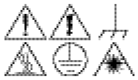
# Prisma Model 6940/6944 Optical Nodes with bdr 2:1 Enhanced Multiplexing Digital Reverse

## Installation and Operation Guide

# For Your Safety

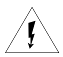
## Explanation of Warning and Caution Icons

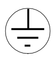


**Avoid personal injury and product damage! Do not proceed beyond any symbol until you fully understand the indicated conditions.**

The following warning and caution icons alert you to important information about the safe operation of this product:

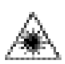
 **You may find this symbol in the document that accompanies this product. This symbol indicates important operating or maintenance instructions.**

 **You may find this symbol affixed to the product. This symbol indicates a live terminal where a dangerous voltage may be present; the tip of the flash points to the terminal device.**

 **You may find this symbol affixed to the product. This symbol indicates a protective ground terminal.**

 **You may find this symbol affixed to the product. This symbol indicates a chassis terminal (normally used for equipotential bonding).**

 **You may find this symbol affixed to the product. This symbol warns of a potentially hot surface.**

 **You may find this symbol affixed to the product and in this document. This symbol indicates an infrared laser that transmits intensity-modulated light and emits invisible laser radiation or an LED that transmits intensity-modulated light.**

## Important

Please read this entire guide. If this guide provides installation or operation instructions, give particular attention to all safety statements included in this guide.

# Notices

## Trademark Acknowledgments



## Publication Disclaimer



## Copyright

# Contents

# Contents, Continued

# Safety Precautions

## Protect Yourself From Electric Shock and Your System From Damage!

- This product complies with international safety and design standards. Observe all safety procedures that appear throughout this guide, and the safety symbols that are affixed to this product.
- If circumstances impair the safe operation of this product, stop operation and secure this product against further operation.

### Safety Symbols

**Avoid personal injury and product damage! Do not proceed beyond any symbol until you fully understand the indicated conditions!**

**You will find this symbol in the literature that accompanies this product. This symbol indicates important operating or maintenance instructions.**

**You may find this symbol affixed to this product. This symbol indicates a live terminal; the flash points to the terminal device.**

**You may find this symbol affixed to this product. This symbol indicates a protective earth terminal.**

**You may find this symbol affixed to this product. This symbol indicates excessive or dangerous heat.**

### Power

**Important!** This product is a Class II product. You must properly earth this product.

### Enclosure

- Do not allow moisture to enter this product.
- Do not open the enclosure of this product unless otherwise specified.
- Do not push objects through openings in the enclosure of this product.

### Cables

- Always pull on the plug or the connector to disconnect a cable. Never pull on the cable itself.
- Do not walk on or place stress on cables or plugs.

### Fuse

- Always use a fuse that has the correct type and rating. The correct type and rating is indicated on this product.
- Always disconnect all power cables before you change a fuse.

### Service

Refer service only to service personnel who are authorized by Cisco.

# Product Compliance

## Electrical Safety

**IEC 60065:1998/EN 60065:1998:** A notified body has issued a Certificate of Compliance according to the Low Voltage Directive of February 19, 1973. A sample of this equipment has been tested and found to be in conformity with IEC 60065:1998/EN60065:1998.

## Laser Safety

**CFR 21:1996:** A sample of this equipment has been found to meet the requirements of CFR 21:1996.

## Environmental

**IEC 529/EN 60529-A1:1992:** A sample of this equipment has been tested according to IEC 529/EN 60529-A1:1992 and found to provide a degree of protection equal to IP 68.

## Electromagnetic Compatibility

**Part 76 of FCC Rules**: This equipment has been tested and found to comply with the limits for **Part 76 of FCC Rules**. These limits provide reasonable protection against harmful interference when operating this equipment in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if the user does not install and use this equipment according to the instruction manual, may cause harmful interference to radio communications.

**EN 50083-2/A1:1998:** According to the provisions of the EMC Directive of May 3, 1989, a sample of this equipment has been tested and found to be in conformity with EN 50083-2/A1:1998.

**CAUTION:**

**Any changes or modifications to this equipment not expressly approved by Cisco could void the user's authority to operate this equipment.**

# Laser Safety

## Introduction

This product contains an infrared laser that transmits intensity-modulated light and emits invisible radiation.

## Warning: Radiation

**WARNING:**

- **Avoid personal injury! Use of controls, adjustments, or procedures other than those specified herein may result in hazardous radiation exposure.**
- **Avoid personal injury! The laser light source on this product emits invisible laser radiation. Avoid direct exposure to the laser light source.**

- Do not apply power to this product if the fiber is unmated or unterminated.
- Do not stare into an unmated fiber or at any mirror-like surface that could reflect light that is emitted from an unterminated fiber.
- Do not view an activated fiber with optical instruments.

## Warning: Fiber Chips

**WARNING:**

**Avoid personal injury! Wear safety glasses and use extreme caution when you handle the glass chips that are inside the cladding of the optical fiber. X-ray cannot detect these glass chips if they become embedded in the skin. Place the chips immediately in a small waste container and discard.**

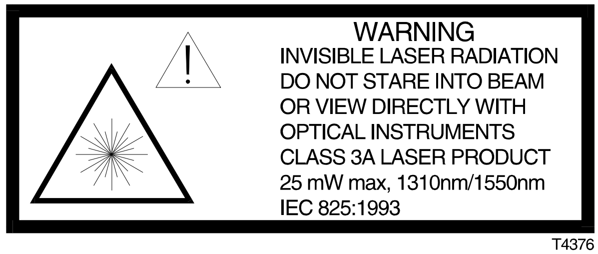
## Modifications

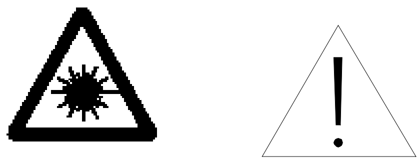
Do not make modifications to this product without the approval of Cisco.

Whenever modifications that may affect hazard levels are made to the optical fiber communication system, the person or organization that performs such modification must reassess hazard levels. They must do this by conducting tests and measurements wherever appropriate to ensure compliance. If there is a change in the hazard level, the product must be relabeled.

## Laser Labels

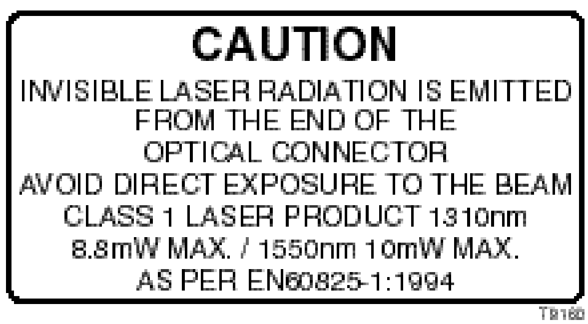
You will find the following labels on the double-wide laser module.



**DANGER**
INVISIBLE LASER RADIATION WHEN OPEN
AVOID DIRECT EXPOSURE TO BEAM

You will find the following labels on the single-wide laser module.




# Chapter 1
# Introducing the Enhanced Digital Reverse Modules

## Overview

### In This Chapter

This chapter introduces the bdr™ enhanced digital reverse modules and explains the functions of the enhanced digital reverse module components.

This chapter contains the following topics.

# Describing the Enhanced Digital Reverse Modules

## Introduction

The bdr enhanced digital reverse modules belong to the Prisma® family of products that employ the baseband digital reverse technology. These products are intended for digital transmission of upstream signals over a fiber optic link from the node to the headend.

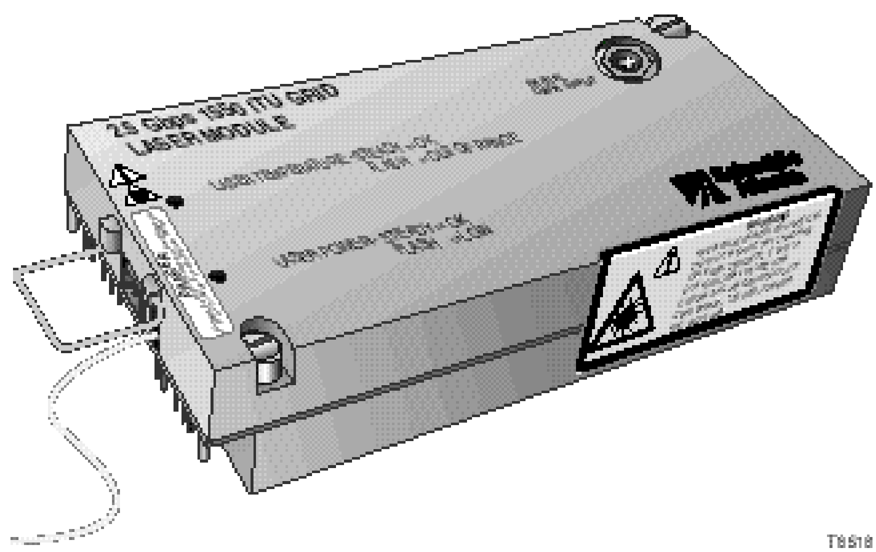
The enhanced digital reverse modules are installed in the Model 6940 4-Port Node or the Model 6944 Optical Node. The three modules that equip the nodes for the bdr technology are the following:

- Double-wide cooled DFB, ITU 1550 laser module
- Single-wide uncooled laser module
- 2:1 enhanced multiplexing digital module

## Double-wide Laser Module

The double-wide laser module is capable of transporting 2.5 Gbps data from the digital module at a 1550 nm International Telecommunications Union (ITU) grid wavelength with a modulated power of 7 dBm. The laser temperature sets the wavelength. A thermo-electric cooler (TEC) controls the laser temperature and maintains the proper operating wavelength, making this module suitable for use in DWDM system applications.

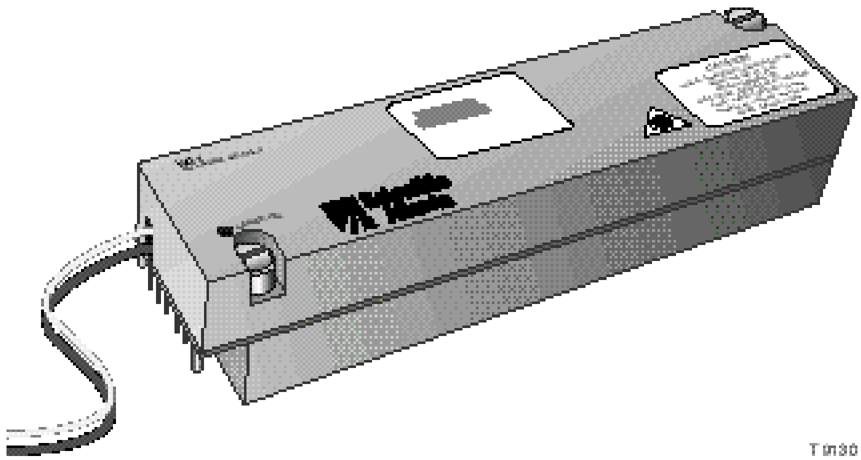
This is an illustration of the double-wide laser module.



# Describing the Enhanced Digital Reverse Modules, Continued

## Single-wide Laser Module

The single-wide laser module is also capable of transporting 2.5 Gbps data from the digital module. These single-wide laser modules transport data over shorter fiber distances than the double-wide module. The single-wide laser module transports data at either 1310 nm or a 1550 nm with a modulated power of 0 dBm for the 1310 nm and 1550 nm DFB and –5 dBm for the 1310 nm FP. This is an illustration of the single-wide laser module.



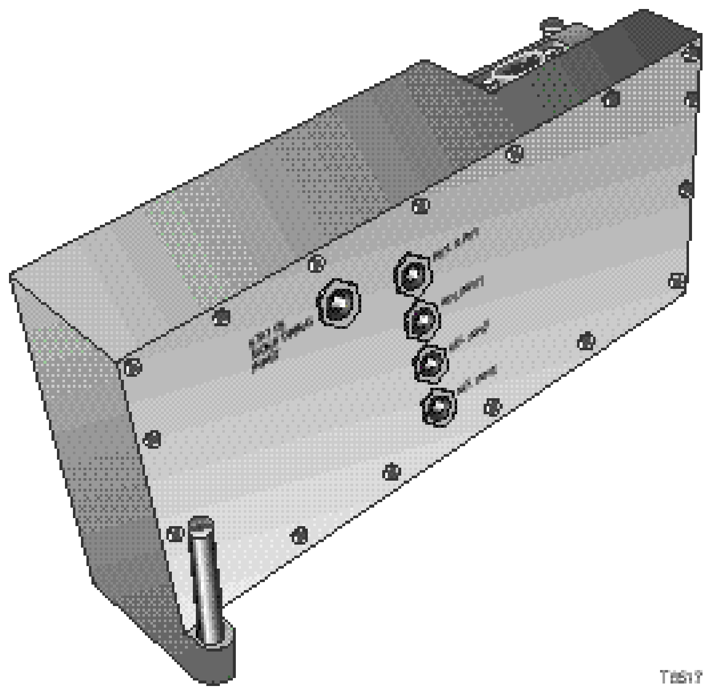
T7130

## 2:1 Enhanced Multiplexing Digital Module

The 2:1 enhanced multiplexing digital module works in conjunction with the laser module to digitize and transmit reverse path signals. The 2:1 enhanced multiplexing digital module accepts separate signals from the four RF signal ports and a fifth signal from the optional status monitor module. It digitizes and multiplexes the signals into one 2.5 Gbps bitstream.

Internally, the signals of the two lower RF input connections are combined to provide a single RF signal. Similarly the signals of the two top RF input connections are combined and further coupled with the Status Monitoring Input signal to provide a second RF signal.

This is an illustration of the 2:1 enhanced multiplexing digital module showing the connection points.



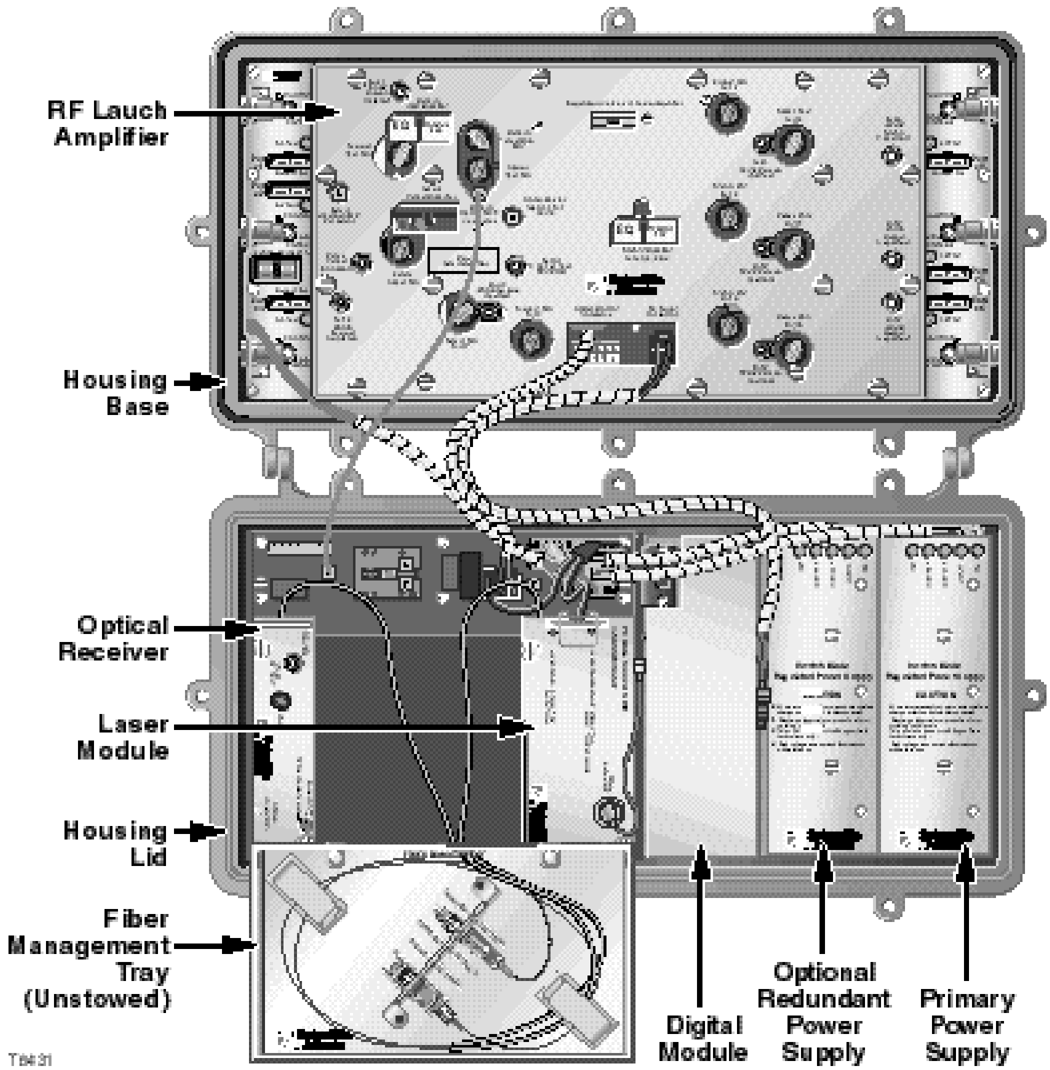
## Describing the Enhanced Digital Reverse Modules, Continued

### Illustration of a Node

This illustration shows a double-wide laser module and a 2:1 enhanced multiplexing digital module installed in a Model 6940 4-Port Node.

**Notes:**

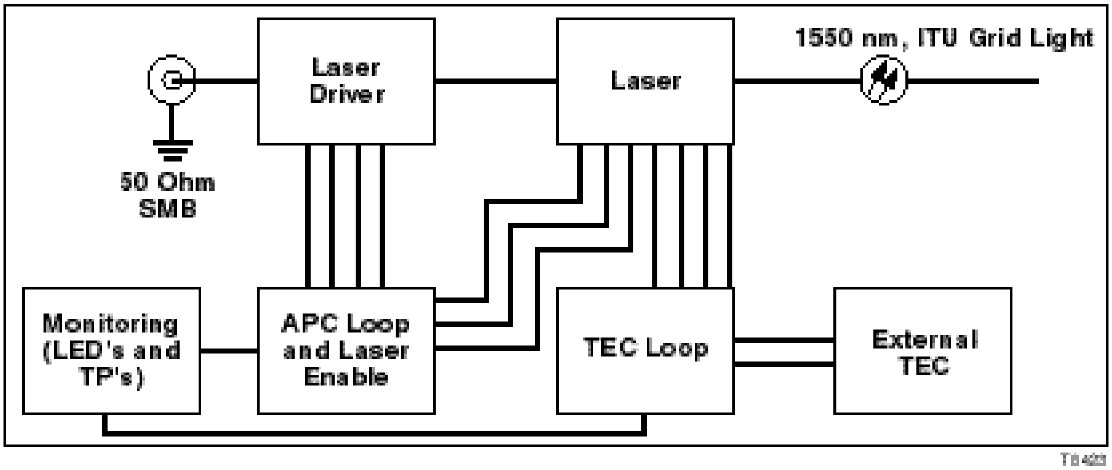
- The installation of the digital reverse modules in a Model 6944 Optical Node is similar to the Model 6940 4-Port Node.



# Functions of the Laser Module Components

## Block Diagram of the Double-wide Laser Module

This is a block diagram of the double-wide laser module.




## Laser and the Laser Driver

The laser driver prebiases and modulates the laser at levels set by the automatic power control (APC) circuitry.  The laser driver accepts a 2.5 Gbps digital signal and conditions the signal to drive the laser. The 1550 laser is a nm cooled DFB laser with a wavelength on the International Telecommunications Union (ITU) dense wave division multiplexing (DWDM) grid.

## Automatic Power Control (APC) Loop

Laser output power is controlled by monitoring the photodiode internal to the laser package. Some of the light emitted from the laser is coupled off to the photodiode. The current flowing through the photodiode is proportional to the amount of light upon it. The APC loop serves to keep the prebias current at the proper level as the laser ages. The modulation current is set to a constant current, as the slope efficiency changes little with age.  The APC loop has monitoring circuits to light the laser power LED and send status signals to the status monitor module.

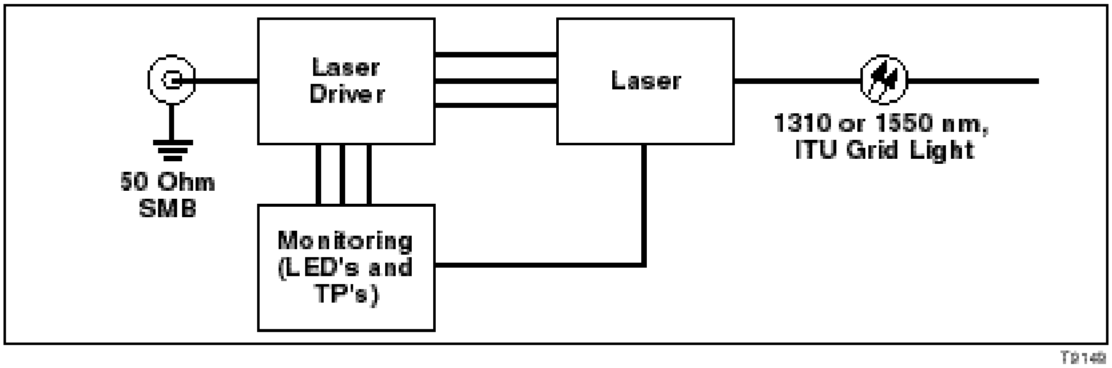
## Thermo-Electric Cooler (TEC) Loop

The TEC loop controls the laser's internal cooler and the external cooler required to maintain a constant temperature in the node over the full temperature range of -40°C and +65°C (-40°F to 149°F). The external TEC mounts to the base of the dual width module, and the laser cradle mounts on the external TEC. The TEC loop controls the temperature within ± 0.1°C.  It provides a temperature status signal to the monitoring circuit.  There is a laser temperature LED that is steady when the temperature is correct and flashes when the temperature is too high or too low.

## Functions of the Laser Module Components, Continued

### Block Diagram of the Single-wide Laser Module

This is a block diagram of the single-wide laser module.



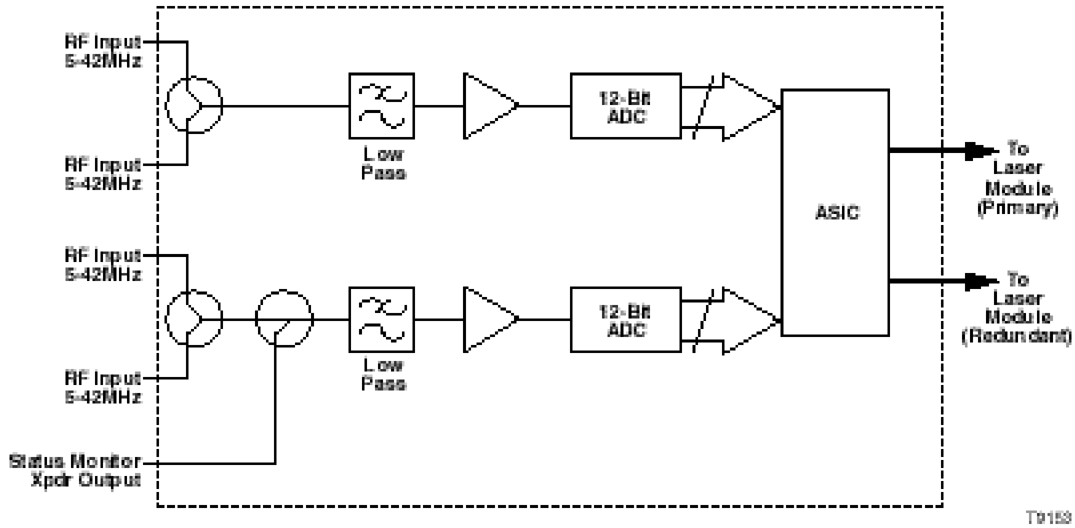

### Laser and the Laser Driver

The laser driver prebiases and modulates the laser. The laser driver accepts a 2.5 Gbps digital signal and conditions the signal to drive the laser. The laser is a 1310 nm or 1550 nm uncooled DFB or 1310 nm FP laser.

# Functions of the 2:1 Enhanced Multiplexing Digital Module Components

## Block Diagram of the 2:1 Enhanced Multiplexing Digital Module

This is a block diagram of the 2:1 enhanced multiplexing digital module.




## RF Reverse Inputs

The 2:1 enhanced multiplexing digital module has five reverse band RF inputs. All inputs are capable of passing signals from 5 MHz to 42 MHz. Four of the inputs are reverse signals from the node's four signal ports. The signals are combined in pairs to provide two composite signals. The fifth RF input is generated from the status monitor module. This input is combined to one of the composite signals. Each composite signal is low pass filtered to remove unwanted noise and reduce higher frequency energy into the passband by the analog-to-digital converter.

## Analog-To-Digital Converter (ADC)

The filtered RF signals are converted to digital signals by the ADC that samples the RF signal and converts the voltage level at a given time into a digital word representation. The ADC is subject to clipping like an analog transmitter with a much larger operating window, and in most cases limits the noise floor of the system. The performance of the link is then directly related to the performance of the ADC.

## Application Specific Integrated Circuit (ASIC)

The ASIC is responsible for framing the data and converting it to a signal that can be transmitted by the laser module. The 12-bit ADC provides its output to the ASIC in a parallel fashion. The ASIC takes this parallel data, multiplexes it with the data from the other ADC, and converts the resulting signal into a serial bit stream that is sent to the laser module.

# Operating Environment

## Overview

Before operating the node with the digital reverse modules installed, ensure that the operating environment is set according to the given standards.

## Temperature Range

The temperature requirements for the digital reverse modules are as follows:

- Ambient temperature range outside the node must be maintained between -40°C and +65°C (-40°F to 150°F).
- Storage temperature range of the digital reverse modules must be maintained between -40°C to +85°C (-40°F to 185°F).
- Humidity range must be maintained between 5% to 95% non-condensing before installation of the enhanced digital reverse modules.

# Chapter 2
# Installing the Enhanced Digital Reverse Modules in the Node

## Overview

### In This Chapter

This chapter gives recommended instructions for installing and connecting the enhanced digital reverse modules in a node.

**Important:** Perform the installation instructions only if you are upgrading the Model 6940/6944 Nodes with the enhanced digital reverse modules. If your node comes with the enhanced digital reverse modules installed, go to Chapter 3, **Reverse Balancing the Node with Digital Reverse Modules**.

This chapter is divided into two sections and contains the following topics.

| Section | Topic | See Page |
|---|---|---|
| A | Installing the Modules | 2-2 |
| B | Connecting the Modules | 2-16 |

**Important:** Depending on the type of node the enhanced digital reverse modules are installed in, make sure you have the following installation and operation guides.

- *Prisma Optical Networks Model 6940 4-Port Optoelectronic Node*, part number 592555
- *Prisma Optical Networks Model 6944 Optoelectronic Node*, part number 716068

# Section A
# Installing the Modules

## Overview

### In This Section

This section contains the following topics.

# Before You Begin

## Overview

Before you begin, make sure that you have the tools and equipment listed here.

## Required Tools

The following tools and equipment are needed to configure and install the digital reverse modules.

- ½-inch hex driver or ratchet
- Two adjustable wrenches for coaxial connectors
- Standard flat-head screwdriver
- Torque wrench, capable of settings up to 100 in-lb (11.3 Nm)

## Required Hardware

Before you install the enhanced digital reverse modules in a node, make sure the node meets the following hardware requirements.

- Six-position optical interface board
- Six-position fiber management tray

## Upgrade Kit

To upgrade a node with the enhanced digital reverse modules, you will need an upgrade kit, part number 736022. The following components are included in the upgrade kit:

- Laser module
- 2:1 enhanced multiplexing digital module
- Reverse plug-in board or the PDD board with 4 SMB connectors (used only with Model 6940 4-Port Node)
- Quad coax cable assembly, approximately 30 inches long
- Semi-rigid coax cable, approximately 16 inches long (used with double-wide laser module only)
- Status monitoring coax cable, approximately 5 inches long
- Y-configured power cable

# Opening the Housing

## Overview

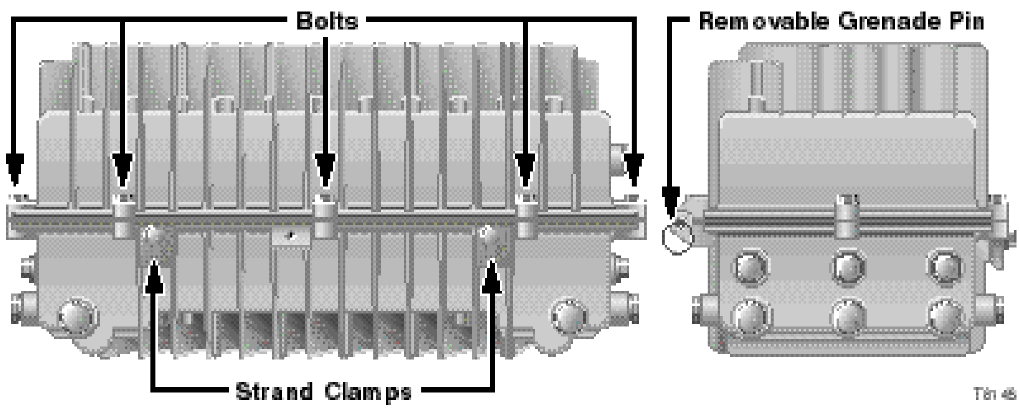
Before you install the digital reverse modules in the optical section (housing lid) of the node, you will first need to open the node housing and then unstow the fiber management tray.

## Opening the Node Housing

Follow these steps to open the node housing.

> **CAUTION:**
>
> **Before unscrewing the housing bolts, make sure the removable grenade pin in the hinge is in place and secure. The grenade pin prevents separation of the lid from the base.**

1. Unscrew the eight ½-in. closure bolts until they are loose.




2. Open the housing.

**Note:** The closure bolts will remain attached to the housing.

# Opening the Housing, Continued

## Inspecting the Inside of the Node

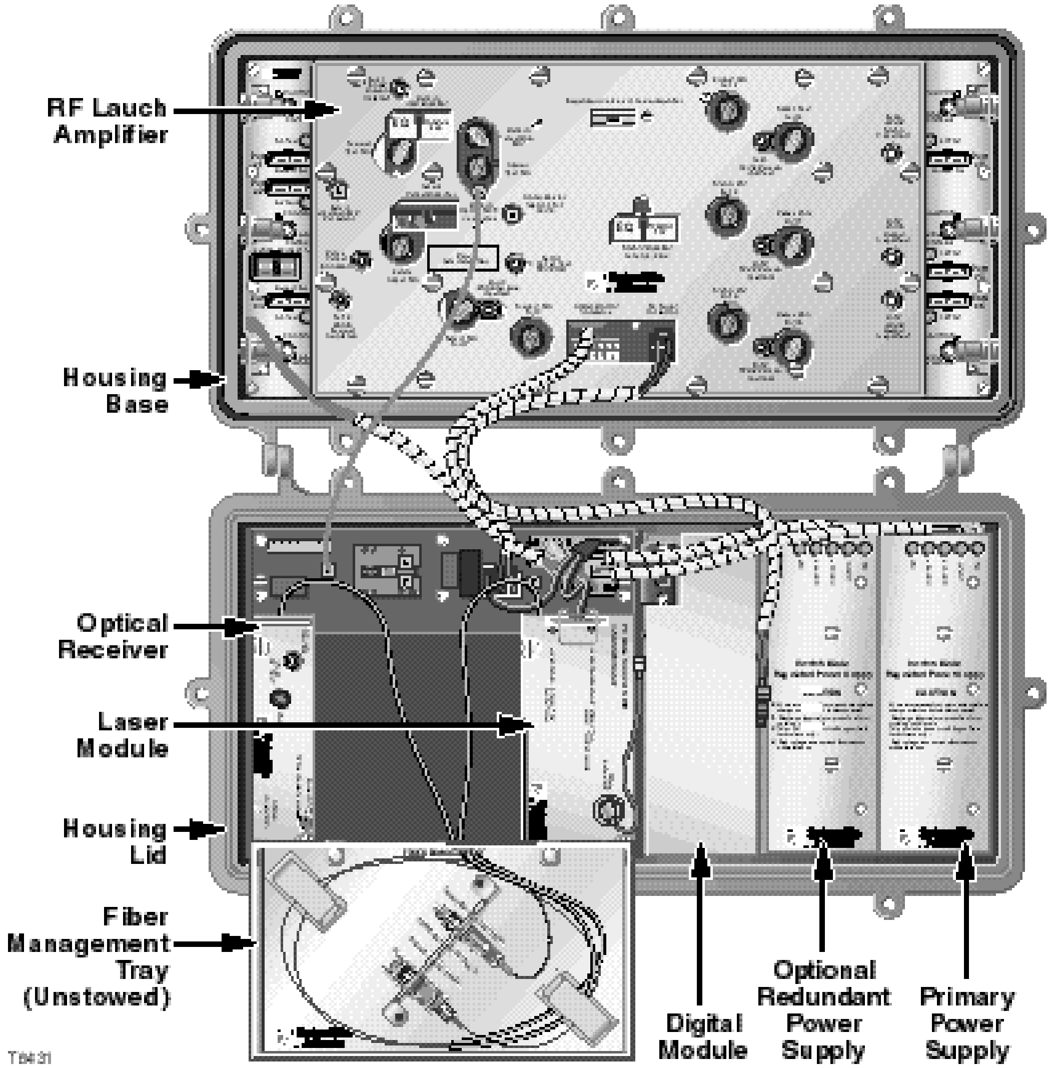
After you have opened the node housing, make sure that the internal modules in the node are not damaged. If you find any damage, contact Cisco Services.

**Important:** For more information about the internal modules in a node, refer to the following installation and operation guides.

- *Prisma Optical Networks Model 6940 4-Port Optoelectronic Node*, part number 592555
- *Prisma Optical Networks Model 6944 Optoelectronic Node*, part number 716068

**Notes:**

- This illustration shows an open node with the digital reverse modules installed in the optical section (housing lid).
- This illustration and others show the double-wide laser module only. The single-wide module is similar except for size. Instructions are the same for both.



## Removing the Status Monitor Module

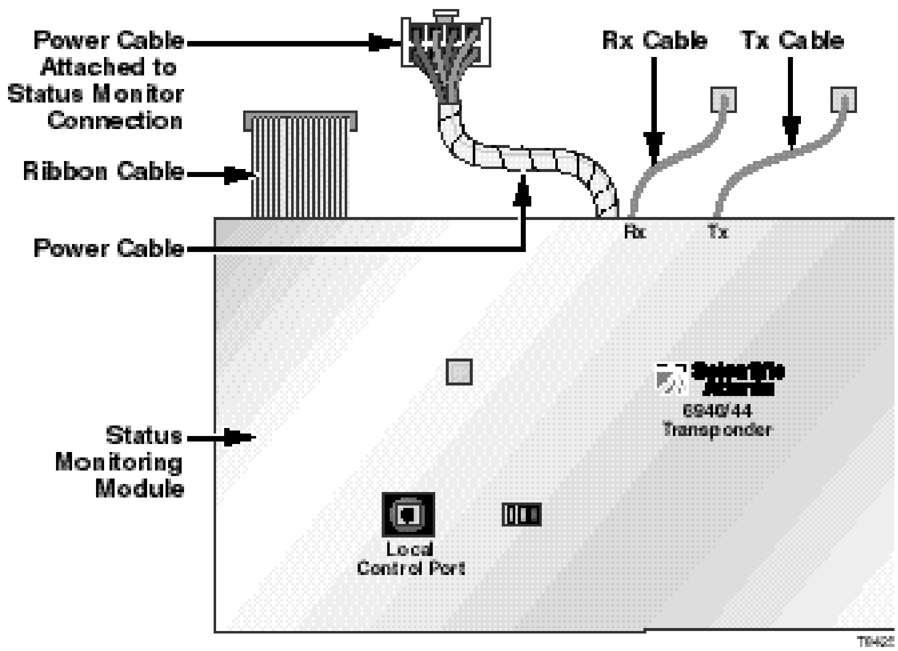
### Overview

An optional status monitor module is positioned above the fiber management tray, in the optical section (housing lid) of the node. This module plugs into the optical interface board. It has a housing tamper switch, and it monitors the DC voltages, the AC input voltage, optical transmitter and receiver power levels, node temperature, and the RF levels.

### Removing the Status Monitor Module

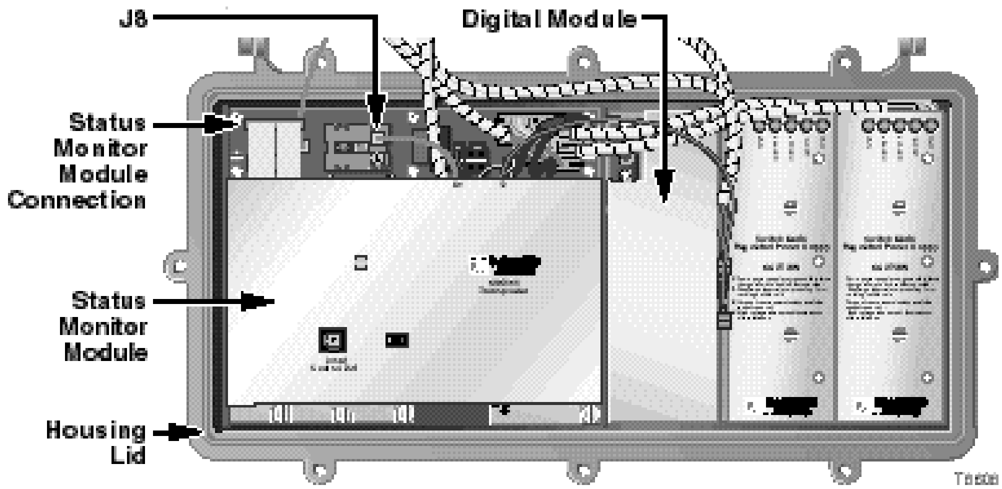
Follow these instructions to remove the status monitor module.

1. Disconnect the power cable that is attached to the status monitor module from the Status Monitor connection on the RF launch amplifier. The illustration below shows the status monitor module with the cables attached.



# Removing the Status Monitor Module, Continued

2. Disconnect the cable that is attached to the Tx (transmitter) connector on the status monitor module, from the Status Monitoring Input on the RF launch amplifier module.
3. Disconnect the cable that is attached to the Rx (receiver) connector on the status monitor module, from the J8 connector location on the J8 jumper board.




4. Disconnect the ribbon cable that is attached to the status monitor module from the Status Monitor module connection on the optical interface board.
5. Remove the status monitor module from the fiber management tray bracket.

   **Note:** Gently pull the fiber management tray bracket sides (closest to the RF section of the housing) out to allow the pins to be removed from the holes of the status monitor module.

# Unstowing the Fiber Management Tray

## Procedure to Unstow the Fiber Management Tray

The following procedures provide instructions to unstow the fiber management tray and open the plastic cover of the fiber management tray.

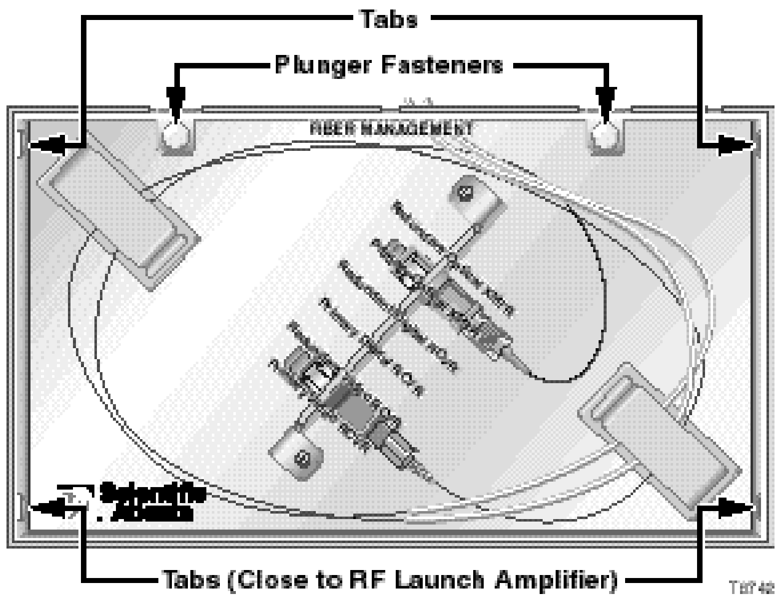
> ⚠ **WARNINGS:**
>
> **Only trained service personnel using proper safety precautions and equipment, such as protective eyewear, should disconnect and service the laser transmitter equipment.**
>
> **Laser transmitters, when disconnected from their optical fiber path emit invisible laser radiation that is harmful to the human eye. If viewed at close range, the radiation may be of sufficient power to cause instantaneous damage to the retina of the eye.**
>
> **Always wear safety glasses and use extreme caution when handling the glass chips found inside the optical fiber cladding. X-rays are unable to detect these chips when embedded in the skin.**

Follow these steps to unstow the fiber management tray.

**Important:** Be careful not to damage the fibers.

1. Locate the two tabs that fit into the holes on either side of the aluminum frames.

   **Note:** There are a total of four tabs on the fiber management tray. When the tray is in the stowed position, these two tabs are closest to the RF launch amplifier.

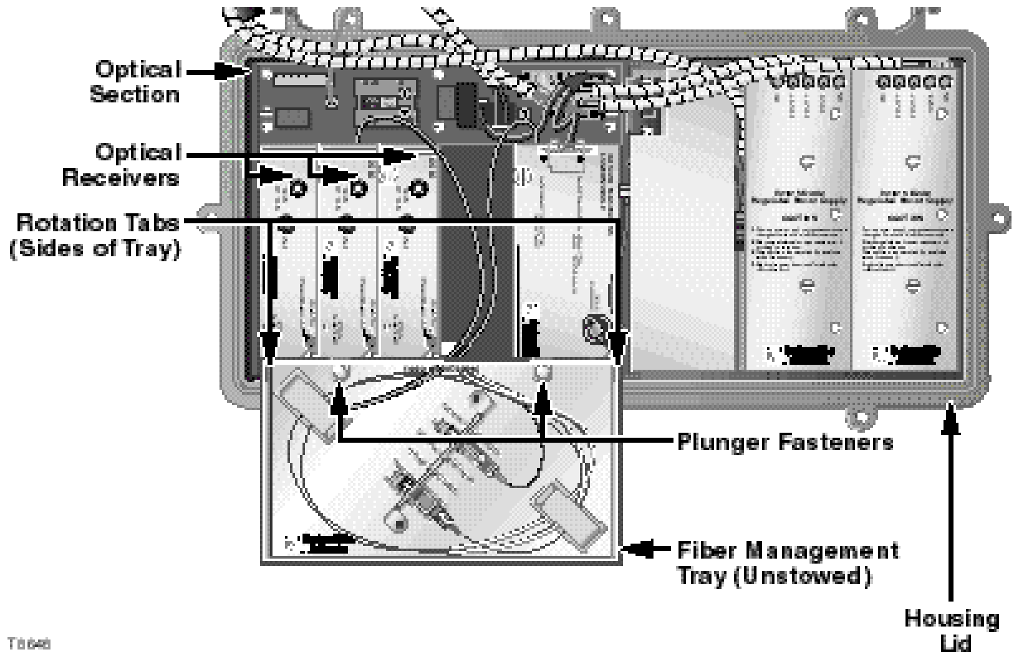



# Unstowing the Fiber Management Tray, Continued

2. Pull the aluminum frame slightly away from one side of the optical section and slip each tab out of the hole. Repeat procedure for the other side.

3. Swing the tray out from the optical section and the other two tabs rotate in their slots allowing easy access to the tray.

   **Note:** This illustration and others show the double-wide laser module only. The single-wide module is similar except for size. The instructions are the same for both.




**Result:** The fiber management tray is open and the enhanced digital reverse modules are ready to be installed in the optical section (housing lid) of the node.

## Opening the Plastic Cover of the Fiber Management Tray

Follow these steps to open the plastic cover of the fiber management tray.

1. Pull out the plunger fasteners that keep the plastic cover of the fiber management tray in place.

2. Open the clear plastic cover.

# Installing the Enhanced Digital Reverse Modules

## Overview

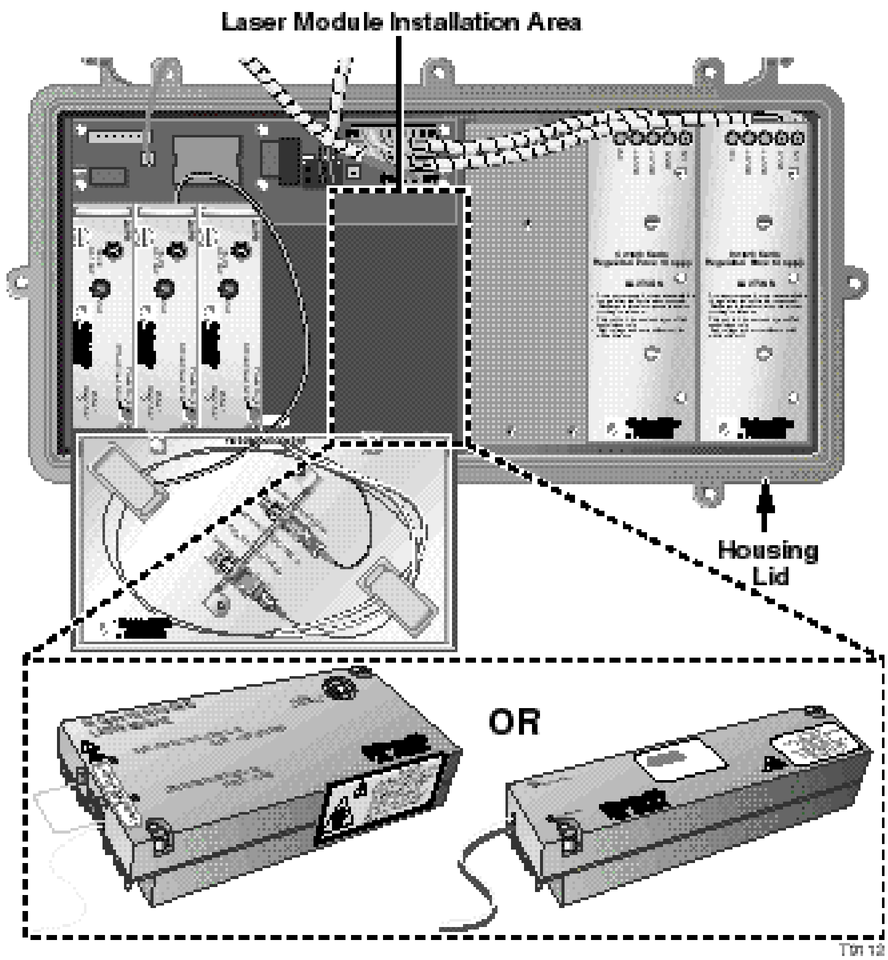
After you have opened the housing, removed the optional status monitor module, and unstowed the fiber management tray, you can install the enhanced digital reverse modules in the optical section (housing lid) of the node.

**Important Notes**:

- If a reverse transmitter has been previously installed in the node, it must be removed prior to the installation of the digital laser module.
- The Model 6944 Optical Node must be equipped with the six-position optical interface board.
- The installation of the enhanced digital reverse modules in a Model 6944 Optical Node is similar to the Model 6940 4-Port Node.

## Laser Module Installation Location

This illustration shows the location where the double-wide and the single-wide laser module is installed in the optical section (housing lid) of the node.



# Installing the Enhanced Digital Reverse Modules, Continued

## Installing the Laser Module

Follow these steps to install the laser module in the optical section (housing lid) of the node.

1. Align the laser module on the optical interface board.
2. Push the laser module in the slot and ensure that the module is seated properly.

**Notes:**

- The double-wide laser module occupies two transmitter slots in the node.
- The single-wide laser module occupies one transmitter slot in the node.
- Space limitation may require you to make cable connections prior to seating the laser module, refer to **Connecting the Modules**, Section B of this chapter.

⚠ **WARNINGS:**

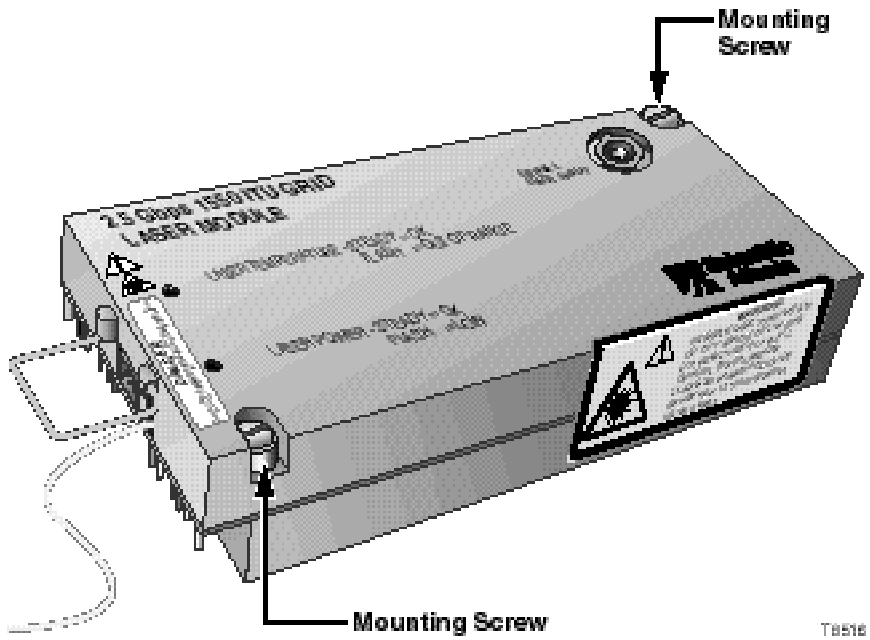
**Connect the power cable (double-wide laser module only) after the fiber connections have been made and are secure in the fiber management tray.**

**Laser transmitters when disconnected from their optical fiber path emit invisible laser radiation, which is harmful to the human eye. If viewed at close range, the radiation may be of sufficient power to cause instantaneous damage to the retina of the eye. Only trained service personnel using proper safety precautions and equipment, such as protective eyewear, should disconnect and service the laser transmitter equipment.**

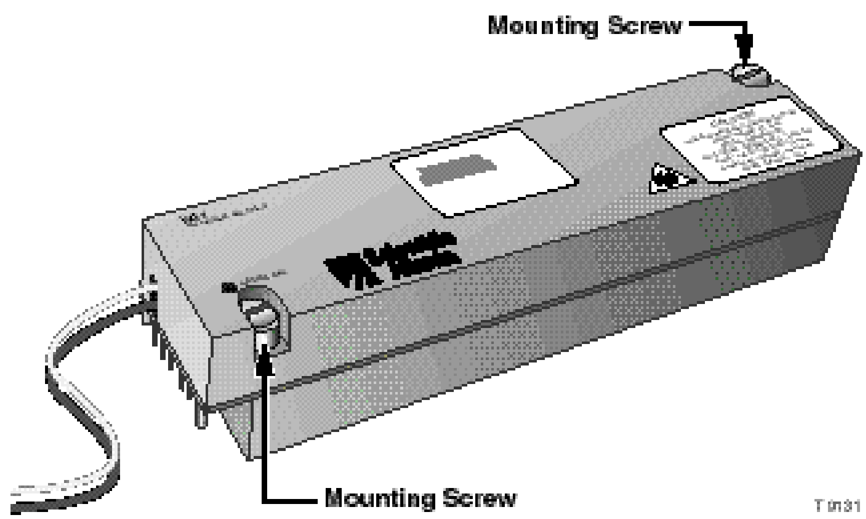
# Installing the Enhanced Digital Reverse Modules, Continued

3. Using a flat-blade screwdriver, torque the two mounting screws from 15 in-lbs to 20 in-lbs (1.7 Nm to 2.3 Nm).

**Double-wide Laser Module**




**Single-wide Laser Module**

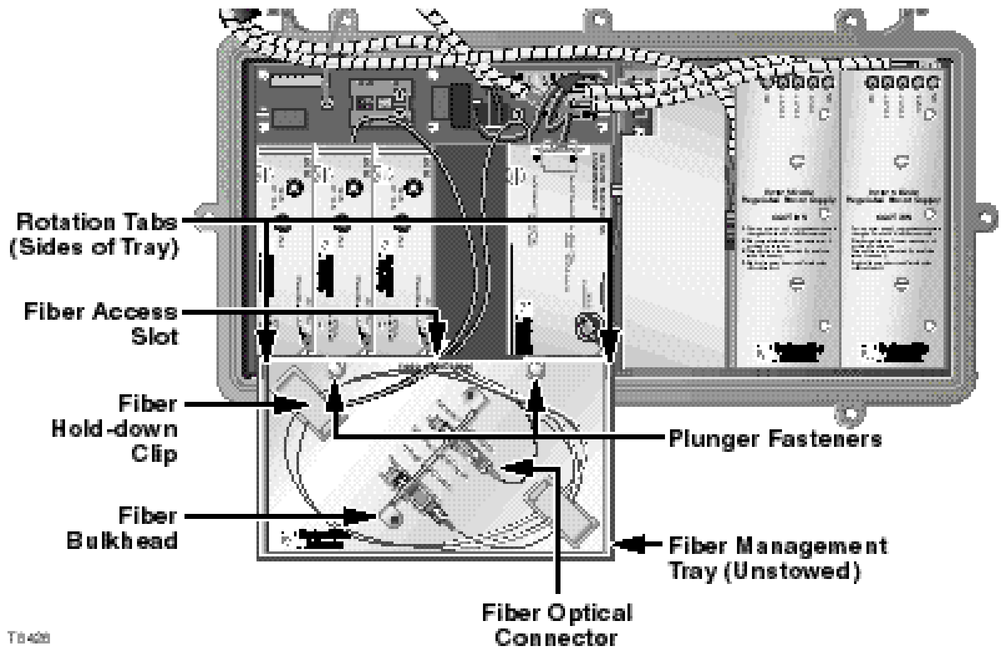


# Installing the Enhanced Digital Reverse Modules, Continued

4. Route the optical fiber through the fiber access slot located between the tabs in the fiber management tray.

   **Notes:**

   - Route the excess fiber loosely through the fiber hold-down clips.
   - This illustration shows the double-wide laser module only.



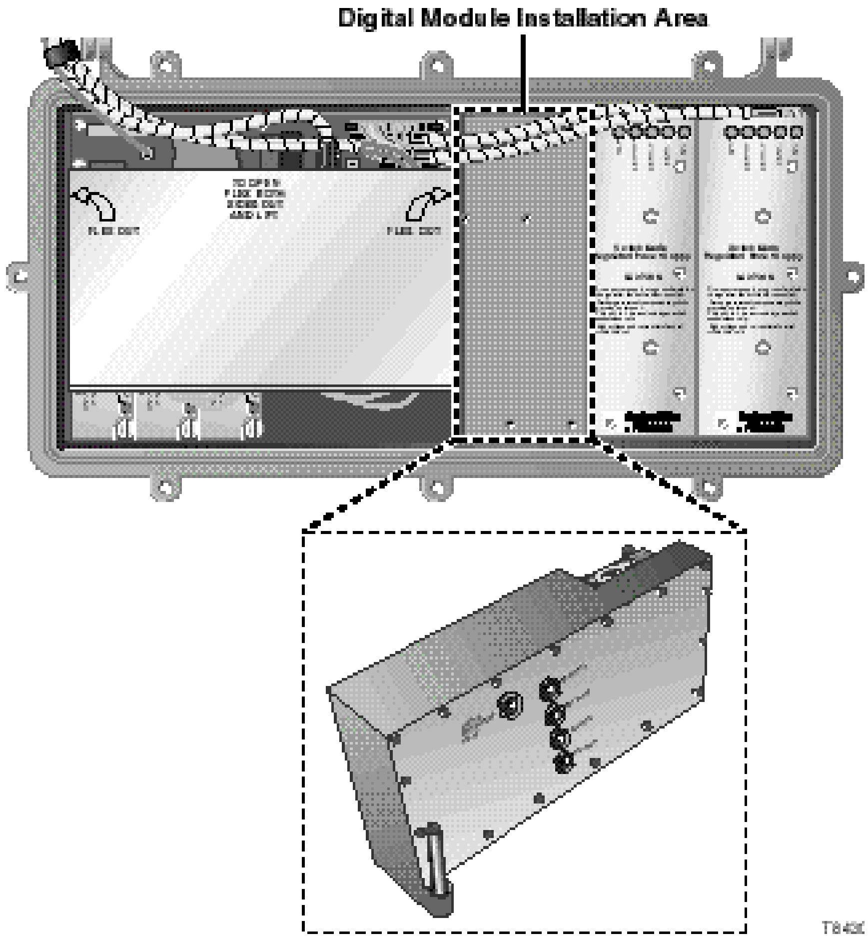

5. Insert the optical fiber into the fiber bulkhead location marked **Primary Optical XMTR**.

6. To connect the laser module, refer to **Connecting the Modules,** Section B of this chapter.

# Installing the Enhanced Digital Reverse Modules, Continued

## 2:1 Enhanced Multiplexing Digital Module Installation Location

This illustration shows the location where the 2:1 enhanced multiplexing digital module is installed in the optical section (housing lid) of the node.



# Installing the Enhanced Digital Reverse Modules, Continued

## Installing the 2:1 Enhanced Multiplexing Digital Module

Follow these steps to install the 2:1 enhanced multiplexing digital module.

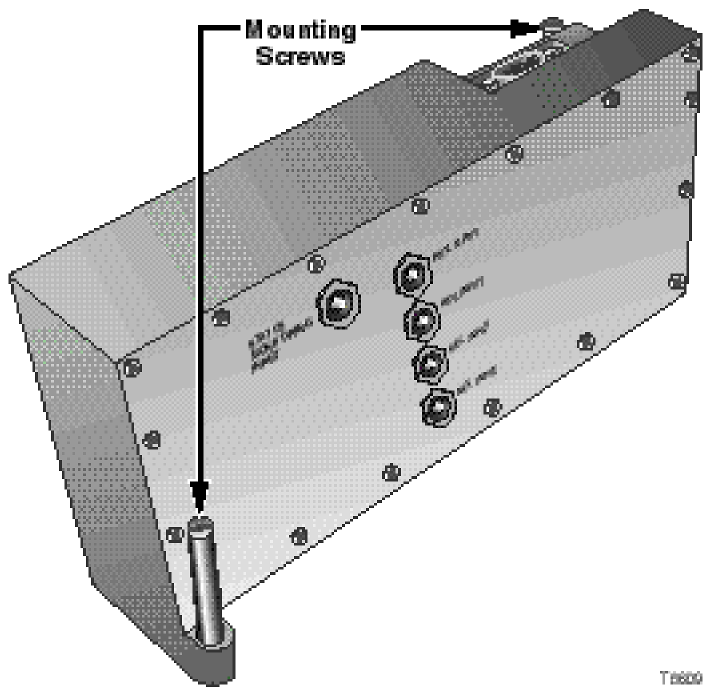
1. Using a blunt flat-edge screwdriver, pry off the cable hold-down clip from the housing where the 2:1 enhanced multiplexing digital module is to be installed.

2. Insert the 2:1 enhanced multiplexing digital module into the housing lid adjacent to the six-position optical interface board.

   **Note:** Ensure that the DB 9-connector end of the 2:1 enhanced multiplexing digital module points toward the lid hinges and the RF ports face the power supply.

3. Using a flat blade screwdriver, torque the mounting screws from 15 in-lbs to 20 in-lbs (1.7 Nm to 2.3 Nm).

   **Note:** If the node is equipped with two power supplies, the cable connections should be made prior to securing the mounting screws, refer to **Connecting the Modules,** Section B of this chapter.




4. To connect the 2:1 enhanced multiplexing digital module, refer to **Connecting the Modules**, Section B of this chapter.

# Section B
# Connecting the Modules

## Overview

### In This Section

This section contains the following topics.

# Serial Data Connection

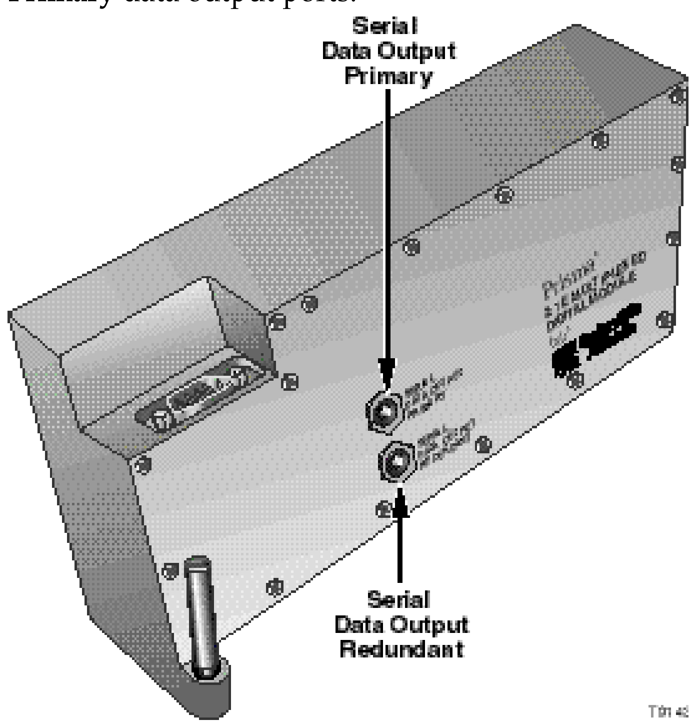
## Overview

The following procedures detail how to interconnect the modules to the node. Perform these procedures with the housing open, the optional status monitor module removed, and the fiber management tray unstowed.

## Serial Data Interconnection

Follow these steps to make the serial data interconnection.

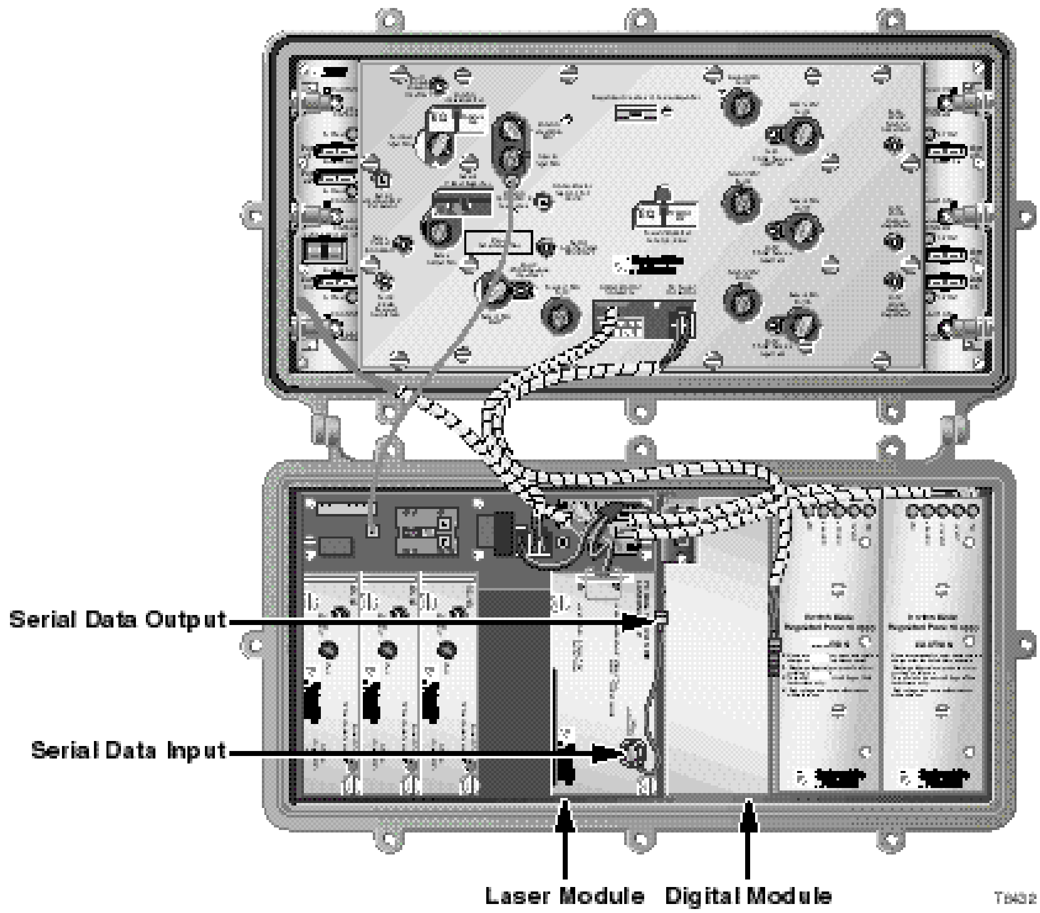
1. **Double-wide Laser Module:**
   Connect one end of the semi-rigid coax cable to the **Serial Data Output Primary** connection on the 2:1 enhanced multiplexing digital module. Terminate the redundant serial data output connection.
   **Single-wide Laser Module:**
   The 16″ semi-rigid coax cable is not used to connect the single-wide laser module to the 2:1 enhanced multiplexing digital module. One end of a semi-rigid coax cable is permanently attached to the single-wide laser module. Connect the other end of this cable to the **Serial Data Output Primary** connection on the 2:1 enhanced multiplexing digital module. Terminate the redundant serial data output connection.
   **Note:** If you're using two laser modules, connect both the **Redundant** and **Primary** data output ports.




2. Route the semi-rigid coax cable along the side of the 2:1 enhanced multiplexing digital module, away from the housing lid hinges and around the fiber tray bracket to the **Serial Data Input** on the laser module (double-wide laser module only).
   **Note:** There is ample space by the side of the 2:1 enhanced multiplexing digital module to store the extra length of cable.

3. Insert the other end into the **Serial Data Input** connection on the double-wide laser module. Refer to this illustration for serial data interconnection.

   **Note:** This illustration and others show the double-wide laser module only. The single-wide module is similar except for size. Instructions are the same for both.



# RF Interconnections for Model 6940 4-Port Node

## Cable Color Coding Scheme for Model 6940 4-Port Node

This table gives the factory default cable color coding scheme used to differentiate the cables for the four RF connectors in the Model 6940 4-Port Node.

| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 3 | White | Top |
| Port 4 | Blue | Second to top |
| Port 5 | Black | Second to bottom |
| Port 6 | Green | Bottom |

**Notes:**

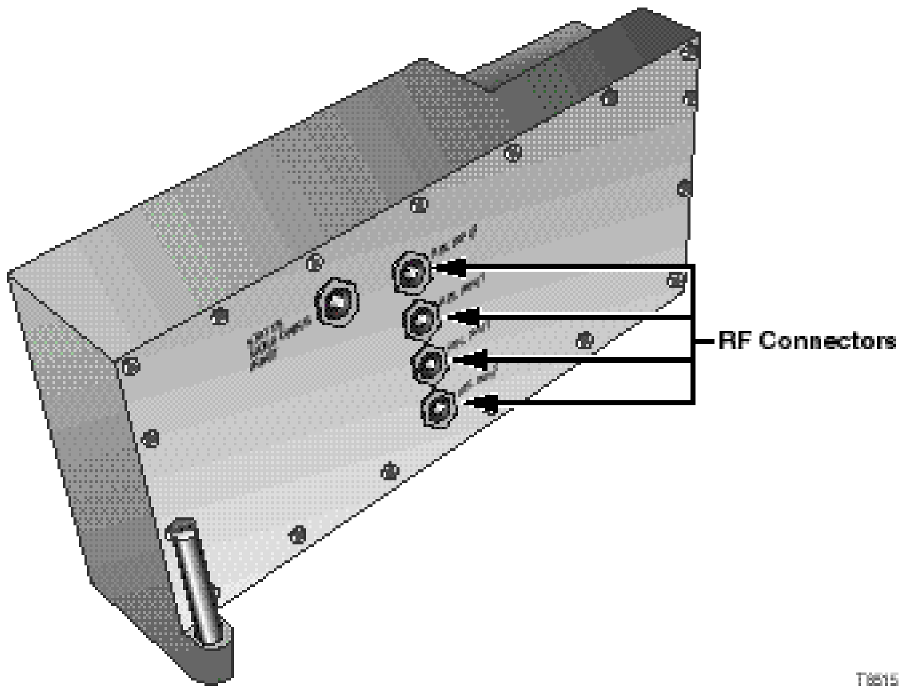
- If the above cable color code recommendation is followed, then the blue and white cables connect to ports 3 and 4 whose reverse paths are combined. The black and green cables connect to ports 5 and 6 whose reverse paths are combined.
- The opposite end of these colored coax cables should be connected to the node ports whose reverse paths are to be combined.
- Internally, the signals of the two lower RF input connections of the 2:1 enhanced multiplexing digital module are combined to provide a single RF signal. Similarly, the signals of the two top RF input connections of the 2:1 enhanced multiplexing digital module are combined and further coupled with the Status Monitoring Input signal to provide a second RF signal. Refer to the **Block Diagram of the 2:1 Enhanced Multiplexing Digital Module** in Chapter 1.
- In order to better balance the reverse path signals, the ports can be connected differently than shown in the table above. The following table gives an example of connecting the ports differently.

| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 3 | White | Top |
| Port 5 | Black | Second to top |
| Port 4 | Blue | Second to bottom |
| Port 6 | Green | Bottom |

### Interconnecting the Model 6940 4-Port Node

Follow these steps to make RF interconnections in the Model 6940 4-Port Node.

1. Insert the four SMB connectors in the RF connections on the 2:1 enhanced multiplexing digital module in the order recommended for port combining.

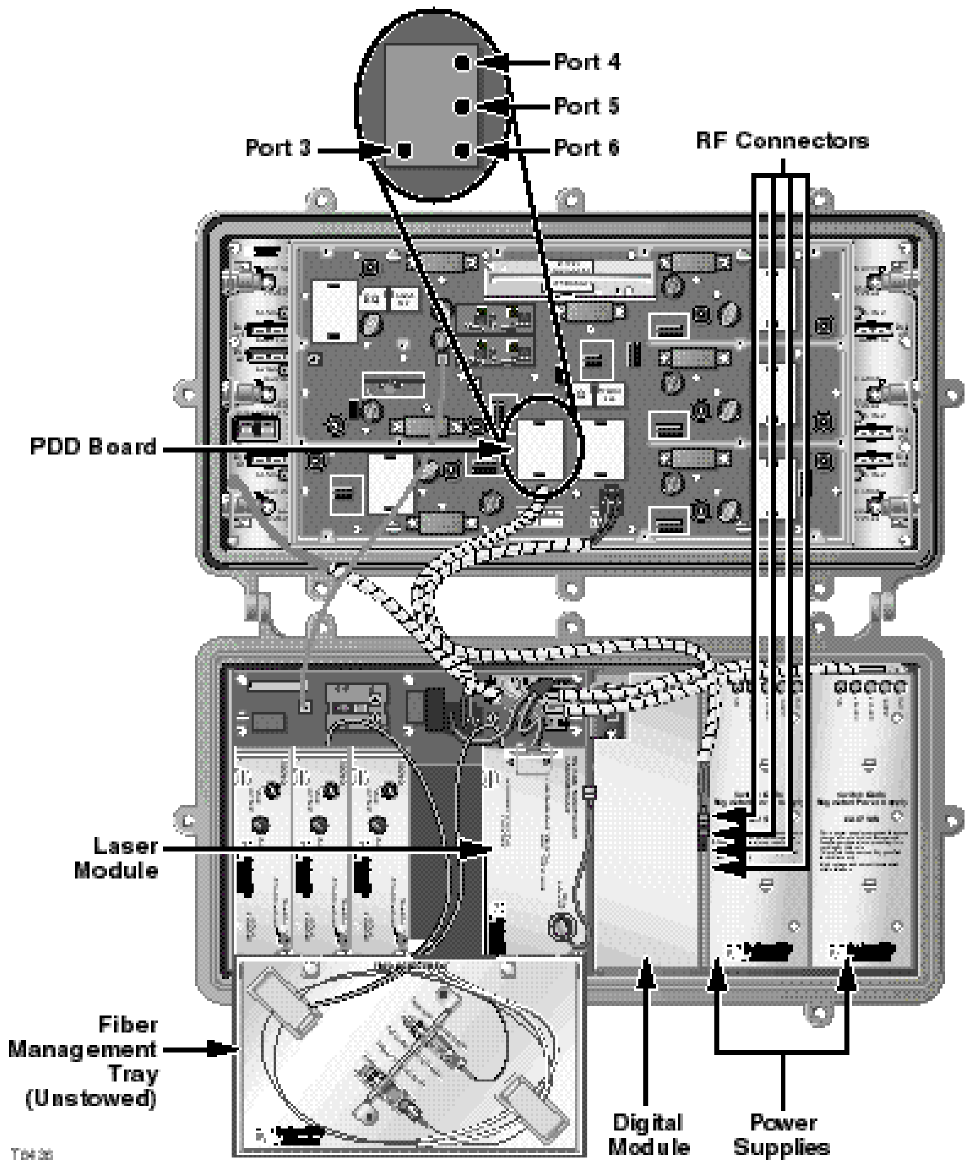



2. Remove the RF launch amplifier cover by loosening the four long screws, the center hold-down screw, and the fourteen spring-loaded screws that always remain attached to the RF launch amplifier cover.
3. Remove the plug-in PDD board from the RF launch amplifier.

4. Plug in the reverse plug-in board with the four SMB connectors on the PDD board.
5. Connect the connectors of the quad coax assembly to the PDD board in the order recommended for port combining.

   **Notes:**

   - Insert the quad coax assembly through the square opening of the RF launch amplifier cover prior to making the connections.
   - This illustration shows the double-wide laser module only. The single-wide module is similar except for size. Instructions are the same for both.




6. Attach the RF launch amplifier cover and tighten the screws firmly.

# RF Interconnections for Model 6944 Optical Node

## Cable Color Coding Scheme for Model 6944 Optical Node

This table gives the factory default cable color coding scheme used to differentiate the cables for the four RF connectors in the Model 6944 Optical Node.

| Port Identifier on the Node | Cable Color Code | Connection on the 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 1 | Blue | Top |
| Port 3 | White | Second to top |
| Port 4 | Black | Second to bottom |
| Port 6 | Green | Bottom |

**Notes:**

- If the above color code recommendation is followed, then the black and green cables connect to ports 4 and 6 whose reverse paths are combined. The blue and white cables connect to ports 1 and 3 whose reverse paths are combined.
- The opposite end of the colored coax cables should be connected to the node ports whose reverse paths are to be combined.
- Internally, the signals of the two lower RF input connections are combined to provide a single RF signal. Similarly, the signals of the two top RF input connections of the 2:1 enhanced multiplexing digital module are combined and further coupled with the Status Monitoring Input signal to provide a second RF signal. Refer to the **Block Diagram of the 2:1 Enhanced Multiplexing Digital Module** in Chapter 1.
- In order to better balance the reverse path signals, the ports can be connected differently than shown in the table above. The following table gives an example of connecting the ports differently.

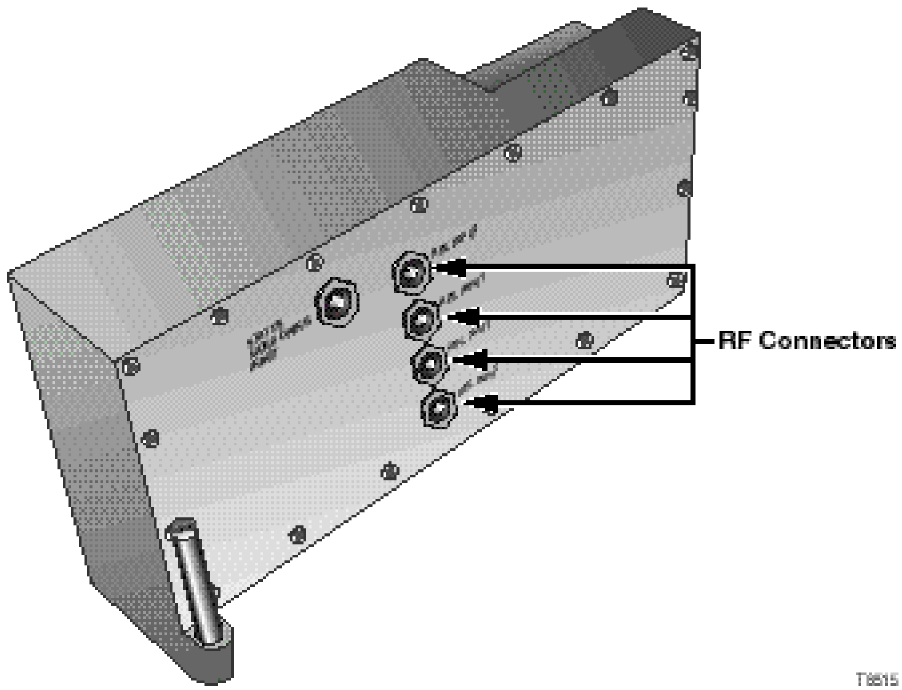
| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 1 | Blue | Top |
| Port 4 | Black | Second to top |
| Port 3 | White | Second to bottom |
| Port 6 | Green | Bottom |

# RF Interconnections for Model 6944 Optical Node, Continued

## Interconnecting the Model 6944 Optical Node

Follow these steps to make RF interconnections in the Model 6944 Optical Node.

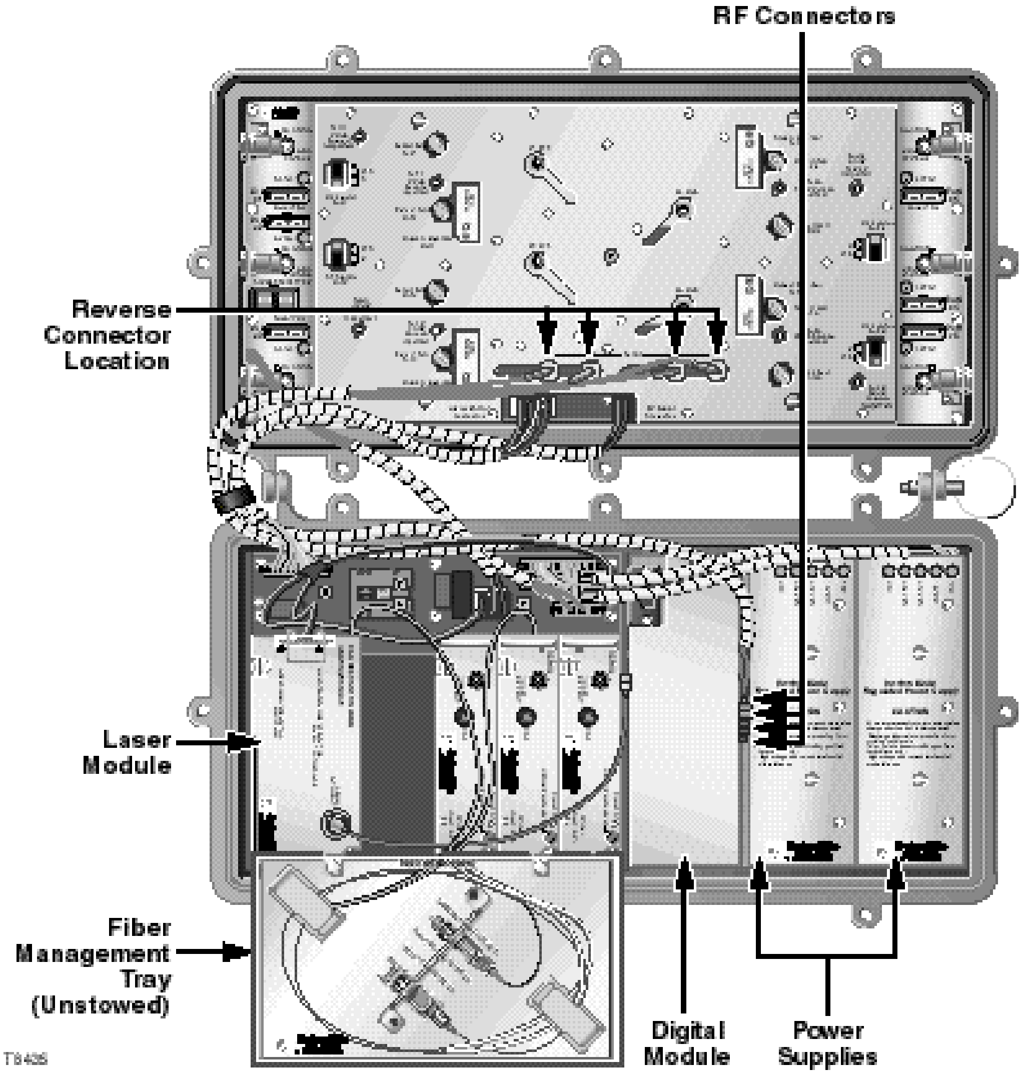
1. Insert the four SMB connectors in the RF connections on the 2:1 enhanced multiplexing digital module in the recommended order for port combining.




2. Route the other end of the four SMB connections to the RF launch amplifier.

3. Insert the four SMB connections in the reverse connector location on the RF launch amplifier**.**

**Note:** This illustration and others shows the double-wide laser module only. The single-wide module is similar except for size. Instructions are the same for both.



## DC Connection

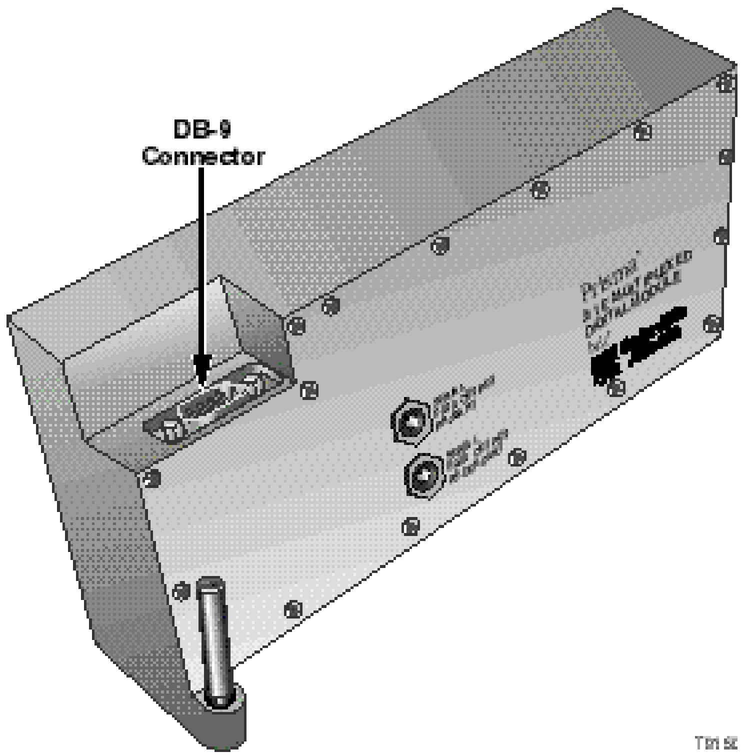
### DC Interconnection

Follow these steps for DC interconnections.

**Note:** One end of the DC power cable is Y-configured.

1. Connect the right angle DB-9 connector on the 2:1 enhanced multiplexing digital module.

   **Note:** Secure the screws located on either side of the DB-9 connector.

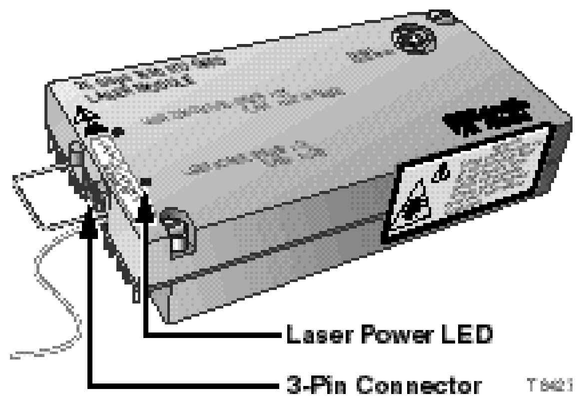


# DC Connection, Continued

2. Insert one end of the Y-configured cable at the 3-pin connector location on the laser module (double-wide only) connector location next to the optical fiber.

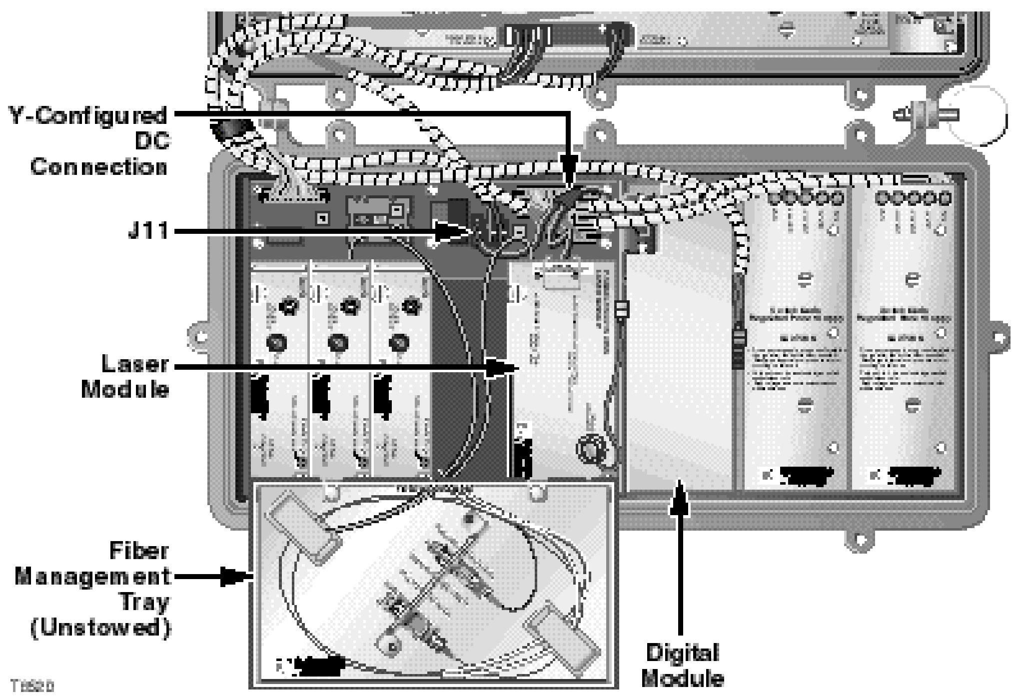
   **Important:** This will activate the laser in the laser module, therefore the connection should be made after the optical fiber connections have been made and secured in the fiber management tray.

   **Note:** The single-wide laser module does not require a connection to the Y-configured cable.




3. Insert the other end of the Y-configured cable in the J11 connector location on the optical interface board.

   **Note:** The following illustration shows the Y-configured DC connection.



# Stowing the Fiber Management Tray

## Overview

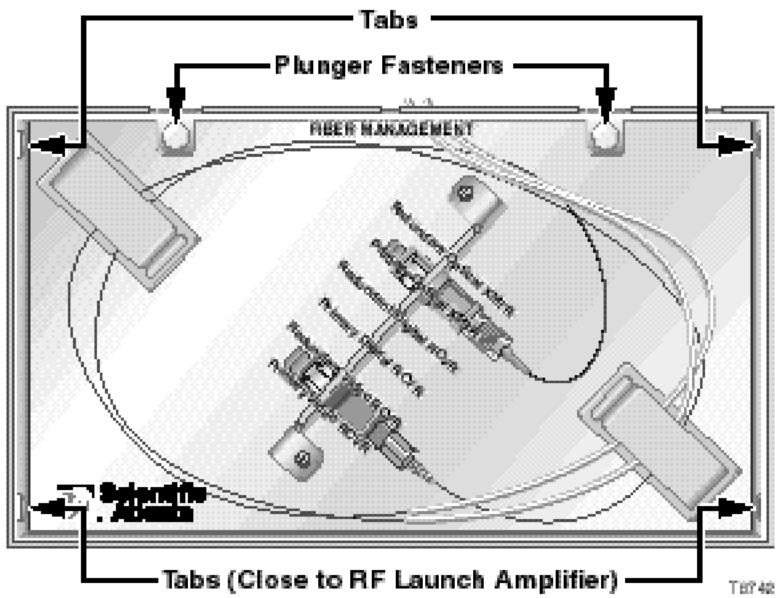
After you complete installing the enhanced digital reverse modules and making connections, you need to stow the fiber management tray, install the optional status monitor module, and close the node housing.

## Stowing the Fiber Management Tray

Follow these steps to close the cover and stow the fiber management tray.

1. Make sure the two plunger fasteners are in an up position.
2. Push the clear plastic cover down immediately next to the nylon plunger.

   **Note:** The plunger fasteners will snap into place.



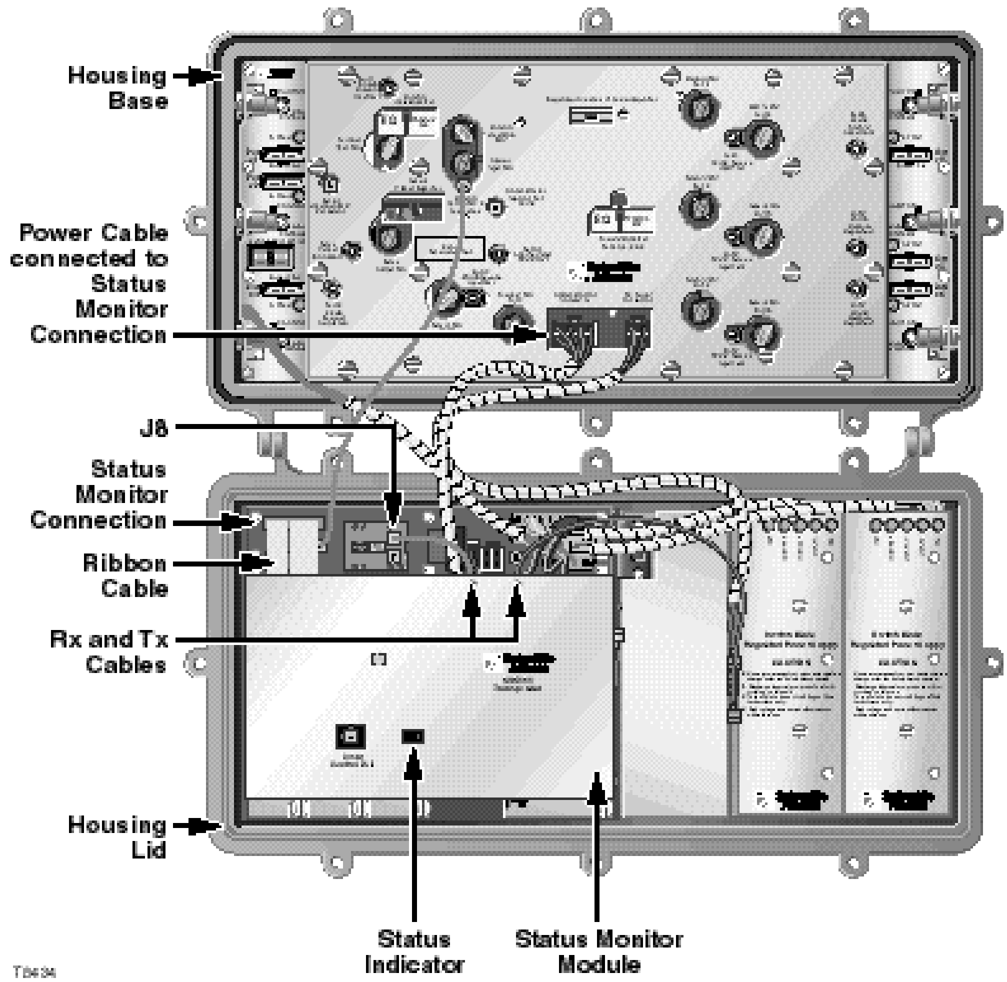

3. Secure the plunger fasteners by pushing the fasteners down.
4. Place the tray in the stowed position.
5. Replace the tabs into the holes on either side of the aluminum frames.

## Status Monitoring Connection

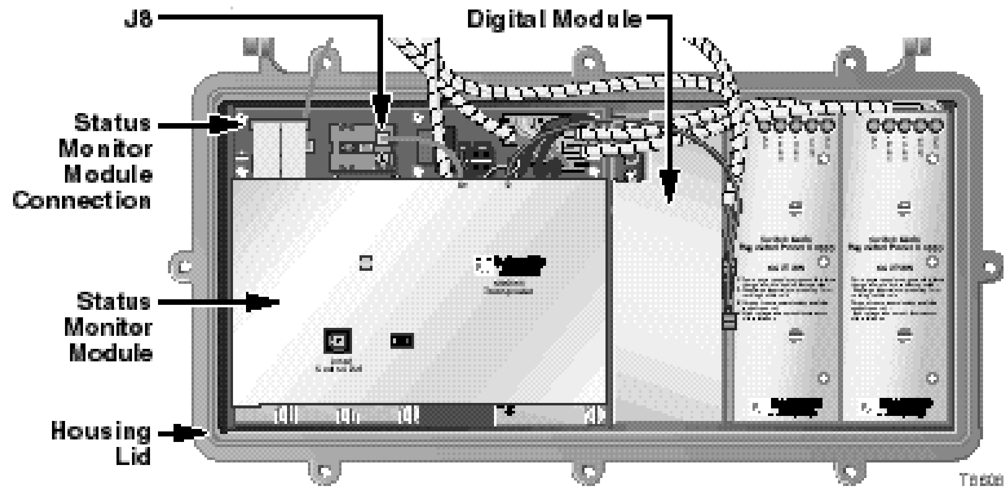
### Installing and Connecting the Status Monitor Module to the Node

Follow these steps to install and connect the status monitor module to the node.

1. Align the status monitor module to the optical interface board.
2. Insert the status monitor module on the optical interface board.
3. Connect the ribbon cable that is attached to the status monitor module to the Status Monitor module connection on the optical interface board.



4. Connect the cable that is attached to the Rx (receiver) connector on the status monitor module to the J8 connector location on the J8 jumper board.




5. Connect the cable that is attached to the Tx (transmitter) connector on the status monitor module to the Status Monitoring Input on the 2:1 enhanced multiplexing digital module using the status monitoring coax cable provided with the enhanced digital reverse modules.

6. Connect the power cable that is attached to the status monitor module to the Status Monitor connection on the RF launch amplifier.

   **Results:**

   - The Status Indicator on the status monitor module illuminates to indicate the unit has power.
   - The Status Indicator flickers when the status monitor module is communicating with the status monitoring system.

7. Route all cables to ensure they are not damaged when the housing is closed.

# Closing the Housing

## Closing the Node Housing

Follow these steps to close the node housing.

1. Make sure the housing gaskets are clean and in the correct position, and all the cables are properly routed.
2. Close the housing.

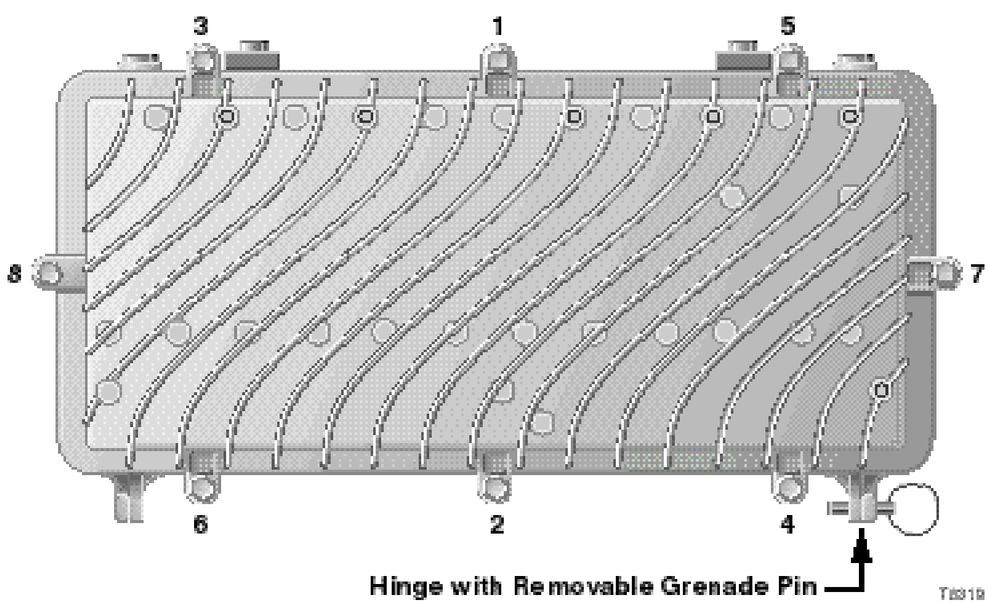
> ⚠ **CAUTION:**
>
> **Ensure all the cables are out of the way when closing the housing.**

3. Lightly secure the eight ½-in. closure bolts with a hex driver or ratchet.
4. Using a torque wrench, tighten the eight closure bolts to 25 in-lb (2.8 Nm).

   **Important:** Refer to **Torquing Sequence** for proper torquing sequence.
5. Using the same pattern, tighten the closure bolts from 60 in-lb to 70 in-lb (6.8 Nm to 7.9 Nm).

## Torquing Sequence

The following diagram shows the proper torquing sequence for closing the housing.



# Chapter 3
# Reverse Balancing the Node with the Enhanced Digital Reverse Modules

## Overview

### In This Chapter

This chapter explains the reverse balancing procedures for the node with the digital reverse modules.

⚠ **CAUTION:**

**Never attempt to reconfigure the unit beyond its normal setup. Changes to the node's configuration may cause degradations that affect its performance. Do not use digital carrier measurement to set up the forward or reverse paths. Familiarize yourself with your cable system's specifications before performing the setup.**

This chapter contains the following topics.



**Important:** To setup and balance the enhanced digital reverse modules with the Model 6940 4-Port Node or the Model 6944 Optical Node, make sure you have the following installation and operation guides.

- *Prisma Optical Networks Model 6940 4-Port Optoelectronic Node,* part number 592555
- *Prisma Optical Networks Model 6944 Optoelectronic Node,* part number 716068

# Preparing for Reverse Balancing

## Note for Reverse Path

When balancing the reverse path, reference your system design print for the required reverse signal level. Use appropriate padding and equalization to provide proper signal level to the reverse transmitter.

## Baseband Digital Reverse Balancing

Baseband digital reverse technology is designed to carry reverse path signals from 5 MHz to 42 MHz. This technology digitizes the analog input and then sends a high-speed serial bitstream over fiber to a digital receiver at the link end. By converting the analog RF band to a digital format, two full bandwidth digital links can be multiplexed together over the same fiber and recovered at the receiver.

There are a variety of test equipment combinations that enable proper balancing of the reverse path. Regardless of the type of equipment used, the balancing process is fundamentally the same.

A reverse RF test signal (or signals) of known amplitude is injected into the RF path at the RF input of the node. The reverse transmitter converts the RF test signal(s) to an optical signal and transmits it to the headend (or hub site) via fiber optic cable. At the headend, the reverse optical receiver converts the optical signal back to an RF signal which is then routed out through the receiver's RF output. The amplitude of the injected test signal must be monitored at the receiver's output, and compared to the expected (design value) amplitude.

## Method of Generating and Monitoring Test Signals

The reverse RF test signals that are injected into the reverse path of the RF launch amplifier being balanced may be generated by the following method.

- Multiple CW signal (tone) generator
- Reverse sweep transmitter

The amplitude of the received test signals at the output of the reverse optical receiver in the headend or hub may be measured and monitored using the following:

- Spectrum analyzer (when using a CW generator for test signals)
- Signal level meter (when using a CW generator for test signals)
- Reverse sweep receiver (when using a reverse sweep transmitter for test signal)

The variance in relative amplitude of the received signal from desired (reference) may be relayed to the field technician via the following:

- Radio (by a second technician in the headend/hub who is monitoring a spectrum analyzer or signal level meter)
- A dedicated forward TV channel, whose associated modulator has its video input being generated by a video camera focused on the spectrum analyzer display
- An associated forward data carrier (if using a particular type of reverse sweep system)

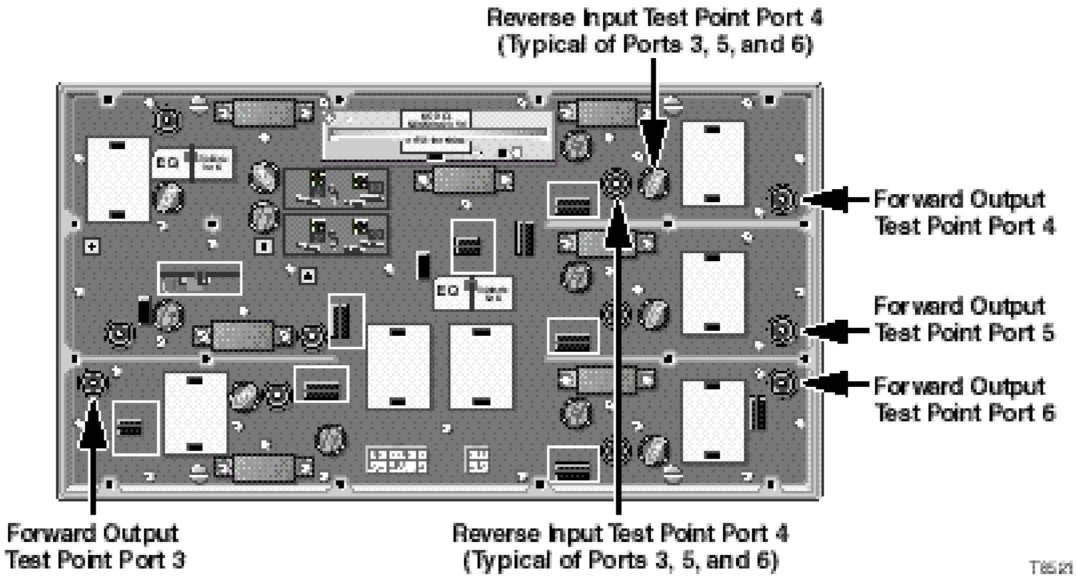
If a portable reverse sweep generator with built-in forward data receiver is used to generate the reverse test signals, only one technician is required to perform the balancing. This type of system is becoming increasingly popular due to its ease of use.

In this case, the sweep system includes a combination reverse sweep receiver and forward data transmitter, which is located in the headend/hub. The frequency response characteristics of the received sweep signal (including relative amplitude and tilt) are converted by the headend sweep receiver to a data format, and transmitted in the forward RF path as a data carrier (by combining it into the forward headend combiner). The portable sweep generator/data receiver that is injecting the test signal into the RF launch amplifier's reverse path in the field is simultaneously receiving the incoming data carrier via the forward RF path. The incoming data is converted back to a sweep display that represents what is being received by the headend unit.

# Preparing for Reverse Balancing, Continued

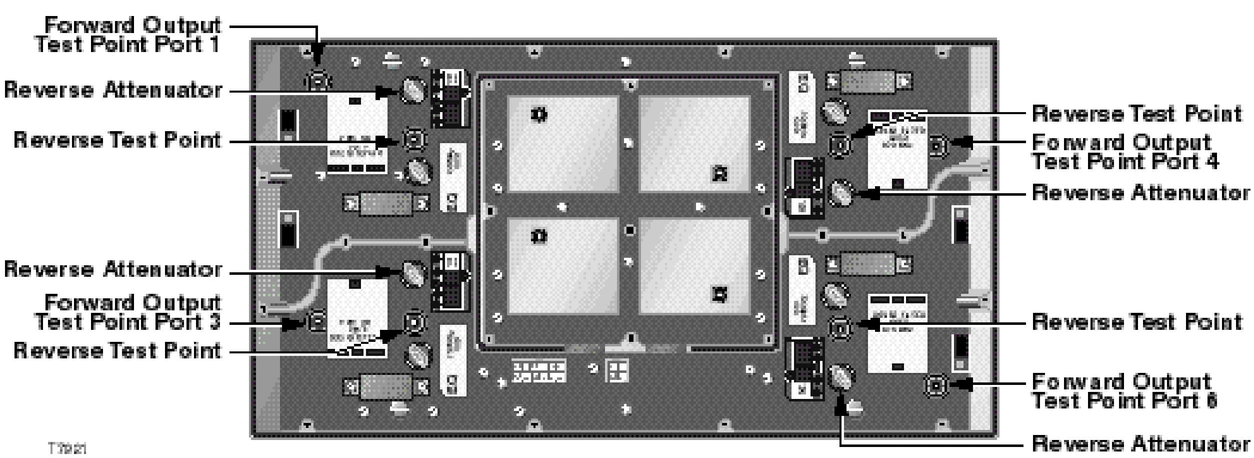
## Reverse Test Points and Accessories for the Model 6940 4-Port Node

This illustration shows the reverse test point and accessory in the Model 6940 4-Port Node.




## Reverse Test Points and Accessories for the Model 6944 Optical Node

This illustration shows the reverse test points and accessories in the Model 6944 Optical Node.



# Port Combination Options

## Factory Default Port Combination in the Model 6940 4-Port Node

This table gives the factory default port combination scheme in the Model 6940 4-Port Node.

| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 3 | White | Top |
| Port 4 | Blue | Second to top |
| Port 5 | Black | Second to bottom |
| Port 6 | Green | Bottom |

**Notes:**

- If the above cable color code recommendation is followed, then the blue and white cables connect to ports 3 and 4 whose reverse paths are combined. The black and green cables connect to ports 5 and 6 whose reverse paths are combined.
- The opposite end of these colored coax cables should be connected to the node ports whose reverse paths are to be combined.
- Internally, the signals of the two lower RF input connections of the 2:1 enhanced multiplexing digital module are combined to provide a single RF signal. Similarly, the signals of the two top RF input connections of the 2:1 enhanced multiplexing digital module are combined and further coupled with the Status Monitoring Input signal to provide a second RF signal. Refer to the **Block Diagram of the 2:1 Enhanced Multiplexing Digital Module** in Chapter 1.

## Port Combination Option in the Model 6940 4-Port Node

In order to better balance the reverse path signals, the ports can be connected differently than shown in the table above. The following table gives an example of connecting the ports differently.

| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 3 | White | Top |
| Port 5 | Black | Second to top |
| Port 4 | Blue | Second to bottom |
| Port 6 | Green | Bottom |

# Port Combination Options, Continued

## Factory Default Port Combination in the Model 6944 Optical Node

This table gives the factory default cable color coding scheme used to differentiate the cables for the four RF connectors in the Model 6944 Optical Node.

| Port Identifier on the Node | Cable Color Code | Connection on the 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 1 | Blue | Top |
| Port 3 | White | Second to top |
| Port 4 | Black | Second to bottom |
| Port 6 | Green | Bottom |

**Notes:**

- If the above color code recommendation is followed, then the black and green cables connect to ports 4 and 6 whose reverse paths are combined. The blue and white cables connect to ports 1 and 3 whose reverse paths are combined.
- The opposite end of the colored coax cables should be connected to the node ports whose reverse paths are to be combined.
- Internally, the signals of the two lower RF input connections are combined to provide a single RF signal. Similarly, the signals of the two top RF input connections of the 2:1 enhanced multiplexing digital module are combined and further coupled with the Status Monitoring Input signal to provide a second RF signal. Refer to the **Block Diagram of the 2:1 Enhanced Multiplexing Digital Module** in Chapter 1.

## Port Combination Option in the Model 6944 Optical Node

In order to better balance the reverse path signals, the ports can be connected differently than shown in the table above. The following table gives an example of connecting the ports differently.

| Port Identifier on the Node | Cable Color Code | Connection on 2:1 Enhanced Multiplexing Digital Module |
|---|---|---|
| Port 1 | Blue | Top |
| Port 4 | Black | Second to top |
| Port 3 | White | Second to bottom |
| Port 6 | Green | Bottom |

## Reverse Balancing Procedure

### Overview

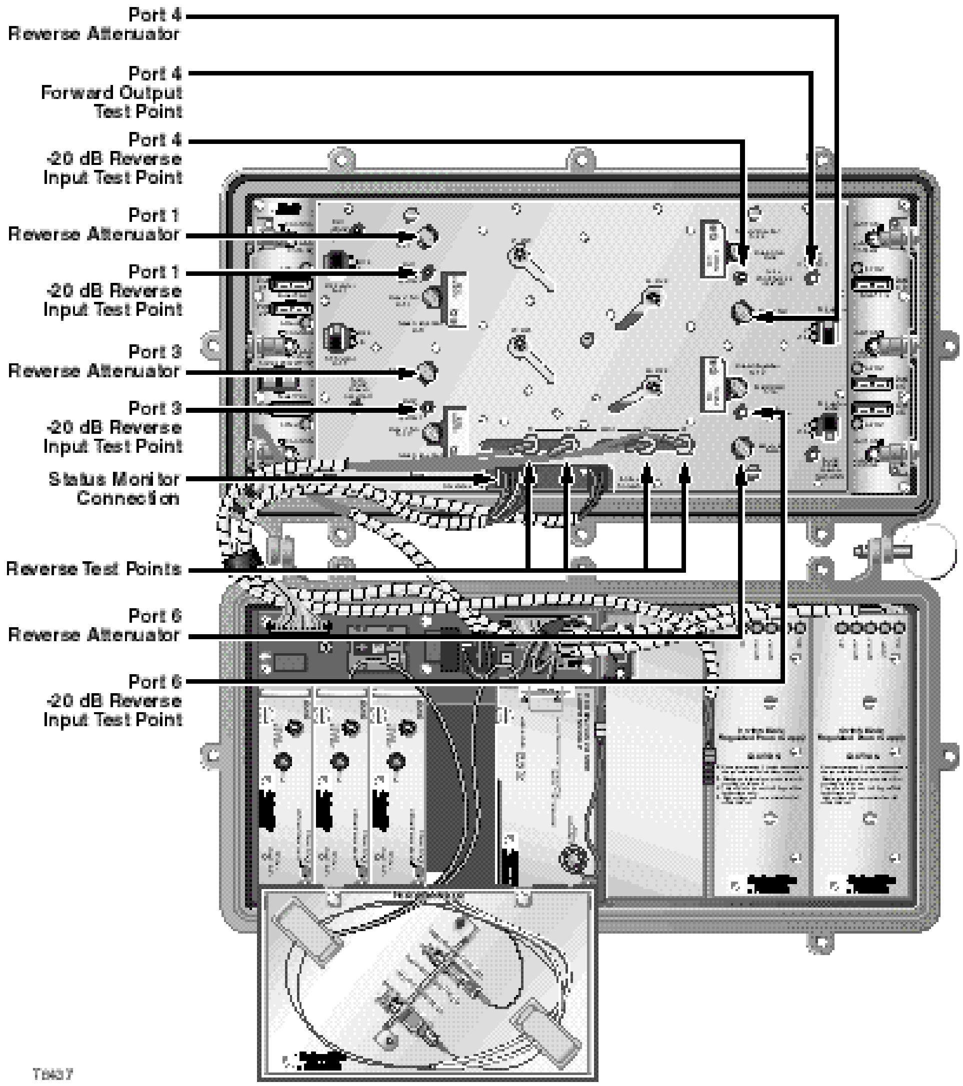
Baseband digital reverse technology is designed to have a constant link gain, regardless of the length of fiber or amount of passive optical loss in the link. That is, if the RF signal amplitude of all ports in all nodes is set to a constant value, the signal level at the output of the receiver will be balanced automatically to a constant power level. Minor differences in levels can be trimmed out at the receiver with no penalty to link performance.

## Reverse Balancing and Alignment Procedure

Follow these steps to reverse balance and align the node with the digital reverse modules.

1. Open the housing. Refer to **Opening the Housing** in Section A of Chapter 2.
2. Refer to the reverse system design print and inject the proper level into the forward output test point of a port of the RF launch amplifier with a reverse sweep transmitter or a CW signal generator. The insertion loss of all forward output test points is 20 dB (relative to corresponding port).

   **Note:** This illustration and others shows the double-wide laser module only. The single-wide module is similar except for size. The instructions are the same for both.



**Note:** For the location of forward output test point of each port, refer to the illustrations showing the reverse test points and accessories on the RF launch amplifier given earlier in this chapter.

**Important:** To calculate the correct signal level to inject, simply add the reverse input level (from the design print) to the insertion loss of the forward output test point.

**Formula:**

Reverse input + Insertion loss = Signal generator setting

**Example:**

Reverse input = 17 dBmV

Insertion loss = 20 dBmV

**Result:** Signal generator setting=17 dBmV + 20 dB = 37 dBmV

**Notes:**

- The ADC full-scale (100%) level for a single CW carrier is +46 dBmV. This is the level at which the ADC begins clipping.
- The reverse attenuator (pad) and reverse equalizer in the Model 6940 4-Port Node and Model 6944 Optical Node is selected during the reverse system design, and it is based on the drive level into the digital module which is determined by system performance requirements, type and quantity of return carriers, etc. Consult data sheet to determine proper operational level.

3. Verify the level of the reverse output test point. This output level leaves the RF launch amplifier via the coaxial cable to the 2:1 enhanced multiplexing digital module input (Use a SMB to F test cable).
4. Have the person in the headend refer to the headend system design and set the output of the bdr receiver to the specified output level. See the instruction guide that was shipped with bdr receiver for setup procedures.
5. Close the housing. Refer to **Closing the Housing** in Section B of Chapter 2.

## Verifying Hardware Security

### Security of Screws and Caps

Follow these steps to ensure that the screws and caps are secure.

1. Verify that the 16 screws that attach the metal cover of the RF launch amplifier are tight.

   **Important:** If they are not tight, the system response may be affected.

2. Check the unused RF ports, fiber ports, and external test ports.

   **Important:** Using a torque wrench, tighten these ports from 90 in-lb to 100 in-lb (10.2 Nm to 11.3 Nm) to prevent water coming into the node.

   **CAUTION:**

   **Do not over-torque the screws and caps. It may damage the node.**

3. Using a flat blade screwdriver, verify that the following screws are secure and tight:
   - Four hold-down screws on the RF launch amplifier
   - Two screws on each power supply
   - Two screws on each optical receiver
   - Two mounting screws on the laser module
   - Two mounting screws on the digital module

4. Check that all the connectors are properly seated.

5. Close the housing. Refer to **Closing the Housing** in section B of Chapter 2**.**

# Chapter 4
# Troubleshooting

## Overview

### In This Chapter

This chapter contains steps you may take to troubleshoot the enhanced digital reverse modules after they have been installed in the node.

This chapter contains the following topic.



**Important:** To troubleshoot the enhanced digital reverse modules installed in Model 6940 4-Port Node or the Model 6944 Optical Node, make sure you have the following installation and operation guides.

- *Prisma Optical Networks Model 6940 4-Port Optoelectronic Node*, part number 592555
- *Prisma Optical Networks Model 6944 Optoelectronic Node*, part number 716068

# Troubleshooting Guide

## Equipment

The following equipment may be necessary to perform some troubleshooting procedures.

- Cisco's fiber optic ferrule cleaner, part number 468517, to clean fiber optic connectors
- Cisco's 99% alcohol and lint free wipes to clean fiber connectors
- Optical power meter to measure light levels
- Proper fiber connector for optical power meter to make optical connections
- Digital voltmeter to measure voltages
- Spectrum analyzer or a field strength meter to measure RF levels
- Cisco's test probe, part number 501111, to access test points
- Cisco's external test probe, part number 591122, to access external test points

## Troubleshooting the Laser Module

Follow the steps in the table below to troubleshoot the laser module.

| Problems | Possible Causes | Possible Solutions |
|---|---|---|
| No optical signal output | Laser temperature could be too high or low. (Double-wide laser module only) | • Allow up to one minute after the power is ON for the temperature to stabilize.<br>• Telephone our Technical Assistance Center for help. |
| | Laser could be faulty. | Telephone our Technical Assistance Center for help. |
| | Automatic power control circuit failure. | Telephone our Technical Assistance Center for help. |
| | Damaged fiber. | Telephone our Technical Assistance Center for help. |

| Problems | Possible Causes | Possible Solutions |
|---|---|---|
| No optical signal output, cont. (Double-wide laser module only) | Y-harness cable not connected to optical interface board, the digital module, or the laser module. | Ensure that the Y-harness cable is plugged firmly on the optical interface board, the enhanced digital module, or the laser module. |
| | No +5 V from digital module. | Check the enhanced digital module. |
| Bad state error in receiver | Module may not have 2.5 Gbps input. | Verify 2.5 Gbps input. Also refer to **Troubleshooting the 2:1 Enhanced Multiplexing Digital Module**. |

## Troubleshooting the 2:1 Enhanced Multiplexing Digital Module

Follow the steps in the table below to troubleshoot the 2:1 enhanced multiplexing digital module.

| Problems | Possible Causes | Possible Solutions |
|---|---|---|
| No 2.5 Gbps signal | One or more power supply voltages are out of specification. | Check the power supplies for proper operation. |
| | Loose, unplugged, or damaged power cords. | Check the power supply power cord connections. |
| | No AC at receptacle. | Check the receptacle for AC power. |
| | A blown fuse on the power supply. | Check the power supply fuse. Repair or replace as needed. |
| | Loose connectors. | Check that the digital module is securely connected to the node. Refer to the procedure, **Installing the Digital Reverse Modules** in Chapter 2. |
| | A faulty module. | Telephone our Technical Assistance Center for help. |
| No +5 V to laser module | Loose connector | Tighten the connector. |

# Chapter 5
# Customer Information

## If You Have Questions

If you have technical questions, call Cisco Services for assistance. Follow the menu options to speak with a service engineer.

Access your company's extranet site to view or order additional technical publications. For accessing instructions, contact the representative who handles your account. Check your extranet site often as the information is updated frequently.

# Glossary

| Term, Acronym, Abbreviation | Meaning |
|---|---|
| **A** | Ampere (amp) is the unit of measure for electrical current. |
| **AC** | Alternating current |
| **ADC** | Analog to digital |
| **Addressable** | The ability to control an individual unit in a system of many similar units. |
| **AFC** | Automatic Frequency Control |
| **AGC** | Automatic Gain Control |
| **AM** | Amplitude Modulation |
| **Amplifier Cascade** | Two or more amplifiers in a series, the output of one feeding the input of another. |
| **APC** | Automatic power control |
| **ASIC** | Application Specific Integrated Circuit |
| **ATC** | Automotive fuse |
| **Attenuation** | A decrease in signal magnitude occurring in transmission from one point to another or in passing through a loss medium. |
| **Attenuator** | A device designed to reduce signal strength by an amount specified in dB. |
| **ATX** | Addressable transmitter |
| **AUX** | Auxiliary |
| **Baseband** | The total signal before it is modified for transmission or otherwise manipulated. |
| **Baud (Bd)** | A measure of signaling rate based on the number of signaling events per unit of time. |
| **bdr™** | Baseband digital reverse |
| **Beamwidth** | The included angle between two rays (usually the half-power points) on the radiation pattern, which includes the maximum lobe, of an antenna. |

| | |
|---|---|
| **BER** | Bit error rate |
| **BERT** | Bit error rate test |
| **BIG** | Broadband Integrated Gateway |
| **BIOS** | Basic Input/Output System |
| **BIST** | Built-in self-test |
| **Bit** | Short for Binary Digit. Can be either a "one" or a "zero." |
| **Blanking level** | The amplitude of the front and back porches of the composite video signal. |
| **BNC** | A coaxial connector that uses a bayonet type attachment to secure the cable. It is also known as Baby N connector. |
| **BPF** | Bandpass filter |
| **Bps** | Bits per second - The total number of bits sent in a second of time. |
| **BPSK** | Binary Phase Shift Keying |
| **BW** | Bandwidth |
| **Byte** | A group of bits treated as a unit |
| **CF** | Continuous feed |
| **Circuit switching** | The type of signal switching traditionally used by telephone companies to create a physical connection between a caller and a called party. |
| **CIRD** | Commercial Integrated Receiver Decoder |
| **CIM** | Communications Interface Module |
| **CISC** | Complex Instruction Set Computer. A computer that uses many different types of instructions to conduct its operations, i.e., IBM PCs, Apple Macintosh’s, IBM 370 mainframes. |
| **CIU** | Customer Interface Unit |
| **C/N or CNR** | Carrier-to-noise ratio |

| | |
|---|---|
| **Compression** | The non-linear change of gain at one level of a signal with respect to the change of gain at another level for the same signal. Also, the elimination of redundant information from an audio, data, or video signal to reduce transmission requirements. |
| **CSO** | Composite Second Order |
| **CTB** | Composite Triple Beat |
| **C/T** | Carrier-to-noise temperature ratio |
| **CW** | Continuous Wave |
| **dB** | Decibel |
| **dBc** | Decibels relative to a reference carrier |
| **DBDS** | Digital Broadband Delivery System |
| **dBm** | Decibels relative to 1 milliwatt |
| **dBi** | Decibels of gain relative to an isotropic radiator |
| **dBuV** | Decibels relative to 1 microvolt |
| **dBW** | Decibels relative to 1 watt |
| **dBmV** | Decibels relative to 1 millivolt |
| **DC** | Direct current |
| **DC** | Directional coupler |
| **DES** | Data Encryption Standard |
| **Deviation** | The peak difference between the instantaneous frequency of the modulated wave and the carrier frequency, in an FM system. |
| **DFB** | Distributed feed back laser |
| **Differential gain** | The difference in amplification of a signal (superimposed on a carrier) between two different levels of carrier. |
| **Diplex filter** | A filter which divides the frequency spectrum into a high frequency segment and a low frequency segment so that two different signals can be sent down the same transmission path. |

| | |
|---|---|
| **Distribution System** | Part of a cable system consisting of trunk and feeder cables used to carry signals from headend to subscriber terminals. |
| **Downconverter** | A device that converts an input signal to a lower frequency output signal. |
| **Down link** | A transmission path carrying information from a satellite or spacecraft to earth. |
| **DP** | Data processing |
| **DPU** | Digital processing unit |
| **DSP** | Digital signal processor |
| **DSR** | Digital Storage and Retrieval System |
| **D to U** | Desired to undesired signal ratio |
| **DTMF** | Dual Tone Multiple Frequency |
| **Duplexer** | A device which permits the connection of both a receiver and a transmitter to a common antenna. |
| **DVM** | Digital voltmeter |
| **DWDM** | Dense Wave Division Multiplexing |
| **ECL** | Emitter coupled logic |
| **ECM** | Entitlement Control Message |
| **EDFA** | Erbium Doped Fiber Amplifier |
| **EDFA** | Erbium Doped Fiber Amplifier |
| **EEPROM** | Electrically Erasable Programmable Read-Only Memory |
| **EIA** | Electronics Industry Association |
| **EMI** | Electromagnetic interference |
| **Emission designer** | An FCC or CCIR code that defines the format of radiation from a transmitter. |
| **EPROM** | Erasable Programmable Read-Only Memory |
| **EQ** | Equalizer |

| | |
|---|---|
| **Equalization** | The process of compensating for an undesired result. For example, equalizing tilt in a distribution system. |
| **ERP** | Effective radiated power |
| **FAOC** | Frequency agile output converters |
| **FET** | Field-effect transistor |
| **FIFO** | First in, first out |
| **FM** | Frequency modulation |
| **Forward path** | Signal direction from the headend to the set-top terminal. |
| **FP** | Fabry-Perot laser |
| **Fiber** | A single strand of glass used as an optical transmission medium; or a bundle of glass strands in a CATV system. |
| **Frequency** | The number of similar shapes in a unit of time. For example, the number of sine waves moving past a fixed point in a second. |
| **Frequency Agile** | The ability to change from one frequency to another without changing components. |
| **Frequency Modulation** | A system of modulation where the instantaneous radio frequency of the carrier varies in proportion to the instantaneous amplitude of the modulating signal while the amplitude of the radio frequency carrier is independent of the amplitude of the modulating signal. |
| **Frequency Response** | The effect that changing the frequency has on the magnitude of a signal. |
| **Frequency Reuse** | A technique in which independent information is transmitted on orthogonal polarizations to "reuse" a given band of frequencies. |
| **Frequency Stability** | A measure of the departure from nominal frequency value of a signal, with respect to time, temperature, or other influence. |
| **FSM** | Field strength meter |
| **FSK** | Frequency-shift keying |

| | |
|---|---|
| **ft-lb** | Foot-pound |
| **FTP** | File Transfer Protocol |
| **Gain** | An increase in signal relative to a reference |
| **Gbps** | Gigabits per second |
| **Headend** | Location and equipment that receives data from a satellite (or other) source and reformats that data for input to a broadband distribution network. |
| **HEDA** | Headend Driver Amplifier |
| **HGD** | High Gain Dual |
| **Hertz** | A unit of frequency equal to one cycle per second. |
| **Hetrodyne** | Changing the frequency of a signal by mixing it with another signal to get the sum and difference of the two. |
| **I/O** | Input/output |
| **IC** | Integrated circuit |
| **ICIM** | Intelligent Communications Interface Module |
| **ICP** | Internal Control Program. A series of policies to protect company sensitive and export controlled information. |
| **IDR** | Intermediate Data Rate |
| **IEC** | International Electro-technical Commission |
| **IF** | Intermediate frequency |
| **IFL** | Interfacility link |
| **IP** | Internet protocol |
| **ITU** | International Telecommunications Union |
| **Kbps** | Kilobits per second |
| **in-lb** | Inch-pound |
| **LCD** | Liquid crystal display |

| | |
|---|---|
| **LCI** | Local craft interface |
| **LED** | Light-emitting diode |
| **LIFO** | Last-in, first-out |
| **LNA** | Low-noise amplifier |
| **LNB** | Low-noise block converter |
| **LNC** | Low-noise converter |
| **LOCATE(TM)** | Systems for monitoring, analyzing, or reporting electric power outages |
| **Mbps** | Megabits per second |
| **MCU** | Master Control Unit |
| **Multipath (multipath transmission)** | The phenomenon which results from a signal traveling from point to point by more than one path so that several copies of the signal arrive at the destination at different times or at different angles. |
| **mux** | multiplexed |
| **Nanosecond** | 1 thousandth of a microsecond |
| **Nm** | Newton meter |
| **NIU** | Network Interface Unit |
| **Node** | A branching or exchange point. |
| **OEM** | Original equipment manufacturer |
| **OOB** | Out of band |
| **OIM** | Optical interface module |
| **PCB** | Printed circuit board |
| **PCM** | Pulse code modulation |
| **PDI** | Pressure differential indicator |
| **PDU** | Power distribution unit |

| | |
|---|---|
| **PLL** | Phase Lock Loop. An electronic servo system controlling an oscillator to maintain a constant phase angle relative to a reference signal. |
| **PROM** | Programmable Read Only Memory |
| **PWB** | Printed wiring board |
| **QAM** | Quadrature Amplitude Modulation |
| **QPR** | Quadrature Partial Response |
| **QPSK** | Quadrature Phase-Shift Keying |
| **RC** | Reverse conditioner |
| **Reverse path** | Signal flow direction toward the headend. |
| **RF** | Radio frequency |
| **RF Bypass** | A bypass feature that allows subscribers to view a clear analog channel while recording a digital or analog channel on a VCR. |
| **RFI** | Radio frequency interference |
| **RMA** | Return material authorization |
| **RMS** | Root Mean Square |
| **Router** | A data communications device which examines a packet and routes the packet to an output port appropriate to the packet destination. |
| **RS** | Remote Sensing |
| **RX** | Receive or receiver |
| **SA** | Spectrum analyzer |
| **SAM** | Signal analysis meter |
| **SAT** | Site acceptance test |
| **S-band** | The group of frequencies between 2 and 4 GHz. |
| **SET** | Secure electronic transaction |

| | |
|---|---|
| **Scattering** | Random directional change of a wave or part of a wave caused by an irregular reflecting surface or by passing through an inhomogeneous transmission medium. |
| **SLM** | Signal level meter |
| **SM** | Status monitor |
| **SMC** | Status monitoring and control |
| **SMIU** | Status Monitor Interface Unit |
| **SMU** | Server Management Unit |
| **S/N or SNR** | Signal-to-noise ratio |
| **SNMP** | Simple Network Management Protocol |
| **SONET** | Synchronous optical network |
| **SP** | Splitter. It is a device that divides power from an input to deliver multiple outputs or combines multiple input into one output. |
| **Spread Spectrum** | A modulation technique to spread a narrow band signal over a wide band of frequencies. |
| **Spurious** | Anything other than the desired result |
| **SSPA** | Solid-state power amplifier |
| **Sweep generator** | A signal source which can automatically vary its frequency continuously from one frequency to another. |
| **Synchronous transmission** | A method of sending information over a path and separating discrete characters and symbols by a precise separation in time. |
| **TEC** | Thermo-electric cooler |
| **TCP/IP** | Transmission control protocol/internet protocol |
| **TDM** | Time division multiplexing |
| **TNCS** | Transmission Network Control System |
| **Torque** | Force applied to bolt or screw to tighten the device. |
| **TS** | Transport Stream |

| | |
|---|---|
| **TTCN** | True tilt correction network |
| **Tx** | Transmit or transmitter |
| **UBT** | Unbalanced triple |
| **UPS** | Un-interruptible power supply |
| **Upstream** | Signal transmission toward the headend |
| **UTP** | Unshielded twisted pair |
| **uV** | One millionth of a volt (microvolt) |
| **V** | Volt |
| **V AC** | Volts alternating current |
| **VBR** | Variable bit rate |
| **VCA** | Voltage controlled attenuator |
| **V DC** | Volts direct current |
| **VOD** | Video-on-demand |
| **VOM** | Volt ohm meter |
| **W** | Watts |
| **WDM** | Wave Division Multiplexing |
| **YEDFA** | Ytterbium/erbium doped fiber amplifier |

# Index

# J



# L



# M



# O



# P



# R

Cisco Systems, Inc.
5030 Sugarloaf Parkway, Box 465447
Lawrenceville, GA 30042

678 277-1120
800 722-2009
www.cisco.com



October 2012 Printed in USA

Part Number 78-741939-01 Rev C