

2 Preparation

Introduction

This chapter highlights the requirements and site preparation for the installation of a Mahi Networks Mi7 Optical Transport Switch Router (OTSR). Figure 1 shows the recommended configuration of an installation.

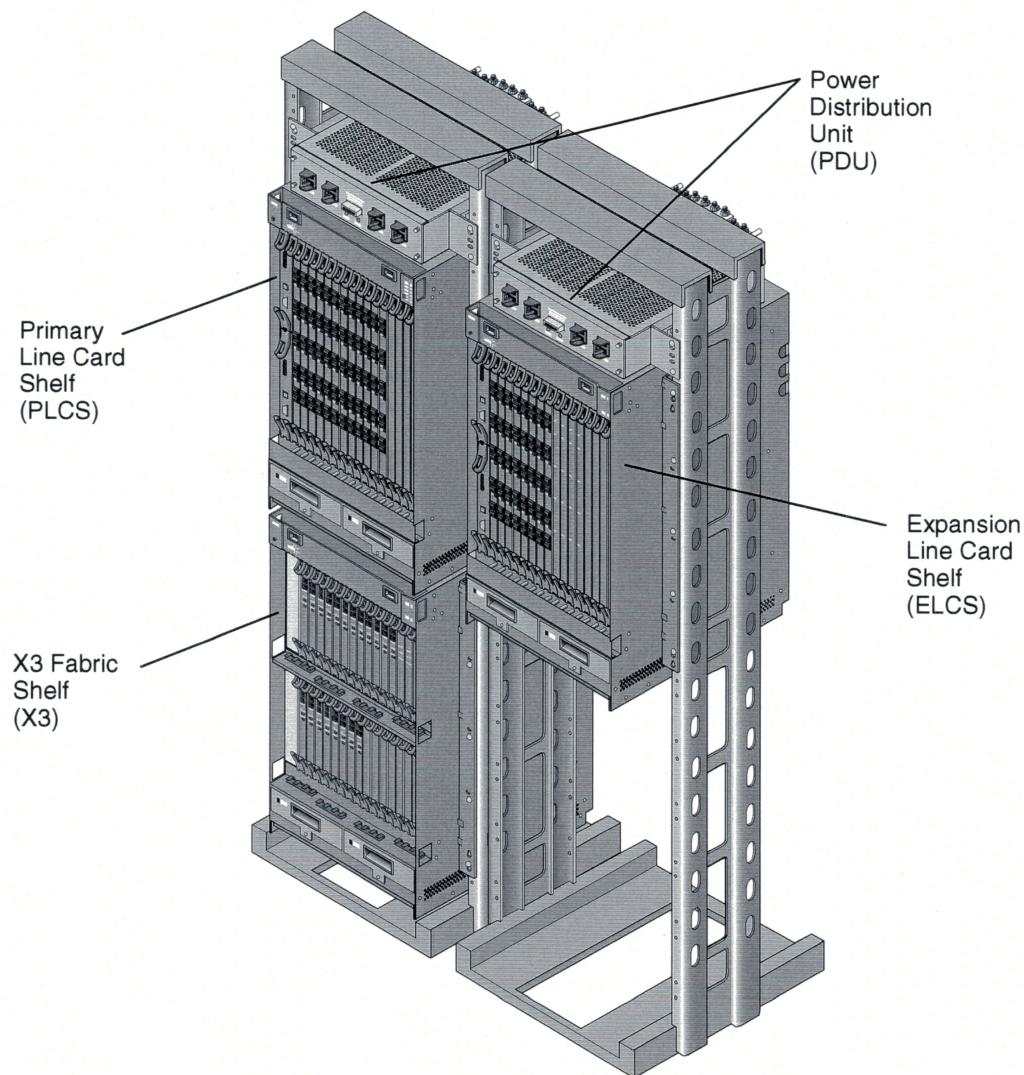


Figure 1 Completed Installation of a Mahi Networks Mi7 Optical Transport Switch Router -
Shelves and PDUs Are Shown in Their Recommended Rack Positions
(cabling and front panels are not shown)

Overview of the Mi7 OTSR

The basic Mi7 OTSR system consists of an X3 Fabric Shelf (X3), a Primary Line Card Shelf (PLCS), and a Power Distribution Unit (PDU), all of which can be installed in a single, 7-foot rack. The system can be expanded with an Expansion Line Card Shelf (ELCS) and a PDU in a second rack. Front panels are provided with each shelf and PDU to protect cable and wiring connections. The mounting brackets for each shelf and PDU are adaptable to both domestic and ETSI rack dimensions.

An Mi7 installation requires redundant -48V DC power inputs to the PDU in each rack. The PDU in turn powers each shelf.

Each shelf is cooled by four fans (X3) or six fans (PLCS, ELCS) with a low speed and a high speed. The fans are temperature controlled and vary their speed automatically.

Craft access is achieved with a computer connected to the active Network Controller Card (NCC) on the PLCS. Management access is achieved through connectors in the Maintenance, Alarm, and Timing panel in the upper area of the PLCS.

Optical traffic input and output is through the line cards in the PLCS.

Shelves are interconnected with fiber optic and CAT-5 electrical cables which are provided by Mahi Networks, and are connected during installation. See “Chapter 10, Installing the Wiring” and “Chapter 11, Installing the Fiber Cabling” in this guide.

See “Special Requirements” on page 12 for information on other cabling and wiring.

Installation Template

An Installation Template is provided to aid in the correct mounting of each shelf and PDU on the rack. In the case where two shelves and a PDU must be located in the same rack, the installation must be done from the bottom up, and placement of the lower rack units must be exact. One way to accomplish the exact placement of the shelves and PDU is with the Installation Template.

The Installation Template is constructed in three panels, and has 10 holes punched along the right and left edges. See Figure 3 for a drawing of the template. See “Setting the Keyhole Slot Screws with the Template” on page 22 for instructions on using the template.

For an alternate method of determining placement of the shelves and PDU, see “Setting the Keyhole Slot Screws by Measuring” on page 19.

Cables, Wires, and Terminations

- Power cables from the office facility must be 4/0 gauge and terminate in two-hole, right-angle compression lugs.
- Timing wire, sense information, and alarm wire must be suitable to transmit a DS-1 signal (for example, a 22-AWG twisted pair). These wires terminate in wire wrap or screw terminals.
- The management modem port is a data terminal equipment (DTE) modem port for remote access. Its connector is a DB9 M RS-232. The modem port is factory hard-coded for VT100/ANSI terminal emulation at 9.6 Kbaud, 8 bits data, no parity, 1 stop bit, and hardware flow control.
- The craft terminal port is a data communications equipment (DCE) port. Its connector is a DB9 M RS-232. The craft port is factory hard-coded for VT100/ANSI terminal emulation at 19.2 Kbaud, 8 bits data, no parity, 1 stop bit, and XON/XOFF flow control.
- The craft Ethernet port connector is an RJ-45.
- Facility fiber optic cabling must terminate in suitable connectors mating with the connectors on the line cards.

Management interfaces are located on the Maintenance, Alarm, and Timing (MAT) panel of the Primary Line Card Shelf (PLCS), and are intended to be wired permanently for remote management.

Craft interfaces are located on the Network Controller Card (NCC) faceplate, and are intended for transitory connections.

Mechanical Requirements

This section contains the site requirements and preparation for an Mi7 installation.

Rack Requirements

The Mi7 OTSR installs in a standard 23-inch telecom rack that is 43 U high or taller. Its mounting hardware is compatible with tapped holes at 1 inch or 1-1/2 inches vertically on centers, and 22-5/16 inches horizontally on centers.

Safety grounding for the rack must be connected to the Common Bonding Network (CBN) or the Isolated Bonding Network (IBN) per local practice.

The rack should be bolted to the floor and mounted to a super bar for stability.

Hardware

All hardware needed for installing the Mi7 OTSR is provided.

Special Requirements

This section contains the requirements for building, environmental, electrical, timing and space considerations.

Building Requirements

The building housing the Mi7 installation should have a loading dock for equipment delivery, and a hand truck or forklift for moving equipment to the installation location. The building should have an elevator if the installation site is on a floor other than ground level.

Crating

The Mi7 shelves are shipped in wooden crates that measures about 31 inches wide, 33 inches deep, and 48 inches high. The loaded weight of the crates is about 175 lbs. (about 80 kg). All doors and elevators to the installation location must be able to accommodate the crate size.

Cable Management

Fiber raceways, fiber trays, or cable ladder racks are recommended for cable management.

Spares Storage

Cards for the Mi7 OTSR require special consideration for spares storage. See Table 1 for dimensions of individual cards.

Table 1 Dimensions of Cards

Card	Top (in.)	Side (in.)
Line Card	20	24
Network Controller Card (NCC)	19-1/2	11-3/4
Port Card	8	10-1/2
Fabric Controller Card (FCC)	7	16-1/2
XC Switch Matrix Card	7	16-1/2

Environmental Requirements

The Mi7 OTSR requires an operating environment of 32° to 122° F, at 0 to 10,000 Ft., with adequate cooling to accommodate a 10,000 Watt, fully-configured system.

Electrical Requirements

The Mi7 OTSR requires two power inputs of -48 VDC (-38 VDC to -75 VDC), designated A and B input facilities. Each input facility must consist of two -48 V cables, and two return (RTN) cables. See “Special Requirements” in this chapter. Each rack in the Mi7 OTSR installation must be separately powered.

The input facilities must be rated to supply 80 Amp, 250 Amp, 300 Amp, and 450 Amp, depending on the requirements of the specific combination of shelves in the rack. See “Chapter 6, Installing the Power Distribution Unit” for further information.

Each PDU supplied with the Mi7 OTSR is equipped with the appropriate circuit breakers.

Timing Requirements

The recommended timing source for the Mi7 OTSR is Building Integrated Timing Supply (BITS) or Synchronization Timing Unit (STU) (both supplied by copper wire). The system can also be configured to operate using line timing.

Space Requirements

The Mi7 installation fits into a standard 7-ft. rack. The front cover has a swing radius of 20 inches. A line card installation requires about 20 inches in front of the shelf in order to line up the line card properly with the slot.

A comfortable clearance for working on the Mi7 installation is 3.5 feet in front of the rack, and 3 feet behind the rack. Most servicing for the Mi7 is done from the front. Rear access is for X3 Fabric Shelf maintenance only. See Figure 2 for a diagram of the space requirements.

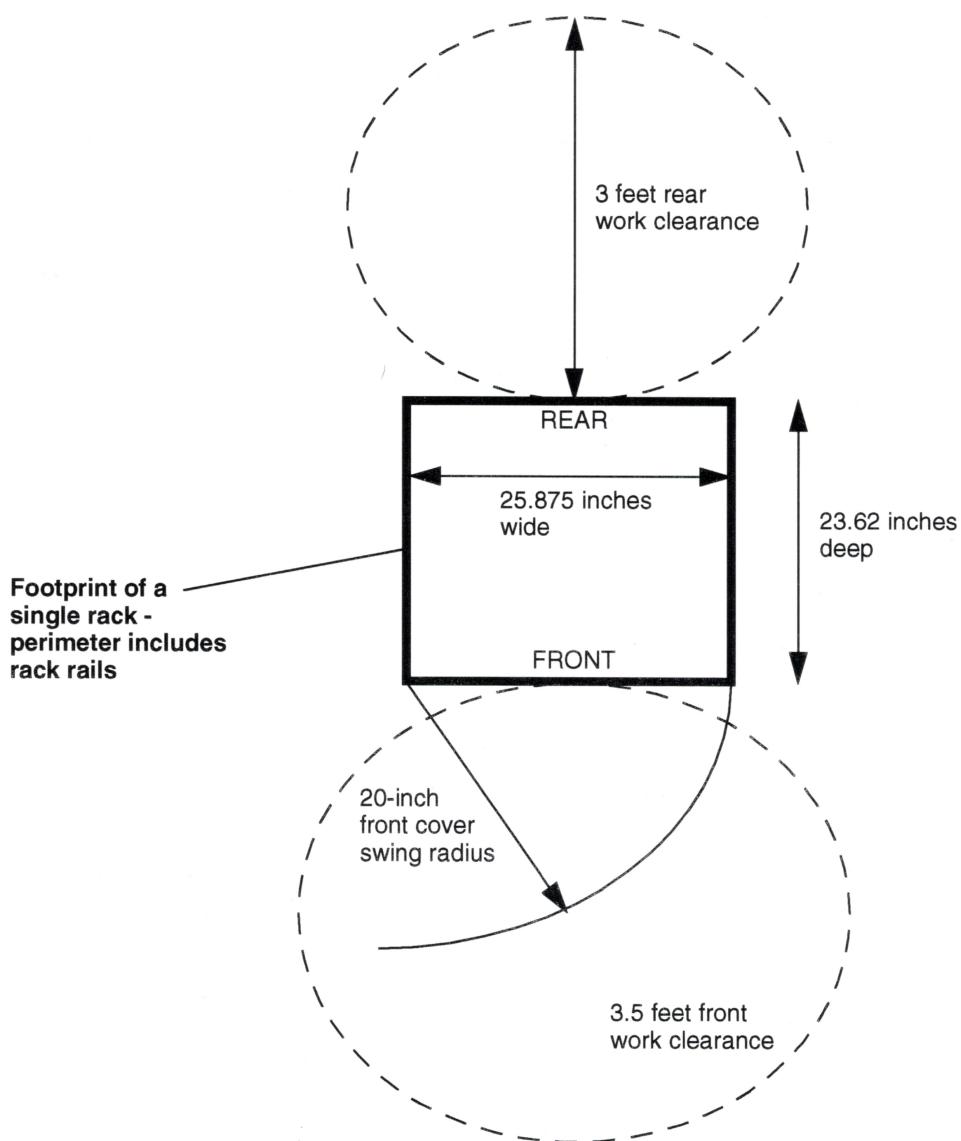


Figure 2 Space Requirements for a Single Rack in an Mi7 Installation

Tools and Equipment

The following tools and equipment are required in order to complete the installation of the Mi7:

- Safety glasses
- Wire wrap tool
- Wire cutters
- Wire crimpers
- Flat blade screwdriver, 1/4-inch head
- Flat blade screwdriver, 1/8-inch head
- Phillips screwdriver
- 3/8-inch nut driver
- 1/2-inch nut driver
- Optical meter
- Fiber-cleaning box
- Tie wraps or lacing string
- Carpenter's level, min. 2 ft. long
- Steel tape measure
- Torque wrench
- Stepping stool or small ladder

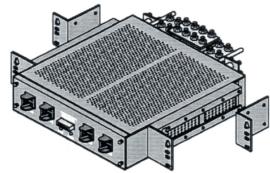
Preparation and Installation

Site Preparation

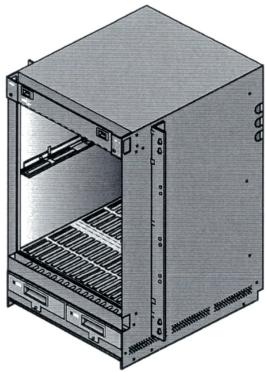
Compare the invoice to the office documents and confirm that all the necessary equipment has been received.

Mechanical Descriptions

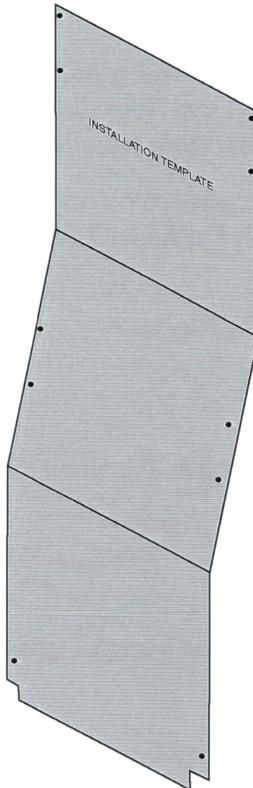
This section contains a description of each of the mechanical units of the Mi7. See Figure 3 for drawings of the main rack units.



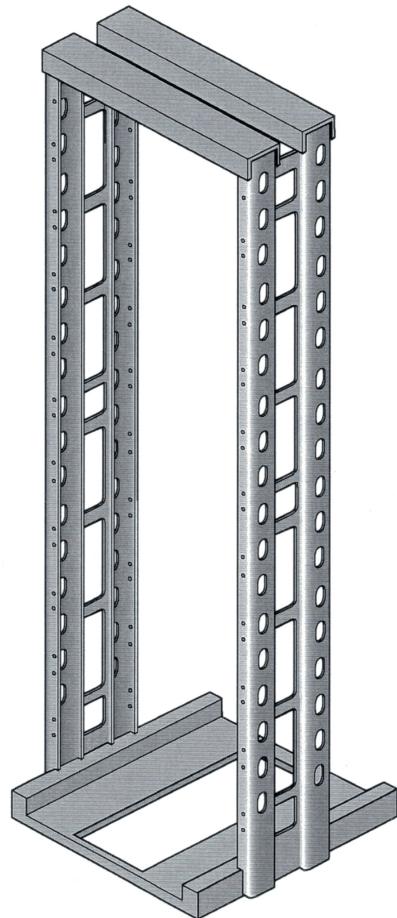
Power Distribution Unit



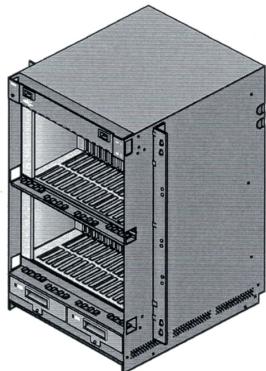
Primary Line Card Shelf



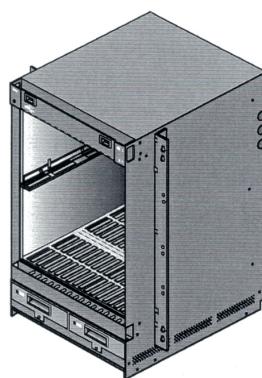
Installation Template



Rack



X3 Fabric Shelf



Expansion Line Card Shelf

Figure 3 The Main Rack Units in the Mi7 Installation

Racks

The Mi7 installs in 23-inch or ETSI racks. It is recommended that seismic racks are used. Racks may be optionally purchased from Mahi Networks.

Shelves

There are, at minimum, two shelves in an Mi7 installation; an X3 Fabric Shelf (X3), and a Primary Line Card Shelf (PLCS). Each shelf measures 19 inches wide, 23-1/2 inches deep, and 35-3/4 inches high. Addition of the front panel adds about two inches to the depth.

Expansion of the installation is accomplished by adding Expansion Line Card Shelves (ELCS), which are the same in size as the X3 and PLCS.

The weight of each shelf, without fans, cables, and cards installed, is about 110 lbs. Each shelf ships with the mounting brackets attached.

X3 Fabric Shelf

The X3 Fabric Shelf houses the Port Cards, X3 Switch Matrix Cards, and the Fabric Controller Cards.

Primary Line Card Shelf

The Primary Line Card Shelf houses the Network Controller Cards, and the line cards See Figure 3.

Expansion Line Card Shelf

The Expansion Line Card Shelf also houses Network Controller Cards and line cards. See Figure 3.

Power Distribution Unit

The PDU is 17.18 inches wide, 17.88 inches deep, and 3.38 inches high. Terminal connectors extend 3.13 inches from the back, and are covered with a plastic safety cover. Addition of the front panel adds about two inches to the depth. The PDU ships with part of the mounting system attached. The rest of the mounting system is attached during installation on the rack.



3 Installing the Shelves

Introduction

The X3 Fabric Shelf (X3), the Primary Line Card Shelf (PLCS), and the Expansion Line Card Shelf (ELCS) can be mounted underneath the Power Distribution Unit (PDU) in one of two rack positions; the upper-shelf rack position or the lower-shelf rack position. This chapter contains the procedures for installing the shelves in either rack position, and connecting the chassis ground wires.



DANGER: In the case where two shelves and a PDU must be located in the same rack, the installation must be done from the bottom up. Due to tight spacing in the rack, it is very dangerous to position a shelf if there is a PDU or a shelf already installed in the rack location above.

Setting the Keyhole Slot Mounting Screws

The shelf installation begins with establishing the locations for a set of screws, called *keyhole slot screws* (12-24, half-inch screws). Keyhole slot screws must be set for each of the shelves on the rack and the PDU, and are used to support the units while the rest of the mounting screws (also 12-24, half-inch screws) are threaded through the mounting brackets and tightened. Correct placement of the keyhole slot screws is important, as misalignment of the screws can result in personal injury or damage to the equipment.

Four keyhole slot screws are installed for each shelf, and two keyhole slot screws are installed for the PDU. The location of the keyhole slot screws can be determined by measuring up from the bottom of the rack, or by using the Installation Template provided. Proceed to the next section, “Setting the Keyhole Slot Screws by Measuring” to use a tape measure for setting the keyhole slot screws. Proceed to “Setting the Keyhole Slot Screws with the Template” on page 22 to set the screws using the Installation Template.

Setting the Keyhole Slot Screws by Measuring

This section describes the procedure for measuring for the keyhole slot screw locations.

Set the keyhole slot screws by measuring.

1. Using a tape measure, measure from the top edge or surface of the base of the rack, and thread a keyhole slot screw partway into each of the locations indicated in Figure 4.

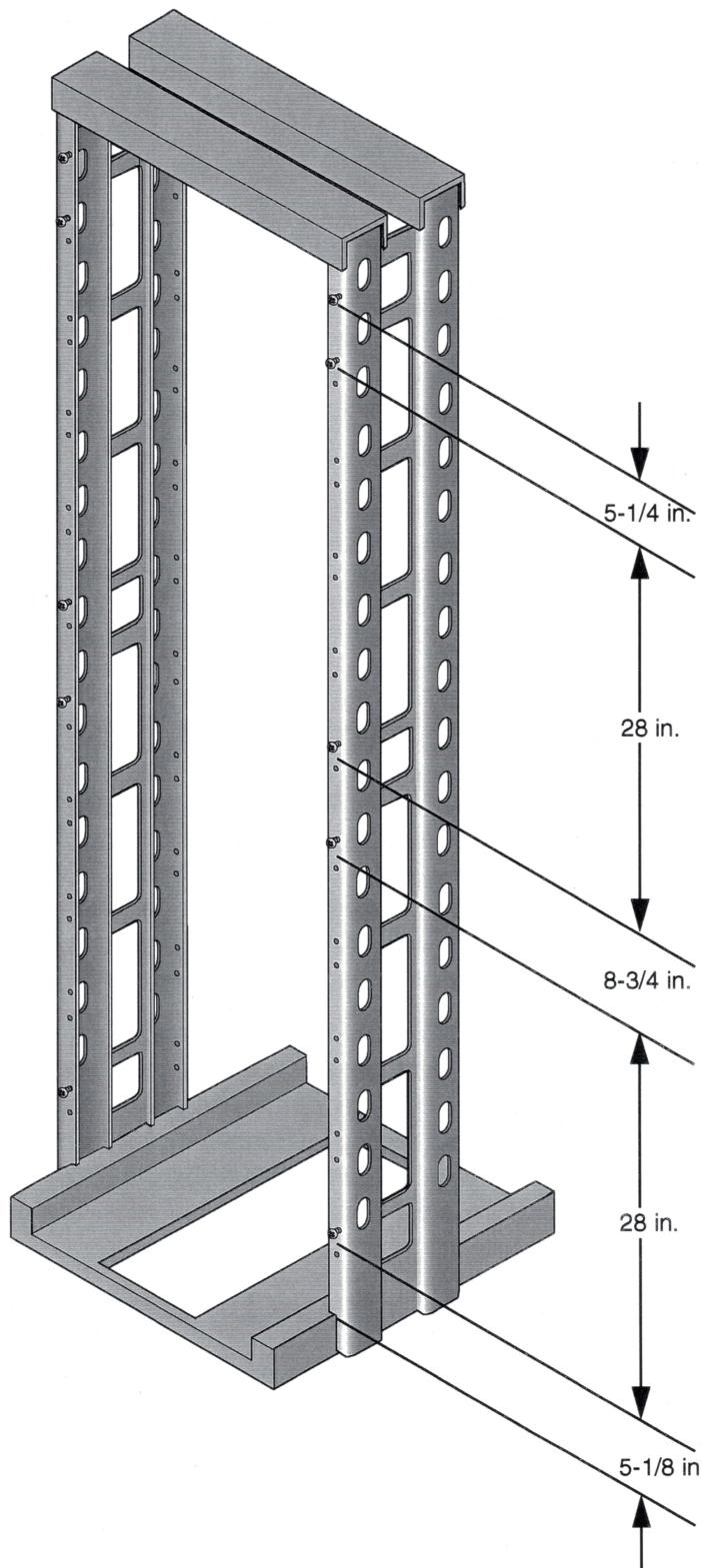


Figure 4 Setting the Keyhole Slot Screws by Measuring
(Screw Heads are Exaggerated)



NOTE: If the rack is not going to have a full complement of equipment (two shelves and a PDU), put the screws only in the locations required for the specific equipment to be installed.

2. Advance the screws so that several turns of thread are engaged, but there is adequate gap between the screw head and the rack frame to fit the thickness of the mounting brackets of the Mi7 equipment; about 1/4-inch (6 mm). See Figure 5.

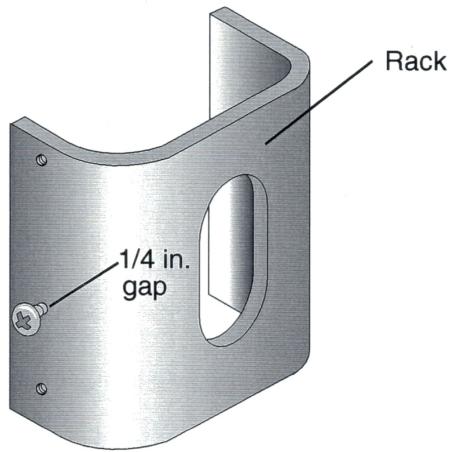


Figure 5 Keyhole Slot Screw with Threads Engaged, and a Gap Adequate to Fit the Mounting Bracket

3. Use a carpenter's level on top of each horizontal pair of screw heads to double-check that the two screws are level with each other (confirming that the screw locations on both sides of the rack match). See Figure 6.



Figure 6 Check that Each Horizontal Pair of Screws is Level

Proceed to “Installing a Shelf in the Lower-Shelf Rack Position” on page 26.

Setting the Keyhole Slot Screws with the Template

This section describes the procedure for using the Installation Template to install the keyhole slot screws.

Set the keyhole slot screws with the Installation Template.

1. Unfold the Installation Template, locate the top, and hold the template up to the rack. Set the bottom edge of the template near the base of the rack, and check the spacing between the top of the rack and the top of the template. The length of the template is equal to the length of a 43 U installation of a PDU and two shelves. For a 43 U rack, the base of the template should be nominal 1/8-inch from the top of the base of the rack. See Figure 7.

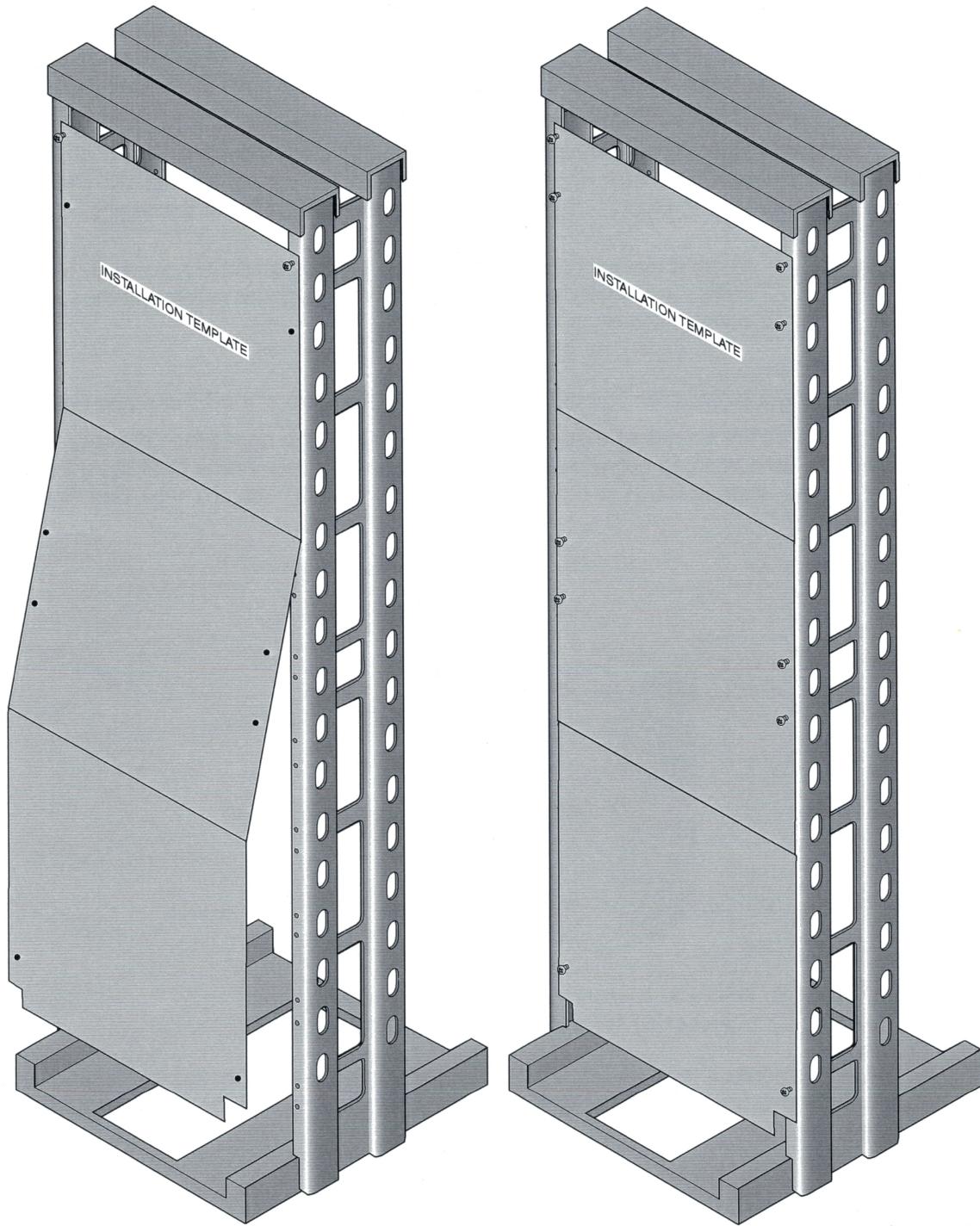


Figure 7 Placement of Installation Template on the Rack

2. When the positioning of the template on the rack is satisfactory, install two keyhole slot screws through the holes in the top of the template and thread them partway into the rack. Allow the template to hang from these keyhole slot screws. These are the first two of the 10 keyhole slot screws necessary for an installation of two shelves and a PDU in a 43 U rack. These two keyhole slot screws will be used to support the PDU later in this chapter. See Figure 7.
3. Insert keyhole slot screws through the remaining 8 holes in the template and thread them partway into the rack. If the holes on the template do not line-up with the holes in the rack, refer to Figure 7 again and recheck the orientation of the template.



NOTE: If the rack is not going to have a full complement of equipment (two shelves and a PDU), put the screws only in the locations required for the specific equipment to be installed.

4. Remove the Installation Template from the rack by working it off the screw heads.
5. Advance all the screws so that several turns of thread are engaged in the rack, but there is adequate gap between the screw head and the rack frame to fit the thickness of the mounting brackets of the Mi7 equipment; about 1/4-inch (6 mm). See Figure 8.

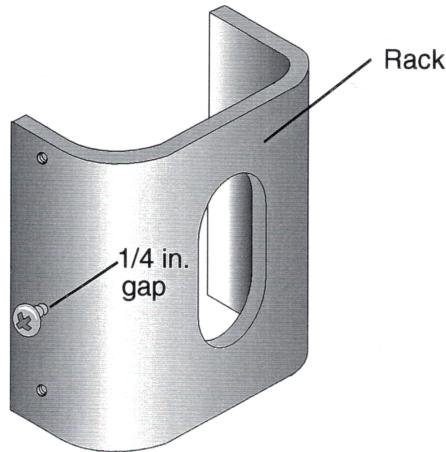


Figure 8 Keyhole Slot Screw with Threads Engaged, and a Gap Adequate to Fit the Mounting Bracket

6. Use a carpenter's level on top of each horizontal pair of screw heads to double-check that the two screws are level with each other (confirming that the screw locations on both sides of the rack match). See Figure 9

3. Lift the shelf and align the appropriate keyhole slots of the shelf mounting brackets with the lower four keyhole slot screws in the rack. Adjust the shelf until the narrow ends of each of the four keyhole slots rest on the screw shanks. Make sure all four screws are engaged with the keyhole slots. See Figure 10. Tighten the screws with a Phillips screwdriver while making sure the shelf is firmly in place and is fully in contact with the rack.
4. Fully secure the shelf by threading and tightening the shelf-mounting screws in the remaining bracket holes. See Figure 11 for the completed installation of a shelf in the lower-shelf rack position.

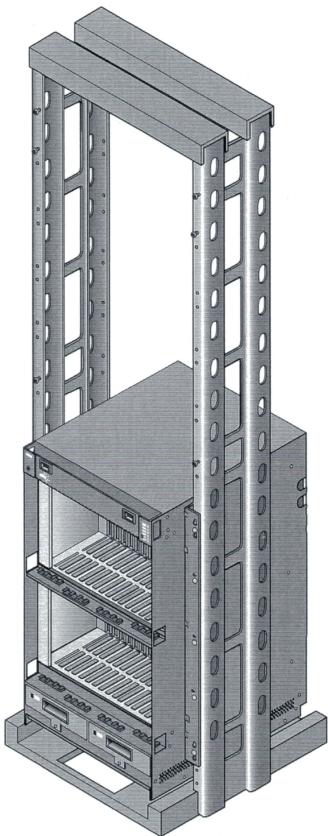


Figure 11 Completed Installation of the Shelf
in the Lower-Shelf Rack Position

Installing a Shelf in the Upper-Shelf Rack Position

Follow the instructions in this section to install a shelf in the upper-shelf rack position.



DANGER: The shelf, without cards or fans, weighs about 110 lbs. (about 50 kg). Use caution when moving or lifting the shelf. Do not attempt to lift the shelf alone.



DANGER: Do not attempt to perform this installation if there is a PDU already installed in the rack position above. Serious personal injury and equipment damage may result.

Unpack the shelf.

1. Transport the crated shelf to a location close to the rack where it will be installed. Remove the crating and set aside the fans, hardware, ground wire, and any covers.

Mount the shelf onto the rack.

2. Bring the shelf as close to the front of the rack as possible, and rotate it so that the rear of the shelf is facing towards the rack. Keep in mind that the shelf weighs about 110 lbs. (about 50 kg).



NOTE: The keyhole slots on the mounting brackets are grouped in pairs. To mount a shelf in the upper-shelf rack position in a 43 U rack, use the upper set of keyhole slots (the upper keyhole slot of each pair). See Figure 12.

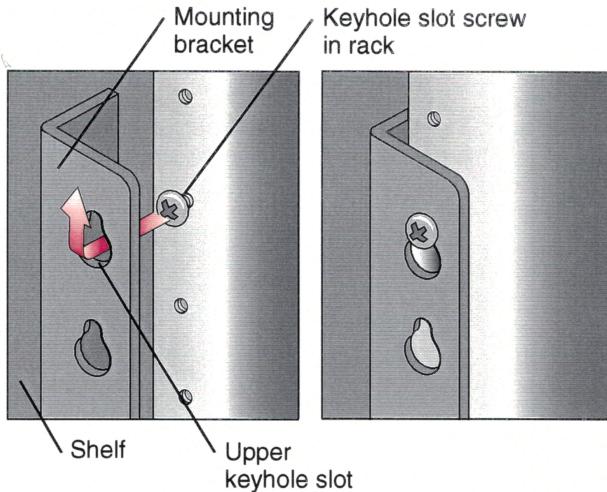


Figure 12 Use the Upper Keyhole Slot for an Upper-Shelf Installation

3. Lift the shelf and align the appropriate keyhole slots of the shelf mounting brackets with the four keyhole slot screws associated with the upper-shelf rack position. These screws are located just under the top screw which is slotted for the PDU. Adjust the shelf until the narrow ends of each of the four keyhole slots rest on the screw shanks. Make sure all four screws are engaged with the keyhole slots. See Figure 12. Tighten the screws with a Phillips screwdriver while making sure the shelf is firmly in place and is fully in contact with the rack.
4. Fully secure the shelf by threading and tightening the shelf mounting screws in the remaining bracket holes. See Figure 11 for the completed installation of the shelf in the upper-shelf rack position.

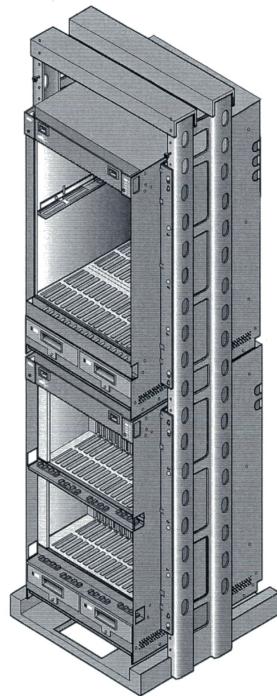


Figure 13 Completed Installation of the Shelf in the Upper-Shelf Rack Position

Connecting the Shelf Chassis Ground to the Rack

The chassis ground wire for each type of shelf is shipped with the unit.

Connect the chassis ground wire to the shelf.

1. Locate the chassis ground wire. This 6 AWG wire terminates at each end with a grounding lug.
2. Go to the Maintenance, Alarm, and Timing area (MAT) of the shelf, and open the door by sliding the two door latches towards each other, and swinging the MAT door downward. Locate the GROUND terminal on front left of the MAT compartment.
3. Remove the nut from the GROUND terminal.
4. Place the lug from one end of the chassis ground wire onto the terminal, and secure it tightly with the nut.

Connect the other end of the chassis ground wire to the rack.

5. Select the thread-cutting screw with threads suitable for the type of rack used in this installation.
6. Secure the lug on the free end of the chassis ground wire to the rack with the thread-cutting screw, and tighten. See Figure 14.
7. Dress the wire per local practice.

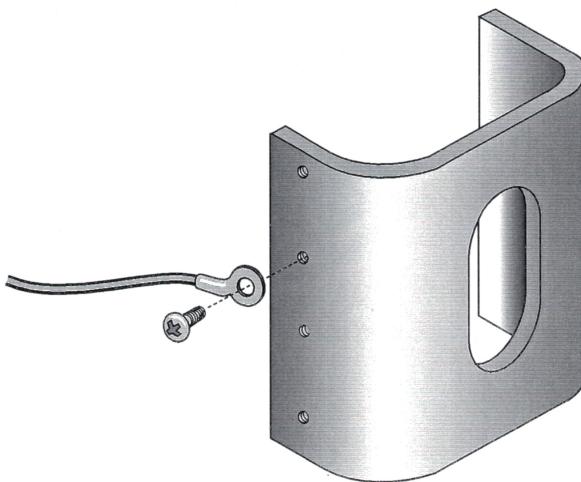


Figure 14 Rack Connection for Chassis Ground Wire



7 Installing the Shelf Power and Return Cables

Introduction

This chapter details the procedure for connecting the power and return cables between the PDU at the top of the rack and each of the shelves. Table 3 shows a cable schedule of the power and return cables for each shelf. All of the cables installed in this chapter are shipped with their respective shelves.

Table 3 Shelf Cabling Schedule Showing Cable Requirements for Each Shelf

Shelf	Power Cables (red)		Return Cables (black)		Size (Awg)	Insulation Rating	
	A	B	A	B		(°C)	(V)
Primary Line Card Shelf (PLCS)	2	2	1	1	1/0	105	600
Expansion Line Card Shelf (ELCS)	2	2	1	1	1/0	105	600
X3 Fabric Shelf	1	1	1	1	6	105	600



NOTE: For the purpose of this procedure, shelves are numbered according to their position in the rack in order to correspond with terminal connections on the PDU. The instructions in this section assume the unit in the upper-shelf rack position (the PLCS) is SHELF 1, and the unit in the lower-shelf rack position (the X3) is SHELF 2. Check local practice and the network operations center (NOC) installation orders for shelf assignments, and designate the shelf numbers accordingly.

Shelf assignments vary among installations. If shelf assignments change before the installation is completed, contact the Mahi Global Support Center to order cables of adequate length.



DANGER: This equipment contains parts at HAZARDOUS ENERGY LEVELS that can be directly accessed during the installation procedure. This equipment must be installed, operated, and serviced by qualified technical personnel only.

Connect Primary Line Card Shelf Power and Return Cables

There are six power cables for the PLCS; two for A power, two for B power, one for A return, and one for B return. Follow this procedure to connect these cables between the PLCS and the PDU.



NOTE: Each of the power and return cables for the PLCS terminates at a two-hole lug at each end. The wider lug connects to the PLCS, and the narrower lug connects to the PDU. See Figure 28.

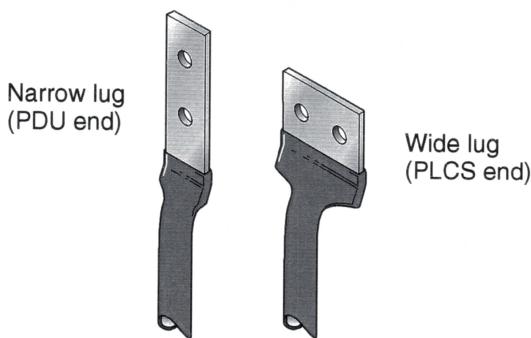


Figure 28 Two-Hole Lugs on a PLCS Cable

Connect the power and return cables to the back of the PLCS.

1. If the power terminal cover is not on the back of the PLCS, skip to Step 2. The back of the PLCS has three covers: the top cover, the power terminal cover, and the lower rear cover. Remove the power terminal cover with a Phillips screwdriver to expose the backplane. Retain the screws.
2. There are three horizontal terminal strips in the power terminal area of the rear of the PLCS. The terminal strips are labeled, from left to right, -48VB, -48V RTN, -48VA. Using a $3/8$ -inch nut driver, remove all the nuts on the three terminal strips and retain them.
3. Making sure to use the ends with the wider lugs (see Figure 28), connect the four red power cables to the two outside terminal strips labeled -48VB and -48VA, and secure with the No. 10 nuts. See Figure 29.

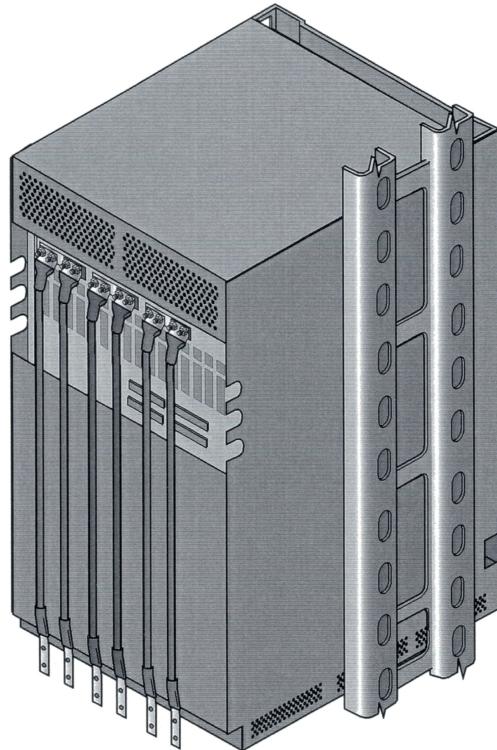


Figure 29 PLCS with Power and Return Cables Connected (Rear view)

4. Making sure to use the ends with the wider lugs, connect the two black return cables to the middle terminal strip labeled -48V RTN, and secure with the remaining No. 10 nuts. See Figure 29.

Connect the PLCS power and return cables to the PDU.

5. Using a 1/2-inch nut driver, remove the nuts from the threaded posts on the back of the PDU on the bus labeled SHELF 1 CIRCUIT A. Also remove the nuts from the threaded posts on the bus labeled A-B RETURN CIRCUIT A. See Figure 30 and Figure 31 for the bus locations.

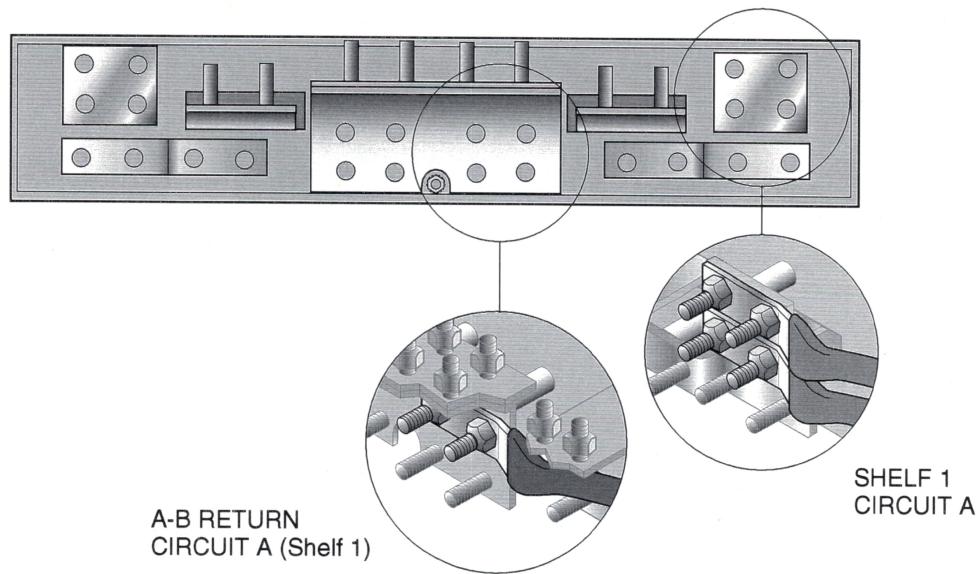


Figure 30 Circuit A PLCS Power and Return Connections (Upper-Shelf Position) on the PDU (Rear view)

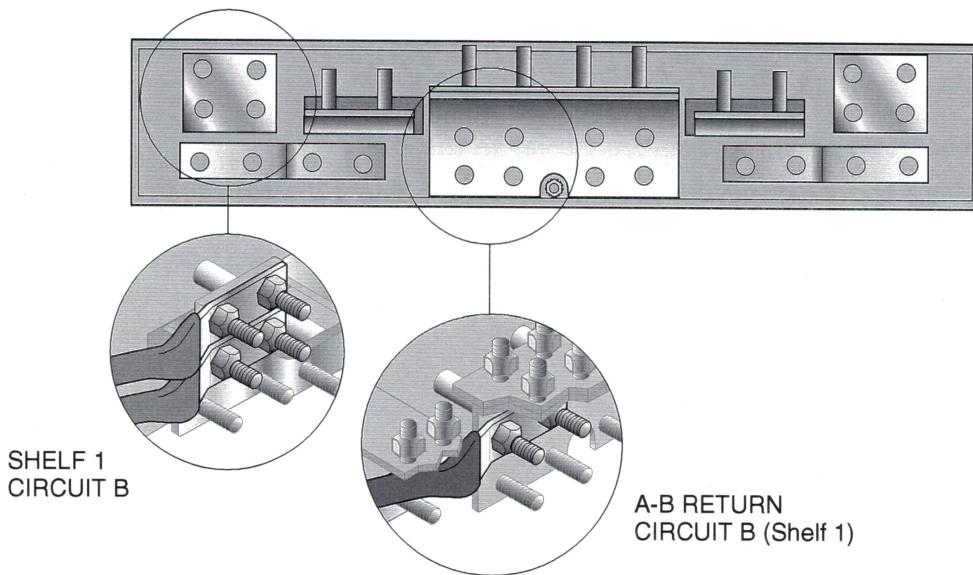


Figure 31 Circuit B PLCS Power and Return Connections (Upper-Shelf Position) on the PDU (rear view)

6. Place the free end of the A-side return cable over the posts of the A-B RETURN CIRCUIT A bus. Replace the nuts and tighten with a $1\frac{1}{2}$ -inch nut driver. See Figure 30, Circuit A insert.

7. Place the free ends of the A-side power cables over the posts of the SHELF 1 CIRCUIT A bus. Make sure the power cable that was on the right side of the bus on the back of the PLCS is connected to the upper posts on the bus on the PDU. Replace the nuts and tighten. See Figure 30, Circuit A insert.
8. Using a 1/2-inch nut driver, remove the nuts from the threaded posts on the back of the PDU on the bus labeled SHELF 1 CIRCUIT B. Also remove the nuts from the threaded posts on the bus labeled A-B RETURN CIRCUIT B. See Figure 30 for the bus locations.
9. Place the free end of the B-side return cable over the posts of the A-B RETURN CIRCUIT B bus. Replace the nuts and tighten with a 1/2-inch nut driver. See Figure 30, Circuit B insert.
10. Place the free ends of the B-side power cables over the posts of the SHELF 1 CIRCUIT B bus. Make sure the power cable that was on the left side of the bus on the back of the PLCS is connected to the upper posts on the bus on the PDU. Replace the nuts and tighten with a 1/2-inch nut driver. See Figure 30, Circuit B insert.
11. There are three cutouts on each side of the PLCS. Place the A cables into the cutouts in the right side of the PLCS. Place the return cable in the bottom cutout, the left-hand -48VA power cable in the middle cutout, and the right-hand -48VA power cable in the top cutout.
12. In like fashion, place the circuit B cables into the cutouts in the left side of the PLCS. Place the return cable in the bottom cutout, the right-hand -48VB power cable in the middle cutout, and the left-hand -48VB power cable in the top cutout.
13. Replace the power terminal cover and secure with the screws. If the cover was not originally on the shelf, locate it in the shipping crate. (The screws are attached to the cover.)
14. Dress the cables per local practice.

Connect Expansion Line Card Shelf Power and Return Cables (Upper-Shelf Position)

The procedure for connecting the power and return cables for an Expansion Line Card Shelf (ELCS) in the upper-shelf rack position is the same as the procedure described in “Connect Primary Line Card Shelf Power and Return Cables” on page 44. Repeat the procedure for all ELCSs in this installation that are in the upper-shelf rack position.

Connect X3 Fabric Shelf Power and Return Cables

There are four power cables for the X3 Fabric Shelf; one for A power, one for B power, one for A return, and one for B return. Follow this procedure to connect these cables between the X3 and the Power Distribution Unit (PDU).

Connect the power and return cables to the back of the X3.

1. Using a Phillips screwdriver, remove the top cover on the back of the X3 and retain the screws. Locate the X3 power distribution board on the right side of the shelf (viewing the shelf from the rear).
2. There are four horizontal terminal strips on the power distribution board. The terminal strips are labeled, from top to bottom, N48V A, RTN A, RTN B, and N48V B. Using a $3/8$ -inch nut driver, remove all the No. 10 nuts on the four terminal strips and retain them. See Figure 32.

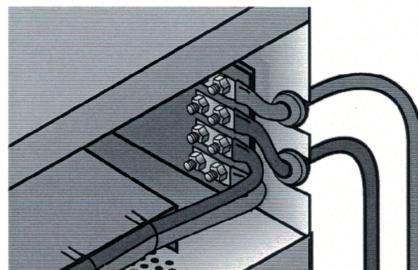


Figure 32 X3 Fabric Shelf Power and Return Connections and Cable Routing



NOTE: Each of the power and return cables for the X3 terminates at a two-hole lug at each end. The (slightly) wider lug connects to the PDU, and the narrower lug connects to the X3. See Figure 33.

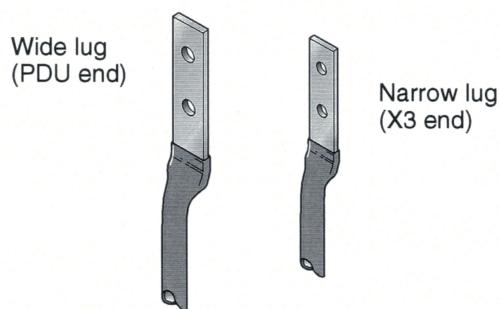


Figure 33 Two-Hole Lugs on an X3 Fabric Shelf Cable

3. Making sure to use the end with the narrower lug, connect the shorter of the two red cables to the terminal strip labeled N48V A, secure with the No. 10 nut and tighten with a $3/8$ -inch nut driver. Connect the longer of the two red cables to N48VB, and secure with the No. 10 nut. See Figure 32.
4. Making sure to use the ends with the narrower lugs, connect the two black cables to the terminal strips labeled RTN A and RTN B, (connecting the longer of the two to RTN B), secure them with the No. 10 nuts and tighten with a $3/8$ -inch nut driver. See Figure 32.
5. Route the red cable that is connected to the N48V A terminal, and the black cable that is connected to the RTN A terminal out the right side of the shelf by placing the grommets that are preassembled on the cables into the cutouts. Place the red cable in the top cutout. See Figure 34.

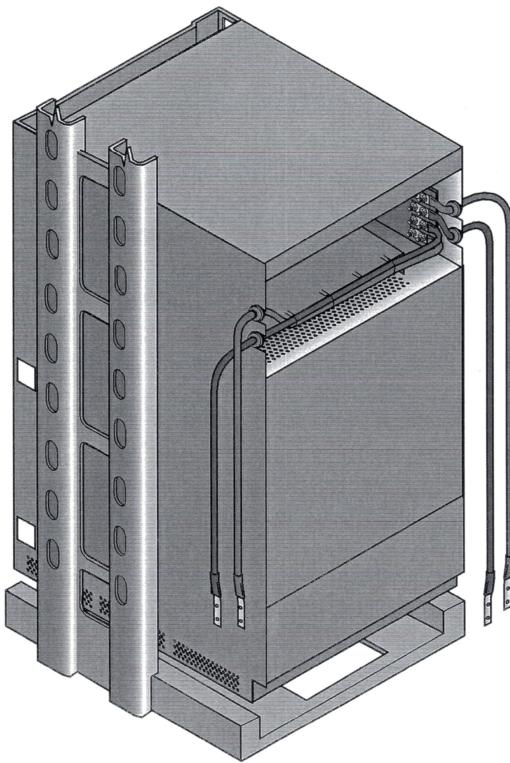


Figure 34 X3 Fabric Shelf with Power and Return Cables Connected (Rear view)

6. Route the black cable that is connected to the RTN B terminal, and the red cable that is connected to the N48V B terminal out the left side of the shelf by placing the grommets that are preassembled on the cables into the cutouts. Place the red cable in the top cutout. See Figure 34.
7. Dress the cables that cross over to the left side of the X3 with tie wraps looped around the five lances on the air ramp below the cables.

Connect the X3 Fabric Shelf power and return cables to the PDU.

8. Using a $1\frac{1}{2}$ -inch nut driver, remove the nuts from the threaded posts on the back of the PDU on the bus labeled SHELF 2 CIRCUIT A. Also remove the nuts from the threaded posts on the bus labeled A-B RETURN CIRCUIT A. See Figure 35 for the bus locations.

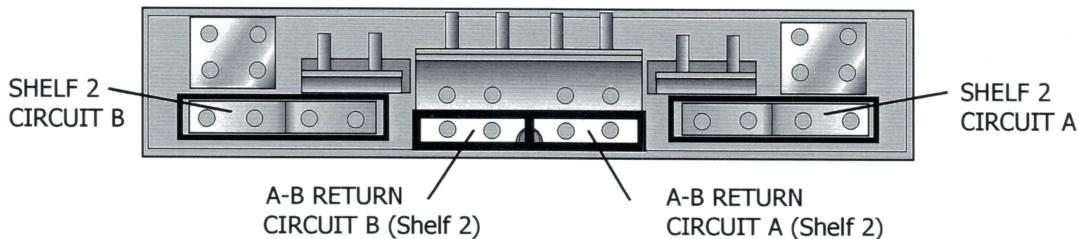


Figure 35 X3 Fabric Shelf Connections (Lower-Shelf Position) on the PDU (Rear view)

9. Place the free end of the A-side return cable over the posts of the A-B RETURN CIRCUIT A bus. Replace the nuts and tighten with a $1\frac{1}{2}$ -inch nut driver. See Figure 35, Circuit A insert.
10. Place free ends of the A-side power cables over the posts of the SHELF 2 CIRCUIT A bus. Replace the nuts and tighten with a $1\frac{1}{2}$ -inch nut driver. See Figure 35, Circuit A insert.
11. Using a $1\frac{1}{2}$ -inch nut driver, remove the nuts from the threaded posts on the back of the PDU on the bus labeled SHELF 2 CIRCUIT B. Also remove the nuts from the threaded posts on the bus labeled A-B RETURN CIRCUIT B. See Figure 35 for the bus locations.
12. Place the free end of the B-side return cable over the posts of the A-B RETURN CIRCUIT B bus. Replace the nuts and tighten with a $1\frac{1}{2}$ -inch nut driver. See Figure 35, Circuit B insert.
13. Place the free ends of the B-side power cables over the posts of the SHELF 2 CIRCUIT B bus. Replace the nuts and tighten. See Figure 35, Circuit B insert.
14. Replace the top cover on the back of the X3 Fabric Shelf and secure with the screws.
15. Dress the cables per local practice.

