ADC FlexWave® Prism Element Management System 7.1

User Manual

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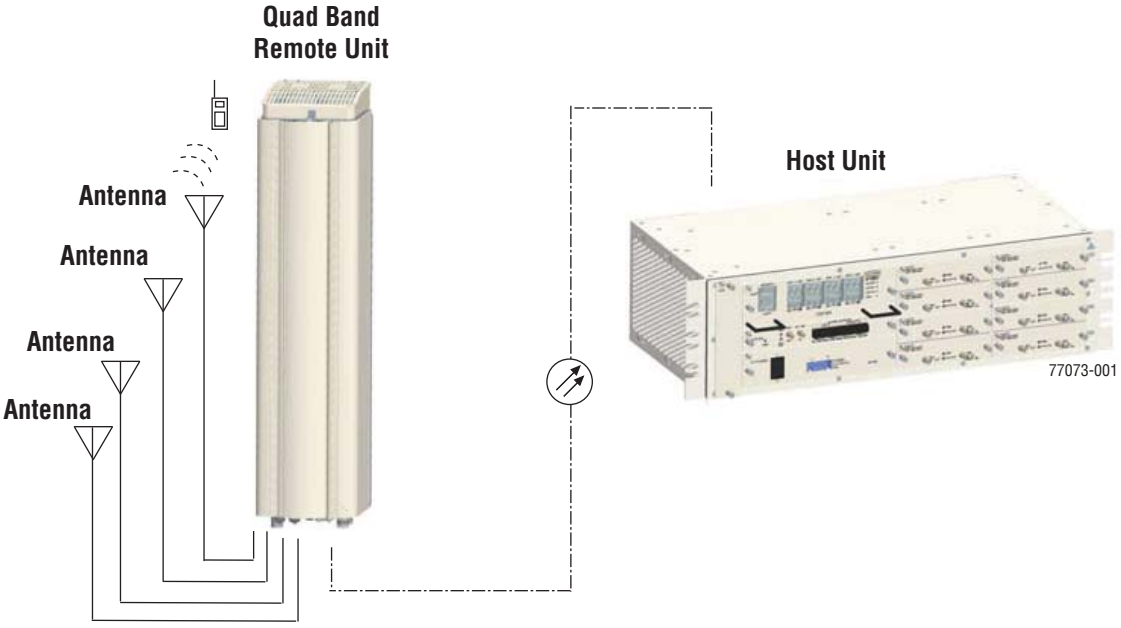

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Screenshots in User Documentation

Due to concurrent development of this documentation, artwork, and the FlexWave Prism EMS product, there may be some minor discrepancies between screenshots contained in this documentation and those actually displayed in the FlexWave Prism EMS. These discrepancies will generally be few and minor and should not affect your understanding of FlexWave Prism EMS.

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PREFACE

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The information in this document guides you through configuring an ADC® FlexWave® Prism system through its web-based Element Management System (EMS) Release 7.1. The EMS is an embedded software application that runs on the Host and that may be accessed via an internet connection using a web browser.

CAUTION! The instructions in this document assume that you have already installed the FlexWave Prism units as described in their respective installation guides (see Table 1).

The *Preface* describes how to use the FlexWave Prism user documentation.

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FLEXWAVE PRISM USER DOCUMENTATION

FlexWave Prism documentation is intended for system administrators, engineers and installers responsible for planning, administering, configuring, and maintaining FlexWave Prism systems. The following table lists the manuals that correspond to this FlexWave Prism release.

Title	ADCP Number
FlexWave Prism Host Unit II Installation Guide	77-089
FlexWave Prism Host Unit II Module Replacement Guide	77-090
FlexWave Prism Remote Unit Installation Guide	77-072
FlexWave Prism Remote Mounting Kit Installation Instructions	77-077
FlexWave Prism Remote RF Module Installation Instructions	77-079
FlexWave Prism External CWDM Enclosure Installation Guide	77-151
F*lexWave Prism Element Management System 7.1 User Manual*	77-177

Accessing User Documentation on the Customer Portal

1. Click on the following URL link or enter the URL into your web browser, and then press ENTER on your keyboard:

   http://www.adc.com/Americas/en_US/1268116693520

NOTE: **Access to the Customer Portal requires a user account and password. If you do not have an account, click on the registration link on the Log In page.**

2. On the **Customer Portal Home** page, click **Manuals & Spec Sheets**.
3. On the **Manuals & Spec Sheets** page, click on the title of the manual that you wish to open or download.

Document Cautions and Notes

Two types of messages, identified below, appear in the text:

CAUTION! **Caution text indicates operations or steps that could cause personal injury, induce a safety problem in a managed device, destroy or corrupt information, or interrupt or stop services.**

NOTE: **Note text contains information about special circumstances.**

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Document Fonts

You will find the following font conventions in use throughout the document.

- **This font** represents a reference to a EMS dialog box, menu item, configuration option, or other parameter.
- **<*This Font*>** in angle brackets represents a reference to a EMS dialog box, menu item, configuration option, or other parameter that is a variable. The text within the angle brackets changes according to a **`get`** or **`set`** command. For example:
  - The **Password for <*username*> has been changed** message displays.
  - The **Password for *JohnSmith* has been changed** message displays.
- **`This font`** represents non-variable text that you type at a prompt.
- **THIS FONT** represents keys that you need to press on your keyboard.

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Document Graphics

This manual documents an EMS, the features of which display in a web browser window, as described in "How to Use the EMS Graphical User Interface" on page 40. To display the entire web browser would reduce the image size in this document, which would reduce the document's usability. The screen graphics will therefore focus on the element of the web page under discussion. In most instances, this will be the current view in the EMS View frame, which is encircled in red in Figure 1.

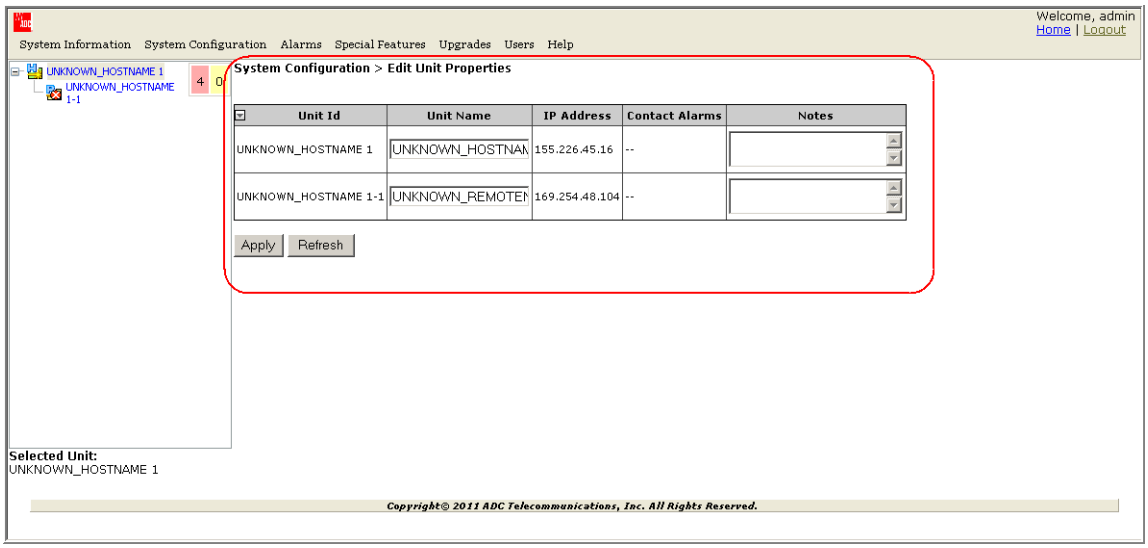

Figure 1. EMS in Web Browser

For example, when discussing the **Edit Unit Properties** page shown in Figure 1, only the **Edit Unit Properties** panel will be illustrated (see Figure 2).

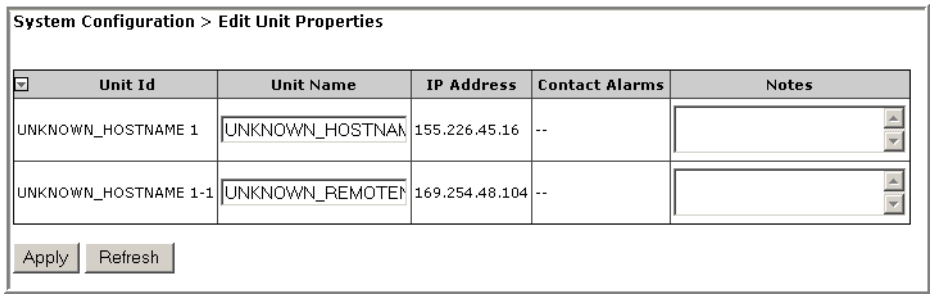

Figure 2. Edit Unit Properties Panel

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ABBREVIATIONS/ACRONYMS

This section defines abbreviations/acronyms used in this manual.

Abbreviations/Acronyms	Definition
AC	*Alternating Current*
BDA	*Bi-Directional Amplifier*
BER	*Bit Error Rate*
BTS	*Base Transceiver Station*
COM	*Common*
CWDM	*Coarse Wavelength Division Multiplexer*
DART	*Digital/Analog Radio Transceiver*
DAS	*Distributed Antenna System*
db	*Decibels*
dBm	*decibel measured in reference to milliwatts*
DC	*Direct Current*
EMS	*Element Management System*
FLM	*Forward Link Monitoring*
FWD	*Forward*
GUI	*Graphical User Interface*
Id	*Identification*
IF	*Intermediate Frequency*
LNA	*Low Noise Amplifier*
LPA	*Linear Power Amplifier*
MHz	*Megahertz*
MMW	*Millimeter Wave*
μS	*Microseconds*
NC	*Normally Closed*
NIC	*Network-Interface Connection*
nm	*Nanometer*
NO	*Normally Open*
OSP	*Outside Plant*
Pkt	*Packet*
PLL	*Phase-Locked Loop*
PRU	*Prism Remote Unit*
RDI	*Remote DART Interface*
REV	*Reverse*
RF	*Radio Frequency*
RLM	*Reverse Link Monitoring*
RSI	*Remote SeRF Interface*
RX	*Receive*
SeRF	*Serialized RF*
SFP	*Small Form-Factor Pluggable*

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Abbreviations/Acronyms	Definition
SNMP	*Simple Network Management Protocol*
TX	*Transmit*
UPS	*Uninterruptible Power Supply*
URU	*URH Remote Unit*
VLAN	*Virtual Local Area Network*
VSWR	*Voltage Standing Wave Ratio*
WDM	*Wavelength Division Multiplexer*

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PART I

FLEXWAVE PRISM HARDWARE

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PRISM SYSTEM OVERVIEW

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This section provides a basic description of an ADC® FlexWave® Prism system.

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PRISM SYSTEM OVERVIEW

ADC's FlexWave® Prism is a compact radio head utilized for precision and macro gap coverage, which supports up to four frequency bands, while delivering high-performance coverage with end-to-end management. FlexWave Prism is ideal for enhancing outdoor and indoor coverage in urban, suburban, canyons, tunnels, campuses, stadiums and other public venues.

A Prism system offers the following features:

- ADC's patented RF-over-fiber transport eliminates installation-dependent gain or fiber length adjustments
- Improved manageability for installation and upgrades
- Smaller size to ease placement and zoning approvals
- 4G readiness with Four Band remote, which is ideal for incorporating 2G and 3G services with needs of 4G technologies such as LTE
- The unique capability to support digital RF as well as baseband compatibility into a single fiber pair and remote radiating point
- Support for millimeter wave backhaul
- With its unique use of wideband digital RF transport, FlexWave Prism delivers reliable and consistent performance in all environments. Signals are not affected by reflection, dispersion, or frequency attenuation over fiber. FlexWave Prism delivers a reliable signal at every remote location.

The ADC FlexWave Prism family of products is a Distributed Antenna System (DAS) that provides ADC's patented technology—bidirectional transport of digitized RF spectrum over fiber. The high-speed digitalization of a wideband portion of spectrum allows for transport of RF signals over extended distances, without the RF degradation that normally results when analog systems are impacted by optical effects. The basic function of the FlexWave Prism platform is to transport via fiber optic cable RF signals from a Base Transceiver Station (BTS) to an antenna interface allowing communication to a mobile device. Multiple BTS communication paths are allowed over a single Prism system.

A very basic Prism system consists of a Host Unit (Host) and a Prism Remote Unit (PRU).

- The Host is a three rack unit high chassis with multiple cards that mounts in a standard equipment rack.
- The PRU consists of multiple electronic and optical modules mounted in an outdoor enclosure.

On an optional basis, the Prism system supports reverse path diversity. In addition, various accessory items such as a passive Wavelength Division Multiplexer (WDM) system and a Coarse Wavelength Division Multiplexer (CWDM) system are available as accessories.

Control and monitoring functions are provided by the FlexWave Element Management System (EMS).

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Examples of FlexWave Prism Systems are shown in Figure 1, Figure 2 on page 6, and Figure 3 on page 7.

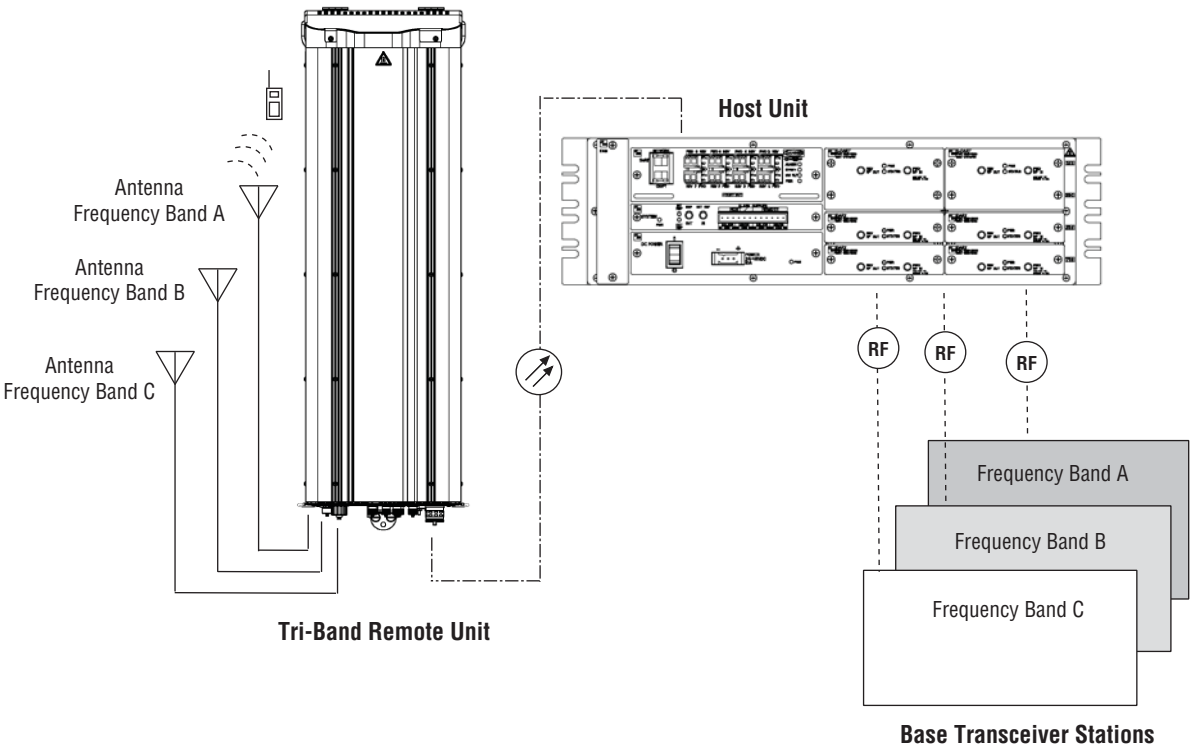

Figure 1. Three Bands to One PRU (No Simulcast)

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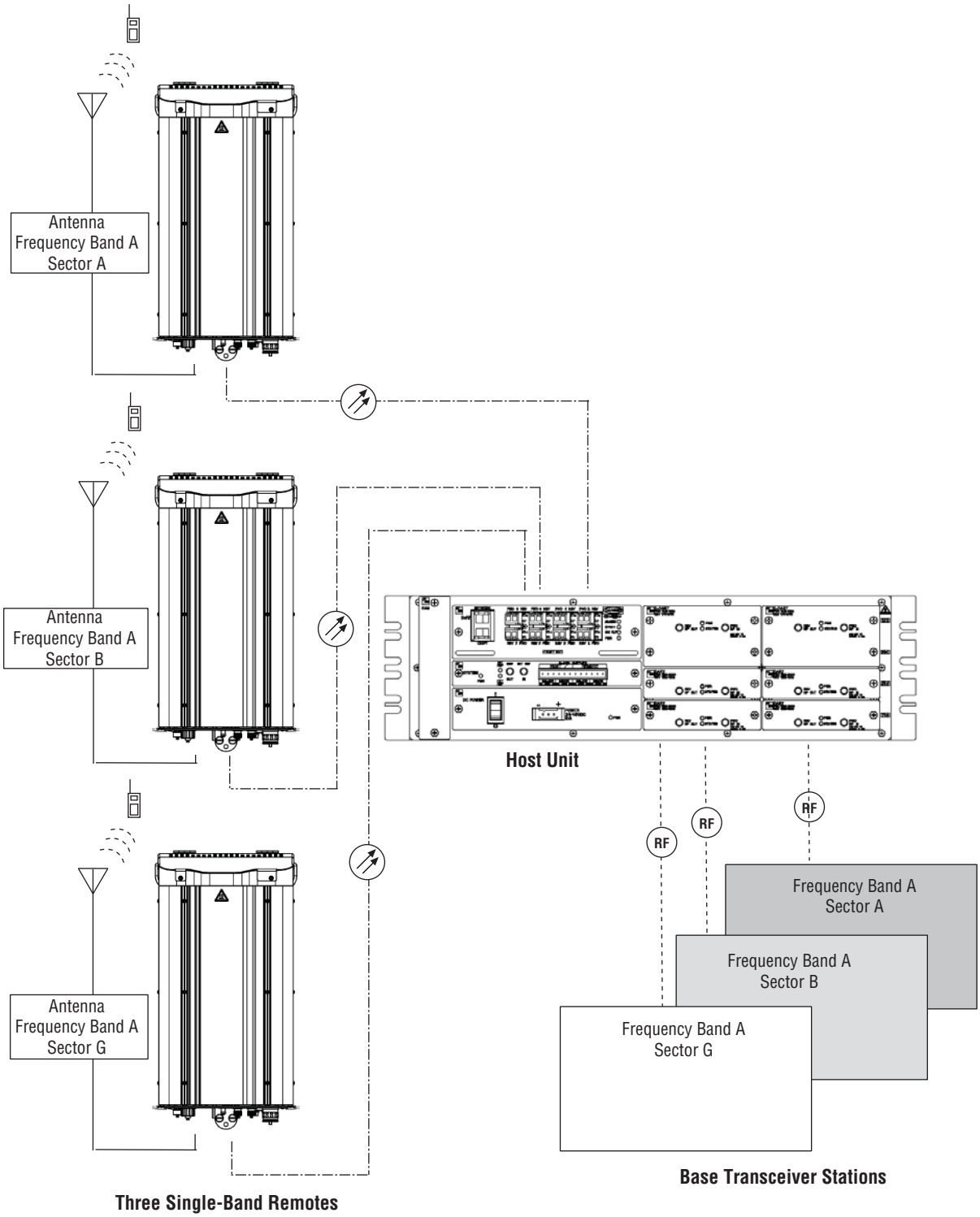

Figure 2. Multiple Point-to-Point Configuration
(One Band per PRU, Three Nodes)

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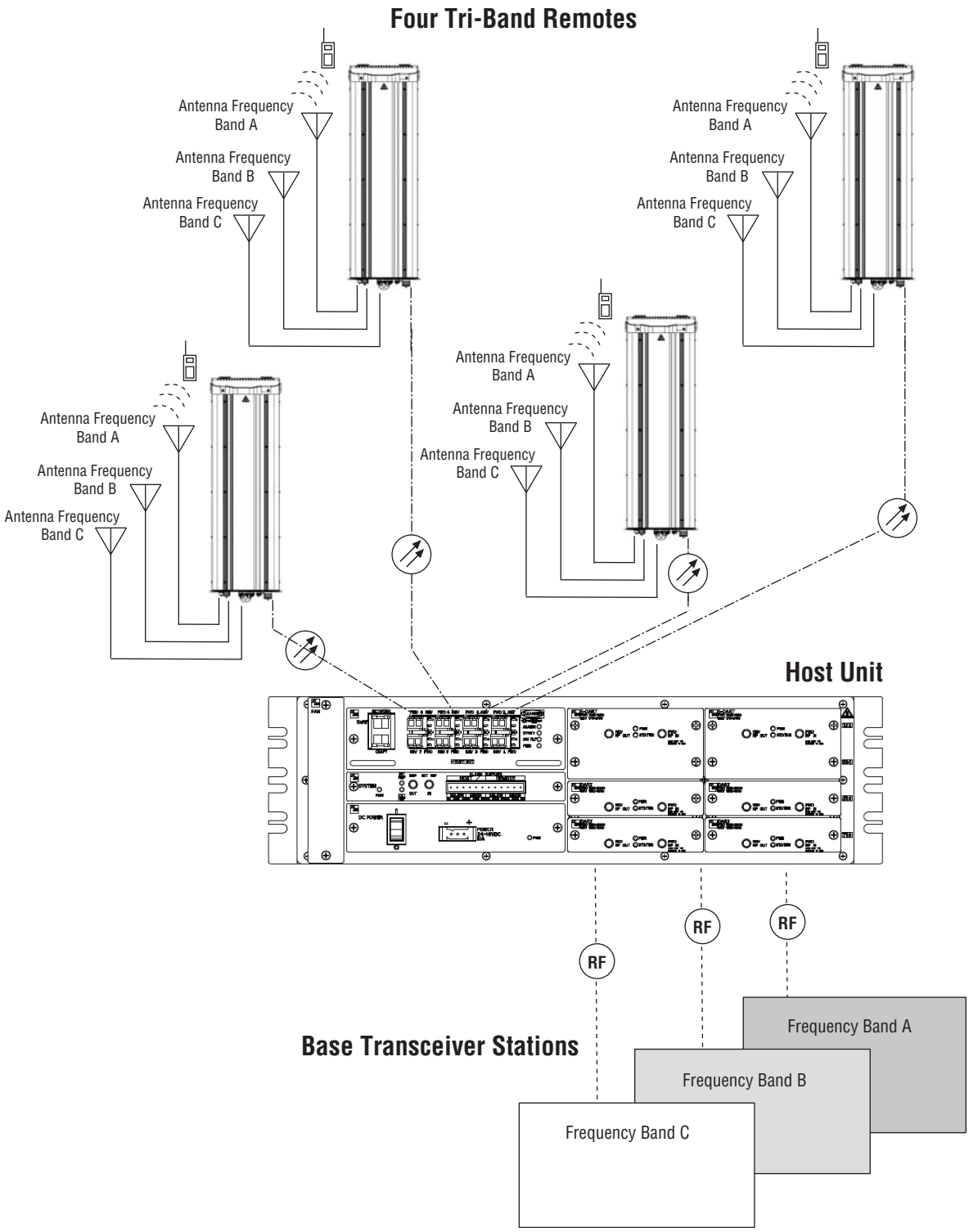

Figure 3. Four PRU Simulcast, Three Frequency Bands

Each link consists of a Host that provides the interface between the base station RF ports and the optical fiber, and at least one Remote that provides the interface between the optical fiber and the remote antenna.

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A block diagram of a point-to-point system is shown in Figure 4.

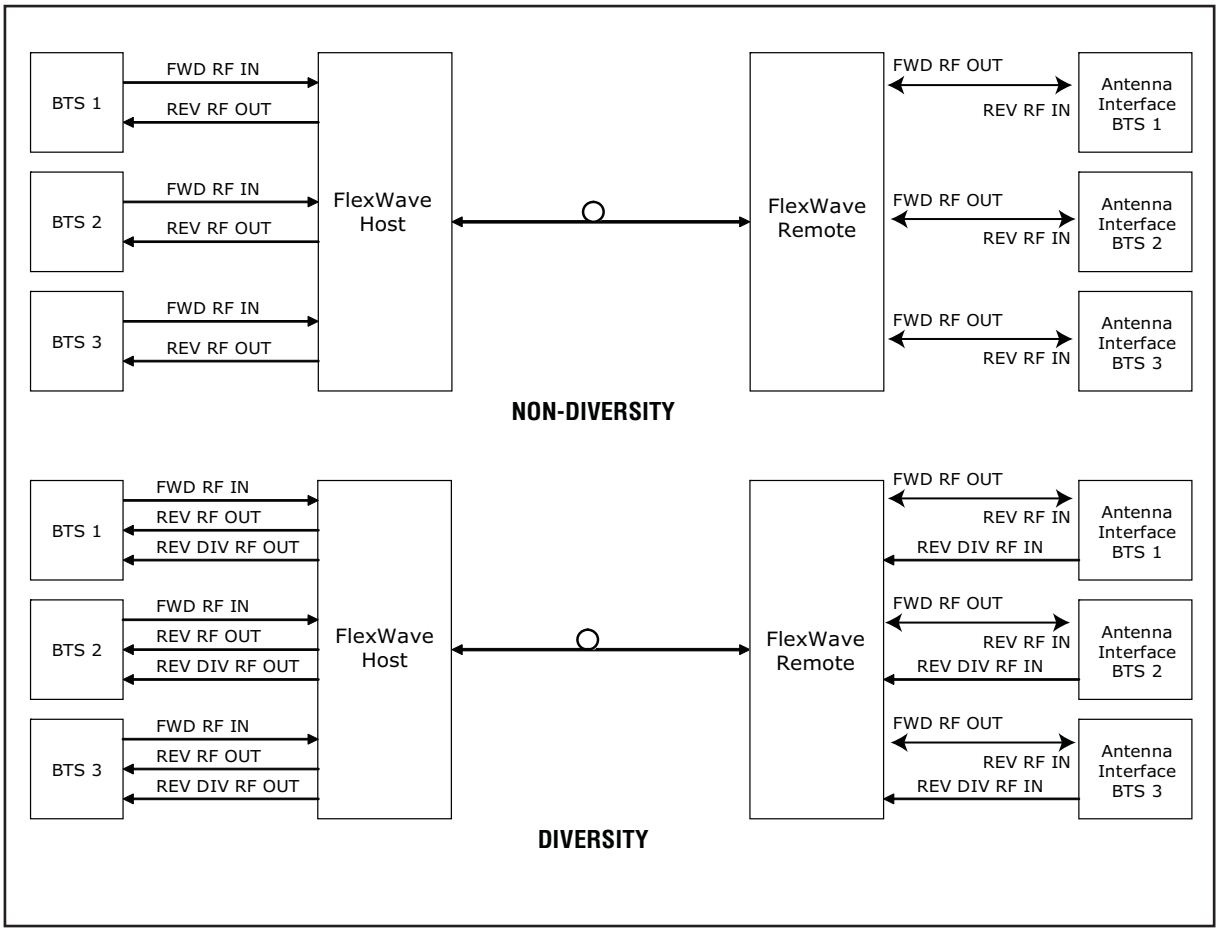

Figure 4. FlexWave Tri-Band Prism Block Diagram

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The basic function of FlexWave Prism simulcast (point-to-multipoint) is to transport, via fiber optic cable, RF signals from a BTS to multiple antenna interfaces allowing communication to a mobile device (see Figure 5). Up to 8 simulcast Remote Units are supported by each Host Unit.

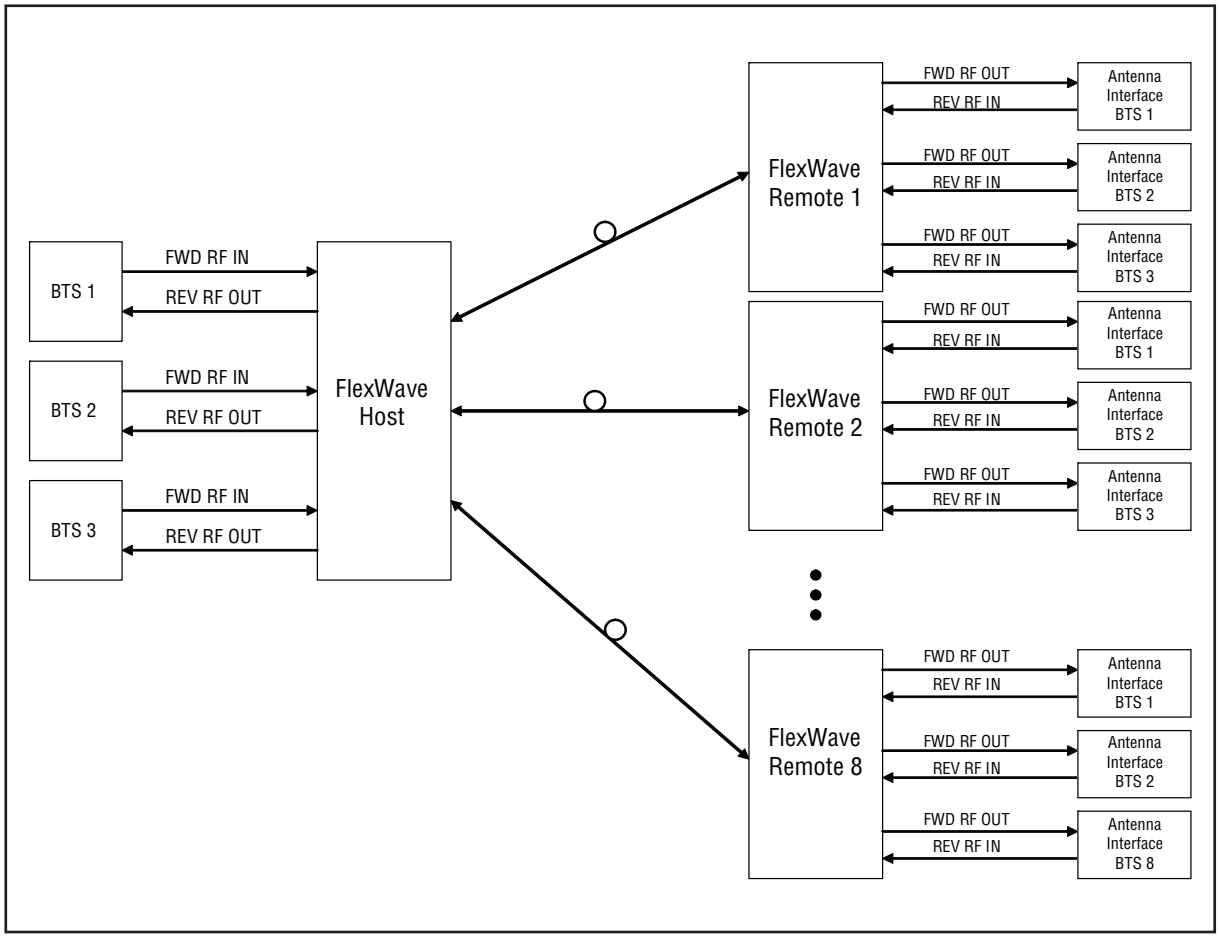

Figure 5. System Block Diagram for Eight-Way Simulcast

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FIBER OPTIC TRANSPORT

In a FlexWave Prism system, each BTS provides the RF channel inputs and outputs for a designated sector. Each Host may be interfaced with one or more Base Transceiver Station (BTS).

On the forward path, the Host receives Analog RF signals from the BTS, digitizes the designated RF bands, and then transports them over single-mode fiber to up to 8 Remote Units. The Remote Unit(s) receives the digitized spectrum from the Host and converts the spectrum back into an analog RF signal to be distributed via an externally mounted antenna system.

On the reverse path, the Remote Unit digitizes the designated RF spectrum and digitally transports it over single mode fiber or Millimeter Wave (MMW) to the Host. The Host receives the digitized RF signals from the Remote Unit and converts them back to Analog RF for the BTS.

In a typical Prism system the Host is connected to the Remote using two single-mode optical fibers. One fiber is used to transport the **forward path** optical signal and a second fiber is used to transport the **reverse path** optical signal. Because the optical signal is digital, the input and output RF signal levels at the Host or the Remote are not dependent on the level of the optical signal or the length of the optical fiber. A diagram of the standard fiber optic transport system for both a non-diversity and diversity system is shown in Figure 6.

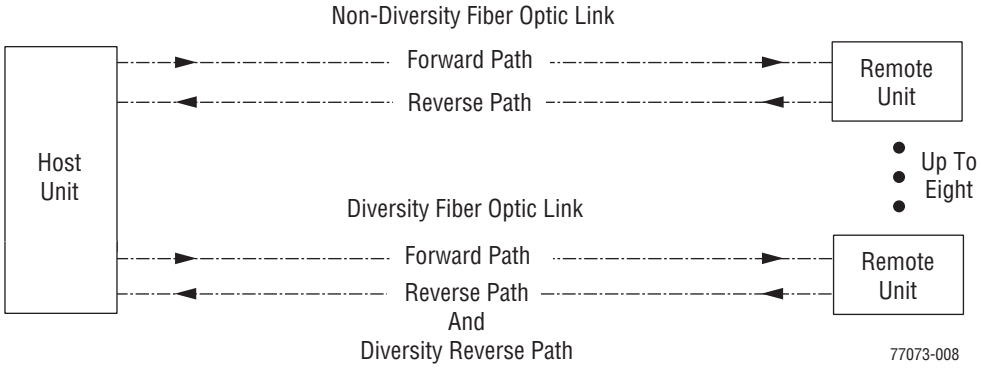

Figure 6. Standard Fiber Optic Transport Application

The maximum length of the optical links is dependent on the loss specifications of the optical fiber and the losses imposed by the various connectors and splices. The system provides an optical budget of **25 dB** (typical) when used with 9/125 single-mode fiber. There must be at least 10 dB of optical loss to prevent over-driving and possible damage to the optical receiver.

NOTE: The RF modulation used determines the maximum fiber length between the Host and Remote units, which is dependent on how much delay that modulation type will handle.

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HOST UNIT OVERVIEW

The rack-mountable Host is typically located with the RF source—a Base Transceiver Station (BTS). The Host is DC powered and supports up to eight BTS interfaces through DART (Digital/Analog Radio Transceiver) cards. (For further information on DART Modules, see "DART Modules" on page 24.)

The Host is designed for use within a non-condensing indoor environment, such as inside a base-station shelter, Central Office, wiring closet, or a controlled-environment cabinet. It is installed into a 19- or 23-inch, rack-mounted chassis, that is 9-inches deep and can hold up to three units. All controls, connectors, and indicators, except for the grounding point, are accessible on front of the Host. Figure 7 shows the main elements of the Host.

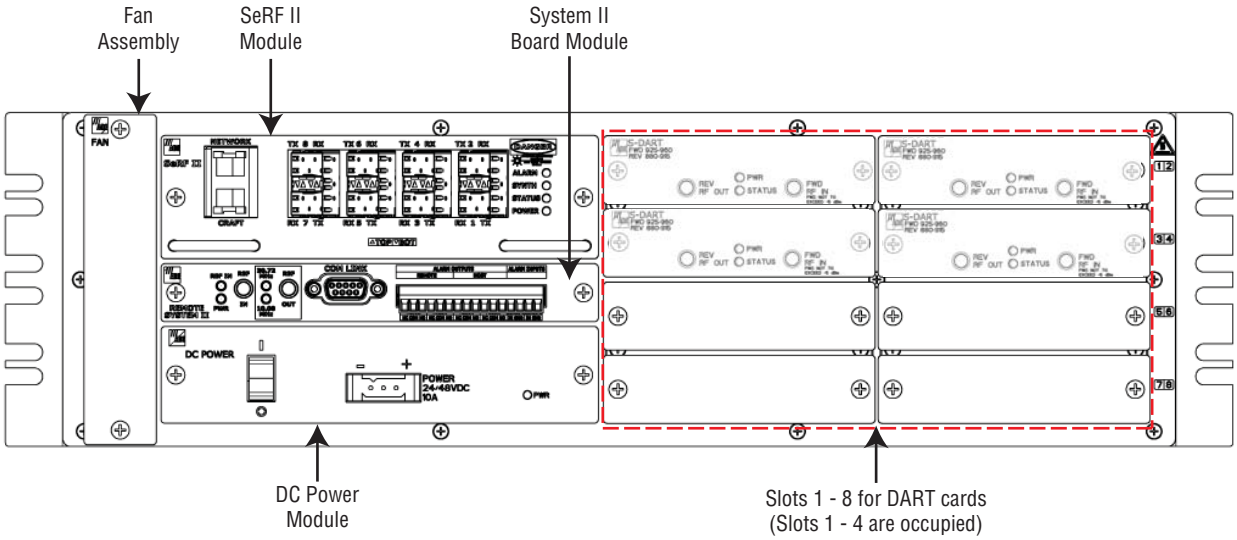

Figure 7. Host Front Panel

NOTE: **The Host comprises a Fan Assembly, a SeRF II Board Module, a Host System II Module, and a DC Power Module. These modules are pre assembled in the Host chassis at the factory. This document describes them as separate modules for reference only.**

Fan Module

The Fan Module, mounted on the left side of the Host, continuously blows cool air into the Host enclosure, and vents hot air out of the chassis on the right. An alarm is generated if a high-temperature condition occurs. The Fan Module is field replaceable (see the *Prism Host Unit Installation Guide*, ADCP-77-089).

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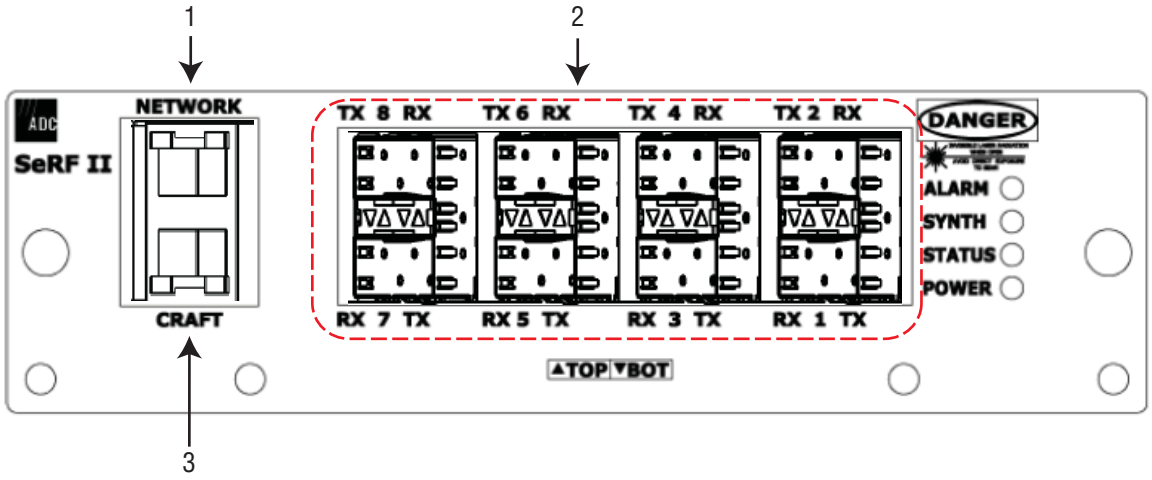
SeRF II Module

The SeRF II Module:

- manages communications and alarms
- receives digitized signals from the DART and sends the digitized RF bands to the designated PRU
- receives digitized RF signals from the PRU and sends the digitized RF signal to the DART for conversion from Digital RF to Analog RF for the BTS/BDA
- supports eight Small Form-factor Pluggable (SFP) optical transceivers
- provides two Ethernet interfaces.

SeRF II Module Ports



Ref #	Component	Device	Function
1	Network port	RJ-45 jack (female)	Networking access to an external DHCP server
2	TX/RX Optical port (1–8)	LC (flat-polished) connector (single-mode)	Input/output connection points for Ports 1 through 8 Transmit (TX) and Receive (RX) optical fiber pairs
3	Craft port	RJ-45 jack (female)	Local Ethernet access to the Host

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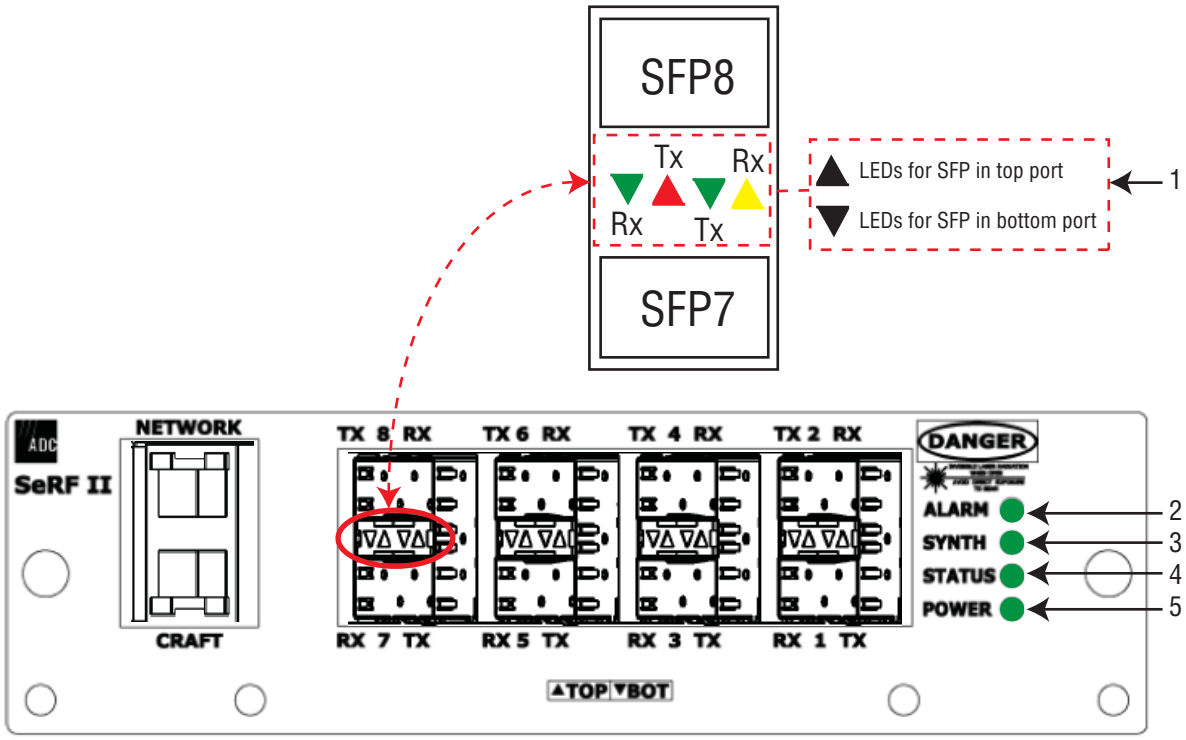
SeRF II Module LEDs



Ref #	LED	LED Color	Description
1	SFP TX	• OFF • GREEN • RED	• No Small Form-Factor Pluggable (SFP) present • SFP is present and the FPGA internal Phase-Locked Loop (PLL) is locked • SFP is present and the FPGA internal PLL is not locked
	SFP RX	• OFF • GREEN • AMBER • RED	• No SFP present • Receiver has locked and framed to the incoming signal • Receiver has light, but is not locked to the incoming frequency or not framed • Receiver has no light
2	ALARM	• GREEN • RED	• No major alarm is present in the system • Initial bootup sequence, or a major alarm is present in the system
3	SYNTH	• GREEN • RED	• Locked • Unlocked
4	STATUS	• GREEN	• No alarm for the SeRF II Module
		• RED	• Initial bootup sequence and should become GREEN within 1 minute; if RED after bootup, a Major alarm exists for the SeRF II Module
5	POWER	• GREEN • RED • OFF	• Power OK and operating properly • Power supply out of tolerance • No power present

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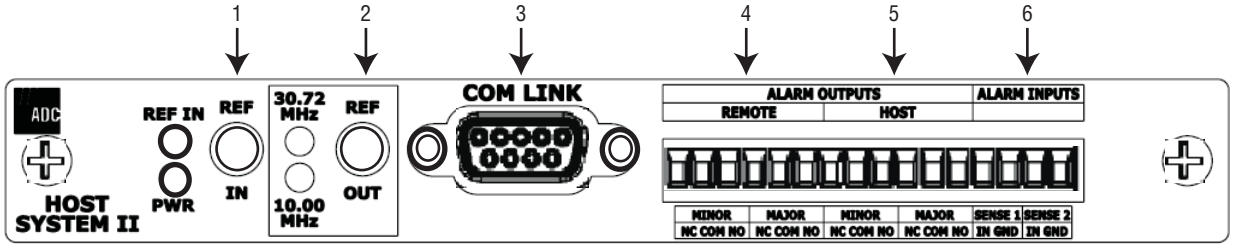
Host System II Module

The Host System II Module:

- provides output dry alarm contacts for reporting alarms to an external management system
- can output the reference clock to a daisy-chained Host.

Host System II Module Ports and Connectors



Ref #	Component	Device	Function
1	REF IN connector	QMA-Type female RF coaxial connector	10 MHz reference clock input that may be used to synchronize between multiple Hosts in a daisy-chain configuration.
2	REF OUT connector	QMA-Type female RF coaxial connector	10 MHz reference clock output that may be used to synchronize between multiple Hosts in a daisy-chain configuration.
3	COM LINK connector	DB9 female connector	Not applicable to the Prism Host. The COM Link is only used when the System II Board is configured as a Remote System II Board.
4	Alarm Outputs—PRU	Twelve position terminal block. Screw-type terminal connector (14–26 AWG)	Connection points for a major and minor dry alarm contacts. Includes normally closed (NC), common (COM), and normally open (NO) wiring connections.
5	Alarm Outputs—Host		
6	Alarm Inputs	Two contact closure inputs	Connection points for monitoring external devices, which allows the Alarm connector to monitor the output contact closures from an Uninterruptible Power Supply (UPS) or a Bi-Directional Amplifier (BDA). This feature is currently not supported by Prism systems.

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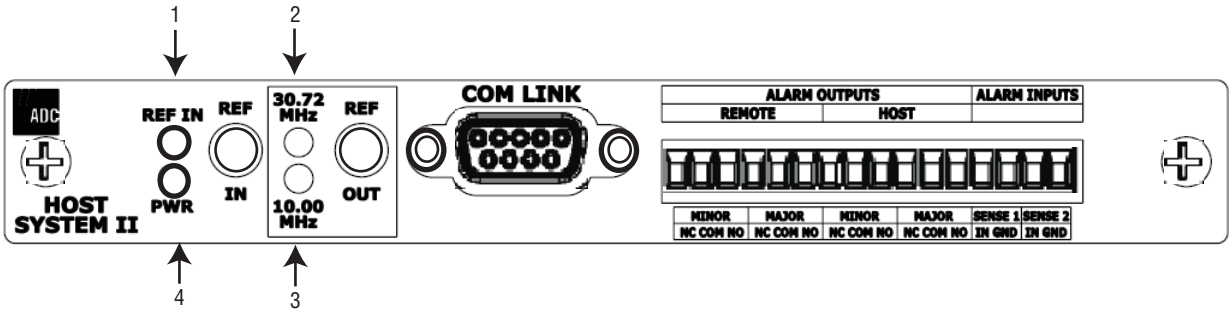
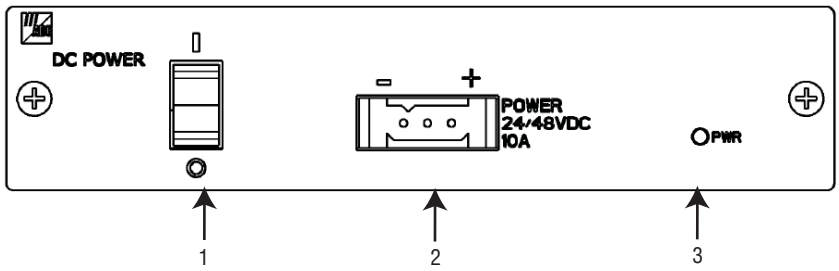
Host System II Module LEDs



Ref #	LED	LED Color	Description
1	REF IN	• Green • Off	• An external reference has been selected in the Prism Element Management System GUI. Once this selection has been made in the GUI, the REF IN LED is green, regardless of the presence of a signal on the REF IN connector. • No external reference has been selected in the Prism Element Management System GUI.
2	30.72 MHz	Off	For this release, this LED will always be off in a Prism Host Unit.
3	10 MHz	• Green • Off	• The system is configured to output a 10MHz signal on the Ref Out connector. (The input of an external 10MHz clock on the Ref In connector is indicated by the REF In LED.) • External 10 MHz reference disabled.
4	PWR	• Green • Off	• Host System II board is receiving power. • Host System II board is not receiving power.

DC Power Module

The DC Power Module converts ±24 - ±48 VDC to the DC voltages used by the Host modules.



Ref #	Component	Device	Function
1	ON/OFF Switch	Rocker switch	Turns Host power on/off
2	POWER connector	Three position connector	10A connector for DC power wiring; FCC qualification meets 21-60 VDC

Ref #	LED	LED Color	Description
3	PWR	• Green • Red	• DC Power Supply OK • DC Power Supply Fault

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PRISM REMOTE UNITS

The Prism Remote Unit (PRU), shown in Figure 8, controls RF emissions, interfaces with the FlexWave Host and performs the optical to electrical conversions for transport to the antennas. The PRU is an IP-65 rated enclosure that houses the electronic assemblies such as the RF Module Group, SeRF assembly and AC/DC power supplies, and seals out dirt and moisture. The PRU uses fans located on the top of each unit to cool the chassis. The antenna cable connectors, fiber connectors, AC power connector, and the unit status indicator are located on the bottom of the unit.

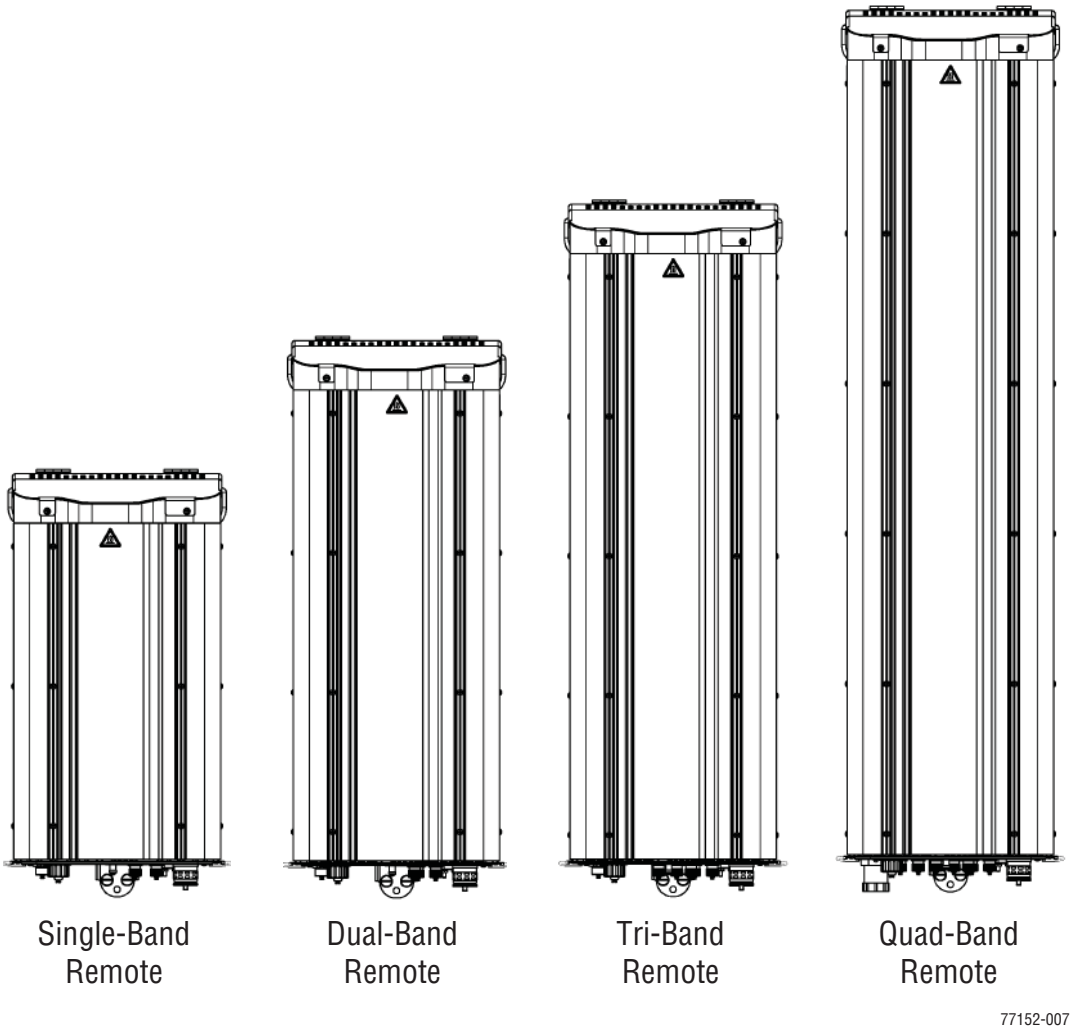

Figure 8. Prism Remote Units (PRUs)

The FlexWave Remote receives on the forward path the digitized spectrum from the Host and converts the spectrum back into an RF signal to be distributed via an externally mounted antenna system. On the reverse path, the Remote digitizes the designated RF spectrum and digitally transports it over single-mode fiber or Millimeter Wave (MMW) to the Host. The PRU also provides RF interface (antenna port) for the antennas, and accepts AC power input.

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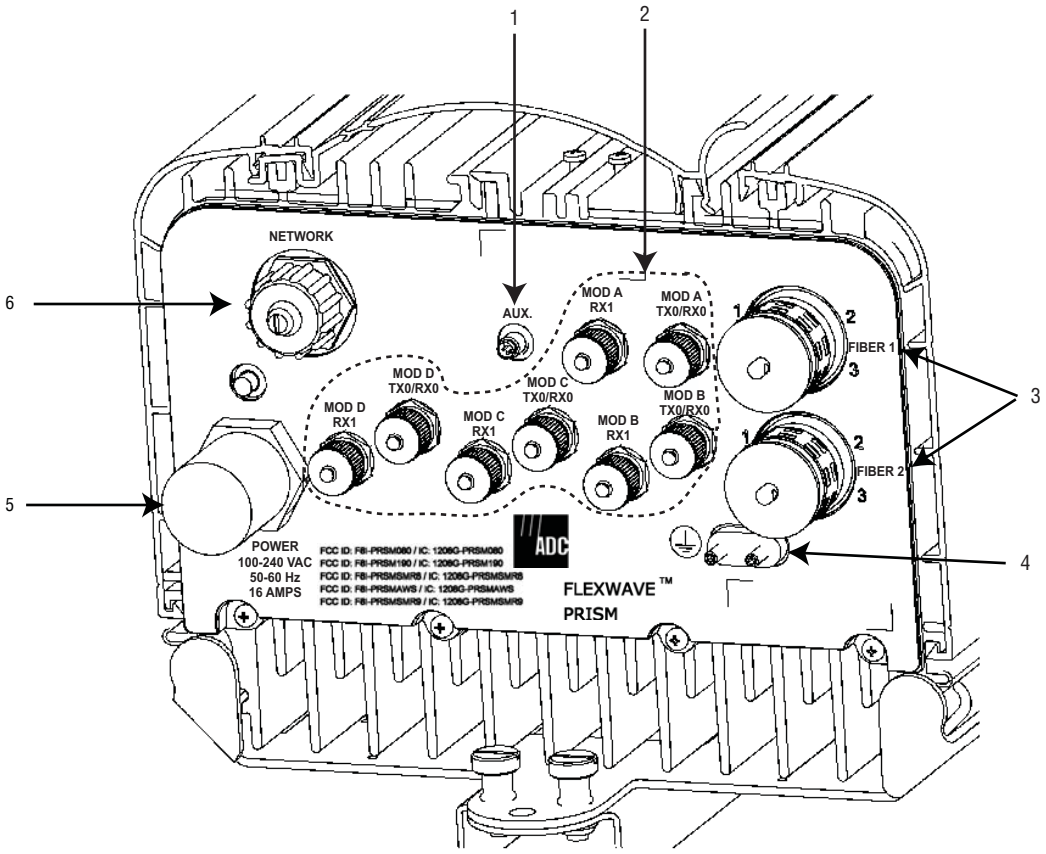
PRU Ports and Connectors (Bottom of PRU)



Bottom of a PRU

Ref #	Component	Device	Function
1	Aux Connector	Four contact closure inputs	Connection points for external alarm inputs.
2	Antenna Connectors	Eight 50Ω N-Type (female) connectors	• Connection points between the PRU and up to four antennas are labeled as **Mod *X* TX0/RX0** (where the first ***X*** can be **A**, **B**, **C**, or **D**). • Connection points between the PRU and Diversity receive for RF power from the antenna are labeled as **Mod *X* RX1** (where the first ***X*** can be **A**, **B**, **C**, or **D**).
3	Fiber Connectors	ProAx connectors that provide four BX5 connectors	Connection points between the PRU and the Outside Plant (OSP) box.
4	Dual-Ground Connector	Ground connector	Grounds the PRU.
5	AC Power Port	Sealed 3-pin port	Connection point between the PRU and an AC power junction box.
6	Network Connector Port	RJ-45 female connector	IP servicing between the Host and PRU(s); allows communications with the internal processor and transfer of service data to the optical protocol.

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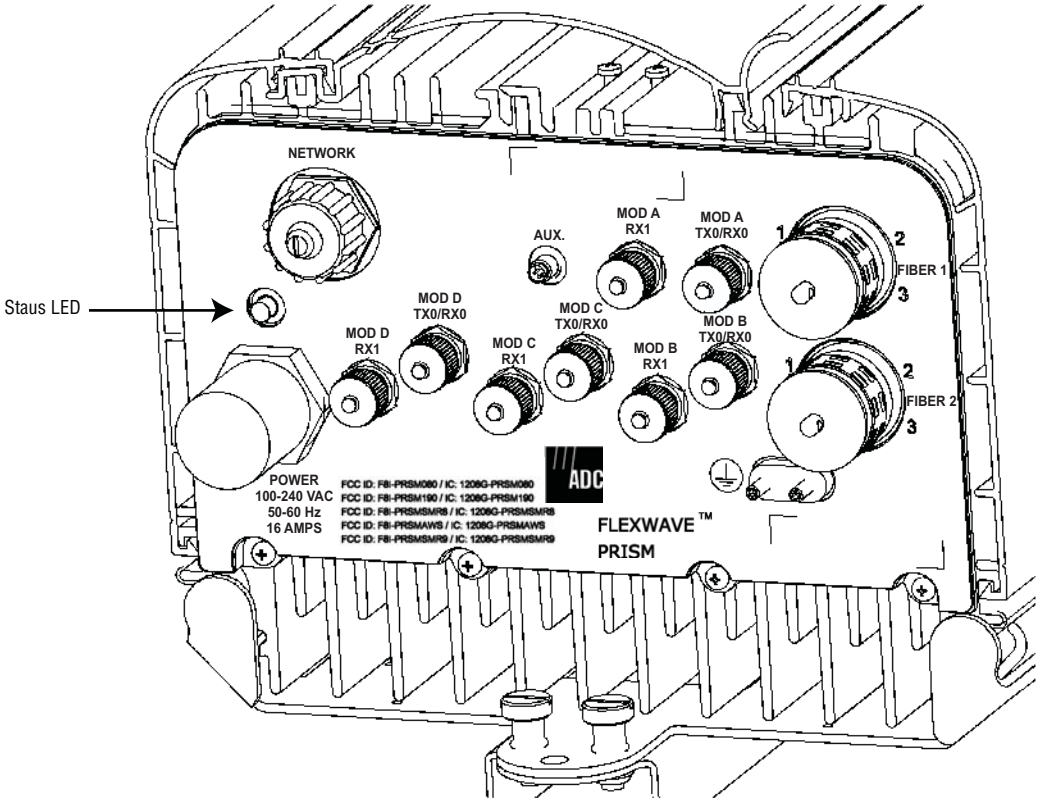
PRU Status LED (Bottom of PRU)



Status LED—Bottom of a PRU

The PRU has a single red Status LED that is located on the bottom of the chassis. At system startup, the PRU Status LED is red to indicate that the PRU is powering up and that the SeRF processor does not yet control the PRU.

After start up, if the PRU Status LED is red, it indicates the presence of major alarm(s) on the PRU. The PRU Status LED stays red until all the major alarm conditions that exist on the PRU clear. (For information on alarms that pertain to the PRU, see “Troubleshooting Alarms” on page 185.)

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PRU Components

The PRU chassis is an outdoor-rated enclosure that comprises the following components:

- Power Supplies
- SeRF Module
- Fans
- Interface connections as described in "PRU Ports and Connectors (Bottom of PRU)" on page 17
- External Status LED (see "PRU Status LED (Bottom of PRU)" on page 18)
- Remote (AC) power and RF Module (DC) power switches

PRUs ship with specified RF Modules pre-installed. The Prism RF Modules comprise:

- DARTs
- Linear Power Amplifier (LPA)
- Duplexer with one or two Low Noise Amplifiers (LNAs) and a Power Detector (PD)
- Remote DART Interface (RDI) Module

For further information on the RF Modules, see "RF Module Capabilities and GUI Representation" on page 21.

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Figure 9 shows components within the Remote Unit chassis.

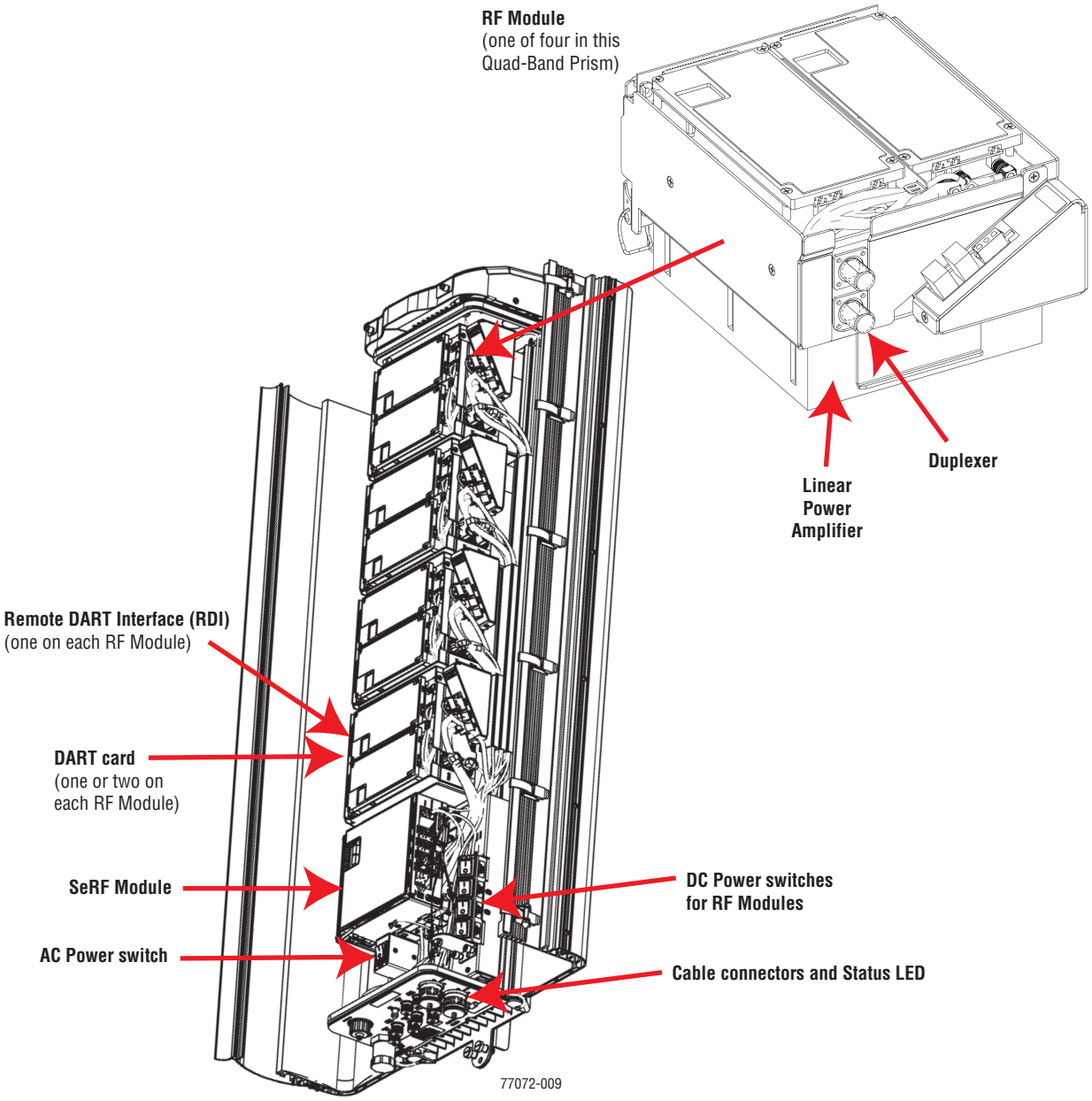

Figure 9. Prism Remote Unit (PRU) Components

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RF Module Capabilities and GUI Representation

A PRU comprises from one to four RF Module slots. Each RF Module can comprise any of the following DART combinations:

- one Classic DART or one Single SuperDART
- two Classic DARTs
- two Single SuperDARTs
- one Dual SuperDART.

A PRU can therefore comprise up to eight single-slot DARTS or up to four Dual SuperDARTs, dependent on the Remote chassis size and the number of RF Modules installed. To link the Remote Unit DARTs to the DARTs in a Host Unit, the DARTs must be the same type (such as, PCS to PCS).

NOTE: PRU RF Modules are not field serviceable. To replace a DART within a PRU, you must replace the RF Module.

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Table 1 and Figure 10 on page 23 describe how the EMS references the RF group assignments and corresponding components of each RF Module.

Table 1. *Remote RF Group Assignments (from Top/Down)*

Physical RF Slot	RF Group	DART Number	LNA Number		LPA Number	Power Detector Number
			Primary	Diversity		
D	D	8		8	4	4
		7	7			
C	C	6		6	3	3
		5	5			
B	B	4		4	2	2
		3	3			
A	A	2		2	1	1
		1	1			
		SeRF Board				

NOTE: **In a dual-LPA system, the Configure Remote Forward Gain page shows two values for the LPA status, one for each LPA. Changing the LPA Mode or resetting the LPA applies to both LPAs at the same time. For further information on setting the LPA Mode, see** "Configure Remote Forward Gain" on page 91**. For further information on resetting an LPA, see** "Resetting an LPA" on page 165**.**

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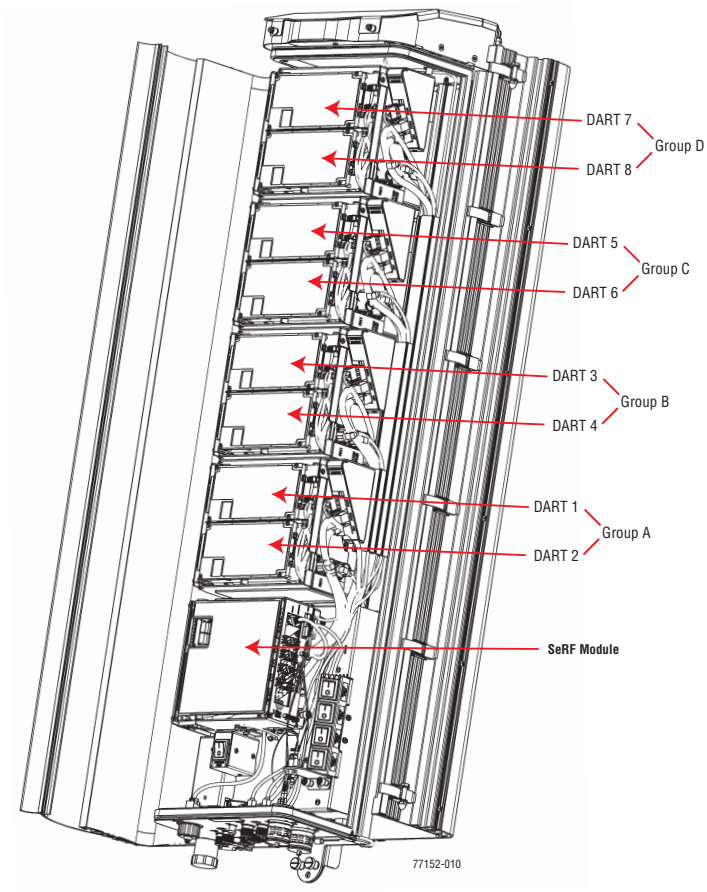

Figure 10. DART RF Groups in a Prism Remote Unit

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DART MODULES

DART Modules:

- amplify, down-convert, filter and digitize the incoming RF signal
- convert incoming digital signal from the SeRF to analog, filter, amplify and up-convert the frequency from Intermediate Frequency (IF) to RF
- provide a bi-directional interface between RF and the SeRF board (via FPGA, D/A converter, and A/D converter)
- provide uplink gain
- support Simplex RF interfacing to/from the BTS
- perform adjustable delay processing.

Prism supports the following types of DART Modules:

- Classic DARTs are 6-timeslot DARTs that support up to 35 MHz contiguous bandwidth (see Table 2).
- Single SuperDARTs are 6-timeslot DARTs that support two non-contiguous bands in the entire frequency range of the DART, but cannot exceed 35 MHz total RF bandwidth (see Table 3 on page 25).
- Single SuperDARTs that can support 70/75 MHz bandwidth in positions 1 or 3 when installed in a Host Unit II that has both a SeRF II Module and a Backplane II chassis installed. (See Table 4 on page 25.)
- Dual SuperDARTs are 12-timeslot DARTs that support up to 70/75MHz with two non-contiguous bands (see Table 4 on page 25).

NOTE: Industry Canada PCS 20 dB nominal bandwidth is less than 61.5 MHz.

NOTE: Industry Canada AWS 20 dB nominal bandwidth is less than 47.2 MHz

Table 2. *Single-Slot Classic DARTs*

DART Name	Maximum Bandwidth (MHz)	Number of Fiber Slots
800 APAC iDEN Classic	19	3
800 SMR Classic	18	3
850 Classic	25	4
900 SMR Classic	5	1

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Table 3. *Single-Slot SuperDARTs* (1)

DART Name	Maximum Frequency Span (MHz)	Maximum Bandwidth (MHz)	Maximum Fiber Slots
1800 SGL SuperDART	75	39	6
1900 PCS SGL SuperDART	70	39	6
2100 SGL AWS SuperDART	45	39	6
2100 SGL UMTS SuperDART	60	39	6
700 LowerABC SGL SuperDART		18	3
700 UpperC SGL SuperDART		10	2
900 EGSM SGL SuperDART		35	6

(1) When using a Host Unit II with both the SeRF II and System Board II modules, the bandwidths and fiber slots shown are only available in Host DART Slots 1 and 3 for Single-Slot SuperDARTs.

Table 4. *Dual-Slot SuperDARTs*

DART Name	Maximum Bandwidth (MHz)	Number of Fiber Slots
1800 DL SuperDART	75	12
1900 PCS DL SuperDART	70	12
2100 DL AWS SuperDART	45	8
2100 DL UMTS SuperDART	60	12

For further information on DART Modules, see also "Host DARTs" on page 26 and "RF Module Capabilities and GUI Representation" on page 21 (Remote RF Modules contain Remote DARTs).

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Host DARTs

The Host can support up to eight Classic DARTS and/or Single SuperDARTs or up to four Dual SuperDARTs. Figure 11 provides generic representations of Classic DARTS or Single SuperDARTs and Dual SuperDARTs.

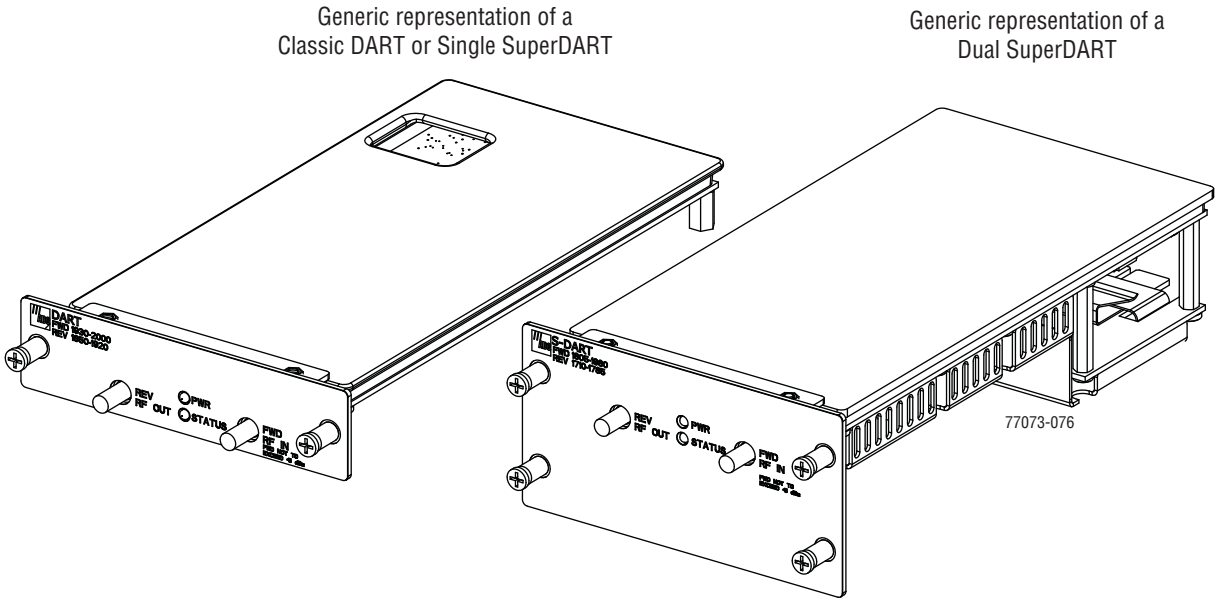

Figure 11. DART Modules

Figure 12 shows a Host that is fully loaded with Dual SuperDART Modules.

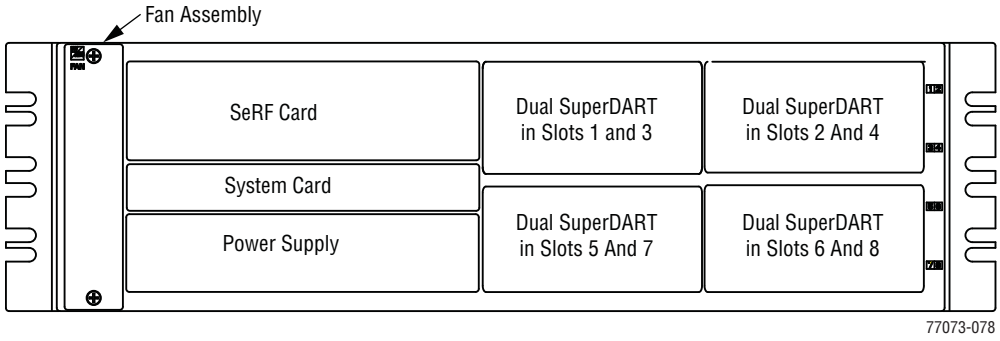

Figure 12. Host with Dual SuperDARTs

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Host DART Slots

Figure 13 shows the possible slot assignments for Single and Dual SuperDARTs, and where slot-divider bars are located.

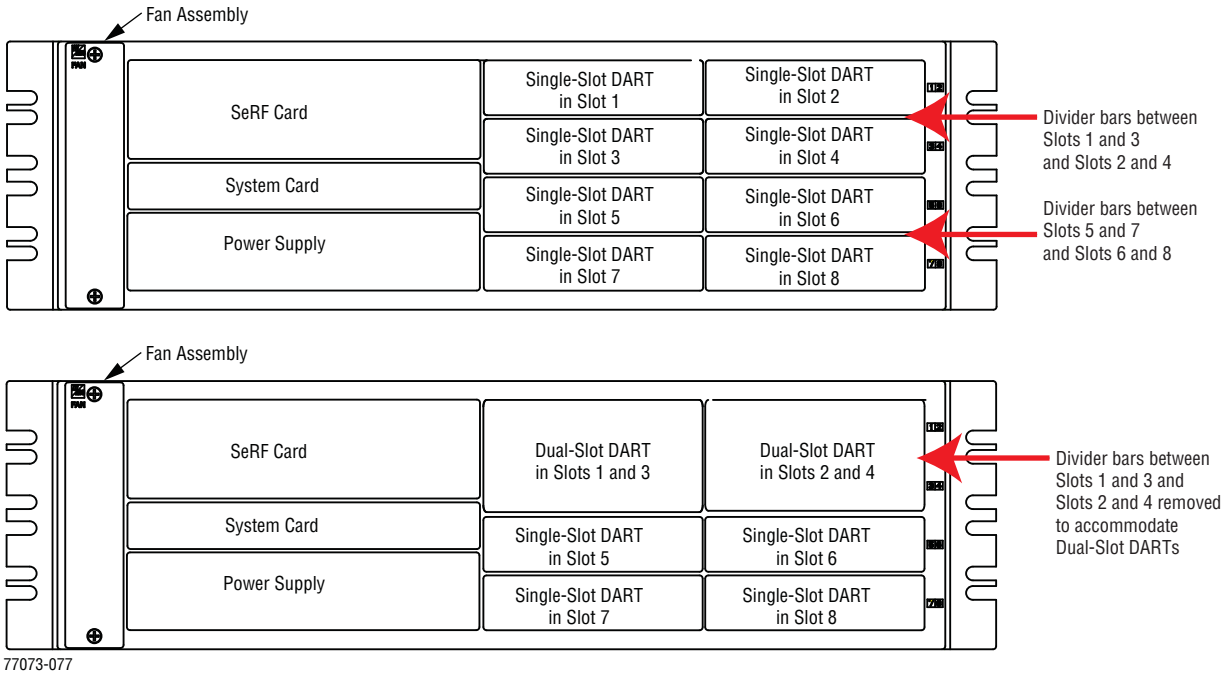

Figure 13. DART Slot Assignments in Host Chassis

Possible slot assignments for Single and Dual SuperDARTs are listed below.

- A Classic DART or Single SuperDART can be installed in each of the eight slots in the Host.
- Single-Slot SuperDARTs plugged into slots 1 or 3 of a Host that has both a SeRF II Module and a Backplane II chassis installed can pass 12 fiber slots like a dual-slot SuperDART.
- Dual SuperDARTs require that slot divider bars be removed as their size requires two-slot combinations, which are available in the following vertical groupings:
  - Slots 1 and 3
  - Slots 2 and 4
  - Slots 5 and 7
  - Slots 6 and 8.
- Dual SuperDARTs cannot occupy horizontal slot combinations:
  - Slots 3 and 5
  - Slots 4 and 6.
- Any combination of DARTs may be installed.

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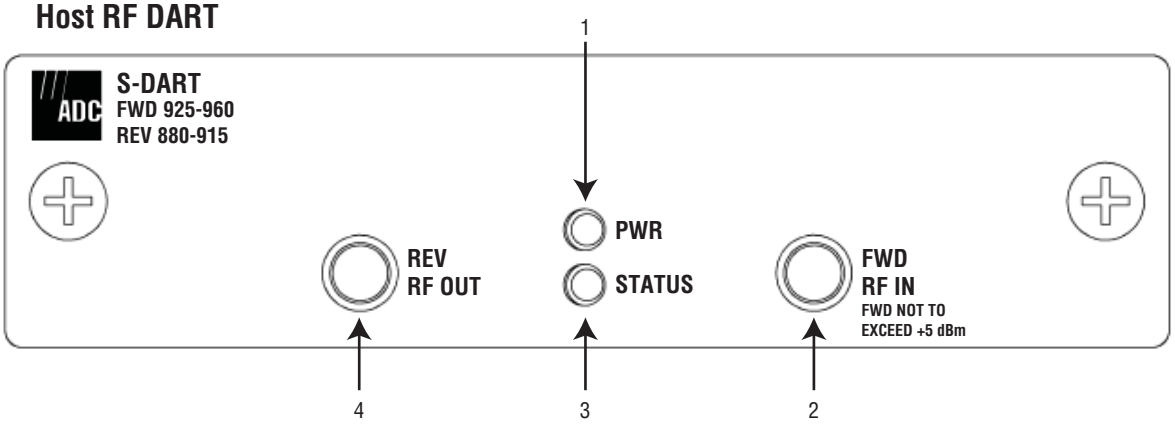
Host DART Connectors and LEDs

Only RF DART Modules can be installed in the Host Unit.

Host RF DART



DART Type	Ref #	Component	Device	Function
Host RF	2	FWD RF IN	QMA-Type female RF coaxial connector	Input connection point for the forward path RF coaxial cable to the BTS
	4	REV RF OUT	QMA-Type female RF coaxial connector	Output connection point for the reverse path RF coaxial cable to the BTS

Ref #	LED	LED Color	Description
1	PWR	• Green • Red • Off	• Card is powered. • Problem with onboard power • No power present at card.
3	STATUS	• Green • Red • Yellow	• OK • Major Alarm • Automatic Level Control active

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Serialized RF (SeRF) Digital Protocol

The SeRF (Serialized RF) digital protocol consists of digitized RF, Fast Ethernet, and Host to Remote communication and management. The protocol provides you with full access to the 100BASE-T (Ethernet) connection between the Host and each Remote, and the ability to provision the RF spectrum of the DARTs. The digitized RF portion of the SeRF protocol is divided into 12 timeslots, with each timeslot representing roughly 5 MHz of digitized RF spectrum. Utilizing the full 12 timeslots yields between 60 and 75 MHz of total digitized RF on each SeRF Small Form-Factor Pluggable (SFP) laser connection (single fiber pair).

The available RF bandwidth per timeslot is shown in Table 5.

Table 5. *Available RF Bandwidth*

Number of Timeslots	Maximum Contiguous RF Bandwidth (MHz)	
	Classic DARTs	Single and Dual SuperDARTs
1	5	6
2	12.5	12
3	20	18
4	25	25
6	35	39
8	---	45
12	---	60-75

For example, a user who wishes to transport PCS A block, Cellular A, and AWS B block, the system would require the following:

PCS A 15MHz, 3 timeslots
Cellular A 10MHz, 2 timeslots
AWS B 10MHz, 2 timeslots

_____

Total = 35MHz, 7 timeslots

Each fiber pair supports 12 timeslots, or up to 75 MHz of bandwidth. Table 5 shows the maximum bandwidth versus the number of timeslots.

If more than 70 MHz is required per Remote, up to three additional fiber pairs can be brought to the Remote to get up to up to 280MHz per Remote (or 300MHz if all four are GSM-1800).

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Simulcast Groups

Simulcast combining occurs when more than one Remote DART is linked to the same Host DART. The gains of the reverse signals are reduced before summation to prevent over-flow when the digital signals are added together. This simulcast gain reduction is accomplished as a function of the number of Remote DARTs linked to the Host DART (N) and the selected Reverse Gain Mode:

- **Mode 1 (Noise Floor Matching)**—uses an algorithm that normalizes the noise floor of all Remote Units.
- **Mode 2 (Legacy Prism/URH)**—reduces the gain by 20*log10(N).
  - **Mode 1 (Noise Floor Matching)** uses an algorithm that normalizes the noise floor of all Remote Units.
  - **Mode 2 (Legacy Prism/URH)**—reduces the gain by 20*log10(N).

Table 6 illustrates gain reduction for Mode 1 and Mode 2.

Table 6. *Reverse Gain Mode and Gain Reduction*

# Remote DARTs	Reduction (dB)	
	Mode 1	Mode 2
1	0	0
2	3.0	6.0
3	4.7	9.5
4	6.0	12.0
5	7.0	14.0
6	7.8	15.6
7	8.3	16.9
8	9.0	18.0

Simulcast groups are restricted to using the same timeslots on the fibers to each Remote. For example, if the first link established in a simulcast group is using timeslots 1-3 on a fiber for the PCS A passband, timeslots 1-3 must be used for that passband on each of the other Remotes in the simulcast group. If timeslots 1-3 are not available on a Remote's fiber, the Remote cannot be added to the simulcast group.

To minimize timeslot conflicts, simulcast groups should be configured before other passbands. If a conflict occurs while attempting to link a DART, an error message displays indicating that the DART linking failed. The DART using the conflicting timeslots must be unlinked to allow the DART in the simulcast group to be linked.

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Use of Multi Fibers

The EMS provides the ability to install “multi fibers” between a Host and Remote. This means that, in addition to the minimum single fiber pair (RX and TX) in the Host to Remote connection, one or more additional fiber pairs are installed. This is done to increase the bandwidth or number of timeslots between the Host and Remote.

Each fiber pair can handle approximately 75 MHz of RF bandwidth and each fiber is capable of supporting 12 timeslots, as described in “DART Modules” on page 24.

When a Host DART is linked to a Remote DART in a multi-fibers configuration, the EMS uses the first fiber (in numerical order) on which the required number of timeslots is available for the passband being linked. The EMS will not divide up the timeslots between two fibers. So, for example, if the passband requires eight timeslots, and only six timeslots are available on the first fiber, the EMS will bypass the first fiber and assign all eight timeslots to the second fiber, leaving four timeslots unused on the second fiber.

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E911 Support

The DART type determines the maximum number of links, where there can be up up to 8 Classic DARTs or Single SuperDARTs that support 35MHz each, or up to 4 Dual SuperDARTs that support up to 75MHz each.

E911 support may be achieved by using a configuration similar to the one shown in Figure 14. Remote simulcasting in this configuration requires analog splitting and combining to and from the individual Host DARTs. External analog splitting/combining ensures that the E911 system receives uplink signals from each Remote location before they are combined with uplink signals from the other Remotes in the simulcast.

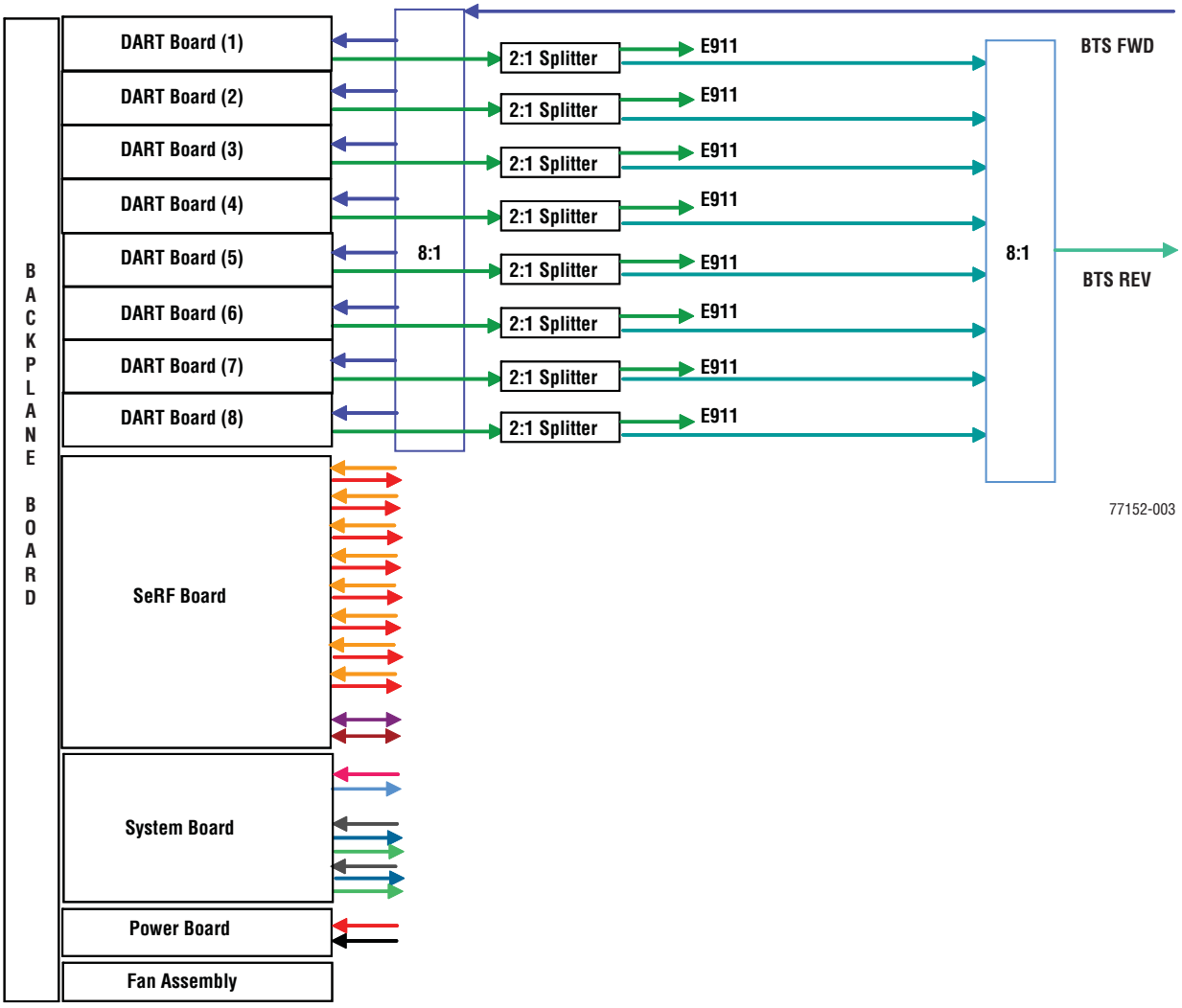

Figure 14. 8:1 Analog Simulcast U-TDoA E911 Support Diagram

NOTE: **When external E911 equipment is required, simulcasting must be accomplished via external RF splitting and combining. The DARTs will then be in a point-to-point configuration, as opposed to point-to-multipoint.**

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PRISM SYSTEM SPECIFICATIONS

Table 7. *RF and Optical Specifications*

Parameter	Specification [a]			Remarks
RF Specifications				
Supported Frequency Blocks	1-8 per Host Unit			
Bandwidth	1.5 to 75 MHz non-contiguous			
Supported Frequency Bands	• 850 Cellular • 1900 PCS • 700 LowerABC • 700 UpperC • 2100 AWS • 800/900 E-SMR • 900 GSM • 1800 DCS • 2100 UMTS			
Propagation Delay				
System Delay	<12 microseconds			
Delay Management Digital	Manual or Automatic			
Reverse Path	**Noise Figure Typical**	**Noise Figure Maximum**	**Input IP3**	
Normal Mode	5 dB	6 dB	>-8 dBm	
High Gain Mode - Classic DARTs	4 dB	5 dB	>-12 dBm	
High Gain Mode - SuperDARTs	3 dB	4 dB	>-14 dBm	
System Gain	**Standard Mode**	**High Gain Mode**		
Classic DARTs	36 dB	38 dB		
SuperDARTs	30 dB	36 dB		
Optical Budget for optical BER of 10^{-6}	**Standard**	**Optional**		
	26 dB	13 dB		
Digital Transport Rate	3.072 Gbps			
Optical power levels	**Minimum**	**Maximum**		
Intermediate Range Launch Power	-5 dBm	1 dBm		
Intermediate Range Receive Power	-18 dBm	1 dBm		
Long Range Launch Power	-2 dBm	3 dBm		
Long Range Receive Power	-27 dBm	-9 dBm		
Transceiver Wavelengths				For information on transceiver transmissions with a CWDM, see the *ADC FlexWave Prism Coarse Wavelength Division Multiplexer User Manual* (ADCP-75-353).
Transmits	1550 nm signal			
Receives	1550 or 1310 nm signal			

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Table 7. *RF and Optical Specifications (Cont.)*

Parameter	Specification [a]		Remarks
Optical - Host II and Remote Units			
Fiber type	9/125, single-mode		
Number of fibers required	up to 75 MHz RF per fiber pair (or fiber if using WDM).		Assumes RF bandwidth does not exceed 3 Gbps data rate capacity of the fiber.
Optical - WDM			
WDM Passband	1310 nm ± 20 nm 1550 nm ± 20 nm		
Forward path insertion loss	**Host WDM** 0.7 dB	**Remote WDM** 0.3 dB	Does not include connector loss
Reverse path insertion loss	**Host WDM** 0.3 dB	**Remote WDM** 0.7 dB	Does not include connector loss
Isolation	> 30 dB minimum		
Return loss (Reflectance)	< –50 dB		All input ports
[a] All specifications apply after a five minute warm-up period.			

Table 8. *Host Unit II Technical Specifications*

Parameter	Specification	Notes
Power		
DC Power	±21 – ±60 Vdc floating	
Power consumption	Maximum: 320 Watts Nominal: 202 Watts	
Current rating for maximum system (eight DARTs and eight SFPs)	7.5 Amps @ 48Vdc 15 Amps @ 24Vdc	
Connectors and Ports		
RF coaxial cable connectors	50 ohm QMA – type (female)	50 ohms input/output impedance
Network and Craft connectors	RJ–45 jack	
External alarm connector	Screw-type terminals	Normally Open (NO), Common (COM), and Normally Closed (NC) relay contacts
Optical ports	SFP transceivers	Industry standard LC (UPC); Host and WDM
Physical Specifications		
Dimensions	**Height x Width x Depth** **Inches** 5.17 × 17.26 × 9.5 **Millimeters** 131.3 × 438.4 × 241.3	Width dimension does not include the mounting brackets for 19- or 23-inch racks.
Mounting	19- or 23-inch rack	EIA or WECO
Weight	20 lbs. (9.1 kg)	
Environmental		Environmentally controlled outdoor cabinet
Weather resistance	Indoor installation only	
Operating temperature	0º to 50º C (32º to 122ºF)	
Storage temperature	–40º to 70º C (–40º to 158ºF)	
Humidity	10% to 90%	No condensation
Reliability at 25ºC	MTBF 200,000 hours	Excluding fans

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Table 9. *Remote Unit Technical Specifications*

Parameter		Specification					Remarks
Enclosure dimensions		**Height**	**x**	**Width**	**x**	**Depth**	
Single-Band	**Inches**	25.2	×	12.2	×	11.2	• Dimension for width includes the mounting brackets. • To have adequate clearance to open the Remote chassis door, allow a minimum of 7 inches at the left, right and front of each Remote.
	Centimeters	64	x	30.99	x	28.45	
Dual-Band	**Inches**	33.2	×	12.2	×	11.2	
	Centimeters	84.3	x	30.99	x	28.45	
Tri-Band	**Inches**	41.2	×	12.2	×	11.2	
	Centimeters	104.6	x	30.99	x	28.45	
Quad-Band	**Inches**	52.4	×	12.2	×	11.2	
	Centimeters	133.10	x	30.99	x	28.45	
Mounting		Wall, Pole, Inside Pole, and Vault					
Weight		**Unpopulated**		**Populated**			• "Unpopulated" weight includes the Solar shields, which are always present. • "Populated" weight is the weight of the chassis that has the SeRF Module and RF Modules installed.
Single-Band	**Pounds**	65		83			
	Kilograms	29		38			
Dual-Band	**Pounds**	81		117			
	Kilograms	37		53 kg			
Tri-Band	**Pounds**	97		151			
	Kilograms	44		68 kg			
Quad-Band	**Pounds**	116		188			
	Kilograms	53		85 kg			
Outside Ambient							
Temperature Rating		-40° C to +50° C (-40° F to +122° F)					
Storage Temperature		-40° C to +70° C (-40° F to +158° F)					
Humidity		10% to 90% non-condensing					
Weather Resistance		IP-65					Indoor or outdoor installation
Lightning Protection		20kA IEC 1000-45 8/30 ìs Waveform					Provided by external lightning protector, which is an accessory.
Cooling		Fan, IP-55					
Operating Voltage Range		10 - 28 Vdc					
Operating Temperature Range		-10 - 70°C (14°F - 158°F)					
Storage Temperature Range		-40 - 70°C (-40°F - 158°F)					
Connectors							
Network port		RJ-45 female connector					
AC power connector		Sealed 3-pin					Connection point for the AC power cord
Antenna cable connector		50 ohm N-Type (female)					50 ohms input/output impedance
Voltage input		100 to 240 VAC, 50 to 60 Hz					Operating range 90 to 265 VAC
Current rating		15 AMPS					
Encapsulation		PBT Encapsulated Motor and Control PCB					
Bearings		Abec 3, double shielded, chrome ball bearings					
Continuous Duty Life-Cycle		50,000 hours at 25°C (77°F)					
Safety		UL/C-UL File E137077, TUV					

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PART II

SYSTEM SETUP

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USING THE PRISM EMS

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This section provides a basic description of the Prism Element Management System (EMS).

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HOW TO USE THE EMS GRAPHICAL USER INTERFACE

You use a web browser to access the EMS Graphical User Interface (GUI) shown in Figure 15 and described in Table 10.

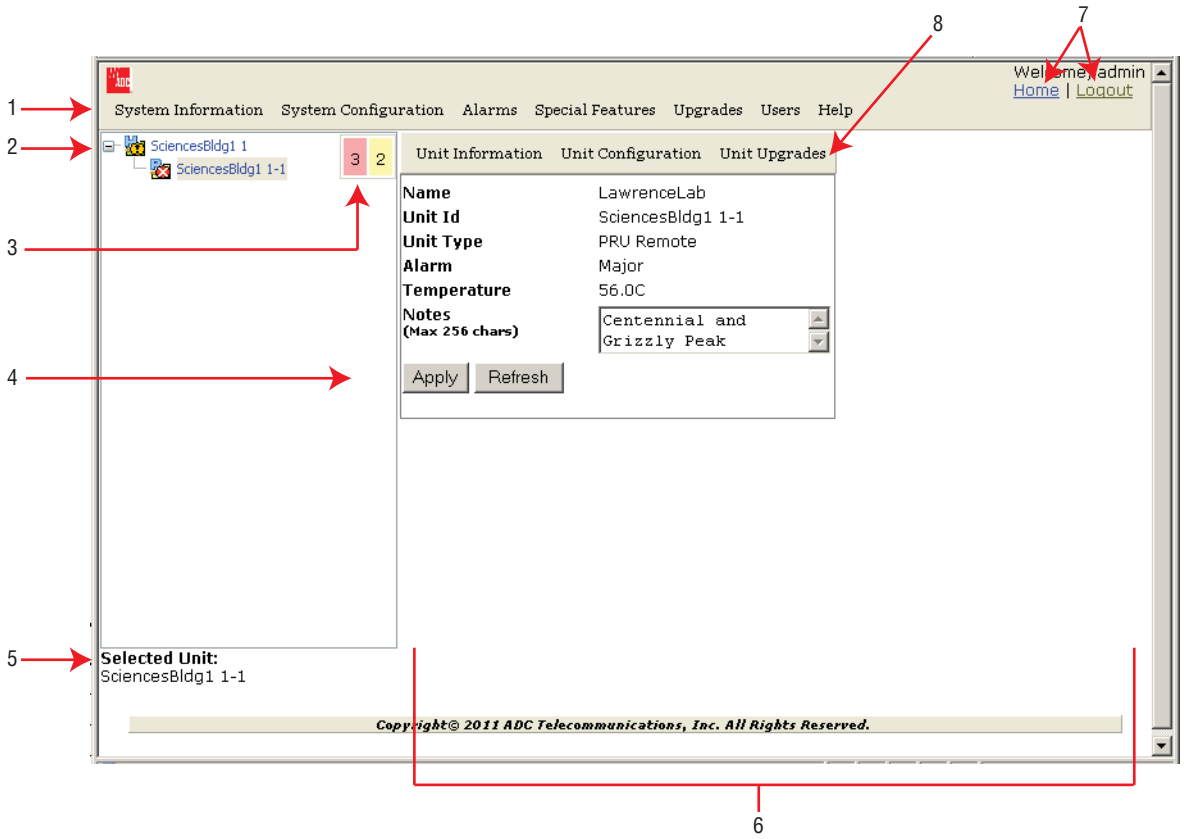


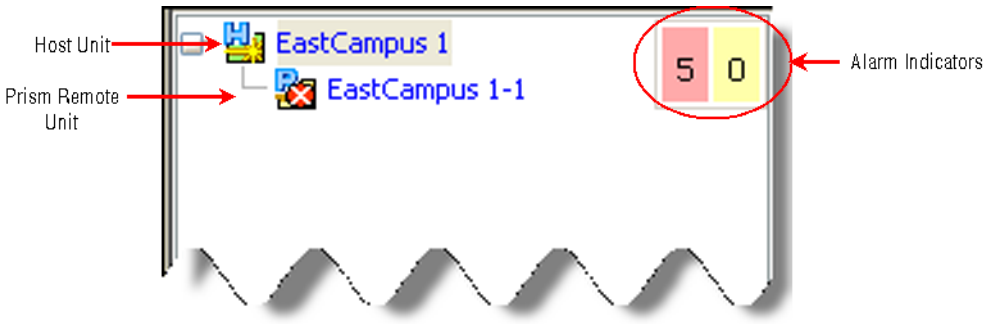
Figure 15. EMS Graphical User Interface

Table 10. *GUI Components*

ID #	Component	Description
1	System Menu bar	Provides access to menus that allow you to configure or view system settings and alarms.
2	System Tree	See "System Tree" on page 41.
3	Alarm indicators	Provides a visual view of the number of active alarms and their severity level.
4	Operational buttons	Execute the command for which the button is labeled: • **Apply**—Applies your configuration changes without closing the dialog. • **Refresh**—Updates status information to reflect current conditions.
5	Unit Identifier	Identifies which system component is selected in the System Tree.
6	EMS View Frame	Provides the work space in which you access a Prism EMS web page specific to a unit or function. **NOTE:** You can use your keyboard to navigate through the EMS pages: •**SPACE** key on the keyboard scrolls down by a page •**SHIFT+SCROLL** scrolls up one page.
7	Orientation links	Provides links that allow you to navigate within the GUI: • **Home**—returns you to the Home page • **Logout**—logs you out of the EMS.
8	Unit Menu bar	Provides access to menus that allow you to configure or view settings and alarms that pertain to the unit that is actively selected in the System Tree.

System Tree

The System Tree displays a Prism system as device icons within a hierarchical tree that is automatically organized by Unit ID:



You click on a node to navigate to a web page within the EMS View Frame that corresponds to the selected unit.

The Alarm indicators in the upper-right corner of the System Tree let you know how many active alarms there are, and at what severity level. In the preceding figure, the Alarm indicators show:

- 5 active Major alarms, as indicated by the red box
- 0 active Minor alarms, as indicated by the yellow box.

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System Tree Icons

Table 11 describes the icons used in the System Tree.

Table 11. *System Tree Icons*

Icon	Unit/State	Description
	Host	Host Unit; normal status
	PRU	Prism Remote Unit; normal status
	URU	Universal Radio Head Remote Unit; normal status
	Minor Alarm State	A yellow caution overlay on a unit icon indicates that the unit has an active Minor alarm. If the icon is blinking, the alarm is unacknowledged.
	Major Alarm State	A red danger overlay on a unit icon indicates that the unit has an active Major alarm. If the icon is blinking, the alarm is unacknowledged.
	Contact Alarm State	Indicates a Contact Alarm state: • Static—the alarm is acknowledged. • Blinking—the alarm is unacknowledged.
	No Contact Alarm State	Indicates a No Contact Alarm state.
	Disconnect	Indicates that the unit is disconnected. Applicable only to PRUs and URUs.
	Unknown Unit	Identifies a unit that the EMS has found but cannot recognize.

EMS View Frame Elements

Figure 16 and Table 12 describe the different elements found within the EMS View Frame.

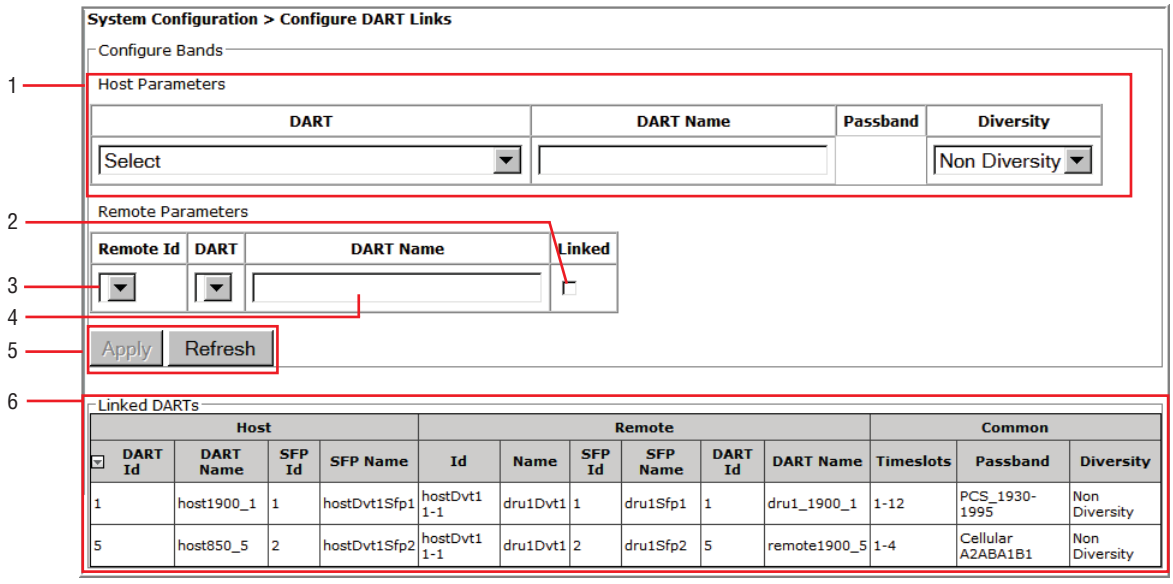

Figure 16. Elements within a View Frame

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Table 12. *View Frame Elements*

ID #	Element	Description
1	Panel	A panel is a grouping of fields or parameters enclosed within a grey box, with the panel title in the upper-left corner.
2	Selection box/Radio button	A square box is a selection box that you click on to select or deselect an option. When selected, a checkmark displays in the box. When the option is deselected, the box is empty. If the selection box is round, it is referred to as a radio button. When a radio button is selected, the round "button" is filled in. When a radio button is deselected, its circle is empty.
3	List	A menu that lists the options for the corresponding parameter. Click on the down arrow to display the list.
4	Text box	A text box allows you to enter custom information for the corresponding field.
5	Operational buttons	Execute the command for which the button is labeled. When a button is greyed out, that function is not available.
6	Table	A table collects information that corresponds to the EMS View Frame and provides it in table format. The table is enclosed within a panel, with the table title in the upper-left corner.

NOTE: The View Frame is designed to update its contents within a web browser approximately every 20 seconds.

Unit Identification

Figure 17 shows the Unit ID in the System Tree. The Unit ID is the *hostname* (user-defined label) plus the layer address. The layered address is H-R, so the Unit ID is **<*hostname*>H-R**, where:

- H—Host # is always 1
- R—Remote Unit # (PRU or URU), which can be 1 - 8 and is based on the SFP port number to which the Remote Unit is connected

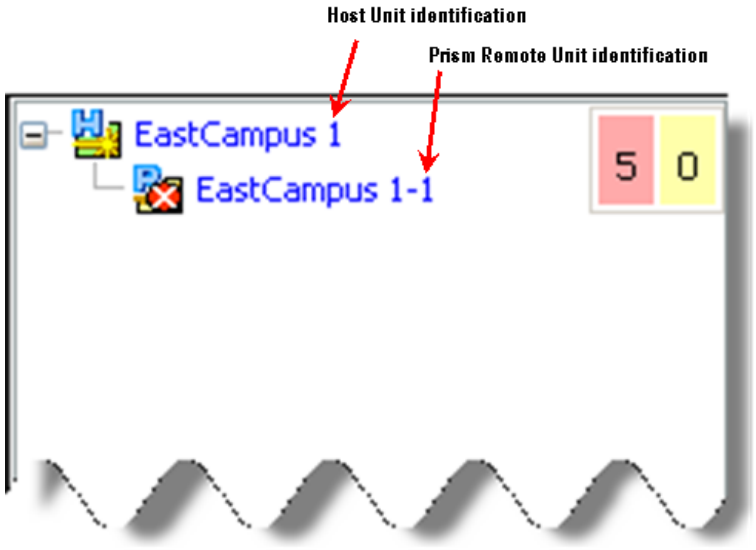

Figure 17. System Tree Unit IDs

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Viewing Parameters and Alarms

You can view any parameter or alarm by navigating to the page in which the parameter or alarm resides. To quickly find information about a parameter or alarm:

- All parameters are listed alphabetically in this manual's Index.
- All alarms are listed alphabetically in this manual's Index of Alarms.
- All traps are listed alphabetically in this manual's Index of Traps.

Alarm Color Codes

Alarms are color coded in the GUI according to the level of the alarm:

- Green—No alarm
- Blue—Information alarm, which provides information on a successful user action, such as a change in a forward or reverse delay setting
- Yellow—Minor alarm
- Red—Major alarm
- Gray—the alarm has been disabled; see "Enable and Disable Host and Remote Unit Alarms" on page 178
- White—a device has not been installed. For example, in Figure 18, which shows the **Unit Information > View Status** page, the **Module Status** table shows that a DART has not been installed in slots 3, 7, or 8. The **Optical Status** table shows that SFPs are not installed in Optical ports 2 through 8.

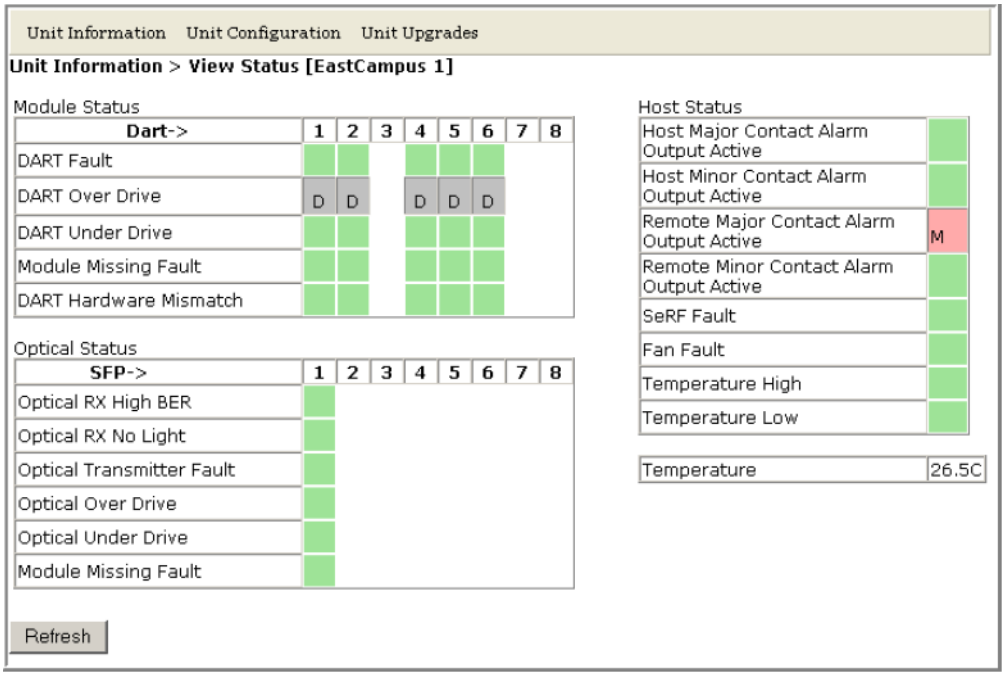

Figure 18. Understanding Color Codes for Empty Slots

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