

Table 2-2. Typical Spectrum Transport Module User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	FWD (PORT 1)	SC connector (single-mode)	Input connection point for the forward path optical fiber.
2	REV (PORT 2)	SC connector (single-mode)	Output connection point for the reverse path primary optical fiber.
3	I/O	On/Off rocker switch	Provides AC power on/off control.
4	No designation	3-wire AC power cord connector	Connection point for the AC power cord.
5	No designation	2-wire DC power cord connector	Connection point for the back-up battery power cord.
6	AUXILIARY	DB-9 connector (female)	Connection point for the RS-232 auxiliary communications interface cable.
7	SERVICE	DB-9 connector (female)	Connection point for the RS-232 service interface cable.
8	AC POWER	Multi-colored LED (green/red)	Indicates if the STM is powered by the AC power source (green) or the back-up battery system (red). See Note.
9	STANDBY	Multi-colored LED (green/yellow/red)	Indicates if the system is in the Normal state (off) Standby state (blinking green), Test state (blinking red), or Program Load state (blinking yellow). See Note.
10	HOST 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 HU. See Note.
11	STM	Multi-colored LED (green/yellow/red)	Indicates if the STM is normal (green) or faulty (red). See Note.
12	PA	Multi-colored LED (green/yellow/red)	Indicates if the power amplifier is normal (green), over temperature (yellow), has a fan failure (yellow), is turned off (red), or faulty (red). See Note.
13	VSWR	Multi-colored LED (green/yellow/red)	Indicates if the forward path VSWR is above (red) or below (green) the fault threshold.
14	FWD/REV (PORT 1/PORT 2)	Multi-colored LED (green/red)	Indicates if the forward path optical signal from the HU are normal (green), if no signal is detected (red), or errors are detected (red). See Note.
15	ALARM IN MINOR ALARM IN MAJOR	Screw-type terminal connector (14–26 AWG)	Connection point for two external alarm inputs. The door-open switch lead wires are typically connected to the major alarm terminals.
16	ANTENNA	N-type female RF coaxial connector	Connection point for the antenna.
Note: A more detailed description of LED operation is provided in Section 4.			

4 35 WATT LINEAR POWER AMPLIFIER

The 35 Watt Linear Power Amplifier (LPA), shown in [Figure 2-5](#), works in conjunction with the STM to amplify the forward path RF signal. The STM is interfaced with the LPA through the D-sub connectors and wiring harness located at the rear of the RU outdoor cabinet or indoor mounting shelf. The RF signal is passed to the LPA for amplification and then passed back to the STM for filtering and output via the STM's ANTENNA port. The STM also supplies DC power to the LPA through the same interface.

4.1 Primary Components

The LPA consists of several electronic circuit board assemblies and two fan units that are mounted within a powder-paint coated sheet metal enclosure. The metal enclosure provides a mounting point for the electronic components and controls RF emissions. Except for the fan units, the electronic components are not user replaceable. The LPA is designed for use with the RU outdoor cabinets and the indoor mounting shelf. All controls, indicators, and switches are mounted on the LPA front panel for easy access. A carrying handle is provided on the front of the LPA to facilitate installation and transport.

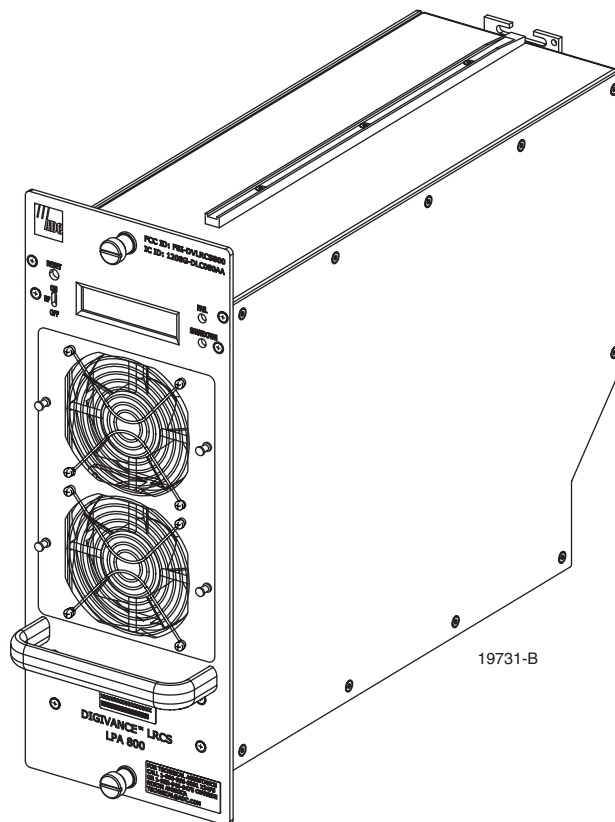


Figure 2-5. 35 Watt Linear Power Amplifier Module

4.2 Mounting

The 35 Watt LPA mounts within the RU outdoor cabinets and the indoor mounting shelf. Runners on the top and bottom of the LPA mesh with tracks within the cabinet or mounting shelf. The runners and tracks guide the LPA into the installed position. The electrical interface between the STM and LPA is supported by a D-sub female connector located on the rear side of the LPA. A corresponding D-sub male connector mounted at the rear of the RU outdoor cabinet or indoor mounting shelf mates with the LPA connector. Captive screws are provided for securing the LPA in the installed position.

4.3 Fault Detection and Alarm Reporting

The 35 Watt LPA, in conjunction with the STM, detects and reports various faults including power amplifier fault, output power fault, temperature fault, and fan fault. Various Light Emitting Diode (LED) indicators, located on the front panel of the LPA, turn from green to red or yellow if an LPA fault is detected. In addition, a digital display located on the LPA front panel provides various fault messages. The status of the LPA, the alarm state (major or minor), and other more detailed information is summarized and reported (by the STM) over the optical interface to the HU and also to the service interface. This information may be accessed through the EMS software GUI, the NOC/NEM interface, or the SNMP interface.

4.4 Powering

The LPA is powered by various DC voltages which are supplied by the STM over the electrical interface provided by the D-sub connectors and wiring harness mounted within the RU outdoor cabinet or indoor mounting shelf.

4.5 Cooling

Continuous air-flow for cooling is provided by a pair of fans. In the previous version of the LPA, fans are mounted at the front and the rear side of the LPA housing. The front fan pulls cool air into the module and the rear fan exhausts heated air out of the module. In the new version of the LPA, two front mounted fans pull cool air into the module. The heated air is exhausted out the back of the module. An alarm is provided that indicates if a high temperature condition (>50° C/ 122° F) occurs or if a fan failure occurs. The fans may be field replaced if a failure occurs.

4.6 User Interface

The LPA user interface consists of the various LEDs, message displays, and switches that are provided on the LPA front panel. The LPA user interface points are indicated in [Figure 2-6](#) and described in [Table 2-3](#).

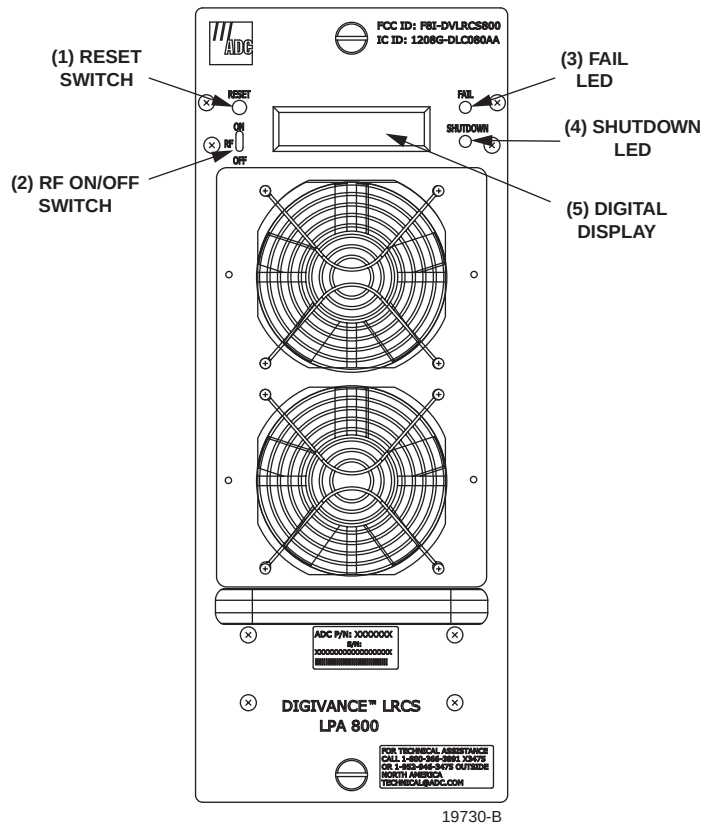


Figure 2-6. Linear Power Amplifier User Interface (Typical)

Table 2-3. Linear Power Amplifier User Interface

REF NO	USER INTERFACE DESIGNATION	DEVICE	FUNCTIONAL DESCRIPTION
1	RESET	Momentary contact push button switch	Momentarily pressing the push button clears all alarms and restarts the amplifier
2	RF ON OFF	2-position switch	Placing the switch in the OFF position puts the LPA in the standby state with RF output disabled. With the switch off, the STM can not control the LPA output power. Placing the switch in the ON position puts the LPA in the normal state and allows the STM to enable and disable the RF output.
3	FAIL	LED indicator (yellow)	Indicates the LPA is normal (off) or faulty (yellow).
4	SHUTDOWN	LED indicator (red)	Indicates the LPA is in service (off) or shutdown (red).
5	No designation	Digital display	Provides status and alarm messages. See Note.
Note: A more detailed description of the digital display messages is provided in Section 4.			

5 REMOTE UNIT MOUNTING SHELF

This section provides a brief description of the remote unit indoor mounting shelf. For complete information, refer to the Installation and Maintenance Manual for the mounting shelf.

5.1 Indoor Mounting Shelf

The indoor mounting shelf, shown in [Figure 2-7](#), 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 mounting shelf is designed for **indoor** installation in a 19- or 23-inch, EIA or WECO, equipment rack. The frame assembly is constructed of aluminum and steel and is painted putty white for corrosion protection. The indoor mounting shelf **does not** provide a mounting slot for a back-up battery.

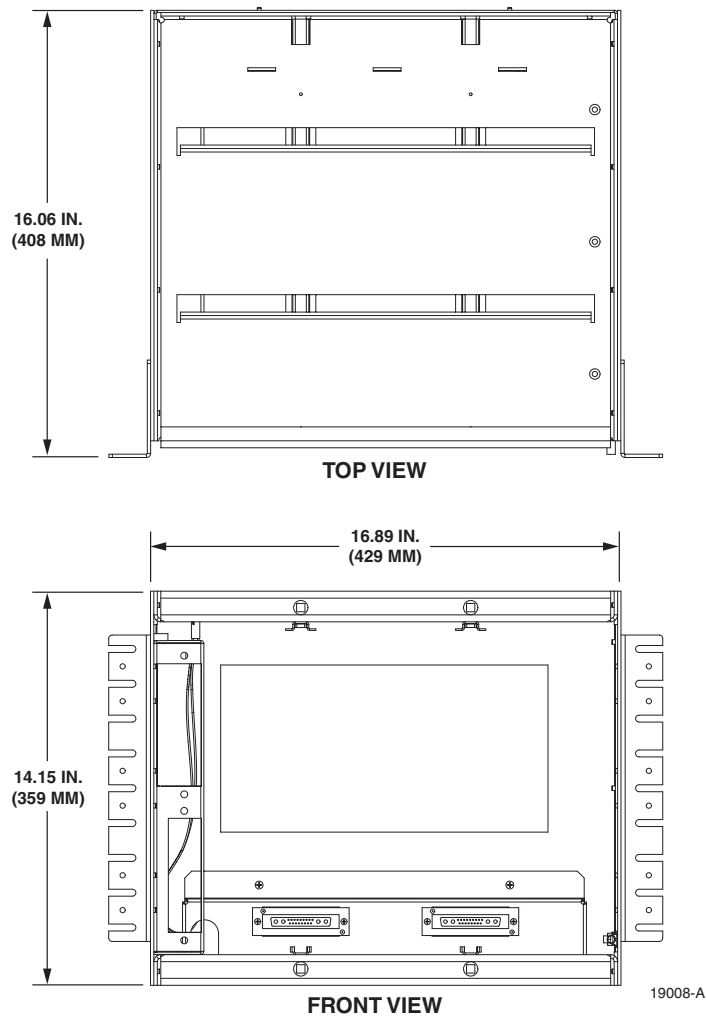


Figure 2-7. indoor Mounting Shelf

The AC power, fiber optic, and antenna cables route to the front of the indoor mounting shelf for connection to the STM front panel. A lightning protector kit (accessory) is available separately if lightning protection is required. A grounding lug is provided on the side of the mounting shelf for connecting a grounding wire.

The indoor mounting shelf user interface consists primarily of the mounting slots and the AC and DC power cables. The user interface points are shown in [Figure 2-8](#). For additional information, refer to the Digivance LRCS System Indoor Remote Unit Installation and Maintenance Manual (ADCP-75-160).

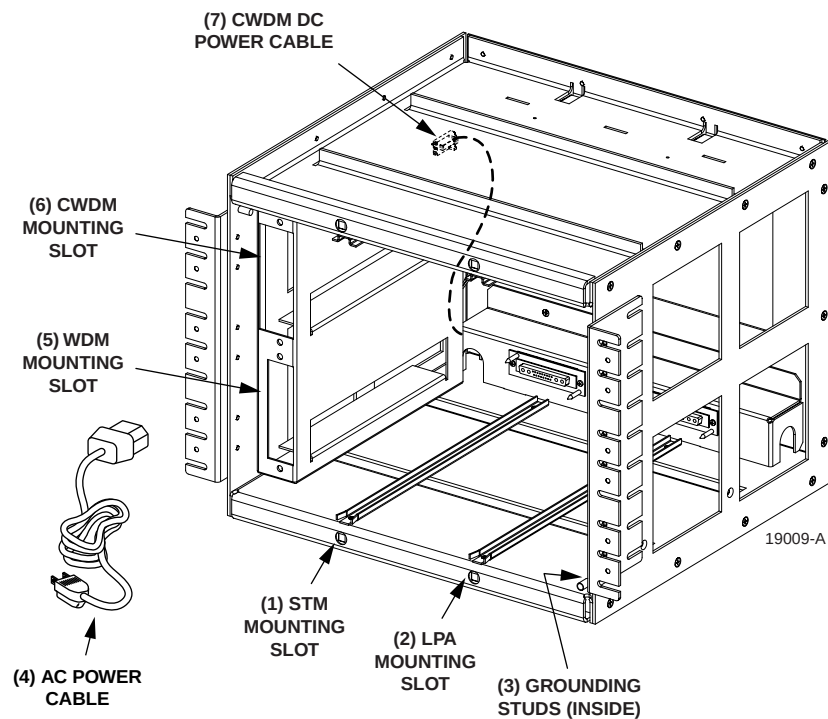


Figure 2-8. indoor Mounting Shelf User Interface

6 SLIM-STYLE REMOTE UNIT CABINETS

This section provides a brief description of the slim-style remote unit cabinets. Four types of slim-style cabinets are available. For complete information, refer to the Installation and Maintenance Manual for the cabinet.

Each slim-style cabinet enclosure is constructed of heavy gauge aluminum and is painted putty white for reduced solar loading and corrosion protection. Connection and entry points are provided in the bottom of the enclosure for the antenna coaxial cables, fiber optic cable, and AC power cable. Vent openings are provided in the bottom of the enclosure to permit air exchange for cooling.

The slim-style 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 hole openings in the bottom of the cabinet allow any moisture that does enter the cabinet to drain out. The cabinet door may be padlocked to prevent unauthorized entry. A door open switch is provided so that a customer-selectable major or minor alarm is generated whenever the cabinet door is opened.

The slim-style cabinet can be mounted on a flat vertical surface, a pedestal, or from a utility pole. A pedestal-mount kit (accessory) is available for pedestal-mount installations and a pole-mount kit (accessory) is available for pole-mount installations. A grounding lug is provided on the bottom of the cabinet for connecting a grounding wire.

6.1 Slim-Style Single-STM Cabinet

The **slim-style single-STM** cabinet, shown in [Figure 2-9](#), is a NEMA-3R enclosure (with removable dust filter) that houses the remote modules and protects them from the environment. The cabinet consists of the enclosure, mounting slots for the STM and LPA modules, an AC power interface, a lightning protector, two fiber slack spools, and a mounting slot for a WDM or CWDM (accessory) remote module.

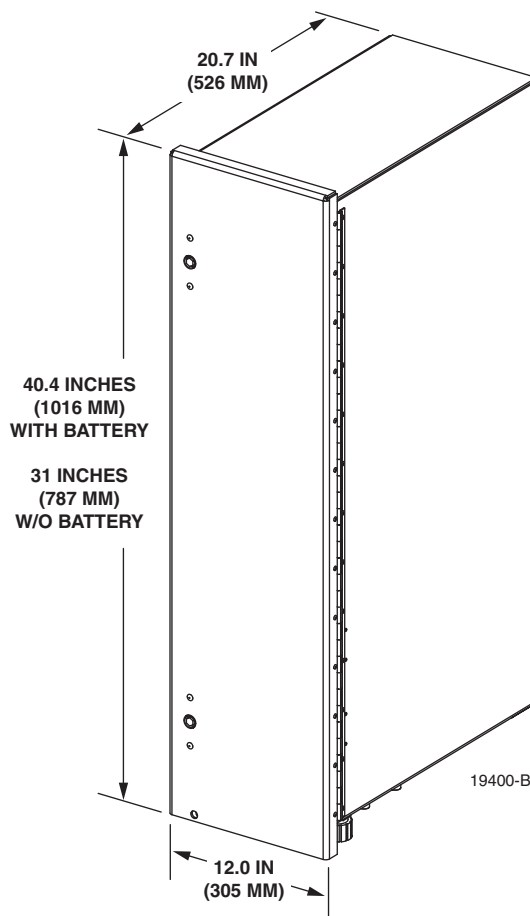


Figure 2-9. Slim-Style Single-STM Cabinet

On an optional basis, the cabinet is available either with or without a battery compartment. The battery compartment version provides a mounting tray for a back-up battery. The slim-style cabinet is designed for use in an outdoor environment but may be mounted indoors if required. Opening the hinged door provides full access to the interior of the enclosure to facilitate module and cable installation.

The slim-style single-STM cabinet user interface consists of the various connectors, fittings, outlets, and switches that are provided on the interior and exterior of the enclosure. The user interface points are indicated in [Figure 2-10](#) and [Figure 2-11](#). For additional information, refer to the Digivance LRCS System Slim-Style Single-STM Remote Unit W/Battery Installation and Maintenance Manual (ADCP-75-165); or the Digivance LRCS System Slim-Style Single-STM Remote Unit Without Battery Installation and Maintenance Manual (ADCP-75-173).

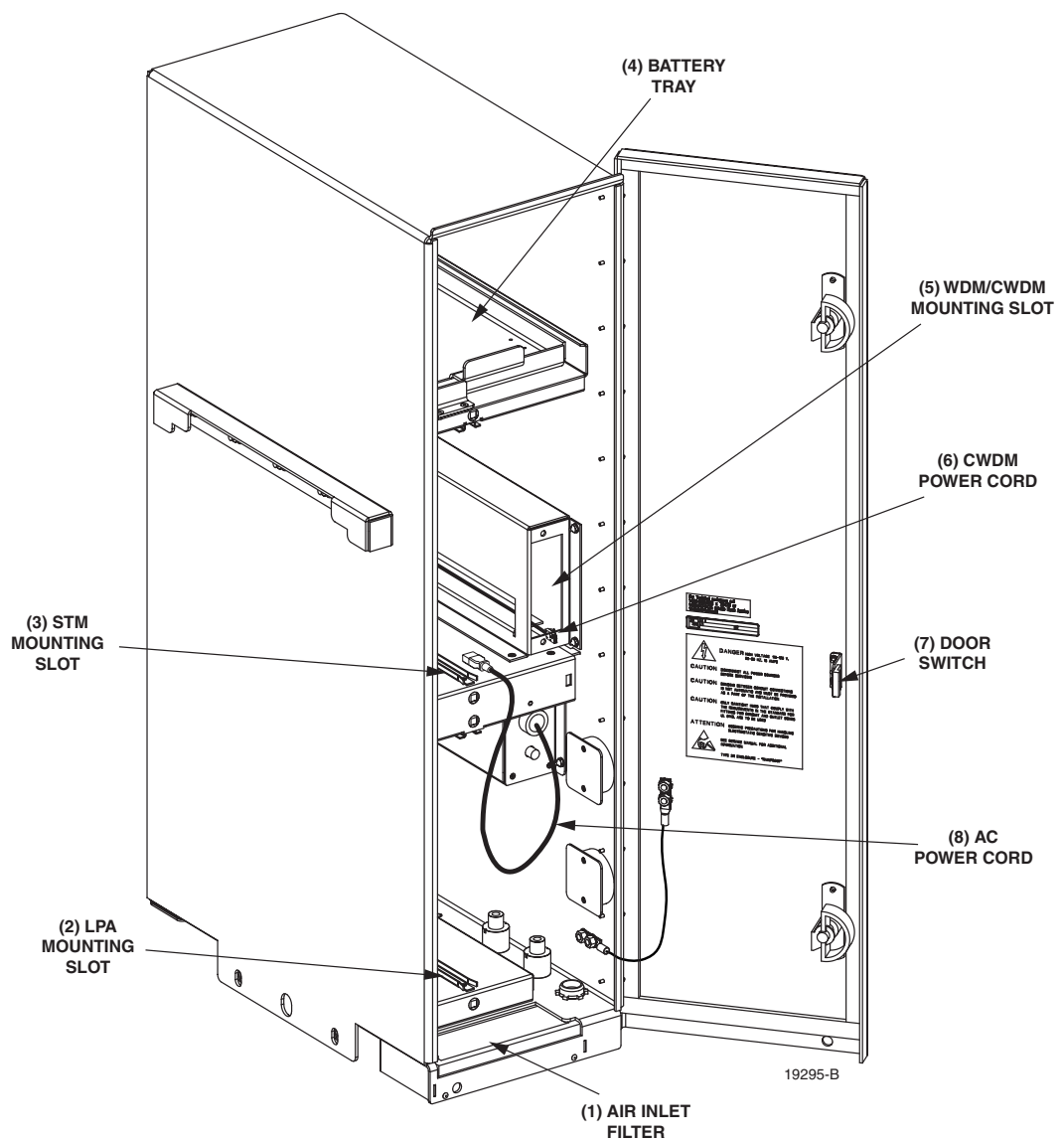


Figure 2-10. Slim-Style Single-STM Cabinet User Interface - Top Front View

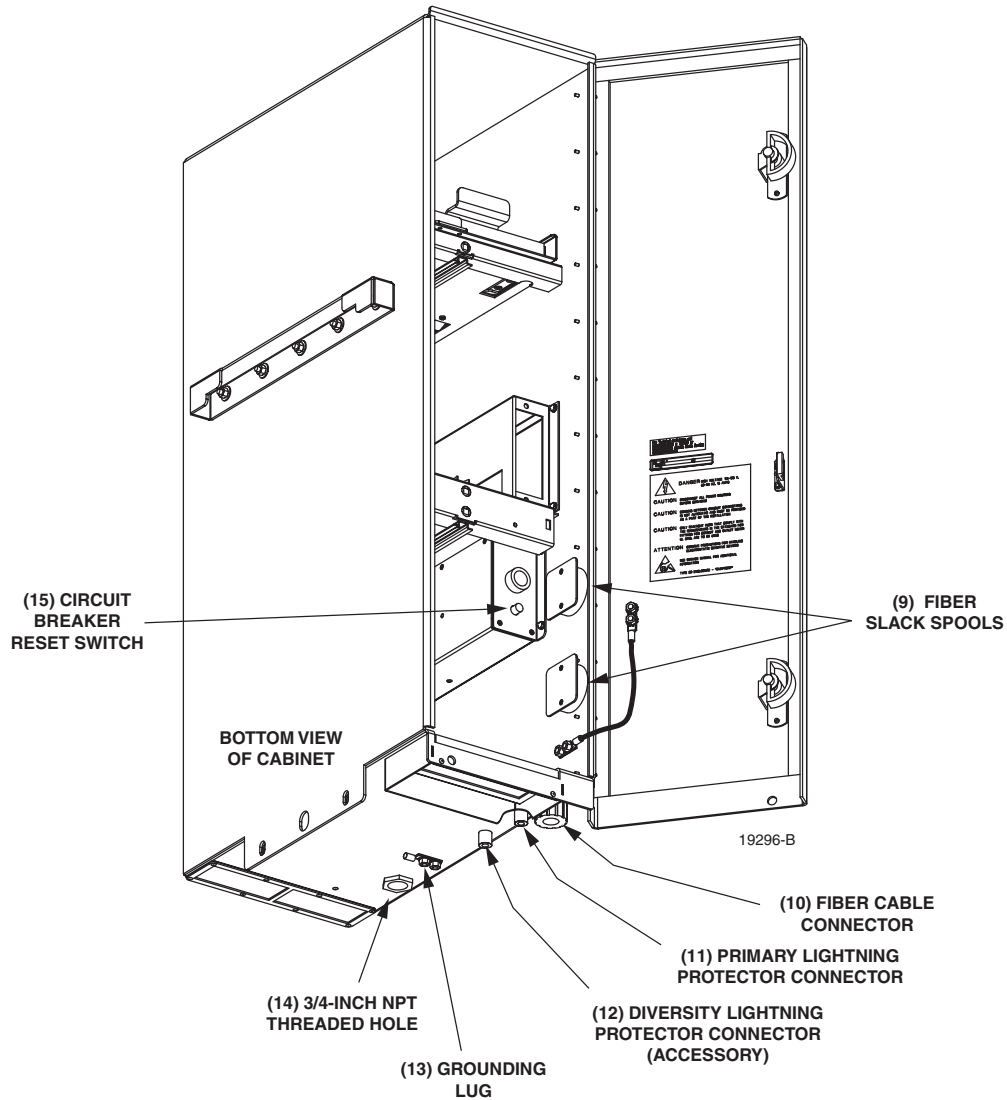


Figure 2-11. Slim-Style Single-STM Cabinet User Interface - Bottom Front View

6.2 Slim-Style Dual-STM Cabinet

The **slim-style dual-STM** cabinet, shown in [Figure 2-12](#), is a NEMA-3R enclosure (with removable dust filter) that houses the remote modules and protects them from the environment. The cabinet consists of the enclosure, mounting slots for the STM and LPA modules, an AC power interface, two lightning protectors, two fiber slack spools, and mounting slots for WDM or CWDM (accessory) remote modules.

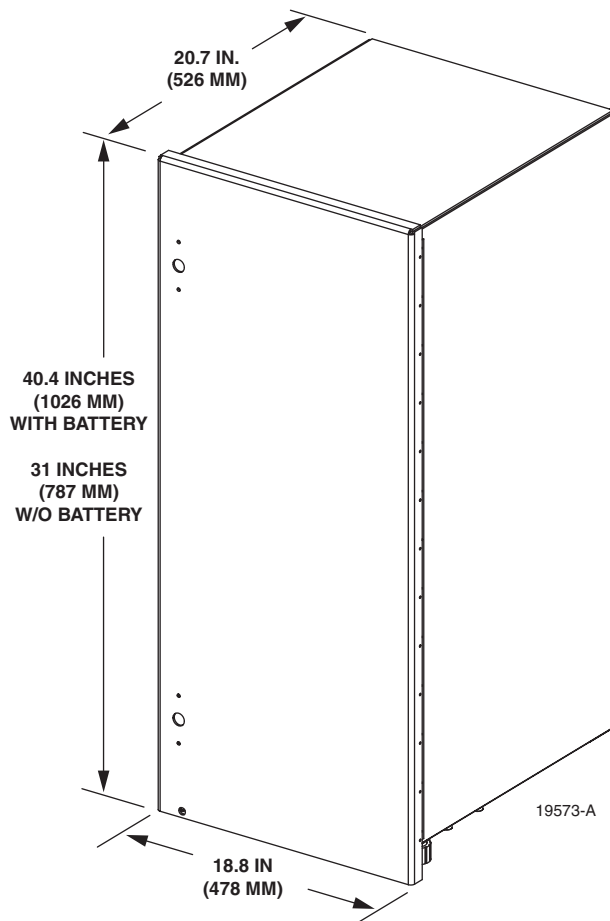


Figure 2-12. Slim-Style Dual-STM Cabinet

On an optional basis, the cabinet is available either with or without a battery compartment. The battery compartment version provides a mounting tray for a back-up battery. The slim-style cabinet is designed for use in an outdoor environment but may be mounted indoors if required. Opening the hinged door provides full access to the interior of the enclosure to facilitate module and cable installation.

The slim-style dual-STM 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 user interface points are indicated in [Figure 2-13](#) and [Figure 2-14](#). For additional information, refer to the Digivance Slim-Style Dual-STM Remote Unit W/Battery Installation and Maintenance Manual (ADCP-75-172); or the Digivance Slim-Style Dual-STM Remote Unit Without Battery Installation and Maintenance Manual (ADCP-75-174).

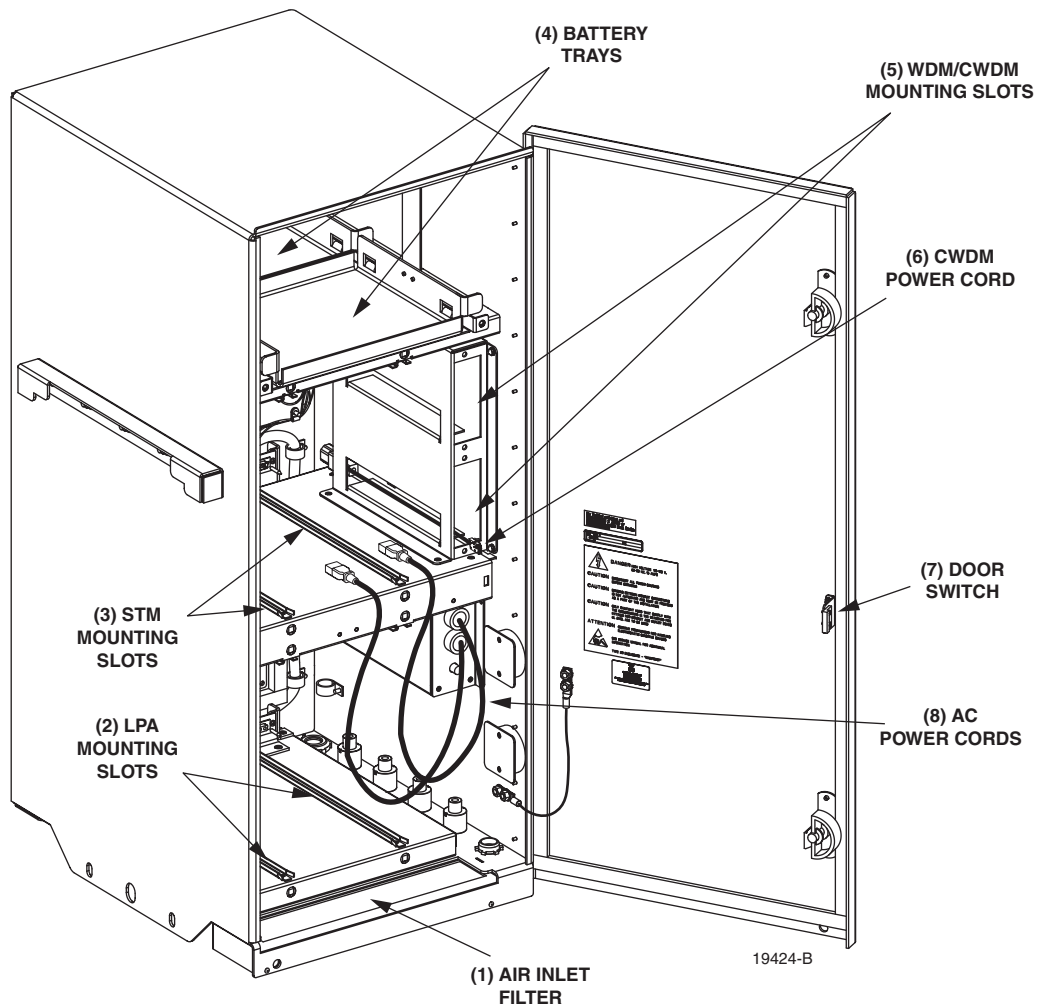


Figure 2-13. Slim-Style Dual-STM User Interface - Top Front View

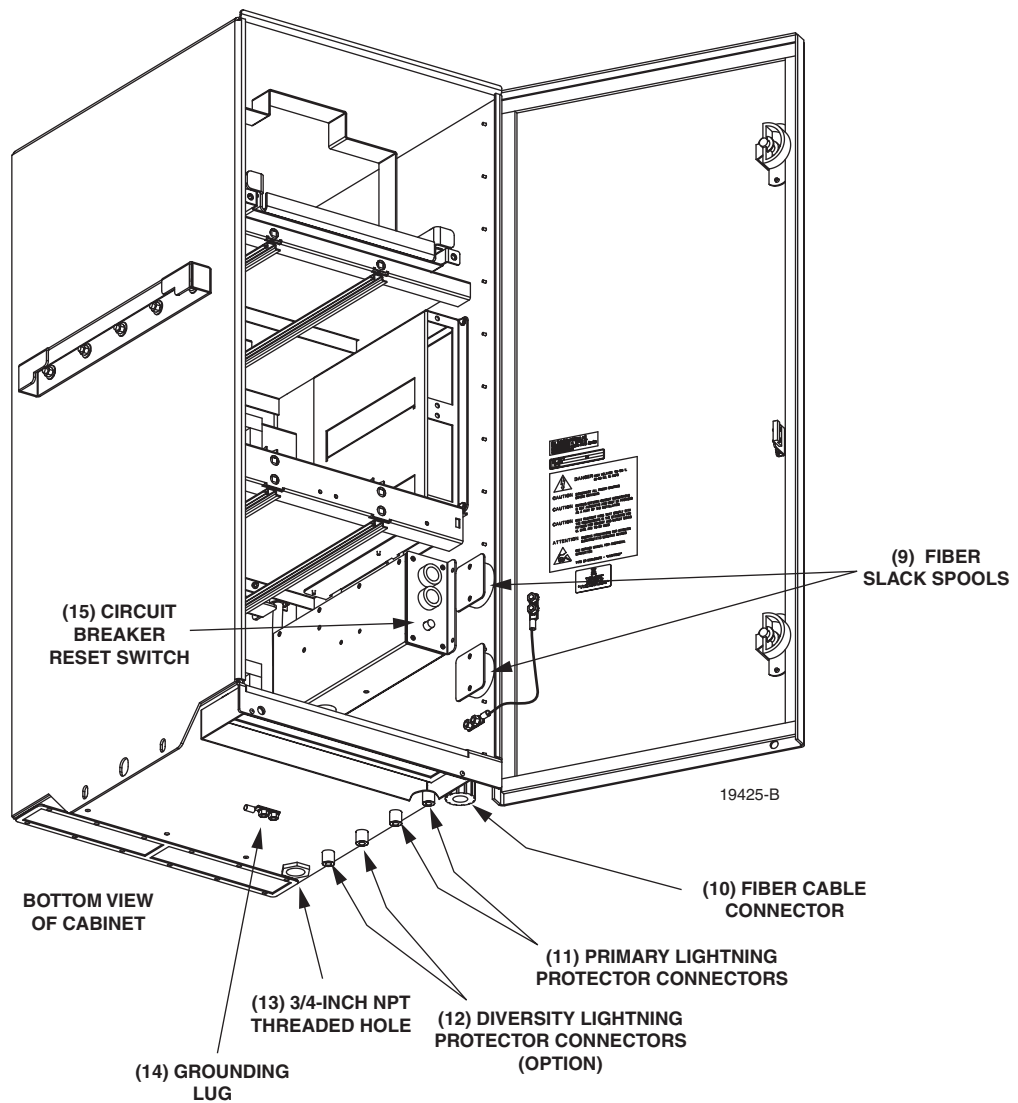


Figure 2-14. Slim-Style Dual-STM User Interface - Bottom Front View

7 ACCESSORY ITEMS

This section provides a brief description of various accessory items that are available separately. The accessory items may or may not be required depending on the application.

7.1 Remote Unit Back-up Battery Kit

A back-up battery kit (accessory item), shown in [Figure 2-15](#), is available when the application requires that the remote system remain operational during an AC power outage. A battery tray is provided within specified enclosures for mounting the battery. The tray includes a heating pad that keeps the battery warm during cold weather. A temperature sensor regulates the operation

of the heating element 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 with the 50 Watt LPA and 2 hours with the 20 Watt LPA.

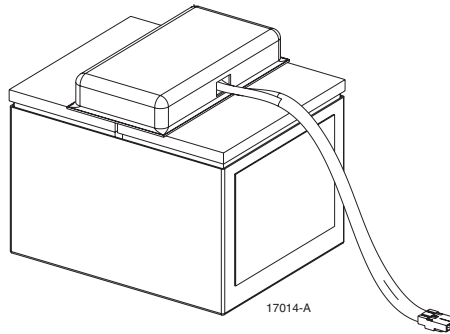


Figure 2-15. Back-Up Battery Kit

7.2 Wavelength Division Multiplexer System

The Wavelength Division Multiplexer (WDM) system is an accessory product that is used when it is desirable or necessary to combine the forward and reverse path optical signals from one Digivance system onto a single optical fiber. Each WDM system consists of a host module, host module mounting shelf, and remote module. The WDM host module mounting shelf can support two WDM host modules. The RU indoor mounting shelf and the outdoor cabinets provide a mounting slot for installing a WDM remote module. The WDM host module and host module mounting shelf are shown in [Figure 2-16](#). The WDM remote module is shown in [Figure 2-17](#).

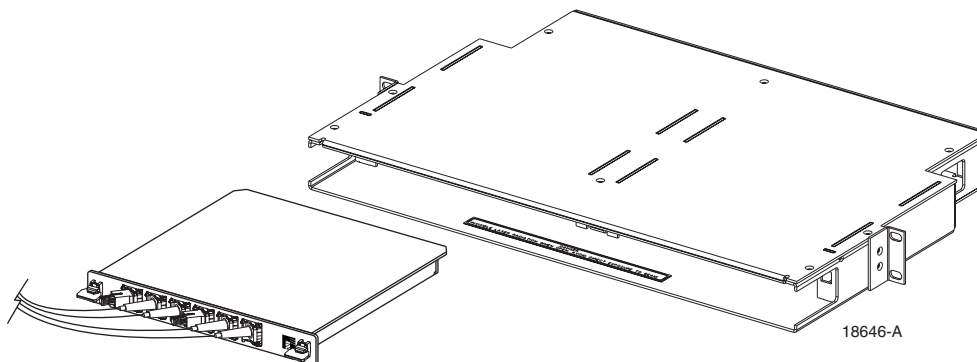


Figure 2-16. WDM Host Module and Host Module Mounting Shelf

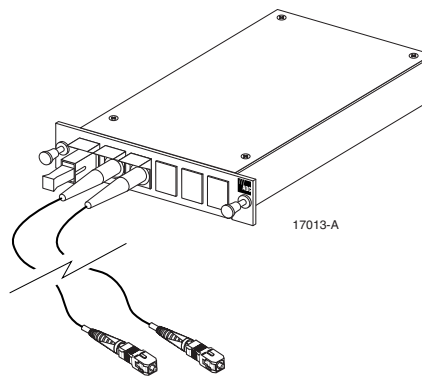


Figure 2-17. WDM Remote Module

Each WDM module consists of either one (remote module) or two (host module) bi-directional wavelength division multiplexers mounted within a powder-paint coated sheet metal enclosure. An SC-type optical connector port is provided for connecting the forward/reverse path optical fiber to the WDM module. A pair of pigtail leads with SC-type connectors are provided for connecting the WDM module to the forward and reverse path optical ports on the HU or STM.

7.3 Coarse Wavelength Division Multiplexer System

The Coarse Wavelength Division Multiplexer (CWDM) system is an accessory product that is used when it is desirable or necessary to combine the forward and reserve path optical signals from up to four Digivance systems onto a single optical fiber. Each CWDM system consists of a Host Module, Host Module mounting shelf, and Remote Module. The CWDM Host Module mounting shelf can support up to three CWDM Host Modules. The RU indoor mounting shelf and the outdoor cabinets provide a mounting slot for installing a CWDM Remote Module.

The CWDM Remote Module is shown in [Figure 2-18](#). The CWDM Host Module and Host Module Mounting Shelf are shown in [Figure 2-19](#). For complete information about the CWDM system, refer to the Digivance System Coarse Wavelength Division Multiplexer User Manual (ADCP-75-142).

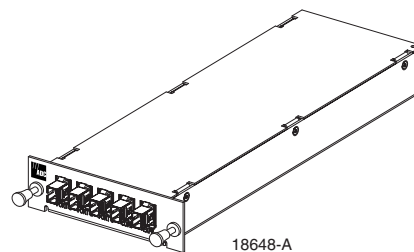


Figure 2-18. CWDM Remote Module

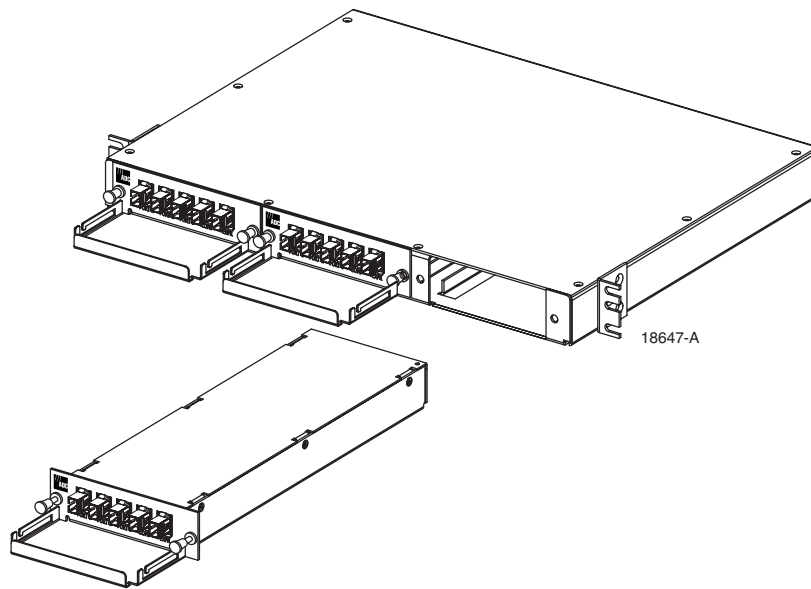


Figure 2-19. CWDM Host Module and Host Module Mounting Shelf

8 DIGIVANCE ELEMENT MANAGEMENT SYSTEM

The Digivance Element Management System (EMS) is a software-based network management tool that provides control and monitoring functions for the Digivance system. Digivance EMS is used to provision and configure new systems for operation, set system operating parameters, get system alarm and status messages, and upgrade the system software. Digivance EMS supports **local** control by an on-site service technician and also **remote** control through a Network Operations Center (NOC) interface or an SNMP interface.

8.1 Digivance EMS Primary Components

The primary components of the Digivance EMS, shown in [Figure 2-20](#), are packaged separately from the various Digivance hardware items and consist of the following items: User Manuals, mouse pad, license agreement, and three CD-ROMs which contain both software and various technical publications. All software items install on a PC-type computer which is not provided. A cable (DGV L-000000CBPC) for connecting the EMS computer to either the HU or RU is available separately as an accessory item.

EMS CD-ROM: The EMS software, the Java 2 Version 1.3.1 Runtime Environment software, and the Control and FPGA software (HU and RU firmware files) are loaded on the EMS CD-ROM. The EMS software provides **local** monitor and control functions through a Graphical User Interface (GUI) and **remote** monitor and control functions through the NOC/NEM interface. Several Control and FPGA firmware programs are also included on the EMS CD-ROM for downloading to the HU and RU in case either hardware unit is not already loaded with the current firmware.

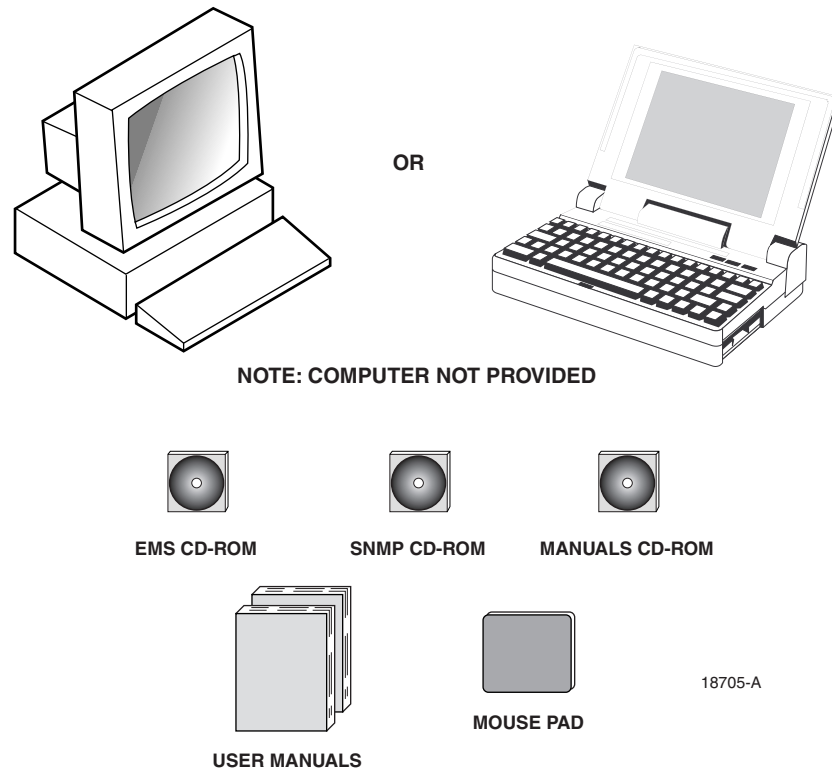


Figure 2-20. Digivance Element Management System

SNMP CD-ROM: The SNMP Proxy Agent software is optional and is provided on the SNMP CD-ROM. The SNMP Proxy Agent software provides for remote monitor and control functions through a network SNMP manager. If the SNMP interface is required for system operation, both the EMS software and SNMP Proxy Agent software must be installed on the same computer. The SNMP Proxy Agent software will not function without the EMS software.

Manuals CD-ROM: PDF files of the various Digivance technical publications are provided on the Manuals CD-ROM. A copy of Acrobat Reader is required to open and print the publication files. A copy of Acrobat Reader may be downloaded free of charge from the Adobe.com website if necessary.

8.2 Software Installation

Software installation consists of inserting each software CD-ROM into the computer's CD-ROM drive and then running the software install programs. This places the EMS, Java 2 Runtime Environment, and SNMP Proxy Agent software files in assigned folders on the computer's hard drive. Software installation instructions are provided in the Digivance Element Management System User Manual (ADCP-75-151).

8.3 Computer Operation

Permanent control and monitoring functions may be provided by a PC-type desk-top computer that is permanently connected to a HU. The EMS program must be running in order for the NOC interface to function. Both the EMS program and SNMP Proxy Agent program must be running in order for the SNMP interface to function. A PC-type lap-top computer running just the EMS program can be used as a portable network management tool for service and maintenance purposes. The laptop computer may be connected temporarily to a HU or RU to trouble-shoot problems on-site and then removed when the maintenance task is completed. The specifications for the EMS computer are provided in the Digivance Element Management System User Manual (ADCP-75-151).

8.4 Digivance EMS Computer Interface Connections

The service interface connection between the EMS computer and the HU or RU requires that the EMS computer be equipped with a DB-9 connector that is configured to provide an RS-232 DCE interface. A straight-through RS-232 interface cable (accessory item) equipped with a male DB-9 connector on one end and a PC-compatible connector on the other end is required to link the EMS computer to the HU or RU. If multiple HUs are networked together using the CAN interface, all units may be managed by connecting the EMS computer to the service connector on any one of the networked HUs.

The NOC interface connection between the EMS computer and the NOC requires that the EMS computer be equipped with a connector that is configured to provide an RS-232 ASCII interface. The link between the EMS computer and the NOC would generally be supported by a T1 system, DS0 with RS232 conversion, or other medium. Cables and equipment (not provided) to support the RS-232 interface connection between the EMS computer and the NOC interface are required.

The SNMP interface connection between the EMS computer and the SNMP manager requires that the EMS computer be equipped with an Ethernet port. The link between the EMS computer and a network SNMP manager would generally be supported by a Local Area Network (LAN). Cables and equipment (not provided) to support the connection between the EMS computer and the LAN are required.

8.5 Digivance EMS User Interfaces

The Digivance EMS provides three user interfaces: the EMS Graphical User Interface (GUI), the Network Operation Center–Network Element Manager (NOC/NEM) interface, and the SNMP GUI interface. The EMS GUI, the NOC interface, and the SNMP GUI provide the same basic functions. However, the NOC interface and the SNMP GUI cannot be used to download new system software to the Digivance system. In addition, the SNMP GUI cannot be used to assign a system site number to a HU/RU pair during installation.

The EMS GUI is used for **local** control and monitoring operations. The EMS GUI consists of a series of displays and screens, such as the one shown in [Figure 2-21](#), that provide the user with alarm and status information and that allow the user to set various operating parameters. Directives are implemented by pointing and clicking on the desired action and also by entering text in various dialog boxes. Refer to the Digivance Element Management System User Manual (ADCP-75-151) for additional information.

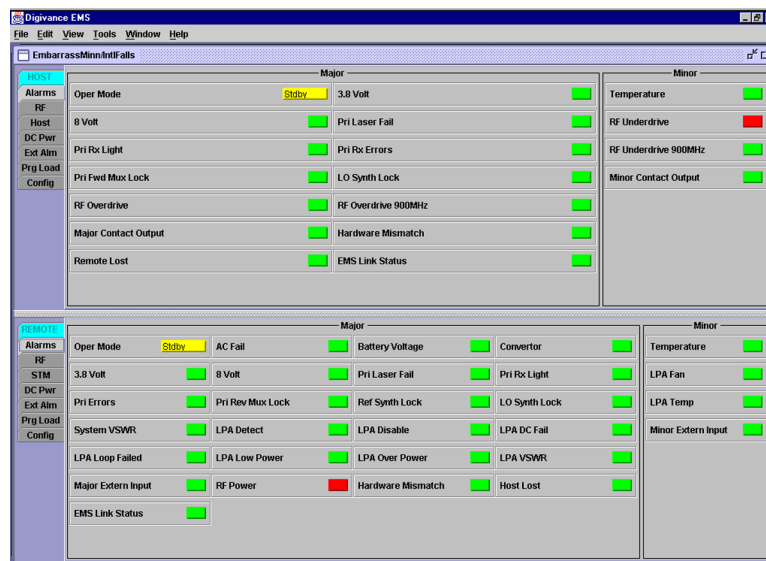


Figure 2-21. Graphical User Interface Host/Remote Display

The NOC/NEM interface is a text-based command line interface that is used for **remote** control and monitoring operations (**except software download**). The NOC/NEM interface consists of defined ASCII text strings that are input as SET or GET commands followed by the action or information required. A text string response is received from the specified Digivance system or systems to confirm the requested action or to report the requested information. Examples of several typical NOC-NEM interface commands and the responses received are shown in [Figure 2-22](#). The NOC/NEM interface requires only a VT100 terminal/emulator or a PC-type computer that is loaded with a communication software such as Procomm Plus. While primarily intended for use at the NOC, the NOC/NEM interface commands may also be input locally from the EMS computer. Refer to the Digivance Element Management System User Manual (ADCP-75-151) for additional information.

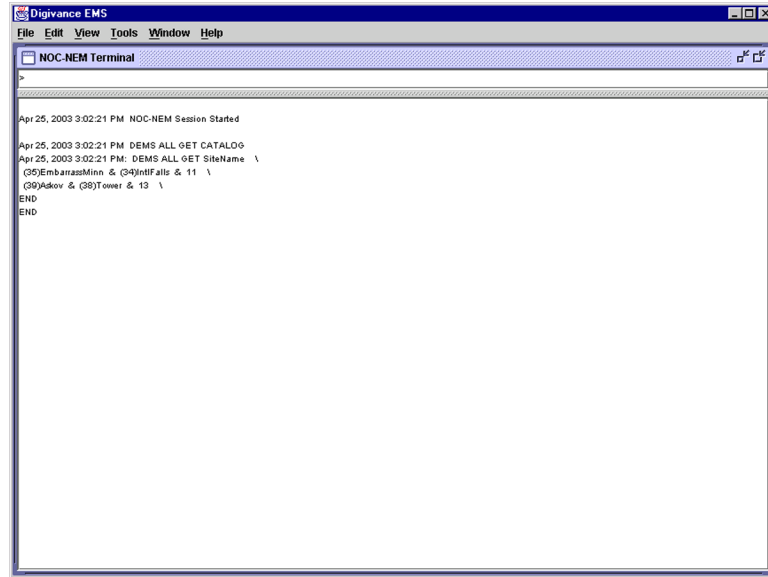


Figure 2-22. NOC/NEM Interface Typical Commands

The SNMP interface is a GUI that is used for **remote** control and monitoring operations (**except software download and site number assignment**). The SNMP interface uses a Management Information Base (MIB) to define a list of identifiers that are supported by the SNMP agent. The SNMP manager communicates with the SNMP agent over a LAN. Directives, based on the MIB identifier, are issued by the SNMP manager to the SNMP agent along with instructions to either get the specified identifier or set the specified identifier. The directive is then executed on the Digivance system by the SNMP agent. The SNMP agent also has the ability to send autonomous messages (called traps) to the SNMP manager to report changes in the status of the managed system. The SNMP manager Stargazer Version 8.0 is available from ADC for use with the LRCS SNMP agent. Other SNMP managers are available from various network management software vendors. Refer to the SNMP Agent Software User Manual (ADCP-75-152) for additional information.

9 SPECIFICATIONS

Refer to [Table 2-4](#) for the Digivance SMR LRCS system nominal specifications. All specifications apply after a five minute warm-up period.

Table 2-4. 800/900 MHz SMR System Nominal Specifications

PARAMETER	SPECIFICATION	REMARKS
Optical - Host and Remote Unit		
Fiber type	9/125, single-mode	
Number of fibers required		
With WDM	1	The wavelength division multiplexer (WDM) is an accessory item.
Without WDM	2	
Forward path wavelength	1550 nm	
Reverse path wavelength	1310 nm	
Optical transmit power output		
Host Unit	0 dBm	
Remote Unit	+2 dBm	
Optical budget	25 dB	For optical BER of 10^{-6}
Optical Receive Input	-15 dBm	
Optical connectors	Industry standard SC	Host, remote, and WDM
Optical - Host and Remote WDM		
Passband	1310 nm $\pm$ 20 nm 1550 nm $\pm$ 20 nm	
Forward path insertion loss		
Host WDM	0.7 dB	Does not include connector loss
Remote WDM	0.3 dB	
Reverse path insertion loss		
Host WDM	0.3 dB	Does not include connector loss
Remote WDM	0.7 dB	
Isolation	> 30 dB minimum	
Return loss (Reflectance)	< -50 dB	All input ports
RF Forward Path - 800/900 MHz		
System bandwidth	18 MHz 5 MHz	800 MHz transmit 900 MHz transmit
Frequency range	851–869 MHz 935–940 MHz	
Gain of forward path (Host input to Remote primary antenna port)	85 dB with 35 Watt LPA	At band center, room temperature, and 0 dB attenuation setting. Includes power amplifier.
Gain flatness		
Band flatness	$\pm$ 2.0 dB across freq. range	
Channel flatness	$\pm$ 1 dB variation across any 1.25 MHz channel	

Table 2-4. 800/900 MHz SMR System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Gain variation	± 3 dB over temp and unit-to-unit	
Propagation delay	6 μ s	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μ s 0.1 μ s $\pm$ 100 ns	Plus standard propagation delay
Spurious In-band self generated Dynamic range (noise floor)	-13 dBm at remote output <-60 dBc	
Transmit peak-to-average	10 dB	
Two-tone Intermodulation	≤ -60 dBc	
Nominal composite RF input signal level	-43 dBm at 0 dB attenuation -12 dBm at max. attenuation	An input signal level of -43 dBm provides maximum output power
Configurable input level Range Step size	31 dB 1 $\pm$ 0.5 dB $\pm$ 10% of attenuation monotonic	
Composite RF Output power of both bands with 35 Watt LPA	43.4 dBm (22 Watts) at remote antenna port with -43 dBm input	35 Watts at LPA output
Configurable RF Output Range Step size	31 dB at remote unit 1 $\pm$ 0.5 dB $\pm$ 10% of attenuation monotonic	
Transmit path insertion loss	2.5 dB maximum	
RF Reverse Path - 800/900 MHz		
System bandwidth	18 MHz 5 MHz	800 MHz receive 900 MHz receive
Frequency range	806-824 MHz 896-901 MHz	
Propagation delay	6 μ s	Excludes fiber delay
Configurable propagation delay Range Step size	Up to 63 μ s 0.1 μ s $\pm$ 100 ns	Plus standard propagation delay
Gain of reverse path Overall gain Gain variation	30 $\pm$ 2 dB at band center at room temperature 3 dB over temperature	
Gain flatness Band flatness Channel flatness	≤ 1.5 dB across frequency range ≤ 1 dB variation across any 1.25 MHz channel	
Out-of-band rejection	-40 dB at ≤ 30 MHz	

Table 2-4. 800/900 MHz SMR System Nominal Specifications, continued

PARAMETER	SPECIFICATION	REMARKS
Spurious (in-band self generated)	-110 dBm referred to input	
Intermodulation	-62 dBc	
System noise figure	8 dB at mid-band	
Configurable RF output Range Step size	31 dB $1 \pm 0.5 \text{ dB} \pm 10\%$ of attenuation monotonic	
Blocking dynamic range	70 dB	
Level limiting ALC threshold	-40 dBm ± 3 dB instantaneous	
Level limiting ALC range	30 dB	
Physical/Environmental/ Electrical - Host Unit Dimensions (H×W×D)	3.5 × 17.1 × 12.2 inches (88 × 433 × 311 mm)	Dimension for width does not include the mounting brackets which can be installed for either 19- or 23-inch racks.
Mounting	19- or 23-inch rack	EIA or WECCO
Weight	18 lbs. (8.2 kg)	
Weather resistance	Indoor installation only	
Operating temperature	0° to 50° C (32° to 122° F)	
Storage temperature	-40° to 70° C (-40° to 158°F)	
Humidity	10% to 90%	No condensation
External alarm connector	Screw-type terminals	NO and NC relay contacts
DC power connector	Screw-type terminal strip	
RF coaxial cable connectors	N-type (female)	
Service connector	DB-9 (female)	RS-232 DTE interface
Auxiliary connector	DB-9 (female)	RS-232 DTE interface
CAN connectors	RJ-45 jack	
Power input	± 24 or ± 48 VDC	± 21 to ± 60 VDC
Power consumption	55 watts	
Current rating	1 Amp at -48 VDC	
Reliability at 25°C	MTBF 80,000 hours	Excluding fans

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SECTION 3: OPERATION

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1 BEFORE STARTING OPERATION

This section provides guidelines for turning-up the Digivance system, verifying that all units are operating properly, testing to ensure that all performance requirements are satisfied, and correcting any installation problems. This process assumes that the various units have been installed in accordance with the system design plan.

1.1 Tools and Materials

The following tools and materials are required in order to complete the procedures in this section:

- Portable spectrum analyzer or RF power meter
- AC/DC voltmeter
- External attenuators (if specified in system design plan)
- PC-type computer with Digivance Element Management System (EMS) Version 3.01 software installed
- Straight-through RS-232 DB-9 interface cable (accessory)
- Handset
- Pencil or pen
- Writing pad

1.2 Readiness Check

Before starting the turn-up process, inspect the complete Digivance system to verify that all components of the system are ready to be powered-up. This will ensure that no units of the system will be damaged during turn-up and that all existing systems will continue to function properly.

1.2.1 Host Unit Installation Checks

Complete the following checks at the HU prior to starting the turn-up process:

1. Verify that the ON/OFF switch on the HU is in the **OFF** position (press **0**).

► **Note:** When connecting the equipment to the supply circuit, be sure to check equipment nameplate ratings to avoid overloading circuits which may cause damage to over-current protection devices and supply wiring.

2. At the fuse panel, install a 3 Amp GMT fuse in the circuit that supplies DC power to the HU.
3. Using a DC voltmeter, verify that the DC voltage level at the HU power terminals is between ± 21 to ± 60 VDC (nominal ± 24 or ± 48 VDC). The DC power provided to the HU can be either polarity.
4. Verify that all electrical and optical connections have been completed and that all optical fibers, coaxial cables, and wires are properly routed and secured.

1.2.2 Remote Unit Installation Checks

Complete the following checks at the RU prior to starting the turn-up process:

1. Verify that the ON/OFF switch on the STM is in the **OFF** position (press **0**).
2. Verify that the RF ON/OFF switch on the LPA in the **OFF** position.
3. At the AC breaker box, close the circuit breaker for the circuit that supplies AC power to the RU.
4. Using an AC voltmeter, verify that the AC voltage level at the AC outlet is between 110 and 120 VAC (for 120 VAC powered systems) or between 220 and 240 VAC (for 240 VAC powered systems).
5. Verify that all electrical and optical connections have been completed and that all optical fibers, coaxial cables, and wires are properly routed and secured.

2 TURN-UP SYSTEM AND VERIFY OPERATION

The process of turning-up the system and verifying operation involves powering up the various system components, verifying that the LED indicators show normal operation, setting the site number and name, adjusting the RF signal levels, and adjusting the path delay.

2.1 Turn-Up Procedure

Each Digivance system must be turned-up separately before being networked together with multiple systems through the CAN interface. Use the following procedure to turn-up each Digivance system:

1. Temporarily disconnect the external alarm system or notify the alarm system provider that testing is in progress.
2. If the HU is networked together with multiple HU's, temporarily disconnect the CAN cables from the NET IN and NET OUT ports of the HU.

► **Note:** By default, all HU's and RU's are programmed with the same site number and name. This can cause problems for the EMS if multiple HU's with the same site number and site name are networked together through the CAN interface. It is therefore necessary to temporarily disconnect the CAN interface cables from the HU when it is being configured for operation until a unique site number and name can be assigned.

3. Determine if the forward path composite input signal level at each host unit RF IN port (851–869 FORWARD and 935–940 FORWARD) is appropriate to produce the required RF output signal level. Adjust by installing an **external attenuator** if necessary. Refer to [Section 2.3](#) for the calculation and adjustment procedure.
4. Connect the EMS computer (if not already connected) to the SERVICE connector on the HU or STM front panel. If necessary, a separate laptop computer loaded with EMS Version 3.01 software can be temporarily connected and used to initially configure the system.
5. At the HU: Place the ON/OFF switch on the HU in the **ON** position (press **I**).
6. At the RU: Make sure the RF switch on the LPA is in the **OFF** position. Then place the ON/OFF switch on the STM in the **ON** position (press **I**).
7. Wait 6 to 8 seconds for the HU and the RU modules to initialize and then observe the LED indicators on the HU, STM and LPA. Refer to Section 4 for the troubleshooting procedures if the indicators do not respond as specified in [Table 3-1](#).

Table 3-1. LED Indicator Operation at Initial Turn-Up

HOST UNIT	SPECTRUM TRANSPORT MODULE	35 WATT LPA
POWER – Green	AC POWER – Green	FAIL – Off
STANDBY – Off	STANDBY – Off	SHUTDOWN – Red
HOST UNIT – Green	HOST UNIT – Green	Digital Display – FORCED SHUTDOWN
REMOTE UNIT – Green	STM – Green	
DRIVE 851–869 and DRIVE 935–940 – Green, Yellow, or Red	PA – Green	
FWD/REV (PORT 1/PORT 2) – Green	VSWR – Green	
	FWD/REV (PORT 1/PORT 2) – Green	

8. Start up the EMS Version 3.01 software program. The EMS main window will open as shown in [Figure 3-1](#). Note: The EMS software should be installed on a PC-type computer and the PC's COMM port should be configured to interface with the HU. For information about installing the EMS software and configuring the PC's COMM port, refer to the Digivance Element Management System Version 3.01 User Manual (ADCP-75-151).

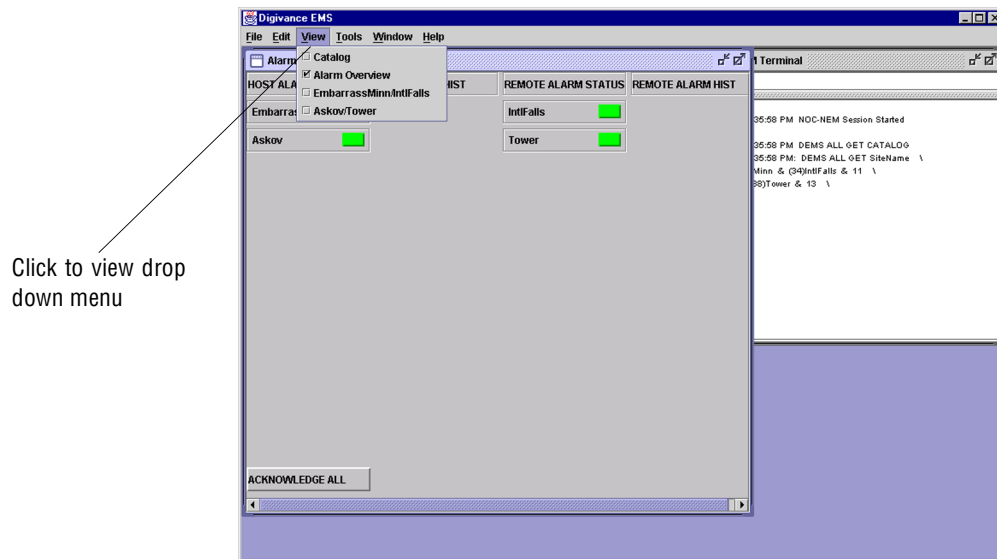


Figure 3-1. Digivance Element Management System Main Window

9. Open the **View** drop down menu and connect to the Host and Remote pair by selecting the “NotNamed/NotNamed” Host/Remote pair. The **HOST Alarms** display and the **REMOTE Alarms** display will open within the main window as shown in [Figure 3-2](#).

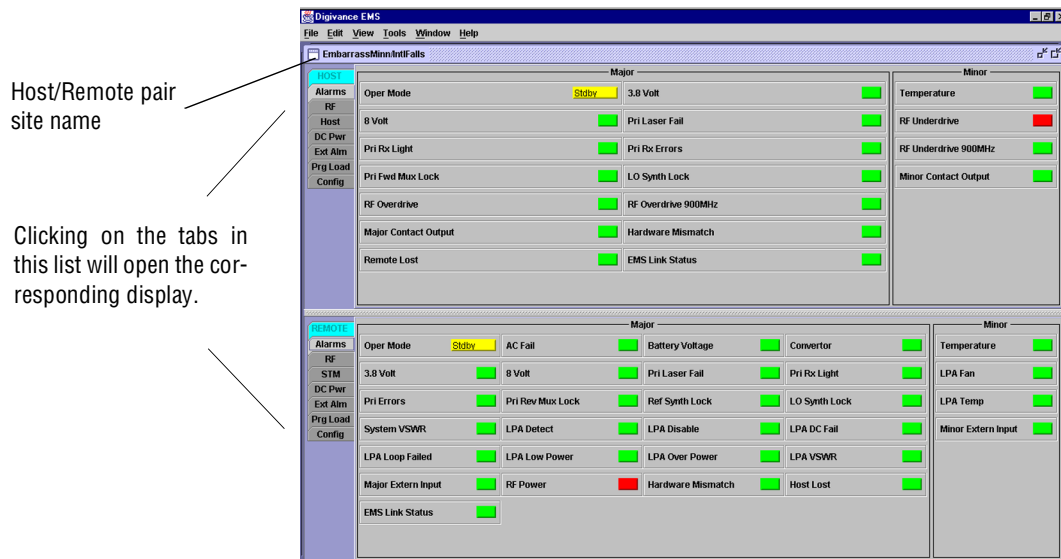


Figure 3-2. Selecting Display Tabs

10. New Control program software and FPGA program software will be provided separately on a “as needed” basis. If new Control and FPGA software is not provided with the system, skip this step and proceed to step 11. If new Control and FPGA software is provided, check the version numbers of the new software against the version numbers of the software loaded on the Host and Remote Units. If the software loaded on the Host and Remote Units is **older** than the new software, download the new software to both the Host Unit and the Remote Unit. Refer to [Section 2.2](#) for details.
11. Click on the **HOST Config** tab and on the **REMOTE Config** tab (see [Figure 3-2](#)). The **HOST Config** display and the **REMOTE Config** display will open within the main window.
12. Enter the **Site Name** and **Site Number** for both the HOST and the REMOTE unit. Refer to [Section 2.4](#) for details.

▶ **Note:** The Site Name and Site Number must be unique for each Digivance system.
13. If the Digivance system will be networked together with other Digivance systems, reconnect the CAN cables to the HU’s NET IN and NET OUT ports.
14. Verify that no Major or Minor alarms (except Major or Minor Extern Alarm) are being reported in either the **HOST Alarm** displays (except as indicated in the note below) and that all alarm fields (except Major or Minor Extern Alarm) are green.

▶ **Note:** The Host RF Underdrive may indicate a minor alarm until the Host Fwd Att and Remote Fwd Att values are set. The Remote LPA disable will indicate a major alarm until the LPA is enabled.
15. Click on the **HOST RF** tab (see [Figure 3-2](#)). The **HOST RF** display will open within the main window.
16. Enter the **Host Fwd Att** (Forward Attenuation) value. This sets the forward input RF signal level at the HU. Refer to [Section 2.5](#) for details. By default, this value is set to 31 dB. If the DRIVE 851–869 and DRIVE 935–940 LED’s on the HU front panel were red, both should turn green when this step is completed.
17. Determine if the RF output power at the STM ANTENNA is at the correct level per channel up to a composite maximum of +43.4 dBm (22 Watts). Refer to [Section 2.6](#) for details.
18. Place the RF ON/OFF switch on the LPA in the **ON** position.
19. Verify that the SHUTDOWN LED indicator on the LPA turns from red to off and the Digital Display message changes from FORCED SHUTDOWN to NORMAL OPERATION.
20. Click on the **REMOTE RF** tab (see [Figure 3-2](#)). The **REMOTE RF** display will open within the main window.
21. Enter the **Remote Fwd Att** value. This adjusts the RF output signal level at the STM ANTENNA port. By default this value is set to 31 dB. Refer to [Section 2.7](#) for details.
22. Click on the **HOST RF** tab (see [Figure 3-2](#)). The **HOST RF** display will open within the main window.

23. Enter the **Host Rev Att** (Reverse Attenuation) values. This sets the reverse output RF signal levels at the two host unit RF OUT ports (806–824 REVERSE and 896–901 REVERSE). By default each value is set to 31 dB. Refer to [Section 2.8](#) for details.
 24. If a delay adjustment is required, enter the **Host Fwd Delay** and **Host Rev Delay** values. By default, the delay values are set to 0. Refer to [Section 2.9](#) for details.
 25. If a separate laptop computer loaded with the EMS software was used to initially configure the system, disconnect the laptop computer from the SERVICE connector.
- **Note:** When two or more HU's are connected together through the CAN interface, only one EMS computer is required to manage the networked Digivance systems. The EMS computer may be connected to the SERVICE port on any one of the HUs in the network.
26. Reconnect the external alarm system or notify the alarm system provider that the turn-up process has been completed.

2.2 Check/Download HU and RU Control Program and FPGA Program Software

The HU's and RU's may require a Control program or FPGA program software download if they are not loaded with the current software. Use the following procedure to check the Control or FPGA program software and if necessary, to download the current software:

1. Click on the **HOST Prg Load** tab and on the **REMOTE Prg Load** tab. The **HOST Prg Load** display and the **REMOTE Prg Load** display will open within the EMS main window as shown in [Figure 3-3](#).

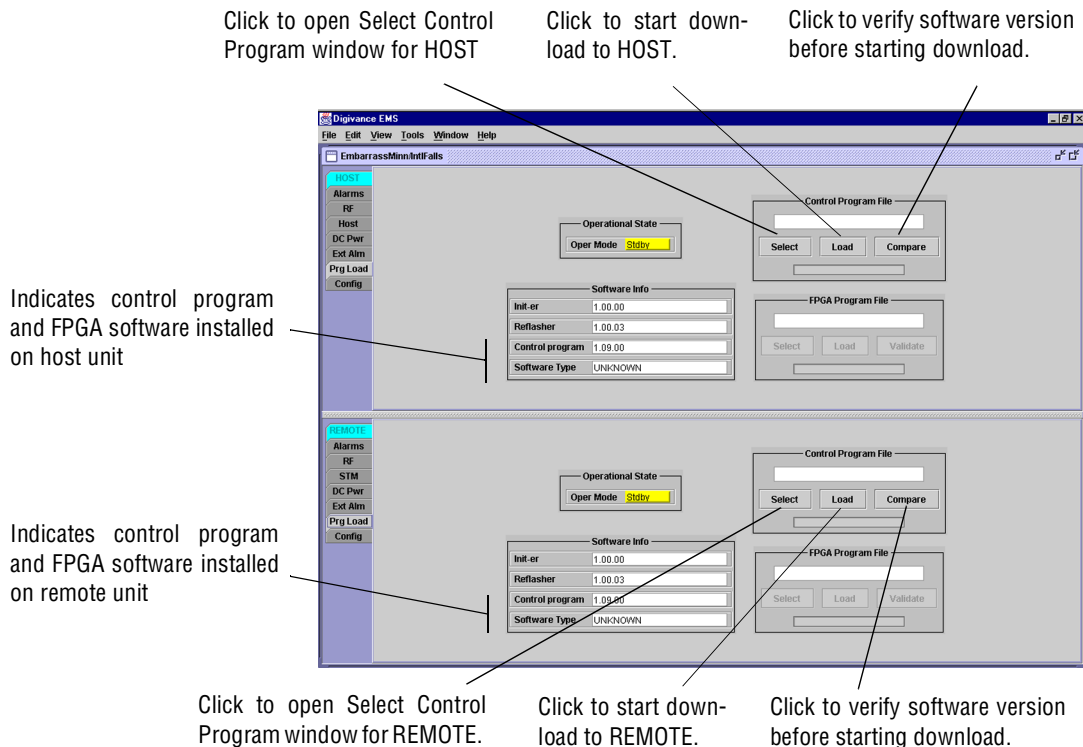


Figure 3-3. HOST and REMOTE Prg Load Displays - Control Program Download

2. Within the HOST display, locate the **Control Program File** field.
3. Click on the **Select** button (see Figure 3-3). The **Select Control Program File** window will open as shown in Figure 3-4. Browse until the folder where the Control Program files are located is selected and the software files are displayed in the window. Select the first Control program file and then click on the **OK** button.

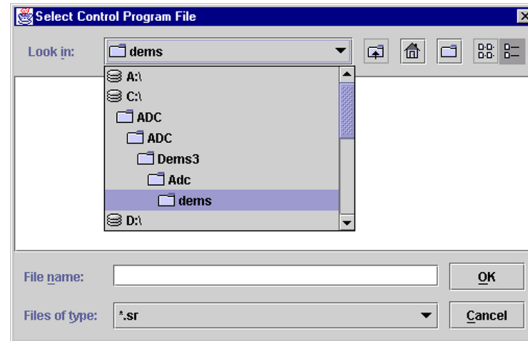


Figure 3-4. Select Control Program File Window

4. Click on the **Compare** button to determine if the software file selected is the same version of the file already loaded on the unit. A message will appear to indicate the result.
5. If the software file is the same, a software download is not required. If the file selected is different, check the version number shown in the **Software Info** field against the number of the file displayed in the **Control Program File** field. If the file in the unit is **older** (lower number) than the file selected, proceed with the software download. If the file in the unit is the same as the file selected, the software download is not required.
6. To start the Control program download (if necessary), click on the **Load** button (see Figure 3-3). When downloading is complete, verify that the program has loaded correctly.
7. Check the **FPGA Program** field. If the program shown is UNKNOWN, the unit has older hardware and the FPGA program is non-replaceable. If a version number is shown, locate the **FPGA Program File** field. Click on the **Validate** button to verify that the FPGA is functional (working). A message will appear to indicate if the FPGA is functional or not.
8. If the FPGA is functional, click on the **Select** button. The **Select FPGA Program File** window will open. Browse until the folder where the FPGA Program file is located and the file is displayed in the window. Select the FPGA file and click on the **OK** button.
9. Check the version number shown in **FPGA Program** field against the version number of the file displayed in the **FPGA Program File** field. If the software in the unit is older (has a lower version number) than the file selected, proceed with the download. If the software in the unit is the same as the file selected, the software download is not required.
10. To start the FPGA program download, click on the **Load** button. When downloading is complete, verify that the program has loaded correctly.
11. Within the REMOTE display, locate the **Control Program File** field. Then repeat steps 3 through 10 to download the Control and FPGA program files to the REMOTE unit.

2.3 Determine Forward Path Input Signal Level

The level of the composite RF input signals received at the host unit 851–869 FORWARD RF IN and 935–940 FORWARD RF IN ports will vary depending on the EBTS, the cable loss, the number of channels present, and the required forward path composite power. If maximum composite RF output is required at the RU, the level of the composite RF input signal received at the HU must fall within a range of **–12 to –43 dBm**. If the signal level is not within this range, it must be adjusted using an external attenuator.

When connecting a single HU to a single EBTS, use the following procedure to measure and adjust the input RF signal level at the HU:

1. Connect a spectrum analyzer or power meter to the 851–869 MHz forward path output port at the EBTS. The required signal levels and test points are shown in [Figure 3-5](#).

► **Note:** Check the input rating of the test equipment and the output rating of the EBTS. To avoid burning out the spectrum analyzer or power meter, it may be necessary to insert a 30 dB 100W (or similar) attenuator between the EBTS and test equipment.

2. If using a spectrum analyzer, proceed to step 3. If using a power meter, measure the composite signal power from the EBTS and then proceed to step 5.
3. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer is 30 kHz. Maximum power in any channel should not exceed 5W (+37 dB).
4. Calculate the total composite signal power from the EBTS using the following formula:

$$P_{\text{tot}} = P_c + 10\text{Log } N \text{ where,}$$

P_{tot} is the total composite power in dBm

P_c is the power per carrier in dBm as measured in step 3, and

N is the total number of channels.

5. Determine the total cable loss that is imposed by the forward path coaxial cable that links the EBTS to the HU and also any insertion loss imposed by splitters or combiners.
6. Subtract the total cable loss and any insertion losses from the total composite power calculated in step 4.
7. Subtract –25 (midpoint of the required range) from the value determined in step 6. The difference (which should be positive) equals the value of the external attenuator that is required to reduce the forward path signal level to fall within the required range. The following formula outlines the required calculations for steps 6 and 7:

$$P_{\text{tot}} - (\text{Cable and insertion loss}) - (-25) = \text{Value of external attenuator required}$$

► **Note:** If the input signal level is already within the required range of –12 to –43 dBm, then no external attenuator is required.

8. Select an attenuator that is as close to the value calculated in step 7 as possible. Select a value that will adjust the signal level of the composite input signal to fall within the specified range.

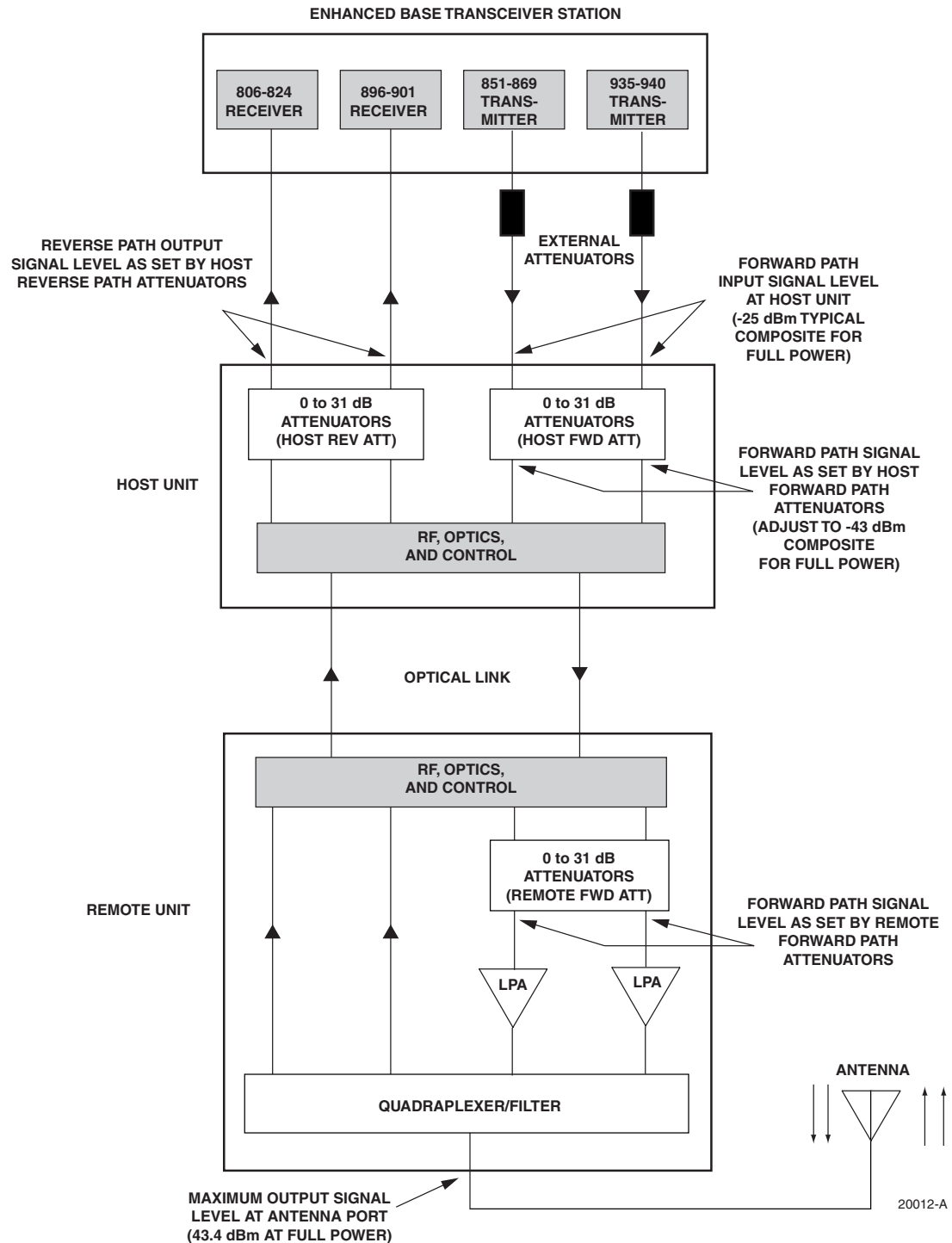


Figure 3-5. Signal Levels, Test Points, and Adjustments

9. Install the external attenuator in the coaxial cable that is connected to the 851–869 FORWARD RF IN port at the HU.



Caution: *The Host Unit can be damaged if it is overdriven by the EBTS. Always install an **external protective attenuator** at the Host Unit FWD RF IN port if the forward path composite input signal level is greater than -12 dBm.*

10. Repeat steps 1–8 for the 935–940 forward path output port at the EBTS. Install the external attenuator in the coaxial cable that is connected to the 935–940 FORWARD RF IN port at the HU.
11. Subtract the value of the external attenuators from the total composite signal power (P_{tot}) and record the result. This value will be required when setting the attenuation of the HU's internal forward path attenuators.

2.4 Enter Site Name and Site Number

All HU's and RU's are programmed with the same site name and site number. It is therefore necessary to assign a unique site name and site number to the HU and RU before they can be connected to the same CAN network. Use the following procedure to assign a unique site name and number to each HU and RU system:

1. Click on the HOST **Config** tab and on the REMOTE **Config** tab. The HOST **Config** display and the REMOTE **Config** display will open within the EMS main window as shown in [Figure 3-6](#).

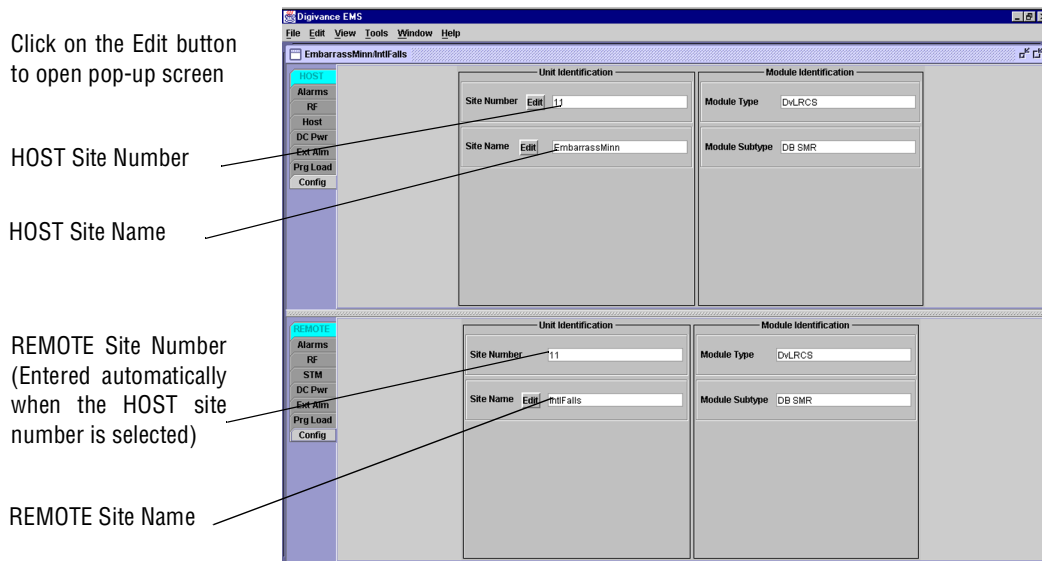


Figure 3-6. HOST and REMOTE Config Displays