:

1. Name of vessel.
2. Vessel's call sign.
3. Operator's signature.
4. Date and listening time on 2182 KHz or 156.8 MHz, using the 24 hour clock.
5. All distress (MAYDAY) messages heard or transmitted.
6. All urgency (PAN) and safety (SECURITY) messages transmitted.
7. Distress, urgency, and safety messages should be logged in as much detail as possible, including date, time of day, operating frequencies, vessel's name and position, and nature of the emergency.
8. All installation, service, and maintenance details that affect the operation of the transmitter must be entered by the licensed technician performing such work, including his address and the class, serial number and expiration date of his license.

A.9 PHONETIC ALPHABET

To help make call letters more clearly understood, and to assist in spelling out similar sounding or unfamiliar words, radiotelephone users often employ the international phonetic alphabet.

PHONETIC ALPHABET

A - ALPHA	J - JULIET	S - SIERRA
B - BRAVO	K - KILO	T - TANGO
C - CHARLIE	L - LIMA	U - UNIFORM
D - DELTA	M - MIKE	V - VICTOR
E - ECHO	N - NOVEMBER	W - WHISKEY
F - FOXTROT	O - OSCAR	X - X-RAY
G - GOLF	P - PAPA	Y - YANKEE
H - HOTEL	Q - QUEBEC	Z - ZULU
I - INDIA	R - ROMEO	

A.10 MARITIME MOBILE RADIOTELEPHONE CONTACTS

For information on any of the three Bell System Marine services, or for registration of your vessel, call the Telephone Company representative in your area.

Atlanta, GA	404-877-3895	Milwaukee, WI	414-350-8870
Baltimore, MD	301-393-1036	Montreal, Canada	514-870-7189
Birmingham, AL	205-321-8509	Newark, NJ	201-649-2014
Boston, MA	617-743-4035	New Orleans, LA	504-581-7337
Charleston, SC	803-722-9011	New York, NY	212-564-0410
Charlotte, NC	704-372-9456		212-393-7394
Chicago, IL	312-727-1574	Norfolk, VA	804-424-9911
Cincinnati, OH	513-397-3431	Omaha, NB	402-422-8656
Cleveland, OH	216-822-4840	Philadelphia, PA	215-466-4648
Detroit, MI	313-354-9550	Portland, OR	503-224-6261
Houston, TX	713-521-6355	San Francisco, CA	415-986-5216
	713-521-7708		415-442-2262
Indianapolis, IN	317-630-1697	Seattle, WA	206-345-2341
Jacksonville, FL	904-353-2315	Washington, DC	202-392-3682
Los Angeles, CA	213-744-1616		202-637-9900
Miami, FL	305-379-0745	Wilmington, NC	919-763-4675
	305-350-8016		

A.11 SUMMARY

1. An accurate, complete radio log is required by FCC regulations.

2. Maintain a watch on the international distress channel (Channel 16 - 156.8 MHz) whenever your receiver is operating. Enter the date and listening time in the log.

3. If both VHF and medium frequency (MF) radiotelephones are installed, VHF must be used whenever within VHF range. This is required by FCC regulations.

4. Listen before transmitting on any frequency to avoid interfering with other vessels' communications.

5. Make all messages brief and to the point. The maritime radiotelephone service is a "party line". If a call is unsuccessful at first, wait at least two minutes before trying again.

6. If a MAYDAY call is heard, respond only if in a position to render assistance or relay the distress message.

7. Profanity on the air is unlawful. Violation, under the Communications Act of 1934, carries a maximum fine of $10,000 and imprisonment for up to two years.

8. False distress signals are prohibited. Violators may be prosecuted under FCC regulations, which carry a maximum fine of $10,000 and one year in prison.

9. Keep the radiotelephone equipment in good working order. Have it checked periodically by a qualified, licensed technician. Do not stake the safety of a vessel or passengers on a questionable radiotelephone.

10. Radiotelephone messages, like telephone conversations, are private. It is unlawful to make use of any information intended for others.

CIRCUIT DESCRIPTION

The MC3357 is a low power FM IF circuit designed primarily for use in voice communication scanning receivers.

The mixer-oscillator combination converts the input frequency (e.g., 10.7 MHz) down to 455 kHz, where, after external bandpass filtering, most of the amplification is done. The audio is recovered using a conventional quadrature FM detector. The absence of an input signal is indicated by the presence of noise above the desired audio frequencies. This "noise band" is monitored by an active filter and a detector. A squelch trigger circuit indicates the presence of noise (or a tone) by an output which can be used to control scanning. At the same time, an internal switch is operated which can be used to mute the audio.

The oscillator is an internally-biased Colpitts type with the collector, base, and emitter connections at pins 4, 1, and 2 respectively. A crystal can be used in place of the usual coil.

The mixer is doubly-balanced to reduce spurious responses. The input impedance at pin 16 is set by a 3 kΩ internal biasing resistor and has low capacitance, allowing the circuit to be preceded by a crystal filter. The collector output at pin 3 must be dc connected to B+, below which it can swing 0.5 V.

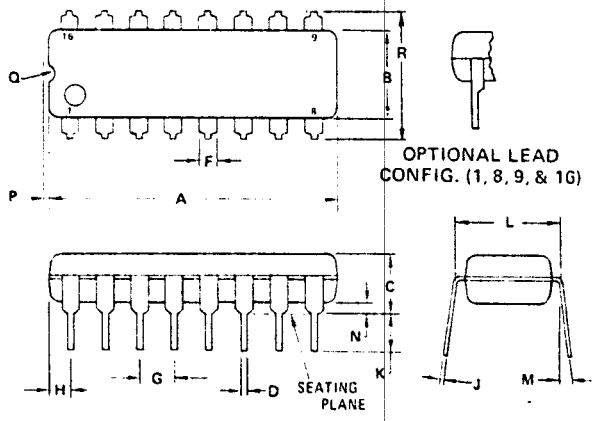
After suitable bandpass filtering (ceramic or LC) the signal goes to the input of a five-stage limiter at pin 5. The output of the limiter at pin 7 drives a multiplier, both internally directly, and externally through a quadrature coil, to detect the FM. The output at pin 7 is also used to supply dc feedback to pin 5. The other side of the first limiter stage is decoupled at pin 6.

The recovered audio is partially filtered, then buffered giving an impedance of around 400 Ω at pin 9. The signal still requires de-emphasis, volume control and further amplification before driving a loudspeaker.

A simple inverting op amp is provided with an output at pin 11 providing dc bias (externally) to the input at pin 10 which is referred internally to 2 V. A filter can be made with external impedance elements to discriminate between frequencies. With an external AM detector the filtered audio signal can be checked for the presence of noise above the normal audio band, or a tone signal. This information is applied to pin 12.

An external positive bias to pin 12 sets up the squelch trigger circuit such that pin 13 is low at an impedance level of around 60 kΩ, and the audio mute (pin 14) is open circuit. If pin 12 is pulled down to 0.7 V by the noise or tone detector, pin 13 will rise to approximately 0.5 Vdc below supply where it can support a load current of around 500 μA and pin 14 is internally short-circuited to ground. There is 100 mV of hysteresis at pin 12 to prevent jitter. Audio muting is accomplished by connecting pin 14 to a high-impedance ground-reference point in the audio path between pin 9 and the audio amplifier.

OUTLINE DIMENSIONS



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	–	22.10	–	0.870
B	6.10	6.60	0.240	0.260
C	–	5.08	–	0.200
D	0.38	0.53	0.015	0.021
F	–	1.78	–	0.070
G	2.54 BSC		0.100 BSC	
H	0.38	2.41	0.015	0.095
J	0.20	0.38	0.008	0.015
K	2.92	–	0.115	–
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	–	0.020	–
R	–	8.26	–	0.325

P SUFFIX
PLASTIC PACKAGE
CASE 648-04
$R_{\theta JA}$ = 100°C/W (Typ)

NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
4. "F" DIMENSION IS FOR FULL LEADS. "HALF" LEADS ARE OPTIONAL AT LEAD POSITIONS 1, 8, 9, and 16).
5. DIMENSION "R" TO BE MEASURED AT THE TOP OF THE LEADS (NOT AT THE TIPS).

THERMAL INFORMATION

The maximum power consumption an integrated circuit can tolerate at a given operating ambient temperature, can be found from the equation:

$$P_{D(T_A)} = \frac{T_{J(max)} - T_A}{R_{\theta JA(Typ)}}$$

Where: $P_{D(T_A)}$ = Power Dissipation allowable at a given operating ambient temperature. This must be greater than the sum of the products of the supply voltages and supply currents at the worst case operating condition.

$T_{J(max)}$ = Maximum Operating Junction Temperature as listed in the Maximum Ratings Section

T_A = Maximum Desired Operating Ambient Temperature

$R_{\theta JA(Typ)}$ = Typical Thermal Resistance Junction to Ambient

MC3357

Advance Information

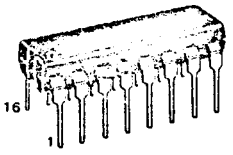
LOW POWER NARROW BAND FM IF

. . . includes Oscillator, Mixer, Limiting Amplifier, Quadrature Discriminator, Active Filter, Squelch, Scan Control, and Mute Switch. The MC3357 is designed for use in FM dual conversion communications equipment.

- Low Drain Current (3.0 mA (Typ) @ V_{CC} = 6.0 Vdc)
- Excellent Sensitivity: Input Limiting Voltage — (-3.0 dB) = 5.0 μV (Typ)
- Low Number of External Parts Required

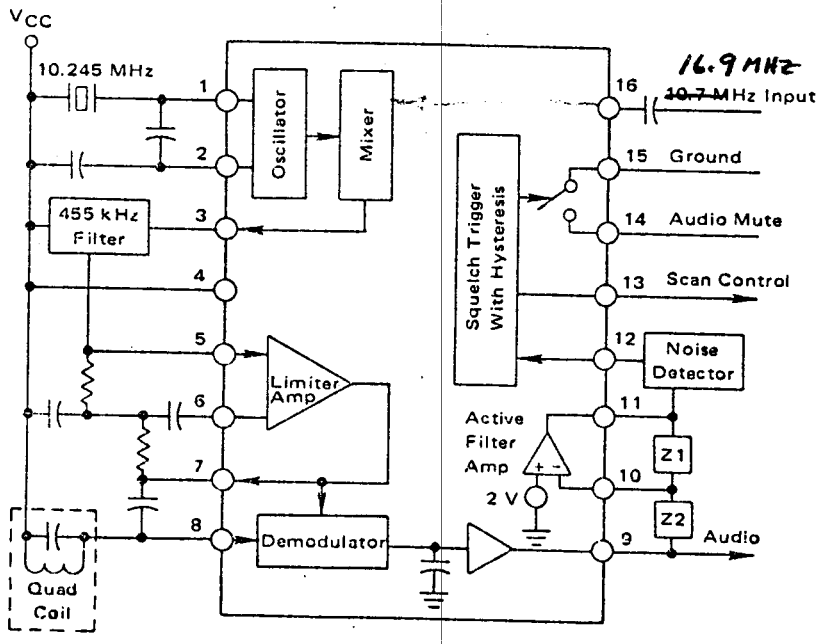
LOW POWER
FM IF

MONOLITHIC SILICON
INTEGRATED CIRCUIT

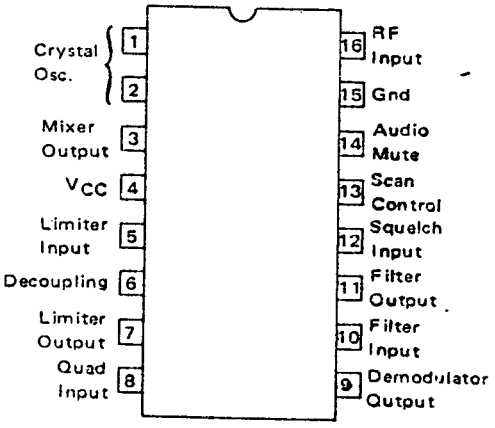


P SUFFIX
PLASTIC PACKAGE
CASE 648

FIGURE 1 – FUNCTIONAL BLOCK DIAGRAM



PIN CONNECTIONS



This is advance information and specifications are subject to change without notice.

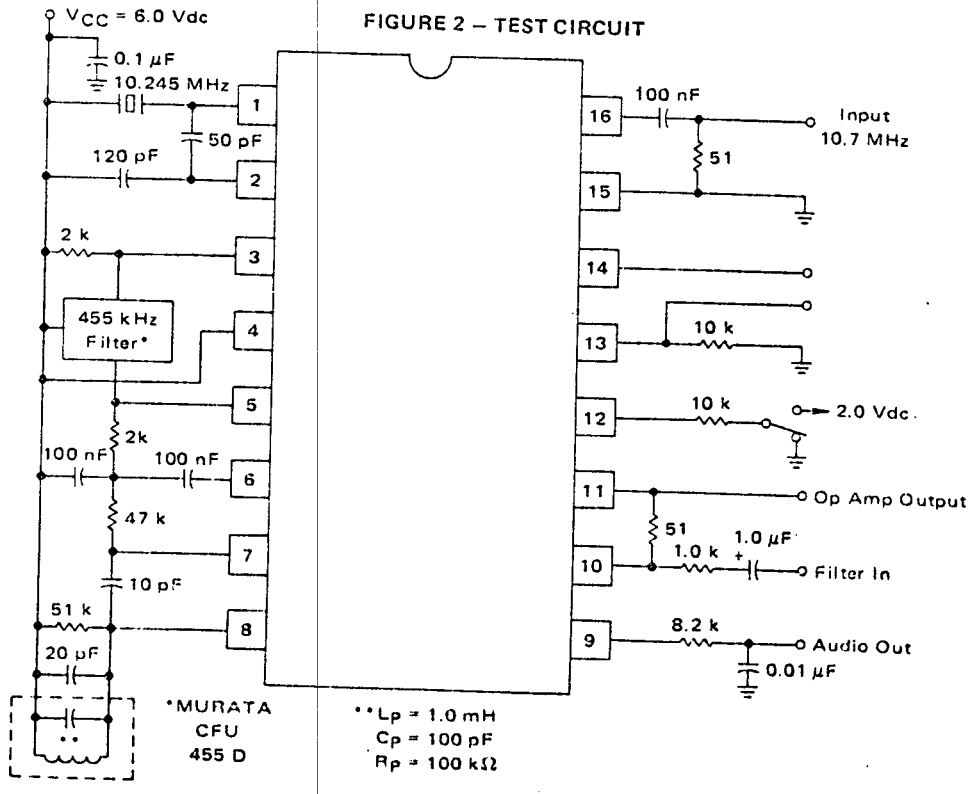
MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Pin	Symbol	Value	Unit
Power Supply Voltage	4	V_{CC}(max)	12	Vdc
Operating Supply Voltage Range	4	V_{CC}	4 to 8	Vdc
Detector Input Voltage	8	–	1.0	Vp-p
Input Voltage (V_{CC} = 6.0 Volts)	16	V_{16}	1.0	V_{RMS}
Mute Function	14	V_{14}	-0.5 to 5.0	V_{pk}
Junction Temperature	–	T_J	150	°C
Operating Ambient Temperature Range	–	T_A	-30 to +70	°C
Storage Temperature Range	–	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 6.0 Vdc, fo = 10.7 MHz, Δf = ± 3.0 kHz, f_{mod} = 1.0 kHz, T_A = 25°C unless otherwise noted.)

Characteristic	Pin	Min	Typ	Max	Unit
Drain Current	4				mA
Squelch Off		–	2.0	–	
Squelch On		–	3.0	5.0	
Input Limiting Voltage (-3 dB Limiting)	16	–	5.0	10	μV
Detector Output Voltage	9	–	3.0	–	Vdc
Detector Output Impedance	–	–	400	–	Ω
Recovered Audio Output Voltage (V_{in} = 10 mV)	9	200	350	–	mVrms
Filter Gain (10 kHz) (V_{in} = 5 mV)	–	40	46	–	dB
Filter Output Voltage	11	1.8	2.0	2.5	Vdc
Trigger Hysteresis	–	–	100	–	mV
Mute Function Low	14	–	15	50	Ω
Mute Function High	14	1.0	10	–	MΩ
Scan Function Low (Mute Off) (V_{12} = 2 Vdc)	13	–	0	0.5	Vdc
Scan Function High (Mute On) (V_{12} = Gnd)	13	5.0	–	–	Vdc
Mixer Conversion Gain	3	–	20	–	dB
Mixer Input Resistance	16	–	3.3	–	kΩ
Mixer Input Capacitance	16	–	2.2	–	pF

FIGURE 2 – TEST CIRCUIT



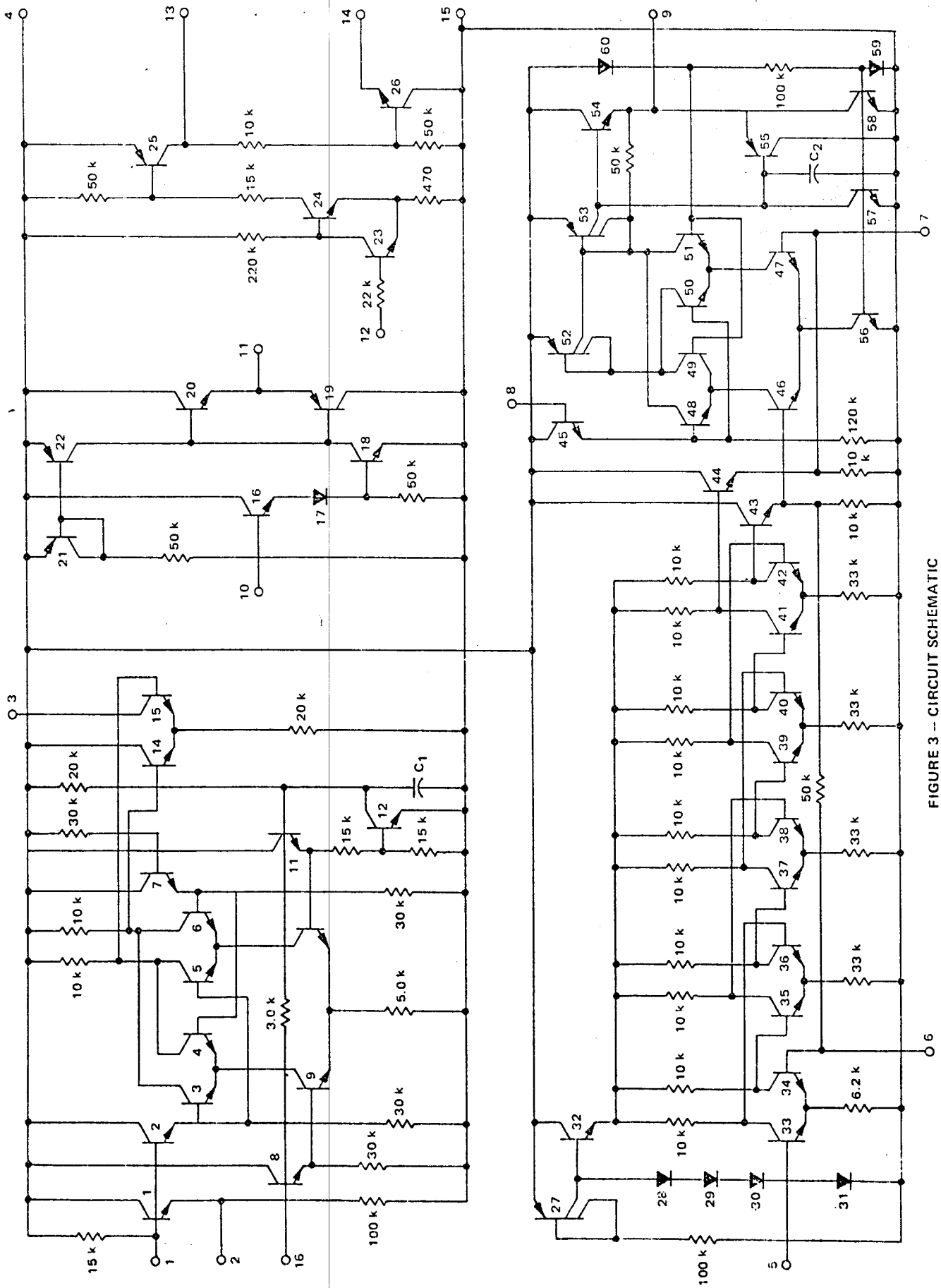
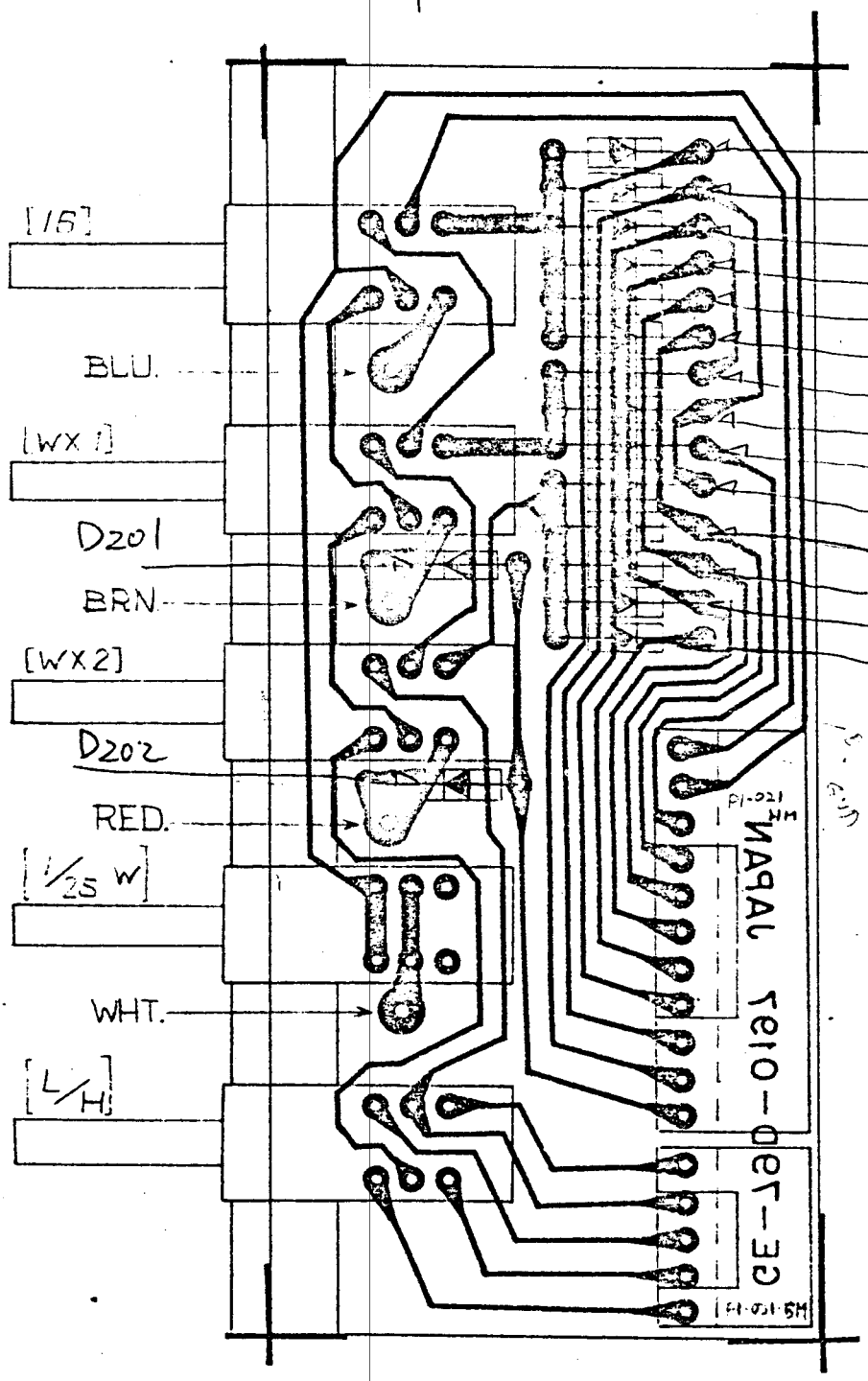


FIGURE 3 – CIRCUIT SCHEMATIC

Top View



(1) PCB. GE-79D-0197
(2) SW SS-0004DF 2060
(3) DIODED 1S555 × 16本
(4) CON. P'N. PI-021-5M
PI-021-16M
(5) 抵抗
BLU
BRN
RED
WHT

DATE	SIGN	REVISIONS	BY	APPROVED	NUMBER	TITLE	QUANT	MATERIAL	REMARK
SCALE	1/1								
	PAINT								
DATE	7/3								
DRAWING NO.	GE-79D-0437								

DRAWN T. OSHIMA
CHECKED
APPROVED

7913 / CLIPPER-02
PUSH SW. P.C.B. PARTS LOCATION

ISSUED

GENERAL RESEARCH OF ELECTRONICS INC.

APPENDIX B

LICENSING

B.1 GENERAL

All radio stations aboard U.S. flag vessels must be licensed by the FCC under part 83 of the FCC regulations. The licensee is responsible at all time for the lawful and proper operation of his station. Licenses are not granted to aliens except where the radio installation is required by law or treaty. Ship stations are licensed primarily for safety of life and property. Distress and safety communications must, therefore, have absolute priority.

B.2 SHIP STATION LICENSE

Application for a ship radiotelephone and/or radionavigation station (radar) license is made on FCC Form 502, except that FCC Form 501 shall be used for radiotelephone stations required by Title III, Part II of the Communications Act of 1934, as amended, or the Safety of Life at Sea Convention, or where the applicant is also the licensee of radiotelegraph equipment aboard the vessel. FCC Form 501 is used for party boats and commercial vessels which require a radiotelephone installation.

B.3 RENEWAL OF SHIP STATION LICENSE

An application for renewal of a ship radiotelephone and/or ship radionavigation (radar) station license shall be filed on FCC Form 405-B, except that FCC Form 405-A shall be filed for renewal of a ship station license which also authorizes radiotelegraph equipment. Insofar as possible, FCC Form 405-B is mailed to the station licensee 60 days prior to expiration of his license. If it has not been received 30 days prior to expiration, FCC Form 405-B may be obtained upon request from the nearest FCC office. The application for renewal must be received by the Commission prior to the expiration date.

B.4 INTERIM SHIP STATION LICENSE FOR RADIOTELEPHONE

An interim license authorizing the operation of a ship radio station for a 6-month period may be obtained at any Commission field engineering office upon presentation (by the applicant or any person who informs the office that he has been authorized to act in behalf of the applicant in securing an interim ship station license) of a properly completed application and an informal request for an interim license.

In Alaska only, an interim ship station license may be obtained by mailing a properly completed application and a written request for an interim ship station license to the Commission's field engineering office at Anchorage.

The full-term license will be mailed to the licensee prior to the expiration of the interim license.

The interim license procedure does not apply to renewal applications.

B.5 OPERATOR LICENSE

The radiotelephone transmitter in a ship station may be operated only by a licensed radio operator. The licensed operator may permit others to operate the transmitter if he starts, supervises, and ends the operation, makes the necessary log entries, and transmits the necessary identification. The license usually held by radio operators aboard small vessels not required to carry a radio installation for safety purposes is the Restricted Radiotelephone Operator Permit or verification card of a second class or higher radiotelegraph or radiotelephone license. The Restricted Radiotelephone Operator Permit or verification card of a higher class license must be posted or kept on the operator's person (Rule 83.165). For vessels requiring radiotelephone installation, the operator must have a third class radiotelephone operator permit.

B.6 APPLICATION FOR OPERATOR PERMIT

Field offices will accept applications filed on FCC Form 753 for the Restricted Radiotelephone Operator Permit if the applicant makes a satisfactory showing of immediate need for a permit for safety, and if the application is presented in person by the applicant or his agent. However, this lifetime permit is usually obtained by mailing an FCC Form 753 to the FCC at Gettysburg, Pennsylvania 17325. No oral or written examination is required. An application for a Restricted Radiotelephone Operator Permit must be accompanied by a filing fee (see fee schedule below).

B.7 FEES

The appropriate fee must be enclosed with each application for a station license. An additional fee is required for an interim license. DO NOT SEND CASH. Make check or money order payable to the Federal Communications Commission. In general, the fee will not be refunded even if the license is not granted. Also, fee overpayments of $2.00 or less will not be refunded. (No fee is required for an application filed by a Government Agency or for a special temporary authority of brief duration or minor character.)

B.8 APPLICATIONS

Application forms, which can be mailed to the proper agencies, are provided with most radiotelephones.

APPENDIX C

ANTENNAS

C.1 GENERAL

The antennas cited below are designed to operate on the VHF/FM Bands for ship communications. The antennas are factory pretuned and need no adjustment. The cables are RG-58/U (273-1022P1) with connector PL-259 (276-7177P1) attached. All antennas listed are fiberglass and sealed with a special process to prevent rattle and moisture damage. Four VHF antennas are listed for use with this radiotelephone, and described below.

MODEL M68W, for pleasure craft use.

3dB gain
58" long
20' cable/connector
Vertical/horizontal split ball mount, M68W.

MODEL M70, for pleasure craft use.

9dB gain
21' long
20' cable/connector
Uses swivel mount AM-1WA.

MODEL M74, for pleasure craft and small commercial vessel use.

6dB gain
9'7" long
20' cable/connector
Uses ratchet mount model AM18C for deck, bulkhead, or extension mounting.

MODEL M73, for sailboat use.

Unity gain
39.5" long
No cable supplied, use RG8/U.
A 2" x 3" stainless steel "L" bracket and mounting hardware for installation on an aluminum or wooden sailboat mast are included

C.2 ANTENNA MOUNT MODEL AM-1W

This mount provides the strength and holding power necessary to withstand rough water conditions. The deluxe universal swivel base mount swings a full 90 degrees in all directions away from the cabin for laydown. The base is chrome-plated brass, and the top mount is durable Delrin with a rapid lock-up and release.

NOTE

When using this mount with the M70 antenna, the insulator should be removed.

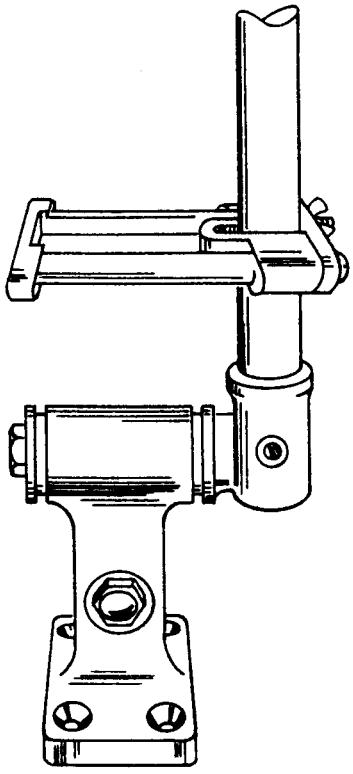
C.3 ANTENNA MOUNTING/INSTALLATION

Attach the mount to the craft in a convenient position with 1/4" hardware. If the mounting hardware extends through the panel into the craft, use large flat washers under the nut on the inside. Use only stainless steel or chrome-plated hardware.

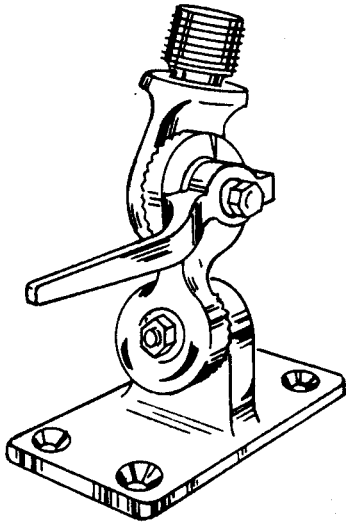
To prolong the life of the mounting, all hardware should be encapsulated with a silicone rubber compound to prevent atmospheric deterioration.

CAUTION

Verify that the mounting surface is sufficiently strong to support the mount and antenna. If it is not, a backing plate such as 1/4" steel or 3/4" woodstock, may be used.



AM-1WA Swivel Mount
For use with M70 Antenna



AM18C Mount
For use with M69 Antenna

Figure C-1 Antenna Mounts

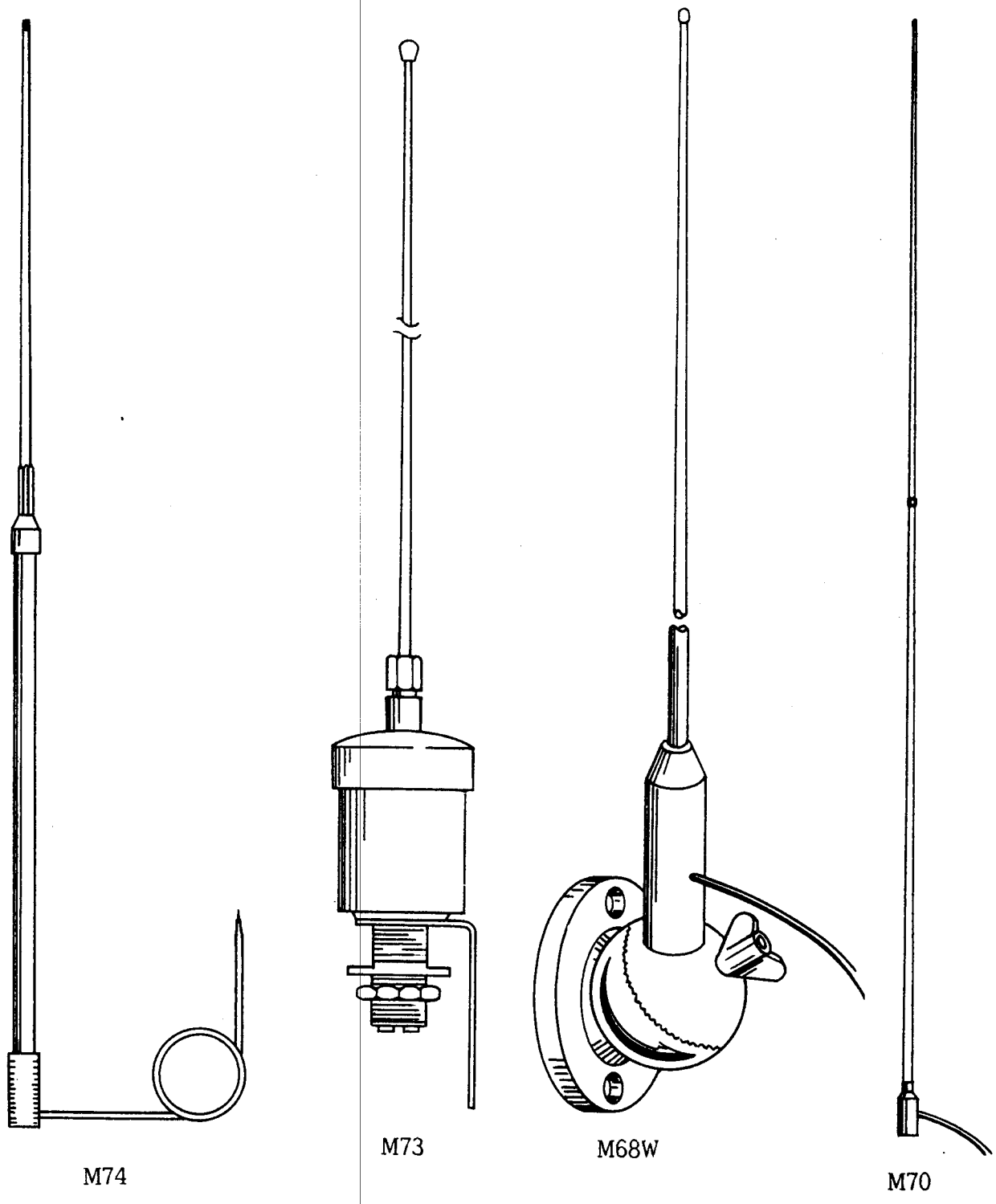


Figure C-2 Antennas

Apelco Marine Electronics
676 Island Pond Road, Manchester, N.H. 03103
(603) 668-1600

A Raytheon Company

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