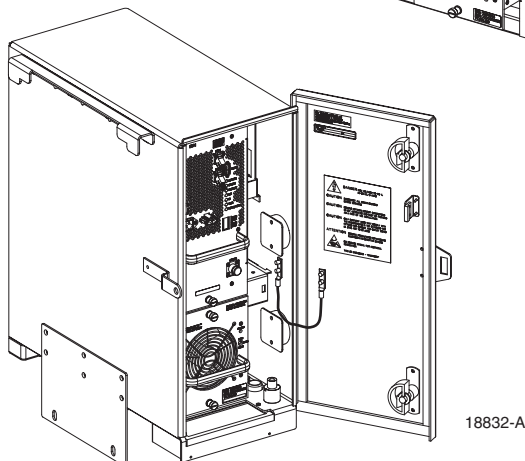
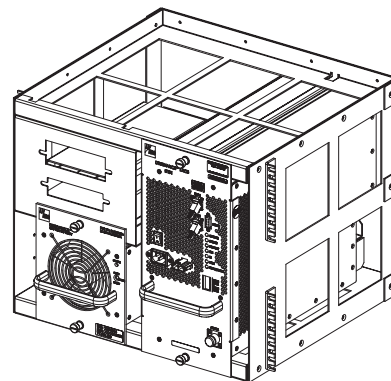
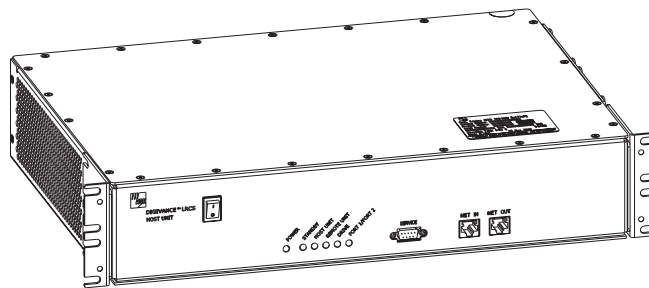




Digivance® SMR 20 Watt System with Version 2.00.01 EMS Software Installation and Operation Manual





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Digivance® SMR 20 Watt System with Version 2.00.01 EMS Software Installation and Operation Manual

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ABOUT THIS MANUAL

This installation and operation manual provides the following information:

- An overview of the Digivance SMR 20 Watt System.
- A description of the basic system components including the Host Unit (HU), Spectrum Transport Module (STM), Linear Power Amplifier (LPA), Remote Unit (RU) outdoor cabinet, RU indoor mounting shelf, 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
Digivance 20 Watt Indoor Remote Unit Installation Instructions Provides instructions for installing the STM, LPA, and accessories in the indoor remote unit mounting shelf and for installing and connecting the fiber optic, coaxial, and AC power cables.	75-149
Digivance 20 Watt Outdoor Remote Unit Installation Instructions Provides instructions for installing the STM, LPA, and accessories in the outdoor remote unit cabinet and for installing and connecting the fiber optic, coaxial, and AC power cables.	75-148
Digivance 20 Watt Remote Unit Outdoor Cabinet Mounting Instructions Provides instructions for locating and mounting the remote unit outdoor cabinet.	75-147
Digivance Element Management System Version 2.0 User Manual Provides instructions for installing the Digivance Element Management System software and for using both the Graphical User Interface (GUI) and the Network Operations Center (NOC) versions of the software.	75-125

**Digivance RF Transport Solution 800 and 1900 MHz Interface
Panels User Manual****75-144**

Describes the 800 and 1900 MHz Conditioning Panel and Duplexing Panel and provides procedures for configuration and installation.

Digivance System Coarse Wavelength Division Multiplexer User Manual**75-142**

Describes the Coarse Wavelength Division Multiplexer and provides procedures for configuration and installation.

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 90.

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. The term “IC:” before the radio certification number only signifies that Industry Canada Technical Specifications were met.

LIST OF ACRONYMS AND ABBREVIATIONS

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

AC	Alternating Current
ASCII	American Standard Code for Information Interchange
Att	Attenuation
AWG	American Wire Gauge
BER	Bit Error Rate
C	Centigrade
CAN	Controller Area Network
CDRH	Center for Devices and Radiological Health
CD-ROM	Compact Disk Read Only Memory
COM	Common
Config	Configuration
CUL	Canadian Underwriters Laboratories
CWDM	Coarse Wavelength Division Multiplexer
DC	Direct Current
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
EBTS	Enhanced Base Transceiver Station
EIA	Electronic Industries Association

EMS	Element Management System
ESD	Electrostatic Discharge
F	Fahrenheit
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FSO	Free Space Optics
Fwd	Forward
GFCI	Ground Fault Circuit Interrupting
GUI	Graphical User Interface
HU	Host Unit
IC	Industry Canada
LED	Light Emitting Diode
LPA	Linear Power Amplifier
MHz	Mega Hertz
MPE	Maximum Permissible Exposure
MTBF	Mean Time Between Failure
NC	Normally Closed
NEM	Network Element Manager
NO	Normally Open
NOC	Network Operations Center
NPT	National Pipe Tapered
OSP	Outside Plant
PA	Power Amplifier
PC	Personal Computer
PCS	Personal Communications System
Prg	Program
Pwr	Power
Rev	Reverse
RF	Radio Frequency
RMA	Return Material Authorization
RU	Remote Unit
RX	Receive or Receiver
SMR	Specialize Mobile Radio
STM	Spectrum Transport Module
TX	Transmit or Transmitter
UL	Underwriters Laboratories
VAC	Volts Alternating Current
VDC	Volts Direct Current
VSWR	Voltage Standing Wave Ratio
WECO	Western Electric Company
WDM	Wave Division Multiplexer

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1 INTRODUCTION

This section provides basic description, application, and configuration information about the Digivance SMR 20 Watt System. Throughout this publication, all items referenced as “accessory items” are not furnished with the basic product and must be purchased separately.

2 SMR 20 WATT SYSTEM OVERVIEW

The Digivance SMR 20 Watt System is an RF signal transport system that provides long-range RF coverage in areas where it is impractical to place an Enhanced Base Transceiver Station (EBTS) at the antenna site. High real estate costs and community restrictions on tower and equipment locations often make it difficult to install the EBTS at the same location as the antenna. The Digivance system 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 system, 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 System Components

The basic components of a Digivance 20 Watt System and their functions are shown in [Figure 1-1](#). A 20 Watt system consists of the Host Unit (HU) and the Remote Unit (RU). Both an indoor and an outdoor remote unit are available. Control and monitoring functions are provided by the Digivance Element Management System (EMS), a PC-based software program. In addition, various accessory items are available separately including a passive Wavelength Division Multiplexer (WDM) system, an active Coarse Wavelength Division Multiplexer (CWDM) system, primary interface panels and expansion panels (for interfacing multiple HU's

with the EBTS), network cables (for connecting multiple HU's together), and an EMS cable (for connecting the EMS computer to the HU).

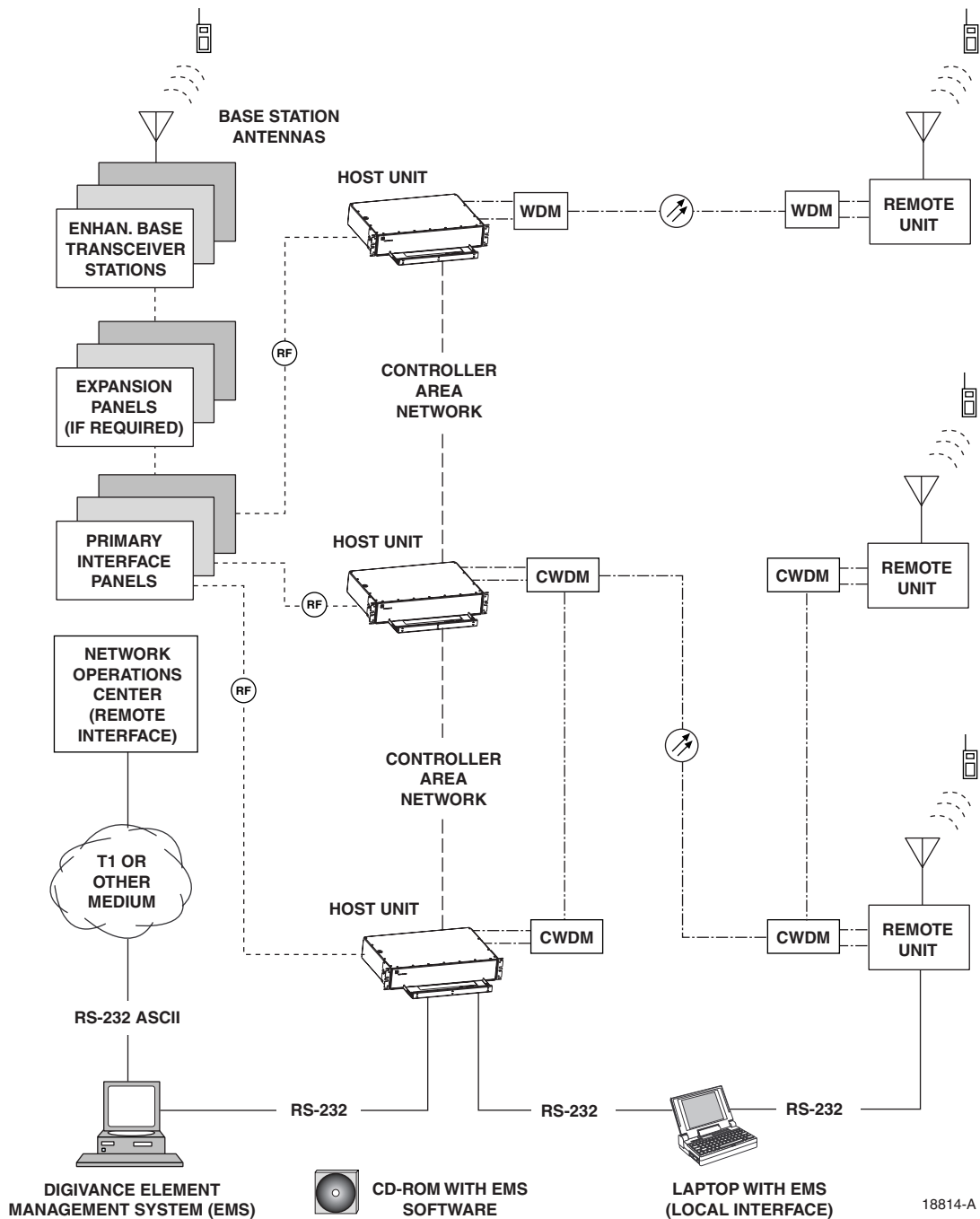


Figure 1-1. 20 Watt System Overview Diagram

2.2 Enhanced Base Transceiver Station to Host Unit Interface

The HU may be interfaced with one or more EBTS's. Each EBTS provides the RF channel inputs and outputs for a designated sector. Interfacing the HU with multiple EBTS's will generally require installation of the SMR Interface Panels which are accessory products for the Digivance system.

Two types of Interface Panels are available: the Primary Interface Panel and the Expansion Panel. The Primary Interface Panel provides attenuation of the forward path signal to the level required for input to the Host Unit. The Primary Interface Panel also provides forward and reverse path combining and splitting to permit up to 6 EBTS's to be connected to a single Host Unit. A typical Primary Interface Panel configuration with multiple EBTS's connected to a single Host Unit is shown in [Figure 1-2](#).

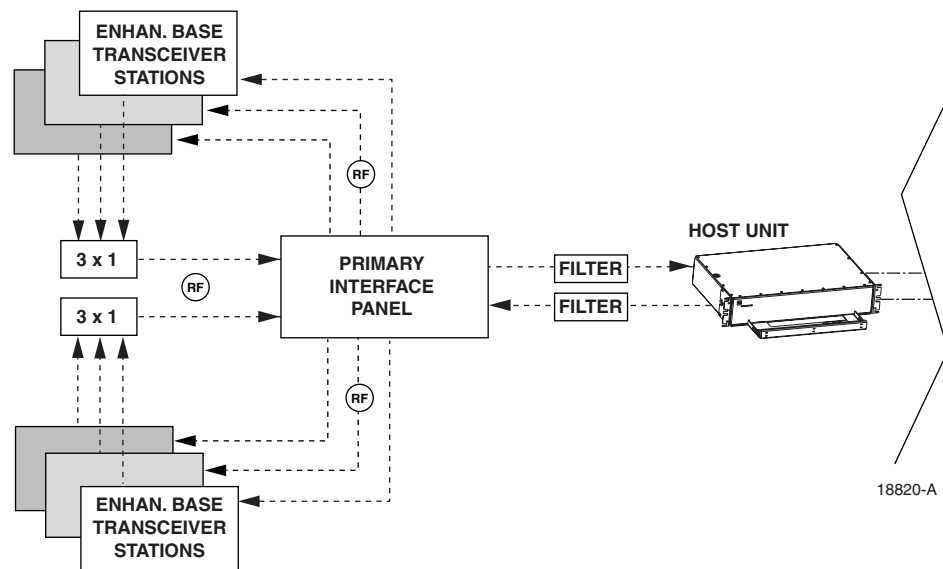


Figure 1-2. EBTS/HU Interface with Primary Interface Panel

The Expansion Panel is used in conjunction with the Primary Interface Panel when the Host Unit must be interfaced with more than six EBTS's. Each Primary Interface Panel can support two Expansion Panels and each Expansion Panel can support up to six EBTS's. When configured as shown in [Figure 1-3](#), a total of eighteen EBTS's can be interfaced with one Host Unit.

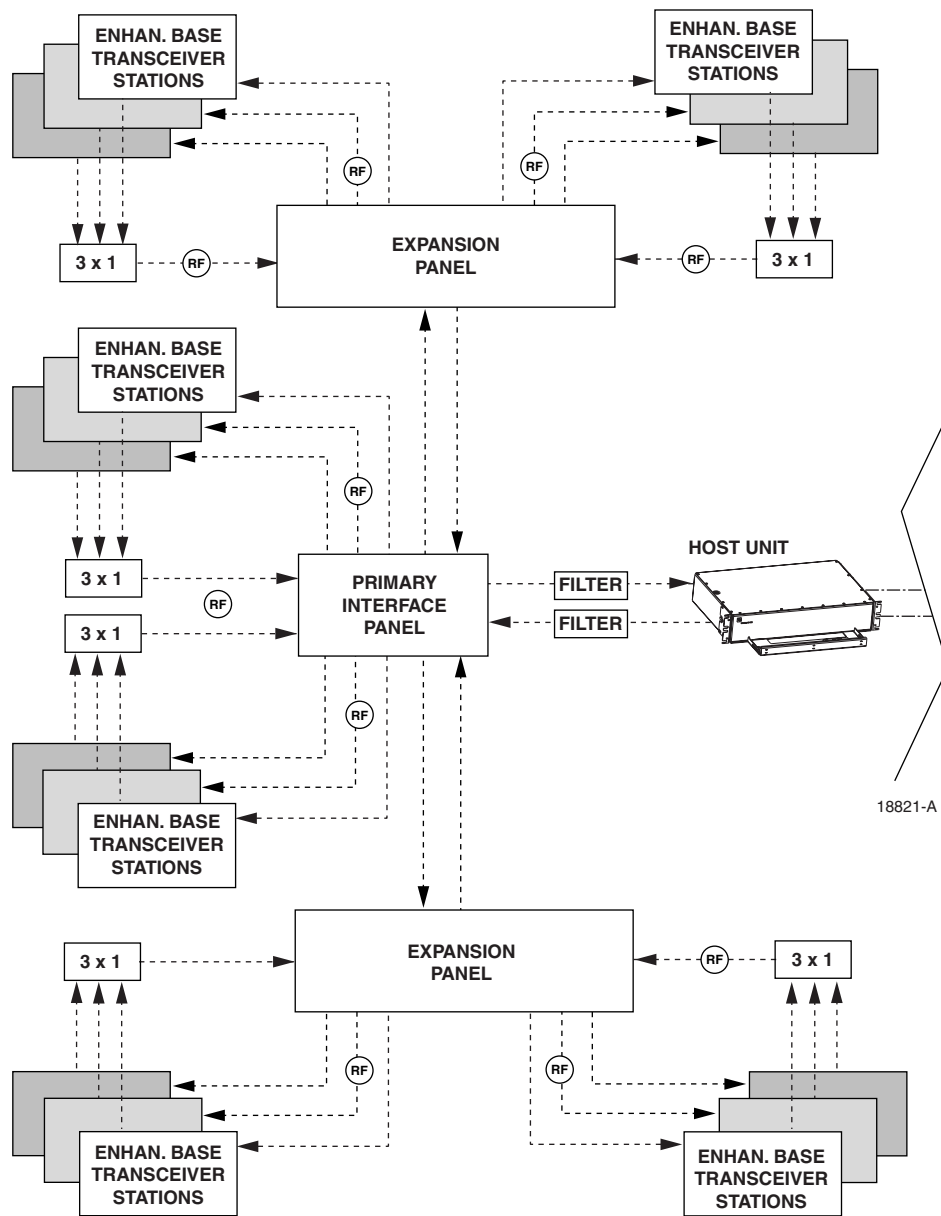


Figure 1-3. EBT/HU Interface With Primary Interface Panel and Expansion Panels

2.3 Handset Interface

The RU interfaces with the handsets (cell phones) through an antenna (not provided) which transmits and receives the handset RF signals. 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 over the fiber optic link. 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.

2.4 Local Service Interface

Local communications with an individual Digivance system is supported through a local service interface capability as shown in Figure 4. 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 Digivance system. The EMS computer can be directly connected to either the HU or RU through the computer's RS-232 port. Operation is done 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.

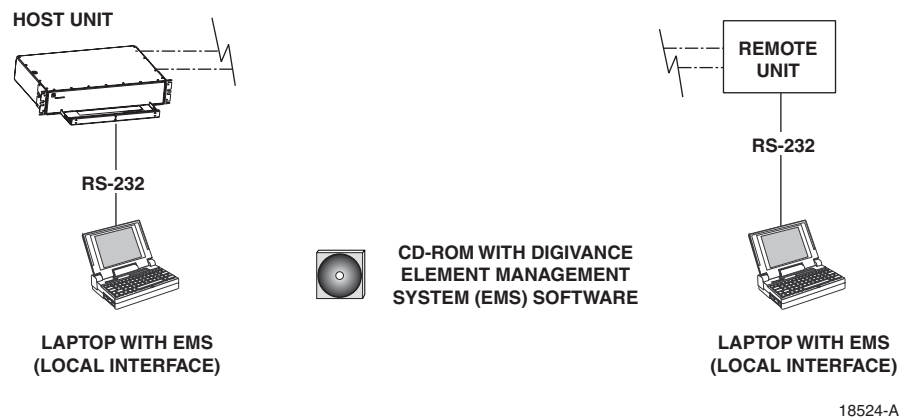


Figure 1-4. Local Service Interface

2.5 Remote NOC Interface

Remote communications between a Network Operations Center (NOC) and a networked grouping of multiple Digivance systems is supported by a remote NOC interface capability as shown in Figure 1-5. The primary component of the remote NOC interface is a PC-type desktop computer loaded with the Digivance Element Management System (EMS) software. The Digivance EMS provides the various control and monitoring functions required for **remote** management of multiple Digivance 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 T1 system or other medium. The EMS computer's RS-232 port #2 interfaces with the T1 system equipment. The T1 equipment must be capable of interfacing with an RS-232 ASCII interface port.

At the NOC, control and monitoring of the networked Digivance 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 desktop computer may also be used locally to manage the networked Digivance systems. Local operation is through the EMS software GUI.

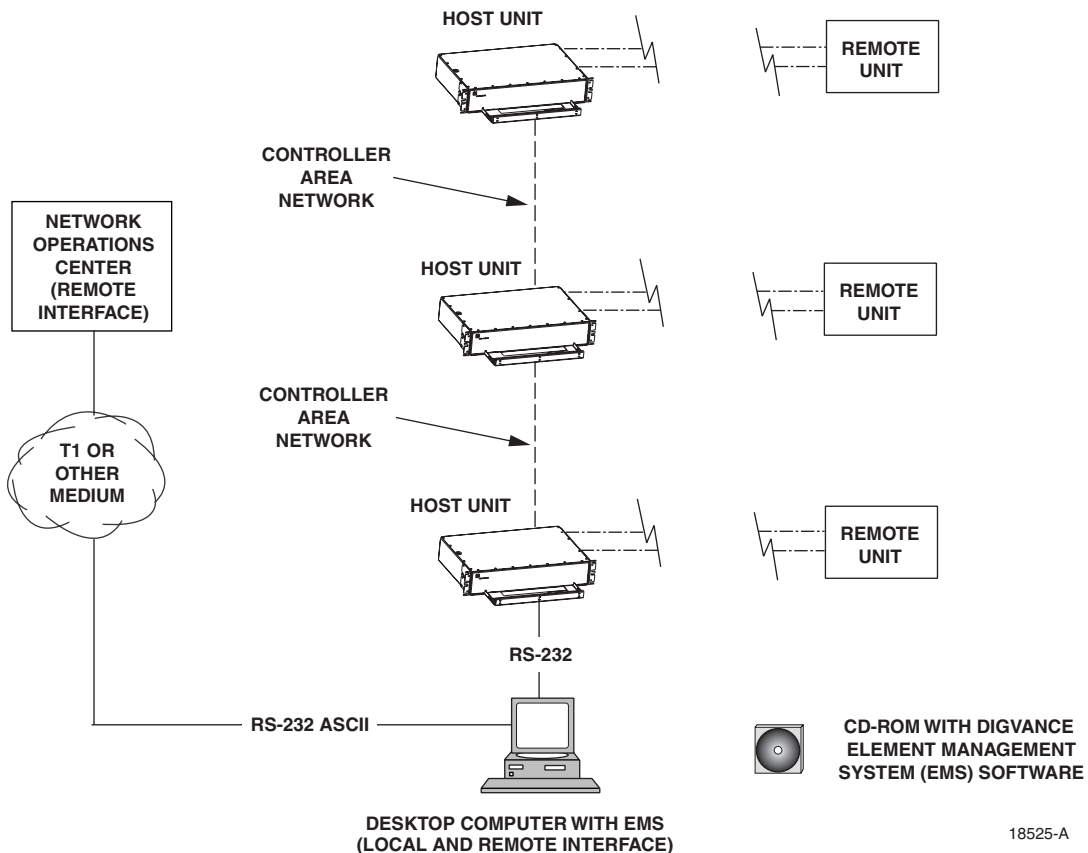


Figure 1-5. Remote NOC Interface

3 SYSTEM FUNCTIONS AND FEATURES

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

3.1 Fiber Optic Transport

In a typical Digivance 20 Watt system with a single HU and RU, 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 typical Digivance system is shown in [Figure 1-6](#). The Digivance 20 Watt system does not support reverse path diversity at this time.

The maximum length of the optical fibers is dependent on the loss specifications of the optical fiber and the losses imposed by the various connectors and splices. The SMR Digivance system provides an optical budget of **17 dB** (typical) when used with 9/125 single-mode fiber.

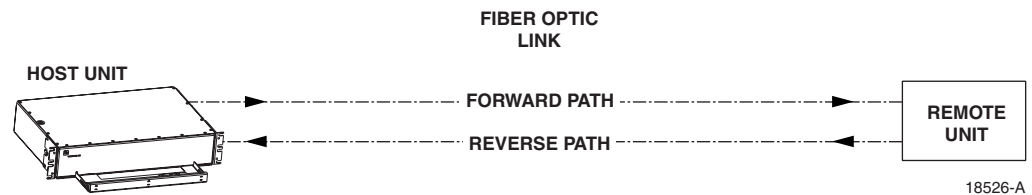


Figure 1-6. Standard Fiber Optic Transport

In some applications, it may be desirable or necessary to combine the forward path and reverse path optical signals from a single HU/RU pair onto a single optical fiber. This can be accomplished by using a passive bi-directional Wavelength Division Multiplexer (WDM) system. The optical wavelengths used in the Digivance system are 1550 nm for the forward path and 1310 nm for the reverse path. Because the Digivance system uses different optical wavelengths for the forward and reverse paths, both signals can be combined on a single optical fiber. One WDM module is mounted with the HU and the other WDM module is mounted with the RU as shown in [Figure 1-7](#). The WDM system is available as an accessory item.

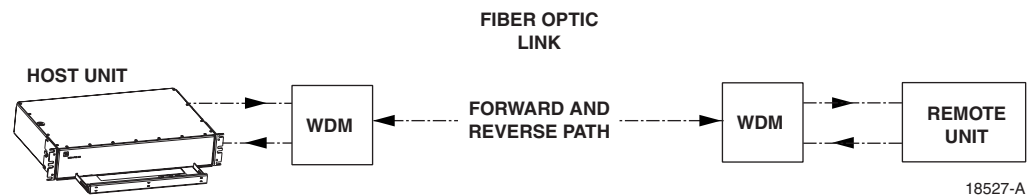


Figure 1-7. Wavelength Division Multiplexer Application

In some applications, it may be desirable or necessary to combine the forward and reverse path optical signals from multiple HU's and RU's onto a single optical fiber. This can be accomplished by using an active Coarse Wavelength Division Multiplexer (CWDM) system. Up to four Digivance systems may be configured to operate over a single optical fiber. A CWDM module is mounted with each HU and RU as shown in [Figure 1-8](#). The CWDM system converts the optical signal transmitted by each HU and RU to a new optical wavelength that is unique for each unit. This allows the CWDM system to distinguish between the optical signals generated by each HU and RU and therefore to distribute those signals to the appropriate destination. The CWDM system is available separately as an accessory item.

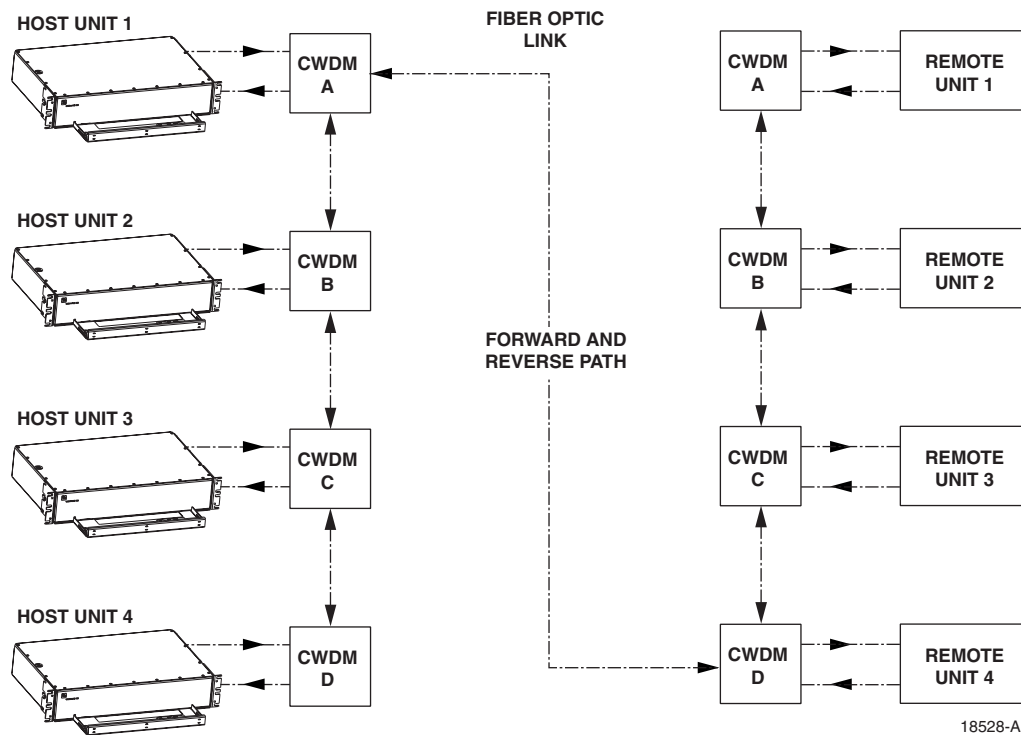


Figure 1-8. Coarse Wavelength Division Multiplexer Application

A Free Space Optics (FSO) system (that meets the Digivance system data rate performance and BER requirements) may be used in applications where it is desirable or necessary 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 1-9](#). FSO systems are available from various equipment manufacturers.

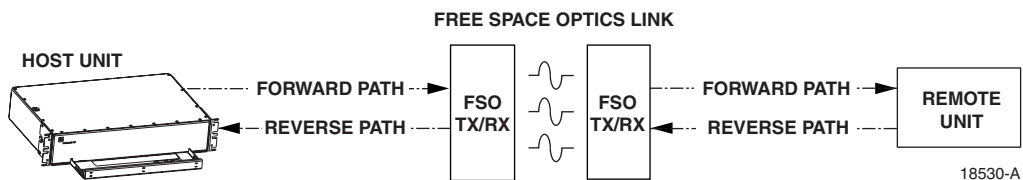


Figure 1-9. Free Space Optics Application

3.2 Control and Monitoring Software

The Digivance EMS software supports control and monitoring functions for both the local and remote service interfaces. The EMS software is stored on a CD-ROM which is included with the EMS software package. 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 is used to provision and configure the Digivance 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 ± 24 or ± 48 VDC and must be hard-wired to a local office battery power source through a fuse panel. A screw-down terminal strip is provided on the rear side of the HU for the power connections.

The RU is powered by 120 or 240 VAC (50 or 60 Hz) and must be connected to an AC power source through a 20 Amp breaker box. A three-wire cable is provided for the AC power connections. A 120 VAC outlet should be installed near the RU for powering test equipment or power tools. In certain applications, it may be necessary to install a surge protector (not provided) in the AC power feed to prevent equipment damage from AC power spikes.

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 WEKO or EIA equipment rack, usually within 20 feet of the EBTS.

The outdoor RU is designed for mounting in an **outdoor** environment. The outdoor 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 outdoor cabinet can be mounted from a flat-vertical surface, from a utility pole (requires pole-mount kit), or mounted on a pedestal (requires pedestal kit). Slots are provided within the cabinet for the STM and LPA modules. Storage spools are provided for storing short lengths of excess fiber slack. A mounting slot is also provided for a WDM or CWDM remote module (accessory items). A lighting protector for the antenna is included with the outdoor cabinet to prevent equipment damage from lighting strikes.

The indoor RU is designed for mounting in a **non-condensing indoor** environment such as inside a wiring closet or within an environmentally-controlled cabinet. The indoor RU is intended for rack-mount applications and may be mounted in either a 19- or 23-inch WECO or EIA equipment rack. The indoor RU consists of a Spectrum Transport Module (STM), a Linear Power Amplifier (LPA) module, and a mounting shelf that supports the modular components. The mounting shelf installs in the equipment rack. Slots are provided in the mounting shelf for the STM and LPA modules. Slots are also provided for mounting the WDM or CWDM remote module (accessory items).

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1 INTRODUCTION

This section describes the basic components of the Digivance SMR 20 Watt system including the Host Unit (HU), the Remote Unit (RU), and the Digivance Element Management System (EMS). Also described are various accessory items including the Interface Panels, Wavelength Division Multiplexer (WDM) system, and Coarse Wavelength Division Multiplexer (CWDM) system. The RU is an assembly that consists of a cabinet (for outdoor applications) or mounting shelf (for indoor applications), 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 EBTS servicing unit for the Digivance system. The HU provides the following basic functions:

- Provides a gain adjustable RF interface with the EBTS.
- 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-paint 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. The RF connectors, optical connectors, alarm output connectors, DC power terminal strip, and grounding lug are mounted on the HU rear side. The On/Off power switch, LED indicators, service interface connector, and Controller Area Network connectors are mounted on the HU front panel.

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 WECCO equipment rack. When installed, the front panel of the HU is flush with the front of the rack. Fasteners are provided for securing the HU to the equipment rack.

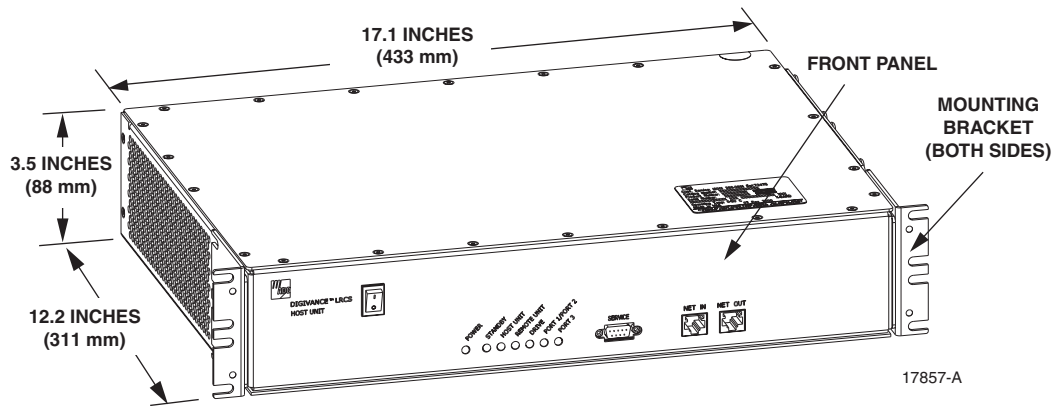


Figure 2-1. Host Unit

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 interface 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 detailed 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 EBTS are supported through two N-type female connectors. One connector is used for the forward path RF signal. The other connector is used for the reverse path RF signal. The current 20 Watt system does not support a diversity reverse path. In installations where multiple EBTS's will be connected to a single HU, it will usually be necessary to install a Primary Interface Panel and an Expansion Panel (accessory items) to support the interface between the HU and the EBTS. The HU should be as close as possible to the EBTS 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 20 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 -20 dBm to -40 dBm can be adjusted to produce maximum power output. **Additional external attenuation is required if the input signal level is greater than -20 dBm.**

The **host reverse path** attenuator adjusts the level of the **output** RF signal and will add from $+10$ dB of gain (attenuator set to 20 dB) to $+30$ dB of gain (attenuator set to 0 dB) to the RF output signal at the HU.

2.6 Propagation Delay

The HU forward and reverse path propagation delays may be adjusted in 1 μ sec increments within a range of 0 to 63 μ 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 two SC-type optical connector ports. 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.

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 ± 21 to ± 60 VDC power (nominal ± 24 or ± 48 VDC). 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 (accessory item). 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 user interface points are indicated in [Figure 2-2](#) and described in [Table 2-1](#).

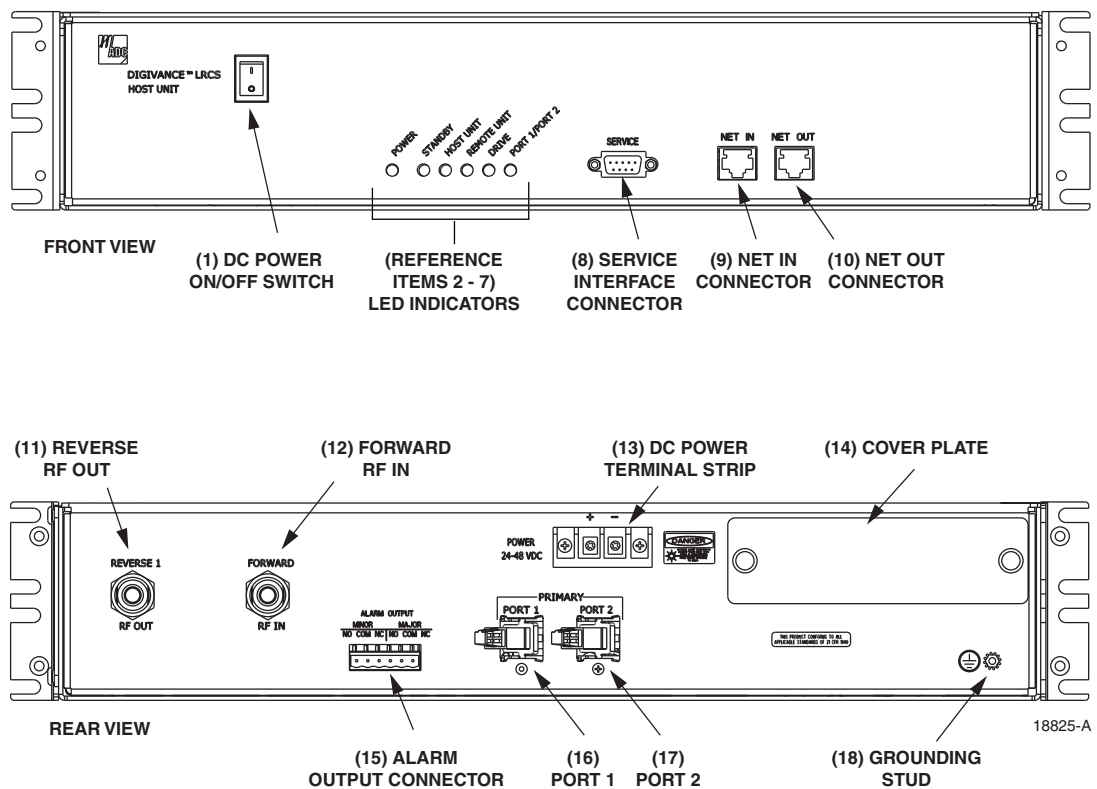


Figure 2-2. Host Unit User Interface

Table 2-1. Host Unit User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	I/O	On/Off rocker switch	Provides DC power on/off control.
2	POWER	Multi-colored LED (green/yellow)	Indicates if the HU is powered (green) or unpowered (off). See Note.
3	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.
4	HOST UNIT	Multi-colored LED (green/yellow/red)	Indicates if the HU is normal (green), overheated (yellow), or faulty (red). See Note.
5	REMOTE UNIT	Multi-colored LED (green/yellow/red)	Indicates if no alarms (green), a minor alarm (yellow), or a major alarm (red) is reported by the RU. See Note.
6	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.
7	PORT 1/PORT 2	Multi-colored LED (green/red)	Indicates if the reverse/forward path optical signals from the STM/HU are normal (green), if no optical signal is detected (red), or if excessive errors are detected (red). See Note.
8	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
9	NET IN	RJ-45 jack (female)	Connection point for CAN interface input cable.
10	NET OUT	RJ-45 jack (female)	Connection point for CAN interface output cable.
11	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.
12	REVERSE 1 RF OUT	N-type female RF coaxial connector	Output connection point for the primary reverse path RF coaxial cable.
13	FORWARD RF IN	N-type female RF coaxial connector	Input connection point for the forward path RF coaxial cable.
14	POWER 24–48 VDC (Rear side - not shown)	Screw-type terminal strip	Connection point for the DC power wiring.
15	No designation	Cover plate	Covers mounting position in chassis for wage division multiplexer.
16	PORT 1	SC connector (single-mode)	Output connection point for the forward path optical fiber.
17	PORT 2	SC connector (single-mode)	Input connection point for the reverse path primary optical fiber.
18		Grounding stud	Connection point for grounding wire.
Note: A more detailed description of LED operation is provided in Section 5.			

3 REMOTE UNIT OUTDOOR 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 (WDM or CWDM) and protects them from the weather.
- Provides electrical interface connections for the STM and LPA modules.
- Provides ventilation openings to allow for entry of cool air and the escape of heated air.
- Provides a point for connecting the antenna cable and ground cable.
- Provides entry points for the fiber optic cable and AC power cable.
- Provides lightning protection
- Provides limited storage for fiber optic pigtails and patch cords.
- Provides electrical connections for the CWDM

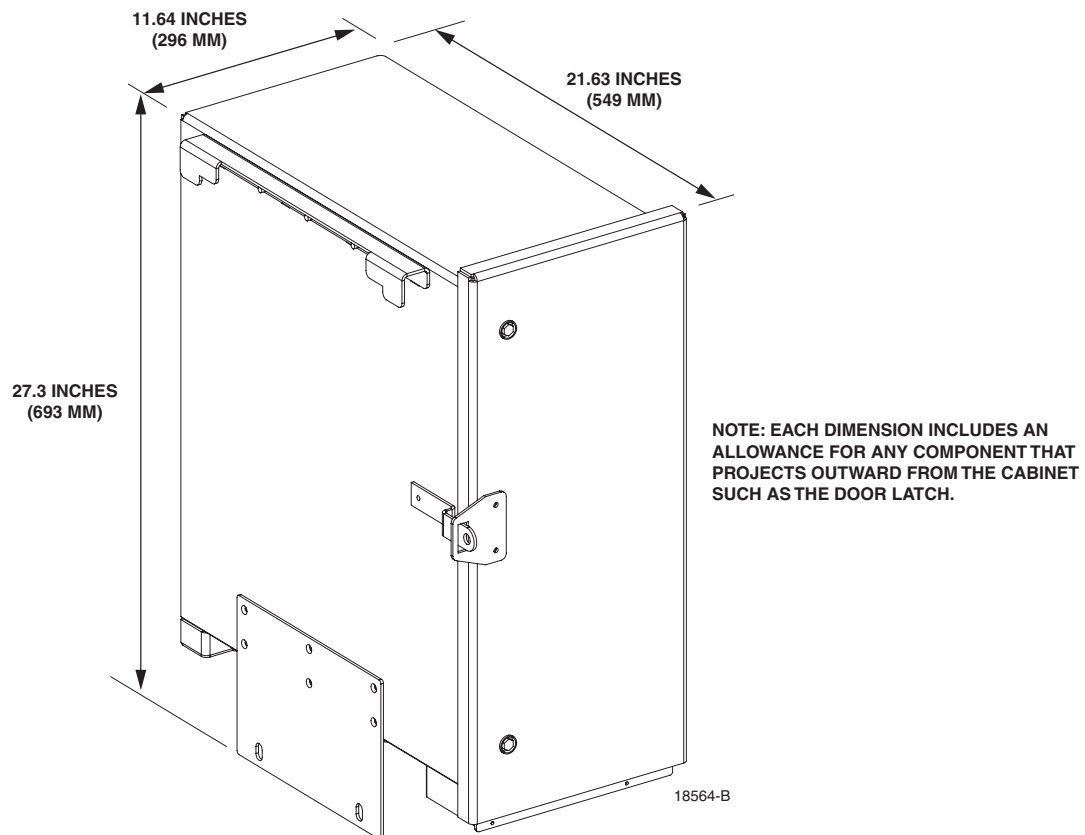


Figure 2-3. Remote Unit Outdoor Cabinet

3.1 Primary Components

The RU outdoor cabinet consists of the enclosure, mounting slots for the STM and LPA modules, connectors and a wiring harness for interfacing the STM and LPA modules, a mounting slot for either the WDM or CWDM module (accessory items), lightning protector, and two fiber storage spools. The RU outdoor cabinet is designed for use in an outdoor 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/or 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 bottom 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) on a utility pole, or on a pedestal. 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 pole-mount kit (accessory item) is available for mounting the cabinet from a utility pole. A pedestal-mounting kit (accessory item) is available for mounting the cabinet on a flat horizontal surface.

3.3 STM and LPA Module Installation

Two mounting slots are provided within the RU cabinet for installing the STM and LPA modules. The mounting slots include tracks that guide each module into the installed position. Separate mounting slots are provided for STM and LPA modules. Two D-sub connectors (one male, one female) are located at the rear of each mounting slot. Each mounting slot connector mates with a corresponding D-sub connector located on the rear side of each module. A wiring harness links the mounting slot 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 WDM and CWDM Installation

A mounting slot is provided within the RU cabinet for installing a WDM or CWDM remote module (accessory items). Each module is equipped with push-pull type fasteners for securing the module to the mounting slot. A power cable is included with the cabinet for providing power when a CWDM module is installed. Fiber storage spools are provided for storing excess pigtail and/or patch cord slack.

3.5 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.

3.6 Antenna Cable Connection

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

3.7 AC Power Wiring and Grounding

The RU outdoor cabinet is equipped with a stub cable for the AC power connections. The AC power cable provides three wire leads (Load, Neutral, and Ground) that must be connected to a 120 or 240 VAC power source. The AC power cable exits the cabinet through a 3/4-inch NPT threaded hole located on the bottom of the cabinet. The threaded hole accepts a standard 3/4-inch AC conduit fitting. A 3/4-inch to 1/2-inch reducer is also included if 1/2-inch conduit is preferred over 3/4-inch conduit.

From the exit point in the bottom of the cabinet, the AC power cable must be routed through conduit to an external AC junction box (not provided) where it can be connected to the AC power wiring. The junction box should be located within two feet of the cabinet and should be equipped with a 120 VAC GFCI outlet for powering test equipment and/or power tools. If AC power spikes are likely to occur, the junction box should also include a surge protector to protect the equipment from damage.

Three wire nuts are included with the cabinet for completing the AC power wiring connections. The junction box wiring should be connected to the AC power source through a 20 Amp breaker box (not provided). All AC power wiring should be run within conduit. A grounding lug is provided on the underside of the enclosure for connecting a separate grounding wire directly to the cabinet.

3.8 Ventilation

Vent openings are provided in the bottom of the RU cabinet to permit air exchange for cooling. Air enters the cabinet through an opening in the front/bottom side of the cabinet. A Filter removes dirt particles so that only clean air enters the enclosure. Both the STM and LPA 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 LPA has a fan on the front that draws air into the module and exhausts it toward the rear of the enclosure. The heated air exits through an opening in the rear/bottom side of the enclosure.

3.9 User Interface

The RU cabinet user interface consists of the various connectors, fittings, mounting slots, and switches that are provided on both the interior and exterior of the enclosure. The 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	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	Door switch	Indicates to the fault detection and alarm reporting system if the cabinet door is open (major alarm) or closed.
4	LPA mounting slot	Provides a mounting point for the LPA module.
5	STM mounting slot	Provides a mounting point for the STM module.
6	WDM/CWDM mounting slot	Provides a mounting point for either the WDM or CWDM module.
7	CWDM power cord	Provides DC power to the CWDM module.
8	Fiber slack spools	Provide a storage place for excess fiber pigtail and patch cord 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 Outdoor Cabinet User Interface

4 REMOTE UNIT INDOOR MOUNTING SHELF

The RU indoor mounting shelf, shown in [Figure 2-5](#), is a rack-mountable framework that provides the following basic functions:

- Supports the various electronic modules (STM and LPA) and accessories (WDM or CWDM) for mounting within a standard 19-inch, WECO or EIA, equipment rack.
- Provides the electrical interface connections for the STM and LPA modules.
- Provides an AC power cord for powering the STM module
- Provides DC power connections for the CWDM module.

4.1 Primary Components

The RU indoor mounting shelf is a rack-mountable frame assembly that provides mounting slots for the STM, LPA, WDM (accessory), and CWDM (accessory) modules plus connectors and a wiring harness for interfacing the STM and LPA modules. The indoor mounting shelf is designed for mounting in a standard 19-inch, EIA or WECO, equipment rack. The frame assembly is constructed of aluminum and is painted putty white for corrosion protection.

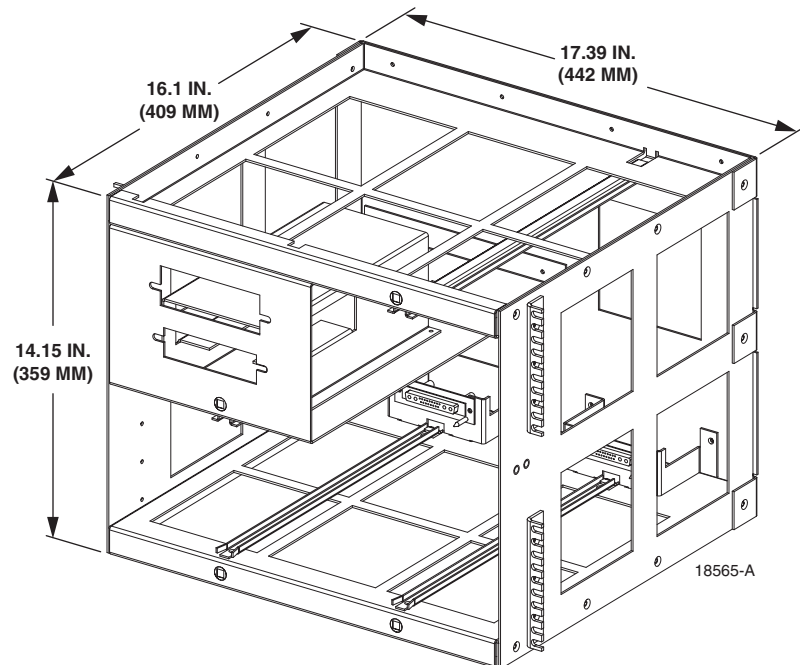


Figure 2-5. Remote Unit Indoor Mounting Shelf

4.2 STM and LPA Module Installation

Two mounting slots are provided within the indoor mounting shelf for installing the STM and LPA modules. The mounting slots include tracks that guide each module into the installed position. Separate mounting slots are provided for STM and LPA modules. Two D-sub connectors (one male, one female) are located at the rear of each mounting slot. Each mounting slot connector mates with a corresponding D-sub connector located on the rear side of each module. A wiring harness links the mounting slot 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.

4.3 WDM and CWDM Installation

Mounting slots are provided in the indoor mounting shelf for installing a WDM or CWDM module (accessory items). Each module is equipped with push-pull type fasteners for securing the module to the mounting slot. A power cable is included with the mounting shelf for supplying DC power when a CWDM module is installed.

4.4 Fiber Optic Cable Installation

Fiber optic cables and patch cords should be routed to the indoor mounting shelf using existing fiber management systems. All fiber optic connections are made directly with the STM, WDM, or CWDM modules. It is recommended that some provision be made at the mounting shelf for storing excess patch cord slack.

4.5 Antenna Cable Connections

The antenna cable should be routed to the indoor mounting shelf for connection to the STM module. If lightning protection is required, it is recommended that a lightning protector (accessory) be installed near the point where the antenna cable enters the building or enclosure.

4.6 AC Power Wiring and Grounding

A standard three-conductor AC power cord is provided with the indoor mounting shelf for the AC power connections. The receptacle end of the power cable connects to the AC connector on the STM. The plug end of the power cable connects to a standard 120 VAC outlet. If AC power spikes are likely to occur, a surge protector should be installed to protect the equipment from damage. A grounding stud is provided on the left side of the mounting shelf for connecting a separate grounding wire directly to the mounting shelf chassis.

4.7 User Interface

The RU mounting shelf user interface consists primarily of the mounting slots and AC and DC power cables. The user interface points are indicated in [Figure 2-6](#) and described in [Table 2-3](#).

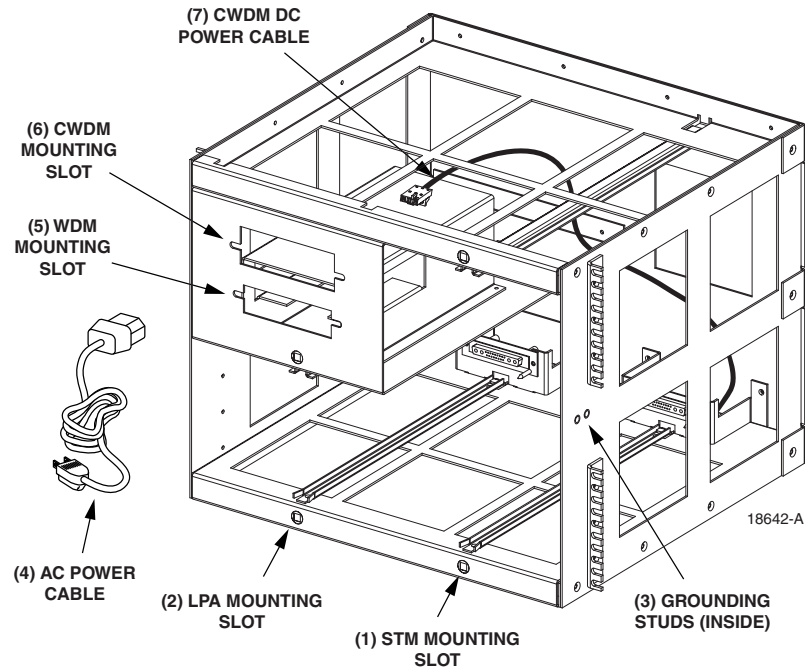


Figure 2-6. Remote Unit Indoor Mounting Shelf User Interface

Table 2-3. Remote Unit Outdoor Mounting Shelf User Interface

REF NO	DEVICE	FUNCTIONAL DESCRIPTION
1	STM mounting slot	Provides a mounting point for the STM module.
2	LPA mounting slot	Provides a mounting point for the LPA module.
3	Grounding lug	Provides a connection point for an external grounding cable.
4	AC power cable	Provides AC power to the STM.
5	WDM mounting slot	Provides a mounting point for the WDM module.
6	CWDM mounting slot	Provides a mounting point for the CWDM module.
7	CWDM power cord	Provides DC power to the CWDM module.

5 SPECTRUM TRANSPORT MODULE

The Spectrum Transport Module (STM), shown in [Figure 2-7](#), provides the following basic functions:

- Provides an RF interface (antenna port) to the remote antenna.
- Provides an optical interface to the HU.
- Converts the digitized forward path optical signal to a digitized RF signal.
- Converts the digitized RF signal to a composite RF signal.