# 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 unit (HPCP or RIU) has been installed and tested. The procedures for installing and testing the HPCP or RIU are provided in the user manual that is shipped with the unit.

## 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 8, 9, and 10 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 5.4 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. If DHU will be connected to an ancillary interface device, adjust the level of the RF input and output signals at the DHU and complete all remaining coaxial cable connections as described in Section 5.3.
6. Place the **PORT 1** ON/OFF switch on the DHU in the **ON** position (press **I**).
7. If a DEU is connected to port 1, proceed to step 8. If a DRU is connected to port 1, skip steps 8 and 9 and proceed to step 10.
8. Place the ON/OFF switch on the DEU in the **ON** position (press **I**).
9. Verify that the UNIT LED on the DEU turns yellow (for approximately 6 seconds) and then green.

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

**Table 8. 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 9. 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 10. 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 RF Input and Output Signal Level Adjustments

The DHU may be connected to either a donor antenna or a base transceiver station through an ancillary interface device. The following sections provide general guidelines for using the interface device to adjust the forward and reverse path signals to the correct level.

### 5.3.1 Forward Path RF Signal Level Adjustment

Use the following procedure to adjust the level of the forward path composite RF signal input to the DHU so that the maximum RF output signal level is provided at the DRU:

1. Complete all remaining forward path coaxial cable connections between the BTS and the local interface device or between the antenna and the remote interface device as specified in the instructions provided with the equipment.
2. Connect a spectrum analyzer or power meter to the forward path output port on the interface device.

➧ Note: Check the input rating of the test equipment and the output rating of the interface device. 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 interface device and test equipment.

3. Adjust the interface device to provide the maximum RF signal level at the output port.
4. If using a spectrum analyzer, proceed to step 5. If using a power meter, measure the composite signal power from the interface device and then proceed to step 7.
5. 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.
6. Calculate the total composite signal power from the interface device using the following formula:

   $P_{tot} = P_c + 10\text{Log } N - (\text{see Note})$

   Where,

   $P_{tot}$ is the total composite power in dBm

   $P_c$ is the power per carrier in dBm as measured in step 4

   N is the total number of channels.
7. Adjust the interface device to provide a composite RF signal level of approximately **–20 dBm** at the interface device RF output port.
8. Disconnect the test equipment from the interface device
9. Connect the forward path cable (attached to the **RF IN** connector on the DHU) to the interface device RF output port.
10. Use the interface device to slowly increase the level of the forward path RF signal supplied to the DHU. Make all adjustments to the signal level in 1 dB increments.

⚠ **Caution**: *Do not supply the DHU with an RF input signal that is 0 dBm or greater or the system could be damaged.*

11. Continue to increase the forward path RF signal level until the DHU overdrive LED just begins to turn **red**.
12. Reduce the level of the RF input signal by 1 dB and then verify that the DHU Overdrive LED stays green.

### 5.3.2 Reverse Path RF Signal Level Adjustment

The level of the reverse path composite RF signal output from the interface must be adjusted so that the correct RF signal level is input to the BTS or the antenna. When the level of the reverse path signal at the DRU antenna port is at a composite maximum of **–40 dBm**, the level of the RF output signal from the DHU will be **–30 dBm**. This equals a system gain of 10 dB. Use the following procedure to adjust the reverse path RF signal level:

1. Complete all remaining reverse path coaxial cable connections .
2. Determine the maximum acceptable DRU path loss per the system design specifications.
3. Determine the total cable loss that will be imposed by the reverse path coaxial cables and any other devices (splitters, connectors, etc) that will impose a lose on the signal.
4. Determine the total gain that will be provided by the DRU antenna and by the donor antenna (if present).
5. Use the following formula to calculate the total gain or loss that must be added by the interface device to provide **unity** gain:

   Reverse Path Gain/Loss Required = [$\sum$ System Insertion Loss + Designed Path Loss*] – [System Gain (10 dB) + $\sum$ Antenna Gain]

   *Designed path loss is defined as the loss between a BTS antenna and a donor site antenna.
6. Adjust the interface device to provide the amount of gain or loss required per the calculation in step 5.

## 5.4 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.

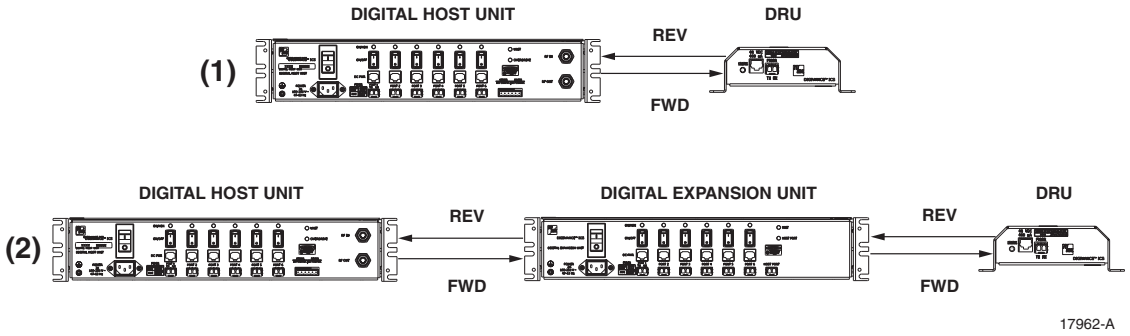



**Figure 24. ICS System Basic Configurations**

**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 RIU or LIU. |

| 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. Local Interface: Faulty forward path coaxial connections between the DHU, HPCP and BTS. Faulty reverse path coaxial connections between the DHU and BTS. | 1. Check forward path signals at the HPCP and the DHU. Check reverse path signals at the BTS. |
| 2. Remote Interface: Faulty forward or reverse path coaxial connections between the DHU and the RIU. Faulty coaxial connections between the RIU and donor antenna. | 2. Check forward and reverse path signals at the DHU, RIU, and donor antenna. |
| 3. Faulty HPCP or RIU. | 3. Adjust or replace HPCP or RIU. |
| 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.

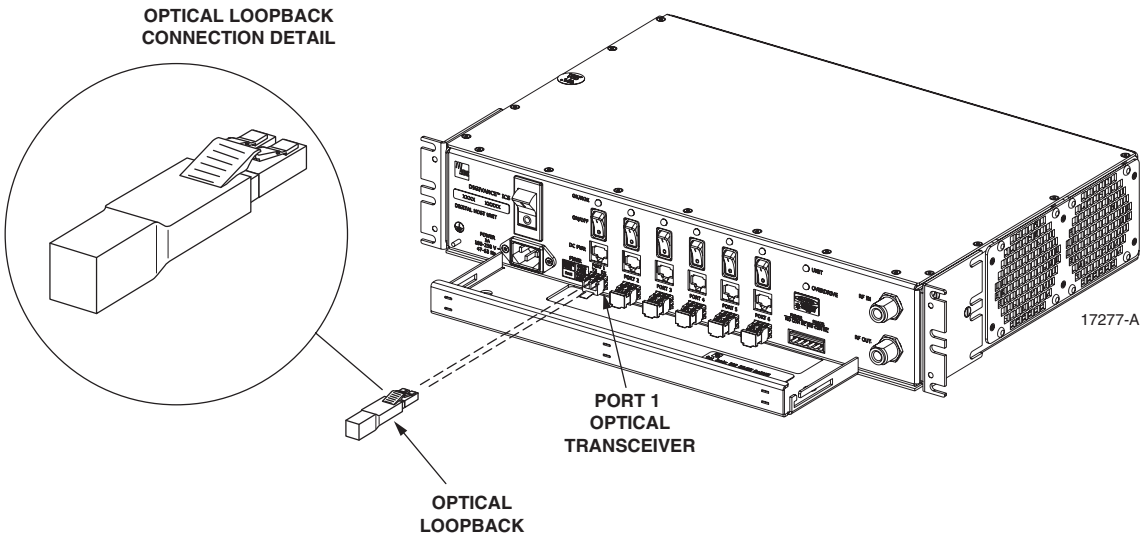



**Figure 25. DHU/DEU Loopback Test**

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.

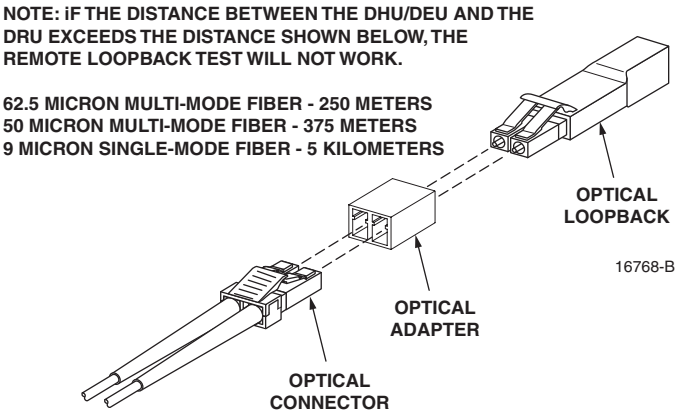



**Figure 26. Optical Fiber Loopback Test**

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**).

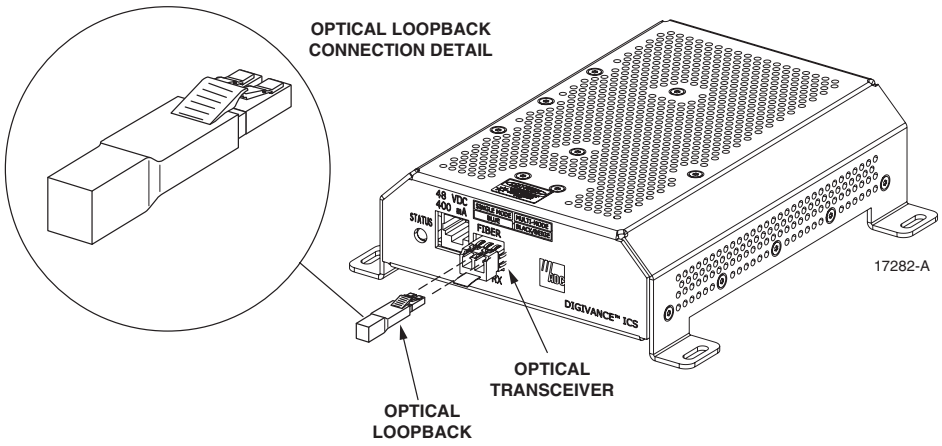



**Figure 27. DRU Loopback Test**

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.

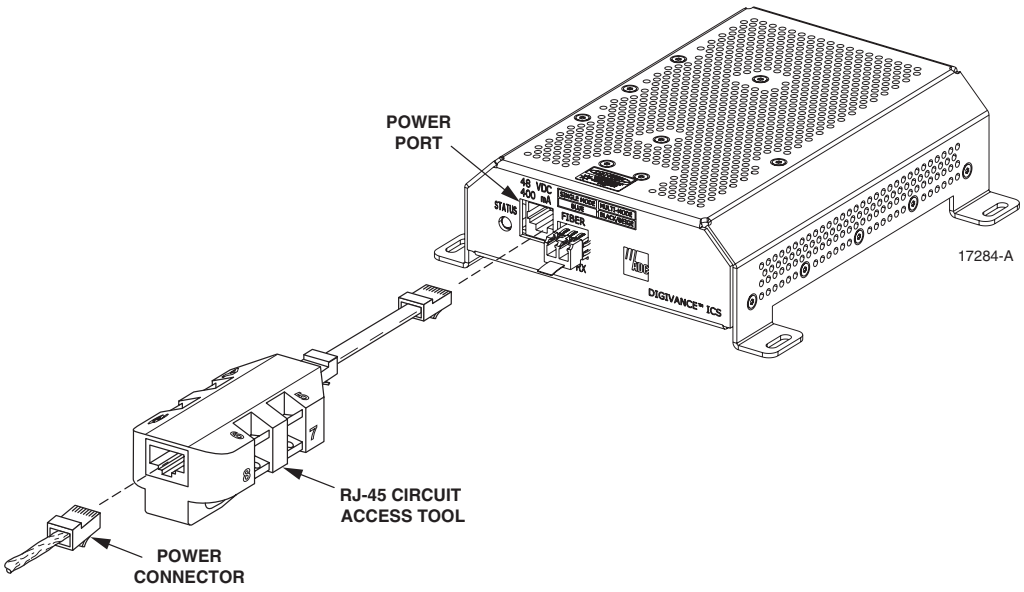



**Figure 28. Connect RJ-45 Circuit Access Tool**

3. Connect the DC power cable to the RJ-45 circuit access tool (see Figure 28).
4. Using a DC voltmeter, verify that the DC voltage level is between 34 and 48 VDC between any set of positive and negative (+/-) terminals at the RJ-45 circuit access tool as shown in Figure 29. Due to source current limiting at the DHU or DEU, low voltage can mean excess wire resistance, low source voltage, or excess remote current.

⚠ **Warning**: *The DRU uses 48 VDC power. To avoid electric shock or burns, use extreme care when working near exposed terminals or uninsulated cables. Be careful not to touch exposed terminals or to cause a short between terminals when checking voltage levels.*

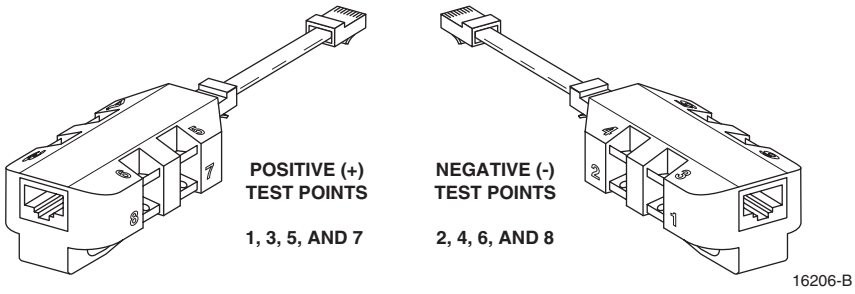



**Figure 29. RJ-45 Circuit Access Tool Pin/Wire Designations**

5. Disconnect RJ-45 circuit access tool from the DRU.
6. Use the DC voltmeter to check for open pin connections by checking for voltage between the +/– pairs on the RJ-45 circuit access tool (see Figure 29).
7. Disconnect the DC power cable from the RJ-45 circuit access tool.
8. Re-connect DC power cable to the DRU.

## 6.5 DHU or DEU Fan Replacement Procedure

It is recommended that the fans (catalog # DGVI-100000FAN) be replaced every five years. Replacement of a fan requires that the DHU or DEU be turned off for a short period of time. This will drop all existing calls, cause a temporary loss of service, and generate a major alarm. Use the following procedure to replace the cooling fans within the DHU or the DEU:

1. Before touching the DHU or DEU or handling a fan, slip on an Electro-Static Discharge (ESD) wrist strap and connect the ground wire to an earth ground source. Wear the ESD wrist strap while completing each section of the fan installation procedure.

⚠ **Warning**: *Electronic components can be damaged by static electrical discharge. To prevent ESD damage, always wear an ESD wrist strap when working on the DHU or DEU and when handling electronic components.*

2. Observe the fans (located on right side of enclosure) to determine which fan requires replacement. The faulty fan may be stopped, running at a reduced speed, or the fan bearing may be noisy.

➧ **Note**: Because the Mean Time Between Failures (MBTF) is the same for both fans, it may be more efficient to replace both fans at the same time.

3. Notify the NOC or alarm monitoring system operator that the system is going offline.
4. Place the DHU or DEU AC power On/Off switch (see Figure 3 or Figure 7) in the OFF position (press **O**).
5. Remove the six flat-head screws (requires TORX screwdriver with T15 bit) that secure the fan/grill assembly to the side of the enclosure as shown in Figure 30 and save for reuse.

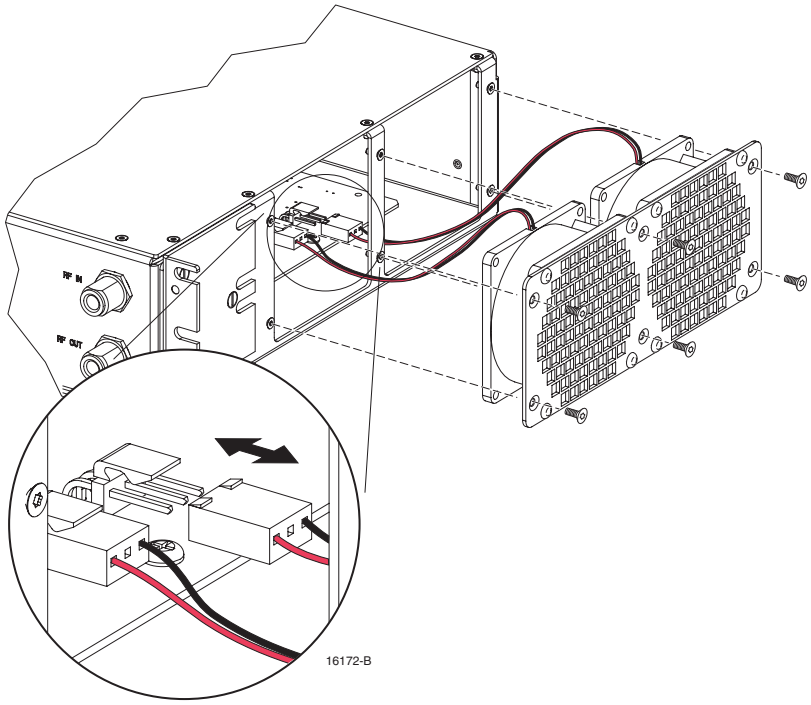



**Figure 30. Fan/Grill Assembly Removal**

6. Carefully withdraw the fan/grill assembly from the enclosure until the wiring harness is exposed and the connectors are accessible.
7. Lift the small latch on each wiring harness connector (see Figure 30) and carefully unplug each connector from the circuit board connector.
8. Remove the four plastic rivets that secure the faulty fan to the grill by pushing outward on rivet center post until the rivet can be withdrawn from the grill as shown in Figure 31.
9. Remove the faulty fan(s) from the grill and then locate the replacement fan(s).
10. Use the rivets removed in step 8 to secure the replacement fan to the grill. Orient the fan so the wiring harness is on the top and the arrow on the fan housing faces into the enclosure.
11. Connect the two wiring harness connectors to the circuit board connectors.
12. Secure the fan/grill assembly to the side of the enclosure (see Figure 30) using the six flat-head screws removed in step 5.

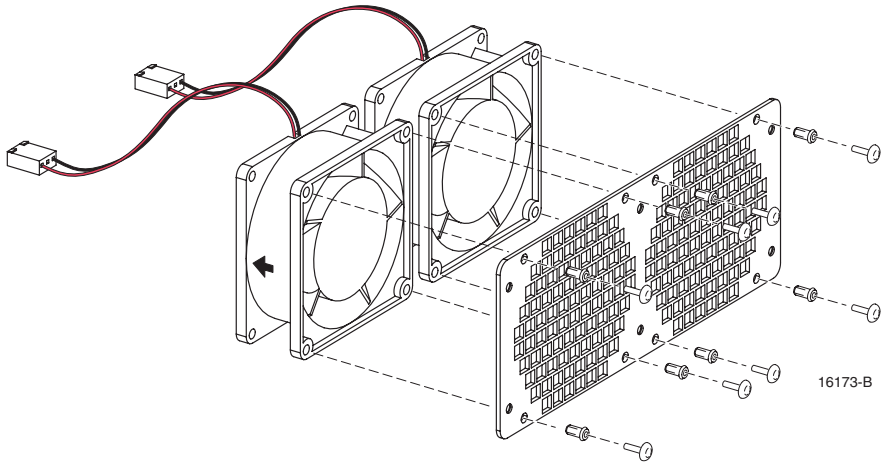



**Figure 31. Removing Fan From Grill**

13. Place the DHU or DEU AC power On/Off switch in the ON position (press **I)**.
14. Verify that the fans run properly following power up.
15. Notify the NOC or alarm monitoring system operator that the system is going back online.

## 6.6 DHU or DEU Modular Optical Transceiver Replacement Procedure

The modular optical transceiver should be replaced when testing indicates that the transceiver has failed. Use the following procedure to replace an optical transceiver in a DHU or DEU:

⚠ **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. Slip on an Electro-Static Discharge (ESD) wrist strap and connect the ground wire to an earth ground source such as the grounding stud on the DHU or DEU front panel. Wear the ESD wrist strap while completing the optical transceiver replacement procedure.

⚠ **Warning**: *Electronic components can be damaged by static electrical discharge. To prevent ESD damage, always wear an ESD wrist strap when handling electronic components.*

3. Place the PORT ON/OFF switch for the optical transceiver being replaced in the **OFF** position (press **O**).

**Note**: The HOST PORT on the DEU does not have an On/Off switch and can only be disabled by placing the DEU AC power On/Off switch in the OFF position (press **0)**. Turning off the power to the DEU will create an alarm condition. If the DEU must be turned off, inform the NOC or alarm monitoring system operator that an alarm will be reported.

4. Disconnect the optical fiber connectors from the optical transceiver and place a dust cap over each connector.
5. Release the optical transceiver from the transceiver socket by pulling outward on the release lever (if type A) or release tab (if type B) as shown in Figure 32.

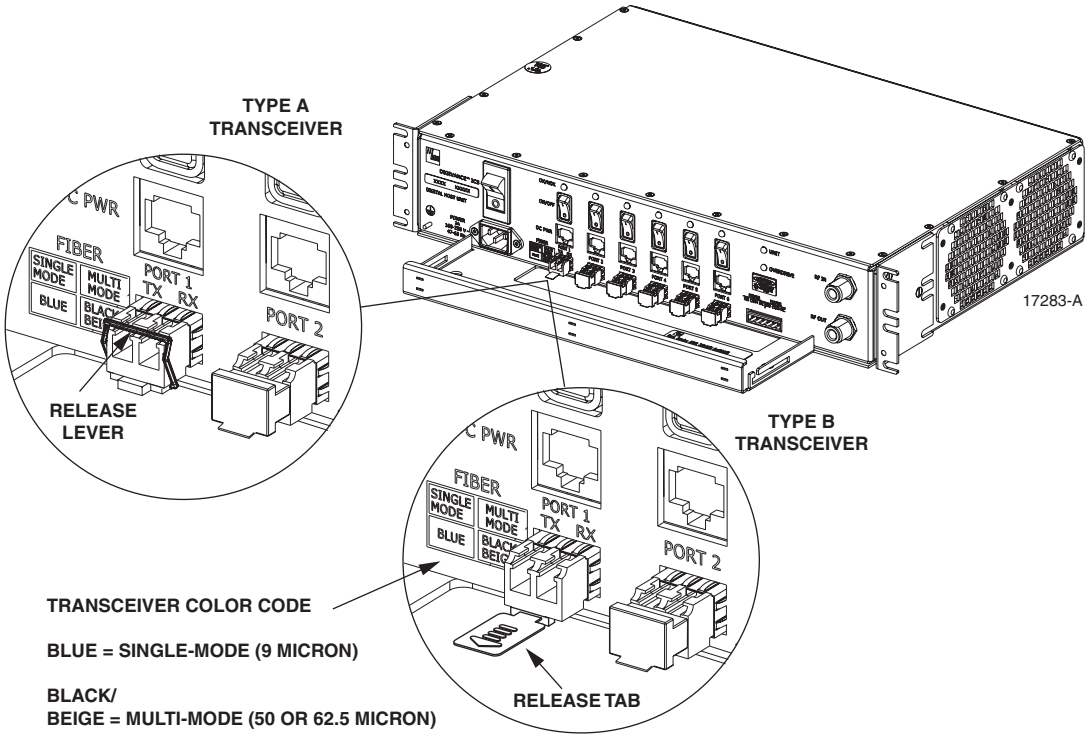



**Figure 32. DHU or DEU Optical Transceiver Removal**

6. Remove the optical transceiver from the transceiver socket.
7. For replacement, select an optical transceiver that corresponds to the type of fiber (single- or multi-mode) used in the installation. The color of the transceiver corresponds to the transceiver fiber type (see Figure 32).
8. Remove the optical transceiver from the anti-static packaging and orient for installation as shown in Figure 33.

**Note**: Two types of optical transceivers, type A and type B, are available. Both types provide the same functionality. On the type A optical transceiver, the release lever (see Figure 33) must be closed for installation.

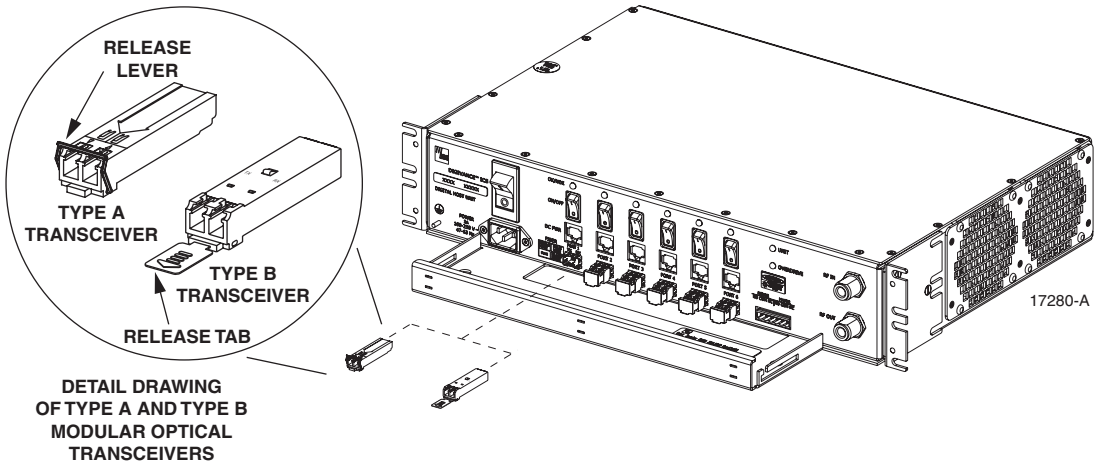



**Figure 33. DHU or DEU Optical Transceiver Installation**

9. Insert the optical transceiver into the socket until it locks into place.
10. Clean the optical fiber connectors and reconnect to the optical transceiver.
11. Place the PORT ON/OFF switch for the optical transceiver that was replaced in the **ON** position (press **I**).

➧ **Note**: If the DEU was turned off to replace the HOST PORT optical transceiver, place the DEU AC power On/Off switch in the ON position (press **I**) and inform the NOC or alarm monitoring system operator that the alarm has been cleared.

12. Verify that the DHU or DEU optical port LED indicators shown normal optical port operation (refer to Table 7 or 8).

## 6.7 DRU Modular Optical Transceiver Replacement Procedure

The modular optical transceiver should be replaced when testing indicates that the transceiver has failed. Use the following procedure to replace an optical transceiver in a DRU:

⚠ **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. Slip on an Electro-Static Discharge (ESD) wrist strap and connect the ground wire to an earth ground source. Wear the ESD wrist strap while completing the optical transceiver replacement procedure.

⚠ **Warning**: *Electronic components can be damaged by static electrical discharge. To prevent ESD damage, always wear an ESD wrist strap when handling electronic components.*

3. Disconnect the DC power cable connector from the RJ-45 power jack on the DRU front panel.

**Note**: Disconnecting the power from the DRU will create an alarm condition. Inform the NOC or alarm monitoring system operator that the alarm will be reported.

4. Disconnect the optical fiber connectors from the optical transceiver and place a dust cap over each connector.
5. Release the optical transceiver from the transceiver socket by pulling outward on the release lever (if type A) or release tab (if type B) as shown in Figure 34.

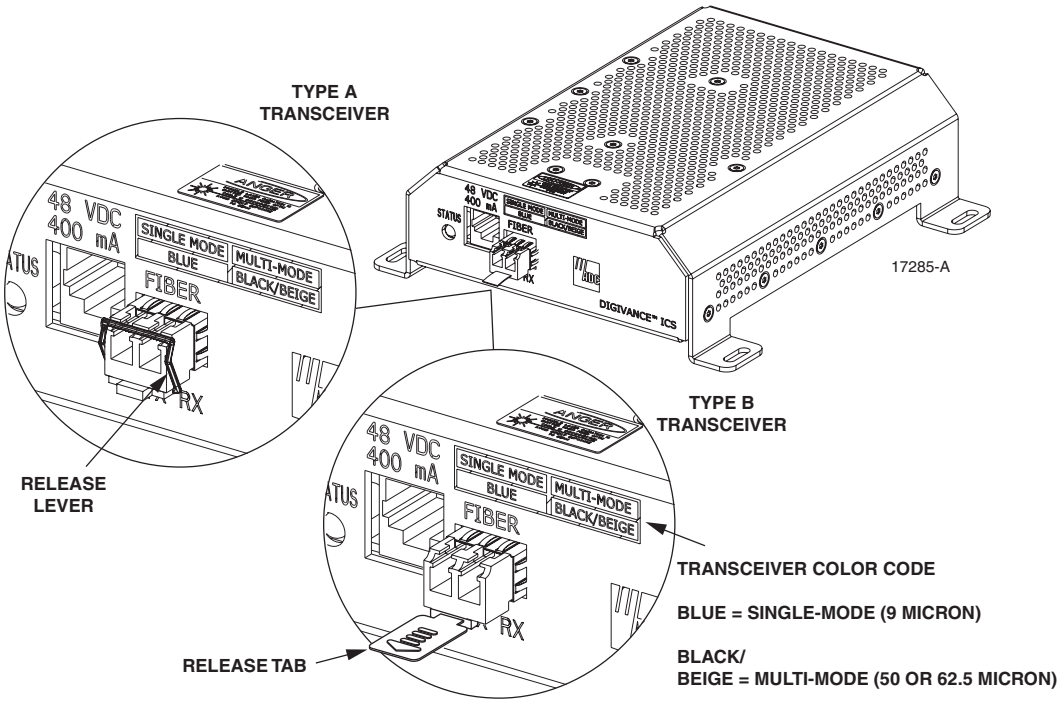



**Figure 34. DRU Optical Transceiver Removal**

6. Remove the optical transceiver from the transceiver socket.
7. For replacement, select an optical transceiver that corresponds to the type of fiber (single- or multi-mode) used in the installation. The color of the transceiver corresponds to the fiber type (see Figure 34).
8. Remove the optical transceiver from the anti-static packaging and orient for installation as shown in Figure 35.

**Note**: Two types of optical transceivers, type A and type B, are available. Both types provide the same functionality. On the type A optical transceiver, the release lever (see Figure 35) must be closed for installation.

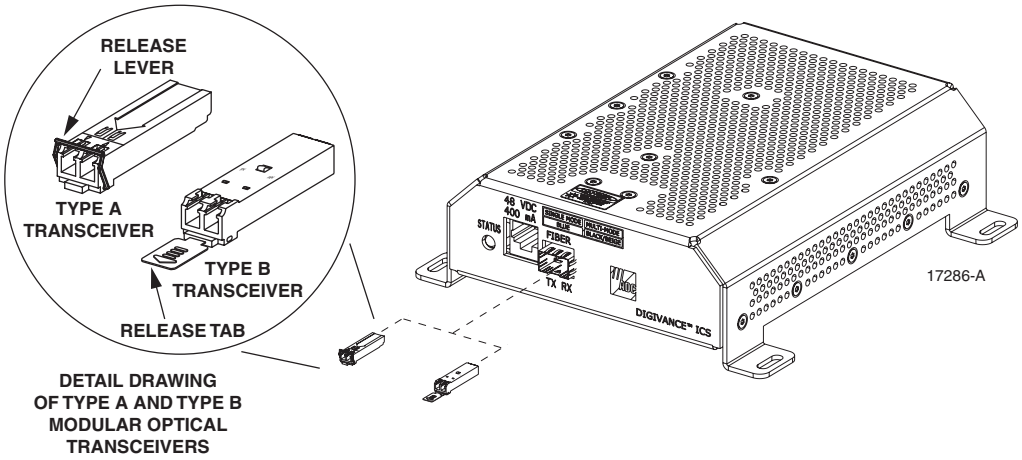



**Figure 35. DRU Optical Transceiver Installation**

9. Insert the optical transceiver into the socket until it locks into place.
10. Clean the optical fiber connectors and reconnect to the optical transceiver.
11. Reconnect the DC power cable plug to the RJ-45 jack on the DRU front panel and inform the NOC or alarm monitoring system operator that the alarm has been cleared.
12. Verify that the DRU LED indicator shows normal operation (refer to Table 9).

# 7 GENERAL INFORMATION

## 7.1 Warranty/Software

The Product and Software warranty policy and warranty period for all ADC products is published in ADC's Warranty/Software Handbook. Contact the Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (outside U.S.A. and Canada) for warranty or software information or for a copy of the Warranty/Software Handbook.

## 7.2 Software Service Agreement

ADC software service agreements for some ADC Products are available at a nominal fee. Contact the Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (outside U.S.A. and Canada) for software service agreement information.

## 7.3 Repair/Exchange Policy

All repairs of ADC Products must be done by ADC or an authorized representative. Any attempt to repair or modify ADC Products without authorization from ADC voids the warranty.

If a malfunction cannot be resolved by the normal troubleshooting procedures, contact the Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (outside U.S.A. and Canada). A telephone consultation can sometimes resolve a problem without the need to repair or replace the ADC Product.

If, during a telephone consultation, ADC determines the ADC Product needs repair, ADC will authorize the return of the affected Product for repair and provide a Return Material Authorization number and complete shipping instructions. If time is critical, ADC can arrange to ship the replacement Product immediately. In all cases, the defective Product must be carefully packed and returned to ADC.

## 7.4 Repair Charges

If the defect and the necessary repairs are covered by the warranty, and the applicable warranty period has not expired, the Buyer's only payment obligation is to pay the shipping cost to return the defective Product. ADC will repair or replace the Product at no charge and pay the return shipping charges.

Otherwise, ADC will charge a percentage of the current Customer Product price for the repair or NTF (No Trouble Found). If an advance replacement is requested, the full price of a new unit will be charged initially. Upon receipt of the defective Product, ADC will credit Buyer with 20 percent of full price charged for any Product to be Out-of-Warranty. Products must be returned within (30) days to be eligible for any advance replacement credit. If repairs necessitate a visit by an ADC representative, ADC will charge the current price of a field visit plus round trip transportation charges from Minneapolis to the Buyer's site.

## 7.5 Replacement/Spare Products

Replacement parts, including, but not limited to, button caps and lenses, lamps, fuses, and patch cords, are available from ADC on a special order basis. Contact the Technical Assistance Center at 1-800-366-3891, extension 73476 (in U.S.A. or Canada) or 952-917-3476 (outside U.S.A. and Canada) for additional information.

Spare products and accessories can be purchased from ADC. Contact Sales Administration at 1-800-366-3891, extension 73000 (in U.S.A. or Canada) or 952-938-8080 (outside U.S.A. and Canada) for a price quote and to place your order.

## 7.6 Returned Material

Contact the ADC Product Return Department at 1-800-366-3891, extension 73748 (in U.S.A. or Canada) or 952-917-3748 (outside U.S.A. and Canada) to obtain a Return Material Authorization number prior to returning an ADC Product.

All returned Products must have a Return Material Authorization (RMA) number clearly marked on the outside of the package. The Return Material Authorization number is valid for 90 days from authorization.

## 7.7 Customer Information and Assistance

**PHONE:**

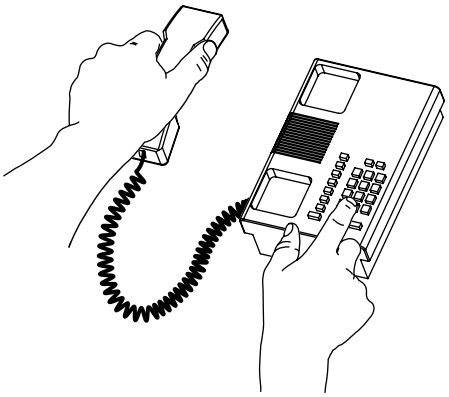
**U.S.A. OR CANADA**
Sales: 1-800-366-3891 Extension 73000
Technical Assistance: 1-800-366-3891
Connectivity Extension 73475
Wireless Extension 73476

**EUROPE**
Sales Administration: +32-2-712-65 00
Technical Assistance: +32-2-712-65 42

**EUROPEAN TOLL FREE NUMBERS**
Germany: 0180 2232923
UK: 0800 960236
Spain: 900 983291
France: 0800 914032
Italy: 0800 782374

**ASIA/PACIFIC**
Sales Administration: +65-6294-9948
Technical Assistance: +65-6393-0739

**ELSEWHERE**
Sales Administration: +1-952-938-8080
Technical Assistance: +1-952-917-3475

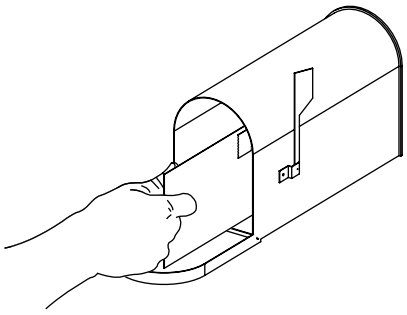


**WRITE:**

**ADC TELECOMMUNICATIONS, INC**
**PO BOX 1101,**
**MINNEAPOLIS, MN 55440-1101, USA**

**ADC TELECOMMUNICATIONS (S'PORE) PTE. LTD.**
**100 BEACH ROAD, #18-01, SHAW TOWERS.**
**SINGAPORE 189702.**

**ADC EUROPEAN CUSTOMER SERVICE, INC**
**BELGICASTRAAT 2,**
**1930 ZAVENTEM, BELGIUM**



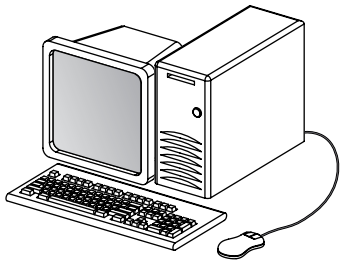
**PRODUCT INFORMATION AND TECHNICAL ASSISTANCE:**

**connectivity.tac@adc.com**

**wireless.tac@adc.com**

**euro.tac@adc.com**

**asiapacific.tac@adc.com**



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