

**TECHNICAL MANUAL**

**OPERATOR, UNIT, DIRECT SUPPORT  
AND GENERAL SUPPORT  
MAINTENANCE MANUAL  
(INCLUDING REPAIR PARTS AND  
SPECIAL TOOLS LIST)**

**FOR**

**WATER PURIFICATION BARGES  
(NSN 1930-01-234-2165)  
VOLUME 12  
COMMUNICATIONS SYSTEM**

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content requirements normally associated with the Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment

**Approved for public release; distribution is unlimited.**

\*This manual supersedes TM 55-1930-209-14&P-12, 30 January 1989

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**HEADQUARTERS, DEPARTMENT OF THE ARMY  
15 OCTOBER 1992**

## WARNINGS AND SAFETY NOTICES

### WARNING

DANGEROUS VOLTAGES AND HAZARDOUS MATERIALS  
ARE USED IN THIS EQUIPMENT.  
DO NOT TAKE CHANCES!

### GENERAL WARNINGS

- Always red-tag electrical equipment, controls, circuits, and switches before beginning repairs
- Do not service or adjust high voltage electrical equipment when alone.
- Do not overload circuits.
- Always use authorized, insulated tools and test equipment when working on electrical equipment.
- Remove all jewelry before working on or around electrical equipment with exposed current-carrying areas.
- Do not wear clothing with exposed metal fasteners when working on electrical equipment
- Always use approved breathing apparatus when working with chemicals
- Avoid chemical contact with eyes, skin, and clothing.
- Always wear safety glasses, gloves, and rubber aprons when handling chemicals.
- Wear protective clothing and safety glasses as required when working on barge equipment.
- Always wear approved ear protection in noise hazard areas.

### SPECIFIC WARNINGS

- Do not connect any new circuit to an existing circuit.
- Do not energize circuits if water condensation is present.
- If any sparks are seen, stop operation immediately. Determine cause and take corrective action.
- Never touch radio antennas of fixed-base radio transmitters. When transmitting, antennas contain high voltage.
- Always use approved breathing apparatus when handling material in multimedia filters and chlorinator unit descaling acid crystals. Do not breathe dust from these materials.
- Avoid breathing vapors from coagulant aid chemicals. Use in a well-ventilated area. In case of chemical contact with skin, wash with water. For eyes, immediately flush at eyewash station and obtain medical help as soon as possible.
- Always wear work gloves and shirts with full length buttoned sleeves when handling fuel oil and gasoline.

- Do not smoke or have open flames within 10 feet when handling fuel oil or gas. Only minimum number of personnel necessary to conduct fueling operation is permitted in area.
- Before starting any repairs on compressed air system, always release pressure from air receiver and compressor and open and red-tag circuit breakers.
- On air compressor, do not adjust automatic regulator switch (pressure switch) and pilot valve settings.
- To avoid flying particles lodging in eyes, do not use compressed air to "dust-off" clothing or workspace.
- Stay clear of anchor cables when operating anchor winches.
- Always wear safety glasses or face shield when using power tools.
- Always wear lifevests when on weatherdeck and throughout the barge during storm conditions.
- Lifevests are to be worn at all times aboard workboat.
- Only qualified persons will operate and maintain arc and fuel gas welders.
- When welding, always make sure those working with or near the welder wear proper clothing: heavy, hole-free gloves, heavy shirt, cuffless trousers, high shoes, and cap. Keep clothing dry and free of oil and other flammable substances.
- Use dry heavy canvas drop cloth to cover work area and adjacent deck when arc welding.
- Before welding on bulkheads, deck plating and similar surfaces, always check carefully to make sure that the other side of the surface to be welded does not hide fuel or compressed gas tanks, flammable or hazardous materials, or electrical equipment or wiring.
- When welding, keep your head out of the fumes and make sure area is well ventilated.
- Before welding on surfaces which have been cleaned with cleaning solutions containing chlorinated hydrocarbons, always wash with water, dry and ventilate area thoroughly.
- Use shield with proper filter lens when welding. Do not allow others near welding operations to assist or observe without proper eye protection. This must include side shields during slag chipping operations.
- Warn personnel in area during welding operations not to look at arc or expose themselves to hot spatter or metal.
- In an extreme emergency, when welding is required in void 2 port, shut down chlorination system. Close all valves. Cover the parts of chlorination system not being welded with a heavy canvas drop cloth. Turn on vent 8 and, if available, provide additional forced air ventilation.

- Before welding on fuel oil or sludge tank, make sure tank is gas-free by: 1) removing all liquid from tank, 2) cleaning tank thoroughly, 3) seeing that tank is thoroughly dry, and 4) force ventilating tank.
- Connect arc welding work cable as close to welding area as possible. Work cables connected to barge framework or other locations far from welding site increase the possibility of the welding current passing through lifting chains, crane cables or other possible circuit paths. This can create fire hazards or weaken lifting chains or crane cables until they break or fall.
- Always weld with all doors, portholes, and hatches propped open and necessary ventilation systems operating.
- Take frequent breaks away from the area where you are welding
- Do not take oxygen and acetylene tanks into confined areas when welding.
- Always use a friction lighter to start oxyacetylene torch.
- Always maintain all welding equipment in proper working condition. If you have any doubts about the safety of any welding equipment, do not use the welder.

#### **ELECTRICAL SHOCK SAFETY STEPS**

Five safety steps to follow if someone is the victim of electrical shock.

1. Do not try to pull or grab individual.
- 2.. Turn off electrical power when possible.
3. If you can not turn off electrical power, pull, push, or lift person to safety using a wooden pole, rope, or some other insulating material.
4. Get medical help as soon as possible.
5. After the injured person is free of contact with the source of electrical shock, move the person a short distance away and, if needed, start CPR immediately.

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**INTRODUCTION TO****TM 55-1930-209-14&P-12**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Troop Support Command, ATTN: AMSTR-MMTS, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

**1. SCOPE**

TM 55-1930-209-14&P covers the Reverse Osmosis Water Purification Barges, Models 300-WPB-1, 300-WPB-2 and 300WPB-3, NSN 1930-01-234-2165. This manual consists of twenty-one volumes.

**2. REVERSE OSMOSIS WATER PURIFICATION BARGES**

The Reverse Osmosis Water Purification Barges provide up to 300,000 gallons of drinking water per 24 hour period. The drinking water, converted from seawater or brackish water, is for use by a Rapid Deployment Force in a forward area. When needed, the drinking water can be pumped to a shore facility or to another vessel. This manual provides operation and maintenance procedures for all the component systems on the barges.

**3. VOLUME 1 -- NORMAL OPERATIONS**

This volume provides information and procedures on normal Reverse Osmosis Water Purification Barge operations, including barge movement and deployment, communications and electrical power systems, drinking water production, shutdown, and required operational maintenance. Emergency shutdown procedures are also provided.

**4. VOLUME 2 -- SEAWATER SYSTEM**

This volume describes operation and maintenance of the seawater system which supplies seawater to the Reverse Osmosis Water Purification Units (ROWPUs) for processing to the air conditioning unit for cooling to the ballast tank for barge trimming to the chlorination unit for priming and cooling, and to the diesel generators for cooling.

**5. VOLUME 3 -- REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) SYSTEM**

Volume 3 provides operation and maintenance procedures for the ROWPU System which processes seawater or brackish water to produce drinking water. Normally, this system processes seawater supplied by the seawater system (TM 55-1930-209-14&P-2) to create product water. Chlorine is then added to this product water by the chlorination system (TM 55-1930-209-14&P-4). The resultant drinking water is discharged into four storage tanks that are part of the drinking water system (TM 55-1930-209-14&P-5).

**6. VOLUME 4 -- CHLORINATION SYSTEM**

Operation and maintenance procedures for the chlorination system onboard the Water Purification Barges are contained in this volume. This system produces chlorine in a sodium hypochlorite solution, upon demand, to water processed by the ROWPU system just before the water enters the four drinking water storage tanks

## 7. VOLUME 5 - DRINKING WATER SYSTEM

The drinking water system provides storage for water produced by the ROWPUs and includes pumps and valves to move this water from onboard storage tanks to the shore discharge system, to another vessel, or overboard. The drinking water system also provides a pressurized water supply for drinking and washing onboard the barges.

## 8. VOLUME 6 -- SHORE DISCHARGE SYSTEM

This volume provides operation and maintenance procedures for the shore discharge system which transfers drinking water from barge storage tanks to holding/storage facilities ashore.

## 9. VOLUME 7 -- COMPRESSED AIR SYSTEM

Volume 7 describes the operation and maintenance of the compressed air system which provides compressed air to five air stations in the ROWPU space, one in the workshop, and one on stem weatherdeck. This system also provides compressed air to two air stations for blowdown of seachests in void 2 starboard and void 4 port. Compressed air is used on the barges to operate air-powered impact tools, to propel air through the shore discharge hose, to blowdown seachest, and for general cleaning blowdown.

## 10. VOLUME 8 -- FUEL OIL SYSTEM

This volume provides operation and maintenance procedures for the fuel oil system which functions as a centralized receiving storage and distribution system for diesel fuel used for barge operations. This onboard fuel system provides fuel for two 155 kW diesel ship service generators, a 20 kW ship auxiliary generator, two ROWPU high-pressure pump diesel engines, and a fueling station for the barge workboat.

## 11. VOLUME 9 -- ELECTRICAL POWER SYSTEMS

Operation and maintenance procedures for the two electrical power systems installed aboard the Water Purification Barges are contained in Volume 9. The normal electrical power system generates, controls and distributes all electrical power for operating the water purification system and its auxiliary systems. The emergency electrical system supplies 24 Vdc from a battery bank to 24 Vdc equipment and converts to 24 Vdc through an inverter to 120 Vac to power emergency lighting and equipment.

## 12. VOLUME 10 -- LIGHTING SYSTEM

Volume 10 contains operation and maintenance procedures for the onboard lighting systems for the Water Purification Barges. This system supplies interior and exterior lighting. Normal and emergency interior lighting is provided in the deckhouse ROWPU space, dayroom, workshop, and voids. Exterior lighting consists of searchlights and floodlights for use at night or during reduced visibility. Lights on the weather decks and standard navigation and status lights are for use during operation and towing.

## 13. VOLUME 11 -- EQUIPMENT MONITORING SYSTEM

This volume provides operation and maintenance procedures for the equipment monitoring system which monitors the operation of several equipment components onboard the Water Purification Barges. This system monitors operating conditions such as amount of drinking water in storage tanks and temperature of diesel engine cooling water. Sensors detect unacceptable operating conditions, the main processor flashes at double intensity and remote alarms (horns, strobe lights and buzzer alert crewmembers that corrective action is necessary.

## 14. VOLUME 12 -- COMMUNICATIONS SYSTEM

Operation and maintenance procedures for the communications system are provided in Volume 12. This system consists of three separate communications methods, radio communications, foghorn and intercom telephones

## 15. VOLUME 13 -- HANDLING EQUIPMENT

This volume contains operation and maintenance procedures for handling equipment used for lifting, transporting and repositioning equipment and materials onboard the barges. The system includes a bridge crane, bow crane and a void 4 trolley hoist

## 16. VOLUME 14 -- ANCHOR, MOORING, AND TOWING EQUIPMENT

Volume 14 describes the operation and maintenance procedures for the anchor mooring, and towing equipment on the Water Purification Barges. This equipment provides a method to hold (anchor) the barges in a fixed position offshore, at dockside, or next to another vessel and a method to move the barges from one location to another.

## 17. VOLUME 15 -- MISCELLANEOUS EQUIPMENT (DAYROOM, WORKSHOP, ACCESSES, AND SANITATION SYSTEMS)

Volume 15 addresses operation and maintenance procedures for miscellaneous equipment installed on the Water Purification Barges. This equipment includes the dayroom on the forward starboard side of deckhouse, the workshop on the forward portside of deckhouse, accesses such as deckhouse doors and portholes and various accesses to and from the voids, and two separate sanitation systems (toilets and bilge). Additional equipment addressed in this volume includes guard rails, rubber fendering, removable rubber floor mats, eyewash stations, component labels, caution, warning and danger signs, and storage areas.

## 18. VOLUME 16 -- VENTILATION, HEATING, AND AIR CONDITIONING SYSTEMS

This volume contains operation and maintenance procedures for the deckhouse and voids ventilation systems and the heating and air conditioning (HAC) system installed on the Water Purification Barges. The ventilation system provides fresh air circulation in the deckhouse and voids with 17 hatches and 10 ventilation fans. The HAC controls the temperature in the dayroom and deckhouse.

## 19. VOLUME 17 -- WORKBOAT, LIFESAVING, AND FIREFIGHTING EQUIPMENT

Volume 17 includes procedures for the operation and maintenance of:

- a. Workboat -- provides water transportation for crew members and visitors, small cargo items, transportation of the messenger line for the shore discharge hose and similar work-related tasks associated with operating the Water Purification Barges.
- b. Lifesaving Equipment -- Installed on the barges and consisting of 2 liferafts, 15 Type II and 24 Type V lifevests and 4 lifesaving rings.
- c. Firefighting Equipment -- Installed on the barges and consisting of Halon 1301 system, 2 CO<sub>2</sub> hose reel units, a smoke detector system, 17 portable CO<sub>2</sub> fire extinguishers, 5 dry chemical fire extinguishers, 5 self-contained breathing apparatuses, and a portable, engine driven firefighting pump. The workboat also has a 10-pound, portable, dry chemical fire extinguisher.

## 20. VOLUME 18 -- SUPPORTING APPENDICES FOR VOLUMES 1-17

Volume 18 contains the Maintenance Allocation Chart, Components of End Item List, Tools and Test Equipment List, Expendable/Durable Supplies and Materials List and the Repair Parts and Special.

All of the information contained in this volume is common to volumes 1-17 and does not appear in each individual volume.

Appendix A in volumes 1-17 provides information unique to each volume. Appendix B in volumes 1-17 provides manufacturers manuals and instructions unique to the system described in each volume. Appendixes C-G are located in Volume 18.

21. VOLUME 19 -- PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Volume 19 contains PMCS pertinent to all onboard systems for the Reverse Osmosis Water Purification Barges.

22. VOLUME 20 -- SUPPLEMENTAL DATA

Volume 20 contains the Basic Issue Items List, and additional Authorization List for all onboard systems for the Reverse Osmosis Water Purification Barges.

23. VOLUME 21 -- WINCH, DOUBLE DRUM, DIESEL

This volume contains operation and maintenance procedures for the 20-ton double drum diesel engine winch used on the Water Purification Barges Appendix B of Volume 21 contains the Maintenance Allocation Chart and the Repair Parts and Special Tools List for the winch.



TECHNICAL MANUAL  
NO. 55-1930-209-14&P-12

HEADQUARTERS  
DEPARTMENT OF THE ARMY,  
WASHINGTON D. C., 15 OCTOBER 1992

TECHNICAL MANUAL

OPERATORS', UNIT, DIRECT SUPPORT  
AND GENERAL SUPPORT  
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(INCLUDING REPAIR PARTS AND  
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FOR  
WATER PURIFICATION BARGES  
(NSN 1930-01-234-2165)  
VOLUME 12  
COMMUNICATIONS SYSTEM

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Troop Support Command, ATTN AMSTR-MMTS, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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\* Supersedes TM 55-1930-209-14&P-12, 30 January, 1989

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**NOTE**

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 MAINTENANCE ALLOCATION CHART (MAC)  
 TOOLS AND TEST EQUIPMENT LIST (TTEL)  
 EXPENDABLE /DURABLE SUPPLIES AND MATERIALS LIST (ESML)  
 REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)  
 REPAIR PARTS LIST TO FIGURE NUMBER CROSS-REFERENCE LIST

**NOTE**

The following appendices, common to all TM's in this series, are in TM 55-1930-209-14&P-20.  
 COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIILL)  
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## CHAPTER 1 INTRODUCTION

**1-1 Purpose.** This Technical Manual (TM) describes the operation and maintenance of the communications system on Water Purification Barges. Information on other systems Installed onboard is in TM 55193020914P-1 thru P-11 and P-13 thru P-18. TM 55-1930-209-14P-18 and TM 55-1930-209-14&P-20 contain appendices common to all TM's. Location of major barge components is shown in Figure 1-2

**1-2 Scope.** The communications system consists of three separate communications methods. These include radio communications equipment, foghorn, and Intercom telephones, which are briefly described as follows Details are In Chapters 2 thru 4.

**1-2.1 Radio communications equipment.** This equipment, located In the barge dayroom and cabin of the workboat, consists of a type ANNRC-46 High Frequency (HF) Frequency Modulation (FM) Army issue radio (hereafter called the HF/FM Army radio), a Very High Frequency/Frequency Modulation (VHF/FM) commercial marine radio, and Ultra High Frequency (UHF) FM handheld walkie-talkie transceivers

**1-2.1.1 Army radio.** The HF/FM Army radio provides communications with other stations equipped with radio frequencies reserved for military (primarily US Army) use This radio enables the barge to communicate with Its towing vessel, other military support vessels, military shore-based radio stations, and military aircraft. Transmission distance is normally 25 miles or less.

**1-2.1.2 Commercial marine radios.** These provide VHF/FM radio communications between workboat and barge and between workboat or barge and other vessels equipped with radios working these same channel frequencies. Transmission distance is normally 25 miles or less

**1-2.1.3 Walkie-talkies.** These preset, crystal-controlled, hand-held, nickel cadmium (n-cad) battery-powered portable radios can be preset to the same frequencies available on commercial marine radio channels. They provide VHF/FM communications between crew personnel onboard, between shore and crew personnel, and between crew personnel on workboat and barge. Transmission distance is normally 5 miles or less

### NOTE

**Under U.S. Federal Communications Commission (FCC) regulations, commercial marine ship radio and walkie-talkie stations, operating in U.S. and adjacent waters, are primarily reserved for safety of life and property. Therefore, distress and safety communications have absolute priority. Those frequencies not reserved for calling, distress or other safety purposes, however, may be used for radio telephone calls to coast stations or between ships. Operation of radios using military frequencies is controlled by Army Standard Signal Instructions (SSI) and Signal Operating Instructions (SOI). Extracts of necessary portions of these documents are obtained from Army unit to which the barge is attached or assigned.**

**1-2.2 Foghorn equipment.** This equipment sounds the foghorn to warn oncoming vessels of barge location during poor visibility.

**1-2.3 Telephone system.** This system provides Intercommunications between dayroom system operator and crewmembers at any telephone station on the barge. Telephone stations provide jack receptacles for connecting a headset. By using dayroom telephone equipment, operator can page and communicate with personnel at any telephone station. When on line with operator, crewmembers at telephone stations can communicate with operator or crewmembers plugged into other stations

**1-3 Warranties and guarantees.** Manufacturers' warranty/guarantee information is in Section VII In Chapters 2 thru 4

**1-4 Maintenance forms and records.** These are explained in DA PAM 738750, The Army Maintenance Management System (TAMMS)

**1-5 Destruction of Army materiel to prevent enemy use.** This shall be as directed In TM 750-244-3

**1-6 Storage.** For storage of this equipment, refer to Section V in Chapters 2 thru 4

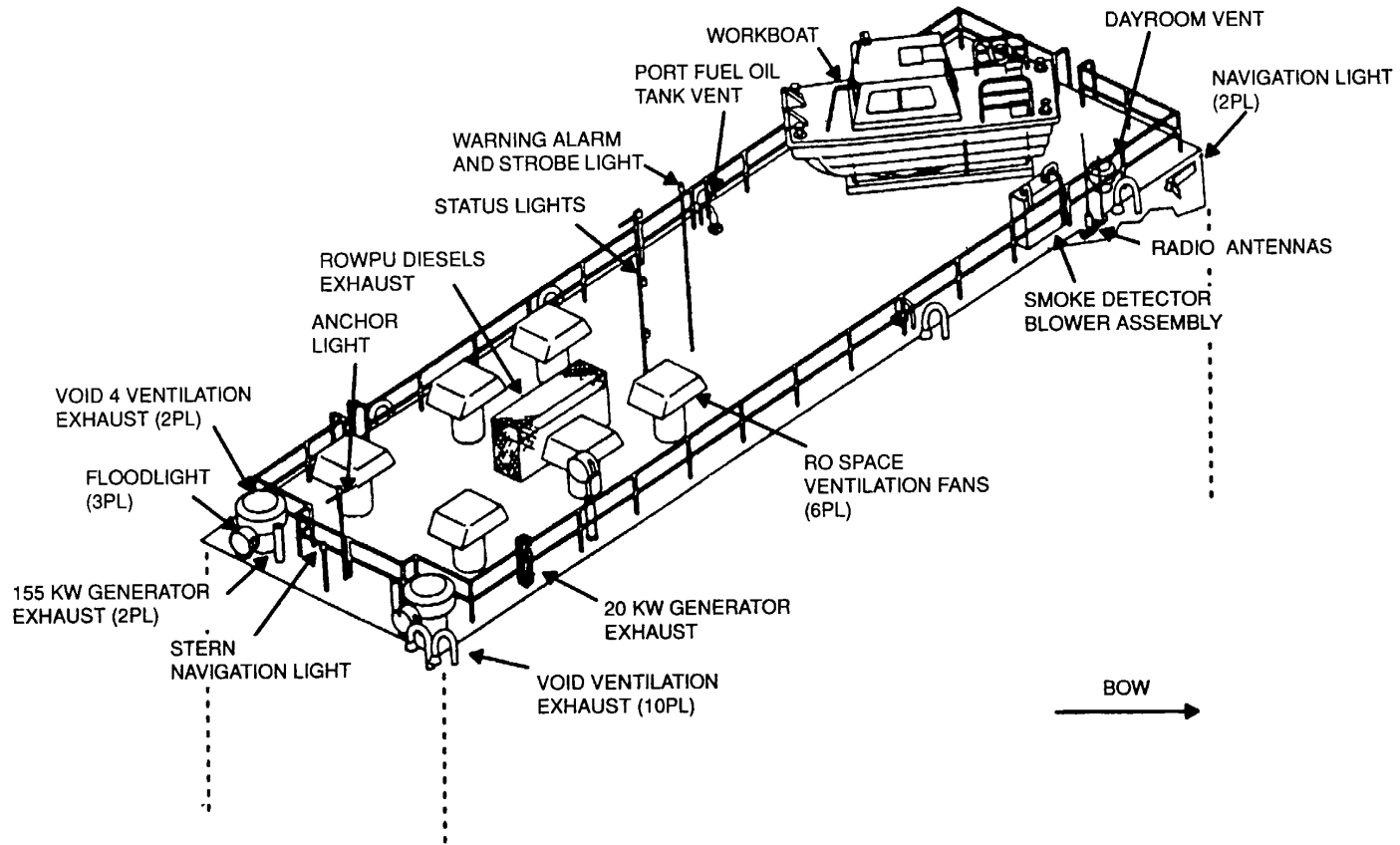


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof (Sheet 1 of 3)

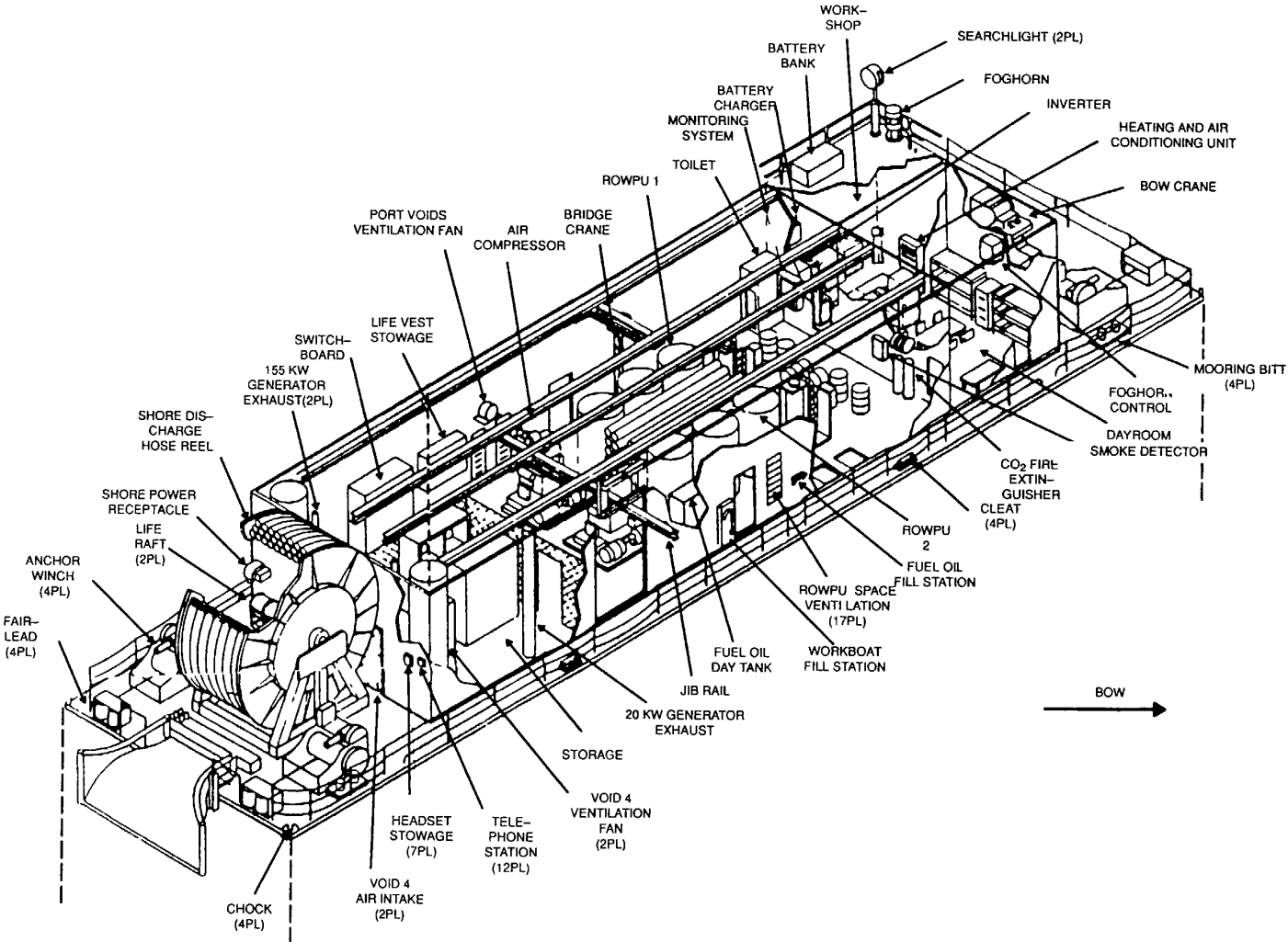


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Deckhouse (Sheet 2 of 3)

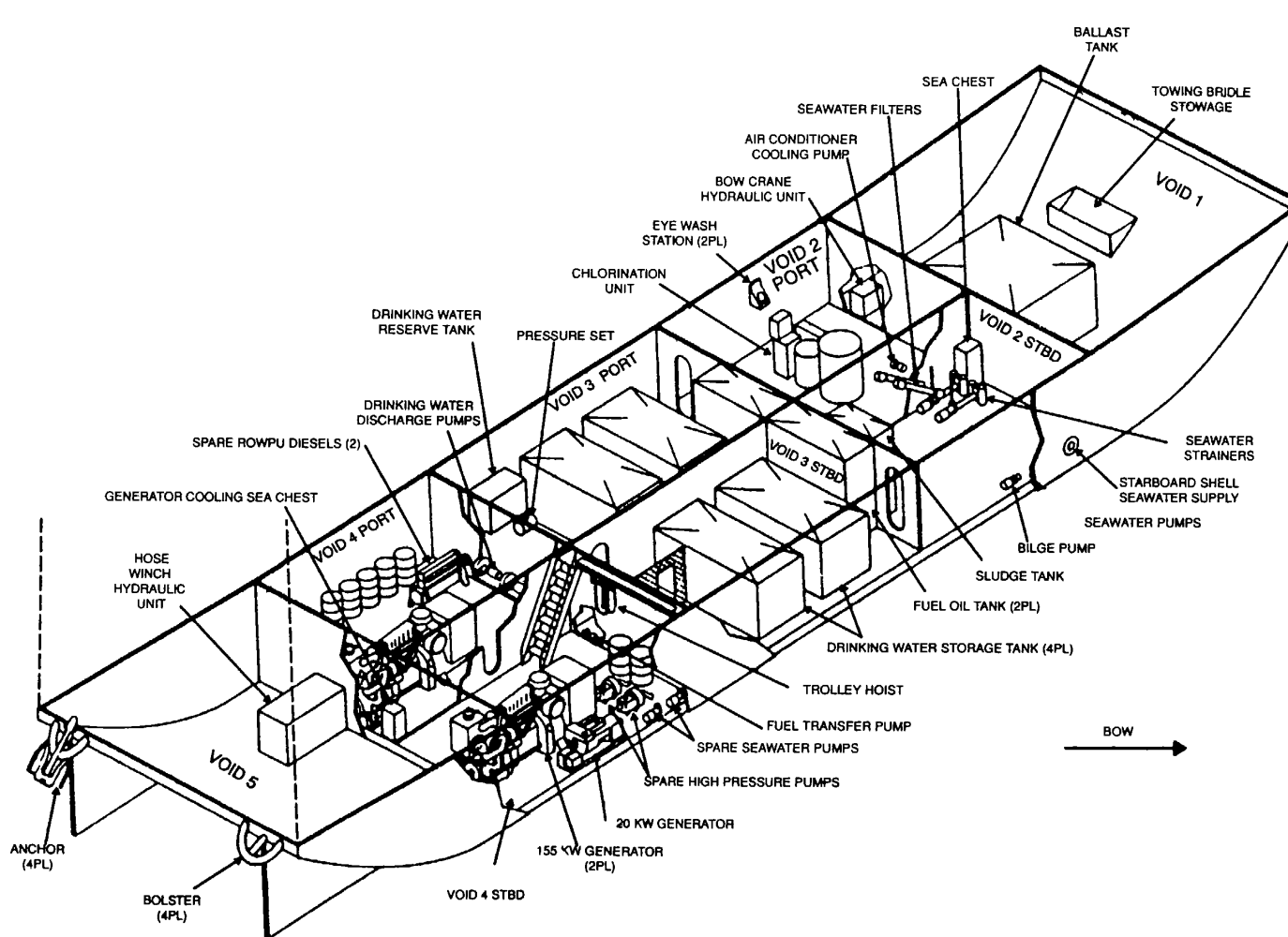


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Voids (Sheet 3 of 3)

## CHAPTER 2 RADIO COMMUNICATIONS SYSTEM

### Section I. Description and data

**2-1 Description.** The radio communications system for Water Purification Barges includes a US Army tactical radio ANNRC-46, two commercial marine radios, and three walkie-talkies. Each is designed to provide radio communications with stations equipped with similar type radios operating on matching frequencies. This system, shown in Figure 2-1, consists of the major components listed in Table 2-1. Individual radio equipment is shown in Figures 2-2 thru 2-4. Installation is shown on drawings listed in Appendix A. Additional information is contained in manufacturers' service manuals/instructions listed in Section VI and US Army technical manuals listed in Appendix A.

### 2-2 Capabilities

**2-2.1 Army radio.** The Army radio provides HF/FM communications with other military radio stations operating on frequencies within the band assigned for military use. These may include other military ships such as Army or Navy tugboats, military commanders and their headquarters and staffs, and military bases ashore. Transmission distance normally is 25 miles or less.

**2-2.2 Commercial marine radios.** Commercial marine radios provide VHF/FM radio communications with commercial (nonmilitary) radio stations equipped to operate in the FCC-assigned marine radio band (156 250 162 550 MHz). These may include commercial tugboats, other commercial vessels, commercial shore stations allied with ships and seagoing activities, and United States Coast Guard (USCG) ships and stations. Transmission distance is normally 25 miles or less.

There are two marine radios, one in the barge dayroom and one in the workboat cabin. These are identical pieces of equipment, operate in the same manner, on the same channels/frequencies and are interchangeable. The barge-mounted radio has a separate power supply to provide proper voltage for radio operation. The workboat-mounted radio uses power from the workboat electrical system.

**2-2.3 Walkie-talkies.** Three walkie-talkies provide short-distance communications (normally less than 5 miles) on three preset frequencies in the FCC-assigned marine radio band. They provide communications between crewmembers carrying these transceivers, with the commercial marine sets in the barge dayroom and workboat cabin, and other radio equipment operating on the same frequencies within the marine VHF/FM radio band. Transmission distance is normally 5 miles or less.

**2-3 Special limitations.** Operation of commercial marine radios must be in accordance with FCC regulations. Operation of Army radios must follow Army SSI/SOI. For specifics, refer to applicable service manual/instructions. According to FCC regulations, marine radios are licensed primarily for safety of life and property. Therefore, distress and safety communications have absolute priority. However, frequencies that are not reserved for these purposes may be used for ship-to-ship and ship-to-shore official communications.

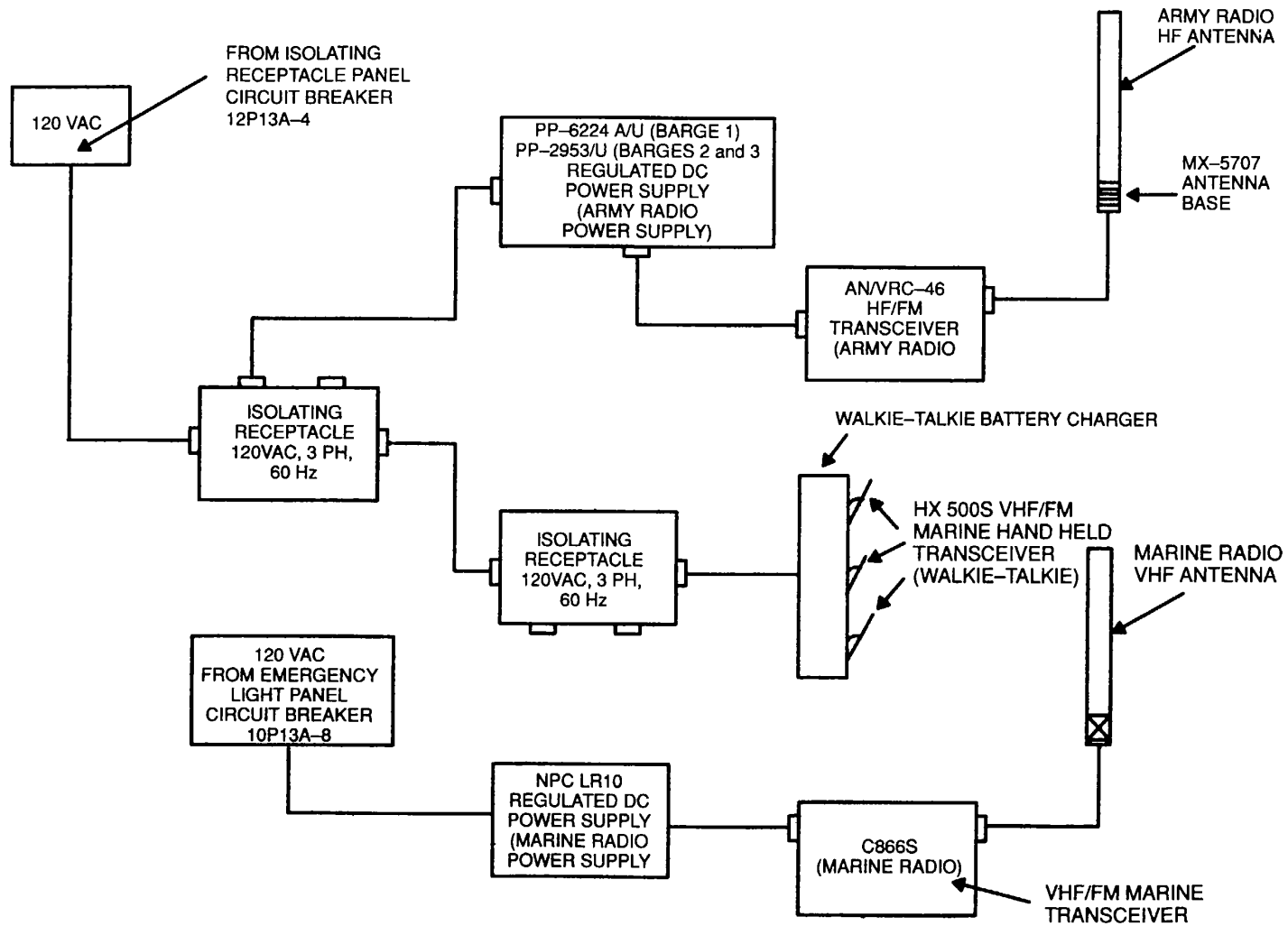


Figure 2-1. Radio Communications System Major Components

**Table 2-1. Radio Communications System Major Components**

<u>Component</u>	<u>Location</u>	<u>Function</u>
Army AN/VRC-46 transceiver/1	Mounted on shelf on aft bulkhead in dayroom	For radio communications with military stations
*Army M-80/GR microphone/1	Connected to AN/VRC-46 transceiver on aft bulkhead in dayroom	For transmitting voice messages
*Army PP-6224 A/U (Barge 1) Army PP-2953/U (Barges 2 and 3) power supply/1 ea	Mounted on shelf on aft bulkhead in dayroom 46 transceiver operation	Provides a regulated +25.2 Vdc for AN/VRC-
*Army HF antenna AS-1 729/VRC/1	Mounted on deckhouse top, starboard	For receiving or transmitting radio waves
Marine C866S VHF/FM transceiver/2 and in workboat cabin Marine regulated DC power supply/1	Mounted under shelf on aft bulkhead in dayroom commercial marine band Mounted on shelf on aft bulkhead in dayroom	For radio communications within FCC-assigned  Supplies a regulated +13.8 Vdc power supply for 866S VHF/FM marine transceiver operation
Marine VHF antenna/2 top, starboard and	Mounted on deckhouse radio waves on workboat cabin	For receiving or transmitting
HX500S VHF/FM marine handheld transceivers (walkie-talkies)/3	Positioned in battery charger on portside of operator's desk or workshop rack	For radio communications within the FCC-assigned commercial marine band
Handheld transceiver CSB50AM battery charger/1	Mounted in workshop on supply rack	Supplies a 7.5 Vdc output for charging nicad battery packs

\*Component of AN/VRC-46



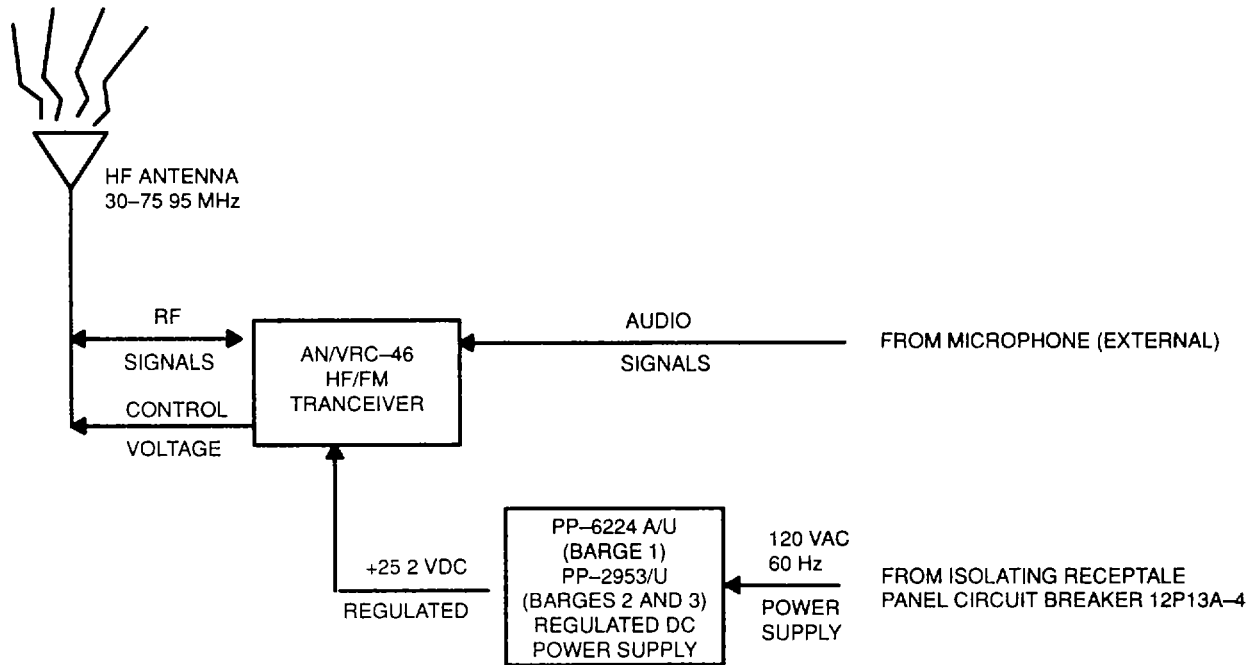


Figure 2-2. Army Radio Equipment Interface

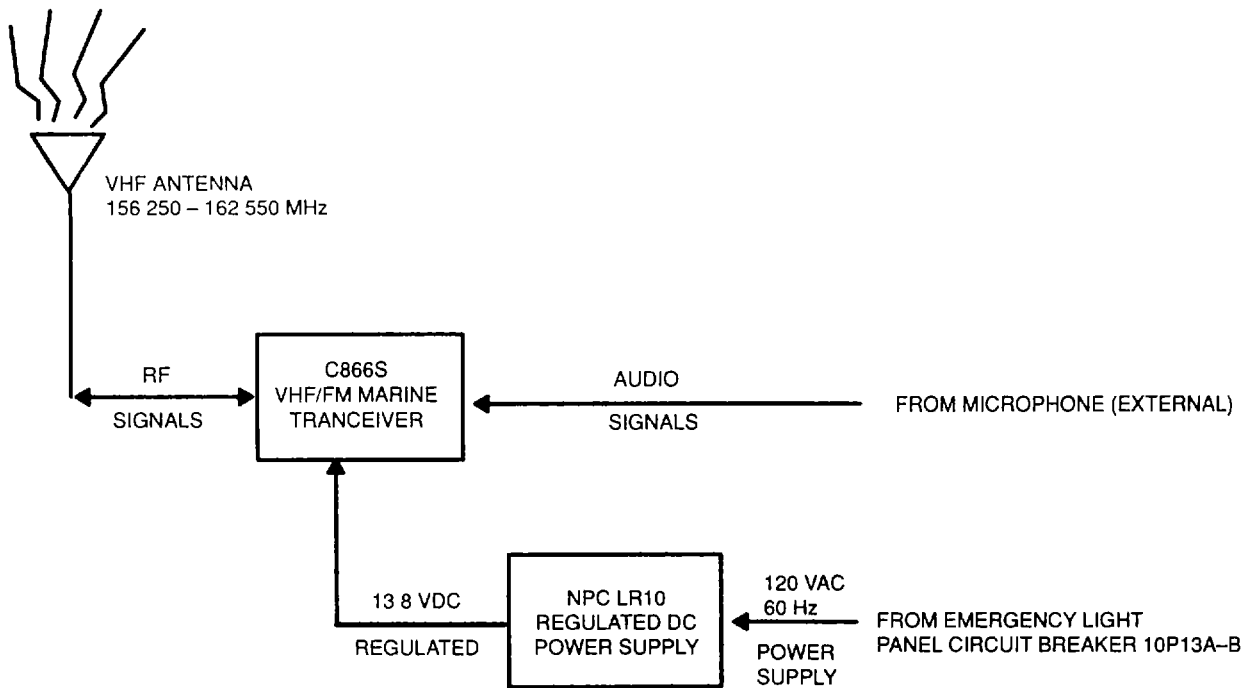


Figure 2-3. Marine Radio Equipment Interface

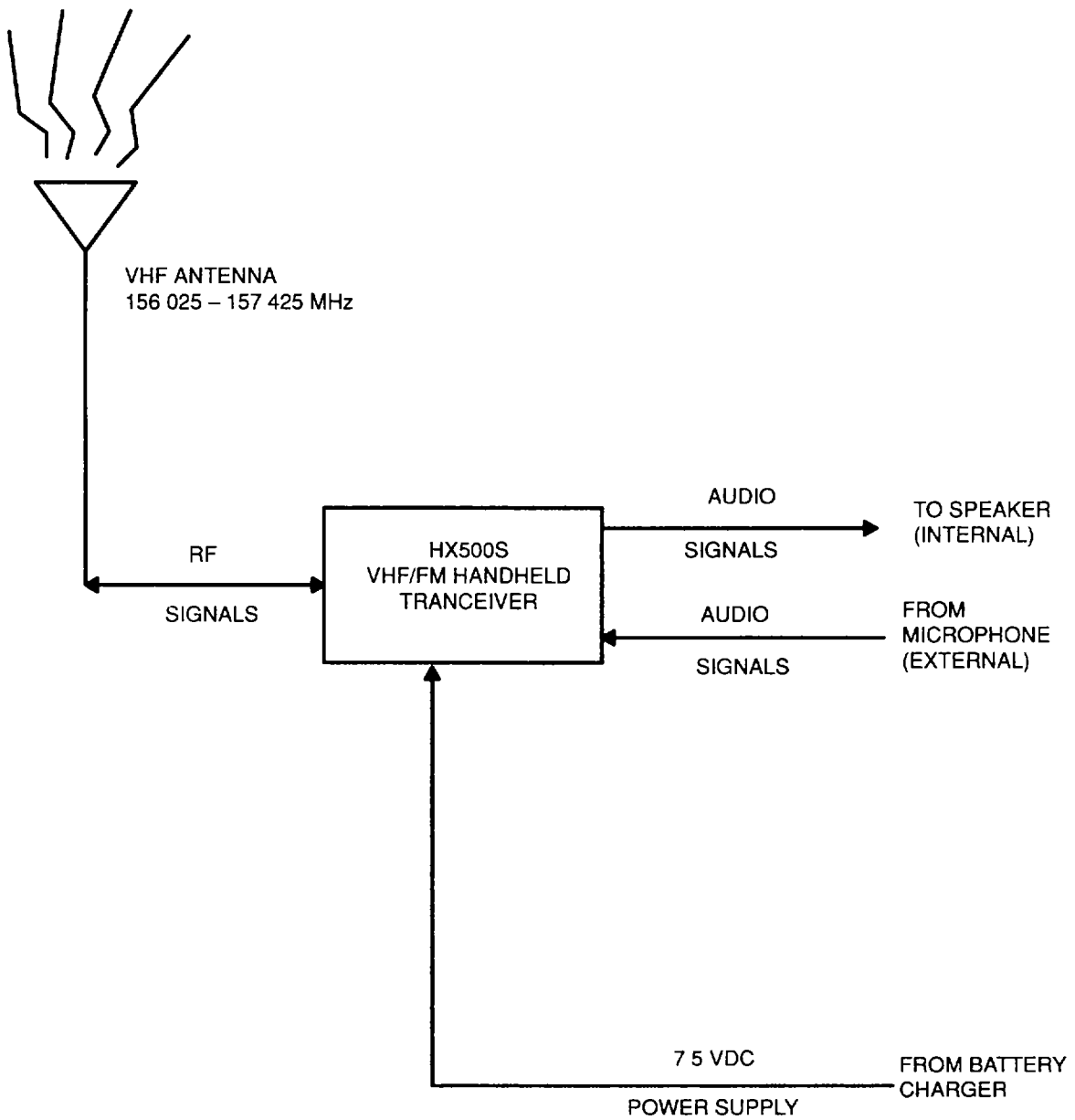


Figure 2-4. Walkie-Talkie Equipment Interface

**2-4 Performance characteristics**

- a. Seawater flow rate from seawater pump
  - Frequency range 30 to 75 95 MHz
  - Channels 920
  - RF output power Low-0 5 to 10 W  
High-35 to 65 W
  - Transmission distance About 5 miles on low power,  
about 25 miles on high power
  
- (1) Army radio power supply
  - Power input PP-6224 A/U (Barge 1)  
or PP-2953/U (Barges 2 and 3)  
regulated power supply
  - Regulated power output 115/230 Vac, 60 Hz  
25 2 Vdc at 10 A
  
- (2) Army radio HF antenna (AS-1729/VRC HF antenna)
  - Frequency range 30 to 76 MHz
  - Power handling capability 70 W, maximum
  
- b. Marine radio (C866S VHF/FM marine transceiver)
  - Input voltage 13 8 Vdc (+ 20 percent)
  - Frequency range 156 250-162 550 MHz
  - Channels - Receive - 50  
Transmit - 46
  - RF power output Low - 1 W  
High - 25 W
  
- (1) Marine radio antenna (VHF antenna)
  - Frequency range 156 025 to 157 8 MHz
  
- (2) Marine radio power supply (NPC LR 10 regulated dc power supply)
  - Input power requirement 115/230 Vac, 60 Hz
  - Regulated power output 13 8 Vdc
  
- c. Walkie-talkie (HX-500S VHF/FM marine handheld transceiver)
  - Input voltage 7 5 Vdc (+/-15 percent)
  - Frequency range Transmit- 156 025 to 157 425 Mhz  
Receive - 156 050 to 157 425 MHz
  - Channels 6
  - RF power output Low - 1 W  
High - 5 W
  
- (1) Walkie-talkie battery charger (Model CSB50AM battery charger)
  - Input power requirement 120/220/240 Vac, 50/60 Hz
  - Power handling capability 6 5 W
  - Regulated power output 7 5 Vdc at 90 mA rate

**2-5 Equipment specifications**

- a. Army radio
  - (1) Army radio
    - Supplier Government furnished
    - Model no AN/VRC-46
    - Type FM
    - Power requirement 24 Vdc
    - Quantity 1

- (2) Army radio microphone
  - Manufacturer U S Army (Sonetronlcs)
  - Part no M-80/U
  - Quantity 1
- (3) Army radio power supply
  - Supplier Government furnished
  - Part no PP-6224 A/U (Barge 1)
  - Part no PP-2953/U (Barges 2 & 3)
  - Type ac-dc
  - Power requirement Regulated ac
  - Quantity 1
- (4) Army radio antenna
  - Supplier Government furnished
  - Part no AS-1729 VRC
  - Quantity 1
- (5) Army radio antenna base and mounting
  - Supplier Government furnished
  - Part no MT-1029/VRC
  - Quantity 1

b. Marine radios (barge and workboat)

- (1) Marine radio with antenna
  - Manufacturer Standard Communications Corp.
  - CAGEC 61057
  - Part no Model 866S
  - Type VHF/FM
  - Weight 4-1/2 lb
  - Dimensions 2-3/4"H x 7"W x 9 1/2"D
  - Input voltage 13.8 Vac +/-20 percent
  - Quantity 2
- (2) Marine radio power supply
  - Manufacturer Vanco Corp
  - CAGEC 56749
  - Model no PS-12-5
  - Type Current limiting
  - Power requirement 117 V, 60 Hz, 100 W
  - Quantity 1
  - Walkie-talkie
- (1) Walkie-talkie
  - Manufacturer Standard Communications Corp
  - CAGEC 61057
  - Model no HX500S
  - Type VHF/FM
  - Power requirement CNB4 ni-cad battery pack (9 batteries)
  - Quantity 3
- (2) Walkie-talkie battery charger
  - Manufacturer Standard Communications Corp
  - CAGEC 61057
  - Part no CSB50AM
  - Type Wall-mounted, master gang
  - Power requirement Any 120-240 Vac, 60 Hz, source
  - Quantity 1

**2-6 Items furnished**

**2-6.1** Components Installed as part of the radio communications system are listed on the parts list of drawings listed in Appendix A and In the Components of End Item List in TM 55-1930-209-14&P-20.

**2-6.2** Common and bulk items onboard are listed in the Expendable Supplies and Materials List in TM 55-1930-209-14&P-20.

**2-6.3** Repair parts and special tools onboard are listed in the Repair Parts and Special Tools List In TM 55-1930-209-14&P-1 8.

**2-7** Items required but not furnished. All required items are furnished.

**2-8** Tools and test equipment. Use existing tools and equipment onboard A complete list of tools and test equipment onboard Is in the Tools and Test Equipment List In TM 55-1930-209-14&P-18.

**Section II. Description of operation**

**2-9 General.** Each radio has four main components: antenna, transceiver and speaker, regulated DC power supply, and microphone When power is turned on, the radio can be used for receiving or transmitting radio messages Receiving and transmitting radio messages is described in paragraphs 2-9.1 and 2-9.2.

**2-9.1 Receiving radio messages.** After radio is turned on, the antenna picks up incoming radio waves. These input radio waves are then converted into sound (audio) output signals to produce words and sounds through the radio speaker.

**2-9.2 Transmitting radio messages.** After the radio is turned on and the microphone push-to-talk button is pressed, words spoken into the microphone are converted into radio waves in the transceiver. The radio waves are then broadcast from the antenna for reception by other radio stations.

**Section III. Operating instructions**

**2-10 Operating controls and indicators.** Controls and indicators for radio communications system major components are shown in Figures 2-5 thru 2-9.

**2-11 Prestart procedures.** The following prestart procedures should be performed by system operator before activating radio communications system.

- a. Make sure power switches are set to OFF position for all radio system operating equipment.

**CAUTION**

**Be sure proper fuse ampere rating and type are installed in the Army radio power supply. If a larger ampere-rated fuse is installed, damage to equipment circuitry can occur.**

- b. Make sure correct power fuses are installed in the radio equipment specified in the following:

<u>Operating equipment</u>	<u>Fuse rating</u>	<u>Location</u>
Army radio power supply	3A ac	Front panel of power supply
Marine radio	10A	ac power cord to radio
Walkie-talkie	3/4A	In series with power input circuit from CNB4 ni-cad battery pack

- c. Perform before operation preventive maintenance procedures in paragraph 2-16.

d. Make sure circuit breakers are closed (ON) for the radio equipment specified in the following'

<u>Radio Equipment</u>	<u>Circuit breaker no.</u>	<u>Panel</u>	<u>Location</u>
Army radio	3P14	24 Vdc power panel	Workshop on aft bulkhead
Army radio power supply	12P13A-4	Isolating receptacle panel	Workshop on aft bulkhead
Marine radio and radio power supply	10P13A-8 panel	Emergency light supply starboard	ROWPU space on forward
Walkie-talkie battery charger	N/A	N/A	N/A

**2-12 Operating procedures.** Radio operators must comply with FCC and Army radio communications procedures when operating any radio. These procedures are available in FCC regulations, Army radio training materials and SSI/SO. They are not part of these instructions.

**2-12.1 Army radio**

- a. Perform following to turn on Army radio'
  - (1) Turn power supply (Figures 2-5 and 2-) ac voltage selector switch to 115 V 50-60 400 cycle position.
  - (2) Turn power supply POWER ON/OFF switch to ON Green ac ON indicator lamp should light.
  - (3) Turn radio (Figure 2-6) BREAKER-RESET power switch to LOW.
  - (4) Set radio LIGHT selector switch to ON so that LAMP and CALL control indicators come on.

**CAUTION**

**Do not use following frequencies because they will cause improper operation of Army radio: 33.90 MHz, 45.20 MHz, 56.50 MHz, and 67.80 MHz. Do not use frequencies that are separated exactly by 5.75 MHz or 23.00 MHz.**

- b. On Army radio (Figure 2-6), perform following to receive transmissions from another Army radio station:

**NOTE**

**Radio operator must obtain assigned frequencies (primary and alternate), network and call signs for barge radio and other stations to be contacted. Frequencies, call signs, and network organizations are obtained from SSI/SOI. Unit headquarters provides extracts of SSI and SOI.**

- (1) Turn BAND selector switch to either A or B position for desired frequency band.

**NOTE**

**When using SQUELCH control, radio background noise is silenced when transmitter is not keyed. Newer model FM radio sets use a squelch control which automatically disables radio squelch circuitry. For reliable communications, make sure that both distant radio stations and barge and workboat radio squelch controls are in same position, i.e., NEW ON or OLD ON. If unsure of distant station squelch control setting, initially tune with squelch in either OFF position.**

- (2) For SQUELCH operation, turn SQUELCH control to either NEW ON or OLD ON, as appropriate.
- (3) Turn MC TUNE control to desired MHz frequency MC TUNE control provides manual tuning of radio in 1 MHz steps as indicated by outer section of dial window.
- (4) Turn KC TUNE control to desired kHz frequency KC TUNE control provides manual tuning of radio in 0.05 MHz steps as indicated by Inner section of dial window.

- (5) Turn SPEAKER selector switch to ON position and adjust to a comfortable listening level.
- c. On Army radio (Figure 2-6), perform following to transmit to a radio station on your frequency in your radio net.

**NOTE**

**If there are problems with interference, have Intermediate Direct Support /Intermediate General Support (IDS/IGS) maintenance check Interfering frequency charts to make sure an Interference-free frequency is being used.**

**WARNING**

**Do not touch Army radio antenna while radio is operating. Antenna contains high voltage which will cause serious injury.**

- (1) Perform step b, (1) thru (5) in paragraph 2-12.1.
- (2) Remove microphone from mounting. Key Army radio set by pressing and holding the PUSH-TO-TALK button.
- (3) Speak into microphone using proper radio call signs and procedures.

**NOTE**

**A sidetone should now be heard in the loudspeaker. Request distant station transmit to you and then release PUSH-TOTALK button. Sidetone should stop. Blower will continue to run if equipment is warm; otherwise, it will stop.**

- (4) Listen to loudspeaker for signal from distant station and readjust SPEAKER control to obtain a comfortable listening level.

**NOTE**

**If desired radio station cannot be reached on LOW power setting, repeat steps c, (1) thru (4) in paragraph 2-12.1, using HIGH power setting.**

**2-12.2 Commercial marine radios.** These radios operate in the 156.250-162.550 MHz frequency range, develop up to 25 W of radio frequency (RF) power, receive 50 channels for operational and environmental announcements, and transmit on 46 channels. When barge is deployed in U.S coastal waters and marine radio is not being used for two-way communications, monitor channel 16. Both USCG and commercial vessels initiate contact on this channel.

- a. When using the radios for two-way communications, observe secure transmission procedures as specified in unit Communication Electronics Operation Instructions.
- b. Perform following to turn on the marine radio.
  - (1) On marine radio power supply, set power switch to ON.
  - (2) On marine radio (Figure 2-7), turn VOLUME control clockwise to mid-position on dial.
- c. Perform the following to receive from a remote radio station:
  - (1) On marine radio, turn CHANNEL selector switch to the desired channel in accordance with Table 2-2. In most instances channel 16 is used to establish initial contact and for DISTRESS and SAFETY communications. Once contact is made on channel 16, the appropriate working channel is selected and set

**NOTE**

**Selection of channel 15 or channel 17 automatically reduces radio output power to 1 W in compliance with US FCC regulations.**

- (2) Select/set the desired HI/LO power setting.
- (3) Turn SQUELCH control clockwise until background noise just disappears. Do not adjust control beyond this point or the marine radio receiver sensitivity will be reduced.
- (4) When message is received, adjust VOLUME control to obtain desired listening level.
- d. Perform the following to transmit to a remote radio station.

**NOTE**

**Do not transmit on frequencies assigned to other radio sets. Refer to Table 2-2 for a general listing of channel assignments and the purpose for which these channels are to be used.**

- (1) Turn HI-LO POWER selector switch to desired setting.

**NOTE**

**HI-LO POWER selector switch should initially be set in LO position (1 W RF output power) for near stations (1-2 miles). Use HI position (25 W RF output power) when contact cannot be made using low power (LO position) or for distant stations (over 2 miles).**

- (2) Turn CHANNEL selector switch to obtain desired channel, normally channel 16, to establish initial contact (Channels 16 and 22 are always monitored by the USCG.)

**NOTE**

**Refer to Table 2-2 to select the proper channel to be used as a working channel after initial contact. Before transmitting on the working channel, make sure channel selected is not in use.**

- (3) Hold microphone about 1 inch from the mouth, press and hold PUSH-TO-TALK button on microphone, and speak into it slowly and distinctly.

- (4) When message is complete, release PUSH-TO-TALK button so acknowledgment and incoming messages can be received. Marine radios cannot receive incoming messages while transmitting. Wait until Incoming message is completed before pressing PUSH-TOTALK button again to transmit.

**2-12.3 Walkie-talkies.** The three walkie-talkies are solid state VHF/FM transceivers that operate in the 156.025 to 157.425 MHz frequency range. These frequencies and channels are within the marine radio band as indicated in Table 2-2. Each walkie-talkie operates on six channels' two channels are preprogrammed (i e, channel 6 for Intership safety and channel 16 for distress, safety and calling), and four channels A, B, C, and D which may be programmed by the operator. Each walkie-talkie develops 1 or 5 W of RF output power.

**NOTE**

**Walkie-talkie battery charger should be connected to a 115 Vac power source.**

- a. Perform the following to receive incoming messages:

**NOTE**

Following procedures are performed using the controls and receptacles on top of the walkie-talkie. Each walkie-talkie must have a VHF antenna. If one is not available, obtain part number from TM 55-1930-209-14&P-18 and requisition a replacement.

- (1) Make sure each walkie-talkie has been fully charged on battery charger for 6 hrs.
- (2) Remove walkie-talkie from battery charger (Figure 2-8).
- (3) Attach external VHF antenna to receptacle if not in place.



- (4) Turn VOLUME ON/OFF control clockwise to mid-position on dial.
  - (5) Turn squelch control fully counterclockwise.
  - (6) Set channel selector switch to desired position.
  - (7) Turn SQUELCH control clockwise until background noise just disappears.
  - (8) When message is received, adjust VOLUME/ON/OFF control to desired listening level.
- b. Perform the following to transmit messages to another station on the same frequency:

**NOTE**

**Before transmitting, listen to channel to be used to make sure it is not being used. Make sure external VHF antenna is connected to receptacle on top of unit.**

- (1) Set HI-LO power switch to desired setting.

**NOTE**

**Use low power setting when communicating with stations within 100 yd of location.**

- (2) Speak slowly and distinctly into built-in microphone located in lower left corner of speaker grille, while pressing PUSH-TO-TALK button on side of walkie-talkie.
- (3) If using an external microphone, associated PUSH-TO-TALK button will activate walkie-talkie.

**2-13 Shutdown procedures**

**2-13.1. Army radio**

- a. On Army radio (Figure 2-6), set LIGHT selector switch to OFF. The LAMP and CALL control indicators will go out. Then turn BREAKER-RESET power switch to OFF.
- b. On Army radio power supply (Figure 2-5), turn POWER ON/OFF switch to OFF. The AC ON green light will go out.

**2-13.2. Marine radio**

- a. On marine radio (Figure 2-7), turn VOLUME control fully counterclockwise.
- b. On marine radio power supply, set power switch to OFF.

**2-13.3. Walkie-talkies**

- a. On walkie-talkie, turn VOLUME-ON/OFF control fully counterclockwise.
- b. Replace walkie-talkie in battery charger receptacle and make sure red light next to it goes on to indicate continued charging of walkie-talkie. If red light does not come on, make sure battery charger ON/OFF switch is in ON position.

**2-14 Operation under extreme conditions. In cold weather**

- a. Do not bend cables or cords suddenly.
- b. Keep radio operating. If not possible, allow radio to warm up before using.
- c. Keep ice off antennas. Exercise care not to damage antennas.

**WARNING**

Do not touch Army radio antenna while radio is operating. Antenna contains high voltage which will seriously injure a person touching the antenna during transmissions.

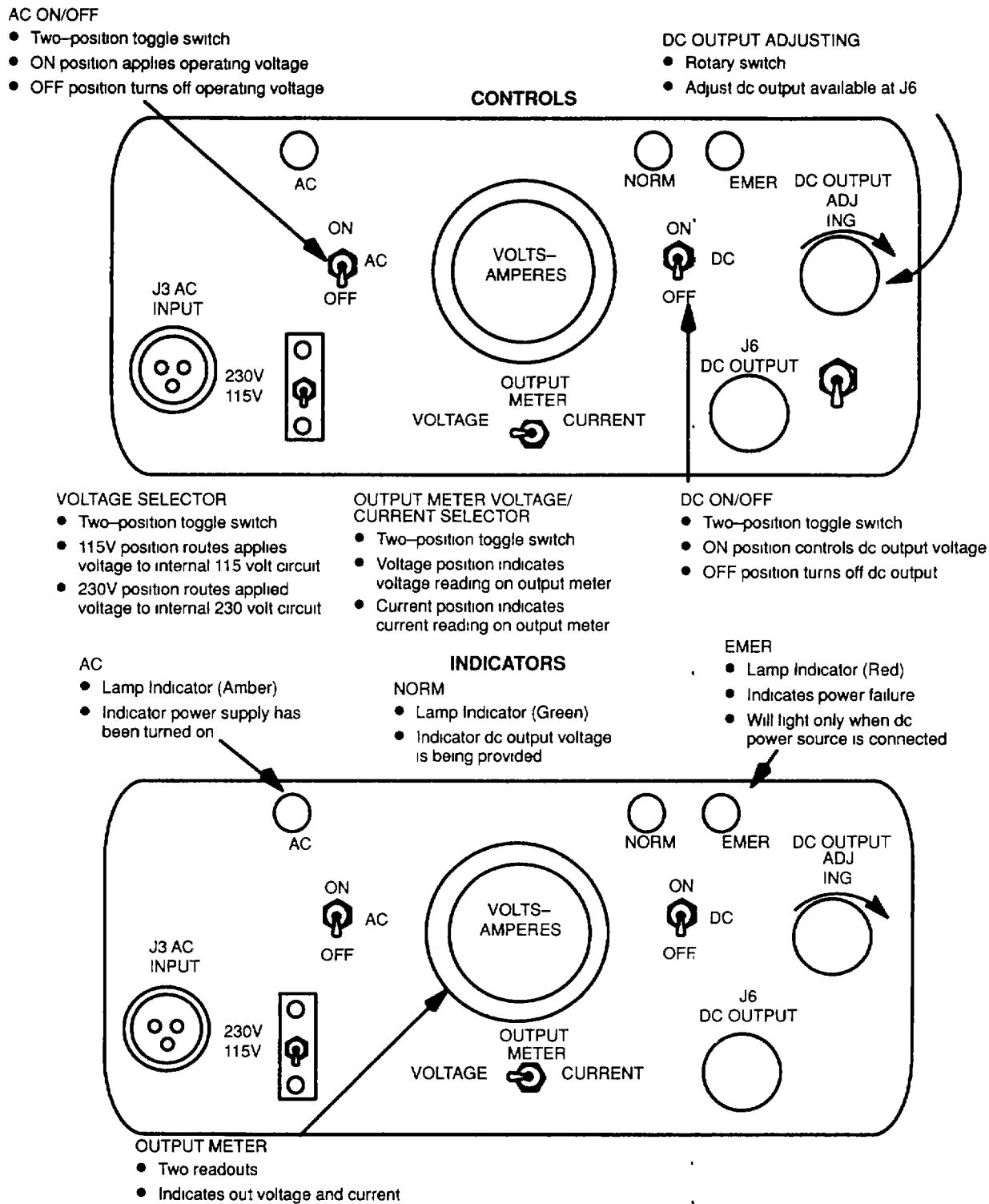


Figure 2-5. Army Radio Power Supply PP-6224 A/U Controls and Indicators (Barge 1)

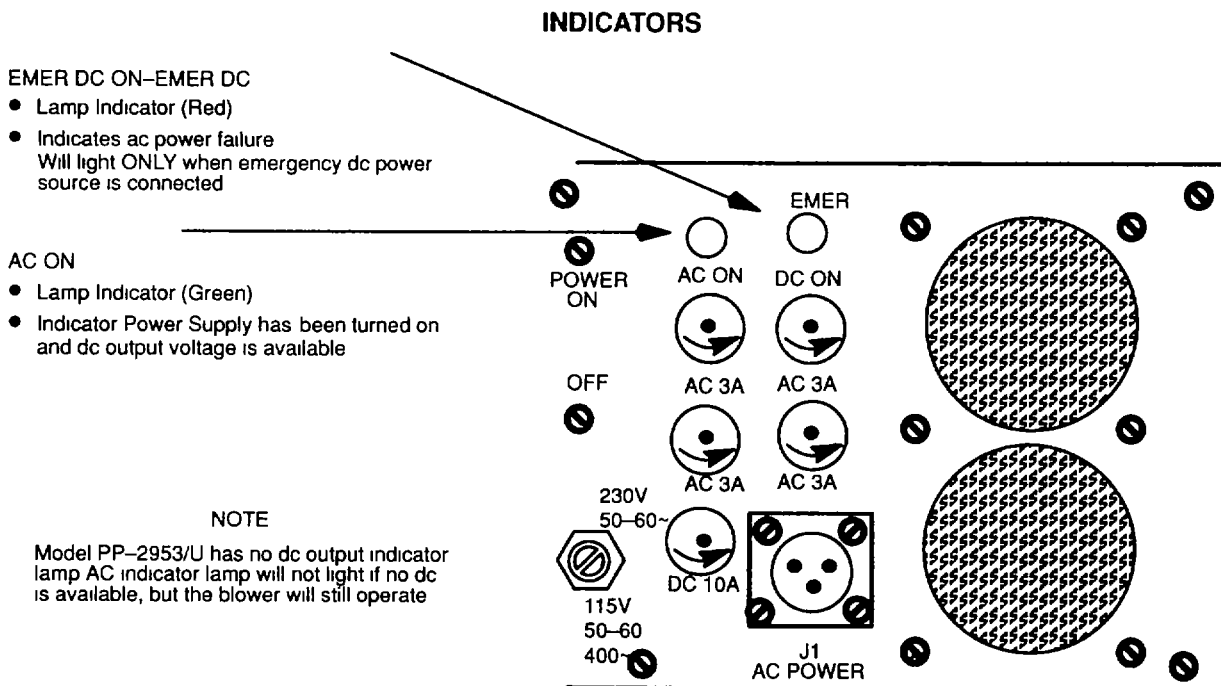
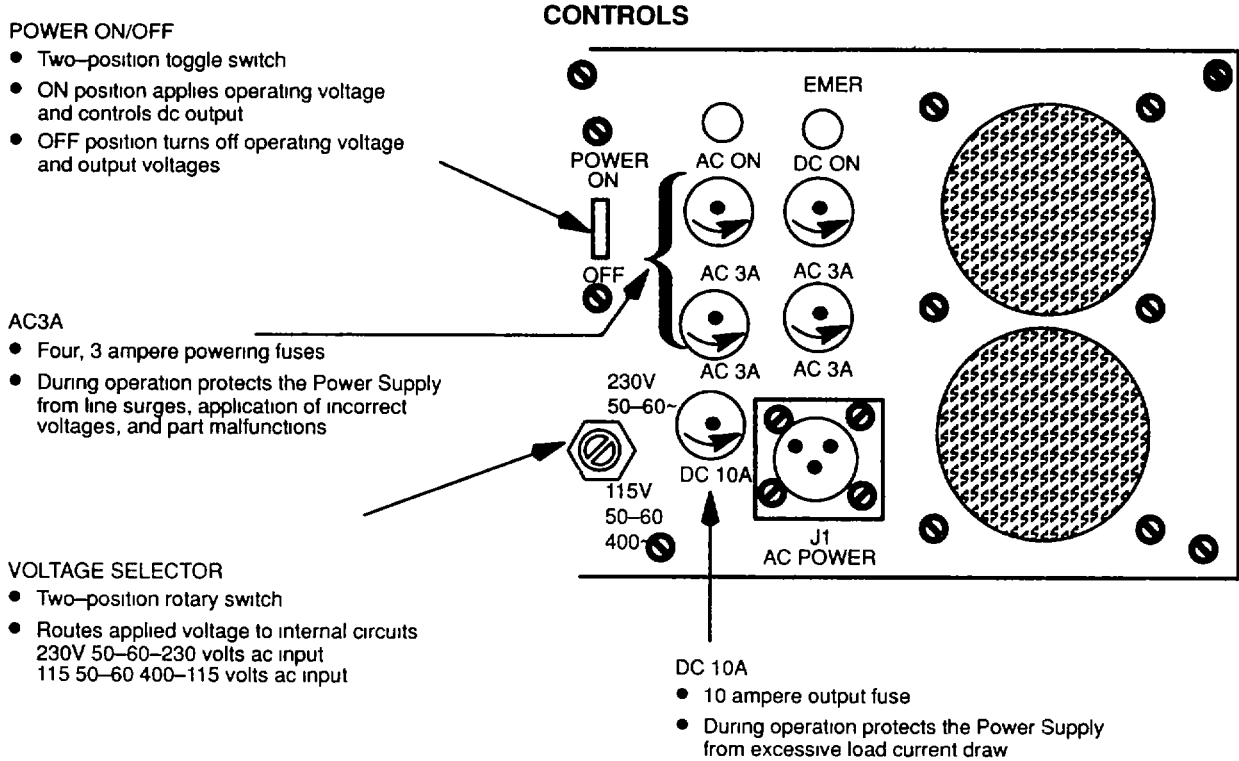
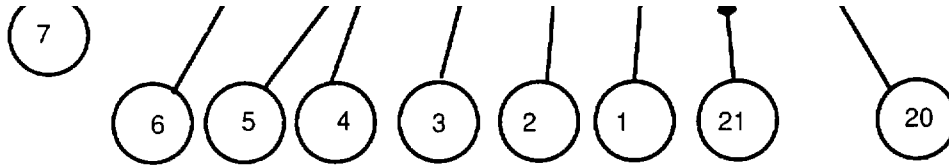


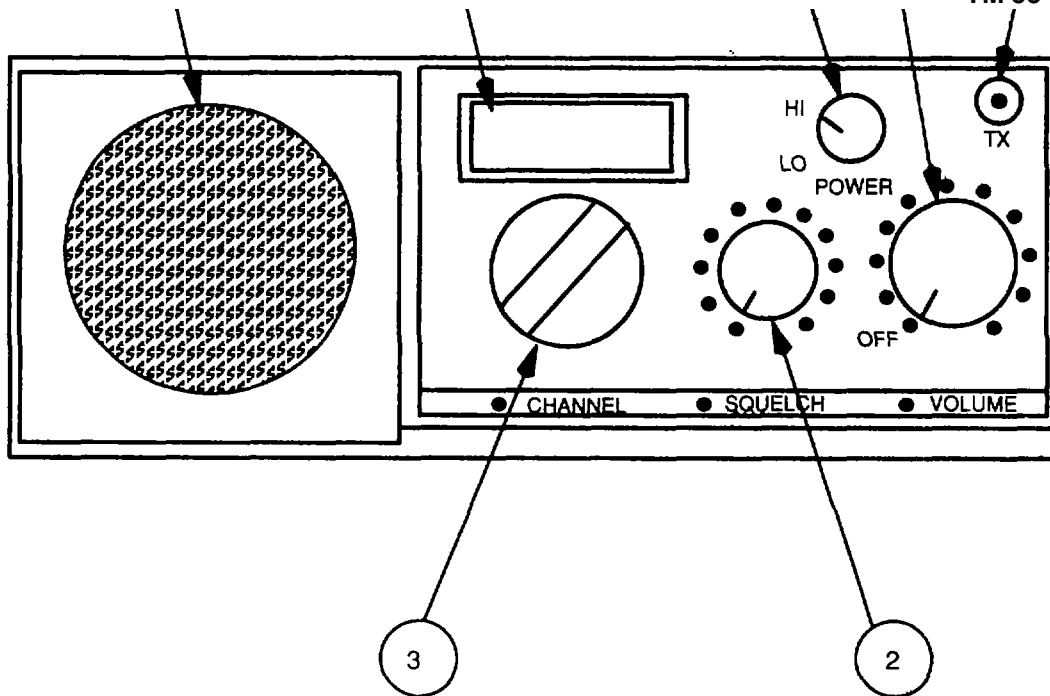
Figure 2-6. Army Radio Power Supply PP-2953/U Controls and Indicators (Barges 2 and 3)



- |                                   |   |
|-----------------------------------|---|
| 1. SPKR Receptacle                | 12. CALL Control Indicator                    |
| 2. RETRANSMIT R/W Receptacle      | 13. BAND Selector Switch                      |
| 3. BREAKER-RESET Power Switch     | 14. KC TUNE Control                           |
| 4. VOLUME Control                 | 15. Frequency Write-in Plate                  |
| 5. Latch (Mechanical-Lock Device) | 16. LIGHT Selector Switch                     |
| 6. SQUELCH Control                | 17. SPEAKER Selector Switch                   |
| 7. MC TUNE Control                | 18. Speaker                                   |
| 8. Band Shutter Dial Window       | 19. ANT Receptacle                            |
| 9. KC Frequency Display           | 20. X-MODE Receptacle (cover contains wiring) |
| 10. MC Frequency Display          | 21. ANT CONT Receptacle                       |
| 11. LAMP Control Indicator        |   |

- |                                   |   |
|-----------------------------------|---|
| 1. SPKR Receptacle                | 12. CALL Control Indicator                    |
| 2. RETRANSMIT R/W Receptacle      | 13. BAND Selector Switch                      |
| 3. BREAKER-RESET Power Switch     | 14. KC TUNE Control                           |
| 4. VOLUME Control                 | 15. Frequency Write-in Plate                  |
| 5. Latch (Mechanical-Lock Device) | 16. LIGHT Selector Switch                     |
| 6. SQUELCH Control                | 17. SPEAKER Selector Switch                   |
| 7. MC TUNE Control                | 18. Speaker                                   |
| 8. Band Shutter Dial Window       | 19. ANT Receptacle                            |
| 9. KC Frequency Display           | 20. X-MODE Receptacle (cover contains wiring) |
| 10. MC Frequency Display          | 21. ANT CONT Receptacle                       |
| 11. LAMP Control Indicator        |   |

**Figure 2-7. Army Radio Controls and Indicators**



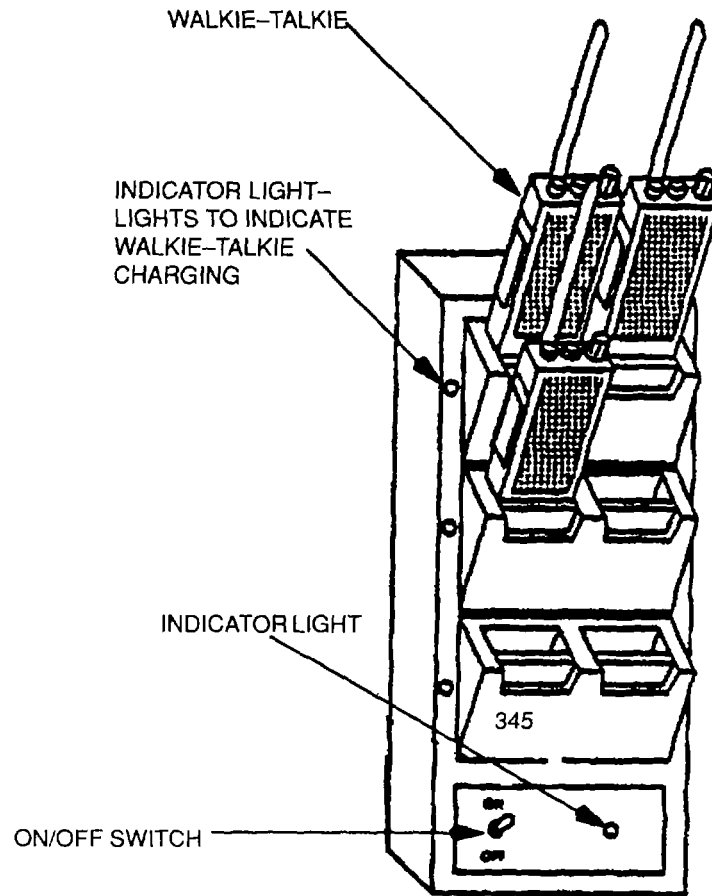
- 1 TX Control Indicator
- 2 SQUELCH Control
- 3 CHANNEL Selector Switch

- 4 Speaker
- 5. Channel Indicator Display
- 6. HI-LO POWER Selector Switch
- 7. VOLUME Control

- 1. TX Control Indicator
- 2. SQUELCH Control
- 3. CHANNEL Selector Switch
- 7. VOLUME Control

- 4. Speaker
- 5. Channel Indicator Display
- 6. HI-LO POWER Selector Switch

Figure 2-8. Marine Radio Controls and Indicators

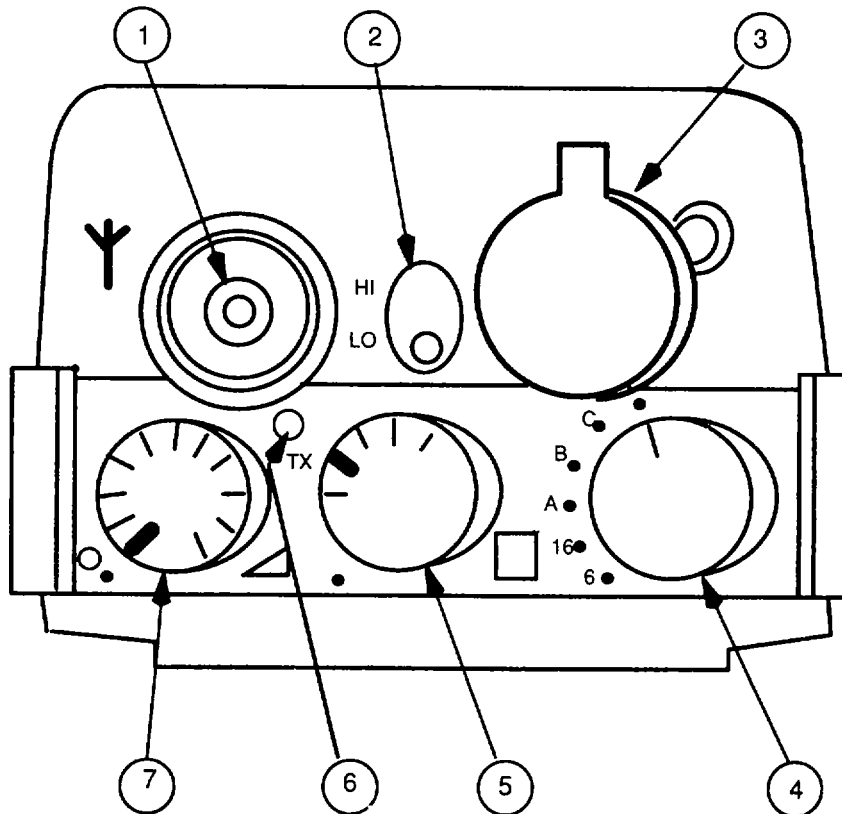


**NOTE:** Input cord/plug from 120/220/240 Vac, 50/60 Hz power source not shown.

**Figure 2-9. Walkie-Talkie Battery Charger Controls and Indicators**

TOP VIEW

TOP VIEW



- 1 Antenna Receptacle
- 2. HI-LO Power Switch

- 5. Squelch Control
- 6. TX Control Indicator

Figure 2-10. Walkie-Talkie Controls and Indicators

**Table 2-2. Frequency/Channel Chart for Commercial Marine Radios in USA**

<u>Channel</u>	<u>TX frequency</u>	<u>Rx frequency</u>	<u>Channel assignment</u>
01	---	162.550	Weather
02	---	162.400	Weather
03	---	162.475	Weather
05	156.250	156.250	Port operations-Intership-ship/coast
06	156.300	156.300	Intership safety
07	156.350	156.350	Commercial intership-ship/coast
08	156.400	156.400	Commercial intership
09	156.450	156.450	Noncommercial intership-ship/coast
10	156.500	156.500	Commercial intership-ship/coast
11	156.550	156.550	Commercial intership-ship/coast
12	156.600	156.600	Port operations-Intership-ship/coast
13	156.650	156.650	Navigational intership-ship/coast
14	156.700	156.700	Port operations-intership-ship/coast
15	---	156.750	Environmental-ship/coast
16	156.800	156.800	DISTRESS, SAFETY, and calling
17	156.850	156.850	State control-ship/coast
18	156.900	156.900	Commercial intership, ship/coast
19	156.950	156.950	Commercial intership, ship/coast
20	157.000	161.600	Port operations-Intership-ship/coast
21	157.050	161.650	Port operations
22	157.100	157.100	USCG liaison-EMERGENCY
23	157.150	157.150	US government
24	157.200	161.800	Public-ship/coast
25	157.250	161.850	Public-ship/coast
26	157.300	161.900	Public-ship/coast
27	157.350	161.950	Public-ship/coast
28	157.400	162.000	Public-ship/coast
65	156.275	156.275	Port operations-Intership-ship/coast
66	156.325	156.325	Port operations-Intership-ship/coast



**Table 2-2. Frequency/Channel Chart for Commercial Marine Radios in USA (continued)**

<u>Channel</u>	<u>TX frequency</u>	<u>Rx frequency</u>	<u>Channel assignment</u>
67	156.375	156.375	Commercial intership
68	156.425	156.425	Noncommercial intership-ship/coast
69	156.475	156.475	Noncommercial intership-ship/coast
70	156.525	156.525	Noncommercial intership
71	156.575	156.575	Noncommercial intership-ship/coast
72	156.625	156.625	Noncommercial intership
73	156.675	156.675	Port operations-intership-ship/coast
74	156.725	156.725	Port operations--intership-ship/coast
77	156.875	156.875	Commercial intership
78	156.925	156.925	Noncommercial intership-ship/coast
79	156.975	156.975	Commercial intership-ship/coast
80	157.025	157.025	Commercial intership-ship/coast
81	157.075	157.075	US government only
82	157.125	157.125	US government only
83	157.175	157.175	US government only
84	157.225	161.825	Public-ship/coast
85	157.275	161.875	Public-ship/coast
86	157.325	161.925	Public-ship/coast
87	157.375	161.975	Public-ship/coast
88	157.425	157.425	Commercial intership

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## Section IV. Maintenance instructions

### 2-15 General

#### 2-15.1 Maintenance concept

**2-15.1.1** Unit level and Intermediate Direct Support/Intermediate General Support (IDS/IGS) maintenance on radio communications system equipment is performed onboard by barge crew members whenever possible.

**2-15.1.2** Any IDS/IGS maintenance beyond capability of crew members is provided by a shore-based area support maintenance unit. This unit also determines if depot support maintenance is required.

**2-15.1.3** Intermediate support maintenance is accomplished by replacement of components or major end items.

**2-15.1.4** Unless other Intermediate support procedures are directed, IDS/IGS maintenance normally is provided by an Army Transportation Corps floating craft intermediate support maintenance unit serving terminal operating area Components to be disposed of are processed by this unit.

**2-15.1.5** Maintenance Allocation Chart (MAC) is in TM 55-1930-209-14&P-18 For maintenance of other equipment onboard, consult appropriate manual.

**2-15.2 Maintenance instructions.** Maintenance instructions are presented in paragraphs 2-16, Preventive maintenance checks and services, Appendix C, Troubleshooting, and 2-18, Maintenance procedures.

**2-16 Preventive maintenance checks and services.** See TM 55-1930-209-14&P-12, Appendix C for preventive maintenance checks and services for the communications system. See TM 55-1930-209-14&P-19 for complete preventive maintenance checks and services for all ROWPU Barge Systems.

#### 2-17 Troubleshooting

**2-17.1 Army radio.** Perform troubleshooting in TM 11-5820-401-10-1, TM 11-5820-401-20-1, and TM 11-6130-233-12 as appropriate.

**2-17.2 Commercial marine radios.** Troubleshoot commercial marine radio as given in Table 2-3. Additional troubleshooting is in manufacturer's service manual/instructions listed in Section VI and contained in Appendix B Table 2-3 lists only common malfunctions that may occur during operation if a malfunction occurs that is not listed and the cause is not readily apparent, request IDS/IGS maintenance assistance.

**2-17.3 Walkie-talkies.** Troubleshoot walkie-talkies as given in Table 2-4.

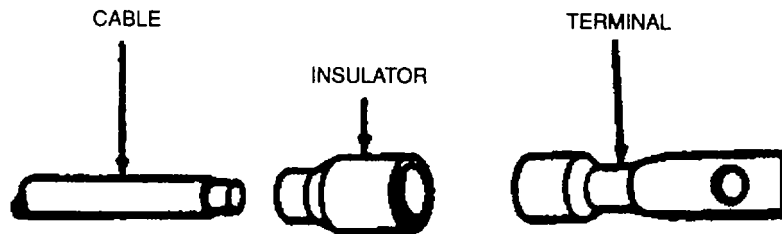
**2-18 General maintenance.** Maintenance for the system consists of disassembling, repairing/replacing, and reassembling items listed in the Repair Parts List in TM 55-1930-209-14&P-18. When performing maintenance, be sure to observe precautions listed in manufacturer's manuals/instructions and the following:

- a. Always use new seals and gaskets, same as original, before reassembling components that have been disassembled for repair. Carefully install so as not to damage during assembly.
- b. When replacing gaskets, make sure mating surfaces are clean and free of old gasket material, adhesive, oil, or grease. These precautions will ensure a leak-proof joint.
- c. When replacing O-rings, make sure all surfaces are clean and free of dirt, grit or foreign material. Prior to installation, apply a thin coat of silicone grease to O-ring for ease of assembly. Protect O-rings by applying tape over threads, sharp corners and edges of components in which the O-ring will be placed.

- d. When replacing electrical components, follow proper procedures for soldering in TB SIG 222. Crimp connections as shown in Figure 2-11. Check all grounding. Make sure current carrying members are properly insulated to avoid short-circuiting. Check for abrasions and chafing of insulation on wires and cables. Repair with tape or replace as necessary.

**WARNING**

**To prevent electrical shock, either disconnect equipment power cord or open applicable circuit breaker to branch equipment circuit. Redtag circuit breaker with: "WARNING-DO NOT ACTIVATE. REPAIRS BEING MADE." Also, when cleaning, repairing, or replacing Army radio antenna, redtag Army radio to prevent operation and transmission.**



- (1) Strip cable insulation equal to depth of terminal well.
- (2) Slide insulator (if used) over cable.
- (3) Insert cable into terminal well and crimp.
- (4) Slide insulator (if used) over crimped end of terminal.

**Figure 2-11. Replacement of Crimped Terminals**

**NOTE**

**Due to mission and crew capabilities of this vessel, maintenance normally assigned to higher echelons may be assigned to the crew.**

**2-18.1 Cleaning.** Clean and touch up components.

**2-18.2 Fuse replacement.** Replace fuses listed in step 2-11b as necessary.

**2-18.3 Indicator lamps.** Replace indicator lamp when burned out.

**2-18.4 Cable replacement.** Check and replace all interconnecting cables as follows.

**WARNING**

**Disconnect power cord or open appropriate circuit breaker before replacing cable.**

- a. Disconnect cable and redtag connector/receptacle.
- b. Check connectors at both ends of cable for looseness or bent pins. Secure connectors and straighten pins as necessary.
- c. Check cable for continuity.
- d. Install repaired or new cable. Make sure connections are secure.
- e. Check to ensure satisfactory operation.

**Table 2-3. Commercial Marine Radio Troubleshooting**

<u>Component</u>	<u>Possible Cause</u>	<u>Suggested Action</u>
1. When marine radio is keyed, no sound is heard and TX control Indicator does not light.	a. Circuit breaker 10P13A-8 open	a. Close circuit breaker 10P13A-8
	b. Volume control in OFF position	b. Turn unit on using VOLUME control.
	c. Marine radio inline fuse blown	c. Check fuse element. Replace if defective.
	d. Interconnecting input cabling disconnected	d. Make sure cable is properly connected. If not, check that no obvious reason exists for condition and plug into receptacle.
	e. Power supply faulty	e. Remove and replace power supply.
2. When transmitting on frequency, only radio sldetone can be heard.	a. Incorrect channel selected	a. Check that proper assigned frequency was selected in accordance with Table 2-2 Tune radio to correct frequency.
	b. Remote station out of range	b. Ensure that HI-LO POWER button/switch is in HI position.
	c. VHF antenna faulty	c. Ensure that antenna is not loose.

**Table 2-4. VHF/FM Marine Handheld Transceiver Troubleshooting**

<u>Component</u>	<u>Possible Cause</u>	<u>Suggested Action</u>
1. When handheld transceiver is keyed and no sound is heard and TX control indicator does not light	a. Battery pack in need of charging	a. Charge battery pack on battery charger for 6 hours.
	b. Volume control in off position	b. Turn unit on using volume control.
	c. Battery pack power supply faulty	c. Remove and replace (NiCad) battery pack.
2. When transmitting only a radio sidetone can be heard	a. Squelch control too high	a. Adjust squelch to proper position.
	b. Antenna is disconnected or damaged	b. Connect, tighten, straighten or repair antenna as necessary
	c. Channel selector switch out of adjustment	c. Check that proper assigned frequency was selected in accordance with Table 2-2. Tune to correct frequency
	d. Receiving station is out of range	d. Ensure that HI-LO power button/switch is in HI position

## 2-18.5 Equipment

**2-18.5.1 Army radio.** Refer to the appropriate Technical Manual listed in Appendix A for maintenance procedures.

### 2-18.5.2 Commercial marine radios

- a. Test. Perform the test procedures outlined in the Maintenance Chapter Performance Test of the manufacturer's manual included in Appendix B of this manual.
- b. Repair. Perform necessary repairs as directed in the Maintenance chapter of the manufacturer's manual included in Appendix B.
- c. Replace. Use the instruction on installation of the manufacturer's manual included in Appendix B of this manual. Use the antenna Instruction Manual in Appendix B to replace the antenna.

**2-18.5.3 Walkie-talkies.** Perform maintenance procedures listed in the manufacturer's manual included in Appendix B.

- a. Battery pack
  - (1) Push battery lock button and remove walkie-talkie battery pack.
  - (2) Properly position a new battery pack on walkie-talkie and snap into position.
- b. Antenna
  - (1) Release lock and remove old antenna
  - (2) Position new antenna and lock into place

### 2-18.5.4 Battery charger

- a. Test
  - (1) Make sure battery charge unit is properly plugged into a 115 Vac wall outlet and that power is being supplied to wall outlet.
  - (2) Turn ON/OFF switch to ON position and check for ON light.
  - (3) If light does not come on, disconnect power and check fuse Replace fuse if faulty.
  - (4) With power ON, check output voltage at battery wells for 7.5 Vdc if voltage is not 7.5 Vdc, replace battery charger.
- b. Replace
  - (1) Unplug battery charger unit.
  - (2) Remove four mounting screws and remove battery charger unit.
  - (3) Install new battery charger with four mounting screws.
  - (4) Plug in battery charger unit and check for proper operation.

## Section V. Storage

**2-19 Short-term storage.** If barge is taken out of service for more than 7 days but less than 30 days, and radio communications system is not used while in storage, follow normal shutdown procedures in paragraph 2-13. Inspections are not required of this system during short-term storage.

**2-20 Administrative storage.** If barge is taken out of service for more than 30 days but less than 6 months, barge remains a unit responsibility and shall be maintained by unit personnel. Process for administrative storage as follows:

- a. Turn off each piece of equipment.
- b. Open appropriate circuit breakers.
- c. Perform before operation checks and services in Appendix C as appropriate.
- d. Disconnect AC power cords and interconnecting cabling from each radio system antenna.
- e. Disconnect all interconnecting cables between each piece of radio system equipment, as appropriate, then tag each cable end to ensure easy reconnection.
- f. Package each piece of equipment in an approved container. Store radio system components. In an area where the temperature is maintained at 40 to 90 degrees Fahrenheit, with relative humidity less than 80 percent.
- g. Mark each container with nomenclature, model identification, and serial number of each component.

**2-21 Long-term storage.** If barge is to be taken out of service for 6 months or more, turn it in to depot for preparation and placement into long-term storage. If barge is in administrative storage and is to be taken out of service and placed in depot long-term storage (6 months or more), process radio communications system components for normal operation before releasing to depot.

**Section VI. Manufacturers' service manuals/instructions**

**2-22 General.** These references provide additional information on radio communications system components. Ready reference copies are in Appendix B. Refer to both these manuals and drawings listed in Appendix A while performing procedures in these manuals.,

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
866S, VHF/FM marine transceiver	Horizon USA/CANADA 866S, VHF/FM Marine Transceiver Owner's Operating and Maintenance Manual	Standard Communications Corporation P O Box 92151 Los Angeles, CA 90009 Ph (213) 532-5300
HX500S VHF/FM marine handheld transceiver	HX500S VHF/FM Handheld Owner's Operating Manual	
Model CSB50AM master gang battery charger	Instructions, CSB50AM Master Gang Charger	
8 ft VHF marine antenna 801754	Instruction Manual, Order, no 969	Telex Communications 9600 Aldrich Ave , S Minneapolis, MN 55420 Ph (612) 884-4051
NPC LR10 regulated dc power supply	NPC LR10 Electrical Schematic	Astron Corporation 2852 Walnut Avenue, E Tustin, CA 92680 Ph (714) 832-7770

**Section VII. Manufacturers' warranties/guarantees**

**2-23 General.** Information on radio communications system major components is listed below:

<u>Component</u>	<u>Manufacturer</u>	<u>Duration</u>	<u>Coverage</u>
866S, VHF/FM marine transceiver	Standard Communications Corp P O Box 92151 Los Angeles, CA 90009 Ph (213) 532-5300	1 year from date of purchase	Materials and workmanship
HX500S VHF/FM marine handheld transceiver			
Model CSB50AM master gang battery charger			
NPC LR10 regulated dc power supply	Astron Corp 2852 Walnut Ave, E Tustin, CA 92680 (714) 832-7770	1 year from date of purchase	Materials and workmanship
8 ft VHF marine radio antenna 801754	Telex Communications, Inc 9600 Aldrich Ave, S Minneapolis, MN 55420 (612) 884-4051	1 year from date of purchase	Materials and workmanship

**CHAPTER 3 FOGHORN EQUIPMENT**

**Section I. Description and data**

**3-1 Description.** The foghorn produces an omidirectional sound to warn approaching vessels of barge location during periods of poor visibility. The foghorn shown in Figure 3-1 consists of the major components listed in Table 3-1. Installation is shown on drawings listed in Appendix A. Additional information about the equipment is contained in manufacturers' service manuals/instructions in Appendix B.

**3-2 Capabilities.** The foghorn meets USCG requirement 33 CFR 67 for a 1/2-mile sound signal. It sounds automatically for approximately 2 seconds, is silent for 18 seconds, and repeats the cycle until turned off. The foghorn sound can be heard in all directions.

**3-3 Special limitations.** The foghorn does not provide any warning to barge crew members of approaching vessels.

**3-4 Performance-characteristics**

Power input	12 Vdc/2A
Frequency	390 +/- 3 Hz
Distance of sound	1/2 mile in all directions
Frequency of sound	2 seconds with 18 seconds silence
Sound level	122.7 dB @ 12 V

**3-5 Equipment specifications**

a. Foghorn remote control	
Manufacturer	Pennwalt Corp
	Automatic Power Division
	28763
CAGEC	
Part no	9001-0454
Quantity	1
b. Regulator (converter assembly)	
Manufacturer	Pennwalt Corp
	Automatic Power Division
	28763
CAGEC	
Part no	9040-0033
Type	Solid state
Rating Input	24 Vdc, output 12 Vdc
Quantity	1
c. Foghorn	
Manufacturer	Pennwalt Corp.
	Automatic Power Division
	28763
CAGEC	
Part no.	1001-1100
Type	Omnidirectional w/ timer, OSC/ regulator, driver and hub
Quantity	1

**3-6 Items furnished**

**3-6.1** Components installed as part of the foghorn are listed on the parts list of drawings referenced in Appendix A and in the Components of End Item List in TM 55-1930-209-14&P-20.

**3-6.2** Common and bulk Items onboard are listed in the Expendable Supplies and Materials List in TM 55-1930-209-14&P-20.



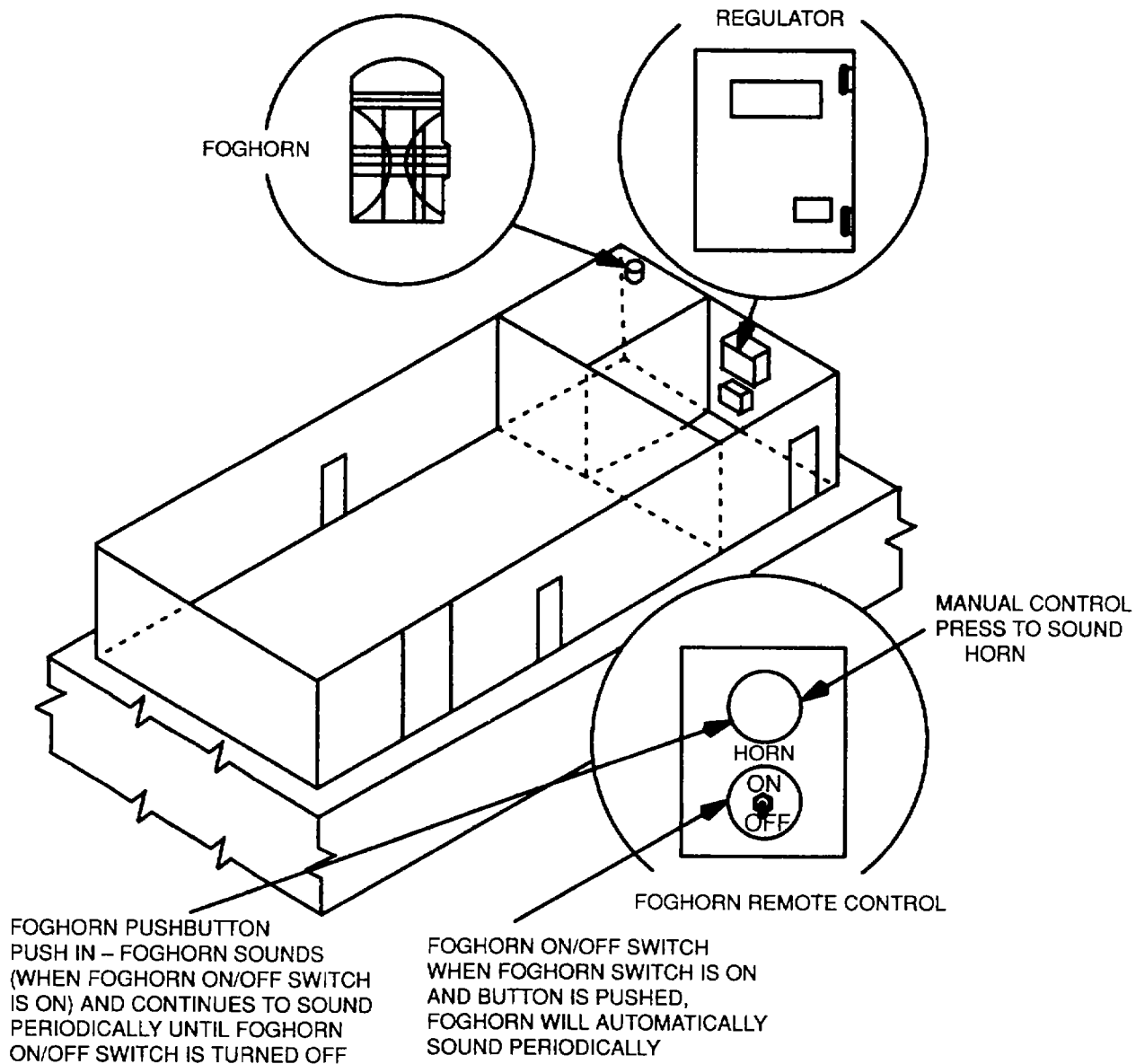


Figure 3-1. Foghorn Major Component Location

**Table 3-1. Foghorn Major Components**

<u>Component</u>	<u>Location</u>	<u>Function</u>
Foghorn remote control assembly 9001-0454	Dayroom on forward bulkhead	For manual or automatic activation of foghorn
Regulator converter assembly 9040-0033	Dayroom on forward bulkhead	Converts 24 Vdc input to 12 Vdc output required by foghorn
Foghorn FA 390/1	Deckhouse top on portside forward	Produces an omidirectional signal that can be heard 1/2 mile away

**3-6.3** Repair parts and special tools onboard are listed in the Repair Parts and Special Tools List in TM 55-1930-209-14&P-18.

**3-7 Items required but not furnished.** All required items are furnished.

**3-8 Tools and test equipment.** Use existing tools and equipment onboard. A complete list of tools and test equipment onboard is in the Tools and Test Equipment List in TM 55-1930-209-14&P-18.

## **Section II. Description of operation**

When foghorn ON/OFF switch on foghorn remote control is set to ON and foghorn pushbutton is pressed foghorn will automatically sound periodically. Foghorn will sound until foghorn switch is set to OFF.

## **Section III. Operating instructions**

**3-9 Operating controls and indicators.** Foghorn controls are shown in Figure 3-1.

**3-10 Prestart procedures.** The following procedures should be performed by operator before activating foghorn.

- a. Make sure foghorn ON/OFF switch is off.
- b. Make sure circuit breaker 6P14 on 24 Vdc power panel is closed (ON).

**3-11 Operating procedures.**

- a. Turn foghorn ON/OFF switch on remote control box (Figure 3-1) to ON.
- b. Press foghorn button to start foghorn sound.

### **NOTE**

**Foghorn will automatically sound for 2 seconds, be silent for 18 seconds, and repeat cycle until stopped.**

**3-12 Shutdown procedure.** To stop foghorn, set foghorn ON/OFF switch to OFF.

**3-13 Operation under extreme conditions.** In cold weather.

- a. Do not bend cables or cords suddenly.
- b. Keep foghorn ON/OFF switch ON. If impossible, allow foghorn remote control to warm up before sounding foghorn.
- c. Keep ice off foghorn. Exercise care not to damage foghorn or electrical connections.

**Section IV. Maintenance instructions**

**3-14 General**

**3-14.1 Maintenance concept**

**3-14.1.1** Maintenance tasks will be performed by either the barge crew or IDS/GS support units. Crew capabilities and equipment will determine which tasks the crew will perform. IDS/GS support units will perform tasks the crew is not prepared to perform.

**3-14.1.2** Intermediate support maintenance is accomplished by replacement of components or major end items.

**3-14.1.3** MAC data is contained in TM 55-1930-209-14&P-18. For maintenance of other equipment onboard, consult appropriate manual.

**3-14.2 Maintenance instructions.** Maintenance instructions are presented in the following paragraphs 3-15, Preventive maintenance checks and services, 3-16, Troubleshooting, and 3-17, Maintenance procedures.

**3-15 Preventive maintenance checks and services.** See TM 55-1930-209-14&P-12, Appendix C for preventive maintenance checks and services for the communications system. See TM 55-1930-209-14&P-19 for complete preventive maintenance checks and services for all ROWPU Barge Systems.

**3-16 Troubleshooting.** Troubleshoot foghorn as given in Table 3-2. This table lists only common malfunctions that may occur during operation. If a malfunction occurs that is not listed and cause is not readily apparent, request IDS maintenance assistance.

**Table 3-2. Foghorn Equipment Troubleshooting**

<u>Condition</u>	<u>Possible Cause</u>	<u>Suggested Action</u>
1. Horn does not blow	a. Circuit breaker 6P14 on 24 Vdc power panel open (OFF) b. Foghorn ON/OFF switch OFF c. Foghorn button not pushed in d. Other possible causes	a. Close (ON) circuit breaker b. Set switch to ON c. Push in button d. See paragraph 4.2 in manufacturer's service manual/instructions in Appendix B
2. Horn blows improperly	a. Several possible causes	a. See paragraph 4.3 in manufacturer's service manual/instructions in Appendix B

### 3-17 Maintenance procedures

#### WARNING

To prevent electrical shock, open circuit breaker 6P14 on 24 Vdc power panel. Redtag circuit breaker with "WARNING - DO NOT ACTIVATE. REPAIRS BEING MADE." Also, wear hearing protection when servicing foghorn.

#### NOTE

Due to mission and crew capabilities of this vessel, maintenance normally assigned to higher echelon may be assigned to the crew.

**3-17.1 General maintenance.** Perform appropriate general maintenance in paragraph 2-18. Clean and inspect electrical components as follows:

- a. Wipe clean exterior of electrical component with clean rag. Vacuum clean or clean inside with electrician's brush. Avoid using solvents for cleaning inside of component. Solvents leave a greasy film on components that may reduce electrical continuity.
- b. Visually inspect for indications of burns, corrosion, loose connections, damaged parts, or chipped paint. Clean corrosion from contacts and terminals, tighten loose connections, and replace damaged parts. Clean electrical contacts with silver polish, fine sandpaper, or burnishing tool. DO NOT use emery paper or steel wool. Vacuum to remove residue. Touch up paint according to TB 43-014. Do not paint threads or labels.

**3-17.2 Equipment maintenance.** Perform foghorn maintenance in accordance with paragraph 4.0, Maintenance, of manufacturer's service manual/instructions as appropriate.

#### 3-17.3 Foghorn remote control assembly circuit test

- a. With 24 Vdc power panel circuit breaker 6P14 closed (ON), check voltage at 24 Vdc inputs to regulator (converter assembly) for 24 Vdc (see Figure 3-2). If voltage is not 24 Vdc, go to step b. If voltage is 24 Vdc, go to step c.
- b. Check voltage at breaker 6P14 output for 24 Vdc. If voltage is not 24 Vdc, circuit breaker or power source is at fault. If voltage is 24 Vdc, repair or replace power cable from 6P14 to regulator cable.
- c. Check voltage at outputs of regulator converter for 12 Vdc. If voltage is 12 Vdc, go to step d. If voltage is not 12 Vdc, replace regulator converter.
- d. Check voltage and polarity to remote control assembly across terminal board points 6 (+) and 7 (-) for 12 Vdc. If voltage is 12 Vdc, go to step e. If voltage is not 12 Vdc, repair or replace power cable from regulator converter assembly 12 Vdc outputs to remote control assembly TB6 and TB7 as given in paragraph 3-17.5.
- e. Check voltage and polarity at regulator oscillator terminal board across point 1 (+) and 4 (-) for 12 Vdc. If voltage is 12 Vdc, go to step f. If voltage is not 12 Vdc, repair or replace cable from remote control assembly TB6 (+) and TB7(-) to oscillator/regulator PC assembly TB1 (+) and TB4 (-).

- f. Open (OFF) 24 Vdc circuit breaker 6P14 and disconnect wires from TB2 and TB3 at timer terminal board. Check continuity of remote circuit between two wires from TB2 and TB3. With remote switch closed, circuit must be closed and with remote switch opened, circuit must be open. If improper operation exists, go to step (1). If proper operation exists, go to step g.
- (1) Check continuity between points S1 and S2 at switch SW when switch is closed and open circuit when switch is open. If switch indicates proper operation, go to step (2). If switch indicates improper operation, replace switch.
  - (2) Check continuity between point S1 at switch SW and TB4 and between point S2 at switch SW and TB5 at remote control assembly. If open circuit exists, repair or replace cable from remote control terminal board to remote switch SW. If continuity exists, repair or replace cable from remote control assembly TB4 and TB5 to timer TB2 and TB3 Reconnect all wires.
- g. Reconnect all wires from step f and disconnect wires from TB4 and TB5 at oscillator/regulator PC assembly. With remote PB-SW switch pressed, check continuity of circuit between wires from TB4 and TB5. If continuity does not exist go to step (1) if continuity exists, go to step h.
- (1) With remote switch PB-SW pressed, check continuity between points R1 and R2 at switch. If continuity exists, go to step (2). If continuity does not exist, replace switch remote PB-SW as given in paragraph 3-17.4.
  - (2) Check continuity of wires from switch PB-SW to remote assembly terminal board between points R1 and TB2 and points R2 and TB3. If both checks indicate closed circuit, go to step (3). If either check indicates an open circuit, repair or replace faulty wire(s).
  - (3) Check resistance of resistor between points T1 and T2 for 1000 ohms. If resistance is 1000 ohms, go to step (4). If resistance is not 1000 ohms, replace resistor.
  - (4) Check continuity of wire from 1000 ohm resistor to remote assembly terminal board between points T1 and TB2 and points T2 and TB1. If continuity exists, replace cable from oscillator/regulator PC assembly TB4 and TB5 to remote control assembly-TB1 and TB3. If continuity does not exist, replace wire(s) from remote control assembly TB1 and TB3 to 1000 ohm resistor point T1 and T2. Reconnect all wires.
- h. Close (ON) 24 Vdc circuit breaker 6P14 and check for negative voltage at oscillator/regulator between terminals 2 (+) and 5 (-) for 12 Vdc. This voltage should correspond to the timer characteristic which is 2 seconds ON and 18 seconds OFF. If voltage is 12 Vdc, go to step 1. If voltage is not 12 Vdc or does not correspond to the timer characteristic, replace timer.
- i. Check voltage at oscillator/regulator between terminals 6 and 7 for approximately 24 Vac. This voltage should correspond to the timer characteristic which is 2 seconds ON and 18 seconds OFF. If voltage is not approximately 24 Vac or is out of time, go to step j. If voltage is approximately 24 Vac and is in time, go to step (k).
- j. Check the fuse in the oscillator/regulator. If the fuse is blown, replace it with a AGC-5 buss or equivalent (API Part No 4035 0022). If the new fuse does not blow, go to step k. If the new fuse blows, replace the oscillator/regulator.
- k. Check voltage at driver unit between points 1 and 2 for 24 Vac. This voltage should correspond to the timer characteristic which is 2 seconds ON and 18 seconds OFF. If the voltage is not approximately 24 Vac, replace input wire(s) to drive unit. If voltage is approximately 24 Vac, replace the driver unit.

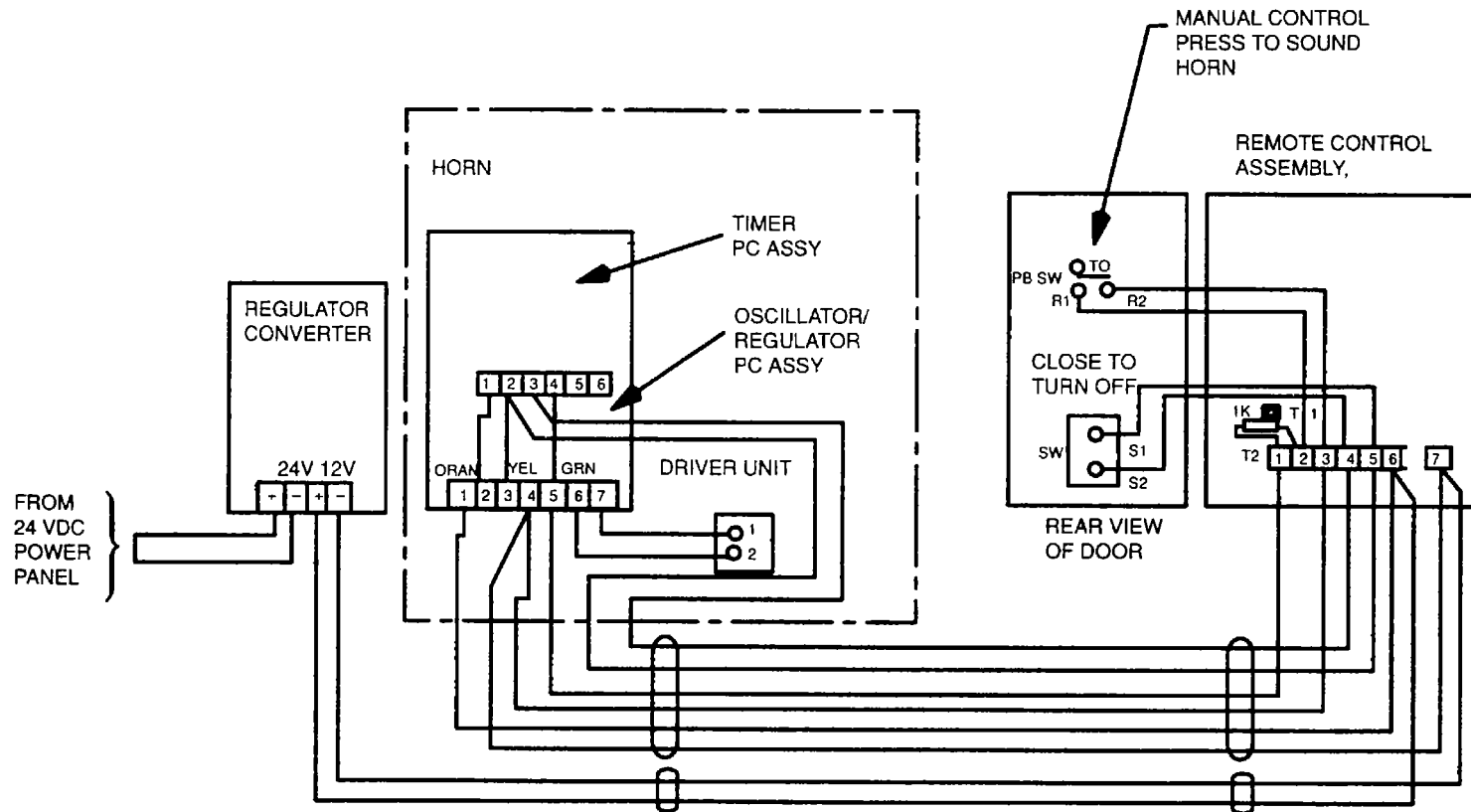


Figure 3-2. Foghorn Wiring Diagram

**3-17.4 Foghorn remote control assembly switch replacement**

- a. Open (OFF) circuit breaker 6P14.
- b. Remove screws on remote control cover plate and detach cover plate taking care not to damage any wires.
- c. Tag and disconnect wires and remove faulty switch.
- d. Mount new switch making sure wires are in correct position.
- e. Reinstall cover plate.

**3-17.5 Regulator converter assembly replacement**

- a. Open (OFF) circuit breaker 6P14.
- b. Open the cover of the regulator converter and disconnect and tag the input cable and the output cable from the terminal board.
- c. Remove the mounting screws and remove the regulator converter.
- d. Install a new regulator converter and install mounting screws.
- e. Connect the input cable and output cable to the proper terminals of the terminal board.
- f. Close the cover and close (ON) circuit breaker 6P14.

**3-17.6 Foghorn replacement**

- a. Open (OFF) circuit breaker 6P14.
- b. Unplug the cable to the foghorn.
- c. Remove the mounting hardware that mounts the foghorn to the deckhouse top.
- d. Install new foghorn to the deckhouse top.
- e. Plug cable into foghorn connector.
- f. Close (ON) circuit breaker 6P14.

**Section V. Storage**

**3-18 Short-term storage.** If barge is taken out of service for more than 7 days but less than 30 days, and foghorn is not used while in storage, follow normal shutdown procedure in paragraph 3-12. Inspections are not required of this system during short-term storage.

**3-19 Administrative storage.** If barge is taken out of service for more than 30 days but less than 6 months, barge remains a unit responsibility and shall be maintained by unit personnel. Foghorn will be processed for administrative storage as follows.

- a. Set foghorn ON/OFF switch to OFF
- b. Open (OFF) circuit breaker 6P14 on 24 Vdc power panel
- c. Perform before operation preventive maintenance as appropriate

**3-20 Long-term storage.** If barge is to be taken out of service for 6 months or more, turn. It in to depot for preparation and placement into long-term storage. If barge is in administrative storage and is to be taken out of service and placed in depot long-term storage (6 months or more), process foghorn for normal operations before releasing to depot for long-term storage.

**Section VI. Manufacturers' service manuals/instructions**

**3-21 General.** These references provide additional information on foghorn components and are available in Appendix B. Refer to both this manual and drawings listed in Appendix A while performing procedures on this equipment.

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
Foghorn 1001-1100	FA-390 HORN	Pennwalt Corp Automatic Power Division 213 Hutcheson St. Houston, TX 77003 Ph: (713) 228-5208

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**Section VII. Manufacturers' warranties/guarantees**

**3-22 General.** Information on foghorn component warranties/guarantees is listed below.

<u>Component</u>	<u>Manufacturer</u>	<u>Duration</u>	<u>Coverage</u>
Foghorn remote control 9001-0454	Pennwalt Corp. Automatic Power Division 213 Hutcheson St. Houston, TX 77003 Ph: (713) 228-5208	1 year	Materials and work- manship
Regulator 9040-0033			
Foghorn 1001-1100			



## CHAPTER 4 TELEPHONE SYSTEM

## Section I. Description and data

**4-1 Description.** The telephone system is an intercom/paging system used for communicating between a system operator in the dayroom and 12 crew telephone stations. The system can also be used for communicating between crew telephone stations. Twelve telephone stations are connected to 21 headset stations that are serviced by 14 buzzers, 3 strobe lights, and 10 telephone set stowage boxes.

The telephone system shown in Figure 4-1 consists of the components listed in Table 4-1. Onboard installation is shown on drawings listed in Appendix A. Additional information concerning equipment is in manufacturer's service manuals/instructions in Appendix B.

**4-2 Capabilities.** Telephone system provides two-way conversation capability between a dayroom system operator and crewmembers at 21 telephone headset stations or between crewmembers at these stations.

**4-3 Special limitations.** Paging can be done only from the dayroom telephone station selector. However, after a telephone headset has been plugged into a headset station jack receptacle, a crewmember can talk through the speaker to page dayroom system operator, talk to dayroom system operator, or talk to another headset station.

**4-4 Performance characteristics**

a. Telephone power amplifier	
Input impedance	80,000 ohm minimum
Output	2 W @ 24 Vdc and 16 ohms
Gain	32 dB
b. Telephone speaker	
Input impedance	8 ohms
c. Telephone power control module	
Power input	24 Vdc nominal
Output current	0.5 A
d. Telephone headset	
Microphone	M-1/dc Amplified Dynamic, nominal 100 ohms
Earphone	Dynamic, nominal 300 ohms
Noise capacity	125 dB
e. Strobe light	
Input power requirement	120 Vac, 50/60 Hz
Light output	500,000 candlepower, 60 flashes/min , white
f. Buzzer	
Input power requirement	120 Vac, 50/60 Hz

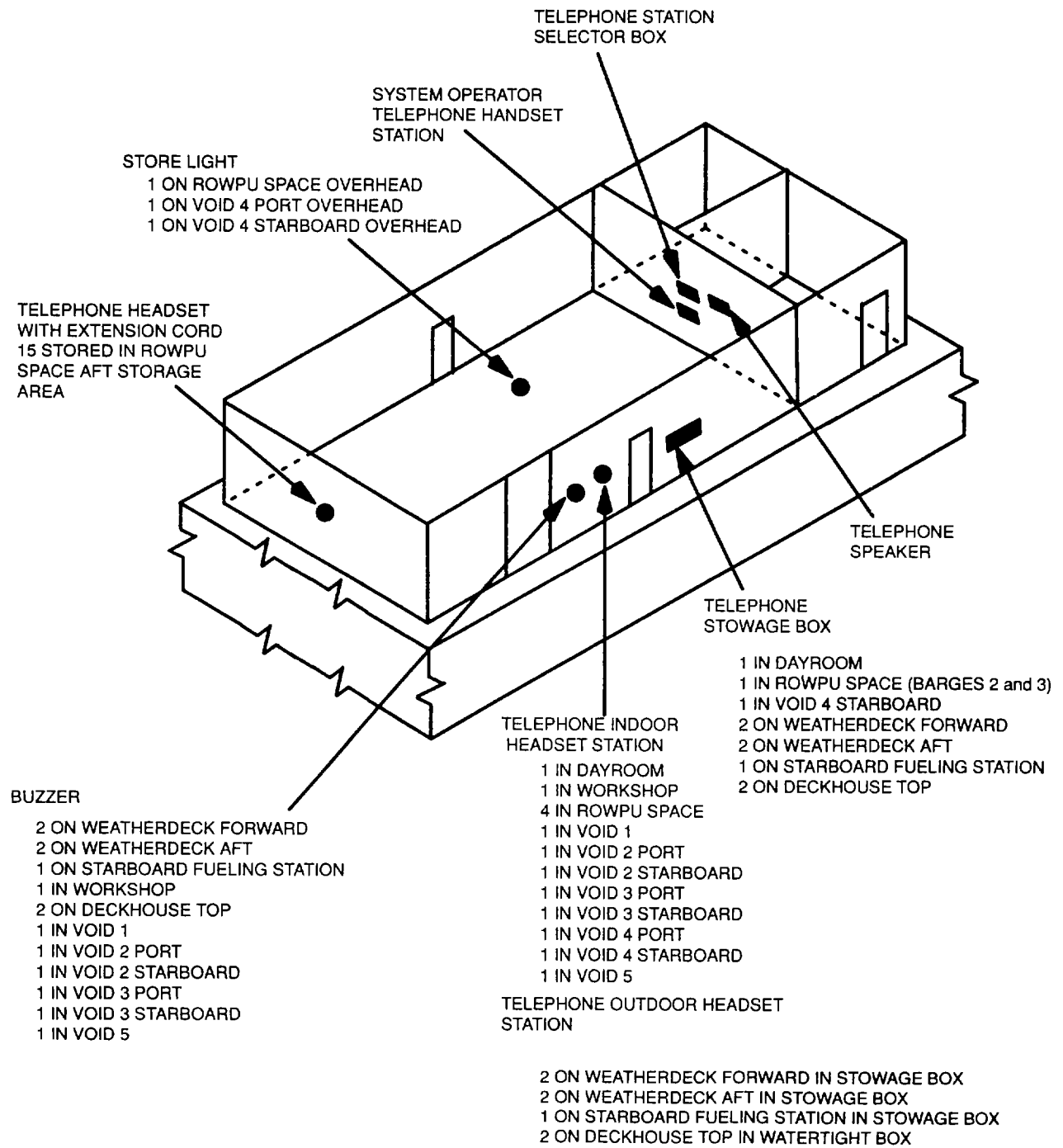


Figure 4-1. Telephone System Major Component Location

**Table 4-1. Telephone System Major Components**

<u>Component /Quantity</u>	<u>Location</u>	<u>Function</u>
Telephone power amplifier/1 (M3131)	Mounted in station selector box on aft bulkhead in dayroom	Amplifies calls from handset station so they can be heard at the headset stations
Telephone speaker/1 (801-401)	Located above operator's desk in dayroom	For converting signals from headset stations into sound
Telephone power control module/1 (M3116)	Mounted in station selector box on aft bulkhead in dayroom	Acts as regulator between power source and power amplifier
Telephone station selector box/1	Mounted on aft bulkhead in dayroom	For selecting telephone station (12 stations) to alert crew personnel by activating buzzer or strobe light, for controlling telephone power amplifier volume and for turning on/off 24 Vdc to telephone system
Telephone headset/15 (H3342)	Stored in the ROWPU space aft storage area	Allows crew personnel to receive incoming calls from system operator and transmit messages (talk-back) when connected to associated headset station jack receptacle
Telephone station buzzer/14 (1C/Z154)	Mounted throughout barge near headset stations	Alerts crew personnel at headset station that they are being paged
Telephone station strobe light/3 (6850-138)	Mounted on overhead in center of ROWPU space and in void 4 port and starboard	Alerts crew personnel at headset station that they are being paged
Telephone indoor headset station/1 4 (M3141)	Mounted in dayroom, workshop, ROWPU space, and each void	Allows crew personnel to plug in telephone headset and communicate with dayroom system operator or another headset station
Telephone outdoor headset station/7 (M3141)	Mounted on weatherdeck in 5 stowage boxes and on top of deckhouse in two watertight boxes	Allows crew personnel to plug in telephone headset and communicate with dayroom system operator or another headset station
Operator telephone handset station/i (WE-2)	Mounted on operator's desk in dayroom	Allows messages to be sent to and received from crew telephone stations
Telephone headset stowage box/10 (10444-003)	2 on weatherdeck forward 1 In dayroom 1 In ROWPU space (Barges 2 and 3) 1 in void 4 starboard 1 on weatherdeck starboard (fuel oil fill) 2 on weatherdeck aft 2 on deckhouse top	For stowing headsets at telephone stations
Handset adapter module/1 (M3146)	Dayroom	Permits connection of telephone handset to telephone system

**4-5 Equipment specifications**

<p>a. Telephone power amplifier                      Manufacturer                      CAGEC                      Part no                      Type                      Quantity</p>	<p>David Clark Company, Inc                      71483                      M3131                      2 W output w/selector switch                      1</p>
<p>b. Telephone speaker                      Manufacturer                      CAGEC                      Part no                      Type                      Quantity</p>	<p>Gai-Tronics Corporation                      52782                      801-401                      Indoor monitor w/volume control                      1</p>
<p>c. Telephone power control module                      Manufacturer                      CAGEC                      Part no                      Type                      Quantity</p>	<p>David Clark Company, Inc                      71483                      M 3116                      Regulated dc                      1</p>
<p>d. Telephone station selector box                      Manufacturer                      CAGEC                      Part no                      Size                      Quantity</p>	<p>Hoffman Engineering Company                      00843                      A-884GSC                      8 in X8 in X4 in                      1</p>
<p>e. Telephone headset                      Manufacturer                      CAGEC                      Part no                      Type                      Quantity</p>	<p>David Clark Company, Inc                      71483                      H3342                      Headset amplifier with headband for two-way                      communications while wearing safety hat                      15</p>
<p>f. Telephone station buzzer                      Manufacturer                      CAGEC                      Type                      Part no                      Quantity</p>	<p>Henschel Corporation                      A unit of General Signal Corp.                      28195                      1 C/Z1 S4, wall-mounted, low-intensity, watertight                      Not available                      14</p>
<p>g. Telephone station strobe light                      Manufacturer                      CAGEC                      Part no                      Type                      Quantity</p>	<p>Gai-Tronics Corporation                      04106                      6850-138                      500,000 candlepower, 120 Vac,                      60 flashes/min, amber                      3</p>

h. Telephone headset station jack box	
Manufacturer	Killard Electric Manufacturing Company
CAGEC	75282
Part no	FSC 1
Type	Single, wall-mounted station
Material	Plastic
Quantity	21
i. Telephone headset station jack box cover	
Manufacturer	Eagle Manufacturing Company
CAGEC	72041
Part no	S1962
Type	Plastic
Quantity	21
J. Telephone headset station	
Manufacturer	David Clark Company, Inc
CAGEC	71483
Part no	M3141
Quantity	21
k. System operator telephone handset station	
Manufacturer	Soundelier, Inc
CAGEC	21260
Part no	WE-2
Type	Single, indoor, desk-edge mounted hand station
Quantity	1
l. Telephone headset stowage box	
Manufacturer	Gai-Tronics Corporation
CAGEC	52782
Part no	10444-003
Material	Plastic
Quantity	10
m. Telephone handset adapter module	
Manufacturer	David Clark Company, Inc
Part no	M3146
Quantity	1
n. Telephone extension cord	
Manufacturer	David Clark Company, Inc
Part no	C35-25
Quantity	15

**4-6 Items furnished**

**4-6.1** Components installed as part of the telephone system are listed on the parts list of drawings referenced in Appendix A and in the Components of End Item List in TM 55-1930-209-14&P-20

**4-6.2** Common and bulk items onboard are listed In the Expendable Supplies and Materials List in TM 55-1930-209-14&P-20

**4-6.3** Repair parts and special tools onboard are listed In the Repair Parts and Special Tools List in TM 55-1930-209-14&P-18

**4-7 Items required but not furnished** . All required items are furnished.

**4-8 Tools and test equipment** . Use existing tools and equipment onboard A complete list of tools and test equipment onboard is in the Tools and Test Equipment List in TM 55-1930-209-14&P-18.

## Section II. Description of operation

**4-9 General.** The telephone system has 11 major components telephone station selector box containing power amplifier and power control module, speaker, headset, buzzer, strobe light, crew headset station, system operator handset station, 25-foot headset extension cord, and headset stowage box. These components of the telephone system are used for paging between the dayroom system operator and crew personnel and for two-way communications between crew telephone stations. Various modes of communicating with this system are discussed in paragraphs 4-9.1 thru 4-9.3.

**4-9.1 Paging from system operator to crew personnel.** When system operator in dayroom selects crew telephone station to be paged on telephone station selector panel and presses BUZZER switch on selector, station buzzer will sound and/or station strobe light will light.

**4-9.1.1** Crewmembers upon hearing buzzer or seeing white strobe light, are alerted to connect their headset into headset station jack receptacle. To speak into headset microphone to let the system operator know that he is online, the crewmember must press the PUSH-TO-TALK switch on the earphone. To listen to the system operator, the crewmember must release the PUSH-TO-TALK switch.

**4-9.1.2** As soon as crewmember is online, system operator stops buzzer/strobe by pressing BUZZER switch to OFF position. To speak, operator must remove telephone handset from cradle and speak into the handset microphone.

**4-9.2 Paging from crew personnel to system operator.** After crewmember plugs telephone headset into headset station jack receptacle, depresses PUSH-TO-TALK switch on earphone, and speaks into microphone, his voice will be heard from dayroom speaker.

**4-9.2.1** Upon hearing speaker page, system operator responds by selecting station to be communicated with on telephone station selector box, removes telephone handset from cradle, and speaks into handset microphone

**4-9.2.2** Operator, using telephone handset, and crewmember, by pressing and releasing PUSH-TO-TALK button on earphone and speaking into headset microphone, can communicate.

**4-9.3 Two-way communications between crew personnel.** After crewmembers plug telephone headsets into jack receptacles at headset stations, they can communicate with each other.

## Section III. Operating instructions

**4-10 Operating controls and Indicators.** Controls and indicators for the telephone system are shown in Figures 4-2 thru 4-6.

**4-11 Prestart procedures.** Following prestart procedures should be performed by operator before activating telephone system.

- a. Make sure power switches are set to OFF position for all system operating equipment.

### CAUTION

**Make sure the proper fuse ampere/voltage rating and type are installed in telephone equipment. If a larger ampere rated fuse is used, this equipment will be damaged.**

- b. Make sure telephone power control module has a 0.5 A fuse in the fuse holder on the side of the telephone headset station selector (Figure 4-2).
- c. Make sure circuit breakers are closed (ON) in accordance with Table 4-2.

**Table 4-2. Circuit Breaker Safety Guide**

Equipment	Rating	Circuit Breaker	Identification	Location
Telephone system except headset station buzzers and strobe light	24 Vdc	3P14	24 Vdc power panel	Workshop on aft bulkhead
Emergency light panel to provide power to emergency light panel	120 Vac	10P13	Emergency light panel	ROWPU space on forward bulkhead
Headset buzzes and strobe light	120 Vac	10P13A-7	Power panel 3	ROWPU space on forward bulkhead

**NOTE**

**Any one of 12 crew telephone stations can be paged. Telephone stations 2, 6, 8, 9, 11, and 12 include more than one telephone headset station.**

**4-12 Operating procedures.** Telephone system normally requires a system operator in the dayroom. Normal operating procedures are described in the following paragraphs:

**4-12.1 Talking with telephone station from operator station in dayroom**

- a. On telephone station selector box (Figure 4-2), press telephone system PUSH-ON/PUSH-OFF button to supply 24 Vdc power to telephone system. Make sure white indicator light comes on.
- b. On telephone station selector box, turn selector switch knob to station to be called
- c. On telephone station selector box, press BUZZER switch to ON position.

**NOTE**

**Telephone headset station buzzer or strobe light at telephone station being paged is activated. Alarms alert crew to an incoming call. Table 4-1 provides detailed headset station location.**

- d. Operator removes telephone handset (Figure 4-3) from hook (hang-up switch) on side of radio operator's desk and checks that corresponding station is online. Then, operator speaks into handset microphone.

**NOTE**

**Telephone station being called should answer page using station location as a call sign.**

**NOTE**

**Hold telephone handset approximately 1/2 to 1 in from mouth for best results. When message is complete, hang up telephone handset on hook at mounting facility.**

- e. When conversation is finished, system operator must return telephone handset to its cradle on the mounting facility.

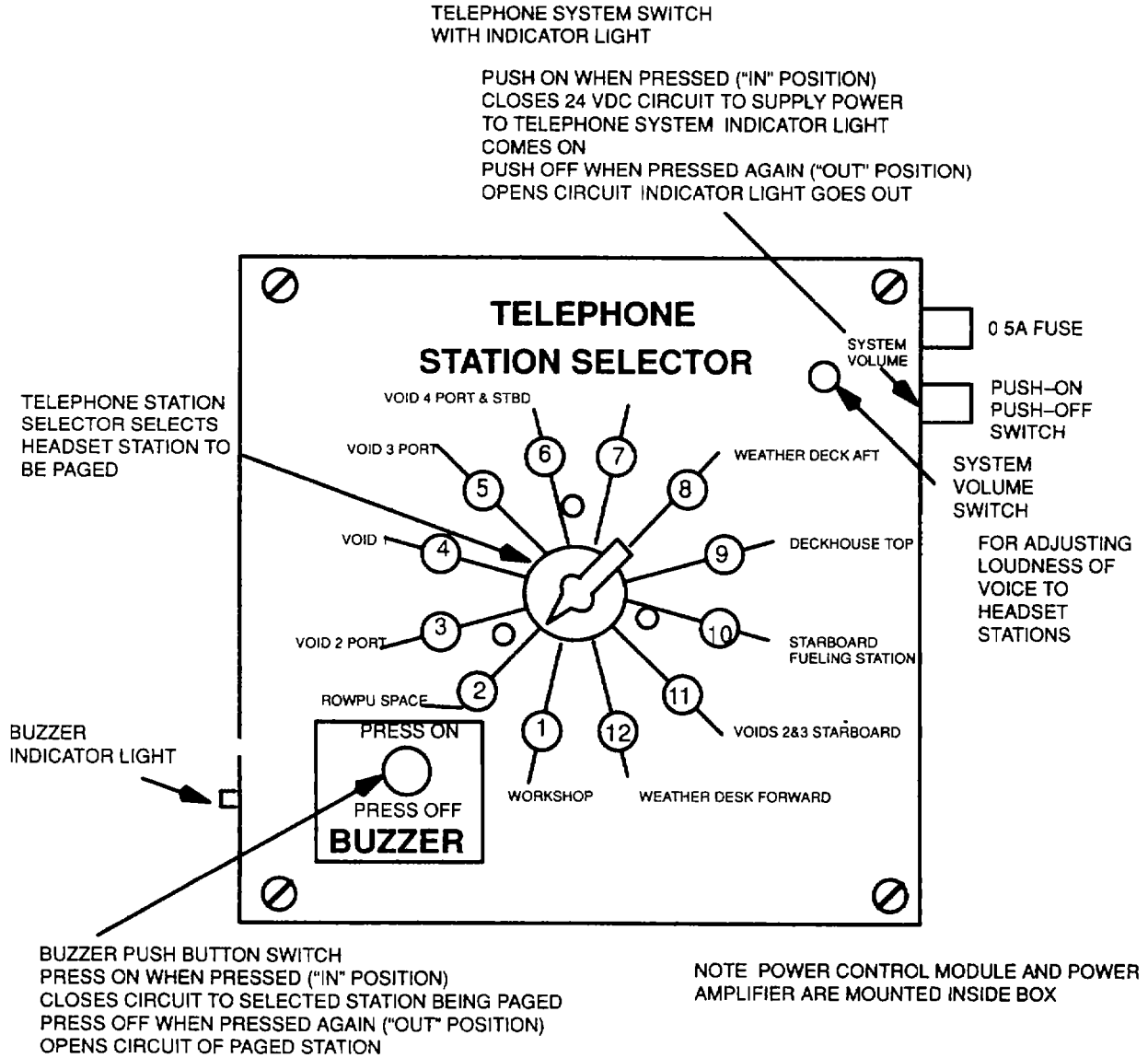


Figure 4-2. Telephone Station Selector Box Controls



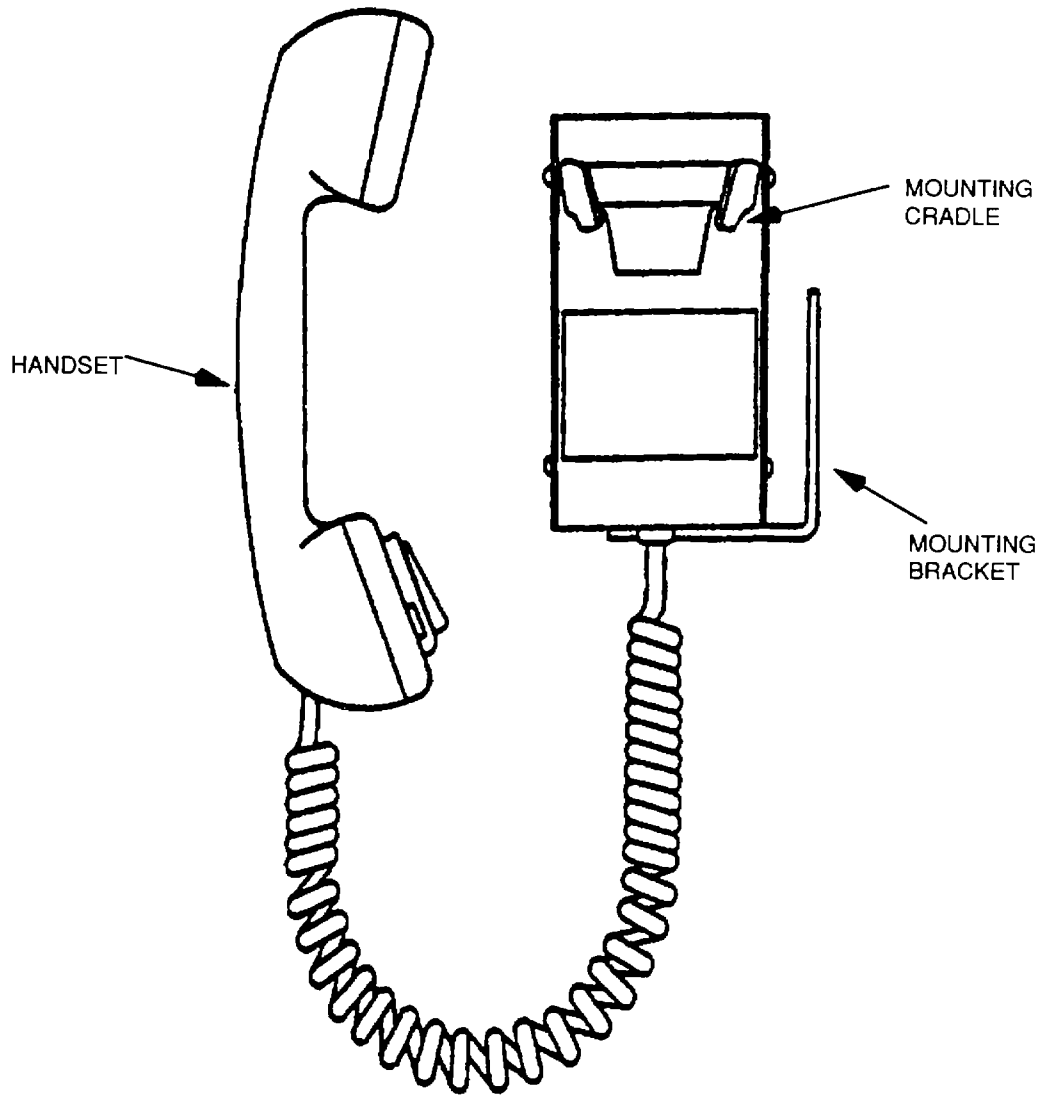


Figure 4-3. System Operator Telephone Handset Station

**4-12.2 Talking with system operator from crew telephone station.** Perform following procedures when crewmembers at any telephone headset station use telephone system to talk with system operator in dayroom.

- a. Connect telephone headset (Figure 4-4) to appropriate telephone headset station jack receptacle (Figure 4-5). Control volume by adjusting volume switch on headset station.

**NOTE**

**Crewmember's voice is heard from dayroom speaker and speaker volume is adjusted by setting speaker volume switch on bottom of speaker to desired loudness.**

- b. Press PTT switch on headset and speak into microphone using proper call signs. Release switch to hear system operator.

**NOTE**

**System operator answers crewmember's page by removing handset from hook (hang-up switch) and responding with proper call sign.**

- c. After system operator responds, send message.
- d. Continue talking until communications are complete. Then unplug telephone headset from headset station.

**4-12.3 Talking between telephone stations.** Crewmembers at any telephone station talk to other crewmembers at any other telephone station online by following these procedures:

**NOTE**

**Perform following procedures at front panel of the respective equipment unless otherwise noted. Telephone stations online with each other from telephone station selector box are as follows: telephone stations 1-4; telephone stations 2 and 9-12; telephone stations 2 and 5-8.**

- a. Connect telephone headset to appropriate telephone headset station jack receptacle.
- b. Press PTT switch on earphone and speak into microphone using proper call sign. Control volume by adjusting volume switch on headset station

**NOTE**

**Paged headset station should answer page with station location as a call sign.**

- c. After headset station responds, send message
- d. Continue talking until communications are complete, then, unplug telephone headsets from headset station.

**4-13 Shutdown procedures.** When telephone system is to be shut down for any length of time, perform the following:

- a. Make sure BUZZER switch on telephone buzzer station selector panel (Figure 4-2) is off.
- b. Make sure telephone headsets with 25-ft extension cord are properly stored in either telephone stowage boxes or in ROWPU space aft storage area
- c. Press telephone system PUSH-ON/PUSH-OFF button to OFF (Figure 4-2). Make sure white indicator light goes out.
- d. Open (OFF) circuit breakers 10P13A-7 on emergency light panel and 3P14 on 24 Vdc power panel

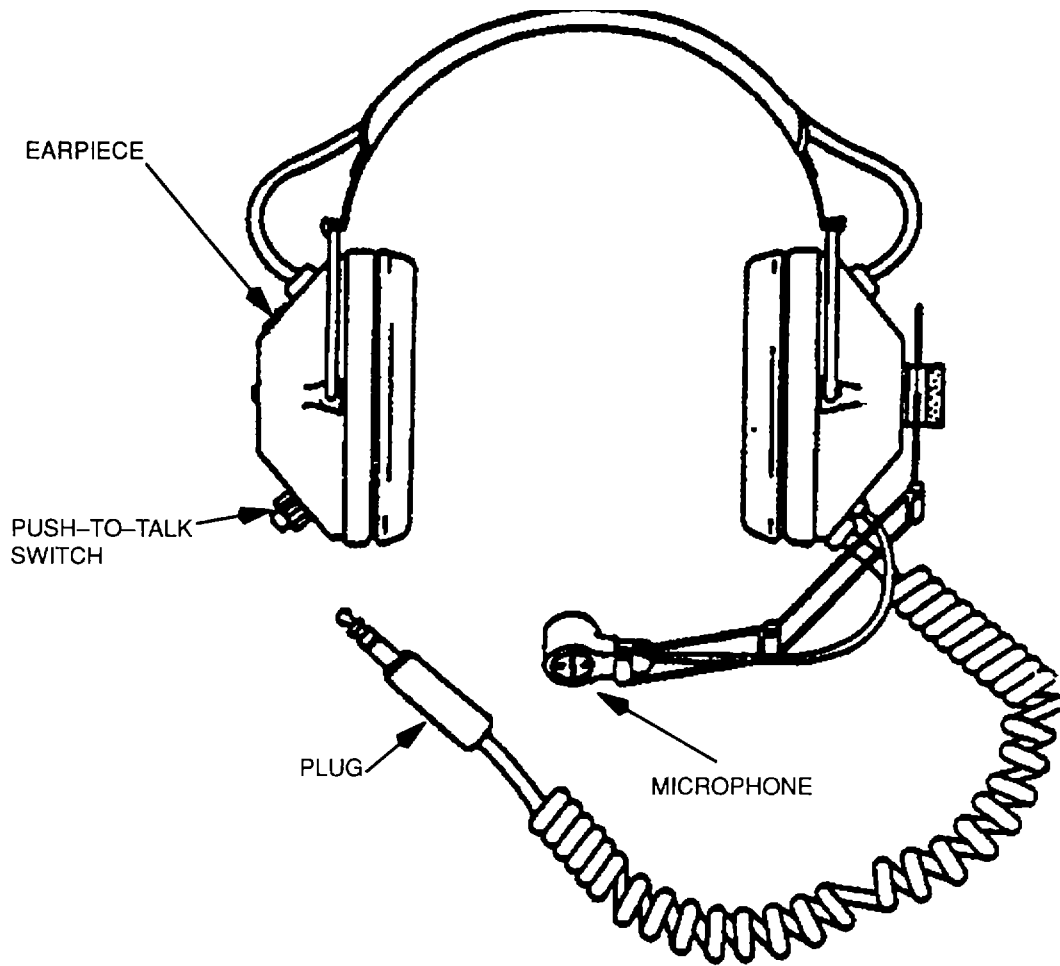
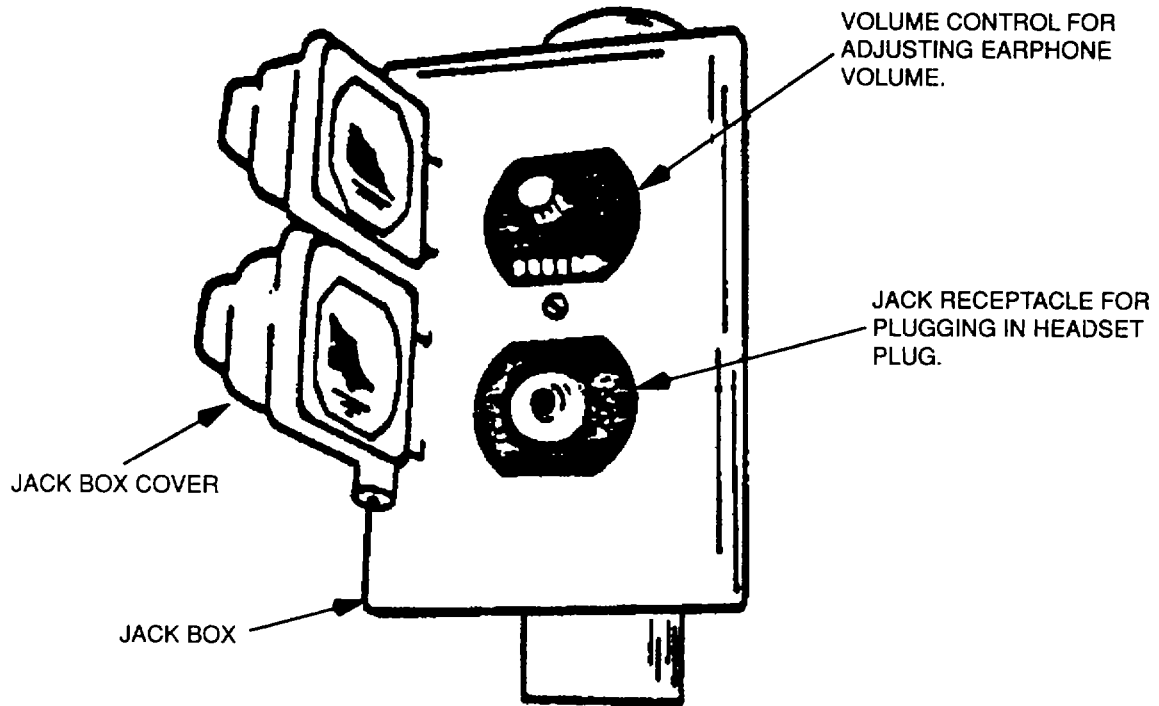


Figure 4-4. Telephone Headset Controls and Plug



NOTE HEADSET STATIONS ON BOW, STERN AND STARBOARD WEATHERDECK ARE INSTALLED IN STOWAGE BOXES HEADSET STATIONS ON TOP OF DECK HOUSE FORE AND AFT ARE CONTAINED IN A WATERTIGHT BOX

Figure 4-5. Telephone Headset Station

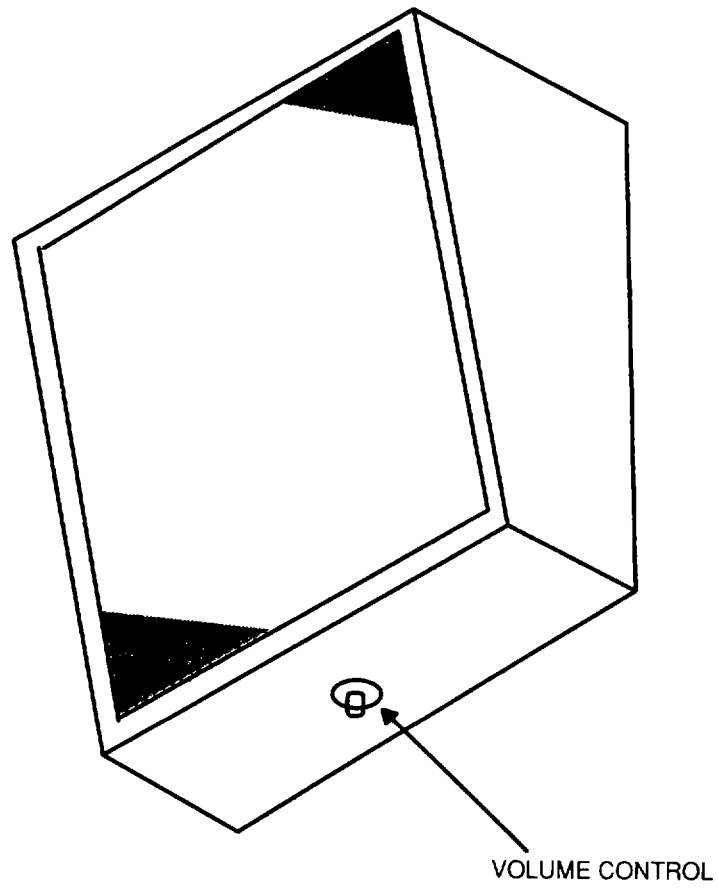


Figure 4-6. Telephone Speaker

**4-14 Operation under extreme conditions**

- a. Cold weather
  - (1) Do not bend cable or cords suddenly
  - (2) Keep ice off outdoor headset stations and buzzers
- b. Hot weather Keep headsets and other electrical components free from condensation

**Section IV. Maintenance instructions**

**4-15 General**

**4-15.1 Maintenance concept**

**4-15.1.1** Maintenance tasks will be performed by either the barge crew or IDS/GS support units Crew capabilities and equipment will determine which tasks the crew will perform IDS/GS support units will perform tasks the crew is not prepared to perform.

**4-15.1.2** Intermediate support maintenance Is accomplished by replacement of components or major end items.

**4-15.1.3** MAC data is contained In TM 55-1930-309-14&P-18 For maintenance of other equipment onboard, consult appropriate manual

**4-15.2 Maintenance procedures.** Maintenance instructions are presented in paragraphs 4-16, Preventive maintenance checks and services, Appendix C, Troubleshooting, and 4-18, Maintenance procedures

**4-16 Preventive maintenance checks and services.** See TM 55-1930-209-14&P-12, Appendix C for the preventive maintenance checks and services for the communications system See TM 55-1930-209-14&P-19 for complete preventive maintenance checks and services for all systems on the ROWPU Barge.

**4-17 Troubleshooting.** Troubleshoot the telephone system as given in Table 4-3. This table lists only common malfunctions that may occur during operation If a malfunction occurs that is not listed and the cause is not readily apparent, notify IDS or IGS maintenance for assistance.

**Table 4-3. Telephone System Troubleshooting**

Condition	Possible Cause	Suggested Action
1. Telephone system not operating	a. Circuit breaker 3P14 supplying 24 Vdc open (OFF)	a. Close (ON) circuit breaker
	b. Telephone station selector box PUSH-ON/PUSH-OFF switch is off	b. Press (PUSH-ON) switch
	c. Telephone station selector box fuse blown	c. Replace 0.5 A fuse
	d. Batteries low or emergency electrical system malfunctioning	d. Troubleshoot emergency electrical system as given in TM 5-1930-209-14&P-9
	e. Station selector box assembly malfunctioning	e. Test and repair or replace, see para 4-18.2.4

**Table 4-3. Telephone System Troubleshooting (continued)**

<u>Condition</u>	<u>Possible Cause</u>	<u>Suggested Action</u>
	f. Power control module and power amplifier malfunctioning	f. Test and repair or replace, see para 4-18.2.5
2. Telephone component not operating	a. Circuit breaker 3P14 supplying 24 Vdc open (OFF) b. Loose connection c. Cable damaged	a. Close (ON) circuit breaker b. Check connection c. Check circuit using multimeter
3. Telephone handset not operating	a. See 2 a, b, and c above b. Not plugged in properly c. Handset malfunctioning d. Handset adapter module malfunctioning	a. See 2a, b, and c above b. Check receptacle c. Replace handset, see para 4-18.2.1.2 d. Test and repair or replace module, see para 4-18.2.2
4. Indoor speaker monitor not operating	a. See 2a, b, and c above b. Volume off c. Amplifier malfunctioning d. Speaker malfunctioning	a. See 2a, b, and c above b. Adjust volume control c. Test and repair or replace, see para 4-18 2 5 d. Test and repair or replace speaker, see para 4-18 2 3
5. Telephone headset not operating	a. See 2 a, b, and c above b. Not plugged in properly c. Handset malfunctioning d. Headset station malfunctioning on station selector box	a. See 2a, b, and c above b. Check receptacle c. Test handset by substitution and replace if necessary d. Test and repair or replace, see para 4-18.2.7
6. Telephone handset or headset sound too low or too loud	a. Volume control not properly set b. Not plugged in properly	a. Reset volume control b. Check receptacle

**Table 4-3. Telephone System Troubleshooting (continued)**

Condition	Possible Cause	Suggested Action
7. Strobe light not operating	a. Bulb burned out	a. Replace bulb; see para 4-18.2.8.2
	b. Circuit breaker 10P13 or 10P13A-7 supplying 120 Vac open (OFF)	b. Close (ON) circuit breaker
	c. See 2b and c above	c. See 2 b and c above
	d. Strobe light malfunctioning	d. Test and if necessary replace strobe light; see para 4-18.2.8.3
8. Station buzzer does not sound	a. Circuit breaker 10P13 or 10P13A-7 supplying 120 Vac open (OFF)	a. Close (ON) circuit breaker
	b. See 2b and c above	b. See 2b and c above
	c. Buzzer malfunctioning	c. Test and if necessary replace buzzer; see para 4-18.2.9

**4-18 Maintenance procedures**

**WARNING**

To prevent electrical shock, open circuit breakers 10P13A-7 on emergency light panel and 3P14 on 24 Vdc power panel. Redtag circuit breakers with "WARNING - DO NOT ACTIVATE - REPAIRS BEING MADE."

**NOTE**

Due to the mission and crew capabilities, maintenance normally assigned to higher echelon of maintenance may be assigned to the crew.

**4-18.1 General maintenance.** Perform appropriate general maintenance procedures in paragraph 2-18. Clean and inspect electrical components as follows:

- a. Wipe clean exterior of electrical component with clean rag Vacuum clean or clean Inside with electrician's brush. Avoid using solvents for cleaning inside of component. Solvents leave a greasy film on components that may reduce electrical continuity.
- b. Visually inspect for indications of burns, corrosion, loose connections, damaged parts, or chipped paint. Clean corrosion from contacts and terminals, tighten loose connections, and replace damaged parts. Clean electrical contacts with silver polish, fine sandpaper, or burnishing tool DO NOT use emery paper or steel wool. Vacuum to remove residue. Touch up paint according to TB 43-0144. Do not paint threads or labels.

**4-18.2 Equipment maintenance**

**4-18.2.1 Handset station (desk telephone)**

**4-18.2.1.1 Test and repair.** Operationally test handset If handset is not properly sending or receiving signals, do not repair handset. Replace handset station as given in paragraph 4-18.2.1.2.



#### 4-18.2.1.2 Replacement

- a. Remove side panel from hookset by removing four mounting screws.
- b. Tag and disconnect wires from terminal board.
- c. Remove hookset mounting screws and remove telephone handset station.
- d. Install new telephone handset station and tighten mounting screws.
- e. Remove four screws and remove side plate.
- f. Connect tagged wires to terminal board and remount side plate.

#### 4-18.2.2 Handset adapter module

##### 4-18.2.2.1 Test and repair

- a. With circuit breaker 3P14 of 24 Vdc power panel closed (ON), check voltage at handset adapter module terminal board (Figure 4-10) across points 1 ground (-) and 8 positive (+) for 24 Vdc.
- b. Open (OFF) circuit breaker 3P14 at 24 Vdc power panel.

#### **WARNING**

**Make sure circuit breaker 3P14 is opened (OFF) before making continuity checks. Redtag circuit breakers 3P14 with "WARNING - DO NOT ACTIVATE - REPAIRS BEING MADE."**

- c. Check continuity of power line to handset adapter module terminal board points 1 and 8.
- d. If input voltage is 24 Vdc in step a and no signal is being received from handset adapter module, do not repair module. Replace handset adapter module as given in paragraph 4-18.2.2

##### 4-18.2.2.2 Replacement

- a. Remove four mounting screws from side cover plate and remove side cover plate
- b. Tag and disconnect wires from handset adaptor module
- c. Remove two mounting screws and remove handset adaptor module
- d. Install new handset adaptor module and connect tagged wires.
- e. Remount side plate and tighten four mounting screws

#### 4-18.2.3 Indoor speaker monitor

##### 4-18.2.3.1 Test and repair

- a. Test telephone power amplifier as given in paragraph 4-18.2.5.1.
- b. Check continuity of speaker wire from power amplifier terminal board to speaker terminal block if circuit is open, replace speaker wire.
- c. If power amplifier and speaker wire check ok, do not repair speaker. Replace indoor speaker monitor as given in paragraph 4-18.2.3.2.

#### 4-18.2.3.2 Indoor speaker monitor replacement

- a. Tag and remove speaker line from speaker terminal block.
- b. Remove two mounting screws and remove speaker.
- c. Install new speaker and tighten mounting screws.
- d. Reconnect speaker line to speaker terminal block.

#### 4-18.2.4 Station selector box assembly

##### 4-18.2.4.1 Telephone paging test - stations 1 thru 12

a. With circuit breaker 1 OP1 3A7 at the emergency lighting panel closed (ON), check voltage at inputs to paging system between points B1 and B2 for 115 Vac (see Figure 4-7) If voltage is not 115 Vac, go to step b. If voltage is 115 Vac, go to step c.

b. Check voltage at circuit breaker 1 OP1 3A7 output for 115 Vac If voltage is not 115 Vac, circuit breaker or power source is at fault. If voltage is 115 Vac, repair or replace power cable from circuit breaker 10P13A7 to buzzer station.

c. With paging switch pressed, see if light illuminates. If light comes on, go to step g. If light does not come on, check bulb. If bad, replace bulb. If bulb is good, check voltage between points B1 and S1 of switch for 115 Vac. If voltage is 115 Vac, go to step d. If voltage is not 115 Vac, repair or replace wire from point B2 to switch point S1.

d. Check voltage between points B2 and L1 of lamp for 115 Vac. If voltage is 115 Vac, go to step e. If voltage is not 115 Vac, repair or replace wire from B1 to lamp point L1.

e. With buzzer pushbutton switch (paging switch) pushed, check voltage between points B1 and S2 of switch for 115 Vac If voltage is 115 Vac, go to step f If voltage is not 115 Vac, replace paging switch as given in paragraph 4-18 2.4.2a.

f. Check voltage between points B1 and L2 of lamp for 115 Vac. If voltage is 115 Vac, replace lamp fixture. If voltage

#### **WARNING**

**Make sure paging system is electrically dead before making continuity checks. Redtag circuit breaker 10P13A7 with "WARNING - DO NOT ACTIVATE - REPAIRS BEING MADE."**

g. Open (OFF) circuit breaker 10P13A7 and check continuity of wire between point S2 of buzzer switch and point X of station switch. If continuity exists, go to step h. If open circuit exists, repair or replace wire from buzzer switch point S2 to station switch point X.

h. Starting at station 1 position, check continuity of station selector switch between point X and point 1. If continuity exists, check continuity of station positions, 2 thru 12. If continuity exists at all station positions, go to step i. If open circuit exists at any station position, replace station selector switch as given in paragraph 4-18.2.4.2b.

i. Close (ON) circuit breaker 10P13A7 and with paging switch pushed, check voltage at any buzzer station not sounding or strobe light not lighting Make sure station switch is at the position you are checking. If voltage is 115 Vac, replace buzzer as given in paragraph 4-19.9 or strobe light as given in paragraph 4-19.8. If voltage is not 115 Vac at the buzzer or strobe light, check voltage at nearest junction box until faulty wire is localized and replaced.

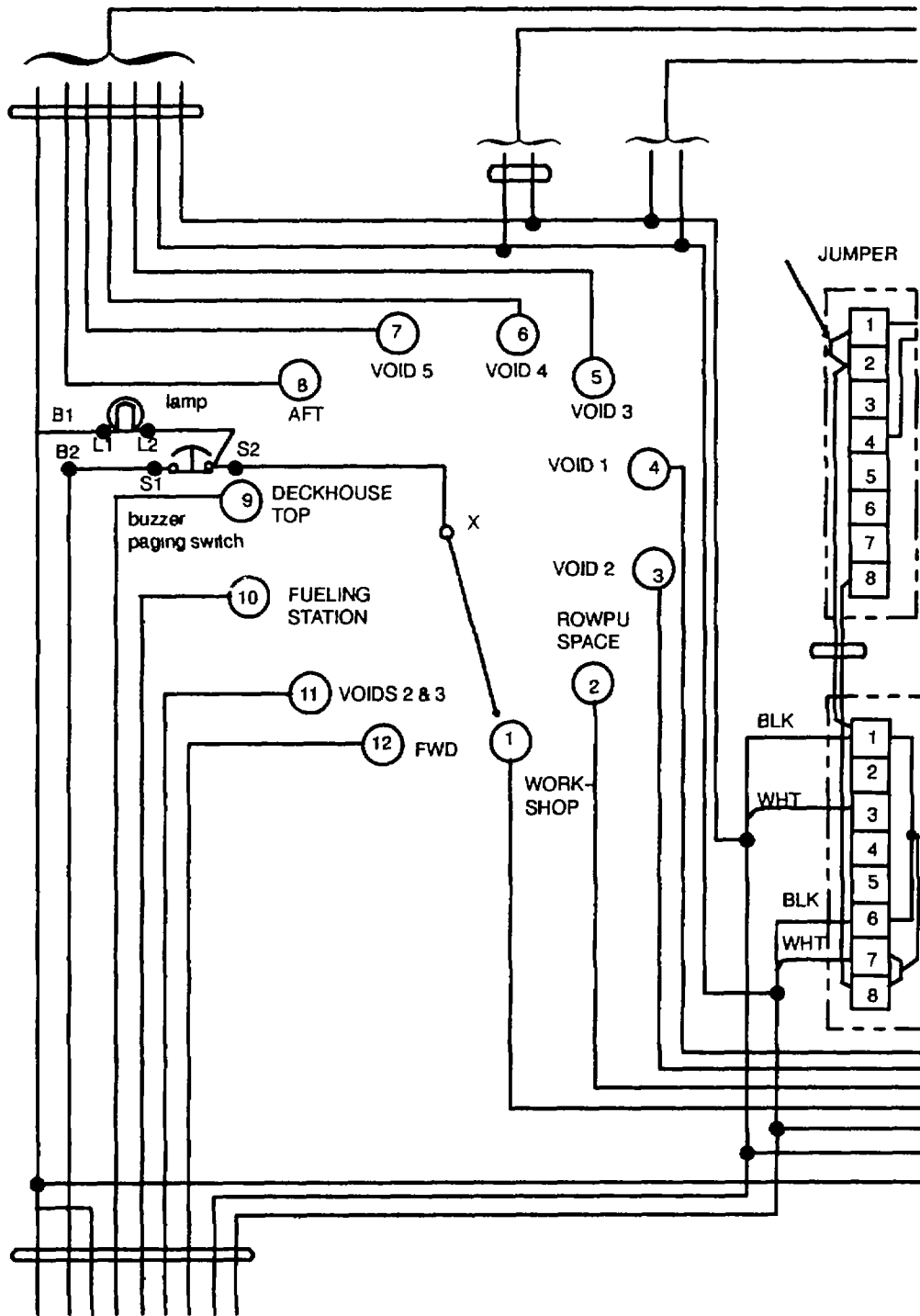


Figure 4-7. Station Selector Switch

**4-18.2.4.2 Repair****WARNING**

**Make sure telephone system is electrically dead before making repairs on station selector box. Open (OFF) and redtag circuit breakers 3P14 and 10P13A7 with: "WARNING - DO NOT ACTIVATE. REPAIRS BEING MADE."**

## a. Buzzer pushbutton switch replacement

- (1) Remove four screws securing telephone station selector box cover and remove cover.
- (2) Tag and disconnect wires from switch
- (3) Remove switch mounting hardware and remove switch
- (4) Install new switch on cover plate.
- (5) Reconnect wires
- (6) Secure cover plate with four mounting screws.
- (7) Make sure switch operates normally.

## b. Station selector switch replacement

- (1) Remove four screws securing telephone station selector box cover and remove cover plate.
- (2) Tag and disconnect all wires from power amplifier terminal board.
- (3) Remove Allen screw and selector knob from switch.
- (4) Remove station selector switch from cover plate by removing three screws.
- (5) Mount new station selector switch on cover plate. Mount selector knob and reconnect wires.
- (6) Secure cover plate with four mounting screws. Make sure switch operates normally.

## c. Power control module and power amplifier repair and replacement See paragraph 4-18.2.5.

**4-18.2.4.3 Replacement****WARNING**

**Make sure telephone system is electrically dead before replacing telephone station selector box. Open (OFF) and redtag circuit breakers 3P14 and 10P13A7 with: "WARNING - DO NOT ACTIVATE. REPAIRS BEING MADE."**

- a. Tag and unplug cables to telephone station selector box.
- b. Remove four mounting screws securing selector box.
- c. Remove box.
- d. Install and secure box with four mounting screws.
- e. Plug cables to box.
- f. Make sure selector box operates normally.

**4-18.2.5 Power control module and power amplifier. These components are located inside the station selector box.**

**4-18.2.5.1 Test and repair**

- a. With 24 Vdc circuit breaker 3P14 closed (ON), check for light on ON power control module. If lamp is not lit, check for faulty bulb. If bulb is ok, check voltage at Inputs to power control module between points TB1 and TB4 for 24 Vdc (see Figures 4-8 and 4-9). If voltage is not 24 Vdc, go to step b. If voltage is 24 Vdc, go to step d. If lamp is lit, go to step 1.
- b. Check voltage at circuit breaker 3P14 outputs for 24 Vdc. If voltage is 24 Vdc, go to step c. If voltage is not 24 Vdc, circuit breaker or power source is at fault.
- c. Check voltage at junction box between power control module and 24 volt panel for 24 Vdc. If voltage is 24 Vdc, repair or replace wires from junction box to power control module. If voltage is not 24 Vdc, repair or replace wires from junction box to circuit breaker 3P14.
- d. Check voltage at power control module between points TB2 and TB4 for 24 Vdc. If voltage is 24 Vdc, go to step e. If voltage is not 24 Vdc, repair or replace jumper from TB1 to TB2.

**WARNING**

**Make sure power control module is electrically dead before making continuity checks. Redtag circuit breaker 3P14 with: "WARNING DO NOT ACTIVATE REPAIRS BEING MADE."**

- e. Open (OFF) circuit breaker 3P14 and check fuse for continuity. If fuse is ok, go to step f. If fuse indicates open circuit, replace fuse as given in paragraph 4-18.2 5 2.
- f. With ON/OFF switch in ON position, check continuity of ON/OFF switch between points E1 and E2. If check indicates closed circuit, go to step g. If check indicates open circuit, replace ON/OFF switch.
- g. Close (ON) circuit breaker 3P14 and check voltage between points TB4 and G1 of lamp for 24 Vdc. If voltage is 24 Vdc, go to step h. If voltage is not 24 Vdc, repair or replace wire from TB2 to lamp point G1.
- h. Check voltage between points TB2 and E1 of ON/OFF switch for 24 Vdc. If voltage is 24 Vdc, go to step i. If voltage is not 24 Vdc, repair or replace wire from TB4 to ON/OFF switch point E1.
- i. Check voltage between points TB2 and F1 of fuse for 24 Vdc. If voltage is 24 Vdc, go to step j. If voltage is not 24 Vdc, replace wire from switch point E2 to fuse point F1.
- j. Check voltage between point TB2 and H1 of diode for 24 Vdc. If voltage is 24 Vdc, go to step k. If voltage is not 24 Vdc, repair or replace wire from fuse point F2 to diode point H1.
- k. Check voltage between points TB2 and H2 of diode for 24 Vdc. If voltage is 24 Vdc, repair or replace wire from diode point H2 to lamp point G2. If voltage is not 24 Vdc, replace diode.
- l. Check voltage outputs from power control module between points TB2 and TB8 or 24 Vdc. If voltage is 24 Vdc, go to step n. If voltage is not 24 Vdc, go to step m.
- m. Check voltage between point TB2 and point D (termination point for white output wire) for 24 Vdc. If voltage is not 24 Vdc, replace power control module as given in paragraph 4-18 2 5 2b. If voltage is 24 Vdc, repair or replace wire from point D to TB8.
- n. Check voltage to Inputs of power amplifier between points TB1 and TB8 for 24 Vdc. If voltage is 24 Vdc, go to step (1). If voltage is not 24 Vdc, repair or replace cable from power control module to power amplifier.
  - (1) Check voltage at power amplifier between points TB1 and TB7 for 24 Vdc. If voltage is 24 Vdc, go to step (2). If voltage is not 24 Vdc, replace jumper wire from TB7 to TB8.
  - (2) Check voltage between points TB1 and TB5 for 3.3 to 3.5 Vdc. If voltage is 3.3 to 3.5 Vdc, go to step (u). If voltage is not 3.3 to 3.5 Vdc, replace power amplifier as given in paragraph 4-18.2.5.2c.
- o. If communication system is still not operating, test operation by using different handset mike and different headset station that is operational. If operation is nonexistent, replace power amplifier. If operation is apparent, replace handset or headset station as given in paragraph 4-18 2.7.2.

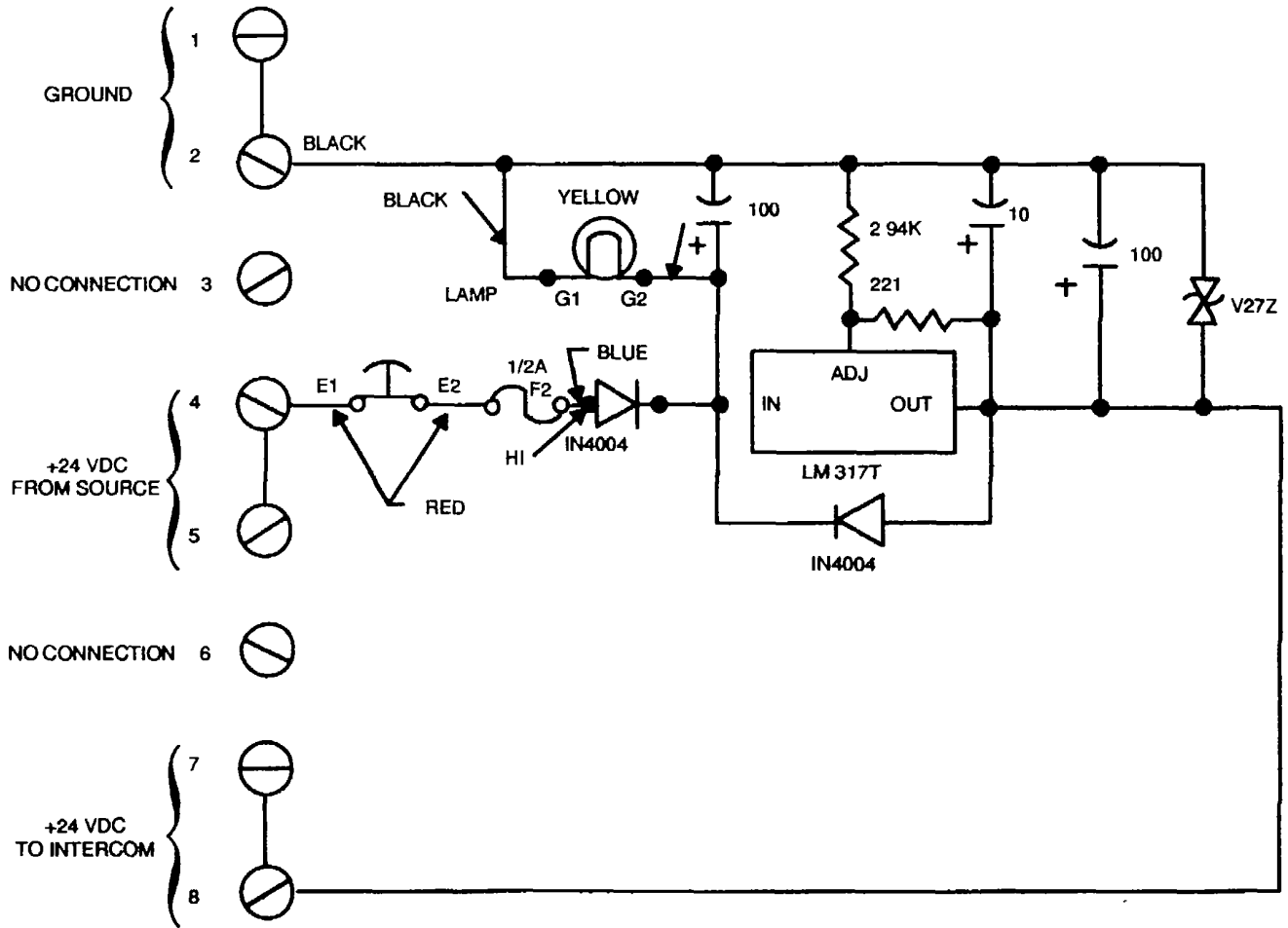


Figure 4-8. Schematic Diagram, Model M3116, Power Control Module

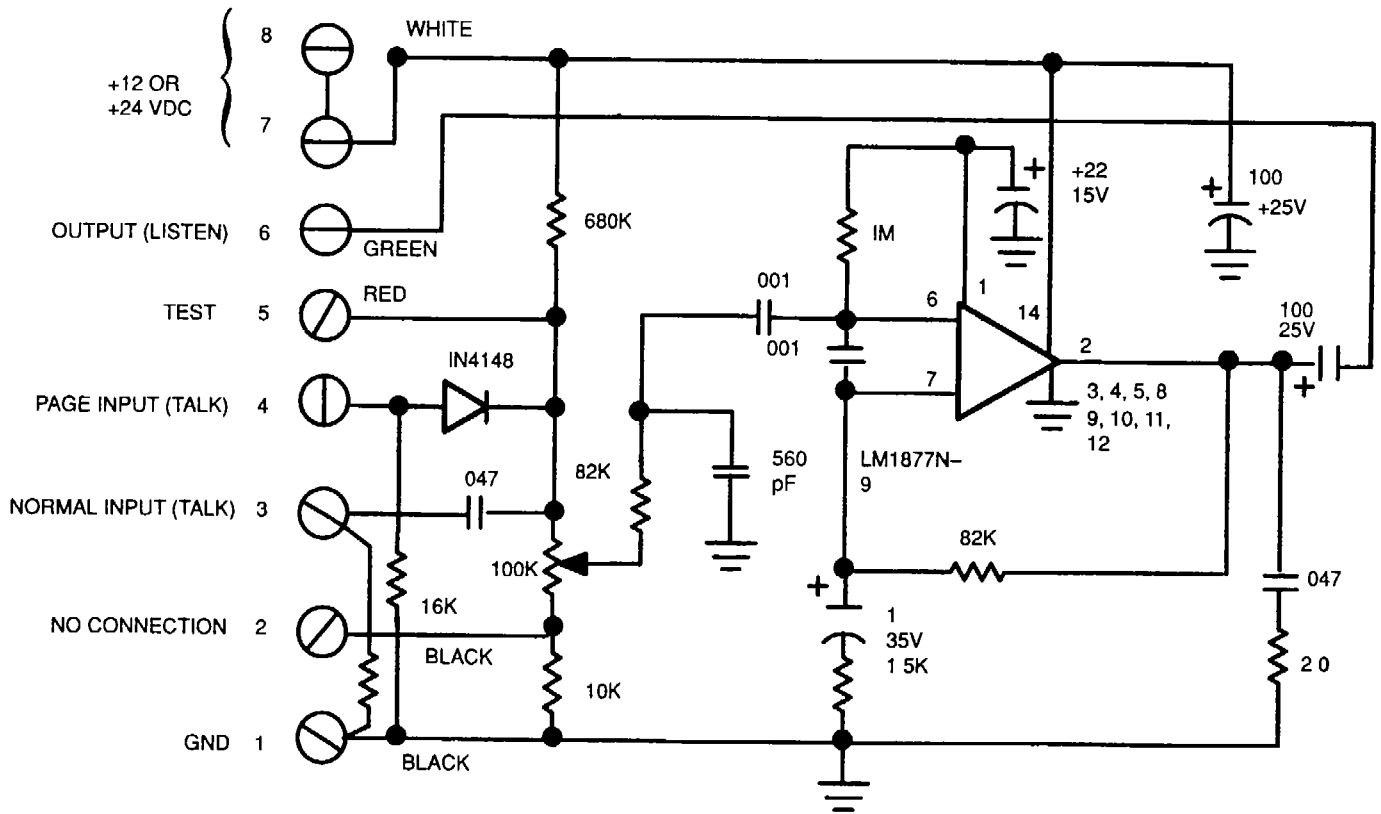


Figure 4-9. Schematic Diagram, Model M3131, Power Amplifier

**4-18.2.5.2 Replacement**

- a. Power control module fuse Replace 0.5 A fuse located on side of telephone station selector box as follows:
  - (1) Unscrew fuse holder
  - (2) Remove bad fuse
  - (3) Install new fuse
  - (4) Replace fuse holder
  - (5) Check that indicator light on telephone station selector box telephone system PUSH-N/PUSH-OFF switch comes on when switch is pushed on
- b. Power control module

**WARNING**

**Make sure telephone paging system is electrically dead before making repairs on power amplifier. Open (OFF) and redtag circuit breakers 3P14 and 10P13A7 with: "WARNING DO NOT ACTIVATE. REPAIRS BEING MADE."**

- (1) Remove four screws securing power control module box cover and remove cover.
- (2) Tag and disconnect all wires from power control module terminal board.
- (3) Remove power control module from power control module enclosure.
- (4) Install new power control module in enclosure.
- (5) Reconnect all tagged wires to terminal board.
- (6) Install cover and attach with four mounting screws.

- c. Power amplifier

**WARNING**

**Make sure telephone paging system is electrically dead before making repairs on power amplifier. Open (OFF) and redtag circuit breakers 3P14 and 10P13A7 with: "WARNING DO NOT ACTIVATE. REPAIRS BEING MADE."**

- (1) Remove four screws from power amplifier box cover and remove cover.
- (2) Tag and disconnect all wires from power amplifier terminal board.
- (3) Remove power amplifier from power amplifier enclosure.
- (4) Install new power amplifier in power amplifier enclosure
- (5) Reconnect all tagged wires to terminal board.
- (6) Install cover and attach with four mounting screws.

**4-18.2.6 Headset.** No maintenance procedures are applicable for headset other than test by substitution and replace if faulty.

**4-18.2.7 Headset station**



**4-18.2.7.1 Test and repair**

- a. With 24 Vdc circuit breaker 3P14 closed (ON), check that power amplifier is properly operating per telephone power control module and power amplifier operation.
- b. Try operation of a different headset that has tested ok.
- c. Remove headset station cover and check for loose or broken wires. Repair or replace if any faults found.
- d. Disconnect power from power control module at ON/OFF switch.
- e. Disconnect and tag wires from power amplifier terminals 1, 3, 6, and 8. Tag and disconnect wires from headset terminals 1, 3, 6, and 8 (see Figure 4-10).
- f. Check continuity of wires 1 to 1, 3 to 3, 6 to 6, and 7 to 8.

**NOTE**

**Continuity may be checked by tying two wires together and testing for a closed circuit at the other end of the two wires.**

- g. If an open circuit exists, make continuity check at nearest junction box until open circuit is localized and repair or replace wire.
- h. If wires check ok, replace headset station.

**4-18.2.7.2 Replacement**

- a. Remove jack box cover plate from telephone headset station.
- b. Remove faulty headset station by removing two mounting screws.
- c. Tag and disconnect wires from headset station (see Figure 4-10).
- d. Connect tagged wires at their proper positions to the new headset station.
- e. Mount new headset station with two screws and mount cover plate.

**4-18.2.8 Strobe light****4-18.2.8.1 Test**

- a. Close (ON) circuit breaker 10P13A7.
- b. Push buzzer switch on telephone station selector box.
- c. Position station selector switch on telephone station selector box to ROWPU space 2 for strobe light station mounted on overhead in center of ROWPU space. Position switch to Void 4 Port and Starboard Station 6 for strobe light located in Void 4 Port or Void 4 Starboard.
- d. If strobe light does not light, check bulb. Replace if bad as given in paragraph 4-18.2.8.2. If bulb is good, go to step e.
- e. Check voltage at strobe light.
- f. If voltage is 115 Vac, replace strobe light as given in paragraph 4-18.2.8.3. If voltage is not 115 Vac, check continuity of wires to buzzer. If open circuit exists, replace wire. If continuity exists, check station selector switch on telephone station selector box as given in paragraph 4-18.2.4.1.

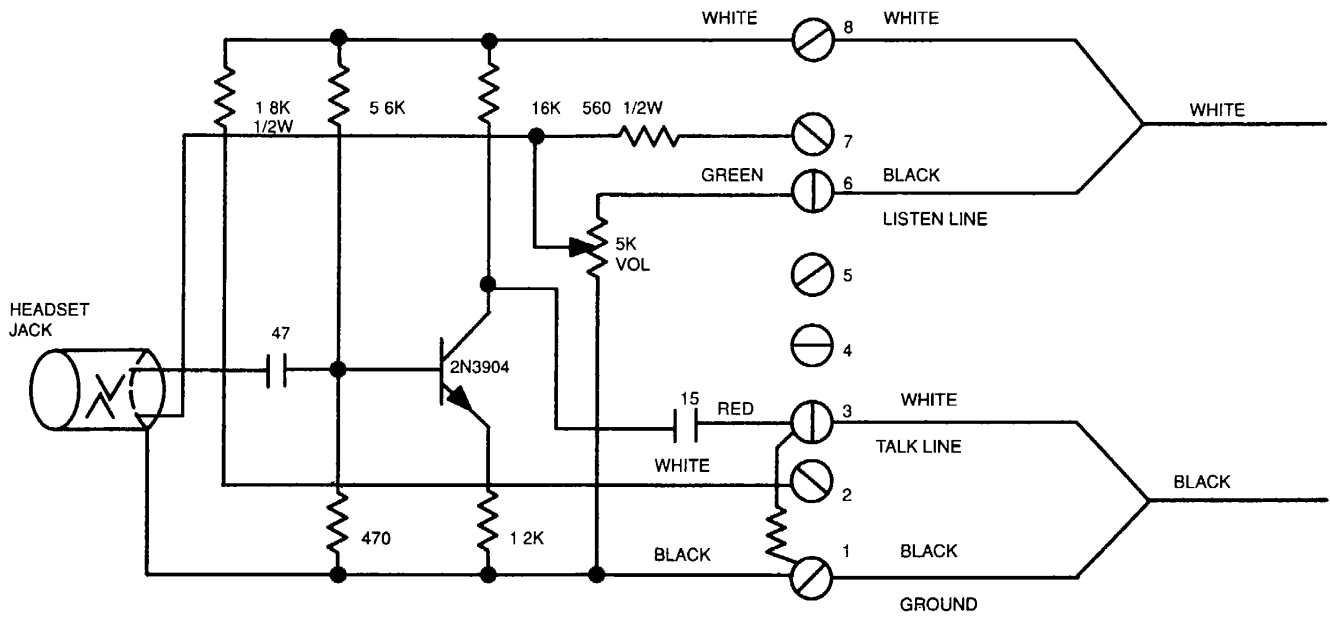


Figure 4-10 . Schematic Diagram, Model M3141, Headset Station

**4-18.2.8.2. Bulb replacement**

- a. Remove lens and burned out bulb.
- b. Install new bulb.
- c. Reinstall lens.
- d. Check that strobe light comes on

**4-18.2.8.3. Strobe light replacement****WARNING**

**Make sure telephone system is electrically dead before making repairs on strobe light. Open circuit breaker 10P13A7 on emergency light panel and 3P14 on 24 Vdc power panel. Redtag circuit breakers with: "WARNINGDO NOT ACTIVATE. REPAIRS BEING MADE."**

- a. Remove lens and remove strobe light from mounting bracket.
- b. Tag and disconnect three wires from terminal block and remove wire cable from light.
- c. install cable to new light and connect tagged wires.
- d. Install new strobe light to mounting bracket and mount lens.
- e. Make sure strobe light operates normally.

**4-18.2.9 Station buzzer****4-18.2.9.1 Test**

- a. Close (ON) circuit breaker 10P13A7.
- b. Push buzzer switch on telephone station selector box.
- c. Position station selector switch on telephone station selector box to station of buzzer malfunctioning.
- d. Check voltage at buzzer.
- e. If voltage is 115 Vac, replace buzzer as given in paragraph 4-18 2 9 2. If voltage is not 115 Vac, check continuity of wires to buzzer. If open circuit exists, replace wire. If continuity exists, check station selector switch on telephone selector box as given in paragraph 4-18 2.4 1.

**4-18.2.9.2. Replacement****WARNING**

**Make sure telephone system is electrically dead before making repairs on strobe light. Open circuit breaker 10P13A7 on emergency light panel and 3P14 on 24 Vdc power panel. Redtag circuit breakers with: "WARNING DO NOT ACTIVATE. REPAIRS BEING MADE."**

- a. Remove buzzer cover.
- b. Tag and disconnect wires to buzzer.
- c. Unplug cable from buzzer.
- d. Remove buzzer mounting hardware.
- e. Remove buzzer.
- f. Install new buzzer and secure with mounting hardware.
- g. Remove buzzer cover.
- h. Plug cable to buzzer.
- i. Install buzzer cover.
- j. Make sure buzzer operates normally.

#### 4-18.2.10. Electrical wiring and cables

**4-18.2.10.1. Inspection.** Inspect wiring and harnesses for chafed or burned insulation. Look for causes of chafing or burns. Inspect terminal connectors for corrosion, loose connections, and broken parts. Clean corrosion and replace damaged connector pins or wires, replace damaged connectors or replace harness assembly. Check mounting hardware, hangers, and receptacles for tightness. Tighten If necessary.

**4-18.2.10.2. Repair and replacement.** When replacing wires or repairing wire harnesses, lay wires alongside wire or harness and cut new wires at least 1 ½ inches longer than wire being replaced.

### Section V. Storage

**4-19 Short-term storage.** If barge is taken out of service for more than 7 days but less than 30 days, and telephone system is not used while in storage, follow normal shutdown procedures in paragraph 4-13 . Inspections are not required of this system during short-term storage.

**4-20 Administrative storage.** If barge is taken out of service for more than 30 days but less than 6 months, barge remains a unit responsibility and shall be maintained by unit personnel. If placed in administrative storage, and telephone system is not being used, it will be processed for administrative storage as specified in the following:

- a. Open circuit breakers 1OP13A-7 on emergency light panel and 3P14 on 24 Vdc power panel.
- b. Perform before operation preventive maintenance in Appendix C as appropriate
- c. When authorized by bargemaster, perform the following:
  - (1) Disconnect power cords and Interconnecting cabling to system.
  - (2) Disconnect all interconnecting cables between telephone system components (speaker, handset, and headsets) that are to be stored. Tag each cable end to ensure easy reconnection.
  - (3) Package each piece of equipment to be stored in an approved container.
  - (4) Store telephone system components In an area where temperature is maintained at 40 to 90°F, with relative humidity less than 80 percent.
  - (5) Mark each container with nomenclature, model identification, and serial numbers of each component .

**4-21 Long-term storage.** If barge is to be taken out of service for 6 months or more, turn it in to depot for preparation and placement into long-term storage. If barge is in administrative storage and is to be taken out of service and placed in depot long-term storage (6 months or more), process telephone system for normal operations before releasing to depot.

**Section VI. Manufacturers' Service Manuals/Instructions**

**4-22 General.** These references provide additional information on components of the telephone system. A ready reference copy is in Appendix B. Refer to both this manual and drawings listed in Appendix A while performing procedures in these manuals.

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
Telephone headset, model 3342	Parts List Model 3342	David Clarke Company, Inc 360 Franklin St Worcester, MA 01604 Ph: (617) 756-6216
Telephone headset station, model M3141	17206P-71 (9-83) Application Note M3141 and M3142 headset Stations	
Telephone module handset adaptor, model M3146	17209P-02 (April 1976) Application Note model M3146 Soundelier Handset Adaptor Module	
Telephone power control module, model M3116	17206P-27 (Rev June 1976) Application Note Models M3115 and M3116 Power Control Modules	
Telephone power amplifier, model M3131	17209P-03 (8-83) Application Note M3131 Power Amplifier with Push-to-Page Feature	
Telephone speaker, 801-401	Drawing No B70744 Cone Speaker Assembly	Gai-Tronics Corporation P O Box 31 Reading, PA 19603 Ph: (215) 777-1374

**Section VII. Manufacturer's Warranties/Guarantees**

**4-23 General.** Information on telephone system major components is listed below:

<u>Component</u>	<u>Manufacturer</u>	<u>Duration</u>	<u>Coverage</u>
Telephone headset, model M3342	David Clark Company, Inc 360 Franklin Street Worcester, MA 01604	1 year from date of purchase	Materials and workmanship
Telephone headset station, model M3141	Ph: (617) 756-6216		
Telephone module handset adapter, model 3146			
Telephone control module, model M3116			
Telephone power amplifier, M3131			
Telephone speaker, model 801-401	Gai-Tronics Corporation P O Box 31 Reading, PA 19603 Ph: (215) 777-1374	1 year from date of installation/2 years after date of shipment, whichever occurs first	Materials and workmanship

**APPENDIX A**

**REFERENCES**

**A-1 Drawings**

US Army Belvoir Research, Development and Engineering Center (97403)

13226E1892	ROWPU/Barge Arrangement
13226E1893	List of Label Plates
13226E1932	Electrical Power Schematic Diagram
13226E1933	Communications System

**A-2 Painting**

TB 43-0144	Painting of Vessels
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**A-3 Lubrication**

Federal Specification	Isopropyl Alcohol TT-1-735
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**A-4 Demolition to Prevent Enemy Use**

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use
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**A-5 Cleaning**

Federal Specification	Metal Cleaning Solvent for Army Use P-C-680
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Military Specification	Silicone Compound, NATO Code Number S-736 MIL-S-8660
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**A-6 Maintenance**

TM 11-5820-401-10-1	Operator's Manual Radio Sets AN/VRC Series
TM 11-5820-801-10-2	Operator's Manual Radio Sets, AN/VRC Series
TM 11-5820-401-10-4	Operator's Quick Checks for Receiver-Transmitter, RT/VRC Series
TM 11-5820-401-20-1	Organizational Manual AN/VRC Series
TM 11-5820-401-20-2	Organizational Maintenance Manual for Radio Sets, AN/VRC Series
TM 11-5820-401-20P	Organizational Maintenance Repair Parts and Special Tools List for Radio Sets, AN/VRC Series

TM 11-5820-401-34-2-1	Direct Support and General Support Maintenance Manual for Radio Sets AN/VRC Series
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TM 11-5820-401-34-2-2	Direct Support and General Support Maintenance for Radio Sets AN/VRC Series
TM 11-5820-401-34-3	Direct Support and General Support Maintenance Manual for Radio Sets AN/VRC Series
TM 11-5820-401-34P-2-1	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Receiver-Transmitter, RT/VRC Series
TM 11-5820-401-34P-2-2	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Receiver-Transmitter, RT/VRC Series
TM 11-5820-401-34P-3	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Receivers RIVRC Series
TM 11-6130-233-12	Operator's and Organizational Maintenance Manual Power Supplies PP-2953/U, PP-2953A/U, PP-2953B/U, and PP-2953 C/U (NSN 6130-00-985-7899)
TM 11-6130-233-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List for Power Supplies PP-2953/u, PP-2953A/u, PP-2953B/u, and PP-2953 C/u (NSN 6130-00-985-7899)
TM 11-6130-266-15	Operator's, Organizational, Direct Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List) for Power Supply, PP-6224/U and PP-6224 A/U (NSN 6130-00-133-5879)
DA PAM 738-750	The Army Maintenance Management System (TAMMS)
TM 9-214	Inspection, Care and Maintenance of Antifriction Bearings
TM 9-237	Welding Theory and Application
TB SIG 222	Solder and Soldering



## APPENDIX B

## MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS

**B-1 Commercial Radios**

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
866S, VHF/FM marine transceiver	Horizon USA/CANADA 866S, VHF/FM Marine Transceiver Owner's Operating and Maintenance Manual	Standard Communications Corporation P O Box 92151 Los Angeles, CA 90009 Ph: (213) 532-5300
HX500S VHF/FM marine handheld transceiver	HX500S VHF/FM Handheld Transceiver Owner's Operating Manual	
Model CSB50AM master gang battery charger	Instructions, CSB50AM Master Gang Charger	
8 ft VHF marine antenna 801754	Instruction Manual, Order, no 969	Telex Communications 9600 Aldrich Ave, S Minneapolis, MN 55420 Ph: (612) 884-4051
NPC LR10 regulated dc power supply	NPC LR10 Electrical Schematic	Astron Corporation 2852 Walnut Avenue, E Tustin, CA 92680 Ph: (714) 832-7770

**B-2 Foghorn**

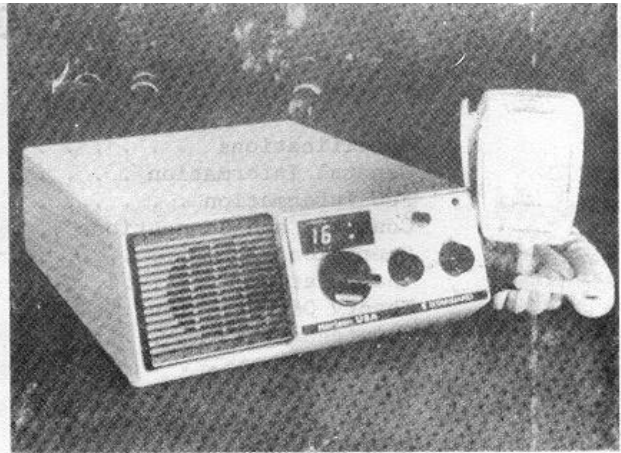
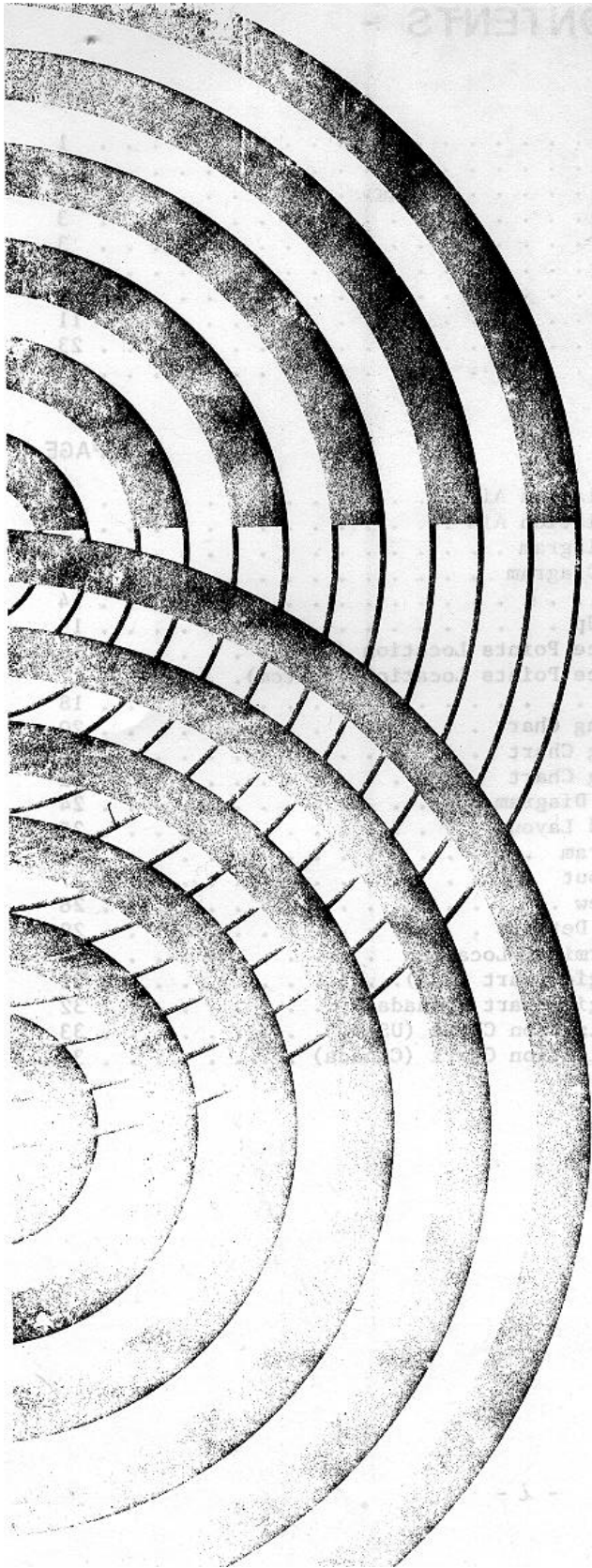
<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
Foghorn 1001-1100	FA-390 HORN	Pennwalt Corp Automatic Power Division 213 Hutcheson St Houston, TX 77003 Ph: (713) 228-5208

**B-3 Telephone System**

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
Telephone headset, model 3342	Parts List Model 3342	David Clark Company, Inc 360 Franklin St Worcester, MA 01604 Ph: (617) 756-6216
Telephone headset station, model M3141	17206P-71 (9-83) Application Note M3141 and M3142 Headset Stations	
Telephone module handset adaptor, model M3146	17209P-02 (April 1976) Application Note model M3146 Soundelier Handset Adaptor Module	
Telephone power control module, model M3116	17206P-27 (Rev June 1976) Application Note Models M3115 and M3116 Power Control Modules	

**B-3 Telephone System (continued)**

<u>Component</u>	<u>Document title</u>	<u>Manufacturer</u>
Telephone power amplifier, model M3131	17209P-03 (8-83) Application Note M3131 Power Amplifier with Push-to-Page Feature	
Telephone speaker, 801-401	Drawing No B70744 Cone Speaker Assembly	Gai-Tronics Corporation P O Box 31 Reading, PA 19603 Ph: (215) 777-1374



**Horizon**  
**USA/CANADA**  
**866S**  
VHF/FM Marine Transceiver

**Owner's Operating  
And Maintenance  
Manual**

**Contains:** Specifications • FCC Information •  
Operation • Installation • Theory of Operation •  
Performance Tests • Alignment Procedure •  
Troubleshooting Charts • Complete Drawings •  
Parts Lists

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Communications**

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**SPECIFICATIONS**

Performance specifications are nominal, unless otherwise indicated, and are subject to change without notice.

**GENERAL**

Frequency Range.....	156.25-162.55 MHz
Channels .....	50*
Input Voltage .....	13.8 VDC (+20%)
Current Drain (Standby).....	650 mA
(Receive) .....	1.5 A
(Transmit) .....	5.0 A (Hi): 1.5 A (Lo)
Dimensions .....	2 3/4" H x 7" W x 9 1/2" D
Weight .....	4 1/2 lbs.
FCC Parts .....	83
FCC Type Acceptance Number .....	T0479
Microphone .....	MP345W
Speaker .....	8 ohm Dynamic
Circuitry .....	All Solid-State

**TRANSMITTER**

RF Output.....	25 W (Hi); 1 W (Lo)
Spurious and Harmonics.....	65 dB (Hi); 50 dB (Lo)
FM Hum and Noise .....	45 dB
Audio Response.....	Within +1/-3 dB of 6 dB/Octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion.....	3%
Modulation .....	16F3
Frequency Stability .....	±0.001% max. (-300C to +60°C)

**RECEIVER**

Sensitivity (20 dB Quieting).....	0.35 uV
(12 dB SINAD).....	0.32 uV
Squelch Sensitivity (Threshold).....	0.16 uV
Modulation Acceptance.....	+7.5 kHz
Selectivity (EIA SINAD).....	65 dB
Spurious and Image Rejection.....	62 dB
Intermodulation Rejection @ 12 dB SINAD Sensitivity.....	65 dB
Audio Output @ 10% Distortion.....	3.0 W
Audio Response .....	Within +1/-3 dB of 6 dB/Octave de-emphasis characteristic from 300 to 3000 Hz
Frequency Stability .....	±0.001% max. (-300C to +600C)

\* See the frequency channelization charts at the rear of this manual for a complete list of channel frequencies and their uses.

## GENERAL INFORMATION

The Standard Communications Corp. (SCC) Horizon USA/Canada is an all solidstate, VHF/FM transceiver designed for use in the frequency range of 156-162 MHz. It requires 13.8 VDC ( $\pm 20\%$ ) input power for operation, and develops up to 25 watts RF output power. It is designed for 50 receive channels and 46 (USA) or 47 (Canada) transmit channels. White in color, the unit measures approximately 2  $\frac{3}{4}$ " x 7" x 9  $\frac{1}{2}$ " and weighs about 4  $\frac{1}{2}$  pounds.

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Service Information Inserts (SII's).

## FCC INFORMATION

The Horizon USA has been specifically designed to comply with the FCC requirements necessary to operate it in the Maritime Radio Service. The user must be cognizant of, and comply with, Part 83 of the FCC Rules and Regulations, the governing document for this service. The user is also required to have a copy of Part 83 on board the ship. This may be obtained by writing to:

SUPERINTENDENT OF DOCUMENTS  
Government Printing Office  
Washington, D.C. 20402

A valid station license is required before operation of the radio is permissible, obtained by submitting a properly and fully completed FCC Form 506 to the FCC.

The radiotelephone transmitter in a ship station may be operated only by a licensed radio operator. The licensed operator may permit others to speak into the microphone if he starts, supervises, and ends the operation, makes the necessary log entries, and gives 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. This lifetime permit is obtained by submitting to the FCC a properly and fully completed FCC Form 753. No oral or written examination is required.

*NOTE: It is the responsibility of Canadian residents to comply with all licensing requirements of the DOC, the governing body for communications equipment in Canada.*

The licensee of a ship radio station is responsible at all times for the lawful and proper operation of the station. Ship stations are licensed primarily for safety of life and property; therefore, distress and safety communications must have absolute priority. Secondly, however, certain frequencies which are not reserved for calling, distress, or other safety purposes may be used for radiotelephone calls to coast stations or between ships.

The following data for the Horizon USA may be helpful when filling out the license application:

Type Accepted - Yes (FCC Part 83)  
 Output Power - 25 Watts (Hi); 1 watt (Lo)  
 Emission - 16F3  
 Frequency Range - 156.25 - 162.55 MHz  
 Type Number - T0479

### CONTROLS AND CONNECTIONS

Before operating the transceiver, the user should become familiar with all the controls and connections. These are all marked and easily located on the radio. For a description of each, refer to the following list.

1. Channel Selector Switch - Selects the desired operation channel.
2. Hi/Lo Power Switch - Selects the desired transmitter output power (25 watts in "HI" position, 1 watt in "LO" position.)
3. Off/Volume Control - Applies power to the unit and adjusts audio output level.
4. Squelch Control - Proper adjustment of this control eliminates the objectionable background noise heard in the speaker.
5. TX Indicator - Illuminates when the radio is in the transmit mode.
6. LED Channel Indicator Display - Indicates by digital display the number of the selected channel. In addition, the "W" indicator illuminates when a weather channel is selected, and the "A" indicator illuminates when a channel with an "A" suffix is selected.
7. Microphone - Hard-wired to the radio, the microphone contains a push-to-talk switch which, when depressed, puts the radio in the transmit mode. Releasing the PTT switch puts the radio in the receive mode.
8. Internal Speaker - The internal speaker is located on the front left side of the radio.
9. External Speaker Jack - Allows for connection of an external speaker, if desired.
10. Antenna Receptacle - Allows for connection of the antenna.
11. DC Power Cord - Cord assembly includes a fuse (10 ampere) and allows for connection of the radio to the specified power source.
12. Mounting Bracket - Allows for mechanical installation of the transceiver.

### OPERATION

Operation of the transceiver is as follows.

1. Rotate the on/volume control clockwise to mid-position on the dial.

2. Rotate the squelch control fully counterclockwise.
3. Set the channel selector switch to the desired channel.
4. Rotate the squelch control clockwise until the background noise just disappears. This is the proper squelch setting, and the control should not be rotated beyond this point or receiver sensitivity will be degraded.
5. Set the desired hi/lo power setting. This switch should be in the "LO" position when conditions allow it. Use the "HI" position when you cannot make contact in the "LO" position or you are a considerable distance from the station you are attempting to reach.

NOTE: Selection of channel 15 (Horizon USA) or 17 (Horizon USA and Horizon Canada) automatically reduces the radio output power to one watt, in compliance with FCC and DOC regulations.

6. When a message is received, adjust the volume control to the desired listening level.
7. To transmit, depress the push-to-talk switch on the microphone and hold it in while you give your message. Speak slowly and distinctly. (Before transmitting, insure that the channel selected is not in use, as required by FCC regulations.)
8. When you have finished transmitting your message, release the PTT switch so incoming messages can be received.

NOTE: The transceiver cannot receive a call while transmitting. Therefore, wait until an incoming message is completed before transmitting.

## INSTALLATION

### PRE-INSTALLATION

Prior to installation of the transceiver, its performance should be checked to insure optimum operation. In addition, FCC regulations require that the deviation and frequency of the radio be checked before the unit is placed in operation and at least annually thereafter. Refer to the Performance Test section of the Maintenance chapter for complete performance check instructions. (If the transceiver does not meet the performance check requirements, proceed with the alignment and troubleshooting procedures, also in the Maintenance chapter, until the requirements are met.)

Consideration should be given to the following to determine the most ideal location for the transceiver.

1. Keep in mind that cables from the antenna, power source and external speaker (if used) must be connected to the radio unit.
2. Do not locate the radio unit or external speaker close to the compass. Both the microphone and speaker contain permanent magnets which could result in erroneous compass readings.



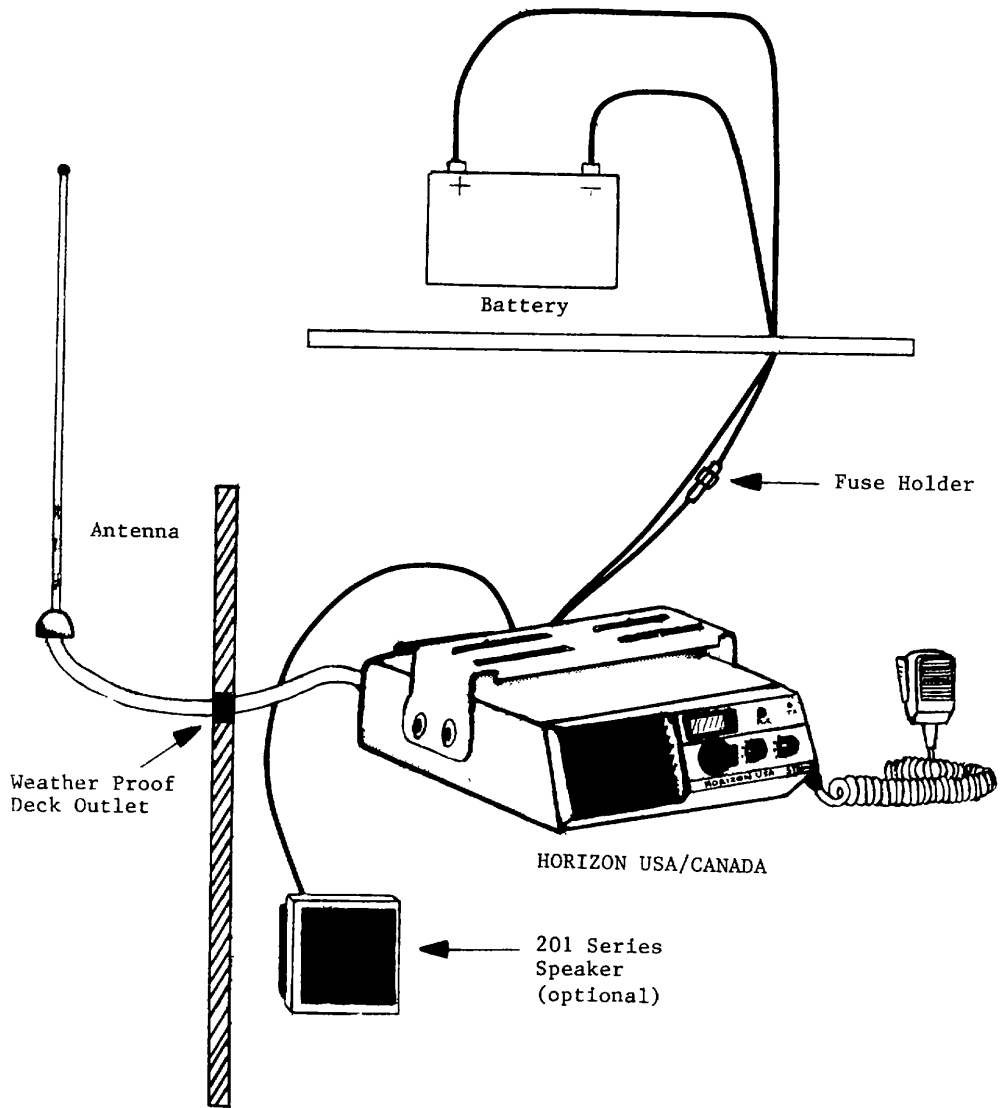
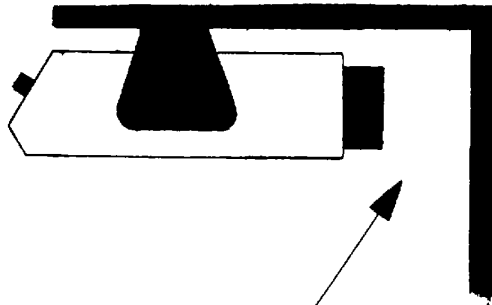


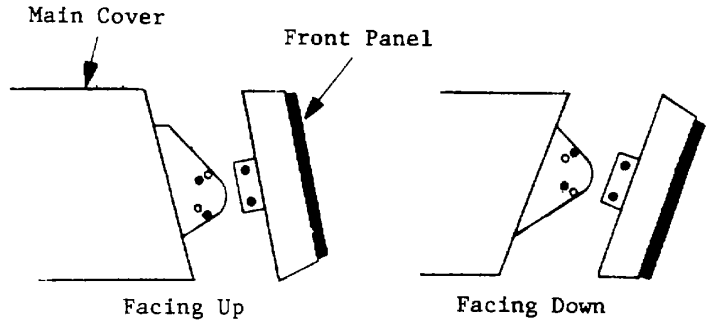
FIGURE 1. ELECTRICAL INSTALLATION AID



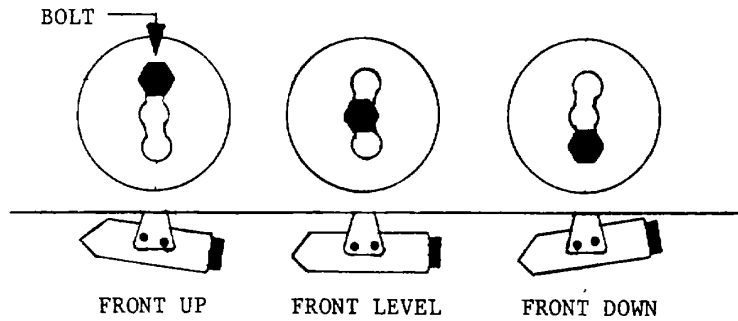
The transceiver can be mounted in the under-dash or the over-dash position



When mounting the transceiver, be sure to leave approximately 2 inches here for ventilation of the heat sink, in addition to space for antenna hook-up, connection of external speaker or replacement of the fuse.



Angle of front panel is changed as shown. Black dots represent placement of mounting screws for the two different angles.



The transceiver can be mounted in any one of the positions shown above. To do this, simply bolt one of the 3 holes in the position indicated for the desired level of the transceiver.

**FIGURE 2. MECHANICAL INSTALLATION AID**

3. The unit should be mounted so the controls and microphone are both visible and readily accessible.

Refer to Figures 1 and 2 for electrical and mechanical installation aids.

## **MECHANICAL**

The transceiver can be mounted in any attitude or on any suitable surface. Normal installation includes under the dashboard, on top of the dash or desk, or on the cabin overhead. To install, simply secure the "U"-shaped bracket to the mounting location, then secure the radio to the bracket at the desired angle.

The microphone hanger should be mounted on a vertical surface in close proximity to the radio.

If the unit is to be mounted overhead, the control panel can be repositioned for proper viewing as follows:

1. Remove the two case screws at the rear of the radio and slide the chassis out from the case.
2. Remove the four screws securing the control panel to the radio chassis.
3. Reposition the control panel to an approximately 45° downward angle and secure it to the chassis in this position, utilizing the screw holes on the chassis which align with the control panel screw holes in this position.
4. The radio case must now be inverted 180° before sliding it back onto the radio chassis. Following this, secure the case to the chassis.

## **ELECTRICAL**

1. A power cord assembly for connection to a suitable 13.8 VDC ( $\pm 20\%$ ) power source is included with the transceiver. Connect the black lead to negative ground and the red lead to positive voltage.
2. Connect a suitable VHF antenna to the antenna jack at the rear of the transceiver.
3. If desired, connect an external speaker (4 ohm) to the external speaker jack at the rear of the radio.

## **INSTALLATION CHECK**

After installation, the transceivers VSWR should be checked with a thru-line wattmeter. It should be 1.5:1 or better. Deviation and frequency should also be checked to insure optimum operation.

## **THEORY OF OPERATION**

Refer to the functional block diagram (Figure 4) and the schematic diagrams in the Drawings section for the following description.

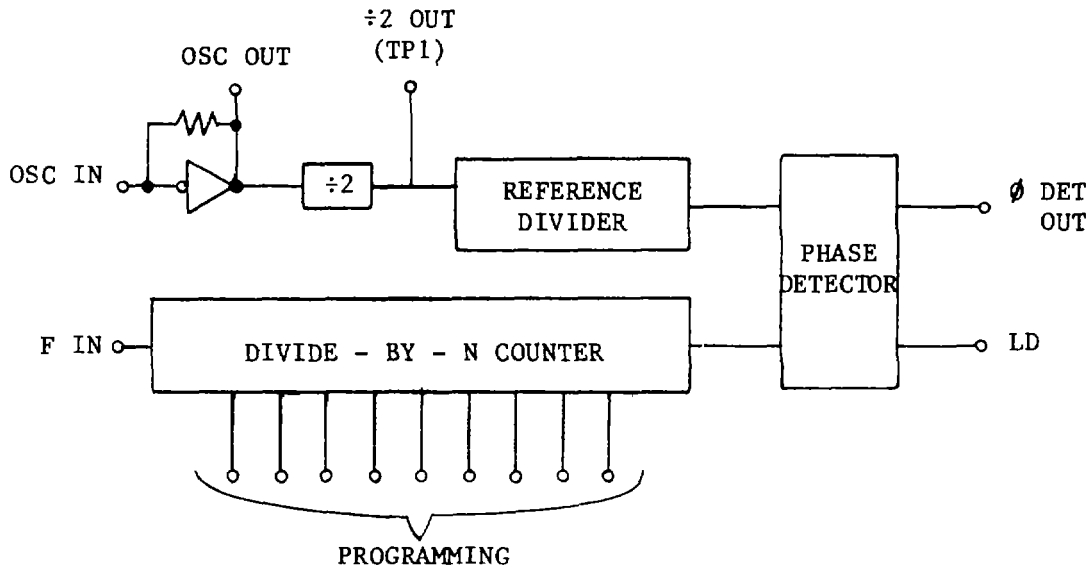
**PHASE-LOCKED LOOP FREQUENCY SYNTHESIZER**

The transmitter output frequency and the receiver operating frequency are controlled by the phase-locked loop frequency synthesizer.

1. Receive Operation

In the receive mode, a voltage controlled oscillator (QV02, VCO) is oscillating at the receiver first local frequency, and the signal is amplified by QV03, QP71, and QP81 to be used as first local injection. The signal is also used to obtain a control signal for the VCO through the logic circuit.

First the signal is mixed down with the receive local frequency (43.63 MHz, QP34) and pre-scaled by a divider (QP06), then fed to a multi-function integrated circuit (QP01) to be further counted down to 6.25 kHz when locked on signals.



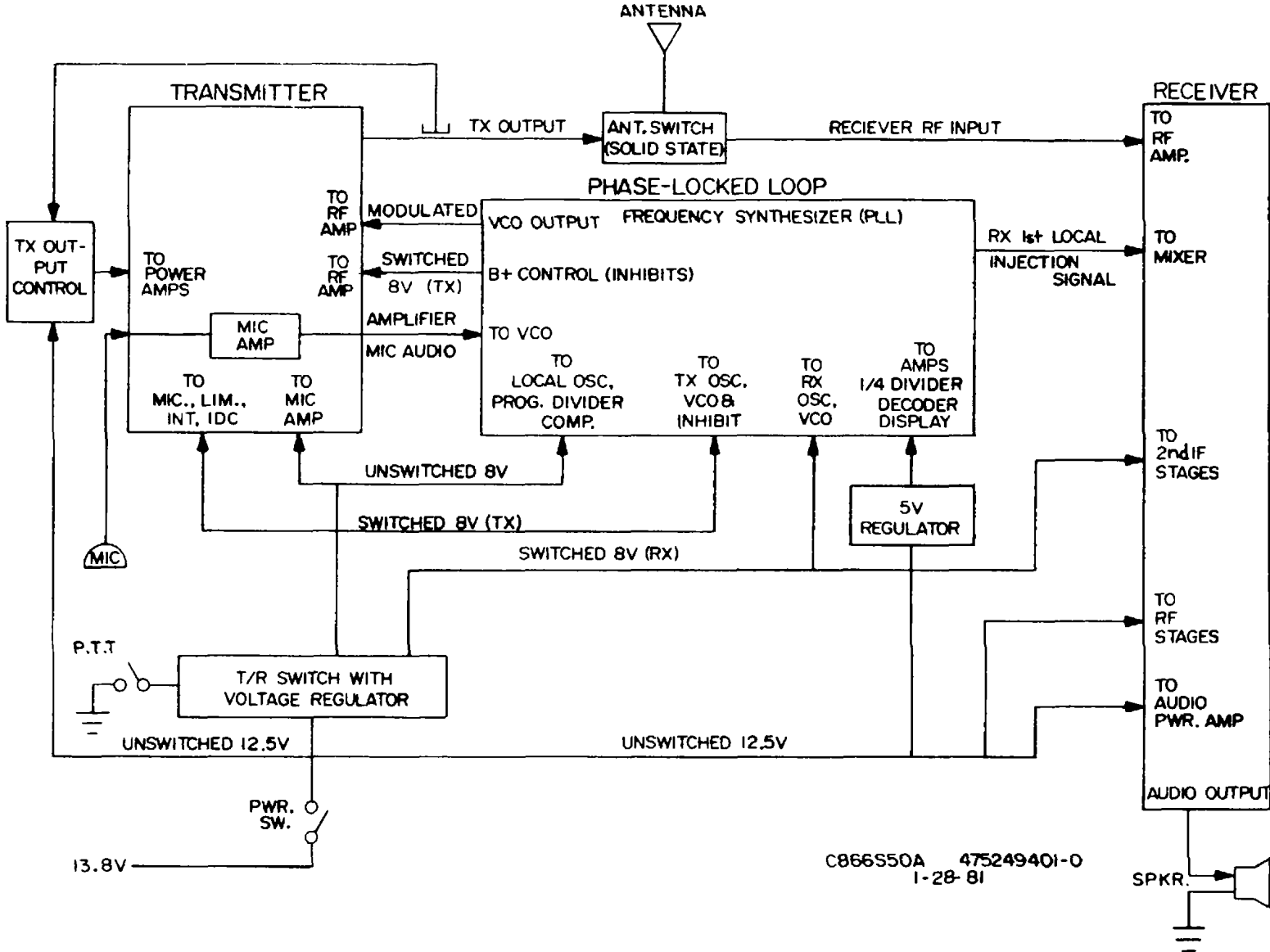
**FIGURE 3. QP01 FUNTIONAL DIAGRAM**

The front panel rotary switch controls the programmable counter to give the right division number to the integrated circuit. The reference oscillator and the divider are also located in QP01, which obtain a 6.25 kHz reference signal by dividing 12.80 MHz.

After these two signals are compared in the phase Comparator in the IC, the output (control voltage) is fed back to the VCO through a low pass filter to keep the oscillator frequency locked on.

2. Transmit Operation

The basic function of the PLL synthesizer for transmit operation is similar to receive operation, with two exceptions. The local oscillator is switched to TX (50.76 MHz) and the programmable counter programming is changed by an added circuit (QC02 and QCO1), thus the VCO is generating the transmit frequency. In the TX mode, the VCO signal is modulated by the audio signal from the microphone amplifier (direct FM).



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FIGURE 4. FUNCTIONAL BLOCK DIAGRAM

3. Unlock Detection

In the event that the lock state is not obtained, the logic circuit automatically inhibits the transmitter to prevent illegal transmissions.

**TRANSMITTER**

The transmitter is designed for operation in the VHF Marine frequency range of 156 - 158 MHz.

1. Microphone Amplifier

The audio signal originated at the microphone is applied to a microphone amplifier circuit consisting of a high pass filter, a microphone amplifier, a 6 dB pre-emphasis network, instantaneous deviation control (I.D.C.), and a low pass filter.

The amplified audio signal is fed to the PLL frequency synthesizer to obtain an FM modulated RF signal.

2. Small Signal Stage

The modulated RF carrier output from the PLL frequency synthesizer is applied to the RF amplifier stages (Q501 and Q502).

3. Power Stage

The RF signal from the small signal stage is fed to a power amplifier stage consisting of a pre-driver (Q503), driver (Q504), and final transistor (Q505).

4. Output Filter/Matching Network

The transmit signal, having been amplified by the power stage, is fed through a four-stage filter network to remove unwanted signals and to insure proper matching to the antenna. This section also includes a solid-state antenna switching circuit to supply the signals received at the antenna to the receiver circuit, and an RF power sensor to send information to the power control circuit.

5. Power Control Circuit

The DC signal which is sent from the sensor causes a voltage regulator to respond, levelling the transmitter output power and, if high VSWR is present in the antenna line, automatically reducing the power to a safe operating level. The output power in high and low modes are individually adjustable.

**RECEIVER**

The receiver is a double conversion superheterodyne designed for operation in the VHF Marine frequency range of 156-163 MHz.

1. RF Stage

The RF signal is picked up at the antenna and fed into a two-stage bandpass

filter which employs aluminum slugs for insuring high Q. It is then amplified by a J-FET common gate amplifier (Q101) and again filtered through a high Q bandpass filter.

2. First Mixer

After the initial amplification and filtering, the signal is applied to the gate of the first mixer transistor (Q102) while the first local signal is injected into the source of the mixer transistor. This permits the mixer stage to have a wide dynamic range. The first local frequency is obtained by the following formula.

$$\text{First Local Frequency} = \text{Receive Frequency} - 21.40 \text{ MHz}$$

3. First And Second IF

The heterodyning action of the first mixer produces a 21.4 MHz intermediate frequency, which is filtered by a crystal filter (F201), then passed to the second mixer (Q201). The first IF signal is mixed with a 21.855 MHz signal at this stage to produce a 455 kHz intermediate frequency (second IF).

The 455 kHz signal obtained at Q201 is fed through the second IF filters (F202 and F203), then amplified by limiting amplifiers Q203 and Q251.

4. Discriminator

A conventional FM discriminator (L251, L252, Q252, and Q253) is placed after the above stages to recover the audio signal from the modulated RF signal. The audio signal is amplified by Q351 to obtain the power to drive the speaker.

5. Noise Squelch

A noise-actuated squelch circuit consisting of a noise amplifier/limiter (Q301), noise detector (Q302 and Q303), and a DC control circuit (Q304 and Q305) is included in the receiver to cut off the audio amplifier. This eliminates static which would otherwise be heard at the speaker during intervals between received messages.

**MAINTENANCE**

**GENERAL**

The inherent quality of the solid-state components used in the transceiver will provide many years of continuous use without failure, assuming the unit is treated with care. The following precautions should always be observed to prevent damage to the radio.

1. Never key the transmitter unless an antenna or suitable dummy load is connected to the antenna receptacle of the radio.
2. Avoid excessive supply voltage. The voltage should not exceed 16 VDC, nor should it fall below 11 VDC.

Maintenance on the transceiver should be performed in the following sequence.

1. Performance Test - Conducted to check the overall performance of the transceiver. Should be performed prior to the sale/installation of the radio and prior to any corrective maintenance.
2. Alignment/Adjustment - Conducted if the transceiver fails the Performance Test and/or a critical electrical component has been replaced in the transceiver. In addition, SCC recommends that the radio be returned whenever maintenance is performed on it.
3. Troubleshooting - Isolates a fault in the transceiver.

Remove the covers from the radio to obtain access to the test and adjustment points. Connect the radio to a suitable DC source (+13.8 VDC  $\pm$ 20%). Test equipment hookup for alignment procedure is illustrated in Figures 6 and 9. Alignment reference points locations are illustrated in Figures 7 and 8.

**TEST EQUIPMENT**

The following maintenance procedure is supplied assuming the repair technician has access to the following test equipment, or its equivalent.

<u>EQUIPMENT</u>	<u>MODEL</u>
FM Communications Monitor	Cushman CE-6A
RF Wattmeter w/50 Ohm Load	Bird 6154
Tone Generator	Cushman CE-11
Voltmeter	Hewlett Packard 427A
RF Probe	Hewlett Packard 11096B
Frequency Counter	Hewlett Packard 5314A
Scope	Hewlett Packard 1220A
DC Microammeter	Simpson 374
Power Supply	Adjustable 9.5 V to 17 V 25 Amp.

Optional (Recommended but not required)

RF Spectrum Analyzer	Hewlett Packard 8558B w/Display
Digital Voltmeter	Danometer 2000
Signal Generator	Wavetech 3000
Sinadder	Helper Instruments

**PERFORMANCE TEST**

- I. Transmitter
  1. Connect a wattmeter w/50 ohm dummy load to the antenna receptacle.
  2. Set the power mode switch to the high position.
  3. Key the transmitter by depressing the microphone PTT switch.
  4. Verify that the power output is 25 watts minimum on channels 06, 16, and 26.
  5. Set the power mode switch to the low position.



6. Key the transmitter and verify that there is 0.8 to 1 watt power output on channels 06, 16, and 26.
7. Key the transmitter and verify that there is no power output on channels 01W, 02W, and 0W.
8. Set an FM communications monitor to measure the exact transmitter frequency of channel 06.
9. Key the transmitter and verify that the FM monitor indicates the exact frequency  $\pm 500$  Hz.
10. Repeat Steps 8 and 9 for channels 16 and 26.
11. Set the communications monitor to measure transmitter deviation.
12. Key the transmitter and speak into the microphone. Deviation must not exceed  $\pm 5.0$  kHz.

II. Receiver

1. Connect the signal generator function of the FM communications monitor to the antenna receptacle.
2. Connect a voltmeter, set for AC volts, to the speaker jack with a 4 ohm, 5 watt resistor in parallel.
3. Select channel 06.
4. Turn the squelch control fully counterclockwise (maximum speaker noise).
5. Adjust the volume control for a voltmeter reading of 1.4 VAC.
6. Set the signal generator to the exact receiver frequency (no modulation).
7. Slowly increase the signal level until the voltmeter reading is reduced to 0.14 VAC (20 dB decrease). Verify that the signal generator output does not exceed 0.5  $\mu$ V.
8. Reduce the signal generator output to zero.
9. Adjust the squelch control to the point where speaker noise just cuts out (threshold).
10. Set the internal modulation of the signal generator to  $\pm 3$  kHz, with 1 kHz audio, then increase the output until audio is regained. Verify that the signal generator output does not exceed 0.25  $\mu$ V.
11. Turn the squelch control fully clockwise (fully squelched).
12. Increase the signal generator output until audio is regained. Verify that the signal generator output does not exceed 6.5  $\mu$ V.
13. Repeat Steps 4 through 12 for channels 16 and 26.

**ALIGNMENT/ADJUSTMENT****I. PLL Circuit**

Prior to alignment of the PLL circuit, connect test equipment as shown in Figure 6.

1. Select channel 01W.
2. Connect the voltmeter, equipped with an RF probe, to the base of QP36.
3. Preset the slugs of LP35, LP36, and LP71 to the bottom and the slugs of LP81, LP91, and LV03 to the top. (See Figure 5 below.) FIGURE 5. SLUG ADJUSTMENT
4. Key the transmitter and adjust LP71 for the maximum RF voltmeter reading.
5. In the receive mode, adjust LP36 for the maximum RF voltmeter reading.
6. Connect the voltmeter, set for DC volts (no RF probe), to TP2.
7. Adjust LV03 for a 6.5 VDC reading.
8. Select channel 06.
9. Connect the frequency counter to TP1.
10. Adjust CPO1 to obtain a 6.40 MHz reading on the frequency counter.
11. Connect the frequency counter to TP4.
12. Adjust CP31 to obtain a 134.90 MHz reading on the frequency counter.
13. Key the transmitter and adjust CP33 to obtain a 156.30 MHz reading on the frequency counter.
14. Connect the voltmeter, set for DC volts, to TP5.
15. Adjust LP81 to obtain the same voltmeter reading on channels 01W and 06.
16. Connect the voltmeter, set for DC volts, to TP51.
17. Key the transmitter and adjust LP91 to obtain the maximum voltmeter reading on channel 06.

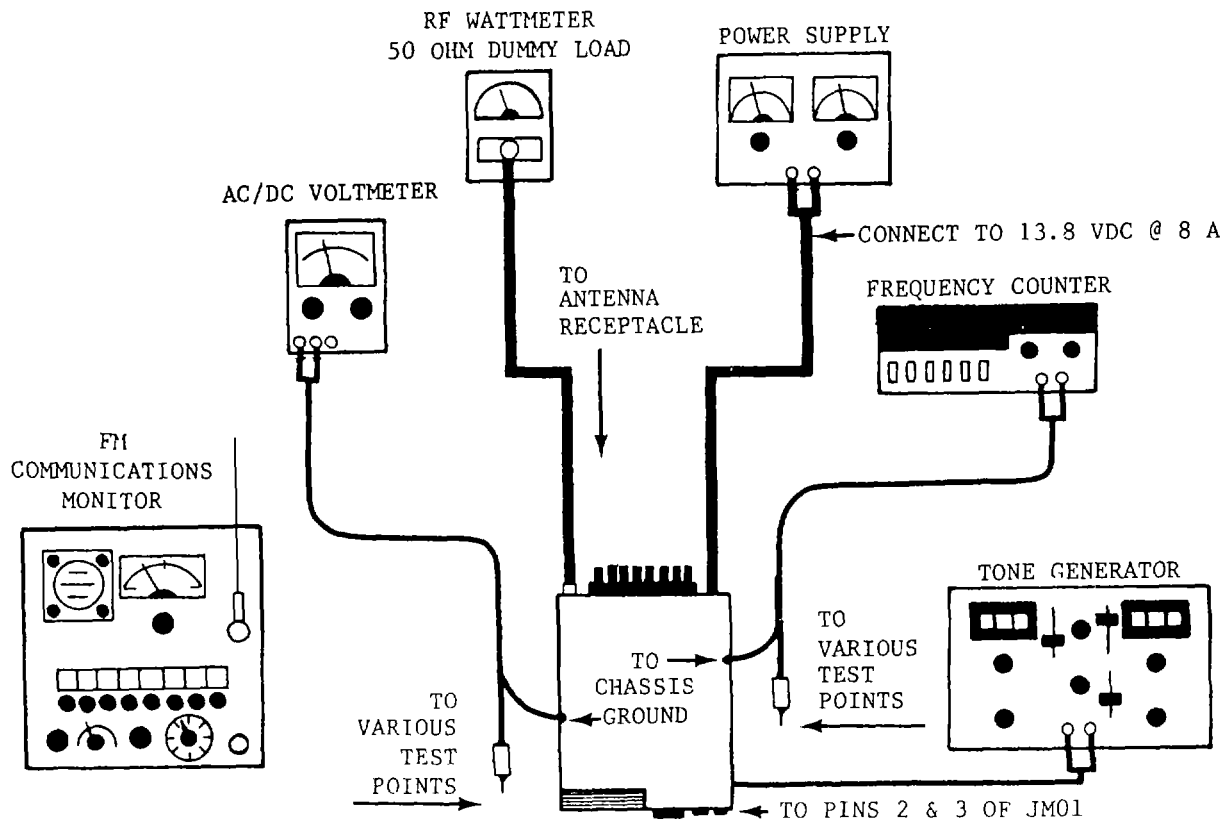
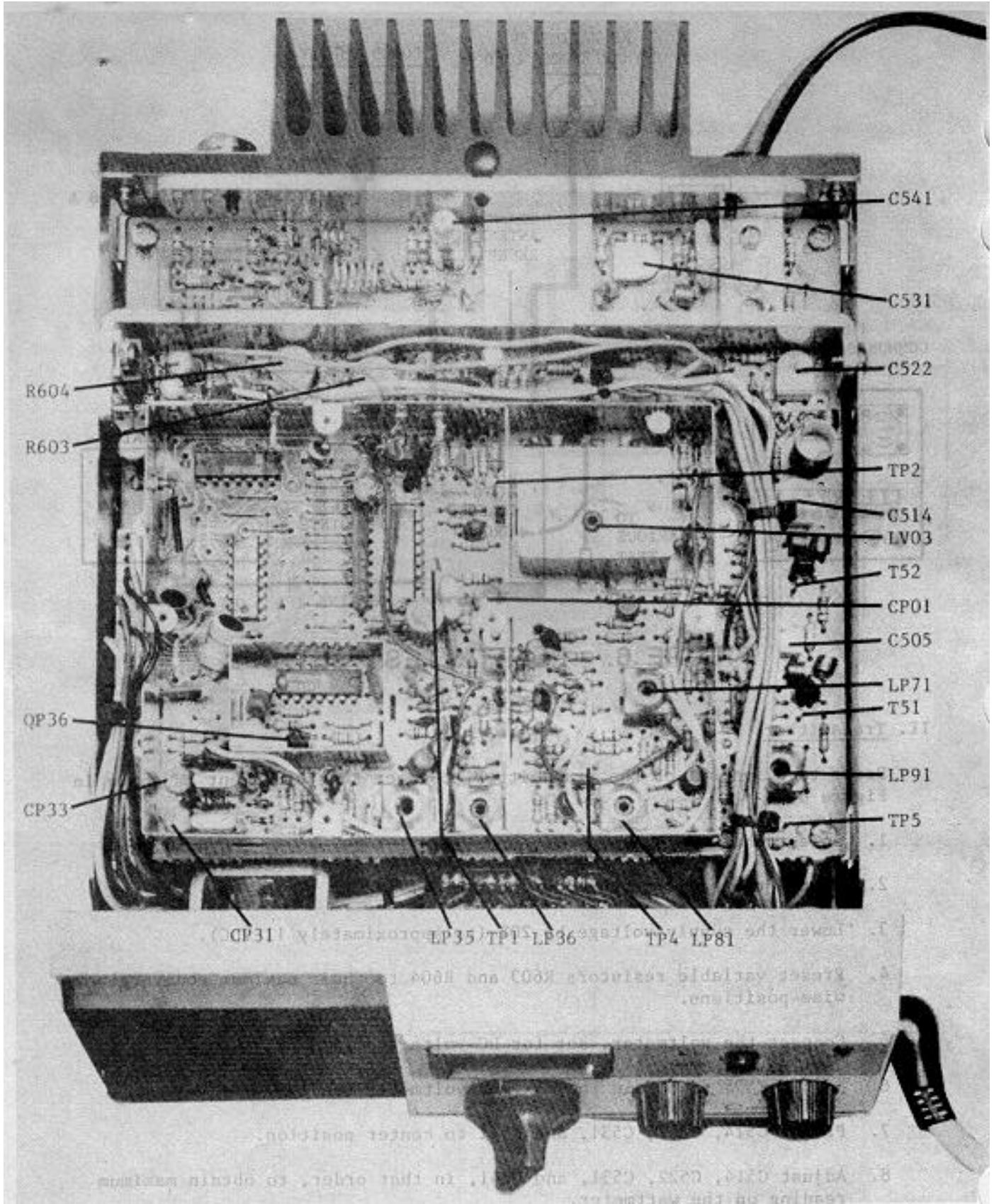


FIGURE 6. PLL, TX TEST SET-UP

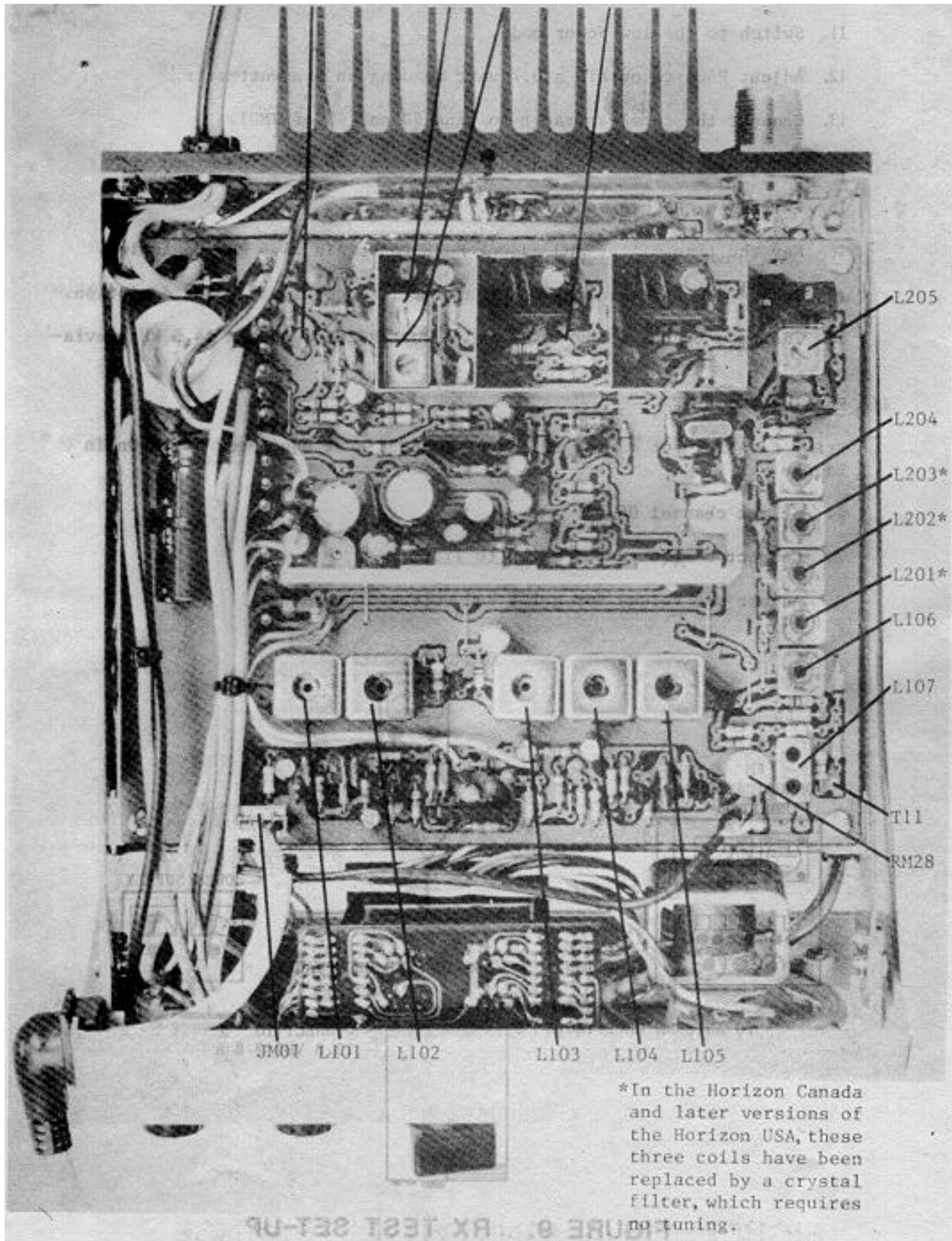
II. Transmitter

Prior to alignment of the transmitter, connect test equipment as shown in Figure 6.

1. Select channel 16.
2. Switch the radio to the low power mode.
3. Lower the supply voltage by 20% (to approximately 11 VDC).
4. Preset variable resistors R603 and R604 to their maximum counterclockwise positions.
5. Connect the voltmeter, set for DC volts, to T52.
6. Adjust C505 to obtain the maximum voltmeter reading.
7. Preset C514, C522, C531, and C541 to center position.
8. Adjust C514, C522, C531, and C541, in that order, to obtain maximum reading on the wattmeter.
9. Reset the power supply voltage to 13.8 VDC and switch to the high power mode.
10. Adjust k603 to obtain a 24 watt reading on the wattmeter.



**FIGURE 7. ALIGNMENT REFERENCE POINTS LOCATION (TOP)**



**FIGURE 8. ALIGNMENT REFERENCE POINTS LOCATION (BOTTOM)**

11. Switch to the low power mode.
12. Adjust R604 to obtain a 0.7 watt reading on the wattmeter.
13. Connect the tone generator to pins #2 and #3 of JMO1.
14. Set the output of the generator to 1 kHz, 20 mV.
15. Switch to the high power mode.
16. Key the transmitter and adjust RM28 to obtain  $\pm 4.5$  kHz deviation.
17. Reduce the tone generator output level to obtain  $\pm 3.0$  kHz deviation.
18. Increase the level by 20 dB and adjust RM28 to obtain  $\pm 4.5$  kHz deviation.

III. Receiver

Prior to alignment of the receiver, connect test equipment as shown in Figure 9.

1. Select channel 06.
2. Connect a zero center meter to T13.
3. Adjust the volume for a 1.4 VAC voltmeter reading.

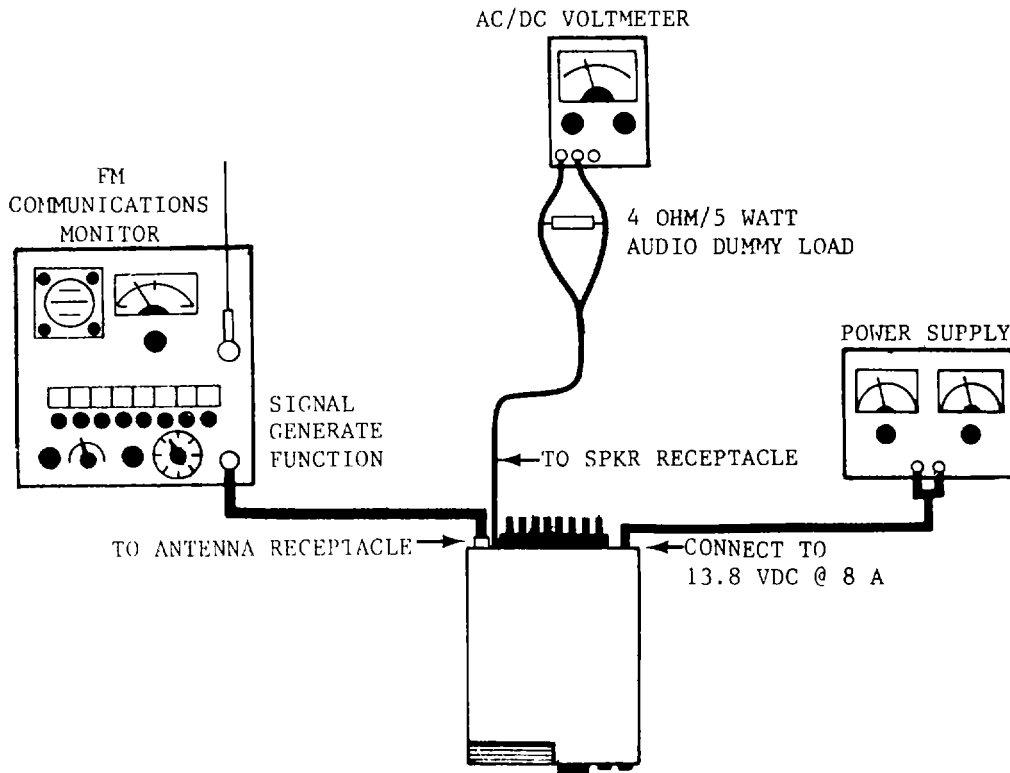


FIGURE 9. RX TEST SET-UP

4. Adjust L106, L201, L203, L204, L251, and L252 to obtain the maximum audio (noise) level.

NOTE: The Horizon Canada and later versions of the Horizon USA do not have coils L201, L202 and L203, but a crystal filter instead. No tuning of the crystal filter is necessary.

5. Adjust L251 to obtain a zero reading on the zero center meter.
6. Connect the voltmeter, set for DC volts, to T12.
7. Preset the slugs of L101 and L103 to the top, and the slugs of L102, L104, and L105 to the bottom (see Figure 5).
8. Adjust L107 for maximum voltmeter reading.
9. Readjust L107 to obtain the same voltmeter readings on channels 01W and 06. If this cannot be obtained, readjust LP81 slightly.
10. Select channel 06 again.
11. Connect the voltmeter, set for DC volts, to T12.
12. Set the output level of the communications monitor at 3 to 5 times higher than that of no signal meter reading.
13. Adjust L101, L102, L103, L104, L105, L106, L201, L202, L203, L204, and L205 for maximum voltmeter reading. Reduce the output level of the signal generator as tuning progresses.

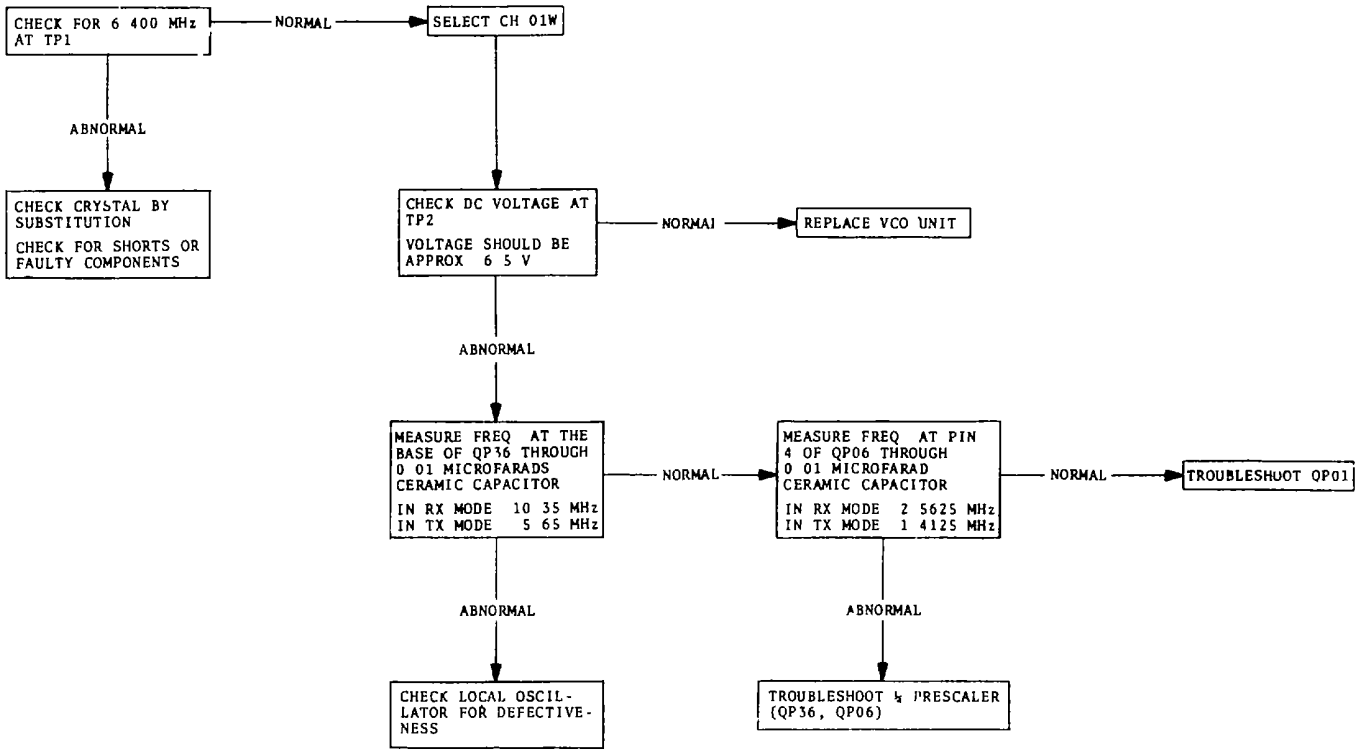
NOTE: The Horizon Canada and later versions of the Horizon USA do not have coils L201, L202 and L203, but a crystal filter instead. No tuning of the crystal filter is necessary.

14. Repeat Steps 9 through 12 several times.
15. Adjust L105 to obtain the same voltmeter reading at T12 on channels 01W and 06.
16. Readjust L105 to obtain the same 12 dB QS on channels 01W and 06.

## TROUBLESHOOTING

By following the sequence of steps shown on the Troubleshooting Charts (Figures 10, 11, and 12), a defective stage or component may be isolated.

NOTE: The troubleshooting charts are for use after the transceiver has been aligned to the desired frequency.



SYMPTOM VCO DOES NOT LOCK

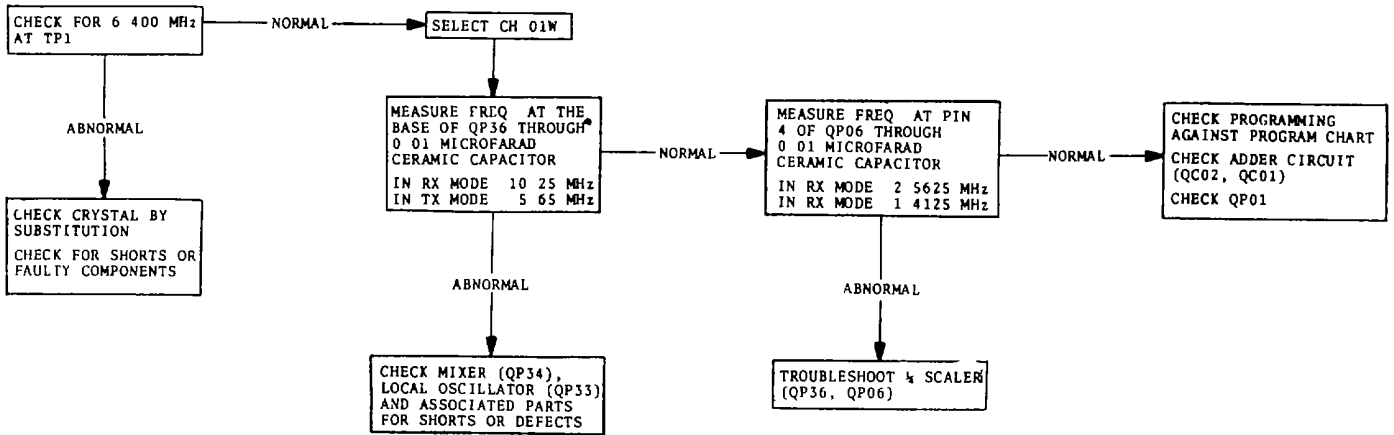


FIGURE 10. PLL TROUBLESHOOTING CHART



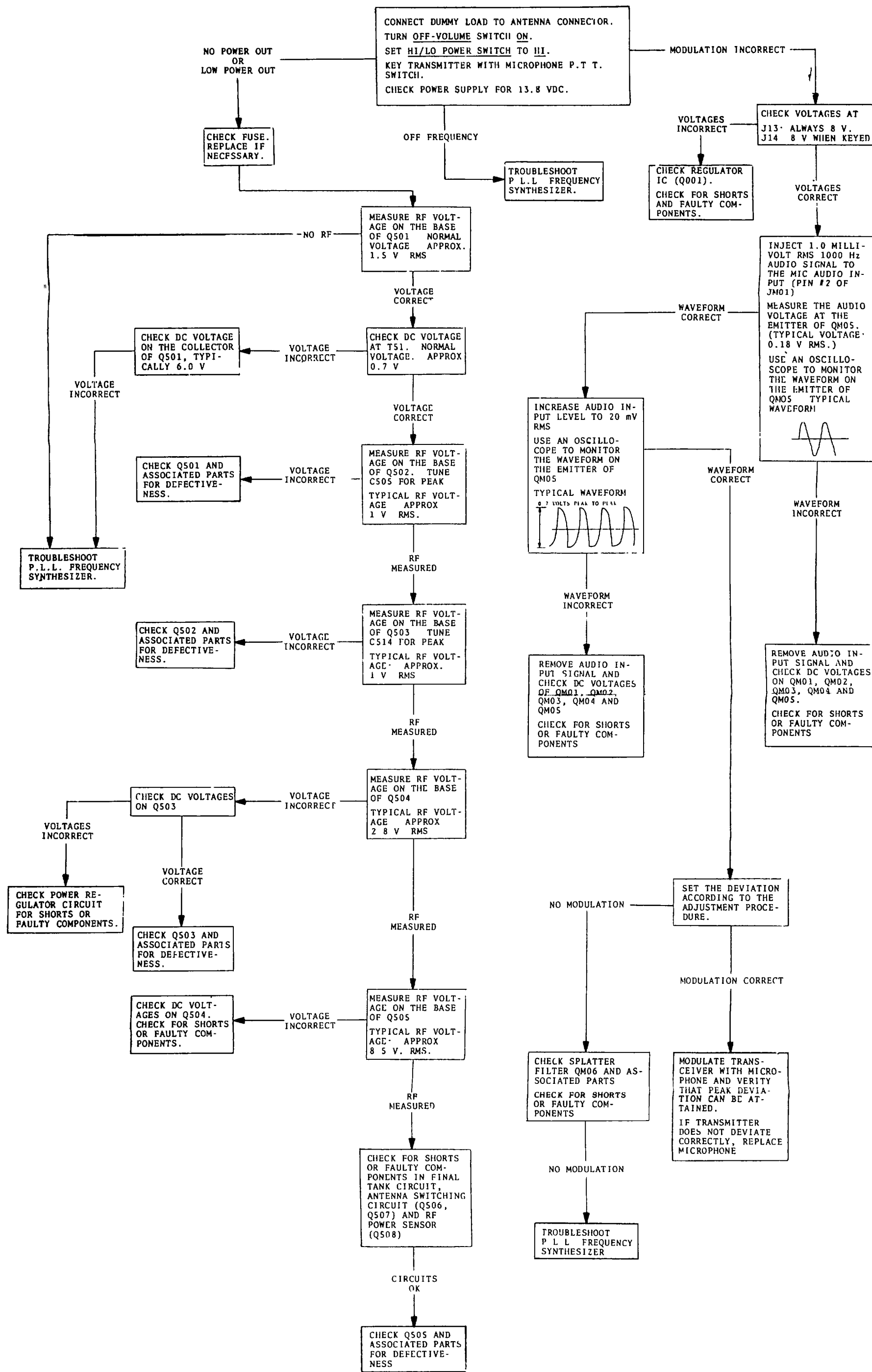


FIGURE 11. TX TROUBLESHOOTING CHART

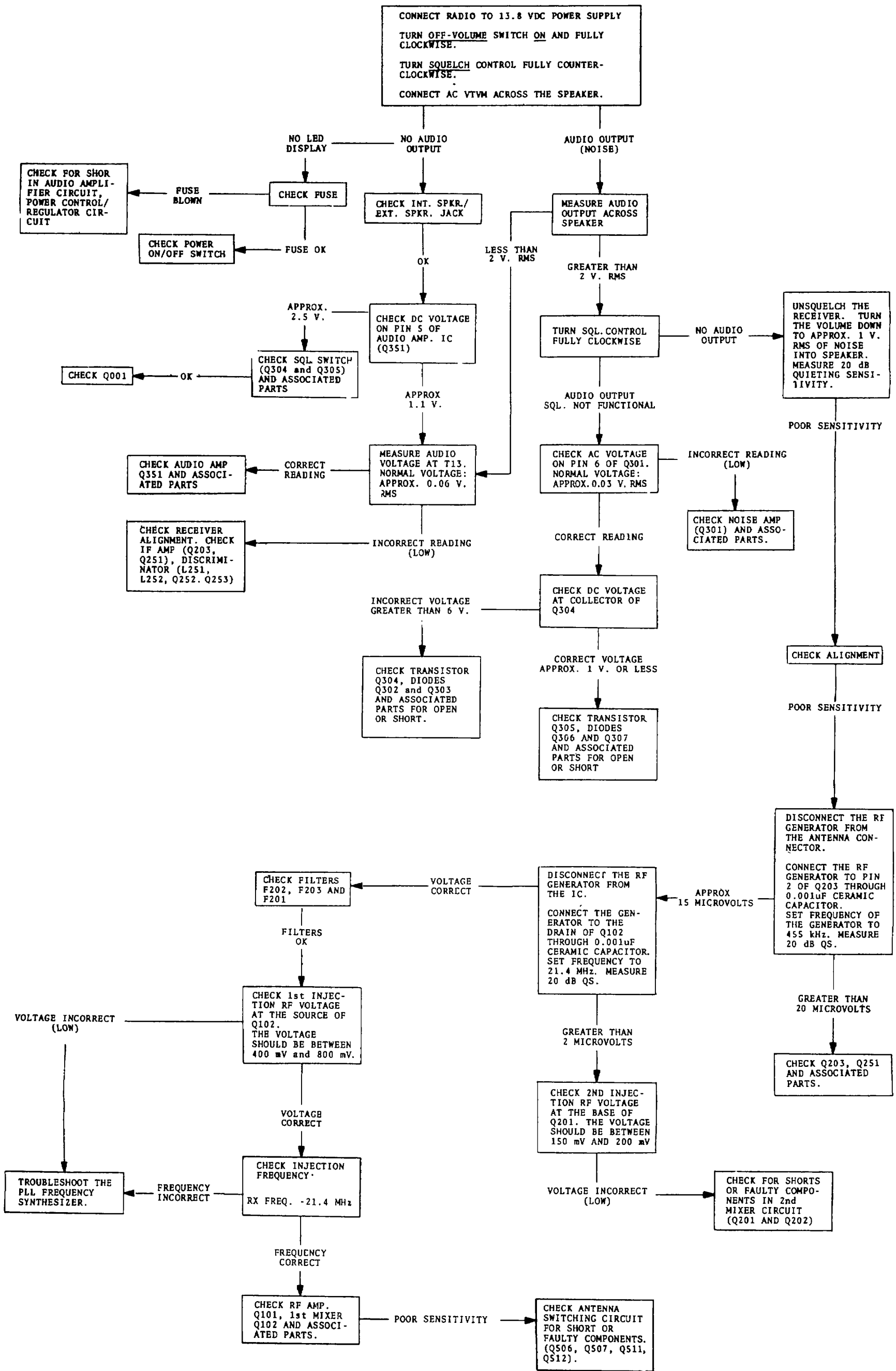


FIGURE 12. RX TROUBLESHOOTING CHART

## DRAWINGS

### GENERAL

The following drawings illustrate the electrical and mechanical details of the transceiver. The corresponding parts lists for each drawing are detailed in the Parts Lists chapter.

### REVISIONS

As drawings are updated, information about the change(s) is incorporated into a revision column. This revision column appears in the manual on the back side of the revised drawing. It lists the reference designator of the part involved, a description of the revision and the effective serial number of the change. With this information, the technician can determine the correct drawing for the current version, and any previous version, of the transceiver covered by the manual. (If the revision is applicable for all versions of the transceiver, it is not included in the revision column, as the change applies to all units.)

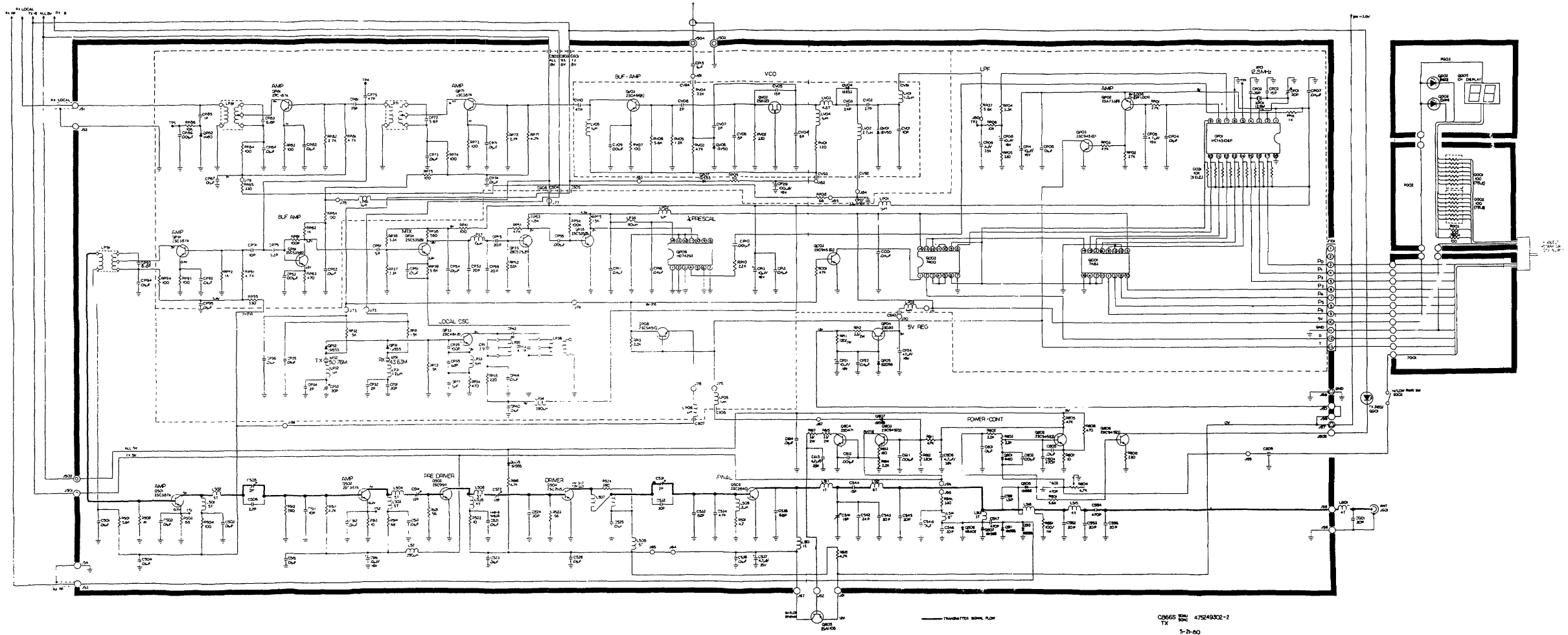
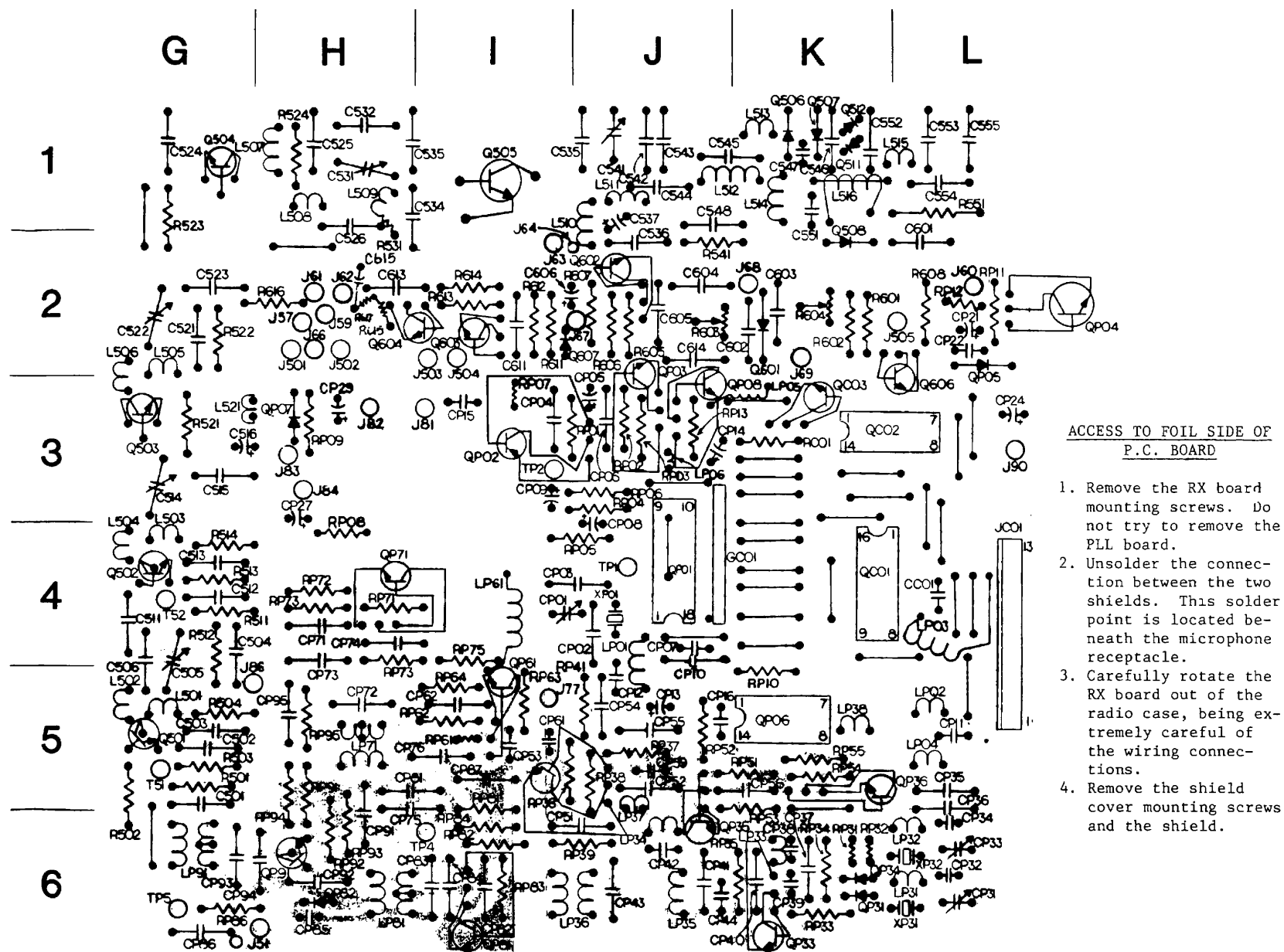


FIGURE 13. PLL, TX SCHEMATIC DIAGRAM



TX AND PLL C866S 475249403-1  
5-23-80

FIGURE 14. PLL, TX P.C. BOARD LAYOUT  
(FOIL SIDE WITH COMPONENT OVERLAY)

ACCESS TO FOIL SIDE OF  
P.C. BOARD

1. Remove the RX board mounting screws. Do not try to remove the PLL board.
2. Unsolder the connection between the two shields. This solder point is located beneath the microphone receptacle.
3. Carefully rotate the RX board out of the radio case, being extremely careful of the wiring connections.
4. Remove the shield cover mounting screws and the shield.

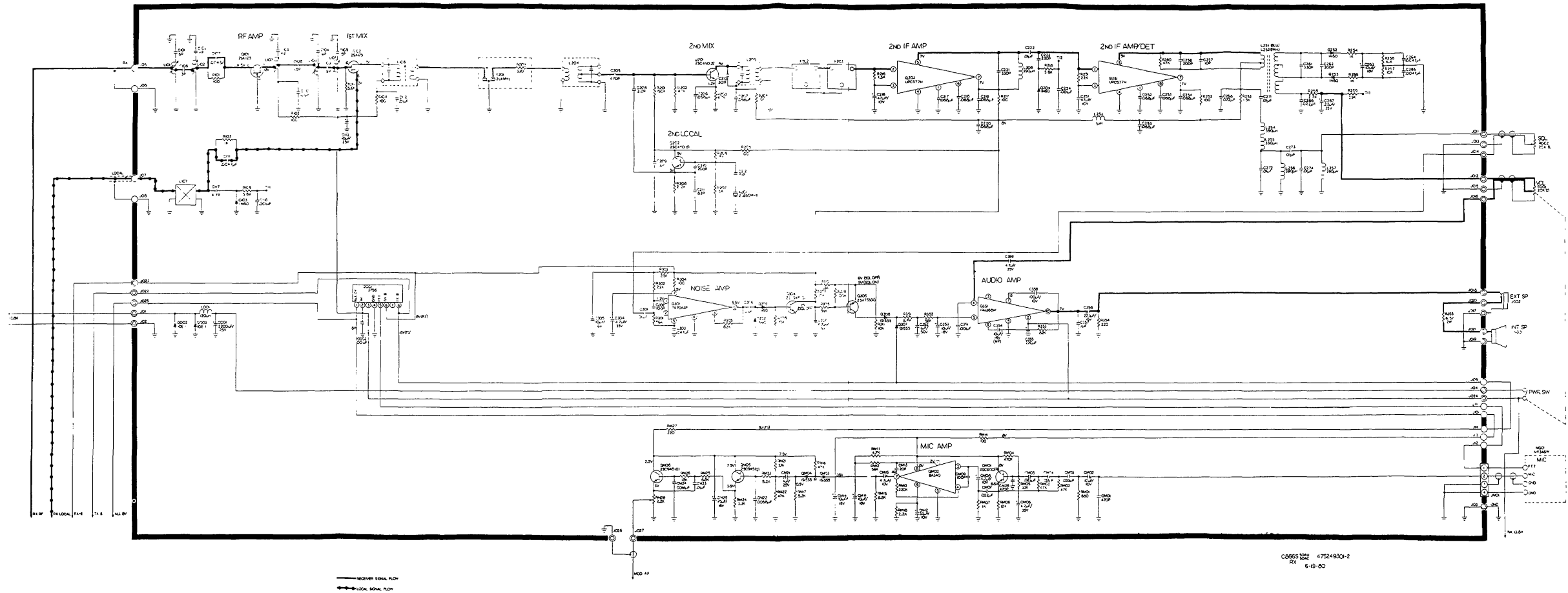


FIGURE 15. RX SCHEMATIC DIAGRAM

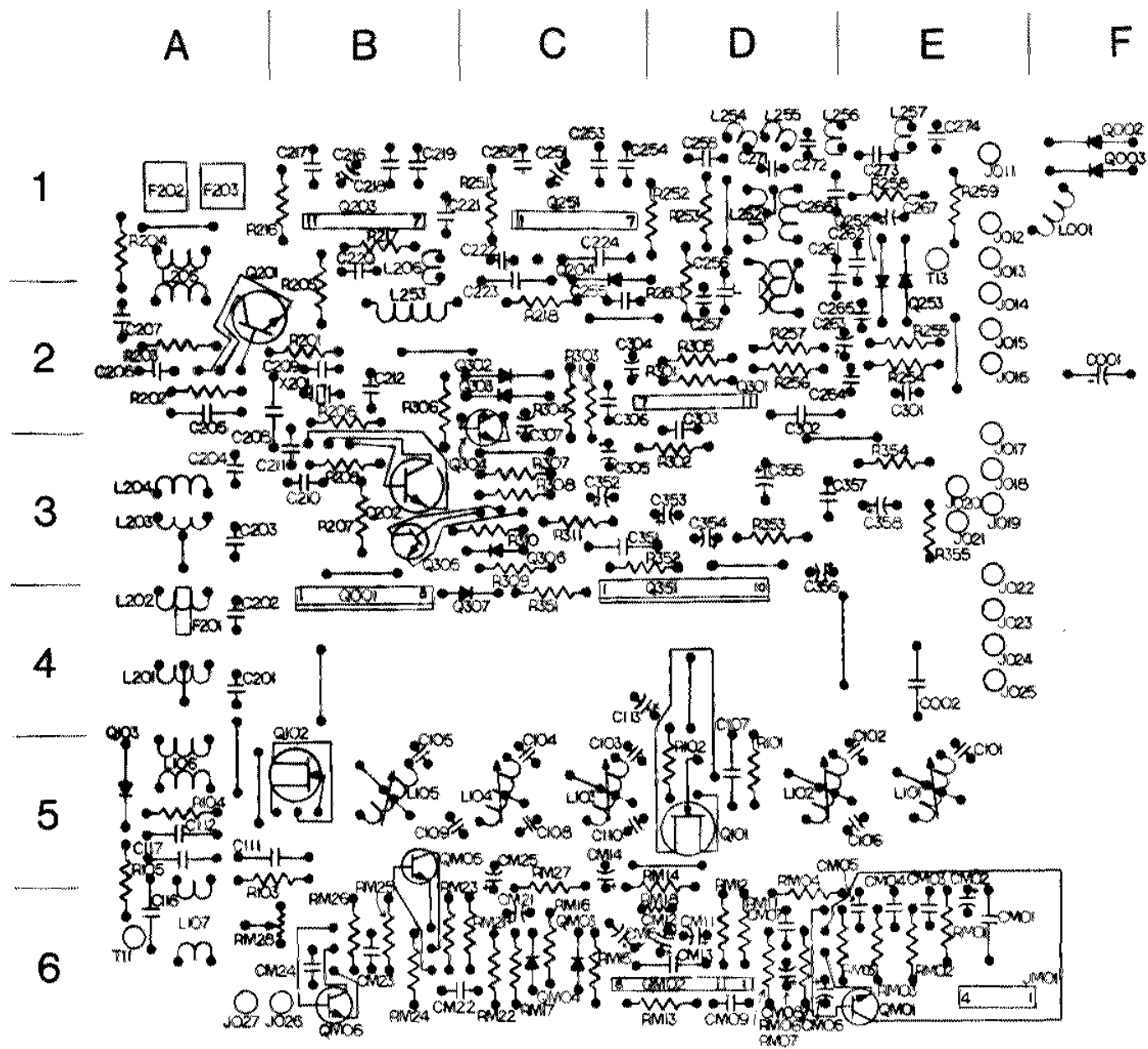
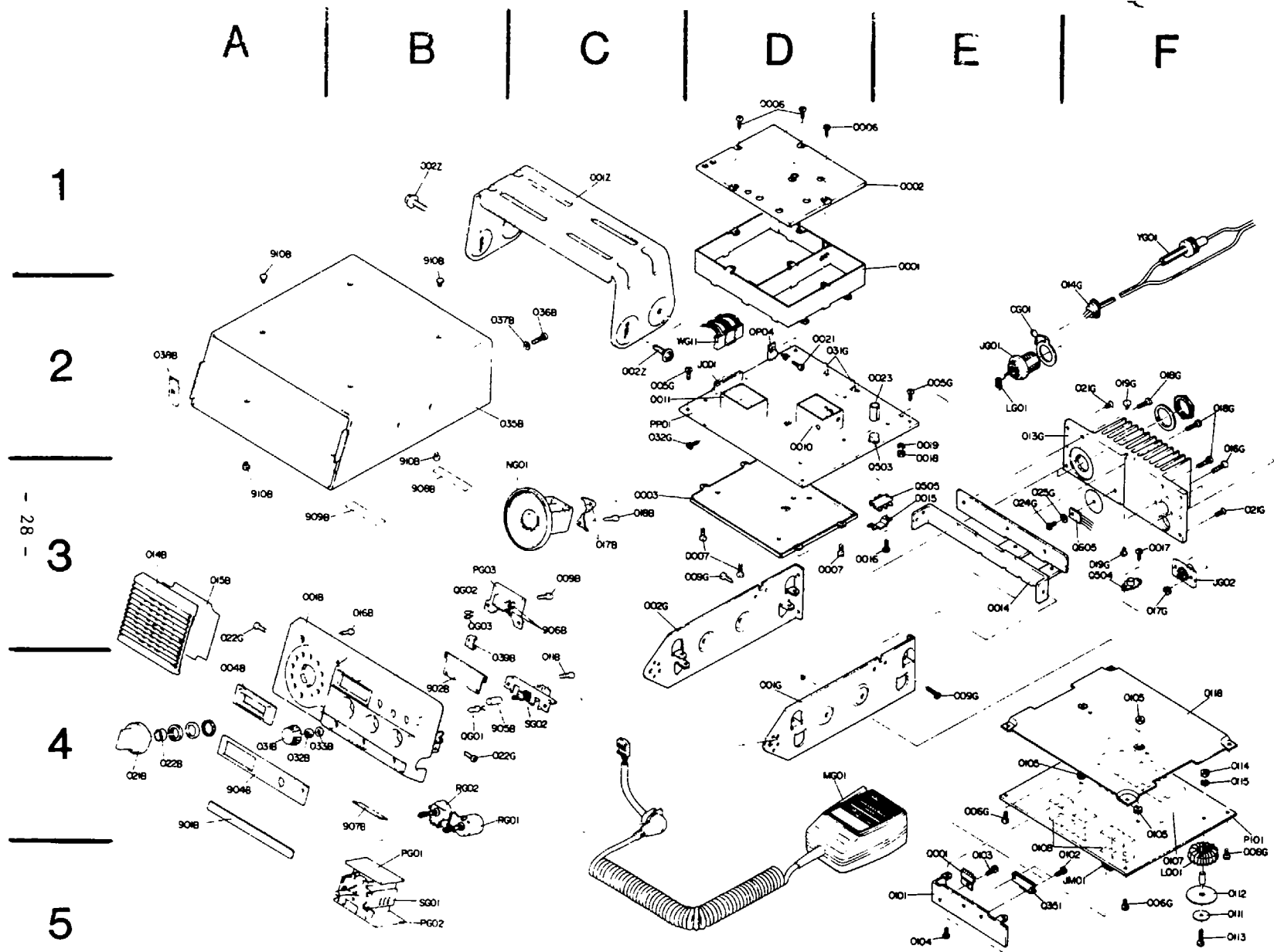


FIGURE 16. RX P.C. BOARD LAYOUT  
(FOIL SIDE WITH COMPONENT OVERLAY)



1

2

- 28 -

3

4

5

FIGURE 17. EXPLODED PARTS VIEW



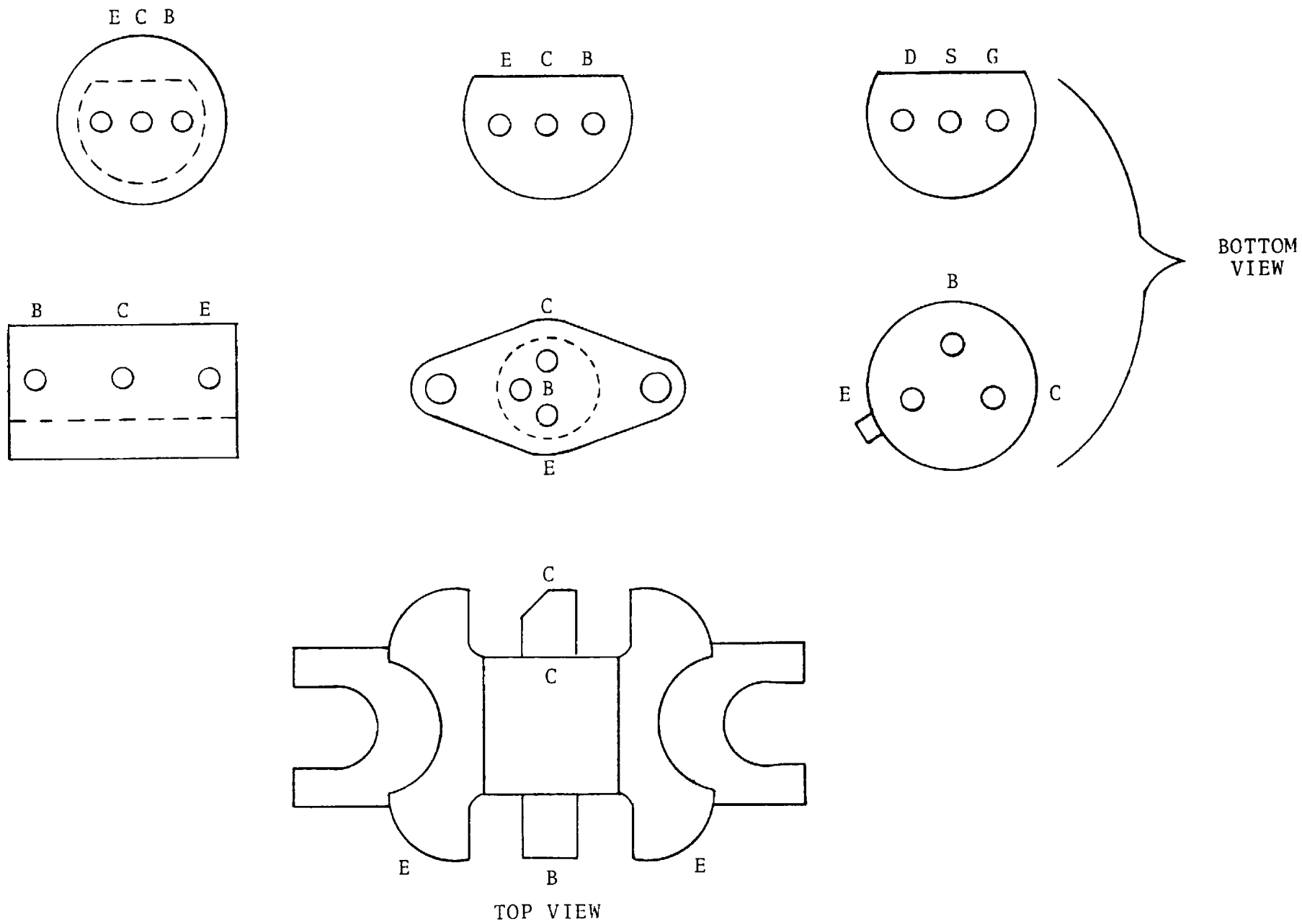


FIGURE 18. SEMICONDUCTOR PIN DETAILS

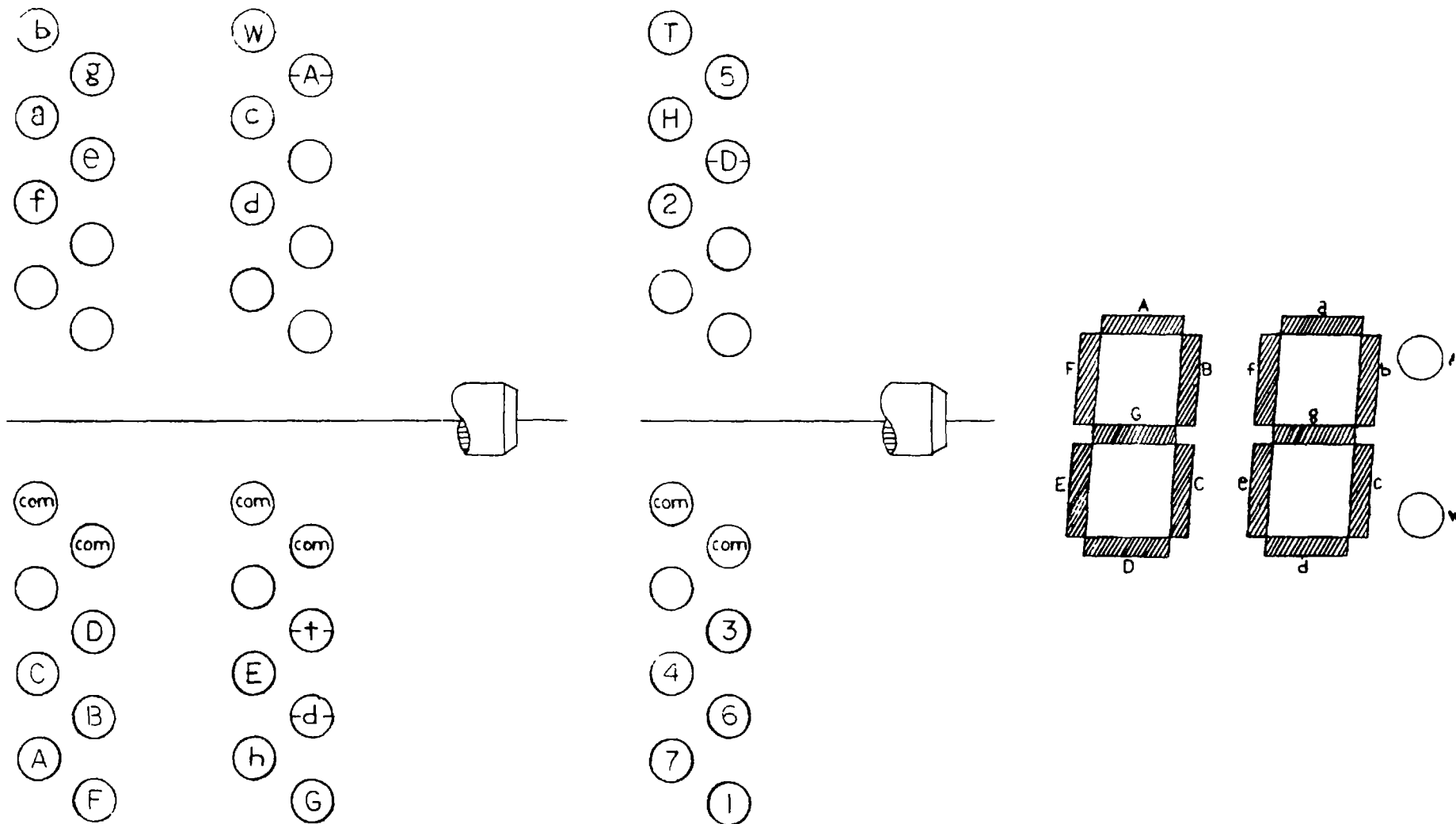


FIGURE 19. CHANNEL SWITCH TERMINAL LOCATION (FOIL SIDE VIEW SHOWN)

SWITCH POSITION/ DISPLAY NUMBER	SWITCH TERMINAL NUMBER																												
	FREQUENCY FUNCTION										LEDS																		
	1	2	3	4	5	6	7	-D-	T	11	A	B	C	D	L	r	G	a	b	c	d	e	f	g	-A-	W	-J-	t	h
1/01W	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	0	1	0	0	
2/02W	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	
3/03W	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	0	
4/05A	0	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	0	1	0	
5/06	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	
6/07	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1	0	
7/08	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	
8/09	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	
9/10	0	0	0	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	0	1	
10/11	0	1	0	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0	
11/12	0	0	1	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	0	0	1	0	1	1	0	1	
12/13	0	1	1	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	1	1	0	1	1	0	1	0	
13/14	0	0	0	0	1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	1	0	0	1	1	0	1	0	
14/15W	0	1	0	0	1	1	0	0	0	1	1	0	0	1	1	1	1	0	1	0	0	1	0	0	1	0	0	1	
15/16	0	0	1	0	1	1	0	0	1	0	1	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	
16/17	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	
17/18A	0	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	1	0	
18/19A	0	1	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	1	0	0	0	1	0	1	0	
19/20	0	0	1	1	1	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	
20/21	0	1	1	1	1	1	0	1	1	0	0	0	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	0	
21/21A	0	1	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1	0	1	
22/22A	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	
23/23A	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	1	0	
24/24	0	0	1	0	0	0	1	1	1	0	0	0	1	0	0	1	0	1	0	0	1	1	0	0	1	1	1	0	
25/25	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	0	
26/26	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	1	0	
27/27	0	1	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	1	1	0	
28/28	0	0	1	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	
29/65A	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	
30/66A	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	
31/67	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	
32/68	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	
33/69	1	1	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	
34/70	1	0	0	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0	1	
35/71	1	1	0	1	0	1	0	0	1	0	0	0	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	
36/72	1	0	1	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	0	0	1	0	1	1	0	1	0	
37/73	1	1	1	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	1	1	0	1	1	0	1	0	
38/74	1	0	0	0	1	1	0	0	1	0	0	0	1	1	0	1	1	0	0	1	1	0	0	1	1	0	1	0	
39/77	1	1	1	0	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	1	0	1	1	1	0	1	0	
40/78A	1	0	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
41/79A	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	
42/80A	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	
43/81A	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	0	1	0	1	
44/82A	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	
45/83A	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1	
46/84	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	1	0	
47/85	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	0	
48/86	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	
49/87	1	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	
50/88A	1	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

FIGURE 20. CHANNEL SWITCH LOGIC CHART (USA)

SWITCH POSITION/ DISPLAY NUMBER	SWITCH TERMINAL NUMBER																													
	FREQUENCY FUNCTION												LEDS																	
	1	2	3	4	5	6	7	-D-	T	H	A	B	C	D	E	F	G	a	b	c	d	e	f	g	-A	W	-d-	-t-	h	
1/01	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	0	1	0	0	0	
2/02	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	1	0	
3/03	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1	0	0	
4/06	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1	0	0	
5/07A	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1	0	0	
6/08	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	
7/09	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	
8/10	0	0	0	1	0	1	0	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	0	
9/11	0	1	0	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	0	
10/12	0	0	1	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	0	0	1	0	1	1	0	1	0	
11/13	0	1	1	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	1	1	0	1	1	0	1	0	
12/14	0	0	0	0	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	0	1	0	0	1	0	1	1	0	0	
13/15	0	1	0	0	1	1	0	0	1	1	1	0	0	1	1	1	1	0	1	0	0	1	0	0	1	1	0	1	1	
14/16	0	0	1	0	1	1	0	0	1	0	1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	1	0	
15/17	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	0	0	0	1	1	0	1	1	1	0	1	1	
16/18	0	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	0	
17/19A	0	1	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	
18/20	0	0	1	1	1	1	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	
19/21	0	1	1	1	1	1	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	0	
20/21A	0	1	1	1	1	1	0	0	1	0	0	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	0	
21/22A	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	
22/23	0	1	0	0	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	1	1	1	0	
23/23A	0	1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	
24/24	0	0	1	0	0	0	1	1	1	0	0	0	1	0	0	1	0	1	0	0	1	1	0	0	1	1	1	1	0	
25/25	0	1	1	0	0	0	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	1	1	0	
26/26	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	1	1	0	
27/27	0	1	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	1	1	1	0	
28/28	0	0	1	1	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	
29/65A	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	
30/66A	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	
31/67	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	
32/68	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	
33/69	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	
34/70	1	0	0	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	
35/71	1	1	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	
36/72	1	0	1	1	0	1	0	0	1	0	0	0	0	1	1	0	1	0	0	1	0	0	1	0	1	1	0	1	0	
37/73	1	1	1	1	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	
38/74	1	0	0	0	1	1	0	0	1	0	0	0	0	1	1	0	1	1	0	0	1	1	0	0	1	1	0	1	0	
39/75	1	1	1	0	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	1	0	1	1	1	0	1	0	0	
40/78A	1	0	0	1	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	
41/79A	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	
42/80A	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	
43/81A	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	0	1	0	1	0	
44/82A	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	
45/83A	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	
46/84	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	1	0	
47/85	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	1	1	0	
48/86	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	
49/87	1	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	
50/88	1	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0

FIGURE 21. CHANNEL SWITCH LOGIC CHART (CANADA)

CHANNEL	TX FREQ. (MHz)	RX FREQ. (MHz)	CHANNEL ASSIGNMENT
01	-	162.550	WEATHER
02	-	162.400	WEATHER
03	-	162.475	WEATHER
05A	156.250	156.250	PORT OPERATIONS - INTERSHIP, Ship/Coast
06	156.300	156.300	INTERSHIP SAFETY
07A	156.350	156.350	COMMERCIAL - INTERSHIP, Ship/Coast
08	156.400	156.400	COMMERCIAL - INTERSHIP
09	156.450	156.450	NON-COMMERCIAL - INTERSHIP, Ship/Coast
10	156.500	156.500	COMMERCIAL - INTERSHIP, Ship/Coast
11	156.550	156.550	COMMERCIAL - INTERSHIP, Ship/Coast
12	156.600	156.600	PORT OPERATIONS - INTERSHIP, Ship/Coast
13	156.650	156.650	NAVIGATIONAL - INTERSHIP, Ship/Coast
14	156.700	156.700	PORT OPERATIONS - INTERSHIP, Ship/Coast
15A	-	156.750	ENVIRONMENTAL - Coast/Ship
16	156.800	156.800	DISTRESS, SAFETY, AND CALLING
17	156.850	156.850	STATE CONTROL - Ship/Coast
18A	156.900	156.900	COMMERCIAL - INTERSHIP, Ship/Coast
19A	156.950	156.950	COMMERCIAL - INTERSHIP, Ship/Coast
20	157.000	161.600	PORT OPERATIONS - INTERSHIP, Ship/Coast
21	157.050	161.650	PORT OPERATIONS
21A	157.050	157.050	U.S. GOVERNMENT
22A	157.100	157.100	U.S. COAST GUARD, LIAISON - EMERGENCY
23A	157.150	157.150	U.S. GOVERNMENT
24	157.200	161.800	PUBLIC - Ship/Coast
25	157.250	161.850	PUBLIC - Ship/Coast
26	157.300	161.900	PUBLIC - Ship/Coast
27	157.350	161.950	PUBLIC - Ship/Coast
28	157.400	162.000	PUBLIC - Ship/Coast
65A	156.275	156.275	PORT OPERATIONS - INTERSHIP, Ship/Coast
66A	156.325	156.325	PORT OPERATIONS - INTERSHIP, Ship/Coast
67	156.375	156.375	COMMERCIAL - INTERSHIP
68	156.425	156.425	NON-COMMERCIAL - INTERSHIP, Ship/Coast
69	156.475	156.475	NON-COMMERCIAL - INTERSHIP, Ship/Coast
70	156.525	156.525	NON-COMMERCIAL - INTERSHIP
71	156.575	156.575	NON-COMMERCIAL - INTERSHIP, Ship/Coast
72	156.625	156.625	NON-COMMERCIAL - INTERSHIP
73	156.675	156.675	PORT OPERATIONS - INTERSHIP, Ship/Coast
74	156.725	156.725	PORT OPERATIONS - INTERSHIP, Ship/Coast
77	156.875	156.875	COMMERCIAL - INTERSHIP
78A	156.925	156.925	NON-COMMERCIAL - INTERSHIP, Ship/Coast
79A	156.975	156.975	COMMERCIAL - INTERSHIP, Ship/Coast
80A	157.025	157.025	COMMERCIAL - INTERSHIP, Ship/Coast
81A	157.075	157.075	U.S. GOVERNMENT ONLY
82A	157.125	157.125	U.S. GOVERNMENT ONLY
83A	157.175	157.175	U.S. GOVERNMENT ONLY
84	157.225	161.825	PUBLIC - Ship/Coast
85	157.275	161.875	PUBLIC - Ship/Coast
86	157.325	161.925	PUBLIC - Ship/Coast
87	157.375	161.975	PUBLIC - Ship/Coast
88A	157.425	157.425	COMMERCIAL - INTERSHIP

FIGURE 22. FREQUENCY CHANNELIZATION CHART (USA)

CHANNEL	TX FREQ. (MHz)	RX FREQ. (MHz)	CHANNEL ASSIGNMENT
01	-	162.550	WEATHER
02	-	163.275*	WEATHER
03	-	162.400	WEATHER
06	156.300	156.300	SAFETY - INTERSHIP
07A	156.350	156.350	COMMERCIAL - INTERSHIP, Ship/Coast
08	156.400	156.400	COMMERCIAL - INTERSHIP
09	156.450	156.450	COMMERCIAL - Ship/Coast
10	156.500	156.500	COMMERCIAL - INTERSHIP, Ship/Coast
11	156.550	156.550	COMMERCIAL - INTERSHIP, Ship/Coast
12	156.600	156.600	PORT OPERATIONS - INTERSHIP, Ship/Coast
13	156.650	156.650	NAVIGATIONAL - INTERSHIP, Ship/Coast
14	156.700	156.700	PORT OPERATIONS - INTERSHIP, Ship/Coast
15	156.750	156.750	WEATHER
16	156.800	156.800	DISTRESS, SAFETY AND CALLING
17	156.850	156.850	STATE CONTROL - Ship/Coast
18A	156.900	156.900	COMMERCIAL - INTERSHIP, Ship/Coast
19A	156.950	156.950	COMMERCIAL - INTERSHIP, Ship/Coast
20	157.000	161.600	PORT OPERATIONS - Ship/Coast
21	157.050	161.650	COAST GUARD
21A	157.050	157.050	COAST GUARD
22A	157.100	157.100	COAST GUARD
23	157.150	161.750	COAST GUARD
23A	157.150	157.150	COAST GUARD
24	157.200	161.800	PUBLIC CORRESPONDENCE - Ship/Coast
25	157.250	161.850	PUBLIC CORRESPONDENCE - Ship/Coast
26	157.300	161.900	PUBLIC CORRESPONDENCE - Ship/Coast
27	157.350	161.950	PUBLIC CORRESPONDENCE - Ship/Coast
28	157.400	162.000	PUBLIC CORRESPONDENCE - Ship/Coast
65A	156.275	156.275	PORT OPERATIONS - INTERSHIP, Ship/Coast
66A	156.325	156.325	PORT OPERATIONS - INTERSHIP, Ship/Coast
67	156.375	156.375	COMMERCIAL - INTERSHIP
68	156.425	156.425	NON-COMMERCIAL - INTERSHIP, Ship/Coast
69	156.475	156.475	NON-COMMERCIAL - Ship/Coast
70	156.525	156.525	NON-COMMERCIAL - INTERSHIP
71	156.575	156.575	NON-COMMERCIAL - Ship/Coast
72	156.625	156.625	NON-COMMERCIAL - INTERSHIP
73	156.675	156.675	PORT OPERATIONS - INTERSHIP, Ship/Coast
74	156.725	156.725	PORT OPERATIONS - INTERSHIP, Ship/Coast
77	156.875	156.875	COMMERCIAL - INTERSHIP
78A	156.925	156.925	NON-COMMERCIAL - Ship/Coast
79A	156.975	156.975	COMMERCIAL - INTERSHIP, Ship/Coast
80A	157.025	157.025	COMMERCIAL - Ship/Coast
81A	157.075	157.075	COAST GUARD
82A	157.125	157.125	
83A	157.175	157.175	COAST GUARD AUX.
84	157.225	161.825	PUBLIC CORRESPONDENCE - Ship/Coast
85	157.275	161.875	PUBLIC CORRESPONDENCE - Ship/Coast
86	157.325	161.925	PUBLIC CORRESPONDENCE - Ship/Coast
87	157.375	161.975	PUBLIC CORRESPONDENCE - Ship/Coast
88	157.425	162.075	COMMERCIAL - INTERSHIP

\*NOTE: The frequency of Channel 02 (Weather) was changed to 162.475 MHz in models with serial numbers XXC03001 and subsequent.

FIGURE 23. FREQUENCY CHANNELIZATION CHART (CANADA)

## PARTS LISTS

### GENERAL

The following parts lists include the significant mechanical parts and all the electrical parts, except certain common resistors, contained in the transceiver. The following information will be useful in interpreting data in the parts lists which is not self-explanatory.

### REVISIONS

The parts lists in this manual are for the current build of the transceiver, as of the printing date. If a different part was used in a previous build, details of the parts change are included in the revision table on the back of the applicable drawing, in the Drawings chapter, enabling you to determine the correct replacement part. (If the new part is the recommended replacement part for all units, the old part is not listed in the revision table.)

### P.C. BOARD LOCATION

This guide references each electrical part to a corresponding location on the printed circuit board layout drawing. The P.C. board layout drawing is gridded for easy location. An asterisk (\*) indicates the part is not mounted on a printed circuit board. "VCO" indicates the part is contained in the potted voltage controlled oscillator, which should be ordered as a complete assembly. "EPV" indicates the part is illustrated in the exploded parts view of the transceiver.

### EXPLODED PARTS VIEW LOCATION

This guide references each mechanical part to a corresponding location on the exploded parts view drawing. The exploded parts view drawing is gridded for easy location. An asterisk (\*) indicates the part is not shown on the exploded parts view.

### ORDERING REPLACEMENT PARTS

To order replacement parts for your transceiver from the factory, contact the SCC Parts Department at (213) 532-5300, ext. 248, or write to that department at P.O. Box 92151, Los Angeles, California, 90009.

When ordering replacement parts, you must give complete information including reference designator, description, value, part number and model number the part is for. Failure to provide sufficient information may result in SCC's inability to fill your parts orders.

Please note that crystals and crystal filters are not stocked by the Parts Department, but instead by the Frequency Management Department. When ordering crystals/crystal filters, contact Frequency Management at the number listed above, ext. 251, or write to them at the above address.

TRANSCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
<u>CAPACITORS</u>				
C001	2200 uF, 25 V	Electrolytic	EG22802510	F2
C002	0.001 uF	Ceramic	DA17102011	E4
C101,C102,C104	6 pF, 50 V	Ceramic	DD11060300	E5,E5,C5
C103,C105	5 pF	Ceramic	DD10050300	C5,B5
C106	3 pF	Ceramic	DD10030300	E5
C107,C111	0.0047 uF	Ceramic	DA17472011	D4,A5
C108,C109	1.5 pF	Ceramic	DD10015300	C5,B5
C110	0.01 uF, 50 V	Ceramic	DK18103030	C5
C112	0.01 uF	Ceramic	DA17103011	A5
C113	10 uF, 25 V	Electrolytic	EA10602590	C4
C116	0.001 uF	Ceramic	DA17102011	A6
C117	4.7 pF	Ceramic	DA16047021	A5
C205	470 pF	Ceramic	DA16471011	A2
C206,C207,C217, C218,C219,C220, C252,C253,C254, C255	0.068 uF	Semiconductor	DS17683010	A2,A2,B1, B1,B1,B1, C1,C1,C1, C2
C208	2.2 pF	Ceramic	DA16022011	A3
C209	0.1 uF, 50 V	Semiconductor	DS17104010	B2
C210,C256	200 pF	Ceramic	DD15201360	B3,D1
C211	82 pF	Ceramic	DD15820330	B3
C212	51 pF	Ceramic	DD15510300	B2
C213	30 pF	Ceramic	DD15300300	A2
C216,C251	47 uF, 10 V	Electrolytic	EA47601090	B1,C1
C221	330 pF	Ceramic	DD15331360	B1
C222,C271,C272, C273,C274	0.01 uF	Semiconductor	DS17103010	C1,D1,C1, E1,E1
C223	220 pF	Ceramic	DA16221011	C2
C224	0.001 uF	Ceramic	DA17102011	C1
C257	10 pF	Ceramic	DD12100040	D2
C258,C266	0.022 uF	Semiconductor	DS17223010	D1,D1
C261	240 pF	Ceramic	DD15241330	D1
C262	220 pF	Ceramic	DD15221320	D1
C263	10 uF, 16 V	Electrolytic	EA10601690	E2
C264,C265	0.0047 uF	Semiconductor	DS17472010	E2,E2
C267	0.22 uF, 35 V	Electrolytic	EV22403560	E1
C301,C306	0.01 uF	Semiconductor	DS17103010	E2,C2
C302	100 pF	Ceramic	DA15101011	D2
C303	0.047 uF	Semiconductor	DS17473010	D2
C304	4.7 uF, 35 V	Electrolytic	EA47503590	C2
C305	10 uF, 16 V	Electrolytic	EA10601690	C3
C307	4.7 uF, 16 V	Electrolytic	EV47501660	C2
C351	0.001 uF	Ceramic	DA17102011	C3
C352	1 uF, 50 V	Electrolytic	EA10505090	C3
C353	10 uF, 16 V	Electrolytic	EA10601690	D3



TRANCEIVER ELECTRICAL

TRANCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
C354	10 uF, 16 V	Electrolytic	EQ10601620	D3
C355	220 uF, 25 V	Electrolytic	EA22702590	D3
C356	100 uF, 10 V	Electrolytic	EA10701090	D3
C357	0.1 uF	Semiconductor	DS17104010	D3
C358	220 uF, 16 V	Electrolytic	EE22701650	E3
C359	4.7 uF, 25 V	Electrolytic	EA47502590	E3
C501,C502,C503, C504,C512,C513, C515,C521,C523, C525,C526,C536, C548	0.01 uF	Ceramic	DA17103011	G5,G5,G5, G4,G4,G4, G3,G2,G2, H1,H2,J2, J2
C505,C514,C522, C531	12 pF	Trimming	CT11050010	G5,G3,G2, H1
C506	2.2 pF	Ceramic	DA16022011	G4
C511	10 pF	Ceramic	DA15100021	G4
C516	10 uF, 16 V	Electrolytic	EA10601690	G3
C524,C542,C543, C545,C552,C553, C555	20 pF	Ceramic	DA15200021	G1,J1,J1, J1,K1,L1, L1
C532,C546	30 pF, 50 V	Ceramic	DA15300021	H1,K1
C533	82 pF, 50 V	Ceramic	DA15820010	H1
C534	47 pF, 50 V	Ceramic	DA15470010	H1
C535	68 pF, 50 V	Ceramic	DA15680010	H1
C537	4.7 uF, 35 V	Electrolytic	EA47503590	J2
C541	15 pF	Trimming	CT11500010	J1
C544	15 pF	Ceramic	DA15150021	J1
C547	470 pF, 50 V	Ceramic	DK16471300	K1
C551	1.5 pF	Ceramic	DD10015020	K1
C554	470 pF	Ceramic	DA16471011	L1
C601,C605,C614	0.01 uF	Ceramic	DA17103011	L2,J2,J2
C602,C611,C613	0.001 uF	Ceramic	DA17102011	K2,I2,H2
C603,C604	470 pF	Ceramic	DA16471011	K2,J2
C606	4.7 uF, 35 V	Electrolytic	EA47503590	I2
CC01	0.04 uF	Ceramic	DK18403020	L4
CG01	20 pF	Ceramic	DD15200300	*
CM01,CM26	470 pF	Ceramic	DA16471010	E6,D6
CM02,CM11,CM12, CM25	10 uF, 16 V	Electrolytic	EA10601690	E6,D6,C5, C5
CM03,CM04	0.033 uF, 50 V	Semiconductor	DS17333010	E6,E6
CM05,CM07	0.022 uF, 50 V	Semiconductor	DS17223010	E6,D6
CM06	4.7 uF, 35 V	Electrolytic	EA47503590	E6
CM08,CM15	4.7 uF, 10 V	Electrolytic	EV47501060	D6,C6
CM09	100 pF	Ceramic	DD15101370	D6
CM12	33 uF, 10 V	Electrolytic	EV33601060	D6
CM13	20 pF	Ceramic	DA15200021	D6
CM21	1 uF, 25 V	Electrolytic	EV10502560	C6
CM22	0.0068 uF, 50 V	Semiconductor	DS17682010	C6

TRANSCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
CM23	0.01 uF, 50 V	Semiconductor	DS17103010	B6
CM24	0.0018 uF	Film	DF16182300	B6
CP01,CP31,CP33	20 pF	Trimming	CT12000090	I4,L6,L6
CP02	15 pF	Ceramic	DA15150021	I4
CP03,CP81	39 pF	Ceramic	DA15390021	I4,H5
CP04,CP06,CP35,CP36,CP37,CP40,CP51,CP54,CP62,CP71,CP73,CP74,CP82,CP84,CP87,CP92,CP94,CP95	0.01 uF	Ceramic	DA17103011	I3,J3,L5,L5,K6,J6,I5,J5,I5,H4,H5,H4,I6,I6,I5,H6,G6,H5
CP05	4.7 uF, 16 V	Electrolytic	EV47501660	J3
CP07,CP11,CP12,CP16,CP22	0.04 uF	Ceramic	DK18403020	J4,L5,J5,J5,L2
CP08	10 uF, 16 V	Electrolytic	EV10601660	J3
CP09	0.1 uF, 35 V	Electrolytic	EV10403560	I3
CP10,CP56,CP86	0.001 uF	Ceramic	DA17102011	J4,K5,G6
CP13,CP14,CP21	10 uF, 16 V	Electrolytic	EA10601690	J5,J3,L2
CP15	0.1 uF	Semiconductor	DS17104010	I3
CP24	47 uF, 16 V	Electrolytic	EA47601690	L3
CP27	33 uF, 16 V	Electrolytic	EG33601610	H3
CP29	100 uF, 16 V	Electrolytic	EG10701620	H3
CP32,CP34	2 pF	Ceramic	DD10020350	L6,L6
CP38	62 pF	Ceramic	DD15620010	K6
CP39	100 pF	Ceramic	DD15101050	K6
CP41	3.9 pF	Ceramic	DA16039030	J6
CP42	2 pF	Ceramic	DD10020300	J6
CP43	4.7 pF, 50 V	Ceramic	DA16047030	J6
CP44	0.01 uF, 50 V	Ceramic	DA18103320	J6
CP52,CP55	20 pF	Ceramic	DA15200021	J5,J5
CP53	0.001 uF, 50 V	Ceramic	DK18102300	I5
CP59	20 pF, 50 V	Ceramic	DD15200300	J5
CP61	0.5 pF	Ceramic	DD10005370	I5
CP72	5.6 pF, 50 V	Ceramic	DA16056030	H5
CP75	4.7 pF	Ceramic	DA16047021	H6
CP76	3.3 pF, 50 V	Ceramic	DA16033021	H5
CP83,CP93	6.8 pF	Ceramic	DA16068031	H6,G6
CP85	1 pF	Ceramic	DD10010300	H6
CP91	10 pF	Ceramic	DA15100021	H6
CS01,CS02,CS03,CS04,CS05,CS06,CS07,CS08,CS09,CS10	2000 pF	Feedthrough	DC18202020	*,*,*,*,*,*,*,*
CV01	10 pF	Ceramic	DD11100360	VCO
CV02	27 pF	Ceramic	DD15270360	VCO
CV03	24 pF	Ceramic	DD15240300	VCO
CV04	6 pF	Ceramic	DD11060300	VCO

TRANSCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
CV05	15 pF	Ceramic	DD15150300	VCO
CV06	8 pF	Ceramic	DD11080300	VCO
CV07, CV08	2 pF	Ceramic	DD10020300	VCO
CV09	0.001 uF	Ceramic	DK18102300	VCO
CV10	47 pF	Ceramic	DD15470300	VCO
<u>INDUCTORS:</u>				
L001	120 uH	Choke Coil	LC12400010	F1
L101	-	Ant. Coil	LA12037010	E5
L102	-	Ant. Coil	LA12037020	D5
L103	-	Ant. Coil	LA12037030	C5
L104	-	Ant. Coil	LA12037040	C5
L105	-	Ant. Coil	LA12037050	B5
L106	21.4 MHz	Doubler Coil	LW10187010	A5
L107	138 MHz	Ant. Coil	LA70260030	A6
L204	21.4 MHz	Doubler Coil	LW10187010	A3
L205	455 kHz	I.F.T.	LI10016260	A1
L206, L254, L255, L256, L257	390 uH	Choke Coil	LC13940010	B1, D1, D1, D1, E1
L251	-	I.F.T.	LI10010460	D2
L252	-	I.F.T.	LI10010450	D1
L253	1 mH	Choke Coil	LC11050040	B2
L501, L502, L503, L504, L506, L508	-	Choke Coil	LC16000010	A5, A5, G4, G4, G2, H1
L505, L515	-	Choke Coil	LC17000010	G2, L1
L507	-	Twist Coil	LM42830010	H1
L509	0.2 uH	Choke Coil	LC12010012	H1
L510, L511	-	Choke Coil	LC12500020	J2, J1
L512	-	Choke Coil	LC12010060	J1
L513	-	Choke Coil	LC11510012	X1
L514	-	Choke Coil	LL26301050	X1
L516	-	Ant. Coil	LF50080040	K1
L521	390 uH	Choke Coil	LC13940010	G3
LG01	-	Choke Coil	LC17000010	*
LP01, LP02, LP03	1 mH	Choke Coil	LC21050010	J4, L5, *
LP05, LP06, LP61	1 mH	Choke Coil	LC11050040	*, *, *
LP31	1.2 uH	Choke Coil	LC11220020	L6
LP32, LP33	1 uH	Choke Coil	LC11020020	L6, K6
LP34, LP38	390 uH	Choke Coil	LC13940010	J6, K5
LP35, LP36, LP71, LP81, LP91	-	Ant. Coil	LA10368010	J6, I6, H5, H6, G6
LP37	10 uH	Choke Coil	LC11030020	J5
LV01	1.2 uH	Choke Coil	LC11220020	VCO
LV02	2.7 uH	Choke Coil	LC12720020	VCO
LV03	4.5 T	Ant. Coil	LA12038020	VCO

## TRANSCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
LV04, LV05	1 uH	Choke Coil	LC11020020	VCO
<u>SEMICONDUCTORS:</u>				
Q001	MB3756	IC	HC10003180	B4
Q002, Q003	IOE-1	Diode	HD20022100	F1, F1
Q101, Q102	2SK125	F.E.T.	HF201252A0	D5, B5
Q103	1N60	Diode	HD10001050	A5
Q201, Q202	2SC460	NPN Transistor	HT304601B0	A2, B3
Q203, Q251	UPC577H	IC	HC10023060	B1, C1
Q204, Q252, Q253	1N60	Diode	HD10001050	C2, E2, E2
Q301	TA7063P	IC	HC10037050	D2
Q302, Q303	1N60	Diode	HD10001050	C2, C2
Q304	2SC945	NPN Transistor	HT309451Q0	C3
Q305	2SA733	PNP Transistor	HT107331R0	B3
Q306, Q307	1S1555	Diode	HD20011050	C3, B4
Q351	HA1366W	IC	HC10031010	D3
Q501, Q502	2SC387A	NPN Transistor	HT30387100	G5, G4
Q503	2SC994	NPN Transistor	HT30994100	G3
Q504	2SC2118	NPN Transistor	HT321180A0	*
Q505	2SC2640	NPN Transistor	HT326400A0	*
Q506	MI402	Diode	HD20003200	K1
Q507, Q508, Q511, Q512	1S1555	Diode	HD20011050	K1, L2, K1, K1
Q601	1N60	Diode	HD10001050	K2
Q602, Q603, Q606	2SC945	NPN Transistor	HT309451Q0	J2, I2, L3
Q604	2SD471	NPN Transistor	HT404711L0	H2
Q605	2SA1105	PNP Transistor	HT11105100	*
Q607	1S1555	Diode	HD20011050	I2
Q608	1S1555	Diode	HD20011050	*
QC01	7484	IC	HC70830000	K2
QC02	7400N	IC	HC10004110	K3
QC03	2SC945	NPN Transistor	HT309451Q0	K3
QG01	-	L.E.D.	HI10002050	*
QG02	-	L.E.D.	HI10001050	*
QG03	-	L.E.D.	HI10004050	*
QG05	-	L.E.D.	HI10005030	*
QM01	2SC900	NPN Transistor	HT309001F0	E6
QM02	BA340	IC	HC10014210	D6
QM03, QM04	1S1555	Diode	HD20011050	C6, C6
QM05, QM06	2SC945	NPN Transistor	HT309451Q0	B5, B6
QP01	MC145106P	IC	HC10011170	J4
QP02	2SA733	PNP Transistor	HT107331R0	J3
QP03, QP08	2SC945	NPN Transistor	HT309451Q0	J2, J2
QP04	2SD313	NPN Transistor	HT403131D0	L2
QP05	BZ058	Zener Diode	HD30058090	L3

TRANSCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
QP06	HD74293	IC	HC72930100	K5
QP07, QP31, QP32	1S155	Diode	HD20011050	H3, K6
QP33	2SC461	NPN Transistor	HT304611B0	K6
QP34, QP35, QP36, QP61	2SC535	NPN Transistor	HT305351B0	K6, J5, K5, I4
QP71, QP81, QP91	2SC387A	NPN Transistor	HT30387100	H4, I6, H6
QP82	1N60	Diode	HD10001050	B6
QV01, QV05	1SV50	Varicap	HD40001060	VCO
QV02	2SK125	F.E.T.	HF201252A0	VCO
QV03	2SC461B	Transistor	HT304611B0	VCO
QV04	1SS53	Diode	HD20010060	VCO
<u>RESISTORS</u>				
GC02	10K ohm, 1/8 W	Composite	BW10103020	K4
GG01, GG02	100 ohm	Composite	BW20101010	*, *
R355	6.8 ohm, 2 W	Film	GJ05068020	E3
R551	100 ohm, 1 W	Film	GJ05101010	L1
R603	2.2K ohm	Trimming	RA02220100	J2
R604	47K ohm	Trimming	RA0S030110	K2
R615, R617	33 ohm, 2 W	Film	GJ05330020	H2, *
RG01	20K ohm	Variable	RK12030070	*
RG02	20K ohm	Variable	RK02030450	*
RG03, RG04	100 ohm, 1/8 W	Fixed Carbon	GC05101180	*, *
RM28	2.2K ohm	Trimming	RA02220100	A6
RP11	120 ohm, 1 W	Fixed Carbon	GJ05121010	L2
RP12	3.3 ohm, 2 W	Film	GJ05033020	L2
Resistors not listed are standard, fixed carbon composition, ±5%, 1/4 watt. The resistance values, in ohms, are indicated on the schematic diagrams.				
<u>MISCELLANEOUS ELECTRICAL</u>				
F201	21.4 MHz	Crystal	XU421400M5	A4
F202, F203	-	Ceramic Filter	FG455304E2	A1, A1
FG01	10 A	Fuse	FS11000010	*
JC01	-	Plug	YP01001130	*
JG01	-	Ant. Jack	YJ10000910	*
JG02	-	Speaker Jack	YT02010080	*
JM01	-	Plug	YP01001040	*
MG01	-	Microphone	MP10000410	*
NG01	8 ohm, 2 1/2 W	Speaker	QK00601062	*
SG01	-	Rotary Switch	SR03500040	*
SG02	-	Push Switch	SP02010400	*
VCO	-	Voltage Controlled Oscillator Module	ZZ47520010	I3
X201	21 855 MHz	Crystal	XA22185504	B2
XP01	12.8 MHz	Crystal	XY41280002	*

TRANCEIVER ELECTRICAL

REFERENCE DESIGNATOR	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
XP31	43.633 MHz	Crystal	XB301003G2	K6
XP32	50.766 MHz	Crystal	XB301004G2	L6
YG01	-	DC Power Cord	YC01500090	*
YG01	-	DC Power Cord	YC01500110	*
YG02	-	DC Power Cord	YP00310040	*

TRANSCEIVER MECHANICAL

REFERENCE DESIGNATOR	DESCRIPTION	SCC PART NO.	EXPLODED PARTS VIEW LOCATION
0001	Shield	4752109102	D1
0002	Shield	4752109110	D1
0003	Shield	4752109120	D3
0006,0007	Screw	51100205E0	D1,D3
0010	Shield	4723109093	D2
0011	Shield	4723109290	D2
0014	Heatsink	4752267022	E3
0015	Shield	4752109130	E3
0016	Screw	51102608E0	E3
0017	Screw	51102610E0	F3
0018	Nut	53112603E0	E2
0019	Washer	54042602N0	E2
0021	Screw	51100306E9	D2
0023	Heatsink	4618267050	E2
0101	Heatsink	4752267040	E5
0102	Screw	51102610E0	F5
0103	Screw	51102606E0	E5
0104	Screw	51100310B9	E5
0105	Nut	53110303B9	F4
0107	Shield	4752109082	F4
0108	Shield	4562109250	F5
0111,0115	Washer	54110149A0	F5,F4
0112	Spacer	4618118040	F5
0113	Screw	51100316E9	F5
0114	Nut	53110303E9	F4
0118	Shield	4752109092	F4
0201	Microphone Hanger	4746155012	*
001B	Case	4752064012	A3
004B	Cover	4752053020	A4
009B,011B	Screw	51280306B0	C3,C4
014B	Cover	4752053010	A3
015B	Net	4752202010	A3
016B	Screw	51282608B0	A3
017B	Clamper	1932005010	C3
018B	Screw	51102610E0	C3
021B	Knob	4618154023	A4
022B	Spring	71400249Q0	A4
031B	Knob	4618154014	A4
032B	Nut	53218069E0	A4
033B	Washer	54012089E0	B4
035B	Case	4752064022	B2
036B	Screw	51060312L9	C2
037B	Washer	54020301E0	C2
038B	Insulator	4752120010	A2
039B	Mask	4752303010	B4

## TRANSCEIVER MECHANICAL

REFERENCE DESIGNATOR	DESCRIPTION	SCC PART NO.	EXPLODED PARTS VIEW LOCATION
040B	Spacer	4752118010	-
901B	Name Plate (Horizon USA)	4752203010	A4
901B	Name Plate (Horizon Canada)	4752203020	A4
902B	Window	4752158013	B4
904B	Escutcheon	4752063010	A4
905B	Knob	4618154033	C5
906B	Bushing	4752259010	C3
907B	Label, FCC (Horizon USA)	4752861010	B4
907B	Label, DOC (Horizon Canada)	4752861040	B4
908B	Label (Horizon USA)	4752861020	B3
908B	Label (Horizon Canada)	4752861030	B3
909B	Label (Horizon USA)	4618861070	B3
910B	Bushing	4618259053	B2
001G	Chassis	4752105010	D4
002G	Chassis	4752105020	C3
005G,006G	Screw	51100306E9	C2,E4
009G	Screw	51280306B0	F2
013G	Heatsink	4752267013	F2
014G	Busing	1455259070	F2
016G,019G	Screw	51100312H9	F3,F2
017G	Nut	53110303E9	F3
018G	Screw		
021G	Screw	74260019G0	F2
022G	Screw	51100306E9	A3
024G	Screw	51100310E9	E3
025G	Washer	54020301E0	F4
031G	Lug	62030049W0	D2
032G	Screw	51280305B0	C2
001Z	Bracket	4752160010	C1
002Z	Bolt	52490515L9	B1



MP345W MICROPHONE

REFERENCE DESIGNATOR	DESCRIPTION	SCC PART NO.
<u>ELECTRICAL:</u>		
N001	Microphone Element	MS10000060
S001	P.T.T. Switch	SS02020680
-	Connector (Plug)	YP01001040
<u>MECHANICAL</u>		
-	Coiled Cord	YB02000190
-	Front Case	011C064050
-	Back Case	011C064060
-	P.T.T. Lever	011C354030
-	Label ("MP345W")	011C265050
-	Label ("Standard")	011C203030
-	Microphone Net	011C202010
-	Hanger Knob	011C155010
-	Screw (Hanger Knob)	51060308A9
-	Washer (Hanger Knob)	54050300R0
-	Screw (Case)	51380318R0
-	Hanger	4746155010
-	Screw (Hanger)	51400312R0
-	Screw (Hanger)	51400330R0



TELEX COMMUNICATIONS, INC  
9600 ALDRICH AVE SO MINNEAPOLIS MN 55420 U S A

**INSTRUCTION  
MANUAL**

**ORDER NO. 969**

**8' VHF Marine Antenna**

PN 801754

**General  
Description**

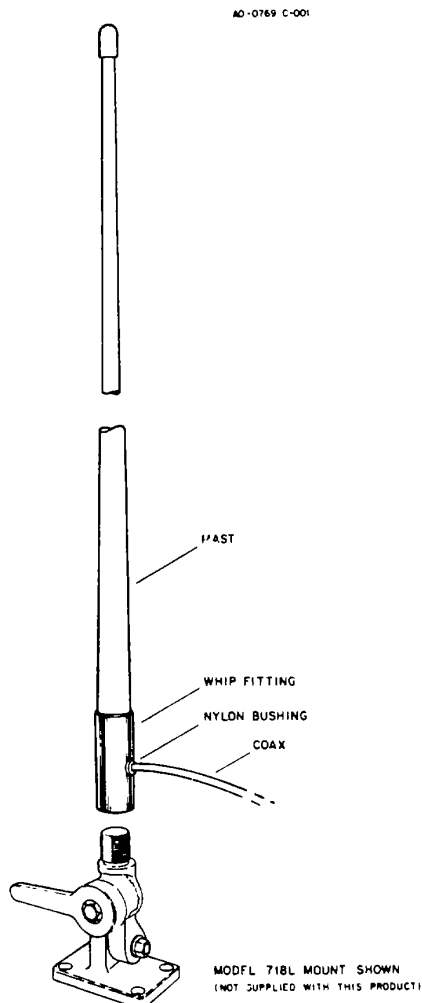
This antenna is designed for use in the entire VHF marine band (156.2 to 157.8 MHz)

The antenna is a 50-ohm match to any VHF transceiver without field tuning

Complete with 18 feet of coaxial cable and RF connector

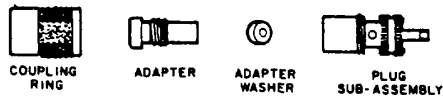
**Mounting**

The antenna may be mounted on any 1"-14 mount. Either the Hy-Gain Model 718L Ratchet Mount or the Model 7014 Lift-and-Lay Mount are recommended. Be sure the antenna is positioned as far away from metallic objects as possible, such as masts and slays.

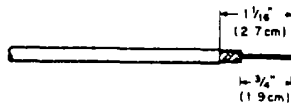


### Installing PL-259 Connector

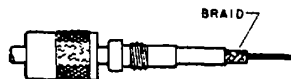
MA-0000-C-040



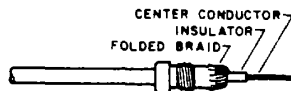
- 1 Cut the end of the coax cable off square
- 2 Carefully remove 1 1/16" (2.7 cm) of the vinyl jacket from the end of the cable with a sharp knife, not a razor blade. Do not nick the braid.



- 3 Remove 3/4" (1.9 cm) of both the braid and center conductor insulation from the end of the coax. Do not nick center conductor.



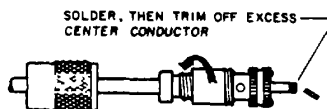
- 4 Slide the coupling ring and then the adaptor onto the coax, well up out of your way.



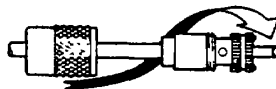
- 5 Position the adaptor flush with the end of the coax.
- 6 Fold the braid back over the adaptor and press it down over the body of the adaptor.



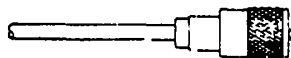
- 7 Slip the adaptor washer over the center conductor and its insulation so the washer butts against the braid.

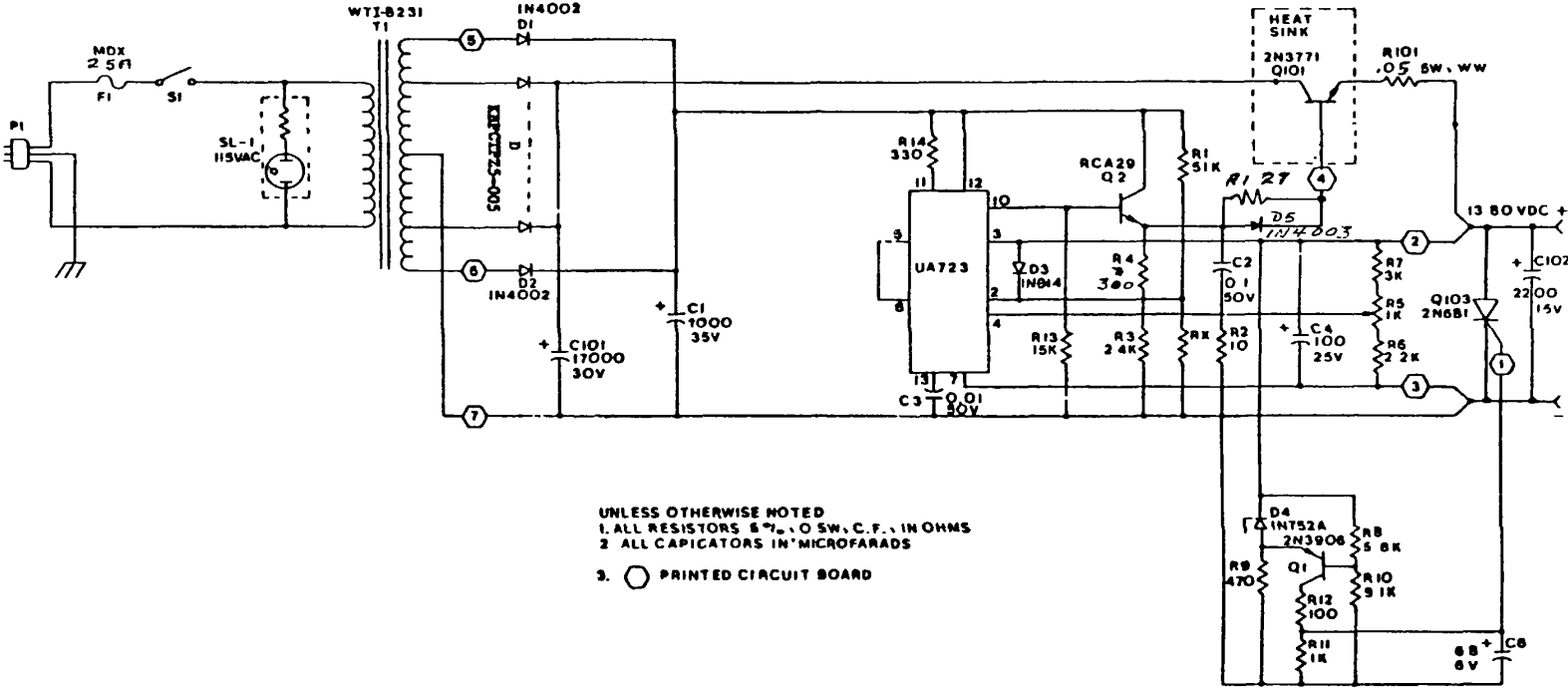


- 8 Screw the plug subassembly fully on the adaptor (you may need to use pliers).



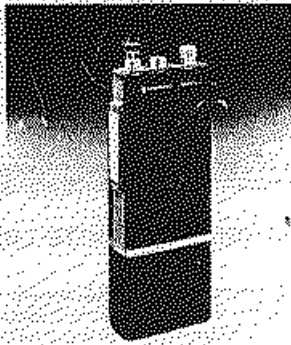
- 9 Push the coupling ring over the plug subassembly and screw into position.





UNLESS OTHERWISE NOTED  
 1. ALL RESISTORS 1/4, 1/2, 1, 2, 5, 10 SW. C. F. IN OHMS  
 2. ALL CAPACITORS IN MICROFARADS  
 3. ○ PRINTED CIRCUIT BOARD

<b>ASTRON CORPORATION</b> TUSTIN, CA	
Drawn: <i>[Signature]</i> Date: 9-1-61	Checked by: EMG Date:
<b>ELECTRICAL SCHEMATIC</b>	
<b>NPC LR10</b>	



# HX500S

VHF/FM Marine  
Handheld  
Transceiver

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## Owner's Operating Manual

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**CONTAINS:**

- General Information
- Specifications
- FCC Information
- Operation
- Maintenance and Care
- Schematic Diagram

**Standard  
Communications**

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3/83

HX500S0100



**MARINE PRODUCTS LIMITED WARRANTY**

Standard Communications Corp (SCC) warrants to the original consumer purchaser (the Purchaser ) only that each new Marine Product will be free from defects in materials and workmanship under conditions of normal use and service for a period of one (1) year from the date of delivery to the Purchaser. SCC's liability under this warranty shall be limited to repair or replacement of the defective product at SCC's option, and under no circumstances shall SCC be liable for consequential, incidental or other damages arising out of or in any way connected with a failure of the product to perform as set forth herein.

THIS LIMITED WARRANTY EXTENDS ONLY TO THE PURCHASER AND IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

In the event of a defect, malfunction, or failure of the product to conform to specifications during the one-year warranty period, SCC will repair or replace, at its option and without charge to the Purchaser, the product which upon examination by SCC shall appear to be defective or not up to factory specifications. SCC will pay all labor charges incurred in providing such warranty service. To obtain warranty service, the defective product must be returned to SCC together with proof of the date of purchase. The Purchaser must pay any transportation expenses in returning the product to SCC. SCC will examine the product and respond to the Purchaser in approximately four (4) weeks from the date of receipt of the product claimed to be defective.

This limited warranty does not extend to any product which has been subjected to misuse, neglect, accident, improper installation, or subject to use in violation of the maintenance or operating instructions, if any, furnished by SCC, nor does this warranty extend to products on which the serial number has been removed, defaced, or changed. SCC reserves the right to make changes or improvements to its products during subsequent production without incurring the obligation to install such changes or improvements on previously manufactured or sold products.

Some states do not allow limitations on the duration of the warranty or exclusions or limitations of incidental or consequential damages, so these limitations or exclusions may not apply to you. This warranty gives you specified legal rights which vary from state to state.

(A)

**CUSTOMER RECORD**

Purchase Date \_\_\_\_\_

Purchased From \_\_\_\_\_

Equipment Model No \_\_\_\_\_

Equipment Serial No \_\_\_\_\_

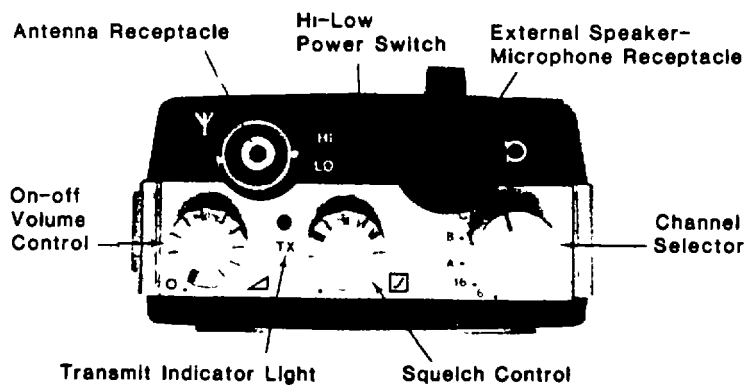
**GENERAL INFORMATION**

The Standard Communications Corp. (SCC) model HX500S is an all solid-state, VHF-FM handheld transceiver designed for use in the frequency range of 156.025 to 157.425 MHz. It requires 7.5 VDC input power for operation, supplied internally by a battery pack, and develops a switchable RF power output of 5 watts or 1 watt. Designed for up to six channel operation (crystal controlled), the HX500S is brown in color, measures 6 3/4 H by 2 1/2 W by 1 1/2 D in., and weighs 1 1/4 lb.

The HX500S features include an on-off/volume control, squelch control, channel selector, high-low power switch, push-to-talk switch, and a transmit indicator light which will inform the user as to when the battery is low. It comes already programmed for channels 6 (Intership Safety) and 16 (Distress, Safety, and Calling), and offers four more channels which may be programmed to any frequency of the user's choice, within the general frequency range of the transceiver.

Other features include an antenna receptacle and an external speaker-microphone. Battery-charge contacts are located at the bottom of the unit to allow for recharging of the battery whether it is still attached to the unit or it is separate. A battery-lock button provides for easy removal of the battery pack.

The purpose of the Owner's Operating Manual is to familiarize you with the controls and connections, operation, and any licensing requirements that you should know and fulfill prior to the operation of your new transceiver. We strongly recommend that you read this manual carefully before using your transceiver.



**FIGURE 1. HX500S CONTROLS AND CONNECTIONS (TOP)**

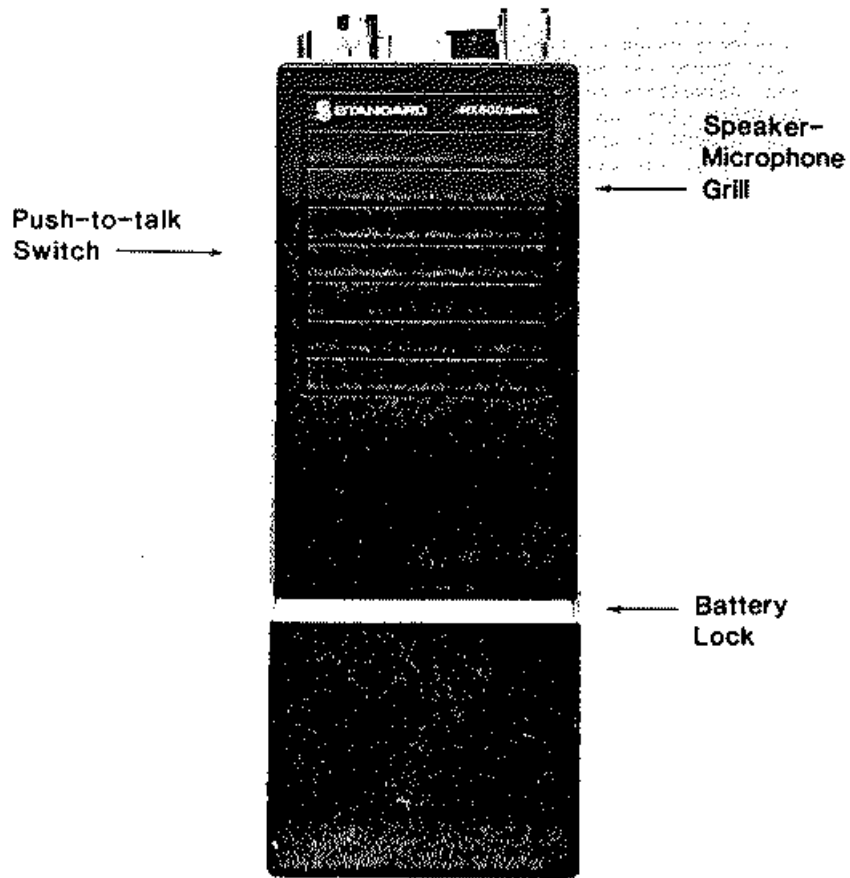


FIGURE 2. HX500S CONTROLS AND CONNECTIONS (FRONT)



**FCC INFORMATION**

The HX500S has been designed to comply with the Federal Communications Commission (FCC) requirements necessary for operation in the Maritime Radio Service. The user must be cognizant of and comply with all parts of the FCC rules and regulations which apply to the service used. You are also required to have a copy of Part 8e on board your ship at all times. This may be obtained by writing to:

SUPERINTENDENT OF DOCUMENTS  
Government Printing Office  
Washington, D. C. 20402

A valid station license and a call sign are required before operation of the transceivers permissible, obtained by submitting a properly and fully completed application to the FCC. It is the user's responsibility to apply for and obtain a radio license from the FCC.

NOTE. A form for ordering a copy of Part 83 is attached to the Application for Ship Radiotelephone License (FCC Form 506).

The radiotelephone transmitter in a ship station may be operated only by a licensed radio operator. The licensed operator may permit others to speak into the microphone if he starts, supervises, and ends the operation, makes the necessary log entries, and gives the necessary identification. The license usually held by the radio operators aboard small vessels that are not required to carry a radio installation for safety purposes is the Radiotelephone Operator Permit. This is a lifetime permit, obtained by submitting a properly and fully completed FCC Form 753 to the FCC. No oral or written exam is required. (It is the responsibility of Canadian residents to comply with all licensing requirements of the DOC, the governing body for communications equipment in Canada.)

You should remember that as a licensee of a ship radio station, you are responsible at all times for the lawful and proper operation of the station. Ship stations are licensed primarily for safety of life and property, therefore, distress and safety communications must have absolute priority. Certain frequencies, however, which are not reserved for calling, distress or other safety purposes, may be used for radio telephone calls to coast stations or between ships.

The SCC Dealer from whom you purchased your transceiver will assist you in all licensing procedures. In addition, the following information for the HX500S will be helpful in filling out your application.

Type Accepted- Yes (FCC Part 83)  
Output Power- 5 or 1 watts  
Emission- 16F3  
Frequency Range- 156.025 to 157.425 MHz  
FCC Type Number- APV9T20482

### OPERATION

1. Turn the On-Off Volume Control clockwise until the desired volume is attained.
2. Set the Channel Selector to the desired position.
3. Adjust the Squelch Control to its position of highest sensitivity. To achieve this, turn the Squelch Control clockwise, just until the background noise disappears. This is the proper squelch setting and the control should not be rotated beyond this point, or receiver sensitivity will be degraded.
4. When a message is received, adjust the volume to the desired listening level.
5. Before transmitting, monitor the channel that you intend to use to ensure that it is not busy, in accordance with FCC regulations.
6. Set the High-Low Power Switch to the desired setting.
7. To transmit, depress the Push-to-Talk switch, located at the side of the transceiver, and hold it in while you give your message. Speak slowly and distinctly into the speaker grill. (The actual microphone is located in the lower-left corner of the speaker grill. Speak into this portion of the grill for best results.)

NOTE: If you use an external speaker-microphone, its push-to-talk switch will activate the transmitter.

The Transmit Indicator Light will show the user that his message is being transmitted.

8. When you have finished transmitting your message, release the Push-to-Talk Switch so that incoming messages can be received. (Your transceiver can not receive a call while you are transmitting, therefore, you should wait until an incoming message is completed before transmitting a call.)

## HANDHELD POWER SOURCE

### GENERAL

The HX500S is equipped with a CNB4 battery pack, which is the recommended power source for the handheld transceiver. The CNB4 consists of nine individual nickel-cadmium batteries, encased in the lower case of the transceiver. It supplies the 7.5 volts direct current required for proper operation. To remove the CNB4 from the handheld, there is a button on the right side. This button will unlock the battery. Turn the bottom portion of the handheld to remove it from the upper portion. To replace it, simply attach the lower portion properly, and turn it until it locks into place.

### BATTERY CHARGING

The operational characteristics of the nickel-cadmium (ni-cad) batteries under load are different than those of conventional alkaline or lead-acid batteries. A ni-cad battery will maintain its operational voltage output level until it is near complete discharge, when the voltage level will drop abruptly. For this reason, it is difficult to determine its state of charge.

The CNB4 battery pack incorporates charging contacts at the bottom. Designed for use with the CSA50 Drop-in Charger, the battery pack may be charged when it is connected to or separate from the transceiver.

The CSA50 will slow charge the CNB4 in approximately six (6) hours. To operate the charger, plug it into the specified power source, then insert the battery pack into the charger. The contacts of the charger must connect to those of the battery pack, so be sure to insert the battery pack correctly. A red light on the charger will illuminate to indicate that the contacts are connecting and the battery pack is being charged.

NOTE: The CSA50 Drop-in Charger features a switch at the back for selecting the desired charging voltage of 120 or 240 VAC.

## MAINTENANCE AND CARE

Your SCC transceiver requires practically no routine maintenance. Proper care and good judgment in using your transceiver will ensure that its life will be long and useful. The following guidelines will assist you in maintaining your transceiver in peak performance.

1. Avoid operating your transceiver on supply voltages of less than 6 VDC or more than 9 VDC. High supply voltage is a common cause for transceiver failure.
2. Do not energize the transmitter when the antenna is disconnected, or if any visible defects are noted in the antenna.
3. Have an FCC-licensed technician check the transceiver and its operating antenna. This is in accordance with FCC rules and regulations.
4. Should your transceiver require repair or additional Maintenance, take it to the SCC Dealer from whom you purchased it.

## SPECIFICATIONS

Performance specifications are nominal, unless otherwise indicated, and are subject to change without notice.

## GENERAL

Frequency Range . . . . . Transmit, 156.025 to 157.425 MHz  
 Receive, 156.050 to 157.425 MHz  
 Number of Channels . . . . . 6  
 Input Voltage . . . . . 7.5 VDC ( $\pm 15\%$ )  
 Current Drain (Standby) . . . . . 18 mA max  
 (Receive) . . . . . 0.28 A  
 (Transmit) . . . . . 2.3 A (High); 1.2 A (Low)  
 Channel Spacing . . . . . 25 kHz  
 Battery Life (Transmit, Receive, and Standby in percentage)  
 CNB4 . . . . . 5-5-90%: 3.1 hr (High), 5.7 hr (Low)  
 10-10-80% 1.6 hr (High); 2.9 hr (Low)  
 CNB5 . . . . . 5-5-90%: 5.6 hr (High); 8.4 hr (Low)  
 10-10-80%: 2.9 hr (High); 4.6 hr (Low)  
 Dimensions . . . . . 6 3/4 H by 2 1/2 W by 1 1/2 D in.  
 171 H by 65 W by 34 D mm  
 Weight . . . . . 1 1/4 lb  
 Compliance . . . . . FCC Part 83; DOC 182  
 FCC Type Acceptance Number . . . . . APV9T20482

TRANSMITTER (Measurements made in accordance with EIA Standard  
 RS-316-B)

RF Power Output . . . . . 5.0 W (High); 1.0 W (Low)  
 Spurious and Harmonic Emissions . . . . . 70 dB  
 FM Hum and Noise . . . . . 50 dB min  
 Modulation . . . . . 16F3  
 Audio Distortion . . . . . 3%  
 Frequency Stability ( $-30^{\circ}$  to  $+60^{\circ}$  C). . . . .  $\pm 0.001\%$  max  
 Channel Spread . . . . . 2 MHz max

RECEIVER (Measurements made in accordance with EIA Standard  
 RS-316-B)

Sensitivity (12 dB SINAD) . . . . . 0.32  $\mu$ V  
 (20 dB Quieting) . . . . . 0.4  $\mu$ V  
 Squelch Sensitivity (Threshold) . . . . . 0.25  $\mu$ V max  
 Modulation Acceptance Bandwidth . . . . . 7.0 kHz min  
 Selectivity . . . . . 70 dB min  
 Spurious and Image Rejection . . . . . 70 dB min  
 Intermodulation Rejection . . . . . 70 dB  
 Audio Power Output at 10% Distortion . . . . . 0.6 W  
 Frequency Stability ( $-30^{\circ}$  to  $+60^{\circ}$  C). . . . .  $\pm 0.001\%$  max  
 Channel Spread . . . . . 2 MHz max

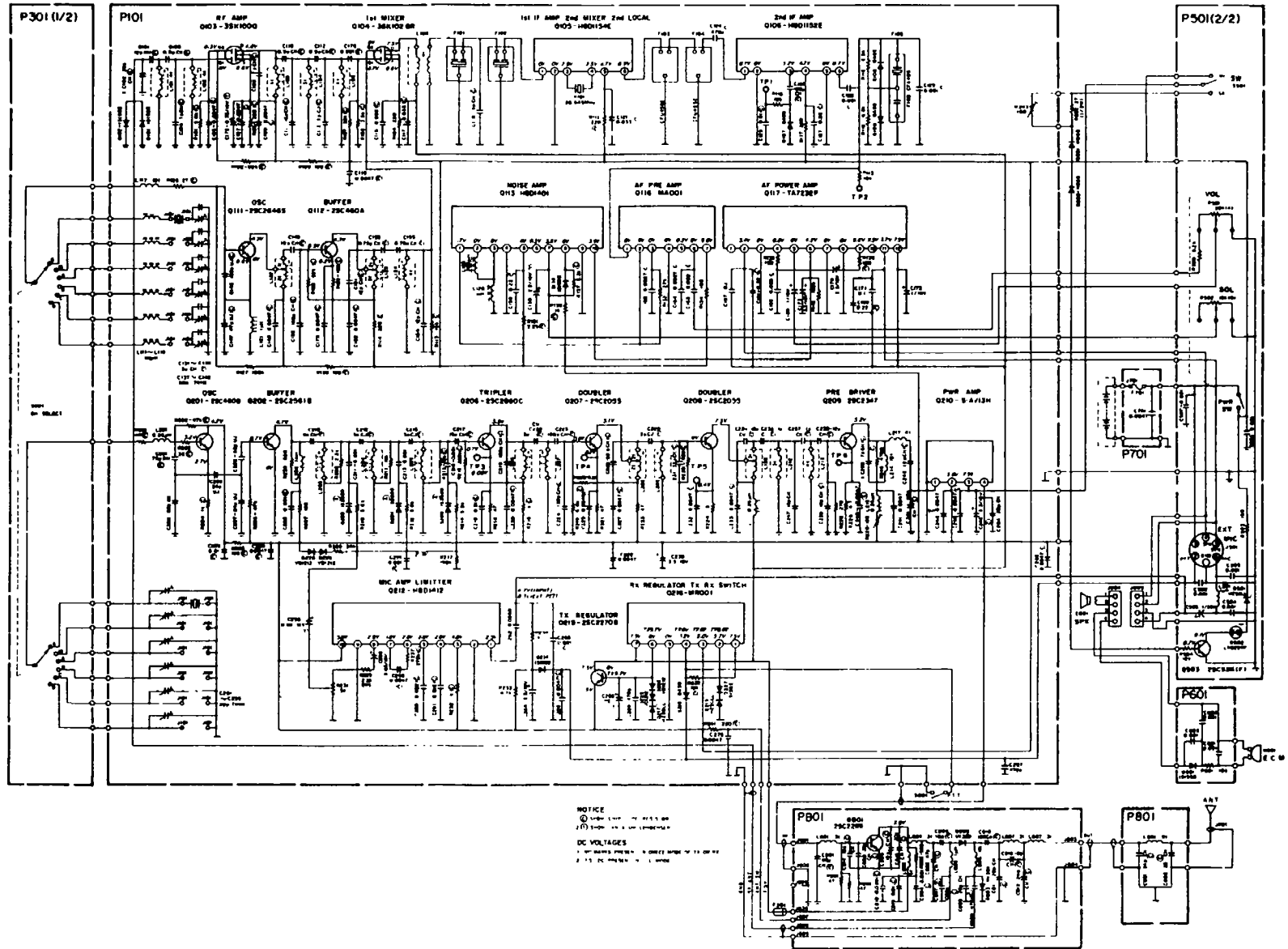


FIGURE 3. HX500S SCHEMATIC DIAGRAM

# Standard Communications Corp.

## Instructions

### CSB50AM Master Gang Charger

#### DESCRIPTION

The CSB50AM master gang battery charger recharges up to 6 CNB4 and/or CNB5 battery packs simultaneously. These are the battery packs used in the HX500 series transceivers. The CSB50AM charges the battery packs at a 90 mA rate.

The CSB50AM has switchable 120, 220, or 240 VAC input power requirements at 50/60 Hz. A European adapter plug is provided. Four mounting screws are provided for wall-mounting the unit. Two leg stands are provided to support the unit on a flat surface.

#### SPECIFICATIONS

Output Voltage .....	7.5 VDC
Operating Temperature Range.....	-4°F to 122°F (-20°C to +50°C)
Color .....	Brown
Dimensions.....	9 3/8-W x 4 3/4 -D x 16 1/4 -H in. (238-W x 120-D x 405-H mm)
Weight.....	10 1/2 lb. (4.8 kg)

#### INSTALLATION

To secure the CSB50AM in an operational position:

- use the four screws to hang the unit on the wall or to secure it to the wall, or
- unscrew the three screws on both side bottoms, align the leg stands with these holes, and reinstall the screws.

#### OPERATION

1. Connect the CSB50AM to a 120, 220, or 240 VAC power source. Ensure that the CSB50AM VAC switch located on the underside of the unit is set to the VAC of the power source.
2. Flip the power switch to ON. The green POWER LED will illuminate.

3. The battery packs may be inserted into the CSB50AM in one of two ways:

- Detach the battery pack from it's transceiver and insert it into one of the CSB50AM battery wells.
- Leave the battery pack attached to its transceiver. Insert the transceiver into the battery well. Do not operate the transceiver while the battery pack is charging.

After the CNB4/CNB5 has been inserted into a battery well, the red LED adjacent to its battery well will illuminate to show that sufficient charge-to-battery contact has been made.

4. Remove the battery pack when fully charged. The CNB4 battery packs are fully charged after 6 hours; the CNB5, after 14 hours.

**Caution:** Remove the battery packs promptly when fully charged to prevent damage from overheating.

**PARTS LIST**

**General**

Parts orders should be referred to the Parts Department at (213) 532-5300 ext. 248, or write:

Standard Communications Corp.  
 Parts Department  
 P.O. Box 92151  
 Los Angeles, CA 90009-2151

Please note that SCC may not be able to fill replacement orders without such identifying information as:

- reference designator
- description
- part number
- unit model number

**Replacement Parts**

Reference Designator	Description	SCC Part Number
F201 .....	Fuse, 3 A.....	FS20300700
J001.....	Cord, Connective.....	YB00120040
J005.....	Jack .....	YJ04000240
S001 .....	Switch .....	SC01020320
S002 .....	Switch, Selector, AC Voltage.....	BY05110010
T101 .....	Transformer.....	TS16704010
Q001, Q002, Q003, Q004, Q005, Q006.....	LED, Red.....	H110006300
Q007.....	LED, Green .....	H110007300
Y001 .....	Cord, Power .....	YC02000240



**FA232/FA390A 1/2 MILE SOUND SIGNAL SYSTEM**

Safety Notice

Sound Levels:

This equipment produces sound levels near the emitters which may be dangerous to hearing. Use proper ear protection when servicing this equipment.

Electronic Devices:

This equipment uses semiconductor devices. Understand semiconductor device operation and testing procedures before attempting to service this equipment.

Battery Powered Equipment:

This equipment is normally powered by batteries either primary (non-rechargeable) or secondary (rechargeable). Always wear safety glasses or goggles when working around batteries and equipment which may arc with intense flashes. In case of contact with the electrolyte of either type battery, flush with large quantities of water immediately. For eye contact flush with fresh water for at least 15 minutes and then obtain medical attention as soon as possible.

High Voltage:

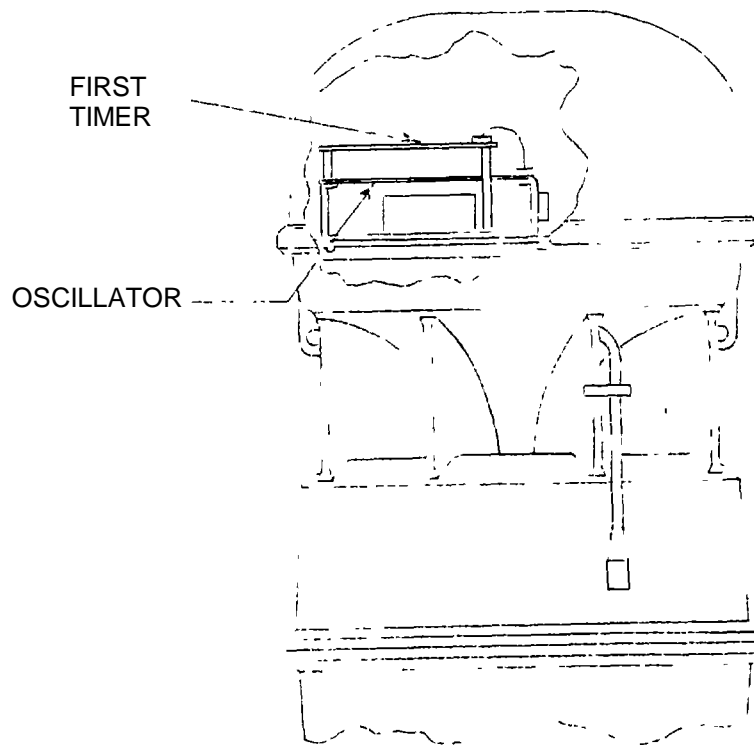
This equipment operates from a 12 V DC supply and produces an AC voltage of less than 50 VAC. However, the equipment may be connected to an AC rectifier system in which case dangerous potentials may be present in associated equipment.

1.0 Description

The Automatic Power, Inc. FA232/FA390A produces an omnidirectional sound signal to meet the provisions of 33 CFR 67 for a one half mile sound signal.

The frequency of  $390 \pm 3$  HZ is determined by a highly reliable feedback oscillator mounted inside the dome cover of the signal, and coupled to the emitter driver.

A solid state program timer forms an integral part of the oscillator module. The timer PCB module mounts above and connects directly to the oscillator. See drawing below.



Form No. 6310 0238

**PENWALT**  
**AUTOMATIC POWER**

*Manufacturers and Designers  
of*

**SIGNAL AND POWER SYSTEMS**  
**—**  
**NAVIGATIONAL AIDS**

**FAA-390 HORN**

*P. O. BOX 18738, HOUSTON, TEXAS  
77223 • (713) 228-5208*

1.1. Theory of Operation:

1.1.1 Oscillator-Regulator

The oscillator and series regulator for the FA 390A are one assembly (See drawing M-2259-C). The regulator consists of Q1, Q2, Q3, Q4, and Q5, and associated components. The oscillator consists of Q6, Q7, Q8 and associated components.

1.1.2 Series Regulator

The series regulator is keyed on by placing a negative going signal from the timer on terminal 5 through a 470Ω resistor R2. This negative signal biases Q1 to a full-on condition. When Q1 turns on it biases Q5 on, and applies a short pulse to the base of Q4 through C2, a 10 MFD capacitor. With Q5 biased on and Q4 pulsed on, Q3 is biased on. Q3 is connected to Q2, a high power transistor mounted on one end of the mounting bracket in a Darlington configuration. When the Q3-Q2 circuit is driven on it causes Q2 to pass current through its collector to the oscillator circuit. Capacitor C2 charges rapidly to full potential as supplied by Q1, therefore Q4 must obtain base drive through R10 and divider network R17, R18, and R19. Voltage regulation is obtained by proper adjustment of adjustable component R18.

At the end of the on signal, Q1 is turned off which turns Q5 off, which removes drive from the remainder of the circuit, thus turning the regulator off.

The regulator is adjusted to give 8 V DC output when 12 V DC is applied to the input. This will maintain a constant 17.8 watts output from the oscillator with a DC voltage range of 10-14 V DC.

### 1.1.3 Oscillator-Driver

With the application of power to the oscillator-stage of the power supply (which occurs when the timer-stage codes the regulator "on") the oscillator and fog signal driver (coil and diaphragm mounted in magnetic field) oscillate as a system at a natural frequency of approximately 390 HZ.

The chamber in which the diaphragm moves is designed to operate as one half of an acoustic transformer. The connecting plumbing and the horn can be considered the other half. The chamber allows the diaphragm to move a small volume of air at high pressure, and the plumbing and horn transform this into a large volume at low pressure. The chamber thus allows the small diaphragm to operate at maximum efficiency.

As the sound enters the main throat of the horn, it divides into two equal parts which are radiated at the top and bottom of the horn. Along a plane passing through the center of the horn, perpendicular to the vertical axis, the sound waves will add. This plane represents the maximum sound level available from the horn. As the angle of radiation increases or decreases with respect to this plane, the sound waves tend to subtract. This characteristic of the horn results in a horizontal "pancake" of sound with consequent suppression of vertical radiation.

**Form No. 6310 0238**

**v**

### 1.1.3 Continued

The oscillator (inverter) is shown schematically on drawing M-2194-C. The nominal 12 V DC input is connected to + (1) and -(4), and the driver leads to "D" (6) and "D" (7). Note driver leads receive AC, no polarity (unless signals are stacked and phasing must be retained).

The inverter circuit terminal 2 is connected to terminal 1 on the timer board and is the positive supply for the timer board. Terminal 3 is connected to terminal 2 on timer board and is the negative supply for this board. Terminal 5 is connected to terminal 4 on the timer board and is the coding terminal for the oscillator. (see drawing S-4368-C)

The regulator is turned on when it sees a negative on terminal 5. The oscillator may be keyed on continuously for testing by connecting a 1000 ohm resistor from terminal 5 to negative A schematic of the FA 390A Oscillator is shown in Drawing M-2194-C.

Assume that when the regulator is turned on Q7 conducts first. The following sequence of events will occur, Current will flow through the upper half of the winding of  $T_2$ . By transformer action, Q8 will be cut off (open switch) due to lowered net voltage on the collector, and reverse bias being developed on the base. Shortly after current has started to flow Q7 will be driven into saturation (closed switch) placing most of the battery voltage across the upper winding of  $T_2$ . The current through this winding will now be

**1.1.3 Continued**

controlled by its inductance. As a result of this, the current through the winding rises linearly with time, producing a constant, or flat-topped output voltage until core saturation takes place. At this time, the current tries to increase to large values in an attempt to keep the rate of change of flux and hence the output constant.

The current through Q7; however, is limited by the base drive provided by T1, which in turn depends upon the output voltage. When the current and the resulting flux can no longer increase, the induced voltages drop to zero and Q7 is cut off (open switch). Cessation of current in the upper half of the winding of T2 allows the flux to decrease toward its remanance value, inducing voltages of the opposite polarity in all windings. This action holds Q7 off (open switch) and turns Q8 on (closed switch). The battery is now connected across the lower half of the winding on T2, and the flux builds up linearly to saturation in the opposite direction. The core thus oscillates between positive and negative saturation at a frequency depending upon core area, number of turns on T2, and battery voltage. In the FA 390A Oscillator these factors have been selected to produce a nominal free-running frequency of 200 HZ. The oscillator will run at this frequency when unloaded, or terminated with a resistor.

**Form No. 6310 0238**

**1.1.3 Continued**

The transformer T1 and resistor R12 is selected at manufacture to provide this frequency. When the driver unit and horn are connected the following changes take place in the above sequence of events:

At the instant Q7 starts to conduct, the coil on the driver starts to move. Since the natural period of the mechanical suspension is 390 HZ, the coil reaches its maximum position and starts to reverse its motion when approximately half of the free-running Q7 "on" time has expired. As soon as the coil stops moving, it represents a virtual dead short on T2, causing the output voltage to suddenly drop to zero. This sudden change when amplified by Q6 causes Q7 to turn off and consequently Q8 to turn on prematurely. The net result is a sudden change in the frequency of the oscillator. The frequency is now controlled by the motion of the driver-coil. The remaining components are to remove voltage transients caused by the sudden changes in current in T2, and to provide the necessary bias current and driving circuits for Q6, Q7, and Q8. The net result of the previously described sequence of events is to cause the coil and hence the diaphragm on the driver unit to oscillate at its natural period. The oscillator has changed the battery current (D.C.) to alternating current (A.C.) and at the same time has approximately doubled the voltage. Due to this doubling action, when 10 volt D.C. is supplied to the oscillator, the alternating current output will be approximately 20 volts from

**Form No. 6310 0238**

**viii**



1.1.3 transistor Q7 collector to Q8 collector. The transformer T2 is an auto transformer with a ratio of 1.42:1, therefore its output voltage will be about 28 V AC.

#### 1.1.4 Program Timer

See drawing M-1331-C, Diode D1 and transistor Q1 provide a regulated input to the timing circuit. The timing circuit consists of a basic unijunction "clock" circuit (R3, R5, C2 and Q2), "clock" pulse amplification (Q3 and Q8), digital counting circuits (IC1, IC3), and logic readout (IC2), and final signal amplification to output. Note remote control point at terminal "3". Closing a contact between this point and negative will hold the signal "off". Terminal 5, on the timer board is used only for initial timing, or for subsequent timing checks with an electronic counter by "reading" across this terminal and negative.

## 2.0 Installation

The fog horn must be mounted base down as shown in the dimension drawing S-4369-C. Power is obtained from a nominal 12 volt direct current source such as a battery, the capacity of which should be adequate to deliver the 2 amperes average blast current for the desired service period. Normal battery voltage is 12 volts.

The fog horn is furnished with a 2 wire power supply cable. As directed on the decal on the side of the fog horn, the black lead should be connected to the positive (plus) side of the battery and the white lead to the negative (minus) side.

### 3.0 Operation

No manual operation of the horn is required. The horn will sound automatically on characteristic when voltage is applied. To turn OFF, remove voltage, or use remote control by connecting a relay as shown on drawing M-1331-C and described in note 1 thereon.

### 4.0 Maintenance

#### 4.1 General

In many cases, it will be found that the location of the fog horn is such that any component requiring service is best removed and serviced in a shop.

Removal of Dome. (see Drawing S-4368-C)

Loosen the nut on the clamp ring. If the nut is completely disengaged, be careful not to lose it. Unhook the clamp and slide it down. The dome may then be lifted off.

#### 4.1.1 Driver Unit (See Drawing S-2124-C)

The driver unit contains a powerful permanent magnet which is capable of attracting dirt and ferrous particles to its surface. Care must be exercised at all times to keep particles away from driver unit, especially when the unit is removed from the horn. To remove the driver unit, remove the dome, then disconnect the two leads and remove the 4 screws 8045 0545. The driver may then be lifted out. Drawing S-2124-C shows the driver unit inverted for servicing on a flat surface.

There is no reason for disassembling the permanent magnet and its related parts. If the magnetic structure is disassembled, it

4.1.1 Continued

will immediately lose much of its magnetic strength and factory instructions for remagnetizing will be required.

For this reason, no part numbers are shown for parts which should not be disassembled.

Should it be necessary to replace the diaphragm and coil unit, 9055 0010, proceed as follows:

1. Remove the driver unit from the horn as described above.
2. Remove 4 bolts 8050 0063, 4 lockwashers 8065 0502, 4 bolts 8050 0066, and 4 lockwashers 8065 0502.
3. Lift off mounting plate 8088 0008.
4. Lift off diaphragm support 8088 0009 with attached diaphragm and coil unit.
5. Remove screw holding springs 8089 0001 to diaphragm and coil unit. Remove old diaphragm and coil unit and position new one.
6. Place slotted ends of springs between clip and insulating strip on new diaphragm and coil unit 9055 0010.
7. Tighten screws and secure with glyptol lacquer or equivalent.
8. Support the diaphragm support 8088 0009 above working surface and center the diaphragm in the recess provided.
9. Replace the 4 bolts 8050 0063 and 4 lockwashers 8065 0502.
10. CAREFULLY position the assembly in the magnet unit.
11. Install the 4 bolts 8050 0066 and 4 lockwashers 8065 0502 but do not tighten.
12. Center the coil in the magnet unit. Tighten the bolts 8050 0066.

**Form No. 6310 0238**

13. Check the centering of the coil unit. Adjust if necessary by repeating Step 12.
14. Run the driver unit to check for rubbing between the coil and magnet units. A clear tone indicates absence of interference.
15. Install the driver unit in the fog horn.

#### 4.2 Trouble Shooting

##### 4.2.1 Horn does not blow.

1. Check battery voltage.
2. Check voltage and polarity at terminals one C+) and four (-) on oscillator 9010-0144.
3. Check for negative coded voltage on terminals 2 (+) and 5 (-) This voltage should correspond to characteristic. If no voltage appears, program timer is inoperative.
4. Measure AC voltage between oscillator terminals 6 and 7, During "on" period of program timer, this voltage should be approximately double the value of the battery voltage bu AC rather than DC.
5. If no voltage is obtained between 6 and 7, check the fuse in the oscillator. If the fuse is blown, replace it with a AGC-5 Buss or equivalent (API Part. No. 4035 0022). If the new fuse blows, it is probable that a transistor Q7 or Q8 is defective. Replace the oscillator or install a new matched pair of 2N3612 transistors . When transistors are replaced, be sure that a light coating of silicone grease is applied to the insulating washers.
6. If the fuse is not blown, disconnect a lead from either terminal 6 or 7 and recheck the AC voltage between 6 and 7. If this

voltage is obtained, the driver unit 9055 0005 must be repaired or replaced.

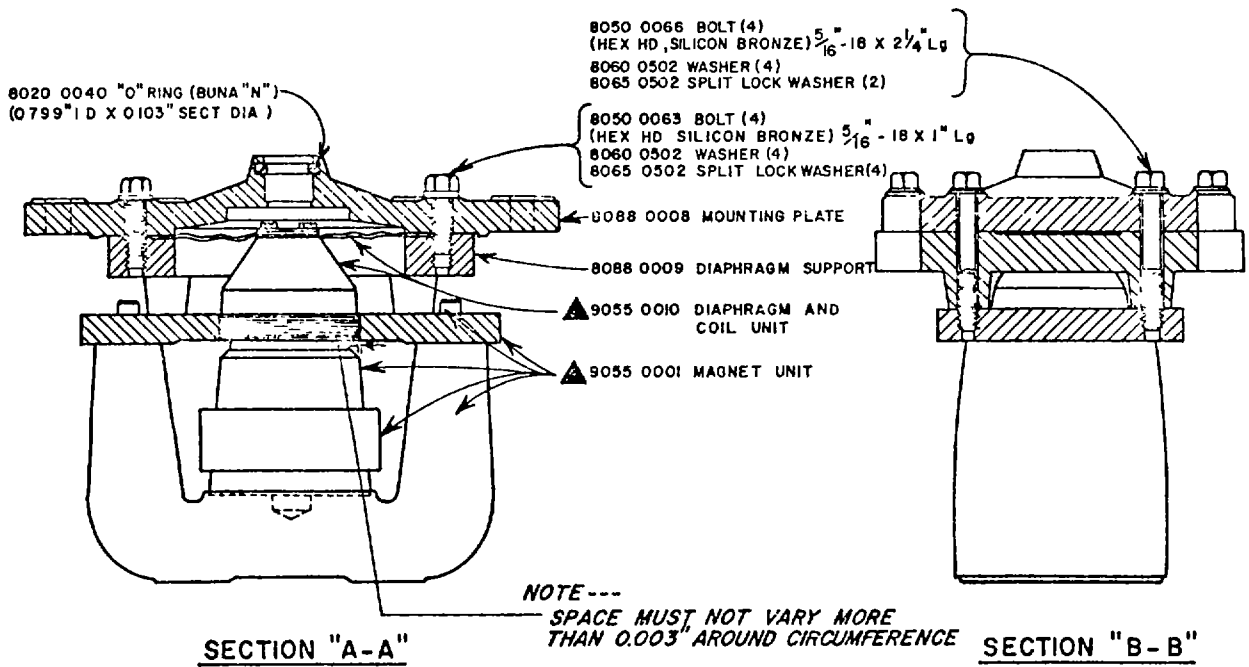
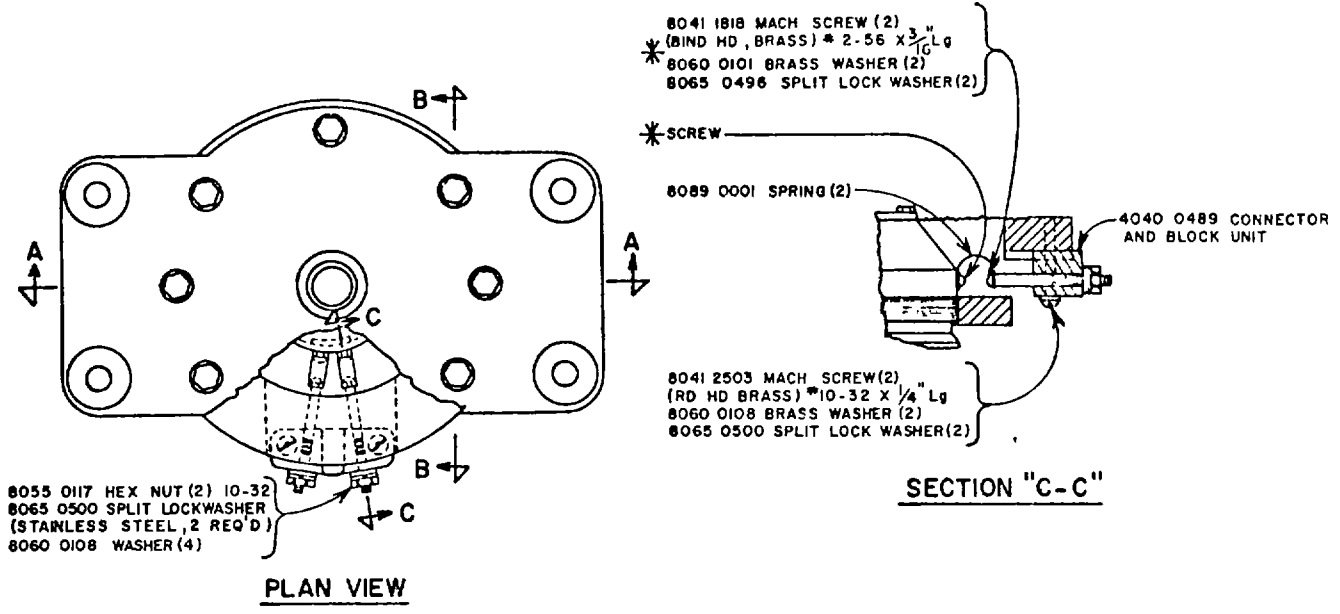
7. If not above, check regulator for proper operation. Connect meter from 4 (-) to transistor Q2 case. Check for + 10 V DC when timer codes circuit.

Form No. 6310 0238

4.3 Trouble Shooting Outline

4.3.1 Horn Blows Improperly

<u>Symptom</u>	<u>Cause</u>	<u>Maintenance</u>
Horn draws near normal current, has very low output; noise has screeching tone	Broken coil	Replace diaphragm and coil unit 9055 0010
Horn draws high current; has low output, tone is normal	Indicates friction. Rubbing coil.	Realign diaphragm and coil unit
Horn draws normal current, has normal output; frequency changes rapidly, noise is a warbling type	Defective oscillator P.C. Board Assembly 9045 0103 or 9045 0105	Replace oscillator - Board Assembly 9045 0275
Horn draws low current; has low output, tone is normal.	Applied battery voltage below specification.	<ol style="list-style-type: none"> <li>1. Re-adjust battery voltage.</li> <li>2. Readjust regulator</li> </ol>
Horn draws high current; has high output, tone is normal	<ol style="list-style-type: none"> <li>1. Applied battery voltage above specified maximum</li> <li>2. Regulator defective program timer not working properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Readjust battery voltage.</li> <li>2. Readjust regulator.</li> <li>3. Repair program timer or replace regulator, DSC Assy. 9010-0144</li> </ol>
Horn draws normal current, has normal output, tone is normal. Horn's blast is periodical. (Does not keep within the specified on-off timing)		



NOTE ---  
UNIT SHOWN IN POSITION FOR SERVICING,  
REFER TO INSTRUCTION BOOK TEXT  
BEFORE DOING ANY WORK.

▲ DO NOT DISASSEMBLE

\* DENOTES POINTS TO BE SEALED  
WITH GLYPTAL LACQUER OR  
EQUIVALENT



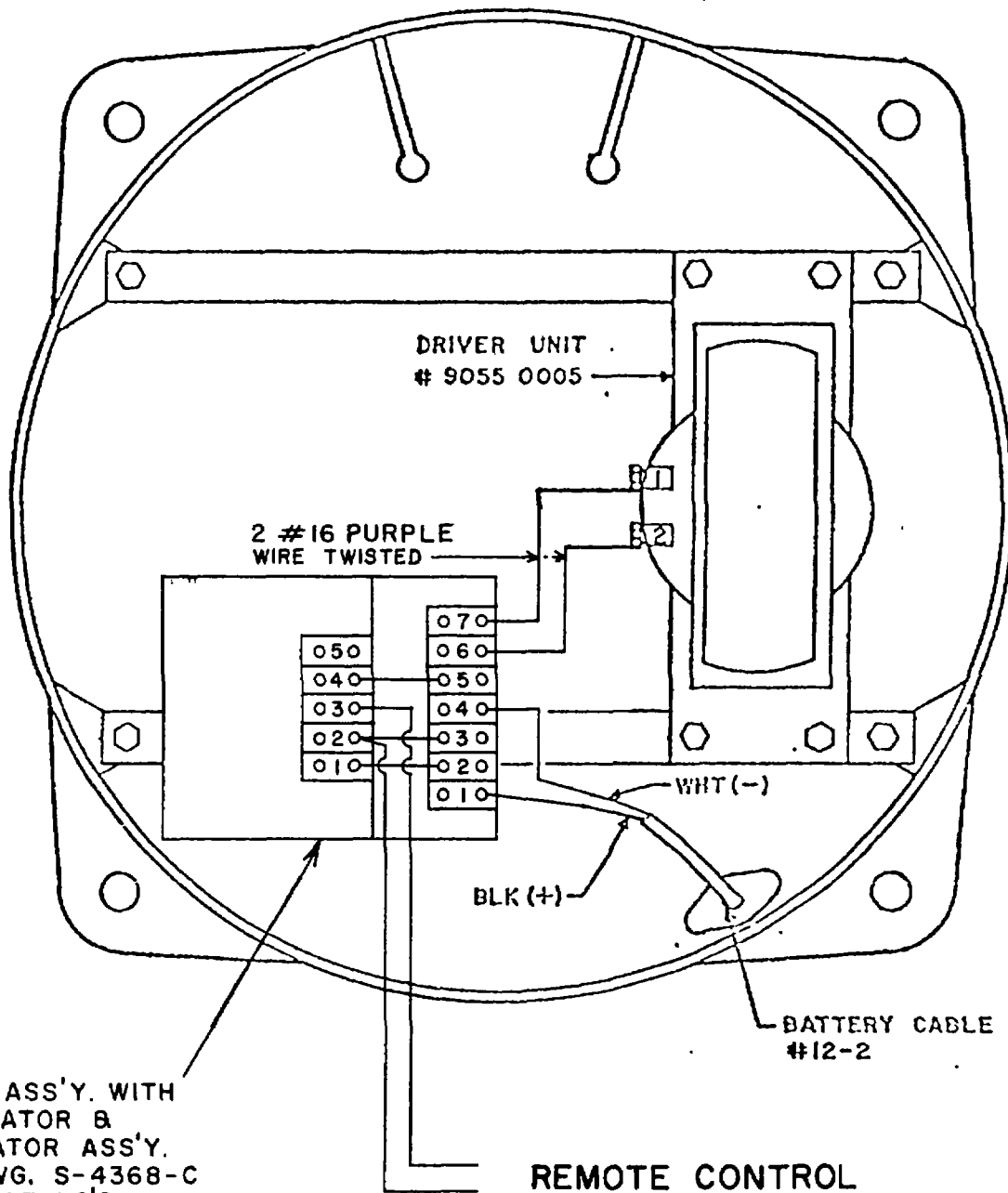
NO. 9055 0005 DRIVER ASSEMBLY

**AUTOMATIC POWER** DIVISION  
NAVIGATIONAL AIDS

DWG. NO. S - 2124 - C

8-16-68

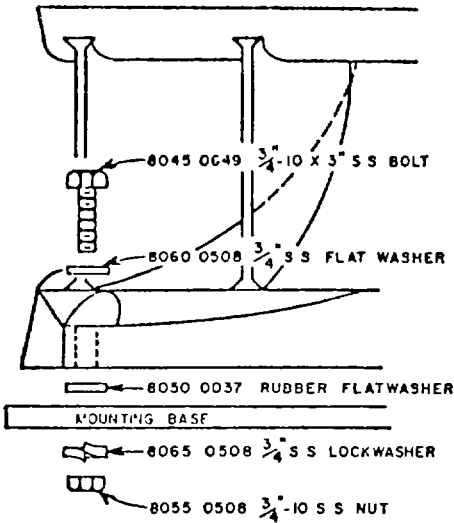
213 HUTCHESON STREET HOUSTON TEXAS 77003



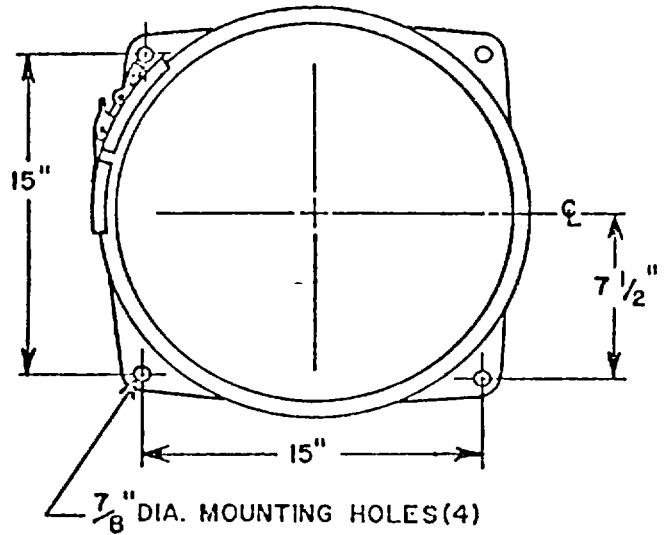
CLOSED CIRCUIT THESE CONTACTS -  
HORN OFF

OPEN CIRCUIT THESE CONTACTS -  
HORN ON





MOUNTING DETAIL



LIFTING LUG

TWO CONDUCTOR, NO. 12 CABLE  
(APPROX., 18" LG) WITH ELECTRICAL  
MALE CONNECTOR NO. 4050 0118

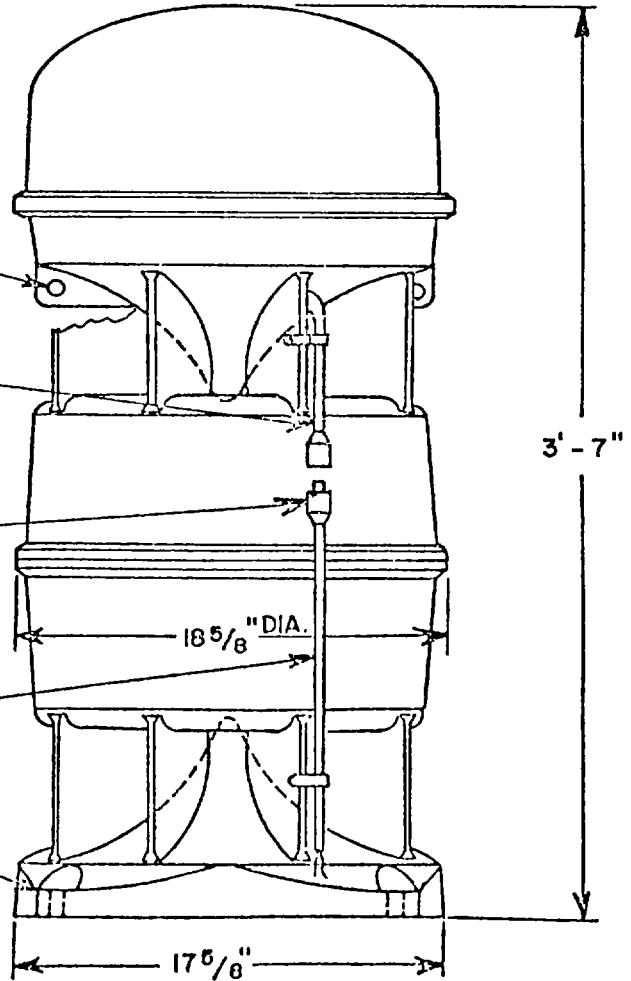
ELECTRICAL FEMALE CONNECTOR  
KIT NO. 4040 0483 PROVIDED  
FOR CUSTOMERS  
TWO CONDUCTOR, NO. 12 CABLE



CONNECTOR KIT ASSY.  
NO. 4040 0488

CABLE BY  
CUSTOMER

SEE MOUNTING  
DETAIL



**AUTOMATIC POWER** DIVISION  
NAVIGATIONAL AIDS

213 HUTCHESON STREET, HOUSTON, TEXAS 77003

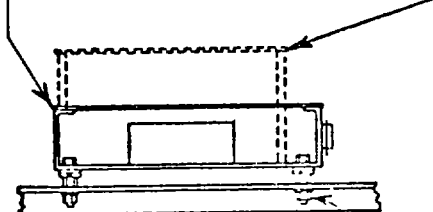
FA232 / FA390A

OUTLINE & MTG. DETAIL

2-10-77

S-4369-C

HORN TIMER PC 9045 0301  
 OSCILLATOR / REGULATOR  
 ASS'Y. 9010 0144



- 8045 0503 BOLT  $\frac{1}{8}$ " - 20 X 1" Lg
- 8055 0501 NUT  $\frac{1}{4}$ " - 20 (4)
- 8060 0501 FLAT WASHER (2)
- 8065 0501 LOCKWASHER (4)

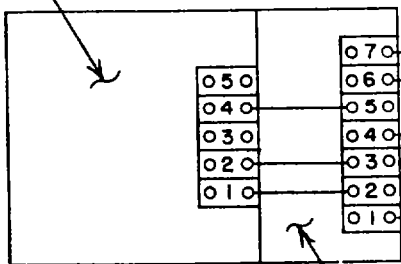
- 8030 0123 CLAMP
- 8020 0038 RING GASKET
- 8050 0067 WASHER

- 8045 0544 BOLT (4)  $\frac{3}{8}$ " - 16 X 1  $\frac{1}{4}$ " Lg.
- 8050 0039 RUBBER WASHER (8)
- 8080 0503 WASHER (4)
- 8065 0503 LOCKWASHER (4)

- 8075 0128 SILICA GEL (3)

- 8030 0124 HOSE CLAMP (2)
- 8035 0378  $\frac{3}{4}$ " HOSE - 1  $\frac{3}{8}$ " Lg

TIMER PC ASS'Y.  
 9045 0301



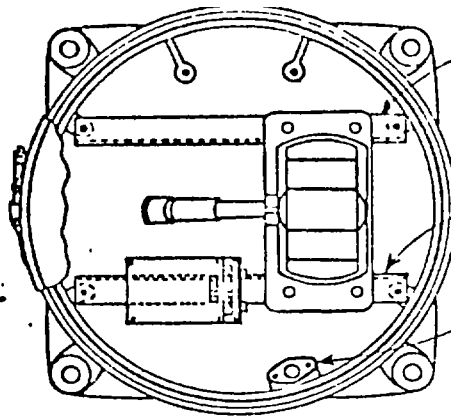
OSCILLATOR /  
 REGULATOR PC ASS'Y.  
 9045 0471

REMOTE CONTROL:  
 SEE DWG. NO S-4373-C



**AUTOMATIC POWER** DIVISION  
 NAVIGATIONAL AIDS

213 HUTCHESON STREET, HOUSTON, TEXAS 77003



8010 0454 MOUNTING ANGLE

8010 0455 MOUNTING ANGLE

- 8010 0485 CLAMPING PLATE  $\frac{3}{8}$ "
- 8041 2693 SCREW (2) 10-32 X  $\frac{3}{8}$ " Lg.
- 8060 0108 WASHER (2)
- 8020 0039 RING GASKET

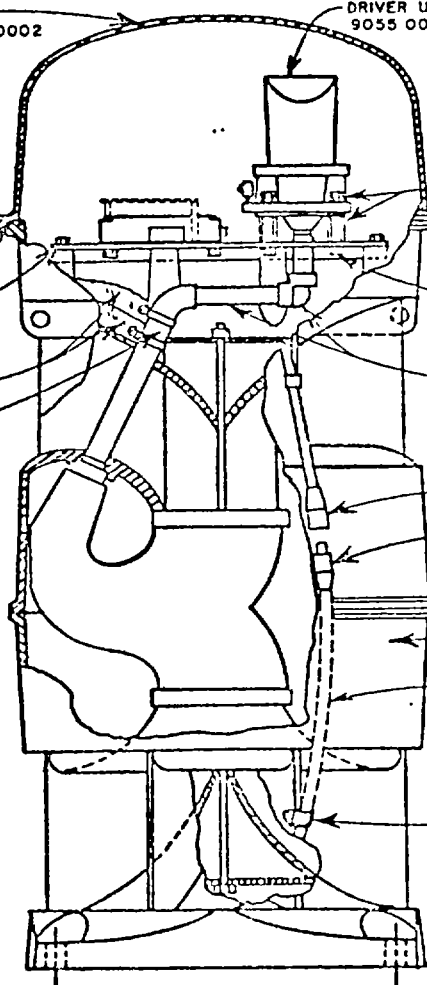


CABLE

DECAL  
 8015 0185

8088 0002 DOME

9055 0005 DRIVER UNIT



- 8045 0545 BOLT (4)  $\frac{3}{8}$ " - 16 X 1  $\frac{1}{2}$ " Lg
- 8065 0503 LOCK WASHER (4)
- 8060 0503 WASHER (4)
- 8030 0122 SPACER (4)
- 8050 0039 RUBBER WASHER (8)

- 8045 0542 BOLT (4)  $\frac{3}{8}$ " - 16 X  $\frac{3}{4}$ " Lg.
- 8065 0503 LOCK WASHER (4)
- 8060 0503 WASHER (4)

8035 0377 THROAT TUBE

4030 0118 CABLE ASSY #12-2

4040 0488 CONNECTOR KIT

8088 0001 HORN

CABLE BY CUSTOMER #12-2

- 8030 0121 CLIP (2)
- 8041 1669 SCREW (2) 10-32 X  $\frac{5}{8}$ " Lg
- 8060 0500 WASHER (4)
- 8065 0500 LOCKWASHER (2)
- 8055 0600 HEX NUT (2) 10-32

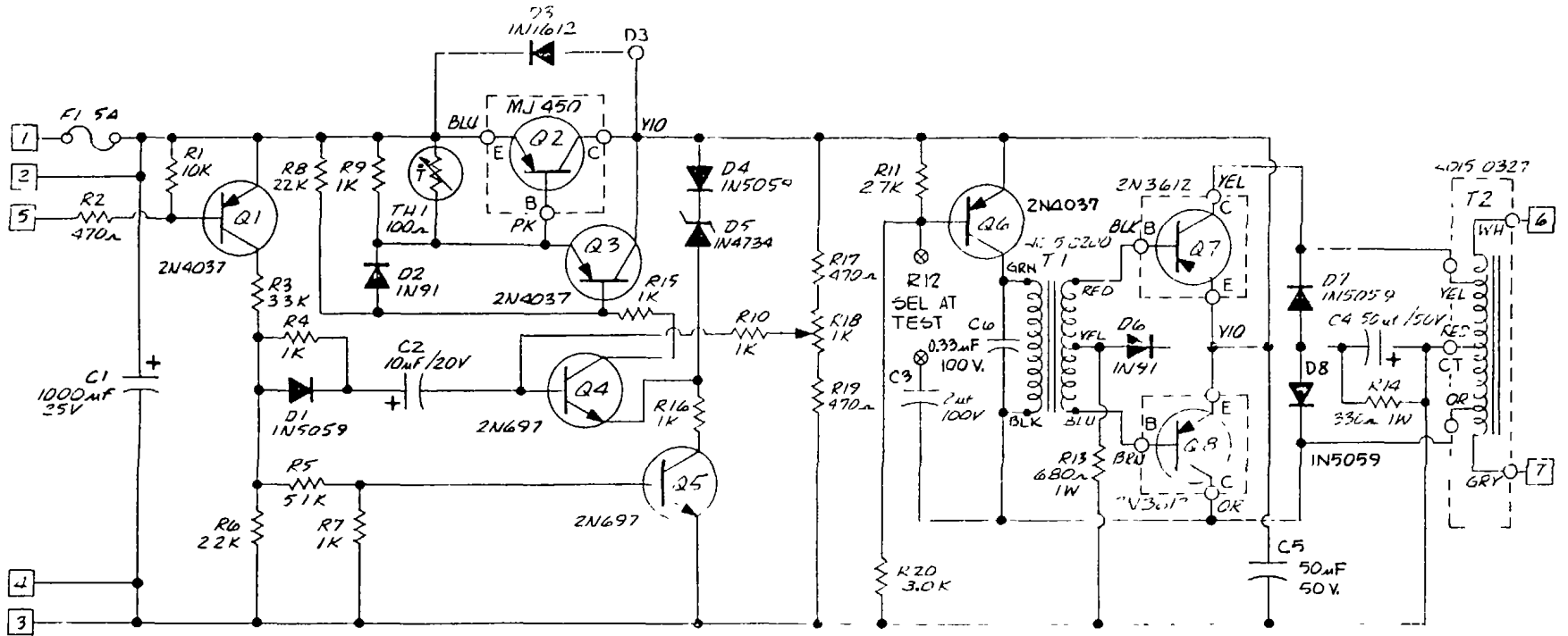
FA232 / FA390A

PARTS LAYOUT & PART NO'S.

DWG. NO.

S-4368-C

2-10-77



OSCILLATOR ASSY NO 9010 0144

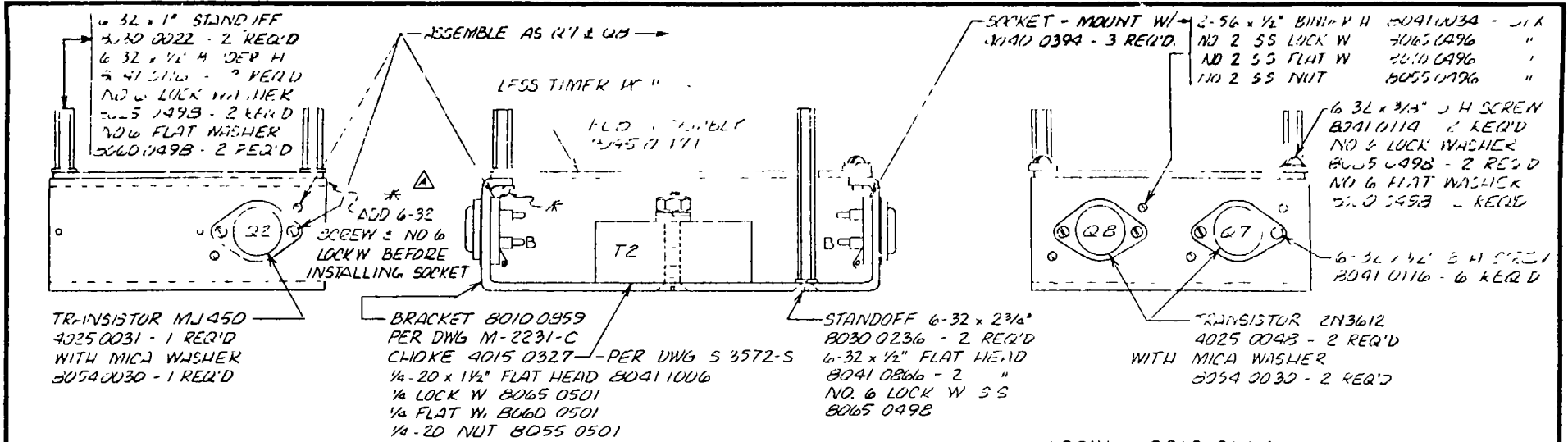
PARTS LAYOUT DWG NO M-2197 C

NOTE

- 1 ○ - SOLDER EYELET ON PC BOARD
- 2 ⊗ - PUSH-IN TERMINAL FLEA-CLIP
- 3 [PART] - NOT ON PCB ASSEMBLY

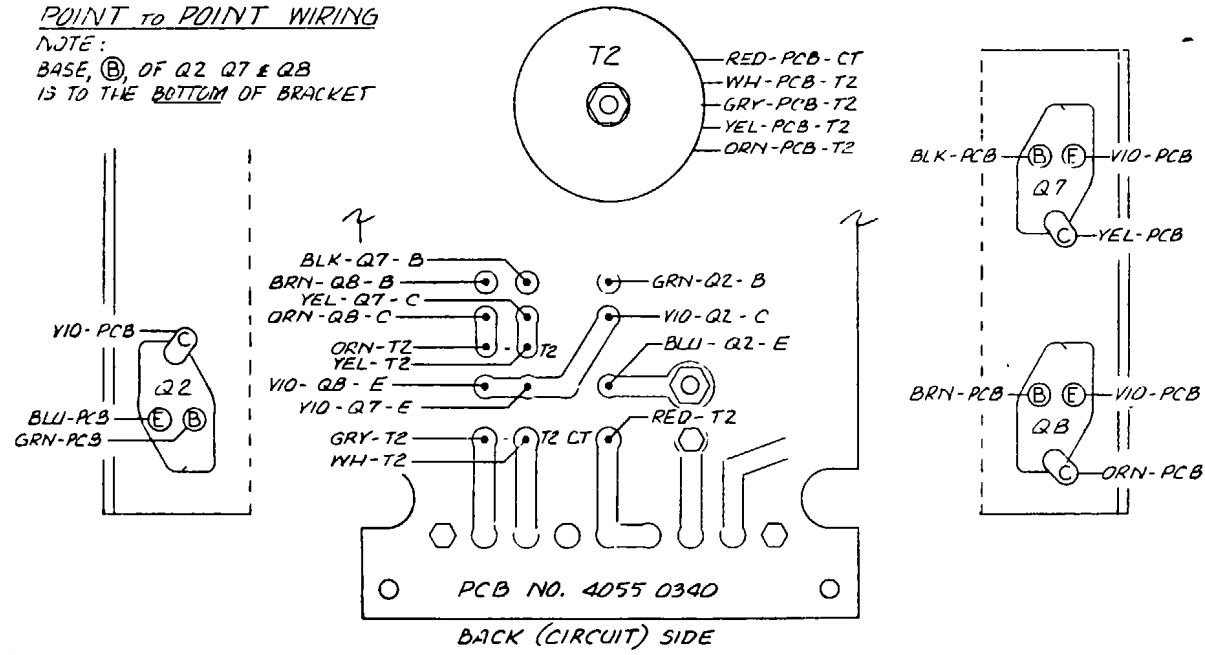
PCB 4055 0340

REVISIONS			AUTOMATIC POWER INC.	
NO	DATE	BY	Division of the PENNWALT CORP 213 Hutcheson Street, Houston, Texas	
1	11-27-76	RFF	SCHEMATIC OSCILLATOR W/REG	
2	9-13-79	RF	FA-390 POWER SUPPLY	
3	9-29-82	RFF		
4				
5			DRAWN BY RFF	CHECKED JMS
6			DATE 6-17-76	APPROVED [Signature]
			DRAWING NO	M 2194-C



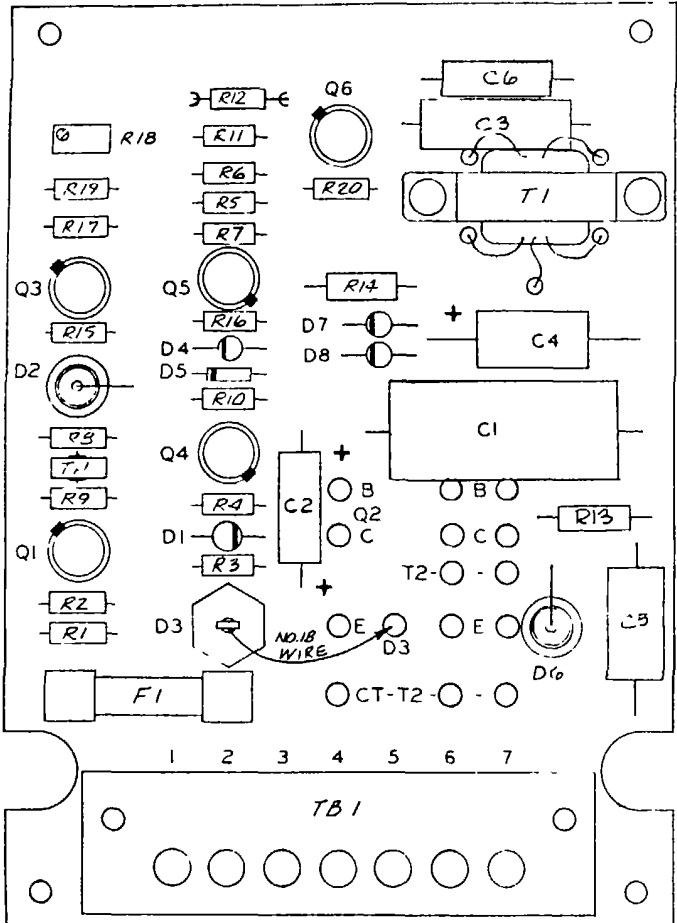
ASS'Y 9010 0144

POINT TO POINT WIRING  
 NOTE:  
 BASE, (B), OF Q2 Q7 & Q8  
 IS TO THE BOTTOM OF BRACKET



INTERCONNECTING TO TIMER PC S-4375-C  
 PER BILL NO. 6382 1175 COL A  
 PCB PARTS LAYOUT DWG. M-2197-C  
 SCHEMATIC DWG M-2194-C

REVISIONS			AUTOMATIC POWER INC.		
NO	DATE	BY			
A	2-21-77	RE/112	Division of the PENNWALT CORP 213 Hutcheson Street, Houston, Texas		
			ASSEMBLY 9010144 & PARTS - FA390 POWER SUPPLY		
			DRAWN BY RFF	CHECKED	DRAWING NO
			DATE 12-7-76	APPROVED <i>[Signature]</i>	M-2259-C



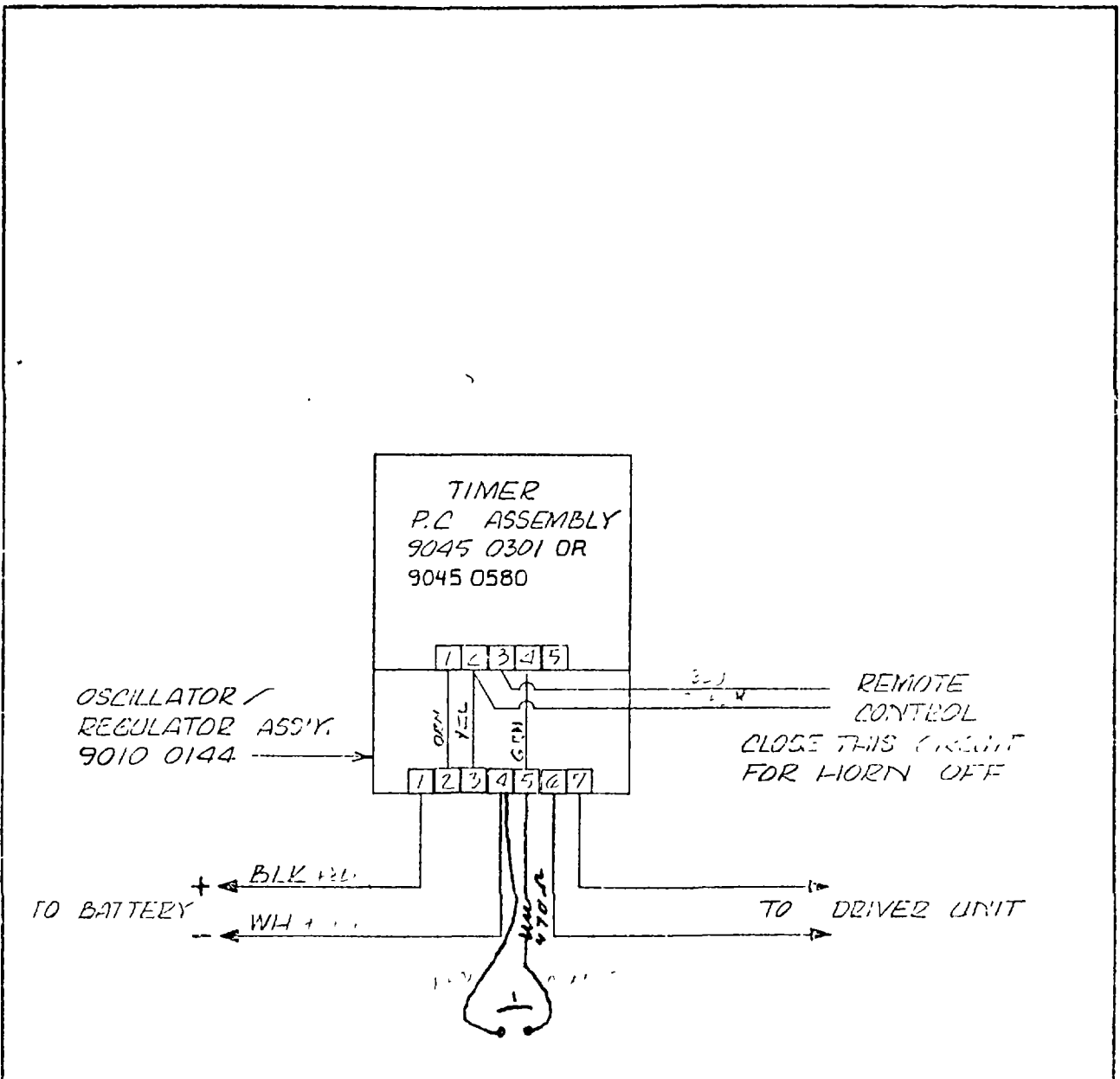
PCB NO 4055 0340 B

QTY	PART NO	DESCRIPTION	UNIT	REMARKS
4	4055 0340	PCB	PCB	
11, 14	4055 0340	RESISTOR	1K	
4	4055 0385	RESISTOR	5K	
4, 10, 5, 7	4055 0373	RESISTOR	1K	
1	4055 0390	RESISTOR	51K	
R2, 9	4055 0325	RESISTOR	2.1K	
1	4055 0384	RESISTOR	30K	
R11	4055 0343	RESISTOR	1.1K	
C12	4055 0339	RESISTOR	10K	
R12	4055 0331	RESISTOR	330Ω	
R13	4055 1002	POTENTIOMETER		
C1	4055 0094	CAPACITOR	100μF	
C2	4055 0112	CAPACITOR	10μF	
3	4055 0095	CAPACITOR	2μF	
C4, 5	4055 0123	CAPACITOR	30μF	
D1, 4, 7, 8	4050 0093	DIODE	1N5059	
D3, 6	4050 0104	DIODE	1N191	
D5	4050 0042	DIODE	1N112	
D7	4050 0094	DIODE	1N14734	
Q1, 3, 6	4055 0032	TRANSISTOR	2N413	
Q4, 5	4055 0017	TRANSISTOR	2N697	
11, 1	4051 0123	TRANSISTOR	100Ω	
T1	4055 0200	TRANSFORMER	250VA	
F1	4055 1111	FILTR		
2055 0022		1.5F 5A 25V		
TB1	4055 0262	TERMINAL	2-RIP	
	4055 0294	TERMINAL	PUSH-IN	
PCB	4055 0340	PRINTED	CIRCUIT	
	4055 0390	MATERIAL	PAD	
C6	4055 0177	CAPACITOR	0.33μF	100V

1 O SOLDER EYELET ON PCB  
2 ? PUSH IN TERMINAL

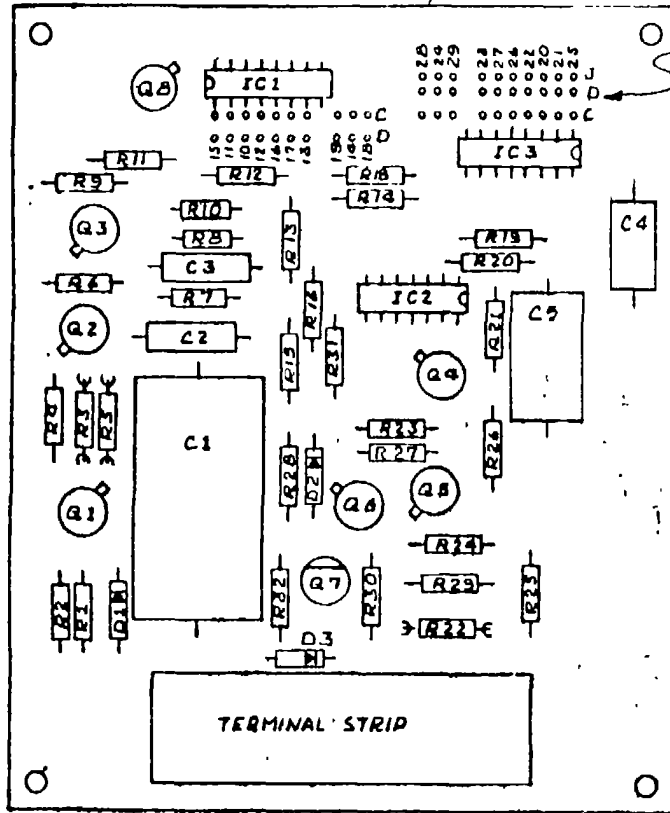
ASSEMBLY NO 4045 0471  
BILL NO 382 1158 COL A  
SCH-EMATIC DWGS AND M-2194-C

REVISIONS			AUTOMATIC POWER INC. Division of the PENNVALT CORP 213 Hutcheson Street, Houston, Texas	
NO	DATE	BY		
1	11-24-74	RF		
2	9-13-79	RF		
3	8-22-80	RF	PARTIAL - HYUNT - OSCILLATOR PCB	
4	9-29-84	RF	LA-390 POWER SUPPLY	
5			DRAWN BY RIF CHECKED JTB DRAWING NO	
6			DATE . . . . . APPROVED . . . . . 14 2197-C	



REVISIONS			AUTOMATIC POWER INC.		
NO	DATE	BY	213 Hutcheson Street, Houston, Texas		
1			INTERCONNECTING P.C. TIMER & P.C. OSC./REG. FOR FA-3901A		
2			DRAWN BY	CHECKED	DRAWING NO.
3			DATE	APPROVED	S-4373-C
4					
5					

PCB 4055 0207 C



DIODE GO FROM C\*TO'D\* WITH CATHODE AT 'D' JUMPER GO FROM C\*TO'J'

R8, 11, 21, 23, 28

R13, 14

R15, 16, 20, 19

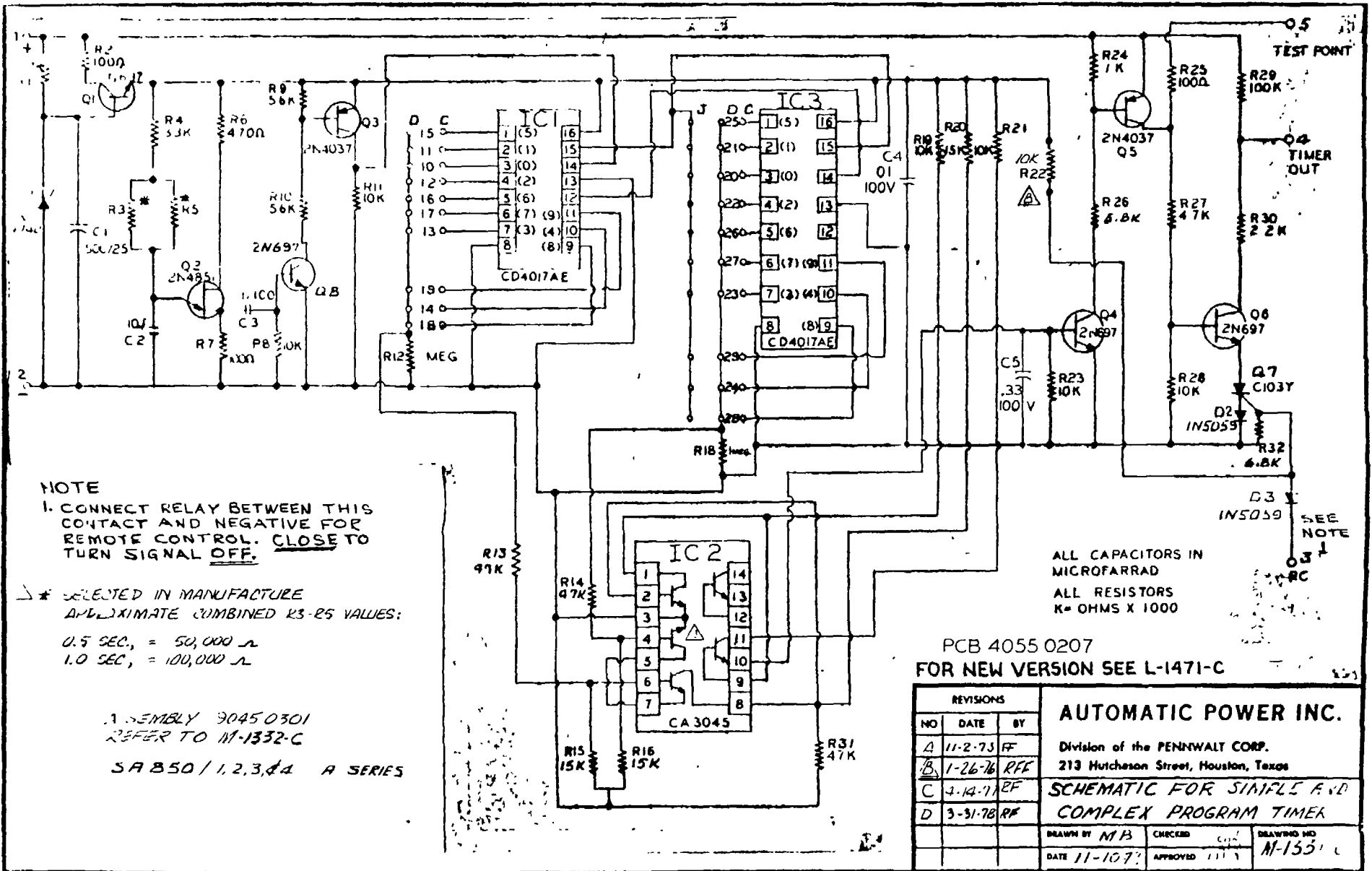
SCHEMATIC DRAWING, M-1331-C

NOTE: PARTS LAYOUT FOR SIMPLE AND COMPLEX CHARACTER (EXCEPT MORSE U) TIMER ASSY 5045 0301 FOR CHARACTERISTIC SEE TIMING CHART. PER M-1427-C FOR MORSE U USE 5045 0328 PER DWG L-670-C

ITEM	PART NR	DESCRIPTION
PCB	4055 0207	PC-296 DRILL PER L-513-3
TS	4040 0360	TERMINAL STRIP C-J *5 164Y
CS	4040 0480	CAN SEAT, GARLOCK *49011-1080
	8015 0123	NAMEPLATE PER 5-2950-3
IC1,3	4026 0024	INTER. CKT. , R.C.A. CD 9017AE
IC-2	4026 0027	INTER. CKT. , R.C.A. CA-3005
Q1,4,6	4025 0017	TRANSISTOR 2N697
Q3,5	4025 0092	TRANSISTOR 2N4037
Q2	4025 0063	UNIJUNCTION 2N4851
Q7	4020 0140	5CK GE *C103Y
R1	4001 0383	RESISTOR 27K. 1/2W
R2,7,25	4001 0349	RESISTOR 100Ω. 1/2W
R4	4001 0385	RESISTOR 33K. 1/2W
R6	4001 0365	RESISTOR 470Ω. 1/2W
	4001 0397	RESISTOR 10K. 1/2W
R9,10	4001 0391	RESISTOR 56K. 1/2W
R12,18	4001 0445	RESISTOR 1MEG. 1/2W
R27	4001 0389	RESISTOR 97K. 1/2W
R30	4001 0381	RESISTOR 2.2K. 1/2W
R31	4001 0413	RESISTOR 47K. 1/2W
C1	4005 0026	CAP. C*O*BR-500-25 500±25
C2	4005 0112	CAP. KEMET *T10B106 020AS 10±20
C3	4005 0109	CAP. TRW *463F .1±100
D1	4020 0097	DIODE 1N4740
D2,3	4020 0093	DIODE 1N5059
	4001 0401	RESISTOR 15K. 1/2W
R24	4001 0373	RESISTOR 1K. 1/2W
R26,32	4001 0393	RESISTOR 6.8K. 1/2W
R29	4001 0421	RESISTOR 100K. 1/2W
	4020 0093	TIMING DIODE, 1N5059
C4	4005 0109	CAP. ELDAC Z1A109 1/2W ±10%
C5	4005 0177	CAP. ELDAC Z1A334 0.33µF ±10%

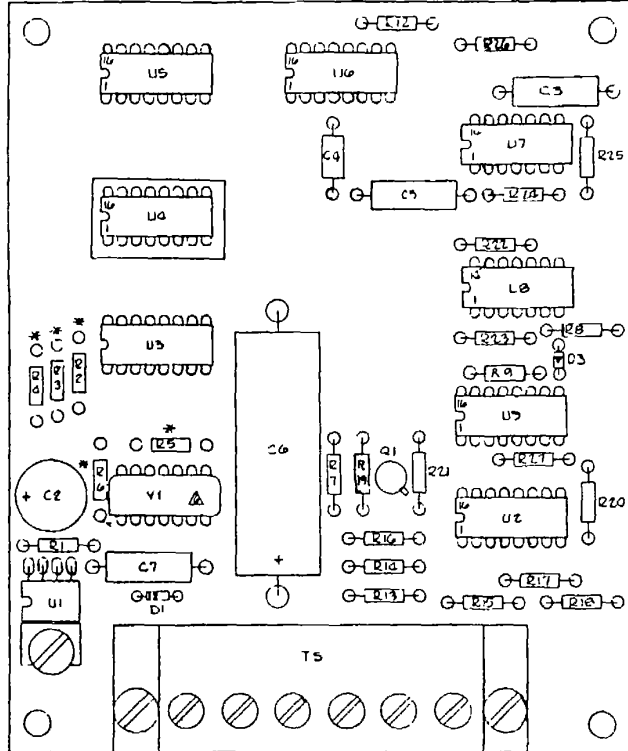
FOR NEW VERSION SEE L-1473-C

REVISIONS			AUTOMATIC POWER INC.		
NO	DATE	BY	Division of the PENNVALT CORP		
1	11-2-73	RF	213 Hutchason Street, Houston, Texas		
2	6-10-76	RF	PARTS LAYOUT ~ SIMPLE ~		
3	3-31-78	RF	CHARACTER PRODUCTION		
			EXCEPT MORSE U 5045 0328		
			DRAWN BY MB	CHECKED	DRAWING NO
			DATE 11-10-76	APPROVED	1/1





**NOTE**  
 WHEN CRYSTAL OSCILLATOR Y1 IS  
 CORNER WINFIELD S14FC USE  
 RESISTOR R6  
 WHEN MONITOR PRODUCTS MODEL  
 910C USE RESISTOR R5  
 WHEN PERIOD LESS THAN 30 SEC  
 USE R2 THIS PRODUCES A LSB OF  
 .050 SECONDS  
 WHEN PERIOD BETWEEN 30 SEC  
 AND 100 SEC USE R3 THIS PRODUCES  
 LSB OF 1 SEC  
 WHEN PERIOD OF 100 SEC TO 200 SEC  
 USE R4 THIS PRODUCES LSB OF  
 2 SEC.



\* SELECT

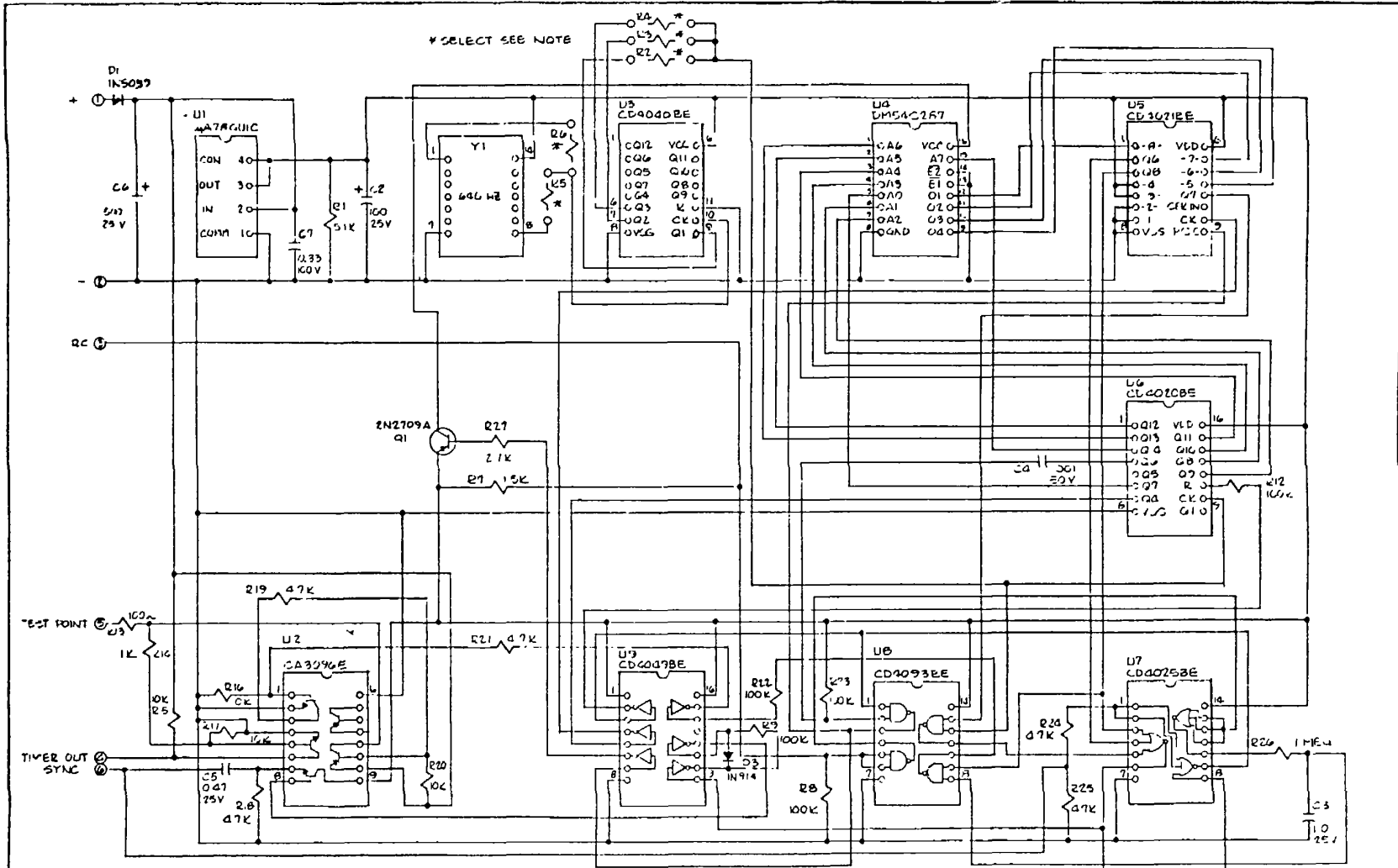
PCB 4055-0410 A

REFERENCE	PART #	DESCRIPTION
R15	4001 0304	RESISTOR 100K
R7	4001 C377	15K
R16, R17, R18, R20	4001 0393	27K
R1	4001 0390	51K
R10, R11, R12, R13	4001 0397	10K
R21	4001 0300	1MEG
R9, R12, R13, R8	4001 0321	150K
R2 or R3 or R4	4001 0325	10K CHOOSE ONE
R5 or R6	4001 0325	10K CHOOSE ONE
R14, R8	4001 0313	1K
C6	30150026	CAP-CATOR 500MFD 25V
C7	4005 0117	0.33MFD 160V
C8	4005 0194	100MFD 25V
C3	4005 0296	10MFD 25V
C4	4005 0298	601MFD 50V
C5	4005 0305	47MFD 25V
U8	4006 0069	INTEGRATED CIRCUIT CD4093 BE
U1	4006 0087	IC 40286LIC
U2	4006 0094	IC 40289BE
U6	4006 0096	IC 40287BE
Y1	4006 0090	OSCILLATOR 910C 1/20 1/2
U4	4006 0081	IC D75651B7
U5	4006 0097	IC CD4018H
U7	4006 0096	IC CD3025BE
U9	4006 0088	IC CD4058BE
D1	4006 0093	DIODE 1N5059
U3	4006 0049	INTEGRATED CIRCUIT CD4040BE
T5	40000001	TERMINAL STRIP 1/4 1/4-T
R27	4001 0383	RESISTOR 27K 1/2W
Q1	4005 0098	TRANSISTOR 2N2501A
U4 SOCKET	4000 0723	IC SOCKET FOR U4
D3	40000193	DIODE 1N914
	4005 0410	PRINTED CIRCUIT-PCB L 1473-C SCHEMATIC L 1473-C

90 15 0580

REVISIONS			AUTOMATIC POWER INC	
NO	DATE	BY	213 Hawthorne Street, Houston, Texas	
1	10 17 81	JF	HORN TIMER WITH PROM	
2	2 3 81	JF	PARTS LAYOUT	
3	1 7 81	JF		
4	1 1 81	JF		
5	10 7 81	JF		
6	1 1 81	JF		

18-19-84



NOTE. SELECT R2 FOR PERIOD LESS THAN 50 SEC - OUTPUT 320HZ LSB 50MS  
 SELECT R3 FOR PERIOD 50 SEC TO 100 SEC - OUTPUT 160HZ LSB 100MS  
 SELECT R4 FOR PERIOD 100 SEC TO 200 SEC - OUTPUT 80HZ LSB 200MS

SELECT R5 WHEN OSCILLATOR OUTPUT IS PIN 8  
 SELECT R6 WHEN OSCILLATOR OUTPUT IS PIN 1

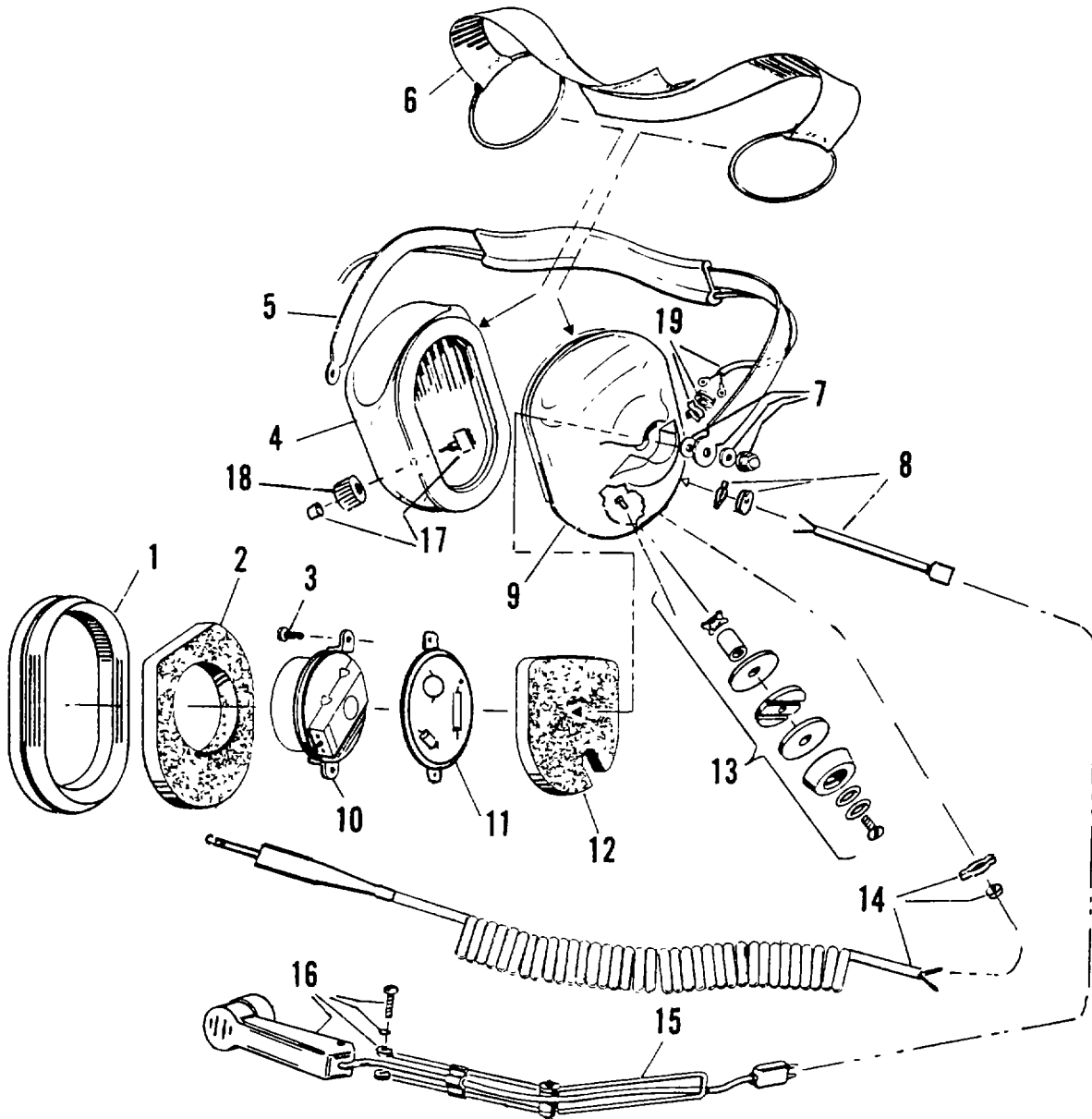
PCB 4055 0410  
 9045 0580

PARTS LAYOUT L-1473 C

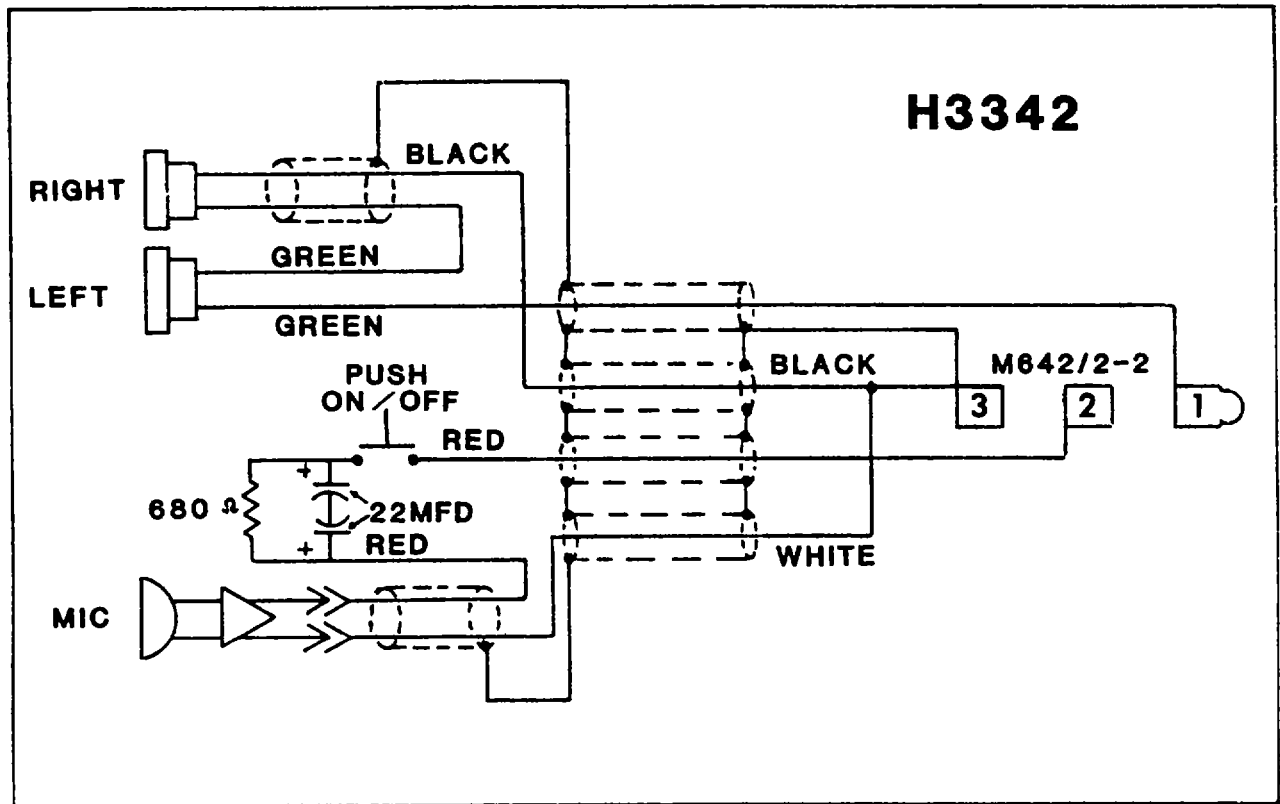
REVISIONS			AUTOMATIC POWER INC	
NO	DATE	BY	213 Mulvick Street Houston Texas	
1	0 15 61	LF	HJEN TIMER WITH PDM	
2	1 5 61	LF	SCHEMATIC	
3	2 5 61	LF		
4	3 12 61	LF		
5	5 19 61	LF	DESIGNED BY	APPROVED
6			DATE	BY

L-1471-C

TM 55-1930-209-14&P-12  
**PARTS LIST**  
**MODEL H3342**



<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Item no.</u>	<u>Description</u>	<u>Part No.</u>
1	EAR SEAL (PAIR)	18316G-02	10	EARPHONE ASSEMBLY	103766-17
2	DOME FILTER	25629P-05	11	PCB ASSEMBLY	18289G-09
3	SCREW (10/PK)	00023M-07	12	DOME FILTER	11410P-02
4	RIGHT DOME	11407P-30	13	BOOM GUIDE KIT	128406-01
5	SPRING ASSEMBLY	10117G-11	14	COMM CORD KIT	18028G-34
6	SUPPORT ASSEMBLY	103706-03	15	MIC BOOM ASSY	12765G-03
7	NUT AND WASHER KIT (10/PK)	12052G-01	16	M-1/DC DYNAMIC MICROPHONE	12948G-01
8	MICROPHONE JACK CORD	10405G-05	17	SWITCH PUSHBUTTON	09851P-17
9	LEFT DOME	11407P-13	18	SWITCH GUARD	13148P-01
			19	OVERHEAD CORD KIT	22607G-01



**APPLICATION NOTE**  
**M3141 and M3412 HEADSET STATIONS**  
**(Formerly Models 4S-V and 4S-VP)**

**INTRODUCTION**

The M3141 and M3142 headset stations are communications modules which permit the connection of headset-microphones into David Clark Company intercom systems. The M3142 is equipped with a push-to-page button.

**PHYSICAL CHARACTERISTICS**

The M3141 and M3142 modules are designed to fit into standard electrical wiring boxes that are at least 1-3/4 inches deep. They each occupy one "space", or the equivalent of one duplex outlet, and may be covered with any cover plate. Any number of modules may be nested together using a multiple gang box.

The M3141 and M3142 modules may also be mounted in a panel in two different ways. One method requires drilling holes so that the lock and the potentiometer nuts hold the module on. The other method requires drilling clearance holes for the jack and the potentiometer, and holding the module to the back of the panel by using a 6-32 screw that would normally hold the cover plate on. People using Switchcraft 298 plugs may remove the plastic caps on the front of the modules to retain the lock-down feature, provided that the mounting panel is not more than 1/8" thick.

The rear of the M3141 and the M3142 contains an 8 terminal strip which gives access to the circuitry. The easiest crimp terminal to use is an insulated, slotted-tongue flanged spade, such as the AMP P/N 324608 or an equivalent.

**ELECTRICAL CHARACTERISTICS**

The M3141 and M3142 operate into a 4-wire intercom line which has +24 volts DC, ground, a talk line (input to power amplifier), and a listen line (output of power amplifier). The M3141 contains a mike amplifier, a DC power source for a carbon mike or for an amplified dynamic mike, a jack for connecting a 3-wire headset/microphone, and a volume control for the headset. This volume control is after all amplifiers, and only reduces the audio going to the headset.

The M3142 has all the above mentioned characteristics, plus one other. It is equipped with a push-to-page button. This push-to-page feature allows any headset station user to push the button and be heard over an external loudspeaker which is normally muted. A push-to-page system is particularly desirable in areas where a station may not always be manned. When the desired person hears the page, he goes to the nearest station and uses the headset or handset at that location.

The M3142 will only retain its push-to-page feature when used in conjunction with a M3131 audio power amplifier. A more detailed explanation of push-to-page operation is outlined in application note 17209P-03.

All David Clark Company amplifiers, and headsets using carbon or amplified dynamic mikes are designed to work with the M3141 and M3142 modules. Sound powered headsets, and headsets using low impedance dynamic mikes are not designed to work with the M3141 and M3142. Also, these modules cannot be operated from an external 12 volt DC power source.

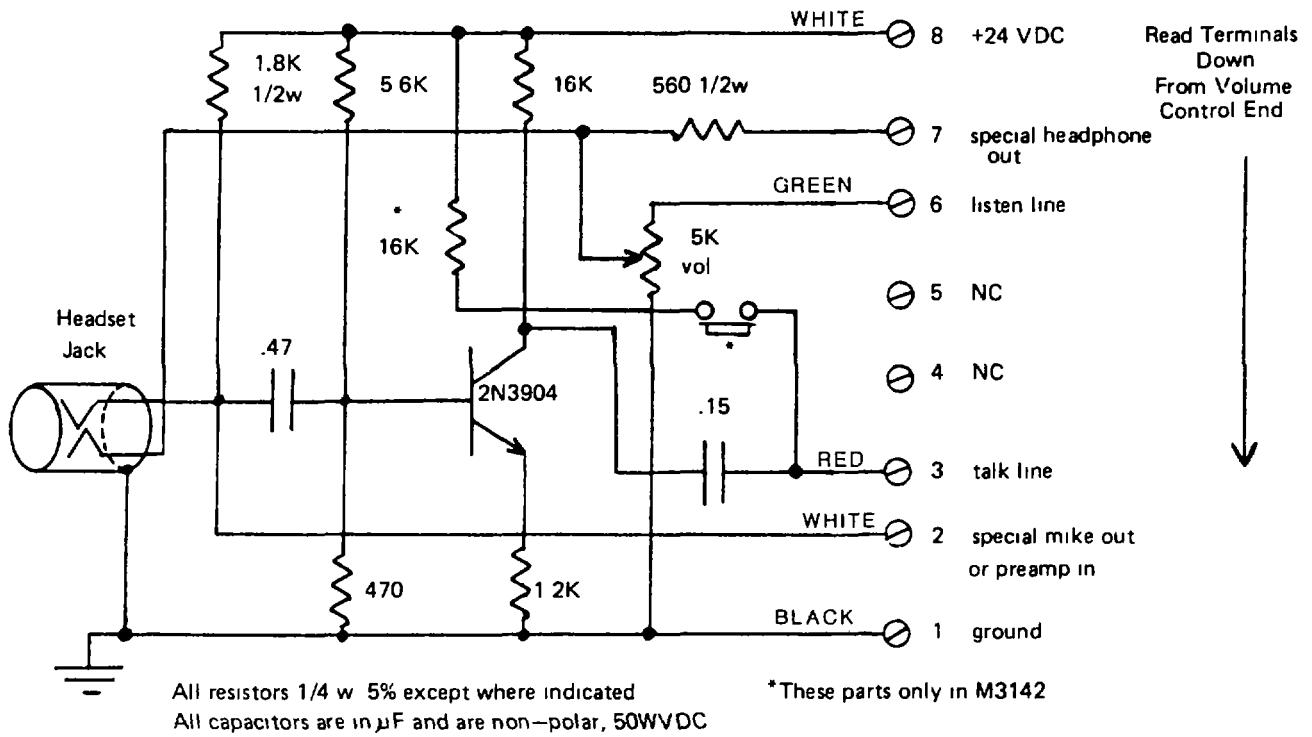
**SPECIFICATIONS**

The M3141 and M3142 use common emitter amplifiers with a voltage gain of 0.4 into the specified 500 ohm talk line impedance. The input impedance of the amplifier is 420 ohms, and the output impedance is 16K ohms. The maximum output swing is approximately 1 volt p-p. The frequency response is contoured for best speech intelligibility. Twelve mA DC is supplied for the carbon mike or for the amplified dynamic mike. The volume control is a 5000 ohm audio taper pot, wired so that the minimum impedance a power amplifier would see is 5000 ohms in parallel with the headphone impedance. This is 640 ohms for a 600 ohm headset and 145 ohms for a 150 ohm headset.

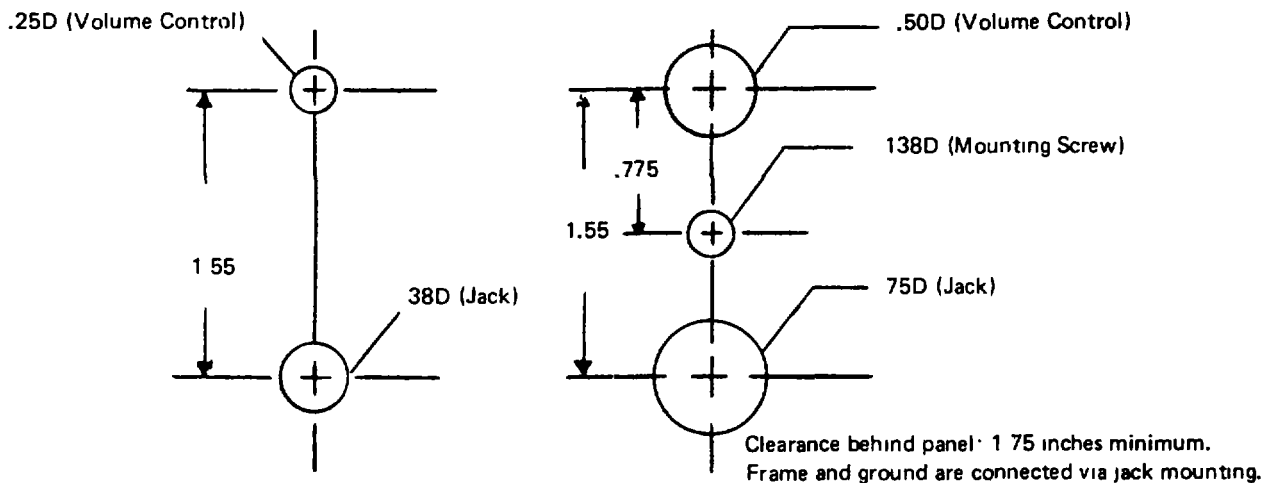
For special applications, access is provided to the headset signal (after the volume control), and to the input node of the amplifier. This input node can be used to provide access to the unamplified mike signal, and it can also be used as an input to the module.

when no mike is connected. Keep In mind that this mike access point has DC on It, and that a signal of 2.5 volts p-p drives the amplifier to clipping.

When the push-to-page button is pushed, the talk line is connected to +24 volts DC through a 16,000 ohm resistor. This, in conjunction with a 16,000 ohm resistor from the diode-blocked input to ground on the M3131 amplifier, will apply 12VDC to the diode, forward biasing it and "opening" the input. See Application note 17209P-03 for further details on push-to-page



Schematic Diagram for Models M3141 and M3142



**David Clark** COMPANY  
INCORPORATED  
360 Franklin St., Worcester, Mass. 01604

**APPLICATION NOTE  
MODEL M3146 SOUNDOLIER HANDSET ADAPTOR MODULE  
(Formerly Model 4HS)**

**INTRODUCTION**

The M3146 module permits the connection of a Soundolier telephone handset/hookswitch assembly into a David Clark Company intercom system.

**PHYSICAL CHARACTERISTICS**

Unlike most other David Clark Company intercom system modules, the M3146 is not designed to fit into standard electrical wiring boxes. It is designed to be attached to the rear of a plate-mounted handset/hookswitch assembly, such as the Soundolier "W" series. This includes their Models WE-2 (beige), and WB-2 (black). MODELS WITH DYNAMIC TRANSMITTERS (MICROPHONE) MUST NOT BE USED. USE CARBON TRANSMITTER ONLY.

To mount the M3146, use the following procedure: First remove the two screws that hold the terminal strip to the rear of the Soundolier mounting plate. The mounting legs of the M3146 module are spaced so that they may be positioned over the holes, and held with the two screws that were removed. Finally, connect the black, blue, and yellow wires of the M3146 to the same color wires on the Soundolier terminal strip. The M3146 requires 1-3/4 inches of clearance behind the panel.

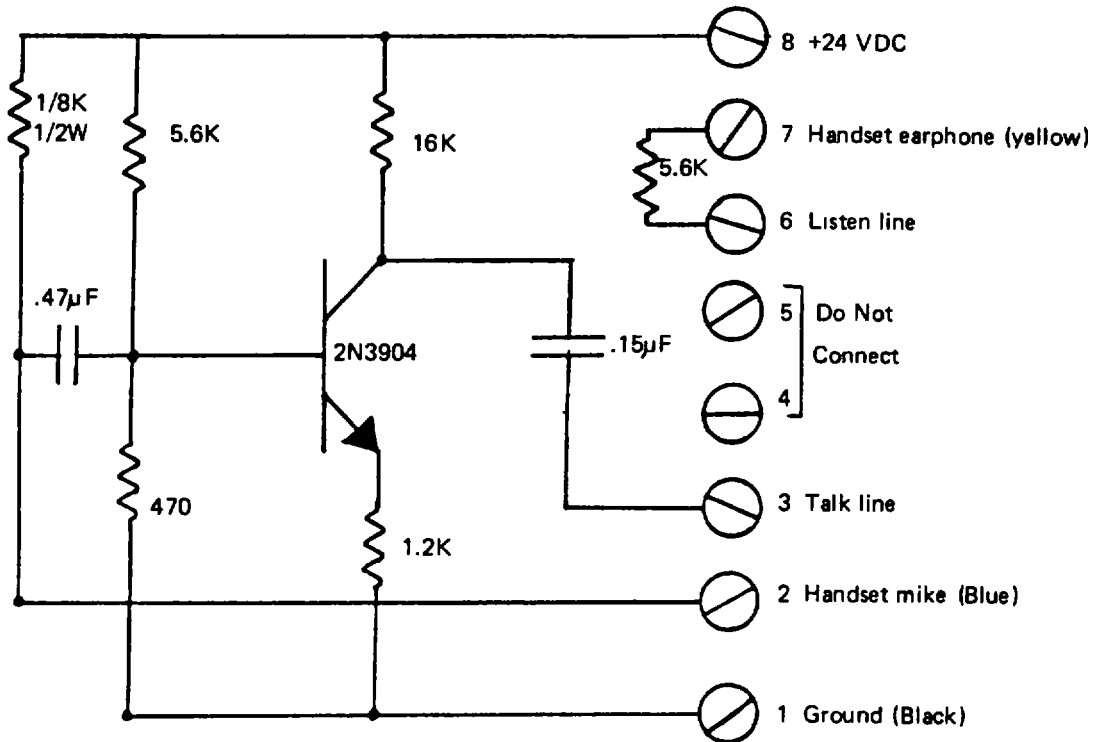
**ELECTRICAL CHARACTERISTICS**

The M3146 module operates into a 4-wire intercom line which has: +24 volts DC, ground, a talk line (input to power amp), and listen line (output from power amp). The M3146 contains a microphone preamplifier and DC source for the mouthpiece, and a resistor for properly connecting the earpiece. The hookswitch in the handset/hookswitch assembly cuts off both the earpiece and the mouthpiece.

After installation, the handset is used in the normal fashion. When lifted from the cradle, communication with other people in the intercom system may take place.

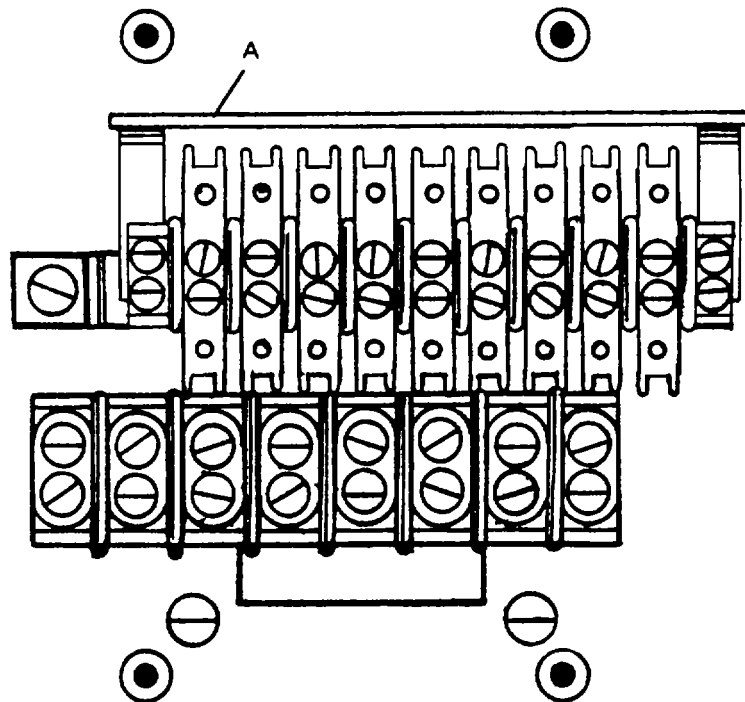
**SPECIFICATIONS**

The microphone (mouthpiece) pre-amplifier and DC power source electronics are identical to those use in the M3141 and M3142 headset stations, (application note 17206P-71). The handset earphone has a 5600 ohm resistor between it and the listen line, which matches the listening level to the rest of the intercom system. The sketch shows the location (A) of the M3146 after installation.



All resistors 1/4 W 5% except where indicated.  
 Capacitors are non-polar, 50 WVDC

Model M3146 Schematic Diagram





**David Clark** COMPANY  
INCORPORATED  
360 Franklin St., Worcester, Mass 01604

**APPLICATION NOTE  
MODELS M3115 and M3116  
POWER CONTROL MODULES  
(Formerly Models 3PC-12 and 3PC-24)**

## **INTRODUCTION**

The M3115 and M3116 are modules which allow David Clark Company Incorporated intercom systems to be powered by external batteries or by an external DC power source when a M3111 power supply is not used. The M3115 uses a 12-14 volt source, and the M3116 uses a 24-26 volt source.

## **PHYSICAL CHARACTERISTICS**

The M3115 and M3116 modules are designed to fit into a standard electrical wiring box that is at least 1-3/4 inches deep. They each occupy one 'space', or the equivalent of one duplex outlet, and may be covered with any duplex outlet cover. Any number of modules may be nested together using a multiple gang box.

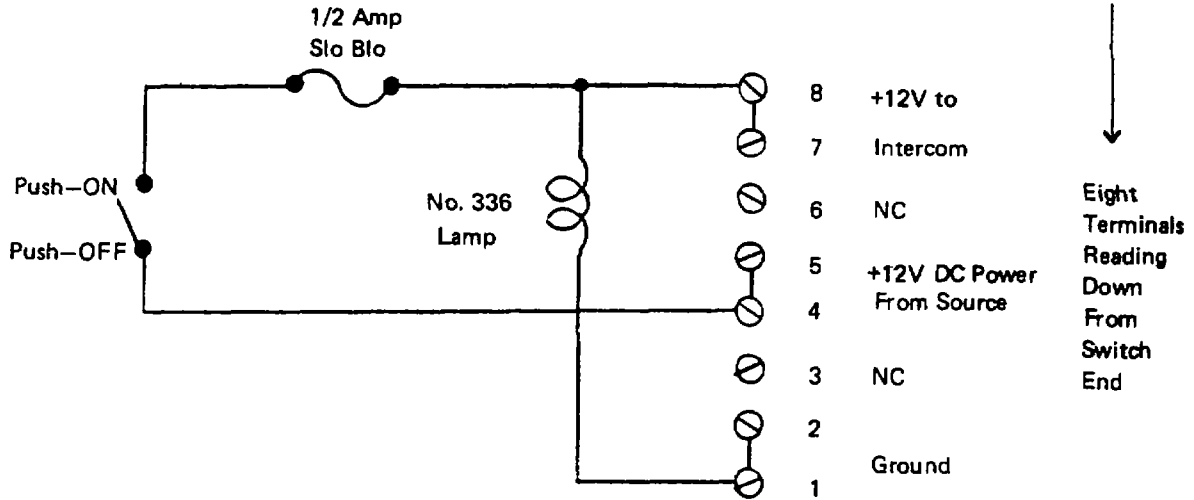
The M3115 and M3116 may also be mounted in a panel by drilling clearance holes for the fuseholder, the shank of the illuminated switch, and a 6-32 screw. The module is held against the back of the panel by the 6-32 that normally holds the cover plate on, and by the nut on the switch shank.

The rear of the M3115 and M3116 contain an 8-terminal strip which gives access to the circuitry. The easiest crimp terminal to use is an insulated, slotted-tongue flanged spade such as the AMP P/N 324608 or an equivalent.

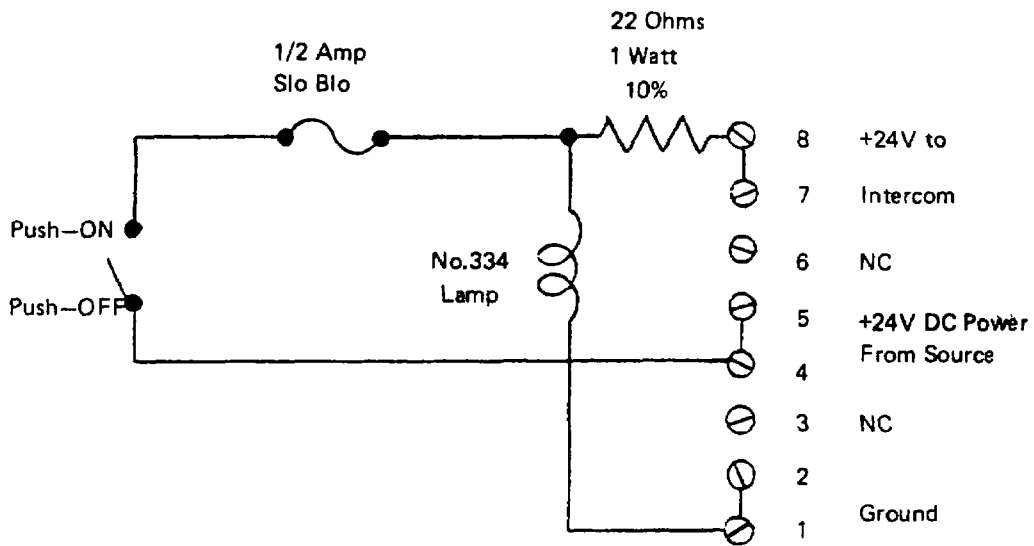
## **ELECTRICAL CHARACTERISTICS**

The M3115 operates from a 12 to 14 volt battery or DC power source. The indicator lamp provided is a No. 336, which draws 0.08 amps at 14 volts. The output of the M3115 is protected by a 1/2 amp slow blow fuse, type MDA-1/2, and the power switch is a push on/push off type that lights up when the system is on. A M3115 will operate a David Clark Company intercom normally, with two exceptions. First, the only headset station that will run on 12 volts is the-M3145, and ten of these may be used, provided that each headset has a push-to-talk switch. The other exception is that the maximum obtainable audio level at the headset will be half (6 dB less) of what it would be if the system were run on 24 volts.

The M3116 operates from a 24 to 26 volt battery or DC power source. If a 24 volt battery is used which has a charging facility connected to it, care must be taken that the voltage never goes above 26 volts at any time. The battery charger must be disconnected while the intercom system is running if the voltage could go over 26 volts. The M3116 comes with a No. 334 indicator lamp, which draws 0.04 amps at 28 volts. The output is protected by a 1/2 amp slow blow fuse, type MDA-1/2, and the power switch is the same push-on/push-off type used on the M3115. All David Clark Company intercom system modules will operate normally from the M3116, with no changes required. A M3116 plus external 24 volt DC source is directly interchangeable with the A.C. operated M3111 power supply.



Model M3115 Schematic



Model M3116 Schematic

**APPLICATION NOTE  
M3131 POWER AMPLIFIER  
WITH PUSH-TO-PAGE FEATURE  
(Nearest Equivalent, Model 4PA-V2)**

**INTRODUCTION**

The M3131 is a general purpose audio power amplifier that is designed to drive loudspeakers and headset earphone circuits.

**PHYSICAL CHARACTERISTICS**

The M3131 module is designed to fit into a standard electrical wiring box that is at least 2 inches deep. It occupies one "space", or the equivalent of one duplex outlet, and may be covered with any cover plate. There is no electrical connection to the mounting frame. Any number of intercom modules may be nested together using a multiple gang box.

The M3131 may also be mounted behind a panel by drilling a clearance hole for the potentiometer, and holding the module to the back of the panel by using a 6-32 screw that would normally hold the cover plate on.

The rear of the amplifier has an 8 terminal strip which gives access to the circuitry. The easiest crimp terminal to use is an insulated, slotted-tongue flanged spade, such as the AMP P/N 324608 or an equivalent.

Although every effort has been made to properly ground the amplifier, any high gain circuit may be susceptible to radio frequency fields. To minimize this effect, the box into which the amplifier is mounted should be connected to the intercom system ground. A short pigtail fastened to a box mounting screw and connected to a ground terminal on the amplifier usually will work.

**ELECTRICAL CHARACTERISTICS**

The M3131 operates into a 4-wire intercom line which has +24 Volts DC, ground, a talk line (input to amp), and a listen line (output from amp). In normal use, headset stations are connected to the amplifier's input, and the output is connected to loudspeakers or to headset earphones via the headset stations. At no time may the amplifier see a load across its output terminals of less than 16 ohms. This can be made up of headset earphones, loudspeakers, or both. Maximum loads might be thirty-two 600 ohm headsets, or nine 150 ohm headsets, or three 45 ohm speakers, or one 16 ohm loudspeaker. Any combination may be used, as long as the parallel combination of all loads is not lower than 16 ohms. The M3131 is rated at 2 watts continuous power into a 16 ohm resistive load.

The amplifier is equipped with a volume control. If the signal coming from someone's headset station is so strong that it overloads the amplifier, turn down this volume control. Turning down volume controls on headset stations will not stop the overloading. The overloading sounds like a harshness or fuzziness, and is due to "clipping" of the amplifier. Since the volume controls in the headset stations appear after the amplifier, they can only turn down a signal that is already distorted.

The M3131 Amplifier has a push-to-page feature. To utilize this feature, a second M3131 amplifier (in addition to system amplifier) must be used, and a headset station with a push-to-page button must be connected, (such as our Models M3142, U3411, and U3211 ) The user at one of these stations pushes his button, which causes his voice to come over an external speaker running from the second M3131. When the button is not pushed, the external speaker is silent.

A push-to-page system is desirable for use in areas where headset stations are not always manned. When the person hears himself being paged over the loudspeaker, he goes to the nearest headset station to communicate.

The amplifier has two inputs. One is used for the push-to-page application, and the other is used for the "normal" always-on application. Always-on operation is used for powering headsets in a regular intercom system, or for powering always-on monitoring speakers. The push-to-page input has a diode switch. The switch is turned on when an activated push-to-page button on a headset station puts DC on the talk line. Because the switch can't discriminate where the DC is coming from, everybody talking at that moment on the intercom system can be heard over the paging speaker, even if only one push-to-page button is activated.

To use the push-to-page feature, it may be necessary to add a capacitor. If the talk line impedance is established by the M3162 Module, no additional parts will be needed. If the talk line impedance is established by a fixed resistor, that fixed resistor must be in series with a 10pF 25 WVDC capacitor, with the (+) end towards the talk line.

The M3131 is an integrated circuit amplifier which will turn itself off if it overheats, or if a short accidentally appears across its output. When the short is removed, or after it cools down, the amplifier will automatically start again. If the M3131 stops working, or works intermittently, see if the Integrated circuit, or the copper heat sink, is getting hot. It might be caused by having a load of lower than 16 ohms, by inadequate ventilation, or by system oscillation. Oscillation may be supersonic, in which case an oscilloscope will be necessary to detect it.

**SPECIFICATIONS**

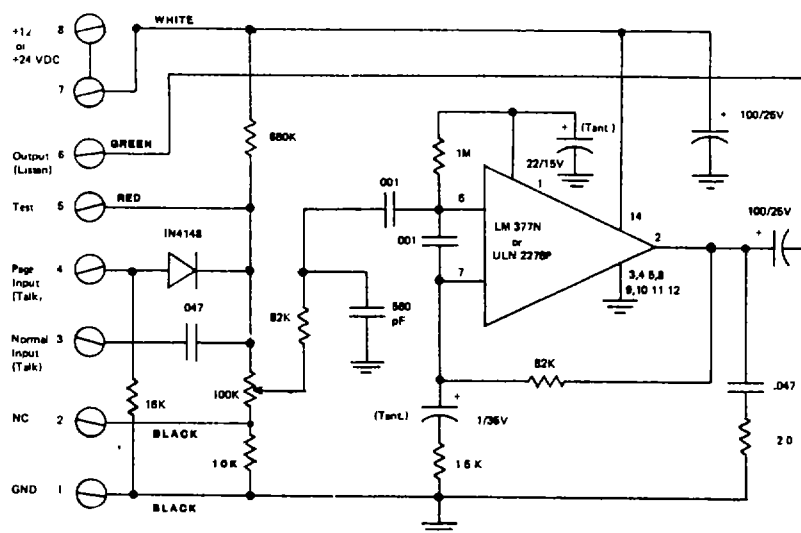
The M3131 is an IC amplifier with an 80,000 ohm input Impedance. It is rated at 2 watts continuous power output into a 16 ohm resistive load, with a 24 VDC supply. It also may be operated with an external 12 volt DC power source, in which case the maximum output is 0.5 watts into a 16 ohm load. The M3131, with a gain of 32±1 dB, has an input sensitivity of 0.13 volts rms for 5.2 volts rms output.

Capacitors are used to contour the frequency response to within +3 dB from 150-5000 Hz for best speech-to-noise ratio. A DC supply bypass capacitor of 100uF is on each board.

Heatsinking is not adequate for loads lower than 16 ohms at rated output. Also, the output coupling capacitor will limit low frequency response to a frequency above 150 Hz if a lower load impedance is used.

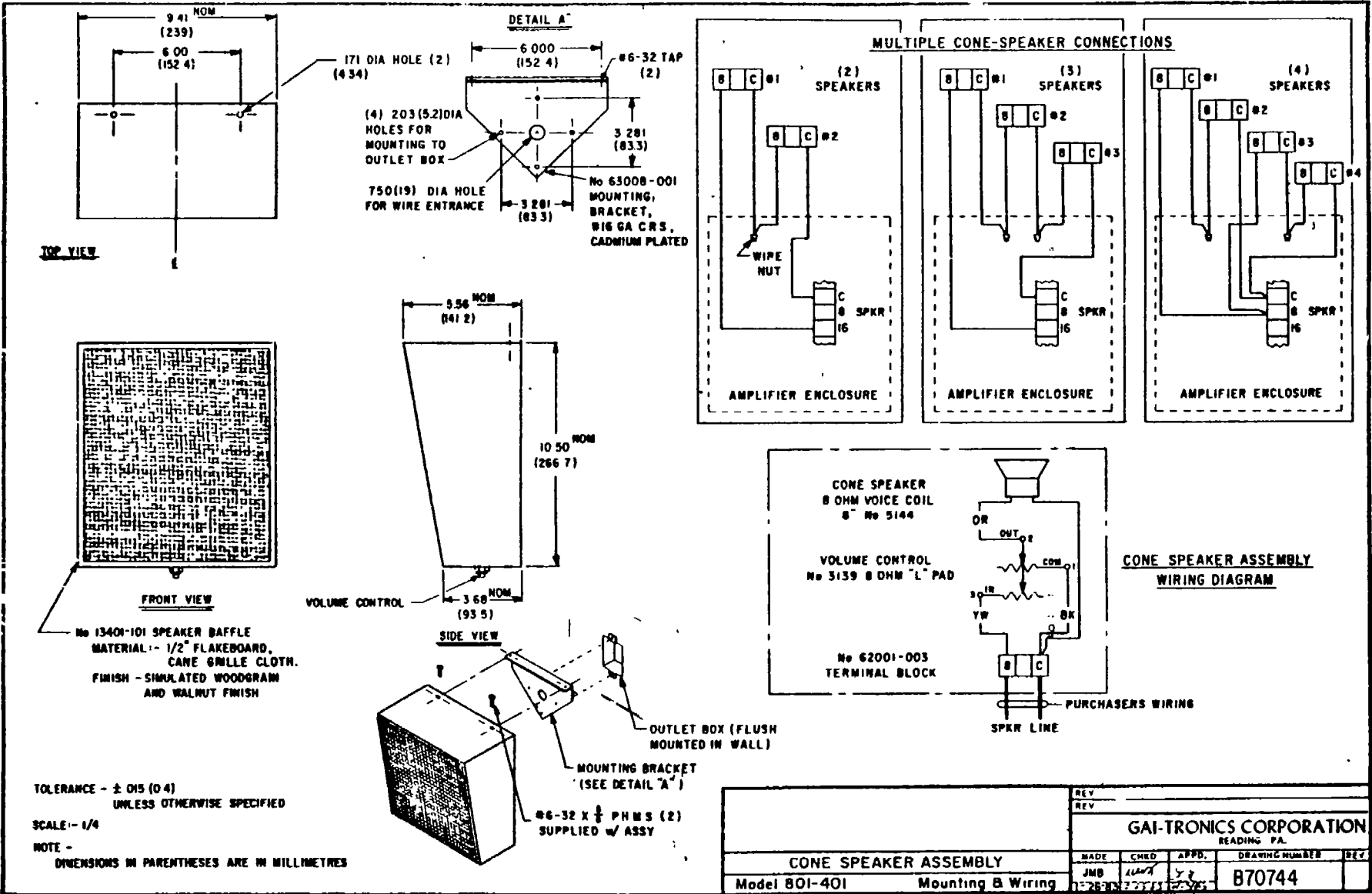
The diode coupled input is used for push-to-page operation. The diode is back biased at 4 to 5 volts DC. When a push-to-page button on a headset station is activated, the talk line is raised to approximately 12 VDC through a 16,000 ohm resistor in the headset station. This forward biases the diode, and "turns on" the input. There is also a conventional capacitor-coupled input for normal operation. Both inputs may not be used at the same time.

NOTE. A 16,000 ohm resistor is connected between the diode-switched input and ground to establish the push-to-page "on" bias (12 VDC) and to aid in switching the diode "off" when the DC is removed. If more than one push-to-page amplifier is used in a given system, this resistor must be clipped out from all but one of the amplifiers that are used in the push-to-page mode. This resistor is located on the M3131 terminal block between pins 4 and 1.



All resistors in ohms 1/4 watt 5%  
All capacitors in uF except where noted

Model M3131 Amplifier Schematic



REV		REV		GAI-TRONICS CORPORATION READING PA.	
CONE SPEAKER ASSEMBLY		MADE	CHKD	APPD.	DRAWING NUMBER
Model 801-401 Mounting & Wiring		JMB	WJA	52	B70744

## APPENDIX C

## Preventive maintenance checks and services (PMCS) for the Communications System

## C-1 Introduction to PMCS

## NOTE

**TM 55-1930-209-14&P-19 contains PMCS FOR systems on the ROWPU Barge. This appendix contains only PMCS for the Communications System**

## a. General

- (1) Systematic (B) before, (D) during, (A) after, and scheduled periodic PMCS are essential to ensure that the Reverse Osmosis Water Purification Barge is in operational readiness at all times. The purpose of the PMCS program is to discover and correct deficiencies and malfunctions before they cause serious damage or failure of the barges and their support systems. An effective PMCS program requires that operators report all unusual conditions noticed before, during and after operation as well as while performing periodic PMCS. All deficiencies and malfunctions discovered during maintenance inspections must be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).
- (2) A schedule for preventive maintenance inspections and service should be established and adhered to. When operating under unusual conditions, such as extreme heat or cold, it may be necessary to perform PMCS more frequently.
- (3) The PMCS items have been arranged and numbered in a logical sequence to provide for greater efficiency and the least amount of downtime required for maintenance.

## b. PMCS columnar entries.

- (1) Item Number Column. Checks and services are numbered in chronological order regardless of interval. This column is used as a source of item numbers for the "Item Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.
- (2) Interval Column. The interval columns tell you when to do a certain check or service, before, during, or after operation. Sometimes a dot may be placed in more than one interval column which would mean you should do the check or service at each of those intervals.
- (3) Item to Be Inspected Column. This column lists the common name of the item to be inspected such as "Air Filters."
- (4) Procedures Column. This column tells you how to do the required checks and services. Carefully follow these instructions.
- (5) Equipment is Not Ready/Available if Column. This column tells you when and why your equipment cannot be used.

## NOTE

The terms "Ready/Available" and "Mission Capable" refer to the same status: equipment is on hand and is able to perform its combat missions. (See DA PAM 738-750).

- (6) Increased Inspections Perform weekly as well as Before Operations PMCS If:
  - (a) You are the assigned operator and have not operated the item since the last weekly PMCS.
  - (b) You are operating the item for the first time.
- (7) Leakage definitions. In checking for fluid leaks, the following leakage definitions apply to all ROWPU barges and barge equipment, product water, and seawater leakage by class type.
  - (a) Class I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
  - (b) Class II - Leakage of fluid great enough to form drops, but not enough to cause drops to drip from the item being checked/inspected.
  - (c) Class III - Leakage of fluid great enough to form drops that fall from the Item being checked/inspected.

### CAUTION

**Equipment operation is allowable with minor leakages (Class I or II). However, the fluid level or operating pressure of the Item being checked/inspected must be considered. When in doubt, notify the shift leader or bargemaster.**

**When operating with Class I or Class II leaks, continue to check fluid levels as required by PMCS and operating instructions.**

- (8) The following fuel and hazardous material leakage procedures apply for any fuel, chemical, or bilge system.

### WARNING

**Class I, II or III leaks or seepage occurring in a fuel, chemical, or bilge container, tank, line, piping, or valve can cause fire or health hazards.**

- (a) If any leaks or seepage from a fuel, chemical, or bilge container, tank, or fluid line is detected, it must be immediately reported to the shift leader or bargemaster for corrective action.
- (b) To prevent combustible or toxic fumes from collecting or contaminated material from spilling, exercise extreme caution after detecting leaks or seepage of flammable or hazardous material.
- c. Continuous operation When equipment must be kept in continuous operation for extended periods of time, check and service only those items that can be checked and serviced without disturbing operations. Perform complete checks and services when the equipment can be shut down.
- d. Maintenance log Always record the time and date of PMCS, any deficiencies noted, and corrective action taken in the PMCS log book.

**C-2 Major components.** The communications system consists of an Army radio, commercial marine radio, and three walkie-talkies. The major components of the communication system are listed in Chapter 1 with basic functions and location on the barge.

**C-3 Communications system description.** This system consists of the methods of communication described below.

**C-3.1 Radio communications equipment.** This equipment, located in the barge dayroom and cabin of the workboat, consists of the type AN/VRC-46 High Frequency (HF) Frequency Modulation (FM) Army issue radio (hereafter called the HF/FM Army radio), a Very High Frequency/Frequency Modulation (VHF/FM) commercial marine radio, and Ultra High Frequency (UHF) FM handheld walkie-talkie transceivers.

**C-3.2 Army radio.** The HF/FM Army radio provides communications with other stations equipped with radio frequencies reserved for military (primarily US Army) use. This radio enables the barge to communicate with its towing vessel, other military support vessels, military shore-based radio stations, and military aircraft. Transmission distance is normally 25 miles or less.

**C-3.3 Commercial marine radios.** These provide VHF/FM radio communications between workboat and barge and between workboat or barge and other vessels equipped with radios working these same channel frequencies. Transmission distance is normally 25 miles or less.

**C-3.4 Walkie-talkies.** These preset, crystal-controlled, hand-held, nickel cadmium (ni-cad) battery-powered portable radios can be preset to the same frequencies available on commercial marine radio channels. They provide VHF/FM communications between crew personnel onboard, between shore and crew personnel, and between crew personnel on workboat and barge. Transmission distance is normally 5 miles or less.

**C-3.5 Foghorn equipment.** This equipment sounds the foghorn to warn oncoming vessels of barge location during poor visibility.

**C-3.6 Telephone system.** This system provides intercommunications between dayroom system operator and crewmembers at any telephone station on the barge.

Telephone stations provide jack receptacles for connecting a headset. By using dayroom telephone equipment, operator can page and communicate with personnel at any telephone station. When on line with operator, crewmembers at telephone stations can communicate with operator or crewmembers plugged into other stations.

**Table C-1. Preventive Maintenance Checks and Services for Communications Systems**

B – Before  
 D – During  
 A – After  
 D – Daily  
 W – Weekly  
 M – Monthly  
 Q – Quarterly  
 S – Semiannually  
 A – Annually

ITEM NO.	INTERVAL										ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF
	B	D	A	D	W	M	Q	S	A				
1											COMMUNICATION SYSTEMS Radio System	<p style="text-align: center;"><b>WARNING</b></p> <p><b>Do not touch Army radio antenna while radio is operating. Antenna contains high voltage which will seriously injure a person touching the antenna during transmissions.</b></p> <p><b>Be sure that electrical power is OFF before performing any maintenance on electrical (communication) systems. Redtag appropriate switches and circuit breakers with: "WARNING – DO NOT ACTIVATE. REPAIRS BEING MADE." Observe all safety precautions listed at the beginning of this manual.</b></p> <p>a. Make sure Army and Marine radio installations are complete, connected to a power source and electrically connected.</p> <p>b. Make sure walkie-talkie battery pack is fully charged. Replace if necessary.</p> <p>c. Check battery charger indicator lights for proper operation. Notify shift leader or bargemaster for corrective action.</p>	Battery charger indicator lights inoperable.



Table C-1. Preventive Maintenance Checks and Services for Communications Systems (Continued)

B – Before  
 D – During  
 A – After  
 D – Daily  
 W – Weekly  
 M – Monthly  
 Q – Quarterly  
 S – Semiannually  
 A – Annually

ITEM NO.	INTERVAL										ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF
	B	D	A	D	W	M	Q	S	A				
												<p align="center"><b>CAUTION</b></p> <p>Use only clean water and a cloth to clean plastic surfaces. Do not paint plastic surfaces. Damage to plastic will result if cleaned with solvent or painted. Avoid damage to insulation and mounting system. DO NOT impair electrical/electronic properties of item being cleaned. DO NOT use solvents to clean internal parts of electrical/electronic components.</p> <p>d. Clean components as follows:</p> <ol style="list-style-type: none"> <li>1) Vacuum internal portions of electrical components.</li> <li>2) Wipe dirt from external components, except plastics, with dry cheesecloth or, if necessary, with a soapy cloth. Cloth should be damp, but not dripping wet.</li> </ol> <p>e. Check controls of components for missing, loose or broken knobs. Check that controls turn properly.</p> <p>f. Check for loose plugs and jacks. Tighten if necessary.</p> <p>g. Check for loose, missing or broken mountings, hardware brackets, etc. Tighten or replace as necessary.</p> <p>h. Check for proper installation and operation of Army and Marine radio antennas.</p> <p>i. Check for normal operation of radios. Notify shift leader or bargemaster of malfunctions so that corrective action can be taken.</p> <p>j. Check antenna base for collection of water. Drain if necessary.</p> <p>k. Check for frayed or damaged cables. Replace as necessary. In cold weather, do not bend cables or cords.</p> <p>l. Make sure connector/receptacle pins on interconnecting cables are straight and free of corrosion and rust. Straighten pins and remove rust as necessary.</p>	<p>Antennas inoperable.</p> <p>Cables frayed or damaged.</p>

Table C-1. Preventive Maintenance Checks and Services for Communications Systems (Continued)

B - Before  
D - During  
A - After

D - Daily  
W - Weekly  
M - Monthly

Q - Quarterly  
S - Semiannually  
A - Annually

ITEM NO.	INTERVAL										ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF
	B	D	A	D	W	M	Q	S	A				
2	•		•		•						Foghorn Equipment	a. Check for complete installation of foghorn equipment. b. Check for corrosion or rust. Clean and touch up paint as necessary in accordance with TB 43-0144 to match surrounding area. DO NOT paint threads or labels. c. Check controls for missing, loose or broken switches and pushbuttons. d. Check for normal operation of foghorn. Foghorn should sound at 18 second intervals. In cold weather, allow foghorn remote control to warm up before sounding foghorn. Notify shift leader or bargemaster so that malfunction can be corrected. e. Check for loose plugs and jacks. Tighten as necessary. f. Check for loose mountings, hardware, brackets, etc. Tighten as necessary. g. Check for frayed or damaged cables. Replace if necessary.	Installation incomplete.  Switches and pushbuttons missing, loose or broken.  Foghorn does not sound at 18 second intervals.  Cables damaged or frayed.
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	•		•		•								
	•		•		•								
	•		•		•								
3	•		•		•					Telephone System	a. Check for complete installation of telephone system components. b. Check for corrosion or rust. Clean and touch up paint as necessary in accordance with TB 43-0144 to match surrounding area. DO NOT paint threads or labels. c. Check controls for missing, loose or broken switches and pushbuttons. d. Check for normal operation of phone. Notify shift leader or bargemaster so that malfunction can be corrected. e. Check for loose plugs and jacks. Tighten as necessary. f. Check for loose mountings, hardware, brackets, etc. Tighten as necessary. g. Check for frayed or damaged cables. Replace as necessary.	Switches or pushbuttons missing or broken.  Cables frayed or damaged.	
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**By Order of the Secretary of the Army:**

GORDON R. SULLIVAN  
General, United States Army  
Chief of Staff

Official:

MILTON H. HAMILTON  
Administrative Assistant to the  
Secretary of the Army  
06920

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## THE METRIC SYSTEM AND EQUIVALENTS

### Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

### Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

### Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. in.  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

### Square measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. in.  
 1 sq. decimeter = 100 sq. centimeters = 15.5 inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. ft.  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 hectometers = .386 sq. miles

### Liquid Measure

1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 metric ton = 10 quintals = 1.1 short tons

### Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce inches	newton-meters	.0070062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
sq. inches	sq. centimeters	6.451	kilometers	miles	.621
sq. feet	sq. meters	.093	sq. centimeters	sq. inches	.155
sq. yards	sq. meters	.836	sq. meters	sq. yards	10.764
sq. miles	sq. kilometers	2.590	sq. kilometers	sq. miles	1.196
acres	sq. hectometers	.405	sq. hectometers	acres	2.471
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
cubic yards	cubic meters	.765	milliliters	fluid ounces	.034
fluid ounces	milliliters	29.573	liters	pints	2.113
pints	liters	.472	liters	quarts	1.057
quarts	liters	.946	grams	ounces	.035
gallons	liters	3.785	kilograms	pounds	2.205
ounces	grams	28.349	metric tons	short tons	1.102
pounds	kilograms	.454	pound-feet	newton-meters	1.356
short tons	metric tons	.907			
pound inches	newton-meters	.11296			

### Temperature (Exact)

°F Fahrenheit temperature

5/9 ( after subtracting 32)

Celsius Temperature °C

