DEPARTMENT OF TE ARMY TECHNICAL MANUAL **TM 11-5895-543-12**

DEPARTMENT OF THE NAVY MANUAL **NAVSHIPS 0967-220-6010**

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER **TO 31W1-2G-211**

ORGANIZATIONAL MAINTENANCE MANUAL

SYNCHRONIZER, ELECTRICAL SN-394(V)/G

This copy is a reprint which includes current pages from Changes 1 through 5.

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE

JANUARY 1967

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 120-volt or 230-volt power supply circuit. Serious injury or death may result from contact with this circuit. Turn off the power and discharge all high-voltage capacitors before making any connections or replacing any parts inside the equipment.

DON'T TAKE CHANCES!

CHANGE

No. 5

DEPARTMENTS OF THE ARMY,
THE NAVY AND THE AIR FORCE
WASHINGTON, DC, 2 May 1984

Organizational Maintenance Manual
SYNCHRONIZER, ELECTRICAL SN-394(V)/G
(NSN 5895-00-999-2435)

TM 11-5895-543-12/NAVELEX 0967-LP-220-6010/TO 31W1-2G-211, 20 January 1967, is changed as follows:

1. New or changed material is indicated by a vertical bar in the margin. New or revised illustrations are indicated by a vertical bar in front of the figure caption. Remove and insert pages as follows:

Remove	*Insert*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
4-3 through 4-6	4-3 through 4-6
A-1	A-1/(A-2 blank)

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TECHNICAL MANUAL
No.11-5895-543-12
NAVSHIPS
No.0967-220-6010
TECHNICAL ORDER
No. 31W1-2G-211

DEPARTMENTS OF THE ARMY,
THE NAVY, AND
THE AIR FORCE

WASHINGTON, D.C., *20 January 1967*

Organizational Maintenance Manual
SYNCHRONIZER, ELECTRICAL SN-394(V)/G
(NSN 5895-00-999-2435)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward direct to prime ALC/MST. For Navy, mail comments to the Commander, Naval Electronics Systems Command, ATTN: ELEX 8122, Washington, DC 20360.

In either case, a reply will be furnished direct to you.

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I GENERAL

1-1. Scope

This manual describes Synchronizer, Electrical SN-394(V)/G (fig. 1-1). It includes instructions for installation, operation, and organizational maintenance

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

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

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update. Air Force personnel will use AFR 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) in accordance with OPNAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) in accordance with OPNAVINST 4790.2, Vol 2, chapter 17.

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

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-3.1. Destruction of Army Electronics Materiel

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

1-3.2. Administrative Storage

Administrative storage of equipment issued and used by Army activities will have prevent maintenance performed in accordance with the PMCS chart before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in paragraphs 5-1 and 5-2.

1-3.3. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your SN-394(V)/G needs improvement let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN:
DRSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. Well send you a reply.

b. Air Force. Air Force personnel are encouraged to submit EIR's in accordance with AFR 900-4.

c. Navy. Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

a. Purpose. Synchronizer, Electrical SN-394(V)/G provides and maintains automatic synchronization of a secure communications system. It also provides an alarm check of the secure communications system and isolation for timing signals passed from red (classified data in clear form) to black (classified data encrypted) or black to red circuitry. Two SN-394(V)/G's (one at each termination of a communications system) are nec essary to achieve synchronization on a full-duplex basis.

b. Use. Synchronizer, Electrical SN-394-(V)/G is used to monitor the transmit, receive, and control signals from the terminal equipment (sending device), the *TSEC/KG*-13, and the modem.

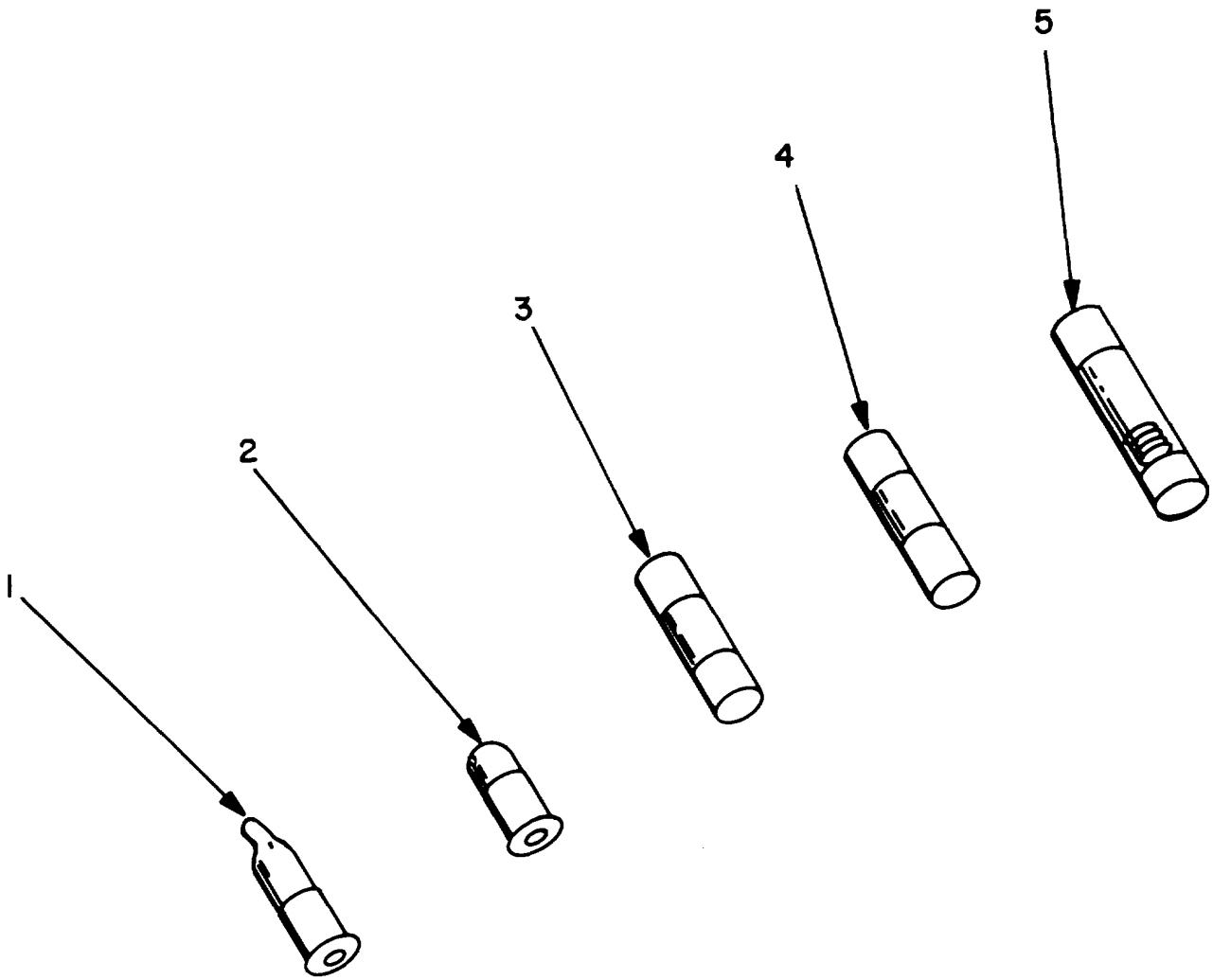


Figure 1-2. Running spares.

1-5. Tabulated Data

Data inputs, red and black:	
Mark (1)	+ 6 volts nominal(+ 0.5-volt minimum).
Space (0)	-6 volts nominal (- 0.5-volt minimum).
Input resistance	6,800 ohms ± 10 percent.
Input capacitance	1,500 picofarads or less.
Data outputs, red and black:	
Mark (1)	+ 6 volts ± 1.
Space (0)	- 6 volts ± 1.
Source impedence	100 ohms or less.
Clock input, red or black:	
Input level	+ and - 6 volts polar(+ and - 0.5-volt minimum).
Input resistance	6,800 ohms ±10 percent.
Input capacitance	1,500 picofarads or less.

Other control signals.	
Sync inhibit (from modem).	
Data inhibit (to terminal).	+ 6 volts nonactivated, 0 volt activated.
Sync initiate from terminal).	
Alarm (to terminal)	
Alarm reset (from terminal).	+ 6 volts or an open circuit nonactivated, a closed circuit when activated.
Power requirements:	
Voltage (single and dual configuration)	120 volts, + 10 percent, -20 percent, or 230 volts ± 10 percent.
Frequency (single and dual configuration).	47.5 to 63.0 cps.
Current (single configuration).	Less than 2 amperes at 120 volts.

Clock output, red and black:	
Output level	+ and - 6 volts polar.
Source impedance	100 ohms or less.
Clock/data phasing	Positive-going clock transitions must be coincident with data transitions.
Data rate	75 to 4,800 baud.
Control signal from SN-394 (V)G to TSECI KG-13:	
KGT preset	When activated, the 4 outputs provide energizing current to their associated
KGR preset	
KGT start	
Alarm check relay exposure at 100 percent	13.
Control signal from TSEC-KG-13 to SN-394(V)/G: '	
KGT alarm indicator	
KGT operate indicator.	- 7.5 volts activated, 0 volt nonactivated
KGR operate indicator.	
Va (single configuration).	25 va starting, 15 va maximum running; 11.5 va normal running.
Environmental requirements:	
Ambient temperature (operating).	From 0º to + 64º C.; exposure not to exceed 4 hours. at the high extreme.
Ambient temperature (nonoperating).	From - 54º to + 65º C.; exposure not to exceed 4 hours at the high extreme and not to exceed 24 hours at the low extreme.
Humidity	97 percent for 24 hours with relays in the TSEC/KG- for 4 hours maximum.
Heat dissipation (single configuration).	51 btu/hour.
Physical dimensions:	
Height	7 inches.
Width	19 inches.
Depth	28 3/8 inches.
Weight	70-lb single configuration; 85-lb dual configuration.

1-6. Items Comprising an Operable Synchronizer, Electrical SN-394(V)/G

FSN	*QTY*	*Nomenclature, part No. and mfr. Code*	*Usable on code*	*Fig. No.*
5895-999-2435		Synchronizer, Electrical, Single Function SN- 394(V)/G		
5895-089-7162		Synchronizer, Electrical, Dual Function SN-394(V)/G which includes:		

NOTE

The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-41142 and used to identify manufacturer, distributor, or Government agency, etc.

alarm, and control device. An equipment case (a below) serves as a mounting platform for the black logic module (b below), red card (c below), and power supply (d below). The initial issue of a synchronizer consists of one red card and one black logic module and is referred to as a single-configuration synchronizer. The addition of a second red card and a second black logic module, within the same equipment case, doubles the capacity of the synchronizer and is referred to as a dual-configuration synchronizer.

a. Equipment Case (figs. 1-1, 1-3, and 1-4). The equipment case is 27 inches long, 17 inches wide, and 7 inches high. Flanges (fig. 1-1) attached to the front of the equipment case permit installation of the synchronizer in a special 19-inch equipment rack. The equipment case is divided into three sections, a left-hand section (as viewed from the front of the case), a center section, and a right-hand section. The left-hand section of the equipment case contains the circuitry and nylon slides (mounting racks or channels) to accept two red cards (fig. 1-3). The center section of the equipment case holds the plug-in black logic module. The right-hand section of the equipment case may be used to install a second plug-in black logic module. The equipment case provides radiofrequency-interference (rfi) shielding (tempest covers) and contains the isolators used for secure red-to-black access. The top and the bottom of the equipment case is marked (fig. 1-4) to facilitate punching the holes to accept the interconnection cable couplings and other wiring.

b. Black Logic Module (fig. 1-5). The black logic module contains black printed circuit cards one through five, the mother board, the sync verify card, the power supply, and the controls and indicators used for operation of the synchronizer. The black logic module is mounted on a drawer-type, plug-in chassis, accessible from the front of the equipment case. The black logic module is held in the equipment case by three captive screws.

c. Red Card (fig. 1-5). The red card is a plug-in type printed circuit card which contains the control logic for the red functions performed by the synchronizer. The red card is accessible from the front of the equipment case after the rfi shield (tempest cover) has been removed.

Caution:
The secure capability of the synchronizer is lost when the tempest cover is

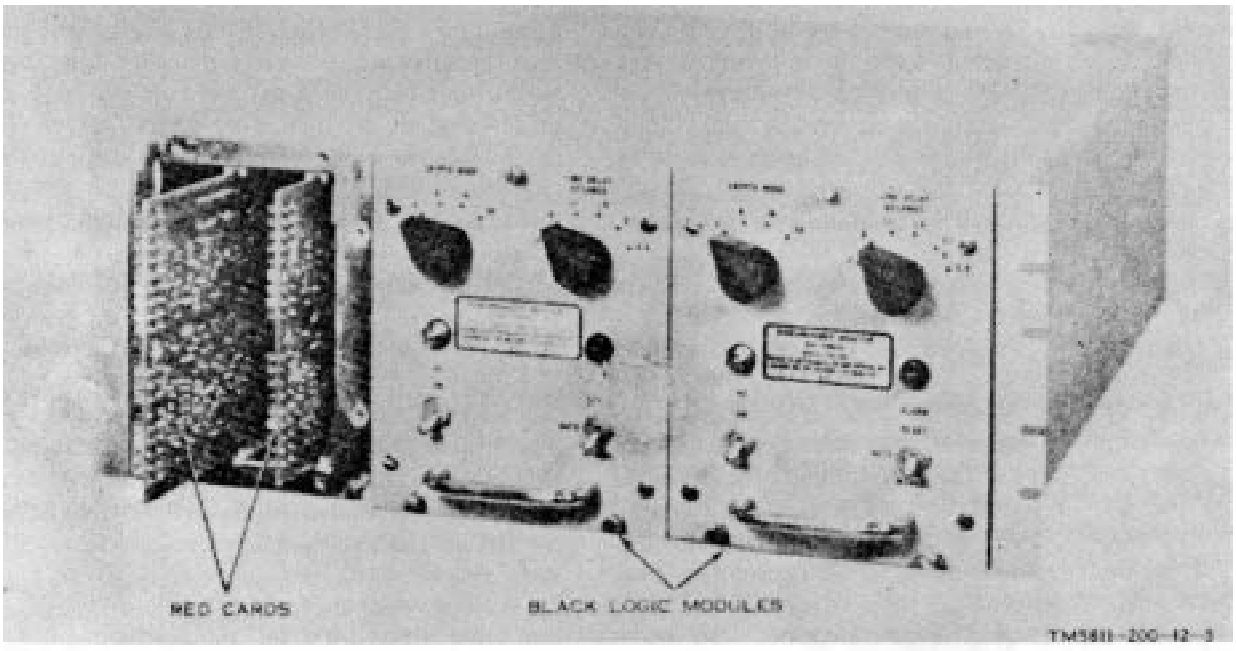


Figure 1-3. Front view of synchronizer showing red cards and black logic modules.

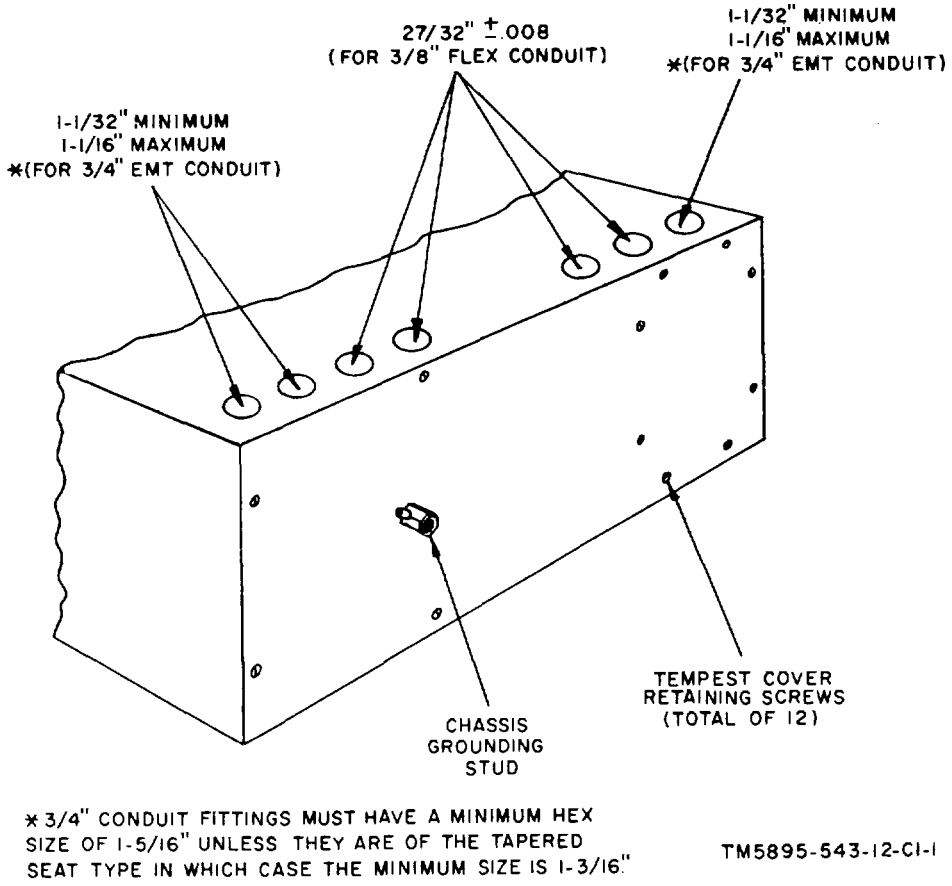


Figure 1-4. Top rear view of equipment case showing interconnection cable holes.

removed. DO NOT remove this shield, during normal operation, under any circumstances.

d. Power Supply (fig. 1-5). The power supply is mounted at the rear of the black logic module. Operating from a single-phase, 120- or 230-volt source, the power supply provides power for the black logic module and, through an isolator, for the red card.

e. Interconnection Cables (fig. 1-6). Eight interconnection cables are supplied with the synchronizer. Four cables are 27 inches long and the remaining four cables are 36 inches long. The cables are sealtite, metal-hose, flexible conduit. Each cable contains either two, four, six, or eight conductors (wires) of American Wire Gauge (AWG) No. 22 wire. Refer to the BIIL (app. B) or paragraph *2-8d* for the exact number of conductors contained in each cable. One end of each cable is terminated in a 17-pin connector. The other end of each cable is inserted through a coupling (for installation in the equipment case) and the ends of the wires are left free for installation of spade lugs and connection to terminal boards within the synchronizer. The spade lugs are not supplied with the cables or the synchronizer. The eight cables are sufficient to install a dual-configuration synchronizer. The cables are identified as SM-D-546972-01 through SM-D-546972-08.

1-9. Additional Equipment Required

Additional cables, conduit, and wiring is required but not supplied with the synchronizer. The required cables, conduit, and wiring must be provided and fabricated locally to meet the needs of each installation. Cables, conduit, and wiring required is as follows:

a. Ac power cable.
b. Black signal wiring.
c. Red signal wiring.
d. Ground wiring.

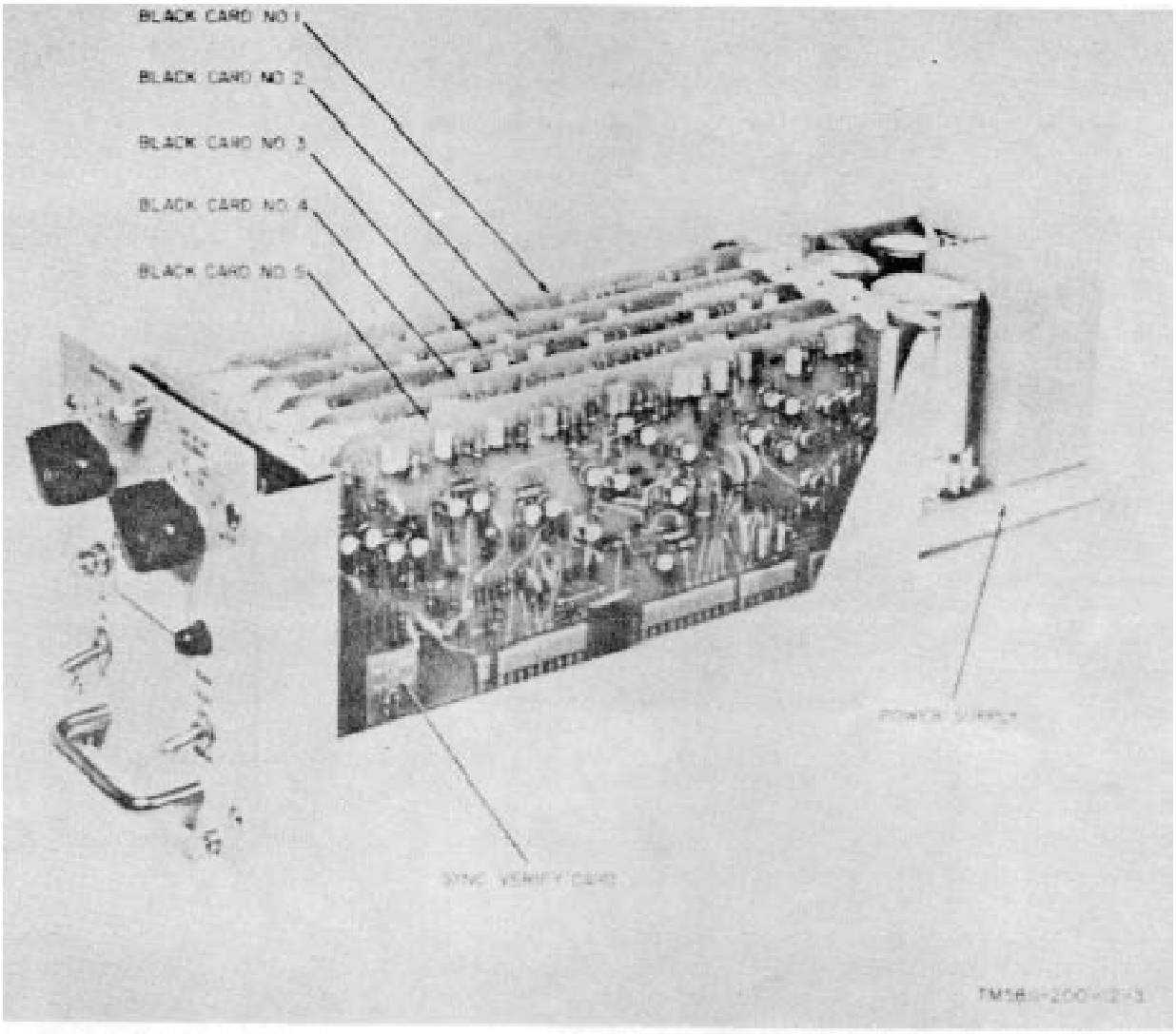


Figure 1-5. Black logic module removed from equipment case.

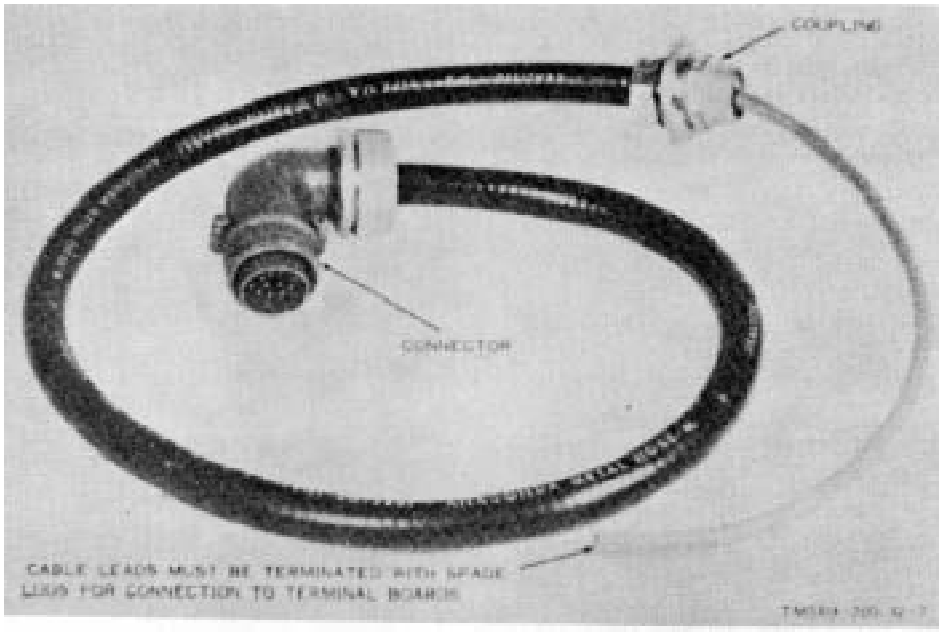


Figure 6-1 Typical interconnection cable

CHAPTER 2
INSTALLATION

NOTE

Installation of the synchronizer will be performed by General Cryptographic Repairman MOS 31K40. He will have the tools and equipment required to make the installation.

2-1. Service Upon Receipt of Equipment

(fig. 2-1)

a. Packaging Data. When packed for shipment, the synchronizer is placed in a cardboard carton which is then wrapped with polyurethane foam and packed in a vee-board box. The vee-board box and its contents are shown in figure 2-1. The dimensions of the vee-board box are: 12 inches high, 33 inches deep, and 22 inches wide; the volume is approximately 5 cubic feet, and the weight is approximately 100 pounds. An additional red card and a black logic module, when required, are shipped in a separate package that is approximately 91/ by 81/4 by 23 inches in size.

b. Removing Contents

CAUTION

Be careful when unpacking and handling the synchronizer. The synchronizer may be damaged by improper use of prying tools.

(1) Slit or remove the waterproof tape that us used to keep the top of the vee-board box closed.
(2) Open the top of the vee-board box; fold back the polyurethane foam.
(3) Lift the inner cardboard carton from the vee-board box and polyurethane foam.
(4) Open the top of the inner cardboard carton.
(5) Remove the cardboard box containing the interconnection cables and set the box aside, to be opened later.
(6) Remove the wood standoffs from the inner cardboard carton.
(7) Remove the synchronizer, which is wrapped in kraft paper, from the inner cardboard carton.
(8) Remove the kraft paper to reach the synchronizer.

2-2. 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 1-3).

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against paragraph 1-6. Report all discrepancies in accordance with TM 38-750. Shortage of a minir assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

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

NOTE

Current MWO's applicable to the equipment are listed in DA Pam 310-4.

2-3. Siting

The synchronizer normally will be installed in a special 19-inch rack, with the TSEC/KG-13, in a fixed-plant communication center.

a. Provide sufficient space for operation and maintenance of the synchronizer.
b. Do not place the synchronizer near equipment that generates excessive heat.
c. Adequate lighting for both day and night operation should be provided for operating personnel.

2-4. Tools and Material Required for Installation

The following tools and materials are required for installation of the synchronizer but are not furnished as part of the synchronizer.

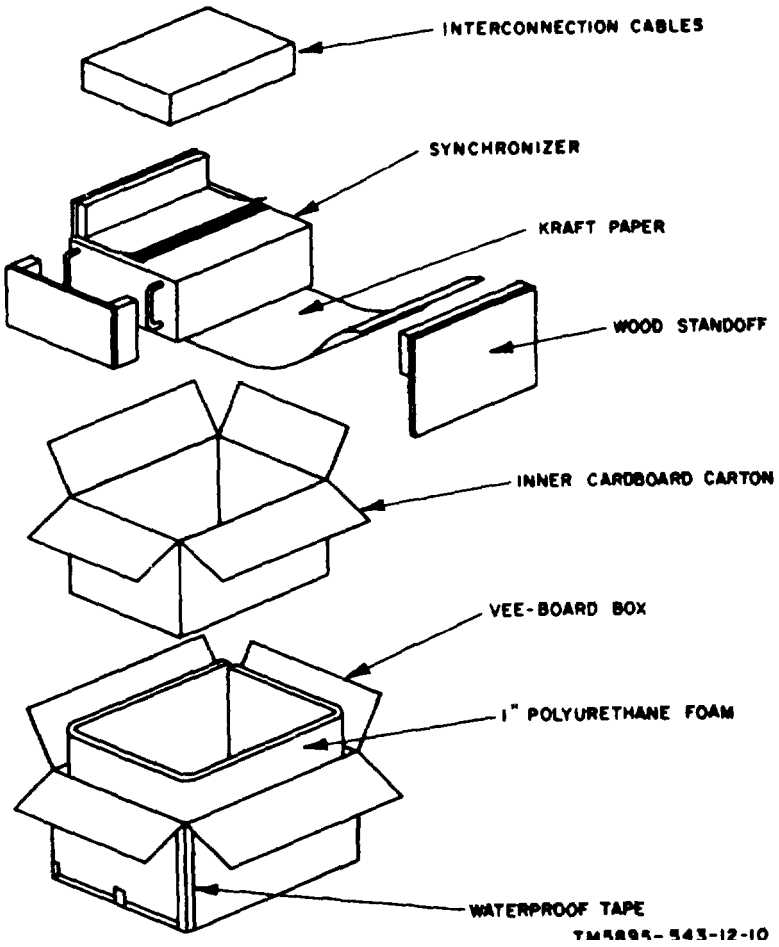


Figure 2-1. Synchronizer, typical packaging diagram.

a. 3/8-inch electric drill.
b. 5/16-inch bit.
c. Greenley punch.
d. Adjustable wrench.
e. Wire strippers.
f. Spade lugs.
g. Crimper pliers
h. Screwdriver.
i. Soldering gun.
j. Solder.
k. Center punch.

2-5. Drill and Punch Holes in Equipment Case

CAUTION

Drill and punch only the number of holes required to avoid degradation of the tempest features of the synchronizer.

It is necessary to drill and punch holes in the top and/or bottom of the quipment case to permit the installation of the interconnection cables, ac power cable, the black signal wiring, and the red

signal wiring. A maximum of 14 holes (7 on top and 7 on bottom) can be made in the equipment case. Determine the number of holes required based on exactly where, within the special 19-inch rack, the synchronizer will be mounted (paras 2-6 and 2-7) and whether it will be used as a single-or dual-configuration synchronizer. The equipment case is marked to indicate where the holes are to be made (figs. 14 and 2-3). To make the holes, proceed as follows:

a. Place the synchronizer on a workbench or other similar adequate working area
b. Remove the red card (para 4-14a) and the black logic module (para 4-14a) from the equipment case.
c. Remove the 12 tempest cover retaining screws

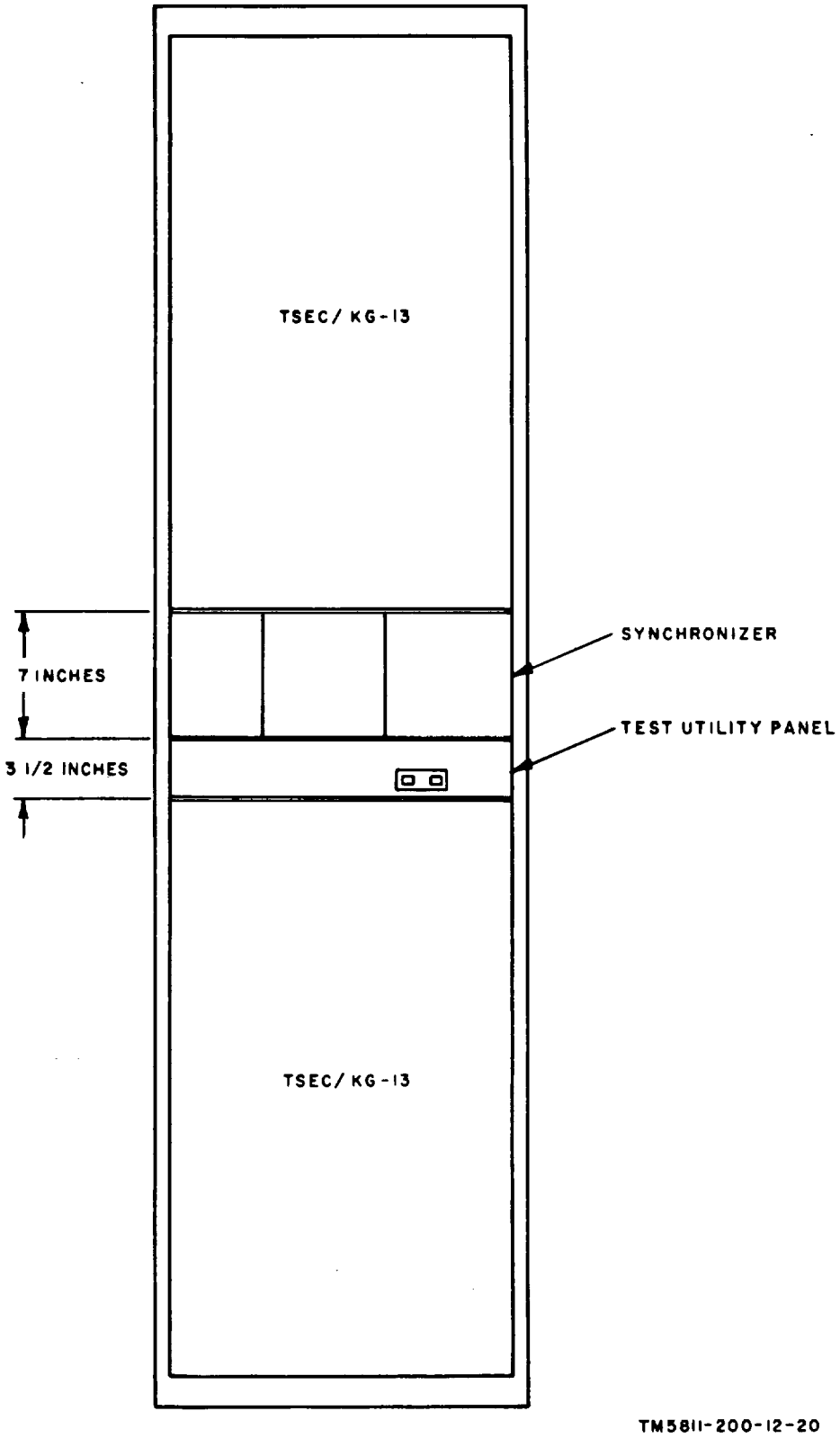


Figure 2-2. Front view of special 19-inch rack.

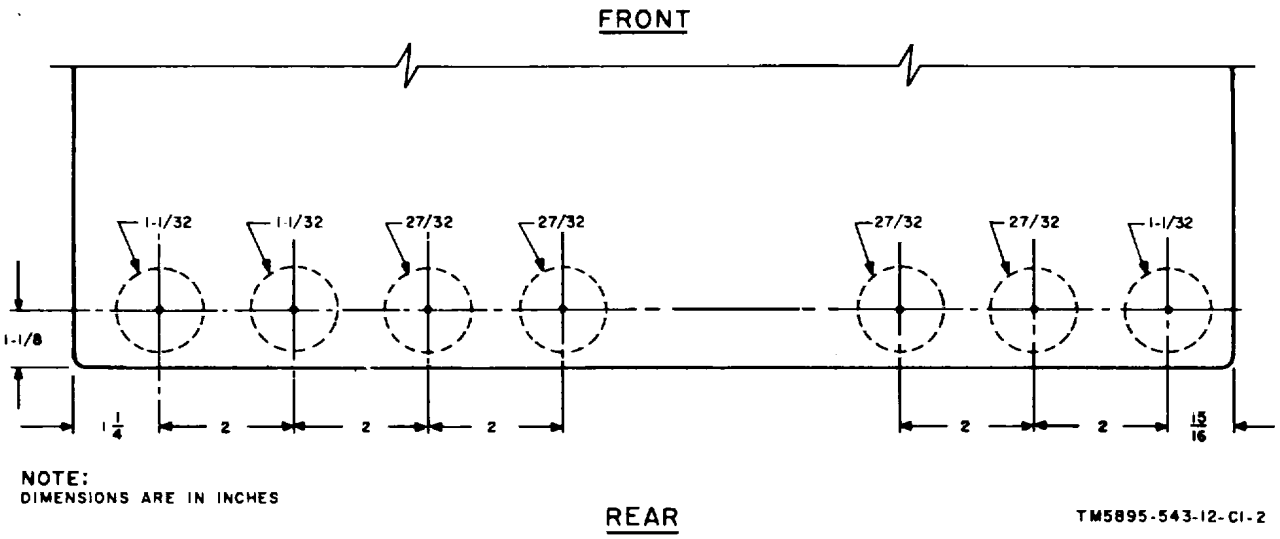


Figure 2-3. Top view of equipment case, location of holes.

(fig. 1-4) and remove the tempest cover from the rear of the equipment case.

d. Drill a 5/16-inch starter hole in the center of the area marked for the cable mounting hole (fig. 1-4).

e. Use a standard 13/16-inch Greenley punch to enlarge the 5/16-inch starter hole. Ream the hole for 27/32-inch diameter to accommodate cable fittings for cables connecting with the TSEC KG-13, or for 1 1/32-inch minimum and 1 1/16-inch maximum diameter for red and black signal cables or ac conduit.

Note.

The diameter of the AC conduit and the mating connectors for the red and black signal cables may vary for different installations. Verify the size of the connector before punching the holes. Failure to comply may result in a loss of RFI integrity.

f. Repeat the procedures in d and e above to make the required number of holes in the equipment case.

g. Clean the equipment case of metal shavings, dirt, oil, and grease.

h. Do not replace the tempest cover, the red card, or the black logic module in the equipment case until the interconnection cables and other wiring has been installed and secured to the equipment case and connections made to terminals on the terminal board.

26. Single-Configuration Connections

a. Synchronizer Mounted Above TSEC/KG-13.

(1) Place a red card in the right-hand slides (slots or channels) or the left-hand section of the equipment case. Place a black logic module in the right-hand section of the equipment case.

(2) Make connections to terminals on terminal boards as listed in paragraph 2-8c(4), (5), (6), (9), and (10).

b. Synchronizer Mounted Below TSEC/KG-13.

(1) Place a red card in the left-hand slides (slots or channels) of the left-hand section of the equipment case. Place a black logic module in the left-hand section of the equipment case.

(2) Make connections to terminals on terminal boards as listed in paragraph 2-8c (1), (2), (3), (7), and (8).

2-7. Dual-Configuration Connections

The synchronizer is mounted between two

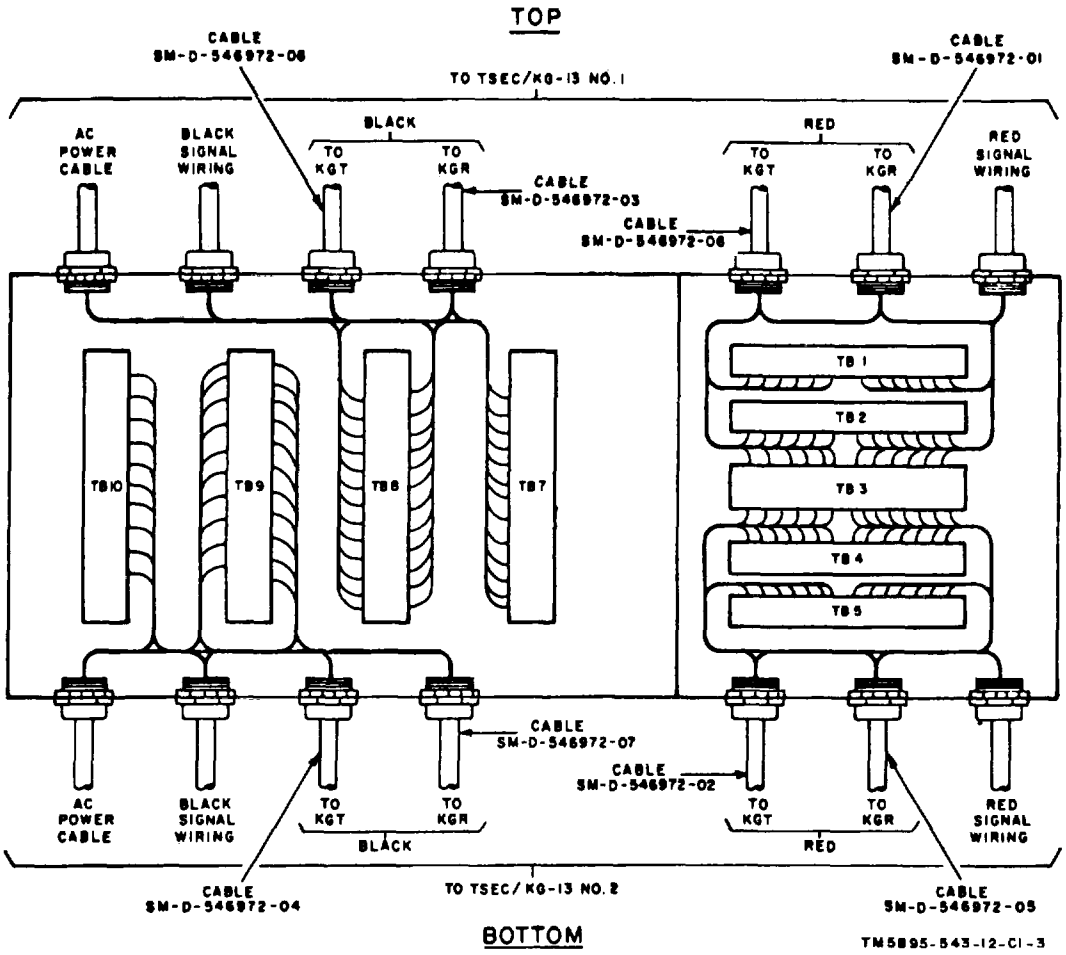


Figure 2-4. Rear view of synchronizer, cover removed.

TSEC/KG-13's for dual-configuration operation.

a. Place red cards in the right- and left-hand slides (slots or channels) of the left-hand section of the equipment case. Place black logic modules in the center and the right-hand sections of the equipment case.

b. Make connections to terminals on all terminal boards as listed in paragraph 2-8c(1) through (10).

2-8. Connection of Cables and Wiring

The synchronizer may be installed in an Automatic Digital Message Switching Center (ADMSC) or an Autodin Digital Subscriber Terminal (ADST). The eight cables, SM-D-546972-01 through SM-D-546972-08 (para 1-8e and fig. 1-6), are sufficient for a dual-configuration installation. The ac power cables, black signal wiring, red signal wiring, and the ADMSC or ADST black-shield ground feeder wiring may or may not be supplied with the synchronizer. Therefore, it may be necessary for the ADMSC or ADST to provide the cables and wiring and to fabricate the cables and wiring in the lengths required to meet each individual requirement. Refer to the applicable publication for the specific ADMSC or ADST in which the synchronizer is to be installed for complete electrical installation data.

a. Install cables and wiring through appropriate holes (para 2-5 and fig. 2-4) in the top and/or the bottom of the equipment case. Use cable couplings or grommets to protect and secure the cables and wiring.

b. The charts in c(1) through (10) below list the connections that must be made to appropriate terminals and terminal boards. Refer to figures 2-5 and 2-6 for the location of terminals on terminal boards.

c. Cut each individual wire to a length sufficient to attach a spade lug to the wire and reach the designated terminal on the designated terminal board. Use crisper pliers to attach the spade lugs to the wires. An explanation of the column headings in the charts (1) through (10) below is as follows:

Column heading	Explanation
Terminal ----------	Terminal on the terminal board.
Cable ----------	Identifies cables or wiring; all numbers -01 through -08 refer to SM-D-546972-01 through SM-D-546972-08.
Wire color ----------	Self explanatory.
Pin----------	Termination of the wire within the connector at the other end of the cable.
Function----------	Describes purpose of the circuit.
Destination/ origin	Denotes where the signal is fed to or received from.

(1) *Connections to TB1 (fig. 2-5)*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	Red----------	----------	----------	XMIT red data input	From terminal equipment.
2	-01----------	White ----------	C	RCV red data input----------	From TSEC/KG-13 receive red output
.					
3	Red----------	----------	----------	RCV red data output --------	To terminal equipment.
4	-06----------	White/red --------	A	XMIT red data output -------	To TSEC/KG-13 transmit red input.
5	Red----------	----------	----------	XMIT red clock input --------	From terminal equipment.
6	-06----------	White/black------	E	XMIT red clock output ------	To TSEC/KG-13 transmit red input.
6	Red----------	----------	----------	--- do----------	To terminal equipment.
7	----- do -----	----------	----------	RCV red clock output -------	Do.
8	----- do -----	----------	----------	Sync initiate ----------	From terminal equipment.
9	----- do -----	----------	----------	Data inhibit ----------	To terminal equipment.
10	----------	----------	----------	Spare ----------	Not connected.

(2) *Connections to TB2 (fig. 2-5).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	Red----------	----------	----------	Signal return XMIT red data input.	From terminal equipment.
2	-01----------	Black----------	D	Signal return RCV red data input	From TSEC/KG-13 receive red output
.					
3	Red----------	----------	----------	Signal return RCV red data output.	To terminal equipment.
4	-06----------	Black/red---------	B	Signal return XMIT red data output	To TSEC/KG-13 transmit red input
.					
5	Red----------	----------	----------	Signal return XMIT red clock input.	From terminal equipment.
6	-06----------	Black/black ------	F	Signal return XMIT red clock output	To TSEC/KG-13 transmit red input.
6	Red----------	----------	----------	---do ----------	To terminal equipment.
7	----- do -----	----------	----------	Signal return RCV red clock output.	Do.
8	----- do -----	----------	----------	Signal return sync initiate	From terminal equipment.
9	----- do -----	----------	----------	Signal return data inhibit	To terminal equipment.
10	----- do -----	----------	----------	Station red signal return ground.	To station ground.

(3) *Connections to TBS, terminals 1 through 10 (fig. 2-5).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	Red----------	----------	----------	Shield ground for XMIT red data input.	From terminal equipment.
2	-01----------	Bare/black -------	B	Shield ground for RCV red data input.	From TSEC/KG-13 receive red output.
3	Red----------	----------	----------	Shield ground for RCV red data output.	To terminal equipment.
4	-06----------	Bare/red----------	M	Shield ground for XMIT red data output.	To TSEC/KG-13 transmit red input.
5	Red----------	----------	----------	Shield ground for XMIT red clock input.	From terminal equipment.
6	-06----------	Bare/black -------	D	Shield ground for XMIT red clock output.	To TSEC/KG-13 transmit red input.
6	Red----------	----------	----------	---do ----------	To terminal equipment.
7	----- do -----	----------	----------	Shield ground for RCV red clock output.	Do.
8	----- do -----	----------	----------	Shield ground for sync initiate	From terminal equipment.
9	----- do -----	----------	----------	Shield ground for data inhibit	To terminal equipment.
10	----- do -----	----------	----------	External ground connection for shield	External red shield ground feeder.

(4) *Connections to TB3, terminals 11 through 20 (fig. 2-5).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
11	Red----------	----------	----------	Shield ground for XMIT red data input.	From terminal equipment.
12	-05----------	Bare/black -------	B	Shield ground for RCV red data input.	From TSEC/KG-13 receive red output.
13	Red----------	----------	----------	Shield ground for RCV red data output.	To terminal equipment.
14	-02----------	Bare/red----------	M	Shield ground for XMIT red data output.	To TSEC/KG-13 transmit red input.
15	Red----------	----------	----------	Shield ground for XMIT red clock input.	From terminal equipment.
16	-02----------	Bare/black -------	D	Shield ground for XMIT red clock output.	To TSEC/KG-13 transmit red input.
16	Red----------	----------	----------	---do ----------	To terminal equipment.
17	----- do -----	----------	----------	Shield ground for RCV red clock output.	Do.
18	----- do -----	----------	----------	Shield ground for sync initiate _	From terminal equipment.
19	----- do -----	----------	----------	Shield ground for data inhibit _	To terminal equipment.
20	----- do -----	----------	----------	External ground connection for shield	External red shield ground feeder.

(5) *Connections to TB4 (fig. 25).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	Red----------	----------	----------	Signal return XMIT red data input.	From terminal equipment.
2	-05----------	Black----------	D	Signal return RCV red data input.	FromTSEC/KG-13 receive red output.
3	Red----------	----------	----------	Signal return RCV red data output.	To terminal equipment.
4	-02----------	Black/red---------	B	Signal return XMIT red data output.	To TSEC/KG-13 transmit red input.
5	Red----------	----------	----------	Signal return XMIT red clock input.	From terminal equipment.
6	-02----------	Black/black ------	F	Signal return XMIT red clock output.	To TSEC/KG-13 transmit red input.
6	Red----------	----------	----------	---do ----------	To terminal equipment.
7	----- do -----	----------	----------	Signal return RCV red clock output.	Do.
8	----- do -----	----------	----------	Signal return sync initiate --	From terminal equipment.
9	----- do -----	----------	----------	Signal return data inhibit ---	To terminal equipment.
10	----- do -----	----------	----------	Station red signal return ground.	To station ground.

(6) *Connections to TB5 (fig. 2-5).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	Red----------	----------	----------	XMIT red data input ---------	From terminal equipment.
2	-05----------	White ----------	C	RCV red data input----------	From TSEC/KG-13 receive red output
3	Red----------	----------	----------	RCV red data output --------	To terminal equipment.
4	-02----------	White/red --------	A	XMIT red data output -------	To TSEC/KG-13 transmit red input.
5	Red----------	----------	----------	XMIT red clock input --------	From terminal equipment.
6	-02----------	White/black------	E	XMIT red clock output ------	To TSEC/KG-13 transmit red input.
6	Red----------	----------	----------	---do ----------	To terminal equipment.
7	----- do -----	----------	----------	RCV red clock output -------	Do.
8	----- do -----	----------	----------	Sync initiate ----------	From terminal equipment.
9	----- do -----	----------	----------	Data inhibit ----------	To terminal equipment.
10				Spare ----------	Not connected.

(7) *Connections to TB7 (fig. 24).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	-08	Yellow.....	T	TSEC/KG-13 transmit preset .	To TSEC/KG-13 transmit black output.
2	-08	Orange.....	S	TSEC/KG- transmit start	Do.
3	-08	Violet.....	L	TSEC/KG-13 transmit alarm check.	Do.
4	-08	Blue	J	TSEC/KG-13 transmit alarm indicator.	Do.
5	-08	Green.....	H	TSEC/KG-13 transmit operate indicator.	Do.
6	-08	Red	C	TSEC/KG-13 transmit black data output.	Do.
7	-08	Black.....	D	TSEC/KG-13 transmit/receive data signal return.	Do.
7	-03	.....do	B&F	.....do	To TSECIKG-13 receive black input.
8	-08	White	N	TSEC/KG-13 transmit/receive control signal return	To TSECIKG-13 transmit black output.
8	-03	.....do	T	.....do	To TSEC/KG-13 receive black input.
9	-03	Orange.....	J	TSEC/KG-13 receive preset	Do.
10	-03	Green.....	E	TSEC/KG-13 receive RCV clock input.	From TSEC/KG-13 receive black input.
11	-03	Red	A	TSEC/KG-13 receive black data input.	Do.
12	-03	Blue	H	TSEC/KG-13 receive operate indication.	Do.
13	.....	.....	.....	Spare.....	Not connected
14	.....	.....	.....	.....do	Do.
15	.....	.....	.....	.....do	Do.
16	.....	.....	.....	.....do	Do.
17	.....	.....	.....	.....do	Do.
18	.....	.....	.....	.....do	Do.
19	.....	.....	.....	Alarm reset shield	Not connected
20	.....	.....	.....	Alarm shield	Do.
21	.....	.....	.....	Alarm reset signal return	Do.
22	.....	.....	.....	Alarm signal return	Tech control.
23	.....	.....	.....	Alarm reset.....	Tech control.
24	.....	.....	.....	Alarm.....	Do.

(8) *Connections to TB8 (fig. 2-6).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	----------	----------	-------	N/A----------	Synchronizer internal connection to TBS-13.
2	----------	----------	-------	XMIT data output signal return.	Not connected.
3	----------	----------	-------	RCV clock input signal return	Do.
4	----------	----------	-------	RCV data input signal return -	Do
5	----------	----------	-------	Sync inhibit signal return ------	Do.
6	----------	----------	-------	XMIT clock input shield --------	Do.
7	----------	----------	-------	XMT clock output shield -------	Do.
8	----------	----------	-------	XMIT data output shield -------	Do.
9	----------	----------	-------	RCV clock input shield ---------	Do.
10	----------	----------	-------	RCV data input shield ----------	Do.
11	----------	----------	-------	Sync inhibit shield ----------	Do.
12	----------	----------	-------	XMIT clock out sig ret ----------	Not connected.
13	Black---------	----------	-------	XMIT clock input signal return ----------	From modem.
14	------do ------	----------	-------	XMIT clock input----------	Do.
15	------do ------	----------	-------	XMIT clock output----------	To modem.
16	------do ------	----------	-------	XMIT data output----------	Do.
17	------do ------	----------	-------	RCV clock input ----------	From modem.
18	------do ------	----------	-------	RCV data input----------	Do.
19	------do ------	----------	-------	Sync inhibit input ----------	Do.
20	Ground ------	----------	-------	Station shield----------	Station black shield ground feeder.
21	------do ------	----------	-------	Station signal return ----------	Station black signal return ground feeder.
22	Ac power ---	----------	-------	Protect ground ----------	Station protective ground.
23	------do ------	----------	-------	Ac power input----------	Station black power.
24	------do ------	----------	-------	----- do----------	Do.

(9) *Connections to TB9 (fig. 2-6).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	-04----------	Yellow----------	T	TSEC/KG-13 transmit preset	To TSEC/KG-13 transmit black output.
2	-04----------	Orange ----------	S	TSEC/KG-13 transmit start	Do.
3	-04----------	Violet----------	L	TSEC/KG-13 transmit alarm check.	Do.
4	-04----------	Blue ----------	J	TSEC/KG-13 transmit alarm indicator.	Do.
5	04----------	Green ----------	H	TSEC/KG-13 transmit operate indicator.	Do.
6	-04----------	Red----------	C	TSEC/KG-13 transmit black data output.	Do.
7	-04----------	Black----------	D	TSEC/KG-13 transmit/receive data signal return.	Do.
7	-07----------	----do----------	B&F	---------do----------	To TSEC/KG-13 receive black input.
8	-04----------	White----------	N	TSEC/KG-13 transmit/receive control signal return	To TSEC/KG-13 transmit black output.
8	-07----------	----do----------	T	---------do----------	To TSEC/KG-13 receive black input.
9	-07----------	Orange ----------	J	TSEC/KG-13 receive preset	Do.
10	-07----------	Green ----------	E	TSEC/KG-13 receive REC clock input.	From TSEC/KG-13 receive black input.
11	-07----------	Red----------	A	TSEC/KG-13 receive black data input.	Do.
12	-07----------	Blue ----------	H	TSEC/KG-13 receive operate indicator.	Do.
13	----------	----------	-------	Spare----------	
14	----------	----------	-------	---------do----------	
15	----------	----------	-------	---------do----------	
16	----------	----------	-------	---------do----------	
17	----------	----------	-------	---------do----------	
18	----------	----------	-------	---------do----------	
19	----------	----------	-------	Alarm reset shield----------	Not connected.
20	----------	----------	-------	Alarm shield ----------	Do.
21	----------	----------	-------	Alarm reset signal return ------	Do.
22	----------	----------	-------	Alarm signal return----------	Tech control.
23	----------	----------	-------	Alarm reset ----------	Tech control.
24	----------	----------	-------	Alarm----------	Do.

(10) *Connections to TB10 (fig. 2-6).*

Terminal	Cable	Wire color	Pin	Function	Destination/origin
1	----------	----------		N/A----------	Synchronizer internal connection to TB10-13.
2	----------	----------		XMIT data output signal return	Not connected.
3	----------	----------		RCV clock input signal return	Do.
4	----------	----------		RCV data input signal return -	Do.
5	----------	----------		Sync inhibit signal return ------	Do.
6	----------	----------		XMIT clock output shield ------	Do.
7	----------	----------		XMIT clock input shield --------	Not connected.
8	----------	----------		XMIT data output shield -------	Do.
9	----------	----------		RCV clock input shield ---------	Do.
10	----------	----------		RCV data input shield ----------	Do.
11	----------	----------		Sync inhibit shield ----------	Do.
12	----------	----------		XMIT clock out sig ret ----------	Not connected.
13	Black---------	----------		XMIT clock input signal return	From modem.
14	---do---------	----------		XMIT clock input----------	Do.
15	---do---------	----------		XMIT clock output----------	To modem.
16	---do---------	----------		XMIT data output----------	Do.
17	---do---------	----------		RCV clock input ----------	From modem.
18	---do---------	----------		RCV data input----------	Do.
19	---do---------	----------		Sync inhibit input ----------	Do.
20	Ground------	----------		Station shield----------	Station black shield ground feeder.
21	---do---------	----------		Station signal return ----------	Station black signal return ground feeder.
22	Ac power ---	----------		Protect ground ----------	Station protective ground.
23	---- do -------	----------		Ac power input ----------	Station black power.
24	---- do -------	----------		------- do ----------	Do.

d. The wires listed as *not connected* in c(7) through (10) above should be strapped according to the installation requirements at each site. The term "Not connected" in the Destination/Origin column indicates that the terminal is not internally connected within the synchronizer. Terminals designated as such are available, at the option of the installer, for terminating shields and unnecessary return lines. In effect, the synchronizer serves as a terminal box and the installer may use these terminals, and the spare terminals, as required for a specific installation. It should be noted that wires designated s*ignal return ground* and *signal ground* must be connected only to their designated terminals. Failure to comply with this requirement may produce crosstalk between the grounds which may reset in faulty operation of the TSEC/KG-13. The connectors of the eight cables (SM-D-546972-01 through SM-D-546972-08) supplied with the synchronizer should be connected to the TSEC/KG-13 for dual-configuration synchronizer operation, as follows:

Cable No	Length (inches)	Number of conductors	TSEC/KG13 connection
SM-D-546972-01	36	2	Receive red output.
SM-D-546972-02	36	4	Transmit red input.
SM-D-546972-03	36	6	Receive black input.
SM-D-546972-04	36	8	Transmit black output.
SM-D-546972-05	27	2	Receive red output.
SM-D-546972-06	27	4	Transmit red input.
SM-D-546972-07	27	6	Receive black input
SM-D-546972-08	27	8	Transmit black output

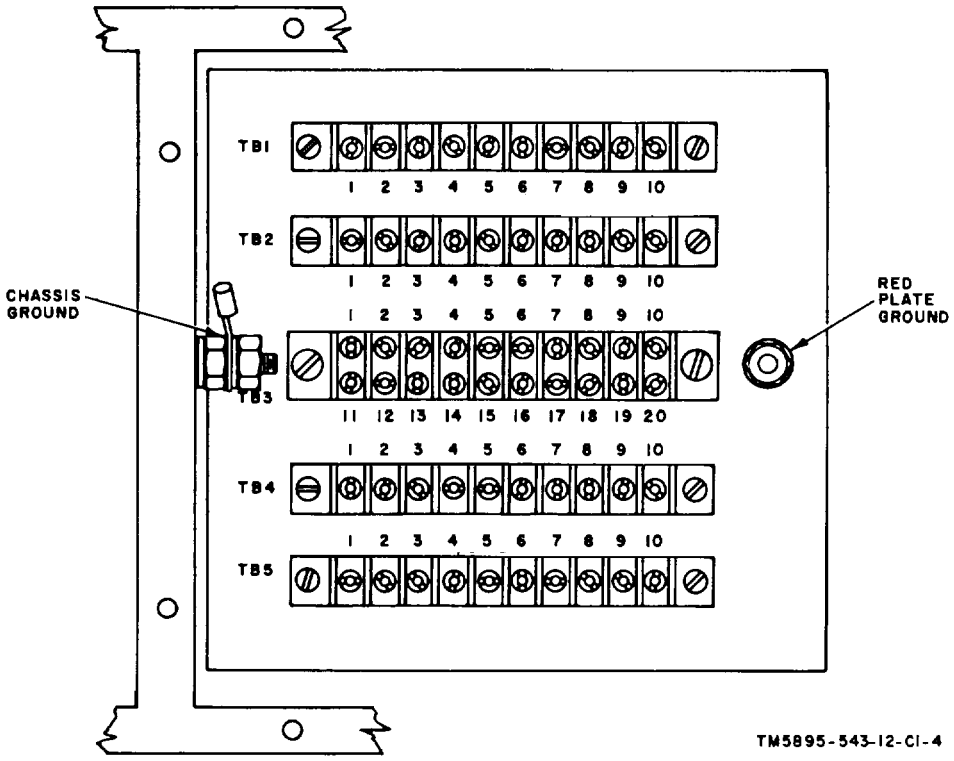


Figure 2-5. Identification of terminals on TB1, TB2, TB3, TB4, and TB5 (red area)

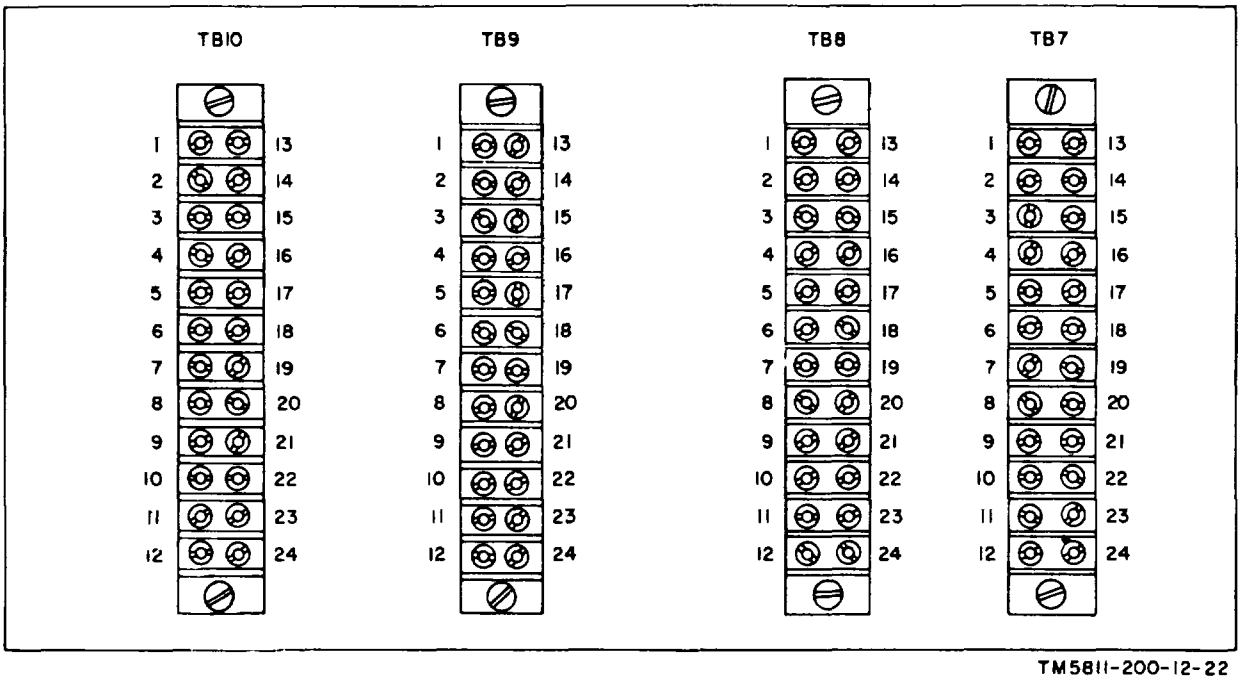
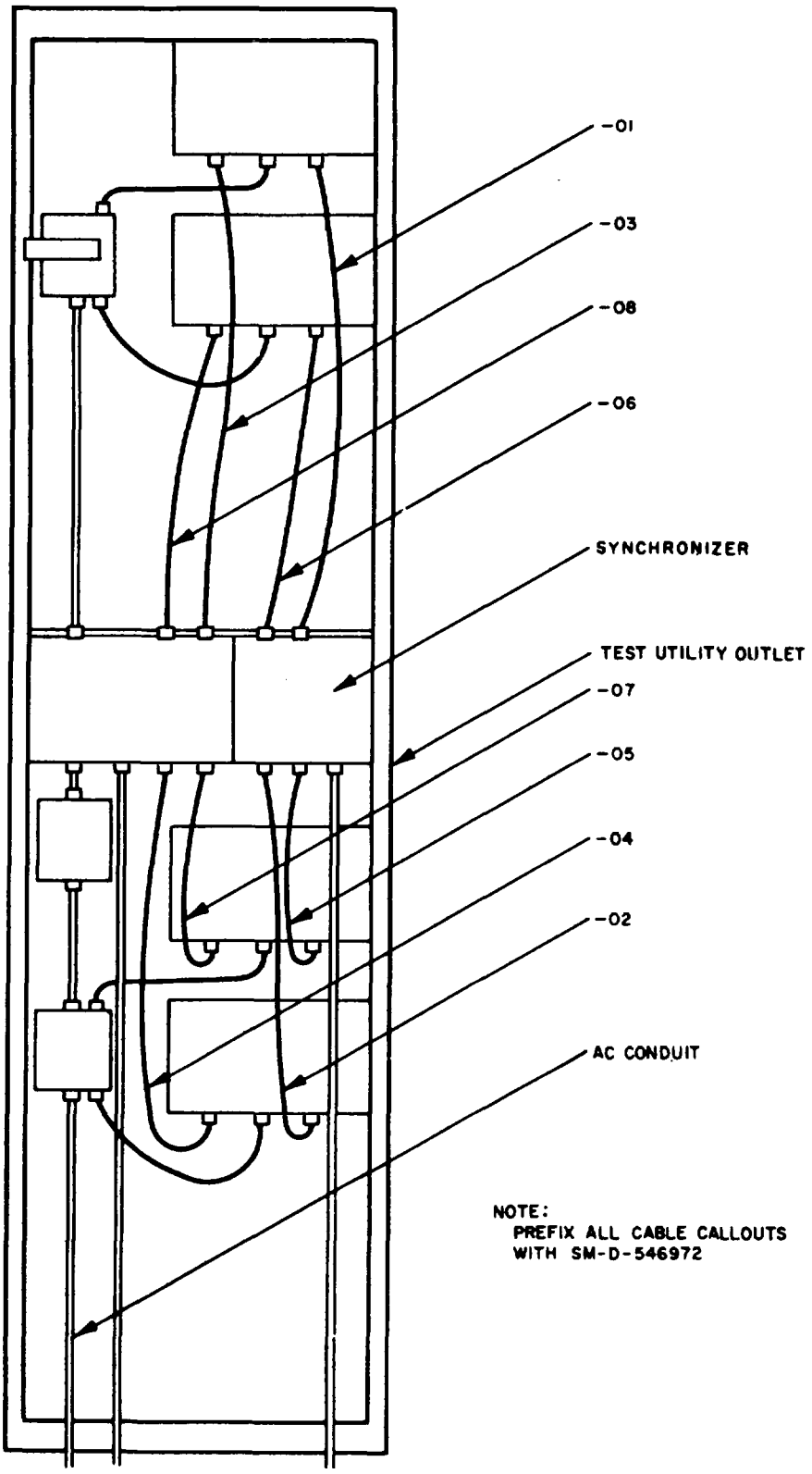


Figure 2-6 Identification of terminals, on TB7, TB8, TB9 and TB10 (back area)



TM5811-200-12-21

FIGURE 2-7. REAR VIEW OF SPECIAL 19-INCH RACK, COVER REMOVED, SHOWING ROUTING OF CABLES.

2-9. Additional Installation Wiring Considerations and Options

The external transmit clock signal can be applied to either the red side (from the terminal equipment) or the black side (from the modem). If the transmit clock signal is applied to the red side, the black input must be strapped to the signal return. If the transmit clock signal is brought into the black side, the red input must be strapped to the signal return.

a. If the transmit clock signal input is applied to terminal 14, of TB10, strap terminal 5 of TB5 TO terminal 5 of TB4.

b. If the transmit clock signal input is applied to terminal 5 of TB5, strap terminal 14 TB10 to terminal 13 of TB10.

c. If the transmit clock signal input is applied to terminal 14 of TB8, strap terminal 5 of TB1 to terminal 5 of TB2.

d. If the transmit clock signal input is applied to terminal 5 of TB1, strap terminal 14 of TB8 to terminal 13 of TB8.

2-10. Power Transformer Strapping for 230-Volt Operation

The power transformer, part of the power supply (para 1-8d and fig. 1-5), is strapped for 120-volt operation when shipped by the manufacturer. The strapping for the 120-volt operation consists of a strap between terminals 1 and 2 and terminals 3 and 4. To convert the synchronizer for 230-volt operation, proceed as follows:

a. Remove the power supply (para 4-19*a*) from the black logic module.

b. Carefully place the power supply on its top to expose the bottom of the power supply and permit access to the bottom of the power transformer (fig. 2-8).

c. Remove the straps between terminals 1 and 2, and terminals 3 and 4.

d. Place a strap between terminals 2 and 3.

e. Replace the power supply on the chassis of the black logic module (para 4-19*b*).

2-11. Installation of Synchronizer in Special 19-Inch Rack

a. Replace the red card(s) previously removed (para 4-14*b*).

b. Replace the black logic module(s) previously removed (para 4-15*b*).

c. Install the synchronizer in the front of the special 19-inch rack in the space provided. Feed the cables and wiring into the opening first.

d. Secure the synchronizer to the special 19-inch rack with four screws.

e. Make electrical connections to components within the special 19-inch rack from the rear of the rack.

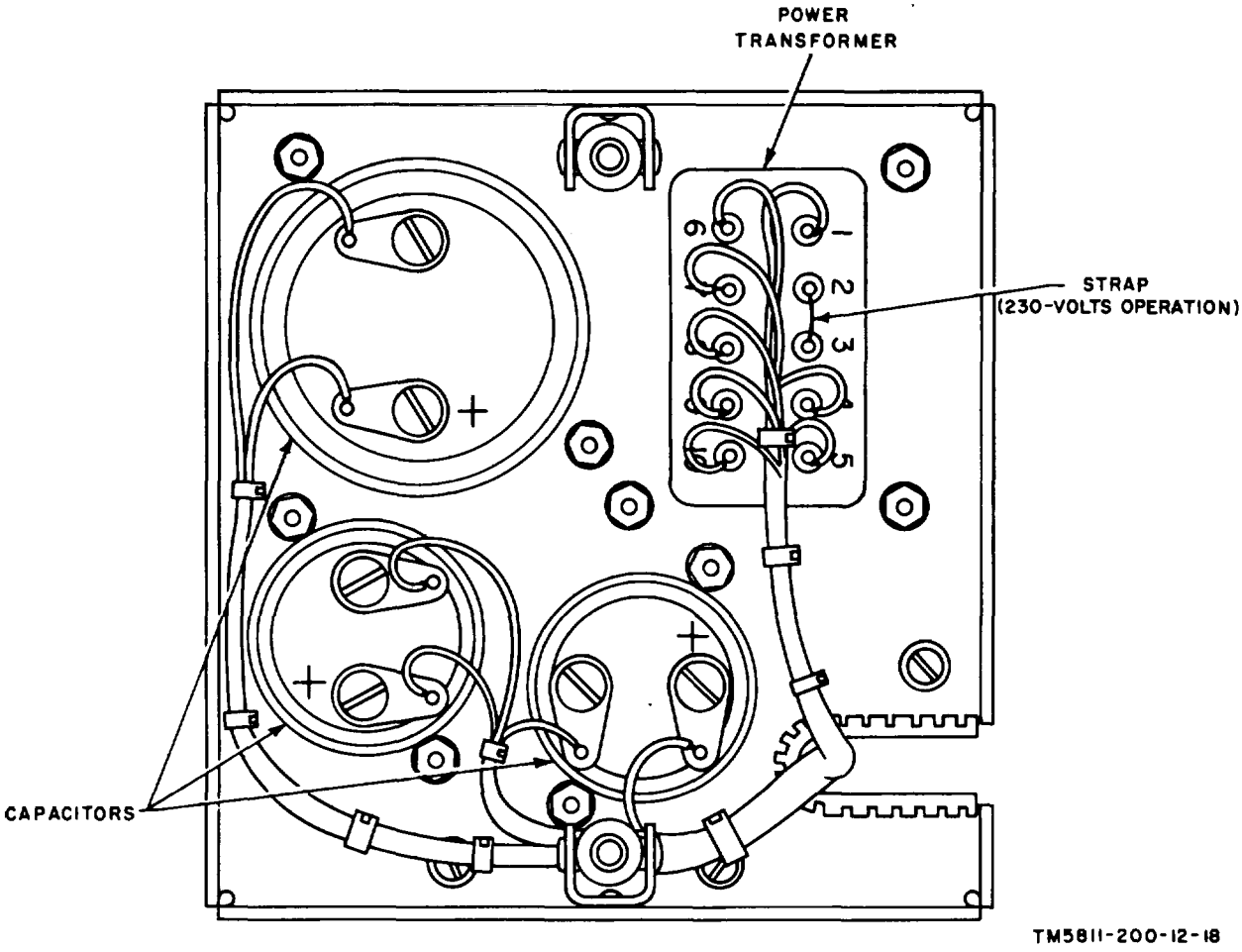


Figure 2-8. Bottom view of power supply, showing strap for 230-volt operation

CHAPTER 3

OPERATION

3-1. Controls, Switches, and Indicators (fig. 3-1)

Control, switch, or indicator	Description or function
CRYPTO MODE switch (S2).------	4 position rotary switch; positions 4, 8, 16, and 32. Each position matches the crypto mode to be used.
LINE DELAY SECONDS switch (S3)	6 position rotary switch; positions 0.1, 0.6, 1.1, 1.6, 2.1, and 2.6. Each position provides compensation for the transmission delay.
AC power switch(S4)----------	2 position toggle switch. *Sw pos* *Function* ON---------Applies ac power to the synchronizer. OFF--------Removes ac power from the synchronizer.
AC indicator lamp----------	Illuminates when ac power is applied to the synchronizer. Extinguishes when ac power is removed from the synchronizer
RESET-AUTO-MANUAL switch (S1).	3 position toggle switch with momentary contact in 1 position, fixed contact (set) in 2 positions. Provides for operation of the synchronizer, as follows: *sw pos* *Fun*ction RESET------Momentary contact position. When depressed, resets synchronizer for normal operation. When the reset switch has been operated several times, without successful synchronization (normal operation), the ALARM indicator will remain lighted and the secure communications system is considered to have a major alarm condition (severe malfunctioning).
AUTO--------	Fixed (set) contact position. Permits normal automatic operation of the synchronizer.
MANUAL----	Fixed (set) contact position. Synchronization circuitry of the synchronizer is bypassed.
ALARM indicator lamp ---------	Illuminates to indicate master alarm condition. Extinguished during normal operation.

3-2. PELIMINARY STARTING PROCEDURE

Note. When the TSEC/KG-13 is operated in the inverted mode (data sampled on negative clock transitions the SN-394(V)/G provides the correct clock phasing.

a. Set the ac power switch to OFF.

b. Set the CRYPTO MODE switch to match the setting on the TSEC/KG-13.

c. Set the RESET-AUTO-MANAL switch to AUTO.

d. Determine the mode of operation of the terminal equipment, TSEC/KG-13, and the modem. Set the LINE DELAY SECONDS switch in the proper position (0.1, 0.6, 1.1, etc.) to correspond to that mode of operation.

Note

If the information pertaining to the mode of operation is not readily available, use a trial and error method to determine the lowest setting of the LINE DELAY SECONDS switch that will allow proper operation of the terminal equipment, TSEC/KG-13, synchronizer, and the modem. Synchronization will not be achieved if the LINE DELAY SECONDS switch is set too low.

3-3. Starting Procedure

a. Place the ac power switch at ON. The AC indicator lamp should light and remain lighted.

b. Application of ac power to the synchronizer cause the TSEC/KG-13 to perform an alarm check and a synchronization

cycle and then return to normal operation.

c. If the alarm check and the synchronization cycle have been successful, the ALARM indicator lamp will extinguish and remain extinguished.

3-4. Operating Procedure

The synchronizer is designed to function automatically and does not require close support from operating personnel. However, if a master alarm condition appears on the synchronizer, the operator should perform the following procedures:

a. Place the RESET-AUTO-MANUAL switch at RESET and then release it. The ALARM indicator lamp should extinguish.

b. If the ALARM indicator lamp re lights, place the RESET-AUTO-MANUAL switch at MANUAL and manually attempt to generate an alarm check and a synchronization cycle from the TSEC/KG-13.

35. Stopping Procedure

Place the ac power switch at OFF. The AC indicator lamp should extinguish. It should be noted that this action will inhibit the transmit and receive data flow.

3-6. Operation Under Unusual Conditions

The operation of the synchronizer may be affected in regions where extreme cold, heat, humidity or other moisture, sand conditions, etc., prevail. Although every precaution has been taken in the design of the synchronizer to maintain its technical characteristics over a wide temperature and humidity range, adverse conditions may cause poor operation unless additional precautions are taken. Observe the precautions in *a, b,* and c, below.

a. Cold Climates.

(1) Keep the synchronizer warm and dry.

(2) When equipment that has been ex- posed to the cold is brought into a warm room, moisture will gather on the equipment; this may cause a change in operating characteristics. When the equipment reaches room temperature, dry it thoroughly.

(3) Extreme cold causes cables and wires to become hard and brittle, and difficult to handle. Be careful when handling the cables and connecting the wires.

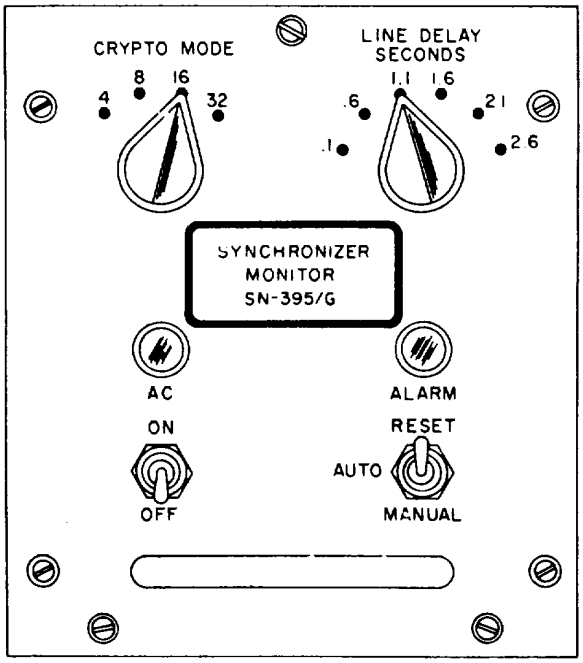


Figure 3-1. Operator's controls, switches and indicators.

b. Tropical Climates

(1) In tropical climates, the high relative humidity causes condensation to form on the equipment whenever the temperature of the equipment becomes lower than that of the surrounding air. To minimize this condition, provide as much ventilation as possible. Dry the equipment thoroughly before operating it.

(2) In warm, damp climates, the equipment is subject to damage from moisture and fungi. Wipe all moisture from the exterior of the equipment with a clean cloth.

c. Hot, Dry Climates. Keep the synchronizer as free from dust as possible. Make frequent preventive maintenance checks. The synchronizer does not require lubrication and should be kept free from oil and grease.

CHAPTER 4
MAINTENANCE

Section I. OPERATOR'S MAINTENANCE INSTRUCTIONS

4-1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of the synchronizer are listed below. These duties do not require special tools or test equipment.

a. Operator's daily preventive maintenance checks and services (paras 4-3 and 4-4).
b. Operator's cleaning procedures (para 4-5).
c. Operator's troubleshooting (para 4-6).

4-2. Operator's Maintenance Materials

Maintenance materials listed below are the only items required for operator's maintenance of the synchronizer. None are furnished as part of the synchronizer.

a. Brush, typewriter, toothbrush style, Federal stock No. 7510-178-8320.
b. Clean, lint-free cleaning cloth.

Warning

Prolonged breathing of cleaning compound is dangerous; make certain that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame.

c. Cleaning compound, Federal stock No. 7930-395-9542, is required to clean the exterior of the equipment case.

4-3. Operator's Preventive Maintenance

Operator's preventive maintenance is the systematic care, servicing, and inspection of the synchronizer to prevent occurrence of trouble, to reduce downtime, and to assure that the synchronizer is serviceable.

a. *Systematic Care*. The procedures described in paragraphs 4-4 and 4-5 cover routine systematic care and cleaning essential proper upkeep and operation of the synchronizer.

b. *Preventive Maintenance Checks and Services*. The preventive maintenance checks and services chart (para 4-5) outlines functions to be performed daily. These checks and services are necessary to maintain the synchronizer in combat serviceable condition; that is, in good general (physical) condition and in good operating condition. The chart indicates what to check, how to check, and the normal conditions; the "References" column lists the illustrations, paragraphs, or manuals that contain detailed maintenance procedures. If the defect cannot be remedied by the operator, higher category maintenance is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM-38-750.

c. *Standby Status*. If the synchronizer is in a standby status, the preventive maintenance checks and services listed in paragraph 4-4 must be performed weekly.

4-4 Operator's Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Exterior surfaces	Clean the front of the equipment case and the black logic module, including the rotary switch knobs, toggle switches, and indicator lamp lenses. When cleaning, check for missing, loose, broken or damaged knobs, switches, or indicator lamp lenses.	Fig. 1-1 and para 4-5.
2	Indicator lamps	a. Be sure that the AC power indicator lamp is lighted when ac power is applied to the synchronizer. Replace the lamp if it is defective.	*a.* Fig. 1-3.
		Note. Perform the following procedure without disrupting operation-	
		b During some convenient idle-circuit time, initiate an alarm check to verify the operation of the ALARM indicator lamp.	*b.* Para 3-3 and fig. 1-3. Replace the lamp if it is defective.

4-5. Operator's Cleaning Procedures

Inspect the exterior surfaces of the synchronizer. The exterior surfaces should be free of dust, dirt, grease, and fungus.

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

Warning: **Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. DO NOT use near a flame.**

b. Use a cloth dampened (not wet) with cleaning compound to remove grease, fungus, and hard-to-remove dirt from the front of the equipment case, tempest cover(s), and the black logic module(s).

c. Remove dust or dirt front the grooves of the rotary knobs of the black logic module(s) with brush.

d. Clean the external panels, toggle switches, and the indicator lamp lenses with a soft, clean cloth. If necessary, slightly dampen the cloth with water and mild soap

4-6. Operator's Troubleshooting Chart

a. General. The operator's troubleshooting chart provides only those corrective measures which the operator can accomplish. If the measures suggested do not restore normal synchronizer performance, higher category maintenance is required.

b. Procedure. With the synchronizer in operation (paras 3-2, 3-3, and 3-4), note the apparent trouble symptom. Locate the symptom in the troubleshooting chart (*c* below), note the probable trouble, and take the indicated corrective action for each probable trouble. If the indicated corrective action does not restore the synchronizer. to an operable condition, report the deficiency in accordance with TM 38-750.

c. Troubleshooting Chart.

Symptom	Probable trouble	Corrective action
AC indicator lamp does not light .	*a.* Defective indicator lamp	*a.* Replace AC indicator lamp (4-17)
	b. Blown power fuse Fl	*b.* Replace fuse F1 (4-16a(1) and (2) and fig. 4-2).
ALARM indicator lamp does not light	*a.* Defective indicator lamp	*a.* Replace AI,ARNI indicator (para 4-17)
	b. Blown fuse Fl, F2, or F3	*b.* Replace fuse Fl, F2, or F3 (para 4-16a(3) and (4) and fig. 4-2)
Synchronizer fails to perform synchronization.	*a.* CRYPTO MODE switch set improperly.	*a.* Set CRYPTO MODE switch in correct operating position (3-1 and 3-2).
	b. LINE DELAY SECONDS switch set improperly	*b.* Set LINE DELAY SECONDS switch in correct operating position (para 3-1 and 3-2).

Section II. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

4-7. Scope of Organizational Maintenance

a. During normal use of the synchronizer, be alert to the need for unscheduled maintenance. The equipment must be clean and complete. All hardware must be secure. This preventive maintenance should be performed as needed.

b. This chapter contains instructions covering organizational maintenance of the synchronizer. It includes instructions for performing periodic preventive maintenance checks and services, adjustment procedures, and those corrective procedures to be performed by the organizational repair technician.

c. Organizational maintenance of the synchronizer includes--
(1) Monthly and quarterly preventive maintenance checks and services (para 4-10, 4-11, and 4-12)
(2) Organizational troubleshooting (para 4-13).
(3) Removal and replacement of organizational parts (para4-14 through 4-19)
(4) Retouching painted surfaces (para 4-12).

4-8. Tools, Materials, and Test Equipment Required for Organizational Maintenance

The tools, materials, and test equipment required for organizational maintenance are listed below.

a. Tools. Tool Kit, Electronic Equipment TK-105/G is authorized for use at organizational maintenance.

b. Materials.
(1) Cleaning compound (NSN 6850-00-597-9765).
(2) Cleaning cloth.

c. Test Equipment. Multimeter AN/USM-162 is authorized for use at organizational maintenance.

4-9. Organizational Preventive Maintenance

a. Organizational preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Organizational preventive maintenance is the responsibility of the organizational maintenance man. It includes the inspection, testing, and replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Organizational preventive maintenance checks and services of the synchronizer are made monthly and quarterly unless otherwise directed by the commanding officer. For all vehicular installations, the preventive maintenance checks and services should be scheduled concurrently with the periodic service schedule of the carrying vehicle.

b. Perform the maintenance functions indicated in the monthly and quarterly preventive maintenance checks and services charts (para 4-10 and 4-11). A month and quarter are defined as approximately 30and 90 calendar days of 24 hour-a-day operation, respectively. Adjustment of the maintenance interval should be made to compensate for any unusual operating conditions. For example: Maintenance intervals for the SN-394(V)/G may be adjusted to coincide with intervals for associated COMSEC equipments so that preventive maintenance can be formed efficiently. Equipment maintained in a stand-by (ready for immediate operation) condition must have monthly preventive maintenance. Equipment in limited storage (requires service before operation) not require monthly preventive maintenance.

c. Maintenance forms and records to be used and maintained on this equipment are specified in DA Pam 738-750.

4-10. Organizational Monthly Preventive Maintenance Checks and Services Chart

Sequence No	Item to be inspected	Procedure	References
1	Equipment Operation	Perform a complete check of all operational features of the synchronizer. DO NO disrupt normal operation to perform this check.	Paragraph 3-2, 3-3, and 3-4

4-11. Organizational Quarterly Preventive Maintenance Checks and Services Chart

Sequence No	Item to be inspected	Procedure	References
1	Publications	Check to see that all publications are complete, serviceable and current	DA Pam 310-1, appendix A.
2	Modifications	Check DA Pam 310-1 to determine if new applicable MWO's have been published. ALL URGENT MWO'S must be applied immediately. ALL NORMAL MWO'S must be scheduled	DA Pam 738-750 as contained in Maintenance Management Update and DA Pam 310-1.
3	Fuses	See that all operating fuses are of the correct value Check spare fuses for proper value and quantity.	Figure 4-2 and Appendix B.

4-12. Organizational Cleaning and Touchup Procedures

When cleaning the synchronizer, use the following procedures:

a. Use No. 0000 sandpaper to remove corrosion.
b. Use a clean, dry cloth or a dry brush to remove loose dirt from the synchronizer.

WARNING

Prolonged breathing of cleaning compound (*c* below) is dangerous. Provide adequate ventilation. Cleaning compound is flammable; do not use it near a flame.

c. Use a cloth slightly moistened with cleaning compound for hard-to-remove dirt and oil or grease deposits; wipe the cleaning compound from the equipment with a clean, dry cloth.
d. If available, use vacuum cleaning equipment for removing loose dust and dirt from the synchronizer.
e. Clean all damaged painted surfaces of the black logic module or the equipment case. Touch up the damaged surfaces with paint. For detailed instructions, refer to TB 43-0118.

4-13. Organizational maintenance Troubleshooting Chart

a. General. Only two faults can be detected by the organizational maintenance repairman: an ac power failure (AC indicator lamp will extinguish) and a communications system (TSEC/KG-13, synchronizer, and modem) malfunction (ALARM indicator lamp will light).

b. Sectionalization of Trouble. When the ALARM indicator lamp lights, perform the procedures described in graph 3-4. If an alarm check and a synchronization cycle cannot be completed successfully, the synchronizer is not operating properly. This can be verified by placing the synchronizer RESET-AUTO-MANUAL switch at MANUAL to bypass the synchronization circuitry of the synchronizer. The operation of the TSEC/KG-13 and the modem can be checked out in this manner.

c. Localization of Trouble. Troubleshooting the synchronizer at the organizational category is primarily concerned with localizing the fault to a defective printed circuit card and repair of the

synchronizer by substitution of an operable printed circuit card for the defective item. No attempt is made, at this category of maintenance, to isolate troubles to a stage, circuit, or component. Only those corrective measures which the organizational maintenance repairman can accomplish are given. When an abnormal condition is observed, refer to the appropriate item in the troubleshooting chart *(d.* below), and perform the corrective measures. If the measure suggested does not restore normal synchronizer performance, troubleshooting is required at a higher maintenance category.

d. Troubleshooting Chart.

Note

The left-hand red card operates with the left-hand (center section of the equipment case) black logic module.

Caution

Do not operate the synchronizer with tempest covers removed.

Warning

Remove ac power before removing printed circuit cards.

Symptom	Probable trouble	Corrective action
AC indicator lamp fails to light.	a. Failure of primary power source.	a. Restore primary power source to operable condition or obtain new primary power source.
	b. Deleted.	b. Deleted.
	c. Defective indicator lamp.	c. Replace indicator lamp (para 4-17).
	d. Loose connector J1	d. Tighten connector J1 (fig. -4).
	e. Defective power supply	e. Replace power supply (para 4-19 and fig. 4-3).
	f. Defective ac power switch	f. Replace defective ac power switch.
Synchronizer fails to perform synchronization.	a. Malfunction of the secure communications System.	a. Set the RESET-AUTO-MANUAL switch to MANUAL and perform a synchronization cycle, manually, at the TSEC/KG-13. If the secure communications system (less the synchronizer) operates properly, it indicates that the trouble is in the synchronizer. In that event, proceed to b and c below.
	b. Loss of power	b. Shut down the secure communications system. Leave ac power applied to the synchronizer. Remove the tempest covering the red card(s). Check voltages at the test points on the front of the red card(s). Primary ground is J5. The voltage present should be as follows: J6, +11 volts; J7, +6 volts; J8, -6 volts; J9, -11 volts. If correct voltages are not present, pull out the associated black logic module and check fuse F4 on the power supply. Replace the fuse if necessary. If the fuse is not defective, replace the power supply. *Note.* Shut off ac power prior to replacing printed circuit cards.
	c. Defective printed circuit card in the synchronizer.	c. Replace all black circuit cards (fig. 1-5) in the black Logic module and the associated red card (fig. 1-3). Operate the secure communication system, including the synchronizer. If the synchronizer fails to operate properly, the trouble may be in the motherboard and higher category maintenance will be required. If the synchronizer operates properly, the red card or one or more of the black cards were at fault. To find exactly which card is faulty, used the cards just removed, as replacements, one at a time, for the new cards just installed. Operate the secure communications system after each individual card replacement The defective card will be discovered when the secure communications system fails to operate properly. Refer the defective card to higher category maintenance personnel.

Section III. REMOVAL AND REPLACEMENT INSTRUCTIONS

4-14. Removal and Replacement of Red Card(s)

(figs. 1-1 and 1-3)

a. Removal

(1) Remove the eight screws (B, fig. 1-1) which hold the tempest cover in place on the left-hand section of the equipment case. Remove the tempest cover.

(2) Grasp the red card (fig. 1-3) between the forefinger and the thumb and pull it straight out. If necessary, pry the red card out by inserting a screwdriver in the hole in the front-center of the card.

b Replacement. Refer to graphs 2-6 and 2-7 for red card and black logic module installation options.

(1) Place a red card (fig. 1-3) in the left-hand, right-hand, or both nylon slides (slots or channels) as required.
Note. When installing a red card in the equipment case, be sure that the components mounted on the red card face away (to the left) from the black logic module.

(2) Slide the red card in slowly until it rests within the connector at the rear of the equipment case. Apply a little additional force at the end of the slide to insure proper seating and good connection with the connector.

(3) Replace the tempest cover on the front left-hand side of the equipment case. Secure it in place with the eight screws previously removed.

4 15. Removal and Replacement of Black Module(s)

(figs. 1-3 and 4-1)

Warning

The power supply, at the rear of the black logic module, contains voltages that can be harmful or fatal. Be sure that the ac power switch is at OFF before pulling the black logic module out of the equipment case.

a. Removal.

(1) Loosen the three captive screws (fig. 1-3) that hold the black logic module in the equipment case.

(2) Grasp the handle of the black logic module and pull the black logic module out until it stops (about halfway out). Reach underneath the black logic module, along the sliding rail, and disengage the catch. Pull the black logic module out until it stops again.

(3) Reach underneath the front of the black logic module and loosen the captive screw (fig 4-1).

(4) Remove the black logic module from the sliding rail of the equipment case.

b. Replacement. Refer to paragraphs 2-6 and 2-7 for red card and black logic module installation options.

(1) Replace the black logic module on the sliding rail of the equipment case.

(2) Reinsert and tighten the captive screw (fig. 4-1) underneath the front of the sliding rail and black logic module.

(3) Push the black logic module back into the equipment case.

(4) Secure the black logic module in the equipment case by tightening the three captive screws (fig. 1-3)

4-16. Removal and Replacement of Fuses

(figs. 4-2 and 4-3)

Warning

Refer to the warning notice at the beginning of paragraph 4-15.

Caution

Never replace a fuse with one of a higher rating. If a fuse blows out immediately after replacement, a fault is present in the equipment. If performance of the authorized organizational troubleshooting procedures (para 4-13*d*) do not result in the location and correction of the trouble, higher category maintenance is required.

All fuses are on the power supply (fig. 4-3) mounted at the rear of the black logic module. Remove and replace fuses as follows:

a. Pull the black logic module out of the equipment case (para 4-15a (1) and (2)).

(1) *Removal of fuse Fl (fig.* 4-2).

(a) Turn the fuse cap for F1 approximately one-half turn counterclockwise (left).

(b) Withdraw the fuse cap and the fuse.

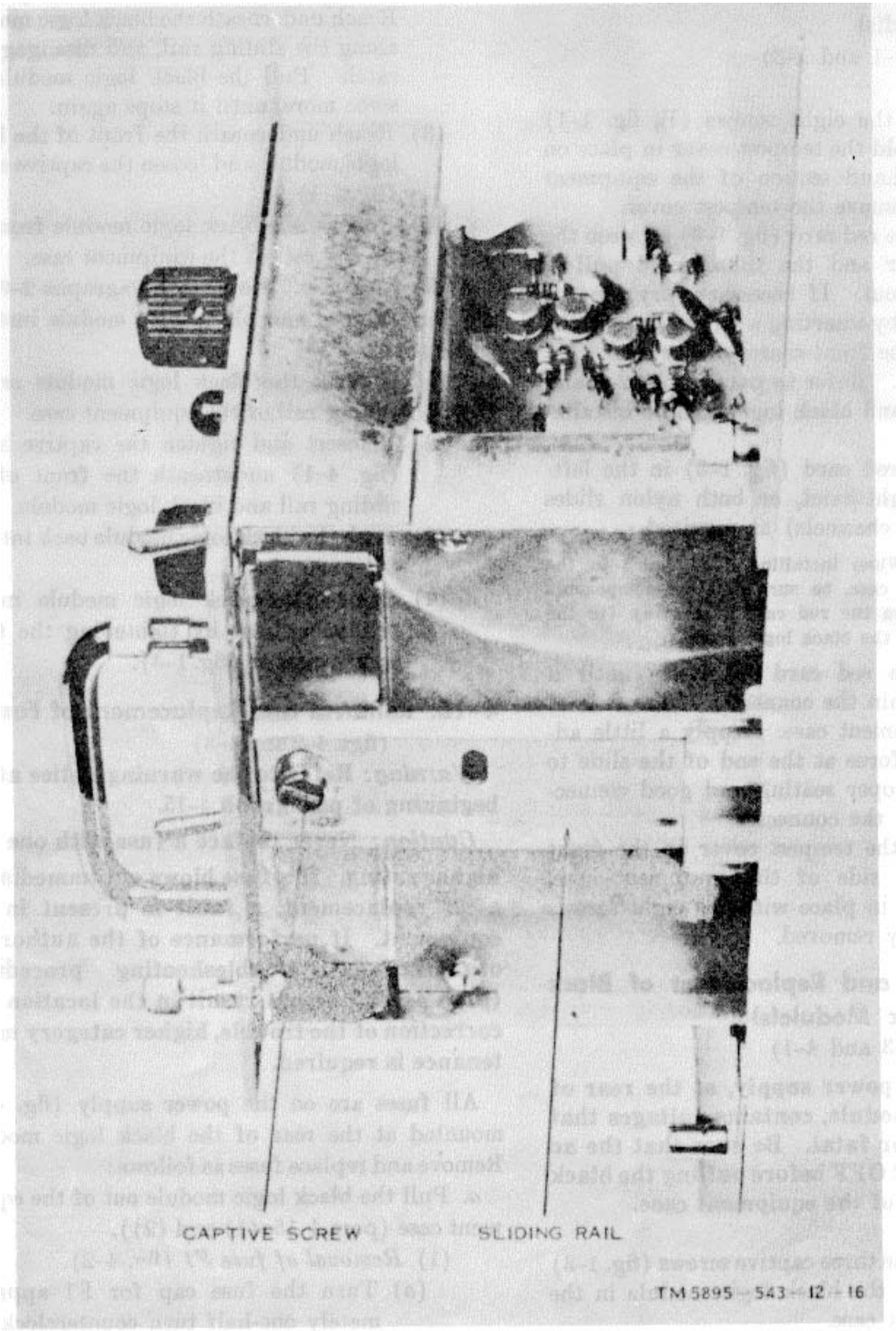


Figure 4-1. Partial view, underside of black logic module and sliding rail.

(*2) Replacement of fuse Fl.*
(*a)* Place the new fuse F1 in the fuse socket.
*(*b) Replace the fuse cap. Turn it one half turn clockwise (right) to secure it in place.
(*3) Removal of fuses F2, F3, and F4 (*fig. 4-2). Remove fuses F2, F3, and F4 by using the fuse puller supplied in Tool Kit, Electronic Equipment TK-105/G.
(*4) Replacement of fuses F2, F3, and F4.* Replace fuses F2, F3, and F4, by placing the fuse in the fuse clip and gently pressing the fuse in place

b. Replace the black logic module (para 4-15*b* (3) and (4)).

4-17. Removal and replacement of AC and ALARM Indicator Lamps

Remove ac power from the synchronizer.

a. Removal
(1) Turn the indicator lens (plastic lamp cover) counterclockwise (left) until the amp assembly is removed from the front of the black logic module.
(2) Remove the lamp from the plastic lamp cover and sleeve.

b. Replacement.
(1) Insert a new lamp in the sleeve.
(2) Replace the lamp assembly in the black logic module.
(3) Turn the indicator lens (plastic lamp cover) clockwise (right) until it is secured in the black logic module.

4-18. Removal and Replacement of Black 1 Through No. 5

(figs. 1-5 and 4-3)

Remove ac power from the synchronizer.

a Removal.
(1) Pull the black logic module out of the equipment case (para 4-15*a*(1) and (2)).

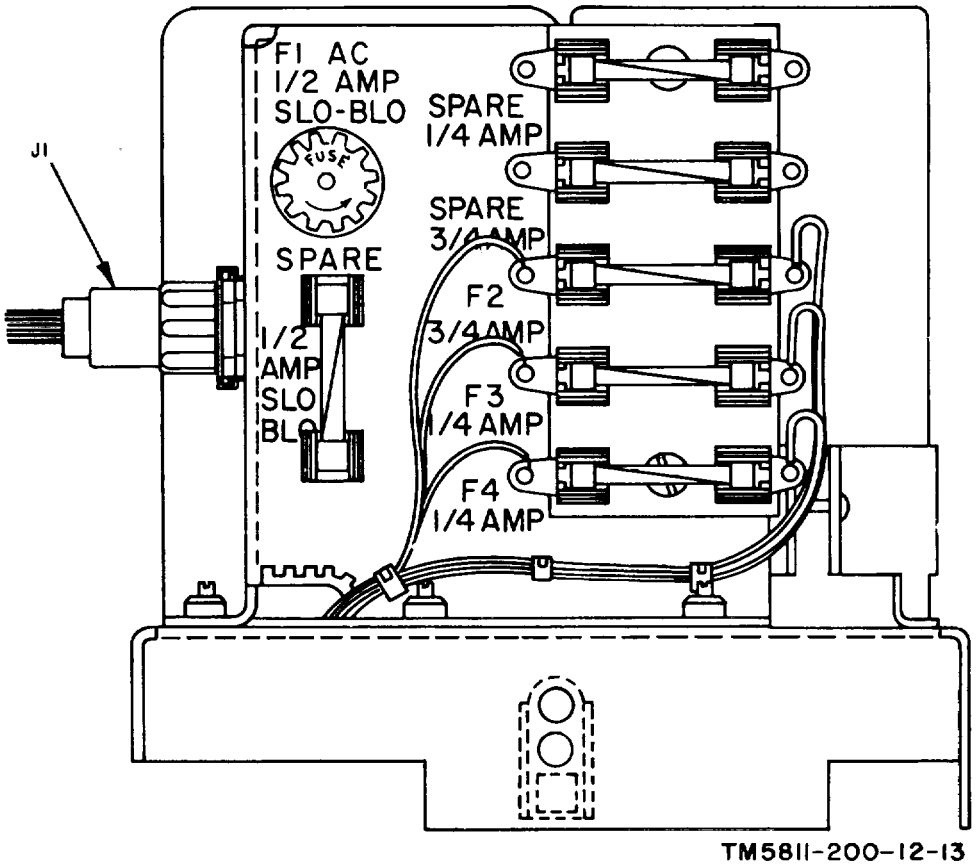


Figure 4-2. Location of fuses.

(2) Grasp the card lifters (fig. 4-3) and pull up to remove the black cards.

b. Replacement.

(1) Insert a new card in the nylon slides and press the card down firmly.

(2) Replace the black logic module (para *4-15b (3)* and (4)).

4-19. Removal and Replacement of Power Supply

(figs. 4-3 and 4-4)

Remove ac power from the synchronizer.

a. Removal.

(1) Remove the black logic module (para 4-15*a).*

(2) Disconnect the power cable at connector J1 (fig. 4-4) by twisting the clamp of J1 about one-half turn counterclockwise (left) and pulling connector J1 from the receptacle.

(3) Place the black logic module on its right side (fuses should be topside).

(4) Loosen the two captive screws (on the bottom of the black logic module) that hold the power supply in place.

(5) Remove the power supply from the black logic module.

b. Replacement. Reverse the procedures in (1) through (5) above to replace the power supply (fig. 4-3).

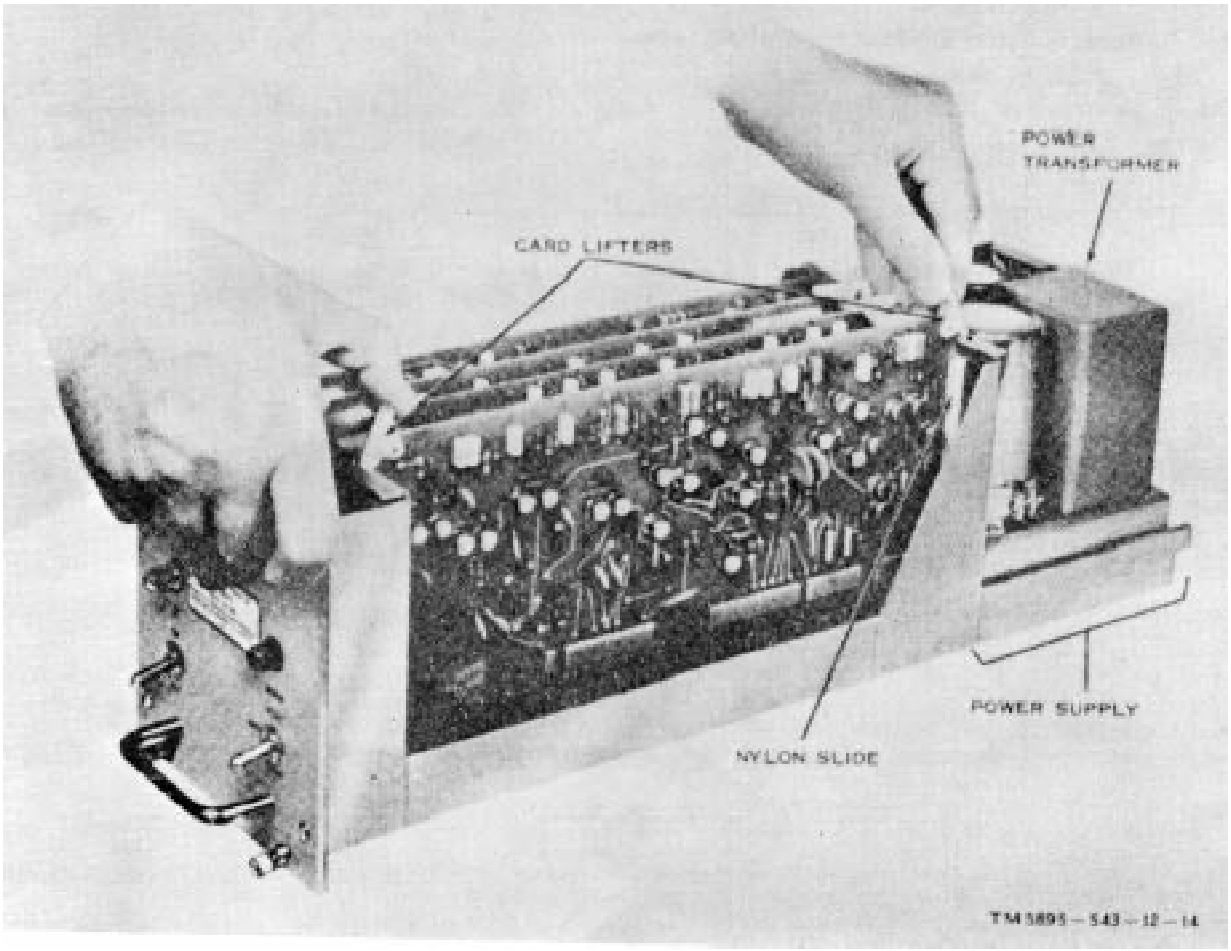


Figure 4-3. Black logic module, showing method of removing black cards.

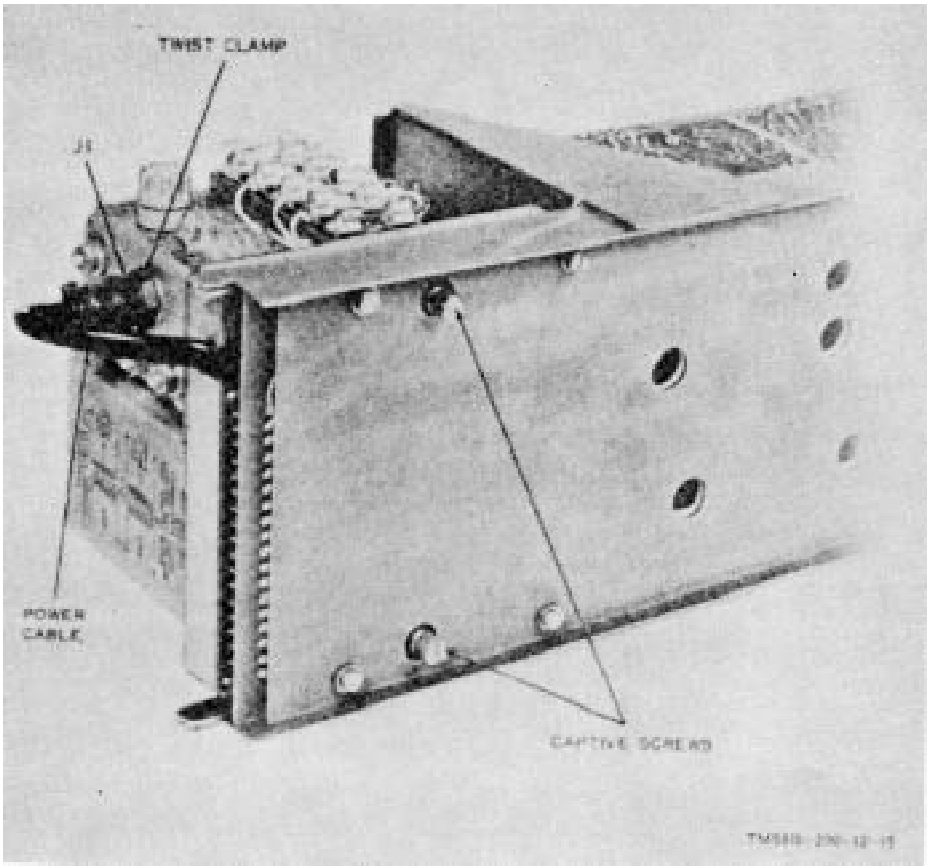


Figure 4-4. Bottom rear view of black logic module.

CHAPTER 5
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

5-1. Disassembly of Synchronizer

Note. Disassembly and repackaging of the synchronizer for shipment or limited storage must be performed by the organizational maintenance man.

Disconnect and remove the synchronizer as follows:

a. Disconnect all synchronizer cables and wiring from the ac power source(s), the TSEC/KG-13(s), and the ground connection(s).

b. Remove the four screws that hold the synchronizer in the special 19-inch rack. Remove the synchronizer, including cables and wiring, from the special 19-inch rack.

c. Place the synchronizer on a workbench or other similar adequate working area.

d. Remove the 12 screws that hold the tempest cover in place at the rear of the equipment case. Remove the tempest cover. Disconnect the wire from the chassis ground stud.

e. Disconnect all external cables and wiring connected to terminals on the terminal boards of the synchronizer. Tag or label each wire with its destination, terminal number, and terminal board number to facilitate installation at a later date.

f. Loosen and remove all cable couplings, cables, and wires from the holes in the equipment case.

g. Replace the tempest cover on the rear of the equipment case.

h. Coil cables and wiring neatly; secure the coils with tape and place all cables and wiring in a card-board box or make a package of the cables and wiring.

i. Be sure that the red card(s) and the black logic module(s) are secured in place.

5-2. Repackaging for Shipment or Limited Storage

a. The exact procedure for repacking depends on the material available and the conditions which the synchronizer is to be shipped or stored. If the original packing materials are on hand, use them and reverse the unpacking procedures given in paragraph 2-1.

b. The prime requirement is to pack the synchronizer so as to prevent damage during transit or limited storage. Package the synchronizer securely and use sufficient wadding to minimize effects of severe jolting. Make sure that the synchronizer is protected from rain or snow.

c. The following materials are required for packaging the synchronizer.

Material	Quantity or size
Filler material	3 lb.
Cardboard carton	10 in. High, 21 in. Wide, 32 in deep.
Adhesive tape	12 ft.
Waterproof paper	14 sq. Ft.
Waterproof tape	20 ft.
Vee-board box	12 in. High, 22 in. Wide, 33 in. deep.

d. When packaging the synchronizer- monitor SN-395/G for return to stock, do not install it in the equipment case. Connectors J1 and J2 may be damaged if the equipment is shipped with the SN-395/G installed. Package the SN-395/G separately as shown in fig. 5-1.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

5-3. Authority for Demolition

Demolition of the synchronizer will be accomplished only upon the order of the commander. The destruction procedures outlined in paragraph 5-4 will be used to prevent further use of the synchronizer.

5-4. Methods of Destruction

Use any of the following methods to destroy the synchronizer:

a. Smash. Smash the controls, switches, printed circuit cards, and the capacitors and the transformer on the power supply. Use sledges, axes, handaxes, pickaxes, hammers, or crowbars.

b. Cut. Cut the interconnection cables ac power cable(s), red and black signal wiring, and ground wires; use axes, cutting pliers, bayonets, or machetes.

c. Burn. Burn printed circuit cards, wiring diagrams, and technical manuals; use gasoline, kerosene, oil, flame-throwers, or incendiary grenades.

d. Bend. Bend printed circuit cards, tempest covers, and the equipment case.

e. Explode. If explosives are necessary, use firearms, grenades or TNT.

f. Disposal. Bury or scatter the destroyed parts or in slit trenches, foxholes, or throw them into streams.

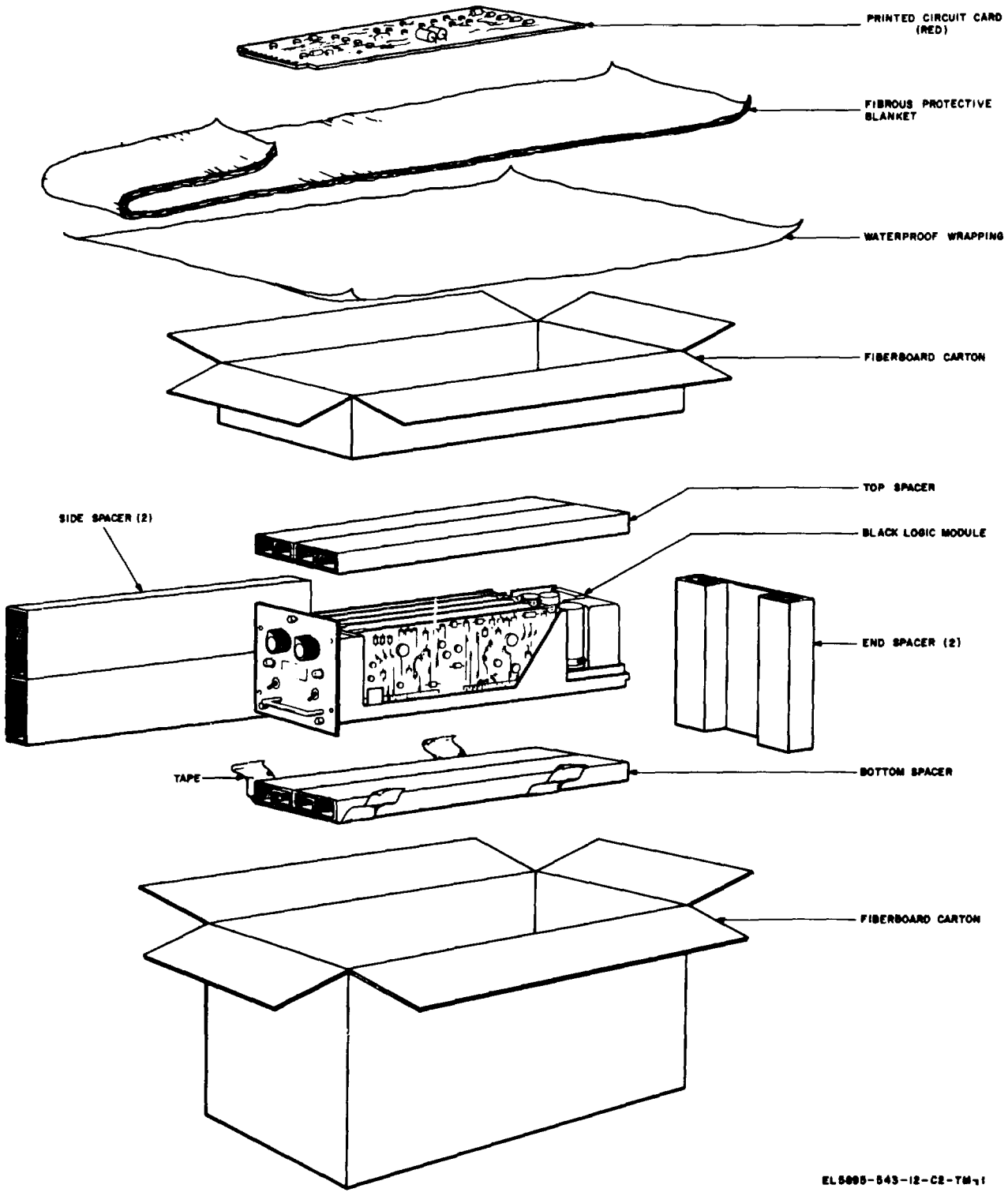


Figure 5-1. Synchronizer-minotor SN-395/G, packaging diagram.

APPENDIX A

REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
TB 43-0118	Field Instruction for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.

APPENDIX C
MAINTENANCE ALLOCATION

Section 1. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Synchronizer, Electrical SN394 (V) /G. It authorizes categories for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used an aid in planning maintenance operations.

C-2. Explanation of Format for Maintenance Allocation Chart

a. Group Number. Group numbers correspond to the reference designation prefix assigned in accordance with ASA Y32.16, Electrical and Electronics Reference Designations. They indicate the relation of listed items to the next higher assembly.

b. Component Assembly Nomenclature. This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Function. This column indicates the maintenance category at which performance of the specific maintenance functions authorized. Authorization to perform function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Codes	*Maintenance category*
C	Operator/crew.
O	Organizational maintenance.
F	Direct Support maintenance.
H	General Support maintenance.
D	Depot maintenance.

d. Tools and Equipment. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in section ll.

e. Remarks. Self-explanatory.

C-3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

a. Tools and Equipment. The numbers int his column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool for maintenance function.

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

e. Tool Number. Not used.

Verification of Repairs to Printed Circuit Cards

When available at Depot the Synchronizer, Electrical (SN-394(V)/G) with a TSEC/KG-13 will be used to verify repairs of printed circuit cards.

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
1.0	SYNCHRONIZER, ELECTRICAL SN-394(V)/G.	C											None	External
		O	O F H O										11 6 1,2,3,5,6,7, 12 thru 16 1,2,3,5,7,8, 9,12 thru 16 11	Internal Voltage & continuity tests All tests on site All tests on site External & internal
										O F H D H			11 & pluck out P/C cards 1,2,3,5,6,7,10, 12 thru 16 1,2,3,5,7,8,9, 10, 12 thru 16 1 thru 5,7,8, 9,10,12 thru 20 1,2,3,5,7,8,9, 10,12 thru 16	Replace knobs, fuses, lamps Repair chassis and panel components. All repairs except P/C cards Repair P/C cards returned by lower category. On site
1.1.0	CASE ELECTRICAL EQUIPMENT RACK MOUNTED-CY-4918/G.	C O	 O F H	 O									None 11 6 isolators & connectors. 6 9 11 slides & touch up paint	External Internal Internal continuity tests of Continuity tests Continuity tests Clean & lubricate draw
										F	H		6,10 defective isolators. 1,5,7,8,9,10, 12 thru 16	Replace connectors & On site
1.1.1	SYNCHRONIZER, MONITOR SN 395/G.	C O	 O F										None 11 6 1,3,5,6,7,	External Internal Voltage & continuity test Voltage, continuity input &

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE SN-394(V)/G (continued)	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
													12 thru 16	output
				H									1,3,5,7,8 thru 10,12 thru 16	All test
					o								11	Clean & lubricate draw slides, touchup paint.
										O			11	Replace knobs, fuse, lamps and pluck out P/C cards
										F			6,10	Repair defective panel components.
										H			1,3,5,7,8 thru 10,12, thru 16	Repair on site except P/C cards
											D		1,3, thru 5,7,8 9,10,12 thru 20	Repair P/C cards returned by lower category
												H	1,3,5,7,8 thru 10,12 thru 16	On site
1.1.1.1	PANEL, SYNCRONIZER	C											None	External
		O											11	Internal
				O									6,11	Continuity, voltage
				F									6,10	Continuity, voltage
										F			6,10	Repair & replace defective components
1.1.1.2	BOARD, PARENT, ASSSEMBLY	O											11	Loose for peeled wiring
				O									6,11	Continuity
					O								11	Remove excessive dust
1.1.1.2.1	PRINTED CIRCUIT CARDS (ALL P/C CARDS IDENTIFIED BELOW).	O											11	
				O									1 thru 5,7 thru 10,12 thru 17	All tests
	(a) Black logic Electrical synchronizer Subassembly PL-1120/G thru PL-1124/G Syncrhronization Verification Module								O				11	
											D		1 thru 5,7 thru 10,12 thru 20	
	(b) Electrical synchronizer Subassembly PL-1119/G													SVM-nonrepairable item
1.1.2	POWER SUPPLY PP-4540	O											11	
				O									6,11	Continuity & voltage
				F									6,10	Continuity & voltage
										F			1,6,7,10	Repair and replace defective components.

Section III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

Tools and equipment	Maintenance category	Nomenclature	Federal stock number	Tool number
		SN-394 (V)/G (continued)		
1	F,H,D	Analyzer ZM-3/U	6625-553-8813	
2	F,H,D	Card Extender (red) SM-D-532026	5895-933-6832	
3	F,H,D	Card Extender (black) SM-D-532022	5895-933-6831	
4	D	Synchronizer, Electrical SN-394(V)/G	5895-999-2435	
5	F,H,D	Oscilloscope HP-140A	6625-957-0509	
6	O	Multimeter ME-185/USM-133	6625-684-3082	
7	F,H,D	Transistor Test Set TS-2086/U (TT-22)	6625-902-9562	
8	H,D	Signal Generator SG-299/U	6625-808-5584	
9	H,D	Multimeter ME-26A/U (HP-410B)	6625-360-2493	
10	F,H,D	Tool Kit TK-100/G	5180-605-0079	
11	O	Tool Kit TK-105/C-	5180-610-8177	
12	F,H,D	Dual Trace Amplifier HP H06-1405A	6625-930-8118	
13	F,H,D	Time Base and Delay Generator HP-1421A	6625-930-8119	
14	F,H,D	Dolly, Oscilloscope HP-111A	6625-078-5217	
15	F,H,D	Voltage Divider Probe HP-CO-2-10003A	6625-078-5219	
16	F,H,D	Voltage Divider Probe HP-CP-2-10003B	6625-917-6729	
17	D	TSEC/KG-13 (2 each required)	5810-863-9816	
18	D	Wide Range Oscillator HP 200CD	6625-518-4659	
19	D	Synchronizer Monitor SN-395/G	5895-999-2440	
20	D	Electrical Synchronizer Subassembly PL-1119/G.	5895-999-2441	

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