

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT

AND GENERAL SUPPORT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS

FOR

PLUG-IN UNIT, SIGNAL LEAD EXTENSION TA-951/FTC

(STELMA SLU-DX-1/DX-2)

(NSN 6625-00- 602-5123)

EXTENDER, PRINTED WIRING BOARD MX-9664/FTC

(NSN 6625-00- 602- 5151)

AND

UNIVERSAL SHELF 90409000-000

(LINE CONDITIONING EQUIPMENT)

HEADQUARTERS, DEPARTMENT OF THE ARMY

NOVEMBER 1975

WARNING

DANGEROUS VOLTAGE

DEATH or SERIOUS INJURY may result from accidental contact with -48 volt dc power present in the equipment.

WARNING

The fumes of trichloroethane used for cleaning purposes are toxic. Provide thorough ventilation whenever used. Do not use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic dangerous gases.

TECHNICAL MANUAL
No. 11-5805-669-14&P



HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 4 November 1975

**Operator's, Organizational, Direct Support,
and General Support Maintenance Manual
Including Repair Parts and Special Tools Lists**

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Current as of July 1975

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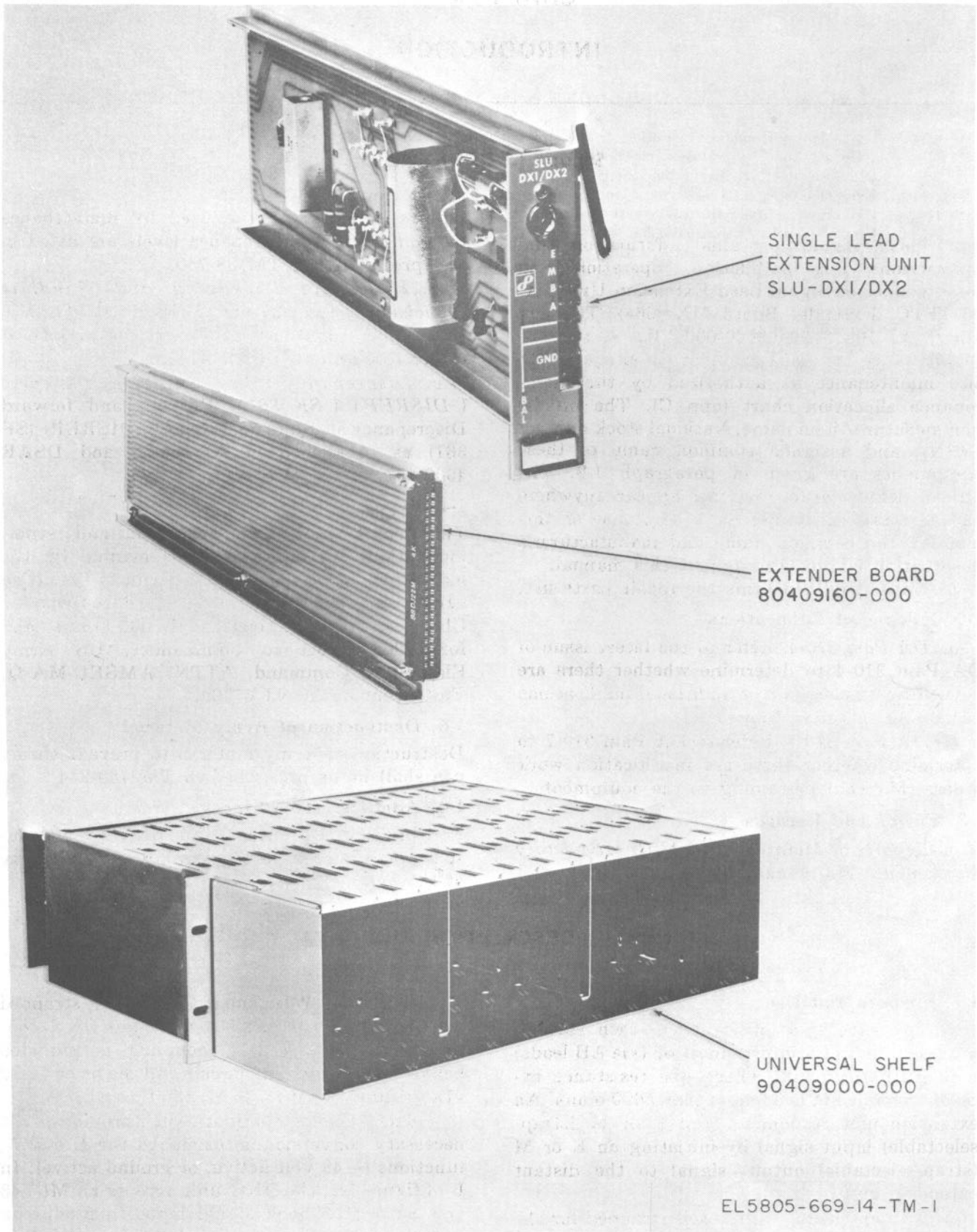


Figure 1-1. Signal lead extension unit SLU-DX-1/DX-2j extender board 80409160-000, and universal shelf 90409000-000.

CHAPTER 1

INTRODUCTION

Section I. GENERAL**1-1. Scope**

a. This manual contains information and instructions for installation, operation and maintenance of Signal Lead Extension Unit TA951/FTC, Extender Board MX-9664/FTC, and Universal Shelf 90409000-000 (fig. 1-1). The maintenance coverage includes on-site and offsite maintenance as authorized by the maintenance allocation chart (app C). The official nomenclature/ item name, National stock number (NSN), and assigned common name of these equipments are given in paragraph 1-9. The official nomenclature does not appear anywhere on the units; therefore, for ease of use of this manual, the common name and manufacturer's designation is used throughout this manual.

b. Appendix B contains the repair parts list.

1-2. Indexes of Publications

a. *DA Pam 310-4*. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Pam 310-7*. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. *Reports of Maintenance and Unsatisfactory Equipment*. Maintenance forms, records, and reports which are to be used by maintenance personnel at all

maintenance levels are listed in and prescribed by TM 38-750.

b. *Report of Packaging and Handling Deficiencies*. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58 and DSAR 4145.8.

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 and DSAR 4500.15.

1-4. Reporting of Errors

The Reporting of errors, omissions and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-Q, Fort Monmouth, NJ 07703.

1-5. Destruction of Army Materiel

Destruction of Army materiel to prevent enemy use shall be as prescribed in TM 750-244-2.

1-6. Administrative Storage

For procedures, forms, and records, and inspections required during administrative storage of this equipment, refer to TM 740-90-1.

Section II. DESCRIPTION AND DATA**1-7. Purpose and Use**

a. Two extension units (one at each station) provide full-duplex interconnection (via AB leads) for signaling circuits whose line resistance exceeds 25 ohms but is no more than 5000 ohms. An extension unit responds to an E or M (strap selectable) input signal by initiating an E or M (strap-selectable) output signal to the distant extension unit.

b. Two extension units, each strapped for the DX-1 configuration (fig. B-2) provide full-duplex coupling between two dc signaling circuits (M to E, and M to E).

With one extension unit strapped for the DX-1, and the other for the DX-2 configuration (C, fig. 1-2), coupling is provided between a dc signaling circuit and the dc end of a vf signaling circuit (M to M, and E to E).

c. The DX-2 configuration provides the necessary conversion to exchange the E and M functions (-48 volt active, or ground active). In B of figure 1-2, the DX-1 unit accepts an M(-48 volt active) off-hook signal input to produce a busy signal at the associated DX-1 unit E-lead (ground active) output.

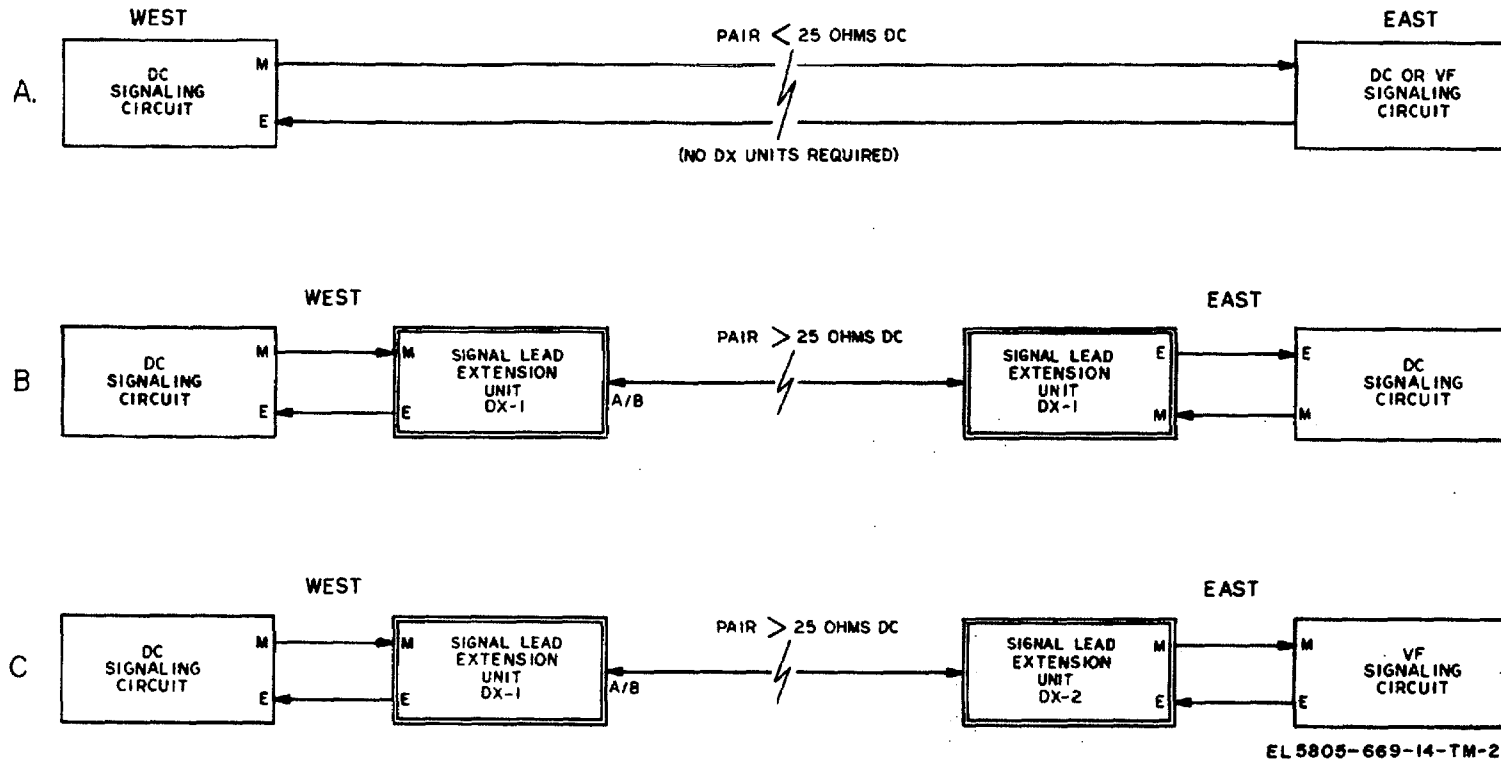


Figure 1-2. Extension unit, mode of operation.

d. In C of figure 1-2, the DX-1 unit accepts an M-lead (-48 volt active) off-hook signal input to produce a busy signal, at the associated DX-2 card M-lead (-48 volt active) output. The DX-2 unit accepts an E-lead (ground active) off-hook signal input to produce a busy signal, at the associated DX-1 unit E-lead (ground active) ½ output.

1-8. Technical Characteristics

The following technical characteristics apply to the extension unit.

Resistance range of facility requiring DX-1 or DX-2 signaling.....	25 to 5000 ohms.
Pulse rate.....	8 to 14 pps.
Inputs:	
DX-1.....	M-lead grounded, on-hook (idle); M-lead at -48 volts dc, off-hook (busy).
DX-2.....	E-lead open, on-hook (idle); E-lead grounded, off-hook (busy).
Outputs:	
DX-1.....	On-hook, E-lead grounded (at distant station); Off-hook, E-lead at -48-volt dc (at distant station).
DX-2.....	On-hook, M-lead grounded (at distant station);

	Off-hook, M-lead at -48-volt dc (at distant station).
	Percent break (ratio of on-hook station to off-hook X 100, during continuous signaling) 47 to 67 %.
Accuracy.....	4% maximum distortion or less.
Input power	48-volt dc, 30 ma, maximum at 25-ohm loaded facility (DX-1);
46-	ma maximum at 25-ohm loaded facility (DX-2).
Environment:	
Nonoperating:	
Air temperature	40° F. to +158° F.
Relative humidity (percent)	95% RH mixture including condensation due to temperature change. +32° F. to +126° F. 95 % RH mixture including condensation due to temperature changes.

1-9. Items Comprising an Operable Equipment

The official nomenclature/item name, National stock number (NSN), and assigned common name of the equipment covered in this manual are listed in the following chart and illustrated in figure 1-1.

NSN	Nomenclature	Common Name	Qty	Height (in.)	Depth (in.)	Width (in.)	Unit	
							Weight (pounds)	Volume (cu. in.)
6625-00-602-5123	Plug-In Unit, Signal Lead Extension TA-951/FTC	Extension unit	1	4 7/8	15	1 3/8	12	100 1/2
6625-00-602-5151	Extender, Printed Wiring Board MX-9664/FTC	Extender board	1	4 5/8	15	7/8	11	60 3/4
	Universal Shelf 90409000-000	Universal shelf	1	5 1/4	16 1/2	19	15.5	1645 7/8

1-10. Description

a. *Extension Unit.* The unit comprises a plug-in printed-circuit (PC) card whose attached front panel contains a handle. A balance adjustment and associated test-points, and a ballast lamp are accessible at the front panel. The card mounts two relays (one of which is a 4-winding mercury-wetted-contact type) and associated passive components. The module may be strapped for the DX-1 configuration (M input, E output) or the DX-2 configuration (E input, M output).

b. *Extender Board.* The extender board enables electrical connection of the extension unit to the universal shelf wiring, while exposing module test points, adjustments, and component parts for maintenance purposes.

c. *Universal Shelf.* The universal shelf, which is front mounted in a standard 19-inch rack, can receive a maximum of 12 extension unit modules. The top and bottom cover plates are equipped with PC card guides to facilitate installation and removal of extension unit modules. Vent holes in the top and bottom cover plates permit the circulation of cooling air. Two stiffener plates, riveted between the top and bottom cover plates, provide additional rigidity. Each of twelve 22-pin receptacles at the rear of the universal shelf provides electrical connections for the extension unit module PC card with which it mates. A cover plate, which is screw-fastened to two brackets on the rear of the universal shelf, protects the electrical receptacles.

CHAPTER 2

SERVICE UPON RECEIPT AND INSTALLATION

Section I. SYSTEMS PLANNING**2-1. General**

Two extension units (one at each station) provide full-duplex interconnection for signaling circuits whose line resistance exceeds 25 ohms but is not more than 5000 ohms. Figure 2-1 shows a typical system application of an extension unit. The extension unit is installed in any one of 12 module locations (22-pin receptacles) in the universal shelf. The universal shelf mounting dimensions are shown in figure 2-2. Allow at least a 20-inch clearance at the front of the universal shelf for

insertion, removal, and maintenance of the extension unit. A similar clearance of 24 inches should be allowed at the rear of the universal shelf for ease of wiring connections and maintenance. If the universal shelf is to be mounted in Universal Rack 90409001-000, refer to TM 11-5805-666-14& P for additional systems planning information. Input/output signal characteristics, power requirements and environmental conditions are listed in paragraph 1-8.

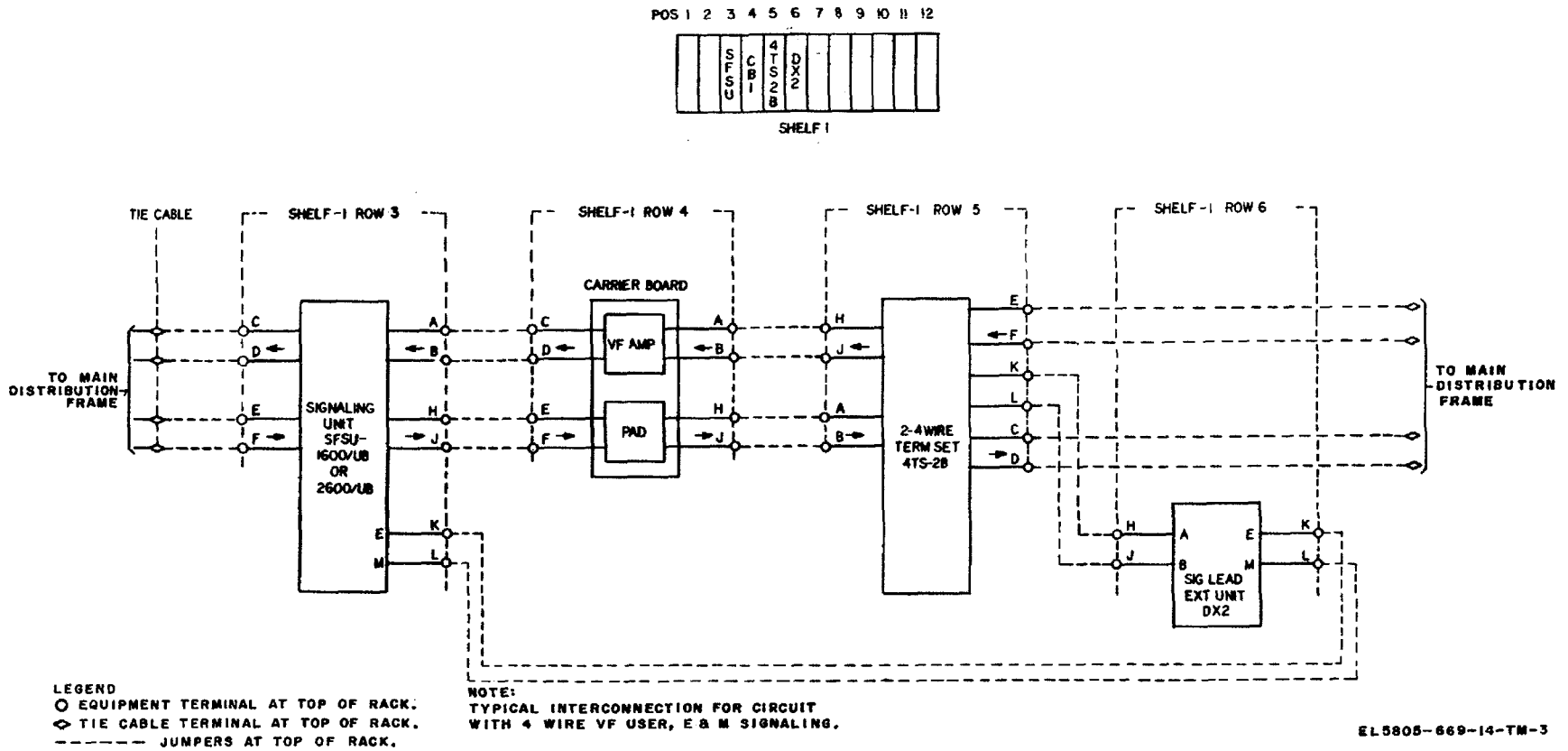
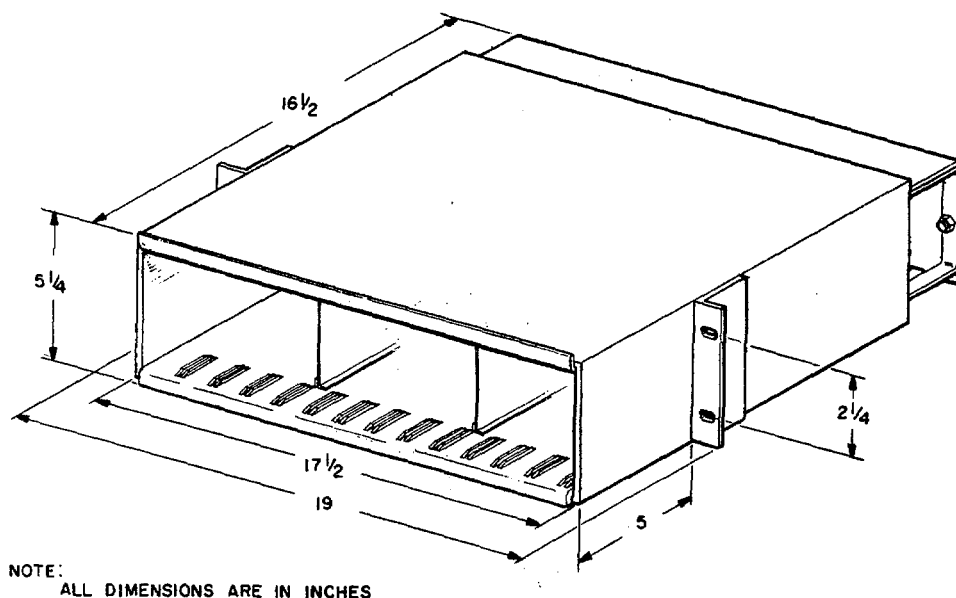


Figure 2-1. Extension unit, typical system application



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Figure 2-2. Universal shelf, mounting dimensions.

2-2. Site and Shelter Requirements

The extension unit and universal shelf are to be installed in predetermined, fixed rack or cabinet locations;

therefore, no detailed information is required for site and shelter considerations.

However, all requirements stated under system planning (para 2-1) are also applicable to shelters.

Section II. SERVICE UPON RECEIPT OF MATERIEL

2-3. Unpacking

The extension unit, extender board and universal shelf are wrapped in greaseproof, waterproof covering, and shipped from the factory in fiberboard boxes prepared with cellulosic cushioning material. Other than exercising normal care in handling, no special precautions are required in unpacking the equipment. Similarly, no special preparations are required of the installation area to receive the equipment.

comprising an operable equipment list (para 1-9). Report all discrepancies in accordance with paragraph 1-3c. The equipment should be placed in service even though a minor assembly or part, that does not affect proper functioning is missing.

c. Check to see whether the equipment has been modified. (Equipment which has been modified will have the MWO number on the front panel, near the silk screened nomenclature.) Also, check to see whether all currently applicable MWO's have been applied. (Current MWO's applicable to the equipment are listed in DA Pam 310-7.)

2-4. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1-3b).

d. For dimensions, weight, and volume of packaged items, see paragraph 1-9.

b. Check equipment against the packing slip to see if the shipment is complete. If a packing slip is not available, check the equipment against the items

Section III. INSTALLATION

2-5. Tools, Test Equipment, and Materials Required for Installation

No special tools or materials are required for installation of the extension unit and the universal shelf. The extender board is provided for use by direct support maintenance personnel in performing onsite maintenance. Multimeter AN/USM-233 is the only piece of test equipment required for preliminary adjustment of equipment and initial checks following equipment installation.

2-6. Installation Instructions

WARNING

Be sure that 48-volt dc operating power is removed from the rack or cabinet.

a. Place the universal shelf into the desired rack or cabinet mounting position and align mounting bracket slots (fig. 2-2) with mounting hardware.

b. Strap the module in accordance with the instructions of paragraph 2-8 for the desired DX-1 or DX-2 configuration.

CAUTION

Before installing the module, position the module in its normal mounted position (handle up; front panel vertical) outside of the universal shelf. Maintain module in this position for at least one minute to insure that the mercury has drained from the relay (K1) contacts.

c. Insert extension unit into universal shelf and check to see that the extension unit connector firmly engages the shelf receptacle.

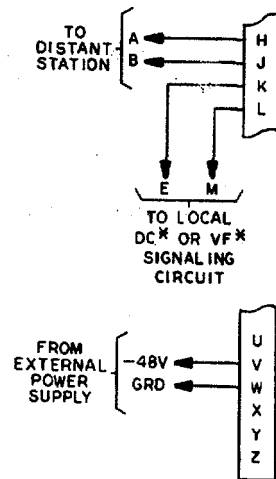
d. Connect wires from universal shelf rear connector for the extension unit directly to a terminal block at the top of the rack or cabinet. Perform the associated jumper connections at the terminal boards for the associated system modules and main distribution frame, as required. Figure 2-1 shows typical signal wiring jumper connections. Figure 2-3 shows external wiring connections for an extension unit at the universal shelf connector.

NOTE

All required electrical connections for the extension unit are effected when the module is installed in the

universal shelf and the universal shelf connector wiring is completed.

e. Insert extension unit (maximum of 12) into universal shelf, and check to see that all module connectors are firmly seated in shelf receptacles.



* FOR DC SIGNALING USE CARD STRAPPED FOR DX-1 CONFIGURATION.
 FOR VF SIGNALING USE CARD STRAPPED FOR DX-2 CONFIGURATION.

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Figure 2-3. Extension unit, external wiring connections.

f. Color coding of cable wire-pairs facilitates wire connections without the need for checking wire continuity. The color-coding permits installation personnel to identify, in any cable, the first wire-pair through the last wire-pair. A mate color, color-coding system is used to distinguish among the different groups, and pairs, within the groups. By means of the mate-wire, the various groups in a cable may be distinguished from one another. For example, the mate-wire of every pair in a particular group will be the same color. The color-wire distinguishes the pairs that make up each group.

g. Perform circuit lineup and initial checks of paragraphs 2-9 and 2-10.

Section IV. PRELIMINARY ADJUSTMENT OF EQUIPMENT

2-7. Preliminary Checks and Adjustments

Preliminary checks and adjustments include:

extension unit strapping options, circuit lineup, and initial check of the module once the extension unit is installed in the universal shelf. All of these functions are the responsibility of direct support maintenance personnel.

2-8. Extension Unit Strapping Options

(fig. FO-2)

Strap for DX-1 configuration to interface with a dc signaling circuit. Strap for DX-2 operation when interfacing with the dc end of a vf signaling circuit.

- a. DX-1 Strapping.
B-C, E-F, H-J, L-M, and P-R
- b. DX-2 Strapping.
A-B, D-E, G-H, K-L, and N-P

2-9. Circuit Lineup

Circuit lineup is to be performed on any extension unit module following installation. Circuit lineup should also be performed before troubleshooting, or whenever it is suspected that improper adjustment is contributing to faulty extension unit operation. Perform the following circuit adjustment steps in the order indicated. Refer to figure B-3 for locations of adjustment controls, test points, and strapping terminals.

- a. Check battery 48-volt dc power supply (at both local and distant stations) for -48 volts nominal level.

- b. Place distant station in on-hook condition.
- c. Place local station in off-hook condition.
- d. Using a multimeter, measure voltage (should be less than 24 volts) across front-panel test points A (TP4, -) and BAL (TP5, +). Note indication.
- e. Connect multimeter across BAL test-points TP5 (-) and TP6 (+).
- f. Adjust front-panel BAL control R1 for indication of 1/4 of the value noted in step *d* above.
- g. Repeat *b* through *f* above for distant station.

2-10. Initial Checks

- a. Doublecheck that the extension units are firmly inserted in the universal shelf.
- b. Doublecheck all external connections at the universal shelf rear connector, rack or cabinet terminal block, and distribution frame.
- c. Using a multimeter, check for presence of -48 volts across terminals V(-) and W(+) on universal shelf rear connector.

CHAPTER 3

OPERATING INSTRUCTIONS

3-1. Operating Controls and Instructions

The operation of the extension unit is automatic, requiring no operator attention. Consequently, no preoperational control settings, starting procedures, operating procedures, or stopping procedures are associated with this equipment.

3-2. Operation Under Unusual or Emergency Conditions

The extension unit maintains its technical characteristics over a wide temperature and humidity range (para 1-8); therefore, no change occurs to the equipment operation because of environmental conditions or emergency communications conditions.

3-3. Preparation for Movement

No operator instructions are involved.

NOTE

The equipment is installed in a communication facility and movement to a new location involves dismantling and where necessary repacking. These functions are performed by direct support maintenance personnel who essentially perform the procedure of paragraph 2-6 in reverse.

CHAPTER 4

FUNCTIONING OF EQUIPMENT

4-1. Introduction

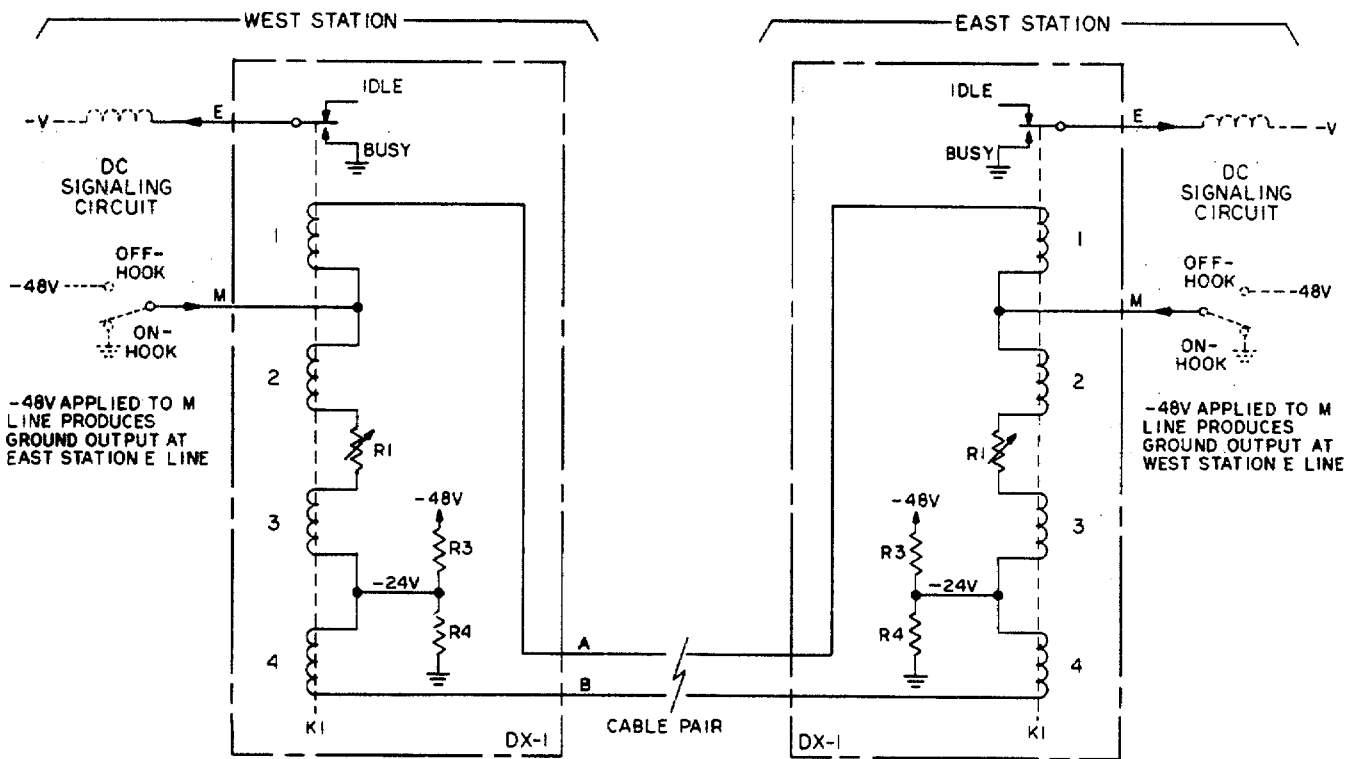
This chapter contains the theory of operation of the extension unit. Depending on the internal strapping applied, the module can function in a DX-1 or DX-2 configuration. The essential differences between the two is that the DX-1 provides an E-lead (ground active) output and an M-lead (-48 volt active) input, and the DX-2 provides an E-lead input and an M-lead output.

The functional description which follows is divided into these two categories of operation.

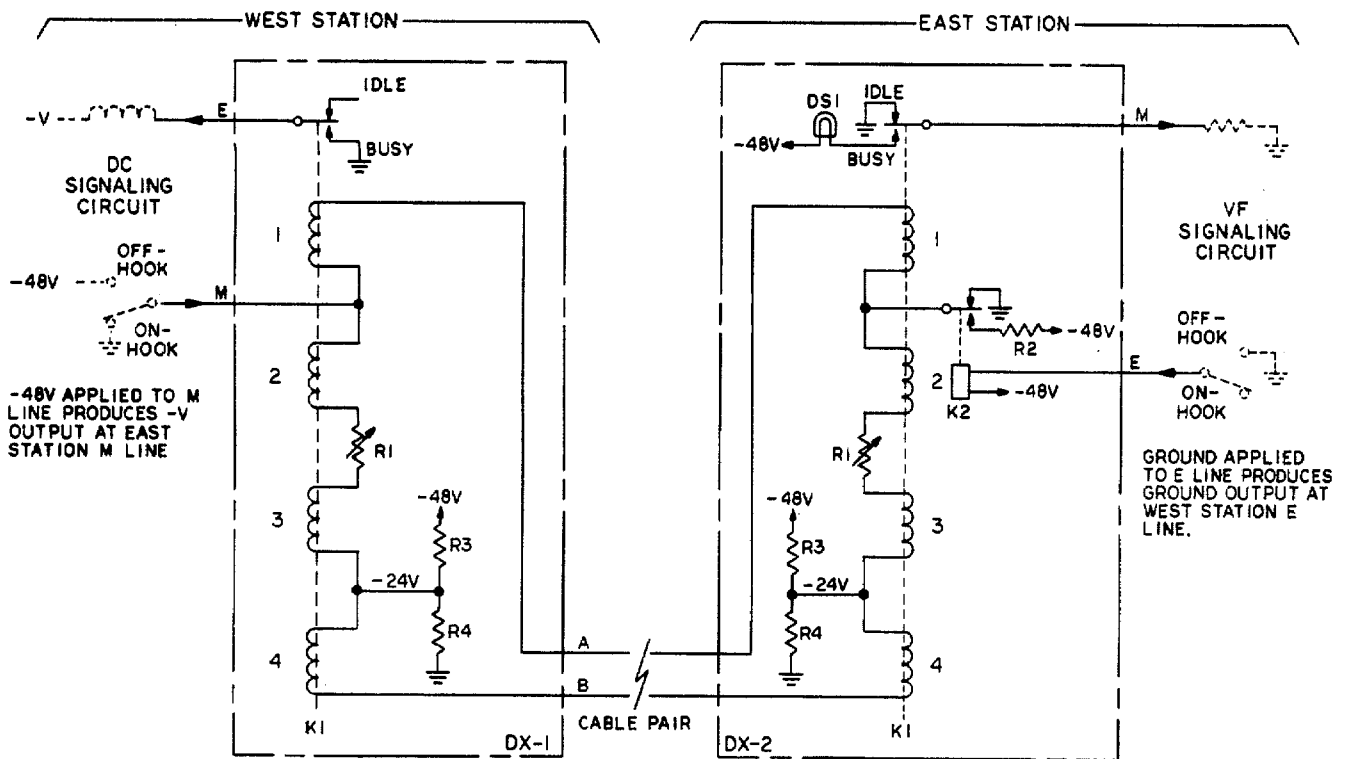
Due to the simplicity of the circuits involved, the circuit analysis is interspersed in this discussion.

4-2. Functional Circuit Analysis

a. *General.* Figure 4-1 is a simplified schematic diagram of the extension unit in both modes of operation. Figure FO-2 is a schematic diagram of the extension unit.



A. DX-1/DX-1 CHANNEL



B. DX-1/DX-2 CHANNEL

Figure 4-1. Extension unit, simplified schematic diagram.

b. *DX-1 Operation.* A of figure 4-1 shows two DX-1 units connected to provide full-duplex J signaling between two stations (east and west). With both stations on-hook as shown, current flows through windings 2 and 3 of both K1 relays. Maintaining both K1 relays in the idle condition, produces no outputs on the E-lead lines. The arrangement is such that: (1) when either station is on-hook, the other station's K1 relay is idle; (2) when either station is off-hook, the other station's K1 relay is busy.

(1) *Off-hook.*

(a) When the west station goes off-hook, -48 volts is applied to the M-lead (-48-volt active) line. The resulting current flow through west station winding 1, maintains K1 in idle position, and through east station winding 1 (resultant flux overcomes opposing flux in-windings 2 and 3) sets west relay K1 to its busy position. The east station relay K1 thus applies a ground output through line E (ground active) to signify that the west station is off-hook.

(b) If, in reply, the east station goes off-hook, current flow through winding 1 of both K1 relays ceases, since -48 volts is applied to both M-lead (-v active) lines. East station relay K1 remains in the busy position, so that -48 volts causes current flow through west station winding 2 and 3, setting K1 to busy position. West station relay K1 applies a ground output through line E (ground active) to signify that the east station is off-hook.

(2) *On-hook.*

(a) If the west station first goes on-hook, -48 volts at the east station causes current flow through east station winding 1 (setting K1 to idle) and through west station winding 1 (maintaining K1 busy).

(b) If, at this point, the east station goes on-hook, current through winding 1 of both K1 relays ceases. Current flow through east station windings 2 and 3 now sets K1 to idle.

(3) *Compensation.*

(a) When a given rate of current flows through winding 1, the resultant flux is twice that produced when the same rate of current flows through the series configuration of windings 2 and 3. Since station-to-station line resistance is in series with winding 1, BAL potentiometer R1 is adjusted to introduce a corresponding resistance in series with windings 2 and 3.

(b) Winding 4 compensates for differences in ground potential between stations. If, for example, the east station were negative with respect to the west station, current would flow from ground,

through east station winding 1 (producing a given flux) and through east station winding 4 (producing an equal, opposing flux). The same applies to the west station, except that current directions are opposite.

c. *DX-2 Operation.* B of figure 4-1 shows DX-1 and DX-2 units connected to provide a dc signaling circuit and the dc end of a vf signaling circuit (M to M and E to E). With both east and west stations on-hook as shown, current flows through windings 2 and 3 of both K1 relays. Maintaining both relays in the idle condition produces no output on the west station E-lead and a ground output on the east station M-lead. The arrangement is such that: (1) when either station is on-hook, the other station's K1 relay is idle; (2) when either station is off-hook, the other station's K1 relay is busy.

(1) *Off-hook.*

(a) When the west station goes off-hook, -48 volts is applied to the M-lead (-48-volt active) line. The resulting current flow through west station winding 1, maintains K1 in idle position, and through east station winding 1 (resultant flux overcomes opposing flux in-windings 2 and 3) sets east relay K1 to its busy position. East station relay K1 thus applies a 48-volt output through M-lead (-48-volt active) to signify that the west station is off-hook.

(b) If, in reply, the east station goes off-hook, the east station E-lead goes to ground energizing relay K2. Current flow through winding 1 of both K1 relays ceases, since -48 volts is now applied to winding 1 of both K1 relays. East station K1 remains in busy position, due to current flow through R2 and windings 2 and 3 of K1, so that -48 volts causes current flow through west station windings 2 and 3, setting west station relay K1 to busy position. K1 applies a ground output through line E (ground active) to signify that the east station is off-hook.

(2) *On-hook.*

(a) If the west station first goes on-hook, -48 volts at the east station causes current flow through east station winding 1 (setting east station relay K1 to idle) and through west station winding 1 (maintaining west station relay K1 busy).

(b) If, at this point, the east station goes on-hook, current through winding 1 of both K1 relays ceases. Current flow through east station windings 2 and 3 now sets K1 to idle.

(3) *Compensation.* In this mode of operation, the function is identical to that described in b (3) above.

CHAPTER 5

ON-SITE MAINTENANCE

Section I. GENERAL

WARNING

DANGEROUS VOLTAGE; DEATH or SERIOUS INJURY may result from accidental contact with - 48 volt dc power present in the equipment.

5-1. Scope of On-Site Maintenance

This chapter contains instructions for performing on-site preventive and corrective maintenance procedures, and the associated testing procedures. If the performance of authorized corrective maintenance procedures does not result in a serviceable equipment, off-site maintenance is required. The responsibility and scope of maintenance is assigned by the maintenance allocation chart (MAC) (app C).

5-2. Tools, Test Equipment, and Materials Required

a. The tools and test equipment required for maintenance and performance tests are listed and identified in paragraph 5-7 a Refer to the repair parts list (app B) for repair parts authorized for on-site maintenance.

b. The materials required for preventive maintenance are listed below.

- (1) Cleaning cloth (NSN 8305-00-267-3015).
- (2) Brush, paint, 1/2-inch width.
- (3) Trichloroethane (NSN 6910-00-6640273).

Section II. PREVENTIVE MAINTENANCE AND TROUBLESHOOTING

5-3. Preventive Maintenance

a. *General.* Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and insure maximum operational capability. Preventive maintenance includes the inspection, testing, and replacement of parts that inspection and tests indicate would probably fail before the next scheduled periodic service.

b. *Preventive Maintenance Checks and Services Periods.* Tables 5-1 and 5-2 list the preventive maintenance checks and services for the equipment. These checks and services must be performed during the specified periods. Records and reports of the preventive maintenance checks and services must be made in accordance with the requirements set forth in TM 38-750.

c. *Cleaning.*

- (1) Remove accumulated dust and dirt from the equipment using a vacuum cleaner

with plastic hose nozzle and dust brush or a clean, dry, lint-free cloth.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic, dangerous gases.

- (2) Remove smudges or stubborn, dirty surface areas by wiping with a clean lint-free cloth moistened with trichloroethane. Wipe dry with a clean, dry cloth.

d. *Refinishing.* Remove rust and corrosion from metal surfaces. Refer to the applicable cleaning and refinishing practices specified in TB 746-10.

Table 5-1. Organizational Weekly Preventive Maintenance Checks and Services

Sequence No.	Item to be Inspected	Procedure	Reference
1	Module front panel condition.	Clean front panel exterior surfaces.	Para 5-3c.
2	Cable assemblies	a. Clean cable insulation. b. See that cable insulation is not cut, cracked, or abraded; repair insulation cuts, cracks, and abrasions with electrical insulation tape as necessary. c. Remove kinks and strains. d. Tighten loose mechanical connections, if necessary.	Para 5-3c.
3	Equipment surfaces	Remove any buildup of dirt.	Para 5-3c.

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

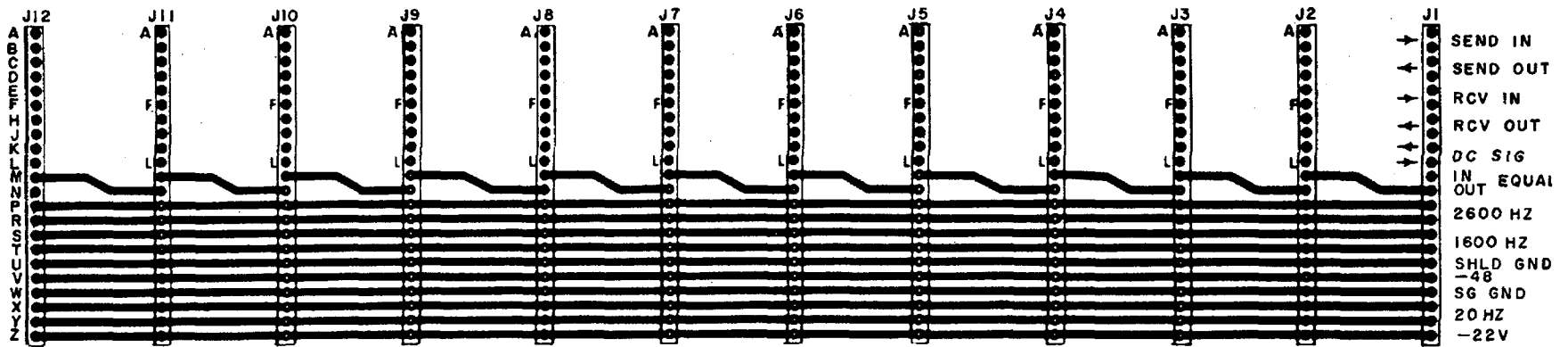
Table 5-2. Organizational Monthly and Quarterly Preventive Maintenance Checks and Services

Sequence NO.	Item	Procedure	Reference
1	Refinishing	Examining module front panel and exterior surfaces for corrosion or need of refinishing.	Para 5-3d.
2	Checking publications	See that all publications are complete and current.	App A.
3	Extension unit, board, and universal shelf	Check for evidence of overheating, burned parts, or breaks in printed circuit wiring.	
4	Extender board	Perform continuity check multimeter connected between A-A, B-B, etc.	using: Fig. B-2.
5	Modifications	Check DA Pam 310-7 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.	DA Pam 310-7 and TM 38-750.

5-4. Troubleshooting

On-site maintenance troubleshooting includes isolating a communications line malfunction to an extension unit and replacing the faulty assembly. Refer to table 5-3 for the detailed procedure. If external equipment is not at fault, and if replacement of the extension unit does not correct the malfunction, perform continuity checks to

isolate a continuity malfunction to printed circuit wiring or a connector on the universal shelf. These continuity tests are performed using a multimeter, referencing the wiring diagram of figure 5-1, with the extender board inserted in the suspected connector on the universal shelf. If the continuity test indicates an open circuit, the faulty connector on the universal shelf shall be replaced.



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Figure 5-1. Universal shelf, receptacle busbar wiring.

Table 5-3. On-Site Troubleshooting

<i>Test conditions</i>	<i>Meter connections</i>	<i>Performance standard</i>	<i>Corrective action</i>
1. Extend extension unit from shelf via extender board.	None	N/A	N/A.
2. Establish on-hook condition at distant station and off-hook condition at local station.	Multimeter connected across TP4 (+) and TP5- (-) to measure voltage.	Note multimeter voltage reading.	None.
3. Place local station on-hook	Multimeter connected across TP5- (+) and TP6 (-).	Note that the multimeter voltage reading is 1/4 of that recorded in step 2.	Adjust BAL potentiometer until correct voltage reading is obtained. If correct reading cannot be obtained, replace module.
4. Establish off-hook condition at distant station and on-hook at local station.	a. Multimeter connected across TP1 and TP7 for continuity check on DX-1 module.	a. 0 ohm	a. Replace module
	b. Multimeter connected across TP2- (-) and TP7 (+) for voltage measurement on DX-2 module.	b. -48 volts dc	b. Replace module.
5. Place local station off-hook	a. Same as step 4a for DX-1.	a. 0 ohm	a. Replace module.
6. Have distant station go on-hook	b. Same as step 4b for DX-2	b. 48 volts dc	b. Replace module.
	a. Same as step 4a. for DX-1.	a. Infinity	a. Replace module.
	b. Same as step 4b for DX-2.	b. 0 volt dc	b. Replace module.

Section III. MAINTENANCE OF THE EXTENSION UNIT, EXTENDER BOARD, AND UNIVERSAL SHELF

CAUTION

Before installing the extension unit module in the universal shelf, position the module in its normal position (handle up; front panel vertical). Maintain module in this position for at least one minute to insure that the mercury has drained from the relay (K1) contacts.

5-5. Removal and Installation

Removal and installation of the extension unit, and the universal shelf is accomplished by performing the applicable portion of paragraph 2-6 in reverse. The extender board is installed in the universal shelf vacated by the extension unit, and the extension unit is then inserted in the extender board receptacle. Removal of the extender board is accomplished in the reverse order of installation. If an extender board is determined to be faulty, via continuity measurements, replace the board.

5-6. Disassembly of the Universal Shelf

Removal and replacement of a faulty receptacle on the universal shelf (fig. B-1) is accomplished as / outlined below.

- a. Unscrew two screws, lockwashers, and nuts which secure the receptacle to the PC card.
- b. Unsolder receptacle pin connections from the PC card. Remove receptacle.
- c. Assemble a replacement receptacle to the PC card by reversing the procedure given in a and b above.

5-7. Direct Support Performance Testing

Bench type test procedures which can be used to determine if a repaired extension unit is capable of performing its assigned mission are given in tables 5-4 (DX-1) and 5-5 (DX-2). These tests check the signaling capability of the module under minimum and maximum range conditions.

- a. *Test Equipment.*

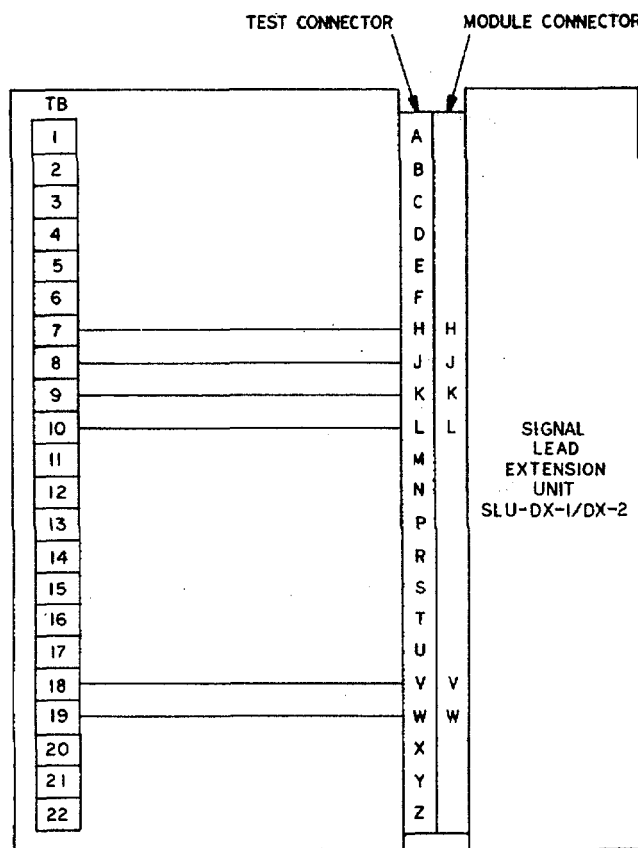
- (1) Connector, 22 pin.
- (2) Multimeter, AN/USM-223.
- (3) Power Supply PP-6547/U.
- (4) Resistor 430 ohms, 2 %, 1w.
- (5) Resistor 5.1K ohms, 2 %, 1w.
- (6) Terminal board, 22 terminals.
- (7) Test Set, Telephone AN/TSM-86.
- (8) Tool Kit, Electronic Equipment TK105/G.

CAUTION

Before applying power to the extension unit module in the bench test setup, position the module in its normal position (handle up; front panel vertical). Maintain module in this position for at least one minute to insure that the mercury has drained from the relay (K1) contacts before applying power to the module.

b. *Test Connections and Conditions.* Fabricate a test connector, wiring layout as shown in figure 5-2. Connect bench test setup as shown in figure 5-3 (DX-1) or figure 5-4 (DX-2) when required in the procedure of table 5-4 (DX-1) or table 5-5 (DX-2), respectively.

c. *Procedure.* Perform the procedure of table 5-4 or table 5-5 in order.



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Figure 5-2. Extension unit test connector, wiring connections.

Table 5-4. Extension Unit (DX-1), Signaling/Range Performance Test

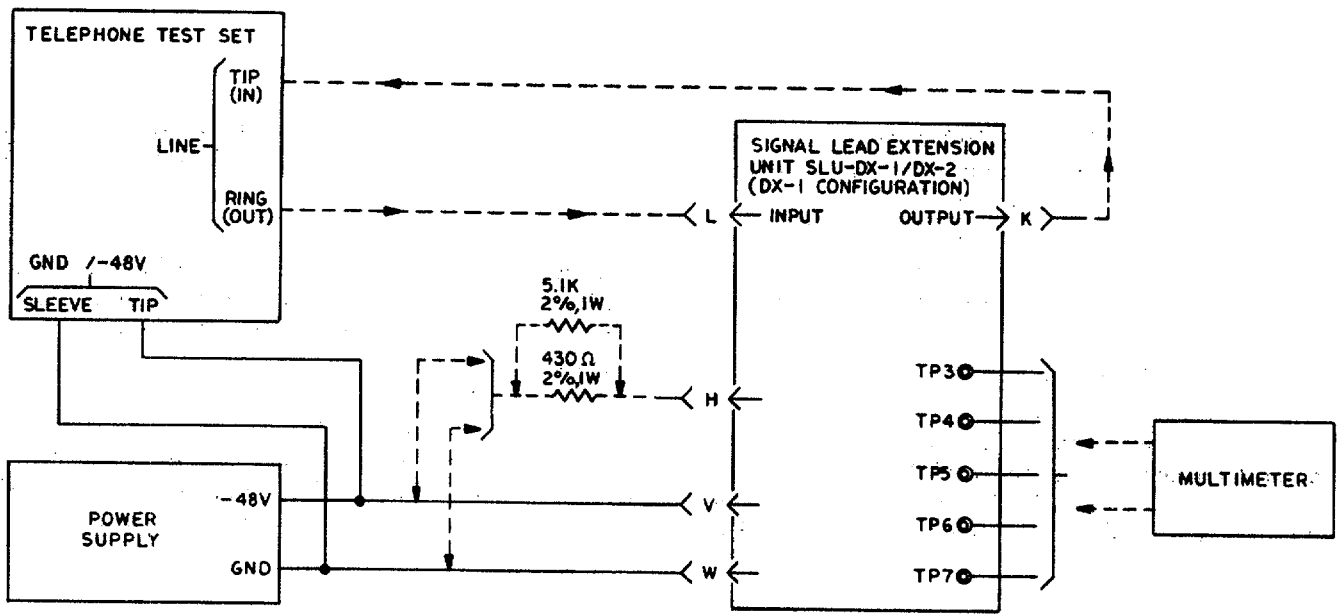
Test conditions	Meter connections	Performance standard
1. Check to see that only the terminals listed below are strapped: B-C, E-F, H-J, L-M, and P-R.	N/A	None.
2. Connect test setup as shown in figure 5-3 with the test resistor (430 ohm) connected to module pin H. Telephone test set input (tip) connected at module pin K.	Multimeter connected across TP3(-) and TP7(+).	-24±2 volts dc.
3. Connect test resistor to -48 volts de and pin L to ground.	Multimeter connected across TP4(+) and TP5(-).	-30±3 volts dc.
4. Adjust BAL potentiometer R1 for a voltage reading 1/4 of that obtained in step 3.	Multimeter connected across TP5(+) and TP6(-).	+7.5±0.75 volts dc.
5. Remove -48 volts de from test resistor and ground from pin L. Connect test set output (ring) to pin L.	N/A	None.
6. Adjust telephone test set for steady state off-hook (-48 volt) M output.	Telephone test set input (tip) connected to pin K.	Line lamp on test test set goes out, indicating that the E lead is grounded.
7. Connect test resistor to ground	Same as step 6	Line lamp on test set lights.
8. Adjust telephone test set for steady state on-hook (ground) M input.	Same as step 6	Line lamp on test set remains lit.
9. Disconnect ground and apply -48 volts de to test resistor.	Same as step 6	Line lamp on test set goes out.
10. Remove test set on-hook condition Disconnect 430 ohm resistor from test circuit and install the 5.1K ohm resistor in its place.	N/A	N/A.

Table 5-4. Extension Unit (DX-1), Signaling/Range Performance Test-Continued.

<i>Test conditions</i>	<i>Meter connections</i>	<i>Performance standard</i>
11. Connect -48 volts dc to test resistor and ground pin L.	Multimeter connected across TP4(+) and TP5(-).	-6.6±0.66 volts dc.
12. Adjust BAL potentiometer for a voltage reading 1/4 of that obtained in step 11.	Multimeter connected TP5(+) and TP6(-).	+1.65± 0.17 volts dc.
13. Remove -48 volts dc from test resistor and ground from pin L. Connect test set output (ring) to pin L.	N/A	None.
14. Adjust telephone test set for steady state off-hook (-48 volt) M output.	Telephone test set input (tip) connected to pin K.	Line lamp on test set goes out, indicating that the E lead is grounded.
15. Connect test resistor to ground	Same as step 14	Line lamp on test set lights.
16. Adjust telephone test set for steady state on-hook (ground) M input.	Same as step 14	Line lamp on test set remains lit.
17. Disconnect ground and apply -48 volts dc to test resistor.	Same as step 14	Line lamp on test set goes out.
18. Remove -48 volts dc from test resistor	N/A	None.
19. Adjust telephone test set for 9 pps output at 50% break. Pulse and measure line.	Same as step 14	Meter on test set indicates 50± 2 percent.

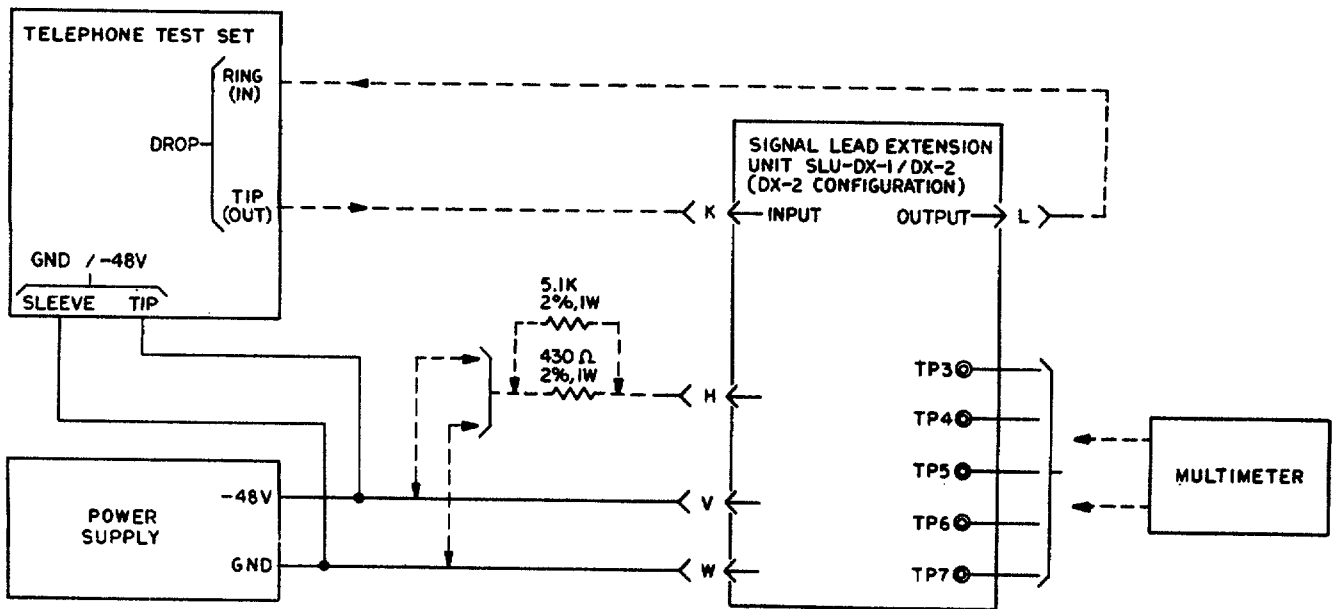
Table 5-5. Extension Unit (DX-2), Signaling/Range Performance Test

<i>Test conditions</i>	<i>Meter connections</i>	<i>Performance standard</i>
1. Check to see that only the terminals listed below are strapped: A-B, D-E, G-H, K-L, and N-P.	N/A.....	None.
2. Connect test setup as shown in figure 5-4 with the 430 ohm test resistor connected to module pin H. Telephone test set input (ring) connected at module pin L.	Multimeter connected across TP3(-) and TP7(+).	-24r 2 volts dc.
3. Connect test resistor to -48 volts dc.	Multimeter connected across TP4(+) and TP5(-).	-30 ±3 volts dc.
4. Adjust BAL potentiometer R1 for a voltage reading 1/4 of that obtained in step 3.	Multimeter connected across TP5(+) and TP6(-).	+7.5 :+0.75 volts dc.
5. Disconnect -48 volts dc from test resistor. Connect telephone test set output (tip) to pin K.	N/A	None.
6. Adjust telephone test set for steady state off-hook (ground) E output.	Telephone test set input (ring) connected to pin L.	Drop lamp on test set goes out, indicating that -48 volts is applied to the M lead.
7. Connect test resistor to ground.	Same as step 6	Drop lamp on test set lights.
8. Adjust telephone test set for steady state on-hook (open) E input.	Same as step 6	Drop lamp on test set lights remains lit.
9. Disconnect ground and apply -48 volts dc to test resistor.	Same as step 6	Drop lamp on test set goes out.
10. Remove test set on-hook condition Disconnect 430 ohm resistor from test circuit and install the 5.1K ohm resistor in its place.	N/A.....	None.
11. Connect test resistor to -48 volts dc.	Multimeter connected across TP4(+) and TP5(-).	-6.6 -0.66 volts dc.
12. Adjust BAL potentiometer for a voltage reading 1/4 of that obtained in step 11.	Multimeter connected across TP5(+) and TP6(-).	+1.65 -:0.17 volts dc.
13. Disconnect -48 volts from test resistor and adjust telephone test set for steady state off-hook (ground) E output.	Telephone test set input connected to pin L.	Drop lamp on test set goes out indicating that -48 volts is applied to the M lead.
14. Connect test resistor to ground	Same as step 13	Drop lamp on test set lights.
15. Adjust telephone test set for steady state on-hook (open) E input.	Same as step 13	Drop lamp on test set remains lit.
16. Disconnect ground and apply -48 volts dc to test resistor.	Same as step 13	Drop lamp on test set goes out.
17. Disconnect -48 volts dc from test resistor.	N/A	None.
18. Adjust telephone test set for 9 pps output at 50% break. Pulse and measure drop.	Same as step 13	Meter on test set indicates 50±2 percent.



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Figure 5-3. Extension Unit (DX-2), signaling/range performance test, bench test setup.



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Figure 5-4. Extension unit (DX-2), signaling/range performance test, bench test setup.

CHAPTER 6

OFF-SITE MAINTENANCE

6-1. Scope of Off-Site Maintenance

This chapter contains troubleshooting procedures for fault isolation of a malfunction to a faulty part on the extension unit and repair of the PC card. These procedures are performed by general support maintenance personnel as directed by the maintenance allocation chart (app C).

6-2. Tools and Equipment

No. special tools are required for maintenance.

Appendix B lists the repair parts authorized for general support maintenance of the extension unit and universal shelf. Tools and test equipment required for off-site maintenance are identical to those listed in paragraph 5-

7 a, except that Tool Kit, Electronic Equipment TK-100/G is substituted for the tool kit listed.

6-3. Troubleshooting

Off-site troubleshooting consists of isolating the malfunction on an extension unit to a replaceable part. This is accomplished in table 6-1 by performing a performance test and, if a performance standard is not achieved, continuing with the corrective action instructions. After a faulty part is replaced, the performance test must again be performed to assure satisfactory performance of the assembly before being returned to- stock.

Table 6-1. Off-Site Troubleshooting

Test conditions	Meter connections	Performance standard	Corrective action
1. Steps 2 through 20 of this procedure pertain to an extension unit strapped for DX-1 operation. Steps 21 through 38 are applicable to a DX-2 configured module.	N/A	None	N/A.
2. Check to see that only the terminals listed below are strapped: B-C, E-F, H, J, L-M, and P-R.	N/A	None	N/A.
3. Connect test setup as shown in figure 5-3 with the 430 ohm resistor connected to module pin H and telephone test set input (tip) connected at module pin K.	Multimeter connected across TP3 (-) and TP7 (+).	-24 :+2 volts dc.	Check VR1, R3, R4, and K1. Replace faulty part.
4. Connect -48 volt dc to test resistor and ground pin L.	Multimeter connected across TP4 (+) and TP5 (-).	-30+3 volts dc.	Replace K1.
5. Adjust BAL potentiometer R1 for a voltage reading 1/4 of that obtained in step 4.	Multimeter connected across TP5 (+) and TP6 (-).	+7.5+0.75 volts dc.	Check R1 and C1. Replace faulty part.
6. Remove -48 volts dc from test resistor and ground from pin L. Connect test set output (ring) to pin L.	N/A	None	N/A.
7. Adjust telephone test set for steady state off-hook (-48 volt) M input.	Telephone test set input (tip) connected to pin K.	Line lamp on test set goes out, indicating that the E lead is grounded.	Replace K1.
8. Connect test resistor to ground	Same as step 7	Line lamp on test set lights.	Replace K1.
9. Adjust telephone test set for steady state on-hook (ground) M input.	Same as step 7	Line lamp on test set remains lit.	Replace K1.
10. Disconnect ground and apply -48 volts dc to the test resistor.	Same as step 7	Line lamp on test set goes out.	Replace K1.
11. Remove test set on-hook condition. Disconnect 430 ohm resistor from test circuit and install the 5.1K ohm resistor in its place.	N/A	N/A.	N/A
12. Connect -48 volts dc to test resistor and ground pin L.	Multimeter connected across TP4 (+) and TP5 (-).	-6.6+0.66 volts dc.	Replace K1.
13. Adjust BAL potentiometer for a voltage reading 1/4 of that obtained in step 12.	Multimeter connected across TP5 (+) and TP6 (-).	+1.65:+0.17 volts dc.	Replace K1.
14. Remove -48 volts dc from test resistor and ground from pin L. Connect test set output (ring) to pin L.	N/A	None	N/A.
15. Adjust telephone test set for steady state off-hook (-48 volt) M input.	Telephone test set input (tip) connected to pin K.	Line lamp on test set goes out, indicating that the E lead is grounded.	Replace K1.
16. Connect test resistor to ground	Same as step 15	Line lamp on test set lights	Replace K1.
17. Adjust telephone test set for steady state on-hook (ground) M input.	Same as step 15	Line lamp on test set remains lit.	Replace K1.
18. Disconnect ground and apply -48 volts dc to test resistor.	Same as step 15	Line lamp on test set goes out.	Replace K1.
19. Remove -48 volts dc from test resistor.	N/A	None	N/A.
20. Adjust telephone test set for 9 pps output at 50% break. Pulse and measure line.	Same as step 15	Meter on test set indicates 50 2 .. percent.	Replace K1.

Table 6-1. Off-Site Troubleshooting-continued

<i>Test conditions</i>	<i>Meter connections</i>	<i>Performance standard</i>	<i>Corrective action</i>
21. Steps 21 through 38 of this procedure pertain to an extension unit strapped for DX-2 operation; check to see that only the terminals listed below are strapped: A-B, E-D, H-G, L-K, and P-N.	N/A	None.....	N/A.
22. Connect test setup as shown in figure 5-4 with the 430 ohm resistor connected to module pin H and telephone test set input (ring) connected at module pin L.	Multimeter connected across TP3 (-) and TP7 (+).	-24+t2 volts dc	Check VR1, R3, R4, and K1. Replace faulty part.
23. Connect test resistor to -48 volts dc. (+) and TP5 (-).	Multimeter connected across TP4	30 - 3 volts dc	Replace K1.
24. Adjust BAL potentiometer R1 for a voltage reading 1/4 of that obtained in step 21.	Multimeter connected across TP5 (+) and TP6 (-).	+7.5:- 0.75 volts dc.	Check R1 and C1. Replace faulty part.
25. Disconnect -48 volts dc from test resistor. Connect telephone test set output (tip) to pin K.	N/A	None	N/A.
26. Adjust telephone test set for steady state off-hook (ground) E output.	Telephone test set input (ring) connected to pin L.	Drop lamp on test goes out, indicating that -48 volts is applied to the M lead.	Check K2, CR1, DS1 and K1. Replace faulty part.
27. Connect test resistor to ground	Same as step 26.	Drop lamp on test set lights.	Check K1 and K2. Replace faulty part.
28. Adjust telephone test set for steady state on-hook (open) E input.	Same as step 26.	Drop lamp on test set remains lit.	Check K1 and K2. Replace faulty part.
29. Disconnect ground and apply -48 volts dc to the test resistor.	Same as step 26	Drop lamp on test goes out.	Check K1 and K2 Replace faulty part.
30. Remove test set on-hook condition. Disconnect 430 ohm resistor from test circuit and install 5.1K resistor in its place.	N/A	None	N/A.
31. Connect test resistor to -48 volts dc. (+) and TP5 (-).	Multimeter connected across TP4	-6.6- 0.66 volts dc.	Replace K1.
32. Adjust BAL potentiometer for a .voltage reading 1/4 of that obtained in step 31.	Multimeter connected across TP5 (+) and TP6 (-).	+1.65 ± 0.17 volts dc.	Check R1 and C1. Replace faulty part.
33. Adjust telephone test set for steady state off-hook (ground) E output.	Telephone test set input (ring) connected to pin L.	Drop lamp on test set goes out indicating that -48 volts is applied to the M lead.	Replace K1.
34. Connect test resistor to ground	Same as step 33	Drop lamp on test set lights.	Replace K1.
35. Disconnect -48 volts from test resistor and adjust telephone test set for steady state off-hook (ground) E output.	Same as step 33	Drop lamp on test set remains lit.	Replace K1.
36. Disconnect ground and apply -48 volts dc to test resistor.	Same as step 33	Drop lamp on test set goes out.	Replace K1.
37. Disconnect -48 volts dc from test resistor.	N/A	None	N/A.
38. Adjust telephone test set for 9 .pps output at 50% break. Pulse and measure drop.	Same as step 33	Meter on test set indicates 50±2 percent.	Replace K1.

6-4. Maintenance of the Extension Unit

(fig. B-3)

Upon removal of the extension unit from the universal shelf, all parts are readily accessible. Replacement of parts determined faulty by troubleshooting is the responsibility of off-site maintenance. When replacing any detail part, use standard precautionary procedures (e. g., a low-wattage soldering iron, heat-sink, etc.) as described in TB SIG 222 to avoid damage to the part or printed circuit wiring.

6-5. Maintenance of the Universal Shelf

Continuity testing of the universal shelf is performed to isolate a faulty connector or printed circuit wiring. Once these items have been determined faulty, replacement of the faulty. Item or repair of the PC card is accomplished as described in paragraph 5-6 and TB SIG 222, respectively.

6-6. General Support Performance Testing

The performance test procedure of paragraph: 5-7 is also applicable to general support maintenance.

APPENDIX A

REFERENCES

The following publications contain information applicable to the operation and maintenance of the equipment.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U.S. Army Equipment Index of Modification Work Orders.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies, and Equipment Used by the Army.
TB SIG 222	Solder and Soldering.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 740-90-1	Administrative Storage of Equipment
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TM 11-5805-666-14&P	Operator's, Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools Lists) for Universal Rack 90409001-000 and Panel, Fuse SB-3800/FTC (Stelma FP-15/30) (NSN 5920-00-598-0469) (Line Conditioning Equipment).

APPENDIX B
ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL
SUPPORT MAINTENANCE REPAIR PARTS AND
SPECIAL TOOLS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists the repair parts required for the performance of organizational, direct support, and general support maintenance of the Universal Shelf, Extender Board, and the Signal Lead Extension Plug-in Unit.

B-2. General

This Repair Parts List is divided into the following sections:

- a. *Section II-Basic Issue Items List.* Not applicable.
- b. *Section III-Items Troop Installed or Authorized List.* Not applicable.
- c. *Section IV-Repair Parts List.* A list of repair parts authorized for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending numerical sequence, with the parts in each group listed in figure and item number sequence.
- d. *Section V-Special Tools List.* Not applicable.
- e. *Section VI-Federal Stock Number and Part Number Index.* A list, in ascending numerical sequence, of all Federal stock numbers appearing in the listings, followed by a list, in alphameric sequence, of all part numbers appearing in the listing. Federal stock number and part numbers are cross-referenced to each illustration figure and item number appearance.

B-3. Explanation of Columns

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

- a. *Illustration.* This column is divided as follows:
 - (1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.
 - (2) *Item number.* The number used to identify each item called out in the illustration.
- b. *Source, Maintenance, and Recoverability Codes (SMR).*

(1) *Source code.* Source codes are assigned to support items to indicate the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

<i>Code</i>	<i>Definition</i>
PA-	Item procured and stocked for anticipated or known usage.
PB-	Item procured and stocked for insurance purpose because essentiality dictates that a minimum quantity be available in the supply systems.
PC-	Item procured and stocked and which otherwise would be coded PA except that it is deteriorative in nature.
PD-	Support item, excluding support equipment, procured for initial issue or outfitting and stocked only for subsequent or additional initial or outfittings. Not subject to automatic replenishment.
PE-	Support equipment procured and stocked for initial issue or outfitting to specified maintenance repair activities.
PF-	Support equipment which will not be stocked but which will be centrally procured on demand.
PG-	Item procured and stocked to provide for sustained support for the life of the equipment. It is applied to an item peculiar to the equipment which, because of the probable discontinuance or shutdown of production facilities, would prove uneconomical to reproduce at a later time.
KD-	An item of a depot overhaul/repair kit and not purchased separately. Depot kit defined as a kit that provides items required at the time of overhaul or repair.
KF-	An item of a maintenance kit and not purchased separately. Maintenance kit defined

<i>Code</i>	<i>Definition</i>
	as a kit that provides an item that can be replaced at organizational or intermediate levels of maintenance.
KB-	Item included in both a depot overhaul/repair kit and a maintenance kit.
MO-	Item to be manufactured or fabricated at organizational level.
MF-	Item to be manufactured or fabricated at the direct support maintenance level.
MH-	Item to be manufactured or fabricated at the general support maintenance level.
MD-	Item to be manufactured or fabricated at the depot maintenance level.
AO-	Item to be assembled at organizational level.
AF-	Item to be assembled at direct support maintenance level.
AH-	Item to be assembled at general support maintenance level.
AD-	Item to be assembled at depot maintenance level.
XA-	Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.
XB-	Item is not procured or stocked, if not available through salvage, requisition.
XD-	A support item that is not stocked. When required, item will be procured through normal supply channels.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded XA, XD, and aircraft support items as restricted by AR 700-42.

(2) *Maintenance code.* Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(a) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the fourth position will indicate one of the following levels of maintenance:

<i>Code</i>	<i>Application/Explanation</i>
C-	Crew or operator maintenance performed within organizational maintenance.
O-	Support item is removed, replaced, used at the organizational level.
I-	Support item is removed, replaced, used by the direct support element of integrated direct support maintenance.

<i>Code</i>	<i>Application/Explanation</i>
F-	Support item is removed, replaced, used at the direct support level.
H-	Support item is removed, replaced, used at the general support level.
D-	Support items that are removed, replaced, used at depot, mobile depot, specialized repair activity only.

NOTE

Codes, "I" and "F" will be considered the same by direct support units.

(b) The maintenance code entered in, the fourth position indicates whether the item is to be repaired and identifies the lowest- maintenance level with the capability to perform complete repair (i.e., all authorized maintenance functions). This position will contain one of the following maintenance codes:

<i>Code</i>	<i>Application/Explanation</i>
O-	The lowest maintenance level capable of complete repair of the support item is the organizational level.
F-	The lowest maintenance level capable of complete repair of the support item is the direct support level.
H-	The lowest maintenance level capable of complete repair of the support item is the general support level.
D-	The lowest maintenance level capable of complete repair of the support item is the depot level, performed by Lexington Blue Grass Army Depot.
L-	Repair restricted to designated specialized repair activity.
Z-	Nonreparable. No repair is authorized.
B-	No repair is authorized. The item may be reconditioned by adjusting, lubricating, etc., at the user level. No parts or special tools are procured for the maintenance of this item.

(3) *Recoverability code.* Recoverability codes are assigned to support items to indicate the disposition action on. unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

<i>Recoverability codes</i>	<i>Definition</i>
Z-	Nonreparable item. When unserviceable, condemn and dispose at the level indicated in position 3.
O-	Reparable item. When uneconomically repairable, condemn and dispose at organizational level.

Recoverability

codes	Definition
F-	Reparable item. When uneconomically reparable, condemn and dispose at the direct support level.
H-	Reparable item. When uneconomically reparable, condemn and dispose at the general support level.
D-	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot level.
L-	Reparable item. Repair, condemnation, and disposal not authorized below depot/specialized repair activity level.
A-	Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material or hazardous material).

c. *Federal Stock Number.* Indicates the Federal stock number assigned to the item.

NOTE

For requisitioning purposes the Federal stock number must be converted to the National stock number by adding: "-00-" after the Federal stock classification (FSC) code (first four digits). For example, FSN 6625-553-0142 converts to NSN 6625-00-553-0142.

d. *Part Number.* Indicates the primary, number used by the manufacturer (individual, company, firms, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

NOTE

When a stock numbered item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. *Federal Supply Code for Manufacturer (FSCM).* The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. *Description.* Indicates the Federal item name and, if required, a minimum description to identify the item.:

g. *Unit of Measure (U/M).* Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in,, pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned .

h. *Quantity Incorporated in Unit.* Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a, functional group, subfunctional group, or an assembly.

B-4. Special Information

Not applicable.

B-5. How to Locate Repair Parts

a. When Federal stock number or part number is unknown.

(1) *First.* Using the table of contents, determine the functional group within which the repair part belongs. This is necessary since illustrations are prepared for functional groups, and listings are divided into the same groups.

(2) *Second.* Find the illustration covering the functional group to which the repair part belongs.

(3) *Third.* Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(4) *Fourth.* Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When Federal stock number or part number is known.

(1) *First.* Using the Index of Federal Stock Numbers and Part Numbers, find the pertinent Federal stock number or part number. This index is in ascending FSN sequence followed by a list of part numbers. in ascending alphameric sequence, cross-referenced to the illustration figure number and item number.

(2) *Second.* After finding the figure and item number, locate the figure and item number in the repair parts list.

B-6. Abbreviations

Not applicable.

(Next printed page is B-5)

Section IV. REPAIR PARTS LIST

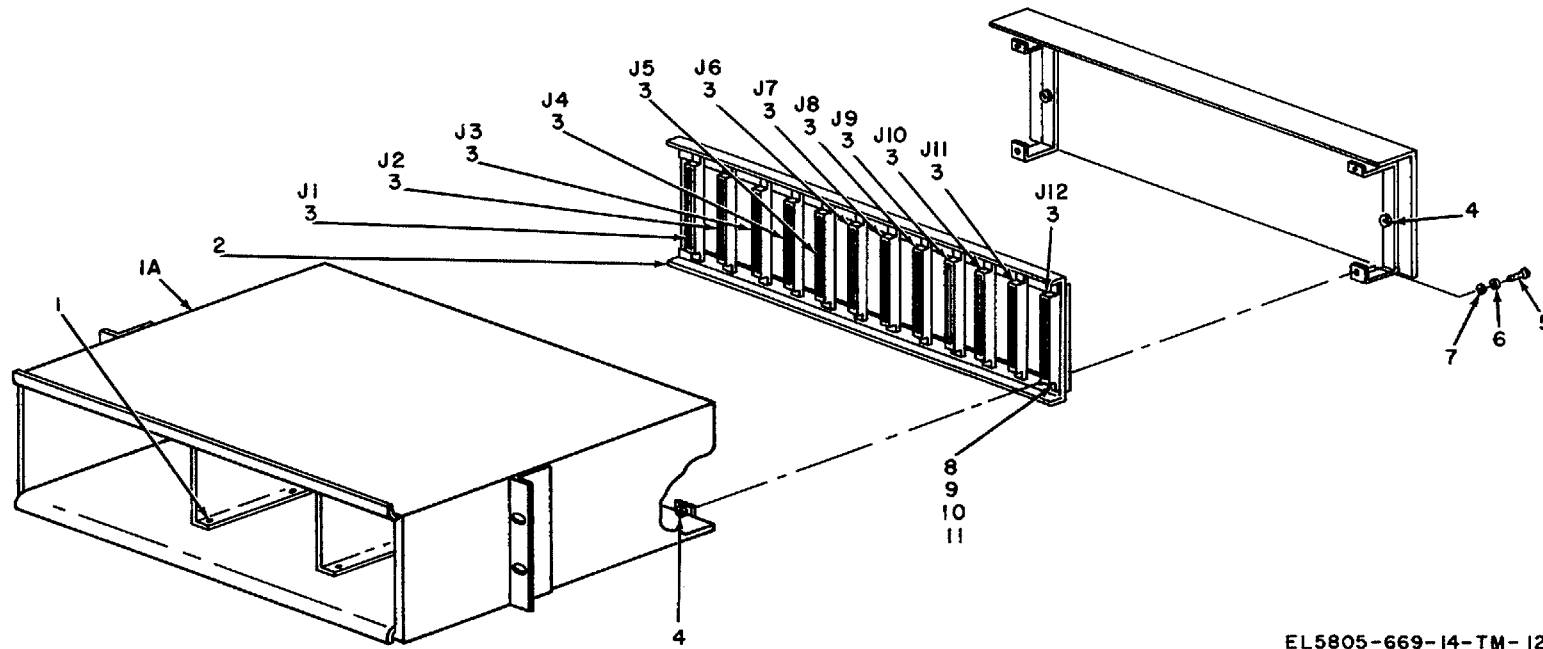
(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6) DESCRIPTION	(7)	(8) QTY INC IN
(a) FIG NO.	(b) ITEM NO.	SMR CODE	FEDERAL STOCK NUMBER	PART NUMBER	FSCM	USABLE ON CODE	UNIT	
						GROUP: 01 UNIVERSAL SHELF		
B-1	1A	PAFHD		90409000-000	96238	UNIVERSAL SHELF.....	EA	1
B-1	1	PAHZZ	5320-879-4473	SD42BS	07707	RIVET, TUBULAR.....	EA	40
B-1	2	PAFHD		80409000-000	96238	PRINTED WIRING BOARD.....	EA	1
B-1	3	PAHZZ		HBD22WO-4080	81312	CONNECTOR, RECEPTACLE, ELECTRICAL, 22 PIN.....	EA	12
B-1	4	PAHZZ	5310-725-4719	CLS632-2	46384	NUT, PLAIN, CLINCH, CRES. NO. 6-32.....	EA	5
B-1	5	XBHZZ	5305-054-6654	MS51957-30	96906	SCREW, MACHINE, CRES, NO. 6-32 X 1/2..... INCH LONG	EA	4
B-1	6	XBHZZ	5310-722-5998	MS15795-805	96906	WASHER, FLAT, CRES, 0.156 INCH ID, 0.312..... INCH OD	EA	4
B-1	7	XBHZZ	5310-929-6395	MS35338-136	96906	WASHER, LOCK, SPLIT, CRES, 0.138 INCH ID,..... 0.250 INCH OD	EA	4
B-1	8	PAHZZ	5305-177-5545	MS51957-120	96906	SCREW, MACHINE, CRES, NO. 4-40 X 9/16..... INCH LONG	EA	24
B-1	9	PAHZZ	5310-595-6211	MS15795-803	96906	WASHER, FLAT, CRES, 0.125 INCH ID, 0.250..... INCH OD	EA	24
B-1	10	PAHZZ	5310-933-8118	MS35338-135	96906	WASHER, LOCK, SPLIT, CRES, 0.115 INCH ID,..... 0.209 INCH OD	EA	24
B-1	11	XBHZZ		SST4-40SMPAT	70318	NUT, PLAIN, HEXAGON, STAINLESS STEEL, NO..... 4-40	EA	24
						GROUP: 01 EXTENDER BOARD		
B-2	1A	PAFZZ	6625-602-5151	80409160-000	96238	EXTENDER, PRINTED WIRING BOARD, MX-9661/ FTC.....	EA	1
B-2	1	PAFZZ	5935-131-8366	88DJ22M	81312	CONNECTOR, RECEPTACLE, ELECTRICAL, 22 PIN.....	EA	1
B-2	2	PAFZZ	5305-054-5653	MS51957-19	96906	SCREW, MACHINE, CRES, NO. 4-40 X 3/4 INCH..... LONG	EA	2
B-2	3	PAHZZ	5310-595-6211	MS15795-803	96906	WASHER, FLAT, CRES, 0.125 INCH ID, 0.250..... INCH OD	EA	2
B-2	4	PAHZZ	5310-933-8118	MS35338-135	96906	WASHER, LOCK, SPLIT, CRES, 0.115 INCH ID..... 0.209 INCH OD	EA	2
B-2	5	PAFZZ	5310-934-9748	MS35649-244	96906	NUT, PLAIN, HEXAGON, CRES, NO. 4-40.....	EA	2

Section IV. REPAIR PARTS LIST (CONTINUED)

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6) DESCRIPTION	(7)	(8) QTY INC IN
(a) FIG NO.	(b) ITEM NO.	SMR CODE	FEDERAL STOCK NUMBER	PART NUMBER	FSCM	USABLE ON CODE	UNIT	
						GROUP: 01 PLUG-IN UNIT		
B-3	1A	PAFHD	6625-602-5123	80409170-000	96238	PLUG-IN UNIT, SIGNAL LEAD EXTENSION TA-951/ FTC	EA	1
B-3	1	PAHZZ	5905-116-8561	RC20GF270J	81349	RESISTOR, FIXED, COMPOSITION, 27 OHMS PORM 5%, 1/2 WATT	EA	1
B-3	2	PAHZZ	5905-104-8350	RC20GF221J	81349	RESISTOR, FIXED, COMPOSITION 220 OHMS PORM 5%, 1/2 WATT	EA	2
B-3	3	PAHZZ	5910-726-1537	WMF2S1	14655	CAPACITOR FIXED, PLASTIC DIELECTRIC, 0.01 UF, PORM 10%, 200 VDCW	EA	2
B-3	4	PAHZZ		46006085-000	96238	RELAY, REED.....	EA	1
B-3	5	PAHZZ	5305-054-5648	MS51957-14	96906	SCREW, MACHINE, CRES, NO. 4-40 X 5/16 INCH LONG	EA	1
B-3	6	PAHZZ	5310-595-6211	MS15795-803	96906	WASHING, FLAT, CRES, 0.125 INCH ID, 0.250 INCH OD	EA	1
B-3	7	PAHZZ	5805-372-2589	62050049-000	96238	EXTRACTOR, CIRCUIT CARD.....	EA	1
B-3	8	PAHZZ	5305-054-5648	MS51957-14	96906	SCREW, MACHINE, CRES, NO. 4-40 X 5/16 INCH LONG	EA	1
B-3	9	PAHZZ	5310-595-6211	MS15795-803	96906	WASHER, FLAT, CRES, 0.125 INCH ID, 0.250 INCH OD	EA	1
B-3	10	PAHZZ	5310-933-8118	MS35338-135	96906	WASHER, LOCK MED 4.....	EA	1
B-3	11	PAHZZ	5310-934-9748	MS35649-244	96906	NUT, PLAIN, HEXAGON, CRES, NO. 4-40.....	EA	1
B-3	12	PAHZZ	6210-911-9536	PJ150	70674	LAMPHOLDER.....	EA	1
B-3	13	PAOZZ	6240-760-8306	60XA	58854	LAMP, GLOW	EA	1
B-3	14	PAHZZ	5935-419-1612	GX81-67-1G8	91506	JACK, TIP, PRINTED CIRCUIT, BLUE.....	EA	7
B-3	15	PAHZZ	5320-117-6010	MS20426AD2-3	96906	RIVET, SOLID ALUMINUM, 1/16 INCH DIA,..... 3/16 INCH LONG	EA	2
B-3	16	PAHZZ	5905-137-0545	260P1-103	80294	RESISTOR, VARIABLE, 10K OHM, 1W	EA	1
B-3	17	PAHZZ		1DP2-503K	81417	CAPACITOR, FIXED PAPER 0.05 UF, PORM 10%, 100 VDCW	EA	1
B-3	18	PAHZZ		46004005-000	96238	RELAY REED.....	EA	1
B-3	19	PAHZZ	5320-879-4473	SD42BS	07707	RIVET, TUBULAR.....	EA	6
B-3	20	PAHZZ		1N3029B	81349	SEMICONDUCTOR DEVICE, DIODE.....	EA	1
B-3	21	PAHZZ	5905-195-5524	RC42GF182J	81349	RESISTOR, FIXED, COMPOSITION 1.8K OHM PORM 5%, 2W	EA	1

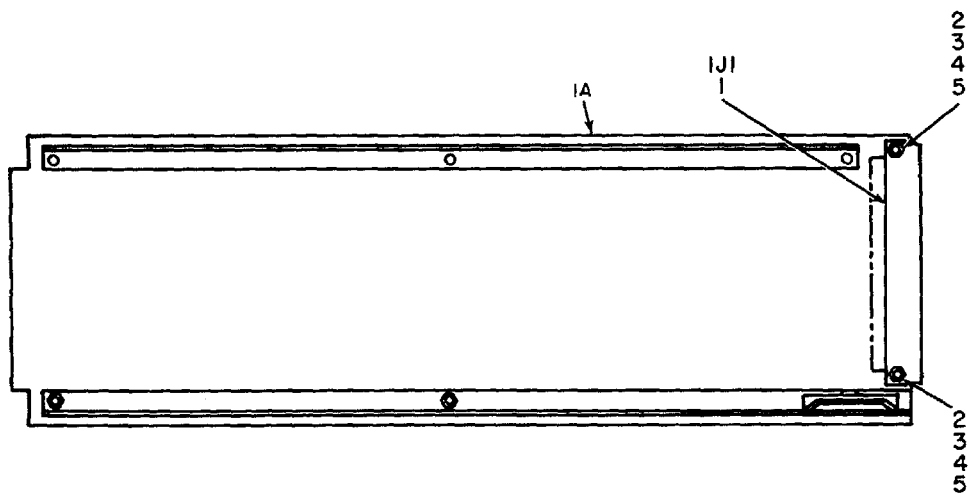
Section IV. REPAIR PARTS LIST (CONTINUED)

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6) DESCRIPTION	(7)	(8) QTY INC IN
(a) FIG NO.	(b) ITEM NO.	SMR CODE	FEDERAL STOCK NUMBER	PART NUMBER	FSCM	USABLE ON CODE	UNIT	
B-3	22	PAHZZ	5905-256-3361	RC42GF102J	81349	RESISTOR, FIXED, COMPOSITION 1K OHMS..... PORM 5%, 2W	EA	1
B-3	23	PAHZZ	5961-866-0476	1N457	81349	SEMICONDUCTOR DEVICE, DIODE.....	EA	1



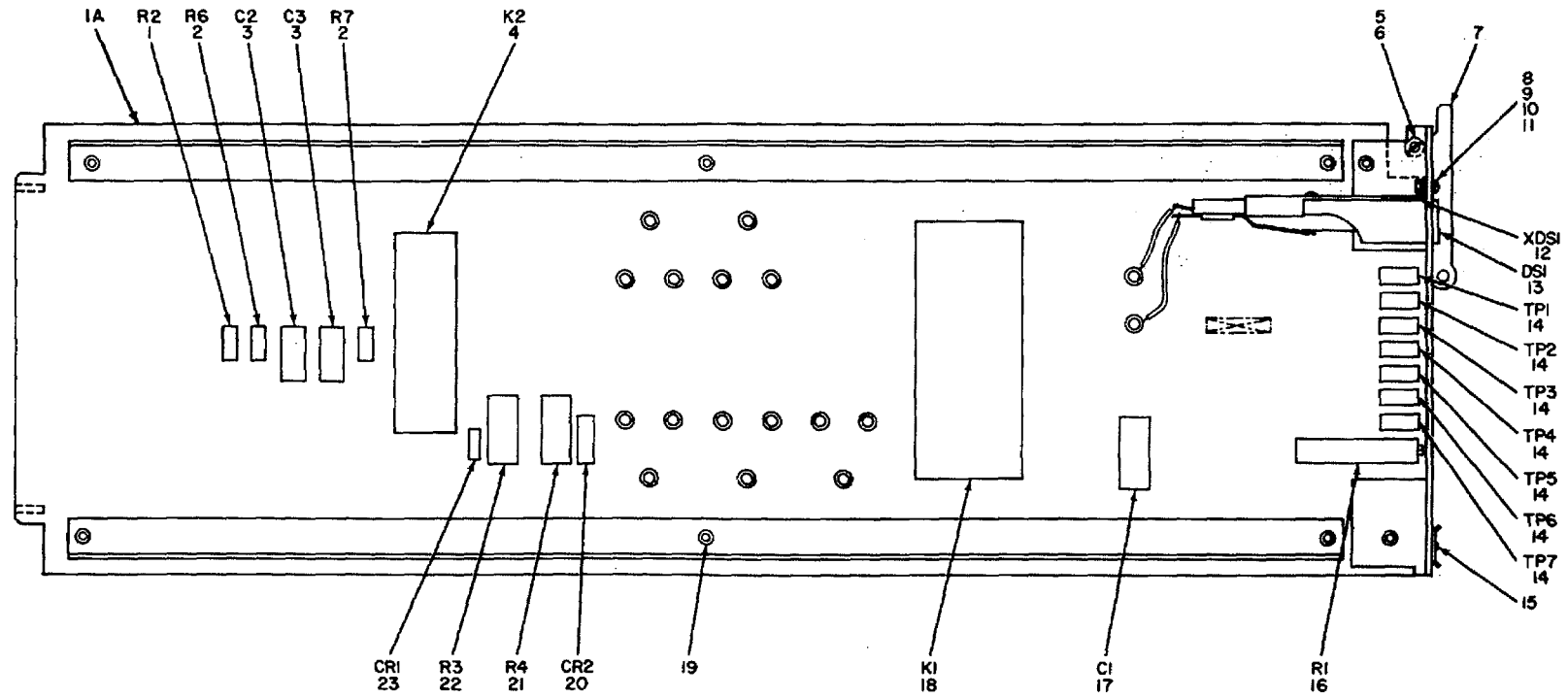
EL5805-669-14-TM-12

Figure B-1. Universal Shelf (90409000-000)



EL5805-669-14-TM-13

Figure B-2. Printed Wiring Board Extender MX-9664/FTC



EL5805-669-14-TM-14

Figure B-3. Signal Lead Extension Plug-In Unit TA-951/FTC

Section IV. FEDERAL STOCK NUMBER AND PART NUMBER INDEX

<u>STOCK NUMBER</u>	<u>FIGURE NO.</u>	<u>ITEM NO.</u>	<u>STOCK NUMBER</u>	<u>FIGURE NO.</u>	<u>ITEM NO.</u>
5305-054-5648	B-3	5	5320-117-6010	B-3	15
5305-054-5648	B-3	8	5320-879-4473	B-1	1
5305-054-5653	B-2	2	5320-879-4473	B-3	19
5305-054-6654	B-1	5	5805-372-2589	B-3	7
5305-177-5545	B-1	8	5905-104-8350	B-3	2
5310-595-6211	B-1	9	5905-116-8561	B-3	1
5310-595-6211	B-2	3	5905-137-0545	B-3	16
5310-595-6211	B-3	6	5905-195-5524	B-3	21
5310-595-6211	B-3	9	5905-256-3361	B-3	22
5310-722-5998	B-1	6	5910-726-1537	B-3	3
5310-725-4719	B-1	4	5935-131-8366	B-2	1
5310-929-6395	B-1	7	5935-419-1612	B-3	14
5310-933-8118	B-1	10	5961-866-0476	B-3	23
5310-933-8118	B-2	4	6210-911-9536	B-3	12
5310-933-8118	B-3	10	6240-760-8306	B-3	13
5310-934-9748	B-2	5	6625-602-5123	B-3	1A
5310-934-9748	B-3	11	6625-602-5151	B-2	1A

<u>PART NUMBER</u>	<u>FSCM</u>	<u>FIG. NO.</u>	<u>ITEM NO.</u>	<u>PART NUMBER</u>	<u>FSCM</u>	<u>FIG NO.</u>	<u>ITEM NO.</u>
CLS632-2	46384	B-1	4	RC20GF221J	81349	B-3	2
HBD22W0-4080	81312	B-1	3	RC20GF270J	81349	B-3	1
GX81-67-1G8	91506	B-3	14	RC42GF102J	81349	B-3	22
MS15795-803	96906	B-1	9	RC42GF182J	81349	B-3	21
MS15795-803	96906	B-2	3	SD42BS	07707	B-1	1
MS15795-803	96906	B-3	6	SD42BS	07707	B-3	19
MS15795-803	96906	B-3	9	SST4-40SMPAT	70318	B-1	11
MS15795-805	96906	B-1	6	WMF2S1	14655	B-3	3
MS20426AD2-3	96906	B-3	15	1DP2-503K	81471	B-3	17
MS35338-135	96906	B-1	10	1N3029B	81349	B-3	20
MS35338-135	96906	B-2	4	1N457	81349	B-3	23
MS35338-135	96906	B-3	10	260P1-103	80294	B-3	16
MS35338-136	96906	B-1	7	46004005-000	96238	B-3	18
MS35649-244	96906	B-2	5	46006085-000	96238	B-3	4
MS35649-244	06906	B-3	11	60XA	58854	B-3	13
MS51957-120	96906	B-1	8	62050049-000	96238	B-3	7
MS51957-14	96906	B-3	5	80409000-000	96238	B-1	2
MS51957-14	96906	B-3	8	80409160-000	96238	B-2	1A
MS51957-19	96906	B-2	2	80409170-000	96238	B-3	1A
MS51957-30	96906	B-1	5	88DJ22M	81312	B-2	1
PJ150	70674	B-3	12	90409000-000	96238	B-1	1A

APPENDIX C

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-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 and to detect / incipient failure 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, preserve, drain, paint, or to replenish fuel/lubricants/hydraulic fluids or compressed air supplies.

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

e. Align. To adjust specified variable elements of an item to 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 equipment used to precision measurement. Consists of the comparison of two instruments, one of which is a ½ 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, module (component or assembly) in a manner to allow the proper functioning of the equipment system.

h. Replace. The act of substituting a serviceable like-type part, subassembly, module (component or assembly) in a manner to allow the proper functioning of an equipment/system.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module component/assembly, end item or system.

j. Overhaul. That maintenance effort (service action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (e.g., DMWR) in pertinent technical manuals. 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 materiel 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.

l. Symbols. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

C-3. Explanation of Format

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

b. Functional Group. Column 2 lists the higher assembly group and the item names of components, assemblies, subassemblies and modules within the group for which maintenance is authorized.

c. *Maintenance Functions.* Column 3 lists the twelve maintenance functions defined in paragraph C-2 above. Each maintenance function required for an item is specified by the symbol among those listed in e below which indicates the level responsible for the required maintenance. Under this symbol is listed an appropriate work measurement time value determined as indicated in e below.

d. *Use of Symbols.* The following symbols are used to prescribe work function responsibility:

- C- Operator crew
- O- Organization
- F- Direct support
- H- General support
- D- Depot

e. *Work Measurement Time.* The active repair time required to perform the maintenance function is included directly below the symbol identifying the category of maintenance. The skill levels used to obtain the measurement times approximate those found in typical TOE units. Active repair time is the average aggregate time required to restore an item (sub-assembly, assembly, component, module, end item or system) to a serviceable condition under--typical field operating conditions. This time includes preparation time, fault isolation diagnostic time, and QA/QC time in addition to the time to perform specific maintenance functions identified for the tasks authorized in the maintenance allocation chart. This time is expressed in manhours and carried to one decimal place (tenths of hours).

f. *Tools and Equipment.* This column is used to specify, by code, those tools and equipment required to perform the designated function.

g. *Remarks.* Self-explanatory.

C-4. Explanation of Format of Tables for Tool and Test Equipment Requirements

a. *Tools and Equipment.* The numbers in this column coincide with the numbers used in the tools and equipment column of the maintenance allocation chart. The numbers indicate the applicable tool for the maintenance function.

b. *Maintenance Category.* The codes in this column indicate the maintenance category normally allocated the facility.

c. *Nomenclature.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. *Federal Stock Number.* This column lists the Federal stock number of the specific- tool or test equipment.

NOTE

For requisitioning purposes, the Federal stock number must be converted to the National stock number by adding "-00-" after the Federal stock classification (FSC) code (first four digits). For example, FSN 6625-553-0142 converts to NSN 6625-00-553-0142

e. *Tool Number.* Not used.

(Next printed page is C-3)

TABLE C2-1. TOOL AND TEST EQUIPMENT REQUIREMENTS (UNIVERSAL 90409000-000)

TOOL AND TEST REQUIREMENTS				
TOOLS AND EQUIP	MAINT. CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	O, F, H	UNIVERSAL SHELF 90409000-000 (CONT'D) MULTIMETER AN/USM-223 (SIMPSON 260)	6625-999-7465	
2	H	TOOL KIT, ELECTRONIC EQUIPMENT TK100/G	5180-605-0079	
3	F	TOOL KIT, ELECTRONIC EQUIPMENT TK105/G	5180-610-8177	

SECTION III. MAINTENANCE ALLOCATION CHART (EXTENDER, PRINTED WIRING BOARD MX-9664/FTC)

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY NOMENCLATURE	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		I N S P E C T	T E S T	S E R V I C E	A D J U S T	A L I G N	C A L I B R A T E	I N S T A L L	R E P L A C E	R E P A I R	O V E R H A U L		
01	EXTENDER. PRINTED WIRING BOARD MX-9664/FTC (80409160-000)	O 0.1	O 0.1					F 0.1				1	
	<p>Note</p> <p>Direct Support (F) level maintenance operations for fixed plant equipment located OCONUS, will be performed by Off Site (Area Maintenance and Supply Facility, AMSF) personnel.</p>												

TABLE C3-1. TOOL AND TEST REQUIREMENTS (EXTENDER WIRING BOARD MX-9664/FTC)

TOOL AND TEST REQUIREMENTS				
TOOLS AND EQUIP	MAINT. CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	O, F, H	MX-9664/FTC (CONT'D) MULTIMETER AN/USM-223 (SIMPSON 260)	6624-999-7465	

SECTION III. MAINTENANCE ALLOCATION CHART (PLUG-IN UNIT, SIGNAL LEAD EXTENSION TA-951/FTC)

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY NOMENCLATURE	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REMARKS
		I N S P E C T	T E S T	S E R V I C E	A D J U S T	A L I G N	C A L I B R A T E	I N S T A L L	R E P L A C E	R E P A I R	O V E R H A U L		
03	Plug-In Unit, Signal Lead Extension TA-951/FTC (SLU-DX- 1/DX-2) <p style="text-align: center;">Note</p> Direct Support (F) level maintenance operations for fixed plant equipment located OCONUS, will be performed by Off Site (Area Maintenance and Supply Facility, AMSF) personnel.	O 0.1	F 0.4		F 0.3			F 0.1		H 0.4		1 thru 7and 9 2 1 thru 8	

TABLE C4-1. TOOL AND TEST REQUIREMENTS (PLUG-IN UNIT, SIGNAL LEAD EXTENSION TA-951/FTC)

TOOL AND TEST REQUIREMENTS				
TOOLS AND EQUIP	MAINT. CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	F, H	TA-951/FTC (CONT'D) CONNECTOR, RECEPTACLE ELECTRICAL, 22 PIN (WINCHESTER HBD22WO-4080)		
2	O, F, H	MULTIMETERAN/USM-223 (SIMPSON 260)	6625-999-7465	
3	F, H	POWER SUPPLY PP6547/U (HP6206B)	6625-823-5359	
4	F, H	RESISTOR, FIXED FILM 430 OHMS 2%, 1W RL32S431G, MIL-R-22684	5905-922-7063	
5	F, H	RESISTOR, FIXED FILM, 5.1K OHMS 2%, 1W RL32S512G, MIL-R-22684	5905-880-4184	
6	F, H	TERMINAL BOARD, 22 TERMINALS (KULKA ELECTRIC JN113062-138)	5940-433-0846	
7	F, H	TEST SET, TELEPHONE AN/TSM-86 (LENKURT 900-26600-00)	6625-973-9254	
8	H	TOOL KIT, ELECTRONIC EQUIPMENT TK100/G	5180-605-0079	
9	F	TOOL KIT, ELECTRONIC EQUIPMENT TK105/G	5180-610-8177	

By Order of the Secretary of the Army:

FRED C. WEYAND
*General, United States Army,
 Chief of Staff.*

Official:

PAUL T. SMITH
*Major General, United States Army,
 The Adjutant General.*

Distribution:

Active Army:

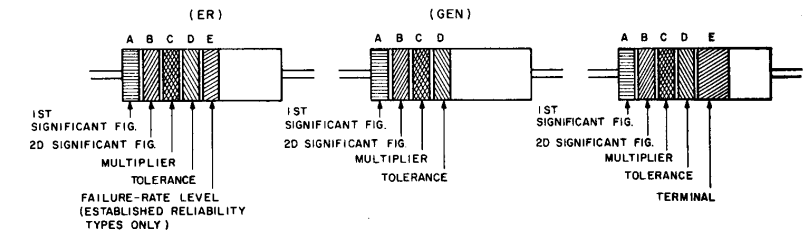
USASA (2)
 Dir of Trans (1)
 COE (1)
 TSG (1)
 USAARENBD (1)
 AMC (1)
 TRADOC (2)
 ARADCOM (2)
 ARADCOM Rgn (2)
 OS Maj Comd (4)
 LOGCOMDS (3)
 MICOM (2)
 TECOM (2)
 USACC (4)
 MDW (1)
 Armies (2)
 Corps (2)
 HISA (Ft Monmouth) (43)
 Svc Colleges (1)
 USASESS (5)
 USAADS (2)
 USAFAS (2)
 USAARMS (2)
 USAIS (2)
 USAES (2)
 USAINTCS (3)

Fort Carson (5)
 WRAMC (1)
 ATS (1)
 Fort Gillem (10)
 Fort Gordon (10)
 Fort Huachuca (10)
 WSMR (1)
 Ft Richardson (ECOM Ofc) (2)
 Army Dep (1) except
 LBAD (14)
 SAAD (30)
 TOAD (14)
 SHAD (3)
 USA Dep (2)
 Sig Sec USA Dep (2)
 Sig Dep. (2)
 Sig FLDMS (1)
 USAERDAA (1)
 USAERDAW (1)
 MAAG (1)
 USARMIS (1)
 Units org under fol TOE
 (1 copy each unit):
 11-500 (AA-AC)
 29-134
 29-136

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 310-50.



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS. COLOR CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL
BLACK	0	BLACK	0	BLACK	1	BROWN	±10 (COMP. TYPE ONLY)	BROWN	M=1.0
BROWN	1	BROWN	1	BROWN	10	BROWN	±1	RED	P=0.1
RED	2	RED	2	RED	100	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)	ORANGE	R=0.01
ORANGE	3	ORANGE	3	ORANGE	1,000	ORANGE		YELLOW	S=0.001
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER		WHITE	
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5		
BLUE	6	BLUE	6	BLUE	1,000,000	RED			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7						
GRAY	8	GRAY	8	SILVER	0.01				
WHITE	9	WHITE	9	GOLD	0.1				SOLD-ENABLE

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS). ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

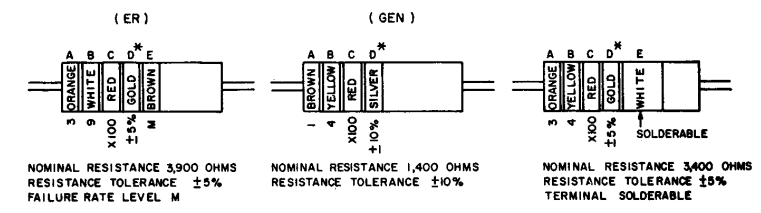
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

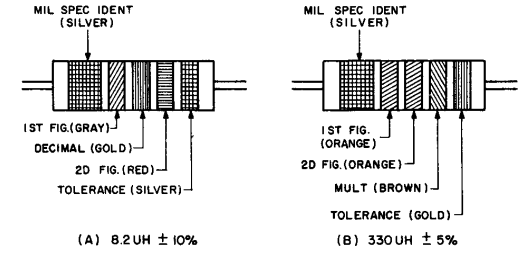
EXAMPLES OF COLOR CODING



COMPOSITION-TYPE RESISTORS FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS. B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.



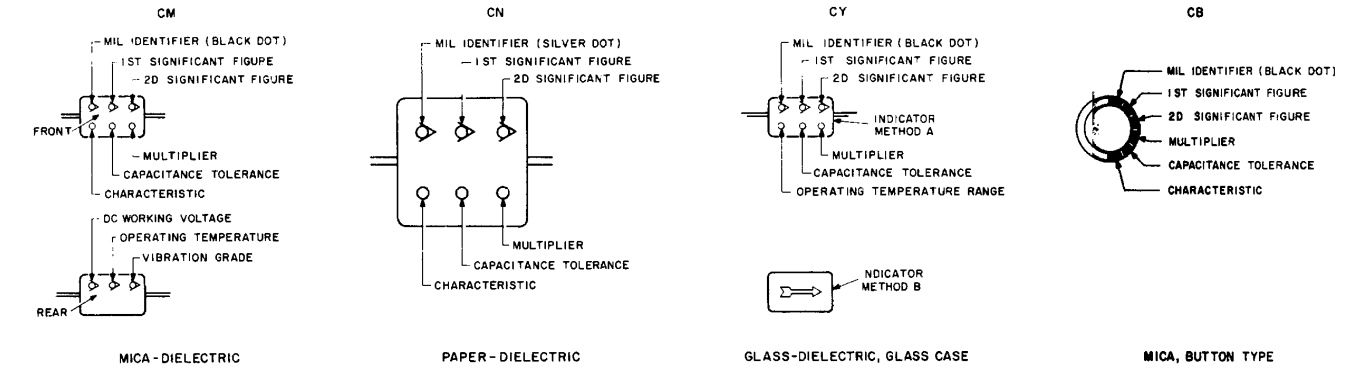
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKES IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

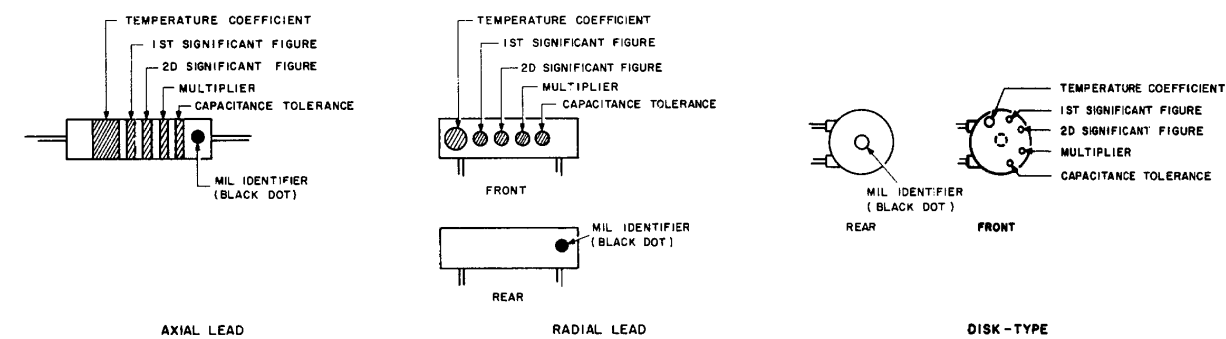
COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD			5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.



MICA-DIELECTRIC PAPER-DIELECTRIC GLASS-DIELECTRIC, GLASS CASE MICA, BUTTON TYPE



AXIAL LEAD RADIAL LEAD DISK-TYPE

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER	CAPACITANCE TOLERANCE				CHARACTERISTIC	DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB				
BLACK	CM, CY, CB	0	0	1			±20%	±20%	A		-55° TO +70°C	10-55 HZ
BROWN		1	1	10					B	E		
RED		2	2	100	±2%		±2%	±2%	C		-55° TO +85°C	
ORANGE		3	3	1,000		±30%			D	D	300	
YELLOW		4	4	10,000					E		-55° TO +25°C	10-2,000 HZ
GREEN		5	5		±5%				F		500	
BLUE		6	6								-55° TO +50°C	
PURPLE (VIOLET)		7	7									
GRAY		8	8									
WHITE		9	9									
GOLD				0.1			±5%	±5%				
SILVER	CN			0.01	±10%	±10%	±10%	±10%				

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT*	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	-30	1	1	10	±1%		
RED	-80	2	2	100	±2%	±0.25 UUF	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		±5%	±0.5 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GRAY		8	8	0.01*			
WHITE		9	9	0.1*	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

- THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
 - LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-250, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
 - LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
 - TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.
- * OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

R MILITARY STANDARD CAPACITORS.

Figure FO-1. Color code markings for MIL-STD resistors, inductors, and capacitors.

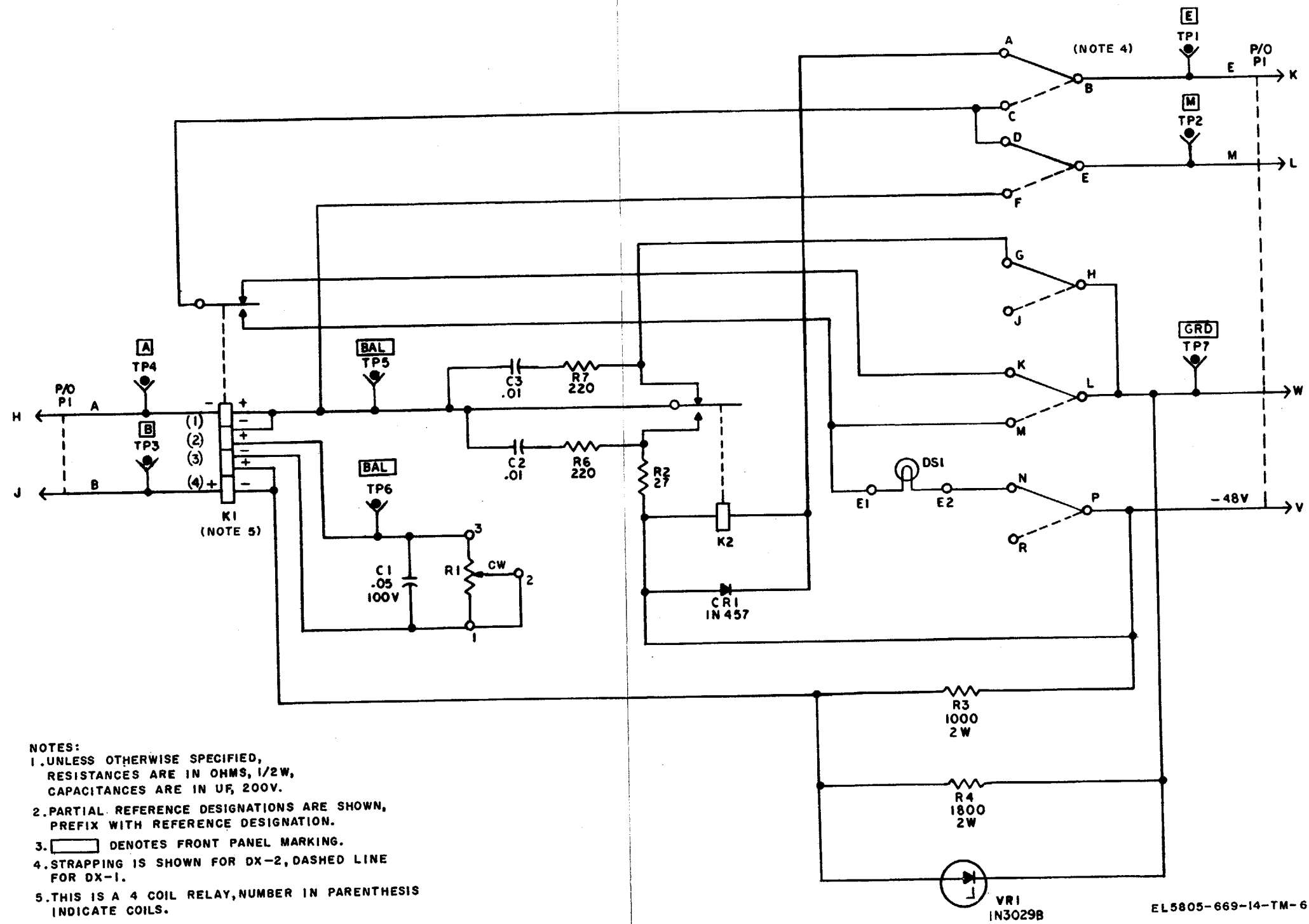


Figure FO-2. Extension unit, schematic diagram.

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