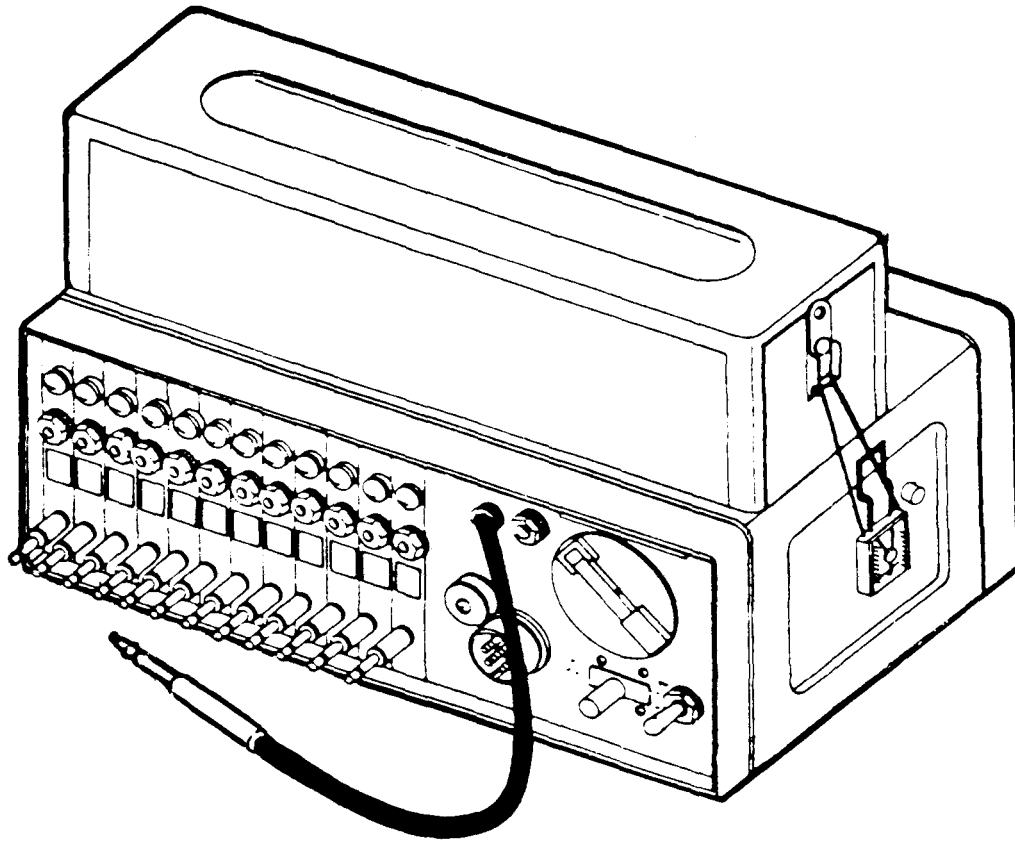


TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT  
MAINTENANCE MANUAL



SWITCHBOARDS

SB-22/PT (NSN 5805-00-257-3602) AND  
SB-22A/PT (NSN 5805-00-715-6171)  
(INCLUDING TONE SIGNALING ADAPTER  
TA-977/PT (NSN 5805-01-040-9653))

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HEADQUARTERS, DEPARTMENT OF THE ARMY  
1983

28 SEPTEMBER 1983



**5**

**SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK**

**1**

**DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL**

**2**

**IF POSSIBLE , TURN OFF THE ELECTRICAL POWER**

**3**

**IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL**

**4**

**SEND FOR HELP AS SOON AS POSSIBLE**

**5**

**AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION**

Change }  
No. 1 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 1 January 1988

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL  
SWITCHBOARDS, TELEPHONE, MANUAL  
SB-22/PT (NSN 5805-00-257-3602) AND  
SB-22A/PT (NSN 5805-00-715-6171)  
(INCLUDING TONE SIGNALING ADAPTER  
TA-977/PT (NSN 5805-01-040-9653))

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Technical Manual  
No. 11-5805-262-34

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, DC, 28 September 1983

**DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL  
SWITCHBOARDS, TELEPHONE, MANUAL  
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**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. In either case, a reply will be furnished direct to you.

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\*This manual supersedes TM 11-5805-262-35, 18 March 1968 including change 1.

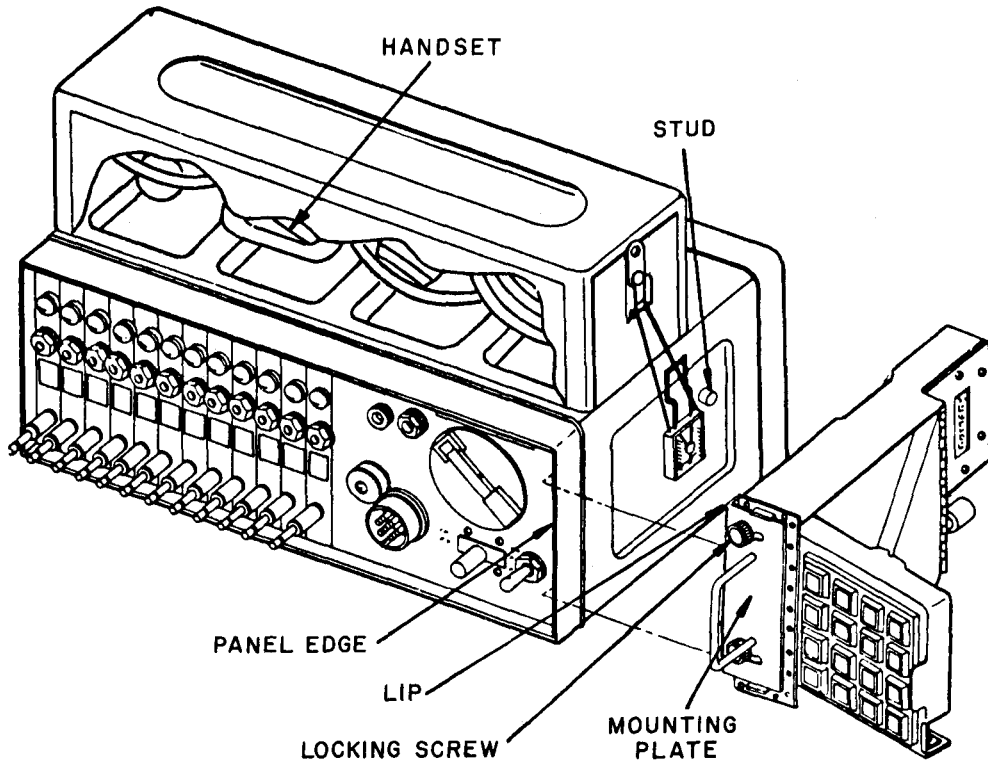
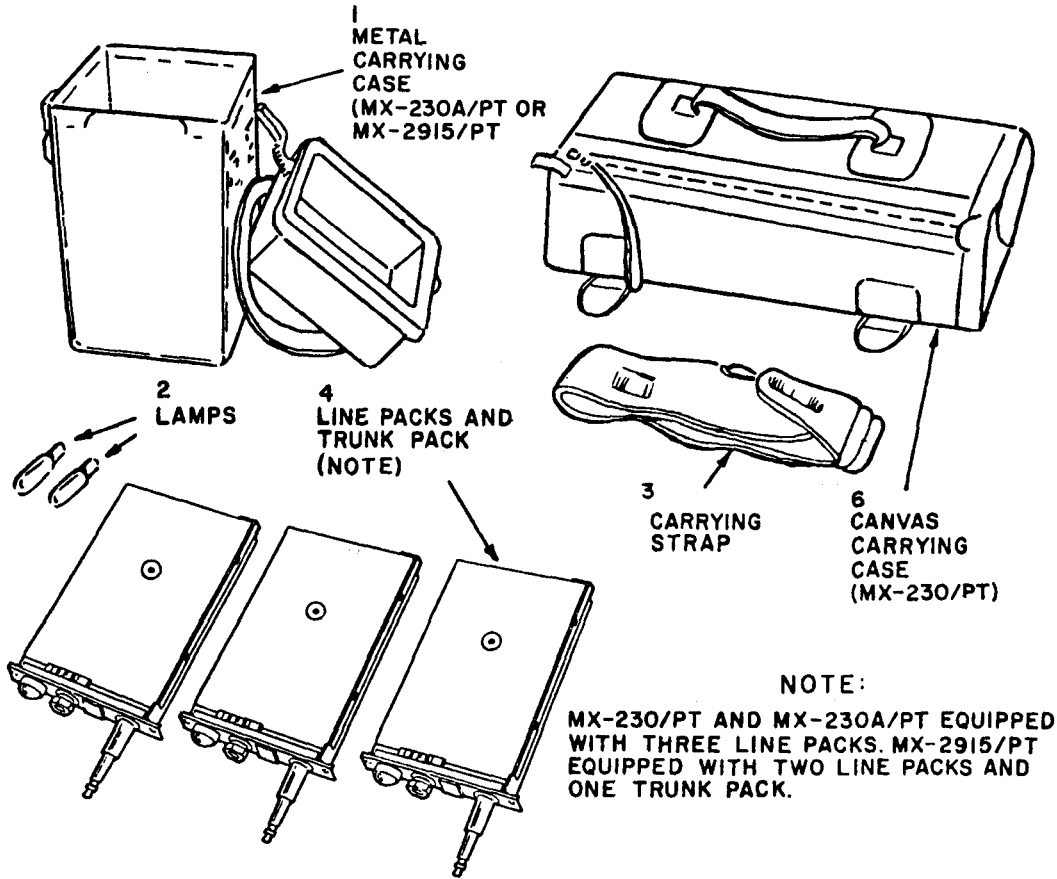


Figure 1-0. Switchboard SB-22/PT or SB-22A/PT.

# CHAPTER 1

## INTRODUCTION

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### Section I. GENERAL

#### 1-1. Scope

a. This manual covers direct support (DS) and general support (GS) maintenance for Switchboards, Telephone, Manuel SB-22/PT and SB-22A/PT (switchboard). It includes instructions for troubleshooting, testing, and repairing the equipment; replacing maintenance parts; and repairing specified maintenance parts. It also lists material and test equipment required for DS and GS maintenance. Detailed functions of the equipment are covered in this chapter. Familiarity with the equipment, how it works, and why it works that way are valuable tools for troubleshooting the equipment rapidly and effectively.

b. Operating instructions, installation, organizational maintenance, and maintenance allocations for the switchboard are contained in TM 11-5805-262-12.

#### 1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

#### 1-3. Reports of Maintenance Forms, Records, and Reports

a. *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (TAMMS).

b. *Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C/DLAR 4500.15.

#### 1-4. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 11-5805-262-12.

#### 1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

#### 1-6. Reporting Equipment Improvement Recommendations (EIR)

If your switchboard needs improvement, let us know. Send us an EIR. You, the user are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

**NOMENCLATURE CROSS-REFERENCE LIST**

This listing includes nomenclature cross-references used in this manual.

<b>COMMON NAME</b>	<b>OFFICIAL NOMENCLATURE</b>
Switchboard	Switchboard, Telephone, Manual SB-22(*)/PT
Line pack	Telephone Circuit, Line Jack TA-222/PT
Operator's pack	Telephone Circuit, Operator's TA-221/PT
Operator's telephone set	Headset-Microphone H-182/U
Trunk pack	Telephone Circuit, Trunk Jack TA-326/PT
Tone signaling adapter	Tone Signaling Adapter TA-977/PT



## Section II. EQUIPMENT DESCRIPTION AND DATA

Refer to Operator's and Organizational Maintenance Manual TM 11-5805-262-12 for characteristics, capabilities, and features of the switchboard.

## Section III. FUNCTIONAL DESCRIPTION

### 1-8. General

This section contains a functional description of the switchboard for use by the technician in sectionalizing and localizing problems.

### 1-9. System Description

a. The switchboard is a monocord switchboard containing facilities for 12 local battery telephone lines. Each line is terminated in an individual line pack that contains a line signal, a line jack, and a plug-ended cord. Telephones connected to each line pack are interconnected by inserting the plug of one line pack into the jack of another line pack.

b. The switchboard is supplied with a trunk pack that provides an automatic one-way ringdown trunk circuit to another central office. The trunk pack may be installed in place of one of the line packs.

c. The operator's pack contains the operator's cord, operator's jack, Generator, Ringing, Hand G-42/PT or G-42A PT (hand ringing generator), and the ringing switch. The operator's pack can be connected to the line and trunk packs by insertion of the operator's cord into the jack of the line or trunk packs. The operator's pack also contains the night alarm and the illuminating lamp circuits.

d. The switchboard case contains bus bars and plugs to interconnect the night alarm circuits of the line and trunk packs with the operator's pack and to interconnect the line and trunk packs with the line binding posts. The bus bars also interconnect the night alarm battery, the transmission battery, and the emergency operator's binding posts with the operator's pack.

e. The tone signaling adapter is electrically connected to the switchboard through the EMER OPR binding posts. It provides 20 hz dual tone signaling for use with a digital switchboard such as Switchboard SB-3614/TT.

1-10. Incoming Line Signal (fig. 1-1)

A 20 hertz alternating current (ac) ringing signal from the calling party's telephone applied to binding posts L1 and L2 causes line signal I201 to change from black to white.

a. Rectifier CR201 conducts more than 20 times the current in the forward direction than it conducts in the reverse direction, resulting in a net current flow in the forward direction when the ac ringing signal is applied. This current sets up a magnetic field in the armature of the line signal indicator I201. A permanent magnet, embedded in the plastic ball that serves as an indicator, is attracted by the core, aligning itself with the core flux and changing the indications of the indicator from black to white.

b. During the other half-cycle of the ringing signal, the high reverse resistance of rectifier CR201 effectively blocks the ringing signal from the winding of line signal I201 to prevent that signal from being returned to black.

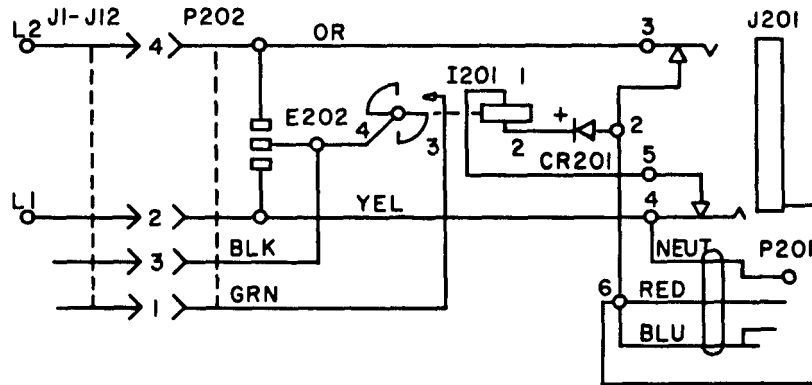


Figure 1-1. Line Pack Schematic Diagram.

1-11. Operator Answering Incoming Call (fig. FO-1)

When the line signal operates from black to white, the operator inserts the plug of the operator's cord into the associated line jack. This mechanically restores line signal I201 to provide a black indication and establishes a transmission circuit between the operator's telephone set and the calling party.

a. *Operator's Transmitting Circuit (to Calling Party).* The transmitting circuit is from the positive terminal of the transmitter (BAT. MIC) battery through jack J302, the switchbox assembly, the microphone; winding 1-2 of induction coil T301, to the negative terminal of the transmitter battery. Voice currents, set up by the variable resistance of the microphone, induce a voltage into winding 3-5 of induction coil T301. The induced voltage causes voice current to flow to the line through contacts of switch S303, operator's plug P301, and jack J201. The earphone is connected across winding 4-5 of induction coil T301 to provide sidetone during transmission. Capacitors C301 and C302 open the circuit to direct current (dc) and work in conjunction with the windings of induction coil T301 to provide an antisidetone network.

b. *Operator's Receiving Circuit (From Calling Party).* The receiving circuit to the operator's headset is from the line pack line 1 and line 2 terminals assigned to the calling party, through contacts 4 and 2 of connector P202 to the tip (T) and ring (R) of jack J201. With the operator's cord inserted in the jack of the calling party's line pack, the series receiving circuit is completed from the tip of plug P301, through contacts of switch S303, pin B of connectors J301 and P401, the earphone, pin A of connectors U-161/U and J301, terminals 4 and 3 of induction coil T301, dc blocking capacitor C302, and contacts of switch S303 to the ring of operator's plug P301.

## 1-12. Completing Call

To complete the call, the operator inserts the plug of the calling party's line pack into the jack of the called party's line pack and signals the called party.

*a. Signaling Called Party Using Hand Ringing Generator.* Normally open contacts 1 and 3 of the hand ringing generator (HG) are closed mechanically when the generator handwheel is turned. With switch S303 not operated, the signaling circuit for the called party is from terminal 3 of hand ringing generator G301 through the contacts of switch S303, the sleeve (S) of plug P301 and jack J201, the ring contact of jack J201 of the called party's plug P201, and the ring contact of jack J201 of the called party's line pack to the called party's telephone. The return path is over the line to the tip (T) of the called party's jack J201, the tip (T) of the calling party's jack J201 and plug p301 to terminal 1 of hand ringing generator G301. The called party's telephone will ring when the generator handwheel is turned.

*b. Signaling Called Party Using Power Ringing.* For power ringing, switch S303 is set to PWR RING FWD. The circuit used to signal the called party differs from that in *a* above as follows:

(1) The ringing signal is supplied through binding posts 16 (POWER RING GEN.) instead of by the hand ringing generator.

(2) Different contacts of switch S303 are used.

*c. Signaling Calling Party (Ringback) Using Hand Ringing Generator.* With switch S303 set to RING BACK, one side of the circuit extends from contact 1 of hand ringing generator G301 to the tip of plug P301. The other side of the circuit extends from contact 3 of generator G301 through the contacts of switch S303 to the ring of plug P301. The calling party is signaled over the tip and ring of jack J201.

*d. Signaling Calling Party (Ringback) Using Power Ringing.* When power ringing is used, the ringing signal is supplied through binding posts 16 (POWER RING GEN.) instead of by the hand ringing generator. Except that different contacts of switch S303 are used, the circuit for power ringback is the same as for ringback using hand ringing generator (*c* above).

## 1-13. Transmission between Calling and Called Parties (fig. FO-1)

When plug P301 is removed from jack J201 of the calling party's line pack, the transmission circuit is through the calling party's cord. The ring spring and ring break contact of the calling party's jack J201 connect one side of the line to the ring spring of the called party's jack J201.

## 1-14. Supervisory Signal (Ring-Off) (fig. FO-1)

When the conversation is completed, each party will ring off by operating the hand ringing generator of his telephone. The ringing current from the calling party's telephone will be applied to the signal on the line pack, as explained in paragraph 1-10. Ringing current from the called party's telephone will be applied to the signal in the calling party's line pack through the tip and ring of the calling party's plug P201. Only line signal 1201 in the calling party's line pack will operate, because the circuit to the called party's line signal 1201 is opened at jack J201.

## 1-15. Conference Calls

Figure 1-2 shows the connections for a conference call involving the calling party and three other participants. The connection from the calling party to one of the called parties of the conference is made by inserting the cord of the calling party's line pack into the line jack of the called party's line pack. Connection to that party is made by the tip and ring of the line plug and line jack used in the connection. The connection of an additional party to the conference is made through the tip and sleeve of jack J201 of the line pack connected to the calling party. Any additional parties are connected one at a time through the tip and ring of plug P201 of the last line pack previously connected to the conference. When all parties to the conference have, in turn, been connected in this fashion, they can all be rung at once by the operator. When the operator leaves after establishing the conference circuit, the connection of the calling party to the called parties is maintained through the ring break contact and ring spring of jack J201 in the calling party's line pack.

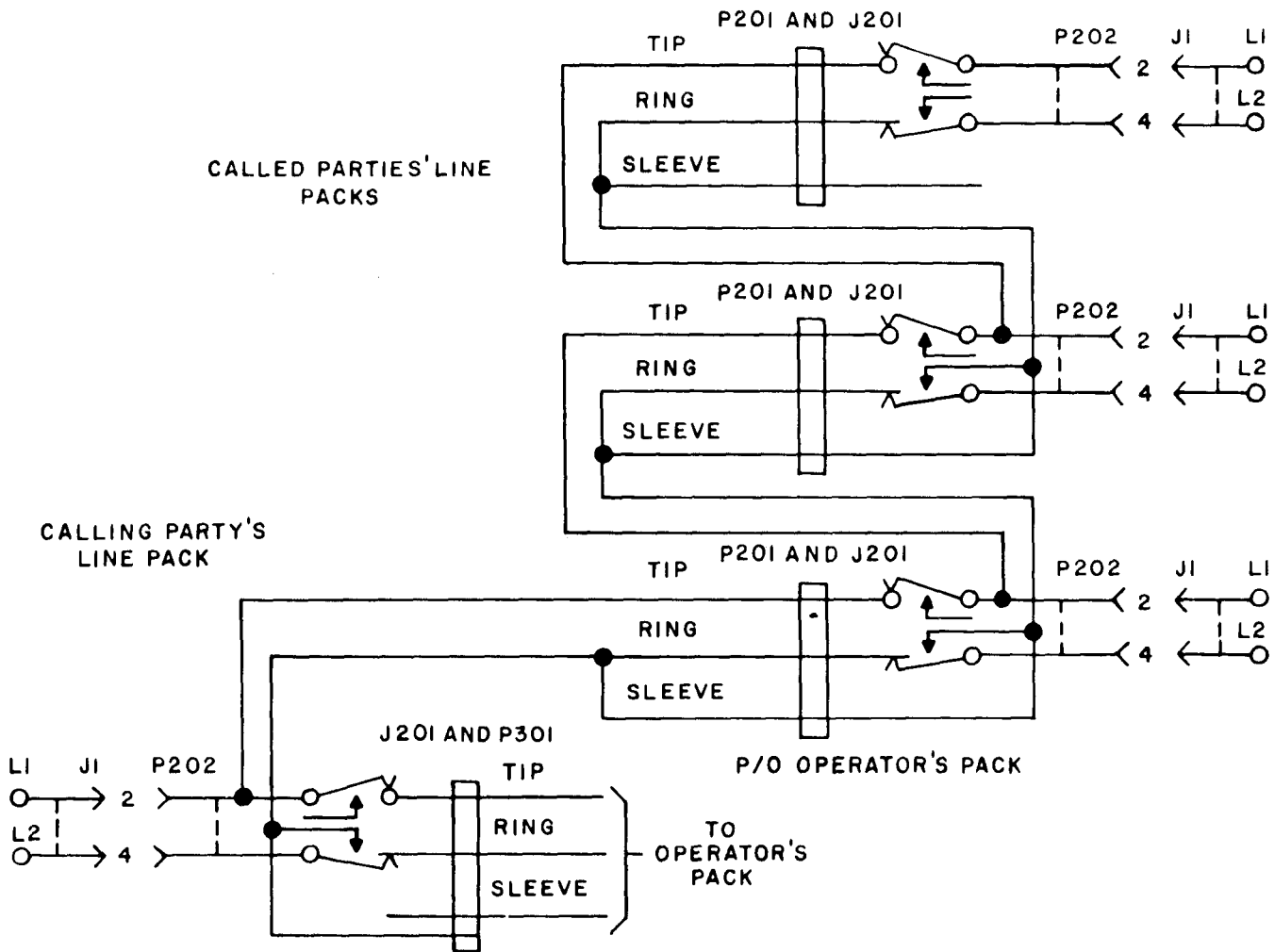


Figure 1-2. Conference Circuit, Connection Diagram.

1-16. Monitoring Circuit

The operator can monitor calls or conference by leaving the cord of the operator's pack connected to jack J201 of the calling party's line pack. If the operator does not operate the RING BACK-PWR RING FWD switch, the conference can proceed unimpeded. The operator can also monitor conferences by connecting himself to jack J201 of the last line pack connected. In this case, operation of the RING BACK-PWR RING FWD switch will remove the operator's telephone set from the circuit, but will not interrupt the conference.

1-17. Automatic Singaling and Supervision (Trunk Pack) (fig. FO-1)

The trunk pack can be connected only to a line terminated in a common battery line circuit at the distant central office. The trunk pack contains a dc circuit that provides automatic signaling and supervision to a distant common battery central office (a and b below). The transmission circuit is the same as the circuit previously described for the line packs (paras 1-10, 1-11 and 1-13). The incoming signaling circuit is identical, except that rectifier CR501 shunts the reverse ringing signal in the low resistance direction.

a. *Automatic Signaling.* When a line pack cord plug is inserted into jack J501, contacts 6 and 7 close, completing a dc circuit across binding posts L1 and L2. The dc closure causes the line lamp at the common battery central office to light, indicating an incoming call.

b. *Automatic Supervision.* When the cord plug is removed from jack J501, contacts 6 and 7 open and light the supervisory lamp at the distant central office. Plug seat switch S501 contacts perform the same functions as contacts 6 and 7 of jack J501, with which they are in parallel. Capacitor C501 opens the circuit to dc through trunk signal I501. Because capacitor C502 and resistor R501 across lines L1 and L2 offer a 600-ohm impedance, the trunk pack can be used to terminate carrier trunks. Telephone induction coil L501 prevents voice currents from being shunted through contacts 6 and 7 of jack J501 or through the contacts of plug seat switch S501.

#### **1-18. Remote Control of Radio Equipment (fig. FO-1)**

When the operator's plug is inserted into jack J201 and switch S401 is operated to the second position, a dc circuit is closed to the remote control equipment. This circuit is as follows: from the tip of plug P301 through the contacts on switch S303, contact 4-3 of switch S401, retardation coil L301, and the contacts on switch S303 to the ring of plug P301. Retardation coil L301 prevents the voice currents from being shunted through contact 3-4 of switch S401.

#### **1-19. Illuminating Lamp Circuit (fig. FO-1)**

When switch S301 is set to LITE-OUT, the illuminating lamp will light. The circuit is completed from the negative side of the night alarm battery (BAT. NA.), through the contacts of switch S301, illuminating lamp I302, to the positive side of the night alarm battery.

#### **1-20. Night Alarm Circuit (fig. FO-1)**

The night alarm circuit provides either an audible or a visual alarm to signal a line indicator has switched from black to white. The night alarm circuit is from the negative side of the night alarm battery, through closed contacts 4-3 of operated line signal I201, to contact 1 of switch S302. The circuit through switch S302 depends on the position (VIS or AUD) of the switch. When the switch is set to VIS, the circuit is completed through contact 2 of switch S302, contacts 3-1 of switch S301, and illuminating lamp I302 to the positive side of the night alarm battery. When the switch is set to AUD, the circuit is completed through contact 3 of switch S302 and buzzer I301 to the positive side of the night alarm battery. The illuminating lamp cannot be used as a visual alarm if it is being used to illuminate the switchboard.



## CHAPTER 2

DIRECT SUPPORT MAINTENANCE

---

**Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT****2-1. Common Tools and Equipment**

For authorized common tools and equipment, refer to the modified table of organization and equipment (MTOE) applicable to your unit.

**2-2. Special Tools, TMDE, and Support Equipment**

Refer to the repair parts and special tools list (RPSTL) and maintenance allocation chart (MAC) for information pertaining to direct support maintenance.

**2-3. Repair Parts**

Repair Parts are listed in the RPSTL (TM 11-5805-262-34P) covering direct support maintenance of this equipment.

**Section II. TROUBLESHOOTING****2-4. General**

a. Troubleshooting at direct support maintenance includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The direct support maintenance procedures supplement those described in organizational maintenance. The systematic troubleshooting procedures, which begin with the operational and sectional checks performed at an organizational category, must be completed by further localizing and isolating techniques. Troubleshooting may be performed while the equipment is operating as part of a system or, if necessary, after the switchboard, or the line, trunk, or operator's packs have been removed from service.

b. Use the troubleshooting charts (para 2-9) to localize trouble to a component, circuit, or part. Refer to the schematic and wiring diagrams (para 2-6a) for the line, trunk, and operator's packs to further check the circuit to which the trouble has been localized. Visually inspect the jack contacts, connections, lightning arrester, signal winding, and cord for defects. Check the entire circuit with Multimeter TS-352B/U (multimeter), functioning as an ohmmeter, to locate the defective part if trouble cannot be located by inspection.

**2-5. Tools and Test Equipment**

All the tools and test equipment required to perform the test and repair procedures authorized at the direct support maintenance category are listed in the maintenance allocation chart in TM 11-5805-262-12.

**2-6. Additional Troubleshooting Data**

a. *Schematic and Wiring Diagrams.* The schematic and wiring diagrams listed in the chart below with the associated equipment will be helpful in localizing faults in the equipment.

Equipment	Type of diagram	Fig. No.
Switchboard	Schematic	FO-1
Operator's pack	Exploded view	2-5
Operator's pack	Wiring	2-6
Line pack	Wiring	2-4
Trunk pack	Wiring	2-3
Operator's telephone set	Wiring	2-7

b. *Reference Designation Assignments.* The reference designations listed in the chart below have been assigned to the components of the switchboard.

Component	Reference designation assignment
Switchboard case . . . . .	1 through 99
Line pack . . . . .	200 through 299
Operator's pack . . . . .	300 through 399
Operator's telephone set . . . . .	400 through 499
Trunk pack . . . . .	500 through 599

**NOTE**

Designations between 100 and 199 are not used.

**2-7. Preparation for Troubleshooting**

The testing procedure used for troubleshooting assumes that a complete switchboard is being tested. When a line pack, trunk pack, or operator's pack is returned separately as defective to direct support for repair, the returned pack must be installed in a switchboard before testing. When a complete switchboard is returned for repair, perform all the troubleshooting tests; when a pack returned as faulty is installed for testing in a switchboard which is otherwise in good working order, perform only the test indicated for the faulty pack.

**2-8. Performing Troubleshooting Tests**

a. *Line Pack.* Make the tests in (1) through (11) below on each line pack, and note each malfunction that occurs during the testing process for further troubleshooting:

- (1) Connect the test telephone to the binding posts of the first line pack.
- (2) Check to see that the line signal indicator of the first line pack is black. If the signal is white, momentarily insert the operator's cord into the line jack of the pack to change the signal from white to black.
- (3) Operate the hand ringing generator on the test telephone. The line signal of the first line pack should change from black to white.
- (4) Insert the operator's cord into the line jack of the first line pack. The line signal should change to black. Make sure that voice transmission between the test telephone and the operator's handset-headset is possible in both directions.
- (5) Operate the hand ringing generator on the test telephone while the plug of the operator's cord is in the line jack. The line signal should remain black during the ringing.
- (6) Connect a second test telephone to the binding posts of another line pack. Insert the plug of the cord from the first line pack into the jack of the second line pack.



(7) With the operator's cord connected to the line jack of the first line pack, operate the bond ringing generator on the operator's pack. The second test telephone should ring.

(8) Check to see that voice transmissions are possible between both test telephones and between the test telephones and the operator's handset-headset.

(9) Remove the plug of the operator's cord from the line jack. Turn the hand ringing generator on each test telephone. The line signal of only the first line pack should change to white.

(10) Insert the operator's cord in to the line jack of the first line pack to restore the line signal to black. Remove the card of the first line pack from the line jack of the second line pack.

(11) If line packs other than the first line pack are to be tested, repeat the procedures in (1) through (10) above for these line packs.

*b. Operator's Pack and Operator's Telephone Set.*

(1) Connect two test telephones to two different line packs which are known to be in good working order.

(2) On the operator's pack being tested, operate the night alarm switch to the VIS or AUD position.

(3) Operate the hand ringing generator on one of the test telephones. The line signal on the associated line pack will change to white, and the night alarm of the operator's pack should operate.

(4) Insert the operator's card into the line jack of the line pack having the line indicator that changed to white ((3) above). The white line signal will change to black, and the night alarm of the operator's pack should go off.

(5) Check to see that transmission is possible in both directions between the test telephone and the operator's handset-headset.

(6) Operate the hand ringing generator at the operator's pack. The test telephone should not ring.

(7) Insert the line cord of the line pack into which the operator's cord is plugged into the line jack of the line pack to which the second test telephone is connected.

(8) Operate the hand ringing generator of the operator's pack. The second test telephone should ring.

(9) Check to see that voice transmissions are possible between both test telephones and the operator's handset-headset.

(10) On the operator's pack, operate the RING BACK-PWR RING FWD switch to RING BACK and operate the hand ringing generator. Only the first test telephone should ring.

(11) Remove the cord of the first line pack from the line jack of the second line pack, and allow the cord to retract. Remove the operator's cord from the line jack of the first line pack.

(12) Blow into the operator's handset-headset transmitter and check to see that sidetone can be heard in the receiver. Insert the operator's card into the operator's jock, and check to see that sidetone can no longer be heard in the receiver.

(13) Set the LITE-OUT-NA-IN switch to LITE-OUT, and check to see that the illuminating lamp lights. Set the switch to NA-IN; and check to see that the lamp is off.

*c. Trunk Pack.* Make the tests in (1) through (11) below on each trunk pack, and note each malfunction that occurs during the testing procedure for further troubleshooting:

(1) Connect the test telephone to the binding posts of the trunk pack.

(2) Check to see that the line signal indicator of the trunk pack is black. If the signal is white, momentarily insert the operator's cord into the line jack of the pack to change the signal from white to black.

(3) Operate the hand ringing generator on the test telephone. The line signal of the trunk pack should change from black to white.

(4) Insert the operator's cord into the line jack of the trunk pack. The line signal should change to black. Make sure that voice transmission between the test telephone and the operator's handset-headset is possible in both directions.

(5) Operate the hand ringing generator on the test telephone while the plug of the operator's cord is in the line jack. The line signal should remain black during the ringing.

(6) Connect a second test telephone to the binding posts of a line pack. Insert the plug of the cord from the trunk pack into the jack of the line pack.

(7) With the operator's cord connected to the line jack of the trunk pack, operate the hand ringing generator on the operator's pack. The second test telephone should ring.

(8) Check to see that voice transmissions are possible between both test telephones and between the test telephones and the operator's handset-headset.

(9) Remove the plug of the operator's cord from the trunk jack. Turn the hand ringing generator on each test telephone. The line signal of only the trunk pack should change to white.

(a) Turn the hand ringing generator on test telephone no. 1 that is connected to the trunk pack. The line signal of the trunk pack should remain black.

(b) Turn the hand ringing generator on test telephone no. 2 that is connected to the line pack. The line signal of only the trunk pack should change to white.

(10) Insert the operator's cord into the line jack of the trunk pack to restore the line signal to black. Remove the cord of the trunk pack from the line jack of the line pack.

(11) If other trunk packs are to be tested, repeat the procedures in (1) through (10) above for these trunk packs.

(12) Remove the trunk pack from the switchboard.

(13) Connect the TS-352B/U, set to measure 100 ohms, between contacts 2 and 4 of connector P502. Check to see that the TS-352B/U indicates an open circuit.

(14) Pull out the cord from the trunk pack. Check to see that the TS-352B/U now indicates 100 ohms  $\pm 10$ .

(15) Allow the cord to retract. Insert a phone plug into the line jack of the trunk pack. Check to see that the TS-352B/U again indicates 100 ohms  $\pm 10$ .

(16) Disconnect the TS-352B/U and remove the phone plug from the trunk pack.

2-9. Localization of Troubles

a. *General.* To localize troubles arising during operation or during the performance of troubleshooting tests (para 2-8), use the troubleshooting charts given in *b*, *c*, and *d* below. The three charts respectively treat troubles in the line pack, the operator's pack, and the trunk pack. Each chart lists a series of symptoms which will indicate trouble during operation or during the troubleshooting tests. The chart assigns the most likely causes to the noted symptoms and provides the remedies for removing the causes of trouble.

**b. Line Pack.**

Item No.	Symptom	Probable Trouble	Correction
1	Line signal fails to operate to white on incoming signal.	Faulty line signal I201. Break contacts on jack J201 dirty or improperly adjusted. Lightning arrester E202 dirty or defective. Shorted conductor in cord or plug P201.	Replace line signal (para 2-15). Clean or replace jack (para 2-14). Replace lightning arrester (para 2-16). Replace cord and plug (para 2-12).
2	Line signal flutters on incoming signal.	Defective rectifier CR201.	Replace rectifier (para 2-17).
3	Night alarm fails to operate.	Defective contacts in line signal I201. Defective receptacle P202.	Replace line signal (para 2-15). Replace connector (para 2-13).
4	Line signal fails to restore.	Defective line signal I201. Defective jack J201.	Replace line signal (para 2-15). Adjust or replace jack (para 2-14).
5	No transmission through line pack.	Defective jack J201. Defective cord reel, cord or plug P201.	Adjust or replace jack (para 2-14). Replace cord and plug (para 2-12) or higher category of maintenance required.
6	Line signal operates to white with plug in line jack.	Defective jack J201.	Adjust or replace jack (para 2-14).

## c. Operator's Pack.

Item No.	Symptom	Probable Trouble	Correction
1	Operator cannot receive or transmit.	Connector U-161/U or receptacle J301 defective. Switch S303 contacts dirty or defective. Loose connections on terminal board TB 301. Defective induction coil T301. Defective cord W301 or plug P301.	Replace connector (para 2-39) or receptacle (para 2-24). Clean, readjust, or replace switch contacts (para 2-28). Tighten loose connections. Replace induction coil (para 2-33). Replace operator's cord and plug (para 2-23).
2	Operator cannot transmit.	Defective batteries. Defective transmitter element MK401. Defective jack J302. Defective switchbox assembly.	Replace batteries. Replace transmitter element. Clean, adjust, or replace jack (para 2-25). Replace switchbox assembly (para 2-40).
3	Operator cannot receive.	Defective receiver element.	Replace receiver element.
4	Operator cannot signal called or calling party.	Defective hand ringing generator G301. Defective cord W301 and plug P301.	Replace hand ringing generator (para 2-29). Replace operator's cord and plug (para 2-23).
5	Operator cannot signal called party.	Defective contacts on switch S303.	Clean, readjust, or replace switch (para 2-28).
6	Operator cannot signal calling party.	Defective contacts on switch S303.	Clean, readjust, or replace switch (para 2-28).
7	Illuminating lamp fails to light.	Defective lamp I 302. Defective night alarm battery. Defective switch S301. Defective contacts of jack J13 or plug P302.	Replace lamp. Replace battery. Replace switch (para 2-26). Replace contacts or plug (para 2-35)
8	Night alarm fails to operate visual (VIS) signal.	Defective night alarm batteries. Defective switch S301. Defective switch S302. Defective lamp I 302. Defective contacts of jack J13 or plug P302.	Replace batteries. Replace switch (para 2-26). Replace switch (para 2-27). Replace lamp. Replace jack or plug (para 2-35).
9	Night alarm fails to operate audible (AUD) signal.	Defective night alarm batteries. Defective switch S302. Defective buzzer I 301. Defective contacts of jack J13 or plug.	Replace batteries. Replace switch (para 2-27). Replace buzzer (para 2-36). Replace jack or plug.
10	No transmission from emergency operator's telephone binding posts.	Defective contacts of jack J15 or plug P305.	Replace jack or plug (para 2-35).
11	Cannot signal with power ringing.	Defective contacts of jack J16 or plug P305.	Replace jack or plug (para 2-35).

d. *Trunk Pack.*

Item No.	Symptom	Probable Trouble	Correction
1	Line lamp at distant switchboard does not light when cord is pulled out or when plug is inserted in trunk jack. (The TS-352B/U continues to indicate an open circuit when cord is pulled out or plug is inserted in trunk jack.)	Open induction coil L501. Defective switch S501. Defective jack J501.	Replace induction coil. Adjust or replace switch. Adjust or replace jack.
2	Supervisory line lamp at distant switchboard lights. (The TS-352B/U indicates continuity even when cord is retracted and no phone plug is inserted in trunk jack.)	Shorted contacts 6 and 7 of jack J501. Shorted contacts of switch S501. Shorted capacitor C501 or C502.	Adjust or replace jack (para 2-14). Replace or adjust switch (para 2-18). Replace capacitor.
3	Signal fails to operate to white on incoming signal.	Defective line signal I501. Break contacts on jack J501 dirty or improperly adjusted. Shorted conductor in cord or plug P501. Shorted rectifier CR501.	Replace line signal (para 2-15). Clean, adjust, or replace jack contacts (para 2-14). Replace cord and plug (para 2-12). Replace rectifier.
4	Line signal flutters on incoming signal.	Open rectifier CR501.	Replace rectifier.
5	Night alarm fails to operate.	Defective contacts on line signal I501. Defective receptacle P502.	Replace line signal (para 2-15). Replace receptacle (para 2-13).
6	Line signal fails to restore.	Defective line signal I501.	Replace line signal (para 2-15).
7	No transmission through trunk jack.	Defective jack J501. Defective cord reel, cord, or plug P501.	Replace jack (para 2-14). Replace cord and plug (para 2-12).
8	Line signal operates to white with plug in line jack.	Defective jack J501.	Replace jack (para 2-14).

### Section III. REPAIR OF LINE AND TRUNK PACKS

#### 2-10. Removal of Line or Trunk Pack from Switchboard Case

- a. Unscrew the captive screw at the top and bottom of the pack to be removed from the switchboard case.
- b. Insert the trunk or line cord plug into the trunk or line jack of the pack to be removed.
- c. Using the plug as a handhold, pull the pack from the switchboard case; be careful not to bend or twist the plug during removal.
- d. Unplug the plug from the jack.

#### 2-11. Removal of Line or Trunk Pack Cover (fig. 2-1 or 2-2)

##### CAUTION

Do not pry the cover from the pack.

Grasp the cover at the rear with one hand while grasping the line or trunk pack case with the other, and pull the cover from the case.

#### 2-12. Removal and Replacement of Line or Trunk Pack Cord and Plug (fig. 2-1 or 2-2)

##### a. Removal of Cord Reel E201 or E501.

(1) Pull a short length of cord off the cord reel, and slide the plug seat out of the U-shaped bracket in the line or trunk pack case.

##### NOTE

During the procedure in (2) below, keep the cord reel under control as it unwinds to release the spring tension. Count and note the number of turns made by the reel in unwinding, until the cord reel spring tension is fully released, so that the replacement reel can be adjusted to the same tension.

(2) Slide the cord and plug out of the hole in the front of the pack. Release the spring tension by allowing the cord reel to unwind while counting the number of turns made by the reel in unwinding.

(3) Remove the two screws and the spacer from the line or trunk pack case.

(4) Lift the cord reel out of the line or trunk pack case; be careful not to break the leads soldered to jack J201 or J501 while lifting the reel out.

(5) Note the position of the leads connected to jack J201 or J501 and unsolder the leads from the jack; be careful not to burn the lead insulation during removal.

##### b. Removing Cord from Reel.

(1) Unscrew the three screws that secure the cord to the cord reel. If necessary, hold the nuts on the opposite side of the reel with a wrench.

(2) Note the position of the leads and the stay cord on the cord reel. Unwind the cord from the cord reel and slide it out of the slot in the reel.

(3) Slide the plug seat off the cord so that it can be reused.

##### c. Installing New Cord.

(1) Slide the plug seat on the new cord.

(2) Slide the terminal end of the new cord into the slot in the cord reel.

(3) Connect the new cord to the terminals on the cord reel. (See figures 2-3 and 2-4 for the correct connection of the cord to the cord reel terminals.) Position the stay cord on the proper screw and make sure that each lead is connected to the correct terminal.

(4) Replace the nuts on the three screws. Do not fasten the nuts so tightly that the screws or cord reel is damaged as a result.

*d. Replacement of Cord Reel E201 or E501.*

(1) Connect and solder the leads from the cord reel to the trunk or line jack; make sure that the leads are connected to the correct jack terminals (figs. 2-3 and 2-4).

(2) Position the cord reel in the trunk or line pack; make sure that the cord reel leads are correctly positioned.

(3) Replace the two screws and spacer on the bottom of the line or trunk pack case.

*e. Retensioning Cord Reel E201 or E501.*

(1) Wrap the cord around the cord reel in a clockwise direction.

(2) Pull the cord off the reel, counting the number of turns made by the cord reel. Stop winding the cord reel when the reel has been wound the same number of turns that the removed reel was unwound in *a(2)* above. It will be necessary to partially rewind the cord so that the required number of turns can be obtained.

(3) While holding the cord reel, rewind the cord on the reel.

(4) Slide the plug and part of the cord through the hole in the front of the line or trunk pack case, and replace the plug seat in the plug seat bracket of the case.

(5) Check the tension on the cord reel. Pull a short length of cord off the cord reel, and release it. The cord reel should retract the cord easily but not violently. Pull the cord out to its full length. It should pull out easily and should not be stopped before the end of the cord is reached. Do not release the cord when fully extended but keep it in control and allow it to rewind slowly.

**2-13. Removal and Replacement of Connector Receptacle P202 or P502 (fig. 2-1 or 2-2)**

*a.* Slide the connector receptacle out of the mounting bracket at the rear of the line or trunk pack, and unsolder the leads connected to the terminals. Note the terminals to which the leads are connected.

*b.* Connect and solder the leads to the terminals on the replacement receptacle. Make sure that the leads are connected to the proper terminals (fig. 2-3 or 2-4).

*c.* Slide the replacement receptacle into the mounting bracket.

**2-14. Removal and Replacement of Line Jack J201 or Trunk Jack J501 (fig. 2-1 or 2-2)**

*a. Removal.*

(1) Disconnect and tag all of the leads connected to the jack, and note the position of each lead.

(2) Unscrew the hexagonal nut from the front of the jack.

(3) Remove the three flat washers and the fiber bushing from the front of the jack.

(4) Slide the jack toward the rear of the line or trunk pack until it clears the front of the pack. Be careful not to damage the plunger in line or trunk signal I201 or I501 during removal of the jack.

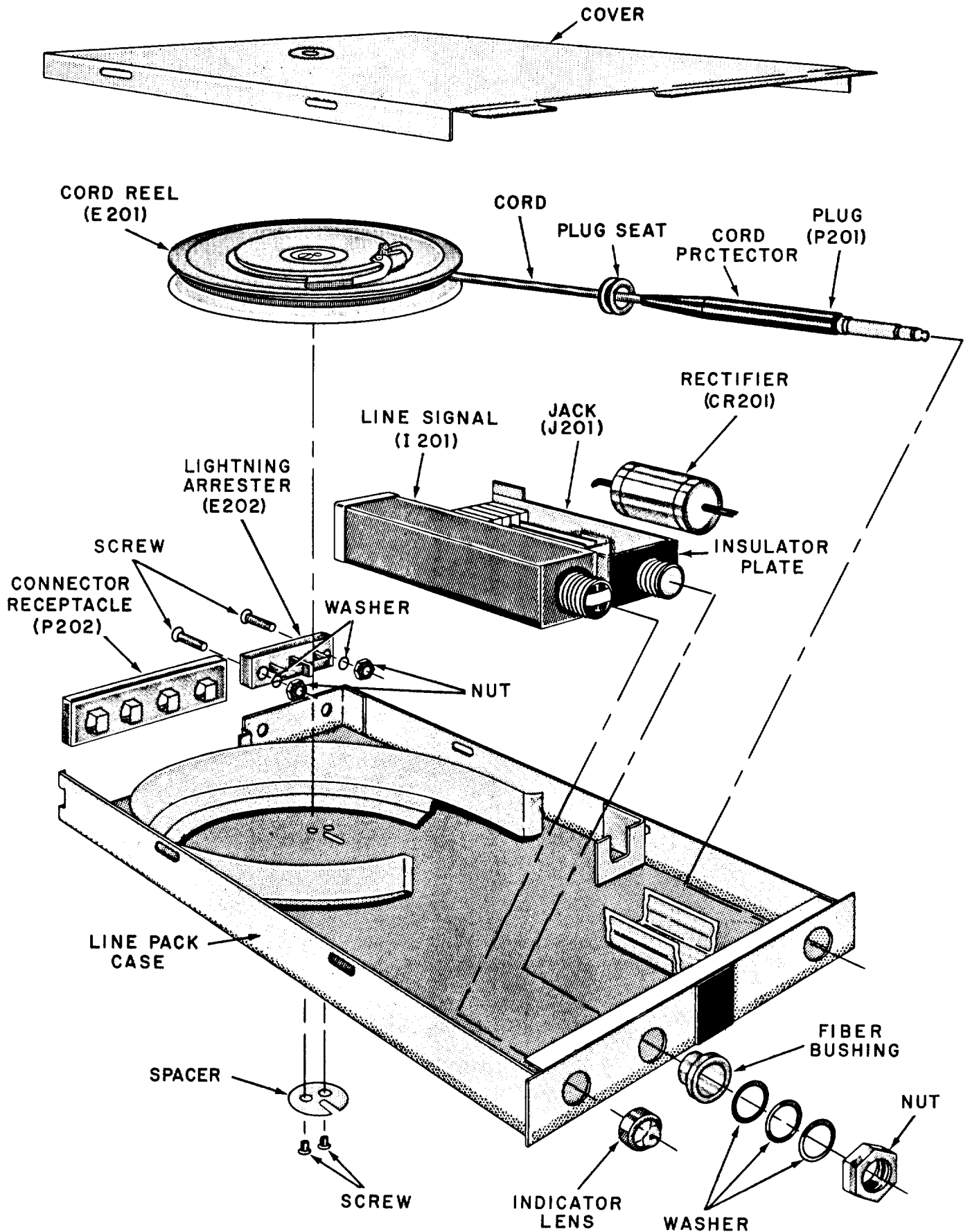


Figure 2-1. Telephone Circuit, Line Jack TA-222/PT, Exploded View.

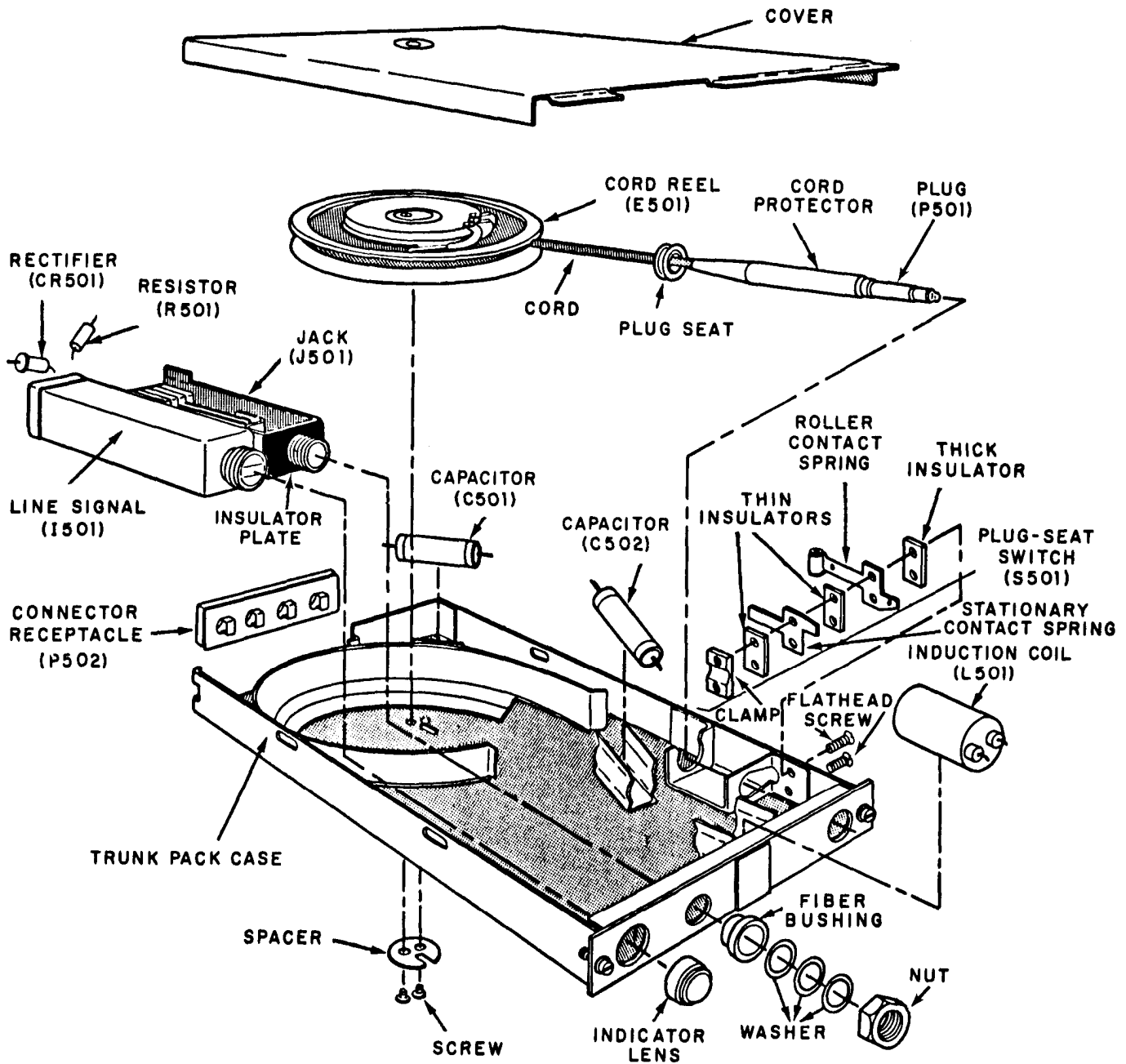


Figure 2-2. Telephone Circuit, Trunk Jack TA-326/PT, Exploded View.

(5) Remove the insulator plate from the front of the jack after the jack is removed from the pack.

b. Replacement.

(1) Slide the insulator plate onto the front of the jack.

(2) Slide the jack into the hole in the front of the line or trunk pack case. Make sure the hole in the jack frame is positioned so that the signal indicator plunger makes contact with the spring pileup of the jack.

(3) Replace the fiber bushing, three flat washers, and hexagonal nut. Position the fiber bushing so that the flat portion fits into the flat portion of the hole. Tighten the hexagonal nut with a wrench.

(4) Connect and solder the leads to the jack terminals, (fig. 2-3 or 2-4) and dress the wiring.

(5) After installation, adjust tip of spring (by bending) to depress reset plunger of line signal I201 or I501 to .010 inch - .015 inch of pretravel.



**2-15. Removal and Replacement of Line or Trunk Signal I201 or I501***a. Removal.*

- (1) Unscrew the indicator lens.
- (2) Lift the terminal end of the line or trunk signal so that it will clear the cord reel, and slide it out of the mounting hole.
- (3) Disconnect and tag the leads from the terminals of the line or trunk signal.

*b. Replacement.*

- (1) Connect and solder the leads to the proper terminals of the line or trunk signal (fig. 2-3 or 2-4).
- (2) Slide the signal into the hole in the front of the line or trunk pack case. Be careful not to damage the indicator ball in the front of the signal or the signal plunger when installing the signal in the hole of the case.
- (3) Replace the indicator lens, and tighten the lens handtight.
- (4) After installation, adjust tip of top spring of jack J201 or J501 (by bending) to depress signal reset plunger to .010 inch - .015 inch of pretravel.

**2-16. Removal and Replacement of Line Pack Lightning-Arrester E202 (fig. 2-1)***a. Removal.*

- (1) Unscrew the two retaining screws holding the nuts; use a wrench, if necessary.
- (2) Remove the lightning arrester from the line pack case. Pull out enough slack on the wires to permit them to be unsoldered, but avoid damaging the components to which the other ends of the wires are connected.
- (3) Unsolder the leads from the lightning arrester. Note the lead positions for ease of replacement.

*b. Replacement.*

- (1) Connect and solder the leads to the replacement lightning arrester (fig. 2-3).
- (2) Position the replacement arrester in the line pack case.
- (3) Replace the retaining screws, lockwashers, and nuts. Dress the wiring.

**2-17. Removal and Replacement of Line Pack Rectifier CR201 (fig. 2-1)***a. Removal.*

- (1) Slide the rectifier out of the retaining clip.
- (2) Note the position of the leads. Check the side of the rectifier to determine the terminal to which the positive lead of the rectifier is connected.
- (3) Unsolder the leads from line jack J201 and line signal I201.

*b. Replacement.*

- (1) Connect the positive rectifier lead to the terminal on line signal I201.
- (2) Connect the other rectifier lead to the ring break contact on line jack J201.
- (3) Slide the rectifier into the retaining clip, and dress the wiring.

**2-18. Removal and Replacement of Trunk Pack Plug Seat Switch S501***a. Removal (fig. 2-2).*

- (1) Pull a short length of cord off the cord reel, and slide the plug seat out of its retaining bracket.
- (2) Slide the card and plug out of the hole in the front of the line pack.
- (3) Remove the two screws that hold switch S501 together, and separate and remove the switch pieces.

*b. Replacement.*

- (1) Insert the two flathead screws that hold the switch in place.
- (2) On the two screws that secure the switch in place, assemble, in order, the thick insulator, the roller contact spring, the thin insulator, the stationary contact spring, the thin insulator, and the clamp.
- (3) Tighten the screws barely enough to hold the assembly in place.
- (4) Align the contact point on the roller contact spring with the contact point on the stationary contact spring.
- (5) Tighten the two screws firmly.

(6) Slide the plug and part of the cord through the hole in the front of the line pack case, and replace the plug seat in the plug seat bracket of the case.

(7) Check the tension on the cord reel. Pull a short length of cord off the cord reel, and release it. The cord should retract easily, but not violently; then pull the cord out to its full length. It should pull out easily and should not be stopped before the end of the cord is reached. Do not release the cord when fully extended, but keep it in control and allow it to rewind slowly.

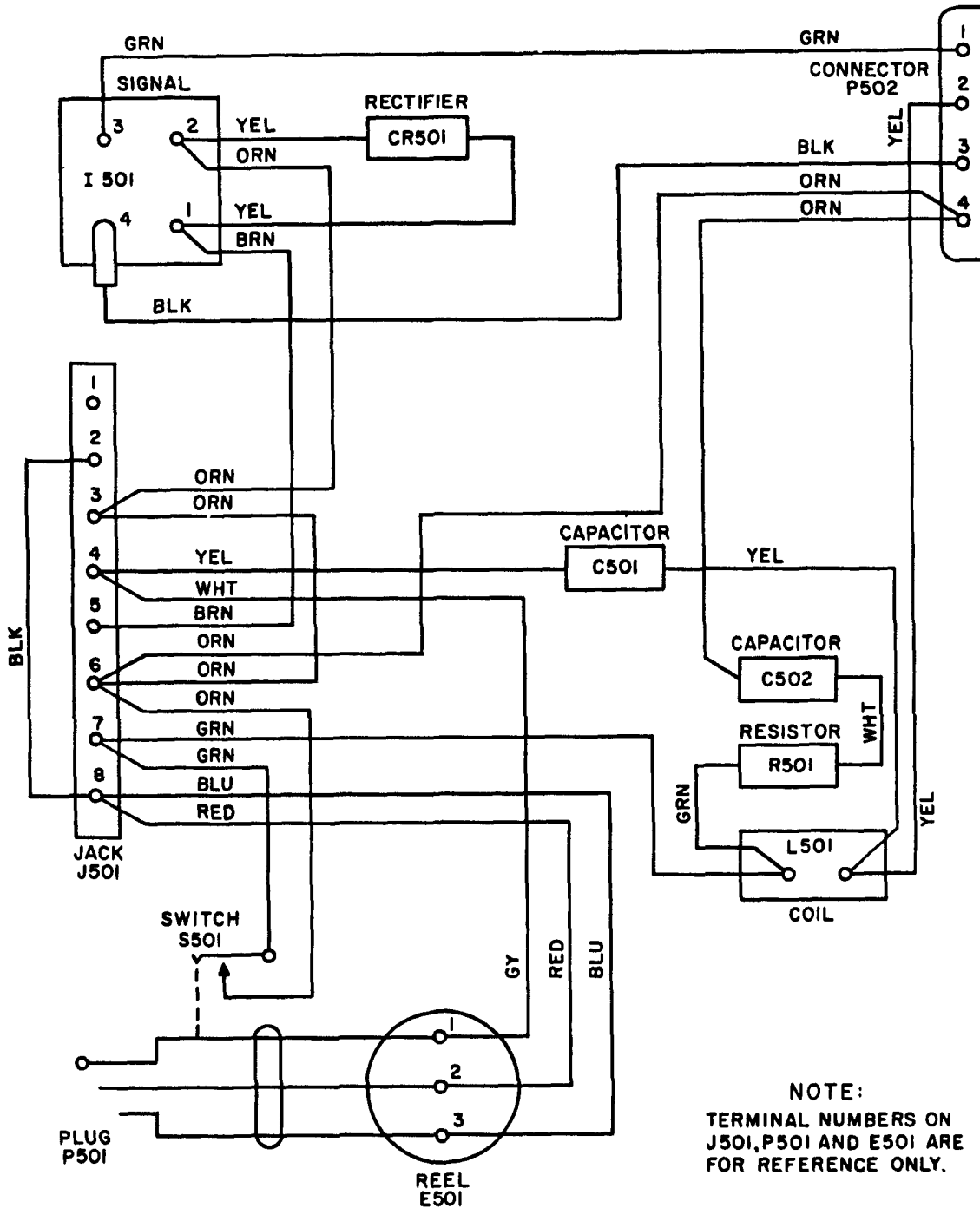


Figure 2-3. Telephone Circuit, Trunk Jack TA-326/PT, Wiring Diagram.

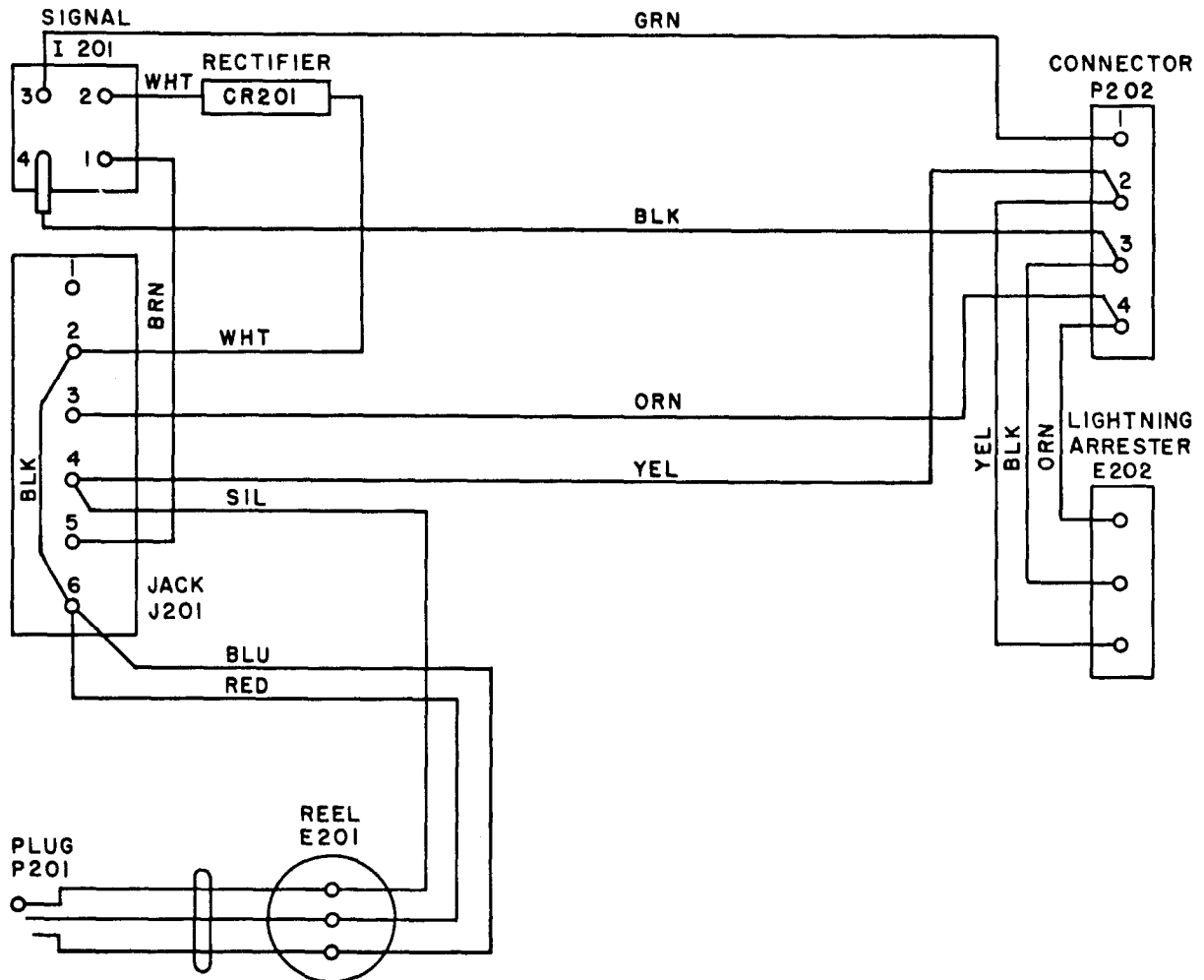


Figure 2-4. Telephone Circuit, Line Jack TA-222/PT, Wiring Diagram.

2-19. Replacement of Line or Trunk Pack Cover (fig. 2-1 or 2-2)

- a. Slide the front edge of the line or trunk pack cover under the flange on the front of the line or trunk pack case.
- b. Push the back of cover on the line or trunk pack case. Make sure that the indentations on the edges of the cover engage the slots of the case.

2-20. Installation of Line or Trunk Pack in Switchboard Case

- a. Slide the pack into the switchboard case. Make sure that the pack is positioned so that the connector at the rear of the pack aligns with the plug in the rear of the switchboard case.
- b. Tighten the retaining screws on the front of the pack with a screwdriver.



## Section IV. REPAIR OF OPERATOR'S PACK

### 2-21. Removal of Operator's pack from Switchboard Case

- a. Unscrew the four retaining screws in the corners of the operator's pack front panel.
- b. Connect the operator's telephone set connector to the receptacle on the front of the operator's pack.
- c. Grasp the operator's telephone set connector, and slide the operator's pack out of the switchboard case.

### 2-22. Removal of Operator's Pack Cover (fig. 2-5)

- a. Unscrew the cover retaining screw (1) from each side and from the top of the operator's pack; then, turn the operator's pack upside down and remove the two screws from the bottom of the operator's pack.
- b. Grasp the cover (2) with one hand and the flange on the front panel with the other, and pull the cover from the chassis of the operator's pack.

### 2-23. Removal and Replacement of Operator's Cord (fig. 2-5)

#### a. Removal.

- (1) Unscrew the stay cord retaining screw (3) from the bottom of terminal board TB301 on the coil and capacitor mounting bracket (25).
- (2) Loosen the three screw terminals that secure the three conductors to the terminals on terminal board TB301.
- (3) Hold the operator's pack chassis with one hand, and pull the operator's cord rubber bushing (4) and operator's cord W301 (5) toward the rear of the operator's pack chassis until the rubber bushing clears the front panel; then slide the cord out of the front panel.
- (4) Grasp the operator's cord rubber bushing (4) in one hand, and pull operator's cord W301 (5) out of the rubber bushing. Slide the bushing over the cord stay and the cord terminals.

#### b. Replacement.

- (1) Tie a short piece of string to each cord terminal.
- (2) Slide the three pieces of string through the operator's cord rubber bushing (4).
- (3) Pull the cord conductors through the rubber bushing, one at a time, by pulling on the piece of string tied to each terminal.

### NOTE

If insertion of the cord into the operator's cord rubber bushing in (4) below is difficult, rub the cord with soap or a bar of paraffin.

- (4) Slide the operator's cord rubber bushing (4) over the stay cord and onto operator's cord W301 (5).
- (5) Slide the plug and operator's cord W301 (5) through the rear of the operator's pack panel. Force the operator's cord rubber bushing (4) into the hole in the panel. The bushing should extend about 1 inch in front of the panel.
- (6) Fasten the stay cord to the bottom of terminal board TB301.
- (7) Reconnect the cord terminals to terminal board TB301.

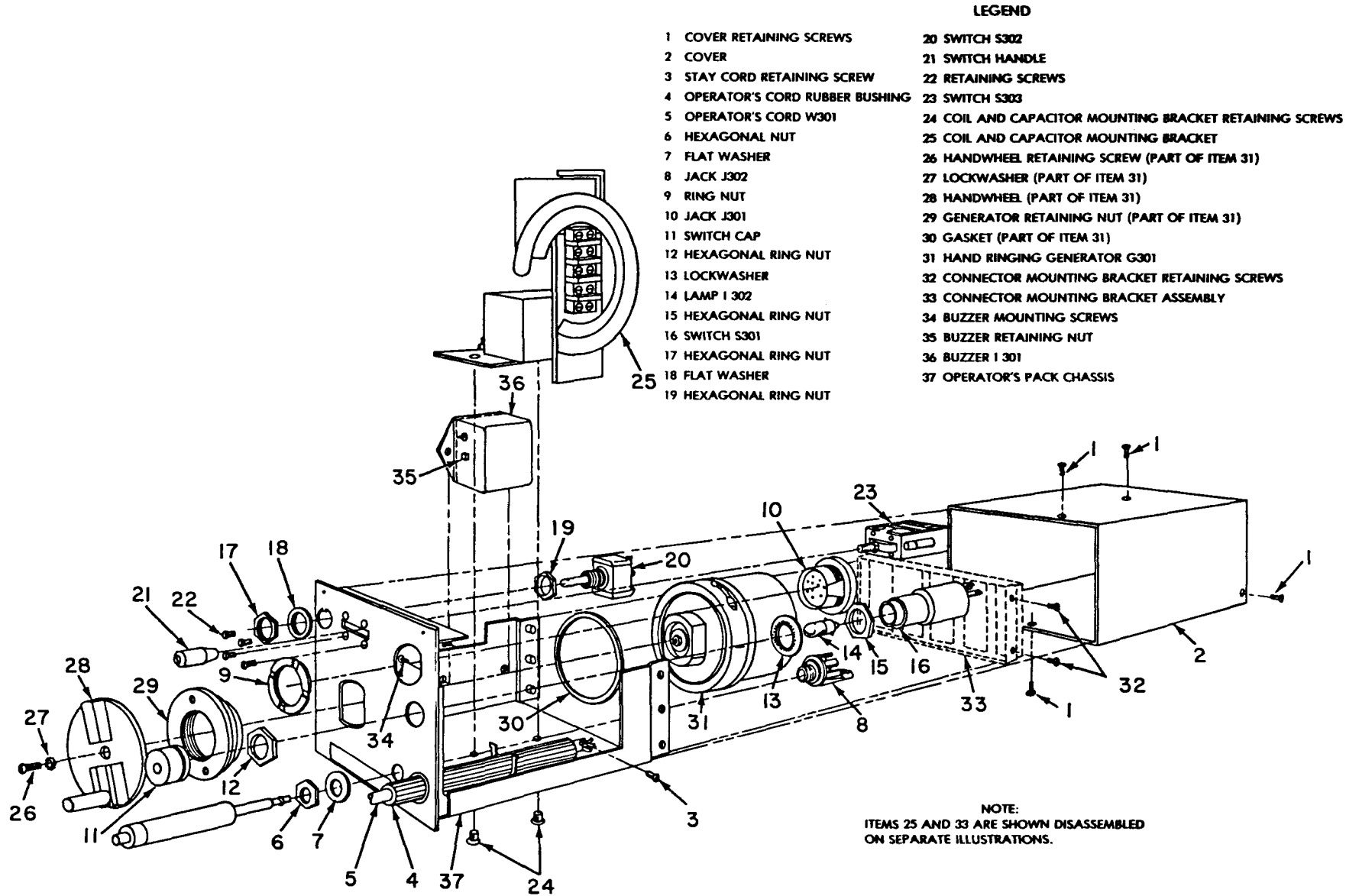


Figure 2-5. Operator's Pack, Exploded View.

**2-24. Removal and Replacement of Jack J301 (Receptacle, Connector U-79/U) (fig. 2-5)***a. Removal.*

- (1) Unscrew the ring nut (9) from the front of jack J301 (10), using a spanner wrench.
- (2) Slide the jack out of the front panel toward the rear of the operator's pack chassis (37).
- (3) Disconnect and tag each of the leads connected to the rear of the jack.

*b. Replacement.*

- (1) Position replacement jack J301 (10) at the side of the operator's pack chassis (37), and connect the leads to the solder terminals. Make sure that the leads are connected to the correct terminals by referring to figure 2-6.
- (2) From the rear, slide the jack into the hole in the chassis front panel. Position the flat portion of the jack against the flat portion of the hole in the front panel.
- (3) Replace the ring nut (9, fig. 2-5) on the jack. Tighten the nut with a spanner wrench.

**2-25. Removal and Replacement of Jack J302 (fig. 2-5)***a. Removal.*

- (1) Remove the hexagonal nut (6) and the flat washer (7) from the front of jack J302 (8) with a wrench.
- (2) Slide the jack out of the front panel, and pull it out to the side of the operator's pack chassis.
- (3) Note the position of the leads connected to the jack, and disconnect the leads.

*b. Replacement.*

- (1) Connect and solder the leads to jack J302 (8). (See figure 2-6 for the correct lead connections.)
- (2) From the rear, slide the jack into the hole in the front panel.
- (3) Replace the flat washer (7, fig. 2-5) and the hexagonal nut (6). Tighten the nut with a wrench.

**2-26. Removal and Replacement of Switch S301 (fig. 2-5)***a. Removal.*

- (1) Pull the switch cap (11) out, and unsolder the three leads connected to the switch terminals. Make sure that the other leads in the operator's pack are clear of the switch and will not be burned during switch removal.
- (2) Turn the switch cap counterclockwise to unscrew it from the front of switch S301 (16).
- (3) Remove the hexagonal ring nut (12) with a wrench from the front of switch S301.
- (4) Slide switch S301 (16) from the hole in the front panel, and remove the lockwasher (13).
- (5) Push in on lamp I302 (14), and turn it counterclockwise. Pull the lamp from the socket.
- (6) Unscrew the hexagonal ring nut (15) from switch S301.

*b. Replacement.*

- (1) Replace the hexagonal ring nut (15) and lockwasher (13) on the replacement switch, and slide switch S301 (16) into the hole in the front panel from the rear.
- (2) Replace the hexagonal ring nut (12) on the front of the switch, and tighten the nut with a wrench.
- (3) Connect and solder the three leads to the terminals at the rear of the switch. Refer to figure 2-6 to check the proper lead connection.
- (4) Insert lamp I302 (14, fig. 2-5) into the socket in the front of the switch, and lock the lamp into position by turning it clockwise.
- (5) Screw the switch cap (11) on the front of the switch.

**2-27. Removal and Replacement of Switch S302 (fig. 2-5)***a. Removal.*

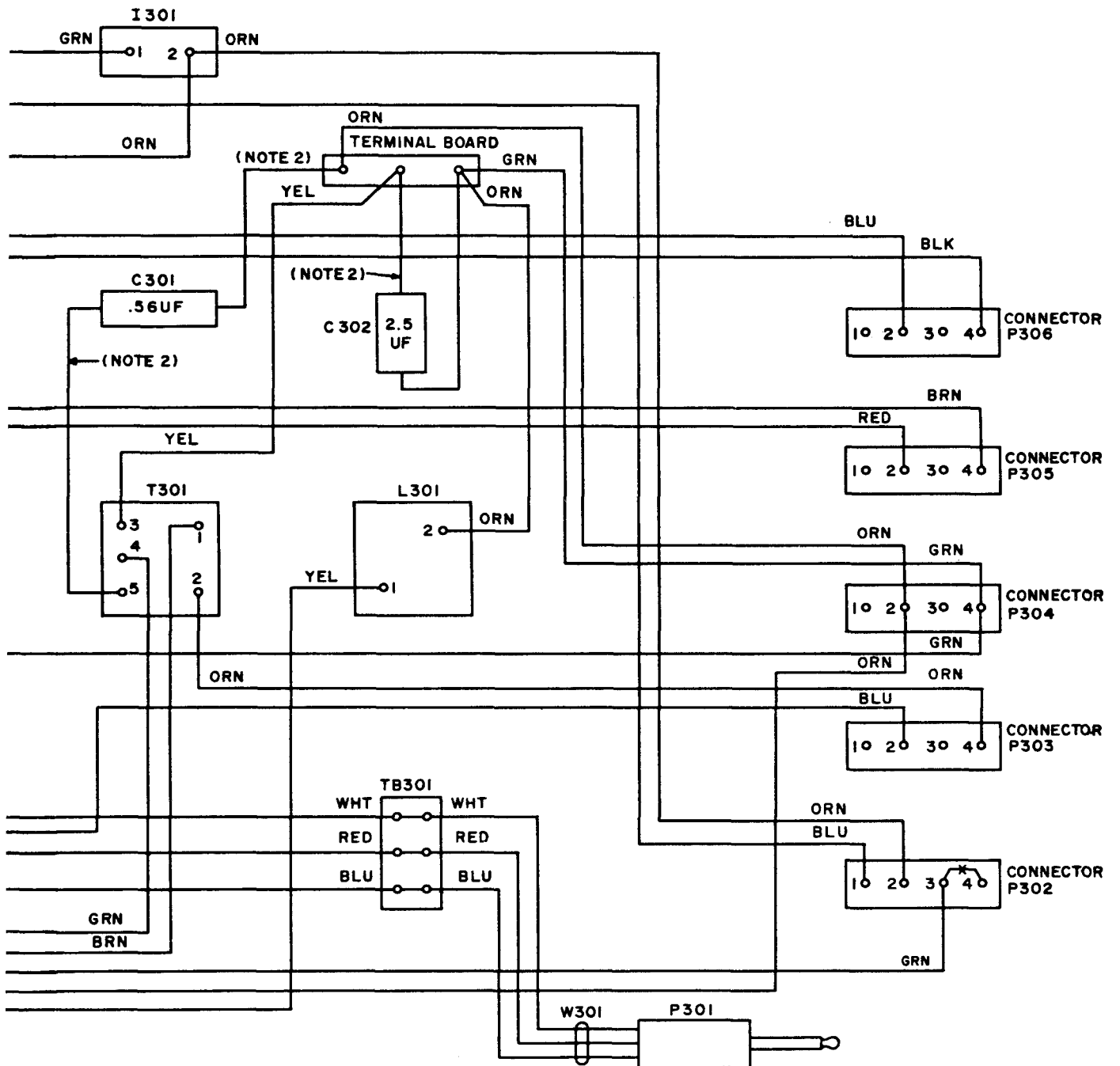
- (1) Disconnect the three leads from switch S302 (20), and note the position of the leads.
- (2) With a wrench, remove the hexagonal ring nut (17) and flat washer (18) from the front of the switch.
- (3) Slide the switch out of the hole in the front panel.
- (4) Remove the hexagonal ring nut (19) from the switch.

*b. Replacement.*

- (1) Replace the hexagonal ring nut (19) on the replacement switch.
- (2) Align the guide slot in the switch with the guide in the front panel hole, and slide switch S302 (20) into the hole.
- (3) Replace the flat washer (18) and the hexagonal ring nut (17), and tighten the nut with a wrench.
- (4) Reconnect the three leads to the switch. Refer to figure 2-6 for the correct lead connections.







## 2-28. Removal and Replacement of Switch S303 (fig. 2-5)

### a. Removal.

- (1) Tag and disconnect the leads connected to the terminals of switch S303 (23).
- (2) Unscrew the switch handle (21) from the switch.
- (3) Unscrew the four retaining screws (22) from the front panel.
- (4) Slide the switch out of the front panel.

### b. Replacement.

- (1) Connect and solder the strapping on the switch terminals. Refer to figure 2-6 for the correct lead and strapping connections.
- (2) Slide switch S303 (23, fig. 2-5) into the hole in the front panel, and replace the four retaining screws (22).
- (3) Replace the switch handle (21).
- (4) Connect and solder the leads to the terminals. Refer to figure 2-6 for the correct lead connections.

## 2-29. Removal and Replacement of Hand Ringing Generator G301 (fig. 2-5)

### a. Removal.

- (1) Remove the coil and capacitor mounting bracket (25) by following the procedure given in paragraph 2-31 a.
- (2) Unscrew the handwheel retaining screw (26).
- (3) Remove the lockwasher (27) and handwheel (28).
- (4) Unscrew the generator retaining nut (29) from the front of hand ringing generator G301 (31).
- (5) Slide the hand ringing generator back to clear the front panel, and lift it out of the operator's pack; be careful not to damage any leads in the process. Remove the gasket (30) from the hand ringing generator.
- (6) Unsolder the four leads connected to the hand ringing generator terminals, and note the position of the leads.

### b. Replacement.

- (1) Connect and solder the four leads to the terminals on the hand ringing generator. Refer to figure 2-6 to check the proper lead connection.
- (2) Replace the gasket (30, fig. 2-5), and slide hand ringing generator G301 (31) through the hole in the front panel of the operator's pack.
- (3) Replace the hand ringing generator retaining nut (29), and tighten it securely.
- (4) Replace the handwheel (28) on the shaft of the hand ringing generator.
- (5) Place the lockwasher (27) on the handwheel retaining screw (26), and attach the handwheel to the hand ringing generator shaft.
- (6) Replace the coil and capacitor mounting bracket (25) by following the procedure given in paragraph 2-31b

## 2-30. Removal and Replacement of Terminal Board TB301 (fig. 2-6)

### a. Removal.

- (1) Loosen the three terminal screws, and disconnect the operator's cord conductors from the terminal board.
- (2) Disconnect the three leads from the other side of the terminal board.
- (3) Unscrew the four mounting screws, and remove the terminal board from the coil and capacitor mounting bracket.

### b. Replacement.

- (1) Position the terminal board on the coil and capacitor mounting bracket, and replace the four mounting screws.
- (2) Connect and solder the three leads to the solder terminals on the terminal board.
- (3) Connect the operator's cord conductors to the terminal screws on terminal board TB301. Tighten the terminal screws.

### 2-31. Removal and Replacement of Coil and Capacitor Mounting Bracket (fig. 2-5)

#### a. Removal.

(1) Unscrew the four mounting screws and remove terminal board TB301 from the mounting bracket (fig. 2-7). Do not disconnect any of the leads from the terminal board.

(2) Unscrew the two coil and capacitor mounting bracket retaining screws (24, fig. 2-5) from the top of the operator's pack chassis, and lift the coil and capacitor mounting bracket out of the chassis.

#### b. Replacement.

(1) Position the coil and capacitor mounting bracket (25, fig.2-5) on the operator's pack chassis (37), and check to see that all wiring is properly dressed.

(2) Replace the two coil and capacitor mounting bracket retaining screws (24) in the top of the operator's pack chassis.

(3) Position terminal board TB301 (fig. 2-7) on the coil and capacitor mounting bracket, and install the four attaching screws. Secure the operator's cord stay with one of the screws.

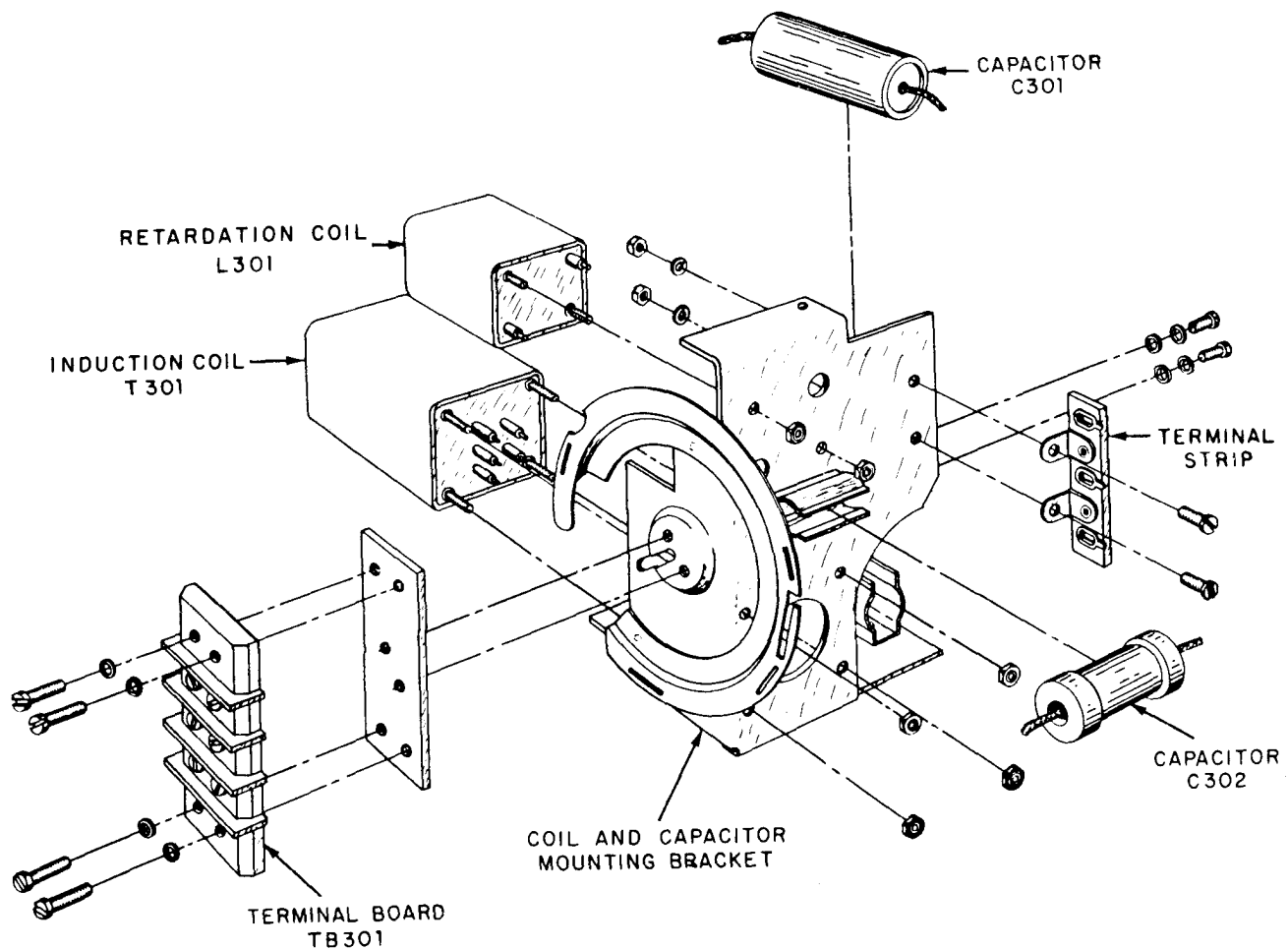


Figure 2-7. Coil and Capacitor Mounting Bracket, Exploded View.

**2-32. Removal and Replacement of Retardation Coil L301 (fig. 2-7)**

- a. Remove the coil and capacitor mounting bracket from the operator's pack (para 2-31 a).
- b. Disconnect the two leads connected to the terminals on the retardation coil.
- c. Unscrew the two nuts from the retardation coil mounting studs, and remove the retardation coil from the coil and capacitor mounting bracket.
- d. Install the replacement retardation coil on the coil and capacitor mounting bracket, and secure the coil to the bracket by installing and tightening the screws on the coil mounting studs.
- e. Reconnect the two leads to the retardation coil terminals. Check the correct lead connection by referring to figure 2-6.
- f. Replace the coil and capacitor mounting bracket in the operator's pack (para 2-31 b).

**2-33. Removal and Replacement of Induction Coil T301 (fig. 2-7)**

- a. Remove the coil and capacitor mounting bracket from the operator's pack (para 2-31 a).
- b. Tag and disconnect the five leads connected to the terminals of the induction coil.
- c. Note the orientation of the induction coil in the coil and capacitor mounting bracket. Unscrew the screws from the induction coil mounting studs, and remove the induction coil mounting studs, and remove the induction coil from the coil and capacitor mounting bracket.
- d. Orient the replacement induction coil with respect to the coil and capacitor mounting bracket, and install the coil on the bracket. Secure the coil to the bracket by installing the screws on the coil mounting studs.
- e. Reconnect the five leads to the induction coil terminals. Check the correct lead connection by referring to figure 2-6.
- f. Replace the coil and capacitor mounting bracket in the operator's pack (para 2-31 b).

**2-34. Removal and Replacement of Capacitor C301 or C302 (fig. 2-6)**

- a. Remove the coil and capacitor mounting bracket from the operator's pack (para 2-31 a).
- b. Disconnect the capacitor leads, noting the terminals to which the leads were connected.
- c. Remove the capacitor from the mounting clip.
- d. Install the replacement capacitor in the mounting clip.
- e. Connect the leads of the replacement capacitor to the proper terminals, covering the leads as required with sleeving. Check the correct lead connection by referring to figure 2-6.
- f. Replace the coil and capacitor mounting bracket in the operator's pack (para 2-31 b).

**2-35. Removal and Replacement of Connectors P302 through P306 (fig. 2-5)**

- a. *Removal.*
  - (1) Unscrew the connector mounting bracket retaining screws (32, fig. 2-5) located on each side of the operator's pack chassis.
  - (2) Slide the connector mounting bracket assembly (33) off the operator's pack chassis; be careful not to pull the leads.
  - (3) Unscrew the retaining screws (fig. 2-8) on the top and bottom of the mounting bracket.
  - (4) Disconnect the leads from the connector that is to be replaced.
  - (5) Separate the two parts of the mounting bracket enough to remove the connector.
- b. *Replacement.*
  - (1) After separating the two parts of the mounting bracket sufficiently, slide the replacement connector into its assigned opening in the mounting bracket.
  - (2) Connect the leads to the replacement connector. Check the correct lead connection by referring to figure 2-6.
  - (3) Fasten the two parts of the mounting bracket together with the four screws.
  - (4) Slide the connector mounting bracket assembly (33, fig. 2-5) on the operator's pack.
  - (5) Install the connector mounting bracket retaining screws (32) on each side of the operator's pack chassis, and dress the wiring.

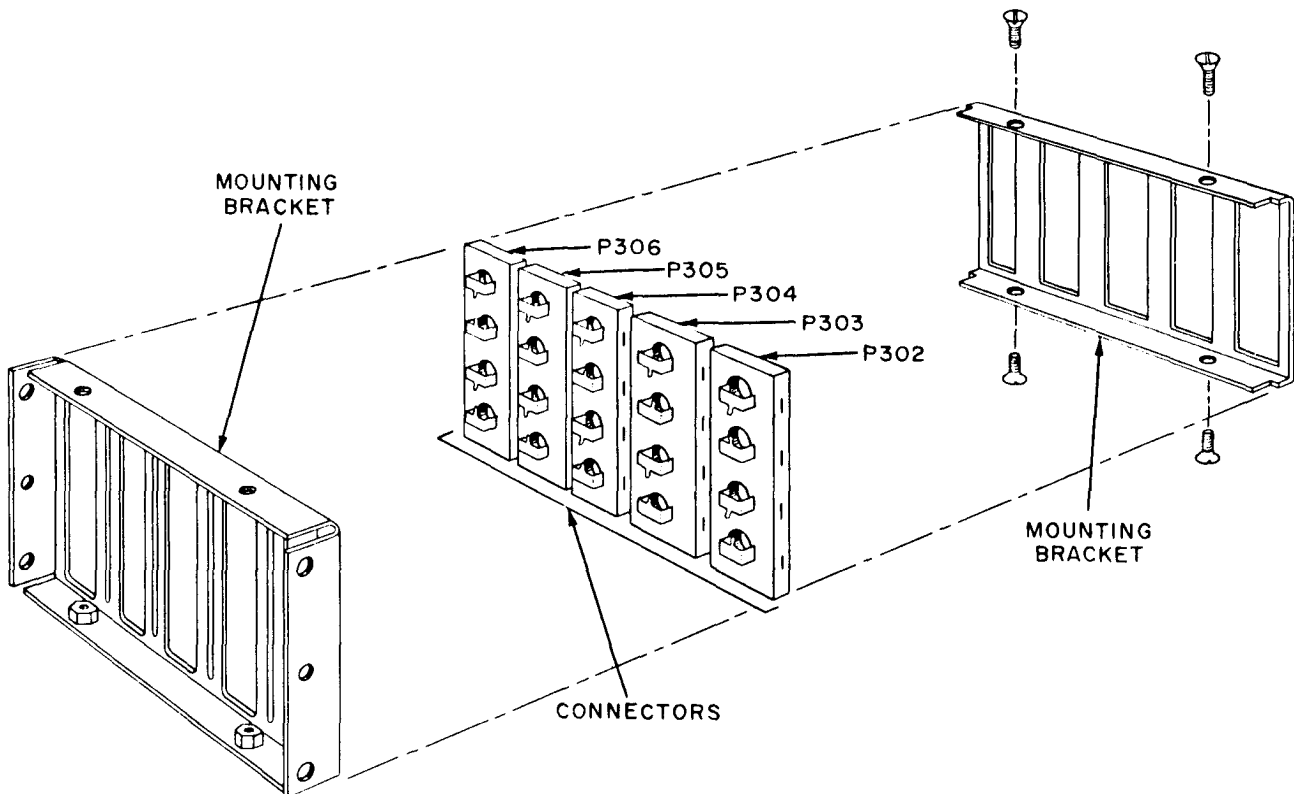


Figure 2-8. Connector Mounting Bracket, Exploded View.

### 2-37. Replacement of operator's Pack Cover (fig. 2-5)

#### a. Removal.

- (1) Unscrew the two buzzer mounting screws (34), the buzzer retaining nuts (35), and buzzer I301 (36) from the operator's pack chassis.
- (2) Unsolder the wires from the buzzer terminals.

#### b. Replacement.

- (1) Connect the three leads to the buzzer terminals. Check the correct lead connection by referring to figure 2-6.
- (2) Slide the buzzer into the operator's pack chassis (37, fig. 2-5), and replace the buzzer retaining nuts (35) and buzzer mounting screws (34).

### 2-36. Removal and Replacement of Buzzer I301 (fig. 2-5)

- a. Slide the operator's pack cover (2) on the operator's pack chassis; make sure that it is properly positioned.
- b. Replace the cover retaining screws (1) in the bottom, top, and sides of the operator's pack.

### 2-38. Installation of Operator's Pack in Switchboard Case

- a. Slide the operator's pack into the switchboard case in the first five line pack spaces at the right side of the switchboard case. Position the operator's pack so that the connectors at the rear of the pack mate with the plugs at the rear of the switchboard case.
- b. Tighten the retaining screw in each corner of the operator's pack front panel.



## Section V. REPAIR OF OPERATOR'S HEADSET

### 2-39. Removal and Replacement of Connector Plug, Electrical U-161/U

*a. Removal.*

- (1) Unscrew the plug bushing, and slide the plug bushing and strain relief spring up the cord.
- (2) Remove the three plug assembly screws, and remove the plug shell from the plug body.
- (3) Remove the plug insert from the plug body.
- (4) Tag and disconnect the seven wires connected to the terminals on the plug body.
- (5) Slide the plug body, strain relief spring, and the plug bushing off the cord.

*b. Replacement.*

- (1) Slide the plug bushing, strain relief spring, and plug body on the handset-headset cord.

**NOTE**

When installing the U-161/U connector on the operator's handset, connect an orange jumper between contacts J and K of the insert before performing the procedure given in (2) below.

- (2) Connect the seven leads to the terminals on the plug insert. Make sure that the leads are connected to the correct terminals by referring to figure 2-9.
- (3) Replace the plug insert in the plug body, and replace the plug shell on the plug body. Secure the plug shell in position with the plug assembly screws.
- (4) Slide the strain relief spring and the plug bushing down the cord to the plug body. Screw the plug bushing into the plug body to secure the strain relief spring in position.

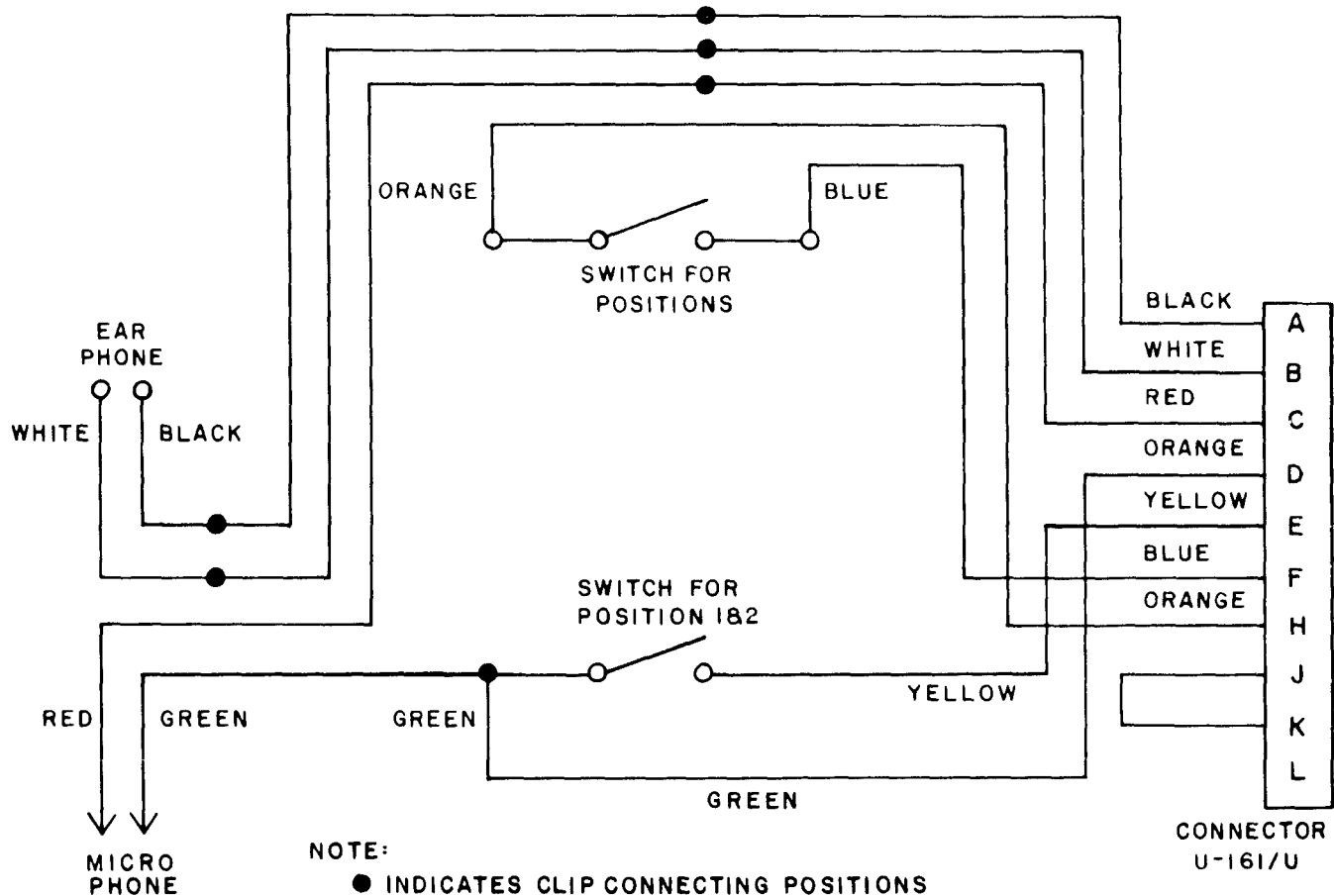


Figure 2-9. Operator's Headset Wiring Diagram.

2-40. Removal and Replacement of Switchbox Assembly (fig. 2-10)

a. Remove the switchbox assembly by performing the following:

- (1) Remove the four mounting screws (1) from the switch cover (2).
- (2) Lift off the switch cover (2) and remove the performed packing (3) from the switch case (7).
- (3) Remove the switch plunger (8), screw (9), washer (10), screws (11), spring (12), and washers (13) from the switch case (7).
- (4) Disengage the wires from the switch (14) and remove the switch from the case.
- (5) Loosen the bushing (4) and remove the seal (5) and washer (6) from the switch case (7).
- (6) Gently pull the wires from the switch case.

- |                    |                  |
|--------------------|------------------|
| 1 Mounting screws  | 8 Switch plunger |
| 2 Switch cover     | 9 Screw          |
| 3 Prefomed packing | 10 Washer        |
| 4 Bushing          | 11 Screw         |
| 5 Seal             | 12 Spring        |
| 6 Washer           | 13 Washer        |
| 7 Switch case      | 14 Switch        |

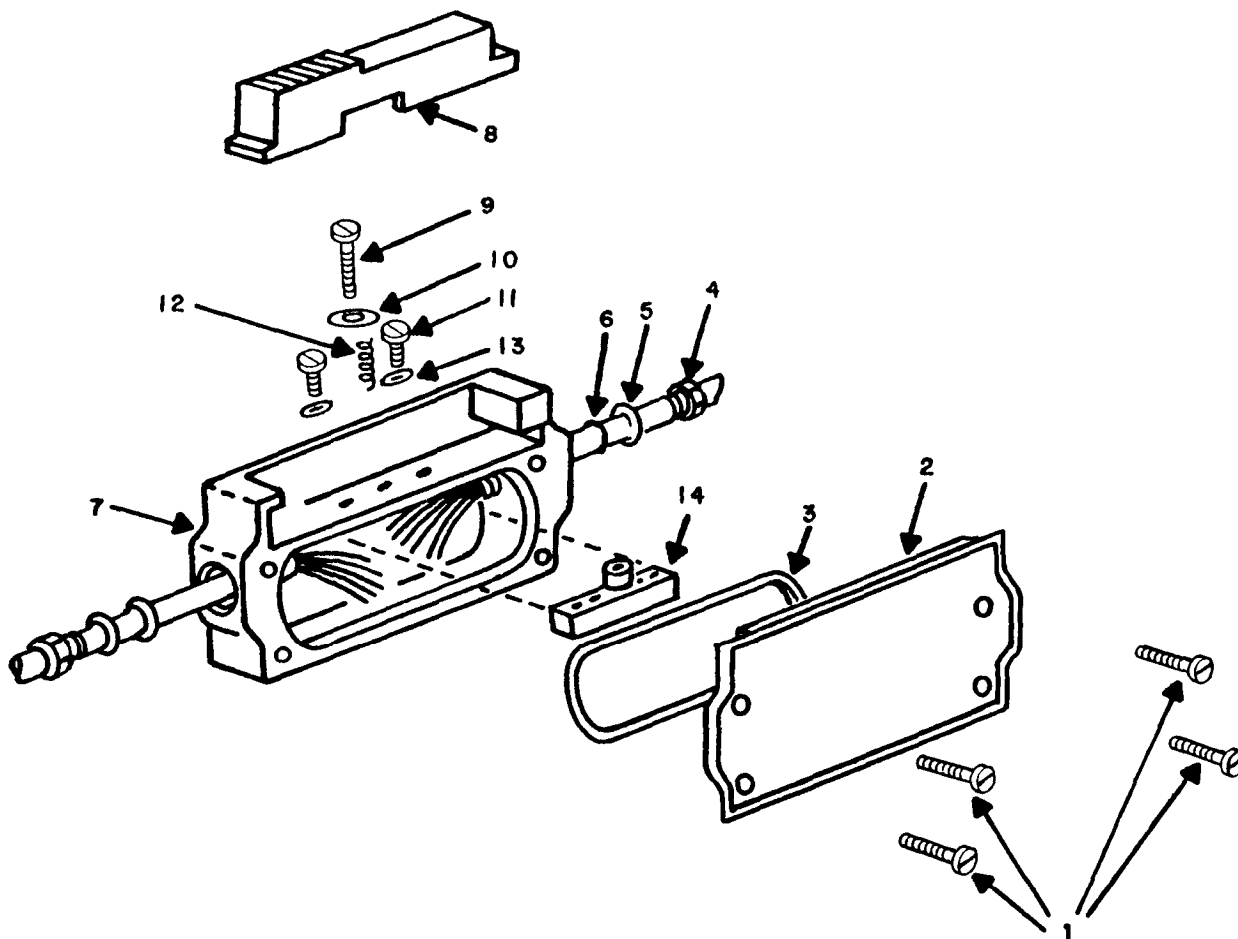


Figure 2-10. Switchbox Assembly, Exploded View.



- b. Replace the switch box assembly by performing the following:
- (1) Place the washer (6) and seal (5), on the wires.
  - (2) Place the wires in the switch case.
  - (3) Place the switch (14) in the case and connect the wires.
  - (4) Replace the switch plunger (8), screw (9), washer (10), screws (11), spring (12), and washers (13) on the switch case (7).
  - (5) Replace the preformed packing (3) on the switch case and replace the switch cover (2).
  - (6) Replace the four mounting screws (1) on the switch cover.

## Section VI. REPAIR OF TONE SIGNALING ADAPTER

### 2-41. Test Procedure

- a. Prior to testing the TA-977/PT, insure that a fresh battery is available and that it is installed properly.
- b. Check for broken or loose wires.
- c. Connect the output of the TA-977/PT to the input of a known, good Telephone Set TA-312/PT.
- d. Remove the handset from the TA-312/PT and depress each keyset button one at a time on the TA-977/PT. Audible tones should be heard in the handset of the TA-312/PT upon the depressing of each button.

### 2-42. Disposition

If the TA-977/PT fails to produce an audible tone as required in para 2-41 d above, it must be replaced. Dispose of the malfunctioning one in accordance with local procedures.

## Section VII. ADJUSTMENTS

### 2-43. Line Pack Adjustments

- a. *Lightning Arrester E202.* Adjust the contacts on the lightning arrester so that they are positioned  $0.005 \pm 0.001$  inch from the ground terminal. Adjust the contacts with a spring bender; do not use long-nosed pliers.
- b. *Jack J201 (fig. 2-11).*
  - (1) Insert plug P201 into jack J201.

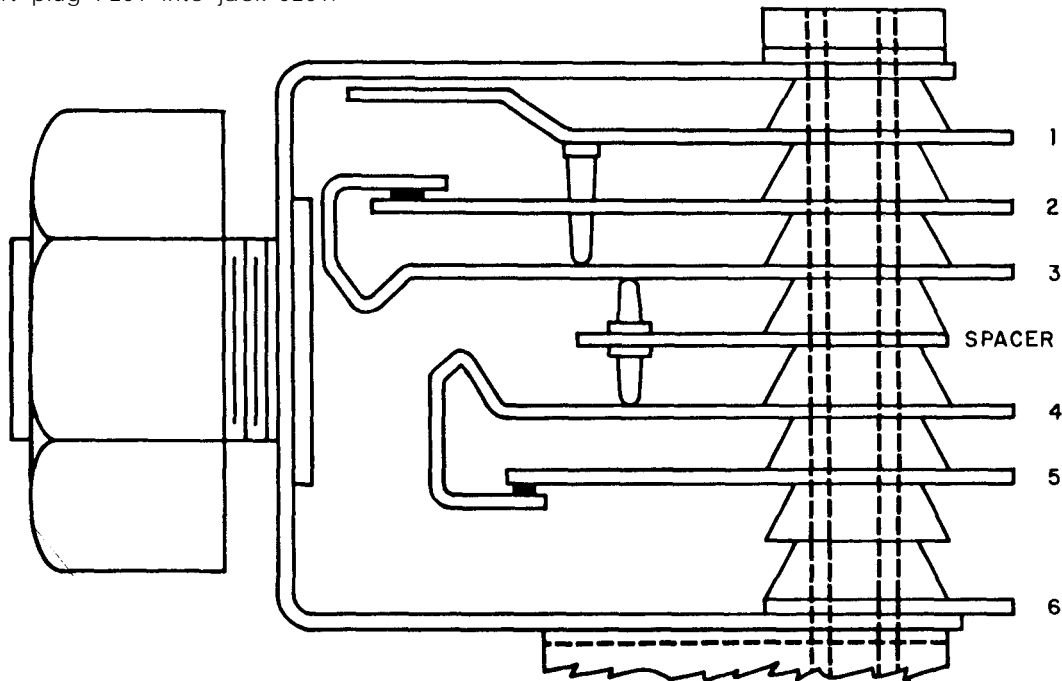


Figure 2-11. Jack J201, Contact Arrangement.

(2) Adjust contacts 3 and 4 so that between 200 and 400 grams are required to move the contact away from the plug.

**NOTE**

Operate spring 1 so that the contact insulator is clear of contact 3.

(3) There should be a minimum of 0.010 inch between contacts 4-5 and contacts 2-3. The spacer should be straight.

(4) Remove plug P201 from jack J201. Adjust contacts 5 and 2 so that they have a minimum of 80 grams tension toward contacts 4 and 3 respectively.

**2-44. Operator's Pack Adjustments**

Check the spring tension on the contacts of switch S303 by applying the gram gage near the contact point. The following spring tensions and airgap clearances must be met on switch S303:

**NOTE**

Make all adjustments with a spring bender. Do not use long-nosed pliers to bend the switch contacts.

a. The center contact on stack K1 through K8 must be adjusted to withstand 45 grams before the normally made contacts break.

b. The make contacts must be 0.008 ±0.001 inch from the center contact when the break occurs.

c. The break contact must clear the center contact 0.008 ±0.001 inch when the switch is fully operated.

**2-45. Trunk Pack Adjustments**

**NOTE**

Make all adjustments with a spring bender. Do not use long-nosed pliers to bend the switch contacts.

a. *Jack J501 (fig. 2-12).*

(1) Insert plug P501 into jack J501.

(2) Adjust contact spring 4 so that from 1,000 to 1,600 grams are necessary to move the contact away from the plug.

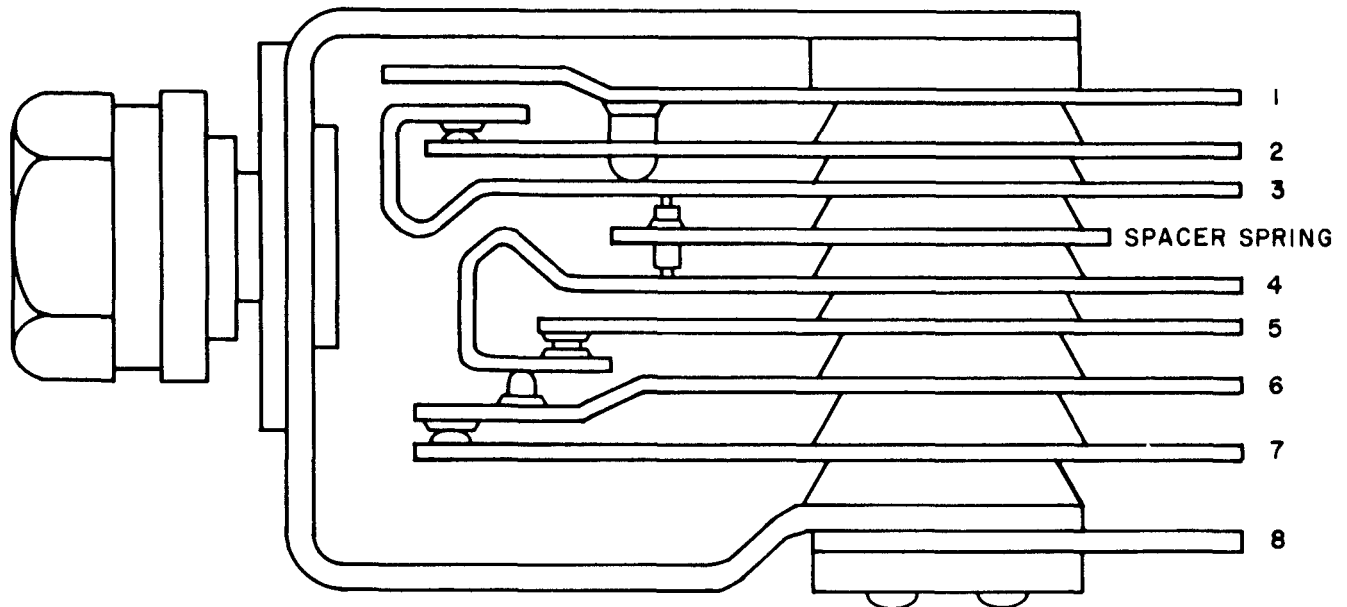


Figure 2-12. Jack J501, Contact Arrangement.

NOTE

Operate contact spring 6 so that its contact insulator is clear of contact spring 4.

- (3) Adjust contact spring 3 so that 1,000 to 1,200 grams are necessary to move the contact from the plug.
  - (4) Adjust contact springs 5 and 2 to provide a minimum of 0.012 inch between contacts 4-5 and 2-3. The spacer should be straight.
  - (5) Adjust contact spring 7 so that at least it has a minimum of 80 grams tension toward contact spring 6.
  - (6) Check to see that there is a minimum of 0.015 inch clearance between springs 4-5, 2-3, and 6-7 at other than contact points. Remove excessive bends and readjust as required to meet the requirement.
  - (7) Remove plug P501 from jack P501. Adjust springs 5 and 2 so that they have a minimum of 80 grams tension toward springs 4 and 3, respectively.
  - (8) Adjust spring 7 to provide a minimum of 0.012 inch clearance between contact springs 6 and 7.
- b. Switch S501 (fig. 2-2).
- (1) With the cord retracted, see that there is a noticeable gap between the stationary contact point and the roller contact point.
  - (2) With the cord extended, the contact points on the two contacts must meet. The stationary contact should follow the roller contact noticeably. Adjust both contacts as required to meet these conditions.



## CHAPTER 3

### GENERAL SUPPORT MAINTENANCE

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#### Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

##### 3-1. Common Tools and Equipment

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

##### 3-2. Special Tools, TMDE, and Support Equipment

###### a. Test Equipment.

Nomenclature	National Stock No.	Reference
Telephone Test Set AN/PTM-6 . . . . .	6625-00-229-1048	TM 11-2062
Test Set I-181 (*) . . . . .	6625-00-229-1042	TM 11-6625-202-14
Multimeter TS-352B/U, . . . . .	6625-00-242-5023	TM 11-6625-366-15
Test Set TS-140/PCM . . . . .	6625-00-243-4888	TM 11-6625-251-15

###### b. Materials.

Nomenclature	No. Required (ea)	National Stock No.
Battery BA-23(p/o AN/PTM-6) . . . . .	2	6135-00-050-0915
Battery BA-26 . . . . .	1	6135-00-120-1023
Battery BA-26(p/o AN/PTM-6) . . . . .	3	6135-00-120-1023
Battery BA-30(p/o SB-22(*)/PT) . . . . .	4	6135-00-120-1020
Battery BA-30(p/o TS-352B/U) . . . . .	1	6135-00-120-1020
Battery BA-31(p/o TS-352B/U) . . . . .	3	6135-00-120-1019
Battery BA-90(p/o TA-977/PT) . . . . .	1	6135-00-850-3177
Battery BA-210/U(p/o AN/PTM-6) . . . . .	4	6135-00-100-0475
Battery BB-223/U(p/o AN/PTM-6). . . . .	1	6135-00-100-0464
Connector, Receptacle U-79/U . . . . .	1	5935-00-549-2646
Connector, Plug, Electrical U-77/U. . . . .	1	5935-00-283-2950
Resistor, 250-ohm, 10-watt . . . . .	1	5905-00-100-8861
Resistor, 40-ohm, 10-watt . . . . .	1	6145-00-179-2409
Wire, stranded, No. 20AWG . . . . .	20 ft	(or equivalent)
Clip, alligator . . . . .	2	5999-00-204-5206

##### 3-3. Repair Parts

Repair parts are listed in the RPSTL (TM 11-5805-262-34P) covering general support maintenance of this equipment.



## Section II. TESTING

### 3-4. General

a. These testing procedures are prepared for light equipment maintenance companies and other organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired electronic equipment. These procedures set forth specific requirements that repaired electronic equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for the testing of equipment that has been repaired at direct support, if the proper tools and test equipment are available. The testing procedures may be used as a guide for depot overhaul standards. A summary of the specific performance standards required by the tests is given in paragraph 3-12.

b. Comply with the instructions preceding each table before proceeding to the table. Perform each test in sequence. Do not vary the sequence. For each step, perform all the actions required in the *Control settings* columns; then perform each specific test procedure, and verify it against its performance standard.

### 3-5. Modification Work Orders

The performance standards listed in the tests (para 3-6 through 3-11) assume that no current modification work orders have been performed. A listing of current modification work orders will be found in DA Pam 310-1.

### 3-6. Physical Tests and Inspection

a. *Test Equipment and Materials.* None.

b. *Test Connections and Conditions.* Remove the front cover of the switchboard and remove the operator's telephone set. Open the rear cover and remove the battery case, Step number 4 pertains to the operator's pack. Step number 5 pertains to the operator's telephone set when tested separately. Perform the procedures in table 3-1 below.

**Table 3-1. Physical Test and Inspection**

Step	Test procedure	Performance standard
1	<p>a. Inspect both front and rear of switchboard for loose or missing screws or nuts.</p> <p>b. Inspect operator's cord for excessive wear.</p> <p>c. Extend all line cords to their limits, and inspect for excessive wear and breaks and for proper retraction into line packs.</p> <p>d. Inspect all plugs for wear, dirt, corrosion, or bent condition.</p> <p>e. Inspect all binding posts for tightness and ability to secure wire tightly.</p> <p>f. Inspect battery case spring contacts for possible breaks, corrosion, or dirt.</p> <p>g. Inspect the battery case for corrosion, dirt or broken parts. Insert battery case into the switchboard and check the retaining springs for proper retention of the battery case; check spring contacts for solid contact with battery case.</p>	<p>a. All screws and nuts must be tight, with none missing.</p> <p>b. Operator's cord must have no breaks in the outside insulation and must show no evidence of dry rot.</p> <p>c. Line cords must be free of breaks or frayed insulation. All line cords must extend easily to their limits and retract fully without binding.</p> <p>d. All plugs must be free of dirt and corrosion. Plugs must not be worn or bent.</p> <p>e. All binding posts must be tight and capable of securing wire firmly.</p> <p>f. Battery case spring contacts must be free of dirt and corrosion and must not be broken.</p> <p>g. Battery case must be free of dirt, corrosion, and broken parts. Battery case spring contacts must make solid contact with the battery case contacts.</p>

**Table 3-1. Physical Test and Inspection - Continued**

Step	Test procedure	Performance standard
	<i>h.</i> Inspect the operator's telephone set for broken parts, loose screws or worn cord.	<i>h.</i> The operator's telephone set must have no broken parts or loose screws. The cord must show no evidence of dry rot.
	<i>i.</i> Inspect the hand ringing generator crank, RING BACK-PWR RING FWD, and AUD-OFF-VIS switches for normal operation.	<i>i.</i> The generator crank and switches must operate freely without binding.
	<i>j.</i> Inspect the operator's telephone set connector and plug for dirty contacts and improper connection.	<i>j.</i> Operator's telephone set connector and plug must be free of dirt and corrosion and must connect properly.
	<i>k.</i> Inspect the operator's telephone set push-to-talk switch for proper operation, tight cover screws, and secure clamping of the cord.	<i>k.</i> The push-to-talk switch must operate in four positions, with proper locking action in the third position. Cover screws must be tight, with none missing, and the card must be secure in each end of the switch.
	<i>l.</i> Inspect the night alarm and light switch for secure mounting and proper operation and for broken or chipped lens or switch knobs.	<i>l.</i> The night alarm and lamp switch must be securely mounted in the panel. It should operate smoothly without binding, and the lens and switch knob must be free of chips or cracks.
	<i>m.</i> Inspect the operator's telephone set receptacle for dirty contacts and improper connection.	<i>m.</i> The operator's telephone set receptacle must be free of dirt and corrosion and must mate properly with the plug.
2	<i>a.</i> Inspect case and cover for broken latches, and check condition of the retaining straps and cover gasket.	<i>a.</i> All latches must operate properly; the retaining straps and cover gasket must be serviceable.
	<i>b.</i> Inspect case and cover for missing parts and defective condition of paint.	<i>b.</i> Latches must secure the covers tightly, and there must be no missing parts. External surfaces intended to be painted must not show bare metal.
<b>NOTE</b>		
<p>Touchup painting is recommended instead of refinishing, whenever practicable. Screwheads, binding posts, receptacles, and plated fastener parts should neither be painted nor polished with abrasives.</p>		
	<i>c.</i> Inspect lettering on front and rear of the switchboard.	<i>c.</i> Panel lettering must be legible.
	<i>d.</i> Check to see that batteries are installed and connected with the correct polarity.	<i>d.</i> Check against case and panel markings.



Table 3-1. Physical Test and Inspection - Continued

Step	Test procedure	Performance standard
3	Perform steps <i>1c</i> and <i>d</i> for the line or trunk pack when tested separately.	Same as steps <i>1c</i> and <i>d</i> .
4	Perform the following procedures for the operator's pack when tested separately: steps <i>1b</i> , <i>d</i> , <i>i</i> , and <i>m</i> , and step <i>2c</i> .	Same as steps <i>1b</i> , <i>d</i> , <i>i</i> , <i>l</i> , and <i>m</i> , and step <i>2c</i>
5	Perform the following procedures for the operator's telephone set when tested separately: steps <i>1h</i> , <i>j</i> , and <i>k</i> .	Same as steps <i>1h</i> , <i>j</i> , and <i>k</i> .

3-7. Rectifier and Push-to-Talk Switch Tests

- a. *Test Equipment and Materials.*
  - (1) Multimeter TS-352B/U (multimeter).
  - (2) Battery BA-30 (four each).
- b. *Test Connections and Connections.*
  - (1) Remove the front cover and open the rear cover.
  - (2) Remove the operator's telephone set from the front cover.
  - (3) Connect the operator's telephone set to the operator's telephone set receptacle on the operator's pack.
  - (4) Install Batteries BA-30 in the switchboard.
- c. *Initial Test Equipment Calibration.*
  - (1) Set the selector switch to RX100.
  - (2) Short circuit the test leads and adjust the OHMS ADJ control until the meter indicates 0 ohms.
- d. Perform the procedures in table 3-2 below.

Table 3-2. Rectifier and Push-to-Talk Switch Tests

Step	Test equipment	Control settings		Test procedure	Performance standard
		Equipment	under test		
1	TS-352B/U FUNCTION: OHMS Range switch: RX100	AUD-OFF-VIS	switch: OFF.	Measure and record the resistance indicated on the multimeter when the test leads are connected, in turn, to the terminals for each of the line packs as shown in A, figure 3-1, step no. 1.	None.
2	TS-352B/U FUNCTION: OHMS Range switch: RX10000	Same as step no. 1.		Measure and record the resistance indicated on the multimeter when the test leads are connected, in turn, to the terminals for each of the line packs as shown in B, figure 3-1, step no. 2.	Meter must indicate a resistance at least 20 times greater than the resistance indicated in step no. 1.
3	TS-352B/U FUNCTION: OHMS Range switch: RX10	Remove the operator's cord from the operator's jack, and connect the equipment as shown in C, figure 3-1, step no. 3.		a. Press the telephone switch on the push-to-talk switch to the locked and unlocked positions while blowing or talking into the operator's telephone set transmitter. b. Press the radio switch on the push-to-talk switch, and observe the multimeter.	a. Sidetone must be heard each time the telephone switch is pressed. b. Meter must indicate less than 100 ohms.
4	TS-352B/U FUNCTION: OHMS Range switch: RX 10000	Cord fully retracted.		Measure and record the resistance indicated on the multimeter when the test leads are connected as shown in D, figure 3-1, step no. 4.	Meter must indicate an open circuit.
5	TS-352B/U FUNCTION: OHMS Range switch: RX100	Cord extended.		Measure and record the resistance indicated on the multimeter when the test leads are connected as shown in D, figure 3-1, step no. 4.	Meter must indicate 100 ohms ±10.

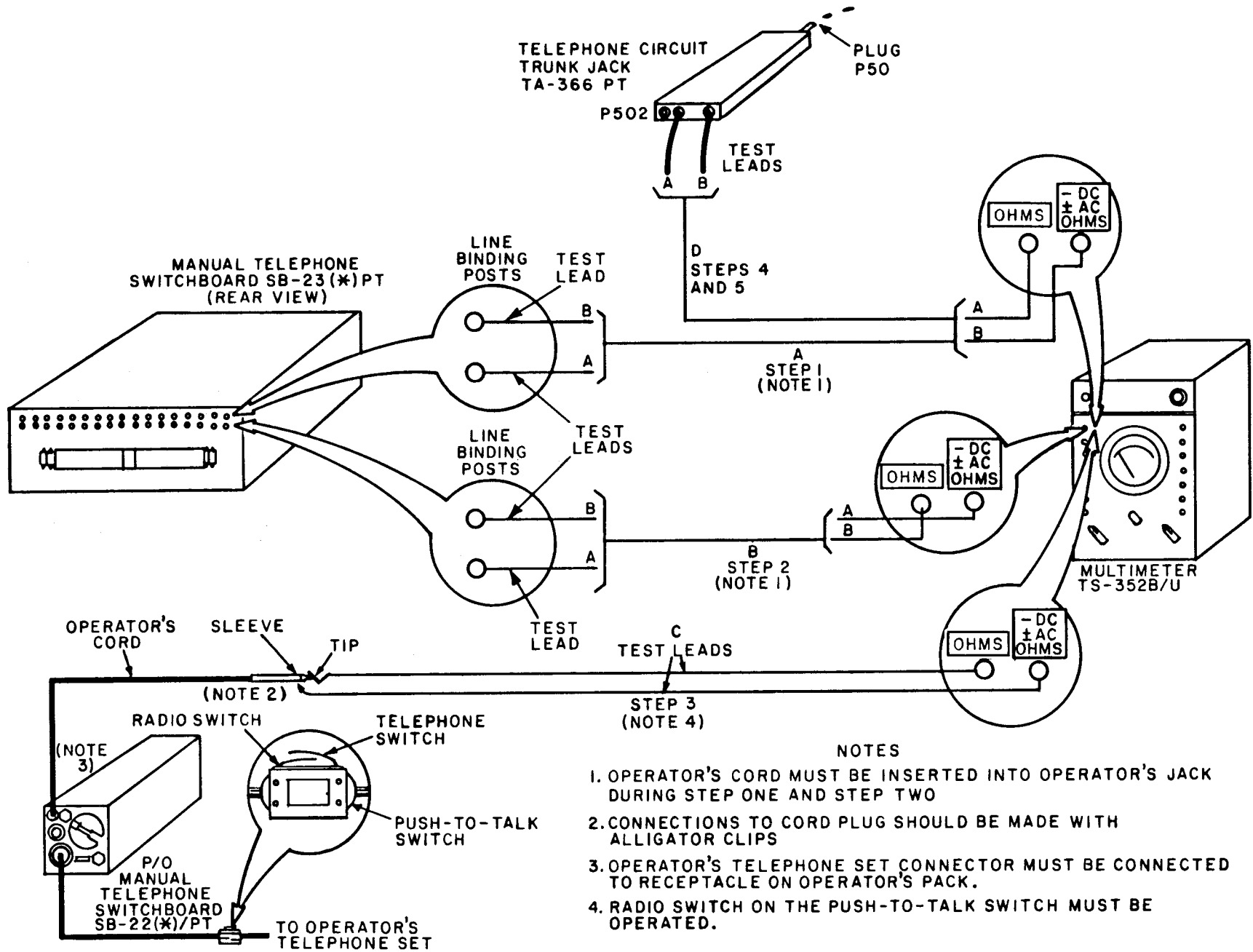


Figure 3-1. Rectifier and Push-to-Talk Switch Test Setups.

3-8. Line and Trunk Signal Efficiency Test

- a. *Test Equipment and Materials.*
  - (1) Test Set I-181-(\*).
  - (2) Battery BA-26 (one each).
  - (3) Battery BA-30 (four each).
- b. *Test Connections and Conditions.*
  - (1) Remove the front cover and open the rear cover.
  - (2) Install Batteries BA-30 in the switchboard.
  - (3) Connect the I-181-(\* ) to the switchboard as shown in figure 3-2.
- c. *Initial Test Equipment Calibration.*
  - (1) Connect Battery BA-26 to the BATT and GRD terminals of the I-181-(\*).
  - (2) Set the No. 1 FINE and COARSE controls to MAX RES.
  - (3) Set the 3000-6000-0 switch to 0.
  - (4) Set the 75-150-15 MA switch to 15 MA.
  - (5) Set the REV switch out.
- d. *Procedure.* Perform the procedures in table 3-3 below:

**Table 3-3. Line and Trunk Signal Efficiency Test**

Step	Test equipment	Control settings Equipment under test	Test procedure	Performance standard
1	I-181-(* ) No. 1 FINE and COURSE: MAX RES. 75-150-15 MA switch: 15 MA. 3000-6000-0 switch: 0. REV switch: Out.	VIS-OFF-AUD switch: a . OFF. All signals on line packs must be black. (Set b. any white line signal to black by momentar- ily inserting a phone plug in the associated c. line or trunk jack).	a. Operate the SOAK-1 switch to the 1 position, and hold both this switch and the 75-150-15 MA switch operated. b. Slowly adjust the COARSE control clockwise while holding the two switches until the line signal operates. Record meter indication when the line signal operates. c. On operator's pack, operate VIS-OFF-AUD switch to both positions, and observe audible and visual alarms with LITE-OUT-NA-IN knob set to NA-IN. d. Plug the line card into the line jock to restore the line signal; then remove the line card. e. Repeat the procedures given in a through d above for each of the other line packs by mov- ing test leads R and T to the corresponding line terminals for each pack.	a. None. b. Meter indicates 12 ma or less when signal operates. c. Buzzer must sound and red light must glow when the line signal is white. d. Line signals must re- store to black when plug is inserted into line jack. e. Same as a through d above.
2	N/A	Same as step no. 1.	a. Set LITE-OUT-NA-IN switch to LITE-OUT, and observe the light. b. Return LIT-OUT-NA-IN switch to NA-IN.	a. Night light must be lighted when switch is at LITE-OUT. b. Nite light must go off.

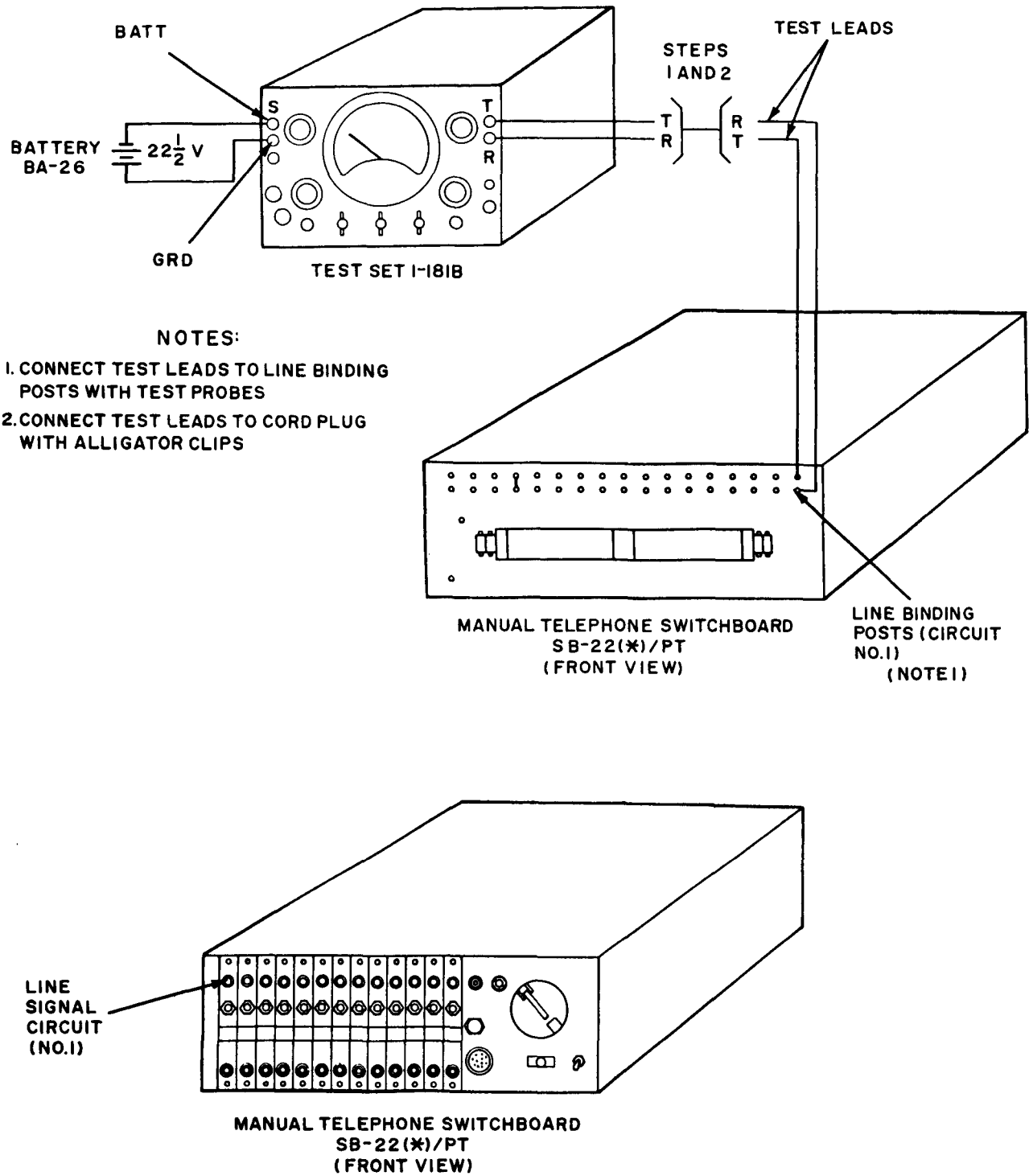


Figure 3-2. Line and Trunk Signal Efficiency Test Setup.

### 3-9. Operator's Pack, Transmission Efficiency Test

#### a. Test Equipment and Materials.

- (1) Test Set TS-140/PCM (includes Signal Generator SG-15A/PCM and Decibel Meter ME-22/PCM).
- (2) Test leads (two each).
- (3) Resistor, 40 ohms, 10 watts.
- (4) Resistor, 250 ohms, 10 watts.
- (5) Clip, battery (two each).
- (6) Connector, Plug, Electrical U-77/U.
- (7) Clip, alligator (two each).

#### b. Test Connections and Conditions.

- (1) Remove the battery case from the rear of the switchboard.
- (2) Connect a strap between the BAT. MIC. binding posts on the rear of the switchboard.
- (3) Connect the 40-ohm resistor across terminals E and C of the U-77/U.
- (4) Connect the U-77/U to the operator's telephone set receptacle on the front of the operator's pack.

#### c. Initial Test Equipment Calibration.

- (1) Connect the test equipment to the power source, and allow a 10-minute warmup period before starting the calibration procedures. Connect the SG-15A/PCM to the ME-22/PCM as shown in A, figure 3-3.
- (2) On the SG-15A/PCM, set the FREQUENCY control to 0.2 KC and the COARSE DBM control to ZERO OUTPUT.
- (3) Adjust the FINE DBM control on the SG-15A/PCM for an indication of +6 decibels (referred to 1 milliwatt in 600 ohms) (dbm) on the OUTPUT LEVEL meter.
- (4) Set the FREQUENCY control to 0 as indicated on the KILOCYCLES dial, and adjust the ZERO BEAT ADJ control for zero beat as indicated by no deflection of the OUTPUT LEVEL meter. The meter indication will deflect a number of times per second, decreasing in frequency as the adjustment is made, until finally there is no deflection at zero beat.

#### NOTE

As the FREQUENCY control is varied above and below 0 on the KILOCYCLES dial, note that the zero beat region is about one-eighth inch wide. Set the ZERO BEAT ADJ control so the 0 is in the center of the region on the KILOCYCLES dial for which a zero beat is obtained.

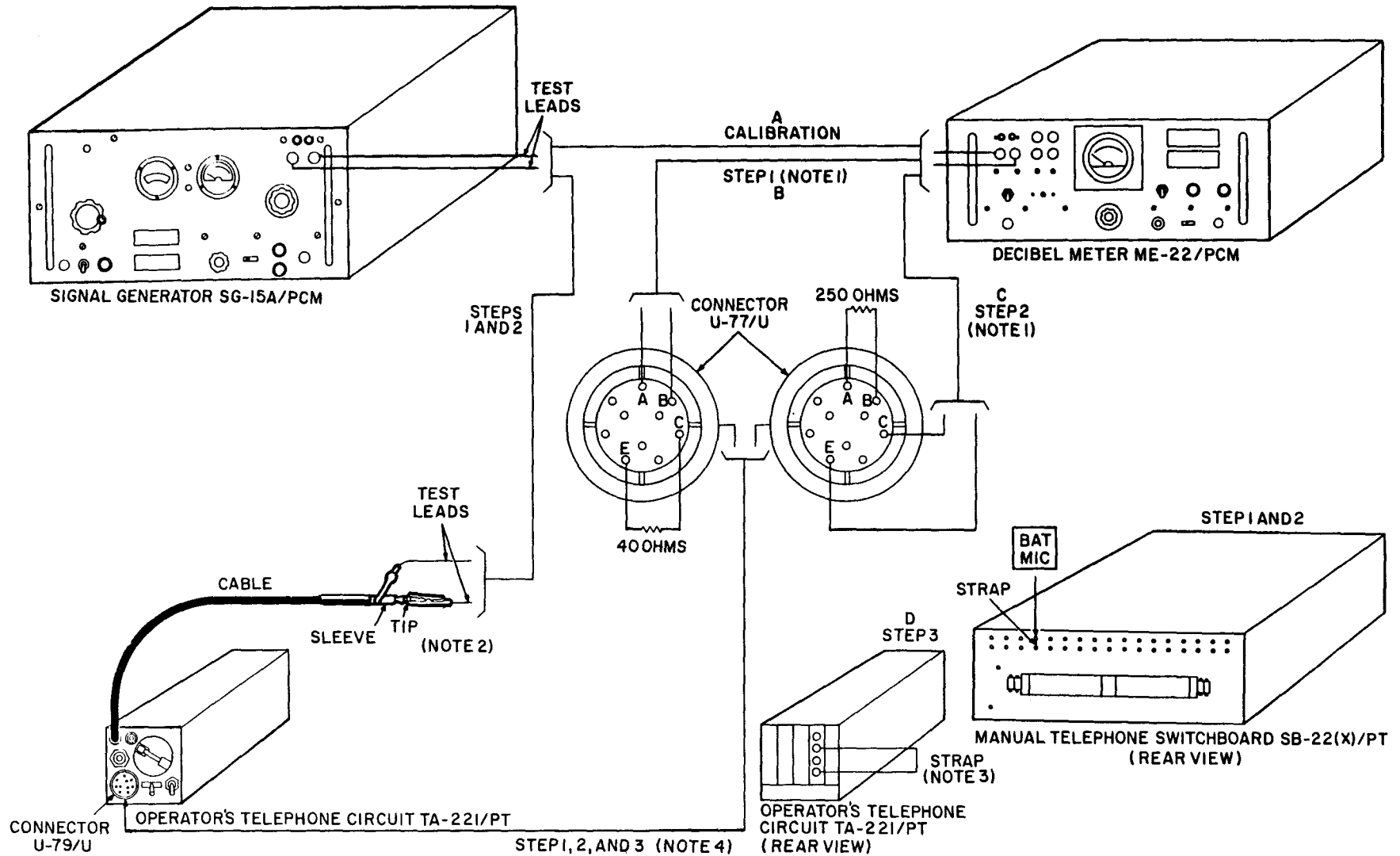
- (5) Set the FREQUENCY control to 1 KC and the COARSE DBM to 0, and adjust the FINE DBM control for an indication of 0 dbm on the OUTPUT LEVEL meter.
  - (6) On the ME-22/PCM, set the INPUT IMPEDANCE switch to 600 ohms.
  - (7) On the ME-22/PCM, set the DBM switch to 0 SCALE B, and adjust the CAL ADJ for an indication of 0 decibels (db) on the db meter.
  - (8) Reset the DBM switch to 0 SCALE A; the db meter must indicate 0 db  $\pm 0.5$ .
  - (9) Disconnect the SG-15A/PCM from the ME-22/PCM.
- d. *Procedure.* Perform the procedures in table 3-4 below.

Table 3-4. Operator's Pack, Transmission Efficiency Test

Step	Control settings Test equipment	Test procedure	Performance standard
1	SG-15A/PCM FREQUENCY: 1 KC COARSE DBM: 0 FINE DBM: 0 ME-22/PCM INPUT IMPEDANCE: 600 OHM. DBM switch: 0 SCALE A.	a. Connect equipment as shown in B, figure 3-3, step no. 1. b. Observe indication on ME-22/PCM.	a. None. b. Meter must indicate between -5.0 and -6.5 dbm.
2	Same as step no. 1	a. Connect equipment as shown in C, figure 3-3, step no. 2. b. Observe the indication an ME-22/PCM. c. Remove strap from between BAT. MIC. binding posts, and disconnect equipment. Reinstall battery case in switchboard.	a. None. b. Meter must indicate between -9.5 and -11.5 dbm. c. None.
3	Same as step no. 1.	Perform steps no. 1 and 2 when testing the TA-221/PT separately. The only change in connections is shown in D, figure 3-3, step no. 3.	Same as steps no. 1 and 2.







NOTES:

1. SPARE CONNECTOR U-77/U MUST BE USED FOR THESE CONNECTIONS.
2. ALLIGATOR CLIPS SHOULD BE USED FOR THESE CONNECTIONS.
3. A SPARE CONNECTOR, FROM AN SB-22/PT CASE, MAY BE USED FOR THIS CONNECTION.
4. CONNECTOR U-77/U CONNECTED TO CONNECTOR U-79/U FOR STEPS 1, 2, AND 3.

Figure 3-3. Operator's Pack, Transmission Efficiency Test Setup.

3-10. Hand Ringing Generator Efficiency Test

a. *Test Equipment and Materials.* Telephone Test Set AN/PTM-6.

b. *Test Connections and Conditions.* The procedures for performing the ringing generator efficiency test are the same whether the operator's pack is installed in the switchboard or is tested separately. The test connections are shown in figure 3-4.

c. *Initial Test Equipment Calibration.* None required.

d. *Procedure.* Perform the procedures in table 3-5 below.

Table 3-5. Hand Ringing Generator Efficiency Test

Step	Control settings Test equipment	Test procedure	Performance standard
1	AN/PTM-6 Key 3: CHK Key 4: GEN Key 6: CKT Key 7: AC	Turn the hand ringing generator on the switchboard at approximately 200 rotations per minute while observing the meter on the test set.	Meter must deflect to the right of 0 db.

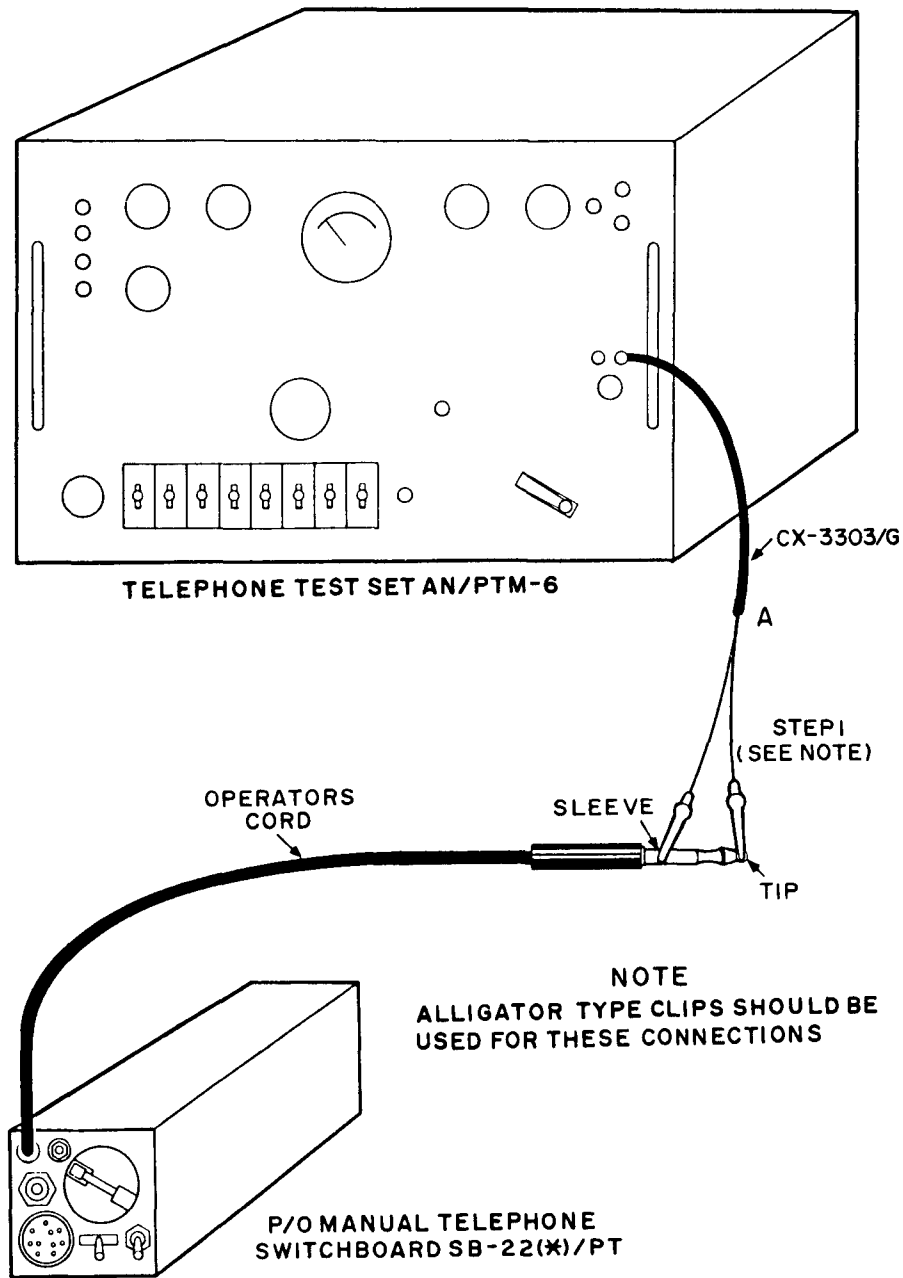


Figure 3-4. Operator's Pack, Hand Ringing Generator Efficiency Test Setup.

3-11. Operator's Telephone Set Efficiency Test

a. *Test Equipment and Materials.*

- (1) Telephone Test Set AN/PTM-6.
- (2) Battery BA-23 (two each).
- (3) Battery BA-26 (three each).
- (4) Battery BA-210/U (four each).
- (5) Battery BB-223/U.
- (6) Receptacle Connector U-79/U.

b. *Test Connections and Conditions.* The efficiency of the operator's telephone set is tested with it disconnected from the switchboard. Connect the equipment as shown in A, figure 3-5, for the procedure in step no. 1 of table 3-6 below, and as shown in B, figure 3-5, for the procedure in step no. 2 of table 3-6 below.

c. *Initial Test Equipment Calibration.* Allow the AN/PTM-6 to warm up for at least 5 minutes before proceeding with the test equipment calibration.

(1) Check the battery voltages as follows:

(a) Set key 7 on the AN/PTM-6 to DC.

(b) Operate circuit D5 control to the 12, 24, and 135 volts positions while observing the meter. The meter should indicate between -2 db and 0 db. If the meter indicates to the left of -2 db, the battery for which the indication is obtained must be replaced.

(c) Operate circuit D5 control to 12 volts, and press switch 9. Check to see that the meter indicates in the blue region of the scale. If the meter indicates to the left of the blue region on the meter, recharge the BB-223/U before proceeding with the test.

(2) Adjust the sound source output as follows:

(a) Operate keys 5 and 7 to CHK.

(b) Press switch 9, and observe the meter indication.

(c) Adjust sound pressure D8 control so that the meter indicates 0 db.

d. *Procedures.* Perform the procedures in table 3-6 below.

Table 3-6. Operator's Telephone Set Efficiency Test

Step	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/PTM-6 Key 1: LBPE Key 2: RCT Key 8: TRANS TRANS D1 control: 2 TRANS D3 control: 2 EQUALIZER: OUT	Push-to-talk switch operated and locked.	Press transmitter of the headset firmly against the center of the sound source screen. Press switch 9 for 1 minute while observing the meter indication.	Meter must indicate at or to the right of -4 db and must maintain this value as long as switch 9 is pressed.
2	AN/PTM-6 Key 1: LBPE Key 2: RCT Key 8: REC REC D2 control: 2 REC D4 control: 6 EQUALIZER: OUT	N/A	a. Position the receiver of the headset centrally on the sound source screen, and press the receiver firmly against the screen. b. Press switch 9, and hold for 30 seconds while observing the indication on the meter.	a. None. b. Meter must indicate to the right of -1 db and must maintain this value as long as switch 9 is pressed.

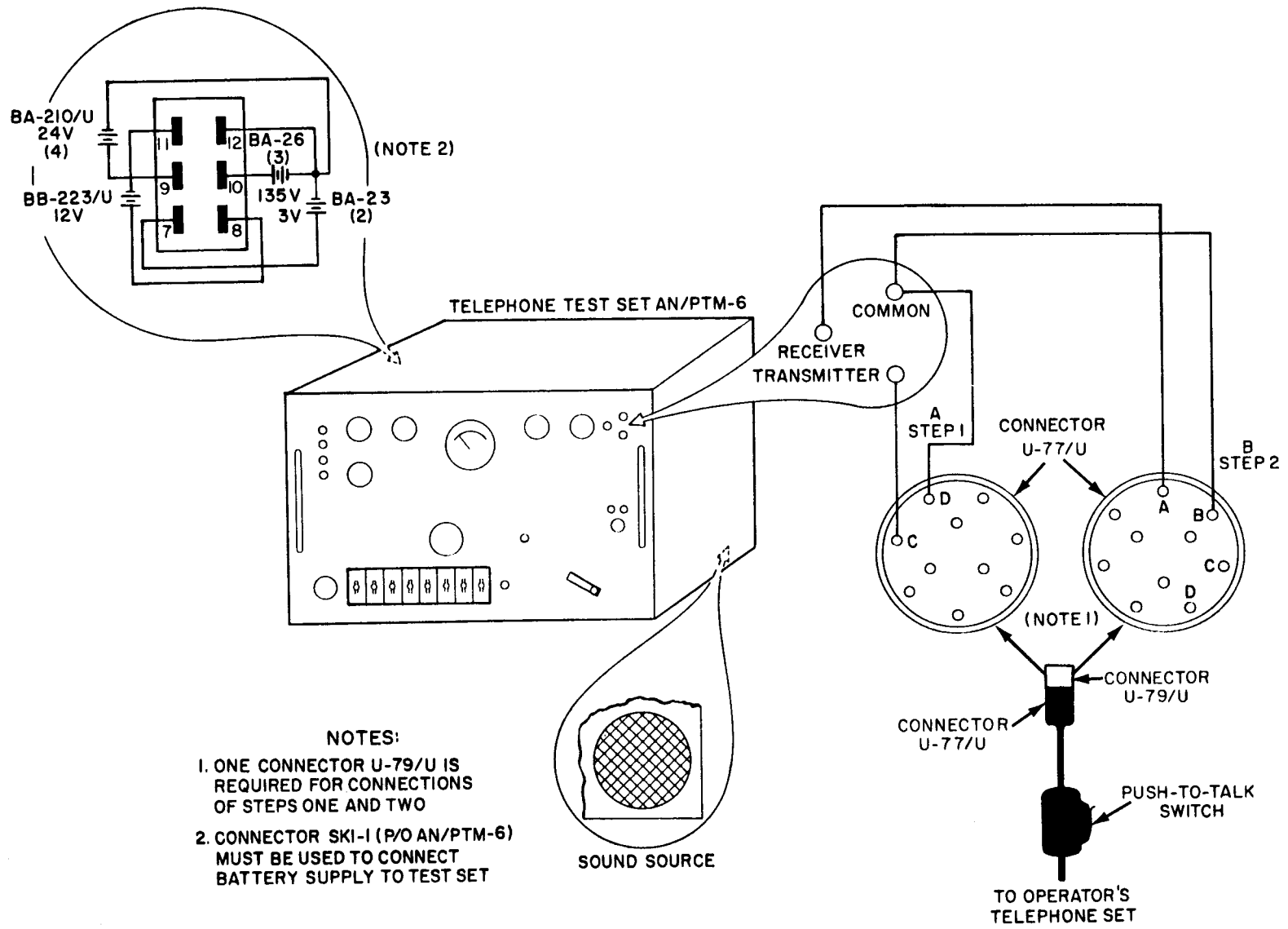


Figure 3-5. Operator's Telephone Set, Efficiency Test Setup.

3-12. Summary of Performance Standards

Table 3-7. Summary of Performance Standards

Test	Test data	Performance standard
RECTIFIER AND PUSH-TO-TALK		
SWITCH TEST		
a. Backward resistance	—	At least 20 times forward resistance.
b. Sidetone	—	Must be audible.
c. Push-to-talk switch	—	Meter indication less than 100 ohms.
d. Trunk jack cord switch	—	Open circuit with cord retracted.
e. Trunk jack line resistance	—	100 ohms $\pm$ 10 with cord extended
LINE SIGNAL EFFICIENCY TEST		
a. Line signal sensitivity	—	12 milliamperes maximum.
b. AUD-OFF-VIS alarm operation	—	Must operate.
c. Line signal restoration	—	Must operate.
OPERATOR'S PACK TRANSMITTING AND RECEIVING TEST		
a. Receiving efficiency	—	-5.0 to -6.5 dbm.
b. Transmitting efficiency	—	-9.5 to -11.5 dbm.
HAND RINGING GENERATOR EFFICIENCY TEST		
Generator output	—	0 db minimum.
OPERATOR'S TELEPHONE SET EFFICIENCY TEST		
a. Receiver efficiency	—	-1 db minimum.
b. Transmitter efficiency	—	-4 db minimum.

## APPENDIX A

## REFERENCES

---

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
SB 11-6	FSC Class 6135; Dry Battery Supply Data.
SB 11-30	FSC Class 6135; Dry Battery Management Data.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TM 11-2062	Test Sets I-142, I-142A, I-142B, and Telephone Test Set AN/PTM-6.
TM 11-2134	Manual Telephone Switchboard SB-86/P; Installation and Operation (NSN 5805-00-503-2660).
TM 11-5540	Electric Light Assembly MX-1292/PAQ (NSN 6695-00-378-5449).
TM 11-5805-201-12	Operator's and Organizational Maintenance Manual: Telephone Set TA-312/PT (NSN 5895-00-543-0012).
TM 11-5805-262-12	Operator's and Organizational Maintenance Manual: Switchboards, Telephone, Manual SB-22/PT (NSN 5805-00-257-3602) and SB-22A/PT (5805-00-715-6171).
TM 11-5805-262-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Switchboards, Telephone, Manual SB-22/PT (NSN 5805-00-257-3602) and SB-22A/PT (5805-00-715-6171).
TM 11-5965-283-15	Operator's, Organizational, Direct Support, and Depot Maintenance Manual (Including Repair Parts and Special Tools Lists): Headset-Microphone H-182/PT.
TM 11-6625-202-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Test Set, Relay, TS-1775/U (NSN 6625-00-064-6096).
TM 11-6625-251-15	Operator's, Organizational, Direct Support, General Support and Depot Maintenance Manual: Test Sets TS-140/PCM; Signal Generators SG-15/PCM and SG-15A/PCM and Decibel Meter ME-22/PCM and ME-22A/PCM.
TM 11-6625-366-15	Operator's, Organizational, Direct Support, General Support and Depot Maintenance Manual: Multimeter TS-352B/U (NSN 6625-00-553-0142).





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PUBLICATION DATE  
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 Radar Set AN/PRC-76

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-10	3-3		3-1
-6	5-8		
		F03	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°.

REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.

Item 5, Function column. Change "2 db" to "3db."

REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.

Add new step f.1 to read, "Replace cover plate removed in step e.1, above."

REASON: To replace the cover plate.

Zone C 3. On J1-2, change "+24 VDC to "+5 VDC."

REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

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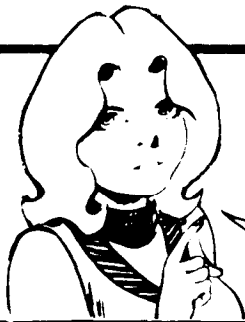
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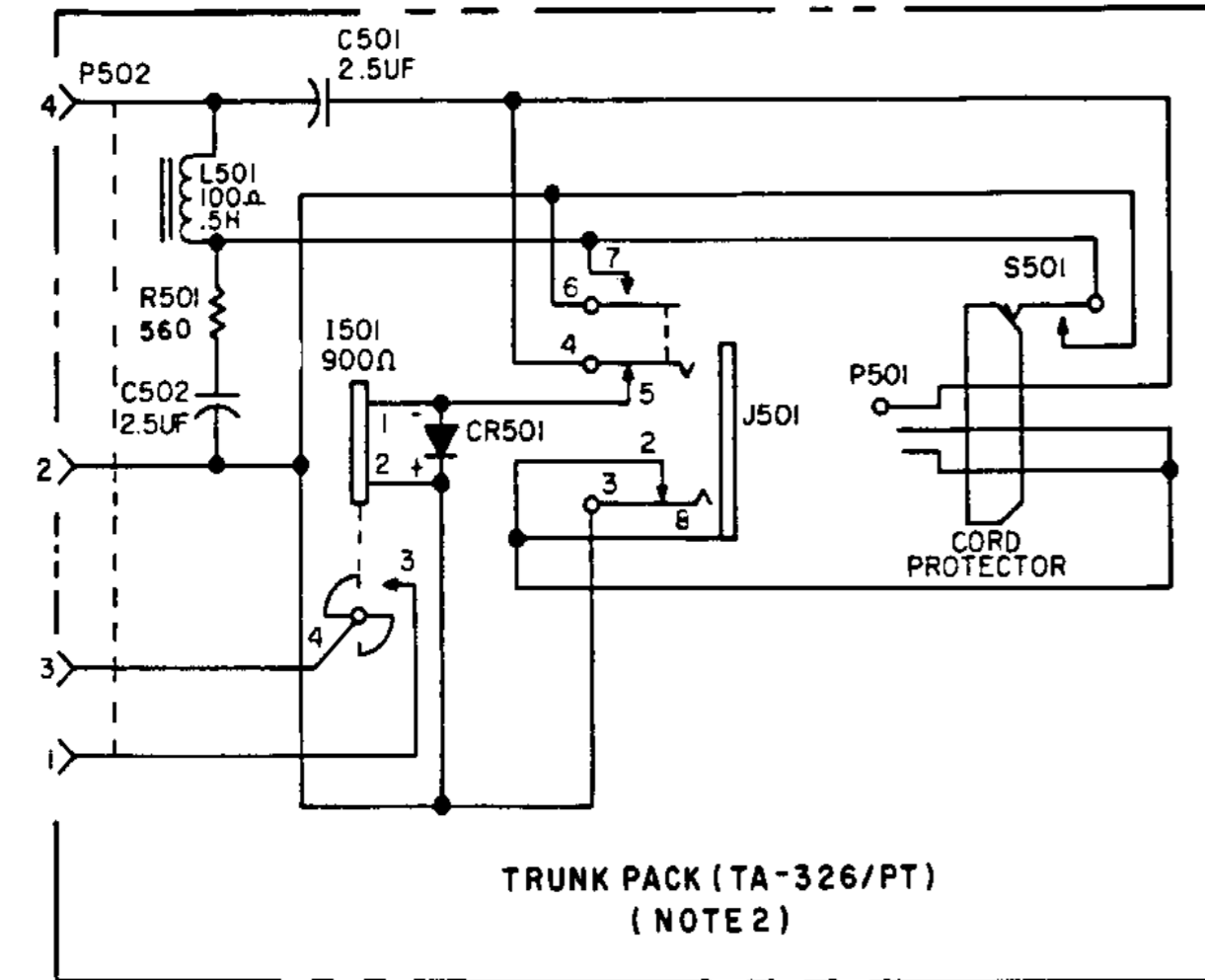
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- NOTES:**
1. INDICATES EQUIPMENT MARKING.
  2. LINE PACKS AND TRUNK PACKS ARE PHYSICALLY INTERCHANGEABLE. NUMBER USED DEPENDS ON CIRCUIT REQUIREMENTS.
  3. J301 AND U-161/U ARE EQUIPPED WITH PRESSURE CONTACTS.

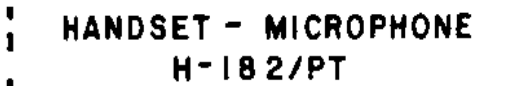
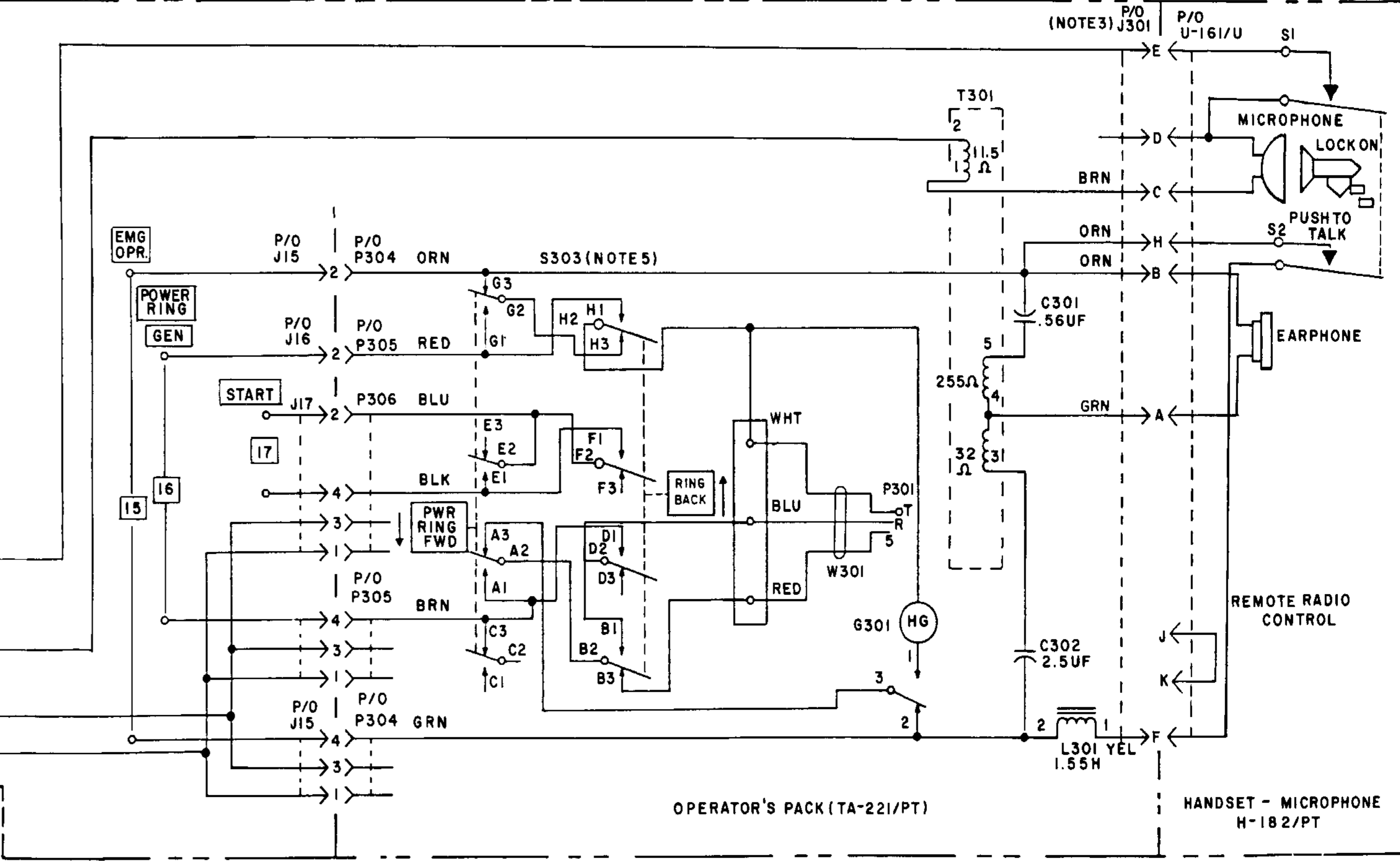
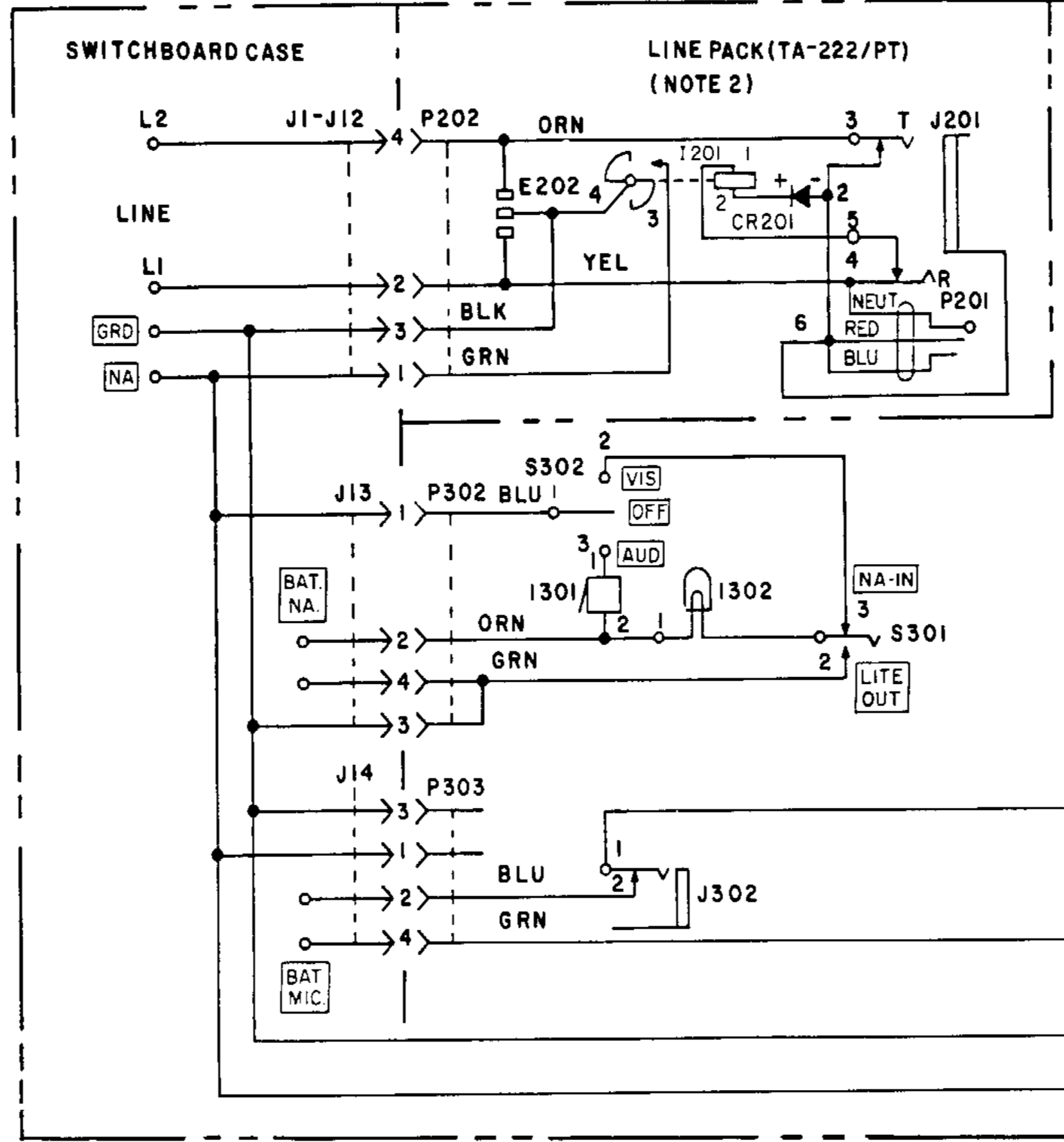
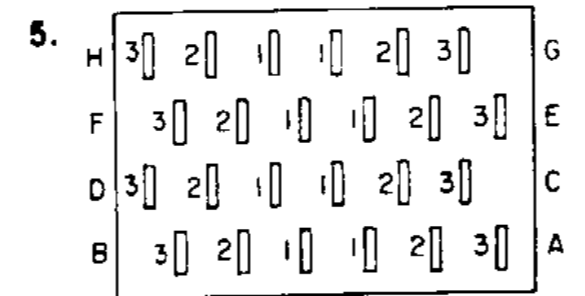
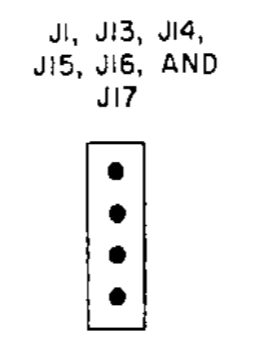
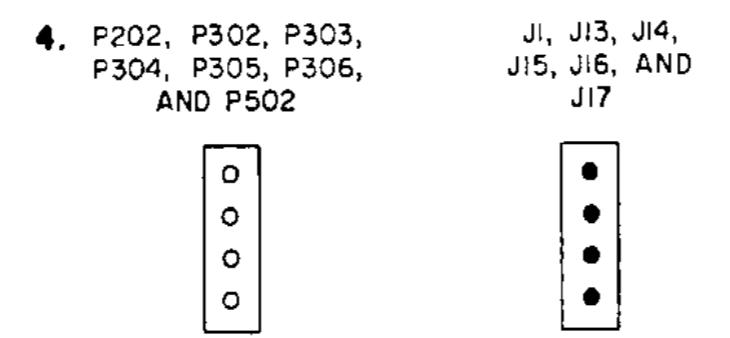
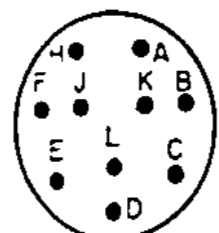
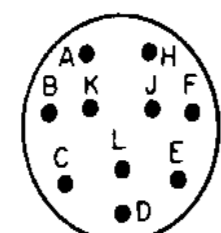


Figure FO-1. Switchboard Schematic Diagram.





