TM 11-286

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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RADIO SETS

AN/VRC-8, AN/VRC-9 AND AN/VRC-10

DEPARTMENT OF THE ARMY • MARCH 1951

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DEPARTMENT OF THE ARMY *MARCH 1951*

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For explanation of distribution formula, see SR 310–90–1.

WARNING

HIGH VOLTAGE

is used in the operation
of this equipment

DEATH ON CONTACT

may result if operating personnel fail
to observe safety precautions

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First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

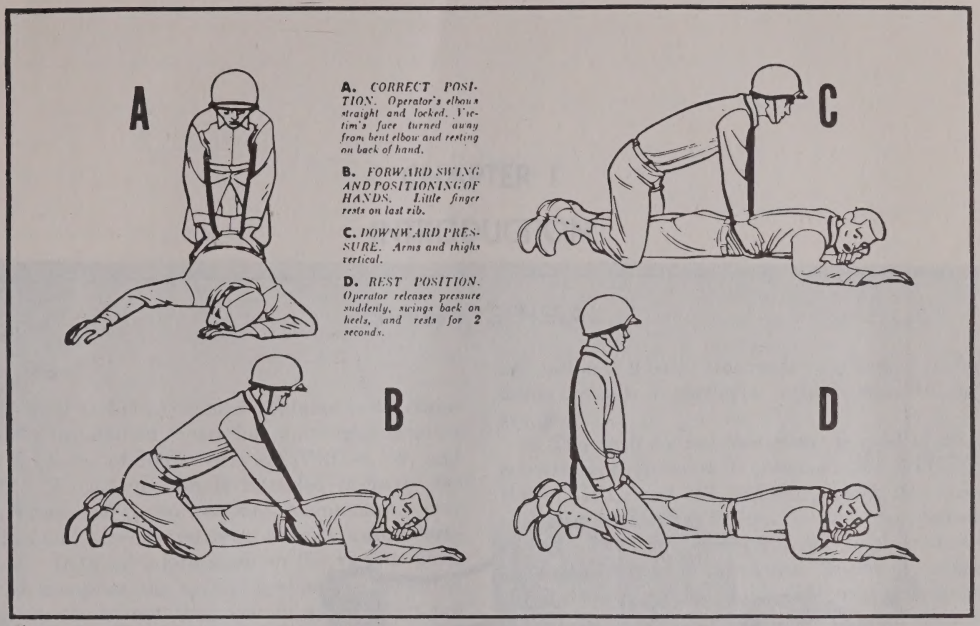
(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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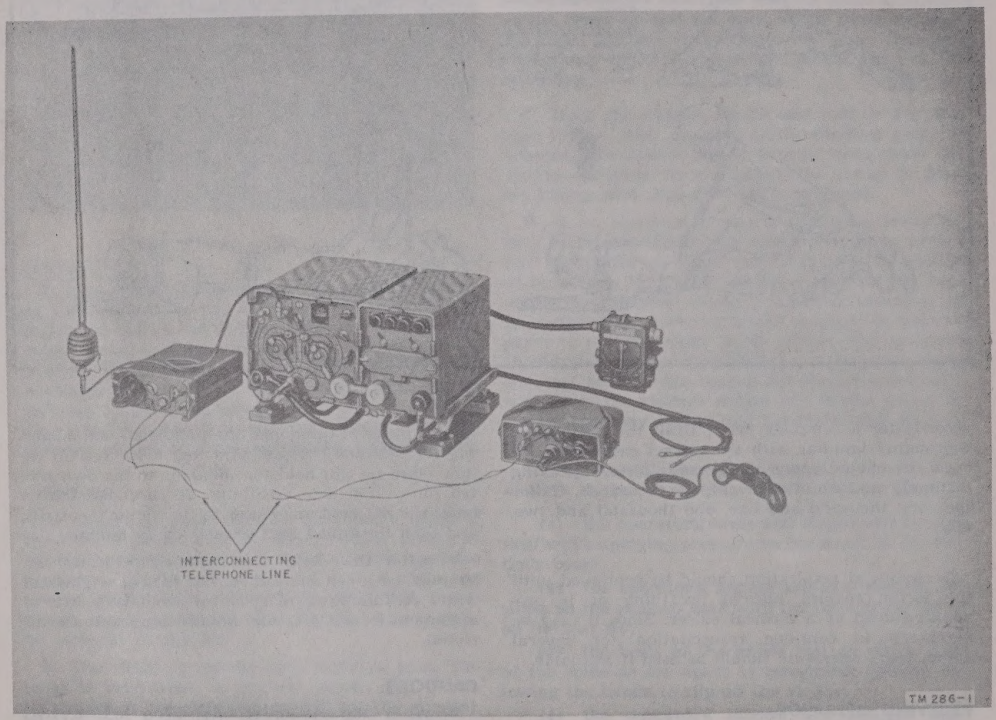


Figure 1. Radio Set AN/VRC–8.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This technical manual contains instructions for the installation, operation, and organizational maintenance of Radio Sets AN/VRC–8, –9, and –10. The information is intended primarly for operators and organizational maintenance personnel and hence is restricted to system considerations. Detailed information on the various units which comprise the several systems is presented only to the extent that system applications are involved. Detailed field maintenance instructions for the individual major components are published in separate manuals.

b. Certain schematic drawings for this equipment are included separately, because of their size, in an envelope following the index. These include figures 35, 56, 66, 67, and 68. To this extent, therefore, figure numbers throughout the manual are not in strict numerical sequence, and whenever the instructions refer to figures—35, 56, 66, 67, or 68, the illustration will be found in the envelope at the back of the manual.

2. Nomenclature

a. To expedite the simultaneous treatment of the three sets, a collective nomenclature has been devised to refer to the sets and their respective units. This expedient is outlined in *b* through *f* below.

b. Radio Sets AN/VRC–8, –9, and –10 are referred to collectively as *radio sets.* Wherever instructions are limited to a particular set or group of sets, specific reference is made to that effect and full nomenclature (e. g., Radio Set AN/VRC–8) is used for the set involved.

c. The term *system* refers to an installed radio set. Each of the radio sets may be installed in a variety of vehicles (par. 7) and a different installation unit is required for each vehicle. The utilization of a basic unit (radio set) and an installation unit in a particular vehicle constitutes a system.

d. The term *receiver-transmitter* is used to refer collectively to Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, which are units of Radio Sets AN/VRC–8, –9, and –10, respectively. The use of a particular receiver-transmitter to cover a particular frequency range (fig. 2) constitutes the major difference among the radio sets. Other differences, dependent on frequency range, are indicated in table I (par. 6).

e. The term *Set 1*, which also is used on schematic diagrams and as a panel designation to indicate the receiver-transmitter, has no distinguishing significance in Radio Sets AN/VRC–8, –9, and –10. In more complex related systems which utilize more than one receiver-transmitter (app. III), the term Set 1 is used to distinguish a particular receiver-transmitter.

f. The term *power supply* is used to designate either Power Supply PP–109/GR or PP–112/GR which may be used to supply operating voltages for the receiver-transmitter. The vehicular battery voltage available, 12 or 24 volts, determines which power supply must be used. In 12-volt systems, Power Supply PP–109/GR is provided as part of the basic radio set; in 24-volt systems, Power Supply PP–112/GR is provided.

3. Forms and Records

The following standard forms will be used for reporting unsatisfactory conditions of Army matériel and equipment and in performing preventive maintenance.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5.

b. DA AGO Form 468, Unsatisfactory Equip-

ment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DA AGO Form 419, Preventive Maintenance Checklist for Signal Corps Equipment, will be prepared in accordance with instructions on the back of the form.

d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

4. Purpose of Equipment

a. Radio Sets AN/VRC–8, –9, and –10 provide f-m (frequency-modulated) radiotelephone facilities within the frequency range of 20.0 to 54.9 mc (megacycles). The specific frequency range of each set, and of other radio equipment with which the sets can communicate, is indicated in the frequency spectrum chart (fig. 2). As indicated on the chart, the frequency coverage of each radio set is that of its respective receiver-transmitter.

b. The radio sets can be installed and operated in trucks, personnel carriers, armored utility vehicles, weapons carriers, and other authorized vehicles (par. 7). The sets are designed primarily for short-range operation (10 to 15 miles) within and between armored, artillery, and infantry units. Specifically, Radio Sets AN/VRC–8, –9, and –10 are intended for use by armored, artillery, and infantry units, respectively. A 900-kc (kilocycle) overlap in frequency coverage between Radio Sets AN/VRC–8 and –9 provides for liaison between armored and artillery units: a similar 900-kc overlap between Radio Sets AN/VRC–9 and –10 provides for liaison between artillery and infantry units.

5. Technical Characteristics

Type of transmission and reception.	Voice and 1,600-cycle f-m signals.
Frequency range	20 to 54.9 mc in the following bands:
AN/VRC–8	20 to 27.9 mc.
AN/VRC–9	27 to 38.9 mc.
AN/VRC–10	38 to 54.9 mc.
Type of tuning	Choice of channels or continuous tuning. Choice of detented channels (80, 120, and 170 for Radio Sets AN/VRC–8, –9, and –10, respectively) at every 100 kc of the tuning range. Provision is also made for presetting any two of the detented channels and for continuous tuning.
Operational facilities:	
Monitoring.	
Push-to-talk operation from local or remote control stations.	
Full-duplex telephone circuit between local and remote control units.	
Communication range	Approximately 10 miles for vehicles in motion, and 15 miles for stationary vehicles.
Total power drain	From 30 to 185 watts, depending upon the mode of operation. Power drains are as follows:

Input voltage	Input amperage	
	Stand-by	Transmission
12.6	2.3	11.9
25.2	1.5	7.3

Transmitter r-f (radio-frequency) power output.	Approximately 16 watts on HIGH power; approximately 2 watts on LOW power.
Receiver a-f (audio-frequency) power output.	Approximately 1 watt and 50 mw (milliwatts) at speaker and phone output terminals, respectively. A third output of approximately 30 mw at fixed-level output is not used in Radio Sets AN/VRC–8, –9, and –10.
Microphone input impedance.	150 ohms.
Audio output impedance	600 ohms at all audio output terminals.
Receiver sensitivity	30-db (decibels) signal-plus-noise to noise ratio with ½-μv (microvolt) input signal.

6. Table of Components

a. A composite table of components for all the basic radio sets is shown in table I. All dimensions and weights are approximate. Although there is only one listing of components for each of Radio Sets AN/VRC–8, –9, and –10, the availability of either Power Supply PP–109/GR or PP–112/GR indicates that there are two variations of each basic set. A basic set including Power Supply PP–109/GR is for 12-volt systems; a basic set including Power Supply PP–112/GR is for 24-volt systems.

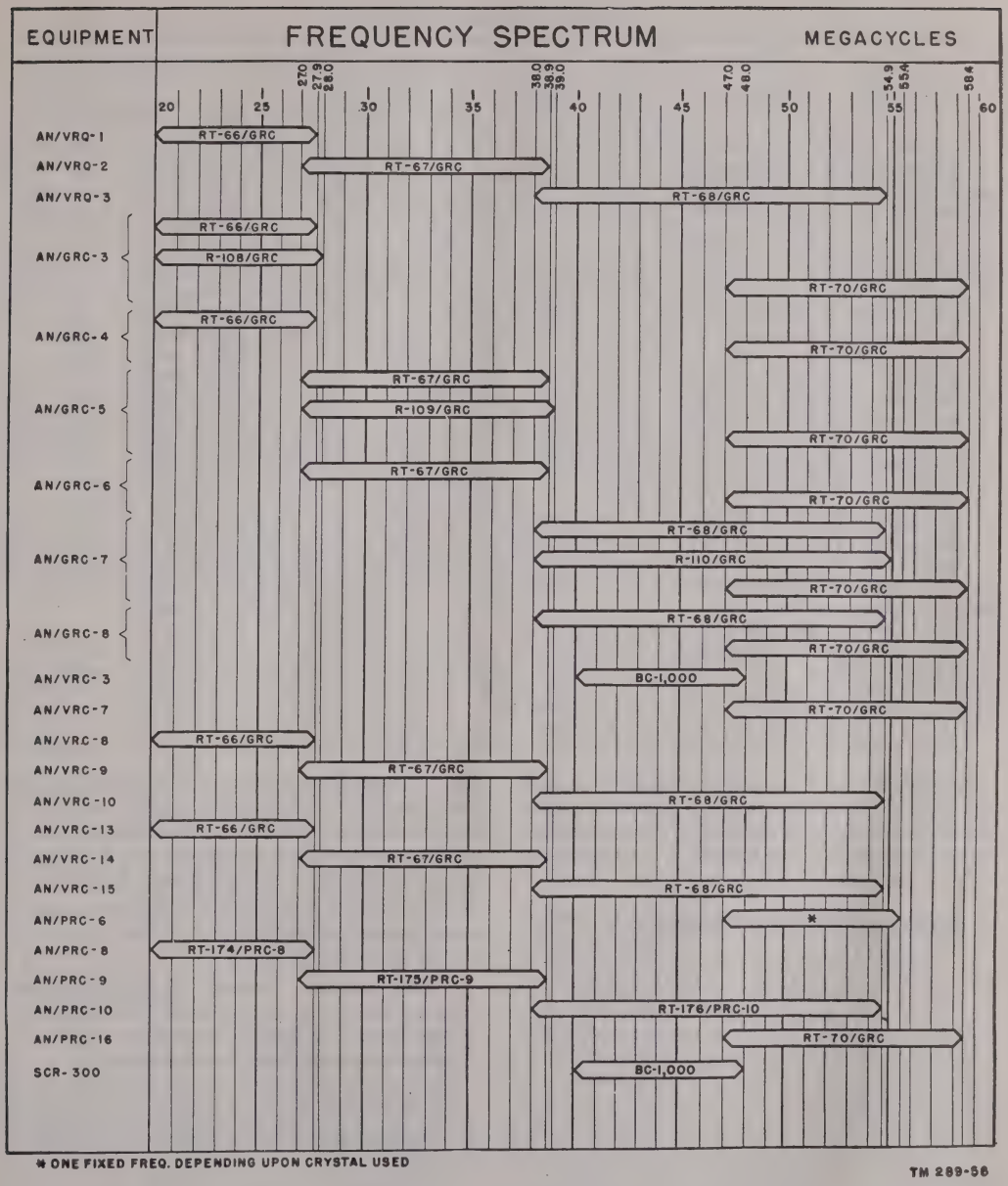


Figure 2. Frequency spectrum chart.

Table I. Table of Components

Component	Radio sets			Dimensions of components				
	Radio Set AN/VRC–8	Radio Set AN/VRC–9	Radio Set AN/VRC–10	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Receiver-Transmitter RT–66/GRC	1			9	13	11¼	.76	35
Receiver-Transmitter RT–67/GRC		1		9	13	11¼	.76	35
Receiver-Transmitter RT–68/GRC			1	9	13	11¼	.76	35
Power Supply PP–109/GR or PP–112/GR	1	1	1	9	13	8	.54	33
Control Box C–375/VRC	1	1	1	7	4	7	.1	3.5
Mounting MT–299/GR	1	1	1	4	13	20	.6	24
Control Group AN/GRA–6:								
Local Control C–434/GRC	1	1	1	3½	10½	8¾	.18	8
Remote Control C–433/GRC	1	1	1	3½	7	9⅜	.13	5
Handset H–33/PT	1	1	1	3	2 1/16	3	.03	2
Bag CW–189/GR	1	1	1	11	7¾	10⅝		1
Mast Section MS–116–A	2	2				39.5	.046	1.6
Mast Section MS–117–A	2	2	2			39.5	.042	1.4
Mast Section MS–118–A	2	2				39.5	.016	.5
Mast Section AB–24/GR			2			23.5	.005	.13
Special Purpose Cable Assembly CX–1211/U	1	1	1				.25	.4
RF Cable Assembly CG–568/U	1					50	.01	.5
RF Cable Assembly CG–530/U		1	1			50	.01	.5
Adapter UG–306/U	1	1	1				.006	.36
Bag CW–206/GR	1	1	1	3 (thk)	5 (wd)	40	.34	3.5
Technical Manual (TM 11–286)	2	2	2	8	¼	10	.08	1
Special Purpose Cable WM–46/U	1	1	1			120	.4	9
Connector and bondnut, Appleton Electric Company, No. 61007 and BL–50, or equal	1	1	1				.01	.5
Adapter UG–273/U	1	1	1				.006	.34
Case CY–684/GR	1	1	1				.17	3
Mast Base AB–15/GR	1	1	1					

b. As indicated in paragraph 2, a basic set does not in itself constitute an operating system. For installation and operation in particular vehicles, the additional equipment listed in paragraph 7 is also required.

7. Additional Equipment Required

a. To install and operate any of the basic radio sets listed in table I, an installation unit is required. Either a 12-volt or a 24-volt basic unit is common to all installations; a separate installation unit is supplied (or must be requisitioned) for each vehicular installation, since such items as audio accessories, cables, junction boxes, and mounting hardware vary with the type of vehicle.

b. Table II indicates the vehicular installation units which can be used with a particular basic radio set. For example, a basic Radio Set AN/VRC–8 installed in a ¼-ton 4 x 4 truck, which has a 21-volt storage battery, utilizes installation unit 2S4502–7–V26/50. The stock number for the basic unit (2S4502–8/12) indicates that a 12-volt power supply is provided. A complete system (basic unit and installation unit) is also designated by a separate stock number. In the above example, 2S4502–8–V26 is the stock number for the complete equipment.

c. The complete contents of the installation units are not listed, but the audio accessories (any of which may be supplied, depending upon the installation) are described in paragraph 16.

d. In addition to the equipment included in basic units and installation units the following dry cells are required for Control Group AN/GRA–6 (par. 34).

(1) Four 1½-volt Batteries BA–30.

(2) One 45-volt Battery BA–414/U.

Table II. Vehicular Installation Units

Radio Set	Type of vehicle	Stock No.		
		Complete equipment	Basic unit	Installation unit
AN/VRC–8	Truck ¼ Ton 4 x 4 (12 Volt)	2S4502–8–V26	2S4502–8/12	2S4502–7–V26/50
AN/VRC–8	Truck 2½ Ton 6 x 6 Cargo	2S4502–8–V35	2S4502–8/12	2S4502–8–V35/50
AN/VRC–8	Truck ¾ Ton 4 x 4 Weapon Carrier	2S4502–8–V36	2S4502–8/12	2S4502–8–V36/50
AN/VRC–8	Truck 2½ Ton 6 x 6 Cargo M34, M35, M36 (24V).	2S4502–8–V56	2S4502–8/24	2S4502–7–V56/50
AN/VRC–8	Car Armored Utility M20	2S4502–8–V63	2S4502–8/24	2S4502–8–V63/50
AN/VRC–8	Personnel Carrier Half Track M3A1	2S4502–8–V68	2S4502–8/12	2S4502–8–V68/50
AN/VRC–8	Carriage Motor Gun Half Track M16	2S4502–8–V69	2S4502–8/12	2S4502–8–V69/50
AN/VRC–8	81MM Carrier Mortar M21	2S4502–8–V71	2S4502–8/12	2S4502–8–V71/50
AN/VRC–8	Truck ¾ Ton Cargo M37 (24 Volt)	2S4502–8–V74	2S4502–8/24	2S4502–8–V74/50
	Truck ¾ Ton Weapon Carrier M42 (24V)			
AN/VRC–8	Truck ¼ Ton 4 x 4 Utility M38 (24V)	2S4502–8–V76	2S4502–8/12	2S4502–7–V76/50
AN/VRC–8	Motor Gun Carriage Twin 40MM M19A1	2S4502–8–V97	2S4502–8/24	2S4502–8–V97/50
AN/VRC–9	Truck ¼ Ton 4 x 4 (12 Volt)	2S4502–9–V26	2S4502–9/12	2S4502–7–V26/50
AN/VRC–9	Truck 2½ Ton 6 x 6 Cargo	2S4502–9–V35	2S4502–9/12	2S4502–8–V35/50
AN/VRC–9	Truck ¾ Ton 4 x 4 Weapon Carrier	2S4502–9–V36	2S4502–9/12	2S4502–8–V36/50
AN/VRC–9	Truck 2½ Ton 6 x 6 Cargo M34, M35, M36 (24V).	2S4502–9–V56	2S4502–9/24	2S4502–7–V56/50
AN/VRC–9	Car Armored Utility M20	2S4502–9–V63	2S4502–9/24	2S4502–8–V63/50
AN/VRC–9	Personnel Carrier Half Track M3A1	2S4502–9–V68	2S4502–9/12	2S4502–8–V68/50
AN/VRC–9	Carriage Motor Gun Half Track M16	2S4502–9–V69	2S4502–9/12	2S4502–8–V69/50
AN/VRC–9	81MM Carrier Mortar M21	2S4502–9–V71	2S4502–9/12	2S4502–8–V71/50
AN/VRC–9	Truck ¾ Ton Cargo M37 (24 Volt)	2S4502–9–V74	2S4502–9/24	2S4502–8–V74/50
	Truck ¾ Ton Weapon Carrier M42 (24V)			
AN/VRC–9	Truck ¼ Ton 4 x 4 Utility M38 (24V)	2S4502–9–V76	2S4502–9/12	2S4502–7–V76/50
AN/VRC–9	Motor Gun Carriage Twin 40MM M19A1	2S4502–9–V97	2S4502–9/24	2S4502–8–V97/50
AN/VRC–10	Truck ¼ Ton 4 x 4 (12-Volt)	2S4502–10–V26	2S4502–10/12	2S4502–7–V26/50
AN/VRC–10	Truck 2½ Ton 6 x 6 Cargo	2S4502–10–V35	2S4502–10/12	2S4502–8–V35/50
AN/VRC–10	Truck ¾ Ton 4 x 4 Weapon Carrier	2S4502–10–V36	2S4502–10/12	2S4502–8–V36/50
AN/VRC–10	Truck 2½ Ton 6 x 6 Cargo M34, M35, M36 (24V).	2S4502–10–V56	2S4502–10/24	2S4502–7–V56/50
AN/VRC–10	Car Armored Utility M20	2S4502–10–V63	2S4502–10/24	2S4502–8–V63/50
AN/VRC–10	Personnel Carrier Half Track M3A1	2S4502–10–V68	2S4502–10/12	2S4502–8–V68/50
AN/VRC–10	Carriage Motor Gun Half Track M16	2S4502–10–V69	2S4502–10/12	2S4502–8–V69/50
AN/VRC–10	Carriage Motor Gun Half Track M21	2S4502–10–V71	2S4502–10/12	2S4502–8–V71/50
AN/VRC–10	Truck ¾ Ton Cargo M37 (24-Volt)	2S4502–10–V74	2S4502–10/24	2S4502–8–V74/50
	Truck ¾ Ton Weapon Carrier M42 (24V)			
AN/VRC–10	Truck ¼ Ton 4 x 4 Utility M38 (24V)	2S4502–10–V76	2S4502–10/12	2S4502–7–V76/50
AN/VRC–10	Motor Gun Carriage Twin 40MM M1941	2S4502–10–V97	2S4502–10/24	2S4502–8–V97/50

8. Packaging Data

The basic components of each of the radio sets (par. 6) are packed for shipment in three wooden boxes. The components first are packaged individually in moisture-vaporproof containers and then distributed in the three wooden boxes. The overall weight and volume of the three containers are listed in *a* below. The contents of each box are listed in *b* below.

Note. Items may be packaged in a manner different from that shown, depending on the supply channels.

a. Weight and Volume of Boxes.

Box No.	Weight (lb)	Volume (cu ft)
1	93	2. 10
2	125	2. 72
3	49	1. 23
Total	267	6. 05

b. Contents of Each Box.

Box No.	Item	Quan.	Notes
1	Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC.	1 ea	RT–66/GRC, RT–67/GRC, and RT–68/GRC for Radio Sets AN/VRC–8, –9, and 10, respectively.
	Power Supply PP–109/GR or Power Supply PP–112/GR.	1 ea	PP–109/GR supplied for 12-volt systems; PP–112/GR supplied for 24-volt systems.
2	Mast Base AB–15/GR	1 ea	
	Mast Section MS–116/A	2 ea	Not supplied with Radio Set AN/VRC–10.
	Mast Section MS–117–A	2 ea	
	Mast Section MS–118–A	2 ea	Not supplied with Radio Set AN/VRC–10.
	Mast Section AB–24/GR	2 ea	Supplied only with Radio Set AN/VRC–10.
	Control Group AN/GRA–6	1 ea	
	Adapter UG–273/U	1 ea	
	Adapter UG–306/U	1 ea	
	Cable Assembly CX–1211/U	1 ea	
	Bag CW–206/GR	1 ea	
	Case CY–684/GR	1 ea	
	Technical Manual (TM 11–286)	2 ea	
3	Cable WM–46/U	10 ft	
	Control Box C–375/VRC	1 ea	
	Mounting MT–299/GR	1 ea	
	Cable Assembly CG–568/U	1 ea	Supplied only with Radio Set AN/VRC–8.
	Cable Assembly CG–530/U	1 ea	Not supplied with Radio Set AN/VRC–8.
	Connector and bondnut, Appleton Electrical Company No. 61007 and BL–50, or equal.	1 ea	

9. General System Description

a. Instruction. All of the basic radio sets have the following items in common: a receiver-transmitter, a power supply, a mounting, three control units, suitable antenna systems, and interconnecting cables. Radio Set AN/VRC–8 described in *b* below and illustrated in figure 3, is typical of all the sets discussed in this manual. The nomenclature outlined in paragraph 2 and the listing of components (table I) will facilitate adaptation of the description to Radio Sets AN/VRC–9 and –10. The system cordage diagram (fig. 24), which is essentially a composite illustration of all sets, is also helpful in the understanding of the various systems.

b. Radio Set AN/VRC–8. Figure 1 shows the major components of Radio Set AN/VRC–8 connected to simulate an operating installation. Power Supply PP–112/GR or PP–109/GR furnishes the operating voltages for Receiver-Transmitter RT–66/GRC. These units are secured on Mounting MT–299/GR which is normally bolted to a vehicular mounting surface. From the mounting, connections are made to the vehicular battery, to the major units supported on the mounting, and to one or more Control Boxes C–375/VRC. Connections to the antenna system are made directly from the panel of the receiver-transmitter (fig. 24). When Control Group AN/GRA–6 is used, Local Control C–434/GRC is connected directly to the receiver-transmitter and through a telephone line to Remote Control C–433/GRC.

c. Radio Set AN/VRC–9, and –10. These systems differ from Radio Set AN/VRC–8 only in the type of receiver-transmitter and antenna system used. Radio Set AN/VRC–9 uses Receiver-Transmitter RT–67/GRC; Radio Set AN/VRC–10 uses Receiver-Transmitter RT–68/GRC. For differences in antenna cables and mast sections, refer to figure 24.

10. Receiver-transmitters

a. Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC are used in Radio Sets AN/VRC–8, –9, and –10, respectively. The receiver-transmitters are very similar in structure, function, and detailed circuit and mechanical arrangement. They differ from each other only in their operating frequency ranges and in those components which determine the frequency range. Hence, Receiver-Transmitter RT–66/GRC (fig. 4)

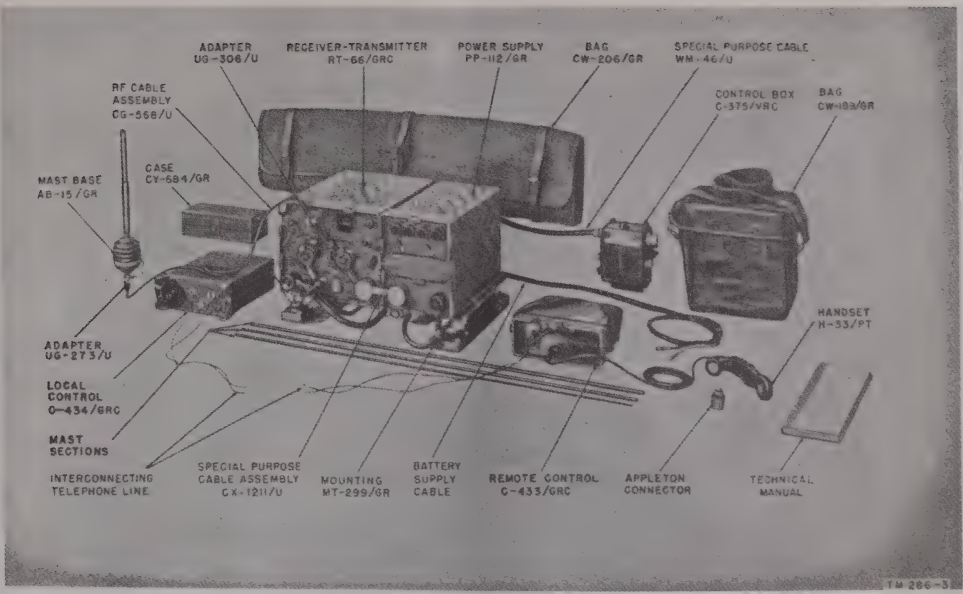


Figure 3. Components of Radio Set AN/VRC–8.

is externally similar to the other receiver-transmitters except for the calibrations of the tuning dial. Characteristics pertinent to system operation are listed in paragraph 5. Complete information on the receiver-transmitters is contained in a separate technical manual.

b. Each receiver-transmitter consists of a double-conversion type, superheterodyne f-m receiver and f-m transmitter which use a common antenna. The tuning mechanism of each receiver-transmitter is detented at every mc and every 100 kc of its range to provide the channel selections indicated in the following chart.

Receiver-Transmitter	Frequency coverage	No. of channels
RT–66/GRC	20 to 27.9 mc	80
RT–67/GRC	27 to 38.9 mc	120
RT–68/GRC	38 to 54.9 mc	170

To allow rapid selection of any two of the detented channels, a preset mechanism is provided (par. 46). To allow continuous tuning between channels, provision also is made to disengage the 100-kc detent mechanism (par. 47).

c. A panel-mounted audio receptacle is provided for the use of a chest set (with headset and microphone), a handset, headset, microphone, or loudspeaker.

d. Structurally, the receiver-transmitters are panel-chassis assemblies inclosed in a metal case (fig. 4). The bottom of the case is fitted with channel rails which are used to secure the unit to the vehicular mounting (par. 29). When the case is removed, the r-f and i-f (intermediate-frequency) chassis assemblies are available at either side of the unit (figs. 42, 43, and 44). All tubes are mounted on these vertical chassis.

e. In vehicular installations, the receiver-transmitter is installed on Mounting MT–299/GR (fig. 6) and is powered by a vehicular power supply such as Power Supply PP–112/GR. Auxiliary operation of the receiver-transmitter is possible (ch. 6) through use of a battery box and/or a hand generator.

11. Power Supply

a. Either Power Supply PP–109/GR or PP–112/GR is used to furnish operating voltages for the receiver-transmitter, depending on whether the vehicular storage battery supplies 12 or 24

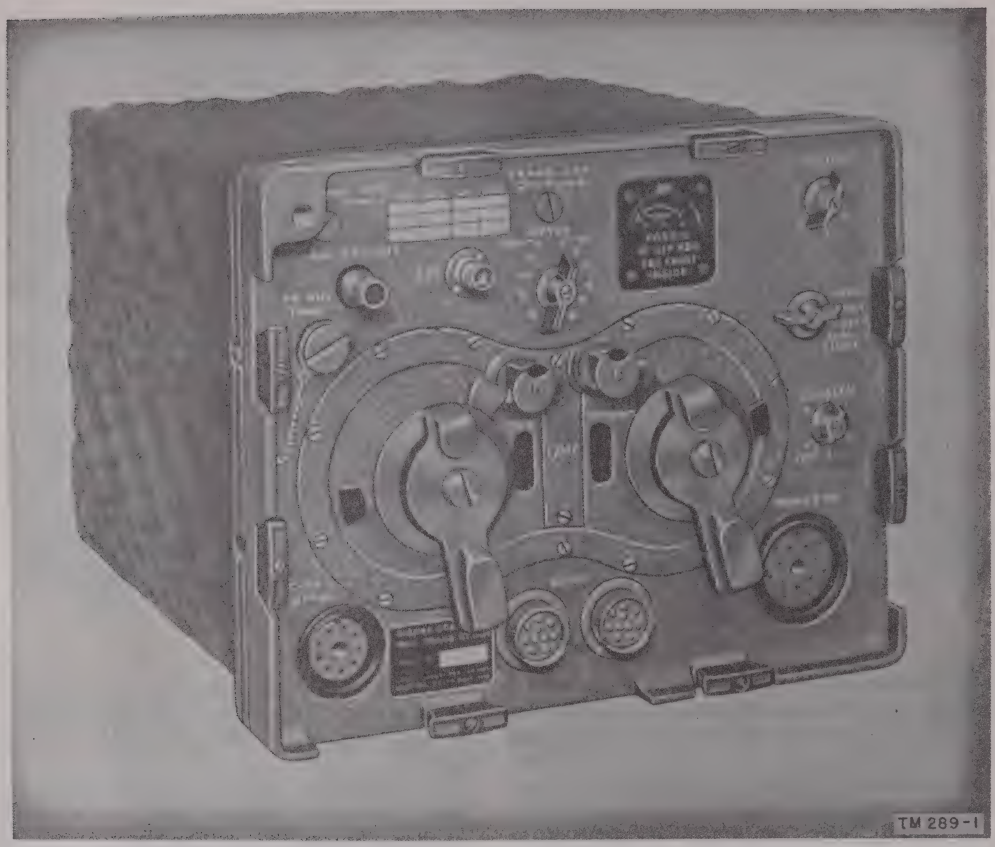


Figure 4. Receiver-Transmitter RT–66/GRC.

volts, respectively. The two units are similar externally (fig. 5), and differ internally only in those circuits necessary to convert the battery voltage to the proper operating voltages for the receiver-transmitter. Detailed information on the power supplies is contained in a separate technical manual.

b. The power supplies develop plate, screen, bias, filament, microphone, and relay potentials for the receiver-transmitter. The plate, screen, and bias voltages are developed by vibrator-type power supply circuits. Input battery voltage is supplied through a POWER IN receptacle on the front panel (fig. 5), and all output voltages are available at the POWER OUT receptacle on the front panel.

c. Structurally, the power supply units are panel-chassis assemblies inclosed in a metal case. Channel rails on the bottom of the case permit it to be installed on Mounting MT–299/GR. When the case is removed (figs. 39, 40, and 41), the replaceable parts on the chassis are accessible.

12. Mounting MT–299/GR

a. Mounting MT–299/GR (fig. 6) serves as a support for the receiver-transmitter and power supply, and as a junction box for interconnecting the power supply with the vehicular power source and the receiver-transmitter with Control Box C–375/VRC. Figures 1 and 24 demonstrate the dual function of the mounting.

b. At either end of the mounting are two shock-mounted supports which are bolted normally to the vehicular mounting surface. A mounting table is secured to these supports, and a junction

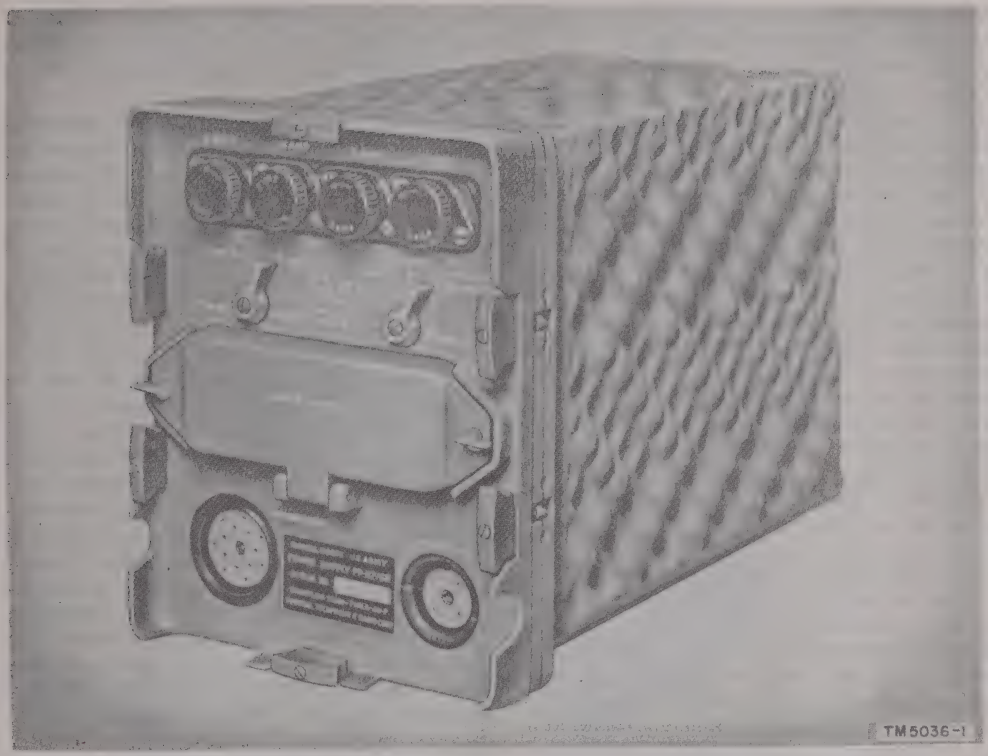


Figure 5. Power Supply PP–112/GR, front view.

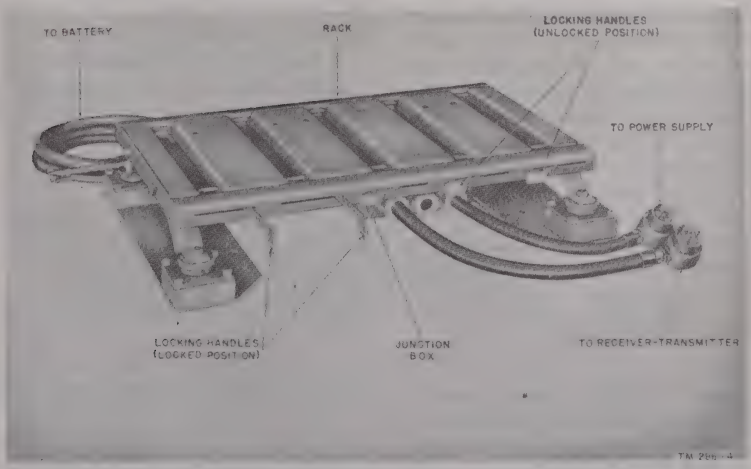


Figure 6. Mounting MT–299/GR, top view.

box is suspended from the under surface of the table near the center of the unit (fig. 6).

c. The mounting table is channeled to accept the rails on the bottom of the receiver-transmitter and the power supply. Locking levers are provided on the front edge of the mounting table to secure the units on the table.

d. The junction box at the center of the unit contains the terminal boards and electrical circuits which serve to connect the units in an operating system. Cables are provided on two sides of the junction box to connect the mounting to the vehicular battery and to the major units. The cables which connect the receiver-transmitter and power supply bear the same identifying nomenclature as the panel receptacles to which they should connect (figs. 4 and 5). For example, the plug on the end of cable W–1 is designated REC-TR CONTROL.

e. Figure 16 shows the under side of the mounting and the junction box with its cover removed.

13. Control Box C–375/VRC

a. One or more Control Boxes C–375/VRC (fig. 7) are used in every installation for push-to-talk control of the radio sets. One unit is supplied with the basic radio set (par. 6); additional units may be supplied in the installation kits (par. 7).

b. The control boxes are normally installed at a distance from Mounting MT–299/GR (in locations convenient for driver, gunner, commander, or another operator) and are connected to the mounting either directly or indirectly by means of Special Purpose Cable WM–46/U. Cable entries are provided at either side of the control box (fig. 7). The cable connection extends the audio and control lines of the receiver-transmitter to the switches on the control box. The switches connect these lines to the audio connectors on either side of the box and to the M1C, and PHONE jacks on the bottom of the box (fig. 31). Suitable audio accessories can be connected for monitoring or push-to-talk control of the radio sets.

14. Control Group AN/GRA–6
(fig. 8)

a. Control Group AN/GRA–6 may be used to provide local or remote monitoring and push-to-talk control of the radio sets, and includes provision for telephone communication between local and remote control stations. The control group includes Local Control C–434/GRC, Remote Control C–433/GRC, Handset H–33/PT, and Bag CW–189/GR. Complete information on the control group is contained in a separate technical manual.

b. Local Control C–434/GRC is connected directly to the panel of the receiver-transmitter by means of one of the plug-terminated cords at the rear of the unit (fig. 27). The switching facilities of the unit allow for push-to-talk transmission over the receiver-transmitter from a handset or chest set (with headset and microphone) plugged into the AUDIO receptacle on the front panel.

c. Remote control C–433/GRC may be as much as two miles away from the local unit. A telephone line is used to interconnect the two units. The combined switching actions of the two units make it possible to extend monitoring and push-to-talk facilities to the remote unit. The remote unit also will accommodate a handset.

d. Handset H–33/PT (fig. 12) may be used at the panel AUDIO connector of either control unit. The handset is equipped with a push-to-talk nonlocking switch which incorporates a DPST (double-pole, single throw) switch. The handset cord is terminated in a 10-pin connector which will mate with any of the 10-pin AUDIO receptacles on the control units and receiver-transmitters.

e. Provisions for duplex telephone communication (including ringing) are also incorporated in the control units. This facility makes the control group adaptable for use as a field telephone.

f. Bag CW–189/GR is provided for storing and carrying purposes. The units may be stored in the bag when they are not used or when they are being transported.

15. Minor Components

a. The following minor components are illustrated in figure 3:

(1) Mast Base AB–15/GR.
(2) Mast Sections MS–116–A, MS–117–A. MS–118–A.
(3) Adapters UG–273/U and UG–306/U.
(4) Special Purpose Cable Assembly CX–1211/U.
(5) RF Cable Assembly CG–568–U (4′ 2″).
(6) Special Purpose Cable WM–46/U.
(7) Bag CW–206/GR.
(8) Case CY–684/GR.

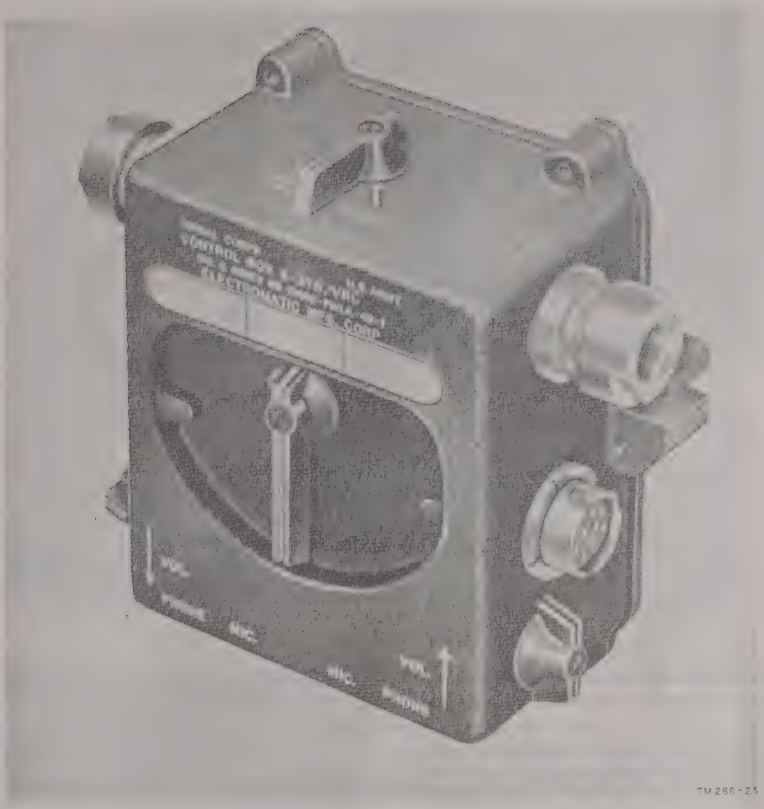


Figure 7. Control Box C-375/VRC, right oblique view.

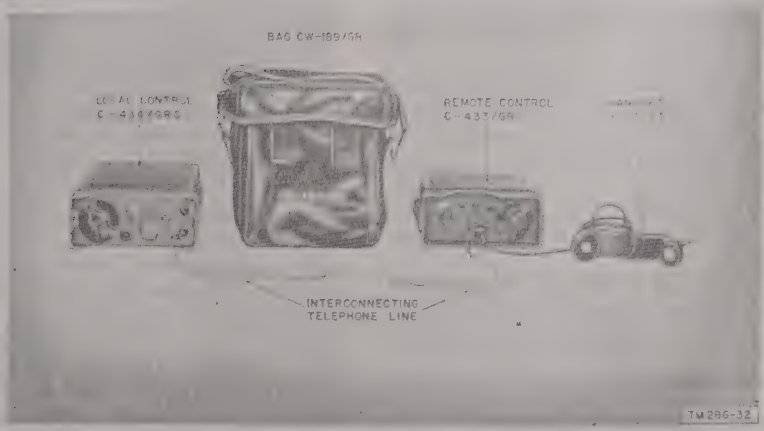


Figure 8. Control Group AN/GRA-6.

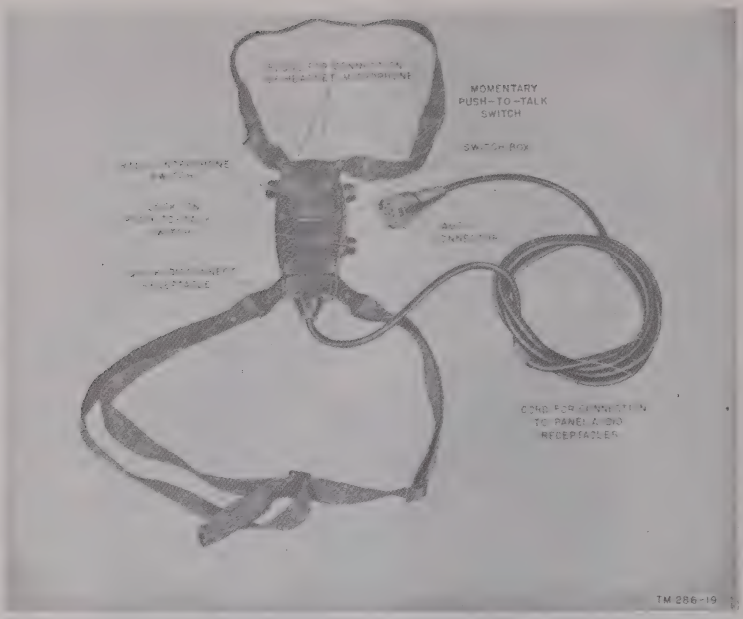


Figure 9. Chest Set Group AN/GSA–6.

(9) Connector and bondnut, Appleton Electrical Company No. 61007 and BL–50, or equal.

Note. With the exception of the last three items listed, all the above components are represented functionally on the system cordage diagram (fig. 24). For physical and electrical description, refer to the identification table of parts.

b. The connector and bondnut are used for connecting the power cable of the radio sets to the vehicular power terminal boards. The connector is of the feed-through type, and the bondnut locks the connector in place.

c. Case CY–684/GR is a metal box provided for storage of tubes, lamps, fuses, and other replaceable parts. The case will not accommodate all the running spares which are supplied with the various units (par. 17), but will accommodate some of each type. Refer to paragraph 35 for recommendations on the selection of spares to be stored in Case CY–684/GR.

d. Bag CW–206/GR is provided for storage of spare antenna masts, Case CY–684/GR, audio accessories (not in use), and technical manuals.

16. Audio Accessories

a. Type. Audio accessories for operating the radio sets are supplied in the installation units. They vary in type and number according to the type of vehicular installation. Some or all of the following items may be supplied:

(1) Chest Set Group AN/GSA–6 and Headset-Microphone H–63/U.

(2) Dynamic Loudspeaker LS–166/U.

(3) Handset H–33/PT.

(4) Microphone M–29/U.

(5) Headset, Navy type CW–49507 and Headset Cord CX–1334/U.

Note. The above listed audio accessories are the only types which can be connected to the 10-pin audio connectors on the radio sets. Control Box C–375/VRC is the only unit equipped with jacks which will accommodate any substitute accessories (par. *h* below).

b. Chest Set Group AN/GSA–6. Chest Set Group AN/GSA–6 (fig. 9), in conjunction with Headset-Microphone H–63/U (*c* below), is the audio accessory most commonly used with the radio sets. The chest set group consists of a chest-mounting switch box and a 5-foot cord which terminates in an 8-contact receptacle and a 10-pin audio connector. The receptacle mates with the plug on one end of the switch box and provides a quick-disconnect feature for the chest set. The audio connector will mate with any of the 10-pin

connectors on the control units, and the receiver-transmitter. Two plugs provided on the switch box will mate with the jacks on Headset-Microphone H–63/U. Two push-to-talk buttons are provided on one side of the switch box; a push-button RADIO-INT switch is provided on the other side of the box. The push-to-talk buttons are electrically identical, but one provides momentary contact and the other locks in position. The lock-on button may be disabled by means of an internal adjustment (fig. 25), when desired. The RADIO-INT switch is a momentary type switch normally in the INT position. An internal adjustment is provided (fig. 25) to lock the switch in either the RADIO or INT position.

c. Headset-Microphone H–63/U. Headset-Microphone H–63/U (fig. 10) consists of two series-connected 300-ohm receivers and a 100-ohm microphone. The microphone is mounted on an adjustable boom attached to the receiver headband. Two 14-inch conductors from the microphone and headset are terminated in two-pin and three-pin jacks, respectively. These jacks will mate with the plugs on Chest Set Group AN/GSA–6.

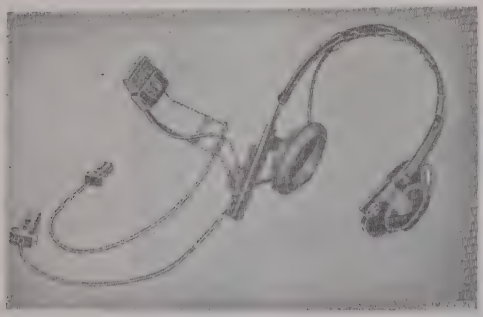


Figure 10. Headset-Microphone H–63/U.

d. Dynamic Loudspeaker LS–166/U Dynamic Loudspeaker LS–166/U (fig. 11) is a 4-inch permanent-magnet dynamic loudspeaker with a voice-coil impedance of 8 ohms and a matching transformer to provide a 600-ohm input impedance. A 5-foot cord, terminated in a 10-pin audio connector, is provided for connecting the speaker to the audio receptacles wired for loudspeaker or phone operation. A two-position switch on the side of the speaker may be used to switch the units from speaker to phone output. A universal

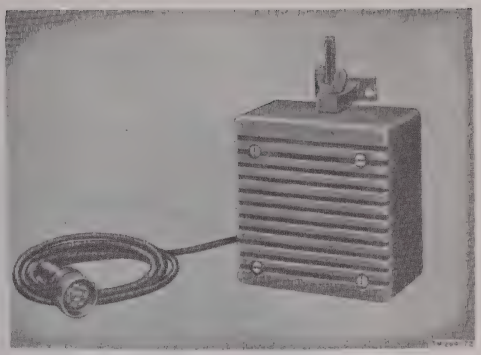


Figure 11. Dynamic Loudspeaker LS–166/U.

type clamp is provided on the speaker case for mounting purposes.

e. Handset H–33/PT. Handset H–33/PT (fig. 12) is a combination microphone and receiver with a push-to-talk switch and connecting cord. Microphone impedance is 40 ohms; receiver impedance is 300 ohms. The push-to-talk switch provided consists of two electrically independent SPST (single-pole, single-throw) switches. The cord is 5 feet long and is terminated in a 10-pin audio connector which will mate with the audio connectors on the receiver-transmitter and the control units.

f. Microphone M–29/U. Microphone M–29/U (fig. 13) consists of a 100-ohm carbon-microphone element in a plastic case with a push-to-talk switch and connecting cord attached. The push-to-talk switch incorporates two electrically independent SPST switches. The connecting cord is 5 feet long and terminates in a 10-pin audio connector which will mate with the connectors on the receiver-transmitter and the control units.

g. Headset Navy Type CW–49507 and Headset Cord CX–1334/U. Headset Navy Type CW–49507 (fig. 14) consists of two series-connected 300-ohm receivers. A 14-inch cord is connected to the receivers and is terminated in a Plug PL–54. The plug will mate with Jack JK–26, on one end of Headset Cord CX–1334/U. Headset Cord CX–1334/U is 5 feet long. It is terminated in a 10-pin audio connector, and serves to connect the headset to the audio connectors on the receiver-transmitter and the control units.

Note. The audio accessories should not be used indiscriminately on any of the units, even though it is possible to connect them physically. Refer to chapter 3 for correct usage of the audio accessories.



Figure 12. Handset H–33/PT.

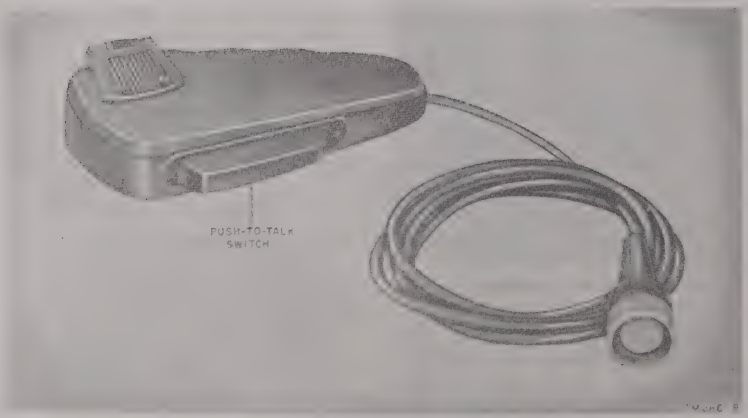


Figure 13. Microphone M–29/U.

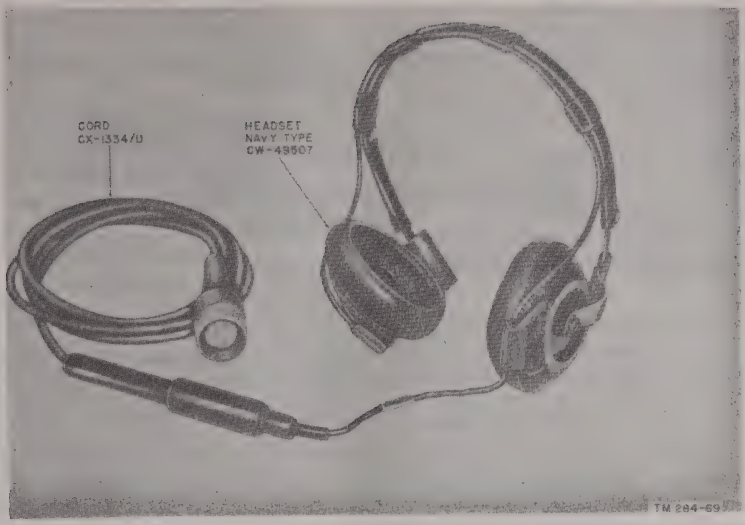


Figure 14. Headset Navy Type CW–49507 and Headset Cord CX–1334/U.

h. Substitute Accessories. The substitute accessories listed in the following chart may be used only if absolutely necessary. Performance will be inefficient, however, because of impedance mismatches. Operating facilities will be confined solely to Control Box C–375/VRC.

Standard item	Substitute item
Chest Set Group AN/GSA–6.	Chest Set TD–4 or Cords CD–307–A and CD–318.
Headset-Microphone H–63/U.	Headset H–16/U and Microphone T–45 or Headset HS–30 with Cord CD–933 and Microphone T–45.
Headset Navy Type CW–49507.	Headset H–16/U or Headset HS–30 with Cord CD–933.
Headset Cord CX–1334/U	Cord CX–307–A.
Microphone M–29/U	Microphone T–17.
Dynamic Loudspeaker LS–166/U.	None.
Handset H–33/PT	None.

17. Running Spares

Running spares for normally expendable items, such as tubes, fuses, and vibrators, are supplied with some of the system components. The spares supplied are listed in the following paragraphs.

Note. Case CY–684/GR, provided for carrying the spare parts, is not ample for carrying all of the parts supplied; therefore, it will be necessary to make a selection of those parts most likely to be needed. A suggested list of such parts is given in paragraph 35.

a. Spare Parts for Receiver Transmitter RT–66/GRC, RT–67/GRC, and RT–68/GRC. The spare parts supplied for each of these components are identical.

2 tubes, electron, type 1A3.
2 tubes, electron, type 1AE4.
2 tubes, electron, type 1L4.
4 tubes, electron, type 1R5.
1 tube, electron, type 1S5.
6 tubes, electron, type 1U4.
3 tubes, electron, type 2E24.
1 tube, electron, type 3A4.
5 tubes, electron, type 3A5.
2 tubes, electron, type 3B4.
6 tubes, electron, type 3Q4.
2 tubes, electron, type 6AK5.

b. Spare Parts for Power Supplies PP–109/GR and PP–112/GR.

(1) *Power Supply PP–109/GR.*

2 fuses, cartridge, type AGU, 5 amperes.
2 fuses, cartridge, type AGU, 10 amperes.
1 relay, thermal (K–1, K–2).
2 tubes, ballast (R–24, R–25, R–31).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 6-volt (E–1, E–2, E–3).

(2) *Power Supply PP–112/GR.*

3 fuses, cartridge, type AGU, 5 amperes.
1 fuse, cartridge, type AGU, 3 amperes.
1 relay, thermal (K–1, K–2).
3 tubes, ballast (R–24, R–25, R–31, R–37, R–38, R–40).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 24-volt (E–1, E–2, E–3).

c. Spare Parts for Control Group AN/GRA–6.

4 lamps, glow, 125 v, 1/25 w, GE lamp NE–51.

d. Spare Mast Sections for Radio Sets AN/VRC–8, –9.

1 Mast Section MS–116–A.
1 Mast Section MS–117–A.
1 Mast Section MS–118–A.

e. Spare Mast Sections for Radio Set AN/VRC–10.

1 Mast Section AB–24/GR.
1 Mast Section MS–117–A.

CHAPTER 2
INSTALLATION INSTRUCTIONS

Section I. INTRODUCTION

18. Scope of Instructions

The installation instructions included in this manual are generalized to make them applicable to any installation. The variety of vehicles in which the radio sets may be installed limits the amount of detail which can be given for exact location of units, routing of cables, placement of antennas, etc. Required clearances, interconnection data, and all other essential information are included. For specific details pertinent to particular vehicles, reference should be made to the installation instructions supplied with the installation units for the vehicles. Each of the installation units listed in paragraph 7 contains instructions pertinent to the particular vehicle for which the unit is intended.

19. General Unpacking Instructions

Take the usual precautions against damage to equipment during the unpacking procedure. The following points of procedure should be observed whenever possible:

a. Unless instructions are given to the contrary, unpack equipment as required, in the order described. Unpacking all boxes simultaneously may interfere with an orderly procedure and will complicate any possible division of labor.

b. As each box is unpacked, check its contents against the master packing slip.

c. Use cutters to clip metal bands.

d. Do not pry off the tops or sides of boxes; use a nail puller to remove the nails, and lift off the sides and/or the tops of boxes.

e. Save boxes, containers, and other packaging material, if practicable, for possible use for storage or reshipment.

Section II. VEHICULAR INSTALLATION DETAILS

Note. Vehicular installation procedures are those which involve modification of the vehicle (for example, the drilling of holes) or some special technique peculiar to a type of vehicle (for example, the routing of cables).

20. Unpacking

The material comprising the installation unit and the material contained in box 3 of the basic unit (par. 8) are required for the vehicular installation details. Unpack the installation unit and box 3 of the basic unit, observing the general precautions noted in paragraph 19.

21. Mounting MT–299/GR

Mounting MT–299/GR should be located and secured in place; all external connections should be complete.

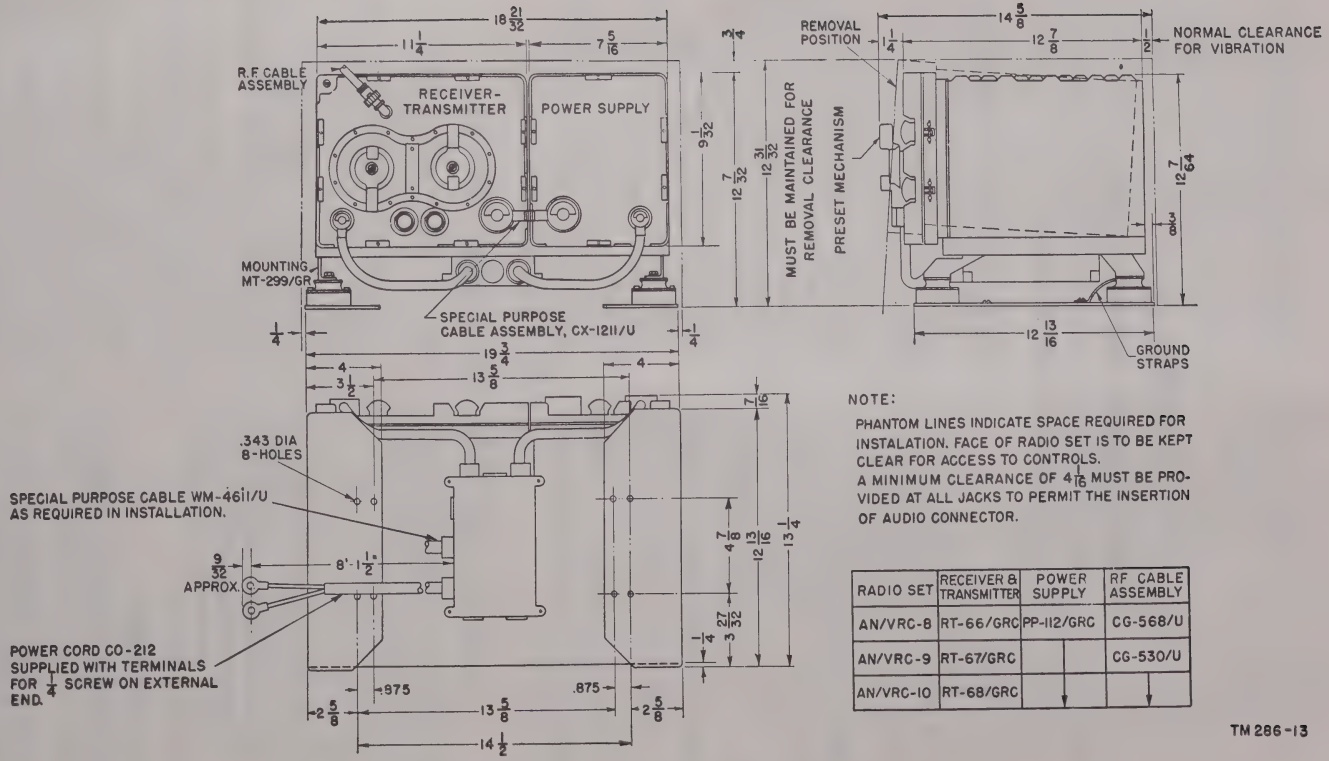
a. Locate Mounting MT–299/GR according to the installation instructions for the particular vehicle. In any installation allow the minimum clearances indicated in figure 15.

b. Spot and drill the eight mounting holes in accordance with the dimensional data shown in figure 15.

c. Turn the mounting upside down to allow access to the junction box. Loosen the four screws at the corners of the junction box and remove the cover plate (fig. 16).

d. Prepare one end of the 10-foot length of Special Purpose Cable WM–46/U for connection to the mounting in accordance with the instructions given in figure 17.

e. Loosen the bondnut on the cable clamp at one of the unused cable entries (fig. 16) (preferably the one at the top center). Remove the nut, metal ring, and rubber washer from the cable clamp and slip them over the prepared end of the



NOTE:

PHANTOM LINES INDICATE SPACE REQUIRED FOR INSTALATION. FACE OF RADIO SET IS TO BE KEPT CLEAR FOR ACCESS TO CONTROLS.
A MINIMUM CLEARANCE OF 4 1/16 MUST BE PROVIDED AT ALL JACKS TO PERMIT THE INSERTION OF AUDIO CONNECTOR.

RADIO SET	RECEIVER & TRANSMITTER	POWER SUPPLY	RF CABLE ASSEMBLY
AN/VRC-8	RT-66/GRC	PP-112/GRC	CG-568/U
AN/VRC-9	RT-67/GRC	↓	CG-530/U
AN/VRC-10	RT-68/GRC	↓	↓

TM 286-13

Figure 15. Radio Sets AN/VRC–8, –9, and –10, outline drawing.

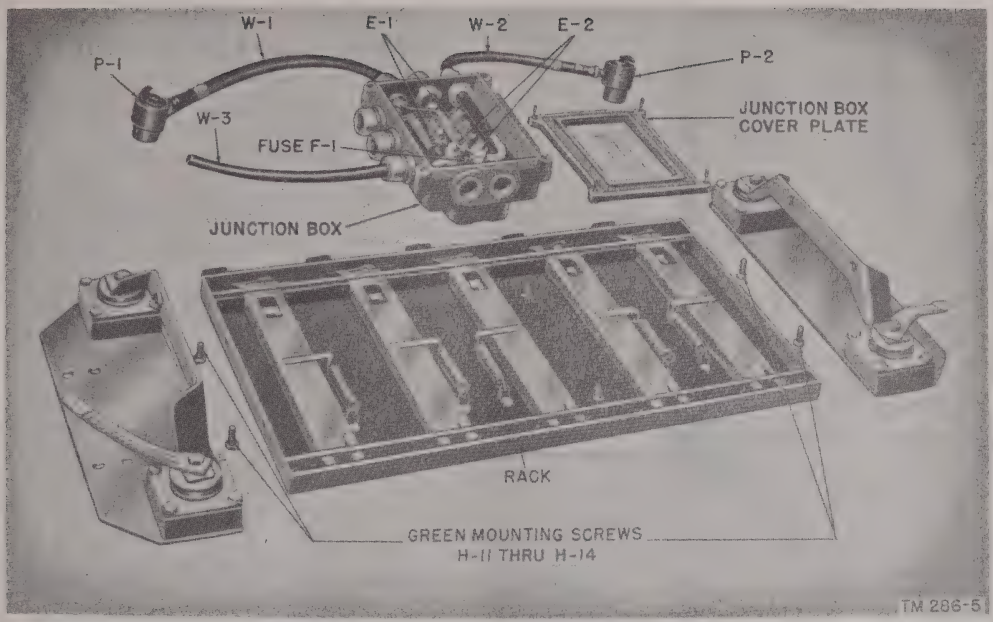


Figure 16. Mounting MT–299/GR, disassembled view.

cable. The rubber plug, which will be found in the cable entry, is for waterproofing an unused entry. It will not be required in the final assembly, but should be saved for use when the equipment is disassembled for reshipment or storage.

f. Insert the prepared end of the cable through the cable entry, and solder the individual conductors to the terminals of the terminal board E–1 in the junction box (fig. 16). (All conductors should be connected, even though all of them are not used.) Observe the color coding indicated in figure 18. The cable should be inserted until the outer insulation protrudes into the inside of the junction box. Sufficient slack should be allowed for all terminal connections. Note that each terminal on E–1 has a pair of contacts; the connections should be made to the open contacts of each pair.

g. When the connections are complete, tighten the bondnut on the cable clamp to effect a watertight seal.

Note. If for some reason the color coding is different from that illustrated in figure 18, note which wire is connected to each terminal and tag the opposite end of the wires accordingly. If necessary, make a continuity check of the individual wires.

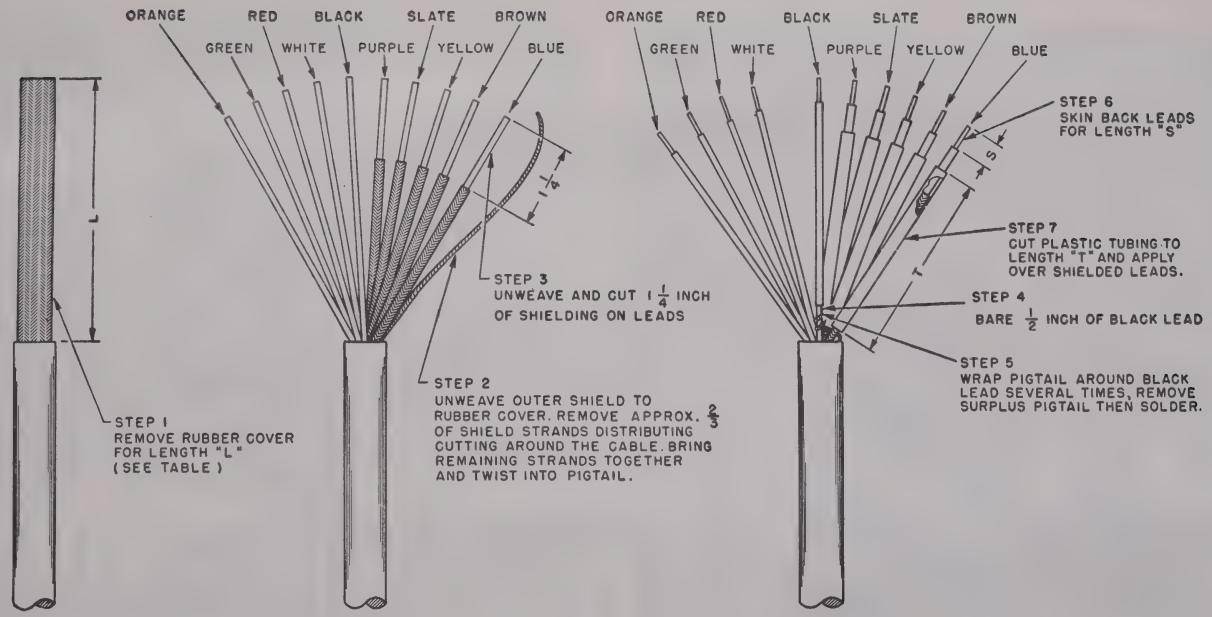
h. Before replacing the cover on the junction box, check the tightness of the solderless connectors, E–2 and E–3, screws, and mounting fuse F–1 (fig. 16). Cable compression can cause these connectors to become loose over a period of time.

i. Replace the cover on the junction box.

j. Turn the mounting right side up and bolt it to the vehicle.

k. Route the loose end of Special Purpose Cable WM–46/U in accordance with the instructions outlined in the installation instructions supplied with the vehicular installation unit. Although the units to be interconnected are Mounting MT–299/GR and Control Box C–375/VRC, vehicular layout will determine whether a direct connection will be made or whether junction boxes and slip rings or junction boxes alone will intervene (par. 22*b*).

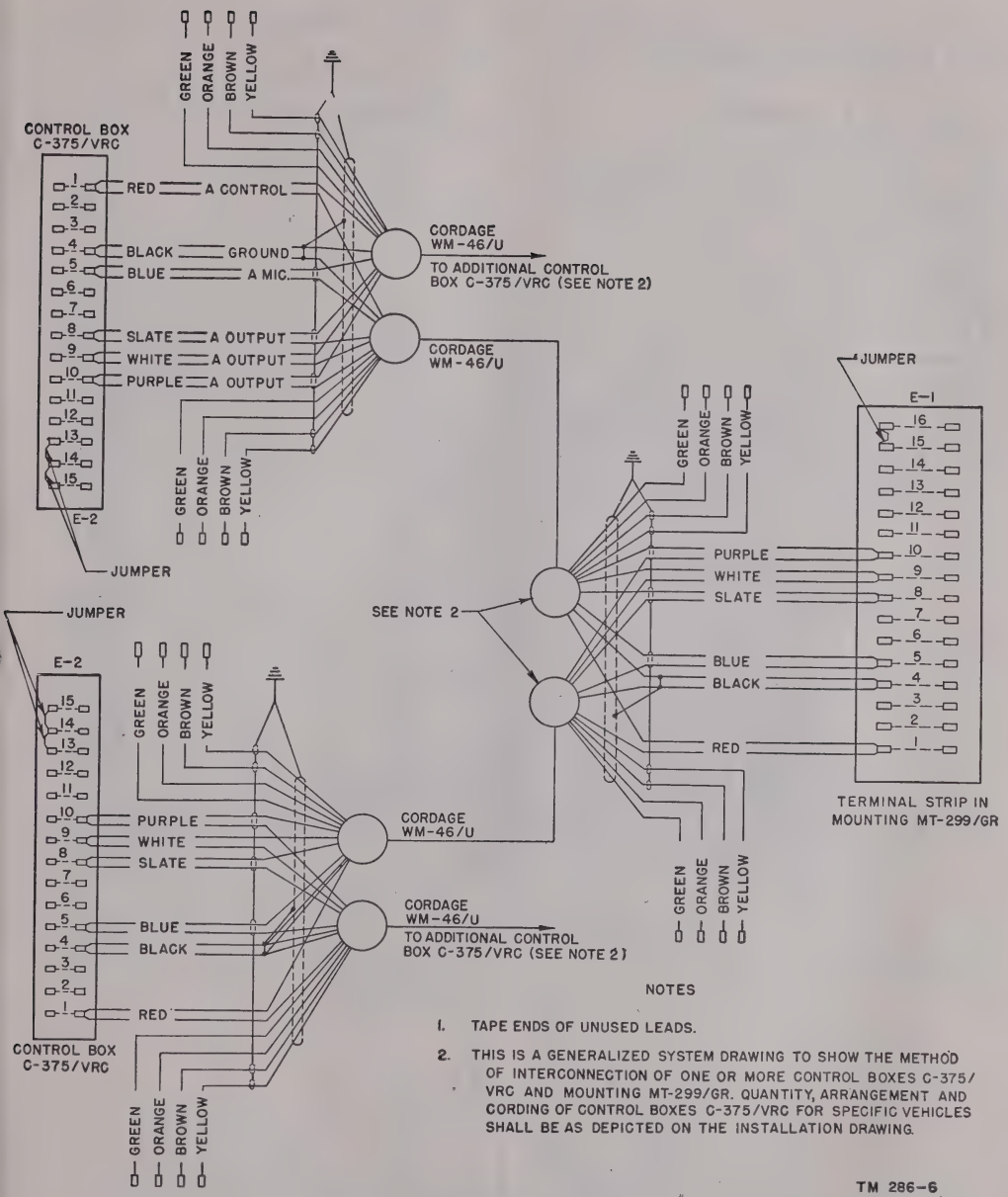
l. The battery cable (fig. 6) is connected in accordance with instructions furnished with the installation unit. Generally, the cable will connect to a vehicular junction box rather than directly to the battery. Use the connector and bondnut supplied with the basic unit to secure the cable at its point of entry into the junction box. Leave



COMPONENT	LENGTH "L"	LENGTH "S"	LENGTH "T"
CONTROL BOX C-375/VRC	4	3/8	3 3/8
MOUNTINGS MT-297/GR, MT-298/GR, MT-299/GR, MT-300/GR	6	3/8	5 3/8
TERMINAL BOX SC-D-5319	6	3/8	5 3/8
TURRET TERMINAL BOX IN MEDIUM TANK M46	10	3/8	9 3/8
BENDIX - SCINTILLA CONNECTOR SIZE 28 SHELL	1 3/8	5/16	NOT USED
BENDIX - SCINTILLA CONNECTOR SIZE 22 SHELL	1 1/4	1/4	NOT USED

TM2643-8

Figure 17. Preparation of Special Purpose Cable WM-46/U.



NOTES

1. TAPE ENDS OF UNUSED LEADS.
2. THIS IS A GENERALIZED SYSTEM DRAWING TO SHOW THE METHOD OF INTERCONNECTION OF ONE OR MORE CONTROL BOXES C-375/VRC AND MOUNTING MT-299/GR. QUANTITY, ARRANGEMENT AND CORDING OF CONTROL BOXES C-375/VRC FOR SPECIFIC VEHICLES SHALL BE AS DEPICTED ON THE INSTALLATION DRAWING.

TM 286-6

Figure 18. Interconnection of Mounting MT-299/GR and Control Box C-375/VRC.

enough slack to allow the mounting table to be removed (for access to the junction box) without straining the cable.

22. Control Box C–375/VRC

One or more Control Boxes C–375/VRC may be supplied in the installation units in addition to the box supplied with the basic unit. The boxes must be located, mounted, and interconnected with Mounting MT–299/GR.

a. Spot the location of the control boxes and drill the mounting holes. The exact location will vary from vehicle to vehicle, and must be determined from the specific instructions supplied with the installation unit. Minimum clearances which are required are indicated in figure 19. The clearances can be reduced when all of the facilities, for example, the jacks at the bottom of the box, are not required. Before mounting the units, make the connections described for each unit (*b* and *c* below).

b. Remove the cover from the control box. Remove the bondnut, ring, and washer from one of the cable clamps at the side of the box, and slip the nut, ring, and washer over the loose end of Special Purpose Cable WM–46/U. (This may be the other end of the cable connected to Mounting MT–299/GR; more commonly it will be an extension of this cable from a vehicular junction box or another Control Box C–375/VRC. In all cases, the cable end should be prepared in accordance with instructions for Control Box C–375/VRC as shown in figure 17. The waterproofing plugs found in the cable entries should be saved (par. 21*e*) if practicable.

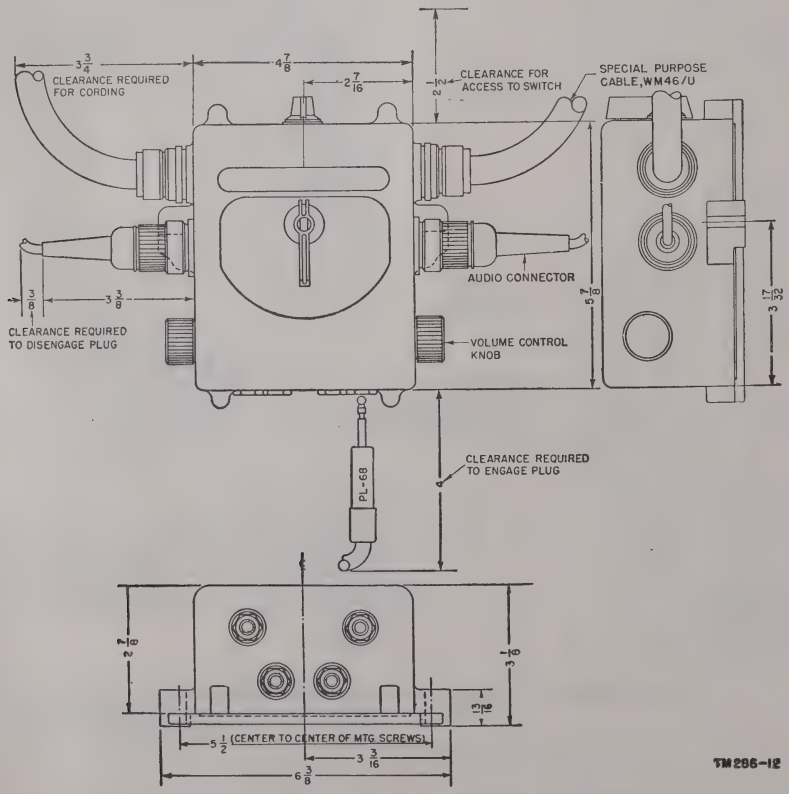


Figure 19. Control Box C–375/VRC, outline drawing.

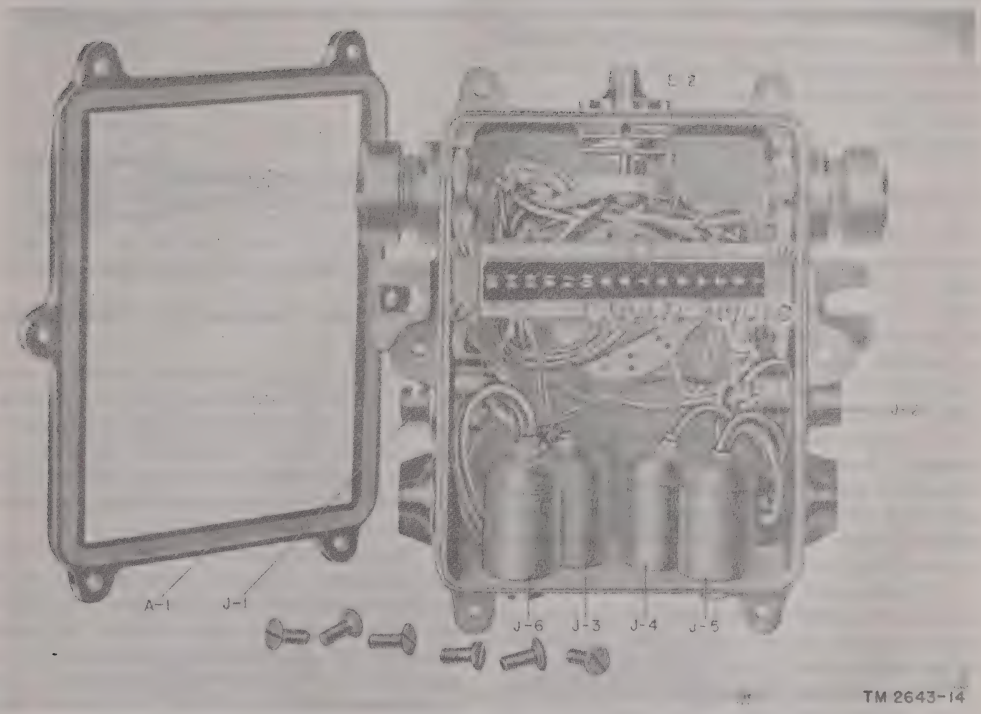


Figure 20. Control Box C-375/VRC, rear view.

c. Insert the prepared end of the cable through the cable entry and solder the individual conductors to open contacts of terminal board E–2 in the control box, observing the color coding shown in figure 18. If the color coding is different, a continuity check should be made to determine that similarly numbered terminals in the mounting and control box are interconnected.

d. When connections are complete, tighten the cable clamp, replace the cover, and mount the units in place. Hardware may be furnished in a bag with the control box.

e. On the composition strips above the selector switch on the panel of each control box, write the following designations from left to right, respectively: "SET 1," "INOPERATIVE," and "INOPERATIVE."

23. Routing Antenna Cables

The antenna cable will be connected from the receiver-transmitter panel to the antenna mast base. While actual connections cannot be made at this time, provisions must be made for routing the cable. RF Cable Assembly CG–568/U is provided for Radio Set AN/VRC–8; Radio Sets AN/VRC–9 and –10 utilize RF Cable Assembly CG–530/U.

a. If the antenna cable is to run free (without clamping) between the panel of the receiver-transmitter and the antenna mast base, store the cable with the audio accessories (par. 25), and connect it after the units have been installed on the mounting (par. 30).

b. If holes must be drilled in the vehicle or if any other vehicular modification must be made in order to route the antenna cables, follow the instructions supplied in the installation unit.

c. If the antenna cable is to be clamped to the vehicle, follow the instructions supplied in the installation unit. When a particular installation calls for the use of Adapter UG–306/U (supplied in the installation units), connect the adapter to the cable end which will connect to the mast base.

Note. In most cases the 50-inch antenna cable supplied with the basic unit will be sufficiently long. In those cases where a greater length is required, cable and connectors will be supplied in the installation units. If the connectors are not already attached to the cable, terminate the cables in accordance with instructions given in figures 21 and 22. If the cables are not installed initially, store them with the audio accessories.

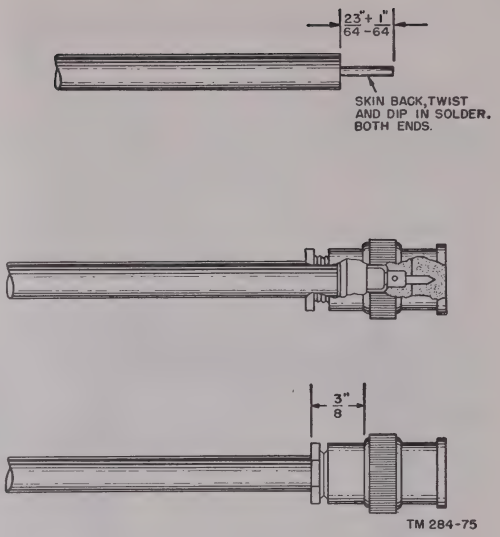


Figure 21. Termination of RF Cable Assembly CG–568/U.

24. Vehicular Provisions for Antenna Mast Base

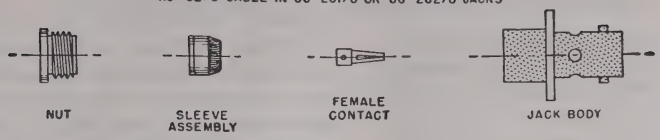
a. Any drilling, installation of mounting brackets, and other vehicular details which are necessary for installing the antenna mast base should be made at this time. Location of the mast and mounting provisions are different for each type of vehicle, and necessary instructions are supplied with the vehicular installation unit.

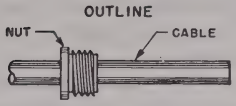
b. Because it is possible, in some instances, that the remaining installation procedures will not be completed until after the vehicle has been shipped to a different depot or organizational unit, actual mounting of the antenna mast bases is not included as a vehicular installation detail. (Its installation might complicate the shipment of the vehicle.) Whether the entire installation is carried through to completion in one or two stages, the antenna mast base is the next item to be installed (par. 27).

25. Storing of Audio Accessories

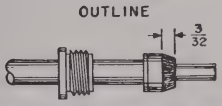
The audio accessories supplied in the installation unit will not be required until the equipment is ready for an operational test (par. 22). The accessories should be unpacked and stored in the vehicle after equipment installation until needed.

RG-62/U CABLE IN UG-261/U OR UG-262/U JACKS

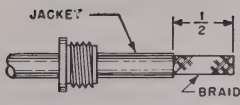




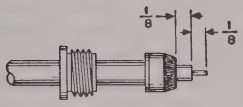
1. CUT OFF SHARP



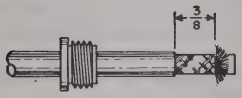
6. WITH SLEEVE IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM TO $\frac{3}{32}$ INCH FROM END.



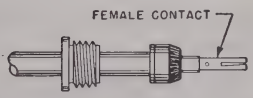
2. CUT OFF JACKET $\frac{1}{2}$ INCH FROM END, BEING CAREFUL NOT TO NICK BRAID.



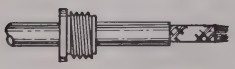
7. CUT INNER DIELECTRIC $\frac{1}{8}$ INCH FROM BRAID, BEING CAREFUL NOT TO NICK INNER CONDUCTOR AND CUT OFF INNER CONDUCTOR $\frac{1}{8}$ INCH FROM END OF DIELECTRIC.



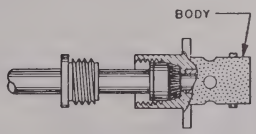
3. CUT OFF INNER INSULATION AND WIRE UNDER BRAID $\frac{3}{8}$ FROM END OF JACKET.



8. TIN INSIDE HOLE OF FEMALE CONTACT, TIN CENTER CONDUCTOR OF CABLE, SLIP FEMALE CONTACT IN PLACE AND SOLDER, REMOVE EXCESS SOLDER. BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC ENTERING BODY.



4. TAPER BRAID

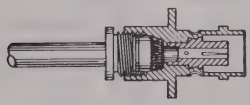


9. PUSH INTO BODY AS FAR AS IT WILL GO, THEN SLIDE NUT INTO BODY AND SCREW INTO PLACE, WITH WRENCH, UNTIL MODERATELY TIGHT. HOLD CABLE AND SHELL RIGIDLY AND ROTATE NUT.



5. SLIDE SLEEVE OVER TAPERED BRAID TO FIT TIGHT AGAINST JACKET. BE SURE INNER SHOULDER OF SLEEVE FITS SQUARELY AGAINST END OF CABLE JACKET.

FINAL ASSEMBLY SHOWN IN SECTION



10. THE ASSEMBLY FOR PLUGS IS THE SAME EXCEPT FOR THE USE OF MALE CONTACTS AND A UG-260/U BODY.

TM284-76

Figure 22. Termination of RF Cable Assembly CG-530/U.

934396°—51—— 3

Section III. EQUIPMENT INSTALLATION DETAILS

Note. The term *equipment installation* has been arbitrarily selected to refer to those installation procedures that are independent of the vehicle in which the radio sets are installed.

26. Unpacking

When all vehicular installation details have been completed, unpack the remaining boxes (1 and 2) of the basic unit (par. 8). Observe the general precautions noted in paragraph 19.

27. Mounting Mast Base AB–15/GR

(fig. 23)

The location of the mast base, in most cases, is determined by the vehicle. In general, the mast base should be placed as high as possible. To install the mast base, follow the instructions outlined below and in figure 23.

a. Loosen the ground clamp on the adapter which is supplied on the mast base. Remove the adapter and replace it with Adapter UG–273/U. Retighten the ground clamp on the new adapter.

b. Separate the two cup insulators by unscrewing the body of the mast base.

c. Insert the body of the mast base, with upper cup-insulator attached, through the hole in the mounting surface. (The mounting surface may be either a special bracket or the shell of the vehicle.)

d. Bring the lower cup-insulator up from the under side of the mounting surface so that the bolt in the lower insulator engages the body of the mast base. The lock washer and the ground braid from the clamp on the adapter should be between the mounting surface and the lower insulator (fig. 23).

e. Turn the body of the mast base in a clockwise direction to tighten the assembly.

f. If the mounting surface does not provide a good ground, an additional ground bond must be made between the mounting surface and the vehicle.

28. Antenna Mast Sections

(fig. 24)

a. Radio Sets AN/VRC–8, and –9 utilize three long mast sections: Mast Sections MS–116–A, MS–117–A, and MS–118–A. Screw the three sections together, then turn the assembly into the mast base.

b. Radio Set AN/VRC–10 utilizes one long and one short mast section: Mast Sections MS–117–A and AB–24/GR. Screw the two sections together, then turn the assembly into the mast base.

29. Receiver-Transmitter and Power Supply

The receiver-transmitter and power supply are installed on the mounting. Use Power Supply PP–109/GR in 12-volt systems and Power Supply PP–112/GR in 24-volt systems.

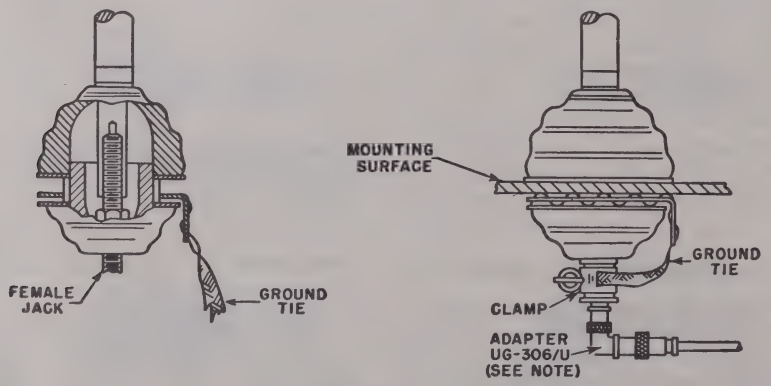


Figure 23. Mast Base AB–15/GR, installation drawing.

a. Release the locking mechanism for the two right-hand channels of the mounting by rotating the locking handles toward the left, as shown in figure 6.

b. Place the power supply on the mounting so that the rails on the bottom of the case rest in the two extreme right-hand channels of the mounting. Rotate the locking handles to the right to lock the unit in place. The handles will detent in the locked position.

c. Place and lock the receiver-transmitter on the mounting next to the power supply.

30. Interconnections

Make the system interconnections outlined below and illustrated in figure 24.

a. Connect Adapter UG–306/U to the ANT connector on the receiver-transmitter. Connect one end of the antenna cable (RF Cable Assembly CG–568/U or CG–530/U, as indicated in fig. 24) to the adapter, and connect the other end of the cable to the mast base.

b. Place the OPERATE switch of the power supply in the OFF position and connect Special

RADIO SET	RECEIVER-TRANSMITTER	MAST SECTIONS	ANTENNA CABLE	POWER SUPPLIES
AN/VRC-8	RT-66/GRC	MS-116-A	CG-568/U	PP-109/GR WHEN USED WITH 12-V SOURCE OR PP-112/GR WHEN USED WITH 24-V SOURCE.
AN/VRC-9	RT-67/GRC	MS-117-A MS-118-A	CG-530/U	
AN/VRC-10	RT-68/GRC	MS-117-A AB-24/GR		

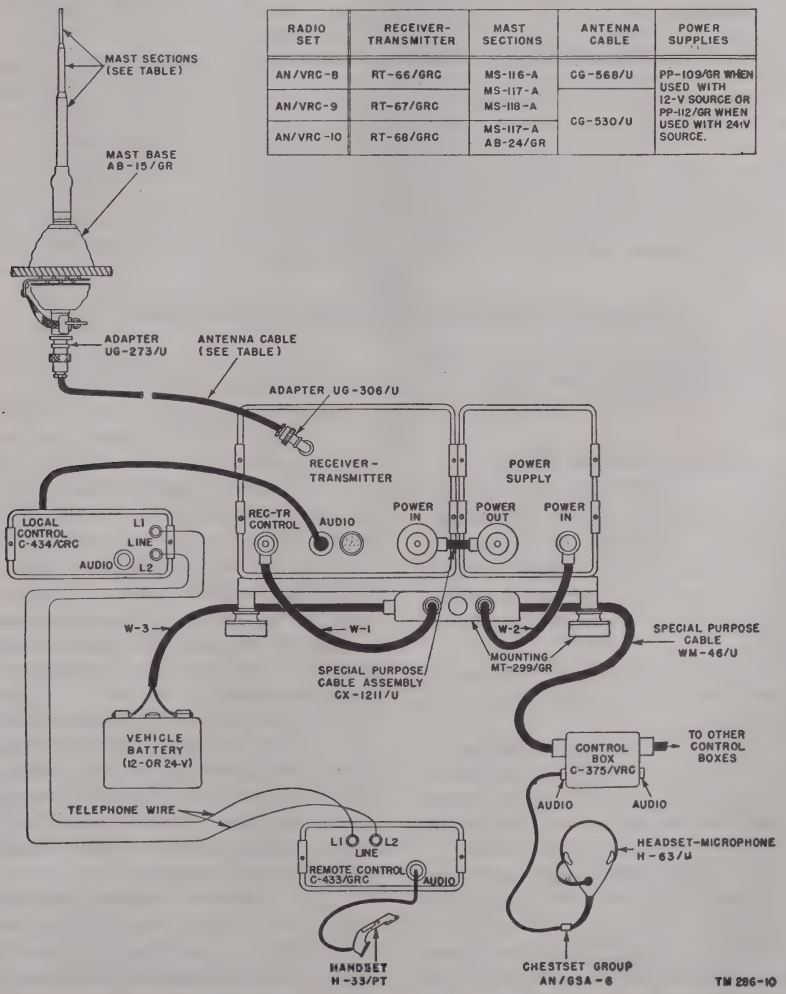


Figure 24. System cordage diagram.

Purpose Cable Assembly CX–1211/U between the POWER OUT receptacle of the power supply and the POWER IN receptacle of the receiver-transmitter. Tighten the screw handles on the cable assembly connectors to effect a watertight seal.

c. Connect cables W–1 and W–2 from the mounting to the REC TR CONTROL and POWER IN receptacles on the receiver-transmitter and power supply, respectively. Tighten the screw handles on the cable connectors to effect a watertight seal.

31. Audio Accessories

a. Assembly. The chest sets, headsets, and headset-microphone sets provided in the installation unit must be assembled and made ready for use. The remaining audio accessories are shipped assembled.

b. Disposition. The specific disposition and usage of audio accessories depends, in part, upon vehicular conditions and modes of operation to be used. Probable dispositions are indicated below. (See chapter 3 for the operating modes possible at the various audio connectors.)

(1) Chest Set Group AN/GSA–6 will be used with Headset-Microphone H–63/U at the audio connectors of Control Box C–375/VRC. When Control Group AN/GRA–6 is used (par. 34), the chest set can be used at the audio connector of Local Control C–434/GRC.

(2) Microphone M–29/U can be used at an audio connector of the receiver-transmitter. (A separate headset or loudspeaker will be required for monitoring purposes.)

(3) Headset Navy Type CW–49507 with Headset Cord CX–1334/U can be used at an audio connector of the receiver-transmitter for monitoring.

(4) Handset H–33/PT generally will be used at either Remote Control C–433/GRC or Local Control C–434/GRC when Control Group AN/GRA–6 is used (par. 34).

Section IV. ADJUSTMENTS FOR OPERATION

Note. Personnel performing the procedures described in this section should be familiar with the use of controls and instruments, and with the operating procedures described in chapter 3.

32. Receiver-transmitter Antenna Tuning

The receiver-transmitter is shipped completely alined but the receiving and transmitting antenna circuits must be turned when the set is connected to its particular antenna system. Once the antenna circuits are tuned for a particular system antenna, it is not necessary to retune during normal operation.

Caution: Keep all personnel removed as far as possible from the antenna while making the following adjustments.

a. Receiver Tuning. Perform steps 1 through 14 of the equipment performance checklist (par. 79) to determine that the receiver is operating. Leave the receiver operating with the SQUELCH control OFF, and adjust as follows:

(1) Tune for a signal in the top 900 kc of the tuning range (par 47). If practicable, arrange to have this signal supplied by another radio set. If another set is not available, radiate the output of an f-m signal generator to the receiver. The signal must be weak so as not to overload the receiver.

(2) Using a screw driver, adjust the REC ANT TUNE control on the receiver panel for maximum noise quieting and maximum signal strength in the headset. Reduce r-f input signal strength as the strength of the a-f signal increases. Repeat the adjustment.

b. Transmitter Tuning. Perform steps 1 through 18 of the equipment performance checklist (par. 79) to determine that the transmitter is operating. To tune the transmitter antenna, proceed as follows:

(1) Tune the receiver-transmitter (par. 45) to the extreme low end of its tuning range (MCS tuning control at lowest mc calibration; TENTH MCS tuning control at zero). Leave the TENTH MCS tuning control at zero throughout the tuning procedure.

Caution: Do not turn the TENTH MCS tuning control while the TR ANT TUNE control is being adjusted. Serious damage to the tuning mechanism can result.

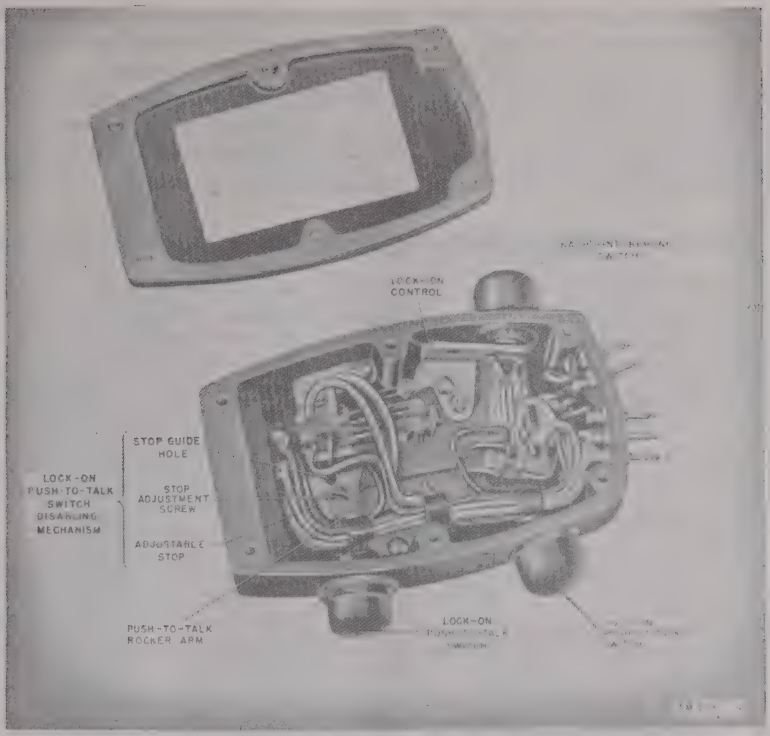


Figure 25. Chest Set Group AN/GSA–6, internal view.

(2) Remove the cap which covers the TRANS ANT COUPLING control on the receiver-transmitter panel and turn the control completely counterclockwise to obtain minimum coupling.

(3) Press and hold the RADIO-INT and press-to-talk switches on the chest set. It may be more convenient to lock the RADIO-INT switch in the RADIO position by means of the internal adjustment provided (fig. 25) and to press the lock-on push-to-talk button.

Caution: The transmitter should not be operated continuously for more than 5 minutes. Allow a 15-minute stand-by period between each 5-minute period of continuous operation. Excessive battery drain must also be avoided.

(4) Remove the cap which covers the TR ANT TUNE control on the receiver-transmitter panel. Engage the control by pressing in on it with a screw driver, and adjust for a maximum r-f reading on the panel meter. If it is impossible to obtain a reading, advance the setting of the TRANS ANT COUPLING control slightly and repeat the procedure. Keep the coupling as low as possible while adjusting the TR ANT TUNE control for a maximum r-f reading. When the maximum reading is obtained, release the RADIO-INT or push-to-talk switch on the chest set.

(5) Repeat the adjustments of steps 3 and 4 above for each integral mc calibration on the MCS dial and for the highest detented frequency of each receiver-transmitter (27.9, 38.9, and 54.9 mc for Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, respectively).

(6) When adjustments are complete for each setting of the MCS tuning control, turn the MCS tuning control to the approximate center of the tuning range, and

adjust the TRANS ANT COUPLING control for a maximum r-f reading.

(7) Repeat the adjustments of steps (3) through (6) above.

33. Operational Check

When the receiver-transmitter has been tuned, make a complete operational check of the system by performing the procedure outlined in the equipment performance checklist (par. 79). Omit steps 24 through 33 which pertain to Control Group AN/GRA–6. If abnormal indications are obtained, it will be necessary to trouble shoot the system. When required, follow the trouble shooting suggestions contained in the checklist.

Section V. CONTROL GROUP AN/GRA–6 AND MISCELLANEOUS EQUIPMENT

34. Control Group AN/GRA–6

Control Group AN/GRA–6 should be installed only when its particular facilities are required (par. 37). An initial installation should be made, however, to determine that the equipment will operate properly. Make this initial installation in accordance with the following instructions after the rest of the system has been completely installed, tuned, and checked.

a. Local Control C–434/GRC.

(1) Loosen the thumbscrew fasteners on the panel, and remove the panel-chassis assembly from the case.

(2) Remove the battery compartment cover by releasing the catch which holds it in place (fig. 26).

(3) Insert two 1½-volt Batteries BA–30 side by side in the battery compartment, making certain that the positive terminal of one battery rests against the flat contact on the bottom of the battery compartment, while the second battery has the negative terminal resting against the spring contact.

(4) Replace the compartment cover making certain that the batteries make contact with the cover contacts.

(5) Set the chassis-mounted switch (S–1) to the BELL position.

(6) Replace the panel-chassis assembly in the case.

(7) Connect the local control to one of the AUDIO receptacles on the receiver-transmitter by means of the Set 1 cable in the cable compartment at the rear of the unit (fig. 27).

b. Remote Control C–433/GRC.

(1) Release the two snap catches which hold the outer case to the panel-chassis assembly, and remove the assembly from the case.

(2) Remove the tape which secures the battery compartment cover to the sides of the unit, and remove the cover. Slide the cover back slightly to clear the tab on the left side and lift the cover.

(3) Install two 1½-volt Batteries BA–30 side by side in the battery compartment. Be certain that one battery rests with the positive terminal against the flat contact and the other with the negative terminal against the spring contact at the bottom of the compartment.

(4) Install a 45-volt Battery BA–414/U in the large compartment in the chassis frame, so that the octal socket on the battery faces up (toward the rear of the unit).

(5) Insert the octal male plug P–1 (fig. 28) into the socket on the battery.

(6) Replace the compartment cover by inserting the two projections at the right edge under the bracket angles on the right side of the chassis. Press the cover down and slide it forward until the tab on the right side of the cover slides under the chassis tab. Release pressure.

(7) Check to be certain that the batteries are making contact with the cover.

c. Interconnections. Interconnect the local and remote units with telephone wire over as great a distance (up to 2 miles) as desired. Strip the insulation off the wires approximately ¾ inch from the ends and tin the bared wires before clamping them in the binding posts (designated LINE L1 and L2) on each of the units. Similarly designated posts should be interconnected. Make a continuity check, if necessary, to insure proper connections.

d. Operational Check. Place the OPERATE switch of the power supply to TRANS & RECEIVE, and perform steps 24 through 32 of the equipment performance checklist (par. 79).

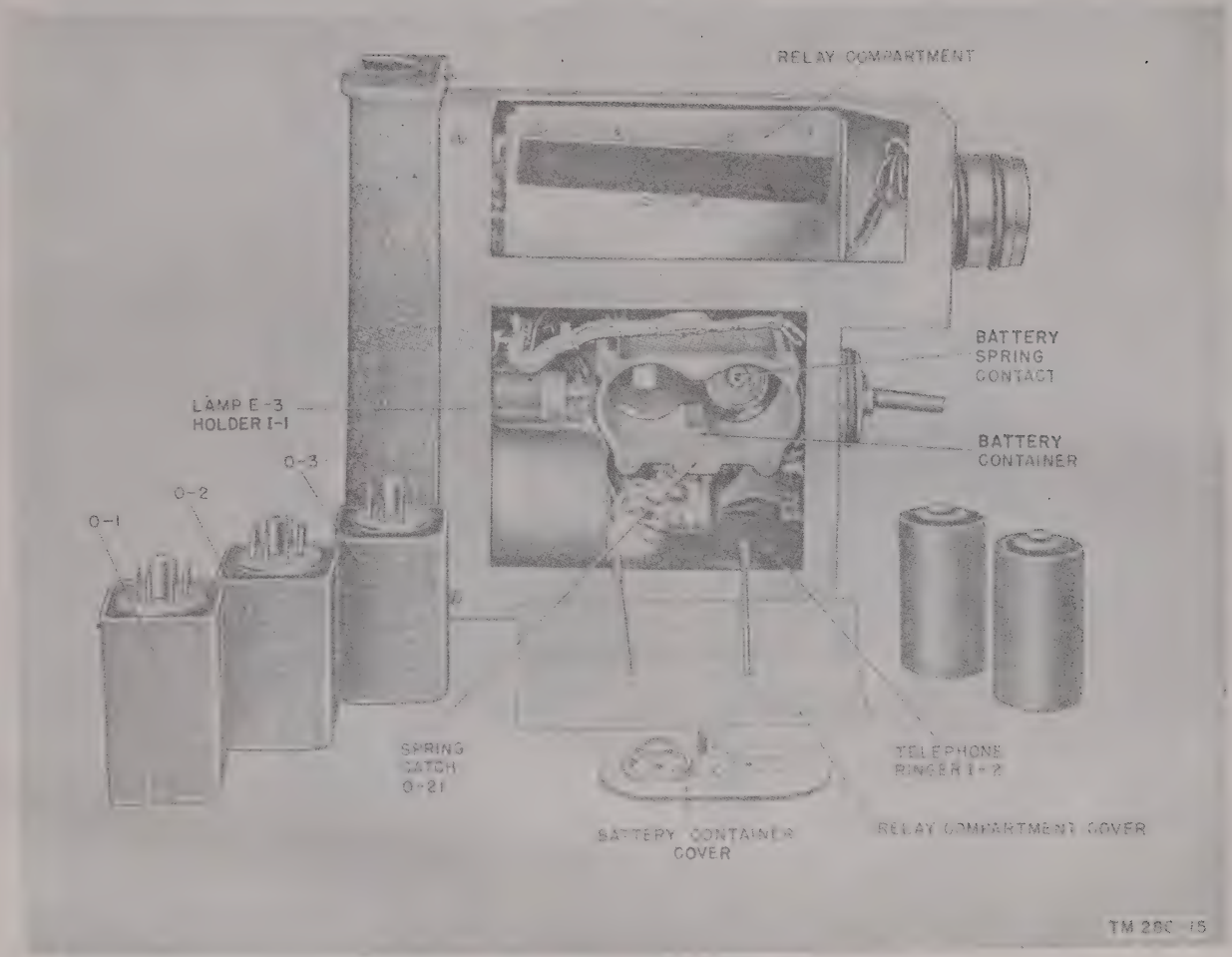


Figure 26. Local Control C-434/GRC, bottom view.

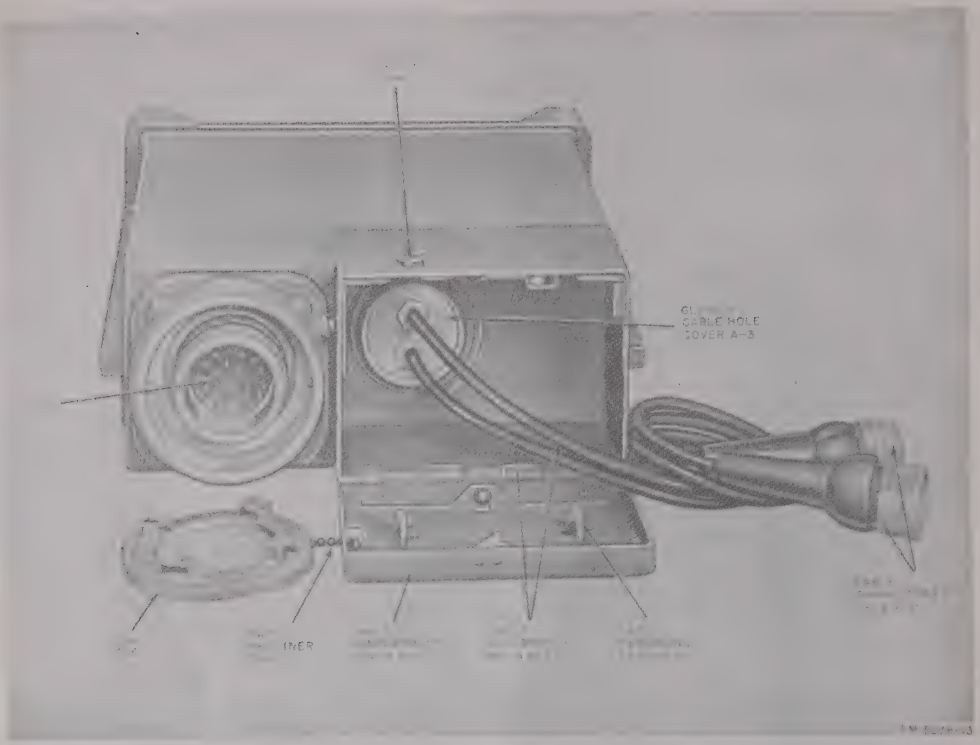


Figure 27. Local Control C–434/GRC, rear view.

e. Disassembly Procedure.

(1) When satisfactory performance has been ascertained, disconnect the local control unit from the receiver-transmitter.

(2) Disconnect the telephone wire from the local and remote units.

(3) Remove the batteries from both the local and remote units. Never leave the batteries installed unless the units will be used within a relatively short period of time.

35. Storage of Equipment Not in Use

Equipment not immediately required for operation, such as running spares, audio accessories, or Control Group AN/GRA–6, should be packed in the containers provided and stored in a convenient location within the vehicle.

a. Running Spares. All spare mast sections should be placed in Bag CW–206/GR in the pockets provided. Case CY–684/GR should be filled with spare parts from the stock of running spares supplied with each unit and stored in Bag CW–206/GR. Since Case CY–684/GR will not hold all the spare parts provided, a careful selection should be made from the spares available. It is suggested that the following list be used as a guide in selecting the spares for packaging in Case CY–684/GR.

b. Audio Accessories and Technical Manuals. Audio accessories not required for operation can be stored in Bag CW–206/GR. Technical manuals can be stored in the same bag.

c. Control Group AN/GRA–6. When the operating units of Control Group AN/GRA–6 are not required for operation, they should be stored in Bag CW–189/GR.

Spare part	Quantity
Vibrator (6- and 24-volt for 12- and 24-volt systems, respectively)	1
Relay, Raytheon CK–118	1
Ballast tube, 800 ma	1
Tube type OA2	1
Tube type OB2	1
Type type 2E24	1
Tube type 6AK5	2
Tube type 3A5	2
Tube type 3Q4	2
Tube type 3A4	1
Tube type 3B4	1
Tube type 1L4	2
Tube type 1S5	1
Tube type 1A3	2
Tube type 1U4	3
Tube type 1R5	2
Tube type 1AE4	2
Tube type CK–1007	1
Lamp NE–51	1

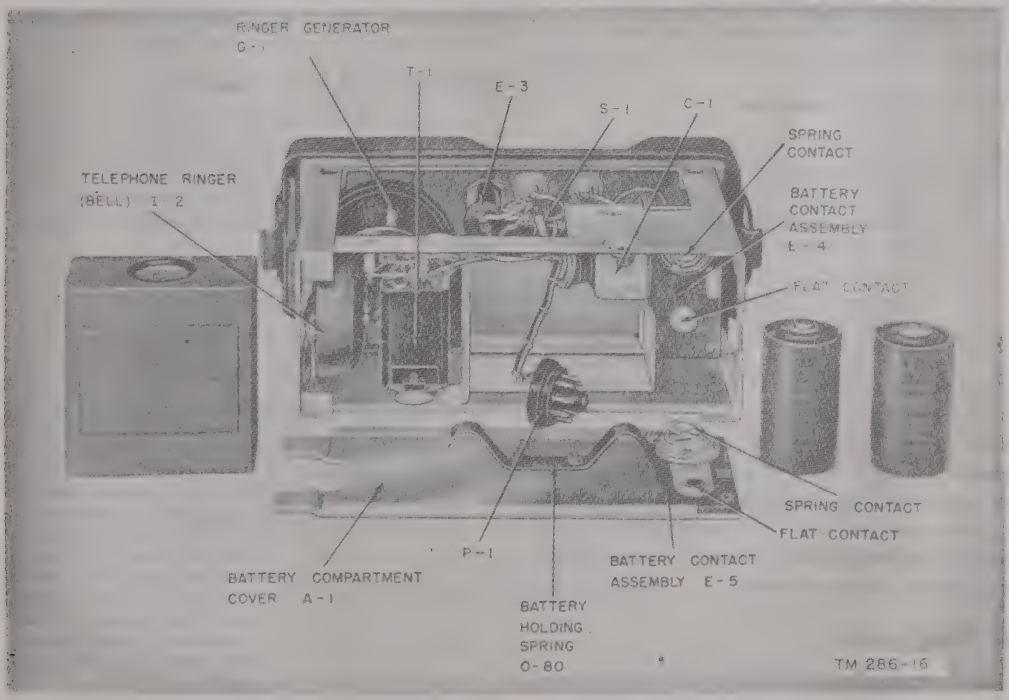


Figure 28. Remote Control C–433/GRC, internal view.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. MODES OF OPERATION

36. Monitoring

Monitoring constitutes listening to received signals with no attempt to communicate with the sending station. Switching facilities are provided on the power supply to allow operation of the radio set strictly as a monitor (receiver), if so desired. Generally, the output of the receiver will be monitored at Control Box C–375/VRC (par. 52), but it is also possible to connect a monitoring device directly to the panel of the receiver-transmitter. When Control Group AN/GRA–6 is used, the monitoring facilities can be extended to both local and remote control units.

37. Push-to-talk Operation

a. Push-to-talk operation utilizes one-way reversible communication facilities. Receiving facilities are available if power is supplied to the equipment, but transmission requires closure of one or more switches (generally the push-to-talk switch of a chest set, handset, or microphone). Communication is possible in one direction at a time. It is impossible for the receiving party to *break in* on the sending party.

b. Push-to-talk operation of the radio set is possible from Control Box C–375/VRC and the panel of the receiver-transmitter by means of a chest set or handset connected directly to the unit audio connector (pars. 52 and 53). The use of Control Group AN/GRA–6 makes it possible to extend push-to-talk operation of the radio set to a control station approximately 2 miles away from the major installation par. 55).

38. Duplex Telephone Facilities

A duplex circuit allows simultaneous two-way (break-in) communication. When Control Group AN/GRA–6 is used for remote control of the radio set, duplex telephone facilities are available for communication between local and remote-control units.

Section II. CONTROLS AND INSTRUMENTS

39. Introduction

Paragraphs 40 through 43 indicate the function of operational controls and instruments on the panels of the various units. Although ordinary operating procedures are confined mainly to control units and audio accessories, the understanding of the controls and instruments on the individual units is essential to the efficient operation and maintenance of the radio sets.

40. Power Supply

The controls for both the 12-volt and 24-volt power supply (Power Supplies PP–109/GR and PP–112/GR, respectively) are the same. Figure 29 illustrates the panel layout of controls. The following chart lists the control functions:

Control	Function
OPERATE switch (S–1).	Controls power to the radio set. OFF: Opens battery circuit at input terminals of the power supply. RECEIVE: Completes battery circuit to receiver power-supply circuits and to receiver-transmitter relay-supply circuit. TRANS AND RECEIVE: Completes battery circuit to transmitter power-supply circuits, in addition to those circuits listed under the RECEIVE position.
TRANS POWER switch (S–2).	Provides for high or low r-f power operation of the transmitter in the HIGH and LOW positions, respectively.

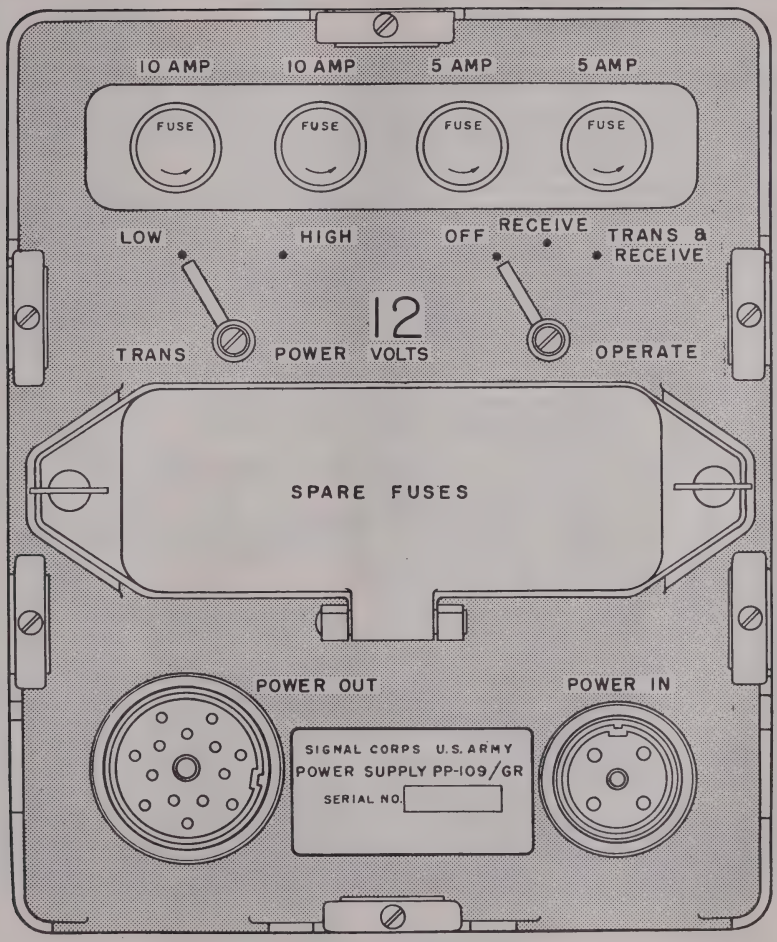


Figure 29. Power supply panel.

41. Receiver-transmitter

The controls for the receiver-transmitter (Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC) are illustrated in figure 30. Their functions are listed in the following chart:

Control or instrument	Function
DIAL LAMP (E–313)	Illuminates tuning dials except when DIAL LIGHT (OFF–ON)-RING switch is OFF.
DIAL LIGHT (OFF–ON)-RING switch (S–302).	Controls dial LAMP, microphone, and ringing oscillator circuits. Spring loaded to return to DIAL LIGHT ON position from RING position. OFF: Completes microphone circuit and turns dial LAMP off. ON: Completes microphone circuit, turns dial LAMP on. RING: Breaks microphone circuit, turns on ringing oscillator, energizes the transmitter, and turns on dial LAMP.
VOLUME control (R–303).	Adjusts the audio output level to speaker and phone terminals of the panel-mounted AUDIO connectors and to Control Box C–375/VRC.
SQUELCH control (R–302 and R–303).	Controls the noise suppression circuits of the receiver and determines what minimum level of input signal will be required for operation of the receiver. In OFF position, provides no noise suppression and allows receiver to operate at maximum sensitivity.
MCS and TENTH MCS tuning controls and dials.	Select and indicate the operating frequency.
MCS and TENTH MCS tuning controls and dials.	MCS: Selects and indicates each integral mc of the tuning range in 1-mc steps. TENTH MCS: Selects and indicates the decimal portion of the operating frequency in either 100-kc steps or in a continuous sequence.
Preset levers	Provide means of presetting one or two detended channels (par. 46).
Meter (M–301)	Indicates transmitter r-f power output, filament continuity, and availability of d-c (85-volt) operating potential.
Meter selector switch (S–301).	Connects meter to test points as indicated below: RF position: Connects meter to transmitter r-f output circuit. Positions 2 through 11: Connects meter to various filament circuits (par. 61). 90V position: Connects meter to 85-volt d-c supply circuit.
Tr Ant Tune control (C–74).	Adjusts transmitter-antenna-circuit tuning. (This is not an operational adjustment.)
Trans Ant Coupling control (L–23).	Adjusts coupling between transmitter output stage and the antenna. (This is not an operational adjustment.)
Rec Ant Tune control (C–1A).	Adjusts receiver-antenna-circuit tuning. (This is not an operational adjustment.)
Audio connectors (J–310 and J–311).	Provide means of connecting chest set (with headset-microphone), microphone, headset, handset, or speaker for monitoring or push-to-talk operation of the receiver-transmitter.

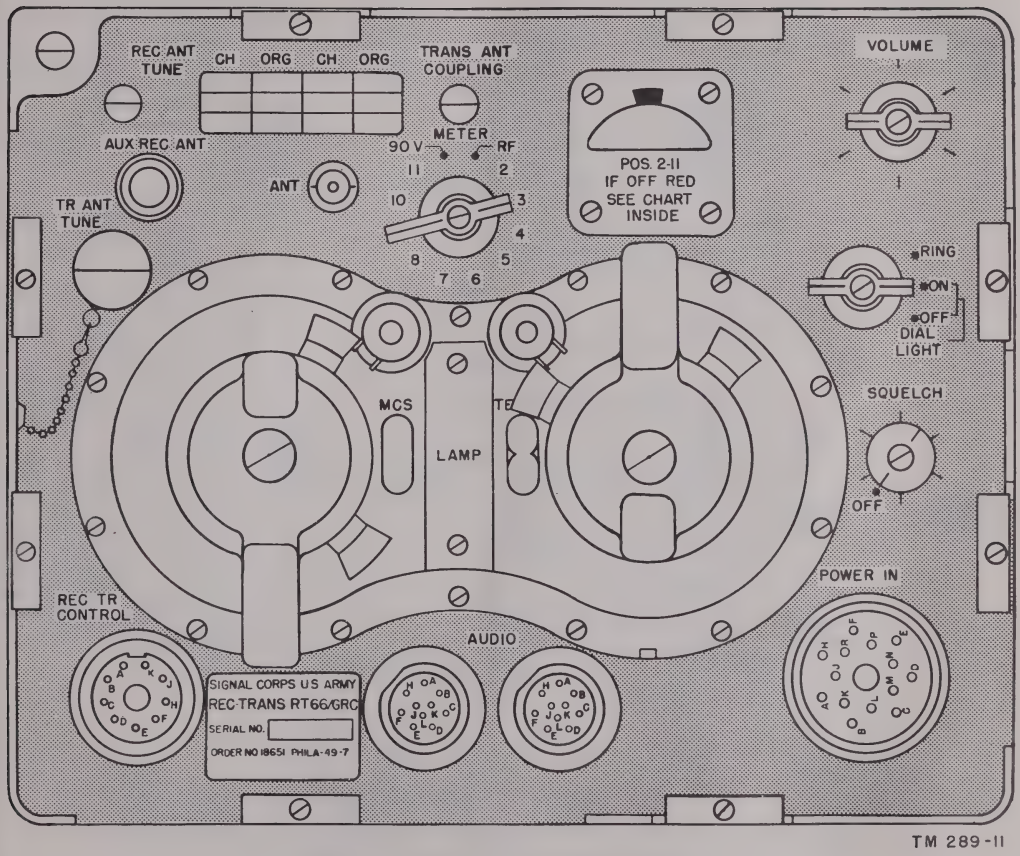


Figure 30. Receiver-Transmitter panel.

42. Control Box C–375/VRC

The controls on Control Box C–375/VRC are illustrated in figure 31. Functions of the controls are listed in the following chart:

Control	Function
SELECTOR switch (S–1).	Completes monitoring circuits to PHONES jacks and headset receptacles. In conjunction with RADIO TRANS switch, completes push-to-talk circuits to MIC jacks and audio receptacles. Counterclockwise position: Completes monitoring circuit regardless of position of RADIO TRANS switch; completes push-to-talk circuit when RADIO TRANS switch is operated. Center and clockwise positions: No function in Radio Sets AN/VRC–8, –9, and –10.
RADIO TRANS switch (S–2).	Controls push-to-talk operation. Spring loaded to return to the center position if not held in either of the RADIO TRANS positions. A locking device is provided to hold the switch in one of the RADIO TRANS positions.
RADIO TRANS switch (S–2).	Clockwise and counterclockwise positions: Complete push-to-talk circuits to MIC jacks and audio receptacles when the Selector switch is in the counterclockwise position. Center position: Opens push-to-talk circuit.
VOL. controls (R–1 and R–2).	Vary the level of signals applied to their associated PHONE jack or audio connector. Volume is increased by turning a control in the direction of the arrow.
Audio connectors (J–1 and J–2).	Provide for connection of Chest Set Group AN/GSA–6 (with Headset-Microphone H–63/U) for operation of the receiver-transmitter.
MIC. jacks (J–3 and J–4).	Provide for connection of Microphone T–17 for operation of receiver-transmitter. (Efficiency of operation will be affected by such usage and is not normally advisable if the standard audio accessories are available.)
PHONE jacks (J–5 and J–6).	Provide for connection of Headset H–16/U or Headset HS–30 in combination with Cord CD–933 for monitoring the receiver-transmitter. (Efficiency of operation will be affected by such usage and is not normally advisable if the standard audio accessories are available.)

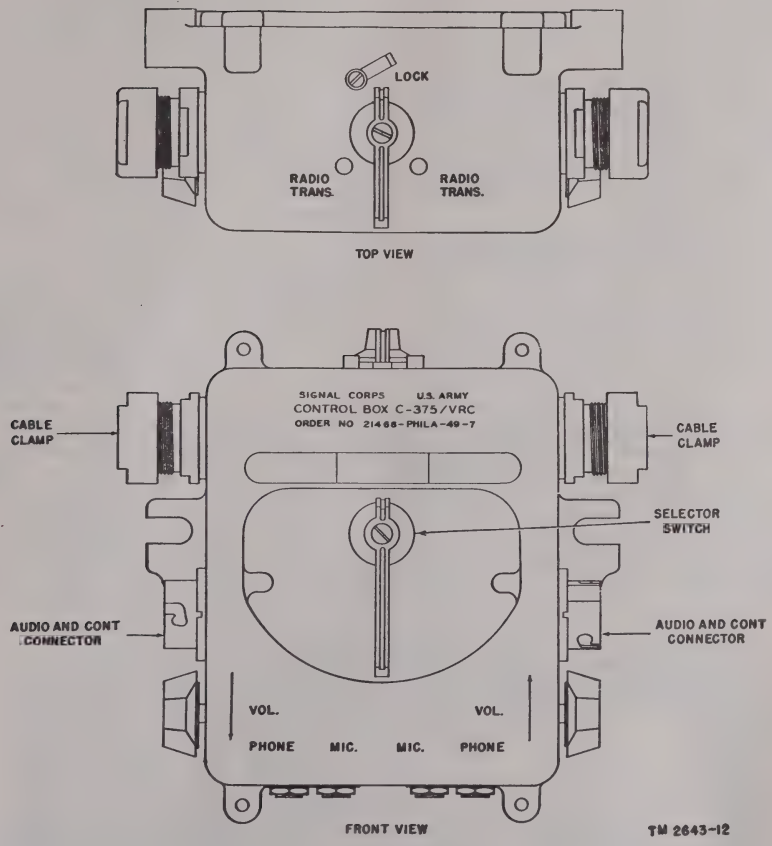


Figure 31. Control Box C-375/VRC, panel view.

43. Control Group AN/GRA–6

a. Local Control C–434/GRC. Figure 32 illustrates the lay-out of controls and instruments on Local Control C–434/GRC. The following chart lists the functions of controls and instruments:

Control or instrument	Function
LOCAL switch (S–3)	Provides for push-to-talk operation of the receiver-transmitter and for duplex telephone operation with the remote unit. SET 1: Allows push-to-talk operation of the receiver-transmitter. TEL: Allows telephone operation with, and radio monitoring at, the remote unit. (Monitoring circut is broken if REMOTE switch is at TEL ONLY position.) Ringing is best with S–3 in TEL position. SET 2: No function in Radio Sets AN/VRC–8, –9, and –10.
REMOTE switch (S–1)	In conjunction with controls at remote unit, provides for remote push-to-talk operation of the receiver-transmitter. Also provides means of limiting operation (at the remote unit) to telephone communication.
REMOTE switch (S–1)	TEL ONLY: Allows for telephone communication between local and remote control units. Ringing is best with S–1 in this position. SET 1 & 2: Provides for remote push-to-talk operation of the receiver-transmitter. SET 1: Provides for remote push-to-talk operation of the receiver-transmitter. SET 2: No function in Radio Sets AN/VRC–8, –9, and –10.
LINE L1 and L2	Binding posts for telephone line connections from remote control.
Ringing generator	Provides means of sending a ringing signal to the remote unit.
CALL LIGHT (E–3)	Indicates (when lit) that a ringing signal is being received from the remote unit. (CALL LIGHT indication can be replaced by a bell, by means of an internal switch.) Dimmer control provides for masking glow of the lamp.
AUDIO connector (J–1).	Provides means of connecting a handset or chest set (with headset and microphone) for telephone communication with the remote unit and push-to-talk operation of the radio set.

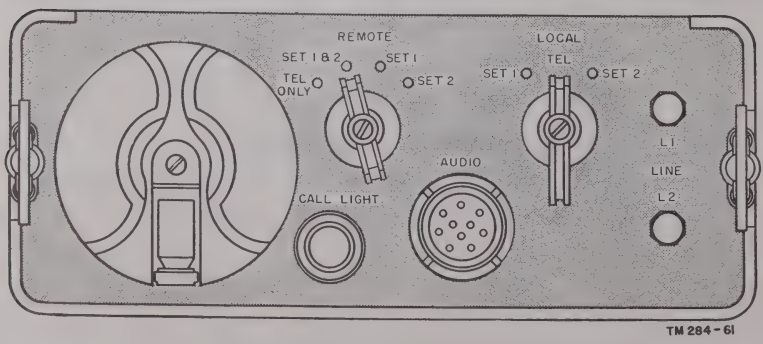


Figure 32. Local Control C–434/GRC, panel view.

b. Remote Control C–433/GRC. Figure 33 illustrates the controls and instruments on Remote Control C–433/GRC. The following chart lists the functions of the controls and instruments:

Control or instrument	Function
SELECTOR switch (S–2).	In conjunction with controls at local control unit, provides for remote push-to-talk operation of the receiver-transmitter and/or telephone communication between local and remote units. Left-hand write-in position: Provides for remote push-to-talk operation of the radio set when the REMOTE switch on the local unit is in either the SET 1 & 2 or SET 1 position.* Right-hand write-in position: No function in Radio Sets AN/VRC–8, –9, and –10.*
SELECTOR switch (S–2).	TEL position: Limits operation (at the remote unit) to monitoring and telephone communication with the local unit.
LINE L1 and L2	Binding posts for connecting the telephone line from local control.
Ringing generator	Provides means of sending a ringing signal to the local control unit.
CALL LIGHT (E–3)	Indicates (when lit) that a ringing signal is being received from the local control unit. (CALL LIGHT indication can be replaced by a bell, by means of an internal switch.) Dimmer control provides for masking glow of the lamp.
AUDIO connector (J–1).	Provides means of connecting Handset H–33/PT for telephone communication with the local unit and push-to-talk operation of the radio set.

*The functions of the write-in positions will be reversed if the telephone line connections are reversed or if the SET 2 cable is used (instead of the SET 1 cable) between the local unit and the receiver-transmitter.

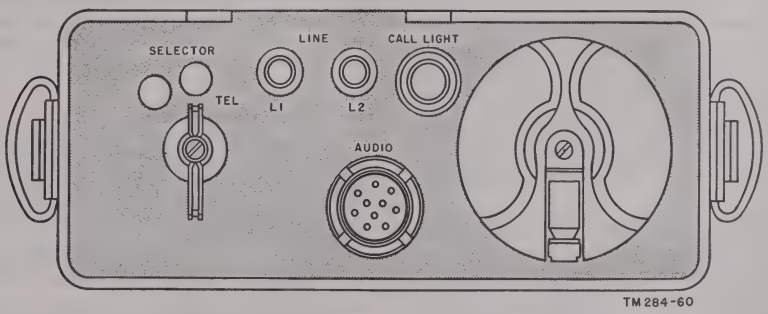


Figure 33. Remote Control C–433/GRC, panel view.

Section III. TUNING

44. Tuning Receiver-transmitter

Once the antenna circuits have been properly tuned (par. 32), the receiver-transmitter can be tuned to any desired channel frequency merely by turning the MCS and TENTH MCS controls to the proper detent positions (par. 45). Continuous tuning between channels is possible by means of the procedure outlined in paragraph 47. Any two detented channels may be preset for rapid selection by means of the procedure outlined in paragraph 46.

45. Channel Selection

Channel selection is possible at every 100-kc interval between the lower and upper ends of the tuning range.

a. Turn the MCS control until the MCS dial indicates the integral portion of the desired frequency (for example, until the dial indicates 24 when the desired frequency is 24.8 mc.).

b. Engage the detent for the TENTH MCS control by turning the control to the extreme

counterclockwise position. (If the detent is already engaged, omit this step.)

c. Turn the TENTH MCS control until the TENTH MCS dial indicates the decimal portion of the desired frequency (for example, until the dial indicates 8 when the desired frequency is 24.8).

Note. Do not hold the MCS control while turning the TENTH MCS control.

46. Presetting Detented Channels

Presetting is obtained by means of stops which limit the rotation of the tuning knobs. The stops can be swung into place for presetting (or removed when the presetting feature is not desired) by means of adjusting knobs. When in place for presetting, the stops will engage the green and red levers on the tuning controls as the controls are rotated. The positions of the red and green levers can be changed so that the stops will function for any desired detented frequency. To preset any two detented frequencies, perform the following steps:

a. Turn the MCS and TENTH MCS tuning controls until the higher of the desired frequencies is indicated on the tuning dials.

b. Pull on the stop adjusting knobs (against the spring tension which holds them locked against the panel) and turn the knobs so that the stops are positioned to engage the red and green preset levers. Make certain that the stops lock into position; that is, that the knob engages the locating pin.

c. Loosen, but do not remove the screw which secures the MCS tuning control.

d. Turn the green lever on the MCS control in a clockwise direction until it strikes against the stop. Hold the lever against the stop and tighten the screw on the tuning control.

e. Loosen, but do not remove the screw which secures the TENTH MCS tuning control.

f. Compare the tenth portions of the two frequencies which are to be preset and set the green preset lever on the TENTH MCS control in one of the following ways:

(1) If the tenth portion of the higher preset frequency is higher than the tenth portion of the lower preset frequency, turn the green lever in a clockwise direction until it strikes the stop. Hold the lever against the stop and tighten the screw on the tuning control.

(2) If the tenth portion of the higher preset frequency is lower than the tenth portion of the lower preset frequency, turn the green lever in a counterclockwise direction until it strikes the stop. Hold the lever against the stop and tighten the screw on the tuning control.

g. Turn the MCS and TENTH MCS controls until the lower of the desired frequencies is indicated on the tuning dials.

h. While holding the green lever in place, loosen the screw on the MCS tuning control and turn the red lever in a counterclockwise direction until it strikes the stop. Tighten the screw on the tuning control.

i. The setting of the red lever on the TENTH MCS control depends upon the setting of the green lever (*f.* above). If the green lever was set in a counterclockwise position set the red lever in a clockwise position, and vice versa.

Note. In describing the presetting procedure, it has been assumed that the green preset levers would be used for the higher frequency and the red levers for the lower frequency. The opposite convention is equally suitable, but consistency in either convention is desirable.

47. Continuous Tuning

Continuous tuning throughout the range of the receiver-transmitter is possible by releasing the channel-detent and preset mechanisms of the TENTH MCS dial.

a. Turn the MCS control (as for channel tuning) until the MCS dial indicates the integral portion of the desired frequency.

b. Turn the TENTH MCS control to the extreme counterclockwise position to release the detent mechanism.

c. Turn the TENTH MCS control clockwise until the TENTH MCS dial indicates the decimal portion of the desired frequency. (Calibration marks between the major 100-kc. (0.1-mc.) divisions represent 25-kc. (0.025-mc.) intervals; when the MCS dial indicates 24, a frequency of 24.85 is selected by turning the TENTH MCS control until the second calibration mark between 8 and 9 appears under the hairline on the TENTH MCS dial.)

Section IV. OPERATION

48. Operational Procedures

a. Operation of the radio sets involves the following procedures:

(1) Start-stop operations.
(2) Squelch adjustments.
(3) Volume-level adjustments.
(4) Tuning.
(5) Transmit-control operations.

b. The first four of the above listed procedures are local operations (performed at the panels of the various major units) and are not necessarily repeated during normal operating periods. (It may be necessary to repeat tuning and squelch adjustments as occasion demands.) The transmit-control operation are normally performed at Control Box C–375/VRC and are continually repeated during normal operating periods. If desired, the radio set may be operated completely from the panel of the receiver-transmitter. When the tactical situation requires it, the transmit-control can be extended to a remote station by means of Control Group AN/GRA–6.

49. Starting Procedure

a. Turn the OPERATE switch of the power supply to the TRANS & RECEIVE position.

b. Turn the TRANS POWER switch of the power supply to the HIGH or LOW position, depending upon the range of transmission required.

c. Turn the SQUELCH control of the receiver-transmitter to the maximum clockwise position.

50. Squelch and Volume-level Adjustments

The SQUELCH and VOLUME controls of the receiver-transmitter should be set as soon as the equipment is placed in operation. The SQUELCH control setting should be checked periodically to insure operation at maximum sensitivity for the particular noise condition present. Set the controls as outlined in *a* and *b* below.

a. Provide a monitor for the receiver by connecting a chest set (with handset and microphone) to one of the AUDIO connectors of Control Box C–375/VRC. Turn the VOL. control associated with the connector to the approximate mid-point of its range. Turn the SELECTOR switch on the control box to the counterclockwise position. Repeat the connections and settings for each control box used.

b. Adjust VOLUME control to the point of maximum output.

c. Turn the SQUELCH control counterclockwise until noise is audible in the headsets. Advance the VOL. control on the control box to obtain a comfortable listening level in the headsets. Then advance the SQUELCH control in a clockwise direction to the point at which the receiver quiets. Any subsequent volume-level adjustments should be made at the individual control boxes.

Note. When the tuning of the set is changed, it may be necessary to reset the SQUELCH control.

51. Frequency Selection

a. To select a detented channel, follow the procedure outlined in paragraph 45.

b. To preset a detented channel, follow the procedure outlined in paragraph 46.

c. To tune to a frequency which lies between detented channels, follow the procedure outlined in paragraph 47.

52. Operation From Control Box C–375/VRC

a. Modes of Operation. When power has been supplied to the radio set, squelch and volume-level adjustments made, and when the frequency of operation has been selected, monitoring and push-to-talk operations are possible at Control Box C–375/VRC.

b. Connection of Audio Accessories. For both modes of operation, connect Chest Set Group AN/GSA–6 to one of the audio connectors on the control box, and connect Headset-Microphone H–63/U to the chest set. Lock the RADIO TRANS switch of the control box in the RADIO TRANS position and turn the selector switch to the counterclockwise position. Remove the cover of the switch box on the chest set and, while depressing the RADIO-INT button, slide the lock-on lever (fig. 25) toward the switch.

c. Monitoring. Received signals will be audible in the headset when the audio accessories have been connected and the switches have been set as outlined above. To vary the signal level in the headset, adjust the VOL. control next to the audio connector being used.

d. Push-to-Talk Operation. For push-to-talk operation of the receiver-transmitter, press either of the push-to-talk buttons on the chest set and talk into the microphone. Release the push-to-talk button to listen. To release the

LOCK ON button, momentarily press the HOLD ON push-to-talk button.

Note. If desired, the lock-on push-to-talk button may be disabled by turning the adjustable stop (fig. 25) so that it blocks the push-to-talk rocker arm.

53. Operation From Receiver-Transmitter Panel

The radio set can be operated locally by using a handset or a chest set (with headset and microphone) connected to an AUDIO receptacle on the panel of the receiver-transmitter. Since there are two audio connectors on the panel of the receiver-transmitter, a microphone and headset or microphone and loudspeaker may be used. Ringing facilities, as well as monitoring and push-to-talk facilities, are available at the panel.

a. Starting Precedure. Power must be supplied to the set, squelch and volume-level adjustments made, and frequency of operation selected as outlined in paragraphs 49, 50, and 51. Received signals will then be audible in the headset, earpiece, or loudspeaker.

b. Ringing. To transmit a 1,600-cycle ringing signal, hold the DIAL LIGHT (ON-OFF)-RING switch in the RING position. Release the switch to listen. When the ringing signal has been acknowledged, proceed on a push-to-talk basis.

c. Push-to-Talk Operation. Press the push-to-talk button on the chest set, handset, or microphone and talk into the microphone (or mouthpiece). Release the button to listen. When a chest set is used, the RADIO-INT switch should be locked in the RADIO position.

54. Stopping Procedure

a. To remove all power from the radio set, place the OPERATE switch of the power supply in the OFF position.

b. To make only the transmitter inoperative, place the OPERATE switch of the power supply in the RECEIVE position.

55. Operation from Control Group AN/GRA–6

a. Modes of Operation. Although Control Group AN/GRA–6 is provided mainly to allow remote operation of the radio sets from points up to 2 miles from the installation, local as well as remote operating facilities are available. The complete facilities are as follows:

(1) Monitoring of received signals at both local and remote units.

(2) Local push-to-talk operation of the transmitter.

(3) Telephone communication, including ringing, between local and remote units.

(4) Remote push-to-talk operation of the transmitter.

b. Installation. Install Control Group AN/GRA–6 as outlined in paragraph 34*a* through *d*. When the installation is completed, start and tune the radio set as outlined in paragraphs 49, 50, and 51.

c. Monitoring. To monitor the output of the receiver at both the local and remote control units, leave the LOCAL switch at TEL and place the REMOTE switch (of the local unit) at any position but TEL ONLY. If the REMOTE switch is placed at TEL ONLY, monitoring is possible.

d. Local Push-to-Talk Operation. For local push-to-talk operation of the transmitter, set the REMOTE switch to SET 1 and 2 (or to SET 1), hold the LOCAL switch in the SET 1 position, press the push-to-talk and RADIO-INT switches on the chest set, and talk into the microphone. Release the chest set and local switches to listen.

Note. The push-to-talk and RADIO-INT switches on the chest set may be locked in position for convenience by means of internal adjustments (fig. 25).

e. Telephone Communication. For normal telephone communication between local and remote units place the REMOTE switch (of the local unit) in the TEL ONLY position, and the SELECTOR switch (of the remote unit) in the TEL position. These are the normal positions of these switches when push-to-talk operation is not desired.

(1) To send a ringing signal in either direction, turn the crank of the ringing generator at the sending unit (local or remote). Either a CALL LIGHT will glow or a bell will ring at the receiving end, depending upon the setting of internal switches in the local and remote units.

Note. A ringing signal should be sent only when the remote control SELECTOR switch is in the TEL position and the local control REMOTE switch is in the TEL ONLY position to avoid accidential transmission of the ringing signal.

(2) To communicate, press the push-to-talk switch on the handset (at the remote unit), or the push-to-talk switch and RADIO-INT switch on the chest set

(at the local unit), and talk into the mouthpiece or the microphone. Full duplex operation is possible; it is not necessary to release the push-to-talk switches to listen, although it is a good practice to conserve the battery power.

f. Remote Push-to-Talk Operation.

(1) The operator at the remote unit must inform the local operator (by telephone) to place the REMOTE switch of the local unit in the SET 1&2 (or SET 1) position.

(2) For remote push-to-talk operation of the transmitter, place the SELECTOR switch of the remote unit in the left-hand write-in position, press the push-to-talk switch on the handset, and talk into the mouthpiece. Release the push-to-talk switch to listen.

Note. If the telephone-line connections at either unit are reversed, the right-hand write-in position will control the transmitter, instead of the left-hand position. Operation will be unaffected otherwise.

CHAPTER 4

THEORY OF OPERATION

Section I. INTRODUCTION

56. Scope

a. System theory is presented to provide an understanding of how the several units are related in the various operations of the radio set. Such an understanding is an effective aid in trouble shooting the equipment to isolate a defective unit and, in some cases, to isolate a defective part within a unit.

b. Most of the information presented in this chapter is concerned only with system application of the several units. Detailed circuit theory of individual units is not discussed except when the units are interconnected in a common circuit. For example, the microphone circuits of the receiver-transmitter are described since they are interconnected with the control units through the mounting. Details of the receiver-transmitter i-f amplifier are not important for system understanding and therefore are not discussed. Complete details on the individual units are published in separate technical manuals. To provide a general acquaintance with the individual units, however, block diagrams of the major units are supplied in this chapter, and schematic diagrams of all units are included at the end of the manual.

57. Basic System Block Diagram

a. Basically each radio set consists of a receiver-transmitter with speech-input and monitoring facilities, as shown in figure 34. This basic unit is the essential part of the system. The power supply, cables, mountings, and other accessory equipment (fig. 3) are supplied to make the basic unit perform its function of transmitting or receiving.

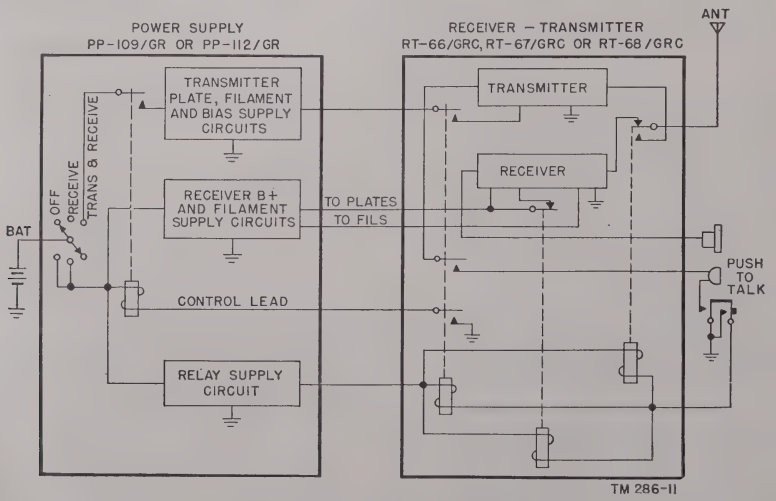


Figure 34. Basic system block diagram.

b. In an actual system installation, microphone and headset facilities are provided at each Control Box C–375/VRC, and the switching provisions on the box or associated audio accessory allow selection of the mode of operation, namely, transmission or monitoring. The control facilities are extended from the individual units to the control box through Mounting MT–299/GR and interconnecting cable (fig. 24).

c. Another adaptation of the basic system is the extension of the microphone and monitoring facilities to a remote point by means of telephone lines. Control Group AN/GRA–6 is provided to accomplish this function (fig. 24).

d. When the switch in the power supply is in the RECEIVE position (fig. 34), voltage is supplied to the B+ and filament supply circuits in the receiver. The receiver is completely operative, but it is impossible to transmit. When the same switch is in the TRANS & RECEIVE position and the push-to-talk button is pressed, all the relays in receiver-transmitter are activated by the completion of the relay supply circuit to ground. One relay switches the antenna from the receiver to the transmitter. Another relay removes the voltages from some of the receiver plates and filaments. A third relay grounds the control lead of a relay in the power supply, which, in turn, supplies voltage for the transmitter plate, filament, and bias supply circuits. This third relay in the receiver-transmitter also closes the microphone circuit to the transmitter and applies power to the transmitter.

58. System Diagram

a. The system diagram (fig. 35) illustrates system interconnections and functioning including complete power distribution, monitoring facilities, and push-to-talk facilities. The push-to-talk circuit is illustrated for Control C–375/VRC, Local Control C–434/GRC, and Remote Control C–433/GRC. Telephone facilities between Local Control C–434/GRC and Remote Control C–433/GRC (units of Control Group AN/GRA–6) also are represented.

b. In paragraphs 59 through 69, the system diagram is discussed in detail for each operational function. By following the discussion and the diagram, it is possible to determine what happens when each switch is thrown or pressed, what voltages are applied to what stage, how the microphone circuits are completed, the disposition of each received signal (from the output of the receiver), and other system functions. The passage of a signal through the transmitter (microphone to antenna) or the path of a received signal (antenna to receiver output circuit) is not discussed. Such detail is peculiar to the units (not the system) and generally is covered in section V of this chapter. Complete details are published in separate manuals.

59. System Legend

a. A system legend has been devised and used on the system diagram (fig. 35) to facilitate circuit tracing from unit to unit. Because each circuit is generally completed through one or more units, and similar reference symbols are used within each unit, it is impossible to tell (without some form of legend) when a circuit leaves one unit and enters another.

b. As indicated on the legend, a letter has been used to identify each unit and this letter has been prefixed to the reference symbol of the part in a particular unit. Thus, in the reference symbol H/P–2B at the middle left-hand corner of figure 35, H indicates Mounting MT–299/GR, P–2 is the reference symbol for a plug on a cable leading from the junction box of the mounting, and B indicates pin B of the plug. The complete legend is shown on figure 35 and is listed below:

Legend

Unit symbol	Unit symbolized
A	Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC
E	Power Supply PP–109/GR or PP–112/GR
H	Mounting MT–299/GR
M	Remote Control C–433/GRC
N	Local Control C–434/GRC
R	Control Box C–375/VRC
T	Handset H–33/PT
V	Special Purpose Cable Assembly CX–1211/U
Y	Chest Set Group AN/GSA–6

c. To correlate the electrical interconnections with the physical interconnections, the following chart indicates the cable connections made between the mounting and other units:

Mounting cable	Cable termination	Mating connector		
		Receptacle	Unit	Receptacle designation
W–1	P–1	J–312	Receiver-Transmitter	REC–TR CONTROL
W–2	P–2	J–1	Power Supply	Power IN
W–3	E–2 and E–3		Battery	
WM–46/U	E–1	E–2	Control Box C–375/VRC	(Terminal board)

Section II. RECEIVING CIRCUITS

60. Power Input Circuits
(fig. 35)

When the power cable is connected from the mounting to receptacle E/J–1 of the power supply, the battery circuit is completed from the mounting to the contacts of the 4-section OPERATE switch (E/S–1 in the power supply). Fuse H/F–1 is in series with the positive lead from the battery. Terminal C of H/P–2 provides a ground connection for the negative lead from the battery. When the OPERATE switch is placed in either RECEIVE or TRANS & RECEIVE position, the receiver-transmitter is ready for monitoring. As long as the push-to-talk switch or other transmit-control switch is not operated, operation is the same for either the RECEIVE or TRANS & RECEIVE position of the OPERATE switch. The RECEIVE position makes it impossible to transmit, even though transmit-control switches are operated.

61. Receiver Filament Circuits
(fig. 35)

In 24-volt systems, the battery voltage is applied to the receiver filaments through section 1D of the OPERATE switch, fuse E/F–1, choke E/L–4, dropping resistor E/R–39, the receiver filament-protection circuit, and choke E/L–16. The filament-protection circuit includes ballast tubes E/R–40 and E/R–31, thermal relay E/K–2, and resistor E/R–32. The ballast tubes maintain a constant voltage for the filaments despite variations of battery voltage. In the 12-volt systems, dropping resistor E/R–39 and ballast tube E/R–40 are not used. Thermal relay E/K–2, whose normally closed contacts short-circuit resistor E/R–32, protects the filaments against overloads. If a voltage overload occurs because of a burned-out filament, for example, the thermal relay operates, and its contacts open. Resistor E/R–32 then is placed in series with the filaments to maintain a safe voltage for the remaining tubes. The filament circuits completed are those of A/V–1 through A/V–4, A/V–101 through A/V–103, and A/V–107 through A/V–116. Complete circuit detail of the series-parallel filament arrangement is shown in figure 38. Dial LAMP A/E–313 is connected in parallel with the filaments of AV–113 and A/V–114 in two positions of the DIAL LIGHT (OFF-ON)-RING switch, A/S–302. In the OFF position, dummy load A/R–304 is substituted for the lamp.

Note. For circuit details of the power supply, refer to figures 64 and 65. A block diagram of the power supply is shown in figure 36.

62. Receiver Plate and Screen Supply
(fig. 35)

a. The battery voltage is supplied through section 1C of the OPERATE switch, fuse E/F–2, and choke E/L–5 to a low-voltage vibrator supply. The 135-volt output from the vibrator is supplied through filter choke E/L–12 to dropping resistor E/R–17 and to a voltage regulating circuit. Resistor E/R–17 drops the voltage to 105 volts for the plate of the second a-f amplifier, A/V–116. The voltage regulating circuit includes dropping resistors E/R–21 and E/R–22 in series with voltage regulator E/V–4 and the load circuit. (Resistor E/R–22 is in the circuit for the HIGH position of the TRANS POWER switch, E/S–2A; it is shorted out for low-power operation, since an increased drain is placed on the 85-volt power supply for that type of operation.)

b. The regulated potential at the plate of A/V–4 is dropped by resistor E/R–23 and choke E/L–13 to 85 volts. This potential is used (during recep-

tion) as a source of screen and plate voltage for tubes A/V–1 through A/V–4, A/V–101 through A/V–103, A/V–107 through A/V–112, and A/V–115. Plate and screen voltage for A/V–1 and screen voltage for A/V–2 are supplied through normally closed contacts (9 and 10) of relay A/O–101.

63. Monitoring
(fig. 35)

a. When the plate, filament, and screen potentials have been supplied as described above, the receiver is operative. Signals picked up by the receiver are routed from antenna to audio output circuits as indicated on the block diagram (fig. 37) and the schematic diagrams (figs. 66, 67, and 68 for Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, respectively).

b. The outputs of the first and second a-f stages, A/V–115 and A/V–116, respectively (fig. 35), are supplied to the phone and speaker terminals of the panel-mounted AUDIO receptacles, A/J–310 and A/J–311 and to the audio receptacles of Control Box C–375/VRC. A headset may be used at any of the audio receptacles to monitor these signals. Monitoring facilities for Control Group AN/GRA–6 are discussed in paragraph 72.

Section III. PUSH-TO-TALK OPERATION FROM CONTROL BOX C–375/VRC

64. Power Input Circuits
(fig. 35)

Until transmit-control circuits have been operated, the power supply circuits for the transmitting circuits remain unenergized. Battery voltage is supplied to sections 1B and 1A of the OPERATE switch in the 150-volt and 300-volt vibrator circuits, but contacts 7–8 and 9–10 of relay E/O–1 in the power supply prevent the circuits from being completed. The circuit to relay E/O–1 is broken in turn by contacts 6–7 of relay A/O–101, which is under control of the push-to-talk switch. The sequence of operation is described in paragraphs 65 and 66.

65. Operational Controls
(fig. 35)

The following switches must be operated before the transmit-control relays (A/O–301, A/O–1, A/O–101, and E/O–1) can be energized from Control Box C–375/VRC.

a. Selector switch R/S–1 on the interphone box must be placed in the counterclockwise position.

b. Switch R/S–2 on the interphone box must be held (or locked) in the RADIO TRANS position.

c. Switches Y/S–1 (RADIO-INT) and Y/S–2 (push-to-talk) on the chest set must be depressed.

66. Transmit-Control Relays

When the controls listed above (or paralleling controls) have been operated, the transmit-control relays operate to perform the following functions.

a. Relay A/O–301. Contacts of relay A/O–301 switch the antenna from the receiver to the transmitter.

b. Relay A/O–1.

(1) Contacts 2 and 3 of relay A/O–1 close to disable the squelch circuit by shunting resistor A/R–109 across the squelch-oscillator load resistor, A/R–110.

(2) Contacts 6 and 7 of relay A/O–1 close in the B-plus leads of A/V–9 and A/V–10, and contacts 4 and 5 close in the screen circuit of A/V–11.

c. Relay A/O–101.

(1) Contacts 9 and 10 open, and contacts 8 and 9 close to switch the 85-volt supply from receiver tubes A/V–1 and A/V–2 to transmitter tubes A/V–104A, A/V–105, A/V–106, and A/V–5 through A/V–8. If DIAL LIGHT (OFF-ON)-RING switch A/S–302 is held in the RING position, voltage is made available to A/V–104B also.

(2) Contacts 2 and 3 of relay A/O–101 close and contacts 1 and 2 open to switch the a-f input to A/V–115 from the normal receive tap on the discriminator output voltage divider to the lower-voltage tap used for sidetone during transmission.

(3) Contacts 4 and 5 of relay A/O–101 close in the microphone circuit and the filament lead to transmitter tubes A/V–5 through A/V–11 and A/V–104 through A/V–106.

(4) Contacts 6 and 7 of relay A/G–101 close to complete the ground return circuit for relay E/O–1 in the power supply. Relay E/O–1 operates to complete the power input circuits for the transmitter

filaments and the transmitter high-voltage supplies.

67. Power Supply Circuits

(fig. 35)

a. Relay E/O–1.

(1) Contacts 2 and 3 of relay E/O–1 complete the battery circuit from section 1D of the OPERATE switch to the filaments and filament-protection circuit for the transmitter. In 24-volt systems, dropping resistor E/R–36 and ballast tubes E/R–37, –38, –24, and –25 are included in the input circuit. In 12-volt systems, E/R–36 and ballast tubes E/R–37 and –38 are omitted. The filament-protection circuit utilizes thermal relay E/K–1 which, when operated, causes resistor E/R–26 to be inserted in series with the transmitter filaments. The filaments supplied are those of the transmitter-tube listed in paragraph 66*c*. Complete filament circuit details are shown in figure 38.

(2) Contacts 4 and 5 of relay E/O–1 close to short-circuit resistor E/R–21 in the 85-volt supply circuit. This operation compensates for the increased drain on the power supply during transmission.

(3) Contacts 7, 8, 9, and 10 of relay E/O–1 complete the battery input circuit from sections 1B and 1A of the OPERATE switch to the 150-volt vibrator power supply and 300-volt vibrator power supply, respectively.

b. High-Voltage and Bias Circuits.

(1) The output of the 150-volt supply furnishes operating voltage for tubes A/V–9 and A/V–10 during high-power operation (S–2A in HIGH position).

(2) The 150-volt potential also is connected in series with the 300-volt supply to furnish a 450-volt potential for the power amplifier, A/V–11. A tap on the 450-volt supply provides approximately 250 volts for the screen of A/V–11.

(3) A negative 27-volt output from the 300-volt vibrator circuit supplies bias to transmitter tubes A/V–5, –6, –9, –10, and –11 during high-power transmission.

68. High-Power Transmission

When the transmitter circuits have been energized as described in paragraphs 64 through 67, the transmitter generates a carrier signal which may be modulated by talking into the microphone or by holding the DIAL LIGHT (OFF-ON)-RING switch in the RING position. The transmit-control circuits also can be energized by using a microphone at either of the panel-mounted AUDIO connectors, A/J–310 or A/J–311.

69. Low-Power Transmission

If TRANS POWER switch E/S–2 is placed in the LOW position, the following circuit changes are effected.

a. The input to the 300-volt vibrator supply is broken (E/S–2B).

b. Tube A/V–11 is switched from the 450-volt supply to the 150-volt supply by section 1A of switch E/S–2A.

c. Tubes A/V–9 and A/V–10 are switched from the 150-volt supply to the 85-volt supply.

d. Resistor E/R–22 in the 85-volt supply lead is short-circuited to compensate for the increased drain on the supply.

e. The grids of A/V–5, –6, –9, –10, and –11 are returned to ground potential instead of a negative 27-volt potential.

Section IV. OPERATION FROM CONTROL GROUP AN/GRA–6

70. Ringing Circuit

(fig. 35)

a. It is always possible to ring from Local Control C–434/GRC to Remote Control C–433/GRC, or vice-versa, when the units are connected by a telephone pair as indicated in figure 35 (lower right-hand side of the drawing). The ringing circuit is independent of the radio sets. If the transmitter is being operated from the receiver-transmitter panel or from Control Box C–375/VRC, however, REMOTE switch N/S–2 must be in the TEL position to avoid superimposing the telephone and radio signals.

b. The ringing signal can be generated by a hand-cranked panel-mounted generator on either unit and can be transmitted in either direction through transformer N/T–1 and M/T–1 and the

telephone line. The ringing signal operates either the CALL LIGHT on the panel of the receiving unit or a bell within the receiving unit. An internal switch (N/S–1 or M/S–1) selects the lamp or bell in the local and remote control units, respectively.

71. Telephone Circuit

(fig. 35)

a. Duplex telephone operation is possible provided the LOCAL switch (N/S–3) is left in the TEL position. Local batteries (BT–1 and BT–2) are located in each unit in series with the microphones. If a push-to-talk switch on an audio device at either unit is pressed, and the operator talks into the mouthpiece, the voice signals will be coupled through the transformers and telephone lines to the earphones at the receiving end.

b. The TEL position of the REMOTE switch on the Local Control C–434/GRC and the TEL ONLY position of the SELECTOR switch on the Remote Control C–433/GRC provide for telephone operation only. For other positions of these switches, radio operation also is possible (pars. 72 and 73).

72. Monitoring and Local Push-to-Talk Operations

(fig. 35)

Local Control C–434/GRC is connected to a panel-mounted AUDIO receptacle so that the monitoring and push-to-talk control circuits parallel the similar facilities in Control Box C–375/VRC. In the following discussion it is assumed that the OPERATE switch of the power supply is in the TRANS & RECEIVE position.

a. Monitoring and local push-to-talk operations are described for a SET 1 & 2 or SET 1 setting of REMOTE switch N/S–2 on Local Control C–434/GRC. The set is in a receiving condition, and any signals received may be monitored at Local Control C–434/GRC. Section 2F front, of the REMOTE switch (fig. 35), couples the signals to the monitoring devices and the line transformer in Local Control C–434/GRC. The signals also are coupled through the line transformers and telephone line to the earphone at Remote Control C–433/GRC.

b. If the LOCAL switch is turned to the SET 1 position, and the push-to-talk switch is pressed, sections 1A and 1B of the switch provide ground returns for the microphone and transmit-control lines, respectively, of the receiver-transmitter. The transmitting circuits are energized as described in paragraphs 64 through 67. Talking into the microphone at Local Control C–434/GRC will cause modulation of the transmitted signal.

73. Remote Push-to-talk Operations

(fig. 35)

a. In remote push-to-talk operations, the ground returns for the transmitter audio input and the control lines are controlled by relays N/O–1 and N/O–2 which are in Local Control C–434/GRC, but whose control voltage is obtained from Remote Control C–433/GRC through the telephone line. Relay N/O–2 is polarized so that it will operate its contacts to the position shown (fig. 35) when the potential applied to it is positive at terminal 3 with respect to terminal 2. When the potential is reversed, the relay contacts will be operated to their opposite position. Relay N/O–1 will operate regardless of the polarity of the applied potential.

b. The polarity applied to relay N/O–2 is controlled by the REMOTE switch in Local Control C–434/GRC and the SELECTOR switch in Remote Control C–433/GRC. For remote push-to-talk operation, the REMOTE switch is left in the SET 1 & 2 or SET 1 position so that the SELECTOR switch has complete control of the relay operation.

c. When the SELECTOR switch at Remote Control C–433/GRC is placed in the left-hand write-in position and the remote push-to-talk switch is depressed, the battery connection to the telephone line is made so that the potential applied to relay N/O–2 causes contacts 6 and 4 to close in the Set 1 control line. Relay N/O–1 also is energized and its contacts operate as follows: Contacts 6 and 4 open to break the ground connection for winding 7–9 of transformer N/T–1; this prevents the sidetone output of the receiver-transmitter from feeding back to the remote unit. Contacts 6 and 7 close to complete the ground return for the Set 1 control line; contacts 5 and 8 close to complete the a-f ground return for the Set 1 microphone line. When the remote operator talks into the microphone, the voice signals are coupled to the Set 1 microphone circuit.

Note. If the telephone line connections are reversed at either unit, the functions of the left-hand and right-hand write-in positions will be reversed. Operation is otherwise the same.

74. Scope

The discussion of unit theory is limited to block diagram analyses of the major units. Although the maintenance information included in this manual is at an organizational level only, familiarity with the block diagrams of the units should be helpful in trouble shooting. A knowledge of which tubes are receiving tubes and which tubes are transmitting tubes, for example, will aid in the replacement of parts for which the operator has running spares. The block diagrams are shown in figures 36 and 37. Complete schematic diagrams for all units also are included (figs. 59 through 68) as additional information for maintenance personnel.

75. Power Supply

(fig. 36)

a. Figure 36 is a functional block diagram of Power Supply PP–109/GR or Power Supply PP–112/GR. It shows the three high-voltage circuits and the three low-voltage circuits supplied from the storage battery input terminals. The high-voltage circuits are used to provide the plate, screen, and bias voltages for the receiver and the transmitter circuits in Receiver-Transmitters RT–66/GRC, RT–67/GRC, or RT–68/GRC. The low-voltage circuits supply the receiver-transmitter filament and relay potentials.

b. The 85-volt circuit (E–3 and T–3) is energized whenever OPERATE switch S–1 is in either the RECEIVE or TRANS & RECEIVE position. The other two high-voltage circuits, E–2 and T–2, E–1 and T–1, and the transmitter filament supply circuit are energized when switch S–1 is in the TRANS & RECEIVE position and relay O–1 is energized. E–1 and T–1 are controlled also by TRANS POWER switch S–2, which must be in the HIGH position for E–1 and T–1 to operate.

c. The low-voltage circuits include: the receiver filament supply circuit with output at terminal L of J–2; the transmitter filament supply circuit with output at terminal N of J–2; and the relay supply circuit with output at terminal A of J–2.

d. Each of the high-voltage and low-voltage circuits is equipped with r-f noise suppression filters in both the input and output leads and l-f (low-frequency) ripple filters in the output of each circuit.

e. TRANS POWER switch S–2 consists of two sections, both of which are used in the high-voltage circuit. One section of S–2 is used to provide full or reduced voltages as required for HIGH or LOW power operation, respectively. The other section of S–2 opens the input to the transmitter high-voltage and bias supply circuits when the TRANS POWER switch is in the LOW position.

76. Transmitting Circuits

(fig. 37)

The block diagram shown in figure 37 pertains equally to Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. The transmitter circuits include a microphone input transformer, a reactance modulator (V–105 and V–106), a transmitter oscillator (V–104A), the common crystal oscillator-harmonic generator (V–3 and V–4) and the transmitter harmonic amplifier (V–5), a mixer stage (V–6), an r-f stage (V–7 and V–8 in parallel), a driver stage (V–9 and V–10 in parallel), the power amplifier stage (V–11), the transmitter antenna circuit, and the common receiver-transmitter antenna.

a. Transmitter Signal Path. Voice signals from an external source are applied through a microphone transformer to the input of the transmitter reactance modulator. Under control of the audio signals, the reactance modulator causes the frequency generated by the transmitter oscillator (section A of V–104) to vary up or down in accordance with the amplitude and frequency of audio signals. Modulation is represented by a shift in the frequency generated by the transmitter oscillator, and ultimately by a corresponding shift of the over-all carrier frequency. The output of oscillator V–104A and the output of harmonic amplifier V–5, are combined in the transmitter mixer stage V–6. A tuned circuit, using one section of tuning capacitor C–1, selects the desired sum frequency at the output of the transmitter mixer and applies it to the transmitter r-f amplifier stage, V–7 and V–8. The output of this stage is tuned to resonance at the carrier frequency by capacitor C–1. Further amplification is provided by transmitter driver stages V–9 and V–10, using a section of the r-f tuning capacitor C–1, and by the transmitter power amplifier stage, V–11. The amplified output then is routed through a tuned circuit to the antenna. The output circuit of the power amplifier uses a section of the main tuning

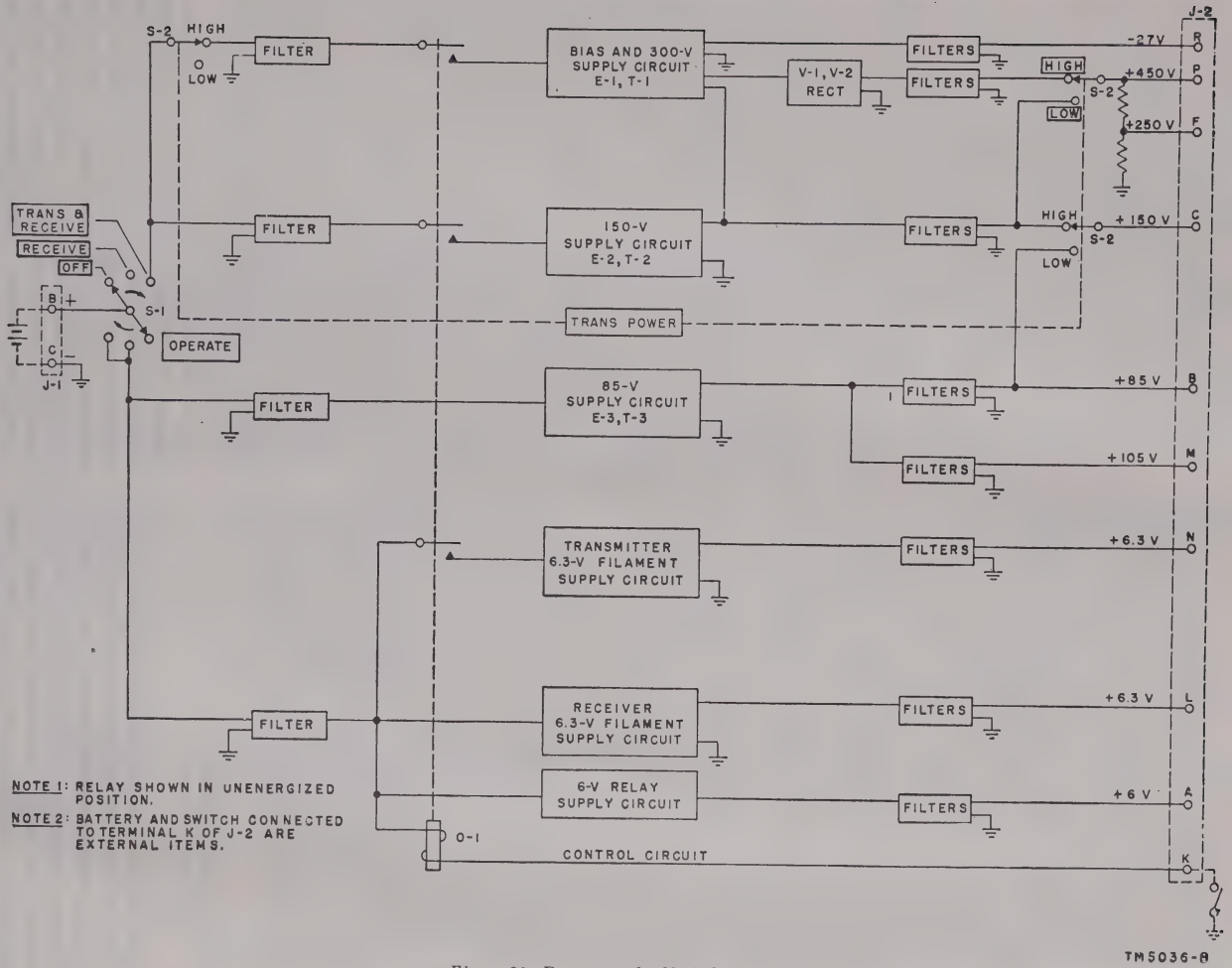


Figure 36. Power supply, block diagram.

capacitor C–1, while the antenna circuit is tuned to resonance by the TR ANT TUNE control capacitor.

b. Automatic Frequency Control. The purpose of the afc (automatic frequency control) circuit is to maintain a constant transmitter-oscillator carrier frequency. The output of the transmitter-oscillator, V–104A, is picked up by the variable i-f stages in the receiver through stray coupling and fed to the rest of the receiver circuit. If the difference between the receiver-oscillator frequency (used as the standard) and the transmitter-oscillator frequency varies from the fixed i-f frequency, a voltage is developed in the discriminator circuit. This voltage is used as the afc voltage and is fed to the transmitter reactance tubes, V–105 and V–106. The transmitter reactance stage then corrects the transmitter-oscillator frequency. The time constant of the afc coupling circuit from the discriminator is such that normal modulation of the i. f. does not appear in the afc voltage.

c. Sidetone. Sidetone voltage is obtained from the transmitter-oscillator, V–104A. This voltage is picked up by the variable i-f stages through stray coupling and is fed through the rest of the receiver circuit to the AUDIO output connector and fixed-level audio terminals.

d. Ringer Circuit. A ringer circuit associated with the transmitter is energized when the DIAL LIGHT (OFF-ON)-RING switch is in the RING position. This switch has the same function for the ringing circuit as the push-to-talk button of the microphone has for the transmitter, since it causes the control relays to be energized when it is in the RING position. In addition, it applies power to the 1,600-cycle ringer oscillator, section B of tube V–104. The output of the ringer oscillator is applied to the microphone transformer. Signal transmission is accomplished as described in subparagraph a above for any other audio signal.

77. Receiving Circuits

(fig. 37)

The receiver is of the double-conversion superheterodyne type, arranged to receive f-m signals. The term *double conversion* means that the incoming carrier signal beats with one local oscillator frequency to produce a first i. f. (between 4.45 and 5.45 mc); this frequency in turn beats with another oscillator frequency to produce a second i. f. (in this case 1.4 mc). The discriminator demodulates the second i-f signal, and the a-f section of the receiver amplifies the audio output of the discriminator. The amplified output is supplied to headphones or loudspeaker.

a. Input Circuit. When the control relays are in the normal or unenergized position, the antenna is connected to the receiver circuits. Carrier signals from the antenna are developed in the antenna circuit, which is tuned by a section of the receiver-transmitter r-f tuning capacitor, C–1. The signals selected are applied to the r-f amplifier stage, V–1, the output of which is tuned by a section of the receiver-transmitter r-f tuning capacitor, C–1. The amplified output of this stage is routed to the receiver first mixer stage. When the SQUELCH control is turned clockwise from the OFF position, the gain of the r-f amplifier stage is controlled by the squelch circuit.

b. First Mixer Stage V–2. This stage combines the output of the harmonic amplifier, V–4, with the amplified output of the first r-f amplifier stage, V–1, to produce the first i. f. in the range of 4.45 to 5.45 mc. The frequency produced depends on the setting the the TENTH MCS control. The crystal oscillator-harmonic generator and first harmonic amplifier serve both the transmitter and the receiver. Since the output frequency of the first harmonic amplifier is below the frequency to which the receiver-transmitter is tuned (between 4.45 and 5.45 mc, depending on the setting of the tuning controls), the first i. f. band resulting from the mixing of the incoming signal with the output of the frequency harmonic amplifier is a band centered about the difference frequency. The plate circuit of mixer stage V–2, located on the r-f chassis, is tuned by a section of the variable i. f. tuning capacitor, C–101.

c. Amplification of First I-F Signal. The difference frequency band at the output of the mixer stage, V–2, is amplified in a two-stage tuned variable i-f amplifier, V–107 and V–108. The variable i-f amplifier stages are tuned by sections of the variable tuning capacitor, C–101.

d. Receiver-Oscillator V–101. The free-running, self-excited oscillator, V–101, generates a frequency between 3.05 and 4.05 mc, depending on the setting of a section of the variable i-f tuning capacitor, C–101. The frequency to which the oscillator is tuned is always 1.4 mc below the frequency to which the variable i-f amplifier is tuned. Thus, if the variable i-f amplifier is tuned to 5 mc, the receiver-oscillator is tuned to 5 minus 1.4, or 3.6 mc.

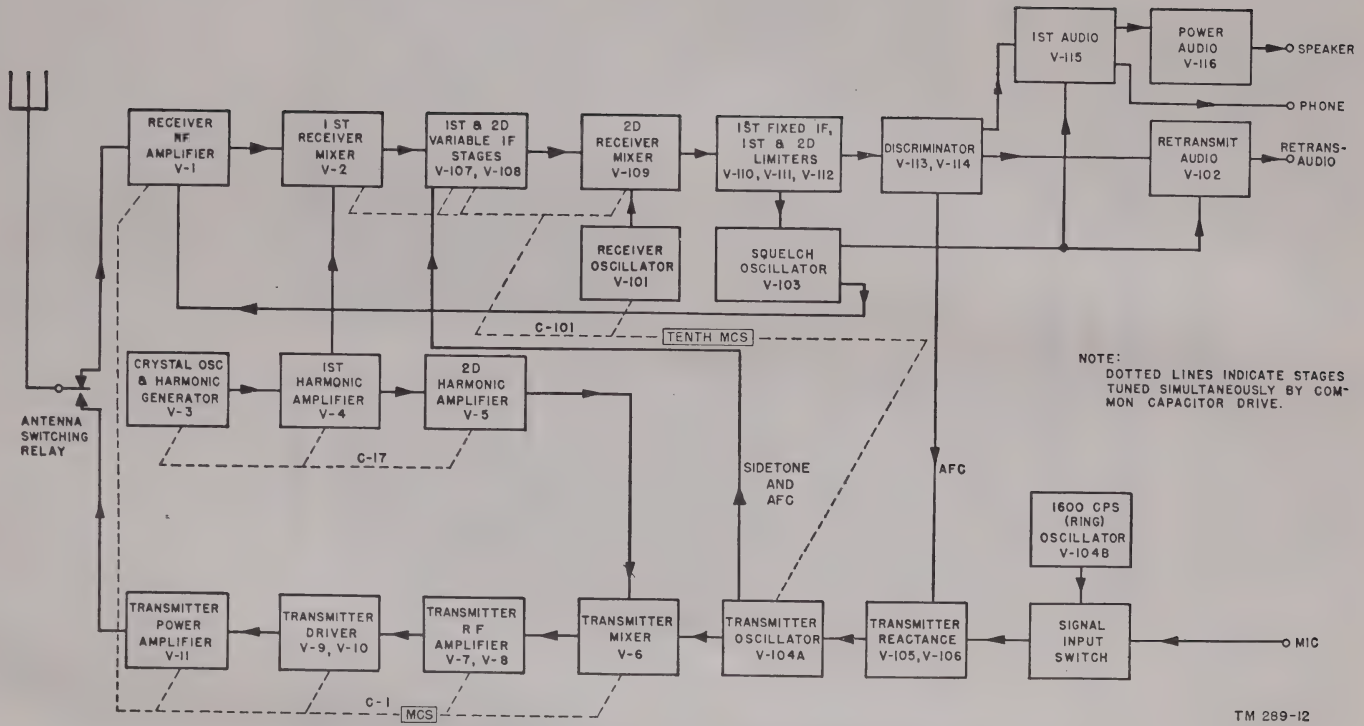


Figure 37. Receiver-transmitter, block diagram.

e. Receiver Second Mixer V–109. The output of the variable i-f amplifier (a frequency between 4.45 and 5.45 mc), together with the output of receiver-oscillator V–101, is combined in the receiver second mixer, V–109. The frequency generated by the oscillator subtracts from the first (variable) i-f signals to produce a second i. f. of 1.4 mc.

f. Fixed Second I-F Amplifier and Limiter. The i. f. of 1.4 mc again is amplified by a three-stage fixed-tuned amplifier. The first stage, V–110, is a conventional i-f amplifier; the second and third stages, V–111 and V–112, are designed to function as limiters to eliminate any amplitude variations of the signal. Such amplitude variations represent noise and are undesirable. Proper functioning of the discriminator, which follows the second limiter, requires that the level of the applied signal be fairly uniform for variations in the level of the incoming signal. A portion of the output of the first limiter is fed to the squelch circuit to provide silencing action.

g. Discriminator. The output of the final limiter stage, V–112, is applied to the discriminator V–113 and V–114. This discriminator is a tuned circuit using two type 1A3 diode tubes as rectifiers. The term discriminator is typical for f-m receivers and signifies a circuit which corresponds to the detector in a-m (amplitude-modulated) receivers. The discriminator performs a function analogous to that of the a-m detector since it extracts the intelligence or audio modulation from the incoming and carrier signal. Since, in frequency modulation, the intelligence to be *detected* appears as frequency variations (that is, shifts of the carrier from a center frequency) instead of amplitude variations, the discriminator is a frequency sensitive, but not an amplitude sensitive device. Thus, the discriminator converts the variations from the center frequency of the incoming signal into audio signals.

h. Audio Amplification. The a-f signals which appear at the output of the discriminator are amplified in two separate audio amplifier circuits.

(1) One circuit is a two-stage audio amplifier, V–115 and V–116, with gain adjustable by means of the panel-mounted VOLUME control. The output of the first stage, V–115, is connected to pin A of each of the AUDIO connectors and is used to provide enough volume to operate a headphone or the earpiece of a handset. The output of the final audio power amplifier stage, V–116, is connected to pin L of each of the AUDIO connectors and has sufficient output to drive a loud-speaker.

(2) The other circuit, a one-stage amplifier, V–102, serves to provide an audio output signal for monitoring and retransmission. (This circuit is not used in Radio Sets AN/VRC–8, –9, and –10.) No panel adjustment of volume is provided. However, an internal potentiometer provides screw-driver adjustment of the gain of the amplifier to obtain the required level. The output of this stage is connected to pin B of the REC-TR CONTROL connector (J–312 on figs. 66, 67, or 68).

i. Squelch Oscillator V–103. A characteristic of very sensitive receivers is that, in the absence of signals, a rushing noise is heard in the receiver, phones, or loud-speaker. The noise is the result of thermal agitation in the vacuum tubes and receiver components and of external electrical disturbances. A squelch circuit is used to suppress this noise during no-signal intervals. The squelch circuit consists of a carrier-switched oscillator and a diode rectifier, V–103. Squelch action is adjustable by means of the panel-mounted SQUELCH control. The squelch circuit can be disabled for test purposes or for reception of very weak or fading signals by turning the squelch control to the OFF position.

CHAPTER 5

ORGANIZATIONAL MAINTENANCE

Section I. TROUBLE SHOOTING

78. Scope

Trouble shooting at an organizational level is limited to the sectionalizing of troubles to defective units which must be replaced as a unit, or to the localization of defective parts for which running spares are available. An equipment performance checklist (par. 79) is included primarily as a sectionalization aid; localizing procedures for the various units are outlined in paragraphs 80 through 85.

79. Equipment Performance Checklist

a. PURPOSE. The equipment performance checklist provides a detailed logical procedure for checking the operation of the radio sets. It should be practiced after the initial installation of the equipment, before the equipment is placed in service, periodically thereafter, and as an aid in trouble shooting.

b. USE OF THE CHECKLIST FOR TROUBLE SHOOTING.

(1) The checklist is arranged in the same sequence the operator would follow when initially applying power to the equipment. The simplest procedure when using the checklist is to perform the various items on the list in sequence until an abnormal indication is observed. When the operator has become familiar with the operation of the equipment, he can adapt the list to his own advantage, omitting those steps which do not pertain to the particular unit he wishes to check.

(2) The first five columns of the checklist are self-explanatory, listing the items to be checked, the units which are involved, the action to take, and the normal indication to be expected. When an abnormal indication is obtained, the operator is referred (in the sixth column) to the paragraph or paragraphs which outline localizing procedures for particular units.

Table III. Equipment Performance Checklist

Item No.	Unit	Item	Action or condition	Normal indication	Possible defective units
1	Mounting	Cabling	All connections properly made (fig. 24).		
2	Power supply	OPERATE switch	Set at OFF		
3	Power supply	TRANSPOWER switch	Set at HIGH		
4	Receiver-transmitter	SQUELCH control	Turn completely clockwise for maximum squelch operation.		
5	Receiver-transmitter	DIAL LIGHT (OFF-ON) RING switch.	Set at DIAL LIGHT ON		
6	Receiver-transmitter	METER selector switch	Set at 90V		
7	Receiver-transmitter	VOLUME control	Turn completely clockwise for maximum volume.		
8	Control boxes	RADIO TRANS switch	Lock in RADIO TRANS position at each unit.		
9	Control boxes	SELECTOR switch	Turn to counterclockwise position at each unit.		
10	Control boxes	VOL. control	Turn to approximate midpoint of range at each unit.		
11	Control box	Chest set and headset microphone.	Connect chest set to audio connector at one of the control boxes; plug headset microphone into chest set. Lock RADIO-INT switch in RADIO position.		
12	Power supply	OPERATE switch	Place at RECEIVE and TRANS & RECEIVE in turn, and check for a normal indication at each position.	Lamp on receiver-transmitter panel glows. Meter on receiver-transmitter panel reads approximately center-scale (in shaded area).	Mounting (par. 83), power supply (par. 82), or receiver-transmitter (par. 82).
13	Receiver-transmitter	METER selector switch	Turn successively to positions 7 through 11.	Meter on panel reads approximately center scale.	Receiver-transmitter (par. 82).
14	Receiver-transmitter	SQUELCH control	Turn counterclockwise. Adjust VOL control on control box for comfortable noise level. If signal is received, tune to an open channel (par. 46).	Rushing noise is heard in headset.	Mounting (par. 83), receiver-transmitter (par. 82), cables (par. 81) or control box (par. 84).
15	Receiver-transmitter	SQUELCH control	Turn clockwise until receiver just squelches.	No output in headset	Receiver-transmitter squelch circuit.
16	Receiver-transmitter	Tuning controls	Tune in signal (par. 46). When normal indication is obtained, tune to an open channel.	Signal heard in headset	Receiver-transmitter squelch circuit or faulty alinement.

17	Chest set	Push-to-talk switch	Press and hold (or lock) for items 18, 19, 20, and 21. (To avoid excessive heat in the power supply or receiver-transmitter, release the switch between tests.)		
18	Receiv r-transmitter	METER selector switch	Turn successively to positions 2 through 6.	Meter on receiver-transmitter panel reads approximately center scale.	Receiver-transmitter (par. 82), power supply (par. 82), mounting (par. 83), control box (par. 84), or cables (par. 81).
19	Receiver-transmitter	METER selector switch	Turn to RF position	Meter shows some deflection	Receiver-transmitter (par. 82).
20	Power supply	TRANS POWER switch	Turn to LOW position. (Return to HIGH after test.)	Meter deflection decreases but still indicates some output.	Receiver-transmitter (par. 82) or power supply (par. 82).
21	Chest set	Microphone	Talk into microphone. (Release push-to-talk switch after test.)	Meter on receiver-transmitter panel deflects and sidetone is heard in headset.	Receiver-transmitter (par. 82).
22	Receiver-transmitter	DIAL LIGHT (OFF-ON)-RING switch.	Hold at RING position	Ringing signal is heard in headset. Meter deflects.	Receiver-transmitter (par. 82).
23	Chest set (with headset and microphone).	Connect in turn to each AUDIO connector at each control box.	Press push-to-talk switch and repeat step 21 for each location of the chest set. Leave chest set connected at final unit.	Output heard in headset	Control box (par. 84), mounting (par. 83), or cables (par. 81).
24	Control Group AN/GRA–6.	Local Control C–434/GRC, Remote Control C-433/GRC, and Handset H-33/PT.	Connect as outlined in paragraph 34. Turn REMOTE switch to TEL ONLY and SELECTOR switch to TEL.		
25	Chest set (with headset and microphone).		Connect to local unit. Lock RADIO-INT switch in RADIO position.		
26	Local Control C–434/GRC.	Ringing generator	Crank generator	Ringing signal should be heard, or CALL LIGHT should glow at remote control unit.	Local control unit (par. 85), remote control unit (par. 85), or telephone line.
27	Handset at Remote Control C-433/GRC.	Push-to-talk switch	Press switch, talk into mouthpiece, and acknowledge call.	Full duplex conversation possible between local and remote units.	Local or remote control unit (par. 85).
28	Remote control unit	Ringing generator	Crank generator	Ringing signal should be heard or CALL LIGHT should glow at local control unit.	Local or remote control unit (par. 85).

Table III. Equipment Performance Checklist—Continued

Item No.	Unit	Item	Action or condition	Normal indication	Possible defective units
29	Local and remote control units.	Ringing generator	Repeat steps 26 and 28 with the internal LAMP-BELL switches set in their alternate positions.	Ringing signals should be heard or CALL LIGHT should glow.	Local or remote control unit (par.85).
30	Local Control C-434/GRC.	LOCAL switch	Turn to SET 1. Press push-to-talk switches and talk into microphone. Release switch to TEL when finished.	Sidetone should be heard at chest set on local unit.	Local control (par. 85) or cabling (par. 81).
31	Local Control C-434/GRC.	REMOTE switch	Turn to SET 1 & 2 or SET 1 position.		
32	Remote Control C-433/GRC.	SELECTOR switch and handset.	Turn to left-hand write-in position, press push-to-talk switch, and talk into mouthpiece.	Sidetone heard at both chest set and handset.	Local or remote control (par. 85).
33	Power supply	OPERATE switch	Turn to OFF.		

80. Localizing Procedures

a. The following paragraphs include localizing procedures designed to isolate troubles to a particular unit, or to a particular part for which a running spare is available. These are the paragraphs which are referred to in the equipment performance checklist (par. 79); they are best used in conjunction with the checklist but can be used individually.

b. Whenever the procedure calls for checking a part, substitute an identical part which is known to be good for the part being checked. If no part is available for such use, a visual and/or continuity check may disclose the trouble. Paragraphs 86 through 90 outline procedures for replacing parts.

81. Cables

When normal indications are obtained at a panel AUDIO connector, but not at a control box, the trouble may be caused by a poor cable connection or an open lead within a cable. Continuity checks must be made to determine such faults. In some instances, the cables are terminated by solder connections on a terminal board within the mounting, control box, or intermediate junction boxes. To obtain access to these points it will be necessary to open the unit involved. Figures 16, 24, and 18 show an internal view of the junction box on the mounting, the system cordage diagram, and the mounting-control box interconnection, respectively. The interior of the interphone box is shown in figure 20. The above mentioned illustrations and the unit schematic diagrams should be used when making continuity checks.

82. Receiver-Transmitter and Power Supply

a. Equipment Set-Up. Operational checks of the receiver-transmitter and the power supply are best performed at the panels of the units. Set up the equipment as follows:

(1) Turn the OPERATE switch to OFF.

(2) Disconnect the REC-TR CONTROL cable from the panel of the receiver-transmitter. Connect terminals H and J of the receptacle by means of the prefabricated plug-in jumper (provided with the Allen wrenches within the receiver-transmitter). (The jumper makes the system independent of control and B-plus interconnections normally made through the mounting. However, the power supply still is dependent upon the mounting for battery power.) When all checks have been completed, remove the jumper and replace the cable.

(3) Connect a handset or chest set (with headset and microphone) to one of the AUDIO connectors on the panel of the receiver-transmitter. If a chest set is used, lock the RADIO-INT switch in the RADIO position.

(4) Turn the OPERATE switch to TRANS & RECEIVE.

b. Lamp Check. If the dial LAMP on the receiver-transmitter does not light with the DIAL LIGHT (OFF-ON)-RING switch in the ON position, operation of the set will be abnormal because of incorrect filament voltages. Turn the switch to the DIAL LIGHT OFF position, and interpret the results as follows:

(1) If the operation is abnormal, the lamp is defective and must be replaced.

(2) If operation still is abnormal, check the filament circuits (par. *d* below and fig. 38).

c. Voltage Check. Turn the METER selector switch to the 90V position and check for a normal reading. If no reading is obtained, make the following checks:

(1) Check fuse F–2 in the power supply (par. 88).

(2) If the fuse is good, check vibrator E–3 and voltage regulator V–4 (fig. 39 and par. 88).

(3) If the above checks do not reveal a defective part, check the inter-unit cabling and wiring in the mounting.

d. Receiver-Transmitter Filament Check.

(1) The following chart lists the receiver-transmitter tubes checked for each position of the METER selector switch on the panel. A center-scale reading is the normal reading for all positions of the switch. If the normal reading is not obtained, the probable defective tube is listed under the type of reading obtained. To obtain a reading in positions 2 through 6 of the METER switch, the push-to-talk button must be pressed.

Filament trouble location chart

METER selector switch position	Zero reading	Too low but not zero reading	Too high but not full-scale reading	Full-scale reading
2	V–7	V–7	V–9	V–9.
3	V–8	V–8	V–10	V–10.
4	V–6			V–5.
5	V–106	V–106		V–104.
6	V–105			
7	V–116, V–114		V–113, V–3	V–3.
8	V–4		V–2	V–2.
9	V–102			V–107, V–103.
10	V–108, V–110		V–112	V–111, V–112.
11	V–115		V–109, V–101	V–109, V–101.

(2) The transmitter power amplifier tube, V–11, and the receiver first r-f amplifier tube, V–1, are not checked by the METER switch. These tubes must be checked by visual inspection. Observe whether (with power applied) the tube filaments are lit. The filament of V–11 is energized when the microphone push-to-talk button is operated.

(3) Because of the series-parallel arrangement of the tube filaments (fig. 38), a break in the filament of one tube in a series string of tubes will cause all the other tubes in the string to go out and will produce indications of a faulty stage involving those tubes.

(4) A high reading for all filaments on positions 7 through 11 may be due to a faulty V–1. A high reading on positions 2 through 6 may be due to a faulty V–11. A low reading for all tubes may be due to the operation of the overload relay in the power supply or trouble in the power supply itself. Turn the equipment off for a full minute to allow the thermal relay to cool, in case it has operated because of a momentary overload. If after turning on the equipment, a fault still is indicated, continue with the following checks. Check fuse F–1, thermal relay K–2, and ballast tubes R–31 and R–40 in the power supply if readings are low on positions 7 through 11. (Ballast tube R–40 is included only in Power Supply PP–112/GR.) If all the readings are very low or zero on positions 2 through 6, check fuse F–1, thermal relay K–1, and ballast tubes R–24, R–25, R–37, and R–38 in the power supply (figs. 39 and 40). (Ballast tubes R–37 and R–38 are included in Power Supply PP–112/GR only.)

e. Receiver Check. Turn the SQUELCH control counterclockwise and check for noise output in the earpiece of the handset. If no noise is heard, check tubes V–2 and V–107 through V–116 for filament continuity (par. *d* above). If the filaments are good, replace the tubes one at a time with identical type tubes which are known to be good until the defective tube is isolated.

f. Transmitter Output Check. Turn the METER switch to the RF position, press the push-to-talk switch on the handset, and talk into the mouthpiece. Interpret the indications as outlined below.

(1) If an abnormally low deflection is obtained on the meter, check the antenna tuning (par. 32). If it is impossible to obtain any output, and the tubes have been checked as outlined in the preceding subparagraphs, the trouble may be due to misalinement.

(2) If r-f output is obtained, sidetone should be audible in the earpiece. If no sidetone is heard, check tubes in the receiver section.

g. Ringing Check. Turn the DIAL LIGHT (OFF-ON)-RING switch to the RING position and check for r-f output on the meter and a ringing signal in the earpiece. If abnormal indications are obtained, check tube V–104 (fig. 44 and par. 89).

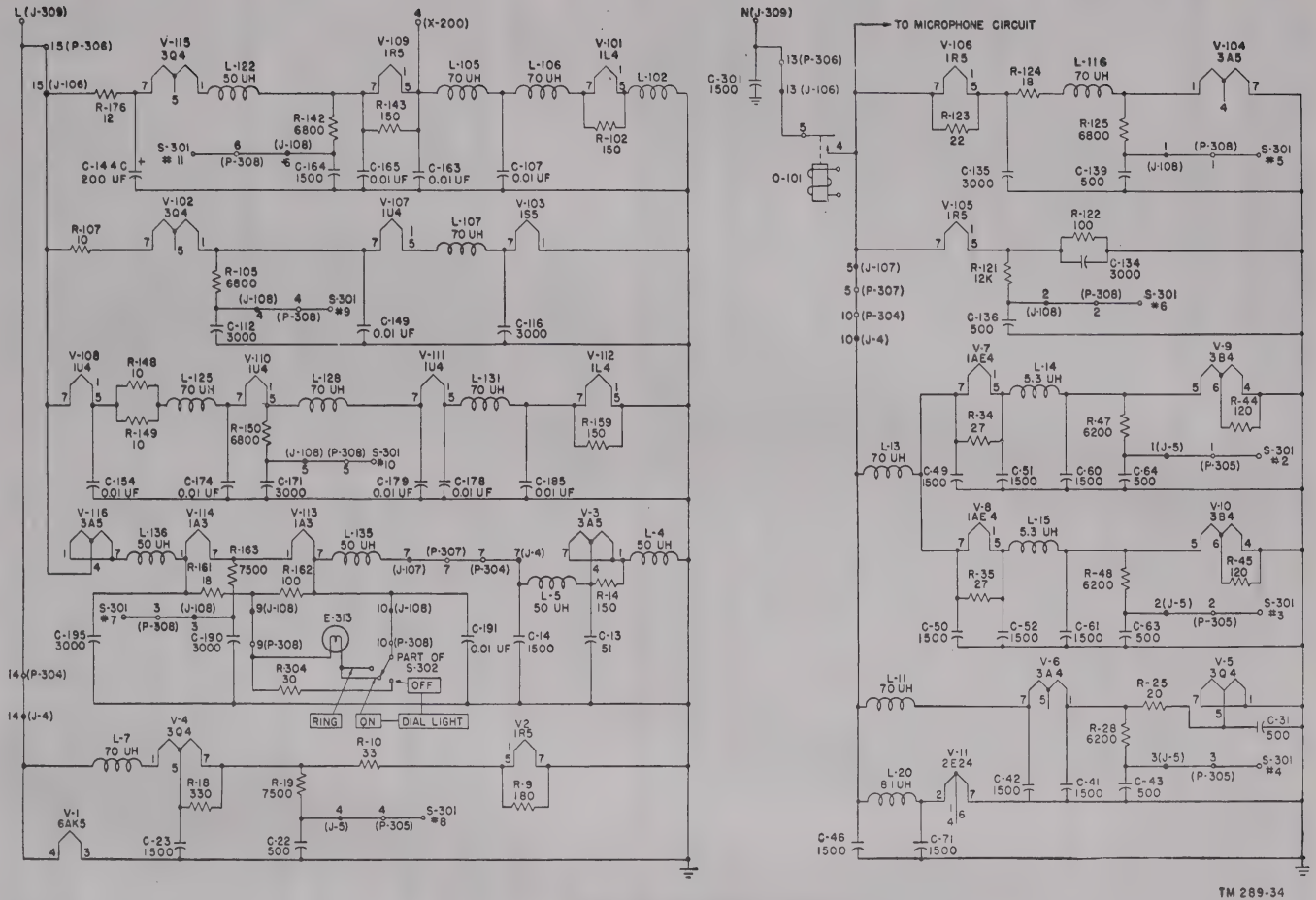


Figure 38. Filament circuit, schematic diagram.

83. Mounting

When normal indications are obtained in the component units, power is available to them. However, when the units do not have power, the trouble may be caused by faulty wiring in the mounting. Continuity checks of the mounting should reveal any troubles which might arise within the mounting. A schematic diagram of the mounting is shown in figure 62. Table IV lists continuity test points within the mounting. Resistance reading should be zero for all measurements.

Note. Battery connections should be removed when taking readings.

Table IV. Mounting Continuity Tests

Points of measurement	
From—	To—
K of P–1	1 of E–1.
D of P–1	4 of E–1, and ground.
C of P–1	5 of E–1.
F of P–1	8 of E–1.
A of P–1	8 of E–1.
B of P–1	12 of E–1.
E of P–1	14 of E–1.
H of P–1	15 of E–1.
J of P–1	16 of E–1.
15 of E–1	16 of E–1.
B of P–2	E–2.
C of P–2	E–3.
E–2	E–4 (+battery cable lug).
E–3	E–5 (−battery cable lug).

84. Control Box C-375/VRC

a. When normal indications are obtained at a panel AUDIO receptacle, but not at a control box, the trouble must be in cable interconnections or in the control box itself.

b. If none of the control boxes are operative for a particular function, the trouble is in either the mounting-control box interconnecting cable or in the internal wiring within the rack-mounted unit being checked.

c. If any one control box is operative and others are inoperative, the trouble is probably in cables which are used to connect the control boxes in parallel.

d. If trouble is isolated to a particular control box, continuity checks on the box should reveal the defect. Table V below lists the measurements which should be taken to check the continuity of all parts and wiring within the control box. A schematic diagram is shown in figure 59.

Table V. Continuity Measurements at Control Box C–375/VRC

Points of measurement	Position of RADIO TRANS switch S–2	Position of selector switch S–1	Resistance reading
Terminal 1 of E–2 to tips of jacks J–3 and J–4 and to F contact of connectors J–1 and J–2.	Center		Infinity.
	RADIO TRANS	Counterclockwise	0.
		Center	Infinity.
		Clockwise	Infinity.
Terminal 2 of E–2 to J contact of connectors J–1 and J–2.			0.
Terminal 2 of E–2 to tips of jacks J–3 and J–4 and to F contacts of connectors J–1 and J–2.	Center		0.
	RADIO TRANS	Counterclockwise	Infinity.
		Center	0.
		Clockwise	Infinity.
Terminal 3 of E–2 to tips of jacks J–3 and J–4 and to F contacts of connectors J–1 and J–2.	Center		Infinity.
	RADIO TRANS	Counterclockwise	Infinity.
		Center	Infinity.
		Clockwise	0.
Terminal 4 of E–2 to B, E, and H contacts of connectors J–1 and J–2.			0.
Terminal 5 of E–2 to rings of jacks J–3 and J–4 and to C contacts of connectors J–1 and J–2.	Center		Infinity.
	RADIO TRANS	Counterclockwise	0.
		Center	Infinity.
		Clockwise	Infinity.
Terminal 6 of E–2 to K contacts of connectors J–1 and J–2.			0.

Table V. Continuity Measurements at Control Box C–375/VRC—Continued

Points of measurement	Position of RADIO TRANS switch S–2	Position of selector switch S–1	Resistance reading
Terminal 6 of E–2 to rings of jacks J–3 and J–4 and to C contacts of connectors J–1 and J–2.	Center		0.
	RADIO TRANS	Counterclockwise	Infinity.
		Center	0.
		Clockwise	Infinity.
Terminal 7 of E–2 to rings of jacks J–3 and J–4 and to C contacts of connectors J–1 and J–2.	Center		Infinity.
	RADIO TRANS	Counterclockwise	Infinity.
		Center	Infinity.
		Clockwise	0.
Terminal 8 of E–2 to tips of jacks J–5 and J–6 and to A contacts of connectors J–1 and J–2.		Counterclockwise	0 to 10 k depending on position of VOL. controls R–1 and R–2.
Terminal 9 of E–2 to tips of jacks J–5 and J–6 and to A contacts of connectors J–1 and J–2.		Center	0 to 10 k depending on position of VOL. controls R–1 and R–2.
Terminal 10 of E–2 to tips of jacks J–5 and J–6 and to A contacts of connectors J–1 and J–2.		Clockwise	0 to 10 k depending on position of VOL. controls R–1 and R–2.
Terminals 11 and 12 of E–2 to chassis			Infinity.
Terminal 13 of E–2 to terminals 14 and 15 of E–2.			0.

85. CONTROL GROUP AN/GRA–6.

To check the operation of Local Control C–434/GRC and Remote Control C–433/GRC, perform the applicable items of the equipment performance checklist (par. 79), and check for normal indications as listed. If abnormal indications are obtained, refer to the schematic diagrams (figs. 60 and 61), and make continuity checks of the units.

Section II. REPLACEMENT OF PARTS

86. General

The following paragraphs list procedures for the replacement of parts for which running spares are provided. Running spares for each unit are listed in paragraph 17. The procedures described will be necessary as a result of sectionalizing trouble in a particular unit and as an aid to localizing trouble in a particular component part.

Note. No lubrication is required for Radio Sets AN/VRC–8, –9, and –10.

87. Removing Immersionproof Cases

Replacement of pluck-out parts (excepting fuses) necessitates the removal of the immersionproof cases which house the panel-chassis assemblies of the various units. To remove the case of the receiver-transmitter or the power supply, perform the following steps:

a. Remove all the external connections from the unit involved.

b. Remove the unit from the mounting.

c. Loosen the Dzus fasteners located at the edges of the unit.

d. Slide the panel-chassis assembly out of the case. Take care not to damage any wiring or components while removing and handling the panel-chassis assembly.

88. Power Supply

The replacement of pluck-out parts for which spares are available is described in the following subparagraphs.

a. Fuses. The panel-mounted fuses may be removed by unscrewing the fuse caps which also serve as fuse extractors. Spare fuses are provided in the front-panel compartment marked SPARE FUSES. To gain access to the fuses, loosen the fasteners which hold the cover plate of the compartment, and remove the plate.

b. Thermal Relays and Ballast Tubes. To gain access to the thermal relays and ballast tubes, it is necessary to remove the panel-chassis

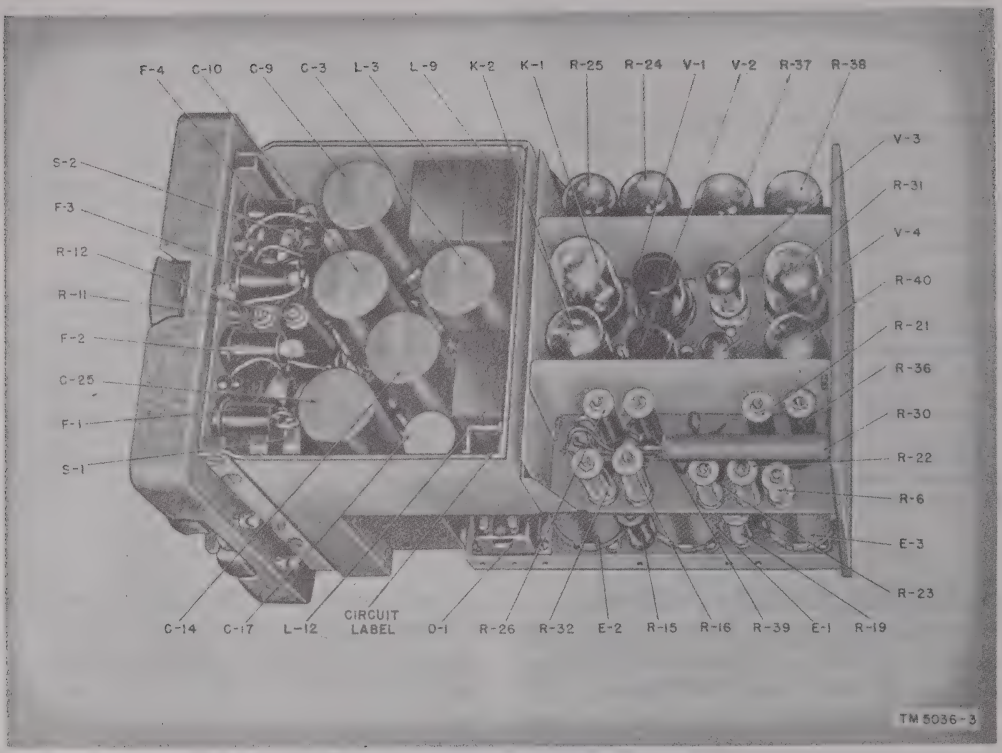


Figure 39. Power Supply PP–112/GR, top view of chassis.

assembly from the case (par. 87). All of these parts are accessible from the top of the chassis (figs. 39 and 40). Remove the relays or ballast tubes, in the same manner as any standard octal-base tube, by a straight upward pull. Do not rock or jiggle the components in their sockets. (Note that similarly designated parts are located differently in the 12- and 24-volt supplies.)

c. Tubes. The four power supply tubes also are accessible from the top of the chassis. To remove V–1 and V–2, pull the tube straight upward. To remove V–3 or V–4, use a tube puller. Do not rock or jiggle the tubes in their sockets as the socket prongs and tubes may be damaged.

d. Vibrators. The three vibrators (E–1, E–2, and E–3) are located on the right-hand side of the power supply chassis (fig. 41). To remove a vibrator, pull straight upward without jiggling. If necessary, use a small screw driver to pry the vibrator out of its socket, but take care not to spread the ring clip at the base of the vibrator.

89. Receiver-Transmitter

The tubes, which are the only replaceable parts in the receiver-transmitter, are mounted on the vertical r-f and i-f chassis (fig. 42). To gain access to the tubes, the panel-chassis assembly must be removed from the case (par. 87).

a. Tubes V–1 through V–11 are mounted on the r-f chassis (figs. 42 and 43). Tubes V–101 through V–116 are mounted on the i-f chassis (fig. 44). With the exception of V–11, each of these tubes may be removed with a tube puller after the shield is removed.

b. Before removing V-11, it is necessary to disconnect the plate cap at the top of the tube. When the top is disconnected, the tube can be

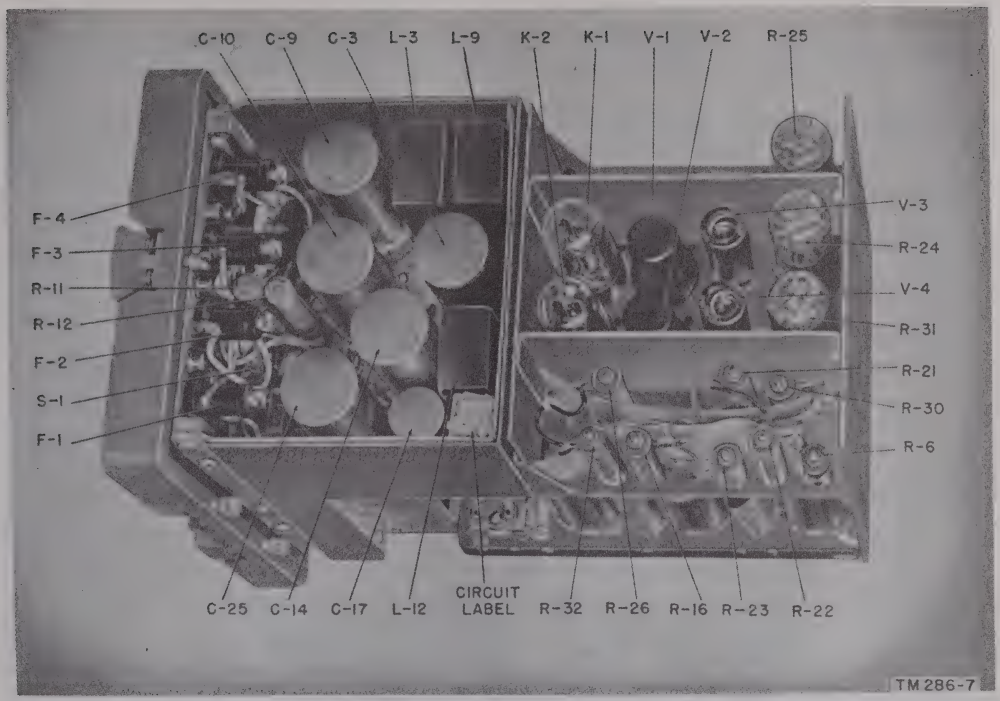


Figure 40. Power Supply PP–109/GR, top view of chassis.

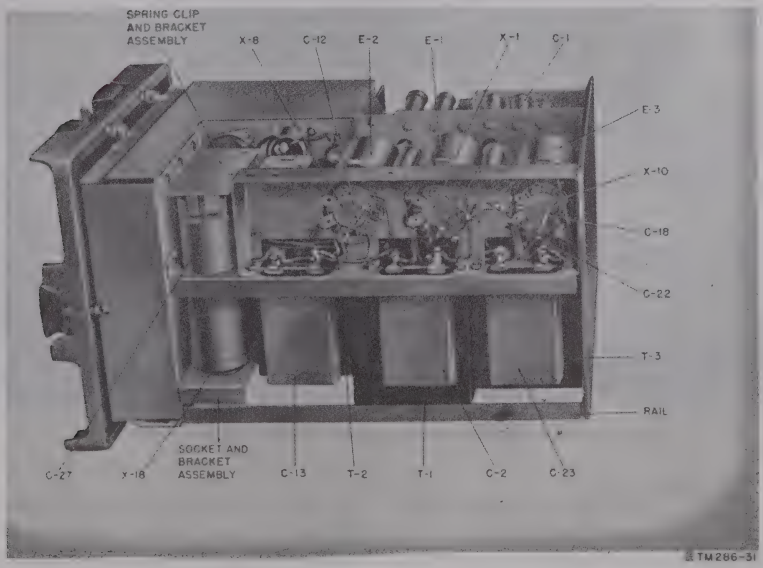


Figure 41. Power Supply PP–112/GR, bottom view of chassis.

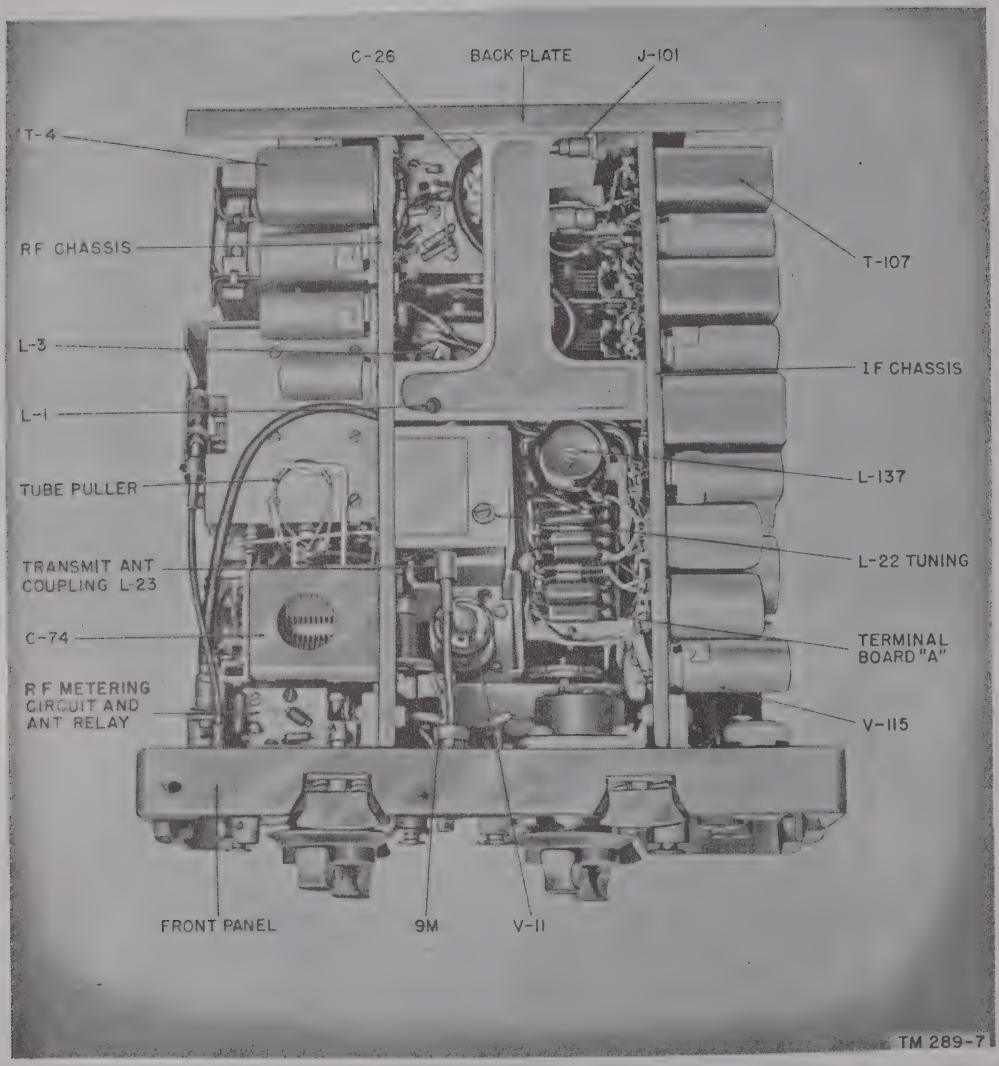


Figure 42. Receiver-transmitter, top view of panel-chassis assembly

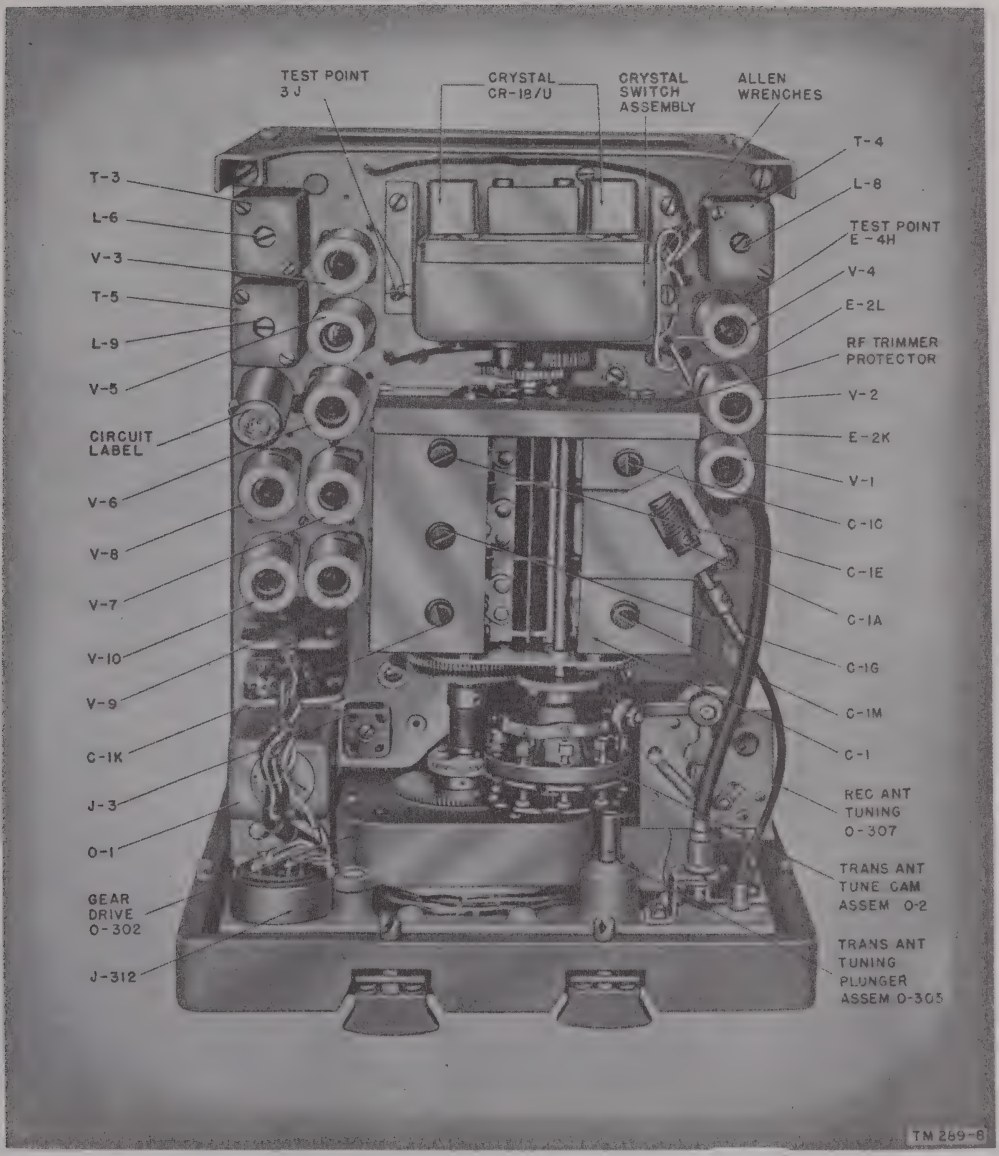


Figure 43. Receiver-transmitter, view of r-f chassis.

removed by a straight upward pull. Do not rock or jiggle the tube in its socket since the socket and tubes may be damaged through careless handling.

90. Control Group AN/GRA-6

The lamps are the only pluck-out parts in either the local or remote control for which running spares are supplied. The lamps are accessible

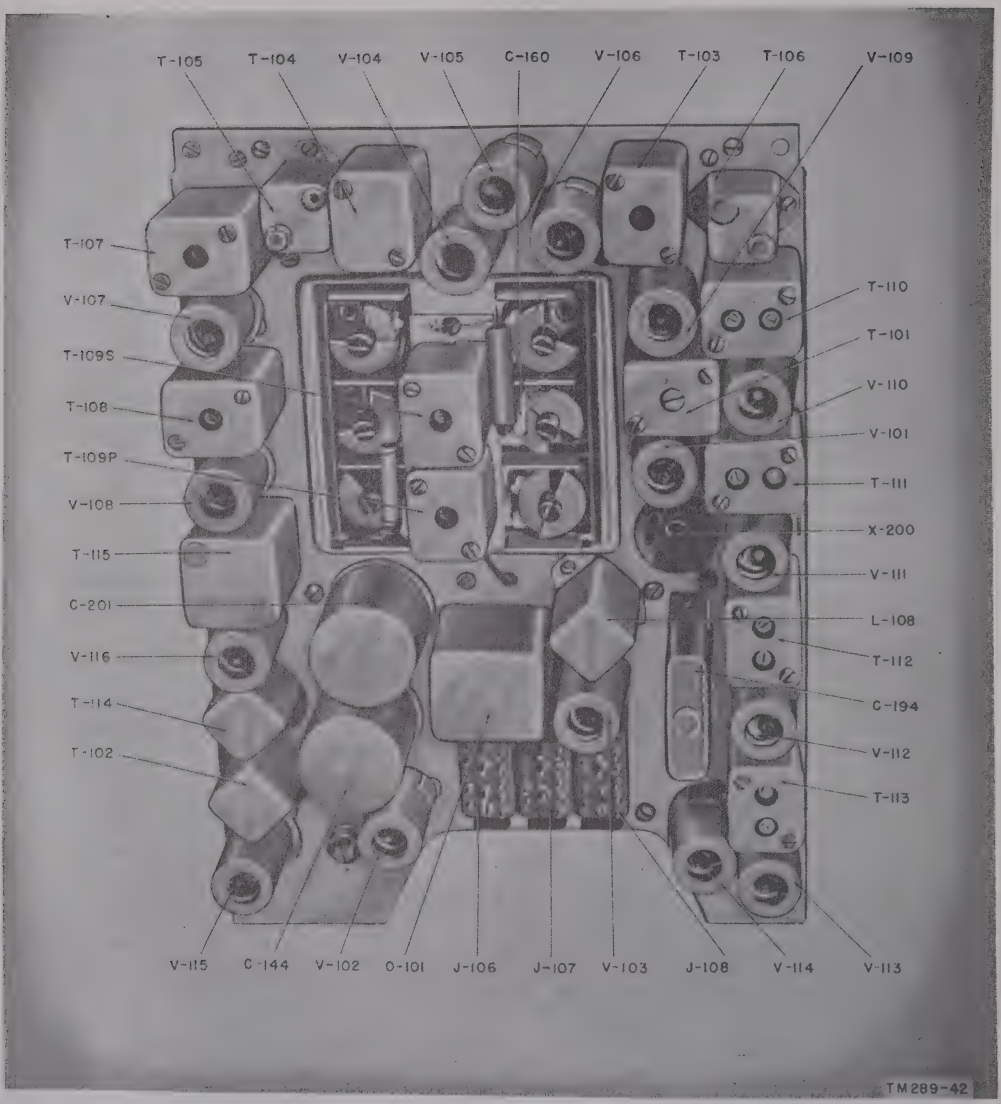


Figure 44. Receiver-transmitter, view of i-f chassis.

from the rear of the front panels after the panel-chassis assemblies have been removed from the cases.

a. To gain access to the lamp in the local control, unscrew the two wing-nut fasteners at the edge of the front panel and slide the unit out of its case. Slide the lamp socket (with lamp) out of the bakelite sleeve (fig. 26). The lamp then may be replaced.

b. To gain access to the lamps in the remote control, loosen the spring clips which secure the panel-chassis assembly in the case. Slide the unit out of its case, and replace the lamp as in paragraph *a* above (fig. 28).

CHAPTER 6

AUXILIARY EQUIPMENT

Section I. MODIFICATION KIT MX–898/GR

91. General

Auxiliary equipment is equipment which is not supplied as a part of the basic radio set (par. 6), but which extends the application of the radio set in some manner. The auxiliary equipment described in this chapter is Modification Kit MX–898/GR. For procurement information, refer to the Army Supply Catalog for Modification Kit MX–898/GR.

92. Purpose and Use

The modification kit is used to provide temporary field operation of the individual receiver-transmitter when it is removed from a vehicle in a temporary fixed location, or when vehicular power is not available. If the modification kit is used in conjunction with Control Group AN/GRA–6 to operate the receiver-transmitter, remote and local operation of the receiver-transmitter is possible in a field installation.

93. Components

The components of Modification Kit MX–898 are listed and briefly described in the following paragraphs.

a. Generator G–8/GRC (fig. 45). Generator G-8/GRC is a hand-operated power source. It is a three-commutator generator with an actuating geartrain, radio-noise filter, and voltage regulator. These components are shock-mounted inside a waterproof, cast-magnesium case. The outside of the case contains apertures for the operating cranks, the power connector, and the straps necessary for attachment of the mounting legs. The generator can supply all the voltages required for the operation of the radio receiver and/or transmitter. The output voltage of the high-voltage section is not as high as that delivered when using a vehicular power supply because the generator would be too difficult to crank. However, the output from the transmitter, when the hand generator is used, is only slightly less than when using other power sources. The generator is intended to be used for portable ground stations and not for mobile operation. A single operator seated on the seat leg operates the generator by turning the cranks at the required speed. When cranked between 50 and 70 rpm, the generator is capable of delivering an output of approximately 85-watts at the voltages required for normal receiver and transmitter operation. The generator should not be operated unless properly connected to the receiver-transmitter. This connection is made either directly or through the battery box (fig. 55). Detailed information on the generator is published in a separate manual.

b. Case CY–590/GR (fig. 46).

(1) The battery box (when used) is connected to the receiver-transmitter. It supplies sufficient power to operate the receiver section without additional power. When the hand generator is connected to it, the generator supplies the additional power needed for transmission.

(2) Case CY–590/GR is a battery box which holds five series-connected 1.5-volt Batteries BA–403/U and one 90-volt Battery BA–419/U.

(3) Two receptacles and a switch are mounted on the front panel of the battery case (fig. 46). The receptacles are used for interconnecting the battery case with the receiver-transmitter and the hand generator. The switch is used to complete or break the battery circuits to the receiver-transmitter. The REMOTE position of the switch is not used with Radio Sets AN/VRC–8 through –10.



Figure 45. Generator G–8/GRC.

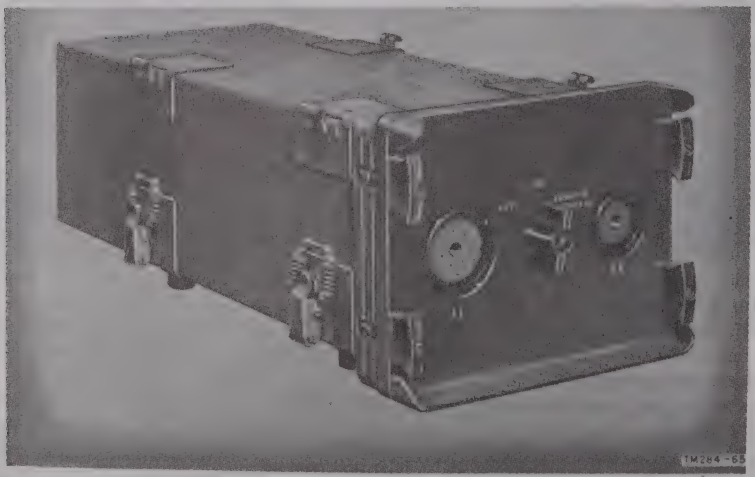


Figure 46. Case CY–590/GRC, front view.

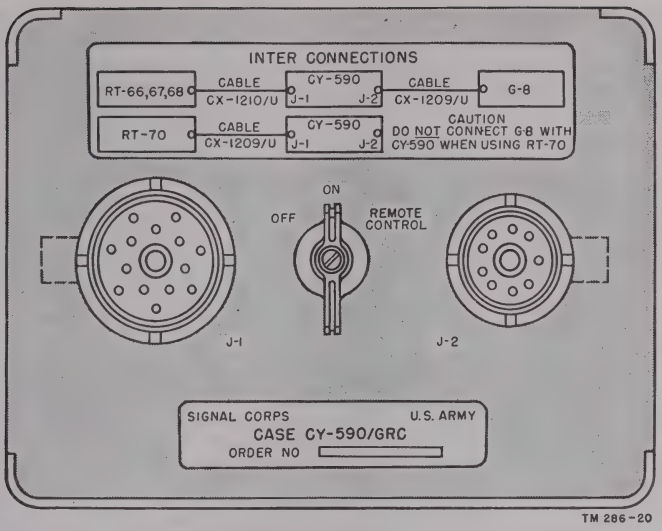


Figure 47. Case CY–590/GRC, front panel.

c. Mast Sections AB–22/GR, AB–23/GR, and AB–24/GR. These sections, in various combinations (depending upon the radio set being used), fit into Mounting MT–652/GR to provide an antenna for field operation. The sections are made of chrome-molybdenum steel tubes and are copper plated. A lusterless olive drab enamel covers all the sections. Each section is approximately 23 inches long, and can fit into any of the other sections.

d. Power Cable Assembly CX–1209/U. This power cable is supplied with the modification kit to connect the hand generator to the battery box when these two units are used (fig. 50).

e. Power Cable Assembly CX–1210/U. This power cable is supplied with the modification kit to connect the battery box to the receiver-transmitter. When the battery box is not used, Power Cable Assembly CX–1210/U connects the hand generator to the receiver-transmitter directly (figs. 50 and 52).

f. Mounting MT–652/GR. Mounting MT–652/GR (figs. 50 or 52) is used to hold the antenna masts used in field installations. The overhanging flange of the receiver-transmitter front panel has a boss which will accept the base of Mounting MT–652/GR. When the mounting is secured, the mast sections supplied with the modification kit (par. *c* above) can be locked into the mounting with a 90°-turn. A rubber-covered lead-in wire, which is part of the mounting, is used to connect the antenna to the ANT post on the receiver-transmitter (fig. 50).

g. Handset H–33/PT. This handset is included in the modification kit to be used as the audio device for the receiver-transmitter. The cord is permanently attached to the handset. The other end connects to the receiver-transmitter through an audio receptacle. A description of the handset is given in paragraph 16.

h. Bag CW–187/GR. Bag CW–187/GR is a canvas bag which will accommodate the handset, antenna mounting, mast sections, cables, generator legs, seat, and cranks, and the technical manuals supplied with the generator. Web straps are provided for closure and carrying.

i. Bag CW–188/GR. Two of these canvas bags are supplied with each kit. One bag is to carry the battery case, special purpose cables, and hand generator; the other bag is to carry a receiver-transmitter. The bag for the receiver-transmitter is normally stored in the other bag of the same type, when the modification is stored away in the vehicles.

94. Applications

Modification Kit MX–898/GR is provided to allow operation of any of the receiver-transmitters as a temporary, portable ground station. The

following applications are possible when using the modification kit:

a. Reception only, using the battery box alone.

b. Reception and transmission, using the generator alone.

c. Reception and transmission, using both the battery box and generator. In this case, the generator must be operated only during transmission.

d. Remote operation if Control Group AN/GRA–6 is used with the receiver-transmitter and modification kit.

95. Unpacking

The components of Modification Kit MX–898/GR are packed individually in cardboard containers but are shipped collectively in a single wooden case. Unpack as follows:

a. Remove the components from the case and remove the wrappings.

b. Loosen the Dzus fasteners on the panel of the battery case and remove the battery tray from the case (fig. 48).

c. Install five 1.5-volt Batteries BA–403/U and one 90-volt Battery BA–419/U in the case. Connect the batteries as indicated in figures 49 and 53. Replace the battery tray in the case.

d. Store the handset, antenna mounting, mast sections, cables, generator legs, seat, and cranks, and generator technical manuals in Bag CW–187/GR. Store the bag in any convenient location in the vehicle.

e. Store the battery case, the hand generator, power-cable assemblies, and one Bag CW–188/GR in the other Bag CW–188/GR. Store the packed bag in some convenient location in the vehicle.

96. Controls

a. On-Off-Remote Control Switch on Case CY–590/GRC (battery box). This is the only labeled control on any unit of the modification kit. In the OFF position, both the 7.5-volt and the 90-volt battery circuits are not connected to ground. In the ON position, the circuits are completed to ground through the switch contacts, and battery power is available to the receiver. The REMOTE CONTROL position is not used with Radio Sets AN/VRC–8 through –10.

b. Crank GC–7. Two of these cranks are supplied with the generator. They are the means of supplying hand power to the generator. One is inserted into each of the generator crank shafts, and turned alternately by the operator.

c. Push-to-Talk Button on Handset H–33/PT. When the handset is plugged into one of the AUDIO receptacles on the receiver-transmitter, the push-to-talk button is pressed by the operator to place the carrier of the transmitter on the air. Speaking into the mouthpiece of the handset, when the button is depressed, modulates the carrier.

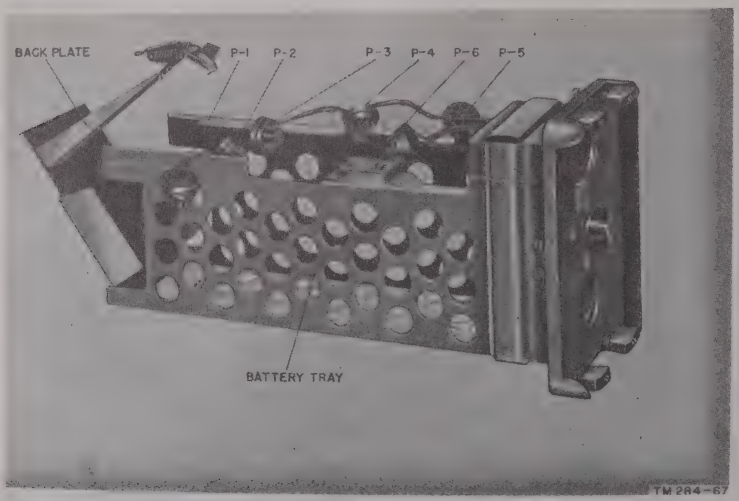


Figure 48. Case CY–590/GRC, case and batteries removed.

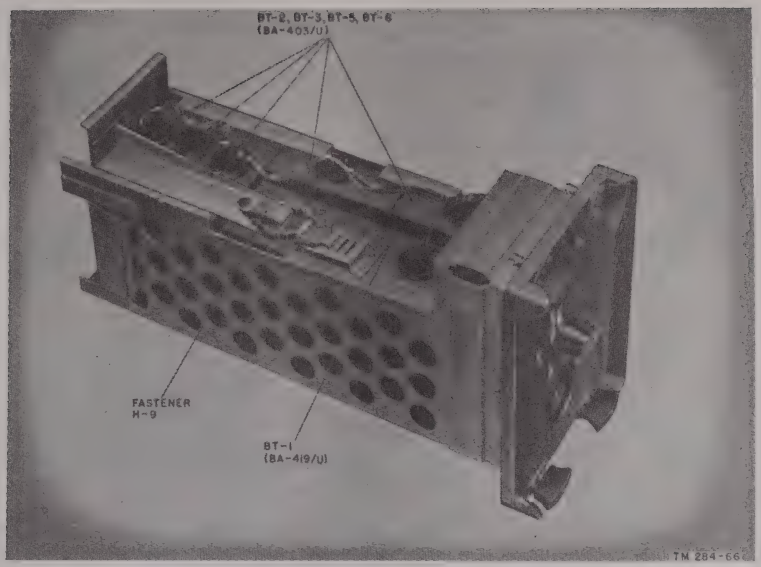


Figure 49. Case CY–590/GRC, case removed, batteries installed.

97. Operation of Receiver-Transmitter with Generator G–8/GRC and Battery Case CY–590/GRC

(fig. 50)

a. Remove the receiver-transmitter from Mounting MT–299/GR, and pack it in the unused Bag CW–188/GR. Carry the three bags (two Bags CW–188/GR and one Bag CW–187/GR) to the location selected for field operation of the set.

b. Set up the generator, battery case, and receiver-transmitter as illustrated in figure 50. Place the operator of the generator facing the operator of the radio set. Allow sufficient room for the operator of the generator to have free and unhampered movement of his arms. Choose as flat a spot as possible for the generator location with space where the operator may brace his feet. These last instructions hold true whenever the generator is used. For detailed information on the installation of the generator, refer to the manual supplied with that unit. Turn the OFF-ON-REMOTE switch of the battery case to the OFF position.

c. Connect one end of Power Cable Assembly CX–1210/U to the 14-pin receptacle on the battery case and the other end to the POWER IN receptacle on the receiver-transmitter. (See fig. 55 for schematic detail of the interconnections made.)

d. Connect one end of Power Cable Assembly CX–1209/U to the generator and the other end to the 9-pin receptacle on the battery case. (See fig. 55 for the schematic detail of the interconnections made.)

e. Insert the antenna mounting into the boss at the top front of the receiver-transmitter and turn the mounting 90° to lock it in place. Connect the lead-in wire to the ANT connector. For Receiver-Transmitters RT–66/GRC and RT–67/GRC, assemble the five mast sections and screw the assembly into the antenna mount. For Receiver-Transmitter RT–68/GRC, assemble three of the mast sections and screw the assembly into the antenna mount.

f. Connect the handset to one of the AUDIO receptacles on the front of the receiver-transmitter.

g. Set the OFF-ON-REMOTE switch of the battery case to ON. The receiver section then is ready for operation. It is not necessary to crank the generator while monitoring. Arrangements should be made between the generator operator and the radio operator so that the generator operator may know immediately when power is not required for the transmitter. In this way, he can

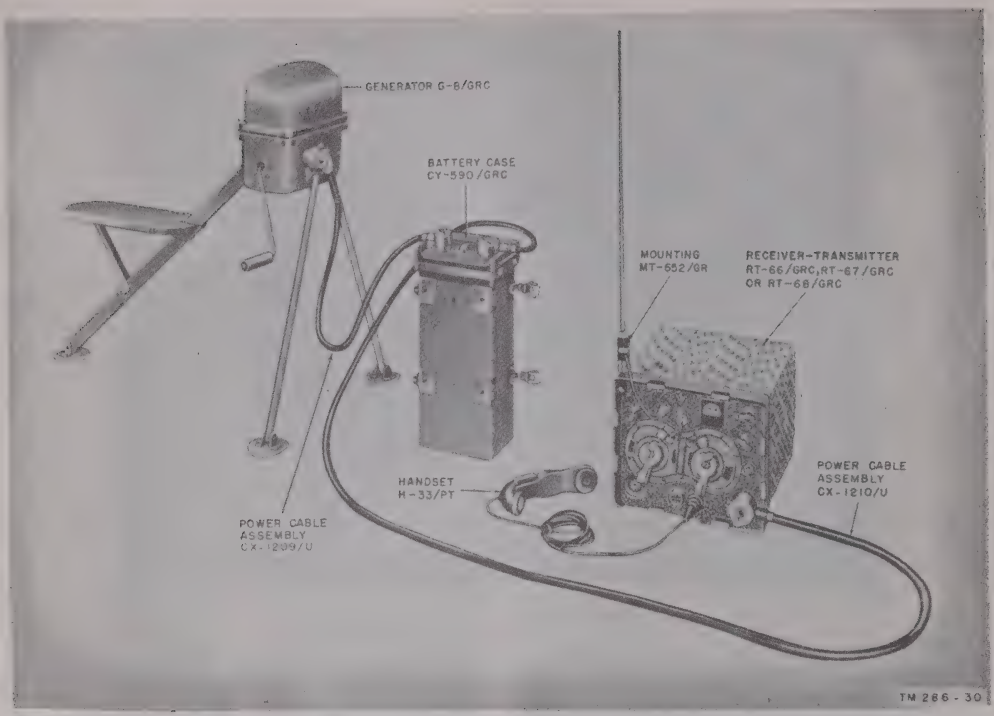


Figure 50. Field operation of receiver-transmitter with Generator G–8/GRC and Case CY–590/GR.

conserve his strength and provide power only when necessary for transmitting signals.

h. To transmit, crank the generator at a steady speed of approximately 1 revolution per second, press the push-to-talk button, and talk into the mouthpiece. Release the push-to-talk button to listen.

i. To turn off the set, stop cranking and turn the OFF-ON-REMOTE switch to OFF.

98. Operation of Receiver-Transmitter With Generator G–8/GRC

(fig. 52)

a. Remove the receiver-transmitter from Mounting MT–299/GR and pack it in Bag CW–188/GR. If the battery case definitely is not going to be used, it can be removed from the other Bag CW–188/GR to lighten the burden. Take the three bags to the location selected for field operation of the set.

b. Set up the generator and receiver-transmitter as indicated in figure 52. Connect Power Cable Assembly CX–1210/U to the generator and the other end to the POWER IN receptacle on the receiver-transmitter. The generator will supply all the operating voltages for both the receiver and the transmitter. The block diagram (fig. 51)

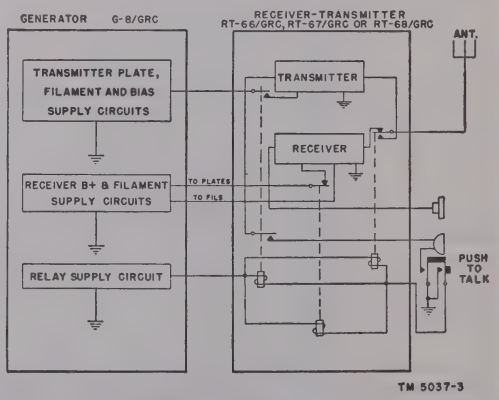


Figure 51. Auxiliary operation of receiver-transmitter, block diagram.

illustrates the function of the generator. Figure 55 shows the interconnections schematically.

c. Connect the antenna mount and mast sections as directed in paragraph 97*e*. Connect the handset to an AUDIO receptacle on the receiver-transmitter panel.

d. To receive, crank the generator at a steady speed of approximately 1 revolution per second, and listen with the handset. To transmit, crank the generator, press the push-to-talk button, and talk into the mouthpiece.

e. To stop the equipment, stop cranking the generator.

99. Remote Operation

If Control Group AN/GRA–6 is used with the modification kit to provide remote control of field operation, the operating procedure is the same as previously described in chapter 3. The remote operator must inform the local operator initially, however, when to start cranking the generator. The telephone facilities of the control group may be used for this purpose.

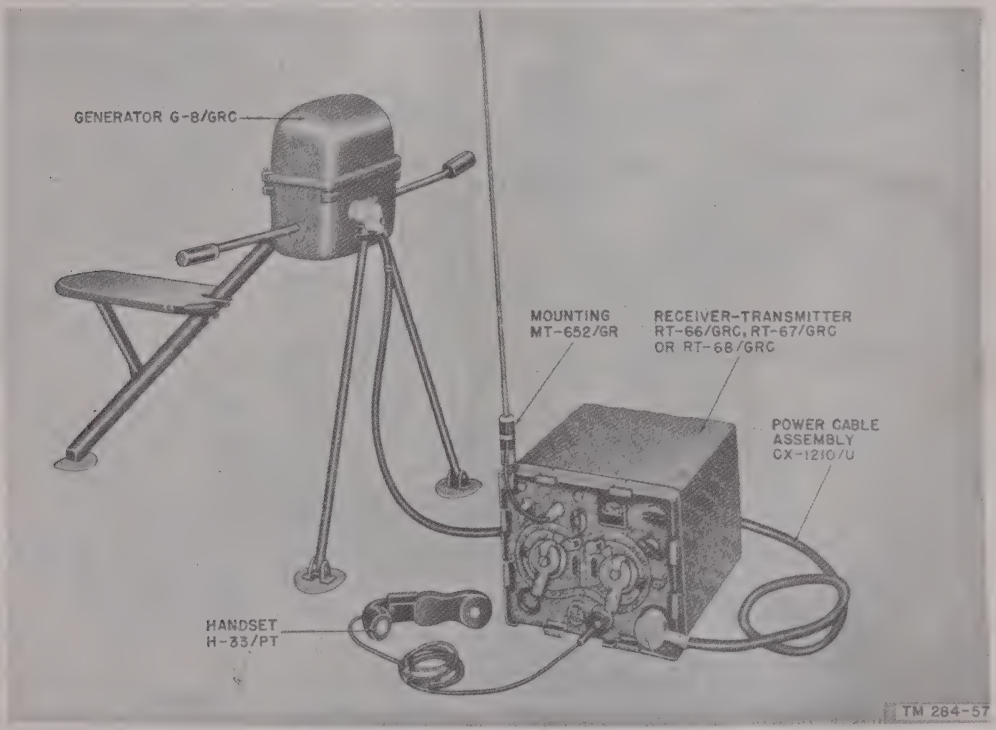


Figure 52. Field operation of receiver-transmitter with Generator G–8/GRC.

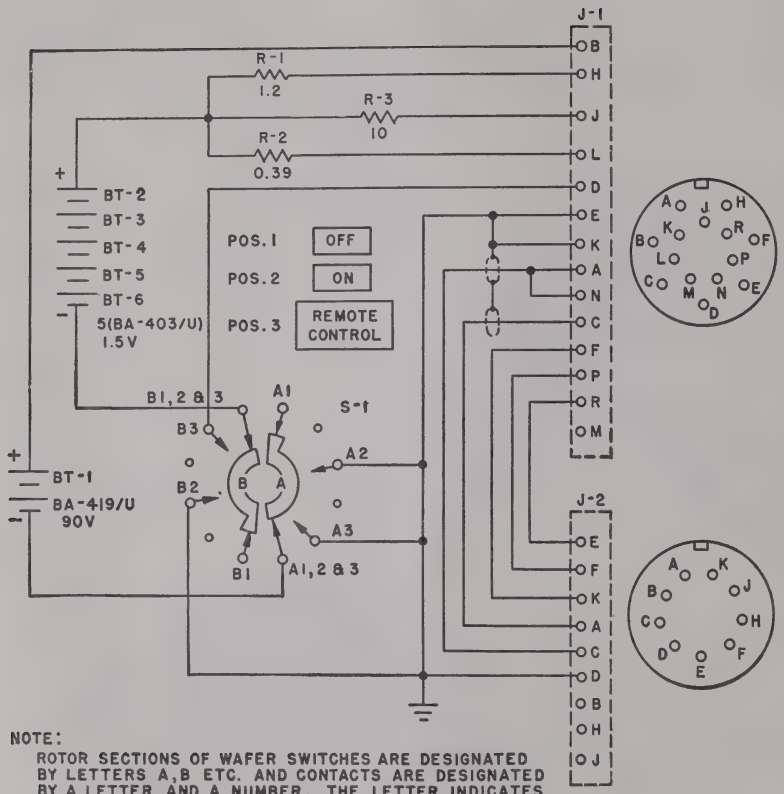
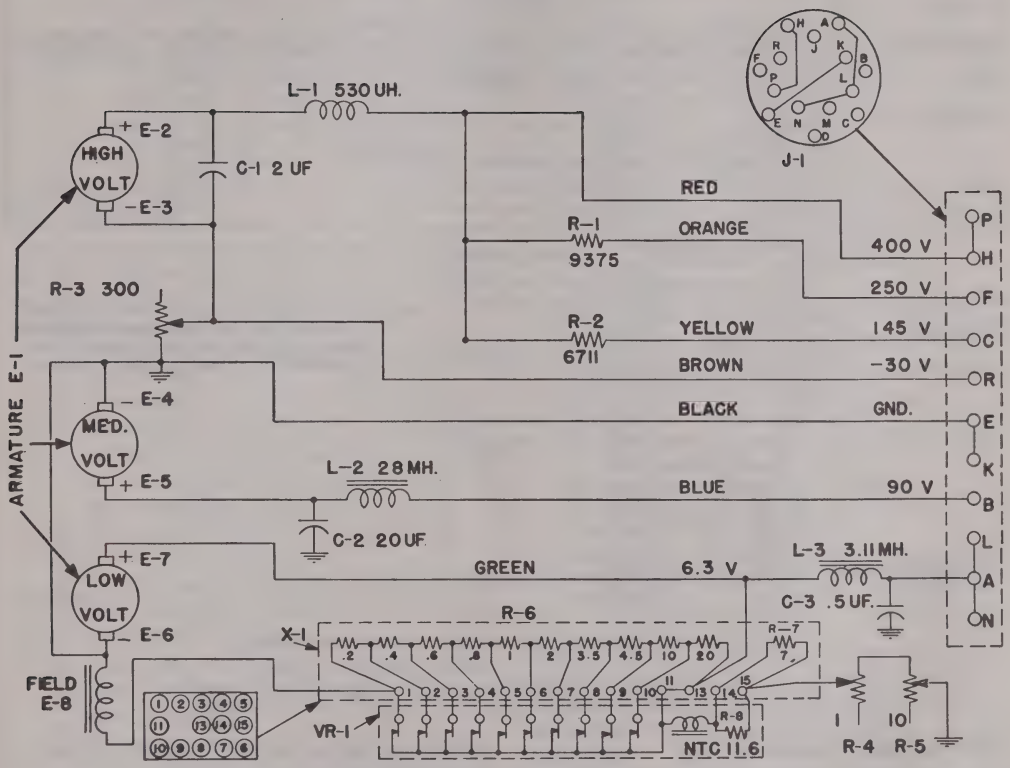


Figure 53. Case CY–590/GRC, schematic diagram.



NOTE:

ALL RESISTOR VALUES IN OHMS

TM 5037-9

Figure 54. Generator G-8/GRC, schematic diagram.

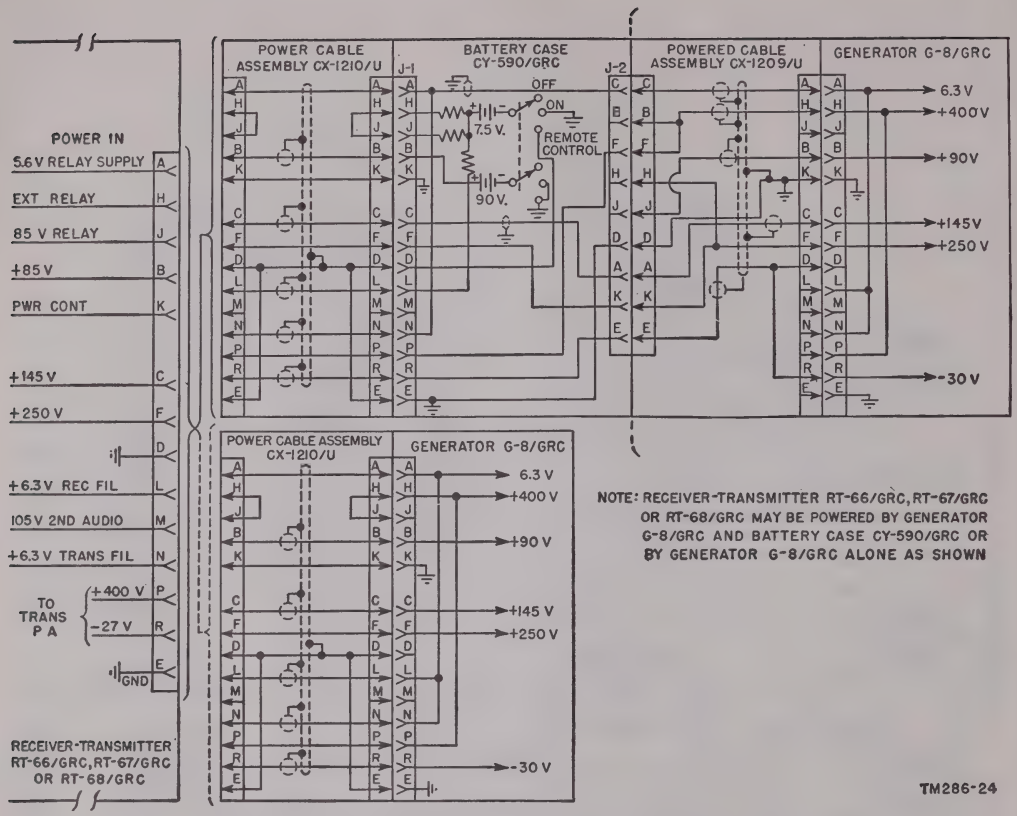


Figure 55. Modification Kit MX–898/GR, interconnection diagram.

Section II. MISCELLANEOUS AUXILIARY FACILITIES

100. Elevated Antenna RC–292

Elevated Antenna RC–292 can be used with Radio Set AN/VRC–8, –9, or –10 to extend the communication range to 25 miles.

101. Intercommunication Set AN/UIC–1

Intercommunication Set AN/UIC–1 can be interconnected with Radio Set AN/VRC–8, –9, or –10 to provide interphone and additional monitoring facilities. When properly interconnected, the resulting combinations have the same facilities as Radio Set AN/VRC–13, –14, or –15, respectively.

102. Radio Set AN/VRC–7

Radio Set AN/VRC–7 can be interconnected with Radio Set AN/VRC–8, –9, or –10 to provide interphone facilities and additional receiving and transmitting facilities. When properly interconnected, the resulting combinations have the same facilities as Radio Set AN/GRC–4, –6, or –8, respectively, except for retransmission.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

103. Disassembly

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

a. Control Group AN/GRA–6.

(1) Disconnect the telephone line and wind it on a reel.

(2) Disconnect plug P–1 of Local Control C–434/GRC from the receiver-transmitter (if connected), and store the cord in the compartment provided for it at the rear of the unit (fig. 27).

(3) Remove the batteries from Local Control C–434/GRC (fig. 26).

(4) Remove the batteries from Remote Control C–433/GRC (fig. 28).

b. Disconnection of Cables.

(1) Disconnect all audio accessories from their receptacles on the units, and coil the cords neatly.

(2) Disconnect all of the interconnecting cables between the units (fig. 24).

(3) Disconnect the battery cable (cable W–3 of Mounting MT–299/GR) from the battery or the vehicular junction box, whichever the case may be (fig. 24).

(4) Disconnect the antenna cable from the receiver-transmitter, remove the cable from its installation (if clamped in place), and coil it neatly (fig. 24).

c. Removal of Units.

(1) Remove the power supply from the mounting.

(2) Remove the receiver-transmitter from the mounting.

(3) Remove Control Boxes C–375/VRC from their mounting surfaces on the vehicle.

(4) Remove Mounting MT–229/GR from its vehicular installation.

d. Removal of Antenna.

(1) Remove the antenna mast sections from the mast base.

(2) Remove the antenna mast base from its mounting surface.

104. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends upon the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 8 for a description of the original packaging.

b. Whenever practicable, package each component separately in a case or carton, and place a dehydrating agent such as silica gel inside the individual cases or cartons. Protect the cartons with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected cartons in a padded wooden box, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

105. General

The demolition procedures outlined in paragraph 106 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.

106. Methods of Destruction

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, transformers, microphones, and headsets, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut cords, cables, headsets, and wiring, using axes, handaxes, machetes, or bayonets.

c. Burn. Burn cords, cables, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cases, chassis, mounting, and antenna mast sections.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy Everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalogs.

1. Army Regulations

AR 380–5___ Safeguarding Military Information.

2. Supply Publications

SIG 1_____ Introduction and Index.
SIG 3_____ List of Items for Troop Issue.
SB 11–6____ Dry Battery Supply Data.
SB 11–47____ Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76____ Signal Corps Kit and Materials for Moisture-and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11–300__ Frequency Meter Sets SCR–211–(*).
TM 11–303__ Test Sets I–56–C, I–56–D, I–56–H, and I–56–J.
TM 11–307__ Signal Generators I–72–G, H, J, and K.
TM 11–321__ Technical Manual for Test Set I–56–E.
TM 11–472__ Repair and Calibration of Electrical Measuring Instruments.
TM 11–2613_ Voltohmmeter I–166.
TM 11–2626_ Test Unit I–176.
TM 11–2627_ Tube Tester I–177.

4. Painting, Preserving, and Lubrication

TB SIG 13__ Moistureproofing and Fungiproofing Signal Corps Equipment.
TM 9–2851__ Painting Instructions for Field Use.

5. Camouflage

FM 5–20____ Camouflage, Basic Principles.

6. Decontamination

TM 3–220___ Decontamination.

7. Demolition

FM 5–25____ Explosives and Demolitions.

8. Other Publications

FM 24–18___ Field Radio Techniques.
FM 72–20___ Jungle Warfare.
SR 310–20–3_ Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4_ Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Table of Equipment.
SR 700–45–5_ General—Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5_ Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), S and A–70–6 (Navy), and AF–MC–U2 (Air Force)).

TB SIG 4___ Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 5___ Defense Against Radio Jamming.
TB SIG 25__ Preventive Maintenance of Power Cords.
TB SIG 54__ Working Through Jamming with Frequency Modulated Radio Sets.
TB SIG 66__ Winter Maintenance of Signal Equipment.
TB SIG 72__ Tropical Maintenance of Ground Signal Equipment.
TB SIG 75__ Desert Maintenance of Ground Signal Equipment.
TB SIG 123_ Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178_ Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 223_ Field Expedients for Wire and Radio.
TB 11–499–( )* Basic Radio Propagation Predictions.
TM 9–2857_ Storage Batteries Lead-Acid Type.
TM 11–310__ Schematic Diagrams for Maintenance of Ground Radio Communications Sets.
TM 11–314__ Antennas and Antenna Systems.
TM 11–415__ Dry Batteries.
TM 11–430__ Batteries for Signal Communication. Except those pertaining to Aircraft.
TM 11–453__ Shop Work.

*A new TB in this series is issued monthly which gives propagation predictions three months in advance.

TM 11–455__ Radio Fundamentals.
TM 11–466__ Radar Electronic Fundamentals.
TM 11–476__ Radio Direction Finding.
TM 11–483__ Suppression of Radio Noises.
TM 11–486_ Electrical Communication Systems Engineering.
TM 11–499__ (Preliminary) Radio Propagation Handbook.
TM 11–660__ Introduction to Electronics.
TM 11–4000_ Trouble Shooting and Repair of Radio Equipment.
TM 38–650__ Basic Maintenance Manual.

9. Abbreviations

ac_____ alternating current.
af_____ audio frequency.
afc_____ automatic frequency control.
C_____ centigrade.
db_____ decibel(s).
dc_____ direct current.
F_____ Fahrenheit.
f-m_____ frequency-modulation.
hf_____ high frequency.
hv_____ high voltage.
i. f_____ intermediate frequency.
lv_____ low voltage.
kc_____ kilocycle.
ma_____ milliampere.
mc_____ megacycle.
mw_____ milliwatt.
rf_____ radio frequency.
ua_____ microampere.
uf, uuf_____ microfarad, micromicrofarad.
uv_____ microvolt.

10. Glossary

For explanation of terms used in this manual, refer to TM 11–455.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The fact that a part is listed in this table is not sufficient basis for requistioning the item. Requistions must cite an authorized basis, such as T/O & E, T/A, T/BA, SIG 7 & 8, SIG 7–8–10, SIG 10, or list of allowances of expendable material. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

1. Scope of Identification Table of Parts

Only those units that are not covered in separate technical manuals are covered in the following identification table of parts. These units are Mounting MT–299/GR, Case CY–590/GRC, and Control Box C–375/VRC. For the other units, refer to the individual technical manuals.

2. Identification Table of Parts for Mounting MT–299/GR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	MOUNTING MT–299/GR: mtg for radio equip.	Mounting base for Radio Sets AN/VRC–8 through AN/VRC–10.	2Z6763–299
	TECHNICAL MANUAL (TM 11–286)		(Order through AGO channels.)
E–1	BOARD ASSEMBLY, terminal	Terminal connecting board for external Special Purpose Cable WM–46/U.	3Z772–1
H–7, H–8, H–9	BUTTON, plug: fits 19/32″ diam hole; .587″ diam x 1⅜″ lg o/a.	Plugs for unused cable clamps	4Z3152
H–10, H–11	BUTTON, plug: fits .828″ diam hole; 1⅛″ diam x ½″ thk o/a.	Waterproof plugs for unused connector holes in junction box.	4Z3152–1
W–2	CABLE ASSEMBLY, power: Sig C Cordage CO–212; 18½″ lg excluding terminations.	Transfers power from the mounting to the receiver-transmitter power supply.	3E7350.1–18.2
W–3	CABLE ASSEMBLY, power: Sig C Cordage CO–212; 8 ft 5″ lg excluding terminations.	Transfers power from the battery to the mounting.	3E7350.1–101.1
W–1	CABLE ASSEMBLY, special purpose: Army-Navy Special Purpose Cable WM–46/U; 20½″ lg excluding terminations.	Connects receiver-transmitter audio and control circuits to the mounting.	3E7350–1.20.3
O–1 through O–5	CAM: mtg plate locking cam	Secure receiver-transmitter and power supply to mounting.	4Z3185–1
H–1 through H–4	CLAMP: cable; accom .61″ diam cable	Entry clamps (for connecting cables between mounting and receiver-transmitter, mounting and power supply, and mounting and battery).	2Z2642.305
H–5, H–6	CLAMP: cable; accom .516″ diam cable	Entry clamps for Special Purpose Cables WM–46/U which are used to connect the mounting to control boxes.	2Z2642.300
F–1	FUSE, cartridge: 50 amp	Overload protection for battery line.	3Z2650
E–2	FUSEHOLDER: block type; for single type 5AG cartridge fuse.	Fuse F–1 holder	3Z3282–1.1

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O–11	GASKET: neoprene; single hole; rectangular, 6⅞″ lg x 4½″ wd x ¼″ thk o/a.	Cover seal for junction box	2Z4868.709
H–40 through H–44	HANDLE: mtg strip locking handle; steel, zinc pl and olive drab iridited finish.	Move locking strips which secure receiver-transmitter and power supply on mounting.	4Z4691
E–6	JUNCTION BOX: cable terminating and term board mtg box; eight .828″ diam outlets.	Junction point for system interconnections.	6Z6512–1
N–1	LABEL: 2⅞″ wd x 5⅝″ lg x .007″ thk	Circuit label	6D16777–7
A–1 through A–4	MOUNT, vibration: Sig C Shock Mount M–449; sq mtg; 2⅜″ sq o/a.	Absorb vibration	2Z8415–449
E–3	POST, binding: compression screw type	Grounding terminal	3Z741–2
H–12 through H–15	SCREW, cap: slot drive; hex head, unfinished; ¼″–28 NF–2 thd; 7/16″ lg.	Bracket mounting screws	6L4904–7. 28S
H–26 through H–29	SCREW, captive: slot drive; finished, fil Bind H; #10–24 NC–2 thd; .937″ lg.	Mounting screws for junction box cover.	6L4770–15. 21SF
H–30 through H–34	SCREW, dowel	Handle, cam, and locking strip assembly screws.	6L5014–10
H–35 through H–39	SCREW, dowel	Handle and cam assembly screws	6L5014–6–1
O–6 through O–10	SPRING: helical extension type; locking strip tension spring; 1.86″ lg x .375″ diam o/a; 27½ turns close wnd.	Locking strip tension springs	2Z8879–323
E–4, E–5	TERMINAL, lug: ring type; for #8 AWG wire	Battery cable terminals	3Z12073–53
W–4, W–5	WIRE BRAID: copper; ⅝″ wd x .125″ thk	Grounding straps	1F6B1–10

3. Identification Table of Parts for Control Box C–375/VRC

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	ARMY-NAVY CONTROL BOX C–375/VRC: interphone and radio push-to-talk operation.	Remote control for Radio Sets AN/GRC–3 through AN/GRC–8, AN/VRC–7 through AN/VRC–10, AN/VRC–13 through AN/VRC–15, and Intercommunication Set AN/UIC–1.	2C666–375
	TECHNICAL MANUAL (TM 11–284)		(Order through AGO channels.)
E–2	BOARD, terminal: general purpose; 2 solder lug term, copper silver pl; 15/16″ lg x 2 9/32″ h x 5/16″ thk o/a.	Junction point for interunit connections.	3Z770–2.49
H–1, H–2	CLAMP: used to hold cable and wp cable entrance; wp.	Secure interconnecting Special Purpose Cables WM–46/U.	2Z2642.241
J–1, J–2	CONNECTOR, receptacle: Army-Navy Receptacle Connector U–79/U; 10 cont, pol; straight.	Connectors for audio input, output, and control circuits.	2Z7250–79
A–2	COVER	Used to waterproof jacks J–3, J–4, J–5, and J–6.	2Z3352.224
J–3, J–4	JACK: Sig C Jack JK–33–C; for 3 cond plug .2065″ diam x 1.093″ lg.	Connect microphone to audio input circuit.	2Z5533C
J–5, J–6	JACK: Sig C Jack JK–34–C; for 2 cond plug .250″ diam x 1 1/32″ lg.	Connect headset to output of audio circuit.	2Z5534C

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	KNOB: bar; aluminum, olive drab finish; for ¼" diam double flatted shaft; luminous ctr line; 1 3/16" lg x ⅞" wd x 15/32" thk.	Control for shaft of volume controls R–1 and R–2.	2Z5821–147
	KNOB: bar; aluminum, olive drab finish; for ¼" diam double flatted shaft; luminous ctr line; 1 15/16" lg x ⅞" wd x 15/32" thk.	Control for shaft of switch S–2 (RADIO TRANS).	2Z5821–148
	KNOB: bar; aluminum, olive drab finish; for ¼" diam double flatted shaft; luminous ctr line; 2 15/16" lg x ⅞" wd x 7/16" thk.	Control for shaft of selector switch S–1.	2Z5821–149
R–1, R–2	RESISTOR, variable: comp; 10,000 ohms ±10%; 2.25 w.	VOL (volume) controls for audio output.	3Z7410–149
S–2	SWITCH, rotary: 2 pole, 3 position	Selects interphone amplifier and radio sets for transmitting.	3Z9825–34.2
S–1	SWITCH, rotary: 3 pole, 3 position	Selects interphone amplifier and radio sets for monitoring and transmitting.	3Z9825–34.1

4. Identification Table of Parts for Case CY–590/GRC

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	ARMY-NAVY CASE CY–590/GRC: battery; aluminum, olive drab finish; 15⅝" lg x 7¼" wd x 5¾" h o/a; removable front panel has metal battery holder which slides into case; immersion and fungus resistant; 2 lock strikes on upper, 2 spring catches on lower edge of ea side; 4 positioning studs on bottom side, 4 positioning holes on top side of case; p/o Army-Navy Radio Set AN/PRC–16; Fed Tele & Rad dwg #GA–2415–14; U. S. Army spec #71–3331.		2Z1891–590
	Technical Manuals TM 11–284, –286, and –291		(Order through AGO channels.)
H–5 through H–8, H–9.	CATCH, fastener: p/o Army-Navy AF Amplifier AM–65/GRC and Army-Navy Case CY–590/GRC; c/o back plate, lever, 2 ea outside and inside links, 2 pins, and 2 springs; steel, zinc pl and olive drab iridited; 2 1/16" lg x 1 1/16" wd x ½" d in locked position; two .144" diam mtg holes on back plate, .437" c to c; Fed Tele & Rad part/dwg #SC–D–20648; Sig C dwg #SC–D–20648.	H–5 through H–8: Mounting catches. H–9: Battery tray fastener catch.	6Z1747–36
P–6	CONNECTOR, plug: 8 round male cont; straight; 5 5/64" lg x 1 9/32" diam o/a; round black phenolic body; mts by means of keyed ctr locating pin and cont; 2 square keys on ctr locating pin 135 deg apart; Fed Tele & Rad part/dwg #ES–A–83778; Sig C dwg #ES–A–83778.	B battery connector	2Z3028–56
P–1 through P–5	CONNECTOR, plug: 8 round male cont; straight; 5 5/64" lg x 1 9/32" diam o/a; round black phenolic body; mts by means of keyed ctr locating pin and cont; 2 rounded keys on ctr locating pin 90 deg apart; Fed Tele & Rad part/dwg #ES–A–83777; Sig C dwg #ES–A–83777.	A battery connectors	2Z3028–57

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
J–2	CONNECTOR, receptacle: 9 round female cont; cont rated 10 amp at 800 v AC; Amphenol dwg #164.3; Fed Tele & Rad part/dwg #GH–2082–12.	Generator input connector	2Z3070–49
J–1	CONNECTOR, receptacle: 14 round female cont; cont rated 10 amp at 800 v AC; Amphenol dwg #164–5; Fed Tele & Rad part/dwg #GH–2083–12.	Output connector	2Z3075–26
H–1 through H–4	FASTENER, Dzus: die cast zinc and steel, olive drab finish; 1⅝″ lg x 1 5/16″ wd x 5/16″ thk o/a; mts by shaft thru ¼″ diam clearance hole; preloaded spring pressure, unlocked approx 32 lb, locked 45 lb; Dzus dwg #X–486; Fed Tele & Rad part/dwg #GA–2178–2.	Panel-to-case fasteners	6Z3809–27
O–5	GASKET: Buna N or neoprene; single hole; rectangular, 6.6″ lg x 4.85″ wd x .187″ thk; hole 6.12″ lg x 4.37″ wd; Fed Tele & Rad part/dwg #GR–1443–12–5.	Panel-to-case waterproofed gasket.	2Z4867–691
H–16 through H–19	INSERT, threaded: steel, cad pl and olive drab iridited; generally rectangular w/2 rounded corners; 2 9/32″ lg x 1 1/32″ wd x .1196″ thk; two #6–32 NC–2 tapped holes on .531″ ctr; Fed Tele & Rad part/dwg #GB–1171–2.	Strike mounting screws, retaining inserts (nuts).	2Z5400–52
H–20 through H–23	INSERT, threaded: steel, cad pl and olive drab iridited; generally rectangular w/1 rounded end; 1 5/16″ lg x ⅜″ wd x .1196″ thk; two #6–32 NC–2 tapped holes on .437″ ctr; Fed Tele & Rad part/dwg #GB–1172–2.	Catch mounting screws, retaining inserts (nuts).	2Z5400–56
E–1, E–2	INSULATOR, standoff: round post shape; natural or black grade LTS–E–4 phenolic w/electro tin pl brass term lug, and cad pl and clear iridited hex brass mtg base and stud; 1 3/16″ lg o/a; 600 v RMS break-down; 5/16″ diam o/a; single #6–32 NC–2 #¼″ lg mtg stud; Fed Tele & Rad part/dwg #GN–2198–2.	Wiring terminal posts	3G350–106
E–3	KNOB: round; w/bar; olive drab zinc alloy; for ¼″ diam double flatted shaft; single #6–32 screw thru hole in face of knob screws into tapped axial hole in end of shaft; 2 white luminous lines on bar portion; 1 1/16″ lg x ⅞″ wd x 15/32″ h o/a; shaft hole .359″ d from bottom surface; luminous markings; Fed Tele & Rad part/dwg #GC–1690–2.	Switch knob	2Z5822–401
N–1	LABEL: decalcomania; 4⅝″ lg x 2⅞″ wd x .007″ thk; white print on back background; individually packed; Meyer cord type G; Fed Tele & Rad part/dwg #GD–2424–12; Sig C dwg #SC–C–40596–A.	Circuit label	6D16777–11
H–10	NUT, castellated: steel, cad pl and olive drab iridited; finished per dwg; ⅜″–32NS–2; ⅛″ thk, 9/16″ OD; 4 slots 3/32″ wd x 3/64″ d spaced 90 deg apart; Fed Tele & Rad part/dwg #GB–1106–2.	Switch mounting nut	6L3006–32S
R–2	RESISTOR, fixed: WW; 39 ohms ±10%; ½ w; JAN type RU3BR39K.	Set 2 filament-dropping resistor	3RU02400
R–3	RESISTOR, fixed: 10 ohms ±10%; 2 w; IRC #BW–2.	Set 2 relay dropping resistor	3Z6001–146
R–1	RESISTOR, fixed: WW; 1.2 ohms ±10%; 2 w; IRC #BW–2.	Set 1 filament-dropping resistor	3Z5991B2

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O–1 through O–4	SPRING: loop type; strike for Dzus fastener; .08″ diam olive drab iridited music wire; 1⅜″ lg x 5/32″ wd x .08″ thk o/a; 2 ends turned perpendicular at 90 deg angle to straight portion on 1/16″ rad; Dzus dwg #X–487; Fed Tele & Rad part/dwg #GB–2414–2.	Fastener strikes	6Z8377–10
H–11 through H–14	STRIKE, fastener: steel, cad pl and olive drab iridited; ⅞″ lg x 9/16″ wd x 11/32″ h o/a; two .169″ diam mtg holes, .531″ c to c; 1 edge shaped into hook on 1/16″ inside rad x 19/32″ wd to provide catch action; Fed Tele & Rad part/dwg #GB–3035–2.	Mounting fastener strikes	6Z8569–4
H–15	STRIKE, fastener: steel, electro tin pl; rectangular; 4″ lg x 1″ wd x ⅜″ h o/a; four .136″ diam mtg holes, 2 on ea end on 9/16″ x 3⅝″ mtg/c; ctr portion raised and has five ⅛″ x 9/16″ slots; Fed Tele & Rad part/dwg #GB–1762–2.	Battery tray fastener strike	6Z8569–6
S–1	SWITCH, rotary: 2 pole, 3 position; single sect; silver pl brass cont; ceramic wafer; 1⅞″ lg x 1⅝″ wd x 29/32″ d from mtg surface; nonshorting cont; locking action; solder lug term; single hole mtg, ⅜″–32 x ⅜″ lg mtg bushing, shaft ¼″ diam x 11/16″ lg from mtg surface; Oak #HIC; Fed Tele & Rad part/dwg #GH–2097–2.	OFF-ON REMOTE CONTROL switch.	3Z9825–62.531

APPENDIX III

RELATED RADIO SETS

1. Basis of Relationship

The major components of the radio sets discussed in this manual are common to numerous other sets which utilize common or overlapping frequency ranges. The frequency spectrum chart (fig. 2) indicates how the sets are related insofar as frequency coverage is concerned. Physical similarities among the sets are indicated in the comparison chart following and in figure 56.

2. Comparison Chart

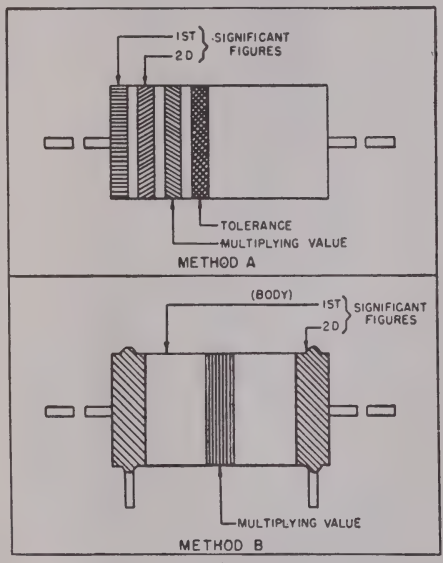
The following chart lists the components of the radio sets discussed in this manual and the components of related radio sets. Analysis of thechart will reveal the high degree of similarity which exists among the sets.

Components	Radio sets																		
	Radio Set AN/GRC-3	Radio Set AN/GRC-5	Radio Set AN/GRC-7	Radio Set AN/GRC-4	Radio Set AN/GRC-6	Radio Set AN/GRC-8	Radio Set AN/VRC-8	Radio Set AN/VRC-9	Radio Set AN/VRC-10	Radio Set AN/VRC-13	Radio Set AN/VRC-14	Radio Set AN/VRC-15	Radio Set AN/VRQ-1	Radio Set AN/VRQ-2	Radio Set AN/VRQ-3	Radio Set AN/VRC-7	Radio Set AN/PRC-16	Intercommunication Set AN/UIC-1	Modification Kit MX 995/GRC
Case CY–684/GR	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1			
Case CY–590/GRC																	1		1
Mounting MT–297/GR	1	1	1	1	1	1				1	1	1							
Mounting MT–299/GR							1	1	1										
Mounting MT–298/GR													1	1	1				
Mounting MT–300/GR																1		1	
Mounting MT–673/GR																	1		
Antenna Mounting MT–652/GR																	1		1
Receiver-Transmitter RT–66/GRC	1			1			1			1			2						
Receiver-Transmitter RT–67/GRC		1			1			1			1			2					
Receiver-Transmitter RT–68/GRC			1			1			1			1			2				
Receiver-Transmitter RT–70/GRC	1	1	1	1	1	1										1	1		
AF Amplifier AM–65/GRC	1	1	1	1	1	1				1	1	1				1		1	

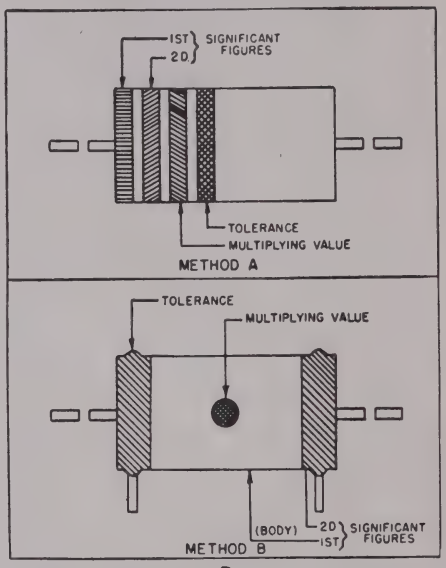
Power Supply PP–282/GRC or PP–281/GRC	2	2	2	1	1	1				1	1	1				1		1	
Power Supply PP–448/GR																1			
Radio Receiver R–108/GRC	1																		
Radio Receiver R–109/GRC		1																	
Radio Receiver R–110/GRC			1																
Power Supply PP–109/GR or Power Supply PP–112/GR	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2				
Control Group AN/GRA–6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Control C–435/GRC	1	1	1	1	1	1							1	1	1				
Control Box C–375/VRC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		2	
Mast Base AB–15/GR	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2	1			
Mast Section MS–116–A	2	2		2	2		2	2		2	2		4	4					
Mast Section MS–117–A	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4				
Mast Section MS–118–A	2	2		2	2		2	2		2	2		4	4					
Mast Section AB–22/GR	2	2	2	2	2	2										2	2		1
Mast Section AB–24/GR	2	2	4	2	2	4			2			2			4	2	2		1
Mast Section AB–23/GR																			3
Generator G–8/GRC																			1
Handset	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1
Special Purpose Cable Assembly CX–1211/U	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2				
Special Purpose Cable Assembly CX–1213/U	1	1	1	1	1	1										1			
Special Purpose Cable WM–46/U	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
RF Cable Assembly CG–568/U	1			1			1			1			2						
RF Cable Assembly CG–530/U	1	2	2	1	2	2		1	1		1	1		2	2	1			
Power Cable Assembly CX–1209/U																	1		1
Power Cable Assembly CX–1210/U																			1
Bag CW–187/GR																			1
Bag CW–188/GR																			2
Adapter UG–273/U	2	2	2	2	2	2	1	1	1	1			2	2	2				
Installation Kit	1	1	1	1	1	1	1	1	1				2	2	2				
Wire W–142	1	1	1																
Adapter UG–306/U	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2	1			
Bag CW–206/GR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Connector and Bondnut (Appl.)	1	1	1	1	1	1				1	1	1						1	

RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS/



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0.1	± 5
SILVER	–	0.01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

/ RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

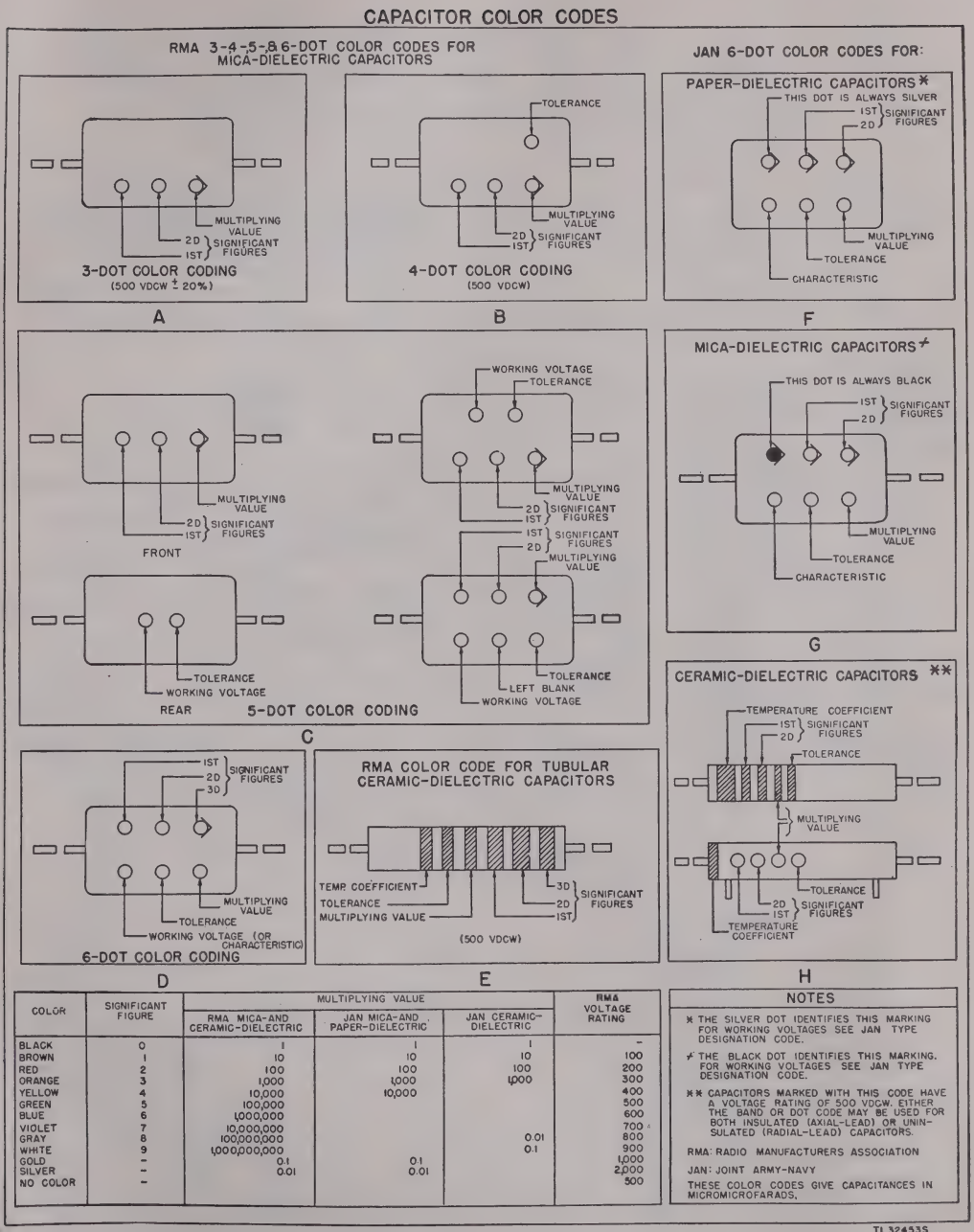
RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL32454S

Figure 57. Resistor color codes.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

† THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

Figure 58. Capacitor color codes.

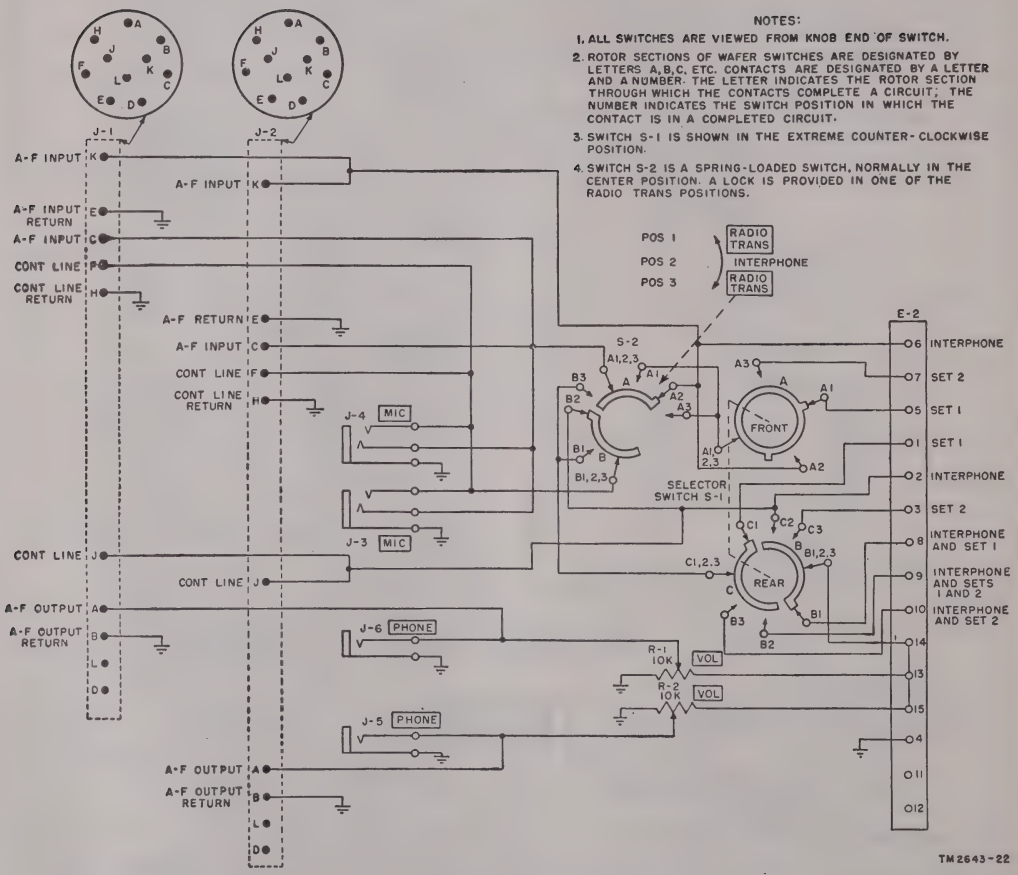
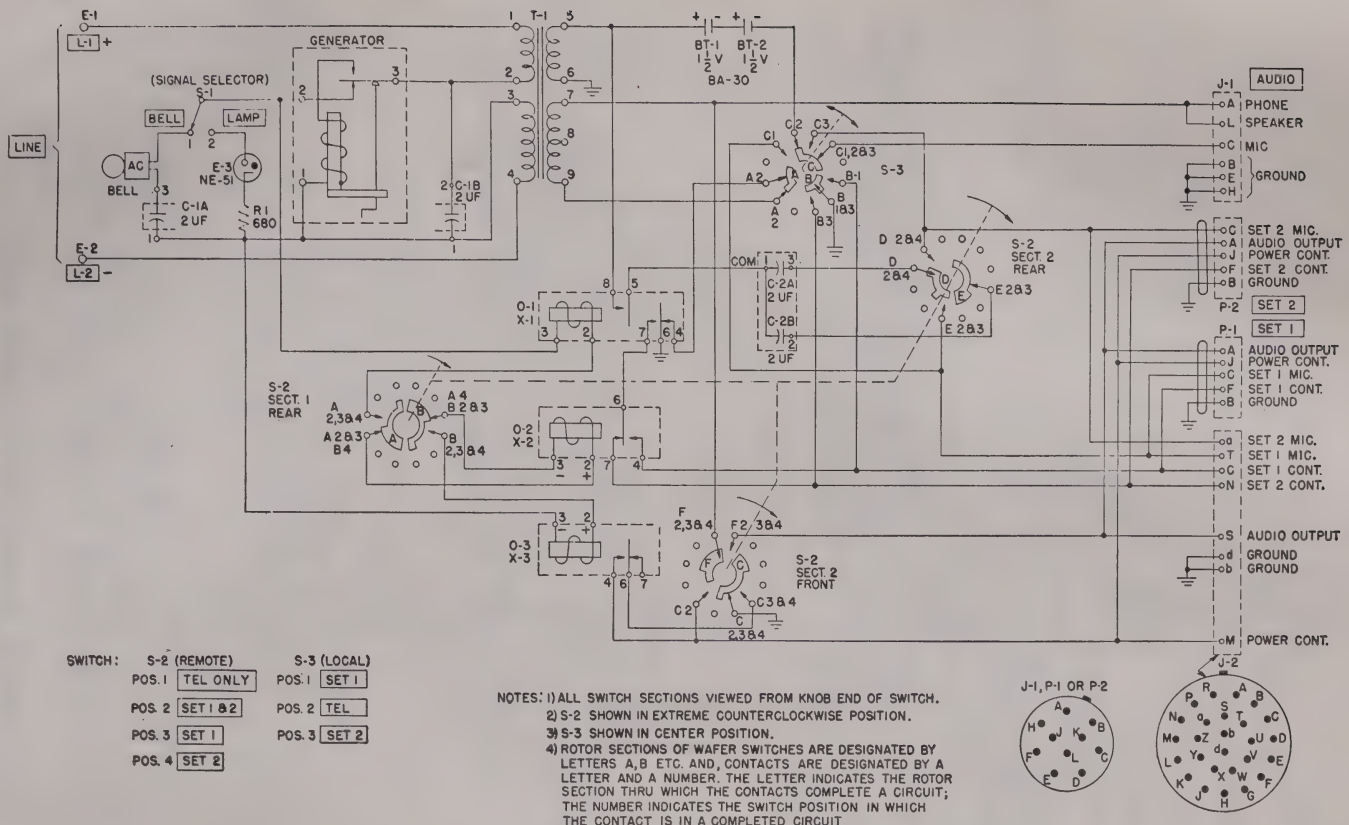


Figure 59. Control Box C-875/VRC, schematic diagram.



SWITCH:	S-2 (REMOTE)	S-3 (LOCAL)
POS. 1	TEL ONLY	SET 1
POS. 2	SET 1 & 2	TEL
POS. 3	SET 1	SET 2
POS. 4	SET 2	

NOTES: 1) ALL SWITCH SECTIONS VIEWED FROM KNOB END OF SWITCH.
2) S-2 SHOWN IN EXTREME COUNTERCLOCKWISE POSITION.
3) S-3 SHOWN IN CENTER POSITION.
4) ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A,B ETC. AND, CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT
5) RELAY O-1 SHOWN DE-ENERGIZED
6) RELAYS O-2 AND O-3 SHOWN WITH NO OPERATING VOLTAGE APPLIED, AND LATCHED BY THE PREVIOUS APPLICATION OF A VOLTAGE OPPOSITE IN POLARITY TO THAT SHOWN ON COIL. COIL MARKINGS (+ AND −) REFER TO VOLTAGE POLARITY REQUIRED TO SWING ARMATURE TO OPEN CONTACT.

J-1, P-1 OR P-2

TM 284-91

Figure 60. Local Control C-434/GRC, schematic diagram.

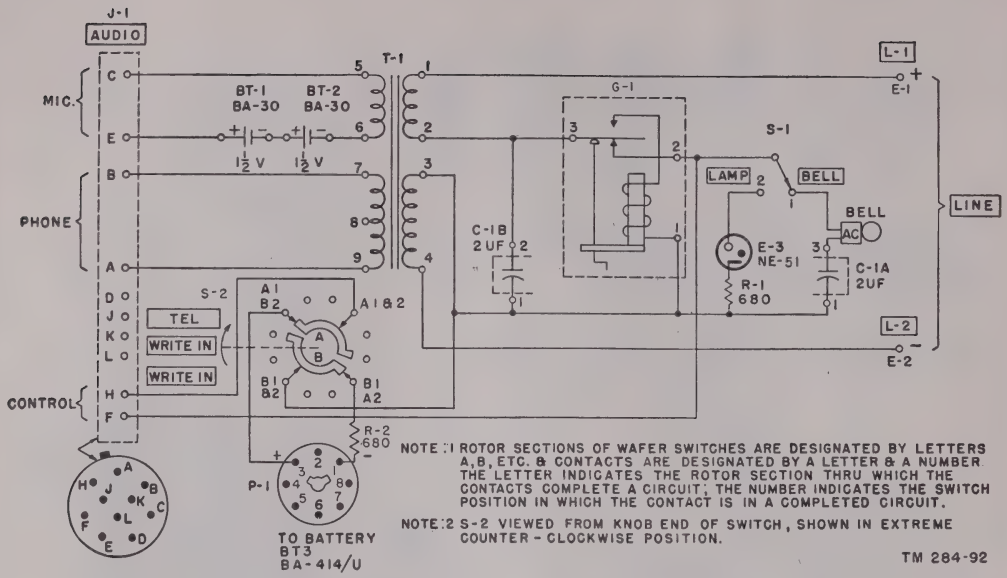


Figure 61. Remote Control C-433/GRC, schematic diagram.

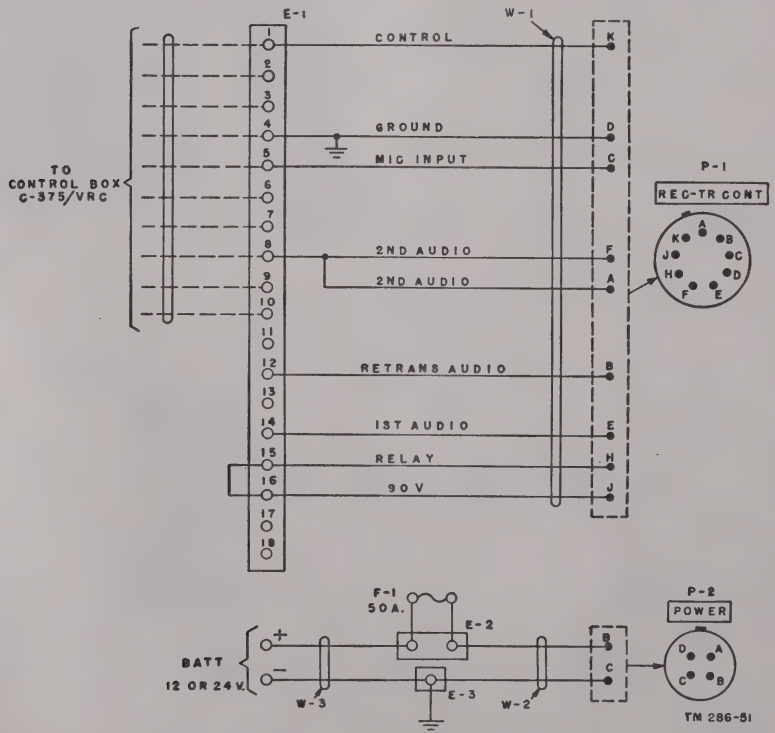


Figure 62. Mounting MT-299/GR, schematic diagram.

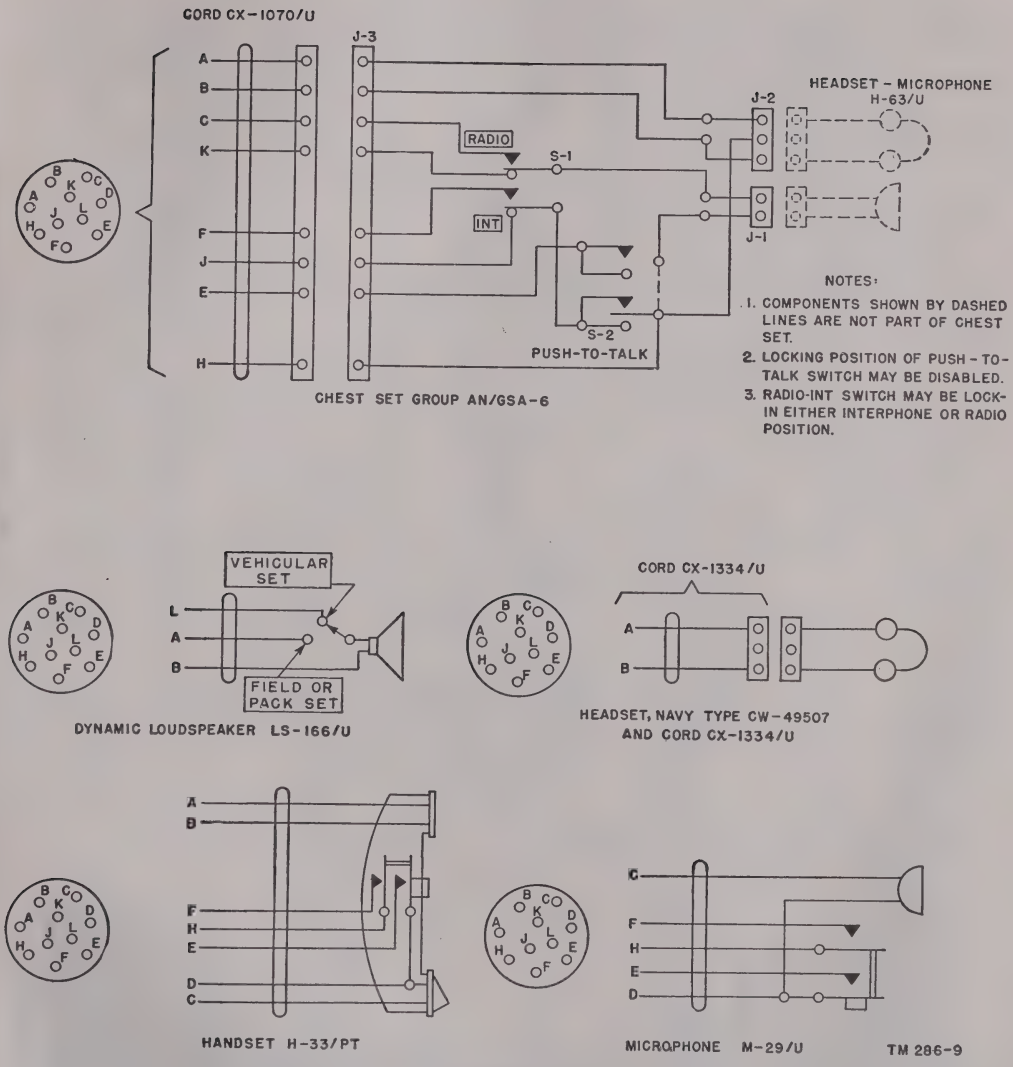


Figure 63. Audio accessories, schematic diagram.

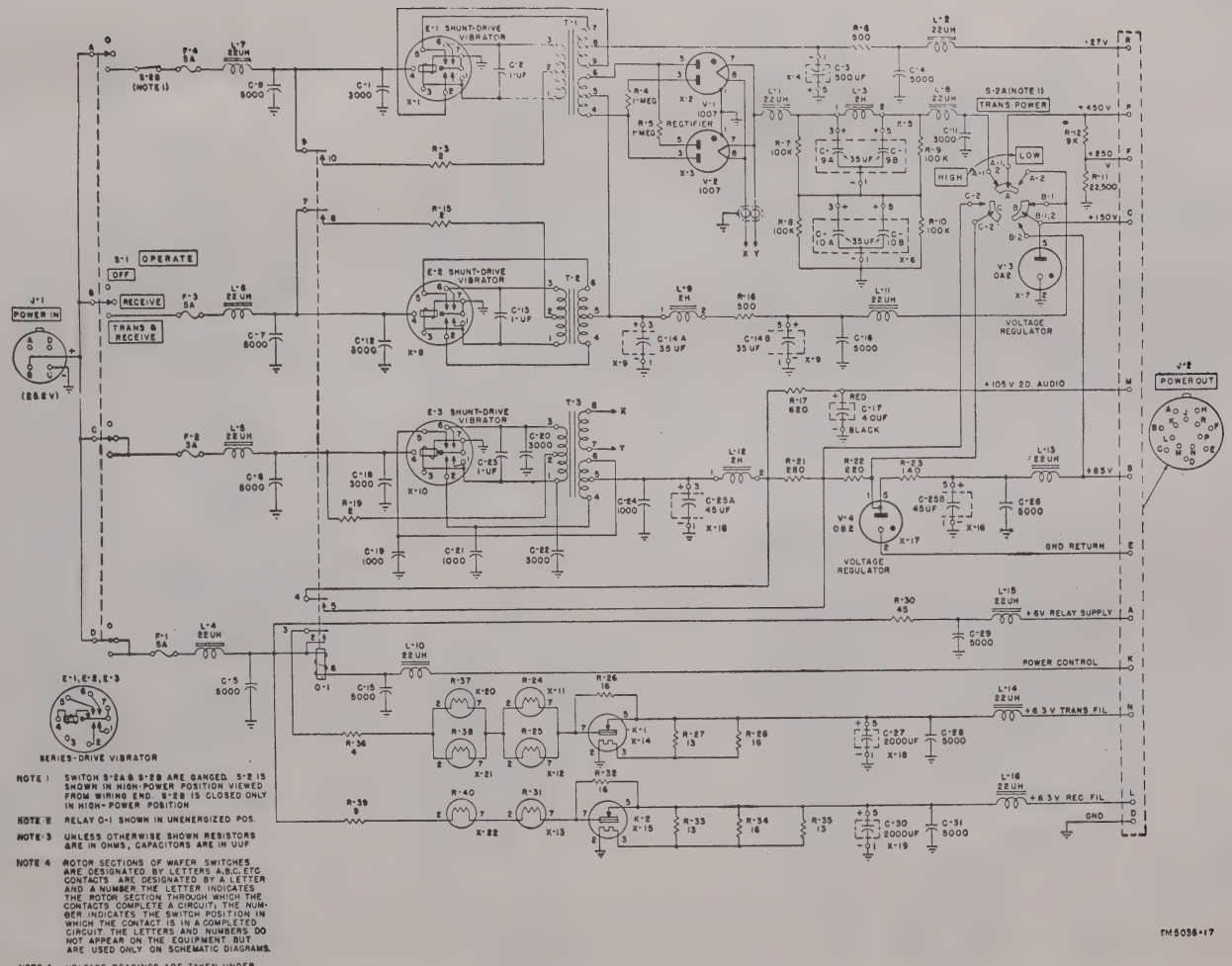
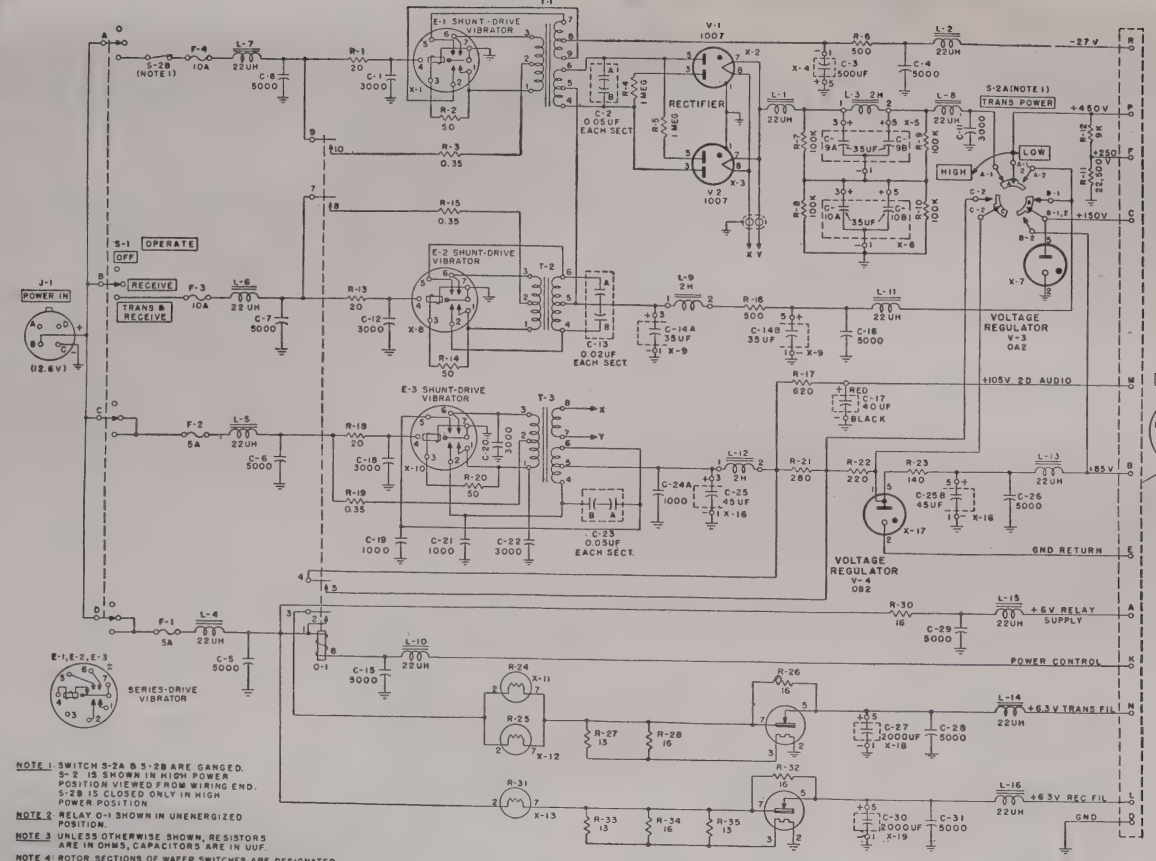


Figure 64. Power Supply PP-112/GR, schematic diagram.



NOTE 1: SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH POWER POSITION

NOTE 2: RELAY O-1 SHOWN IN UNENERGIZED POSITION.

NOTE 3: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE 4: ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B, C, ETC. CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE 5: VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

Figure 65. Power Supply PP-109/GR, schematic diagram.

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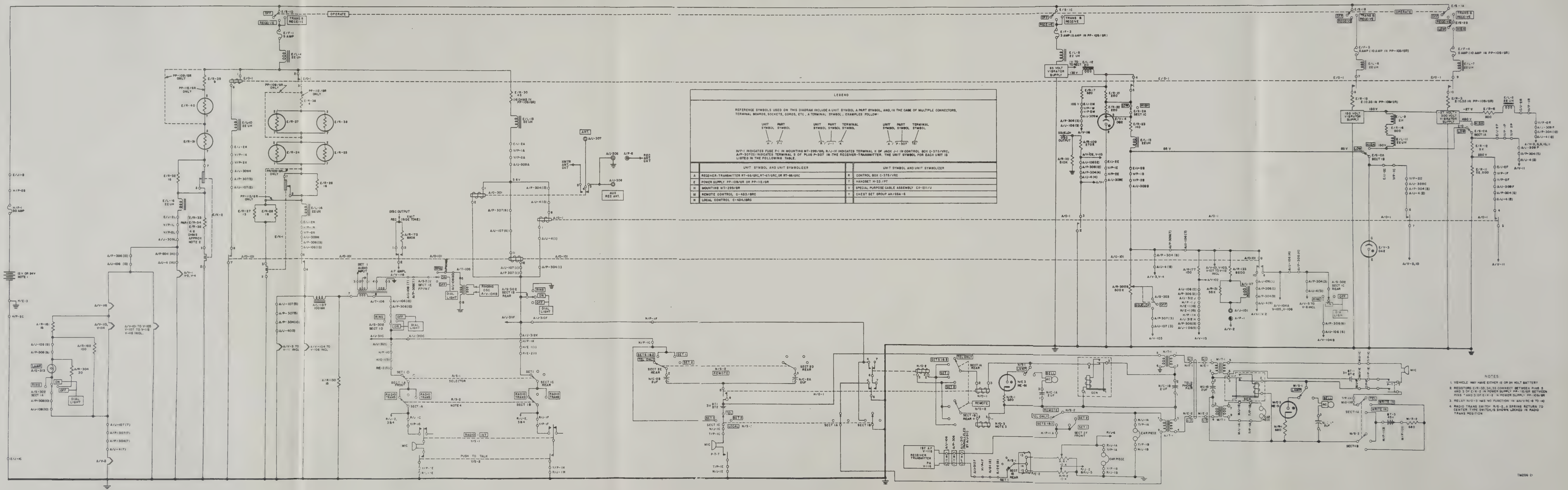
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	Paragraph	Page
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Remote operation with Modification Kit MX–898/GR	99	77
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Replacement of parts:		
Cases	87	65
Control Group AN/GRA–6	90	69
General	86	65
Power supply	88	65
Receiver-transmitter	89	66
Ringing	53*b*	44
Ringing circuit	70	50
Running spares:		
Storage	35*a*	33
Suggested list for packaging	35*a*	33
Supplied	17	15
Scope of manual	1	1
Squelch and volume-level adjustments	50	43
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Substitute accessories	16*h*	15
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Components, table I	6	4
Continuity measurements at Control Box C–375/VRC, table V	84	64
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Mounting MT–299/GRC, continuity tests, table IV	83	64
Vehicular installation units, table II	7	4
Technical characteristics	5	2
Technical manuals, storage of	35*b*	33
Telephone circuit	71	51
Telephone communication using Control Group AN/GRA–6	55*e*	44
Transmitting circuits, unit theory of	76	52
Transmit-control relays	66	49
Trouble shooting:		
Cables	81	61
Control Box C–375/VRC	84	64
Control Group AN/GRA–6	85	65
Filament trouble location	82*d*	61
Mounting	83	64
Power supply	82	61
Receiver-transmitter	82	61
Scope	78	57
Tuning:		
Channel selection	45	41
Continuous tuning	47	42
Presetting detented channels	46	42
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Units, removal of	103*c*	81
Unpacking:		
General instructions	19	17
Instructions	20	17
Vehicular installation units, table II	7	4
Weight and volume of boxes	8*a*	5

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LEGEND

REFERENCE SYMBOLS USED ON THIS DIAGRAM INCLUDE A UNIT SYMBOL A PART SYMBOL, AND, IN THE CASE OF MULTIPLE CONNECTORS, TERMINAL BOARDS, SOCKETS, CORDS, ETC., A TERMINAL SYMBOL. EXAMPLES FOLLOW:

UNIT SYMBOL / PART SYMBOL: H / F-1

UNIT SYMBOL / PART SYMBOL / TERMINAL SYMBOL: R / J-1 K

UNIT SYMBOL / PART SYMBOL / TERMINAL SYMBOL: A / P-307 (5)

H/F-1 INDICATES FUSE F-1 IN MOUNTING MT-299/GR; R/J-1K INDICATES TERMINAL K OF JACK J-1 IN CONTROL BOX C-375/VRC; A/P-307(5) INDICATES TERMINAL 5 OF PLUG P-307 IN THE RECEIVER-TRANSMITTER. THE UNIT SYMBOL FOR EACH UNIT IS LISTED IN THE FOLLOWING TABLE.

	UNIT SYMBOL AND UNIT SYMBOLIZER		UNIT SYMBOL AND UNIT SYMBOLIZER
A	RECEIVER-TRANSMITTER RT-66/GRC, RT-67/GRC, OR RT-68/GRC	R	CONTROL BOX C-375/VRC
E	POWER SUPPLY PP-109/GR OR PP-112/GR	T	HANDSET H-33/PT
H	MOUNTING MT-299/GR	V	SPECIAL PURPOSE CABLE ASSEMBLY CX-1211/U
M	REMOTE CONTROL C-433/GRC	Y	CHEST SET GROUP AN/GSA-6
N	LOCAL CONTROL C-434/GRC		

NOTES

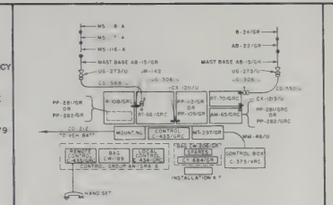
1. VEHICLE MAY HAVE EITHER 12 OR 24 VOLT BATTERY
2. RESISTORS E/R-33, 34, 35 CONNECT BETWEEN PINS 5 AND 3 OF E/R-2 IN POWER SUPPLY PP-112/GR BETWEEN PINS 7 AND 3 OF E/R-2 IN POWER SUPPLY PP-109/GR
3. RELAY N/O-3 HAS NO FUNCTION IN AN/VRC-8 TO -10
4. RADIO TRANS SWITCH R/S-2, A SPRING RETURN TO CENTER TYPE SWITCH, IS SHOWN LOCKED IN RADIO TRANS POSITION

TM296-21

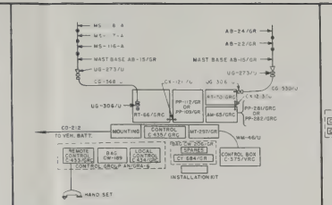
Figure 35. Power distribution and push-to-talk control circuits.

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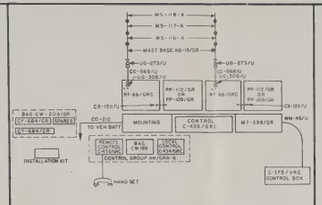
FREQUENCY RANGE 200-279 MCS



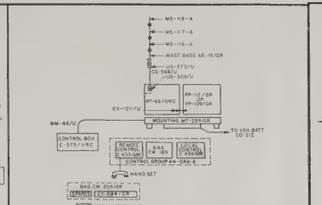
RADIO SET AN/GRC-3



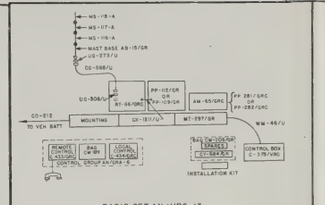
RADIO SET AN/GRC-4



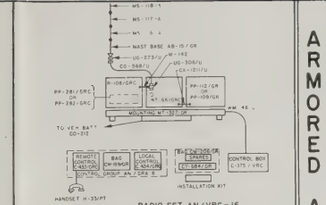
RADIO SET AN/VRQ-1



RADIO SET AN/VRC-8



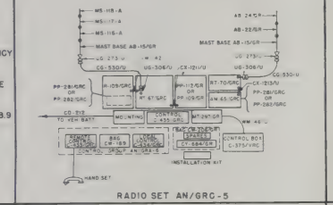
RADIO SET AN/VRC-13



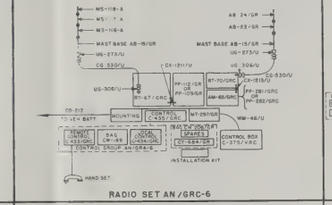
RADIO SET AN/VRC-16

ARTILLERY

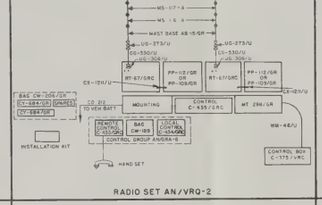
FREQUENCY RANGE 27.0-38.9 MCS



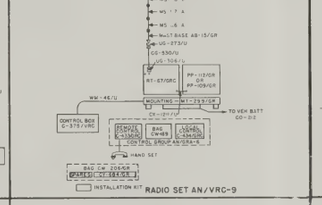
RADIO SET AN/GRC-5



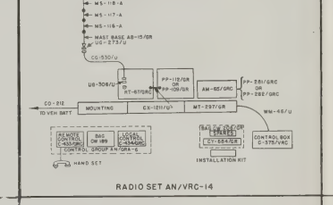
RADIO SET AN/GRC-6



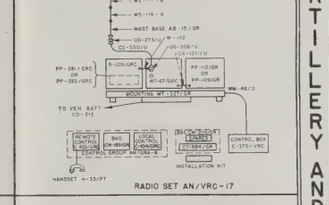
RADIO SET AN/VRQ-2



RADIO SET AN/VRC-9



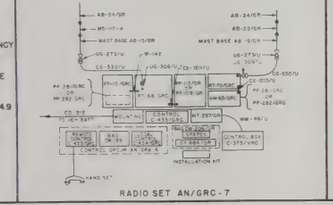
RADIO SET AN/VRC-14



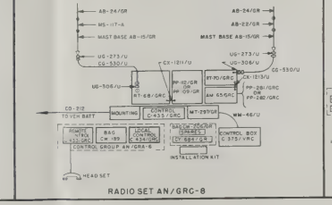
RADIO SET AN/VRC-17

INFANTRY

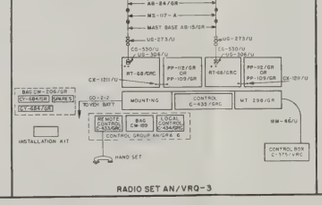
FREQUENCY RANGE 38.0-54.9 MCS



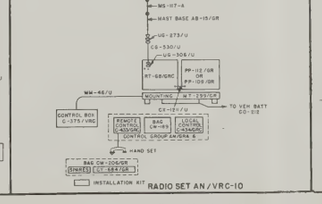
RADIO SET AN/GRC-7



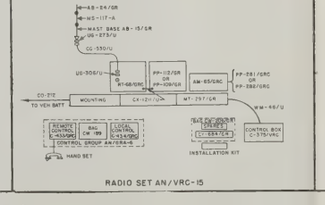
RADIO SET AN/GRC-8



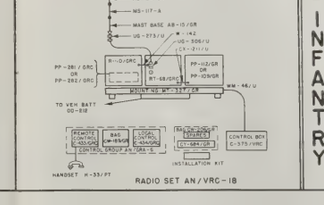
RADIO SET AN/VRQ-3



RADIO SET AN/VRQ-10



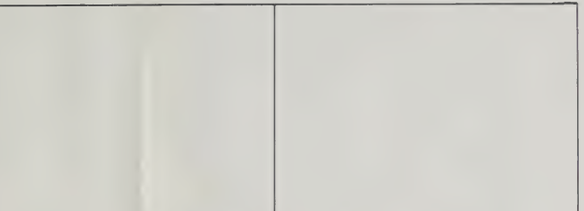
RADIO SET AN/VRC-15

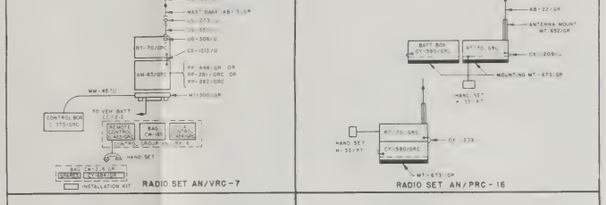


RADIO SET AN/VRC-18

Figure 56. Standardized series of J-w sets.

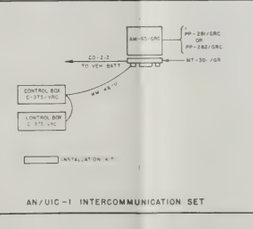
ARMORED ARTILLERY AND INFANTRY



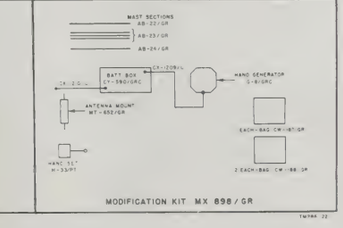


RADIO SET AN/VRC-7

RADIO SET AN/PRC-16



AN/UIC-1 INTERCOMMUNICATION SET



MODIFICATION KIT MX-898/GR

TM11A-22

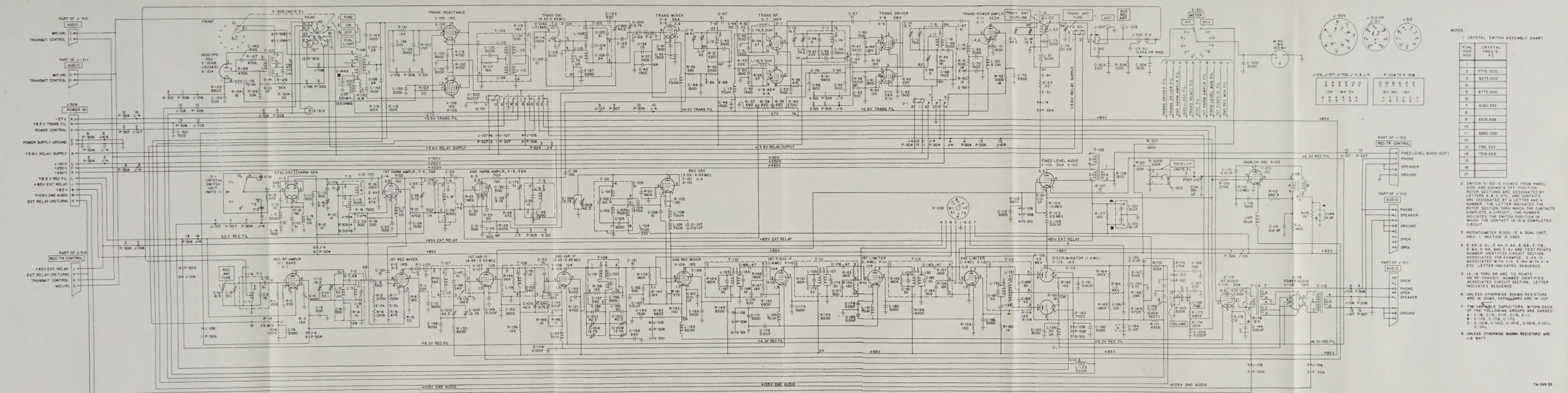


Figure 66. Receiver-Transmitter RT-66/GRC, schematic diagram.

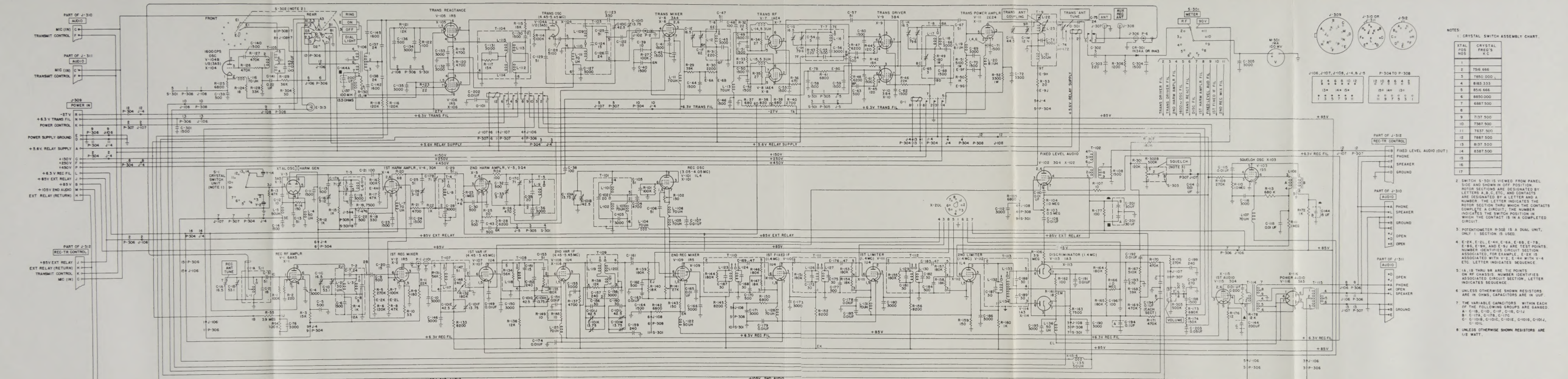


Figure 67. Receiver-Transmitter RT-67/GRC, schematic diagram.

NOTES:

1. CRYSTAL SWITCH ASSEMBLY CHART.

XTAL POS NOS	CRYSTAL FREQ'S KC
1	
2	7516 666
3	7850 000
4	8183 333
5	8516 666
6	8850 000
7	6867 500
8	
9	7137 500
10	7367 500
11	7637 500
12	7887 500
13	8137 500
14	8387 500
15	
16	
17	

2. SWITCH S-301 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
3. POTENTIOMETER R-302 IS A DUAL UNIT, ONLY 1 SECTION IS USED.
4. E-2K, E-2L, E-4H, E-6A, E-6B, E-7B, E-8G, E-9H, AND E-9J ARE TEST POINTS. NUMBER IDENTIFIES CIRCUIT SECTION ASSOCIATED. FOR EXAMPLE, E-2K IS ASSOCIATED WITH V-2; E-4H WITH V-4 ETC. LETTER INDICATES SEQUENCE.
5. 1A, 1B THRU 9R ARE TIE POINTS ON RF CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.
6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
7. THE VARIABLE CAPACITORS WITHIN EACH OF THE FOLLOWING GROUPS ARE GANGED. A: C-1B, C-1D, C-1F, C-1J. B: C-17A, C-17B, C-17C. C: C-101B, C-101C, C-101E, C-101G, C-101J, C-101L.
8. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.

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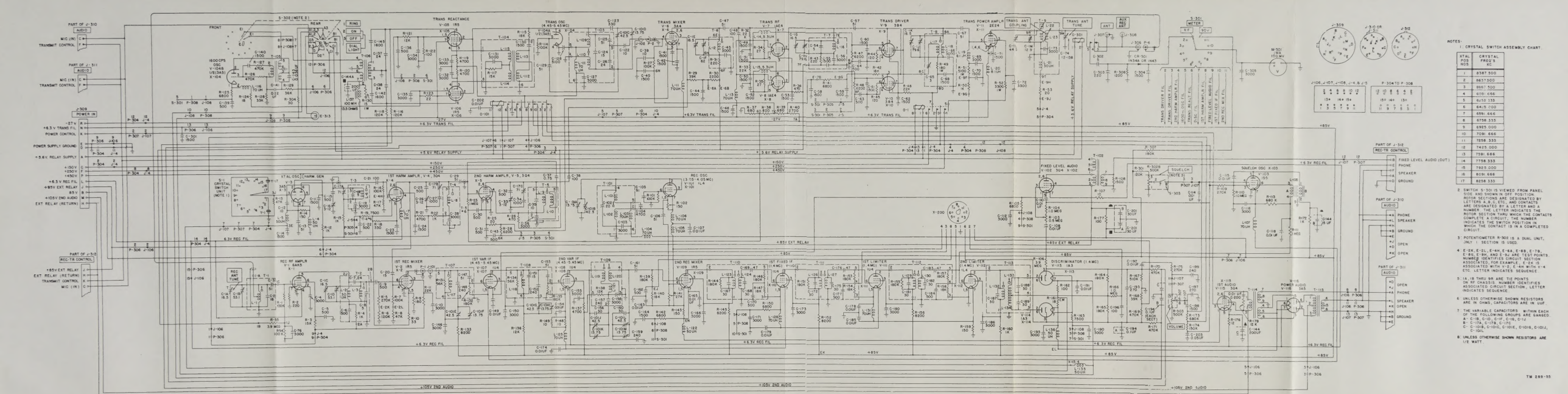


Figure 68. Receiver-Transmitter RT-68/GHC, schematic diagram.

NOTES:

1. CRYSTAL SWITCH ASSEMBLY CHART.

XTAL POS NOS	CRYSTAL FREQ'S KC
1	8387.500
2	8657.500
3	8987.500
4	6091.666
5	6751.333
6	6645.000
7	6591.666
8	6758.333
9	6925.000
10	7091.666
11	7258.333
12	7425.000
13	7591.666
14	7758.333
15	7925.000
16	8091.666
17	8258.333

2. SWITCH S-301 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT. THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

3. POTENTIOMETER R-302 IS A DUAL UNIT, ONLY 1 SECTION IS USED.

4. E-2K, E-2L, E-4H, E-8A, E-8B, E-7B, E-8G, E-8H, AND S-9J ARE TEST POINTS. NUMBER IDENTIFIES CIRCUIT. SECTION ASSOCIATED. EXAMPLE E-2K IS ASSOCIATED WITH V-2, E-4H WITH V-4 ETC. LETTER INDICATES SEQUENCE.

5. 1A, 1B THRU 9R ARE TIE POINTS ON RF CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION. LETTER INDICATES SEQUENCE.

6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

7. THE VARIABLE CAPACITORS WITHIN EACH OF THE FOLLOWING GROUPS ARE GANGED.
A: C-1B, C-1D, C-1F, C-1G, C-1J
B: C-1TA, C-1TB, C-1TC
C: C-1D1B, C-1D1C, C-1D1E, C-1D1G, C-1D1J, C-1D1L

8. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.

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