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

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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. The protective ground connection, where provided, is essential to safe operation and must be verified before connecting the power supply.

Know the following safety warnings and guidelines:

- Dangerous Voltages
Important Safety Instructions

- 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.

Grounding
- Do not violate the protective grounding by using an extension cable, power cable, or autotransformer without a protective ground conductor.
- Take care to maintain the protective grounding of this equipment during service or repair and to re-establish the protective grounding before putting this equipment back into operation.

Installation Site

When selecting the installation site, comply with the following:

- **Protective Ground** - The protective ground lead of the building’s electrical installation should comply with national and local requirements.

- **Environmental Condition** – The installation site should be dry, clean, and ventilated. Do not use this equipment where it could be at risk of contact with water. Ensure that this equipment is operated in an environment that meets the requirements as stated in this equipment’s technical specifications, which may be found on this equipment’s data sheet.

Installation Requirements

**WARNING:**
Allow only qualified service personnel to install this equipment. The installation must conform to all local codes and regulations.

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.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat.
- Place this equipment close enough to a mains AC outlet to accommodate the length of this equipment’s power cord.
Important Safety Instructions

- Route all power cords so that people cannot walk on, place objects on, or lean objects against them. This may pinch or damage the power cords. Pay particular attention to power cords at plugs, outlets, and the points where the power cords exit this equipment.

- Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with this equipment.

- Make sure the mounting surface or rack is stable and can support the size and weight of this equipment.

- The mounting surface or rack should be appropriately anchored according to manufacturer’s specifications. 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.

Ventilation

This equipment has openings for ventilation to protect it from overheating. To ensure equipment reliability and safe operation, do not block or cover any of the ventilation openings. Install the equipment in accordance with the manufacturer’s instructions.

Rack Mounting Safety Precautions

Mechanical Loading

Make sure that the rack is placed on a stable surface. If the rack has stabilizing devices, install these stabilizing devices before mounting any equipment in the rack.

**WARNING:**
Avoid personal injury and damage to this equipment. Mounting this equipment in the rack should be such that a hazardous condition is not caused due to uneven mechanical loading.

Reduced Airflow

When mounting this equipment in the rack, do not obstruct the cooling airflow through the rack. Be sure to mount the blanking plates to cover unused rack space. Additional components such as combiners and net strips should be mounted at the back of the rack, so that the free airflow is not restricted.

**CAUTION:**
Installation of this equipment in a rack should be such that the amount of airflow required for safe operation of this equipment is not compromised.

Elevated Operating Ambient Temperature

Only install this equipment in a humidity- and temperature-controlled environment that meets the requirements given in this equipment’s technical specifications.
Important Safety Instructions

CAUTION:
If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient temperature. Therefore, install this equipment in an environment compatible with the manufacturer’s maximum rated ambient temperature.

Handling Precautions

When moving a cart that contains this equipment, check for any of the following possible hazards:

WARNING:
Avoid personal injury and damage to this equipment! Move any equipment and cart combination with care. Quick stops, excessive force, and uneven surfaces may cause this equipment and cart to overturn.

- Use caution when moving this equipment/cart combination to avoid injury from tip-over.
- If the cart does not move easily, this condition may indicate obstructions or cables that may need to be disconnected before moving this equipment to another location.
- Avoid quick stops and starts when moving the cart.
- Check for uneven floor surfaces such as cracks or cables and cords.

Grounding

This section provides instructions for verifying that the equipment is properly grounded.

Safety Plugs (USA Only)

This equipment may be equipped with either a 3-terminal (grounding-type) safety plug or a 2-terminal (polarized) safety plug. The wide blade or the third terminal is provided for safety. Do not defeat the safety purpose of the grounding-type or polarized safety plug.

To properly ground this equipment, follow these safety guidelines:

- **Grounding-Type Plug** - For a 3-terminal plug (one terminal on this plug is a protective grounding pin), insert the plug into a grounded mains, 3-terminal outlet.
  
  **Note:** This plug fits only one way. If this plug cannot be fully inserted into the outlet, contact an electrician to replace the obsolete 3-terminal outlet.

- **Polarized Plug** - For a 2-terminal plug (a polarized plug with one wide blade and one narrow blade), insert the plug into a polarized mains, 2-terminal outlet in which one socket is wider than the other.
Note: If this plug cannot be fully inserted into the outlet, try reversing the plug. If the plug still fails to fit, contact an electrician to replace the obsolete 2-terminal outlet.

Grounding Terminal

If this equipment is equipped with an external grounding terminal, attach one end of an 18-gauge wire (or larger) to the grounding terminal; then, attach the other end of the wire to a ground, such as a grounded equipment rack.

Safety Plugs (European Union)

- **Class I Mains Powered Equipment** – Provided with a 3-terminal AC inlet and requires connection to a 3-terminal mains supply outlet via a 3-terminal power cord for proper connection to the protective ground.
  
  Note: The equipotential bonding terminal provided on some equipment is not designed to function as a protective ground connection.

- **Class II Mains Powered Equipment** – Provided with a 2-terminal AC inlet that may be connected by a 2-terminal power cord to the mains supply outlet. No connection to the protective ground is required as this class of equipment is provided with double or reinforced and/or supplementary insulation in addition to the basic insulation provided in Class I equipment.
  
  Note: Class II equipment, which is subject to EN 50083-1, is provided with a chassis mounted equipotential bonding terminal. See the section titled **Equipotential Bonding** for connection instructions.

Equipotential Bonding

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

AC Power

Important: If this equipment is a Class I equipment, it must be grounded.

- If this equipment plugs into an outlet, the outlet must be near this equipment, and must be easily accessible.

- Connect this equipment only to the power sources that are identified on the equipment-rating label normally located close to the power inlet connector(s).

- This equipment may have two power sources. Be sure to disconnect all power sources before working on this equipment.

- If this equipment does not have a main power switch, the power cord connector serves as the disconnect device.
Important Safety Instructions

- Always pull on the plug or the connector to disconnect a cable. Never pull on the cable itself.
- Unplug this equipment when unused for long periods of time.

Connection to -48 V DC/-60 V DC Power Sources

If this equipment is DC-powered, refer to the specific installation instructions in this manual or in companion manuals in this series for information on connecting this equipment to nominal -48 V DC/-60 V DC power sources.

Circuit Overload

Know the effects of circuit overloading before connecting this equipment to the power supply.

CAUTION:
Consider the connection of this equipment to the supply circuit and the effect that overloading of circuits might have on overcurrent protection and supply wiring. Refer to the information on the equipment-rating label when addressing this concern.

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.

### 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.

### Fuse Replacement

To replace a fuse, comply with the following:

- Disconnect the power before changing fuses.
- Identify and clear the condition that caused the original fuse failure.
- Always use a fuse of the correct type and rating. The correct type and rating are indicated on this equipment.

### 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.
Important Safety Instructions

- 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 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.
Important Safety Instructions

Otherwise, comply with the following good practices:

- Multi-conductor cables should be of single-braided, shielded type and have conductive connector bodies and backshells with cable clamps that are conductively bonded to the backshell and capable of making 360° connection to the cable shielding. Exceptions from this general rule will be clearly stated in the connector description for the excepted connector in question.

- Ethernet cables should be of single-shielded or double-shielded type.

- Coaxial cables should be of the double-braided shielded type.

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

Introduction

This equipment 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 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 such as eye loupes, magnifiers, or 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.
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 Power and Warning Labels

Warning Labels

One or more of the labels shown below are affixed to this product.
Laser Power and Warning Labels

Location of Labels on Equipment

The following illustration displays the location of warning labels on this equipment.
Introduction

Overview
This guide describes the Cisco Lumin™ Dense Fiber Chassis (DLC) and modules.

Purpose
This guide provides information for installing and operating the Lumin Broadband Fiber Transport System. The system includes the Dense Fiber Chassis (DLC), Dense Fiber Transmitter (DLT), and Dense Dual Return Path Receiver (DDR).

Who Should Use This Document
This document is intended for authorized service personnel who have experience working with similar equipment. The service personnel should have appropriate background and knowledge to complete the procedures described in this document.

Qualified Personnel

WARNING:
Allow only qualified and skilled personnel to install, operate, maintain, and service this product. Otherwise, personal injury or equipment damage may occur.

Only appropriately qualified and skilled personnel should attempt to install, operate, maintain, and service this product.

Document Version
This is the third release of this guide.
In This Chapter

- System Overview and Features ............................................................... 3
System Overview and Features

The Lumin Broadband Fiber Transport System is a family of products that provide analog carriage of RF signals on fiber optic cable networks. The analog nature of the system allows it to carry both traditional analog National Television System Committee (NTSC) or Phase Alternating Line (PAL) modulated video and audio RF carriers. It also allows QAM or similarly modulated digital RF signals or a composite of both analog carriers and digital carriers in the range of 50 to 1003 MHz in transmitters.

DLC Chassis

The DLC chassis serves as the functional platform for the application modules. The chassis can be mounted in an EIA standard 19-inch rack or operated freestanding. It can accommodate 15 functional modules. Any module can be used in any slot, providing the flexibility to position modules to fit the application and to mix any number of functional modules within the 15 slots.

The 3 RU chassis accepts up to two DC to DC converter(s) with provision for external -48 V DC powering.

Chassis Features

Chassis User Interface:

- Two-line by 16-character LCD display provides information and operator-choice entry.
- Four-button keypad provides control interface in conjunction with the LCD display.
Chassis Mechanical:
- Holds hot-swappable DC to DC converter and fan tray.
- External DC input connector for power on the rear panel.

Chassis Power Features
- Removable and hot-swappable with front panel access.
- Auxiliary DC power supply module and chassis provides primary -48 V DC power input.
- On-board +24 V DC, +5 V DC and -5 V DC powering.

Fan Tray
The chassis includes a fan tray with multiple fans for consistent performance over a wide ambient temperature and load range. Fan capacity is designed to maintain operation within specification upon the failure of one fan. Air is moved up along the module sides and is exhausted to the rear. No filters are present that require cleaning.

System Controller Subassembly
The fan tray includes a system controller with processors for actively managing module performance characteristics over time and temperature. The system controller includes a front panel display with LEDs to indicate power, fan and module alarms along with a 2-line, 16-character LCD display. The display and 4-button keypad allow you to configure all chassis and module functions, set operating levels, and manage external communication ports. The power output or input and the temperature of a module is available on the display, as well as error messages for a module in the event of an alarm or failure.

Important: The fan tray is hot-swappable, allowing modules to operate uninterrupted for one to two minutes while addressing a fan tray problem.

Blank Modules
Blank modules (part number 4023578) should be installed in all unused slots to ensure proper airflow when less than 15 modules are operated in the chassis. This allows for proper airflow in a partially populated chassis for thermal management.
External Control Features

- RS-232 port (when DB-9 output port selected)
- SNMP version 2 over Ethernet 10/100Base-T RJ-45 port

Chassis Front Panel

The fan tray with system controller subassembly is mounted in the chassis above the modules to provide system control and monitoring. Two mounting lock screws are located at the upper corners of the fan tray assembly. A pull knob near the left edge is provided to assist with removal. When removing, the fan tray will be snug initially until the power socket disengages. It will then slide smoothly without the use of tools. At the lower right of the panel is a grounding jack.

The fan tray has these connectors and controls:

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<th>Function</th>
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<td>Ethernet 10/100BaseT connection for SNMP management.</td>
</tr>
<tr>
<td>RS-232 DB-9</td>
<td>Serial connection for management.</td>
</tr>
<tr>
<td>Power LED</td>
<td>GREEN when power is applied to chassis.</td>
</tr>
<tr>
<td>Fan Alarm LED</td>
<td>RED when any one of the fan tray fans is not rotating at proper speed.</td>
</tr>
<tr>
<td>Slot Alarm LED</td>
<td>RED when any slot module has an alarm condition, including a fan alarm.</td>
</tr>
<tr>
<td>Display</td>
<td>2-line, x 16-character display for menus and status.</td>
</tr>
<tr>
<td>Menu Buttons</td>
<td>For operator input.</td>
</tr>
<tr>
<td>Grounding Jack</td>
<td>For use by maintenance personnel.</td>
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Installation

This chapter provides instructions for installing the chassis and modules.

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Chapter 2  Installation

Before You Begin

Before you begin the installation procedure, make sure you have all the tools and accessories ready.

Tools

The following tools and equipment are needed to install the system.
- Pan-head or round-head screws and washers
- Flat-head screwdriver
- Phillips-head screwdriver

Inspecting the Chassis and Modules

- Inspect the carton upon receipt and note any damage to the carton. Inspect for possible unit damage.
- Open the carton and unpack carefully.
- No accessory items are packed with the functional modules.

Verify Rack Dimensions

It is important to verify the rack dimensions to guarantee proper installation of the chassis. The minimum Telco rack dimensions needed for installation are as follows.
- The chassis weighs 23 lbs and can be installed into a 19-in. rack. Maximum width not including mounting ears is 17.6 inches.
Installing the Chassis

Mount the empty chassis in the equipment rack, using pan or round head screws and washers in the four front panel corner mounting locations. This enables a secure mount for the size and weight of the unit. You must supply screws matching your rack.

Chassis Location in Rack

The chassis can be placed anywhere within the rack. Hot air discharge from other equipment must not be directed at the chassis front panel. Dust from the surrounding environment should not be ingested in the input airflow. The chassis can be mounted without an air gap, directly above or below another chassis or other equipment that does not thermally exhaust directly at the front panel of the chassis.

Operating Temperature

Make sure the unit is operated in a temperature and humidity-controlled environment.

Note: Maximum operating ambient temperature is 50°C (122°F).

Long-term reliability is best obtained with consistently cool environments. Never place a unit near a heat source. Do not install a unit in areas of high humidity or where there is any danger of water or condensation dripping into or on the unit.
Installing/Removing the Modules

After the chassis is mounted in the rack, all modules are inserted from the front. Guide rails are provided to properly align modules with the backplane connectors.

To Install the Modules

1. Hold module vertically with module front toward you.
2. Align the rib on lower side of the module with a guide slot in the chassis and align top rib with matching guide slot in the top of the chassis.
3. Slide module in smoothly until slight resistance is felt, then continue to push gently until the module connector seats completely.
   **Note:** Check alignment if serious resistance is felt; do not press strongly or connector damage may result. When installing the module in the slot, some side to side movement is intended to ensure proper connector alignment.
4. Tighten by hand the spring-loaded screw on the top front of the module to secure the module in the chassis.

To Remove the Modules

1. Loosen by hand the spring-loaded screw on the top front of the module to release the module from the chassis.
2. Pull slightly to unseat the connector.
3. Hold the module and gently remove from the chassis.
   **Important:** Do not use the spring-loaded screws as a handle when removing the module.
Connections

Although the modules may be hot-swapped when needed to restore services, it is recommended that the chassis be installed and modules inserted before powering the chassis.

It is also recommended that optical fibers be connected to the front panel before powering the system to minimize possible exposure to laser radiation.

**CAUTION:**

Use only SC/APC terminated fiber cables when connecting to modules. Clean the connector using recognized industry practices each time it is to be inserted into any module to prevent performance degradation.

For fiber cleaning information, refer to *Care and Cleaning of Optical Connectors* (on page 36).

**CAUTION:**

Optical transmitters may be powered on whenever installed in a powered chassis. The optical output is shuttered to reduce unintentional access to laser output.

The DLT modules are classified as Class 1M per IEC/EN 60825-1/A2:2001. This product complies with FDA/CDRH, 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated 26 July, 2001.

**DLT Module**

The front panel of the DLT module contains one optical output port, a -20 dB F-connector test port, and a LED indicator.
The rear panel contains two RF input ports.

These two RF inputs are used in one of the following modes:

**ANALOG ONLY Mode:**
- Connect RF input cable to port 1 or broadcast port (top).
- Nominal input RF power should be set at +15 dBmV per channel for 80 channel NTSC loading.
- When enabled, the AGC mode holds the composite OMI level of the modulated light at nominal, over any variations in RF input level from 3.0 dB above nominal to 1.0 dB below nominal from the factory preset setting. Cisco recommends initiating AGC selection through the Lumin Customer Utility (LUC).

**DIGITAL ONLY Mode:**
- Connect the RF cable to port 2 or narrowcast port (bottom).

**DUAL Mode (Analog and Digital):**
- Using single RF input cable, connect RF input cable to port 1 or broadcast port (top).
- Using separate RF input cables, connect the analog RF input cable to port 1 or broadcast port (top) and connect the digital RF input cable to port 2 or
narrowcast port (bottom).

Input Levels
The secondary input is designed to be -20 dB relative to the main input for an identical input power level. This power ratio is not user adjustable.

DLT Input Connections
The transmitters have two input F-connectors. The main input and the secondary input. The secondary input is routed directly to the directional coupler. This leg has a 20 dB loss. Signals of equal level applied to both main and secondary inputs are transmitted at a 20 dB level difference. (Secondary will be -20 dB from main input.)
**DDR Module**

The DDR module contains two receivers in one housing.

- Receiver A input is the top SC/APC connector on the front panel and the receiver A output is the top F-connector on the rear panel.

- Receiver B input is the lower SC/APC connector on the front panel and the receiver B output is the lower F-connector on the rear panel.

A -20 dB F-connector test port is on the front panel and can be connected to either Port A or B using the chassis front panel. The front panel also contains a LED indicator.
Powering the Chassis

The chassis is DC powered and contains dual redundant DC to DC converters. A separate Cisco external power shelf is offered to provide the necessary DC voltage input to the chassis. For details, refer to Appendix A (on page 41).

The external -48 V DC operating power for each DC to DC converter enters the chassis via a dedicated DC power inlet mounted on the chassis back panel.

The nominal voltage input range for DC power systems is -48 V DC to -60 V DC.

DC Input

If the external power shelf is not being used and the chassis is connected to an existing DC distribution system, the DC input connection for each DC converter can be made with power cable PN 4011730, or a custom cable may be made with the following parts and customer supplied wire.

- Molex #50-29-1608 nylon 3-pin connector
- Molex #18-12-1222 crimp socket contact (3)

Use a Molex Crimp Service Tool #63811-1000 or equivalent to crimp the pins to the cable.

As installed in the DC power connector with the locking tab to the right, the top pin of the input connector carries -48 V DC, the bottom pin is the return, and the center pin is chassis ground.
Chapter 2  Installation

If the external power shelf is being used, one of the following connection cables must be used for each converter input.

- 1 ft - part number 4027865
- 2 ft - part number 4027866
- 4 ft - part number 4027867

**AC Input**

For information on Cisco's approved AC powering for the chassis, refer to *Appendix A* (on page 41).
3

Operation

This chapter provides information about operating the Cisco Lumin DLC chassis.

In This Chapter

- Front Panel Operation ................................................................. 18
- Chassis Menu .................................................................................. 21
- DLT Module Menu ........................................................................ 25
- DDR Module Menu ....................................................................... 28
- Adjusting Input Levels Based on Channel Loading .................... 31
Front Panel Operation

The chassis holds the fan tray controller. This plug-in module provides cooling for the 15 plug-in modules and a network management node. The fan tray provides three methods of control.

The first method is a front panel display and operator button array. Through this button array and display, the operator can set various provisioning parameters for modules and monitor the system. Refer to Keypad Operation (on page 18) and Display Operation (on page 19).

The second method is for local access via the front panel RS-232 connection. This is intended for local connection of a PC running the Lumin Utility. Refer to the Cisco Lumin Dense Fiber Chassis (DLC) Configuration Guide, part number 4028088.

The third method is for remote access via the front panel 100BaseT Ethernet connection. This port provides SNMP capability for Network Management. Refer to the Cisco Lumin Dense Fiber Chassis (DLC) Configuration Guide, part number 4028088.

Keypad Operation

The keypad consists of four buttons, Menu, Select, Up and Down. Press a key and release for one operation.

The following table describes the keypad functions.

<table>
<thead>
<tr>
<th>Key</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu</td>
<td>Returns to the main menu display.</td>
</tr>
<tr>
<td>Select</td>
<td>Advances to the next menu in the current chain.</td>
</tr>
<tr>
<td>Up</td>
<td>For sequential values (0 to 100% or 0 to 5.0 dBm), this key increments the value by the smallest unit available. For a long series of digits such as IP addresses, this key advances the cursor to the next digit to be set.</td>
</tr>
<tr>
<td>Down</td>
<td>For sequential values (0 to 100% or 0 to 5.0 dBm), this key decrements the value by the smallest unit available. For a long series of digits such as IP addresses, this key increments the digit currently pointed to by the cursor.</td>
</tr>
</tbody>
</table>
Whenever values or controls are changed by key commands, those changes are stored in nonvolatile memory and become effective immediately. The exceptions to this rule are the values for the IP address, subnet mask, and Gateway which have a separate verification command. Refer to *Cisco Lumin Dense Fiber Chassis (DLC) Configuration Guide*, part number 4028088.

### Display Operation

When the unit powers on, a greeting message displays for a few seconds, followed by a polling result display showing the detected population of plug-in modules. Each slot is represented by one character on the second line of the display. The character displayed tells what the controller found in the slot.

<table>
<thead>
<tr>
<th>Character</th>
<th>Slot Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period ()</td>
<td>Slot is empty.</td>
</tr>
<tr>
<td>T</td>
<td>DLT Transmitter module.</td>
</tr>
<tr>
<td>r</td>
<td>DDR Return Receiver module.</td>
</tr>
<tr>
<td>b</td>
<td>A module is in bootloader mode. This condition occurs if a firmware download attempt failed. The module is not running properly. The module also displays this character if the firmware fails an internal checksum, indicating the firmware may have been corrupted.</td>
</tr>
</tbody>
</table>

After the polling display, the unit enters the main menu. The overall chassis condition is displayed.

The following table describes the display functions.

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Displays current chassis temperature. Pressing the Up or Down key changes the mode displayed.</td>
</tr>
<tr>
<td>Fan Status</td>
<td>If an alarm is displayed, at least one of the five fans in the fan tray has failed.</td>
</tr>
<tr>
<td>Main Power Status</td>
<td>If enabled, the Main Power OK message indicates no detected alarm on the DC converters and DC converter fans. An alarm may indicate a failed DC converter output rail, failed DC converter -48 V input, or failed or not installed DC converter fan.</td>
</tr>
<tr>
<td>Auxiliary Power Status</td>
<td>If enabled, the Auxiliary Power OK message indicates no detected alarms on the external alarm connector (the 16-pin connector on the rear of the chassis). This auxiliary alarm input connector allows you to monitor the external power shelf. Refer to manufacturer data sheet for detailed alarm description. Note: If no external equipment is connected to the auxiliary alarm input connector, no alarm will be indicated by the chassis.</td>
</tr>
</tbody>
</table>

The second line displays a rotating sequence for the occupied slots, indicating the slot number as SLXX (slots are numbers 01 to 15 left to right), followed by a single character, followed by a statement of how many alarm or error conditions are present. If there are no alarms or errors, OK is displayed. You can proceed to the chassis display menu or select a particular slot menu.
Chapter 3  Operation

To go to the chassis display:
1  Press the Select key.
   **Result:** The chassis display is shown.

To select a particular slot menu:
1  Press the **Up** or **Down** key.
   **Result:** The display changes to show one slot number and its module type.
2  Press the **Up** or **Down** key to get to the desired module.
3  Press the Select key to go to that slot’s module-specific menu.
**Chassis Menu**

The Chassis menu provides access to status and configuration items affecting the entire chassis.

The menu options are:

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis Name</td>
<td>Set by the Lumin Utility.</td>
<td>None available via front panel of fan tray</td>
</tr>
<tr>
<td>Port</td>
<td>Displays active communication port. Choices are RS-232, Ethernet.</td>
<td>Up/Down = scroll two choices</td>
</tr>
<tr>
<td>Baud</td>
<td>Displays baud rate for front panel RS-232 communication. Choices are 9600, 19,200, 28,800, 57,600 Bps.</td>
<td>Up/Down = scroll four choices</td>
</tr>
<tr>
<td>DHCP</td>
<td>Displays the DHCP state. Choices are On, Off.</td>
<td>Up/Down = toggle On or Off</td>
</tr>
<tr>
<td>IP Address *</td>
<td>Displays internet protocol address as xxx.xxx.xxx.xxx.</td>
<td>Down = increment cursor selected digit Up = advance cursor to next digit</td>
</tr>
<tr>
<td>Sub-net Mask *</td>
<td>Displays internet protocol subnet mask address as xxx.xxx.xxx.xxx.</td>
<td>Down = increment cursor selected digit Up = advance cursor to next digit</td>
</tr>
<tr>
<td>Gateway *</td>
<td>Displays internet protocol gateway address as xxx.xxx.xxx.xxx.</td>
<td>Down = increment cursor selected digit Up = advance cursor to next digit</td>
</tr>
<tr>
<td>Config OK**</td>
<td>Accept or reject static IP settings.</td>
<td>Up/Down = toggle Yes or No</td>
</tr>
<tr>
<td>Power Monitor Configuration</td>
<td>Displays power supply monitor configuration. Choices are None, Main Only, Aux Only, Both.</td>
<td>Up/Down = scroll four choices</td>
</tr>
<tr>
<td>Chassis Temperature</td>
<td>Displays chassis (inside fan tray) temperature.</td>
<td>Up/Down = toggle Celsius or Fahrenheit</td>
</tr>
<tr>
<td>Module List</td>
<td>Displays list of currently detected modules. Same as the polling result list displayed at startup. This list is updated in real time, and can be used to verify that a module is detected.</td>
<td>None</td>
</tr>
<tr>
<td>Errors and Alarms</td>
<td>Displays list of internally detected module errors and any alarms enabled.</td>
<td>Up/Down = scroll list of outstanding errors and alarms</td>
</tr>
<tr>
<td>Model Number</td>
<td>Displays model number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
</tbody>
</table>
### Chapter 3  Operation

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number</td>
<td>Displays serial number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Software Version</td>
<td>Displays software version number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Defaults</td>
<td>Allows resetting module to factory default values. If YES selected, all settable parameters are reset to factory default values.</td>
<td>Up/Down = flips potential answer from No to Yes</td>
</tr>
</tbody>
</table>

Note: You cannot return to previous settings once defaults are selected. They must be re-entered manually.

* Should only be modified in Ethernet mode with DHCP off.

** Should only be modified in Ethernet mode with DHCP off. Only seen in IP static mode.

The potential alarms to be displayed are:

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Description</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Tray Temp</td>
<td>Fan tray temperature has exceeded limits.</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Fan tray temperature alarm limits are not user settable.</td>
<td></td>
</tr>
<tr>
<td>+5V DC Rail</td>
<td>+5V DC power supply rail in the fan tray has exceeded limits.</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Voltage alarm limits are not user settable.</td>
<td></td>
</tr>
<tr>
<td>-5V DC Rail</td>
<td>-5V DC power supply rail in the fan tray has exceeded limits.</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Voltage alarm limits are not user settable.</td>
<td></td>
</tr>
<tr>
<td>+24V DC Rail</td>
<td>+24V DC power supply rail in the fan tray has exceeded limits.</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Voltage alarm limits are not user settable.</td>
<td></td>
</tr>
<tr>
<td>Fan Failure</td>
<td>One or more fans in the fan tray has stopped rotating.</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> A fan alarm will cause a slot alarm as the fan tray is considered a slot.</td>
<td></td>
</tr>
<tr>
<td>Main Power Fail</td>
<td>An alarm condition on one of the DC to DC converter modules (plugged into the chassis) or one of the DC to DC converter cooling fans. This may be mains failure, individual rail failure, or module fan failure.</td>
<td>User Settable</td>
</tr>
<tr>
<td>Aux Power Fail</td>
<td>An alarm condition on the 16-pin auxiliary alarm input connector. When connected to the external power supply alarm connector, this may indicate a mains failure, individual rail failure, or module fan failure.</td>
<td>User Settable</td>
</tr>
</tbody>
</table>

Note: If no external equipment is connected to the auxiliary alarm input connector, no alarm will be indicated by the chassis.

The potential errors to be displayed are:
<table>
<thead>
<tr>
<th>Error Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash Write Err</td>
<td>An unrecoverable error has occurred in writing to nonvolatile memory.</td>
</tr>
<tr>
<td>Sys Parm Err</td>
<td>An unrecoverable data corruption error has occurred in the parameter.</td>
</tr>
</tbody>
</table>

**Note:** Alarms generate SNMP traps, errors do not. Errors are typically associated with low level internal function and will generate local notifications on the Lumin Utility, front panel display, and front panel LEDs. Alarms may occur in conjunction with errors.
## DLT Module Menu

The DLT menu provides access to status and configuration items affecting one particular slot populated with a DLT module.

The menu options are:

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Displays the name of the module as set via the Lumin Utility.</td>
<td>None</td>
</tr>
<tr>
<td>Laser</td>
<td>Displays and controls the laser function. If disabled, there is no laser light output.</td>
<td>Up/Down = toggle On or Off</td>
</tr>
<tr>
<td>Opt. Pwr</td>
<td>Displays optical output power in dBm.</td>
<td>None</td>
</tr>
<tr>
<td>Mod Temp</td>
<td>Displays internal module temperature.</td>
<td>Up/Down = toggle Celsius or Fahrenheit</td>
</tr>
<tr>
<td>AGC</td>
<td>Displays and controls the Automatic Gain Control function.</td>
<td>Up/Down = toggle AGC On or Off</td>
</tr>
<tr>
<td>Lvl</td>
<td>Displays and controls an operator specified 0 to 5 dB of RF attenuation.</td>
<td>Up/Down = toggle incr/decr attenuation level</td>
</tr>
<tr>
<td>Bias I</td>
<td>Displays the laser bias current in milliAmps.</td>
<td>None</td>
</tr>
<tr>
<td>Errors and Alarms</td>
<td>Displays a list of internally detected module errors and any alarms enabled.</td>
<td>Up/Down = scroll list of outstanding errors and alarms</td>
</tr>
<tr>
<td>Model Number</td>
<td>Displays model number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Serial Number</td>
<td>Displays serial number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Software Version</td>
<td>Displays software version number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Defaults</td>
<td>Allows resetting module to factory default values. If YES selected, all settable parameters are reset to factory default values. <strong>Note:</strong> You cannot return to previous settings once defaults are selected. They must be reentered manually.</td>
<td>Up/Down = No to Yes</td>
</tr>
</tbody>
</table>
The potential alarms to be displayed are:

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Description</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Temp</td>
<td>Module internal temperature has exceeded limits.</td>
<td>Enabled</td>
</tr>
<tr>
<td>Low RF Input</td>
<td>RF input power is outside factory limits.</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

The potential errors to be displayed are:

<table>
<thead>
<tr>
<th>Error Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF In Low</td>
<td>RF input circuit has a low level hardware failure.</td>
</tr>
<tr>
<td>RF In High</td>
<td>RF input circuit has a high level hardware failure.</td>
</tr>
<tr>
<td>In Pwr Low Range</td>
<td>AGC has railed out due to low input power.</td>
</tr>
<tr>
<td>In Pwr High Range</td>
<td>AGC has railed out due to high input power.</td>
</tr>
<tr>
<td>BF Low Range</td>
<td>Back facet monitor has a low level hardware failure.</td>
</tr>
<tr>
<td>BF High Range</td>
<td>Back facet monitor has a high level hardware failure.</td>
</tr>
<tr>
<td>PD Low Range</td>
<td>Forward power detector has a low level hardware failure.</td>
</tr>
<tr>
<td>PD High Range</td>
<td>Forward power detector has a high level hardware failure.</td>
</tr>
<tr>
<td>TEC Low Temp</td>
<td>TEC indicates a low temperature control failure.</td>
</tr>
<tr>
<td>TEC High Temp</td>
<td>TEC indicates a high temperature control failure.</td>
</tr>
<tr>
<td>Flsh Write Err</td>
<td>An unrecoverable error has occurred in writing to nonvolatile memory.</td>
</tr>
<tr>
<td>Sys Parm Error</td>
<td>An unrecoverable data corruption error has occurred in the parameter block.</td>
</tr>
</tbody>
</table>

**Note:** Alarms generate SNMP traps, errors do not. Errors are typically associated with low level internal functions and generates local notifications on the Lumin Utility, front panel display, and front panel LEDs. Alarms may occur in conjunction with errors.
**DDR Module Menu**

The DDR menu provides access to status and configuration items affecting one particular slot populated with a DDR module.

The menu options are:

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Displays the name of the module as set via the Lumin Utility.</td>
<td>None</td>
</tr>
<tr>
<td>Status A Opt. Pwr</td>
<td>Displays optical input power for Port A.</td>
<td>None</td>
</tr>
<tr>
<td>Status B Opt. Pwr</td>
<td>Displays optical input power for Port B.</td>
<td>None</td>
</tr>
<tr>
<td>Config A Atten</td>
<td>Set Port A attenuator level, 0-32 dB</td>
<td>Up/Down = toggle incr/decr attenuator level in 0.2 dB steps</td>
</tr>
<tr>
<td>Config B Atten</td>
<td>Set Port B attenuator level, 0-32 dB</td>
<td>Up/Down = toggle incr/decr attenuator level in 0.2 dB steps</td>
</tr>
<tr>
<td>Status Mod Temp</td>
<td>Displays internal module temperature.</td>
<td>Up/Down = toggle Celsius or Fahrenheit</td>
</tr>
<tr>
<td>Config Test Port</td>
<td>Displays channel connected to front panel test port.</td>
<td>Up/Down = toggle Port A or Port B</td>
</tr>
<tr>
<td>Config A Status Rpt</td>
<td>Enable/disable alarm reporting.</td>
<td>Up/Down = toggle On or Off</td>
</tr>
<tr>
<td>Config B Status Rpt</td>
<td>Enable/disable alarm reporting.</td>
<td>Up/Down = toggle On or Off</td>
</tr>
<tr>
<td>Errors and Alarms</td>
<td>Displays a list of internally detected module errors and any alarms enabled.</td>
<td>Up/Down = scroll list of outstanding errors and alarms</td>
</tr>
<tr>
<td>Model Number</td>
<td>Displays model number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Serial Number</td>
<td>Displays serial number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Software Version</td>
<td>Displays software version number.</td>
<td>Up/Down = scroll first 16 characters or last 16 characters of 32 character value</td>
</tr>
<tr>
<td>Defaults</td>
<td>Reset module to factory default values. If Yes selected, all settable parameters are reset to factory default values.</td>
<td>Up/Down = No to Yes</td>
</tr>
</tbody>
</table>

**Note:** There is no way to return to previous settings once defaults are selected. They must be re-entered manually.

**Note:** There are no alarms enabled on the DDR.
The potential errors to be displayed are:

<table>
<thead>
<tr>
<th>Error Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChAOpt.In.Too Lo</td>
<td>RF input circuit has a low level hardware failure.</td>
</tr>
<tr>
<td>ChAOpt.In.Too Hi</td>
<td>RF input circuit has a high level hardware failure.</td>
</tr>
<tr>
<td>ChBOpt.In.Too Lo</td>
<td>AGC has railed out due to low input power.</td>
</tr>
<tr>
<td>ChBOpt.In.Too Hi</td>
<td>AGC has railed out due to high input power.</td>
</tr>
<tr>
<td>Temp Sense TooLo</td>
<td>Temperature sensor has a low level hardware failure.</td>
</tr>
<tr>
<td>Temp Sense TooHi</td>
<td>Temperature sensor has a high level hardware failure.</td>
</tr>
<tr>
<td>Flash Write Err</td>
<td>An unrecoverable error has occurred in writing to nonvolatile memory.</td>
</tr>
<tr>
<td>Sys Parm Error</td>
<td>An unrecoverable data corruption error has occurred in the parameter block.</td>
</tr>
</tbody>
</table>

Note: Alarms generate SNMP traps, errors do not. Errors are typically associated with low level internal functions and generates local notifications on the Lumin Utility, front panel display, and front panel LEDs. Alarms may occur in conjunction with errors.
Adjusting Input Levels Based on Channel Loading

DLT modules are designed to properly modulate light output with a specified number of channels. The DLT specifications show unit operation with 78 NTSC channels at 15 dBmV input level each, plus 300 MHz of QAM channels at –6dB (9 dBmV) input level. If the number of higher level NTSC signals are reduced, the input levels may be increased to provide the same optical modulation levels and end-to-end performance.

The formula to use is:

\[
\text{Desired Input Level} = \text{Specified Input Level} - 10\log \left( \frac{\text{actual channel count}}{\text{specified channels}} \right)
\]

### Table of Input Level vs Channel Count

<table>
<thead>
<tr>
<th>Channel Count</th>
<th>Delta Input Level</th>
<th>Channel Count</th>
<th>Delta Input Level</th>
<th>Channel Count</th>
<th>Delta Input Level</th>
<th>Channel Count</th>
<th>Delta Input Level</th>
<th>Channel Count</th>
<th>Delta Input Level</th>
<th>Channel Count</th>
<th>Delta Input Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18.92</td>
<td>21</td>
<td>5.70</td>
<td>20.70</td>
<td>41</td>
<td>2.79</td>
<td>17.79</td>
<td>61</td>
<td>1.07</td>
<td>16.07</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>15.91</td>
<td>22</td>
<td>5.50</td>
<td>20.50</td>
<td>42</td>
<td>2.69</td>
<td>17.69</td>
<td>62</td>
<td>1.00</td>
<td>16.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14.15</td>
<td>23</td>
<td>5.30</td>
<td>20.30</td>
<td>43</td>
<td>2.59</td>
<td>17.59</td>
<td>63</td>
<td>0.93</td>
<td>15.93</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12.90</td>
<td>24</td>
<td>5.12</td>
<td>20.12</td>
<td>44</td>
<td>2.49</td>
<td>17.49</td>
<td>64</td>
<td>0.86</td>
<td>15.86</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11.93</td>
<td>25</td>
<td>4.94</td>
<td>19.94</td>
<td>45</td>
<td>2.39</td>
<td>17.39</td>
<td>65</td>
<td>0.79</td>
<td>15.79</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11.14</td>
<td>26</td>
<td>4.77</td>
<td>19.77</td>
<td>46</td>
<td>2.29</td>
<td>17.29</td>
<td>66</td>
<td>0.73</td>
<td>15.73</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10.47</td>
<td>27</td>
<td>4.61</td>
<td>19.61</td>
<td>47</td>
<td>2.20</td>
<td>17.20</td>
<td>67</td>
<td>0.66</td>
<td>15.66</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9.89</td>
<td>28</td>
<td>4.45</td>
<td>19.45</td>
<td>48</td>
<td>2.11</td>
<td>17.11</td>
<td>68</td>
<td>0.60</td>
<td>15.60</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9.38</td>
<td>29</td>
<td>4.30</td>
<td>19.30</td>
<td>49</td>
<td>2.02</td>
<td>17.02</td>
<td>69</td>
<td>0.53</td>
<td>15.53</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8.92</td>
<td>30</td>
<td>4.15</td>
<td>19.15</td>
<td>50</td>
<td>1.93</td>
<td>16.93</td>
<td>70</td>
<td>0.47</td>
<td>15.47</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>8.51</td>
<td>31</td>
<td>4.01</td>
<td>19.01</td>
<td>51</td>
<td>1.85</td>
<td>16.85</td>
<td>71</td>
<td>0.41</td>
<td>15.41</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>8.13</td>
<td>32</td>
<td>3.87</td>
<td>18.87</td>
<td>52</td>
<td>1.76</td>
<td>16.76</td>
<td>72</td>
<td>0.35</td>
<td>15.35</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>7.78</td>
<td>33</td>
<td>3.74</td>
<td>18.74</td>
<td>53</td>
<td>1.68</td>
<td>16.68</td>
<td>73</td>
<td>0.29</td>
<td>15.29</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>7.46</td>
<td>34</td>
<td>3.61</td>
<td>18.61</td>
<td>54</td>
<td>1.60</td>
<td>16.60</td>
<td>74</td>
<td>0.23</td>
<td>15.23</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>7.16</td>
<td>35</td>
<td>3.48</td>
<td>18.48</td>
<td>55</td>
<td>1.52</td>
<td>16.52</td>
<td>75</td>
<td>0.17</td>
<td>15.17</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>6.88</td>
<td>36</td>
<td>3.36</td>
<td>18.36</td>
<td>56</td>
<td>1.44</td>
<td>16.44</td>
<td>76</td>
<td>0.11</td>
<td>15.11</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>6.62</td>
<td>37</td>
<td>3.24</td>
<td>18.24</td>
<td>57</td>
<td>1.36</td>
<td>16.36</td>
<td>77</td>
<td>0.06</td>
<td>15.06</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>6.37</td>
<td>38</td>
<td>3.12</td>
<td>18.12</td>
<td>58</td>
<td>1.29</td>
<td>16.29</td>
<td>78</td>
<td>0.00</td>
<td>15.00</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>6.13</td>
<td>39</td>
<td>3.01</td>
<td>18.01</td>
<td>59</td>
<td>1.21</td>
<td>16.21</td>
<td>79</td>
<td>-0.06</td>
<td>14.94</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5.91</td>
<td>40</td>
<td>2.90</td>
<td>17.90</td>
<td>60</td>
<td>1.14</td>
<td>16.14</td>
<td>80</td>
<td>-0.11</td>
<td>14.89</td>
<td></td>
</tr>
</tbody>
</table>
This chapter provides information to assist you in maintaining and troubleshooting the system.

**In This Chapter**

- General Troubleshooting Guide .......................................................... 34
- Care and Cleaning of Optical Connectors ........................................ 36
## General Troubleshooting Guide

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC converter PWR LED is not lit</td>
<td></td>
</tr>
<tr>
<td>✔️ Check to make sure the DC converter is firmly seated in the chassis.</td>
<td></td>
</tr>
<tr>
<td>✔️ Check to make sure the -48V input cable is plugged into the correct DC converter connector on the back of the chassis.</td>
<td></td>
</tr>
<tr>
<td>DC converter red ALRM LED is lit or LCD displays power error</td>
<td></td>
</tr>
<tr>
<td>✔️ Use a second DC converter to ensure continuous operation of the chassis.</td>
<td></td>
</tr>
<tr>
<td>✔️ If a second DC converter is running on the chassis, remove the suspicious DC converter from the chassis and reseat. If the alarm continues to stay lit, replace the converter.</td>
<td></td>
</tr>
<tr>
<td>✔️ If a second DC converter is not available, removal of the suspicious DC converter will cause the sub-modules to stop functioning. Have a new DC converter on hand prior to removing and replacing the malfunctioning unit to reduce service interruption.</td>
<td></td>
</tr>
<tr>
<td>Fan tray/ Fan alarm red LED is lit or LCD displays fan error</td>
<td></td>
</tr>
<tr>
<td>✔️ Remove fan tray from chassis and reseat. If alarm continues to stay lit, remove fan tray and replace with a new one. Have a new fan tray on hand prior to removing and replacing the malfunctioning unit to reduce service interruption.</td>
<td></td>
</tr>
<tr>
<td>Sub-module Status indicator is red or LCD displays sub-module error</td>
<td></td>
</tr>
<tr>
<td>✔️ Check to make sure the sub-module is firmly plugged into the chassis. See Installing/Removing the Modules (on page 10) for instructions.</td>
<td></td>
</tr>
<tr>
<td>✔️ Check to make sure all cables connected to the sub-module are firmly attached. This includes RF input and output and optical output.</td>
<td></td>
</tr>
<tr>
<td>✔️ Check module temperature.</td>
<td></td>
</tr>
<tr>
<td>✔️ If none of the above suggestions work, return the unit status to normal and replace the module with a new one.</td>
<td></td>
</tr>
<tr>
<td>DC converter fan red LED alarm is lit or LCD displays power error</td>
<td></td>
</tr>
<tr>
<td>✔️ Remove the bracket on the back of the chassis and verify the fans are connected to the chassis wiring.</td>
<td></td>
</tr>
<tr>
<td>✔️ If the two fans are connected, disconnect and replace with new fans.</td>
<td></td>
</tr>
<tr>
<td>External power shelf red LED alarm is lit on the back of the chassis or LCD displays power error.</td>
<td></td>
</tr>
<tr>
<td>✔️ Check external power shelf.</td>
<td></td>
</tr>
</tbody>
</table>
LED Information

Each of the plug-in modules has one LED that can have the following states:

<table>
<thead>
<tr>
<th>LED</th>
<th>General Description</th>
<th>Meaning or Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Module is not powered</td>
<td>Module is not plugged in or chassis power is not operational.</td>
</tr>
<tr>
<td>Green Flash</td>
<td>Startup</td>
<td>Module is in a start-up sequence. It is operational but may not have attained peak operating performance.</td>
</tr>
<tr>
<td>Green</td>
<td>Operation Normal</td>
<td>OK.</td>
</tr>
<tr>
<td>Red</td>
<td>Module Failure</td>
<td>The module has detected an internal failure. Step through module monitors via the fan tray or Lumin Utility for more information.</td>
</tr>
</tbody>
</table>
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 residue. Inspect connectors after cleaning to confirm that they are clean and undamaged.

Recommended Equipment

- CLETOP or OPTIPOP ferrule cleaner (for specific connector type)
- Compressed air (also called “canned air”)
- Lint-free wipes moistened with optical-grade (99%) isopropyl alcohol
- Bulkhead swabs (for specific connector type)
- Optical connector scope with appropriate adaptor

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 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 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.
- Use safety-approved optical fiber cable to maintain compliance with applicable laser safety requirements.

**Important:** Ensure that no optical power is present prior to this procedure.

1. **Turn optical power off to the connector.**
2. Using an optical connector scope, inspect the connector for scratches, burns, or other signs of damage.
   - **Note:** If the connector is damaged, replace the jumper.
3. If the connector requires cleaning, swipe it across the face of the appropriate ferrule cleaner several times.
   - **Result:** This will remove dust and some films.
   - **Note:** You may hear a slight "squeak" while cleaning the connector, indicating that it is clean.
4. Inspect the connector again. If the connector requires further cleaning, clean it using 99% isopropyl alcohol and a lint-free wipe.
5. Swipe the connector across the face of the appropriate ferrule cleaner several more times to remove any film left by the alcohol.
6. Repeat all the steps above as needed until the connector is clean.
5

Customer Support 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.
Cisco External Powering

For AC powering, Cisco offers a separate 1 RU power shelf for providing -48 V DC to the DLC chassis. This appendix describes the AC powering for the DLC chassis.

Important: The customer can use whatever AC to -48 V DC solution they desire, however Cisco does provide an AC solution as described in this section.

In This Appendix

- Safety .................................................................................................................. 42
- Rectifier Power System Description ................................................................. 45
- Installing the Rectifier Power System ............................................................... 48
Safety

Location
- Install this product in a restricted access location

Rack or Cabinet Installation
- The rack or cabinet should be appropriately anchored according to manufacturer's specifications
- The chassis should be mounted to the rack or cabinet prior to installation of any modules

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 disconnect all power cables before servicing this product
- 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

Service
- Refer service only to authorized service personnel
Guidelines

The following guidelines are to be considered before using this product in end-use equipment.

Mounting and Installation

- This product is installed in compliance with mounting requirements for the application.
- This product is installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment.
- This equipment is to be used in controlled environments, i.e., an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified.
- This equipment has been evaluated for use in a continuous ambient temperature of up to 50°C and the application environment should not exceed 50°C.

Output Connections

- All field wiring should comply with the U.S. National Electric Code (NEC) and/or applicable local codes/standards.
- Routing the DC output cables should guarantee that cables are not in contact with sources of heat and surfaces that may damage the cable insulation.
- The output for the system is SELV and has available power greater than 240 VA.
- Use only Cisco DC output cables. Refer to Installing the Rectifier Power System (on page 48).

AC Input Connections

- AC branch circuits to this equipment must be protected with fuses or circuit breakers sized as required by the U.S. National Electric Code (NEC) and/or local codes. Up to four AC mains power cords are required to power the shelf (one for each rectifier module). Each power cord should be connected to a separate AC mains branch circuit with an overcurrent protector rated at no more than 20A.
- An accessible AC disconnect/protection device to remove AC power from the equipment in the event of an emergency must be provided. An accessible socket-outlet/receptacle installed near the equipment is also acceptable as a disconnect.
The equipment is powered by multiple AC inputs (one per rectifier module). Disconnect all power before servicing.

This equipment has been evaluated for connection to an IT system with phase-to-phase voltage less than 240 V AC (AC supply system with the neutral isolated from earth).

**General Safety Procedures**

- Use only properly insulated tools.
- Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
- Wear safety glasses.
- Test circuits before touching.
- Lock out and tag circuit breakers/fuses when possible to prevent accidental turn on.
- Be aware of potential hazards before servicing equipment.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc. Note the condition of these circuits, especially wiring.
- Use care when removing or replacing covers; avoid contacting circuits.
Rectifier Power System Description

Introduction

The -48 V DC Rectifier System consists of a power shelf with up to four power modules installed. The system is designed for worldwide applications in any 1 RU space where nominal -48 V is needed.

Rectifier Power Module Illustration

The following is an illustration of the power module.

Weight and Dimensions

The power module weighs 4.8 lbs. The dimensions are shown in the following illustration.
LED Indicators

The following table shows definitions of the power module's front panel LED indicators.

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC OK</td>
<td>Green</td>
<td>The unit has the correct AC input range.</td>
</tr>
<tr>
<td>DC OK</td>
<td>Green</td>
<td>The unit is powered up and the output is in regulation.</td>
</tr>
<tr>
<td>Fault</td>
<td>Red</td>
<td>The unit has detected an internal fault.</td>
</tr>
</tbody>
</table>

LED Indicator States

The following table shows the states of the power module's LED indicators.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rectifier Power Module LED State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC OK Green</td>
</tr>
<tr>
<td>OK</td>
<td>1</td>
</tr>
<tr>
<td>Thermal alarm (ambient)</td>
<td>1</td>
</tr>
<tr>
<td>Thermal alarm (fan fail)</td>
<td>1</td>
</tr>
<tr>
<td>Blown AC fuse in unit</td>
<td>1</td>
</tr>
<tr>
<td>Low or no AC (single unit)</td>
<td>0</td>
</tr>
<tr>
<td>AC not present in any module</td>
<td>0</td>
</tr>
<tr>
<td>Boost stage failure</td>
<td>1</td>
</tr>
<tr>
<td>Overvoltage latched shutdown</td>
<td>1</td>
</tr>
<tr>
<td>Overcurrent</td>
<td>1</td>
</tr>
<tr>
<td>Any internal failure</td>
<td>1</td>
</tr>
<tr>
<td>Standby (remote)</td>
<td>1</td>
</tr>
</tbody>
</table>

Alarm Signals

Alarm signals can be connected to the chassis through a 16-pin connector that mates with the green 16-pin header on the back of the chassis. All active high alarm signals must connect to any of the 8 pins on the right. All active low alarm signals must connect to any of the 8 pins on the left.
Any single alarm on any of these 16 signals will cause the red LED located next to the header to turn on. If the auxiliary power supply alarm box is checked in the Cisco Lumin Utility, the slot alarm LED on the fan tray front panel will turn on. In addition, an alarm message will show on the fan tray’s front panel LCD display and on the Utility screen.

**Note:** There may be a few seconds delay between an alarm occurrence and alarm acknowledgement by the slot alarm LED, LCD display and the Lumin Utility.

### Power Module Status Signals

The following table shows the power module status signals. These status signals are the alarm signals connected for this shelf.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Status</th>
<th>Active High/Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectifier Fault</td>
<td>The unit has detected an internal fault.</td>
<td>Low</td>
</tr>
<tr>
<td>Over Temperature (OTW)</td>
<td>The unit is overheating. Shutdown is imminent (eight-second warning).</td>
<td>High</td>
</tr>
<tr>
<td>Power Fail Warning (PFW)</td>
<td>The output signal of the power module will fail 5 minutes before module goes out of regulation.</td>
<td>Low</td>
</tr>
</tbody>
</table>
Installing the Rectifier Power System

Before You Begin

Before installing the rectifier system, make sure you read the information contained in this section.

Site Requirement

The rectifier system must be installed in a standard EIA equipment rack.

Required Tools

The following tools are required for the installation of the rectifier system.

- 10 mm socket or nut driver
- Torque wrench
- Flat-blade screwdriver
- Phillips-head screwdriver

Required Equipment

The following table shows the equipment required for the installation of the rectifier system.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power shelf</td>
<td>1</td>
<td>4027071</td>
</tr>
<tr>
<td>Power cables (Each DLC chassis requires two input power cables) Length based on the installation</td>
<td>1 ft (2)</td>
<td>4027865</td>
</tr>
<tr>
<td></td>
<td>2 ft (2)</td>
<td>4027866</td>
</tr>
<tr>
<td></td>
<td>4 ft (2)</td>
<td>4027867</td>
</tr>
<tr>
<td>Rectifier power module</td>
<td>1, 2, 3, or 4</td>
<td>4027072</td>
</tr>
<tr>
<td>AC Power cords</td>
<td>1 per rectifier</td>
<td>US - 1009376</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan - 1009410</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UK - 3993130</td>
</tr>
<tr>
<td></td>
<td></td>
<td>China - 745415</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Italy - 3993130</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Europe - 3989835</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Australia - 1000897</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Argentina - 207340</td>
</tr>
</tbody>
</table>
Optional Equipment

The following table shows the equipment that is optional for the installation of the rectifier system.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Cable</td>
<td>1</td>
<td>4028096</td>
</tr>
</tbody>
</table>

Installing the Power Shelf in the Rack

The standard power shelf is designed to fit inside a 19-in rack. Shelves can be mounted directly to the 19-inch frame using the adjustable mounting ears. These adjustments permit positioning of the shelf flush or extended outward.

**Important:** Make sure the proper site requirements have been met. Refer to *Before You Begin* (on page 48) earlier in this document.

Flush-Mounting the Power Shelf in a 19-inch Rack

Follow these steps to flush-mount the power shelf in the rack.

1. Install power shelf in the rack until shelf’s front panel mounting flanges are flush with the front mounting rails of the rack.
2. Using two screws per side, attach the shelf to the rack. Tighten the two screws.

**WARNING:**

If one side of the DC output is connected to the ground, the shelf must also be connected to the same ground. Failure to do so may cause damage to the AC safety earth ground in case of a DC fault.

Installing the Cables

The following instructions explain how to install the AC power cords and DC output cables.

**Installing the AC Power Cords**

Follow these steps to install the AC power cords.

1. Insert the AC power cords into the module shelf.
2 For added security, a cable tie may be installed on each power cord to secure the AC power cord to the module shelf.

Installing the DC Power Cables

1 Open the protective cover from the outside edge of the power shelf.
   
   **Note:** There is a set of lugs on the left and right side of the shelf. These are tied together on the same bus and either set of terminals can be used.

2 Install cable ring terminals over the lugs and insert nuts. Take care to ensure proper polarity indicated on the power shelf terminals.
   
   **Note:** Two cables can be attached to a single set of nuts.

3 For the primary power connection, connect the red cable to the positive (+) terminal and the black cable to the negative (-) terminal.

4 For a secondary power connection, connect the red cable to the positive (+) terminal and the black cable to the negative (-) terminal.

5 Using a 10 mm socket, torque each lug from 60 in-lb to 65 in-lb (7 Nm).

Installing the Signaling Cable

1 Remove the power supply jumper installed on pins 21 and 23 of the signaling connector.

2 Install the signaling cable as shown in the illustration below.
3 Connect the signal wires to the rear alarm connector on the DLC chassis as shown below.

Typical Cabling Configurations
The following illustration shows a typical cabling configuration. In this configuration, one power shelf powers one chassis.

Considerations
- Fully loaded chassis requires 300W
- 4 chassis can be powered off one power module (with no redundancy)
- Each module is 1200W
- A set of lugs on each side of the shelf are tied together on the same bus
Installing the Rectifier Modules

Follow these steps to install the modules in the module shelf.

1. Install the rectifier modules into the module shelf by sliding the rectifier modules carefully into each module shelf slot.

   Note: Up to four rectifier modules can be installed in one shelf.

2. Connect the AC power cords to the appropriately rated outlets.

Specifications

The following table provides the general specifications for the chassis.

**Electrical**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Input Current</td>
<td>15 A</td>
<td></td>
<td>Per module, IEC-320 connectors</td>
</tr>
<tr>
<td>Total Output Power</td>
<td></td>
<td>8 kW</td>
<td></td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>48 V DC</td>
<td>56 V DC</td>
<td></td>
</tr>
<tr>
<td>Output current (A and B feeds)</td>
<td></td>
<td></td>
<td>Double-hole lug landings for 2ga wires. M6 threaded studs on 5/8-inch centers. Nuts provided. Use 90 degree lug (BurndyYA V2CL2TC14-FX-90) on wireset</td>
</tr>
<tr>
<td>Output Terminations</td>
<td>2 pairs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Environmental**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-50°C</td>
<td>+85°C</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C</td>
<td>+50°C</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Altitude</td>
<td>-200 ft</td>
<td>13,000 ft</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>5%</td>
<td>95%</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>5%</td>
<td>95%</td>
<td>Non-condensing</td>
</tr>
</tbody>
</table>
Installing the Rectifier Power System

Physical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Safety/Standards Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height - 1.71 in. (43.4 mm) (1U)</td>
<td>UL Listed to UL60950</td>
</tr>
<tr>
<td>Width - 16.81 in. (427 mm)</td>
<td>UL Listed for Canada (C22.2 No. 60950-1-03)</td>
</tr>
<tr>
<td>Depth - 16.25 in. (413 mm)</td>
<td></td>
</tr>
<tr>
<td>Weight - 9.5 lb (3.2 kg) w packaging</td>
<td></td>
</tr>
</tbody>
</table>

Product Rating Information

The following table shows the product rating information of the chassis.

<table>
<thead>
<tr>
<th>Input (AC)</th>
<th>Output (DC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>IIN (Max.)</td>
</tr>
<tr>
<td>100, 120 V  ~</td>
<td>15, 12 A</td>
</tr>
<tr>
<td>200-240 V  ~</td>
<td>7.4 A</td>
</tr>
</tbody>
</table>
Glossary

100BaseT
100 Mbps baseband Fast Ethernet specification using UTP wiring.

10BaseT
10 Mbps baseband Ethernet specification using two pairs of twisted-pair cable.

ac, AC
alternating current. An electric current that reverses its direction at regularly recurring intervals.

AGC
automatic gain control. A process or means by which gain is automatically adjusted in a specified manner as a function of input level or other specified parameters.

amplifier
Supplies a transmission line or system with a signal at a stipulated level.

AUX
auxiliary.

backplane
An electronic circuit board containing circuitry and sockets into which additional electronic devices on other circuit boards or cards can be plugged.

CENELEC
Comité Européen de Normalisation ELECtrotechnique. The European Committee for electrotechnical standardization.

CSO
composite second order. A measure of distortion in analog CATV systems caused by second-order distortion in the transmission system.
Glossary

CTB
composites triple beat. A measure of distortion in analog CATV systems caused by third-order distortion in the transmission system.

dB
decibel. One tenth of a bel, the number of decibels denoting the ratio of two amounts of power being ten times the common logarithm of this ratio.

dBm
decibels relative to 1 milliwatt.

dBmV
decibels relative to 1 millivolt.

dc, DC
direct current. An electric current flowing in one direction only and substantially constant in value.

DDR
Dense Dual Return Path Receiver. Lumin receiver.

DLC
Dense Fiber Chassis. Lumin chassis.

DLL
Dense Lumin Lite Chassis. Lumin chassis.

DLT
Dense Fiber Transmitter. Lumin transmitter.

DOCSIS
data over cable service interface specification.

DRP
Dense Redundant Power Chassis. Lumin chassis.

EMC
electromagnetic compatibility. A measure of equipment tolerance to external electromagnetic
fields.

**ESD**

Electrostatic discharge. Discharge of stored static electricity that can damage electronic equipment and impair electrical circuitry, resulting in complete or intermittent failures.

**FCC**

Federal Communications Commission. Federal organization set up by the Communications Act of 1934 which has authority to regulate all inter-state (but not intra-state) communications originating in the United States (radio, television, wire, satellite, and cable).

**GHz**

Gigahertz. A unit of frequency equal to one billion cycles per second.

**HD or HDTV**

High definition. A digital television format providing picture quality similar to 35 mm movies with sound quality similar to compact disk (CD).

**HFC**

Hybrid fiber/coaxial. A network that uses a combination of fiber optics and coaxial cable to transport signals from one place to another. A broadband network using standard cable television transmission components, such as optical transmitters and receivers, coaxial cable, amplifiers, and power supplies. The broadband output stream is transmitted as an optical signal, over the high-speed, fiber optic transmission lines to local service areas where it is split, converted to electrical RF signals, and distributed to set-tops over coaxial cable.

**IEEE**

Institute of Electrical and Electronics Engineers. IEEE was founded in 1963. It is an organization composed of engineers, scientists, and students and is best known for developing standards for the computer and electronics industries.

**LCD**

Liquid crystal display. A display medium made of liquid crystal. Liquid crystal's reflectance changes when an electric field is applied. Commonly used in monitors, televisions, cell phones, digital watches, etc.

**LED**

Light-emitting diode. An electronic device that lights up when electricity passes through it.

**MHz**

Megahertz. A unit of measure representing one million cycles per second; measures
bandwidth.

**MIB**

management information base. SNMP collects management information from devices on the network and records the information in a management information base. The MIB information includes device features, data throughput statistics, traffic overloads, and errors.

**nm**

nanometer. One billionth of a meter.

**NTSC**

National Television Standards Committee. A committee that determines video signal standards for television displays in the United States, Canada, Mexico, and Japan, as well as other Latin American and Asian countries. The NTSC standard calls for fixed-resolution, interlaced displays that are updated 30 times per second with a resolution of 525 lines.

**PAL**

phase alternate line.

**PC**

personal computer.

**QAM**

quadrature amplitude modulation. An amplitude and phase modulation technique for representing digital information and transmitting that data with minimal bandwidth. Both phase and amplitude of carrier waves are altered to represent the binary code. By manipulating two factors, more discrete digital states are possible and therefore larger binary schemes can be represented.

**QPSK**

quadrature phase-shift keying. A phase modulation technique for representing digital information. QPSK produces four discrete states, each state representing two bits of information.

**RF**

radio frequency. The frequency in the portion of the electromagnetic spectrum that is above the audio frequencies and below the infrared frequencies, used in radio transmission systems.

**RMA**

return material authorization. A form used to return products.
RU
rack unit. RU is the measuring unit of vertical space in a standard equipment rack. One RU equals 1.75” (44.5 mm).

tilt
Spectral display slope caused by different attenuation of high frequencies and low frequencies through a medium.

V AC
volts alternating current.

V DC
volts direct current.

VOD
video-on-demand. A service that allows a subscriber to use the remote control to select, purchase, and view an event. Once purchased, the viewer can then forward, reverse, pause, and play the event just as he or she would with a VCR.
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