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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2137

TO 16-35TA182-5

TELEGRAPH-TELEPHONE SIGNAL CONVERTER TA-182/U

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

APRIL 1952

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TELEGRAPH-TELEPHONE SIGNAL CONVERTER TA-182/U

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WARNING

Heavy currents at moderate potentials are carried in the wiring of this equipment. These currents are dangerous to life.

All operating adjustments of this equipment are made with the power on. Be careful when examining the wiring side of the equipment.

When repairing or replacing parts on a particular circuit, remove the power plug to avoid possible electrocution.



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.

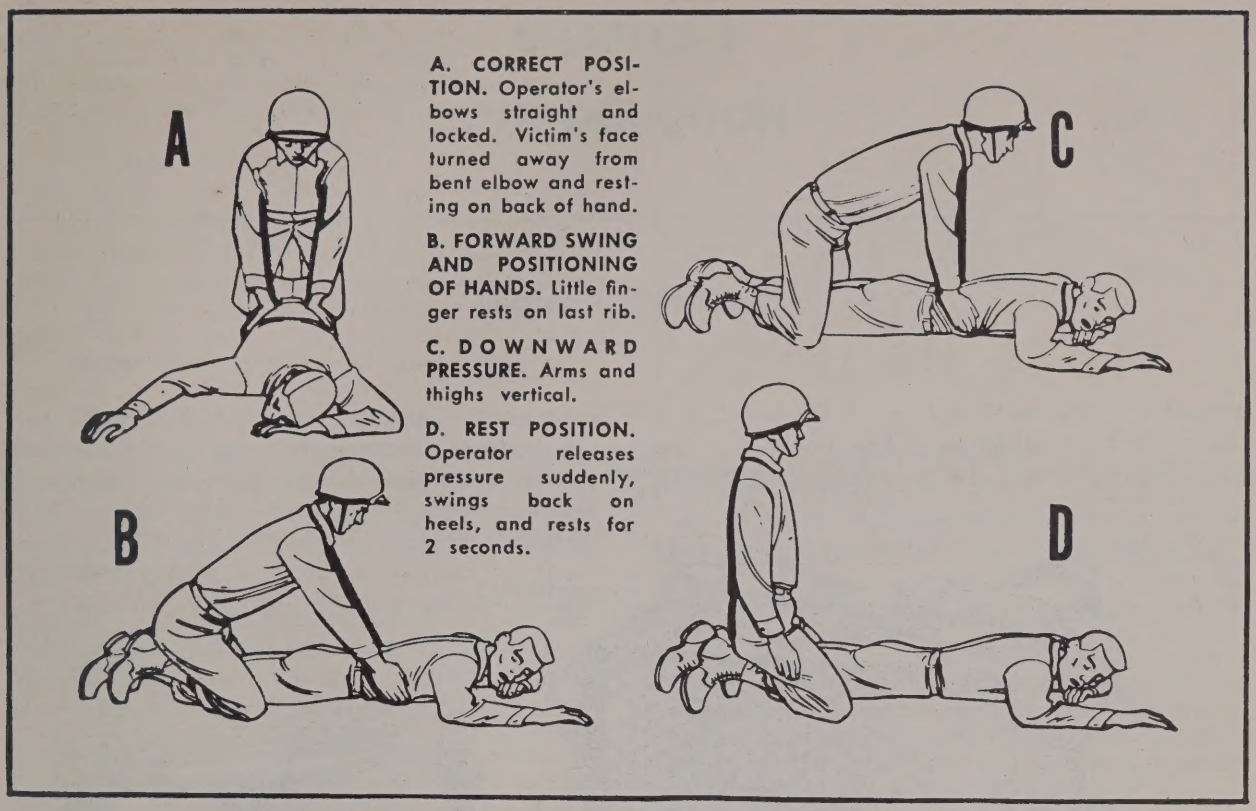
f. The resuscitation procedure is as follows:

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

(*2*) Swing back, suddenly releasing pressure, and sit up 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



A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.

B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.

C. DOWNWARD PRESSURE. Arms and thighs vertical.

D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

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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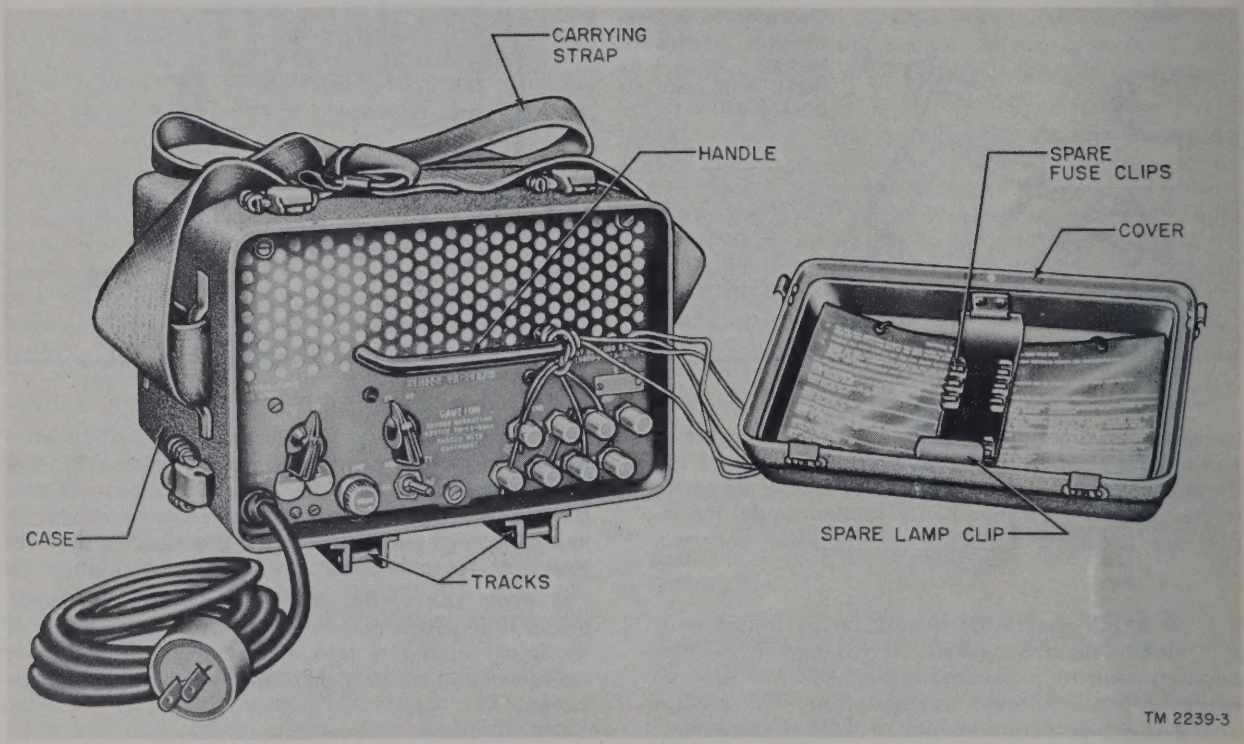


Figure 1. Telegraph-Telephone Signal Converter TA-182/U.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of the personnel to whom this equipment is issued. They contain information covering the installation, operation, maintenance, and repair of Telegraph-Telephone Signal Converter TA-182/U (fig. 1).

b. This manual is prepared in seven chapters and two appendixes. Appendix I contains a list of pertinent references, and appendix II contains an identification table of parts.

2. Forms and Records

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

a. DD Form 6, Report of Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85POO (Navy), and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to the Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 AND AFR 65-26.

d. DA AGO Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment—Radio Communication, Direction Finding, Carrier, Radar, will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment—Radio Communication, Direction Finding, Carrier, Radar, will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. PURPOSE. Telegraph-Telephone Signal Converter TA-182/U provides a means of signaling in circuits which will not pass 20-cps (cycles per second) ringing signals because of line or equipment characteristics.

b. USE. In telegraph circuits, Telegraph-Telephone Signal Converter TA-182/U converts 20-cps ringing signals to 1,225-cps ringing signals, and converts 1,225-cps ringing signals to 20-cps ringing signals. In telephone circuits, Telegraph-Telephone Signal Converter TA-182/U converts 20-cps ringing signals to 1,600-cps ringing signals, and converts 1,600-cps ringing signals to 20-cps ringing signals.

4. System Applications

Note. Throughout this manual the word converter will be used to refer to Telegraph-Telephone Signal Converter TA-182/U; Filter F-98/U will refer to Filter Assembly, Electrical F-98/U; Terminal TH-5/TG will refer to Telegraph Terminal TH-5/TG.

a. GENERAL. (1) The v-f (voice-frequency) telegraph system has an advantage over the d-c (direct-current) telegraph system, because v-f telegraph makes use of existing inside and outside facilities of telephone systems. V-f telegraph loops can be switched by using telephone switchboards. V-f telegraph circuits do not require separate d-c teletypewriter switchboards.

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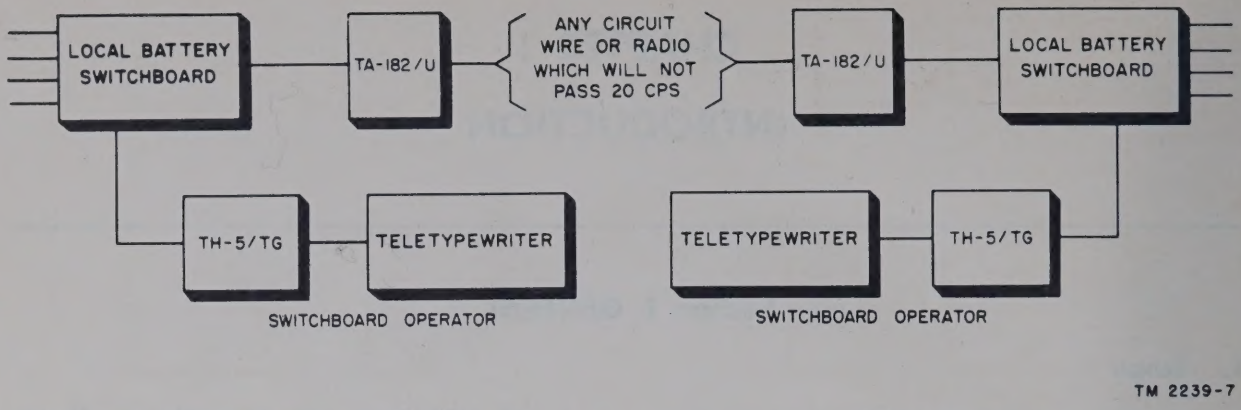


Figure 2. Telegraph-Telephone Signal Converter TA-182/U, telegraph only service.

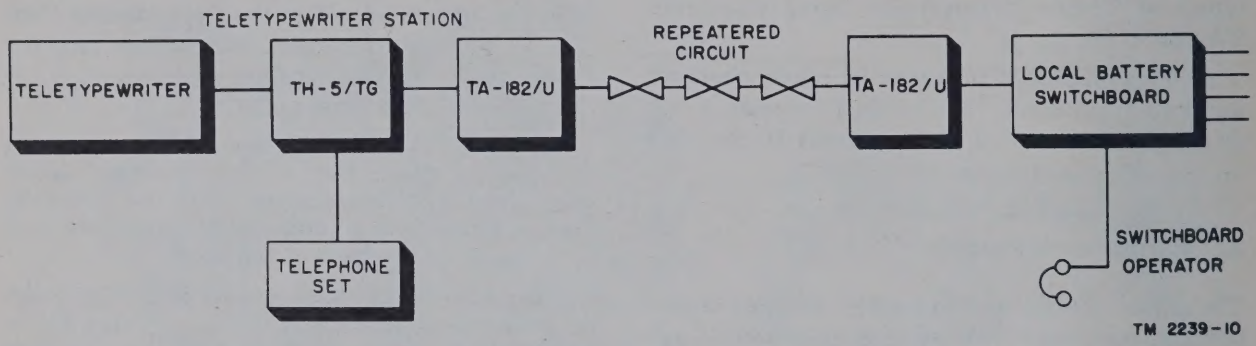


Figure 3. Telegraph-Telephone Signal Converter TA-182/U, alternate telegraph or telephone service.

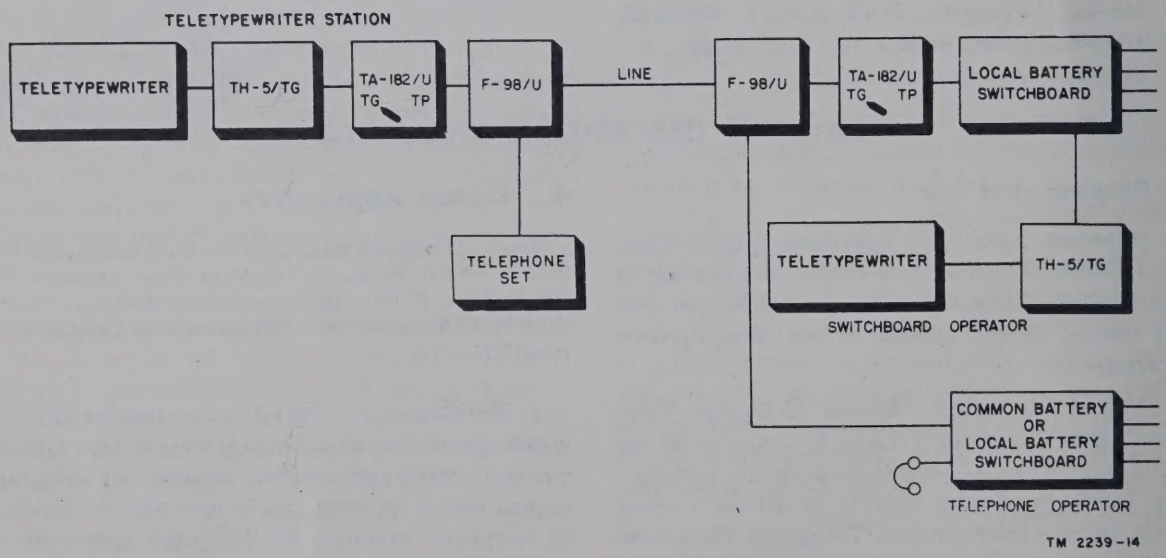


Figure 4. Telegraph-Telephone Signal Converter TA-182/U, speech plus half-duplex service, 2-wire facility passing 20-cps signals.

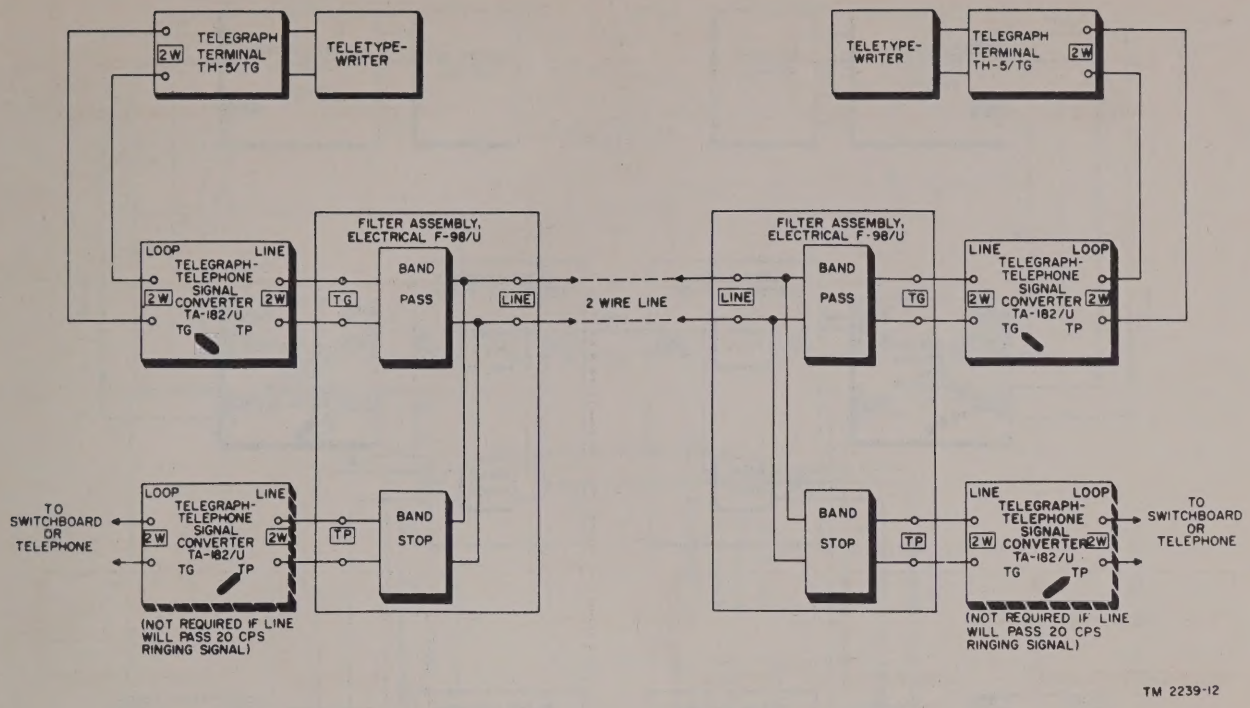


Figure 5. Telegraph-Telephone Signal Converter TA-182/U, speech plus half-duplex service, 2-wire facility not passing 20-cps signals.

(2) In a v-f telegraph system, ringing signals must be in the v-f range, because some types of v-f equipment will not pass 20 cps. Telegraph-Telephone Signal Converter TA-182/U accepts 20-cps ringing signals from the loop and converts the signals to v-f ringing signals for transmission to a distant station. The converter also converts v-f ringing signals from a distant station to 20-cps ringing signals for use in the local circuit.

(3) The converter may be used in various types of telephone and v-f telegraph communication systems. Typical systems are discussed in subparagraphs b through f below.

b. TELEGRAPH ONLY SERVICE (fig. 2). This application provides signaling for telegraph use only. The converter is placed in the circuit to convert 20-cps ringing signals to v-f ringing signals. If the line and equipment between switchboards are capable of passing 20-cps signals, the converter is not needed in the circuit. Terminal TH-5/TG is used in the circuit to change d-c teletypewriter pulses to v-f teletypewriter signals.

c. ALTERNATE TELEGRAPH OR TELEPHONE SERVICE (fig. 3). This application provides signaling for either telephone or teletypewriter use, but not for both at the same time. Two converters are used: one at the teletypewriter station, the other at the switchboard. The converters are used only when the line equipment will not pass 20 cps.

d. SPEECH PLUS HALF-DUPLEX SERVICE. (1) *2-wire facility passing 20-cps signals.* (*a*) Figure 4 illustrates an arrangement which provides teletypewriter and telephone signaling over a 2-wire facility to permit passage of 20-cps signals. The signaling over the teletypewriter circuit and the telephone circuit are independent of each other. Two converters are used in the teletypewriter circuit: one at the teletypewriter station, the other at the switchboard.

(*b*) The converters are necessary in the teletypewriter circuit to change the 20-cps signals to 1,225-cps signals to operate the buzzer in Terminal TH-5/TG. Refer to the instruction book for AN/TCC-14 for a discussion of Telegraph Terminal TH-5/TG. Operation of the buzzer will cause the teletypewriter to run open.

(*c*) Converters are not necessary in the telephone circuit since 20-cps signals may be transmitted over the line.

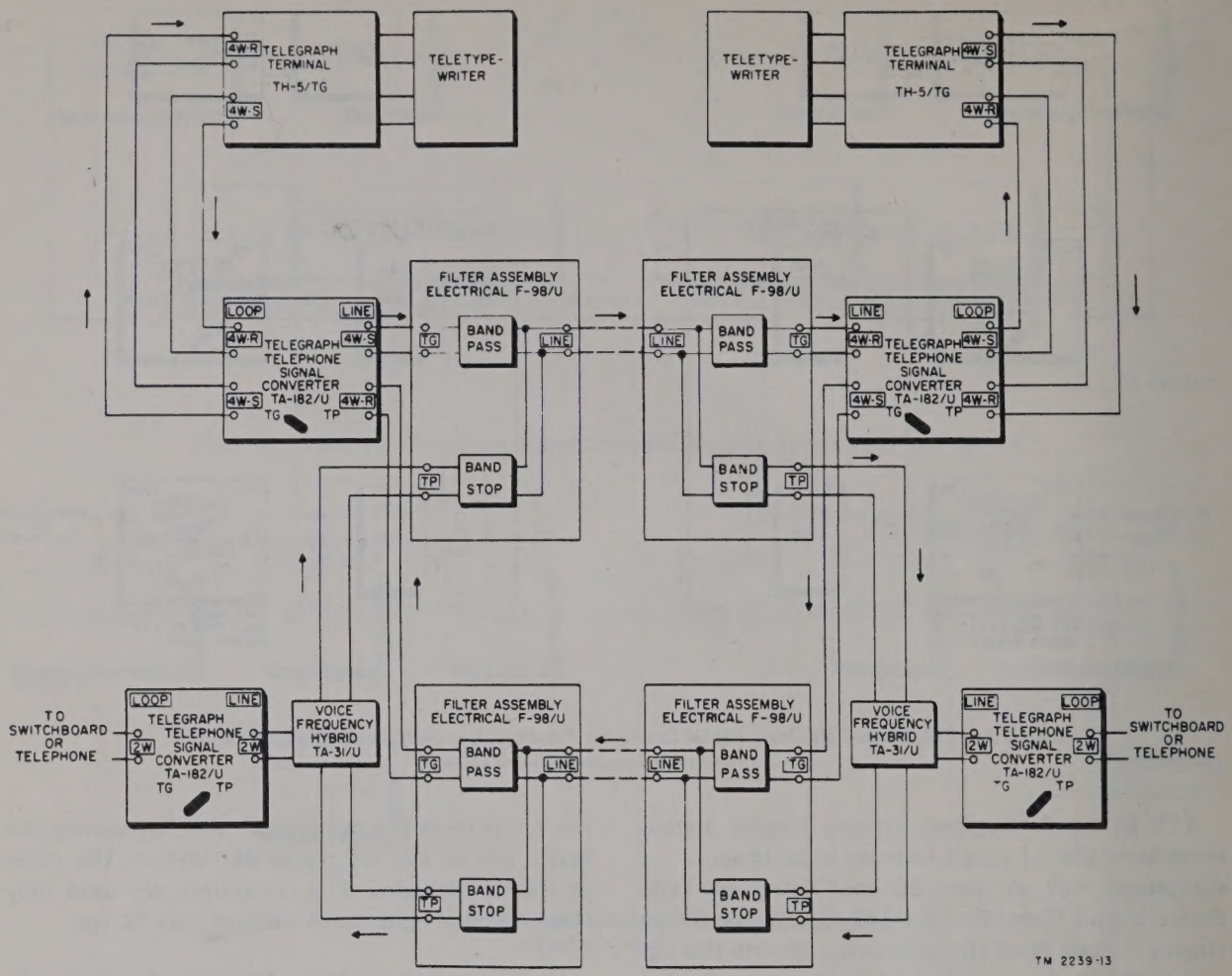


Figure 6. Telegraph-Telephone Signal Converter TA-182/U, speech plus full-duplex service.

(*d*) Filters are used to separate the teletypewriter and telephone circuits.

(2) *2-wire facility not passing 20-cps signals.* (*a*) Figure 5 illustrates an arrangement which provides teletypewriter and telephone signaling over a 2-wire facility which will not permit passage of 20-cps signals.

(*b*) Signaling over the teletypewriter circuit and the telephone circuits are independent of each other. Four converters are used; two in the teletypewriter circuit, two in the telephone circuit.

(*c*) Filters are used to separate the teletypewriter circuit and the telephone circuit.

e. Speech Plus Full-Duplex Service (fig. 6). This application provides independent signaling in both the full-duplex teletypewriter portion and the telephone portion of the circuit. Four converters are required in this arrangement: one at each end of the line in the teletypewriter portion of the circuit and one at each end of the line in the telephone portion of the circuit. A Voice-Frequency Hybrid TA-31/U is used to match the 2-wire telephone circuit to the 4-wire line.

f. Use With Carrier Equipment. Figure 7 illustrates a typical use of Telegraph-Telephone Signal Converter TA-182/U in a carrier system. Telephone Carrier Terminal CF-1-B is a 4-channel carrier telephone terminal.

(1) Channel 1 illustrates the use of converters in an arrangement which provides independent telephone and teletypewriter signaling in a speech plus half-duplex service over a single carrier channel.

(2) Channel 4 illustrates the use of converters in an arrangement which provides independent signal-

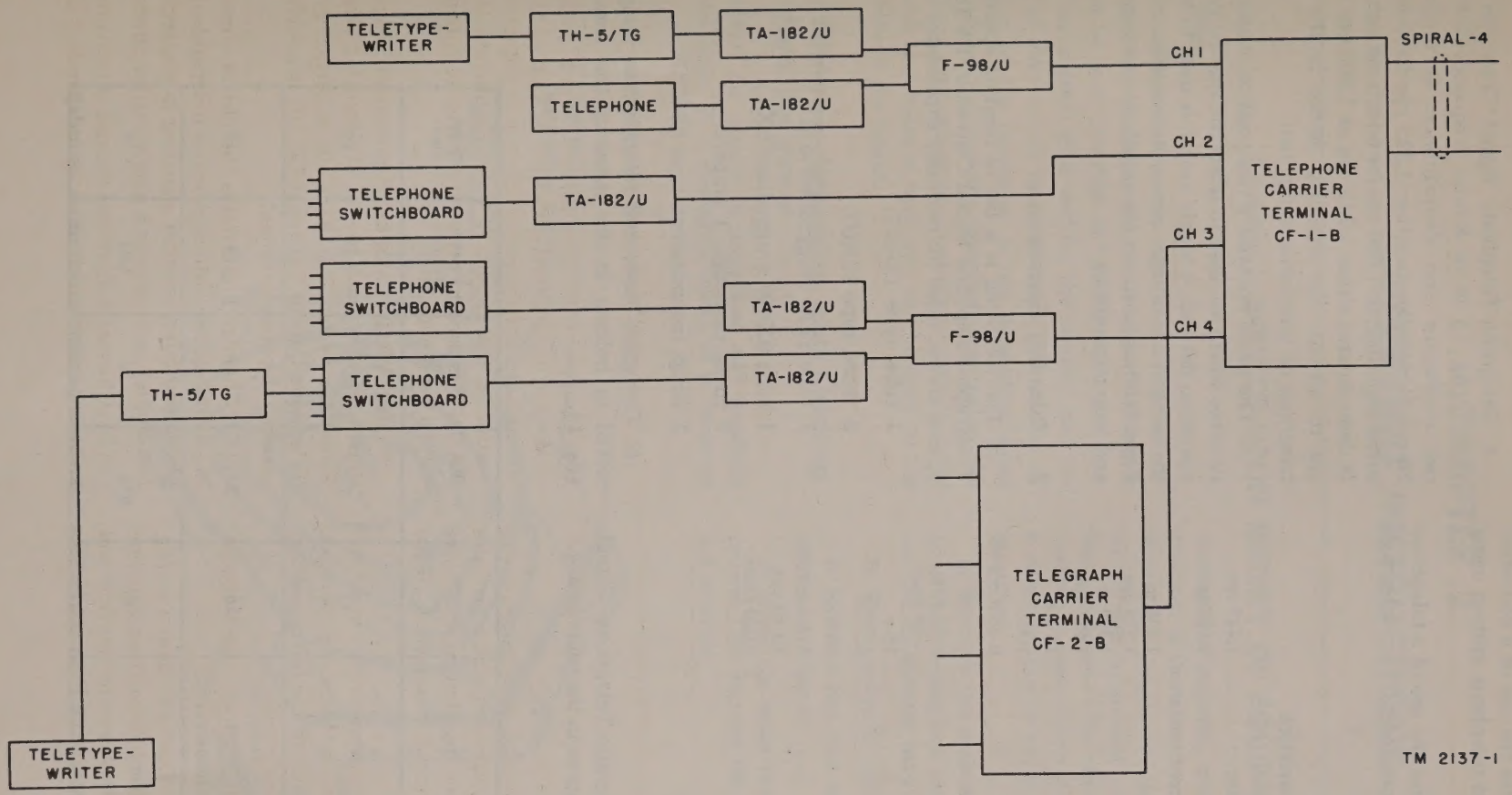


Figure 7. Telegraph-Telephone Signal Converter TA-182/U, typical carrier application.

ing in a speech plus half-duplex switched service over a single carrier channel.

(3) Channel 2 illustrates the use of a converter for signaling in a switched telephone system using a single carrier channel.

(4) Channel 3 illustrates the use of a telephone carrier channel for transmission of four telegraph circuits.

5. Technical Characteristics

Frequency of telegraph signaling	1,225 cps.
Frequency of telephone signaling	1,600 cps.
Frequency limits for satisfactory operation:	
For telegraph	1,108 to 1,278 cps.
For telephone	1,396 to 1,684 cps.
Low-frequency signal input	20 cps.
20-cps output level to loop	100 v.
Output level to line	0 dbm ±2 db.
Receiver sensitivity on line side	
Low sensitivity position	−31 dbm.
High sensitivity position	−58 dbm.
Sensitivity on loop side	25 v.
Number of tubes	8.
Power drain from a-c source	40 w.
Power source requirements	115 v ±10%, 50/60 cps.
Impedance	5,000 ohms.

6. Packaging Data

Packaging data for Telegraph-Telephone Signal Converter TA-182/U are given in the table below.

7. Description of Telegraph-Telephone Signal Converter TA-182/U

a. Telegraph-Telephone Signal Converter TA-182/U (fig. 1) is an 8-tube, frequency-shift carrier modulator and demodulator. It modulates 20-cps frequencies to either 1,225 cps for teletypewriter signaling, or 1,600 cps for telephone signaling. It demodulates either 1,225 cps or 1,600 cps to 20 cps to activate the signaling device in the local telegraph or telephone equipment.

b. The panel contains 2 two-position, wafer-type switches which are used to select the specific type of operation desired. A toggle switch is used to adjust the sensitivity of the converter receiver circuit. Eight binding posts on the panel are used for line and loop connections.

8. Running Spares

a. The following is a list of running spares, for Telegraph-Telephone Signal Converter TA-182/U. Spares are provided for normally expendable items.

1 tube, type 12AX7.

2 tubes, type 12AU7.

1 tube 5726 (ruggedized 6AL5).

1 tube 6X4W (ruggedized 6X4).

7 fuses, cartridge, 1 ampere.

1 lamp, incandescent, type 6S6DCC.

b. The spare fuses and incandescent lamp are stored in holders in the cover of the converter (fig. 1).

	Height (in.)	Width (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Unpacked	11	7½	10½	.502	15
Packed for domestic use	15	8¼	11	.78	19
Packed for export	16	9¼	12	1.02	24

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

9. Siting

The best location for wire equipment depends on the need to house the equipment where its shelter cannot be seen; the type of housing available; possible installation in a vehicle; the terrain; and the need of easy access to messengers. The choice of location of the converter is not dependent upon either the position of the telegraph terminal or the telephone with which the converter operates, since as much as 5 miles of field wire can be used on the loop side of the ringer.

10. Uncrating, Unpacking, and Checking New Equipment

Caution: Be careful in unpacking and handling the converter; it is damaged easily. If it becomes damaged or exposed, a complete overhaul may be required or the equipment may be rendered useless. When new equipment is received, select a location where the equipment may be unpacked without being exposed to the elements and which is convenient to the installation of the equipment. Figure 8 is a cutaway illustration showing how the equipment is packed.

a. Remove the nails with a nail puller from the lid of the packing box. Do not attempt to pry off the lid; the equipment may become damaged.

b. Remove the lid and the packing material.

c. Remove the unit from the case and place it upon a workbench.

d. Open the snap catches and swing open the covers. This exposes the binding posts and operating controls.

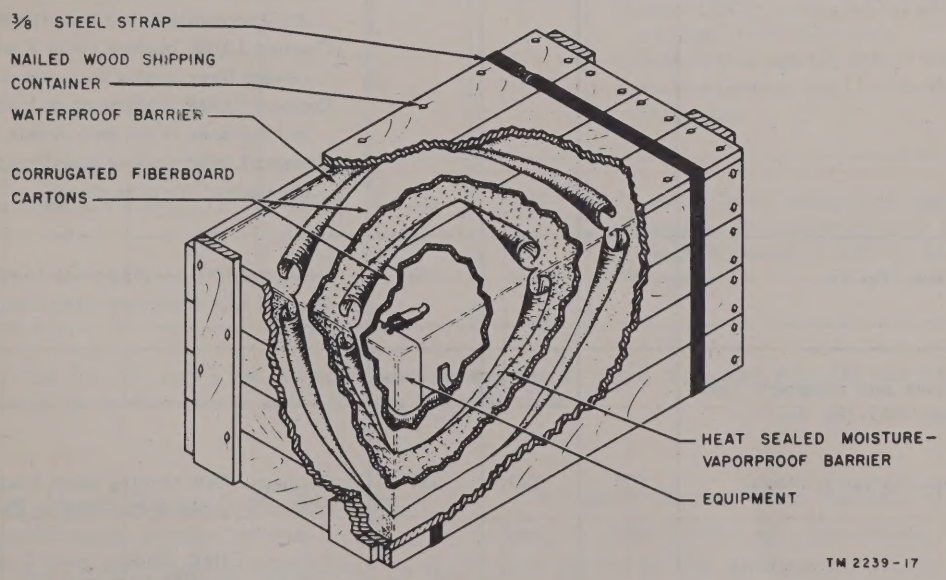


Figure 8. Telegraph-Telephone Signal Converter TA-182/U, packing and packaging diagram.

e. Unwind the power cord. It is located inside the cover.

f. Check the fuse on the front panel for good condition and proper insertion.

g. Check each tube against breakage and make certain that each is in its proper socket (fig. 9).

h. Check the contents of the packing case against the master packing slip. Save the original packing case. It can be re-used when the equipment is packed for storage or shipment.

11. Connections

The converter is connected differently for the various types of operation in which it may be applied. Binding post connections and switch positions for six types of operation are shown in the table below. Figures 5 and 6 show the binding post connections for 2-wire and 4-wire operation. Figures 2 and 7 show typical equipment arrangements. Figure 10 shows location of binding posts on the panel of the converter.

Type of operation	TP-TG switch	HI-LO switch	2W-4W switch	Connections
2-wire telephone (Telephone Terminal CF-1-B or AN/TCC-3 (carrier)) (fig. 7).	TP	LO	2W	Connect LINE binding posts 1 and 2 to carrier terminal binding posts. Connect LOOP binding posts to switchboard.
Speech plus half-duplex (two converters required) (fig. 5).				
Telephone channel converter.	TP	LO	2W	Connect LINE binding posts 1 and 2 to TP binding posts of Filter Assembly, Electrical F-98/U. Connect LOOP binding posts 5 and 6 to switchboard or magneto telephone.
Teletypewriter channel converter.	TG	HI	2W	Connect LINE binding posts 1 and 2 to TG binding posts of Filter Assembly, Electrical F-98/U. Connect LOOP binding posts 5 and 6 to Telegraph Terminal TH-5/TG binding posts 4 and 6.
4-wire telegraph (fig. 2).	TG	LO	4W	Connect LINE binding posts 1 and 2 to the sending lines going to the distant station. Connect LINE binding posts 3 and 4 to the receiving lines coming from the distant station. Connect LOOP binding posts 5 and 6 to the receiving lines of the loop circuit. Connect LOOP binding posts 7 and 8 to the sending lines of the loop circuit.
2-wire telegraph (fig. 2).	TG	LO	2W	Connect LINE binding posts 1 and 2 to the line. Connect LOOP binding posts 5 and 6 to the loop.
4-wire telephone and telegraph (full-duplex operation) (fig. 6).				
Telephone channel converter.	TP	LO	2W	Connect LINE binding posts 3 and 4 to the TG binding posts of the filter in the receiving circuit line. Connect LINE binding posts 1 and 2 to Voice Frequency Hybrid TA-31/U. Connect LOOP binding posts 5 and 6 to switchboard or magneto telephone.

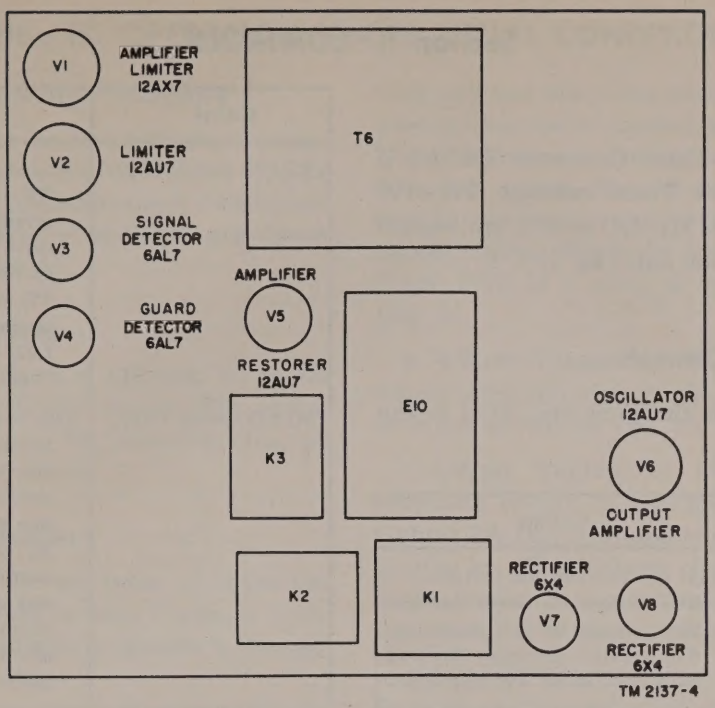


Figure 9. Telegraph-Telephone Signal Converter TA-182/U, tube location diagram.

11. Connections (contd)

Type of operation	TP-TG switch	HI-LO switch	2W-4W switch	Connections
Teletypewriter channel converter.	TG	LO	4W	Connect LOOP binding posts 5 and 6 to the receiving lines of the loop circuits. Connect LOOP binding posts 7 and 8 to the sending lines of the loop circuit. Connect LINE binding posts 1 and 2 to the TG binding posts of the filter in the transmitting circuit line.
Alternate telephone or telegraph.	TP[a] or TG	LO	2W	Connect LINE binding posts 1 and 2 to the line. Connect LOOP binding posts 5 and 6 to Telegraph Terminal TH-5/TG binding posts 4 and 6.

[a]The position of the TP—TG switch will not affect equipment operation in this application provided that the position of the TP—TG switch in the converters at each end of the line is the same.

12. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 10 for uncrating, unpacking, and checking the converter.

b. Check the used or reconditioned converter for tags or other indications pertaining to changes in the wiring of the equipment. If any changes are made, note those changes in this manual.

Section II. CONTROLS

13. General

Telegraph-Telephone Signal Converter TA-182/U contains three switches. These switches, 2W–4W switch, TP–TG switch, HI–LO switch, are located on the front panel of the unit (fig. 10).

14. Function of Controls

The controls and their functions are listed in the table below:

Control	Function
2W-4W switch (S1).	This is a two-position switch: 2W position–Arranges line and loop circuits for 2W operation. 4W position–Arranges line and loop circuits for 4W operation.
TP-TG switch (S2).	This is a two-position switch: TP position–The converter is arranged to transmit and receive 1,600-cps ringing signals on the line side. TG position–The ringer is arranged to transmit and receive 1,225-cps ringing signals on the line side.
HI-LO switch (S3).	This is a two-position switch: LO position–Used for ringing over circuits which do not exceed 25-db (decibel) loss on the line side. HI position–Used for ringing over circuits having up to 45-db loss on the line side. Used on circuits having less than 25-db loss if fading necessitates this position.

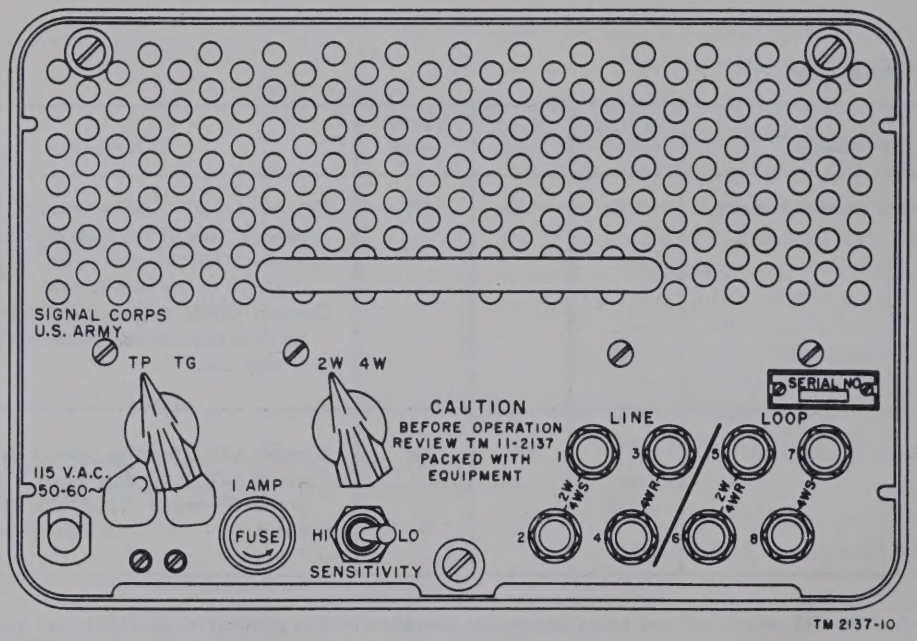


Figure 10. Telegraph-Telephone Signal Converter 182/U, control panel.

Section III. OPERATION UNDER USUAL CONDITIONS

15. Preliminary Starting Procedure

Connect the converter to the line and loop terminations and set the switches for the desired type of operation. Binding post connections and switch positions for the various types of operation are shown in the table in paragraph 11.

16. Starting Procedure

Connect the power plug to a 115-volt, 50 to 60 cycle a-c (alternating-current) source. The equipment is ready for operation. The converter does not contain an off-on power switch.

17. Types of Operation

a. GENERAL. There are six types of operation in which the converter may be used. These six types of operation are listed in subparagraphs b through g below.

b. 2-WIRE TELEPHONE. If the line will pass low-frequency ringing signals, Telegraph-Telephone Signal Converter TA-182/U need not be used in the circuit. If the line will not pass low-frequency ringing signals, two converters must be used in the circuit, one converter at each end of the line (fig. 7).

c. 2-WIRE TELEGRAPH. To secure ringing in a 2-wire telegraph circuit over v-f channels which will not pass 20 cps, a pair of converters must be used, one at each end of the line (fig. 2).

d. 2-WIRE TELEGRAPH AND TELEPHONE (SPEECH PLUS HALF-DUPLEX). To secure ringing in a 2-wire telegraph and telephone circuit, two converters are used at each end of the line. One pair of converters is used in transmission and reception of 1,225-cps telegraph signals. The other pair of converters is used in transmission and reception of 1,600-cps telephone ringing signals. In addition, one separation Filter F-98/U is used at each end of the line (fig. 5).

e. 4-WIRE TELEGRAPH. To secure signaling in a 4-wire telegraph circuit, one converter is used at each end of the line (fig. 2).

f. 4-WIRE TELEPHONE. Operation over 4-wire telephone circuits is possible if Voice Frequency Hybrid TA-182/U is used to convert 4W telephone circuits to 2W telephone circuits and thus permit connection to the telephone instruments (fig. 6). One converter is used at each end of the line.

g. 4-WIRE TELEPHONE AND TELEGRAPH (SPEECH PLUS HALF-DUPLEX). Two converters are used at each end of the line. One pair is used in the transmission and reception of 1,225-cps telegraph signals. The other pair is used in the transmission and reception of 1,600-cps telephone ringing signals. In addition, *two* separation Filters F-98/U are used at each end of the line (fig. 6).

18. Stopping Procedure

The converter goes into the stand-by condition automatically. To take the converter out of service, remove the power plug from the power source.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

19. General

Telegraph-Telephone Signal Converter TA-182/U will operate in regions where extreme cold, heat, humidity, and sand conditions prevail. Therefore, the limits of the converter are the limits imposed upon its associated equipment.

20. Operation in Arctic Conditions

a. Keep the equipment warm and dry. Keep the converter connected to the power source at all times so that the tube filaments remain lighted.

b. When equipment which has been exposed to the cold is brought into a warm room, the equipment will start to sweat and continue to do so until it reaches room temperature. When the converter has reached room temperature, dry it thoroughly. Sweating also may arise when equipment warms up during the day after exposure during a cold night.

21. Operation in Tropical Climates

When operated in tropical climates, the converter may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground level or when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is very poor, and the high relative humidity causes condensation

of moisture on the equipment whenever the temperature becomes lower than that of the ambient air. To minimize this condition, keep the converter connected to the power source so that the tube filaments remain lighted.

22. Operation in Desert Climates

a. Conditions similar to those in tropical climates often prevail in desert areas. Use the measure described in paragraph 21 to insure proper operation of the converter.

b. The main problem which arises with operation in desert areas is the large amount of dust which enters the equipment. Though the converter is mounted in a dustproof case, be careful to place the equipment in as dust-free a location as possible.

c. Never tie power cords or wiring connections to the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk connections loose or break the lines.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

23. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that break-downs and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent the occurrence of troubles rather than to repair the troubles.

24. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, dry-cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts by flushing with carbon tetrachloride (subpar. d below).

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry, compressed air may be used at a line pressure not exceeding 60 psi (pounds per square inch) to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. Gasoline will not be used as a cleaning fluid for any purpose. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: on electrical equipment where inflammable solvents cannot be used because of fire hazard, and for cleaning switch contacts and plugs.

e. For further information on preventive maintenance techniques, refer to TB SIG 123

25. Performing Preventive Maintenance

a. GENERAL. The following preventive maintenance operations should be performed by organizational personnel at the intervals indicated, unless these intervals are reduced by the local commander.

b. PREVENTIVE MAINTENANCE CHECKLIST.

Item No.	What to check	When to check[a]	How to check	Precautions
1	Exterior of case.	D	Inspect for damaged places, chipped paint, dirt, rust, corrosion, fungus growth, and loose or missing screws. Remove stubborn dirt from all easily accessible surfaces with solvent (SD); then wipe with a dry cloth. Retouch paint if necessary. Tighten all loose screws and nuts; replace any that are missing.	Refer to TM 9-2851.

b. PREVENTIVE MAINTENANCE CHECKLIST (contd).

Item No.	What to check	When to check[a]	How to check	Precautions
2	Interior of case.	D	Remove cover and inspect panel. Remove any condensed moisture with a dry cloth or air pressure. Tighten loose screws, binding post connections, and loose switch knob set screws.	Tighten screws snugly, but do not force them.
3	Fuse.	W	Remove fuse from panel holder. Use solvent (SD) to keep contact surfaces of fuse and holder clean. Look for cracks and insufficient tension to insure good contact. See that spare 1-ampere fuses are inserted securely in holder in unit cover.	Be sure all fuses used are 1-ampere fuses.
4	Capacitors C5, C26, C33.	W	Look for leakage, bulging, and heating (fig. 22).	Remove power plug and discharge capacitors before touching them.
5	Tubes.	M	Check with tube tester if available. Look for loose contacts, dirt, cracked bases, and corrosion. Clean with solvent (SD).	Be sure to replace tubes in the proper sockets (fig. 4).
6	Ballast lamp E9.	M	Look for corrosion and dirt on contact surfaces. Be sure there is a spare lamp in holder in cover.	
7	Resistors.	M	Look for blistering, discoloration, and other evidence of overheating.	
8	Wires, power cord.	M	Look for cracked, cut, and frayed insulation.	Remove plug from 115 v receptacle before inspection.
9	Terminal boards.	M	Look for cracks, dirt, and loose connections. Clean, if necessary, with solvent (SD).	
10	Mountings, machine screws and nuts.	M	Check for mechanical looseness. Tighten if necessary.	Tighten screws snugly, but do not force them.
11	Terminal boards.	M	Inspect all visible terminals for loose connections and corrosion.	
12	MFP coatings. Relays K1, K2, and K3.	M	Inspect for breaks. Retouch with a brush if necessary.	Refer to TB SIG 13.
13	Switches S1, S2, and S3.	M	Inspect contacts for dirt, corrosion, and unsatisfactory mechanical action. Clean, if necessary, by flushing contacts with carbon tetrachloride.	Relays are sealed hermetically. Do not attempt to clean or burnish relay contacts.

[a]D — Daily; W — Weekly; M — Monthly.

26. Lubrication

No lubrication is necessary for Telegraph-Telephone Signal Converter TA-182/U. The only moving parts are the switch shafts, which do not require lubrication.

Section II. WEATHERPROOFING

27. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture and extreme temperatures are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moisture-proofing and fungiproofing treatment has been devised, which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TG SIG 66.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to low humidity and excessive sand and dust are explained fully in TB SIG 75.

28. Rustproofing and Painting

a. If the finish on the panel is damaged badly, rust and corrosion can be prevented by touching up bared surfaces. Use #000 or #0000 sandpaper to clean the surface down to the bare metal until the finish is bright and smooth.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the unit by cleaning the corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section III. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

29. General

a. The trouble shooting and repair work that can be performed at the organizational maintenance level is limited necessarily in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining troubles such as burned-out tubes and cracked insulators.

b. The paragraphs which follow in this section help in localizing the fault to the defective stage or item, such as a tube or fuse.

30. Visual Inspection

a. Inspect the equipment visually for one or more of the following faults:

(1) Worn, broken, or disconnected cords or plugs.

(2) Burned-out fuse.

(3) Relay contacts burned because of overload.

(4) Wires broken because of excessive vibration.

(5) Defective tubes.

b. Burned-out parts may be detected by touch or smell. Be careful when touching such parts because they may be extremely hot.

31. Trouble Shooting by Using Equipment Performance Checklist

a. GENERAL. The equipment performance checklist (par. 32), is an aid in locating trouble in the equipment. The list gives the item to be checked, conditions under which the item is to be checked, the normal indications, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. ACTION OR CONDITION. For some items, the information given in the action or condition column consists of switch settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal conditions given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the

operator should note when items are checked. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to paragraphs in chapter 6 indicates that the trouble cannot be corrected by the operator, and that trouble shooting must be done by the higher echelons. However, if the tactical situation requires that communication be maintained, and if the unit is not disabled completely, the operator must maintain the set in operation as long as it is possible to do so.

32. Equipment Performance Checklist

	Item No.	Item	Action	Normal indications	Corrective measures
PREPARATORY	1	Binding posts.	Connect binding posts for desired type of operation as shown in paragraph 11.		
START	2	Filament circuit.	Connect power cable to source of voltage.	Tubes light.	Check fuse and power plug if all tubes do not light. Use a tube tester to check any tubes that do not light. *Note.* Never replace power-supply tubes without first checking power-supply capacitors C33, C26B, C26C, and C5C (par. 49).
EQUIPMENT PERFORMANCE	3	Send circuit.	For 2W operation, operate 2W-4W switch to 2W position. Apply 20-cps ringing signal either from telephone or from Terminal TH-5/TG to 2-wire LOOP binding posts 5 and 6. Connect headphones or telephone across 2-wire line binding posts 1 and 2. Check with TP-TG switch in TP position. Check again with switch in TG position. At completion of check, remove telephone from circuit.	A high tone appears across the telephone when ringing starts and disappears when ringing stops. This occurs for each position of the TP—TG switch.	Check tubes V6A, V6B, V7, and their circuits (pars. 36, 37, 38, 49).

32. Equipment Performance Checklist (contd)

	Item No.	Item	Action	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	3	Send circuit (contd)	For 4W operation operate 2W-4W switch to 4W position. Apply 20-cps ringing signal either from telephone or Terminal TH-5/TG to 4-wire loop binding posts 7 and 8.		
			Connect headphones or telephone across binding posts 1 and 2. Check with TP–TG switch in TP position. Check again with switch in TG position. At completion of check, remove telephone from circuit.	A high tone appears across the telephone when ringing starts and disappears when ringing stops. This occurs for each position of the TP–TG switch.	If the tone is present during one position of the 2W–4W switch but not the other position, check the switch. Refer to paragraphs 50, 51, and 52. If tone is not heard, check tubes V6A, V6B, and V7 and their circuits. Check contact point of relays K1 and K2. Refer to paragraphs 36, 37, 38, and 49.
EQUIPMENT PERFORMANCE	4	Receiving circuit.	For 2W operation operate 2W–4W switch to 2W position. Connect 2-wire loop binding posts 5 and 6 to telephone or Terminal TH-5/TG. Operate TP–TG switch to TG position. Apply 1,225-cps to line binding posts 1 and 2. Operate TP–TG switch to TP position. Apply 1,600-cps to line binding posts 1 and 2.	Buzzer in Terminal TH-5/TG or telephone operates.	Check receiving circuit tubes and circuits. Check power supply tubes V7 and V8. Check 20-cps ringing generator circuit. Refer to paragraphs 48 and 49.
				Buzzer in Terminal TH-5/TG or telephone operates.	If buzzer operates for 1,600-cps and not for 1,225-cps, check switch S2 and capacitor C3. Refer to paragraphs 50 and 51.
			For 4W operation operate 2W–4W switch to 4W position. Connect 4-wire loop binding posts 5 and 6 to telephone or Terminal TH-5/TG. Operate TP–TG switch to TG position. Apply 1,225-cps to 4-wire binding posts 3 and 4. Operate TP–TG switch to TP position. Apply 1,600-cps to line binding posts 3 and 4.	Buzzer in Terminal TH-5/TG or telephone operates.	If buzzer operates for one position of 2W–4W switch, but not for the other, check the switch. Refer to paragraphs 50, 51, 52. If buzzer does not operate at all, check power supply and receiving circuits. Refer to paragraph 39.
				Buzzer in Terminal TH-5/TG or telephone operates.	
STOP	5	Power plug.	Remove power plug from power source.		

CHAPTER 4

AUXILIARY EQUIPMENT

33. Mounting MT-791/U and Mounting MT-300/GR

a. Mounting MT–791/U is provided when the converter is to be mounted in a vehicle. Figure 11 is an illustration of Mounting MT–791/U. The installation of the converter is explained in paragraph 34.

b. Mounting MT–300/GR may be used in place of Mounting MT–791/U. They are identical except for a junction box which is included on Mounting MT–300/GR. This junction box is not used in converter vehicular installations.

34. Installation of Telegraph-Telephone Signal Converter TA-182/U on Mounting MT-791/U or Mounting MT-300/GR

a. Set the runners of the converter into the grooves of the mounting. When the unit is firmly in place, pull forward the two locking handles at the front of the mounting. Be certain to engage the unit when the locking handles are pulled forward.

b. To remove the converter from the mounting, push the locking handles backward until the clamps are disengaged. Lift the converter from the mounting.

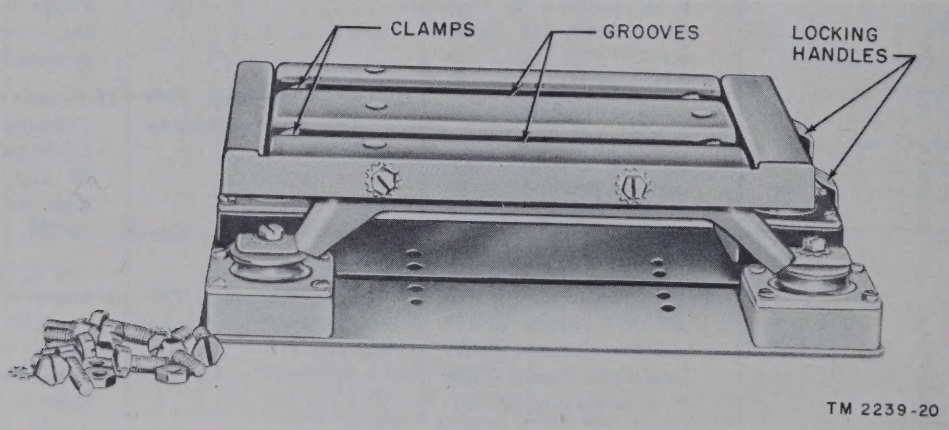


Figure 11. Mounting MT-791/U.

CHAPTER 5

THEORY

Section I. THEORY OF SENDING CIRCUIT

35. General

a. Telegraph-Telephone Signal Converter TA-182/U receives 1,225- or 1,600-cps ringing signals from the line and converts them to 20-cps ringing signals for the loop, or receives 20-cps ringing signals from the loop side and converts them to 1,225- or 1,600-cps ringing signals for the line. The converter is capable of differentiating between voice frequencies used as ringing signals and the same frequencies used in speech or v-f teletypewriter channels (par. 44).

b. Telegraph-Telephone Signal Converter TA-182/U consists of two major circuits (a sending circuit and a receiving circuit) and three auxiliary

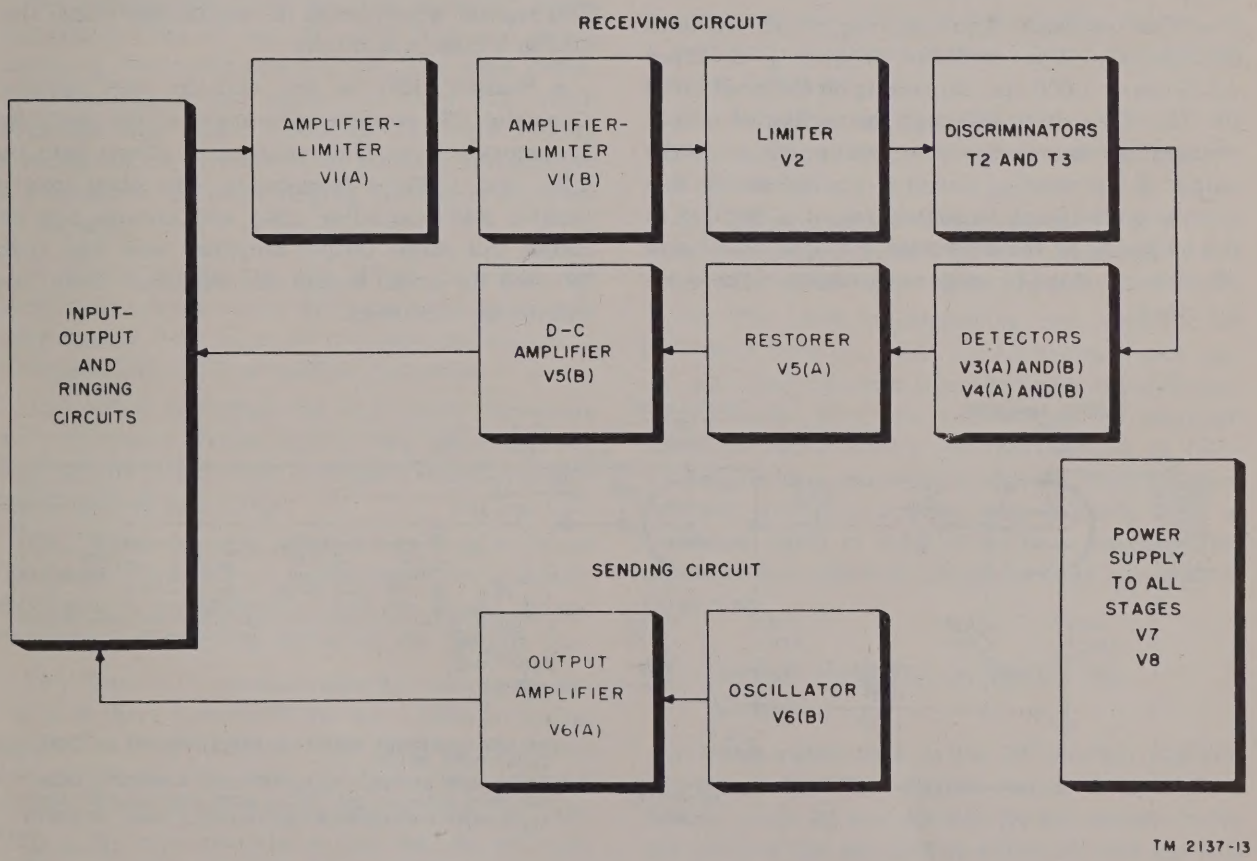


Figure 12. Telegraph-Telephone Signal Converter TA-182/U, block diagram.

circuits (a 20-cps ringing current supply circuit (static ringing generator), a power supply circuit, and an input-output circuit).

c. The theory of the sending circuit is discussed in paragraphs 36 through 38, the receiving circuit in paragraphs 39 through 47, the static ringing generator circuit in paragraph 48, the power supply circuit in paragraph 49, and the input-output circuit in paragraphs 50 through 52. Figure 12 is a block diagram showing the circuits of the converter.

36. Sending Circuit, Functioning

a. The function of the sending circuit (figs. 13 and 26) is to supply a v-f ringing signal to the loop when a 20-cps ringing signal from a Terminal TH-5/TG, a switchboard, or a telephone is received from the loop.

b. This v-f ringing signal is 1,225 cps for teletypewriter signaling and 1,600 cps for telephone signaling. Since these converted signals are v-f signals, they pass over any type of line or through any equipment that passes v-f currents.

c. The oscillator of the sending circuit oscillates continuously. The oscillator frequency is either 1,225 cps or 1,600 cps, depending on the position of the TP–TG switch. Although the oscillation is continuous, its transmission is not continuous, since the output of the sending circuit is applied to the line only when a 20-cps frequency signal is applied to the loop side of the converter. Paragraphs 37 and 38 contain a stage-by-stage explanation of the sending circuit.

37. Oscillator Stage V6B, Sending Circuit

a. The circuit of tube V6B (figs. 13 and 26) is a modified Hartley oscillator. The tuned plate circuit consists of transformer T5 and capacitors C29, C30, C31, and C32. (Capacitors C30 and C32 are fixed trimmer capacitances for which no value is given. See paragraphs 69, 70, and 71 for replacement procedure.)

b. The oscillations in the tuned circuit are coupled to the grid through terminals 1 and 2 of transformer T5 and capacitor C27. Although capacitor C27 is connected between the plate and grid, it varies the interelectrode capacitance between the grid and cathode of the tube. (This is known as the Miller Effect.)

c. When the tube conducts, there is regenerative feedback from the plate to grid through R31 and blocking capacitor C28. This feedback is of sufficient amplitude to set up oscillations in the resonant circuit. Feedback resistor R31 has a very high resistance; consequently, the grid never draws current. This resistor which limits the oscillations biases the tube as a class A oscillator.

d. Resistor R30 is the cathode bias resistor. Capacitor C30 permits adjustment of the oscillator frequency ±8 cps. This adjustment affects both the 1,600- and 1,225-cps frequencies. The plate load is resistor R28. Capacitor C26A and resistor R29 decouple this stage. Output amplifier tube V6A (par. 38) and its circuit isolate the oscillator from line impedance variations.

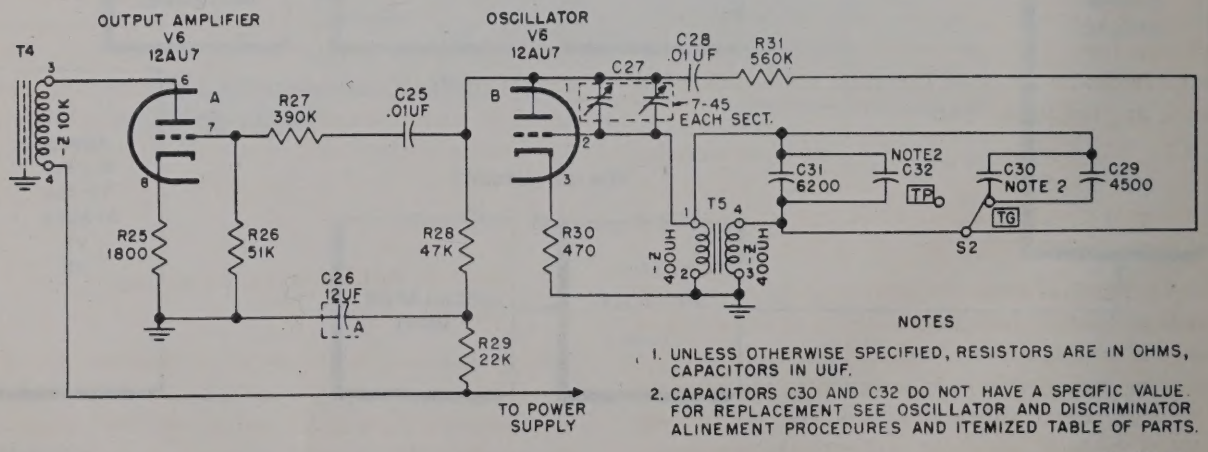


Figure 13. Sending circuit, schematic diagram.

38. Output Amplifier Stage V6A, Sending Circuit

a. Tube V6A (figs. 13 and 26) is a conventional voltage amplifier. The output of the oscillator (par. 37) is fed to tube V6A through coupling capacitor C25 and current-limiting resistor R27.

b. The cathode resistor is R25. Resistor R26 supplies the grid with a d-c path to ground. The output of the sending circuit is across transformer T4. Transformer T4 couples the signal to the line through binding posts E1 and E2 (fig. 18).

c. When switch S1 (fig. 18) is in the 2W position, a 20-cps signal from the loop is received at binding posts E5 and E6 and passes through switch S1 contacts 4-3 and 11-9 to the coil of relay K1. This 20-cps signal energizes relay K1, which closes contacts 3-4. Closing the contacts applies dc from the power supply to the coil of relay K2 and energizes relay K2. Energizing relay K2 closes contacts 5-12 and 3-11.

d. Closing relay K2 contacts 5-12 and 3-11 applies the 1,600- or 1,225-cps output signal from the secondary of transformer T4 to line binding posts E1 and E2.

e. When switch S1 is in the 4W position, a 20-cps signal from the loop is received at binding posts E7 and E8 and passes through switch S1 rear contacts 2-3 and 8-9. Relay K1 is in parallel with S1 contacts 3 and 9. Consequently, relay K1 is energized and, in turn, energizes relay K2 (subpar. c above). Relay K2 applies the 1,600- or 1,225-cps ringing signals to binding posts E1 and E2.

Section II. THEORY OF THE RECEIVING CIRCUIT

39. Receiving Circuit, Functioning

a. GENERAL. The function of the converter receiving circuit (figs. 15 and 26) is to limit and detect incoming ringing signals from the line. After detection, the signals are applied to relay K3, which responds only when 1,600- or 1,225-cps ringing frequencies are received from the line. When relay K3 responds, a 20-cps ringing current is supplied to the loop.

b. 1,225-CPS SIGNAL. (1) When converters are used in v-f teletypewriter systems, 1,225-cps signals may appear from either of two separate sources, a Terminal TH-5/TG or another converter.

(2) When teletypewriter code space characters are sent from a distant station, they are modulated to 1,225 cps by a distant Terminal TH-5/TG before being applied to the line.

(3) When a ringing signal is sent from a distant Terminal TH-5/TG by depressing the ring switch, this signal is modulated to 1,225 cps by the distant converter before being applied to the line.

(4) The 1,225-cps teletypewriter code space signal is of short duration while the 1,225-cps ringing signal is of long duration. Time becomes the differentiating factor. The time duration of the received 1,225-cps signal affects the bias applied to tube V5B of the local converter so that the tube will pass sufficient current to operate relay K3 only when a *1,225-cps signal of long duration* is applied. For details of how this is accomplished, refer to paragraphs 45 and 46.

c. 1,600-CPS SIGNAL. (1) When converters are used in telephone systems, the 1,600-cps signals may appear from either of two separate sources, as a frequency in speech or as a ringing signal from another converter.

(2) Conversation from a distant telephone will contain 1,600-cps frequencies as part of the frequencies of speech.

(3) When a telephone ringing signal is sent from a distant source, it is modulated to 1,600 cps by the distant converter before being applied to the line.

(4) The 1,600 cps originating from conversation is of short duration, while the 1,600-cps ringing signal is of long duration. Time becomes the differentiating factor. The time duration of the received 1,600-cps signal affects the bias applied to tube V5B of the local converter so that the tube will pass sufficient current to operate relay K3 only when a *1,600-cps signal of long duration is applied. For* details of how this is accomplished, see paragraphs 45 and 46.

40. Switch Positions in Receiving Circuit

a. When switch S1 is in the 2W position (fig. 26), the signal from the distant station is applied to binding posts E1 and E2 and passes through relay K2 contacts 12-4 and 11-2 to switch S1 rear contacts 9-11 and 3-4. The signal then passes to the primary winding of the transformer T1 through blocking capacitors C1 and C2 and isolating resistors R1 and R2.

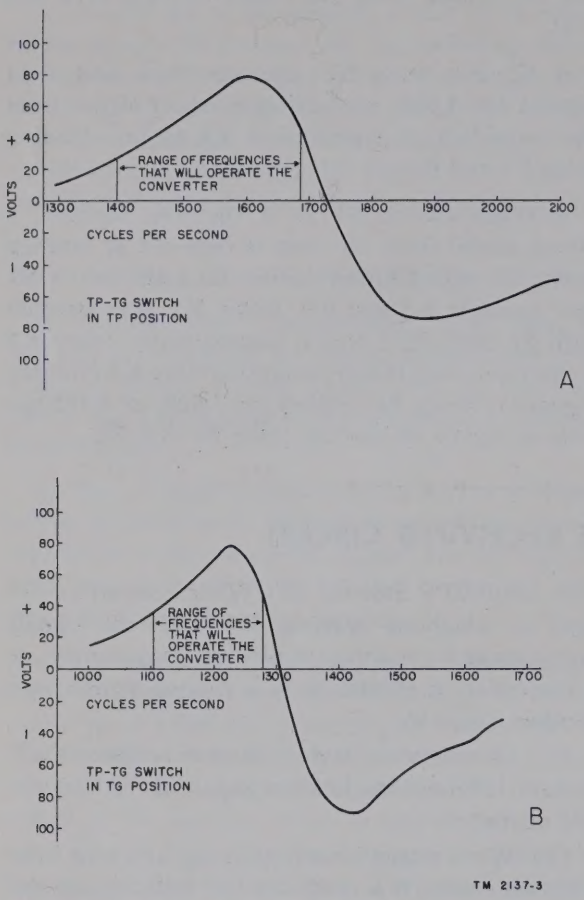


Figure 14. Receiving circuit, discriminator resonant curves.

b. When switch S1 is in the 4W position, the signal from the distant station is applied to binding posts E3 and E4, and passes through switch S1 rear contacts 6-5 and 12-11 to the primary of transfomer T1.

c. In both the 2W and 4W positions of switch S1, the converter is bridged across the line and presents a 5,000-ohm bridging impedance.

d. The signal is induced in the secondary of transformer T1 and is carried to the grid of tube V1A. Capacitor C4 tunes the secondary of transformer T1 to respond to the TP ringing frequency of 1,600 cps. Capacitor C3, which is placed in parallel with capacitor C4 when switch S2 is in the TG position, tunes the secondary of transformer T1 to 1,225 cps, the TG ringing frequency.

41. Limiter and Amplifier Stage V1A, Receiving Circuit

a. Tube V1A (figs. 15 and 26) differs from a conventional voltage amplifier in that the signal is applied to the grid through series resistor R3 to secure current-limiting action on high-level signals. Since resistor R3 is of a high value, the grid of tube V1A will not draw current unless the input signal level is very high. When the grid does draw current, the grid current flow, being of opposite polarity to the input signal, clips the peaks of the incoming signal. Thus, the high level signal is limited by the grid conduction on the positive half-cycle.

b. The tube is biased so that the negative peaks of high-level signals drive the tube to cut-off and produce limiting in the negative half-cycle. On low-level signals, the tube acts as a class A amplifier.

c. Resistor R4 provides a d-c path from the grid to cathode and limits the accumulation of charge upon the grid. The amplified output of tube V1A is developed across resistor R6 which is in series with decoupling resistor R7 and bypass capacitor C5A.

42. Limiter and Amplifier Stage V1B, Receiving Circuit

a. The limiting action of this tube is identical to that of the preceding stage (par. 41) when switch S3 is in the HI position. In this position, resistor R8 is a current-limiting resistor, and resistor R9 provides the grid leak to ground.

b. In the LO position of switch S3, resistors R8 and R24 form a voltage divider. In this position, a lesser signal is fed to the grid of tube V1B (figs. 15 and 26). Capacitor C7 bypasses cathode resistor R10 to ground. Resistor R11 is the plate load resistor. Capacitor C5B and resistor R12 decouple this stage of amplification. Capacitor C6 couples tube V1A to tube V1B.

43. Limiter Stage V2, Receiving Circuit

a. The function of this stage is to remove any amplitude modulation that remains after the limiting action of tubes V1A and V1B (pars. 41 and 42). Limiter stage V2 (figs. 15 and 26) provides the discriminator with a signal of constant amplitude.

b. The input signal to the grid of tube V2, being of large amplitude, causes the grid to draw current when the input signal is positive. As the input signal

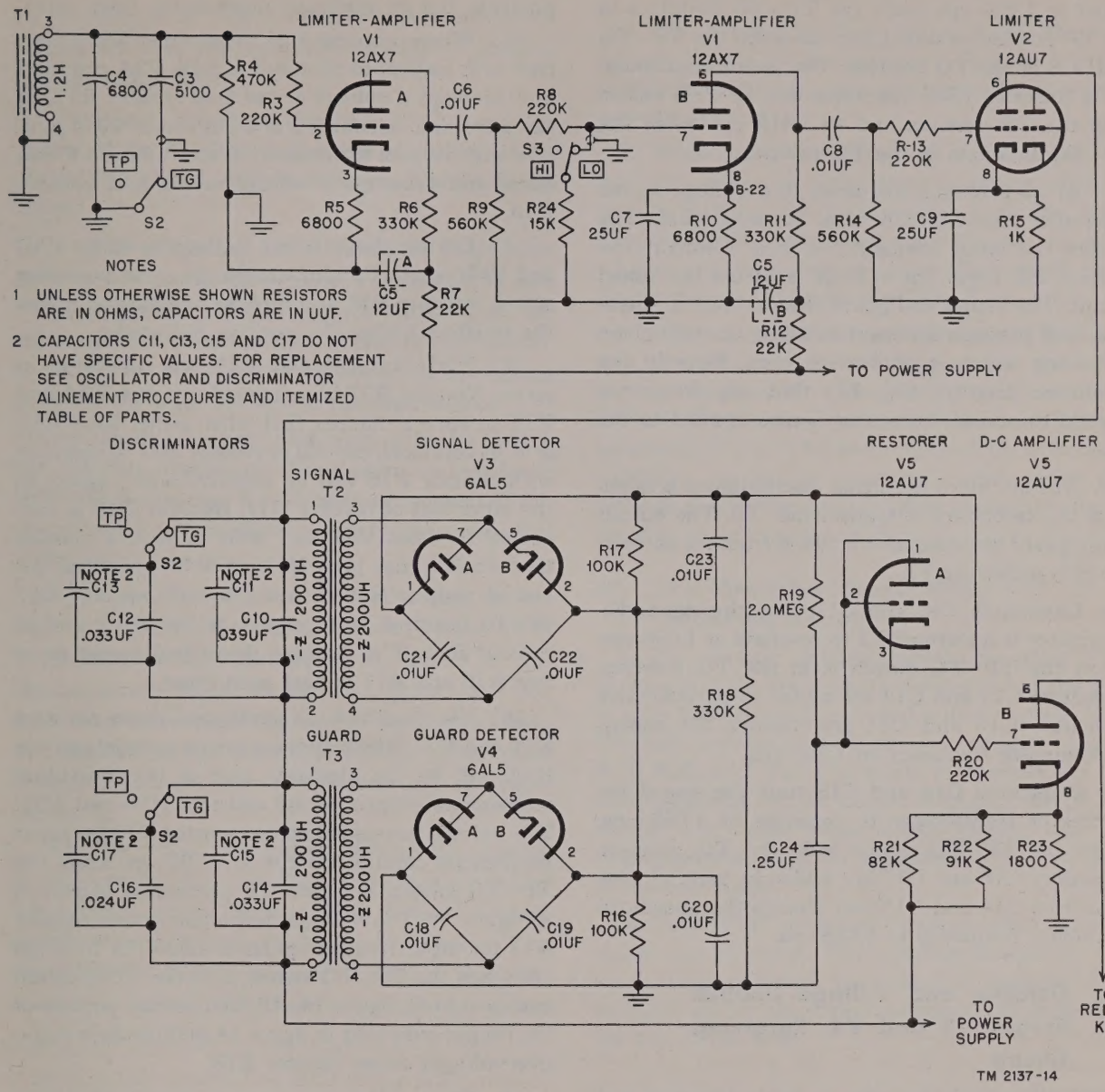


Figure 15. Receiving circuit, schematic diagram.

goes positive, capacitor C8 charges across resistor R14 and makes the grid positive with respect to the cathode. When the grid, now positive, draws current, the positive peaks of the incoming signal are clipped.

c. Limiting is accomplished in the negative half-cycle by driving the tube to cut-off. During this period, there is no flow of plate current, and therefore the negative half-cycle is clipped in the plate circuit. The result is a signal of constant amplitude. Resistor R13 is the grid current-limiting resistor. R15 is the cathode bias resistor. C9 is the cathode bypass capacitor.

44. Discriminators, Receiving Circuit

a. To guard against false operation of the converter when 1,600- or 1,225-cps signals appear from sources other than signaling sources (par. 39), two tuned circuits are needed as discriminators. The input to the discriminators is taken from the plate circuit of tube V2.

b. The *signal discriminator* (figs. 15 and 26) is tuned to 1,600 cps when the TP–TG switch is in the TP position and to 1,225 cps when the TP–TG switch is in the TG position. The *guard discriminator* is tuned to 1,885 cps when the TP–TG switch is in the TP position and to 1,415 cps when the TP–TG switch is in the TG position.

c. At its resonant frequency, the voltage across a parallel tuned circuit is at its maximum. The further the input frequency is from resonant frequency, the lower the voltage is across the tuned circuit. The signal and guard discriminators, therefore, will produce different voltages for any given frequency which is applied to both. Note in the schematic diagram (fig. 15) that any frequency applied to one discriminator is also applied to the other.

d. The output of the signal discriminator is taken from the secondary of transformer T2. The output of the guard discriminator is taken from the secondary of transformer T3.

e. Capacitors C10 and C11 tune the signal-discriminator transformer T2 to resonate at 1,600 cps. When the TP–TG switch is in the TG position, capacitors C12 and C13 are added in parallel with capacitors C10 and C11 and change the signal-discriminator frequency to 1,225 cps.

f. Capacitors C14 and C15 tune the guard-discriminator transformer to resonate at 1,885 cps. When the TP–TG switch is in the TG position, capacitors C16 and C17 are added in parallel with capacitors C14 and C15 and change the guard-discriminator frequency to 1,415 cps.

45. Detector and Voltage Doubler Stages V3 and V4, Receiving Circuit

Tubes V3 and V4 function as both detectors and voltage doublers.

a. DETECTOR ACTION. The function of the detector stages is to change the received v-f ringing signals to a d-c voltage level for application to tube V5A. Since the action of the detectors is similar for either position of the TP–TG switch, only the TG position will be discussed in detail.

(1) The input of the signal detector is the voltage developed across the secondary of transformer T2. The input of the guard detector is the voltage developed across transformer T3. These voltages, as they appear at the transformer secondaries and are applied to tubes V4 and V5, are of the same polarity, but of different magnitudes (par. 44c).

(2) When terminal 3 of transformer T2 is positive with respect to terminal 4, tube V3A conducts and develops a voltage across load resistor R17. At the same time, terminal 3 of transformer T3 is positive with respect to terminal 4, and tube V4A conducts and develops a voltage across load resistor R16.

(3) During the negative half-cycle, tubes V3B and V4B conduct and maintain the same polarities across resistors R17 and R16, as had existed across the resistors during the positive half-cycle.

(4) Resistors R16 and R17 are connected in series. Resistor R17 is connected to tubes V3A and V3B in such a manner that when either tube V3A or V3B conducts, the end of resistor R17 in common with resistor R16 will be negative with respect to the other end of resistor R17. Resistor R16 is connected to tubes V4A and V4B in such a manner that when either tube V4A or V4B conducts, the end of resistor R16 in common with resistor R17 will be negative with respect to the other end of resistor R16. The voltages developed across resistors R16 and R17 oppose each other.

(5) The total voltage developed across resistors R16 and R17, which appears across parallel resistor R18, will be the algebraic sum of the individual voltages developed across resistors R16 and R17. The voltage developed across resistor R18 for input frequencies from 1,300 cps to 2,100 cps when the TP–TG switch is in the TP position is shown in A, figure 14. The voltage developed across resistor R18 for input frequencies from 1,000 cps to 1,600 cps when the TP–TG switch is in the TG position is shown in B, figure 14. All frequencies outside of the ranges indicated in figure 14 will produce negative voltages across resistor R18.

(6) Thus, when the voltage developed across transformer T2 is of greater magnitude than the voltage developed across transformer T3, the voltage across resistor R17 will be greater than the voltage developed across resistor R16, and their sum as it appears across resistor R18 will be positive. When the voltage across transformer T3 is greater than the voltage across transformer T2, the voltage across resistor R18 will be negative.

(7) When a 1,225-cps signal is received with the TP–TG switch in the TG position, a positive voltage appears across resistor R18 (par. 44b).

(8) When the TP–TG switch is in the TP

position, only a 1,600-cps signal will produce a larger voltage at transformer T2 than at transformer T3 and, consequently, produce a positive voltage across R18.

b. VOLTAGE DOUBLER ACTION. (1) Since the action of the doublers is identical regardless of the input frequencies, only the signal doubler is discussed.

(2) When terminal 3 of transformer T2 is more positive than terminal 4, tube V3A conducts and charges capacitor C21. Thus, the cathode, or the upper plate of capacitor C21, is positive in relation to the lower plate of the capacitor by a voltage equal to the peak voltage of the input signal.

(3) During the next half-cycle, tube V3A does not conduct. Capacitor C21 begins to discharge slowly across resistor R17. The time constant of the circuit may be expressed as a rapid charge time and a slow discharge time.

(4) While capacitor C21 is discharging slowly, capacitor C22 charges rapidly through tube V3B. While capacitor C21 is charging, capacitor C22 discharges slowly across resistor R17. Since these two capacitors are series-aiding, the voltage across them, as it appears across resistor R17, is twice the peak voltage developed across the secondary of transformer T2.

(5) The d-c voltage output of tube V3 appears across resistor R17, and the d-c voltage output of V4 appears across resistor R16. These voltages are of opposite polarity (subpar. a(4) above). The net voltage difference (algebraic sum of the voltages) developed across these two resistors appears across resistor R18.

46. Restorer, Receiving Circuit

a. For signals other than ringing signals, the voltage applied to diode-connected V5A is negative in polarity; the ringing and teletypewriter space signals are positive.

b. When positive ringing and space signals are received, capacitor C24 charges slowly through resistor R19 and the back resistance of tube V5A. The tube does not conduct since the cathode is at a higher potential than the plate. This results from the drop in voltage across resistor R19.

c. When negative voltages which arise from signals other than ringing or teletypewriter space signals are applied, the tube conducts and capacitor C24 discharges rapidly through the low forward resistance of tube V5A and resistor R18. Tube V5A conducts during the negative pulse, since the cathode is negative and the plate is positive due to the charge on capacitor C24.

47. D-c Amplifier Stage V5B, Receiving Circuit

a. For a long ringing signal, capacitor C24 charges and applies a positive potential to the grid of tube V5B through current-limiting resistor R20. The tube overcomes the bias set by cathode resistor R21, R22, and R23 and starts to conduct. As the tube conducts, the d-c circuit through relay K3 is closed. The relay contacts are closed, and the ringing generator output is applied to the loop side of the converter.

b. Tube V5B does not conduct when spacing pulses are received. The spacing pulses are not long enough to permit the charge on capacitor C24 to build up to the value necessary to overcome the bias of the tube.

Section III. THEORY OF AUXILIARY CIRCUITS

48. Static Ringing Generator Circuit

a. FUNCTION OF THE STATIC RINGING GENERATOR CIRCUIT. The function of the ringing generator circuit (fig. 16) is to supply a 20-cps telephone ringing signal in telephone applications or a 20-cps break signal to activate the buzzer at a teletypewriter station. This is accomplished by the use of a vibrator, a mechanically resonant electrical device used to change a continuous dc into a pulsating dc. A suppression filter, included in the ringing generator circuit, eliminates radio frequencies that would cause interference in the converter and associated equipment.

b. OPERATION OF THE STATIC RINGING GENERATOR VIBRATOR. (1) When no current is applied to the relay, the armature is at rest midway between the voltage contacts, with the motor (upper left) contact closed as shown in figure 16. In this condition the 18K resistor is shorted out of the circuit by the upper armature section and the motor contact. When current first is applied to the circuit, current

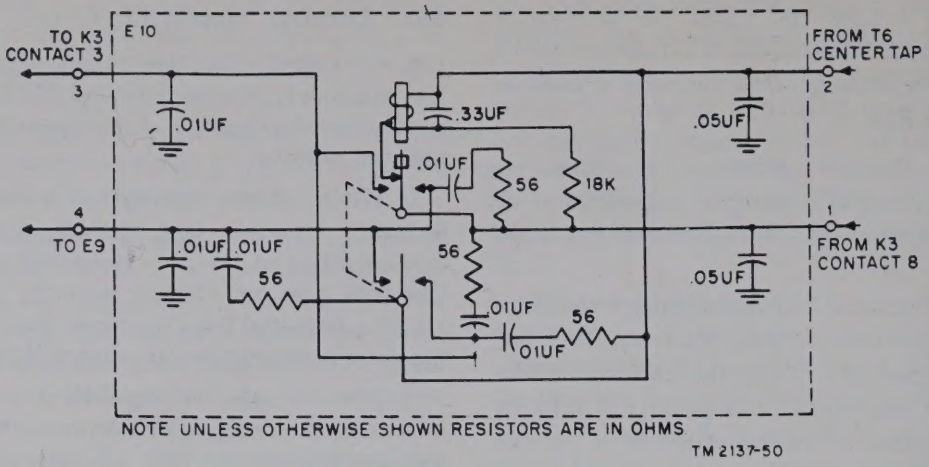


Figure 16. Ringing generator, static, circuit schematic diagram.

flows from tube V8 through terminal 1, through the upper armature section to the motor contact, through the relay winding, and returns to tube V8 through terminal 2. The current flow through the relay winding energizes the winding. Since the core of the winding is bent slightly to the right (not shown in fig. 16), the magnetic field pulls the armature to the right. This motion breaks the motor contacts. Breaking the contacts places the 18K resistor in the circuit. With this added resistance in the circuit, the current flow decreases and causes the collapse of the magnetic field and permits the armature to move back toward its rest position. Inertia carries the armature past its rest position. As the armature passes the rest position, the motor contact is closed and the winding is re-energized. This applies a force to move the armature back to the right. The motor contacts break. In this manner, oscillations are built up until the armature closes and opens the voltage contacts as it vibrates.

(2) When the armature closes the left set of voltage contacts, the path from the negative side of rectifier tube V8 is from terminal 2 through the lower armature section and contact to terminal 4. The positive path is from terminal 1 through the upper armature section and contact to terminal 3. When the armature closes the right set of voltage contacts, the negative path is from terminal 2 to terminal 3, and the positive path is from terminal 1 to terminal 4. Since the armature is mechanically resonant at a 20-cps rate, the polarity of terminals 3 and 4 will change at the same rate and effectively produce a 20-cps alternating current.

(3) Current surges are prevented because a closed circuit (through the relay winding) is offered continuously to the current flow from the power supply. The .33-uf (microfarad) capacitor in parallel with the relay winding decreases the time required for the armature to build up vibrations of sufficient amplitude to make and break the voltage contacts.

c. Operation of the Static Ringing Generator Filter. To prevent interference caused by sparking at the contact points, a suppression filter is included in the generator circuit. The series resistors and capacitors which form the filter attenuate the radio frequencies which might interfere with the operation of the converter and with associated equipment. Further elimination of radiation of radio frequencies is accomplished by housing the entire ringing generator in a sealed metal shield.

49. Power Supply

a. The power supply (fig. 17) consists of two conventional full-wave rectifiers operating from a 110- to 115-volt, 50- to 60-cycle source. The tubes supply d-c voltage to the plate, bias, and ringing supply circuits.

b. The power supply also supplies 6.3 volts to the tube filaments. All 12-volt filaments are center-tapped so that 6.3 volts, applied at the center tap and returned to the power supply through the ends of the filaments, will provide 6.3 volts for each half of the filament, or, effectively, 12.6 volts across the entire filament (fig. 17).

c. Tube V8, filtered by capacitor C33, supplies the 20-cps static ringing generator circuit with a d-c input.

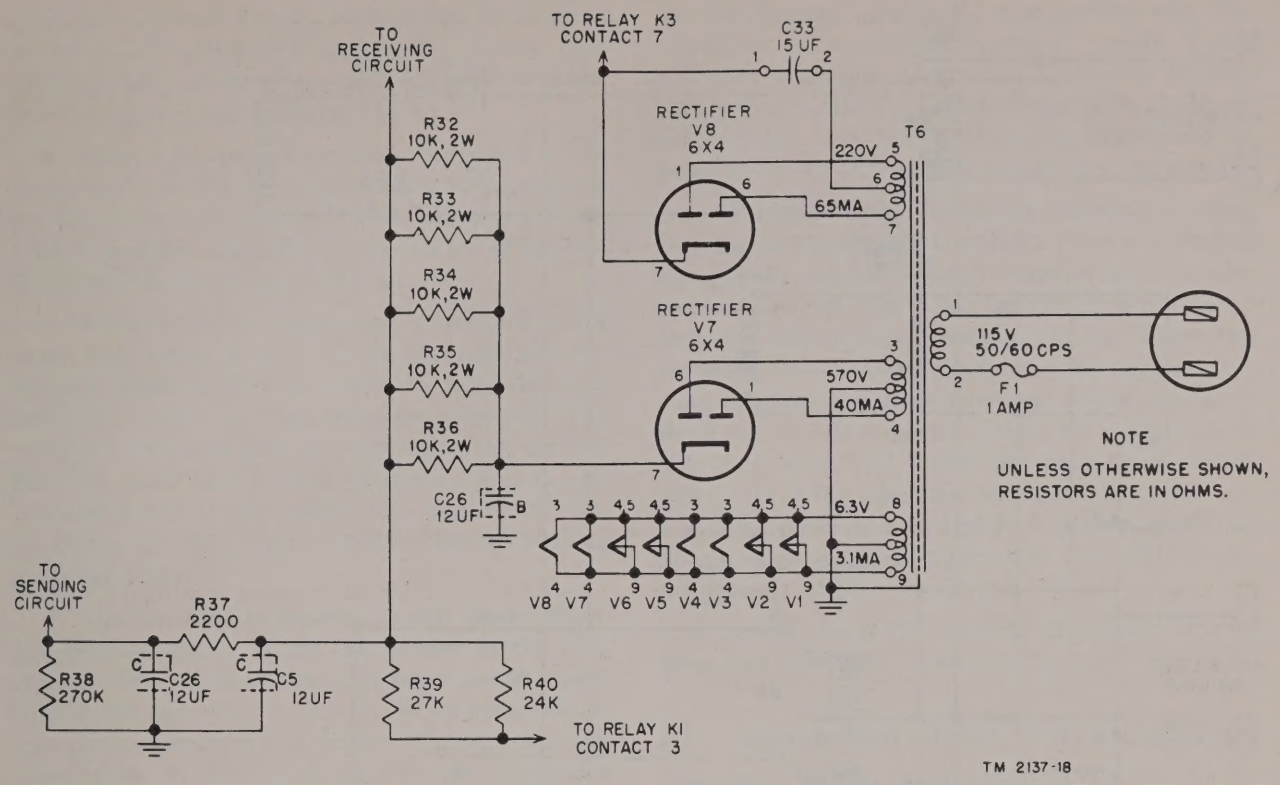


Figure 17. Power supply, schematic diagram.

d. Tube V7, filtered by resistors R32, R33, R34, R35, and R36 and capacitor C26B, supplies plate and bias voltages to the receiving circuit. The plate and bias supplies of the sending circuit derive their voltages from tube V7. Capacitors C5C and C26C and resistor R37 form an additional filter in this circuit. R38 is a bleeder resistor. The d-c supply, used to energize relay K2 in the input-output circuit, passes through current-limiting resistors R39 and R40.

50. Input-output Circuit, General

a. The input-output circuit contains the binding posts, through which the converter is bridged at the line and loop sides, and the 2W—4W switch S1.

b. Switch S1 arranges the converter for either 2W or 4W line operation. Two-wire operation on the line requires 2-wire operation on the loop. Four-wire operation on the line requires 4-wire operation on the loop.

c. When arranged for 2W operation, a 20-cps frequency ringing signal from a Terminal TH-5/TG or a telephone is applied to the loop side of the converter through binding posts E5 and E6. The converter converts a 20-cps ringing signal to a v-f ringing signal and transmits the v-f ringing signal through binding posts E1 and E2. The converter receives v-f ringing signals from the line at binding posts E1 and E2, converts them to 20-cps ringing signals, and transmits them to the loop through binding posts E5 and E6.

d. When arranged for 4W operation, a 20-cps ringing signal from a Terminal TH-5/TG or a telephone is applied at the loop side of the converter through binding posts E7 and E8. The converter converts a 20-cps ringing signal to a v-f ringing signal and transmits the v-f ringing signal to the loop through binding posts E1 and E2. The converter receives v-f ringing signals through binding posts E3 and E4, converts them to 20-cps ringing signals, and transmits them to the loop through binding posts E5 and E6.

51. Input-output Circuit, 2-wire Operation

a. The output of Terminal TH-5/TG or a telephone is applied through binding posts E5 and E6 to relay K3 terminals 2 and 4 (fig. 18). These output voltages are fed through switch S1 rear contacts 5-3 and 11-9, in the 2W position, to the coil of

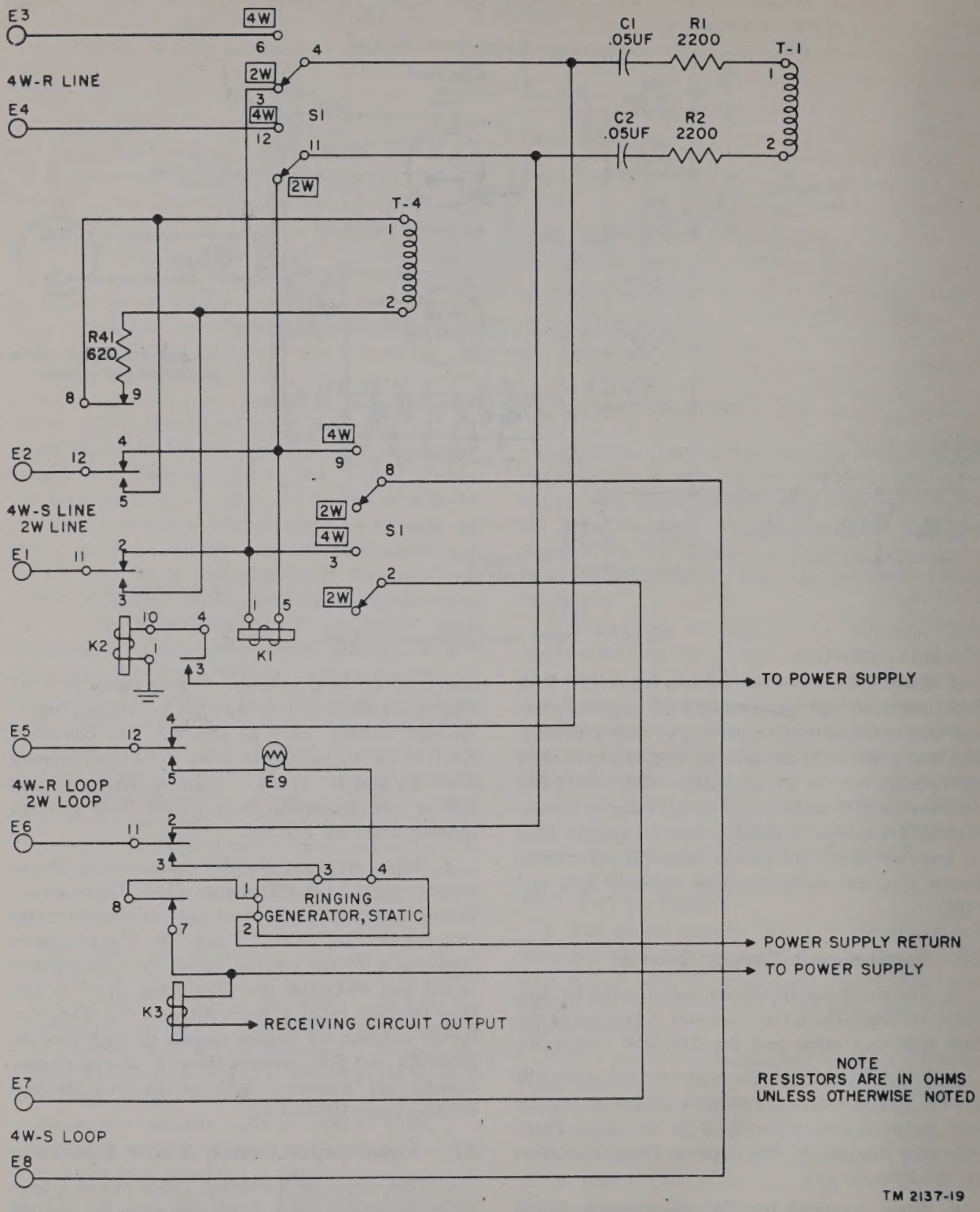


Figure 18. Input-output circuit, schematic diagram.

relay K1 terminals 1 and 5. In parallel with this coil are relay K2 contacts 2 and 4. V-f signals pass through these contact points and are applied to the line through binding posts E1 and E2.

b. When a 20-cps ringing signal is applied to the converter, relay K1 is energized. The voltage of the low-frequency ringing signal is of sufficient amplitude to energize relay K1. V-f signals are of too low an amplitude to energize relay K1.

c. When relay K1 is energized, contacts 3 and 4 close and apply a d-c voltage through current-limiting resistors R39 and R40 to relay K2 coil terminals 1 and 10. This energizes relay K2. The contact between 4 and 12 is broken; the contact between 2 and 11 is broken. Contacts 5 and 12 and contacts 3 and 11 are closed. This applies the output of the sending circuit to the line through binding posts E1 and E2.

d. The terminal impedance is 600 ohms. When the sending circuit is not terminated at the line, resistor R41 matches the impedance across transformer T4 terminals 1 and 2. When relay K2 is energized, contacts 8 and 9 open. The impedance of transformer T4 now is matched by the impedance of the line.

e. V-f ringing signals are applied to the converter through binding posts E1 and E2. These signals pass through relay K2 contacts 11-2 and 12-4 and are applied to the receiving circuit through switch S1 rear contacts 3-5 and 9-11 when switch S1 is in the 2W position. (Relay K1 is in parallel with this input, but the amplitude of the v-f signals is not sufficient to energize the relay.) Capacitors C1 and C2 are low-frequency blocking capacitors. Resistors R1 and R2 increase the bridging impedance of transformer T1 to minimize loss to message signals.

f. All input signals (telegraph marking, spacing, and ringing signals, and telephone voice and ringing signals) are applied to input transformer T1 of the receiving circuit. The receiving circuit is energized only by long-duration ringing signals. When the receiving circuit is energized, relay K3 contacts 7-8 close and apply voltage from the power supply to the static ringing generator. Relay K3 contacts 4-12 and 2-11 open and break the path to Terminal TH-5/TG or the telephone for signals from the line. Relay K3 contacts 5-12 and 3-11 close to apply the 20-cps ringing signal to Terminal TH-5/TG or the telephone.

g. Ballast lamp E9 protects the static ringing generator from short circuits in the loop.

52. Input-output Circuit, 4-wire Operation

The action of the input-output circuit for 4-wire operation is similar to the action in 2-wire operation (par. 51), except for the following:

a. The 2W—4W switch S1 is set in the 4W position.

b. Different binding posts are used (par. 50d).

CHAPTER 6

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance of Telegraph-Telephone Signal Converter TA-182/U. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. PREREPAIR PROCEDURE

53. Tools, Materials, and Test Equipment

Tools, materials, and test equipment needed for performing the prerepair procedures in this section are listed below:

Tool Equipment TE-49.
Solvent, dry-cleaning (SD).
Tube Tester I-177.

54. Removal of Pluck-out Parts

Remove the chassis from the case by removing the three screws from the front panel and sliding the chassis from the case.

a. REMOVING TUBES. After the tubes (fig. 4) have cooled sufficiently, pull up the tube with the fingers. Do not rock the tube or jiggle it excessively if it can be extracted by a direct upward pull. Rock it gently if it does not release easily. Jiggling a tube in its socket during removal spreads the contacts. Label each tube as soon as it is removed so that it can be replaced in its proper socket.

b. REMOVING FUSES. Fuse F1 is located within the front panel (fig. 10). Turn the fuseholder counterclockwise and extract the fuse from its holding sleeve.

c. REMOVING BALLAST LAMP E9. Unscrew the lampholder and remove the bayonet-base lamp by pushing in and turning counterclockwise.

55. Cleaning, Inspecting, and Testing Removed Parts

a. CLEANING, INSPECTING, AND TESTING TUBES. (1) *Cleaning.* Clean the tubes with a cloth moistened with solvent (SD); if necessary, clean the prongs with a crocus cloth.

(2) *Inspecting.* Inspect the tubes for cracks in the glass and base and for bent and broken prongs.

(3) *Testing.* Test the tubes for proper emission, leakage, and short circuits; use a tube tester or place doubtful tubes in a converter known to be operating normally.

b. INSPECTING, CLEANING, AND TESTING FUSE. (1) *Inspecting.* Inspect fuse ends for evidence of burning, corrosion, and looseness.

(2) *Cleaning.* Clean fuse ends with an emery cloth and wipe with a clean cloth. If a file is used to remove deep pits, use a crocus cloth to leave a smooth contact surface and then wipe dry with a clean cloth.

(3) *Testing.* Check the fuse for continuity.

c. INSPECTING, CLEANING, AND TESTING BALLAST LAMP E9. (1) *Inspecting.* Inspect the lamp to see if it is broken.

(2) *Cleaning.* Clean the base with solvent (SD).

(3) *Testing.* Test the lamp for continuity.

56. Cleaning and Inspecting Chassis

a. CLEANING. Thorough cleaning of the converter is necessary to insure optimum performance by preventing corrosion, rust, and dust from damaging parts or causing arc-over or low-resistance leakage between high-voltage points and ground. Remove loose dust and dirt with a brush or blower. Remove dirt and grease which adhere to the chassis and parts with a brush or cloth moistened with solvent (SD). Clean the switches with a small brush or pipe cleaner and solvent (SD).

b. INSPECTING. After the converter has been cleaned thoroughly and carefully, make a visual inspection of parts and wiring for rust, corrosion,

loose connections, frayed and burned insulation, loose screws, and burned and charred resistors and coils. Carefully inspect tube sockets for broken contacts, switches for loose and bent contacts and broken insulation, and terminal boards for broken lugs and signs of burning. Inspect and tighten all loose set screws and knobs.

57. Reassembling Equipment

Replace the tubes, fuse, and ballast lamp in the converter. Be sure that the tubes are put back in the correct sockets (fig. 4).

Section II. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing the converter, be extremely careful because of the voltages exposed. Keep one hand in pocket when measuring socket voltages with the probe. Before touching any part after the voltage is shut off, short the part to ground.

58. Trouble-shooting Procedures

a. GENERAL. The first step in servicing a defective converter is to sectionalize the fault, which means tracing the fault to the *circuit* responsible for the abnormal operation of the converter. The second step is to localize the fault, which means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors and shorted transformers often can be located by sight, smell, or hearing. The majority of faults, however, must be localized by *checking voltage and resistance.*

b. COMPONENT SECTIONALIZATION AND LOCALIZATION. The tests listed in subparagraphs (1) through (5) below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. Remember that the servicing procedure should cause no further damage to the converter. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 30) is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver which might occur through improper servicing methods and in forestalling future failures.

(2) *Operational test.* The operational test (par. 63) is important because it indicates frequently the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

(3) *Resistance and voltage measurements.* These measurements (figs. 19 and 20) prevent further damage to the ringer from possible short circuits and help in isolating the particular part at fault.

(4) *Trouble-shooting chart.* The troubles listed in the trouble-shooting chart (par. 64) will aid greatly in sectionalizing and localizing trouble.

(5) *Intermittent faults.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the converter itself but in the installation, or the trouble may be due to external conditions. In this event, test the installation, if possible.

59. Trouble-shooting Data

The figure references listed below will aid in the rapid location of faults.

Fig. No.	Description
Fig. 4	Tube location diagram.
Fig. 19	Tube socket, voltage and resistance diagram.
Fig. 20	Resistor-capacitor board, voltage and resistance diagram.
Fig. 21	Top view of chassis.
Fig. 22	Bottom view of chassis.
Fig. 23	Location of components on terminal boards.
Fig. 26	Complete schematic diagram.
Fig. 27	Wiring diagram.

NOTES:—
1. HI-LO SWITCH IN LO POSITION UNLESS OTHERWISE SHOWN.
2. TP-TG SWITCH IN TG POSITION.
3. SWITCH 2W-4W IN 2W POSITION.
4. (H) THROW HI-LO SWITCH TO HI POSITION.
5. ALL VOLTAGES DC UNLESS OTHERWISE SHOWN.
6. EXTERNAL SIGNAL OF 1325 CPS APPLIED TO LINE BINDING POSTS E1 AND E2 (NOT SHOWN).
7. ALL RESISTANCES MEASURED IN OHMS TO GROUND.
8. ALL DC VOLTAGES MEASURED TO GROUND USE OHMMETER WITH 20,000 OHMS-PER VOLT SENSITIVITY.

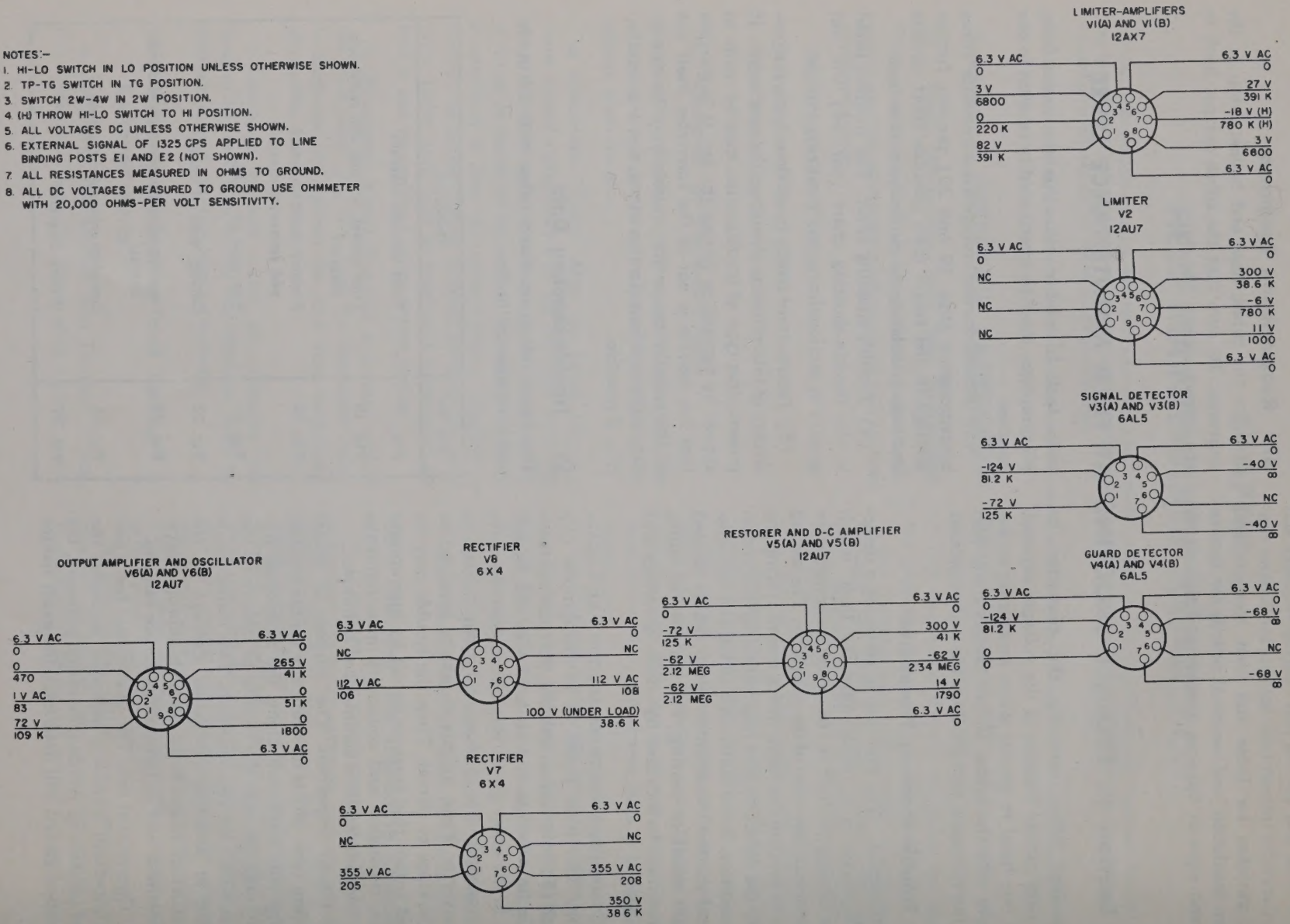
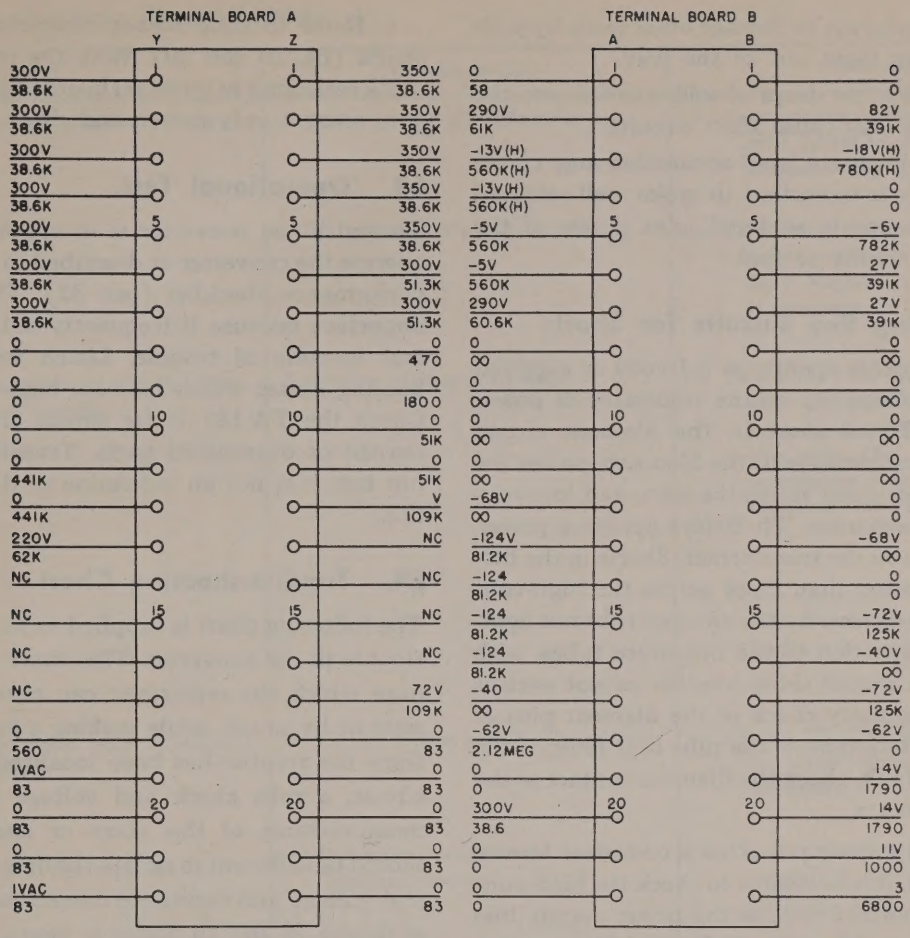


Figure 19. Tube socket voltage and resistance diagram.

TM 2137-20



NOTES:

1. HI-LO SWITCH IN LO POSITION UNLESS OTHERWISE SHOWN.
2. TP-TC SWITCH IN TG POSITION.
3. SWITCH 2W-4W IN 2W POSITION.
4. H. THROW HI-LO SWITCH TO HI POSITION.
5. ALL VOLTAGES DC UNLESS OTHERWISE SHOWN.
6. EXTERNAL SIGNAL OF 1325 CPS APPLIED TO LINE BINDING POSTS E1 AND E2.
7. ALL RESISTANCES MEASURED IN OHMS TO GROUND.
8. ALL DC VOLTAGES MEASURED TO GROUND, USE OHMMETER WITH 20,000 OHMS-PER-VOLT SENSITIVITY.

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Figure 20. Resistor-capacitor board, voltage and resistance diagram.

60. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting and the associated technical manuals are listed below.

Test equipment	Technical manual
Tube Tester I–177 and I–177–A or equal.	TM 11-2627
Multimeter TS-352/U	TM 11-5527

61. General Precautions

Whenever the converter is serviced, observe the following precautions very carefully :

a. Be careful when the unit is exposed; high voltages are exposed.

b. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

62. Checking Key Circuits for Shorts

a. The filaments operate at 6.3 volts ac supplied from a low-voltage tap on the secondary of power transformer T6. A short in the filament circuit would not cause damage to the filaments unless the short circuit occurred across the high- and low-voltage taps of transformer T6. Before applying power, check the taps on the transformer. Shorts in the filament circuit other than those across the high-voltage taps are indicated by the affected tube not lighting. Visual inspection of the miniature tubes, with the power on, should show whether or not each is lighted. A continuity check of the filament pins of the tube will determine if the tube is at fault. If the tube is not at fault, check the filament contact at the sockets for shorts.

b. Before applying power to a converter known to be defective, it is advisable to check the high-voltage line for shorts. Shorts in the power supply line usually are caused by a break-down of filter capacitor C26B. Capacitors C5C, C26C, and C33, also should be checked. If a short is discovered while making the resistance tests, remove the rectifier tube from the circuit in which the short occurs. Retest that circuit for the short, since the breakdown may have occurred within the tube.

c. Refer to tube socket resistance and voltage charts (fig. 19 and 20). With the power removed, check resistance at terminal boards against the resistance chart. Apply power, and check voltages.

63. Operational Test.

To find if the converter is in operating condition, operate the converter as described in the equipment performance checklist (par. 32). This checklist is important because it frequently indicates the general location of trouble. Listen for crackling or buzzing noises which indicate high-voltage arcing. Check the TA-182/U for smoke and the odor of burned or overheated parts. Transformer T6 will run hot; it is not an indication of defective operation.

64. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble in the converter. This chart lists the symptoms which the repairman can observe, either by sight or by sound, while making a few simple tests. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit ordinarily should be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figures 19 and 20. Refer to figure 21 for identification of components as seen from the top of the chassis. Figures 24 and 25 show the resistor and capacitor color codes which should be used as an additional check in identifying the parts on the chassis. Figure 27 is a wiring diagram useful when testing, locating, and replacing parts.

Symptom	Probable trouble	Correction
1. Power applied to converter. Unit fails to operate, and tubes do not light.	Open circuit in fuse, fuseholder, or in power cable.	Test and, if necessary, replace fuse. If fuse blows again, check filter capacitors C5C, C26B, C26C, and C33 (pars. 49 and 62).
2. Receiver and transmitter inoperative. Tubes light.	Power supply inoperative or functioning incorrectly.	Test tube V7. Replace if necessary. Test capacitors C5C, C26B, and C26C (par. 49).
3. Sending circuit inoperative.	*a.* Tube V6 defective.	*a.* Test tube V6. Replace if necessary. Take voltage and resistance readings at tube socket (fig. 19).

64. Trouble-shooting Chart (contd)

Symptom	Probable trouble	Correction
3. Sending circuit inoperative (contd).	*b.* Relay K1 or K2 defective.	*b.* Take resistance readings of relay coils (pars. 38, 51, 52, and 66). Replace relay if necessary.
	c. Transformer T4 open or shorted.	*c.* Take resistance readings of transformer windings (pars. 38 and 66). Replace transformer T4 if necessary.
4. Converter transmits v-f signals other than ringing signals.	Defective oscillator circuit.	*a.* Test tube V6B. Replace if necessary. Take voltage and resistance readings at the socket of this tube (fig. 19). Refer to paragraphs 36 through 38. Aline capacitor C27 (pars. 69 through 71).
		b. Check capacitors C29, C30, C31, and C32 (pars. 69 through 71). Replace if necessary.
5. Converter transmits only telephone ringing signals.	*a.* Dirty contacts of TP–TG switch.	*a.* Check TP–TG switch for dirty or pitted contacts. Replace if necessary.
	b. Defective capacitors in oscillator resonant circuit.	*b.* Check capacitors C29 and C30 (pars. 36 through 38 and 69 through 71).
6. Receiving circuit operates only on 1,600-cps ringing signals.	*a.* Dirty contacts of TP–TG switch.	*a.* Check TP–TG switch for dirty or pitted contacts. Clean contacts or replace switch.
	b. Defective capacitor C3.	*b.* Test capacitor C3 for open and short.
	c. Defective discriminator circuit capacitor C12 or C13.	*c.* Test capacitors C12 and C13 (pars. 44 and 72).
7. No 20-cps ringing signal output.	*a.* Power supply inoperative.	*a.* Test tube V8 and capacitor C33 (par. 49).
	b. Relay K3 inoperative.	*b.* Test relay K3 (par. 66). Replace if necessary.
	c. Static ringing generator inoperative.	*c.* Test static ringing generator and replace if necessary (pars. 48 and 67c).
	d. Receiving circuit inoperative.	*d.* Test receiving circuit tubes. Take voltage and resistance readings at sockets of these tubes (fig. 19). Refer to paragraphs 39 through 47.

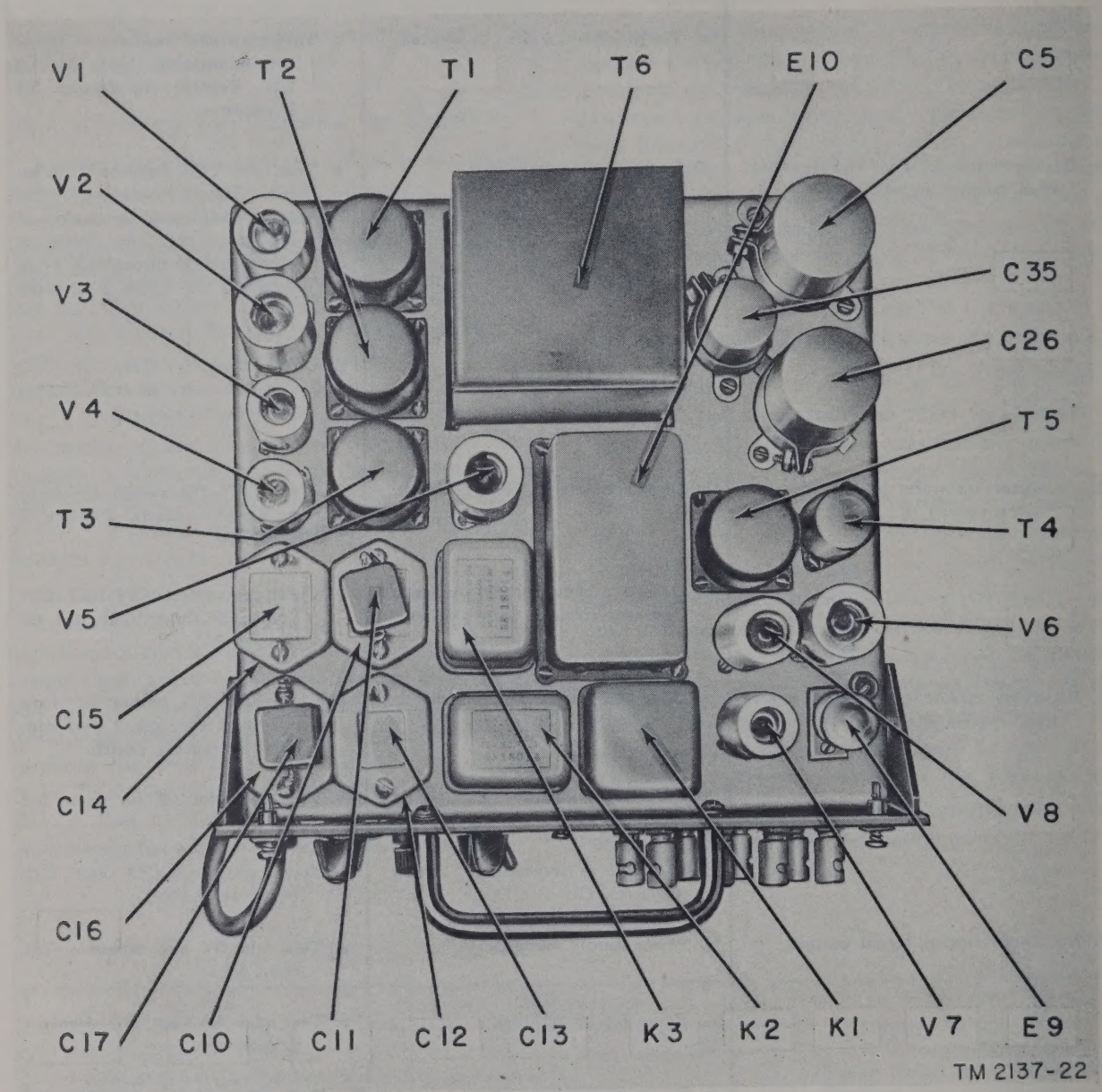


Figure 21. Top view of chassis.

65. Location of TA-182/U Components on Terminal Boards

Although the converter is an extremely compact unit, trouble shooting is facilitated greatly because of the simple method of exposing all component parts. In addition, these parts are marked clearly with symbol numbers corresponding to numbers on the over-all schematic diagram (fig. 26). This enables the repairman to locate any resistor or capacitor immediately. Assume the repairman wants to check capacitor C8 in the receiving circuit. In figure 23 capacitor C8 is wired across terminal contacts B6 and A5. Locate terminal board column A and B. Each column is numbered from 1 to 22 in sequences of five. To locate capacitor C8, count down to point 5 in column A and point 6 in column B. Capacitor C8 is wired across these points. The terminal boards are labeled A and B. The one to the left (fig. 23) is A; the one to the right is B. The sides of the terminal boards facing each other are labeled A′ and B′. The one to the left is A′; the one to the right is B′.

66. D-c Resistance of Transformers and Coils

The d-c resistances of the relay coils and the transformer windings in the converters are listed below. Make all measurements with Multimeter TS-352/U. Before taking measurements, remove the power plug from the power receptacle. When measuring the resistance of relay coil K1, throw 2W-4W switch to the 2W position, and make certain there are no connections to binding posts E1, E2, E5, and E6.

Transformer or coil	Terminals	Ohms
T1	1-2	21
T1	3-4	57.5
T2	1-2	21.3
T2	3-4	26.6
T3	1-2	21.3
T3	3-4	26.6
T4	1-2	59
T4	3-4	920
T5	1-2	81
T5	3-4	82
T6	1-2	10.5
T6	3-4	413
T6	3-G	208
T6	4-G	205
T6	5-6	106
T6	5-7	214
T6	6-7	108
T6	8-9	.075
T6	8-G	.038
T6	9-G	.037
K1	1-5	2000
K2	1-10	6500
K3	1-10	6500

Section III. REPAIR

67. Replacement of Parts

a. Most of the parts in the converter (figs. 21 through 23) are readily accessible and are easily replaced if found to be faulty. If a switch requires replacement, carefully mark the wires connected to the switch with tags or other devices to avoid misconnection when the new switch is installed. The wiring diagram (fig. 27) shows the color coding of the wires. Follow this practice whenever replacement requires the disconnection of numerous wires.

b. To replace any switch, loosen the set screw in the switch knob. Remove the knob, the felt washers, and the metal washer from the switch shaft. Remove the large nut which holds the switch to the receiver panel with a hollow-shank socket wrench or a pair of long-nosed pliers. Move the switch back from the receiver panel, and lift the switch up to a position where all connections are accessible before unsoldering the connecting wires.

c. To replace the static ringing generator (fig. 21), remove the four screws holding the unit to its mounting studs. Unsolder the four wires from the terminals and remove the unit. Note the position

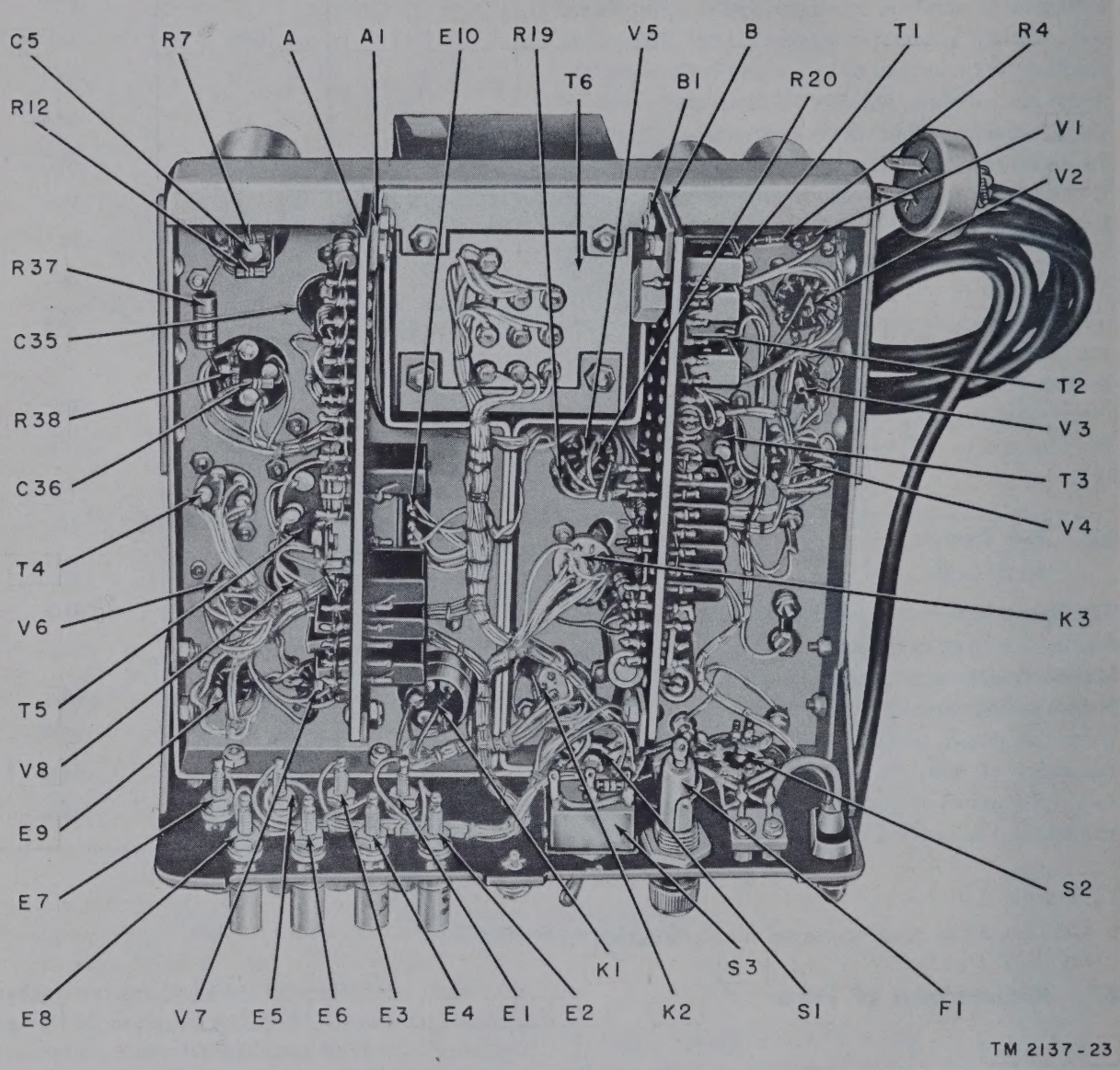


Figure 22. Bottom view of chassis.

of the leads so that no error will be made in connecting the replacement unit.

d. Relays are sealed hermetically. If a relay proves defective do not attempt to clean or burnish the contacts. Replace the entire relay (fig. 21).

68. Refinishing

Badly marred panels should be refinished. Instructions for refinishing panels on exterior cabinets are given in TM 9-2851.

Section IV. ALINEMENT PROCEDURES

69. Test Equipment Required for Alinement

a. Frequency Meter FR-67/U is used in the preferred alinement procedure of the oscillator (par. 70). If Frequency Meter FR-67/U is not available use the alternate oscillator alinement procedure (par. 71). Use the alternate oscillator alinement procedure as an emergency measure only, since it may produce a converter which will operate only with the converter used as the frequency standard in the alinement procedure.

b. A converter known to be operating properly (referred to as the standard converter) and a headphone set are required as test equipment for the alternate oscillator alinement procedure (par. 71).

c. Impedance Bridge TS-460/U, Multimeter 352/U, a standard converter (subpar. b above), and two telephone sets are required as test equipment for the discriminator alinement procedure (par. 72).

Note. There are two adjustment screws in capacitor C27. Both must be adjusted to provide the full range of ±8 cps. Alinement of this capacitor regulates both telegraph and telephone ringing frequencies simultaneously.

70. Preferred Oscillator Alinement Procedure

a. Connect the frequency meter to 2W LINE binding posts 1 and 2.

b. Connect a clip lead across terminals 3 and 4 of relay K1. The oscillator output then will be continuously applied to LINE binding posts 1 and 2.

c. Set the TP-TG switch in the TP position. Set the 2W-4W switch in the 2W position.

d. Take a minimum of three readings on the frequency meter.

(1) If the frequency meter reading is 1,600 cps ±6 cps, omit subparagraphs (2) and (3) below.

(2) If the frequency meter reading is more than 6 cps variation from 1,600 cps, adjust capacitor C27 until the frequency meter shows 1,600 ±6 cps.

(3) If the frequency cannot be brought to within 6 cps of 1,600 cps by adjustment of capacitor C27, replace capacitor C32. Replace capacitor C32 with a larger capacitor if the frequency is above 1,600 cps and a smaller capacitor if the frequency is below 1,600 cps. Select the capacitor from those listed in appendix II, paragraph 2. After replacing capacitor C32 repeat the procedure given in subparagraphs (1) and (2) above.

e. Set the TP-TG switch in the TG position. Set the 2W-4W switch in the 2W position.

f. Take three readings on the frequency meter.

(1) If the frequency meter reading is 1,225 cps ±6 cps, the oscillator alinement is completed.

(2) If the frequency meter reading is more than 6 cps variation from 1,225 cps, adjust capacitor C27 until the frequency meter reading is 1,225 cps ±6 cps. If this adjustment cannot be accomplished, refer to subparagraph (3) below. After adjusting capacitor C27 to obtain 1,225 cps ±6 cps, recheck the 1,600 cps by operating the TP-TG switch to the TP position and measuring the frequency as described in subparagraph d(1) and (2) above. If the frequency meter reading is less than 6 cps variation from 1,600 cps, the oscillator alinement is completed.

(3) If adjustment of capacitor C27 did not correct the frequency to 1,225 cps ±6 cps, or if the adjustment of capacitor C27 misalined the 1,600 cps, replace capacitor C30. Select the replacement capacitor from the list in appendix II, paragraph 2. The selected capacitor must bring the oscillator frequencies to within 6 cps of 1,225 cps when the TP-TG switch is in the TG position and within 6 cps of 1,600 cps when the TP-TG switch is in the TP position.

71. Alternate Oscillator Alinement Procedure

a. Connect LINE binding post 1 of the standard converter (par. 69b) to LINE binding post 1 of the converter being alined. Connect LINE binding post 2 of the standard converter to LINE binding post 2 of the converter being alined.

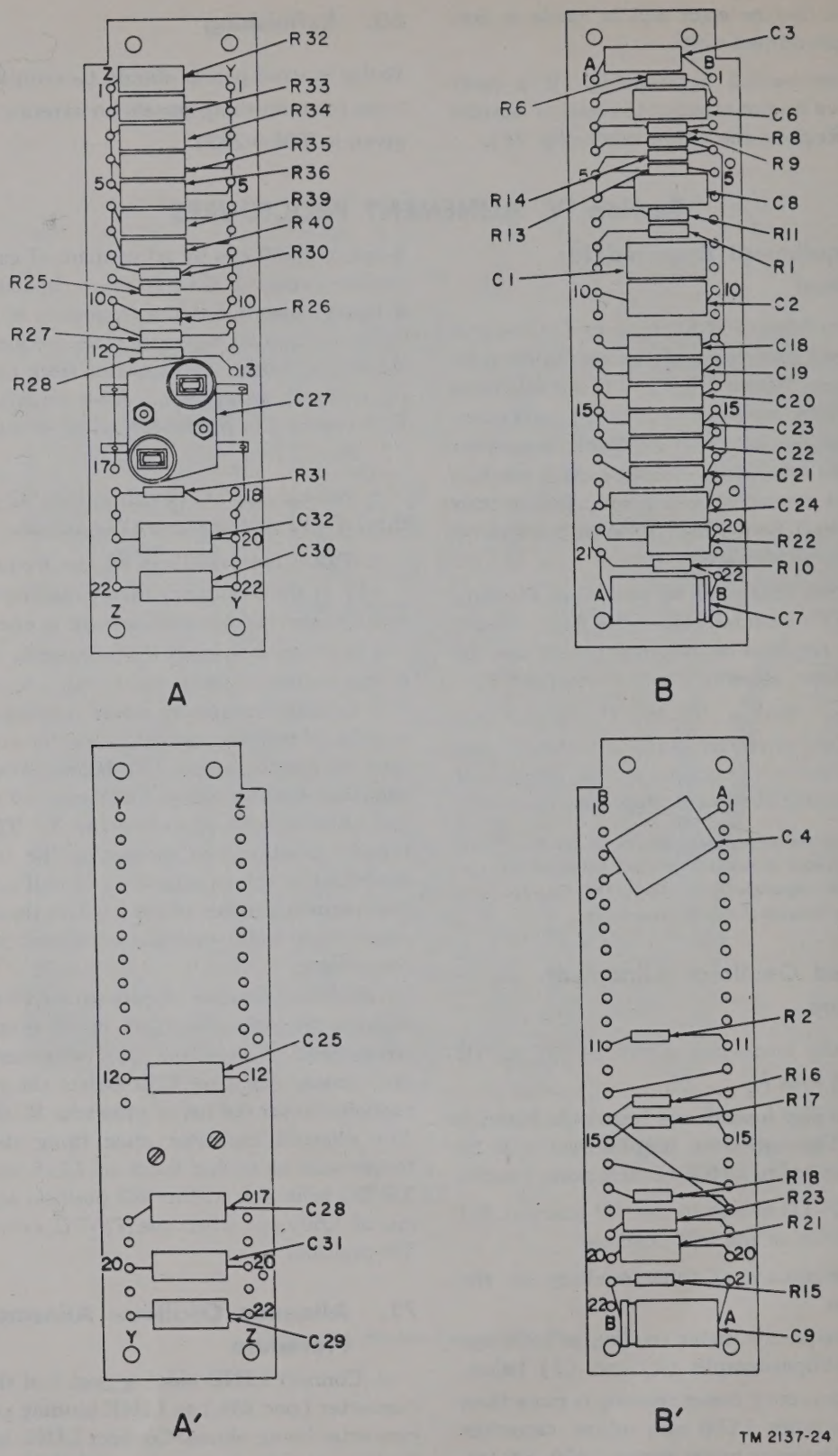


Figure 23. Location of components on terminal boards.

b. Connect headphones across LINE binding posts 1 and 2.

c. Connect a clip lead across relay K1 terminals 3 and 4 in each of the converters. The oscillator output from both converters will then be applied to the headphones continuously.

d. Set the TP-TG switch in the TP position. Set the 2W-4W switch in the 2W position.

(1) If fewer than 6 beats per second are heard in the headphones, disregard subparagraphs (2) and (3) below and proceed to subparagraph e.

(2) If more than 6 beats per second are heard in the headphones, adjust capacitor C27 until fewer than 6 beats per second are heard.

(3) If no adjustment of capacitor C27 produces less than 6 beats per second, replace capacitor C32. By removing one of the leads from LINE binding post 1 determine whether the converter being alined is producing a higher or lower frequency than the standard converter. If the frequency of the converter being alined was producing a higher frequency, replace capacitor C32 with a larger capacitor; if the frequency was lower, replace capacitor C32 with a smaller capacitor. Select the capacitor from those listed in Appendix II, paragraph 2. After replacing capacitor C32 repeat the procedure given in subparagraphs (1) and (2) above.

e. Set the TP-TG switch in the TG position. Set the 2W-4W switch in the 2W position.

(1) If fewer than 6 beats per second are heard in the headphones, the oscillator alinement is completed.

(2) If more than 6 beats per second are heard in the headphones, adjust capacitor C27 until 6 beats per second are heard. If this adjustment cannot be accomplished, refer to subparagraph (3) below. After adjusting capacitor C27 so that fewer than 6 beats per second are heard, recheck the 1,600 cps by operating the TP-TG switch to the TP position and listening for beats as described in subparagraph d(1) and (2) above. If fewer than 6 beats per second are heard in this position of the TP-TG switch, the oscillator alinement is completed.

(3) If adjustment of capacitor C27 did not reduce the number of beats to fewer than 6 per second, or if adjustment of capacitor C27 misalined the 1,600 cps, it is necessary to replace capacitor C30. Select the replacement capacitor from the list in appendix II, paragraph 2. The selected capacitor must produce fewer than 6 beats per second in the headphones for both positions of the TP-TG switch.

72. Discriminator Alinement Procedure

Caution: Do not attempt to aline the discriminators in a faulty converter until it is certain that the fault is in the discriminator circuit. Trouble will rarely be encountered in the discriminator circuits.

a. Signal Discriminator Circuit Check for TP-Position of TP—TG Switch. (1) Connect LINE binding post 1 of the standard converter (par. 69b) to LINE binding post 1 of the converter being alined.

(2) Connect LINE binding post 2 of the standard converter to LINE binding post 2 of the converter being alined.

(3) Connect a clip lead across relay K1 terminals 3 and 4 of the standard converter.

(4) Connect a telephone set to LOOP binding posts 5 and 6 of the converter being alined.

(5) Set the TP—TG switch in the TP position on both converters. Set the 2W—4W switch in the 2W position on both converters.

(6) If the telephone rings when power is applied to the converters, the signal discriminator circuit is operating properly with the TP—TG switch in the TP position. Disregard subparagraphs (7) and b below, and follow the procedure given in subparagraph c below.

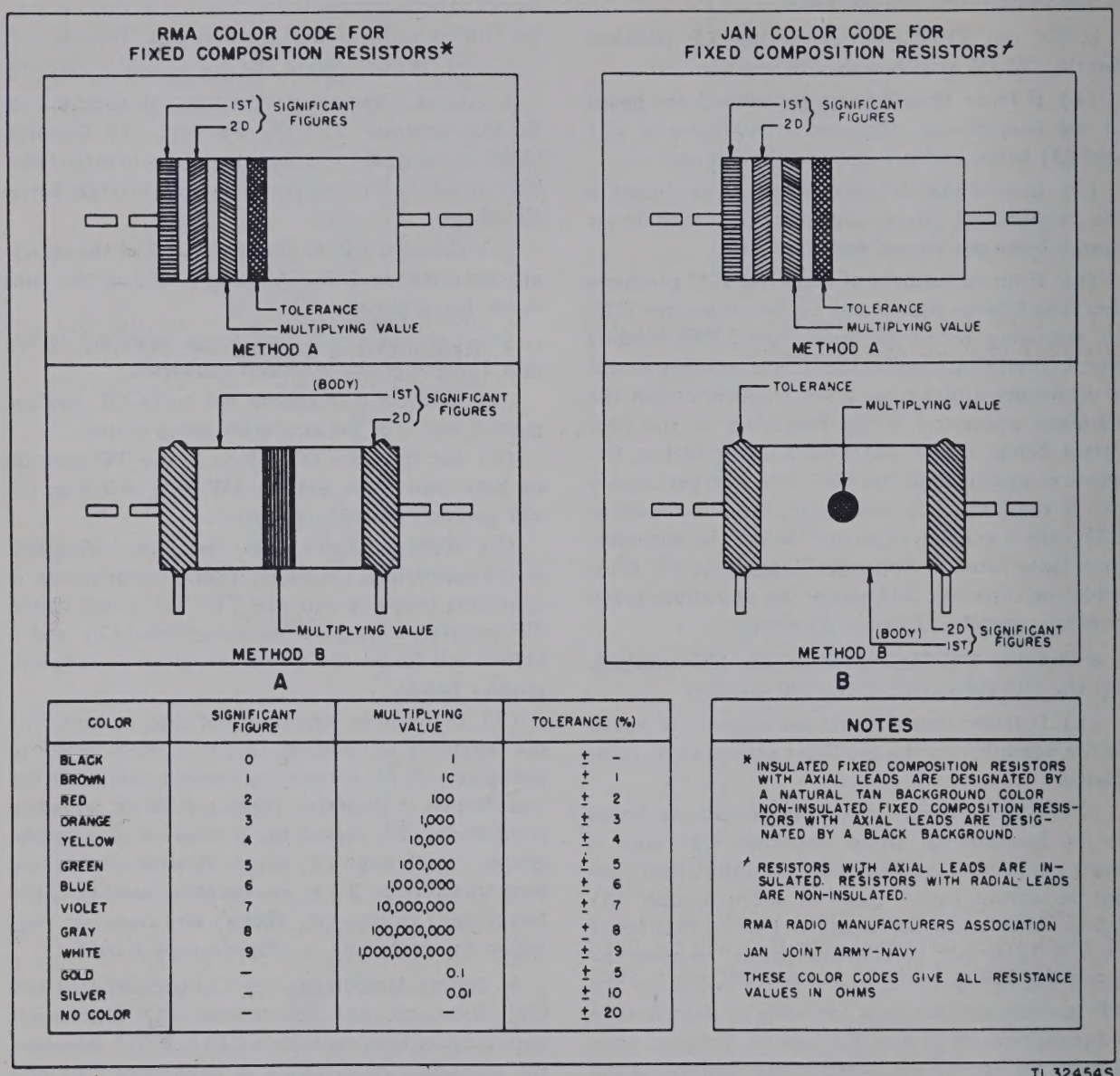
(7) If the telephone does not ring, measure the d-c resistance of transformer T2 windings. Refer to paragraph 66 for correct resistance readings. If the transformer is defective, replace it. After replacing transformer T2, repeat the procedure of subparagraphs (1) through (6) above. If, after establishing that transformer T2 is in operating condition, the telephone (subpar. (6) above) still does not ring, follow the procedure of subparagraph b below.

b. Signal Discriminator Capacitors C10 and C11, Replacement Procedure. (1) Disconnect both leads of both capacitors C10 and C11. Measure the combined capacitance of capacitors C10 and C11 with Impedance Bridge TS-460/U.

(2) If the combined capacitance of these capacitors is not .004 uf $\pm 2\%$, test each capacitor for opens and shorts.

(3) If C11 (the smaller of the two) is defective, replace it with a capacitor having the same value as shown by the color code. If capacitor C10 (the larger of the two) is defective, replace both capacitors C10 and C11 with a combination which has

RESISTOR COLOR CODES



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

Figure 24. Resistor color codes.

value of .044 uf ±2% as shown on the impedance bridge. Capacitor C11 will have a value of either .0039 uf or .0056 uf. Select replacement capacitor from the list in appendix II, paragraph 2.

c. Signal Discriminator Circuit Check for TG Position of TP–TG Switch. (1) Follow the procedure given in subparagraphs a (1) through (4) above.

(2) Set the TP–TG switch in the TG position.

(3) If the telephone rings when power is applied to the converters, the signal discriminator circuit is operating properly and no further adjustment of the signal discriminator is required. Disregard subparagraph d below, and follow the procedure of subparagraph e below.

(4) If the telephone does not ring, follow the procedure of subparagraph d below.

d. Signal Discriminator Capacitors C12 and C13, Replacement Procedure. (1) Set the TP–TG switch in the TP position.

(2) Measure the combined capacitance of capacitors C12 and C13 at the capacitors leads.

(3) If the combined capacitance of capacitors C12 and C13 is not .0356 uf ±2%, open one lead to capacitor C13 (the smaller of the two) and measure the capacitance of capacitor C12. If capacitor C12 is within 5% of .033 uf, remove capacitor C13 and replace capacitor C13 with a capacitor having the same value as shown by the color code of the removed capacitor. Select the replacement capacitor from the list of capacitors in appendix II, paragraph 2.

(4) If capacitor C12 is not within 5% of .033 uf, remove capacitors C12 and C13. Replace capacitor C12 and choose a capacitor for C13 the capacitance of which when combined with C12 will be .0356 ±2%. Capacitor C13 will be either .0036 or .0020 uf. When the above steps have been completed, the signal discriminator should operate properly.

e. Guard Discriminator Circuit Check for TP Position of TP–TG Switch. (1) Connect a telephone set to LOOP binding posts 5 and 6.

(2) Connect another telephone set to LINE binding posts 3 and 4.

(3) Set the TP–TG switch in the TP position. Set the 2W–4W switch in the 2W position.

(4) Speak continuously into the telephone connected to the LINE binding posts for 1 minute.

(5) If the telephone connected to the LOOP binding posts does not ring, the guard discriminator circuit is operating properly with the TP–TG switch in the TP position. Disregard subparagraphs 6 and f below and follow the procedure in subparagraph g below.

(6) If the telephone connected to the LOOP binding posts rings, measure the d-c resistance of transformer T3. Refer to paragraph 66 for correct resistance readings. If the transformer is defective, replace it. After replacing transformer T3, repeat the procedure of subparagraphs (1) through (5) above. If, after establishing that transformer T3 is in operating condition, the telephone rings (subpar. (5) above), follow the procedure given in subparagraph f below.

f. Guard Discriminator Capacitors C14 and C15, Replacement Procedure. (1) Disconnect both leads of capacitors C14 and C15. Measure the combined capacitance of these capacitors with the impedance bridge.

(2) If the combined capacitance is not .0343 ±2%, test each capacitor for opens and shorts.

(3) If capacitor C15 (the smaller of the two) is defective, replace it with a capacitor having the same value as shown by the color code. If capacitor C14 is defective, replace both capacitors with a combination which has a value of .0345 ±2% as shown on the capacitance bridge. Capacitor C15 will be either .0013 uf or .0027 uf. Select the replacement capacitor from the list of capacitors in appendix II, paragraph 2.

g. Guard Discriminator Circuit Check for TG Position of TP–TG Switch. (1) Follow the procedure of subparagraph e(1) and (2) above.

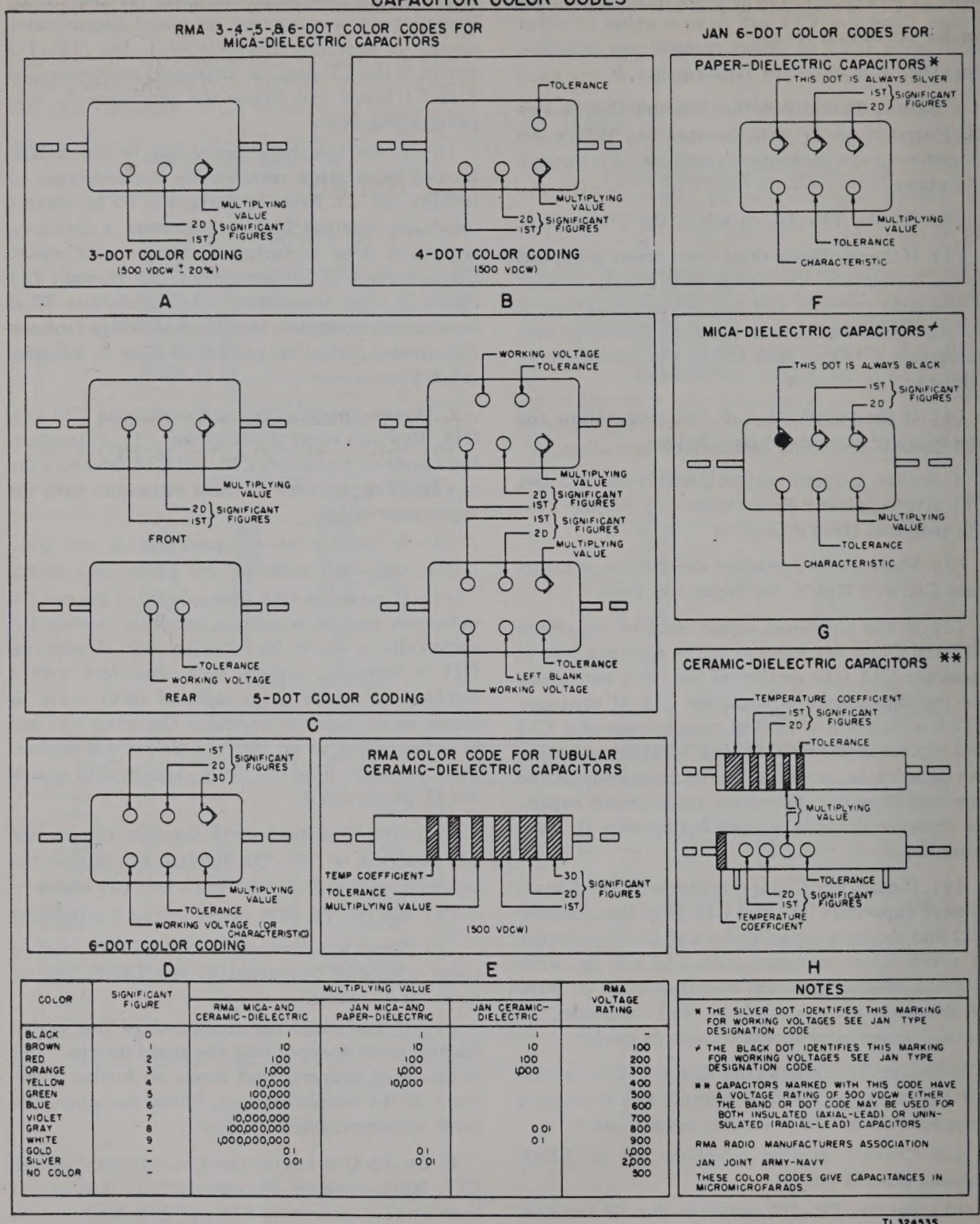
(2) Set the TP–TG switch in the TG position.

(3) Speak continuously into the LINE binding posts telephone connected to the LINE binding posts for 1 minute.

(4) If the telephone connected to the LOOP binding posts does not ring, the guard discriminator is operating properly and needs no further alinement. If the telephone rings, follow the procedure given in subparagraph h below.

h. Guard Discriminator Capacitors C16 and C17, Replacement Procedure. (1) Disconnect both leads of capacitors C16 and C17. Measure the combined capacitance of these capacitors with the impedance bridge.

(2) If the combined capacitance of capacitors



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

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THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

Figure 25. Capacitor color codes.

C16 and C17 is not .0240 uf ±2%, test each capacitor for opens and shorts.

(3) If capacitor C17 (the smaller of the two) is defective, replace it with a capacitor having the same capacitance as shown by the color code. Select the replacement capacitor from the list in appendix II, paragraph 2.

(4) If capacitor C16 is defective, replace both capacitors, C16 and C17, with a combination which has a value of .0240 uf ±2%. Capacitor C17 will be either .0030 uf or .0043 uf.

Section V. FINAL TESTING

73. General

This section is intended as a guide to be used in determining the quality of a repaired Telegraph-Telephone Signal Converter TA-182/U. The minimum test requirements outlined in paragraph 75 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

74. Test Equipment Required for Final Testing

The equipment used in the final testing, together with their associated technical manuals, is listed below.

Multimeter TS-352/U	TM 11-5527
Frequency Meter FR-67/U	
Test Set TS-140/PCM	

75. Tests

a. V-F Ringing Output Level. (1) Connect the power level meter of the test set to LINE binding posts E1 and E2.

(2) Apply a 20-cps ringing signal to binding posts E5 and E6.

(3) The power level meter should indicate a v-f current of 0 dbm (decibels referred to 1 milliwatt in 600 ohms) ±2db.

b. Output Frequency Check. Refer to paragraphs 69, 70, and 71.

c. Receiving Circuit Sensitivity Check. (1) Operate TP–TG switch to TP position.

(2) Operate HI–LO switch to HI position.

(3) Apply a 1,600-cps ringing signal from the test set to line binding posts E1 and E2. The level of this signal should be -45 dbm.

(4) Relay K3 should operate after the signal has been applied for approximately ½ second.

d. Static Ringing Generator Circuit Check. (1) Operate TP–TG switch to the TG position.

(2) Operate HI–LO switch to HI position.

(3) Connect Terminal TH-5/TG or a telephone set to loop binding posts E5 and E6.

(4) Apply a 1,225-cps signal from the test set to line binding posts E1 and E2. The level of this signal should be -45 dbm.

(5) The buzzer of Terminal TH-5/TG should sound, or the telephone should ring.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

76. Disassembly

The following instructions are recommended as a guide for preparing Telegraph-Telephone Signal Converter TA-182/U for transportation and storage. To disassemble the equipment, reverse the procedure for setting up the equipment (par. 11).

a. Disconnect the power plug.

b. Disconnect all communication wires from the binding posts.

c. Remove the converter from Mounting MT-791/U.

77. Repacking for Shipment or Limited Storage

a. The exact procedure for 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 10 and reverse the instructions given in that paragraph.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the packing case. Protect the case with a waterproof paper barrier. Seal the seams of the paper with waterproof sealing compound or tape.

Section II. DEMOLITION TO PREVENT ENEMY USE

78. Methods of Demolition

a. SMASH. Use sledges, axes, handaxes, hammers, crowbars, heavy tools.

b. CUT. Use axes, handaxes, machetes.

c. BURN. Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

d. EXPLODE. Use firearms, grenades, TNT.

e. DISPOSE. Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

Note. Use anything immediately available for destruction of this equipment.

79. Destruction of Equipment

When ordered by your commander, destroy all equipment to prevent it from being used or salvaged by the enemy.

a. Smash (par. 78a) the controls, tubes, coils, switches, capacitors, transformers, and headsets.

b. Cut (par. 78b) cords, headsets, and wiring.

c. Burn (par. 78c) cords, resistors, capacitors, coils, wiring, and technical manuals.

d. Bury or scatter (par. 78e) all of the above parts after they have been rendered useless.

DESTROY EVERYTHING

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 for field manuals and JANAP's. Check SR 310–20–4 for technical manuals, technical bulletins, and supply bulletins.

1. Supply Publication

SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.

2. Technical Manuals for Equipment Associated with Telegraph-Telephone Signal Converter TA–182/U

TM 11–2627	Tube Tester I–177 and I–177–A.
TM 11–2634	Impedance Bridges TS–460/U, TS–460A/U and TS–460B/U.
TM 11–5527	Multimeter TS–352/U.

3. Painting, Preserving, and Lubrication

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

4. Packaging and Packing Information

a. Military (JAN) Specifications.

JAN–D–169(4)	Desiccants (activated).
JAN–P–100	Packaging and Packing for Overseas Shipment—General Specifications.
JAN–P–106A	Packaging and Packing for Overseas Shipment—Boxes; Wood, Nailed (For weight of contents not in excess of 1,000 pounds).
JAN–P–116(2)	Packaging and Packing for Overseas Shipment—Preservation, Methods of.
JAN–P–125(1)	Packaging and Packing for Overseas Shipment—Barrier Materials, Water-Proof, Flexible.
MIL–B–131A	Barrier-Material, Water-Vaporproof, Flexible.

b. U. S. Army Specification.

100–2E	Marking Shipments by Contractors standard specifications for (and Signal Corps Supplement thereto).

5. Decontamination

TM 3–220	Decontamination.

6. Demolition

FM 5–25	Explosives and Demolition.

7. Other Publications

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 Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5 NAV DEP SERIAL 85POO AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), SandA–70–6 (Navy), and AF–MC–U2 (Air Force)).
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–483	Suppression of Radio Noises.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O & E, T/A, SIG 7 & 8, SIG 7–8–10, SIG 10, list of allowances of expendable material, or another authorized supply basis. 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.

1. Telephone-Telegraph Signal Converter TA-182/U

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CABLE, power: 2 conductors; 1,608 cir mils; copper, stranded; 16 strands, #30 AWG, 6.5 ft.	Conducts 115-volt, 60-cycle a-c power from power lines to equipment.	1B3018-2.28
C1, C2	CAPACITOR, fixed: paper; 50,000 uuf ±20%; 400 vdcw.	Blocking.	3DA50-464
C3	CAPACITOR, fixed: mica; 5,100 uuf ±2%; 500 vdcw; JAN type CM35D512G.	Tuning capacitor for transformer T1.	3K3551243
C4	CAPACITOR, fixed: mica; 6,800 uuf ±2%; 300 vdcw; JAN type CM35D682G.	Tuning capacitor for transformer T1.	3K3568243
C5, C5A, C5B, C5C, C26A, C26B, C26C	CAPACITOR, fixed: electrolytic; 350 vdcw; JAN type CE33C120P.	Power supply filter.	3DB12-45
C6, C8, C25, C28	CAPACITOR, fixed: paper; 10,000 uuf ±20%; 600 vdcw; JAN type CN35A103M.	C6, C8, C25—Grid coupling. C28—Feedback coupling.	3DA10-367
C7, C9	CAPACITOR, fixed: electrolytic; 25 uf; 25 vdcw.	Cathode bypass.	3DB25-129
C10	CAPACITOR, fixed: mica; 39,000 uuf ±5%; 600 vdcw; JAN type CM61D393J.	Discriminator transformer tuning.	3K6139342
C11, C13	CAPACITOR: see paragraph 2 of this appendix.	Discriminator transformer tuning.	
C12, C14	CAPACITOR, fixed: mica; 33,000 uuf ±5%; 600 vdcw; JAN type CM56D333J.	Discriminator transformer tuning.	3K5633342
C15	CAPACITOR: see paragraph 2 of this appendix.	Discriminator transformer tuning.	
C16	CAPACITOR, fixed: mica; 24,000 uuf ±5%; 600 vdcw; JAN type CM56D243J.	Discriminator transformer tuning.	3K5624342

1. Telegraph-Telephone Signal Converter TA-182/U (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C17	CAPACITOR: see paragraph 2 of this appendix.	Discriminator transformer tuning.	
C18, C19, C20, C21, C22, C23	CAPACITOR, fixed: mica; 10,000 uuf ±5%; 300 vdcw; JAN type CM35D103J.	Discriminator voltage doubling and filtering.	3K3510342
C24	CAPACITOR, fixed: paper; 25,000 uuf ±10%; 200 vdcw.	Time delay.	3DA250-597
C27	CAPACITOR, variable: ceramic; 2 sec. 7- to 45-uuf capacity each sec.; 500 vdcw; JAN type CV21C450.	Oscillator tuning.	3D9045V-17
C29	CAPACITOR, fixed: mica; 4,300 uuf ±5%, working voltage 500 vdcw; JAN type CM35D432J.	Oscillator tuning.	3K35L13242
C30	CAPACITOR: see paragraph 2 of this appendix.	Oscillator tuning.	
C31	CAPACITOR, fixed: mica; 6,200 uuf ±5%; 500 vdcw; JAN type CM35D622J.	Oscillator tuning.	3K3562242
C32	CAPACITOR: see paragraph 2 of this appendix.	Oscillator tuning.	
C33	CAPACITOR, fixed: electrolytic; 15 uf; 250 vdcw; JAN type CE31C150M.	Power supply filter.	3DB15-70
P1	CONNECTOR, plug: 2 cont, male.	Power connector.	6Z1727
	FASTENER, spring-lock.	Retains panel and chassis in case.	6Z3810-16.15
F1	FUSE, cartridge: 1 amp, 250 v.	Overcurrent safety device.	3Z1926
	GASKET.	Provides immersion proof seal between cover and case.	2Z4868.977
E10	GENERATOR: ringing, machine, (static ringing generator), vibrator type, hermetically sealed, 110 v d-c, .065 amp, output; 65 volts rms, 20 cyc, .05 amp.	Supplies 20 cps for ringing purposes.	4F2318
	GROMMET: .355″ max dia of cable.	Strain relief and insulating bushing.	6Z4865-1
	HOLDER, fuse: accommodates 1 fuse.	Supports cartridge fuse and provides electrical connection between fuse link and adjacent circuit.	3Z3282-49
	KNOB: modified round.	Provides mechanical advantage and visual index for control shafts.	2Z5786.47
	LAMPHOLDER.	Supports incandescent lamp and provides electrical connection between lamp filament and adjacent circuit.	6Z8335-4
E9	LAMP, incandescent: 115-125 v, 6 w, .050 amp.	Ballast lamp for 20-cycle ringing.	6Z6810-6
	LATCH, fastener.	Attaches cover to case with spring locking action.	6Z6918-23
E1, E2, E3, E4, E5, E6, E7, E8	POST, binding.	Provides mechanical and electrical tie points for wiring.	3Z741-39

1. Telegraph-Telephone Signal Converter TA-182/U (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
K1	RELAY, armature: 15 v, 20 cps.	Signal amplifier to operate relay K2.	2Z7599A-336
K2, K3	RELAY, armature: 6500 ohms resistance.	K2—Inserts voice frequency ringer on line. K3—Inserts 20-cps ringing supply on loop.	2Z7999A-337
R1, R2	RESISTOR, fixed: composition; 2200 ohms ±10%; 1/2 w; JAN type RC20BF222K.	Isolating.	3RC20BF222K
R3, R8, R13, R20	RESISTOR, fixed: composition; 220,000 ohms ±10%; 1/2 w; JAN type RC20BF224K.	R3—Grid bias current limiter for tube V1A. R8—Grid bias current limiter for tube V1B. R13—Grid bias current limiter for tube V2. R20—Grid bias current limiter for tube V5B.	RC20BF222K
R4	RESISTOR, fixed: composition; 470,000 ohms ±10%; 1/2 w; JAN type RC20BF474K.	Impedance matching.	3RC20BF474K
R5, R10	RESISTOR, fixed: composition; 6800 ohms ±10%; 1/2 w; JAN type RC20BF682K.	R5—Cathode bias for tube V1A. R10—Cathode bias for tube V1B.	3RC20BF682K
R6, R11, R18	RESISTOR, fixed: composition; 330,000 ohms ±10%; 1/2 w, JAN type RC20BF334K.	R6—Plate load for tube V1A. R11—Plate load for tube V1B. R18—Discriminator load.	RC20BF334K
R7, R12, R29	RESISTOR, fixed: composition; 22,000 ohms ±10%; 1/2 w; JAN type RC20BF223K.	Decoupling (power supply).	3RC20BF223K
R9, R14, R31	RESISTOR, fixed: composition; 560,000 ohms ±10%; 1/2 w; JAN type RC20BF564K.	R9—Grid leak for tube V1B. R14—Grid leak for tube V2. R31—Provides feedback.	3RC20BF564K
R15	RESISTOR, fixed: composition; 1000 ohms ±10%; 1/2 w; JAN type RC20BF102K.	Cathode bias for tube V2.	3RC20BF102K
R16, R17	RESISTOR, fixed: composition; 100,000 ohms ±10%; 1/2 w; JAN type RC20BF104K.	R16—Discriminator load for tube V4. R17—Discriminator load for tube V3.	3RC20BF104K
R19	RESISTOR, fixed: composition; 2.2 meg ±10%; 1/2 w; JAN type RC20BF225K.	Time delay.	3RC20BF225K
R21	RESISTOR, fixed: composition; 82,000 ohms ±5%; 2 w; JAN type RC42BE823J.	Cathode bias for tube V5B.	3RC42BE823J
R22	RESISTOR, fixed: composition; 91,000 ohms ±5%; 2 w; JAN type RC42BE913J.	Cathode bias for tube V5.	3RC42BE913J
R23	RESISTOR, fixed: composition; 1800 ohms ±5%; 1 w; JAN type RC30BF182J.	Cathode bias for tube V5.	3RC30BF182J
R24	RESISTOR, fixed: composition; 15,000 ohms ±10%; 1/2 w; JAN type RC20BF153K.	Shunting resistor for low-sensitivity position.	3RC20BF153K
R25	RESISTOR, fixed: composition; 1800 ohms ±10%; 1/2 w; JAN type RC20BF182K.	Cathode bias for tube V6A.	3RC20BF182K

1. Telegraph-Telephone Signal Converter TA-182/U (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R26	RESISTOR, fixed: composition; 51,000 ohms ±5%; 1/2 w; JAN type RC20BF513J.	Grid leak and voltage divider.	3RC20BF513J
R27	RESISTOR, fixed: composition; 390,000 ohms ±10%; 1/2 w; JAN type RC20BF394K.	Voltage divider.	3RC20BF394K
R28	RESISTOR, fixed: composition; 47,000 ohms ±10%; 1/2 w; JAN type RC20BF473K.	Plate load for tube V6B.	3RC20BF473K
R30	RESISTOR, fixed: composition; 470 ohms ±5%; 1/2 w; JAN type RC20BF471J.	Cathode bias for tube V6B.	3RC20BF471J
R32, R33, R34, R35, R36	RESISTOR, fixed: composition; 10,000 ohms ±10%; 2 w; JAN type RC42BE103K.	Power supply filter.	3RC42BE103K
R37	RESISTOR, fixed: composition; 2200 ohms ±10%; 2 w; JAN type RC42BE222K.	Power supply filter.	3RC42BE222K
R38	RESISTOR, fixed: composition; 270,000 ohms ±10%; 1/2 w; JAN type RC20BF274K.	Power supply filter.	3RC20BF274K
R39	RESISTOR, fixed: composition; 27,000 ohms ±10%; 2 w; JAN type RC42BE273K.	Relay current limiter.	3RC42BE273K
R40	RESISTOR, fixed: composition; 24,000 ohms ±5%; 2 w; JAN type RC42BE243J.	Relay current limiter.	3RC42BE243J
R41	RESISTOR, fixed: composition; 620 ohms ±5%; 1/2 w; JAN type RC20BF621J.	Loading resistor for Transformer T-4 during standby.	3RC20BF621J
	SHIELD, electron tube: 1-3/8" lg.	Tube retention and circuit isolation.	2Z8304.274
	SHIELD, electron tube: cylindrical; 1-15/16" lg.	Tube retention and circuit isolation.	2Z8304.275
	SHIELD, electron tube: cylindrical; 2-1/4" lg.	Tube retention and circuit isolation.	2Z8304.277
	SOCKET, electron tube: miniature size.	Supports electron tube and provides electrical connection between tube elements and adjacent circuits.	2Z8677.171
	SOCKET, electron tube: miniature size.	Supports electron tube and provides electrical connection between tube elements and adjacent circuits.	2Z8679.37
	STOP, electrical switch.	Used as a lock for rotary switch S2.	4Z6923-1
	STRAP, carrying: 72" lg.	Carrying strap for case.	6Z8448-28
S1	SWITCH, rotary: 2 positions; 4 poles.	Two-wire to four-wire selector switch.	3Z9825-62.639
S2	SWITCH, rotary: 1 sec.	Telephone to telegraph ringing function switch.	3Z9825-62.638
S3	SWITCH, toggle: single-pole, double-throw; 6 amp, 250 v dc; JAN type ST-13D.	Sensitivity switch.	3Z9863-13D

1. Telegraph-Telephone Signal Converter TA-182/U (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T1	TRANSFORMER, audio frequency: input type; primary, 21.3-ohm d-c resistance; secondary, 57.8-ohm d-c resistance.	Line to grid impedance matching.	2Z9631.431
T2, T3	TRANSFORMER, discriminator: plate-coupling type; primary 21.4-ohms d-c resistance; secondary, 26.6-ohm d-c resistance.	T2—Marks frequency discriminator transformer. T3—Space frequency discriminator transformer.	2Z9632.668
T4	TRANSFORMER, audio frequency: plate-coupling type; primary, 920-ohm d-c resistance; secondary, 59-ohm d-c resistance.	Plate to line impedance matching.	2Z9632.66
T5	TRANSFORMER, audio frequency: plate-coupling type; primary, 83-ohm d-c resistance; secondary, 83-ohm d-c resistance.	Plate to grid coupling, audio oscillator.	2Z9632.667
T6	TRANSFORMER, power: step-down and step-up; input 115 v ac, 50-60 cycles; single-phase; 3 output windings: #1 secondary 570 v dc; #2 secondary 220 v dc; #3 secondary 6.3 v ac.	Filament and d-c power supply.	2Z9621-233
V1	TUBE, twin-triode: type 12AX7.	Carrier amplifier limiter.	2J12AX7
V2, V5, V6	TUBE, twin-triode: type 12AU7.	V2—Carrier voltage amplifier limiter. V5—Section A, electronic switch diode connected; section B, amplifier. V6—Section A, ringer carrier voltage amplifier; section B, ringer carrier oscillator.	2J12AU7
V3, V4	TUBE, twin-diode: type 6AL5 or 5726.	V3—Mark-frequency discriminator diode. V4—Space-frequency discriminator diode.	2J5726/6AL5
V7, V8	TUBE, twin-diode: type 6X4 or 6X4W (preferred).	V7—Power supply rectifier. V8—Static ringing generator rectifier diode.	2J6X4W

2. Discriminator and Oscillator Capacitor Selection

Capacitors designated C30 and C32 in the preceding paragraph will consist of one or two of the capacitors from the list in subparagraph a below. Refer to paragraphs 69 through 71 for the selection procedure. The capacitor designated C11 will be one of the capacitors listed in subparagraph b below. The capacitor designated C13 will be one of the capacitors listed in subparagraph c below. The capacitor designated C15 will be one of the capacitors listed in subparagraph d below. The capacitor designated C17 will be one of the capacitors listed in subparagraph e below. Refer to paragraph 72 for the selection procedure for capacitors C11, C13, C15, and C17.

a. Capacitors designated C30 and C32 shall each consist of one or two of the following capacitors:

Name of part and description	Signal Corps stock No.
CAPACITOR fixed: silver mica; 47 uuf ±10%; 500 vdcw; JAN CM20C470K.	3K2047031
CAPACITOR, fixed: mica; 100 uuf ±10%; 500 vdcw; JAN CM20C101K.	3K2010131
CAPACITOR, fixed: mica 200 uuf ±5%; 500 vdcw; JAN CM20D201J.	3K2020142
CAPACITOR, fixed: mica; 200 uuf ±5%; 500 vdcw; JAN CM20D301J.	3K2030142
CAPACITOR, fixed: mica; 390 uuf ±5%; 500 vdcw; JAN CM20D391J.	3K2039142
CAPACITOR, fixed: mica; 510 uuf ±5%; 500 vdcw; JAN CM20D511J.	3K2051142
CAPACITOR, fixed: mica; 620 uuf ±5%; 500 vdcw; JAN CM30D621J.	3K3062142
CAPACITOR, fixed: mica; 680 uuf ±5%; 500 vdcw; JAN CM30D681J.	3K3068142

b. The capacitor designated C11 will be one of the following capacitors:

Name of part and description	Signal Corps stock No.
CAPACITOR, fixed: mica; 3900 uuf ±5%; 500 vdcw; JAN CM35D392J.	3K3539242
CAPACITOR, fixed: mica; 5600 uuf ±5%; 500 vdcw; JAN CM35D562J.	3K3556242

c. The capacitor designated C13 will be one of the following capacitors:

Name of part and description	Signal Corps stock No.
CAPACITOR, fixed: mica; 2000 uuf ±5%; 500 vdcw; JAN CM35D202J.	3K3520242
CAPACITOR, fixed: silver mica; 3600 uuf ±5%; 500 vdcw; JAN CM35D362J.	3K3536242

d. The capacitor designated C15 will be one of the following capacitors:

Name of part and description	Signal Corps stock No.
CAPACITOR, fixed: silver mica; 1300 uuf ±5%; 500 vdcw; JAN CM30D132J.	3K3013242
CAPACITOR, fixed: mica; 2700 uuf ±5%; 500 vdcw; JAN CM30D272J.	3K3027242

e. The capacitor designated C17 will be one of the following capacitors:

Name of part and description	Signal Corps stock No.
CAPACITOR, fixed: mica; 3000 uuf ±5%; 500 vdcw; JAN CM35D302J.	3K3520242
CAPACITOR, fixed: mica; 4300 uuf ±5%; 500 vdcw; JAN CM35D432J.	3K3543242

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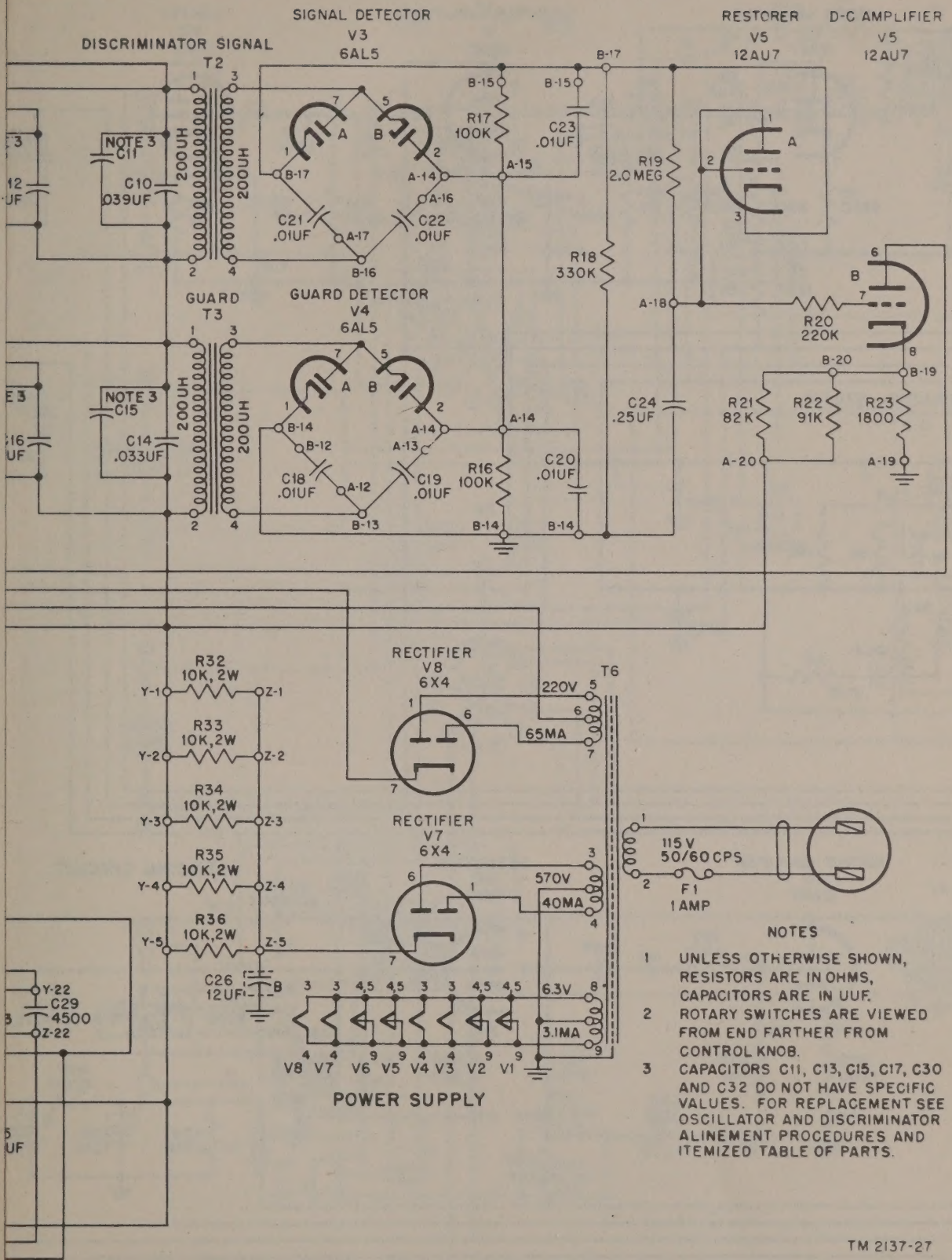
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Weatherproofing:		
Desert	27*d*	15
Tropical	27*b*	15
Winter	27*c*	15



NOTES

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. ROTARY SWITCHES ARE VIEWED FROM END FARTHER FROM CONTROL KNOB.
3. CAPACITORS C11, C13, C15, C17, C30 AND C32 DO NOT HAVE SPECIFIC VALUES. FOR REPLACEMENT SEE OSCILLATOR AND DISCRIMINATOR ALINEMENT PROCEDURES AND ITEMIZED TABLE OF PARTS.

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Figure 26. Telegraph-Telephone Signal Converter TA-182/U, schematic diagram.

	Paragraph	Page
Visual inspection	30, 58*b*	15, 31
Voice Frequency Hybrid TA-31/U	14*c*	10
Voltage and resistance measurements	58*b*	31
Weatherproofing:		
Desert	27*d*	15
Tropical	27*b*	15
Winter	27*c*	15

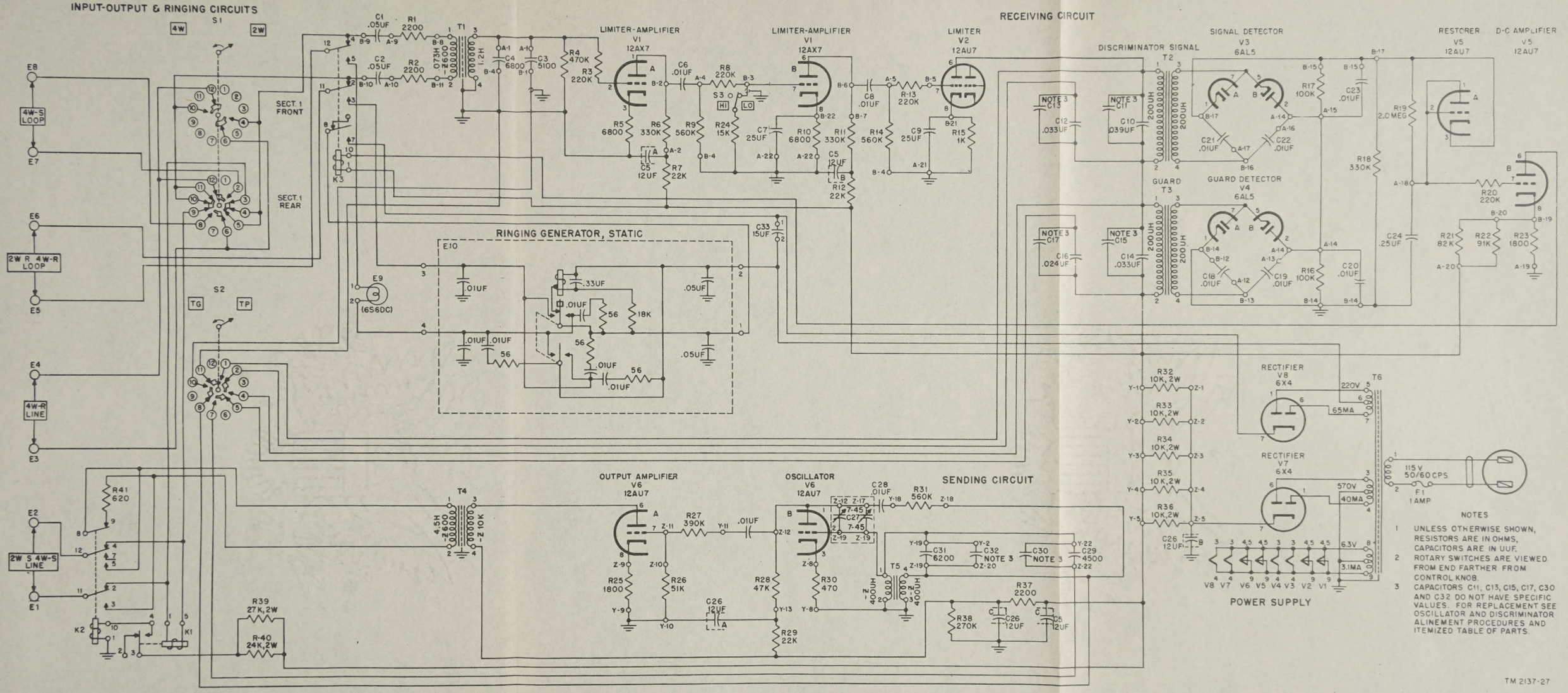
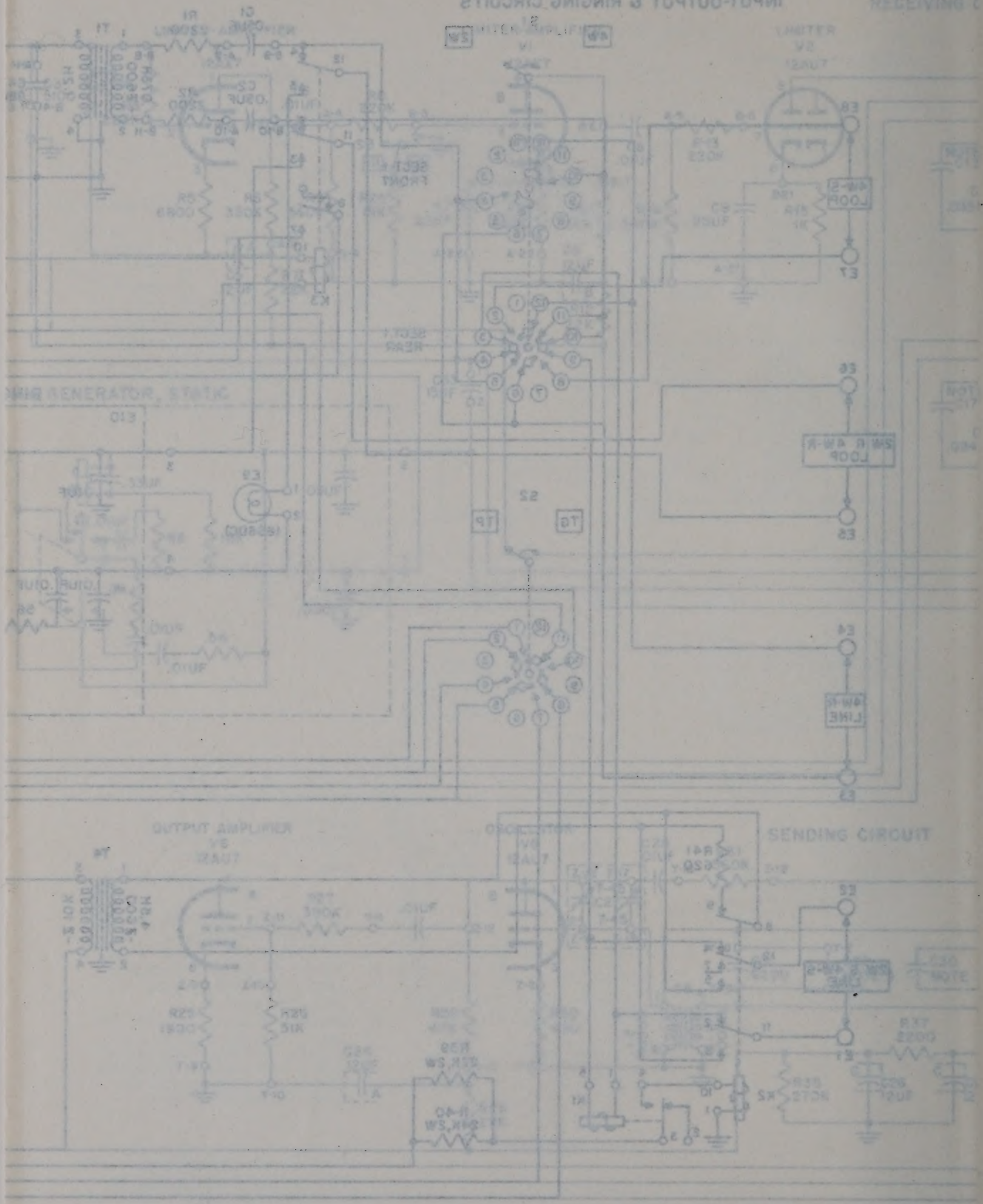
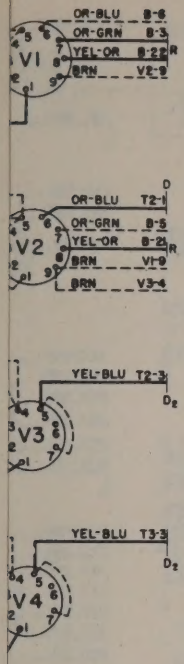


Figure 26. Telegraph-Telephone Signal Converter TA-182/U, schematic diagram.

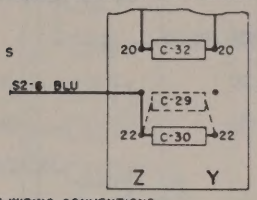

INPUT-OUTPUT & RINGING CIRCUITS
RECEIVING
OUTPUT AMPLIFIER
V6
12AU7
SENDING CIRCUIT



NOTES:

1-COLOR INDICATES COLOR OF TRACERS ON WHITE BASE WIRE.

2-LEGEND FOR AIRLINE WIRING DIAGRAM.



ILLUSTRATES WIRE IN THE "S" CABLE (SEND CABLE) WHICH IS CONNECTED TO TERMINAL Z-21 OF THE TERMINAL BOARD ZY. THE BLUE WIRE RUNS TO TERMINAL "6" OF SWITCH S-2.

3-WIRING CONVENTIONS

A- BLU DENOTES COLOR CODED WIRE IN CABLE.

B- BRN DENOTES STRAPPING, COLOR CODED, (CHASSIS).

C- DENOTES STRAPPING, BARE, (CHASSIS).

D- DENOTES STRAPPING, BARE & INSULATED, (TERMINAL BOARD).

4-CABLE DESIGNATIONS

"R" RECEIVE CABLE

"S" SEND CABLE

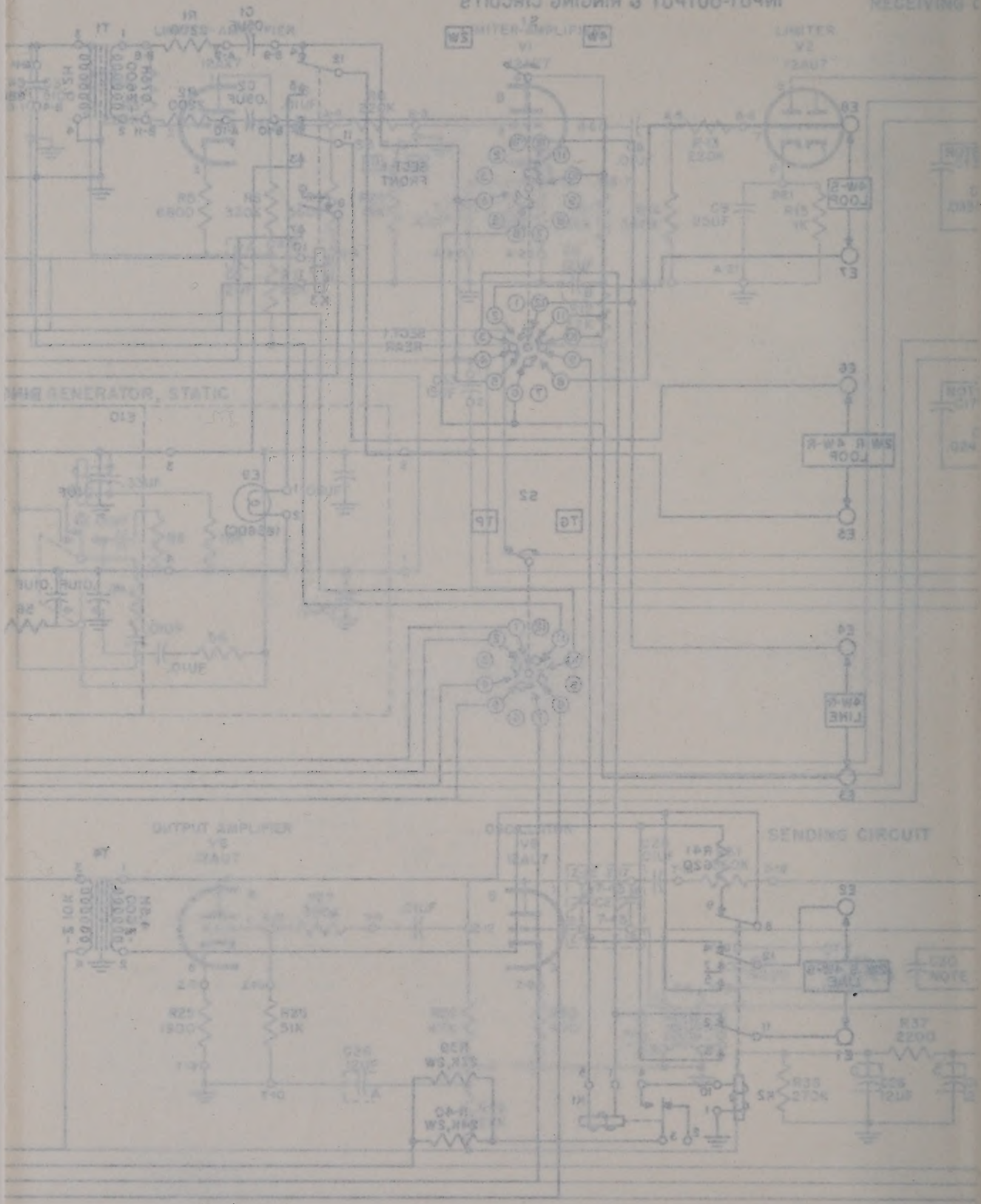
"P" POWER CABLE

"D" DISCRIMINATOR PRIMARY CABLE

"D_2" DISCRIMINATOR SECONDARY CABLE

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Figure 27. Telegraph-Telephone Signal Converter TA-192/U, wiring diagram.


SENDING CIRCUIT

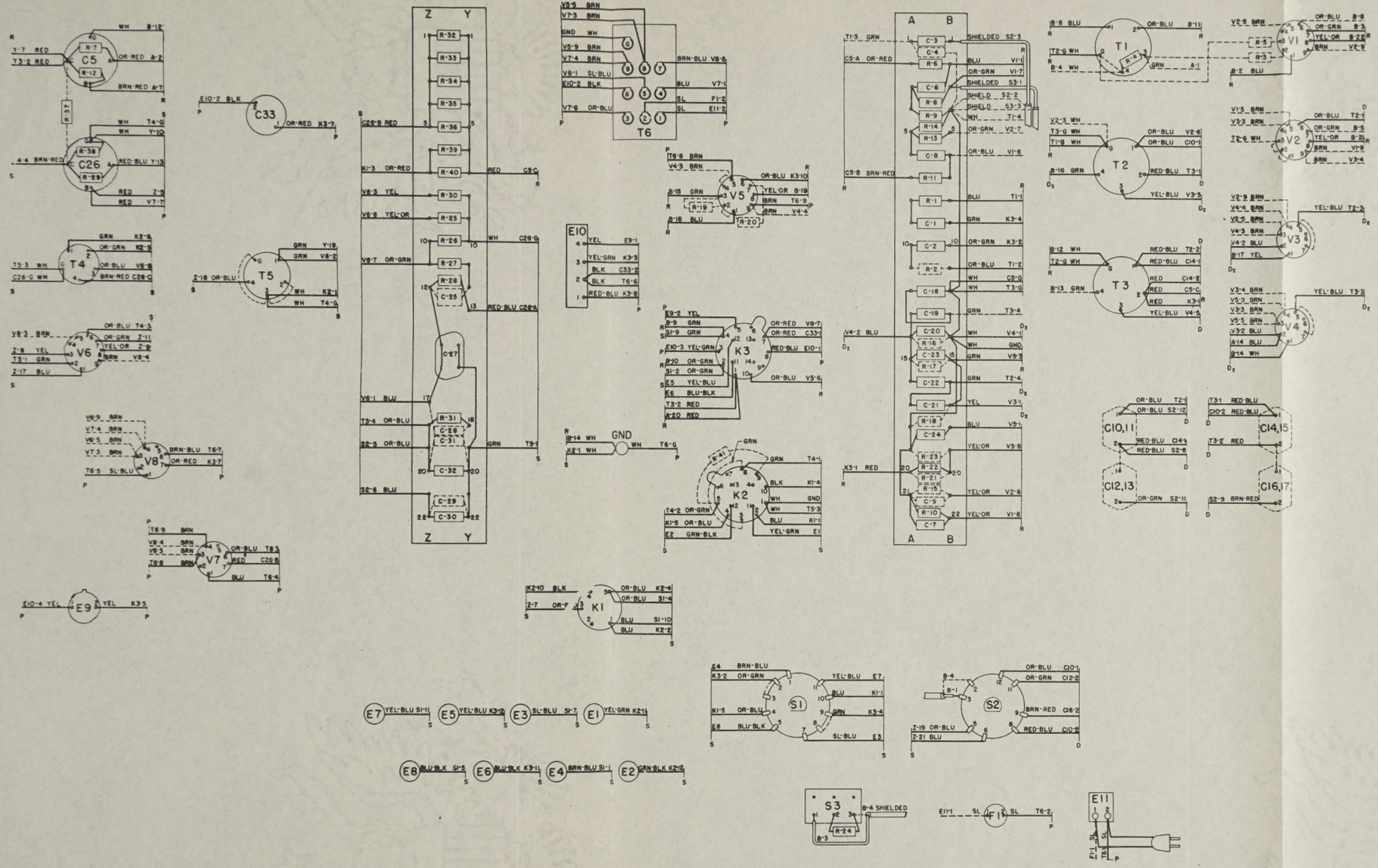


Figure 27. Telegraph-Telephone Signal Converter TA-192/U, wiring diagram.

