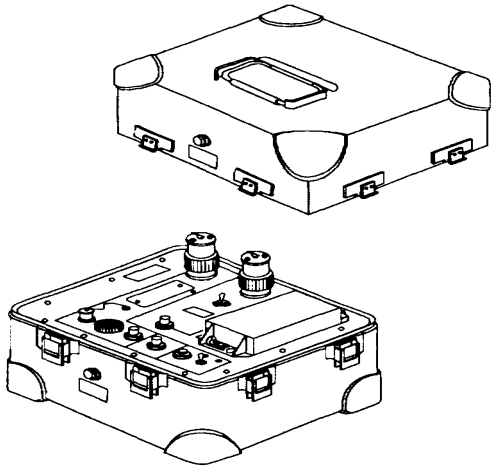
OPERATOR' S, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)



OPTICAL COMMUNICATIONS TEST SET TS-4117/G (NSN 6625-01-189-8155) (EIC:N/A)

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 MAY 1994

Change

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 June 1997

Operator's, Unit, And Direct Support Maintenance Manual (Including Repair Parts and Special Tools List)

OPTICAL COMMUNICATIONS TEST SET TS-4117/G (NSN 6625-01-189-8155) (EIC: HN4)

TM 11-6625-3227-13&P, 15 May 1994, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration caption.

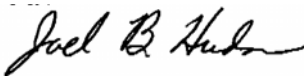
Remove Pages	*Inset Pages*
i through iii/(iv blank)	i and ii
4-1 and 4-2	4-1 and 4-2
None	4-24.1 and 4-24.2
1 through 5-4	5-1 through 5-4
None	5-4.1/(5-4.2 blank)
5-5 and 5-6	5-5 and 5-6
5-23 and 5-24	5-23 and 5-24
None	5-24.1 through 5-24.16
5-25 and 5-26	5-25 and 5-26
B-5 through B-7/(B-8 blank)	B-5 through B-7/(B-8 blank)
F-1 and F-2	F-1 and F-2
(Blank) /Figure F-1	(Blank) /Figure F-1
F-1-1	F-1-1
Figure F-2 (Sheets 1 through 7)	Figure F-2 (Sheets 1 through 7)
F-2-1 and F-2-2	F-2-1 and F-2-2
(Blank) /Figure F-3	(Blank) /Figure F-3
F-3-1	F-3-1
F-I-1 through F-I-3/(1-4 blank)	F-I-1 through F-I-3/(I-4 blank)
None	F-I-5 and F-I-6
Index 1 through Index 15/(Index 16 blank)	Index 1 through Index 16

2. File this change sheet in font of the publication for reference purposes.

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
04332

DISTRIBUTION:

To be distributed in accordance with the initial distribution number (IDN) 369668 requirements for TM 11-6625-3227-13&P.

WARNING

A lithium battery used with your field test set contains pressurized sulfur dioxide gas. The gas is toxic and the battery MUST NOT be abused in any way which may cause the battery to rupture.

WARNING

DO NOT heat, short circuit, crush, puncture, mutilate, or disassemble batteries.

WARNING

DO NOT USE any battery which shows signs of damage, such as bulging, swelling, disfigurement, a brown liquid in the plastic wrap, a swollen plastic wrap, etc.

WARNING

DO NOT test lithium batteries for capacity.

WARNING

DO NOT recharge lithium batteries.

WARNING

DO NOT dispose of lithium batteries with ordinary trash/refuse. Turn in discharged batteries to local supply.

WARNING

If the battery compartment becomes hot to the touch, if you hear hissing or burping (i.e. battery venting), or smell gas (sulfur dioxide), IMMEDIATELY TURN OFF the equipment and leave the area.

Allow the equipment to cool for at least one hour.

Remove and replace battery after the equipment has cooled to the touch.

If there is a safety incident, or if you believe a safety hazard exists, notify your local safety office/officer, file a Product Quality Deficiency Report, SF Form 386, and notify the CECOM Safety Office, Ft. Monmouth, NJ at DSN 995-3112.

WARNING

DO NOT use a Halon type fire extinguisher on a lithium battery fire.

WARNING

In the event of a fire near a lithium battery(ies), rapid cooling of the lithium battery(ies) is important. Flood the equipment with water, or use a carbon dioxide (CO_2) extinguisher. Control of the equipment fire, and cooling, may prevent the battery from venting and potentially exposing lithium metal. In the event the lithium metal becomes involved in fire, the use of a graphite based Class D fire extinguisher is recommended.

WARNING

DO NOT store batteries in unused equipment.

WARNING

DO NOT store lithium batteries with other hazardous materials. Keep them away from open flame or heat.

WARNING

When fastening or unfastening latches on FTS case top, always grasp latch firmly to pre- vent latch from snapping open under pressure causing personal injury.

WARNING

Wear eye protection when clearing debris from optical connector. Debris can cause serious eye injury if protective means or methods are not observed to prevent debris from blowing into eyes.

WARNING

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch gauge (psig) and then only with effective chip guarding and personnel protective equipment. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of what- ever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

WARNING

Wear eye protection when removing or replacing retaining rings and compression springs. Hold compression springs in place when removing or replacing retainer rings. Failure to heed this warning may result in personal injury.

CAUTION

This equipment contains parts sensitive to damage by Electrostatic Discharge (ESD)

Use precautionary procedures when touching, removing, or inserting printed circuit boards.

GENERAL PROCEDURES FOR ESD ITEMS

Use wrist ground straps or manual grounding procedures.

Keep ESD items in protective covering when not in use.

Ground all electrical tools and test equipment.

Periodically check continuity and resistance of grounding system.

Use only metalized solder suckers.

Handle ESD items only in protected areas.


CAUTION

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS and MOSFET used in many equipments can be damaged by static voltage present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.


CAUTION

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

STEP 1 Turn off and/or disconnect all power and signal sources and loads used with the unit.

STEP 2 Place the unit on grounded conductive work surfaces.

STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1 megohm series resistor to protect the operator.

STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.

STEP 6 When these devices and assemblies are removed from the unit, they should be placed in plastic bags that have been coated or impregnated with a conductive material.

STEP 7 When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.

STEP 8 Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

Step 9 Do not mount static pads on conductive surfaces. No test equipment is to be placed on static pads. No equipment resting on a static pad is to be plugged into an electrical outlet.

Technical Manual

No. 11-6625-3227-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 May 1994

Operator's, Unit, And Direct Support Maintenance Manual (Including Repair Parts and Special Tools List)

OPTICAL COMMUNICATIONS TEST SET
TS-4117/G
(NSN 6625-01-189-8155) (EIC: HN4)

Current as of 15 February 1995

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, DA Form 2028 (Recommended Changes to .Publications and Blank Forms) or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-LEO-D-CS-CFO, Fort Monmouth, New Jersey 07703-5007. The fax number is 908-532-1413, DSN 992-1413. You may also e-mail your recommendations to AMSEL-LC-LEO-PUBSCHG@cecom3.monmouth.army.mil

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

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

HOW TO USE THIS MANUAL

Become familiar with every part of the manual before operating the Optical Communications Test Set or attempting any maintenance.

The manual has an edge index that will help you find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the pages lines up with your selected topic printed on the front cover block.

A subject index is also included in the back of the manual to help you quickly locate where a topic is discussed.

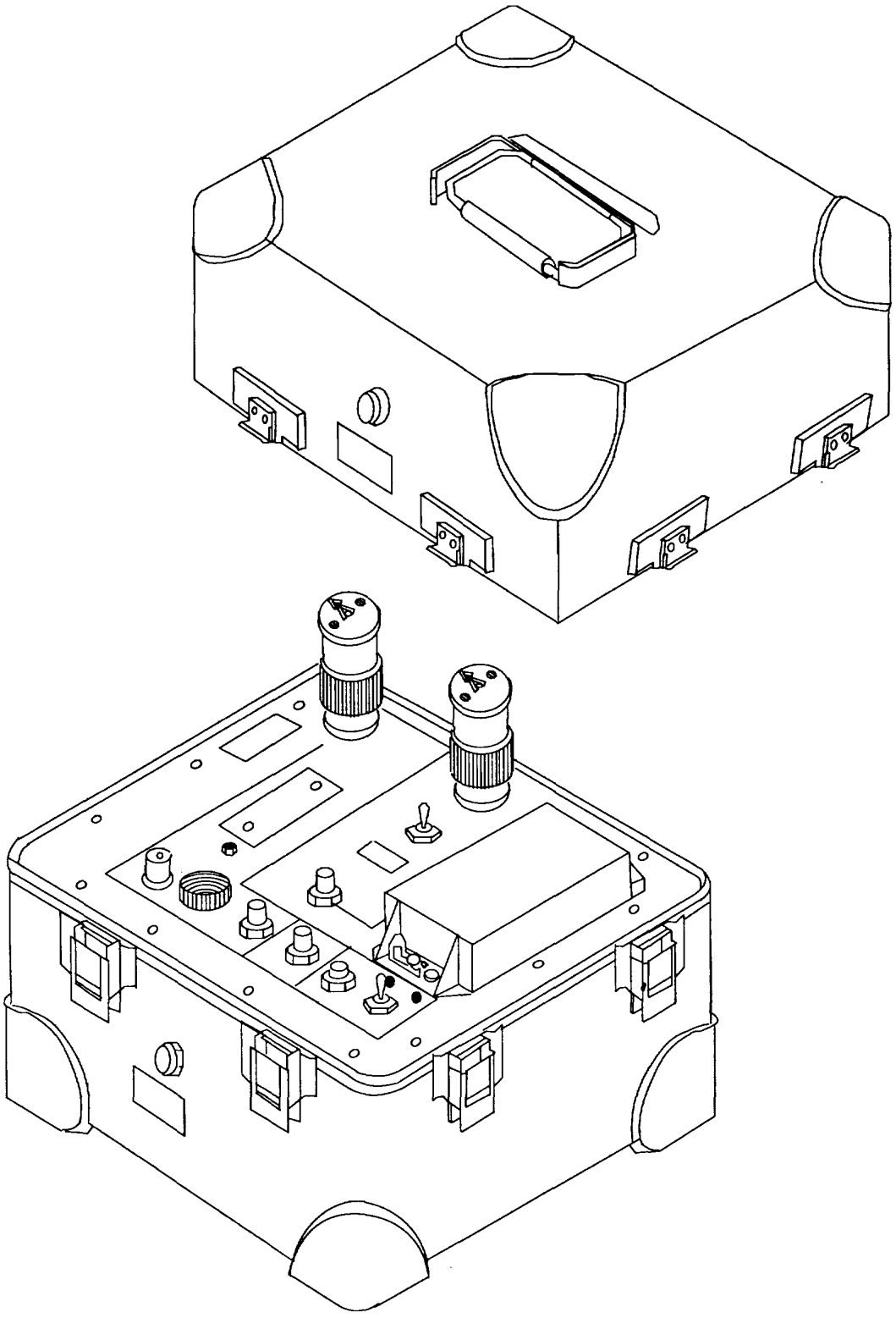


FIGURE 1-1. Optical Communications Test Set TS-4117/G.

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

a. **Type of Manual**. Operator's, Unit, and Direct Support Maintenance Manual Including Repair parts and Special Tools List.

b. **Equipment Name and Model Number**. Optical Communications Test Set TS-4117/G (refer to Fig. 1-1).

c. **Purpose of Equipment**. The TS-4117/G is designed to provide setup, fault detection, and maintenance support for the Fiber Optic Transmission System, which includes Fiber Optic Modems (FOMs) and Fiber Optic Cable Assemblies (FOCAs).

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS

Refer to the latest issue of DA Pam 25-30 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.

b. **Reporting of Item and Packaging Discrepancies**. Fill out and forward SF 364, Report of Discrepancy (ROD), as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/ AFR 400-84/ MCO 4440.3J.

c. **Transportation Discrepancy Report (TDR) (SF 361)**. Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

If your TS-4117/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 or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ED-CFO, Fort Monmouth, New Jersey 07703- 5007. We will send you a reply.

1-5. ADMINISTRATIVE STORAGE

Equipment issued to and used by Army activities will have preventive maintenance checks and services (PMCS) performed in accordance with the PMCS charts before being placed in administrative storage. When equipment is removed from administrative storage, PMCS should be performed to ensure operational readiness. Preparation of equipment for storage or shipment is covered in para. 4-17.

1-6. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

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

1-7. WARRANTY INFORMATION

The TS-4117/G is warranted by FiberCom, Inc., for 24 months. For warranty information, refer to TB 11-6625-3227-35.

1-8. NOMENCLATURE CROSS-REFERENCE LIST

This list gives common names used in this manual for equipment nomenclature. Use official nomenclature when completing report forms.

Common Name	Official Nomenclature
Test Set or Field Test Set (FTS)	Optical Communications Test Set TS-4117/G
Fiber Optic Modem (FOM)	Fiber Optic Modem-Receiver-Transmitter MD-1272/G
Fiber Optic Cable Assembly (FOCA)	Fiber Optic Cable Assembly CX-13295/G
Handset	Handset H-250/U
Optical Fiber Test Set	Optical Fiber Test Set TS-4335/G

1-9. LIST OF ABBREVIATIONS AND ACRONYMS

This list identifies and defines abbreviations and acronyms used in this manual.

Abbreviation/Acronym	Definition
ABS	Absolute (Power Measurement)
ASIC	Application Specific Integrated Circuit
BIT	Built-in-Test
BTRY INTLK	Battery Interlock
CAL	Calibration
cm	Centimeter
CVSD	Continuous Variable Slope Delta
dB	Decibel
dBm	Decibels Above (or Below) One Milliwatt
EMP	Electromagnetic Pulse
FOBC	Fiber Optic Bulkhead Connector
FOCA	Fiber Optic Cable Assembly
FOLBC	Fiber Optic Loopback Connector
FOM	Fiber Optic Modem
FTF	FOCA Test Facility

Abbreviation/Acronym	Definition
FTS	Field Test Set
kb/s	Kilobits per second
Kg	Kilogram
Km	Kilometers (1 Km = 0.6214 miles)
MCF	MOW Communications Facility
MOW	Maintenance Orderwire
NRZ	Non-return-to-zero
OSM	Optical Strength Meter
PS	Power Supply
RCA	Reference Cable Assembly
REL	Relative (Power Measurement)
Vdc	Voltage direct current

1-10. GLOSSARY

Refer to the glossary at the back of this manual for definitions of terms.

Section II. EQUIPMENT DESCRIPTION

1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

a. Characteristics.

(1) Provides electrical-to-optical and optical-to-electrical conversion of signals.

(2) Used for testing CX-13295/G FOCAs and MD-1272/G FOMS.

(3) Includes maintenance orderwire (MOW) transmit/receive circuitry, for half duplex voice communication.

b. Capabilities.

(1) Built-in-circuitry for self-tests.

(2) Measures attenuation of the signal through the FOCA.

(3) Measures optical power, absolute and relative, of the signal through the FOCA.

(4) Three-digit display provides measurement reading, including communication status and low battery indication.

c. Features.

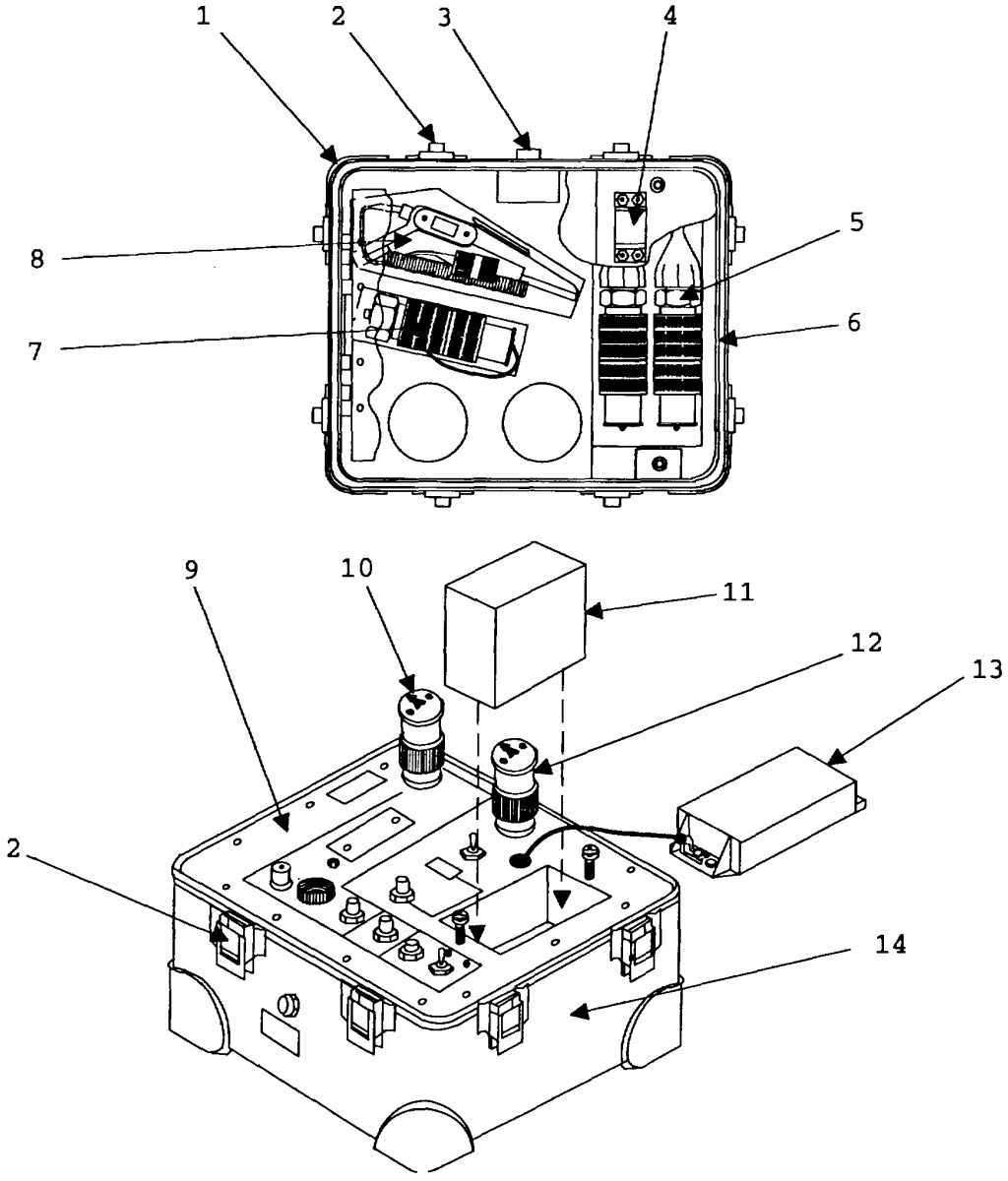
(1) All weather operations.

(2) Portable, battery operated, for field use.

(3) Circuitry protected against Electromagnetic Pulse (EMP).

(4) Operates from a 12 Vdc battery.

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



Key	Name	Description
1	CASE TOP	Provides storage for ancillary equipment.
2	LATCH	Secures the case top to the case bottom.
3	PRESSURE RELIEF VALVE	Equalizes pressure during air shipment.
4	ACTUATOR ASSEMBLY	Activates the battery interlock when the case top is installed on the case bottom.
5	REFERENCE CABLE ASSEMBLY	Cable assembly for testing the FTS and FOCAs.
6	O-RING	Provides moisture seal when case top is installed.
7	FIBER OPTIC LOOPBACK CONNECTOR	Used during MOW Communications Facility (MCF) test, verification of FTS. Provides optical signal loopback for MCF test.
8	HANDSET	Provides voice communications, half duplex capabilities to shelter.
9	PANEL ASSEMBLY	Combination control panel and electrical chassis, providing all controls, indicators, and connectors for operating the FTS.
10	MCF FOBC	Provides connection for the FOCA and FOLBC to MCF.
11	BATTERY	Provides 12 Vdc internal power to FTS.
12	FTF	Provides connection for the FOCA to the FOCA Test Facility (FTF).
13	BATTERY BOX COVER	Protects and secures the battery.

Key	Name	Description
14	CASE BOTTOM	Houses panel assembly with electronics.

1-13. EQUIPMENT DATA

Dimensions:

Length	13 in. (33.02 cm)
Width	11 in. (27.94 cm)
Height	9 in. (22.86 cm)

Weight: 23 lbs (10.4328 Kg)

Power Source: BA-5590/U +12 Vdc Battery.

Power Consumption: 8.0 Watts maximum

Average Transmitted Optical Power (50% duty cycle square wave):

Temperature	Minimum Power	Maximum Power
-23.80F (-31°C)	-16.5 dBm	-7.5 dBm
+77.00F (+25°C)	-19.5 dBm	-10.7 dBm
+125.60F (+52°C)	-21.7 dBm	-13.0 dBm

Average Received Optical Power (50% duty cycle square wave):

Minimum = -44.5 dBm
Maximum = - 7.5 dBm

Humidity: 95% ± 5% at +83°F (+28°C)

Temperature:

Storage and Transit	-70°F to +160°F (-57°C to +70°C)
Starting (minimum)	-25°F to +125°F (-31°C to +52°C)
Operating	-25°F to +125°F (-31°C to +52°C)

Signals:

Receive/Transmit signals on FOCA	NRZ Scrambled Optical Signal
Communications Status	16 Kb/s CVSD encoded
Battery Fault/Low Voltage	11.5 Vdc or less

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-14. FTS BLOCK DIAGRAM

A block diagram of the FTS is shown in Fig. 1-2. Power is provided to the FTS by a BA-5590/U +12 Vdc battery. The POWER switch engages and disengages power to the FTS. The battery interlock (BTRY INTLK) switch interrupts the internal power circuitry when the case top is in- stalled. Pressing and holding the SELF TEST switch, with power on, activates the front panel indicators.

The FTS receives and transmits optical signals for communication via the maintenance orderwire (MOW) communications facility (MCF) FOBC. With the FTS in normal operation mode (Refer to Fig. 1-3), the FTS operator can alert the shelter operator that communication is being attempted, with an active FOCA link connected to the MCF FOBC, by pressing and momentarily holding the RING switch. Voice communication can be made with the handset connected to the MOW orderwire connector. Incoming communication ring signals will activate the audible alarm (CALL).

Optical power signals, for absolute (ABS) and relative (REL) power measurements, are received at the FOCA test facility (FTF) connector. The MODE switch is used to select which power measurement is to be performed. The power readings are displayed on the optical strength meter (OSM) display. The calibration (CAL) switch zeros the OSM display during the relative power measurement.

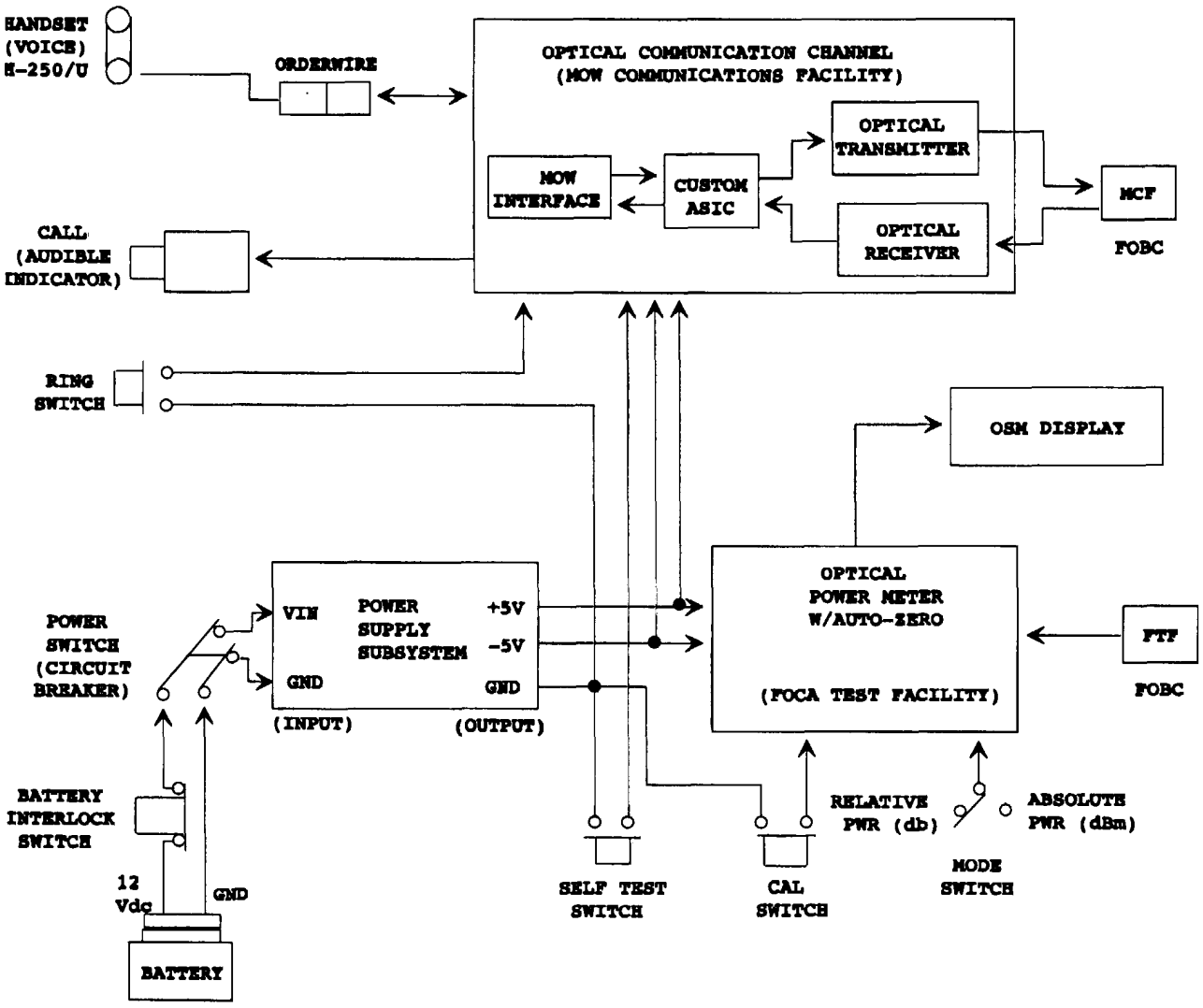


FIGURE 1-2. FTS Block Diagram.

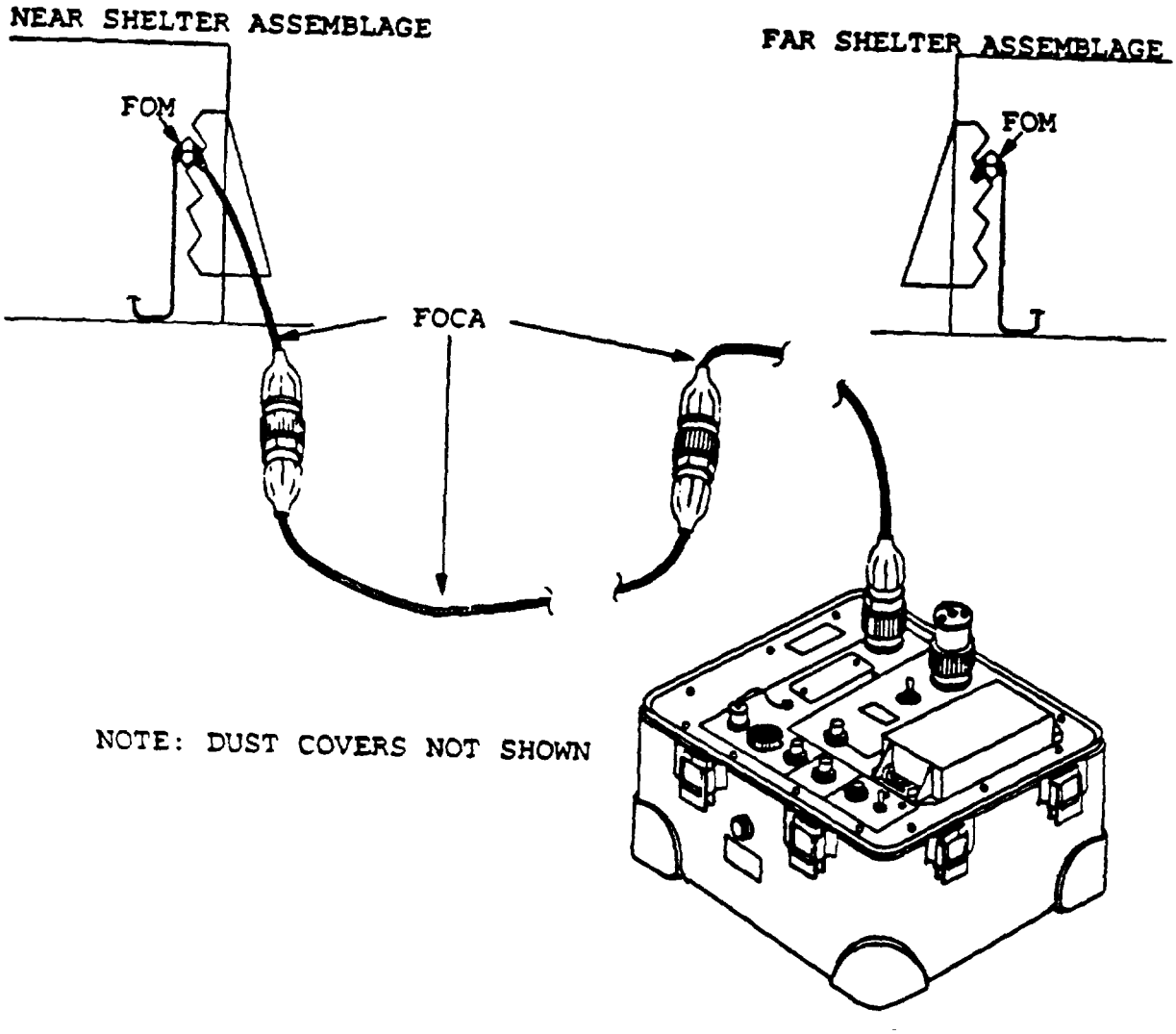
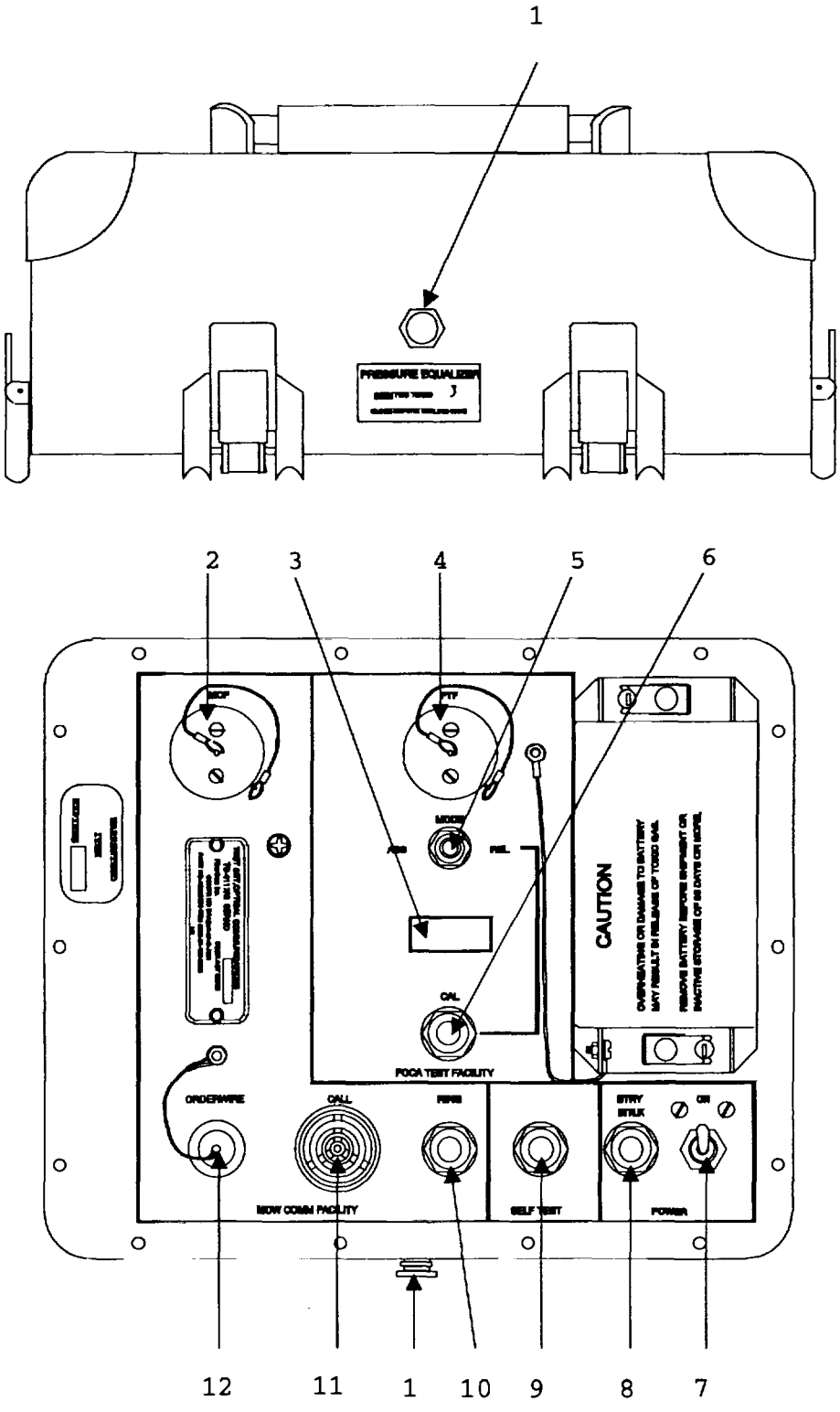


FIGURE 1-3. FTS Normal Communications Operation Mode.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CHAPTER 2
OPERATING INSTRUCTIONS

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

2-1. CONTROLS AND INDICATORS

Key	Control/Indicator	Function
1	Pressure Relief Valve	Used to equalize pressure prior to opening case.
2	MCF Connector (FOBC)	Transmits/receives optical signal or voice communications Also used during self-test and FOCA attenuation testing.
3	OSM Display	Displays all visual indicators and optical power measurements during test of FOCAs, FOMs, and self-test.
4	FTF Connector (FOBC)	Receives optical signals for optical power measurements. Also used during self-test, alignment, and FOCA attenuation testing.
5	MODE Switch	Two-position switch, allows selection of optical power readings for ABS (absolute) or REL (relative) power measurements.
6	CAL Switch	When pressed and released, the OSM display will zero, when the MODE switch is in the REL position.

2-1. CONTROLS AND INDICATORS - Continued

Key	Control/Indicator	Function
7	POWER Switch	Turns power ON and OFF. Provides fault protection, switch is a circuit breaker.
8	BTRY INTLK Switch	Battery interlock, prevents battery drain when case top is placed on case bottom, with power switch ON.
9	SELF TEST Switch	Activates all audible and visual (OSM) indicators of FTS.
10	RING Switch	When pressed and held momentarily, activates MOW ring generator signal to notify shelter operator for MOW communications. Also used for SELF TEST.
11	CALL Indicator	Allows audible ring signal when activated from shelter. Used for MOW communication and SELF TEST.
12	MOW Connector (ORDERWIRE)	Interfaces with handset. Allows communication with shelter during FOCA testing.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. PMCS INTRODUCTORY MATERIAL

a. General. To ensure that equipment is always ready for service, PMCS must be performed as scheduled. When you are doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS.

(1) Before you operate: Always read and understand all WARNINGS and CAUTIONS. Perform your Before (B) PMCS.

(2) If your equipment fails to operate: Refer to higher level maintenance.

b. PMCS Procedures. PMCS for the FTS appears in Table 2-1. There is only one interval of PMCS, B, in the INTERVAL column of the PMCS table. A dot in this column indicates the check and/or service that should be performed at a particular time.

(1) Interval Column. B stands for Before: B-PMCS should be performed before operation to ensure your equipment is ready for operation.

(2) Item to be Inspected Column. This column identifies the equipment to be inspected.

(3) Procedures Column. This column identifies the procedures for the specified checks and services. Follow these procedures carefully.

(4) Equipment is Not Ready/Available If Column. This column contains the criteria that will cause the equipment to be classified as not ready/available because of inability to perform its primary combat mission. An entry in this column will:

(a) Identify conditions that make the equipment not ready/available for readiness reporting purposes.

(b) Deny use of the equipment until corrective maintenance has been performed.

2-3. PMCS GENERAL REQUIREMENTS

Routine checks that are not considered PMCS checks are: checking for loose nuts, bolts, and screws.

Table 2-1. Operator Preventive Maintenance Checks and Services

B-Before Operation

ITEM NO.	INTERVAL B	ITEM TO BE INSPECTED	PROCEDURES CHECK AND HAVE REPAIRED OR ADJUSTED NECESSARY	EQUIPMENT IS NOT READY / AVAILABLE IF:
1	•	Transit Case	Check for dirt, corrosion, dents, scratches, and chipped paint. Check latches for broken and/or missing parts. Ensure pressure equalizer valves turn freely.	Pressure equalizer valves do not move freely.
2	•	Handset	Check for cracks, breaks, and damage to connectors or cord.	Handset is damaged.
3	•	Reference Cable Assembly	Check for kinks, cracks, and damage to connectors. Check to ensure lanyards secure dust caps to cable assembly. Check optical connectors for dirt and contamination.	Reference Cable Assembly is damaged. Optical connectors are dirty or contaminated.
4	•	Fiber Optic Loopback Connector	Check for cracks and damage to connector Check optical connectors for dirt and contamination Check to ensure lanyard secures dust cap to FOLBC.	Fiber Optic Loopback Connector is damaged. Optical connectors are dirty or contaminated.

Table 2-1. Operator Preventive Maintenance Checks and Services - Continued

B-Before Operation

ITEM NO.	INTERVAL B	ITEM TO BE INSPECTED	PROCEDURES CHECK AND HAVE REPAIRED OR ADJUSTED NECESSARY	EQUIPMENT IS NOT READY / AVAILABLE IF:
5	•	Switch Actuator Assembly	Check for loose, broken, and/or missing parts.	
6	•	Case Top O-Ring	Check for cracks, tears, deterioration, and separation from case top.	
7	•	Front Panel	Check for damaged switches	Any switch is damaged.
		OSM Display	Check for a cloudy or cracked window on the display	OSM Display is cloudy or window is cracked.
		Nameplate	Check for loose nameplate.	
		MOW Connector	Damaged MOW connector	Damaged MOW connector.
		Battery Cover	Damaged battery cover	Damaged battery cover.
		Audible Alarm	Damaged or inoperative Damaged or audible alarm	inoperative audible alarm.
		FTF Connector	Damaged FTF connector	Damaged FTF connector.

Table 2-1. Operator Preventive Maintenance Checks and Services - Continued

B-Before Operation

ITEM NO.	INTERVAL B	ITEM TO BE INSPECTED	PROCEDURES CHECK AND HAVE REPAIRED OR ADJUSTED NECESSARY	EQUIPMENT IS NOT READY / AVAILABLE IF:
		MCF	Damaged MCF connector Connector	Damaged MCF connector.
		Dust Covers and Lanyards	Damaged or torn dust covers, missing or cut lanyard	
8	•	Battery	Check battery connector and compartment for leaks and corrosion.	Leakage is observed.
9	•	OSM Display	Turn power ON. Check for BAT reading on OSM display. Turn power OFF	BAT reading on OSM display. OSM display not active.

Section III. OPERATION UNDER USUAL CONDITIONS

2-4. PREPARATION FOR USE

To gain access to the FTS controls and ancillary equipment, perform the following steps:

a. Unscrew pressure relief valve controls.

WARNING

When fastening or unfastening latches on FTS case top, always grasp latch firmly to prevent latch from snapping open under pressure causing personal injury.

CAUTION

Lift case top straight up at least 4 inches to avoid damage to the fiber optic bulkhead connectors (FOBCs).

NOTE

When unlatching case top, release all latches partially prior to full disengagement to prevent uneven pressure on individual latches.

b. Unfasten eight latches securing case top to case bottom.

c. Using handle, remove case top from case bottom.

d. Turn case top over so that the inside of case top is facing up.

e. Locate two pushbutton latches inside case top. Press each latch firmly until inner lid is released.

f. To gain access to the ancillary equipment, grasp inner lid by hole cutout and lift.

2-5. INITIAL ADJUSTMENT AND SELF TEST

You will be ready to operate the FTS after performing the Before Operation PMCS tasks in Table 2-1, and the self tests described below. If any deficiencies are noted, refer to higher level maintenance.

a. Power On Test.

NOTE

A BAT on the OSM display indicates approximately one hour of use remaining. The FTS is fully functional during a low BAT condition.

NOTE

A two minute warm-up for the FTS is only required when taking measurements.

(1) Set POWER switch to ON.

(2) Check OSM display. The segments of the display will activate in a random manner.

(3) Press and release BTRY INTLK switch. The OSM display will not be active while the switch is pressed.

b. Front Panel Indicator Test. Press and hold SELF TEST switch to activate audible indicator (CALL) and all segments of OSM display. Fig. 2-1 shows all active segments of the OSM display.

FIGURE 2-1. Active OSM Display Segments.

c. Maintenance Orderwire Communications Facility (MCF) Test.

NOTE

Install dust covers on connectors when not in use.

(1) Disconnect dust cover from MCF FOBC.

(2) Remove FOLBC from case top.

(3) Disconnect dust cover from FOLBC.

(4) Connect FOLBC to MCF FOBC and tighten securely. The setup for the MCF test is shown in Fig. 2-2.

(5) Verify that OSM display ROA indicator is present.

(6) Remove handset from case top.

(7) Remove protective cap from orderwire connector.

(8) Connect handset to orderwire connector.

(9) Position handset to ear.

(10) Press and hold RING switch approximately one second. An audible signal should be heard through handset, and CALL indicator should be audible after a momentary delay.

(11) Disconnect FOLBC and handset.

(12) Install dust cover on FOLBC.

(13) Install protective cap on orderwire connector.

(14) Place FOLBC and handset in case top.

d. Fiber Optic Cable Assembly Test Facility (FTF) Test.

NOTE

Install dust covers on connectors when not in use.

(1) Set POWER switch to OFF.

(2) Set MODE switch on FTS to ABS.

(3) Remove dust covers from FTF and MCF FOBCs (if required).

(4) Remove RCA from case top.

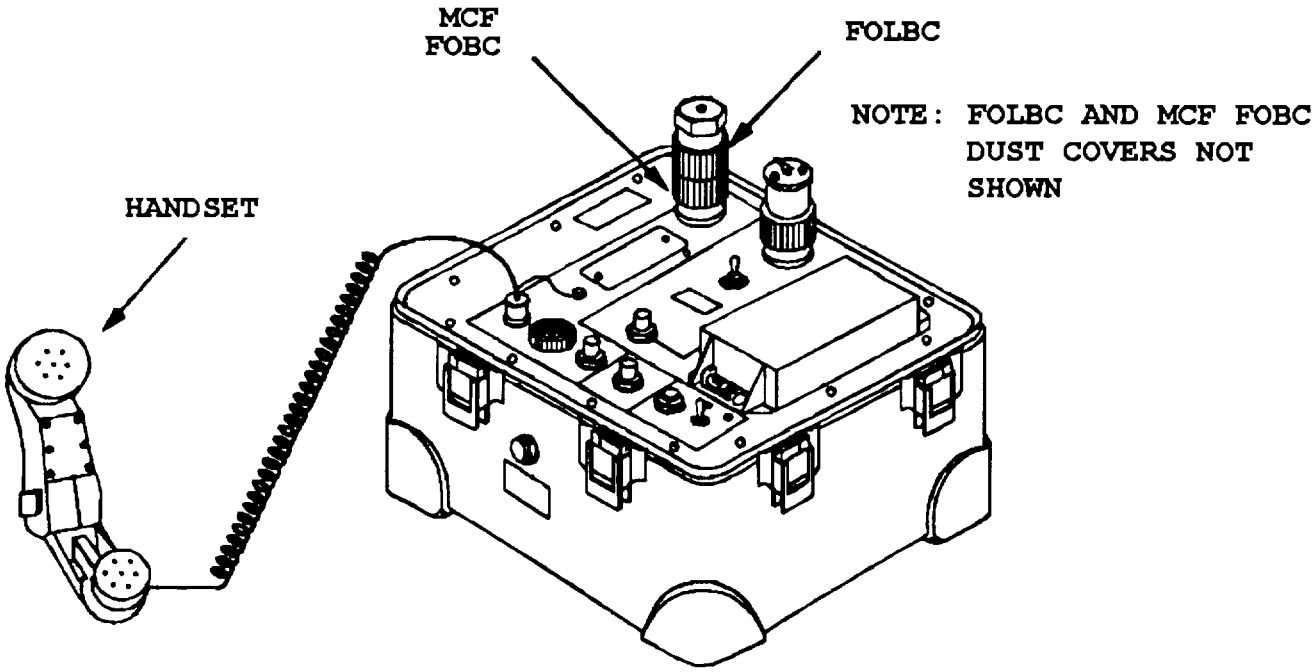


FIGURE 2-2. MCF Test Setup.

(5) Remove dust covers from RCA.

CAUTION

Take care not to let loose dust covers damage OSM display when connecting RCA to FTS.

(6) Connect RCA to FTF and MCF FOBCs. The setup for the FTF test is shown in Fig. 2-3.

(7) Set POWER switch to ON.

(8) Set MODE switch on FTS to REL. OSM display should read 00.0 ± 0.5 dB.

(9) Press and hold BTRY INTLK switch until OSM display is blank. Release switch.

(10) Remove RCA connector at FTF FOBC far enough to break light path.

(11) Reconnect RCA to FTF FOBC. OSM display should read other than zero.

(12) Press and release CAL switch. The OSM display should read 00.0 ± 0.5 dB.

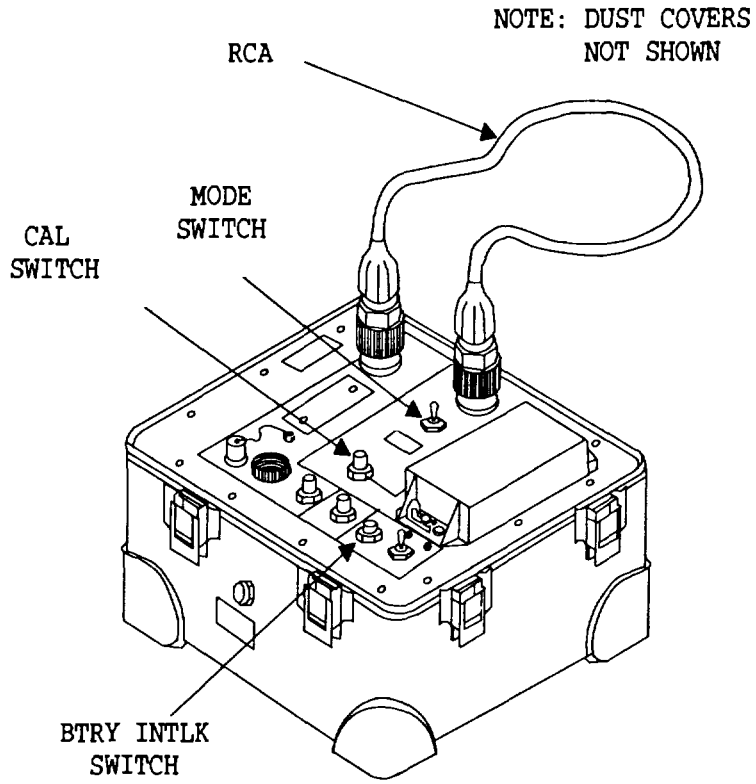


FIGURE 2-3. FTF Test Setup.

e. MCF Optical Transmitter Power Test

(1) Set MODE switch on FTS to ABS.

(2) Remove RCA optical connector at FTF FOBC far enough to break light path.

(3) Reinstall RCA optical connection. Check OSM display for a reading greater than -23.0 dBm (i.e., a reading closer to zero).

(4) Set POWER switch to OFF.

(5) Disconnect RCA from FTF and MCF FOBCs.

CAUTION

Do not kink RCA when placing in case top. Lanyard should be in RCA cutout.

NOTE

Ensure dust covers are installed on all connectors.

(6) Place RCA in case top.

(7) Close inner lid of case top.

(8) Hold inner lid down while pressing pushbutton latches to secure.

This completes initial adjustments and self-test procedures. The FTS is ready for operation. If FTS is to be transported, refer to to para. 2-5f to close case top.

f. Close Case Top.

(1) Tighten pressure relief valve.

CAUTION

From 4 inches above transit case, with pressure relief valve facing front, lower case top straight down onto transit case to avoid damage to the FOBCs. Ensure lanyards face in and do not interfere with the closing of the case top.

(2) Carefully lower case top onto case bottom.

(3) Place eight latches fully in strike before securing latches.

WARNING

When fastening or unfastening latches on FTS case top, always grasp latch firmly to prevent latch from snapping open under pressure causing personal injury.

(4) Latch eight latches located on four sides of FTS.

2-6. OPERATING PROCEDURES

The FOCA attenuation measurement is performed on each FOCA link before installation of FOCAs. The remaining operating procedures are to be performed on installed FOCAs that are part of an established communications link. The operating procedures to be performed on installed FOCAs can be performed in any order.

a. FOCA Attenuation Measurement.

(1) Remove case top if necessary (refer to to para. 2-4).

(2) Set POWER switch to ON. Allow FTS to warm up for a minimum of two minutes.

(3) Remove RCA from case top.

(4) Disconnect dust covers from optical connectors on RCA, FOCA, and MCF and FTF FOBCs before mating connectors.

NOTE

Install dust covers on optical connectors when not in use.

NOTE

Dust covers are secured together on installed equipment to avoid contamination. Unmate dust covers before disconnecting FOCA from FOM or other FOCA links. Ensure dust covers are mated after connecting FOCA to FOM or FOCA links. Ensure all optical connections are clean and secure.

(5) Connect RCA to MCF and FTF FOBCs on the FTS. The test setup for zeroing the OSM display is shown in Fig. 2-4.

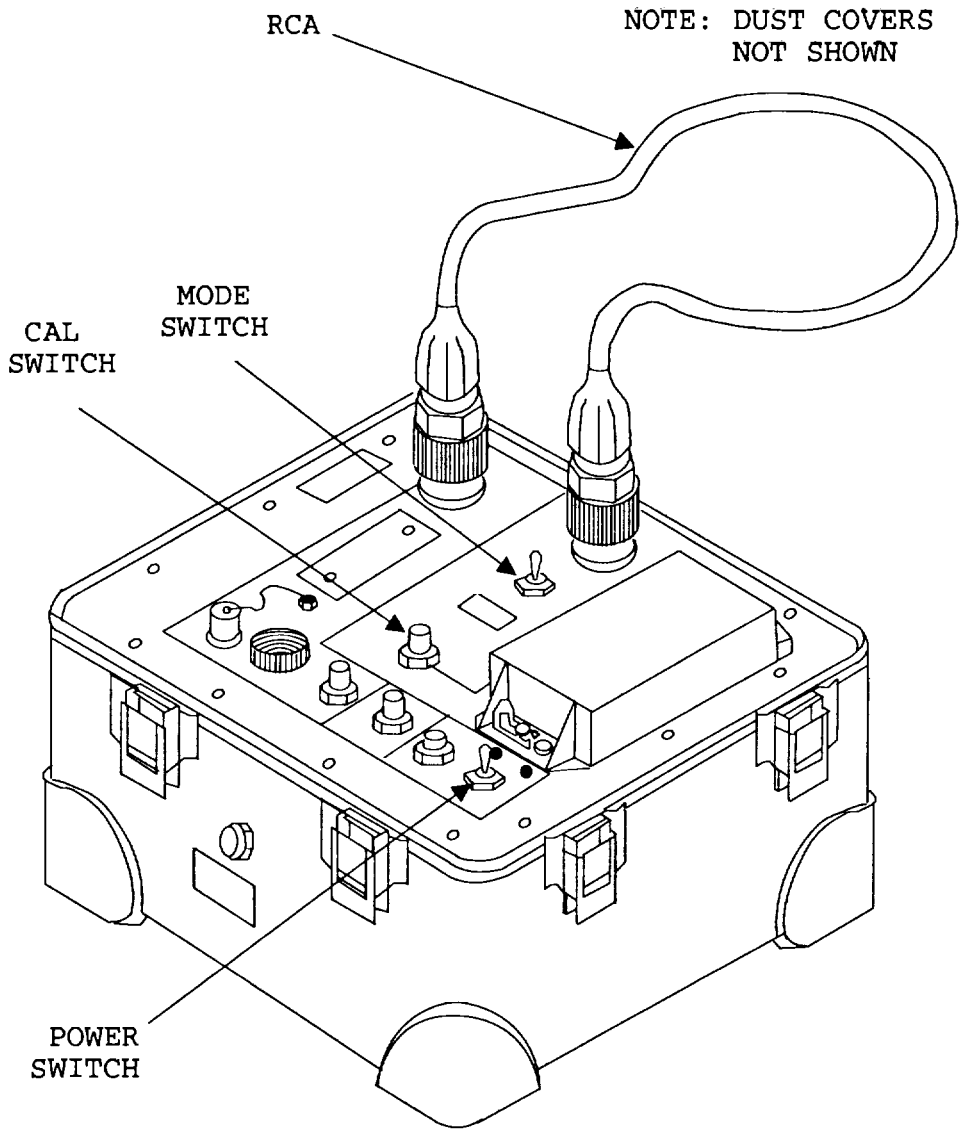


FIGURE 2-4. Test Setup for Zeroing the OSM Display.

(6) Set MODE switch to REL.

(7) Press and release CAL switch to zero OSM display. OSM display should read 00.0 dB ± 0.5 dB.

(8) Disconnect RCA from FTF FOBC.

(9) Connect one end of FOCA to FTF FOBC. Connect other end of FOCA to RCA. The test setup for FOCA attenuation measurement is shown in Fig. 2-5.

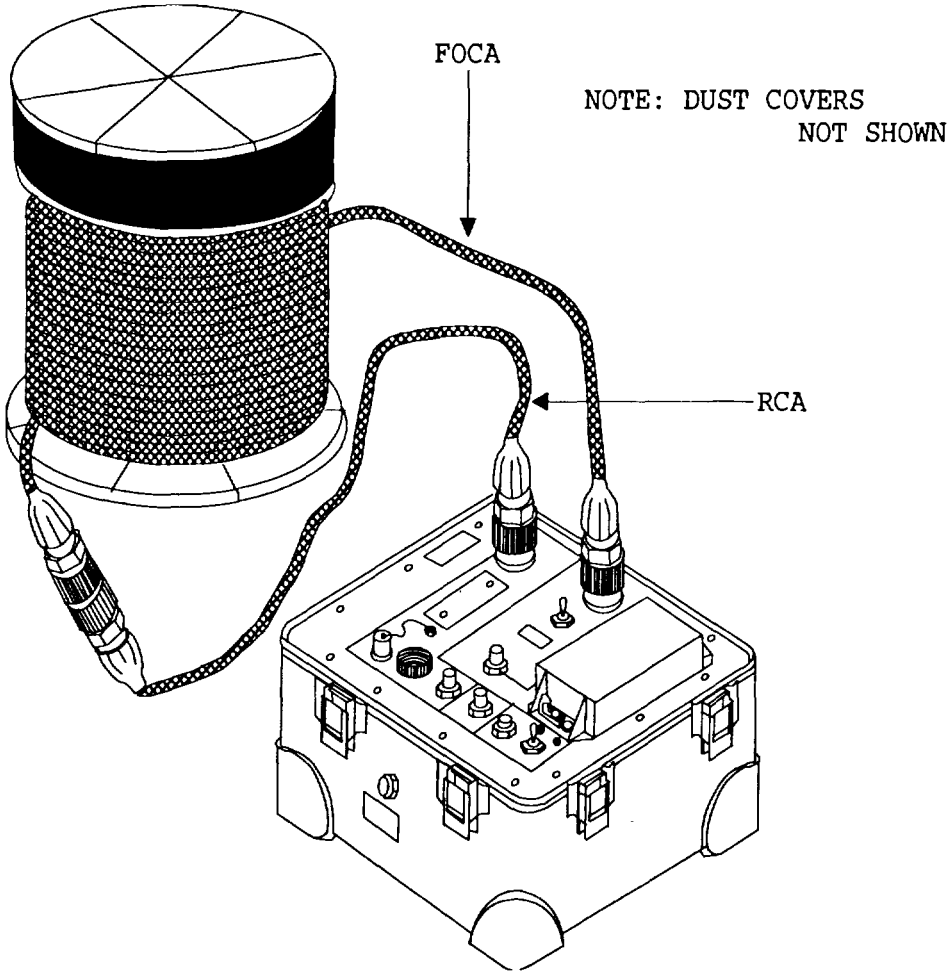


FIGURE 2-5. Test Setup for FOCA Attenuation Measurement.

NOTE

With negative values, greater than means closer to zero, and less than means further from zero.

(10) Check OSM display for an attenuation measurement reading. The reading should be -3.3 dB or greater.

If OSM display reading is within specified limits, proceed with step (11).

If OSM display reading is outside specified limits, ensure connectors are clean and secure. If OSM display reading is still outside specified limits, the FOCA is faulty. Refer to higher level maintenance.

NOTE

Each FOCA link consists of two fibers. One fiber is used for receive signals and the other fiber for transmit signals when FOCA is installed. FOCA attenuation is verified on both fibers to ensure functional FOCA.

(11) Reverse or interchange FOCA ends and repeat steps (9) and (10).

(12) Set POWER switch to OFF.

(13) Disconnect FOCA from RCA and FTF FOBC.

(14) Disconnect RCA from MCF FOBC. If FTS is to be transported, proceed with step (15); otherwise go to para. 2-6b.

(15) Install dust covers and replace RCA in case top.

(16) Close inner lid.

(17) Close case top (refer to para. 2-5f).

b. Optical Power Measurement of Deployed FOCA.

NOTE

This procedure assumes that the shelter operator has already conducted the FOLBC test. The FOLBC is a go/no-go test. It is recommended that fault isolation procedures start at a shelter by measuring the output from the FOM. The shelter the FTS operator starts from will be designated "Shelter 1" and the other "Shelter 2." Each FOCA link contains two separate optical fibers. A shelter transmits on one fiber and receives on the other. A complete check of the link requires the operator to check the received optical power at each connection until the fault is identified and repaired, or determined to be outside the FOCA links.

Negative OSM readings will have to be determined. With negative values, greater than means closer to zero, and less than means further from zero. An example of a less than reading is as follows:

The ABSOLUTE (optical) power value in Table 2-2 for 8 km is less than the value for 6 km.

Table 2-2. Absolute Power Measurement Table

The values in the distance column represent the number of one kilometer cables in the FOCA link being tested. The values in the absolute power column are the minimum acceptable power measurement through the FOCA link or links being tested.	
DISTANCE	ABSOLUTE POWER
1 Km	-25.3 dBm
2 Km	-28.0 dBm
3 Km	-30.8 dBm
4 Km	-33.5 dBm
5 Km	-36.3 dBm
6 Km	-39.0 dBm
7 Km	-41.8 dBm
8 Km	-44.5 dBm

(1) Remove case top if necessary (refer to to para. 2-4).

(2) Set POWER switch to ON. Allow FTS to warm up for a minimum of two minutes.

(3) Ensure MODE switch on FTS is set to ABS.

(4) Remove RCA from case top.

CAUTION

All optical connections must be kept clean and secure. Dust covers should be mated together or installed on optical connectors to avoid contamination.

(5) Remove dust covers from optical connectors on RCA and FTF FOBC.

(6) Disconnect FOCA from FOM.

NOTE

The two ends of the RCA are the same. It does not matter which end is connected to the FOM or FTS.

(7) Connect RCA to FTF and FOM FOBCs. The setup for optical power measurement of a FOM is shown in Fig. 2-6.

(8) Observe OSM display. OSM display should read greater than -23 dBm (closer to zero).

If this is Shelter 1 and display reading is within specified limit, proceed with step (11). If reading is outside specified limit, proceed with step (9).

If this is Shelter 2 and display reading is within specified limit, remove and replace previously tested FOCA, then proceed with step (35). If reading is outside specified limit, proceed with step (9).

(9) Disconnect RCA from FOM and install dust covers. Reconnect FOCA to FOM. Notify shelter operator that problem lies with FOM and/or shelter equipment. If FTS operation is no longer required, proceed with step (13). Otherwise continue with step (10).

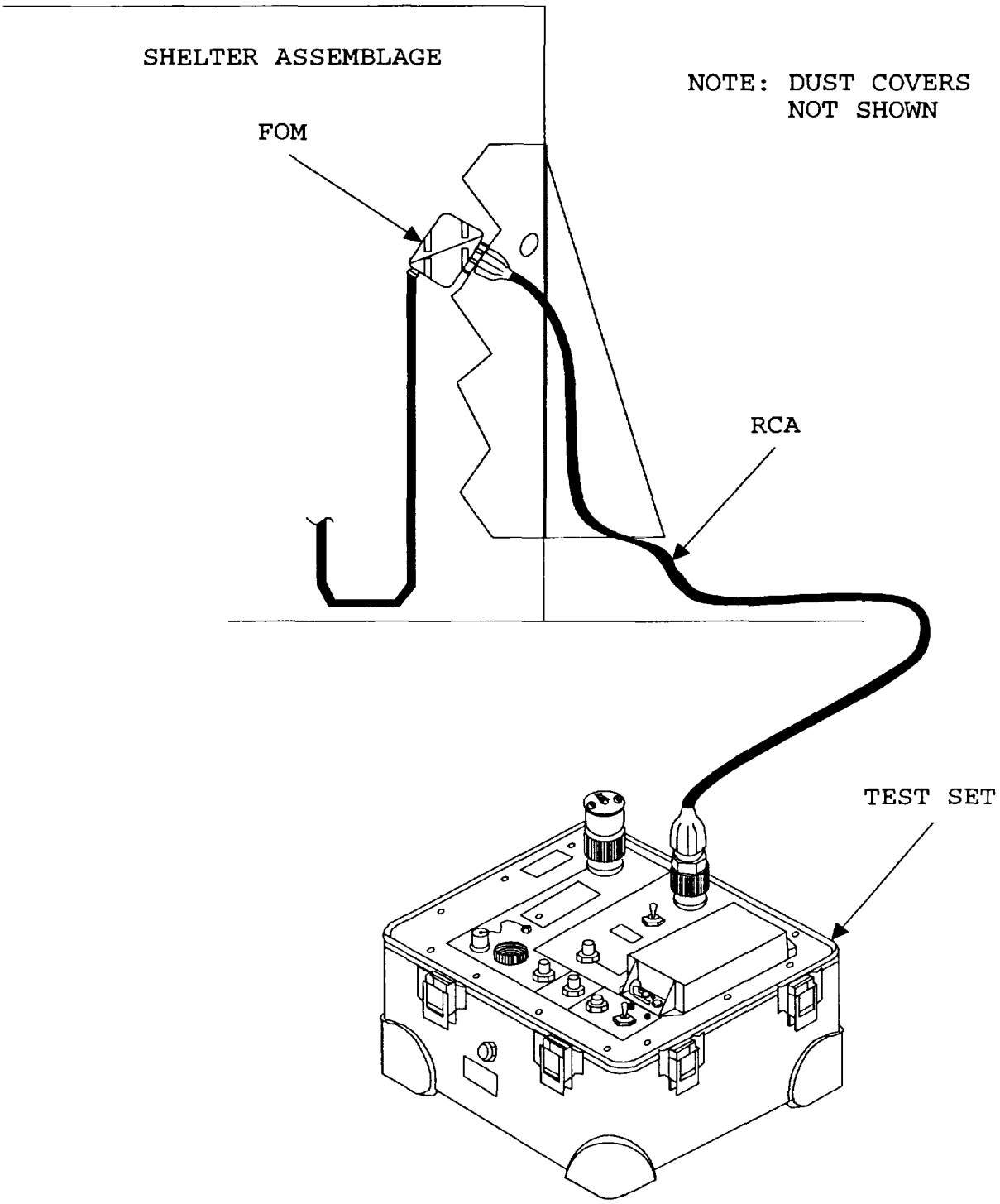


FIGURE 2-6. Setup for Optical Power Measurement Of FOM.

NOTE

After replacement of the FOM and/or shelter equipment, the shelter operator should conduct the FOLBC test and re-establish communication link prior to notifying the FTS operator of any further communication problems.

If problems still exist in the communications link, fault isolation procedures initiated at a specific shelter results in that shelter being designated Shelter 1.

(10) If fault still exists upon replacement of the FOM and/or shelter equipment and re-establishment of communications link, disconnect FOCA from FOM, remove dust cover from RCA, and connect RCA to FOM. Then restart fault isolation procedures beginning with step (8). If fault no longer exists, proceed with step (13).

(11) Disconnect RCA from FOM and FTF FOBCs.

(12) Install dust covers on RCA. Proceed with step (15).

(13) Disconnect RCA from FTF FOBC.

(14) Install dust covers on FTS and RCA.

(15) Place RCA in FTS case top.

(16) Close inner lid of case top.

(17) Hold inner lid down while pressing pushbutton latches to secure.

If FTS operation is still required, proceed with step (20). If not, proceed with step (18).

(18) Set POWER switch to OFF.

(19) Close case top (refer to para. 2-5f). Fault isolation procedure is complete.

NOTE

The following procedure can be applied to the testing of any FOCA link.

(20) Connect FOCA linked to Shelter 2 to FTF connector. The test setup for optical power measurement on a FOCA is shown in Fig. 2-7.

NOTE

If the receive side of the FOCA linked to Shelter 2 is functioning properly, fault isolation procedures need only be done on the fiber being used to transmit signals from Shelter 1.

If the receive side of the FOCA linked to Shelter 2 is not functioning properly, the communication link problem at this step could be either in this fiber, both fibers, the Shelter 2 FOM and/or the Shelter 2 equipment. To eliminate the FOCA as the communications link problem, fault isolate the FOCA links working towards Shelter 2.

(21) Compare OSM display reading to minimum acceptable reading listed in Table 2-2. Record display readings.

(22) Disconnect FOCA from FTF FOBC and reconnect to FOM.

(23) Install dust cover on FTF FOBC.

(24) Set POWER switch to OFF.

(25) Close case top (refer to para. 2-5f). If FTS operation is still required, proceed with step (26).

(26) Transport FTS to next FOCA connection.

NOTE: DUST COVERS NOT SHOWN

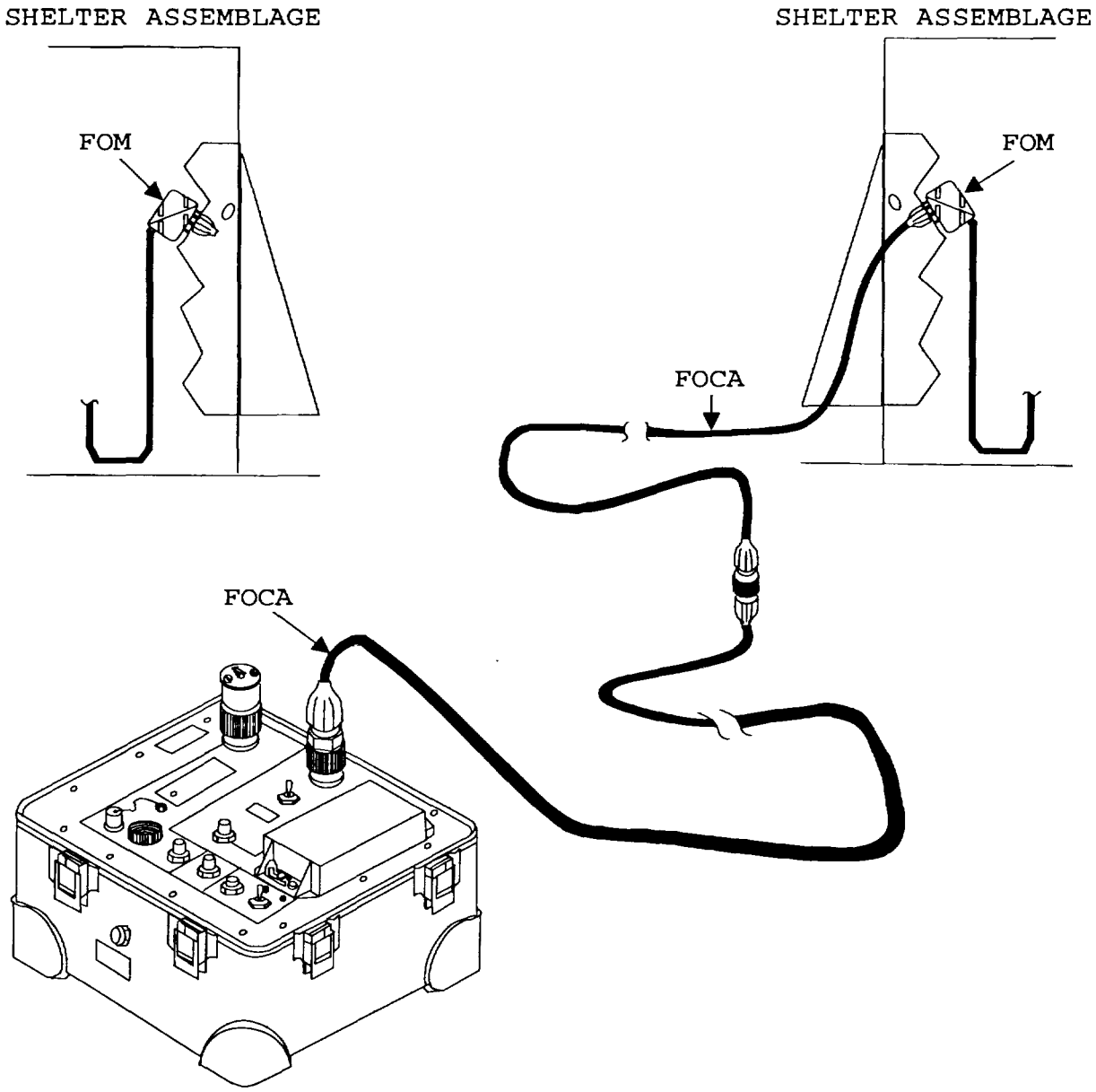


FIGURE 2-7. Test Setup for Optical Power Measurement On A FOCA.

(27) Remove case top (refer to to para. 2-4).

(28) Set POWER switch to ON. Allow FTS to warm up for minimum of two minutes.

(29) Ensure MODE switch on FTS is set to ABS.

(30) Remove dust cover from FTF FOBC.

(31) If initial reading on FOCA was acceptable (step 21), disconnect FOCA linked to Shelter 1 from communication link and connect to FTF FOBC on FTS. Proceed with step (32).

If initial reading on FOCA was not acceptable (step 21), disconnect FOCA linked to Shelter 2 from communication link. If this is the last FOCA in the link, repeat steps (4) thru (8).

If this is not the last FOCA in link, connect FOCA linked to Shelter 2 to FTF FOBC. Proceed with step (33).

(32) Compare OSM display reading to minimum acceptable reading listed in Table 2-2.

If display reading is within specified limit, disconnect FOCA from FTF FOBC. If this is the last FOCA in the link proceed to step (34).

If this is not the last FOCA in the link, disconnect FOCA from FTF FOBC and reconnect to FOCA linked to Shelter 2. Repeat steps (23) thru (31).

If display reading is outside specified limit, disconnect FOCA from FTF FOBC and remove and replace. Proceed with step (35).

(33) Compare OSM display reading to minimum acceptable reading listed in Table 2-2.

If display reading is within specified limit, remove and replace previously tested FOCA. Proceed with step (35).

If display reading is outside specified limit, disconnect FOCA from FTF FOBC and reconnect to FOCA link. Repeat steps (23) thru (31).

(34) Reconnect FOCA to Shelter 2 FOM. Notify Shelter 2 operator that problem is not in FOCA links. Problem must be in the receive side of Shelter 2 FOM and/or equipment. Repeat steps (23) thru (25).

NOTE

Prior to installment, the replacement FOCA should have undergone the FOCA Attenuation Measurement Test (refer to para.2-6a) conducted on FOCAs prior to deployment.

Upon installment of the replacement FOCA, a checkout to verify the communication link should be done. If the FTS operator is not at the shelter location, perform handset operation to verify communication integrity. If FTS operator is at the shelter location, handset operation is not required in order to request the shelter operator perform a two minute checkout of the communications link.

(35) Remove dust covers from connector of replacement FOCA and MCF FOBC.

(36) Connect replacement FOCA to MCF FOBC.

(37) Disconnect electrical cover from MOW connector on FTS.

(38) Remove handset from case top.

(39) Connect handset to MOW connector. The handset to FTS connection is shown in Fig. 2-8.

(40) Set POWER switch to ON.

(41) Press and momentarily hold RING switch to alert shelter that you are calling.

NOTE

The FTS provides half-duplex communication. The shelter operator cannot be heard with PUSH to TALK pushbutton pressed.

(42) Using handset, contact shelter operator and request a two minute operational check of the link.

(43) Disconnect FOCA from MCF FOBC and connect to link for two minutes.

(44) Disconnect FOCA connected to the shelter operator conducting operational check of link and connect to the MCF FOBC.

(45) Using handset, contact shelter operator again for results of two minute operational check.

(46) Disconnect FOCA from MCF FOBC and reconnect to link.

(47) Disconnect handset from MOW connector and place in case top.

(48) Install electrical cover on MOW connector and dust cover on MCF FOBC.

(49) If operational check was satisfactory (no faults indicated), proceed with step (50).

If operational check was not satisfactory, continue fault isolation procedures. Repeat steps (28) thru (31).

(50) Turn POWER switch to OFF.

(51) Close case top (refer to to para. 2-5f). Fault isolation procedure is complete.

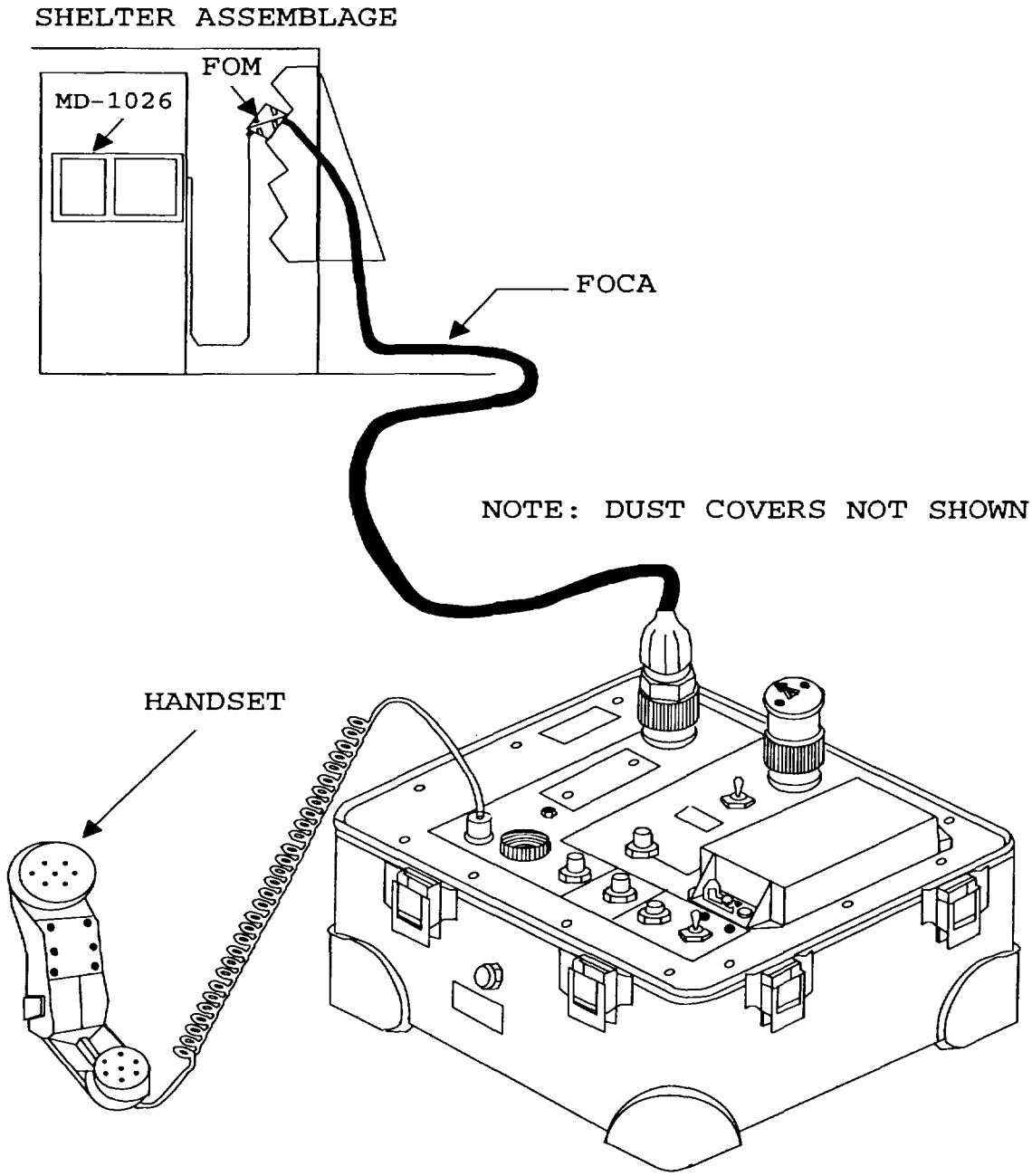


FIGURE 2-8. Handset to FTS Connection.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-7. OPERATION IN UNUSUAL CONDITIONS

There are no special procedures for operating the FTS in unusual conditions. Refer to para. 2-6 to operate the FTS under all conditions.

CHAPTER 3
OPERATOR MAINTENANCE

Section I. LUBRICATION INSTRUCTION

The FTS requires no lubrication.

Section II. OPERATOR MAINTENANCE INSTRUCTIONS

3-1. INSPECTION

Inspection of the FTS equipment should be made in accordance with the PMCS schedule given in Chapter 2. In addition to PMCS, you should perform routine tasks such as tightening loose nuts, bolts, and screws; and checking FTS ancillary equipment, stored in the case top, for any damage.

3-2. CHECKS/ADJUSTMENTS/ALIGNMENTS

The FTS checks are limited to inspection tasks specified in para. 3-1. There are no adjustments or alignments required by the operator.

CHAPTER 4
UNIT MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

All special tools, TMDE, and support equipment required to perform unit level maintenance are listed in the Maintenance Allocation Chart (MAC) (Appendix B of this manual).

4-3. REPAIR PARTS

Unit level repair parts are listed and illustrated in Appendix F of this manual.

Section II. SERVICE UPON RECEIPT

4-4. UNPACKING

a. Unseal, carefully open and fold back lid of outside carton.

b. Carefully lift and remove protective barrier.

c. Carefully lift and remove FTS from outer carton.

d. Save all packing material for use when reshipment of FTS is necessary.

4-5. CHECKING UNPACKED EQUIPMENT

a. Unscrew pressure relief valve controls.

WARNING

When fastening or unfastening latches on FTS case top, always grasp latch firmly to prevent latch from snapping under pressure causing personal injury.

CAUTION

Lift case top straight up at least 4 inches to avoid damage to the fiber optic bulkhead connectors (FOBCs).

NOTE

When unlatching the case top, release all latches partially prior to full disengagement to prevent uneven pressure on individual latches.

b. Unfasten eight latches securing case top to case bottom.

c. Using handle, remove case top from case bottom and set aside.

d. Inspect equipment for damage incurred during shipment. If equipment has been damaged, report damage on SF 364, Report of Discrepancy.

e. Check equipment against packing slip to ensure shipment is complete. Report all discrepancies in accordance with instructions of DA Pam 738-750, Maintenance Management Update.

f. Check DA Pam 25-30, Consolidated Index of Army Publications and Blank Forms, for Modification Work Orders (MWOs) applicable to this equipment.

4-6. BATTERY INSTALLATION

Follow procedural steps in para. 4-11 as appropriate for installation of battery.

4-7. TEST FTS

a. Power On Test.

(1) Remove case top, if necessary. Refer to para. 2-4.

(2) Set POWER switch to ON.

(3) Check optical strength meter (OSM) display. An active OSM display will display segments in a random manner when powered up.

If OSM display reads BAT, troubleshoot FTS (refer to para. 4-9).

If OSM display is active, proceed with step (5).

If OSM display is not active (blank), proceed with step (4).

(4) Press and release BTRY INTLK switch.

If OSM display is still not active, troubleshoot FTS (refer to para. 4-9).

(5) Press BTRY INTLK switch. The switch should press down and spring back when released.

If BTRY INTLK switch is not functioning properly, refer to higher level maintenance.

(6) Check for blank OSM display when BTRY INTLK switch is pressed.

If OSM display remains active, refer to higher level maintenance.

If OSM display goes blank when BTRY INTLK switch is pressed, the FTS has passed the power on test.

b. *Front Panel Indicator Test.* Press and hold SELF TEST switch to activate the audible CALL indicator and all segments of the OSM display. Fig. 4-1 shows all segments of the OSM display.

FIGURE 4-1. Active OSM Display Segments.

If the audible indicator and/or all segments of the OSM display are not active, troubleshoot FTS (refer to para. 4-9).

If all visual and audible indicators are active, proceed with para. 4-7c.

c. ***Maintenance Orderwire Communications Facility (MCF) Test.***

NOTE

Disconnect dust covers from optical connectors before mating connectors. Install dust covers when not in use.

(1) Disconnect dust cover from MCF FOBC.

(2) Remove FOLBC from case top and remove dust cover.

(3) Connect FOLBC to MCF FOBC and tighten securely. The setup for the MCF test is shown in Fig. 4-2.

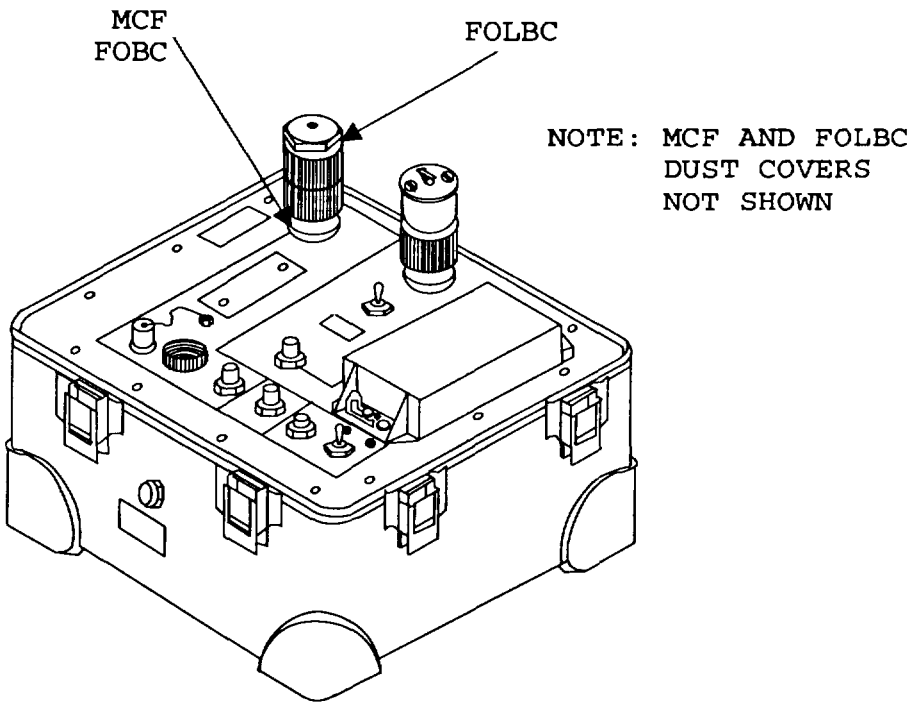


FIGURE 4-2. MCF TEST SETUP.

(4) Press and hold RING switch.

If CALL indicator is audible and "ROA" appears on OSM display, continue to next step.

If CALL indicator is not audible and/or OSM display still does not read "ROA," troubleshoot FTS (refer to para. 4-9).

(5) Disconnect FOLBC and install dust cover.

(6) Place FOLBC in case top.

d. Fiber Optic Cable Assembly Test Facility (FTF) Test.

NOTE

Install dust covers on FTS FOBCs when not in use.

(1) Disconnect dust cover from FTF and MCF FOBCs if necessary.

(2) Remove RCA from case top.

(3) Disconnect dust covers from RCA.

(4) Connect RCA to FTF and MCF FOBCs. The test setup for the FTF test is shown in Fig. 4-3.

(5) Set MODE switch to REL.

(6) Press and release CAL switch. The OSM display should read 00.0 ± 0.5 dBm.

If OSM display reading is within limits, calibration of OSM display is complete. Proceed to para. 4-7e.

If OSM display reading is not within limits, troubleshoot FTS (refer to para. 4-9).

e. XCF Optical Transmitter Power Test.

(1) If necessary, connect RCA to MCF and FTF FOBCs. Set MODE switch to ABS.

(2) Check OSM display for a reading greater than -23.0 dBm (closer to zero).

If the OSM display reading is within limits, proceed with next step.

If OSM display reading is outside limits, reseat RCA connectors.

If the OSM display reading is still outside limits, troubleshoot FTS (refer to para. 4-9).

(3) Disconnect RCA from FTF and MCF FOBCs.

(4) Install dust covers on RCA, FTF, and MCF connectors.

(5) Set POWER switch to OFF.

(6) Place RCA in case top.

(7) Close inner lid of case top.

NOTE: DUST COVERS NOT SHOWN

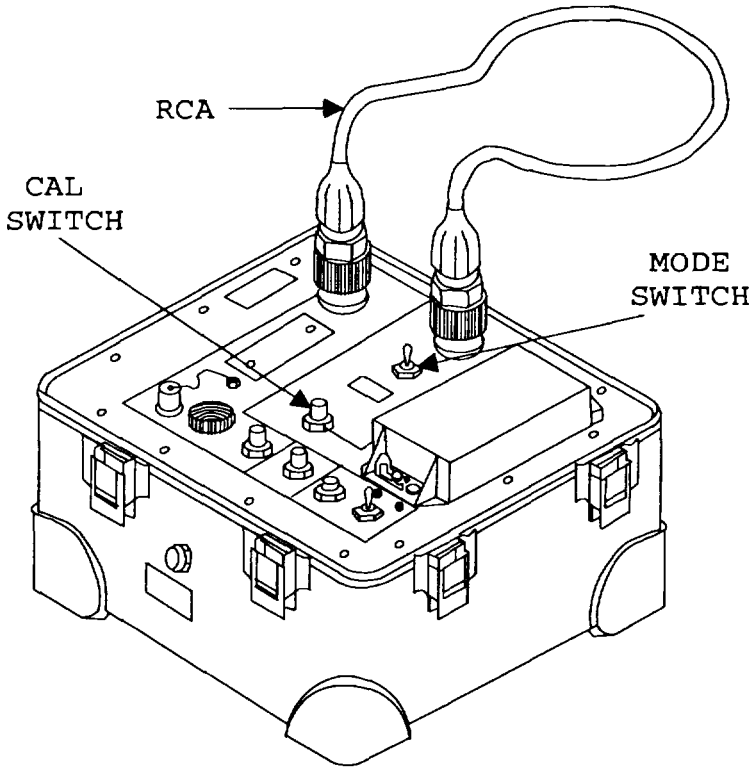


FIGURE 4-3. FTF Test Setup.

f. Install Case Top.

(1) Tighten pressure relief valve controls.

CAUTION

From 4 inches above transit case, with pressure relief valve facing front, lower case top straight down onto transit case to avoid damage to the FOBCs. Ensure lanyards face in and do not interfere with the closing of the case top.

(2) Using handle, carefully lower case top onto case bottom.

(3) Place eight latches fully in strike before securing latches.

(4) Latch eight latches located on four sides of FTS. The FTS is ready for field operation.

Section III. UNIT TROUBLESHOOTING

4-8. GENERAL

This section contains unit troubleshooting instructions for the FTS. The test and inspection for each malfunction are listed in a logical sequence and any corrective actions you take should follow the same sequence. If the fault cannot be cleared by replacing the suspect item or component, refer to higher level maintenance.

4-9. TROUBLESHOOTING

To use the troubleshooting table effectively, follow these procedures:

a. Verify all switch and control settings and equipment control.

b. Refer to Table 4-1 and troubleshoot the FTS.

c. Perform inspection or test steps to aid you in isolating the MALFUNCTION to the most probable suspect item or module.

NOTE

Each inspection or test step should be performed in the sequence given along with any CORRECTIVE ACTION until the MALFUNCTION is cleared or you are directed to report the MALFUNCTION to higher level maintenance.

Table 4-1. Unit Troubleshooting Table

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. Power switch ON, but OSM display is blank.

Step 1. Set POWER switch to OFF.
Step 2. Set POWER switch to ON.

If OSM Display is active, test FTS (refer to para. 4-7).

If battery has not been replaced and OSM display is blank, reseat battery. If OSM display is still blank, remove and install new battery (refer to para. 4-11). Test FTS using new battery (refer to para. 4-7).

If battery has been replaced and OSM display is blank, refer to higher level maintenance.

2. BAT indicator of OSM display stays on.

Step 1. Set POWER switch to OFF.
Step 2. Set POWER switch to ON.

If battery compartment has not been inspected, remove battery and inspect connector for corrosion. If corrosion is present, clean with solvent and let dry. Install battery and repeat steps 1 and 2.

If battery has not been replaced and BAT indicator is still displayed, remove and install new battery (refer to para. 4-11). Test FTS using new battery (refer to para. 4-7).

If battery has been replaced and BAT indicator is still displayed, refer to higher level maintenance.

Table 4-1. Unit Troubleshooting Table - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. Partial OSM display activation.

Step 1. Set POWER switch to OFF.
Step 2. Set POWER switch to ON.
Step 3. Check OSM display. The segments of the OSM display should be active in a random manner. Fig. 4-4 shows all active segments of the OSM display.

Step 4. Press SELF TEST switch.

If all segments of OSM display are active, test FTS (refer to para. 4-7).

If OSM display is partially active or blank, refer to higher level maintenance.

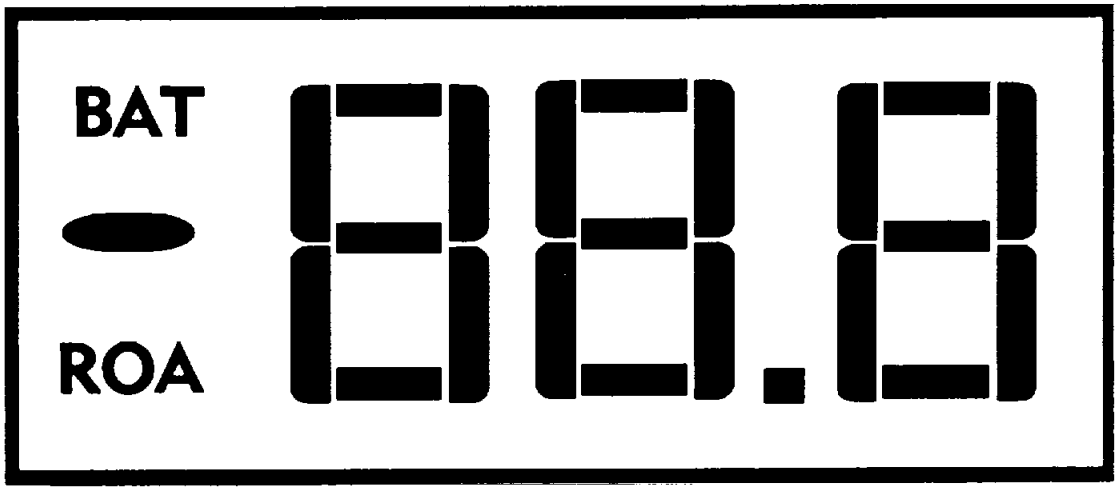


FIGURE 4-4. Active OSM Display Segments.

4. ROA indicator on OSM display does not appear.

Step 1. Set POWER switch to OFF.
Step 2. Ensure FOLBC is securely connected to MCF FOBC.

NOTE

"ROA" indicator on OSM display indicates that an optical signal is being received.

Table 4-1. Unit Troubleshooting Table - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4. ROA indicator on OSM display does not appear - Continued.

Step 3. Set POWER switch to ON.

If ROA indicator appears on OSM display, test FTS (refer to para. 4-7).

If ROA indicator is not active and optical connectors on FOLBC and FTS have not been cleaned, inspect connectors. If necessary, clean connectors (refer to para. 4-10b) and repeat steps 1 thru 3.

If optical connectors of FOLBC and FTS have been cleaned and ROA indicator is still not active, refer to higher level maintenance.

5. CALL indicator not audible.

Step 1. Ensure POWER switch is set to ON.
Step 2. Press and release SELF TEST switch to activate audible indicator.

If CALL indicator is audible, test FTS (refer to para. 4-7).

If CALL indicator is still not audible, refer to higher level maintenance.

6. Optical power is less than -23.5 dBm.

NOTE

With negative values, greater than means closer to zero, and less than means further from zero.

Step 1. Ensure MODE switch on FTS is set to ABS.

Table 4-1. Unit Troubleshooting Table - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. Optical power is less than -23.5 dBm - Continued.

Step 2. Disconnect RCA from MCF and FTF FOBCs.
Step 3. Ensure optical connectors of RCA and FTS are clean.

If optical connectors have not been cleaned, clean connectors (refer to para. 4-10b). Proceed with step 4.

If optical connectors have been cleaned and OSM display reading is less than -23.5 dBm (farther from zero), refer to higher level maintenance.

Step 4. Connect RCA to MCF and FTF FOBCs. Tighten securely.
Step 5. Check OSM display for a reading greater than -23.5 dBm (closer to zero).

If OSM display reading is within limits, test FTS (refer to para. 4-7).

If OSM display reading is outside limits, refer to higher level of maintenance.

7. OSM display will not zero.

Step 1. Ensure MODE switch on FTS is set to REL.
Step 2. Disconnect RCA from MCF and FTF FOBCs.
Step 3. Ensure optical connectors of RCA and FTS are clean.

If optical connectors have not been cleaned, clean connectors (refer to para. 4-10b) and then proceed with step 4.

If optical connectors have been cleaned and OSM display will not zero, refer to higher level of maintenance.

Step 4. Connect RCA to MCF and FTF FOBCs.

Table 4-1. Unit Troubleshooting Table - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. OSM display will not zero - Continued.

Step 5. Press and release CAL switch. The OSM display should read 00.0 + 0.5 dB.

If OSM display is within limits, test FTS (refer to para. 4-7).

If OSM display is outside of limits, refer to higher level maintenance.

Section IV. UNIT MAINTENANCE

4-10. CLEANING

a. ***Exterior Surfaces.***

(1) Inspect exterior of FTS. Exterior surfaces should be clean and free of dirt, dust, grease, and fungus.

(2) Remove dust and loose dirt with a clean, soft cloth.

(3) Remove grease, fungus, and ground-in dirt using a cloth dampened (not wet) with isopropyl alcohol.

b. ***Optical Connectors.***

(1) Preferred cleaning method:

(a) Disconnect fiber optic connectors and dust covers, if mated.

(b) If grease or fungus is found on fiber optic connectors, first remove using a cloth dampened with alcohol.

(c) Dry exposed surfaces with a cloth.

WARNING

Wear eye protection when clearing debris from optical connector. Debris can cause serious eye injury if protective means or methods are not observed to prevent debris from blowing into eyes.

WARNING

Compressed air should be used for cleaning purposes only with effective personnel protective equipment. Compressed air is dangerous and can cause serious bodily harm if precautions are not observed to prevent particles from blowing into eyes or skin of personnel.

CAUTION

To prevent fiber optic connector damage, do not use contact cleaner or solvents other than alcohol or water on connector face. Damage to connector may result if cleaning solvents are used.

(d) Clear debris from fiber optic connectors by blowing refrigerant into fiber optic connectors.

(e) Wipe biconic plugs with cloth.

(f) Clean biconic sleeves by placing cloth over end of cotton-tipped applicator and gently inserting and twirling applicator in sleeves.

(g) Reconnect fiber optic connectors and dust covers.

(2) No water or cleaning supplies available.

WARNING

Wear eye protection when clearing debris from optical connector. Debris can cause serious eye injury if protective means or methods are not observed.

(a) Clear debris from connector by blowing into connector.

(b) Clean biconic plug by gently wiping plug with a dry, clean cloth (refer to Fig. 4-5).

(c) Clean biconic sleeve using a twisted dry clean cloth. Gently insert twisted cloth in biconic sleeve using a twisting motion.

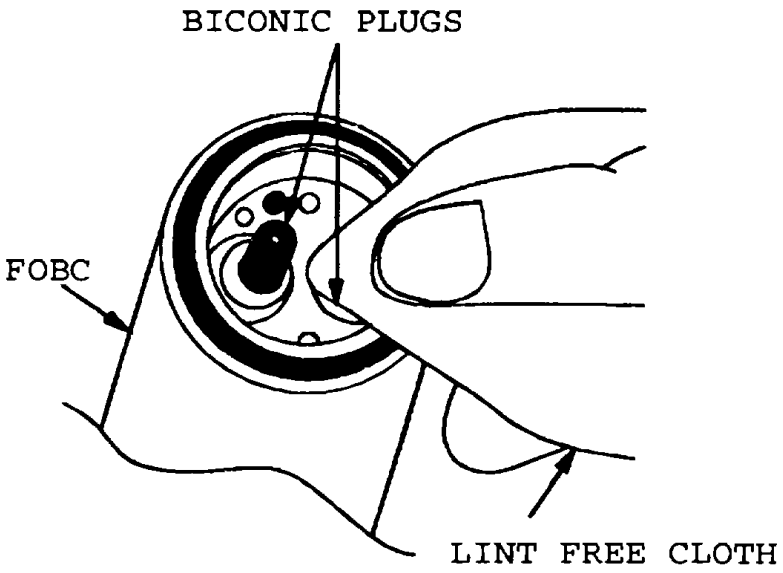


FIGURE 4-5. Cleaning Biconic Plug.

c. ***Cleaning Battery Compartment.***

(1) Use square-edge paint brush to free debris from battery compartment.

(2) Turn FTS upside down and shake any loose debris out of compartment.

(3) Use clean cloth dampened with isopropyl alcohol to wipe inside of battery compartment.

(4) Carefully wipe battery connector contacts with clean cloth dampened with isopropyl alcohol.

WARNING

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch gauge (psig) and then only with effective chip guarding and personnel protective equipment. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

(5) Use compressed air to blow battery compartment clean.

4-11. REMOVE AND REPLACE BATTERY

Refer to Fig. 4-6 and follow the steps of para. a to remove the battery and para. b to replace the battery.

a. ***Remove Battery.***

WARNING

The lithium battery used in your Field Test Set is hazardous if misused or tampered with before, during, or after discharge. Strictly observe the following precautions to prevent injury to personnel or damage to equipment.

DO NOT heat, incinerate, crush, puncture, disassemble, or otherwise mutilate battery.

DO NOT short circuit, recharge, or bypass any internal fuse.

DO NOT store battery in equipment during periods of non-use.

TURN OFF equipment immediately if you feel battery case becoming very hot, hear battery venting (hissing or burping), or smell irritating gas (sulphur dioxide). Remove battery only after it cools to the touch; then return it to supply for disposal.

(1) Ensure POWER switch is set to OFF.

(2) Remove battery cover.

(a) Place thumbs on slide locks of battery cover.

(b) Press down on battery cover and slide locks away from locking pins to unlock cover.

(c) Lift cover and set aside.

(3) Lift battery from storage compartment. Return battery to supply for disposal.

(4) Inspect battery compartment for debris or contamination. Clean if necessary.

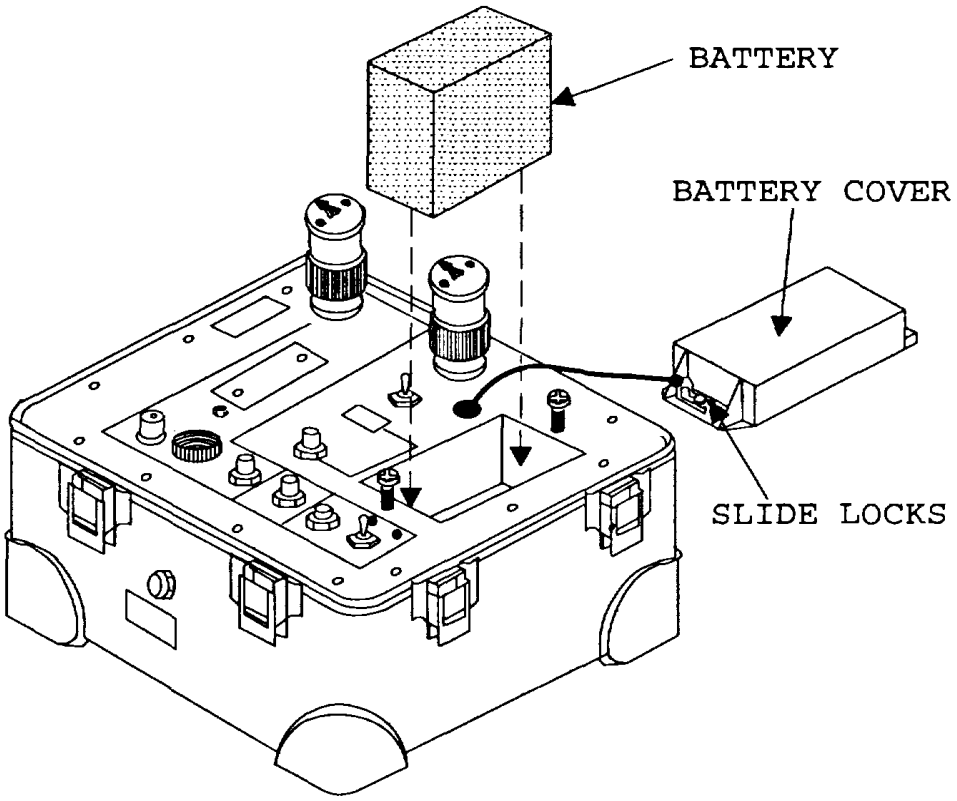


FIGURE 4-6. Remove and Replace Battery.

b. ***Replace Battery.***

(1) Place new battery in storage compartment with connector end down.

(2) Install battery cover on locking pins.

(3) Press down on battery cover. Place thumbs on slide locks and push towards locking pins until cover is secure.

(4) Test FTS with new battery (refer to para. 4-7).

4-12. REMOVE AND REPLACE HANDSET

a. ***Remove Handset from Case Top.***

(1) Open inner lid by locating two pushbutton latches inside case top.

(2) Press each latch firmly until inner lid is released.

(3) Grasp inner lid hole cutout and lift.

(4) Remove handset.

(5) Close inner lid.

(6) Hold inner lid down while pressing latches to secure.

(7) Install case top if necessary (refer to para. 4-7f).

(8) Turn in faulty handset for replacement.

b. ***Remove Handset from FTS.***

(1) Disconnect handset from MOW orderwire connector by pressing and turning the connector counterclockwise until disconnected.

(2) Install case top if necessary (refer to para. 4-7f).

(3) Turn in faulty handset for replacement.

c. ***Replace Handset.***

(1) Remove case top (refer to para. 2-4).

(2) Test FTS using new handset (refer to para. 4-7).

(3) Turn case top over so that inside of case top is facing up.

(4) Locate two pushbutton latches inside case top. Press each latch firmly until inner lid is released.

(5) Grasp inner lid hole cutout and lift.

(6) Place operational handset in case top.

4-13. REMOVE AND REPLACE FOLBC

a. *Remove FOLBC from Case Top.*

(1) Open inner lid by locating two pushbutton latches inside case top.

(2) Press each latch firmly until inner lid is released.

(3) Grasp inner lid hole cutout and lift.

(4) Remove FOLBC.

(5) Close inner lid.

(6) Hold inner lid down while pressing latches to secure.

(7) Install case top if necessary (refer to para. 4-7f).

(8) Refer faulty FOLBC to higher level maintenance.

b. *Remove FOLBC from FTS.*

(1) Disconnect FOLBC from FTS.

(2) Install case top (refer to para. 4-7f).

(3) Refer faulty FOLBC to higher level maintenance.

c. *Replace FOLBC.*

(1) Remove case top (refer to para. 2-4).

(2) Test FTS using new FOLBC (refer to para. 4-7).

(3) Turn case top over so that inside of case top is facing up.

(4) Locate two pushbutton latches inside case top. Press each latch firmly until inner lid is released.

(5) Grasp inner lid hole cutout and lift.

(6) Place operational FOLBC in case top.

4-14. REMOVE AND REPLACE RCA

a. ***Remove RCA from Case Top.***

(1) Open inner lid by locating two pushbutton latches inside case top.

(2) Press each latch firmly until inner lid is released.

(3) Grasp inner lid hole cutout and lift.

(4) Remove RCA.

(5) Close inner lid.

(6) Hold inner lid down while pressing latches to secure.

(7) Install case top if necessary (refer to para. 4-7f).

(8) Refer faulty RCA to higher level maintenance.

b. ***Remove RCA from FTS.***

(1) Disconnect RCA from FTS.

(2) Install case top (refer to para. 4-7f).

(3) Refer faulty RCA to higher level maintenance.

c. ***Replace RCA.***

(1) Remove case top (refer to para. 2-4).

(2) Test FTS using new RCA (refer to para. 4-7).

(3) Turn case top over so that inside of case top is facing up.

(4) Locate two pushbutton latches inside case top and press each latch firmly until lid is released.

(5) Grasp inner lid hole cutout and lift.

(6) Place operational RCA in case top.

4-15. REMOVE AND REPLACE FOBC LANYARD ASSEMBLY

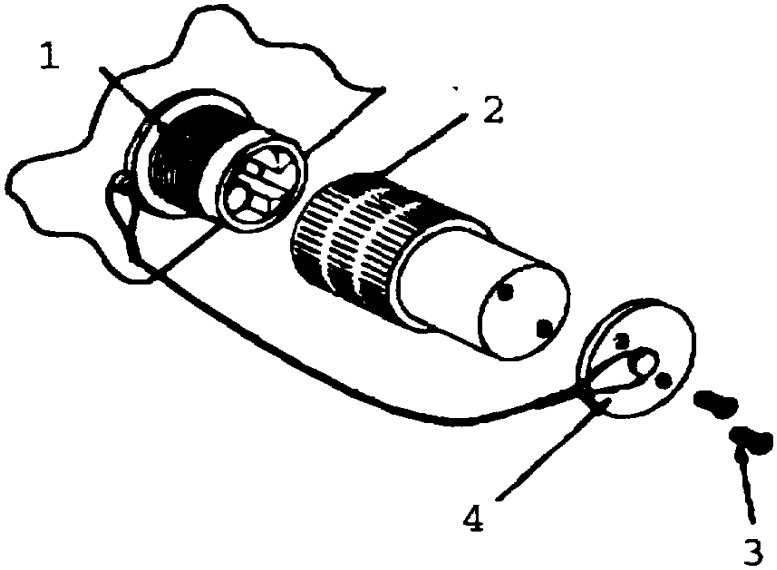


FIGURE 4-7. FOBC Exploded View.

a. ***Remove Lanyard Assembly.***

(1) Disconnect dust cover (2, Fig. 4-7) from FOBC (1).

(2) Locate two screws (3) on top of dust cover (2).

(3) Using flat-tip screwdriver, remove two screws (3) securing lanyard assembly (4) to dust cover (2). Set screws aside.

(4) Locate other end of lanyard assembly that is connected to FOBC or attached to FTS front panel.

(5) If lanyard assembly is connected to FOBC-, use wire cutters and cut lanyard assembly at loop.

If lanyard assembly is attached to FTS front panel, use flat tip screwdriver to remove screw (1, Fig. 4-8), lock washer (2), lanyard end (4), and flat washer (3).

(6) Discard damaged lanyard assembly.

b. ***Replace FOBC Lanyard Assembly***

NOTE

Replacement lanyard assembly is connected to FTS front panel instead of FOBC.

(1) Apply drop of thread lock compound to both threaded holes on top of dust cover (2, Fig. 4-7).

(2) Locate two screws (3) to secure new lanyard assembly (4) to dust cover (2).

(3) Using flat-tip screwdriver, install two screws (3) in dust cover (2) to secure lanyard assembly (4) to dust cover (2).

(4) Using No. 2 cross-tip screwdriver, remove screw (1, Fig. 4-8), lock washer (2), and flat washer (3) from FTS front panel.

(5) Place lock washer, flat washer, and free end of lanyard assembly over screw.

(6) Using No. 2 cross-tip screwdriver, install screw on FTS.

(7) Place dust cover (2, Fig. 4-7) on FOBC (1).

4-16. REMOVE AND REPLACE FOBC DUST COVER

a. ***Remove FOBC Dust Cover.***

(1) Disconnect dust cover (2, Fig. 4-7) from FOBC (1).

(2) Locate two screws (3) on top of dust cover (2).

(3) Using flat-tip screwdriver, remove two screws (3) from top of dust cover (2). Set screws aside.

(4) Discard damaged dust cover.

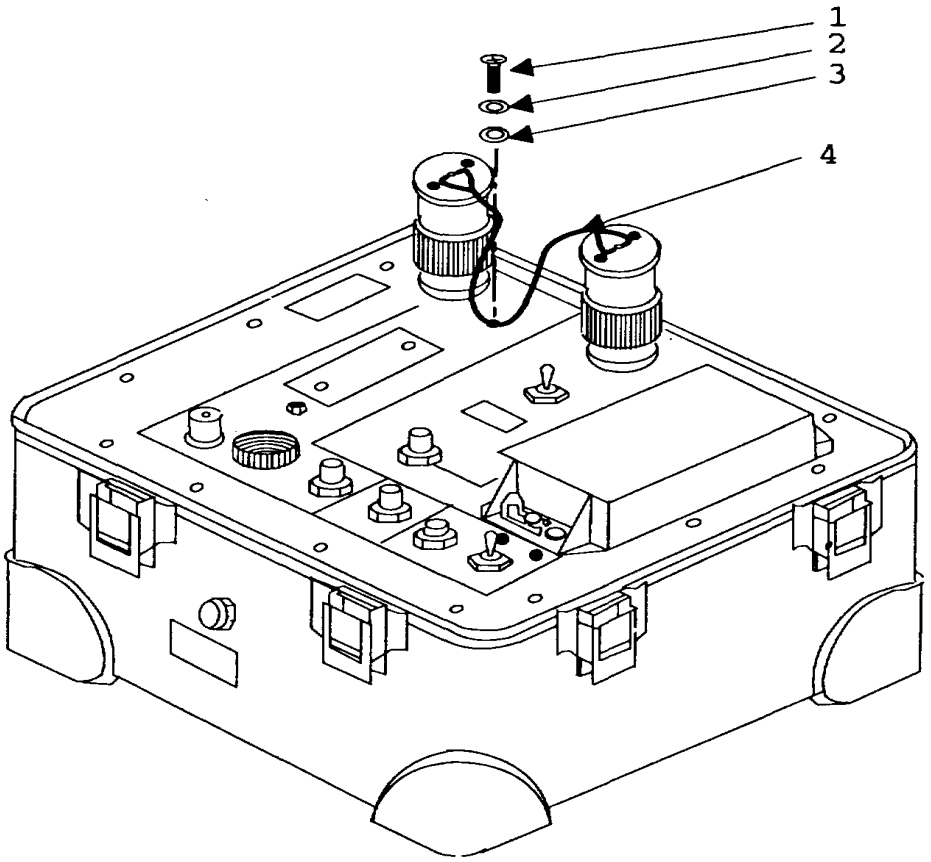


FIGURE 4-8. Replacement Lanyard Attaching Screw.

b. ***Replace FOBC Dust Cover.***

(1) Apply drop of thread lock compound to both threaded holes at top of new dust cover (2, Fig. 4-7).

(2) Locate two screws (3) to secure lanyard assembly (4) to dust cover (2).

(3) Align lanyard assembly (4) to dust cover (2).

(4) Using flat-tip screwdriver, install two screws (3) in dust cover (2) to secure lanyard assembly (4) to dust cover (2).

(5) Install dust cover (2) on FOBC (1).

4-16.1. REMOVE AND REPLACE BATTERY COVER ASSEMBLY

a. ***Remove Battery Cover Assembly.***

(1) Using a nutdriver, remove nut (6, Fig. 4-8.1) and screw (4) from retainer cord (5) attached to the battery cover assembly (3).

(2) Place thumbs on slide locks of battery cover assembly.

(3) Press down on battery cover assembly and slide locks away from locking pins to unlock cover.

(4) Remove battery cover assembly.

b. ***Replace Battery Cover Assembly.***

(1) Install new battery cover assembly on locking pins.

(2) Press down on battery cover assembly. Place thumbs on slide locks and push toward locking pins until cover is secure.

(3) Attach retainer cord to battery cover assembly with screw and nut.

(4) Tighten nut to allow retainer cord to move freely.

4-16.2. REMOVE AND REPLACE SWITCH ACTUATOR ASSEMBLY

a. ***Remove Switch Actuator Assembly.***

(1) Using a nutdriver, remove four nuts (1, Fig. 4-8.1) from studs on transit case assembly top.

(2) Remove switch actuator assembly (2) from studs.

b. ***Replace Switch Actuator Assembly.***

(1) Using a nutdriver, install switch actuator assembly on studs on transit case top with four nuts.

(2) Torque nuts to 9-10 inch pounds.

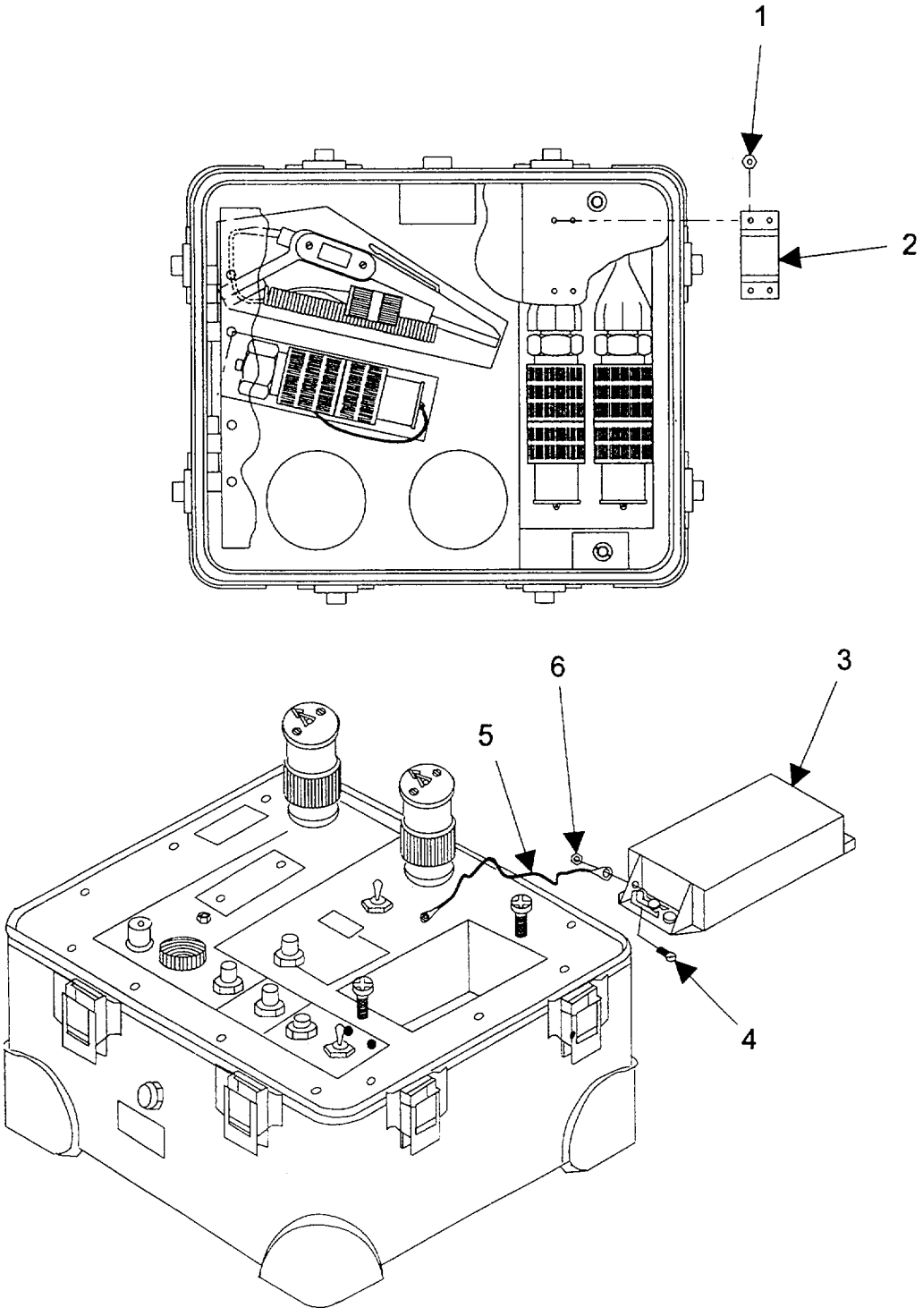


Figure 4-8.1. Battery Cover and Switch Actuator Replacement.

Section V. PREPARATION FOR STORAGE OR SHIPMENT

4-17. PREPARATION FOR STORAGE OR SHIPMENT

a. Packing FTS in Original Shipping Carton.

NOTE

The battery must be removed from the FTS before storage and shipment.

(1) Remove battery from FTS before storage or shipment (refer to para. 4-11a).

(2) Wipe exterior of FTS with clean, dry cloth. Install all dust covers.

(3) Wrap FTS in plastic.

(4) Place FTS in original shipping carton.

(5) Ensure that original packing is in place.

(6) Close carton and secure with shipping tape.

(7) Affix label on outside of carton listing contents and serial number of item. place cellophane tape over label to protect it from moisture. If FTS is being placed in storage, include date packed.

b. *Packing FTS in Cardboard Box.*

NOTE

The battery must be removed from the FTS before storage and shipment.

(1) Remove battery from FTS before storage or shipment (refer to para. 4-11a).

(2) If original shipping carton is not available, use corrugated cardboard box appropriate for shipping.

(3) Wipe exterior of FTS with clean, dry cloth. Install all dust covers.

(4) Wrap FTS in plastic.

(5) Line bottom of box with packing material.

(6) Place FTS in box and surround with packing material.

(7) Ensure that there is sufficient packing material to protect FTS in case of rough handling.

(8) Close carton and secure with shipping tape.

(9) Affix label on outside of box listing contents and serial number of item. Place cellophane tape over label to protect it from moisture. If FTS is being placed in storage, include date packed.

CHAPTER 5
DIRECT SUPPORT MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

5-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

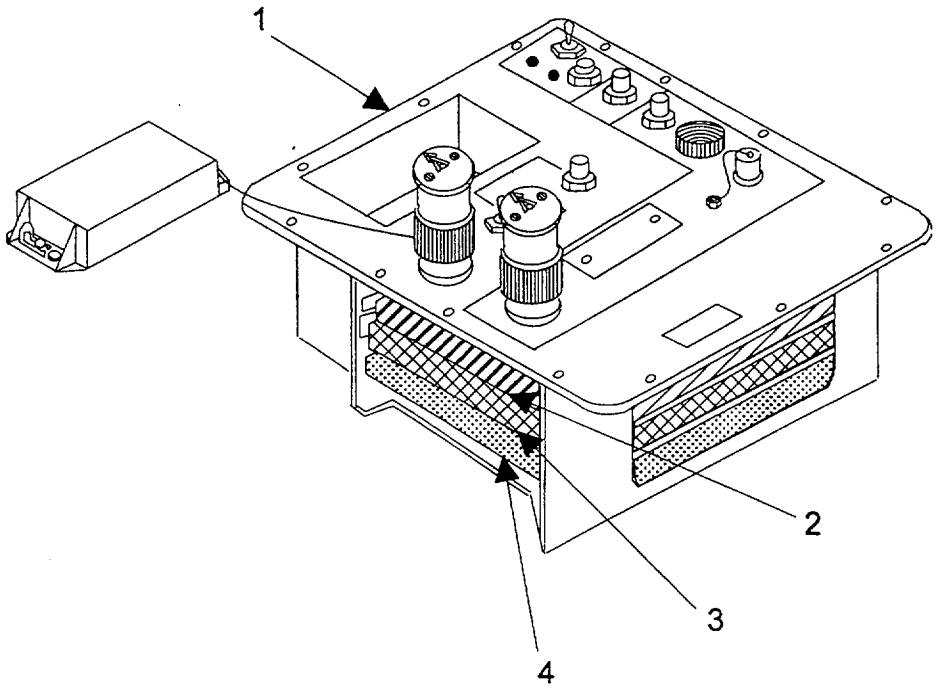
5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

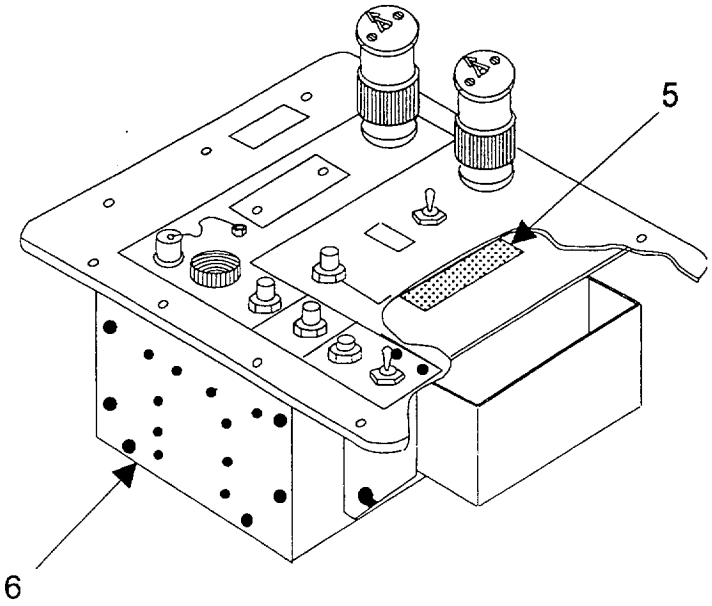
All special tools, TMDE, and support equipment required to perform direct support maintenance are listed in the Maintenance Allocation Chart (MAC) (Appendix B of this manual).

5-3. REPAIR PARTS

Direct support level repair parts are listed and illustrated in Appendix F of this manual.

5-4. LOCATION AND DESCRIPTION OF INTERNAL COMPONENTS





Key	Name	Description
1	FRONT PANEL ASSEMBLY	Houses all 5 circuit card assemblies (CCAs), card cage assembly and battery. Also houses switches, indicators and connectors for operator interface. All electronic assemblies are attached to panel assembly.
2	MCF CCA	Enables operator to communicate over MOW with communications shelter. Internally houses optical transmitter circuitry and optical receiver circuitry that provides for electrical-to-optical and optical-to-electrical conversion of signals.
3	FTF CCA	Enables operator to measure optical power of FOCA and FOM while troubleshooting FOTS (LH). Enables operator to measure FOCA attenuation before installation. Provides both absolute and relative power measurement.
4	PS CCA	Utilizes internal battery to distribute necessary voltages to internal circuitry as required. Contains input over/under-voltage protection device. Also contains nuclear event detection, short circuit, and output over-voltage protection.
5	DISPLAY CCA	Mounted to front panel and contains OSM display. Provides the operator with the attenuation and optical power measurements of FOCA under test. Displays BAT to indicate battery needs to be replaced, and "ROA" to indicate normal communication operation.
6	MOTHERBOARD CCA	Provides interface between front panel discrete functions and CCAs. All CCAs are connected to motherboard CCA.

Section II. DIRECT SUPPORT TESTS AND TROUBLESHOOTING

5-5. PRELIMINARY TEST PROCEDURES

a. ***Verify Reported Malfunction.***

(1) Inspect front panel assembly for damaged OSM display window.

If any damage is noted, remove and replace the OSM display window (refer to para. 5-7.1).

(2) Install BA-5590/U battery in FTS (refer to para. 4-11b).

(3) Perform FTS self-test and verify reported malfunction (refer to para. 4-7).

If no malfunction occurs, remove battery and return FTS to service.

If OSM display remains active when BTRY INTLK switch (SW2) is pressed, remove and replace BTRY INTLK switch (refer to para. 5-7.2).

If no other malfunction is noted, proceed with step (4).

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(4) Disassemble FTS (refer to para. 5-7) and place front panel assembly on static discharge protected pad.

(5) Visually inspect rear end of FOBCs for damage td fibers and connectors.

If the connectors are damaged, replace per paragraph 5-7.8

(6) Visually inspect front panel assembly for burned, frayed, broken, or loose wires.

If any damage is noted, repair as necessary.

(7) Gently push heat shrink on power switch (CB1) contacts back to allow access with multimeter probe.

(8) Using multimeter, check power switch for continuity.

If switch fails continuity check, remove and replace the power switch (refer to para. 5-7.3).

(9) Gently push heat shrink on CAL switch (SW4) contacts back to allow access with multimeter probe.

(10) Using multimeter, check CAL switch for continuity.

If switch fails continuity check, remove and replace the CAL switch (refer to para. 5-7.4).

(11) Gently push heat shrink on MODE switch (SW5) contacts back to allow access with multimeter probe.

(12) Using multimeter, check MODE switch for continuity.

If switch fails continuity check, remove and replace the MODE switch (refer to para. 5-7.5).

(13) Gently push heat shrink on RING switch (SW1) contacts back to allow access with multimeter probe.

(14) Using multimeter, check RING switch for continuity.

If switch fails continuity check, remove and replace the RING switch (refer to para. 5-7.4).

(15) Gently push heat shrink on SELF TEST switch (SW3) contacts back to allow access with multimeter probe.

(16) Using multimeter, check SELF TEST switch for continuity.

If switch fails continuity check, remove and replace the SELF TEST switch (refer to para. 5-7.4).

NOTE

Access to P1 and P2 can be obtained by inserting fingers between motherboard and front panel.

(17) Check to ensure that P1 is properly seated in J1 (located on motherboard inside card cage assembly as shown in Fig. 5-1).

(18) Check to ensure that P2 is properly seated in J2 (located on motherboard inside card cage assembly).

NOTE

CCAs are identified by color coding on card ejectors and card cage assembly as follows:

MCF CCA	WHITE
FTF CCA	RED
PS CCA	BLACK

(19) Perform power on test using power supply (refer to para. b).

b. ***Power on Test Using Power Supply.***

NOTE

The power supply should be current limited and adjusted for 0.5 amps.

(1) Adjust DC power supply to +12 Vdc. Turn off DC power supply.

(2) Remove PS CCA from card cage (refer to para. 5-10a).

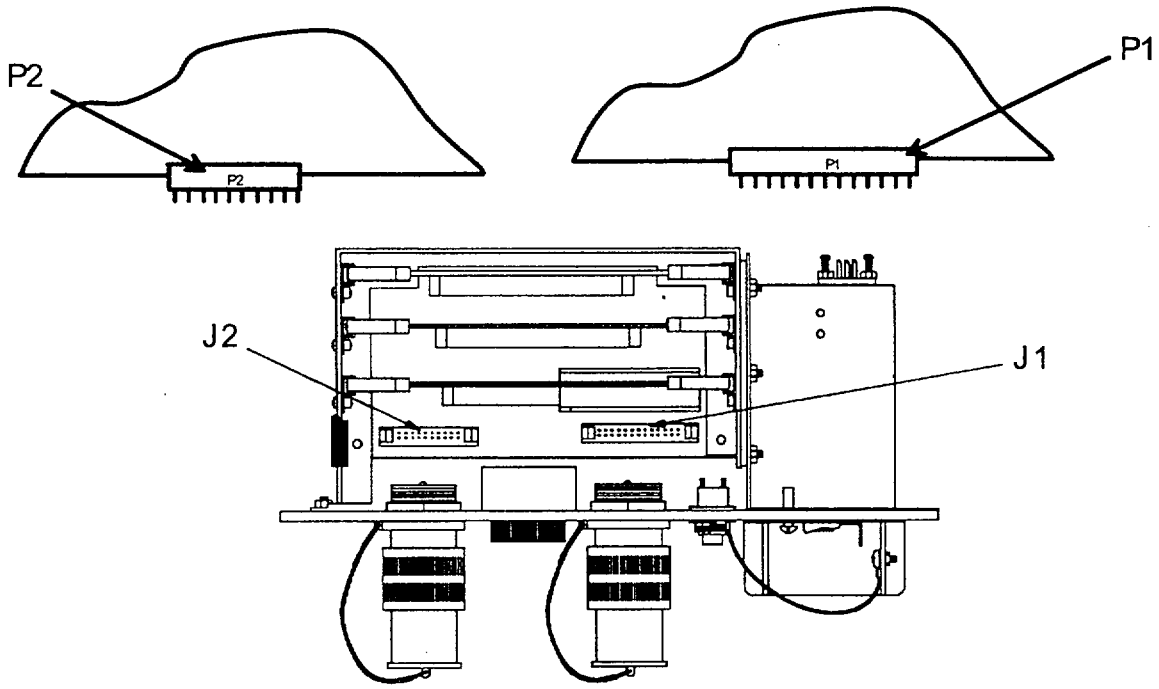


FIGURE 5-1. P1, P2, J1 and J2 Location.

(3) Locate test points TP16 (GND) and TP9 (12 Vdc) on PS CCA (refer to Fig. 5-2).

(4) Connect DC power supply to PS CCA as follows:

Power Supply	PS CCA
Ground	TP16
+12 Vdc	TP9

(5) Locate test points TP15 (+5 Vdc) and TP11 (GND) on PS CCA (refer to Fig. 5-3).

(6) Install PS CCA in card cage assembly (refer to para. 5-10b).

(7) Turn power supply on.

(8) Using multimeter, measure output voltage at TP15 with respect to ground, TP11. Reading should be +5 Vdc ±0.25V.

If output is within limits, perform OSM display functions test (refer to para. 5-5c).

If output is outside limits, troubleshoot FTS (refer to para. 5-6).

c. ***OS Display Functions Test.***

(1) Inspect OSM display for active display.

If OSM display is active, perform MCF communications functions test (refer to para. 5-5d).

If OSM display is blank, proceed with step (2).

(2) Disengage power to FTS.

(3) Ensure all CCAs are securely seated.

(4) Engage power to FTS.

(5) Inspect OSM display for active display.

If OSM display is active, perform MCF communications functions test (refer to para. 5-5d).

If OSM display is still blank or partially active, troubleshoot FTS (refer to para. 5-6)

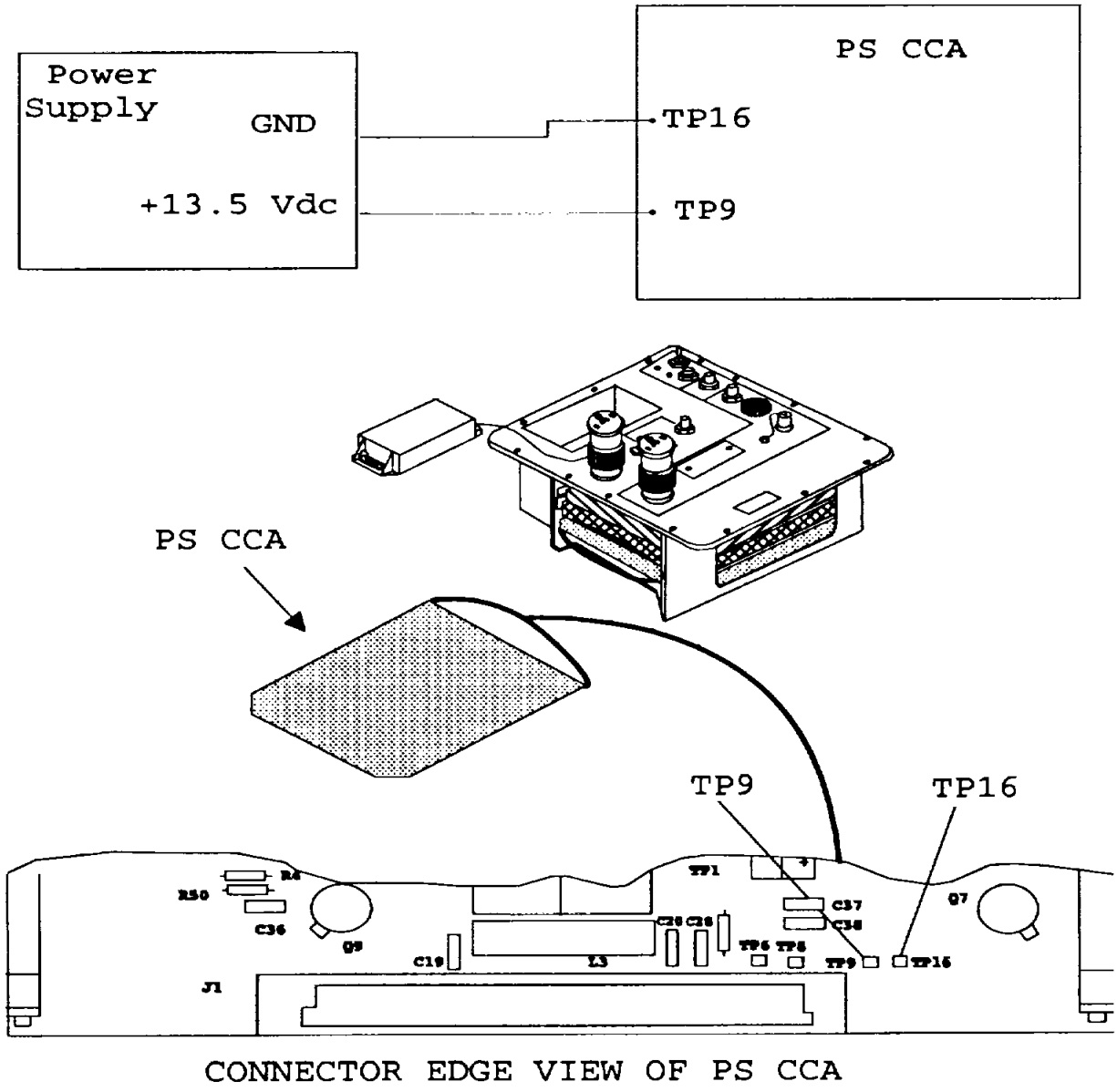


FIGURE 5-2. Power On Test Setup.

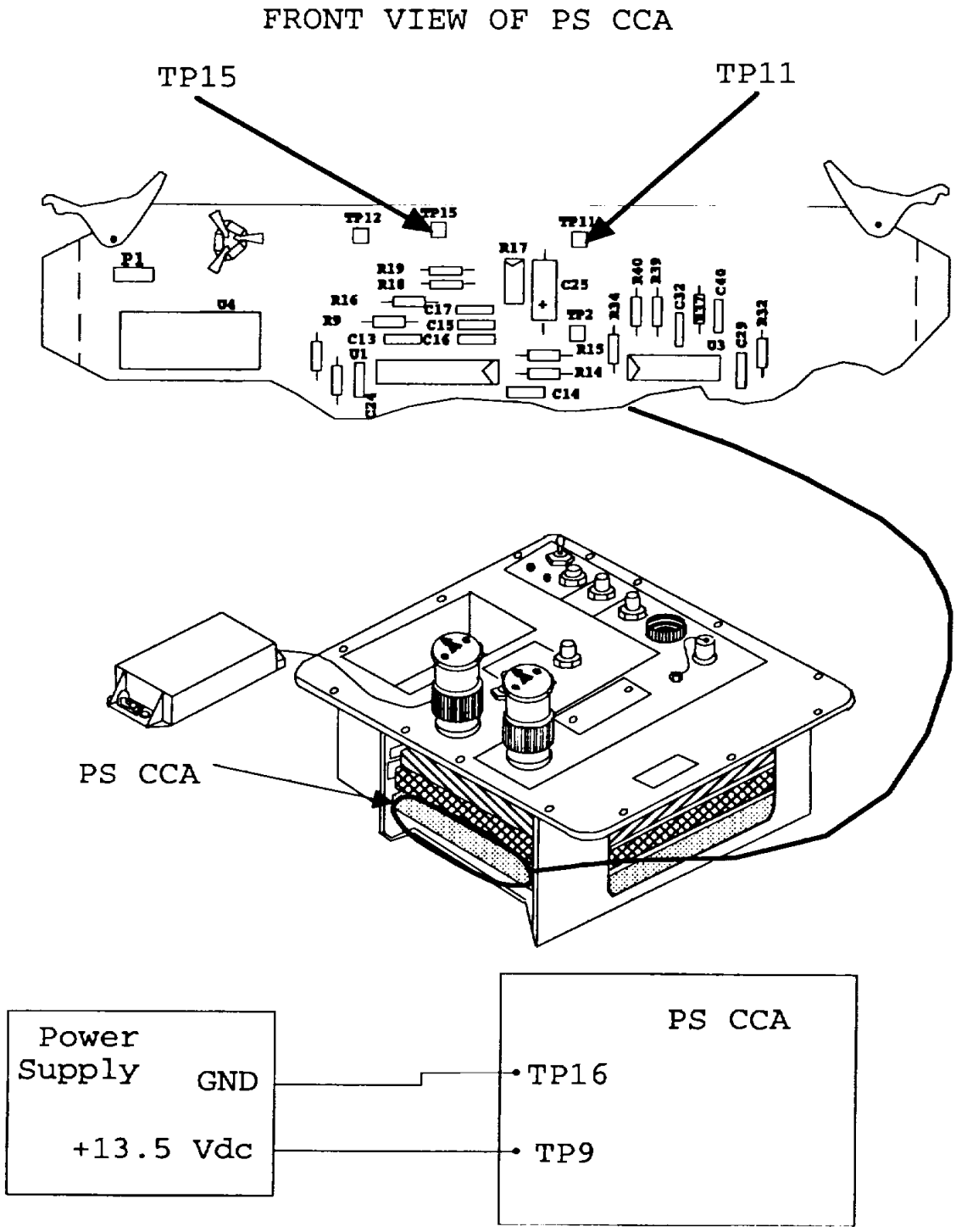


FIGURE 5-3. Location of TP15 and TP11.

d. ***MCF Communications Functions Test.***

(1) Perform front panel indicator test (refer to para. 4-7b).

If FTS passed test, proceed with step (2).

If FTS failed front panel indicator test, troubleshoot FTS (refer to para. 5-6).

(2) Perform MCF test (refer to para. 4-7c).

If FTS passed test, perform MCF optical power test (refer to para. 5-5e).

If FTS failed MCF test, proceed with next step (3).

(3) Ensure all CCAs are securely seated. Repeat MCF functional test.

If FTS passed test, perform MCF optical power test (refer to para. 5-5e).

If FTS failed MCF test, troubleshoot FTS (refer to para. 5-6).

e. ***MCF Optical Power Test.***

(1) Perform MCF optical transmitter power test (refer to para. 4-7e).

If FTS passed MCF optical transmitter power test, perform FTF functional test (refer to para. 5-5f).

If FTS failed KCF optical transmitter power test, proceed with step (2).

(2) Troubleshoot FTS (refer to para. 5-6).

f. ***FTF Functions Test.***

(1) Perform FTF test (refer to para. 4-7d).

If FTS passed test, proceed with step (2).

If FTS failed FTF test, troubleshoot FTS (refer to para. 5-6).

(2) Disconnect RCA from MCF and FTF FOBCs.

(3) Install dust cover plugs on RCA, MCF, and FTF connectors.

(4) Place RCA in case top.

(5) If all tests are passed without a repair required, disassemble test setup and assemble FTS (refer to para. 5-14).

5-6. TROUBLESHOOTING TABLE

Refer to Table 5-1 to troubleshoot the FTS. The test, checks, and inspections for each malfunction are listed in a logical sequence, and any corrective action you take should follow the same sequence. The malfunction should be cleared by performing the troubleshooting procedures.

ST A

TIC SENSITIVE **CAUTION** STATIC SENSITIVE

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

Table 5-1. Direct Support Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. PS CCA output voltage not within +5 Vdc ±0.25 V.

NOTE

Do not remove fiber optic leads from the FOBCs.

Step 1. Disengage power to FTS.

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. PS CCA output voltage not within +5 Vdc ±0.25 V - Continued.

Step 2. Disconnect MCF CCA from motherboard. Place thumbs on card ejectors and flip ejectors toward sides of card cage assembly.
Step 3. Engage power to FTS.
Step 4. Using multimeter, measure voltage at TP15 with respect to ground at TP11. The output measurement of TP15 should be +5 Vdc ±0.25 V. TP15 and TP11 are shown in Fig. 5-4.

If voltage is outside limits, proceed with Step 5.

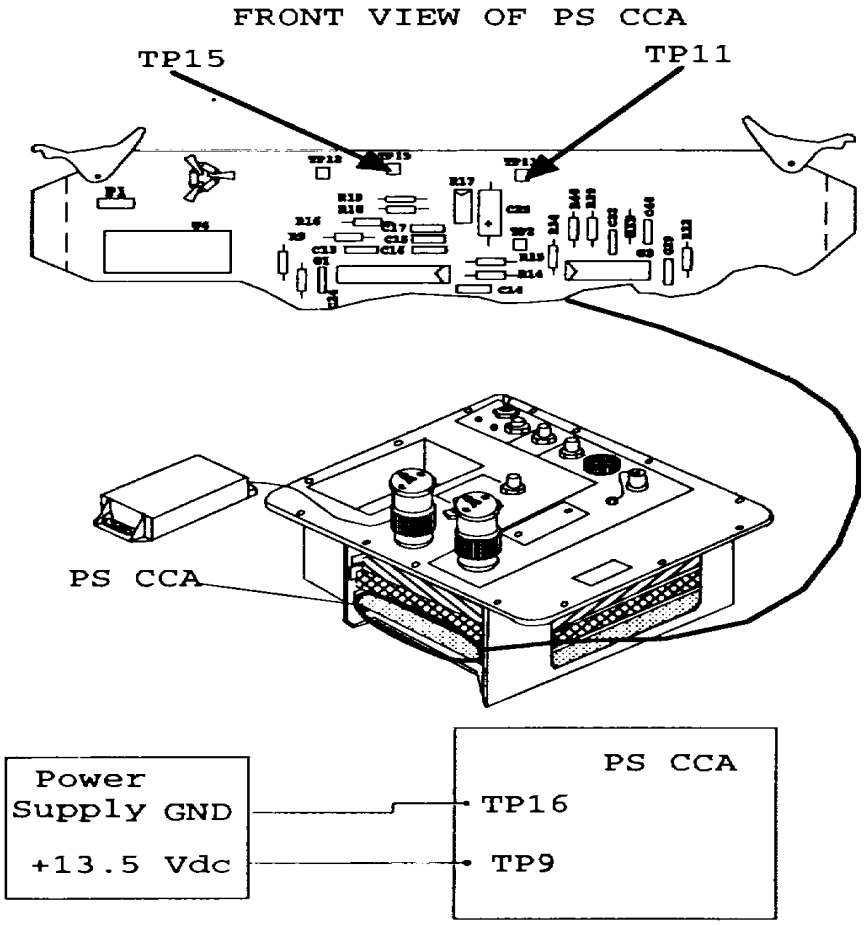


FIGURE 5-4. PS CCA TP11/TP15.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
1. PS CCA output voltage not within +5 Vdc +0.25 V - Continued.	
	If voltage is within limits, remove and replace the MCF CCA (refer to para. 5-8).
Step 5.	Disengage power to FTS.
Step 6.	Disconnect FTF CCA from motherboard. (Do not reinsert MCF CCA.)
Step 7.	Engage power to FTS.
Step 8.	Using multimeter, measure voltage at TP15 with respect to ground at TP11. The output measurement of TP15 should be +5 Vdc +0.25 V.
	If voltage is outside limits, proceed with step 9.
	If voltage is within limits, remove and replace the FTF CCA (refer to para. 5-9).
Step 9.	Disengage power to FTS.
Step 10.	Locate front panel discreet function connector (J1) and OSM display connector (J2). Fig. 5-1 shows the location of J1 and J2.
Step 11.	Remove MCF CCA and FTF CCA from Card Cage Assembly to access J1 and J2.
Step 12.	Disconnect J1 and J2 from motherboard CCA.
Step 13.	Engage power to FTS.
Step 14.	Using multimeter, measure output voltage at TP15 with respect to ground at TP11. The measurement should be +5 Vdc +0.25 V.
	If output is within limits, remove and replace OSM display CCA (refer to para. 5-11).
	If output is outside limits, proceed with step 15.
Step 15.	Disengage power to FTS.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
1. PS CCA output voltage not within +5 Vdc +0.25 V Continued.	
Step 16.	Disengage PS CCA. Grasp CCA and pull away from motherboard just enough to disengage CCA from connector. Do not remove CCA from card cage.
Step 17.	Engage power to FTS.
Step 18.	Using multimeter, measure output voltage at TP15 with respect to ground at TP11. The measurement should be +5 Vdc +0.25 V. If output is within limits, remove and replace motherboard CCA (refer to para. 5-12). If output is outside limits, remove and replace PS CCA (refer to para. 5-10).
2. Power switch ON blank OSM display.	
Step 1.	Using multimeter, measure output voltage at TP15 with respect to ground at TPll1. The measurement should be +5 Vdc +0.25 V. If output is within limits, proceed with step 2. If output is outside limits, perform malfunction 1 (PS CCA output voltage not within 5 Vdc +0.25 V).
Step 2.	Visually inspect OSM display. If OSM display is partially active, proceed with step 3. If OSM display is not active, proceed with step 4.
Step 3.	Press and hold SELF TEST switch on FTS front panel ,/ assembly. Fig. 5-5 shows all segments of the OSM display.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Power switch ON - blank OSM display - Continued.

FIGURE 5-5. Active OSM Display Segments.

If all segments of OSM display are active, test FTS (refer to para. 5-5d).

If OSM display is partially active, proceed with step 4.

Step 4. Disengage power to FTS, ensure FTF CCA is seated.

Step 5. Engage power to FTS.

Step 6. Press and hold SELF TEST switch on FTS front panel assembly.

If all segments of OSM display are activated, test FTS (refer to para. 5-5d).

If OSM display is partially activated, proceed with step 7.

Step 7. Disengage power to FTS.

Step 8. Disconnect power supply from PS CCA.

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Power switch ON - blank OSM display - Continued.

NOTE

Do not disconnect the fiber pigtails from the FOBCs when removing MCF and FTF CCAs.

Step 9. Remove PS CCA, FTF CCA, and MCF CCA from card cage assembly.

Step 10. Release excess fiber from CCAs by pulling up on velcro fiber retainers.

Step 11. Disconnect OSM display ribbon cable from motherboard CCA at J2.

Step 12. Set DC power supply to ON.

Step 13. Adjust DC power supply to provide +5 Vdc and -5 Vdc.

Step 14. Set DC power supply to OFF.

Step 15. Connect DC power supply to OSM test fixture (refer to Fig. 5-6).

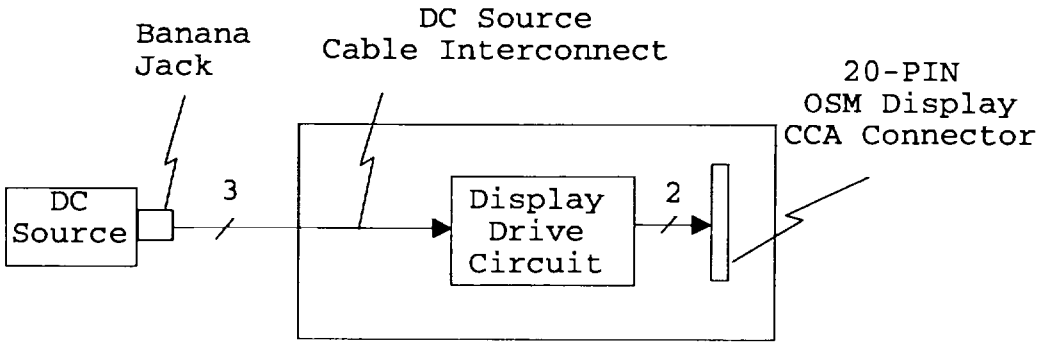


FIGURE 5-6. OSM Display Test Setup.

Step 16. Connect OSM display ribbon cable to OSM test fixture connector.
Step 17. Apply power to test fixture.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
2. Power switch ON - blank OSM display - Continued.	
	NOTE **A functional OSM display consists of the following segments:** ROA BAT MINUS SIGN: - THREE DIGIT SEGMENTS: 888
Step 18.	Inspect OSM display. All segments on OSM display should be active. Fig. 5-5 shows all active segments of OSM display. If all segments of OSM display are not activated, proceed with step 19. If all segments of OSM display are active, proceed with step 21.
Step 19.	Disengage power to OSM test fixture.
Step 20.	Disconnect OSM display from OSM test fixture. Remove and replace OSM display CCA (refer to para. 5-11).
Step 21.	Disengage power to OSM test fixture.
Step 22.	Disconnect OSM display from OSM test fixture.
Step 23.	Connect OSM display ribbon cable to J2 of motherboard CCA.
Step 24.	Set DC power supply to ON.
Step 25.	Adjust DC power supply to +12 Vdc.
Step 26.	Set DC power supply to OFF.
Step 27.	Connect DC power supply to TP16 (GND) and TP9 (+5 Vdc) of PS CCA (refer to Fig. 5-2).
Step 28.	Ensure optical fibers are not twisted. Place FTS so that bottom faces up. Place MCF CCA or FTF CCA component side up with connectors facing motherboard.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. Power switch ON - blank OSM display - Continued.

Step 29. Make loop in fibers approximately 2 inches in diameter. Place loop so that both velcro pieces are covered. Hold loop in place and secure to velcro.

NOTE

CCAs are identified by color coding on card ejectors and card cage assembly. Color codes are as follows: MCF CCA WHITE FTF CCA RED PS CCA BLACK Step 30. Install CCAs.

Step 31. Apply power to FTS.

Step 32. Press and hold SELF TEST switch. All segments of OSM display should be activated. Fig. 5-5 shows all active segments of the OSM display.

If segments of OSM display are active, test FTS (refer to para. 5-5d).

If not all segments of OSM display are active, proceed with malfunction 4, (call signal not audible).

If OSM display is blank, proceed with step 33.

Step 33. Disengage power to FTS.

Step 34. Remove and replace FTF CCA (refer to para. 5-9).

3. Partial OSM display activation.

Perform troubleshooting procedure malfunction 2 (power ON blank OSM display).

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4. Call signal not audible.

Step 1. Disengage power to FTS.

Step 2. Disengage MCF CCA from motherboard CCA.

step 3. Turn on DC power supply.

Step 4. Short pin B16 to B9 on J3 of motherboard (refer to Fig. 5-7).

If audible alarm is active, proceed with step 5.

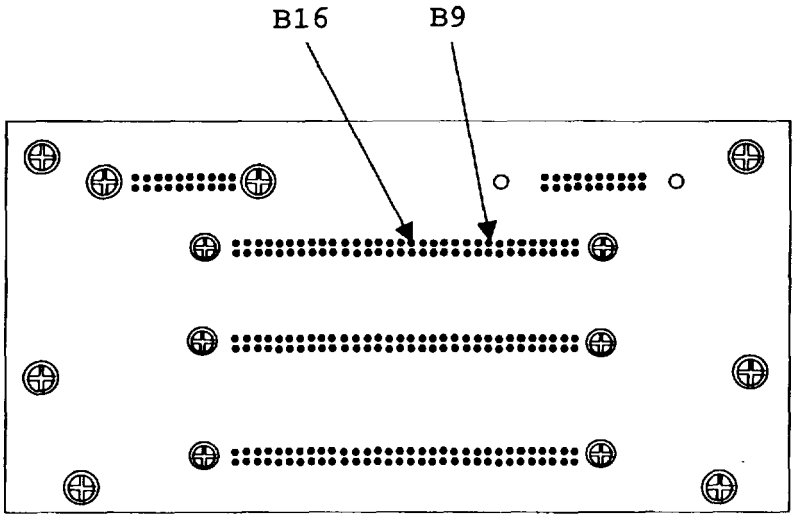


FIGURE 5-7. Location of B16 and B9.

If audible alarm is not active, disassemble test setup, reassemble FTS and refer to FTS higher level maintenance.

Step 5. Disengage power to FTS test setup.

Step 6. Remove and replace MCF CCA (refer to para. 5-8).

5. ROA indicator on OSM display does not appear.

Step 1. Disengage power to FTS test setup.

Step 2. Clean MCF FOBC (refer to para. 4-10b).

Step 3. Inspect optical fibers for kinks, abrasions, or other damage.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	

5. ROA indicator on OSM display does not appear continued.

Step 4. Perform MCF functional test (refer to para. 5-5d).

If FTS passed MCF functional test, test FTS (refer to para. 5-5d).

If FTS failed MCF functional test, proceed with step 5.

Step 5. Remove and replace MCF CCA (refer to para. 5-8).

6. Optical power less than -23.0 dBm.

Step 1. Set MODE Switch on FTS to REL.

Step 2. Locate P1 on FTF CCA.

Step 3. Place micro-clip jumper between center pin of P1 and pin marked 0 dBm. Fig. 5-8 shows the MCF optical power test setup.

Step 4. Apply power to FTS test setup.

Step 5. Press and release CAL switch.

Step 6. Inspect OSM display. OSM display should read 00.0 +0.1 dBm.

If OSM display reading is within limits, proceed with step 8.

If OSM display reading is outside limits and FTF CCA has been aligned or replaced, proceed with step 7.

If OSM display reading is outside limits, align FTS (refer to para. 5-13) and then proceed with step 10.

Step 7. Remove and replace MCF CCA (refer to para. 5-8). Then repeat steps 1 thru 6.

Step 8. Place micro-clip jumper between center pin of P1 and pin marked -20.0 dBm.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	

6. Optical power less than -23.0 dBm. Continued.

Step 9. Inspect OSM display. OSM display should read -20.0 dBm +0.1 dB.

If OSM display reading is within limits, proceed with step 10.

NOTE: POWER SUPPLY CONNECTION NOT SHOWN

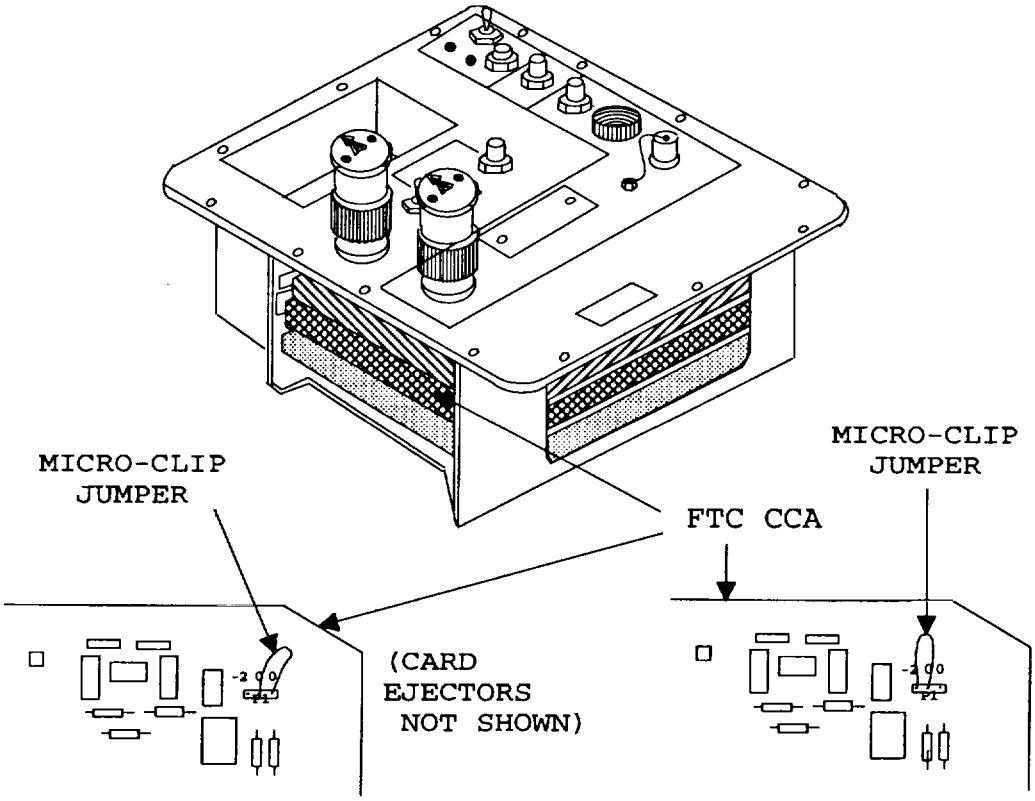


FIGURE 5-8. MCF Optical Power Test Setup.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
6. Optical power less than -23.0 dBm. Continued.	
	If OSM display reading is outside limits, align FTS (refer to para. 5-13).
Step 10.	Perform MCF optical power transmitter test (refer to para. 5-5e).
	If FTS passed MCF optical power transmitter test, perform MCF communications function test (refer to para. 5-5d).
	If FTS failed MCF optical power transmitter test and FTF CCA has been replaced or aligned, assemble FTS (refer to para. 5-14). Refer to higher level maintenance.
7. OSM display will not zero.	
Step 1.	Perform FTF functions test (refer to para. 5-5f).
	If FTS passed FTF functions test, test FTS (refer to para. 5-5b).
	If FTS failed FTF functions test, proceed with step 2.
Step 2.	Stop troubleshooting. Reassemble FTS and refer FTS to higher level maintenance.

Section III. DIRECT SUPPORT MAINTENANCE PROCEDURES

5-7. DISASSEMBLE FTS

An exploded view of the FTS is shown in Fig. 5-9.

NOTE

The FTS contains many small parts and screws. Place parts in parts bag during disassembly.

a. Remove case top, if necessary (refer to para. 2-4).

b. Remove battery (refer to para. 4-11a).

c. Using No. 2 cross-tip screwdriver, remove two screws (3), located in bottom of battery compartment, that secure compartment to shock absorber.

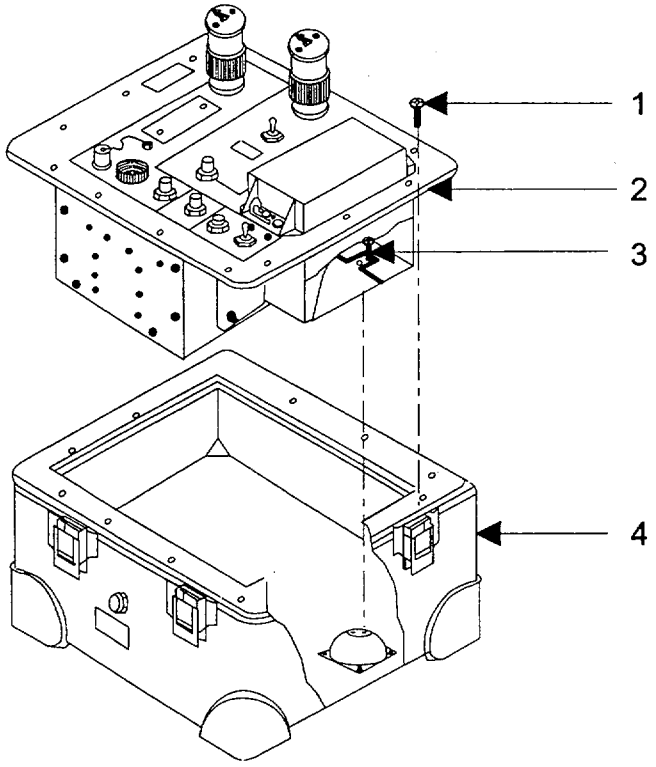


FIGURE 5-9. FTS Exploded View.

d. Using No. 2 cross-tip screwdriver, remove 14 screws (1) from front panel assembly (2).

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

CAUTION

Do not use a screwdriver or other tool to pry the front panel assembly up from the case bottom. This may result in damage to the EMI gasket. When removing front panel assembly, grasp the assembly by the FOBCs and lift straight up.

e. Grasp front panel assembly (2) and pull from case bottom (4). Set case bottom aside.

5-7.1. REMOVE AND REPLACE OSM DISPLAY WINDOW

a. Remove OSM Display Window.

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(1) Remove PS CCA (refer to para. 5-10a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove MCF CCA (refer to para. 5-8a).

(4) Remove OSM display CCA (refer to para. 5-11a).

(5) Remove card cage (refer to para. 5-7.9a).

(6) Using a nutdriver, remove six nuts (1, Fig. 5-9.1).

(7) Carefully remove window retainer (2) and set aside.

CAUTION

To prevent damage to case and studs, carefully remove window.

(8) Remove damaged OSM display window (3).

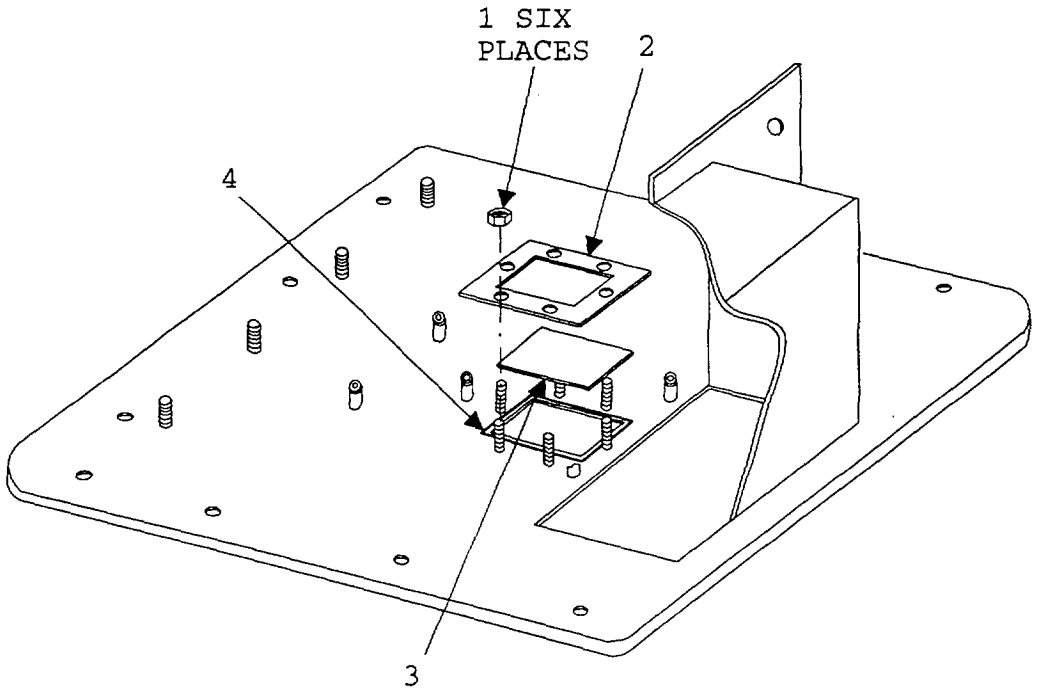


FIGURE 5-9.1. OSM Display Window.

(9) Using a clean lint-free cloth and isopropyl alcohol, remove all RTV silicone adhesive (4) from OSM display window area and studs.

b. ***Replace OSM Display Window.***

(1) Apply a bead of RTV silicone adhesive on back side of front panel at edges of opening for OSM display window.

(2) Install new .OSM display window and seat on RTV silicone adhesive.

(3) Install window retainer onto studs.

(4) Using a nutdriver, install nuts onto studs.

(5) Torque nuts to 4.5-5.0 inch pounds.

(6) Remove excess RTV silicone adhesive.

(7) Install OSM display CCA (refer to para. 5-11b).

(8) Install card cage (refer to para. 5-7.9b).

(9) Install MCF CCA (refer to para. 5-8b).

(10) Install FTF CCA (refer to para. 5-9b).

(11) Install PS CCA (refer to para. 5-10b).

5-7.2. REMOVE AND REPLACE BTRY INTLK SWITCH

a. ***Remove BTRY INTLK Switch.***

(1) Tag wires on BTRY INTLK switch (10, Fig. 5-9.2).

(2) Desolder tagged wires.

(3) Detach switch by removing lock nut (14), lockwasher (13), and switch and O-ring (11) from the front panel assembly.

(4) Discard the faulty BTRY INTLK switch.

b. ***Replace BTRY INTLK Switch.***

(1) Place O-ring onto new BTRY INTLK switch.

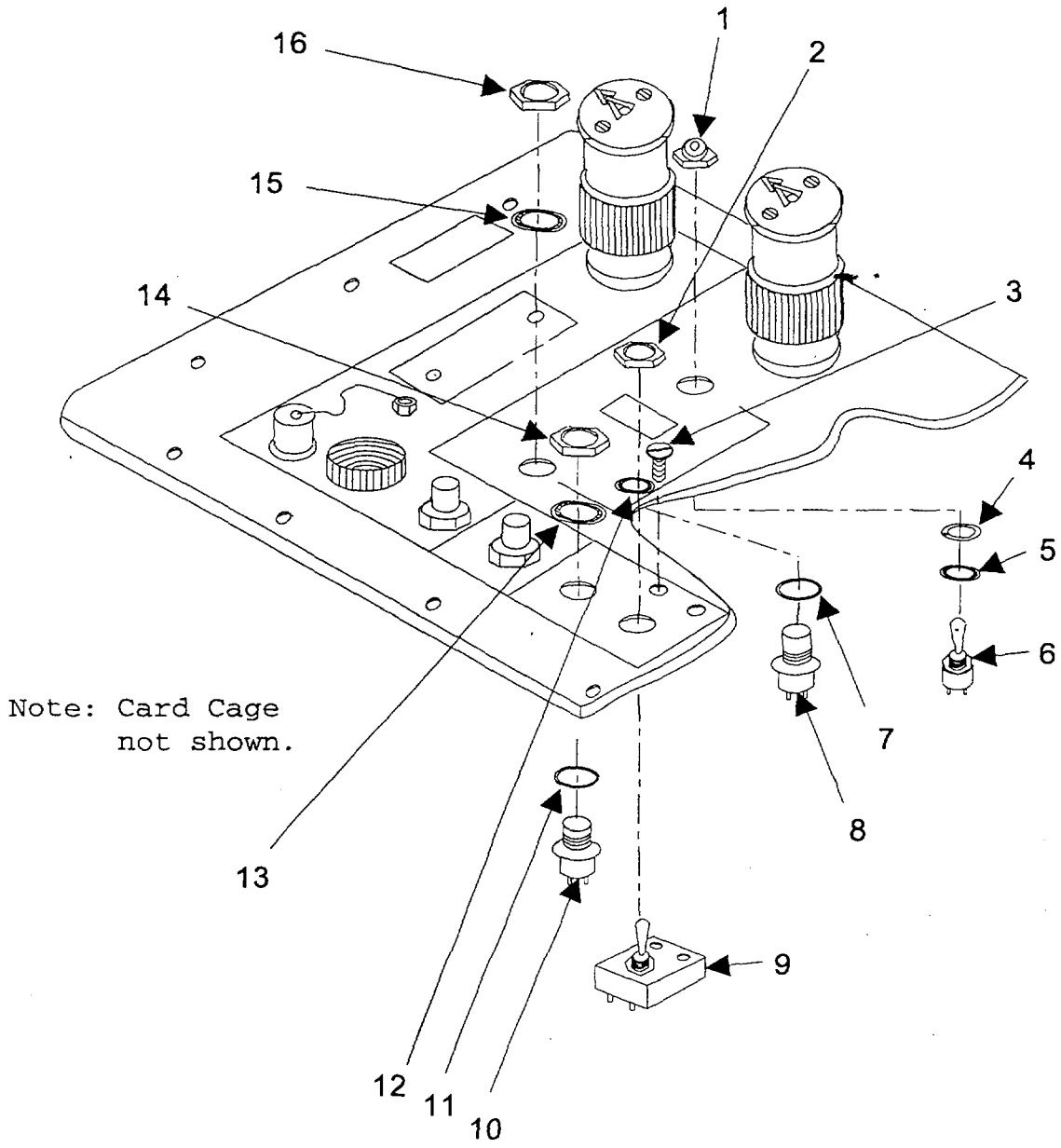


FIGURE 5-9.2. Switch Replacement.

(2) Install new BTRY INTLK switch by inserting the switch through the front panel. Secure switch to front panel with lockwasher and lock nut.

(3) Torque lock nut to 22.5-24.9 inch pounds.

(4) Solder tagged wires to BTRY INTLK switch terminals.

5-7.3. REMOVE AND REPLACE POWER SWITCH

a. ***Remove POWER Switch.***

(1) Tag wires on POWER switch (9, Fig. 5-9.2).

(2) Desolder tagged wires.

(3) Using a slotted blade screwdriver and an open end wrench, remove two screws (3), lock nut (2), lock washer (12), and POWER switch from front panel.

(4) Discard faulty POWER switch.

b. ***Replace POWER Switch.***

(1) Discard locking ring and ON-OFF plate furnished with new POWER switch.

(2) Insert new POWER switch through front panel and secure using lock washer and lock nut.

(3) Torque lock nut to 13.5 to 14.9 inch pounds.

(4) Apply lock tight adhesive to screw threads.

(5) Using a slotted screwdriver, install two screws.

(6) Solder tagged wires to POWER switch terminals.

5-7.4. REMOVE AND REPLACE CAL, RING OR SELF TEST SWITCH

NOTE

The removal and replacement procedures for the CAL, RING and SELF TEST switches are identical.

a. ***Remove Switch.***

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(1) Remove PS CCA (refer to para. 5-10a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove MCF CCA (refer to para. 5-8a).

(4) Tag faulty switch (8, Fig. 5-9.2) wires.

(5) Desolder switch wires.

(6) Remove lock nut (16), lockwasher (15), faulty switch, and O-ring (7) from front panel.

(7) Discard faulty switch.

b. ***Replace Switch.***

(1) Examine O-ring, replace if damaged.

(2) Place O-ring onto new switch.

(3) Insert switch through front-panel. Secure switch to front panel with lockwasher and lock nut.

(4) Torque lock nut to 22.5-24.9 inch pounds.

(5) Solder tagged wires to switch.

(6) Install MCF CCA (refer to para. 5-8b).

(7) Install FTF CCA (refer to para. 5-9b).

(8) Install PS CCA (refer to para. 5-10b).

5-7.5. REMOVE AND REPLACE MODE SWITCH

a. ***Remove MODE Switch.***

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(1) Remove PS CCA (refer to para. 5-10a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove MCF CCA (refer to para. 5-8a).

(4) Tag MODE switch (6, Fig. 5-9.2) wires.

(5) Desolder tagged wires.

(6) Remove dust and water boot (1), MODE switch, lockwasher (5), and locking ring (4) from front panel.

(7) Discard faulty MODE switch.

b. ***Replace MODE Switch.***

(1) Place lockwasher and locking ring on new MODE switch.

(2) Insert new MODE switch through front panel. Secure switch to front panel with dust and water boot.

(3) Tighten hex mounting nut.

(4) Solder tagged wires to MODE switch terminals.

(5) Install MCF CCA (refer to para. 5-8b).

(6) Install FTF CCA (refer to para. 5-9b).

(7) Install PS CCA (refer to para. 5-10b).

5-7.6. REMOVE AND REPLACE AUDIBLE ALARM

a. ***Remove Audible Alarm.***

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(1) Remove PS CCA, (refer to para. 5-10a).

(2) Remove FTF CCA, (refer to para. 5-9a).

(3) Remove MCF CCA, (refer to para. 5-8a).

(4) Tag wires on audible alarm (6, Fig. 5-9.3).

(5) Remove two screws (5) and remove tagged wires.

(6) Unscrew locking ring (11) on front panel.

(7) Remove audible alarm and examine O-ring (4) for damage.

b. ***Replace Audible Alarm Assembly.***

(1) Replace O-ring if defective.

(2) Install audible alarm in front panel.

(3) Install locking ring.

(4) Install wires as tagged using screws from removal procedure.

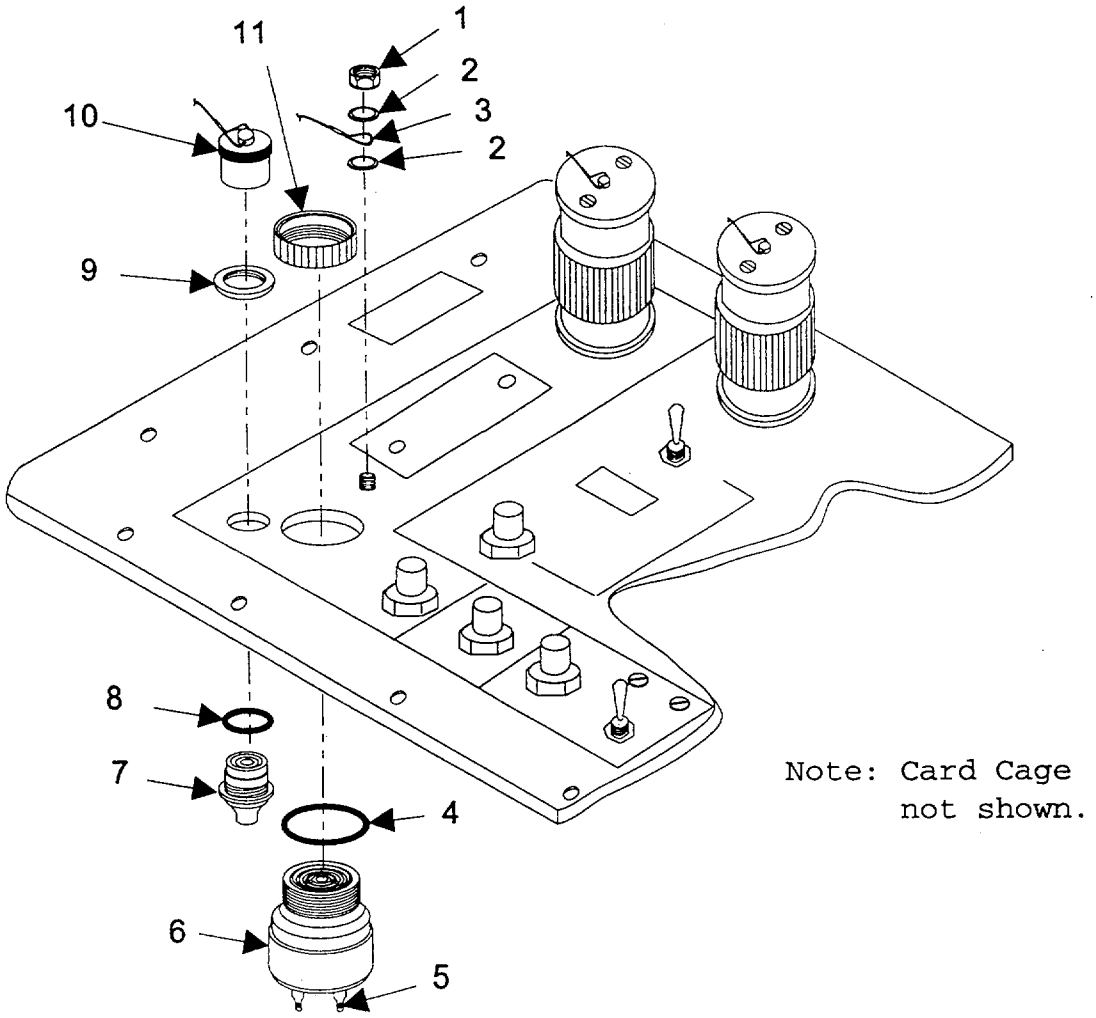


Figure 5-9.3. Audible Alarm and Electrical Connector Replacement.

(5) Install MCF CCA, (refer to para. 5-8b).

(6) Install FTF CCA, (refer to para. 5-9b).

(7) Install PS CCA, (refer to para. 5-10b).

5-7.7. REMOVE AND REPLACE ELECTRICAL RECEPTICLE CONNECTOR

a. ***Remove Electrical Recepticle Connector.***

(1) Unscrew and remove cover (10, Fig. 5-9.3) from electrical recepticle connector (7). Remove cover from Front Panel as follows:

(a) Using nutdriver remove and retain self-locking nut (1).

(b) Remove and retain flat washers (2) and lanyard (3).

(2) Tag wires on electrical recepticle connector.

(3) Desolder wires.

(4) Remove nut (9) using spanner wrench.

(5) Remove electrical recepticle connector and examine O-ring (8) for damage.

b. ***Replace Electrical Recepticle Connector.***

(1) Replace O-ring if defective.

(2) Install electrical recepticle connector in front panel.

(3) Install nut and tighten using spanner wrench.

(4) Solder wires as tagged.

(5) Remove tags.

(6) Install cover to Front Panel using flat washers and self-locking nut retained from removal procedure.

(7) Screw on electrical connector cover.

5-7.8. REMOVE AND REPLACE MCF AND FTF CONNECTORS

a. ***Remove MCF OR FTF Connector.***

(1) Remove PS CCA (refer to para. 5-10a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove MCF CCA (refer to para. 5 -8a).

(4) Disconnect dust cover (2, Fig. 5-9.4) from FOBC.

(5) Using flat tip screwdriver, remove two screws (1) from top of dust cover.

(6) Using flat tip screwdriver, remove two flathead screws (3) of sleeve retainer assembly (4) from connector body (7).

(7) Remove sleeve retainer from connector body and biconic sleeve (5) from sleeve retainer.

(8) Using spanner wrench, remove fiber optic connector locking sleeve (6).

(9) Using installation tool, remove recepticle connector body assembly (7).

(10) Place open end adjustable wrench on outer side of Lanyard Recepticle (8) in Front Panel Assembly.

(11) Place a 1 3/8-inch socket wrench on nut (9) securing Lanyard Receptacle Assembly to Front Panel Assembly. Remove nut and set aside.

(12) Remove Lanyard Receptacle Assembly, containing connector locking sleeve and connector body assembly, and lanyard receptacle "O" seal ring (10) from Front Panel Assembly and set aside.

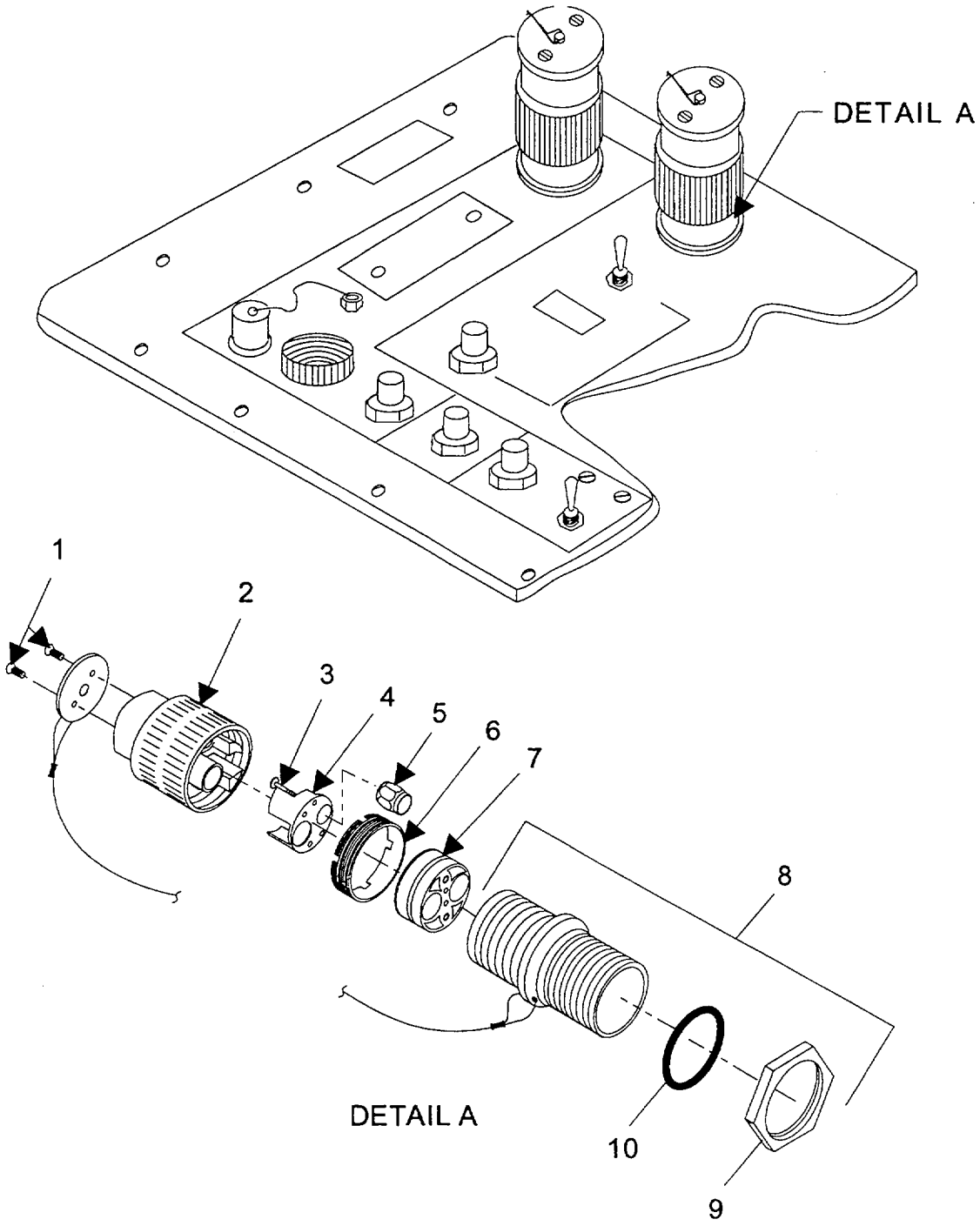


Figure 5-9.4. Lanyard Receptacle Assembly.

b. ***Replace MCF OR FTF Connector.***

(1) Place Front Panel Assembly in a holding device (vise).

(2) Examine lanyard receptacle "O" seal ring for damage. Replace if defective.

(3) Install lanyard receptacle with "O" seal ring in place into Front Panel Assembly.

(4) Place nut on lanyard receptacle and hand tighten. Ensure that flat side of lanyard aligns properly with D-hole of Front Panel Assembly.

(5) Place open end adjustable wrench on outer side of Lanyard Receptacle Assembly.

(6) Place a 1-3/8 inch socket wrench on nut securing Lanyard Receptacle Assembly to Front Panel Assembly and tighten nut.

(7) Install receptacle connector body assembly.

(8) Install fiber optic connector locking sleeve.

(9) Install biconic sleeve in sleeve retainer and install sleeve retainer in connector body.

(10) Install two flathead screws of sleeve retainer assembly into connector body.

(11) Install two screws to secure lanyard assembly to dust cover.

(12) Install dust cover on FOBC.

(13) Install MCF CCA (refer to para. 5-8b).

(14) Install FTF CCA (refer to para. 5-9b).

(15) Install PS CCA (refer to para. 5-10b).

5-7.9. REMOVE AND REPLACE CARD CAGE

a. Remove Card Cage.

(1) Remove MCF CCA (refer to para. 5-8a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove PS CCA (refer to para 5-10a).

(4) Disconnect two ribbon cables from Motherboard.

CAUTION

Take care when separating card cage from panel to avoid damage to switch wiring.

(5) Remove 10 locking nuts.

b. Replace Card Cage.

(1) Replace 10 locking nuts.

(2) Connect two ribbon cables to motherboard.

(3) Install PS CCA (refer to para. 5-10b).

(4) Install FTF CCA (refer to para. 5-9b).

(5) Install MCF CCA (refer to para. 5-8b).

5-7.10. REMOVE AND REPLACE VIBRATION MOUNT

a. Remove Vibration Mount.

(1) Disassemble FTS (refer to para. 5-7).

(2) Remove four nuts (1, Fig. 5-9.5) holding vibration mount (2) to case bottom.

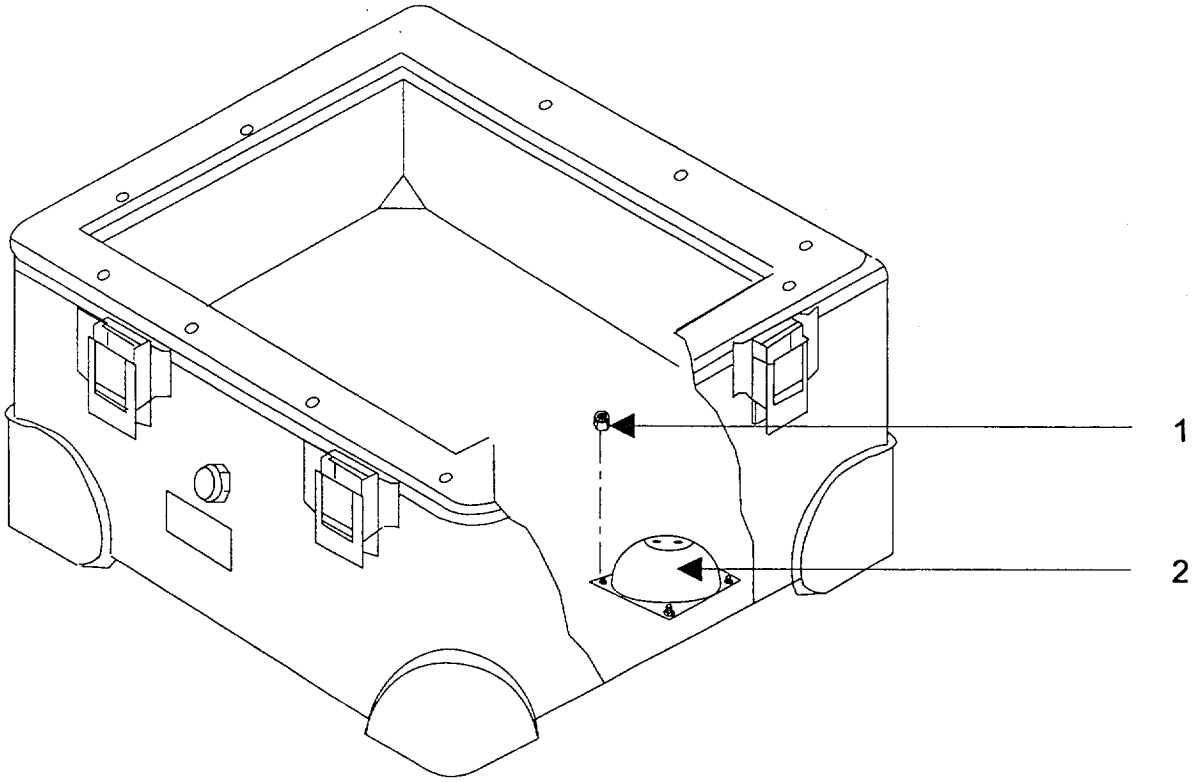


FIGURE 5-9.5. Vibration Mount.

b. Replace Vibration Mount.

(1) Place vibration mount (2) onto four studs attached to case bottom.

(2) Install four nuts (1) and tighten until snug.

(3) Assemble FTS (refer to para. 5-14).

5-7.11. REMOVE AND REPLACE PRESSURE RELIEF VALVES

a. Removal of Case Top or Bottom Pressure Relief Valve.

(1) Disassemble FTS (refer to para. 5-7).

(2) Remove inner nut (2, Fig. 5-9.6).

(3) Remove core and body (1), and gasket (3) from case.

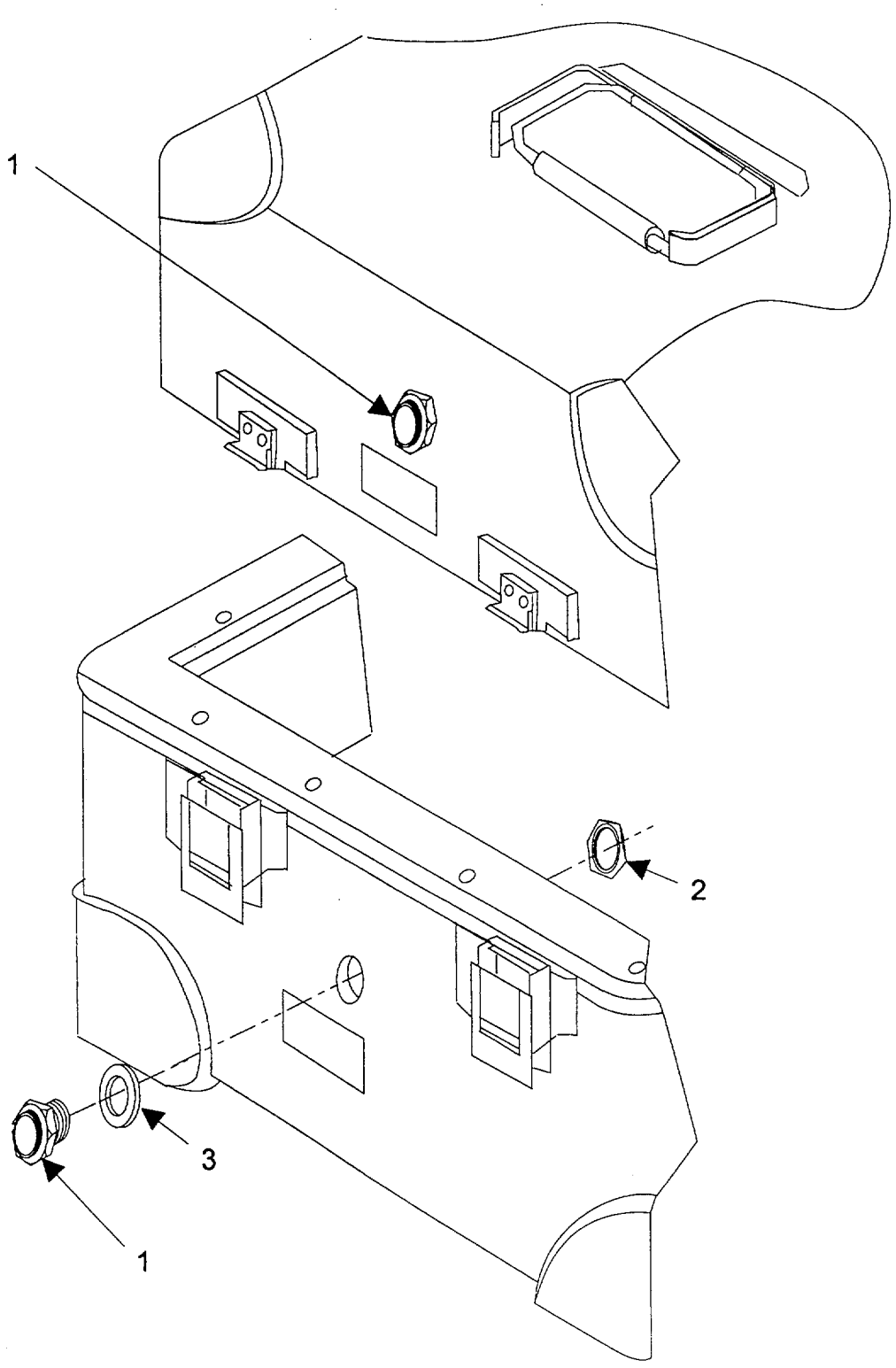


FIGURE 5-9.6. Pressure Relief Valves.

b. Replace Case Top or Bottom Pressure Relief Valve.

(1) Place gasket (3) on core and body (1).

(2) Install core and body (1), and gasket (3) through case.

(3) Install inner locking nut (2).

(4) Assemble FTS (refer to para. 5-14).

5-8. REMOVE AND REPLACE MCF CCA

a. Remove MCF CCA.

STATIC SENSITIVE **CAUTION** **STATIC SENSITIVE**

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

CAUTION

There are many small parts securing optics to MCF FOBC. Place parts in parts bag during disassembly.

(1) Using No. 1 cross-tip screwdriver, remove two screws (8, Fig. 5-10) securing end plate (7) to FOBC (J3).

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

(2) Remove fibers from slots in end plate (7). Set end plate aside.

(3) Grasp shielding gasket (6) and gently pull away from extension studs (4).

(4) Use pliers to gently pull receptacle washer (5) away from extension studs (4).

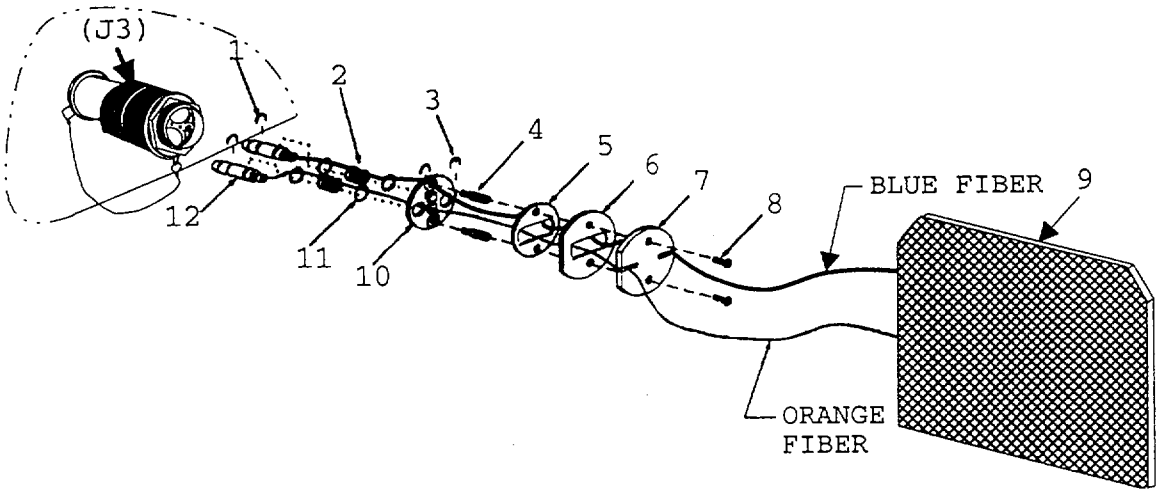


FIGURE 5-10. MCF FOBC Exploded View.

(5) Using nut driver, remove extension studs (4) from retainer plate (10) and set aside.

(6) Using finger, push on biconic connectors (12), compression springs (2), and retainer plate (10) from front panel side of MCF FOBC to dislodge optics.

WARNING

Wear eye protection when removing or replacing retaining rings and compression springs. Hold compression springs in place when removing or replacing retainer rings. Failure to heed this warning may result in personal injury.

(7) Grasp retainer plate (10). Place retaining ring (1) so that open end is facing you. Place biconic connector in hole of jaws of retaining ring removal tool. The retaining ring closest to end of biconic plug is the retaining ring that will be removed at this time. Seat retaining ring in retaining ring removal tool so that closed end is placed at notch in tool. Jaws should press on open end of retaining ring. Gently squeeze handles until retaining ring is dislodged.

(8) Grasp retaining ring with flat part of jaws of retaining ring removal tool. Remove retaining ring and set aside.

(9) Remove compression springs (2) and set aside.

(10) Push biconic connectors (12) through retainer plate (10), receptacle washer (5), and shielding gasket (6).

(11) Using retaining ring removal tool, remove remaining retaining rings from biconic connectors and set aside.

NOTE

The optic fiber of the FTF CCA is in the way of removing the MCF CCA. Remove the FTF CCA from the card cage assembly before removing the MCF CCA.

(12) Using 3/32-inch hex key, loosen four screws on electronic circuit card retainers of FTF CCA and MCF CCA (one on each side of each CCA) (refer to Fig. 5-11). Loosen both sets of screws before removing FTF CCA.

(13) Place thumbs on FTF CCA card ejectors and flip back toward sides of card cage to release FTF CCA.

(14) Remove FTF CCA from card cage assembly.

(15) Release excess fiber on FTF CCA by pulling on velcro fiber retainers.

(16) Set FTF CCA aside.

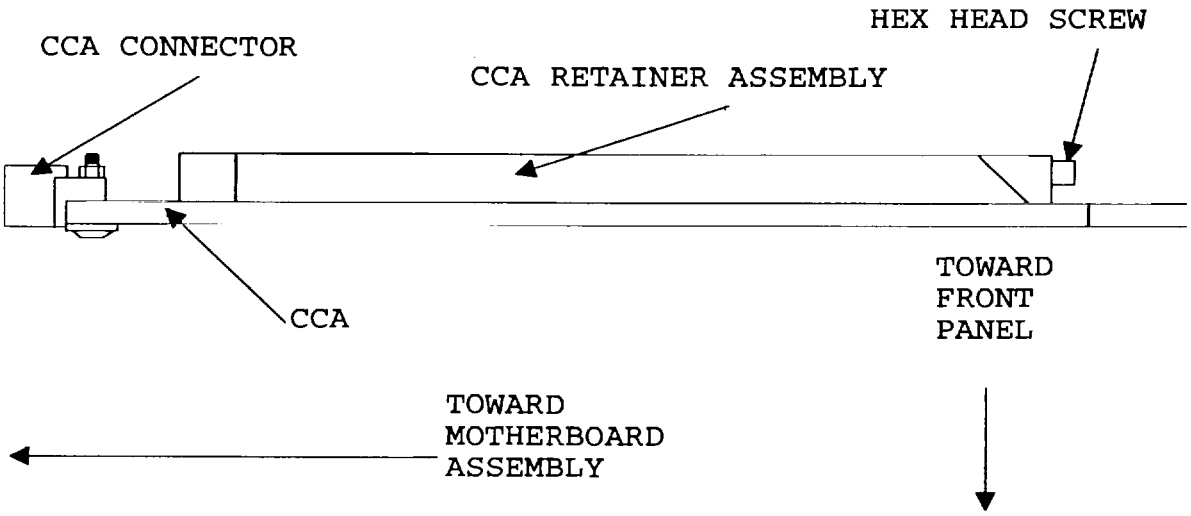


FIGURE 5-11. CCA Retainer

(17) Place thumbs on MCF CCA card ejectors and flip back toward sides of card cage to release MCF CCA.

(18) Remove MCF CCA (9, Fig. 5-10) from card cage assembly.

b. Replace MCF CCA.

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

(1) Place front panel assembly with front panel down.

(2) Ensure that electronic circuit card retainer screws are loosened on FTF CCA and MCF CCA before attempting to insert CCAs in card cage assembly.

(3) Make loop in fibers approximately 2 inches in diameter place loop so that both velcro pieces are covered. Hold loop in place and secure to velcro.

(4) Insert new MCF CCA in card cage assembly.

(5) Insert FTF CCA in card cage assembly.

(6) Secure CCAs by placing thumbs on card ejectors and pushing towards cards.

(7) Using 3/32-inch hex key, tighten electronic circuit card retainer screws to 12 inch pounds.

(8) Turn front panel assembly over with panel side up.

(9) Push biconic connectors (12, Fig. 5-10) through shielding gasket (6) and receptacle washer (5).

(10) Place biconic connector (12) secured to orange fiber through hole 1 stamped on retainer plate (10).

WARNING

Wear eye protection when removing or replacing retaining rings and compression springs. Hold compression springs in place when removing or replacing retainer rings. Failure to heed this warning may result in personal injury.

(11) Install washer (11), compression spring (2), and washer (11) on biconic connector (12).

(12) Using retaining ring installation tool, install retaining ring (1) on front end of biconic connector (12).

(13) Seat biconic connector (12) in hole 1 stamped on retainer plate (10). Place biconic connector and retainer plate in biconic block so that compression springs are inside hole of biconic block (refer to Fig. 5-12).

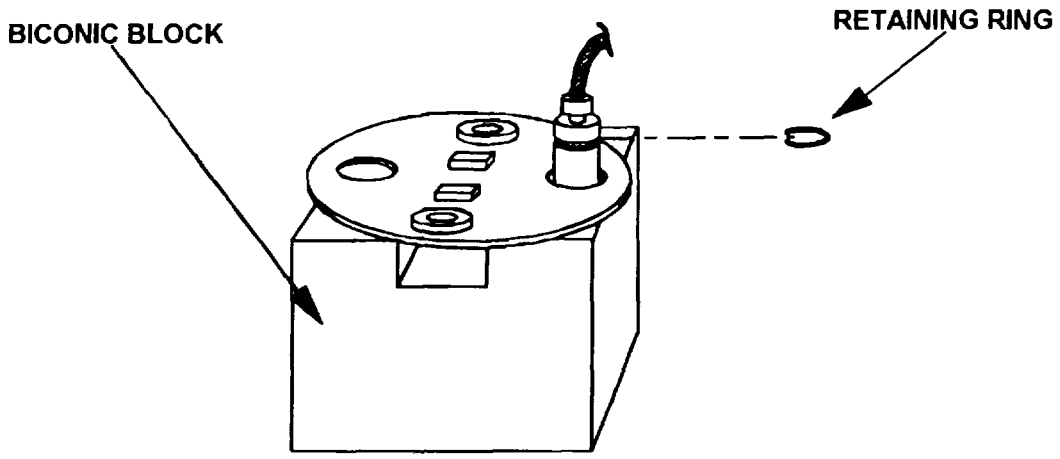


FIGURE 5-12. Biconic Block.

(14) Press retainer plate down to expose back of connector where retaining ring will seat. Using retaining ring installation tool, install retaining ring on connector.

(15) Place biconic connector (12, Fig. 5-10) secured to blue fiber through hole 2 stamped on retainer plate (10).

(16) Repeat steps 9 thru 12, using blue fiber and hole 2 instead of orange fiber and hole 1, to secure remaining biconic connector (12).

(17) Clean biconic connector tip with lint-free cloth moistened with isopropyl alcohol.

(18) Install biconic connectors by aligning keys on retainer plate to holes on MCF FOBC.

(19) Using nutdriver, install two extension studs (4) into retainer plate (10).

(20) Align receptacle washer (5) and shielding gasket (6) to retainer plate (10).

(21) Align end plate (7) and place fibers in slots.

(22) Place two screws (8) through end plate (7), shielding gasket (6), receptacle washer (5), and into extension studs (4).

(23) Using No. 1 cross-tip screwdriver, install two screws (8) into extension studs (4). Tighten securely.

5-9. REMOVE AND REPLACE FTF CCA

a. Remove FTF CCA.

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

CAUTION

There are many small parts securing optics to FTF FOBC. Place parts in parts bag during disassembly.

(1) Using No. 1 cross-tip screwdriver, remove two screws (9, Fig. 5-13) securing end plate (8) to FOBC (J3). Set screws aside.

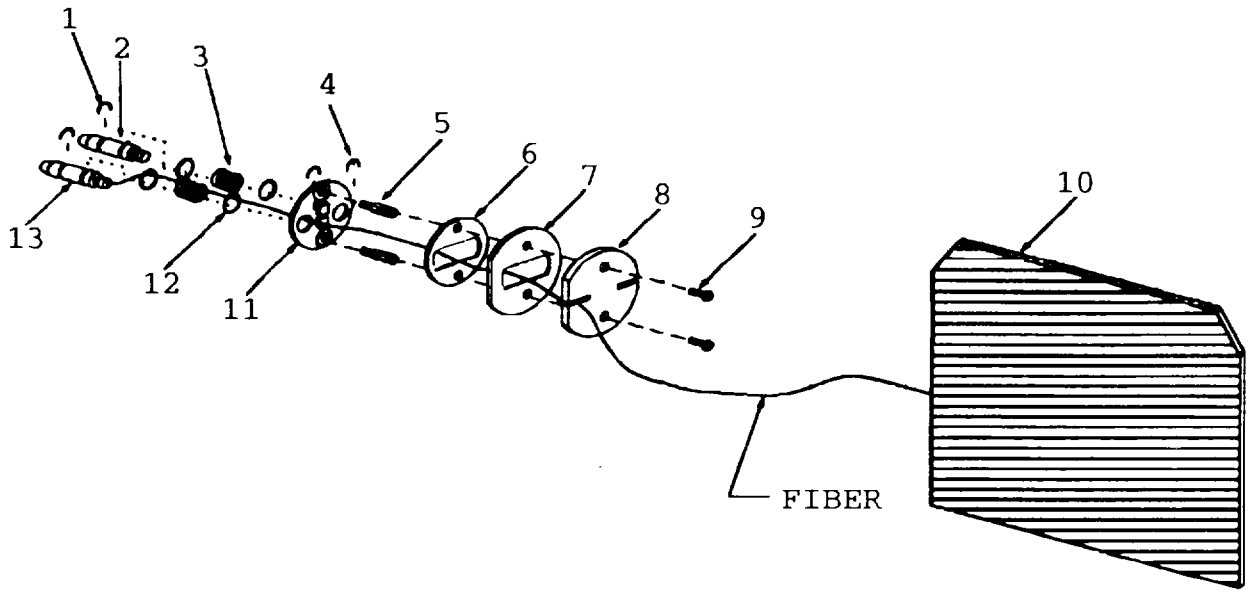


FIGURE 5-13. FTF FOBC Exploded View.

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

(2) Remove fiber from slots in end plate (8). Set end plate aside.

(3) Grasp shielding gasket (7) and gently pull away from extension studs (5).

(4) Using pliers, gently pull extension washer (6) away from extension studs (5).

(5) Using nutdriver, remove extension studs (5) from retainer plate (11) and set aside.

(6) Using finger, push on biconic connector (13), plug Connector (1), springs (3), and retainer plate (11) from front panel side of FTF FOBC to dislodge optics.

WARNING

Wear eye protection when removing or replacing retaining rings and compression springs. Hold compression springs in place when removing or replacing retainer rings. Failure to heed this warning may result in personal injury.

(7) Grasp retainer plate (11). Place retaining ring (1) so that open end is facing you. Place biconic connector in hole of jaws of retaining ring removal tool. The retaining ring closest to end of biconic plug is the retaining ring that will be removed at this time. Seat retaining ring in retaining ring removal tool so that closed end is placed at notch in tool. Jaws should press on open end of retaining ring. Gently squeeze handles until retaining ring is dislodged.

(8) Grasp retaining ring with flat part of jaws of retaining ring removal tool. Remove retaining ring and set aside.

(9) Remove compression springs (3) and two washers (12) and set aside.

(10) Push biconic connector (13) and plug connector (2) through retainer plate (11), receptacle washer (6), and shielding gasket (7).

(11) Using retaining ring removal tool, remove retaining rings from biconic connector and set aside.

(12) Using 3/32-inch hex key, loosen two screws on electronic circuit card retainers of FTF CCA (one on each side of the CCA) (refer to Fig. 5-10).

(13) Place thumbs on FTF CCA card ejectors and flip back toward sides of card cage to release FTF CCA.

(14) Remove FTF CCA from card cage assembly.

(15) Release excess fiber on FTF CCA by pulling on velcro fiber retainers.

b. Replace FTF CCA.

CAUTION

Optical fibers are very delicate. Care must be taken not to kink or damage fibers.

(1) Place front panel assembly with front panel down.

(2) Ensure that electronic circuit card retainer screws are loosened on FTF CCA before attempting to insert CCAS in card cage assembly.

(3) Make loop in fiber approximately 2 inches in diameter. Place loop so that both velcro pieces are covered. Hold loop in place and secure to velcro.

(4) Install new FTF CCA in card cage assembly.

(5) Secure CCA by placing thumbs on card ejectors and pushing towards card.

(6) Using 3/32-inch hex key, tighten electronic circuit card retainer screws to 12 inch pounds.

(7) Turn front panel assembly over so that panel is facing up.

(8) Push biconic connector (13, Fig. 5-13) through shielding gasket (7) and receptacle washer (6).

(9) Place biconic connector (13) secured to fiber through hole 1 stamped on retainer plate (11).

(10) Install washer (12), compression spring (3), and washer (12) on biconic connector (13).

WARNING

Wear eye protection when removing or replacing retaining rings and compression springs. Hold compression springs in place when removing or replacing retainer rings. Failure to heed this warning may result in personal injury.

(11) Using retaining ring installation tool, install retaining ring (1) on front end of biconic connector (13).

(12) Place biconic connector in hole 1 stamped on retainer plate (11). Place biconic connector, plug connector, and retainer plate in biconic block so that compression springs are inside hole of biconic block (refer to Fig. 5-12).

(13) Press retainer plate down to expose back of connector where retaining ring will seat. Using retaining ring installation tool, install retaining ring on biconic connector.

(14) Install washer (12, Fig. 5-13), compression spring (3), and washer (12) on plug connector (2).

(15) Repeat steps (9) and (10), using plug connector (2) and hole 2 to secure the plug connector (2).

(16) Clean biconic connector tip with lint-free cloth moistened with isopropyl alcohol.

(17) Install biconic connector and plug connector by aligning keys on retainer plate to holes on FTF FOBC.

(18) Using nut driver, install two extension studs (5) into retainer plate (11).

(19) Align receptacle washer (6) and shielding gasket (7) to retainer plate (11).

(20) Align end plate (8) and place fiber in slot.

(21) Place two screws (9) through end plate (8), shielding gasket (7), receptacle washer (6), and into extension studs (5).

(22) Using No. 1 cross-tip screwdriver, install two screws (9) into extension studs (5). Tighten securely.

(23) Align FTS (refer to para. 5-13).

5-10. REMOVE AND REPLACE PS CCA

a. Remove PS CCA.

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

(1) Disengage power to FTS. V.

(2) Using 3/32-inch hex key, loosen two screws on electronic circuit card retainers of PS CCA (one on each side of CCA)(refer to Fig. 5-11).

(3) Place thumbs on card ejectors and flip back towards sides of card cage to release CCA.

(4) Remove faulty PS CCA by grasping card and pulling away from card cage assembly.

b. Replace PS CCA.

(1) Place front panel assembly with front panel down.

(2) Ensure that electronic circuit card retainer screws are loosened on PS CCA before attempting to insert CCAs in card cage assembly.

(3) Install new PS CCA in card cage assembly.

(4) Secure CCA by placing thumbs on card ejectors and pushing towards card.

(5) Using 3/32-inch hex key, tighten electronic circuit card retainer screws to 12 inch pounds.

5-11. REMOVE AND REPLACE OSM DISPLAY CCA.

a. Remove OSM Display CCA.

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

STATIC SENSITIVE Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

NOTE

The FTS contains many small parts and screws. Place in parts bag during disassembly.

(1) Remove PS CCA (refer to para. 5-10a).

(2) Remove FTF CCA (refer to para. 5-9a).

(3) Remove MCF CCA (refer to para. 5-8a).

(4) Disconnect OSM ribbon cable from motherboard CCA.

(5) Using offset No. 1 cross-tip screwdriver, remove five screws (1, Fig. 5-14), lock washers (2), flat washers (3), and spacers (6) securing OSM display CCA (4) to front panel.

(6) Carefully remove damaged card by grasping card and pulling away from front panel.

b. Replace OSM Display CCA.

NOTE

The OSM display CCA is the only component to be tested before installation into the FTS. Perform troubleshooting procedure malfunction 2, steps 12 thru 18, in Table 5-1, to test OSM display CCA.

(1) Using lint-free cloth moistened with water or alcohol, wipe underside of window on front panel assembly and face of OSM display.

(2) Place spacers (6, Fig. 5-14) in place on studs (5). Align new circuit card to the back of front panel.

(3) Using offset No. 1 cross-tip screwdriver, install five screws (1), lock washers (2), and flat washers (3) to secure OSM display CCA (4) to front panel.

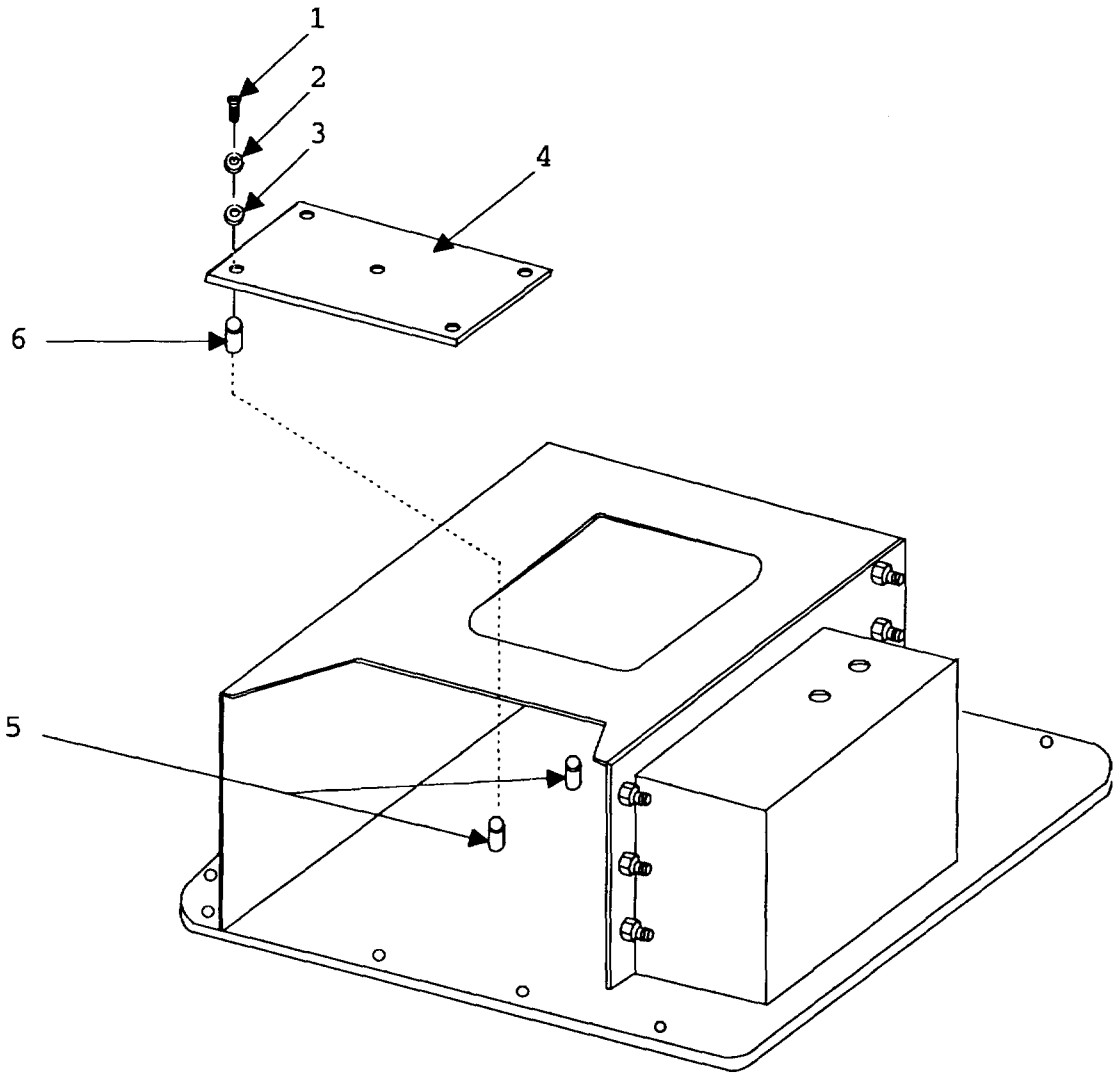


FIGURE 5-14. Panel Assembly Exploded View.

(4) Connect OSM ribbon cable P2 to J2 on motherboard CCA. Place OSM ribbon cable in cable clip (refer to Fig. 5-15).

(5) Install MCF CCA (refer to para. 5-8b).

(6) Install FTF CCA (refer to para. 5-9b).

(7) Install PS CCA (refer to para. 5-10b).

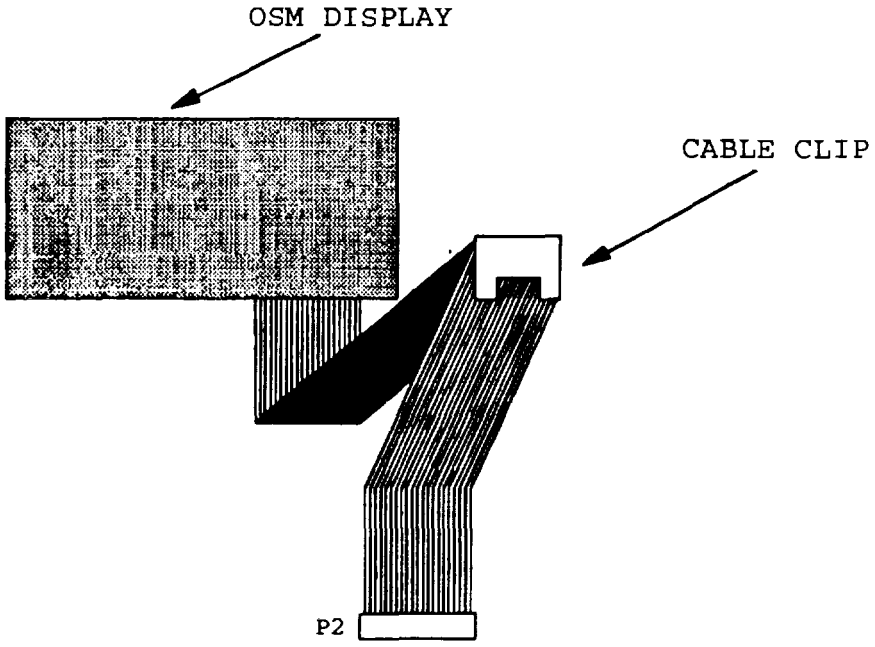


FIGURE 5-15. OSM Ribbon Cable Clip.

5-12. REMOVE AND REPLACE MOTHERBOARD CCA

a. Remove Motherboard CCA.

STATIC SENSITIVE

STATIC SENSITIVE

CAUTION

Static electricity and stray voltages can damage the FTS modules. Use an antistatic pad on the work surface and wear a grounded wrist strap when troubleshooting or handling the modules.

CAUTION

Do not disconnect the optics from the FTF CCA. If the optics are disconnected, the FTF CCA must be aligned.

(1) Disengage power to FTS.

(2) If necessary, remove MCF CCA from card cage assembly. Release excess fiber from CCA by pulling up on velcro fiber retainers.

(3) If necessary, remove FTF CCA from card cage assembly. Release excess fiber from CCA by pulling up on velcro fiber retainers.

(4) Remove PS CCA from card cage assembly, if necessary.

(5) If necessary, disengage ribbon cables at J1 and J2 by releasing ribbon cable fasteners.

(6) Using No. 1 cross-tip screwdriver, remove six screws (5, Fig. 5-16), flat washers (4), and lock washers (3) securing motherboard (2) to card cage assembly (1).

b. Replace Motherboard CCA.

(1) Align motherboard CCA to card cage assembly.

(2) Using No. 1 cross-tip screwdriver, install six screws (5, Fig. 5-16), flat washers (4), and lock washers (3) to secure motherboard CCA (2) to card cage assembly (1).

(3) Connect OSM ribbon cable P2 to J2 on motherboard CCA.

(4) Connect wiring cable P1 to J1 on motherboard CCA.

NOTE

CCAs are identified by color coding on card ejectors and card cage assembly color codes as follows:

MCF CCA	WHITE
FTF CCA	RED
PS CCA	BLACK

(5) Secure fibers in velcro straps and install CCAs in card cage assembly.

(6) Secure CCAs to motherboard connectors.

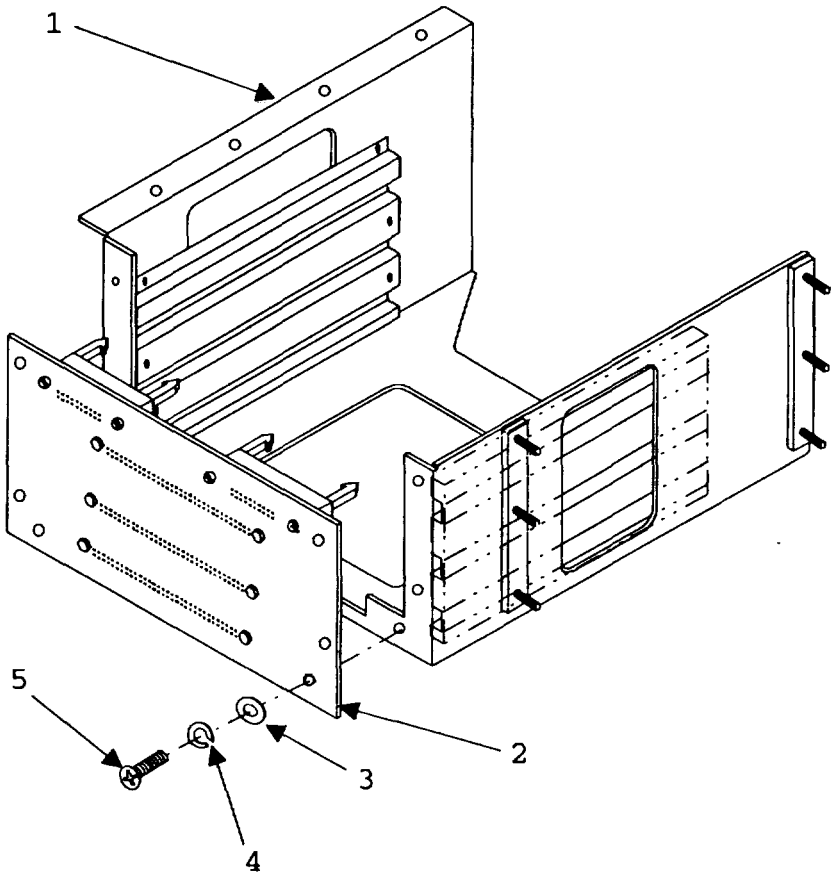


FIGURE 5-16. Card Cage Assembly Exploded View.

5-13. ALIGN ITS

a. Optical Fiber Test Set Transmitter Adjustment.

The test setup for the Optical Fiber Test Set TS-4335/G transmitter adjustment is shown in Fig. 5-17.

(1) Apply power to TS-4335/G and FTS. Allow minimum of 5 minutes for warm up. Perform steps (2) thru (4) during warm up.

(2) Connect one end of source FOCA (orange lead) to TRANSMIT port of TS-4335/G.

(3) Connect one end of detector FOCA (blue lead) to RECEIVE port of TS-4335/G.

(4) Mate fiber optic connectors of two Y-adapter cables.

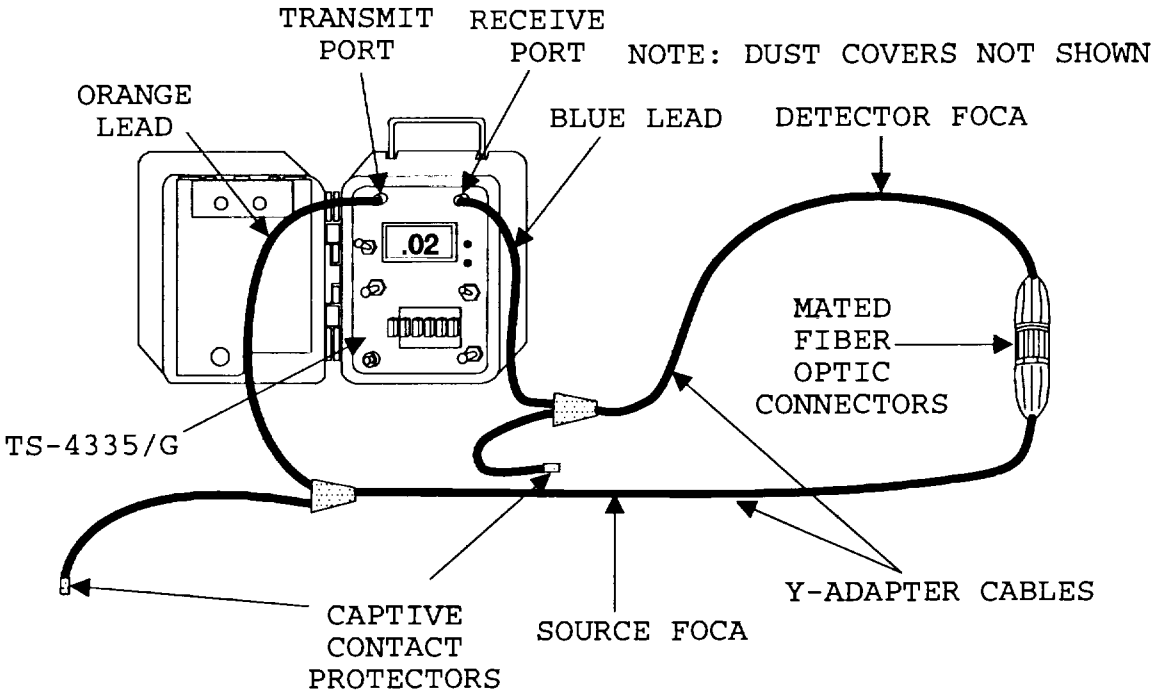


FIGURE 5-17. Test Setup for TS-4335/G Transmitter Adjustment.

(5) After warm up, adjust TS-4335/G TRANSMIT ADJUST control for reading at -20.00 dBm +0.05 dB. Proceed with para. 5-13b and record TS-4335/G and FTS display readings.

b. TS-4335/G and FTS Display Readings (-20.00 dam).

(1) Record TS-4335/G display reading in block l(b) of data sheet (refer to Fig. 5-18).

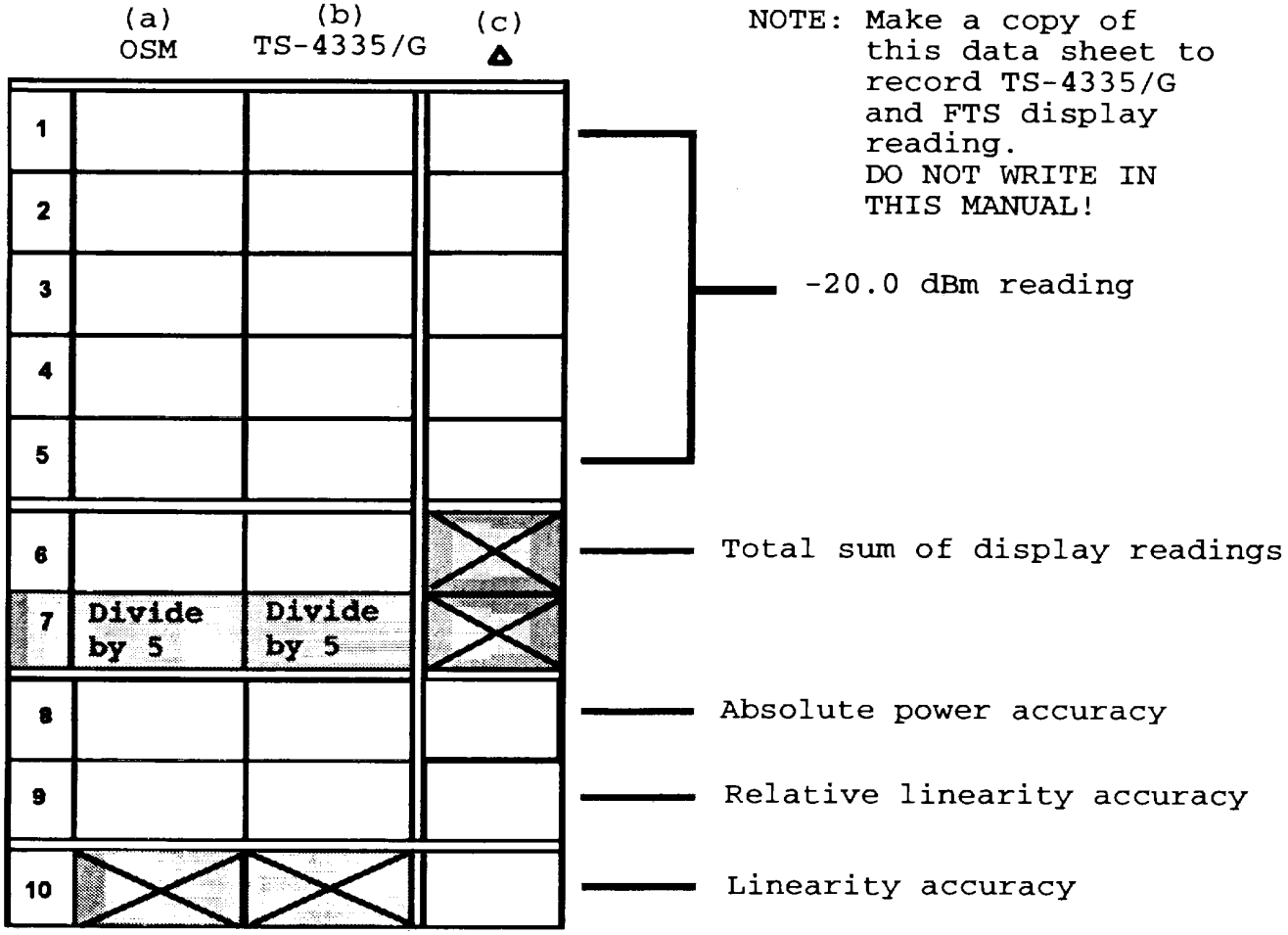
(2) Unmate fiber optic connectors of two Y-adapter cables.

(3) Connect Y-adapter cable (orange lead) from TRANSMIT port of TS-4335/G to FTF FOBC on FTS (refer to Fig. 5-19).

(4) Set MODE switch on FTS to ABS.

(5) Record FTS OSM display reading in block l(a) of data sheet.

(6) Disconnect Y-adapter cable from FTS.



INSTRUCTIONS:

Lines 1 thru 5:
- (a) Record OSM reading
- (b) Record TS-4335/G reading
- (c) Calculate Δ
  Using: Δ= (a)-(b)

Line 6:
- (a) Add l(a) thru 5(a)
- (b) Add l(b) thru 5(b)
- (c) 9(a) - 9(b)

Line 7:
- (a) Divide 6(a) by 5
- (b) Divide 6(b) by 5

Line 8:
- (a) Sum of 7(a)
- (b) Sum of 7(b)
- (c) 8(a) - 8(b)

Line 9:
- (a) OSM reading (-35.0 dBm)
- (b) TS-4335/G reading (-35.0 dBm)

Line 10:
- (c) 8(c) - 9(c)

FIGURE 5-18. Align Data Sheet.

NOTE: DUST COVERS NOT SHOWN

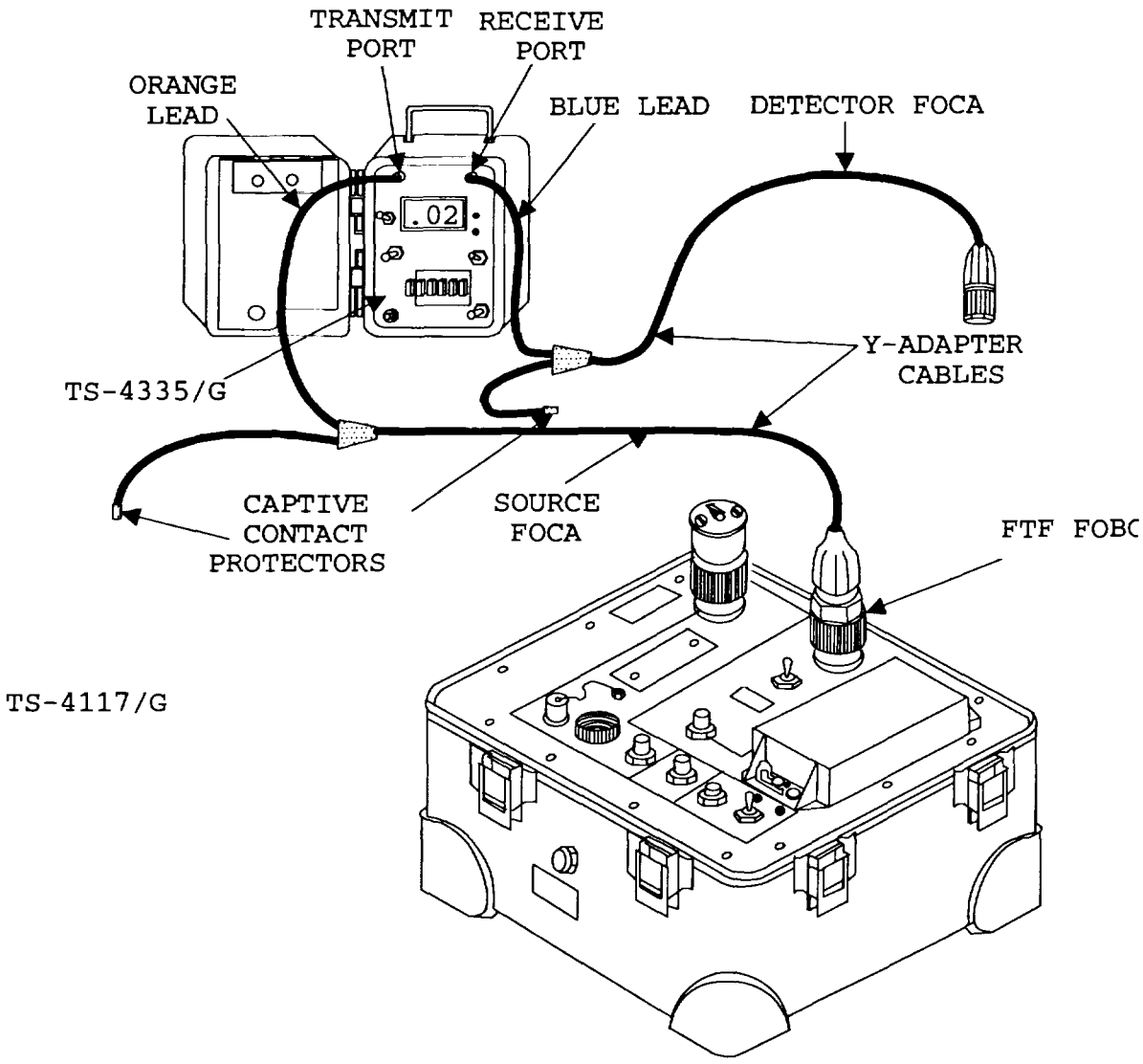


FIGURE 5-19. TS-4335/G to FTS Connection.

(7) Mate fiber optic connectors of two Y-adapter cables.

(8) Repeat TS-4335/G and FTS display readings (refer to para. 5-13a[5] and para. 5-13b) until five sets of readings are recorded. Record readings in appropriate columns of lines 2 thru 5 on data sheet.

(9) Proceed with para. 5-13c.

c. TS-4335/G and FTS Display Reading (-35.00 dBm).

(1) Ensure fiber optic connectors of two Y-adapter cables are mated.

(2) Adjust TS-4335/G TRANSMIT ADJUST control for reading of -35.00 dBm +0.05 dB.

(3) Record TS-4335/G display reading on line 9(b) of data sheet (refer to Fig. 5-18).

(4) Unmate fiber optic connectors of two Y-adapter cables.

(5) Connect Y-adapter cable (orange lead) from TRANSMIT port at the TS-4335/G to FTF FOBC on FTS.

(6) Record FTS OSM display reading in block 9(a) of data sheet.

NOTE

Follow the instructions on the data sheet to calculate the absolute power and linearity accuracy values.

(7) Refer to data sheet and calculate FTF absolute power and linearity accuracy values.

If either absolute power (line 8[c]) or linearity accuracy (line 10[c]) is greater than +1.0 dB, proceed with FTS alignment (refer to para. 5-13d).

If both the absolute power and linearity accuracy are within +1.0 dB, the FTS does not require alignment.

(8) Disassemble test setup used to align FTS.

(9) Test FTS (refer to para. 4-7).

d. Linearity Accuracy Adjustment.

(1) Review absolute power (line 8[c], Fig. 5-18) and linearity accuracy (line 10[c]) recorded reading. Refer to Fig. 5-20 while performing linearity accuracy adjustment.

If linearity accuracy is within +1.0 dB, proceed with para. 5-13e.

(2) Ensure dust cover is secured to FTF connector.

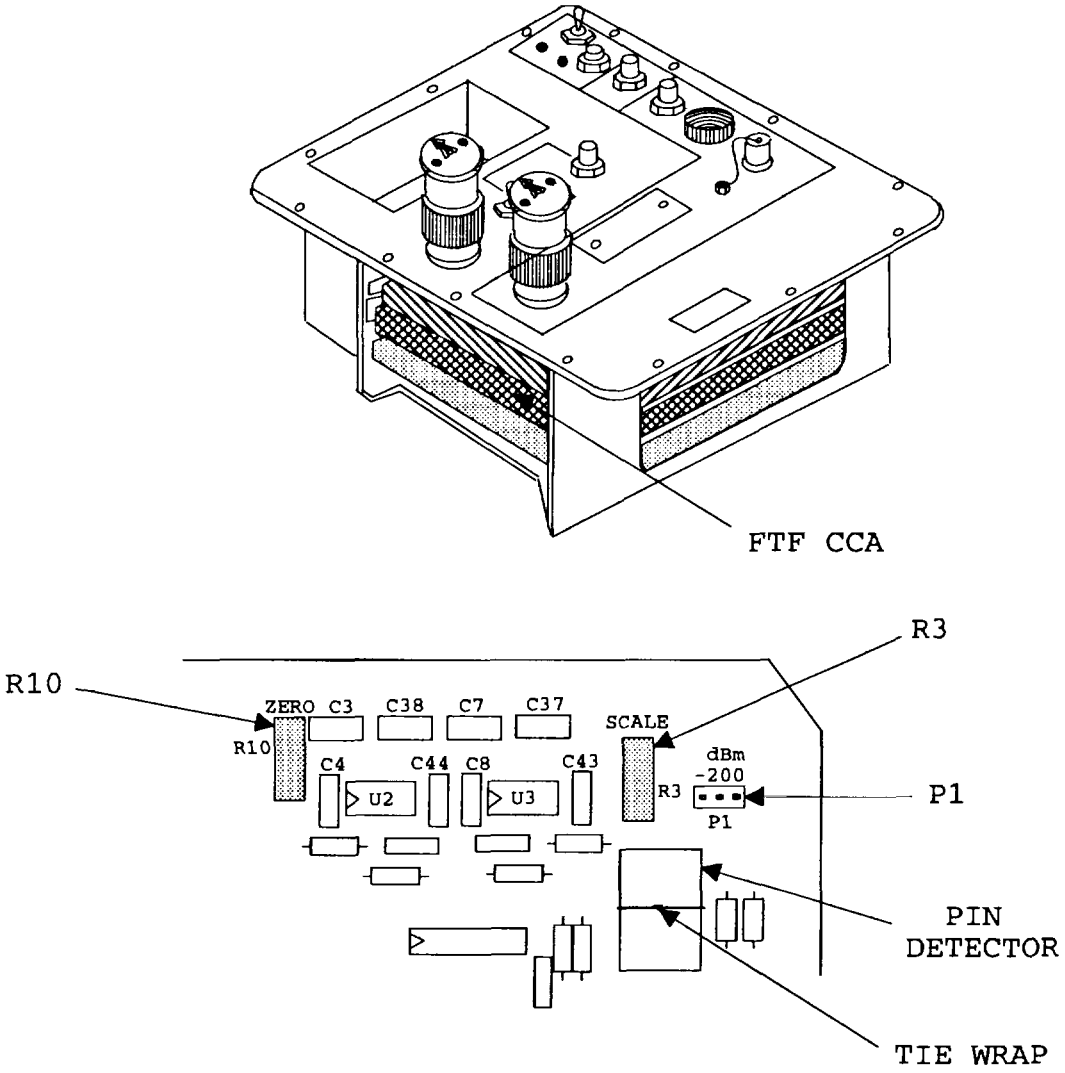


FIGURE 5-20. FTF CCA.

(3) Using diagonal cutter, cut tie wrap securing PIN detector to FTF CCA and discard.

(4) Remove PIN detector from FTF CCA, place in nonconductive foam and set aside.

(5) Locate P1 on FTF CCA.

(6) Attach micro-clip jumper between center pin of P1 and pin marked 00.0 dBm on FTF CCA.

(7) Locate R10 (zero potentiometer) on FTF CCA.

(8) Adjust R10 for OSM display reading of 00.0 dBm +0.1 dB.

(9) Attach micro-clip jumper between center pin of P1 and pin marked -20.0 dBm on FTF CCA.

(10) Locate R3 (scale potentiometer).

(11) Adjust R3 for OSM display reading of -20.0 dBm +0.1 dB.

(12) Remove micro-clip jumper from P1.

(13) Install PIN detector on FTF CCA.

(14) Using new tie wrap, secure PIN detector to FTF CCA.

(15) Verify FTS linearity accuracy by repeating para. 5-13a(5) thru para. 5-13c.

(16) The linearity accuracy adjustment is complete. Perform absolute power adjustment (refer to para. 5-13e).

e. Absolute Power Adjustment.

(1) Mate fiber optic connectors of two Y-adapter cables.

(2) Adjust TS-4335/G TRANSMIT ADJUST control for reading of -20.00 dBm +0.05 dB.

(3) Unmate fiber optic connectors of two Y-adapter cables.

(4) Connect Y-adapter cable (orange lead) from TRANSMIT port of TS-4335/G to FTF FOBC on FTS.

(5) Set MODE switch on FTS to REL.

(6) Press and release the CAL switch to zero OSM display.

NOTE

The negative value for the value recorded in the absolute power accuracy measurement (line 8[c], Fig. 5-17, on the data sheet) is used in the following steps.

Example of the negative value: If the value of line 8(c) is -1.3 dBm, then the negative value is +1.3 dBm.

(7) Adjust R10 (zero potentiometer) for OSM display reading equal to negative value for value recorded in absolute power accuracy (line 8[c]).

(8) Disconnect Y-adapter cable from FTF FOBC.

(9) Mate fiber optic connectors of two Y-adapter cables.

(10) Adjust TS-4335/G TRANSMIT ADJUST control for reading of -20.00 dBm +0.05 dBm.

(11) Record reading in block l(b) of data sheet.

(12) Unmate the fiber optic connectors of the two Y-adapter cables.

(13) Connect Y-adapter cable (orange lead) from the TRANSMIT port of TS-4335/G to FTF FOBC on FTS.

(14) Set MODE switch on FTS to ABS.

(15) Observe OSM display reading.

If OSM display reading exceeds 1.0 dB and FTF CCA has not been replaced, replace FTF CCA (refer to para. 5-9b).

If FTF CCA has been replaced and OSM display reading still exceeds 1.0 dB, refer to higher level maintenance.

If the OSM reading is less than or equal to 1.0 dB, alignment of the FTS is complete.

(16) Test FTS (refer to para. 4-7).

5-14. ASSEMBLE FTS

a. Ensure all CCAs are securely connected.

b. Install front panel assembly (1, Fig. 5-21) into case bottom (4).

c. Using No. 2 cross-tip screwdriver, install 14 screws (2) securing panel assembly to case bottom.

d. Using No. 2 cross-tip screwdriver install two screws (3) in battery compartment securing panel assembly to shock absorber located in case bottom.

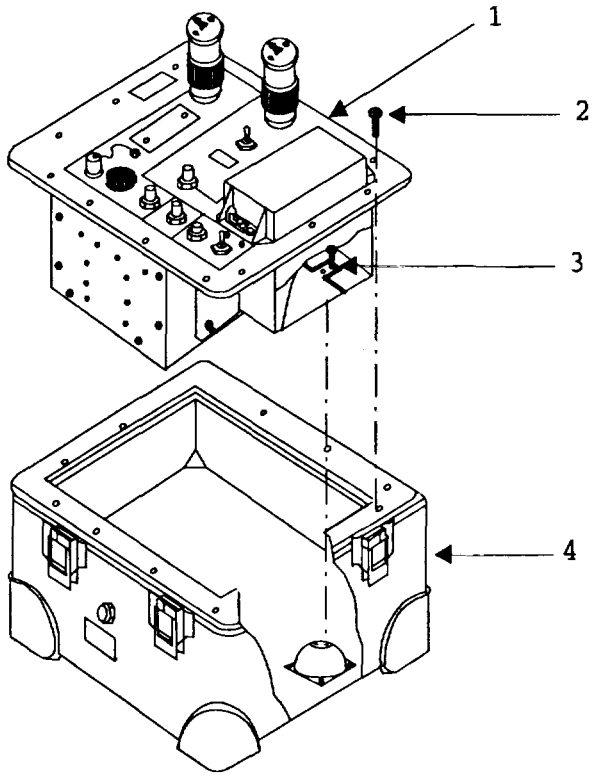


FIGURE 5-21. FTS Assembly.

APPENDIX A
REFERENCES

A-1. SCOPE

This appendix lists all forms, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS

Product Quality Deficiency Report.....SF 368
Recommended Changes to Equipment Technical Publications ..... DA Form 2028-2
Recommended Changes to Publications and Blank Forms .....DA Form 2028
Report of Discrepancy (ROD) .....SF 364
Transportation Discrepancy Report (TDR).....SF 361

A-3. DEPARTMENT OF THE ARMY PAMPHLETS

Consolidated Index of Army Publications and Blank Forms ..... DA Pam 25-30
Maintenance Management Update ..... DA Pam 738-750

A-4. TECHNICAL MANUALS

Operator's, Unit, and Direct Support Maintenance Manual Including Repair Parts and Special Tools List: Fiber Optic Modem-Receiver-Transmitter MD-1272/G ..... TM 11-5895-1518-13&P
Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command) ..... TM 750-244-2
Unit and Direct Support Maintenance Manual: Fiber Optic Cable Assemblies CX-13295/G (300 M) and CX-13295/G (1000 M)..... TM 11-6020-200-23&P

A-5. MISCELLANOUS PUBLICATIONS

Warranty Program for test Set, Optical Communications - TS-4117/G.....TB 11-6625-3227-35

APPENDIX B
MAINTENANCE ALLOCATION

SECTION I
INTRODUCTION

B-1. GENERAL

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the Optical Communications Test Set TS-4117/G.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility of the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e. to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

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

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

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard or known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3rd position code of the SMR code.

i. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, and disassembly/ assembly, procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

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

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

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

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number will be "00".

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

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see preceding section "Maintenance Functions".)

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average amount of time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time, in addition to the time required to perform the specific tasks identified for maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance levels are as follows:

C.....	Operator or Crew (Unit)
O.....	Organizational Maintenance (Unit)
F	Direct Support Maintenance
H.....	General Support Maintenance
L	Specialized Repair Activity (SRA)
D.....	Depot Maintenance

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

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. Explanation of Columns in Tool and Test Equipment Requirements Section III

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

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

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

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The Manufacturer's Part Number.

B-5. EXPLANATION OF COLUMNS IN REMARKS SECTION IV

a. Column I, Reference Code. The code recorded in Column 6, Section II.

b. Column II, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MAINTENANCE ALLOCATION CHART (MAC) FOR TEST SET, OPTICAL COMMUNICATIONS TS-4117/G

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS/ EQUIP	(6) REMARKS
			C	O	F	H	D		
00	TEST SET,	INSPECT	01						A
	OPTICAL	TEST		0.2					B
	COMMUNICATIONS	REPLACE		0.1					
		SERVICE		0.1					C
		REPAIR		0.1				2	D
		TEST			0.2			1	E
		REPAIR			0.6			1,3-8	F
01	PANEL ASSEMBLY	REPAIR		0.1				2	D
		REPAIR			1.2			1,3-8	G
0101	CARD CAGE ASSY	REPAIR			0.4			1,3	H
02	REFERENCE CABLE ASSY	SERVICE		0.1					A
		REPLACE		0.1					
		REPAIR			0.6				I
03	FOLBC	SERVICE		0.1					A
		REPLACE		0.1					
		REPAIR			0.6				I
04	H-250/U HANDSET	REPLACE		0.1					

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR TEST SET, OPTICAL COMMUNICATIONS TS-4117/G

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE NUMBER	NATIONAL/NATO STOCK NUMBER	TOOL
1	F	TOOL KIT, ELECTRONIC EQUIPMENT, TK-100/G	5180-00-605-0079	
2	O	TOOL KIT, ELECTRONIC EQUIPMENT, TK-101/G	5180-00-064-5178	
3	F	TOOL KIT, ELECTRONIC EQUIPMENT, TK-105/G	5180-00-610-8177	
4	F	MULTIMETER, DIGITAL AN/PSM-45A	6625-01-265-6000	27/FM W/ACCE
5	F	DC VOLTAGE SOURCE	6130-00-163-6201	HP-6443B
6	F	OSM TEST FIXTURE		10346901
7	F	FIBER OPTIC CABLE TEST SET TS4335/G	6625-01-316-2753	A3102752
8	F	WORKSTATION KIT, ELECTROSTATIC CONTROL	4940-01-087-3458	
9	F	REPAIR KIT, CABLE, MK2495/G	6080-01-208-1817	

SECTION IV. REMARKS FOR TEST SET, OPTICAL COMMUNICATIONS TS-4117/G

REFERENCE CODE	REMARKS
A	Visual inspection.
B	Verification of system operation using built-in-test (BIT).
C	Service at unit level is limited to cleaning of optical connectors on the front panel, FOLBC and reference cable assembly.
D	Repair at unit level is limited to the removal and replacement of lanyard assemblies, dust covers, battery, battery cover assembly, switch actuator assembly, FOLBC, reference cable assembly, and H-250/U handset.
E	Test using common test equipment to isolate defective replaceable unit.
F	Repair at direct support level includes removal and replacement of pressure relief valves, vibration mount, all CCAs. Alignment of the FTF CCA is also authorized.
G	Repair of panel assembly at direct support level includes removal and replacement of all knobs and switches, MCF/FTF FOBCs (to include piece parts), and OSM Display Window.
H	Repair of the card cage assembly is limited to removal and replacement of the motherboard CCA.
I	Refer to TM 11-6020-200-23&P for maintenance of reference cable assembly and FOLBC.

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS
LISTS

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists components of the end item and basic issue items for the Optical Communications Test Set TS-4117/G to help you inventory the items for safe and efficient operation of the equipment.

C-2. GENERAL

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

a. Section II, Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the Optical Communications Test Set TS-4117/G, but they are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the item.

b. Section III, Basic Issue Items. These are essential items required to place the Optical Communications Test Set TS-4117/G in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the Optical Communications Test Set TS-4117/G during operation and when it is transferred between property accounts. Listing these items is your authority to request/ requisition them for replacement based on the authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. EXPLANATION OF COLUMNS

a. Column (1), Illustration Number. Column (1) gives you the number of the item illustrated.

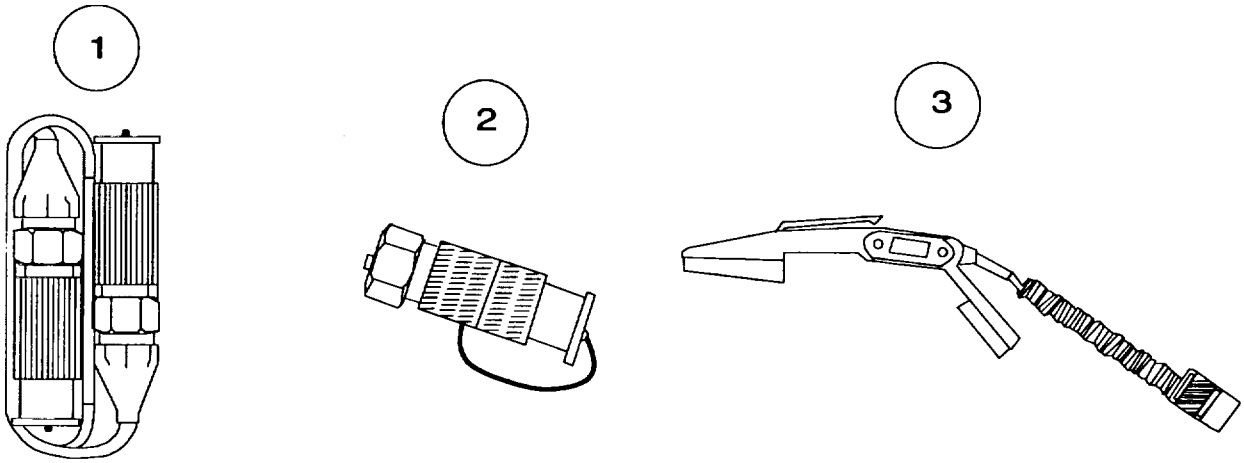
b. Column (2), National Stock Number. Column (2) identifies the stock number of the item to be used for requisitioning purposes.

c. Column (3), Description and Usable on Code. Column (3) identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parenthesis) and the part number.

d. Column (4), U/I (unit of issue). Column (5) indicates how the item is issued for the National Stock Number shown in column 2.

e. Column (5), Qty Rqd. Column (5) indicates the quantity required.

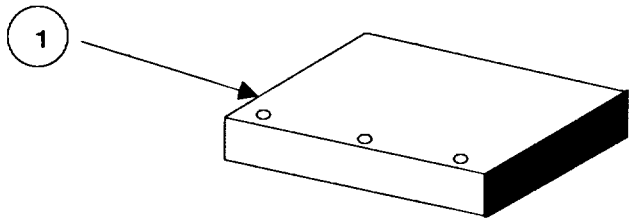
SECTION II. COMPONENTS OF END ITEM LIST



(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC And Part number Usable On Code	(4) U/I	(5) Qty Rqd
1		Reference Cable Assembly (80063) A3102721	EA	1
2		Fiber Optic Loopback Connector (81349) M83526/14-02	EA	1
3		Handset (80058) H-250/U	EA	1

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, (CAGEC) AND PART NUMBER USABLE ON CODE	(4) U/M	(5) QTY RQD
1		Reference Cable Assembly (80063) A3102721	EA	1
2		Fiber Optic Loopback Connector 81349) M83526/14-02	EA	1
3		Handset 80058) H-250/U	EA	1

SECTION III. BASIC ISSUE ITEMS



(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC And Part Number	Usable On Code	(4) U/I	(5) Qty Rqd
1		Technical Manual TM 11-6625-3227-13&P		EA	1

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, (CAGEC) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQD
1		Technical Manual TM 11-6625-3227-13&P		EA	1

APPENDIX D
ADDITIONAL AUTHORIZATION LIST ITEMS

SECTION I. INTRODUCTION

D-1. SCOPE

This appendix lists additional items that are authorized for the support of the Optical Communications Test Set TS-4117/G.

D-2. GENERAL

This list identifies items that do not have to accompany the TS-4117/G and that do not have to be turned in with the TS-4117/G. These items are all authorized by CTA, MTOE, TDA, OR JTA.

D-3 EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

SECTION II. ADDITIONAL AUTHORIZATION LIST (AAL)
ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM AND PART NUMBER	USABLE ON CODE	(3) U/M	(4) QTY AUTH
6135-01-036-3495	Battery, Lithium (81349) BA-5590/U		EA	1

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

E-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the Optical Communications Test Set TS-4117/G. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS

a. Column (1) Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, Item 5, Appendix E").

b. Column (2) Level. This column identifies the lowest level of maintenance that requires the listed item.

C – Operator or Crew (Unit)
O – Organizational (Unit)
F – Direct Support
H – General Support

c. Column (3) - National Stock Number (NSN). This is the NSN assigned to the items. Use the NSN to request or requisition the item.

d. Column (4) - Description. Indicates the Federal Item Name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.

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

SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	0	8305-00-222-2423	CLOTH, CHEESE, LINT-FREE (81348) CCC-C-440	PK
2	0		REFRIGERANT 12, COMPRESSED (80068) A3102618	OZ
3	0		THREAD LOCKING COMPOUND, TYPE II GRADE N (96906) MIL-S-46163	CC
4	0		ISOPROPYL ALCOHOL, USP-REAGENT GRADE, COMPRESSED (80063) A3102617	OZ
5	0		COTTON SWABS (APPLICATOR, DISPOSABLE) (81348) A-A-53101	EA
6	0		PRESSURIZED AIR, OIL FREE	OZ
7	0		TAPE, CELLOPHANE	RL
8	0		TAPE, SHIPPING	RL
9	0		PAINT BRUSH, SQUARE-EDGE	EA

APPENDIX F
UNIT AND DIRECT SUPPORT MAINTENANCE
REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

TABLE OF CONTENTS

Section I. INTRODUCTION

F-1. SCOPE.

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of unit and direct support maintenance of the TS-4117/G. It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the Source, Maintenance and Recoverability (SMR) codes.

F-2. GENERAL.

In addition to Section I, Introduction, this Repair Parts and Special Tools List (RPSTL) is divided into the following sections:

a. *Section II Repair Parts List.* A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. This list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in item name sequence. Repair parts kits are listed separately in their own functional groups within Section II. Repair parts for repairable special tools are also listed in this section. Items listed are shown on the associated illustration(s) / figure(s).

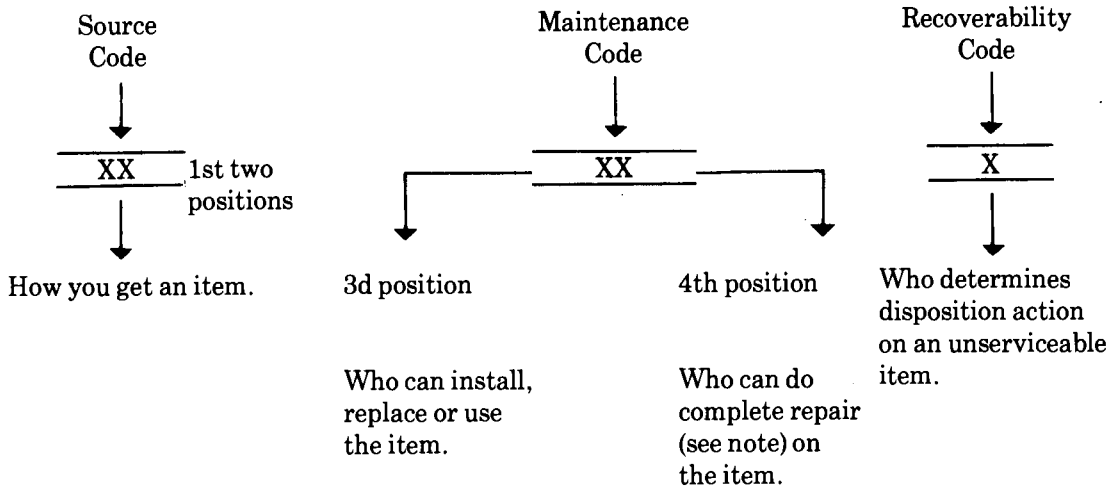
b. *Section III Special Tools List.* A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in DESCRIPTION and USABLE ON CODE column) for the performance of maintenance.

c. *Section IV Cross-reference Index.* A list, National Item Identification Number (NIIN) sequence, of all national stock numbered items appearing in the listing, followed by a list of alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure and item number index lists figure and item numbers in alphanumeric sequence and cross-references NSN, CAGE and part numbers.

F-3. EXPLANATION OF COLUMNS (SECTIONS II AND III).

a. *ITEM NO. (Column 1).* Indicates the number used to identify items called out in the illustration.

b. *SMR CODE (Column 2).* The Source, Maintenance and Recoverability (SMR) code is a 5-position code containing supply/ requisitioning information, maintenance category authorization criteria, and disposition instructions, as shown in the following breakout:



*Complete Repair: Maintenance capacity, capability and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) Source Code. The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/ equipment. Explanations of source codes follow:

Code	Explanation
PA PB PC PD PE PF PG	Stocked items. Use the applicable NSN to request/ requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR Code. **NOTE: Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3rd position of the SMR Code. The complete kit must be requisitioned and applied.

MO—Made at org/ AVUM category
MF—Made at DS/ AVUM category
MH—Made at GS category
ML—Made at Specialized Repair Activity (SRA)
MD—Made at Depot

Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the Description and Usable On Code (UOC)column and listed in the Bulk Material group of the repair parts list in the RPSTL. If the item is authorized to you by the 3rd position of the SMR Code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.

AO—Assembled by org/AVUM category
AF—Assembled by DS/AVUM category
AH—Assembled by GS category
AL—Assembled by SRA
AD—Assembled by Depot

Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position of the SMR Code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.

XA- Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.

XB- Item is not procured or stocked. If not available through salvage, requisition.

XC- Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number.

XD- A support item that is not stocked. When required, item will be procured through normal supply channels.

NOTE: Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those sources coded "XA' or those aircraft support items restricted by requirements of AR 700-42.

(2) Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to USE and REPAIR support items.

(a) The maintenance codes are entered in the third and fourth positions of the SMR Code as follows: (a) The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance:

Code	Application/Explanation
C	Crew or operator maintenance done within organizational or aviation unit maintenance.
O	Unit/organizational or aviation unit category can remove, replace, and use the item.
F	Intermediate/direct support or aviation intermediate level can remove, replace, and use the item.
H	Intermediate/general support level can remove, replace, and use the item.
L	Specialized Repair Activity (SRA) can remove, replace, and use the item.
D	Depot level can remove, replace, and use the item.

(b) The maintenance code entered in the fourth position tells whether or not the item is to be replaced and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions). (NOTE: Some limited repair may be done on the item at a lower level of maintenance if authorized by the MAC and SMR Codes.) This position will contain one of the following maintenance codes:

Code	Application/Explanation
O	Unit/organizational or (aviation unit) is the lowest level that can do complete repair of the item.
F	Intermediate/direct support or aviation intermediate is the lowest level that can do complete repair of the item.

H Intermediate/general support is the lowest level that can do complete repair of the item.

L Specialized Repair Activity (SRA) (designate the SRA) is the lowest level that can do complete repair of the item.

D Depot is the lowest level that can do complete repair of the item.

Z Nonrepairable. No repair is authorized.

B No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

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

Recoverability Codes	Application/Explanation
Z	Nonrepairable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3rd position of the SMR Code.
O	Repairable item. When uneconomically repairable, condemn and dispose of the item at unit/organizational or aviation unit level.
F	Repairable item. When uneconomically repairable, condemn and dispose of the item at the intermediate/direct support or aviation intermediate level.
H	Repairable item. When uneconomically repairable, condemn and dispose of the item at the intermediate/general support or aviation intermediate level.
D	Repairable item. When beyond lower level repair capability, return to depot condemnation and disposal of item not authorized below depot level.

Recoverability Codes	Application/Explanation
L	Repairable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA).
A	Item requires special handling or condemnation procedures because of specific reasons (e.g., precious mental content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/ directives for specific instructions.

(4) *CAGE (Column 3).* The Commercial and Government Entity (CAGE) is a 5-digit number code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

(5) *PART NUMBER (Column 4).* Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

NOTE: When you use a NSN to requisition an item, the item you receive may have a different part number from the part ordered.

(6) DESCRIPTION AND USABLE ON CODE (UOC) (Column 5). This column includes the following information:

(a) The Federal Item Name and, when required, a minimum description to identify the item.

(b) The physical security classification of the item is indicated by the parenthetical entry (insert applicable physical security classification abbreviation, e.g., Phy Sec S1 (C) Confidential, Phy Sec C1 (S) Secret, Phy Sec C1 (T) Top Secret).

(c) Items that are included in kits and sets are listed below the name of the kit or set.

(d) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

(e) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/ fabricated.

(f) When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UOC).

(g) The Usable On Code (UOC), when applicable (see page F-9, Special Information).

(h) In the Special Tools List section, the Basis Of Issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. When density of equipment supported exceeds density spread indicated in the BOI, the total authorization is increased proportionately.

(i) The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both Section II and Section III.

(7) QTY (Column 6). The QTY (Quantity per Figure column) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

F-4. EXPLANATION OF COLUMNS (SECTION IV).

a. NATIONAL STOCK NUMBER (NSN) INDEX.

(1) STOCK NUMBER column. This column lists the NSN by National Item Identification Number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN (e.g., 5305-01-674-1467). When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

(2) FIG. column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II and Section III.

(3) ITEM column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

b. PART NUMBER INDEX. Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers) through (and each following letter or digit in like order).

(1) CAGE column. The Commercial and Government Entity (CAGE) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

(2) PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

(3) STOCK NUMBER column. This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and CAGE columns to the left.

(4) FIG. column. This column lists the number of the figure where the item is identified/located in Section II and Section III.

(5) ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

c. FIGURE AND ITEM NUMBER INDEX.

(1) FIG. column. This column lists the number of the figure where the item is identified/located in Section II and Section III.

(2) ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

(3) STOCK NUMBER column. This column lists the NSN for the item.

(4) CAGE column. The Commercial and Government Entity (CAGE) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

(5) PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

F-5. SPECIAL INFORMATION.

a. KITS. Line item entries for repair parts kits appear in a group in Section II (see Table of Contents).

F-6. HOW TO LOCATE REPAIR PARTS.

a. When National Stock Number or Part Number is Not Known:

(1) First. Using the Table of Contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

(2) Second. Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) Third. Identify the item on the figure and use the Figure and Item Number Index to find the NSN.

b. When National Stock Number or Part Number is known:

(1) First. Using the National Stock Number or the Part Number Index, find the pertinent National Stock Number or Part Number. The NSN index is in National Item Identification Number (NIIN) sequence (see page I-1). The part numbers in the Part Number index are listed in ascending alphanumeric sequence (see page I-2). Both indexes cross-reference you to the illustration/figure and item number of the item you are trying to find.

(2) Second. Turn to the figure and item number, verify that the item is the one you are looking for, then locate the item number in the repair parts list for the figure.

Section II. PARTS LIST

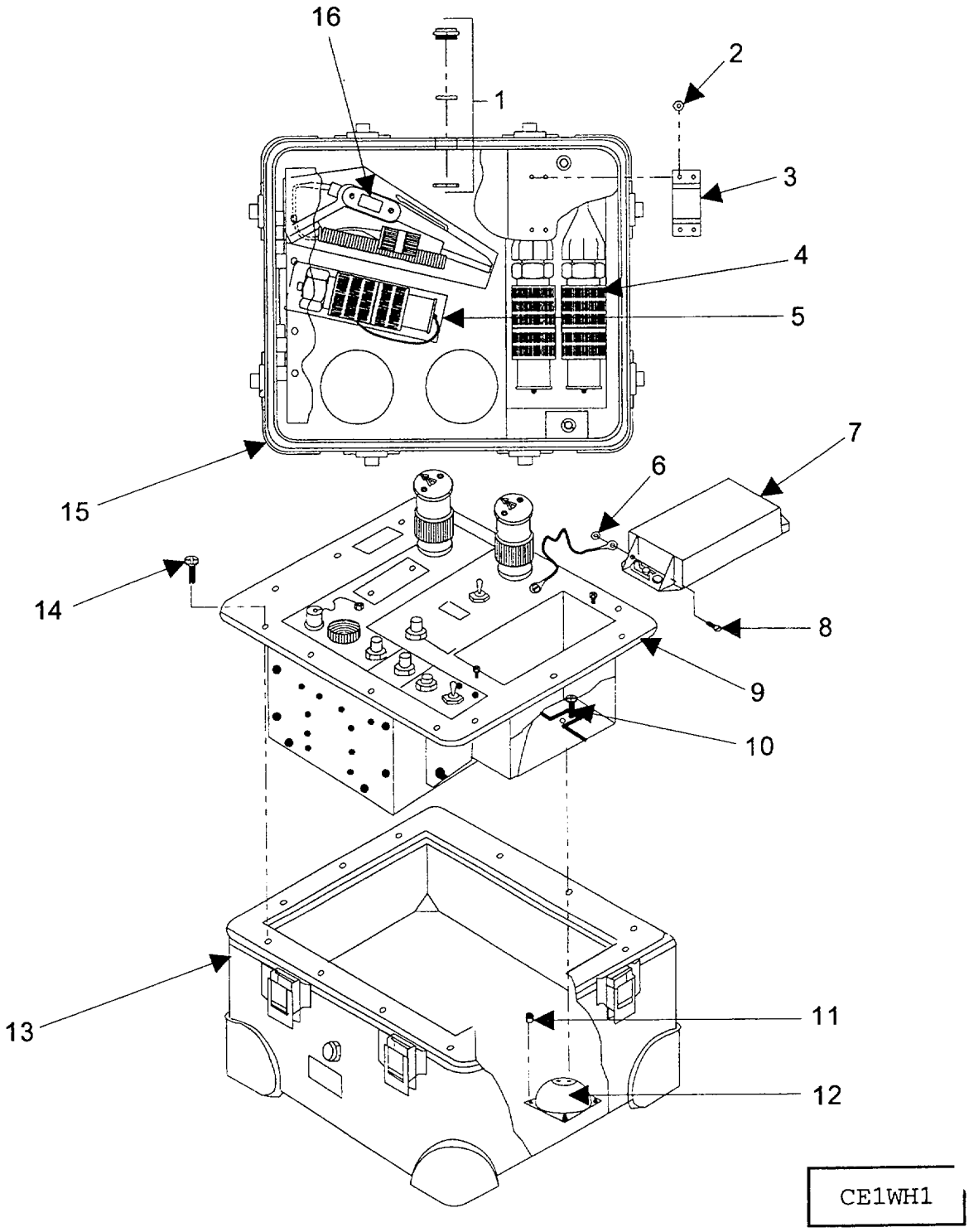


FIGURE F-1. Test Set Optical Communications TS-4117/G.

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
				GROUP: 00 FIG. F-1 TEST SET, OPTICAL COMMUNICATIONS, TS-4117/G	
1	PAFZZ	96906	MS18014-1	VALVE, PRESSURE RELIEF	2
2	PAFZZ	96906	MS21044-C06	NUT, SELF-LOCKING, HEXAGON, REGULAR	4
3	PAFZZ	80063	A3099880	SWITCH ACTUATOR ASSEMBLY	1
4	PAOFF	80063	A3102721	REFERENCE CABLE ASSEMBLY	1
5	PAOFF	81349	M83526/14-02	CONNECTOR, FIBER OPTIC, CIRC HERM	1
6	PAFZZ	96906	MS21044-C04	NUT, SELF-LOCKING, HEXAGON, REGULAR	1
7	PAFZZ	80063	A3099854	BATTERY COVER	1
8	PAFZZ	96906	MS51957-14	SCREW, MACHINE, SLOTTED, CROSS RECE	1
9	XBFDD	80063	A3099859	PANEL ASSEMBLY	1
10	PAFZZ	96906	MS51957-41	SCREW, MACHINE, SLOTTED, CROSS RECE	2
11	PAFZZ	96906	MS21044-C08	NUT, SELF-LOCKING, HEXAGON, REGULAR	4
12	PAFZZ	80063	A3099982-1	VIBRATION MOUNT, HIGH DEFLECTION	1
13	XBFZZ	80063	A3099851-10	BOTTOM, CASE	1
14	PAFZZ	96906	MS3212-35	SCREW, MACHINE, PAN HEAD, CROSS R.....	14
15	XBFZZ	80063	A3099851-11	TOP, CASE	1
16	PAOZZ	80058	H-250/U	HANDSET H-250() / 4	1
				END OF FIGURE	

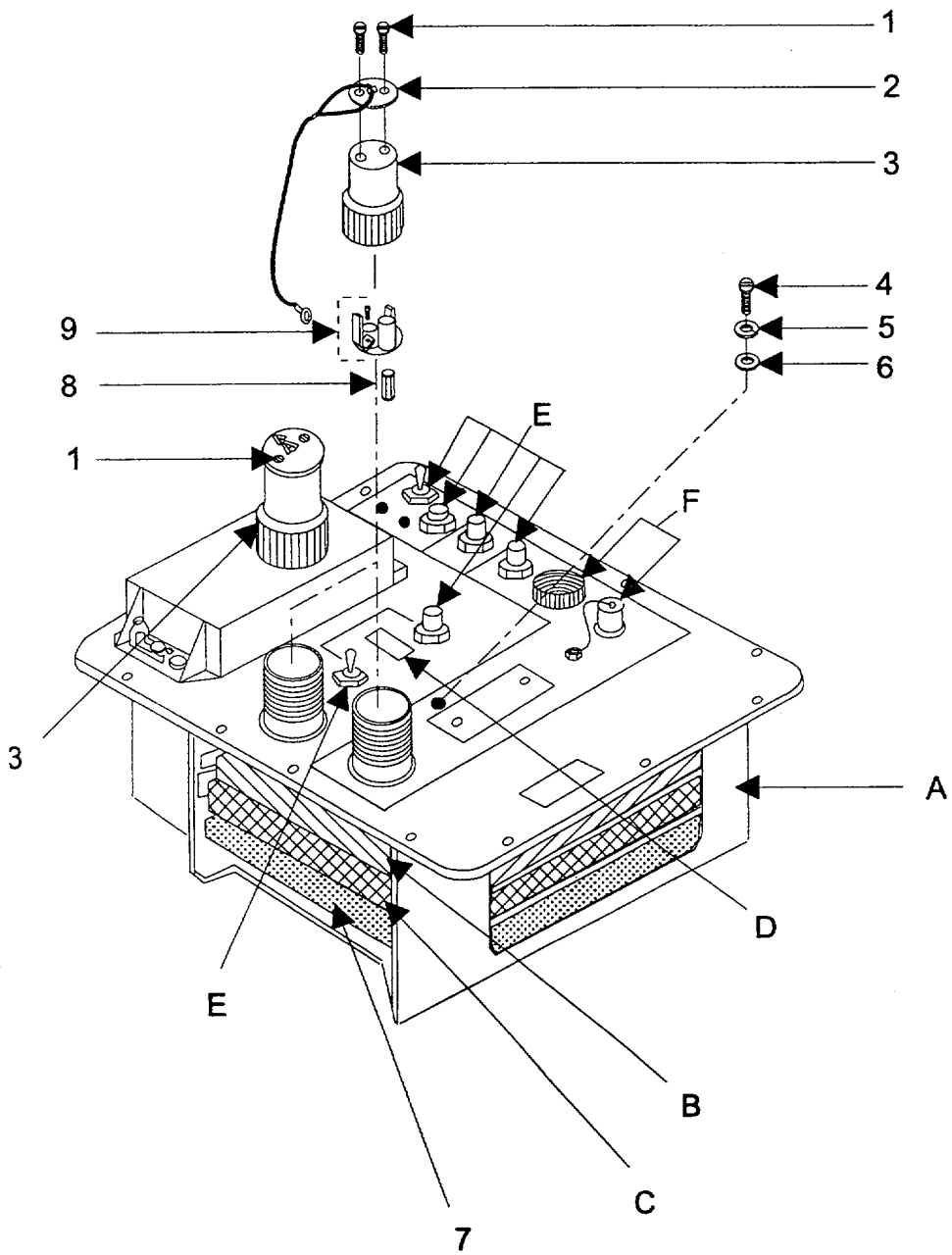
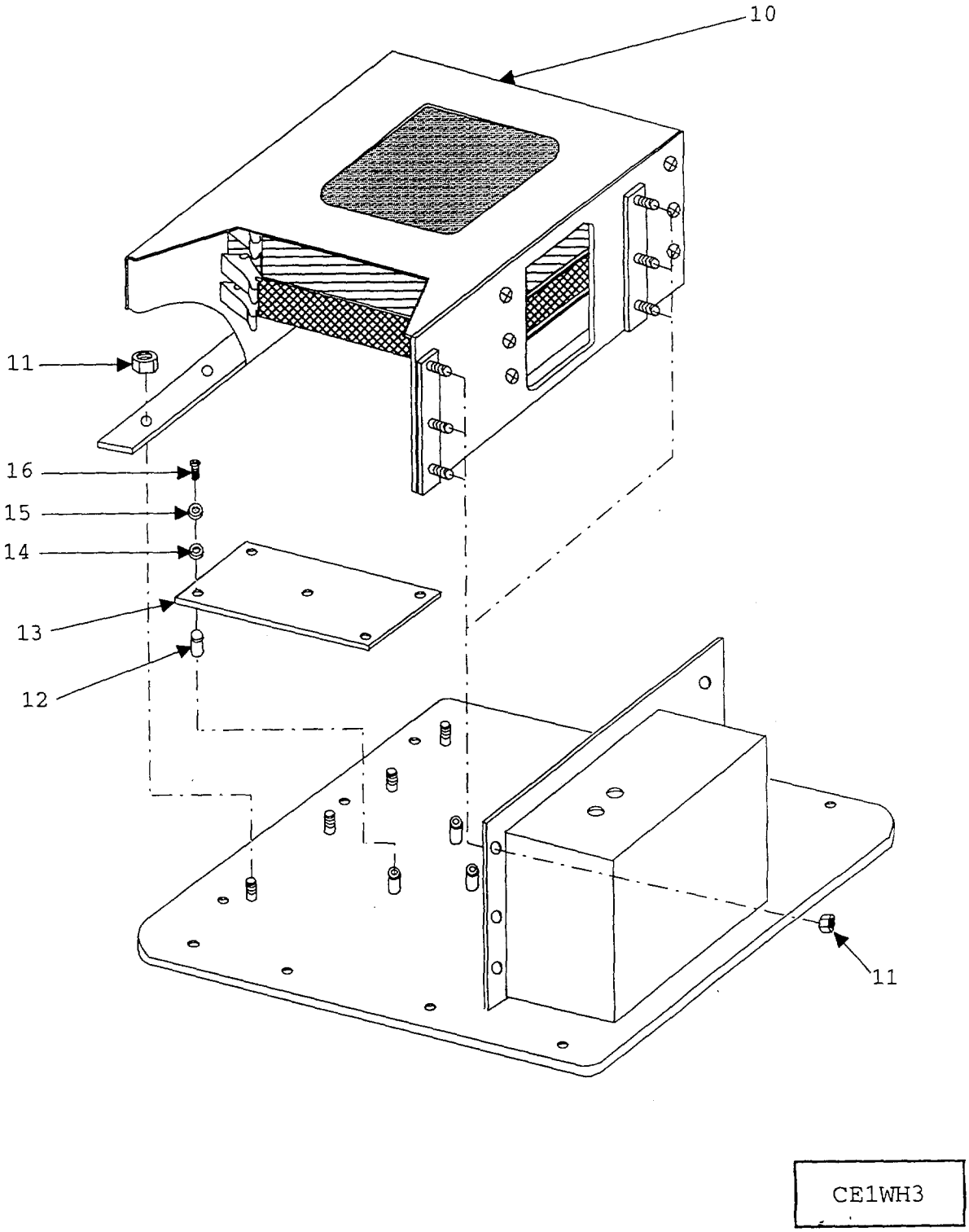


FIGURE F-2. Panel Assembly (Sheet 1 of 7).



A

FIGURE F-2. Panel Assembly (Sheet 2 of 7).

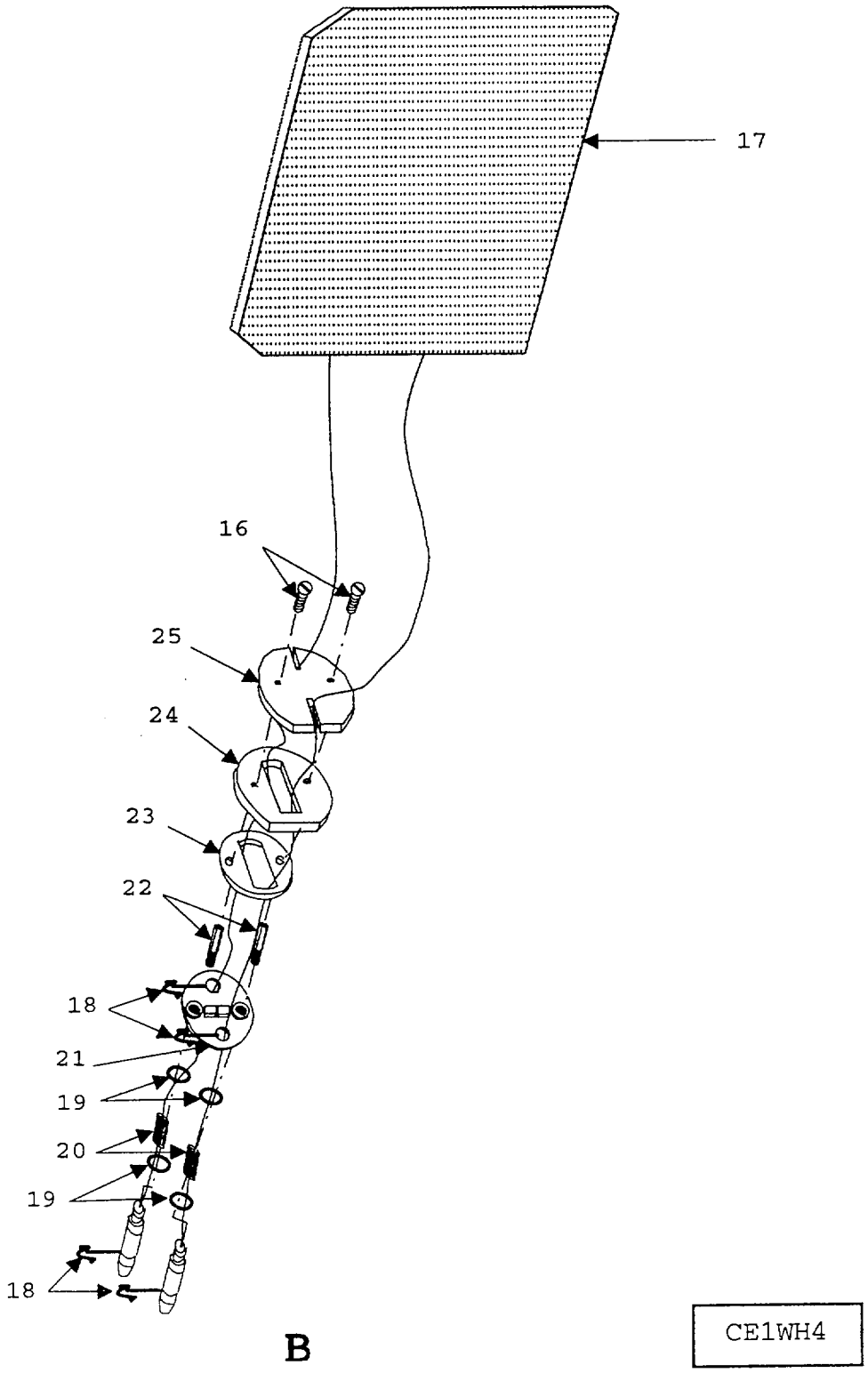


FIGURE F-2. Panel Assembly (Sheet 3 of 7).

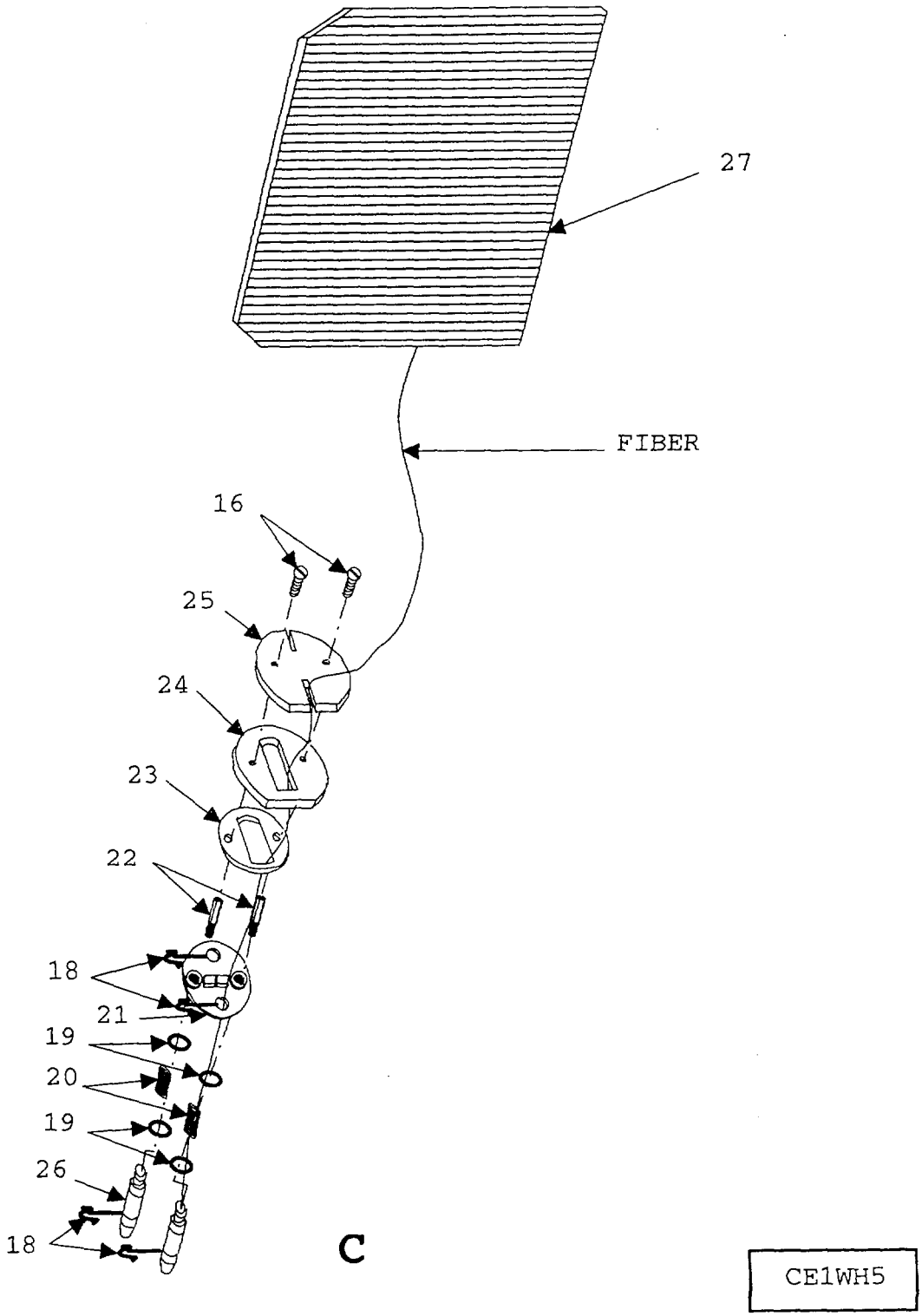


FIGURE F-2. Panel Assembly (Sheet 4 of 7).

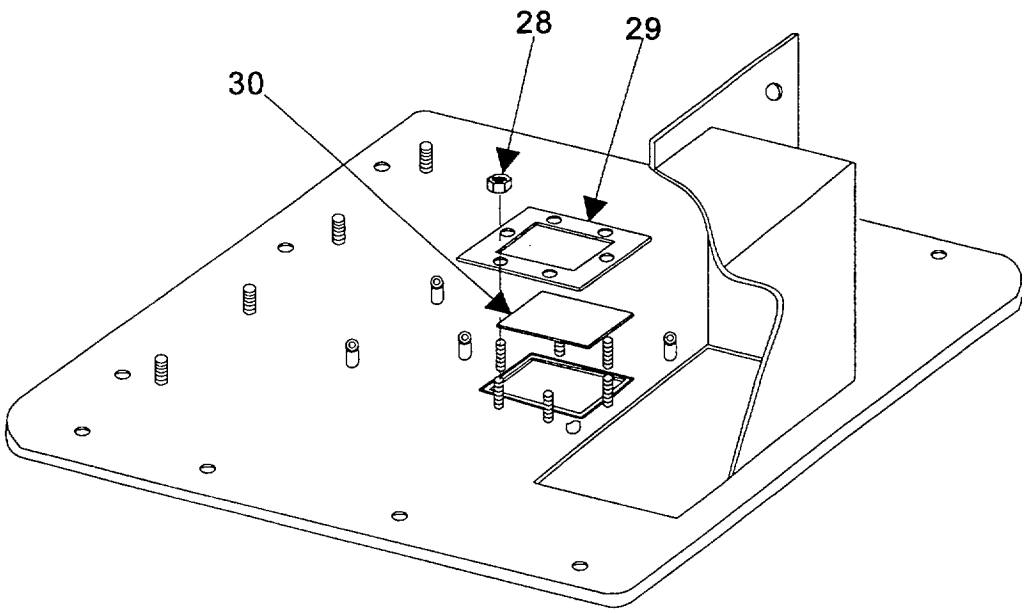


FIGURE F-2. Panel Assembly (Sheet 5 of 7).

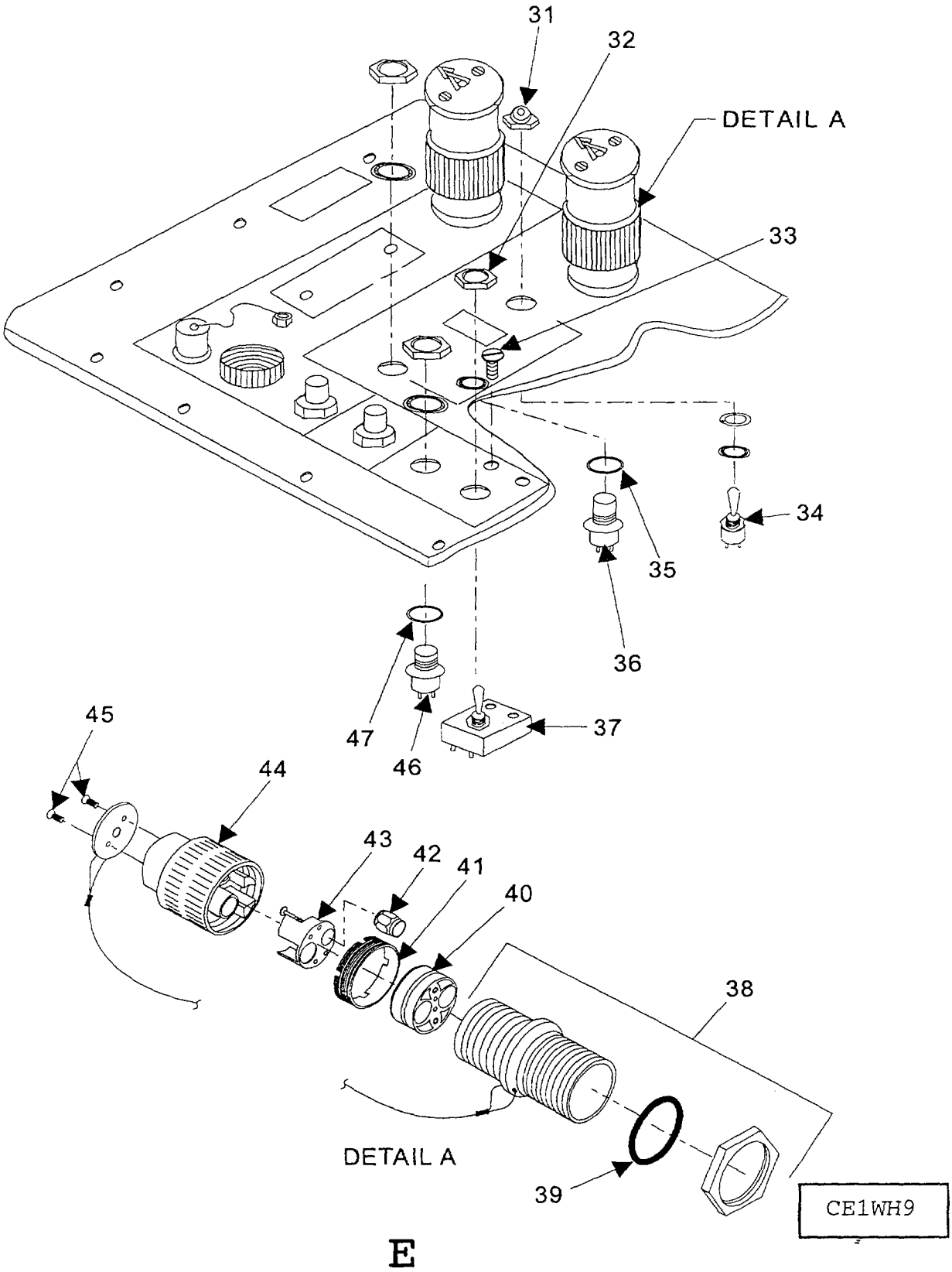


FIGURE F-2. Panel Assembly (Sheet 6 of 7).

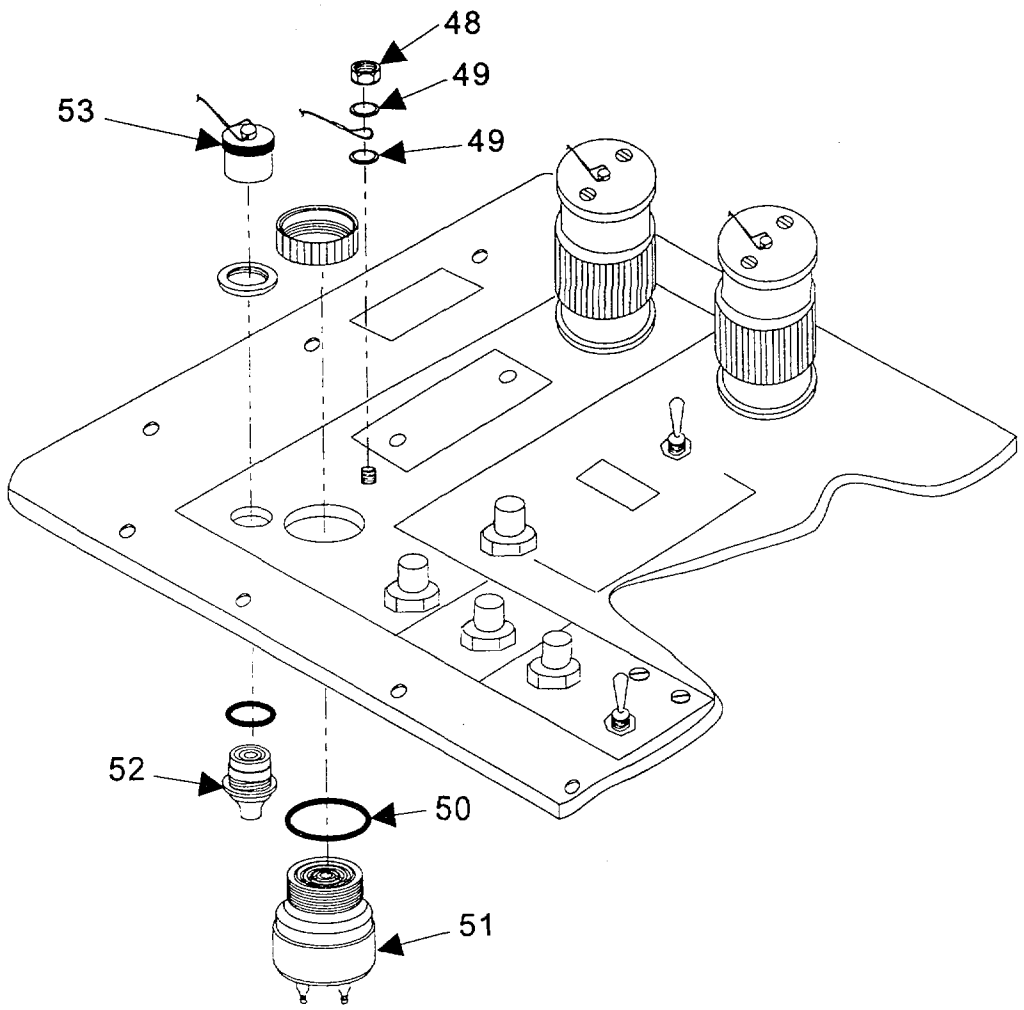


FIGURE F-2. Panel Assembly (Sheet 7 of 7).

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
				GROUP: 01 FIG. F-2 PANEL ASSEMBLY	
1	PAOZZ	96906	MS51959-13	SCREW, MACHINE	4
2	PAFZZ	80063	A3102762	LANYARD ASSEMBLY	2
3	PAOZZ	80063	A3102565	CAP, PLUG, PROTECTIVE, DUST & MSTRE	2
4	PAOZZ	96906	MS51957-43	SCREW, MACHINE, SLOTTED, CROSS RECE	1
5	PAOZZ	96906	MS35338-137	WASHER, LOCK-SPRING, HELICAL, SS, #8	1
6	PAOZZ	96906	MS15795-807	WASHER, FLAT-METAL, ROUND	1
7	PAFDD	80063	A3099865	CIRCUIT CARD ASSY, PWR SPLY	1
8	PAFZZ	80063	A3102547	SLEEVE, BICONIC	2
9	PAFZZ	80063	A3102564	RETAINER ASSEMBLY, BICONIC SLEEVE	2
10.	XBFZZ	80063	A3099886	CARD CAGE ASSEMBLY	1
11	PAFZZ	96906	MS21044-C06	NUT, SELF-LOCKING	10
12	PAFZZ	80063	A3099849	SPACER, DISPLAY	5
13	PAFDD	80063	A3099875	CIRCUIT CARD ASSY, DISPLAY	1
14	PAFZZ	96906	MS15795-804	WASHER, FLAT	5
15	PAFZZ	96906	MS35338-135	WASHER, LOCK: SPRING, HELICAL	5
16	PAFZZ	96906	MS51957-15	SCREW, MACHINE	9
17	PAFDD	80063	A3099868	CIRCUIT CARD ASSY, MCF	1
18	PAFZZ	96906	MS16632-4025	RING, RETAINING	8
19	PAFZZ	80063	A3102583	RETAINER, SPRING	8
20	PAFZZ	80063	A3102584	SPRING, HELICAL, COMP	4
21	PAFZZ	80063	A3102558	PLATE, CONTACT RETAINER	2
22	PAFZZ	80063	A3102725	STUD, EXTENSION	4
23	PAFZZ	80063	A3102726	SHIELDING GASKET, ELECTRONIC	2
24	PAFZZ	80063	A3102724	WASHER, FLAT-CONNECTOR, RECEPT	2
25	PAFZZ	80063	A3102727	END PLATE, CONNECTOR RECEPTACLE	2
26	PAFDD	80063	A3102562	PLUG CONNECTOR	1
27	PAFZZ	80063	A3099871	CIRCUIT CARD ASSY, FTF	1
28	PAFZZ	96906	MS21044-C04	NUT, SELF-LOCKING 6	
29	PAFZZ	80063	A3099895	RETAINER, WINDOW	1
30	PAFZZ	80063	A3099907	WINDOW	1

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
				GROUP: 01 FIG. F-2 PANEL ASSEMBLY (Continued)	
31	PAFZZ	81349	M5423/02-01	BOOT, DUST AND WATER SEAL, TYPE A	1
32	PAFZZ	81349	M25082-20	HEX MOUNTING NUT	1
33	PAFZZ	81349	MS35265-25	SEAL SCREW	2
34	PAFZZ	81349	MS25306-232	SWITCH, TOGGLE, POSITIVE BREAK, ENV S5	1
35	PAFZZ	96906	MS9021-016	PACKING, PREFORMED, "O"RING	3
36	PAFZZ	80063	A3099987-1	SWITCH, WATERTIGHT, SNAP ACTION, S1 S1, S2, S3	3
37	PAFZZ	81349	M39019/3-213	CIRCUIT BREAKER, MAGNETIC, LOW-PROFILE CB1	1
38	PAFZZ	80063	A3102589	RECEPTACLE, LANYARD.....	2
39	PAFZZ	80063	A3102728	PACKING, PREFORMED, "O"RING	2
40	PAFZZ	80063	A3102568	CONNECTOR BODY ASSY, FIBER OPTIC	2
41	PAFZZ	80063	A3102551	SLEEVE, LOCKING, FIBER OPTIC CONN	2
42	PAFZZ	80063	A3102547	SLEEVE, BICONIC, SINGLE MODE.....	2
43	PAFZZ	80063	A3102564	RETAINER ASSY, BICONIC SLEEVE.....	2
44	PAFZZ	80063	A3102565	CAP PLUG, PROTECTIVE, DUST & MSTRE	2
45	PAFZZ	96906	MS51959-13	SCREW, MACHINE-FLAT COUNTERSUNK HEAD	4
46	PAFZZ	80063	A3099924-1	SWITCH, WATERTIGHT, SNAP ACTION, S1 S2.....	1
47	PAFZZ	96906	MS9021-016	PACKING, PREFORMED, "O"RING	1
48	PAFZZ	96906	MS21044-C04	NUT, SELF-LOCKING, HEXAGON,.....	1
49	PAFZZ	96906	MS15795-804	WASHER, FLAT-METAL, ROUND	2
50	PAFZZ	96906	MS9021-028	PACKING, PREFORMED, "O"RING	1
51	PAFZZ	80063	A3099960-1	ALARM, AUDIBLE LS1	1
52	PAFZZ	81349	M55116/9-0	CONNECTOR, RECEPTICLE, ELECTRICAL J1	1
53	PAFZZ	80063	A3099961-1	COVER, ELECTRICAL CONNECTOR	1
				END OF FIGURE	

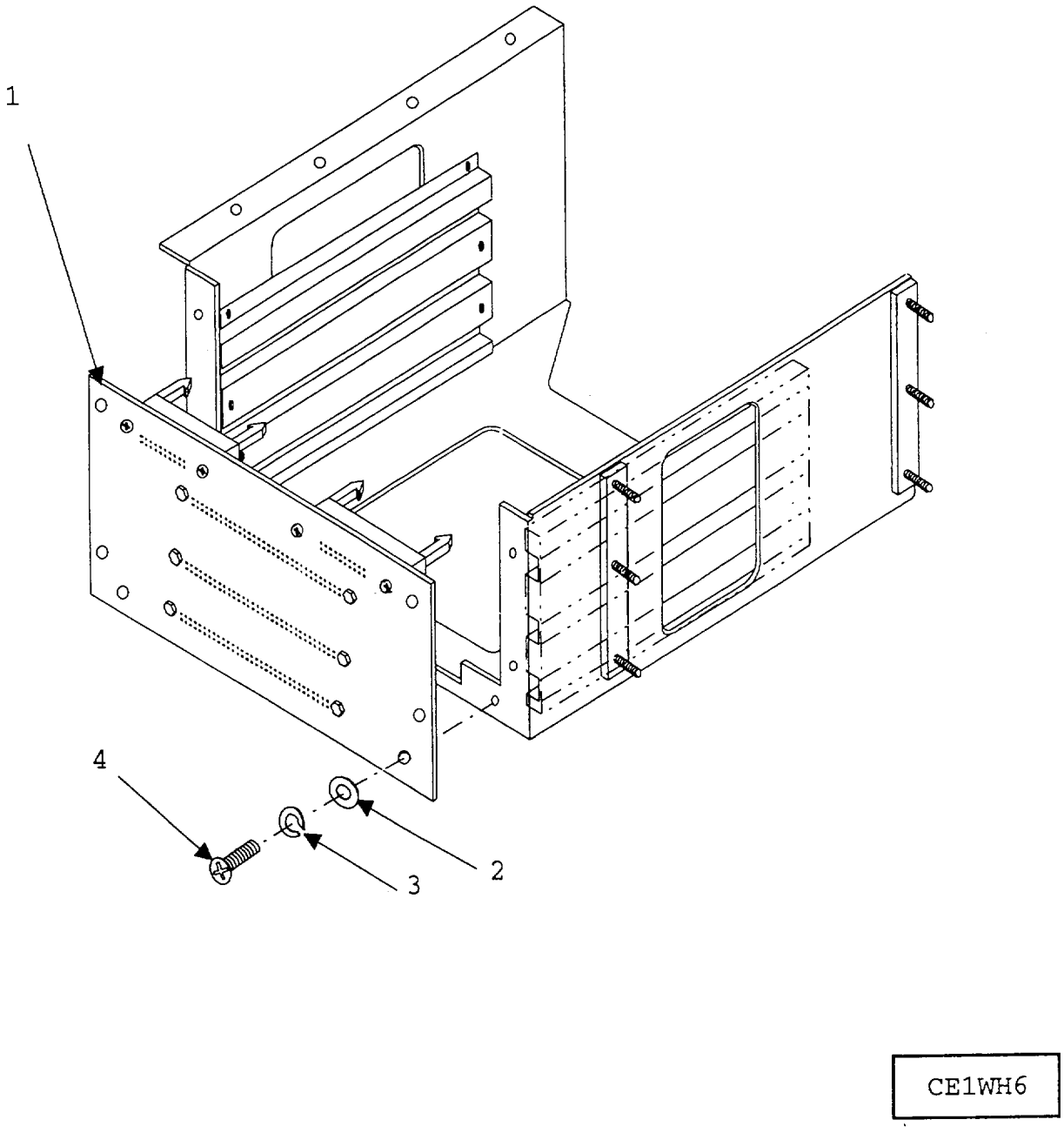


FIGURE F-3. Card Cage Assembly.

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
				GROUP: 0101 FIG F-3 CARD CAGE ASSEMBLY	
1	PAFDD	80063	A3099891	CIRCUIT CARD ASSY, MOTHERBOARD	1
2	PAFZZ	96906	MS35338	WASHER, LOCK	6
3	PAFZZ	96906	MS15795-806	WASHER, FLAT	6
4	PAFZZ	96906	MS51957-26	SCREW, MACHINE	6
				END OF FIGURE	

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5305-00-054-5649	F-2	16			
5305-00-054-6650	F-3	4			
5305-00-054-6668	F-2	4			
5305-00-455-2636	F-1	14			
5365-00-550-5937	F-2	18			
5305-00-765-4244	F-1	10			
5305-00-770-2533	F-2	1			
5310-00-782-1349	F-2	14			
5310-00-880-5976	F-3	3			
5310-00-880-5978	F-2	6			
5310-00-929-6395	F-3	2			
5310-00-933-8118	F-2	15			
5310-00-933-8119	F-2	5			
5310-00-982-6813	F-2	11			
5310-00-982-6814	F-1	11			
5965-01-247-4723	F-1	16			
6020-01-315-9906	F-1	4			
5365-01-358-2596	F-2	12			
5998-01-358-2624	F-2	17			
5998-01-358-2625	F-2	27			
5998-01-358-2626	F-2	7			
5998-01-358-2627	F-3	1			
5998-01-358-2628	F-2	13			
5340-01-358-2633	F-1	12			
5360-01-359-1485	F-2	20			
5307-01-359-3681	F-2	22			
5935-01-359-5409	F-2	9			
5365-01-359-6809	F-2	19			
5999-01-360-1457	F-2	23			
5365-01-361-0329	F-2	24			
5340-01-362-6138	F-2	3			
4010-01-362-6876	F-2	2			
6060-01-363-1094	F-2	8			
5999-01-363-3358	F-2	25			
5999-01-363-3359	F-2	21			
6060-01-377-3474	F-2	26			

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
80063	A3099849		2	12
80063	A3099851-10		1	13
80063	A3099851-11		1	15
80063	A3099854		1	7
80063	A3099859		1	9
80063	A3099865		2	7
80063	A3099868		2	17
80063	A3099871		2	27
80063	A3099875		2	13
80063	A3099880		1	3
80063	A3099886		2	10
80063	A3099891		3	1
80063	A3099895		2	29
80063	A3099907		2	30
80063	A3099924-1		2	46
80063	A3099960-1		2	51
80063	A3099961-1		2	53
80063	A3099982-1		1	12
80063	A3099987-1		2	36
80063	A3102547		2	8
80063	A3102547		2	42
80063	A3102551		2	41
80063	A3102558		2	21
80063	A3102562		2	26
80063	A3102564		2	9
80063	A3102564		2	43
80063	A3102565		2	3
80063	A3102565		2	44
80063	A3102568		2	40
80063	A3102583		2	19
80063	A3102584		2	20
80063	A3102589		2	38
80063	A3102721		1	4
80063	A3102724		2	24
80063	A3102725		2	22
80063	A3102726		2	23
80063	A3102727		2	25
80063	A3102728		2	39

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
80063	A3102762		2	2
80058	H-250/U		1	16
81349	M5423/02-01		2	31
81349	M55116/9-0		2	52
81349	M83526/14-02		1	5.
96906	MS15795-804		2	14
96906	MS15795-804		2	49
96906	MS15795-806		3	3
96906	MS15795-807		2	6
96906	MS16632-4025		2	18
96906	MS18014-1		1	1
96906	MS21044-C04		1	6
96906	MS21044-C04		2	28
96906	MS21044-C04		2	48
96906	MS21044-C06		1	2
96906	MS21044-C06		2	11
96906	MS21044-C08		1	11
81349	MS25082-20		2	32
81349	MS25306-232		2	34
96906	MS3212-35		1	14
81349	MS35265-25		2	33
96906	MS35338-135		2	15
96906	MS35338-136		3	2
96906	MS35338-137		2	5
81349	MS39019/3-213		2	37
96906	MS51957-14		1	8
96906	MS51957-15		2	16
96906	MS51957-26		3	4
96906	MS51957-43		2	4
96906	MS51959-13		2	1
96906	MS51959-13		2	45
96906	MS51959-41		1	10
96906	MS9021-016		2	35
96906	MS9021-016		2	47
96906	MS9021-028		2	50

CROSS-REFERENCE INDEXES

FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
1	1		96906	MS18014-1
1	2		96906	MS21044-C06
1	3		80063	A3099880
1	4		80063	A3102721
1	5		81349	M83526/14-02
1	6		96906	MS21044-C04
1	7		80063	A3099854
1	8		96906	MS51957-14
1	9		80063	A3099859
1	10		96906	MS51959-41
1	11		96906	MS21044-C08
1	12		80063	A3099982-1
1	13		80063	A3099851-10
1	14		96906	MS3212-35
1	15		80063	A3099851-11
1	16		80058	H-250/U
2	1		96906	MS51959-13
2	2		80063	A3102762
2	3		80063	A3102565
2	4		96906	MS51957-43
2	5		96906	MS35338-137
2	6		96906	MS15795-807
2	7		80063	A3099865
2	8		80063	A3102547
2	9		80063	A3102564
2	10		80063	A3099886
2	11		96906	MS21044-C06
2	12		80063	A3099849
2	13		80063	A3099875
2	14		96906	MS15795-804
2	15		96906	MS35338-135
2	16		96906	MS51957-15
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GLOSSARY

This glossary identifies and defines terms used in this manual.

Absolute Power Measurement - The received average optical power measurement in dBm measured with the Fiber Optic Cable Assembly connected to the Fiber Optic Bulkhead Connector of the Fiber Optic Test Set Optical Interface and with the mode switch in the Absolute position.

Attenuation - In an optical fiber, the decrease of average optical power. In optical fibers, attenuation results from absorption, scattering, and other radiation losses. Attenuation is generally expressed in dB without a negative sign. Calculations and equations involving loss show and use the negative sign. Attenuation is often used as a synonym for attenuation coefficient, expressed in dB/km. This assumes the attenuation coefficient is invariant with length.

Connector - A device mounted on the end of a fiber optic cable, light source, receiver, or housing that mates to a similar device to couple light optically into and out of optical fibers. A connector joins two fiber ends or one fiber end and a light source or detector.

Decibel (dB) - A logarithmic comparison of power levels, defined as ten times the base-ten logarithm of the ratio of the two power levels. One-tenth of a bel.

Detector - A transducer that provides an electrical output signal in response to an incident optical signal. The current is dependent on the amount of light received and the type of device. See also: Receiver.

Fiber (optical) - Any filament or fiber made of dielectric materials that guides light whether or not it is used to transmit signals. Synonym: Optical waveguide. See also: Fiber bundle.

Fiber buffer - Material used to protect an optical fiber or cable from physical damage, providing mechanical isolation or protection. Fabrication techniques include both tight jacket, or loose tube, buffering, as well as multiple buffer layers. See also: Fiber bundle.

Fiber bundle - An assembly of unbuffered optical fibers. Usually used as a single transmission channel, as opposed to multifiber cables, which contain optically and mechanically isolated fibers, each of which provides a separate channel.

Fiber-optic link - Any optical transmission channel designed to connect two end terminals or to be connected in series with other channels.

Mode - In a cavity or transmission line, one of those electromagnetic field distributions that satisfies Maxwell's equations and the boundary conditions. The field pattern of a mode depends on the wavelength, refractive index, and cavity or waveguide geometry.

Optical cable assembly - Generally, an optical cable that has been terminated with connectors on both ends, and is ready for installation.

Pigtail - A short length of optical fiber, permanently fixed to a component, used to couple power between the component and a transmission fiber.

Receiver - A detector and electronic circuitry to change optical signals to electrical signals. See also: Detector.

Reflection - The abrupt change in direction of a light beam at an interface between two dissimilar media so that the light beam returns into the medium from which it originated.

Relative - The received average optical power measurement in dBm measured with the Fiber Optic Cable Assembly connected to the Fiber Optic Bulkhead Connector of the Fiber Optic Test Set Optical Interface and with the mode switch in the Relative position.

Source - A device that, when properly driven (with electrical energy), will produce information-carrying optical signals.

Transmitter - A driver and a source used to change electrical signals to optical signals.

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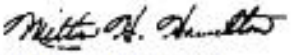

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