Amosphere NPM Installation Procedures (WCS)

Release 1.2

Part 003609A revision 01

Revision History

Revision	Date	Changes Made
01	December 16, 2002	Released

PREFACE

This book explains how to install a Network Port Manager (NPM) basestation. NPM installation includes installing the NPM racks, connecting the NPM to the network core, and powering on the system.

This book is intended for field technicians with experience installing and configuring telecommunications equipment at cellular basestations and network operations centers.

How This Book Is Organized

Table 1 shows how information in this book is organized.

Chapter	Title	Description
Chapter 1	Installation Overview	Provides an overview of the installation process
Chapter 2	Site Preparation	Lists the physical, environmental, electrical, and network requirements of an NPM
Chapter 3	Pre-Installation Activities	Lists activities that must be performed prior to installing an NPM
Chapter 4	Installation Procedures	Provides procedures for installing an NPM basestation
Chapter 5	Power-On Procedures	Provides procedures for applying power to the NPM
Chapter 6	On-Site Software Installation and Configuration Procedures	Provides procedures for installing and configuring the software on the NPM
Appendix A	NPM Decommissioning	Describes how to power off and decommission the NPM

Table 1   Book Organization

Related Documentation

SOMA Networks documentation is modular, so users need to read or carry only those components relevant to a particular job function. This guide makes cross-references to the following documents:

- *Amosphere NPM Maintenance Procedures* – provides procedures for performing maintenance on the NPM.
- *Amosphere OAMP Guide* – provides installation and configuration instructions for the initial commissioning of an NPM basestation.

Additional SOMA Networks Documentation

Table 2 shows the other guides in the SOMA Networks customer documentation suite.

Component	Description	Audience
Amosphere Alarms and Events Reference	Comprehensive list of all alarms and events	Network operations center operators and field technicians
Amosphere Diagnostic Procedures	Procedures for isolating and fixing network problems	Network operations center operators and field technicians
Amosphere NPM Hardware Reference	Description of the NPM hardware architecture	Network operations center operators, field technicians, and network engineers
Amosphere Software Installation Procedures	Procedures for installing core server software	Network operations center operators and field technicians
Amosphere Theory of Operations	Complete solution overview	Network operations center operators and network engineers
Booster Antenna Installation Guide	Installation instructions for optional SOMAport external antenna	Subscribers
SOMAport Setup Guide	Installation and maintenance guide for subscriber premises equipment	Subscribers

Table 2   Amosphere Customer Documentation Components

Third-Party Documentation

Table 3 shows third-party documents that provide additional information which may be useful when installing the NPM.

Document	Description
Central Office Environment Installation/Removal Generic Requirements (GR-1275-CORE)	Available from Telcordia Technologies, Inc. Provides generic installation requirements for telecommunication suppliers and carriers.
Zyfer AccuSync-R GPS Synchronized Time and Frequency Instrument User's Manual (377-8006)	Available from Zyfer, Inc. Provides installation, configuration, and operational information about the GPS clock module.
ZT5550, ZT5541, ZT4804, ZT4805 Hardware User's Manuals	Available from Performance Technologies Inc. The manuals describe the utility bus controllers, radio sector controllers, application hosts, and rear I/O cards in detail.
CPC4400 Ethernet Switching Platform User's and System Integrator's Guide	Available from Performance Technologies Inc. The manual describe the Ethernet switch and rear I/O card in detail.

Table 3   Third-Party Documentation

Conventions

This section outlines the conventions used in this guide.

Measurement Conventions

Measurements in this guide are expressed according to the Systeme International d'Unites (SI) standards for metric units and abbreviation. Equivalent Imperial measurements (used in the United States) are provided in parentheses, except when Imperial is the international standard.

Bits and Bytes

For clarity, bits and bytes are not abbreviated in this document, but their prefixes are. SOMA Networks follows the common practice of using SI prefixes (base 10) with these terms. Thus, 1 kbit/s (kilobit per second) is equivalent to 1000 bits/s; it should not be confused with 1 Kibit/s (kilobinary bit per second) or $1 \times 2^{10} =$ 1024 bits/s.

Unless otherwise specified, SI prefixes with bits and bytes in this document refer to a factor of 10.

Typographical Conventions

Table 4 shows how different fonts are used throughout this guide.

Font	Usage	Example
Courier	System output and all things involving source code (commands, samples, methods, functions, objects, variables, types, constants, fields, properties, and structures)	`echo "NETWORKING=yes HOSTNAME=soma GATEWAY=10.110.0.1"`
Courier bold	User-keyed commands	**`eject cdrom`** ↵
Arial gray	Interface objects: buttons, links, fields, and drop-down list names	Click **OK**.
Italics	Anything that appears as part of the file system, such as files, applications, paths, directories, libraries, scripts, daemons, devices, and commands with parameters when used as a noun	Data is in *subscribers/billing* All devices use *devfs*.
Courier bold italic	Placeholders in commands	**`boot cdrom -install`** ***`arg`*** ↵
Courier italic	Placeholders in code	`n urn:soma:dialplan:`*`domain`*

Table 4   Display Font Usage

Table 5 shows the meaning of symbols used in procedures throughout this guide.

Symbol	Meaning	Example
↵	Indicates that you should press the Return, or Enter, key	**`su admin`** ↵
+	In a keystroke combination, indicates that you should press the keys simultaneously	Control+Alt+Delete
,	In a keystroke combination, indicates that you should press the keys consecutively	Control, Shift, q
→	Indicates that you should choose a menu option or a submenu	Choose File→Import→Formats

Table 5   Symbols Used in Procedures

Special Information

Information of special importance is highlighted in the text using indentation and icons. The following examples show the special information types used in the document. They are listed in ascending order of importance.

NOTE: A note contains information of special interest.

CAUTION: A general caution is shown when there is a risk of affecting service.

WARNING: A general warning is shown when there is a risk of personal injury from a nonelectrical hazard or a risk of irreversible damage to data, software, or the operating system.

WARNING: A heat warning is shown when there is a risk of personal injury from a heat source.

WARNING: An electrical warning is shown when there is danger of physical harm to a person or damage to equipment due to electrical hazard.

Trademark Identification

The following SOMA Networks trademarks are used without notation in the rest of this document:

- Amos^{TM}
- Amosphere^{TM}
- SOMApage^{TM}
- SOMAport^{TM}

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If you have any feedback about this document, e-mail Technical Communications at SOMA Networks: **docs@somanetworks.com**.

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INSTALLATION OVERVIEW

This chapter provides an overview of the installation process. Please familiarize yourself with the installation process in general before proceeding to the next chapter.

Contents

Installation Process Summary

Installation of an NPM basestation should take approximately two to three days, assuming the site already meets the requirements specified in Chapter 2, "Site Preparation".

Three people should be present during the installation, especially when moving NPM equipment.

Table 1.1 lists the procedures to install an NPM.

Step	Chapter Title	Page	Procedures
1	Site Preparation	21	Ensure that the installation site is equipped to handle an NPM. Collect information and add additional infrastructure if necessary.
2	Pre-Installation Activities	39	Unpack the NPM. Review checklists to ensure you have the required equipment, software, and tools to perform an installation.
3	Installation Procedures	53	Install the NPM racks. Connect ground and power. Add components to their respective shelves. Attach cables. Install the GPS, main, and diversity antennas.
4	Power-On Procedures	115	Apply power to the NPM. Perform basic system verification tests.
5	On-Site Software Installation and Configuration Procedures	119	Configure software on the NPM.

Table 1.1   Installation Process Summary

Appendix A contains the procedure for decommissioning an NPM.

See "Post-Installation Activities" on page 125 for information about additional tasks that must be performed for the NPM to be fully functional.

Necessary Conditions for Installation

The installation procedures in this manual assume that the following conditions have been met:

- The core servers located at the network operations center (NOC) are operational and connected to the backhaul.

- The backhaul has been tested and is connected to the edge routers.

- The utility bus controllers, radio sector controllers, and application hosts are each configured in their BIOS to boot from the correct source.

- At least one of the hard disk drives contains an Amosphere software image.

- A power supply that meets the specifications listed in "Electrical Requirements" on page 27 has been installed.

> **N O T E :** If these conditions are not met, it is still possible to complete the physical installation of an NPM. However, you will not be able to boot the NPM and provide cell coverage until you satisfy these conditions.

SITE PREPARATION

This chapter identifies the requirements that your site needs to meet before you can proceed with the installation of the NPM. Please review these requirements before proceeding to the next chapter.

Contents

Physical Requirements

Before you begin installing the NPM, read the following physical requirements. Ensure that each requirement is met before proceeding with the installation, and consult your methods of procedures (MOPs) for information concerning transportation method, route, and precise installation location.

WARNING: Failure to meet the following requirements may result in personal injury and cause damage to or destruction of the NPM basestation and surrounding equipment.

Space

Table 2.1 and Figure 2.1 show the physical dimensions of the NPM racks. These dimensions do not include space for cabling, the insertion and removal of modules, or adequate airflow.

Racks	Width	Height	Depth
One rack	0.6 m (23 5/8 inches)	2.11 m (83 inches)	0.6 m (23 5/8 inches)
Two racks	1.2 m (47 1/4 inches)	2.11 m (83 inches)	0.6 m (23 5/8 inches)

Table 2.1 Rack Dimensions

2.11 m

1.2 m

0.6 m
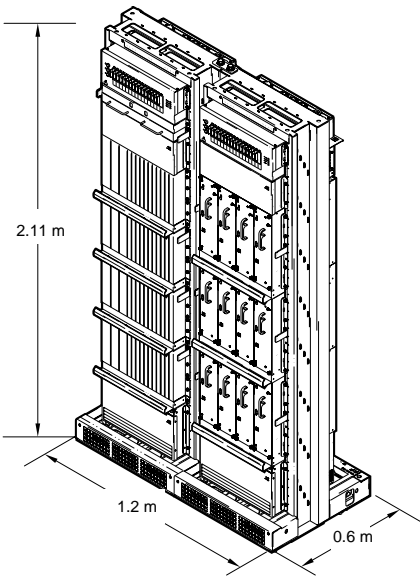
00445

Figure 2.1 NPM Dimensions

Weight

The total weight of a 6-sector NPM is approximately 491 kg (1099 pounds). The NPM has a floor loading of approximately 319 kg/m^2 (66 pounds/foot^2), as per *Telcordia Technologies GR-1275-CORE*. A dolly or crane is required to move the racks.

Table 2.2 shows the weight of the different NPM components.

Component	Weight
Empty single rack	69.2 kg (155 pounds)
RF rack, filled to capacity	276.2 kg (609 pounds)
Radio rack, filled to capacity	204.0 kg (457 pounds)
Utility or radio shelf, empty	6.5 kg (14.3 pounds)
RFSS module	14.1 kg (31.0 pounds)
Lower cooling unit	10.5 kg (23.2 pounds)
Upper cooling unit	8.4 kg (18.8 pounds)
Power distribution panel (PDP)	17.9 kg (40 pounds)

Table 2.2   Weight of NPM Components

Torque Values

Table 2.3 shows the recommended torque values for the different sizes of fasteners used in the NPM racks.

Fastener Size	Recommended Torque
#4 (0.112-inch) screw	6 inch-pounds
#6 (0.138-inch) screw	12 inch-pounds
#8 (0.164-inch) screw	18 inch-pounds
1/4-inch compression lug nuts on PDP	78 inch-pounds
5/16-inch screw	50 inch-pounds
SMA connector	5 inch-pounds
Type-N connector	12 inch-pounds
7/16 DIN connector	17 foot-pounds
RFSS module thumb screws (#6 screw)	12 inch-pounds
Power cable screws	8 inch-pounds

Table 2.3   Torque Values of Threaded Fasteners

N O T E : Unless otherwise specified, torque tolerances are ±2 inch-pounds.

Environmental Requirements

Before you begin installing the NPM, read the following environmental requirements. Ensure that each requirement is met before proceeding with the installation and consult your MOPs for procedures concerning building requirements, hazardous materials and waste, and environmental systems.

WARNING: Failure to meet the following requirements may result in personal injury and cause damage to or destruction of the NPM basestation and surrounding equipment.

Temperature

The NPM is designed to be installed in a temperature-controlled environment. Table 2.4 shows the ambient temperature requirements for the NPM.

Operational State	Temperature Requirement
Operating	+5°C to +40°C (+41°F to +104°F)
Short-term operation (less than 96 hours/year)	−5°C to +50°C (+23°F to +122°F)
Storage	−40°C to +70°C (−40°F to +140°F)

Table 2.4   Temperature Requirements

Humidity

The NPM is designed to be installed in a humidity-controlled environment. Table 2.5 shows the humidity requirements for the NPM.

Operational State	Humidity Requirement
Operating	5% to 85% relative humidity, noncondensing
Short-term operation (less than 96 hours/year)	5% to 90% relative humidity, noncondensing
Storage	5% to 95% relative humidity, noncondensing

Table 2.5   Humidity Requirements

Altitude

Certain components in the NPM are sensitive to altitude. Table 2.6 shows the altitude requirements for the NPM.

Operational State	Altitude Requirement
Operating	−60 m to +1800 m (−197 feet to +5904 feet)

Table 2.6   Altitude Requirements

Airflow

Each NPM rack requires 0.6 m (2 feet) of open space in front of and behind it to allow suitable airflow for cooling. Each cooling fan draws approximately 600 cubic feet per minute (CFM) of air.

Heat Output

Table 2.7 shows the amount of heat produced by the NPM.

Configuration	Heat Output (W)	Heat Output (BTU/hour)
6 sectors	7065	24 107
3 sectors	3810	13 000
1 sectors	1725	5 886

Table 2.7   Heat Output

Shock and Vibration

The NPM uses network equipment-building system (NEBS2000) racks designed for use in level 4 seismic zones.

Electrical Requirements

Before you begin installing the NPM, read the following requirements. Ensure that each requirement is met before proceeding with the installation and consult your MOPs for procedures concerning power, grounding, and high-risk cut-over activities.

WARNING: Failure to meet the following requirements may result in personal injury and cause damage to or destruction of the NPM basestation and surrounding equipment.

Main Power

The NPM requires a +24V DC power supply. See your E1 package for the recommended settings of your power supply.

The minimum DC input voltage at the PDP is 22.6V; the maximum DC input voltage at the PDP is 29.2V. The input power noise level should not exceed a maximum of 100 mV peak-to-peak, DC to 20 MHz.

NOTE: The minimum gauge for the wires connecting the NPM to the main power source is #2 AWG. The maximum loop length of #2 AWG wire is 19.8 m (65 feet). #2 AWG wire that is less than this length will not be damaged or overheat in the event of a current overload or short-circuit condition.

Table 2.8 shows the power consumption for the different configurations of the WCS NPM when receiving +27V DC at the PDP.

Configuration	Radio Rack (A)	RF Rack (A)	Total (A)	Total (W)
6 sectors	79.8	212.4	292.2	7305
3 sectors	46.8	110.4	157.2	3930
1 sectors	28.2	42.4	70.6	1765

Table 2.8   Power Consumption Values

NOTE: Each RFSS module draws 17A at +27V DC.

Main Power Bay Circuit Breaker Size

Each NPM rack requires three +24V DC inputs. Table 2.9 shows the recommended circuit breaker sizes for each +24V line.

Configuration	Radio Rack	RF Rack
6 sectors	40A per breaker (3)	130A per breaker (3)
3 sectors	30A per breaker (3)	70A per breaker (3)
1 sectors	20A per breaker (3)	40A per breaker (3)

Table 2.9   Main Power Bay Circuit Breaker Size

Backup Power

The NPM does not contain any internal battery backup systems. Ensure that your main power source has a backup power system in case of a power failure.

Power Bay Ground and Voltage Levels

Table 2.10 shows the required electrical levels as measured at the PDP terminals.

Unit	Measurement	Specification
Voltage	+24V DC (+) to return (−)	+27.5V DC nominal (25.0V DC min, 28.0V DC max)
Power	+24V DC (+) to return (−)	10kW minimum
Voltage	Return (−) to ground	0.5V DC maximum
Resistance	Return (−) to ground	0.1Ω maximum
Voltage	+24V DC (+) to ground	+25.0V to +28.5V DC

Table 2.10   Required Ground Levels

NPM Circuit Breaker Current Loads

Each NPM rack contains a power distribution panel (PDP). The PDP has up to 16 circuit breakers (CBs). Each breaker switch controls the power to a specific NPM component. Individual NPM components can be powered off by setting the appropriate breaker switch to the OFF (down) position.

Table 2.11 shows the maximum current loading of the circuit breakers in the RFSS and radio rack PDPs.

Circuit Breaker	RFSS Rack PDP	Radio Rack PDP
CB 01	10A	10A
CB 02	30A	30A
CB 03	30A	30A
CB 04	30A	30A
CB 05	30A	30A
CB 06	30A	30A
CB 07	30A	30A
CB 08	30A	30A
CB 09	30A	30A
CB 10	30A	30A
CB 11	30A	30A
CB 12	30A	30A
CB 13	30A	30A
CB 14	10A	10A
CB 15	—	2.5A
CB 16	—	—

Table 2.11   Circuit Breaker Current Loads

Fuses

PDP

The PDP in each NPM rack contains three 0.25A, 250V, fast-blowing fuses (1.25 × 0.25 inch) to protect the alarm cards on the utility shelf from damage in the event of an electrical overload.

WARNING: Circuit breakers protect the other shelves, cards, and modules in the NPM. Removing the fuses does not disable power to the circuit breakers, PDP, shelves, or modules.

Table 2.12 shows the +24V DC feed to which each fuse is connected.

Fuse	Feed
Fuse F1	+24V DC feed 1 (left terminal)
Fuse F2	+24V DC feed 2 (middle terminal)
Fuse F3	+24V DC feed 3 (right terminal)

Table 2.12   PDP Fuse Connections

RFSS Module

Each RFSS module contains one 2A, 250V, fast-blowing fuse (1.25 × 0.25 inch) to protect the RF components from damage in the event of an electrical overload.

Rack Grounds

Table 2.13 shows the grounding requirements for each rack.

Ground Type	Requirement
Frame ground	Each NPM rack requires one connection to its frame assembly for use as a frame ground. The frame ground cable uses #6 AWG wire.
Main ground	Each NPM rack requires one connection to the main building ground, such as the master ground bar (MGB). The ground cable uses #6 AWG wire.
Isolation pad	Each NPM rack must be installed on an isolation pad to ensure proper grounding. The isolation pads are included in the installation kit.

Table 2.13   Grounding Requirements

Compression Lug Color Codes

Table 2.14 shows the compression lug color codes for common wire gauges.

Wire Gauge (AWG)	Color Code
#6 (used for NPM ground cables)	Blue
#4	Gray
#2 (used for NPM main and return power cables)	Brown
#1	Green
1/0	Pink
2/0	Blank

Table 2.14   Compression Lug Color Codes

Network Requirements

Before you begin installing the NPM, read the following network requirements. Ensure that each requirement is met before proceeding with the installation and consult your MOPs and E1 package for procedures involving the network equipment.

Figure 2.2 shows an example of an Amosphere network with redundant systems.
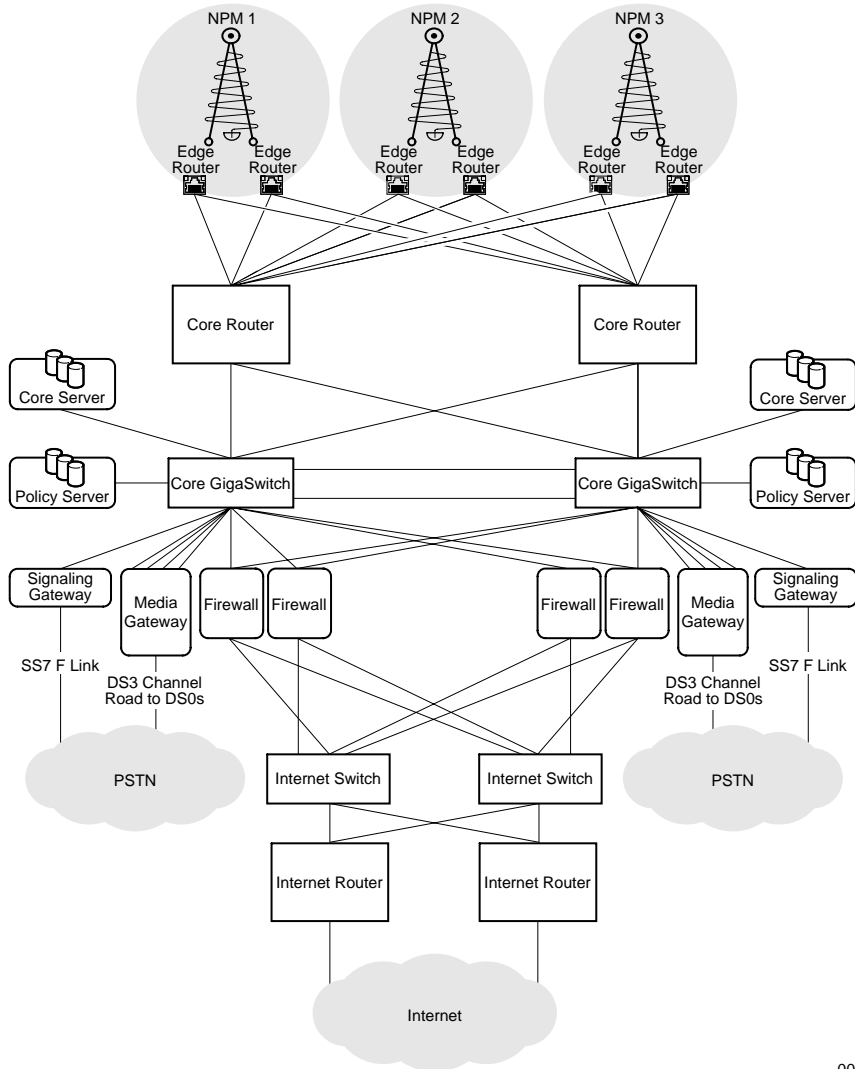
00070

Figure 2.2 Sample Amosphere Network

PSTN Gateway

The NPM does not connect directly to the PSTN. A PSTN gateway, such as a PRI, connects the Amosphere IP-based equipment to the circuit-switched PSTN.

> **N O T E :** Ensure that any equipment connecting the NPM to the PSTN is UL-listed.

Edge Routers

The NPM requires a connection to at least one edge router configured to direct packets between the NPM and the network core. The edge router connects to the NPM using 100-Mbit/s Ethernet.

Backhaul Circuits

Depending on the configuration of your specific network, multiple T1 or DS3/E3 backhaul circuits connecting a remote NPM or edge routers to the network core may be necessary. See your E1 package for information about your site's backhaul circuits and the configuration of any necessary customer service units (CSUs).

> **N O T E :** Backhaul circuits must be tested by qualified personnel before the NPM is placed into operation in order to ensure connectivity with the core servers.

Internet Gateway

See your E1 package for Internet gateway requirements.

Core Servers

See your E1 package for core server requirements.

Site Requirements

Each site has unique requirements and characteristics. See your E1 package for specific requirements relating to your installation. The E1 package contains the site's floor plan, cabling routing and termination, and other site-specific

Restricted Access

Access to the site must be controlled by the authority for that location and granted through the use of special tools, locks and keys, or other means of security. Access should be limited to service personnel who have been instructed about the reasons for the access restrictions and about any precautions that must be taken while at the location.

Mounting Surface

The NPM is suitable for mounting on concrete or other noncombustible surfaces only.

Equipment Entrance and Unloading Area

A route must be provided between the unloading area and the equipment room where no restrictions will be encountered with a clearance less than 0.9 m (36 inches) wide (side-to-side), and 2.0 m (80 inches) high (floor-to-obstruction).

All turns along the route must allow sufficient clearance to turn or tilt an object 0.6 m (24 inches) wide, 0.6 m (24 inches) deep, and 2.1 m (83 inches) high.

AC Outlets

The site must have at least two duplex AC receptacles located within a convenient distance to facilitate installation and maintenance of the NPM.

Antenna Mounting Locations

The NPM uses two antennas (main and diversity) per sector. Ensure that your tower can support the number of antennas shown in Table 2.15.

Sectors Supported by NPM	Required Antennas
1	2
2	4
3	6
4	8
5	10
6	12

Table 2.15   NPM Antenna Requirements

N O T E : See the specifications of your antennas for information about size and weight requirements.

GPS Antenna Mounting Locations

The NPM requires two 1-inch diameter hollow pipes for mounting the two GPS antennas.

Cabling Requirements

Ensure that your site has the necessary cable racks and ladders to accommodate an NPM and that your site has external cable access ports for the GPS and RF antenna cabling. The E1 package contains the cable layout specific to your site.

Fire Protection System

SOMA Networks recommends a fire protection system for the site.

Lighting

The site must have sufficient lighting to conduct work in a safe manner. Emergency lighting is recommended.

Isolated Ground Plane Environment

Ensure that the NPM will be installed in an isolated ground plane environment as defined in *Telcordia Technologies GR-1275-CORE*.

Master Ground Bar Requirements

The site's master ground bar (MGB) must be connected to the building principal ground's electrode system. The building principal ground is the point where grounding conductors of the building (such as air-conditioning, communication systems, and structure) are bonded together.

Ensure that the electrode system meets the requirements specified in the National Electrical Code (NEC) article 250, sections 150–170, 1999.

N O T E : See the floor plan drawing in your E1 package for the location of the MGB.

Ground Riser Cable

The ground riser cable (the cable connecting the MGB to the building principal ground) must have a minimum conductor sizing of 2/0 AWG. If any equipment cables at the site are larger than 2/0 AWG (such as to compensate for voltage drop), the size of the ground riser cable must be adjusted. The ground riser cable must use an equal or larger gauge than the largest conductor. The ground riser cable must be labelled with a tag conforming to *GR-1275-CORE*.

In order for the ground riser cable to be nonrestrictive to lightning, the following guidelines should be observed:

- The cable should be run using the most direct route possible. The number and severity of turns and bends should be minimized. Bends must not exceed 90°.
- The cable must not be looped or coiled.
- The cable must not be supported by metal clamps.
- If a conduit is required to protect the cable, the conduit should be made of PVC. If a metal conduit is used, the conduit must be bonded to the ground riser cable on both ends.
- The cable must not run through or enter any metal boxes unless the boxes are bonded to the ground riser cable at the entry and exit point.

Ground Resistance

The resistance of the building principal ground should be as low as practically possible (typically less than 5Ω). Under no circumstances should the resistance exceed the local electrical utility limits of 25Ω (NEC article 250-56, 1999).

Additional Site Requirements

See *Telcordia Technologies GR-1275-CORE* for a comprehensive description of generic site requirements.

PRE-INSTALLATION ACTIVITIES

This chapter lists the tools and equipment required for installing and testing the NPM equipment. It also provides procedures for unpacking the NPM and configuring individual cards and shelves.

Contents

PREPARING FOR INSTALLATION

This section describes precautions, equipment, and tasks that should be reviewed or performed prior to beginning the NPM installation.

Table 3.1 shows the topics described in this section.

Table 3.1   Pre-Installation Requirements

Antistatic Precautions

WARNING: Components in the NPM are highly sensitive to electrostatic discharges (ESD). Follow the procedures described below to prevent unseen damage from occurring.

To prevent damage to NPM components from static electricity:

- Do not handle circuit boards unless you are using the appropriate antistatic protection, such as wrist straps, boot straps, boots, or a conductive mat. Wrist straps must have snug but comfortable contact with your skin, and they must be connected to a grounding point on the NPM.

- Handle circuit boards by the faceplate, handles, or edges. Do not touch any integrated circuits, connections, pins, or soldered surfaces.

Wrist-Strap Grounding Point

Each NPM rack contains a wrist-strap grounding point in the bottom-left corner of the power distribution panel (PDP). The grounding point is connected to the frame ground and provides antistatic protection when technicians work with circuit cards.

NOTE: The NPM must be grounded for the wrist-strap grounding point to be effective.

00455 —————————Wrist-Strap Grounding Point
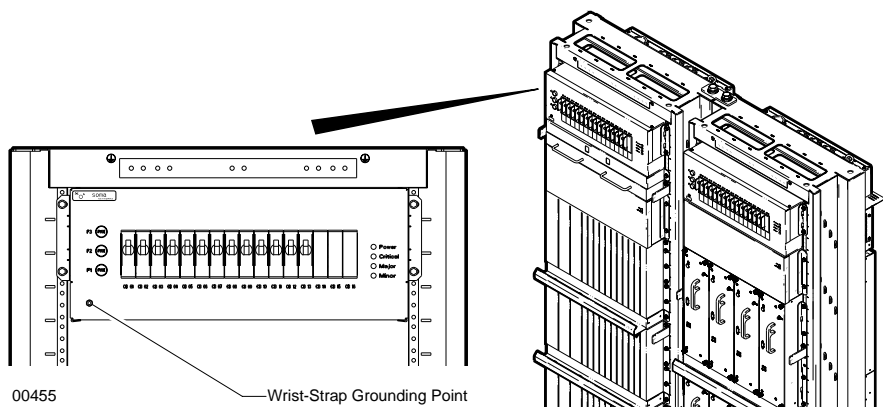
Figure 3.1   Wrist-Strap Grounding Point

Equipment, Tools, and Supplies Checklists

Tools

The following tools are recommended for a typical NPM installation:

- Allen key set
- Bolt cutter
- Cable ties
- Chalk line
- Drill bits (metal and masonry)
- Electrical tape
- Extension cord
- Flat file
- Framing square
- Hacksaw (with blades)
- Hammer drill
- Heat gun (with heat shrink roll)
- Label maker
- Marking pencil
- Oxide-inhibiting compound
- Platform stepladder (6-foot)
- Plumb bob
- Portable bandsaw kit
- Scissors
- Scratch awl
- Shims (for leveling NPM)
- Socket sets (Imperial and metric)
- Strap (with buckle)
- Tape measures (linen and metal)
- Thomas and Betts (T&B) crimper
- Torpedo level
- Torque wrenches
- Utility knife
- Wrench sets (Imperial and metric)
- Vacuum cleaner with high-efficiency particulate air (HEPA) filter

NOTE: Ensure that your torque wrenches are correctly calibrated according to the methods and schedule specified by the manufacturer. The calibration date should be indicated on each wrench.

Safety Equipment

The following safety equipment is recommended for a typical NPM installation.

- Ear plugs
- Electrical gloves
- ESD straps
- First aid kit

- Flashlight
- Portable eye-wash station
- Safety glasses
- Safety shoes

Test Equipment

Table 3.2 shows the equipment recommended for testing NPM functionality.

Equipment	Purpose
Digital multimeter	Checking continuity and electrical characteristics
Sunset OCx	Testing SONET and T-carrier network and services
Workstation or terminal	Installing, configuring, and verifying software
Cable sweep generator	Testing the electrical integrity of antenna and RF cables
Spectrum analyzer	Monitoring RF signal output
Ethernet cable tester	Testing the type and integrity of Ethernet cables
Oscilloscope	Checking input power noise levels

Table 3.2   Recommended Test Equipment

NOTE: Ensure that your test equipment is correctly calibrated according to the methods and schedule specified by the manufacturer. The calibration date should be indicated on each piece of test equipment.

Unpack the Equipment

The NPM racks are delivered on shipping pallets. Each rack is secured in an upright position and is bolted to the pallet. Additional equipment is delivered in separate shipping boxes.

▶ To unpack the NPM equipment

1 Transport the shipping boxes to the installation area using a dolly or pallet jack.

2 Inspect the exterior packaging for any noticeable damage that may have occurred during shipment.

3 Verify that the shipment is complete by checking the contents of each box against the bill of materials (BOM) or shipping invoice that arrives with each box. The BOM for each box may be located on the outside or inside of the box.

4 Report any missing or damaged components to the field support coordinator as soon as possible.

5 Cut the packaging tape on each box using scissors or a utility knife.

6 Remove the cardboard packaging from the racks:

    i Remove the top of the cardboard packaging.

    ii Remove the cardboard sides. The cardboard sides are bolted to the shipping pallet and pull off with minimal effort.

7 Remove the protective bags covering the racks.

8 Check the racks for extra mounting hardware or invoices. If there are additional items, remove them and keep them for future use.

9 Remove the four 9/16-inch bolts that secure the base of each rack to its shipping pallet.

10 Verify the contents of the other boxes by examining their BOMs.

> **NOTE:** Do not remove any items from their antistatic bags until you are ready to install them.

11 Save the packaging material and the BOMs in case any of the equipment needs to be returned or moved in the future.

Review Inventory Checklist

Table 3.3 shows the paperwork that ships with each NPM.

Document	Description
Anchor kit	Lists installation kit contents
NPM BOM	Lists every component in the NPM
Chassis inspection checklist	Factory inspection of each utility and radio shelf

Table 3.3   NPM Inventory Documents

▶ To check the NPM inventory

1 Perform an inventory check using the checklists provided with the E1 package and BOMs.

2 Ensure that all equipment and accessories have been shipped.

3 Document any shortages and report them to the field support coordinator so that any missing equipment may be procured and delivered to the site as soon as possible.

4 Ensure that the serial number for each piece of equipment is recorded in the NPM's on-site documentation.

CONFIGURING CARDS AND SHELVES

Some of the jumpers and switches on the cards and shelves in the NPM require configurations which differ from the factory defaults. This section provides the procedures for making the necessary alterations.

Table 3.4 shows the actions described in this section.

Action	Page
Configure Ethernet Switches	47
Configure Controller Cards	49
Configure Application Hosts	51

Table 3.4   Configuring Cards and Shelves Procedure Summary

Configure Ethernet Switches

It may be necessary to modify the jumpers on the Ethernet switches. The NPM uses a configuration of the Ethernet switches that differs from the manufacturer's original settings.

N O T E : If the Ethernet switches are pre-installed in the shelves, then they have already been configured and this procedure is not required.

Table 3.5 shows the correct settings of the Ethernet switch jumpers.

Jumper	Setting	Appearance	Description
K1	OFF		PCI reset. Removing this jumper causes the card NOT to be reset when the utility bus controller is reset. This jumper must be left OFF.
K2–K4	ON		User-defined. These jumpers must be left ON.
K5, K6	OFF		Burn-in mode (K5) and break detect (K6). These jumpers must be left OFF.
K7	ON (pins 1–2)		CPCI BDSEL. This jumper configures the card for use in a hot-swap chassis. This jumper must be left ON on pins 1 and 2. Pin 3 should be left open.

Table 3.5   Ethernet Switch Jumper Settings

▶ **To configure the Ethernet switches**

1   Remove the two Ethernet switches from their antistatic packaging at a grounded work area. Ensure that you are properly grounded with a wrist or boot strap before handling the cards.

2   Remove the K1 PCI Reset jumper from each card. Figure 3.2 shows the location of the jumper.

K1 PCI Reset Jumper

K7 CPCI BDSEL
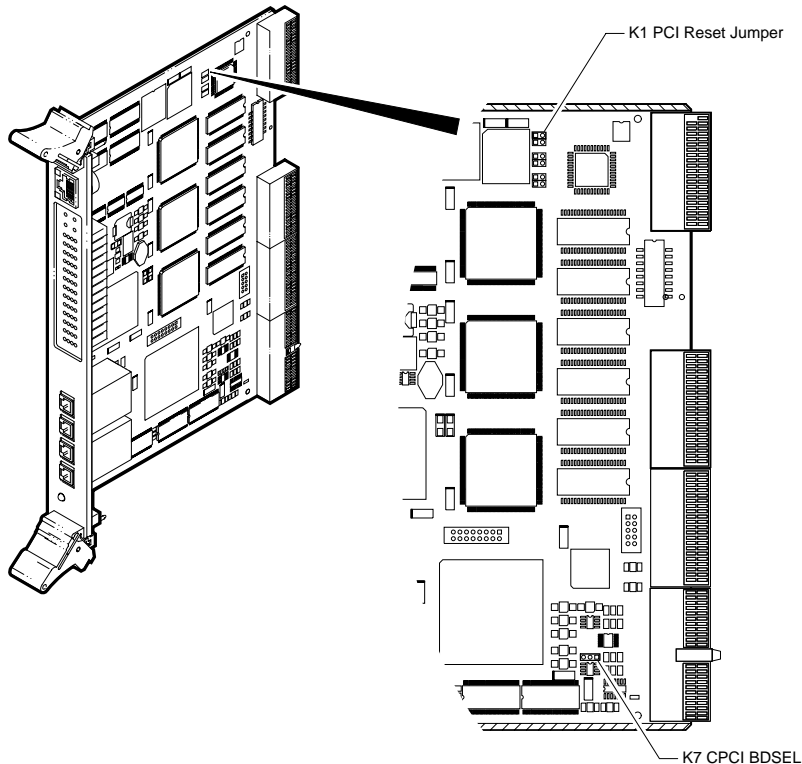
00275

Figure 3.2   Ethernet Switch Jumper Configuration

3   Hang the jumper off the header pins as shown in Table 3.5. This ensures that the jumper is still present if future changes to the cards are required.

4   Ensure that jumpers K2 to K7 are configured as shown in Table 3.5.

5   Place the cards back in their antistatic packaging until you are ready to install them in the shelves.

Configure Controller Cards

It may be necessary to modify the configuration switches on the utility bus controllers and radio sector controllers. The cards are identical and have the same configuration. The NPM uses a configuration of these cards that differs from the manufacturer's original settings.

NOTE: If the controller cards are pre-installed in the shelves, then they have already been configured and this procedure is not required.

Table 3.6 shows the correct settings of the controller cards' configuration switches.

Switch	Setting	Appearance	Description
SW3	SW3-1: ON SW3-2: OFF SW3-3: OFF SW3-4: OFF	Closed (ON) 1 2 3 4 Open (OFF)	SW3-1 and SW3-2 enable battery-backup of the CMOS memory. SW3-1 must be left ON; SW3-2 must be left OFF. The other switches must be left OFF.
SW4	SW4-1: OFF SW4-2: OFF SW4-3: ON SW4-4: ON	Closed (ON) 1 2 3 4 Open (OFF)	SW4-1 and SW4-2 route Ethernet channels to the location set in the BIOS. These switches must be left OFF. The other switches must be left ON.
SW5	SW5-1: ON SW5-2: OFF SW5-3: OFF SW5-4: OFF	Closed (ON) 1 2 3 4 Open (OFF)	SW5-1 causes the card to boot its BIOS from the on-board flash memory. This switch must be left ON. The other switches must be left OFF.
SW6	SW6-1: ON SW6-2: OFF SW6-3: OFF SW6-4: OFF	Closed (ON) 1 2 3 4 Open (OFF)	SW6-1 enables console redirection for the serial port and must be left ON. The other switches are software-defined and must be left OFF.

Table 3.6   Controller Card Configuration Switch Settings

▶ To configure the controller cards

1   Remove cards from their antistatic packaging at a grounded work area. Ensure that you are properly grounded with a wrist or boot strap before handling the cards. Depending on the configuration of your NPM, you may have up to eight cards that need to be configured.

2   On each card, set the SW6-1 switch to the closed (ON) position. Figure 3.3 shows the location of the switch.
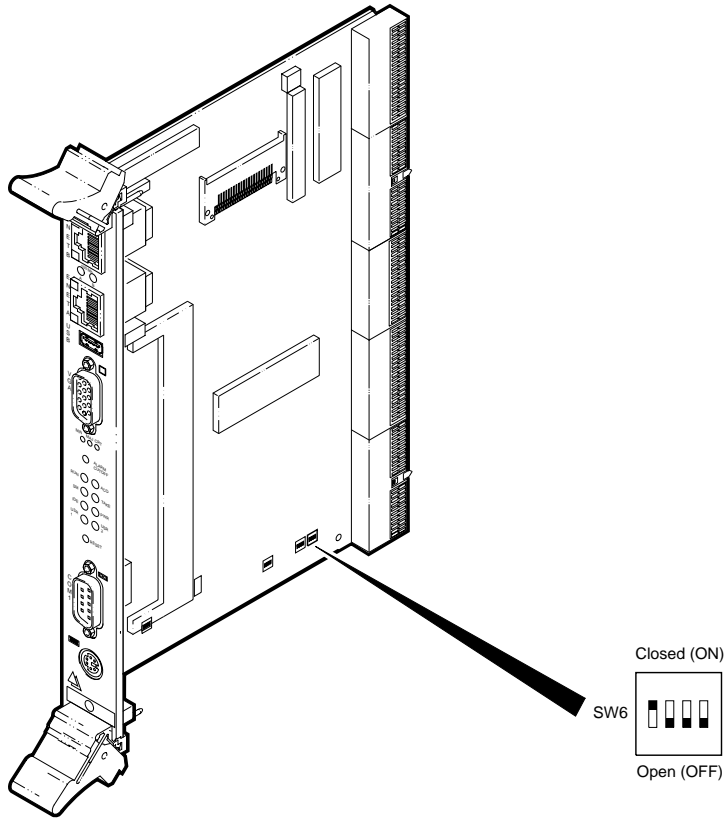
00326

Figure 3.3   Controller Card Switch Configuration

3   Ensure that the other switches are configured as shown in Table 3.6.

4   Place the cards back in their antistatic packaging until you are ready to install them in the shelves.

Configure Application Hosts

It may be necessary to modify the configuration switches on the application hosts. The NPM uses a configuration of the application hosts that differs from the manufacturer's original settings.

> **N O T E :** If the application hosts are pre-installed in the shelves, then they have already been configured and this procedure is not required.

Table 3.7 shows the correct settings of the controller cards' configuration switches.

Switch	Setting	Appearance	Description
SW2	SW2-1: OFF SW2-2: OFF SW2-3: OFF SW2-4: ON	Closed (ON) 1 2 3 4 Open (OFF)	SW2-4 disables the PCI backplane reset and must be left ON. The other switches must be left OFF.
SW3	SW3-1: OFF SW3-2: OFF SW3-3: ON SW3-4: ON	Closed (ON) 1 2 3 4 Open (OFF)	SW3-3 enables console redirection for the serial port and must be left ON. SW3-4 causes the Reset Request button on the rear I/O card to function as a hard reset and must be left ON. The other switches must be left OFF.
SW4	SW4-1: ON SW4-2: OFF SW4-3: OFF SW4-4: OFF	Closed (ON) 1 2 3 4 Open (OFF)	SW4-1 and SW4-2 enable battery-backup of the CMOS memory. SW4-1 must be left ON and SW4-2 must be left OFF. The other switches must be left OFF.

Table 3.7   Application Host Configuration Switch Settings

▶ To configure the application hosts

1 Remove the application hosts from their antistatic packaging at a grounded work area. Ensure that you are properly grounded with a wrist or boot strap before handling the cards. Depending on the configuration of your NPM, you may have up to eight application hosts that need to be configured.

2 On each card, set SW3-3, SW3-4, and SW2-4 to the closed (ON) position. Figure 3.3 shows the locations of the switches.
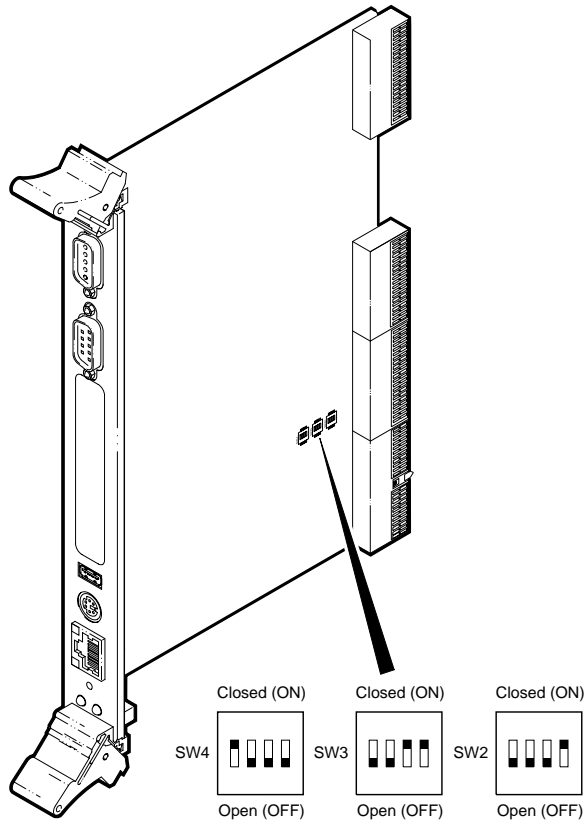
00327

Figure 3.4 Application Host Switch Configuration

3 Ensure that the other switches are configured as shown in Table 3.7.

4 Place the cards back in their antistatic packaging until you are ready to install them in the shelves.

INSTALLATION PROCEDURES

This chapter provides procedures for installing the racks and their internal components. It also provides an overview about installing the antennas used with the NPM.

Before proceeding with this chapter, you must complete all the tasks described in Chapter 3.

Contents

INSTALLING THE NPM RACKS

These procedures describe how to prepare the floor for rack installation, move the racks into place, and secure the racks to each other, to the floor, and to the ceiling.

Table 4.1 shows the actions described in this section.

Action	Page
Prepare the Installation Location	56
Position the Racks	58
Secure the Racks	59

Table 4.1   Installing the NPM Racks Procedure Summary

N O T E : When you install the NPM racks, finish positioning and leveling the first rack before proceeding to the second rack. This makes leveling the racks easier and minimizes the potential for errors that may occur during rack placement.

The NPM is suitable for mounting on concrete or other non-combustible surfaces only.

Prepare the Installation Location

This procedure applies to installing the NPM on a concrete floor and securing the racks using 4-inch concrete expansion bolts (called anchor bolts in this document). These anchor bolts are designed for sites in level 4 seismic zones and may not be suitable for your site. See your E1 package for rack installation procedures specific to your site.

▶ **To prepare the installation location**

1 Mark with a chalk line the location where you will install the racks. Refer to your E1 package for the required location. If there are overhead requirements, use a plumb line to align the rack vertically.

Placed together, the NPM racks have a footprint of 1.2 m by 0.6 m (47 1/4 inches by 23 5/8 inches). The racks are 2.11 m (83 inches) in height.

2 Verify that there is adequate space for the racks:

i Move both racks to the intended installation location.

ii Ensure that you have room for both racks, their cabling, and enough space for airflow and the insertion and removal of components.

See page 26 for airflow requirements.

iii Remove the racks.

3 Place the isolation pad in the precise location designated for the first rack using the chalk line as your guide.

The base of each rack hangs over the edge of its isolation pad by 1 mm (1/32 inch).

4 Trace the anchor hole locations on the concrete floor using the cutouts on the isolation pad as your guide. Use the four outer locations and trace the entire shape of the anchor holes.

5 Remove the isolation pad.

6 Punch the concrete in the outer edge of each anchor guide using the concrete punch. This will make drilling the anchor holes easier.

7 Drill an anchor hole 101 mm (4 inches) deep on the outer edge of each anchor hole using a hammer drill with an 3/4-inch carbide-tipped masonry bit.

8 If the drill bit hits a metal reinforcement bar, move the hole location to the inner edge of the anchor guide and repeat steps 6 and 7.

9 Ensure that the holes are 101 mm (4 inches) deep; otherwise, the anchor bolts will not sit properly.

10 Clean each anchor hole thoroughly using a vacuum cleaner with a narrow nozzle attachment that can reach into the hole and remove the debris.

11 Cover the anchor holes with tape to prevent debris from entering them.

12 Repeat steps 3 to 11 for the second rack.

Position the Racks

This procedure describes how to position and level the racks.

▶ To position the racks

1 Install two eyelet bolts in the top of each rack if you intend to use a crane to move the racks.

2 If you are using anchor bolts, remove the tape from the anchor holes.

3 Place the isolation pad back in the precise location designated for the rack using the chalk line and optional drilled holes as your guide.

4 Position the rack directly over the isolation pad. Take care not to move the isolation pad. When viewed from the front, the radio rack must be installed to the left of the RF rack.

Figure 4.1 shows the correct positions of the NPM racks.
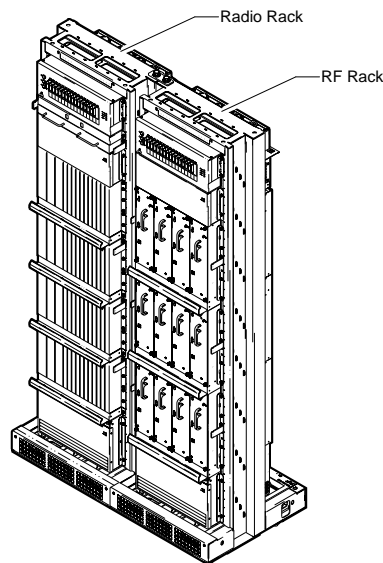
00451

Figure 4.1 NPM Rack Positions

5 Ensure that the rack is vertically aligned, side-to-side and front-to-rear within 0.25 cm (0.1 inches), using a torpedo level. Add shims as needed until the rack is level.

6 Repeat steps 3 to 5 for the second rack.

Secure the Racks

This procedure describes how to secure the radio and RF racks in place. The racks may be secured to the ground, to the ceiling, and to each other.

Figure 4.2 shows the location of the junction bar and the support bolt holes.

00277

Figure 4.2   Junction Bar and Support Bolt Hole Locations

▸ To secure the racks

1   Ensure that the racks are correctly positioned and vertically aligned.

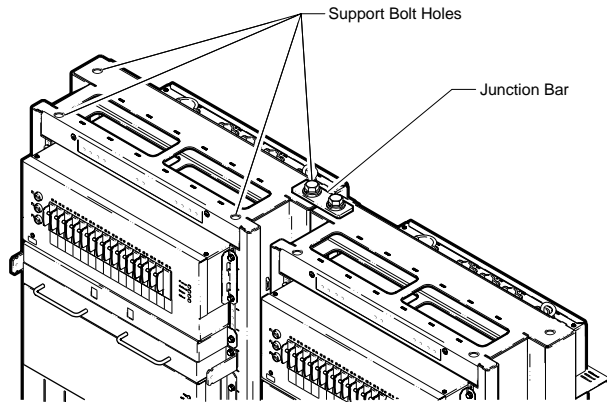**2**   Connect the racks together using the junction bar and two 15/16-inch bolts. If you have trouble inserting the bolts, ensure that the racks are level and located immediately adjacent to each other.

3   If you are securing the racks to the ceiling, consult your MOPs for instructions. Each rack contains four 5/8-inch bolt holes, one on each corner at the top of the rack. These bolt holes may be used to secure the top of the rack.

4   Secure the racks to the floor. If you are using anchor bolts, complete the following steps:

  i   Remove any cables attached to the back of the lower cooling unit.

  ii   Unscrew the 5/16-inch screws holding the lower cooling unit to the rack.

  iii   Slide out the lower cooling unit.

  iv   Remove the front grill.

  The front grill is attached to the frame using two half-turn screws. The screws are vertical when open and horizontal when locked.

  v   Ensure that the parts in the anchor bolt assemblies are not loose.

vi Ensure that the anchor bolt, spacer sleeve, expansion sleeve, and expansion cone do not have any slack. If any of these parts are loose, tighten the parts by hand to remove any slack. Do not start spreading the expansion sleeve.

vii Place a hold-down plate over the holes in the base of each rack.

viii Loosely insert the anchor bolts through the hold-down plates into the base of the rack and the anchor holes. If necessary, tap the top of each anchor bolt to ensure it is fully seated.

ix Tighten the four anchor bolts in the base of each rack by turning the 3/4-inch washer nut while holding the 1/4-inch anchor bolt in place. The expansion sleeve is forced open, which secures the rack to the floor.

x Reattach the lower cooling units to each frame using the 5/16-inch screws. Torque the screws to 50 inch-pounds.

xi Reattach the front grill to each frame using the grill's two half-turn screws. The screws are vertical when open and horizontal when locked.

ATTACHING GROUND AND POWER CABLES

These procedures describe how to ground and power the NPM. Table 4.2 shows the actions described in this section.

Table 4.2   Attaching Ground and Power Cables Procedure Summary

WARNING: Ensure that all of the circuit breakers on each power distribution panel (PDP) are in the OFF (down) position before attaching any cables. Failure to do so may result in personal injury and cause damage to or destruction of the NPM.

Access to the ground and power terminals is prevented by the rear cover of the PDP. The rear cover should always be attached to the PDP during NPM operation. This prevents foreign objects from accidently coming into contact with the live wires and causing a short.

Check PDP Sector Configuration

The PDP sector configuration switch, located inside the PDP, configures the circuit breakers to support a specific number of radio sectors (1–6). In an NPM supporting fewer than six sectors, some of the circuit breakers are not used and are therefore left in the OFF (down) position. The OAMP software uses the switch to determine if a circuit breaker has tripped or is not used.

The switch is set at the factory and does not normally need to be adjusted.

▶ To check the PDP sector configuration

1 Consult your E1 package to determine the number of sectors your NPM is intended to support.

2 If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.

3 Ensure that the PDP sector switch is set to the number of sectors that your NPM is intended to support.

If the switch is not set correctly, set the switch to the correct value:

i Turn screw counter-clockwise as far as possible to find sector 1 position.

ii Turn screw clockwise so that slot points to correct number of sectors.

Figure 4.3 shows the location of the PDP sector switch.
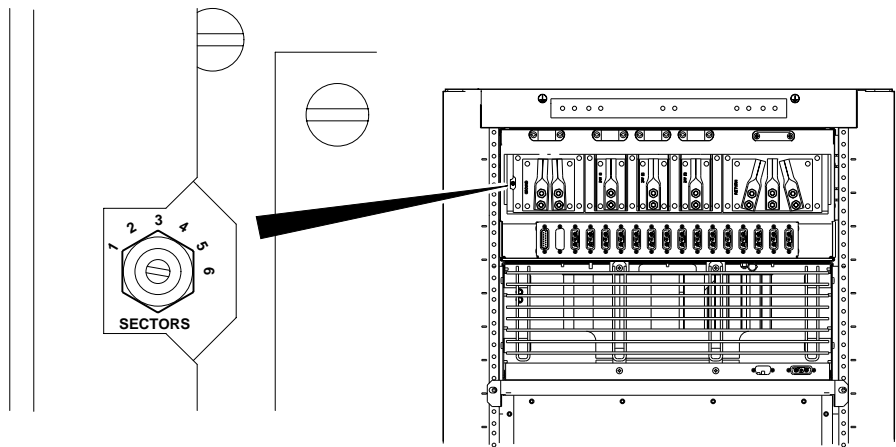
00426

Figure 4.3 PDP Sector Switch

Ground the NPM Racks

Each rack requires a ground cable connecting the PDP to the building's grounding system. A frame ground cable connects the NPM frame to the PDP, ensuring that the frame and its attached components are grounded.

Figure 4.4 shows the cables used to ground the NPM. For clarity, the PDP rear cover is not depicted.
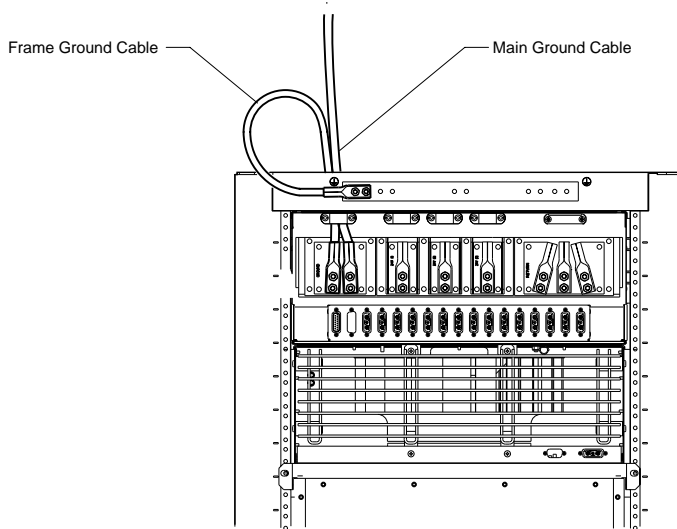
Figure 4.4 Ground Cables

▶ To ground the NPM racks

1   If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.

2   Ensure that all the circuit breakers on the PDP are in the OFF (down) position.

3   Connect the main ground cable to the building's grounding system using a minimum of #6 AWG stranded copper wire.

4   Terminate the main ground cable with a two-hole compression lug. Apply an anti-oxidant solution to the cable before attaching the compression lug.

> **N O T E :** When crimping the compression lug, ensure that you are using the appropriate tool. Compression lugs for #6 AWG wire are colored blue and require that a blue die be used with the crimping tool.

Figure 4.5 shows the dimensions of the compression lugs.
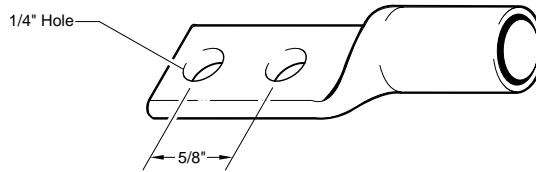
Figure 4.5   Compression Lug Dimensions

5   Apply an anti-oxidant solution to the ground terminals on the PDP.

6   Connect the compression lug on the main ground cable to one of the two ground terminals, as shown in Figure 4.6. Use a 1/4-inch hex nut with a 1/4-inch split-lock washer when securing the cable. Torque each 1/4-inch hex nut to 78 inch-pounds.
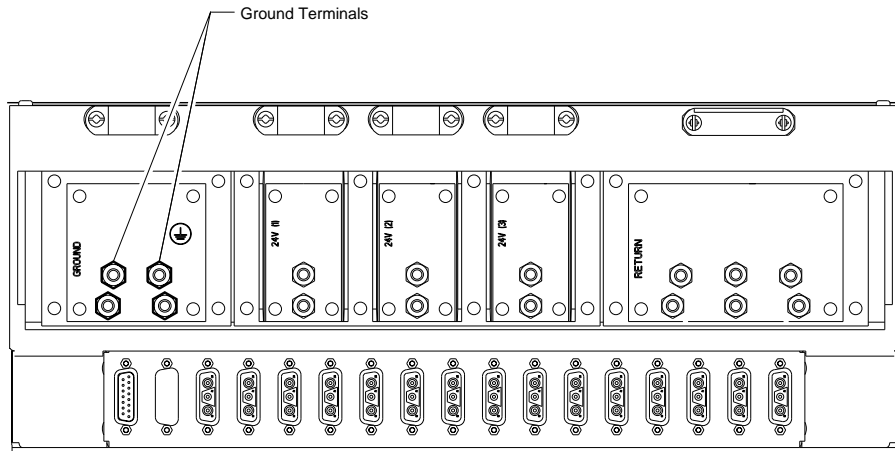
Figure 4.6   Ground Terminals on the PDP

7   Connect the frame ground cable to the second ground terminal on the PDP using a minimum of #6 AWG stranded copper wire.

8   Connect the other end of the frame ground cable directly to the top-left corner (when viewed from behind) of the rack:

    i   Punch a hole in the grounding tape for each compression lug screw location.

    ii   Attach the compression lug using two 5/16-inch hex screws with locking and external tooth washers.

9   Repeat steps 1 to 8 for the second rack.

10   Dress and label the ground cables according to the standards and requirements of your site.

Attach the Main and Return Power Cables

Refer to the MOPs before scheduling or beginning any work involving the site's main power. Before proceeding with this procedure, ensure that all the necessary site cable layout, runaway, and grid work has been completed.

WARNING: Ensure that the necessary requirements and procedures have been reviewed prior to the start of any power-related activity. Refer to your power cut-over MOP for procedures specific to your site.

Ensure that the +24V DC power supply and the NPM are powered off before you begin this procedure. Failure to turn off the power supply may result in personal injury or death and cause damage to or destruction of the NPM basestation and surrounding equipment.

▶ **To attach the main and return power cables**

1   If necessary, remove the PDP rear cover. The rear cover attaches to the PDP using four #1 Phillips screws.

2   Ensure that all the circuit breakers on the PDP are in the OFF (down) position.

3   Ensure that the main +24V DC power supply is powered off.

4   Connect each of the three main power cables to the positive terminals of your +24V DC power supply using a minimum of #2 AWG stranded copper wire.

5   Connect each of the three return power cables to the negative terminals on your +24V DC power supply using a minimum of #2 AWG stranded copper wire.

6   Terminate each of the cables with a two-hole compression lug with the dimensions shown in Figure 4.5 on page 64. Apply an anti-oxidant solution to each cable before attaching the compression lug.

> **NOTE:** When crimping the compression lug, ensure that you are using the appropriate tool. Compression lugs for #2 AWG wire are colored brown and require that a brown die be used with the crimping tool.

7   Apply an anti-oxidant solution to the main and return terminals on the PDP.

8   Connect the compression lugs on the return power cables to the three return terminals shown in Figure 4.7. Use 1/4-inch hex nuts with 1/4-inch split-lock washers when securing the cables. Torque each hex nut to 78 inch-pounds.

9   Connect the compression lugs on the main power cables to the three +24V DC power terminals shown in Figure 4.7. Use 1/4-inch hex nuts with 1/4-inch split-lock washers when securing the cables. Torque each hex nut to 78 inch-pounds.
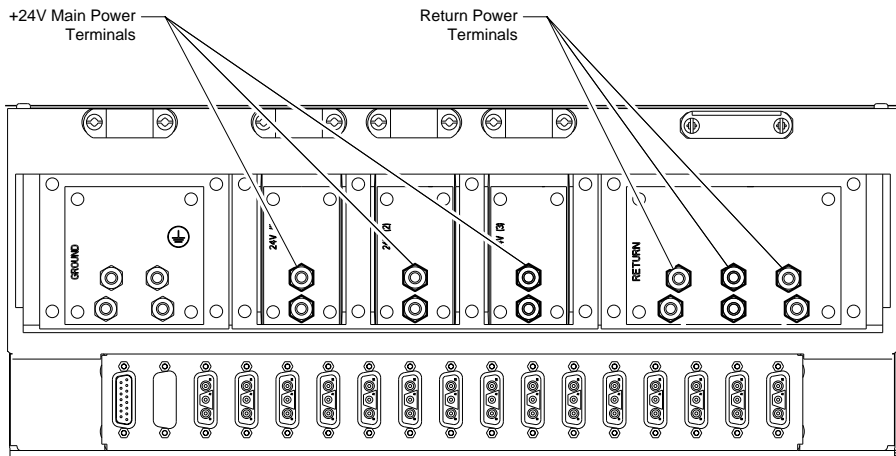
00282

Figure 4.7   Main and Return Power Terminals

10   Ensure the main and return power cables are connected to the main power supply correctly by performing a continuity test on each cable.

11   Dress and label the main and return power cables according to the standards and requirements of your site.

> **N O T E :** Ensure that the main and return power cables are tied in a manner that minimizes the potential for creating electromagnetic fields. When tied together, the main and return power cables should be arranged in an alternating order.

12   Repeat steps 1 to 9 for the second rack.

13   Reattach the rear cover to each rack's PDP using four #2 Phillips screws. Torque each screw to 12 inch-pounds.

Test Power Supply Voltage and Ground

This procedure tests the voltage levels and grounds of the NPM and the main power supply. The test ensures that the main power supply is providing +24V DC and that the power supply and NPM are properly grounded.

Figure 4.8 shows the pins of the NPM power cables.
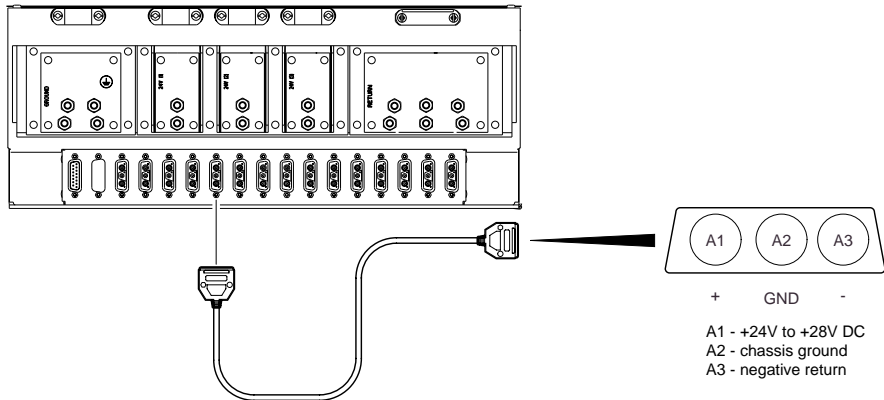
00427

Figure 4.8   Power Cable Pins

WARNING: When CB 11 is in the ON (up) position, pin A1 is hot (+24V DC). Never short-circuit pin A1 with any other pins or objects. Failure to heed this warning may cause damage to or destruction of the NPM.

▸ **To test the power supply voltage and ground**

1   Ensure that all NPM circuit breakers (CB) are in the OFF (down) position.

2   Remove the three fuses from the PDP on the radio rack by using a 1/4-inch flathead screwdriver.

3   Configure your multimeter to read DC voltage. Autoscaling may be used.

4   If the NPM has a pre-installed utility shelf, disconnect the CB 11 power cable from the PS0 connector on utility shelf. Leave the power cable connected to CB 11 connector.

5   Test the voltage potential between the ground and return pins:

   i   Connect the multimeter probes to pins A2 (ground) and A3 (–). Either probe may go to either pin.

     ii   Observe the voltage reading on the multimeter. The voltage should be less than 0.5mV from 0.

          If the voltage is greater than ±0.5mV, there may be a grounding problem. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the NPM until the problem has been resolved.

6   Test the voltage potential between the +24V and return (−) pins:

     i   Flip CB 11 on the radio rack to the ON (up) position.

     ii   Connect the black multimeter probe (−) to pin A3 (−).

     iii   Connect the red multimeter probe (+) to pin A1 (+24V).

     iv   Observe the voltage reading on the multimeter. The voltage should be between +24V and +28V.

          If the voltage is not between +24V and +28V, there may be a problem with the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the NPM until the problem has been resolved.

7   Test the voltage potential between the +24V and ground pins:

     i   Ensure that CB 11 on the radio rack is in the ON (up) position.

     ii   Connect the black multimeter probe (−) to pin A2 (ground).

     iii   Connect the red multimeter probe (+) the pin A1 (+24V).

     iv   Observe the voltage reading on the multimeter. The voltage should be between +24V and +28V.

     v   If the voltage is not between +24V and +28V, there may be a problem with the ground or the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the NPM until the problem has been resolved.

8   Test the voltage potential between the ground and return pins while the circuit is powered on:

     i   Ensure that CB 11 on the radio rack is in the ON (up) position.

     ii   Connect the black multimeter probe (−) to pin A2 (ground).

     iii   Connect the red multimeter probe (+) the pin A3 (−).

     iv   Observe the voltage reading on the multimeter. The voltage should be less than ±0.5mV.

          If the voltage is not between +24V and +28V, there may be a problem with the grounding or the main power supply. See the documentation that ships with your power supply for troubleshooting procedures. Do not power on the NPM until the problem has been resolved.

9   If all the tests described in steps 5–8 passed, then the NPM is properly grounded and the main power supply is operating correctly.

If any if the tests failed, investigate and correct the problem. Repeat this procedure after corrective action is taken. Do not power on the NPM if any of the tests failed.

10 Disconnect both probes from the power cable.

11 Power off CB 11 on the radio rack by setting it to the OFF (down) position.

12 Reconnect the power cable to the PS0 connector on the utility shelf.

13 Reinstall the three fuses in the PDP in the radio rack by using a 1/4-inch flathead screwdriver.