CONTENTS

Preface vii
  For Your Safety vii
    Explanation of Warning and Caution Icons vii
    Important viii
  Important Safety Instructions viii
    Read and Retain Instructions viii
    Follow Instructions and Heed Warnings viii
    Terminology viii
    Electric Shock Hazard ix
    Equipment Placement ix
  Product Ratings ix
  Strand (Aerial) Installation x
  Pedestal, Service Closet, Equipment Room or Underground Vault Installation x
  Connection to Network Power Sources x
    AC Power Shunts xi
    Equipotential Bonding xii
    General Servicing Precautions xiii
    Electrostatic Discharge xiv
    Batteries xiv
      Safety xiv
      Disposal xiv
    Modifications xv
    Accessories xv
    Electromagnetic Compatibility Regulatory Requirements xv
    EMC Compliance Statements xv
  Laser Safety xvi
    Warning: Radiation xvi
Warning: Fiber Optic Cables xvii
Safe Operation for Software Controlling Optical Transmission Equipment xvii
Laser Warning Labels xvii
Location of Labels on Equipment xix

CHAPTER 1
General Information 1
Physical Description 1
Functional Description 3
Node Inputs/Outputs Diagram 4
Module Functional Description 4
Amplifier Output Linear Tilt Chart 5
Ordering Information 6

CHAPTER 2
Theory of Operation 7
System Diagrams 8
Forward Path 8
Forward Path Signal Routing 8
Reverse Path 9
Reverse Path Signal Routing 9
Spectrum Capture 10
Power Distribution 10
RF Amplifier Module 10
AGC 11
Auto-setup 11
Optical Interface Board 11
Intelligent Remote PHY Device 12
Power Supply Module 12
Node Power Limitations 13

CHAPTER 3
Installation 15
Tools and Test Equipment 15
Node Fastener Torque Specifications 16
Node Housing Ports 16
Strand Mounting the Node 17
Pedestal or Wall Mounting the Node 20
Fiber Optic Cable Installation 21
  Color Code 22
  Fiber Management System 22
  Install Fiber Optic Cable 23
RF Cable Installation 27
  Trimming the Center Conductor 27
  Trimming Using the Integrated Cradle 27
  Trimming Using the Strip Line Mark 28
  Connecting the RF Cables to the Node Housing 29
Applying Power to the Node 29
  Node Powering Procedure 30
  Voltage Check Procedure 31

CHAPTER 4
  Setup and Operation 33

CHAPTER 5
  Maintenance 35
  Opening and Closing the Housing 35
    Opening the Housing 35
    Closing the Housing 35
  Preventative Maintenance 36
    Schedule 36
    Visual Inspection 37
    Cleaning 38
    Consumable Materials 38
    Procedure 38
  Removing and Replacing Modules 39
    Module Replacement Procedure 39
    Diplexers and Trim modules 40
    RF Amplifier Assembly Replacement Procedure 40
  Care and Cleaning of Optical Connectors 42
    Recommended Equipment 43
    Tips for Optimal Fiber-Optic Connector Performance 43
    To Clean Optical Connectors 43
      Connectors and Bulkheads 44
      Cleaning Connectors 44
Cleaning Bulkheads 45
Verifying Equipment Operation 46

CHAPTER 6 Troubleshooting 47
OIB 47
Troubleshooting the node 48

APPENDIX A Glossary 51
Preface

- For Your Safety, page vii
- Important Safety Instructions, page viii
- Laser Safety, page xvi
- Laser Warning Labels, page xvii

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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>You may find this symbol in the document that accompanies this product. This symbol indicates important operating or maintenance instructions.</td>
</tr>
<tr>
<td>!</td>
<td>You may find this symbol affixed to the product. This symbol means electric shock hazard. This symbol indicates a live terminal where a dangerous voltage may be present; the tip of the flash points to the terminal device.</td>
</tr>
<tr>
<td>‡</td>
<td>You may find this symbol affixed to the product. This symbol indicates a protective ground terminal.</td>
</tr>
<tr>
<td>⊙</td>
<td>You may find this symbol affixed to the product. This symbol indicates a chassis terminal (normally used for equipotential bonding).</td>
</tr>
<tr>
<td>!</td>
<td>You may find this symbol affixed to the product. This symbol warns of a potentially hot surface.</td>
</tr>
</tbody>
</table>
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.

Important Safety Instructions

Read and Retain Instructions

Carefully read all safety and operating instructions before operating this equipment, and retain them for future reference.

Follow Instructions and Heed Warnings

Follow all operating and use instructions. Pay attention to all warnings and cautions in the operating instructions, as well as those that are affixed to this equipment.

Terminology

The terms defined below are used in this document. The definitions given are based on those found in safety standards.

- **Service Personnel** - The term *service personnel* applies to trained and qualified individuals who are allowed to install, replace, or service electrical equipment. The service personnel are expected to use their experience and technical skills to avoid possible injury to themselves and others due to hazards that exist in service and restricted access areas.

- **User and Operator** - The terms *user* and *operator* apply to persons other than service personnel.

- **Ground(ing) and Earth(ing)** - The terms *ground(ing)* and *earth(ing)* are synonymous. This document uses ground(ing) for clarity, but it can be interpreted as having the same meaning as earth(ing).
Electric Shock Hazard

This equipment meets applicable safety standards.

Warning

To reduce risk of electric shock, perform only the instructions that are included in the operating instructions. Refer all servicing to qualified service personnel only.

Electric shock can cause personal injury or even death. Avoid direct contact with dangerous voltages at all times.

Know the following safety warnings and guidelines:

- Only qualified service personnel are allowed to perform equipment installation or replacement.
- Only qualified service personnel are allowed to remove chassis covers and access any of the components inside the chassis.

Equipment Placement

Warning

Avoid personal injury and damage to this equipment. An unstable mounting surface may cause this equipment to fall.

To protect against equipment damage or injury to personnel, comply with the following:

- Install this equipment in a restricted access location (access restricted to service personnel).
- Make sure the mounting surface or rack is stable and can support the size and weight of this equipment.

Product Ratings

- Electrical Ratings: quasi-square or sinusoidal wave 45 – 90 V, 50 – 60 Hz, max. pass-through current 15 A, max. surge current 25 A, internal power supply max. 185 W.
- Ambient temperature range outside the node must be maintained between -40°C and +60°C (-40°F to 140°F).
- Storage temperature range of the EDR 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 EDR Digital Return module(s).
- Max. altitude: <2000 m.
- Protection Grade: IP68.
• Laser Class: Class 1M.

**Strand (Aerial) Installation**

---

**Caution**

Be aware of the size and weight of strand-mounted equipment during the installation operation. Ensure that the strand can safely support the equipment’s weight.

---

**Pedestal, Service Closet, Equipment Room or Underground Vault Installation**

---

**Warning**

Avoid the possibility of personal injury. Ensure proper handling/lifting techniques are employed when working in confined spaces with heavy equipment.

---

• Ensure this equipment is securely fastened to the mounting surface or rack where necessary to protect against damage due to any disturbance and subsequent fall.

• Ensure the mounting surface or rack is appropriately anchored according to manufacturer’s specifications.

• Ensure the installation site meets the ventilation requirements given in the equipment’s data sheet to avoid the possibility of equipment overheating.

• Ensure the installation site and operating environment is compatible with the equipment’s International Protection (IP) rating specified in the equipment’s data sheet.

**Connection to Network Power Sources**

Refer to this equipment’s specific installation instructions in this manual or in companion manuals in this series for connection to network ferro-resonant AC power sources.

---

**Warning**

Unit is intended to be installed, operated and maintained by trained personnel, in accordance with the local and national regulations.

---

**Warning**

The unit is intended to be powered from the secondary circuit of an APPROVED/CERTIFIED power source with adequate isolation (reinforced or double called out in the applicable standard) between mains and secondary circuit.

---

**Warning**

Use suitably rated CERTIFIED/APPROVED CATV Cable suitable for outdoor use rated VW-1 or FT-1 or better.
Maximum current through the node is 15 Amps. A suitable current limiter is to be provided during end installation or service provider Ferro resonant power source shall have suitable current limiter.

Shock Hazard - Housing/Enclosure of the unit must be reliably bonded to protective earth/ground conductor prior to connecting the unit to a power source.

Do not touch internal conductor of F/COAX connector or coax cable while the node is energized and disconnect power before removing cover because 90 V a.c. can be accessible.

Equipment connected to the protective earthing of the building installation through the mains connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11).

Note
In Norway, due to regulation for installations of cable distribution systems, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1.5 kV r.m.s., 50 Hz or 60 Hz, for 1 min.

Translation to Norwegian (the Swedish text will also be accepted in Norway):

⚠️ Utstyr som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr – og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkoping av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel- TV nettet.

Translation to Swedish:

⚠️ Utrustning som är kopplad till skyddsjord via jorduttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.

**WARNING**

**HIGH LEAKAGE CURRENT**

**EARTH CONNECTION ESSENTIAL**

**BEFORE CONNECTING SUPPLY**

---

**AC Power Shunts**

AC power shunts may be provided with this equipment.

⚠️ **Important**

The power shunts (where provided) must be removed before installing modules into a powered housing. With the shunts removed, power surge to the components and RF-connectors is reduced.
RF connectors and housing seizure assemblies can be damaged if shunts are not removed from the equipment before installing or removing modules from the housing.

Equipotential Bonding

If this equipment is equipped with an external chassis terminal marked with the IEC 60417-5020 chassis icon ( ), the installer should refer to CENELEC standard EN 50083-1 or IEC standard IEC 60728-11 for correct equipotential bonding connection instructions.

⚠️ Shock Hazard - Housing/Enclosure of the unit must be reliably bonded to protective earth/ground conductor prior to connecting the unit to a power source.

⚠️ Do not touch internal conductor of F/COAX connector or coax cable while the node is energized and disconnect power before removing cover because 90 V a.c. can be accessible.

⚠️ Equipment connected to the protective earthing of the building installation through the mains connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11).

Note

In Norway, due to regulation for installations of cable distribution systems, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1.5 kV r.m.s., 50 Hz or 60 Hz, for 1 min.

Translation to Norwegian (the Swedish text will also be accepted in Norway):

⚠️ Utstyrsomær koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr – og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkoping av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel- TV nettet.

Translation to Swedish:

⚠️ Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.
General Servicing Precautions

Warning

Avoid electric shock! Opening or removing this equipment’s cover may expose you to dangerous voltages.

Caution

These servicing precautions are for the guidance of qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Be aware of the following general precautions and guidelines:

- **Servicing** - Servicing is required when this equipment has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into this equipment, this equipment has been exposed to rain or moisture, does not operate normally, or has been dropped.

- **Wristwatch and Jewelry** - For personal safety and to avoid damage of this equipment during service and repair, do not wear electrically conducting objects such as a wristwatch or jewelry.

- **Lightning** - Do not work on this equipment, or connect or disconnect cables, during periods of lightning.

- **Labels** - Do not remove any warning labels. Replace damaged or illegible warning labels with new ones.

- **Covers** - Do not open the cover of this equipment and attempt service unless instructed to do so in the instructions. Refer all servicing to qualified service personnel only.

- **Moisture** - Do not allow moisture to enter this equipment.

- **Cleaning** - Use a damp cloth for cleaning.

- **Safety Checks** - After service, assemble this equipment and perform safety checks to ensure it is safe to use before putting it back into operation.

- **Shock Hazard** - Housing/Enclosure of the unit must be reliably bonded to protective earth/ground conductor prior to connecting the unit to a power source.

- **Do not touch internal conductor of F/COAX connector or coax cable while the node is energized and disconnect power before removing cover because 90 V a.c. can be accessible.**

- **Equipment connected to the protective earthing of the building installation through the mains connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11).**
In Norway, due to regulation for installations of cable distribution systems, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1.5 kV r.m.s., 50 Hz or 60 Hz, for 1 min.

Translation to Norwegian (the Swedish text will also be accepted in Norway):

⚠️ Utstyr som er koplet til beskyttelsesjord via nettplug og/eller via annet jordtkoplet utstyr – og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkoping av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel-TV nettet.

Translation to Swedish:

⚠️ Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.

**Electrostatic Discharge**

Electrostatic discharge (ESD) results from the static electricity buildup on the human body and other objects. This static discharge can degrade components and cause failures.

Take the following precautions against electrostatic discharge:

- Use an anti-static bench mat and a wrist strap or ankle strap designed to safely ground ESD potentials through a resistive element.
- Keep components in their anti-static packaging until installed.
- Avoid touching electronic components when installing a module.

**Batteries**

This product may contain batteries. Special instructions apply regarding the safe use and disposal of batteries:

**Safety**

- Insert batteries correctly. There may be a risk of explosion if the batteries are incorrectly inserted.
- Do not attempt to recharge 'disposable' or 'non-reusable' batteries.
- Please follow instructions provided for charging 'rechargeable' batteries.
- Replace batteries with the same or equivalent type recommended by manufacturer.
- Do not expose batteries to temperatures above 100°C (212°F).

**Disposal**

- The batteries may contain substances that could be harmful to the environment.
• Recycle or dispose of batteries in accordance with the battery manufacturer’s instructions and local/national disposal and recycling regulations.

• The batteries may contain perchlorate, a known hazardous substance, so special handling and disposal of this product might be necessary. For more information about perchlorate and best management practices for perchlorate-containing substance, see [http://www.dtsc.ca.gov/hazardouswaste/perchlorate](http://www.dtsc.ca.gov/hazardouswaste/perchlorate).

**Modifications**

This equipment has been designed and tested to comply with applicable safety, laser safety, and EMC regulations, codes, and standards to ensure safe operation in its intended environment. Refer to this equipment's data sheet for details about regulatory compliance approvals.

Do not make modifications to this equipment. Any changes or modifications could void the user’s authority to operate this equipment.

Modifications have the potential to degrade the level of protection built into this equipment, putting people and property at risk of injury or damage. Those persons making any modifications expose themselves to the penalties arising from proven non-compliance with regulatory requirements and to civil litigation for compensation in respect of consequential damages or injury.

**Accessories**

Use only attachments or accessories specified by the manufacturer.

**Electromagnetic Compatibility Regulatory Requirements**

This equipment meets applicable electromagnetic compatibility (EMC) regulatory requirements. Refer to this equipment’s data sheet for details about regulatory compliance approvals. EMC performance is dependent upon the use of correctly shielded cables of good quality for all external connections, except the power source, when installing this equipment.

• Ensure compliance with cable/connector specifications and associated installation instructions where given elsewhere in this manual.

**EMC Compliance Statements**

Where this equipment is subject to USA FCC and/or Industry Canada rules, the following statements apply:

• **FCC Statement for Class A Equipment**

  This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment.
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case users will be required to correct the interference at their own expense.

• Industry Canada - Industrie Canadienne Statement

This apparatus complies with Canadian ICES-003.
Cet appareil est conforme à la norme NMB-003 du Canada.

• CENELEC/CISPR Statement with Respect to Class A Information Technology Equipment

This is a Class A equipment. In a domestic environment this equipment may cause radio interference in which case the user may be required to take adequate measures.

Laser Safety

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

Warning: Radiation

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 equipment (if a transmitter) or the fiber cables connected to this equipment emit invisible laser radiation. Avoid direct exposure to the laser light source.

Avoid personal injury! Viewing the laser output (if a transmitter) or fiber cable with optical instruments (such as eye loupes, magnifiers, or microscopes) may pose an eye hazard.

Do not apply power to this equipment if the fiber is unmated or unterminated.

Do not stare into an unmated fiber or at any mirror-like surface that could reflect light emitted from an unterminated fiber.

Do not view an activated fiber with optical instruments (e.g., eye loupes, magnifiers, microscopes).

Use safety-approved optical fiber cable to maintain compliance with applicable laser safety requirements.
Warning: Fiber Optic Cables

Warning
Avoid personal injury! Qualified service personnel may only perform the procedures in this manual. Wear safety glasses and use extreme caution when handling fiber optic cables, particularly during splicing or terminating operations. The thin glass fiber core at the center of the cable is fragile when exposed by the removal of cladding and buffer material. It easily fragments into glass splinters. Using tweezers, place splinters immediately in a sealed waste container and dispose of them safely in accordance with local regulations.

Warning
Eye injury can occur - do not pull optical connector or look into the connector or the fiber cable while the node is energized.

Safe Operation for Software Controlling Optical Transmission Equipment

If this manual discusses software, the software described is used to monitor and/or control ours and other vendors’ electrical and optical equipment designed to transmit video, voice, or data signals. Certain safety precautions must be observed when operating equipment of this nature.

For equipment specific safety requirements, refer to the appropriate section of the equipment documentation.

For safe operation of this software, refer to the following warnings.

Warning
- Ensure that all optical connections are complete or terminated before using this equipment to remotely control a laser device. An optical or laser device can pose a hazard to remotely located personnel when operated without their knowledge.
- Allow only personnel trained in laser safety to operate this software. Otherwise, injuries to personnel may occur.
- Restrict access of this software to authorized personnel only.
- Install this software in equipment that is located in a restricted access area.

Laser Warning Labels

One or more of the labels shown below are located on this product.
AVOID EXPOSURE - Laser invisible radiation is emitted from this aperture.

CAUTION:
Invisible Laser Radiation
Class 1 Laser Product

CAUTION: CLASS 1M INVISIBLE LASER RADIATION
WHEN OPEN DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS

RF Test Point -20dB

INVISIBLE LASER RADIATION DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS. CLASS 1M LASER PRODUCT
Location of Labels on Equipment

The following illustrations display the location of warning labels on this equipment.
Location of Labels on Equipment

Remote PHY Module

Laser Aperature Warning Labels
General Information

This manual describes the installation and operation of the Cisco GS7000 Super High Output Intelligent Node (iNode). The iNode is designed to operate using the Cisco 1X2 Remote PHY device rather than standard optical transmitter and receivers from the traditional GS7000 node. The iNode contains microprocessor based setup, balance, and troubleshooting capability.

- Physical Description, page 1
- Functional Description, page 3
- Node Inputs/Outputs Diagram, page 4
- Module Functional Description, page 4
- Amplifier Output Linear Tilt Chart, page 5
- Ordering Information, page 6

Physical Description

This node is the latest generation 1.2 GHz optical node in the GS7000 Node platform. It is based on the same housing developed for the original GS7000 Node Platform. The node is designed to eliminate the need for installing and maintaining the typical amplifier plug-in accessories such as pads, equalizers, trims and signal directors. It also eliminated the need for external test points with circuitry that can remotely report and display RF levels and RF spectrum via Cisco Intelligent Node software. It can eliminate manual tuning and the need for skilled RF technicians to install and maintain the devices in the field. The housing has a hinged lid to allow access to the internal electrical and optical components. The housing also has provisions for strand, pedestal, or wall mounting.

The base of the housing contains:

- an RF amplifier module
- AC power routing

The lid of the housing contains:

- a fiber management tray and track
- power supplies (one or two)
• Intelligent Remote PHY Device

The following illustration shows the external housing of the node.

Figure 1:

![External Housing Illustration](image)

The following illustration shows the node internal modules and components.
**Functional Description**

The node is used in broadband hybrid fiber/coax (HFC) networks.

The node receives forward optical inputs, converts the input to an electrical radio frequency (RF) signal, and outputs the RF signals to up to four ports. The forward bandpass frequency is from 54 MHz to 1218 MHz. The lower edge of the passband is primarily determined by the frequency split of the diplex filters and the reverse amplifier assembly.

The Cisco GS7000 Intelligent Node will contain a Cisco Remote PHY Device (RPD) in lieu of the optical receivers and transmitters which have been used in previous versions of the GS7000 nodes.

The RPD will allow for a single forward/downstream path to be split to up to 4 RF ports. The reverse/upstream path can combine all 4 RF ports onto a single upstream signal or can be split into 2 upstream paths via a switch in the node. No change of a configuration module is required to switch from a combined to segmented reverse path as with earlier GS7000 nodes.

The Remote PHY module communicates with the headend/hub via the Small Form Factor Pluggable (SFP) device which plugs into the module. This transceiver is the optical port for all forward and reverse traffic to/from the Intelligent Node.

45 - 90 V AC input power is converted to +24.5, +8.5, -6.0, and +5.5 V DC by an internal power supply to power the node.
Node Inputs/Outputs Diagram

The following diagram shows the system-level inputs and outputs of the node.

Note

Port 3 and Port 6 are only for power.

- The AC can be applied through any housing base port and routed, if required, to the other ports.
- The DC power supply modules can be fed by any housing base port (1 through 6).

Module Functional Description

This table briefly describes each module. See Theory of Operation, on page 7 for detailed descriptions of the modules.

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Amplifier</td>
<td>The RF Amplifier Module includes:</td>
</tr>
<tr>
<td></td>
<td>• four forward RF output ports</td>
</tr>
<tr>
<td></td>
<td>• four reverse inputs</td>
</tr>
<tr>
<td></td>
<td>• forward and reverse bandwidths that are established by diplexer and reverse low pass filter assembly selection</td>
</tr>
<tr>
<td>Remote PHY Device (iRPD)</td>
<td>The Remote PHY Device includes:</td>
</tr>
<tr>
<td></td>
<td>• two SFP+ 10G interfaces</td>
</tr>
<tr>
<td></td>
<td>• one CONSOLE interface</td>
</tr>
<tr>
<td></td>
<td>• 50-pin B2B connector interface between iRPD and OIB</td>
</tr>
<tr>
<td></td>
<td>• 1 DS X 2 US Physical RF ports between iRPD and GS7000</td>
</tr>
</tbody>
</table>
**Module**  |  **Description**  
--- | ---  
Power Supply  |  The node power supply module has multiple output voltages of +24.5, +8.5, -6.0, and +5.5 V DC. A second power supply can be installed in the node for redundancy or load sharing.  
The node can be set up in the following powering configurations:  
- two power supplies powered by different AC sources  
- two power supplies using the same AC source  
- a single supply using a single AC source  

Fiber Management Tray and Track  |  The fiber management system secures and protects the optical fiber inside the node housing.  

Optical Interface Board  |  The Optical Interface Board (OIB) provides all interconnections between the modules in the housing lid to the RF amplifier module in the housing base. Each module in the lid plugs directly into the OIB through a connector header or row of sockets depending on the module type. A forward path electronic controlled attenuator is provided on the OIB for the setup of the Remote PHY device in the housing lid. A separate reverse path electronic controlled attenuator is also provided on the OIB for the setup of the Remote PHY device.  

---  |  ---  

**Amplifier Output Linear Tilt Chart**  
The following chart can be used to determine the operating level at a particular frequency considering the operating linear tilt.
If the amplifier’s 1 GHz output level is 49.0 dBmV with a linear operating tilt of 14.5 dB (from 50 to 1 GHz), the corresponding output level at 750 MHz would be 45.1 dBmV. This was found by taking the difference in tilt between 1 GHz and 750 MHz (14.5 – 10.6 = 3.9 dB). Then subtract the difference in tilt from the operating level (49.0 - 3.9 = 45.1 dBmV).

**Ordering Information**

Please refer to the iNode Data Sheet for a full listing of the configured node, components, and accessories that are available.

**Note**

Please consult with your Account Representative, Customer Service Representative, or System Engineer to determine the best configuration PID for your particular application.
CHAPTER 2

Theory of Operation

This chapter describes the theory of operation for the node, including functional descriptions of each module in the node.

The node is comprised of two parts, the lid and the base.

The lid houses an optical interface board (OIB), a Remote PHY device (optional), one or two power supplies, and a fiber management tray/track.

The base houses the RF amplifier module, the high pass filter trim (HPFT) module and diplexer that plug into it.

- System Diagrams, page 8
- Forward Path, page 8
- Reverse Path, page 9
- Spectrum Capture, page 10
- Power Distribution, page 10
- RF Amplifier Module, page 10
- Optical Interface Board, page 11
- Intelligent Remote PHY Device, page 12
- Power Supply Module, page 12
System Diagrams

Blue lines: forward path
Red lines: reverse path

Forward Path
Forward path refers to signals received by the node from the hub or headend. These signals are amplified in the node and routed to subscribers through the cable distribution network.

Forward Path Signal Routing
Node forward path signal routing functions are described below.
**Stage** | **Description**
--- | ---
1 | Optical signals from the hub or headend are transported to the Remote PHY device in the node.
2 | The Remote PHY module detects the signal on the optical carrier applied to it and outputs an electrical RF signal to the node Optical Interface Board (OIB).
3 | The RF signal travel across the OIB and cables to the launch amplifier.
4 | The forward amplification path in the RF amplifier module is composed of one common input amplification stage, HPFT and interstage amplification stage in series followed by a 4-way power divider. Each output of the power divider feeds a power doubler output amplification stage. This topology provides four node output ports with one common input signal source.
5 | The forward amplification path in the RF amplifier module also contains trimming, thermal compensation, attenuation, equalization, and filtering circuitry.

### Reverse Path

Reverse path refers to signals received by the node from the cable distribution network. These signals are amplified in the node and returned to the headend optically through the fiber portion of the network.

### Reverse Path Signal Routing

Node reverse path signal routing functions are described below.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reverse path RF signals are applied to node output ports.</td>
</tr>
<tr>
<td>2</td>
<td>The RF signals from ports 1 and 2 are combined as well as the signals from ports 4 and 5. Each set of combined ports are amplified independently in the RF amplifier module. Segmentation or combination of these reverse signals is set by the switch located on the launch amplifier module.</td>
</tr>
<tr>
<td>3</td>
<td>Each of the reverse amplification paths in the RF amplifier module also contains attenuation, trimming, filtering, and RF On/Off switch circuitry.</td>
</tr>
<tr>
<td>4</td>
<td>The pairs (ports 1 and 2, ports 4 and 5) of reverse path signals can be combined or keep separate, depending on the setting of the reverse segmentation switch. They are then routed to the OIB.</td>
</tr>
<tr>
<td>5</td>
<td>The RF signals travel across the OIB to the Remote PHY Device. The Remote PHY Device converts the RF signals to optical signals which are transmitted through the fiber portion of the network back to the hub or headend.</td>
</tr>
</tbody>
</table>
Spectrum Capture

A built-in spectrum analyzer is used to monitor these RF signals: four reverse inputs, four forward outputs and two RPD inputs. Users can monitor each individual signal via the LCS app.

Power Distribution

The node is powered by one or two power supplies. Node power distribution functions are described below.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45 to 90 V AC is applied to one or two power supply modules in the node.</td>
</tr>
<tr>
<td>2</td>
<td>The power supply module(s) convert(s) the AC input to +24.5, +8.5, -6.0, and +5.5 V DC.</td>
</tr>
<tr>
<td>3</td>
<td>The +24.5, +8.5, -6.0, and +5.5 V DC lines are routed to node internal modules.</td>
</tr>
<tr>
<td>4</td>
<td>If two power supplies are installed and both are active, the load is shared equally between them.</td>
</tr>
<tr>
<td>5</td>
<td>An AC segmentable shunt is available to separate the AC connection to ports 1-3 from that of ports 4-6. This allows the node to be configured where one power supply is powered from ports 1-3 and a second power supply is powered from ports 4-6.</td>
</tr>
</tbody>
</table>

RF Amplifier Module

This section describes the RF amplifier module. The RF amplifier module contains the intelligent forward amplifier module (IFAM) and intelligent reverse amplifier module (IRAM).

The IFAM provides all forward signal amplification outside the iRPD in the node. It contains four forward amplification paths. The forward amplification paths have one common input, and each of the forward paths functions the same.

The IRAM provides all reverse signal amplification outside the iRPD in the node. It has four independent signal inputs (from ports 1, 2, 4, and 5). The reverse signals from ports 1 and 2 (left side) are combined as well as the reverse signals from ports 4 and 5 (right side). These (left and right side) reverse path signals then travel through the on board reverse configuration circuitry. This reverse configuration circuitry determines whether the (left and right side) signal paths remain segmented or if they are combined.

There are no physical test points on RF amplifier module, forward and reverse path. Built-in spectrum capture circuitry is used to monitor the forward and reverse paths.

To save power, the user can independently turn off any of the forward path gain blocks. The node can also automatically adjust power consumption based on the channel plan. Note that this feature is disabled by default and the user needs to use LCS to enable it.
AGC

AGC refers to the automatic tilt and level control of the forward amplifiers. AGC operates on each of the four forward ports independently by using the output levels (measured by the internal spectrum analyzer) to continuously adjust the attenuator and equalizers to maintain the desired output level and tilt which are set using LCS. Thermal compensation is also incorporated in the attenuator and equalizer settings. If input levels are significantly changed, it takes AGC several minutes to "lock" back in. The attenuator and equalizer settings are stored in non-volatile memory and restored after a power outage.

Auto-setup

Auto-setup is triggered by LCS and applies only to the forward amplifier. When auto-setup is triggered, the output level of the input source is measured and the attenuator(s) on the OIB are adjusted to optimize the input level into the forward amplifier. Auto-setup has to function any time there is a significant change in the input levels. Note that the attenuator settings are stored in non-volatile memory and restored after a power outage.

Optical Interface Board

The Optical Interface Board (OIB) provides all interconnections between the modules in the housing lid of the node. The modules in the housing lid include the power supplies and iRPD. Each module in the lid plugs directly into the OIB through a connector header, or row of sockets. Software controlled output and input attenuators are provided on the OIB for iRPD in the housing lid. All RF and power cables running between the housing lid and base also plug into the OIB.

There is a USB port on the OIB which is used to connect to a smart mobile device. With this USB port the operator can use the local control software installed on the smart mobile device to configure and monitor the node. For more information, see Cisco GS7000 Super High Output Intelligent Node Software Installation and Configuration Guide.

The OIB integrates a CPU that is used to control all RF functions on the node.

There are 3 LEDs on the OIB, Heartbeat LED, Communication LED, and Power LED.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Power LED</th>
<th>Heartbeat LED</th>
<th>Communication LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>On</td>
<td>Steady blink</td>
<td>Steady blink</td>
</tr>
<tr>
<td>Power supply fault</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Error #1</td>
<td>On</td>
<td>Not blink</td>
<td>Not blink</td>
</tr>
<tr>
<td>Condition</td>
<td>Power LED</td>
<td>Heartbeat LED</td>
<td>Communication LED</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>---------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Error #2</td>
<td>On</td>
<td>Steady blink</td>
<td>Not blink</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OS is ok but node control software is not running or is stuck. If this condition persists for more than a minute or two after power up, check all the cables connecting the lid and launch amplifier. Try cycling power.</td>
</tr>
<tr>
<td>Error #3</td>
<td>On</td>
<td>Not blink</td>
<td>Steady blink</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This condition should not be possible unless Heartbeat LED is damaged.</td>
</tr>
</tbody>
</table>

The OIB is field replaceable. The iRPD, power supplies, RF cables, power cables, and OIB mounting screws must be removed in order to remove the OIB from the housing lid.

**Intelligent Remote PHY Device**

In a Remote PHY network, both downstream and upstream PHY functionality are located at the traditional HFC node site. The node is the optical to electrical transition point in the network.

The Intelligent Remote PHY Device (iRPD) is a plug-in module in the node. It is intended to interact with the cBR-8 router, via a digital physical interface card (DPIC) installed as a module in the cBR-8. It supports these features:

- Full spectrum DOCSIS 3.0 support
- Full spectrum DOCSIS 3.1 support
- Converged broadcast, narrowcast, and VOD video support
- Out of Band (OOB) signaling support
- Dual 10GBE SFP+ backhaul connectivity
- Support of Daisy Chain architecture topology
- CCAP support
- Support of optical overlay architectures

Typically, it takes about 7 minutes after power is applied for an iRPD to go online.

**Power Supply Module**

The power supply module converts a quasi-square wave, 50 – 60 Hz AC input voltage into four well-regulated DC output voltages. The supply is an off-line, switched-mode power supply with a large operating range. This reduces service outages by converting long duration AC surges into load power. The power supply is a constant power device, meaning that it automatically adjusts its internal operating parameters for the most efficient use of the different levels of input voltage and current it will receive within the cable plant.

The DC output voltages generated by the power supply, at given load currents, are shown below:
- 24.5 VDC @ 6.2 Amps
- +8.5 VDC @ 1.0 Amps
- +5.5 VDC @ 1.3 Amps
- -6.0 VDC @ 0.8 Amps

Test points are provided on top of the power supply module for AC input and all output DC voltage rails.

The power supply module plugs directly into the optical interface board, no external cables are required.

A node can be configured with one or two power supplies. AC input voltage can be routed to both power supplies commonly from any node output port. In addition, AC input voltages can be routed in a split fashion to the two power supplies. AC input voltages from the left half of the node (output ports 1 – 3) can be routed to power supply 1 independent of AC input voltages from the right half of the node (output ports 4 – 6) being routed to power supply 2. Each of the power supplies output voltage rails is diode OR’d within the supply. This creates common DC powering circuits when multiple supplies are present in the node.

**Node Power Limitations**

The node must be configured in a manner that prevents potential thermal overloads. Heat generated by the node can reduce the life of the equipment.
The life of the equipment may be reduced if configured to draw more than the recommended level of power from the power supplies.

Caution

Two power supplies can provide a maximum power level of 150 watts to the node. The RF amplifier uses the majority of the available power. Maintain the total power consumption of all modules in the housing within these guidelines to minimize the heat generated. Find the optimal configuration by summing the power consumption of the RF amplifier plus the other individual modules in the housing using the following table.

Important

Do not populate the housing with any combination of modules that would draw more than the available power of 150 watts.

The following table lists the modules and their respective electrical parameters.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum AC through current (continuous)</td>
<td>Amps</td>
<td>15</td>
</tr>
<tr>
<td>Maximum AC through current (surge)</td>
<td>Amps</td>
<td>25</td>
</tr>
<tr>
<td>Component DC Power Consumption (Typical)</td>
<td></td>
<td>+24.5 VDC</td>
</tr>
<tr>
<td>Launch amplifier with reverse amplifier</td>
<td>Amps</td>
<td>3.77</td>
</tr>
<tr>
<td>OIB</td>
<td>Amps</td>
<td>0.23</td>
</tr>
<tr>
<td>iRPD Module</td>
<td>Amps</td>
<td>1.83</td>
</tr>
<tr>
<td>Power supply DC current rating</td>
<td>Amps</td>
<td>6.2</td>
</tr>
</tbody>
</table>
CHAPTER 3

Installation

This chapter describes the installation of the node.

- Tools and Test Equipment, page 15
- Node Housing Ports, page 16
- Strand Mounting the Node, page 17
- Pedestal or Wall Mounting the Node, page 20
- Fiber Optic Cable Installation, page 21
- RF Cable Installation, page 27
- Applying Power to the Node, page 29

Tools and Test Equipment

The following tools and equipment are required for installation.

- Torque wrench capable of 5 to 12 ft-lbs (6.8 to 16.3 Nm)
- 4-inch to 6-inch extension for torque wrench
- 1/2-inch socket for strand clamp bolts and cover bolts
- 1/4-inch flat-blade screwdriver
- #2 Phillips-head screwdriver
- Long-nose pliers
- 1/2-inch deep-well socket for seizure connector
- True-RMS digital voltmeter (DVM)
- EXFO FOT 22AX optical power meter with adapters
- Optical connector cleaning supplies
- Optical connector microscope with appropriate adapters for your optical connectors
Node Fastener Torque Specifications

Be sure to follow these torque specifications when assembling/mounting the node.

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Torque Specification</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing closure bolts</td>
<td>5 to 12 ft-lbs (6.8 to 16.3 Nm)</td>
<td></td>
</tr>
<tr>
<td>Test point port plugs</td>
<td>5 to 8 ft-lbs (6.8 to 10.8 Nm)</td>
<td></td>
</tr>
<tr>
<td>Housing plugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strand clamp mounting bracket bolts</td>
<td>5 to 8 ft-lbs (6.8 to 10.8 Nm)</td>
<td></td>
</tr>
<tr>
<td>Pedestal mounting bolts</td>
<td>8 to 10 ft-lbs (10.8 to 13.6 Nm)</td>
<td></td>
</tr>
<tr>
<td>Module securing screws</td>
<td>25 to 30 in-lbs (2.8 to 3.4 Nm)</td>
<td></td>
</tr>
<tr>
<td>RF Amplifier assembly shoulder screws (cross head screw)</td>
<td>18 to 20 in-lbs (2.0 to 2.3 Nm)</td>
<td></td>
</tr>
<tr>
<td>Seizure nut</td>
<td>2 to 5 ft-lbs (2.7 to 6.8 Nm)</td>
<td></td>
</tr>
<tr>
<td>RF cable connector</td>
<td>Per manufacturer instructions</td>
<td></td>
</tr>
<tr>
<td>Fiber optic cable connector</td>
<td>20 to 25 ft-lbs (27.1 to 33.9 Nm)</td>
<td></td>
</tr>
</tbody>
</table>

Node Housing Ports

The following illustration shows the location of available RF ports, fiber ports, and test points on the node housing.
When replacing test point port plugs, torque from 5 to 8 ft-lbs (6.8 to 10.8 Nm).

**Strand Mounting the Node**

The following procedure explains how to install the node on a strand (aerial installation). Strand mounting allows street-side access to the housing, and the housing does not need to be opened.

**Warning**

- Be aware of the size and weight of the node while strand mounting. Ensure that the strand can safely support the node's maximum weight. A fully loaded node weighs over 50 lbs (22.7 kg).
- Ensure the ground area below the installation site is clear of personnel before hoisting the node. If possible, block off walkway below the hoisting area to prevent pedestrian traffic during hoisting.
- Failure to observe these admonishments can result in serious injury or death.

1. Check the strand size. The minimum strand diameter should be 5/16 inch.
2. Attach the strand clamp brackets to the housing in the position shown in the following illustration. Use a torque wrench tightens the strand clamp bracket bolts from 5 ft-lb to 8 ft-lbs (6.8 to 10.8 Nm).
3. Loosen the strand clamp bolts to separate the clamps enough to insert the strand, but do not remove them. Then lift the housing into proper position on the strand.

4. Slip the clamps over the strand and finger-tighten the clamp bolts. This allows additional side-to-side movement of the housing as needed.
5 Move the housing as needed to install the coaxial cable and connectors. See the illustrations below for an example.

*Figure 2: Powered from Left*

![Image of the node powered from the left side.]

*Figure 3: Powered from Right*

![Image of the node powered from the right side.]

**Note**

If supplying power to the node through a main output port, a power inserter must be installed to inject the AC voltage onto the RF signal.

6 Use a torque wrench and a 1/2-inch socket to tighten the strand clamp bolts from 5 ft-lb to 8 ft-lbs (6.8 to 10.8 Nm).

**Note**

A slight tilt of the face of the housing is normal. Cable tension will cause the housing to hang more closely to vertical.

7 Connect the coaxial cable to the pin connector according to the pin connector manufacturer’s specifications.
8 Continue to Fiber Optic Cable Installation, on page 21 and RF Cable Installation, on page 27.

Pedestal or Wall Mounting the Node

Two mounting holes on the housing allow pedestal or wall mounting.

Follow this procedure for pedestal or wall mounting.

**Warning**

- Be aware of the size and weight of the node while mounting. A fully loaded node weighs nearly 50 lbs (22.7 kg).
- Ensure that proper handling/lifting techniques are employed when working in confined spaces with heavy equipment.
- Failure to observe these warnings can result in serious injury or death.

1. Remove the cover of the pedestal.
2. Remove the self-tapping bolts from the strand clamps, if previously installed, and set the bolts and strand clamps aside.
3. Position the node horizontally in the enclosure and allow for free flow of air around it. Inadequate airflow could cause the node to exceed thermal parameters. Line up the bolt holes on the bottom of the housing with the mounting holes on the pedestal bracket provided by the pedestal manufacturer.
The node housing must be mounted horizontally, as shown, to ensure proper airflow over the housing cooling fins. Do NOT mount the node housing vertically.

4 Secure the node housing to the pedestal bracket using the strand clamp bracket bolts you removed in step 2. Insert the bolts into the mounting holes. Use the strand clamps as spacers if necessary. Torque the bolts from 8 ft-lb to 10 ft-lb (10.8 Nm to 13.6 Nm).

5 Connect the coaxial cable to the pin connector according to connector manufacturer’s specifications.

6 Ground the equipment in accordance with local codes and regulations.

7 Continue to Fiber Optic Cable Installation, on page 21 and RF Cable Installation, on page 27.

**Fiber Optic Cable Installation**

The node can accept a fiber optic cable connector from either the right or left side of the housing, or both. The fiber optic cable(s) carries forward and reverse optical signals.

This procedure assumes a specific type of connector as an example. Your connector may be different from the one shown in these illustrations. Be sure to install the connector according to the connector manufacturer’s instructions.
Fiber optic cable installation is a critical procedure. Incorrect installation can result in severely degraded node performance. Be sure to carefully follow fiber connector manufacturer’s instructions. See Care and Cleaning of Optical Connectors, on page 42.

**Important**

Fiber connectors and adapters are labeled with the following color code. This is only a suggested setup. Your fiber assignment may be different. Refer to your network diagrams to verify your color code.

<table>
<thead>
<tr>
<th>Connector/Adapter Number</th>
<th>Fiber Color Code</th>
<th>Connects to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blue</td>
<td>forward receiver 1</td>
</tr>
<tr>
<td>2</td>
<td>Orange</td>
<td>forward receiver 2</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>reverse transmitter 1</td>
</tr>
<tr>
<td>4</td>
<td>Brown</td>
<td>reverse transmitter 2</td>
</tr>
<tr>
<td>5</td>
<td>Slate</td>
<td>spare</td>
</tr>
<tr>
<td>6</td>
<td>White</td>
<td>spare</td>
</tr>
<tr>
<td>7</td>
<td>Red</td>
<td>spare</td>
</tr>
<tr>
<td>8</td>
<td>Black</td>
<td>spare</td>
</tr>
</tbody>
</table>

**Fiber Management System**

The fiber management system is made up of a fiber tray and a fiber routing track. The fiber tray provides a convenient location to store excess fiber and up to two WDM modules in the node. The tray is hinged to allow it to move out of the way during the insertion of the fibers and for installation or replacement of the node power supplies. The fiber routing track provides a channel for routing fiber pigtails to their appropriate optical modules as well as a location to snap in unused fiber connectors for storage.

The following illustration shows the design of the fiber tray.
Fibers are spooled in a counterclockwise direction in the tray.

The following illustrations show the location and layout of the fiber tray and track in the housing lid.

**Install Fiber Optic Cable**

Install fiber optic cable as described below.
Warning

Laser light hazard. The laser light source on this product emits invisible laser radiation. Avoid direct exposure. Never look into the end of an optical fiber or connector. Failure to observe this warning can result in eye damage or blindness.

- 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.

1 The first step depends on whether the fiber optic cable is factory installed or not.

<table>
<thead>
<tr>
<th>IF...</th>
<th>THEN...</th>
</tr>
</thead>
<tbody>
<tr>
<td>fiber optic cable is factory installed</td>
<td>splice fiber pigtail of optical fiber input cable to your splice enclosure and continue to RF Cable Installation.</td>
</tr>
<tr>
<td>fiber optic cable is not installed</td>
<td>go to step 2.</td>
</tr>
</tbody>
</table>

2 Select the right or left fiber connection port for use and remove its sealing plug.

3 Push in the two release tabs at the top of the fiber tray and swivel the top of the fiber tray up and back to allow a clear view of the fiber routing channel below.
4 One at a time, carefully insert fibers with attached connectors through the fiber connection port, the fiber channel, and then up and through the fiber entry point in the bottom of the fiber tray. Do not bend or kink fibers. Though not necessary, you can also remove the power supplies and open the fiber routing channel cover for additional access.
If using the alternate (right-side) fiber connection port, you have to route the fibers through the fiber channel in the fiber track located underneath the unused fiber holders.

5 Hold the connector body to prevent rotation of the connector or fibers.

6 Carefully thread the 5/8-inch threaded nut into the threaded hole of the fiber port. Tighten to 20 to 25 ft-lbs (27.1 to 33.9 Nm).

7 Firmly tighten the rotational nut against the 5/8-inch threaded nut.

8 Push heat shrink tubing over the connector and fiber port and shrink in place.

9 Identify individual fibers according to their color code and determine to which receiver or transmitter module each fiber will connect.

10 Pivot the fiber tray back down and snap it into place on top of the power supply with its locking tabs.

11 Open the fiber tray cover and carefully wind the fibers around the spool in a counterclockwise direction. Be sure to leave enough fiber so that each connector can reach its intended module. Note that different diameter spool paths are provided to properly adjust the fiber length.

12 Route each fiber to its intended module through the fiber track as shown.
13 Before connection, carefully clean the optical connectors on both fiber and module according to the procedures in Care and Cleaning of Optical Connectors, on page 42.

14 Open the receiver or transmitter module fiber connector cover. Carefully slide the fiber connector into the module connector until it clicks.

15 Repeat steps 12 and 13 for each receiver and transmitter module.

16 Splice fiber pigtail of optical fiber input cable to your splice enclosure.

17 Continue to RF Cable Installation, on page 27.

RF Cable Installation

The node can accept up to four RF cables. These cables carry forward path RF signal outputs and reverse path RF signal inputs. The RF cables also supply the 45 to 90 V AC power input. Power can also be supplied through the 2 Ports (3 and 6) which do not support RF signals.

Trimming the Center Conductor

The node requires pin-type connectors for all RF connections.

Standard pin connectors, with pins extending 1.5 in. to 1.6 in. (3.8 cm to 4.064 cm) from connector shoulder, require no trimming. You must trim longer pins before inserting them into the housing.

Trimming Using the Integrated Cradle

To trim long pins using the integrated cradle, follow these steps.

1 Place the connector on the cradle as shown in the following illustration.
2 If the center conductor extends past the **CUT** stanchion on the housing, trim the pin flush with the end of the **CUT** stanchion.

3 Remove any burrs or sharp edges from the trimmed end of the pin.

**Trimming Using the Strip Line Mark**

To trim long pins using the strip line mark on the housing, follow these steps.

1 Place the connector above the entry port so that it lines up with its installed position.

2 If the center conductor extends past the **STRIP** line on the housing, trim the pin flush with the **STRIP** line.

3 Remove any burrs or sharp edges from the trimmed end of the pin.
Connecting the RF Cables to the Node Housing

Follow these steps to connect the RF cables.

1. Determine which ports receive an RF cable for your configuration.

2. The length of the RF connector center pin is critical to proper operation. The pin length must be 1.6 inches (4.064 cm). Trim pin if necessary before installation. See Trimming the Center Conductor, on page 27.

   Note

   Assemble each RF connector to its cable according to manufacturer’s instructions.

3. Remove the sealing plug of each port to which cables connect. Note that Ports 1, 3, 4, and 6 have the option of a vertical or horizontal connection.

4. Insert the appropriate coaxial connector of each RF cable to the desired housing port and torque to the manufacturer’s specification. Do not exceed recommended torque.

5. Repeat steps 2 through 4 for each RF port used.

6. Continue to Applying Power to the Node, on page 29.

Applying Power to the Node

The node requires input power of 45 to 90 V AC from an external power source. This power is supplied through one or more of the RF cables.

The powering configuration is flexible and can be changed to meet most network requirements. Power direction is configured by installing AC shunts for the ports through which you want to pass AC power. An AC segmentable shunt is provided to configure power direction between the two sides of the node.

The following schematic diagram illustrates node powering.
Node Powering Procedure

Follow these steps to apply power.

1. Determine which of the RF cables carry 45 to 90 V AC input power.

2. Install shunts in the locations that correspond to the AC-powered RF ports. Each port's shunt is located on the RF amplifier module near the port as shown in the following illustration.

![Diagram showing shunts on RF amplifier module]

Note: Shunts are available with both red and black tops. Use red to indicate that power is applied to that port. Use black to indicate that input power is not applied.

3. If desired, remove shunts to block AC power at the individual ports.

4. The next step depends on the power path, as follows:

<table>
<thead>
<tr>
<th>IF...</th>
<th>THEN...</th>
</tr>
</thead>
<tbody>
<tr>
<td>power will pass from left side of housing (Ports 1, 2, and 3) to right side of housing (Ports 4, 5, and 6)</td>
<td>ensure that the AC segmentable shunt is installed.</td>
</tr>
<tr>
<td>power is to be blocked between left side of housing (Ports 1, 2, and 3) and right side of housing (Ports 4, 5 and 6)</td>
<td>ensure that the AC segmentable shunt is removed.</td>
</tr>
<tr>
<td>Ports 1, 2, and 3 are powered from one source and Ports 4, 5 and 6 are powered from another source</td>
<td>ensure that the AC segmentable shunt is removed.</td>
</tr>
</tbody>
</table>

5. Continue to Voltage Check Procedure, on page 31.
Voltage Check Procedure

Always check both AC and DC voltages during initial setup of the node. Follow these steps to check AC and DC voltages.

1. Use a true-rms DVM to check for 45 to 90 V AC input voltage at the AC test point on the power supply module.

2. Check for the various DC output voltages (+24.5, +8.5, -6.0, and +5.5) of the power supply at the DC test points on the power supply module.

3. Verify that the LED on the OIB is on.

4. Carefully close the housing lid. See Opening and Closing the Housing, on page 35.
Setup and Operation

For the setup and operation procedure, refer to Cisco GS7000 Super High Output Intelligent Node Software Installation and Configuration Guide and How To Install the Cisco Remote-PHY Solution.

Refer to your network design diagrams during setup. The design diagrams should specify the exact input and output signal levels required for your network.
CHAPTER 5

Maintenance

This section describes maintenance procedures for the node.

• Opening and Closing the Housing, page 35
• Preventative Maintenance, page 36
• Removing and Replacing Modules, page 39
• Care and Cleaning of Optical Connectors, page 42

Opening and Closing the Housing

Installation or maintenance of the node requires opening the housing to access the internal modules. Proper housing closure is important to maintaining the node in good working condition. Proper closure ensures a good seal against the environment, protecting the internal modules.

Opening the Housing

Open the housing as follows.

1. Remove the bolts securing the lid to the base.
2. Carefully open the lid to allow access to the inside of the housing.
3. Inspect gaskets on the cover flange and on the test port plugs.
4. Replace any gaskets showing signs of wear (cracked, twisted, pinched, or dry) with new, silicon-lubricated gaskets.

Closing the Housing

Close the housing as follows.

1. Ensure any worn gaskets are replaced, and the gaskets are clean and in the correct position.
2. Carefully close the lid.
Preventative Maintenance

Preventive maintenance procedures are regularly scheduled actions that help prevent failures and maintain the appearance of the equipment.

Schedule

Perform the preventive maintenance procedures at these intervals.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Inspection:</td>
<td></td>
</tr>
<tr>
<td>External Surfaces</td>
<td>Semiannually</td>
</tr>
<tr>
<td>Connectors</td>
<td>Semiannually</td>
</tr>
</tbody>
</table>
## Maintenance

### Interval Procedure

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators</td>
<td>Semiannually</td>
</tr>
<tr>
<td>Wiring/Cable Assemblies</td>
<td>Annually</td>
</tr>
<tr>
<td>Cleaning:</td>
<td></td>
</tr>
<tr>
<td>External Surfaces</td>
<td>Annually</td>
</tr>
<tr>
<td>External Controls/Connectors</td>
<td>Annually</td>
</tr>
<tr>
<td>Internal Connectors/Circuit Cards</td>
<td>Annually</td>
</tr>
</tbody>
</table>

### Visual Inspection

Visually inspect the following items.

<table>
<thead>
<tr>
<th>What to Inspect</th>
<th>How to Inspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior surfaces</td>
<td>Inspect for:</td>
</tr>
<tr>
<td></td>
<td>- dust, dirt, lubricants, or other foreign matter worn spots or deep scratches on surfaces</td>
</tr>
<tr>
<td></td>
<td>- corrosion</td>
</tr>
<tr>
<td></td>
<td>- marred protective finish exposing bare metal</td>
</tr>
<tr>
<td></td>
<td>- missing, incorrect or obliterated marking, decals, or reference designators</td>
</tr>
<tr>
<td>Connectors</td>
<td>Inspect for:</td>
</tr>
<tr>
<td></td>
<td>- broken, loose, bent, corroded, or missing pins</td>
</tr>
<tr>
<td></td>
<td>- cracked insulator inserts</td>
</tr>
<tr>
<td>Wiring and cables</td>
<td>Inspect for:</td>
</tr>
<tr>
<td></td>
<td>- cuts, nicks, burns, or abrasions</td>
</tr>
<tr>
<td></td>
<td>- exposed bare conductors</td>
</tr>
<tr>
<td></td>
<td>- sharp bends</td>
</tr>
<tr>
<td></td>
<td>- pinched or damaged wires</td>
</tr>
<tr>
<td></td>
<td>- broken or loose lacing or clamps</td>
</tr>
</tbody>
</table>
Cleaning

Clean exterior surfaces of the equipment at least annually.

Consumable Materials

Use the materials listed below (or equivalent) when cleaning the equipment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropyl alcohol</td>
<td>TT-I-735</td>
</tr>
<tr>
<td>Cheesecloth</td>
<td>CC-C-440</td>
</tr>
<tr>
<td>Spray-type contact cleaner</td>
<td>(none)</td>
</tr>
</tbody>
</table>

Procedure

Clean the equipment as described below.

1. Use a small paintbrush to brush dust from connectors.
2. Wipe surfaces dry with clean, dry cheesecloth.
3. Clean exterior surfaces with clean cheesecloth moistened with isopropyl alcohol or general-purpose detergent. Do not let alcohol or detergent get inside equipment or connectors.

**Warning**

Isopropyl alcohol is flammable. Use isopropyl alcohol only in well-ventilated areas away from energized electrical circuits and heated objects such as soldering irons or open flames. Avoid excessive inhalation of vapors or prolonged or repeated contact with skin. Wear industrial rubber gloves and industrial safety goggles to avoid contact with skin. Do not take internally. Failure to comply with this admonishment can cause injury, physical disorder, or death.

**Caution**

Do not use cleaning fluids containing trichloroethylene, trichloroethane, acetone or petroleum-based cleaners on equipment. Failure to comply with this caution could harm equipment surfaces.

4. Clean electrical contacts with spray-type contact cleaner.
5. Clean internal connectors and circuit boards with hand-controlled, dry-air jet. Do not use pressure exceeding 15 lb/in² (1.05 kg/cm², or 103.43 kPa).
6 Clean interior surfaces with clean cheesecloth moistened with isopropyl alcohol or general-purpose detergent.

7 Clean internal electrical contacts with clean cheesecloth moistened with spray-type contact cleaner.

8 Dry interior with clean, dry cheesecloth.

Removing and Replacing Modules

This procedure describes how to remove and replace the internal modules of the node. All field-replaceable modules can be removed and replaced without removing power from the node.

Field-replaceable modules include:

• Power supply modules
• RF amplifier assembly
• iRPD

Caution

Removing power from the node will interrupt customer service. Removing any module will interrupt customer service unless that module has a redundant backup.

Module Replacement Procedure

Follow this procedure to remove and replace an iRPD, or power supply module.

1 Open the housing. See Opening and Closing the Housing, on page 35.

2 Carefully tag and remove any optical fibers from iRPD.

Warning

Laser light hazard. Never look into the end of an optical fiber or connector. Failure to observe this warning can result in eye damage or blindness.

3 Loosen the screws securing the module.

4 Lift the module straight up out of the housing to unplug it.

Note

Pull up on the built-in handle on the module.

5 Position the new module in the same location and carefully slide the module into its slot until connected to the optical interface board.

6 Tighten the screws securing the module. Torque screws to 25 to 30 in-lbs (2.8 to 3.4 Nm).
7 Carefully reconnect any optical fibers that were removed from the original module. Clean optical connectors before reconnecting. See Care and Cleaning of Optical Connectors, page 42 for cleaning procedure.

---

**Warning**

Laser light hazard. Never look into the end of an optical fiber or connector. Failure to observe this warning can result in eye damage or blindness.

---

8 Close the housing. See Opening and Closing the Housing, page 35.


**Diplexers and Trim modules**

The diplexer modules and High Pass Filter/Trim modules plug into the RF amplifier assembly through cut-outs in its cover.

To remove these modules, loosen the screw (for diplexer modules), pull up carefully on their integrated handles until they separate from the RF amplifier assembly.

**RF Amplifier Assembly Replacement Procedure**

Follow this procedure to remove and replace the RF amplifier assembly.

1 Open the housing. See Opening and Closing the Housing, page 35.

2 Remove the AC power shunts and make a note of their location for reinstallation in the replacement RF amplifier assembly.

---

**Caution**

Damage to the node may result if AC power shunts are not removed before replacing the RF amplifier assembly.

3 Unplug AC1/DC connector, forward path connector, control cable connector, reverse path connector and AC2 connector on the RF amplifier assembly.

4 Loosen the seven shoulder screws securing the RF amplifier assembly to the housing.
The screw locations are identified by number, 1 through 7.

5 Insert a flat-blade screwdriver into the small holes in the metal handles on each side of the RF amplifier assembly and pry up carefully to disconnect the RF amplifier assembly’s rear panel connectors.

Important

Be careful not to damage the housing with the screwdriver.

6 Grasp the two metal handles on the RF amplifier assembly and carefully lift the RF assembly out of the housing.
7 To replace the RF amplifier assembly in the housing, carefully align the assembly in the housing, lower it into place and push down to reconnect the rear panel connectors.

8 Secure the RF amplifier assembly to the housing with the seven cross-head shoulder screws.

---

**Important**

Tighten the screws in order by number, 1 through 7. Repeat the sequence twice, ending with a torque of 18 to 20 in-lbs (2.0 to 2.25 Nm).

---

9 Plug AC1/DC connector, forward path connector, control cable connector, reverse path connector and AC2 connector on the RF amplifier assembly.

10 Reinstall the AC power shunts in their proper locations on the RF amp assembly.

11 Close the housing. See Opening and Closing the Housing, on page 35.


---

### Care and Cleaning of Optical Connectors

---

**Caution**

Proper operation of this equipment requires clean optical fibers. Dirty fibers will adversely affect performance. Proper cleaning is imperative.

The proper procedure for cleaning optical connectors depends on the connector type. The following describes general instructions for fiber-optic cleaning. Use your company's established procedures, if any, but also consider the following.
Cleaning fiber-optic connectors can help prevent interconnect problems and aid system performance. When optical connectors are disconnected or reconnected, the fiber surface can become dirty or scratched, reducing system performance.

Inspect connectors prior to mating, clean as needed, and then remove all residues. Inspect connectors after cleaning to confirm that they are clean and undamaged.

**Recommended Equipment**

- CLETOP or OPTIPOP ferrule cleaner (CLETOP Type A for SC, Type B for LC)
- Compressed air (also called “canned air”)
- Lint-free wipes moistened with optical-grade (99%) isopropyl alcohol
- Bulkhead swabs for LC or SC type connectors (choose appropriate type)
- Optical connector scope

**Tips for Optimal Fiber-Optic Connector Performance**

- Do not connect or disconnect optical connectors with optical power present.
- Always use compressed air before cleaning the fiber-optic connectors and when cleaning connector end caps.
- Always install or leave end caps on connectors when they are not in use.
- If you have any degraded signal problems, clean the fiber-optic connector.
- Advance a clean portion of the ferrule cleaner reel for each cleaning.
- Turn off optical power before making or breaking optical connections to avoid microscopic damage to fiber mating surfaces.

**To Clean Optical Connectors**

**Warning**

- Avoid personal injury! Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Avoid personal injury! The laser light source on this equipment emits invisible laser radiation. Avoid direct exposure to the laser light source.
- Avoid personal injury! Viewing the laser output with optical instruments (such as eye loupes, magnifiers, or microscopes) may pose an eye hazard.

- Connect or disconnect fiber only when equipment is OFF or in Service mode.
• Do not apply power to this equipment if the fiber is unmated or unterminated.
• Do not look 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 such as eye loupes, magnifiers, or microscopes.
• Use safety-approved optical fiber cable to maintain compliance with applicable laser safety requirements.

Connector cleanliness is crucially important for optimum results in fiber optic communications links. Even the smallest amount of foreign material can make it impossible to obtain the expected insertion and return losses. This can reduce the range of the equipment, shorten its expected service life, and possibly prevent the link from initializing at all.

New equipment is supplied with clean optical connectors and bulkheads. Clean these connectors and bulkheads in the field only if you observe and can verify an optical output problem.

Connectors and Bulkheads

Most fiber optic connectors are of the physical contact (PC) type. PC type connectors are designed to touch their mating connector to prevent air gaps, which cause reflections. For optimum performance, all dirt must be removed.

Bulkheads can also become dirty enough to affect performance, either from airborne dust or from contamination introduced by connectors.

Warning

Avoid damage to your eyes! Do not look into any optical connector while the system is active. Even if the unit is off, there may still be hazardous optical levels present.

Note

Read the above warning before performing cleaning procedures.

Cleaning Connectors

It is important that all external jumper connectors be cleaned before inserting them into the optical module. Follow these steps to clean fiber optic connectors that will be connected to the optical module:

Important

Before you begin, remove optical power from the module or ensure that optical power has been removed.

1 Inspect the connector through an optical connector scope. If the connector is damaged, e.g., scratched, burned, etc., replace the jumper.

2 If the connector is dirty but otherwise undamaged, clean the connector as follows:
   a Make several swipes across the face of the connector with the appropriate ferrule cleaner. This will remove dust and some films.
To Clean Optical Connectors

b Listen for a slight "squeak" typically generated during this process, indicating a clean connector.
c Inspect the connector again through the scope to confirm that it is clean.

3 If a second inspection indicates that further cleaning is needed:
a Use 99% isopropyl alcohol and a lint-free wipe to clean the connector.
b Use the appropriate ferrule cleaner again to remove any film left over from the alcohol.
c Inspect the connector again through the scope and confirm that it is clean.

4 If necessary, repeat steps 3a-3c until the connector is clean.

Cleaning Bulkheads

Note
It is generally more difficult to clean bulkhead connectors and verify their condition due to limited accessibility of the fiber end face. For this reason, even on products with accessible bulkhead connectors, you should only attempt to clean a bulkhead connector when a dirty connector is indicated.

Follow these steps to clean the bulkhead:

Warning
• Avoid personal injury! Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.
• Avoid personal injury! The laser light source on this equipment emits invisible laser radiation. Avoid direct exposure to the laser light source.
• Avoid personal injury! Viewing the laser output with optical instruments (such as eye loupes, magnifiers, or microscopes) may pose an eye hazard.

1 Insert a dry bulkhead swab into the bulkhead and rotate the swab several times.
2 Remove the swab and discard. Swabs may be used only once.
3 Check the bulkhead optical surface with a fiber connector scope to confirm that it is clean. If further cleaning is needed:
a Moisten a new bulkhead swab using a lint-free wipe moistened with optical-grade (99%) isopropyl alcohol.
b With the connector removed, fully insert the bulkhead swab into the bulkhead and rotate the swab several times.
c Remove the swab and discard. Swabs may be used only once.
d Check with a fiber connector scope again to confirm that there is no dirt or alcohol residue on the optical surface.
e If any alcohol residue remains, clean it off with a new dry bulkhead swab.
4 Mate all connectors to bulkheads and proceed to Verifying Equipment Operation, on page 46 below.

5 It is also recommended that all connectors be visually inspected after cleaning to verify the connector is clean and undamaged.

**Verifying Equipment Operation**

Perform circuit turn-up. If the equipment does not come up, i.e., fails verification or indicates a reflection problem, clean the connectors and bulkheads again.
Troubleshooting

This troubleshooting section lists common problems and their solutions. If a troubleshooting procedure directs you to replace a module of the node, see Removing and Replacing Modules, on page 39.

- OIB, page 47
- Troubleshooting the node, page 48

OIB

There are 3 LEDs on the OIB, Heartbeat LED, Communication LED, and Power LED.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Power LED</th>
<th>Heartbeat LED</th>
<th>Communication LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>On</td>
<td>Steady blink</td>
<td>Steady blink</td>
</tr>
<tr>
<td>Power supply fault</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Error #1</td>
<td>On</td>
<td>Not blink</td>
<td>Not blink</td>
</tr>
<tr>
<td>Error #2</td>
<td>On</td>
<td>Steady blink</td>
<td>Not blink</td>
</tr>
<tr>
<td>Error #3</td>
<td>On</td>
<td>Not blink</td>
<td>Steady blink</td>
</tr>
</tbody>
</table>
## Troubleshooting the node

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Node is not powered up | - Verify that power is connected to the proper inputs and the powering shunts/fuses are correctly installed.  
- Verify that power supply is installed in the correct power supply slot.  
- Verify that AC input power is within the operating range (45 to 90 VAC rms).  
- Verify DC outputs on power supply test points. |
| No power, all LEDs are off | Check whether shunt fuse and node power supply module have been installed correctly. |
| Only Power LED is on, the other two LEDs are off | Software OS may be not boot up correctly, cycling power supply or press OIB reset button using a hard slim object through the reset hole. |
| No RF output on one or more forward RF ports | - Verify that the ports are turned on with LCS.  
- Verify input cabling and the RF input levels are as expected.  
- Verify the Fwd RF cable between OIB and Launch amp is connected properly.  
- Verify iRPD is operating. |
| No RF output on one or more reverse RF ports | - Verify segmentation setting with LCS.  
- Verify if there is RF port cabling and the RF input levels are as expected.  
- Verify the reverse RF cable between OIB and launch amplifier is connected properly. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGC does not lock</td>
<td>• Verify the RF configuration settings.</td>
</tr>
<tr>
<td></td>
<td>• Verify the USB cable connection in LCS.</td>
</tr>
<tr>
<td>Can not control with LCS</td>
<td>Check whether the USB cable connect correctly and refer to Cisco GS7000 Super High Output Intelligent Node Software Installation and Configuration Guide to see whether USB connection mode on mobile phone has been configured correctly.</td>
</tr>
<tr>
<td>software</td>
<td></td>
</tr>
<tr>
<td>Poor reverse C/N performance</td>
<td>• Check if the headend performance meets system design target.</td>
</tr>
<tr>
<td></td>
<td>• Measure level of RF input to RPD and check if the RF input level is correct.</td>
</tr>
<tr>
<td>Noise on reverse path</td>
<td>Look at the reverse path to determine which port(s) are noisy. Using max hold makes it easier to see bursty noise signals.</td>
</tr>
<tr>
<td>Poor frequency response</td>
<td>• Ensure RF cables are connected properly.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the diplexers match the installed splitter.</td>
</tr>
</tbody>
</table>
Troubleshooting

Troubleshooting the node
Glossary

The following list describes acronyms and definitions for terms used throughout this document:

- **CPU**: Central Processing Unit
- **DOCSIS**: Data Over Cable Service Interface Specification
- **FPGA**: Field Programmable Gate Array
- **HFC**: Hybrid Fiber-Coax
- **IAM**: Intelligent Amplifier Module
- **IFAM**: Intelligent Forward Amplifier Module
- **IRAM**: Intelligent Reverse Amplifier Module
- **iNode**: Intelligent Node
- **iRPD**: Intelligent Remote PHY Device
- **LCS**: Local Control Software
- **MCU**: Microprocessor Control Unit
- **MIB**: Management Interface Base
- **OIB**: Optical Interface Board
- **RPHY**: Remote PHY
- **USB**: Universal Serial Bus