DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-264B

TO 31R2-2GRC-26-81

RADIO SET AN/GRC-26D

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1957

6268A—May

WARNING

EXTREMELY DANGEROUS VOLTAGES EXIST AT ANTENNA TERMINALS

Be careful when working around the transmitter of this equipment.

Be careful when working on the high-voltage connections or any power connections when using this equipment. Turn off the power and discharge all high-voltage capacitors before making any test connections or doing any work inside the equipment.

TECHNICAL MANUAL
No. 11–264B
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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *7 May 1957*

RADIO SET AN/GRC–26D

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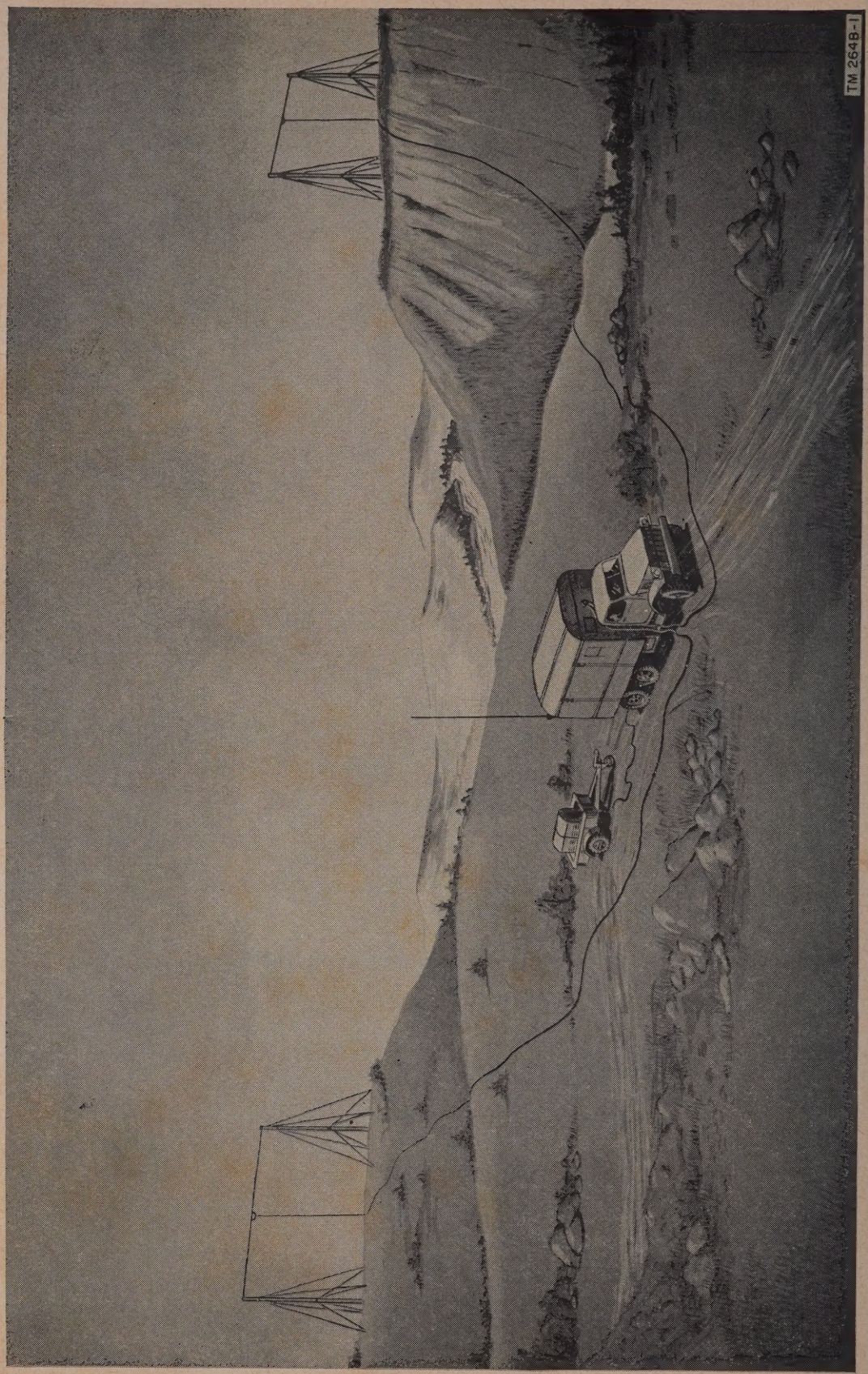


Figure 1. Radio Set AN/GRC-26D.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions cover the installation, operation, maintenance, and repair of Radio Set AN/GRC–26D (fig. 1). Theory and maintenance of Radio Modulator MD–239A/GR, Radio Set Control C–1123/GRC, and Remote Switching Control C–1474/GRC are discussed in detail. Detailed information pertaining to the theory and maintenance of the remainder of the major components comprising Radio Set AN/GRC–26D are contained in manuals listed in *b* below.

b. The components and their respective manuals are listed below. The table of components is included in the appendix. All components of Radio Set AN/GRC–26D are inside the packing case listed in paragraph 15.

Components	Manual	Title
Frequency Shift Converter CV–116B/URR	TM 11–2241	Frequency Shift Converters CV–116/URR, CV–116A/URR, and CV–116B/URR.
Antenna Tuning Unit BC–939–B	TM 11–809	Radio Transmitters T–368/URT, T–368A/URT, T–368B/URT, and T–368C/URT and Antenna Tuning Unit BC–939–B.
Radio Transmitter T–368C/URT	TM 11–809	
Generator Set PU–248/U	TM 11–904	Power Units PE–95–A, –B, –C, –F, –G, –H, –I, and –K.
Teletypewriter Set AN/FGC–20X	TM 11–2230	Teletypewriter Set AN/FGC–20, AN/FGC–20X, AN/FGC–21.
Telephone Set TA–43/PT	TM 11–337	Telephone Sets TA–43/PT and TA–263/PT.
Reperforator-Transmitter Teletypewriter TT–76/GGC.	TM 11–2225	Reperforator-Transmitter Teletypewriter TT–76/GGC.
Radio Receiver R–390/URR or	TM 11–856	Radio Receiver R–390/URR.
Radio Receiver R–390A/URR (can be interchanged with Radio Receiver R–390/URR).	TM 11–856A	Radio Receiver R–390A/URR.

c. Forward comments on this publication directly to Commanding Officer, the United States Army Signal Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

a. Unsatisfactory Equipment Reports.

(1) Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, United States Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

(2) Fill out and forward AFTO Form 29 (Unsatisfactory Report) to Commander, Air Materiel Command, Wright-Patterson Air Force Base, Ohio, as prescribed in AF TO 00–35D–54.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army).

c. Preventive Maintenance Forms.

(1) Prepare DA Form 11–238 (Operator First Echelon Maintenance Check List

for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar)) (fig. 22), in accordance with instructions on the back of the form.

(2) Prepare DA Form 11–239 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar)) (fig. 23), in accordance with instructions on the back of the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Set AN/GRC–26D is a mobile self-contained radioteletype communication center which can be operated while in motion or when at halt (fig. 1). It operates over a frequency range of 1.5 to 20 megacycles (mc) with a power output of approximately 450 watts.

b. Radio Set AN/GRC–26D provides facilities for transmission and reception of frequency-shift keying (fsk), amplitude-modulated (am), continuous-wave (cw), and combination of frequency-shift keying and amplitude-modulated (fsk-am) signals. The radio set is used primarily for fsk service. Normally, am or cw service is used only in an emergency or when operating conditions prevent the use of the fsk facilities. Station-to-station voice communication may be superimposed upon an fsk signal without modifying or recabling the equipment. Radio Set AN/GRC–26D can be controlled from Radio Set Control C–1123/GRC in the shelter, or from Remote Switching Control C–1474/GRC up to a distance of 10 miles.

c. Radio Set AN/GRC–26D may be used in duplex or in one-way reversible (half-duplex) operation. When in motion, only one-way reversible operation is possible because of the nearness of the receiving and transmitting whip antennas mounted on the shelter. When at halt, doublet antennas can be erected to provide the physical separation necessary between transmitting and receiving antennas to allow duplex operation.

4. Technical Characteristics

The technical characteristics of Radio Set AN/GRC–26D are as follows:

Frequency range for transmission.	1.5 mc to 20 mc.
Frequency range for reception.	.5 to 32 mc.
Distance range for transmission.	Over 100 miles.
Types of signals transmitted.	Cw, am, fsk, and fsk-am.
Antennas:	
Fixed-station operation.	Doublet of proper length to match operating frequency or long-wire with antenna tuning unit.
Mobile operation	Whip-type with antenna tuning unit.
Input power requirement	115 volts, 50 cps to 60 cps, single phase.
Power consumption	5 kilowatts (kw) (approx).
Power output:	
Cw	450 watts (approx).
Am	400 watts (approx).

a. Radio Modulator MD–239A/GR.

Frequency range	1.5 mc to 3 mc.
Frequency shifts	850 cps, 425 cps, 212.5 cps, 106.25 cps.
Input signals required:	
Rf	3 to 5 volts.
Dc	60 milliamperes.
Input power requirements	115 volts, 50 cps to 60 cps, single phase.
Power consumption	200 watts (100 watts with crystal oven heaters off).
Output voltage	3 to 5 volts.
Type of circuit	Double superheterodyne.
Frequency control	2 crystals.
Number of tubes	11.
Weight	50 pounds.

b. Radio Set Control C–1123/GRC.

Input power	115 volts, 50 cps to 60 cps, single phase.
Power consumption	15 watts.
Relay operating time	20 milliseconds (max).
Weight	10 pounds.

c. Shelter S–56A/G

Power source	Generator Set PU–248/U or commercial, 115 volts ac, 50 to 60 cps.

Power consumption (shelter only) (heater not included).	460 watts.
Weight (shelter less equipment).	2,470 pounds.
Weight (shelter with equipment).	5,660 pounds.

5. Nomenclature Assignment

Nomenclature and common names for components of Radio Set AN/GRC–26D follow:

Nomenclature	Common name
Radio Set AN/GRC–26D	Radio set
Radio Transmitter T–368C/URT	Transmitter
Radio Modulator MD–239A/GR	Fsk-modulator
Frequency Shift Converter CV–116B/URR.	Converter
Radio Receiver R–390/URR	Receiver
Antenna Tuning Unit BC–939–B	Tuning unit
Generator Set PU–248/U	Power unit
Radio Set Control C–1123/GRC	Control unit
Teletypewriter TT–98/FG	Teletypewriter
Reperforator-Transmitter Teletypewriter TT–76/GGC.	Reperforator
Remote Switching Control C–1474/GRC.	Remote control unit
Electrical Equipment Shelter S–56A/G.	Shelter
Telephone Set TA–43/PT	Telephone
Headset H–113/U	Headset
Microphone M–29/U	Microphone
Key KY–116/U	Key
Loudspeaker Assembly LS–206A/U	Speaker assembly
Electrical Equipment Cabinet CY–1807/G.	Equipment cabinet
Storage Cabinet CY–1721A/GRC	Storage cabinet

6. Description of Radio Set AN/GRC–26D

a. The radio set is comprised of two receivers, a transmitter, an fsk-modulator, a converter, tuning unit, control unit, reperforator, remote control unit, power unit, the shelter, two teletypewriters, three whip and three doublet antennas, interconnecting cables, and accessory components and spare sparts. The appendix lists a complete table of components. Figures 2 and 3 show interior views of the shelter.

b. All components of the radio set except the antennas, the remote switching control, and the trailer-mounted power unit are housed within the shelter during operation.

c. The radio set can be operated from a remote site by using the remote control unit (fig. 6).

d. The radio set receives its operating power from the power unit which is trailer-mounted.

7. Description of Electrical Equipment Shelter S–56A/G

a. The shelter (figs. 4 and 5) is an insulated steel and plywood structure used to house components of the radio set. A roof hatch, six wall windows, and the window in the rear door are provided with screens and shutters. The windows and roof hatch may be opened to provide ventilation. Interior wiring, electrical outlets, fluorescent lights, a window fan and a ventilating blower are permanent parts of the shelter.

b. The power for the operation of the radio set is connected to the shelter circuit breakers through the power input feed-through receptacle mounted in the rear wall of the shelter. The circuit breaker housing contains eight circuit breakers (fig. 2). Two are high current circuit breakers for the main alternating-current (ac) line; four are low current circuit breakers: one for the transmitter, one for lights, one for heater and fans, and one for the remainder of the equipment; two are not connected.

c. The shelter is mounted on a standard ordnance 80- by 144-inch cargo truck body for transportation or mobile operation. Lifting straps (fig. 5) are used when hoisting the shelter onto the truck. Two hold-down assemblies on each side of the shelter secure it to the cargo truck body. Four anchor rings are used to secure the shelter to the cargo truck if the truck bed is a wooden platform. The shelter can be removed from the truck body, when fixed-station operation is desired.

d. The connection between the doublet antennas and the receivers is made through the receiving doublet antenna feed-through receptacle on the front wall of the shelter. The connections to the remote line are made through the remote control unit feed-through receptacle in the curb wall side of the shelter (fig. 4). Connections to the whip antennas are made through feed-through receptacles in each whip

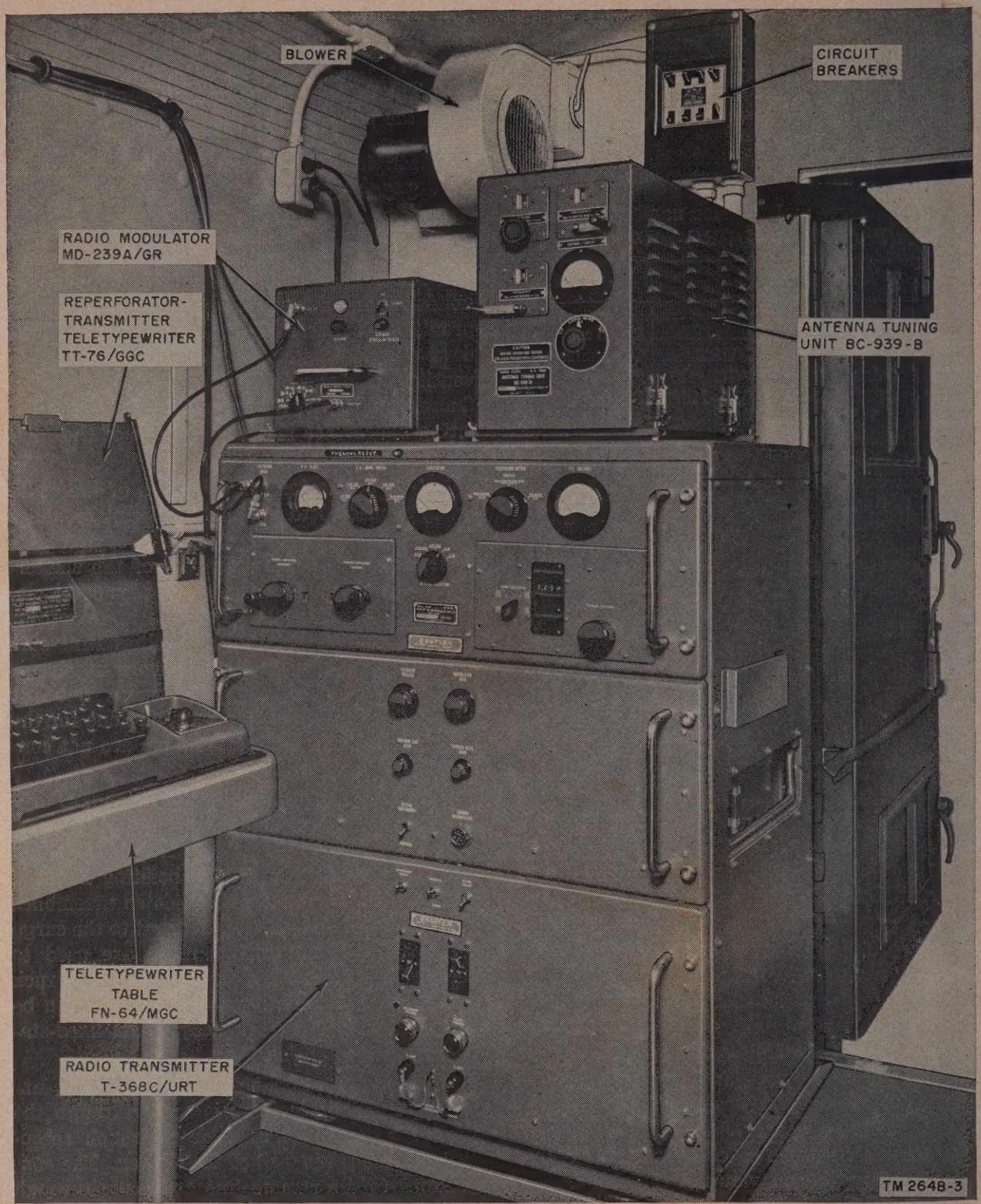


Figure 2. Radio Set AN/GRC-26D, interior rear view.

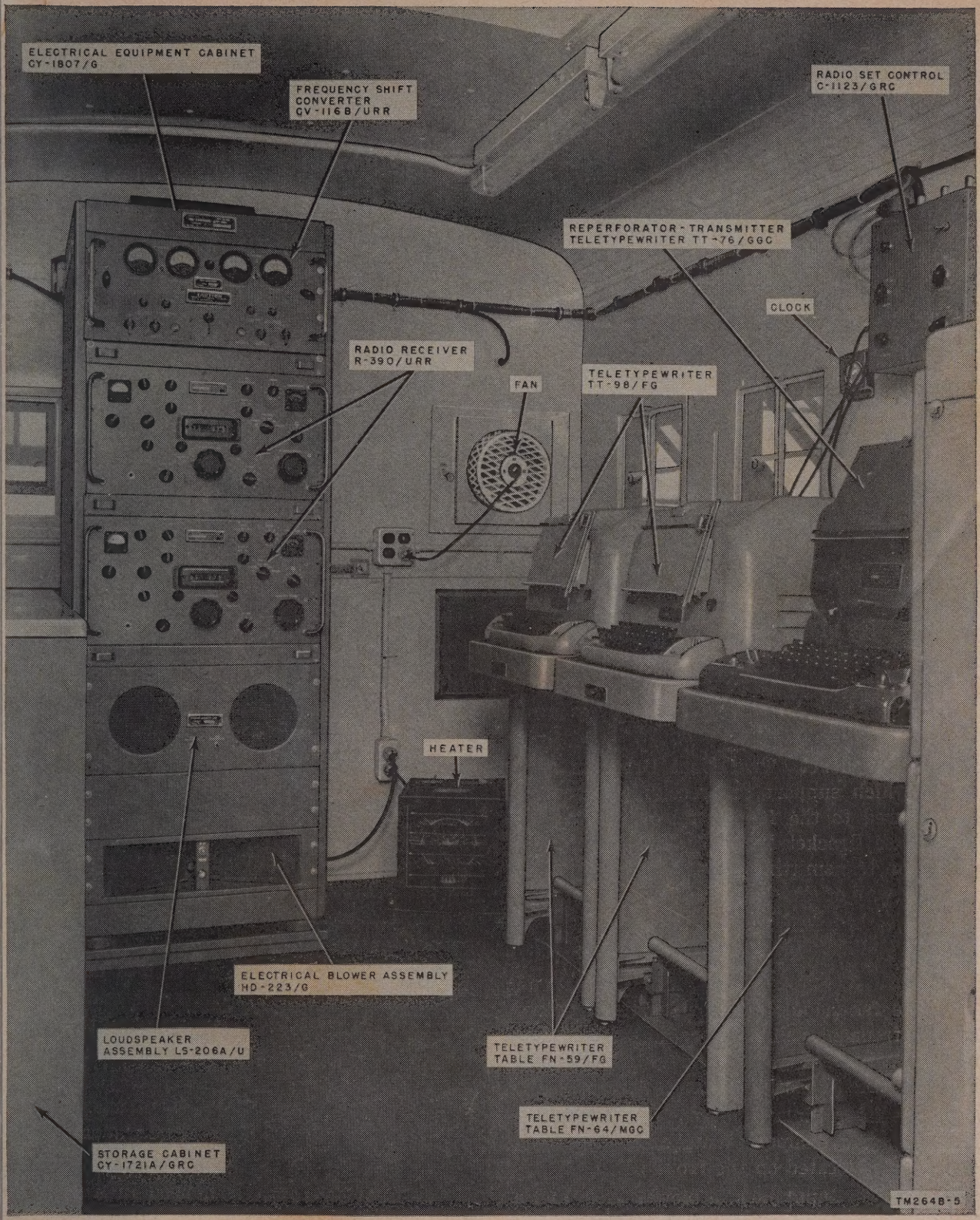


Figure 3. Radio Set AN/GRC–26D, interior front view.

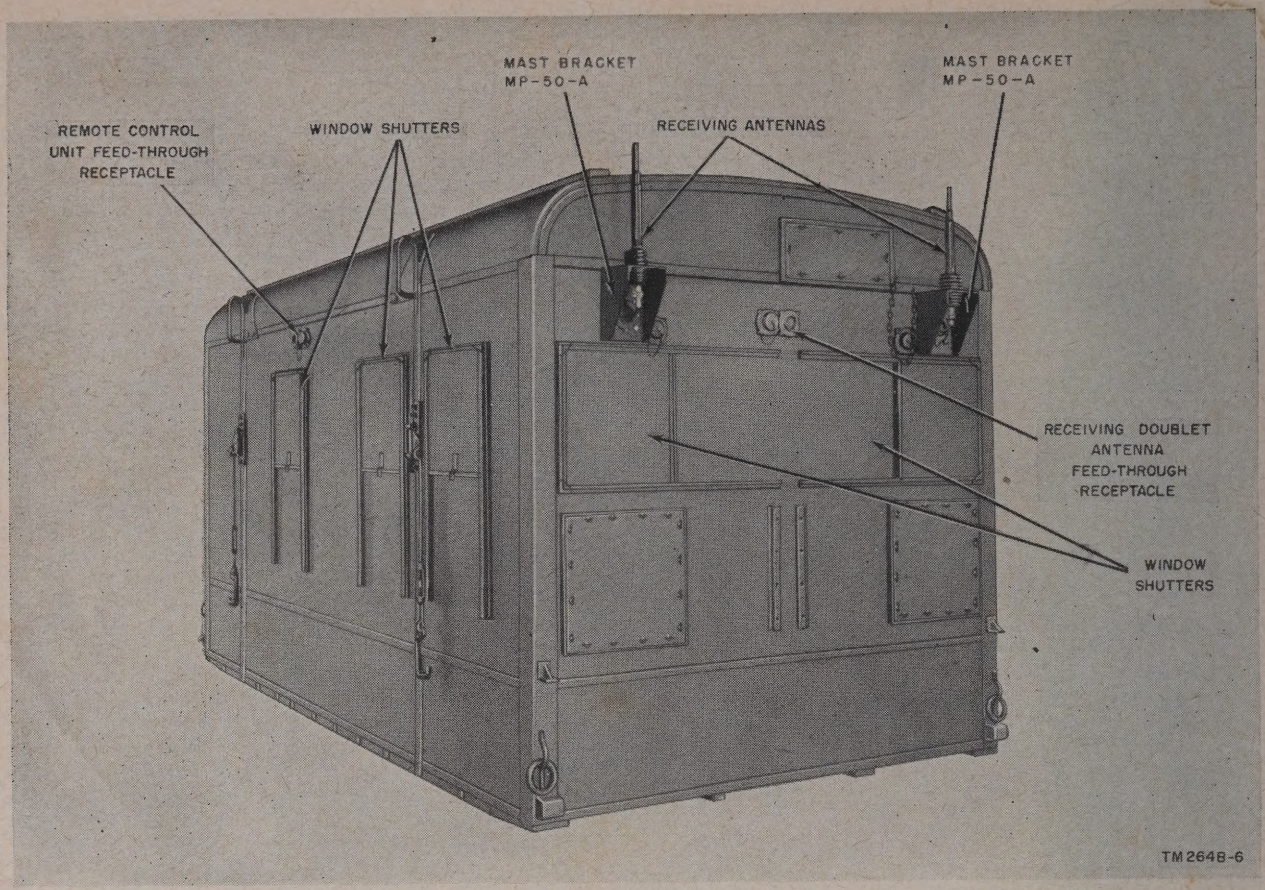


Figure 4. Electrical Equipment Shelter S–56A/G, front oblique view.

mounting bracket. Two Mast Brackets MP–50–A, which support the receiving antennas, are secured to the front wall of the shelter. Mast Base Bracket MT–657/GRC, which supports the transmitting antenna, is secured to the rear wall of the shelter.

8. Description of Radio Modulator MD–239A/GR

a. The fsk-modulator provides the required carrier frequency shift for radio transmission of teletypewriter signals. The fsk-modulator is bolted to the top of the transmitter (fig. 2).

b. The fsk-modulator chassis is contained in a smooth, gray enameled metal case. Operating controls are located on the front panel.

c. A power input jack, a blower jack, and a teletypewriter input jack are mounted on the rear of the chassis. A blower is mounted on the rear of the cabinet; ventilation screens are located near the front of the cabinet.

9. Description of Radio Set Control C–1123/GRC

a. The control unit (fig. 3) is the control center for the radio set. The control unit routes the signals to be transmitted or received to the proper components of the radio set for each particular type of operation (fsk, am, cw, and fsk-am). The control unit receives mark and space signals from the converter and directs them to the teletypewriter equipment. It receives the signals originating from the teletypewriter equipment and directs them to the fsk-modulator; signals initiated by a microphone, telephone, or key are directed to the transmitter.

b. The control unit is housed in a smooth, gray enameled metal case and mounted on the shelter wall above the teletypewriter equipment. Operating controls are located on the front panel. The top and two sides of the control unit

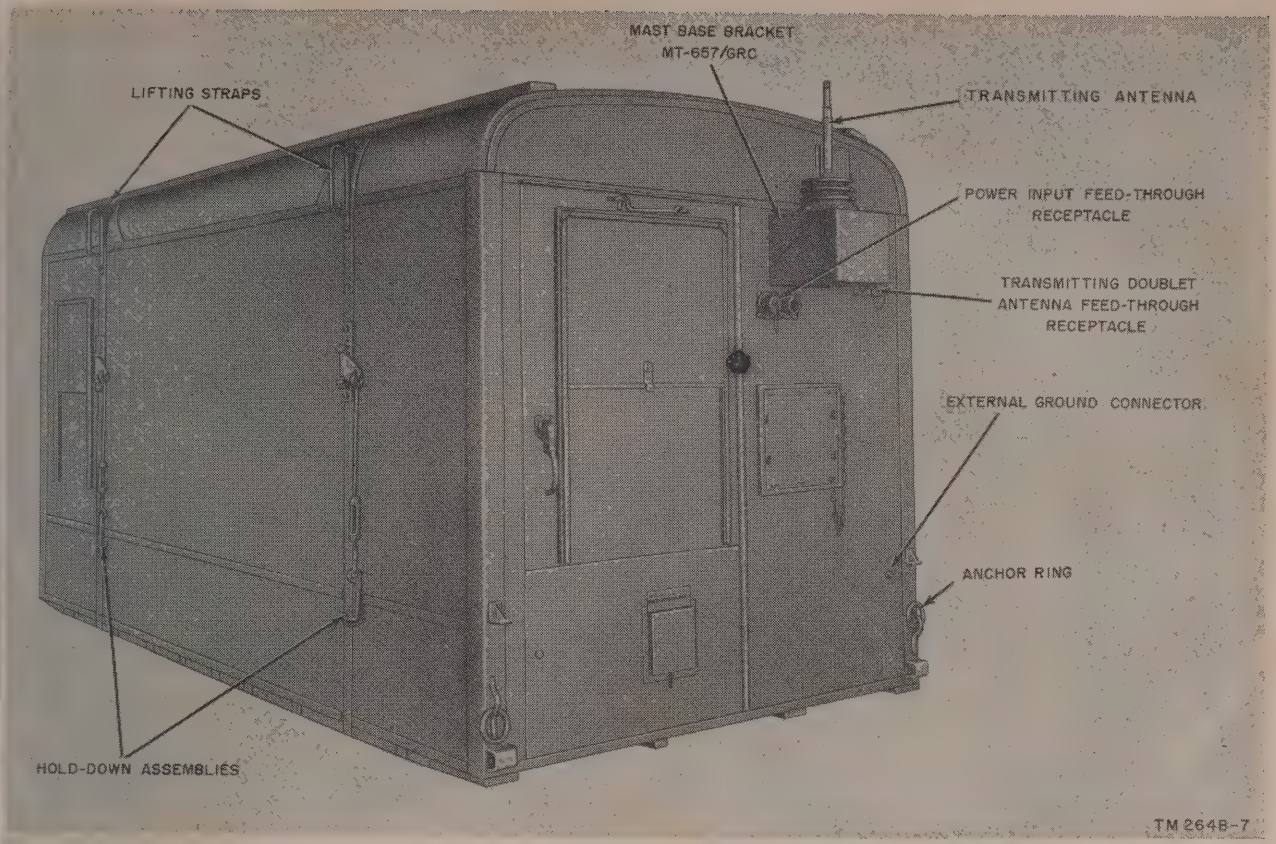


Figure 5. Electrical Equipment Shelter S–56A/G, rear oblique view.

contain jacks and binding posts for connections to the other equipments of the radio set.

10. Description of Remote Switching Control C–1474/GRC

a. The remote control unit (fig. 6) controls the operation of the radio set from a remote site.

b. The remote control unit consists of binding posts and jacks in a metal housing. On the right panel are four sets of binding posts: ONE WAY, REMOTE TEL., REC. DX, and LOCAL TEL. An XMTR ON switch is on the front panel and six telephone type jacks are mounted on the left panel. Below the jacks is a TTY SWITCH coaxial connector. A bracket on top is used for mounting the remote control unit.

11. Description of Electrical Equipment Cabinet CY–1807/G

a. The equipment cabinet (fig. 3) is a metal rack type cabinet used to house two receivers, a converter, speaker assembly, and Electrical Blower Assembly HD–223/G. Shock mounts at the base of the cabinet mate with tapped plates in the floor of the shelter. The equipment cabinet is also secured to the shelter wall with shock mounts.

b. The blowers are mounted in the bottom rack of the equipment cabinet. The speaker assembly is mounted above the blowers. The two receivers are positioned by guide rails in the two spaces above the speaker assembly and the converter is mounted on the top space on two sliding channel bars. All units except the converter are secured to the equipment cabinet with screws.

c. A stainless-steel utility table can be fastened to the front of the cabinet at three different positions, each position corresponding to the correct servicing height of the three major components in the cabinets. When not being used, the utility table is attached to the shelter wall by brackets.

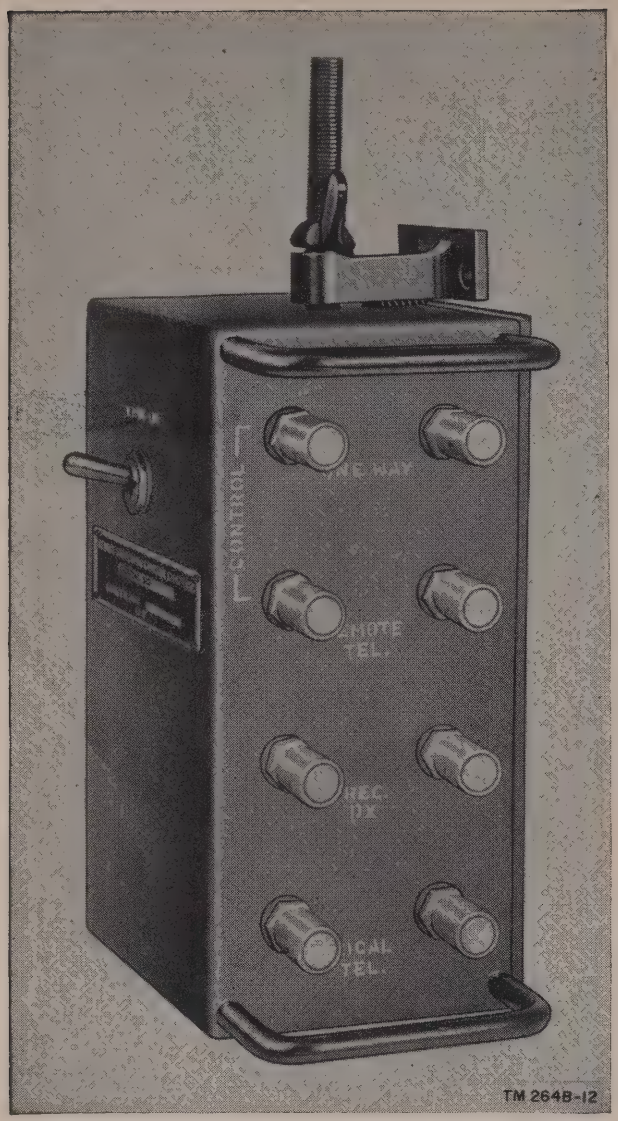


Figure 6. Remote Switching Control C–1474/GRC, oblique view.

12. Description of Antenna Equipment

a. Whip Antennas. One transmitting and two receiving whip antennas are furnished.

(1) Each receiving whip antenna consists of two Mast Sections MS–116–A, one Mast Section MS–117–A, and one Mast Section MS–118–A, assembled and inserted in Mast Base MP–65–B (fig. 9). Mast Base MP–65–B is mounted on Mast Bracket MP–50–A, which is secured to the front exterior wall of the shelter (fig. 4). The whips are tied down with insulated guy assemblies when the set is in motion.

(2) The transmitting whip antenna consists of three Mast Sections MS–116–A, one Mast Section MS–117–A, and one Mast Section MS–118–A, assembled and is inserted in Mast Base MP–76. Mast Base MP–76 (fig. 10) is mounted on Mast Base Bracket MT–657/GRC and secured to the rear exterior wall of the shelter (fig. 5). An insulated guy assembly is provided to tie the whip antenna in a horizontal position when the radio set is in motion.

b. Doublet Antennas. Six Masts AB–155/U (fig. 7) and 1,000 feet of Wire W–1 are furnished for the construction of half-wave doublet antennas. At the higher frequencies (4 to 20 megacycles (mc)), where shorter wire lengths are required, two Masts AB–155/U are used to support each doublet. Therefore, three antennas may be erected; two are used for receiving on space diversity bases and one is used for transmitting. Two RF Cable Assemblies CG–1334/U are used for receiving antenna lead-ins. One RF Cable Assembly CG–692/U (fig. 15) is used as a transmission line for the transmitting doublet. Figure 7 shows the components that make up one complete Mast AB–155/U.

13. Description of Minor Components

a. Operating Components.

(1) *Headset H–113/U.* The headset consists of two replaceable headphones, each having soft rubber earpieces. The headphones are mounted to a thin steel headband, which is covered by a cushioning material, and is adjustble to the contour of the head. The cord that connects the headphones is also protected by the cushioning cover and terminates in a plastic connector, which plugs into the headphones. From one plastic connector, a cable terminates in a telephone plug.

(2) *Telephone Set TA–43/PT.* The telephone set is a lightweight, rugged, waterproof, self-contained field telephone set. Turning the handle generates the power for ringing. Two batteries are fixed in position. The

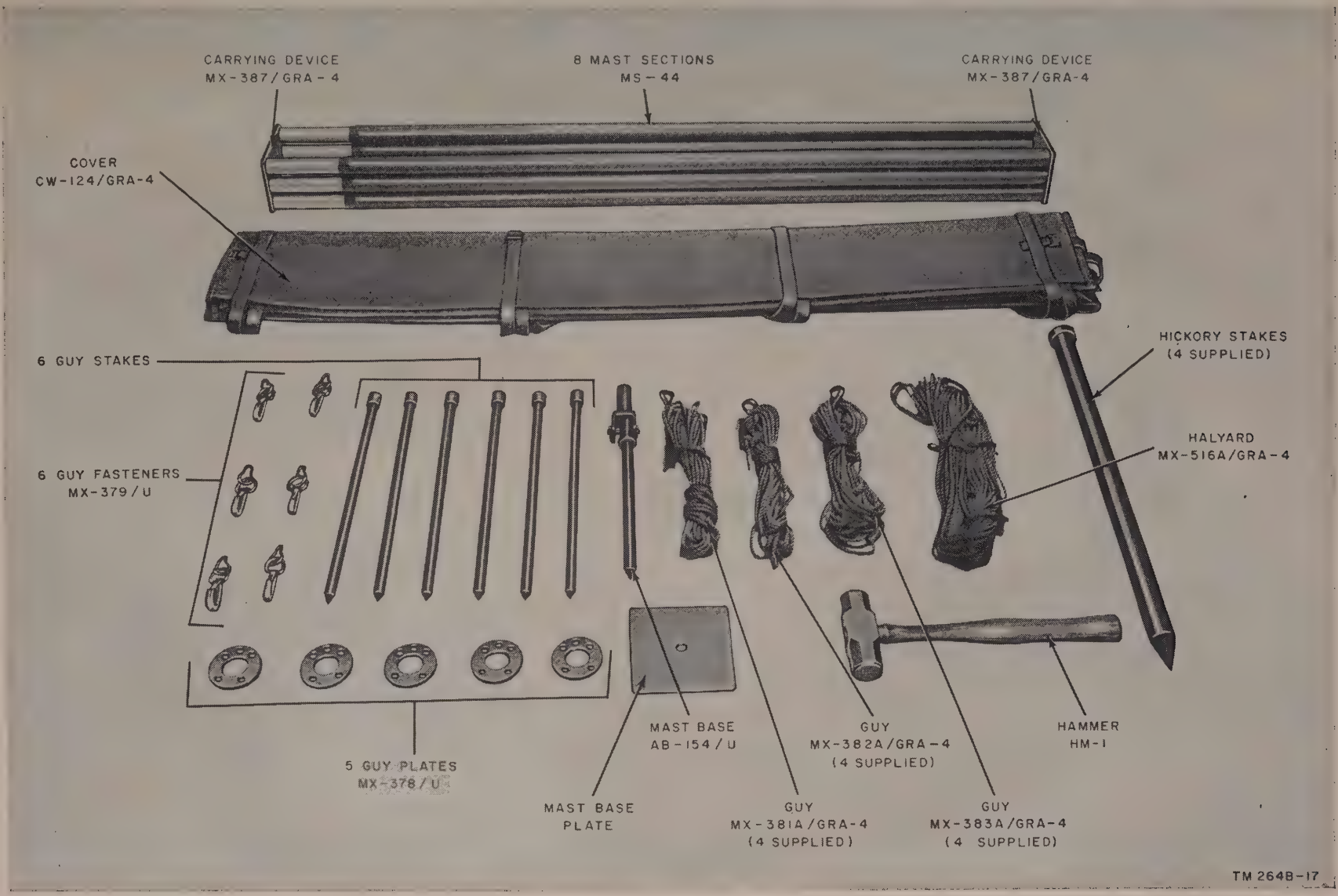


Figure 7. Mast AB–155/U, components.

handpiece is provided with a press-to-talk switch, and is connected by a cord to the case. This portable field telephone is used on either local or common battery telephone systems. The telephone set is mounted in a metal box, which is secured to the side of the storage cabinet.

(3) *Key KY–116/U.* The key is a hand-keying device provided with an adjustable metal band which can be placed around the thigh. The key is equipped with four brass screws for mechanical adjustments and two brass screws for connecting the key through Special Purpose Electrical Cable Assembly CX–1852/U to the control unit.

(4) *Microphone M–29/U.* The microphone is a unidirectional, low-impedance, carbon button, hand-held microphone. It is provided with a 3-wire cord terminating in an adapter plug on one end and in the microphone through a switch on the other. A metal hanger is provided at the top of the handle for storage when not in use. The microphone is connected to the MIC OR KEY JACK on the control unit and operated by the press-to-talk button on the handle.

(5) *Loudspeaker Assembly LS–206A/U.* The speaker assembly (fig. 3) consists of two permanent-magnet-type speakers housed in a smooth, gray enameled metal cabinet. Each speaker is baffled by its individual compartment and has its individual line-to-voice coil transformer. The connections to each speaker are made to terminal posts at the rear of the cabinet. Two toggle-type switches are mounted on the speaker panel for individual speaker control. The front panel has slots on each side for rack mounting.

(6) *Electrical Blower Assembly HD–223/G.* Electrical Blower Assembly HD–223/G (fig. 3) consists of two blowers mounted on a standard 19-inch rack. The rack exterior is finished in smooth gray enamel. An air cleaner element is provided for each blower. A toggle switch operating control and an indicator lamp are mounted on a vertical bracket in the center of the rack. The rack is mounted in the bottom section of the equipment cabinet.

b. Nonoperating Components.

(1) *Storage Cabinet CY–1721A1/GRC.* The storage cabinet (fig. 3) is positioned on the road side of the shelter and is secured to the shelter floor and wall by rotor-lock fasteners. The metallic cabinet has an exterior finish of smooth gray enamel. The table top of the storage cabinet is of formica material. Sliding drawers with rollers provide storage for minor components and accessories of the radio set. Within each drawer is a chart itemizing the contents.

(2) *Clock, type A–11.* This aircraft-type clock (fig. 3) is mounted in a metal case. The mounting frame has four holes which are used to mount the clock on the wall above the teletypewriter equipment.

(3) *Heater, electric.* The heater (fig. 3) is housed in a black metal case with a cast aluminum grid. It operates on 115 volts, 50- to 60-cycles, single-phase ac and consumes 1,500 watts. A thermal reset switch is located on the front panel below the grid. A fan mounted in front of the heater element circulates the heated air. A toggle switch, located on the top panel of the housing, allows the fan to be operated independent of heat, but heat cannot be turned on without placing the fan in operation. Four wing-type Dzus fasteners secure the heater to the floor of the shelter.

14. Running Spares

Running spares for the radio set are stowed in the storage cabinet, accessory, and/or overflow boxes. Refer to the table of components and to the chart within drawer No. 1 of the storage cabinet for parts location.

CHAPTER 2

INSTALLATION

15. Unpacking

a. Packaging Data. When packed for shipment, the components of the radio set are secured in the shelter. The shelter is then packed in a wooden crate. The packaged crate is 154 inches high, 88 inches deep, 91¼ inches wide, has a volume of 715½ cubic feet, and weighs approximately 8,152 pounds.

b. Removing Contents. Perform the steps outlined below when unpacking equipment. Save the original packing case and containers; they can be useful for repacking.

(1) Remove the lag screws from the top of the shelter crate (fig. 8). Remove the top first to facilitate the removal of the sides. Use nail pullers and crowbars for dismantling the crate.

(2) Have two men secure one side of the crate while a third man removes the lag screws that secures the side. Remove the side.

(3) Follow the directions in (2) above for removing the other side and then the ends of the crate.

(4) Unfasten the four holddown clamps from the crate base.

(5) Place the shelter in the desired location, using a suitable hoist, and continue unpacking.

(6) Remove caps, covers, and plugs over openings.

(7) Open the door and dismantle the wooden blocking frame and remove the desiccant bags. Avoid thrusting tools into cabinets, chests, and boxes.

(8) Remove all other ties used to secure the components within the shelter.

(9) Check the contents of each box against the packing list.

(10) For complete instructions on uncrating and unpacking the power unit, see TM 11–904.

16. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, refer to paragraph 2.

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against the table of components in the appendix.

c. If the equipment has been used or reconditioned, see whether it has been changed by a Modification Work Order (MWO). If modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see that this MWO number also appears on the schematic diagram of the manual accompanying the equipment; if not, add a note to the overall schematic diagram.

d. On other procurements, the transmitter is used only as a utility transmitter, and internal cabling requirements of the rf deck differ in utility use as compared to system use in the radio set. Check the rf deck for proper internal cabling as instructed in TM 11–809.

17. Siting

When locating the antennas, consider the following:

a. Radio signals are absorbed and sometimes reflected by nearby obstructions, such as hills, metal buildings, and bridges, or telephone lines that extend above the height of the antenna. Transmitted signals have a greater range when the antenna is as high above the ground as possible. Transmission and reception are best over water or level ground.

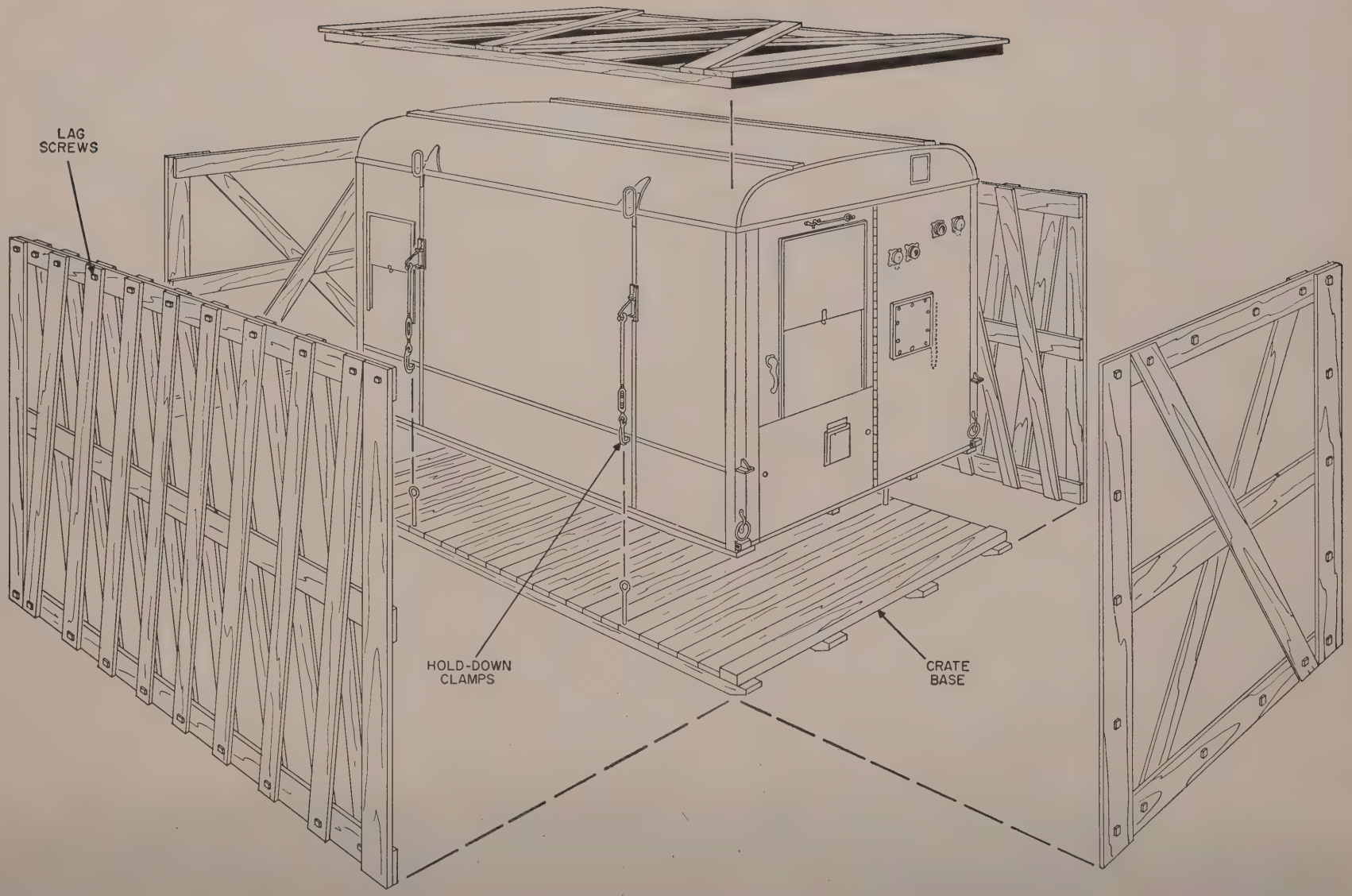


Figure 8. Removing packing crate from shelter.

b. If transmission and reception in all directions are required, place the antenna on the highest hill within the designated area.

c. When in rear areas, avoid placing the set near sources of electrical interference, such as power or telephone lines, radar sets, and field hospitals.

d. Try several locations within the general area and select the one that provides the best signals from the desired stations.

e. Enemy jamming action against the receiver is always a possibility. The effects of enemy jamming may be reduced by locating the antenna so that nearby obstructions act as a screen in the direction of probable sites of enemy jamming transmitters. This screening action may also reduce the transmitted signal strength in a direction toward the enemy and thereby make it more difficult for the enemy to intercept the signals.

f. For space diversity reception, a clear area suitable for the erection of two doublet receiving antennas is required. The receiving antennas should be separated by at least 3 wave lengths or more at the operating frequency, but the separation should not exceed 900 feet. The best reception is possible when the receiving antennas are perpendicular or broadside to the desired incoming signal and in line with transmitted signals from local installations. For each receiving antenna, it is desirable to have a clear level area, the size of which is determined by the frequency of operation. At 2 mc, each antenna will require an area of 285 feet by 50 feet, the long dimension being perpendicular to the direction of reception. At 18 mc, each antenna will require an area of 80 feet by 50 feet. The shelter should be midway between the two receiving antennas. If a long-wire transmitting antenna is used, an additional level area of approximately 200 feet by 40 feet is required. The center of the transmitting antenna should be approximately 30 feet from the shelter.

g. Where a large number of radio sets are in operation, careful layout of the numerous antennas is necessary. Improper layouts will cause mutual interference between the various radio sets. This interference may be great enough to affect the intelligibility of the incoming signals. Mutual interference from nearby transmitters may be reduced by separating the receiving antennas from the transmitting antennas as much as possible. Other means of reducing interference are: orienting the antennas to take best advantage of their directional patterns, selecting operating frequencies properly, tuning transmitters accurately, and alining receivers properly.

18. Installation of Shelter

If the radio set is to be used as a mobile station, the shelter should be installed on a 2½-ton, 6 by 6 cargo truck (fig. 1). Use the following procedure for setting up the radio set for mobile use.

a. Remove the canvas cover and side framing from the truck. Drop the tailgate.

b. Obtain a hoist capable of lifting the shelter. Lift the shelter by its four lifting straps and place it on the truck body with the entrance door toward the rear of the truck. If no hoist is available, skids may be used to slide the shelter on the truck. Skid Equipment MX–157/U may be used for this purpose. Hook two wooden skids to the rear of the truck body. Attach two ropes or steel cables to the shelter and feed them through the front gate of the truck, one on each side of the truck cab. Attach the other ends of the ropes or cables to a second truck and pull the shelter up the skids. If a second truck is not available, the winch on the truck that will carry the shelter may be used by attaching a pulley to a nearby tree and running the cable back through the front gate of the truck body.

c. Attach the holddown clamps on the shelter to the truck body sides to hold the shelter firmly in place. If the cargo truck has a wooden platform, secure the shelter by means of the four anchor rings (fig. 5).

d. Couple the power unit trailer to the rear of the truck.

19. Installation of Whip Antennas

a. The antenna bracket assemblies and whip antennas are disassembled and stowed within the shelter during shipment of the radio set. Install the transmitting and receiving whip antennas as instructed in *b* through *k* below.

b. Remove the antenna bracket assemblies from the cartons. Be careful not to lose the mounting hardware in the attached cloth bags.

c. Each Mast Bracket MP–50–A is supplied with a predrilled wooden spacer which is inserted between the bracket and shelter wall. Mount the two Mast Brackets MP–50–A, with the wooden spacers, to the front wall of the shelter (fig. 4); use the four 5/16- by 3½-inch carriage bolts, washers, and nuts provided with each bracket (fig. 9).

d. Mount Mast Base MP–65–B on Mast Bracket MP–50–A (fig. 9). Place a neoprene washer on the top and bottom of the bracket and locate the metal ring, with braid and clamp attached, between the bottom washer and the bracket. Place the neoprene gasket between the feed-through receptacle and the mast bracket. Secure the feed-through receptacle to the mast bracket and the wooden spacer; use the four No. 10 by 1¼-inch wood screws and flat washers. Place the clamp around the coaxial cable connector after the cable has been installed.

e. Mount the Mast Base Bracket MT–657/GRC (fig. 5) to the rear wall of the shelter; use the materials provided. Secure the Mast Base Bracket MT–657/GRC to the shelter wall by means of the four ⅜- by 2¾-inch carriage bolts, and matching nuts and lockwashers (fig. 10).

f. Aline the white ceramic insulator bowl, from within the shelter, with the predrilled hole in the shelter wall. Be sure that the neoprene gasket is correctly seated on the end of the insulator bowl and secure the insulator bowl to the shelter wall; use the six No. 8 by 1¼-inch wood screws and washers.

g. Insert Mast Base MP–76 in Mast Bracket MT–657/GRC (with neoprene gasket between) and fasten in place with the six ⅜- by ¾-inch carriage bolts, nuts, and lockwashers.

h. Insert the 22-inch cable (Wire W–128 attached to the base of Mast Base MP–76) through the hole of the insulator bowl preparatory to connecting it to the tuning unit.

i. Select the following items from the storage cabinet:

Quantity	*Item*
7	Mast Sections MS–116–A
3	Mast Sections MS–117–A
3	Mast Sections MS–118–A
2	Receiving whip antenna holddown guys
1	Transmitting whip antenna holddown guy

j. Assemble a receiving antenna as follows:

(1) Screw one Mast Section MS–116–A into another Mast Section MS–116–A. Be sure that the connection is tight. Tape the joint with ¾-inch friction tape.

(2) Repeat this procedure with one Mast Section MS–117–A and one Mast Section MS–118–A.

(3) Screw the two assembled sections together and tape the joint. One receiving antenna will consist of two Mast Sections MS–116–A and one each of Mast Sections MS–117–A and MS–118–A.

(4) Screw the bottom Mast Section MS–116–A into Mast Base MP–65–B on the left front corner of the shelter.

(5) Assemble another receiving antenna by repeating the procedure in (1) through (3) above. Screw the bottom Mast Section MS–116–A into Mast Base MP–65–B on the right front corner of the shelter.

(6) If the radio set is to be operated while in motion, attach the whip antenna holddown guys for the receiving antennas at the junction of the third and fourth sections. Pull the antennas down to a forward horizontal position. Secure the other ends of the whip antenna holddown guys to the headlight grill of the truck.

k. Assemble the transmitting antenna as follows:

(1) Screw three Mast Sections MS–116–A together and tighten the connections. Tape the joints with ¾-inch friction tape.

(2) Screw one Mast Section MS–117–A into a Mast Section MS–118–A. Tighten the connection and tape the joint with ¾-inch friction tape.

(3) Screw the two assembled mast sections together and tape the joint. One trans-

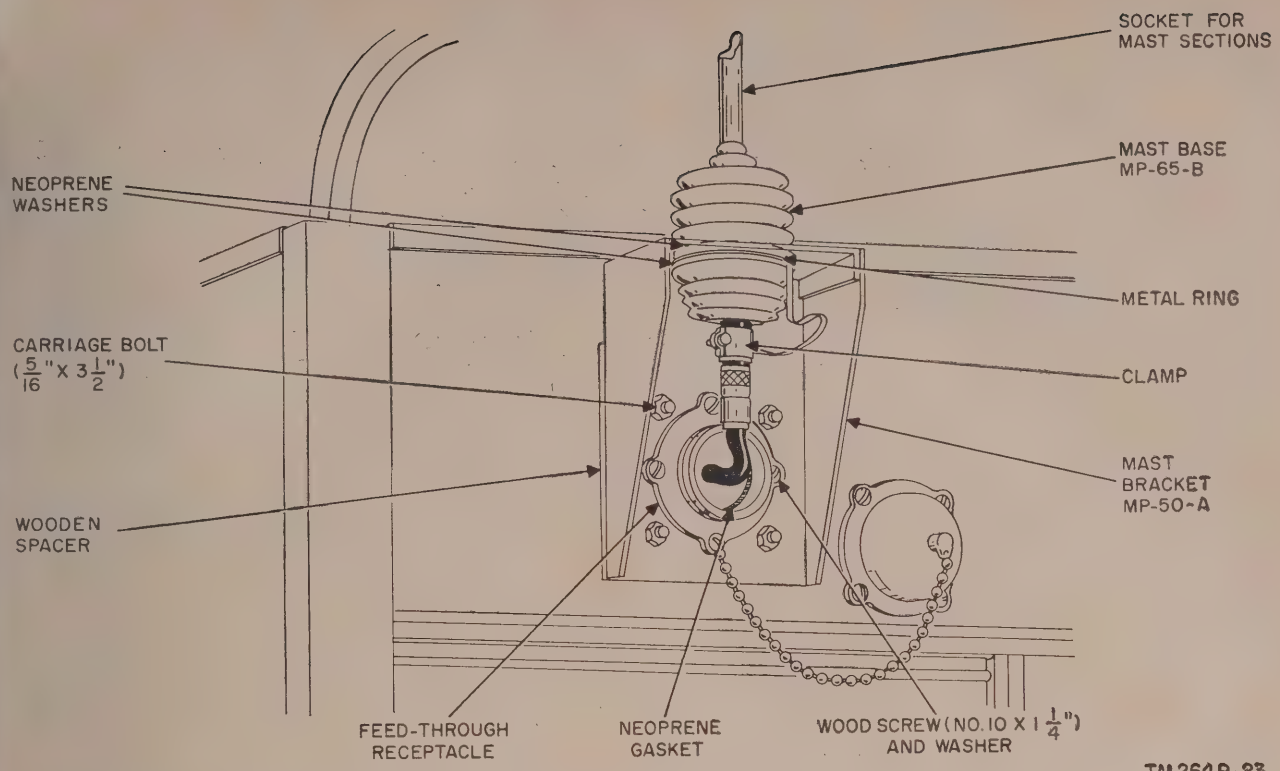


Figure 9. Assembly of Mast Bracket MP–50–A and Mast Base MP–65–B, for receiving whip antenna.

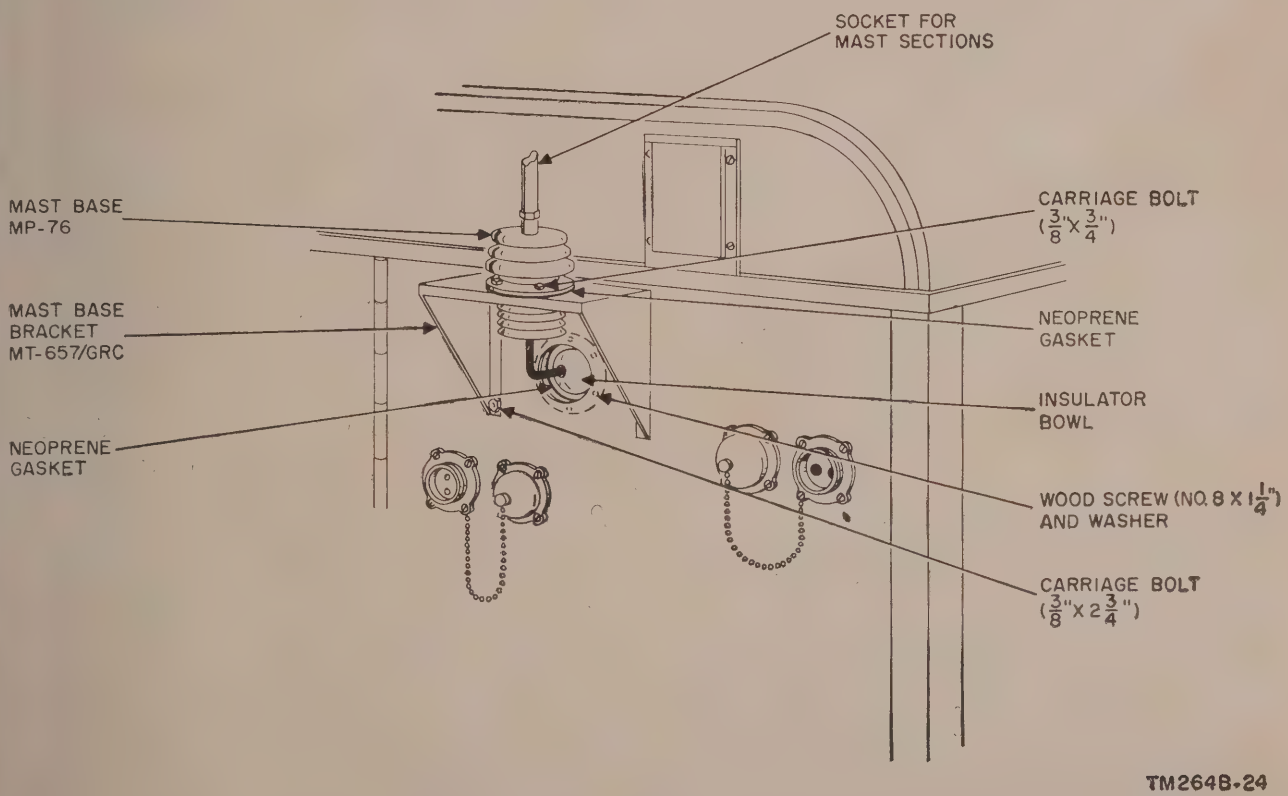


Figure 10. Assembly of Mast Base Bracket MT–657/GRC and Mast Base MP–76, for transmitting whip antenna.

mitting antenna will consist of three Mast Sections MS–116–A and one each of Mast Sections MS–117–A and MS–118–A.

(4) Screw the assembled mast sections into Mast Base MP–76.

(5) If the radio set is to be operated while in motion, bend the antenna backward to a horizontal position and attach the whip antenna holddown guy rope to the top of the highest Mast Section MS–116–A. Attach the other end of the guy to the cargo trailer.

20. Installation of Doublet Antenna and Mast

a. Installation of Doublet Transmitting Antenna.

(1) Doublet transmitting antenna equipment is furnished with Radio Set AN/GRC–26D and may be used instead of the whip antenna which is normally used. The doublet antenna may be used in a fixed or a semifixed installation whenever the greater directivity or signal pickup is desired.

(2) Three sectionalized 40-foot Masts AB–115/U are required to support the antenna within the frequency range of 1.5 to 4 mc because of the length of the antenna. At higher frequencies, the physical length of the antenna is short enough to omit the center mast and hence use only two supports.

(3) The antenna wire is made up of sections of Wire W–1 separated by strain insulators. The sections may be connected by jumpers which will allow preselection of various lengths for operation on different frequencies (fig. 11). Compute the lengths desired for the various antenna sections as follows:

(*a*) The antenna is a half-wave doublet which is to operate at the half-wave fundamental of the desired frequency, or on any odd harmonic of the fundamental. Figure 12 is a graph of frequency plotted against antenna length for the half-wave fundamental, third, fifth, and seventh harmonics. The antenna is normally used on the half-wave fundamental wave length. Only when the antenna is used at its half-wave fundamental length, with regard to frequency, will the radiation pattern be broadside.

(*b*) Refer to figure 11 and select the proper antenna lengths for the operating frequencies to be used. Example: Assume that operation is desired on frequencies of 2,600, 2,750, 3,100 and 3,900 kilocycle (kc). The graph in figure 12 shows that these frequencies require antenna lengths of 178, 169, 152, and 120 feet, respectively.

(4) The shortest antenna must be constucted first. In the case of the sample above, the shortest antenna is the 120-foot, 3,900-kc antenna.

(*a*) Determine the length of a quarter-wave antenna for the shortest half-wave to be used. In this example, a quarter-wave would be $\frac{120}{2}=60$ feet. Attach one end of the antenna wire to the coaxial connector; use a Burndy connector, type KS–90, and the wing nut on the coaxial connector ends (fig. 11). The coaxial connector terminates one end of RF Cable Assembly CG–692/U. Attach the other end of the antenna wire to a strain insulator. Be sure that the distance from the center of the coaxial connector to the end fastened to the insulator is exactly 60 feet as shown in figure 11. Construct the other half of the half-wave antenna similarly by using the remaining terminal on the coaxial connector as a starting point.

(*b*) Select the next shortest antenna desired; in this case, the 152-foot, 3,100-kc antenna. Attach a piece of antenna wire to the unused end of the strain insulator of the 3,900-kc antenna already constructed. Allow enough

free wire which can be used for a jumper connection. Follow the procedure already outlined to obtain the correct length for a quarter-wave for 3,100 kc: $\frac{152}{2} = 76$ feet. Run out enough wire to bring the total length of one side of the antenna to 76 feet as measured from the center of the coaxial connector to the end of the antenna; include in this measurement the length of the insulators. The other side of the antenna is constructed similarly.

(*c*) Construct each additional lower-frequency antenna by adding more wire to the antenna already formed. Each antenna length is calculated from the center of the coaxial connector to the end of the antenna being constructed; include in its calculations the length of the insulators.

(*d*) After the desired lengths have been determined and constructed, connect each jumper in place by using a Burndy connector, type KS–90, as shown in figure 11. Each antenna selected will operate on the fundamental and odd harmonics of the frequency to which it is cut. An antenna constructed as shown in figure 11 will be the correct length for the following frequencies:

Fundamental (kc)	3d harmonic (kc)	5th harmonic (kc)
2,600	7,800	13,000
2,750	8,250	13,750
3,100	9,300	15,500
3,900	11,700	19,500

Note. Refer to figure 12 to calculate harmonics versus length of antenna wire.

(5) After the antenna wire has been constructed, determine the position of the antenna to be erected. Only when the antenna is used at its fundamental wave length will the radiation pattern be broadside. A compass is required for accurate determination of antenna orientation. Stretch the fabricated antenna wire along the ground in the desired position. Place the end masts several feet beyond the end insulators. The center mast should be at the coaxial connector and offset 3 feet from the line between the two end masts (fig. 15) so that the antenna will clear the center mast. Place the center mast within 30 feet of the shelter to allow for proper connection of RF Cable Assembly CG–692/U. The rf cable assembly should be taped to the center mast to relieve the strain on the coaxial connector. A center mast will not be required if the antenna is less than 120 feet; only the two end masts will be used in this case.

(6) Place Mast AB–155/U at each mast location and remove the canvas cover from Carrying Device MX–387/GRA–4. Figure 7 shows components of Mast AB–155/U. Drive the stake of Mast Base AB–154/U into the ground at the desired mast location, with the swivel end of the mast base pointing 45° from the line of the antenna (fig. 13). If the ground is soft or sandy, place the mast base plate (fig. 15) on the ground and push it down firmly. Then drive the stake of Mast Base AB–154/U through the hole in the mast base plate.

(7) Align the female ends of Mast Sections MS–44 toward the mast base. Connect the first and the second sections and place Guy Plate MX–378/U over the third section. Connect the next two sections and add another guy plate. Add three more mast sections and place a third guy plate over the last section (fig. 13).

(8) For this step use four Guy Fasteners MX–379/U and four guy stakes (fig. 7). Slip a guy fastener over each stake before it is driven into the ground. Drive a guy stake (back guy stake) as close as possible to the junction of the fifth and sixth mast sections (25 feet from base). Use a guy rope to measure the distances between the mast base and the front and side guy stakes. Place them 90° apart as shown in figure 13. If the

ground is soft or sandy, use the wooden stakes instead of the aluminum stakes, and omit the guy fasteners. In this case, the guys should be looped over the stakes.

(9) Four each Guy MX–381A/GRA–4, Guy MX–382A/GRA–4, and Guy MX–383A/GRA–4 (figs. 7 and 13) are necessary for the next operation. Each guy has a color-coded identification tag at the snap fastener end. Guy MX–381A/GRA–4 (white tag) is 42 feet long, Guy MX–382A/GRA–4 (blue tag) is 33 feet long, and Guy MX–383A/GRA–4 (red tag) is 52 feet long. Fasten the four 52-foot guys (Guy MX–383A/GRA–4) to top Guy Plate MX–378/U, the four 42-foot guys (Guy MX–381A/GRA–4) to the center guy plate, and the remaining four 33-foot guys (MX–382A/GRA–4) to the bottom guy plate. The guys are fastened by snapping the fastener at the end of each guy into one of the four holes located 90° apart on the guy plate. Next, carry the free ends of the three back guys to a side guy stake to measure their correct length. Fasten these guys to the back guy stake by means of Guy Fastener MX–379/U. Connect both sets of side guys to their respective side guy stake and remove slack by adjusting Slide Fastener FT–9 (fig. 13). Do not tighten too much or the mast may bend. Keep the three front guys together and stretch them along the mast toward the front guy stake.

(10) Remove Halyard MX–516A/GRA–4 from the carrying device and attach the snap fastener on the pulley to the unused hole in the top guy plate. Slip the halyard rope through the pulley (fig. 15) and tie the free end of the rope near the mast base to keep the rope from running through the pulley when erecting the mast.

(11) Assemble the additional masts by repeating the operations in (5) through (10) above.

(12) If the center mast is used, attach the fastener assembly on the halyard to the center coaxial connector on RF Cable Assembly CG–692/U (fig. 11).

(13) Fasten the halyard on each end mast to the antenna wire by attaching one end of a wire (approx 15 in. of Wire W–1) to the end insulator and the other end to the fastener assembly of the halyard.

(14) To raise the mast, three men are required. One man takes a position near the mast base. One man holds the front guys and halyard. The third man stands near the top end of the mast (fig. 14), raising the mast as he walks toward the mast base. Proceed as follows:

(*a*) The man that holds the guys pulls steadily on them, keeping slightly more tension on the top guy to bow the mast slightly while being raised. Simultaneously, the man at the bottom end of the mast holds the end at the designated position as the mast is raised to a vertical position.

(*b*) The man who raised the mast will then help the other man adjust the front guys to their proper length.

(*c*) Adjust the guys until the mast is vertical. Whenever a guy is tightened, the opposite one may have to be loosened slightly to keep the mast from bowing.

(15) After all the masts are erected, pull the antenna wire into position by means of the halyards. Tie each halyard to the mast to prevent the weight of the antenna from pulling the loose end of the halyard back through the halyard pulley. Figure 15 shows a doublet antenna completely erected.

(16) When the doublet antenna is completely erected, be sure to disconnect RF Cable Assembly CG–1333/U (which is used in whip antenna operation) from J9 on the transmitter and the terminal posts on the antenna tuning unit. Pass the disconnected end of the antenna transmission line, the 75-foot RF Cable Assembly CG–692/U, through the feed through in the shelter wall (fig. 5) and connect it to rf output J9 (fig. 18) on the transmitter; use Radio Frequency Adapter

UG–27C/U as a coupling. The antenna lead-in should be raised off the ground on poles. In cold weather, this prevents the lead-in from freezing to the ground and, at all times, minimizes damage which might result from lying on the ground. In addition, the lead-in should be taped to both the mast and the shelter to relieve the tension on the coaxial connectors. The coaxial cable is structurally weak and should not be used as a support or line. This also applies to the lead-ins of the receiving antennas.

b. Installation of Doublet Receiving Antenna.

(1) The doublet receiving antennas should be separated by at least three wave lengths to obtain satisfactory space diversity reception. At the lowest operating frequency, the centers of the antennas should be separated about 950 feet. Always position the antenna broadside to the received signal source.

(2) When operating from 2 to 4 mc, three 40-foot Masts AB–155/U are used to support each doublet antenna; however, for operation from 4 to 18 mc, the antenna wire is short enough (120 feet or less) to omit the center mast, thus requiring only four masts for a space diversity receiving antenna installation (two antennas).

(3) The construction and the erection of receiving antennas are the same as for the transmitting antenna (*a* above).

(4) Disconnect RF Cable Assembly CG–718A/U from J107 (fig. 18) of each receiver. Pass the disconnected end of the antenna transmission lines, the 500-foot RF Cable Assemblies CG–1334/U, through the receiving doublet antenna feed-through receptacle (fig. 4) and connect them to J108 (fig. 18) of each receiver; use Connector Adapter UG–971/U as a coupling.

c. Other Antenna Installation. If there is not enough time to erect the 40-foot masts, then construct a semifixed installation by using materials other than those supplied as a support for the doublet antenna wire. Antenna supports can be improvised by using poles, trees, buildings, or other suitable supports whenever possible. The doublet antenna must always be insulated from its supports.

21. Installation of Operating Equipment

a. Shelter.

(1) The operating equipment is installed within the shelter by the manufacturer. Check to see that all tubes and tube caps are firmly in place. Location of tubes in Radio Modulator MD–239A/GR is shown in figure 16. Tube location for the remaining components of the radio set are shown in the components associated technical manual (par. 1).

(2) Be sure that the correct fuses and crystals are installed in the equipment. The equipment may fail if fuses other than those specified are used.

(*a*) The chart below lists the fuses used in each component.

Equipment	Fuse	Rating (amp)	Location
Radio Transmitter T–368C/URT	F1	6	Front panel of power supply deck.
	F2	3	
Radio Modulator MD–239A/GR	F1	1½	Front panel.
	F2	1½	
Frequency Shift Converter CV–116B/URR	F1	3	Back panel.
	F2	3	
Radio Receiver R–390/URR	F101	3	Back panel.
	F102	⅜	

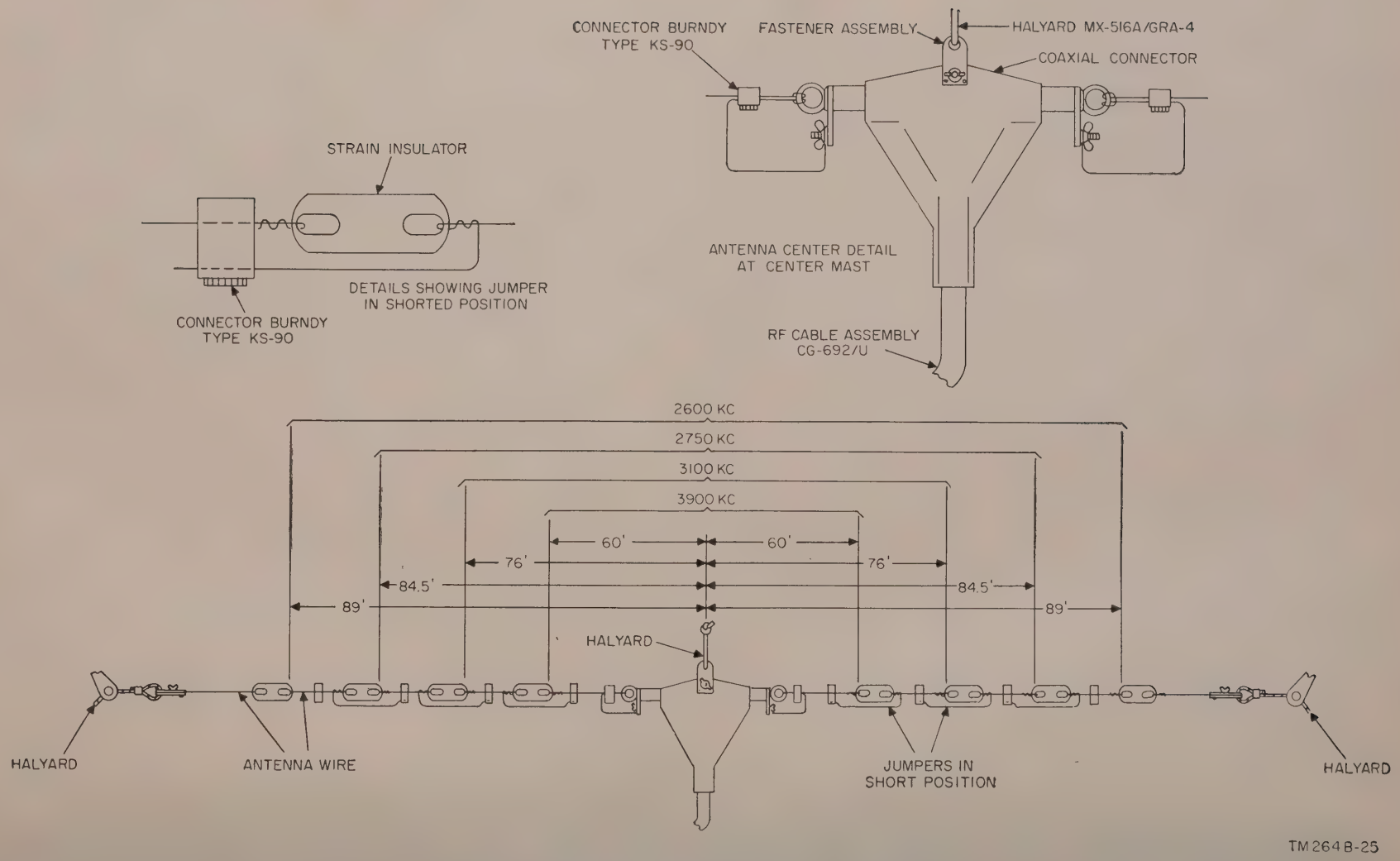


Figure 11. Construction and assembly of doublet antenna.

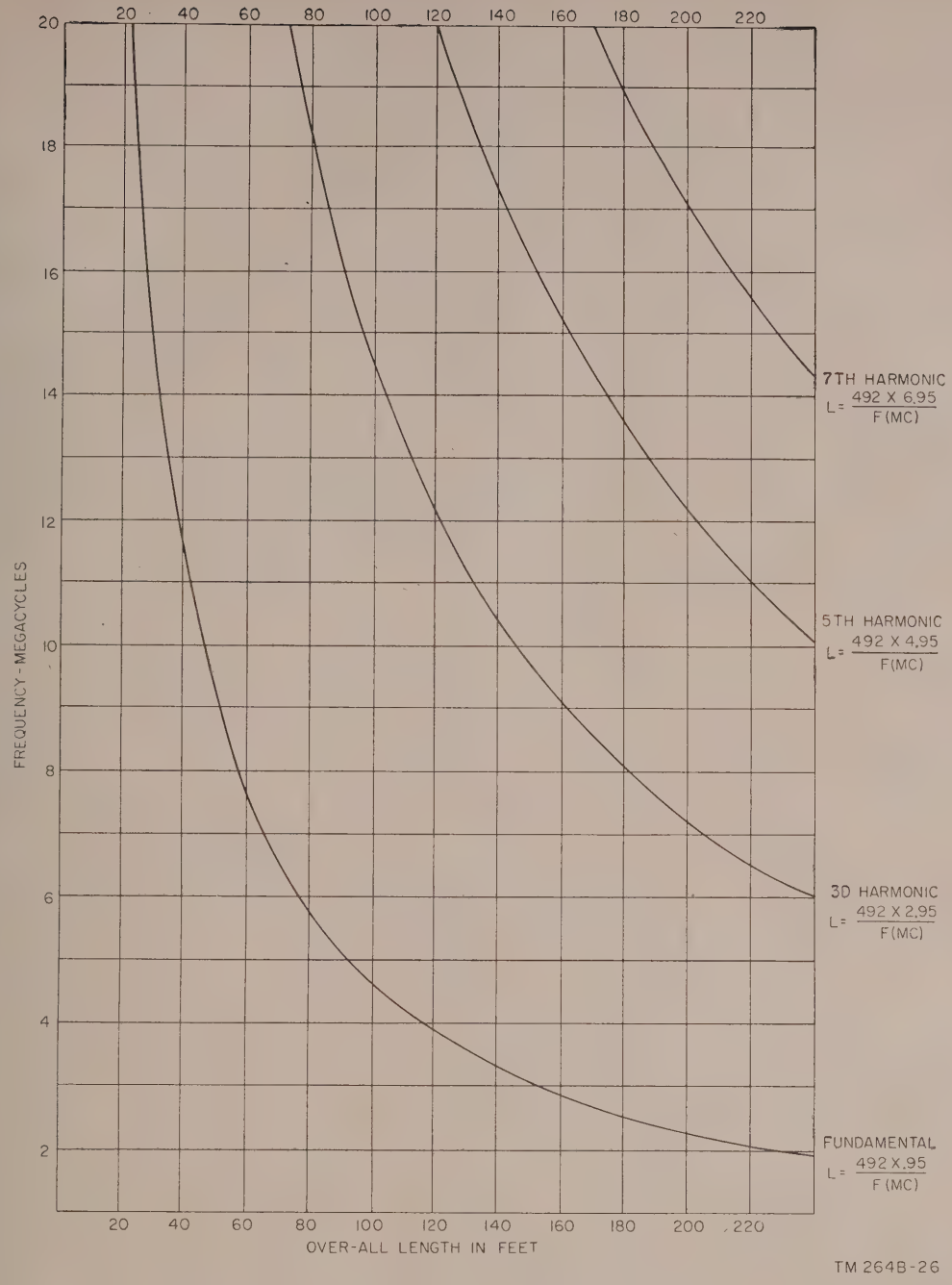


Figure 12. Graph of antenna length versus frequency.

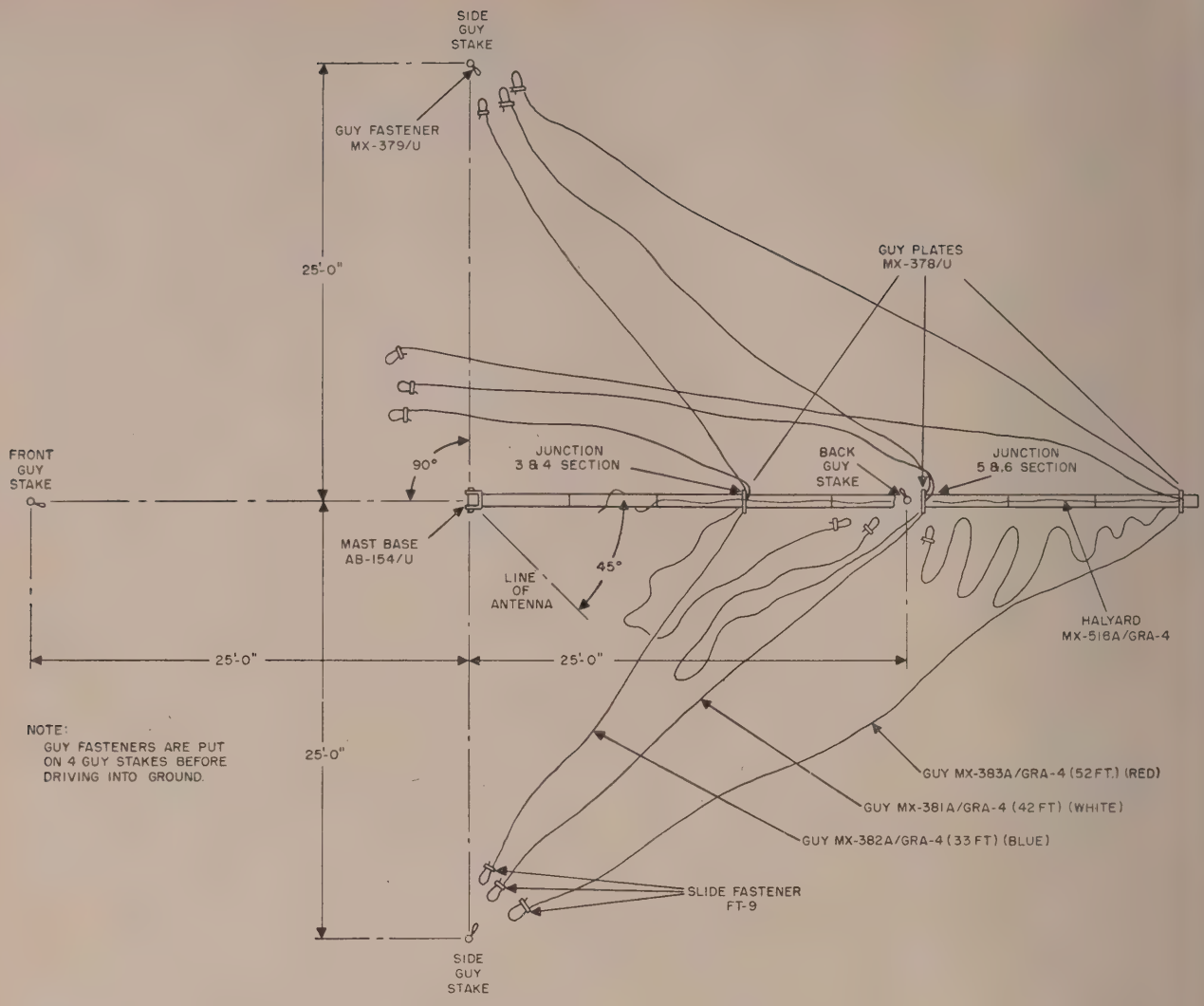


Figure 13. Preparing antenna mast for erection.

(*b*) The chart below lists the crystals used in each component.

Equipment	Crystal freq (kc)	Crystal socket	Location
Radio Modulator MD–239A/GR	12,000.000	XY1	Top of chassis, in crystal ovens.
	12,000.000	XY2	
Frequency Shift Converter CV–116B/URR.	405.0	XY1	Top of chassis.
	425.7	XY2	
Radio Receiver R–390/URR	7,000.000	XY405	Crystal-oscillator subchassis.
	12,000.000	XY406	
	15,000.000	XY407	
	6,200.000	XY408	
	14,000.000	XY409	
	8,000.000	XY410	
	9,000.000	XY411	
	10,000.000	XY412	
	11,000.000	XY413	
	13,000.000	XY414	
	8,500.000	XY415	

Equipment	Crystal freq (kc)	Crystal socket	Location
	11,333.333	XY416	
	10,666.667	XY417	
	10,333.333	XY418	
	9,666.667	XY419	
	12,500.000	XY420	
	11,500.000	XY421	
	10,500.000	XY422	
	9,500.000	XY423	
	455.000	XY501	Part of Z501 on if subchassis.
	1,000.000	XY901	In crystal oven on crystal calibrator unit.

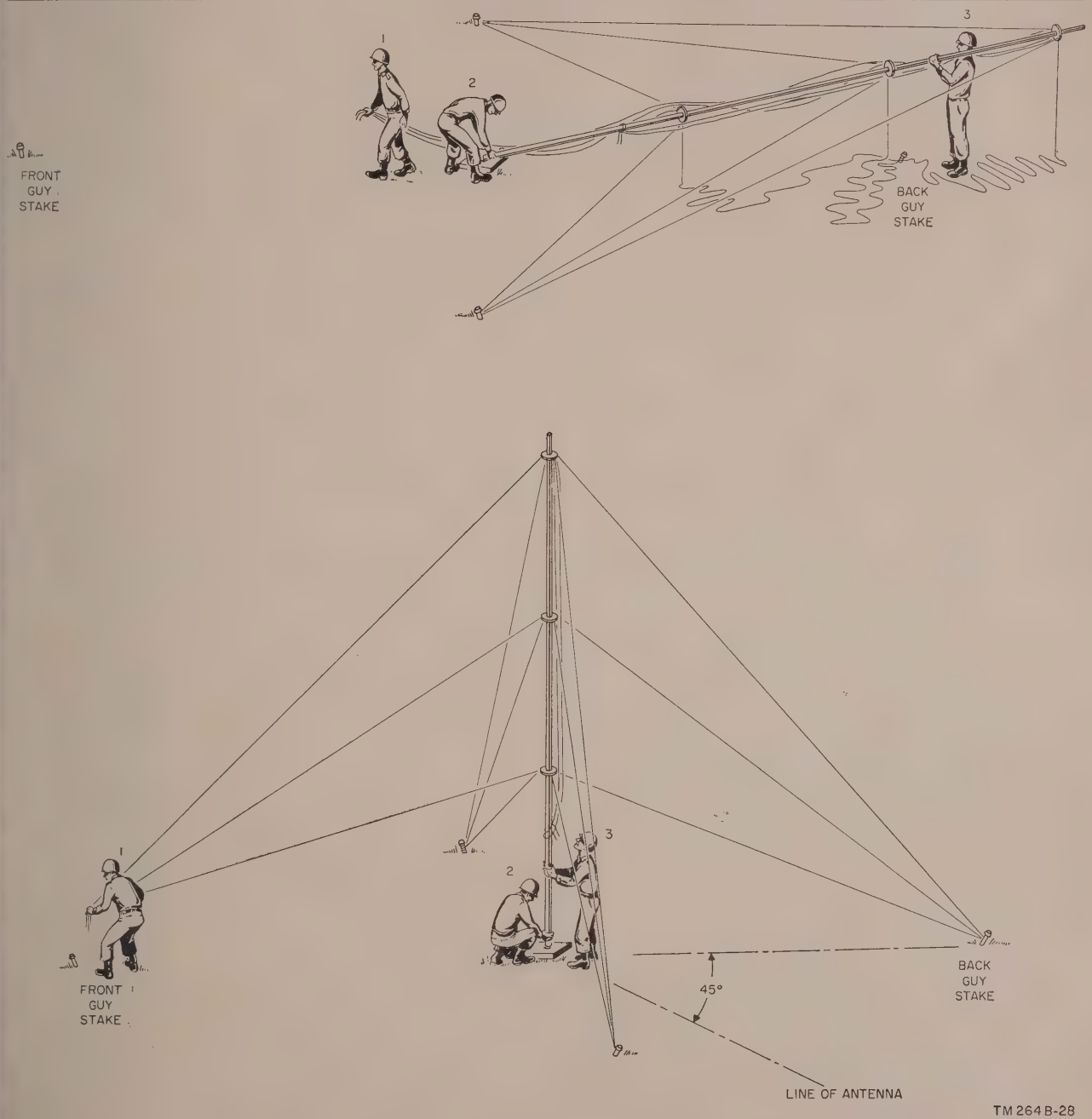


Figure 14. Raising assembled antenna mast.

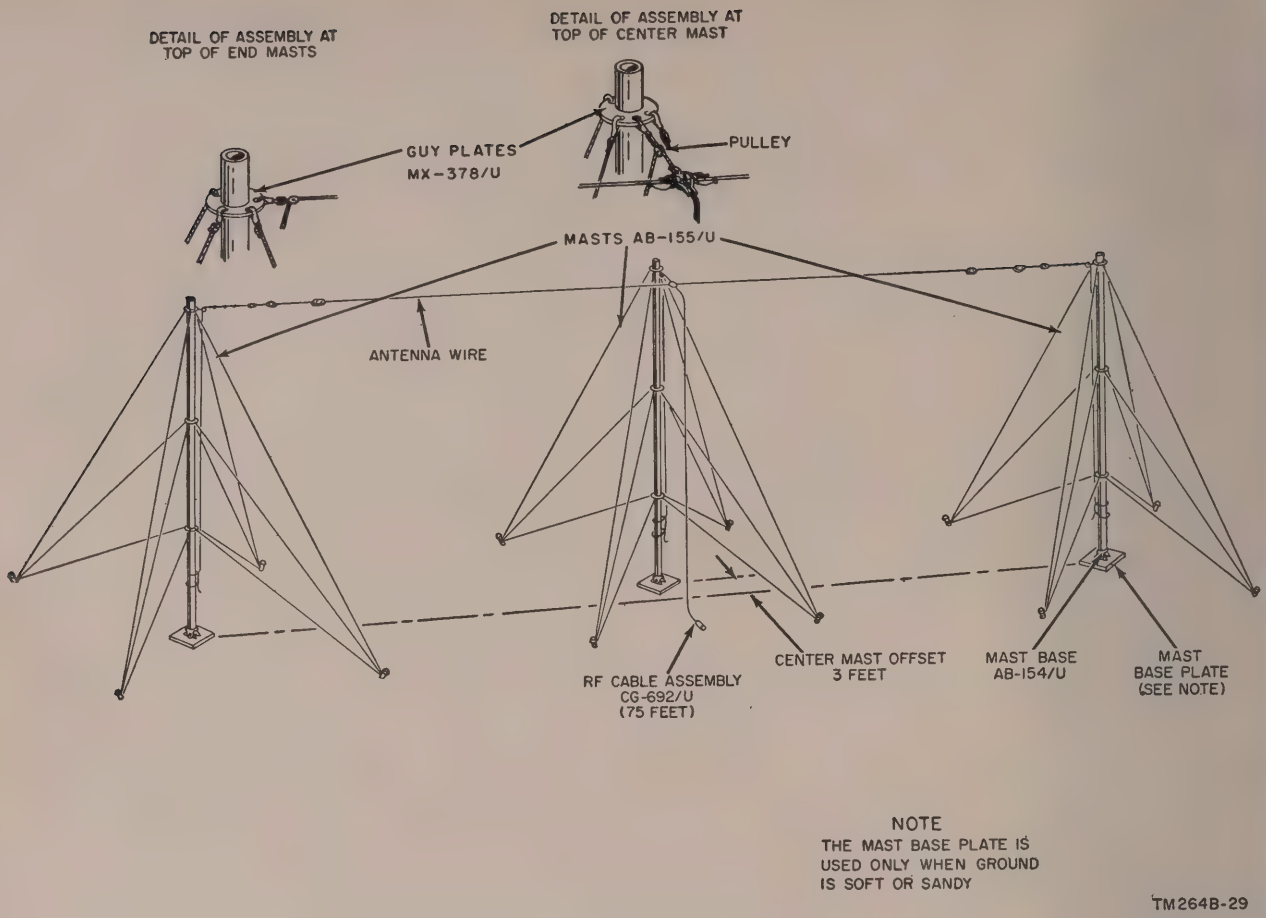


Figure 15. Doublet antenna, erection completed.

(3) Telephone Set TA–43/PT requires two Batteries BA–30. Dry batteries are not furnished with the radio set and must be requisitioned from depot supply or other source. For battery installation instructions, refer to TM 11–337.

b. Generator Set PU–248/U. Examine the storage battery for the power unit. Instructions for preparing the battery for service are attached to each battery. Follow the instructions carefully for best results.

22. Connections

(figs. 17 and 18)

a. Primary Power. The shelter contains permanently wired power outlets that provide ac power to components of the radio set. When the power unit is used as a power source, connect Power Cable Assembly CX–1165/U to the shelter ac input. If the power unit must be more than 12 feet from the shelter, insert the extension Power Cable Assembly CX–1166/U between Power Cable Assembly CX–1165/U and the shelter.

b. Bonding.

(1) A ground bonding system (fig. 17) is permanently installed along the shelter walls and is an integral part of the shelter. The tuning unit, fsk-modulator, and the transmitter are grounded by means of a bond strap from the ground bus to a mounting stud on top of the transmitter. Bond straps also connect to the right side panel of the storage cabinet and the equipment cabinet. At the left of the transmitter, a ground strap assembly is attached to the primary power conduit, placing the housing of all ac outlets at ground potential.

(2) The reperforator is grounded through the ac power cord shield to the ac outlet housing. The spade lug, terminating the shield, is attached to the existing retain-

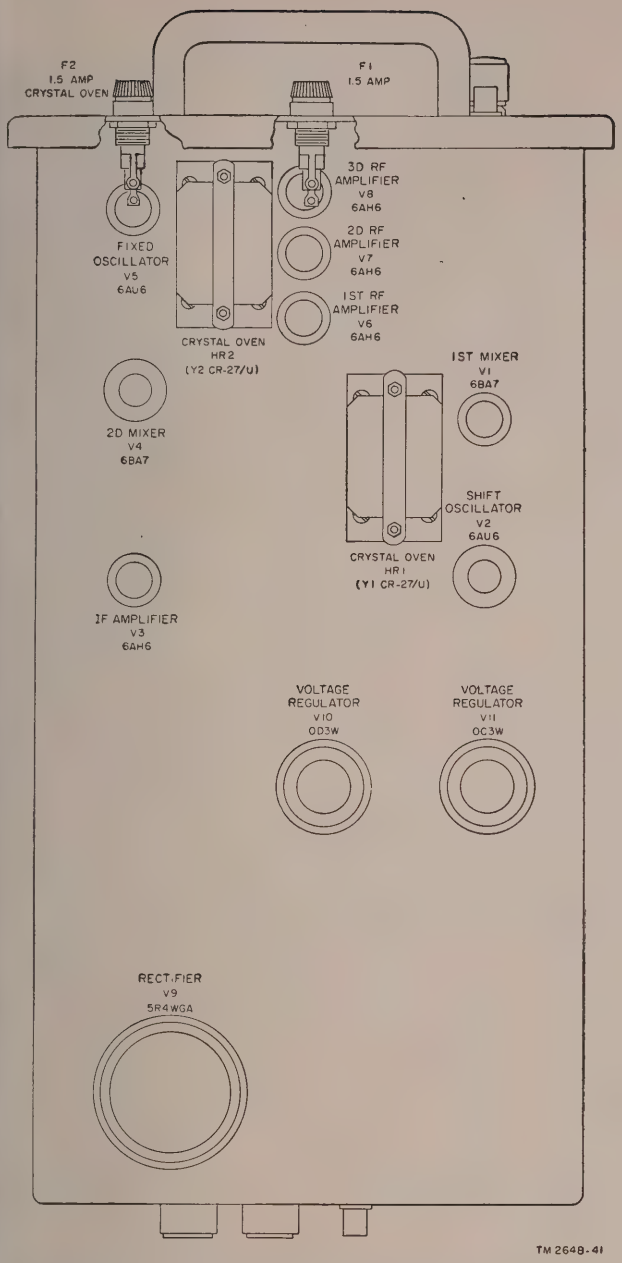


Figure 16. Radio Modulator MD–239A/GR tube, fuse, and crystal location.

ing screw on the ac outlet. The ac power cord shield of each teletypewriter is attached directly to the ground bus (fig. 17). Teletypewriter tables are automatically placed at ground potential when they are secured to the shelter wall (and ground bus) by means of the roto-lock fasteners.

(3) Place the shelter bonding system at earth ground potential by using the ground rod and the 10-foot electrical lead. Drive the ground rod into the earth, leaving approximately 8 inches protruding above the surface. Clamp one end of the electrical lead to the ground rod and attach the free end of the lead to the shelter external ground connector (fig. 5).

(4) When the shelter has to be stationed over soil having a very low conductivity, treat the soil to reduce its resistance by mixing a quantity of coal dust with the soil. The soil can also be treated with substances that are highly conductive when in solution. Some of these substances, listed in order of preference, are sodium chloride (common salt), calcium chloride, and magnesium sulphate (epsom salt). The amount required depends on the type of soil and its moisture content. When these substances are used, it is important that they do not seep into nearby drinking water supplies.

c. Component Cabling (fig. 18). Components within the shelter have been cabled for operation prior to equipment shipment. A cabling diagram of interconnections between components in the shelter is shown in figure 18. Check the condition of cables and tightness of cable connectors and plugs prior to operating the equipment.

d. Doublet Antenna Connections.

(1) When a doublet transmitting antenna is used, RF Cable Assembly CG–1333/U is disconnected from J9 of the transmitter and RF Cable Assembly CG–692/U is connected to jack J9 through Radio Frequency Adapter UG–27C/U.

(2) To use doublet antennas for receiving, disconnect RF Cable Assembly CG–718A/U from jack J107 of each receiver and connect RF Cable Assembly CG–1334/U to jack J108 (each receiver) through Connector Adapter UG–971/U.

e. Remote Site. The application of teletypewriter equipment at the remote site varies, because of its flexibility. The cabling as indicated in this section covers general operation. As using organizations become better acquainted with the equipment, cabling for other applications can be found.

(1) One-way reversible and duplex operation at the remote site is possible by using the remote control unit, telephone, and auxiliary teletypewriter equipment. The remote site is connected to the radio set by Wire W–1, or equal. The interconnecting wire and teletypewriter equipment for the remote site must be requisitioned from depot supply or other source.

(2) Connection of wire pairs between the remote site and the shelter is illustrated in figure 19. For proper operation, wire polarity must be observed between the control unit and the remote control unit. It is not necessary to observe wire polarity between the telephone and the remote control unit.

(3) Over short distances, wire pairs can be readily identified. Over long runs, some simple electrical means can be used to identify specific wires. Before cutting wires, be sure to provide enough slack after laying. Bring the wires into the shelter through the feedthrough above the control unit and connect them to their respective binding posts as shown in figure 19.

(4) Remote operation is generally intended for distances up to 10 miles or less. Greater distances will result in increased losses that cannot be compensated. All normal remote operation may be accomplished when the remote site is cabled to components in the shelter as shown in figure 19 and remaining shelter components are cabled as shown shown in figure 18.

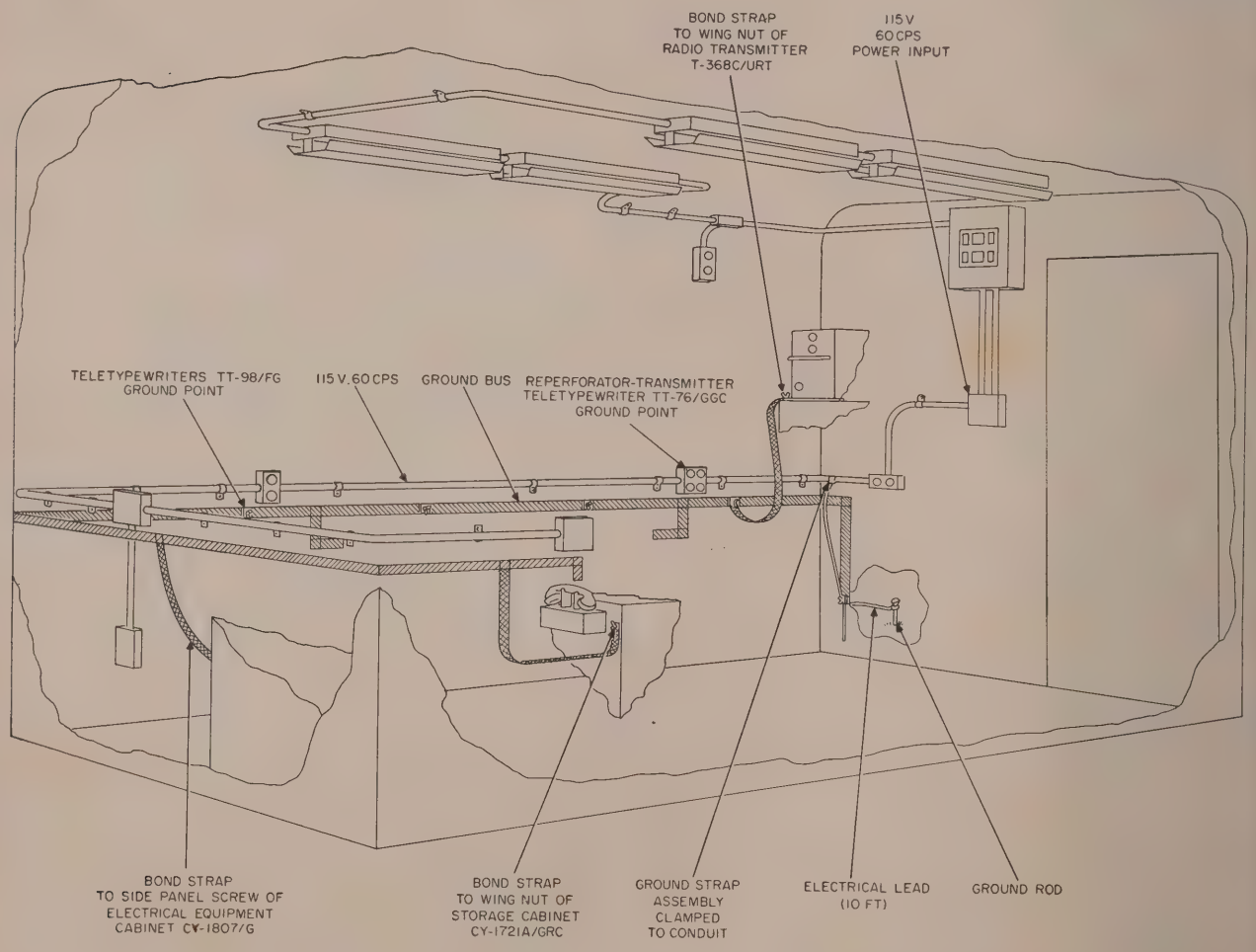


Figure 17. Electrical Equipment Shelter S–56A/G, primary power and bonding system.

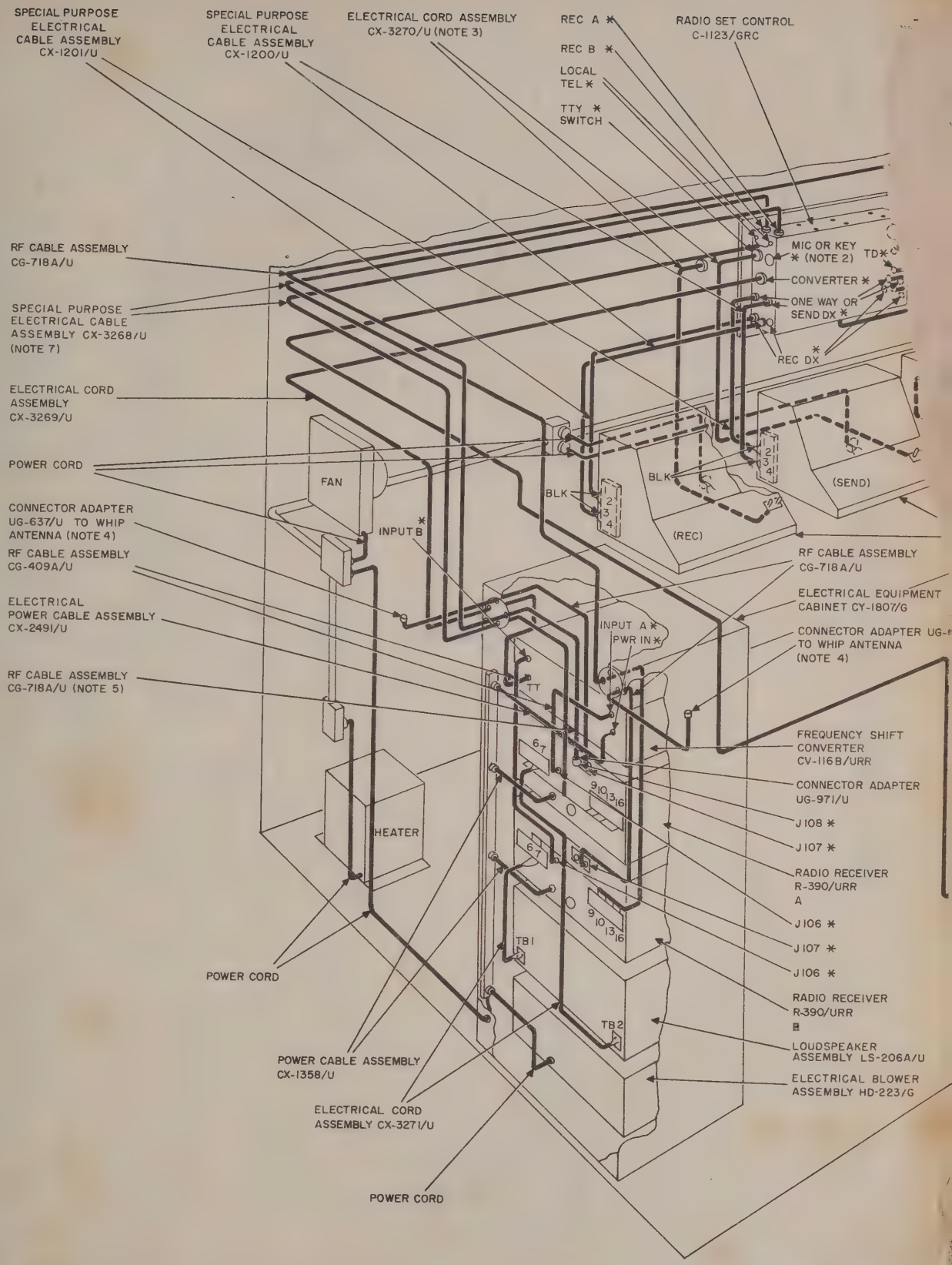
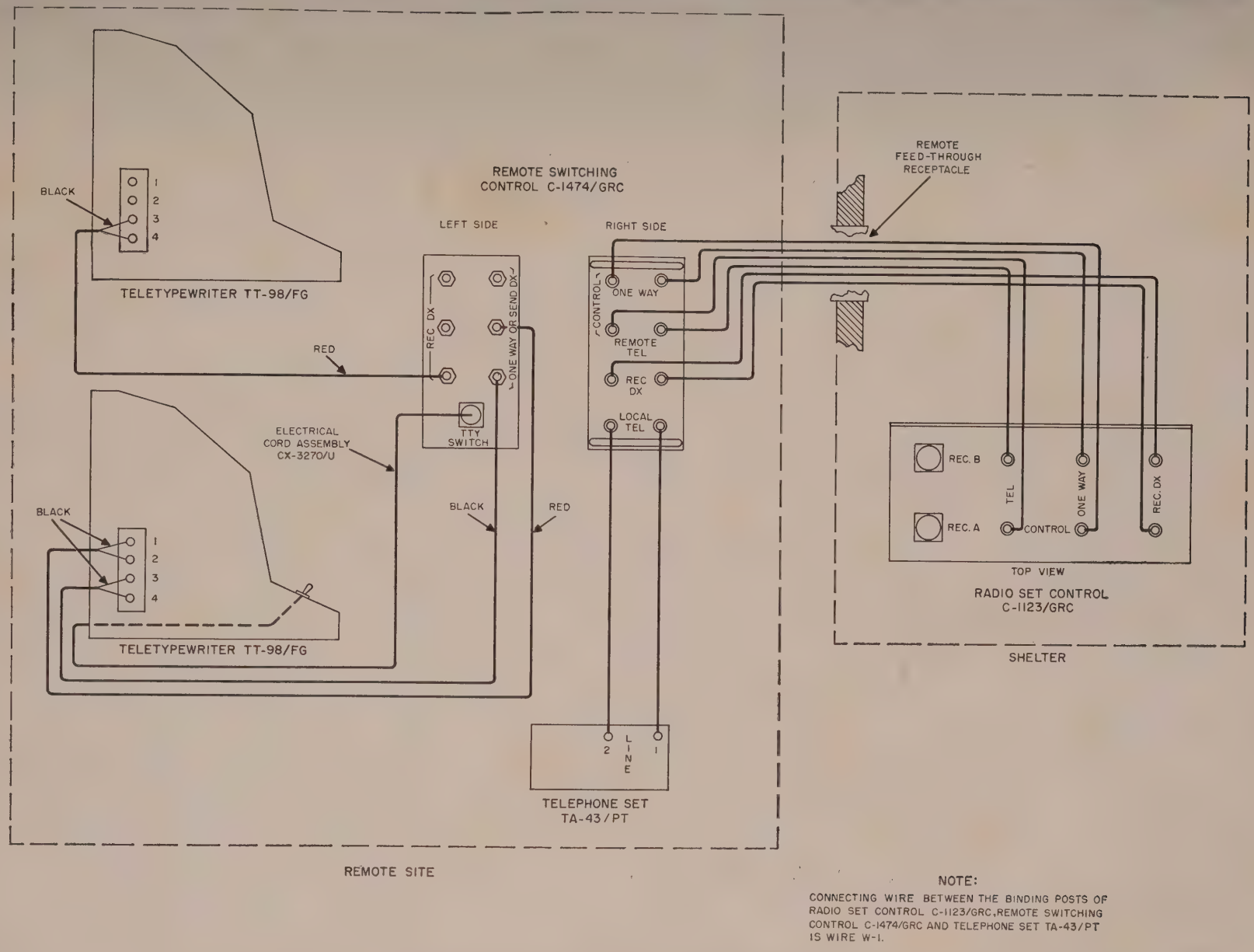


Figure 18. Electrical Ec



NOTE:

CONNECTING WIRE BETWEEN THE BINDING POSTS OF RADIO SET CONTROL C-1123/GRC, REMOTE SWITCHING CONTROL C-1474/GRC AND TELEPHONE SET TA-43/PT IS WIRE W-1.

TM 2648-31

Figure 19. Typical remote site intercabling diagam.

23. Initial Adjustments of Equipment

a. Initial adjustments, performed only during initial installation, are required for the power unit, converter, teletypewriter, and reperforator. Detailed initial adjustment instructions for each of the above components are covered in the components associated technical manual (par. 1).

b. Adjustments to the receiver, transmitter, and tuning unit are normally performed only during a change in operating frequency.

c. The fsk-modulator, remote control unit, and control unit do not require any initial adjustments.

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. CONTROLS AND INSTRUMENTS

Note. This section locates, illustrates, and describes the controls and instruments provided for the proper operation of the equipment.

24. Radio Modulator MD–239A/GR Controls

(fig. 20)

The following table lists the controls of the fsk-modulator and indicates their functions:

Control or instrument	Function
POWER switch	Applies ac power to the fsk-modulator when in the ON position.
BAND SELECTOR switch	Eight-position switch which selects the amount of frequency shift applied to the transmitter.
	Position — *Function* 1.5–2 mc — 850 cps shift 2–3 mc — 850 cps shift 3–4 mc — 425 cps shift 4–6 mc — 425 cps shift 6–8 mc — 212.5 cps shift 8–12 mc — 212.5 cps shift 12–16 mc — 106.25 cps shift 16–20 mc — 106.25 cps shift
Pilot lamp	Indicates the presence of ac power in the equipment.

25. Radio Set Control C–1123/GRC Controls

(fig. 21)

The following table lists the controls of the control unit and indicates their function:

Control or instrument	Function
Power ON–OFF switch	In the ON position, connects ac power to the control unit.
SIDETONE switch	Switches transmitter sidetone to either receiver.
REMOTE TEL switch	In LOCAL TEL position, allows duplex phone operation from the shelter or a remote site; in REC A and REC B positions, permits one-way reversible operation from the shelter or remote site through receivers A and B, respectively.
HYBRID BAL control	Compensates for telephone line losses from the remote site.
TELETYPE switch	In the NORMAL DX position, allows full-duplex operation from shelter. NORMAL OW position allows one-way reversible operation from shelter. In the REMOTE position, allows either duplex or one-way reversible operation when the switch is in the DX or OW position, respectively.
Pilot lamp	Indicates presence of ac power.

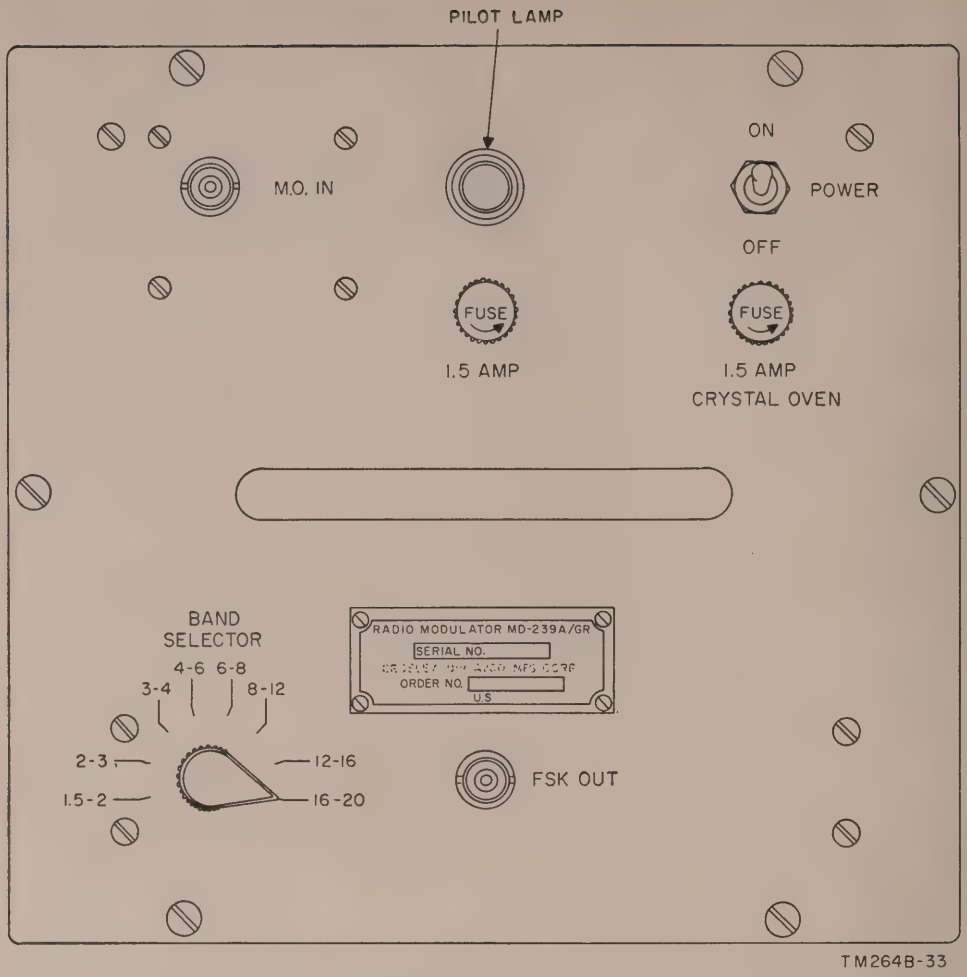


Figure 20. Radio Modulator MD–239A/GR, front panel controls.

26. Minor Component Controls

a. Remote Switching Control C–1474/GRC (fig. 6). This unit contains an external toggle switch labeled XMTR ON. When the proper connections are made between the radio set and the remote switching control, the transmitter will be keyed when the switch is placed in the XMTR ON position.

b. Loudspeaker Assembly LS–206A/U (fig. 3). This unit contains two external toggle switches labeled ON CHANNEL A and ON CHANNEL B, respectively. The ON CHANNEL A switch allows audio signals to be received from the channel A receiver when placed in the on (up) position. The ON CHANNEL B switch allows audio signals to be received from the channel B receiver when placed in the on (up) position.

c. Electrical Blower Assembly HD–223/G (fig. 3). This unit contains an external toggle switch and controls ac power to the blowers. When the switch is thrown to the ON position, the two blowers inside the assembly are activated.

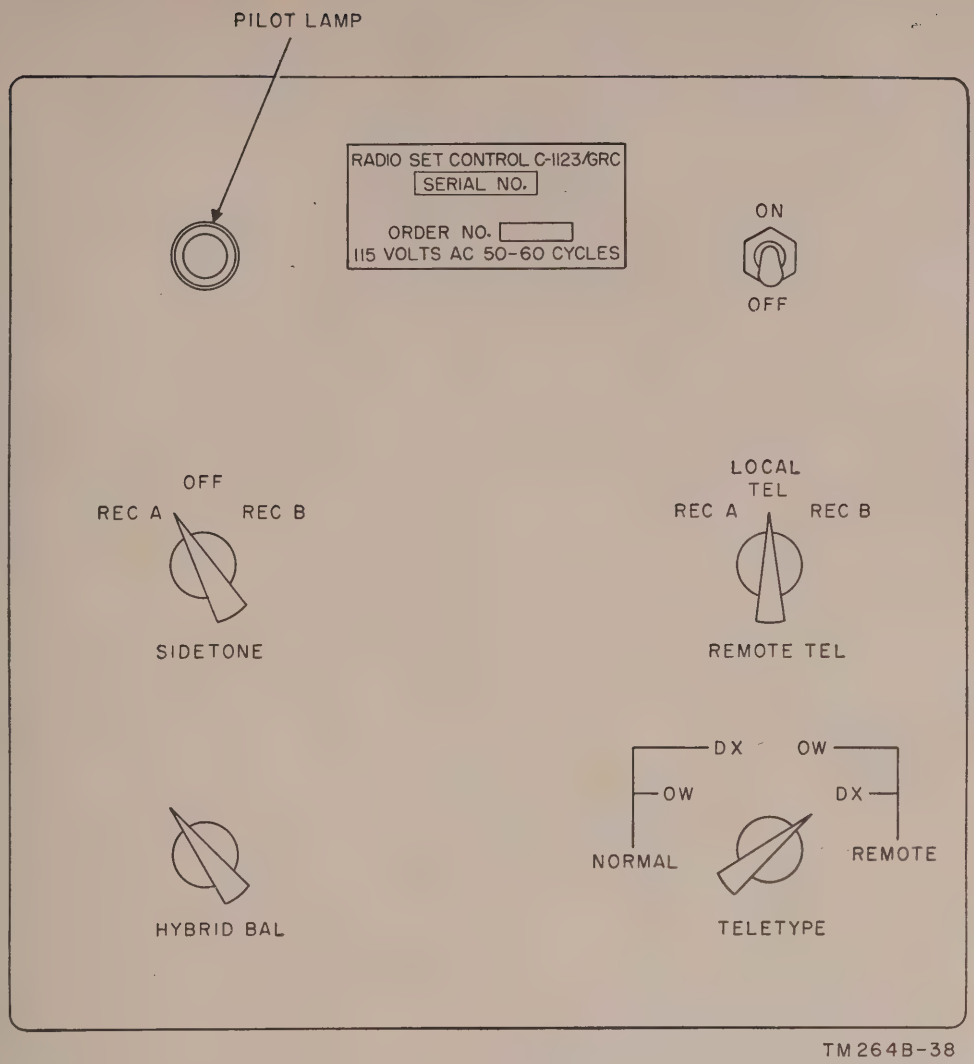


Figure 21. Radio Set Control C–1123/GRC, front panel controls.

Section II. OPERATING UNDER USUAL CONDITIONS

27. General

a. The radio set may be operated locally (from the shelter) or from a remote site. Remote operation is possible through the use of the remote control unit. Either duplex or one-way reversible operation may be used. When in motion, one-way reversible operation is normally employed; duplex operation is not used because of the nearness of the receiving and transmitting whip antennas on the shelter. When at halt, doublet antennas can be erected to provide the separation necessary between the transmitting and receiving antennas to allow duplex operation.

b. The radio set is used primarily as a teletypewriter station. Am and cw services are used in emergencies or when operating conditions prevent the use of fsk facilities.

c. To operate the equipment for any type of operation, always perform the following procedures:

(1) The preliminary starting procedure (par. 28).
(2) The starting procedure (par. 29).
(3) The tuning procedure (par. 30).
(4) The procedure for the desired type of operation.

28. Preliminary Starting Procedure

After initial installation described in para-

graphs 15 through 23 has been completed, preliminary starting procedures can be performed. The settings and adjustments for each unit of the radio set are given in the following chart.

Component	Control	Position
Power unit	CIRCUIT BREAKER switch	OFF
	MANUAL START-REMOTE START switch	REMOTE START
Shelter	Circuit breakers	OFF
	FILAMENT POWER circuit breaker	OFF
	PLATE POWER circuit breaker	OFF
	TUNE-NORMAL switch	TUNE
	PLATE RELAY switch	Down position (off)
	KEYING switch	NORMAL
Fsk-modulator	POWER switch	OFF
Tuning unit	Range switch	Position as per tuning charts in TM 11-809.
	COUPLING control	Position as per tuning charts in TM 11-809.
	FREQUENCY controls	Position as per tuning charts in TM 11-809.
Control unit	Power switch	OFF
	SIDETONE switch	OFF
	TELETYPE switch	NORMAL DX
	REMOTE TEL switch	LOCAL TEL
	POWER switch	OFF
Converter	AFC switch	OFF
	AFC SHIFT ADJUSTMENT controls	O
	AFC THRESHOLD LEVEL controls	OFF
	CHANNEL SELECTOR switch	A
	MARK HOLD–XTAL–AFC switches	MARK HOLD
	DRIFT INDICATOR controls	O
Receivers	FUNCTION switches	OFF
	LINE METER switches	OFF
	LINE GAIN controls	O
	LIMITER switches	OFF
	BREAK IN switches	OFF
	BFO PITCH controls	O
	ANT TRIM controls	O
	BFO switches	OFF
	LOCAL GAIN controls	O
	RF GAIN controls	O
	OVENS switches	OFF
	AGC switches	FAST
	AUDIO RESPONSE switches	WIDE
Speaker assembly	ON CHANNEL A switch	Down position
	ON CHANNEL B switch	Down position
Blower assembly HD-223/G.	Power switch	OFF
Reperforator	POWER switch	OFF
	MOTOR switch	OFF
	KEYBOARD SEND-LOCK switch	LOCK
	LIGHT switch	OFF
	MAGNET START-STOP-FEED RETRACT switch.	STOP
Teletypewriters	POWER switch (under dust cover)	OFF
	MOTOR switch	OFF
	LIGHT switch	OFF
	SEND-REC switch	REC
	DC switch (under dust cover)	OFF

29. Starting Procedure

Note. If an abnormal indication is obtained during the starting procedure, refer to the equipment performance checklist (par. 45) for corrective measures.

With the controls set as outlined in the preliminary starting procedure, perform the steps as outlined in the following chart.

Component	Control	Position
Power unit	START button	Press until engine starts
	CIRCUIT BREAKER	ON
Note. Except in emergency, allow the power unit to operate 10 to 15 minutes before applying load.		
Shelter	Circuit breakers	ON
Electrical Blower Assembly HD–223/G	Power switch	ON
Transmitter	FILAMENT POWER circuit breaker	ON
Teletypewriters	POWER switches (under dust cover)	ON
	MOTOR switches	ON
	LIGHT switches	ON
Reperforator	POWER switch	ON
	MOTOR switch	ON
	LIGHT switch	ON
	SELECTOR switch	Position 1
Speaker assembly	ON CHANNEL A switch	ON (up)
	ON CHANNEL B switch	ON (up)
Fsk-modulator	POWER switch	ON
Control unit	Power switch	ON
Receivers	FUNCTION switches	AGC
	OVENS switches	ON
Converter	POWER switch	ON

30. Tuning Procedure

Follow all the steps in the preliminary tuning procedure when initially tuning the radio set or when changing frequency.

Note. Be sure antennas, either doublet or whip, are connected to the receivers and transmitter. When a whip antenna is used with the transmitter, the antenna tuning unit must be connected between it and the transmitter, and set to the correct frequency range (see TM 11–809).

a. Radio Transmitter T–368C/URT. TM 11–809, shows a series of five tuning and five loading charts for the transmitter. The vertical numbers along the left edge of the charts represent the dial readings of the POWER AMPLIFIER TUNING and POWER AMPLIFIER LOADING indicators of the transmitter, depending on whether a tuning or a loading chart is being used. The horizontal numbers along the bottom edge of the charts represent the transmitter operating frequency in megacycles. Locate the desired transmitting operating frequency at the bottom of the chart, follow the line upward to the approximate center of the shaded area of the curve. From this point, follow in a horizontal line to the left edge and note the number intersected. Set the tuning or loading control (whichever adjustment is being made from the appropriate chart) at the number found. Three numbers are exposed on each of the tuning control dials. The first two numbers cover the ten's and twenty's units as white numbers on a black background and the third covers the tenth's units as black numbers on a white background.

(1) *Transmitter tuning using doublet antenna.*

(*a*) Set the SERVICE SELECTOR switch to FSK.

(*b*) Adjust the FILAMENT VOLTAGE control for a reading of 5 to 5.2 volts on the FIL VOLTAGE meter.

(*c*) Set the TUNE-NORMAL switch to TUNE.

(*d*) Set the TUNING CONTROL to the desired frequency.

(*e*) Set the POWER AMPLIFIER TUNING and POWER AMPLIFIER LOADING controls to the numbers

that correspond to the desired frequency as per tuning charts in TM 11–809.

(*f*) Turn the BAND SELECTOR switch to the desired band.

(*g*) Turn the P A BAND SWITCH to the desired band.

(*h*) Turn the EXCITATION METER SWITCH to PA GRID X2.

(*i*) Throw the KEYING switch to CONTINUOUS.

(*j*) Throw the PLATE POWER circuit breaker to ON.

(*k*) Throw the PLATE RELAY switch to on (up). Check to see that the red PLATE POWER indicator lamp goes on and that the P A PLATE meter shows a reading.

(*l*) Adjust the POWER AMPLIFIER TUNING control to resonance (tuning to desired frequency) as indicated by the minimum (dip) reading on the P A PLATE meter.

(*m*) Adjust the POWER AMPLIFIER LOADING control to obtain a reading of 150 ma on the P A PLATE meter.

(*n*) Repeat the steps in (*l*) and (*m*) above.

(*o*) Throw the TUNE-NORMAL switch to NORMAL. The P A PLATE meter should indicate approximately 350 ma. If it does not, repeat the steps in (*l*) and (*m*) above until 350 ma is indicated. The EXCITATION meter should indicate 8 to 12 ma when the EXCITATION METER SWITCH is set to PA GRID X2 position. Set the EXCITATION METER SWITCH to INT AMP PLATE X10 position. EXCITATION meter should indicate between 20 to 70 ma.

Caution: Be sure not to exceed 70 ma, because the life of the intermediate power-amplifier tube will be reduced considerably if it draws too much current.

(2) *Transmitter tuning using whip antenna.*

Warning: Extremely high rf voltages are present in the antenna tuning unit when the transmitter is operating. Painful burns will result upon contact.

(*a*) Follow the tuning procedure in (1) (*a*) through (*g*) above.

(*b*) Set the COUPLING and FREQUENCY controls of Antenna Tuning Unit BC–939–B to the settings that correspond to the desired frequency. The tables in paragraph 22*b* of TM 11–809 give the correct control settings for the antenna tuning unit when used with the transmitter.

(*c*) Perform the instructions in (1) (*h*) through (*n*) above, but use the frequency control of the antenna tuning unit instead of the POWER AMPLIFIER LOADING control. Best loading will be indicated by a maximum reading on the ANTENNA CURRENT meter.

(*d*) If the minimum P A PLATE meter reading is above or below 350 ma, alternately decrease or increase the coupling control to obtain 350 ma.

(3) *Transmitter tuning using long-wire antenna.* The tuning procedure for the long wire is identical with the whip antenna tuning procedure with the following exceptions:

(*a*) Set the COUPLING control of the antenna tuning unit at approximately 2.

(*b*) Turn the FREQUENCY control that covers the low-frequency range to about the center of its range.

(*c*) Set the range switch to LONG WIRE.

(*d*) Turn the COUPLING and FREQUENCY controls for a maximum indication on the ANTENNA CURRENT meter.

b. Radio Receivers R–390/URR.

(1) Disengage the DIAL LOCK controls.

(2) Set the MEGACYCLE CHANGE controls to the desired band.

(3) Tune in the desired signal with the KILOCYCLE CHANGE controls. To tune in an unknown station, refer to tuning procedures in TM 11–856.

(4) Adjust the LOCAL GAIN and RF GAIN controls for the best signal.

(5) Adjust the ANT TRIM control for maximum signal on the CARRIER LEVEL meter.

31. Operating Conditions

One of several operating conditions can be used depending upon the existing situation. The radio set is capable of mobile, mobile-at-halt, or semifixed operation.

Note. Refer to TM 11–856 for antijamming instructions.

a. Mobile Operation. In this type of operation, the radio set is used while in motion. The tied-down whip antennas are used for transmission and reception of signals. One-way reversible operation is usually employed. In one-way reversible operation, the transmitter and receiver do not operate simultaneously. When the transmitter is used, the receivers (or receiver) are disabled; when the receivers are used, the transmitter is disabled. The transmitter and receivers can use the same frequency in this type of operation. However, it is advantageous to use two frequencies separated by at least 400 kc for transmission and reception to quickly change to duplex operation for mobile-at-halt operation.

b. Mobile-at-Halt Operation. In this type of operation, the radio set is stopped but may move again with a minimum delay. Duplex operation could be used instead of one-way reversible operation. In duplex operation, the transmitter and receiver operate on frequencies separated by at least 400 kc, and the receiving and transmitting antennas should be separated as far as possible to prevent interaction. This makes it possible for the radio set to transmit and receive at the same time without interference beween the transmitter and receiver.

c. Semifixed Operation. Semifixed operation describes a more permanent condition in which the antennas are erected and are not a part of the shelter. The shelter may be removed from the vehicle and placed in a more concealed position. Under these conditions, doublet antennas are erected and either space diversity duplex or space diversity one-way reversible operation is used. Space diversity theory is explained in paragraph 56*b*.

d. Operating Procedures. The radio set may be operated either locally (within the shelter) or from a remote location (at a max distance of 10 miles). Operation is possible in any one of four ways: fsk, fsk-am, am, and cw. The control unit is the control center for the radio set. All signals to or from the teletypewriter equipment and from a microphone or key are routed through the control unit. To operate the radio set, start and tune the equipment as instructed in paragraphs 28 through 30, and follow the procedure for the desired type of operation as discussed in paragraphs 32 through 35.

32. Fsk Operation

The signals from the sending teletypewriter equipment are routed through the control unit and key the fsk-modulator, which in turn keys the transmitter. The receiving teletypewriter equipment is actuated by signals received from the control unit through the two receivers and the converter. The TELETYPE switch on the control unit is used to select the type of teletypewriter operation desired. The switch has four positions: two are used with local operation and two are used with remote operation.

a. Fsk Duplex Operation From Shelter.

(1) Set the DC switch of the send teletypewriter to ON, the LINE SELECTOR switch to 60, and adjust LINE INCREASE rheostat for 60 ma dc output.

(2) Set the SEND–REC switch of the send teletypewriter to SEND.

(3) Set the SEND–LOCK switch of the reperforator to SEND.

(4) Set the SERVICE SELECTOR switch of the transmitter to FSK.

(5) Set the KEYING switch of the transmitter to NORMAL.

(6) Set the BAND SELECTOR switch of the fsk-modulator to correspond to the BAND SELECTOR switch setting on the transmitter.

(7) Set the TELETYPE switch of the control unit to NORMAL DX.

(8) Set the BFO switch on receiver A to ON.

(9) Set the BANDWIDTH control of receiver A to 1 KC.

(10) Slowly rock the KILOCYCLE CHANGE control of receiver A while observing CHANNEL A DISCRIMINATOR meter on the converter. The input teletypewriter space and mark signals should deflect the meter needle the same amount to right and left for best tuning.

Best tuning is also indicated by maximum indication on the SIGNAL INPUT meter.

(11) Adjust the receiver gain controls for an indication of 30 to 70 ma on the SIGNAL INPUT meter on the converter.

(12) Rotate the CHANNEL A MARK–HOLD switch on the converter to the left hand XTAL position. If the teletypewriter printing has no meaning, rotate MARK HOLD switch to the right hand XTAL position.

(13) Set the BFO switch on the receiver to OFF.

(14) Repeat the steps in (8) through (13); use receiver B and channel B section of the converter when space diversity reception is desired.

(15) Set the CHANNEL SELECTOR switch on the converter to A + B position when space diversity reception is desired.

Note. The receive teletypewriter should print page copy of the information being received. At the same time, typing on the send teletypewriter or the reperforator keyboard should modulate the transmitter, both the send teletypewriter and reperforator should print copies of the transmission on page and tape respectively. Tape run through the tape transmitter section of the reperforator should modulate the transmitter, and the send teletypewriter should print a page copy of the tape. To prepare a tape for future transmission while the station is in duplex operation, turn the reperforator SELECTOR switch to position 3 (LOCAL REPUNCH), and type on the reperforator. There should be no interference between the reperforator and the message originating at the send teletypewriter.

b. Fsk Duplex Operation From Remote Site. All shelter equipment remains as outlined in *a* above with the exception of the TELETYPE switch on the control unit; set the TELETYPE switch to REMOTE DX. The remote control unit must be connected as shown in figure 19. To monitor the remote site at the shelter, set the send teletypewriter SEND–REC switch to REC and set the reperforator SEND–LOCK switch to LOCK. Adjust the remote site equipment as follows:

(1) Set the receive teletypewriter MOTOR and POWER switches to ON.

(2) Set the receive teletypewriter SEND–REC switch to REC.

(3) Set the send teletypewriter MOTOR and POWER switches to ON.

(4) Set the send teletypewriter SEND–REC switch to SEND and proceed with the operation from the remote site.

c. Fsk One-Way Reversible Operation From Shelter. Follow the adjustment procedures as outlined in *a* above with the following exceptions.

(1) Set the TELETYPE switch on the control unit to NORMAL OW.

(2) Set the BREAK IN switch on the receiver to ON.

(3) For receiving messages, set the SEND–REC switch on the send teletypewriter to REC. For transmitting messages, set the SEND–REC switch on the send teletypewriter to SEND. For sending a prepared tape copy from the reperforator, set the SELECTOR switch to position 1 and set the SEND–REC switch of the send teletypewriter to SEND.

d. Fsk One-Way Reversible Operation From Remote Site. Follow the adjustments procedure as outlined in *b* above with the following exceptions:

(1) Set the TELETYPE switch on the control unit to REMOTE OW.

(2) Set the shelter teletypewriter SEND–REC switch to REC.

(3) Turn on the remote teletypewriter and set the SEND–REC switch to SEND to transmit messages and to REC to receive messages.

(4) The shelter teletypewriter will monitor both the received and transmitted copy.

33. Am Operation

For am operation, perform the tuning procedure listed in paragraph 30, and then adjust the equipment as instructed in the appropriate subparagraph below.

a. Am Duplex Operation From Shelter.

(1) Tune in a voice signal on the receiver and adjust for the desired volume with the LOCAL GAIN control.

(2) If noise is excessive, rotate the LIMITER control clockwise as required.

(3) Set the BANDWIDTH switch to the 4 KC position, or to the 2 KC position if interference is encountered.

(4) If the signal fades rapidly, set the AGC switch to FAST.

(5) To quiet the receiver between transmissions, set the FUNCTION switch to SQUELCH and rotate the RF GAIN control to reduce high-level noise. Avoid reducing the gain so that the desired signal is also eliminated. Do not use the SQUELCH control if the desired signals are weak or subject to fading.

(6) Tune receiver B by following the same procedure used to tune receiver A when space diversity operation is desired.

(7) Set the SERVICE SELECTOR switch on the transmitter to AM.

(8) Set the TUNE–NORMAL switch to TUNE.

(9) Set the EXCITATION METER SWITCH to the MOD PLATE X20 position and adjust the MODULATOR BIAS control for an indication of 50 ma on the EXCITATION meter.

(10) Connect the carbon mike to the CARBON MICROPHONE receptacle on the transmitter.

(11) Pull open the modulator deck of the transmitter and turn the clipper control fully counterclockwise, then close the modulator deck.

Warning: Be careful that the deck is not pulled out too far. The operator may be injured or the equipment may be damaged because there are no stops to prevent the deck from falling out of the transmitter housing.

(12) Hold the mike and press the mike switch. Hum or whistle a sustained note into the mouthpiece while adjusting the CARBON MIKE GAIN control for an indication of 250 ma on the EXCITATION meter.

(13) Pull open the modulator deck of the transmitter and adjust the clipper control to produce an indication of 230 ma on the EXCITATION meter (approx the midposition) when a sustained note is applied to the mike. The setting of the clipper control will have to be approximated because plate power is removed when the deck is pulled open. Repeat the procedure until the desired results are obtained, then secure the deck to the housing.

(14) Readjust the CARBON MIKE GAIN control for an indication of 250 ma on the EXCITATION meter.

(15) Connect the microphone to the control unit if operation from that position is desired.

(16) If a 600-ohm line input is used in place of the microphone, adjust the 600 OHM LINE GAIN control instead of the CARBON MIKE GAIN control as in (12) through (15) above, and set the KEYING switch to CONTINUOUS.

b. Am Duplex Operation From Remote Site. All shelter equipment remains the same as in *a* above except the REMOTE TEL switch of the control unit is set to REC A and the transmitter must be adjusted for 600-ohm line input.

(1) Set the XMTR ON switch of the remote control unit to on. (The KEYING switch on the transmitter is set to NORMAL.)

(2) Close the remote telephone push-to-talk switch and speak into the telephone at the remote site.

(3) The remote telephone signal will modulate the transmitter. The remote telephone may be monitored on the shelter telephone. The shelter telephone may be used to modulate the transmitter in the same manner as the remote telephone.

(4) Differences in line level, due to losses in the remote line, are compensated with the HYBRID BAL control of the control unit in the shelter.

c. Am One-Way Reversible Operation From Shelter. All shelter equipment remains the same as in *a* above with the following exceptions:

(1) The receiver can be tuned to the same frequency as the transmitter.

(2) Set the BREAK IN switch of the receiver to ON.

(3) The receiver will receive am signals. Pressing the microphone switch will dis-

able the receiver and talking into the microphone will amplitude-modulate the transmitter.

d. Am One-Way Reversible Operation From Remote Site. All shelter equipment remains the same as in *a* above with the following exceptions:

(1) The receiver can be tuned to the same frequency as the transmitter.

(2) Set the REMOTE TEL switch of the control unit to REC A.

(3) Set the XMTR ON switch of the remote control unit to off. The signal being received by the receiver in the shelter will be heard in the telephone at the remote site.

(4) Set the XMTR ON switch of the remote control unit to on. Received signal will stop; speaking into the remote telephone will modulate the transmitter.

34. Fsk-Am Operation

To operate the radio set in the fsk-am mode, perform the tuning procedure listed in paragraph 30; adjust the radio set for fsk duplex operation as instructed in paragraph 32*a*; adjust the radio set for duplex am operation as instructed in paragraph 33*a*; then set the SERVICE SELECTOR switch on the transmitter to FSK–AM.

a. Fsk-Am Duplex Operation From Shelter.

(1) Set the TELETYPE switch of the control unit to NORMAL DX.

(2) Copy typed through the keyboard of the send teletypewriter will modulate the transmitter through the fsk-modulator.

(3) Connect the microphone to the control unit.

(4) Speaking into the microphone will amplitude-modulate the transmitter.

(5) Radioteletype signals will be printed on the receive teletypewriter.

(6) Am signals will be audible over the loudspeakers.

b. Fsk-Am Duplex Operation From Remote Site. Adjustments are the same as for shelter duplex fsk-am operation with the following exceptions:

(1) Set the TELETYPE switch on the control unit to REMOTE DX.

(2) Substitute the remote send teletypewriter for the send teletypewriter and the remote receive teletypewriter for the receive teletypewriter.

(3) Set the REMOTE TEL switch of the control unit to REC A.

(4) Set the LINE CONTROL of the receivers to ZERO.

(5) While speaking into the remote telephone, set the transmitter 600 OHM LINE GAIN control for proper swing of the EXCITATION meter with EXCITATION METER SWITCH in the MOD PLATE X20 position.

(6) Copy typed through the remote send teletypewriter will fsk modulate the transmitter through the fsk-modulator.

(7) The receiver will accept radioteletype signals and apply them to the remote receive and shelter receive teletypewriters through the converter.

(8) Voice signals received will be heard in the speaker of the receiver, and may be heard in the remote telephone receiver.

c. Fsk-Am One-Way Reversible Operation From Shelter. Adjust the equipment as indicated in *a* above with the following exceptions:

(1) Set the receiver BREAK IN switch to ON.

(2) Set the TELETYPE switch of the control unit to NORMAL OW.

(3) To receive, set the SEND–REC switch of the send teletypewriter to REC. The teletypewriter should print copy from the receiver through the converter. The receiver will simultaneously receive voice signals on the speaker.

(4) To transmit, set the SEND–REC switch of the send teletypewriter to SEND, and press the microphone switch. Typing on the teletypewriter and speaking into the microphone will modulate the transmitter. The receiver is disabled during transmission.

d. Fsk-Am One-Way Reversible Operation From Remote Site. Adjust the equipment as indicated in *a* above with the following exceptions:

(1) Set the TELETYPE switch of the control unit to REMOTE OW.

(2) To receive, set the SEND–REC switch of the send teletypewriter to REC. The

teletypewriter should print copy from the receiver through the converter over connections to the remote site. Simultaneously, voice signals will be received over the telephone.

(3) To transmit, set the SEND–REC switch of the send teletypewriter to SEND. Typing on the teletypewriter and speaking into the telephone will modulate the transmitter. The receiver is disabled during transmission.

35. Cw Operation

For cw operation, perform the tuning procedure (par. 30) and proceed as follows:

a. Cw Duplex Operation From Shelter.

(1) Set the SERVICE SELECTOR switch on the transmitter to CW.

(2) Throw the PLATE RELAY switch on the transmitter to on.

(3) Throw the KEYING switch on the transmitter to NORMAL.

(4) Connect a KEY to the MIC or KEY input jack on the control unit.

(5) Set the BFO switch on receiver A to ON.

(6) Tune in the cw signal and adjust the BFO control for a comfortable pitch.

(7) If signal interference is encountered, set the BANDWIDTH switch to 1 KC or .1 KC position and the AUDIO RESPONSE switch to SHARP. Set the BFO PITCH control to 0, tune receiver A for a zero beat, and readjust the BFO PITCH control for a comfortable pitch.

(8) For manual gain control only, set the FUNCTION switch to MGC and adjust the sensitivity with the RF GAIN control.

(9) When receiving machine code transmission, turn the AGC switch to SLOW.

(10) To reduce effects of fading, set the FUNCTION switch to AGC and turn the AGC switch to SLOW. For full sensitivity, rotate the RF GAIN control to position 10 (max clockwise).

(11) Tune receiver B by following the same procedure used for receiver A when space diversity reception is desired.

b. Cw One-Way Reversible Operation From Shelter. To tune for one-way reversible operation, follow the procedure in *a* above and proceed as follows:

(1) Throw the receiver BREAK IN switch to ON.

(2) The receiver will receive cw signals. When the key is pressed, the receiver will be disabled and the transmitter will radiate signals.

c. Cw Operation From Remote Site. No provisions are made for normal cw operation from the remote site. To operate emergency cw from the remote site, proceed as follows:

(1) Adjust the equipment as instructed in *a* above.

(2) Set the TELETYPE switch of the control unit to REMOTE OW.

(3) Connect the key at the remote site to the terminals on the remote control unit labeled CONTROL (this parallels the TTY SWITCH jack and the XMTR ON switch of the remote control unit).

(4) Press and release the key to key the transmitter to send cw signals.

36. Stopping Procedure

The entire radio set may be disabled by setting the shelter main circuit breakers to their OFF positions or by pressing the STOP button on the power unit. Complete disabling in this manner is only performed as an emergency measure, because the individual components must be set to their respective off positions before restarting. To perform the normal de-energizing procedure for the individual components, set the controls as follows:

Component	Control	Position
Teletypewriters	LIGHT switches	OFF
	MOTOR switches	OFF
	POWER switches	OFF
Reperforator	LIGHT switch	OFF
	MOTOR switch	OFF
	POWER switch	OFF
Converter	POWER switch	OFF
Control unit	Power switch	OFF
Speaker assembly	ON CHANNEL A switch	Off (down)
	ON CHANNEL B switch	Off (down)
Receivers	OVENS switches	OFF
	FUNCTION switches	OFF
Fsk-modulator	POWER switch	OFF
Electrical Blower Assembly HD–223/G	Power switch	OFF
Transmitter	PLATE RELAY switch	Off (down)
	PLATE POWER circuit breaker	OFF
	FILAMENT POWER circuit breaker	OFF
Shelter	Circuit breakers	OFF
Power unit	CIRCUIT BREAKER	OFF
	STOP button	Press until engine stops

CHAPTER 4
ORGANIZATIONAL MAINTENANCE

Section I. PREVENTIVE MAINTENANCE SERVICES

37. Tools and Equipment Supplied

The table of components in the appendix includes the tools and equipment supplied with the radio set. The tools and test equipment for the organizational maintenance of the receiver and transmitter are listed in the individual manuals and are sufficient for all organizational maintenance of Radio Set AN/GRC–26D. The following materials are required for performing maintenance:

Cleaning Compound (Federal stock No. 7930–395–9542)

Cleaning cloth

Fine sandpaper.

38. General Preventive Maintenance Techniques

a. Use the floor broom, bench brush, and cheesecloth for cleaning the shelter.

b. Use fine sandpaper to remove corrosion from the antenna masts. After cleaning, touch up all areas not used for electrical contact with olive drab paint.

c. Use a clean, dry, lint-free cloth or a dry brush for cleaning. When cleaning, use a cloth or brush moistened with Cleaning Compound.

Caution: Cleaning Compound is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation.

39. Use of Preventive Maintenance Forms

a. DA Form 11–238 (fig. 22) is a preventive maintenance checklist to be used by the operator. Items not applicable to the radio set are lined out in the figure. Instructions for the use of the form appear on the back of the form.

b. DA Form 11–239 (fig. 23) is a preventive maintenance checklist to be used by the unit repairman. Items not applicable to the equipment are lined out in the figure. Instructions for the use of the form appear on the back of the form.

c. Records of the maintenance and inspection of the major components which make up the radio set are maintained on separate Forms DA 11–238 and DA 11–239 for the individual components. Specific instructions on the preventive maintenance of each of these are contained in their respective manuals (par. 1).

d. Figures 22 and 23 are applicable to the *remaining* equipments of the radio set. These include the shelter, the various antennas, antenna accessories and lead-ins, fsk-modulator, control unit, and remote control unit. Items not applicable to these equipments are lined out in the figure.

40. Lubrication Instructions

a. General.

(1) The type of lubricant to be used, the interval, and the specific instructions for each component of the radio set are given in the respective technical manuals (par. 1). Lubrication for the shelter ventilator blower is given in *b* below.

(2) Gasoline will not be used as a cleaning fluid for any purpose. When a component is overhauled or repairs are made, clean the parts with Cleaning Compound (SD).

Note. Before applying lubricant, be sure parts are clean and free from dust and dirt. Lubricate sparingly. Wipe off excess lubricant.

(3) Apply Oil, Lubricating, Preservative, Special (PL-Special) sparingly to springs and loops of all helical springs, to prevent wear and rust.

b. Shelter Ventilating Blower. Lubricate with Oil, Engine (OE–10) in oil cups located at each

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
RADIO SET AN/GRC-26D	1

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT ~~(receiver, transmitter~~, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).		✓	✓				
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		✓	✓				
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, ~~CHESTSETS~~, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.		✓	✓				
4	~~INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.~~							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, ~~WORN OR CHIPPED GEARS~~, MISALIGNMENT, POSITIVE ACTION.		✓	✓				
6	CHECK FOR NORMAL OPERATION.		✓	X				

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.	✓	13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.	(X)	14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	✓
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.	✓	15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	✓
10	INSPECT ANTENNA FOR ~~ECCENTRICITIES~~, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS~~.	✓	16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING.	✓
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	✓	17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	(X)
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ~~ELECTRICAL TRANSFORMERS, POWERSTATS~~, RELAYS, ~~SELSYNS~~, ~~MOTORS~~, BLOWERS, ~~CAPACITORS~~, ~~GENERATORS~~, AND PILOT LIGHT ASSEMBLIES.	X	18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 2648-51

Figure 22. DA Form 11–238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO SET AN/GRC-26D

EQUIPMENT SERIAL NO.: /

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).*	✓	19	~~ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTIONS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.~~	(X)
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.	✓	20	~~INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.~~	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, ~~CHESTSETS,~~ KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.	✓	21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	✓
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.	(X)	22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	✓
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.	✓	23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	(X)
6	CHECK FOR NORMAL OPERATION.	✓	24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE.	✓
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, ~~WAVE GUIDES,~~ AND CABLE CONNECTIONS.	(X)	25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.	✓
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.	✓	26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	✓
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.	✓	27	~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS.~~	(X)	28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	✓
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	✓	29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	✓
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, ~~POWERSTATS,~~ RELAYS, ~~CELSYNS,~~ MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.	(X)	30	INSPECT GENERATORS, ~~AMPLIDYNES, DYNAMOTORS,~~ FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	(X)
13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.	(X)
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	✓	32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.	✓
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	✓	33	~~BEFORE SHIPPING OR STORING - REMOVE BATTERIES.~~	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	✓	34	~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	(X)	35	~~INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.~~	
18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	✓	36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	✓
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 16-64382-1

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Figure 23. DA Form 11-239.

end of the motor. This blower motor is located near the ceiling of the shelter above the transmitter.

c. Mechanical Devices of Shelter. Lubricate all movable parts of the shelter, such as hinges, latches, etc, with a light coat of oil (OE–10) to insure against rust and corrosion and provide for better operation. Wipe off excess lubricant to prevent contamination by dirt or dust.

d. Raceways of Cabinets. The raceways of cabinets should be lubricated with oil (PL-Special) to assure easy removal of chassis for repairs.

e. Lubricants. For operation in extreme temperatures, use the lubricants listed below in place of those specified.

Lubricant specified	For temperature		
	Above +32° F.	+32° F. to 0° F.	Below 0° F.
OE–10 PL-Special	OE–10	PL-Special	PL-Special
Grease, Aircraft and Instruments (GL)	GL	GL	PL-Special
Grease, General Purpose No. 2 (WB)	WB	GL	GL

Section II. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

41. General

a. The troubleshooting and repair that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such trouble as burned-out tubes, fuses, etc.

b. Paragraphs 42 through 45 help to determine which component, such as the receiver or transmitter, is at fault and to localize the fault in that component to the defective stage or part.

42. Visual Inspection

a. Many of the faults appearing in the radio set may be detected by a visual inspection of the system components. Pilot lamps are used to indicate that power has been applied to a component. If pilot lamps fail to light, check to see that the power cords are connected to the proper receptacles and that the plugs are properly inserted.

b. One type of fault is improper setting of controls and switches. Check the control and switch settings for the type of operation to be used.

43. Sectionalization

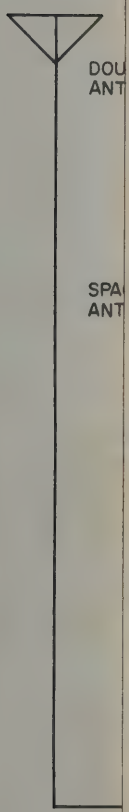
Sectionalization of trouble to a component in the system is the first step in troubleshooting. Generally, there are two methods of troubleshooting. One is a step-by-step procedure, such as the equipment performance checklist (par. 45*e*), that will eventually pinpoint the malfunctioning component and possibly even a defective stage or part. The other is tracing of service paths within the system, such as power input, received signal, and transmitted signal. These paths are broken down as described below.

a. Power Input. Complete failure of the system can be caused by trouble in the power unit or a faulty input power cable. Partial de-energizing of the radio set can be caused by faulty circuit breakers or broken or loose wires in the ac distribution circuit. Check the following items:

(1) Power Unit PE–95–B for proper power output.
(2) Power input cables for breaks or loose cable connections.
(3) Circuit breakers for positive contact.
(4) Shelter ac wiring for breaks or loose connections.
(5) Ac cords of components for breaks or improper plug seating.

b. Received Signal. Troubles along the received signal path are indicated as follows:

(1) No signal at the receiver.
(*a*) Receiver inoperative.


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(*b*) Coaxial cable to antenna shorted, broken, or defective connections.

(2) Receiver good, but no signal output from converter.

(*a*) Converter inoperative.

(*b*) Interconnecting cables between converter and receiver broken or disconnected.

(3) Converter good but teletypewriter not operating.

(*a*) Teletypewriter inoperative.

(*b*) Interconnecting cables damaged or disconnected.

(*c*) Control unit improperly connected or switches improperly set.

c. Transmitted Signal. Troubles along the transmitted signal path are as follows:

(1) Transmitter will not tune.

(*a*) Transmitter inoperative.

(*b*) Interconnecting cables damaged or disconnected.

(2) Transmitter tunes but will not load.

(*a*) Improper antenna match.

(*b*) Antenna damaged or coaxial cable to antenna broken or connections loose.

(*c*) Antenna tuning unit inoperative.

(3) Teletypewriter signals not being transmitted; transmitter and fsk-modulator good.

(*a*) Teletypewriter inoperative.

(*b*) Interconnecting cables damaged or disconnected.

(*c*) Improper switch settings of control unit or teletypewriters.

44. Electron Tube Testing Techniques

When the trouble has been sectionalized to a component (receiver, transmitter, etc.), the trouble usually can be localized by a systematic check of the component, and/or by testing the tubes.

a. Inspect all interior cables, connections, fuses, and the general condition of the equipment before removing any electron tubes.

b. Tube location diagrams for Radio Receiver R–390/URR, Frequency Shift Converter CV–116B/URR, and Radio Transmitter T–368C/URT along with organizational maintenance instructions will be found in their respective technical manuals (par. 1). A tube location diagram for Radio Modulator MD–239A/GR is shown in figure 16. Isolate the trouble, if possible, to a particular section or subchassis of the defective component and proceed as follows:

(1) If Electron Tube Test Set TV–7/U or equivalent is available, remove and test one tube at a time. Substitute new tubes only for those that are defective.

(2) If a tube tester is not available, troubleshoot by the tube substitution method. Substitute a new tube for an original tube. If no change occurs in the operation of the receiver, replace the new tube with the original. Similarly, check each original tube, in turn, until the equipment becomes operative or until all suspected tubes have been tested and the need for further troubleshooting is indicated.

45. Equipment Performance Checklist

a. General. The equipment performance checklist will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *Action or condition* column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the *Normal indication* column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. If the radio set is completely inoperative, or if the recommended corrective measures do not yield results, troubleshooting is necessary.

Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
1	Power unit	CIRCUIT BREAKER switch	Set at OFF.		
2	Power unit	MANUAL START-REMOTE START switch.	Set at REMOTE START.		
3	Shelter	Circuit breakers	Set at OFF.		
4	Transmitter	FILAMENT POWER circuit breaker.	Set at OFF.		
5	Transmitter	PLATE POWER circuit breaker.	Set at OFF.		
6	Transmitter	TUNE-NORMAL switch	Set at TUNE.		
7	Transmitter	PLATE RELAY	Set at off (down).		
8	Transmitter	KEYING switch	Set at NORMAL.		
9	Transmitter	BAND SELECTOR switch	Set at desired band.		
10	Transmitter	TUNING CONTROL	Turn to desired operating frequency.		
11	Transmitter	P A BAND SWITCH	Set at desired band.		
12	Transmitter	POWER AMPLIFIER TUNING and POWER AMPLIFIER LOADING controls.	Settings found from calibration charts for desired frequency.		
13	Transmitter	SERVICE SELECTOR switch.	Set to FSK.		
14	Transmitter	EXCITATION METER switch.	Set to PA GRID X2.		
15	Fsk-modulator	POWER switch	Set at OFF.		
16	Fsk-modulator	BAND SELECTOR switch	Set at desired band.		
17	Control unit	POWER switch	Set at OFF.		
18	Control unit	SIDETONE switch	Set at OFF.		
19	Control unit	TELETYPE switch	Set at NORMAL OW.		
20	Control unit	REMOTE TEL switch	Set at LOCAL TEL.		
21	Converter	POWER switch	Set at OFF.		
22	Converter	AFC switch	Set at OFF.		
23	Converter	AFC SHIFT ADJUSTMENT controls.	Set at 0.		
24	Converter	AFC THRESHOLD LEVEL controls.	Set at OFF.		
25	Converter	CHANNEL SELECTOR switch.	Set at A.		
26	Converter	AFC–XTAL-MARK HOLD switches.	Set at MARK HOLD.		
27	Converter	DRIFT INDICATOR controls	Set at 0.		
28	Converter	SPEED switch (on rear panel).	Set at LOW.		

PREPARATORY	29	Receivers	FUNCTION switches	Set at OFF.		
	30	Receivers	LINE METER switches	Set at OFF.		
	31	Receivers	LINE GAIN controls	Set at 0.		
	32	Receivers	LIMITER switches	Set at OFF.		
	33	Receivers	BREAK IN switches	Set at OFF.		
	34	Receivers	BFO PITCH controls	Set at 0.		
	35	Receivers	ANT TRIM controls	Set at 0.		
	36	Receivers	BFO switches	Set at OFF.		
	37	Receivers	LOCAL GAIN controls	Set at 0.		
	38	Receivers	RF GAIN controls	Set at 0.		
	39	Receivers	OVENS switches (on rear panel).	Set at OFF.		
	40	Receivers	MEGACYCLE CHANGE controls.	Set at desired band.		
	41	Receivers	KILOCYCLE CHANGE controls.	Set to desired frequency.		
	42	Receivers	AUDIO RESPONSE switches.	Set at MED.		
	43	Receivers	BANDWIDTH switches	Set at 4 to 8 kc.		
	44	Speaker assembly	ON CHANNEL A switch	Set at down position.		
	45	Speaker assembly	ON CHANNEL B switch	Set at down position.		
	46	Electrical Blower Assembly HD–223/G.	POWER switch	Set at OFF.		
	47	Reperforator	POWER switch	Set at OFF.		
	48	Reperforator	MOTOR switch	Set at OFF.		
	49	Reperforator	SEND-LOCK switch	Set at LOCK.		
	50	Reperforator	LIGHT switch	Set at OFF.		
	51	Reperforator	MAGNET START-STOP-FEED RETRACT switch.	Set at STOP.		
	52	Teletypewriters	POWER switches	Set at OFF.		
	53	Teletypewriters	MOTOR switches	Set at OFF.		
	54	Teletypewriters	LIGHT switches	Set at OFF.		
	55	Teletypewriters	SEND-REC switches	Set at REC.		
	56	Teletypewriters	DC switches	Set at OFF.		
START	57	Power unit	START button	Press and hold in	Power unit starts	Check for discharged battery. Check fuel. Refer to TM 11–904.
	58	Power unit	CIRCUIT BREAKER switch	Set at ON	Normal line voltage (117 volts indicated on AC VOLTS meter on power unit panel).	Check circuit breaker. Refer to TM 11–904.

	Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
START	59	Shelter	Circuit breakers	Set at ON	Shelter lamps illuminate when individual lamp switches are on. Shelter ventilating blower and fan energize when their power switches are in the on position.	Check circuit breakers. Check Power Cable Assemblies CX–1165/U (12 ft) and CX–1166/U (50 ft) from power unit or commercial source if used.
	60	Electrical Blower Assembly HD–223/G.	Power switch	Set at ON	Blowers operate, pilot lamp illuminates.	Check switch. Check ac line cord and plug. Check pilot lamp. Check fuse F101.
	61	Receivers	FUNCTION switches	Set at AGC	Dial lamps illuminate	Check ac line cord and plug. Check fuses F1 and F2.
	62	Converter	POWER switch	Set at ON	Pilot lamp illuminates Fan operates	Check ac line cord and plug. Check pilot lamp. Check pilot lamp. Check ac line cord and plug.
	63	Control unit	Power switch	Set at ON	Pilot lamp illuminates	
	64	Control unit	TELETYPE switch	Set at NORMAL DX.		
	65	Speaker assembly	ON CHANNEL A switch	Set at up position.		
	66	Speaker assembly	ON CHANNEL B switch	Set at up position.		
	67	Fsk-modulator	POWER switch	Set at ON	Pilot lamp illuminates Blower operates	Check fuse F1. Check pilot lamp. Check ac line cord and plug.
	68	Fsk-modulator	BAND SELECTOR switch	Set at desired band.		
	69	Transmitter	FILAMENT POWER circuit breaker.	Set at ON.		
	70	Transmitter	PLATE POWER circuit breaker.	Set at ON	FILAMENT POWER indicator lamp illuminates. Blower operates. FIL VOLTAGE meter indicates 5 volts.	Check Cord CD–763 (13 ft) and connectors between ac source and ac power receptacle J14. Check cables to J7 (power supply deck) and J1 (rf deck), and the connectors. Check fuses F1 and F2. Check FIL VOLTAGE meter M1 and FILAMENT VOLTAGE control R18. Check blowers. Check FILAMENT POWER circuit breaker CB1. Check FILAMENT POWER lamp.

START	71	Receive teletypewriter.	POWER switch	Set at ON.		
	72	Receive teletypewriter.	MOTOR switch	Set at ON	Motor should operate.	
	73	Send teletypewriter.	POWER switch	Set at ON.		
	74	Send teletypewriter.	MOTOR switch	Set at ON	Motor should operate.	
	75	Reperforator	POWER switch	Set at ON.		
	76	Reperforator	MOTOR switch	Set at ON	Motor should operate.	
	77	Reperforator	SELECTOR switch	Set at 1.		
EQUIPMENT PERFORMANCE	78	Transmitter	SERVICE SELECTOR switch.	Set at FSK.		
	79	Transmitter	PLATE RELAY switch	Set at on (up).		
	80	Transmitter	KEYING switch	Set at CONTINUOUS	PA PLATE meter reads 150 ma.	Adjust POWER AMPLIFIER TUNING and POWER AMPLIFIER LOADING. Check RF Cable Assemblies CG–530B/U (2 ft) from transmitter to fsk-modulator. Check fsk-modulator.

Approximately 25 seconds after circuit breaker is set at ON, PLATE POWER indicator lamp illuminates. Also PA PLATE meter indicates a low reading.

Check PLATE POWER circuit breaker CB2, PLATE POWER indicator lamp, THERMAL RESET switch, and OVERLOAD RESET switch.
Check relays K5 through K8 on power supply deck under protective cover.
Check plug P11 for firm seating in jumper plug receptacle J13.
Check high-voltage rectifier tubes V18 and V19 and see that all decks are closed.
Check PA PLATE meter M3.
Check clamper tube V2.

Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
81	Transmitter	TUNE-NORMAL switch	Set at NORMAL	PA PLATE meter reads 350 ma.	Adjust POWER AMPLIFIER TUNING and POWER AMPLIFIER LOADING. Check V1; check jack J103 and plug P8 for firm seating.
				EXCITATION meter reads 8 to 12 ma with EXCITATION METER SWITCH at PA GRID X2.	Check V104. Refer to TM 11–809.
				EXCITATION meter reads 20 to 70 ma with EXCITATION METER SWITCH at INT AMP PLATE X10 position.	Check 104 and seating of plug P101 in J8. Refer to TM 11–809.
				Equipment ready for fsk transmission. *Note.* In all modes of operation, signals from the transmitter master oscillator to the second buffer stage are routed through the fsk-modulator.	
82	Transmitter	KEYING switch	Set at NORMAL.		
83	Transmitter	SERVICE SELECTOR switch.	Set at AM.		
84	Transmitter	EXCITATION METER SWITCH.	Set at MOD PLATE X20.		
85	Transmitter	Carbon microphone and mike switch.	Press mike switch and apply a sustained note to mike.	EXCITATION meter indicates 250 ma.	Readjust CARBON MIKE GAIN control. Check setting of clipper control on modulator deck. Check mike and mike switch. Check speech amplifier tubes. Refer to TM 11–809.
86	Transmitter	SERVICE SELECTOR switch.	Set at CW.		
87	Transmitter	PLATE POWER circuit breaker.	Set at ON.		
88	Transmitter	PLATE RELAY switch	Set to up position	PA PLATE meter reads 350 ma.	Adjust POWER AMPLIFIER TUNING and POWER AMPLIFIER

					LOADING. Refer to TM 11–809.
89	Transmitter	Key KY–116/U	Held closed	ANTENNA CURRENT meter (on tuning unit) indicates maximum.	Check control settings, tuning, coupling, and antenna range switch. Check handkey.
90	Transmitter	SERVICE SELECTOR switch (Checks performed as described for FSK and AM operation).	Set at FSK-AM.		
91	Fsk-modulator	BAND SELECTOR switch	Set to correspond to transmitter BAND SELECTOR switch.	Reading of 8 ma on transmitter EXCITATION meter at PA GRID X2 position when transmitter is keyed.	Check fsk-modulator BAND SELECTOR switch. Check fuses F1 and F2. Check RF Cable Assemblies CG–530B/U. Check connections and seating of Connector Adapters UG–306A/U at modulator M.O. IN jack and FSK OUT jack, and at transmitter EXT EXC jack and FSK jack.
92	Receivers	ANT TRIM controls	Rotate	Peak indication on CARRIER LEVEL meter.	Refer to TM 11–856.
93	Receivers	MEGACYCLE CHANGE and KILOCYCLE CHANGE controls.	Adjust	Use for receiver tuning.	Refer to TM 11–856.
94	Receivers	BFO switches	Set at ON.		
95	Receivers	BFO PITCH controls	Rotate BFO PITCH control	Beat note can be heard to pass through zero beat.	Refer to TM 11–856.
96	Speaker assembly	Loudspeakers	Operating normally	Signal is heard	Check cable connections. Refer to TM 11–856.
97	Receivers	LOCAL GAIN controls	Rotate control in either direction.	Volume at loudspeaker increases or decreases.	Refer to TM 11–856.
98	Receivers	LINE GAIN controls	Rotate control	LINE LEVEL meter increases and decreases.	Refer to TM 11–856.
99	Receivers	RF GAIN controls	Rotate control	Audio output, and CARRIER LEVEL meter increases or decreases.	Refer to TM 11–856.
100	Receivers	FUNCTION switches	Set to MGC	With no signal input, noise level should increase but CARRIER LEVEL meter does not indicate.	Refer to TM 11–856.
			Set to CAL and operate KILOCYCLE CHANGE control.	Deflection on CARRIER LEVEL meter at each 100-kc reading.	Reset ANT. TRIM control. Refer to TM 11856.

Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
			Set to SQUELCH and operate KILOCYCLE CHANGE control. Return to AGC and set RF GAIN control to 10.	No reception of noise while tuning between stations.	Adjust RF GAIN control until squelch is effective.
101	Receivers	BREAK IN switches	Set at ON	Receiver disabled and LINE LEVEL meter does not indicate when transmitter is keyed.	Check BREAK IN switch. Check Special Purpose Electrical Cable Assembly CX–3268/U and connection to terminal 9 on rear panel of receiver. Check relay K2 of control unit. Refer to TM 11–856.
102	Converter	CHANNEL SELECTOR switch.	Set to **A**.		
103	Converter	AFC–XTAL-MARK HOLD switch.	Set to MARK HOLD.		
104	Converter	KILOCYCLE CHANGE control of receiver A.	Retune	Equal left and right deflection on converter's CHANNEL A DISCRIMINATOR meter. Maximum reading on SIGNAL INPUT meter of converter.	Check receiver tuning. Refer to TM 11–856 or TM 11–2241.
105	Converter	Receiver A LOCAL GAIN and RF GAIN controls.	Adjust	Reading of 30 to 70 ma on converter SIGNAL INPUT meter.	Refer to TM 11–2241.
106	Converter	CHANNEL SELECTOR switch.	Set to B.		
107	Converter	AFC-XTAL-MARK HOLD switch.	Set to MARK HOLD.		
108	Converter	KILOCYCLE CHANGE control of receiver B.	Retune	Equal left and right deflection on converter's CHANNEL B DISCRIMINATOR meter. Maximum reading on SIGNAL INPUT meter of converter.	Check receiver tuning. Refer to TM 11–856 or TM 11–2241.
109	Converter	Receiver B LOCAL GAIN and RF GAIN controls.	Adjust	Reading of 30 to 70 ma on converter SIGNAL INPUT meter.	Refer to TM 11–2241.
110	Control unit	SIDETONE switch	Set to OFF (transmitter set for CW operation).	When transmitter is keyed, 1,000-cycle note not audible in either receiver speaker.	Check SIDETONE switch. Refer to TM 11–856 and TM 11–809.

111	Control unit	SIDETONE switch	Set to REC A (transmitter set for CW operation).	When transmitter key is closed, 1,000-cycle note is audible in receiver A speaker.	Check SIDETONE switch. Check loud speaker ON CHANNEL A switch. Check receiver Special Purpose Electrical Cable Assembly CX–3268/U and Electrical Cord Assembly CX–3271/U. Check transmitter cable Special Purpose Electrical Cable Assembly CX–3267/U. Refer to TM 11–856 or TM 11–809.
112	Control unit	SIDETONE switch	Set to REC B (transmitter set for CW operation).	When transmitter key is closed 1,000-cycle note is audible in receiver B speaker.	Check same as item 111.
113	Receive teletypewriter.	SED-REC switch	Set to REC	Teletypewriter runs closed	Refer to TM 11–2230.
114	Receive teletypewriter.	Keyboard	Press keys on keyboard	Keyboard locked, teletypewriter does not print.	
115	Send teletypewriter.	LOOP CURRENT switch	Set to ON	LOOP CURRENT meter reads 60 ma.	
116	Send teletypewriter.	SEND-REC switch	Set to SEND	Teletypewriter runs closed	Refer to TM 11–2230.
117	Send teletypewriter.	Test message	Type out test message on keyboard.	Machine prints test message	Refer to TM 11–2230.
118	Reperforator	SEND-LOCK switch	Set to SEND	Reperforator runs closed	Refer to 11–2225.
119	Reperforator	Space bar	Depress for 10 seconds	Signal lamp lights indicating end of line.	Refer to 11–2225.
120	Reperforator	CAR RET key	Depress	Light goes out	Refer to 11–2225.
121	Reperforator	Test message	Type test message on keyboard.	Tape should be printed and perforated correctly.	Refer to 11–2225.
122	Final equipment test.	Test message	Send test message by prearrangement with a distant station.	Test message should be printed correctly on send teletypewriter and on receive teletypewriter at distant station.	
			Tune receivers to distant station. Have distant station send test message.	Test message from distant station should be printed correctly on receive teletypewriter as well as on send teletypewriter at distant station.	

	Item No.	Unit	Action or condition	Item	Normal indication	Corrective measures
STOP	123	Receivers	FUNCTION switches	Set to OFF	Pilot lamp goes out	Check switch.
	124	Control unit	POWER switch	Set to OFF	Pilot lamp goes out	Check switch.
	125	Speaker assembly	ON CHANNEL A switch	Set at down position	Speaker silent	Check switch.
	126	Speaker assembly	ON CHANNEL B switch	Set at down position	Speaker silent	Check switch.
	127	Reperforator	MOTOR switch	Set to OFF	Motor stops	Check switch S3.
	128	Reperforator	POWER switch	Set to OFF	Power is removed	Check switch S5. Refer to TM 11–2225.
	129	Send teletype-writer.	MOTOR switch	Set to OFF	Motor stops	Refer to TM 11–2230.
	130	Send teletype-writer.	POWER switch	Set to OFF		
	131	Receive teletype-writer.	MOTOR switch	Set to OFF	Motor stops	Refer to TM 11–2230.
	132	Receive teletype-writer.	POWER switch	Set to OFF		
	133	Converter	POWER switch	Set to OFF	Pilot lamp goes out. Fan stops.	Check switch.
	134	Transmitter	PLATE RELAY switch	Set at off (down)	PA PLATE meter indicates a very low reading.	Check PLATE RELAY switch. Refer to TM 11–809.
	135	Transmitter	PLATE POWER circuit breaker.	Set at OFF	PLATE POWER indicator lamp goes out. PA PLATE meter reads zero.	Check circuit breaker. Refer to TM 11–809.
	136	Transmitter	FILAMENT POWER circuit breaker.	Set at OFF	FILAMENT POWER indicator lamp goes out. Blower stops. FIL VOLTAGE meter indicates zero.	Check FILAMENT POWER circuit breaker. Refer to TM 11–809.
	137	Fsk-modulator	POWER switch	Set at OFF	Pilot lamp goes out. Blower stops.	Check switch.
	138	Shelter	Circuit breakers	Set at OFF	All power to shelter off	
	139	Power unit	STOP button	Press and hold in	Power unit stops AC VOLTS meter on power unit panel indicates zero.	Refer to TM 11–904.

CHAPTER 5
THEORY

Section I. INTRODUCTION

46. General

a. This chapter covers general and component theory of the radio set. The radio set consists of a number of wire and radio equipments operating as a unit. Technical manuals have been published which cover the theory of all major components of the radio set except the fsk-modulator and the control unit. Paragraphs 57 through 65 covers the theory of the fsk-modulator and the control unit in detail.

b. Since the primary use of the radio set is for radioteletype communications, emphasis is placed on the adaption of the equipment to this type of operation.

47. General Theory of Radio Set

a. The transmitter rf carrier is frequency-shift modulated for teletypewriter operation, keyed on and off for continuous-wave (cw) operation, and amplitude modulated for voice operation. The rf carrier is modulated by teletypewriter and voice signals simultaneously for fsk-am operation. Frequency shift of the transmitter rf carrier is controlled by the fsk-modulator. A cutoff bias, in various stages of the transmitter, is interrupted with a handkey to produce cw operation. Am operation is accomplished by plate modulating the transmitter final amplifier stage with an amplified audio signal initiated at a microphone or telephone set.

b. The receiver in the radio set will accept signals that are either frequency-shift modulated by teletypewriter signals, amplitude modulated by audio signals, or both frequency-shift modulated and amplitude modulated simultaneously.

c. When only one frequency is available for communication, one-way reversible operation must be used; the transmitter is disabled during reception and the receiver is disabled during transmission. When two frequencies are available, duplex operation can be used and disabling either the receiver or transmitter is unnecessary.

48. Transmitting Theory

Figure 24 is a block diagram of the signal paths in the radio set. The transmitting units of the radio set consist of teletypewriter equipments, control unit, fsk-modulator, transmitter, telephone, microphone, and key. Figure 24 shows the wave shapes and signal paths from the teletypewriter equipment to the transmitting radio antenna.

a. The teletypewriter equipment initiates neutral signals which are routed through the control unit to the fsk-modulator.

b. The master oscillator of the transmitter applies a 1.5 to 3.0 megacycle (mc) signal to the fsk-modulator. The fsk-modulator shifts the master oscillator frequency in accordance with signals from the teletypewriter equipment. When the transmitting frequency is higher than 3.0 mc, frequency multiplication is required in the transmitter. Four different frequency shifts are available in the fsk-modulator to compensate for the amount of frequency multiplication required in the transmitter.

c. Mark signals from the teletypewriters do not shift the master oscillator frequency. However, a space signal applied to the fsk-modulator causes the master oscillator frequency to be shifted down. The amount of frequency shift is determined by the position of the fsk-modulator band selector switch. The switch setting must correspond to the transmitter BAND SELECTOR switch setting. The transmitter BAND SELECTOR switch position determines the frequency of the transmitted carrier and, therefore, the number of frequency multiplier

stages required in the transmitter. The master oscillator frequency can be multiplied two times, four times, or eight times; therefore, the fsk-modulator must supply frequency shifts of 425 cycles, 212.5 cycles, and 106.25 cycles for the respective amount of multiplication. The final transmitted frequency, when shifted, must deviate exactly 850 cycles from the carrier frequency. When the modulator BAND SELECTOR switch is in positions 1 and 2 (1.5–3.0 mc), the frequency shift is 850 cycles. In positions 3 and 4 (3.0 and 6.0 mc), the frequency shift is 425 cycles. In positions 4 and 5 (6.0–12.0 mc), the frequency shift is 212.5 cycles. In positions 5 and 6 (12.0–20.0 mc), the modulator supplies a 106.25-cycle frequency shift. The output of the fsk-modulator is applied to the transmitter second buffer and frequency multiplier stages as required.

d. The output of the transmitter second buffer stage and required multiplier stages drives the intermediate amplifier stage. The intermediate amplifier supplies the proper excitation to operate the class C power amplifier stage. The output of the power amplifier is link coupled into the balanced doublet antenna system. When a whip or long-wire antenna is used, the tuning unit is used to provide the proper impedance match between the transmitter and the antenna.

e. The transmitter rf carrier may be amplitude modulated by audio signals from the microphone or telephone. Also, the rf carrier may be amplitude modulated at the same time it is frequency-shift keyed by teletypewriter signals. In either case, the audio signal path is the same. The audio signals from a microphone or telephone are routed through the control unit and amplified by the transmitter speech amplifier stages to a level suitable for plate modulating the final rf power amplifier.

f. The transmitter carrier is keyed for cw operation by removing a cutoff bias voltage from the grids of several stages of the transmitter. The handkey is routed to the transmitter through the control unit. Transmitter keying is covered in detail in paragraph 50.

49. Receiving Theory

The receiving units consist of two radio receivers, converter, control unit, teletypewriter equipment, speaker assembly, telephone, and headset.

a. Figure 24 shows the wave shapes and signal paths from the antenna to the receiving teletypewriter equipment. The space diversity doublet antennas must be spaced a minimum of 3 wave lengths apart. The rf signals are applied from the antennas to the input circuits of the radio receivers. These signals consist of carrier frequency which has been frequency shifted by teletypewriter signals and, when required, amplitude modulated by voice signals. The rf signals are amplified and heterodyned in the receiver rf amplifier and mixer stages. The difference frequency from the mixer stages is amplified by the if. amplifier stages and coupled to the detector stage. The audio component is detected by the detector, amplified by the audio amplifiers, and drives the speaker assembly. The frequency-shifted if. signals which contain the mark-space component are applied to the converter from the output of the if. stages in the receiver.

b. The converter has two identical input circuits, each of which accepts the frequency-shifted if. signals from one receiver channel. These signals are converted to lower if. signals (50 kc and 29.3 kc) which are coupled into a common limiter where all amplitude modulation is removed. The discriminator network converts the mark and space if. signals into mark and space dc signals. These signals are coupled to the keyer circuits and amplified. Neutral output is provided by the converter.

c. The control unit receives the dc signals from the converter and routes them to the teletypewriter equipment. The individual teletypewriter components are connected to the control unit.

d. When only one receiving antenna is used, as in one-way reversible operation, either receiver may provide if. signals to the converter.

50. Interunit Keying Circuits (fig. 25)

The transmitter is keyed by grounding the bias line of the transmitter ipa stage. The bias line may be grounded at the transmitter by placing the KEYING switch to the CONTINUOUS position. The external keying circuits are all in shunt with the KEYING switch. Individual interunit connections and methods of keying are explained in *a* through *d* below.

a. Within the shelter, the transmitter is keyed by the teletypewriter, microphone, or key. The

microphone or key, as required, is connected to the MIC OR KEY jack (J8) of the control unit. Closing the microphone or key contacts grounds the transmitter bias line through pins H and F of jack J8 and pin A of jack J6 on the control unit, and pin A of remote control receptacle jack J12, on the transmitter.

b. The shelter send teletypewriter keys the transmitter when SEND-REC switch S2 is set at SEND. This circuit completes the path to energize relay K1. Relay contacts 6 and 8 ground the bias line and key the transmitter.

c. The transmitter may be keyed from the remote site by XMTR ON switch S1 or teletypewriter SEND–REC switch S2. These switches are in parallel and connect to CONTROL terminals E2 and E3 of the remote control unit. Closing either switch (SEND–REC switch at SEND or XMTR ON switch set in the up position) completes the circuit to energize relay K1 in the control unit, and grounds the transmitter bias line through closed contacts 6 and 8 of relay K1.

d. Emergency cw keying can be accomplished at the remote site by connecting a key to CONTROL terminals E2 and E3 on the remote control unit. Closing the key energizes relay K1 of the control unit in the same manner as XMTR ON switch S1 in the remote control unit.

51. Receiver Disabling Circuits (fig. 26)

a. In one-way reversible operation of the radio set, the receivers are disabled during rf transmission. Three different components are used in controlling receiver disabling: the transmitter, the control unit, and one or both receivers. Receiver disabling is provided by completing the path to ground for specific relay coils and circuits in the control unit and the receivers.

b. Two grounding actions disable the receivers. The antenna input circuits of the receivers are grounded, and on three specific receiver functions the audio signals in the receivers are grounded in addition to the antenna grounding.

c. When the transmitter is keyed, the transmitter bias line is grounded and blocking bias is removed from relay control tube V22 (fig. 26). Transmitter keying methods are covered in paragraph 50. Removing this blocking bias causes V22 to conduct heavily; plate current flows

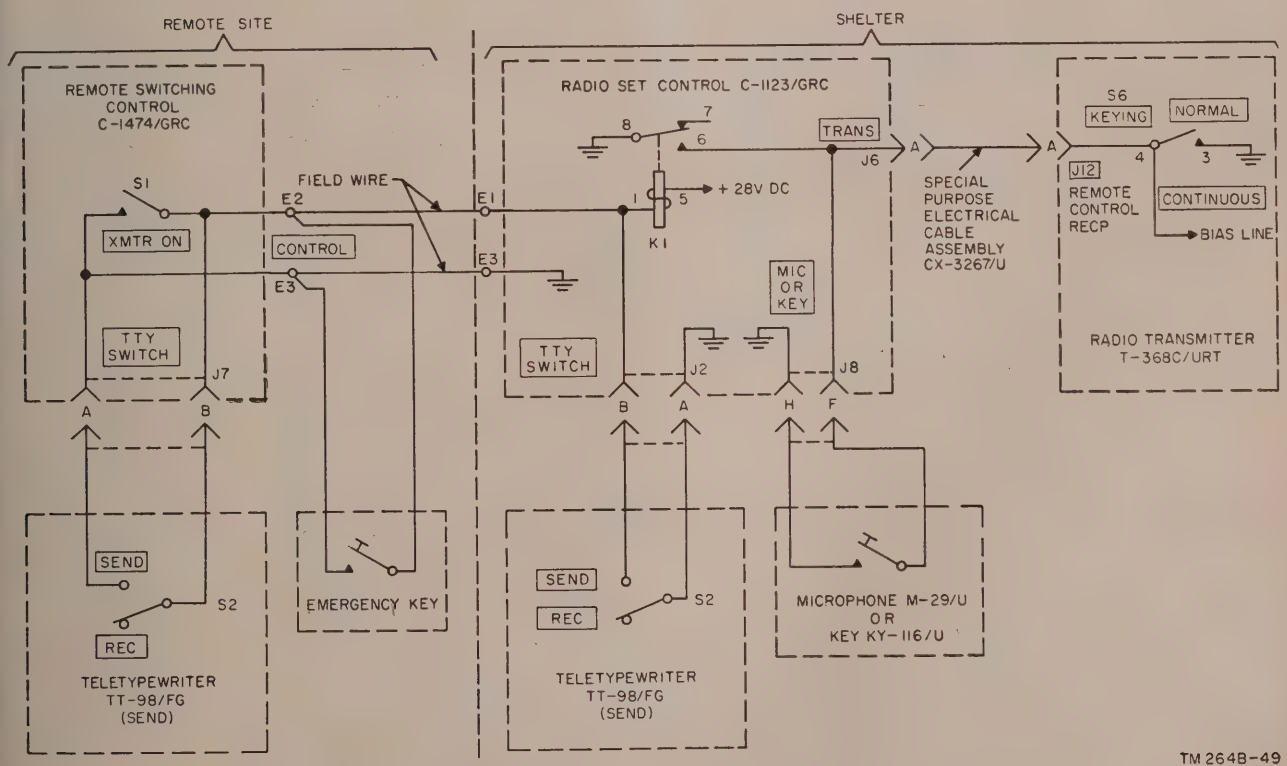
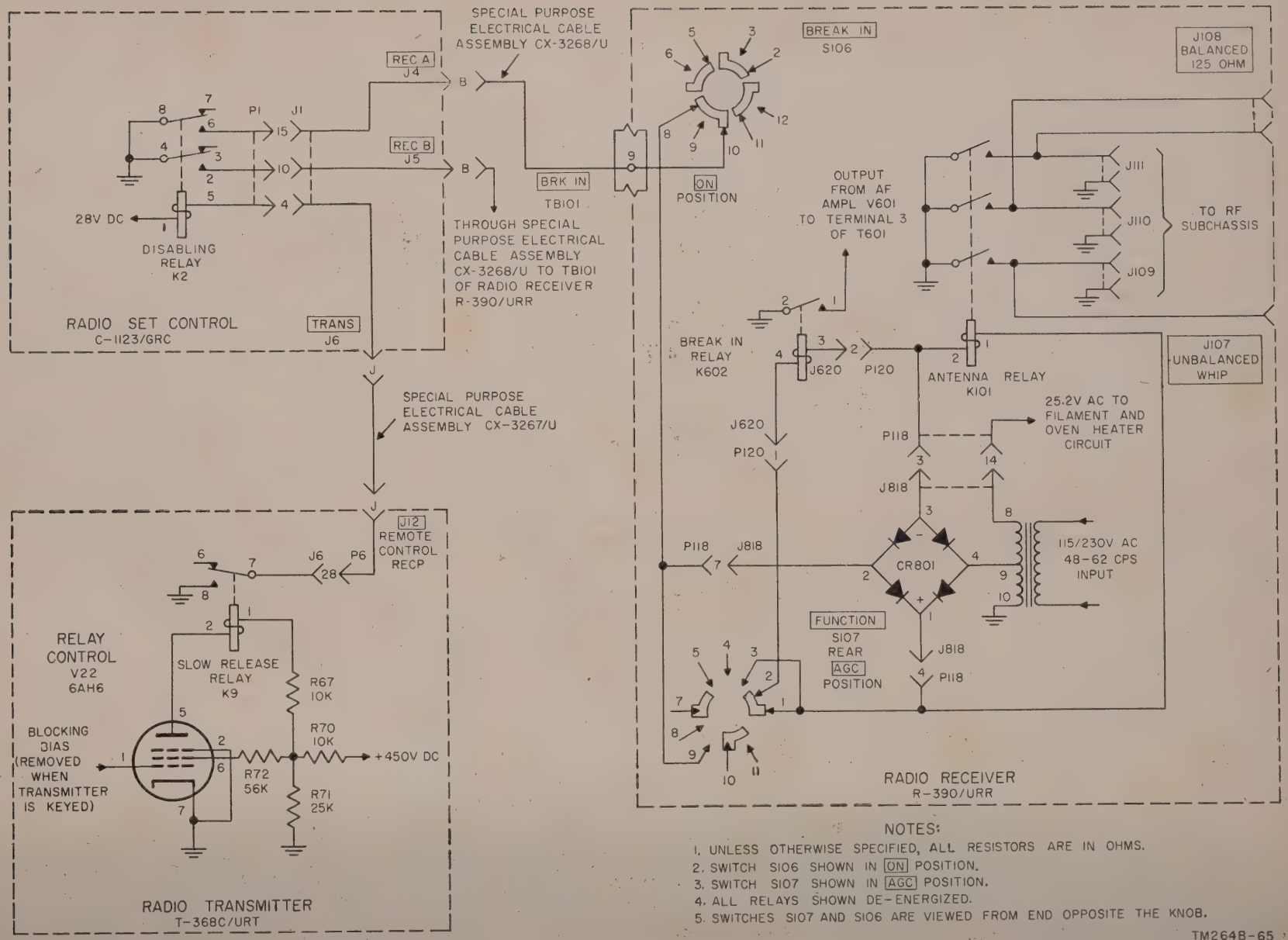


Figure 25. Radio Set AN/GRC–26D interunit keying circuit, functional diagram.



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS.
2. SWITCH S106 SHOWN IN ON POSITION.
3. SWITCH S107 SHOWN IN AGC POSITION.
4. ALL RELAYS SHOWN DE-ENERGIZED.
5. SWITCHES S107 AND S106 ARE VIEWED FROM END OPPOSITE THE KNOB.

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Figure 26. Radio Set AN/GRC-26D receiver disabling circuit, functional diagram.

unit. The signal and control paths are too numerous to be shown clearly in block diagram form; therefore, a block diagram type of discussion will not be included in this section.

(1) *SIDETONE switch.* The SIDETONE switch controls the routing of a 1,000-cycle audio signal from the TRANS jack to either REC A (position 1) or REC B (position 3) to allow the operator to monitor the keying during cw operation. In the OFF position, no sidetone signal is applied to either receiver.

(2) *REMOTE TEL switch.* The REMOTE TEL switch controls the routing of voice signals between telephone sets. With the switch in either REC A or REC B position, voice signals from the LOCAL TEL connections, REMOTE TEL connections, and the selected receiver will modulate the transmitter. The signal from the selected receiver will be heard at the telephone sets. All voice signals pass through hybrid coil T1. In the LOCAL TEL position, the hybrid coils are switched out of the circuit and the LOCAL TEL and REMOTE TEL terminals are connected together. Two-way telephone conversations may be conducted. The transmitter will not be modulated nor will received signals be heard in either telephone.

(3) *TELETYPE switch.* The TELETYPE switch routes teletypewriter signals to the proper units of the radio set for the different types of teletypewriter operation (fig. 54). Paths for the teletypewriter signals in the various switch positions are as follows:

(*a*) *NORMAL OW.* When the TELETYPE switch is set to NORMAL OW, one-way reversible operation from the shelter is selected. The path for the received signal is from CONVERTER jack J3 through contacts 12 and 8 on section 1 of S4, contacts 3 and 4 of de-energized relay K1, and red jack J11, to the send teletypewriter. The path for the received signal is interrupted by opening contacts 3 and 4 of relay K1 when the relay is energized for transmission. The path for the transmitted signal is from send teletypewriter black jack J10 through FS MOD jack to the fsk-modulator.

(*b*) *NORMAL DX.* When the TELETYPE switch is set to NORMAL DX, duplex operation from the shelter is selected. The path for the received signal is from CONVERTER jack J3, through contacts 12 and 9 on section 1 of S4, and red jack J16 to the shelter receive teletypewriter. The path for the transmitted signal is from send teletypewriter black jack J10 through FS MOD jack J7 to the fsk-modulator.

(*c*) *REMOTE OW.* When the TELETYPE switch is set to position 3, one-way reversible operation from the remote site is selected. The path for the received signal is from CONVERTER jack J3 through contacts 12 and 10 on section 1 of S4, contacts 3 and 4 of de-energized relay K1, and red jack J11 (either through the shorted contacts of J11 or through shelter send teletypewriter as monitor) through the shorted contacts of J13 and ONE WAY terminals E3 and E4 to the remote send teletypewriter. The path for the received signal is interrupted by energizing relay K1 and opening contacts 3 and 4 whenever the transmitter is keyed. The path for the transmitted signal is from the remote send teletypewriter through ONE WAY terminals E3 and E4, red jacks J13 and J11, contacts 4 and 2 of energized relay K1, black jack J12, and FS MOD jack J7 to the fsk-modulator. The shelter send teletypewriter can monitor the remote transmission.

(*d*) *REMOTE DX.* When the TELETYPE switch is set to REMOTE DX, duplex operation from the re-

mote site is selected. The path for the received signal is from CONVERTER jack J3 through contacts 12 and 11 on section 1 of S4, red jack J16, and REC DX terminals E5 and E6 to remote receive teletypewriter. The path for the transmitter signal is the same as that for remote one-way reversible operation.

(4) *Control relay K1.* The received teletypewriter signal path is completed or interrupted by the contacts of control relay K1. Relay K1 also controls the interunit keying of the transmitter. The interunit keying circuit (fig. 25) is explained in paragraph 50.

(5) *Disabling relay K2.* The receiver disabling circuits from both receivers are grounded when disabling relay K2 is energized. Refer to paragraph 57 for a detailed explanation of the receiver disabling circuits (fig. 26).

(6) *FS MOD jack.* Signals from the send teletypewriters are fed to the FS MOD jack for transmission to the fsk-modulator.

(7) *TTY SWITCH jack.* Teletypewriter control of control relay K1 is connected through the TTY SWITCH jack.

(8) *ON-OFF switch.* This switch controls ac power to the control unit power supply circuit.

d. Power Supply (fig. 28). The power supply consists of transformer T2 which has two primaries connected in parallel, bridge rectifier CR1 and a pi-type filter consisting of capacitor C1, resistor R1, choke L5, capacitor C2, and bleeder resistor R2. The output voltage of this supply is approximately 28 volts dc with respect to ground. ON-OFF indicator DS1 lights when power is applied.

e. Hybrid Coil (fig. 29). The hybrid coil is an audio coupling transformer which allows modulation of the transmitter by either the local or remote telephone and also the incoming received signal. REMOTE TEL switch S3 of the control unit determines which circuits are connected to the hybrid coil. The operation of these circuits in the various switch positions is explained in (1) through (3) below.

(1) When the REMOTE TEL switch is set to REC A, the circuits connected are as shown in figure 29. Terminals 1 and 2 are connected to the transmitter 600-ohm line input. Terminals 3 and 6 are connected to remote telephone terminals E1 and E2. Terminals 7 and 9 are connected to local telephone terminals E7 and E8. Terminals 11 and 12 are connected to the audio output of receiver A. With these connections, the receiver output can be heard at the local telephone. When the transmitter is keyed, speaking into the local telephone will modulate the transmitter. The signal from the receiver will also modulate the transmitter, and the radio set may be used as a radio relay station. To avoid retransmitting the received signal when relay operation is not desired, the receiver LINE GAIN control is set to 0. Radio relay operation is only possible in duplex operation. When remote site is in operation (TELETYPE switch in the REMOTE position), the output of receiver A can be heard at either the remote or local telephone. Operators can talk with each other on the remote and local telephones. These telephones can be used to modulate the transmitter when it is keyed. Resistors R4 and R5, placed across the remote and local telephone terminals, respectively, provide a constant impedance match for the 600-ohm line telephone circuits.

(2) When the REMOTE TEL switch is in LOCAL TEL position (fig. 27), the hybrid coil is bypassed. The local and remote telephones are directly connected, allowing two-way voice communications between the local and remote sites without modulating the transmitter. Also, signals from receiver A or B cannot be monitored by either telephone nor can they modulate the transmitter.

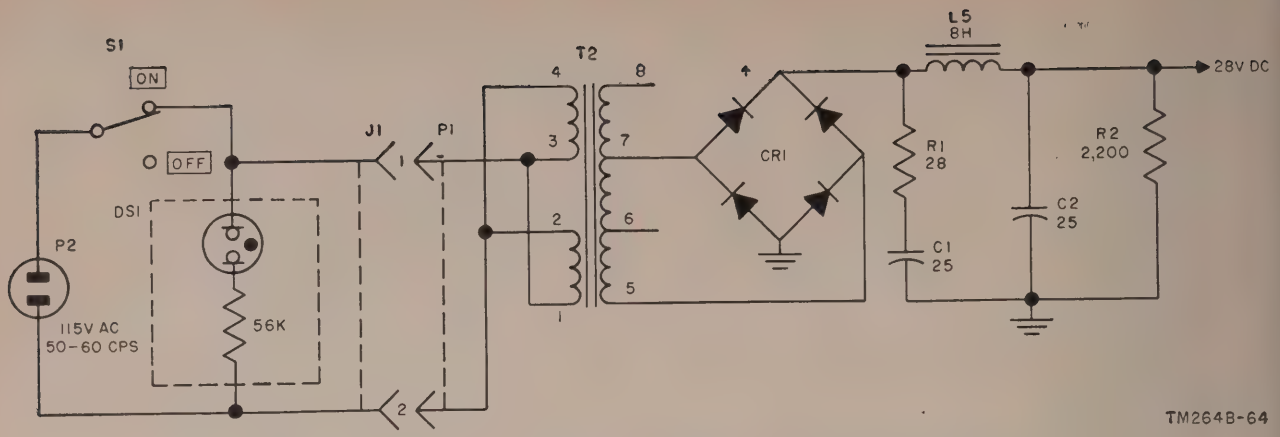


Figure 28. Radio Set Control C–1123/GRC power supply, partial diagram.

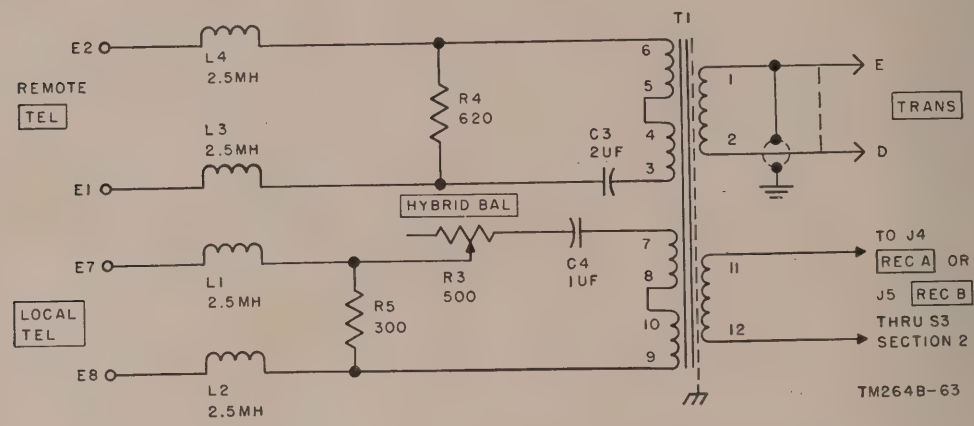


Figure 29. Radio Set Control C–1123/GRC hybrid coil, functional diagram.

(3) When the REMOTE TEL switch is in REC B position, switch S3 connects receiver B to terminals 11 and 12 of the hybrid coil. All functions discussed for receiver A now apply to receiver B.

54. Remote Control Unit

(fig. 30)

a. The remote control unit provides facilities for operating the radio set from a remote location. When connected to the control unit, the teletypewriter jacks of the remote control unit are placed in parallel with the corresponding jacks of the control unit (fig. 19). This allows duplex or one-way teletypewriter operation from the remote site. The transmitter is keyed from the remote site by the XMTR ON switch, which is connected in parallel with the TTY SWITCH jack of the control unit (fig. 25).

b. The telephone at the remote site, when connected to the remote control unit (fig. 19), provides facilities for two-way conversation between the remote and shelter sites. The remote telephone may also amplitude modulate the transmitter and monitor the shelter receiver.

55. Shelter Primary Power Distribution

(fig. 31)

a. Power is supplied to the shelter circuit breakers from Power Unit PE–95–B or a commercial ac source through the power input feedthrough receptacle on the shelter wall (fig. 4). Main 50-ampere circuit breakers Nos. 1 and 2 supply power to the individual circuits within the shelter.

b. Main circuit breaker No. 1 supplies power to circuit breakers Nos. 3, 5, and 7. A 20-ampere circuit breaker, No. 3, supplies power to the heater, fan, and blower. No. 5 is a spare 20-ampere circuit breaker. No. 7 is a 30-ampere circuit breaker which supplies power to the transmitter.

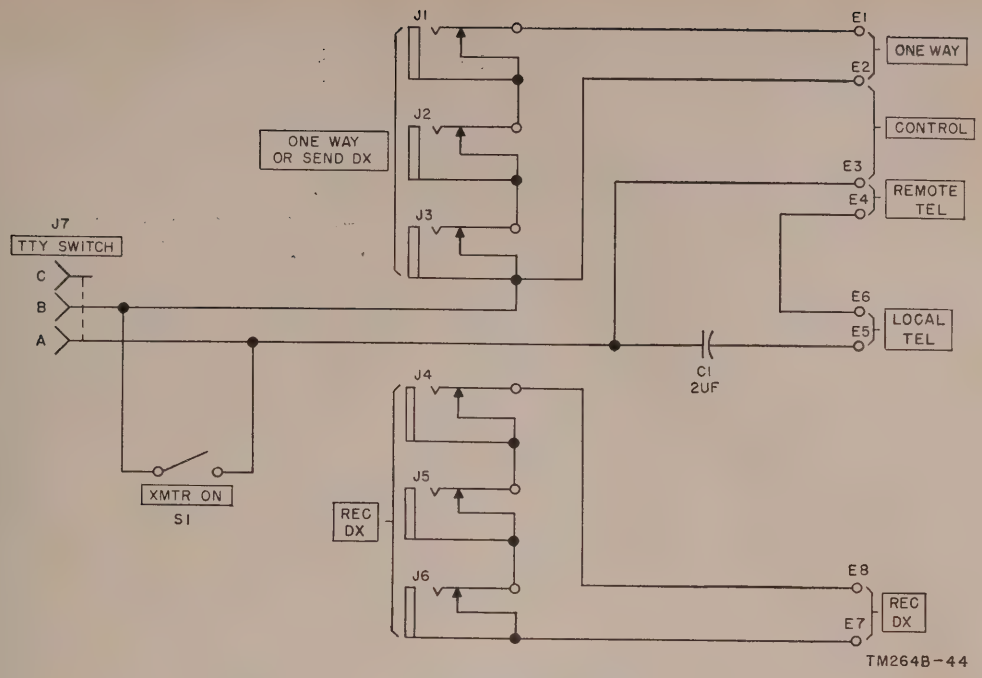


Figure 30. Remote control unit, schematic diagram.

c. Main circuit breaker No. 2 supplies power to circuit breakers Nos. 4, 6, and 8. A 20-ampere circuit breaker, No. 4, supplies power to the teleptypewriters, reperforators, control unit, fsk-modulator, and equipment cabinet. No. 6 is a spare 15-ampere circuit breaker. No. 8 is a 15-ampere circuit breaker which supplies power to the fluorescent lights. Each light has an individual toggle switch to control shelter lighting.

56. Antennas

a. Types and Characteristics of Antennas.

(1) *Whip antenna.* Whip antennas transmit and receive equally well in all directions. The advantage of a whip antenna is its small space requirement. The distance over which satisfactory communications can be maintained with whip antennas is less than with doublet antennas.

(2) *Long-wire antenna.* Long-wire antennas are directional and afford satisfactory communications over long distances. Their radiation patterns are similar to those of the doublet antenna.

(3) *Doublet antenna.* A doublet antenna provides efficient termination of the antenna feeder by having two feeder leads connected to the center of the antenna to insure a balanced load for each lead. The doublet half-wave antenna is directional and suitable for satisfactory communications over long distances in either direction perpendicular to the axis of the wire. For further information regarding antenna theory and operation, refer to TM 11–666, Antenna and Radio Propagation.

b. Space Diversity Reception.

(1) Space diversity reception is designed to reduce the effects of fading radio signals. In high-speed radioteletype operation, even short variations in signal strength have a marked effect upon the accuracy of a message. Fading is caused by several factors, such as a shift in the height of the ionosphere and multipath signal transmission with the resulting out-of-phase recombination of the signal at the antenna.

(2) A space diversity system is based on the probability that instantaneous fading will not occur everywhere at one time. If two receiving antennas are

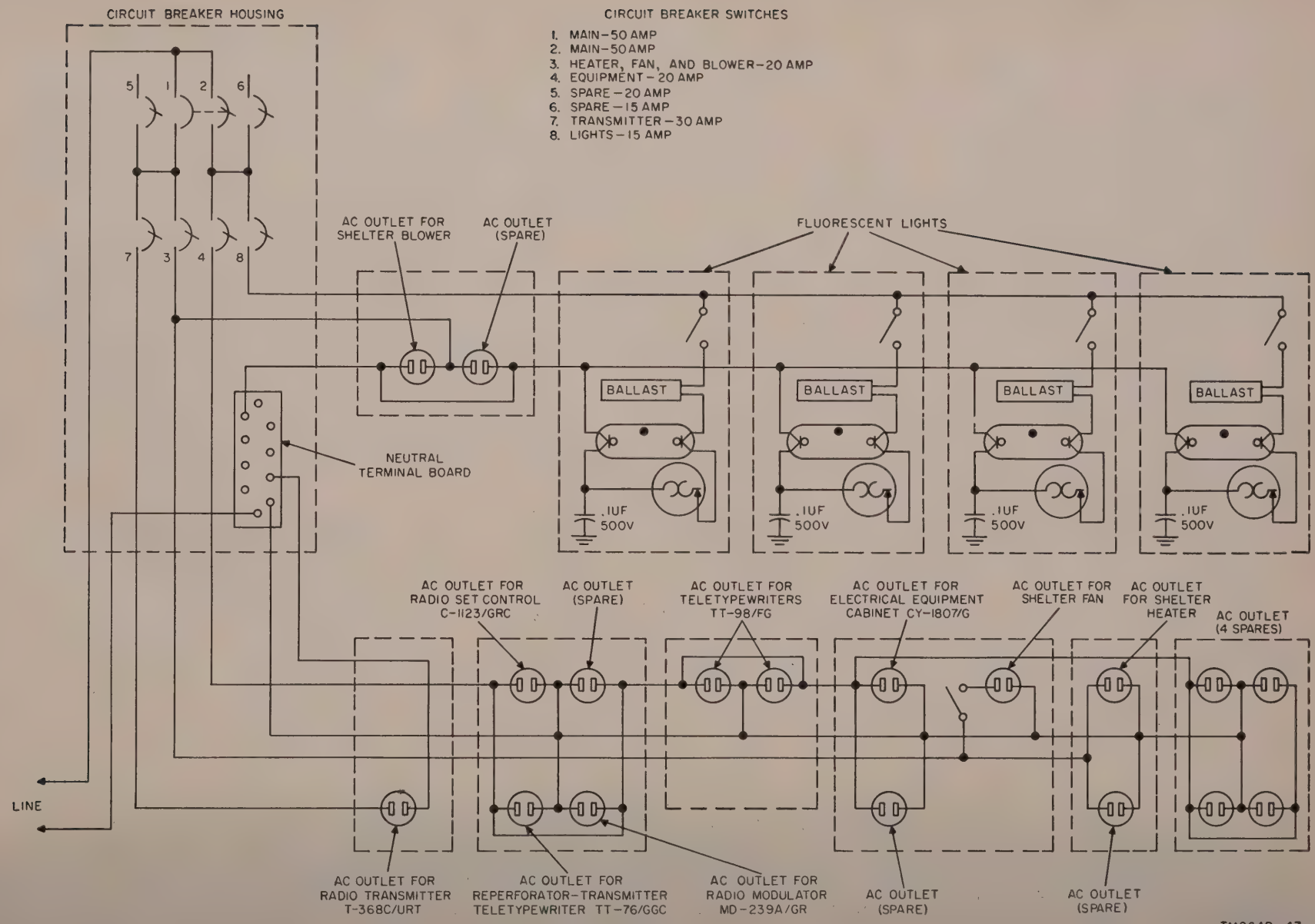


Figure 31. Shelter, primary power ac outlet connections.

spaced several wave lengths apart, it is highly probable that a strong signal will be received on either one or the other. The major components required are two receiving antennas, two receivers (one for each antenna), and a converter which combines the output of the receivers.

Section III. THEORY OF FSK-MODULATOR

57. General

a. The fsk-modulator shifts an injected 1.5- to 3.0-megacycle signal in accordance with signals from teletypewriter equipment. The incorporation of four different frequency shifts (850, 425, 212.5, and 106.25 cycles) permits the fsk-modulator to be used with the transmitters that double, quadruple, or double and quadruple the 1.5- to 3.0-mc signal to obtain operation in the desired band. When operating without frequency shift, the fsk-modulator circuits pass the 1.5- to 3.0-megacycle signal without modification or attenuation.

b. The fsk-modulator functions as a double superheterodyne circuit that first increases the injected signal frequency and adds the frequency shift, then decreases the signal to its original frequency but does not remove the shift. The output signal frequency of the fsk-modulator is the same as the input signal frequency except that the shift has been added.

58. Block Diagram of Fsk-Modulator (fig. 32)

The keying input circuit switches the frequency of shift oscillator V2 to correspond with a signal from a teletypewriter machine. The signal from the shift oscillator is combined with the signal from an external source, and the intermediate frequency (if.) produced in first mixer V1 is amplified by if. amplifier V3. Fixed oscillator V5 operates under the same temperature and circuit conditions as shift oscillator V2. Frequency drift caused by temperature variations in shift oscillator V2 is cancelled by a similar drift in fixed oscillator V5 when the fixed oscillator signal is heterodyned with the signal from if. amplifier V3. The difference frequency from second mixer V4 is selected and amplified by first, second, and third rf amplifiers V6, V7, and V8. The 3- to 5-volt output is used to drive the buffer stage of the transmitter. The power supply provides filament power, power to heat the crystal ovens, and plate voltages.

59. Shift Oscillator (V2) (fig. 33)

Shift oscillator V2 is a crystal-controlled oscillator tuned by variable capacitors shunting the crystal. Additional capacitors shunt across the crystal to provide the required frequency shift. The addition of frequency-shifting capacitors is controlled through a diode keying network.

a. The crystal oscillator circuit has the cathode isolated from ground by rf choke L5. Capacitor C10 provides the impedance across which the rf feed-back voltage is developed. This feed-back voltage is coupled into the grid circuit by capacitor C8. Capacitor C12 is the screen grid bypass capacitor and R15 is the screen grid dropping resistor. The plate circuit of V2 is tuned by plate tank circuit Z3. Resistor R16 and capacitor C13 form a decoupling filter in the plate supply lead.

b. BAND SELECTOR switch S1 determines which set of capacitors will be shunted across the crystal. With the BAND SELECTOR switch in the position shown in figure 33 (position 1), C9 determines the operating frequency of the oscillator. Capacitor C45 is effectively in the circuit when the diodes CR1 and CR2 are conductive because its ground return path is through the diode network keying input circuit. This circuit can be compared to an electronic switch that uses the cutoff and conducting impedance characteristics of crystal diodes to electronically switch C45 into or out of the V2 grid circuit. The addition of capacitance to the tuned circuit decreases its resonant frequency and produces frequency shift.

c. Capacitors C47, C49, and C50 are used for the other positions of BAND SELECTOR switch S1 to shift the frequency down whenever a *space* signal is applied to the keying input of the fsk-modulator. Therefore, the amount of

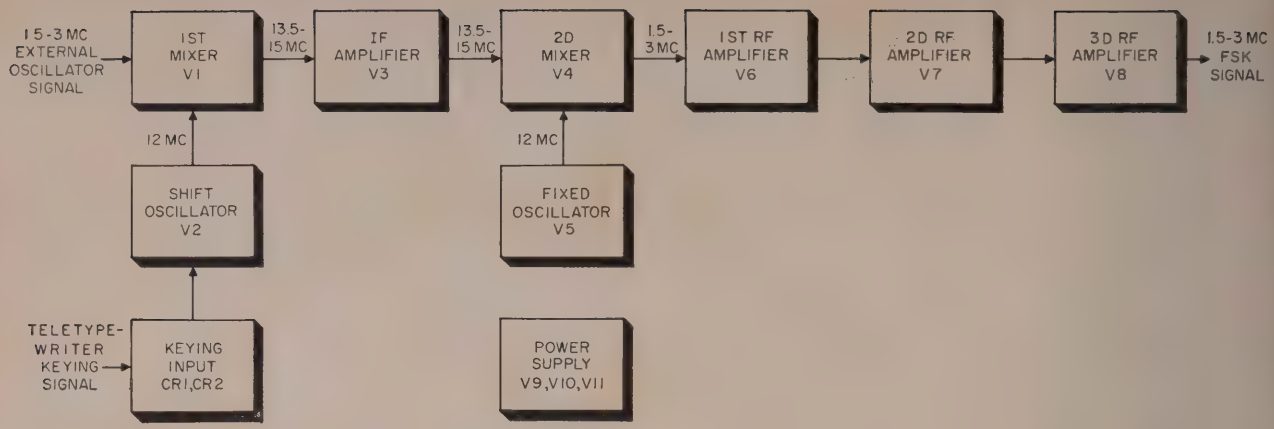


Figure 32. Radio Modulator MD–239A/GR, block diagram.

shift depends on the position of BAND SELECTOR switch S1. The selected capacitor is electrically in the circuit only when crystal diodes CR1 and CR2 are conducting. With no current flow, the impedance of the diodes is high and maintains an open circuit between the selected capacitor and ground. When current flows through the diodes, the impedance is greatly reduced, and a path to ground is provided for the selected capacitor. This places it in shunt with the crystal circuit of oscillator stage V2 and shifts the frequency.

d. Crystal diodes CR1 and CR2 are connected in series. The cathode of CR1 is connected to ground through load resistor R52. The anode of CR2 is connected to ground. The junction of the diodes is connected through the capacitor to be grounded. When no 60-ma signal from the teletypewriter (space impulse) is applied to TTY IN jack J12, the ac voltage produced by the crystal circuit of V2 causes the diodes to conduct and ground the selected capacitor. This shifts the operating frequency down. When a 60-ma signal is applied (mark impulse), the voltage developed across C52 prevents CR1 and CR2 from conducting. This action opens the ground path for the additional capacitor and shifts the operating frequency up.

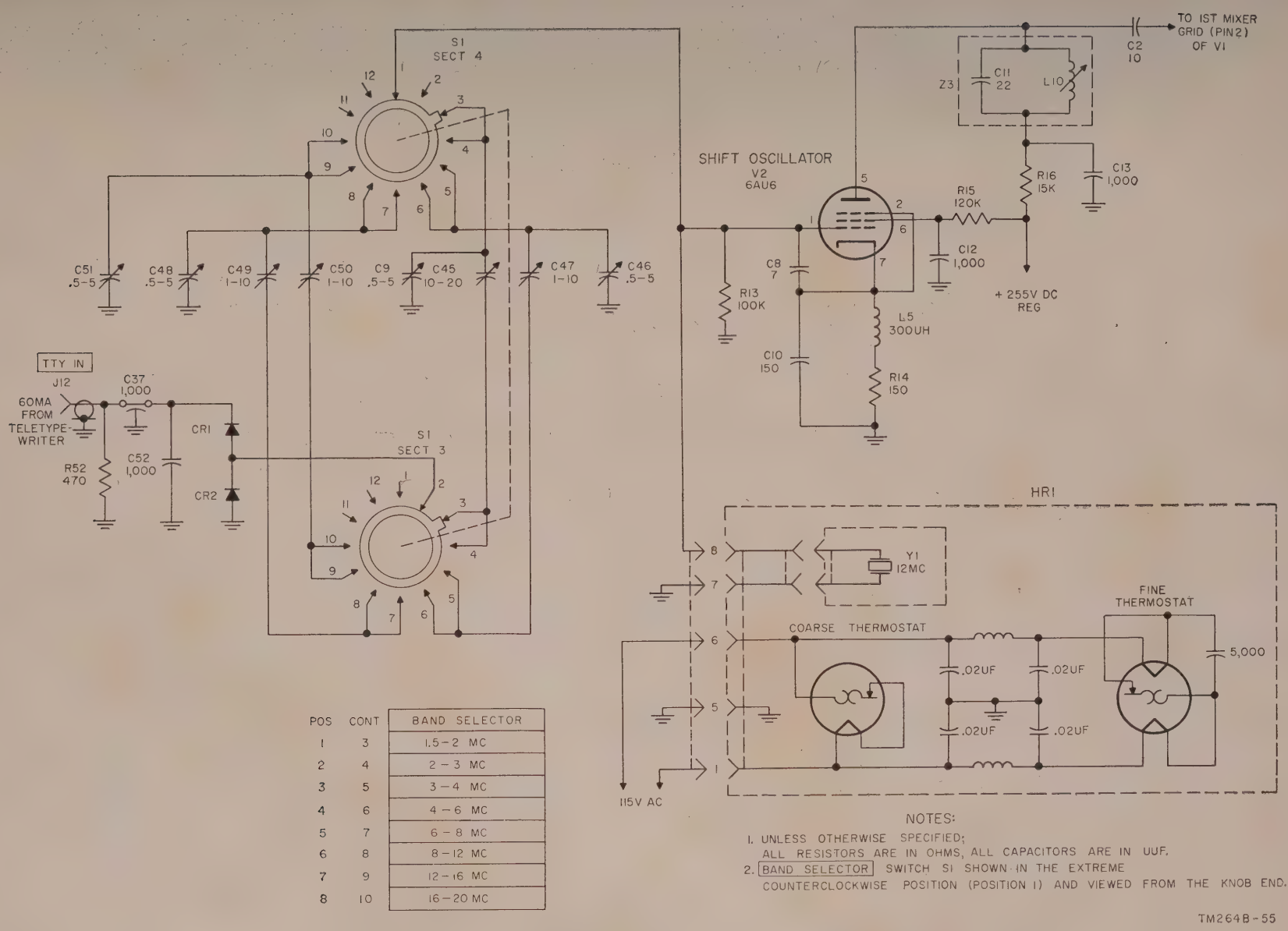
e. The 12-mc output of V2 is coupled through capacitor C2 to the oscillator grid (pin 2) of first mixer V1.

f. Crystal oven HR1 maintains a constant operating temperature for crystal Y1. The temperature is controlled by a coarse and fine thermostat.

60. First Mixer (V1)
(fig. 34)

The first mixer stage contains a type 6BA7 tube which mixes the injected signal (1.5–3.0 mc) with the signal from frequency-shift oscillator V2 (12 mc, or 12 mc with frequency shift). The output of the stage contains all frequencies introduced into the stage plus the sum and difference frequencies. However, band-pass filter FL3 passes only those frequencies between 13 and 16 mc. This keeps the fundamental frequencies and the difference frequency out of the following circuits:

a. The injected signal, from M.O. IN jack J1, is taken from the arm of input level adjust potentiometer R1 and fed through antiloading resistor R3 or R4 to impedance network FL2 or FL1, respectively. The resistors prevent the impedance networks from loading down the master oscillator. The selection of either FL1 or FL2 is determined by section 2 of BAND SELECTOR switch S1. If the injected frequency is between 1.5 and 2.0 mc, FL1 is used. This filter has an upper cutoff frequency about 2 mc, and filters out all harmonics which might fall in the 2- to 3-mc band. If the injected frequency is between 2.0 and 3.0 mc, filter FL2 is used. This filter has a band-pass characteristic with the least attenuation between 2 and 3 mc. For circuitry and component values of the filters, see figure 52. The signal output of the selected filter is coupled into the signal injection grid (pin 7) of first mixer V1 through capacitor C1 and grid load resistor R5. The shift, if there is any, is applied in frequency-



POS	CONT	BAND SELECTOR
1	3	1.5–2 MC
2	4	2 – 3 MC
3	5	3 – 4 MC
4	6	4 – 6 MC
5	7	6 – 8 MC
6	8	8 – 12 MC
7	9	12 – 16 MC
8	10	16 – 20 MC

NOTES:

1. UNLESS OTHERWISE SPECIFIED;
   ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. BAND SELECTOR SWITCH S1 SHOWN IN THE EXTREME
   COUNTERCLOCKWISE POSITION (POSITION 1) AND VIEWED FROM THE KNOB END.

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Figure 33. Shift oscillator and keying input circuit, schematic diagram.

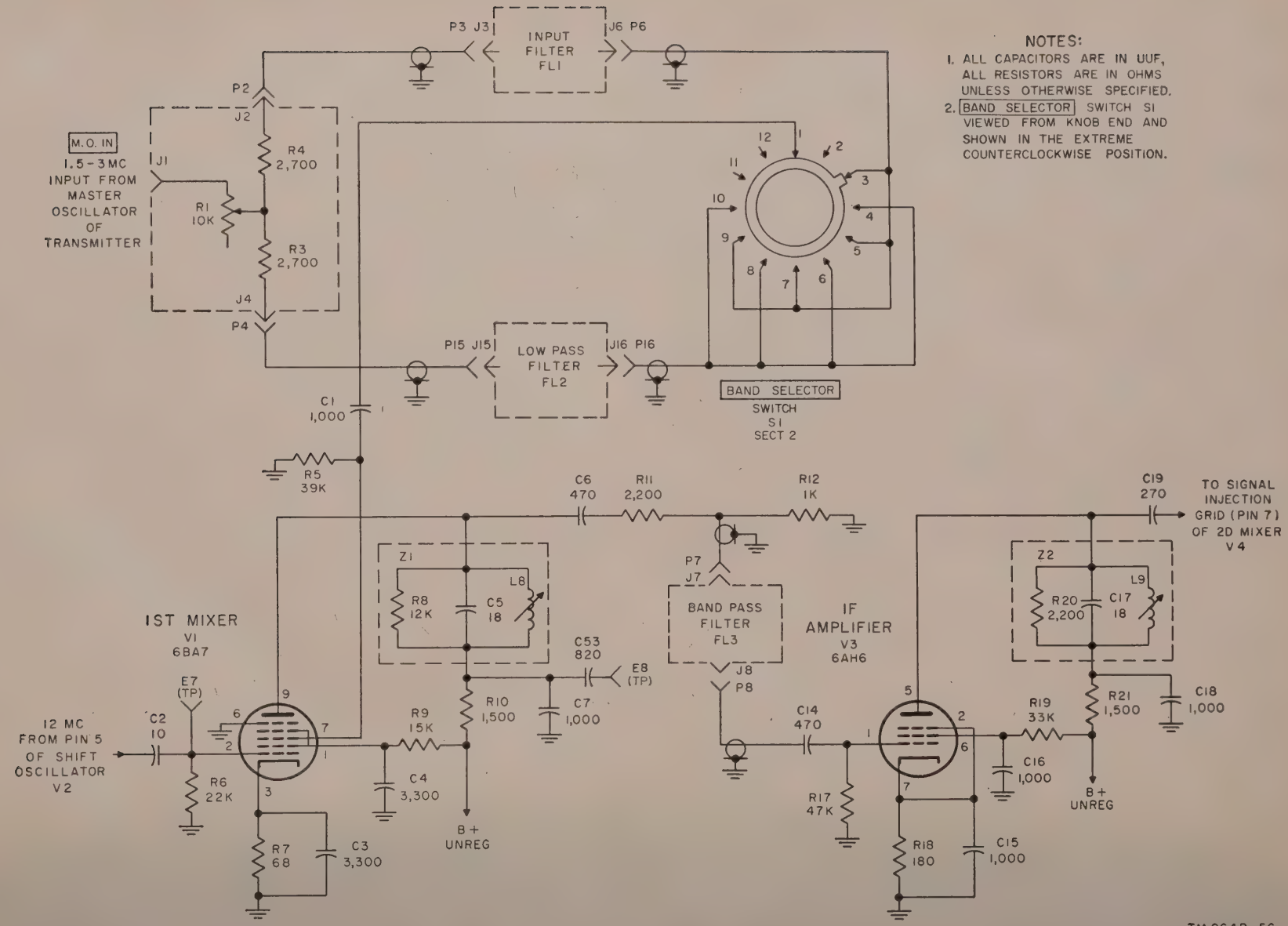


Figure 34. First mixer stage V1 and if. amplifier V3, schematic diagram.

shift oscillator V2 and changes the frequency of the oscillator (12 mc) downward by 850, 425, 212.5, or 106.25 cycles. The output of V2 is fed into the oscillator grid (pin 2) of V1 through coupling capacitor C2.

b. Resistor R6 is the grid load. Resistor R7 is the cathode-biasing resistor, and C3 is the cathode rf bypass capacitor. Resistor R9 is the screen voltage dropping resistor, and C4 is the screen grid bypass capacitor. Resistor R10 and capacitor C7 form a plate decoupling network. Impedance Z1 is the plate tank of the first mixer. Resistor R8 loads the tuned circuit to give it the broad-band characteristics to pass signals in the 13.5- to 15-mc band. The voltage is fed through coupling capacitor C6 and into the impedance-matching network of R11 and R12. These resistors provide the proper impedance match for band-pass filter FL3. Filter FL3 is designed to pass only those frequencies between 13.5 and 15.0 mc. The output of band-pass filter FL3 is applied to if. amplier V3.

61. If. Amplifier V3
(fig. 34)

If. amplifier V3 acts as a buffer between the first and second mixer stages.

a. Band-pass filter FL3 rejects all frequencies other than 13.5 to 15 mc. The if. signal from the band-pass filter is coupled to the grid of if. amplifier V3, a 6AH6 pentode type tube, through capacitor C14. The output of V3 is developed across impedance Z2 and is coupled to second mixer stage V4 through capacitor C19.

b. Self-bias is developed across cathode resistor R18. The cathode rf bypass capacitor is C15. The grid load resistor is R17. Resistor R21 and capacitor C18 form the plate decoupling network. Screen dropping resistor R19 and capacitor C16 form the screen decoupling network.

62. Fixed Oscillator
(fig. 35)

Fixed oscillator V5 produces a signal which is identical in frequency with that of the frequency-shift oscillator before shifting (12 mc). This frequency is mixed with the 13.5- to 15.0-mc frequency. The stabilizing frequency is combined with that from if. amplifier V3, and the difference is the injected frequency.

a. Fixed oscillator V5 is similar to frequency-shift oscillator V2 except that only one capacitor is used in tuning the crystal circuit. Variable capacitor C26 varies the frequency of V5, controlled by crystal Y2. The output of V5 is applied to pin 2 of the second mixer V4 through C20.

b. Circuit elements in the fixed oscillator stage have the same functions as their counterparts in the frequency-shift oscillator.

63. Second Mixer
(fig. 35)

Second mixer V4 combines the 13.5- to 15.0-mc if. signal, produced in the first mixer, with the 12-mc signal from the fixed oscillator. The difference frequency is extracted in low-pass filter FL4. When there is no modulating signal from the teletypewriter, the inputs from the shift oscillator and fixed oscillator are both 12 mc and no difference frequency exists.

a. The if. signal (13.5–15.0 mc) from if. amplifier V3 is applied to the signal injection grid (pin 7) of second mixer V4, a 6BA7 pentagrid converter type tube, and is combined with the fixed oscillator signal (12.0 mc) which is applied to oscillator grid (pin 2) of V4. The intermediate frequencies produced in V4 are developed across plate load resistor R26 and coupled to low-pass filter FL4 through capacitor C24.

b. Resistor R27 and capacitor C23 form the plate decoupling network. Self-bias is developed across resistor R24. The cathode rf bypass capacitor is C22. Resistor R23 is the grid load resistor for the oscillator grid, and R22 is the grid load resistor for the signal injection grid.

c. The output of second mixer V4 is applied to low-pass filter FL4 where the high frequencies are attenuated. The desired frequencies (1.5–3.0 mc) are passed by the filter and coupled through capacitor C31 to the grid of amplifier V6.

64. First, Second, and Third Rf Amplifiers V6, V7, and V8
(fig. 36)

The first, second, and third rf amplifiers increase the signal output of the second mixer to

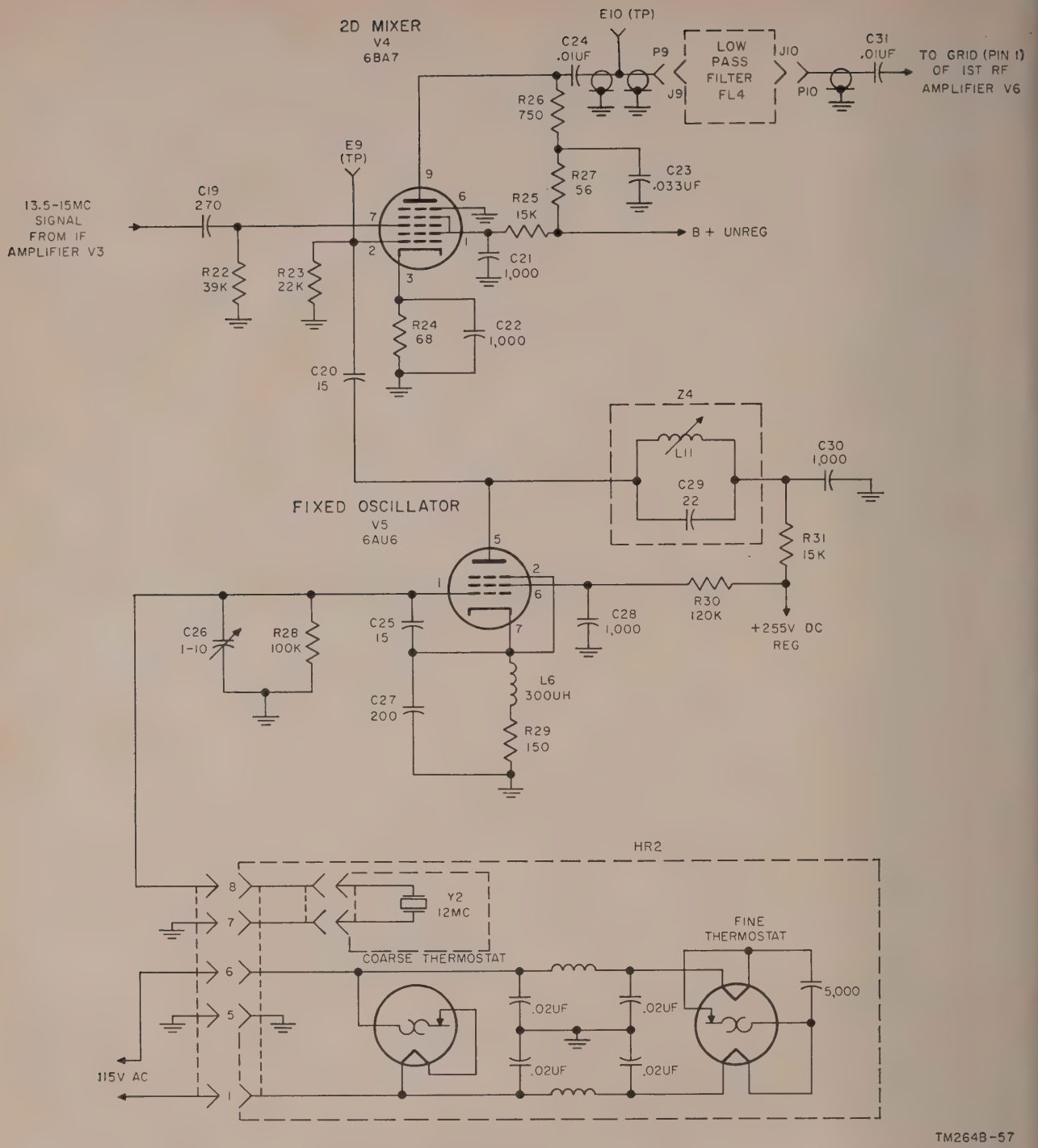


Figure 35. Fixed oscillator and second mixer, schematic diagram.

a 3- to 5-volt level, suitable for driving the intermediate amplifier stage of the transmitter.

a. The output of low-pass filter FL4 (1.5–3 mc) is coupled through capacitor C31 to the grid of first rf amplifier V6, a 6AH6 pentode type tube. The output is developed across plate load resistor R37 and inductance L1 and coupled to second rf amplifier V7 through capacitor C35.

b. Self-bias is developed across cathode resistor R33. The cathode bypass capacitor is C32. Resistor R36 and capacitor C34 form the plate decoupling network. Screen dropping

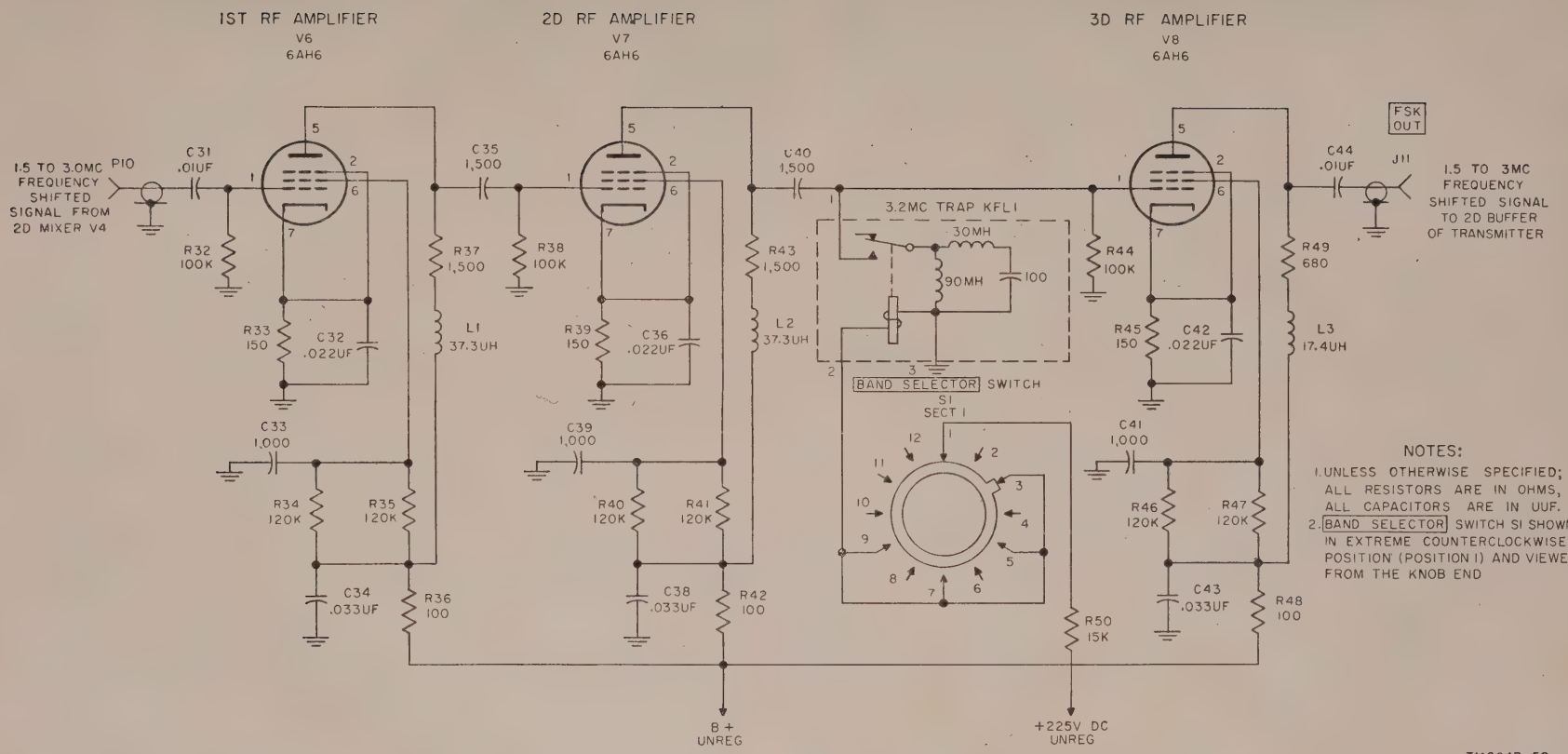


Figure 36. First, second, and third rf amplifiers, schematic diagram.

resistors R34 and R35 and capacitors C33 form the screen decoupling network. The grid load resistor is R32.

c. Component values of the second rf amplifier and third rf amplifier are approximately the same as for the first rf amplifier described in *a* and *b* above; and each component part serves the same function.

d. A 3.2-mc filter trap (KFL1) is inserted in the grid circuit of third rf amplifier V8 whenever BAND SELECTOR switch S1 is set to position 1, 3, 5, or 7 (contact 3, 5, 7, or 9). The filter trap eliminates any unwanted harmonics of the basic 2- to 3-mc signal that might be amplified when the lower portion of the band is used.

e. The output of third rf amplifier V8 is coupled through capacitor C44 to the second buffer stage of the transmitter, then through multiplier stages or directly to the intermediate amplifier stage of the transmitter, depending on the frequency selected.

65. Power Supply

(fig. 37)

a. The power supply provides filament voltage and plate voltage for the tubes, and heater voltage for the crystal ovens. A single transformer, T1, is used to supply the ac voltage for both the filament and the plate power. The dc voltage supply is developed by a full-wave rectifier circuit that uses a type 5R4WGA tube (V9). The filtering network is a capacitance input type comprised of capacitor C54, filter choke L4, and sections A and B of capacitor C55. The dc output is applied through limiting resistor R53 to two voltage regulating tubes, V10, and OD3W type 150-volt regulator, and V11, an OC3W type 105-volt regulator. Resistor R53 and capacitor C56 also functions as an additional filter circuit. Resistors R54 and R55 form a bleeder network. The plate and filament voltage lines pass through feed-through capacitors to bypass any stray radio frequencies to ground.

b. The blower motor is connected across the primary of T1. Windings 1 and 3 and 2 and 4 are connected in parallel. When POWER switch S2 is turned to ON, power is applied to the blower motor.

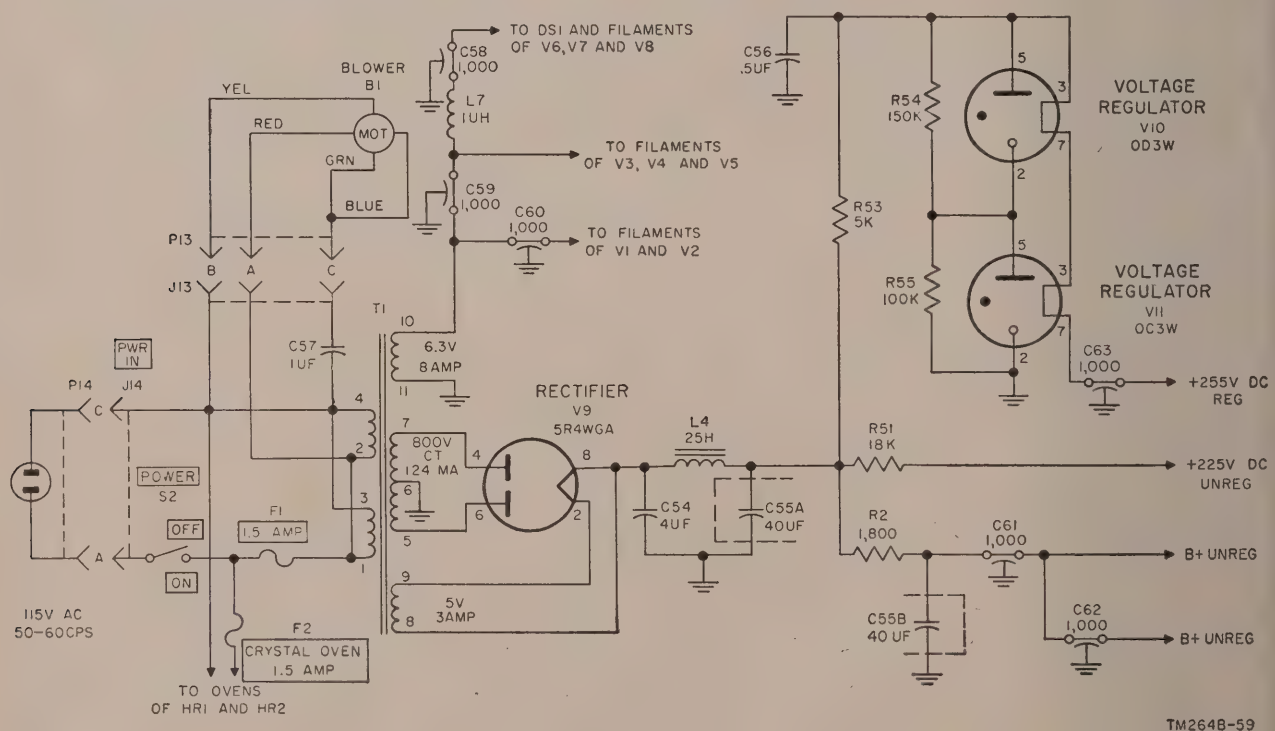


Figure 37. Power supply, schematic diagram.

CHAPTER 6
FIELD MAINTENANCE INSTRUCTIONS

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warnings:

1. Extremely high voltages are present in the transmitter that are dangerous to life. When servicing the transmitter, be sure that the back cover and the three decks are closed before applying plate power to the transmitter. The red PLATE POWER pilot lamp on the front panel of the transmitter indicates when the high voltage is turned on. Do not rely upon the lamp entirely to indicate the absence of high voltage since the lamp may be burned out. Also, do not rely entirely on protective electrical interlock switches.

2. Extremely high rf voltages are present at the antenna tuning unit when in operation. Be sure the power is off and use a shorting stick before changing parts and making repairs in the radio set. Always observe the cautions in the individual equipment technical manuals.

66. General Instructions

a. Troubleshooting at a field maintenance level includes all the techniques outlined for organizational maintenance and any other techniques that may be required to isolate a defective part. The field maintenance instructions supplement the procedures described in organizational maintenance. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at an organizational level, must be completed by sectionalizing, localizing, and isolating techniques presented in this chapter.

b. When trouble has been traced to a particular component, refer to the technical manual covering the component (par. 1) for detailed maintenance instructions.

67. Troubleshooting Procedure

a. General. To be effective, troubleshooting must be systematic. Generally, it is necessary to perform a *sequence* of operational checks, observations, and measurements before a defect will be revealed. If the proper sequence is used, the trouble will be traced first to a unit, then to a portion of the unit, and finally to the defective part. The sequence of steps is commonly referred to as the sectionalization, localization, and isolation of trouble.

b. Sectionalization. A defective system should first be sectionalized to a particular unit. Determine the defective unit through visual checks or operational procedures (pars. 42–45).

c. Localization. When the defective unit has been determined, localize the trouble to a particular portion of the unit. Use inspection and operational techniques first, and when necessary, use the specialized testing procedures as presented in the technical manuals for components listed in paragraph 1.

Caution: Never apply power to a set or unit unless the operational symptoms are known, and are of such nature as to eliminate the possibility of further damage when power is applied.

d. Isolation. After a trouble has been isolated to a portion of a major component, such as a stage or a group of functionally related circuits, use visual inspection and voltage and resistance measurements to determine the defective part.

68. Test Equipment Required

The test equipment recommended for testing individual components of Radio Set AN/GRC–26D are listed in the components technical manuals (par. 1). Test equipment required for testing the complete radio set are listed below.

Test equipment	Technical manual	Common name
Test Set TS–2/TG	TM 11–2208, Test Sets TS–2/TG, TS–2A/TG and TS–2B/TG.	Teletype signal distortion test set
Signal Generator AN/URM–25.	TM 11–5551 R.F. Signal Generator Set AN/URM–25	Signal generator
Frequency Meter AN/USM–26.	AN 16–30 USM 26–1, AN 16–30 USM–26–2 } Handbook of maintenance instructions	Frequency meter
Tool Equipment TE–50–B		Tool equipment
Multimeter TS–352/U	TM 11–5527, Multimeter TS–352/U	Multimeter
Voltmeter, Meter ME–30A/U	REP–1117, Signal Corps Repair Standard	Voltmeter

Section II. INTERUNIT TROUBLESHOOTING

69. General

a. If the radio set is defective, operate the equipment in accordance with the equipment performance checklist (par. 45*e*). The checklist indicates the general location of trouble. Use the troubleshooting chart (par. 70) as an aid in locating the possible source of the defect. Detailed troubleshooting procedure can be obtained from the component technical manuals listed in paragraph 1.

b. If Radio Modulator MD–239A/GR or Radio Set Control C–1123/GRC is at fault, refer to paragraphs 71 through 77 for detailed troubleshooting procedures.

70. Interunit Troubleshooting Chart

The following troubleshooting chart is supplied as an aid in locating trouble in the radio set. The chart lists symptoms which may be observed while operating the radio set and supplements the equipment checklist. Follow the starting procedure described in paragraph 29. The information in this paragraph is in the same sequence as the steps in the starting procedure. For troubles other than those described below, refer to the individual technical manuals as indicated in the chart.

Item	Indication	Probable trouble	Corrective procedure
1.	Power unit fails to start when START button is pressed.	MANUAL–REMOTE switch on power unit in MANUAL position.	Set MANUAL REMOTE switch to REMOTE position.
		Discharged batteries in power unit	Start power unit with hand crank (MANUAL–REMOTE switch must be in MANUAL position). Recharge battery.
		Battery terminals loose or corroded	Clean and tighten battery connections.
		Defective power unit	Refer to TM 11–904.
2.	Power unit operating, but no power available at shelter	Faulty connection at either end of Power Cable Assembly CX–1165/U or Power Cable Assembly CX–1166/U (extension cable).	Check connections at power unit, shelter, and between cables (if extension cable is used).
		Circuit breaker on panel of power unit in OFF position.	Set circuit breaker on panel of power unit to ON position.
		Circuit breakers 1 and 2 on shelter wall in OFF position.	Set shelter circuit breakers 1 and 2 to ON position.
3.	Shelter circuit breaker 8 set to ON but fluorescent lamps do not light.	Fluorescent lamp switches in off position.	Set fluorescent lamp switches to ON position.
		Defective lamp	Replace lamp.
		Defective starter	Replace starter.
		Defective on-off switch	Replace switch.

Item	Indication	Probable trouble	Corrective procedure
4.	Blowers of Electrical Blower Assembly HD–223/G not activated when power switch is set to ON.	No ac power to blower motors	Set shelter circuit breaker 4 to ON. Check connection of ac power cord. Check connections on blower assembly terminal board.
		Defective blower	Replace defective blower.
5.	Blower motors actuated but indicator lamp does not light when power switch is set to ON.	Defective lamp	Replace indicator lamp.
		Defective lamp socket	Check socket. Replace if necessary.
		No power to indicator lamp	Check connections on terminal board.
6.	FUNCTION switch of receiver (A or B) set to AGC position, but dial lamp not lighted.	Fuse F101 on rear panel of receiver open.	Check fuse; replace if defective.
		Power Cable Assembly CX–1358/U disconnected.	Check cable for breaks; check connection to ac power.
7.	Receiver (A or B) dial lamp lights, but no output in loudspeakers.	ON CHANNEL A (B) switch defective.	Check switch; replace or repair.
		Electrical Cord Assembly CX–3271/U defective.	Check cord and connectors to terminal boards. See TM 11–856.
8.	Random noise in speaker but no intelligence received.	Not tuned to frequency	Retune receiver.
		Defective rf cables to antenna	Check cables for breaks; check for tight jack connections to receiver and antenna.
		Defective antenna	Check antenna; repair or replace.
9.	Am intelligence received but no fsk reception.	Converter not activated	Check fuses F1 and F2; check ac input connections and Power Cable Assembly CX–2491/U.
		Electrical Cord Assembly CX–3269/U defective.	Check conductors for continuity; check connection from J4 (TT) of converter to J3 (CONVERTER) receptacle on control unit.
		Control unit defective	Check and repair (par. 79).
10.	Teletypewriter does not print page copy during one-way reversible operation.	Teletypewriter not activated	Check power cord and connection to ac line. Set POWER and MOTOR switches to ON.
		Defective SEND–REC switch	Repair or replace.
		Relay K1 of control unit defective	Replace relay.
		Electrical Cord Assembly CX–3270/U defective.	Check receptacle and conductors for shorts.
		TELETYPE switch of control unit	Set switch to NORMAL OW. Check switch; repair or replace.
		KEYING switch of transmitter	Set switch to NORMAL position.
		Teletypewriter defective	See TM 11–2230.
11.	Teletypewriter does not print page copy during duplex operation.	Teletypewriter not activated	Check power cord and ac line connection. Set POWER and MOTOR switches to ON.
		TELETYPE switch of control unit	Check switch; repair or replace if defective.
		Special Purposes Cable Assembly CX–1201/U.	Check conductor for breaks; check jack for proper connection. See TM 11–2230.
12.	Reperforator does not punch tape of received message.	Reperforator not activated	Check power cord and ac line connections. Set POWER and MOTOR switches to ON.

Item	Indication	Probable trouble	Corrective procedure
		SELECTOR switch on reperforator	Set to position 1. Check switch; repair or replace. See TM 11–2225.
		Receive cord to reperforator defective	Check cord for breaks and tight jack connection.
13.	FILAMENT POWER circuit breaker of transmitter set to ON FILAMENT POWER lamp does not light.	FUSE F1 or F2	Check fuses; replace if open.
		Cord CD–763	Check cord for breaks; check connection to ac power.
		Indicator lamp	Replace if defective.
14.	PLATE POWER circuit breaker and PLATE RELAY switch of transmitter set to ON; PLATE POWER lamp does not light.	Interlock switches open	Close and secure all decks.
		Jumper plug not connected	Seat P11 firmly in J13.
		Defective indicator lamp	Replace. See TM 11–809
15.	No rf signal output when transmitter is keyed.	Antenna changeover relay	Repair or replace.
		Cabling to fsk-modulator	Check RF Cable Assembly. CG–530B/U and terminating connections. Check proper seating of Connector Adapters UG–306A/U and UG–636A/U.
		Fsk-modulator not activated	Set POWER switch to ON. Check Power Cable Assembly CX–2491/U for continuity and positive connection to ac line.
		Fsk-modulator defective	See paragraph 75.
		Defective antenna cable	Check RF Cable Assembly CG–692/U for continuity and tight terminating connections. Check Radio Frequency Adapter UG/27C/U for proper seating.
		Antenna tuning unit defective	See TM 11–809 for repair of tuning unit. Check RF Cable Assembly CG–1333/U for continuity and tight terminating connections.
		Defective antenna (whip or doublet)	Check antennas for completeness of assemblies.
16.	Rf signal radiated when KEYING switch of transmitter is set to CONTINUOUS; no signal radiated when handkey is pressed.	Defective handkey or Special Purpose Electrical Cable Assembly CX–1852/U.	Check contacts on handkey. Check cable for continuity and tight connections to handkey and control unit.
		Special Purpose Electrical Cable Assembly CX–3267/U defective.	Check cable for continuity. Check connections to remote control receptacle J12 on transmitter and to TRANS receptacle on control unit.
17.	Transmitter operation normal in cw mode, but carrier not modulated in am mode.	Microphone switch	Check microphone and switch; repair or replace.
		Setting of MODULATOR BIAS control on transmitter.	Check setting of control.
		Defective modulator stage	See TM 11–809.
18.	No fsk output; cw output normal.	Send teletypewriter not activated	Check POWER and MOTOR switches. Check ac line cord and connection to ac line. Set SEND–REC switch to SEND.
		Teletypewriter defective	See TM 11–2230.

Item	Indication	Probable trouble	Procedure
		Cables from teletypewriter to control unit disconnected.	Check connections of red and black jacks to ONE WAY or SEND DX receptacle of control unit.
		Control relay K1 in control unit not operating.	Set power switch on control unit to ON.
			Check ac line cord and connection to ac line.
			Check relay K1 in control unit; replace if defective.
		RF Cable Assembly CG–409A/U defective.	Check continuity of cable and check connections to fsk-modulator and control unit.
		Fsk-modulator defective	See paragraphs 71 through 77.
19.	No telephone comunication between shelter and remote site.	REMOTE TEL switch of control unit	Set to LOCAL TEL position.
		Telephone batteries weak or defective	Replace batteries.
		Telephone Cord COS–2(18) (20 ft) defective.	Check conductors for continuity; check for tight terminal connections.
		Telephone defective	See TM 11–337.
20.	No am communications from remote site.	REMOTE TEL switch of control unit	Set to REC A or REC B position.
		Hybrid coil of control unit defective	See paragraph 53.
21.	No teletypewriter communications from remote site.	TELETYPE switch of control unit	Set to REMOTE OW or REMOTE DX position.
		Interconnecting wires	Check conductors between shelter and remote site.

Section III. TROUBLESHOOTING RADIO MODULATOR MD–239A/GR, RADIO SET CONTROL C–1123/GRC, OR REMOTE SWITCHING CONTROL C–1474/GRC

71. Bench Testing

a. General. When testing the fsk-modulator, control unit, or the remote control unit, remove the component from the frame or bulkhead mountings. Set the component on a bench or table for ease in servicing. In some cases, a packing box, crate, or portable table can be placed near the rest of the equipment to support the component and test equipment. Provide good lighting.

b. Fsk-Modulator Bench Testing. There are five cable connections to the fsk-modulator: Fan B1 mounts and connects into the rear of the fsk-modulator. Ac power and teletypewriter signals connect into the rear of the unit. The master oscillator input and fsk output signal cables connect to the front of the fsk-modulator. In some cases, when bench testing the fsk-modulator near the transmitter, it will be necessary to loosen and re-route the connecting cables. In many cases, troubleshooting or testing the fsk-modulator can be done by applying only ac power to the component. The use of a separate power cord at this time may be helpful.

c. Control Unit and Remote Control Unit Bench Testing. The control unit and remote control unit can be worked on easily when they are removed from their mountings and positioned for ease of testing. Provide good lighting.

72. General Precautions

When servicing one of the components, observe the following precautions:

a. When the fsk-modulator is removed from the top of the transmitter housing for servicing or testing, reconnect the ground strap to the transmitter and connect a suitable ground to the fsk-modulator from the main frame of the transmitter. This is a safety precaution and also prevents the occurrence of abnormal electrical effects caused by the absence of the ground connection.

b. Be sure all power is removed from the transmitter and the component under test; also,

be sure to carry out the capacitor shorting practice before contacting any of the wiring or parts that are connected to or in the vicinity of high voltage.

c. Before operating or testing any component, be sure all cable and cord connections are correct, that there are no unnecessary connections, or that some of the required connections are not missing. If possible, have another repairman check your bench test setup before applying power and conducting the test. Often some point that is overlooked will be discovered immediately by a second person.

d. Careless or incorrect replacement of parts or repair can cause more damage and trouble than the original defect. Before unsoldering a part, note the position of the leads and parts involved. If the part has numerous connections, such as a transformer, make notes and sketches of the original location and placement of parts and lead wires. This assures lead wire dress and parts locations to duplicate the original condition and minimizes the possibility of wiring errors.

e. Before testing or troubleshooting, check the source voltages of the power supply circuits. Abnormal supply voltages often affect frequency and stability characteristics and the output or gain of the circuits.

73. Operational Test

a. General. Operate the equipment as described in the equipment performance checklist (par. 45*e*). Use this checklist to sectionalize and localize a trouble to a particular part of the system. Follow the instructions as outlined, and note the symptoms that result. Then refer to the equipment performance checklist in the appropriate manual for the particular component. This applies to all components except the fsk-modulator, control unit, and remote control unit. These three components are covered by this manual.

b. Fsk-Modulator Operational Test. Follow the instructions in the equipment performance checklist (par. 45*e*). The output signal of the fsk-modulator is the same as the input signal, both in frequency and signal level, except for the frequency shift affected by the teletypewriter mark signals. Because frequency conversion is applied twice, filtered, and amplified, a failure of any stage in the modulator will have an effect on the output level and/or frequency of the fsk-modulator. The effect of the frequency-shifting circuits in the fsk-modulator can be examined as follows:

(1) Apply a signal from the master oscillator of the transmitter to the fsk-modulator, and tune the receiver to the same frequency.

(2) Disconnect RF Cable Assembly CG–530B/U from FSK jack J16 on the transmitter and loosely couple this cable to RECEIVER input jack J107.

(3) With no 60-ma signal applied to TTY IN jack J12, monitor the output of the receiver. Listen to the beat note as the BAND SELECTOR switch of the fsk-modulator is changed. A different beat note, increasing in frequency, should be audible as the BAND SELECTOR switch is advanced clockwise.

(4) Apply a 60-ma signal to the TTY IN jack (this should be the mark signal from the teletypewriter equipment). No shift in frequency should occur regardless of the position of the BAND SELECTOR switch.

74. Fsk-Modulator Signal Tracing Procedure

a. General. This procedure consists of sampling the rf signals in the fsk-modulator by coupling some of the rf signals from the individual tubes and receiving them on a communication receiver. Use Radio Receiver R–390/URR (as used with the radio set) or equal. This receiver has superior stability and frequency calibration accuracy. This test can be conducted without tuning over the fsk-modulator chassis.

b. Test Cable Fabrication. Prepare a short length of flexible and shielded wire or coaxial cable with a Connector Adapter UG–573/U that will fit the whip antenna connector (J107) on the rear panel of the receiver. Trim approximately one-half or three-fourths inches of the outer jacket and braid from the other end of the shielded wire or coaxial cable. Solder this

end to a miniature tube shield of the same size used on the fsk-modulator tubes. This tube shield is used to capacity-couple rf signals from the tube under test to the receiver. Slide a plastic or phenolic sleeve over the tube shield to prevent it from contacting adjacent parts in the modulator. Taping the test tube shield will serve if a suitable sleeve is not available.

c. Sampling Rf Signal. This test enables the repairman to determine whether or not each individual tube is producing a signal in its plate circuit. It also permits the repairman to obtain a *relative* indication of the signal amplitude and to measure the frequency of the signal within the dial calibration accuracy of a properly operating receiver. To sample the signal from the individual tube in the fsk-modulator, remove the individual tube shield and the test tube shield slipped over the tube under test. *Do not allow the bottom of the test tube shield to contact the chassis or anything other than the glass envelope of the tube under test.* If the tube shield fits loosely, squeeze the tube shield to assure a snug fit. If the test tube shield contains a tube retaining spring, remove the spring so the shield may be slipped over most of the glass envelope of the tube. The chart in *d* below indicates the frequency of the signal at the plate circuit of each tube for different positions of the BAND SELECTOR switch when no 60-ma signal (space condition) is applied to the TTY IN jack.

d. Signal Detection and Measurement. Use the receiver as a detector and monitor and tune in the signal as an ordinary radio signal. The frequency measured on the frequency dial of the receiver should be within at least 300 cycles of that as listed in the chart below for the tube under test. This method of testing quickly isolates the trouble to a particular stage. For example: If the rf input frequency applied to M.O. IN jack J1 is 1,800 kilocycles (kc) and the BAND SELECTOR switch is set to the 1.5–2 mc position, the frequency at V1 should be 13,799.15 kc. If the frequency tuned in on the receiver is 13,800 kc, the repairman should suspect the capacitors inserted in the frequency-shift network as being defective (open). If the signal cannot be detected on the receiver near 13,799.15 kc but a signal is present at 11,999.15 kc, the repairman can assume the 1,800-kc signal from the M.O. IN jack (J1) is not getting through to the input of V1, and should check for defective components in the signals path. If a signal is not present on the receiver at 13,799.15 kc but can be tuned in at 1,800 kc, the technician can assume that the shift oscillator (V2) or associate circuits are at fault. This procedure and analysis can be applied to the remaining stages in the modulator.

Tube under test	BAND SELECTOR switch setting (mc)	Frequency shift due to space condition (cps)	Frequency at tube stage (kc)
V1, V3	1.5–2 or 2–3	850	Rf input +11,999.15[a]
V1, V3	3–4 or 4–6	425	Rf input +11,999.575[a]
V1, V3	6–8 or 8–12	212	Rf input +11,999.788[a]
V1, V3	12–16 or 16–20	106	Rf input +11,999.894[a]
V2	1.5–2 or 2–3	850	11,999.150
V2	3–4 or 4–6	425	11,999.575
V2	6–8 or 8-12	212	11,999.788
V2	12–16 or 16–20	106	11,999.894
V4, V6, V7, V8	1.5–2 or 2–3	850	(Rf input[a] + 11,999.15)—12,000
V4, V6, V7, V8	3–4 or 4–6	425	(Rf input[a] +11,999.575) —12,000
V4, V6, V7, V8	6–8 or 8–12	212	(Rf input[a] +11,999.788) —12,000
V4, V6, V7, V8	12–16 or 16–20	106	(Rf input[a] +11,999.894) —12,000
V5	12,000 kc under any conditions		

[a] Denotes rf input signal fed to M.O. IN Jack J1 of modulator.

75. Troubleshooting Chart for Radio Modulator MD–239A/GR

The following troubleshooting chart is supplied as an aid in locating troubles in the fsk-modulator. Refer to figures 51 and 53 for aid in troubleshooting the fsk-modulator.

Item	Indication	Probable trouble	Procedure
1.	POWER switch at ON. Indicator lamp does not light. Blower does not operate.	No ac to equipment	Check Power Cable Assembly CX–2491/U. Check seating of plug P14 in jack J14. Check fuse F1.
2.	POWER switch at ON. Indicator lamp lights but blower motor does not operate.	No ac to blower B1	Check connection of jack J13 and plug P13. Check connections to blower motor.
3.	POWER switch at ON. Blower operates but indicator lamp does not light.	Power transformer T1 Indicator lamp DS1	Check secondary of T1. Check indicator lamp DS1.
4.	No output with 1.5- to 2.0-mc input frequency; operates normally with a 2.0- to 3.0-mc input.	Resistor R4 Input filter FL1 BAND SELECTOR switch S1	Check R4. Check input filter FL1. Check contacts of BAND SELECTOR switch S1, section 1.
5.	Normal output on all bands but no frequency shift during space signals.	Crystal diodes CR1 and CR2 BAND SELECTOR switch	Check diodes CR1 and CR2. Check contacts of sections 3 and 4 of BAND SELECTOR switch S1.
6.	Output frequency shifted during mark signals.	TTY IN jack J12 TTY IN input circuit	Check TTY IN jack J12. Check resistor R52 and feed-through capacitor C37 (fig. 42).
7.	Normal output with a 1.5- to 2.0-mc input signal; unstable operation (harmonics present) with 2.0- to 3.0-mc input signal.	3.2-mc trap KFL1 BAND SELECTOR switch Resistor R51	Check trap KFL1. Check contacts of BAND SELECTOR switch S1, section 1. Check resistor R51 (fig. 42). Check resistor R50 and feed-through capacitor C64 (fig. 43).
8.	Unstable operation on all bands	Crystals Y1 and Y2 Crystal ovens HR1 and HR2 CRYSTAL OVEN fuse F2 Shift oscillator V2 and fixed oscillator V5. Voltage regulators V10 and V11	Check crystals Y1 and Y2. Check crystal ovens HR1 and HR2. Check CRYSTAL OVEN fuse F2. Check tubes V2 and V5. Check regulators V10 and V11.

76. Voltage and Resistance Checks

Voltage and resistance diagrams for the modulator are shown in figures 38 and 39. These drawings indicate the values that should be obtained at the tube-socket pins and terminal boards. If a value, as read on the multimeter, varies (outside of reasonable tolerance limits) from the value given in the diagram, note the amount of variance and use it to aid in determining which part is at fault. For instance, if a 100,000-ohm resistance reading is indicated at a given tube-socket pin on a diagram and the actual reading is 30,000 ohms on the meter, the circuit diagram should be examined for the presence of a resistor in the circuit under test that could, if defective, account for the incorrect reading. Such a resistor would then be suspected and should be checked. Another possibility would be that a capacitor has shorted out and is shunting a resistor. Refer to figures 49 and 50 for capacitor and resistor color codes.

77. Troubleshooting Radio Set Control C–1123/GRC and Remote Switching Control C–1474/GR

Because of the simplicity of the control unit and remote control unit, troubleshooting is confined to continuity and resistance measurements. All measurements are made with the cables removed. The measurements are tabulated in the charts below. Refer to figures 54, 55, and 56 for aid in troubleshooting.

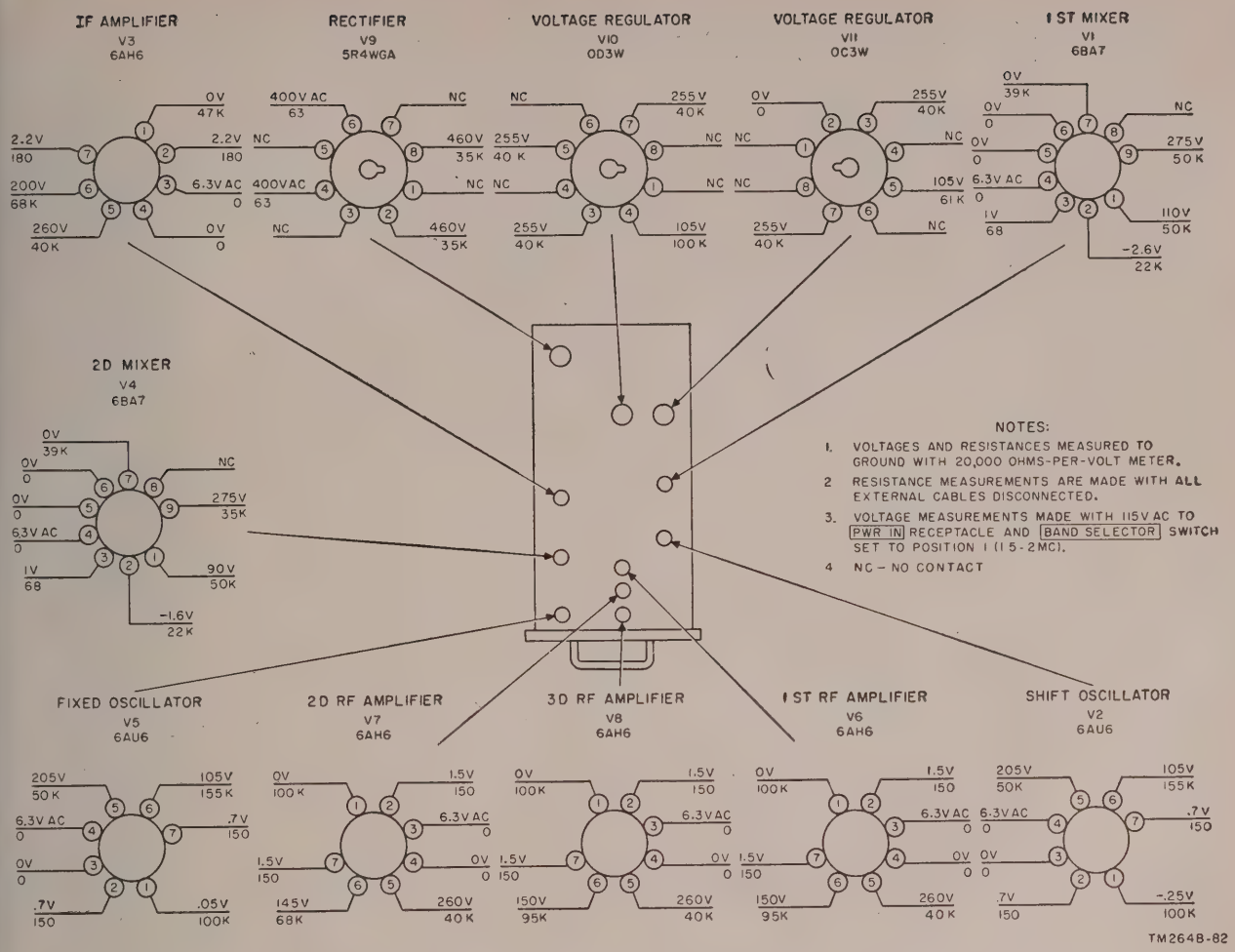
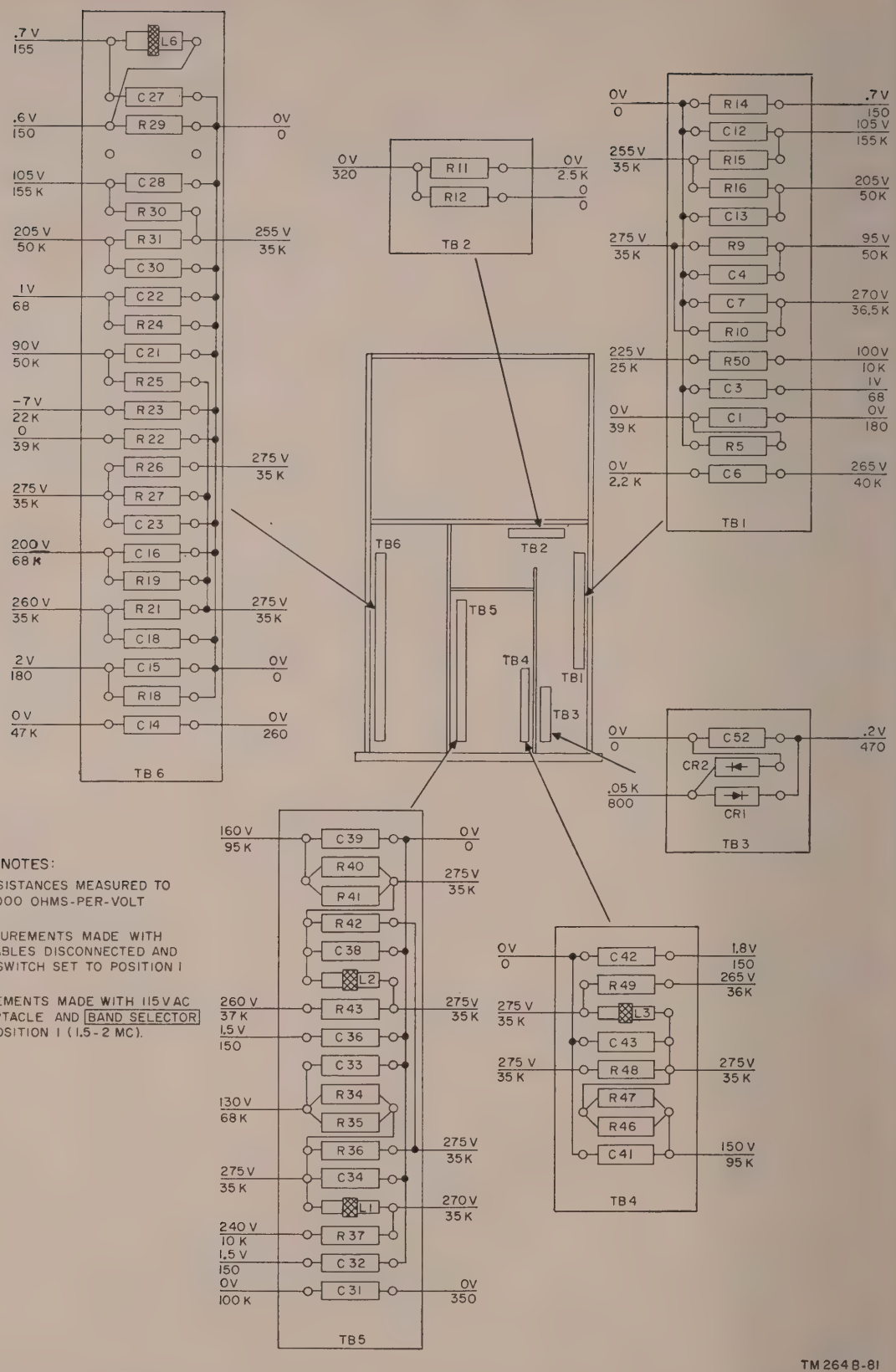


Figure 38. Radio Modulator MD–239A/GR, tube-socket voltage and resistance measurements.

a. Control Unit Resistance Chart.

Switch position	Point of measurement	Normal indication
1. TELETYPE switch at NORMAL OW. SIDETONE switch at REC A. REMOTE TEL switch at REC A.	J2–A to ground	0
	J2–B to E1	40
	J3–A to ground	0
	J3–B to ground	0
	J3–D to ground	0
	J4–A to J4–C	27
	J4–D to J6–H	0
	J4–E to ground	0
	J5–E to ground	0
	J6–A to J8–F	0
	J6–D to ground	27
	J6–E to ground	0
	J6–F to J8–C	0
	J6–J to ground	9750
	J8–E to ground	0
	J8–H to ground	0
	E1 to E2	700
	E3 to E4	0
	E5 to E6	0
	E7 to E8	380



NOTES:

1. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000 OHMS-PER-VOLT METER.
2. RESISTANCE MEASUREMENTS MADE WITH ALL EXTERNAL CABLES DISCONNECTED AND BAND SELECTOR SWITCH SET TO POSITION 1 (1.5-2 MC).
3. VOLTAGE MEASUREMENTS MADE WITH 115 V AC TO PWR IN RECEPTACLE AND BAND SELECTOR SWITCH SET TO POSITION 1 (1.5-2 MC).

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Figure 39. Radio Modulator MD-239A/GR, terminal board voltage and resistance measurements.

Switch position	Point of measurement	Normal indication
	All other pins of J1 through J8 read infinity to ground.	
2. TELETYPE switch at NORMAL DX. SIDETONE switch at OFF. REMOTE TEL switch at LOCAL TEL.	J4A to J4C	Infinity
	J4D to J6H	Infinity
	J6D to ground	Infinity
	E1 to E2	Infinity
	E2 to E8	80
	E7 to E8	Infinity
	All other readings are the same as listed under step 1.	
3. TELETYPE switch at REMOTE OW. REMOTE TEL switch at REC B. SIDETONE switch at REC B.	J4–A to J4–C	Infinity
	J4–D to J6–H	Infinity
	J5–A to J5–C	27
	J5–D to J6–H	0
	E3 to E4	Infinity
	All other readings are the same as listed under step 1.	
4. TELETYPE switch at REMOTE DX. REMOTE TEL switch at REC A. SIDETONE switch at REC A.	J3–D to ground	Infinity
	E3 to E4	Infinity
	E5 to E6	Infinity
	All other readings are the same as listed under step 1.	

b. Remote Control Unit Resistance Chart.

Point of measurement	Normal indication
E1 to E2	0
E4 to E5	0
E7 to E8	0
E3 to TTY switch jack J7–A	0
E7 to TTY switch jack J7–B	0
XMTR ON switch closed	
TTY switch jack J7–B to TTY switch jack J7–A	0
E2 to E3	0
E1 to E3	0
E6 to any jack	Infinity

Section IV. REPAIRS

78. Repair and Replacement of Parts in Radio Modulator MD–239A/GR

Figures 41, 42, and 43 show the location of all parts in the fsk-modulator. Filters FL1 through FL4 and impedance networks Z1 through Z4 are all replaced as units. Figure 52 shows typical filter internal circuits and typical values for reference purposes only. Filter KFL1, 3.2-mc trap, crystal heaters HR1 and HR2 are also replaced as units. To replace crystal Y1 or Y2, refer to figure 40 and proceed as follows.

a. Remove the holddown assembly that secures the oven in place by removing the two nuts and washers from the mounting studs.

b. Remove the oven housing from the oven mounting bracket.

c. Remove the cover from the oven housing by grasping firmly with the thumb and forefinger and pulling loose.

d. Remove the padding from around the crystal holder.

e. Remove the two screws and lockwashers that secure the crystal holder.

f. Grasp the protruding stud and remove the crystal holder from the oven housing.

g. Remove the crystal from the crystal holder.

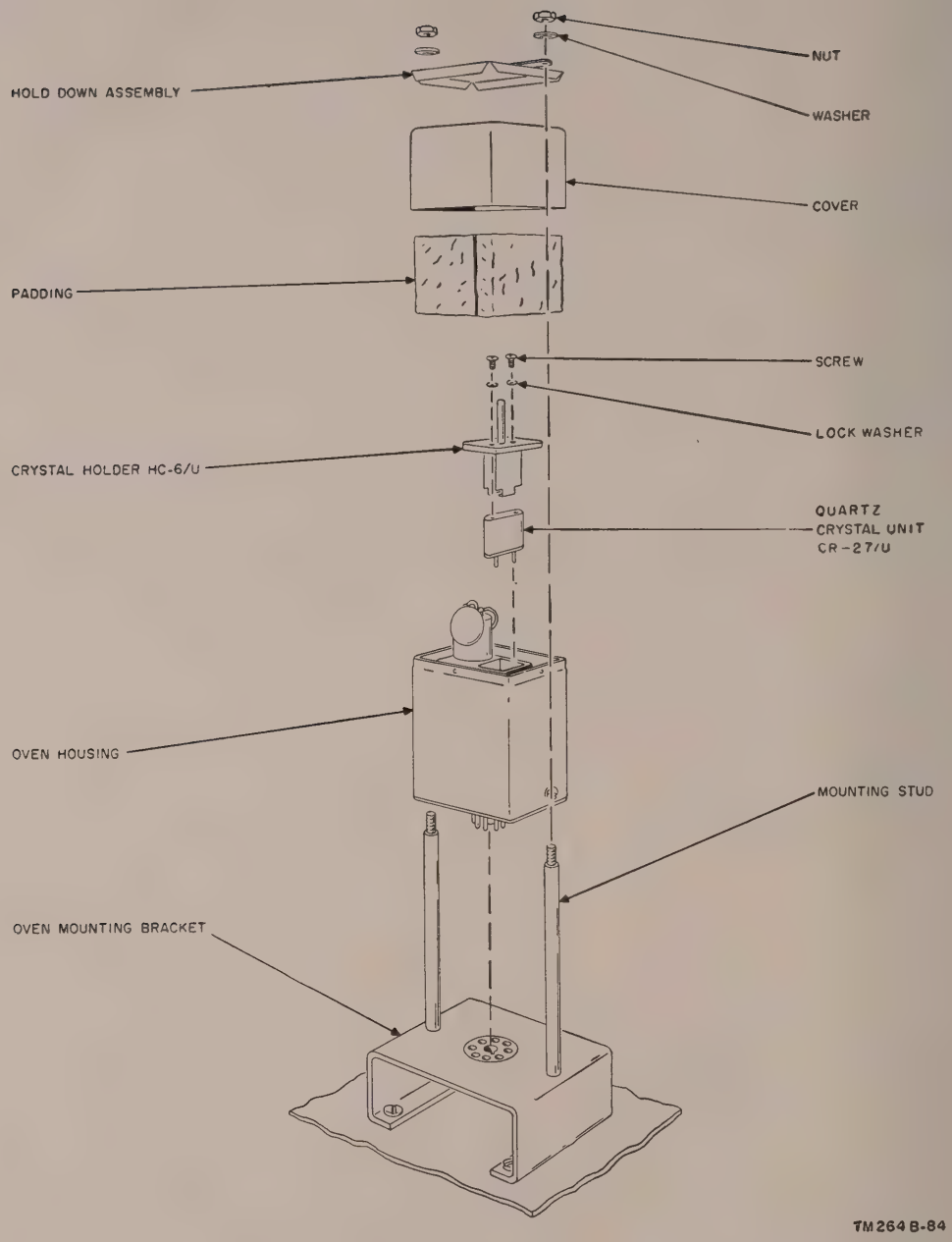


Figure 40. Quartz Crystal Unit CR–27/U, removal from crystal oven.

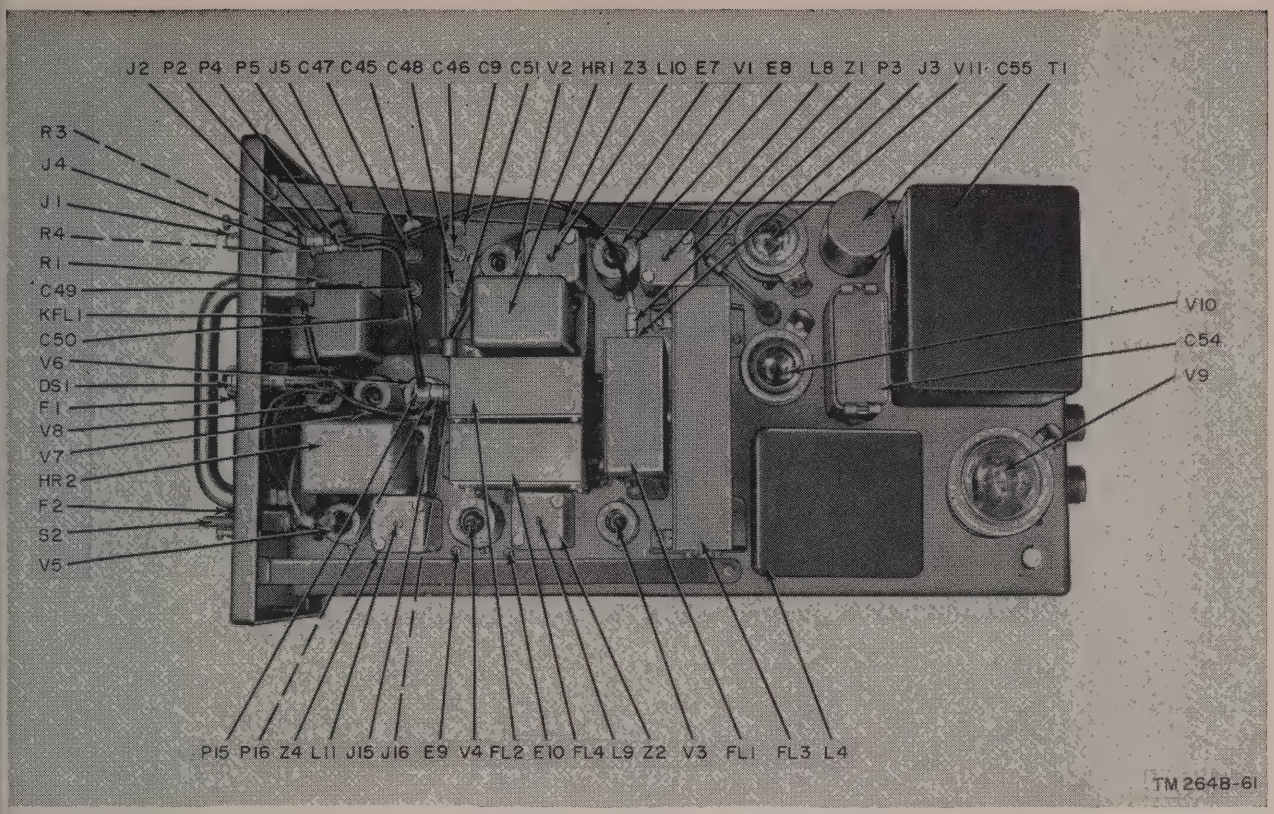


Figure 41. Radio Modulator MD–239A/GR, top view.

79. Repair and Replacement of Parts in Radio Set Control C–1123/GRC

Figures 44 and 45 show the location of all components in the control unit. To remove the control unit from the shelter wall, disconnect all cables and remove the four screws that secure it to the shelter wall. Remove the back plate by removing the four screws. To remove the subchassis, remove the four screws that secure it to the main chassis. All parts can be easily reached and serviced.

80. Repair and Replacement of Parts in Remote Switching Control C–1474/GRC

Figure 46 shows the location of all components of the remote control unit. To reach the parts, remove the rear panel by removing the four screws.

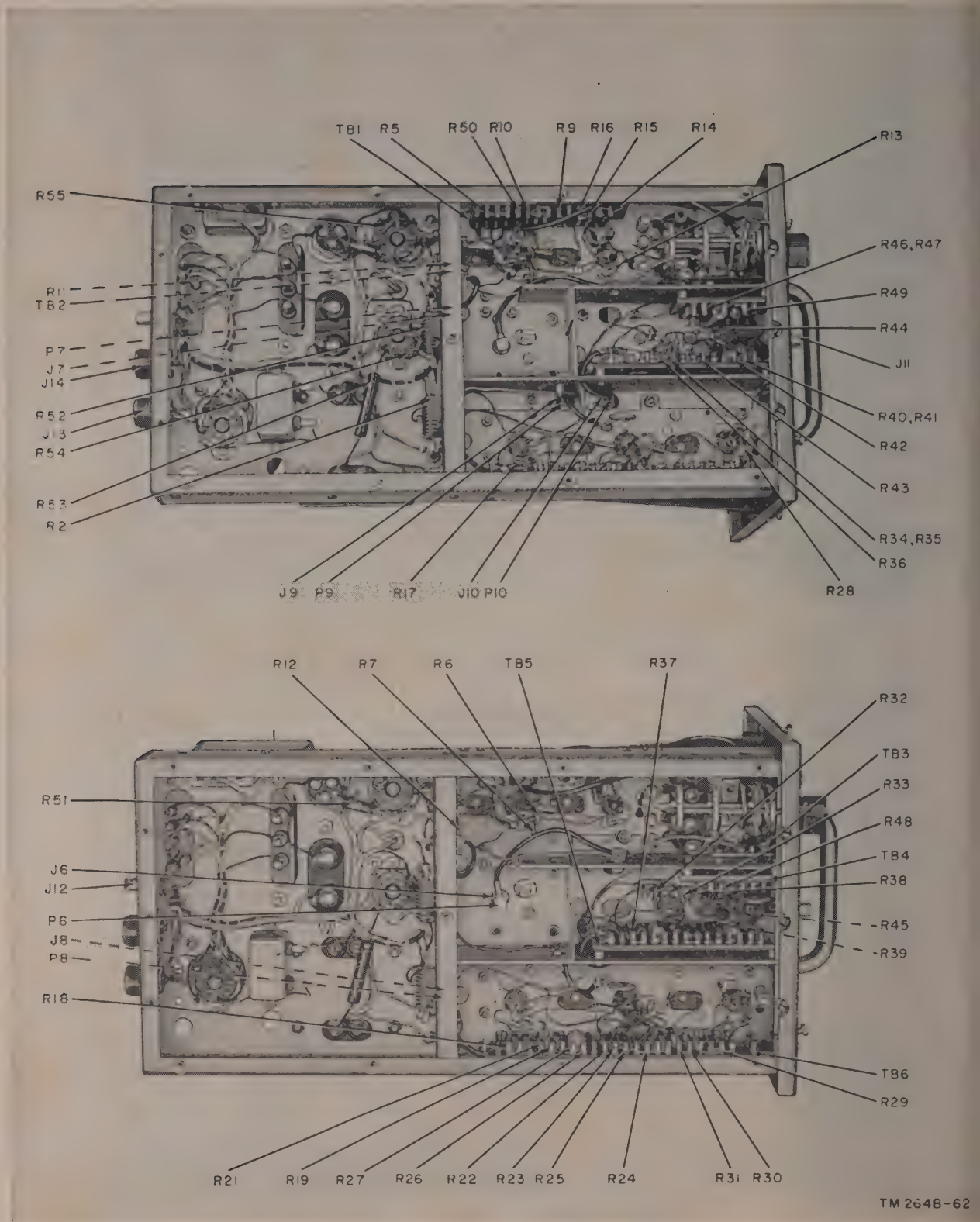


Figure 42. Radio Modulator MD–239A/GR, bottom view, resistor, rectifier, terminal board and jack location.

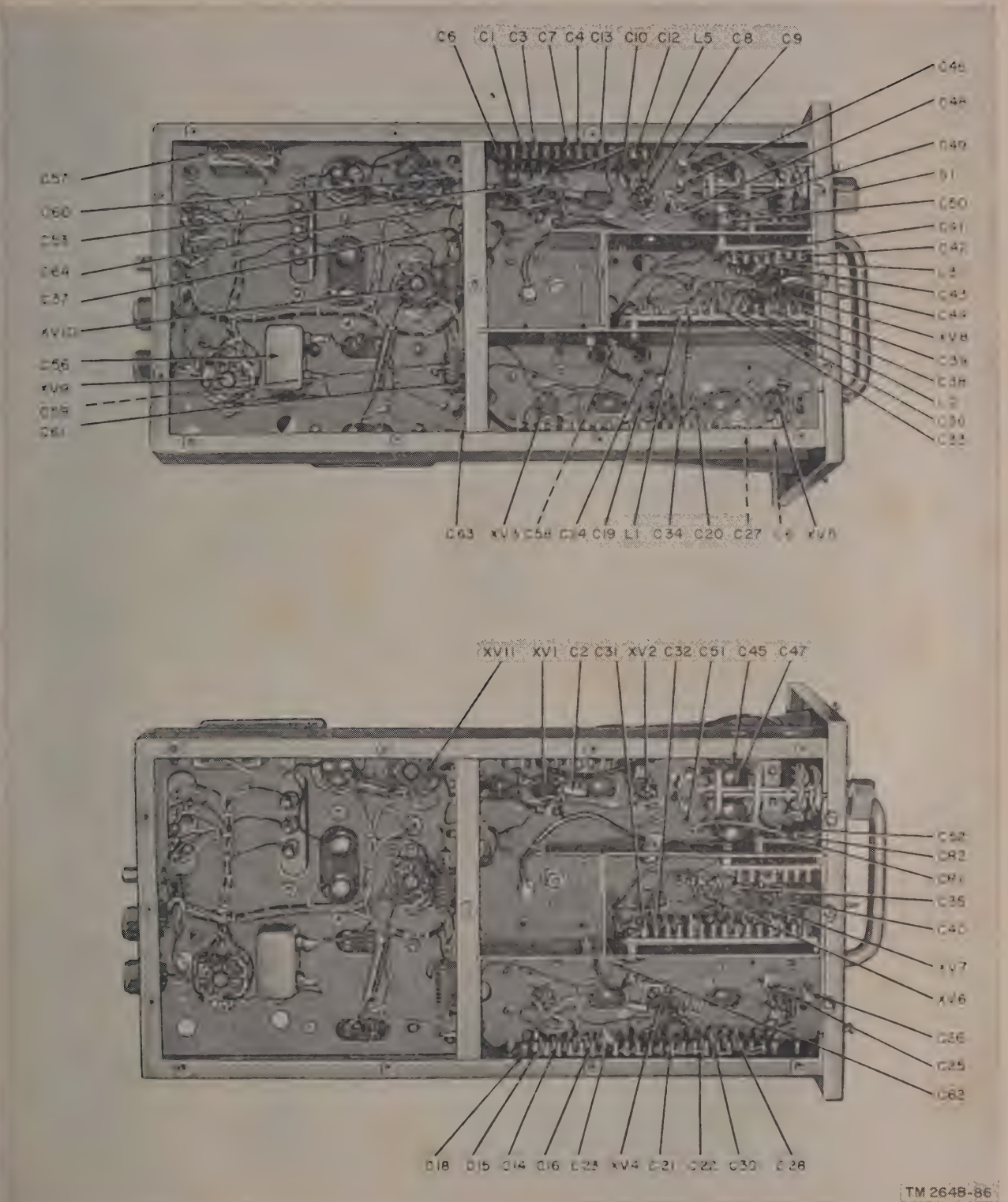


Figure 43. Radio Modulator MD–239A/GR, bottom view, capacitor, choke, tube socket, switch and crystal location.

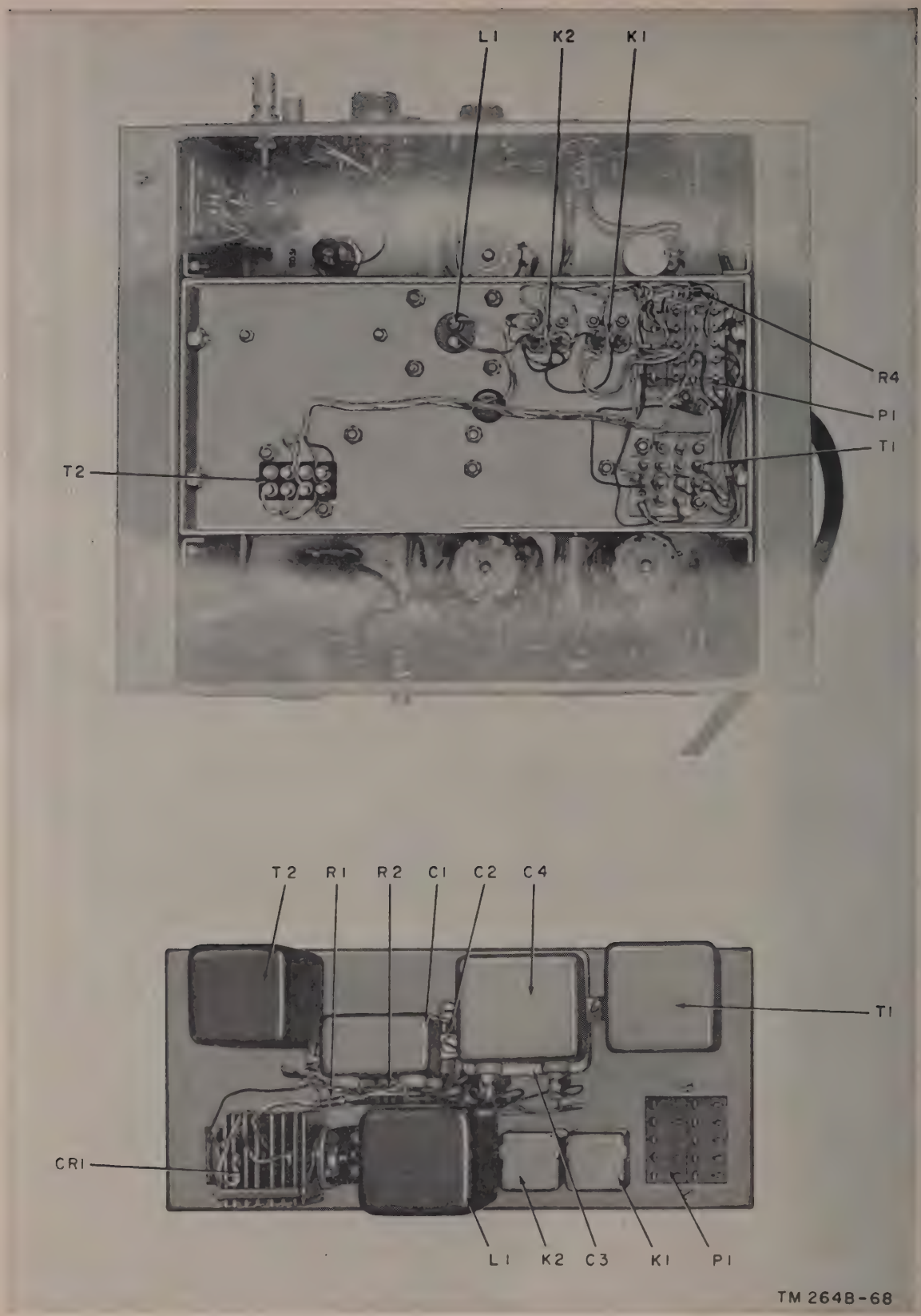


Figure 44. Radio Set Control C–1123/GRC, subchassis.

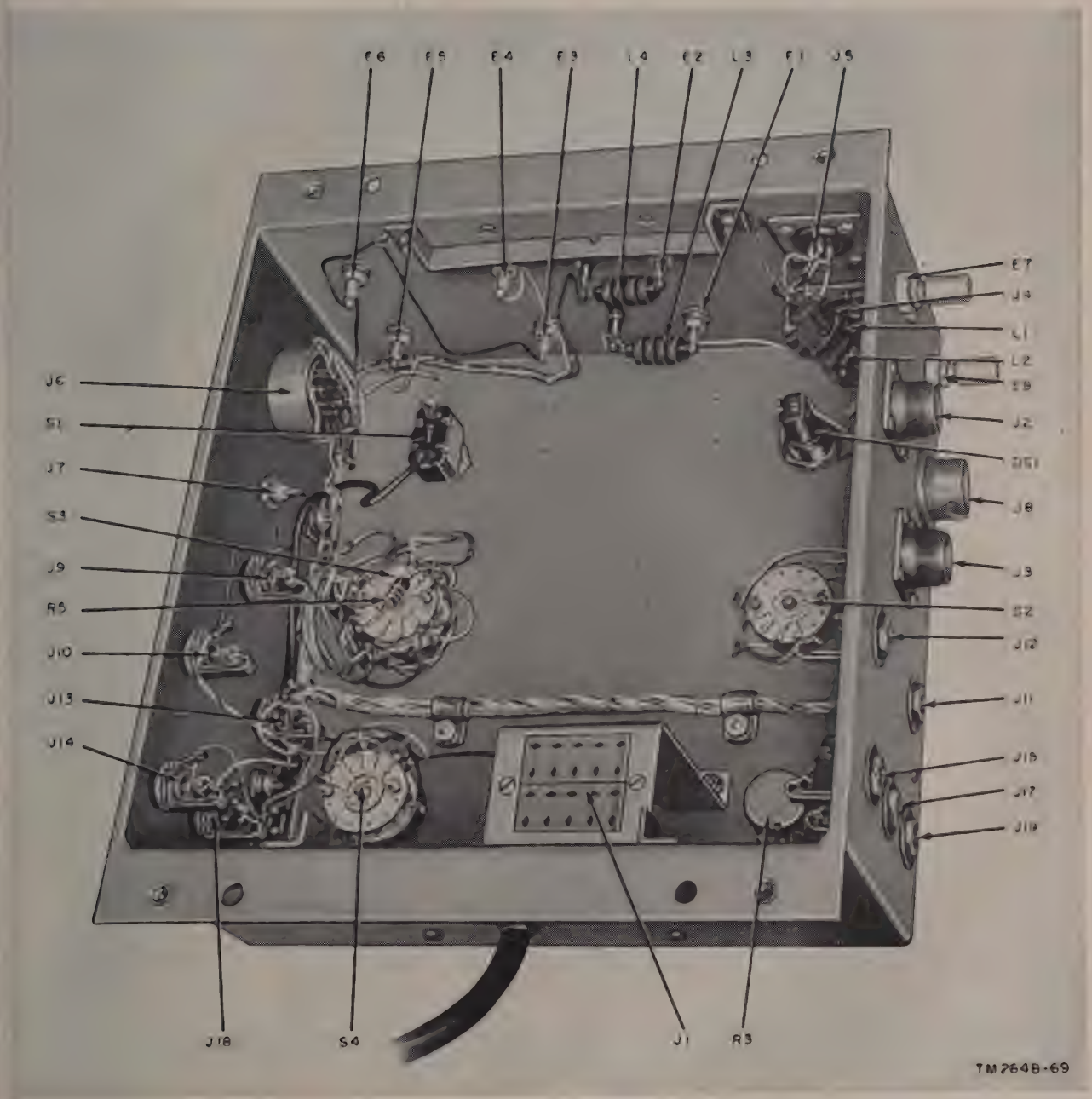


Figure 45. Radio Set Control C–1123/GRC, interior view.

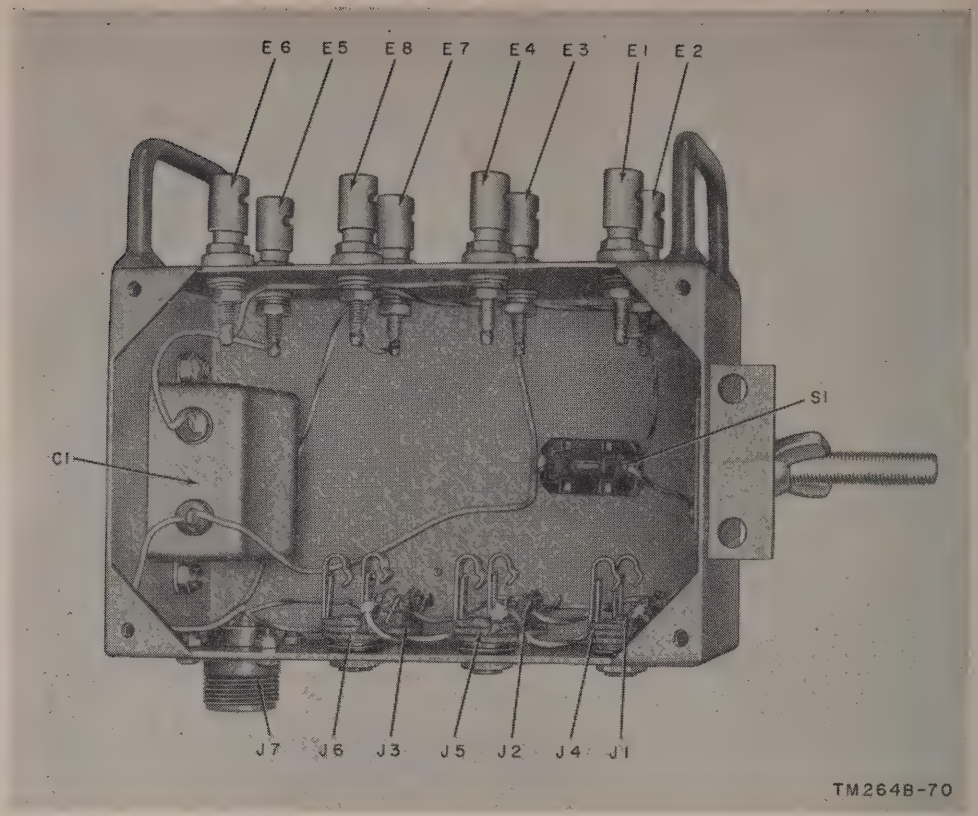


Figure 46. Remote Switching Control C–1474/GRC, interior view.

Section V. ALINEMENT AND ADJUSTMENT PROCEDURES FOR RADIO MODULATOR MD–239A/GR

81. Test Equipment Required for Alinement

The following test equipment is required for alinement:

a. Electronic Counter AN/USM–26, capable of operating from 1.5 to 15 mc.

b. Electronic Multimeter TS–505/U.

c. Power supply keying source of 60 ma, 120 volts, or a Teletypewriter TT–98/FG.

d. A signal generator capable of producing 1.5 to 3.0 mc at 3 to 5 volts or a Radio Transmitter T–368C/URT.

82. Alinement Procedures

Remove the fsk-modulator from its case and connect the equipment as shown in figure 47.

a. Preliminary Adjustments. With power and excitation disconnected from the fsk-modulator, refer to figure 48 and preset the controls listed in the following chart as indicated.

Note. To insure correct settings, turn all trimmer controls listed fully counterclockwise before setting to the indicated position.

Trimmer	Turns clockwise	Shaft exposed (inches)
C26	15	9/32
C45	9	1/2
C47	17	1/4
C49	13	3/8
C50	10	7/16
C9	3	9/16
C46	8	15/32
C48	9	7/16
C51	14	5/16
L8 (Z1)	--	1/2
L9 (Z2)	--	1/2
L10 (Z3)	Fully counterclockwise	
L11 (Z4)	Fully counterclockwise	

b. Alinement of Shift Oscillator V2 Without Shift Applied (Mark Signal Applied). Apply power to the fsk-modulator and allow the unit to warm up for 1 hour. Perform the alinement procedure outlined below.

(1) Set the BAND SELECTOR switch to position 1 (1.5–3 mc).

(2) Connect the electronic multimeter to test point E7, and adjust the slug of Z3 (L10) for a meter indication of —7 volts. Be sure the first —7-volt indication is obtained as approached from the extreme counterclockwise setting of Z3. Slugs Z1 (L8) and Z2 (L9) require no further adjustment other than the initial setting.

(3) Connect the meter to test point E9, and adjust the slug of Z4 (L11) for a meter indication of —7 volts (as in (2) above).

(4) Turn trimmer C9 fully counterclockwise.

(5) Apply a 60-ma mark signal to TTY IN jack J12 and observe the frequency at test point E8, as indicated on the frequency counter. The frequency should be between 11,999.8 kc and 12,000 kc. If the frequency is not within the specified limits, replace crystal Y1; select a crystal that will produce the desired frequency.

(6) Adjust trimmer capacitor C9 for the maximum attainable frequency at test point E8, and record this frequency.

(7) Calculate a frequency 50 cps *below* that recorded in (6) above, and readjust trimmer capacitor C9 for this calculated frequency.

(8) Set the BAND SELECTOR switch to position 3 and adjust trimmer capacitor C46 for the frequency calculated in (7) above.

(9) Set the BAND SELECTOR switch to position 5 and adjust trimmer capacitor C48 for the frequency calculated in (7) above.

(10) Set the BAND SELECTOR switch to position 7 and adjust trimmer capacitor C51 for the frequency calculated in (7) above.

c. Alinement for Frequency Shift. Connect the output of the signal generator or the master oscillator output of the transmitter to M.O. IN jack J1 of the fsk-modulator. Adjust the input frequency to 1.5 mc, and proceed as follows.

(1) Apply a 60-ma mark current to TTY IN jack J12.

(2) Connect the frequency counter to test point E9, and adjust trimmer capacitor C26 for a frequency output of 12,000 kc. If this frequency is not obtainable, replace crystal Y2 with a crystal that will produce the desired frequency.

(3) Set the BAND SELECTOR switch to 1.5–2 mc position.

(4) Connect the frequency counter to test point E10, and observe the frequency indicated. It should be the same as the input frequency to M.O. IN jack J1 (1,500 kc). If not, readjust trimmer

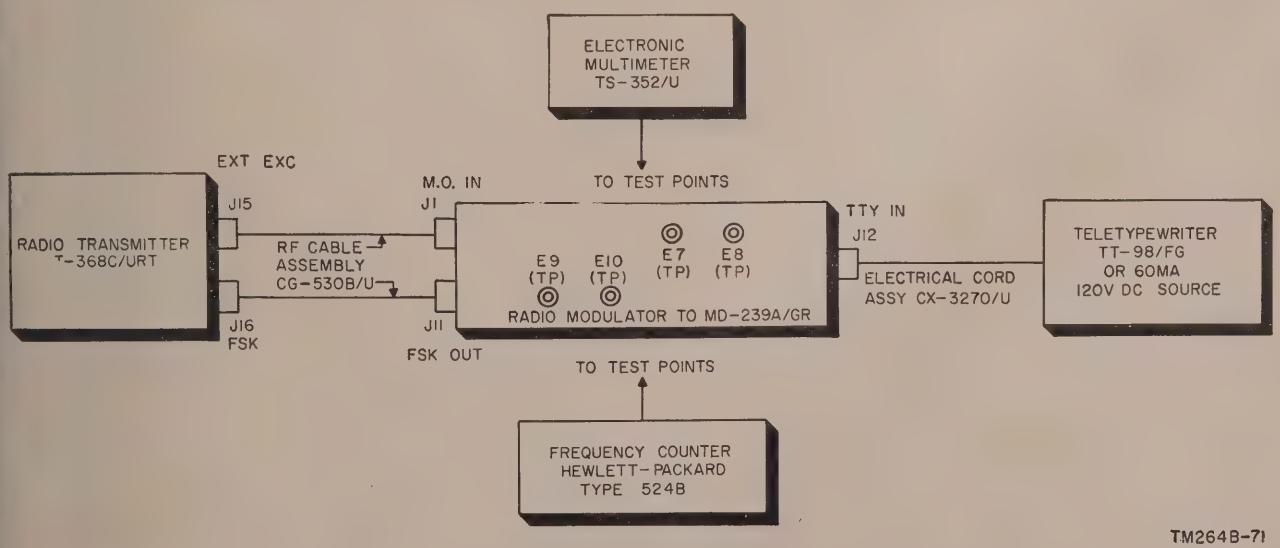


Figure 47. Radio Modulator MD-239A/GR, test bench setup.

capacitor C26 until the frequency indicated is 1,500 kc.

(5) Remove the 60-ma mark signal from TTY IN jack J12.

(6) Adjust trimmer capacitor C45 until the frequency at test point E10 is exactly 850 cps below the input frequency of 1,500 kc.

(7) Set the BAND SELECTOR switch to 3–4 mc position.

(8) Adjust trimmer capacitor C47 until the frequency at E10 is exactly 425 cps below the input frequency.

(9) Set the BAND SELECTOR switch to 6–8 mc position.

(10) Adjust trimmer capacitor C49 until the frequency at E10 is exactly 212 cps below the input frequency.

(11) Set the BAND SELECTOR switch to 12–16 mc position.

(12) Adjust trimmer capacitor C50 until the frequency at E10 is exactly 106 cps below the input frequency.

83 Final Testing

The final test of the fsk-modulator is to insure producing enough drive without distorting Radio Transmitter T–368C/URT. Proceed as follows:

a. Connect the fsk-modulator in the radio set

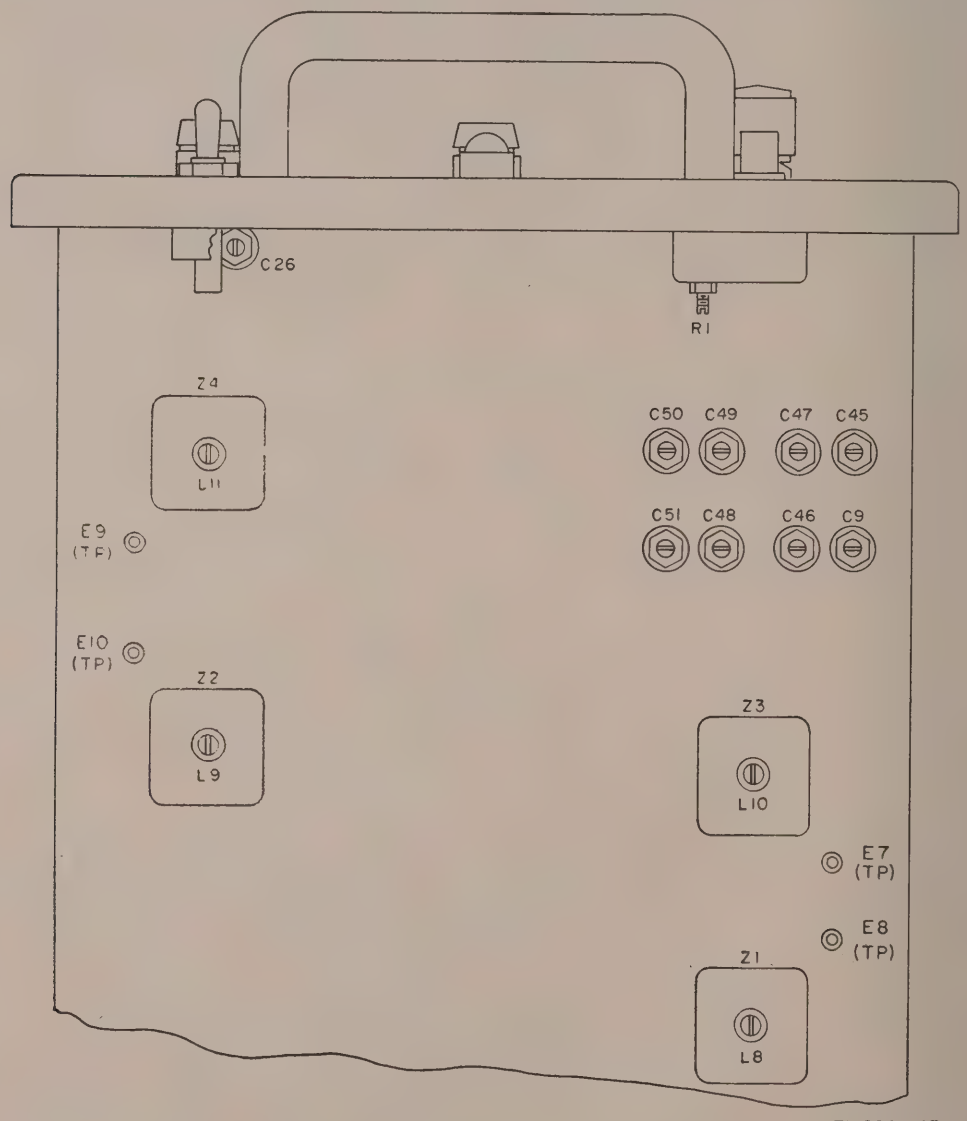


Figure 48. Radio Modulator MD–239A/GR, alignment points.

and turn on the send teletypewriter, the transmitter, and the fsk-modulator.

b. Tune the transmitter to 1.5 mc and set the BAND SELECTOR switch of the fsk-modulator to the 1.5–2 mc position.

c. Set the teletypewriter SEND-REC switch to SEND.

d. Set the transmitter EXCITATION METER SWITCH to PA GRID X2 position.

e. The EXCITATION meter should indicate a minimum grid drive of 8 ma. If it does not, turn gain control potentiometer R1 (fig. 48) clockwise until it does.

f. Repeat this check with the transmitter tuned to the midband position and at the high end of the band. The fsk-modulator BAND SELECTOR switch must be set to correspond to the frequency setting of the transmitter.

CHAPTER 7
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

84. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Disconnect any outside field lines. Disconnect the power cord to the power unit.

b. Roll up the power cords and stow them in the shelter.

c. Take down the doublet antennas, if used; disconnect the coaxial cables. Repack the antennas and replace the cables on the reels provided.

d. Dismantle whip antennas and remove the mast bases. Reverse the procedure outlined in paragraph 19 to remove the mast bases. Stow the mast bases and antennas in shelter.

e. Disconnect the grounding wire, and stow the wire and ground rod in the shelter.

f. Cover the teletypewriters and reperforator with the canvas covers provided.

g. Be sure that all components are mounted securely and fastened tightly.

h. Stow all loose items, such as headset, key, and technical manuals in the compartments of storage cabinet.

i. Pack empty spaces in the cabinet to prevent shifting of contents. Close the cabinet drawers securely.

j. Close all windows, roof hatch, and feed-through holes in shelter.

k. Stow the coaxial cables and reels, antenna mast equipment, power cables, and Reel RL–29 in the shelter to prevent their loss if the trailer becomes separated from the shelter. Secure all these components to prevent shifting during transportation.

85. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored.

b. In addition to steps given in paragraph 84, place protective wrapping around the heater, fire extinguisher, and other unprotected components.

c. Place bags of silica gel inside the shelter and cabinents as a dehydrating agent.

d. Brace and shore-up the interior of the shelter if required material is available.

e. Close and lock the shelter door. Close and secure the blackout shields over the closed windows and skylight. Seal the door, windows, roof hatch, and feed-through holes with waterproof sealing tape and sealing compound.

f. For packing of the power unit, refer to TM 11–904.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

86. General

The demolition procedures outlined in paragraph 87 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished *ONLY* upon order of the commander.

87. Methods of Destruction

Destroy the components within the shelter and the shelter itself by using any of the following methods:

a. Weapons Fire. Fire on the radio set with artillery or use small arms inside the shelter. Throw incendiary grenades into the shelter.

b. Explosives. Place demolition charges at various places throughout the shelter and detonate them simultaneously with detonating cord and suitable detonator.

c. Smashing. Smash tubes, meters, coils, antennas, and controls; use sledges, axes, hammers, or crowbars. The entire unit can be pushed over a cliff or other height onto a hard surface.

d. Burning. Pack rags, clothing or canvas under and around the components. Saturate this packing with gasoline, oil, or diesel fuel and ignite it.

APPENDIX

TABLE OF COMPONENTS

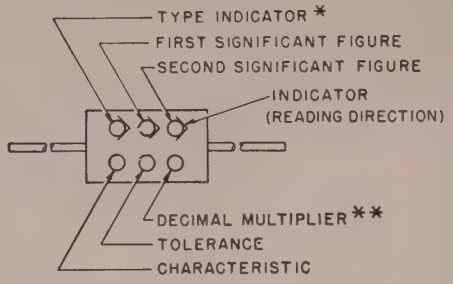
Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Unit weight (lb)
Radio Modulator MD/239A/GR	1	8¾	9½	17	50
Power Cable Assembly CX–2491/U (6 ft)	1			72	
Quartz Crystal Unit CR–27/U	2				
Running spares as follows:					
Fuse: 1.5 amp, type F02D1R508	5				
Pilot lamp: 6 to 8 v GE #7	1				
Tube 5R4WGA	1				
Tube 6AH6	1				
Tube 6AU7	1				
Tube 6BA7	1				
Tube OC3W	1				
Tube OD3W	1				
Connector Adapter UG–306A/U	4				
Connector Adapter UG–636A/U	1				
RF Cable Assembly CG–530B/U (2 ft)	2			24	
Radio Transmitter T–368C/URT	1	41½	31	32	650
Cord CD–763 (13 ft)	1				156
Running spares as follows:					
Tube 6AH6	1				
Tube 6000	1				
Tube 5749/6BA6W	1				
Tube 4–400A	1				
Tube 5933	1				
Tube 0A2	2				
Tube 5R4WGA	1				
Tube 4D21	1				
Tube 5726/6AL5W	1				
Tube 6C4WA/6100	1				
Tube 12AT7WA	1				
Tube 5814A	1				
Tube 3B28	1				
Fuse: 6 amp, 250 v type FO2G6ROOA	3				
Fuze: 3 amp, 250 v, type FO2G3ROOA	5				
Lamp LM–41: 6w 110 v	1				
Technical Manual TM 11–809	2				
Frequency Shift Converter CV–116B/URR	1	8¾	17	19	69
Electrical Power Cable Assembly CX–2491/U (6 ft).	1			72	
Crystal Unit CR–25U/405	1				
Crystal Unit CR–25/U–425	1				
Running Spares as follows:					
Fuse: 3 amp, 250 v, type FO2G3ROOA	11				
Glow lamp NE–51	1				
Tube 5814A	4				
Tube 5726/6AL5W	4				
Tube 6BA7	1				
Tube 6AU6	4				
Tube 6005/6AQ5W	1				
Tube 6X4W	2				

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Unit weight (lb)
Technical Manual TM 11–2241	2				
RF Cable Assembly CG–409A/U (6 ft)	2			72	
Connector, type AN3106R–145–2P	1				
Cable adapter, type AN–3057–6A	1				
Teletypewriter Set AN/MGC–5 consisting of:	1				
Reperforator-Transmitter Teletypewriter TT–76/GGC.	1	12	18	21	45
Teletypewriter Table FN–64/MGC	1	28	18	28	15
Teletypewriter Set AN/FGC–20X consisting of:	2				
Teletypewriter TT–98/FG	1	13½	24	20⅝	54
Teletypewriter Table FN–59/FG	1	27	21	20	22
Radio Receiver R–390/URR	2	10½	17¼	19	65
Running spares as follows:					
Tube 6AJ5	6				
Tube 6BJ6	3				
Tube 6C4	2				
Tube 12AU7	3				
Tube 5749/6BA6W	4				
Tube 6AK6	2				
Tube 26Z5W	1				
Tube 6082	1				
Tube 6BH6	1				
Tube 5651	1				
Tube 12AT7	1				
Tube 3TF7 (Ballast)	2				
Dial lamp	4				
Fuse: ⅜ amp, 125 v, type FO2DR375B	6				
Fuse: 3 amp, 125 v, type FO2D3ROOB	6				
Power Supply PP–621/URR	2	5⅞	4⅛	6¾	15
Power Cable Assembly CX–1358/U (8 ft)	1			96	
Antenna Tuning Unit BC–939–B	1				48
Capacitor: vacuum, 55 $\mu\mu$f	1				
Capacitor: fixed, .12 $\mu\mu$f	1				
Radio Set Control C–1123/GRC	1	12	4½	$10\frac{1}{16}$	10
Generator Set PU–248/U consisting of:	1				
Trailer M–105	1				2,350
Power Unit PE–95	1	38½	27¼	72½	1,360
Bracket assembly	6				
Tube: flexible, nozzle	3				
5-gallon liquid container	6				
Mast AB–155/U (each consisting of):	6				
Carrying Device MX–387/GRA–4	1				
Cover CW–124/GRA–4	1				
Guy Fastener MX–379/U	6				
Guy Plate MX–378/U	5				
Guy MX–381A/GRA–4	4				
Guy MX–382A/GRA–4	4				
Guy MX–383A/GRA–4	4				
Halyard MX–516A/GRA–4	1				
Hammer HM–1	1				
Mast Base AB–154/U	1				
Mast Base Plate	1				
Mast Section MS–44	8				
Slide Fastener FT–9	3				
Guy stake: 18½ in. by ⅝ in. dia	6				
Hickory wood stake	4				

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Unit weight (lb)
Electrical Equipment Shelter S–56A/G	1	77	75	138½	2,470
Fire extinguisher: carbon dioxide type	1				
Telephone Set TA–43/PT	2	4	7	11	9½
Electrical Equipment Cabinet CY–1807/G	1				100
Electrical Blower Assembly HD–223/G	1				
Storage Cabinet CY–1721A/GRC	1	31 3/32	15⅞	48⅞	147½
Electric heater: 1,500 watts	1				15½
Headset H–113/U	2				
Loudspeaker Assembly LS–206A/U	1				
Microphone M–29/U	1 and 1 spare				
Antenna rope clamp	3 and 3 spares				
Mast Base Bracket MT–657/GRC	1				
Ground rod	1 and 1 spare				
Guy: whip antenna, receiving	2 and 1 spare				
Guy: whip antenna, transmitting	1 and 1 spare				
Insulator bowl: stand-off	1				
Strain insulator	12 and 12 spares				
Electrical lead: for ground	2				
Mast Bracket MP–50–A	2				
Mast Base MP–65–B	2				
Mast Base MP–76	1				
Mast Section MS–116–A	7 and 7 spares				
Mast Secton MS–117–A	3 and 3 spares				
Mast Section MS–118–A	3 and 3 spares				
Radio Frequency Adapter UG–27C/U	1 and 1 spare				
Connector Adapter UG–567A/U	1 and 1 spare				
Connector Adapter UG–637/U	2 and 1 spare				
Connector Adapter UG–643/U	2 and 1 spare				
Connector Adapter UG–971/U	2 and 1 spare				
Connectors: solderless (Burndy KS–90)	12 and 12 spares				
Special Purpose Cable Assembly CX–1200/U (5 ft).	2			60	
Special Purpose Cable Assembly CX–1201/U (5 ft).	2			60	
Electrical Cord Assembly CX–3271/U (6 ft)	2			72	
Telephone Cord COS–2(18) (20 ft)	1			240	
Electrical Cord Assembly CX–3269/U (3 ft 6 in.)	1			162	
RF Cable Assembly CG–718A/U (8 ft)	2			96	
RF Cable Assembly CG–718A/U (24 ft)	1			288	
RF Cable Assembly CG–409A/U (8 ft)	1			96	
Electrical Cord Assembly CX–3270/U (5 ft)	2			60	
Special Purpose Electrical Cable Assembly CX–3267/U (12 ft 6 in.).	1			150	
Special Purpose Electrical Cable Assembly CX–3268/U (14 ft).	2			168	
Special Purpose Electrical Cable Assembly CX–1852/U (6 ft).	1			72	
Power Cable Assembly CX–1165/U (12 ft)	2			144	
Power Cable Assembly CX–1166/U (50 ft)	2			600	
RF Cable Assembly CG–692/U (75 ft)	1 and 1 spare			900	
RF Cable Assembly CG–1334/U (500 ft)	2			6,000	
RF Cable Assembly CG–1333/U (3 ft 2 in.)	1 and 1 spare			38	
Cord CD–307–A (6 ft)	2			72	
Bond strap	1				
Electrical lead: #7 AWG braided, 3 ft 6¾ in.				42¾	
Electrical clamp: 2⅞ in. x 2¾ in. x 4½ in.	2				

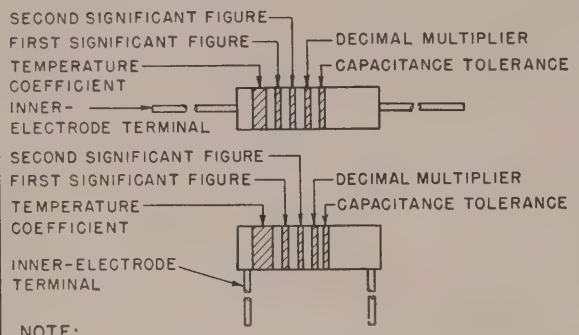
Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Unit weight (lb)
Wire W–1: 500 ft	2			6,000	
Wire W–128	1				
Reel RL–159	2				
Reel RL–29	2				
Rope: size 5, 50 ft	1			600	
Axle RL–27–D	1				
Aluminum chair	2				
Wooden chair	1				
Clipboard: 9 in. x 12½ in.	1				
Chart holder	3				
Clip: 2½ in., 12 in box	1				
Paper clip: No. 1, 100 in box	1				
Clock, type A–11	1				
Remote switching control C–1474/GRC	1				
Extension light: 25-ft cord	1	6⅝	3⅛	4 3/16	
Incandescent lamp: Mazda 50 watts	2				
White fluorescent lamp 20 watts	4 and 4 spares				
Key KY–116/U	1				
Mucilage: 4-oz bottle	2				
Lubricating oil: 4 oz, preservating	1				
Padlock MC–92: 2 keys	1				
Teletypewriter paper: type 1, grade B, 8½ in. wide x 350 ft long roll.	15				
Teletypewriter paper: type 1, grade B, 8⅛ in. wide x 350 ft long roll, 2 carbon inserts.	15				
Pencil M–140: 12 in box	1				
Rack MT–655/GRC	2				
Telephone box	1				
Broom: upright	1				
Lamp starter	4 and 4 spares				
Blank recording teletypwriter tape	50				
Steel measuring tape: 100 ft	1			1,200	
Wrench assembly: for removing mounting bolts of transmitter.	1				

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



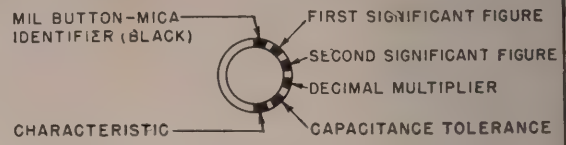
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
** INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

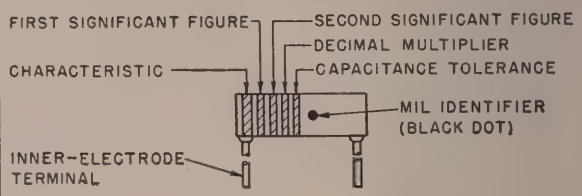


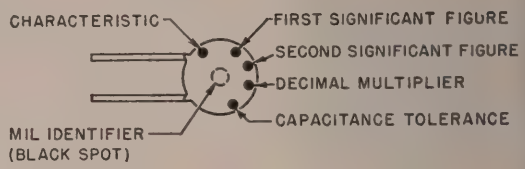
NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



BUTTON-MICA (CB)





NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

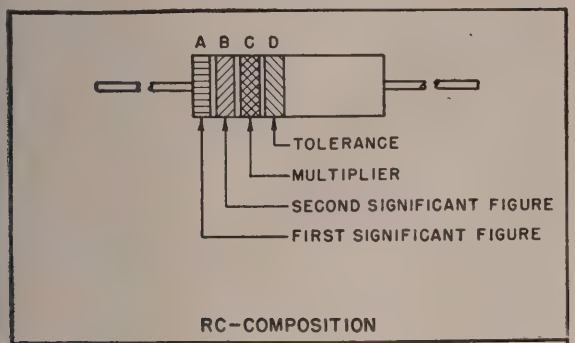
1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

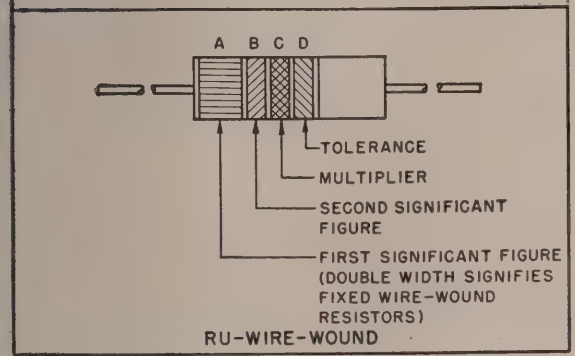
Figure 49. Capacitor color codes.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)

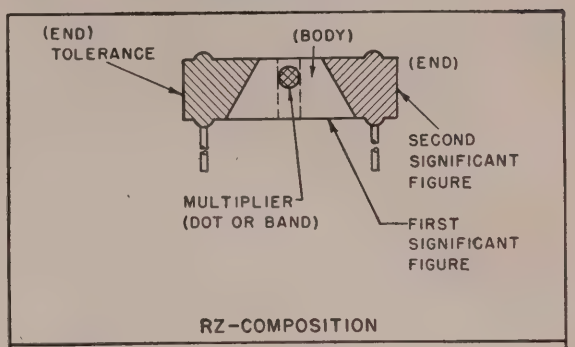


RC-COMPOSITION

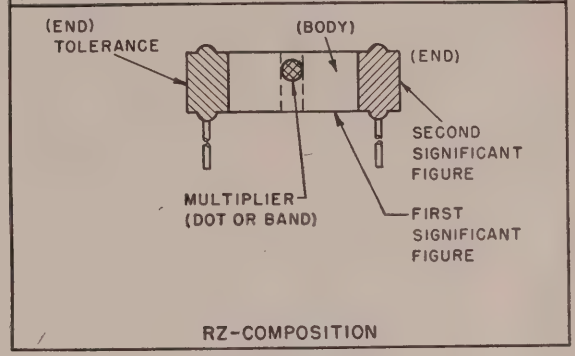


RU-WIRE-WOUND

RADIAL-LEAD RESISTORS (UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

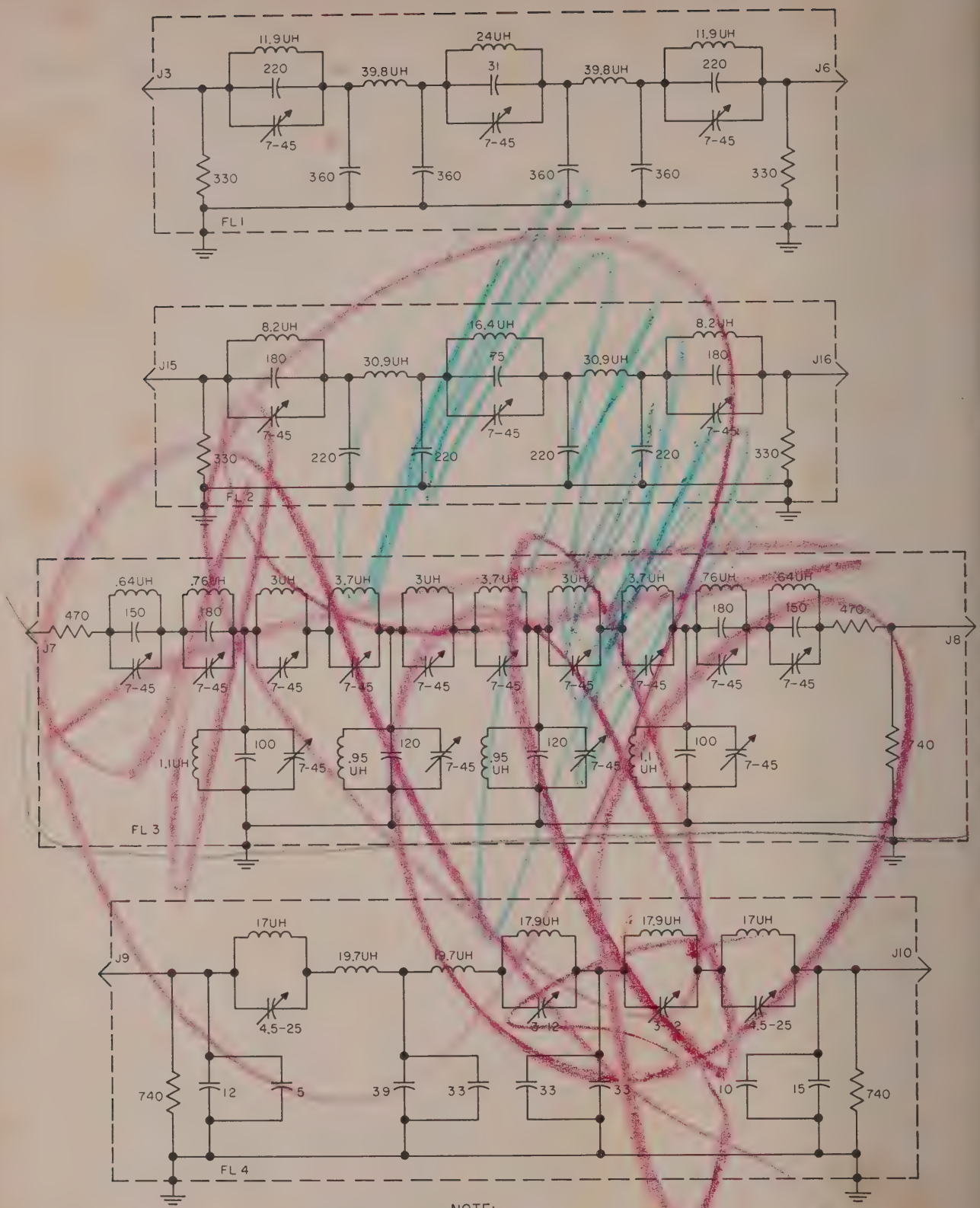
*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

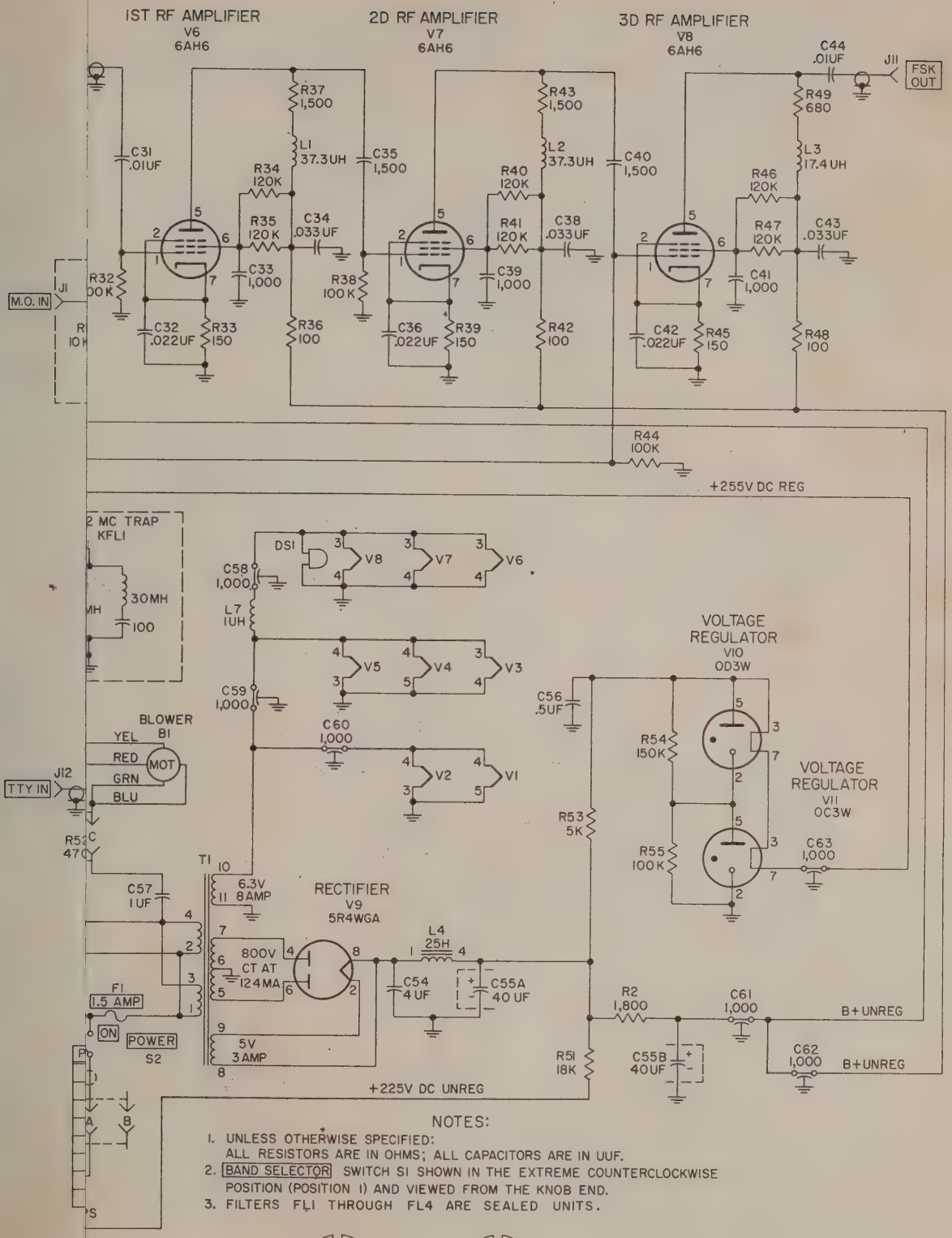
Figure 50. Resistor color codes.



NOTE:
UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS; ALL CAPACITORS ARE IN UUF.

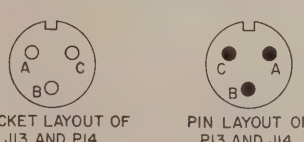
TM264B-85

Figure 52. Radio Modulator MD-239A/GR, typical filters.

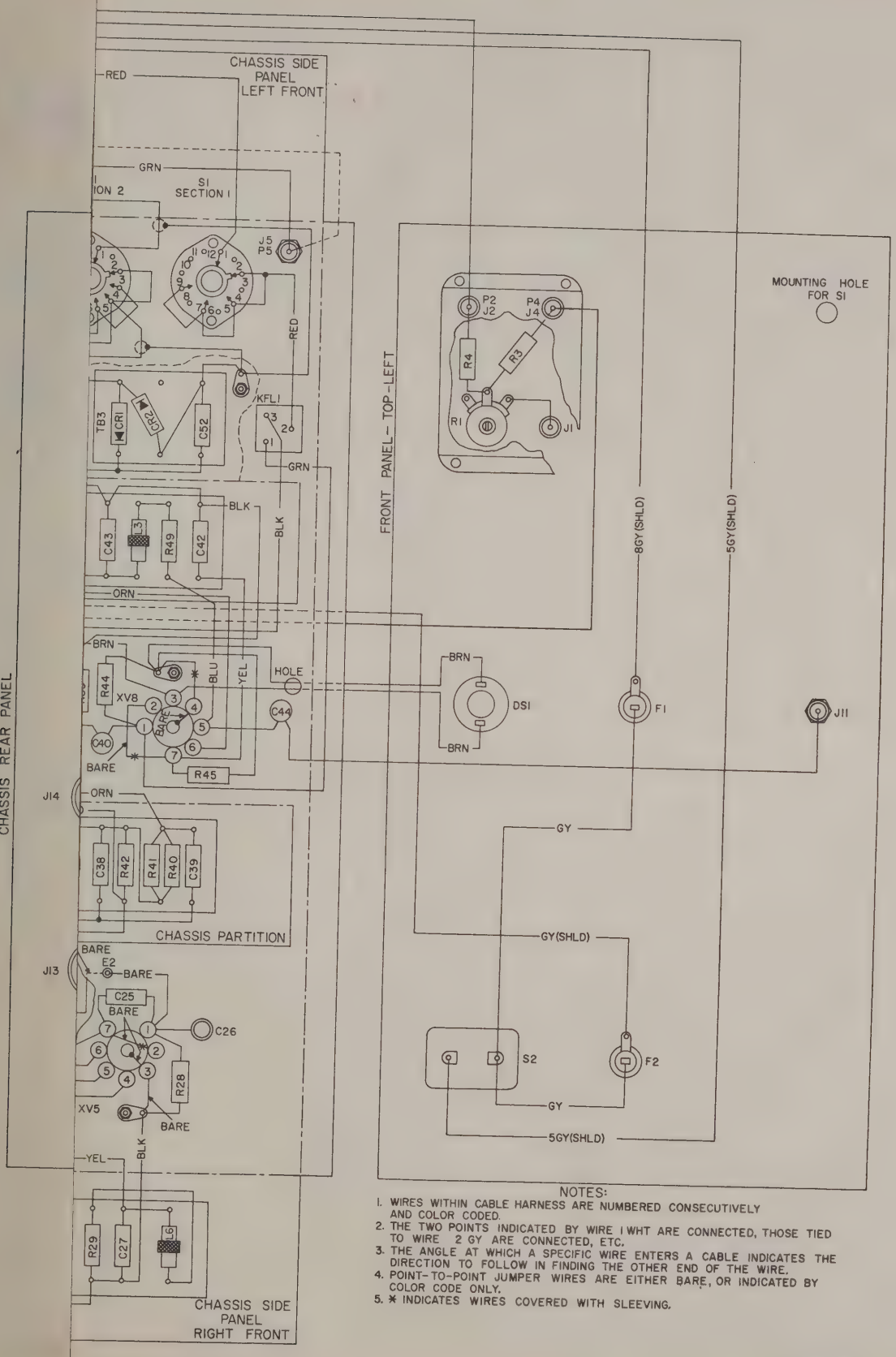


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS; ALL CAPACITORS ARE IN UUF.
2. BAND SELECTOR SWITCH S1 SHOWN IN THE EXTREME COUNTERCLOCKWISE POSITION (POSITION 1) AND VIEWED FROM THE KNOB END.
3. FILTERS FL1 THROUGH FL4 ARE SEALED UNITS.



TM264B-66



NOTES:

1. WIRES WITHIN CABLE HARNESS ARE NUMBERED CONSECUTIVELY AND COLOR CODED.
2. THE TWO POINTS INDICATED BY WIRE 1 WHT ARE CONNECTED, THOSE TIED TO WIRE 2 GY ARE CONNECTED, ETC.
3. THE ANGLE AT WHICH A SPECIFIC WIRE ENTERS A CABLE INDICATES THE DIRECTION TO FOLLOW IN FINDING THE OTHER END OF THE WIRE.
4. POINT-TO-POINT JUMPER WIRES ARE EITHER BARE, OR INDICATED BY COLOR CODE ONLY.
5. * INDICATES WIRES COVERED WITH SLEEVING.

TM2648-60



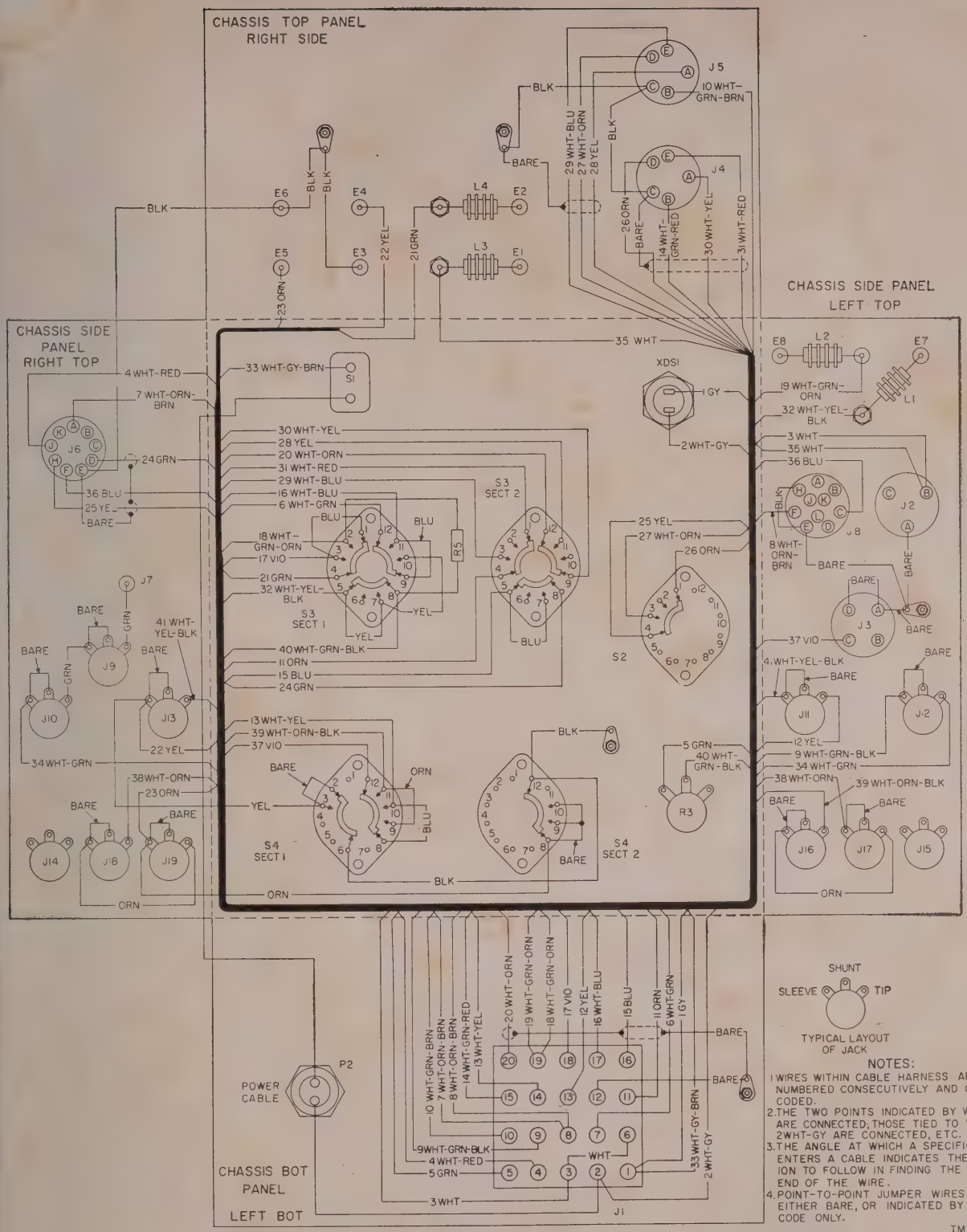


Figure 54. Radio Set Control C–1123/GRC, main chassis wiring diagram.

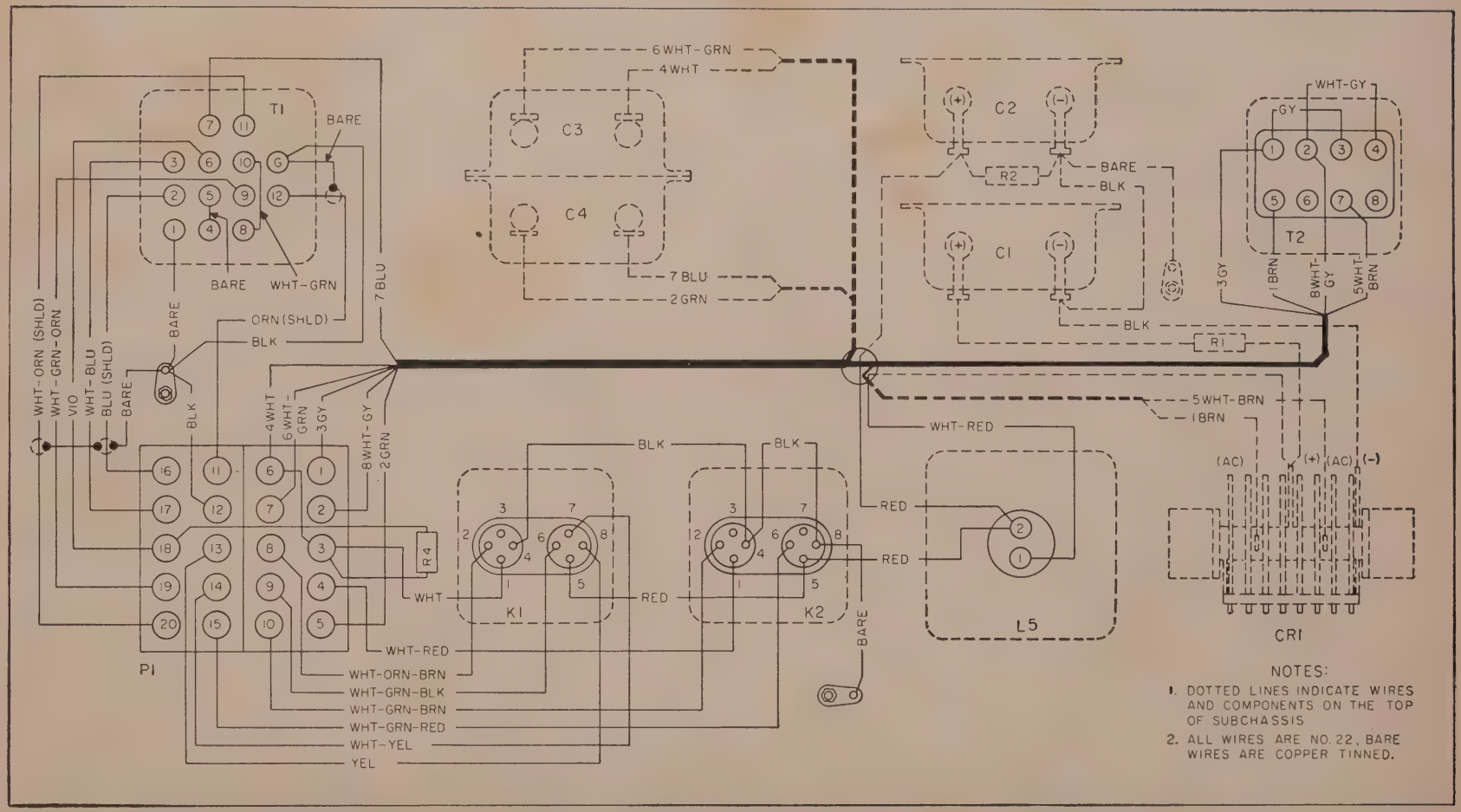


Figure 55. Radio Set Control C–1123/GRC, subchassis wiring diagram.

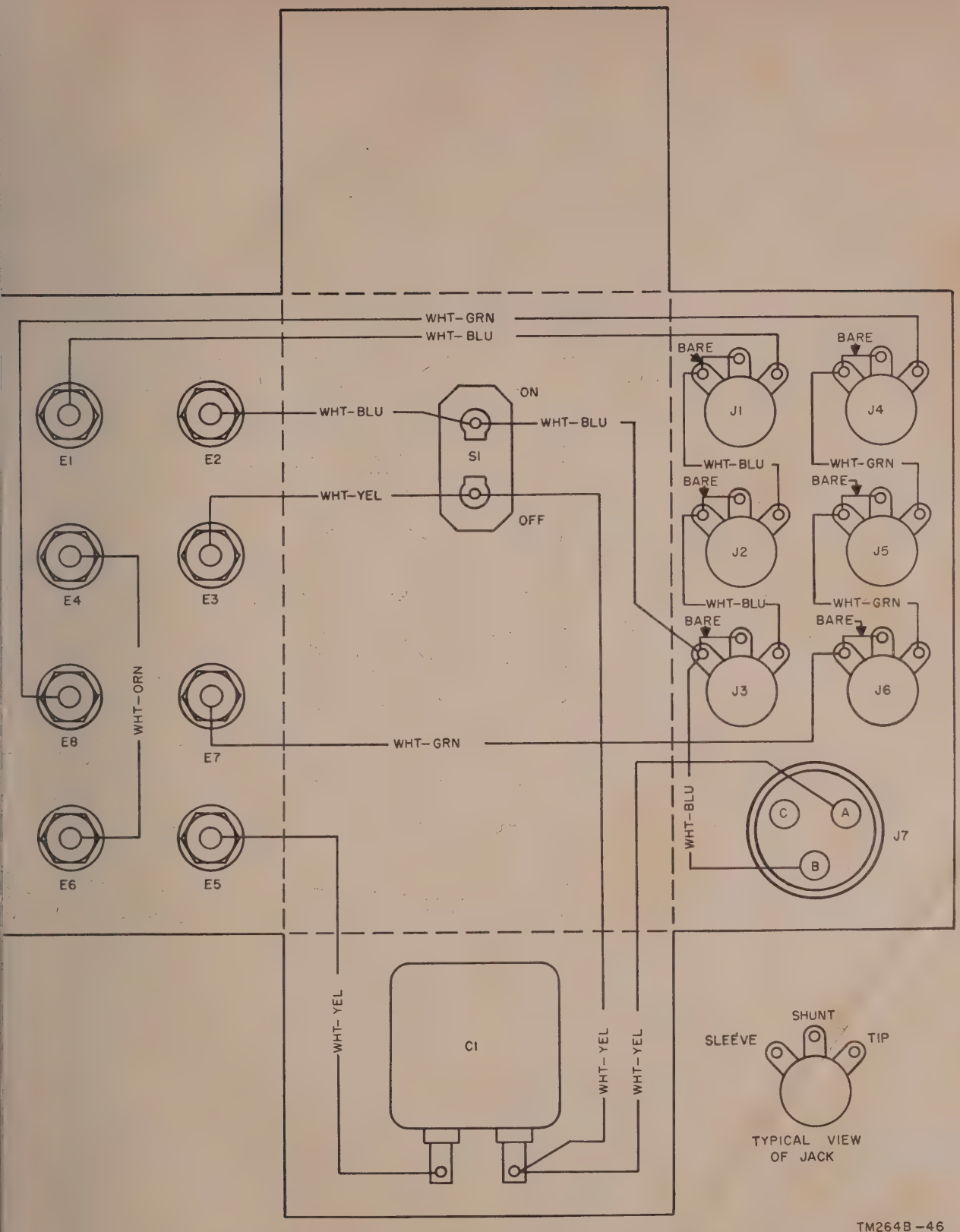


Figure 56. Remote Switching Control C-1474/GRC, wiring diagram.

	Paragraph	Page
Adjustments, initial	23	30
Alinement, Radio Modulator MD–239A/GR.	83	94
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Installation	20	18
Theory	56	65
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Description	12*a*	10
Installation	19	15
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Telephone	21*a*(3)	26
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Bonding	22*b*	26
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Remote site	22*b*	26
Shelter	22*e*	27
Cabinet:		
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Antenna equipment	12	10
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Doublet antennas	12*b*	10
Electrical Blower Assembly HD–223/G.	13*a*(6)	12
Electrical Equipment Cabinet CY–1807/G.	11	9
Headset H–113/U	13*a*(1)	10
Heater, electric	13*b*(3)	12
Key KY–116/U	13*a*(3)	12
Loudspeaker Assembly LS–206A/U	13*a*(5)	12
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Radio Modulator MD–239A/GR	8	8
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Radio Set Control C–1123/GRC	9	8
Remote Switching Control C–1474/GRC.	10	9
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DA Form 239	39*b*	43
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Frequency Shift Converter CV–116B/URR.	6	5
Fuse location	21	21
Generator Set PU–248/U	6	5
Grounding	22*b*(1)	26
Headset H–113/U	13*a*(1)	10
Heater, electrical	13*b*(3)	12
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Antenna:		
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Doublet transmitting	20*a*	18
Whip	19	15
Electrical Equipment Shelter S–56A/G.	18	15
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Loudspeaker Assembly LS–206A/U	13*a*(5)	12
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	Paragraph	Page
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Operating instructions:		
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NG: State AG; units—same as Active Army.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

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