



TMX 880 Installation Guide

Release 8.0

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About This Guide

This guide describes the TMX 880TM MPLS Core Switch its features and components. Specifically, this guide describes how to set up, install, and configure the system chassis and its modules.

Intended Audience

This guide is intended for two audiences:

- Customers who prepare the site for the system and install the chassis.
- Lucent Customer Service representatives who install the modules in the chassis and configure the system.

Order of Installation

To successfully install the TMX 880 system, you must follow the Installation order listed below.

1. Before you begin, observe the site requirements and specifications defined in **Chapter 2, “Site Planning Requirements”** to prepare the site for the system installation and operation.
2. Follow the steps described in **Chapter 3, “Unpacking and Installing the Chassis”** to unpack the TMX 880 MPLS Core Switch and mount the chassis.
3. Once the chassis is installed in its rack-mount cabinet, you must ground the unit and connect power to the chassis. Follow the instructions detailed in **Chapter 4, “Connecting Power to the Chassis.”**
4. After the connecting power the chassis, follow the instructions in **Chapter 5, “Installing Hardware Modules”** to install the modules into the chassis.
5. With the cabling the modules installed, you can now setup the TMX 880 system by observing the steps listed in **Chapter 6, “Setting up and Testing Basic Configuration.”**

Product Documentation

The following documentation supports the TMX 880 MPLS Core Switch:

- *TMX 880 Installation Guide*
- *TMX 880 Command Reference*
- *TMX 880 Command Quick Reference*
- *TMX 880 Configuration Guide*
- *Release Notes for the TMX 880 MPLS Core Switch - OS Software*
- *Navis TMX 880 Element Management System Installation Guide*
- *Navis TMX 880 Element Management System User's Guide*
- *Release Notes for Navis TMX 880 Element Management System*

Conventions

This manual uses the following conventions:

Convention	Indicates	Example
Courier regular	Screen output or syntax.	logging source-interface pos2/1
<i>Courier italic</i>	Variable; generic text for which you supply a value.	show ip interface [interface-name]
Courier bold	User input.	TMX 880# show ip ospf database
Sans serif bold	Command names, options, and keywords in text.	By omitting the no-summary option...
Braces { }	Required argument; choose one.	clock-source {line internal}
Brackets []	Optional argument.	set-overload-bit [on-startup seconds]
Vertical bar	Separates required or optional arguments to select from ("or").	show buffers swFab-buffers {iop swfab} show ip bgp neighbors [ip-address as-number] events [count]
<i>ver</i>	Variable version number in filenames.	r <i>ver</i> .tar

This guide also uses the following conventions to call attention to important information.

► Notes provide additional information or helpful suggestions that may apply to the subject text.



Cautions notify the reader to proceed carefully to avoid possible equipment damage or data loss.



Warnings notify the reader to proceed carefully to avoid possible personal injury.

Acronyms and Abbreviations

The following table lists acronyms and abbreviations used in the documentation:

Acronym	Meaning
AAL	ATM adaptation layer
ARP	Address Resolution Protocol
AS	autonomous system
ATM	asynchronous transfer mode
BGP	Border Gateway Protocol
CLI	command line interface
dBm	Decibels per milliwatt. The measure of power in decibels (dB) referenced to one milliwatt.
DLCI	Data link connection identifier
DS	differential service
ESD	electrostatic discharge
HDLC	high-level data link control
ICMP	Internet Control Message Protocol
IOA	input/output adapter card
IOP	input/output processor
IS-IS	Intermediate System-to-Intermediate System
LAP	Link Access Protocol

Acronym	Meaning
LLC	logical link control
LMI	local management interface
MAC	Media Access Control
Mbps	megabits per second
MIB	Management Information Base
MXOS	Multiservice Switch Operating Software
NNI	Network-to-Network Interface
OSPF	Open Shortest Path First
PCMCIA	Personal Computer Memory Card International Association
PDU	power distribution unit
PIM	Protocol Independent Multicast
POS	Packet over SONET (Synchronous Optical Network)
PPP	Point-to-Point Protocol
PVC	permanent virtual circuit
QoS	quality of service
RCP	route control processor
RFC	request for comments
SF	switch fabric
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
STA	SONET Timing/Alarm module
VCI	virtual circuit identifier
VCD	virtual circuit description
VPI	virtual path identifier
WFQ	weighted fair queuing

Overview

This chapter provides an overview of the TMX 880 MPLS Core Switch, its features, architecture, and system components.

Features

The system's scalable architecture offers the following key features and benefits:

- **Flexible Multiservice Platform:** The Lucent TMX 880 MPLS Core Switch provides flexibility and interoperability between IP, Frame Relay, MPLS, ATM and PIM. The system supports MPLS with traffic engineering, fast reroute and load balancing. The system can operate as an ATM to MPLS switch, an IP over MPLS router with Label Switch Router (LSR) capabilities, and a Frame Relay switch. This capability enables service providers to preserve their investment and reduce future risks associated with changes in the service mix, and growth of the network.
- **ATM over MPLS:** The TMX 880 system integrates into Lucent ATM networks to increase core capacity. The TMX 880 MPLS Core Switch provides encapsulation of ATM traffic for transmission over MPLS links. Forwarding the traffic through an MPLS domain, with MPLS running on POS interfaces, provides higher speed links than ATM.

Dynamic access to ATM trunks (through Navis TMX 880) received from CBX 500TM and GX 550TM switches simplifies traffic aggregation for transmission through a high-speed MPLS core. OPTimum cell trunks, received from the ATM systems, are carried over MPLS label-switched paths. Traffic can be transmitted in either cell mode (AAL1, AAL2) on packet mode (AAL5).

- **Quality of Service (QoS):** The system uniquely supports QoS on OC-3c/STM-1 ATM, OC-12c/STM-4 ATM, OC-48c/STM-16 POS and OC-192c/STM-64 POS interfaces without sacrificing throughput performance. Lucent's patented QoS is an enabling technology for the convergence of quality voice, video, and data along with best effort IP traffic on a high performance IP/MPLS core backbone.
- **Flexible QoS Options:** The QoS Scheduler supports a configurable packet-scheduling engine for strict priority queuing, weighted fair queuing (WFQ), or priority fair queuing. This implementation provides bandwidth guarantees and supports the tight delay and delay variation bounds demanded by real-time applications. This architecture gives service providers the ability to offer highly profitable enhanced and differentiated services, and the first high quality voice over IP.

- **Software Design:** The unique Lucent Technologies® multiservice switch operating software (MXOS) architecture supports the application of software bug fixes and patches with minimum service disruption.
- **Multiprotocol Support:** The software supports BGP, OSPF v2, IS-IS, MPLS, ATM over MPLS with traffic engineering, RSVP, PIM-SM and network management protocols.
- **High Performance and Density:** The TMX 880 MPLS Core Switch provides high performance and high port density, delivered in the smallest possible footprint to efficiently utilize valuable and expensive floor space.
- **RCP Redundancy:** The TMX 880 system is capable of supporting two RCP modules (primary and secondary). You can add a second, redundant, RCP to the system dynamically, with no data loss or degradation in performance to the components.

The primary acts as the RCP for the system while the secondary RCP updates itself with the data required to run the system. If the primary RCP fails, the secondary RCP continues to forward data packets.
- **Navis™ TMX 880 Element Management System:** The Navis TMX 880 Element Management System provides selective system management and system monitoring through a graphical user interface. It has limited integration with NavisCore™, but can also run over HP OpenView, or in a stand-alone environment. For information about this program, see the *Navis TMX 800 Element Management System User's Guide*.

Hardware Components

The system hardware is housed in a 40-slot, 19-inch rack-mount chassis. The hardware compounds are listed below.

- 1 to 4 Switch Fabric (SF) modules (1 in base system)
- 1 or 2 SONET/SDH Timing/Alarm (STA) modules (1 in base system)
- 1 or 2 Route Control Processor (RCP) modules (1 in base system)
- 1 to 16 Processor Engines or Input/Output Processors (IOPs)
- 1 to 16 Line Cards or Input/Output Adapters (IOAs)
- 1 or 2 Power Distribution Units (PDUs) (1 in base system)
- 3 Fan assemblies (front bottom, front top, and rear top)



It is imperative that the Processor Engines (IOPs) be installed in a specific slot order. See **“IOP Slot Installation Sequence”** on page 5-9 for important instructions.

Table 1-1 summarizes the functionality of the hardware components. (Refer to **Appendix A, “TMX 880 Input/Output Modules”** for the individual module specifications.

Table 1-1. Hardware Components

Component	Description
<p>Processor Engines or Input/Output Processors (IOPs)</p> <ul style="list-style-type: none"> Hot-swappable 	<p>IOPs plug into the chassis midplane from the front. The IOPs house an onboard-distributed forwarding engine that retains a local copy of routing tables. Separate onboard processors handle control and signaling functions.</p> <p>Each IOP is composed of a processing card and a daughter card, which gives a specific <i>personality</i> to each processor card. The IOPs are designed to be used with several specific IOAs. Additional IOA modules can be added without affecting other installed modules.</p> <p>Supported IOPs include:</p> <ul style="list-style-type: none"> OC-192C/STM-64 POS <i>Note:</i> Three Switch Fabrics are required for the OC-192. OC-48c/STM-16 POS <i>Note:</i> Three Switch Fabrics are required for the QOC-48. OC-48c/STM-16 POS (for the 1-port IOA) OC-48c/STM-16 POS (for the 4-port IOA) OC-3c/STM-1 ATM OC-3c/STM-1 POS OC-12c/STM-4 ATM OC-12c/STM-4 POS Gigabit Ethernet (for the 2-port IOAs) Gigabit Ethernet (for the 8-port IOAs)

Table 1-1. Hardware Components

Component	Description
Line Cards or Input/Output Adapters (IOAs) <ul style="list-style-type: none">• Hot-swappable	<p>IOAs plug into the chassis from the back to provide the physical connectivity to the network.</p> <p>IOAs are designed to be used with a specific IOP. Removal and replacement of the IOAs affect only the directly connected IOP and will not affect operation of the rest of the system.</p> <p>Additional cards can also be added without affecting the other installed modules.</p> <p>Supported IOAs include:</p> <ul style="list-style-type: none">• 8-port OC-3c ATM• 8-port OC-3c POS• 2-port OC-12c ATM• 4-port OC-12c POS• 1-port OC-48c POS• 4-port OC-48c POS• 1-port OC-192c POS• 2-port Gigabit Ethernet• 8-port Gigabit Ethernet
Switch Fabric modules <ul style="list-style-type: none">• Hot-swappable	<p>Switch fabric modules provide simultaneous IP routing, Frame Relay switching and support ATM. Each is completely independent. The switch fabric is capable of N+1 redundancy. Should one fabric fail, traffic throughput is not minimized.</p>
SONET/SDH Timing/Alarm modules (STA) <ul style="list-style-type: none">• Hot-swappable	<p>The STA provides audible and visual alarming capabilities. It features a Stratum 3 clock source for high-performance synchronization.</p>

Table 1-1. Hardware Components

Component	Description
Route Control Processor (RCP) <ul style="list-style-type: none"> Redundant (optional) Hot-swappable 	<p>The RCP processes protocols, computes routing tables, and manages and updates the line card forwarding tables, signaling and control protocols and SNMP. The system supports up to two RCPs. The second RCP is for redundancy.</p> <p>The RCP has an EIA-232 service interface port for console command and diagnostic access, 10/100 Base-T Ethernet port for system management, and a PCMCIA card reader for the operating software and configurations. The management interface is available from the primary RCP, even if all network interfaces are down.</p> <p>The TMX 880 system is configurable with one or two RCP modules (primary and secondary). You can add a second (redundant) RCP to the system dynamically, with no data loss or degradation in performance to the components. The primary RCP or the secondary RCP can be removed and replaced while the system is powered.</p> <p>The redundant system supports hardware failover from the primary RCP to the secondary RCP, both automatically and under administrative control (from the command line interface). The primary acts as the RCP for the system while the secondary periodically checks on the status of the primary. The secondary controller updates itself with the data required to run the system. If the primary RCP should fail, the secondary RCP, mounted in the same chassis, continues to forward data packets. The system generates a notification message when switching from the primary RCP to the secondary RCP.</p> <p>When a redundant RCP is present in the system and you issue the <code>copy running-config startup-config</code> command, the system automatically copies both the startup configuration file and the backup file of the startup configuration to the secondary RCP.</p>
Power Distribution Units (PDUs) <ul style="list-style-type: none"> Redundant (optional) 	<p>The PDUs distribute and maintain 150 amps of DC power. Each PDU can carry a full system load, although two PDUs provide independent -48 VDC feeds to each system module. The system only draws the power necessary to power the cards in use.</p>
Fan Trays <ul style="list-style-type: none"> Hot-swappable Redundant 	<p>The fan trays displace 300 linear feet per minute of air, pulling it in at floor level and venting it out the top of the chassis.</p>

Figure 1-1. "TMX 880 Chassis with Bezels" on page 1-6 shows the front view of the chassis as shipped with filler panels, bezels and trim panels in place but with no modules installed.

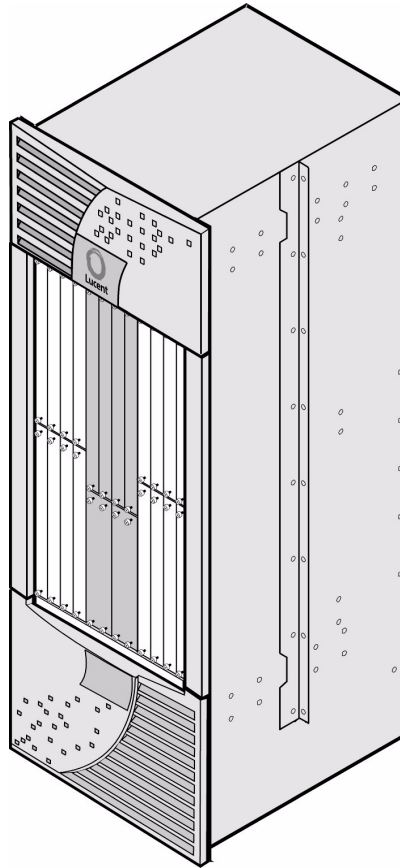


Figure 1-1. TMX 880 Chassis with Bezels

Figure 1-2. "TMX 880 Chassis Front View" on page 1-7 shows the front view of the chassis and the location of system components.

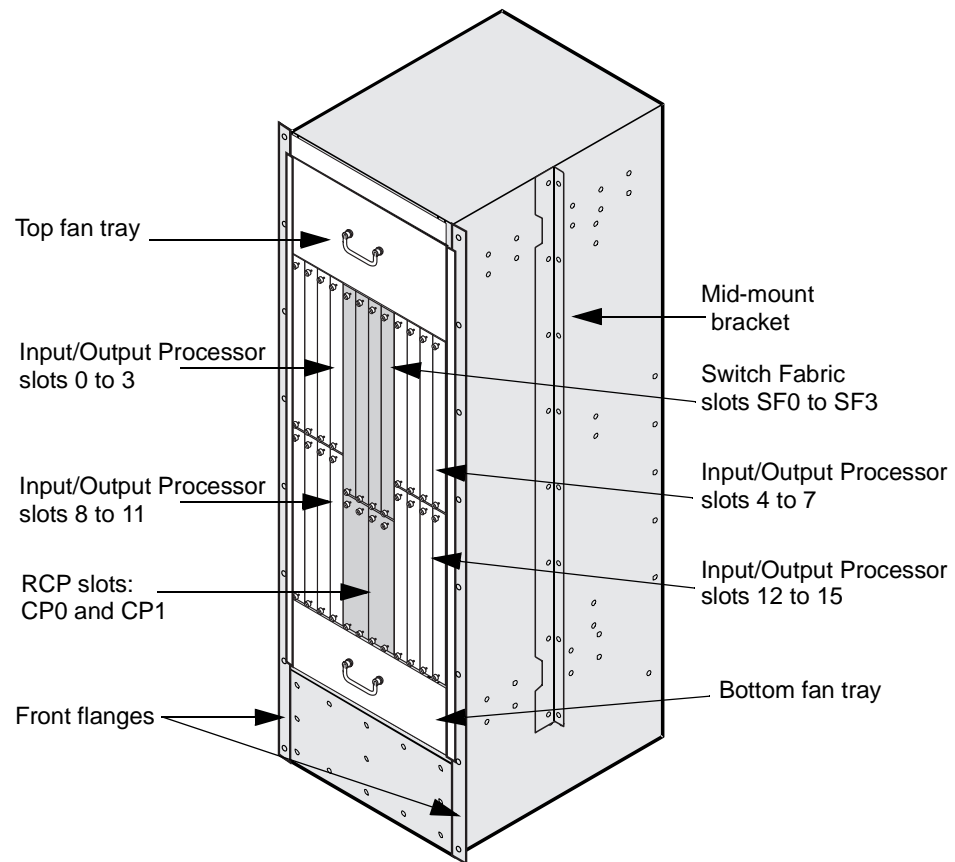


Figure 1-2. TMX 880 Chassis Front View

Figure 1-3. "TMX 880 Chassis Rear View" shows the rear view of the chassis and the location of system components.

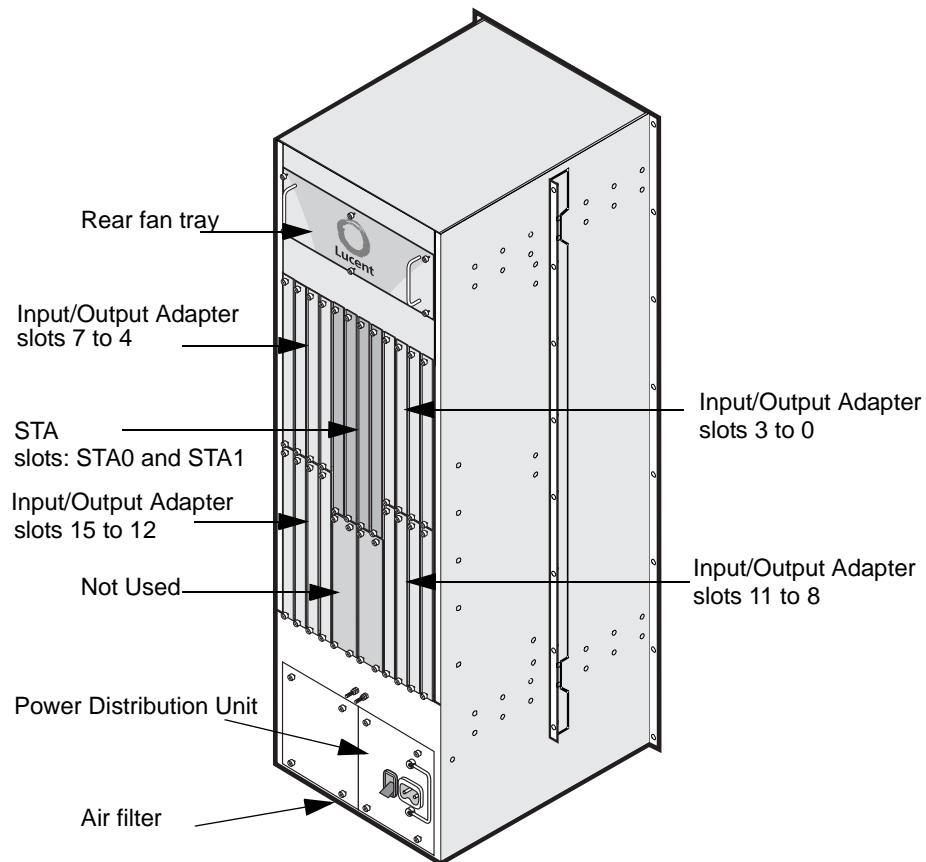


Figure 1-3. TMX 880 Chassis Rear View

Network Management

You can configure services and manage the system using the command line interface (CLI). See the *TMX 880 Configuration Guide* for detailed information about the CLI and its supported commands.

Supported Protocols and Standards

The system supports the following protocols and network standards:

- IP version 4
- Border Gateway Protocol
- Open Shortest Path First (OSPF)
- Integrated IS-IS
- IP over Frame Relay (RFC 1490)

- Frame Relay DLCI switching
- Point-to-Point Protocol
- ATM UBR, AAL5, RFC 1483
- SNMP version 2c
- Multiprotocol Label Switching (MPLS)
- Resource Reservation Protocol (RSVP)
- Protocol Independent Multicast—Sparse Mode (PIM-SM)

Regulatory Information

The TMX 880 MPLS Core Switch systems have been extensively tested and certified to meet the agency requirements listed in **Table 1-2. "Compliant Agency Requirements" on page 1-10.**

FCC Compliance

This equipment generates, uses, and may emit radio frequency energy. The equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operating this equipment in a residential area may cause harmful radio interference. In this case, the users will be required to take measures necessary to correct the interference, at their own expense.

Any modifications to this device—unless expressly approved by the manufacturer—can void the user's authority to operate this equipment under part 15 of the FCC rules.

European Common Market



Warning!

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.



¡Advertencia!

Este es un producto de la clase A. En un entorno doméstico este producto puede causar interferencia en el radio y, en tal caso, puede ser necesario que el usuario tome medidas apropiadas.



Attention!

Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.



Achtung!

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Industry Canada Compliance

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Agency Specifications

The TMX 880 MPLS Core Switch complies with the following agency requirements.

Table 1-2. Compliant Agency Requirements

Condition	Compliance
Safety	<ul style="list-style-type: none">• UL listed to UL 1950• cUL listed to CSA C22.2 No.950• IEC 950 (EN60950) CE Marking
Emissions	<ul style="list-style-type: none">• FCC Part 15 Class A• AS 3548 Class A• CISPR22 Class A (EN55022) CE Marking• BSMI Class A• VCCI Class A
Immunity	<ul style="list-style-type: none">• EN 50082-1:1982
Proposed Telco Compliance (Pending)	<ul style="list-style-type: none">• ETSI EN 300 386-2 1997• GR-0063-CORE Network Equipment Building System (NEBS)• GR-1089-CORE Electromagnetic Compatibility and Electrical Safety

Safety Guidelines



Refer to **Appendix C, "Safety Instructions"**, for general safety and laser safety instructions.

Site Planning Requirements

This chapter describes the following site requirements and specifications you must follow in preparing the site for the system installation and operation.

- System Specifications
- System Power Requirements
- Environmental Specifications
- System Location

System Specifications

The System Specifications section lists the TMX 880 MPLS Core Switch chassis physical dimensions and defines the requirements for rack mounting, weight and the clearances required for airflow and system maintenance.

Dimensions

- **Height:** 61.25 in. (155.57 cm.)
- **Width:** 19 in. (48.26 cm.)
- **Depth:** 23 in. (58.42 cm.)

These dimensions do not include airflow or maintenance clearances. See [Table 2-2. "System Airflow Clearances" on page 2-3](#) and the ["Maintenance Clearances" section on page 2-3](#) for this information.

Mounting Requirements

Lucent recommends mid-mounting the chassis in either a 19-inch rack or 23-inch rack. You can also front-mount the chassis in a 19-inch rack. For information on mounting the chassis in a cabinet, see ["Cabinet Mounting Requirements" on page 2-2](#).

Rack Mounting Requirements

The TMX 880 chassis is designed to mount in a standard 19-inch EIA rack. However you can mount the chassis in a 23-inch rack if required. The rack must conform to the following specifications:

- Rails: steel construction recommended. Aluminum is adequate if the top and bottom are secured.
- Support: the rack must be capable of holding up to 750 lb. (340.90 kg.)
- The 19-inch EIA rack is required for all NEBS seismic compliant installations

- ▶ Mid-mounting is required for NEBS seismic compliant installations. Also note the TMX 880 chassis must be mounted at the lowest mounting height supported. See [Table 2-2. "System Airflow Clearances"](#) for mounting height information.

For information on installing the chassis into the rack, refer to [Chapter 3, "Unpacking and Installing the Chassis"](#).

- ▶ The chassis ships with mid-mount brackets attached. Lucent recommends mid-mounting the chassis, if possible. Mid-mounting the chassis in the rack distributes the weight more evenly and reduces overhang in the rear of the chassis.

Cabinet Mounting Requirements

To mount the chassis in a cabinet, the cabinet must be capable of holding up to 750 lb. (340.90 kg.).

- ▶ Lucent recommends the TMX 880 system be installed in the Amco cabinet, part number S35243 or equivalent. This cabinet is a NEBS Seismic (Zone 4) compliant cabinet with approved mounting hardware included. For information regarding the use of the Amco cabinet with TMX 880 systems, contact E.S.I. (Prime Distributor) at 847-240-1800.

Weight

When shipped, the TMX 880 chassis contains the power distribution units (PDUs) and fan assemblies. With modules installed, the chassis weighs approximately an additional 200 lbs. (90.90 kg). [Table 2-1. "Chassis and Component Weights"](#) lists the weights of the various components that together comprise the total chassis weight.

Table 2-1. Chassis and Component Weights

Component	Approximate Weight
TMX 880 chassis with one power distribution unit (PDU) and three fan trays	450 lb. (204.1 kg.)
Each 150 amp PDU (2 maximum)	30 lb. (13.60 kg.)

Table 2-1. Chassis and Component Weights (Continued)

Component	Approximate Weight
Each processor engine/line card combination (16 maximum.)	12 lb. (5.4 kg.)
Each switch fabric module (4 maximum)	10 lb. (4.54 kg.)
Each Route Control Processor (2 maximum)	5 lb. (2.27 kg.)
SONET Timing/Alarm module (2 maximum)	5 lb. (2.3 kg.)
Chassis with maximum number of components installed	732 lb. (332 kg.)
Chassis maximum lb./sq. ft.	241 lb. /sq. ft. (1176.66 kg/m ²)

Airflow Clearances

The TMX 880 chassis requires clearance for air intake (from the bottom) and heat exhaust (out the top). **Table 2-2. "System Airflow Clearances"** lists both the minimum required and recommended airflow clearances.

Table 2-2. System Airflow Clearances

Heat Output (@ nominal Voltage)	Chassis Location	Required Space	Recommended Space
15,689 BTU/hr (whole chassis)	Front	4 in. (10.16 cm.)	6 in. (15.24 cm.)
	Rear	4 in. (10.16 cm.)	6 in. (15.24 cm.)
	Top	8 in. (20.32 cm.)	11 in. (27.94 cm.)
	Bottom	8 in. (20.32 cm.)	12 in. (30.48 cm.)

Maintenance Clearances

The TMX 880 system occupies 3.03 square feet of floor space (0.281496 square meters). In addition to this basic requirement, site preparation must also consider clearance requirements for system maintenance; that is, removal and replacement of IOPs, fan trays, and PDUs. Lucent recommends that you allow 4 feet at the front of the chassis and 4 feet at the back of the chassis.

Consider that if you mid-mount the chassis, it will extend about 10 inches (25.4 centimeters) at the front and 10 inches at the back of the rack. If you front-mount the chassis, it will extend approximately 20 inches (50.8 centimeter) at the back of the rack.

- Lucent recommends mid-mounting the chassis in the rack to distribute the weight more evenly and reduce overhang in the rear.

System Power Requirements

The TMX 880 system uses nominal -48VDC distributed power. The system electrical rating has a range of -42VDC to -60VDC (150A). However, the system uses only the power necessary to support the modules in use. **Table 2-3. "TMX 880 System and Module Power Requirements"** lists the TMX 880 system and module power requirements.

The Power Consumption is 4601W total maximum. Power feeders should be calculated based on the 150A circuit breaker in the TMX 880 (each feeder maximum, two feeders per unit).

Table 2-3. TMX 880 System and Module Power Requirements

System/Module	Current Draw (Amps)	Power Consumption (Watts)
Base Chassis - 1 PDU, 3 Fans	3.6	155.0
Route Control Processor	0.7	30.0
SONET Timing/Alarm	0.4	17.0
Switch Fabric	4.1	176.0
IOP-OC3-POS with IOA	4.3	186.0
IOP-OC3-ATM with IOA	5.3	228.0
IOP-DOC12-ATM with IOA	5.2	224.0
IOP-QOC12-POS with IOA	4.5	193.5
IOP-SOC48-POS with IOA	4.8	206.0
IOP-QOC-48c POS with IOA	4.6	197.8
IOP-SOC192-POS with IOA	5.2	224.0
IOP D-Gigabit Ethernet with IOA	4.5	193.5
IOP Q-Gigabit Ethernet with IOA	5.2	250.0
Notes: Power calculations are based on a -43VDC input power source. IOP designations use the following conventions: S = single or 1-port; D = dual or 2-port; Q = quad or 4-port; O = octal or 8-port.		

- Lucent recommends that you increase the total power-consumption number by 10% - 15% when providing power to the chassis to allow for module-to-module variation.

Power and Ground Cables

The system is shipped with the Elcon power connector (408-00016-00). Before this connector can be connected to the system, the customer must:

- Provide the power cables and the ground cable.
- Assemble the power cables to the connector.
- Terminate the ground cable with a straight lug.

See [Chapter 4, “Connecting Power to the Chassis”](#) and [Appendix B, “Cable Connectors and Pinouts”](#) for detailed information.

Providing Power to the System

The system can be powered from a single input or a dual, redundant input power source depending on whether one or two PDUs are installed in the chassis. The system is protected internally against power faults, but it is also necessary to provide circuit protection at the source of power distribution.

Three connections must be made to the chassis: Return (+ or 0 VDC), -48 VDC and safety ground (earth ground). A sample power connection diagram for 1 PDU is shown in [Figure 2-1. “Sample Power Connection for 1 PDU”](#).

Each installation must be line engineered. The power ratings in this document are for the TMX 880 system only. Wire-size, length and fuse size vary from installation-to-installation. The Installer must follow required company and local codes.

- Install the RCP before turning the PDU circuit breaker to the On position. See [“Installing the Route Control Processor” on page 5-3](#) for detailed instructions on installing the RCP and [“Powering the TMX 880 Chassis” on page 5-6](#) before providing power to the system.

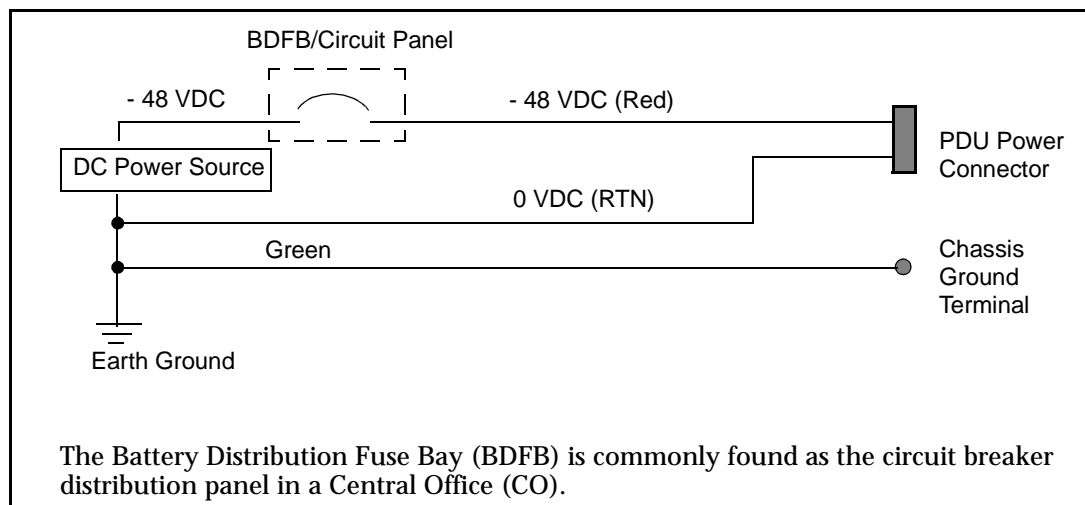


Figure 2-1. Sample Power Connection for 1 PDU

When the system has two PDUs, for proper operation, the returns for PDU “A” and PDU “B” must be connected to a common potential (that is, 0 VDC). The two-PDU system diagram for these connections is shown in **Figure 2-2. "Sample Power Connection for 2 PDUs"**.

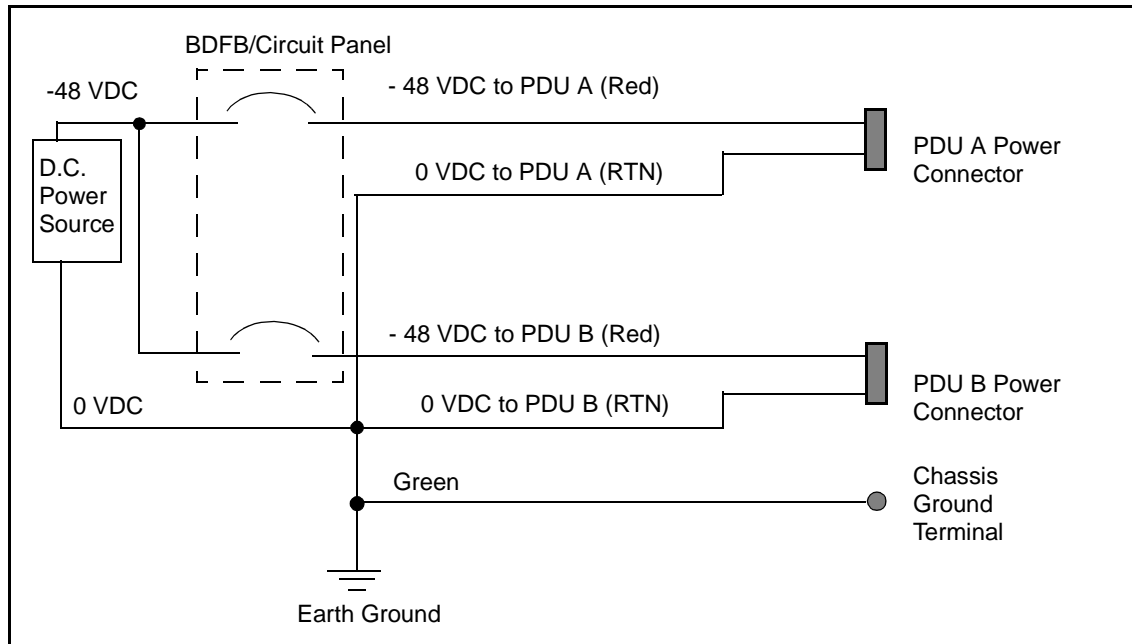


Figure 2-2. Sample Power Connection for 2 PDUs

Environmental Specifications

The environmental conditions, required for the system, are listed below.

- **Altitude:**
 - Operating and storage: 0 to 10,000 ft. (0 to 3040 m.)
- **Humidity:**
 - Operating: 5% to 90% (noncondensing)
 - Storage: 5% to 95%
- **Temperature:**
 - Operating: 32° to 104° F (0° to 40° C)
 - Storage: -40° to 149° F (-20° to 65° C)

System Location

The system must be installed in a *restricted-access* location by authorized customer or Lucent personnel and must be installed on a dry, non-flammable surface, preferably concrete.

Unpacking and Installing the Chassis

To successfully install the TMX 880 system, you must follow the installation order as described on [page ix](#).

This chapter describes how to unpack the TMX 880 MPLS Core Switch and install the chassis into a 19-inch rack, 23-inch rack or cabinet. This chapter describes the following:

- Required Installation Tools
- Unpacking and Verifying the Shipment
- Determining the Rack Mounting Configuration
- Removing Shipping Hardware
- Transferring the Chassis from the Pallet to the Rack
- Securing the Chassis to the Rack Rails
- Installing the Air Filter
- Installing the Cable-Management Brackets

► Review this chapter before you begin the installation to become familiar with all the required procedures.

Required Installation Tools and Materials

In addition to the items shipped with the system, you need the following tools to complete the installation including ITE numbers where applicable:

- Wire cutter (R-4131, 8" cable cutter or R-6433, 5" Diagonal cutter)
- No. 1 and No. 2 Phillips screwdrivers
- Ratcheting socket wrenches 1/2", 3/8" & 9/16" (R-6001)
- Adjustable wrench
- Voltmeter (ITE-6930 or ITE-6379C)
- Multiport hub (Ethernet Hub, 5 Port, is ITE-7131A)
- Tape measure or ruler (R-6054, 26' Tape Measure, R5942 or R5952)
- Torque wrench (capable of 50 inch lbs. of torque)
- Cletop Connector Cleaning System (ITE # 7137)

- Optical Power meter, calibrated for the optical wavelength to be measured.
- 2 AWG (.067 in sq.)(43.3 mm sq.) stranded (flexible) cable for the power and ground cables. The cables must be a maximum of 10-feet (3.048 meters) in length, so that the cable is long enough to go from the system to a splice point above or below the system.
- Power cable lugs and ground cable lugs.

► ITE numbers are order numbers for Lucent employees only.

► See [Appendix B, "PDU Connector"](#) for the power and ground cable specifications and the power and ground cable lug dimensions.

Unpacking and Verifying the Shipment

The system and components are shipped on two or more pallets. One pallet holds the system chassis, the other pallet(s) contain system modules and other installation accessories. The content of these boxes is listed in [Table 3-1. "Contents of the Shipping Containers"](#).

Lucent recommends that you save the chassis shipping crate and packing material in the event you need to move the system to another location. If your original shipping crate is damaged or discarded, you can order a replacement. See [Appendix D, "Part Numbers and Ordering Information"](#) or contact your local Lucent account manager for the latest TMX 880 system product information.

Unpacking Procedure

To facilitate transportation, the chassis is shipped securely attached to a reinforced pallet.



The chassis crate weighs about 500 pounds (227 kilograms). To prevent personal injury or damage to the equipment, you must use a forklift to transfer the crate from the truck to the shipping dock. Use a pallet jack to transfer the chassis from the dock to the installation setup area.

Follow the steps listed below to unpack the system:

1. Move the chassis (on the pallet) and any accompanying boxes to the installation setup area.
2. Use a wire cutter to cut and remove the packaging straps on the cardboard boxes.
3. Remove the top of the system chassis box and lift the bottom portion of the box straight up and off the chassis.
4. Remove the foam top cap and any bubble-wrap from the chassis.
5. Unpack the dolly. The dolly is used to move the chassis from the setup area to the equipment rack.
6. Unpack the install-leveling shelf.

- It is possible for two people to set up and install the chassis in a 19-inch rack in less than 1 hour using the dolly and the install-leveling shelf.

7. Open the other boxes to verify their contents.



Store the module boxes and the software kit box in a safe area until they are required by the installation procedure, so that the contents is not damaged.

Make sure to wear an electrostatic discharge (ESD) wrist strap when handling any module components. If you open the boxes containing the modules, do not remove the modules from their anti-static bags until you are ready to install them into the chassis.

Verifying the Shipment

Check the contents of the shipping crate and additional boxes to verify complete shipment. **Table 3-1. "Contents of the Shipping Containers"** lists the contents of the shipment. If any boxes are missing, contact your shipping carrier. If any items are missing from the boxes, contact your Lucent account manager.

Table 3-1. Contents of the Shipping Containers

Box/Crate	Contents
Chassis	System chassis with fan trays, power distribution unit(s), standard 19-inch rack mid-mount brackets.
Accessory kit	<ul style="list-style-type: none">• 2 electrostatic discharge (ESD) cords and wrist straps• 1 power connector (2 if system is ordered with two PDUs)• 1 Air filter• Rack-mount screws (16 each: 10-32 x 1/2 and 12-24 x 1/2)• 2 cable-management brackets• Cable accessory kit containing:<ul style="list-style-type: none">– RJ45-to-DB9 adapter (432-0001-00)– RJ45-to-DB25 adapter (432-0002-00)– DB25-to-DB9 adapter (432-0003-00)– optical cable extension with MTRJ connector (400-00004-00)• <i>TMX 880 Installation Guide</i>
Modules	Route Control Processors, Switch Fabrics, SONET Timing/Alarm, Processor Engines and Line Cards (as ordered.)

Table 3-1. Contents of the Shipping Containers (Continued)

Box/Crate	Contents
Software kit	<ul style="list-style-type: none">• MXOS software suite on the PCMCIA card(s)• <i>TMX 880 Configuration Guide</i>• <i>TMX 880 Command Reference</i>• <i>TMX 880 Command Quick Reference</i>• <i>TMX 880 Troubleshooting Guide</i>• <i>Release Notes for the MXOS Software</i>• User documentation on CDROM
Installation kit	<ul style="list-style-type: none">• One box, containing the dolly• One box, containing the install-leveling shelf and a bag of required hardware.
23-inch Rack Mount kit	Shipped only if ordered, the kit includes: <ul style="list-style-type: none">• 23-inch rack mid-mount brackets• 23-inch rack leveling shelf brackets

- Customers must supply their own optical cables and alarm cables. See [Chapter 4, “Connecting Power to the Chassis”](#) and [Appendix B, “Cable Connectors and Pinouts”](#) for detailed information

Mounting the Chassis

Before you begin, make sure the staging area and the installation area are clear, then unpack the installation kit. At this point, the chassis should still be bolted to its pallet in the installation staging area.

Lucent recommends mid-mounting the chassis in either a 19-inch rack or 23-inch rack. You can also front-mount the chassis in a 19-inch rack. For information on mounting the chassis in a cabinet, see [“Installing the System in a Cabinet” on page 3-5](#).

- Some installations prevent you from reading the serial number when the router is installed. Record the serial number (located on the on the side of the router) according to your company’s specifications before installing the system.
- For NEBS seismic compliant installations, mid mounting is required for 19-inch EIA rack mounting.

Determining the Rack Mounting Configuration

The chassis ships ready to be mid-mounted (mounted by midpoint brackets) in a 19-inch rack. Mid-mounting distributes the chassis weight more evenly and reduces overhang at the rear of the rack. You can also mount the chassis in a 19-inch rack from the front flange (referred to as front-mounting) See the “[Preparing the Chassis for Front-mounting](#)” section for detailed instructions.

The chassis can also be mid-mounted in a 23-inch rack. If you are planning to mount the chassis in a 23-inch rack, you must replace the mid-mount brackets on the chassis (refer to “[Preparing the Chassis for Mid-mounting in 23-inch Rack](#)”) and the brackets on the install-leveling shelf (refer to “[Modifying the Install-leveling Shelf for a 23-inch Rack](#)”). The 23-inch Mounting kit (ordered separately) contains the 23-inch mounting brackets.

- ▶ Lucent recommends mid-mounting the chassis, if possible, to distribute the weight more evenly.
- ▶ If you are not front-mounting the chassis in a 19-inch rack or mid-mounting the chassis in a 23-inch rack, skip to the “[Removing Shipping Hardware](#)” section on [page 3-7](#).

Installing the System in a Cabinet

For cabinet installation, Lucent recommends the TMX 880 system be installed in the Amco cabinet, part number S35243 or equivalent. This cabinet is a NEBS Seismic (Zone 4) compliant cabinet with approved mounting hardware included. See “[Cabinet Mounting Requirements](#)” on [page 2-2](#) for more information.

Preparing the Chassis for Front-mounting

To front-mount the system by the chassis flange remove the front bezels and side-trim panels (refer to [Figure 3-1. "Removing Bezels and Trim Panels"](#)) while the chassis is secured to the pallet.

- ▶ You can front-mount the chassis only in a 19-in rack.
- ▶ For NEBS seismic compliant installations, mid-mounting is required for 19-inch EIA rack mounting.

To front-mount the chassis:

1. Remove the top and bottom bezels by grasping the bezels by the corners and pulling them away from the chassis. They are attached by ball studs and separate easily.
2. Remove the side-trim panel on each side of the chassis. Remove the two screws that attach each panel to the chassis. Slide the panel upward and remove it from the chassis.
3. Place the side-trim panels and the bezels in a secure place. You can replace them after the chassis is installed in the rack.
4. Remove the 12 screws securing each mid-mount bracket to the chassis and remove the brackets. Save the screws.

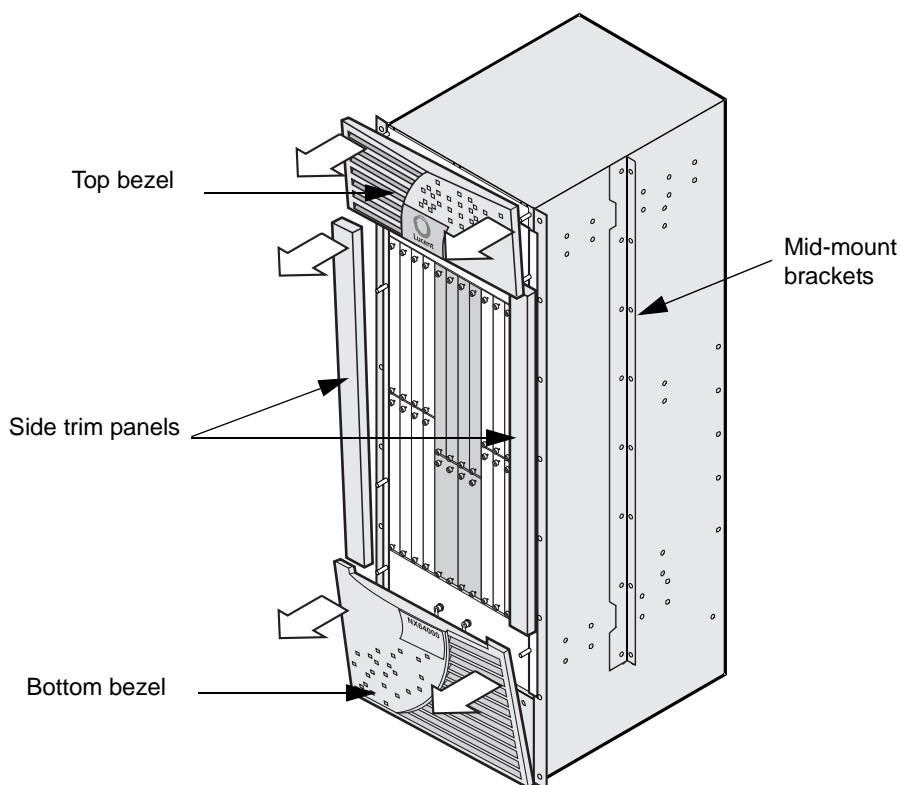


Figure 3-1. Removing Bezels and Trim Panels

5. Skip to the section on **“Removing Shipping Hardware”** on page 3-7.

Preparing the Chassis for Mid-mounting in 23-inch Rack

The chassis can be mounted either in a 19-inch or in a 23-inch rack by the mid-mount brackets. The chassis ships ready to be mid-mounted in a 19-inch rack. To mount the chassis in a 23-inch rack, replace the mid-mount brackets with larger brackets that are shipped in the 23-inch rack mount kit.

- If you are not mid-mounting the chassis in a 23-inch rack, skip to the next section, **“Removing Shipping Hardware.”**

To replace the brackets, perform the following operations while the chassis is secured to the pallet:

1. Using a #2 Phillips-head screwdriver, remove and save the 12 screws that secure each bracket to the chassis.
2. Position each larger bracket so that the 2 notches in each bracket clear the two sets of screws at the top and bottom of the chassis.
3. Use the screws that you removed in step 1 to secure each new bracket to the chassis. Tighten the screws to securely mount the brackets to the chassis.
4. Follow the steps listed below in **“Removing Shipping Hardware”**.

Removing Shipping Hardware

The chassis is secured to the pallet using two shipping brackets, one on each side of the unit. Remove the shipping brackets and the front piece of the pallet as follows (see **Figure 3-2. "TMX 880 Chassis Attached to the Shipping Pallet"**):

1. Using the 3/8-inch socket wrench, remove the 4 screws on each side of the chassis that secure the shipping-bracket to the chassis. Save the screws.
2. Using the 9/16-inch socket wrench, remove the 4 bolts on each side of the chassis that attach the shipping-bracket to the pallet. Save the bolts and the shipping-brackets.
3. Using the 9/16-inch socket wrench, remove the 2 bolts that hold the front 2x4 board of the pallet frame (save the bolts). With this board removed, the chassis can slide forward.

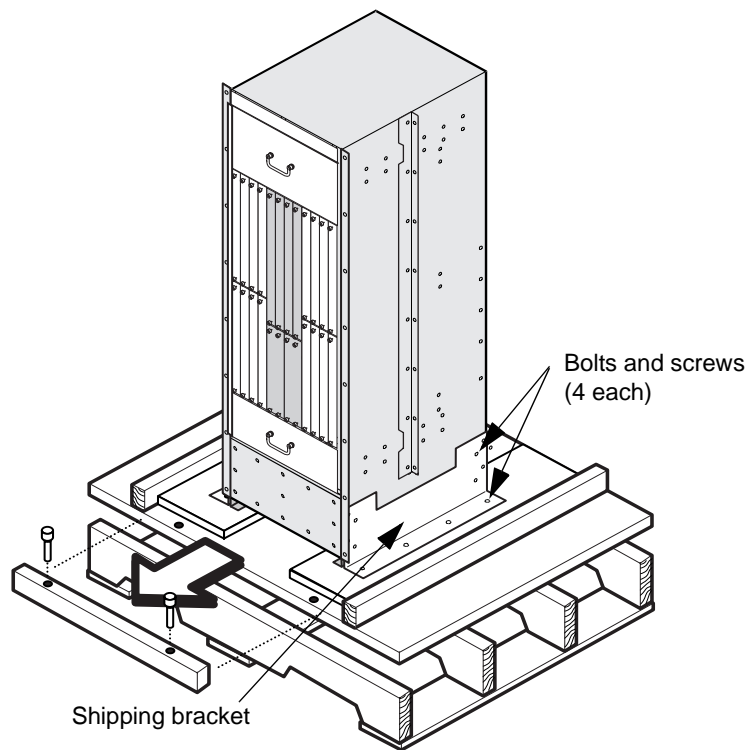


Figure 3-2. TMX 880 Chassis Attached to the Shipping Pallet

Transferring the Chassis from the Pallet

You must move the chassis onto the wheeled dolly (shipped with the system) to transport it to the rack for installation.

To move the chassis to the dolly:

1. Wheel the dolly, with the outriggers forward, until the dolly comes to rest against the pallet, so that the hole in each outrigger aligns with the threaded hole in each aluminum runner under the chassis (see to **Figure 3-3. "Transferring the Chassis to the Dolly"**).

► Installation with the dolly requires at least a 30-inch (76.2-centimeter) gap of free space to roll the chassis to its spot on the rack.

2. Secure the dolly and pallet together using the 2 dolly bolts (shipped with the dolly).

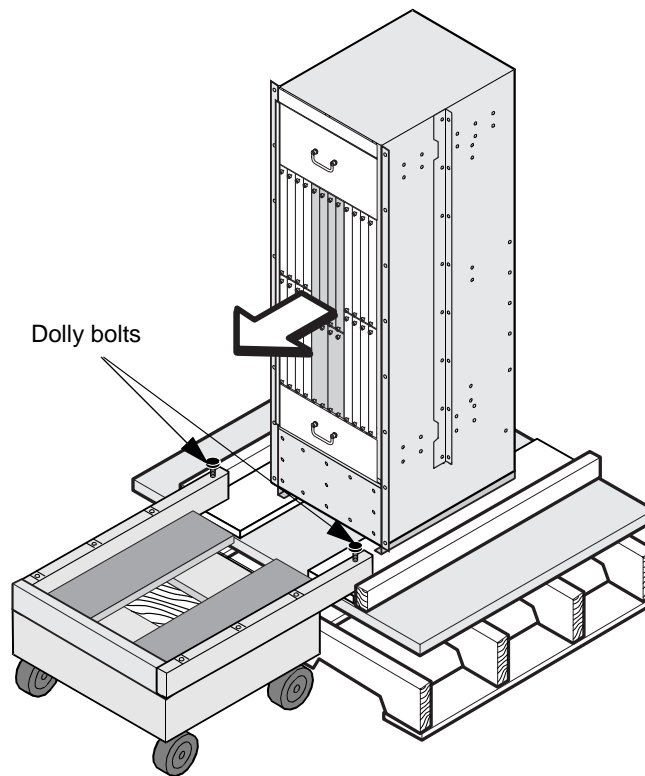


Figure 3-3. Transferring the Chassis to the Dolly



Make sure that the top surface of the pallet and the dolly are at the same height.

3. Slowly slide the chassis from the pallet onto the dolly.



The chassis is extremely heavy. To avoid injury, be sure to slide and not lift the unit as you move it onto the dolly.



Due to the height and weight of the chassis, there is the possibility of it tipping while you are moving it onto the dolly. The unit is stable as long as you move it slowly and smoothly at all times.

4. Remove the dolly bolts and save the bolts for later use. The unit is now ready for transport to the rack (see **Figure 3-4. "Chassis Ready for Moving"**).

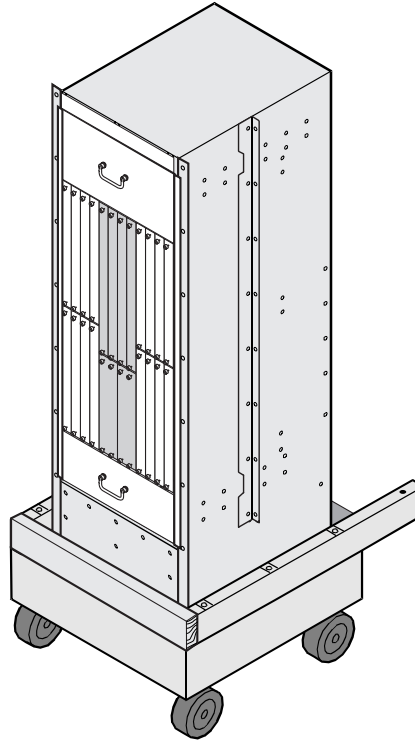


Figure 3-4. Chassis Ready for Moving

Using the Install-leveling Shelf

Before moving the chassis into the rack for installation, you must set up the install-leveling shelf and secure it to the rack. The shelf is designed to align the chassis in the rack at the recommended height of 12 inches (30.48 centimeter) off the floor. This clearance allows for proper airflow under the chassis.

Modifying the Install-leveling Shelf for a 23-inch Rack

To secure the install-leveling shelf to a 23-inch rack, the two shelf brackets (one on each side) that secure the shelf to the rack must be replaced with the larger shelf brackets that are provided the 23-inch install kit.

- If you are not mid-mounting the chassis in a 23-inch rack, skip to the next section, **"Securing the Install-leveling Shelf to the Rack."**

To replace the brackets proceed as follows:

1. Notice how the brackets are positioned laterally on each side of the shelf.

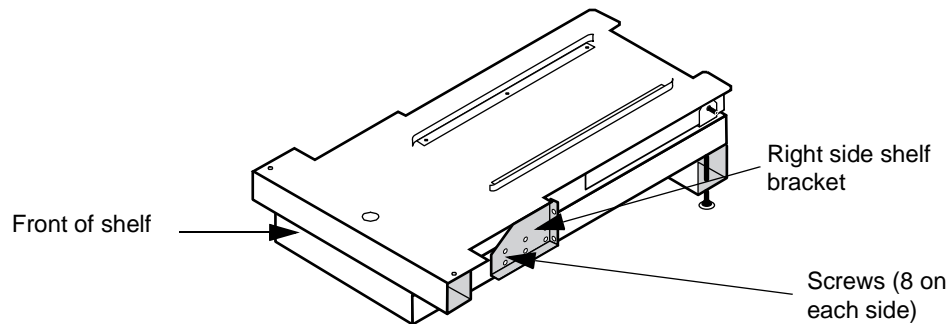


Figure 3-5. Install-leveling Shelf

2. Remove the 8 screws that secure the right-side bracket to the shelf, save the screws.
3. Remove the right-side brackets from the shelf.
4. Position the larger right-side bracket (shipped in the kit) on the right side of the shelf and secure it firmly to the shelf with the 8 screws removed in step 2.
5. Replace the left-side bracket in the same manner.

Securing the Install-leveling Shelf to the Rack

Secure the shelf to the rack as follows (see **Figure 3-6. "Install-leveling Shelf in Rack"):**

1. Center the shelf in the rack. Slide the shelf into the rack until the brackets meet with the rail.

Because you are going to slide the chassis from the dolly to the shelf, the top surface of the shelf must be set to the same height as the dolly (approximately 12 inch/30.48 cm). The shelf is designed to be at the proper height when positioned in the rack correctly.

2. Attach the brackets on each side of the shelf to the rack rails using three 10-32 x 1/2 or 12-24 x 1/2 screws for each side.
3. Using the adjustable wrench, adjust the leveling feet at the back of the shelf until they rest securely on the floor.

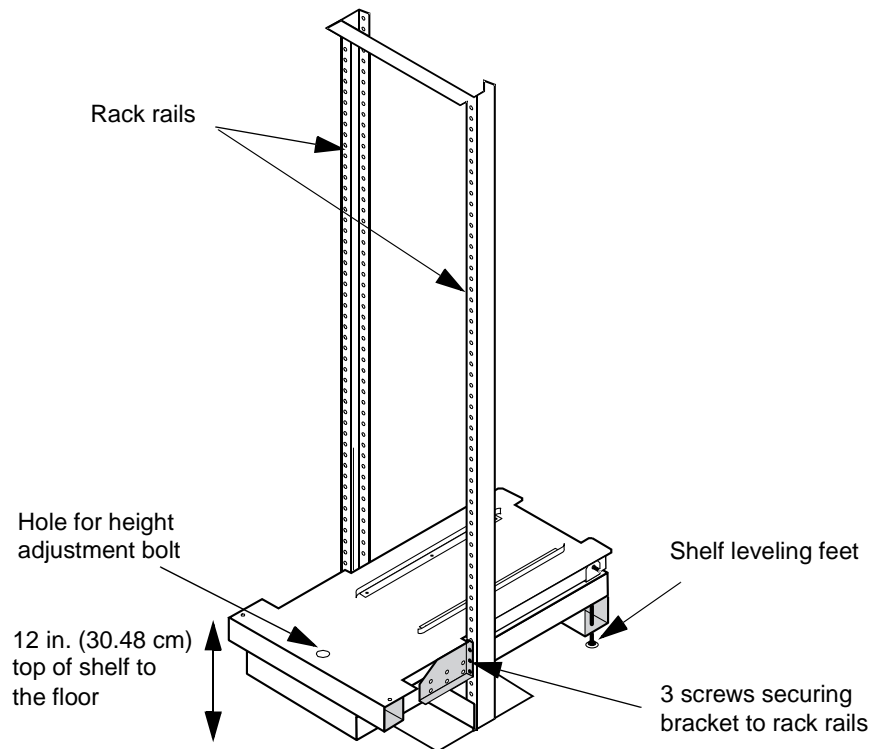


Figure 3-6. Install-leveling Shelf in Rack

Transferring the Chassis to the Rack

When the install-leveling shelf is secured to the rails and level, you can move and install the chassis into the rack.



When moving the chassis to the rack-mount unit, move it slowly on the dolly as the chassis weighs about 500 pounds (226.796 kilograms).

To transfer the chassis to the rack:

1. Wheel the dolly, with the chassis on it, up to the install-leveling shelf.
2. Use the dolly bolts to attach the dolly to the shelf as shown in **Figure 3-7. "Transferring the Chassis into the Rack"**.
3. Slide the chassis from the dolly onto the install shelf. The rails on the shelf help to guide the system evenly between the rack rails.
4. Slide the chassis into the rack until either the mid-mount brackets (for mid-mounting) or the chassis flange (for front-mounting) come in contact with the rack rails.

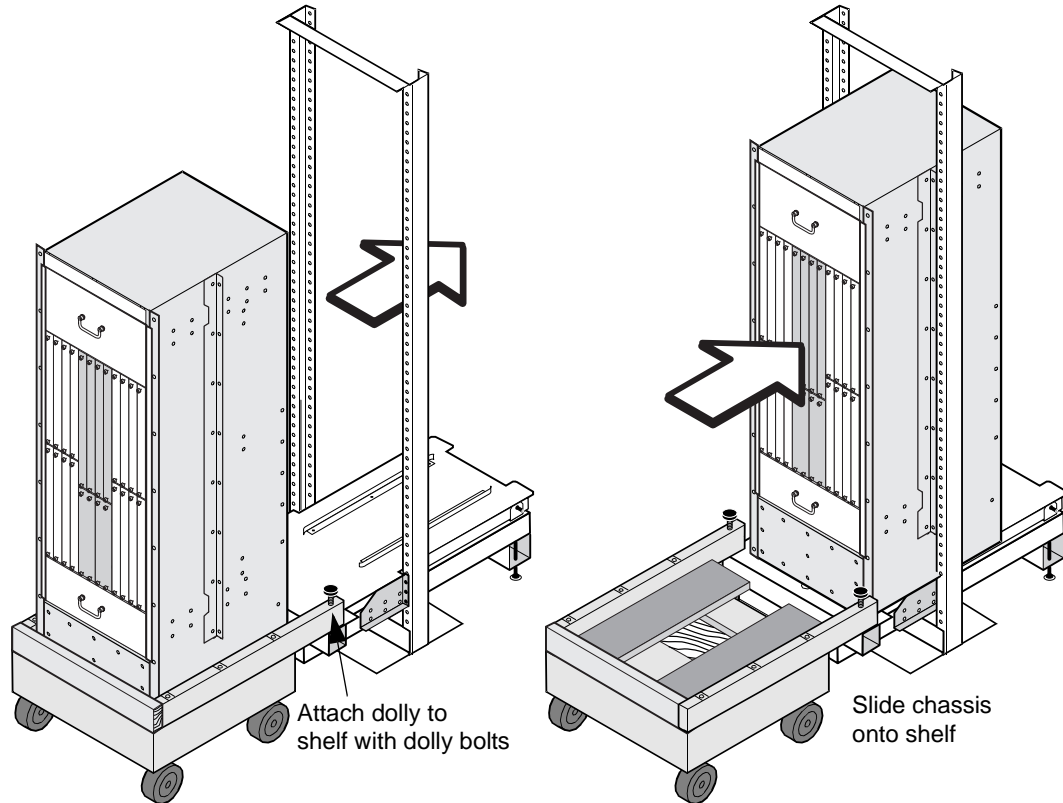


Figure 3-7. Transferring the Chassis into the Rack

5. Remove the dolly bolts and the dolly from the shelf.

► Save the dolly and the dolly bolts in case you have to move the chassis at some future time.

Securing the Chassis to the Rack Rails

After moving the chassis into the rack, you must secure it to the rack rails. Use the 1/2-inch bolt shipped with the leveling shelf to adjust the height of the chassis in the rack.

1. Drop the 1/2-inch bolt through the height-adjustment hole in the install-leveling shelf (see [Figure 3-8. "Attaching the Chassis to the Rack"](#)).
2. With the mid-mount brackets or front flanges against the rack rails, tighten the bolt with the 1/2-inch socket wrench until the holes in the chassis brackets or flanges align with the holes in the rack rails.
3. Secure the chassis to the rails using the 16 10-32 x 1/2 or 12-24 x 1/2 screws (8 on each side) shipped in the accessory kit. Insert all of the screws and then tighten from the top down.

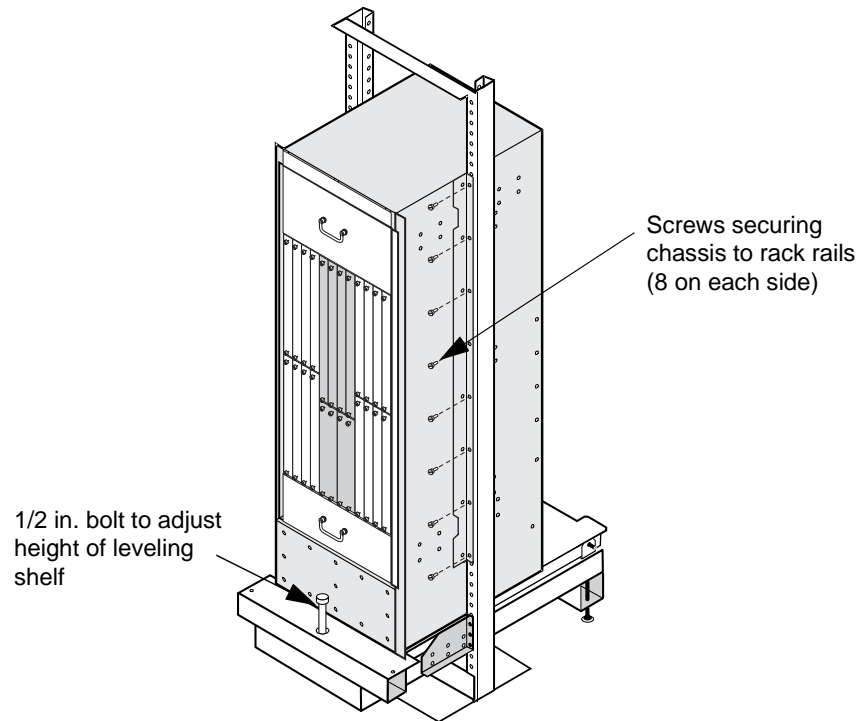


Figure 3-8. Attaching the Chassis to the Rack

Removing the Install-leveling Shelf

After the chassis is secured to the rack rails, remove the shelf from under the chassis to allow proper airflow to the system.



Do not run the system with the shelf in place because it blocks airflow to the system.

To remove the shelf:

1. Loosen the 1/2-inch height-adjustment bolt in the install-leveling shelf.
2. Recheck and retighten the rack-mount screws after the loosening the height-adjustment bolt and then remove the 1/2-inch bolt.
3. Remove the rear support bracket with leveling feet from the shelf by loosening the leveling feet with the adjustable wrench and then removing the two 10-32 screws (see [Figure 3-9. "Removing the Install-leveling Shelf"](#)).
4. Remove the quick-release pins from the rear of the shelf.
5. While standing at the front of the rack, slide the top half of the shelf from beneath the chassis by pulling it towards you.
6. Remove the shelf bracket screws and remove the bottom half of the shelf from the rack.

- Save all install-leveling shelf components and hardware in case you have to move and re-install the chassis at some future time.

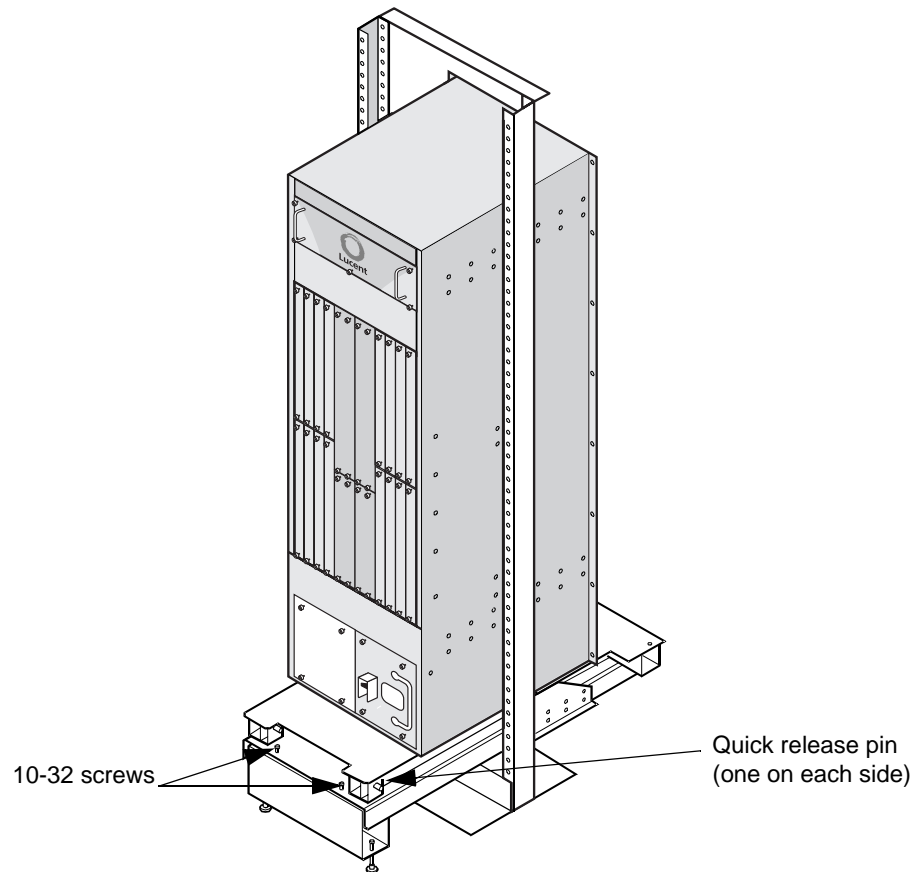


Figure 3-9. Removing the Install-leveling Shelf

7. If you removed the bezels and trim panels from the front of the chassis, you can replace them now.

Installing the Air Filter

Install the air filter in the chassis by sliding it into the C-brackets at the bottom rear of the unit (see **Figure 3-10. "Installing the Air Filter"**). Install the filter with the metal mesh side up.

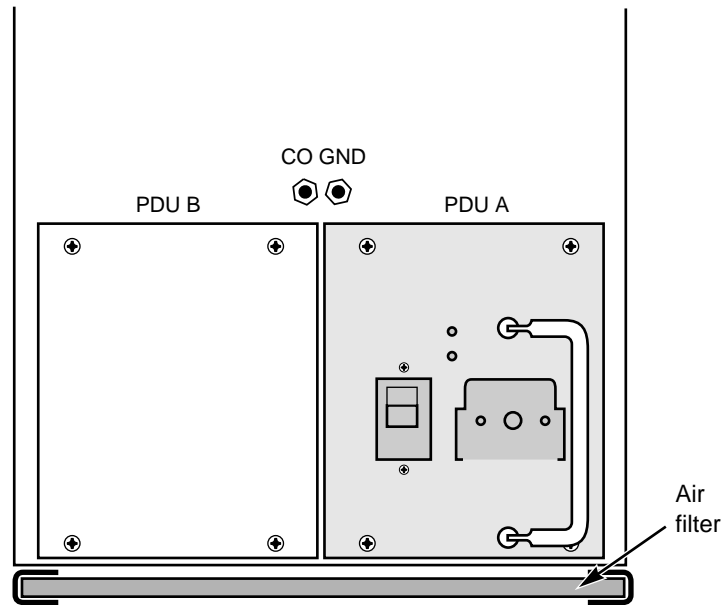


Figure 3-10. Installing the Air Filter

Installing the Cable-management Brackets

After the installing the chassis in the rack, install the cable-management brackets (top and bottom). The cable-management brackets hold and direct the cables, at the back of the chassis, from the line cards to the central office cable trays. The cable-management brackets are provided in the accessory kit.

To install the cable-management bracket (refer to **Figure 3-11. "Cable-management Brackets on Rear of Chassis"):**

1. Position the top cable-management bracket on the mounting plate and secure it to the mounting plate using 2, 6-32 pan-head screws.
2. Position bottom cable-management bracket on the mounting plate and secure it to the mounting plate using 2, 6-32 pan-head screws.
3. After you have installed the IOAs in the chassis, you can route the cables through the cable-management bracket. See **Chapter 5, "Installing Hardware Modules,"** for information on installing the IOA cards.

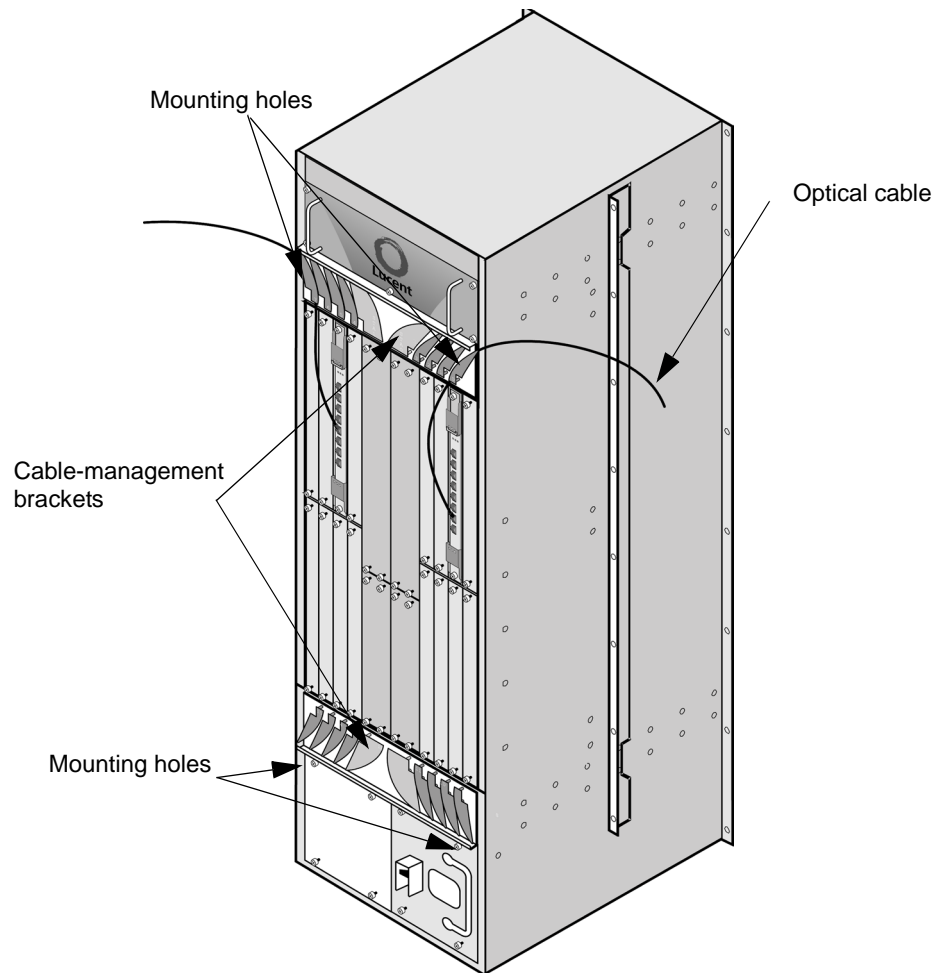


Figure 3-11. Cable-management Brackets on Rear of Chassis

Connecting Power to the Chassis

Once the chassis is installed in its rack-mount cabinet, you must ground the unit and connect power to the chassis. Depending on your configuration, you must connect either one or two power connectors to the power distribution unit(s). For additional information about the power connector, see “[System Power Requirements](#)” on page 2-4 and see [Appendix B, “Cable Connectors and Pinouts.”](#)

This chapter describes the following:

- Safety guidelines
- Grounding the chassis
- Connecting the power supply and testing the input voltage

Safety Guidelines

Observe the following safety guidelines to prevent physical injury and to prevent damage to the equipment when installing or operating the TMX 880 MPLS Core Switch:

- Locate the emergency power switch or breaker for the equipment and make sure it is set to Off.
- Disconnect all power and external cables *before* moving a chassis.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit, always check.
- Do not do anything that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as wet floors, ungrounded power extension cables or missing safety grounds.



Refer to [Appendix C, “Safety Instructions”](#) for safety information concerning working with lasers.

Grounding the Unit

After you have completed the chassis-to-rack installation, you must ground the unit. Customers must terminate the ground cable with a straight lug before these cables can be connected to the system.

To ground the unit:

1. Attach a ground cable to your dedicated ground service. Lucent recommends 2 AWG (.067 in sq.) (43.3 mm sq.) stranded (flexible) cable, a maximum of 10-feet (3.048 meters) in length be used for the power and ground cables. Refer to [Appendix B, "Cable Connectors and Pinouts"](#) for more information.
 2. Connect the spade lug at the other end of the ground cable to the ground terminals located above the PDU bays (see [Figure 4-1. "Grounding the Chassis"](#)).
- Lucent recommends torquing the nuts on the ground terminals to 50 in. lbs. for a secure connection.

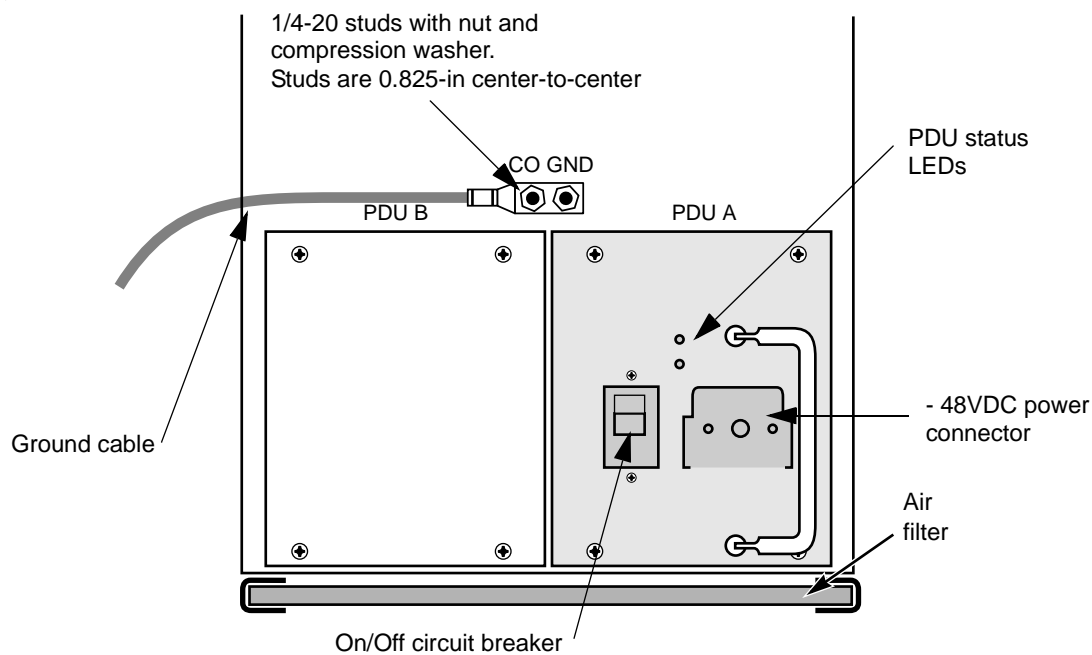


Figure 4-1. Grounding the Chassis

Attaching the Power Connector

The system can be powered from a single input or a dual, redundant input power source depending on whether one or two PDUs are installed in the chassis.

Each PDU in the chassis uses an Elcon power connector that is shipped in the accessory kit. Customers must assemble the power cables to the connector before connecting them to the system. See **"Providing Power to the System"** on page 2-5 for diagrams of these three connections and Appendix B **"PDU Connector"** on page B-3 for detailed connector assembly instructions.

To attach the power connector to the PDU:

1. At the bottom rear of the chassis, locate the PDU and its components (see **Figure 4-1. "Grounding the Chassis"**).



Ensure that the On/Off circuit breaker is in the *down* (Off) position.

2. Attach the power connector to the power receptacle by aligning the connector guide pin with the receptacle.
3. Twist the guide-pin handle clockwise until the connector clicks into place (see **Figure 4-2. "Attaching the Power Connector (Redundant PDUs)"**).

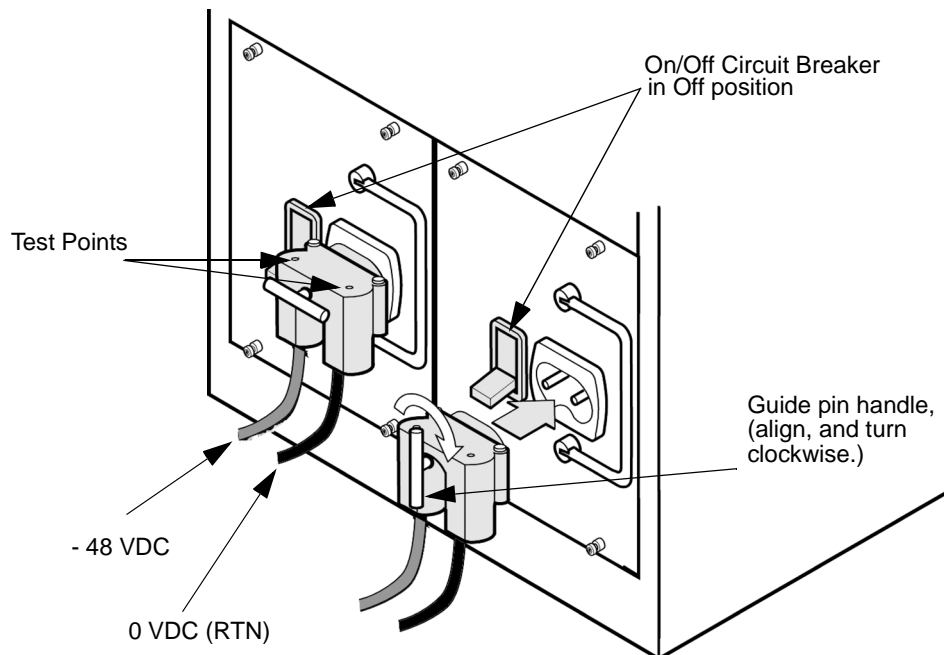


Figure 4-2. Attaching the Power Connector (Redundant PDUs)

4. Repeat these steps for a second PDU, if applicable.
5. Attach the non-terminated end of the power connector(s) to a DC power source. Observe proper polarity when making connections.
6. Make sure the On/Off circuit breaker on the PDU(s) is in the down (Off) position, and then apply power at the DC source.

7. Using a voltmeter, check the voltage at the test points on the top of the power connector(s) (see **Figure 4-2. "Attaching the Power Connector (Redundant PDUs)"**) to ensure a nominal -48 VDC source.
 - ▶ Install the RCP before turning the PDU circuit breaker to the On position, refer to **Chapter 5, "Installing Hardware Modules,"** for detailed instructions on installing the RCP.

Installing Hardware Modules

This chapter describes how to install the modules into the chassis; it includes information on:

- Determining module slot location in the chassis
- IOP slot sequencing
- Installing and cabling modules
- Powering the chassis and viewing operational status

Before You Begin

Before you begin to handle and install the system modules, to minimize the chance of electrostatic discharge (ESD) damage, observe the following precautions:



The TMX 880 system components can be damaged by static electricity. Static voltages as high as 35,000 volts can build from handling plastic or foam packing material, or sliding an electronic assembly across plastic or carpeting. Intermittent or complete component failures can result.

- Always wear an ESD wrist/ankle strap with good contact to the skin when handling the modules.
- Insert the equipment end of your ESD strap (the banana plug) into an ESD socket in the front or back of the chassis before handling a module. See [Figure 5-4. "IOP Population Slot Locations" on page 5-10](#) and [Figure 5-5. "IOA Slot Locations \(Rear View\)"](#) for location of the ESD sockets.
- Avoid contact between the cards and your clothing. The wrist strap protects cards from ESD voltages on the body only; ESD voltages on clothing can still cause electronic-component damage.
- Always place a card component-side up on an anti-static surface, in an anti-static card rack, or in a static-shielding bag. If you are returning a card to the factory, immediately place it in a static-shielding bag.
- Install modules using the ejector levers ([Figure 5-2. "Module Slide Latch and Ejector Levers" on page 5-7](#)) to properly seat the card connectors to the chassis, tighten all captive screws.



To prevent possible operational failure, make sure to install all Input/Output modules in the order described in ["IOP Slot Installation Sequence" on page 5-9](#).

Installing Modules

The TMX 880 system chassis contains only the PDUs and fan assemblies when shipped. The card modules are installed after the chassis has been secured to the rack. Modules are hot-swappable, which means you can install modules while the system is powered. However, to facilitate the process of booting the system for the first time, we recommend that you install the RCP and PCMCIA card before powering up the chassis. See [Chapter 4, “Connecting Power to the Chassis”](#) for more information about powering the system.

Determining Module Location

Table 5-1 provides the slot allocation and module orientation information required for installing the modules.

Table 5-1. Modules and Slot Orientation

Module Type	Slots	Slot Location in Chassis	Label and Slide Latch Orientation
Processor Engine (IOP)	0 through 7	Front	Top
Processor Engine (IOP)	8 through 15	Front	Bottom
Line Card (IOA)	0 through 7	Rear	Bottom
Line Card (IOA)	8 through 15	Rear	Top
Switch Fabric	SF0 through SF3	Front	Top
SONET Timing/Alarm	STA0 or STA1	Rear	Bottom
Route Control Processor	CP0 or CP1	Front	None, install with PCMCIA slot at top.



The IOPs must be installed in the chassis in a specific order to maintain proper operating temperature in the chassis and prevent operational failure. See [“IOP Slot Installation Sequence” on page 5-9](#) for more information.

Determining Installation Order

Install the modules in the order listed in **Table 5-2. "Module Installation Order"**

Table 5-2. Module Installation Order

Installation Order	Module
1.	Route Control Processor (RCP)
2.	Switch Fabric module
3.	SONET Timing/Alarm module
4.	Processor Engines (IOPs)
5.	Line Cards (IOAs)



Before you begin, attach the ESD strap to your wrist and connect the strap banana plug into the ESD socket in the chassis (see **Figure 5-4. "IOP Population Slot Locations"** on page 5-10 and **Figure 5-5. "IOA Slot Locations (Rear View)"** on page 5-11).



When installing modules, you must adhere to the module orientation, specified in **Table 5-1. "Modules and Slot Orientation"**; otherwise, you are likely to damage either the card or the chassis connector pins.

Installing the Route Control Processor

Install the Route Control Processors (RCPs) in slot CP0 or CP1 at the front of the chassis.



When there is a single RCP, Lucent recommends that you install it in slot CP0.

To install the RCP, follow these steps:

1. Using a #2 Phillips-head screwdriver, remove the filler panel from slot CP0, and CP1 if you are installing two RCPs.
2. Remove the RCP from its anti-static bag.
3. Orient the RCP module so that the PCMCIA slot is at the top (see **Figure 5-1. "Route Control Processor Module"**).
4. If you are installing the RCP in slot CP0, align the RCP carrier with the second rail from the left. If you are installing the RCP in slot CP1, align the RCP carrier with the first rail from the right.
5. Slide the card in gently until it seats completely in the slot.

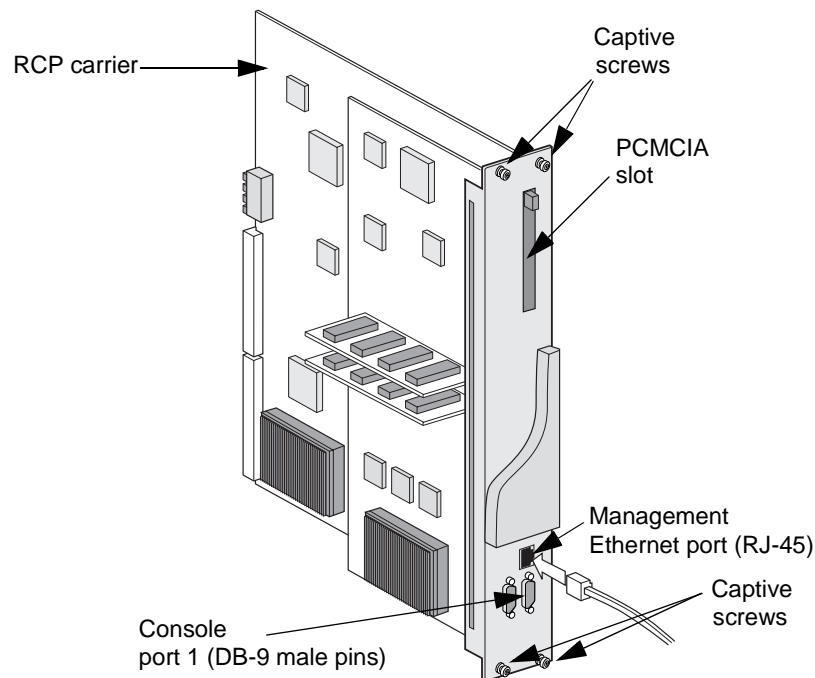


Figure 5-1. Route Control Processor Module

6. Tighten the four captive screws using a #2 Phillips-head screwdriver.
7. Insert the PCMCIA Flash card in the RCP PCMCIA slot.
8. Install the second RCP, if applicable.

► Two RCPs can be connected to the Ethernet via a multiport hub.

Connecting the Management Console

To access the command line interface from the management console and connect to the Ethernet port, you must connect the specified cables (shipped in the accessory kit) to the RCP. In a redundant system, a system with two RCPs, you execute CLI commands from the primary RCP. The route control processor (RCP) provides connections to the CLI through:

- The management Ethernet port
- The console 1 port

Ethernet Connection

The interface for the management Ethernet port allows access to the RCP through a TCP/IP connection. The most common way to establish a remote connection is by setting up a Telnet session through the management Ethernet port to emulate a CLI session. For information about managing Telnet access to the system, see the chapter on system security and access in the *TMX 880 Configuration Guide*.

You will assign an IP address to the Ethernet management port, during the system installation, when you setup the basic configuration (see [Chapter 6, "Setting up and Testing Basic Configuration."](#)) For information about how to change or set the IP address of the management Ethernet port, see the chapter on configuring the Internet Protocol in the *TMX 880 Configuration Guide*.

Setting up a Console Connection

You can setup a connection to the console 1 port on the RCP for either a modem or a terminal. When working at the site, you can set up terminal access, then change to modem access when the system is unattended. Terminal and modem access both require the RJ-45/25-pin adaptor, making it easy to switch from one line to the other.

See [Figure 5-1. "Route Control Processor Module"](#) to locate these connections on the RCP module. See [Appendix B, "Cable Connectors and Pinouts,"](#) for the connector illustrations and wiring assignments.

Setting up a Terminal Connection

Set the following for the terminal connection:

Table 5-3. Terminal Connection Settings

Setting	Value
Port speed	9600 baud
Data protocol	Standard EC
Compression	Enabled
Flow Control	None

Setting up a Modem Connection

Set the following on the modem to ensure proper operation with the system:

Table 5-4. Modem Connection Settings

Setting	Value
Data terminal ready	Use override
Verbal result	On
Results display	On
Echo commands	On
Automatic answer	On
Carrier detect	Normal
Factory defaults	On
Dumb (or terminal) mode	On

The settings for data terminal ready and carrier detect are required to provide access when the system is booting. Otherwise, if the modem detects that the system is not operational, it disconnects a current modem session, or does not form a new one.

- In some cases, you may not see the CLI output to the screen. Indicating that flow control is not enabled. Enter Ctrl-Q to enable flow control. When flow control is enabled, the screen displays CLI output.

Powering the TMX 880 Chassis

The RCP and the PCMCIA card must be installed before you power the chassis. Follow the installation order as described on [page ix](#), also see “[Installing Modules](#)” on [page 5-2](#).

Power the chassis by turning the PDU On/Off circuit breakers to the *up* (On) position.

For about 12 seconds, the fan and PDU Status LEDs light amber. This is a temporary condition, displayed only during the system boot cycle. The fans start and the contact relays close on the PDUs. After approximately another 12 seconds, the Status LEDs turn green. This is the amount of time for the PDUs to power the chassis, not for the system to boot.

- On subsequent power up, when modules are installed in the chassis, each module's PWR LED stays lit as long as all voltages are normal. If any on-board voltages exceed normal levels, the module PWR LEDs turn off. See the section on operational status in the *TMX 880 Configuration Guide* for information about module LEDs and viewing operational status.

The system boots off the PCMCIA card using the boot parameter defaults and loads the MXOS software.

- After the system boots, the PCMCIA card must remain in the RCP.

After the system has booted, and the image files are loaded the system with one RCP, has the default prompt, `TMX 880#` displayed on the RCP management console. For systems with two RCPs, the management console of the primary RCP also displays the default prompt `TMX 880#`; the management console of the second RCP displays the prompt `standbyRCP#`.

You enter commands to configure and run the system from the `TMX 880#` prompt. However, before configuring the system, install the remaining modules as described below.

See the *TMX 880 Troubleshooting Guide* for information on loading, stopping, starting, and unloading modules.

Installing the Additional Modules

After the system is powered and has booted, you can add the other system modules. To install these additional modules, follow the steps in this section.



When installing modules, the card name (label) should appear on the *bottom* of the card when installed in the top slots of the chassis, and on the *top* of the card when installed in the bottom slots (applies to both the switch fabric and the STA).

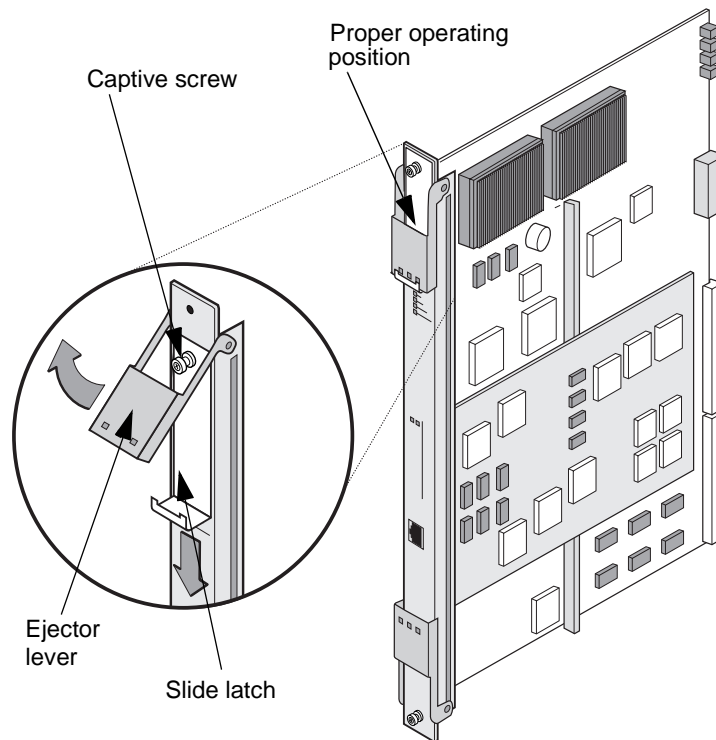


Figure 5-2. Module Slide Latch and Ejector Levers

Installing the Switch Fabric

Install the switch fabric(s) in slot SF0 through SF3 at the front of the chassis.

To install the switch fabric:

1. Establish which slot you will use and remove the filler panel from the slot. Refer to [Table 5-1. "Modules and Slot Orientation" on page 5-2](#).
2. Remove the module from its anti-static bag. Make sure that the ejector levers on the top and bottom of the card are open (see [Figure 5-2. "Module Slide Latch and Ejector Levers"](#)). With the ejector levers up (open), hold the module on opposite ends of the faceplate, and carefully guide it into the top and bottom card-cage rails. Slowly slide the module along the tracks until the ejector levers contact the chassis (see [Figure 5-3. "Inserting a Module into the Chassis" on page 5-8](#)).

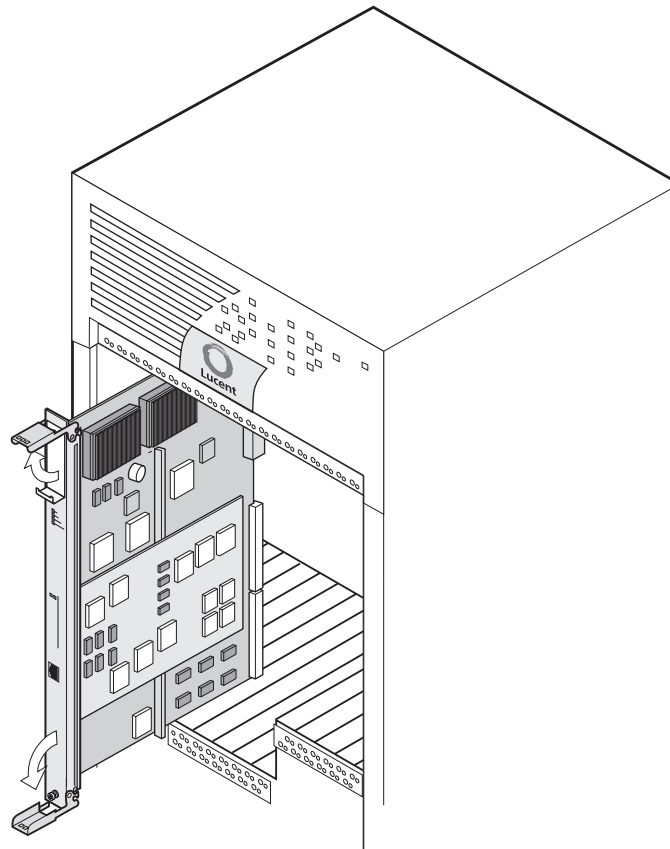


Figure 5-3. Inserting a Module into the Chassis

3. Be sure the ejector-lever hooks catch the lip of the card cage, and then gently push both levers down until they are flush with the faceplate. The LEDs on the card illuminate.



The chassis has a mechanical key mechanism to prevent incompatible card installation. It is critical that if you feel any resistance when seating a card, you remove it and double check that you have the correct card type and orientation (depending on top or bottom slots). Do not force a card into a slot.

4. Push the slide-latch into place (up or down depending on slot location). This activates the card.



For the ejector lever and the slide latch to be in the proper position for activating the cards, the slide latch must overlap the end of the ejector lever.
See [Figure 5-2. "Module Slide Latch and Ejector Levers"](#).

5. Tighten the two captive screws on the top and bottom of card using a #2 Phillips-head screwdriver.

Installing the SONET Timing/Alarm Module

Install the SONET Timing/Alarm Module (STA) in either slot STA0 or STA1 at the rear of the chassis. Determine which slot you will use and remove the filler panel from the slot. Refer to [Table 5-1. "Modules and Slot Orientation" on page 5-2](#) and [Table 5-2. "Module Installation Order" on page 5-3](#).

Follow the steps 2 through 6 of ["Installing the Switch Fabric" on page 5-7](#) to install the STA.

Installing the IOAs and IOPs

Each IOP installed in the front of the chassis must be paired with a compatible IOA installed in the back of the chassis. Rear slots are numbered from right to left, opposite the front slots which are numbered left to right, so that paired modules have the same slot number. For example, if you have installed an OC-48c IOP in slot 1, the corresponding slot at the rear of the chassis is also slot 1. [Table 5-7. "Adapter Cable Connectors Usage"](#) lists the IOP-to-IOA relationship.

Table 5-5. IOPs-to-IOAs Relationship

Input/Output Processors	Input/Output Adapters
OC-3c/OC-12c ATM	<ul style="list-style-type: none">• 8-port OC-3c ATM• 2-port OC-12c ATM
OC-3C/OC-12c POS	<ul style="list-style-type: none">• 8-port OC-3c POS• 4-port OC-12 POS
OC-48c/STM-16 POS	<ul style="list-style-type: none">• 1-port OC-48c POS
QOC-48c/STM-16 POS	<ul style="list-style-type: none">• 4-port QOC-48c POS
OC-192c/STM-64 POS	<ul style="list-style-type: none">• 1-port OC-192c POS
Gigabit Ethernet	<ul style="list-style-type: none">• 2-port Gigabit Ethernet• 8-port Gigabit Ethernet

► **Note:** Three Switch Fabrics are required for the QOC-48 and the OC-192.

IOP Slot Installation Sequence

The IOPs must be installed in the chassis in a specific order. For example, the first IOP, IOP 1, must be installed in IOP 1 (slot 1), the second IOP in IOP 2 (slot 5), the third IOP in IOP3 (slot 2), etc. [Table 5-6. "IOP-to-Slot Installation Order"](#) lists the slot installation order, [Figure 5-4. "IOP Population Slot Locations"](#) on page 5-10 shows the location of the slots with the sequence in which IOP slots must be populated.

Table 5-6. IOP-to-Slot Installation Order

IOP Install Order	Slot Number	IOP Install Order	Slot Number
IOP 1	1	IOP 9	10
IOP 2	5	IOP 10	14
IOP 3	2	IOP 11	9
IOP 4	6	IOP 12	13
IOP 5	3	IOP 13	8
IOP 6	7	IOP 14	12
IOP 7	0	IOP 15	11
IOP 8	4	IOP 16	15



Populating the chassis in this order is mandatory to maintain proper operating temperature in the system and prevent operational failure. Make sure to install filler panels on all empty slots.

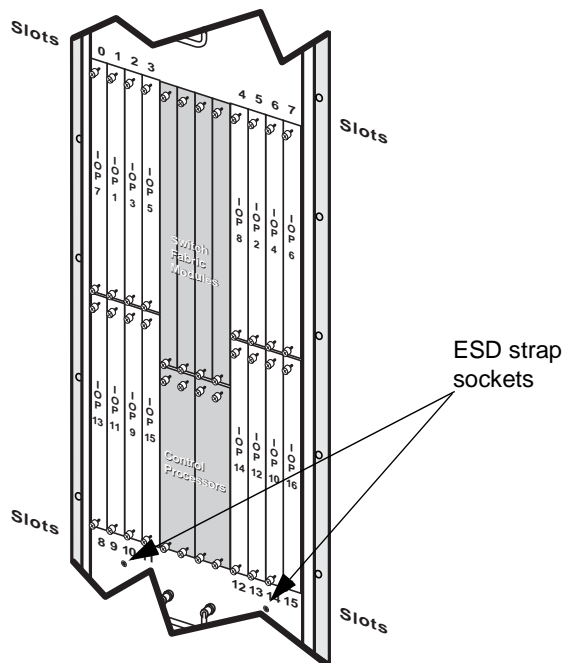


Figure 5-4. IOP Population Slot Locations

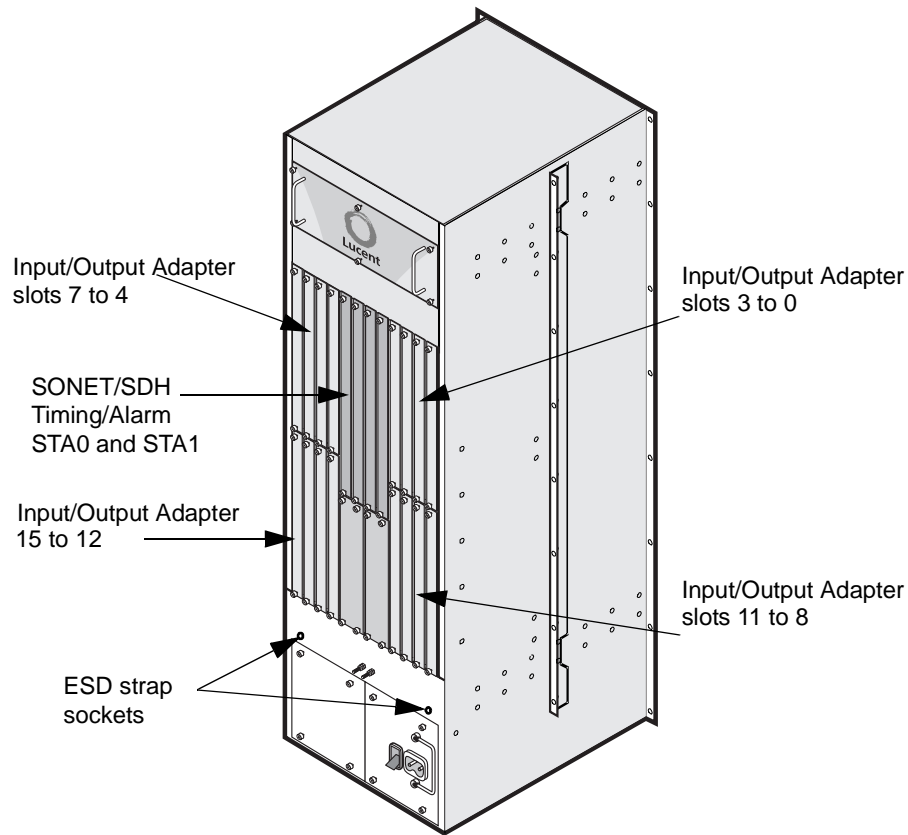


Figure 5-5. IOA Slot Locations (Rear View)

On the rear of the IOP card are black and white female resin connectors. The black connector is the FABIO interface (FABric Input/Output); the white connects the line card to the system buses. The aluminum block on the top of the card contains keyed holes that correspond with pins from the correct IOA, to prevent a mismatch between the IOP and IOA, which can lead to permanent card failure.

To install and activate the IOPs and IOAs:

1. Observing the IOP population sequence ([Table 5-6. "IOP-to-Slot Installation Order" on page 5-10](#)), determine which slot you will use and remove the filler panels from those slots. Be sure you understand the relationship and numbering between the IOPs (chassis front) and the IOAs (chassis rear). Refer to [Table 5-5. "IOPs-to-IOAs Relationship" on page 5-9](#).
2. Remove the module from its anti-static bag. Make sure that the ejector levers on the top and bottom of the card are open (see [Figure 5-2. "Module Slide Latch and Ejector Levers"](#)). The figure shows the proper orientation for seating an IOP in slots 0 through 7.




When installing modules, the card name (label) should appear on the *bottom* of the card when installed in the top slots of the chassis, and on the *top* of the card when installed in the bottom slots (applies to both IOPs and IOAs).

3. With the ejector levers *up* (open), hold the module on opposite ends of the faceplate, and carefully guide it into the top and bottom card-cage rails. Slowly slide the module along the tracks until the ejector levers contact the chassis (see [Figure 5-3. "Inserting a Module into the Chassis"](#)).

► The OC-192 IOA does not have ejector levers; two captive screws on the flange secure it to the chassis (see [Figure 5-7. "OC-192 IOA Faceplate" on page 5-15](#)). Skip to step 6 if you are installing the OC-192 IOA.

4. Be sure the ejector-lever hooks catch the lip of the card cage, and then gently push both levers down until they are flush with the faceplate. The LEDs on the card illuminate.

 The chassis has a mechanical key mechanism to prevent incompatible card installation. It is critical that if you feel any resistance when seating a card, you remove it and double check that you have the correct card type and orientation (depending on top or bottom slots). Do not force a card into a slot.

5. Push the slide latch into place (up or down depending on slot location). This activates the card. Both the IOP and IOA slide latches must be locked in place for the module to be correctly activated.

► For the ejector lever and the slide latch to be in the proper position for activating the cards (both IOPs and IOAs), the slide latch must overlap the end of the ejector lever. See [Figure 5-2. "Module Slide Latch and Ejector Levers"](#).

6. Tighten the two captive screws on the top and bottom of card using a #2 Phillips-head screwdriver.
7. Install any remaining modules.
8. If the RCP boots, but the line cards do not, you may need to set the path of the system image that the system boots at startup by running the boot system command:

```
TMX 880(config)# boot system/device/pathname
```

For example:

```
TMX 880(config)# boot system /pcmcia0/releases/current
```

where *current* identifies the release folder that contains the single image file *rver.tar*, where *ver* is the version of the software. To verify the location of the *rver.tar* file, use the *dir* and *cd* commands to locate the image file on the PCMCIA card.

9. When you have installed all modules, proceed to the next section, ["Cabling the Modules."](#)

Cabling the Modules

The system uses SC, LC and MTRJ connectors to connect the line cards to the network. Refer to [Figure 5-6. "Line Card Connector Types"](#) and [Table 5-7. "Adapter Cable Connectors Usage"](#) on page 5-14 for connector to line card information.

- ▶ Observe safety precautions whenever working directly with the system. See [Appendix C, "Safety Instructions."](#)

To cable a module:

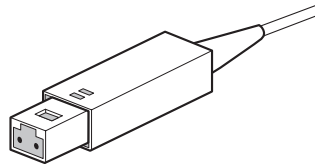
1. Remove the dust cover from the cable connector.

- ▶ Do not to remove the dust cover from the IOAs until you are ready to connect the cleaned fiber.

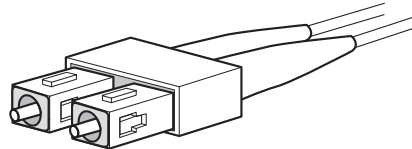
2. Properly clean all fibers using the Cletop Connector Cleaning System before connecting them to the IOA.
3. Verify the receive signal with a calibrated light meter.
4. The receive signal levels must be set to the correct values for the optical carrier (OC) associated with the interface. If the receive signal level is higher than the specified value, use inline attenuation to reduce the level of the receive signal. To review the values for receive signal levels. See [Table A-2. "Line Cards Signal Levels"](#) on page A-2, [Appendix A, "TMX 880 Input/Output Modules."](#)

- ▶ Due to variances in different optical interfaces, it is possible to overdrive optical inputs with excessive power. This could result in system errors that may be difficult to detect and/or damage the optical components.

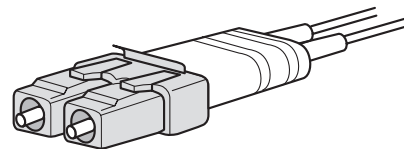
5. Remove the dust covers from the port on the IOA.
6. Attach the proper cable to each port on the IOA.



MTRJ Connector



Duplex SC Connector



Duplex LC Connector

Figure 5-6. Line Card Connector Types

Table 5-7. Adapter Cable Connectors Usage

Connector	IOA Type
MTRJ connector multimode duplex	<ul style="list-style-type: none">• 8-port OC-3c ATM• 8-port OC-3c POS• 2-port Gigabit Ethernet <p>Lucent recommends using Volex, FCI or Computer Crafts MTRJ connector.</p>
SC connector single-mode duplex	<ul style="list-style-type: none">• 1-port OC-48c POS• 4-port OC-48 POS• 1-port OC-192c POS
LC connector single-mode duplex	<ul style="list-style-type: none">• 2-port OC-12 A ATM• 4-port OC-12 POS• 8-port Gigabit Ethernet

Viewing Operational Status

The following section describes normal and alarm conditions and LED patterns during start-up and normal operation. The LEDs are located on the module faceplates.

Line Card LEDs

All Line Cards, with the exception of the Gigabit Ethernet IOA (see **"Gigabit Ethernet Line Card"** section), provide three status LEDs. The LEDs indicate the following card status:

- **RED** indicates one of the optical interfaces has a local SONET error. To determine which interface is affected, see the associated processor engine on the front of the chassis.
- **YEL** (yellow) indicates one of the optical interfaces has a far-end SONET error. To determine which interface is affected, see the associated IOP on the front of the chassis.
- **PWR** (green) indicates that the module is getting the correct power.

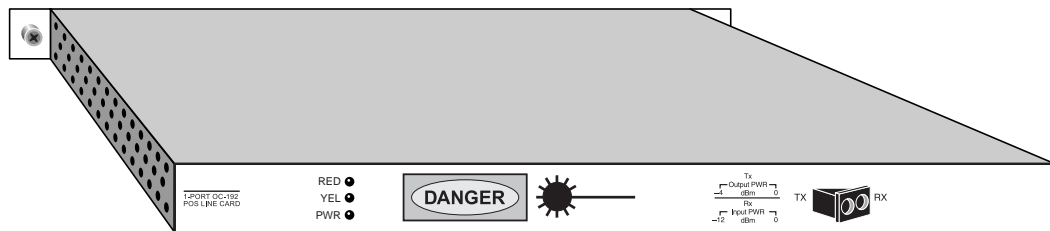


Figure 5-7. OC-192 IOA Faceplate

Gigabit Ethernet Line Card

In addition to the green power status LED, Gigabit Ethernet line cards (see **Figure 5-8. "Two-port Gigabit Ethernet IOA Faceplate"**) provide one bank of 3 LEDs for each port. The LEDs provide the following information:

- **TX**: If the 0 LED is BLINKING, it indicates that data is being transmitted out port 0. If the 1 LED is BLINKING, it indicates that data is being transmitted out from port 1.
- **RX**: If the 0 LED is BLINKING, it indicates that data is being received on port 0. If the 1 LED is BLINKING, it indicates that data is being received on port 1.
- **Link Per Port**: If the corresponding port LED is lit, it indicates that the receive link for that port is up and synchronized.

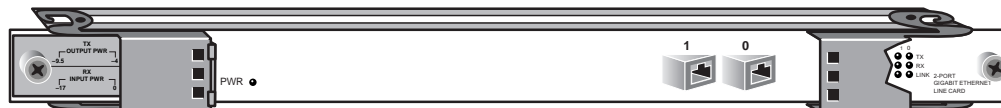


Figure 5-8. Two-port Gigabit Ethernet IOA Faceplate

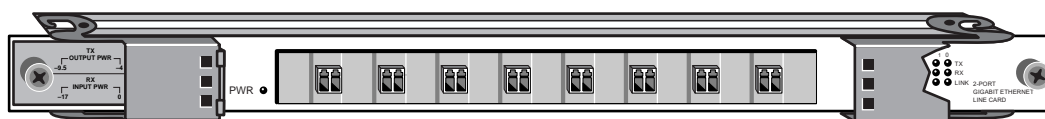


Figure 5-9. Eight-port Gigabit Ethernet IOA Faceplate

Processor Engine LEDs

The following describes the LEDs on the TMX 880 Processor Engines.

OC-3c and OC-12c IOPs (ATM and POS)

Both the ATM and POS OC-3c/OC-12c IOPs, are a single module that can be configured for either OC-3 or OC-12 transmission. If the OC-3c/OC-12c IOP is configured in OC-12c mode, only the first two columns of alarm LEDs apply.

The module has the following banks of LEDs (see **Figure 5-10. "OC-3c/OC-12c ATM IOP Faceplate"**):

- A bank of four LEDs showing the machine state (PWR, RUN, BOOT, and FAULT).
- Two LEDs indicating either OC-12c or OC-3c configuration.
- Two banks of eight alarm LEDs displaying critical (RED) or non-critical (YEL) SONET failure for each port. Under normal conditions, alarm LEDs are not illuminated.

The only difference in the faceplate of this module is in the label, which specifies either POS or ATM.

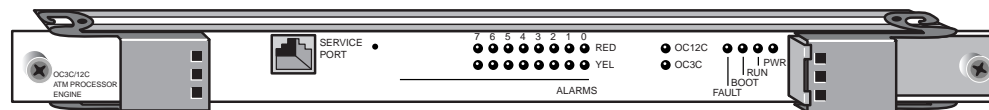


Figure 5-10. OC-3c/OC-12c ATM IOP Faceplate

OC-48c POS IOP

The OC-48c IOP (see **Figure 5-11. "OC-48c POS IOP Faceplate"**) provides the following two banks of LEDs:

- A bank of four LEDs showing machine state (PWR, RUN, BOOT, and FAULT).
- One bank of alarm LEDs displaying critical (RED) or non-critical (YEL) SONET failure at the port.

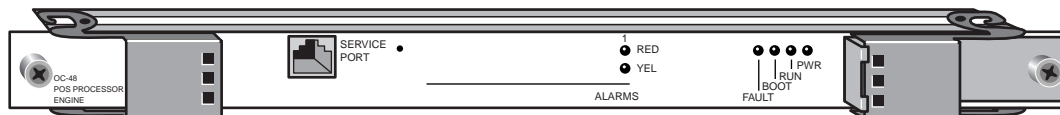


Figure 5-11. OC-48c POS IOP Faceplate

QOC-48c POS IOP

The QOC-48c IOP (see [Figure 5-12. "QOC-48c POS IOP Faceplate"](#)) provides the following banks of LEDs:

- A bank of four LEDs showing machine state (PWR, RUN, BOOT, and FAULT).
- Two banks of four LED alarms displaying critical (RED) or non-critical (YEL) SONET failure for each port.

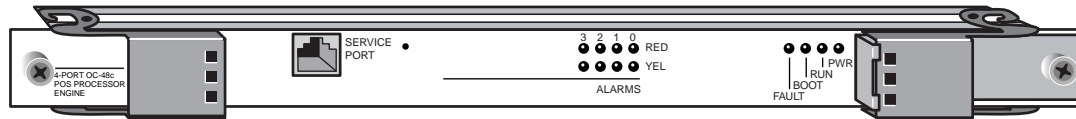


Figure 5-12. QOC-48c POS IOP Faceplate

OC-192c POS IOP

The OC-192c IOP (see [Figure 5-13. "OC-192c POS IOP Faceplate"](#)) provides the following banks of LEDs:

- A bank of four LEDs showing machine state (PWR, RUN, BOOT, and FAULT).
- One bank of LED alarms displaying critical (RED) or non-critical (YEL) SONET failure for the port.

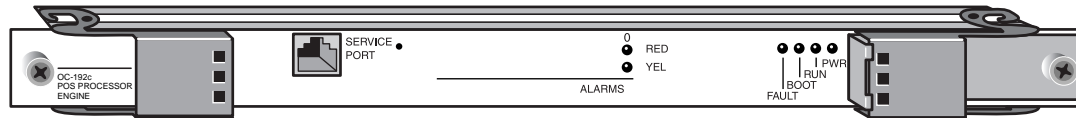


Figure 5-13. OC-192c POS IOP Faceplate

Gigabit Ethernet IOP

The Gigabit Ethernet IOPs provide a bank of four LEDs showing machine state (PWR, RUN, BOOT, and FAULT). See [Figure 5-14. "Gigabit Ethernet IOP Faceplate"](#).

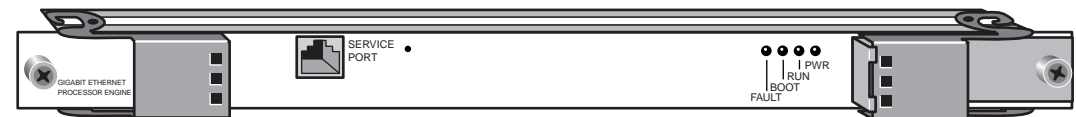


Figure 5-14. Gigabit Ethernet IOP Faceplate

Switch Fabric LEDs

The switch fabric (see [Figure 5-15. "Switch Fabric Faceplate"](#)) provides four banks of LEDs to monitor the module operation:

- A bank of four LEDs showing machine state (PWR, RUN, BOOT, and FAULT).
- Two LEDs showing Master (primary) and Online status.
- Two banks of three LEDs indicating the status of the fan trays:
 - LED A = front top fan tray
 - LED B = front bottom fan tray
 - LED C = rear top fan tray
- Two banks of two LEDs showing PDU status:
 - LED A = PDU A (PDU on the right)
 - LED B = PDU B (PDU on the left)

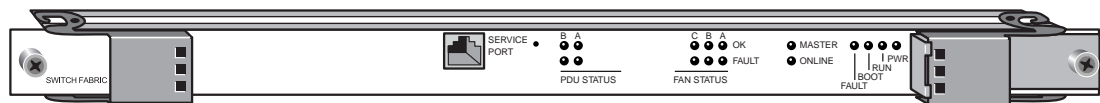


Figure 5-15. Switch Fabric Faceplate

Understanding the System-Boot LED Sequence

The system may take from 3 to 5 minutes to boot. During a typical IOP, SONET Timing/Alarm module, or switch fabric module boot process, the following events occur at start-up:

- The Power-on Self-test/Diagnostics turns on all card LEDs for 1 or 2 seconds. All of the LEDs turn off except for the PWR LED, which stays on continuously, and the BOOT LED, which flashes at 1-second intervals.
 - IOP and switch fabric boot LEDs flash as the system boots and light steady green when the system is online.
 - If an error occurs, the TMX 880 diagnostics turns the FAULT LED on and the BOOT LED continues flashing every second.
 - When operational code is loading (the next machine state), if an error occurs, the FAULT LED is lit and the BOOT LED continues flashing at half-second intervals.
 - As the operational state begins, the BOOT LED shuts off and the RUN LED turns on.
- The fans and PDU(s) appear to be in a false or fault state shortly after the system boots. This is a temporary status condition that occurs only during the boot cycle.

FLASH Update LED Conditions

During a FLASH code update, the RUN and BOOT LEDs illuminate on the modules being updated.



Do not remove IOPs until the FLASH update is completed, otherwise the image may be corrupted.

Power LEDs

The PWR LED (green) on the IOP, SONET Timing/Alarm or switch fabric modules illuminates and stays on when all power supplies are within tolerance.



The Power (PWR) LED stays on as long as all voltages are normal. If any on-board power supply voltages exceed normal levels, the PWR LED turns off.

Alarm LEDs

Each bank of alarm LEDs on the IOPs corresponds to a SONET port on the associated IOAs. If the OC-3c/OC-12c IOP is configured in OC-12c mode, only the first two columns of alarm LEDs apply. Under normal conditions, the alarm LEDs are not illuminated.

If a SONET timing error occurs on the remote end of the TMX 880 connection, the YEL LED illuminates. If the error occurs locally, the RED LED illuminates.

Alarm Subsystem

The TMX 880 system provides an alarm subsystem for local visual and audible alarms to warn administrators of actual or potential problems. Local alarm relay contacts are provided on the SONET/SDH Timing/Alarm Modules (STA), installed in the rear of the system. Local surveillance involves the annunciation of audio and visual alarms when a problem occurs in the chassis or with the fiber; conditions that are due to external failures are not announced locally.

The MXOS generates and communicates the alarm events to the STA card, which operates the alarm relay contacts for the system. See the chapter on Configuring Cards and Interfaces in the *TMX 880 Configuration Guide* for more information about the alarm subsystem.

Silencing the Alarm

The TMX 880 system can trigger an audio alarm when an error condition occurs. Once asserted, any active alarm remains asserted until the problem is eliminated. For example, manually deactivating a card results in an alarm condition. The physical removal of a card deactivates the associated card alarm.

You can silence any audio alarm by pressing the ACO button (located in the rear of the chassis on the STA terminal block) or by entering clear alarms relay at the command line interface.



Silencing an audio alarm does not resolve the cause of the alarm or remove the alarm condition. The alarm will remain active until the problem is eliminated.

Setting up and Testing Basic Configuration

After installing and cabling the modules, you can connect a management console to the Route Control Processor (RCP) module. You can configure and manage the TMX 880 system by issuing commands through the management console. See [“Connecting the Management Console” on page 5-4](#).

This chapter describes the following tasks:

- Issuing commands at the command line interface (CLI)
- Changing the host name
- Assigning an IP address to the Ethernet management port
- Testing network connectivity
- Setting up a backup directory
- Configuring interfaces
- Configuring a user name
- Configuring SNMP parameters

After the system is configured, you can set up the network services and protocols supported on the system. See the *TMX 880 Command Reference* for detailed command information, including examples of syntax and sample output.

Required Information

You will need the following information to configure the system.

- System name
- IP Address
- Subnet Mask
- Username
- Default Gateway
- SNMP community name
- SNMP sever address
- SNMP contact information
- SNMP location

Issuing Commands

The Command Line Interface (CLI) provides access to all configuration and monitoring activities on the system. Running the commands has an immediate effect, for example, the **show** commands.

You enter the other prompt levels from the **TMX 880#** prompt to run most of the configuration commands.

These are:

- Configuration mode, shown by the **(config)#** prompt
 - Interface configuration mode, shown by the **(config-if)#** prompt
-
- Type a question mark (?) command name at a prompt level to see a list of commands available from that prompt.
 - Type a command name followed by a question mark (?) (no space) to display a description of the command or argument.

For example:

```
TMX 880(config)# router?
```

- Type a command name followed by a space and then a question mark (?) to display a list of the suboptions or commands that match the string.

For example:

```
TMX 880(config)# router ?
```

- To exit the CLI, or to return to the previous command-mode level, type **exit**.

At this point, it is advisable to execute the **show chassis** command to display chassis information, including temperature and status of fan trays, PDU(s), and installed modules. For example:

```
TMX 880# show chassis
Chassis Up Time: 64 days, 17:39:50
Date/time: 2002-1-14, 9:8:21.1,+0:0
Incoming Air Temperature 31
Up time of last Chassis Configuration Change: 0:04:40
Chassis Serial Number: XXX0000000000000
Fan Trays Present: Fan1: True , Fan2: True , Fan3: True
Fan Tray Status:   Fan1: OK   , Fan2: OK   , Fan3: OK
Power Distribution Units Present: Pdu1: True , Pdu2: False
Power Distribution Unit Status:   Pdu1: OK   , Pdu2: FAULT
Chassis Clock Source: Network Derived
BITS port number: 1
Network Timing, Primary Card#: 3
Network Timing, Secondary Card#: 9
Alarm State: 1 Current Alarm: 0
Chassis Card Slots:
RCP-0   RCP-1   SF-0   SF-1   SF-2   SF-3   STA-0   STA-1
primary |         |active |         |         |         |active |active |
        |         |up    |         |         |         |up    |up    |
IO-0    IO-1    IO-2    IO-3    IO-4    IO-5    IO-6    IO-7
        |lowSpeed|         |         |lowSpeed|         |         |

```

	OC12			OC12			
	8 ifs			4 ifs			
	up			up			
IO-8	IO-9	IO-10	IO-11	IO-12	IO-13	IO-14	IO-15
	POS	ATM		POS			
	OC192	OC3		OC48			
	1 if	8 ifs		4 ifs			
	up	up		up			

Table 6-1. "Fan Trays" and Table 6-2. "Power Distribution Units" show the correspondence of fan tray and PDU numbers in the output of `show chassis` to the status LEDs on the switch fabric and their location in the chassis.

Table 6-1. Fan Trays

Fan tray number in show chassis output	Location of fan tray in chassis	Corresponding Status LED on Switch Fabric
1	Front top	A
2	Front bottom	B
3	Rear top	C

Table 6-2. Power Distribution Units

PDU number in show chassis output	Location of PDU in chassis	Corresponding Status LED on Switch Fabric
1	Rear right	A
2	Rear left	B

To verify the software release number, run the `show version` command. The `show version` command displays a list of the applicable release number for each module. For release 8.0 the

```

TMX 880# show version
Card      Revision
SFC                               0
Release Number → R 8.0.0 (BL XX).
              SFC Image.
              Wed Jan 30 03:28:50 EST 2002
              BSP:3.1/4
              OS: 5.3.1 .
              .
              .

```

release number is shown as 8.0.0.

See the *TMX 880 Command Reference* for more information on the **show** commands.

Changing the System Name

The system ships with a factory-assigned default system name of `TMX 880#`, but you can define this name as desired. The host name is used in the CLI prompts and the configuration files.

► Examples in this chapter use the default `TMX 880#` prompt.

To define a new host name:

1. Enter the following:

```
TMX 880# configure terminal
```

The system enters configuration-level prompt, as shown by the `(config)#` prompt.

2. Enter a new host name:

```
TMX 880(config)# hostname name
```

For example, entering `hostname SwitchRouter` changes the host name to `SwitchRouter`. The name is case sensitive.

After you issue the command, the system responds with the new host name prompt:

```
SwitchRouter(config)#
```

Assigning an IP Address to the Ethernet Port

For management purposes, you must assign an IP address to the Ethernet interface on the system. Some IP addresses are reserved and cannot be used for host, subnet, or network addresses.

Table 6-3. "Reserved and Available IP Addresses" on page 6-4 lists the IP address ranges of reserved and available addresses.

Table 6-3. Reserved and Available IP Addresses

Class	Address or Range	Status
A	0.0.0.0	Reserved
	1.0.0.0 through 126.0.0.0	Available
	127.0.0.0	Reserved
B	128.0.0.0	Reserved
	128.1.0.0 through 191.254.0.0	Available
	191.255.0.0	Reserved
C	192.0.0.0	Reserved
	192.0.1.0 through 223.255.254	Available
	223.255.255.0	Reserved

Table 6-3. Reserved and Available IP Addresses

Class	Address or Range	Status
D	224.000. through 239.255.255.255	Reserved for multicast traffic
E	240.0.0.0 through 247.255.255.255	Reserved for future use

Two broadcast interfaces are predefined on the system loopback0 and ethernet0. You can execute the `show interfaces` command to verify this. The loopback0 interface is a software-defined interface for routing and testing; ethernet0 is the management Ethernet interface. You must assign an IP address to ethernet0 to enable network connectivity. When the management Ethernet interface can reach the network, you can, for example, download configuration files and software upgrades.

To assign an IP address and a network mask to ethernet0:

1. At the `TMX 880#` prompt, issue the command `configure terminal`.

```
TMX 880# configure terminal
```

The system enters configuration mode and displays the `(config)#` prompt.

2. Issue the interface command, specifying `ethernet0` as the interface.

```
TMX 880(config)# interface ethernet0
```

The system enters interface configuration mode and displays the `(config-if)#` prompt.

3. Issue the `ip address ip-address mask` command, specifying an IP address and network mask (the mask identifies the bits that denote the network number in an IP address).

For example:

```
TMX 880(config-if)# ip address 172.100.29.0 255.255.0.0
```

4. If you access the system through another router, you must set up a static route to your destination. At the configuration-level prompt, issue the `ip route net-prefix mask {next-hop | interface}` command, supplying the destination's network prefix, subnet mask, and next hop. For example:

```
TMX 880(config-if)# exit
```

```
TMX 880(config)# ip route 192.168.1.0 255.255.0.0 10.0.0.1
```

- Do not set the IP address of the Ethernet management port to 10.0.100.74. The RCP uses this address for communications within the system.

Testing Network Connectivity

Once you have assigned an IP address to the management Ethernet interface, you can check for network connectivity. Use the **ping** command to check the network connection.

For example, execute the **ping** command from the **TMX 880#** prompt:

```
TMX 880# ping 255.255.255.255
```

Specify the IP address of another device on the network that you know to be operational. The command returns **ping** messages to indicate connectivity.

- ▶ Be sure that the IP address you enter is that of another device, not of the interface you just assigned. If you enter the interface IP address, **ping** returns successful results, but that does not indicate network connectivity.

Setting up the Backup Directory on the Primary RCP

Release 1.7 and greater provides a backup utility to boot the system if the image in the **pcmcia0/releases/current** directory fails. To use the backup utility:

1. Copy the image file to the **/pcmcia0/releases/backup** directory.

```
TMX 880# backup
```

2. Run the **show boot** command to verify that path for the boot backup is set to **pcmcia0/releases/backup/**.

```
TMX 880# show boot
BOOT_SYSTEM variable = /pcmcia0/releases/current/
BOOT_BACKUP variable = /pcmcia0/releases/backup/
CONFIG_FILE variable = /pcmcia0/startup.cfg
```

If required, run the **boot backup** command to set the path for backup image file. For example:

```
TMX 880# configure terminal
TMX 880(config)# boot backup /pcmcia0/releases/backup/
TMX 880(config)# exit
```

Configuring an Interface

One common use of the CLI is to configure interfaces. When executing commands to configure an interface, you must enter an interface name (documented as *interface-name* in the syntax and descriptions). An interface name consists of an interface type, slot number, and port number. **Table 6-4. "Interface Name Entry Format"** lists the valid options for these interfaces:

Table 6-4. Interface Name Entry Format

<i>type</i>	Enter the type of interface to be configured: <ul style="list-style-type: none"> • pos — Packet Over SONET interface. • atm — Asynchronous Transfer Mode interface. • ethernet — Ethernet IEEE 802.3 management interface. • loopback — Software-only (virtual) loopback interface that emulates an interface that is always up. • null — Null interface. • gigabitethernet — Gigabit Ethernet
<i>slot number</i>	Specify the slot number. The slot number must be between 0 and 15.
<i>port number</i>	Specify the port number. Valid port numbers depend on the card type: <ul style="list-style-type: none"> • 8-port OC-3c — ports 0 through 7 • 2-port OC-12c — ports 0 and 1 • 1-port OC-48c — port 0 • 4-port OC-48c — ports 0 through 3 • 1-port OC-192c — port 0 • 2-port Gigabit Ethernet — ports 0 and 1 • 8-port Gigabit Ethernet — ports 0 through 7

To set up POS and ATM interfaces in the *typeslot/port* format; enter the type followed by a forward slash and the port number. For example:

```
pos2/1
atm9/0
gigabitethernet1/0
```

Configure each card type by executing the interface *typeslot-number//interface-number* command at the (config)# prompt.

For example:

```
TMX 880(config)# interface pos2/1
TMX 880(config)# interface atm9/0
TMX 880(config)# interface gigabitethernet1/0
```

Ethernet, loopback, and null interfaces are entered in the format *typeport*. For example:

```
null0
```

The following are valid options for these components:

Ethernet	Ethernet0 is the only valid interface name.
Loopback	Loopback supports up to 256 interfaces, 0 through 255.
Null	Null0 is the only valid interface name.

To display the configured interfaces, issue the `show interfaces` command at the `TMX 880#` prompt.

Configuring Framing

SONET and SDH are a set of standards for synchronous data transmission over fiber optic networks. Framing enables the correct physical-layer standard for SONET-based interfaces, either North America SONET or rest-of-the-world SDH. By default, system interfaces use SONET framing. The following example configures the connection for European standards, SDH, on interface atm2/0:

```
TMX 880# configure terminal
TMX 880(config)# interface atm2/0
TMX 880(config-if)# framing sdh
```

Configuring POS Line Cards

After you define a line card interface, assign an IP address and a network mask to the interface.

To configure and assign an IP address to a POS interface:

1. Enter the configuration mode for the interface. For example:

```
TMX 880(config)# interface pos2/1
```

2. From the `(config-if)#` prompt, enable Frame Relay or PPP encapsulation. In our example Frame Relay encapsulation is enabled:

```
TMX 880(config-if)# encapsulation frame-relay
```

3. Assign an IP address and network mask (the mask identifies the bits that denote the network number in an IP address). Execute the `ip address ip-address mask` command to assign an IP address and network mask. For example:

```
TMX 880(config-if)# ip address 192.1.1.1 255.255.255.0
```

4. Set up a static map to associate a next-hop address with a DLCI by issuing the `frame-relay map ip protocol-address dlci-number` command. For example:

```
TMX 880(config-if)# frame-relay map ip 20.1.1.2 20
```

5. Test network connectivity for the line card by following the instructions described in [“Testing Network Connectivity”](#) section on [page 6-6](#).

Configuring ATM Line Cards

To Configure and assign an IP address to an ATM interface:

1. Enter the configuration mode for the interface. For example:

```
TMX 880(config-if)# interface atm9/0
```

2. From the (config-if)# prompt, create a permanent virtual circuit (PVC) on the ATM interface, specifying a virtual circuit descriptor, virtual path identifier, virtual circuit identifier, and AAL encapsulation type (aal5mux ip or aal5snap).

```
atm pvc vcd vpi vci {aal5mux ip | aal5snap} [inarp minutes]
```

The following example specifies a virtual path identifier (VPI) of 0 and a virtual circuit identifier (VCI) of 33. When a map list is associated with interface atm14/1, and that list contains a circuit with virtual circuit description (VDC) 32, the PVC learns its protocol address and destination address and is activated.

```
TMX 880# configure terminal
```

```
TMX 880(config)# interface atm14/1
```

```
TMX 880(config-if)# atm pvc 32 0 33 aal5snap class CBR2 inarp 20
```

3. Assign an IP address and network mask (the mask identifies the bits that denote the network number in an IP address):

```
TMX 880(config-if)# ip address 20.1.1.1 255.255.255.0
```

4. Associate the interface with a map group, specifying a name you will also use as a map-list name in [step 6](#).

For example:

```
TMX 880(config-if)# map-group boston
```

5. Exit the (config-if)# mode:

```
TMX 880(config-if)# exit
```

6. Create a map list, using the name used in [step 4](#).

```
TMX 880(config)# map-list boston
```

7. Associate a protocol and address with the virtual circuit identifier used in [step 1](#).

```
protocol protocol-address atm-vc vcd
```

For example:

```
TMX 880(map-list)# ip 20.1.1.2 atm-vc 1
```

8. Test network connectivity for the line card by following the instructions described in [“Testing Network Connectivity”](#) section on [page 6-6](#).

Configuring a User Name

The first username configured for the system must have a privilege level of 15. This privilege level gives the user read-write access and lets the user connect to the system via FTP. Users with other privilege levels cannot connect to the system via FTP. For a full description of the `username` command, see the reference page in the *TMX 880 Command Reference*.

To specify password encryption, which controls display of the password text when you view the user database, you must enable the `service password-encryption` command before configuring users.

The following example activates password encryption:

```
TMX 880# configure terminal
TMX 880(config)# service password-encryption
TMX 880(config)#
```



If `service password-encryption` is enabled and later disabled, the configuration of all users with the encrypted passwords (users that were configured using the `username` command while `service password-encryption` was enabled) will be lost on the next system reboot.

When configuring users, apply privilege level 15 for privileged users and 0 for non-privileged users (lowest privilege). Level 15 provides full read-write access and is required to run any configuration commands. Privilege level 0 provides read-only access, the user with privilege level 0 is not authorized to run configuration commands. The default is 0. See the *TMX 880 Command Reference* for a full description of the `username` command.



- The first user that you configure **must** be assigned privilege level 15.
- You cannot set the username to “target”
- You cannot delete the last privileged user on a system.
- If only one privileged user exists on a system, you cannot change that user's privilege level.
- If you passing an encryption-level 1 (password encryption requested) but the `password-encryption` is not enabled the `username` command will reject the request.

Run the `username` command to enter a user into a system database for login authentication. The following example shows how to configure privilege levels and password encryption for specified users:

```
TMX 880# configure terminal
TMX 880(config)# username contract privilege 15 password 1 contractor
TMX 880(config)# username visitor privilege 0 password 1 guestpass
TMX 880(config)#
```

When you view the running configuration file using the `show running-config` command, the password string preceded by a 0 or 1 indicate the encryption setting.

For example:

```
TMX 880# show running-configuration
Current configuration:
service password-encryption
!
auth-order local
username visitor privilege 0 password 1 t46dh47e
```

Where 1 indicates password encryption and t46dh47e is the encrypted password.

- ▶ If you configure users but do not copy the running configuration file to the startup configuration file, those users will not have access to the system when the system reboots. See [“Saving the Configuration” on page 6-12](#) for more information.
- ▶ Different prompts are displayed depending on the user privilege level setting.
 - The prompt for Read-Only access appears as `TMX 880>`.
 - The prompt for Read-Write access appears as `TMX 880#`.

Configuring SNMP

Lucent provides remote configuration through its support of SNMP versions 1 and 2. Both versions of SNMP are enabled at startup. The following basic tasks are useful in setting up SNMP on the TMX 880 system.

For additional information on other SNMP features supported by the system, refer to the chapter on setting up system monitoring in the *TMX 880 Configuration Guide*.

Creating an SNMP Community

Use the `snmp-server community` command to name and configure an SNMP community. Communities define a category of system users that are allowed access to SNMP.

For example:

```
TMX 880# configure terminal
TMX 880(config)# snmp-server community estonia ro
```

You can also use the `snmp-server community` command to specify the version of trap messages, which are to be sent to the configured SNMP host. For example:

```
TMX 880# configure terminal
TMX 880(config)# snmp-server community estonia ro trapv2
```

The `view` option serves as an access control mechanism to include or exclude portions of the Management Information Base (MIB) hierarchy tree from the community. To display the views that are currently configured run the `show views` command. For example:

```
TMX 880# show views
View      Type      Subtree
all        included  internet
default    included  internet
```

```
default          excluded nexabitSnmp
TMX 880#
```

You can use a view that is already established, or create one with the `snmp-server view` command. For example:

```
TMX 880(config)#
TMX 880# configure terminal
TMX 880(config)# snmp-server view estonia 1.3.6.1.4.1.* exclude
```

Configuring an SNMP Host

After you define an SNMP community, define a host to receive the SNMP trap messages using the `snmp-server host` command. The command adds hosts, specified by their IP address, to a previously defined community. A host can be assigned to multiple communities. You can execute the command for a given community any number of times, adding a member with each entry. For example:

```
TMX 880# configure terminal
TMX 880(config)# snmp-server host 172.100.29.0 estonia
```

- ▶ Enter the IP address of the host server and a previously defined community name. Entering an IP address of 0.0.0.0 allows access from any host.

Naming an SNMP Contact

You can record a string of system contact information (up to 255 alphanumeric characters) using the `snmp-server contact` command. This information is written to the MIB and is viewed using the `show snmp` command. Use the `no` form of the `snmp-server contact` command to remove any system contact data.

For example, issue the command below to specify the System Administrator Fred Manager as the contact, with the given telephone number:

```
TMX 880# configure terminal
TMX 880(config)# snmp-server contact System Administrator Fred Manager
@ 508 567 1234
```

Specifying an SNMP Location

You can document the SNMP server location (using up to 255 alphanumeric characters) by issuing the `snmp-server location` command. For example, issue the command as shown below to specify the Eastern Division Office as the site of the SNMP server:

```
TMX 880# configure terminal
TMX 880(config)# snmp-server location Eastern Division Office
```

Saving the Configuration

At this point, and each time the configuration changes, you must save the running configuration to startup configuration as follows:

```
TMX 880(config)# exit
```



```
TMX 880# copy running-config startup-config
TMX 880#
```

- When a redundant RCP is present in the system and you issue the `copy running-config startup-config` command, the system automatically copies both the startup configuration file and the backup file of the startup configuration to the secondary RCP.

Synchronizing Files

In a system that uses both a primary RCP and secondary RCP, the files on the PCMCIA card in the secondary RCP should be synchronized with the files on the primary RCP to ensure that the system continues to work as expected should the primary RCP fail. The `copy sync` command lets you synchronize one file, all files, or the boot parameters.

When you run the `copy sync` command, the primary RCP obtains the required free space on the PCMCIA card in the secondary RCP and transfers the file. If there is not enough disk space available, the copy command will be terminated with an error message.

If you synchronize all files, the system reformats the PCMCIA card in the second RCP and deletes the old files on the card, except for the following:

- `.del` files (deleted files)
- Recycled directory
- `Inet` on ethernet boot parameter

The following example synchronizes all of the files on the secondary RCP with the version of the files on the primary RCP:

```
TMX 880# copy sync all
```

Installing Routing Protocols

Detailed information about configuring routing protocols is provided in the “Configuring Cards and Interfaces”, “Configuring BGP”, “Configuring OSPF”, “Configuring ISIS”, and “Configuring PIM” chapters of the *TMX 880 Configuration Guide*.

Making Backup Copies

After you install the new software, create backup copies of the `rver.tar` file and the `startup.cfg` files on the network. See the *TMX 880 Troubleshooting Guide* for information about booting the RCP from the `nxrcp.st` file.

TMX 880 Input/Output Modules

This appendix describes the TMX 880 Input/Output modules and their specifications. The following is the list of the system modules:

- 1-port OC-192c POS
- 4-port OC-48c POS
- 1-port OC-48c POS
- 4-port OC-12c POS
- 2-port OC-12c ATM
- 8-port OC-3c POS
- 8-port OC-3c ATM
- 2-port Gigabit Ethernet
- 8-port Gigabit Ethernet

Table A-1. "Card Physical Dimensions" lists the physical dimensions of the TMX 880 cards.

Table A-2. "Line Cards Signal Levels" lists line card signal levels. The remainder of the appendix provides information specific to each module relating to payload rates and mapping, maintenance and performance monitoring, and network timing, etc.

For information about installing modules or viewing module operational status, see **Chapter 5, "Installing Hardware Modules."**

Table A-1. Card Physical Dimensions

Module	Width	Height
Route Control Processor	16.05 in. (40.77 cm)	12.3 in. (34.44 cm)
Switch Fabric	16.05 in. (40.77 cm)	20 in. (50.80 cm)
SONET Timing and Alarm	5.56 in. (14.12 cm)	20 in. (50.80 cm)
All Input/Output Processors	16.05 in. (40.77 cm)	16 in. (40.64 cm)
All Input/Output Adapters (except the OC-192 POS IOA)	5.56 in. (14.12 cm)	16 in. (40.64 cm)
OC-192c POS IOA	10.26 in. (26.06 cm)	16 in. (40.64 cm)

Table A-2. Line Cards Signal Levels

Line Card	Min. Output Power(dBm)	Max. Output Power(dBm)	Min. Input Power(dBm)	Max. Input Power(dBm)
8-port OC-3c ATM Short Reach, Multimode Maximum Distance: 2 km	-23.5	-14	-30	-14
8-port OC-3c POS Short Reach Multimode Maximum Distance: 2 km	-23.5	-14	-30	-14
2-port OC-12c ATM Intermediate Reach, Single-mode Maximum Distance: 15 km	-15	-8	-31	-8
4-port OC-12c POS Intermediate Reach, Single-mode Maximum Distance: 15 km	-15	-8	-31	-8
1-port OC-48c POS Short Reach, Single-mode Maximum Distance: 2 km	-10	-3	-18	0
4-port OC-48c POS Short Reach, Single-mode Maximum Distance: 2 km	-10	-3	-18	-3
1-port OC-192c POS Very Short Reach, Single-mode, (VSR-1) Maximum Distance: 600 m	-6	-1	-11	-1
1-port OC-192c POS Short Reach, Single-mode, (SR-1) Maximum Distance: 12 km	-6	-0	-11	-1
1-port OC-192c POS Intermediate Reach, Single-mode, (IR-1) Maximum Distance: 40 km	-1	2	-14	-3
2-port Gigabit Ethernet Short Reach, Multimode (SX) Maximum Distance: 500 m	-9.5	-4	-17	0
2-port Gigabit Ethernet Long Reach, Single-mode (LX) Maximum Distance: 10 km	-9.5	-3	-20	-3

Table A-2. Line Cards Signal Levels

Line Card	Min. Output Power(dBm)	Max. Output Power(dBm)	Min. Input Power(dBm)	Max. Input Power(dBm)
8-port Gigabit Ethernet Short Reach, Multimode (SX) Maximum Distance: 1 km	-17	-9.5	-4	-3
8-port Gigabit Ethernet Long Reach, Multimode (LXS) Maximum Distance: 10 km	-9	-3	-20	-3
8-port Gigabit Ethernet Long Reach, Single-mode (LXL) Maximum Distance: 25 km	-20	-9.0	-3.0	-3.0
8-port Gigabit Ethernet Ultra Long Haul Reach, Single-mode (ZX) Maximum Distance: 70 km	-23.0	-3.0	-3.0	2.0

- The QOC-48c POS and the OC-192c cards require that the system have *three* switch fabric cards.

Module Features

OC-192c POS

Payload Rates and Mapping

- Single SONET OC-192c (10 Gbits/s) with STS-192c fully concatenated payload.
- RFC 1619 and RFC 1662-compliant PPP over SONET within payload.
- Frame Relay over SONET within payload.
- HDLC CRC-CCITT or CRC-32
- X43+1 payload scrambling

SONET Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Out of Frame (OOF)
 - Line and Path Alarm Indication and Signaling (AIS-L, AIS-P)
 - Loss of Pointer (LOP-P)
 - Remote Defect Indications and Signaling (RDI-L, RDI-P)
- Section, Line and Path Error Indication
 - B1, B2, and B3 error indication and counting
 - Remote Error Indication and Signaling (REI-L, REI-P)
 - Path Unequipped Indication (UNEQ-P)
 - Path Label Mismatch Indication (PLM-P)

SONET Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture
- Path Label Signal Control (C2)

SONET Network Timing Features

- SONET Stratum 3 Holdover (fully redundant)
- External BITS timing
- Looptiming
- Linetiming
- S1 Byte Monitoring and Control

SONET Equipment Maintenance Features

- Facility Loopback

OC-48c POS and QOC-48

Payload Rates and Mapping

- SONET/SDH OC-48c (2.5 Gbps) with STS-48c/STM-16 fully concatenated payload
- RFC 1619 and RFC 1662-compliant PPP over SONET/SDH within payload
- Frame Relay over SONET/SDH within payload
- HDLC CRC-CCITT 16 and 32-bit configurable (32-bit is default)
- $X^{43}+1$ scrambling
- MPLS over SONET within payload

SONET/SDH Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Line or Path Alarm Indication Signal (AIS-L, AIS-P)
 - Loss of Payload Pointer (LOP-P)
 - Remote Defect Indicators at Line and Path Layers (RDI-L, RDI-P)
 - Path Payload Label Mismatch (PLM)
 - Path Unequipped (UNEQ-P)
- Section (B1), Line (B2) and Path (B3) errors
 - Performance counts at Section, Line and Path layers
 - Remote Error Indicator Performance Counts at Line and Path layers (REI-L, REI-P)

SONET/SDH Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture

SONET/SDH Network Timing

- SONET/SDH Stratum 3 (Fully Redundant Timing Module)
- External Timing (from BITS or other external source) Inputs on two T1/E1 lines
- Line Timing
- Loop Timing selectable on a per-interface basis
- Synchronization Status Messages supported per Bellcore GR-253, with S1 byte on SONET interfaces and ESF messages on T1 timing signals

SONET/SDH Equipment Maintenance Features

- Facility Loopback

OC-12c ATM

Payload Rates and Mapping

- SONET/SDH OC-12c (622 Mbps) with STS-12c/STM-4 fully concatenated payload
- ANSI T1.105.02 ATM payload mapping
- AAL5 framing
- RFC 1577 Classical IP over ATM
- RFC 1483 Multiprotocol encapsulation over AAL5
- ATM layer functions as defined in ITU specifications I.356 (cell transfer performance), I.432 (UNI physical layer) and I.610 (OAM)
- MPLS over SONET within payload

SONET/SDH Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Line or Path Alarm Indication Signal (AIS-L, AIS-P)
 - Loss of Payload Pointer (LOP-P)
 - Remote Defect Indicators at Line and Path Layers (RDI-L, RDI-P)
 - Path Payload Label Mismatch (PLM)
 - Path Unequipped (UNEQ-P)
- Section (B1), Line (B2) and Path (B3) errors
 - Performance counts at Section, Line and Path layers
 - Remote Error Indicator Performance Counts at Line and Path layers (REI-L, REI-P)

SONET/SDH Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture

SONET/SDH Network Timing

- SONET/SDH Stratum 3 (fully redundant timing module)
- External Timing (from BITS or other external source) Inputs on two T1/E1 lines
- Line Timing for locations without a co-located external Stratum clock
- Loop Timing selectable on a per-interface basis
- Synchronization Status Messages supported per Bellcore GR-253, with S1 byte on SONET interfaces and ESF messages on T1 timing signals

SONET/SDH Equipment Maintenance Features

- Facility Loopback

OC-12c POS

Payload Rates and Mapping

- SONET/SDH OC-12c (622 Mbps) with STS-12c/STM-4 fully concatenated payload
- RFC 1619 and RFC 1662-compliant PPP over SONET/SDH within payload
- Frame Relay over SONET/SDH within payload
- HDLC CRC-CCITT 16 and 32-bit configurable (32-bit is default)
- $x^{43}+1$ scrambling
- MPLS over SONET within payload

SONET/SDH Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Line or Path Alarm Indication Signal (AIS-L, AIS-P)
 - Loss of Payload Pointer (LOP-P)
 - Remote Defect Indicators at Line and Path Layers (RDI-L, RDI-P)
 - Path Payload Label Mismatch (PLM)
 - Path Unequipped (UNEQ-P)
- Section (B1), Line (B2) and Path (B3) errors
 - Performance counts at Section, Line and Path layers
 - Remote Error Indicator Performance Counts at Line and Path layers (REI-L, REI-P)

SONET/SDH Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture

SONET/SDH Network Timing

- SONET/SDH Stratum 3 (Fully Redundant Timing Module)
- External Timing (from BITS or other external source) Inputs on two T1/E1 lines
- Line Timing for locations without a co-located external Stratum clock
- Loop Timing selectable on a per-interface basis
- Synchronization Status Messages supported per Bellcore GR-253, with S1 byte on SONET interfaces and ESF messages on T1 timing signals

SONET/SDH Equipment Maintenance Features

- Facility Loopback

OC-3c ATM

Payload Rates and Mapping

- SONET/SDH OC-3c (155 Mbps) with STS-3c/STM-1 fully concatenated payload
- ANSI T1.105.02 ATM payload mapping
- AAL5 framing
- RFC 1577 Classical IP over ATM
- RFC 1483 Multiprotocol encapsulation over AAL5
- ATM layer functions as defined in ITU specifications I.356 (cell transfer performance), I.432 (UNI physical layer) and I.610 (OAM)
- MPLS over SONET within payload

SONET/SDH Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Line or Path Alarm Indication Signal (AIS-L, AIS-P)
 - Loss of Payload Pointer (LOP-P)
 - Remote Defect Indicators at Line and Path Layers (RDI-L, RDI-P)
 - Path Payload Label Mismatch (PLM)
 - Path Unequipped (UNEQ-P)
- Section (B1), Line (B2) and Path (B3) errors
 - Performance counts at Section, Line and Path layers
 - Remote Error Indicator Performance Counts at Line and Path layers (REI-L, REI-P)

SONET/SDH Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture

SONET/SDH Network Timing

- SONET/SDH Stratum 3 (Fully Redundant Timing Module)
- External Timing (from BITS or other external source) Inputs on two T1/E1 lines
- Line Timing for locations without a co-located external Stratum clock
- Loop Timing selectable on a per-interface basis
- Synchronization Status Messages supported per Bellcore GR-253, with S1 byte on SONET interfaces and ESF messages on T1 timing signals

SONET/SDH Equipment Maintenance Features

- Facility Loopback

OC-3c POS

Payload Rates and Mapping

- SONET/SDH OC-3c (155.52 Mbps) with STS-3c/STM-1 fully concatenated payload
- RFC 1619 and RFC 1662-compliant PPP over SONET/SDH within payload
- Frame Relay over SONET/SDH within payload
- HDLC CRC-CCITT 16 and 32-bit configurable (32-bit is default)
- $x^{43}+1$ scrambling
- MPLS over SONET within payload

SONET/SDH Maintenance and Performance Monitoring

- Section and Path Failures
 - Loss of Signal (LOS)
 - Loss of Frame (LOF)
 - Line or Path Alarm Indication Signal (AIS-L, AIS-P)
 - Loss of Payload Pointer (LOP-P)
 - Remote Defect Indicators at Line and Path Layers (RDI-L, RDI-P)
 - Path Payload Label Mismatch (PLM)
 - Path Unequipped (UNEQ-P)
- Section (B1), Line (B2) and Path (B3) errors
 - Performance counts at Section, Line and Path layers
 - Remote Error Indicator Performance Counts at Line and Path layers (REI-L, REI-P)

SONET/SDH Administrative Features

- Access to J0 Byte
- SONET/SDH 64/16-byte Path Trace (J1) Insertion and Capture

SONET/SDH Network Timing

- SONET/SDH Stratum 3 (Fully Redundant Timing Module)
- External Timing (from BITS or other external source) Inputs on two T1/E1 lines
- Line Timing for locations without a co-located external Stratum clock
- Loop Timing selectable on a per-interface basis
- Synchronization Status Messages supported per Bellcore GR-253, with S1 byte on SONET interfaces and ESF messages on T1 timing signals

SONET/SDH Equipment Maintenance Features

- Facility Loopback

Gigabit Ethernet

Gigabit Ethernet Line Card Hardware Specifications

- Two Full-duplex, Full Bandwidth Gigabit Ethernet ports per Card
- Support IEEE 1000Base-SX.
- Auto-Negotiation
- 802.3x Frame Based Flow Control (transmit)
- Physical Connectors: 2-port MTRJ, 8-port LC.
- Multi Mode Version Supports Both 62.5/125 and 50/125 Micron Multi-Mode Fiber
- Supports multimode, short range IOAs.
- Jumbo Packet Support - Can Support a Maximum Jumbo Frame Size of up to 9,600 Bytes
- MPLS Tag Support
- MAC Address filtering: Up to 16 Destination Address Filters, Single Source Address Filter
- IP Fragmentation

Supported Software Features

- ARP
- Ethernet MIB (RFC2665)
- IP Fragmentation
- ICMP
- Ethernet V2 and 802.3 Encapsulation support.

Protocol Support and Standards Compliance

- IEEE 802.2 LLC
- IEEE 802.3z- Gigabit Ethernet
- RFC 791- Ipv4 - Internet Protocol Version 4
- RFC 792 - ICMP - Internet Control Message Protocol
- RFC 826 - Ethernet Address Resolution Protocol
- RFC 894 - Standard for the transmission of Ethernet datagrams over Ethernet networks
- RFC 1213 - MIB-II
- RFC 2665 - Ethernet MIB

Cable Connectors and Pinouts

This appendix describes the following cables and connectors used on the TMX 880 system.

- RCP cable connectors
- Line card cable connectors
- PDU connector

Route Control Processor Cable Connectors

The Route Control Processor uses two DB-9 serial port connectors for local management and an RJ-45 connector for connection to an Ethernet console or management port. **Figure B-1. "DB-9 Connector (Female)"** shows a DB-9 cable connector; **Table B-1. "DB-9 Pinout Assignments"** lists the pinouts for the DB-9 connector.

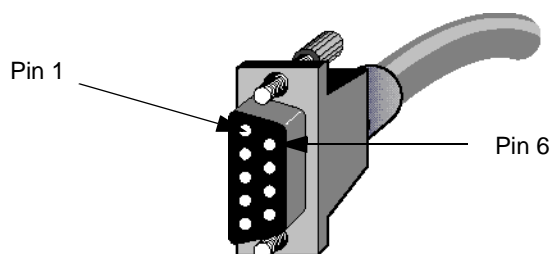


Figure B-1. DB-9 Connector (Female)

Table B-1. DB-9 Pinout Assignments

Pin Number	Signal	Pin Number	Signal
1	DCD (Data Carrier Detect)	6	DSR (Data Set Ready)
2	RXD (Receive Data)	7	RTS (Request To Send)
3	TXD (Transmit Data)	8	CTS (Clear To Send)
4	DTR (Data Terminal Ready)	9	RI (Ring Indicator)
5	GND (Signal Ground)		

Figure B-2. "RJ-45 Connector for Ethernet Management Port" shows an RJ-45 connector; Table B-2. "RJ-45 Pinout Assignments" lists the pinouts on the RJ-45 connector.

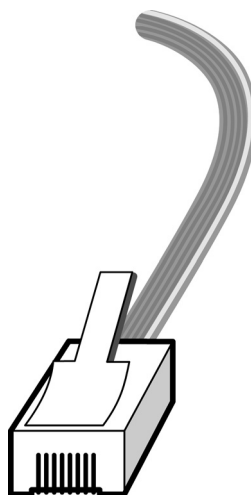


Figure B-2. RJ-45 Connector for Ethernet Management Port

Table B-2. RJ-45 Pinout Assignments

Pin Number	Signal
1	TD+
2	TD-
3	RD+
4	Common Mode Termination
5	Common Mode Termination
6	RD-
7	Common Mode Termination
8	Common Mode Termination

Line Card Cable Connectors

The TMX 880 line cards use SC, LC, and MTRJ connectors depending on the type of IOA. Refer to **Figure 5-6. "Line Card Connector Types"** and **Table 5-7. "Adapter Cable Connectors Usage"** on page 5-14 for additional information on these connectors.

► Lucent recommends using Volex, FCI or Computer Crafts MTRJ connector.

PDU Connector

The system is shipped with the Elcon power connector (408-00016-00) but before the power and ground cables can be connected to the system the customer must:

- Provide the power cables and the ground cable
- Terminate the power cables with a straight lug
- Assemble the power cables to the connector
- Terminate the ground cable with a straight lug

See [Chapter 4, "Connecting Power to the Chassis"](#) and for information on connecting power to the system.

Lucent recommends 2 AWG (.067 in sq.)(43.3 mm sq.) stranded (flexible) cable for the power and ground cables. The power and ground cables must be a maximum of 10 feet (3.048 meters) in length, so that the cable is long enough to go from the system to a splice point above or below the TMX 880 system.

Table B-3. "Dimensions for Power Cable Lugs and Ground Cable Lug" lists the dimensions for the recommended power and ground cable lugs. The dimension reference for the power cable lug is provided in [Figure B-3. "Power Cable Lug Dimension Reference"](#) on page B-4. The dimension reference for the ground cable lug is provided in [Figure B-4. "Ground Cable Lug Dimension Reference"](#).

Table B-3. Dimensions for Power Cable Lugs and Ground Cable Lug

Dimension	Standard Copper Barrel	For TMX 880 Power Cables	For TMX 880 Ground Cable
C	Bolt Hole Size	0.3125 in. (0.79375 cm)	0.25 in. (0.635 cm)
I.D.	Barrel Internal Diameter	0.57 in. (1.4478 cm)	0.57 in. (1.4478 cm)
O.D.	Barrel Outside Diameter	0.71 in. (1.8034 cm) (0.75 in. (1.905cm) maximum allowed	0.71 in. (1.8034 cm)
A	Overall Length of Lug	2.38 in. (6.0452 cm)	2.36 in. (5.9944 cm)
B	Barrel Length	1.19 in. (3.0226 cm)	1.19 in. (3.0226 cm)
W	Overall Width at Tongue	1.06 in. (2.6924 cm) (maximum allowed)	1.06 in. (2.6924 cm)
E	Hole Center-to-Center	Not Applicable	0.825 in. (2.0955 cm)
G	Center of Hole to Tip of Lug	0.35 in. (8.89 mm)	0.35 in. (8.89 mm)
T	Thickness of Tongue	0.14 in. (3.556 mm)	0.14 in. (3.556 mm)

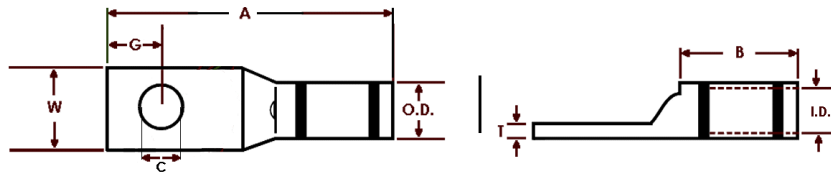


Figure B-3. Power Cable Lug Dimension Reference

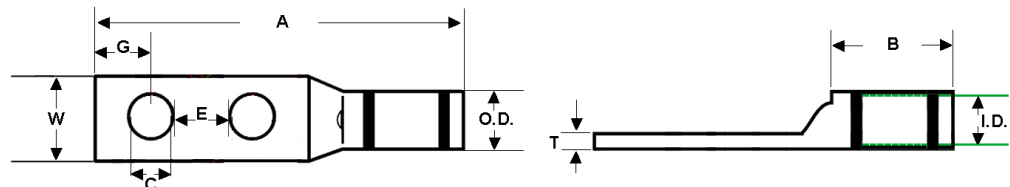


Figure B-4. Ground Cable Lug Dimension Reference

- It is advisable to pass the power cables through the lower half of the Elcon connector before assembling the lugs to the cables.

Use the following illustration as a reference to assemble wire to the connector.

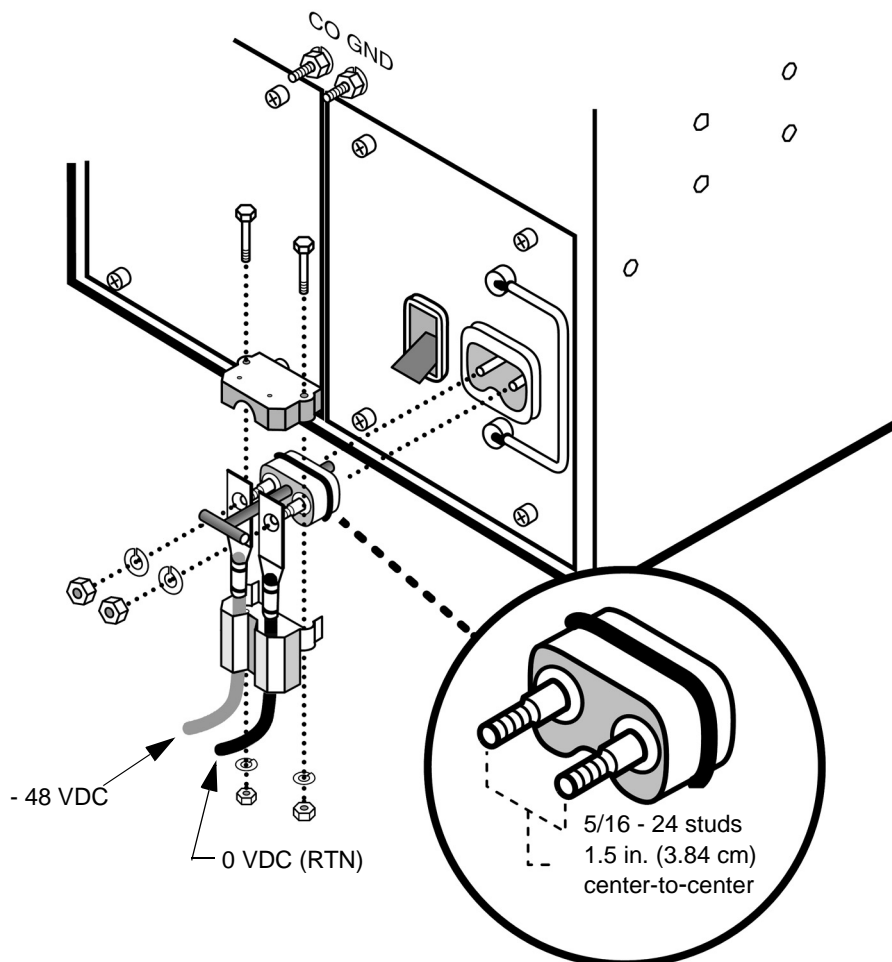


Figure B-5. Exploded View of PDU Power Connector

Safety Instructions

Important Safety Instructions

Observe the following safety guidelines to prevent physical injury and to prevent damage to the equipment when installing or operating the Lucent TMXTM 880 MPLS Core Switch.



This symbol notifies the reader to proceed carefully to avoid possible equipment damage or data loss.



This symbol notifies the reader to proceed carefully to avoid possible personal injury.

- The Lucent TMX 880 MPLS Core Switch must be installed in a *restricted access* location by authorized customer or Lucent personnel and must be installed on a dry, non-flammable surface, preferably concrete.
- Before installing the system, locate the emergency power switch or breaker for the equipment on which you are working and make sure it is set to OFF.
- Disconnect all power and external cables *before* moving a chassis.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit; always check.
- Do not do anything that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as wet floors, ungrounded power extension cables, and missing safety grounds.

Laser Class 1

This equipment is a Class 1 Laser Product and is intended for connection to Class 1 devices only. Lasers used in this equipment meet the regulatory requirements for casual exposure to the eye, however it is recommended that you do not look directly into the laser light source.

Consignes de sécurité importantes

Respectez les consignes de sécurité suivantes pour prévenir les dommages physiques et les dégâts qui pourraient être occasionnés à l'équipement lors de l'installation ou du fonctionnement du commutateur TMX 880 MPLS Core Lucent:



Ce symbole avertit le lecteur de procéder prudemment afin de prévenir les risques d'endommagement du matériel ou d'altération des données.



Ce symbole invite le lecteur à procéder prudemment afin d'éviter les risques de blessures corporelles.

- Le commutateur TMX 880 MPLS Core Lucent doit être installé à un emplacement dont *l'accès est limité* au client autorisé ou au personnel Lucent et doit être installé sur un sol sec, non-inflammable et de préférence en béton.
- Avant de procéder à l'installation, identifiez le commutateur de marche-arrêt d'urgence ou le coupe-circuit de l'équipement sur lequel vous travaillez et assurez-vous qu'il est en position OFF.
- Mettez hors tension tous les câbles électriques et externes *avant* de déplacer un châssis.
- Veillez à ne pas travailler seul en présence de conditions de danger potentielles.
- Vérifiez TOUJOURS que le circuit est effectivement hors tension; ne vous limitez jamais à le supposer.
- Ne procédez jamais à aucune opération pouvant être à l'origine de dangers potentiels pour les personnes ou pouvant rendre l'équipement dangereux.
- Examinez soigneusement la zone de travail et considérez les sources de danger éventuelles telles que les sols mouillés, les câbles de rallonge non mis à la terre et les masses de sécurité manquantes.

Laser de Classe 1

Cet équipement est un Produit Laser de Classe 1; il doit par conséquent être raccordé exclusivement à des appareils de Classe 1. Les lasers utilisés dans cet équipement sont conformes aux normes réglementaires en cas d'exposition accidentelle des yeux, il est toutefois recommandé de ne pas regarder directement la source d'émission laser.

Wichtige Sicherheitshinweise

Bitte beachten Sie die folgenden Sicherheitsrichtlinien, um Körperverletzungen und Geräteschäden zu vermeiden, wenn Sie den TMX 880 MPLS Core Schalter von Lucent:



Dieses Symbol weist den Leser darauf hin, vorsichtig fortzufahren, um möglichen Geräteschaden oder Datenverlust zu vermeiden.



Dieses Symbol weist den Leser darauf hin, vorsichtig fortzufahren, um möglichen Körperverletzungen vorzubeugen.

- Der TMX 880 MPLS Core Schalter von Lucent muß von vom Kunden autorisierten oder Lucent-Personal an einem Ort mit *beschränktem Zugang* auf einer trockenen, nicht brennbaren Oberfläche, bevorzugt Zement, installiert werden.
- Vor der Installation vergewissern Sie sich, wo sich der Notstromschalter bzw. Notunterbrecher befindet und daß er sich in der abgeschalteten Position (OFF) befindet.
- Stecken Sie alle Strom- und externen Kabel aus, *bevor* Sie ein Chassis verschieben.
- Arbeiten Sie unter potentiell gefährlichen Bedingungen nicht alleine.
- Gehen Sie niemals davon aus, daß keine Spannung am Schaltkreis anliegt, prüfen Sie dieses immer nach.
- Unternehmen Sie nichts, was für andere Personen zur Gefahr werden könnte oder die Anlage unsicher machen könnte.
- Überprüfen Sie Ihren Arbeitsplatz sorgfältig auf mögliche Gefahren wie z.B. feuchte Böden, nicht geerdete Stromverlängerungskabel und fehlende Schutzleiter.

Laser Klasse 1

Diese Anlage ist ein Produkt der Laser Klasse 1 und ist ausschließlich für den Anschluß an Geräte der Klasse 1 vorgesehen. Die mit dieser Anlage verwendeten Laser erfüllen die Vorschriften für versehentliches Exponieren der Augen, es wird jedoch empfohlen, nicht direkt in die Laserlichtquelle zu schauen.

Importantes instrucciones de seguridad

Observe las siguientes pautas de seguridad para prevenir daños personales y al equipo al instalar u operar TMX™ 880 MPLS Core Switch de Lucent:



Este símbolo le indica al lector que debe proceder con cuidado para evitar pérdida de datos o daño al sistema.



Este símbolo le indica al lector que debe proceder con cuidado para evitar daño personal.

- TMX™ 880 MPLS Core Switch de Lucent lo debe instalar en un *área de acceso restringido* el personal de Lucent o personal autorizado por el cliente y debe instalarse en una superficie seca y no inflamable, preferiblemente de cemento.
- Antes de instalar el sistema, busque dónde se encuentra el interruptor de corriente de emergencia para el equipo en el que está trabajando y asegúrese que esté en la posición OFF (apagado).
- Desconecte la corriente eléctrica y los cables externos *antes* de mover cualquier chasis.
- No trabaje solo si existen condiciones potencialmente peligrosas.
- Nunca asuma que la corriente eléctrica está desconectada, siempre debe comprobarlo antes de ponerse a trabajar.
- No haga nada que cree un riesgo potencial para otras personas o que comprometa la seguridad del equipo.
- Examine con cuidado su área de trabajo para comprobar que no haya peligros, tales como suelos mojados, cables de extensión de corriente no conectados a tierra y la falta de conexiones a tierra de seguridad.

Láser clase 1

Este equipo es un producto Láser de clase 1 y tiene como objetivo su conexión a dispositivos de la clase 1 solamente. Los láseres usados en este equipo cumplen los requisitos necesarios para la exposición a los ojos. Sin embargo, se recomienda que no mire directamente a la fuente de luz del láser.

重要的安全说明

在安装或操作 Lucent TMX™ 880 MPLS Core Switch 时，请遵循如下安装指南以避免造成人身伤害和设备损坏：



本符号提醒读者小心操作，以免损坏设备或丢失数据。



本符号提醒读者小心操作，以免造成可能的人身伤害。

- 必须将 Lucent TMX™ 880 MPLS Core Switch 安装在一“禁止入内”的区域。必须由授权客户或朗讯工作人员实施安装，且必须安装在干燥、不易燃的地面上，最好是混凝土地面。
- 在安装该系统前，请查看设备的电源或断路器，确保其已被设置为“关闭”。
- 在移动底板以前，断开所有电源和外接电缆。
- 如果存在潜在的危险情况，切勿单独工作。
- 在亲自进行查看以前，切勿臆断已经断开电源。
- 不要进行可能伤害他人或损坏设备的任何操作。
- 仔细检查工作区，确保没有潜在危险，如湿地板、未接地的电源扩展电缆和没有安全接地。

类激光

本设备属于 1 类激光产品，只能用于 1 类设备的连接。本设备所使用的激光符合对人眼辐照的规定要求，不过，请最好不要直视激光光源。

安全上の重要注意事項

ルーセント TMX™ 880 MPLS Coreスイッチを設置または操作する際、人体の怪我および装置の損傷を予防するため、以下の安全ガイドラインを守ってください。



このシンボルは、装置の損傷あるいはデータの損失を予防するため、注意して先へ進むよう警告するためのものです。



このシンボルは、人体の怪我を予防するため、注意して先へ進むよう警告するためのものです。

- ・ ルーセント TMX™ 880 MPLS Core スイッチは、許可されたお客様またはルーセントの作業員が、入室制限口ケーションに設置すること。また、乾燥した非可燃性の床（できればコンクリート）上に設置すること。
- ・ システムを設置する前に、作業する装置の非常用電源スイッチまたはブレーカの位置を確認し、それがオフになっているのを確認すること。
- ・ シャーシを移動する前に、すべての電源および外部ケーブルを切断すること。
- ・ 危険な状況が潜在する場合には、一人で作業しないこと。
- ・ 電源が回線から切断されていると思い込まずに、常にチェックすること。
- ・ 人体に潜在的な危険を及ぼしたり、装置を安全でない状態にするようなことはしないこと。
- ・ 床が濡れている、電源延長ケーブルがアースされていない、安全なアースがない等、作業エリアに危険が潜在していないかどうか、注意深く調べること。

レーザクラス 1

この装置はクラス 1 のレーザ製品であり、クラス 1 機器接続専用です。この装置で使用されているレーザは、軽度の目への照射についての規定要件は満たしていますが、レーザ光源を直接見つめないことをお勧めします。

Laser Safety Guidelines

General Laser Information

Optical fiber telecommunication systems, their associated test sets, and similar operating systems use semiconductor laser transmitters that emit infrared (IR) light at wavelengths between approximately 800 nanometers (nm) and 1600 nanometers. The emitted light is above the red end of the visible spectrum, which is normally not visible to the human eye. Although radiant energy at near-IR wavelengths is officially designated invisible, some people can see the shorter wavelength energy even at power levels several orders of magnitude below any that have been shown to cause injury to the eye.

Conventional lasers can produce an intense beam of monochromatic light. The term monochromaticity means a single wavelength output of pure color that may be visible or invisible to the eye. A conventional laser produces a small-size beam of light, and because the beam size is small the power density (also called irradiance) is very high. Consequently, lasers and laser products are subject to federal and applicable state regulations as well as international standards for their safe operation.

A conventional laser beam expands very little over distance, or is said to be very well collimated. Thus, conventional laser irradiance remains relatively constant over distance. However, lasers used in lightwave systems have a large beam divergence, typically 10 to 20 degrees. Here, irradiance obeys the inverse square law (doubling the distance reduces the irradiance by a factor of 4) and rapidly decreases over distance.

Lasers and Eye Damage

The optical energy emitted by laser and high-radiance LEDs in the 400-1400 nm range may cause eye damage if absorbed by the retina. When a beam of light enters the eye, the eye magnifies and focuses the energy on the retina magnifying the irradiance. The irradiance of the energy that reaches the retina is approximately 10^5 or 100,000 times more than at the cornea and, if sufficiently intense, may cause a retinal burn.

The damage mechanism at the wavelengths used in an optical fiber telecommunications is thermal in origin, that is, damage caused by heating. Therefore, a specific amount of energy is required for a definite time to heat an area of retinal tissue. Damage to the retina occurs only when one looks at the light sufficiently long that the product of the retinal irradiance and the viewing time exceeds the damage threshold. Optical energies above 1400 nm cause corneal and skin burns but do not affect the retina. The thresholds for injury at wavelengths greater than 1400 nm are significantly higher than for wavelengths in the retinal hazard region.

Classification of Lasers

Manufacturers of lasers and laser products in the U.S. are regulated by the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) under 21 CFR 1040. These regulations require manufacturers to certify each laser or laser product as belonging to one of four major Classes: I, II, IIIa, IIIb, or IV. The International Electro-technical Commission is an international standards body that writes laser safety standards under IEC-60825. Classification schemes are similar with Classes divided into Classes 1, 2, 3A, 3B, and 4. Lasers are classified according to the accessible emission limits and

their potential for causing injury. Optical fiber telecommunication systems are generally classified as Class I/1, because, under normal operating conditions, all energized laser transmitting circuit packs are terminated on optical fibers which enclose the laser energy with the fiber sheath forming a protective housing. Also, a protective housing / access panel is typically installed in front of the laser circuit pack shelves. The circuit packs themselves, however, may be FDA/CDRH Class I or IIb or IEC Class 1, 3A, or 3B.

Laser Safety Precautions for Optical Fiber Telecommunication Systems

In its normal operating mode, an optical fiber telecommunication system is totally enclosed and presents no risk of eye injury. It is a Class I/1 system under the FDA and IEC classifications.

The fiber optic cables that interconnect various components of an optical fiber telecommunication system can disconnect or break, and may expose people to laser emissions. Also, certain measures and maintenance procedures may expose the technician to emission from the semiconductor laser during installation and servicing. Unlike more familiar laser devices, such as solid-state and gas lasers, the emission pattern of a semiconductor laser results in a highly divergent beam. In a divergent beam, the irradiance (power density) decreases rapidly with distance. The greater the distance, the less energy will enter the eye, and the less potential risk for eye injury. Inadvertently viewing an unterminated fiber or damaged fiber with the unaided eye at distances greater than 5 to 6 inches normally will not cause eye injury provided the power in the fiber is less than a few milliwatts at the near IR wavelengths and a few tens of milliwatts at the far IR wavelengths. However, damage may occur if an optical instrument such as a microscope, magnifying glass or eye loupe is used to stare at the energized fiber end.



Use of controls, adjustments and procedures other than those specified herein may result in hazardous laser radiation exposure.

Laser Safety Precautions for Enclosed Systems

Under normal operating conditions, optical fiber telecommunication systems are completely enclosed; nonetheless, the following precautions shall be observed:

1. Because of the potential for eye damage, technicians should not stare into optical connectors or broken fibers.
2. Under no circumstance shall laser/fiber optic operations be performed by a technician before satisfactorily completing an approved training course.
3. Since viewing laser emissions directly in excess of Class I/1 limits with an optical instrument such as an eye loupe greatly increases the risk of eye damage, appropriate labels must appear in plain view, in close proximity to the optical port on the protective housing/access panel of the terminal equipment.

Laser Safety Precautions for Unenclosed Systems

During service, maintenance, or restoration, an optical fiber telecommunication system is considered unenclosed. Under these conditions, follow these practices:

1. Only authorized, trained personnel shall be permitted to do service, maintenance and restoration. Avoid exposing the eye to emissions from unterminated, energized optical connectors at close distances. Laser modules associated with the optical ports of laser circuit packs are typically recessed, which limits the exposure distance. Optical port shutters, Automatic Power Reduction (APR), and Automatic Power Shut Down (APSD) are engineering controls that are also used to limit the emissions. However, technicians removing or replacing laser circuit packs should not stare or look directly into the optical port with optical instruments or magnifying lenses (Normal eyewear or indirect viewing instruments such as Find-R-Scopes are not considered magnifying lenses or optical instruments).
2. Only authorized, trained personnel shall use optical test equipment during installation or servicing since this equipment contains semiconductor lasers (Some examples of optical test equipment are Optical Time Domain Reflectometers (OTDR's), Hand-Held Loss Test Sets, and Feature Finders).
3. Under no circumstances shall any personnel scan a fiber with an optical test set without verifying that all laser sources on the fiber are turned off.
4. All unauthorized personnel shall be excluded from the immediate area of the optical fiber telecommunication systems during installation and service.

Consult ANSI Z136.2 American National Standard for Safe Use of Lasers in the U.S. or outside the U.S., IEC-60825, Part 2 for guidance on the safe use of optical fiber optic communication systems in the workplace.

Internal Laser Circuit Packs Optical Specifications

Laser Circuit Pack Code	Wavelength (nm)	Output Power (mW)	Fiber Type (μm)	Connector Type	FDA Class /IEC Class
OC-3c POS 8-port (LED)	1300	0.04	MM(62.5)	MT-RJ	I/1
OC-3c ATM 8-port (LED)	1300	0.04	MM(62.5)	MT-RJ	I/1
OC-12c POS 4-port	1310	0.158	SM(8.8)	LC	I/1
OC-12c ATM 2-port	1310	0.158	SM(8.8)	LC	I/1
OC-48c POS 4-port	1300	0.5	SM(8.8)	SC Duplex	I/1
OC-48c POS 1-port	1300	1.0	SM(8.8)	SC	I/1
OC-192c POS 1-port <ul style="list-style-type: none"> • Very Short Reach • Short Reach, single-mode • Intermediate Reach, single-mode 	1310	0.794	SM(9.5)	SC	I/1
	1550	1.0	SM(8.8)	SC	I/1
	1550	1.58	SM(8.8)	SC	I/1
Gigabit Ethernet 2-port <ul style="list-style-type: none"> • SX • LX 	850	0.398	MM(62.5)	MT-RJ	I/1
	1310	0.500	SM(8.8)	MT-RJ	I/1
Gigabit Ethernet 8-port <ul style="list-style-type: none"> • SX • LXS • LXL • ZX 	850	0.398	MM(62.5)	Duplex LC	I/1
	1310	0.500	SM(8.8)	Duplex LC	I/1
	1310	1.258	SM(8.8)	Duplex LC	I/1
	1550	1.585	SM(8.8)	Duplex LC	I/1

SX = 1 km typical

LXS = 10 km typical

ZX = 70 km typical

LX = 5 km typical

LXL = 25 km typical



Lucent Technologies TMX 880 systems comply with 21CFR 1040.10 and 1040.11 as Class I and IEC 60825-1 Class 1 laser products. They are assessed as IEC-60825-2 Hazard Level 1 Optical Fiber Communication Systems as per Part 4.1.1.

Part Numbers and Ordering Information

The **Table D-1** lists the TMX 880 equipment part numbers.

► **Note:** RCP = Route Control Processor; SF = Switch Fabric module; STA = SONET Timing/Alarm module; PDU = Power Distribution Unit.

Table D-1. TMX 880 Part Numbers

Item/Component	Lucent ComCode
Switch/Router Common Equipment	
TMX 880 Simplex Common Equipment, 150 Amp PDU (rack-mount chassis, 1 each: RCP, SF, STA and PDU)	300134152
TMX 880 Duplex Common Equipment, 150 amp PDU (rack-mount chassis, 2 each: RCP, SF, STA and PDU)	300134160
MXOS Software RTU (flash card), 1 required per chassis	300351178
NX-EMS Element Management System 1-15 nodes (License)	300134293
Common Equipment Redundancy/Spares Kit, 150 amp PDU for simplex-to-duplex upgrade (includes 1 each: RCP, SF, STA, and PDU)	300134186
Switch Fabric Module (SF)	300134178
SONET Timing/Alarm module (STA)	300134400
Route Control Processor module (RCP)	300134418

Table D-1. TMX 880 Part Numbers (Continued)

Item/Component	Lucent ComCode
Interface Modules (includes IOP, Daughterboard and IOA)	
8-port OC-3c/STM-1 ATM Interface Module, short-reach, multimode	300134194
8-port OC-3c/STM-1 POS Interface Module, short-reach, multimode	300134210
2-port OC-12c/STM-4 ATM Interface Module, intermediate-reach, single-mode	300134236
4-port OC-12c/STM-4 POS Interface Module, intermediate-reach, single-mode	300134244
2-port Gigabit Ethernet Interface Module, SX-Optics	300298304
2-port Gigabit Ethernet Interface Module, LX-Optics multimode	300319886
1-port OC-48c/STM-16 POS Interface Module, short-reach, single-mode	300134251
4-port OC-48c/STM-16 POS Interface Module, short-reach, single-mode	300134277
1-port OC-192c/STM-64 POS Interface Module, very-short-reach, single-mode	300333440
1-port OC-192c/STM-64 POS Interface Module, short-reach, single-mode	300305919
1-port OC-192c/STM-64 POS Interface Module, intermediate-reach, single-mode	300333465
I/O Processor	
OC-3c/OC-12c/STM-4 POS Processor Engine	300155926
OC-3c/STM-1 / OC-12c/STM-4 ATM Processor Engine	300134301
OC-48c/STM-16 POS Processor Engine (for 1-port IOA)	300134350
OC-48c/STM-16 POS Processor Engine (for 4-port IOA)	300134384
OC-192C/STM-64 POS Processor Engine	300319894
Gigabit Ethernet Processor Engine, 2 port	300300985

Table D-1. TMX 880 Part Numbers (Continued)

Item/Component	Lucent ComCode
Gigabit Ethernet Processor Engine, 8 port	300421807
Line Cards	
8-port OC-3c/STM-1 ATM Line Card, short-reach, multimode	300134319
8-port OC-3c/STM-1 POS Line Card, short-reach, multimode	300155942
8-port OC3c/STM -1 POS Line Card, intermediate-reach, single-mode	300319944
2-port OC-12c/STM-4 ATM Line Card, intermediate-reach, single-mode	300134343
4-port OC-12c/STM-4 POS Line Card, intermediate-reach, single-mode	300155959
1-port OC-48c/STM-16 POS Line Card, short-reach, single-mode	300134368
4-port OC-48c/STM-16 POS Line Card, short-reach, single-mode	300134392
1-port OC-192c/STM-64 POS Line Card very-short reach single-mode	300333457
1-port OC-192c/STM-64 POS Line Card short reach single-mode	300319969
1-port OC-192c/STM-64 POS Line Card, intermediate-reach, single-mode	300333473
2-port Gigabit Ethernet Line Card SX-optics, multimode	300298312
2-port Gigabit Ethernet Line Card long-reach multimode	300300977
8-port Gigabit Ethernet Line Card, SX-Optics, multimode	300421823
8-port Gigabit Ethernet Line Card LXS-Optics, multimode	300421815
8-port Gigabit Ethernet Line Card, LXL-Optics, single-mode	300425931
8-port Gigabit Ethernet Line Card, ZX-Optics, single-mode	300421831

Table D-1. TMX 880 Part Numbers (Continued)

Item/Component	Lucent ComCode
Miscellaneous	
Adapter cable - MT-SC	300134426
Adapter cable - LC-SC	300155967
Adapter cable pair, SMB-BNC, jack	300269321
Adapter cable pair, SMB-BNC, plug	300269339
TMX 880 base rack-mount chassis	300155975
Cable Management Kit	300134442
Fan Tray, rear	300134459
Fan Tray, bottom front	300155983
Fan Tray, top front	300134467
Replacement air filter	300134475
PCMCIA Flash Card, 110 MB, blank	300134491
DC Power Distribution Unit, 150 amp	300134509
Shipping/Installation Kit	300134517
Blank Filler Plate, Power Distribution Unit	300134525
Blank Filler Plate, Processor Engine and Line Card	300134541
Blank Filler Plate, Control Processor (CP)	300134558
Blank Filler Plate, Switch Fabric and SONET Timing/Alarm module	300134566
19-inch Rack-mount Kit	300134574
23-inch Rack-mount Kit	300134582
Side Trim for Rack	300134590
Top Bezel for Rack	300134608
Bottom Bezel for Rack	300134616

To order any of the TMX 880 equipment listed above, contact your Lucent account manager.

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Technical Support

The Lucent Technical Assistance Center (TAC) is available to assist you with any problems encountered while using this Lucent product. Call the appropriate number in the following table, or log on to our Customer Support web site (www.lucent.com/support) to obtain numbers for the Lucent TAC in your region.

Country/Region		Telephone Number
United States, Canada, United Kingdom, and Europe www.lucent.com/support	United States and Canada	1-866-LUCENT8 (1-866-582-3688)
	United Kingdom	0-800-96-2229
	Europe	Toll-free calls from most European countries: 00-800-0058-2368 Toll calls from other countries: 353-1-692-4579
Asia-Pacific www.lucent.com/support	Australia	1-800-458-236
	China	(00) 800-5823-6888 Hotline: 86-10-8518 8275
	Hong Kong	(001) 800-5823-6888 Hotline: (852) 2596-4110
	Japan	+81-3-5325-7397
	Malaysia	(00) 800-5823-6888
	New Zealand	(00) 800-5823-6888
	Singapore	(001) 800-5823-6888
	South Korea	Via Telecom: (001) 800-5823-6888 Via Dacom: (002) 800-5823-6888
	Taiwan	(00) 800-5823-6888
	Thailand	(00) 800-5823-6888
	All other AP Countries	+61-3-9614-8530
Central America and Latin America www.lucent.com/support	Argentina	0-800-222-8537
	Brazil	Within Brazil: 0800-55-6400 Outside Brazil: +55-19-3707-7900
	Colombia	54-11-4340-8681
	Mexico	Within Mexico: 800-2-658588 (01 800 26 LT LT) or 800-3-158588 (01 800 31 LT LT) Outside Mexico: 52 5 278 7005
	Puerto Rico	888-866-8537
	Venezuela	800-5287683

Problem Reporting Information

To expedite the troubleshooting process, please have available and provide the following information. Note any deviations from initially installed component version information.

Source Information	Description
Primary Contact Name:	
Location:	
Phone/Pager:	
Availability:	
Secondary Contact Name:	
Location:	
Phone/Pager:	
Availability:	
System type:	
Installed HW components / versions:	
Installed SW modules / versions:	
Affected component (SW module, HW component, etc.):	
Question/Problem:	
Severity of impact:	

Source Information	Description
Supporting documentation (configuration files, log files, topology diagrams, trace files, etc.):	
