TM 11-5805-658-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,

AND GENERAL SUPPORT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

FOR

NORTHERN RADIO E & M TO 20HZ

CONVERTER TYPE 1022 MODEL 4

(NSN 5805-00-611-7425)

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1975

TECHNICAL MANUAL
No. 11-5805-658-14&P

HEADQUARTERS
DEPARTMENTOF THE ARMY
WASHINGTON, DC, 28 *May 1975*

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Current as of 3 March 1975

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This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

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CHAPTER 1

INTRODUCTION

1-1. Scope

This manual describes Northern Radio E & M to 2OHz Converter Type 1022 Model 4 and covers its operation, and organizational, and direct and general supporr maintenance. Appendix A contains a list of applicable references. Appendix B contains a list of repair parts and special tools, and appendix C contains the maintenance allocation.

1-2. Indexes of Publications

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

b. Refer to the latest issue of DA Pam 310-7 to determine if there are modification work orders (MWO's) pertaining to this equipment.

1-3. Maintenance 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/NAVSUPINST 4030.29/AFR 71. 13/MCO P4030.29A, 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/NAVSUPINST 4610.33A/AFR 75.l8/MCO P4610.19B, 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. Administrative Storage

Administrative storage of electronics equipment is covered in detail in TM 740-90-l.

1-6. Destruction of Army Materiel

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

1-7. Purpose and Use

The Type 1022 Model 4 E & M Converter, hereafter referred to as the converter, is used in conjunction with voice frequency communication systems to adapt E & M signaling trunks to the system switchboards, or to interface subscribers using ringdown signaling to the line equipment, by converting the E-lead signals to 20 Hz ringing signals and the 20 Hz ringing signals to M-lead control signals.

1-8. Description

The converter is a plug-in printed circuit assembly. The front panel contains eight test points for input and output monitoring of four wire' or two wire operation, as well as two telephone jacks for monitoring the E & M lines. The lower edge of the panel contains a knurled head. captive screw, to secure the assembly in a Type 1026 Model 6 shelf. All input and output connections are made through the card rear edge connector plug which mates with a receptacle mounted in the shelf.

1-9. Technical Characteristics

Impedance	The converter does not affect voice frequency circuits passing through, except when an E-signal is present, then a resistive termination of 600-ohms (when strapped) or 900-ohms (not strapped) is presented to the voice frequency receive line for 4 wires or the 2 wire line for 2 wires.
Return loss	Greater than 26 dB
Frequency response	300 Hz to 4000 Hz, flat within 0.1 dB reference to 1 kHz level
Strappable options	*a.* 2 or 4 wire operation *b.* 600-ohm or 900-ohm idle line termination during ringing *c.* M-lead output, -48 volt dc or ground *d.* E-lead activating a ringing signal to the drop by a ground or open circuit condition
Ringing signal (incoming)	35 to 120 vac, 16 to 50 Hz

Test points:	
TPl and TP2. orange	4 wire receive drop or 2 wire of drop
TP3 and TP4. green	1 wire transmit line or 2 wire of line
TP5 and TP6. brown	4 wire receive line
TP7 and TP8. yellow	4 wire send drop
Jacks	E & M line monitoring. 1 each
Mounting	lx converters plug-in mounted in receptacles of a Type 1026 Model 6 Shelf which. when fully equipped, mounts in a 19 inch rack.
Cabling requirements	Shelf receptacles are prewired to terminals of a signal distribution block mounted on the rear of the shelf.

1-10. Items Comprising an Operable Equipment

NSN	*Item*	Qty	Dimensions (in.)			*Weight (16)*
			Height	*Width*	*Depth*	
5805-00-611-7425	Northern Radio E & M to 20Hz *Converter Type* 1022 Yodel 4	1	5	3	12	1 lb, 6 oz

CHAPTER 2

INSTALLATION

2-1. Mounting

The converter is plug-in mounted in a Northern Radio Type 1026 Model 6 Universal Mounting Shelf by inserting the unit into the appropriate card guide of the shelf and pushing it into the shelf until the edge card connector mates with the receptacle in the shelf. Tighten the captive screw of the unit to **secure it in place in the shelf.**

2-2. Primary Power and Grounding Requirements

The converter requires an input power of 48 volts dc ± 10 percent. The rack in which the converter and associated shelf are mounted should be connected to the station ground system by AWG No. 6 (or larger) **cable.**

CAUTION

Be careful when handling this equipment to avoid mechanical damage to the equipment or its components.

2-3. Cable Requirements

The converter has an edge card connector which mates with an edge card receptacle mounted in the shelf. The receptacle contacts are prewired to the terminals of a signal distribution block mounted on the rear of the shelf.

2-4. Initial Checking

The initial checking of the converter consists of inspecting the unit for mechanical damage due to rough handling in shipment. When shipped, no jumpers have been installed on the strapping terminals. These must be installed at the operation site.

2-5. Strapping Options

Before the converter is installed in the Type 1026 Model 6 Shelf, appropriate jumpers must be installed on the strapping terminals. Refer to table 2-1 (strapping options), and install proper strapping for the required operation.

2-6. Initial Adjustment

Other than a possible change in the circuit **strapping option, no** initial adjustment is required by the converter.

2-7. Electrical Connections

All electrical connections to the converter are made through the edge card connector at the rear of the card. **Table 2-2 lists the converter electrical** connections. These connections are extended through the shelf edge card receptacle to the terminals of a signal distribution block on the rear of the shelf.

2-8. Installation Instructions

These instructions assume that the Type 1026 Model 6 Shelf has been installed in a 19 inch rack. The converter should be handled carefully to avoid any mechanical damage to it or its components. To install the converter, insert the assembly in the appropriate guide of a Type 1026 Model 6 Shelf. Push the assembly into the shelf until the card edge plug mates with the receptacle in the shelf and secure it in place by tightening the captive screw in the lower part of the converter front panel.

Table 2-1 Strapping Options

E - Lead Signaling:		
	Action desired	*Install strap(s)*
E- lead level	20 Hz to drop	N
E-lead to ground	No 20 Hz to drop	N
E-lead open	20 Hz to drop	M & P
E-lead open	No 20 Hz to drop	M & P
E-lead to ground		
M-Lead Signaling.		
	Action desired	*Install strap(s)*
M-lead level	20 Hz from drop	A & B
M-lead to ground	No 20 Hz from drop	A & B
M-lead to -48 vdc	20 Hz from drop	C & D
M-lead to - 48 vdc	No 20 Hz from drop	C & D
M-lead to ground		
Line Split Termination:		
Impedance	Install strap L	
600 ohms		
900 ohms	Leave strap L open	

Table 2-Z. Strapping Options-Continued

	Action desired	*Install strap(s)*
Voice Frequency Line: Type Line 2 wire 4 wire	Install strap(s) F, G, J, and K E and H	

Table 2-2. Electrical Connections

Plug pin numbers	Function
1	
2	Common
3	20 Hz input
4	20 Hz input
5	−48 volts dc
6	
7	
8	M-lead
9	E-lead
10	4 wire transmit drop
11	4 wire transmit drop
12	4 wire or 2 wire transmit vf line
13	4 wire or 2 wire transmit vf line
14	4 wire or 2 wire receive drop
15	4 wire or 2 wire receive drop
16	4 wire receive line
17	4 wire receive line

CHAPTER 3

OPERATION

3-1. General

The E & M to 20Hz Converter Type 1022 Model 4, interfaces subscriber equipment to line equipment by converting E-lead signals to 20Hz, and 20Hz ringing signals to M-lead control signals.

3-2. Controls and Indicators

a. *Controls*. The converter contains no operating controls other than the strapping options in table 2-1. The front panel contains eight test points and two closed circuit jacks. The test points are identified in table 3-1 and figure 3-1. The closed circuit jacks are identified in table 3-2.

***b. Indicators.* No indicators are required.**

3-3. Damage from Improper Settings

The converter has no controls subject to improper settings other than the terminal strapping (table 3- 1). Improper strapping will render the converter inoperative but not necessarily result in damage to the converter.

Table .7-l. Test Point Identification

Test point	*Color*	*Marking*	*Test functions*
TPl	Orange	TPl	4 wire vf received from drop or 2 wire drop
TP2	Orange	TP2	4 wire vf received from drop or 2 wire drop
TP3	Green	TP3	4 wire vf send to line or 4 wire vf line
TP4	Green	TP4	4 wire vf send to line or 4 wire vf line
TP5	Brown	TP5	4 wire vf received from line
TP6	Brown	TP6	4 wire vf received fr9m line
TT7	Yellow	TP7	4 wire send to drop
TP8	Yellow	TP8	4 wire send to drop

Table 3-2. Closed Circuit Jacks

Jack	*Marking*	*Function*	*Location*
J1	E	E-lead monitoring	Front panel
52	M	M-lead monitoring	Front panel

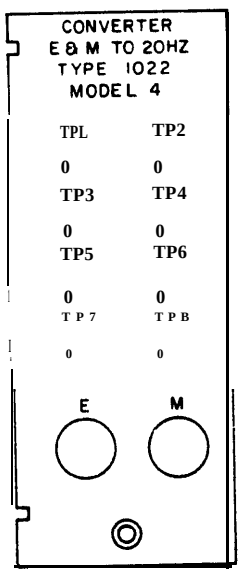

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Figure 3-1. E & M to 2OHz converter type 1022 *model 4. front panel view.*

CHAPTER 4

CIRCUIT FUNCTIONING

4-1. General

The overall circuit functioning is described in paragraph 4-2. The effects of the various strapping arrangements are described in paragraphs 4-2a through d.

4-2. Detailed Circuit Functioning

(fig. 4-1)

When the subscriber goes "off-hook" and inserts a 20Hz ringing voltage to the 2 wire voice frequency drop in the 2 wire mode. or 4 wire voice frequency drop in the 4 wire mode, it is coupled through capacitor Cl to the CR3 diode bridge. and a positive voltage is developed. The positive voltage is applied through Zener diode CR1 to capacitor C2 and the Kl relay coil to operate the relay, switching the M-lead to the level appropriate to the strapping option employed. The purpose of the Zener diode CR1 is that during the positive portion of a low levei audio signal, the detector circuitry is not seen by the line, thus the greater than 26 db return loss. The positive voltage generated by the detector is integrated by capacitor C2 and the resistance of the K1 coil to bridge the 20Hz positive peaks during ringing bursts. Diode CR2 across the coil of relay K2 is an arc suppressor. Resistor R4 in series with **capacitor** C3 and resistor R5 in series with capacitor C4 protect the contacts of relay K1 by removing the transients generated when the relay contacts are opera ted.

a. When straps C and D are installed and a 20Hz ringing signal is present, relay K1 operates and applies -48 volts dc to the M-lead. When straps C and D are installed and no 20Hz ringing signal is present, relay K1 is deenergized and ground is applied to the M-lead.

b. If straps A and ***B*** are installed and no 20Hz ringing signal is present, relay K1 is deenergized and - 48 volts dc is applied to the M-lead. With straps A and B installed and a 20Hz ringing signal present, ground is applied to the M-lead. 'The E-lead control circuitry strapping provides for either an open circuit condition of the E-lead, or a ground level on the E-lead to apply a 20-Hz ringing signal to the drop.

c. When the E-lead goes to an open circuit condition with straps M and P made, the current path is -48 volts at pin 5 through resistor R3 to relay K2 coil terminal 13, and from coil terminal 14 to common (ground), and relay K2 operates. This applies a 20Hz ringing signal to the drop side, splitting the line equipment, and terminates the line equipment in 600 ohms if strap L is installed, or 900 ohms if strap L is removed. When a ground is applied to the E-lead with straps M and P made, relay K2 is shorted, no 20Hz ringing signal is applied to the drop, and the line equipment is not terminated in 600 ohms or 900 ohms.

d. When strap N is made, an open condition of the E-lead maintains relay K2 deenergized, no Hz ringing signal is applied to the drop, and the line equipment is not terminated in 600 ohms or 900 ohms. When a ground is applied to the E-lead with strap N made, the current loop for relay K2 is completed to ground and relay K2 operates. This applies a 20Hz ringing signal to the drop, splitting the line, and terminates the line equipment in 600 ohms if strap L is installed or 900 ohms if strap L is removed.

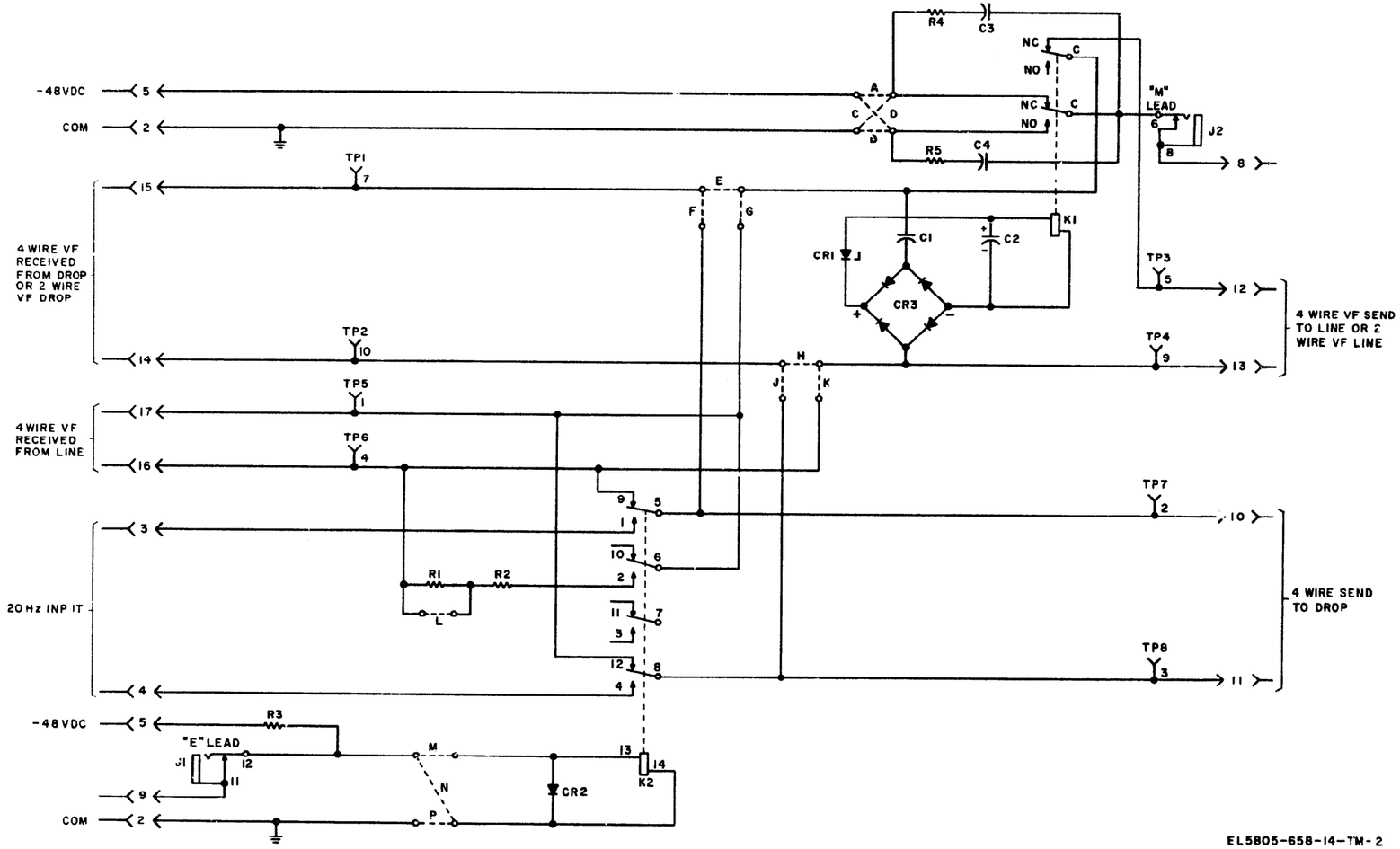
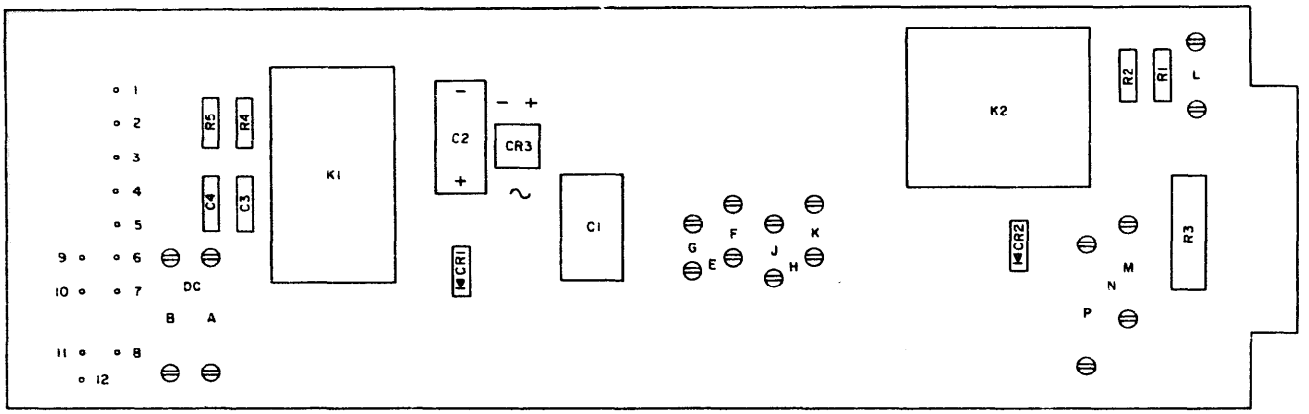


Figure 4-1. E & M to 20Hz converter type 1022 model 4. schematic diagram.

Figure 4-1. E&M to 20Hz converter type 1022 model 4. schematic diagram.



CIRCUIT BOARD SUB-ASSEMBLY NRC 2314
(CONSISTS OF ETCHED BOARD WITH COMPONENTS)
EB426 (ETCHED BOARD ONLY)

EL5805-658-14-TM-3

Figure 4-2. E&M to 20hz converter type 1022 model 4, sub assembly NRC 2311 component layout.

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

5-1. Scope of Direct Support and General Support Maintenance

The scope of direct and general support maintenance consists of inspecting the converter unit for mechanical damage. checking the strapping for conformance with the system, replacement of components, and testing the converter unit for satisfactory performance.

5-2. Tools and Test Equipment Required

a. Tools. The tools required for direct and general support maintenance are contained in Tool Kit, Electronic Repairman TK-105/G (NSN 5180-00-610-8199).

b. Test Equipment. The following test equipment or suitable equivalents will be used in testing the converter unit:

Item	*NSN*	*Qty*	*Applicable literature*
Oscilloscope AN USM-281C	6625-00-055-3112	1	TM 11-6625-1703-15
Ringing Static Generator TA-480 FT	5805-00-254-9959	1	
Power Supply PP-4399 FCC		1	
Extender Card NRC 2128		1	

5-3. Troubleshooting

To troubleshoot the converter unit, refer to figure 4-1 and paragraph 4-2. Follow standard troubleshooting procedures to check all circuits and components.

5-4. Performance Standards

When the converter unit repair work has been completed, it must meet the performance standards covered by the test procedures before being returned to service or stock.

5-5. Test Procedures

The test procedures to insure that the converter will perform satisfactorily are given in ***a*** and b below. The test preparations are for out of the shelf testing; however, the tests may be performed at an operational site where a Type 1026 Model 6 Universal Shelf, a 20-Hz source, and a -48-volt dc power supply are available and properly interconnected. **When ringing** signals are not present, the converter is entirely transparent to voice frequencies.

a. Test Preparation.

(1) Connect an insulated stranded wire to the **tip** contact of each phone plug and attach an alligator clip to the opposite end of each wire.

(2) Obtain a dual 17 pin (34 pin) test connector and connect insulated leads to terminals 2, 3, 4, and 5.

(3) With no power applied, connect terminal 2 to the +48-volt terminal of the power supply, which is also the signal ground.

(4) Connect a 2OHz ringer source to terminals 3 and 4.

(5) Connect terminal 5 to the ---#-volt terminal of the power supply.

(6) Mate the converter in the test receptacle.

(7) Turn on the -48-volt power and 20Hz ringer source.

b. Test Procedures.

(1) Jumper connect a 20Hz ringing signal to test points TPl and TP2 and check the N-lead, with respect to signal ground, for the proper level corresponding to the strapping of the terminals. Use a tip-sleeve plug in the M-jack for access to the M-lead.

(2) Remove and reapply the ringing signal while observing the M-lead for proper change of level.

(3) Remove the ringing signal jumper connections from TPl and TP2.

(4) Apply the proper level (ground or -48 volts dc), corresponding to the strapping. to the E-lead at the E jack on the front panel.

(5) Check for a 20-Hz ringing signal at test **points** TP7 and TP8 when strapped for four wire operation or test points TPl and TP2 when strapped for two wire operation with an oscilloscope.

(6) Disconnect all test equipment and dc power, and return the converter to operation or stock.

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals. Technical Bulletins, Supply Manual (Types 7, 8, anti 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. Support and Equipment Used by the Army.
TB SIG 355-l	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-Z	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB SIG 746-10	Field Instructions for Painting and Preserving Electronics Comr Equipment.
TM 11-6625-1703-15	Operator's, Organizational, DS, GS, and Depot Maintenance Materials Including Repair Parts and Special Tool Lists: Oscilloscope AN/USM-281A.
TM 38-750	The Army -Maintenance Management Systems (TAMMS).

APPENDIX B

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS)

Section I. INTRODUCTION

1-1. Scope

This appendix lists repair parts required for the performance of general support and depot maintenance of Converter Assembly Type 1022, Model 4.

NOTE

NO repair parts authorized for stockage at organizational or direct support maintenance.

3-2. General

This repair parts list is divided into the following sections:

a. Basic Issue Items List-Section II. Not applicable.

b. Items Troop Installed or Authorized List- Section III. Sot app!icable.

c. Repair Parts for organizational Main- tenance- ***Section*** IV. Not applicable.

d. Special Tools, Test and Support Equipment For Organizational Maintenance-Section V. Sot applicable.

e. Repair Parts for Direct Support, General Support. and Depot Maintenance-Section VI. A ist of repair parts authorized for performance of maintenance at the general support and depot levels. 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.

f. ***Special Tools, Test and Support Equipment for Direct Support. General Support. and Depot Maintenance - Section VII.*** Not applicable.

g. Index-Federal Stock Number and Reference h-umber Cross-Reference to Figure Number and Reference Designation- Section VIII A list. in ascending numerical sequence, of all Federal stock numbers appearing in the listings, followed by a list in alphanumeric sequence, of all reference numbers appearing in the listings. Federal stock numbers and reference numbers are cross-referenced to each illustration figure number and reference designation.

h. Index-Reference Designation Cross-Reference to Page Number-Section IX. A list of reference designations cross-referenced to page numbers.

B-3. Explanation of Columns

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

a. Source, Maintenance, and Recoverability Codes (SMR I.

(1) ***Source code.*** Indicates the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are:

Code	Explanation
P A -	Item procured and stocked for anticipated or known usage.
A H -	Item to be assembled at general support maintenance level.
X A -	Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.
X B -	I tern is not procured or stocked. If not available through salvage requisition.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except thosecoded XA,XD, and aircraft support items as restricted ***by AK 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) Use ***(third position).*** **The maintenance code entered in the third position indicates the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third position indicates one of the following levels of maintenance:**

Code	Applications/Explanution
H	Support item is removed, **replaced, used at the general support maintenance.**

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

Code	Application/Explanation
H	The lowest maintenance level capable of complete repair of the support item is general support.
Z	Non-repairable. No repair is authorized.

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

Code	Definition
z	Non-repairable item. When unserviceable, condemn and dispose at the level indicated in the first digit of the maintenance code.
H	Repairable item. When uneconomically repairable, condemn and dispose at the general support level.

b. 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.

c. Description. **Indicates** the federal item **name and a minimum description required to** identify the item. The last line indicates the reference number followed by the applicable Federal Supply Code for Manufacturer (FSCM) in **parentheses. The FSCM is used as an element in** item identification to designate manufacturer or distributor or Government agency, etc.. and is identified in SB 708-42.

d. Unit of Measure (U/M). Indicates the **standard or basic quantity by which the listed item is used in performing the actual maintenance function. This measure is expressed by a two character alphabetical abbreviation, e.g., ea. ir 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.**

e. Quantity Incoporated in Unit. **Indicates** *the* **quantity of the item used in the breakout show on the illustration figure, which is prepared for functional group, subfunctional group,** or a **assembly. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF."**

f. 30-Day GS Maintenance Allowances. **The repair parts indicated by asterisk entries i separate allowance columns for GS represents those authorized for use at that category c maintenance to be requisitioned on** an "as required" basis.

g. 1-Year Allowances Per 100 Equipments/Contingency Planning Purposes. **Column intentionally left blank.**

h. Depot Maintenance Allowances Per 100 Equipments. **This column indicates that the** items identified with an asterisk are authorized t be requisitioned as required.

i. Illustrations. **This column is divided a** follows:

(1) ***Figure number.*** Indicates the figure number of the illustration on which the item i shown.

(2) ***Item number or reference designation.*** Indicates the reference designation used to identify the item on the illustration.

B-4. Special Information

(Not applicable).

B-5. How to Locate Repair Parts

a. This appendix contains two cross-reference indexes (sec. VIII and IX) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part number), or reference designation is known. The first column in each index is prepared in numerical or alp hanumeric sequence in ascending order. Where a Federal stock number is not listed. refer to the reference number (manufacturer's part number) immediately following the Federal stock number.

b. When the Federal stock number or ***reference*** number is known, follow the procedures given in (1) and (2) below.

(1) Refer to the index of Federal stock numbers (sec VIII) and locate the Federal stock number or reference number. The FSN of

Reference number is cross-referenced to the applicable figure number and reference designation.

(2) When the reference designation is determined, refer to the reference designation index (sec IX). The reference designations are listed in alphanumeric ascending order and are cross-referenced to the page number on which they appear in the repair parts list (sec VI). Refer the page number noted in the index and locate the reference designation in the repair parts list.

c. When the reference designation is known, follow the procedure given in *b (2)* above.

d. When neither the FSN, reference number, nor reference designation is known, identify the part in the illustration and follow directions given in c above; or scrutinize column 3 of the repair parts list.

B-6. Abbreviations

(Not applicable)

(Next printed page is B-5)

SECTION VI REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION / REFERENCE NUMBER & MFR CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY OS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CATGCY	(9) DEPOT MAINT ALW PER 100	(10) ILLUSTRATIONS (a) FIG NO	(b) ITEM NO OR REFEREN DESIGNATIO
		GROUP: 00 CONVERTER ASSEMBLY 1022-4												
		GROUP: 01 FRONT PANEL ASSEMBLY A1												
XBHZZ		PANEL,FRONT ASSEMBLY 1022-4-21 (88183)	EA	1									B-1	A1
PAHZZ	5130-934-9748	NUT,PLAIN,HEXAGON MS35649-244 (96906)	EA	2				*	*	*		*	B-1	A1H1
PAHZZ	5305-763-7822	SCREW,MACHINE MS51959-14 (96906)	EA	2				*	*	*		*	B-1	A1H2
PAHZZ	5310-550-3715	WASHER,LOCK MS35333-70 (96906)	EA	2				*	*	*		*	B-1	A1H3
PAHZZ	5305-225-1388	SCREW,CAPTIVE ASSEMBLY 51-28-406-24 (94222)	EA	1				*	*	*		*	B-1	A1H4
PAHZZ	5935-222-8213	JACK,TELEPHONE 142A (82389)	EA	2				*	*	*		*	B-1	A1J1
PAHZZ	5935-222-8213	JACK,TELEPHONE 142A (82389)	EA	REF				*	*	*		*	B-1	A1J2
PAHZZ		JACK,TIP SKT0804-016-8010BROWN (98291)	EA	2				*	*	*		*	B-1	A1TP5
PAHZZ		JACK,TIP SKT0804-016-8010BROWN (98291)	EA	REF				*	*	*		*	B-1	A1TP6
PAHZZ		JACK,TIP SKT0804-016-8010GREEN (98291)	EA	2				*	*	*		*	B-1	A1TP3
PAHZZ		JACK,TIP SKT0804-016-8010GREEN (98291)	EA	REF				*	*	*		*	B-1	A1TP4
PAHZZ		JACK,TIP SKT0804-016-8010ORANGE (98291)	EA	2				*	*	*		*	B-1	A1TP1
PAHZZ		JACK,TIP SKT0804-016-8010ORANGE (98291)	EA	REF				*	*	*		*	B-1	A1TP2
PAHZZ		JACK,TIP SKT0804-016-8010YELLOW (98291)	EA	2				*	*	*		*	B-1	A1TP7
PAHZZ		JACK,TIP SKT0804-016-8010YELLOW (98291)	EA	REF				*	*	*		*	B-1	A1TP8
XBHZZ		PANEL,FRONT 1022-4-10 (88183)	EA	1									B-1	A1MP1
		GROUP: 02 PRINTED CIRCUIT BOARD ASSEMBLY A2												
AHHHH		PRINTED CIRCUIT BOARD ASSEMBLY 1022-4-23 (88183)	EA	1									B-2	A2
PAHZZ	5961-892-7187	BRIDGE,DIODE MDA920A3 (04713)	EA	1				*	*	*		*	B-2	A2CR3
PAHZZ	5910-958-0414	CAPACITOR,FIXED ELECTROLYTIC TE1404 (56289)	EA	1				*	*	*		*	B-2	A2C2
PAHZZ	5910-280-8393	CAPACITOR,FIXED CERAMIC DD102 (71590)	EA	2				*	*	*		*	B-2	A2C3
PAHZZ	5910-280-8393	CAPACITOR,FIXED CERAMIC DD102 (71590)	EA	REF				*	*	*		*	B-2	A2C4
XAHZZ		PRINTED CIRCUIT BOARD 1022-4-24 (88183)	EA	1									B-2	A2E1
PAHZZ		RELAY,REED 170-0239 (04221)	EA	1				*	*	*		*	B-2	A2K1
PAHZZ		RELAY,ARMATURE 180-14D100 (04221)	EA	1				*	*	*		*	B-2	A2K2
PAHZZ	5905-683-7723	RESISTOR,FIXED COMPOSITION RC07GF152J (81349)	EA	2				*	*	*		*	B-2	A2R4
PAHZZ	5905-683-7723	RESISTOR,FIXED COMPOSITION RC07GF152J (81349)	EA	REF				*	*	*		*	B-2	A2R5
PAHZZ	5905-894-0824	RESISTOR,FIXED FILM RN60C3010F (81349)	EA	1				*	*	*		*	B-2	A2R1
PAHZZ	5905-842-6855	RESISTOR,FIXED FILM RN60C6040F (81349)	EA	1				*	*	*		*	B-2	A2R2

SECTION VI REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION / REFERENCE NUMBER & MFR CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100	(10) ILLUSTRATIONS (a) FIG NO	(b) ITEM NO. OR REFERENCE DESIGNATION
PAHZZ		RESISTOR,FIXED WIREWOUND VC5E700 (12697)	EA	1				*	*	*		*	8-2	A2R3
PAHZZ	5961-921-3781	SEMICONDUCTOR DEVICE,DIODE 1N4001 (81349)	EA	1				*	*	*		*	8-2	A2CR2
PAHZZ		SEMICONDUCTOR DEVICE,DIODE 1N5233 (81349)	EA	1				*	*	*		*	8-2	A2CR1

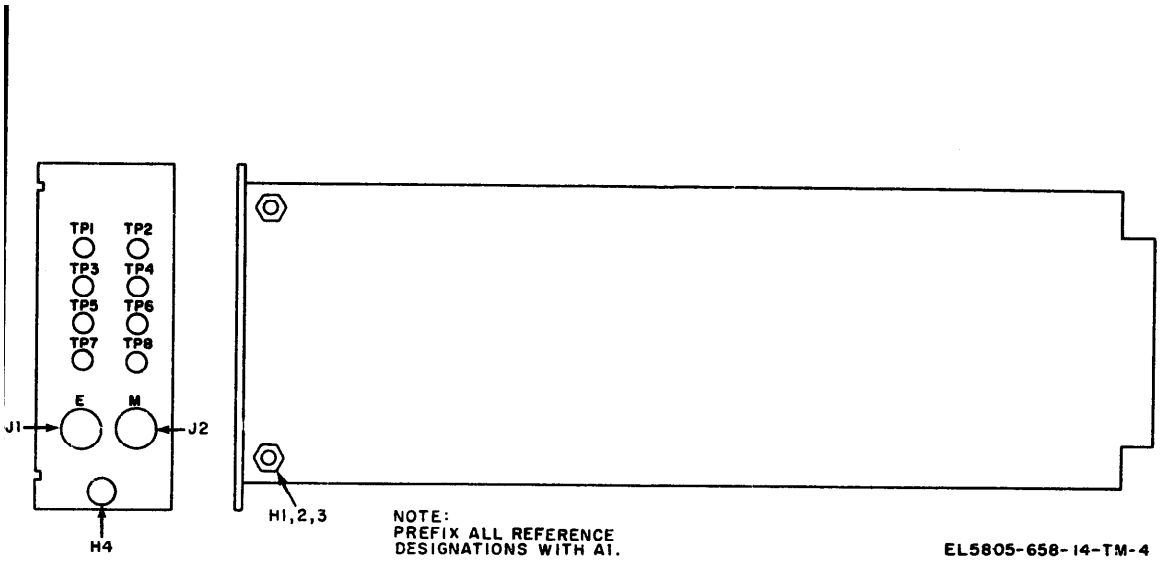


Figure B-1. Panel, front assembly A1.

Figure B-1. Panel, front assembly A1.

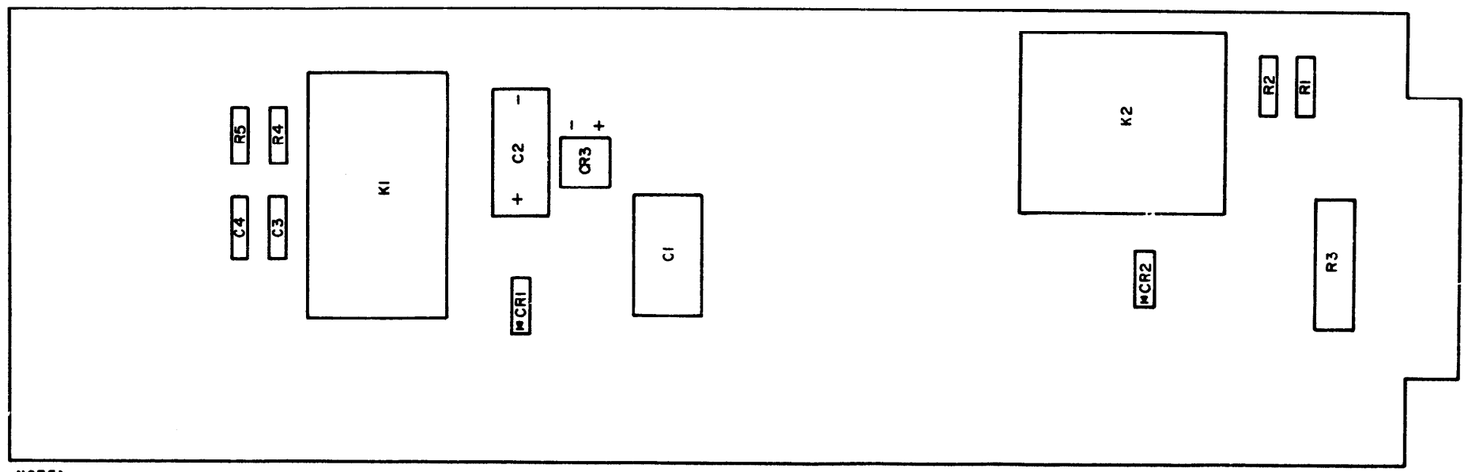


Figure B-2. Printered circuit board assembly A2.

SECTION VIII. INDEX-FEDERAL STOCK NUMBER AND REFERENCE NUMBER CROSS-REFERENCE TO FIGURE NUMBER AND REFERENCE DESIGNATION

STOCK NUMBER	FIG NO.	REF. DES.
5130-934-9748	B-l	A1H1
5305-225-1388	B-l	A1H4
5305-763-7822	B-l	A1H2
5310-550-3715	B-i	A1H3
5905-683-7723	B-2	A2R4
	B-2	A2R5
5905-842-6855	B-2	A2R2
5905-894-0824	B-2	A2R1

STOCK NUMBER	FIG NO.	REF. DES.
5910-280-8393	B-2	A2C3
	B-2	A2C4
5910-958-0414	B-2	A2C2
5935-222-8213	B-l	AlJl
	B-l	AlJ2
5961-782-7187	B-2	A2CR3
5961-921-3781	B-2	A2CR2

REFERENCE NO.	MFR CODE	FIG NO.	REF. DES.
DD102	71590	B-2	A2C3
		B-2	A2C4
MDA920A3	04713	B-2	A2CR3
MS35333-70	96906	B-l	AlH3
MS35649-244	96906	B-l	AlHl
MS51959-14	96906	B-l	AlH2
RC07GF152J	81349	B-2	A2R4
RN60C3010F	81349	B-2	A2Rl
RN60C6040F	81349	B-2	A2R2
SKT0804-016-8010 BROWN	98291	B-l	AlTP5
		B-l	AlTP6
SKT0804-016-8010 GREEN	98291	B-l	Al.P3
		B-l	AlTP4
SKTOB04-016-8010 ORANGE	98291	B-l	AlTPl
		B-l	AlTP2
SKTOB04-016-8010 YELLOW	98291	B-l	AlTP7
		B-l	AlTP8
TE1404	56289	B-2	A2C2
VCSE700	12697	B-2	A2R3
lN4001	81349	B-2	A2CR2
lN5233	81349	B-2	A2CRl
1022-4-10	88183	B-l	A1MP1
1022-4-21	88183	B-l	Al
1022-4-23	88183	B-2	A2
1022-4-24	88183	B-2	A2E1
742A	82389	B-l	A1J1
170-0239	04221	B-2	A2K1
180-14D100	04221	B-2	A2K2
51-28-406-24	94222	B-l	A1H4

REFERENCE NO.

SECTION IX. INDEX-REFERENCE DESIGNATION CROSS-REFERENCE TO PAGE NUMBER

REFERENCE DESIGNATION	PAGE NO.
A1	B - 5
A1H1	B - 5
A1H2	B - 5
A1H3	B - 5
A1H4	B - 5
A1J1	B - 5
A1J2	B - 5
AMP1	B - 5
A1TP1	B - 5
A1TP2	B - 5
A1TP3	B - S
A1TP4	B - 5
A1TPS	B - 5
A1TP6	B - 5
A1TP7	B - 5
A1TP8	B - 5
A2	B - 5
A2CR1	B - 6
A2CR2	B - 6
A2CR3	B - 5
A2C2	B - 5
A2C3	B - 5
A2C4	B - 5
A2E1	B - 5
A2K1	B - 5
A2K2	8 - S
A2R1	B - 5
A2R2	B - 5
A2R3	e - 5
A2R4	e - 5
A2R5	

APPENDIX C

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations covered in the **equipment** literature for Northern Radio E & M to 20Hz Converter Type 1022 Model 4. 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 in precision measurement. Consists of the comparison 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/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 material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment /components.

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

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

c. Column 3. Maintenance Function. Column

3 lists the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

(1) Use *of* symbols. The following symbols are used to prescribe work function responsibility:

Code	*Maintenance category*
C	Operator crew
O	Organizational
F	Direct support
H	General support
D	Depot

(2) ***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 (subassembly, 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 required to perform specific maintenance functions identified for the tasks authorized in the maintenance allocation chart. This time is expressed in man-hours and carried to one decimal place (tenths of hours).

d. Column 4. Tools and Equipment. Column 4 specifies, by code, those tools and equipment required to perform the designated function. The numbers appearing in this column refer to specific tools and test equipment which are identified in table I.

e. Column 5. Remarks. Self-explanatory.

C-4. Explanation of Format of Table I, Tool and Test Equipment Requirements

The columns in Table I, Tool and Test Equipment Requirements, are as follows:

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.

e. Tool Number. Not used.

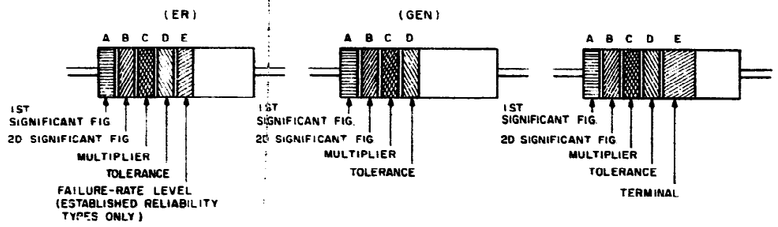
MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY NOMENCLATURE	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
00	CONVERTER ASSEMBLY 1022-4		F 1.0						F 0.1				1 thru 4	See note
01	FRONT PANEL ASSEMBLY A1									H 0.5			1 thru 5	
02	PRINTED CIRCUIT BOARD ASSEMBLY A2 (1022-4-23)									H 2.0			1 thru 5	

NOTE
Direct support (F) maintenance operations for fixed plant equipment located OCONUS, will be performed by OFF-SITE (Area Maintenance and Supply Facility, AMSF) personnel.

TABLE I. **TOOL AND TEST EQUIPMENT REQUIREMENTS**

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	F,H	OSCILLOSCOPE AN/USM-281C	6625-053-3112	
2	F,H	RINGING STATIC GENERATOR TA-48( )/FT	5805-254-7759	
3	F,H	POWER SUPPLY PP-4399/FCC		
4	F,H	EXTENDER CARD NRC 2128		
5	F,H	TOOL KIT TK-105/G	5180-610-8177	



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	TERM.
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		SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
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 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL

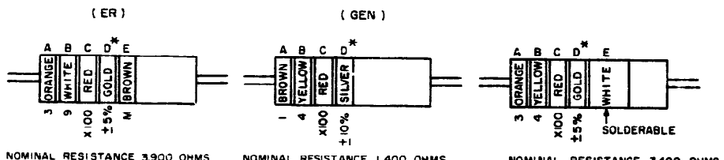
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

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 1ORO = 10.0 OHMS

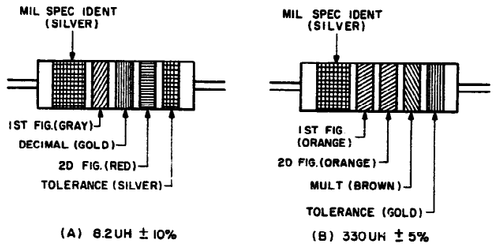
FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



* 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.

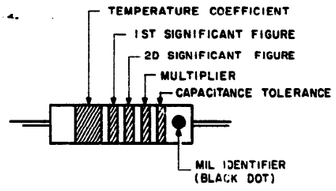


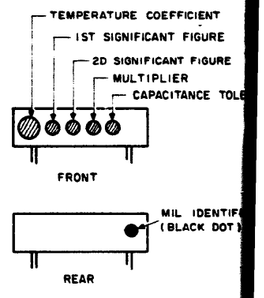
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

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.

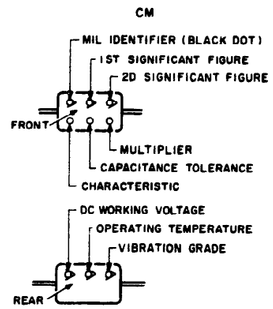




AXIAL LEAD RADIAL LEAD

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

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



GLASS-D

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

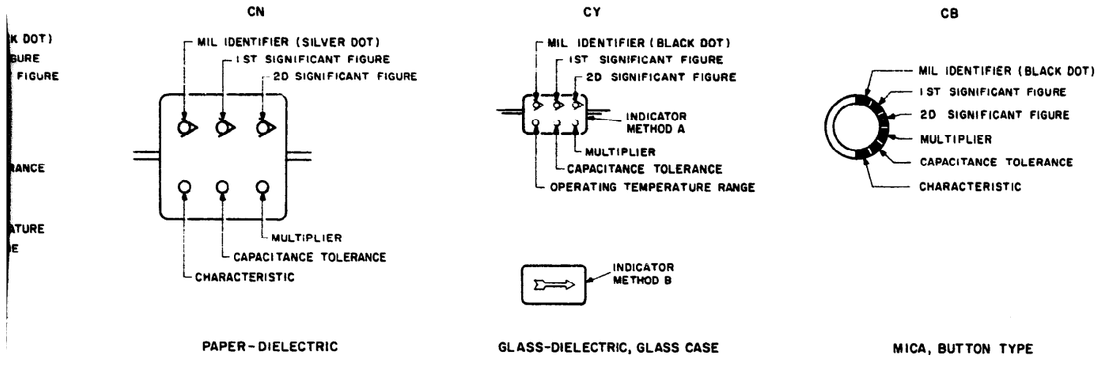


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

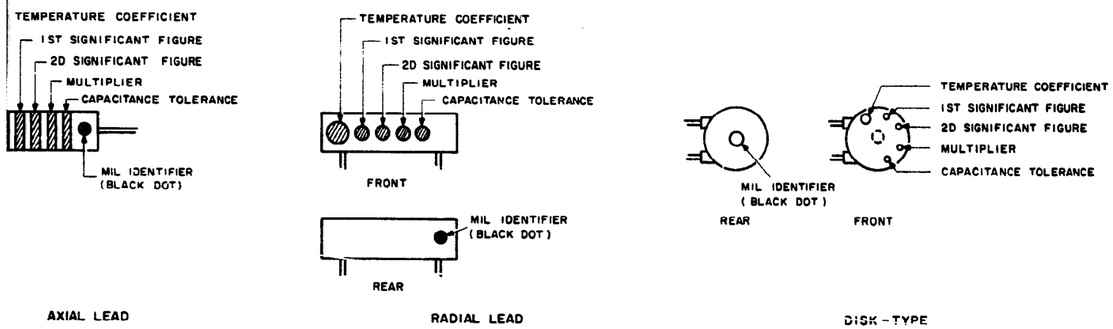
COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY CB	0	0	1			±20%	±20%		A			-55°$_{TO}$+70°C	10-55 Hz
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±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%	±10%	±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	8	0.01*			
WHITE		9	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-25D, 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

Figure F0-1. Color code marking for MIL STD resistors, inductors, and capacitors.

By Order of the Secretary of the Army:

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

Official:
VERNE L. BOWERS
Major General, United States Army,
The Adjutant General.

Distribution:

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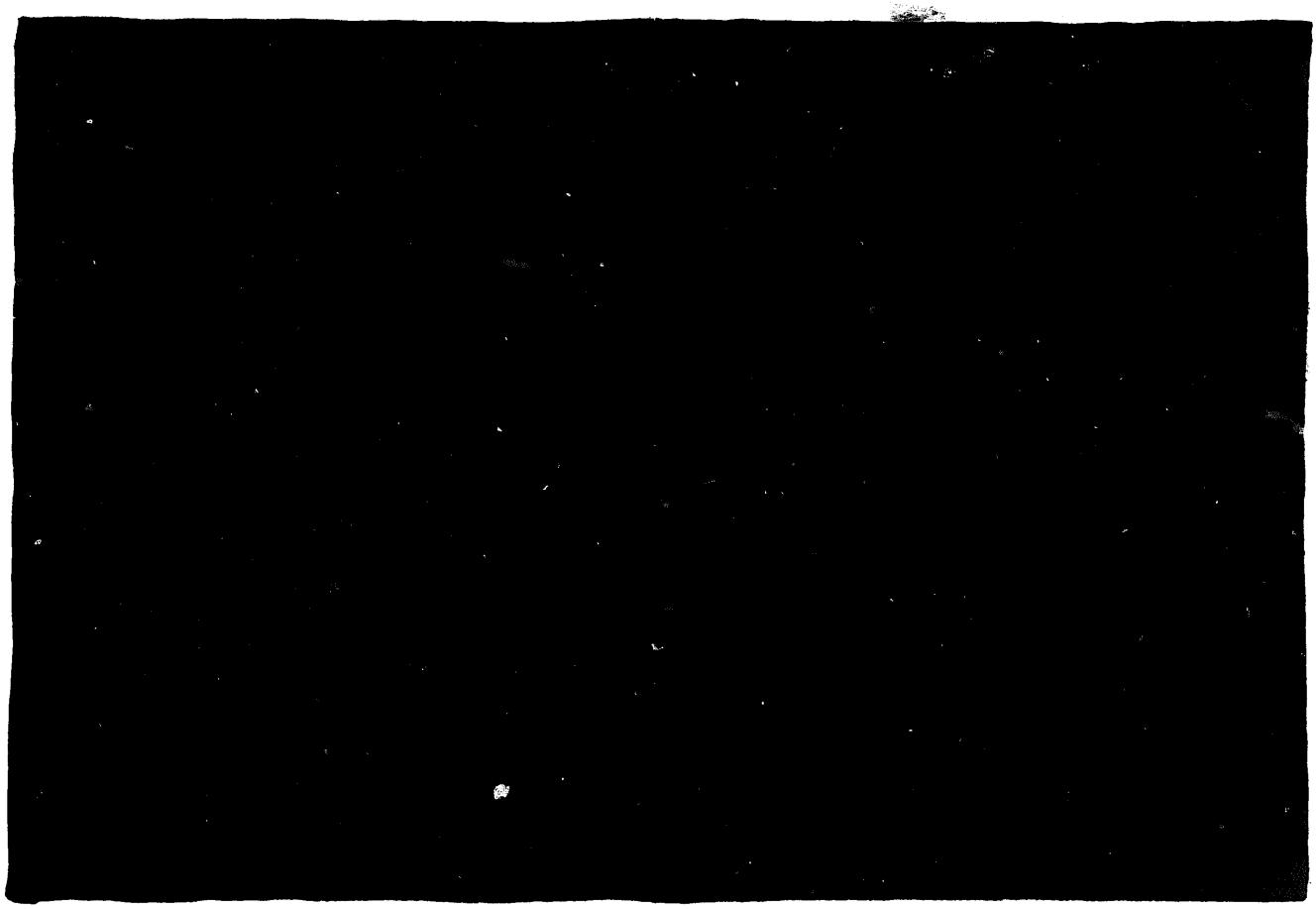

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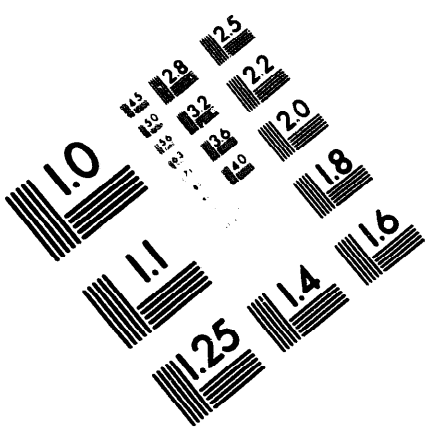
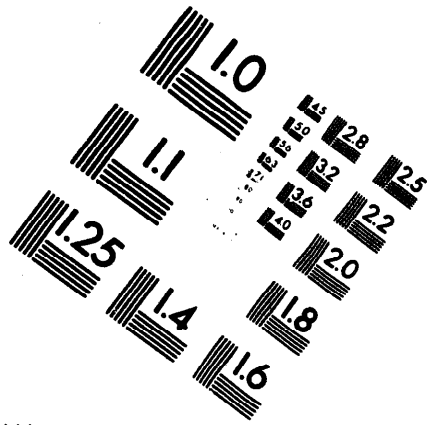




150 MM

1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

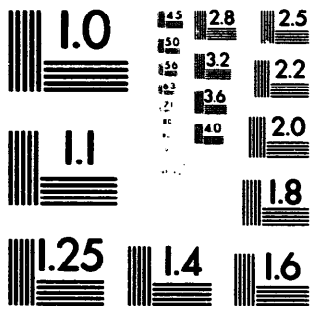
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

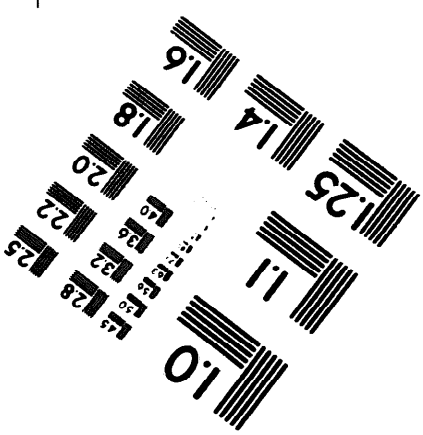
2.0 mm (e= 1.37 mm)

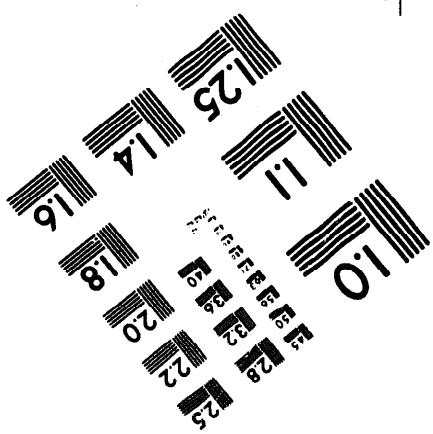
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM