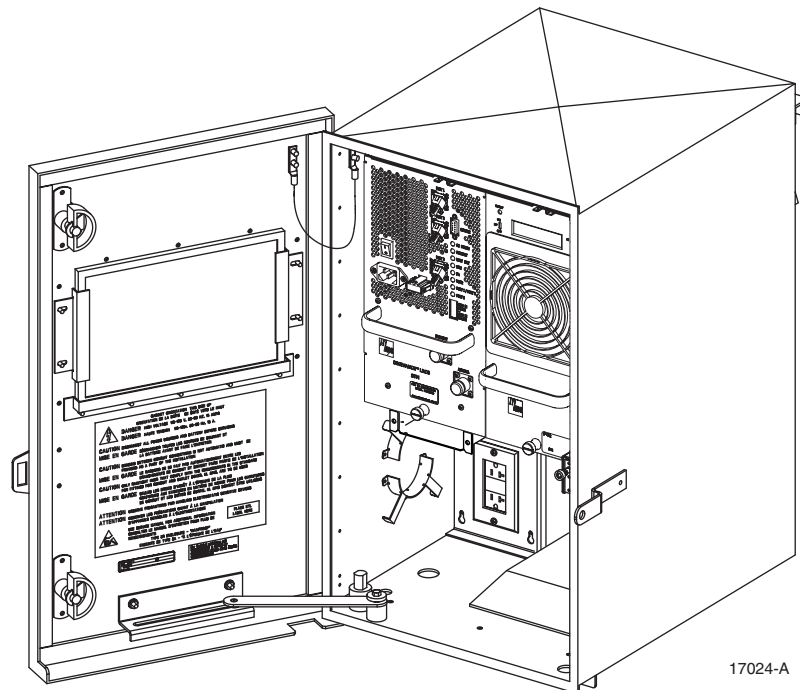
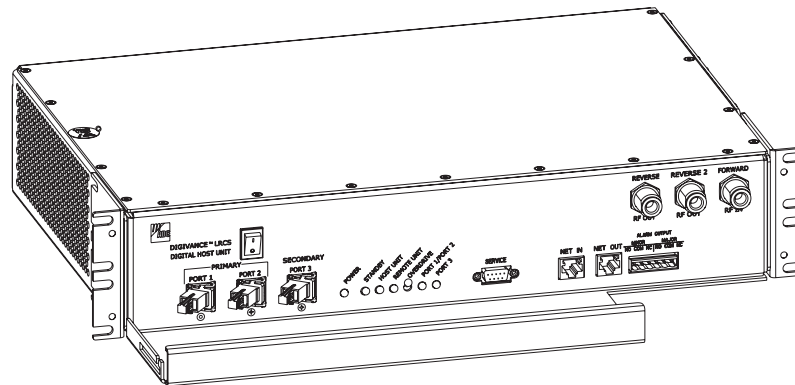




# Digivance™ Long-Range Coverage Solution Single Band 1900 MHz System Installation and Operation Manual





# **Digivance™ Long-Range Coverage Solution Single Band 1900 MHz System Installation and Operation Manual**

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ADC Telecommunications, Inc.  
P.O. Box 1101, Minneapolis, Minnesota 55440-1101  
In U.S.A. and Canada: 1-800-366-3891  
Outside U.S.A. and Canada: (952) 938-8080  
Fax: (952) 917-1717

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## ABOUT THIS MANUAL

This installation and operation manual provides the following information:

- An overview of the Digivance single band 1900 MHz Long-Range Coverage Solution (LRCS).
- A description of the basic system components including the Host Unit (HU), Spectrum Transport Module (STM), Linear Power Amplifier (LPA), Remote Unit (RU) cabinet, and Digivance Element Management System (EMS).
- Installation procedures for the HU.
- Procedures for tuning-up the system and verifying that the system is functioning properly.
- Procedures for maintaining the system including troubleshooting problems and replacing faulty components.
- Product warranty, repair, return, and replacement information.

The procedures for installing the remote unit and for installing and using the EMS software are provided in other publications which are referenced in the Related Publications section and at appropriate points within this manual.

## RELATED PUBLICATIONS

Listed below are all the related manuals, their content, and their publication numbers. Copies of these publications can be ordered by contacting the Technical Assistance Center at 1-800-366-3891, extension 73475 (in U.S.A. or Canada) or 952-917-3475 (outside U.S.A. and Canada).

Title/Description	ADCP Number
<p><b>Digivance LRCS Single Band 800 and 1900 MHz Remote Unit Installation Instructions</b></p> <p>Provides instructions for installing the STM, LPA, and optional battery in the remote unit cabinet and for installing and connecting the fiber optic, coaxial, and AC power cables.</p>	<b>75-122</b>
<p><b>Digivance LRCS Single Band Remote Unit Cabinet Installation Instructions</b></p> <p>Provides instructions for locating and mounting the remote unit cabinet.</p>	<b>75-117</b>
<p><b>Digivance Element Management System Version 2.0 User Manual</b></p> <p>Provides instructions for installing the Digivance EMS software and for using both the Graphical User Interface (GUI) and the Network Operations Center (NOC) versions of the software.</p>	<b>75-125</b>



## ADMONISHMENTS

Important safety admonishments are used throughout this manual to warn of possible hazards to persons or equipment. An admonishment identifies a possible hazard and then explains what may happen if the hazard is not avoided. The admonishments — in the form of Dangers, Warnings, and Cautions — must be followed at all times. These warnings are flagged by use of the triangular alert icon (seen below), and are listed in descending order of severity of injury or damage and likelihood of occurrence.



**Danger:** *Danger is used to indicate the presence of a hazard that **will** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



**Warning:** *Warning is used to indicate the presence of a hazard that **can** cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



**Caution:** *Caution is used to indicate the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided.*

## GENERAL SAFETY PRECAUTIONS



**Danger:** *This equipment uses a Class 1 Laser according to FDA/CDRH rules. Laser radiation can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not look directly into the optical transceiver of any digital unit or exposure to laser radiation may result. An optical power meter should be used to verify active fibers. A protective cap or hood **MUST** be immediately placed over any radiating transceiver or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure. This practice also prevents dirt particles from entering the adapter or connector.*



**Danger:** *Do not look into the ends of any optical fiber. Exposure to laser radiation may result. Do not assume laser power is turned-off or the fiber is disconnected at the other end.*



**Danger:** *Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.*



**Warning:** *The HU is powered by 48 VDC power which is supplied over customer-provided wiring. To prevent electrical shock when installing or modifying the HU power wiring, disconnect the wiring at the power source before working with uninsulated wires or terminals.*



**Caution:** *Always allow sufficient fiber length to permit routing of patch cords and pigtails without severe bends. Fiber optic patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (50 mm).*

## STANDARDS CERTIFICATION

**FCC:** This equipment complies with the applicable sections of Title 47 CFR Part 24.

**UL/CUL:** This equipment complies with UL and CUL 50 Standard for Enclosures for Electrical Equipment. This equipment provides the degree of protection specified by IP43 as defined in IEC Publication 529.

**FDA/CDRH:** This equipment uses a Class 1 LASER according to FDA/CDRH Rules. This product conforms to all applicable standards of 21 CFR Part 1040.

**IC:** This equipment complies with the applicable sections of RSS-131.

## LIST OF ACRONYMS AND ABBREVIATIONS

The acronyms and abbreviations used in this manual are detailed in the following list:

<b>AC</b>	Alternating Current
<b>ASCII</b>	American Standard Code for Information Interchange
<b>Att</b>	Attenuation
<b>AWG</b>	American Wire Gauge
<b>BER</b>	Bit Error Rate
<b>BTS</b>	Base Transceiver Station
<b>C</b>	Centigrade
<b>CAN</b>	Controller Area Network
<b>CDRH</b>	Center for Devices and Radiological Health
<b>CD-ROM</b>	Compact Disk Read Only Memory
<b>COM</b>	Common
<b>Config</b>	Configuration
<b>CUL</b>	Canadian Underwriters Laboratories
<b>DC</b>	Direct Current
<b>DCE</b>	Data Communications Equipment
<b>Div</b>	Diversity
<b>DTE</b>	Data Terminal Equipment
<b>EIA</b>	Electronic Industries Association
<b>EMS</b>	Element Management System
<b>ESD</b>	Electrostatic Discharge
<b>F</b>	Fahrenheit
<b>FCC</b>	Federal Communications Commission
<b>FDA</b>	Food and Drug Administration
<b>FSO</b>	Free Space Optics
<b>Fwd</b>	Forward
<b>GFCI</b>	Ground Fault Circuit Interrupter
<b>GUI</b>	Graphical User Interface

<b>HU</b>	Host Unit
<b>IC</b>	Industry Canada
<b>LED</b>	Light Emitting Diode
<b>LPA</b>	Linear Power Amplifier
<b>LRCS</b>	Long-Range Coverage Solution
<b>MHz</b>	Mega Hertz
<b>MPE</b>	Maximum Permissible Exposure
<b>MTBF</b>	Mean Time Between Failure
<b>NC</b>	Normally Closed
<b>NEM</b>	Network Element Manager
<b>NO</b>	Normally Open
<b>NOC</b>	Network Operations Center
<b>NPT</b>	National Pipe Tapered
<b>OSP</b>	Outside Plant
<b>PA</b>	Power Amplifier
<b>PC</b>	Personal Computer
<b>PCS</b>	Personal Communications System
<b>Prg</b>	Program
<b>Pwr</b>	Power
<b>Rev</b>	Reverse
<b>RF</b>	Radio Frequency
<b>RIM</b>	Radio Interface Module
<b>RMA</b>	Return Material Authorization
<b>RU</b>	Remote Unit
<b>RX</b>	Receive or Receiver
<b>SMR</b>	Specialized Mobile Radio
<b>STM</b>	Spectrum Transport Module
<b>TX</b>	Transmit or Transmitter
<b>UL</b>	Underwriters Laboratories
<b>VAC</b>	Volts Alternating Current
<b>VDC</b>	Volts Direct Current
<b>VSWR</b>	Voltage Standing Wave Ratio
<b>WECO</b>	Western Electric Company
<b>WDM</b>	Wave Division Multiplexer

## SECTION 1: OVERVIEW

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### 1 INTRODUCTION

This section provides basic description, application, and configuration information about the Digivance single band 1900 MHz Long-Range Coverage Solution (LRCS). Throughout this publication, all items referenced as “accessory items” are not furnished with the basic product and must be purchased separately.

### 2 SINGLE BAND SYSTEM OVERVIEW

The Digivance single band 1900 MHz LRCS is an RF signal transport system that provides long-range RF coverage in areas where it is impractical to place a Base Transceiver Station (BTS) at the antenna site. High real estate costs and community restrictions on tower and equipment locations often make it difficult to install the BTS at the same location as the antenna. The Digivance LRCS is designed to overcome equipment placement problems by allowing base stations to be hubbed at a central location while placing remote antennas at optimum locations with minimal real estate requirements. With the Digivance LRCS, RF signals can be transported to one or more remote locations to expand coverage into areas not receiving service or to extend coverage into difficult to reach areas such as canyons, tunnels, or underground roadways.

#### 2.1 Basic Components

The basic components of a single band Digivance LRCS system and their functions are shown in [Figure 1-1](#). A single band LRCS system consists of a Host Unit (HU) and a Remote Unit (RU). Control and monitoring functions are provided by the Digivance Element Management System (EMS). On an optional basis, each HU and RU system may be ordered either with or without reverse path diversity. In addition, various accessory items including a back-up battery kit (for the RU), a Wave Division Multiplexer (WDM) module (for the HU and RU), network cables (for connecting multiple HU's together), and EMS cable (for connecting the EMS computer to the HU) are available separately.

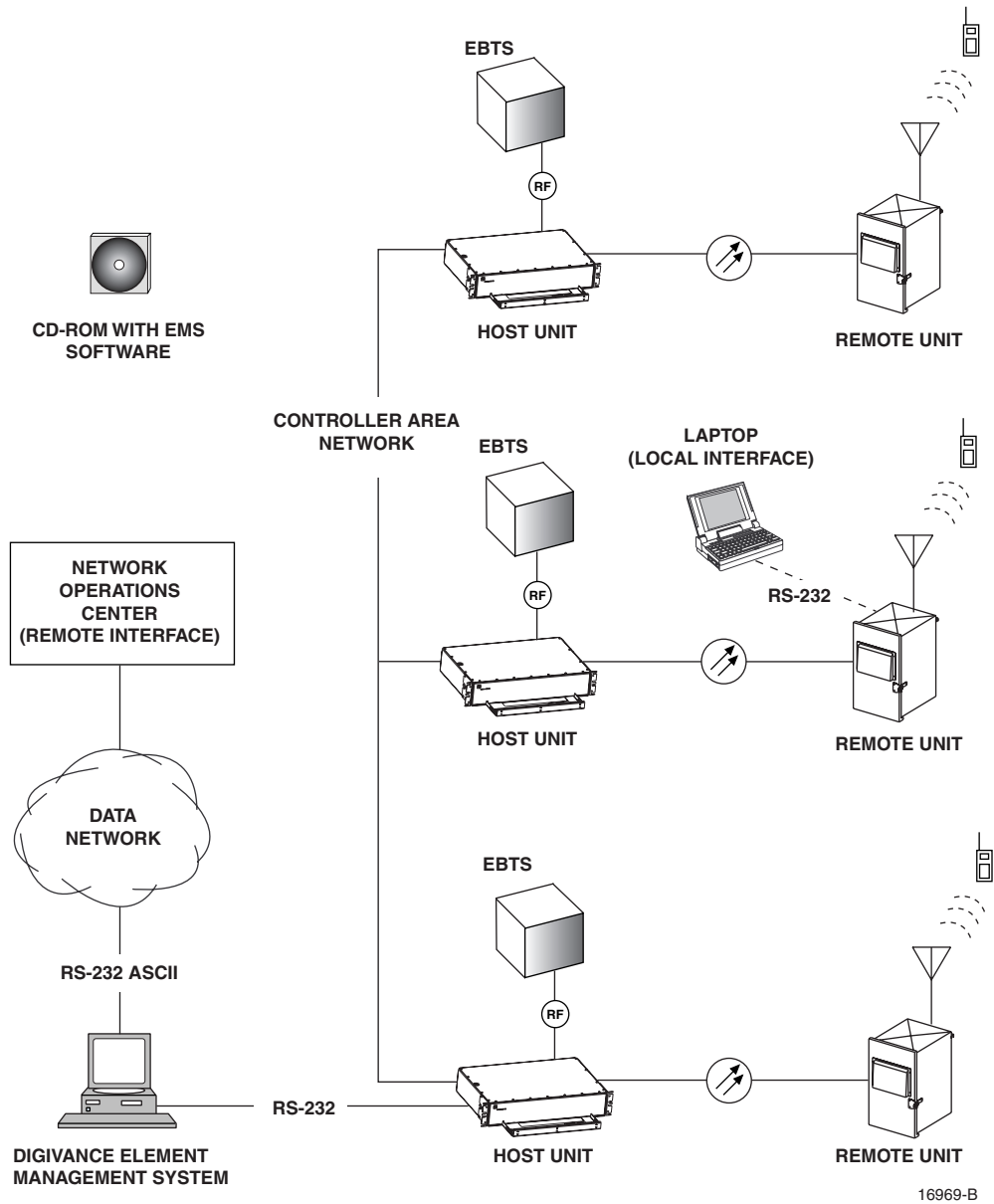


Figure 1-1. System Overview Diagram

## 2.2 Base Transceiver Station Interface

The HU is co-located with the BTS and interfaces directly with the BTS over coaxial cables. In the forward path, the HU receives RF signals from the BTS. The HU digitizes the RF signals and then converts them to digital optical signals for transport to the RU. In the reverse path, the HU receives digital optical signals from the RU. The HU converts the digital optical signals back to RF signals for transmission to the BTS.

## 2.3 Handset Interface

The RU interfaces with the handsets through an antenna. In the reverse path, the RU receives RF signals from each handset. The RU digitizes the RF signals and then converts them to digital optical signals for transport to the HU. In the forward path, the RU receives digital optical signals from the HU. The RU converts the optical signals to RF signals for transmission to the handsets. The RU is connected to an antenna which transmits and receives the handset RF signals.

## 2.4 Local Service Interface

Local communications with an individual Digivance LRCS system is supported through a local service interface capability. The primary component of the local interface is a PC-type laptop computer loaded with the Digivance Element Management System (EMS) software. The EMS provides the various control and monitoring functions required for **local** management of each LRSC system. The EMS computer can be directly connected to either the HU or RU through the computer's RS-232 port. Operation is effected through the EMS Graphical User Interface (GUI). The GUI consists of a series of screens from which the user selects the desired option or function. An RS-232 service port is provided on both the HU and the RU for connecting the EMS computer.

## 2.5 Remote NOC Interface

Remote communications between a Network Operations Center (NOC) and a networked grouping of multiple Digivance LRCS systems is supported by a remote NOC interface capability. The primary component of the remote NOC interface is a PC-type desktop computer loaded with the Digivance Element Management System (EMS) software. In addition to the local management functions described in the previous section, the EMS also provides the various control and monitoring functions required for **remote** management of multiple LRSC systems through a NOC.

A Controller Area Network (CAN) port is provided on each HU so that up to twenty-four HU's can be networked together in daisy-chain fashion and controlled through the same EMS computer. The EMS computer connects to the networked HU's through the computer's RS-232 port #1. All HU's can then be controlled through the same EMS computer.

The NOC is connected to the EMS computer through a data network or dial-up modem. The EMS computer's RS-232 port #2 interfaces with the data network equipment. The network or dial-up modem equipment must be capable of interfacing with an RS-232 ASCII interface port.

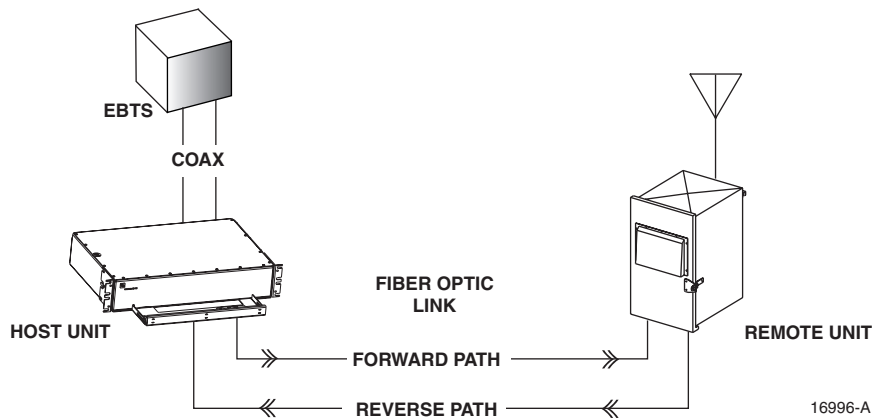
At the NOC, control and monitoring of the networked LRCS systems are effected through a Network Element Manager (NEM) interface which requires only a VT100 terminal/emulator for operation. The NEM interface language consists of simple ASCII text strings. All communications are input as either SET or GET commands which result in ASCII text string responses from the specified system or systems. The EMS computer may also be used locally to manage the networked LRCS systems. Local operation is through the EMS software GUI.

### 3 SYSTEM FUNCTIONS AND FEATURES

This section describes various system level functions and features of the Digivance LRCS.

#### 3.1 Fiber Optic Transport

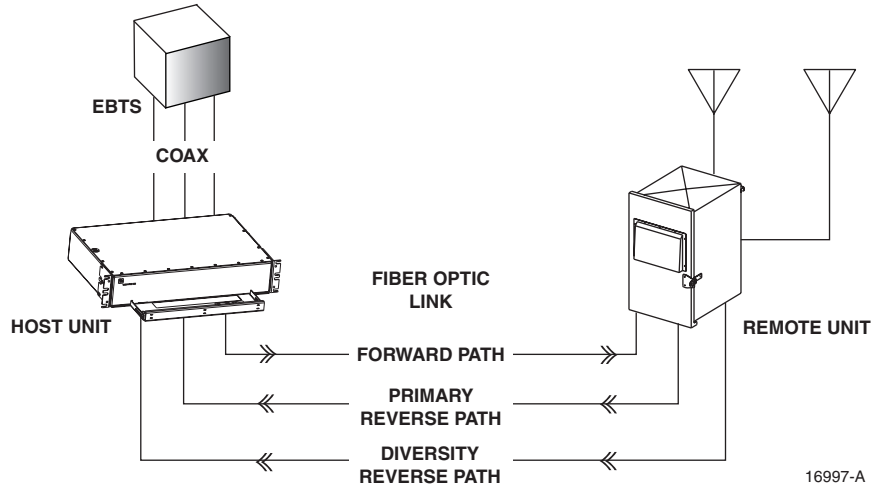
On an optional basis, the Digivance LRCS is available either with or without reverse path diversity. On **non-diversity** systems that do not use a WDM module, the HU is connected to the RU over a pair of single-mode optical fibers. One fiber is used to transport the forward path optical signal. The other 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 HU or the RU are not dependent on the level of the optical signal or the length of the optical fiber. A diagram of the fiber optic transport system for a non-diversity system that does not include the WDM module is shown in [Figure 1-2](#).



**Figure 1-2. Fiber Optic Transport without Diversity and Without WDM Module**

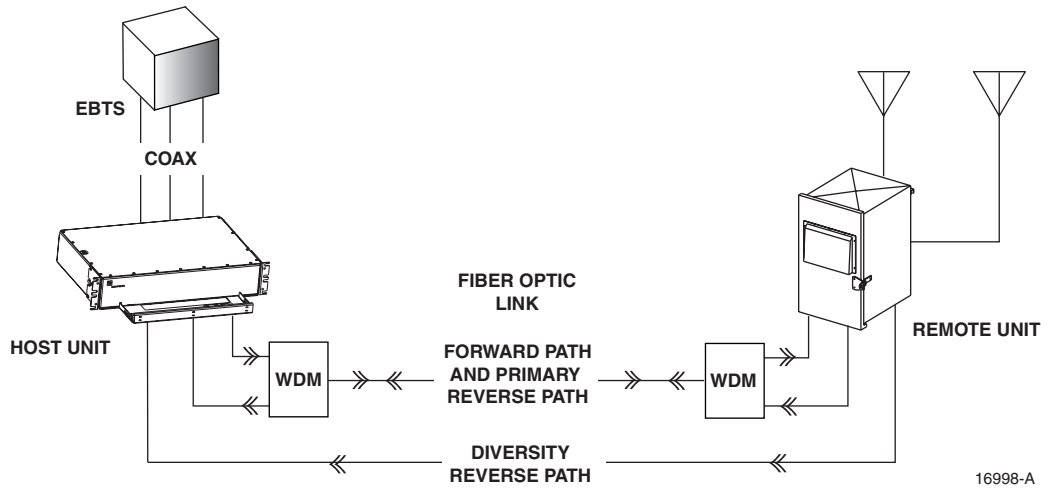
On diversity systems that do not use a WDM module, the HU is connected to the RU over three single-mode optical fibers. One of the optical fibers is used to transport the forward path optical signal. A second optical fiber is used to transport the primary reverse path optical signal. The third optical fiber is used to transport the diversity reverse path optical signal. A diagram of the fiber optic transport system with the diversity option is shown in [Figure 1-3](#).

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.



**Figure 1-3. Fiber Optic Transport with Diversity and Without WDM Module**

The optical wavelengths used in the system are 1550 nm for the forward path and 1310 nm for the reverse path. Because different wavelengths are used for the forward and reverse paths, a pair of bi-directional wavelength division multiplexers (WDM) may be used in applications where it is desirable to combine the forward path and reverse path optical signals on a single optical fiber. One WDM may be mounted with the HU and the other WDM mounted with the RU. A diagram of a fiber optic transport system with a WDM application is shown in [Figure 1-4](#). The WDMs are available as accessory items.



**Figure 1-4. Wavelength Division Multiplexer Application**



Because separate forward and reverse path optical inputs and outputs are provided at the HU and RU, a Free Space Optics (FSO) system (that meets the Digivance LRCS data rate performance and BER requirements) may be used in applications where it is desirable to bridge an open span and where it is impractical to lay a fiber optic cable. One FSO transceiver unit may be mounted on the HU side of the open span and the other FSO transceiver unit may be mounted on the RU side of the open span. A system diagram of an FSO application is shown in Figure 1-5. FSO systems are available from various equipment manufacturers.

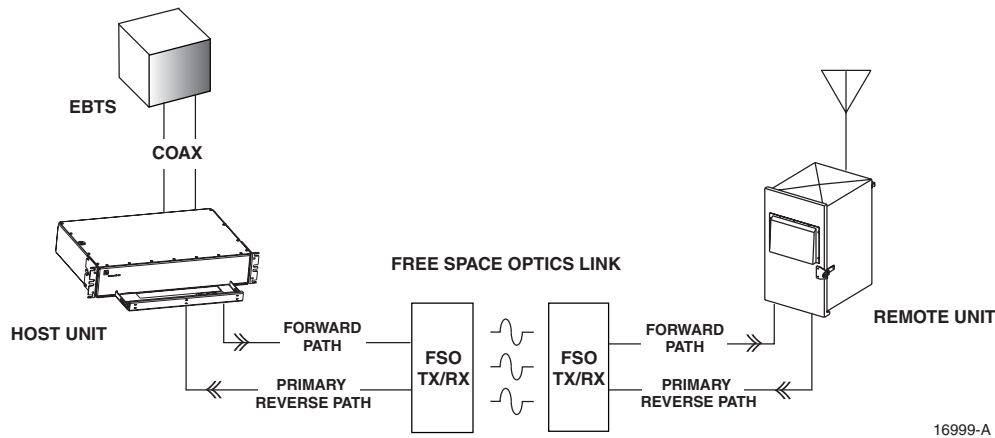


Figure 1-5. Free Space Optics Application

### 3.2 Control and Monitoring Software

The Digivance EMS software supports system control and monitoring functions for both the local and remote service interfaces. The EMS software is stored on a CD-ROM and shipped separately with each HU. Software installation consists of copying the software files from the CD-ROM to a designated directory on the hard-drive of the EMS computer. The EMS software may also be copied to the hard-drive of a laptop computer when a local service interface connection with a specific HU or RU is required.

The EMS software is used to provision and configure the system for operation. This includes selecting a sitename, setting alarm thresholds, and setting forward and reverse path RF gain adjustments. The EMS software is also used to get alarm messages (individual or summary), data measurements, or to upgrade the HU/RU system software. All control and monitor functions (except software upgrade which can only be done using the EMS software GUI) can be effected using either the NOC/NEM interface or the EMS software GUI.

### 3.3 Fault Detection and Alarm Reporting

LED indicators are provided on the front panel of the HU and on the front panels of the RU modules to indicate if the system is normal or if a fault is detected. In addition, normally open and normally closed alarm contacts (for both major and minor alarms) are provided at the HU for connection to a customer-provided external alarm system. All alarms can also be accessed through the NOC/NEM interface or the EMS software GUI.

### 3.4 Powering

The HU is powered by  $\pm 24$  or  $\pm 48$  Vdc and must be hard-wired to a local office battery power source through a fuse panel. The RU is powered by 120 or 240 Vac (50 or 60 Hz) and must be hard-wired to the AC power source through a 20 Amp breaker box. The RU is pre-wired for 120 Vac operation but can be converted to 240 Vac operation if required. The RU is equipped with a surge protector to prevent equipment damage from AC power spikes and a lightning protector to prevent equipment damage from lighting surges. A 120 Vac outlet is provided within the RU cabinet for powering for test equipment or power tools. On an optional basis, a back-up battery kit is available for the RU. The battery-backup system powers the RU if the AC power source is disconnected or fails.

### 3.5 Equipment Mounting and Configuration

The HU is designed for mounting in a **non-condensing indoor** environment such as inside a wiring closet or within an environmentally-controlled cabinet. The HU is intended for rack-mount applications and may mounted in either a 19- or 23-inch WECO or EIA equipment rack, usually within 20 feet of the BTS.

The RU is designed for mounting in either an **indoor or outdoor** environment. The RU consists of a Spectrum Transport Module (STM), a Linear Power Amplifier (LPA) module, and a self-contained cabinet which houses the modular components and protects them from the elements. The RU cabinet is weather-tight but contact with salt-air mist should be avoided as it may degrade the MTBF of the product. The cabinet can be mounted from a flat-vertical surface or from a utility pole (requires pole-mount kit). Slots are provided within the cabinet for mounting the STM and LPA modules. A storage spool is provided for storing short lengths of excess fiber slack. A bracket is provided for mounting a WDM module (accessory item). A tray with a heated base is provided for mounting the back-up battery (accessory item).

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## 1 INTRODUCTION

This section describes the basic components of the Digivance 1900 MHz LRCS system including the Host Unit (HU), the Remote Unit (RU), and the Element Management System (EMS). The RU is an assembly that consists of a cabinet, a Spectrum Transport Module (STM), and a Linear Power Amplifier (LPA) module. For clarity, the various components that comprise the RU are described separately.

## 2 HOST UNIT

The HU, shown in [Figure 2-1](#), serves as the BTS servicing unit for the Digivance LRCS. The HU provides the following basic functions:

- Provides an adjustable RF interface with the BTS.
- Provides a fiber optic interface with the RU.
- Digitizes the forward path composite RF signal.
- Converts the digitized forward path RF signal to a digital optical signal.
- Converts the digitized reverse path optical signal to a digitized RF signal.
- Converts the digitized reverse path RF signal to a composite RF signal.
- Signals alarm information to an external alarm system through relay contact closures
- Provides an RS-232 interface for connecting the EMS computer.
- Provides a CAN interface for networking multiple HUs.

### 2.1 Primary Components

The HU consists of an electronic circuit board assembly and a fan assembly that are mounted within a powder-coated sheet metal enclosure. The enclosure provides a mounting point for the circuit board and fan assemblies and controls RF emissions. The only user-replaceable component is the fan assembly. The HU is designed for use within a non-condensing indoor environment such as inside a wiring closet or cabinet. All controls, connectors, and indicators (except the power terminal strip) are mounted on the HU front panel for convenient access. Cable management functions for the coaxial cables and copper wiring are provided by a cable management tray that extends outward from the HU front panel.

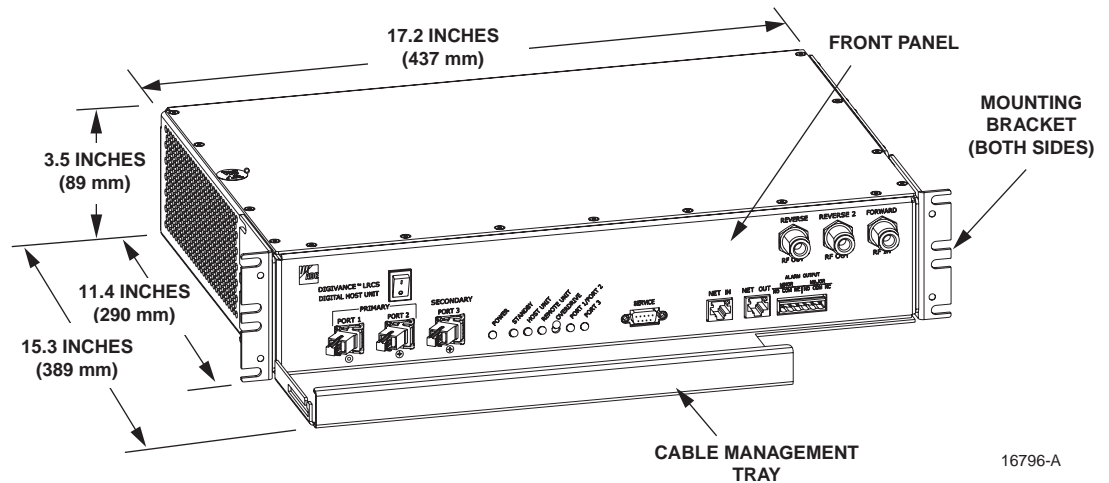


Figure 2-1. Host Unit

## 2.2 Mounting

The HU is intended for rack-mount applications. A pair of reversible mounting brackets is provided that allow the HU to be mounted in either a 19-inch or 23-inch EIA or WECO equipment rack. When installed, the front panel of the HU is flush with the front of the rack. The cable management tray extends 3.9 inches (99 mm) beyond the front panel. Fasteners are provided for securing the HU to the equipment rack.

## 2.3 Fault Detection and Alarm Reporting

The HU detects and reports various faults including host unit fault, optical fault, power fault, temperature fault, and RF fault. Various front panel Light Emitting Diode (LED) indicators turn from green to red or yellow if a fault is detected. A set of alarm contacts (normally open and normally closed) are provided for reporting an alarm to an external alarm system when a fault is detected. Both major alarm (system operation seriously affected) and minor alarm (system operation not affected or only slightly degraded) contacts are provided.

The status of the HU, the alarm state (major or minor), and other alarm information is summarized and reported over the service interface, the CAN interface, and also over the optical fiber to the RU. In addition, the state of the RU is received over the optical fiber and reported over the service interface and the CAN interface. This information may be accessed remotely through the NOC/NEM interface or locally through the EMS software GUI.

## 2.4 RF Signal Connections

The RF signal connections between the HU and the BTS are supported through either two (non-diversity unit) or three (diversity unit) N-type female connectors. On non-diversity units, one connector is used for the forward path RF signal. The other connector is used for the reverse path RF signal. On diversity units, a third connector is used for the diversity path RF signal. In

most installations, it is usually necessary to install an external attenuator in the forward path link between the HU and the BTS. The HU should be as close as possible to the BTS to minimize cable losses.

## 2.5 RF Signal Level Adjustments

The HU is equipped with several attenuators for adjusting the signal levels of the forward and reverse path RF signals. The attenuators provide an attenuation adjustment range of 0 to 30 dB and can be set in 1 dB increments. The attenuators are software controlled and are adjusted through the NOC/NEM interface or the EMS software GUI.

The **host forward path** attenuator adjusts the level of the **input** RF signal to the HU. Using the forward path attenuator, an input signal with a nominal composite signal level of  $-10$  dBm to  $-40$  dBm can be adjusted to produce maximum power output. **An external attenuator is required if the input signal level is greater than  $-10$  dBm.**

The **host reverse path** attenuator adjusts the level of the **output** RF signal and will add from 0 dB of gain (attenuator set to 30 dB) to 30 dB of gain (attenuator set to 0 dB) to the output signal at the HU. The **host diversity reverse** path attenuator provides the same function as the host reverse path attenuator but for the diversity reverse path.

## 2.6 Propagation Delay

The HU forward, reverse, and diversity reverse path propagation delays may be adjusted in 1  $\mu$ s increments within a range of 0–63  $\mu$ s. The propagation delay is software controlled and may be adjusted through the NOC/NEM interface or the EMS software GUI.

## 2.7 Optical Connection

Optical connections between the HU and the RU (STM) are supported through either two (non-diversity unit) or three (diversity unit) SC-type optical connector ports. On non-diversity units, one port is used for connecting the forward path optical signal and the other port is used for connecting the primary reverse path optical signal. On diversity units, a third optical port is used for connecting the diversity reverse path optical signal.

## 2.8 Controller Area Network Interface Connection

Controller Area Network (CAN) interface connections between multiple HUs are supported by a pair of RJ-45 jacks. One of the jacks is designated as the network IN port and the other jack is designated as the network OUT port. The CAN interface allows up to 24 HUs to be connected together (in daisy-chain fashion) and controlled through a single Digivance EMS computer.

## 2.9 Service Interface Connection

The service interface connection between the HU and the Digivance EMS computer is supported by a single DB-9 female connector. The service connector provides an RS-232 DTE interface. When multiple HUs are networked together, the supporting EMS computer may be connected to the service connector of any one of the networked HUs.

## 2.10 Powering

The HU is powered by  $\pm 24$  or  $\pm 48$  Vdc power. The power is fed to the HU through a screw-down type terminal strip located on the rear side of the unit. Power to the HU must be supplied through a fuse panel such as the 20 position PowerWorx fuse panel (available separately). The power circuit for each HU must be protected with a 3 Amp GMT fuse. An On/Off switch is provided on the HU front panel.

## 2.11 Cooling

Continuous airflow for cooling is provided by dual fans mounted on the right side of the HU housing. A minimum of 3 inches (76 mm) of clearance space must be provided on both the left and right sides of the HU for air intake and exhaust. An alarm is provided if a high temperature condition ( $>50^{\circ}\text{C}/122^{\circ}\text{F}$ ) occurs. The fans may be field-replaced if either fan fails.

## 2.12 User Interface

The HU user interface consists of the various connectors, switches, terminals, and LEDs that are provided on the HU front and rear panels. The HU user interface points are indicated in [Figure 2-2](#) and described in [Table 2-1](#).

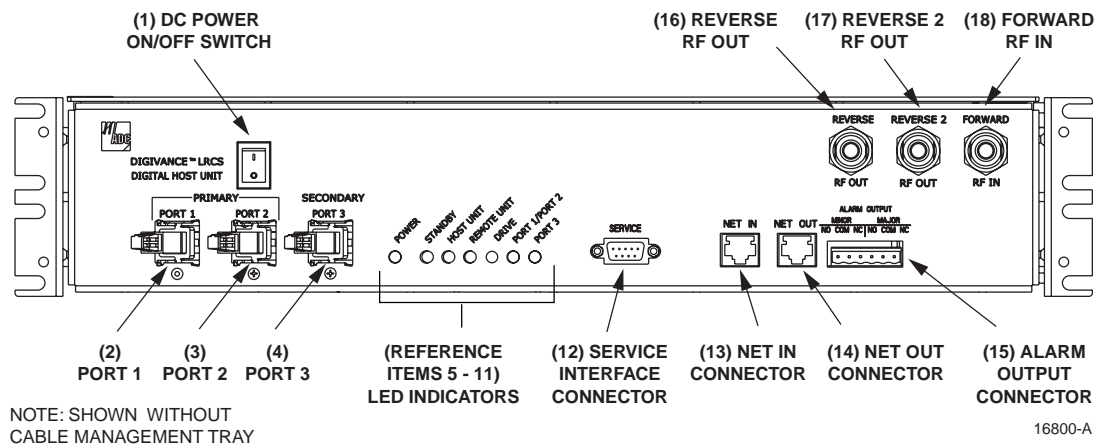


Figure 2-2. Host Unit User Interface

Table 2-1. Host Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	1/0	On/Off rocker switch	Provides DC power on/off control.
2	PORT 1	SC connector (single-mode)	Connection point for the forward path optical fiber.



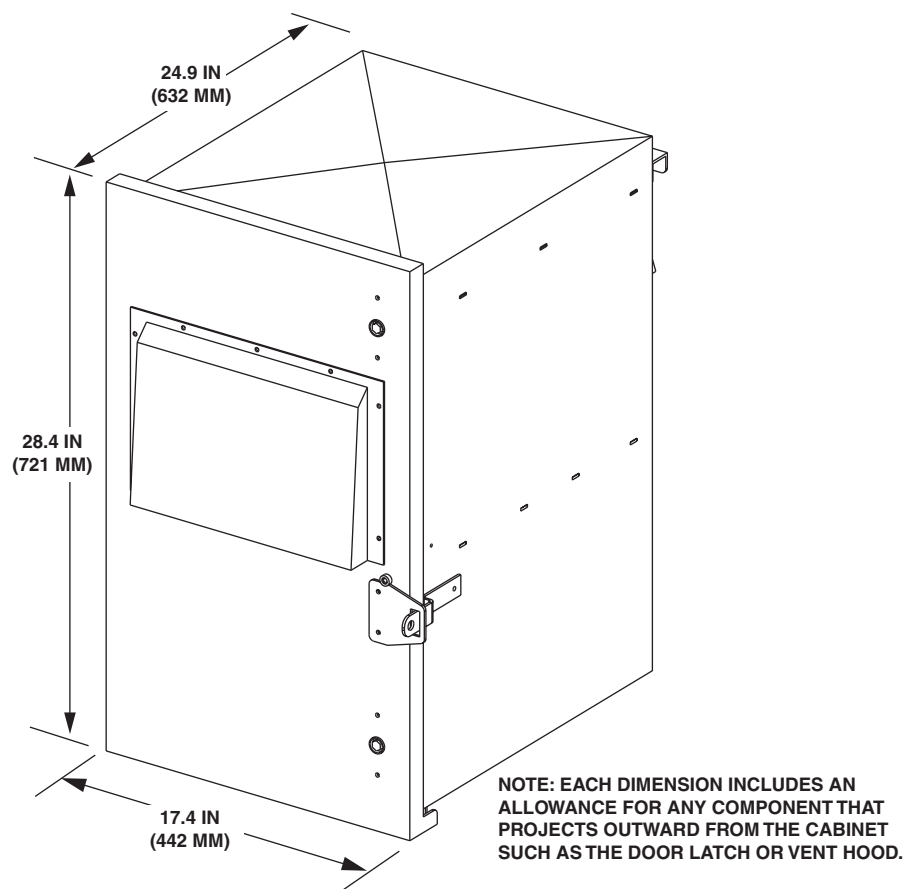
**Table 2-1. Host Unit User Interface, continued**

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
3	PORT 2	SC connector (single-mode)	Connection point for the reverse path primary optical fiber.
4	PORT 3 (diversity unit only)	SC connector (single-mode)	Connection point for the reverse path diversity optical fiber.
5	POWER	Multi-colored LED (green/yellow)	Indicates if the HU is powered (green) or unpowered (off). See Note.
6	STANDBY	Multi-colored LED (green/yellow/red)	Indicates if the system is in the Normal (off), Standby (blinking green), Test (blinking red), or Program Load (blinking yellow) state. See Note.
7	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green), overheated (yellow), or faulty (red). See Note.
8	REMOTE UNIT	Multi-colored LED (green/yellow/red)	Indicates if no alarms (green), a minor alarm (yellow), or a major alarm (red) is detected at the RU. See Note.
9	DRIVE	Multi-colored LED (green/yellow/red)	Indicates if the level of the RF input signal to the HU is normal (green), low (yellow), or high (red). See Note.
10	PORT 1/PORT 2	Multi-colored LED (green/yellow/red)	Indicates if the reverse path optical signal received from the RU is normal (green), if no signal is detected (red), or if errors are detected (red). See Note.
11	PORT 3 (diversity unit only)	Multi-colored LED (green/yellow)	Indicates if the diversity reverse path optical signal received from the RU is normal (green), if no signal is detected (yellow), or if errors are detected (yellow). See Note.
12	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
13	NET IN	RJ-45 jack (female)	Connection point for the CAN interface input cable.
14	NET OUT	RJ-45 jack (female)	Connection point for the CAN interface output cable.
15	ALARM OUTPUT	Screw-type terminal connector (14–26 AWG)	Connection point for an external alarm system. Includes normally open (NO), normally closed (NC), and common (COM) wiring connections.
16	REVERSE RF OUT	N-type female RF coaxial connector	Connection point for the primary reverse path RF coaxial cable.
17	REVERSE 2 RF OUT	N-type female RF coaxial connector	Connection point for the diversity reverse path RF coaxial cable.
18	FORWARD RF IN	N-type female RF coaxial connector	Connection point for the forward path RF coaxial cable.
	POWER 24–48 VDC (Rear side - not shown)	Screw-type terminal strip	Connection point for the DC power wiring.
Note: A more detailed description of LED operation is provided in Section 5.			

### 3 REMOTE UNIT CABINET

The RU cabinet, shown in [Figure 2-3](#), is a NEMA-3R enclosure (with removable dust filter) that provides the following basic functions:

- Houses the various electronic modules (STM and LPA) and accessories (back-up battery kit and WDM kit) and protects them from the weather.
- Provides electrical interface connections for the STM and LPA modules.
- Provides ventilation openings to allow the entry of cool air and the escape of heated air.
- Provides a point for terminating the coaxial antenna cable, the fiber optic cable, the AC power cable, and ground cable.
- Provides AC power surge protection
- Provides lightning protection
- Provides access to an AC power outlet for test equipment and power tools.
- Provides limited storage for fiber optic pigtails.
- Provides a warming pad for the battery



16792-A

**Figure 2-3. Remote Unit Cabinet**

### 3.1 Primary Components

The RU cabinet consists of the enclosure, a mounting shelf for the STM and LPA modules, an AC power interface, a lightning protector, a mounting shelf for the back-up battery accessory, a fiber storage spool, and a mounting bracket for the WDM accessory. The RU cabinet is designed for use in either an outdoor or indoor environment. Opening the hinged door provides full height and width access to the interior of the enclosure to facilitate module and cable installation.

The enclosure is constructed of heavy gauge aluminum and is painted putty white for corrosion protection. Connection and entry points are provided in the bottom of the enclosure for the antenna coaxial cable, fiber optic cable, and AC power cable. Vent openings are provided in the door and the rear side of the enclosure to permit air exchange for cooling. The RU cabinet is weather-tight but contact with salt-air mist should be avoided as it may degrade the Mean Time Between Failure (MTBF) of the product. Drain holes in the bottom of the cabinet allow any moisture that does enter the cabinet to drain out. The cabinet door is equipped with a sturdy latch so that the enclosure may be padlocked to prevent unauthorized entry. A door open switch is provided so that a major alarm is generated whenever the cabinet door is opened.

### 3.2 Mounting

The RU cabinet may be mounted on a flat vertical surface (such as the side of building) or on a utility pole. A special mounting bracket is provided with each enclosure. Installation consists of securing the bracket to the mounting surface and then hanging the enclosure from the bracket. The mounting bracket may be attached to a variety of surfaces such as wood, concrete, or masonry. Various fasteners including hex-head capscrews, tee-nuts, and concrete anchors are provided. A separate pole-mounting kit (accessory item) is available for attaching the mounting bracket to a utility pole.

### 3.3 Module Installation

A mounting shelf is provided within the RU cabinet for installing the STM and LPA modules. The mounting shelf includes tracks that guide each module into the installed position. Separate mounting locations are provided for each type of module. Two D-sub connectors (one male, one female) are located at the rear of the mounting shelf. Each mounting shelf connector mates with a corresponding D-sub connector located on the rear side of each module. A wiring harness links the mounting shelf connectors together. The connectors and the attached wiring harness provide the electrical interface between the STM and LPA modules. The modules are held in the installed position with captive screws.

### 3.4 Fiber Optic Cable Entry

A plastic cord connector is provided in the exterior bottom side of the RU cabinet for routing a fiber optic cable into the enclosure. The cord connector provides cable strain relief and a watertight seal at the fiber optic cable entry point. As the connector nut is tightened, a soft neoprene bushing compresses to tightly grip the cable without applying excessive force to the fibers. The cord connector can accommodate cables that range from 0.375 to 0.875 inches (10 to

23 mm) in diameter. A spool is provided directly above the fiber optic cable entry hole for storing excess pigtail slack.

In a typical installation, the connectorized end of a multi-fiber outside plant cable is routed into the enclosure through the cord connector and the individual fibers are broken out into pigtails. The pigtails are connected to the optical ports on the STM and the excess pigtail slack is stored on the fiber storage spool. The stub end of the cable is routed to an external splice enclosure (not provided) for splicing to the fiber optic cable.

### **3.5 Antenna Cable Connection**

An N-type female connector is provided on the exterior bottom side of the RU cabinet for connecting the primary antenna coaxial cable. The exterior connector is on the surge side of a lightning protector that is mounted on the interior bottom side of the enclosure. On the inside of the enclosure, a second N-type female connector is provided on the protected side of the lightning protector. A coaxial jumper cable (included with the enclosure) is used for connecting the protected side N-type connector to the ANTENNA port on the STM.

A diversity lightning protector kit (accessory item) is available if a diversity STM is mounted in the enclosure. A diversity lightning protector (Catalog # DGVL-000010LADK) is required if a diversity antenna is installed. A hole is provided in the bottom of the enclosure for mounting the diversity lightning protector.

### **3.6 AC Power Wiring Entry and Grounding**

A 3/4-inch NPT threaded hole is provided in the exterior bottom side of the RU cabinet for connecting a standard 3/4-inch AC conduit fitting to the enclosure. A 3/4-inch to 1/2-inch reducer is also included with the enclosure if 1/2-inch conduit is preferred over 3/4-inch conduit. The conduit should be installed between the enclosure and an external 20 Amp breaker box (not provided) and all AC power wiring (three wires required) should be run within the conduit. Three lead wires (Hot, Neutral, and Ground) are provided within the enclosure for connection to the AC wiring. Three wire nuts are included with the enclosure for completing the connection. A grounding lug is provided on the underside of the enclosure for connecting the RU cabinet to an earth ground source.

The standard RU cabinet is equipped with a 120 VAC Ground Fault Circuit Interrupter (GFCI) outlet and should only be wired for operation on 120 VAC current. The cabinet may be re-wired for 240 VAC if required.

### **3.7 Back-up Battery Kit**

A back-up battery kit (accessory item) is available when the application requires that the system remain operational during an AC power outage. A tray is provided within the enclosure for mounting the battery. The battery tray includes a heating pad that keeps the battery warm during cold weather. A temperature sensor regulates the operation of the heating pad and a circuit breaker provides overcurrent protection. The back-up battery kit includes a wiring harness for connecting the battery to the STM. During normal operation, the STM provides charging

current to maintain the battery charge level. During an AC power outage, the battery provides DC power to the STM to maintain system operation. The battery can maintain operation of the RU for approximately 1 hour at 50 Watts.

### 3.8 Ventilation

Vent openings are provided in the door and the rear side of the RU cabinet to permit air exchange for cooling. Air enters the enclosure through the opening in the door. A filter on the inside of the door removes dirt particles so that only clean air enters the enclosure. Both modules have cooling fans. The STM has a rear mounted fan that pulls air through the module and exhausts it toward the rear of the enclosure. The heated air exits through an opening in the rear side of the enclosure. The LPA works in a similar manner except it also has a fan on the front to help draw air into the module.

### 3.9 User Interface

The RU cabinet user interface consists of the various connectors, fittings, outlets, and switches that are provided on both the interior and exterior of the enclosure. The RU cabinet user interface points are described in [Table 2-2](#) and indicated in [Figure 2-4](#).

**Table 2-2. Remote Unit Cabinet User Interface**

REF NO	DEVICE	FUNCTIONAL DESCRIPTION
1	Air inlet filter	A reusable filter that prevents the entry of dirt particles when outside air is pulled into the cabinet for cooling.
2	AC power cord	Provides AC power to the STM.
3	Circuit breaker reset switch	Used to reset the battery heater circuit following correction of an overcurrent condition.
4	Door switch	Indicates to the fault detection and alarm reporting system if the cabinet door is open (major alarm) or closed.
5	Module mounting shelf	Provides a mounting point for the STM and LPA modules.
6	Battery tray	Provides a mounting point for the back-up battery (when used).
7	120 Vac GFCI outlet (standard)	Standard 120 Vac GFCI outlet for connecting AC power tools or test equipment.
8	Fiber slack spool	Provides a storage place for excess fiber pigtail slack.
9	Lightning protector	Provides lightning surge protection for the antenna connection.
10	Fiber cable connector	Provides both an entry point and strain relief for the fiber optic cable.
11	3/4-inch NPT threaded hole	Provides a connection point for a 3/4-inch AC conduit fitting.
12	Grounding lug	Provides a connection point for an external grounding cable.

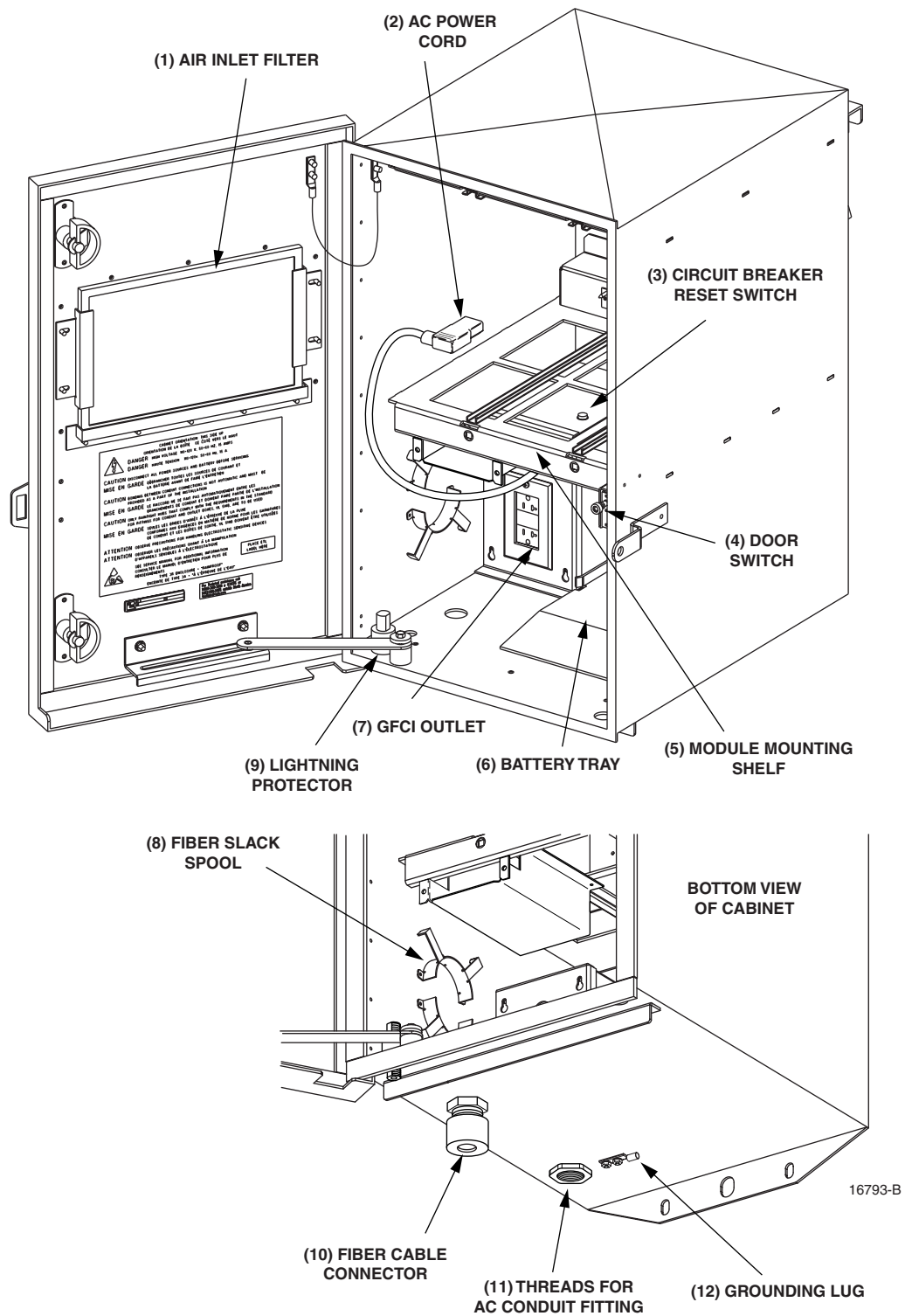


Figure 2-4. Remote Unit Cabinet User Interface