8 CONTROLLER AREA NETWORK CONNECTIONS

Controller area Network (CAN) interface connections between multiple HU's are supported by a pair of RJ-45 jacks. One of the jacks is designated as the NET IN port and the other jack is designated as the NET OUT port. The CAN interface allows up to 15 HU's to be connected together (in daisy-chain fashion) and controlled through a single Digivance EMS computer. A one meter long cable is provided with each HU for CAN connections. Use the following procedure to connect CAN interface cables between multiple HU's:

1. Connect one end of the CAN interface cable (provided with the HU) to either the NET IN or NET OUT port on HU #1 as shown in Figure 3-11.
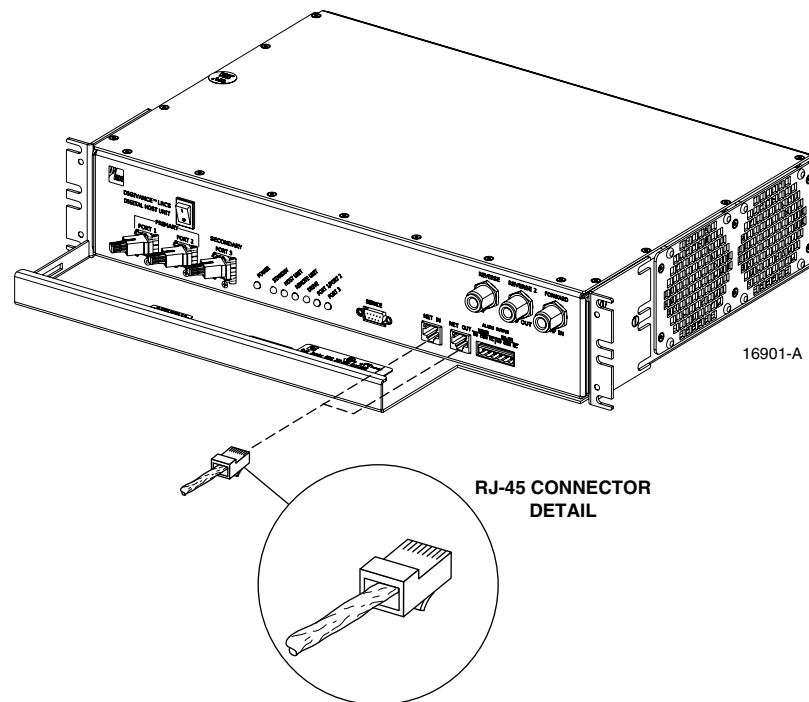

16901-A

RJ-45 CONNECTOR
DETAIL

Figure 3-11. Controller Area Network Connections

2. Route the CAN interface cable to HU #2 and connect the cable's free end to the port that is the **logical opposite** of the network port the cable was connected to at HU #1.

▶ **Note:** If connected to a NET OUT port at HU #1, connect to the NET IN port at HU #2. If connected to a NET IN port at HU #1, connect to a Net OUT port at HU #2.

3. If a third HU will be connected to the network, connect a second CAN interface cable to the remaining network port on HU #2.

4. Route the second CAN interface cable to HU #3 and connect the cable's free end to the port that is the logical opposite of the port that the cable is connected to at HU #2.

5. Repeat steps 3 and 4 for each additional HU that is added to the network up to a total of 15 HU's. A diagram of typical CAN interface connections is shown in Figure 3-12.
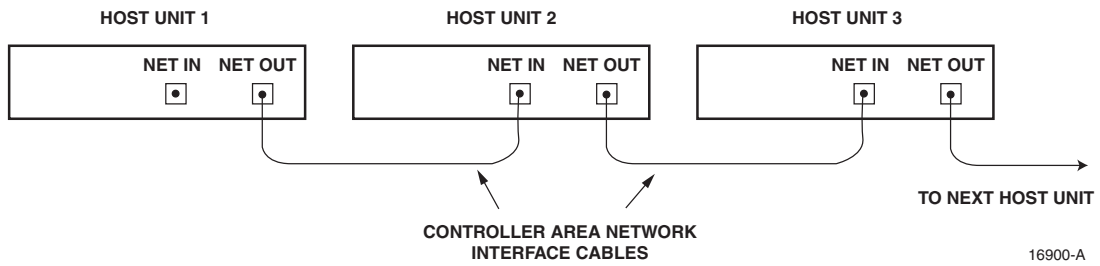
Figure 3-12. Configuring CAN Connections with Multiple Host Units

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. A three meter long straight-through RS-232 interface cable is provided with the HU for connecting the EMS computer to the HU. Use the following procedure to install the service interface cable:

1. Connect one end of the service interface cable (provided with HU) to the SERVICE port as shown in Figure 3-13.

2. Route the service interface cable to the EMS computer and connect the free end of the cable to the computer's RS-232 DCE port. Refer to the user manual provided with the computer to locate the required port.
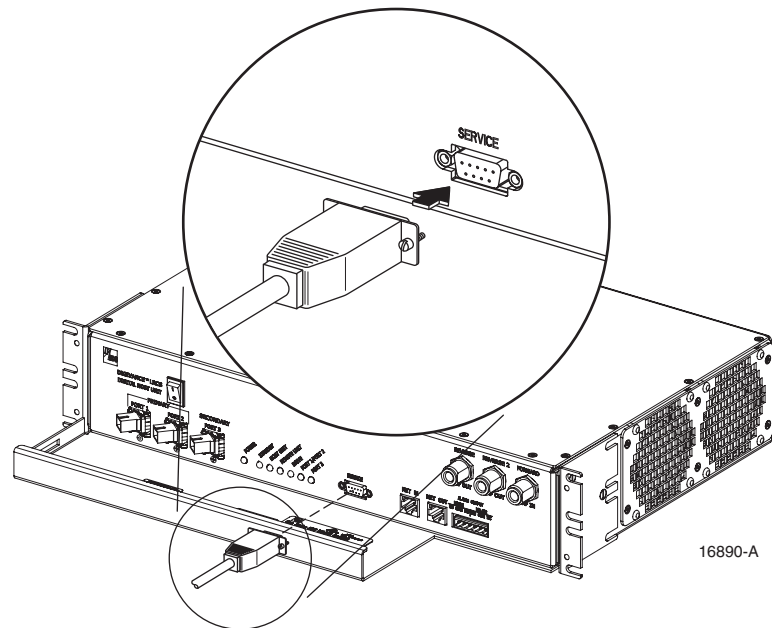

Figure 3-13. Service Interface Connection

10 EXTERNAL ALARM SYSTEM CONNECTIONS

The alarm interface between the HU and an external alarm system is supported by a six-terminal plug (with screw-type terminals) that connects to a receptacle mounted on the HU front panel. The terminal plug provides connections to normally open (NO) and normally closed (NC) dry type alarm contacts for both major and minor alarms. A category 3 or 5 cable is typically used to connect the HU to the external alarm system. Use the following procedure to install the alarm wiring and connect it to the HU:

1. Obtain the required length of category 3 or 5 cable.

2. Route the cable between the HU and the external alarm system (if not already routed) and then cut to the required length. Allow sufficient slack for dressing and organizing the cable at the HU.

3. Strip back the outer cable sheath and insulation to expose the wires at both ends of the cable and strip back 0.2 inches (5 mm) of insulation from each wire.

4. Connect the Major alarm wire pair to the MAJOR COM/NC or MAJOR COM/NO terminals (whichever is required by the external alarm system) on the HU alarm terminal connector (supplied with HU) as shown in Figure 3-14.
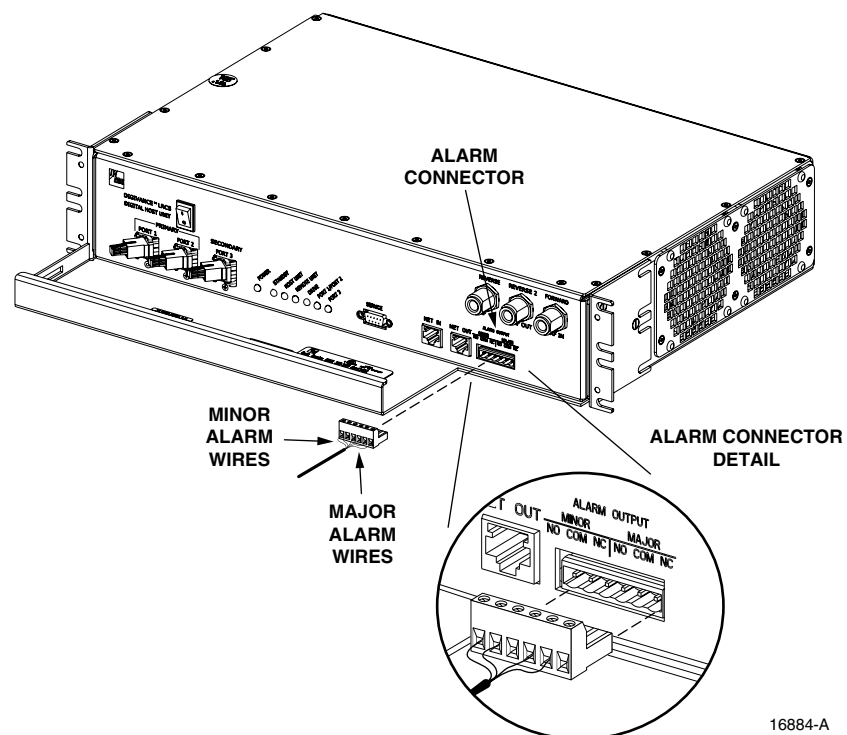
Figure 3-14. External Alarm System Connections

5. Connect the Minor alarm wire pair to the MINOR COM/NC or MINOR COM/NO terminals (whichever is required by the external alarm system) on the HU alarm terminal connector (see Figure 3-14).

6. Connect the Major and Minor alarm wire pairs to the appropriate terminals on the external alarm system.

7. Dress and secure cable per standard industry practice.

11 DC POWER CONNECTIONS

The HU is powered by ± 24 or ± 48 Vdc power. The power is fed to the HU through a screw-down type terminal strip located on the rear side of the unit. Power to the HU must be supplied through a fuse panel such as the 20 position PowerWorx fuse panel (available separately) and the power must be protected with a 3 Amp GMT fuse. Use the following procedure to install the power wiring:

1. Obtain one pair of #18 AWG (1.00 mm) red and black insulated copper wire for use as the power wiring.

2. Terminate one end of each wire with a fork terminal as shown in Figure 3-15.

3. Connect the power wires to the power terminal strip at the rear of the HU.
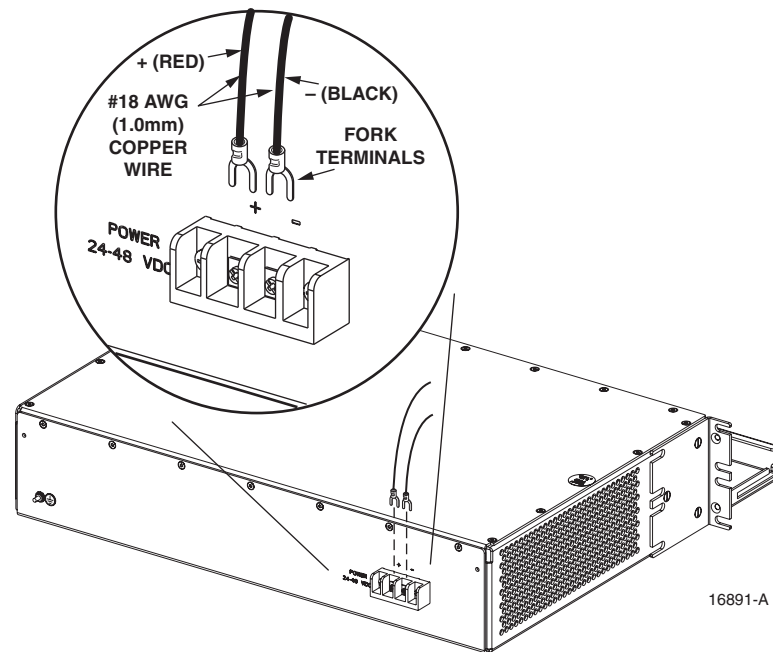

Figure 3-15. DC Power Connections

4. Route the free ends of the wires to the fuse panel and locate the terminals that will be used for the power feed. Refer to the user manual provided with the fuse panel for specific information.

5. Remove the fuse from the circuit that will power the HU.

6. Connect the power wires to the appropriate terminals as specified in the fuse panel user manual.

7. Dress and secure the power wiring at the fuse panel and the HU. The procedure for checking the voltage level and verifying that the HU is ready to power up is provided in SECTION 4: OPERATION.

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SECTION 4: OPERATION

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1   BEFORE STARTING OPERATION

This section provides guidelines for turning-up the Digivance LRCS, 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) software installed

- Straight-through RS-232 DB-9 interface cable (ADC part # 1192835)

- Handset

- Pencil or pen

- Writing pad

1.2 Readiness Check

Before starting the turn-up process, inspect the complete LRCS 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**).

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 ± 24 or ± 48 Vdc (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/OF 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

Use the following procedure to turn-up the system:

1. Temporarily disconnect the external alarm system or notify the alarm system provider that testing is in progress.

2. If turning-up multiple HU and RU systems that have not been configured for operation before, temporarily disconnect the CAN cables from the NET IN and NET OUT ports of each 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 Digivance EMS if multiple HU's with the same site number and site name are networked together through the CAN interface. It is therefore advisable to temporarily disconnect the CAN interface cables from the HU until a unique site number and name can be entered for each HU and its corresponding RU.

3. Determine if the forward path input signal level at the Host Unit FORWARD RF IN port is between –20 and –40 dBm and adjust level if required. 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 the EMS software can be temporarily connected and used to initially configure the system.

5. Place the ON/OFF switch on the HU in the **ON** position (press **I**).

6. 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 5 for the troubleshooting procedures if the indicators do not respond as specified.

HOST UNIT	SPECTRUM TRANSPORT MODULE	LINEAR POWER AMPLIFIER
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 – Green, Yellow, or Red	PA – Green	
PORT 1/PORT 2 – Green	VSWR – Green	
PORT 3 – Green (diversity unit only)	PORT 1/PORT 2 – Green	
	PORT 3 – Green (diversity unit only)	

8. Start up the Digivance EMS software program. The EMS main window will open as shown in Figure 4-1. Note: The EMS software should be installed on a PC-type computer and the PC's COM port should be configured to interface with the HU. For information about installing the EMS software and configuring the PC's COM port, refer to the Digivance Element Management System Software User Manual (ADCP-75-118).

Click to view drop down menu
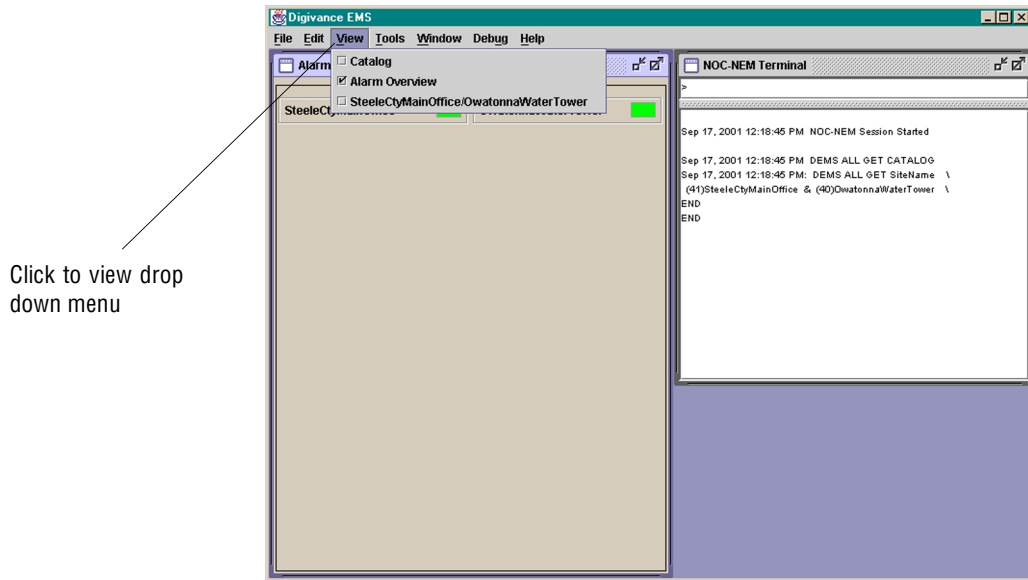
Figure 4-1. Digivance Element Management System Main Window

9. Open the **View** drop down menu and connect to the Host and Remote pair by selecting "NotNamed/NotNamed". The HOST **Alarms** display and the REMOTE **Alarms** display will open within the main window as shown in Figure 4-2.

10. Download the system software to both the Host and the Remote unit. Refer to Section 2.2 for details.

Host/Remote pair site name

Clicking on the tabs in this list will open the corresponding display.

Figure 4-2. Selecting Display Tabs

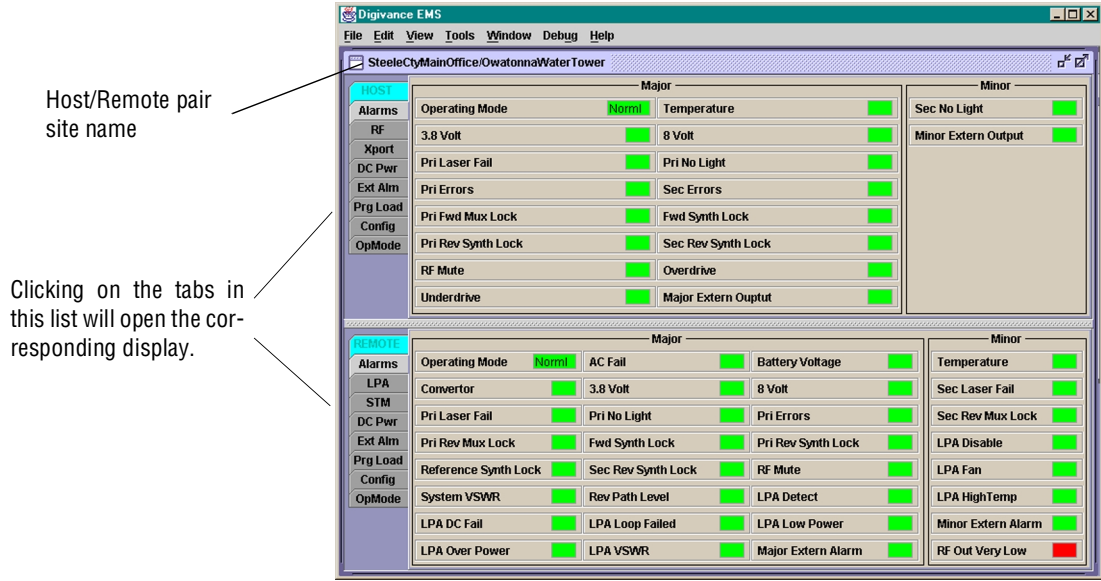11. Click on the HOST **Config** tab and on the REMOTE **Config** tab (see Figure 4-2). The HOST **Config** display and the REMOTE **Config** display will open within the main window.

12. Enter the **Site Number** and **Site Name** for both the HOST and the REMOTE unit. Refer to Section 2.4 for details.

13. Reconnect the CAN cables to the HU's NET IN and NET OUT ports.

14. Verify that no Major (except Major Extern Alarm) or Minor alarms are being reported in either the HOST or REMOTE **Alarm** displays and that all alarm fields (except Major Extern Alarm) are green.

15. Click on the HOST **RF** tab (see Figure 4-2). The HOST **RF** display will open within the main window.

16. Enter the **Host Fwd Att** (Forward Attenuation) values. 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 0 dB. If the DRIVE LED on the HU front panel was red, it should turn green when this step is completed.

17. Determine if the RF output power at each DDS ANTENNA port is at the correct level per channel up to a maximum of 12 watts. Refer to Section 2.6 for details.

18. Click on the REMOTE **LPA** tab (see Figure 4-2). The REMOTE **PA** display will open within the main window.

19. Enter the **Remote Fwd Att** value. This adjusts the RF output signal level at the STM ANTENNA port. Refer to Section 2.7 for details. By default this value is set to 0 dB.

20. Place the RF ON/OFF switch (on LPA front panel) in the **ON** position.

21. Verify that the SHUTDOWN LED indicator (on LPA front panel) turns from red to off and the Digital Display message changes from FORCED SHUTDOWN to NORMAL OPERATION.

22. Click on the HOST **RF** tab (see Figure 4-2). The HOST **RF** display will open within the main window.

23. Enter the **Host Rev Att** (Reverse Attenuation), and **Host Div Rev Att** (Diversity Reverse Attenuation) values. This sets the reverse output RF signal levels at the HU. Refer to Section 2.8 for details.

24. If a delay adjustment is required per the system design plan, enter the **Host Fwd Delay**, **Host Rev Delay**, and **Host Div 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 on the HU front panel.

▶ **Note:** Each HU and RU pair will generally remain permanently connected to a PC-type desktop computer loaded with the EMS software. When two or more systems are connected together through the CAN interface, only one EMS computer is required to manage the networked HU and RU systems. The EMS computer may be connected to the SERVICE power 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 Download HU and RU System Software

The HU's and RU's may require a system software download to make them operational. Use the following procedure to download the system 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 4-3.

Click to start download to HOST.

Click to open Select Control Program window for HOST

Click to start download to REMOTE.

Click to open Select Control Program window for REMOTE.

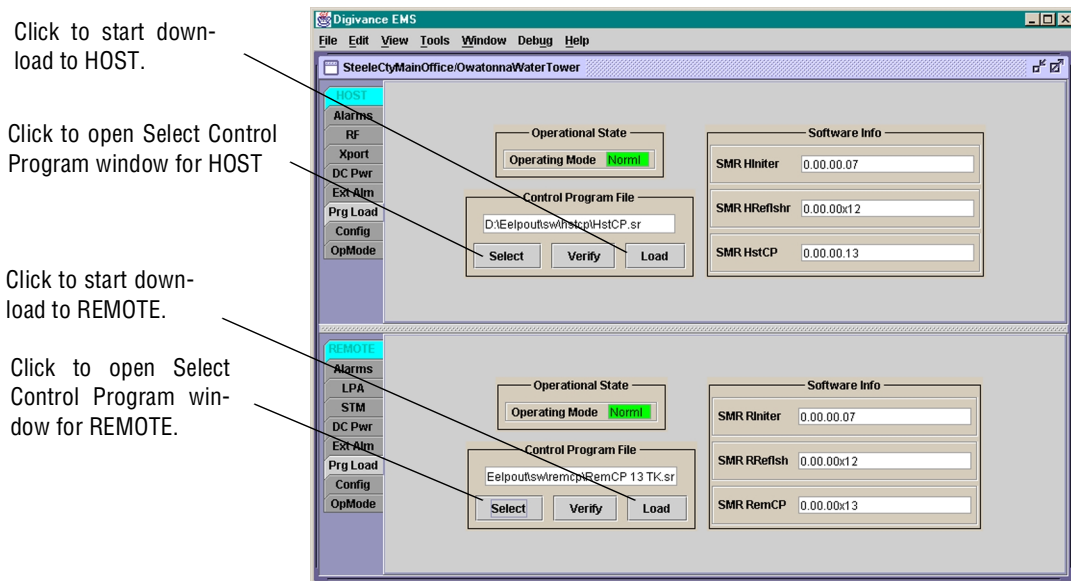**Figure 4-3. HOST and REMOTE Prg Load Displays**

2. Click on the HOST **Select** button (see Figure 4-3). The **Select Control Program File** window will open as shown in Figure 4-4. Browse until the folder where the Control Program files are located is selected and the software files are displayed in the window.
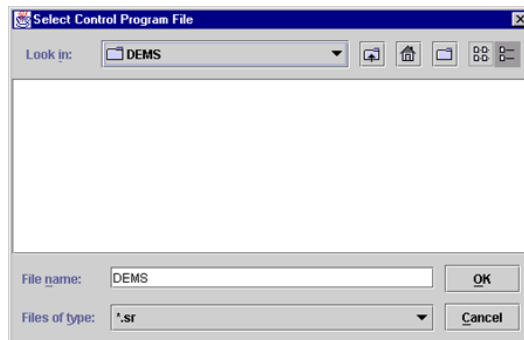

Figure 4-4. Select Control Program File Window

3. Select the required file to download and click on the **OK** button.

4. Click on the HOST **Load** button (see Figure 4-3) to start the download.

5. Repeat steps 2 through 4 for the REMOTE.

2.3 Determine Baseline Forward Path Input Signal Level

The level of the composite RF output signal at the FORWARD RF IN port at the HU will vary depending on the type of BTS, the cable loss, and the number of channels present. To interface with the HU, the signal level of the composite forward path RF signal must be adjusted to fall within a range of **–20 to –40 dBm**. If the signal level is not within this range, it must be adjusted to fall within this level through the use of an external attenuator. 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 forward path output port at the EBTS. The required signal levels and test points are shown in Figure 4-5.

2. Measure the RF level of a single carrier, such as the control channel, in dBm. Make sure the resolution bandwidth of the spectrum analyzer or power meter is narrow enough to measure the power of the single 30 kHz channel only.

3. Verify that all carriers are coming in at equal power at bandwidth and adjust to the same level if necessary.

4. Calculate the total composite signal power from the EBTS using the following formula:

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

   Where,

   P_{tot} is the total composite power in dBm

   P_c is the power per carrier in dBm as measured in step 2, 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 –30 (the 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_{tot} – (Cable and insertion loss) – (–30) = Value of external attenuator required

◆ **Note:** If the input signal level is already within the required range of –20 to –40 dBm, then no external attenuator is required.

**EXTENDED BASE
TRANSCEIVER STATION**

DIVERSITY
RECEIVER

TRANS-
MITTER

PRIMARY
RECEIVER

**EXTERNAL
ATTENUATOR**

**INPUT SIGNAL LEVEL
(-20 to -40 dBm
COMPOSITE)**

ADJUSTMENTS TO OUTPUT
SIGNAL LEVEL AS SET BY HOST
DIVERSITY PATH ATTENUATOR

0 to 20 dB
ATTENUATOR
(HOST DIV ATT)

0 to 20 dB
ATTENUATOR
(HOST FWD ATT)

0 to 20 dB
ATTENUATOR
(HOST REV ATT)

ADJUSTMENTS TO OUTPUT
SIGNAL LEVEL AS SET BY HOST
REVERSE PATH ATTENUATOR

HOST UNIT

RF, OPTICS,
AND CONTROL

ADJUSTMENTS TO INPUT
SIGNAL LEVEL AS SET BY HOST
FORWARD PATH ATTENUATOR

OPTICAL LINK

RF, OPTICS,
AND CONTROL

0 to 20 dB
ATTENUATOR
(REMOTE FWD ATT)

REMOTE UNIT

LPA

ADJUSTMENTS TO
OUTPUT SIGNAL LEVEL
AS SET BY THE REMOTE
FORWARD ATTENUATOR

ANTENNA 2

ANTENNA 1

DUAL DUPLEXER/SPLITTER
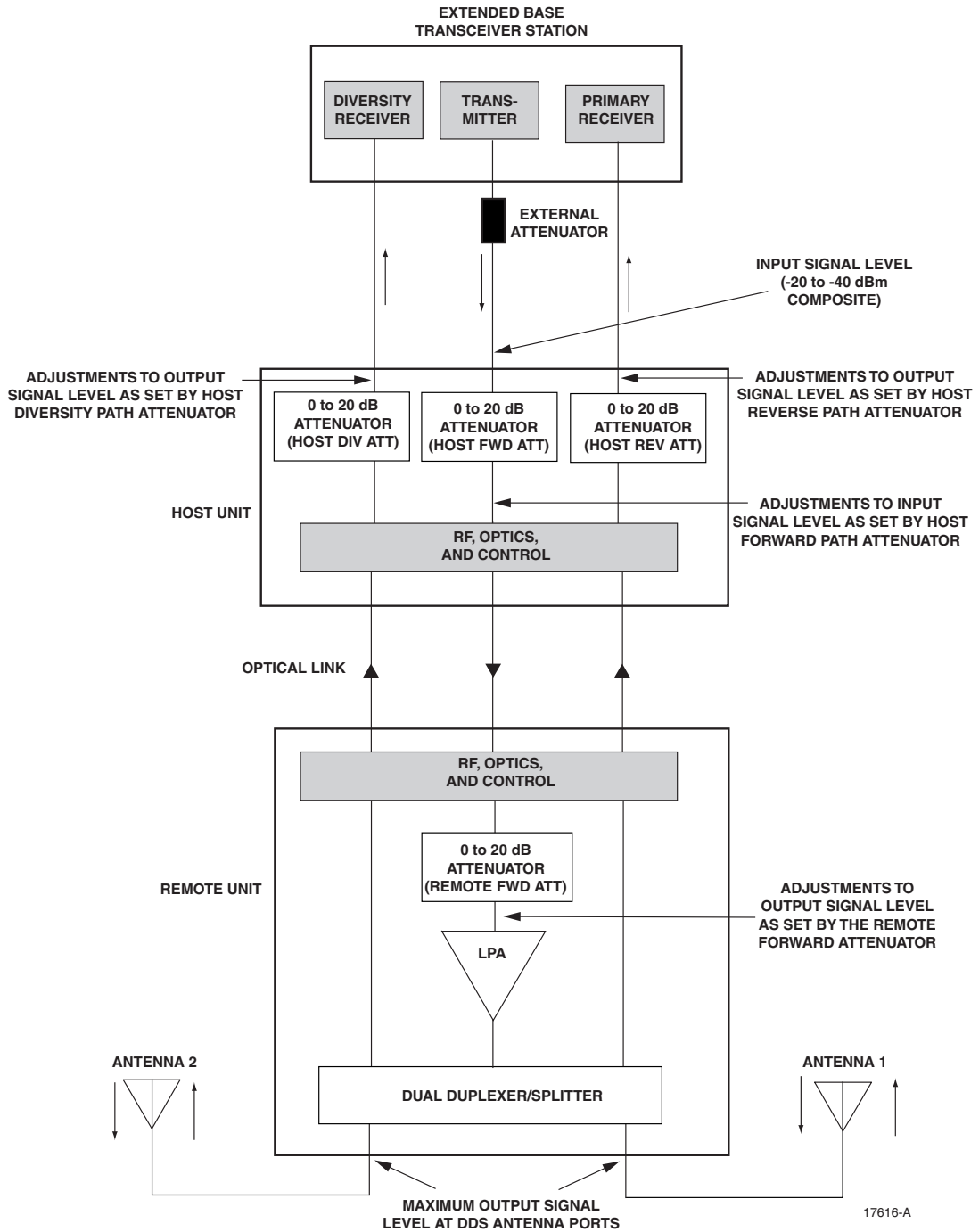
**MAXIMUM OUTPUT SIGNAL
LEVEL AT DDS ANTENNA PORTS**

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Figure 4-5. Signal Levels, Test Points, and Adjustments