5. Insert the optical transceiver into the socket until it locks into place.
6. Replace the optical transceiver dust cap if it was removed for installation.
7. Repeat procedure for each optical transceiver that requires installation.
8. Install a port cover (see Figure 18) over each unused optical transceiver socket.

4.8 Ports 1–6 Optical Connections

The optical interface between the DHU and each DEU or DRU is supported by six optical ports. Each of the six optical ports provides a duplex LC-type optical transceiver which is mounted on the DHU front panel. One side of the transceiver provides the optical fiber connection for the forward path (downlink) signal. The other side of the transceiver provides the optical fiber connection for the reverse path (uplink) signal. Use the following procedure to install the forward and reverse path optical fibers and to connect them to the DHU:

⚠ **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 transceiver or connector.*

1. Obtain the required lengths of single- or multi-mode fiber optic cable.
2. Route the fiber optic cable between the DHU and the DEU or DRU (if not already routed) and cut to required length. Allow sufficient slack for dressing and organizing the cables at each unit. Maintain a minimum bend radius of 2 inches (50 mm).

➧ **Note**: The maximum path lengths for the optical fibers are as follows: 500 meters (1,641 feet) for 62.5 micron core multi-mode fiber, 750 meters (2,461 feet) for 50 micron core multi-mode fiber, and 10 km (32,808 ft) for 9 micron core single-mode fiber.

3. Terminate each optical fiber with a field-installable LC type fiber optic connector as shown in Figure 19. Follow the instructions provided by the connector manufacturer for installing the connector.
4. Test each fiber for optical loss as described in Subsection 6.4.2 of this manual.
5. Designate one of the fibers as the **forward path** fiber and the other as the **reverse path** fiber and label both ends of each fiber with the path designation.
6. Use the plastic joiner provided with the LC connectors to join the DHU Port 1 forward and reverse path connectors together (see Figure 19). Make sure the **forward path** and **reverse path** connectors are oriented as shown.

➧ **Note**: When viewing any **Port 1-6** optical transceiver from the front, the forward path port is on the left and the reverse path port is on the right as shown in Figure 20. In addition, single-mode transceivers are colored blue and multi-mode transceivers are colored black or beige. Both single- and multi-mode transceivers may be mounted on the same DHU.

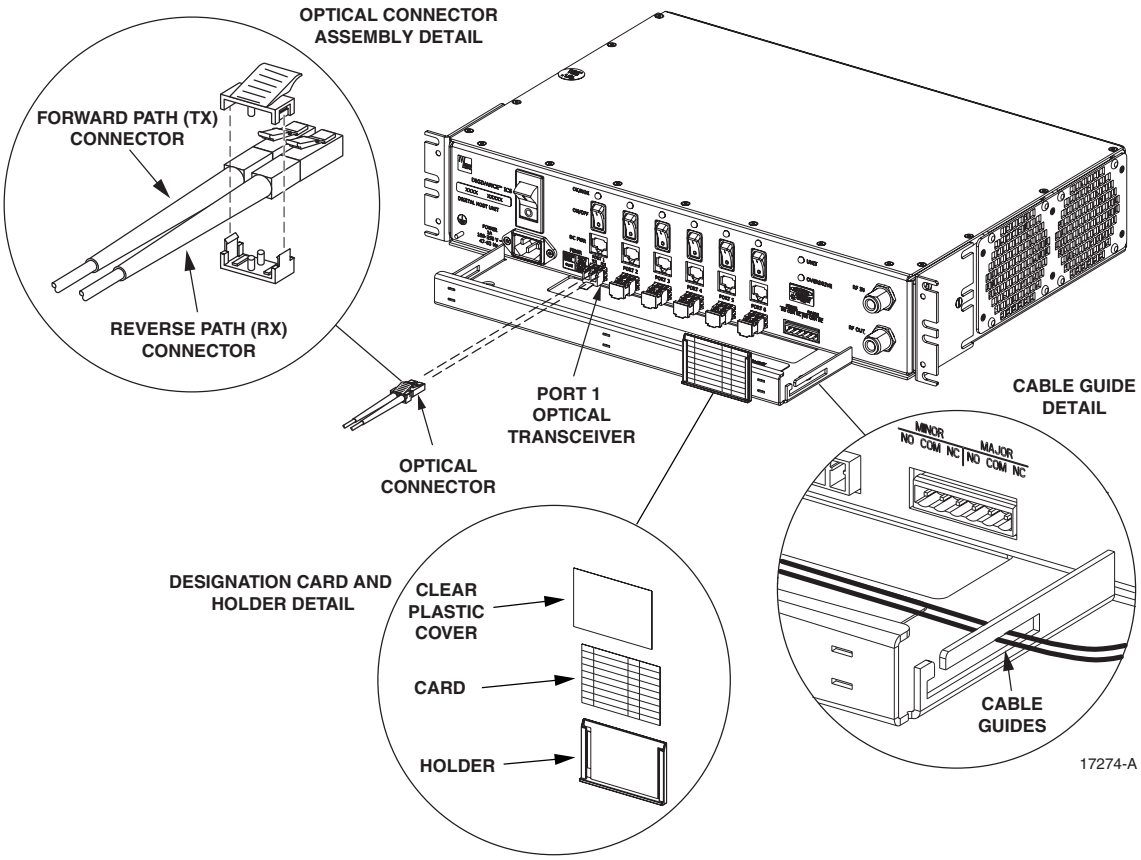


Figure 19. Ports 1–6 Fiber Optic Cable Connections

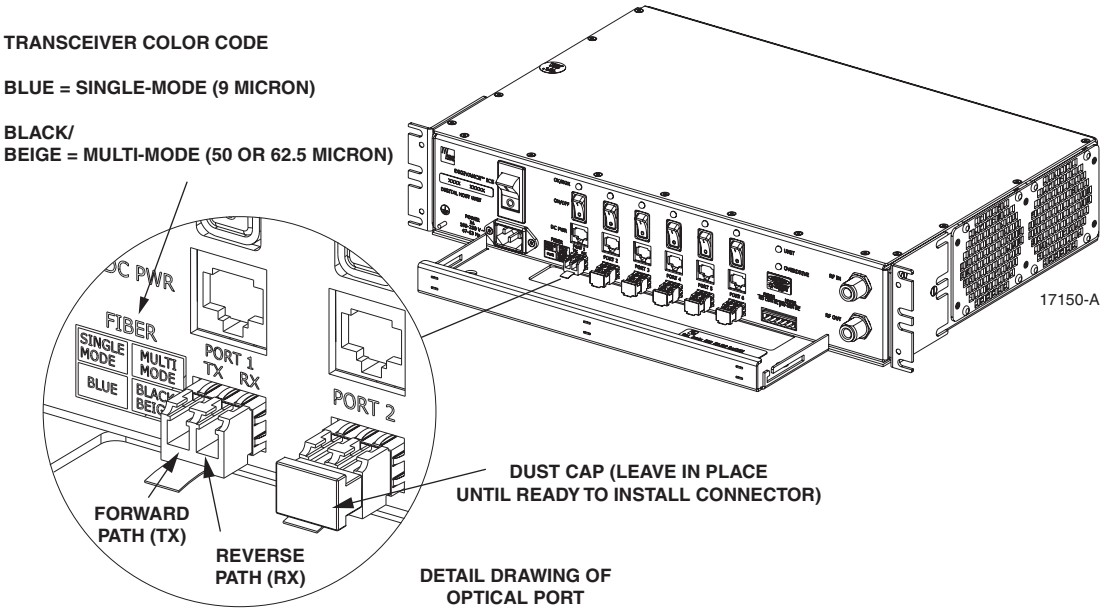


Figure 20. Optical Transceiver Designations

7. Remove the dust caps from the optical fiber connectors and the port 1 optical transceiver.

Note: Leave the dust cap in place on any unused optical transceiver.

8. Clean each connector (follow connector supplier's recommendations) and then insert the optical fiber connector pair into DHU optical port 1 (see Figure 19).
9. Place the optical fibers within the cable guides provided on the cable management tray (see Figure 19) and then dress and secure the fibers at the DHU per standard industry practice.
10. Connect the forward and reverse path optical fibers to the DEU or the DRU as specified in the instructions provided with that unit.
11. Use the designation card provided (see Figure 19) to indicate the location and name of the DRU or DEU that is connected to each optical fiber pair. The designation card holder may be attached to any convenient flat surface such as the DHU cable management tray
12. Repeat steps 1–11 for each remaining optical port.

4.9 DC Power Connections

The DC power interface between the DHU and each DRU is supported by six RJ-45 female connectors. Each DHU RJ-45 connector provides nominal 48 Vdc power for the associated DRU except when the DRU is powered with an ac/dc converter. A category 3 or 5 twisted pair cable is used to feed the power from the DHU to the DRU. Use the following procedure to install the DC power cable and to connect it to the DHU.

1. Obtain the required length of category 3 or 5 twisted pair cable.
2. Route the cable between the DHU and the DRU (unless already routed) and then cut to required length. Allow sufficient slack for dressing and organizing the cable at the DHU.

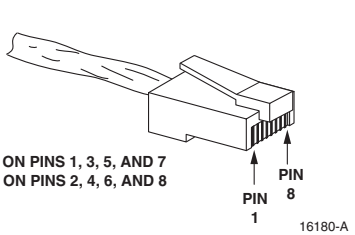
Note: The maximum distance for routing power cable is 500 meters (1,641 feet).

3. Terminate each end of the cable with a male RJ-45 connector. Match the wire color to the connector pin as specified in Table 6.

Caution: *The DRU will be damaged if the RJ-45 connector is wired incorrectly.*

4. Perform a continuity test to verify that each wire is properly connected to the terminating RJ-45 connector and check the connector for correct polarity (see diagram in Table 6).

Table 6. RJ-45 Connector Pin Designations

PIN NUMBER	WIRE COLOR	CONNECTOR PINS
1	White/Green	
2	Green	
3	White/Orange	
4	Orange	
5	White/Blue	
6	Blue	
7	White/Brown	
8	Brown	

5. Connect the DC power cable to the DHU port 1 DC PWR jack as shown in Figure 21.
6. Place the DC power cable within the cable guides provided (see Figure 21) and then dress and secure the cable at the DHU per standard industry practice.

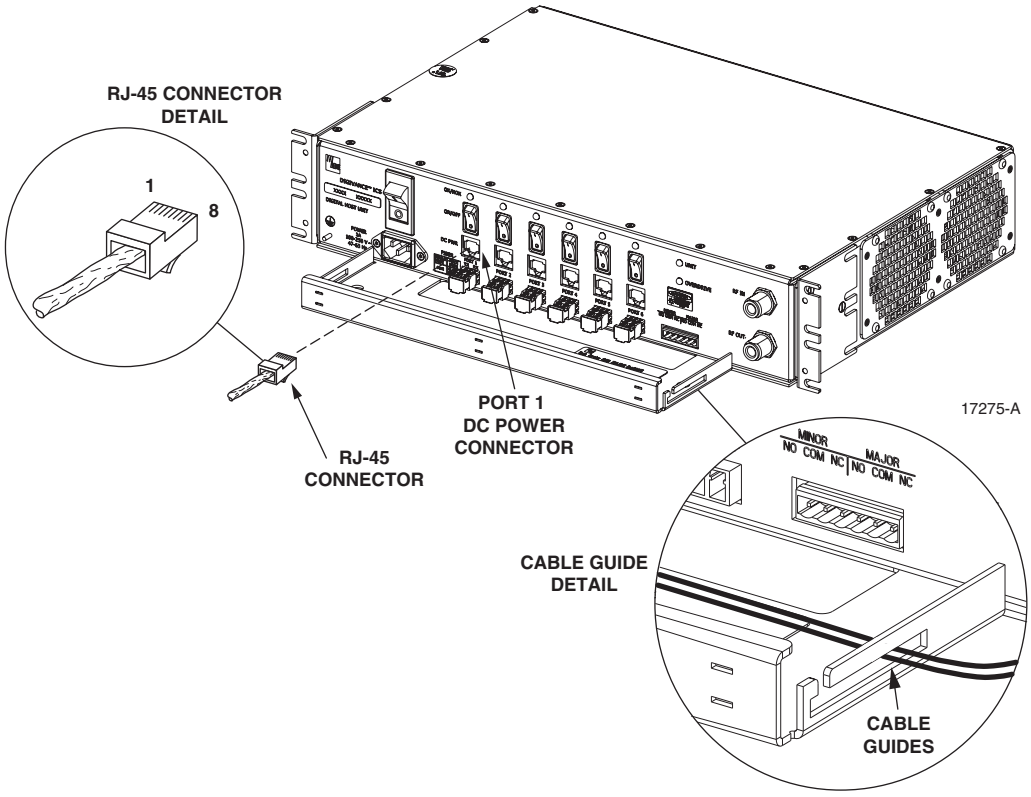


Figure 21. 48 Vdc Power Cable Connection

7. Connect the DC power cable to the DRU as specified in the instructions provided with that unit.
8. Repeat steps 1–7 for each remaining DRU that will be powered by the DHU.

4.10 External Alarm System Connections

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

1. Obtain the required length of category 3 or 5 cable.
2. Route the cable between the DHU and the external alarm system (if not already routed) and then cut to required length. Allow sufficient slack for dressing and organizing the cable at the DHU.

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 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 DHU alarm terminal connector (supplied with DHU) as shown in Figure 22.

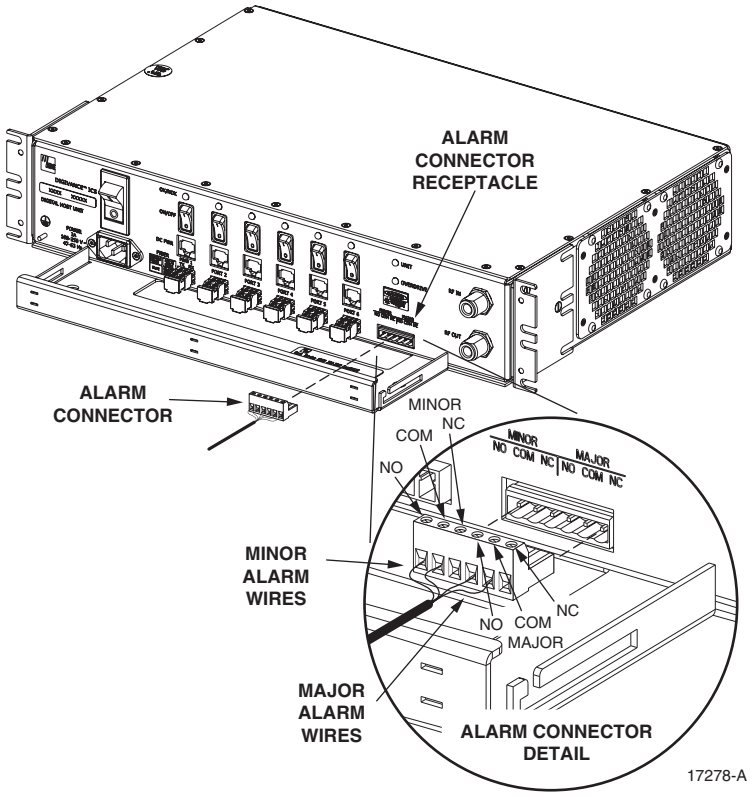


Figure 22. External Alarm System Connections

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 DHU alarm terminal connector as shown in Figure 22.
6. Insert the alarm terminal connector into the receptacle on the DHU front panel.
7. Connect the Major and Minor alarm wire pairs to the appropriate terminals on the external alarm system.
8. Dress and secure cable per standard industry practice.

4.11 AC Power Connections

The AC power interface between the DHU and the AC power source is supported by a 3-wire AC power cord connector located on the DHU front panel. The AC connector provides a connection point for the power cord which is provided separately with the DHU. Use the following procedure to install the AC power cord:

1. Locate the AC power cord which is provided separately with the DHU. Use only the AC power cord provided with the DHU or an equivalent UL/CUL listed 3-conductor, 18 AWG cord terminated in a molded-on plug cap rated 125 V, 15 A with a maximum length of 6 feet (1.8 m).

Note: The DHU is intended to be used with a 3-wire grounding type plug which has a grounding pin. Equipment grounding is required to ensure safe operation. Do not defeat the grounding means. Verify DHU is reliably grounded when installed.

2. Place the DHU AC power ON/OFF switch, shown in Figure 23, in the **OFF** position (press **O**).

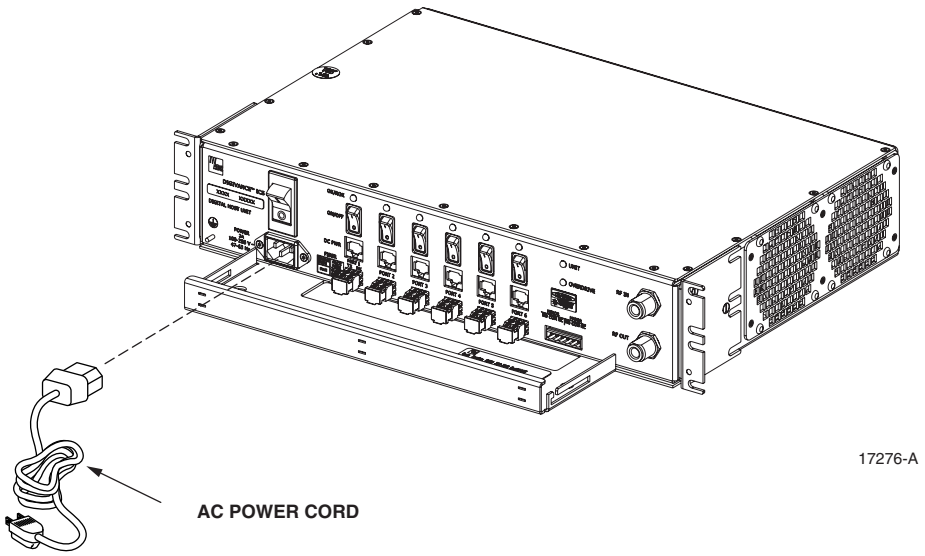


Figure 23. AC Power Connection

3. Connect the receptacle end of the power cord to the AC connector on the DHU.
4. Route the plug end of the power cord to the specified AC outlet (per the system design) and connect plug to outlet.

Warning: *The current rating of the DHU is **2.0 Amps at 120 Vac**. Avoid overloading circuits which may cause damage to over-current protection devices and supply wiring.*

5. Dress and secure cable per standard industry practice.
6. When all units of the Digivance ICS have been installed, refer to Section 4 of this manual for the system power up and test procedures.

4.12 Create As-Built Drawing

Following installation, create an “as-built” drawing of the complete Digivance ICS system. Using a drawing of the building floor plan, show the installed location of each piece of equipment including the various Digivance electronic units, the antennas, the interface units, and the microcell (if used). In addition, show the location and routing of all copper, coaxial, and fiber optic cable runs used with the system. Retain the as-built drawing for reference when troubleshooting or when planning for system expansion.

5 SYSTEM OPERATION

This section provides guidelines for turning-up the Digivance ICS, 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 that comprise the Digivance ICS have been installed in accordance with the system design plan and the BTS interface device has been installed and tested.

5.1 Tools and Materials

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

- Portable spectrum analyzer
- Portable test transmitter
- Cell phone
- Pencil or pen
- Writing pad

5.2 Turn-Up System and Verify Operation

The process of turning-up the system and verifying operation involves powering up the various system components and then verifying that the LED indicators show normal operation. Refer to Tables 7, 8, and 9 as needed for a complete description of the unit LED indicators. Use the following procedure to power-up the system. If any unit does not respond as described, refer to Subsection 5.3 for the correction procedures.

1. Temporarily disconnect the alarm system or notify alarm system provider that testing is in progress.
2. Verify that each AC powered unit is connected to the appropriate outlet.
3. Place the ON/OFF switch on the DHU in the **ON** position (press **I**).
4. Verify that the UNIT LED and the OVERDRIVE LED on the DHU turn yellow (for approximately 6 seconds) and then green.
5. Place the **PORT 1** ON/OFF switch on the DHU in the **ON** position (press **I)**.
6. If a DEU is connected to port 1, proceed to step 7. If a DRU is connected to port 1, skip steps 7 and 8 and proceed to step 9.
7. Place the ON/OFF switch on the DEU in the **ON** position (press **I**).
8. Verify that the UNIT LED on the DEU turns yellow (for approximately 6 seconds) and then green.
9. Verify that the PORT 1 OK/NOK LED on the DHU turns yellow (for approximately 6 seconds) and then green.
10. If a DEU is connected to PORT 1, proceed to step 11. If a DRU is connected to PORT 1, skip steps 11 through 13 and proceed to step 14.

11. Verify that the HOST PORT LED on the DEU turns green.
12. Place the **PORT 1** ON/OFF switch on the DEU in the **ON** position (press **I**).
13. Verify that the PORT 1 OK/NOK LED on the DEU turns yellow (for approximately six seconds) and then green.
14. Verify that the STATUS LED on the DRU connected to PORT 1 turns yellow (for approximately six seconds) and then green.
15. Repeat the procedure covered in steps 5 through 14 for each of the remaining DHU optical ports (ports 2 through 6) that is connected to a DEU or a DRU.
16. Reconnect the alarm system and notify alarm system provider that system is operational.

Table 7. Digital Host Unit LED Indicators

INDICATOR	COLOR	DESCRIPTION
UNIT LED		**Indicates when the DHU is normal or faulty.**
	Green	DHU in normal state, no faults detected.
	Yellow	DHU high temperature fault detected. (see Note)
	Red	DHU fault detected (see Note).
	Off	AC power off to DHU or DHU internal fault.
PORT 1–6 OK/NOK LEDs		**Indicates if any connected DEU or DRU is normal or faulty or if the optical inputs from any connected DEU or DRU are normal or lost.**
	Green	All connected units in normal state, no faults detected.
	Yellow	High temperature fault detected in connected DEU. (see Note)
	Red (steady)	Fault detected in a connected DEU or DRU. (see Note)
	Red (blinking)	No reverse path optical signal detected from a connected DEU or DRU or excessive reverse path errors detected from a connected DEU or DRU. (see Note)
	Off	Port disabled (via front panel switch) or DHU internal fault.
OVERDRIVE LED		**Indicates when the forward path RF input is below or above the overdrive threshold.**
	Green	RF input signal level at DHU below overdrive threshold.
	Red	RF input signal level at DHU above overdrive threshold.
Note: Detection of any fault will generate an alarm. A high temperature fault will generate a **minor** alarm (yellow LED). All other types of faults will generate a **major** alarm (red LED).		

Table 8. Digital Expansion Unit LED Indicators

INDICATOR	COLOR	DESCRIPTION
UNIT LED		**Indicates when the DEU is normal or faulty.**
	Green	DEU in normal state, no faults detected.
	Yellow	DEU high temperature fault detected. (see Note)
	Red	DEU internal fault detected. (see Note)
	Off	AC power off to DEU or DEU internal fault.
HOST PORT LED		**Indicates when the optical inputs from the DHU or supporting DEU are normal or lost.**
	Green	DHU or supporting DEU in normal state, no faults detected.
	Red (blinking)	No forward path optical signal detected from DHU or supporting DEU or excessive forward path errors detected from DHU or supporting DEU. (see Note).
	Off	DEU internal fault.
PORT 1–6 OK/NOK LEDs		**Indicates if any connected DEU or DRU is normal or faulty or if the optical inputs from any connected DEU or DRU are normal or lost.**
	Green	DRU or remote DEU in normal state, no faults detected.
	Yellow	High temperature fault detected in connected DEU. (see Note)
	Red (steady)	Fault detected in a connected DEU or DRU. (see Note)
	Red (blinking)	No reverse path optical signal detected from a connected DEU or DRU or excessive reverse path errors detected from a connected DEU or DRU.
	Off	Port disabled (via front panel switch) or DEU internal fault.
Note: Detection of any fault will generate an alarm. A high temperature fault will generate a **minor** alarm (yellow LED). All other types of faults will generate a **major** alarm (red LED).		

Table 9. Digital Remote Unit LED Indicator

INDICATOR	COLOR	DESCRIPTION
STATUS LED		**Indicates if the DRU is normal or faulty or if the forward path optical inputs to the DRU are normal or lost.**
	Green	DRU in normal state, no faults detected.
	Red (steady)	DRU internal fault detected. (See Note)
	Red (blinking)	No forward path optical signal from the DHU or DEU detected.
	Off	DC power off to DRU or DRU internal fault.
Note: Detection of any fault will generate an alarm. A high temperature fault will generate a **minor** alarm (yellow LED). All other types of faults will generate a **major** alarm (red LED).		

5.3 Test System Performance

Testing the performance of the system involves completing various RF tests and telephone service tests that verify if the system is functioning properly. Use the following procedure to test the system performance:

1. Verify that the forward path (downlink) input signal level at the DHU is optimized. The peak **COMPOSITE** forward path input signal level at the DHU should be set at **–20 dBm**.

Note: In a CDMA system, the power level is dependent on the traffic. For optimum operation in a CDMA system, the input signal level should be set below the level of the pilot signal.

2. Verify that the reverse path (uplink) signal level at the local BTS or donor antenna is optimized. Note that the reverse path output signal level required is dependent on service provider signal to noise requirements, ICS system noise floor, the service provider equipment, and the system configuration.
3. Check and record the Received Signal Strength Indication (RSSI) and any spurious emission levels at and between all DRU antennas. Analyze all DRU's and the DHU interface using a spectrum analyzer.
4. Plot the RSSI levels on a floor plan of the building and check against the pre-installation RSSI levels to determine the overall and average RSSI improvement attributed to the Digivance ICS. Check the entire Digivance coverage area.
5. Verify call processing and voice quality within the coverage areas. Initiate and receive multiple long and short duration calls. Document the performance and address any issues as calls are processed within the entire coverage area. Assuming a properly functioning server RF link and BTS and a properly designed and optimized ICS system, there should be no clicks, mutes, clipping, or crackles within the coverage area. In a wireless office application, hand off will not occur.
6. If the DHU interfaces with a local BTS (microcell), verify the handoff function by placing a call and confirming handoffs between the Digivance/microcell coverage area and the outdoor macrocell coverage area (macro system) and vice versa. The handoff should take place without any noticeable call quality or performance issues.
7. If the DHU interfaces with a remote BTS through a donor antenna, verify call quality by placing a call and then walking between the Digivance coverage area and an area receiving good coverage directly from the cell site base station. There should be no noticeable difference in call quality.
8. Following service provider guidelines, test the 411 and 911 links to verify the routing of emergency and special services calls on local BTS configurations.
9. Verify that the alarm reporting system functions properly by turning the DHU off. This should generate a major and minor alarm and operate both the major and minor alarm contacts. Check for alarm confirmation from the service provider's local switch and Network Operations Center (NOC). Note that this tests only the external alarm system and does not verify operation of the Digivance alarm reporting system.

6 SYSTEM MAINTENANCE PROCEDURES

This section explains the alarm reporting system, provides a method for isolating and troubleshooting faults, and provides procedures for replacing the modular transceivers and the DHU or DEU cooling fans.

The Digivance ICS requires no regular maintenance to insure continuous and satisfactory operation. Maintenance, as it applies to the Digivance ICS, primarily involves diagnosing and correcting service problems as they occur. When an alarm is reported, it will be necessary to follow a systematic troubleshooting procedure to locate the problem. Once the source of the problem is isolated, the appropriate corrective action can be taken to restore service. The only unit components that can be replaced are the cooling fans that mount in the DHU and DEU and the modular optical transceivers. The failure of any other component within a unit will require replacement of that unit.

6.1 Tools and Materials

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

- ESD wrist strap
- IR filtering safety glasses
- Optical loopback device (such as Stratos Lightwave LC5 series) and LC duplex adapter
- Optical power meter
- Magnification device for inspecting LC connectors
- Laser light source
- Multimeter
- Cell phone
- RJ-45 circuit access tool (such as the Harris 8-wire Banjo Adapter)
- Medium and small size flat-bladed screwdrivers
- TORX screwdriver (T10)

6.2 Fault Detection and Alarm Reporting

Detection of a fault by the Digivance ICS will generate an external alarm response. LED indicators are provided on the front panel of the various units to indicate when a fault is detected. In addition to LED indicators, the DHU also provides normally open (NO) and normally closed (NC) dry alarm contacts for reporting **minor** and **major** alarms to an **external** alarm system. A minor alarm is defined as a high temperature condition. A major alarm is defined as any fault condition except high temperature.

When the DHU alarm contacts are connected to an external alarm system, detection of a fault will generate an alarm at the Network Operations Center (NOC). However, various types of faults may not generate an alarm response. In this case, the first indication of a problem will probably be from cell phone users reporting a loss of service or poor service. Whenever a problem is reported, whether by a external alarm system or by a call from a user, refer to Subsection 6.3 to isolate and correct the fault.

6.3 Fault Isolation and Troubleshooting

Fault isolation and troubleshooting guidelines are provided in Tables 11, 12, 13, and 14. When an alarm is reported, determine the type of alarm generated (minor or major) and then check the LED indicators on the DHU and note any that are **red, yellow,** or **off**. If any of the Port 1–6 OK/NOK LED indicators on the DHU are red or yellow, also check the LED indicators on the connected DEU's and/or DRU's and note if any are red or yellow. Start the troubleshooting process at the DHU and then work toward the unit where the alarm originated. The troubleshooting tables are organized according to unit type. Locate the problem in the appropriate table, check out the suggested possible causes, and take corrective action as required.

Figure 24 shows two basic ICS system configurations. The troubleshooting tables list possible causes for various problems. If the cause of a particular problem is specific to either of the two system configurations shown in Figure 24, the type of system configuration (1 or 2) will be referenced in the table.

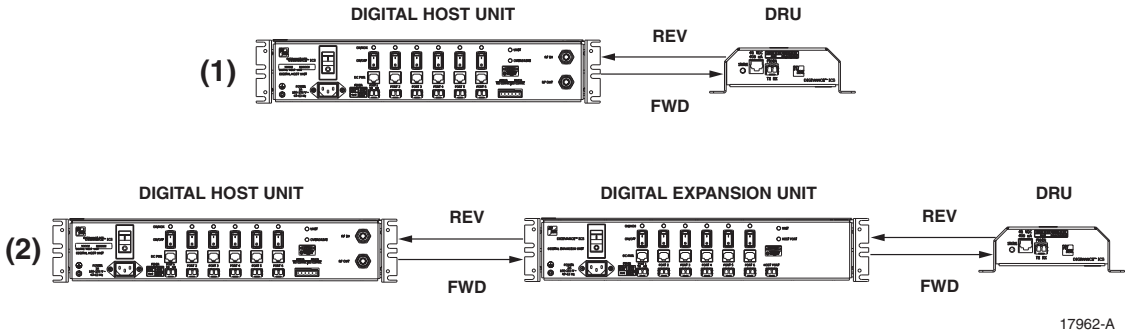


Figure 24. ICS System Basic Configurations

Table 11. DHU Fault Isolation and Troubleshooting Guidelines

Alarm Type	LED	LED COLOR
Minor	UNIT	Yellow
Problem : The DHU is overheating.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Air intake or exhaust openings to DHU chassis blocked.		1. Remove cause of air-flow blockage.
2. Ambient temperature > 50º C/122º F.		2. Reduce ambient temperature.
3. Faulty fan.		3. Replace fan (see Subsection 6.5).
Alarm Type	**LED**	**LED COLOR**
Major	UNIT	Red
Problem : The DHU detects an internal circuitry fault.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty DHU.		1. Replace DHU.

(Continued)

Table 11. DHU Fault Isolation and Troubleshooting Guidelines (Continued)

Alarm Type	LED	LED COLOR
Major	OVERDRIVE	Red
Problem: Forward path RF input level too high.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Incorrect attenuation in forward path RF coaxial link.		1. Adjust attenuation at interface device.
Alarm Type	**LED**	**LED COLOR**
Minor	OK/NOK	Yellow
Problem: The DHU is receiving a minor alarm signal from the DEU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. The connected DEU is overheating (2).		1. Check DEU UNIT indicator and then refer to the appropriate troubleshooting section for procedures.
Alarm Type	**LED**	**LED COLOR**
Major	OK/NOK	Blinking Red
Problem: The DHU is not receiving an optical signal from the DRU or DEU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Forward and reverse path optical fibers reversed between DHU and DRU (1); or between DHU and DEU (2).		1. Check fiber connections for correct polarity and reverse connectors at either unit if mismatched.
2. Faulty reverse path optical fiber between DHU and DRU (1).		2. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
3. Faulty optical receive port at DHU or faulty optical transmit port at DRU (1).		3. Make sure transceiver is fully plugged in and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).
4. Faulty forward or reverse path optical fiber between DHU and DEU (2).		4. Clean optical connectors and then test optical fibers. Repair or replace if faulty (see Subsection 6.4.2).
Alarm Type	**LED**	**LED COLOR**
Major	OK/NOK	Red
Problem: The DHU is receiving a major alarm signal from the DRU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty forward path optical fiber between DHU and DRU (1).		1. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
2. Faulty optical transmit port at DHU or faulty optical receive port at DRU (1).		2. Make sure transceiver is fully plugged in and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).
3. The DRU is faulty (1 and 2).		3. Check DEU UNIT indicator or DRU STATUS indicator and then refer to appropriate trouble-shooting section for procedures.
4. Faulty forward or reverse path optical fiber between the DEU and DRU (2).		4. Check the status of the OK/NOK LED on the DEU and then Refer to Table 12.

Table 12. DEU Fault Isolation and Troubleshooting Guidelines

Alarm Type	LED	LED COLOR
Minor	UNIT	Yellow
Problem : The DEU is overheating.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Air intake or exhaust openings to DEU chassis blocked.		1. Remove cause of air-flow blockage.
2. Ambient temperature > 50º C/122º F.		2. Reduce ambient temperature.
3. Faulty fan.		3. Replace fan (see Subsection 6.5).
Alarm Type	**LED**	**LED COLOR**
Major	UNIT	Red
Problem : The DEU detects an internal circuitry fault.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty DEU.		1. Replace DEU.
Alarm Type	**LED**	**LED COLOR**
Major	HOST PORT	Blinking Red
Problem: The DEU is not receiving an optical signal from the DHU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty forward path optical fiber between DEU and DHU (2).		1. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
2. Faulty optical receive port at DEU or faulty optical transmit port at DHU (2).		2. Make sure transceiver is fully plugged it and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).
Alarm Type	**LED**	**LED COLOR**
Minor	OK/NOK	Yellow
Problem: The DEU is receiving a minor alarm signal from a connected DEU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. The connected DEU is overheating.		1. Check DEU UNIT indicator and then refer to the appropriate troubleshooting section for procedures.
Alarm Type	**LED**	**LED COLOR**
Major	OK/NOK	Blinking Red
Problem: The DEU is not receiving an optical signal from the DRU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Forward and reverse path optical fibers reversed between DEU and DRU.		1. Check fiber connections for correct polarity and reverse connectors at either unit if mismatched.
2. Faulty reverse path optical fiber between DEU and DRU.		2. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
3. Faulty optical receive port at DEU or faulty optical transmit port at DRU.		3. Make sure transceiver is fully plugged in and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).

(Continued)

Table 12. DEU Fault Isolation and Troubleshooting Guidelines (Continued)

Alarm Type	LED	LED COLOR
Major	OK/NOK	Red
Problem: The DEU is receiving a major alarm signal from the connected DRU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty forward path optical fiber between DEU and DRU.		1. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
2. Faulty optical transmit port at DEU or faulty optical receive port at DRU.		2. Make sure transceiver is fully plugged in and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).
3. The connected DRU is faulty.		3. Check DRU STATUS indicator and then refer to appropriate troubleshooting section for procedures.

Table 13. DRU Fault Isolation and Troubleshooting Guidelines

Alarm Type	LED	LED COLOR
Major	STATUS	Off
Problem : The DRU is not powered.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. DC power cable open.		1. Test cable for continuity and repair or replace if faulty.
2. No power or insufficient power output from ac/dc power converter, DHU (1), or DEU (2).		2. Check DC voltage level at the DRU (see Subsection 6.4.3). Replace converter, DHU, or DEU (whichever applies) if voltage is not within 34 to 48 Vdc.
3. Faulty DRU.		3. Replace DRU.
Alarm Type	**LED**	**LED COLOR**
Major	STATUS	Blinking Red
Problem : The DRU is not receiving an optical signal from the DHU or DEU; or the DHU or DEU is not receiving an optical signal from the DRU.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty forward or reverse path optical fiber between DHU and DRU (1), DEU and DRU (2), or DEU and DHU (2).		1. Clean optical connector and then test optical fiber. Repair or replace if faulty (see Subsection 6.4.2).
2. Faulty optical transmit or receive port at the DHU (1) or DEU (2); or faulty optical transmit or receive port at DRU (1 and 2).		2. Make sure transceiver is fully plugged it and then test optical port. Replace optical transceiver if port is faulty (see Subsection 6.4.1).
Alarm Type	**LED**	**LED COLOR**
Major	STATUS	Red
Problem: The DRU detects an internal circuitry fault.		
POSSIBLE CAUSE		**CORRECTIVE ACTION/COMMENTS**
1. Faulty DRU.		1. Replace DRU.

Table 14. System Fault Isolation and Troubleshooting Guidelines

Alarm Type	LED	LED COLOR
None	All	Normal

Problem: Loss of phone service from one DRU. Service normal at all other DRU's.

POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. DRU antenna cable disconnected.	1. Re-connect DRU antenna cable to DRU.
2. DRU antenna obstructed or misdirected.	2. Remove antenna obstruction or re-orient antenna.
3. DRU antenna faulty.	3. Replace antenna.
4. DRU faulty.	4. Replace DRU.

Alarm Type	LED	LED COLOR
None	All	Normal

Problem: Loss of phone service from all DRU's.

POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Faulty coaxial connection between DHU and the interface device.	1. Check forward path signals at the DHU. Check reverse path signals at the interface device.
2. Faulty coaxial connection between interface device and the BTS or donor antenna.	2. Check forward path signals at the interface equipment. Check reverse path signals at the BTS or antenna.
3. Faulty interface equipment.	3. Adjust or replace interface equipment.
4. Faulty DHU	4. Replace DHU.
5. Fault with cellular network or equipment.	5. Contact cell service provider and verify that cellular network and equipment is operational.

Alarm Type	LED	LED COLOR
None	All	Normal

Problem: Calls may be originated and terminated but service is noisy.

POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Some electrical device in the immediate vicinity is creating interference.	1. Try turning off each device that may be causing interference and see if problem corrects itself.

Alarm Type	LED	LED COLOR
None	All	Normal

Problem: Sudden high rate of blocked calls (delay dial tone).

POSSIBLE CAUSE	CORRECTIVE ACTION/COMMENTS
1. Too many users for the number of channels available.	1. Wait a few minutes and try dialing again. Upgrade service if additional channels are required.
2. Faulty DHU, DEU, or DRU.	2. Replace defective unit.

6.4 Test Procedures

6.4.1 Optical Loopback Test Procedure

Dirty optical connectors, a faulty optical transceiver, a break in an optical fiber, or a fault in an optical connector will interrupt communications between fiber-linked components. Use the following procedure to determine if a fault exists with an optical port or with an optical fiber:

⚠ **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 transceiver or connector.*

1. Put on the IR filtering safety glasses.
2. At the DHU or supporting DEU, place the PORT ON/OFF switch for the fiber port or fiber to be tested in the **OFF** position (press **O**).
3. Disconnect the optical connectors for the fiber port to be tested and place a dust cap over each connector.
4. Plug a loopback into the optical port to be tested as shown in Figure 25.

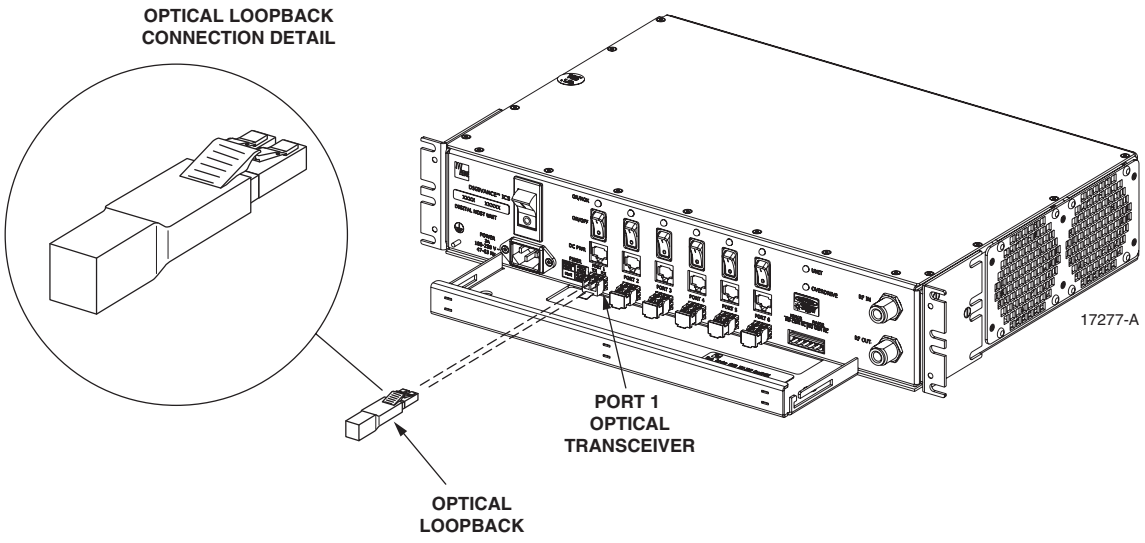


Figure 25. DHU/DEU Loopback Test

5. At the DHU or supporting DEU, place the PORT ON/OFF switch in the **ON** position (press **I**).

6. The PORT OK/NOK LED will turn either blinking red or green. If the LED turns blinking red, the optical port is faulty. Replace the optical transceiver and then recheck system operation. If the LED turns green, the optical port is good. Proceed to step 7 to continue the test procedure.
7. Place the PORT ON/OFF switch in the **OFF** position (press **O**).
8. Disconnect the loopback from the DHU or supporting DEU.
9. Clean and then reconnect the optical fiber connectors to the DHU or DEU optical port.
10. Disconnect the optical connectors at the DRU optical port or remote DEU host port (far end of fiber).
11. Clean the optical fiber connectors and then using an LC optical adapter, connect the loopback to the connectors as shown in Figure 26.

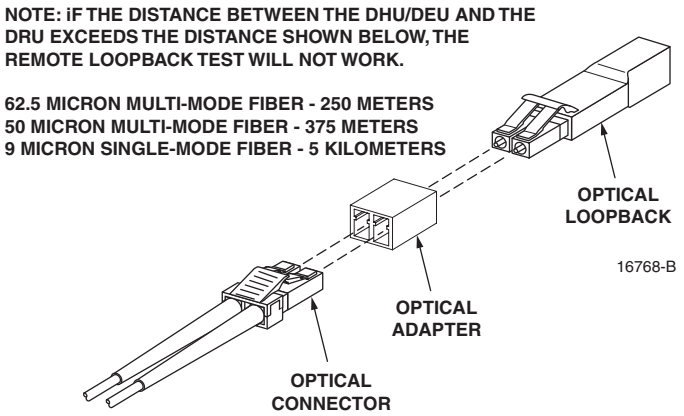


Figure 26. Optical Fiber Loopback Test

12. Insert a dust plug into the DRU optical port or remote DEU host port.
13. At the DHU or supporting DEU, place the PORT ON/OFF switch in the **ON** position (press **I**).
14. The PORT OK/NOK LED will turn either blinking red or green. If the LED turns blinking red, one of the optical fibers is faulty. Refer to Subsection 6.4.2 to isolate which fiber is at fault. If the LED turns green, the optical fibers are good. Proceed to step 14 to finish the test procedure.
15. At the DHU or supporting DEU, place the PORT ON/OFF switch in the **OFF** position (press **O**).
16. Disconnect the loopback and the optical adapters from the optical fiber connectors.
17. Place a dust cap over the connector for each optical fiber
18. Remove the dust plug from the DRU optical port or remote DEU host port.
19. Plug the loopback into the DRU optical port or DEU host port as shown in Figure 27.
20. If testing a DRU that is powered by the DHU or by a supporting DEU, place the PORT ON/OFF switch in the **ON** position (press **I**).

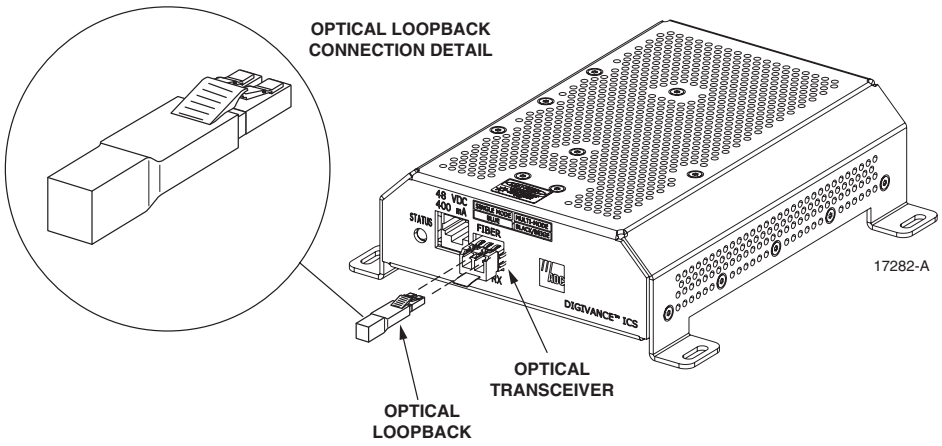


Figure 27. DRU Loopback Test

21. The DRU STATUS LED or DEU HOST LED will turn either blinking red or green. If the LED turns blinking red, the optical port is faulty and the optical transceiver must be replaced. If the LED turns green, the optical port is good.
22. At the DHU or supporting DEU, place the PORT ON/OFF switch in the **OFF** position (press **O**).
23. Remove the loopback from the DRU optical port or remote DEU host port.
24. Clean the optical fiber connectors and then reconnect the optical fibers to the DRU optical port or remote DEU host port.
25. At the DHU or supporting DEU, place the PORT ON/OFF switch in the **ON** position (press **I**).
26. Verify that the PORT OK/NOK LED turns green.

6.4.2 Optical Loss Test Procedure

A break in an optical fiber or a fault with the optical connector will interrupt communications between linked components. Use the following procedure to isolate a problem with an optical fiber or optical connector:

⚠ **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 transceiver or connector.*

1. Put on the IR filtering safety glasses.
2. At the DHU or supporting DEU, place the PORT ON/OFF switch for the optical fiber to be tested in the **OFF** position (press **O**) if not already off.

3. Disconnect the optical connectors at the DHU or supporting DEU and at the corresponding DRU or remote DEU.
4. Inspect the optical connectors. Verify that each connector is clean and that no scratches or imperfections are visible on the fiber end. Clean and polish the optical connector if necessary.
5. Connect a laser light source to one end of the first optical fiber and an optical power meter to the other end.
6. Verify that the power loss is within specifications (8 dB loss) for the length of the fiber installed. If the power loss is not within specifications, repair or replace the optical fiber and/or connector per local practice.
7. Repeat steps 5 and 6 for the second optical fiber.
8. Reconnect the optical connectors at the DHU or supporting DEU and the corresponding DRU or remote DEU.
9. At the DHU or supporting DEU, place the PORT ON/OFF switch for the fiber that was tested in the **ON** position (press **I**).

6.4.3 DC Power Test Procedure

The DRU is powered by 34–48 Vdc power which is supplied through the RJ-45 connector. Power to the DRU may be supplied by the DHU, DEU, or by a 120 Vac to 48 Vdc power converter (available separately as an accessory item) plugged into a properly grounded 120 Vac outlet. Use the following procedure to test the DC power cable:

1. Disconnect the DC power cable from the DRU.
2. Connect the RJ-45 circuit access tool to the DRU as shown in Figure 28.

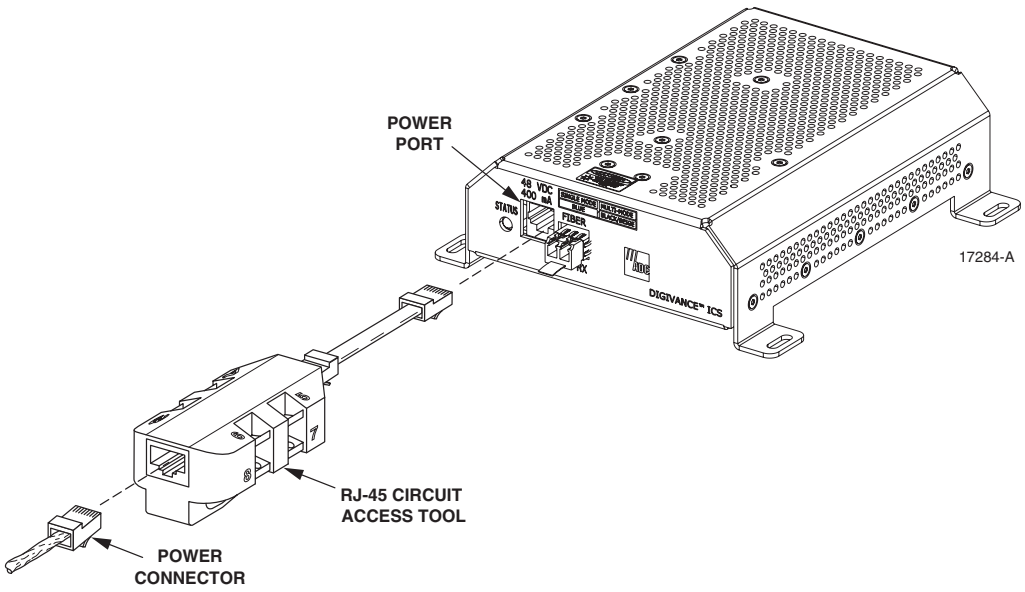


Figure 28. Connect RJ-45 Circuit Access Tool