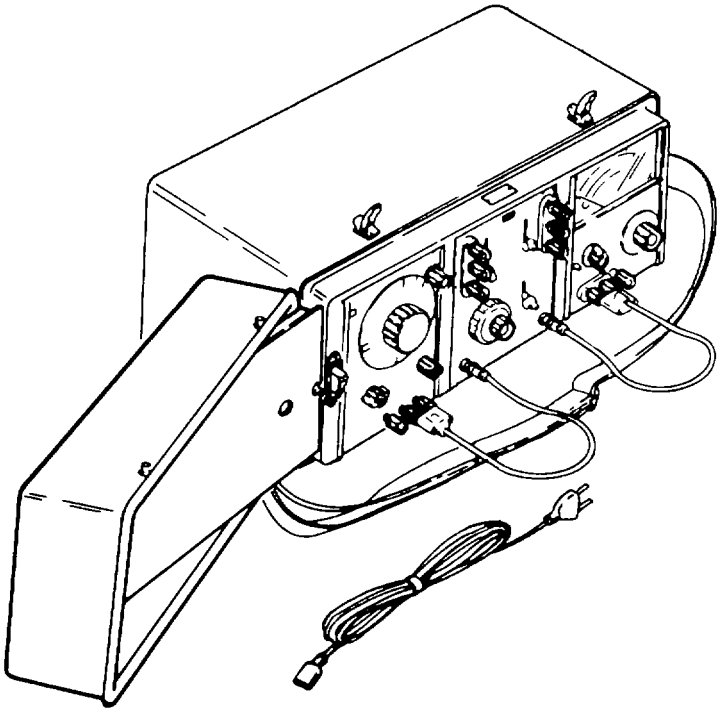
OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

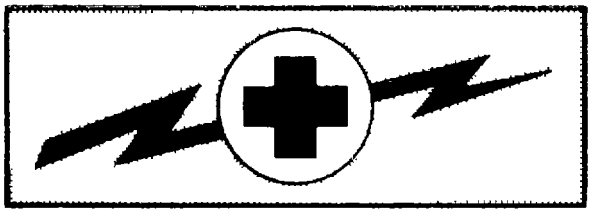


TEST SETS, TELEPHONE:
AN/USM-181B (NSN 6625-00-086-4271)
AND
AN/USM-181C (NSN 6625-00-244-3032)

HEADQUARTERS, DEPARTMENT OF THE ARMY
15 MAY 1987

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 DRY WOODEN POLE OR A DRY 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**



WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections of 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "low voltage. " Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

HOW TO USE THIS MANUAL

- This technical manual is a guide to use the test set for measuring various telephone equipment and lines.

- The manual should be used to familiarize both the operator and organizational maintenance repair personnel with the usage and maintenance of the test set.

- Follow the instructions in this manual for unpacking and initial adjustment of the test set, application, preventive maintenance and calibration, and, in the event that the test set malfunctions, troubleshooting and repair.

- References are made throughout the manual and in appendix A for other publications that are used in conjunction with this manual.

- Use the Maintenance Allocation Chart (MAC) in appendix B for a summary of levels of maintenance assigned to a particular group. The maintenance procedures in the body of the manual follow the MAC with occasional deviation where practical.

TECHNICAL MANUAL

No. 11-6625-602-12-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 May 1987

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL
TEST SETS, TELEPHONE:
AN/USM-181B (NSN 6625-00-086-4271)
AND
AN/USM-181C (NSN 6625-00-244-3032)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of 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 back of this manual direct to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN AMSEL-PA-MA-D, Fort Monmouth, New Jersey 107703-5000. In either case, a reply will be furnished direct to you

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*This manual supersedes TM 11-6625-602-12-1, 6 July 1972, including all changes.

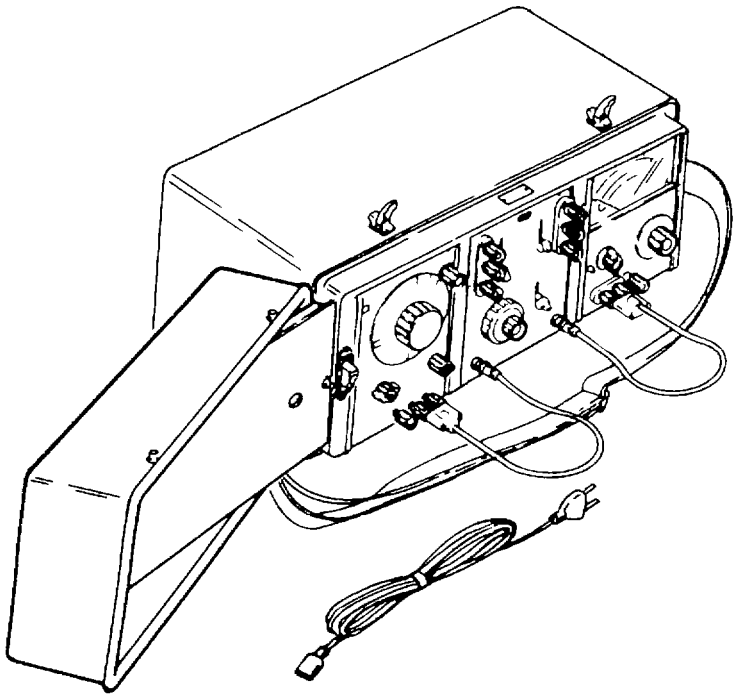


Figure 1-1. Telephone test set (*), front view.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. SCOPE
This manual describes Test Set, Telephone AN/USM-181B and AN/USM-181C (fig. 1-1) and provides instructions for Installation, operation, and operator and organizational maintenance It includes instructions for operation under usual and unusual conditions, cleaning and inspection of the equipment, and replacement of parts available to the operator and organizational repair person. Hereinafter, the equipments are referred to as telephone test set (*) unless otherwise specified.

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. MAINTENANCE FORMS, RECORDS, AND REPORTS
- Reports of Maintenance and Unsatisfactory Equipment Department of the Army forms and procedures used for equipment maintenance will be those prescribed In DA Pam 738-750 as contained In Maintenance Management Update.

- **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 73B/AFR 400-54/MCO 4430 3H.

- **Discrepancy In Shipment Report (DISREP) (SF 361).** Fill out and forward Discrepancy In Shipment Report (DISREP) (SF 361) as prescribed in AR 55 38/NAVSUPI NST 461 0 33C/AFR 75-18/ MCO P4610 1 9D/DLAR 4500 15.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)
If your equipment 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 AMSEL-PA-MA D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

1-5. 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 is covered in TB 750-25.

1-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL
Destruction of Army electronics materiel to prevent : enemy use shall be in accordance With TM 750-244-2.

1-7. CALIBRATION
Refer to TM 11-6625-602 40-1 for calibration procedures.

Section II. DESCRIPTION AND DATA

1-8. PURPOSE AND USE

Telephone test set (*) is a portable signal generator, voltmeter, and attenuator combination for measuring gain and attenuation In relation to frequency, crosstalk, noise, and power levels in telephone transmission lines, carrier circuits, filters, amplifiers, and attenuators It covers both the audio frequency and carrier frequency ranges and is suitable for direct and general support and depot maintenance use It operates on both alternating current (ac) or on storage batteries within the test set The signal generator supplies a test signal through an Impedance matching transformer In the attenuator to the external circuit under test. The voltmeter receives the test signal from the circuit under test through an impedance matching transformer in the attenuator and indicates the test signal level in decibels (referred to 1 milliwatt (mW) in 600 ohms) (dBm), in decibels (dB) above or below the level of the test signal applied to the circuit, and in root mean square (rms) volts The terminals on the attenuator can be connected to grounded, ungrounded, balanced, or single-ended circuits. The attenuator permits measurements on systems terminated in 135, 600, and 900 ohms, and bridging measurements on a 600-ohm basis In the bridging mode, the Input impedance Is 10,000 ohms.

1-9. TECHNICAL DATA

Frequency range ..... 5 Hz to 1 2 MHz
Line-voltage input..... 115 or 230 volts, 48 to 440 Hz, <4 watts
Weight
- In carrying case ..... 30 1/2 pounds.
- In shipping carton ..... 44 1/2 pounds

ATTENUATOR

Input:
- Frequency range ..... 50 Hz to 560 kHz
- Frequency response..... ±1/2 dB, 50 Hz to 560 kHz
- Balance..... Better than 40 dB
- Impedance ..... 135, 600, 900, and bridging (10k) ohms, center tapped.
- Insertion loss..... Less than 3/4 dB at 1 kHz
- Maximum level ..... +22 dBm (10 volts rms at 600 ohms)

Output:
- Frequency range ..... 50 Hz to 560 kHz
- Frequency response..... ± 1/2dB, 50 Hz to 560 kHz
- Balance..... Better than 40 dB
- Impedance ..... 135, 600, and 900 ohms, center tapped
- Insertion loss..... Less than 3/4 dB at 1 kHz
- Distortion ..... Less than 1%, 50 Hz to 560 kHz
- Maximum level ..... +22 dBm (10 volts rms at 600 ohms)
- Accuracy- 1 to 110 dB
  - 10-dB section ..... Error is less than ±0.25 dB
  - 100-dB section ..... Error is less than ±0.05 dB

Connections ..... Binding posts, which accept banana plugs on 3/4-inch centers, and BNC connectors

1-9. TECHNICAL DATA - Continued

VOLTMETER

Range .....0.001 to 300 volts rms, 12 range settings
-72 dBm to +52 dBm, 12 range settings

Frequency range .....5 Hz to 2 MHz

Accuracy and temperature range:

Temperature	Accuracy		
	5 to10 Hz	10 Hzto1 MHz	1 to2 MHz
0 to +50°C	±5%	±2%	±5%
-20 to 0°C	±8%	±8%	±8%

Nominal input impedance 2 megohms shunted by approximately 40 uuf on 0 001 volt to 0 03-volt ranges, 25 uuf on 01 -volt to 300-volt ranges.

Signal overload protection.....Fuse protected, 1/1 6 amp.

Dc isolation .....Signal ground may be ±500 volts dc from the test set case.

SIGNAL GENERATOR

Frequency range:
5 Hz to 1 2 MHz.....6 range settings
Dial Accuracy .....±3%
Frequency response.....±3% Into rated load
Output Impedance.....600 ohms
Output level .....10 milliwatts (2.5 V rms) maximum 600 ohms, 5 V rms into open circuit, ungrounded, continuously adjustable 0 to 20 dB
Distortion.....Less than 0.1%
Hum and noise.....Less than .05%.
Sync impedance .....10 K ohms

POWER SUPPLY (SIGNAL GENERATOR AND VOLTMETER)

Identical characteristics exist in the signal generator and voltmeter power supplies Both have four rechargeable nickel cadmium batteries Forty hour operation per recharge (20 hours at -20°C), up to 500 recharging cycles The recharging circuit operates on 115 or 230 volts ±10%, 48 to 440 Hz.

1-10. COMPONENTS OF TELEPHONE TEST SET (*)

Quantity	Item	Height (in)	Depth (in)	Width (in)	Weight (lb)	Fig. no
1	Carrying case (with cover)	8 3/8	13 1/4	19 1/4	14 1/2	1-2
1	Voltmeter	6 3/32	8	5 1/8	61/2	1-4
1	Attenuator	6 3/32	8	5 1/8	6 1/2	1-5
1	Signal generator	6 3/32	8	5 1/8	6	1-3
1	Shoulder strap, adjustable					1 -2
3	Cable assembly, special purpose, electrical CX-1 259/USM-181 B					1-2
2	Cable assembly, radio frequency CG-3566/U					1-2
1	Fuse, spare (inside right side panel of ac voltmeter)					2-1

1-11. DESCRIPTION OF TELEPHONE TEST SET (*)

- The telephone test set (*) includes three self-contained units (signal generator, attenuator, and voltmeter), power and signal cable assemblies, a carrying strap, and a carrying case. Figure 1-1 shows the major components of the test set assembled.

- The signal generator attenuator, and voltmeter are assembled in a carrying case (figure 1-2) Power for the signal generator and voltmeter is supplied by rechargeable batteries contained in each assembly. When the test set is connected to an ac source (115 or 230 volts ac), the power supplies in the signal generator and voltmeter (FUNCTION switch set to ON) supply operating power and recharge the batteries.

- The output of the signal generator and the input of the voltmeter are connected to the attenuator by the two patch cables (figure 2-2) The voltmeter is adjusted to indicate the output of the attenuator The Input and output terminals of the attenuator are connected to the transmission line under test to measure insertion loss and frequency response on the voltmeter (figure 2-5).

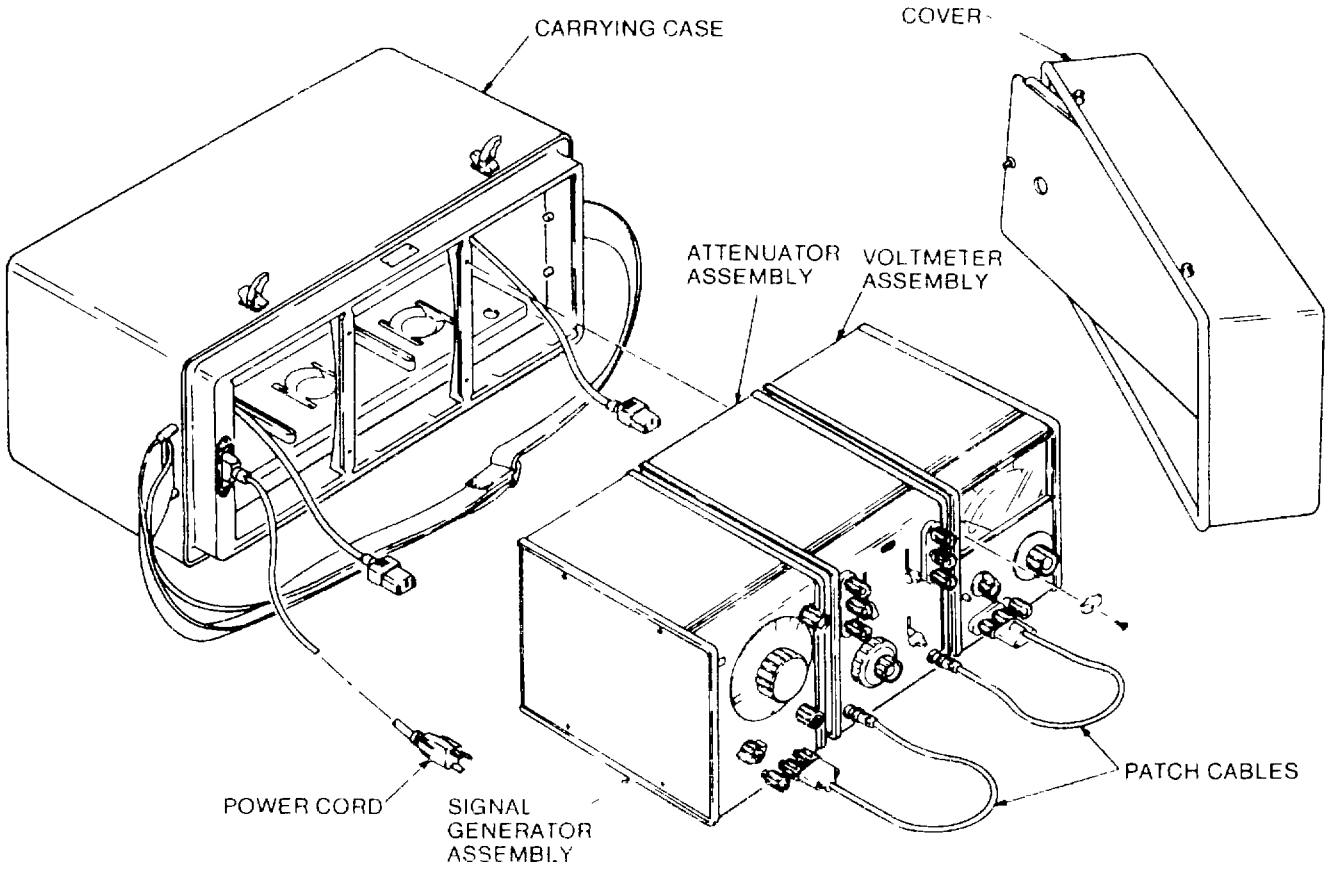


Figure 1-2 Telephone Test Set (*) (assembly diagram)

1-12. DESCRIPTION OF SIGNAL GENERATOR

The signal generator (figure 1-3) produces a frequency of 5 Hz to 1.2 MHz In six ranges. It has an amplitude adjustment to 10 milliwatts (mW) maximum. All signal connectors and controls are located on the front panel. The ac source connection and line voltage selection switch are located at the rear of the assembly.

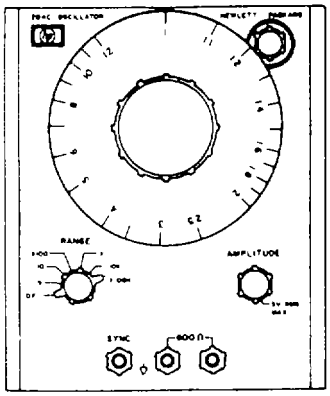


Figure 1-3. Signal Generator SG-543B/U and SG-543C/U controls, connectors, and indicators (front view)

1-13. DESCRIPTION OF VOLTMETER, ELECTRONIC ME-260B/U

The voltmeter (figure 1-4) measures voltages at frequencies from 5 Hz to 2 MHz. The meter indicates voltages of 0.001 to 300 Vrms full scale, and dB levels of -72 to +52 dBm in 12 ranges (1, 3, 10 sequence). All signal connectors and controls are located on the front panel The ac power connection and line voltage selector switch are located at the rear of the voltmeter assembly The selfcontained power supply functions automatically when the ac power is connected and the FUNCTION switch is set to ON.

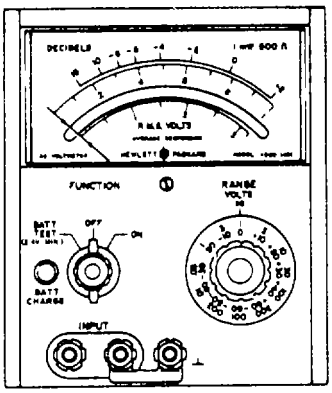


Figure 1-4. Voltmeter, Electronic ME-260B/U and ME-260C/U controls, connectors, and indicators (front panel).

1-14. DESCRIPTION OF ATTENUATOR, IMPEDANCE MATCHING CN-947B/USM-181

The attenuator (figure 1-5) requires no operating power Operating frequencies are 50 Hz to 560 kHz. Attenuations developed are 1 to 110 dB In steps of 1 to 10 dB. The attenuator also provides matching impedances for input and output connections of 1 35, 600, and 900 ohms All connectors and controls are on the front panel.

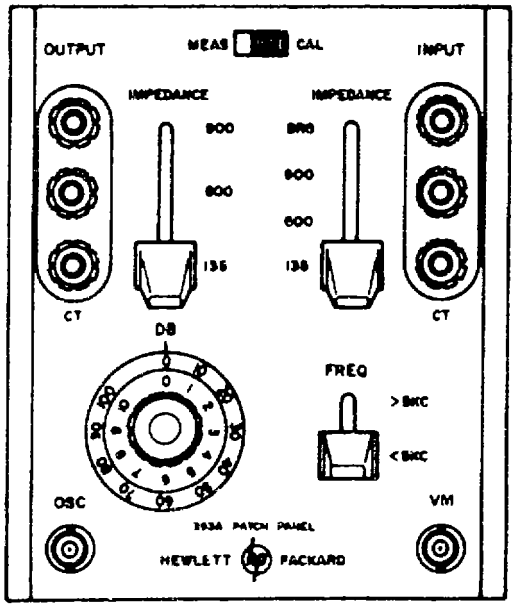


Figure 1-5. Attenuator, Impedance Matching CN-947B/USM-181 and CN-947C/USM-181 controls and connectors (front panel).

1-15. DESCRIPTION OF MINOR COMPONENTS

The minor components of telephone test set (*) are shown In figure 1-2 and consist of a detachable ac power cord and two patch cables for attaching the voltmeter and signal generator to the attenuator. The patch cables are terminated on one end by a BNC-type connector, and on the other end by a banana plug with 3/4-inch centers The cables and power cord are stored In the cover of the Instrument for transit, storage, or shipment.

1-16. DIFFERENCES BETWEEN MODELS

NOTE

Both models are functionally and electrically interchangeable

Item	AN/USM-181B	AN/USM-181C
Fuses		
Voltmeter	2, one is a spare	3, one is a spare
Signal Generator	None	1

1-17. EQUIPMENT NOMENCLATURE AND CABLE DESIGNATIONS

Component	AN/USM-181 B	AN/USM-181 C
Voltmeter	ME-260B/U	ME-260C/U
Signal Generator	SG-543B/U	SG-543C/U
Attenuator	CN-947B/USM-181	CN-947C/USM-181
Case	CY-7047/USM-1 81 B	CY-7047A/USM-1 81 B
Patch Cable	CG-3566/U	CG-3566/U
Power Supply Cable	CX-1 2594/USM-1 81 B	CX-1 2594/USM-1 81 B

Section III. SERVICE UPON RECEIPT OF EQUIPMENT

1-18. UNPACKING

PACKAGING DATA

When packed for shipment, the entire unit is packed In one carton A typical shipping carton and Its contents are shown in figure 1-6. The dimensions of the shipping carton are 15 1/8 by 18 3/4 by 24 7/8 inches. The volume is 4 cubic feet and the shipping weight (with test set included) is 44 1/2 pounds.

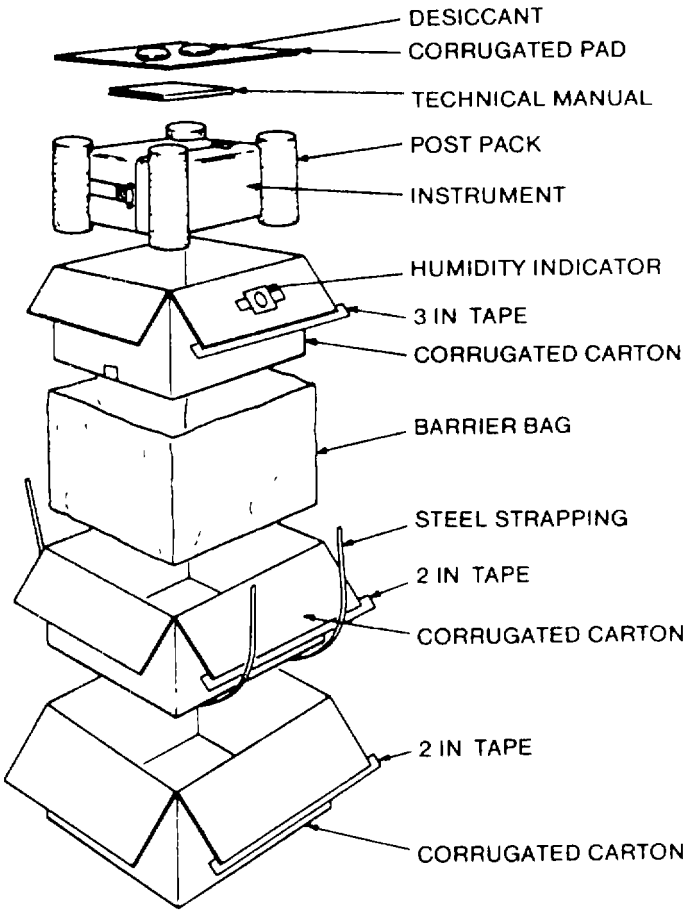


Figure 1-6. Telephone test set (*), packaging diagram.

1-18. UNPACKING- Continued

REMOVING CONTENTS

- Cut the tape on top of the carton and fold back the flaps.
- Cut the steel strapping and tape on top of the inner carton and fold back the flaps.
- Open the barrier bag.
- Cut the tape on top of the instrument carton and fold back the flaps.
- Remove the desiccant and the corrugated pad.
- Remove the envelope that contains the manual.
- Remove the four post paks from the instrument.
- Remove the equipment cover.
- Remove the inside panel of the cover by pressing the two buttons on each end of the panel and lift out the panel.
- Remove the cables and power cord from the inside cover.

1-19. CHECKING UNPACKED EQUIPMENT

- Inspect the equipment for damage Incurred during shipment If equipment has been damaged, report the damage on an SF 364 (Report of Discrepancy (ROD)).

- See that the equipment is complete as listed on the packing slip If a packing slip is not available, check the equipment against the list of components in paragraph 1-10 Report all discrepancies in accordance with DA Pam 738-750 and SF 361 Shortages of minor assemblies or parts that do not affect proper functioning of the equipment should not prevent use of the equipment.

- If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO) If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate If modified, see that any operational Instruction changes resulting from the modification have been entered In the equipment manual.

NOTE

Current MWO's applicable to equipment are listed in DA Pam 310-1

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND CONNECTORS

2-1. GENERAL

- After the equipment has been unpacked and all components are present, make connections as shown. In figure 2-2 The power cord is used only for ac operation or for charging the batteries, and need not be connected unless the battery voltages are low.

- Telephone test set (*) is shipped with a signal overload fuse (figure 2-1) installed in the voltmeter.

CAUTION

Use only fuses of correct value when replacing a fuse Overfusing can result in damage to the equipment.

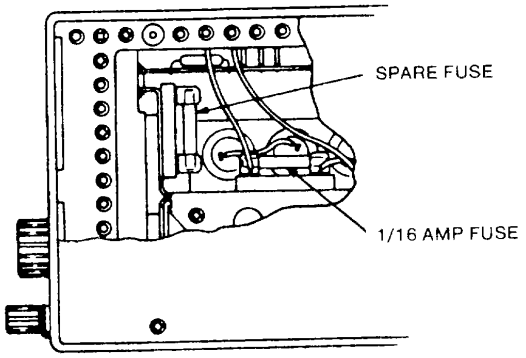


Figure 2-1. Overload fuse (location diagram).

2-2. INITIAL ADJUSTMENT OF EQUIPMENT (Figure 2-2)

A Set the voltmeter FUNCTION switch (1) to OFF.

B Rotate the voltmeter meter adjusting screw (2) (below center of meter) clockwise until pointer is below zero. Continue clockwise rotation until pointer is exactly on zero.

C If pointer (3) passes zero, repeat B above.

D Rotate meter adjusting screw (2) approximately 15'* counterclockwise to disconnect adjusting screw from meter movement.

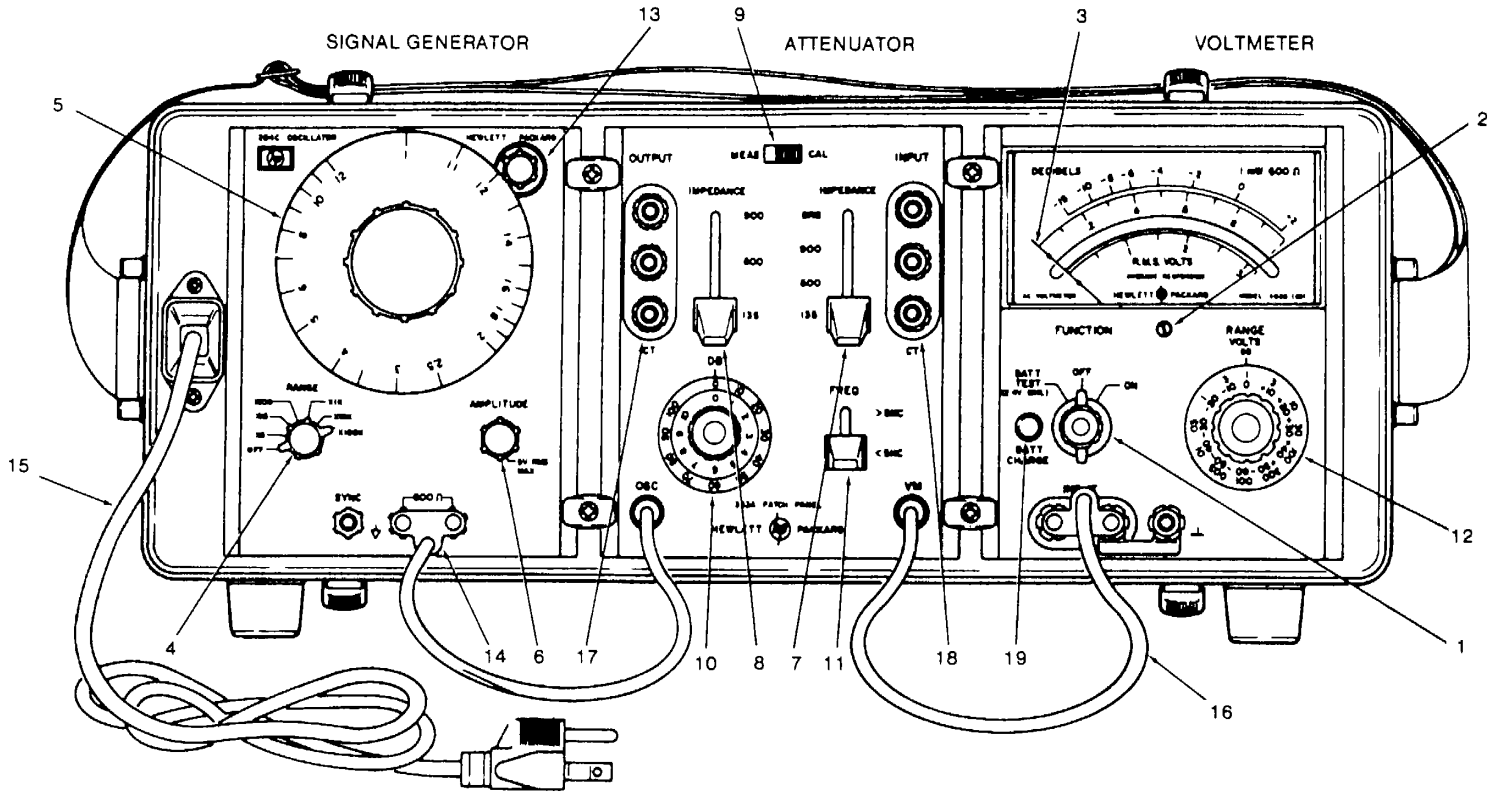
E If pointer moves off zero, repeat B. C, and D above.

F Set RANGE switch (4) on signal generator to OFF.

G Set and hold voltmeter FUNCTION switch (1) on BATT TEST.

H The voltmeter must indicate 2 4 volts on 0-3 range If less than 2 4 volts, connect the telephone test set (*) ac power source and set the voltmeter FUNCTION switch (1) to ON.

I Set signal generator RANGE switch (4) to X 100, dial (5) to 5. and AMPLITUDE control (6) to MAX.



LEGEND

1. FUNCTION switch
2. Meter adjusting screw
3. Pointer
4. RANGE switch
5. Dial
6. AMPLITUDE control
7. INPUT IMPEDANCE switch
8. OUTPUT IMPEDANCE switch
9. MEAS-CAL switch
10. DB control
11. FREQ switch
12. RANGE VOLTS switch
13. Vernier control
14. Jacks J2 and J3
15. Power cable
16. Patch cable
17. OUTPUT lack J303
18. INPUT lack J304
19. BATT CHARGE indicator

Figure 2-2 Telephone test set (*) (connection and controls diagram)

J Set INPUT IMPEDANCE (7) and OUTPUT IMPEDANCE (8) switches of attenuator to 600.

K Set attenuator M EAS-CAL switch (9) to CAL.

L Set attenuator DB control (10) to 0.

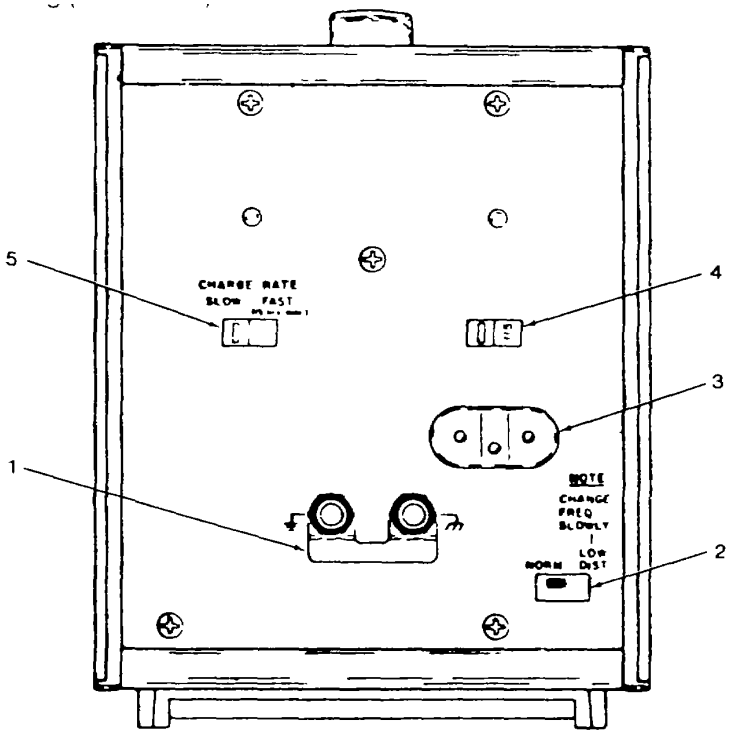
M Set attenuator FREQ switch (11) to <5 KC.

N Set voltmeter RANGE VOLTS switch (12) to 3 and set FUNCTION switch (1) to ON.

O With the ac power cord disconnected from the power source, the voltmeter must Indicate more than 2.3 volts on the 0-3 range If the indication is less than 2.3 volts, recharge the batteries by connecting the power cord to the ac power source The telephone test set (*) may be used while the batteries are being recharged.

2-3. POWER SUPPLY CONTROLS AND SWITCHES

The power supply controls and switches are located on the rear of the signal generator (figure 2-3). Before connecting the telephone test set (*) to an ac source, check the line voltage selection switch (4) for the proper setting (115 or 230).



1 Ground Strap Connects the floating chassis ground to earth ground.

2 NORM/LOW DIST Switch Selects normal or low distortion on the X5 and X10 ranges.

3 Ac Power Receptacle Mates with ac power cord supplied for line power connection.

4 Voltage Selector Switch Selects line voltage of 115 of 230 volts ac.

5 CHARGE RATE Switch Selects last or slow rate of recharging the nickel cadmium batteries.

Figure 2-3 Signal generator (rear view), power supply section.

2-4. DAMAGE FROM IMPROPER SETTINGS

The following precautions should be taken:

- Before connecting equipment to an ac source, check the line voltage selection switch (figure 2-3) at the rear of the signal generator for proper setting (115 or 230 volts).
- Do not connect the telephone test set (*) to an ac power source when the ambient temperature is above 50°C (1 22°F) To do so will damage the batteries.
- Do not connect the signal generator output terminals to a direct current (dc) voltage of reverse polarity and do not connect the output terminals to dc voltages greater than 25 volts To do so may damage the output blocking capacitor.
- Do not connect the attenuator input and output terminals to a dc voltage source To do so may damage the transformers.
- Limit the ac power to the input and output terminals of the attenuator to 10 milliwatts More than 10 milliwatts may damage the transformers.

2-5. SIGNAL GENERATOR OPERATING CONTROLS, INDICATOR, AND CONNECTORS (Refer to figures 2-2 and 2-3 for locations)

CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
Voltage selection switch (rear of unit)	Permits operation from either 115 or 230 volts ac
Dial control (5)	Selects desired frequency within range selected by RANGE switch
Vernier control (13)	Provides fine adjustment of frequency
RANGE switch (4)	Selects range containing desired frequency and indicates the multiplying factor to be applied to the FREQ dial reading to give output frequency.
AMPLITUDE control (6)	Adjusts output amplitude level from 0 volt to 2.5 volts maximum into 600 ohms
OUTPUT terminals (14)	Provides output connections and cabinet ground connection
Ac source voltage connection (15)	Connect signal generator recharging circuit to power receptacle on telephone test set (*)

2-6, ATTENUATOR OPERATING CONTROLS AND CONNECTORS (Refer to figure 2-2 for locations)

CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
OSC connector (14)	Receives the lest signal from the signal generator
VM connector (1 6)	Supplies test signal for connection to the voltmeter
DB control (10)	Provides attenuation of 0 to 110 dB between the OSC terminal and the output terminals In steps of 1 dB or 10 d B
FREQ switch (11)	Limits frequency response to the range from 50 Hz to 5 kHz or from 50 to 560 kHz
OUTPUT terminals (17)	Provide output connections to the transmission line being tested
IMPEDANCE switch (8) (OUTPUT)	Selects output Impedances of 135, 600, or 900 ohms to match Impedance of transmission line being tested
INPUT terminals (18)	Provide input connections from the transmission line being tested
IMPEDANCE switch (7) (INPUT)	Selects input Impedances to terminate the trans-mission line In 135, 600, 900, or 10,000 ohms
MEAS-CAL switch (9)	Selects measurement of the test set signal from the transmission line under test on MEAS, or measure-ment of the test signal from the signal generator on CAL

2-7. VOLTMETER OPERATING CONTROLS, INDICATORS, AND CONNECTORS
(Refer to figure 2-2 for locations]

CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
Voltage selection switch (at rear of voltmeter)	Permits operation from 115 volts or 230 volts ac
RANGE VOLTS DB control (12)	Selects range containing voltages to be measured Volts from 0.001 to 300, and from -72 to +52 dB in 12 ranges (1, 3, and 10 sequence)
FUNCTION switch (1)	Provides for battery test, and turning the voltmeter off or on
FUNCTION switch Indicator (1)	Glows when FUNCTION switch is at ON
BATT CHARGE indicator (19)	Lights red when the FUNCTION switch is at ON and the test set is connected to an ac power source
INPUT terminals (16)	Provide Input connections and chassis ground
DECIBELS RMS VOLTS meter (3)	Indicates voltages or decibels within the range selected by the RANGE VOLTS DB control
Adjusting screw (2)	Provides a means of setting the meter pointer to zero
Ac source voltage connection (at rear of voltmeter)	Connects the voltmeter to the power line receptacle on the telephone test set (*)

Section II. OPERATION UNDER USUAL CONDITIONS

2-8. TYPES OF OPERATION
- Telephone test set (*) may be operated as a general telephone circuit measuring device to measure frequency response, attenuation, or insertion loss. The individual components may also be used independently for general purpose testing.

- For types of operation using telephone test set (*), perform the starting procedure, procedures for the desired type of operation, and stopping procedure.

2-9. STARTING PROCEDURE
Make sure that connections and initial adjustments of equipment have been performed before this procedure is started.

PRELIMINARY CONTROL (Refer to figure 2-2)	POSITION
Signal Generator:	
Dial control (5)	Any
RANGE switch (4)	OFF
AMPLITUDE control (6)	Any
Attenuator:	
DB control (10)	0
FREQ switch (1 1)	Same as signal generator frequency
OUTPUT IMPEDANCE switch (8)	Any
INPUT IMPEDANCE switch (7)	Any
MEAS-CAL switch (9)	CAL
Voltmeter:	
FUNCTION switch (1)	OFF
RANGE VOLTS DB control (12)	A range higher than voltage to be measured

2-9. STARTING PROCEDURE - Continued

STARTING

- Set the signal generator RANGE switch to desired range of frequency to be used and allow 20 seconds to stabilize.
- Set the voltmeter FUNCTION switch to ON and allow 20 seconds to stabilize.

CAUTION

If the transmission line to be tested has dc voltages applied to it, connect a dc holding coil to each end of the line. This allows for a dc path and enables the signal to enter and leave the transmission line. No dc should be allowed to flow through the attenuator (figure 2-4).

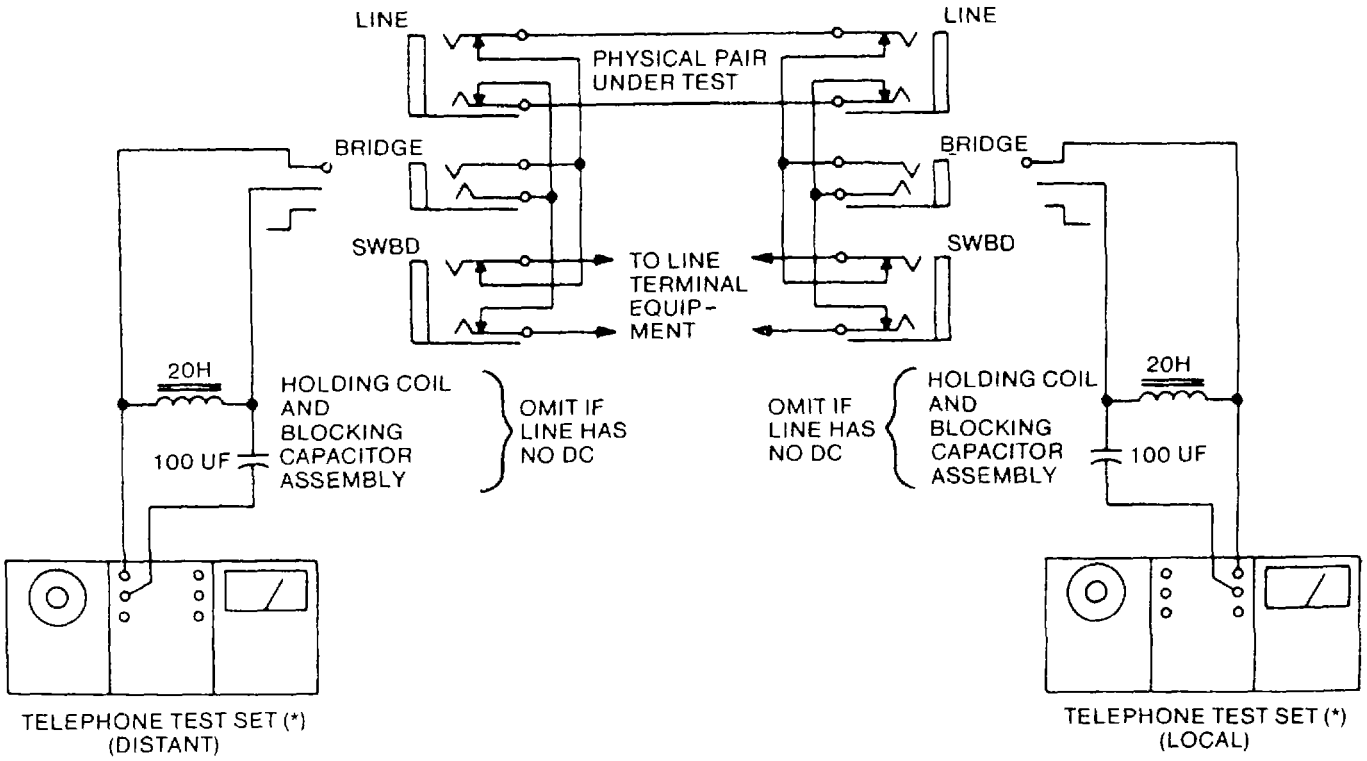


Figure 2-4. Transmission line tests (connection diagram)

2-10. MEASUREMENTS OF FILTERS, AMPLIFIERS, OR ATTENUATORS

Start the equipment and perform the following for measuring characteristics of filters, amplifier, or attenuators (figure 2-5).

- Set the signal generator RANGE switch and dial to testing frequency.
- Set the signal generator AMPLITUDE control to testing power level.
- Set the attenuator IMPEDANCE switches (INPUT and OUTPUT) to match impedance of the equipment under test.
- Set the attenuator FREQ switch to correspond to testing frequency <5 KC or >5 KC.
- Set the voltmeter RANGE switch to the 3-volt range and the FUNCTION switch to ON.

Various tests may be performed by varying the frequency of the signal generator with the frequency dial and RANGE switch the amount of attenuation with the DB control (10) on the attenuator and the output level of the signal generator with the AMPLITUDE control.

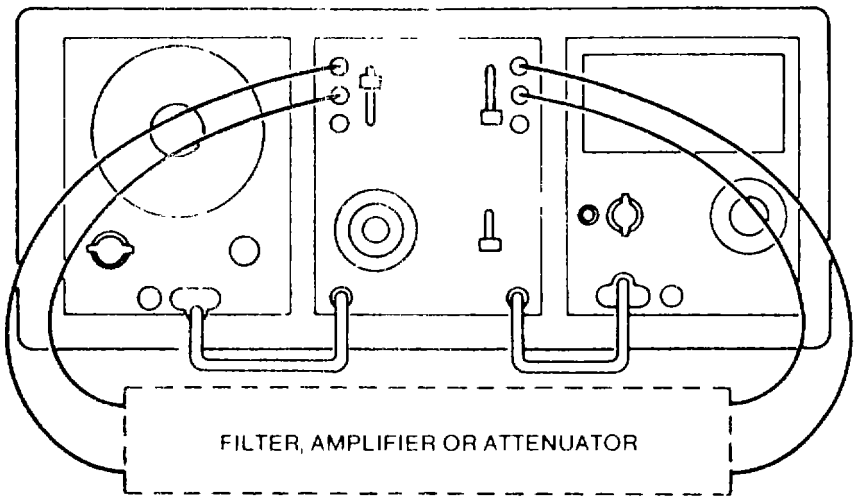


Figure 2-5. Filter, amplifier, and attenuator tests (connection diagram)

2-11. MEASUREMENTS OF TRANSMISSION LINES

- To perform measurements on telephone transmission lines, a telephone test set (*) Is required at each end of the line The telephone test set (*) connected to the distant end of the line supplies the test signal The telephone test set (*) connected to the local end of the line measures the amplitude of the test signal.
- Start the equipment and perform the following:

DISTANT TELEPHONE TEST SET (*)

A Set the signal generator frequency dial and RANGE switch to the testing frequency.

B Set the attenuator MEAS-CAL switch to CAL and the OUTPUT IMPEDANCE switch to match the impedance of the telephone line under test.

C If the telephone line has a dc potential, install a holding coil and blocking capacitor assembly (figure 2-5) to Isolate the attenuator and to complete the dc path for common battery circuits.

2-11. MEASUREMENTS OF TRANSMISSION LINES - Continued

D Connect the attenuator OUTPUT terminals to the telephone line.

E Adjust the signal generator AMPLITUDE control to the output level specified for the system.

F Set the attenuator MEAS-CAL switch to MEAS.

LOCAL TELEPHONE TEST SET (*)

A Set the voltmeter RANGE VOLTS DB switch to power level specified for the system

B Set the attenuator MEAS-CAL switch to MEAS and the FREQ switch to correspond to testing frequency.

C Set the attenuator INPUT IMPEDANCE switch to match the impedance of the telephone line under test, or the BRG. If the line power is to be measured while remaining connected to its normal load**.**

D If the telephone line has a dc potential, Install a holding coil and blocking capacitor assembly (figure 2-4) to Isolate the attenuator and to complete the dc path for common battery circuits.

E Connect the attenuator INPUT terminals to the LINE lack (figure 2-4) when the line is to be terminated and tested, to the BRIDGE lack when the line to be tested is terminated by terminal equipment or to the SWBD lack when the terminal equipment is to be tested**.**

F Read the power levels on the voltmeter.

2-12. VOLTAGE MEASUREMENTS

- Disconnect the voltmeter from the attenuator.
- Set the voltmeter FUNCTION switch to ON and allow a 20-second warmup period.
- Set the voltmeter RANGE VOLTS DB control to approximate level of voltage to be measured.

- Connect the voltage to be measured to the INPUT terminals of the voltmeter.

NOTE

When measuring voltages from a high Impedance source, hum pickup can affect the meter Indications The use of shielded leads will reduce pickup but may cause excessive circuit loading (at frequencies of 1 to 2 MHz in the 300-volt range, the accuracy is reduced to ± 10 percent).

2-13. DECIBEL MEASUREMENTS

- Disconnect the voltmeter from the attenuator.
- Set the voltmeter FUNCTION switch to ON and allow a 20-second warm-up period.

- Set the voltmeter RANGE VOLTS DB switch to approximate decibel level to be measured.
- Connect the signal voltage to be measured to the INPUT terminals of the voltmeter.

2-13. DECIBEL MEASUREMENTS - Continued

- The dB level is an algebraic sum of the dB scale indication and the RANGE VOLTS DB position.

NOTE

To measure power directly in dBm (0 dBm = 1 milliwatt into 600 ohms), the measurement must be made across 600 ohms. Measurements in differences of dB may be obtained by direct indictions of the meter and RANGE VOLTS DB control in each measurement is made same impedance value.

- To compute dBm signal level on transmission lines having Impedances other than 600 ohms, use the impedance correction graph (figure 2-6) to convert the voltmeter dB indication to dBm. Locate the transmission line impedance at the bottom of the graph and follow that impedance line up to the diagonal line. The dBm level is the algebraic sum of the level Indicated on the meter and the correction shown on the graph. For example: if the indication on the DECIBELS scale is +2, the RANGE selector switch is In the +30 position, and the measurement is made across an impedance of 135 ohms, the corrected level is +39 dBm and is obtained as follows:

+ 2	(meter Indication)
+30	(range switch position)
+32	(sum)
+ 7	(correction factor from graph)
+39 dBm	(corrected level)

2-14. USE OF SIGNAL GENERATOR WITH OTHER EQUIPMENT

CAUTION

To prevent damage to the telephone test set (*), install a blocking capacitor in series with the attenuator output when It Is to be connected to a circuit on which there is a dc potential The capacitor-voltage product (microfarad X volts) should be less than 200 Example For a 20-volt potential difference (200 ¸ 20 = 10) use a 1 O0-microfarad (/f) or smaller capacitor.

CAUTION

Do not connect the attenuator OUTPUT across loads which are off ground by more than ±25 volts.

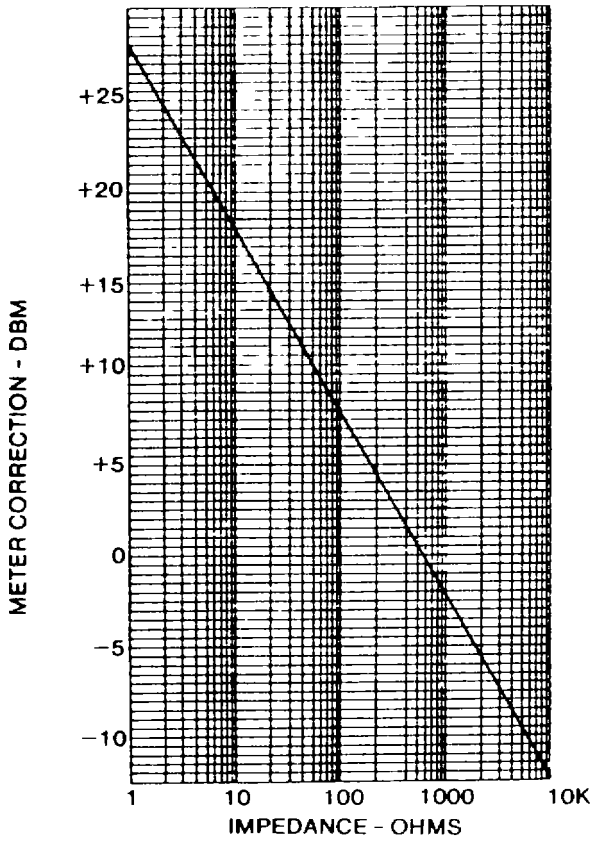


Figure 2-6. Impedance correction graph.

- Disconnect the signal generator from the attenuator.

- Set the signal generator RANGE switch and frequency dial to desired frequency output. Allow 10 seconds to stabilize.
- Set the signal generator AMPLITUDE control to desired level.
- Connect the signal generator OUTPUT terminals to 600-ohm load.

NOTE

If connected to loads other than 600 ohms, an instrument for impedance matching must be Installed between the signal generator and the load The attenuator may be used to match Impedances of 135 or 900 ohms.

2-15. STOPPING PROCEDURE

- Set the signal generator RANGE switch to OFF, and disconnect the patch cable from the attenuator
- Set the voltmeter FUNCTION switch to OFF, and disconnect the patch cable from the attenuator

NOTE

If equipment is to be carried, disconnect power cord from equipment and ac source (If connected). Store power and patch cables In cover and Install cover on equipment carrying case.

CHAPTER 3
MAINTENANCE

Section I. OPERATOR'S MAINTENANCE

3-1. SCOPE OF OPERATOR'S MAINTENANCE

The maintenance duties assigned to the operator of telephone test set (*) are listed below. These duties do not require special tools or test equipment.

- Preventive maintenance checks and services
- Cleaning

3-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

Refer to TM 750-244-2 for proper procedures for destruction of this equipment to prevent enemy use.

Scheduled PMCS are things that you must do at specified times to make sure that your equipment is operationally ready As scheduled PMCS is done, associated routine PMCS should also be done Scheduled PMCS, and when to do them, are listed In paragraph 3-4.

- Before you operate, always keep In mind and observe the WARNINGS and CAUTIONS contained in this technical manual and plates installed on the equipment that are associated with the functions you are about to perform. Perform your before (B) PMCS from the PMCS chart.

- While you operate, always keep in mind and observe the WARNINGS and CAUTIONS contained in this technical manual and plates Installed on the equipment that are associated with operation functions. Perform your during (D) PMCS from the PMCS chart.

Routine checks like CLEANING, PRESERVATION, DUSTING, WASHING, CHECKNG FOR FRAYED CABLES, STOWING ITEMS NOT IN USE, COVERING UNUSED RECEPTACLES, CHECKING FOR LOOSE NUTS AND BOLTS, AND COMPLETENESS are not listed as PMCS checks. They are things that you should do any time you see they must be done If you find a routine check like one of those listed in your PMCS, It is because other operators reported problems with this item.

NOTE

When you are doing any PMCS or routine checks, keep in mind the **WARNINGS** and **CAUTIONS**

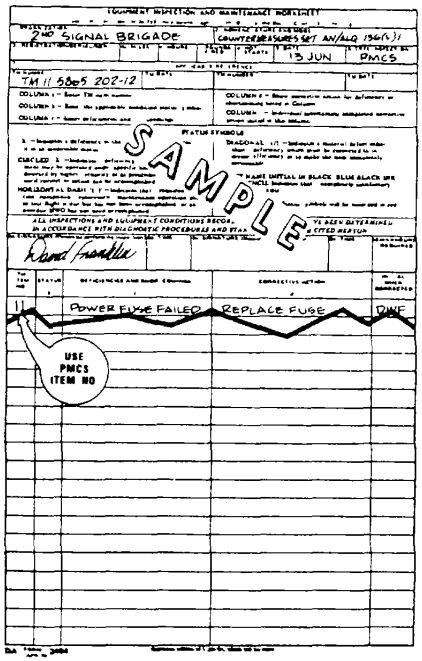
NOTE

The PROCEDURES column in your PMCS chart Instruct how to perform the required checks and services. Carefully follow these instructions.

3-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued
Use DA Form 2404 to report deficiencies and shortcomings found while doing PMCS.

NOTE

Use the PMCS Item No of the PMCS charts for the TM ITEM NO of Column a on DA Form 2404 (Equipment and Inspection Work Sheet)



3-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES PERIODS
Preventive maintenance procedures are designed to help maintain equipment in serviceable condition They include Items to be checked and how to check them These checks and services are classified as Before Operation (B), During (D), Weekly (W), and Monthly (M).

3-4. BEFORE OPERATION AND DURING OPERATION PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

B - Before D - During

Item No.	Interval B	Interval D	Item to be Inspected.	Procedure
1	•		Telephone test set (*)	Inspect equipment for completeness and satisfactory condition
2	•		Exterior surfaces	Remove dirt, dust, grease, moisture, and fungus from the exterior of the case, front panel, controls, and meter Inspect painted surfaces for bare spots, rust, and corrosion Inspect meter glass and indicator lens for cracks and breaks.

3-4. BEFORE OPERATION AND DURING OPERATION PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART - Continued

B - Before D - During

Item No.	Interval B	Interval D	Item to be Inspected.	Procedure
3	•		Line cord and connectors	Inspect the line cord for breaks, deterioration, and loose connections. Check tightness of all connectors
4	•	•	Controls and Indicators	While making operational checks (Item 5), observe that mechanical action of each knob, dial, and switch is smooth and free of external and internal binding, and that there is no excessive looseness. Check meter for sticking or bent pointer.
5		•	Operation	Operate the equipment according to the procedures outlined In chapter 2. Be alert for any unusual indications and conditions.

3-5. CLEANING

Inspect the exterior surfaces of the telephone test set (*) The exterior surfaces should be free of dust, dirt, grease, and fungus.

- Remove dust and loose dirt with a clean, soft cloth.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat of open flame, the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken Internally, consult a physician immediately.

- Remove grease, fungus, and ground-in dirt from the case. Use a cloth dampened (not wet) with cleaning compound.
- Remove dust or dirt from plugs and lacks with a brush.

CAUTION

Do not press on meter face (glass) when cleaning, the meter may be damaged.

- Clean the front panels, meter, and control knobs with a soft, clean cloth If necessary, use mild soap.

Section II. ORGANIZATIONAL MAINTENANCE

3-6. SCOPE OF ORGANIZATIONAL MAINTENANCE

- This section contains instructions covering organizational maintenance of telephone test set (*). It includes instructions for performing preventive arid periodic maintenance services, and repair function to be accomplished by the organizational repair person.

- Organizational maintenance of telephone test set (*) includes weekly preventive maintenance checks and services, monthly preventive maintenance checks and services, touchup painting, troubleshooting, and replacement of easily accessible items.

3-7. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

Refer to TM 750-244-2 for proper procedures for destruction of this equipment to prevent enemy use.

Organizational preventive maintenance procedures are designed to help maintain equipment in serviceable condition They Include items to be checked and how to check them. These checks and services are to be made at Weekly (W) and Monthly (M) intervals.

NOTE

When you are doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame, the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with the skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

3-8. WEEKLY AND MONTHLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Perform the maintenance functions indicated in the weekly and monthly preventive maintenance checks and services charts on the telephone test set (*) at the intervals specified and in the sequence listed Whenever an abnormal condition or result is observed, take corrective action In accordance with the paragraph listed under References. All deficiencies and shortcomings will be recorded, and those deficiencies not corrected during the preventive maintenance checks and services tests will be reported to higher level maintenance as specified in DA Pam 738-750. Equipment that has deficiencies which cannot be corrected at the organizational level will be deadlined in accordance with DA Pam 738-750 Equipment maintained In a standby condition (ready for Immediate operation) must have monthly maintenance checks and services. Equipment in limited storage (requires services before operation) does not require monthly preventive maintenance.

NOTE

A month is defined as approximately 30 calendar days of 8-hour-a-day operation. For 16-hour-a-day operation, the monthly preventive maintenance checks and services will be performed at 15-day intervals. Adjustment of the maintenance Interval must be made to compensate for any unusual operating conditions.

3-9. WEEKLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

W-- Weekly

Item No.	Interval W	Item to be Inspected	Procedure
1	•	Cables	Inspect cables for chafed, cracked, or frayed insulation. Replace connectors that are broken, stripped, or worn excessively.
2	•	Latches	Inspect latches for looseness. Replace or tighten as necessary.
3	•	Metal surfaces	Inspect exposed metal surfaces for corrosion, scratches, and pitting. Clean and touchup paint as required.
4	•	Panel mounting screws	Check all panel screws and retainers for tightness or breakage Replace or tighten as necessary

3-10. MONTHLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

M - Monthly

Item No.	Interval W	Item to be Inspected.	Procedure
1	•	Publications	See that all publications are complete, serviceable, and current.
2		Modifications	Check DA Pam 31 0-1 to determine if new applicable MWO's have been published All URGENT MWO's must be applied immediately All NORMAL MWO's must be scheduled.
3	•	Spare parts	Check all spare parts (operational and organizational) for general condition and method of storage No over-stock should be evident, and all shortages must be on' valid requisitions.
4	•	Jacks	Inspect lacks for snug fit and good contact.
5	•	Terminals	Inspect all terminals for tightness and good contact.
6	•	Carrying strap	Inspect carrying strap for wear or cuts.
7	•	Batteries	Check the batteries In the signal generator and volt-meter assemblies.

3-11. TOUCHUP PAINTING INSTRUCTIONS

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on bare metal to protect It from further corrosion.

3-12. GENERAL TROUBLESHOOTING INFORMATION

Troubleshooting this equipment is based on the operational check (Item 5 in chart of paragraph 3-4). To troubleshoot the equipment, perform all functions given in the preventive maintenance checks and services chart and proceed through the items until an abnormal condition or result is observed. Check the abnormal condition against the Trouble symptom column in the troubleshooting chart, and perform the checks and corrective actions indicated. If the corrective measures indicated do not result In correction of the trouble, higher level maintenance is required.

3-13. TROUBLESHOOTIN6 CHART

Item No	Trouble symptom	Probable trouble	Checks and corrective measures
1	Meter indicates less than 2.4 volts under test conditions outlined in paragraph 2-2, steps F and G.	Low battery voltage in voltmeter.	Charge voltmeter batteries (paragraph 3-15).
2	Meter indicates less than 2.3 volts under test conditions outlined in paragraph 2-2, steps I through N.	Low battery voltage in signal generator.	Charge signal generator batteries (paragraph 3-16).
3	Meter indicates zero under test conditions outlined in 1 and 2 above.	Defective fuse or loose connections	Check connections

3-14. REPLACEMENT OF EASILY ACCESSIBLE ITEMS

REPLACEMENT OF PLASTIC RETAINER

- Remove the screw holding the broken or cracked retainer.
- Replace with new retainer and screw.

REPLACEMENT OF SHOULDER STRAP

- Remove the four screws and plastic retainers holding the assemblies in the carrying case.
- Remove the assemblies from the carrying case and disconnect the ac power cords from the voltmeter and signal generator.
- Remove the nuts and washers holding the strap loop to the carrying case.
- Remove the strap from the strap loops.
- Replace the new strap on the strap loops.
- Replace the strap loops, nuts, and washers.
- Connect the ac power cords to the signal generator and the voltmeter.
- Replace the assemblies in the carrying case.
- Install the retainers and screws holding the assemblies in the carrying case.

REPLACEMENT OF COVER LATCH

- Remove the four screws and plastic retainers holding the assemblies in the carrying case.
- Remove the assemblies from the carrying case and disconnect the ac power cords from the voltmeter and signal generator.
- Remove the two nuts and washers holding the latch.
- Install the new latch, using the two nuts and washers.

3-14. REPLACEMENT OF EASILY ACCESSIBLE ITEMS - Continued

- Connect the ac power cords to the voltmeter and signal generator.
- Replace the assemblies in the carrying case.
- Replace the four screws and plastic retainers.

REPLACEMENT OF INTERNALAC POWER CORDS

- Remove the four screws and plastic retainers that hold the assemblies in the carrying case.
- Remove the assemblies from the carrying case and disconnect the ac power cords from the rear of the voltmeter and signal generator.

- Remove the two screws holding the external ac connector to the carrying case and remove Internal ac power cords.

- Install the new Internal ac power cords and replace the two screws holding the external ac connector to the carrying case.

- Connect the Internal ac power cords to the rear of the voltmeter and signal generator * Replace assemblies In carrying case.

- Replace the four screws and plastic retainers.

3-15. VOLTMETER BATTERY-CHARGING RATE CALIBRATION

The battery-charging rate is set at the factory and will not normally need readjustment. When the voltmeter is used in the field, a fast-charging rate may be necessary. When the voltmeter is used for bench work, a slow-charging rate is used to prolong battery life.

* Hold the FUNCTION switch on BATT TEST and observe the Indication on the meter If the voltage is below 2 4 volts recharge the batteries.

NOTE

To charge the voltmeter batteries, connect the voltmeter to an ac source and turn the FUNCTION switch to ON.

- Remove the voltmeter from the carrying case.

- Connect the voltmeter power cord to the ac power source.

- Set the FUNCTION switch to ON and allow a 2-minute warmup.

- Clip the dc milliammeter probe to the violet battery lead (figure 3-1).

- Adjust R39 for a 6 2-ma indication on the dc milliammeter (figure 3-2).

- Remove the dc milliammeter probe and replace the voltmeter In the carrying case.

NOTE

If the indication is in a negative direction, reverse the clip-on probe. Resistor R39 may be adjusted for a charging rate of 11 -ma indication on the milliammeter (fast charge) when the equipment is used primarily. In the field, where an ac charging source is not readily available. When the equipment is used primarily for bench work and connected to an ac source, do not adjust R39 for the fast charge rate. If the equipment is adjusted for the fast charge, attach a tag to the front of the equipment stating that the equipment is adjusted for fast charge, and the prolonged charging will shorten the battery life.

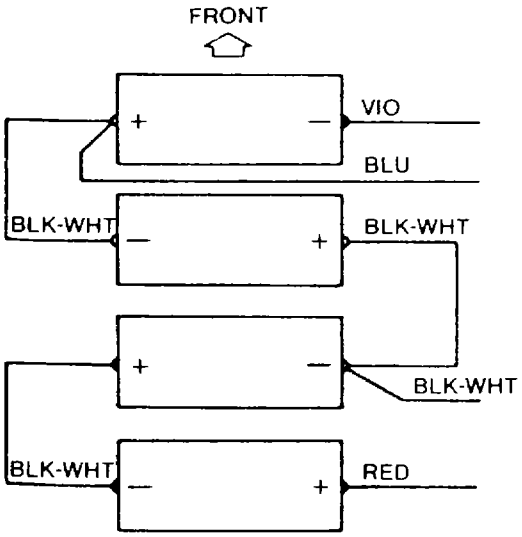


Figure 3-1 Voltmeter, battery wiring diagram.

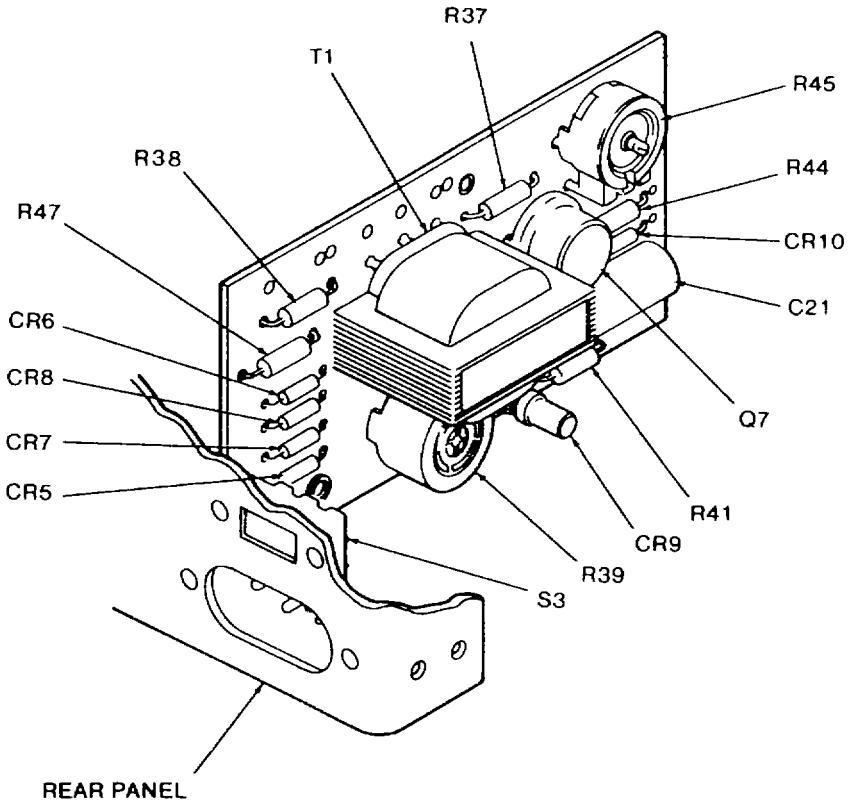


Figure 3-2. Voltmeter, parts location diagram.

3-16. SIGNAL GENERATOR BATTERY-CHARGING RATE CALIBRATION

ù The battery charger voltage is set at the factory and will not normally need readjustment. Use a clip-on dc milliammeter for this adjustment.

ù Adjust R102 (figure 3-3) as follows.

A Check batteries for full charge If not fully charged, recharge batteries. After the batteries are fully charged, proceed with steps below.

NOTE

To charge the signal generator batteries, connect the signal generator to an ac source.

B Set the RANGE switch to OFF

C Remove the signal generator from the carrying case.

D Connect the signal generator power cord to a proper ac outlet.

E Clip the dc milliammeter probe to the violet lead (figure 3-4) on the batteries.

F Adjust R102 for a milliammeter indication of 55 ma ±0 5.

G Remove the milliammeter probe and replace the signal generator In the carrying case.

NOTE

Resistor R102 may be adjusted for not more than 15-ma Indication on the milliammeter (fast charge) when the equipment is used primarily in the field where an ac charging source is not readily available. When the equipment is used primarily for bench work and is connected to an ac source, do not adjust R102 for the fast charge rate. If the equipment is adjusted for the fast charge, attach a tag to the front of the equipment, stating that the equipment is adjusted for fast charge, and that prolonged charging will shorten battery life.

3-17. BATTERY OPERATION

CAUTION

The hermetically sealed cells in these batteries may be permanently damaged or their life drastically reduced. If exposed to extremely high temperatures. This danger Increases under prolonged conditions

ù It is recommended that the power cord be connected to a power source whenever possible. This will prevent self-discharge of the battery cells and will assure a fully charged battery whenever portable operation is required. Turn the equipment off when not in use, particularly when operating with the power cord disconnected.

ù When fully charged, the batteries will power the signal generator for approximately 35 hours of continuous or intermittent operation provided they are at a temperature of 81 °F ± 10%. If the batteries are operated at higher or lower temperatures, their capacity is reduced as the temperature extremes are approached, approximately 28 hours at 122°F (50°C) or approximately 20 hours -4°F (-20°C) At temperatures beyond these extremes, the batteries are not capable of supplying their characteristic stable discharge voltage.

ù The +122°F to -4°F temperature range is adequate for most users, however, keep these limits in mind when operating under field conditions Internal temperatures In excess of 122°F are easily obtained If the instrument is left In the sun, even with a moderate ambient temperature. Good practice would be to avoid storing, transporting, or operating In direct sunlight other than for a very short period.

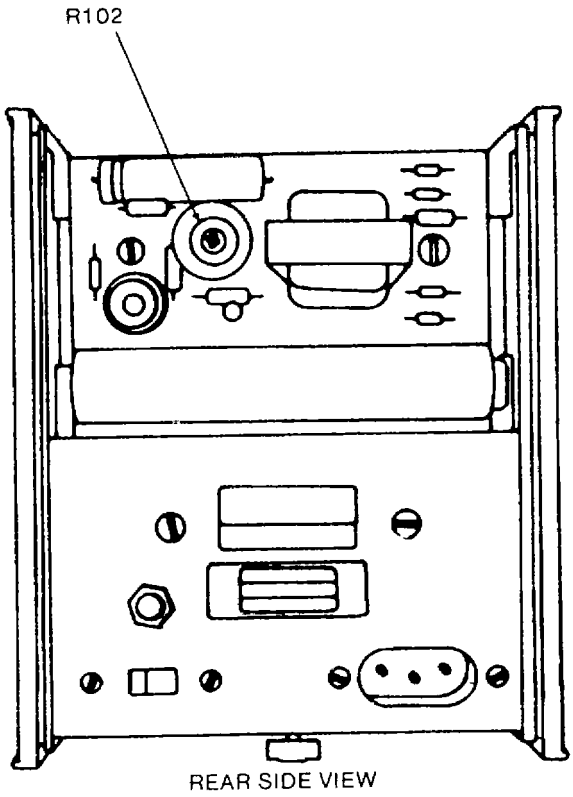


Figure 3-3 Signal generator, power supply board.

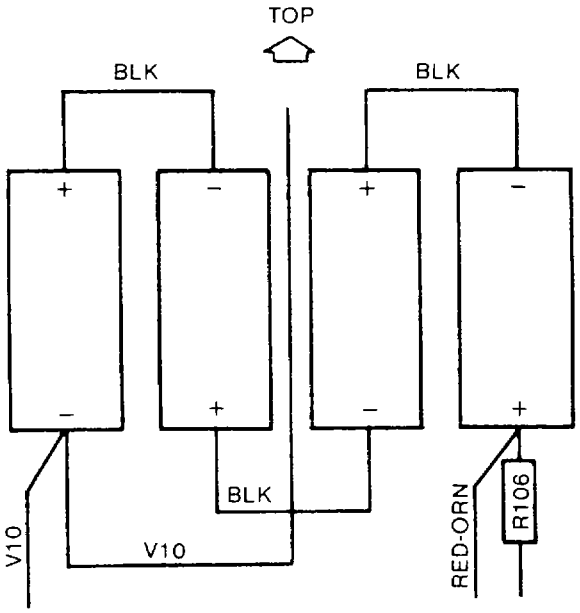


Figure 3-4 Signal generator, battery wiring diagram.

3-18. RECHARGING NICKEL-CADMIUM BATTERIES

CAUTION

The four nickel-cadmium batteries are hermetically sealed and can be damaged. If charged at a fast rate at temperatures above 104°F (40°C). Do not charge at the fast rate for more than 15 hours.

ù To recharge the batteries connect power cord to a suitable power source. The equipment can be used during recharging since the charge rate is the same whether the equipment is off or operating.

ù The fast charge rate should be used only when a quick charge is necessary. Repeated charging at a fast rate will shorten battery life.

ù The batteries will be fully charged in approximately 60 hours at the 6 mA SLOW charge rate, and 15 hours at the 20 mA FAST rate if they were fully discharged initially.

ù The batteries can be charged at any temperature between +32°F and + 104°F (0°C to +40°C). However, to obtain optimum battery life, recharging should be done at a temperature of 80.6°F ±10°F (27°C ±5.6°C).

3-19. CYCLE-LIFE OF NICKEL-CADMIUM BATTERIES

ù As extremes in temperature are approached, the cycle-life (complete charge-discharge cycles) of the batteries is reduced. Storage at high temperatures will increase the self-discharge rate and also decrease the cycle-life. Permanent battery damage may result if the batteries are stored at a high temperature for a prolonged period.

ù Battery cycle-life can be extended by recharging before the batteries are completely discharged, by charging at the slow rate, and by not overcharging.

ù The cycle-life of the batteries is based, by the manufacturer, on an end point of 80% of the rated 225 milliampere-hour capacity. This is with a ten-hour charge and discharge current of 22.5 milliamperes with discharge carried to the normal ten-hour end voltage (110 volts (cell X 5) = 5.50 volts (battery)) on every cycle. Under these conditions, a cycle-life in excess of 100 cycles can be expected

ù When used to power the equipment, the batteries are discharged at approximately a 35-hour rate. The batteries are not fully discharged if they are recharged as recommended.

ù Optimum battery life can be obtained by preventing complete battery discharge, keeping fast charges to a minimum, and operating at moderate temperatures when possible.

ù Disconnect power cord after 60 hours of continuous charging with signal generator turned off (15 hours if charging batteries at a fast rate).

APPENDIX A
REFERENCES

Following is a list of applicable publications available to the operator and organizational repairperson of telephone test set (*).

AR 380-40	Policy for Safeguarding and Controlling COMSEC Information
AR 735-11-2	Reporting of Transportation Discrepancies In Shipment
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TB SIG 222	Solder and Soldering
TB 43-0118	Field Instructions for Painting and Preserving Communications-Electronics Equipment.
TB 750-25	Administrative Storage of Equipment
TM 11-6625-602-20P-1	Organizational Maintenance Repair Parts and Special Tool Lists for Test Sets, Telephone AN/USM-1 81 B and AN/USM-1 81 C (NSN 6625-00-740-0344)
TM 11-6625-602-40-1	General Support Maintenance Manual for Test Set, Telephone, AN/USM-181 B
TM 11-6625-602-40P-1	General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools) for Test Set, Telephone AN/USM-181 B and AN/USM-181 C (NSN 6625-00-740-0344)
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command)

APPENDIX B
MAINTENANCE ALLOCATION CHART
Section I. INTRODUCTION

B-1. GENERAL

A This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

B The Maintenance Allocation Chart (MAC) In Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

C Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

D Section IV contains supplemental instructions and explanatory notes for a particular maintenance as referenced from Section II.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows.

A Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/ or electrical characteristics with established standards through examination.

B Test. To verify serviceability by measuring the mechanical or electrical characteristics of an Item and comparing those characteristics with prescribed standards.

C Service. Operations required periodically to keep an item In proper operating condition, i e, to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, hydraulic fluids, compressed air supplies, or gases.

D Adjust. To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

E Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

F Calibrate. To determine and cause corrections to be made or to be adjusted on Instruments or test, measuring, and diagnostic equipments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy In the accuracy of the Instrument being compared.

G Install. The act of emplacing, seating, or fixing into position an Item, part, or module (component or assembly) In a manner to allow the proper functioning of an equipment or system.

H Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

I Repair. The application of maintenance services1 or other maintenance actions[2] to restore serviceability to an Item by correcting specific damage, fault, malfunction, or failure In a part, subassembly, module (component or assembly) end item or system.

[1] Services - Inspect, test, service, adjust, align, calibrate, or replace.
[2] Actions - welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

B2. MAINTENANCE FUNCTIONS - Continued

J Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards in appropriate technical publications (i.e, DMWR) Overhaul is normally the highest degree of maintenance performed by the Army Overhaul does not normally return an item to like-new condition.

K Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards Rebuild is the highest degree of material maintenance applied to Army equipment The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc) considered In classifying Army equipment/components

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

A Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

B Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules on which maintenance is authorized.

C Column 3, Maintenance Function. Column 3 lists functions to be performed on the item listed in Column 2 (For detailed explanation of these functions, see paragraph B-2.)

D Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (2), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end Item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart The symbol designations for the various categories are as follows:

C - Operator or crew
O - Organizational maintenance
F - Direct support maintenance
H - General support maintenance
D - Depot maintenance

E Column 5, Tools and Test Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function The code in this column is keyed to the tool and test equipment list in Section III.

F Column 6, Remarks. Column 6 contains, when applicable, a code, which IS keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

A Column 1, Tool or Test Equipment Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

B Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

C Column 3, Nomenclature. Name or identification of the tool or test equipment.

D Column 4, National Stock Number. The National stock number of the tool or test equipment.

E Column 5, Tool Number. The manufacturer's part number.

Section II MAINTENANCE ALLOCAT ION CHART
FOR TEST SET, TELEPHONE AN/USM-181B, AN/USM-181C

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
00	Test Set, Telephone AN/USM-181B, AN/USM - 181C	Inspect	0.1						
		Service	0.2						A
		Test		0.2					B
		Repair		0.2		1.0		12	C
		Test				2.0		10,12	
		Adjust				1.0		1 thru 9, 11	D
		Align				1.0		1 thru 9, 11	E
		Overhaul					40 0	1 thru 9, 11	
01	Attenuator, Impedance Maltching CN-947B/USM-181, CN-947C/USM-181	Replace		0 2				12	C
		Rep,Cu		0 2				12	C
		Test				0 5		1 thru 9, 11, 13 thru 19	
		Repair				2 0			
0101	Attenuctor, Varnable (NSN 5905-00-910-7970)	Replace				0 2			
		Repair				1.0			
0102	Switch Assembly (FSCM 28480, Part No. 253A3A)	Replace				0.2			
		Repair				1.0			
02	Voltmeter, Electronic ME - 260B /U, ME- 260C /U	Replace		0.2				12	C
		Repair		0.2				12	C
		Test				0.5		1 thru 9, 11, 15	
		Repair				2.0		10,12	
0201	Circuit Card Assembly (NSN 5999-00-929-3597)	Replace				0.2			
		Repair				1.0		10,12	
0202	Clrcuit C,lrcl Assenibly (NSN 6625-00-110-4172)	Replace				0.2			
		Repair				1.0		10,12	
03	Signal Genei alor SG - 543B/U, SG - 543C/U	Replace		0.2					C
		Repair		0 2					C
		Test				0.5		1 thru 9, 11, 15	
		Repair				2.0		10,12	
0301	Circuit Card Assembly (NSN 6625-00-466-2628)	Replace				0.2			
		Repiur				1.0		10,12	
0302	Circuit Card Assembly (FSCM 28480, Part No. 00204-66528)	Replace				0.2			
		Repair				1.0		10,12	
04	Cable Assernbly, Radio Frequency	Repair		0.2	12				
05	Case, Test Set CY-7047/USM-181B	Repiar		0 2	12				
06	Case, Test Set (FSCM 28480, Part No. 11046-64404)	Repair				0.2		10,12	

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR TEST SETM TELEPHONE AN/USM-181B, AN/USM-181C

(1) Tool or Test Equipment Ref Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	H1,D	Oscilloscope AN/USM-281/A	6625-00-228-2201	
2	H,D	Meter Test, Set, TS-682/GSM-1	6625-00-669-0747	
3	H,D	Frequency Calhbrator Set AN/URM-18	6625-00-376-9793	
4	H,D	Frequency Meter AN/USM-459	6625-01-061-8928	
5	H,D	Analyzer, Spec TS-3237/U	6625-00-668-9418	
6	H,D	Electronic Voltmeter NIE-459/U	6625-00-229-0457	
7	H,D	Multimeter AN/PSNI- 45	6625-01-139-2512	
8	H,D	Multimeter AN/USM-486	6625-01-145-2430	
9	H,D	Test Set, Transistor TS-1836D/U	6625-00-138-7320	
10	H,D	Tool Kit, Electronic Equipment TK-100/G	5180-00-605-0079	
11	H,D	Oscllator SC-1128/U	6625-00-450-7590	
12	O, H,D	Tool Kit Electronic Equipment TK-101/G	5180-00-064-5178	
13	H,D	100K Ohm Shielded Resistoi		
14	H,D	200K Ohm Resistor		
15	H,D	600-ohm Resistor ± 1%		
16	H,D	67.5-ohm Resistol ±1% (2 required)		
17	H,D	150-ohm Resistor ±1% (3 required)		
18	H,D	300-ohm Resistor ±1% (2 required)		
19	H,D	450-ohm Resistor ±1% (2 required)		

SECTION IV REMARKS

REFERENCE CODE	REMARKS
A	Clean.
B	Operational, continuity checks of cords and cables.
C	Replace burned out fuses and damaged cables: charge batteries and fix connectors.
D	Voltage, current distortion.
E	Frequency tracking alignment.

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists components of end item and basic issue items for the telephone test set (*) to help you inventory Items required for safe and efficient operation.

C-2. GENERAL

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

A Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These Items are part of the end Item, but are removed and separately packaged for transportation or shipment. As part of the end Item, these items must be with the end item whenever it is issued or transferred between property accounts illustrations are furnished to assist you in identifying the items.

B Section III. Basic Issue Items. These are the minimum essential Items required to place the telephone test set (*) In operation, to operate it, and to perform emergency repairs. Although shipped separately packed, BII must be with the telephone test set (*) during operation and whenever It is transferred between property accounts. The illustrations will assist you with hard-to-identify Items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end Item.

C-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found In the tabular listings:

A Column (1) - Illustration Number. This column indicates the number of the illustration in which the Item is shown and the Item number.

B Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

C Column (3) - Description. Indicates the Federal Item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

Code	Used On
BDB	Model B
CUV	Model C

D Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance functions This measure is expressed by a two-character alphabetical abbreviation (e g, ea, in , pr).

E Column (5) - Quantity Required (Qty reqd). Indicates the quantity of the item authorized to be used with/on the equipment.

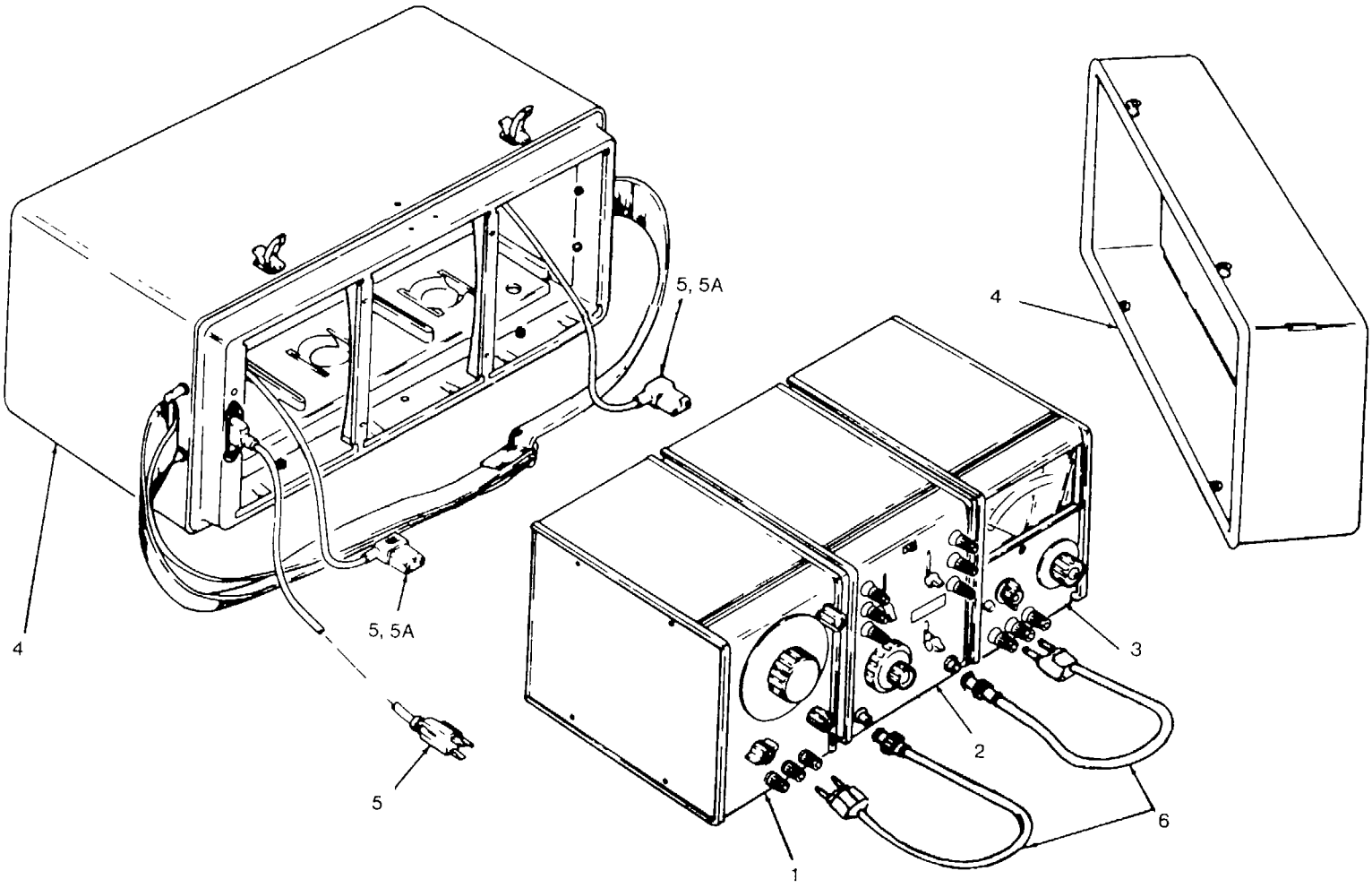
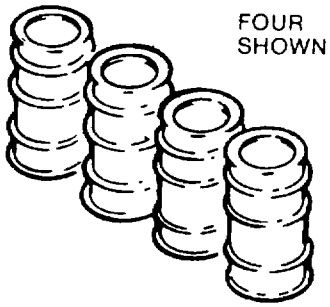


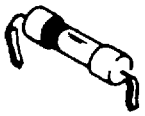
Figure C-1. Telephone test set (*).

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQD
C-1 (1)	6625-00-159-2356	GENERATOR, SIGNAL (80058) SG-543B/U	BDB	EA	1
C-1 (1)		GENERATOR, SIGNAL (80058) SG-543C/U	CUV	EA	1
C-1 (2)	6625-00-763-2390	ATTENUATOR, IMPEDANCE MATCHING (80058) CN-947B/USM-181	BDB	EA	1
C-1 (2)		ATTENUATOR, IMPEDANCE MATCHING (80058) CN-947C/USM-181	CUV	EA	1
C-1 (3)	6625-00-911-0744	VOLTMETER, ELECTRONIC (80058) M E-260B/U	BDB	EA	1
C-1 (3)		VOLTMETER, ELECTRONIC (80058) M E-260C/U	CUV	EA	1
C-1 (4)	6625-00-159-2357	TEST SET CARRYING CASE (80058) CY-7047A/USM-181 B	BDB,CUV	EA	1
C-1 (5)	61 50-00-351-3405	CABLE ASSEMBLY, ELECTRICAL POWER (80058) CX-1 259/USM-181 B	BDB	EA	3
C-1 (5)	6150-00-351-3405	CABLE ASSEMBLY, ELECTRICAL POWER (80058) CX-1 259/USM-181 C	CUV	EA	2
C-1 (5A)	CABLE ASSEMBLY,	ELECTRICAL POWER (70903) KH-7146	CUV	EA	2
C-1 (6)	5995-00-764-3646	CABLE ASSEMBLY, RADIO FREQUENCY (28480) CG-3566/U	BDB,CUV	EA	2



C-2



C-3

C-4

C-5

Section III. BASIC ISSUE ITEMS

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQD
C-2	6140-00-794-9959	BATTERY, STORAGE (31741) 6-0V2258	BDB,CUV	EA	8
C-3		FUSE, CARTRIDGE (75915) 315-062	CUV	EA	3
C-4	5920-00-221-4528	FUSE, CARTRIDGE (75915) 31 2-062	BDB,CUV	EA	2
C-5	6210-00-761-8898	LIGHT, INDICATOR (72765) 599-124	BDB,CUV	EA	1

APPENDIX D
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the telephone test set (*). These Items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)

D-2. EXPLANATION OF COLUMNS

A Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e g , "Use cleaning compound, Item 2, App D").

B Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed Item (enter as applicable).

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

C Column (3) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

D Column (4) - Description. Indicates the Federal item name and, If required, a description to identify the item, The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

E Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function, This measure is expressed by a two-character alphabetical abbreviation (e g , ea, In , pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C	8305-00-205-3496	CLOTH, COTTON, LINT FREE (81349)	1 YD
2	C	6850-00-105-3084	TRICHLOROTRIFLUOROETHANE	1 PT

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