IP-RN 8000 Installation and Commissioning Guide

Release 2.0

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IP-RN 8000 Installation and Commissioning Guide

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About this guide

About this chapter

This chapter provides information you need to use the IP-RN 8000 Installation and Commissioning Guide effectively. Specifically, it contains the following sections:

Purpose

This guide provides detailed processes and procedures required to install and commission an IP-RN 8000.

Audience

This guide should be read by network planners in order to understand the installation and commissioning process and requirements. This guide should be used by field technicians to install and commission nodes at cell sites.

Field technicians installing nodes must be able to use the following:

- Common tools such as screwdrivers and wrenches
- Torque wrench
- Thread tapping kits
- Crane for lifting the cabinet onto the concrete pad
- 66-punch blocks

Field technicians commissioning nodes must use a variety of software applications, including:

- Window 98 (at least)
- FTP
- HyperTerminal or an equivalent terminal emulation program.

They must also be able to understand serial connections, CLI node management, telnet, and Ethernet connections.

Conventions

This section describes Airvana document conventions. It contains these sections:

Text conventions

Table 1 lists and describes the text conventions in Airvana guides.

Table 1 Airvana text conventions

Convention	Description
bold face angle brackets < >	Indicate a required parameter in a Command Line Interface (CLI) command. For example: >**band-class <*class*>** In the above example, **<*class*>** is a required parameter that happens to be a variable parameter (indicated by the italics) with a range of 1 to 3. A valid command in this syntax is: >**band-class 3**
	Indicate that you press the keyboard character enclosed in the brackets. For example: • Press <**ENTER**> to continue. In the above example, you press the Enter key to continue. • Press <**CTRL**><**ALT**><**DELETE**> to reboot your computer. In the above example, you press the Ctrl, Alt, and Delete keys simultaneously to reboot your computer.
boldface screen font	Indicates text that must be entered exactly as shown. For example: • Enter **ping 192.23.10.12** at the CLI prompt. • Enter **255.255.255.0** in the Net Mask field. In both examples above, you must enter the bold text exactly as shown.
italic screen font	Indicates a variable parameter in a CLI command. For example: >**authentication key <*aukey*>** In the above example, **<*aukey*>** is a variable parameter that specifies the authentication key for which you must enter a value, containing up to 16 numbers. A valid command in this syntax is: >**authentication key 9782503000**
boldface square brackets **[ ]**	Indicates an optional parameter in a CLI command. For example: >**activate image <*version*> [reboot]** In the above example, **[reboot]** is an optional parameter. A valid command in this syntax is: >**activate image rnc8500.2.0.0**
boldface pipe character |	Indicates you enter one or the other of the identified parameter options. For example: >**channel-included <yes | no>** A valid command in this syntax is: >**channel-included yes**

Table 1 Airvana text conventions *(continued)*

Convention	Description
A.B.C.D	Indicates a standard IP address. For example: >**telnet <*A.B.C.D*>** A valid command in this syntax is: >**telnet 10.0.0.1**
/bit-length-mask	Indicates an IP mask in bit-length format. For example: >**ip address <*A.B.C.D/bit-length-mask*>** A valid command in this syntax is: >**ip address 10.1.1.1/24**
AA:BB:CC:DD:EE:FF	Indicates a Media Access Control (MAC) hardware address specified as six pairs of hexadecimal characters separated by colons. For example: >**ip address <A.B.C.D> <AA:BB:CC:DD:EE:FF>** A valid command in this syntax is: >**ip address 10.1.1.1 11:22:33:DD:EE:FF**
arrow icon (⇒)	Indicates the Graphical User Interface (GUI) menu path. For example: Select **Edit** ⇒ **Add Network** to open the Add Network screen. In the above example, you select the **Add Network** option from the **Edit** menu to open the Add Network screen.
blue underline text	Indicates a hypertext link in a PDF file to the cross-referenced text. For example: See Audience on page xiv. In the above example, clicking on **Audience** brings you to the appropriate section and page in a PDF file for the *Audience* section.
`plain screen font`	Indicates system output in a command line or system-generated file. For example: `IP address 192.23.10.12 is alive.` The above example shows the system's response after you successfully ping the identified IP address.
boldface font	Indicates GUI menu options, drop-down lists, and buttons. For example: 1. Select **Edit** ⇒ **Delete Node**. The system prompts you to confirm the request. 2. Click **OK**.
plain italic font	Indicates file and directory names, book titles, and emphasized words.

Icon conventions

Airvana documents use the following icons:

 CAUTION	The caution icon appears in procedures, that, if performed incorrectly, can damage equipment or lose data.
 NOTE	The note icon appears in text that provides additional or helpful information.
	The tip icon appears in text that describes procedure shortcuts.
 WARNING	The warning icon appears in procedures, that, if performed incorrectly, can physically harm you. Before you perform the procedure, you must be aware of electrical circuitry hazards and be familiar with standard practices for preventing accidents.
 WRIST STRAP	The wrist strap icon appears in procedures that require you to wear a wrist strap.

Related documentation

This section describes documentation related to the IP-RN 8000 Installation and Commissioning Guide. It contains these sections:

Release 2.0 document set

Table 2 lists and briefly describes each guide in the Airvana Release 2.0 Customer Documentation set.

Table 2 Release 2.0 document set

Guide title	Brief description
Airvana Release 2.0 Notes	Introduces Release 2.0 features and identifies known anomalies and any workarounds.
Airvana Release 2.0 Documentation Road Map	Single-page document graphically depicting Airvana IP-RAN deployment steps, with pointers to the appropriate Airvana Release 2.0 guide documenting each step.
Airvana IP-RAN RF and 1xEV-DO Planning Guide	Provides a comprehensive understanding of the Airvana IP-RAN planning process, identifying the information a qualified network engineer needs to design the radio frequency (RF) portion of a new IP-RAN to meet an operator's service quality, coverage, and capacity requirements. This information enables the network engineer to determine cell site locations and the number of carriers each cell site requires. Additionally, identifies the information a qualified network engineer needs to design the 1xEV-DO portion of a new IP-RAN, focusing on how to: • Determine the number of IP-RNC 8500s required to support the IP-RN 8000s • Associate IP-RN 8000s with IP-RNC 8500s • Implement fault tolerance in the IP-RAN • Configure the PDSN • Configure any AN-AAAs on the IP-RAN • Overlay an IP-RAN on a cdma-2000 network
Airvana IP-RAN Network Planning Guide	Provides a comprehensive understanding of the IP planning portion of designing a new IP-RAN. Discusses IP address/subnet design and network element IP requirements, as well as load balancing and static route/RIP recommendations. Includes a chapter on AirVista™ Management System planning, including remote-access options and fault-tolerance planning.

Table 2 Release 2.0 document set *(continued)*

Guide title	Brief description
Airvana Cell Site Planning Guide	Provides professionals responsible for the wireless operator's planning, cell-site acquisition/zoning, and architecture/civil engineering functions, the specifications they need to select and prepare cell sites for Airvana IP-RN 8000 (IP Radio Node 8000) installations that are greenfield deployments. The guide focuses on the IP-RN 8000 standard configuration.
Airvana Script Generation Guide	Describes how to use the Airvana Merge Tool and Script Generation Tool to produce customized configuration scripts for commissioning IP-RN 8000s and IP-RNC 8500s.
Airvana 1xEV-DO Parameters Reference Guide	Provides parameter details for configurable 1xEV-DO parameters. This guide is available post Release 2.0.
Getting Started with the AirVista Management System	Printed guide shipped with the AirVista Management System software CD. Contains AirVista licensing information, software and hardware requirements, and describes how to install AirVista server software, including guidelines or installing the Oracle® and VERITAS® software required to support AirVista.
IP-RNC 8500 Installation and Commissioning Guide	Describes how to physically install the IP-RNC 8500 at the data center, including: rack-mounting instructions, backhaul network connections, the Packet Data Serving Node (PDSN) connection, and CLI management station connection. Describes the power-on process and how to use the CLI to run the configuration script to commission the device. Lists physical and environmental specifications, agency approvals, and cable specifications and pinouts.
IP-RN 8000 Installation and Commissioning Guide	Describes how to physically install the IP-RN 8000, including how to physically secure the IP-RN 8000 at the cell site, connect the IP-RN 8000 to the backhaul network, cell-site antenna, cell-site grounding system, GPS antenna, and CLI management station. Describes how to power on the IP-RN 8000 and use the CLI to run the configuration script to commission the device. Covers physical and environmental specifications, agency approvals, cable specifications, pinouts, voltage power requirements, and concrete and crane installations.
AirVista Management System Administrator Guide	Describes how to administer, configure, and maintain the AirVista server.
AirVista Management System User Guide	Describes how to use AirVista client software to manage an Airvana IP-RAN.
Airvana Network Integration Guide	Describes the steps to integrate various pieces of equipment and test connectivity in the IP-RAN prior to going operational. This guide is available post Release 2.0.

Table 2 Release 2.0 document set *(continued)*

Guide title	Brief description
Airvana Command Line Interface (CLI) Reference Guide	Provides a CLI overview and describes the function of every CLI command.
Airvana Logging Message Reference Guide	Provides a logging overview and describes each log message, identifying what each message means, possible causes, and guidelines for responding to each error message.
IP-RN 8000 Hardware Maintenance Guide	Provides instructions for maintaining IP-RN 8000 hardware. This guide is available post Release 2.0.
IP-RNC 8500 Hardware Maintenance Guide	Provides instructions for maintaining IP-RNC 8500 hardware. This guide is available post Release 2.0.

Documentation CD-ROM

The Airvana Release 2.0 document set and additional literature are available in a CD-ROM package. Airvana updates the documentation CD-ROM with every software release, as well as periodically between releases. To order an Airvana Release 2.0 Documentation CD-ROM, contact your local sales representative or Airvana customer support.

Release 2.0 online documentation

The entire Airvana Release 2.0 document set is available as HTML online documentation integrated with the AirVista Management System. The Release 2.0 online documentation features:

- Context-sensitive help support for all AirVista screens
- Integrated email support for contacting Airvana customer support
- Access to PDF files of all Release 2.0 documents
- Full-text search support and bookmarks

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Chapter 1

Introducing the IP-Radio Node 8000

This chapter provides an overview of the IP-RN 8000 from a hardware perspective. This chapter contains the following sections:

Understanding the network

Figure 1 shows a typical deployment of the IP Radio Node 8000 (IP-RN 8000).

- The IP-RN 8000 is installed at the base of a cell tower and achieves two-way radio communications with access terminals through RF antennas as appropriate.
- The IP-RN 8000 receives timing signals through primary and optional redundant Global Positioning System (GPS) antennas.
- The IP-RN 8000 is grounded and connected to a power source.
- Each IP-RN 8000 is connected through backhaul links (up to four T1/E1s or a primary and optional redundant 10/100 Mbit/sec Ethernet) to an IP Radio Network Controller 8500 (IP-RNC 8500).

  These backhaul links carry access terminal data communications and IP-RN 8000 management communications.
- The IP-RNC 8500 is connected to the Internet through a packet data serving node (PDSN). This link carries all data communications between the access terminals and the Internet.

For more information on IP-RN 8000 backhaul, antenna, power, ground and other connections, see Understanding external connections on page 34.

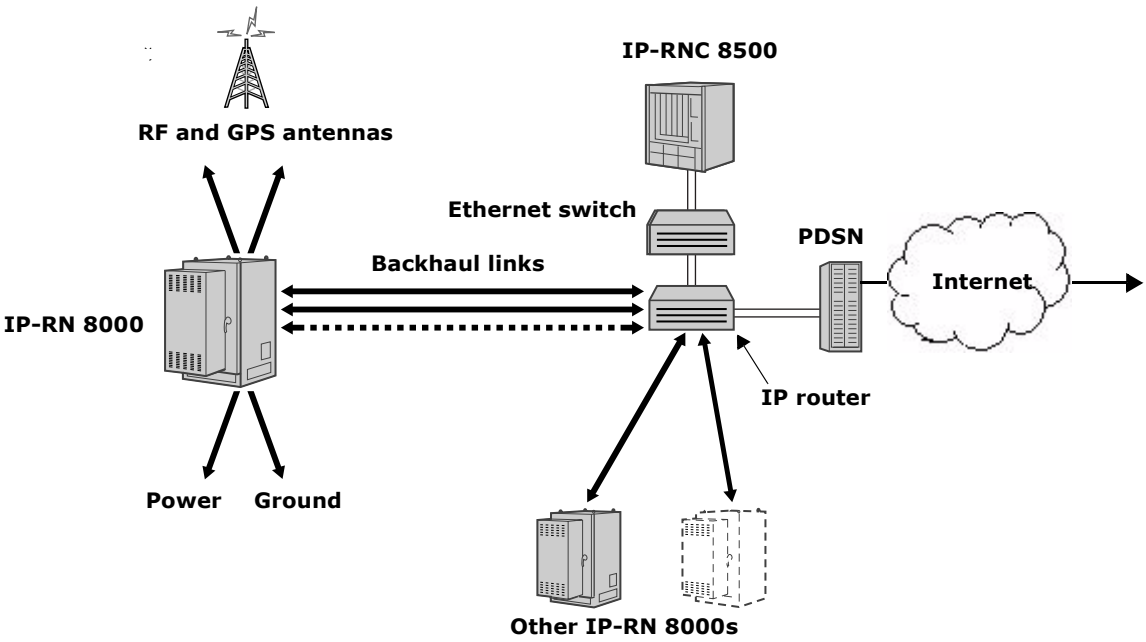


Figure 1 Typical network topology with IP-RN 8000(s), IP-RNC 8500, and other devices and links

NOTE

Figure 1 shows the network connections and devices in a typical IP-RN 8000 deployment. As with all networks, there are many variations of deployment and connectivity options. For more information, see the IP-RAN Network Planning Guide.

Understanding IP-RN 8000 front, side and back views

This section introduces the main IP-RN 8000 hardware components and contains the following sections:

NOTE

For information about the overall installation processes and related procedures, see Understanding the installation process on page 40.

Understanding the cabinet font view

Figure 2 shows the hardware components that are visible when the IP-RN 8000 is viewed from the front with the door open. This IP-RN 8000 has three Sector Radio Kits and two Digital Module Kits for fail-safe operation and redundancy.

Table 3 explains all labeled components.

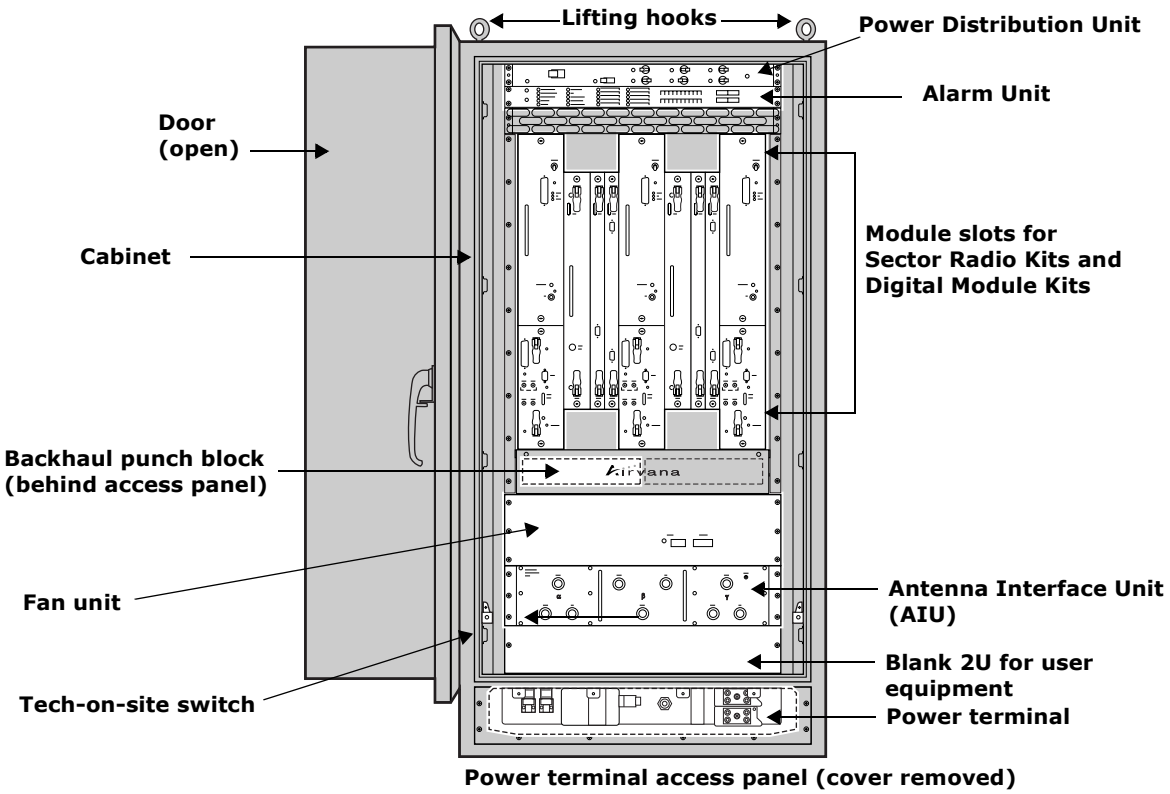


Figure 2 Front view

Table 3 Front view components

Component	Description
Cabinet	The cabinet is the entire node, including the frame, the sheet metal exterior, all modules and units, etc.
Door (open)	The front door features a latching handle that can be padlocked from the outside. The door also has a locking bar for propping the door open during configuration and maintenance. The door contains an exhaust vent an intake vent, and a heat exchanger, as well as a laptop shelf and a container for holding documents and cables. • See Appendix B, Using the door
Lifting hooks (eye bolts)	There are four lifting hooks (eye bolts) that you screw into 1/2 inch diameter holes in the four corners of the top of the cabinet during installation. After the cabinet has been removed from its shipping palette, the only way to lift it is with these lifting hooks.
Power Distribution Unit	The Power Distribution Unit (PDU) contains the main power switches and circuits breakers and other switches and circuit breakers that control power flow to various components. • See Understanding the Power Distribution Unit on page 27.
Alarm Unit	Has LED's that display the status of 20 alarm circuits, 10 of which are hard wired, 10 of which can be attached to contact screws on the Alarm Unit. Has 20 on/off switches controlling all alarms. • See Understanding the Alarm Unit on page 29.
Module slots	Sector Radio Kit modules and Digital Module Kit modules are inserted into these slots. All modules are field replaceable. • See Understanding the Sector Radio Kit and the Antenna Interface Unit on page 13. • See Understanding the Digital Module Kit on page 19
Antenna Interface Unit (AIU)	Connects Sector Radio Kit modules on the cabinet front side to the RF antenna cables on the cabinet backside. • See Understanding the Sector Radio Kit and the Antenna Interface Unit on page 13
Blank 2U for user equipment	You can install additional equipment into the chassis behind this access panel. The slot provides 2U space.
Power terminal	The terminal to which the power cables are attached.
Tech-on-site switch	Used by authorized technicians to suppress door intrusion alarms during normal servicing. When the switch shaft is pulled forward, the tech-on-site LED lights red and the door/ intrusion alarm is suppressed and its LED remains green. • See Understanding the tech-on-site switch on page 36 • See Opening the door on page 198
Power terminal access panel	Contains the power/ground terminal to which the power cables are connected during installation. Also contains the space through which backhaul cables are fed on the way to the backhaul punch block. This section is normally hidden behind an access panel cover. • See Connecting the power supply on page 65. • See Understanding surge protection and grounding on page 33
Fan Unit	Moves air vertically through the chassis from the bottom to the top. • See Understanding the Fan Unit on page 31

Table 3 Front view components *(continued)*

Component	Description
Backhaul punch block	A punch block for connecting the T1/E1 and Ethernet physical lines for the backhaul network after they have been routed through the backhaul conduit and through cabinet. • See Understanding the backhaul punch block and switch on page 32

Understanding cabinet right side view

Figure 3 shows the hardware components that are visible when you view the IP-RN 8000 from the right side with the front door open.

Table 4 explains all labeled components.

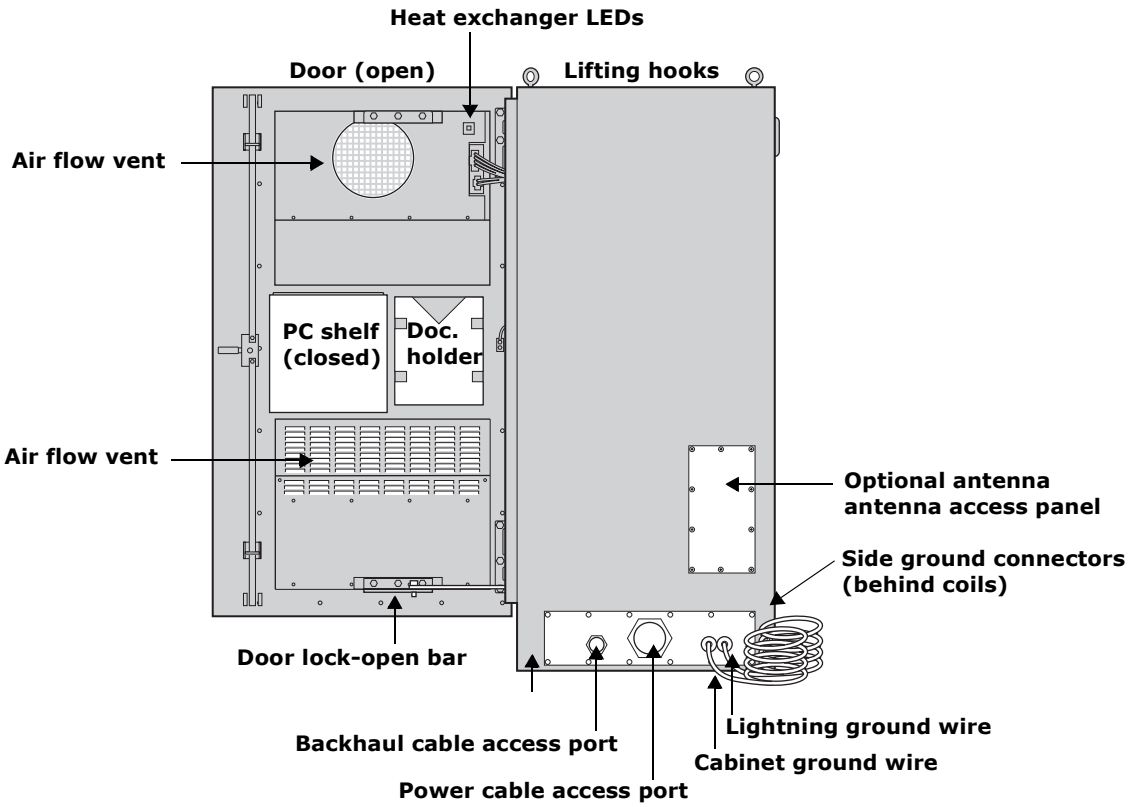


Figure 3 Right side view with the front door open

Table 4 Right side view components

Hardware feature	Description
Door (open)	The front door is shown all the way open. See Appendix B, Using the door
Heat exchanger LEDs	Four LEDs that indicate heat exchanger status.
Lifting hooks (eye bolts)	There are four lifting hooks (eye bolts) that you screw into 1/2 inch diameter holes in the four corners of the top of the cabinet during installation. After the cabinet has been removed from its shipping palette, the only way to lift it is with these lifting hooks.
Optional antenna cable access panel	One of four possible access panels into which the Rox System™ cabinet seal can be installed. The Rox System Cabinet seal threads RF and GPS antenna cables into the IP-RN 8000 chassis and seals off external environmental conditions. You can perform the installation using an access panel at the bottom of either side, at the bottom of the back, or at the top of the back. *The standard installation uses the top-back antenna access panel*. See Installing the Rox System cabinet seal on page 94
Side ground connectors	Connect to site grounding infrastructure for additional grounding protection as needed. These are dual threaded lug holes with 1/4-20 threads. See Understanding surge protection and grounding on page 33
Cabinet ground wire	A copper coil that provides the main grounding connection for the cabinet.The coil must be connected to an earth ground system that meets all local codes and requirements. See Understanding surge protection and grounding on page 33
Lightning ground wire	A copper coil that provides the grounding connection for the RF and GPS antennas. *This is a secondary surge suppression system; an external primary surge suppression system is required.* The coil must be connected to an earth ground system that meets all local codes and requirements. See Understanding surge protection and grounding on page 33
Power cable access port	Feed power cable through this port for internal connection into the power terminals. Optionally attach 3 inch conduit as appropriate and required. See Connecting the power supply on page 65.
Backhaul cable access port	Feed T1/E1 or Ethernet backhaul cables through this port for internal connection into the Backhaul Punch Block. Backhaul cables can optionally be combined with power cable and be fed with the power cable through the power cable access port. Optionally attach 1 inch conduit as appropriate and required. See Chapter 5, Connecting the backhaul.
Door lock-open bar	Locks the door into an open position. See Opening the door on page 198
Air flow vents	Vents for the internal air flow loop. See Understanding cabinet air flow on page 37
Doc. holder	A holder for documents and extra cables.

Table 4 Right side view components *(continued)*

Hardware feature	Description
PC shelf (closed)	A shelf for holding a laptop PC used for a terminal connection to the node. Shown in the closed position.

Understanding the cabinet back view

Figure 4 shows the hardware components that are visible when you view the IP-RN 8000 from back side. This view shows the Rox System cabinet seal already installed and the surge suppressor access panel removed.

Table 5 explains all labeled components.

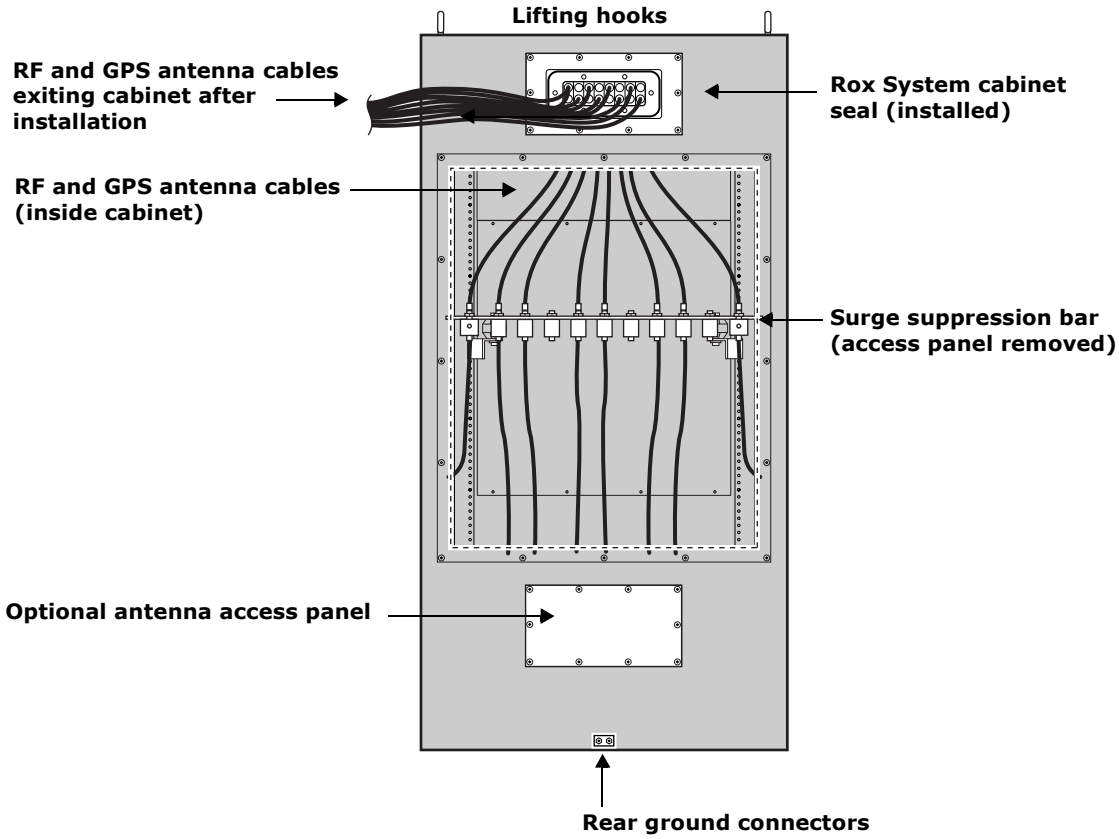


Figure 4 Rear view with the Rox System cabinet seal and antenna cables installed and with the surge suppressor access panel removed

Table 5 Rear view

Item	Description
RF and GPS antenna cables	The bundle of Global Positioning System (GPS) and radio frequency (RF) transmit/receive antenna cables exiting the IP-RN 8000. • See Chapter 6, Connecting antennas
Lifting hooks (eye bolts)	There are four lifting hooks (eye bolts) that you screw into 1/2 inch diameter holes in the four corners of the top of the cabinet during installation. After the cabinet has been removed from its shipping palette, the only way to lift it is with these lifting hooks.
Rox System cabinet seal (installed)	The Rox System Cabinet seal threads antenna cables into the IP-RN 8000 chassis and seals off external environmental conditions. The Rox System cabinet seal is installed during IP-RN 8000 installation. • See Installing the Rox System cabinet seal on page 94.
Surge suppression bar (access panel removed)	External antenna cables are attached to the connectors on the surge suppression bar. This grounded bar and its surge suppressor connectors constitute a secondary surge protection system that provides additional protection from power surges and lightening strikes. A primary external surge protection equipment is required. • See Understanding the antenna installation process on page 86
Rear ground connectors	Connect to site grounding infrastructure for additional grounding protection as needed. • See Understanding surge protection and grounding on page 33
Antenna access panel	One of four possible access panels into which the Rox System cabinet seal can be installed. The Rox System Cabinet seal threads antenna cables into the IP-RN 8000 chassis and seals off external environmental conditions. You can perform the installation using an access panel at the bottom of either side, at the bottom of the back, or at the top of the back. *The standard installation uses the top-back antenna access panel.* • See Installing the Rox System cabinet seal on page 94v
RF and GPS antenna cables (inside cabinet)	The number of RF (transmit and receive) and GPS antenna cables depends on the particular installation. This part of the figure shows the cables routing down from the Rox System cabinet seal and connecting to the surge protection bar. • See Understanding surge protection and grounding on page 33. • See Connecting GPS and RF antennas on page 96
RF and GPS antenna cables (exiting cabinet)	The number of RF (transmit and receive) and GPS antenna cables depends on the particular installation. This part of the figure shows the antenna cables exiting the cabinet through the Rox System cabinet seal, on their way to connection with antenna cables on the cell tower. • See Connecting GPS and RF antennas on page 96

Understanding access panels

Figure 5 shows the 10 access panels. There are three access panels on the front, two on each side, and three on the back. These access panels provide access to internal components and allow for different installation options. Table provides descriptions of each access panel and the explains the standard installation documented in this guide.

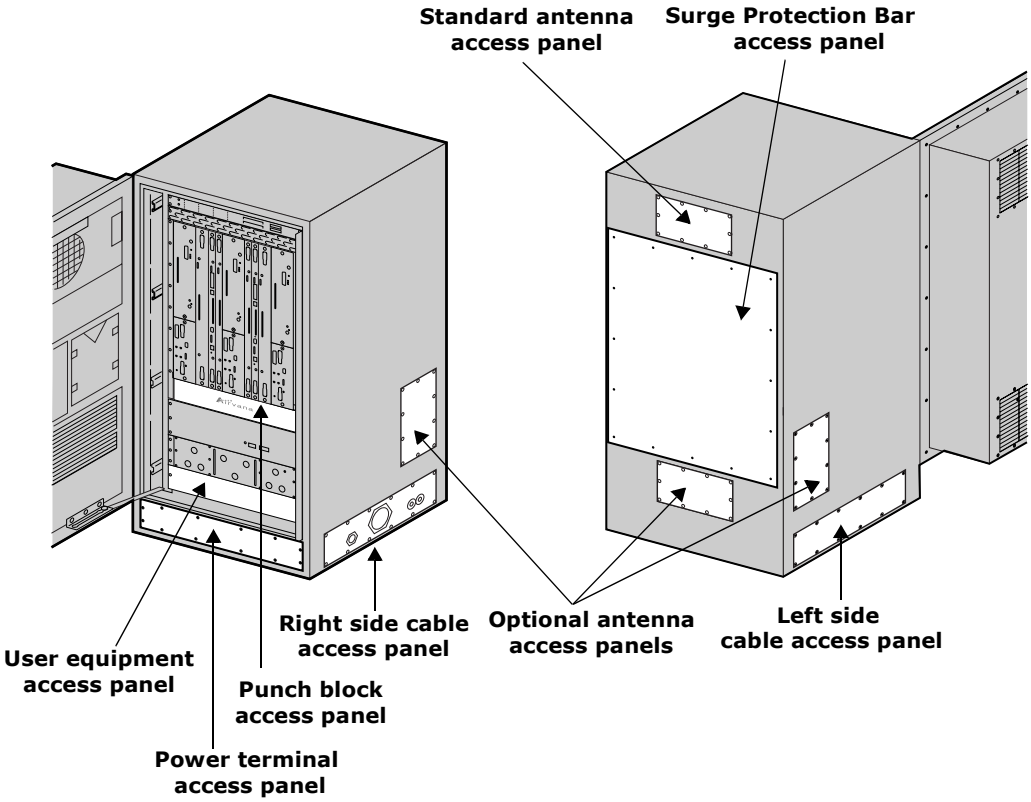


Figure 5 Access panels

Table 6 Access panels

Access panel	Description
Standard antenna cable access panel	There are four access panels into which the Rox System Cabinet Seal can be installed. (The Rox System Cabinet Seal is the environmentally sealed unit through which RF and GPS antenna cables enter the cabinet.) This installation guide explains how to install the Rox System Cabinet seal into the standard antenna cable access panel at the top of the back of the cabinet.
Optional antenna cable access panels	The Rox System Cabinet Seal can optionally be installed into any of three other antenna access panels. However, these installation options required non-standard configurations of internal components, and in these cases the cabinet must be special ordered.
Right side cable access panel	There are two access panels through which the power cable, the the backhaul cable(s), and the alarm cables (if any) can enter the cabinet, one on the right side, one on the left side. The right side is the standard configuration.This installation guide explains how to install all systems using the right side access panel. You can optionally route the backhauls and the power cables through the left side access panel without special ordering the cabinet as the internal configurations are identical. This access panel also provides access to cabinet mounting bolts.
Left side cable access panel	The left side has an optional access panel through which the power, backhaul, and alarms cables can optionally enter the cabinet. This access panel also provides access to cabinet mounting bolts.
Power terminal access panel	Provides access to the power cable terminals and the routing harness for the backhaul cables.
User equipment access panel	Behind this access panel is a chassis placeholder for optional installation of customer equipment. There is 2U space.
Surge Protection Bar access panel	Provides access to the surge Protection bar. All antennas (RF and GPS) must be connected to the surge protection bar during installation.
Punch block access panel	Provides access to the Backhaul Punch Block and the Alarm Punch Block (reserved for future use). Backhaul connections must be wired to the Backhaul Punch Block during installation.

Understanding module slot numbering

Figure 6 shows the nine vertical slots for field replaceable modules. See Table 7 on page 12 for details about which modules are installed into which slots for various system configurations.

- Slots 1, 5, and 9 are horizontally divided into a top part and a bottom part and contain the two modules that make up the Sector Radio Kit: the RM and PA modules. See Understanding radio sectors on page 13.

  You can install one, two or three Sector Radio Kits.Each Sector Radio Kit corresponds to a radio sector. Radio sectors are named alpha, beta, and gamma.

- Slots 2, 3, 4, 6, 7, and 8 contain the modules that make up the Digital Module Kit: the TFU, BIO/SC, and 1xDOM modules. See Understanding Digital Module Kit redundancy on page 20.

  You can install one or two Digital Module Kits. Two Digital Module Kits provide additionally hardware and software redundancy for service continuity through failures.

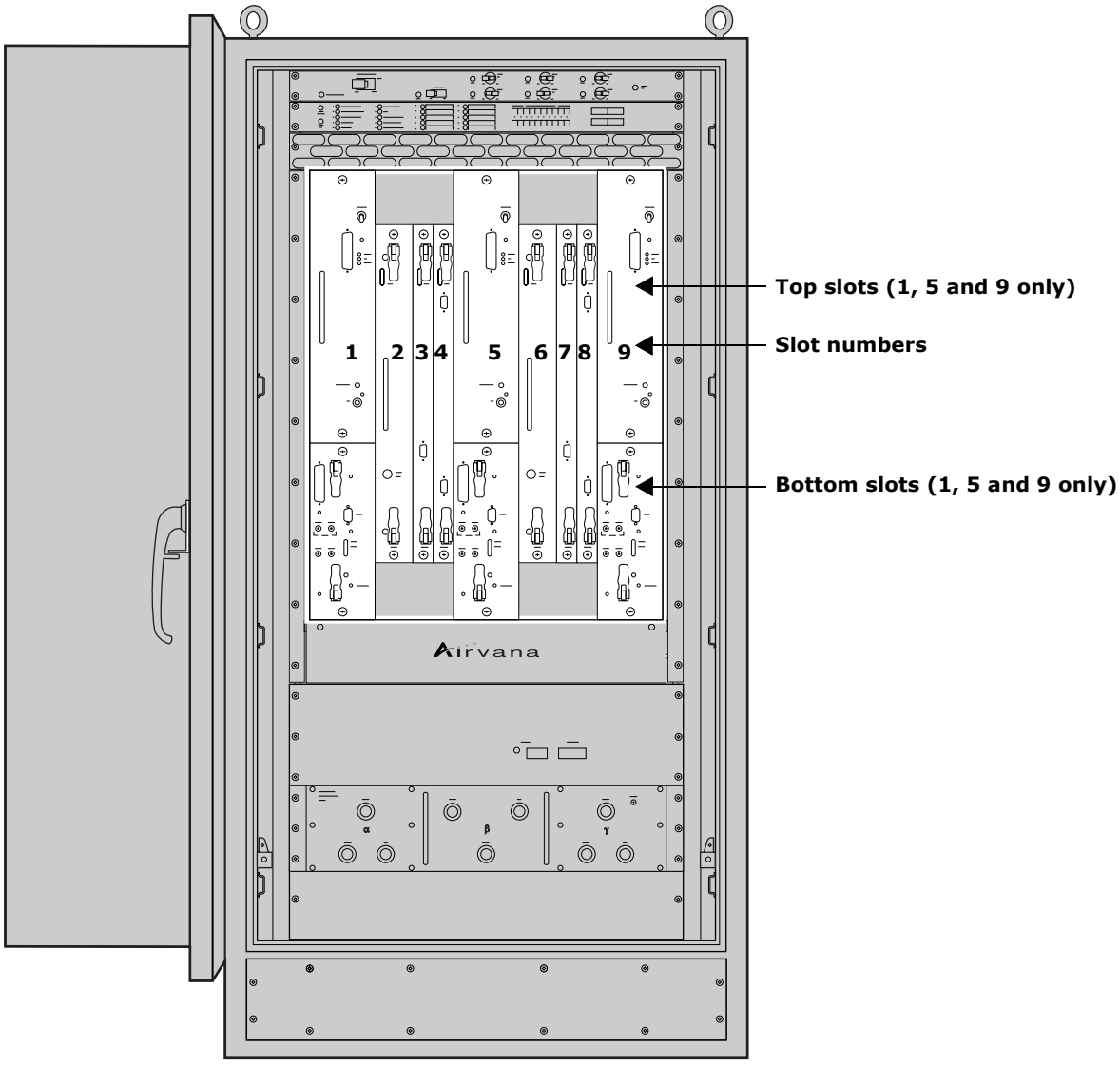


Figure 6 Slot numbers

Table 7 IP-RN 8000 slot numbering

Install	Module(s)	In this slot
Sector Radio Kit for *alpha* sector	PA	1— top *
	RM	1 — bottom *
Primary Digital Module	TFU	2
	BIO/SC	3
	1xDOM	4
Sector Radio Kit for *beta* sector	PA	5 — top *
	RM	5 — bottom *
Redundant Digital Module	TFU	6
	BIO/SC	7
	1xDOM	8
Sector Radio Kit for *gamma* sector	PA	9 — top *
	RM	9 — bottom *
* Slots 1, 5 and 9 are divided by a horizontal separator into a top part and a bottom part.		

Understanding replaceability terms

This guide describes whether modules and other items are “field replaceable,” “hot-swappable,” and whether replacing them entails any service disruption. Here are the definitions of these terms:

- “Field-replaceable” means the item can be replaced without returning the entire network element to Airvana. Field-replaceable items may or may not be hot-swappable.
- “Hot-swappable” means the item can be replaced without powering down other modules or the cabinet as a whole. Hot swappable items may or may not cause service disruption when swapped out.
- “Service disrupting” means replacing the item causes some break in the continuity of service to at least some user sessions.

Understanding the Sector Radio Kit and the Antenna Interface Unit

This section describes the Sector Radio Kit and the Antenna Interface Unit (AIU). This section contains the following subsections:

NOTE

For information about installation processes and procedures, see Understanding the installation process on page 40.

Understanding radio sectors

The 360 degrees of horizontal radio transmission/reception is often divided into three 120 degree radio sectors labeled: alpha, beta, and gamma. Different deployments may use a different numbers of sectors, and each sector can provide a different amount of radio coverage. For example, an omni antenna can provide 360 degrees of radio coverage and only uses a single sector. Each sector requires:

- Installation of a Sector Radio Kit.
- Connection of the Sector Radio Kit RF transmit and receive antennas to the cell tower antenna cables through the Antenna Interface Unit (AIU)

You can install one, two, or three Sector Radio Kits depending on deployment requirements. Typical deployments use all three sectors and provide 360 degree radio coverage.

There is no requirement that single-sector deployments must use the alpha sector. Sectors can be installed and deployed in any order. However, as a convention in this guide, single sector deployments always use the alpha sector.

Table 8 shows the slots into which you install Sector Radio Kits for one, two, and three sectors of radio coverage.

Table 8 Radio sector installation guidelines

Sectors utilized	Install Radio Sector Kits into these slots
Alpha	1
Beta	5
Gamma	9

Understanding the Sector Radio Kit

The Sector Radio Kit consists of two field-replaceable modules, the Radio Module (RM) and the Power Amplifier (PA). The two modules are installed in the appropriate cabinet slots and cable connections must be completed.

- See Understanding the Radio Module on page 14.
- See Understanding the Power Amplifier module on page 16.
- See Installing a Power Amplifier on page 105.

Understanding the Radio Module

The Radio Module (RM) is one of two modules that make up the Sector Radio Kit. See Figure 7 and Table 9. The RM provides modulation, demodulation, and radio frequency conversion services for a single radio sector. Typical deployments supporting 360 degree radio coverage require three RMs. The RM is installed in the bottom part of slots 1, 5, or 9, depending on the sector.

The RM is field-replaceable and hot swappable. Replacing an active RM in the field is service disrupting for its sector.

For information about installing the RM module:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

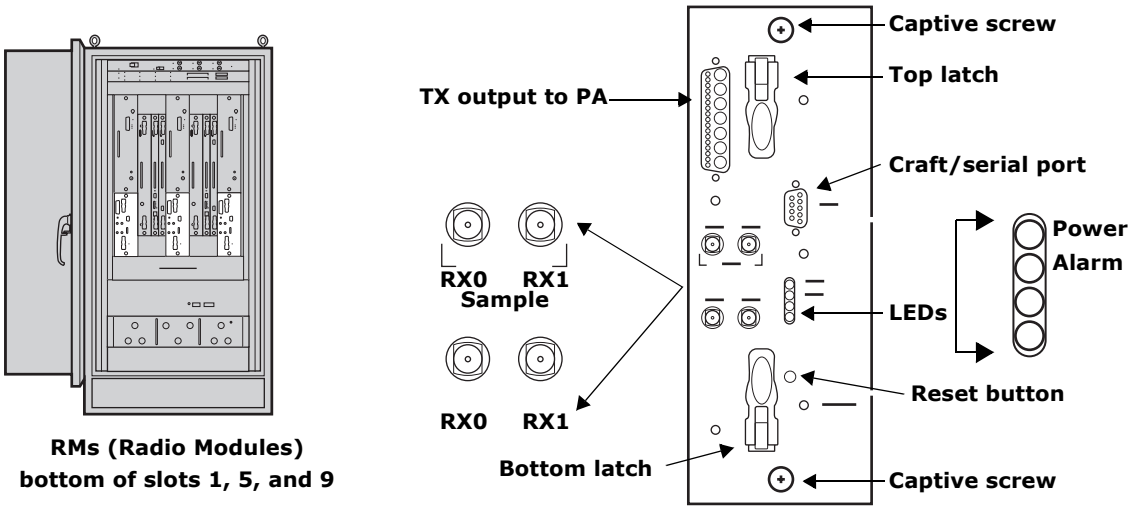


Figure 7 Radio Module

Table 9 Radio Module (RM) faceplate components

Component	Description	
Latches and screws	Top and bottom latches	Close to insert the RM in its slot.
		Open to remove the RM from its slot.
	Captive screws	Tighten to secure the module into its slot.
		Loosen before removing the RM from its slot.
LEDs	Power	Lights green when the RM is receiving power. Flashes during module initialization.
	Alarm	Lights red when the RM is in an alarm state.
Interfaces	RX0	Connects to the RX0 interface for this radio sector on the AIU. Carries one of two received RF signals. Connector type: SMA receptacle (female).
	RX1	Connects to the RX1 interface for this radio sector on the AIU. Carries one of two received RF signals. Connector type: SMA receptacle (female).
	RX0 (Sample)	Provides a receiver injection port for use with externally connected mobile test radios or test equipment. Connector type: SMA receptacle (female).
	RX1 (Sample)	Provides a receiver injection port for use with externally connected mobile test radios or test equipment. Connector type: SMA receptacle (female).
	TX output to PA	Connects transient RF signals to/from the PA module using Airvana cable installed during the installation process. Also carries control information to the PA and status information from the PA to the RM. Connector type: SMA receptacle. Contour type: blind mate.
	Craft/serial port	Connects to a management PC for CLI access to the RM. DB-9 interface. The serial port speed is 115,200 bit/second. For information on the DB-9 pin-out, see Table 35 on page 196.
Reset button	Recessed button	Pressing this recessed button resets the RM processor.

Understanding the Power Amplifier module

The Power Amplifier (PA) is one of two modules that make up the Sector Radio Kit. See Figure 8 and Table 10. PAs install in upper slots 1, 5, and 9, depending on the radio sector. The PA supports a single sector and a single corresponding antenna. Typical deployments support three sectors and use three PAs.

The PA is field-replaceable and hot swappable. Replacing an active PA in the field is service disrupting for its sector.

For information about installing the PA module:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

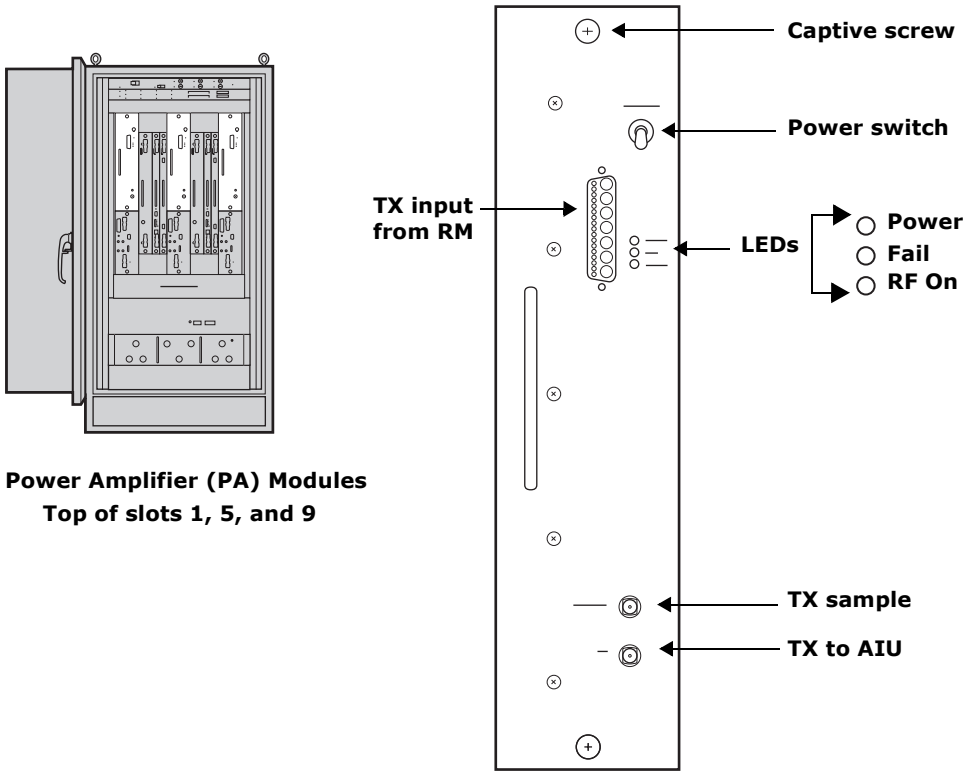


Figure 8 Power Amplifier

Table 10 Power Amplifier faceplate components

Component	Description	
Captive screw(s)	Tighten to secure the PA in its slot.	
	Loosen to remove the PA from its slot.	
Power switch	Flip up to turn on power to the PA.	
	Push down to turn off power to the PA.	
LEDs	Power	Lights green when the PA receives power.
	Fail	Lights red when the PA has failed.
	RF On	Lights green when the RF is applied.
Interfaces	TX (Sample)	Connects to an external spectrum analyzer. Carries a duplicate of the TX signal for sampling purposes. Connector type: SMA receptacle
	TX (to AIU)	Connects to the TX interface on the AIU using a cable installed during the installation process. Transmits the radio signal from the PA to the AIU for filtering and transmission from the cell tower antenna. Connector type: SMA receptacle.
	TX input from RM	Receives the transmit radio signal generated by RM. The PA amplifies the signal and transmits it to the AIU over the TX (to AIU) interface. Also carries control information from the RM to the PA and status information from the PA to the RM. Connector type: blind mate.

Understanding the Antenna Interface Unit module

The Antenna Interface Unit (AIU) is a pre-installed unit residing in the lower part of the front of the cabinet. See Figure 9 and Table 11.

The AIU contains filters and duplexors.

The AIU is divided into three sectors, one for each radio sector, from left to right: alpha, beta, and gamma. Each radio sector has two receive antenna connectors and one transmit antenna connector that connect to corresponding connectors on the appropriate Sector Radio Kit.

This AIU has nine ports on the faceplate, three for each sector. During installation, you connect these faceplate ports Sector Radio Kits.

The AIU also has ports on the rear side that you cannot see. There are two versions of the AIU that differ in the number of rear-facing ports: the 6-port AIU and the 9-port AIU. The rear-facing ports are connected to the surge suppression bar, and then to RF antenna cables. The 6-port AIU is the standard configuration.

The AIU is field-replaceable but it is not hot swappable. Therefore, replacing the AIU is service disrupting for all sectors.

For information about installing the AIU:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

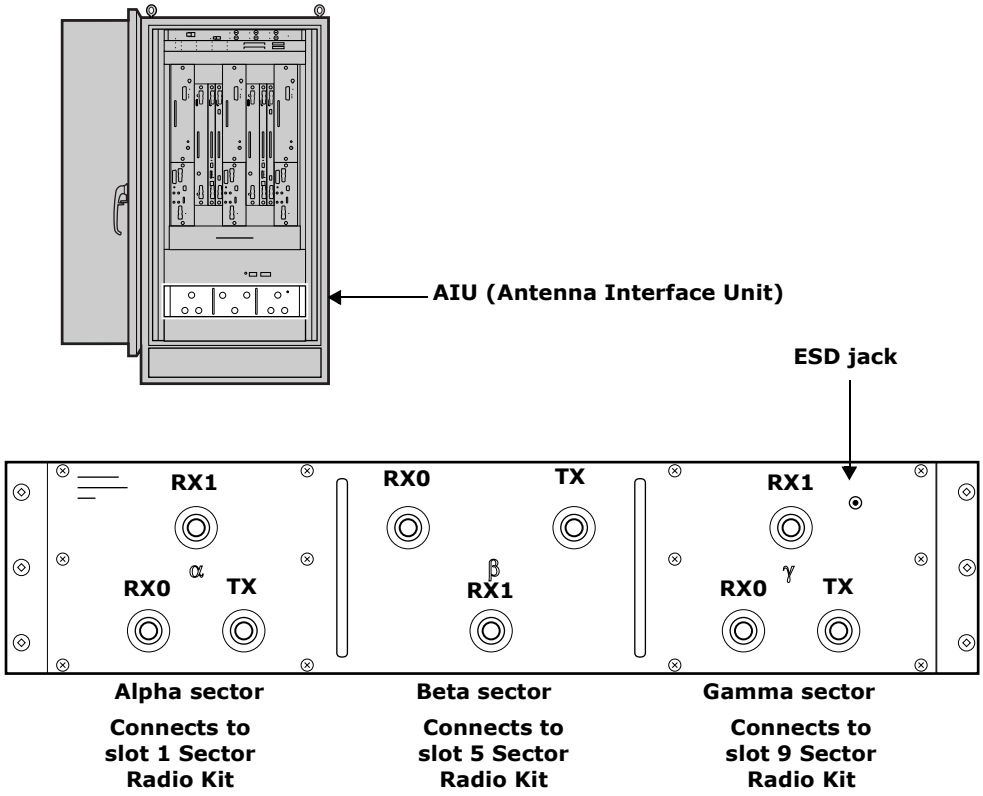


Figure 9 Antenna Interface Unit

Table 11 Antenna Interface Unit faceplate components

Component		Description	
Interfaces	Alpha sector	RX 0	Connects to the RX0 connector on the RM in slot 1.
		RX 1	Connects to the RX1 connector on the RM in slot 1.
		TX	Connects to the TX connector on the PA in slot 1.
	Beta sector	RX 0	Connects to the RX0 connector on the RM in slot 5.
		RX 1	Connects to the RX1 connector on the RM in slot 5.
		TX	Connects to the TX connector on the PA in slot 5.
	Gamma sector	RX 0	Connects to the RX0 connector on the RM in slot 9.
		RX 1	Connects to the RX1 connector on the RM in slot 9.
		TX	Connects to the TX connector on the PA in slot 9.
ESD jack	This is the jack for the electric static discharge wrist strap that must be worn and plugged in here at all times when installing, servicing, or touching the inside of the IP-RN 8000. **Warning:** Failure to wear a wrist strap that is plugged into this jack can result in service outages and equipment damage.		

Understanding the Digital Module Kit

This section describes the Digital Module Kit and contains the following sections:

Understanding Digital Module Kit modules

The Digital Module Kit consists of three modules:

- Timing Frequency Unit (TFU)

  See Understanding the Timing Frequency Unit module on page 21.
- Base Input Output/System Controller (BIO/SC)

  See Understanding the Base Input Output/System Controller module on page 22
- 1xDOM

  See Understanding the 1xDOM module on page 25.

All three modules must be installed for each Digital Module Kit. One or two Digital Module Kits can be installed depending on the need for system redundancy.

- See Understanding Digital Module Kit redundancy on page 20

Understanding Digital Module Kit redundancy

You can install one or two Digital Module Kits. Only a single (primary) Digital Module Kit is required for non-redundant operation. This non-redundant configuration provides less protection from potential faults in Digital Module Kit components. See Figure 10.

For non-redundant systems, use the following installation guidelines:

- The primary Digital Module Kit modules install in slots 2, 3, and 4.
- The primary GPS antenna cable connects to a GPS antenna.

For redundancy, install two Digital Module Kits.

- The secondary Digital Module Kit modules install in slots 6, 7 and 8
- The secondary GPS antenna cable connects to a second GPS antenna.

NOTE

There is no hardware or software requirement that the primary Digital Module Kit is installed in slots 2, 3, and 4 and secondary in 6, 7, and 8. The primary can be installed in slots 6, 7, and 8, and the secondary in slots 2, 3, and 4. However, this guideline is followed throughout this guide for clarity.

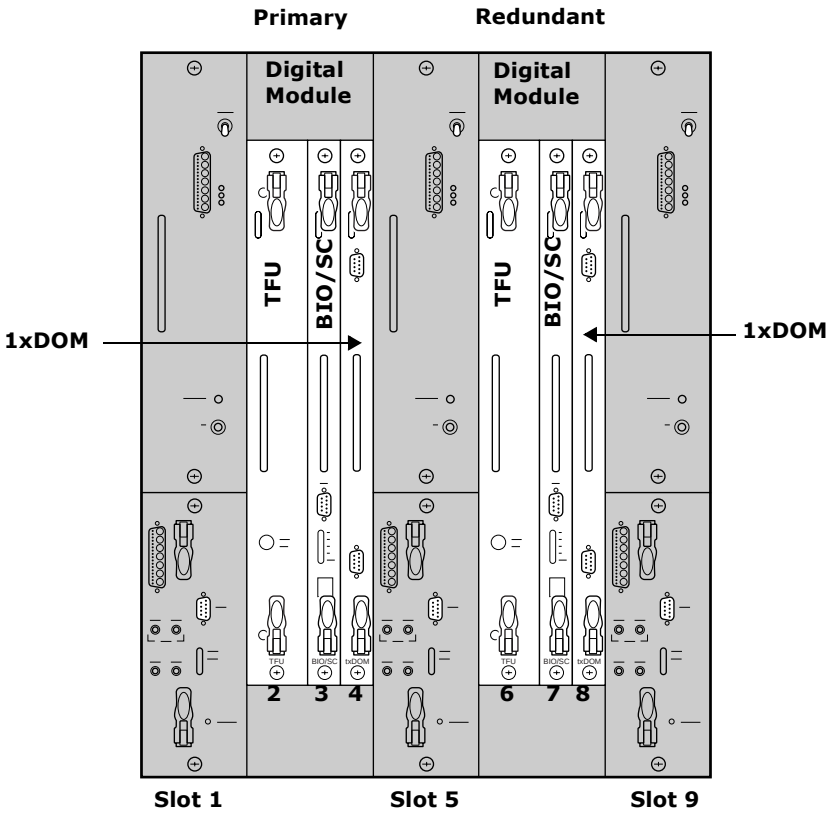


Figure 10 Primary and redundant Digital Module Kits with slot numbers for each module

Understanding the Timing Frequency Unit module

The Timing Frequency Unit (TFU) provides system timing from Global Positioning System (GPS) antenna. See Figure 11 and Table 12.

The primary TFU module installs in slot 2. The optional redundant TFU installs in slot 6.

The TFU is field-replaceable and hot swappable. Hot swapping a TFU is service disrupting if it is the active TFU in a redundant configuration. Therefore switching service to the standby TFU in redundant systems before replacing the module is recommended.

For information about installing the TFU:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

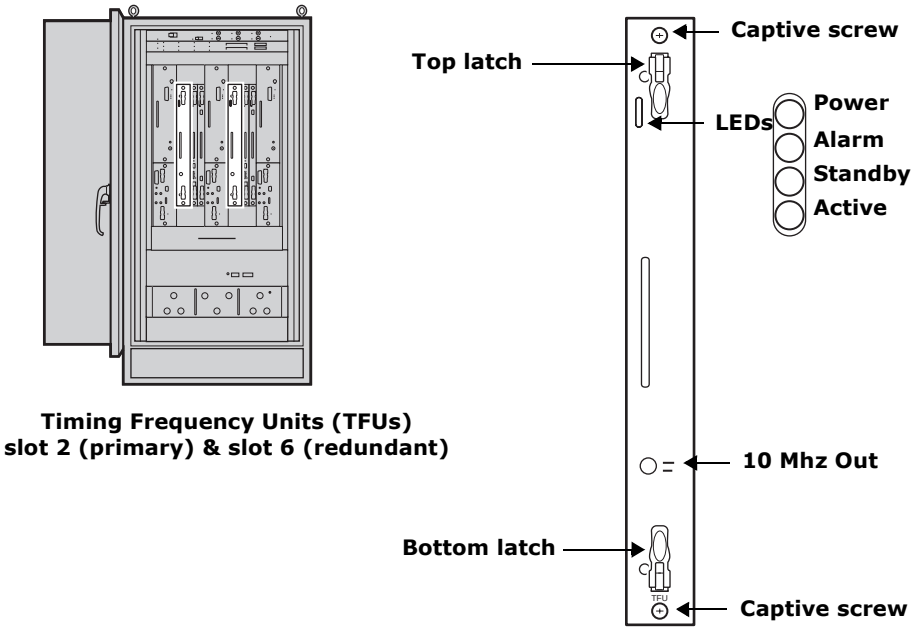


Figure 11 Timing Frequency Unit

Table 12 TFU faceplate components

Component	Description	
Latches and screws	Top and bottom latches	Close to insert the TFU in its slot.
		Open to remove the TFU from its slot.
	Captive screw(s)	Tighten to secure the TFU in its slot.
		Loosen before removing the TFU from its slot.
LEDs	Power	Lights green when the TFU receives power.
	Alarm	Lights red when the TFU is in an alarm state.
	Standby	Lights amber when the TFU is in standby mode in a redundant configuration.
	Active	Lights green when the TFU is in active mode in a redundant configuration.
10 MHz Out	This is a 10 MHz sample port for connecting external test equipment. Connector type: BNC.	

Understanding the Base Input Output/System Controller module

The Base Input Output/System Controller (BIO/SC) provides backhaul support, system control services, and timing distribution to internal IP-RN 8000 components. See Figure 12 and Table 13.

The primary BIO/SC installs in slot 3. The optional redundant BIO/SC installs in slot 7.

The BIO/SC is field-replaceable and hot swappable. Hot swapping a BIO/SC is service disrupting if it is the active BIO/SC in a redundant configuration. Therefore switching service to the standby BIO/SC in redundant systems before replacing the module is recommended.

For information about installing the BIO/SC module:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

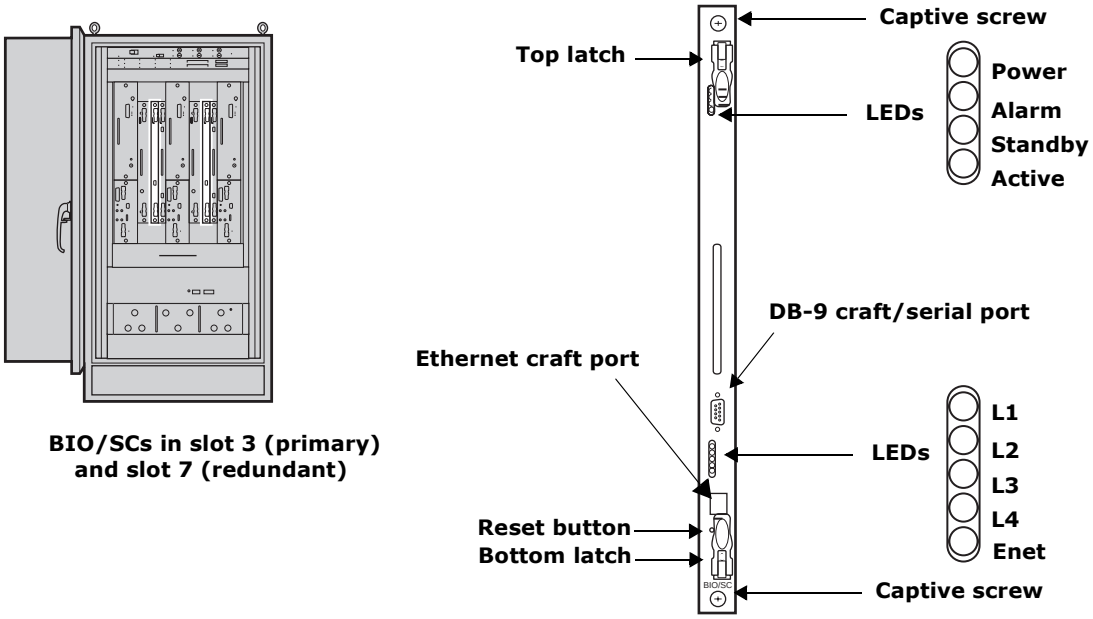


Figure 12 BIO/SC module

Table 13 BIO/SC faceplate components

Component	Description	
Latches and screws	Top and bottom latches	Close when inserting the BIO/SC in its slot
		Open when removing the BIO/SC from its slot
	Captive screw(s)	Tighten when securing the BIO/SC in its slot
		Loosen removing the BIO/SC from its slot
LEDs	Power	Lights green when the BIO/SC receives power.
	Alarm	Lights red when the BIO/SC is in an alarm state.
	Standby	Lights amber when the BIO/SC is in standby mode in a redundant configuration.
	Active	Lights green when the BIO/SC is in active mode in a redundant configuration.
	L1	Lights when the first of up to four T1/E1 backhaul links has a “link up” status
	L2	Lights when the second of up to four T1/E1 backhaul links has a “link up” status.
	L3	Lights when the third of up to four T1/E1 backhaul links has a “link up” status
	L4	Lights when the fourth of up to four T1/E1 backhaul links has a “link up” status.
	Enet	Lights when the Ethernet backhaul has a “link up” status.
Craft ports	Serial craft, Female DB-9	Serial port for terminal connection and Command Line Interface (CLI) control of the node. Speed 38,400 bit/second. For information on the DB-9 pin-out, see Table 35 on page 196.
	Ethernet craft	An RJ-45 modular jack Ethernet interface for local craft Ethernet connectivity.
Reset button	Recessed button	Pressing this button resets the BIO/SC processor.

Understanding the 1xDOM module

The 1xDOM (1xEV Data Only Modem) processes packets between the backhaul network and the 1xEV-DO baseband interfaces. See Figure 13 and Table 14.

The 1xDOM uses Qualcomm technology and features FLM (Forward Link Module) and RLM (Reverse Link Module) processors. The 1xDOM receives timing synchronization from the TFU and the BIO/SC.

The primary 1xDOM installs in slot 4. The optional redundant 1xDOM installs in slot 8.

The 1xDOM is field-replaceable and hot swappable. Hot swapping a 1xDOM is service disrupting if it is the active 1xDOM in a redundant configuration. Therefore switching service to the standby 1xDOM in redundant systems before replacing the module is recommended.

For information about installing the 1xDOM module:

- See Understanding the installation process on page 40.
- See Understanding the module installation process on page 104.

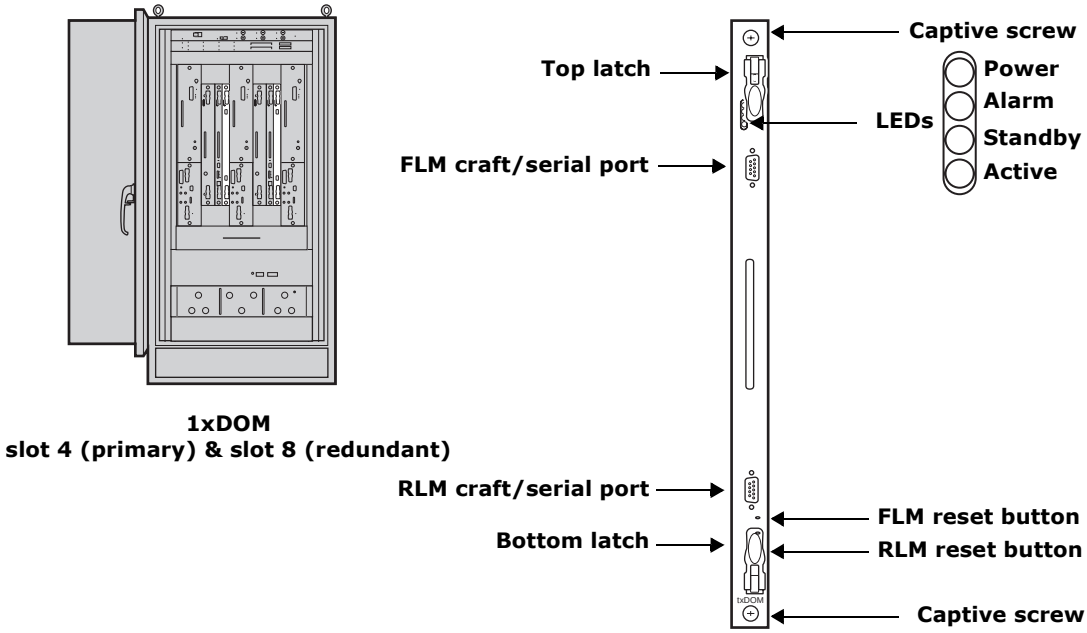


Figure 13 1xDOM module

Table 14 1xDOM faceplate components

Component	Description	
Latches and screws	Top and bottom latches	Close when installing the 1xDOM in its slot.
		Open when removing the 1xDOM from its slot.
	Captive screw(s)	Tighten when securing the 1xDOM in its slot.
		Loosen when removing the 1xDOM from the slot.
LEDs	Power	Lights green when the 1xDOM receives power.
	Alarm	Lights red when the 1xDOM is in an alarm state.
	Standby	Lights amber when the 1xDOM is in standby mode in a redundant configuration.
	Active	Lights green when the 1xDOM is in active mode in a redundant configuration.
Interfaces	FLM craft/serial DB-9 port	Provides CLI/terminal access to the Forward Link processor for debugging purposes only. Speed 38,400 bit/second.
	RLM craft/serial DB-9 port	Provides CLI/terminal access to the Reverse Link processor for debugging purposes only. Speed 38,400 bit/second.
Reset buttons	FLM reset button	Pressing this recessed button resets the FLM processor.
	RLM reset button	Pressing this recessed button resets the RLM processor.

Understanding the Power Distribution Unit

The Power Distribution Unit (PDU) contains control switches and circuit breakers that control power flow through the IP-RN 8000. See Figure 14 and Table 15.

The PDU is pre-installed. The PDU is field-replaceable. Replacing the PDU is service disrupting.

For information about power the node on, see Powering the node on page 126.

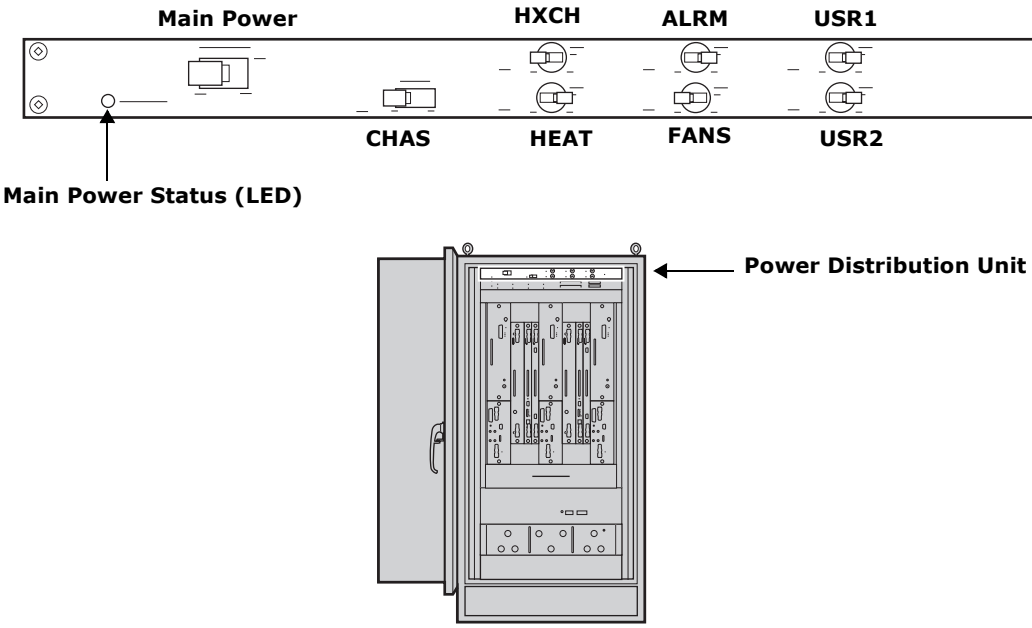


Figure 14 Power Distribution Unit

Table 15 Power Distribution Unit faceplate components

Component	Faceplate label	Description
Main Power	Main Power	Switch left to turn on power flow to the IP-RN 8000.
		Switch right to turn off power flow to the IP-RN 8000.
Main power status LED	Main Power Status	Lights green when Main Power switch is flipped to the left and a power supply is delivering power.
Chassis	CHAS	Switch left to turn on power to the module enclosure and all installed modules.
		Switch right to turn off power flow to the module enclosure and all installed modules.
Heat exchanger	HXCH	Switch left to turn on power flow to the front-door heat exchanger.
		Switch right to turn off power flow to the front-door heat exchanger.
Alarms	ALRM	Switch left to turn on power flow to the Alarm Unit and to the Heat Exchanger controller.
		Switch right to turn off power flow to the Alarm Unit and to the Heat Exchanger controller..
USR1	Reserved for future use.	
USR2		
Heater	HEAT	Reserved for future use.
Fan	FANS	Switch left to turn on power flow to the Fan Unit.
		Switch right to turn off power flow to the Fan Unit.

Understanding the Alarm Unit

The Alarm Unit provides LEDs for all alarm circuits and switches for enabling and disabling them. See Figure 15 and Table 16.

The Alarm Unit is pre-installed. The Alarm Unit is field-replaceable. Replacing the Alarm Unit is service disrupting.

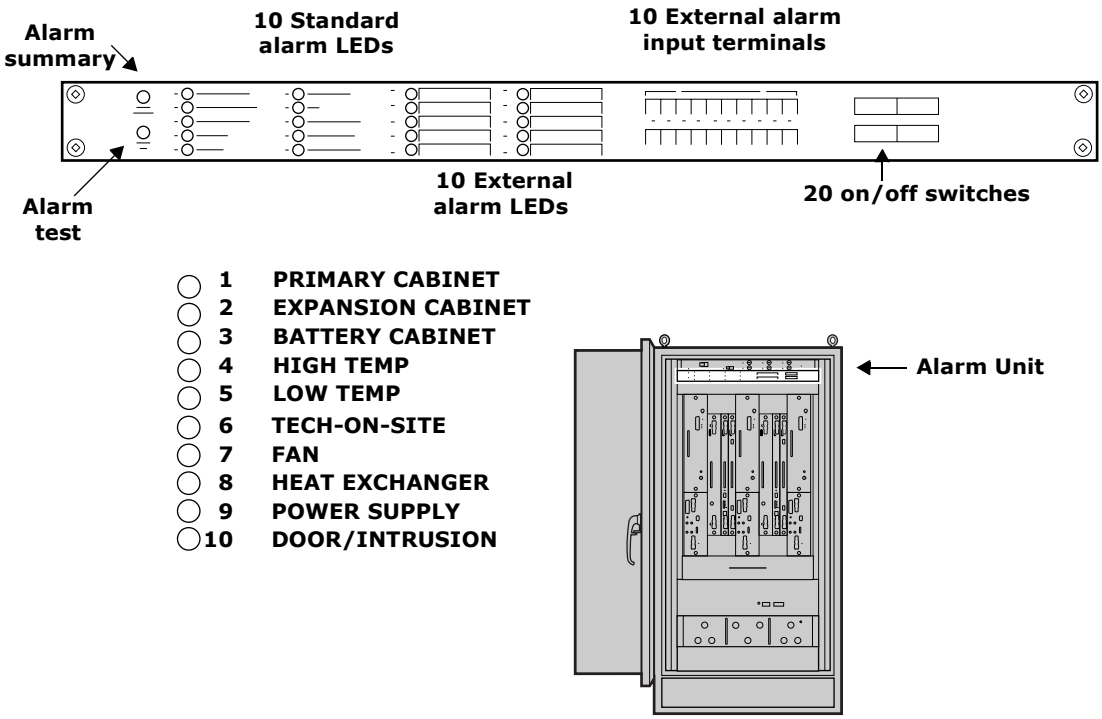


Figure 15 The Alarm Unit

Table 16 Alarm Unit faceplate components

Component	Description		
LEDs See Understanding LEDs on page 37	Alarm summary	When any alarm LED turns RED, this LED changes from green to red. If this LED is green, it means all 20 alarm LEDs are green	
	10 Standard LEDs	1 PRIMARY CABINET	Reserved for future use.
		2 EXPANSION CABINET	Reserved for future use.
		3 BATTERY CABINET	Reserved for future use.
		4 HIGH TEMP	Lights red when the internal temperature exceeds 90 degrees F.
		5 LOW TEMP	Lights red when the internal temperature falls below 50 degrees F.
		6 TECH-ON-SITE	Lights green under normal circumstances. Authorized technicians should pull the shaft forward to light the LED red and suppress door intrusion alarms. • See Understanding the tech-on-site switch on page 36. • See Opening the door on page 198.
		7 FAN	Lights red when an alarm occurs in the Fan Unit.
		8 HEAT EXCHANGER	Lights red when an alarm occurs in the heat exchanger.
		9 POWER SUPPLY	Reserved for future use.
		10 DOOR/INTRUSION	Lights red when the front door is open and the tech-on-site switch is not pulled. • See Understanding the tech-on-site switch on page 36. • See Opening the door on page 198.
	10 external alarm LEDs	These LEDs correspond to the 10 external alarm circuits that are optionally wired to the 10 alarm input terminals. They light green to indicate a non-alarm condition, red to indicate an alarm condition.	
Alarm test	Press this button to tests the alarm unit. When pressed, all alarm LEDs light up red.		
10 external alarm input terminals	You can optionally attach 10 external alarm circuits to these terminals.		

Table 16 Alarm Unit faceplate components *(continued)*

Component	Description
20 on/off switches	Switches 1-10 turn on and off the standard alarms. Turned off alarm circuits report no alarm status on LEDs.
	Switches 11-20 turn on and off the 10 external alarms circuits. Turned off alarm circuits report no alarm status on LEDs.

Understanding the Fan Unit

The Fan Unit moves air vertically through the chassis from the bottom to the top. See Figure 16 and Table 17.

The Fan Unit is pre-installed. The Fan Unit is field-replaceable. Replacing the Fan Unit is service disrupting.

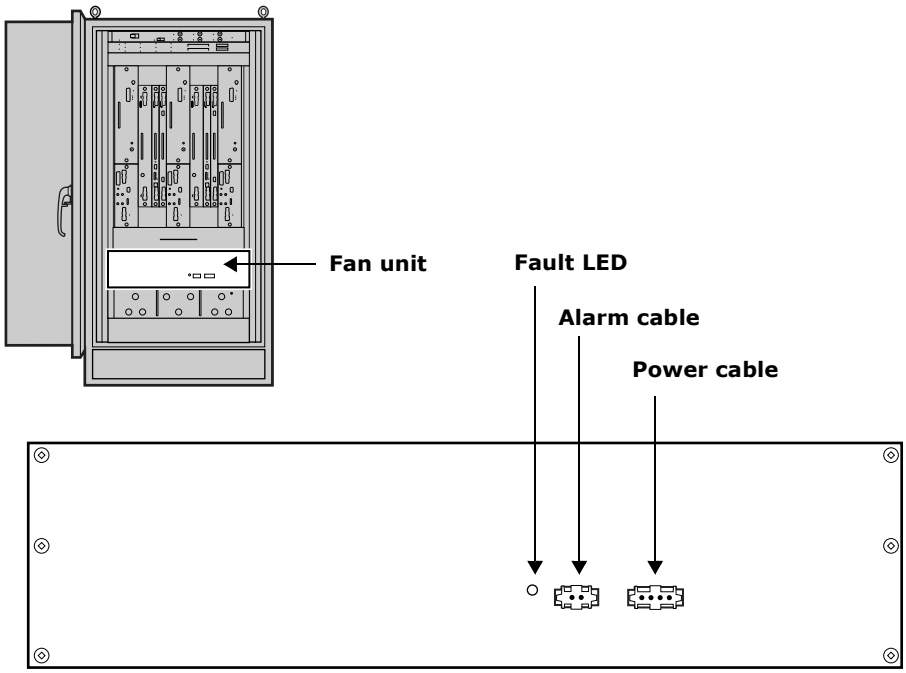


Figure 16 Fan Unit

Table 17 Fan Unit faceplate components

Component	Description
Fault LED	Lights when a hardware fault is detected
Alarm cable	Connects the Fan Unit to alarm system
Power cable	Provides power to the Fan Unit.

Understanding the backhaul punch block and switch

Backhaul links connect the IP-RN 8000 to an IP-RNC 8500 and carry user traffic and management traffic. There are two components to the backhaul system on the IP-RN 8000:

- Backhaul punch block — a wiring punch block used to physically connect T1/E1 or Ethernet links to the IP-RN 8000
- Backhaul switch — an internal switch module that provides surge protection and connects the backhaul punch block (and backhaul links) to the primary and optional redundant BIO/SC modules.

  For more information, see Understanding the backhaul switch on page 33.

Understanding the backhaul punch block

The backhaul punch block is a standard type 66-block and provides hardware for connecting T1/E1 or Ethernet lines for the backhaul network. The backhaul punch block is behind an access panel on the chassis front that covers both the backhaul punch block and the alarm punch block.

See Chapter 5, Connecting the backhaul.

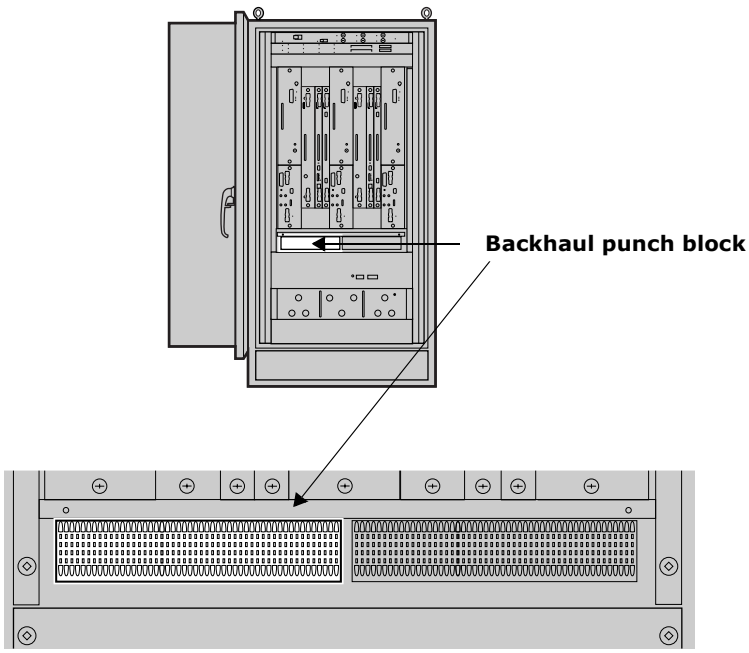


Figure 17 Backhaul punch block

Understanding the backhaul switch

The backhaul switch is pre-installed. The backhaul switch is field-replaceable. Replacing the backhaul switch is service disrupting.

The backhaul switch is inside the cabinet and is not visible. It performs two important functions:

- Secondary surge protection

  The IP-RN 8000 is protected from system transients on the backhaul caused by lightning and power cross conditions.

- T1/E1 backhauls are switched and connected with the BIO/SC that is currently active.

  For example, if your backhaul is a single T1 and you have a redundant IP-RN 8000 (with two Digital Module Kits), you only need to provision a single T1 and wire it to the backhaul punch block. If the redundant Digital Module Kit become active, the backhaul switch switches the T1 from the primary to the redundant Digital Module Kit.

  Ethernets are not switched. If you are deploying an Ethernet backhaul and you have a redundant IP-RN 8000 (with two Digital Module Kits), you must provision and connect two Ethernets to the backhaul punch block. One Ethernet is used as the backhaul by the primary Digital Module Kit and the other Ethernet is used by the redundant Digital Module Kit.

Understanding surge protection and grounding

The IP-RN 8000 has multiple connections for attachment to the site's grounding infrastructure. The IP-RN 8000 has a secondary surge protection system for additional protection against lightning strikes beyond the protection provided by a required primary external surge suppression system. A primary surge protection system must be designed by qualified personnel for each site and must be installed accordingly to prevent equipment damage and to minimize danger to nearby persons during lightning strikes.

Installation of a primary surge protection system and proper grounding of the IP-RN 8000 according to all relevant codes and requirements is necessary to avoid potential damage to the equipment and to minimize danger persons near the equipment during surges. Lightning protection design must be performed by qualified personnel for each IP-RN 8000 installation.

Understanding the secondary surge protection system

The secondary surge protection system consists of surge suppressors for each antenna and surge suppressors for the T1/E1 backhaul links that are electrically connected to the lighting ground coil. (For information about the lightning ground coil, see Figure 3.) The lightning ground coil must be connected to an external earth ground infrastructure.

The secondary surge protection system is designed to supplement a *required external primary surge protection system*. Both must be in place to protect equipment and persons against lightning strikes traveling down the cell tower along the RF and GPS antennas to the IP-RN 8000. Any surge that passes the required external primary surge protection system is expected to take the following path to the earth ground infrastructure:

- From the RF and GPS antennas through the surge suppressors onto the surge protection bar
- From the surge protection bar to the directly connected lead to the lightening ground coil
- From the lightning ground coil to the required external earth ground infrastructure

Understanding grounding requirements

Connection of the cabinet ground wire and the lightening ground wire to external earth ground systems that meet all relevant codes and requirements is required.

Grounding must be performed according to all relevant electrical codes and requirements. The site planner must review grounding requirements and determine the grounding plan accordingly. Failure to provide adequate grounding can result in damage to equipment and danger to personnel.

Beyond the lightning ground wire and the cabinet ground wire, the following additional and optional ground connections are available and may be utilized as required and appropriate at each site:

- Three pairs of dual lug holes with 1/4-20 threads. See Figure 3 on page 5 and Figure 4 on page 7,
- A third wire ground connected at the power terminal to provide a grounded link to an external power cabinet.

Understanding external connections

During installation, you must connect the IP-RN 8000 to a range of external cables. Procedures for making these cable connections are spread throughout this book. For an overview of the complete installation procedure, see Chapter 2, Installation process.

Table 18 lists all connections that must be made and provides additional information.

Table 18 IP-RN 8000 cable connections

Cable	Description
Power cable	External input ranging from 24 V DC to 29 V DC, 27 V DC nominal at the cabinet power terminal See Table 28 on page 193 for power specifications.
Ground connections	Provides grounding for safety and equipment protection. A main ground is required. Additional optional grounding connections can also be installed. See Understanding surge protection and grounding on page 33 See Table 29 on page 193 for grounding specifications.
RF antenna cables	There are two basic antenna configurations per sector. • The main receive (RX0) and the transmit (TX) can be combined on a single antenna cable and the diversity receive (RX1) can be on a second antenna cable • The main receive, the transmit, and the diversity receive can be on separate cables. Antenna cables feed into the IP-RN 8000 through the Rox System cabinet seal and must be connected internally to RF surge suppressors. See Table 32 on page 194 for cable specifications.

Table 18 IP-RN 8000 cable connections *(continued)*

Cable	Description
Global Positioning System (GPS) antenna cables	The Global Positioning System (GPS) provides the IP-RN 8000 with an accurate clock source to synchronize network functions. Two GPS antennas are required for redundancy and service continuity; if you are installing a non-redundant system, only a single GPS antenna is required. The far end of the GPS cable(s) typically use an “N-type” connector, although other options are available. The GPS antenna cables feed into the IP-RN 8000 through the Rox System cabinet seal and must be connected internally to GPS surge suppressors. See Table 32 on page 194 for cable specifications.
Backhaul connections	Connect the IP-RN 8000 to the IP-RNC 8500 through a backhaul network. Carry user data (AT to Internet) and management data between the IP-RN 8000 to the IP-RNC 8500 Can install one, two, three, or four T1/E1 backhaul connections or one or two 10/100 Mbit/sec Ethernet backhaul connections as appropriate for the deployment’s bandwidth and connectivity needs. the T1/E1 backhaul links are used simultaneously providing all combined bandwidth; only a single Ethernet backhaul link is used at a time, depending on which BIO/SC module is active on a redundant system. See Table 30 on page 193 for backhaul specifications.
Antenna Interface Unit (AIU) cables	There are two antenna configurations that correspond to two versions of the Antenna Interface Unit (AIU): the 6-port AIU and the 9-port AIU. This installation guide provides procedures for installation of the 6-port AIU. In this configuration, each radio sector has two antenna cables. One cable carries one transmit and one receive signal. The other cable carries the diversity receive signal that leads to a second antenna. With the 9-port AIU, each sector has three antenna cables, two for receive and one for transmit.
Terminal cable for CLI access	A COM port on a laptop PC is connected to the female DB-9 craft interface on the active BIO/SC module to provide terminal access to the node. Terminal access is required to complete the commissioning of the node.For information on the DB-9 pin-out, see Table 35 on page 196.
Ethernet cable for software update at the site	A craft Ethernet port on the BIO/SC module allows a technician to use FTP to transfer node software releases from a laptop to the node. IP configurations on the laptop and the Ethernet port must be made first.

Understanding the tech-on-site switch

The tech-on-site switch is a security feature that enables detection of unauthorized entry into the cabinet through the door. The switch is located at the lower left of the front side of the cabinet and is only visible when the door is open. See Figure 2.

The state of the switch is determined by the position of the main shaft. See Figure 18. The main shaft has three positions:

- Normal — The shaft is spring loaded to take this position when the door opens causing the *Tech-on-site* LED to light green.

  In this position, opening the door triggers a *Door/intrusion* alarm. The *Door/intrusion* LED lights red and the alarm is reported through software to the AirVista management system.

- Pulled forward— Technicians must pull the shaft of the switch forward to set the switch to this position, which lights the *Tech-on-site* LED red and suppresses *Door/intrusion* alarms.

  This position indicates an authorized technician has the door open. The *Tech-on-site* alarm LED lights red and the *Door/intrusion* alarm is disabled and its LED lights green.

NOTE

Whenever an authorized technician opens the door, they must pull the shaft of the switch forward into the tech-on-site position to disable the *Door/intrusion* alarm. See Opening the door on page 198

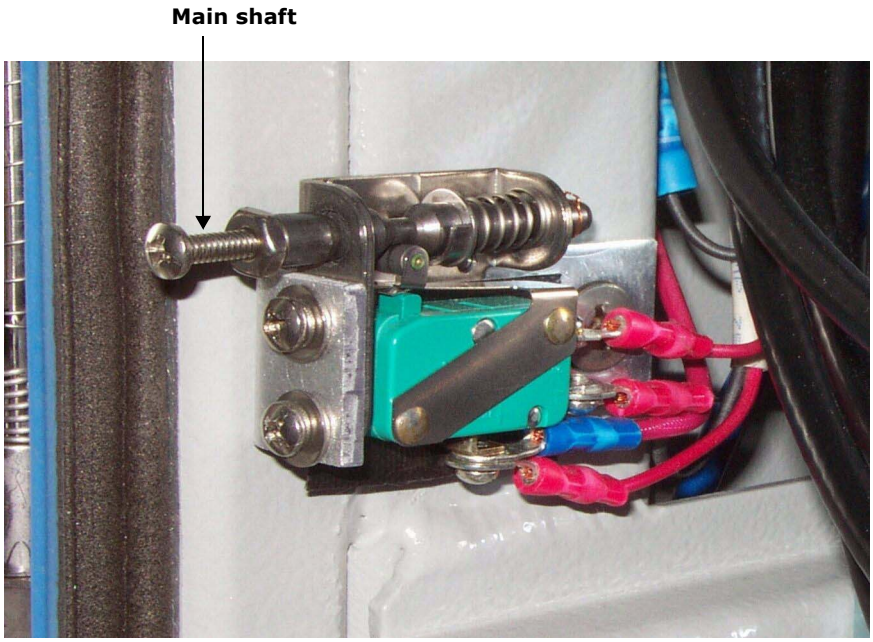


Figure 18 The tech-on-site switch

Understanding LEDs

LEDs (light emitting diodes) on the faceplates of modules and units provide status information.

LEDs can take three states:

- Unlit — Indicates the LED or corresponding component is turned off
- Green — Indicates normal operation (or TRUE)
- Red — Indicates a condition that may require attention (or FALSE).

The states of LEDs are documented in relevant sections of this chapter.

The current status of LEDs is remotely available through the AirVista network management system.

Understanding cabinet air flow

Temperature is maintained in the cabinet using a heat exchanger in the front door and a fan unit in the cabinet. There are two loops of air flow:

- The ambient loop provides air to the heat exchanger at ambient (external) temperature.
- The closed internal loop moves air through the inside of the cabinet.

The heat exchanger controls the temperature of the closed internal loop.

The heat exchanger is pre-installed. The heat exchanger is field-replaceable. Replacing the heat exchanger is not service disrupting.

See Figure 19.

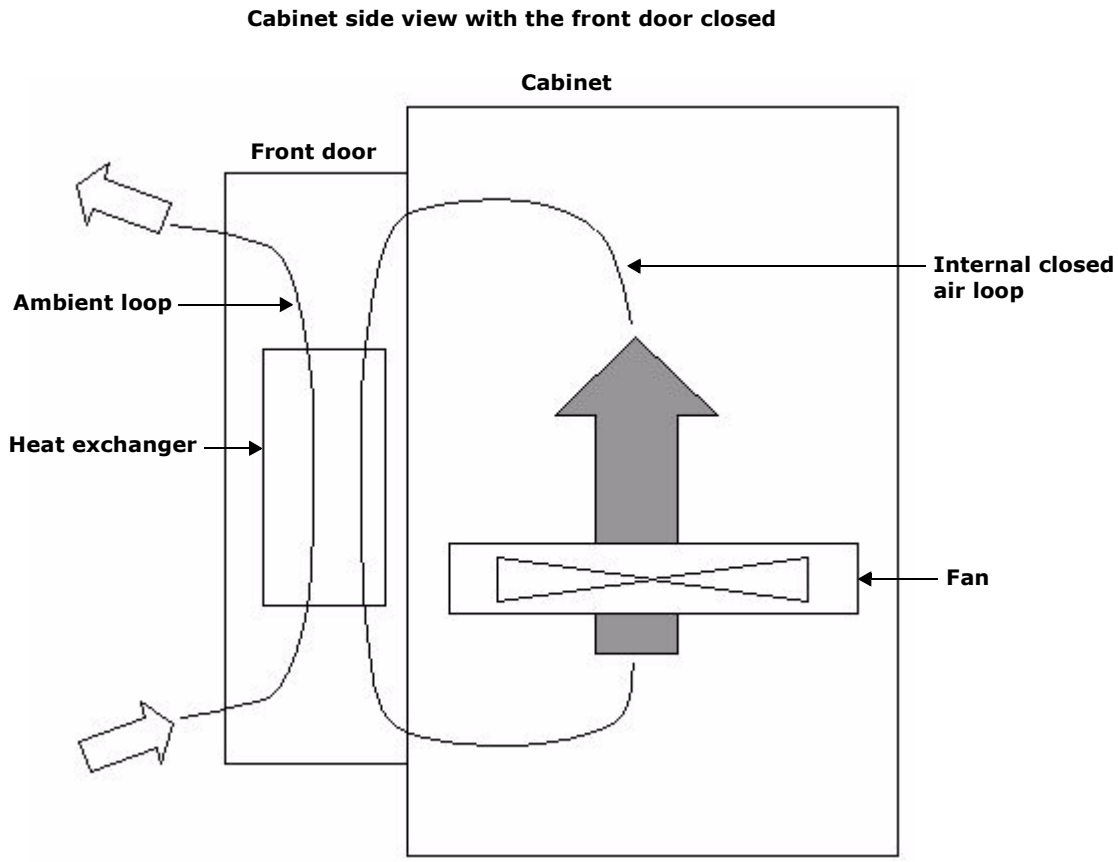


Figure 19 Two loops of air flow for temperature control

Chapter 2

Installation process

About this chapter

This chapter explains installation and commissioning and provides the process for installing the IP-RN 8000. This chapter contains the following section.

Understanding installation and commissioning

This book explains how to physically install an IP-RN 8000 and how to commission it.

- Installation covers all physical tasks, such as attaching the cabinet to the concrete pad, inserting modules, connecting power, connecting antennas, and so forth.

  Installation is performed first. See Understanding the installation process on page 40.
- *Commissioning* covers all configuration and testing that must be performed by a technician at the site. Commissioning is performed after installation is complete.

  Commissioning is performed second. See Understanding the commissioning process on page 128.

Understanding the installation process

This process explains the steps to follow when installing the IP-RN 8000. Each step consists of one or more procedures that must be performed in order and to completion before proceeding with the next step.

1. **Planning and constructing the site**

   The site planner or installation manager must read the *Airvana Cell Site Planning Guide* and plan and construct the site accordingly, ensuring that all site requirements are met. Site planning and construction must be completed before installation starts.

2. **Preparing for the installation**

   Before installation, you must read and understand all safety warnings and recommendations, and understand IP-RN 8000 GR-1089 electrostatic discharge compliance and warnings.

   See Understanding alternative installation on page 41.

   See Chapter 3, Before you install.

3. **Installing the cabinet**

   Plan the installation, prepare the cabinet, place and anchor the cabinet on the concrete pad, install power and ground conduit as appropriate for you site, and connect power and ground.

   See Chapter 4, Understanding the cabinet installation process on page 50.

4. **Connecting the backhaul**

   Thread the backhaul cables through the cabinet and wire them into the backhaul punch block.

   See Chapter 5, Understanding the backhaul installation process on page 74

5. **Installing the antennas**

   Install the Rox System cabinet seal and connect all RF and GPS antennas.

   See Chapter 6, Understanding the antenna installation process on page 86

6. **Installing the modules**

   Install all modules into the cabinet.

   See Chapter 7, Understanding the module installation process on page 104.

7. **Powering on the IP-RN 8000**

   Power on the IP-RN 8000.

   See Chapter 8, Powering the node on page 126.

The installation process is complete. You are now ready to continue with commissioning the IP-RN 8000. Go to Chapter 9, Understanding the commissioning process on page 128

Understanding alternative installation

The order of events in the installation process are flexible to some degree. For example:

- You can install the modules before connecting the antennas
- You can install the antennas before the backhaul links.

CAUTION

If you install antennas before the modules, power spikes could damage the modules.

Chapter 3

Before you install

About this chapter

This chapter explains steps to take, warnings to follow, and notices to read, before installation. This chapter contains the following sections:

Site planning and construction

Before installation, the site planner or installation manager must read the *Airvana Cell Site Planning Guide*. This guide explains all site requirements that must be met for a successful installation. These requirements include the following:

- Site construction, including the concrete pad or equivalent pad or floor that meets loading requirements
- Power supply
- Grounding infrastructure
- Backhaul link(s)
- Power and backhaul conduits
- Antenna configuration
- Global Positioning System (GPS) antenna(s)
- Primary external lightening/surge protection equipment

Planning the network

The network has to be planned. Network planning includes radio network planning, backhaul infrastructure planning, and IP address/network planning.

Receiving all shipping and materials

All expected crates and packages associated with the installation must be received at the installation site.

- All shipping containers must be present and accounted for.
- All shipping containers must be undamaged

Electro static discharge and GR-1089 compliance

The IP-RN 8000 complies with GR-1089 System Level Electrostatic Discharge with the door closed.

When the front door is open, an electro static discharge wrist strap must be worn and connected to the ESD jack on the Antenna Interface Unit prevent potential service disruption.

Wear an ESD strap () and connect the strap to the ESD jack in the Antenna Interface Unit whenever the front door is open. See Understanding the Antenna Interface Unit module on page 17.

Safety Recommendations and Warnings

The guidelines that follow help to ensure your safety and to protect the IP-RN 8000. These guidelines may not address all potentially hazardous situations in your working environment, so be alert, and exercise good judgement at all times.

- Keep the chassis area clear and dust-free before, during, and after installation.
- Keep tools away from walk areas where people could fall over them.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which may become caught in the chassis.
- Wear safety glasses if you are working under any conditions that may be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.

Radio frequency radiation exposure limits

Upon installation, this product is required to comply with the requirements of Federal Communications Commission 47CFR 1.1310, Radio frequency radiation exposure limits. Care must be taken by the installer to insure that the antenna chosen along with its installation position and orientation does not violate these limits.

Lithium battery warning

The BIO/SC module contains a lithium battery to which the following warning applies:

Caution: there is a danger of explosion if the battery is incorrectly replaced. Replace the batter only with the same type or with an equivalent type that is recommended by the manufacturer. Discard used batteries according to the manufacturer’s instructions.

The same warning in French:

Attention: Il y a danger d’explosion s’il y a remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du même type ou d’un type recommandé par le constructeur. Mettre au rébut les batteries usagées conformément aux instructions du fabricant.

Maintaining Safety With Electricity

Before working on a chassis or working near power supplies, unplug the power cords on an AC-powered system. On a DC-powered system, disconnect the power at the circuit breakers. Follow these guidelines when working on equipment powered by electricity:

- Locate the emergency power-off switch for the area in which you are working. If an electrical accident occurs, you can quickly turn off the power.
- Do not work alone if potentially hazardous conditions exist anywhere in your work space.
- Never assume that power is disconnected from a circuit: always check the circuit.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, or missing safety grounds.
- If an electrical accident occurs:
  - — Use caution. Do not let yourself become a victim.
  - — Disconnect power from the system.
  - — If possible, send another person to get medical aid. Otherwise, assess the condition of the victim then call for help.

Install the IP-RN 8000 following local, national, or international electrical codes:

- United States — National Fire Protection Association (NFPA70), United States National Electrical Code.
- Canada — Canadian Electrical Code, Part 1, CSA C22.1.
- Other countries — International Electromechanical Commission (IEC) 364, Part 1 through Part 7.

Warning Definition

Warning means danger. You are in a situation that could cause bodily injury or death. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Product Disposal

Ultimate disposal of this product should be handled according to all national laws and regulations.

Lightning Activity Warning

Do not work on the system or connect or disconnect cables during periods of lightning activity.

Jewelry Removal Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

Power Supply Warning

Do not touch the power supply when the power cord is connected. Line voltages are present within the power supply even when the power switch is off and the power cord is connected.

Power Supply Disconnection Warning

Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units.

Power Disconnection Warning

Before working on a system that has an On/Off switch, turn OFF the power and unplug the power cord.

Grounded Equipment Warning

This equipment is intended to be grounded. Ensure that the IP-RN 8000 is connected to earth ground during normal use.

Installation Warning

Read the installation instructions before you connect the system to its power source.

Notices

Part-68 Notice

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. On the right hand side of the Backhaul Switch Panel of this equipment is a label that contains, among other information, a product identifier in the format US: ARVDENANRN8000. If requested, this number must be provided to the telephone company.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service might be required. If advance notice is not practical, the telephone company notifies you as soon as possible. Also, you are advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, please contact Airvana at 1-866-344-7437 for repair and warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment from the network until the problem is resolved.

This equipment uses Uniform Service Order Code (USOC) jack number RJ48H.

Chapter 4

Installing the cabinet, power, and ground

About this chapter

This chapter explains in the procedures for installing the chassis and contains the following sections:

Understanding the cabinet installation process

This process explains all steps and procedures to follow when installing the IP-RN 8000 cabinet at the cell site, connecting the main ground rods, and connecting power. Two people are required for cabinet installation.

1. **Understanding outdoor and indoor installation**

   Read these sections to understand outdoor and indoor installation requirements.

   - See Understanding outdoor installation on page 51.
   - See Understanding indoor installation on page 52.

2. **Planning conduit and grounding installation order**

   Plan the order in which you install conduit and connect the grounding wires.

   See Planning conduit and grounding installation on page 53

3. **Preparing for cabinet installation**

   Unpack the cabinet, remove two access panels, and unbolt the cabinet from its shipping palette.

   a. See Unpacking the cabinet from its shipping container on page 54.
   b. See Removing access panels on page 56.
   c. See Unbolting the cabinet from its palette on page 57.

4. **Anchoring the cabinet**

   Place the cabinet onto its concrete pad, bolt it in place, and reinstall the left side cable access panel.

   a. See Placing the cabinet on the concrete pad on page 58.
   b. See Bolting the cabinet in place on page 62.
   c. See Re-installing the left side access panel on page 63

5. **Removing the power terminal access panel**

   See Removing the power terminal access panel on page 204.

6. **Installing power and backhaul cables/conduit and closing right side access panel**

   This section provides general instructions for routing power and backhaul cables into the cabinet and installing external conduit. Cable and conduit installation methods and materials vary from site to site and must be performed according to all local codes and practises.

   See Routing power and backhaul cables into cabinet and closing right side access panel on page 64

7. **Connecting power and grounding**

   Connect site power to the IP-RN 8000, grounding the IP-RN 8000, and testing power flow to the IP-RN 8000 and to its internal components.

   a. See Connecting the power supply on page 65
   b. See Grounding the cabinet on page 67
   c. See Testing primary power on page 69

This process is complete. You must connect the backhaul link(s). Go to Understanding the backhaul installation process on page 74.

Understanding outdoor installation

This chapter provides a detailed process for outdoor cabinet installation. Additional detailed site planning and construction requirements are provided in the *Airvana Cell Site Planning Guide*. Also adhere to the following when planning the site.

Mounting pad

The procedures in this chapter refer to constructing a concrete pad onto which the cabinet is installed. Concrete is recommended, but you can also install the cabinet onto other suitable pads or frameworks. For example, you can install onto steel rails. You must ensure the mounting pad/structure meets all loading and seismic requirements.

Airvana supplies a rubber insulation pad in the cabinet shipping crate that must be installed between the mounting surface and the cabinet.

Loading

The mounting pad/structure must be able to support the load of the cabinet when fully populated with all optional equipment. Loading is a function of the weight and the footprint dimensions.

- A fully populated cabinet weighs 630 pounds.
- The footprint dimensions are: width: 30.5 inches; depth 39 inches.

Lifting - overhead space

There must be sufficient space above the cabinet to lift it into place. The cabinet is 59.5 inches in height.

Once the cabinet is disconnected from its shipping palette, it can only be moved by attaching a sling to the lifting hooks on the top and using a crane (or other lifting device capable of handling the cabinet's unloaded weight of 500 pounds). There must be sufficient headroom above the cabinet to attach a sling and a crane and then to lift the cabinet into place. The sling must allow five feet between the crane hook and the cabinet top. See Placing the cabinet on the concrete pad on page 58.

Earthquakes

The mounting surface onto which the cabinet is installed must able to withstand local earthquakes. The surface must be constructed according to local earthquake codes to withstand seismic events of the local seismic zone (seismic zone 1, 2, 3, or 4).

Mounting hardware

You must supply the mounting hardware:

- Four anchor bolts — 1/2 inch bolts that comply with the ASTM specification with a minimum protrusion above the floor of 1 1/8 inches
- Four flat washers, lock washers, and nuts

Airvana supplies a cardboard template that indicates the position of the anchor bolts. This template is included in the cabinet's shipping crate.

Understanding indoor installation

For indoor installation, you can follow the outdoor installation process, but you must adhere to the following requirements.

Loading

The building and floor must be able to support the load of the cabinet when fully populated with all optional equipment. The loading is a function of the weight and the footprint dimensions.

- A fully populated cabinet weighs about 630 pounds.
- The footprint dimensions are: width: 30.5 inches; depth 39: inches.

Lifting - overhead space

There must be sufficient space above the cabinet to lift it into place. The cabinet is 59.5 inches in height.

Once the cabinet is disconnected from its shipping palette, it can only be moved by attaching a sling to the lifting hooks on the top and using a crane (or other lifting device capable of handling the cabinet's unloaded weight of 500 pounds). There must be sufficient headroom above the cabinet to attach a sling and a crane and then to lift the cabinet into place. The sling must allow five feet between the crane hook and the cabinet top. See Placing the cabinet on the concrete pad on page 58.

Earthquakes

The building/structure in which the cabinet is installed must able to withstand local earthquakes. The building/structure must be constructed according to local earthquake codes to withstand seismic events of the local seismic zone (seismic zone 1, 2, 3, or 4).

Mounting

You must supply the mounting hardware:

- Four anchor bolts — 1/2 inch bolts that comply with the ASTM specification with a minimum protrusion above the floor of 1 1/8 inches
- Four flat washers, lock washers, and nuts

Airvana supplies a cardboard template that indicates the position of the anchor bolts. This template is included in the cabinet's shipping crate.

Planning conduit and grounding installation

It is important to plan the order in which you install conduit and connect the grounding coils to prevent difficulty.

The difficulty could arise when:

- Installing the second conduit after the first conduit is in place. The access panel could be difficult to remove if inflexible conduit is already installed.
- Installing any conduit after the grounding coils are connected without slack. If the grounding coils are installed without slack, it may be difficult to back the access panel away from the cabinet in order to attach the conduit.

The installation process documented here assumes that you can install power cables and conduit and backhaul cables and conduit at the same time. This only requires removing the access panel once. If you need to install these items at different times, you might want to take the following steps:

- When you connect the grounding coils, run the wires straight out from the cabinet side for about one foot to enable the access panel to be backed away from the cabinet later for conduit installation.
- When you install the first conduit, install a stub conduit for the second opening. Make sure the stub conduit is plugged properly to seal the inside of the cabinet from damage from the environment. This prevents the need to open the access panel later, which might requiring disassembling the first conduit.

NOTE

This installation process does not specify the type of conduit you use or the manner of installation. The site planner must specify all conduit according to local standards and codes.

CAUTION

Improper selection or installation of conduit may compromise the EMI/RFI integrity of the system.

Unpacking the cabinet from its shipping container

This procedure explains how to unpack the cabinet from its shipping container.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

Requirements

- 5/8 inch open ended wrench
- Slotted screwdriver

Procedure

1. Familiarize yourself with the shipping crate.

   The IP-RN 8000 is shipped as follows: it is bolted to a palette, covered with a plastic bag, and wooden sides and a top are attached with metal snaps. Additional material may be shipped in boxes tucked beneath the cabinet door.

2. Using a slotted screwdriver, remove the metal snaps that hold the wooden top of the shipping cabinet in place.

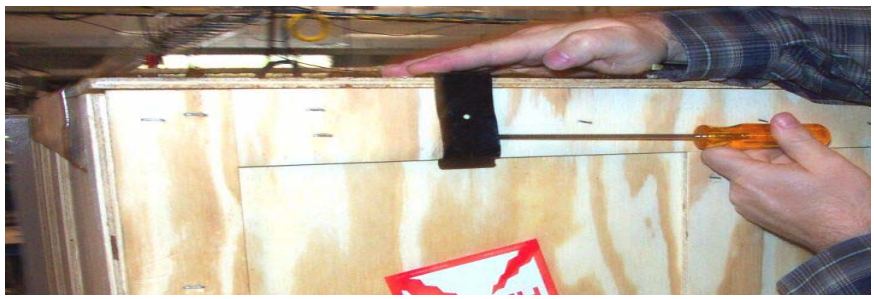
   To remove the snaps:

   a. Insert the screwdriver behind the half of the snap that has a wedge shaped relief for it, and hold the other half of the snap against the cabinet with your open hand.

   b. Gently pry the snap away from the cabinet until it releases.

CAUTION

Hold the snap as you pry it off. Otherwise, the snap may fly into the air when it is pried off.



3. Lift the wooden top off.

4. Using the same procedure, carefully remove the snaps holding the shipping crate's wooden sides in place.

CAUTION

As you remove the snaps, the wooden sides will fall off. Hold the sides in place as you remove the snaps.

5. Remove the plastic bag covering the cabinet.
6. Remove any boxes that may have been tucked beneath the cabinet front door.

   A cardboard template is tucked in the crate that can be used to locate the anchor bolts you embed in the concrete pad when the pad is poured.

This procedure is complete. Go to Removing access panels on page 56

Removing access panels

This procedure explains how to remove the left-side access panel and to back the right side cable access panel away from the cabinet. Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

Requirements

- 5/32 inch, tamper-resistant hex driver
- 17 mm open ended wrench

Procedure

1. Locate the left side access panel. See Figure 3 on page 5.
2. Using a 5/32 inch, tamper-resistant hex driver, remove the 12 screws and rubber washers holding the *left side access panel* in place, being careful not to let the access panel fall when the final screws are removed.

CAUTION

Access panels must be handled carefully. If they are bent they may not form a proper seal with the cabinet when they are re-installed. An intact seal on the inside edge of the access panel is required to ensure external environmental conditions are sealed out.

3. Set aside the 12 access panel screws and washers.

   The screws and washers will be required for re-installing the access panel after the cabinet is bolted to the concrete installation pad.
4. Locate the right side cable access panel. See Figure 3 on page 5.
5. Remove the bubble wrap covers from the two grounding coils. See Figure 3 on page 5.
6. Uncoil about one foot of each grounding coil starting at the cabinet end of the coil.

   Straightening out the cabinet end of the coils will enable the right side access panel to be backed away from the cabinet.
7. Use an 17 mm open ended wrench to loosen the two nuts where the coils feed through the access panel.

   Loosening these nuts enables the access panel to slide down the coils as it is backed away from the cabinet.
8. Using a 5/32 inch, tamper-resistant hex driver, remove the 12 screws and rubber washers holding the *right side access panel* in place.
9. Set aside the 12 access panel screws and washers.

   The screws and washers will be required for re-installing the access panel after the cabinet is bolted to the concrete installation pad.
10. Carefully pull the access panel away from the cabinet, feeding the straightened grounding coils through their holes in the access panel.

This procedure is complete. Go to Unbolting the cabinet from its palette on page 57.

Unbolting the cabinet from its palette

This procedure explains how to unbolt the cabinet from its shipping palette. At this point, the left side access panel is removed and the right side access panel is backed away from the cabinet. You now have access to the four bolts that attach the cabinet to the palette.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

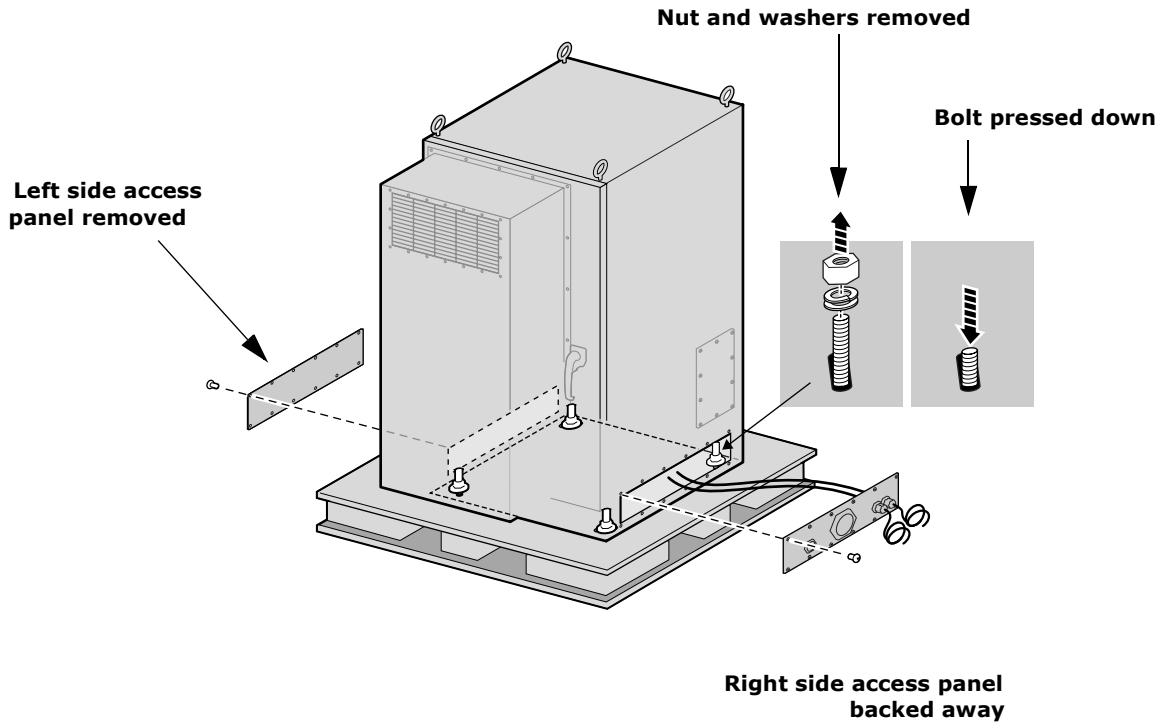
Requirements

- 5/8 inch open ended wrench

Procedure

1. Using a 5/8 inch open-end wrench, remove the four nuts, lock washers and washers that secure the cabinet to the pallet.

   Access the nuts through the side access panels you have just removed.



2. Set the four nuts, washers, and lock washers aside.

   These may be used to bolt the cabinet to the concrete pad. You may also use other nuts and washers that are appropriate for the type of anchor bolts you have embedded in the concrete pad.

3. Physically push down on each bolt forcing it out of the bottom of the pallet.

CAUTION

Do not open the door, or push on, or lean against the cabinet. The cabinet cab can tip over and cause death, injury, and equipment damage. Do not move the palette after removing the anchor bolts.

This procedure is complete. Go to Placing the cabinet on the concrete pad on page 58.

Placing the cabinet on the concrete pad

This procedure explains how to place the cabinet on its insulation pad and concrete pad or floor.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

NOTE

This step requires two people to ensure safety and to protect equipment from damage.

Requirements

- Insulation pad shipped with the IP-RN 8000
- Four eye bolts that were shipped with the IP-RN 8000 (used to lift the cabinet)
- Crane sufficient to safely lift the 500 pound IP-RN 8000

Procedure

WARNING

The IP-RN 8000 is now disconnected from the palette. Do not open the door, or push on or lean against the cabinet as it may tip over causing equipment damage, injury, or death. Do not move the palette.

1. Lay the insulation pad that was shipped with the IP-RN 8000 on the concrete pad.

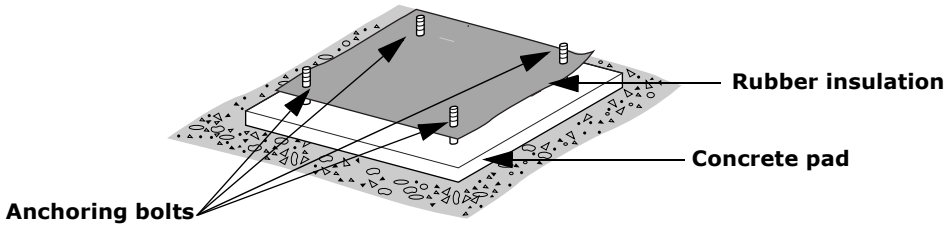
   Ensure the four bolts embedded in the concrete pad or floor stick up through the holes at the corners of the insulation pad. Ensure the pad lays flat and is not wrinkled or folded.

CAUTION

Proper placement of this pad is essential to prevent corrosion.

CAUTION

The quality of the concrete must meet 3000-pound per square inch (psi) concrete specifications and should be at least 8 inches thick to achieve the design requirement for wind and seismic loading.



2. Ensure the cabinet door is closed and latched.

   See Closing the door on page 199.

3. Screw the four eye bolts into the top of the cabinet.

   Ensure the eye bolts are screwed in snugly.

   The eye bolts are shipped with the cabinet.

WARNING

Failure to screw the eye bolts in all the way could cause them to fall out during lifting and this could cause death, injury, or equipment damage.

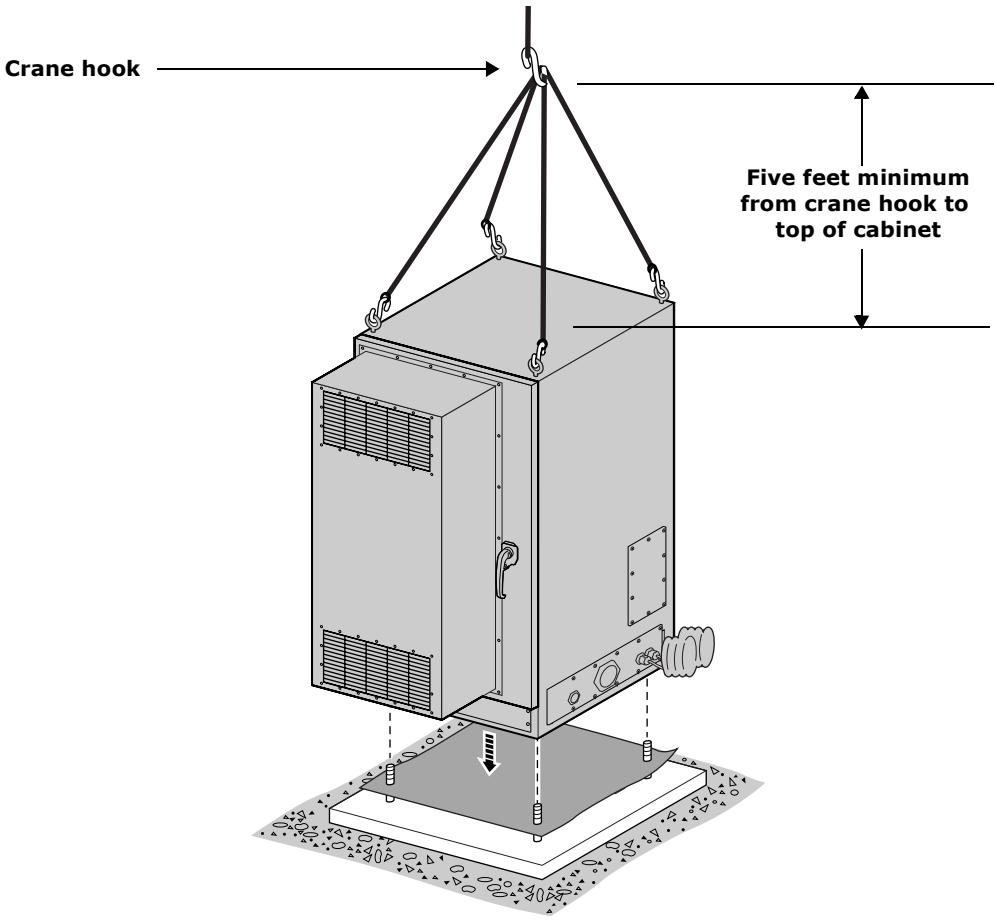
4. Use the four lifting hooks on the top of the enclosure to attach the IP-RN 8000 to a crane or proper lifting device.

WARNING

Use of improper lifting equipment can result in personal injury or death and may result in damage to the IP-RN 8000.

WARNING

There must be a minimum of five feet clearance between the top of the cabinet and the crane hook to ensure shear forces do not bend and break the eye bolt hooks. Failure to provide this clearance could result in the cabinet dropping from the crane causing personal injury or death and equipment damage.



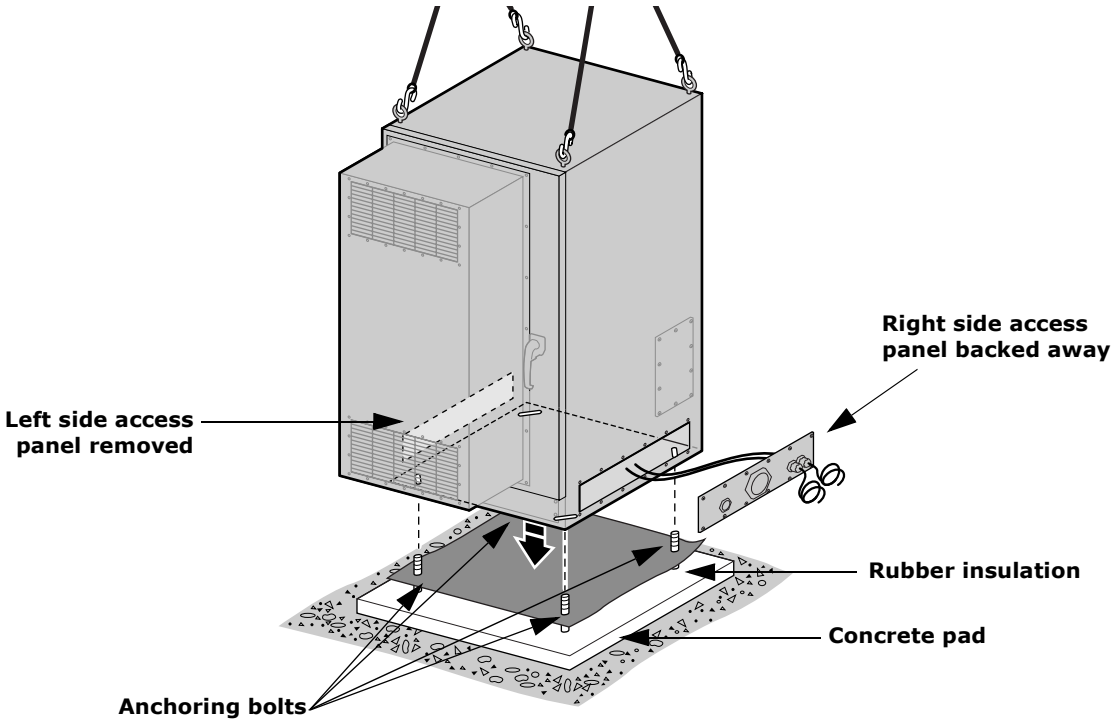
NOTE

In the following steps, one person should operate the lift and the other person should hold the backed away access panel up and out of the way and help align the cabinet with the four anchor bolts in the concrete pad as the cabinet is lowered into place.

CAUTION

When lowering the cabinet onto the pad, take special care not to damage the threads on the anchor bolts. These four anchor bolts are essential to a successful installation.

5. With one person operating the crane and another holding the access panel out of the way and aligning the cabinet as the cabinet is lowered, lift the IP-RN 8000 off the pallet and lower it onto the concrete pad, ensuring the following:
   - The four corner bolts stick up through the four bolt holes in the base of the enclosure.
   - No part of the IP-RN 8000 enclosure has direct contact with the concrete. The insulation pad should be visible all the way around the cabinet.



This procedure is complete. Go to Bolting the cabinet in place on page 62.

Bolting the cabinet in place

This procedure explains how to bolt the cabinet onto the concrete insulation pad.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

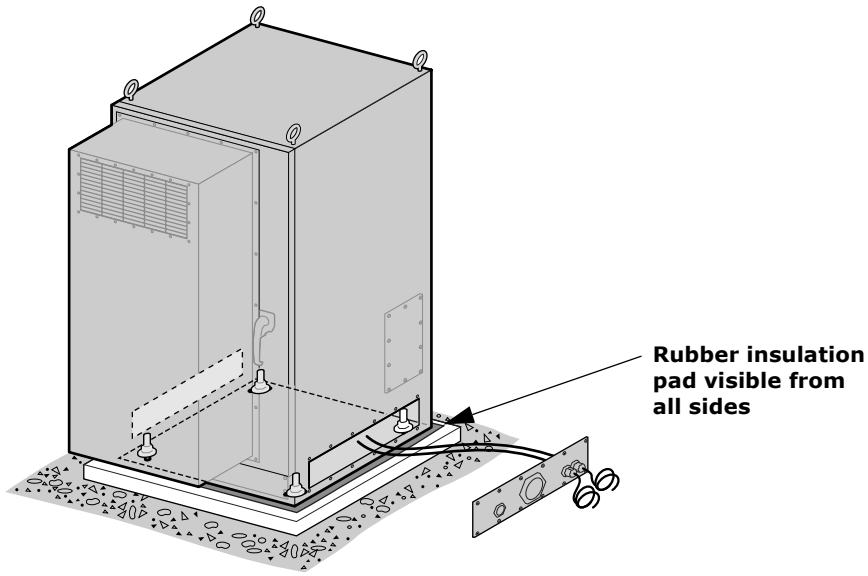
Requirements

- Open ended wrench of appropriate size for your anchor bolt nuts
- Four washers, lock washers, and nuts for the anchor bolts embedded in the concrete pad

  These are not provided by Airvana but are specified by the site planner.

Procedure

1. Look through the removed left side access panel and the backed away right side access panel and find the four anchoring bolts sticking up from the concrete pad through holes in the cabinet base.



2. Using the four washers, lock washers and nuts, thread a washer, lock washer and nut onto each anchor bolt.
3. Use an appropriately sized open ended wrench to tighten the four nuts.

This procedure is complete. Go to Re-installing the left side access panel on page 63

Re-installing the left side access panel

This procedure explains how to re-install the left side access panel. Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

The right side access panel will remain backed away from the cabinet in order to install power and backhaul cables and conduit.

Requirements

- 5/32 inch tamper-resistant hex driver
- Thread tapping set with 1/4-20 bit for 3/4 depth

Procedure

1. Retrieve the 12 tamper-proof screws and rubber washers that you set aside when removing the panel.
2. Ensure the left side access panel is undamaged:

   Examine the inside edge of the access panel. The gasket on the inside edge must be intact to ensure a proper seal.
3. Position the access panel and start all screws by hand. See Understanding access panels on page 9.

   Thread the rubber sealing washer on the screw shank before inserting it in the access panel screw hole.

Screws should be started by hand. It is possible to damage the thread in the cabinet if you use a hand tool or a power tool. Damaged threads must be repaired or the cabinet will be improperly sealed and the IP-RN 8000 can be damaged. *Use a thread tapping set to fixed damaged threads.* If the thread is damaged beyond repair, contact Airvana.

4. Use a torque wrench with a 5/32 inch tamper-resistant hex drive bit set to 18 inch-pounds to tighten all screws evenly.

If access panels screws are not tightened with the correct torque, water intrusion may occur causing equipment malfunction.

At this point, the cabinet is installed on the concrete pad and the left access panel is re-installed.

This procedure is complete. Go to Routing power and backhaul cables into cabinet and closing right side access panel on page 64.

Routing power and backhaul cables into cabinet and closing right side access panel

At this point the cabinet is secured to its concrete pad, and the right side cable access panel is backed away from the cabinet. This is an appropriate time to thread the power cable into the cabinet and install the power conduit and to thread the backhaul cable into the cabinet and install its conduit according to your site planner's specifications. This procedure explains in general how to perform these steps, but the details of conduit installation are dependent on your site planner's specifications.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

- If it is not possible to schedule technicians to install power and backhaul cables at this time, you must re-install the right side access panel to ensure the cabinet is sealed. See Re-installing the right side cable access panel on page 207.
- Later procedures assume the power and backhaul cables are available inside the cabinet.

Power supply must meet IP-RN 8000 specifications. See Power specifications on page 193.

Requirements

Tools required depend on the particular grounding methods and materials specified by the site planner for this particular site.

Procedure

1. Remove the power terminal access panel. See Removing the power terminal access panel on page 204.
2. Thread the power cable through its conduit and attach the power conduit to the power cable access port on the right side access panel. To locate the power cable access port, see Right side view with the front door open on page 5.
3. From the front of the cabinet, reach through the power terminal access panel area and grip the power cable.
4. Pull enough power cable forward to the front of the cabinet so that you will be able to attach the cable to the power terminal.

   For information on the power terminal, see Understanding the cabinet font view on page 3.

5. Thread the backhaul cable through its conduit and attach the backhaul conduit to backhaul cable port on the right side cable access panel. To locate the backhaul cable port, see Right side view with the front door open on page 5.

The backhaul cable could consist of one to four separate cables. See Understanding the backhaul installation process on page 74

6. Reach through the power terminal access panel area and grip the backhaul cable(s).
7. Pull five feet of backhaul cable(s) forward to the front of the cabinet.
8. Re-install the right side cable access panel. See Re-installing the right side cable access panel on page 207.

This procedure is complete. Go to Connecting the power supply on page 65.

Connecting the power supply

This procedure explains how to connect the power wires to the power terminals.

You can optionally connect a third wire ground if your site planner specifies it. See Understanding surge protection and grounding on page 33.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

This procedure assumes the power cables are already threaded inside the cabinet. See Routing power and backhaul cables into cabinet and closing right side access panel on page 64.

Power supply must meet IP-RN 8000 specifications. See Power specifications on page 193.

Requirements

- 3/16 inch hex wrench

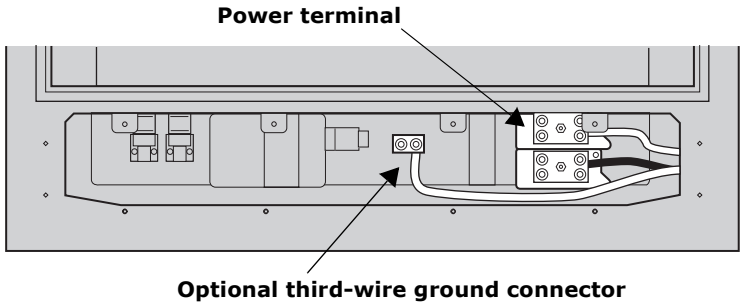
Procedure

1. Open the main circuit breaker to disable power flow through the power cable. *Break the circuit so that there is no power on the power cable.*

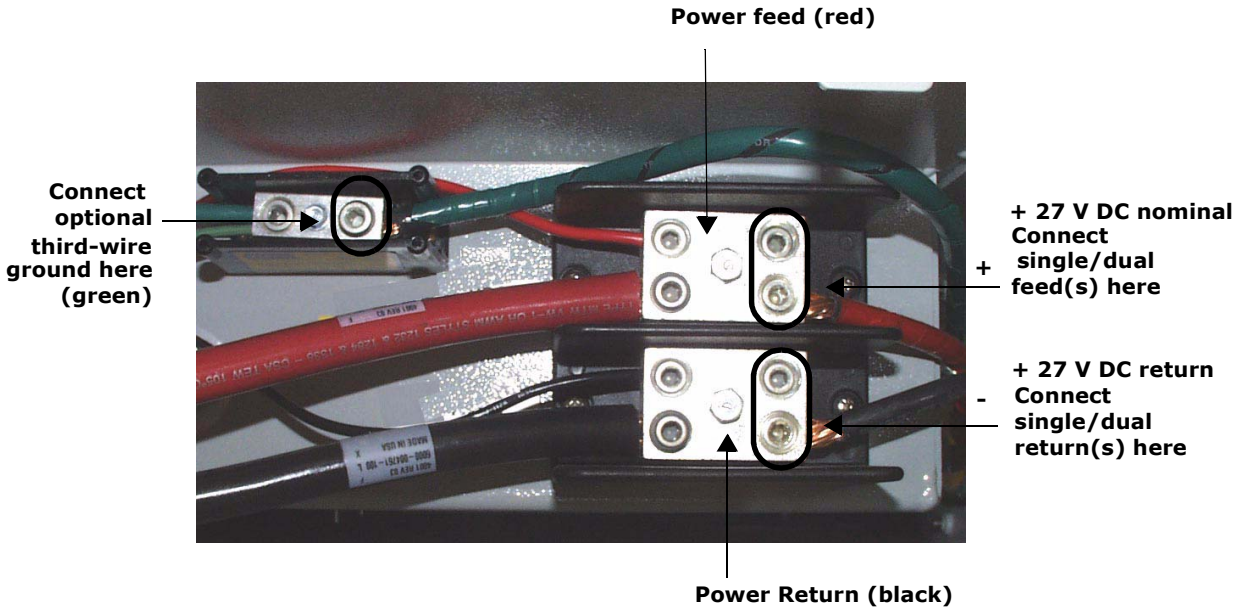
> **CAUTION**
>
> Failure disconnect the power from the power cable before connecting the power cable to the IP-RN 8000 can result in injury or death.

2. Flip all power switches on the power distribution unit (PDU) to the right. See Understanding the Power Distribution Unit on page 27.

   This turns off power to the IP-RN 8000
3. Remove the power terminal access panel, if it is not already open. See Removing the power terminal access panel on page 204.
4. Locate the power terminal and optional third-wire ground terminal.



5. Examine the power terminal to determine where to connect power wires.



6. Strip the insulation from the power cable wires or prepare the wire ends as appropriate for the cable type and following all relevant codes and practices.
7. Using the 3/16 inch hex wrench, open the hex nuts on the power feed and return terminals.

   Open two hex nuts on each terminal if you are using a dual-wire cable.

   (Optionally, if you are using a three wire cable with a ground wire, use the hex wrench to open the ground hex nut.)
8. Insert the power wires (and optional ground wire if appropriate) and tighten the hex nuts snugly.
9. Visually inspect the power terminal access area for any loose connections or components.

CAUTION

All connections must be tight and all components secured before continuing. Loose connections or components can cause short circuits and injure or kill nearby persons and damage equipment.

This procedure is complete. Go to Grounding the cabinet on page 67

Grounding the cabinet

This procedure explains how to connect the two main grounding coil wires to a required external grounding infrastructure.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

WARNING

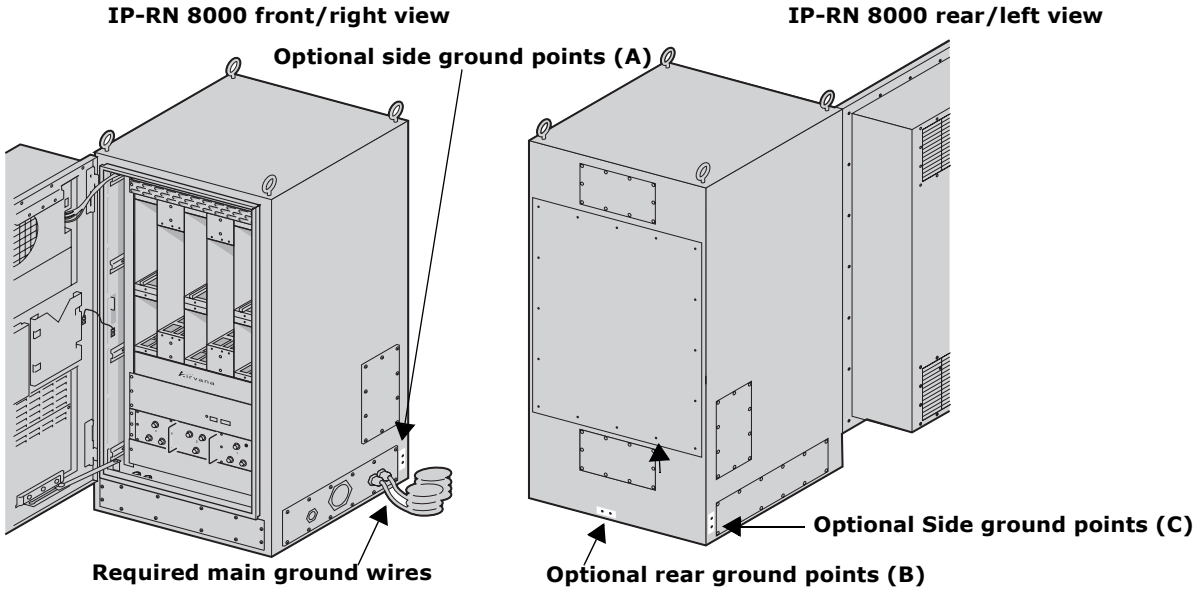
Grounding the IP-RN 8000 correctly according to local conditions and following all applicable codes is required. Failure to ground correctly can result in damage to the IP-RN 8000 and danger to nearby person. See Understanding surge protection and grounding on page 33.

Requirements

Tools required depend on the particular grounding methods and materials specified by the site planner for this particular site.

Procedure

1. Locate the two ground wires protruding from the lower right hand side of the cabinet.



2. Connect both ground wires to the site ground rod.

   The method of connecting the grounding wires to the site grounding system varies. The particular method you use depends on many factors. The rods can be connected to separate grounding rods or external grounding plates. The connection can be welded, terminal lugs can be used, or a different type of connection can be used. Follow local codes and practise as appropriate for local conditions.

NOTE

- The grounding coils can be trimmed to an appropriate length. Do not cut them too short as they are difficult to replace.
- If you will need to remove the right side access panel after the grounding coils have been connected to the site grounding infrastructure, consider running the ground coil wires straight out from the cabinet for one foot. This enables backing the access panel away from the cabinet without disconnecting and straightening out the grounding coils. See Planning conduit and grounding installation on page 53.

3. Optionally (and in addition to main ground connection), connect the site ground system to the optional three pairs of grounding contacts (see A, B, and C in the above figure).

   - Two ground points are on the bottom rear of the IP-RN 8000 enclosure
   - Two ground points are located next to the access panels on the right rear of the IP-RN 8000.
   - Two ground points are located next to the access panels on both the left rear of the IP-RN 8000.

   These optional ground points are threaded double hole lugs. The thread is 1/14-20.

This procedure is complete. Go to Testing primary power on page 69.

Testing primary power

This procedure explains how to test whether power is applied to the IP-RN 8000, whether the voltage is at the correct nominal level at the cabinet's power terminals, and whether power is distributed internally.

Be sure you have read and understood Understanding the cabinet installation process on page 50 before continuing.

Take all appropriate safety precautions before closing the main circuit breaker and turning on power. Failure to do so can result in personal injury and equipment damage.

Do not perform this procedure in the raid or injury or death may occur.

Requirements

No tools are required.

Procedure

1. Open the front door and visually examine the compartment for loose wires or components.

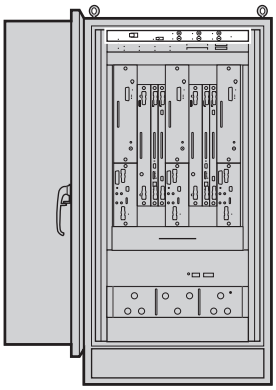
All connections must be tight and all components secured before continuing. Loose connections or components can cause short circuits and injure or kill nearby persons and damage equipment.

2. Pull the backhaul cable(s) ends forward and through the power terminal access panel.

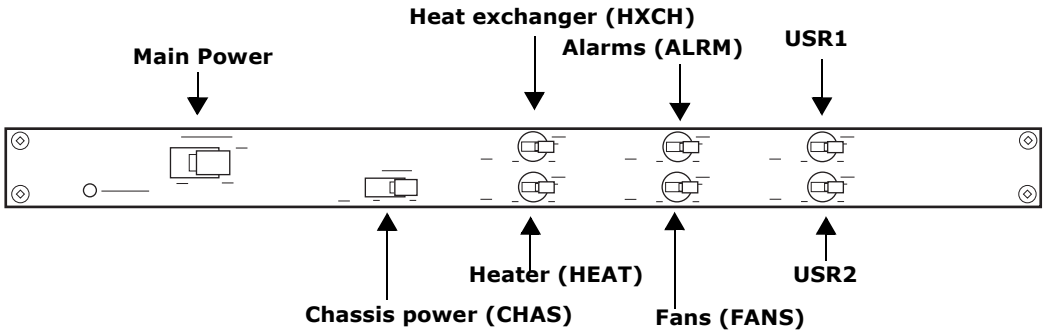
Pulling the backhaul cable ends out of the cabinet through the power terminal access panel is necessary to prevent short circuits, to prevent danger, and protect equipment.

3. Ensure the power supply at the power terminal is as the correct voltage level.
   a. Connect a volt meter to the power terminal by connecting the positive volt meter lead to the positive cabinet power terminal and the negative lead to the negative terminal.
   b. The volt meter should show voltage at 27 V DC nominal.
   c. Disconnect the volt meter.

4. Locate the Power Distribution Unit (PDU).



5. Ensure all power switches on the PDU panel are set to **OFF** (flipped to the right).



6. Close the external circuit breaker to apply power to the IP-RN 8000.

NOTE

This circuit breaker is external equipment that is not provided by Airvana.

---

7. Flip the *Main Power* switch on the PDU to the left to enable main power.

   The PDU's *Main Power Status* LED lights green indicating power flow. If the LED does not light green, open the external circuit breaker to disable power application to the cabinet and contact Airvana.

   For information about the PDU, see Understanding the Power Distribution Unit on page 27.

8. Flip the *ALRM* power switch on the PDU to the left to enable power application to the Alarm Unit and to the Heat Exchanger controller.
   a. To test whether power is applied to the Alarm Unit, press in the *Alarm Test* button at the lower left corner of the Alarm Unit.

      All 20 alarm LEDs light red indicating power application. If the LEDs do not light red, contact Airvana.

      For information about the Alarm Unit, see Understanding the Alarm Unit on page 29.
   b. To test whether power is applied to the Heat Exchanger controller, watch the Heat Exchanger LEDS.

      During a period of initialization that may last several minutes, the LEDs blink. Then the top two LEDs light green and the bottom two light RED. Contact Airvana if the LEDs do not light.

      For information about the Heat Exchanger LEDs, see Understanding cabinet right side view on page 5.
9. Flip the *FANS* switch to the left on the Power Distribution Unit.

   To test whether power is applied to the Fan Unit, listen for the sound of the fan and/or carefully insert your hand into a module slot and feel a breeze moving upwards. If the Fan Unit is not operative, contact Airvana.

If you place your hand in an empty module slot to try to feel a breeze to verify that the fan is operating, do not allow your fingers or hand to move below the module slots or you may touch moving fan blades and injury can occur.

   For information about the Fan Unit, see Understanding the Alarm Unit on page 29.
10. Flip the *HXCH* switch to the left to apply power to the heat exchanger.

    All four Heat Exchanger LEDs light green.
11. Flip the *Main Power* switch to the right to turn off power application to the IP-RN 8000.
12. Open the main circuit breaker to disconnect the IP-RN 8000 from its power source.

Ensure you disconnect the IP-RN 8000 from its power source by opening its external main circuit breaker before doing anything else. Failure to do so could result in personal injury or equipment damage.

This procedure is complete. Go to Understanding the backhaul installation process on page 74.

Chapter 5

Connecting the backhaul

About this chapter

This chapter explains how to thread the backhaul link(s) through the cabinet and wire the backhaul(s) into the backhaul punch block. This chapter has the following sections:

Understanding the backhaul installation process

This process explains all steps and procedures to follow when installing the backhaul.

During the commissioning phase, backhaul links are tested with loopback tests. These tests require installing an external loopback on each link. If you plan to install the loopback into the punch block itself, the backhaul will have to be un-installed, then re-installed after the loopback test. In this case, it may make sense to postpone backhaul installation until after the loopback tests are performed. For more information, see Chapter 13, Loopback testing backhaul links.

1. **Ensuring all grounding and surge protection equipment is in place**

   Do not perform any work on the IP-RN 8000 until you have installed grounding and external surge protection equipment.

   See Understanding surge protection and grounding on page 33.

2. **Ensuring the backhaul cable is already installed into the cabinet base**

   See Routing power and backhaul cables into cabinet and closing right side access panel on page 64.

3. **Removing the punch block access panel**

   The punch block access panel and the power terminal access panel must be removed to gain access to the punch block.

   See Removing the punch block access panel on page 76.

4. **Routing backhaul to the backhaul punch block**

   The backhaul is threaded from the bottom of the cabinet in the power terminal access panel area, through cinch blocks, and up the inside of the left side of the cabinet to the backhaul punch block.

   See Routing backhaul to the backhaul punch block on page 77.

5. **Connecting backhaul to backhaul punch block**

   The backhaul is wired into the backhaul punch block.

   See Wiring backhaul to the backhaul punch block on page 79.

6. **Re-installing access panels**

   The backhaul punch block access panel and the power terminal access panel are re-installed.

   See Re-installing the access panels on page 83.

This procedure is complete. This process is complete. You must connect the antennas. Go to Understanding the antenna installation process on page 86.

Understanding backhaul links

The backhaul connects the IP-RN 8000 to the IP-RNC 8500 and carries user traffic (access terminal to Internet) and management traffic (AirVista to IP-RN 8000). See Understanding the backhaul punch block and switch on page 32.

Backhaul deployment/installation options are as follows:

- One to four T1/E1 leased lines

  The combined total bandwidth of the T1/E1 leased lines is available for backhaul traffic.

  The backhaul switch makes the total T1/E1 backhaul bandwidth available to whichever BIO/SC is currently active. (In non-redundant systems, there is only one BIO/SC, typically in slot 3).

- Or, one or two 10/100 Mbit/sec Ethernet links

  The bandwidth of a single Ethernet is available at a time for backhaul traffic because the Ethernets are not switched between the BIO/SCs like T1/E1s Instead the Ethernet link(s) pass directly through the backhaul switch and are directly connected to each BIO/SC module(s).

  If you are using Ethernet backhauls on a redundant system with two Digital Module Kits, *you must install two Ethernet backhauls.*

  Non-redundant digital module kits require *only a single Ethernet backhaul.*

The backhaul cable(s) installed should have connectors on the far end that are appropriate for the application. For example, if Ethernet backhauls are used, the far end of the cables should have Ethernet connectors that are appropriate for the Ethernet switch, patch panel, router, or other device that the cables will connect to (typically RJ-45 modular jacks).

Backhaul cable specifications are as follows:

- T1 — 100 ohm twisted pair cable complying with ANSI/EIA/TIA 568
- E1 — 120 ohm twisted pair cable
- Ethernet— Cat5 cable or better. Ensure the cable can withstand the temperature range inside the cabinet.

Make sure that temperature specification of the Ethernet cable you provide is within the expected operational temperature limits of the inside of the cabinet. See Table 27 on page 192.

Removing the punch block access panel

This procedure explains how to remove the punch block access panel.

Be sure you have read and understood Understanding the backhaul installation process on page 74 before continuing.

Requirements

- Number 2 Phillips head screwdriver

Procedure

Wear an ESD strap and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

1. Ensure that power is not being delivered to the IP-RN 8000.
   a. Ensure the Main Power switch on the Power Distribution Unit is flipped to the right.
      See Understanding the Power Distribution Unit on page 27.
   b. Ensure the external circuit breaker that controls power flow to the IP-RN 8000 is opened, eliminating power on the IP-RN 8000 circuit.
2. Locate the punch block access panel.
   See Understanding access panels on page 9.
3. Using a number 2 Phillips head screw driver, remove the three screws that hold the access panel in place.
4. Set the access panel and the three screws aside for later re-installation
5. Ensure the power terminal access panel has been removed.
   If the power terminal access panel is not currently removed, follow the procedure explained in Removing the power terminal access panel on page 204.

This procedure is complete. Go to Routing backhaul to the backhaul punch block on page 77.

Routing backhaul to the backhaul punch block

This procedure explains how to thread the backhaul cable(s) from the base of the cabinet up to the backhaul punch block in preparation for wiring the cables to the punch block. This procedure assumes that power is not being delivered to the cabinet.

Be sure you have read and understood Understanding the backhaul installation process on page 74 before continuing.

Requirements

- Small slotted screw driver
- Cable ties to wrap cables into a single bunch. (Ties are unnecessary if there is only a single cable.)

Procedure

WRIST STRAP

Wear an ESD strap and connect the strap to the ESD jack in he Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

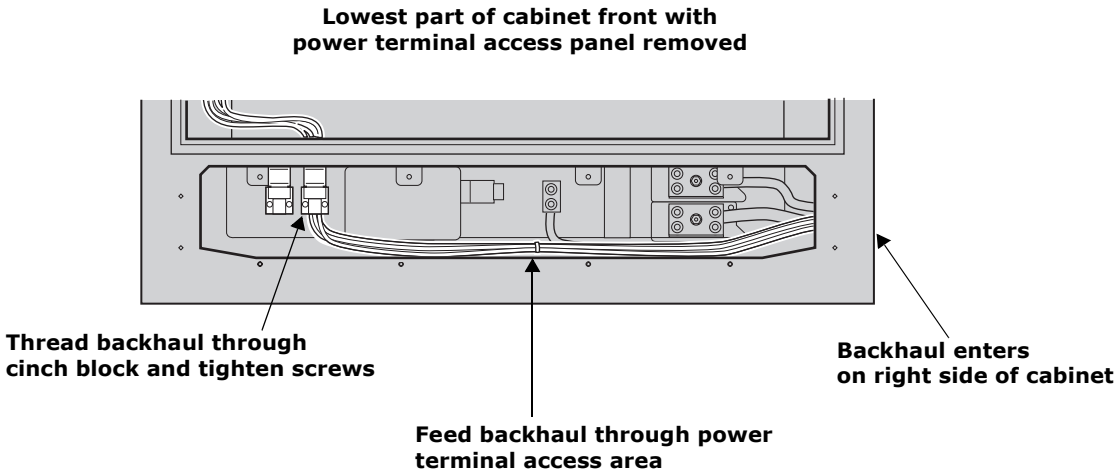
1. Ensure there is five feet of backhaul cable inside the cabinet for each backhaul link.

   If there is not five feet of cable inside the cabinet, reach into the cabinet base through the power terminal access area and pull five feet of backhaul cable into the cabinet.

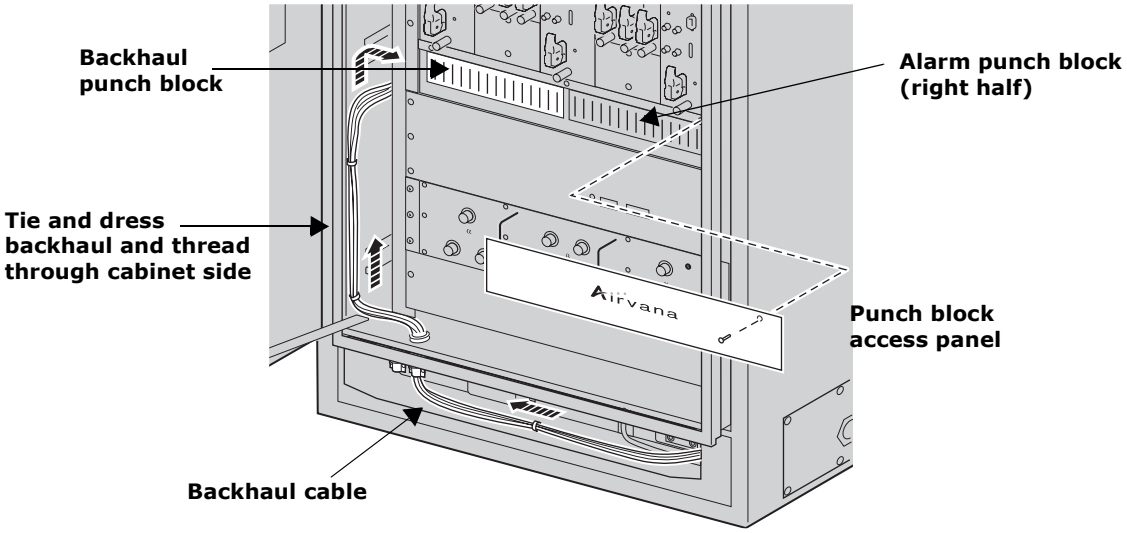
2. Thread the backhaul cable(s) through one of the cinch blocks in the left of the power terminal access area.

   Use the small slotted screwdriver to loosen the two screws in the cinch block as needed to make room for the cable.

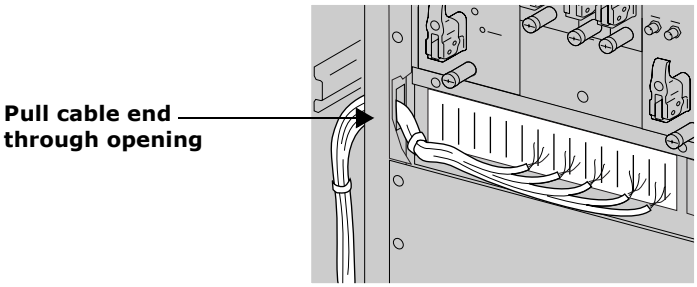
   If the cable bunch does not fit through one of the cinch blocks, split it into two groups and thread the cables through both cinch blocks, then re-tie the cables into a single bunch using cable ties.



3. Thread the backhaul from the cinch block up the left side of the cabinet between the cabinet and the chassis frame.



4. Pull the end of the backhaul through the opening at the left side of the backhaul punch block



5. Tie and dress the backhaul to secure it along its length inside the cabinet and adjust the position of the cable with regard to the cinch blocks.

NOTE

Be sure to tie the backhaul cables securely to the frame to the left of the punch block to provide stain relief for the wiring into the punch block.

6. When the cable is in its final position, tighten the two screws on the cinch block to hold it securely in place.

This procedure is complete. Go to Wiring backhaul to the backhaul punch block on page 79.

Wiring backhaul to the backhaul punch block

This procedure explains how to connect the backhaul wires to the backhaul punch block. Be sure you have read and understood Understanding the backhaul installation process on page 74 before continuing.

Requirements

- Wire cutters
- Electrician's tool or knife to peel back wire coatings
- Standard punch down tool for type 66-Block punch block.

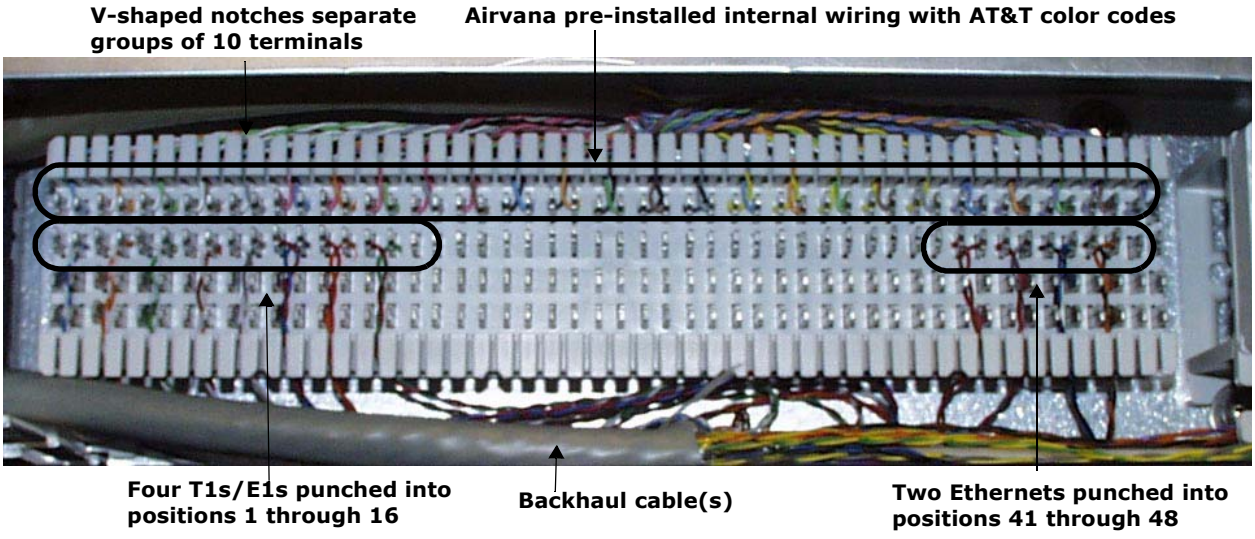
Procedure

WRIST STRAP

Wear an ESD strap and connect the strap to the ESD jack in he Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

1. Familiarize yourself with the backhaul punch block.

   The punch block is of type 66-Block. The punch block terminal positions onto which you punch down wires are numbered from left to right, from 1 to 50. V-shaped notches in the plastic below and above the punch block terminals separate the terminal positions into groups of 10 to make it easier to find the correct terminal to punch into.



NOTE

Simultaneous use of Ethernet and T1/E1 backhauls as shown in is not supported in software. You can only enable use one type or the other type at any one time.

2. Use Table 19to determine the backhaul cable wires to punch into the terminal positions.

Table 19 Backhaul punch block pin-out

Airvana wire color code (pre-wired into the punch block)	Backhaul wire signal description	Punch down position
white wire/blue stripe	T1/E1 backhaul number 1. Transmit. Positive (tip)	1
blue wire/white stripe	T1/E1 backhaul number 1. Transmit. Negative (ring)	2
white wire/orange stripe	T1/E1 backhaul number 1. Receive. Positive (tip)	3
orange wire/white stripe	T1/E1 backhaul number 1. Receive. Negative (ring)	4
white wire/green stripe	T1/E1 backhaul number 2. Transmit. Positive (tip)	5
green wire/white stripe	T1/E1 backhaul number 2. Transmit. Negative (ring)	6
white wire/brown stripe	T1/E1 backhaul number 2. Receive. Positive (tip)	7
brown wire/white stripe	T1/E1 backhaul number 2. Receive. Negative (ring)	8
white wire/slate stripe	T1/E1 backhaul number 3. Transmit. Positive (tip)	9
slate wire/white stripe	T1/E1 backhaul number 3. Transmit. Negative (ring)	10
red wire/blue stripe	T1/E1 backhaul number 3. Receive. Positive (tip)	11
blue wire/red stripe	T1/E1 backhaul number 3. Receive. Negative (ring)	12
red wire/orange stripe	T1/E1 backhaul number 4. Transmit. Positive (tip)	13
orange wire/red stripe	T1/E1 backhaul number 4. Transmit. Negative (ring)	14
red wire/green stripe	T1/E1 backhaul number 4. Receive. Positive (tip)	15
green wire/red stripe	T1/E1 backhaul number 4. Receive. Negative (ring)	16
red wire/slate stripe	Not used	17
slate wire/red stripe		18
red wire/brown stripe	Not used	19
brown wire/red stripe		20
black wire/blue stripe	Not used	21
blue wire/black stripe		22
black wire/orange stripe	Not used	23
orange wire/black stripe		24
black wire/green stripe	Not used	25
green wire/black stripe		26
black wire/brown stripe	Not used	27
brown wire/black stripe		28

Table 19 Backhaul punch block pin-out *(continued)*

Airvana wire color code (pre-wired into the punch block)	Backhaul wire signal description	Punch down position
black wire/slate stripe	Not used	29
slate wire/black stripe		30
yellow wire/blue stripe	Not used	31
blue wire/yellow stripe		32
yellow wire/orange stripe	Not used	33
orange wire/yellow stripe		34
yellow wire/green stripe	Not used	35
green wire/yellow stripe		36
yellow wire/brown stripe	Not used	37
brown wire/yellow stripe		38
yellow wire/slate stripe	Not used	39
slate wire/yellow stripe		40
violet wire/blue stripe	Primary Ethernet backhaul. Transmit. Positive (tip)	41
blue wire/violet stripe	Primary Ethernet backhaul. Transmit. Negative (ring)	42
violet wire/orange stripe	Primary Ethernet backhaul. Receive. Positive (tip)	43
orange wire/violet stripe	Primary Ethernet backhaul. Receive. Negative (ring)	44
violet wire/green stripe	Redundant Ethernet backhaul. Transmit. Positive (tip)	45
green wire/violet stripe	Redundant Ethernet backhaul. Transmit. Negative (ring)	46
violet wire/brown stripe	Redundant Ethernet backhaul. Receive. Positive (tip)	47
brown wire/violet stripe	Redundant Ethernet backhaul. Receive. Negative (ring)	48
violet wire/slate stripe	Not used	49
slate wire/violet stripe		50

3. Find the correct punch down terminal positions on the punch block by counting from the left or by using the color of the Airvana pre-installed wire.

   Airvana uses AT&T punch block wire color coding.

4. Using standard punch block wiring techniques, punch the backhaul wires into the backhaul punch block.

   Ensure each wire pair is twisted evenly to within 1/2 inch of the terminal.

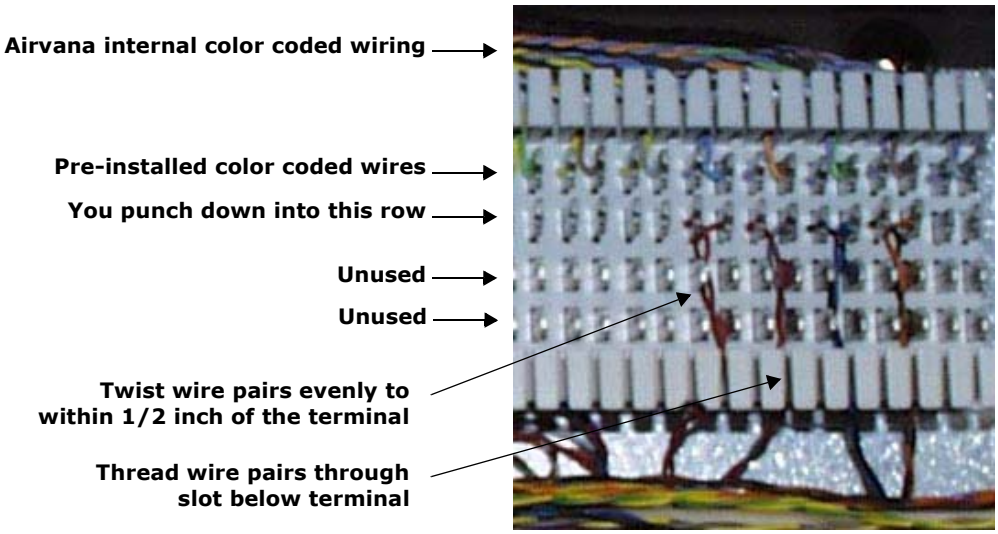
CAUTION

If the untwisting of the wire pairs occurs more than 1/2 inch from the terminal the backhaul may not operate correctly.

Ensure the wire pair is threaded through the slot beneath the terminal.

NOTE

You cannot use the punch block's bottom two rows (labeled "Unused" in the figure below). These rows are not connected internally.



This procedure is complete. Go to Re-installing the access panels on page 83.

Re-installing the access panels

This procedure explains how to re-install the backhaul access panel and the power terminal access panel.

Be sure you have read and understood Understanding the backhaul installation process on page 74 before continuing.

Requirements

- Number 2 Phillips head screwdriver

Procedure

Wear an ESD strap and connect the strap to the ESD jack in he Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

1. Retrieve the three Phillips head screws and the punch block access panel previously set aside.
2. Hold the panel in place over the back haul punch block and start the three screws by hand.
3. Tighten the three screws snugly. Do not over tighten or you might strip the screw threads.
4. Re-install the power cable access panel.

   Go to Re-installing the power terminal access panel on page 205.

This procedure is complete. Go to Understanding the antenna installation process on page 86.

Chapter 6

Connecting antennas

About this chapter

This chapter explains how to install the Rox System cabinet seal and how to connect RF and GPS antennas internally and externally. This chapter has the following sections:

Understanding the antenna installation process

This process explains all steps and procedures to follow when connecting RF and GPS antenna cables.

1. **Understanding cautions and warnings**

   Understand and follow all warnings and cautions or injury, death, or damage to equipment can occur.

   See Understanding warnings and cautions on page 87.

2. **Understanding the Rox System**

   This section explains the pre-assembled configuration in which the Rox System ships.

   See Understanding the pre-assembled Rox System on page 87.

   You can optionally assemble your own Rox System.

   See Optionally assembling your own Rox on page 89.

3. **Removing access panels**

   Remove the antenna access panel in order to install the Rox System cabinet seal. You must also remove the surge protection access panel in order to connect Rox System antenna cables internally to the surge protection bar.

   See Removing access panels on page 91

4. **Installing the Rox System cabinet seal**

   The Rox System cabinet seal must be installed into the cabinet opening created when you remove the antenna access panel on the top back of the cabinet. Installation involves routing the cables into the cabinet and screwing the Rox System cabinet seal into place.

   See Installing the Rox System cabinet seal on page 94.

5. **Connecting GPS and RF antennas**

   All antenna cables routed through the Rox System cabinet seal must be connected to the surge protection bar on the inside of the cabinet and to external antenna cables/surge protection equipment on the outside of the cabinet. The surge protection access panel must be re-installed.

   See Connecting GPS and RF antennas on page 96.

This procedure is complete. This process is complete. You must install modules. Go to Understanding the module installation process on page 104.

Understanding warnings and cautions

This section contains warnings and cautions that apply to all procedures in this chapter.

Be sure you have read and understood Understanding the antenna installation process on page 86 before continuing.

Do not perform any of these procedures when there is a possibility of lightning strikes. Death or injury could occur if lightning strikes during installation.

Upon installation, this product is required to comply with the requirements of Federal Communications Commission 47CFR 1.1310, Radiofrequency radiation exposure limits. Care must be taken by the installer to insure that the antenna chosen along with its installation position and orientation does not violate these limits.

Do not perform any of these procedures if the IP-RN 8000 has not been properly grounded.

Wear an ESD strap and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

Understanding the pre-assembled Rox System

The Rox System cabinet seal typically ships pre-assembled and is ready to install. The pre-assembled Rox System cabinet seal supports:

- Three radio sectors
- Each radio sector has two RF antenna cables. One cable carries two signals, a transmit signal and a receive signal. The second contains a single receive antenna cable.
- Two GPS antenna cables — one primary GPS antenna and one redundant GPS antenna

The pre-assembled Rox System can be used on installations with:

- One, two, or three radio sectors. See Understanding radio sectors on page 13.

  If fewer than three radio sectors are used at a particular installation, the unused RF antenna cables exiting through the Rox System cabinet seal must be connected to external surge suppression equipment to prevent equipment damage from lightning strikes.

- Redundant and non-redundant Digital Module Kits.

  Redundant installations use two GPS antennas; non-redundant installations use a single GPS antenna. (See Understanding Digital Module Kit redundancy on page 20.) In non-redundant installations, the secondary GPS antenna cable must be connected to external surge suppression equipment to prevent damage from lightning strikes.

The pre-assembled Rox System cannot be used for installations that have three separate RF antenna cables for each radio sector. In this case, you must use a specially-ordered Rox System cabinet seal with nine RF cables.

The pre-assembled Rox System is shipped fully assembled with cables that are 8 feet long, 3/8 inch or 1/2 inch in diameter, and have male N-Type connectors at both ends. See Table 20.

NOTE

If you special ordered a Rox System cabinet seal, or assembled it yourself, you might have a different number of cables and different connector types.

Table 20 The standard Rox System cabinet seal assembly

Type	Sector	Use	label	Connector (both ends)
RF	alpha	Receive antenna cable	α RX1	male N-type
		Transmit and receive antenna cable	α TX/RX0	male N-type
	beta	Receive antenna cable	β RX1	male N-type
		Transmit and receive antenna cable	β TX/RX0	male N-type
	gamma	Receive antenna cable	χ RX1	male N-type
		Transmit and receive antenna cable	χ TX/RX0	male N-type
GPS	not applicable	primary GPS antenna cable	GPS_P	male N-type
		secondary GPS antenna cable	GPS_R	male N-type

Optionally assembling your own Rox

You can optionally assemble your own Rox System cabinet seal. If you are not assembling your Rox System cabinet seal, you can skip this section.

With this option, Airvana provides the Rox System cabinet seal and related components, but you must provide the antenna cables and cable connectors.

CAUTION

If you assemble the Rox System cabinet seals, you are responsible for any damage resulting from improper assembly. Ensure that only qualified personnel perform the assembly.

Airvana Rox kits

This Airvana Rox Kit consists of the following:

- RoxTec Frame Kit, ES-CF-16, quantity: 1
- RoxTec Module Kit, ES-CM-20 w40, quantity: 8
- Mounting Plate with gaskets, quantity: 1

For more additional information about the Rox Kit, you can contact RoxTec. The Rox Kit is identified by part number 6000-004652-100

Assembly requirements

When assembling Rox System cabinet seals, you must adhere to the following requirements. These requirements are for installation in the top rear antenna access panel opening.

Requirements:

- Internal connectors: N-type, male, straight, hex
- External connectors: site specific, defined by customer
- Length of internal cables: 21 inches, measured from inside edge of Rox System to the end of connector
- Overall cable length: site specific, defined by customer (21 inches internal length + 1.5 inches Rox thickness + user defined external length)
- Cable size: maximum overall diameter (OD) of 14.5mm (0.571 inches) including sheath; minimum OD of 4 mm (0.157 inches) of cable screen
- Cable type: defined by customer (suggested type: Andrew Corporation Part #FSJ4-50B, 1/2 inch 50 ohm Superflex or Times Microwave LMR400DB with EZ connectors)

RF and GPS cable locations

Airvana recommends installing the RF and GPS cables into the positions in the Rox System cabinet seal that are shown in Figure 20. This enables determination of which cable serves which function after the Rox System cabinet seal has been installed even if cable labels are missing. This recommendation is for a three sector node, with two RF antennas per sector, and in a redundant configuration requiring two GPS cables.

Cables should be labeled as to their function on both the internal side and the external side of the Rox System cabinet seal.

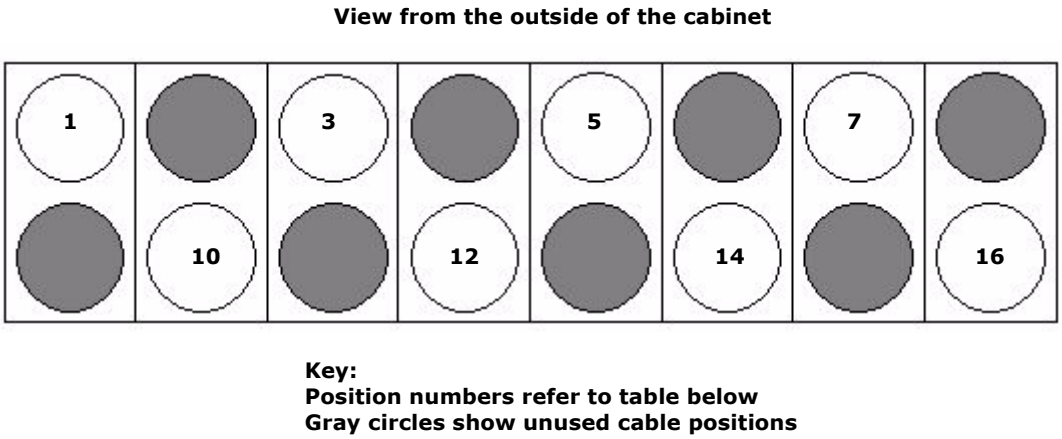


Figure 20 Recommended cable positions in Rox System viewed from the external side of the Rox

Table 21 Recommended cable positions in Rox System cabinet seal

Position	Cable description
1	Redundant GPS cable
3	TX/RX0 cable for gamma sector
5	TX/RX0 cable for beta sector
7	TX/RX0 cable for alpha sector
10	RX1 cable for gamma sector
12	RX1 cable for beta sector
14	RX1 cable for alpha sector
16	Primary GPS cable

Removing access panels

This procedure explains how to remove the two required access panels in order to install the Rox System Cabinet seal and connect all antennas.

Be sure you have read and understood Understanding the antenna installation process on page 86 before continuing.

Requirements

- 5/32 tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

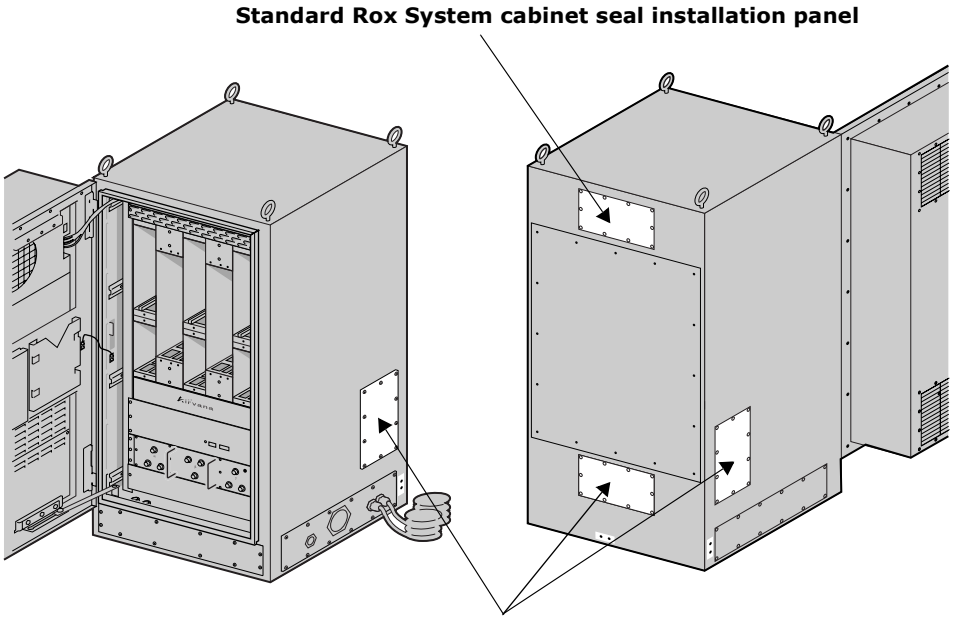
1. Ensure that power is not being delivered to the IP-RN 8000.
   a. Ensure the Main Power switch on the Power Distribution Unit is flipped to the right.
      See Understanding the Power Distribution Unit on page 27.
   b. Ensure the external circuit breaker that controls power flow to the IP-RN 8000 is opened, eliminating power on the IP-RN 8000 circuit.

2. Locate the antenna access panel on the cabinet where you will install the Rox System.

   There are four antenna access panels. The Rox System can be installed into any one of the cabinet openings created when the access panels are removed.

   The standard configuration requires installing the Rox System into the access panel on the *top of the back of the cabinet.*

Installing the Rox System cabinet seal into any of the three non-standard access panels requires a different internal configuration of the cabinet, and it must have been specially ordered.



3. Remove the 10 screws from the antenna access panel with the tamper-proof screwdriver, being careful not to let the access panel fall when the final screw is removed.

CAUTION

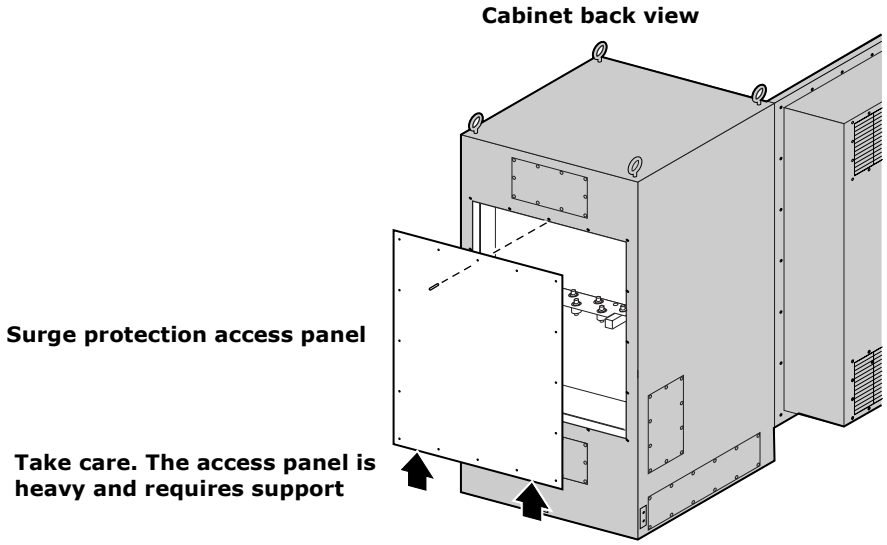
Access panels must be handled carefully. If they are bent they may not form a proper seal with the cabinet when they are re-installed. An intact seal on the inside edge of the access panel is required to ensure external environmental conditions are sealed out.

4. Set aside the 10 antenna access panel screws and washers.

   The screws and washers will be required for installing the Rox System cabinet seal.

   The antenna access panel cover that you just removed will not be required for this installation. Save it for later use as appropriate.

5. Locate the surge protection access panel.



6. Remove 15 of the 16 screws holding the surge protection access panel in place. *Leave the top middle screw in place.*
7. Hold the surge protection access panel firmly in place and remove the final screw using the tamper resistant screw driver.

WARNING

The surge protection access panel is heavy. Take all necessary precautions to avoid injury and to avoid damaging the access panel. Do not allow it to be bent. Do not allow the seal around the inside edge to be damaged.

8. Set aside all 16 screws and washers from the surge protection access panel.

   These screws will be used to re-install the access panel after all antennas are connected.

This procedure is complete. Go to Installing the Rox System cabinet seal on page 94.

Installing the Rox System cabinet seal

This procedure explains how to install the Rox System cabinet seal. This procedure assumes that the power supply has been turned off and that power is not flowing to the cabinet.

Be sure you have read and understood Understanding the antenna installation process on page 86 before continuing.

Requirements

- 5/32 inch tamper-resistant screw driver
- Torque wrench with bit for 5/32 inch tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

WRIST STRAP

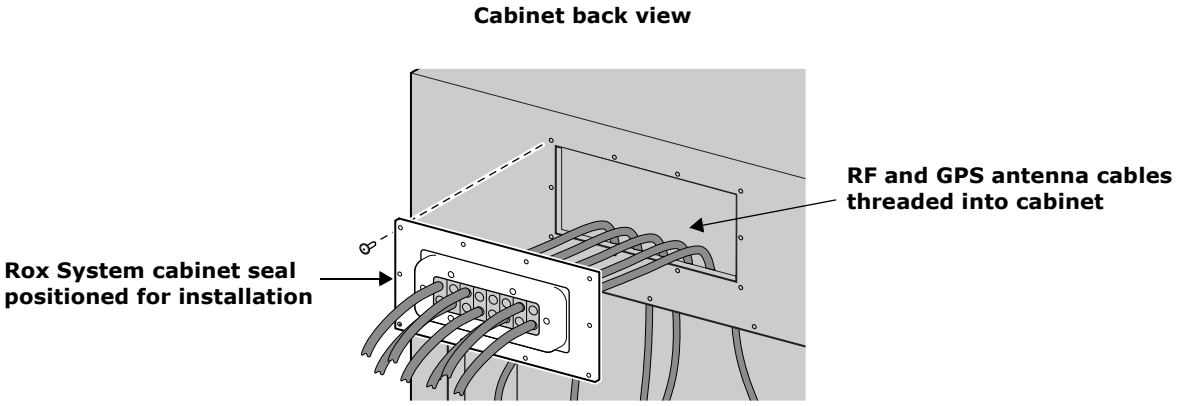
Wear an ESD strap and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

1. Remove the Rox System cabinet seal from its box and remove all packing materials.
2. Retrieve the 10 access panel screws and the corresponding rubber washers that you set aside when you removed the antenna access panel.
3. Examine the back side of the Rox System cabinet seal.
   - The gasket along the edge must be undamaged to ensure a proper seal.
   - A spacing washer must be embedded in the gasket for each screw. See Connectors, screws, nuts, washers on page 194.
4. Examine all cable labels. Each cable should be labeled at both ends.

   If any label is not present, trace the cable through the Rox System cabinet seal and attach a label to both ends of the cable. You must be able to determine which cable on the outside of the Rox System cabinet seal is associated with which cable on the inside of the Rox System cabinet seal.
5. Hold the Rox System cabinet seal near the open antenna access panel so that its back side faces the cabinet and thread the 21 inch internal ends of the antenna cables into the top back cabinet hole.

NOTE

Be sure not to knock any of the spacer washers off the gasket on the inside edge of the Rox system cabinet seal. These spacer washers are required to ensure proper installation and EMI/RF shielding.



6. Gently push the Rox System cabinet seal against the cabinet and position it for final attachment.
7. Screw in the one of the top middle screws by hand.

   Be sure to thread the rubber sealing washer on the screw shank before inserting it in the Rox System screw hole. Check to ensure each screw shank has a spacing washer as well.

WARNING

Screws should be started by hand. It is possible to damage the thread in the cabinet if you use a hand tool or a power tool. Damaged threads must be repaired or the cabinet will be improperly sealed and the IP-RN 8000 can be damaged. *Use a thread tapping set to fixed damaged threads.*

8. Start all screws with rubbers washers in by hand. Install them all loosely before tightening any one of them.
9. Use a torque wrench with a 5/32 inch tamper-resistant hex drive bit set to 18 inch-pounds to tighten all screws evenly.

WARNING

If access panels screws are not tightened with the correct torque, electronic interface may occur causing equipment malfunction.

This procedure is complete. Go to Connecting GPS and RF antennas on page 96.

Connecting GPS and RF antennas

This procedure explains how to:

- Connect the GPS and the RF antenna cables to the surge protection bar on the inside of the cabinet and to a required surge protection system/antenna cables system on the outside of the cabinet
- Re-install the surge protection access panel.

This procedure assumes that the power supply has been turned off and that power is not flowing to the cabinet.

Be sure you have read and understood Understanding the antenna installation process on page 86 before continuing.

Requirements

- 13/16 inch open ended wrench
- Torque wrench with 13/16 inch open ended bit
- 5/32 tamper-resistant screw driver
- Thread tapping kit with 1/4-20 thread bit at 3/4 inch depth

Procedure

Wear an ESD strap and connect the strap to the ESD jack in the Antenna Interface Unit when performing any installation procedure. See Understanding the Antenna Interface Unit module on page 17.

Do not touch or connect antennas when there is any chance of a lightning strike. Injury or death can occur if lightning strikes an antenna during installation.

Antenna cables emit radio frequency energy. Exposure to radio frequency energy can cause burns or other health problems. Take all appropriate precautions to avoid risk and danger.

Power to the IP-RN 8000 must be turned off.

The IP-RN 8000 must be properly grounded before antennas are installed. Failure to properly ground the IP-RN 8000 can result in danger to nearby persons and damage to equipment. See Understanding surge protection and grounding on page 33.

The IP-RN 8000 has a secondary surge suppression system. A primary external surge suppression system is required to protect nearby persons from danger should a surge occur and to protect the IP-RN 8000 from damage. See Understanding surge protection and grounding on page 33.

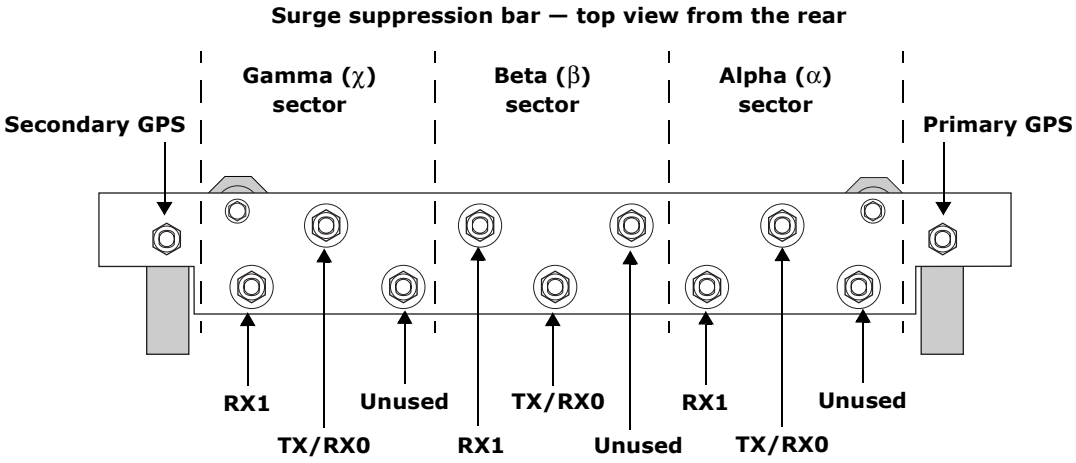
1. Look at the surge suppression bar in the cabinet and compare it with that shown in the following figure.

   Use the label on each cable to plan which cables dangling from the inside of the Rox System cabinet seal will connect to which connectors on the surge protection bar.

   It is essential that the proper cables are connected to the proper surge suppressors. Each cable on the Rox System cabinet seal is labeled on both ends, both the end that dangles inside the cabinet and the end that is outside the cabinet. See Understanding the antenna installation process on page 86.

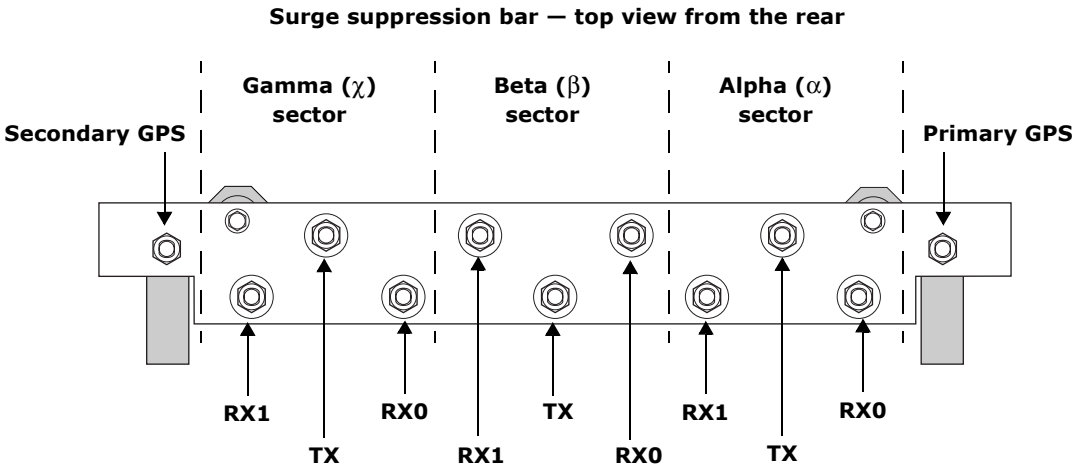
If you connect cables to the wrong surge suppressors, damage to equipment may occur and the equipment may not operate correctly.

If your deployment uses two antenna cables per sector, connect the cables to the connectors as follows:



Cable connections with two RF cables per sector

If your deployment uses three antenna cables per sector, connect the cables to the connectors as follows:



Cable connections with three RF cables per sector

2. First finger tighten the RF and GPS antenna cables to the correct surge suppressor connectors on the top side of the surge protection bar inside the cabinet.

CAUTION

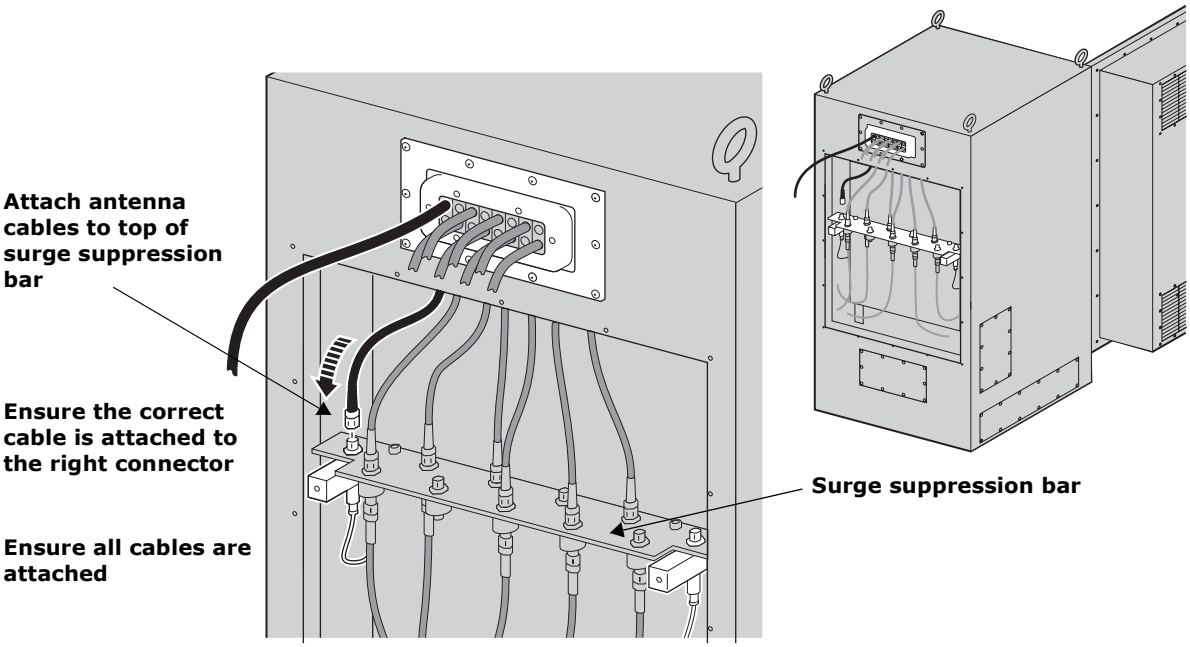
All antenna cables dangling inside the cabinet *must be connected* to the surge suppressor connectors, even if they are not connected to antennas externally. Failure to connect all cables could result in equipment damage and loss of EMI protection.

3. Use the torque wrench set to 10 inch pounds with the 13/16 inch open ended wrench bit to tighten every antenna cable connection on the surge suppression bar.

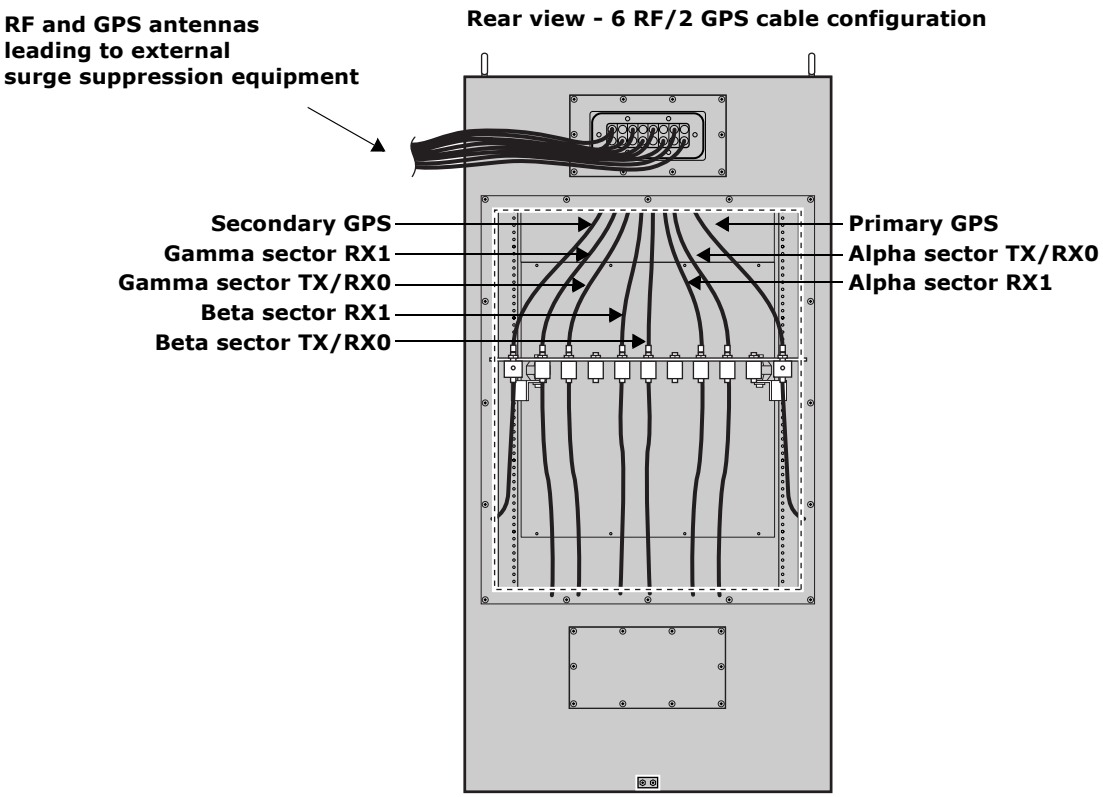
WARNING

Tightening the connectors to more than 15 inch pounds can damage the equipment.

Rear view - Attaching antenna cables internally



4. After all internal antenna cables are connected to the correct surge suppressors, the cabinet appears as shown in the following figure.



5. Retrieve the 16 tamper-proof screws and rubber washers that you set aside when removing the panel.
6. Ensure the access panel is undamaged:
   - Examine the inside edge of the access panel. The gasket on the inside edge must be intact to ensure a proper seal.
   - A spacing washer must be embedded in the gasket for each screw.
7. Position the surge protection access panel and screw in the top middle screw by hand.

   Be sure to thread the rubber sealing washer on the screw shank before inserting it in the access panel screw hole.

WARNING

Screws should be started by hand. It is possible to damage the thread in the cabinet if you use hand tool or a power tool. Damaged threads must be repaired or the cabinet will be improperly sealed and the IP-RN 8000 can be damaged. *Use a thread tapping set to fixed damaged threads.*

8. Start the remaining 15 screws (with washers) by hand. Install them loosely before tightening any one of them.

9. Use a torque wrench with a 5/32 inch tamper-resistant hex drive bit set to 18 inch-pounds to tighten all screws evenly.

If access panels screws are not tightened with the correct torque, electronic interface may occur causing equipment malfunction.

10. Connect all antenna cables to the proper external antennas/surge protection equipment.

    The connections are typically N-type and require a 13/16 inch open ended wrench.

    Tighten connections snugly. Do not overtighten.

All external antenna cables exiting the Rox System cabinet seal must be connected to an external surge suppression system, even if the cables are not used. Failure to connect unused cables to a surge suppression system leaves them open to lightning strikes, which could damage the IP-RN 8000.

This procedure is complete. Go to Understanding the module installation process on page 104.