TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

FOR

PLUG-IN UNIT, LINE SIGNAL ATTENUATOR CN-1449/FTC

(Stelma AT-2P)

(NSN 6625-00-602-5120)

PLUG-IN UNIT, CARRIER BOARD MT-4722/FTC

(Stelma CB-1)

(NSN 5820-00-593-4790)

EXTENDER, PRINTED-WIRING BOARD MX-9664/FTC

(NSN 6625-00-602-5151)

AND

UNIVERSAL SHELF 904090000-000

(LINE CONDITIONING EQUIPMENT)

This copy is a reprint which includes current pages from Changes 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
NOVEMBER 1975

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.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *6 December 1978*

Operator's, Organizational, Direct Support and General Support Maintenance Manual For PLUG-IN UNIT, LINE SIGNAL ATTENUATOR CN-1449/FTC (STELMA AT-2P) (NSN 6625-00-602-5120) PLUG-IN UNIT, CARRIER BOARD MT-4722/FTC (STELMA CB-1) (NSN 5820-00-593-4790) EXTENDER, PRINTED-WIRING BOARD MX-9664/FTC (NSN 6625-00-602-5151) AND UNIVERSAL SHELF 90409000-000 (LINE CONDITIONING EQUIPMENT)

TM 11-5805-672-14&P, 3 November 1975, is changed as follows:

1. The title of the manual has been changed as shown above.
2. New or changed material is indicated by a vertical bar in the margin.
3. Remove and insert pages as indicated below:

Remove	*Insert'*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
3-1	3-1
5-1 and 52	5-1 and 5-2
6-1 and 6-2	6-1 anti 6-2
A-1	A-1
B-1 thru B-12	None
C-1 thru C-10	C-1 thru C-5

4. File this change sheet in front of the manual for reference purposes.

By Order of the Secretary of the Army'

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Chief of Staff

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TOAD (14)
USA Dep (1)
Sig Sec USA Dep (1)
Units org under fol TOE
11-500 (AA-AC) (1)
29-134 (1)
29-136 (1)
29-207 (2)
29-610 (2)

ARNG: NONE
USAR: NONE
For explanation of abbreviations used, see AR 310-50

TECHNICAL MANUAL
No.11-5805-672-14&P

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *3 November 1975*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL FOR

PLUG-IN, UNIT, LINE SIGNAL ATTENUATOR CN-1449/FTC (Stelma AT-2P) (NSN 6625-00-602-5120)

PLUG-IN UNIT, CARRIER BOARD MT-4722/FTC (Stelma CB-1) (NSN 5820-00-593-4790)

EXTENDER, PRINTED-WIRING BOARD MX-9664/FTC (NSN 6625-00-602-5151) AND UNIVERSAL SHELF 90409000-000 (LINE CONDITIONING EQUIPMENT)

LIST OF ILLUSTRATIONS

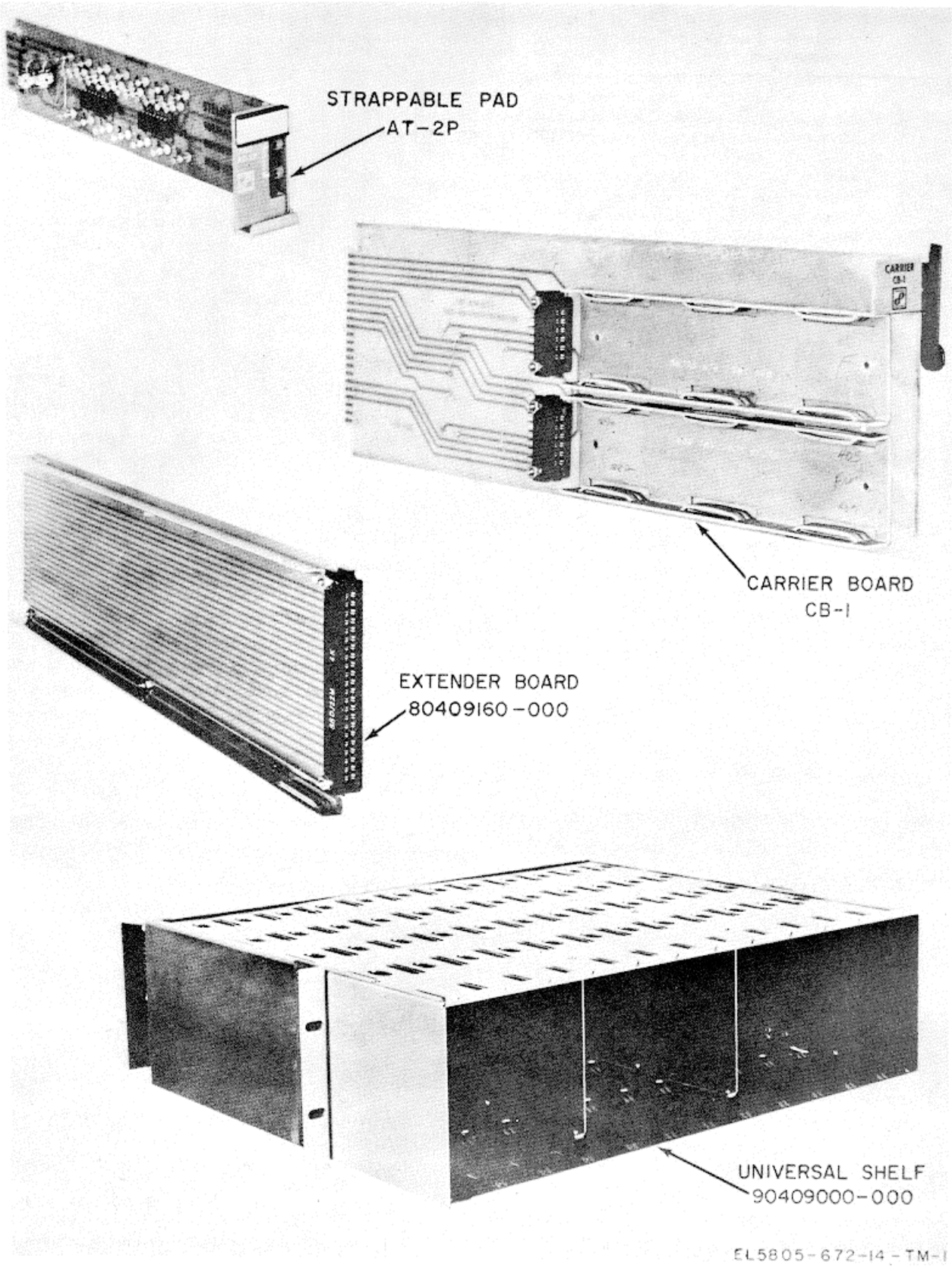

Figure 1-1. Strappable Pad AT-2P, Carrier Board CB-1,. Extender Board 80409160-000, and Universal Shelf 90409000-000

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains information and instructions for installation, operation and maintenance of Plug-in Unit, Line Signal Attenuator CN-1449/FTC (strappable pad model AT-2P); Plug-in Unit, Carrier Board MT-4722/FTC(carrier board model CB-1); Extender, Printed-Wiring Board AIX-9664/FTC (extender board 80409160-000); and Universal Shelf 90409000-000 (fig. 1-1). The maintenance coverage includes on-site and off-site maintenance as authorized by the maintenance allocation chart (app B). The official nomenclature/item name, National Stock Number (NSN), and assigned common names of these items are given in paragraph 1-9. The official nomenclature does not appear anywhere on the items, therefore, the common name is used throughout this manual for ease of use.

b. Refer to TM 11-5805-672-34P for any illustrations pertaining to the Repair Parts and Special Tools List. These figure numbers will be preceded by the letter B (e.g., B-3, B-4 etc).

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 the latest issue of 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 70058/NAVSUPINST 4030 29/AFR 71-13/MCO P4030.29Aand DLAR 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/NAVSUPINST 4610.33B/AFR 75-18/ MCO P4610.19C and DLAR 4500.15.

1-4. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication 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 Communications and Electronics Materiel Readiness Command, ATTN. DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

1-4.1 Reporting Equipment Improvement Recommendations (EIR)

EIR's will be prepared using SF 368 (Quality Deficiency Report). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

1-5. Administrative Storage

Administrative storage of equipment issued to and used by Army activities shall be in accordance with paragraph 3-40.

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.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

The strappable pad is used in line conditioning equipment to provide insertion loss in a 600-ohm balanced line. Selection of the desired insertion loss is accomplished by strap adjustment, (0.5 db steps) within the range of 0 to 31.5 db attenuation. The strappable pad can be used with various line amplifiers to establish desired levels at various points in a voice frequence (vf) communications circuit.

1-8. Technical Characteristics

a. Strappable Pad Signal Line Characteristics.

(1) Input power level (max)....+20 dbm
(2) Input/output impedance ...600 ohms +2% balanced
(3) Input and output
return loss.....40 db from 200 to 4000 Hz with opposite terminals terminated in 600 ohms
(4) Insertion loss.....Strappable in 0.5 db steps from 0 to 31 5 db

b. Environment Conditions.

(1) Nonoperating (storage)
Air temperature .....Minus 40°F to +158°F
Relative humidity
(percent) ..... 95%, RH mixture including condensation due to temperature changes
(2) Operating
Air temperature ..... +32°F to + 130°F
Relative humidity
(percent) ..... 95% RH mixture including condensation due to temperature changes

1-9. Items Comprising an Operable Equipment

The official nomenclature/item name, National Stock Number(NS), 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/ item name	Common name	Qty	Dimensions (in)			Unit	
				Height	Depth	Width	Weight (oz.)	Volume (cu in.)
6625-00-602-5120	Plug-in Unit, Line Signal Attenuator CN-1449/FI'C	Strappable pad AT-2P	1	1-3/4	8 ½	1	1	14-7/8
5820-00-593-4790	Plug-in Unit, Carrier Board MT4722/FTC	Carrier board CRB-1	1	4-5/8	15	1-1/4	11	86-3/4
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 lbs	1645 7/8

1-10. Description

a. Strappable Pad. The strappable pad consists of a printed circuit card fastened to a front panel Its major components are two attenuator networks which are housed in solid state miniature modules on the printed circuit card. The PC card is inserted into one of two receptacles on the carrier board. The bottom of the strappable pad's front panel is U-shaped and is easily grasped to remove the unit from the carrier board. A cutout in the front panel of the strappable pad provides access to two output test points.

b. Carrier Board. The carrier board consist of a PC card on which two fixtures are mounted. Each fixture contains three upper and lower PC card guides and a 6-pin receptacle. A 12-inch receptacle that mates with the connector tabs at the rear of the strappable pad is also provided for each fixture. Each 12-pin receptacle is connected by printed-circuit wiring to the connector tabs at the rear of the carrier board. The carrier board connector tabs mate with a 22-pin receptacle in the universal shelf. A pivoted extractor arm fastened to the front of the carrier board facilitates removal of the board from the adapter shelf.

NOTE

The carrier board is capable of accepting a Plug-In Unit, Line Ampli-fier AM-6745/FTC (LA-3) (TM 11-5805-675-14 & P) adjacent to a strappable pad. A line amplifier/strappable pad combination, serving any particular vf circuit, may therefore be mounted on one carrier board to simplify installation and maintenance.

c. Extender Board. The extender board enables electrical connection of the carrier board, and modules mounted thereon, to the universal shelf wiring, while exposing module component parts for maintenance purposes.

d. Universal Shelf. The universal shelf, which is front-mounted in a standard 19-inch rack, can receive a maximum of 12 carrier boards. The top and bottom cover plates are equipped with PC card guides to facilitate installation and removal of carrier boards. 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. Twelve 22-pin receptacles at the rear of the universal shelf provide electrical connection for the carrier boards with which they mate. A cover plate, 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

As previously described in chapter 1, the strappable pad is used to establish desired levels at various points in a voice-frequency (vf) communications circuit. Typical system application of the strappable pad is shown in figure 2-1. Each strappable pad is installed on a carrier board, which is, in turn, installed in any one of 12 module locations (22-pin receptacles) m the universal shelf. The universal shelf mounting dimensions are shown in figure 2-2. Allow at least a 30-inch clearance at the front of the universal shelf for insertion, removal and maintenance of each strappable pad installed in a carrier board. 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 signal power, Impedance, insertion loss and environmental conditions are listed in paragraph 1-8.

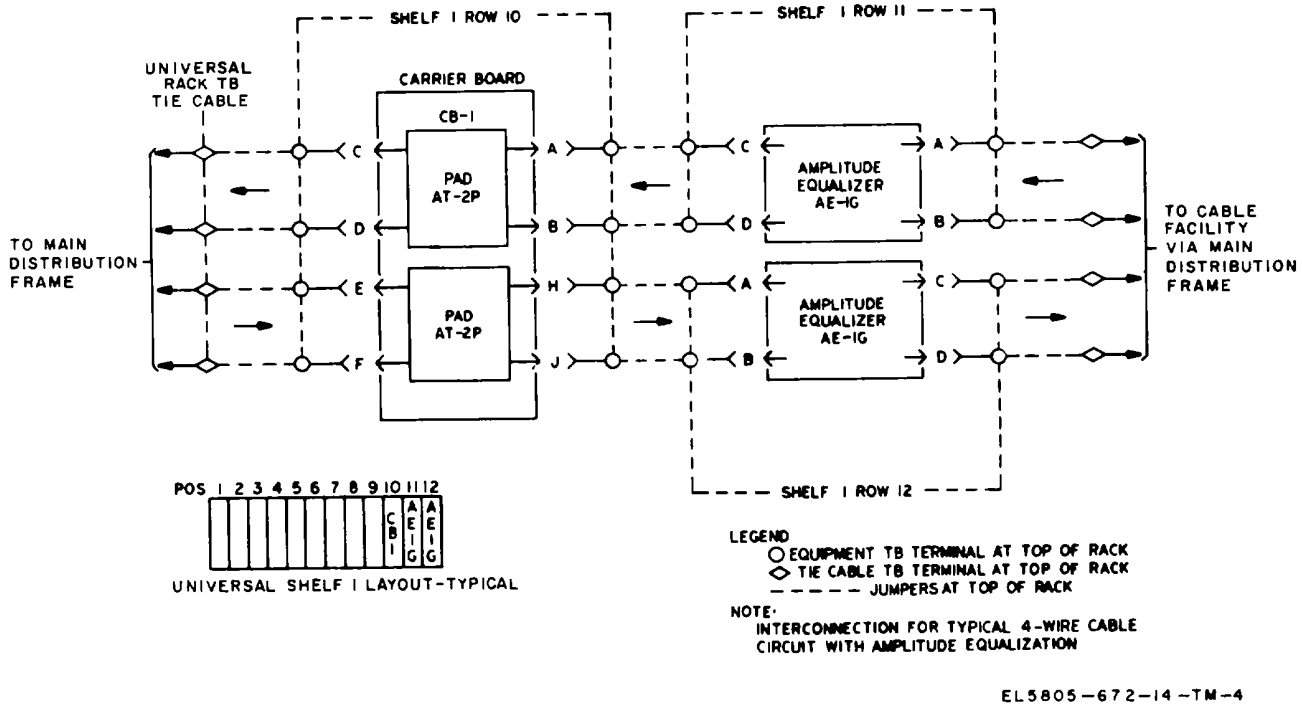

Figure 2-1. Strappable pad, typical system application.

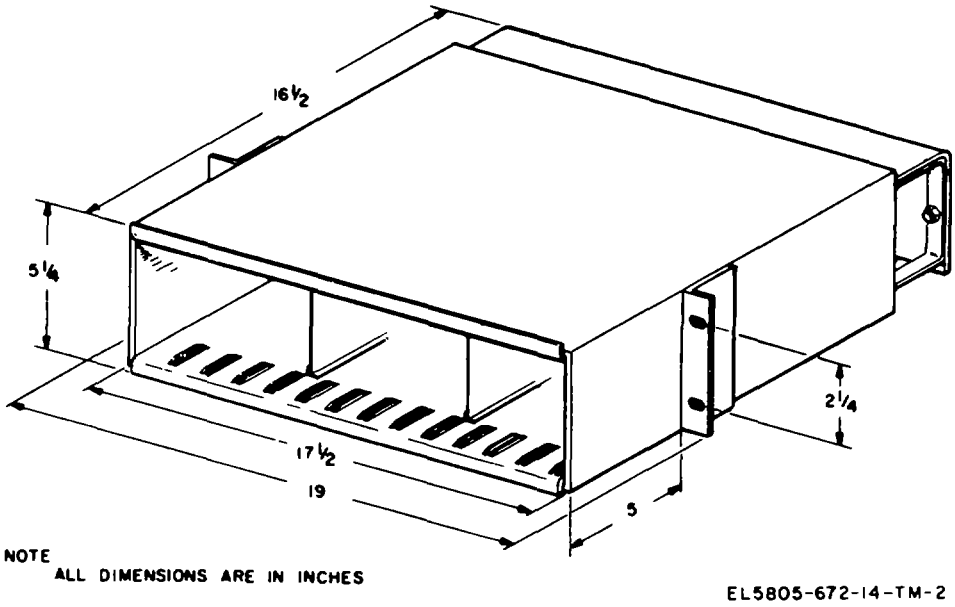

Figure 2-2. Universal shelf, mounting dimensions.

2-2. Site and Shelter Requirements

The strappable pad, carrier board 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 strappable pad, carrier board, 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.

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).

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 comprising an operable equipment list (para 1-9). Report all discrepancies in accordance with paragraph 1-3*c*. The equipment should be placed m 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.)

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

Section III. INSTALLATION

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

No special tools or materials are required for installation of the universal shelf, carrier board and strappable pad. The extender board is provided for use by direct support personnel in performing maintenance. Table 2-1 lists the test equipment required in performance of preliminary adjustment and initial check of the equipment.

Table 2-1. Tools and Test Equipment

Items	*Purpose*	*Common name*
1. Generator, Signal AN/USM-264	Preliminary checks and adjustment of equipment.	Signal generator.
2. Multimeter AN/USM-223	Preliminary checks and adjustment of equipment.	Multimeter.
3. Resistor, Fixed Film 600 ohm, 1%, 1/2w, RN70B6000F, MIL-R-10509	Preliminary checks and adjustment of equipment.	Terminating resistor.
4. Tool Kit, Electronic Equipment TK-105/G	Preliminary checks and adjustment of equipment.	Tool Kit.
5. Voltmeter Electronic AN/USM-265	Preliminary checks and adjustment of equipment.	Ac voltmeter.

2-6. Installation Instructions

WARNING

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

a. Place universal shelf into the desired rack or cabinet mounting position.

b. Align mounting bracket slots (fig. 2-2) with rack or cabinet mounting holes, and secure universal shelf with mounting hardware.

c. Strap the desired insertion loss on the associated strappable pad as described in paragraph 2-7.

d. Insert strappable pads (1 or 2) into the fixture on the carrier board. Check to see that module connectors are firmly seated in carrier board receptacle.

e. Insert carrier board (maximum of 12) into universal shelf and check to see that the carrier board connector firmly engages the shelf receptacle.

f. Connect wires from universal shelf rear connector (fig. 2-3) for each strappable pad to be installed) directly to a terminal block at the top of the rack or cabinet. Perform the associated jumper connections of the terminal board for the associated system modules and main distribution frame, as required. Figure 2-1 shows typical signal wiring jumper connections.

NOTE

All required electrical connections for two strappable pads, when installed on the carrier board, are affected when the carrier board is inserted in the universal shelf and the rear universal shelf receptacles wiring is completed.

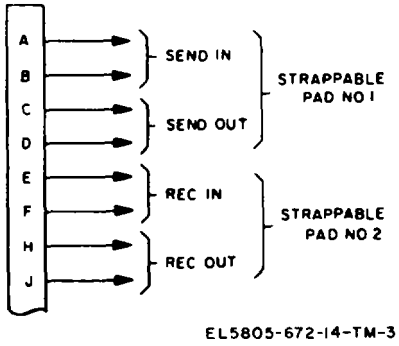

Figure 2-3. Strappable pads, external wiring connections

g. 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 (i.e., 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.

h. Whenever possible, identify the line which the strappable pad services. An insert is provided on the front panel of each strappable pad for this purpose

Section IV. PRELIMINARY ADJUSTMENT OF EQUIPMENT

2-7. Insertion Loss Strapping

Selection of the insertion loss to the place in a particular communications line is accomplished by connecting terminals on the strappable pad to be placed in that line, before installing the module on the carrier board. This attenuation adjustment (fig. 2-4) is performed by direct support maintenance personnel as outlined below

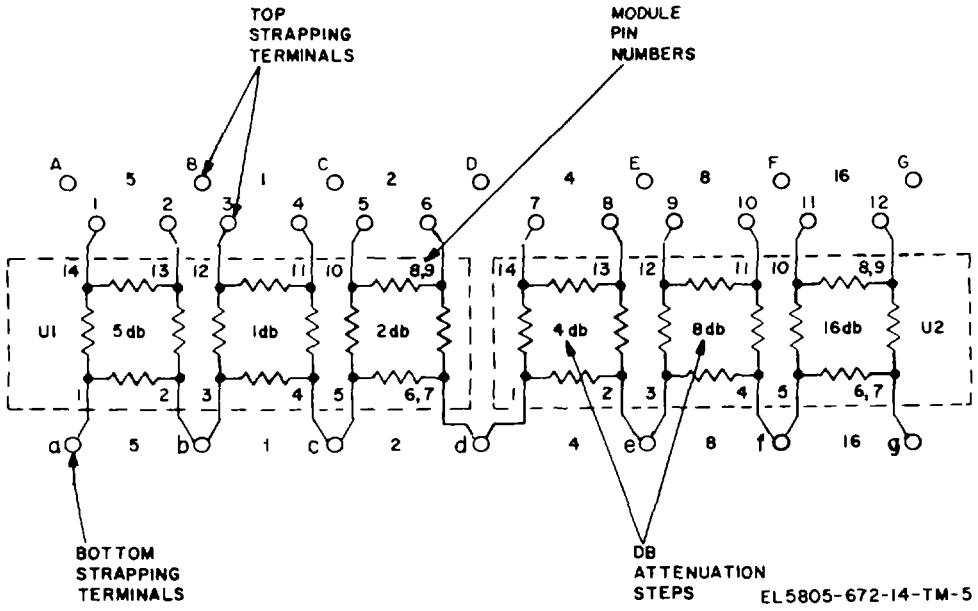

Figure 2-4. Strapping terminal identification.

a. Determine the pad value to be used by calculating which values, when totaled, equal the desired attenuation. Six pad values (0.5, 1, 2, 4, 8, and 16 db) are available (fig. 2-4). However, these may be strapped, in 0.5 db steps, for any value from 0 through 31.5 db.

b. For example, if the strappable pad is to be set for 11.5 db attenuation, the pad values 0.5, 1, 2, and 8 provide the required total. Therefore, the strapping terminals, listed below, must be connected so that the required pad values are in series between the input and output terminals of the strappable pad.

Strapping Terminals

From	*To*
A	1
2	3
4	5
6	D,E, 9
10	F, G
d	e
f	g

NOTE

Wires to terminals D, E, and F need only be wrapped (not soldered) to facilitate later change. These terminals are used only to insure that the strapping wire does not short against the outer case or another pad section.

c. If it is desired to provide an attenuation level other than – 11.5 db, refer to table 2-2 for the range of attenuation values available from each strappable pad. When using table 2-2, note that between numbers or letters separated by a diagonal line, no wire connections are to be made.

Table 2-2. Strapping Terminal Connections

Dob loss	*Module top terminal connections*	*Module bottom terminal connections*
0.0	A-B-C-D-E-F-G	a-b-c-d-e-f-g
0.5	A-1/2-B-C-D-E-F-G	b-c-d-e-f-g
1.0	A-B-3/4-C-D-E-F-G	a-b/c-d-e-f-g
1.5	A-1/2-3/4-C-D-E-F-G	c-d-e-f-g
2.0	A-B-C-5/6-E-E-F-CG	a-b-c/d-e-f-g
2.5	A-1/2-B-C-5/6-D-E-F-G	b-c/d-e-f-g
3.0	A-B-3/4-5/6-D-E-F-G	a-b/d-e-f-g
3.5	A-1/2-3/4-5/6-D-E-F-G	d-e-f-g
4.0	A-B-C-D-7/8-E-F-G	a-b-c-d/e-f-g
4.5	A-1/2-B-C-D-7/8-E-F-G	b-c-d/e-f-g
5.0	A-B-3/4-C-D-7/8-E-F-G	a-b/c-d/e-f-g
5.5	A-1/2-3/4-C-D-7/8-E-F-G	c-d/e-f-g
6.0	A-B-C-5/6-7/8-E-F-G	a-b-c/e-f-g
6.5	A-1/2-B-C-5/6-7/8-E-F-G	b-c-/e-f-g
7.0	A-B-3/4-5/6-7/8-E-F-G	a-b/e-f-g
7.5	A-1/2-3/4-5/6-7/8-E-F-G	e-f-g
8.0	A-B-C-D-E-9/10-F-G	a-b-c-d-e/f-g
8.5	A-1/2-B-C-D-E-9/10-F-G	b-c-d-e/f-g
9.0	A-B-3/4-C-D-E-9/10-F-G	a-b-/c-d-e/f-g
9.5	A-1/2-3/4-C-D-E-9/10-F-G	c-d-e/f-g
10.0	A-B-C-5/6-E-E-9/10-F-G	a-b-c/d-e/f-g
10.5	A-1/2-B-C-5/6-D-E-9/10-F-G	b-c/d-e/f-g
11.0	A-B-3/4-5/6-D-E-9/10-F-G	a-b/d-e/f-g
11.5	A-1/2-3/4-5/6-D-E-9/10-F-G	d-e/f-g
12.0	A-B-C-D-7/8-9/10-F-G	a-b-c-d/f-g
12.5	A-1/2-B-C-D-7/8-9/10-F-G	b-c-d-e/f-g
13.0	A-B-3/4-C-D-7/8-9/10-F-G	a-b/c-d/f-g
13.5	A-1/2-3/4-C-D-7/8-9/10-F-G	c-d/f-g
14.0	A-B-C-5/6-7/8-9/10-F-G	a-b-c/f-g
14.5	A-1/2-B-C-5/6-7/8-9/10-F-G	b-c/f-g
15.0	A-B-3/4-5/6-7/8-9/10-F-G	a-b/f-g
15.5	A-1/2-3/4-5/6-7/8-9/10-F-G	f-g
16.0	A-B-C-D-E-F-11/12-G	a-b-c-d-e-f
16.5	A-1/2-B-C-D-E-F-11/12-G	b-c-d-e-f-
17.0	A-B-3/4-C-D-E-F-11/12-G	a-b/c-d-e-f
17.5	A-1/2-3/4-C-D-E-F-11/12-G	c-d-e-f
18.0	A-B-C-5/6-D-E-F-11/12-G	a-b-c-/d-e-f
18.5	A-1/2-B-C-5/6-D-E-F-11/12-G	b-c/d-e-f
19.0	A-B-3/4-5/6-D-E-F-11/12-G	a-b/d-e-f
19.5	A-1/2-3/4-5/6-D-E-F-11/12-G	d-e-f
20.0	A-B-C-D-7/8-E-F-11/12-G	a-b-c-d/e-f
20.5	A-1/2-B-C-D-7/8-E-F-11/12-G	b-c-d/e-f
21.0	A-B-3/4-C-D-7/8-E-F-11/12-G	a-b/c-d/e-f
21.5	A-1/2-3/4-C-D-7/8-E-F-11/12-G	c-d/e-f
22.0	A-B-C-5/6-7/8-E-F-11/12-G	a-b-c/e-f
22.5	A-1/2-B-C-5/6-7/8-E-F-11/12-G	b-c/e-f
23.0	A-B-3/4-5/6-7/8-E-F-11/12-G	a-b/e-f
23.5	A-1/2-3/4-5/6-7/8-E-F-11/12-G	a-b/e-f
24.0	A-B-C-D-E-9/10-11/12-G	a-b-c-d-e
24.5	A-1/2-B1-C-D-E-9/10-11/12-G	b-c-d-e
25.0	A-B-3/4-C-D-E-9/10-11/12-G	a-b/c-d-e
25.5	A-1/2-3/4-C-D-E-9/10-11/12-G	c-d-e
26.0	A-B-C-5/6-D-E-9/10-11/12-G	a-b-c/d-e
26.5	A-1/2-13-C-5/6-D-E-9/10-11/12-G	b-c/c-e
27.0	A-B-3/4-5/6-D-E-9/10-11/12-G	a-b/d-e
27.5	A-1/2-3/4-5/6-D-E-9/10-11/12-G	d-e
28.0	A-B-C-D-7/8-9/10-11/12-G	a-b-c-d
28.5	A-1/2-B-C-D)-7/8-9/10-11/12-G	b-c-d
29.0	A-B-3/4-C-D-7/8-9/10-1/12-G	a-b/c-d
29.5	A-1/2-3/4-C-D-7/8-9/10-11/12-G	c-d
30.0	A-B-C-5/6-7/8-9/10-11/12-CG	a-b-c
30.5	A-1/2-B-C-5/6-7/8-9/10-11/12-G	b-c
31.0	A-B1-3/4-5/6-7/8-9/10-11/12-G	a-b
31.5	A-1/2-3/4-5/6-7/8-9/10-11/12-G	None

2-8. Initial Checks

The strappable pad has no adjustments or alignment procedures associated with it However, the unit should be tested by direct support maintenance personnel to insure proper strapping and installation.

a. At the distribution frame or rack terminal block (fig. 2-1), connect the output of a signal generator and ac voltmeter (electronic voltmeter) across the terminals wired to the strappable pad to be tested b If the output of the strappable pad is not properly terminated into 600 ohms, place a 600-ohm terminating resistor across the distribution frame terminals that are connected to the output of the strappable pad.

c. Set the signal generator for 1000 Hz output. Adjust output level until indication on ac voltmeter equals the level that will be present at the input to the strappable pad during normal operation

d. At the loading equipment or patching facility requiring the specific level, place ac voltmeter across the connections associated with the output of the strapped pad. The difference between the input and output should equal the strapped value established during the procedure of paragraph 2-7

CHAPTER 3
OPERATING INSTRUCTIONS

3-1. Operating Controls and Instructions

Once installed, the operation of the strappable pad is automatic, requiring no operator attention. Consequently, there are no preoperational control settings, starting procedures, operating procedures, or stopping procedures associated with this equipment.

3-2. Operation Under Unusual or Emergency Conditions

Since the equipment operation is automatic, and maintains its technical characteristics over a wide temperature and humidity range (para 1-8), no change occurs to the equipment operation due to unusual environmental conditions or emergency communication conditions.

3-3. Preparation for Movement

Since the equipment Is Installed in a communication facility, movement to a new location involves dismantling and repacking where necessary. These functions are performed by direct support maintenance personnel, therefore, no operator instructions are involved.

3-4. Administrative Storage

Administrative storage is short term storage of the equipment (1 to 45 days). Perform the following whenever administrative storage is accomplished.

a. Wrap the equipment in greaseproof, waterproof covering and place in a wooden crate or sturdy fiberboard box, which has been prepared with cellusosic cushioning or other shock absorbing material.

b. Perform complete initial checks (para 2-8) prior to installation when equipment is removed from storage.

CHAPTER 4

FUNCTIONING OF EQUIPMENT

4-1. Introduction

This chapter contains the theory of operation of strappable pad AT-2P. The discussion will include functional system operation and a circuit analysis description.

4-2. Functional System Operation

Operation of the strappable pad in line-signal attenuation is illustrated in figure 4-1. In this example, a – 2 dbm reference level is to be established at an audio-circuit patching facility. With a receive level of – 17 dbm, two strappable pads are set for 10 db and 6 db attenuation at the input and output, respectively, of a line amplifier. Adjusting the line amplifier for a gain of 31 db, will produce the required – 2 dbm level at the audio-circuit patching facility.

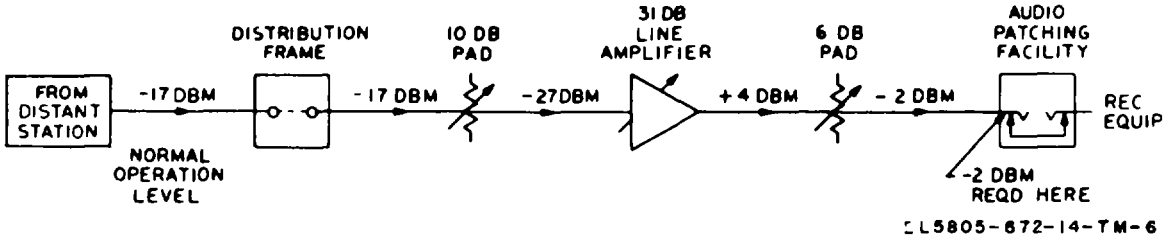

Figure 4-1. Strappable pad, operation.

4-3. Circuit Analysis
(fig. 4-2)

The strappable pad is a ladder-type, balanced attenuator comprising six individual attenuator sections, 0 5 db, 1 db, 2 db, 4 db, 8 db, and 16 db. Each section is a balanced – 0 attenuator providing 600-ohm Input and output impedance. Selected attenuator values are wired in series with the input and output terminals. Voltage surge protection is provided in the input and output lines by surge arrestors V1 and V2

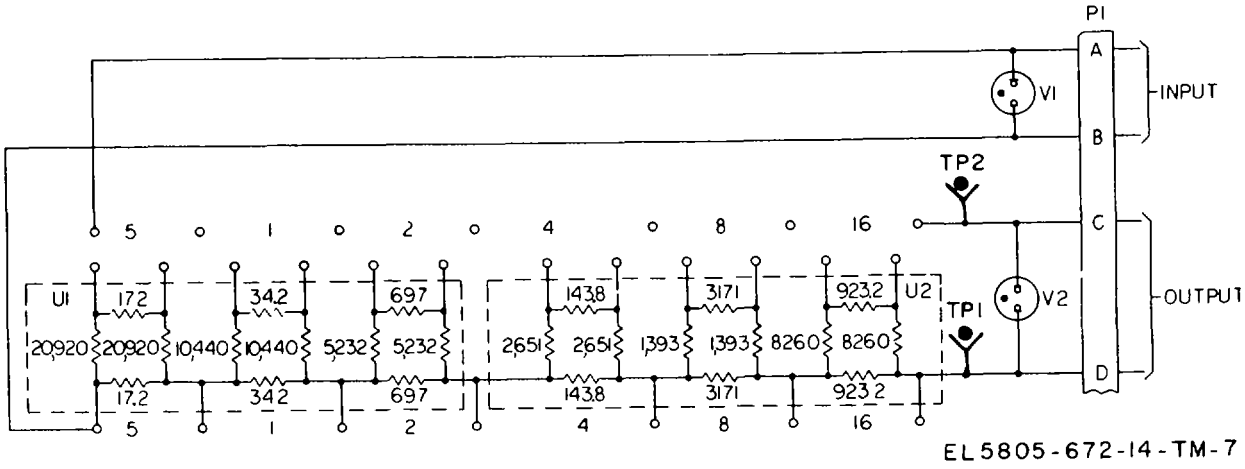

Figure 4-2. Strappable pad AT-2P, schematic diagram.

CHAPTER 5

ON-SITE MAINTENANCE

Section I. GENERAL

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. Instructions are included for inspection, cleaning, refinishing, performance testing, and localizing a malfunction to a faulty strappable pad or a connector on carrier board or universal shelf. If the performance of authorized corrective maintenance procedures does not result in a serviceable equipment, off-site maintenance required. The responsibility and scope of maintenance is assigned by the maintenance location chart (MAC) (app B).

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

a. The tools and test equipment required for maintenance, including performance testing, are listed in paragraph 5-7*a.*

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 6810-00-664-0273).

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 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 8-750

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 trlchloroethane 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 43-0118.

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

Sequence no.	*Item*	*Procedure*	*Reference*
1	Module front panel condition	Clean front panel exterior surfaces	Para 5-3e
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	Para 5-3c
3	Equipment surfaces	Clean 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	Examine 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	Strappable pad carrier board, extender board, and universal shelf	Check for evidence of overheating, burned parts, or breaks in printed-circuit wiring	
4	Extender board	Perform continuity check using multimeter connected between A-A, B-B, etc	fig B-2 TM 11-5805-672-34P
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 strappable pad AT-2P 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 strappable pad does not correct the malfunction, perform continuity checks to isolate a continuity malfunction to printed-circuit wiring or a connector on the carrier board or universal shelf. These continuity tests are performed using a multimeter (figs. 5-1 and 5-2) with the carrier board extended from the shelf receptacle vi a the extender board. If the continuity test indicates an open circuit, the faulty connector on the carrier board or universal shelf shall be replaced.

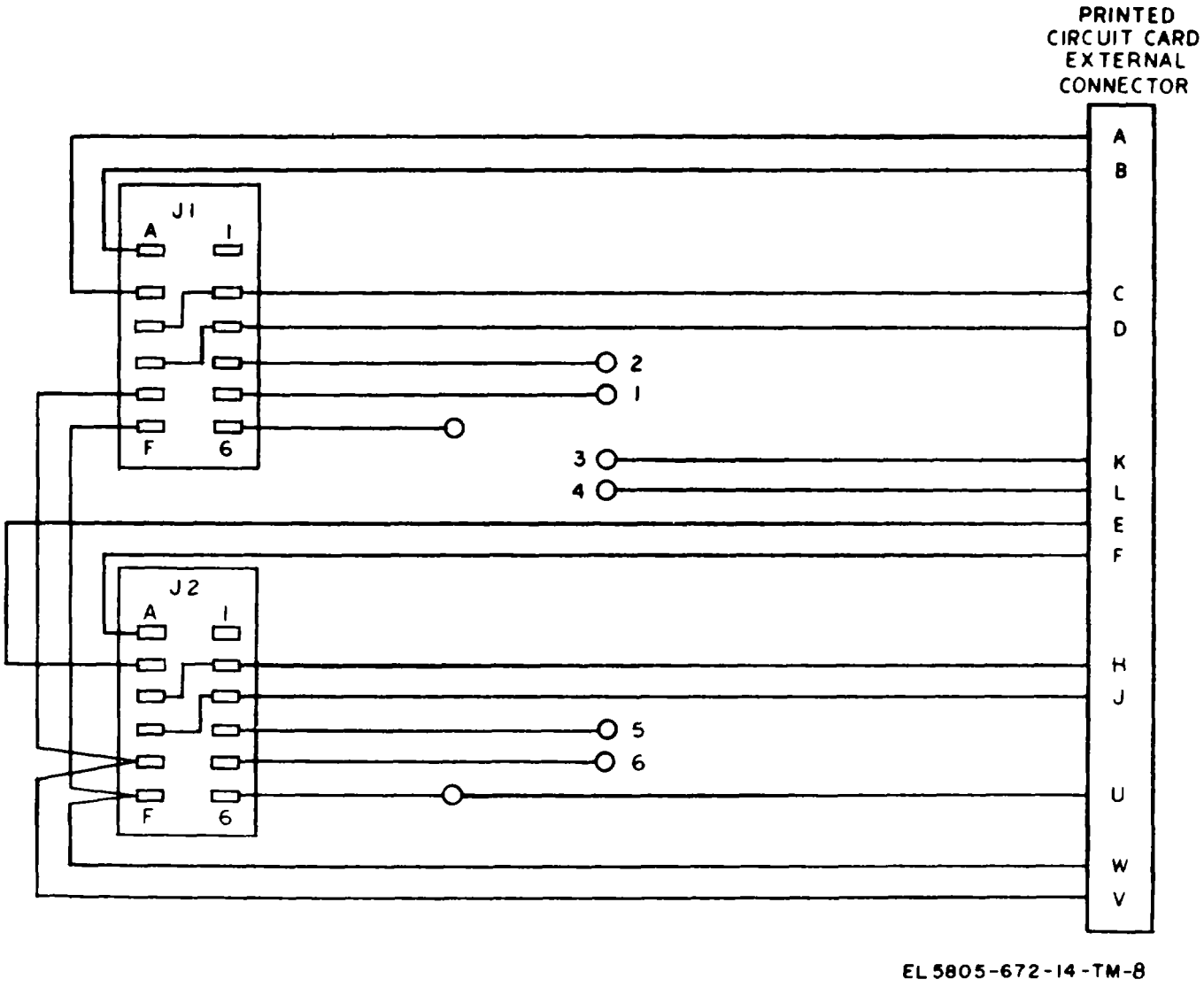

Figure 5-1. Carrier board, wiring diagram

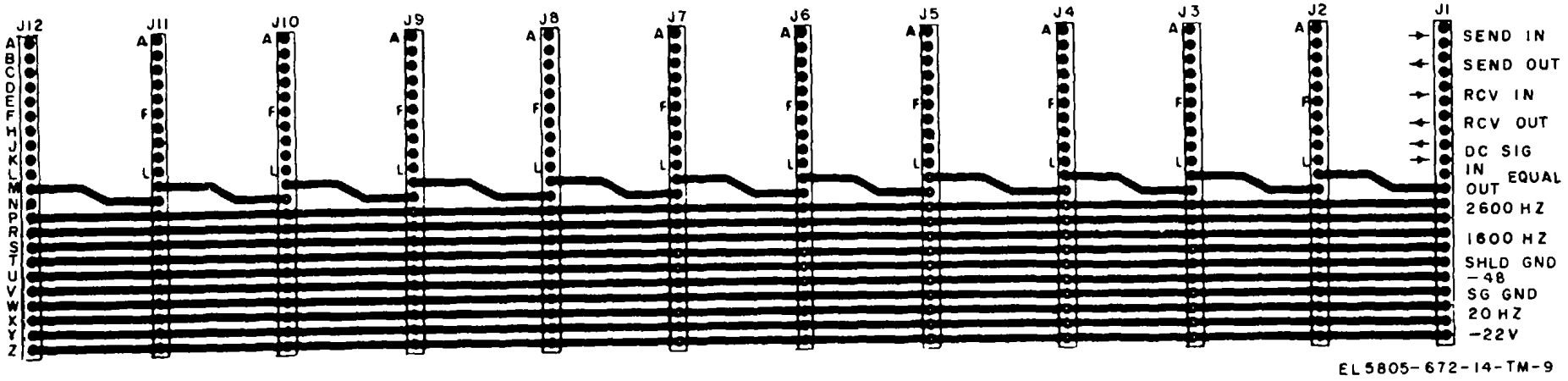

Figure 5-2. Universal shelf, receptacle bus bar wiring

Table 5-3. Troubleshooting

Test conditions	*Meter connections*	*Performance standard*	*Corrective action*
1. Carrier board extended from universal shelf 2. 600 ohm resistor connected across TP1 and TP2 3. Signal generator (1000 Hz output) connected across pins A and B (fig 4-2) Adjust signal generator output level to that which Is normally present on communication line (max input of 15 dbm)	Ac voltmeter connected across pins A and B signal generator. Ac voltmeter connected across pins C and D	Ac voltmeter (db) scale indicates desired db level input set on Ac voltmeter (db scale) indicates signal level reduced by db attenuation strapped for pad (para 2-7).	 If correct db reading is not obtained, replace strappable pad.

Section III. MAINTENANCE OF THE STRAPPABLE PAD, CARRIER BOARD, EXTENDER BOARD AND UNIVERSAL SHELF

5-5. Removal and Installation

Removal and installation of the strappable pad, carrier board and universal shelf is accomplished by performing the applicable portion of paragraph 2-6 in reverse. The extender board is installed in the universal shelf in the receptacle vacated by the carrier board. The carrier board, with strappable pad installed 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 (fig. B-2) is determined faulty, via continuity measurements, replace the extender board.

5-6. Disassembly of the Carrier Board, and Universal Shelf

Removal and replacement of a faulty receptacle from the carrier board (fig. B-3) or universal shelf (fig. B-4) is accomplished as outlined below:

a. Unscrew 2 screws, lockwashers and nuts which secure 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 strappable pad is capable of performing its assigned mission are given below This performance test checks insertion loss

a. Test Equipment
- (1) Signal generator, AN/USM-264
- (2) Voltmeter, Electronic AN/USM-265
- (3) Resistor, 600 ohm, 1/2 watt, ±1 %
- (4) 6-pin connector
- (5) 22-terminal, terminal board

b. Test Connections and Conditions Fabricate a test connector layout, wired to a test terminal board, as shown in figure 5-3 Connect bench test setup as shown in figure 5-4.

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

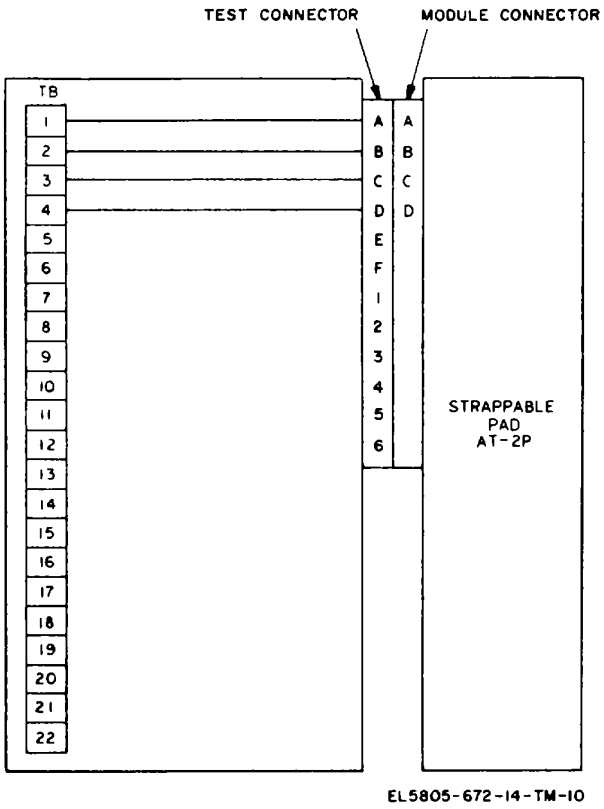

Figure 5-3. At-2P test connector, wiring connections.

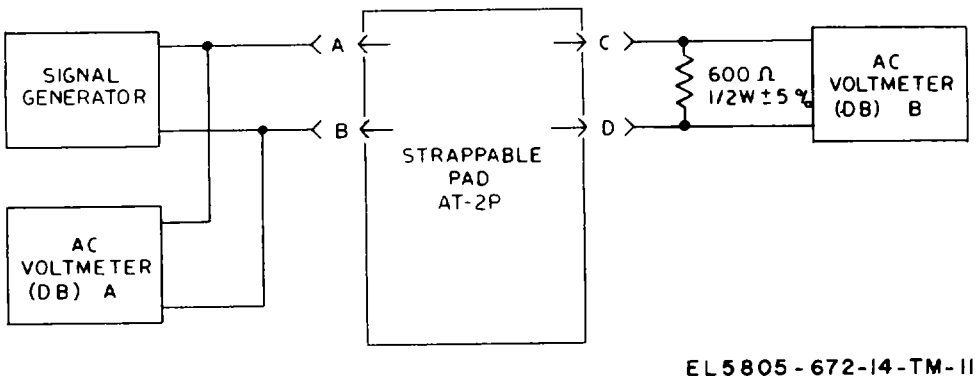

Figure 5-4. Insertion loss performance test, bench test setup

Table 5-4. Insertion Loss Performance Test

Test conditions	*Meter connections*	*Performance standard*
1. Adjust signal generator for 1000 Hz output at an output level of +5.5 dbm.	Ac voltmeter indicates 5.5 dbm.	None.
2. Strap pad to provide 25 5 db attenuation as described in paragraph 2-7. Ac voltmeter connected across pins C and D of strappable pad.	Same as step 1, above.	-20 dbm ± 0.3 db.
3. Strap pad to provide 31.5 db attenuation.	Same as step 1, above	-26 dbm ± 0.3 db

CHAPTER 6
OFF-SITE MAINTENANCE

6-1. Scope of Off-Site Maintenance

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

6-2. Tools and Equipment

Refer to the repair parts and special tools list in TM 11-5805-672-34P for a list of the repair parts authorized for general support maintenance of the strappable pad, carrier board, extender board and universal shelf. Tools and test equipment required for off-site maintenance are listed, including performance testing, in paragraph 5-7a. One exception to this list of equipment is the Tool Kit, Electronic TK-100/G which is required for general support maintenance.

6-3. Troubleshooting

Off-site troubleshooting consists of isolating the malfunction on a strappable pad to a replaceable part. This is accomplished in table 6-1 by performing a performance test and, if a performance standard is not achieved, continue 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. Troubleshooting

Step No.	Test conditions	Meter connections	Performance standard	Corrective action
	Attenuating network U1			
1.	Perform test connections of paragraph 5-7b			
2.	Signal generator set for 1000 Hz output at an output level of 0 dbm	Ac voltmeter A connected across pins A and B	0 dbm	N/A
3.	Strap pad for 3.5 db attenuation as described In paragraph 2-7	Ac voltmeter B connected across TP1 and TP2	3 5 ±0.3 db	Proceed to step 4
	Attenuating network U2			
4.	Strap pad for 4 db attenuation as described in paragraph 2-7	Ac voltmeter B connected across TP1 and TP2	-4 ± 0.3 db	a. If correct result Is obtained for step 3 and not for step 4, replace U2. b. If correct result Is obtained for step 4 and not for step 3, replace U1. c. If correct result is not obtained for steps 3 or 4, replace surge arrestors VI and/or V2.

6-4. Maintenance of the Strappable Pad

Upon removal of the strappable pad from is carrier board, all parts are readily accessible, (fig. B-4). Replacement of parts determined faulty by troubleshooting are the responsibility of off-site maintenance. When replacing any detail part, use standard precautionary procedures, such as 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 Carrier Board, and Universal Shelf

Continuity testing of the carrier board, and universal shelf is performed to Isolate a faulty connector or printed-circuit wiring. Once a connector on the carrier board or universal shelf has been determined faulty, replacement of the connector or repair of the PC card is accomplished as described m paragraph 5-6 and TB SIG 222, respectively.

6-6. General Support Performance Testing

The performance test 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	US 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 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
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).
TM 11-5805-672-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Plug-In Unit, Line Signal Attenuator CN-1449/ FTC (Stelma AT-2P) (NSN 6625-00-602-5120), Plug-In Unit, Carrier Board MT-4722/FTC (Stelma CB-1) (NSN 5820-00-593-4790), Extender, Printed-Wiring Board MX-9664/FTC (NSN 6625-00-602-5151) and Universal Shelf 90409000-000 (Line Conditioning Equipment).
TM 11-5805-675-14 & P	Operator's Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools Lists) for Plug-In Unit, Line Amplifier AM-6745/FTC (Stelma LA-3) (NSN 5820-00-557-1671, Plug-In Unit, Line Amplifier AM-6746/FTC (Stelma DLA-3) (NSN 6625-00-602-5119), Plug-In Unit Carrier Board MT-4722/FTC (Stelma CB-1) (NSN 5820-00-593-4790), Extender Printed Wiring Board MX-9664/FTC (NSN 6625-00-602-5151) and Universal Shelf 90409000-000 (Line Conditioning Equipment).
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX C
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for Universal Shelf, MT-4722/FTC, CN-1449/FTC and MX-9664/FTC. 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 Function

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 (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To 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 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 used in precision measurement. Consists of comparisons of two instruments, 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, module (component or assembly) in a manner to allow the proper functioning of the 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 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 or 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 (i.e., DMWR) in appropriate technical publications. 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 equipments/components.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group 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 noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level 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 number of task-hours specified by 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. Subcolumns of column 4 are as follows:

C - Operator/Crew
0 - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code .

C-4. Tool and Test Equipment Requirements (sec III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C-5. Remarks (sec IV)

a. Reference Code. This code refers to the appropriate item In section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in Section II.

Section II. MAINTENANCE ALLOCATION CHART FOR

UNIVERSAL SHELF, MT-4722/FTC, C-1449/FTC AND MX-9664/FTC

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	UNIVERSAL SHELF (90409000-000)	Replace			0.1			3	
		Inspect		0.2					
		Test		0.5			1		
		Service		0.2					
		Repair			0.8			1, 3	A
		Repair				1.5		1, 2	
00	PLUG-IN UNIT, CARRIER BOARD MT-4722/FTC (CB-1)	Inspect		0.1					
		Test		0.1				1, 2	
		Replace			0.1				
		Repair					0 4	1,2	
00	PLUG-IN UNIT, LINE SIGNAL ATTENUATORCN-1i49/FTC (AT-2P)	Inspect		0 1					
		Test			0.2			2 thru 8	
		Adjust			0.3			4 thru 8	
		Replace			0.1				
		Overhaul					0.3	1, 2, 4 thru 7, 8	
00	EXTENDER, PRINTED WIRING BOARD MX-9664/FTC (80409160-000)	Inspect		0.1					
		Test		0.1				1, 2	
		Replace			0.1				
		Repair				1.5		1,2	
	NOTE DIRECT SUPPORT (F) MAINTENANCE OPERATIONS FOR FIXED PLANT EQUIPMENT LOCATED OCONUS, WILL BE PERFORMED BY OFF SITE (AMSF) PERSONNEL.								

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

UNIVERSAL SHELF, MT-4722/FTC, CN-1449/FTC AND MX-9664/FTC

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O,F,H	MULTIMETER AN/USM-223 (SIMPSON 260)	6625-00-999-7465	
2	F,H	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/0	5180-00-605-0079	
3	F,H	TOOL KIT, ELECTRONIC EQUIPMENT TK-105/G	5180-00-610-8177	
4	F,H	CONNECTOR RECEPTACLE ELECTRICAL 6 PIN (WINCHESTER 8BDJ6M)	5935-00-717-6327	
5	F,H	GENERATOR, SIGNAL AN/USM-264 (MP 652A)	6625-00-935-4214	
6	F,H	RESISTOR, FIXED FILM 600 OHM, 1%, 1/2W, RN 70B6000F, MIL-R-10509	5905-00-542-9532	
7	N,H	TERMINAL BOARD, 22 TERMINALS (KULKA ELECTRIC JN113062-138)	5940-00-433-0846	
8	F,H	VOLTMETER ELECTRONIC AN/USM-265 (HP-400EL02) (2 ea)	6625-00-935-4294	

Section IV. REMARKS

REFERENCE CODE	REMARKS
A	REPLACE CONNECTOR ON PC BOARD.

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Chief of Staff.

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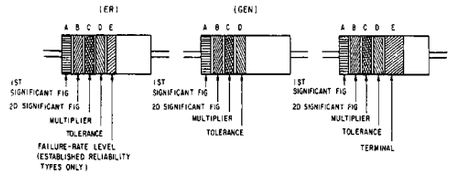
  - LBAD (14)
  - SAAD (30)
  - TOAD (14)
  - SHAD (3)
- USA Dep (2)
- Sig Sec USA Dep (2)
- Sig Dep (2)
- Sig FLDMS (1)
- USAERDAA (1)
- USAERDAW (1)
- MAAG (1)
- USARMIS (1)
- Units org under fol TOE.
  - (1 copy each unit)
  - 11-500(AA-AC)
  - 29-134
  - 29-136

NG: None
USAR: None
For explanation of abbreviations used, see AR 310-50

* U.S. GOVERNMENT PRINTING OFFICE: 1987 O-181-421 (60758)



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS

TABLE I
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	M=1.0
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1
RED	2	RED	2	RED	100			ORANGE	R=0.01
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP TYPE ONLY)	WHITE	
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5		SOLDERABLE
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7						
GRAY	8	GRAY	8	SILVER	0.01				
WHITE	9	WHITE	9	GOLD	0.1				

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 1½ TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL

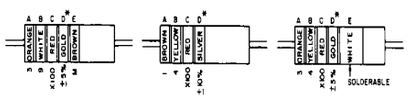
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

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



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

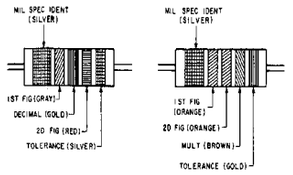
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

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



COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE 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	DECIMAL POINT		5

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

B COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS

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

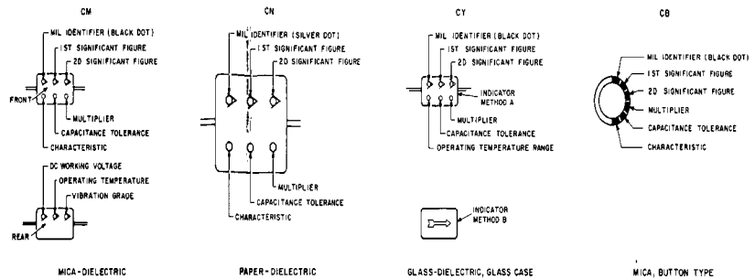


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB

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	CM	CN	CB	CM	CY, CM	CM
BLACK	CM CY CB	0	0	1			±20%	±20%		A			-55°to+70°C	10-55Hz
BROWN		1	1	10					B	E	B			
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+125°C	10-2,000Hz
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55°to+150°C	
PURPLE (VIOLET)		7	7											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±10%	±30%	±10%	±10%						

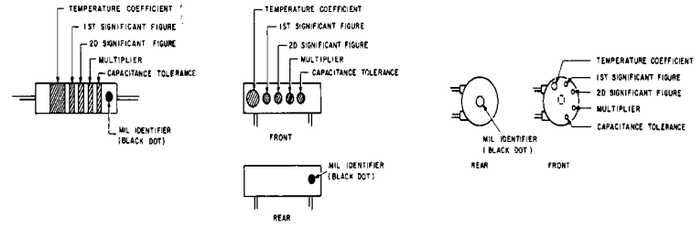


TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	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	0.01*			
WHITE			9	0.1*	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

1 THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF

2 LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS MIL-C-5, MIL-C-250, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY

3 LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D

4 TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE

* OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE

C COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

ESC FM 913 73

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

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