Ray45

VHF Radio

Owner's Handbook

Raymarine
ON BOARD

TABLE OF CONTENTS

SECTION 1 GENERAL DESCRIPTION

SECTION 2 INSTALLATION

SECTION 3 OPERATIONS

SECTION 4 TECHNICAL DESCRIPTION

SECTION 5 MAINTENANCE AND ALIGNMENTS

SECTION 6 PARTS LIST & DRAWINGS

SECTION 7 APPENDIX

GLOSSARY OF TERMS

VHF ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Very High Frequency (30MHz to 300MHz).

FM ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Frequency Modulation.

MODULATION ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ To vary a carrier wave.

CARRIER WAVE ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ A radio frequency on which intelligence is superimposed.

DUAL WATCH ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Monitors channel 16 while working on another channel.

U.S.A.CHANNELS ⋯⋯⋯⋯⋯⋯⋯⋯⋯ Channel designations as defined by the FCC.

INTERNATIONAL CHANNELS ⋯⋯⋯⋯⋯ Channel designations as defined by the international Telecommunication Union.

CANADIAN CHANNELS ⋯⋯⋯⋯⋯⋯⋯ Channel designation as defined by the IC.

WEATHER CHANNELS ⋯⋯⋯⋯⋯⋯⋯ Channels for routine and emergency weather information broadcast by NOAA.

SIMPLEX ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Transmit and receive on the same frequency.

DUPLEX ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Transmit and receive on different frequencies.

SQUELCH ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ To suppress totally.

LCD ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Liquid crystal display.

TX ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Transmit.

RX ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Receive.

RF ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Radio Frequency.

CPU ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Control Processor Unit.

PLL ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Phase Lock Loop (A type of Frequency Synthesizer).

VCO ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Voltage Controlled Oscillator.

PTT SWITCH ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ Microphone push-to-talk switch

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

Congratulations on your purchase of RAYTHEON'S RAY45 marine radiotelephone.

The RAY45 is a CPU-controlled, digitally synthesized, compact transceiver which provides reliable simplex and duplex (two-frequency) communications between ships and from ships at sea to public or private shore stations. The RAY45 provides two-way communications on the International and US channels, reception on 10 separate weather channels, and two-way communications on the International calling and safety channel (16)

This manual describes the physical and functional characteristics of the radiotelephone.

1.2 EQUIPMENT FEATURES

The RAY45 is designed and manufactured to provide ease of operation with excellent reliability. The important built-in features of the equipment are listed below:

• Waterproof to U.S.C.G. standard CFR-46.

• All solid-state circuitry for low current drain and maximum reliability.

• Series diode protection on input power circuits to prevent reverse polarity damage.

• High-performance receiver section with optimum selectivity.

• 53 channel transmit and 93 channel receive capability within the assigned VHF-FM maritime band. All US and International channels are included.

• Exclusive circuit that automatically selects 16 PLUS (priority) channel when the radio is turned on.

• Exclusive weather alert feature (when in monitor mode).

• Selected channel number indicated on the LCD digital display.

• Key entries for "Quick" 16 PLUS, and 10 weather channels WX0 through WX9.

SECTION 2

INSTALLATION

2.1 UNPACKING AND INSPECTION

Use care when unpacking the unit from the shipping carton to prevent damage to the contents. It is also good practice to save the carton and the interior packing material. The original packing material should be used in the unlikely event it is necessary to return the unit to the factory.

2.2 EQUIPMENT SUPPLIED

The following is a list of materials supplied with the RAY45

Description	Part No.
Radiotelephone	E43006
Instruction Manual	G627266-5
Microphone Bracket w/hardware	G627266-6
Power/External Speaker Cable	G623680-3
FCC Instructions	FCC Form 506
Mounting Yoke	G627266-7
Yoke Knob	G627266-9
Yoke Knob Spacer	G623680-6

M314493

Table 2.1 Equipment Supplied

2.2.1 Optional Accessories

Item #	Description	Part No.
1	Flush Mounting Kit	E46001
2	Flush Mounting Face Cover	E46003
3	8' Fiberglass VHF Antenna	M51118E
4	3' Stainless Antenna w/STD Mount Thread	M511352

5	4-Way Lexan Mount w/Thru Deck Fitting	M51054
6	4-Way Brt Chrome Mount w/Thru Deck Fitting	M51116

Table 2.2 Optional Accessories

These optional accessories may be ordered by calling our Customer Service Department directly at (603) 647-7530 ext. 2120 Monday through Friday 8:30 a.m. - 5:00 p.m. E.S.T.

2.3 PLANNING THE INSTALLATION

When planning the installation for your RAY45, the following conditions should be considered to insure dependable and trouble-free operation.

• The mounting location should be easily accessible to allow operation of the front panel.

• There should be adequate ventilation for the control unit.

• A sufficient space should be secured behind the transceiver to allow enough space for proper cable connections to the rear panel connectors.

• The transceiver should be located as near to the power source as possible.

• The selected location should be as far apart as is possible from any devices that may cause interference such as motors, generators, and other on board electronics.

• Generally speaking, the transceiver should be protected from prolonged direct exposure to rain and salt spray. It is always a good practice to protect your valuable electronic equipment as much as possible.

• Use adequate sized wire for all DC power connections and make sure to solder all in-line connectors or splices.

2.3.1 Typical Mounting Methods

The RAY45 can be conveniently mounted on a chart table, bulkhead, overhead, or any other desired location. (Refer to Figure 2-1 for typical mounting methods)
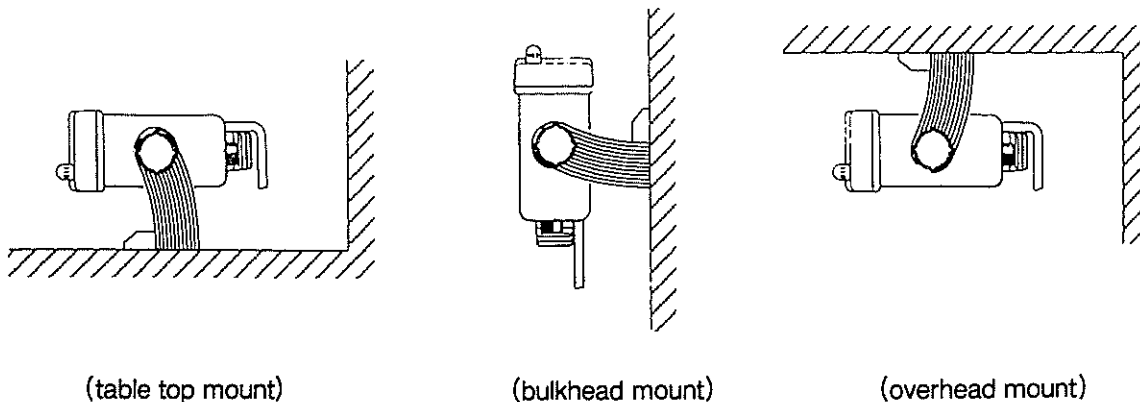

(table top mount)   (bulkhead mount)   (overhead mount)

Fig. 2-1 TYPICAL MOUNTING METHODS

2.3.2 Flush Mounting

In addition to the Typical Mounting Methods, the RAY45 may also be flush mounted using the optional Flush Mount kit (E46001). These kits are available from our Customer Service Department.

To flush mount the radio with the Flush Mount Kit, proceed as follows:

1) Select the location for the VHF. A clear, flat area, of sufficient height and width, having at least 6" depth behind the panel is required.

2) Unpack the Flush Mount kit and confirm that all hardware is present.

3) Place the trim ring at the desired location on the panel. Using the inside of the trim ring, trace a cutout guide. Remove the trim ring.

4) Drill a pilot hole inside of the cutout guide area.

5) Using an appropriate saw, cut along the outside of the cutout line.

6) Remove the yoke knobs and the bracket from the VHF cabinet. Check that the VHF will fit into the cutout area.

7) Install the power and antenna cables in the console.

8) Slip the trim ring onto the VHF from the rear.

9) Install the VHF using the clamps and hardware supplied in the kit. A suitable sealant may be used between the trim ring and console to prevent moisture entry. The trim ring should be secured to the console with the countersunk flathead screws.

10) Connect the power/external speaker and antenna cables.

CAUTION
Make sure there are no hidden electrical wires or other items behind the desired location before proceeding. Check that free access for mounting and cabling is available.
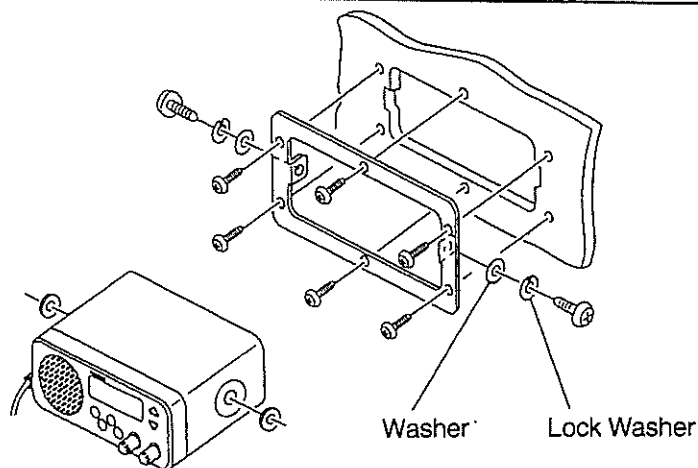

Washer   Lock Washer
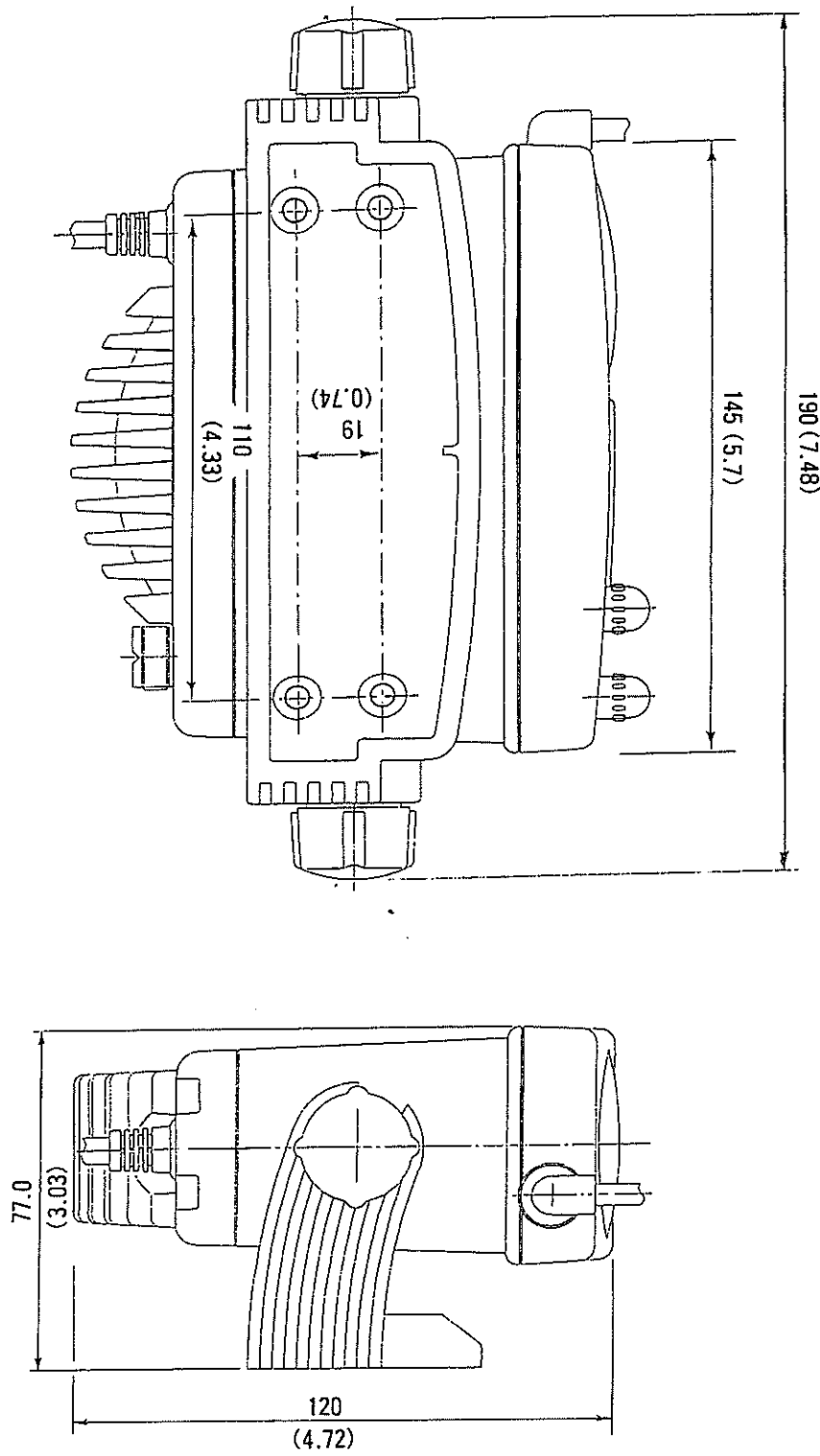
Fig.2-2 FLUSH MOUNTING

110
(4.33)

19
(0.74)

145 (5.7)

190 (7.48)

77.0
(3.03)

120
(4.72)

Fig. 2-3 OUTLINE AND MOUNTING DIMENSIONS

All dimensions are shown in (inches) and millimeters

2.4 ELECTRICAL CONNECTIONS

ANTENNA JACK   POWER/EXTERNAL SPEAKER CABLE
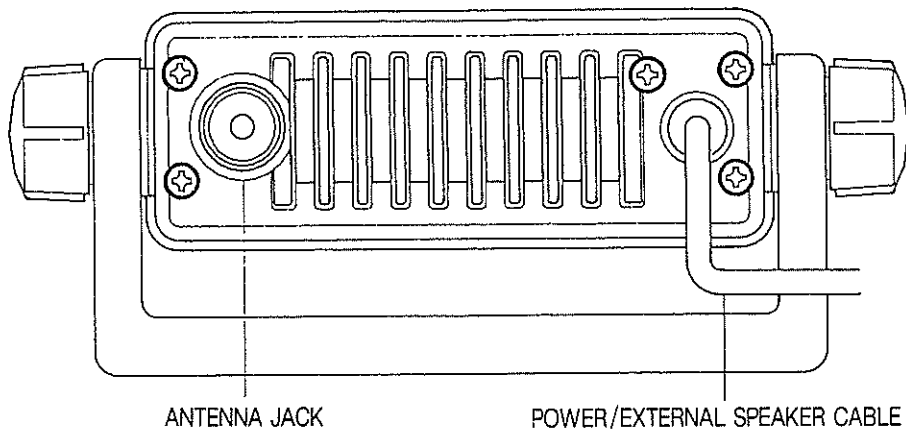
Fig. 2-4 REAR VIEW

CAUTION
DO NOT INSTALL THIS RADIO ON VESSELS WITH POSITIVE GROUND BATTERY SYSTEMS.

2.4.1 DC Power Connections

The power cable comes with external speaker attachments. The power/external speaker cable provided is 6 feet long and plugs into the 4 pin connector cable at the rear panel of the radio. The RED(+) wire with an in-line fuse(10 amps) and the BLACK(-) wire of the 4 pin connector cable are used for connecting the RAY45 to the ship's 12V DC power system.(Refer to Fig.2-5)

POWER/EXTERNAL
SPEAKER CABLE

RED
(DC INPUT+)
BLACK
(DC INPUT-)
YELLOW
(SPEAKER+)
GREEN
(SPEAKER-)

4PIN
CONNECTOR CABLE

Fig.2-5 POWER/EXTERNAL SPEAKER CABLE AND 4 PIN CONNECTOR CABLE

In most cases, the length of the supplied cable should be adequate to reach the DC power source. If additional wire length is required, the cable can be extended by adding more cable as necessary. However, for power cable runs longer than 15 f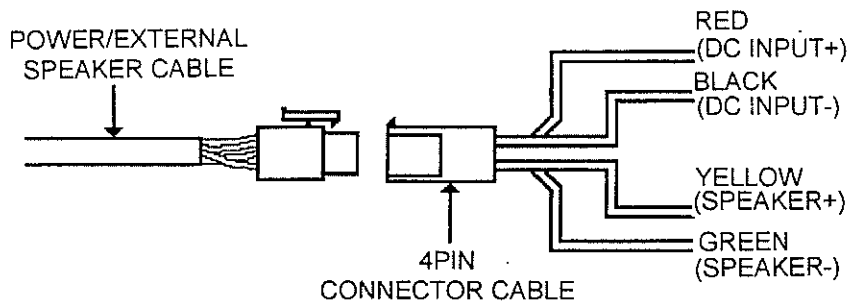eet, larger wire diameter size should be used to prevent line loss. Fig. 2-6 below provides recommended wire sizes to use for various cable run distances.
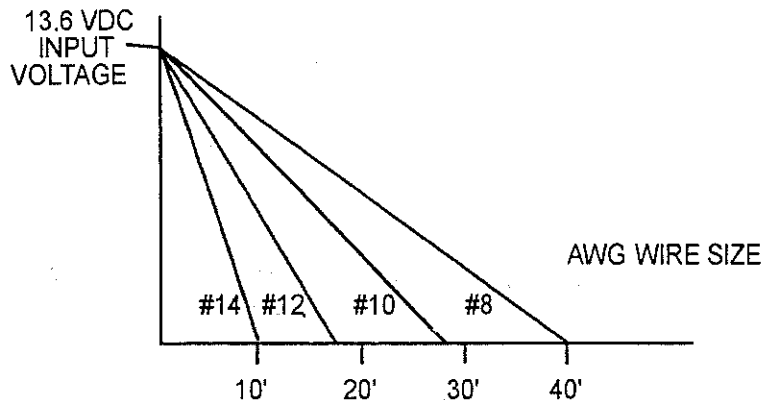

Fig. 2-6 POWER CABLE LENGTH

Your VHF radio should be connected to the nearest primary source of ship's DC power. A typical source may be a circuit breaker on the power panel or a fuse block located near the unit. When connecting to either of these sources, the circuit breaker or other in-line fuse should be rated at 10 amps.

It is recommended that terminal lugs be used to connect the power cable to the DC supply and that the lugs should be both **crimped and soldered**. This is very important in order to insure adequate current draw to the equipment. Intermittent operation may result if an insufficient connection is made to the power source. The connection terminals should be clean and with no sign of corrosion.

The RED (+) wire is connected to the positive terminal of the power source or battery. The BLACK (-) wire is connected to the negative (ground) of the power source or battery. Should the power polarity be inadvertantly reversed, the 10 amp. in-line fuse located in the RED (+) conductor will open. Check the input power leads for correct polarity with a VOM, reconnect the leads observing correct polarity, and replace the fuse. Be sure to use the same rate and type of fuse.

2.4.2 External Speaker Connections

The YELLOW (+) wire and GREEN (-) wire are used for connecting the RAY45 to an external speaker. (Refer to Fig. 2-5)

Three (3) watts of audio output power is provided for an external 4 ohm speaker. A suitable speaker can be purchased from your local marine dealer.

Connect the YELLOW (+) wire and GREEN (-) wire to the speaker observing polarity as it is marked on the speaker. When connected, the external speaker will function simultaneously with the internal speaker.

7

2.4.3 Antenna Connections

The coaxial cable from your VHF antenna is intended to be connected to the antenna jack on the rear chassis using a PL259 VHF-type connector. The antenna cable may be cut to desired length. If a longer cable length is required, RG-58 50-ohm coaxial or equivalent cable may be used for antenna runs up to a maximum of 50 feet. If the distance required is even greater, then we recommend using low loss RG-213 or equivalent cable for the entire run in order to avoid excessive losses in power output.

If the antenna connector is likely to be continuously exposed to the marine environment, a protective coating of silicon grease (similar to Dow Corning DC-4) can always be applied to the connector before mating it to the radio to help prevent poor contact. Any other extension or adapters in the cable run should also be protected by silicon grease and then wrapped with a weather-proofing tape.

2.4.4 Antenna Mounting Suggestions

The best radio in the world is useless without a good antenna location. Mounting the VHF antenna properly is very important because how it is mounted will directly affect the performance of your VHF radio. A standard VHF antenna which is designed for use aboard water craft should be used.

There are several factors to consider so as to maximize the effective communication range of the radio.

•Since VHF transmissions are essentially Line-of-Sight, mount the antenna at the highest possible location on the vessel and free of obstructions in order to obtain maximum range.

•Use an antenna with the highest possible gain characteristics.

•If you must extend the length of the coaxial cable between the antenna and the radio, use a cable designed for the least amount of power loss over the entire cable length.

•Keep the coaxial cable between the radio and antenna as short as possible.

2.4.5 Grounding

While special grounding is not generally required for VHF radiotelephone installations, it is a good marine practice to properly ground all electronic equipment to the ship's ground system. The RAY45 can be connected to ground by attaching a wire to the screw indicated in the drawing below and then to the nearest ship's ground connection point. The recommended wire to be used for grounding is #10 AWG.
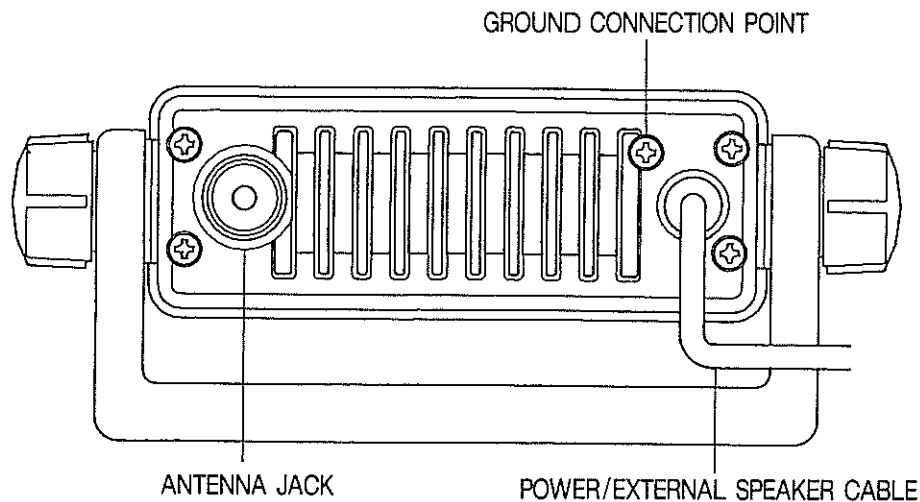
GROUND CONNECTION POINT

ANTENNA JACK   POWER/EXTERNAL SPEAKER CABLE

Fig. 2-7 TYPICAL GROUNDING METHODS

8

SECTION 3

OPERATIONS

3.1 INTRODUCTION

Your RAY45 has the capability to transmit on 53 and receive on 93 Marine VHF radiotelephone channels. There are channels that are FCC approved but may only be used by authorized stations for specific purposes, depending on the type of vessel (commercial or non-commercial). Refer to Table 3-1 on pages 14 and 15. These tables list all of the marine VHF channels available in your RAY45 for International and U.S. radiotelephone use. Full familiarization with this table is essential when selecting your channels. The International frequencies were agreed upon by the attending countries at the 1968 International Telecommunication Union meeting in Geneva and are in active use around the world. The U.S. channels are those channels authorized for use in the U.S.A. by the FCC.

3.2 CONTROLS AND LCD DISPLAY

Refer to Fig. 3-1 (page 10) for familiarization with the controls and mode display.

3.2.1 Controls

① VOLUME Control (On/Off)
Turns the radio On and Off and controls the Volume of the audio output to the speaker.

② [▲] [▼] Keys
The Up and Down keys are used to move the channel numbers up or down. The channel number can be increased or decreased once with each key press or will continue to increase or decrease the number as long as the key is held.

③ SQUELCH control
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.

④ [16 PLUS] Key
Used to select channel 16 immediately. This channel has been preset to channel 16 at the factory prior to shipment. Refer to section 3.3.2 (page 13) for instructions on how to change the 16 PLUS channel. The 16PLUS key on the microphone has the same function as the 16 PLUS key on the radio.

⑤ [WX] Key
When pressed puts the radio into the weather channel receiving mode. A "WX" will be displayed on the LCD along with the weather channel number (0-9). When in this mode, the transmitter is always disabled.

⑥ [MON/INT] Key
When pressed, puts the radio into the MONITOR mode and "MONITOR" is displayed on the LCD. In this mode, the radio will scan (monitor) 16 PLUS (priority) channel, a selected working channel, and a weather channel for the weather alert tone.

To select International channels, press and hold the MON/INT for 2 seconds. You will hear a "beep" and "INT" will appear on the display. This causes the synthesizer to program International channel frequencies. When pressed and held again for 2 seconds, you will again hear a "beep" and the synthesizer programs US frequencies. ("INT" indication disappears)

⑦ [1/25] Key
When pressed, alternately changes the transmitter output power from 1 watt ("1WATT" will be displayed) to 25 watts. ("1WATT" disappears)

⑧ PTT (Push-To-Talk) Switch
When pressed, puts the radio into the transmit mode and "TX" will be displayed on the LCD

All of the above keys will produce an audible "beep" when pressed.
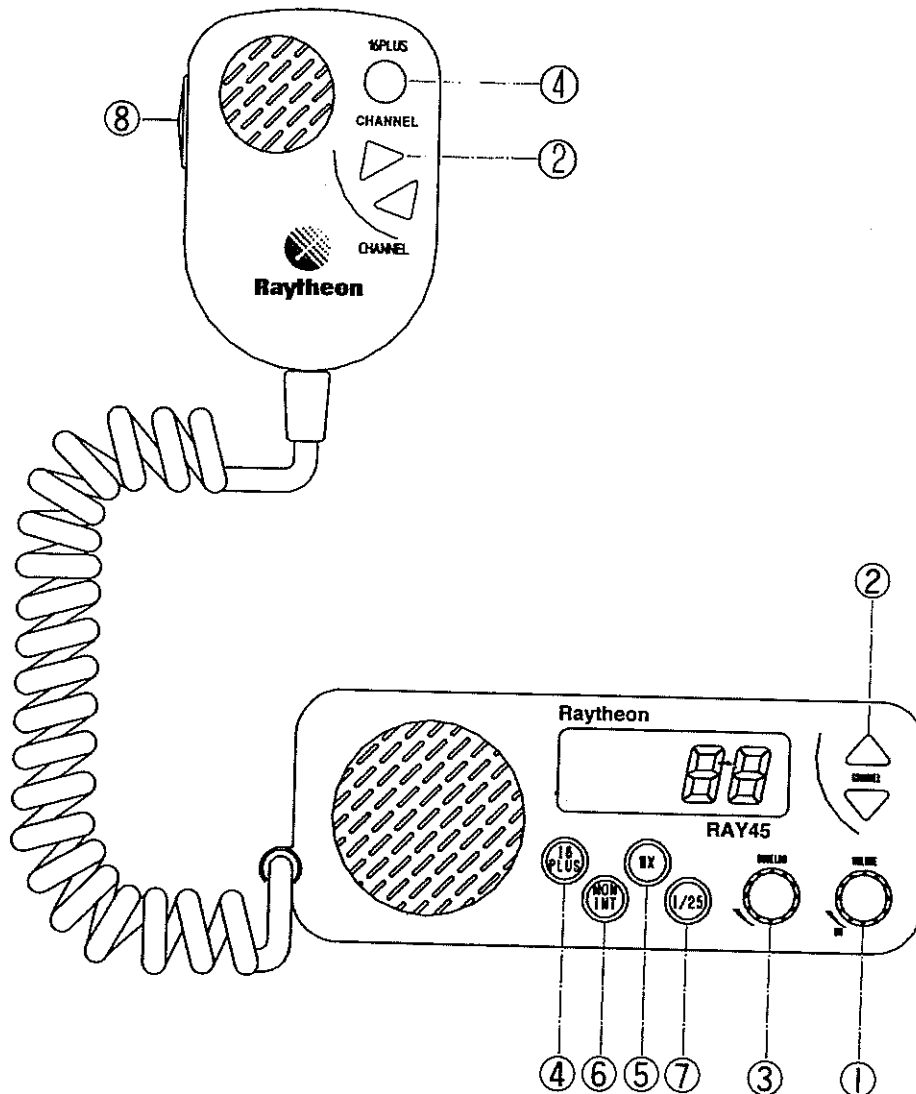
Fig. 3-1 LAYOUT OF CONTROLS

3.2.2 LCD Display

A number of characters appear on the LCD display in different locations. The following list describes the characters as well as when and where they will appear.
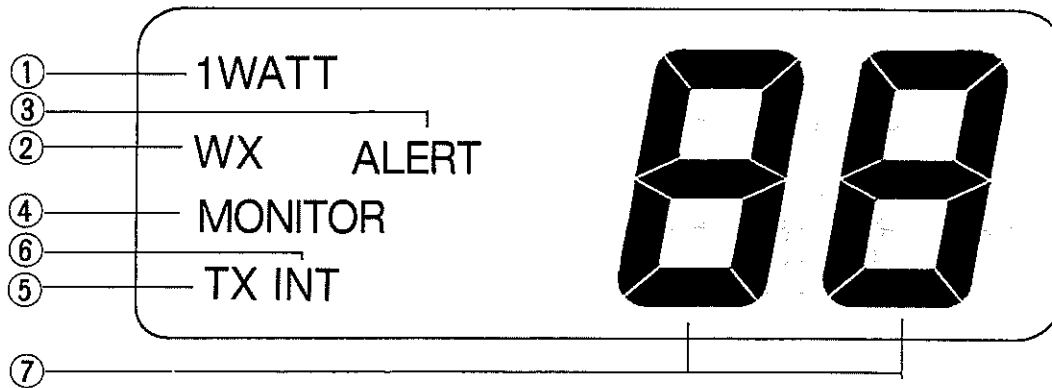
Fig. 3-2 LCD DISPLAY

① 1 WATT (High/Low Power): Will be displayed when the transmitter circuits are providing 1 watt of power to the antenna. When the transmitter is supplying 25 watts to the antenna, the "1 WATT" indication will be extinguished.

② WX (Weather): Will be displayed when the channel selected to be monitored is a weather channel.

③ ALERT (Weather Alert): Will blink when a Weather Alert Tone has been detected.

④ MONITOR: Will be displayed when the MON/INT key is pressed. This indicates the radio is in the MONITOR mode.

⑤ TX (Transmit): Will be displayed on the LCD when the Push-To-Talk (PTT) switch is depressed indicating the transmitter circuits are providing a signal to the antenna.

⑥ INT (International/USA): Will be displayed when International channels are programmed for use. "INT" is not displayed when US channels are programmed for use.

⑦ LCD Segments: Will display channel number in use.

11

3.3 OPERATING PROCEDURES

Specific operating procedures for the RAY45 are presented in this section. General information regarding correct marine channel usage may be found in the Appendix section. Refer to the Controls section beginning on page 9 for a thorough description of all RAY45 functions.

3.3.1 Turning the Power On

1) Rotate the ON/OFF/VOLUME control clockwise to turn the radio on.

NOTE

When the Power is turned on, the synthesizer automatically programs for USA channel frequencies and selects the calling channel 16. (Refer to 16 PLUS operation to change this channel.)

Setting the Volume

1) Rotate the SQUELCH control fully counterclockwise. Background noise will be heard.
2) Rotate the VOLUME control for the desired volume level.

Setting the Squelch

1) Rotate the SQUELCH control slowly clockwise until the background noise ceases.

Setting the Power Output

1) Simply press the "1/25" key to toggle between 1 watt output or 25 watt output. When "1 WATT" is displayed, the output power is 1 watt. If "1 WATT" is extinguished, 25 watts is being output. Which one to use is dependent upon the distance of transmission and transmitting conditions. In certain US harbors and on certain channels, the FCC requires the power to be limited to 1 watt. On these "required" channels, the radio automatically selects the 1 watt power output when the channel is selected.

Selecting the Channel

1) To select the appropriate channel, press the [▲] or [▼] channel select keys. Refer to Table 3-1 to select your "working" channel.

To Transmit

1) Select the desired mode (INT or USA) by holding the MON/INT key for more than 2 seconds. Then simply press the Push-To-Talk switch and speak into the microphone using a clear normal voice.

2) When the power is initially turned on, simply press the Push-To-Talk switch. The radio will be ready for transmission on CH 16 or a user selected priority channel (16 PLUS).

The RAY45 is designed to meet the new FCC Rules Part 80.203, which states, if the Push-To-Talk switch is pressed continuously for over five minutes, transmission is forcibly inhibited. If this occurs, audible beeps will sound and "to" (time out) blinks on the LCD until the Push-To-Talk switch is released. After releasing the Push-To-Talk switch, the radio will return to normal operation.

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┌─────────────────────────────────────────────────────────┐
│                          NOTE                             │
│  Initial communication contacts are usually made over channel 16 as all │
│  ships and shore stations monitor this channel.  Then a shift to a working │
│  channel will be necessary.                               │
└─────────────────────────────────────────────────────────┘
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To Select a Weather Channel

1) Press the WX key, then the Up [▲] or Down [▼] key to select the desired weather channel from 0 to 9 When this mode is selected, the transmitter is always inhibited.

2) If a weather alert signal is received on your selected WX channel (when in the Monitor Mode) there is a five-second audible alarm generated. To cancel the audible alarm, simply press any key.

3.3.2 The 16 PLUS (priority) Channel

The 16 PLUS channel has been preset to channel 16 prior to shipment from the factory, but the 16 PLUS channel can be changed freely, with the exception of all weather channels.

1) Press the Up [▲] or Down [▼] key to select the desired channel. Then press and hold the 16 PLUS key for 3 seconds. An audible beep tone will confirm that the selected channel is stored in memory as the 16 PLUS channel.

2) To set channel 16 as the 16 PLUS channel again, repeat step 1 for channel 16.

3.3.3 Monitor Mode

Before entering the Monitor Mode you must first select the WX channel you wish to monitor for the weather alert tone. Next, you must also select a working channel to be monitored for traffic. For this example, we will use channel 83 as our working channel and WX2 as our weather channel. Now simply press the MON/INT key and the radio will begin to scan the channel designated for 16 PLUS, 83, and WX2, repetitively. The 16 PLUS channel programmed into the radio is automatically selected as one of the monitored channels. To cancel the Monitor mode, press any key except "1/25" key

Working Channel
If a signal is received on CH 83, the scan will stop on CH83, but will continue to monitor 16 PLUS and the selected weather channel every 7 seconds.

16 PLUS (priority) Channel
If while scanning, a signal is received on the designated 16 PLUS channel, the scanning will stop on 16 PLUS as long as the signal is being received. If the signal ceases for more than five seconds, the scanning will continue.

Weather Channel
Until a weather alert tone signal is received on WX2, the scan will stop on WX2 briefly, but will not give any audio output. When a weather alert tone (1050 Hz) is received, the monitor will stop and an audible alarm will sound. To silence the alarm, simply push any key.

3.3.4 Master Reset

To perform a master reset, press and hold the 16 PLUS key while turning the radio on, "CL" will then appear on the LCD. This procedure clears memory and defaults the 16 PLUS channel to channel 16.

3.3.5 RAY45 Marine Channels and Their Usage

CAUTION
The transmitter of the RAY45 is disabled when channel 15 or WX0-WX9 is displayed.

CHANNEL DESIG.	FREQUENCY (MHZ)			TYPE OF TRAFFIC	FUNCTION	
	TX	RX (USA)	RX (INT'L)		SHIP TO SHIP	SHIP TO SHORE
01#	156.050	156.050	160.650	-	-	-
02#	156.100	156.100	160.700	-	-	-
03#	156.150	156.150	160.750	-	-	-
04#	156.200	156.200	160.800	-	-	-
05	156.250	156.250	160.850	Port Operations	Yes	Yes
06	156.300	156.300	156.300	Intership Safety	Yes	No
07	156.350	156.350	160.950	Com'l	Yes	Yes
08	156.400	156.400	156.400	Com'l	Yes	No
09	156.450	156.450	156.450	Call & Ship/Ship	Yes	Yes
10	156.500	156.500	156.500	Com'l & Ship/Ship	Yes	Yes
11	156.550	156.550	156.550	Com'l & Ship/Ship	Yes	Yes
12	156.600	156.600	156.600	Port Operations	Yes	Yes
13**	156.650	156.650	156.650	Nav. Ship/Bridge	Yes	Yes
14	156.700	156.700	156.700	Port Operations	Yes	Yes
15#	-	156.750	156.750	Environmental	-	-
16	156.800	156.800	156.800	Emerg/Calling	Yes	Yes
17*	156.850	156.850	156.850	State Controlled	Yes	Yes
18	156.900	156.900	161.500	Com'l	Yes	Yes
19	156.950	156.950	161.550	Com'l	Yes	Yes
20	157.000	157.600	161.600	–	No	Yes
21(CG)	157.050	157.050	161.650	Coast Guard	Yes	Yes
22(CG)	157.100	157.100	161.700	Coast Guard	Yes	Yes
23(CG)	157.150	157.150	161.750	Coast Guard	Yes	Yes
24	157.200	161.800	161.800	Public Corresp.	No	Yes
25	157.250	161.850	161.850	Public Corresp.	No	Yes
26	157.300	161.900	161.900	Public Corresp.	No	Yes
27	157.350	161.950	161.950	Public Corresp.	No	Yes
28	157.400	162.000	162.000	Public Corresp.	No	Yes
60+	156.025	156.025	160.625	-	-	-
61+	156.075	156.075	160.675	-	-	-
62+	156.125	156.125	160.725	-	-	-
63	156.175	156.175	160.775	Com'l	Yes	Yes
64+	156.225	156.225	160.825	-	-	-

Table 3-1

* 1 watt only

** 1 watt initially. User can override to high power (25 watts) via front panel controls.

\# The transmitter is automatically disabled when channels 1, 2, 3, and 4 for USA are selected and when 15 for USA and International are selected.

\+ Assigned by the Canadian Government, proper authorization must be ensured prior to use.

CAUTION
Operation on channels not designated for use by your classification of craft or on International Channels within the US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

CHANNEL DESIG.	FREQUENCY (MHZ)			TYPE OF TRAFFIC	FUNCTION	
	TX	RX (USA)	RX (INT'L)		SHIP TO SHIP	SHIP TO SHORE
65	156.275	156.275	160.875	Port Operations	Yes	Yes
66	156.325	156.325	160.925	Port Operations	Yes	Yes
67**	156.375	156.375	156.375	Com'l	Yes	No
68	156.425	156.425	156.425	Non Com'l	Yes	Yes
69	156.475	156.475	156.475	Non Com'l	Yes	Yes
70#	-	156.525	156.525	DSC	Yes	Yes
71	156.575	156.575	156.575	Non Com'l	Yes	Yes
72	156.625	156.625	156.625	Non Com'l	Yes	No
73	156.675	156.675	156.675	Port Operations	Yes	Yes
74	156.725	156.725	156.725	Port Operations	Yes	Yes
75#	-	156.775	156.775	-	-	-
76#	-	156.825	156.825	-	-	-
77*	156.875	156.875	156.875	Port Operations	Yes	No
78	156.925	156.925	161.525	Non Com'l	Yes	Yes
79	156.975	156.975	161.575	Com'l	Yes	Yes
80	157.025	157.025	161.625	Com'l	Yes	Yes
81	157.075	157.075	161.675	Coast Guard	Yes	Yes
82	157.125	157.125	161.725	Coast Guard	Yes	Yes
83	157.175	157.175	161.775	Coast Guard	Yes	Yes
84	157.225	161.825	161.825	Public Corresp.	No	Yes
85	157.275	161.875	161.875	Public Corresp.	No	Yes
86	157.325	161.925	161.925	Public Corresp.	No	Yes
87	157.375	161.975	161.975	Public Corresp.	No	Yes
88	157.425	157.425	162.025	Com'l	Yes	No

Table 3-1 (Continued)

* 1 watt only

** 1 watt initially. User can override to high power (25 watts) via front panel controls.

\# The transmitter is disabled when channels 75 and 76 are selected. Channel 70 is now used for DSC calling only, therefore transmission on this channel is disabled on this radio.

CAUTION

Operation on channels not designated for use by your classification of craft or on International Channels within US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

RAY45 Weather Channels and Frequencies

CHANNEL	FREQUENCY (MHZ)	TYPE OF TRAFFIC	FUNCTION-SHIP TO SHORE
WX0	163.275	NOAA Weather	Receive Only
WX1	162.550	NOAA Weather	Receive Only
WX2	162.400	NOAA Weather	Receive Only
WX3	162.475	NOAA Weather	Receive Only
WX4	162.425	NOAA Weather	Receive Only
WX5	162.450	NOAA Weather	Receive Only
WX6	162.500	NOAA Weather	Receive Only
WX7	162.525	NOAA Weather	Receive Only
WX8	161.650	Canadian Weather	Receive Only
WX9	161.775	Canadian Weather	Receive Only

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The RAY45 can be considered as consisting of two major sections. They are:

- The Control Circuitry(consisting of the front panel controls, the LCD display, control CPU).

- The Transmitter/Receiver/PLL circuits.

4.2 THE CONTROL SECTION

The heart of the control section is the CPU, IC201, located on the display PCB. The CPU controls all of the following items:

- Controls the Squelch circuit by detecting a busy signal from the second IF circuit IC4.

- Generates a beep tone when a key is activated on the keyboard.

- Mutes the transmitter modulation circuit when receiving.

- Controls the output power of the transmitter High/Low.

- Controls the dividing ratio N of the PLL circuit.

- Switches On/Off the transmitter power.

- Mutes AF audio.

- Detects a weather alert signal (when in Monitor Mode).

- Controls the LCD display.

4.3 THE TRANSMITTER/RECEIVER/PLL SECTION

In reading through the following circuit descriptions, it may be helpful to refer to Figure 4-1 Block Diagram of the TX/RX/PLL circuits.

4.3.1 PLL (Phase Lock Loop Circuit)

The PLL circuit is the frequency synthesizer in the RAY45

The reference frequency of 12.8 MHz is provided by crystal XTL1 and IC3. IC3 contains the reference oscillator (12.8 MHz) circuit, the phase comparator, the program counter and the phase detector. The 12.8 MHz reference signal is divided by 512 in the program counter in IC3 to obtain a 25 KHz reference signal. The dividing ratio is determined by CPU IC201. The VCO output from oscillator Q4 is amplified by buffer amplifier Q3, and returned to IC3 and is divided by the dividing ratio N to obtain a 25 KHz signal. N for 1N in IC3 is determined by CPU IC201. Both of these 25KHz signals are fed into the phase comparator circuit of IC3.

The phase detected signal, obtained by comparing the phase difference between these two signals, is applied to LPF between pins 11 and 12 of IC3 to get a DC voltage correlated with the phase difference.

The DC voltage acts on the VCO to make the two 25 KHz signals the same phase. When this condition is met, the PLL circuit is locked. If the two signals have a large phase difference, the PLL is unlocked. In this condition, the unlocked signal is fed to CPU IC201 from IC3 and the transmitter is compelled to stop.

The VCO output fom Q4 is fed to the TX amplifier Q2 and the first RX mixer Q19 through buffer amplifier Q3.

4.3.2 Transmitter Circuit

A signal from the microphone is fed to a pre-emphasis operations amplifier IC3, and modulates VCO (Q4) through active LPF IC2.

The VCO output signal from Q4 is sent to the RF power amplifiers IC1, Q1 and Q2 through buffer amplifier Q3. The RF signal from IC1 is fed to the antenna through a low pass filter.

The DC voltage correlative to the RF output is detected by D2 and Q9, amplified by Q24 and fed to IC1. The output voltage from IC1 controls the RF power to keep the RF output at a constant level.

4.3.3 Receiver Circuit

1) RF Circuit
   The signal from the antenna passes through the single tuned band pass filter,and is amplified by RF amplifier Q17, and is fed into a triple tuned band pass filter. The signal is then mixed by Q19 (first mixer) and produces the first IF signal of 21.6 MHz. This signal is sent to a crystal filter (21.6MHz) and first IF amplifier Q20, mixed by IC4, the second mixer, and becomes an audio signal after detection.

2) AF Circuit
   The AF signal from IC4 is amplified by IC5 to drive the speaker while the receiver is in the squelched condition. Muting control of IC5 is carried out by the CPU IC201.

3) Weather Alert Tone Detecting Circuit
   If a weather alert tone is included in the AF signal from IC4 while receiving the weather service broadcast, IC6 detects it and notifies an alert condition to CPU IC201.

4) IF Circuit
   The output of the first IF amplifier Q20 is fed into IC4. IC4 contains the second mixer, second local oscillator, 455 KHz amplifier, quadrature detector and DC switching amplifier.

   A 455 KHz ceramic filter is installed between pins 3 and 5 of IC4 to examine the selectivity of this unit.
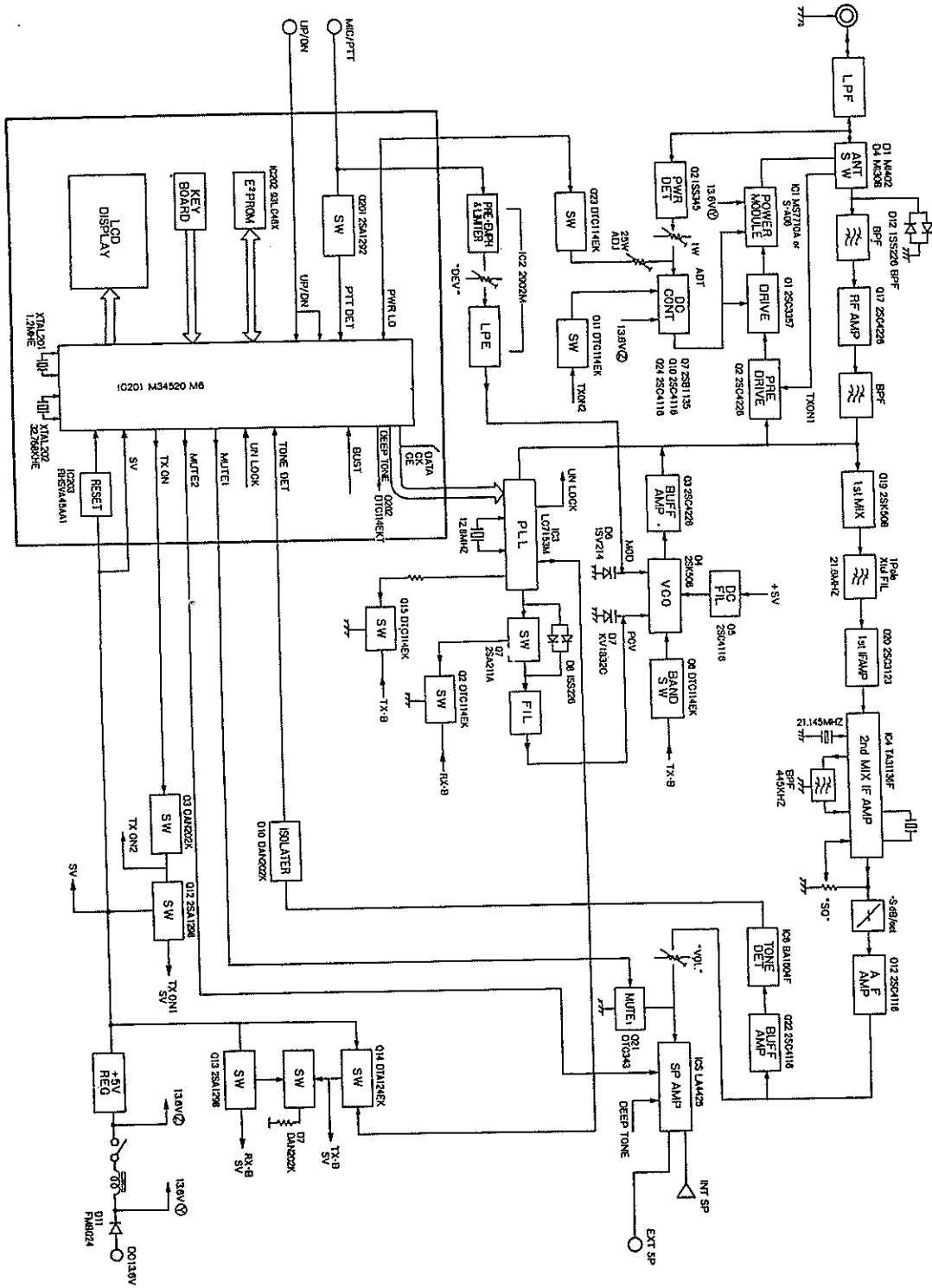
17

BLOCK DIAGRAM

fig. 4-1 RAY45 Block Diagram

18

4.4 SPECIFICATIONS

Transmitter

Channels	53 US/International
Frequency Stability	±10PPM (±0.001%) (-20°C to +50°C)
Frequency Range	156.025 to 157.425 MHz
Channel Spacing	25 KHz Increments
Power Output	25 Watts switchable to 1 Watt into 50 Ohms at 13.6 Vdc
Modulation	Frequency modulated 16F3 (±4.5KHz at 1000Hz)
Modulation Audio Response	Shall not vary +1/ -3 dB from true 6 dB pre-emphasis from 300 to 2500Hz,reference 1000 Hz.Audio frequences 3-20 KHz shall be attenuated (at 1 KHz by 60 log f/3 dB.Above 20KHz by 50dB)
FM Hum & Noise Level	Greater than -40dB below audio
Audio Distortion	Less than 10% at 1KHz for ±3KHz deviation
Spurious & Harmonic Emssions	Attenuated at least 43 +10 log Po (below rated radiated carrier power)per FCC Rules Parts 2 & 80
Antenna Impedance	50 Ohms
Transmitter Protection	Shall survive open or short circuit of antenna system without damage(10 min.test)

Receiver

Channels	93(includes 10 weather channels)
Frequency Range	156,025 to 163.275 MHz in 25 KHz increments
Frequency Stability	±10 PPM (±0.001%) from -20°C to +50°C
Usable Sensitivity	0.3μV for 12dB(SINAD)
Squelch Sensitivity Threshold	0.2μV or better 1.0μV full squelch
Adjacent Chl Rejection	Greater than 65dB
Spurious Image Rejection	Greater than 65dB
Intermodulation Rejection	Greater than 65dB

19

Audio Output	3 Watt or more at 10% or less distortion into 4 Ohm load
Hum & Noise in Audio	Less than -40dB

Operating Requirements

Input Voltage	13.6 Vdc±15%(11.6 to 15.6Vdc)
Current Required Transmit	Less than 5.8 amp at 25 Watts Less than 1.5 amp at 1 Watt
Operating Temperature	-20℃ to +50℃
Duty Cycle	Continuous, 80%receive, 20%transmit (max 10min, @25℃)
Humidity	100% at 50℃ for 8hours

Radio Dimensions

Height	54 mm (2.2inches)
Width	145 mm (5.7 inches)
Depth	120 mm (4.72 inches)
Weight	Approx. 750g (1.7 lb)

SECTION 5

MAINTENANCE

5.1 GENERAL

The purpose of this section is to provide servicing instructions to the service technician. The RAY 45 is designed to provide long periods of trouble-free operation.It is recognized,however,that environmental and other factors may result in a need for occasional service.

5.1.1 How to contact Raytheon

Technical Support: 1-800-539-5539 ext.2444 or (603)647-7530 ext.2444

You may reach our Technical Support Department Monday to Friday 8:15 AM to 5:00 PM Eastern Standard Time. Our Technical Support Specialists are available to answer installation, operation, and trouble-shooting questions about your Raytheon unit.Our Technical Support Department may also be reached via the Internet. Questions may be addressed directly to:
  rmc_tech_raytheon@raymarine.com.
Or visit the Raytheon Electronics World Wide Web site:
  www.raymarine.com

Accessories and Parts 1-800-539-5539 ext.2333 or (603) 647-7530 ext.2333

Many Raytheon accessory items and parts are available through your authorized Raytheon dealer. However if you are in need of an item not availavble through your retailer feel free to contact our Customer Service department Monday to Friday 8:15 AM to 5:00 PM Eastern Standard Time. If you are uncertain about what item to choose for your Raytheon unit please contact our Technical Support Department Prior to placing your order at 1-800-539-5539 ext.2065.

Product Repair and Service

In the unlikely event your Raytheon unit should develop a problem please contact the Raytheon dealer from where the unit was purchased.Your Raytheon dealer is best equipped to handle your service needs. Service may also be obtained by returning your unit to Raytheon's Product Repair Center at the address below:

  Raytheon Product Repair Center
  676 Island Pond Road
  Manchester NH 03109-5420

A postcard acknowleding we have received your unit will be mailed to you upon arrival at our Product Repair Center.We will do everthing possible to return your unit as quickly as possible. To inquire about the status of your unit our Product Repair Center may be reached by calling 1-800-539-5539 ext.2118.
Please keep a record of the serial number of your unit and have this number ready when you call.

In Europe, Raytheon equipment may be returned for service at the following address:

> Raytheon Marine Ltd.
> Anchorage Park,Portsmouth,Hampshir
> PO3 5TD.England
> ATT.Service Department

5.2 PREVENTATIVE MAINTENANCE

The procedurse listed below for the RAY 45 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 connectors and the condition of any soldered connections.
2. Fuse holders and their connections may be subject to corrosion which can increase circuit resistance. The in-line fuse should be removed from its holder, inspected and cleaned of any accumulation of dirt or corrosion.
3. The radio front panel should be cleaned with a tissue or soft non-abrasive cloth.Care should be exercised when cleaning any plastic surface to prevent scratching, especially the LCD window area. Mild soap and water my be used in stubborn cases. The radio case should be cleaned of any salt spray or dust as often as necessary.

CAUTION

Do not use solvents or other chemicals for cleaning this equipment.

NOTE: The following alignment procedures have been provided in this manual to aid FCC licensed technicians and service personnel only.

5.3 ALIGNMENTS AND SERVICE

This transceiver is completely aligned at the factory and does not require any adjustments at installation. The test equipment listed below are used for the test setup shown in Fig 5-1.This test setup is used either part or in total during the following adjustments.

TEST EQUIPMENT
1. DC Power Supply (20V,10A)set at 13.6Vdc
2. RF Power Meter (40W,50ohn,150-200 MHz)
3. RF Signal Generator (50ohm Output,150-200MHz)
4. FM Linear Detector (FMLD) or Deviation Monitor 150-200MHz
5. Frequency Counter
6. Digital Voltmeter (DC Voltmeter)
7. Oscilloscope (any oscilloscop accurate for audio signal tracing)
8. SINAD Meter
9. Distortion Meter
10. Toggle Switch (for use as a PTT switch)
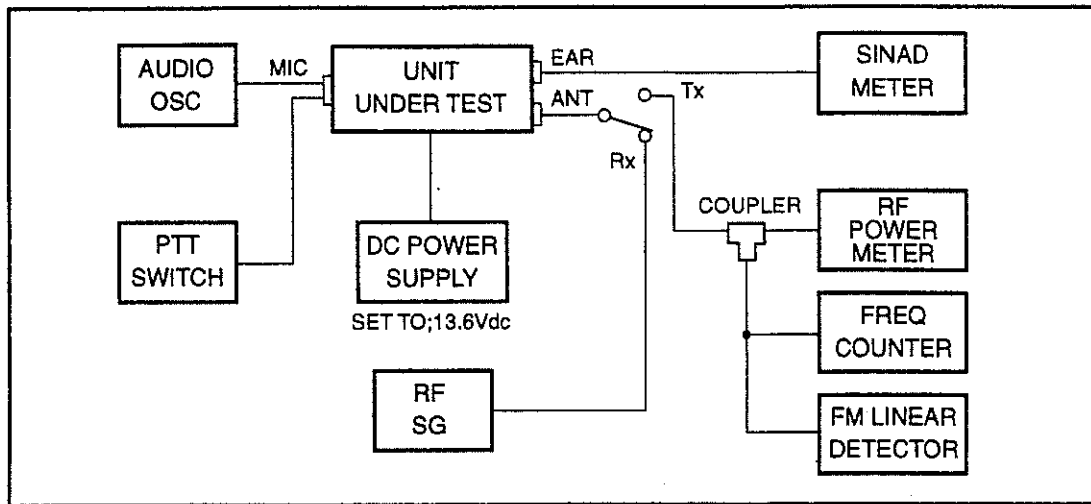11. Coaxial Switch for TX/RX antenna switching

Fig. 5-1   TEST SETUP

5.3.1 PLL Adjustment (TRANSMITTER/RECEIVER)

1) Connect the power supply (13.6 V,10 A)to the power line and the PTT switch to the micro-
   phone terminal.
2) Connect a digital voltmeter or high impedance tester (positive lead to TP1,negative to
   ground) and adjust T1 on the RF module as shown in Table 5-1(See Fig 5-2)

Sequence	Item	Condition	Adj. point	Adj. volt.
1	TX	transmit CH.60 USA	T1	3.5 ± 0.1 Vdc
2	RX	receive CH.60	---	check for 1.65±0.3Vdc
3	RX	receive CH.WX0	---	check for 3.4±0.3Vdc

Table   5-1

5.3.2 Frequency Adjustment (TRANSMITTER)

1) Connect the coupler output to a frequency counter, set the radio on CH16(156.800MHz),
   key the transmitter, and read the indication on the frequency counter.
2) Adjust trimmer capacitor CV1 on the RF module for the desired frequency(156.800MHz)
   ±200 Hz on the frequecy counter.

5.3.3 Modulation Adjustment (TRANSMITTER)

1) Connect the coupler output to a FM linear detector.
   Connect an audio oscillator to the microphone connector and key to the transmitter,
2) Set the audio oscillator output to—20 dBm,300 Hz and adjust RV 3 on the RF module for a
   deviation of 4.5 KHz ±300 Hz.
3) Set the audio oscillator output to 43 dBm,1 KHz and read the deviation meter (±2.8 KHz
   —±3.2 KHz).

23

5.3.4 Power Output Adjustment (TRANSMITTER)

1) Connect a RF power meter to the antenna connector through the coupler. Key the transmitter, and adjust RV1 and RV2 on the main PCB as shown in Table 5-2.

Sequence	Condition	Adj. Point	Target Power
1	13.6 VDC LOW PWR TX	RV1 Low Power	0.9 W +/- 0.05 W (limit 1.0 W)
2	13.6 VDC HI PWR TX	RV2 High Power	24 W +/- 0.5 W (limit 25W)

Table 5-2

5.3.5 RF Sensitivity Adjustment (RECEIVER)

1) Connect an RF signal generator to the antenna connector and a SINAD meter to the external speaker line.

2) Set the deviation of the RF signal generator to 1 KHz +/- 3 Hz.

3) Set the output level of the RF signal generator and adjust T2 - T6 on the RF module as shown in Table 5-3.

Sequence	Condition	Adj. Point	Target Level
1	CH. 88 (157.425 MHZ) SG output: 60dBu	T2 - T6	Max. Sensitivity
2	CH. WX0 SG output: -6dBu	T2 - T6	Over 12 dB SINAD

Table 5-3

5.3.6 Weather Alert Frequency Adjustment (RECEIVER)

1) Connect an RF signal generator to the antenna connector.
Set the RF signal generator as follows:

- Frequency: 162.550 Mhz with no modulation

- Output level: 60 dBµ

2) Select the weather channel WX1.

3) Connect a frequency counter to TP3 on the MAIN PCB and adjust VR4 to obtain 1050 kHz ±5 Hz on the frequency counter.

5.4 TROUBLESHOOTING GUIDE

Table 5-4 provides a general troubleshooting chart for use by a technician to isolate circuitry failures to specific functional areas within the VHF radio.

```
┌─────────────────────────────────────────────────────────────────────┐
│                              NOTE                                     │
│  Micro-components within the radio are generally not field replaceable.│
│  Therefore repairs to the radio typically go down to the PC board     │
│  level only.  A replacement parts list for the  RAY45                 │
│  can be found in Section 6.                                           │
└─────────────────────────────────────────────────────────────────────┘
```

Item Number	Symptom	Possible Cause
1	Unit does not turn on	a. Defective power switch b. 10 amp. fuse in power line open c. Diode D11 open d. Noise filter L15 open e. Capacitor C119 and C120 shorted f. Defective regulator IC7 (5V)
2	No sound with AF signal applied to pins 1 and 2 of IC6	a. Defective internal speaker b. Defective IC5 and/or associated components
3	No sound with AF signal applied to volume control	a. Defective volume control b. Defective mute circuitry (IC201)
4	Squelch circuit inoperative	a. Check squelch control b. Defective IC4 and/or associated circuitry between pins 7 and 9
5	No receive (RX)	a. Defective regulators IC7 (5V) b. Defective Q13 (RX B+) c. Check IC4 audio output voltage at pin 9 d. Defective AF amplifier Q21 e. Defective mute circuitry IC201 f. Check XLT2 output for 21.145 MHz signal g. Check 21.6 MHz output of first mixer Q19 h. Check 21.6 MHz output of ceramic filters FIL1 i. Check 21.6 MHz output of first IF amplifier Q20 j. Check 455 KHz signal from ceramic filter FIL2 k. Failure of VCO circuit (Q4, Q3, and/or PLL IC3) l. Defective CPU (IC201)
6	Low receiver sensitivity	a. Check antenna and connector for possible corrosion or bad connection b. Failure of the output from Q17, Q19, Q20, and/or IC4 c. Check the output level of VCO per para. 5.3.1

Table 5-4 TROUBLESHOOTING CHART

Item Number	Symptom	Possible Cause
7	CPU inoperative	a. Turn off the power once, and try again b. Check for CPU clock frequencies on pins 22, 23, 26, and 27 of IC201 c. If clock frequency is not present, check for +5VDC line
8	Display malfunction	a. Check the interconnection to the LCD display b. Inoperative CPU
9	No transmit (TX)	a. Defective PTT switch b. Defective regulators IC7 (5V) c. Defective Q12 (TX +B) d. Check power transmit cuircuit (Q1,Q2, and/or IC1) e. Failure of VCO circuit (Q4 and /or Q3) or PLL IC3 f. Check PLL control voltage for 3.5 VDC at TP1 on channel 60. g. Failure of talk detection circuit (IC201)
10	Low RF power output	a. Check RF power output from IC1. If it checks good, check the triple Pi type network conponents (C2-6, L1-3, etc.) and antenna switching diode (D4). If not good then check the voltage level outputs of the drive amplifiers Q1 and Q2 as well the associated circuitry b. Check power control circuit (Q24, Q9, Q10) and IC4
11	Poor or no modulation	a. Check VCO output frequency at pin 14 of PLL IC PLL phase detector output at pin 12 of PLL IC3 and associated circuitry b. Check 12.8 MHz crystal (XLT1)
12	PLL output frequency or level incorrect	a. Check frequency of 12.8 MHz crystal (XLT1) b. Check the frequency input at pin 14 of IC3 and verify the transmit frequency

Table 5-4 (Continued)

6.1 PARTS L

CKT, SY

D1,4
D2
D3
D5
D6
D7
D8
D9
D10
D11

FL101
F901,F!
F905
F906

IC1
IC2
IC3
IC4
IC5
IC6
IC7

Q1
Q2
Q3
Q4
Q5
Q6,8,11,
Q7
Q9
Q10

SECTION 6

PARTS LIST AND DRAWINGS

6.1 PARTS LOCATION LIST

MAIN PCB ASSEMBLY SECTION

CKT, SYMBOL	DESCRIPTION	PART NO.
	Main PCB Assembly	G623681-1
D1,4	Ant Sw, M1308	
D2	RF Power Det, ISS345	
D3	--------------------	
D5	RF Sw, ISV128	
D6	Mod/Vari/Cap, ISV214	
D7	VCO/Vari/Cap, KV1832C	
D8	Sw, ISS226	
D9	Sw, DAN202	
D10	Isolator, DAN202	
D11	Isolator, FMBG24	
FL101	Xtal, 32.768 Khz	
F901,F907	Xtal, MF21.6-RB	
F905	Xtal, 21.145 Khz	
F906	Xtal, 12.8 Mhz	G263479-55
IC1	TX Power Module, M57710A (or S-AV6)	1032698-85
IC2	OP Amp, 2902M	
IC3	PLL IC, LC7153M	
IC4	FN IC, TA31136FN	
IC5	AF Power Amp, LA4485	G263720-10
IC6	Tone Detector, BA1604	
IC7	+5V Regulator, 78M05	
Q1	TX Driver, 2SC3357	
Q2	TX Pre-Driver, 2SC4226	
Q3	Buff Amp, 2SC4226	
Q4	VCO, 2SK508	
Q5	DC Fil, 2SC4116	
Q6,8,11,15,23	Sw, DTC114EK	
Q7	Sw, 2SA811A	
Q9	DC Control, 2SB1185	
Q10	DC Control, 2SC4116	

MAIN PCB ASSEMBLY SECTION (CON'T)

CKT, SYMBOL	DESCRIPTION	PART NO.
Q12,13	Sw, 2SA1298	
Q14	Sw, DTA124EK	
Q16,21	AF Sw, DTC343	
Q17	RF Amp, 2SC4226	
Q18,22	AF Amp, 2SC4116	
Q19	First Mixer, 2SK508	
Q20	First IF Amp, 2SC3123	

CPU PCB ASSEMBLY SECTION

CKT, SYMBOL	DESCRIPTION	PART NO.
	CPU PCB Assembly	G623681-2
H200	LCD, 211	G623681-16
IC201	CPU, M34520M6	
IC202	EEPROM, 93LC46X	
IC203	Reset, RH5VA45AA	
PL-201	Pilot Lamp, 93 (14V)	G263720-24
Q201	Sw, 2SA1298	
Q202	Sw, DTC124EKT	

VOLUME/SQUELCH PCB ASSEMBLY

CKT, SYMBOL	DESCRIPTION	PART NO.
	Volume/Squelch PCB Assembly	G623681-3

RAY45 ASSEMBLY DRAWING
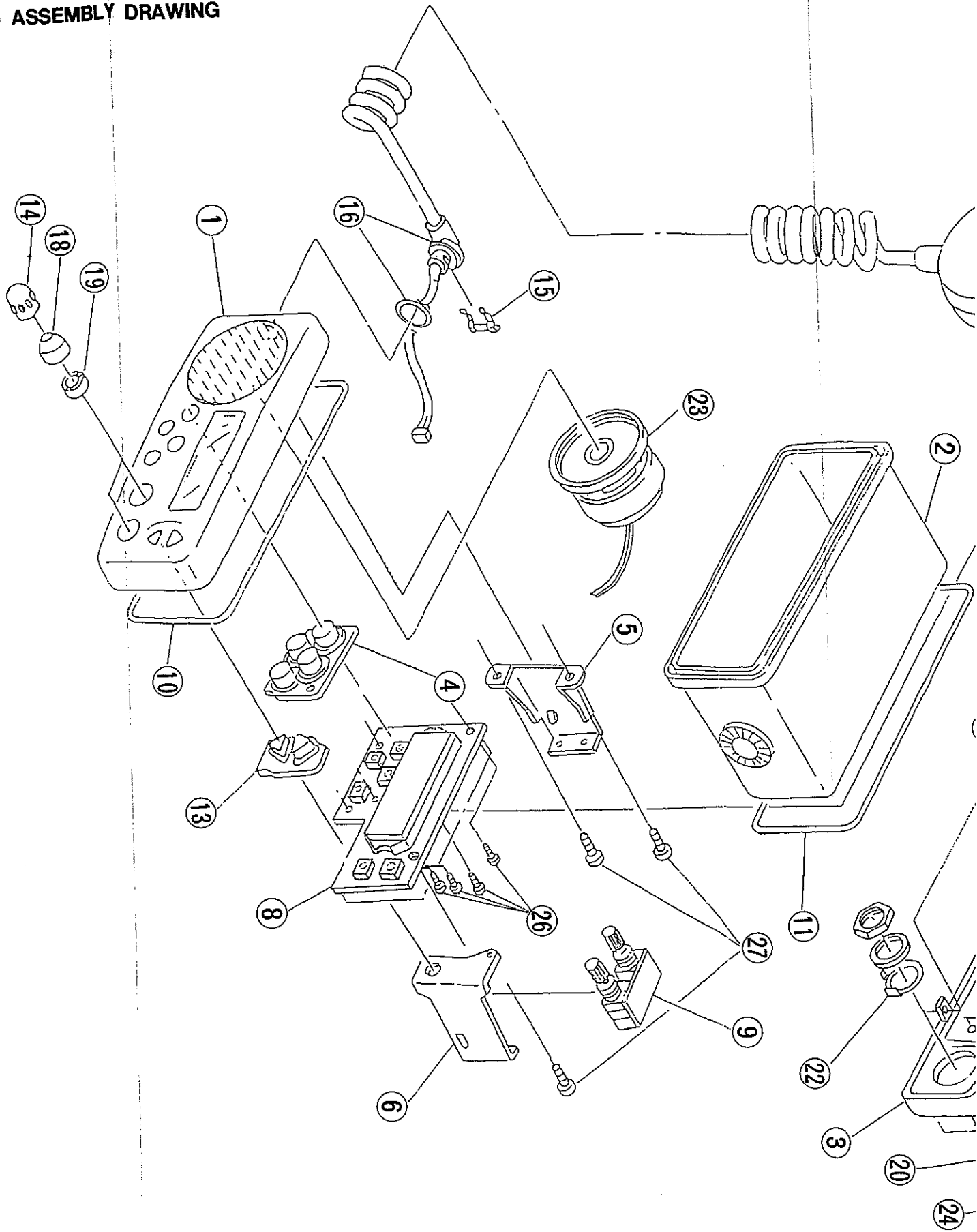
CABINET & CHASSIS

LOCATION No.	DESCRIPTION	RMC Part No.
1.	FRONT PANEL ASSEMBLY	G627266-1
2.	MID COVER ASSEMBLY	G627266-2
3.	REAR COVER	G627266-3
4.	P. BUTTON (A)	G627266-4
5.	LEFT SIDE BRACKET	
6.	RIGHT SIDE BRACKET	
7.	MAIN PCB ASSEMBLY	G623681-1
8.	CPU PCB ASSEMBLY	G626341-2
9.	VOL/SQ PCB ASSEMBLY	G623681-3
10.	FRONT GASKET	G623681-8
11.	REAR GASKET	G623681-9
12.	POWER CORD ASSEMBLY	G623681-10
13.	P. BUTTON (B)	G623681-11
14.	KNOB	G263720-37A
15.	PLATE SPRING	G263720-34
16.	O-RING (9)	G263720-33
17.	O-RING (M3)	G263720-32
18.	KNOB GASKET	G623681-12
19.	VOL/SQ POT NUT	G263720-35
20.	GASKET (20)	G263720-31
21.	MICROPHONE ASSEMBLY	G627266-8
22.	GND TERMINAL	
23.	INTERNAL SPEAKER	G623681-14
24.	ANTENNA RF CONNECTOR	
25.	RIBBON CABLE	G623681-15
26.	SCREW T's 2.6 x 8	
27.	SCREW T's 3 x 8	
28.	SCREW B 3 x 8	
29.	SCREW B 3 x 4	
30.	SCREW B 3 x 8 sus	
31.	SCREW B 3 x 45 sus	
32.	WASHER	

MAIN PCB

IC4 TA31136FN

8

C

2nd MIX IF AMP — 13, 9, 7,8

XTL2 21.145MHz — 1, 3, 5

−6dB DCT.

13.6V Ⓩ

TX B — EK

Q18 2SC4116 — **AF AMP**

SPK AMP — 7,8

BEEP 1, 10

Q21 DTC343 — **MUTE1**

Q22 2SC4116 — **BUFF AMP**

TC6 BA1604F — **TONE DET.**

C

EK

RX B

TP−3

TX B

DC 5V

SW — Q14 DTA124E

DC 5V REG. — IC7 78M05

Main PC

Main PC

CPU PC

IC20

DISPLAY PCB

1WATT
WX ALERT
MONITOR
TX INT

88

IC201 M34520M6

7 UL, 5 DA, 4 CK, 3 CE, 25,29,30,38 Vcc, 17 BUSY, 16 PWR H/L, 12 TX ON

COM 42,43,44

SEG 53 ~ 61

31

32

WX/INT   MON/1/25

TONE DET 18, BEEP 13, MUTE1 64, MUTE2 9

E² ROM — 2,4,5,6

22, 23, 26, 27

XTAL 101, XTAL 202

IC202 CAT93C46JI CT

16PLUS   CH UP   CH DOWN

gram

Main PCB-Bottom view

CPU PCB-Top view

SW204

SW205

SW203   SW202

SW201   SW206

VHF 4500
5200 DISP

Main PCB-Top view

MAIN

Bottom view

VHF 4500-VR
5200
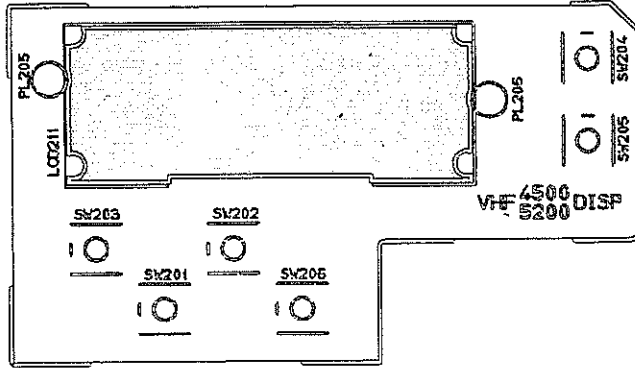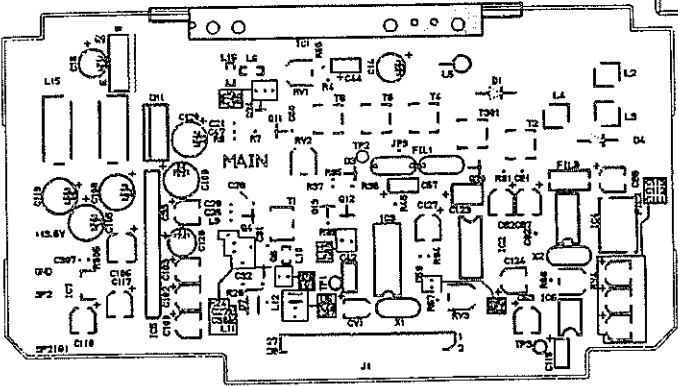
VOL/SQ PCB

CPU PCB-Bottom view

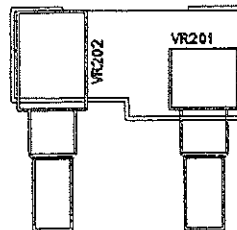IC202   IC201

Top view

VR202   VR201
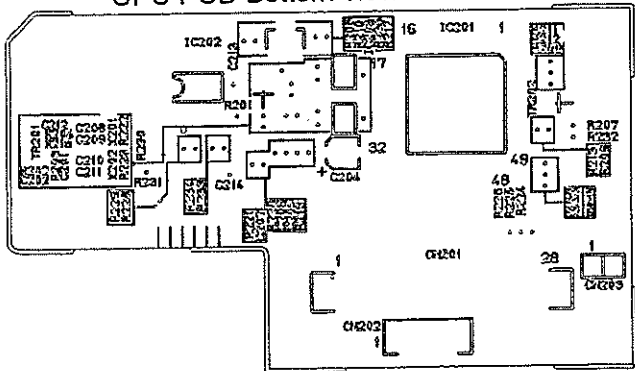
Fig. 6-3 RAY45 PCB LAYOUT
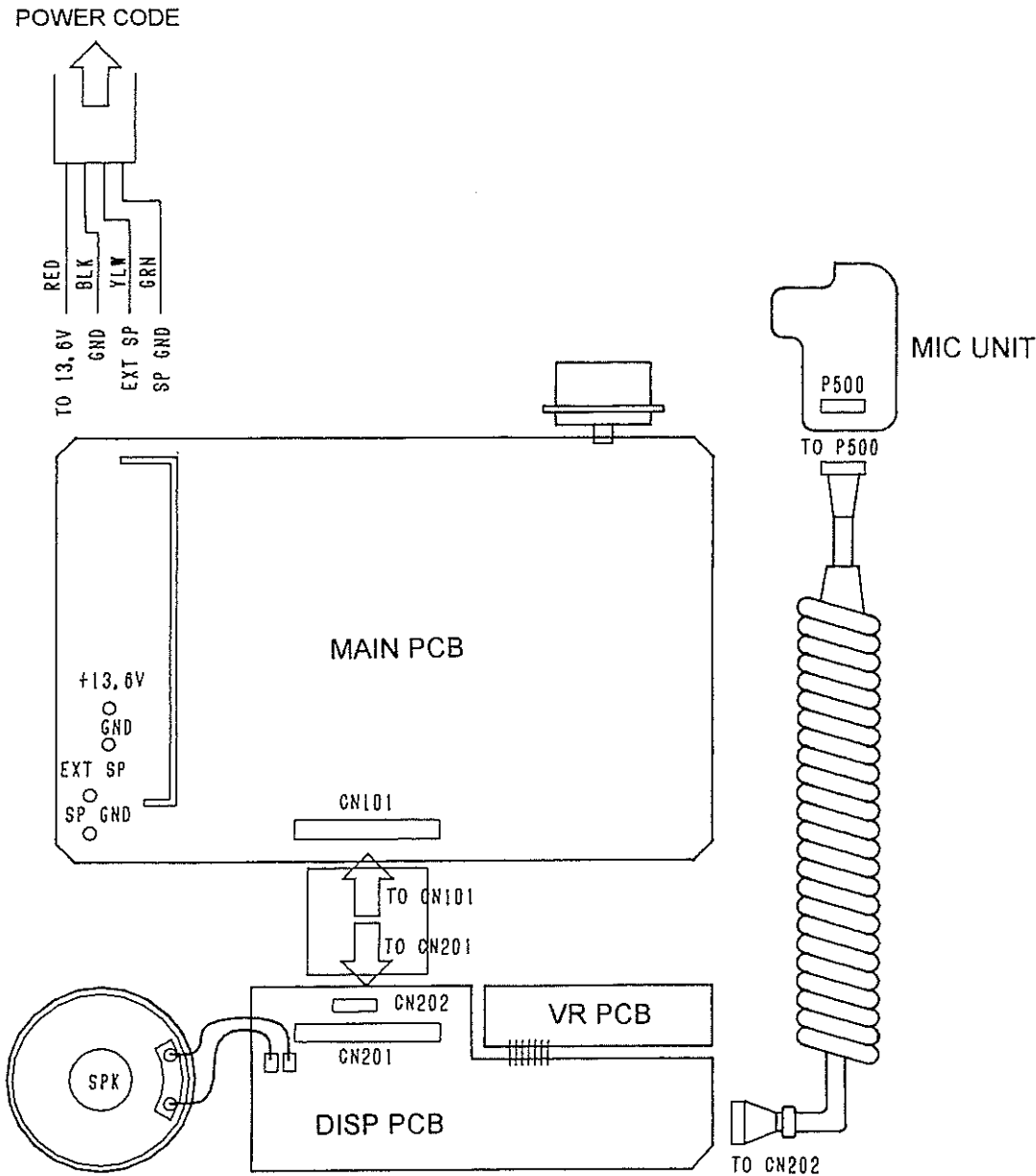
32

INTERNAL WIRING DIAGRAM

Fig. 6-4 INTERNAL WIRING DIAGRAM

7.1 VHF MAR

Most of the inform
letin No. 2 REVIS

REMEMBER:

- Maintain a
  only.

- Use VHF
  pose callii
  municatioi

- Your VHF
  Unnecess

- Always us

- Be sure oi
  Know the

- Limit calls
  again. Kee

- Never trar

OTHER REMINDI

- Do not ins
  sign by co
  Service, P
  ate operat

You need a radio
port or leave a for

- Your radio
  tion licens

SECTION 7

APPENDIX

7.1 VHF MARINE CHANNEL USAGE GUIDE AND LICENSING REQUIREMENTS

Most of the information found in this section is reprinted in whole or in part from FCC Information Bulletin No. 2 REVISED EDITION February 1991 and FCC Fact Sheet PR-5000 March 1990.

REMEMBER:

- Maintain a radio watch on Channel 16. Channel 16 is used for distress and safety purposes only.

- Use VHF Channel 70 only for Digital Selective Calling (DSC). It may be used for general-purpose calling using DSC. Your cooperation in not using Channel 70 for general intership communications is necessary to prevent interference.

- Your VHF transceiver has a high-low power switch. Use low power whenever feasible. Unnecessary high-power operations can interfere with other important communications.

- Always use your radio call sign at the beginning and end of each transmission.

- Be sure only qualified persons operate your radio. You are responsible for control of your radio. Know the rules.

- Limit calls to other vessels to 30 seconds. If you receive no reply, wait 2 minutes; then try again. Keep communications brief and avoid chit-chat.

- Never transmit false distress messages, and never use profanity on the air.

OTHER REMINDERS:

- Do not install or operate your radio until it is licensed. You can obtain a station license and call sign by completing FCC Form 506 and mailing it with the required fee to the FCC, Marine Ship Service, P.O. Box 358275, Pittsburgh, PA 15251-5275. Form 506-A provides you with immediate operating authority, valid for 90 days after you mail your license application.

You need a radio operator license to operate a VHF Marine Radio only if you plan to dock in a foreign port or leave a foreign port to dock in a U.S. port.

- Your radio license is not transferable. If you sell your boat, request the FCC to cancel your station license.

If you replace your radio, you do not need to change your license unless the new radio operates on another frequency band. If you install equipment to operate on another frequency band, apply for modification of your license.

- If you carry more than six passengers for hire, your vessel must be certified as a passenger-carrying vessel by the FCC and the Coast Guard.

Licensing Requirements for Hand Held Portable VHF Marine Transceivers 10 Watts Power or Less

All transceivers, hand helds included, operated in the Maritime Radio Services are required to be operated under an appropriate maritime station license. Operation of hand held VHF Marine transceivers without proper station license can lead to fines and/or administrative sanctions issued against its user and/or owner.

VHF Marine hand held transceivers can be operated and licensed as follows:

a) Associated Ship Unit: A hand held VHF Marine transceiver can be operated under an existing valid ship station license under the following conditions only:

   i) Except for safety purposes, the hand held transceivers must be used only to communicate with the ship station with which it is associated. Such associated ship units MAY NOT be operated from shore.

   ii) The transmitting power is limited to ONE WATT only.

   iii) The hand held transceiver must be identified by the call sign of the ship station along with its associated unit designator.

b) Portable Ship Station: The Commission may grant a station license permitting operation of a portable ship station aboard different vessels of the United States. Each application (FCC Form 506-Application for a Ship Radio Station License) for a portable ship station license must include a showing that:

   i) The station will be operated aboard a vessel.

   ii) A station license for portable equipment is necessary to eliminate separate applications to operate a ship station aboard different vessels.

c) Marine Utility Station: A utility station in the maritime mobile service consists of one or more hand held transceiver units licensed under a single authorization. Each unit is capable of operating while being hand carried by an individual. There are two types of stations authorized:

   i) Marine Utility Coast- when transmitters are located on land; may communicate directly to vessels only.

   ii) Marine Utility Coast/Ship- transmitters from land may communicate with vessels or when aboard a vessel, may communicate with other vessels or coast stations.

   NOTE: A Marine Utility Ship license will not be authorized.

The station operates under the rules applicable to a private coast station when the unit (s) are on land and under the rules applicable to a ship station when the unit (s) are aboard a vessel. FCC Form 503, application for Land Radio Station License is used when applying for a marine utility License.

USAGE GUIDE

Emergency	Calling	Monitoring	Intership Safety	U.S. Coast Guard

Navigation	Port Operations	Noncommercial	Commercial	Marine Operator

State Control	Environmental	Weather

Emergency

Channel 16

If:

- Your ship is **sinking, or on fire**

- Someone has been lost overboard

- There exists grave and imminent danger

Use this distress procedure:

- Select Channel 16

- Say "Mayday, Mayday, Mayday."

- Give call sign and boat name

- Give location of boat

- Describe emergency

- If no answer, repeat; then try and other channel

Caution

Every ship at sea is obliged to give absolute priority to radio communications relating to ships in distress—it is vital that false distress calls or messages not be broadcast.

Calling

Channel 16 & Working Channel

If—you wish to establish communications with another station

And—you know which working channel the station is monitoring

Then—initiate the call directly on that working channel

If—you wish to establish communications with another station

And—you do not know what working channel the station may be monitoring

Then—initiate the call on channel 16. After contact is made switch to a working channel. **NOTE: Due to congestion on channel 16 caused by frequent hailing of other vessels, the FCC has approved channel 9 as a second hailing channel.**

Avoid excessive calling and radio checks

Always monitor before transmitting
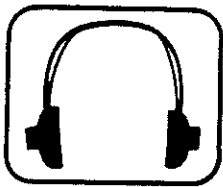
Never interrupt emergency communications
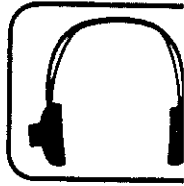
Monitoring

Channel 16 & W

When—your VH being used to ex

You Must—moni

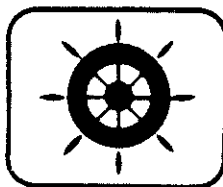As an operating employ a secon tor a working cha neously.

37

Monitoring

Channel 16 & Working Channel

When—your VHF station is turned on and it is not being used to exchange communications

You Must—monitor channel 16

As an operating convenience, many stations employ a second receiver so that they can monitor a working channel and channel 16 simultaneously.

Intership Safety

Channel: 6

Vessels: Any

Use: Communicating navigational and weather warnings to other ships

Communicating with U.S. coast Guard stations or other vessels during search and rescue operations

Between: Ship-to-ship only

Comments: Do not use for routine communications. This is a safety channel.
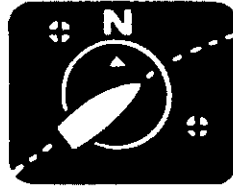
U.S. Coast Guard

Channel: 22

Vessels: Any

Use: Working channel for exchange of communications with stations of the U.S. Coast Guard

Between: Ship to U.S. Coast Guard ship, coast to aircraft stations

Comments: U.S. Coast Guard does not regularly monitor this channel. Establish contact on channel 16 and shift to channel 22 as directed.

Navigation

Channel: 13

Vessels: Any

Use: Safety communications pertaining to the maneuvering of vessels or the directing of vessel movements

Primarily ship-to-ship and secondarily ship-to coast

This is commonly called the Bridge-to-Bridge channel. Large vessels and towboats depend on this channel for their safe navigation. Railway or highway bridges which open for ship navigation often operate on this channel.

Bridge-to-Bridge stations must reduce power to one watt for routine operations.

Port Operatior

Channels: 5,12

Vessels: Any

Use: Messages
dling, movemer
ports, locks anc

Between: Ship-

Comments: Ch:
tions to and fror
the movement ɛ

Note: Channels
vessel traffic se
Lawrence Seaw

Port Operations

**Non commercial
(Boat Operations)**

Channels: 5,12, 14, 20, 65, 66, 73, 74, [77]

Channels: 19, 68, 69, 71, 72 78

Vessels: Any

Vessels: Recreational boats and any others not used primarily for commercial transport.

Use: Messages relating to the operational handling, movement and safety of vessels in or near ports, locks and waterways

Use: Communications pertaining to the needs of the vessel (i.e., fishing, rendezvous, maneuvers, berthing, scheduling of repairs, provisioning, etc.)

Between: Ship-to-ship or ship-to-coast

Between: Ship-to-ship or ship to limited coast stations

Comments: Channel 77 is limited to communications to and from commercial pilots concerning the movement and docking of vessels.

Comments: Channel 72 may not be used for ship to coast communications. Channel 9 is shared with Commercial users.

Note: Channels 11, 12, 13 and 14 are used for vessel traffic service on the Great Lakes, St. Lawrence Seaway and designated major ports.

If you regularly monitor one of these channels with a second receiver, please notify frequently-called stations of this practice. Help reduce congestion on channel 16.
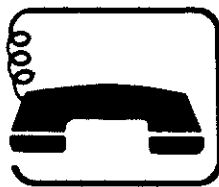
Commercial

Channels: 7, 8, 9, 10, 11, 18, 19, 67, 79, 80, [88]

Vessels: Those used primarily for commercial transport of persons or goods, or engaged in servicing other vessels

Use: Communications pertaining to the purpose for which the vessel is used

Between: Commercial transport vessels (ship-to-ship) or between commercial transport vessels and limited coast stations

Channels 8, 67 and 88 may not be used for ship-to-coast communications

Recreational boats are not permitted to use these channels

Channel 88 not available on Great Lakes and St. Lawrence Seaway.

Marine Operator

Channels: 24, 25, 26, 27, 28, 84, 85, 86, 87, 88

Vessels: Any

Use: To place a telephone call to any location in the world or to a vessel outside of your transmitting range

Between: Vessels and public coast stations

Comments: Contact the marine operator on the channel assigned to your navigating area.
If unable to determine this channel, use channel 16.

Be patient. Do not interrupt calls in progress. Avoid excessive calling if the operator does not answer—give the operator a chance to reply.

State Control

Channel: 17

Vessels: State

Use: Coordina ing activities a vessels.

Between: Ship state and local

Weather

Channels: WX

Vessels: Any

Use: Continuo (National Ocea tion

State Control

Channel: 17

Vessels: State and local government

Use: Coordination, regulation and control of boating activities and the rendering of assistance to vessels.

Between: Ship and coast stations associated with state and local governments.

Environmental

Channel: 15

Vessels: Any (receive only)

Use: Broadcast of information concerning the environmental conditions in which vessels operate-weather, sea conditions, time signals, notices to mariner, hazards to navigation

Between: One-way broadcast from coast to ship stations

Note: Currently used for Class C EPIRB emergency signals.

Weather

Channels: WX1, WX2, WX3

Vessels: Any

Use: Continuous weather information from NOAA (National Oceanic and Atmospheric Administration

Between: One-way broadcast from NOAA to any interested parties

Comments: Receive only. You are not allowed to transmit on these frequencies.

42

PHONETIC ALPHABET:

To help make call letters more clearly understood, and to assist in spelling out similar sounding or unfamiliar words, radiotelephone users usually 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- FOX-TROT	O- OSCAR	X- X-RAY
G- GOLF	P- PAPA	Y- YANKEE
H- HOTEL	Q- QUEBEC	Z- ZULU
I- INDIA	R- ROMEO	