9450GT
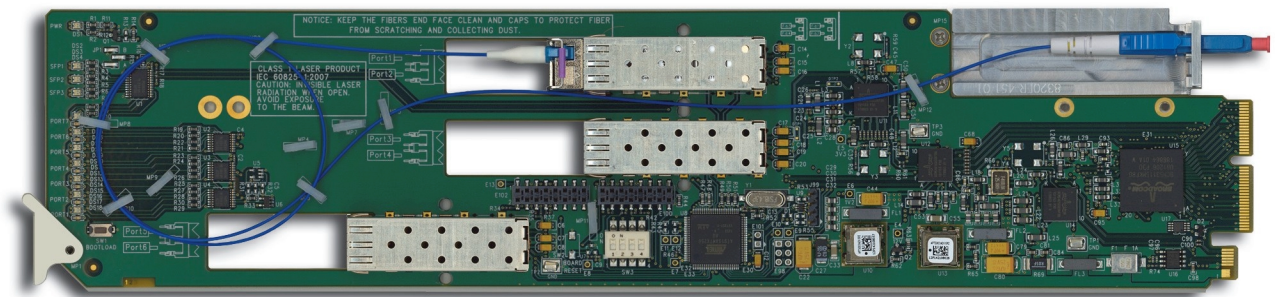
Fiber Ethernet Switch Transceivers
Product Manual

COBALT.

openGear

Ethernet Fiber Switch Transceivers Product Manual

- Cobalt Part Number: 9450GT-OM_V1.1
- Release Date: February 23, 2017.

The information in this manual is subject to change without notice or obligation.

Patents

This product is protected by the following US Patents: 4,205,346; 5,115,314; 5,280,346; 5,561,404; 7,304,886; 7,508,455; 7,602,446; 7,834,886; 7,914,332. This product is protected by the following Canadian Patents: 2039277; 1237518; 1127285. Other patents pending.

Notice

The material in this manual is furnished for informational use only. It is subject to change without notice.

Trademarks

- Cobalt® is a registered trademark of Cobalt Digital Inc.
- openGear® is a registered trademark of Ross Video Limited.
- DashBoard Control System™ is a trademark of Ross Video Limited.
- All other product names and any registered and unregistered trademarks mentioned in this manual are used for identification purposes only and remain the exclusive property of their respective owners.

Important Regulatory and Safety Notices to Service Personnel

Before using this product and nay associated equipment, refer to the "**Important Safety Instructions**" listed below to avoid personnel injury and to prevent product damage.

Product may require specific equipment, and/or installation procedures to be carried out to satisfy certain regulatory compliance requirements. Notices have been included in this publication to call attention to these specific requirements.

Symbol Meanings

This symbol on the equipment refers you to important operating and maintenance (servicing) instructions within the Product Manual Documentation. Failure to heed this information may present a major risk of damage to persons or equipment.

Warning — *The symbol with the word "**Warning**" within the equipment manual indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.*

Caution — *The symbol with the word "**Caution**" within the equipment manual indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.*

Notice — *The symbol with the word "**Notice**" within the equipment manual indicates a potentially hazardous situation, which, if not avoided, may result in major or minor equipment damage or a situation which could place the equipment in a non-compliant operating state.*

ESD Susceptibility — *This symbol is used to alert the user that an electrical or electronic device or assembly is susceptible to damage from an ESD event.*

Important Safety Instructions

Caution — *This product is intended to be a component product of the DFR-8300 and OG3-FR series frames. Refer to the DFR-8300 and OG3-FR Series Frame Product Manual for important safety instructions regarding the proper installation and safe operation of the frame as well as its component products.*

Warning — *Certain parts of this equipment namely the power supply area still present a safety hazard, with the power switch in the OFF position. To avoid electrical shock, disconnect all A/C power cords from the chassis' rear appliance connectors before servicing this area.*

Warning — *Service barriers within this product are intended to protect the operator and service personnel from hazardous voltages. For continued safety, replace all barriers after any servicing.*

This product contains safety critical parts, which if incorrectly replaced may present a risk of fire or electrical shock. Components contained with the product's power supplies and power supply area, are not intended to be customer serviced and should be returned to the factory for repair. To reduce the risk of fire, replacements fuses must be the same time and rating. Only use attachments/accessories specified by the manufacturer.

⚠ **Warning** — *This product includes an "Ethernet Port" which allows this product to be connected to a local area network (LAN). Only connect to networks that remain inside the building. Do not connect to networks that go outside the building.*

EMC Notices

United States of America
FCC Part 15

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 the 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 the user will be required to correct the interference at their own expense.

⚠ **Notice** — *Changes or modifications to this equipment could void the user's authority to operate this equipment.*

CANADA

This Class "A" digital apparatus complies with Canadian ICES-003.

Cet appariel numerique de la classe "A" est conforme a la norme NMB-003 du Canada.

EUROPE

This equipment is in compliance with the essential requirements and other relevant provisions of CE Directive 93/**8**/EEC.

INTERNATIONAL

This equipment has been tested to **CISPR 22:1997** along with amendments **A1:2000** and **A2:2002**, and found to comply with the limits for a Class A Digital device.

⚠ **Notice** — *This is a Class A product. In domestic environments, this product may cause radio interference, in which case the user may have to take adequate measures.*

Maintenance/User Serviceable Parts

Routine maintenance to this openGear product is not required. This product contains no user serviceable parts. If the module does not appear to be working properly, please contact Technical Support using the numbers listed under the "Contact Us" section on the last page of this manual. All openGear products are covered by a generous 5-year warranty and will be repaired without charge for materials or labor within this period. See the "Warranty and Repair Policy" section in this manual for details.

Important Laser Safety Measures and Notices

Before using this product and any associated equipment, refer to the sections below so as to avoid personnel injury and to prevent product damage. For further safety information when using fiber products, consult the following publications:

- *IEC-60825- 2, Safety of Laser Products - Part 2: Safety of Optical Fiber Communication Systems (OFCS)* (for use outside of the U.S.A.)
- *ANSI Z136.2, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources* (for use in the U.S.A.)

Products may require specific equipment, and /or installation procedures be carried out to satisfy certain regulatory compliance requirements.

Caution — *Before operating or servicing this product, all personnel should be familiar with laser safety and fiber handling practices.*

Safety Measures for Operation

During normal operation of this product, heed the following safety measures:

- Do not stare at, or into, broken, or damaged, fibers.
- Do not stare at, or into, optical connectors.
- Only properly trained and authorized personnel shall be permitted to perform laser/fiber optic operations.
- Ensure that appropriate labels are displayed in plain view and in close proximity to the optical port on the protective housing/access panel of the terminal equipment.

Safety Measures for Maintenance and Servicing

Warning — *Do not use optical equipment, such as a microscope or an eye loupe, to stare at the energized fiber end. Doing so may damage your eyes.*

During maintenance and servicing of this product, only properly trained and authorized personnel shall be allowed to use optical test or diagnostic equipment.

Laser Information

CLASS 1 LASER PRODUCT
IEC 60825-1:2007
Caution — *INVISIBLE LASER RADIATION WHEN OPEN. AVOID EXPOSURE TO THE BEAM.*

Environmental Information

The equipment that you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

To avoid the potential release of those substances into the environment and to diminish the need for the extraction of natural resources, you are encouraged to use the appropriate take-back systems. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

The crossed out wheelie bin symbol invites you to use these systems.

If you need more information on the collection, re-use, and recycling systems, please contact your local or regional waste administration.

Contents

Introduction

In This Chapter

This chapter contains the following sections:

- Overview
- Features
- User Interfaces
- Documentation Terms and Conventions

Overview

The Fiber Ethernet Switch Transceivers are configured in various modes depending on the number of small form-factor pluggable fiber transceivers (SFPs) installed and the rear module used. There are up to six user ports (a combination of fiber optic and RJ45 connectors) plus one GigE (SERDES) port connected to the OG3-FR series frame midplane that communicates with the switch on the MFC-8322-N Network Controller cards. (Model 9450GT-NF omits the fiber I/O interfaces.)

The switching function operates transparently for DHCP, ARP, Multicast and Broadcast, and VLAN services (except where restricted by configuration). Note that the Fiber Ethernet Switch Transceivers do not provide POE (Power Over Ethernet) but will work with switches that follow 802.3eaf/at.

The Fiber Ethernet Switch Transceivers are fully hot-swappable with all active components on the front removable module. No active components are installed on the rear module. This design greatly reduces down time eliminating any need for users to access the back of the openGear frame.

CWDM Series

Some Fiber Ethernet Switch Transceivers are equipped with Coarse Wavelength Division Multiplexing (CWDM) lasers. This enables you to expand your current fiber infrastructure from one wavelength to up to 16 wavelengths on a fiber.

High Sensitivity Series

Some Fiber Ethernet Switch Transceivers are equipped with high sensitivity SFPs for increased link budgets. These cards are compatible with standard 1310nm receivers, and the CWDM receivers from 1270nm to 1610nm (attenuation may be required to reduce optical power below -10dBm).

Part Number	Description
9450GT-20KM-LC	Single-Link Ethernet/Fiber Transceiver. Dual-Fiber 20km, 1310nm Tx/Rx. Includes Rear I/O Module (LC connectors only)
9450GT-40KM-LC	Single-Link Ethernet/Fiber Transceiver. Dual-Fiber 40km, 1310nm Tx/Rx. Includes Rear I/O Module (LC connectors only)
9450GT-80KM-LC	Single-Link Ethernet/Fiber Transceiver. Dual-Fiber 80km, 1550nm Tx/Rx. Includes Rear I/O Module (LC connectors only)
9450GT-NF	4-Port Ethernet Switch (omits fiber I/O interfaces). Includes Rear I/O Module.
9450GT-CWDM-XXXX-LC	Single-Link Ethernet/Fiber Transceiver. Dual-Fiber 20km, CWDM Tx/Rx. Includes Rear I/O Module (LC connectors only). Replace "XX" with desired CWDM wavelength when ordering. See table below for available CWDM wavelengths.
9450GT-CWDM-XXXXH-LC	Single-Link Ethernet/Fiber Transceiver. Dual-Fiber 20km, CWDM Tx/Rx with high-sensitivity Rx. Includes Rear I/O Module (LC connectors only). Replace "XXXX" with desired CWDM wavelength when ordering. See table below for available CWDM wavelengths.
	-27: 1270nm -29: 1290nm -31: 1310nm -33: 1330nm -35: 1350nm -37: 1370nm -43: 1430nm -45: 1450nm -47: 1470nm -49: 1490nm -51: 1510nm -53: 1530nm -55: 1550nm -57: 1570nm -59: 1590nm -61: 1610nm

Features

The following features are common for the Fiber Ethernet Switch Transceivers:

- Compliant with IEEE 802.3 (10/100/1000BASE-T, 1000BASE-X)

- Supports 10/100/1000[1] Base T Ethernet on RJ45 connectors

- Auto negotiation for 10/100/1000[1] speeds, half/full duplex modes, MDI/MDIX auto-crossover

- Supports two trunk groups between two devices with each trunk group having up to four ports

- Supports port-based VLAN by allowing the partition of switching ports into virtual private domains based on individual ports

- Allows for port disabling

- Up to seven available ports using a combination of ethernet (via RJ45 connections), fiber optic ports, and a GigE internal link to the MFC-8322-N card in the OG3-FR series frames.

- LC/UPC optical blind-mate connections

- Card-edge LED indicator for power status

- Rear modules are fully passive using a blind mate LC connection

- Hot-swappable from front of frame with no external connect/reconnect required

- Reports status and configuration remotely via the DashBoard Control System

- Compatible with the OG3-FR series frames

- Fully compliant with openGear specifications

- 5-year transferable warranty

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1. GigE SERDES support only available when the card is installed in the OG3-FR series frames with an MFC-8322-N.

User Interfaces

The following interfaces are available for your Fiber Ethernet Switch Transceiver.

DashBoard Control System

The DashBoard Control System enables you to monitor and control openGear frames and cards from a computer. DashBoard communicates with the Fiber Ethernet Switch Transceiver and other cards in the openGear frame through the Network Controller Card.

For More Information on...

* installing and using DashBoard, refer to the *DashBoard Product Manual*.
* menus available in DashBoard for the Fiber Ethernet Switch Transceiver, refer to the chapter "**DashBoard Menus**".
* using the Network Controller Card, refer to the *MFC-8300 Series Product Manual*.

Card-edge Controls

The front-edge of the Fiber Ethernet Switch Transceiver cards have an LED indicator for power status. LEDs on the rear modules indicate communication and traffic activity.

For More Information on...

* the card-edge LED, refer to the section "**Card-edge LEDs**".
* the rear module LEDs, refer to the section "**Rear Module LEDs**".

SNMP Monitoring and Control

The Network Controller Card in the openGear frame provides optional support for remote monitoring of your frame and using the Simple Network Management Protocol (SNMP), which is compatible with many third-party monitoring and control tools.

For More Information on...

* the SNMP controls on the cards, refer to your Fiber Ethernet Switch Transceiver Management Information Base (MIB) files.
* SNMP Monitoring and Control, refer to the *MFC-8300 Series Product Manual*.

Documentation Terms and Conventions

The following terms and conventions are used throughout this manual.

Terms

The following terms are used:

- "**Board**", and "**Card**" refer to openGear terminal devices within openGear frames, including all components and switches.
- "**CWDM**" refers to models that include Coarse Wavelength Division Multiplexing lasers.
- "**DashBoard**" refers to the DashBoard Control System.
- "**Fiber Ethernet Switch Transceiver**" includes all versions of the 9450GT and any available options unless otherwise noted.
- "**9450GT**" includes all versions of the 9450GT unless otherwise noted.
- "**Network Controller Card**" refers to the MFC-8322-N and MFC-8322-NS unless otherwise noted.
- "**OG3-FR series**" refers to all versions of the OG3-FR frames and any available options unless otherwise noted.
- "**openGear frame**" refers to the 8321 series or equivalent 20-slot frame that house openGear cards.
- "**Operator**" and "**User**" refer to the person who uses the Fiber Ethernet Switch Transceiver.
- "**SFP**" refers to a small form-factor pluggable fiber transceiver.
- "**System**" and "**Video system**" refer to the mix of interconnected production and terminal equipment in your environment.
- "**Trunking**" refers to using two or more ethernet links between points to increase bandwidth or provide redundancy.
- "**VLAN**" refers to Virtual Local Area Network.
- "**WDM**" refers to Wavelength Division Multiplexing.

Conventions

The following conventions are used:

- The "**Operating Tips**" and "**Note**" boxes are used throughout this manual to provide additional user information.

Installation

In This Chapter

This chapter provides instructions for installing the rear module(s) for the Fiber Ethernet Switch Transceivers, installing the cards into the frame, cabling details, and updating the software.

The following topics are discussed:

- Before You Begin
- Physical Installation
- Ethernet Communications
- Software Upgrades

Before You Begin

Before proceeding with the instructions in this chapter, ensure that your openGear frame is properly installed according to the instructions in its manual.

✳ **Important** — *Contact your IT Department before connecting to your facility network to ensure that there are no conflicts or the possibility of creating a network loop.*

Static Discharge

Throughout this chapter, please heed the following cautionary note:

⚠ **ESD Susceptibility** — *Static discharge can cause serious damage to sensitive semiconductor devices. Avoid handling circuit boards in high static environments such as carpeted areas and when synthetic fiber clothing is worn. Always exercise proper grounding precautions when working on circuit boards and related equipment.*

Unpacking

Unpack each Fiber Ethernet Switch Transceiver you received from the shipping container and ensure that all items are included.

Working with Fiber Optic Connectors

Keep the following in mind when working with fiber optic connectors:

* Every time you are required to insert a connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.

* Connectors must always be inserted into a device or have a dust cap on. (**Figure 2.1**)
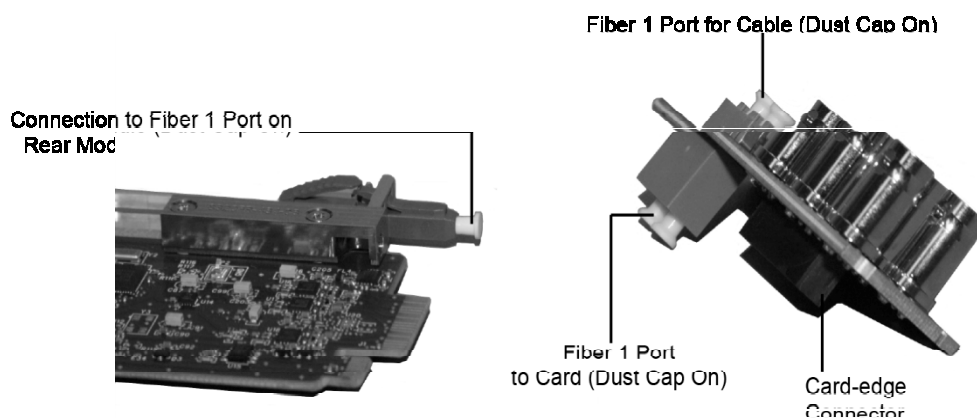

Figure 2.1 Card Connectors with Dust Caps Installed

* A poor optical connection is often similar to a poor electrical connection. Try removing the connector, cleaning, and re-inserting the connector. A bad connection can result in experiencing instability of signal, high loss, or a noisy signal.

Physical Installation

This section outlines how to install a rear module and a card in an openGear frame. However, the specific rear module you need to install depends on your application. The internal GiGE interface is available only when the card is installed in an OG3-FR series frame.

Installing a Rear Module

If the rear module is already installed, proceed to the section "**Installing a Card**".

To install a rear module in your openGear frame

1. Locate the card frame slots on the rear of the frame.

2. To apply a label to your rear module:

    •   Verify whether your **Rear Module Label** is self-adhesive by checking the back of the label for a thin wax sheet. You will need to remove this wax sheet before applying the label in order that the label can be affixed to the rear module surface.

    •   Affix the supplied **Rear Module Label** to the BNC area of the rear module.

3. Remove the Blank Plate from the slot you have chosen for the installation.

4. Remove the dust caps from the Fiber ports on the rear module that face the interior of the frame.

5. Seat the bottom of the rear module in the **Module Seating Slot** at the base of the frame's back plane. (**Figure 2.2**)

Figure 2.2 *Rear Module Installation in an 20-Slot Frame (Cards not shown)*
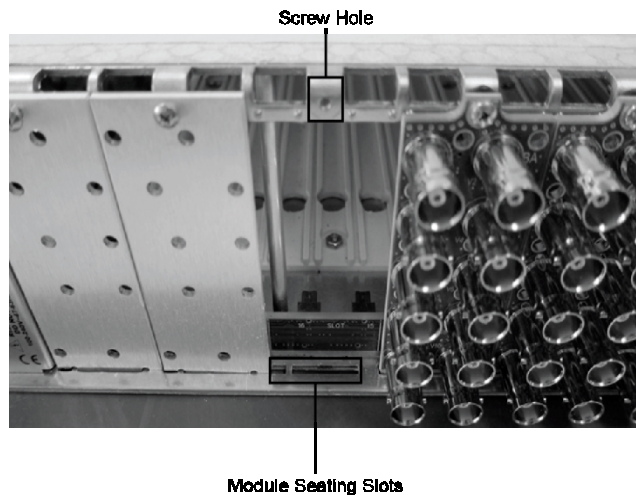
6. Align the top hole of the rear module with the screw on the top-edge of the frame back plane.

7. Using a Phillips screwdriver and the supplied screw, fasten the rear module to the back plane of the frame. Do not over tighten.

8. Ensure proper frame cooling and ventilation by having all rear frame slots covered with rear modules or Blank Plates.

Installing a Card

Refer to the section "**Important Laser Safety Measures and Notices**" at the beginning of this manual for safety information when handling fiber optic components.

To install the card in an openGear frame

1. Locate the rear module you installed in the procedure "**Installing a Rear Module**".

2. Ensure that the rear module is one of the required models for your card.

3. Refer to the appropriate chapter in this manual to learn which ports are used by your card and remove the dust caps from the connectors as required.

⚠️

Caution — *Never attempt to look down the barrel of a connected fiber or device transmitting an optical signal. The transmitted light is not in the visible spectrum and may cause permanent eye damage. Turn off all laser sources before disconnecting devices.*

4. Ensure that the exposed surface of the ceramic ferrule(s) of the connectors are clean. Refer to the section "**Working with Fiber Optic Connectors**" for cleaning tips.

5. Hold the card by the edges and carefully align the card-edges with the slots in the frame.

6. Fully insert the card into the frame until the rear connection plus is properly seated in the rear module. You will feel a click when the card mates onto the rear module.

7. When are you ready to cable your rear module:
   • Remove the dust cap from the fiber port(s) that will be used on the rear module that faces the exterior of the frame.
   • Ensure the ceramic ferrule of the connector(s) is clean.

Ethernet Communications

The RJ45 ports on the rear modules support 10/100/1000 Base T Ethernet communications. The number of ports depends on the card model you are using.

In addition to the **Ethernet** ports on the rear module, you must also provide an ethernet connection to the openGear frame as outlined in its manual.

✳ **Important** — *Contact your IT Department before connecting to your facility network to ensure that there are no conflicts or the possibility of creating a network loop.*

For More Information on...

• setting up ethernet communications for your openGear frame, refer to the ***MFC-8300 Series Product Manual***.

Ethernet Cabling Overview

The exact steps for connecting to your facility via an ethernet network depends on the network requirements of your facility.

You will require a standard network CAT-5e cable to connect the card to your facility network. (**Figure 2.3**) There is no need for a crossover cable as the rear modules include an Auto-MDIX ethernet PHY that will switch from straight to crossover automatically as needed.

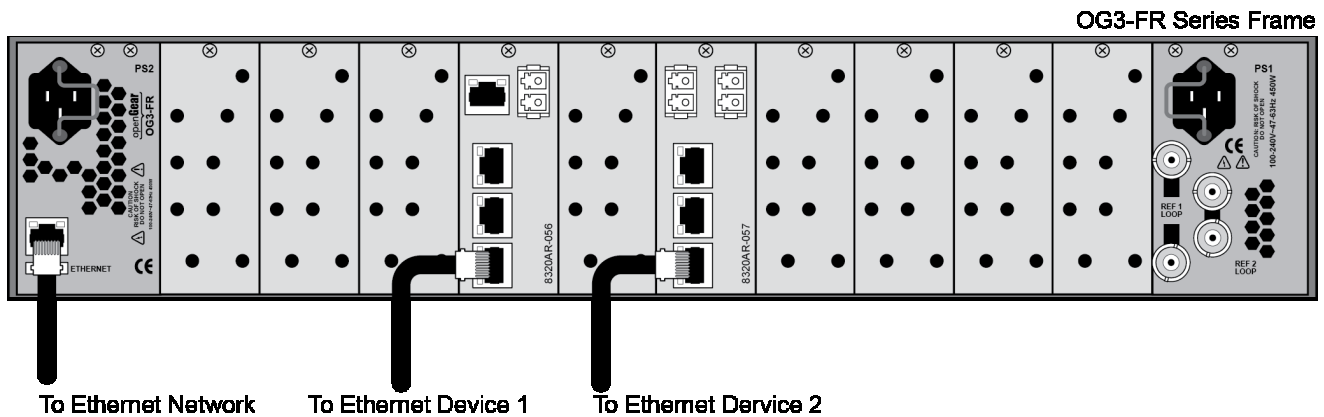
Figure 2.3 *Cabling to Ethernet Port 1 on the Rear Modules*

Internal GigE Link

Port 7 out of each Fiber Ethernet Switch Transceiver provides a GigE SERDES interface to the OG3-FR midplane to provide a link to the Ethernet switch on the MFC-8322-N Network Controller Card. This interface is identified as **Internal Link** in the DashBoard menus for the Fiber Ethernet Switch Transceiver.

Software Upgrades

This section provides instructions for upgrading the software for your card using the DashBoard Control System.

To upgrade the software on your card

1. Contact Technical Support for the latest software version file.

2. In DashBoard, display the **Device View** of the card by double-clicking its status indicator in the **Basic Tree View**.

3. From the **Device** tab, click **Upload** to display the **Select File for upload** dialog box.

4. Navigate to the ***.bin** file you wish to upload.

5. Click **Open**.

6. If you are upgrading a single card:

   • Click **Finish** to display the **Uploading to Selected Devices** dialog.

   • Proceed to step 8.

7. If you are upgrading multiple cards:

   • Click **Next >** to display the **Select Destination** menu. This menu provides a list of the compatible cards based on the card selected in step 2.

   • Specify the card(s) to upload the file to by selecting the check box(es) for the cards you wish to upload the file to.

   • Verify the card(s) you wish to upload the file to. The **Error/Warning** fields indicate any errors, such as incompatible software or card type mismatch.

   • Click **Finish** to display the **Uploading to Selected Devices** dialog.

8. Monitor the upgrade.

   • The **Uploading to Selected Devices** dialog enables you to monitor the upgrade process.

   • Click **OK** to complete the upgrade process.

   • The card(s) are temporarily taken offline during the re-boot process. The process is complete once the status indicators for the **Card State** and **Connection** fields return to their previous status.

Troubleshooting

If you encounter problems when upgrading your card software, verify that the file you are attempting to load is a ***.bin** file that is for the card you are upgrading and that you have a valid network connection.

9450GT Setup

In This Chapter

This chapter provides the cabling designations and the technical specifications for the 9450GT Single Link Ethernet Fiber Transceivers. Note that specifications are subject to change without notice.

The following topics are discussed:

- 9450GT Overview
- Cabling for the 9450GT
- 9450GT Technical Specifications

9450GT Overview

The 9450GT series provide a two fiber, and four copper (RJ45) Ethernet ports. This gives you five links (one fiber and four RJ-45) plus the Internal Link interface. Each card uses a standard SFP with an FP 1310nm laser and PIN receiver. High power and CWDM transmitters are available, as is a high sensitivity receiver.

The 9450GT series requires the Rear Module which includes one LC duplex connector and four RJ-45 connectors.

Table 3.1 9450GT Series — Models

Model	Descripti
9450GT-20KM-LC	Dual Fiber 20km 1310nm transmitter and wideband receiver
9450GT-40KM-LC	Dual Fiber 40km 1310nm transmitter and wideband receiver
9450GT-80KM-LC	Dual Fiber 80km 1550nm transmitter and wideband receiver

CWDM and High Sensitivity Models

Options are also available with Coarse Wavelength Division Multiplexing (CWDM) transmitters, with a standard or high sensitivity receiver. The high sensitivity models are indicated with an H in the model number (e.g. 9450GT-27H). The CWDM models are identified with a two digit suffix as indicated in **Table 3.2** The wavelength for each model are also indicated.

Table 3.2 9450GT — Operating Wavelengths

Model	Transmit Wavelength
9450GT-CWDM-27-LC	1270nm
9450GT-CWDM-29-LC	1290nm
9450GT-CWDM-31-LC	1310nm
9450GT-CWDM-33-LC	1330nm
9450GT-CWDM-35-LC	1350nm
9450GT-CWDM-37-LC	1370nm
9450GT-CWDM-43-LC	1430nm
9450GT-CWDM-45-LC	1450nm
9450GT-CWDM-47-LC	1470nm
9450GT-CWDM-49-LC	1490nm
9450GT-CWDM-51-LC	1510nm
9450GT-CWDM-53-LC	1530nm
9450GT-CWDM-55-LC	1550nm
9450GT-CWDM-57-LC	1570nm
9450GT-CWDM-59-LC	1590nm
9450GT-CWDM-61-LC	16 0nm

9450GT Functional Block Diagram

This section provides a functional block diagram that outlines the workflow of the 9450GT series regardless of the model type. (Model 9450GT-NF omits the fiber I/O interfaces.)
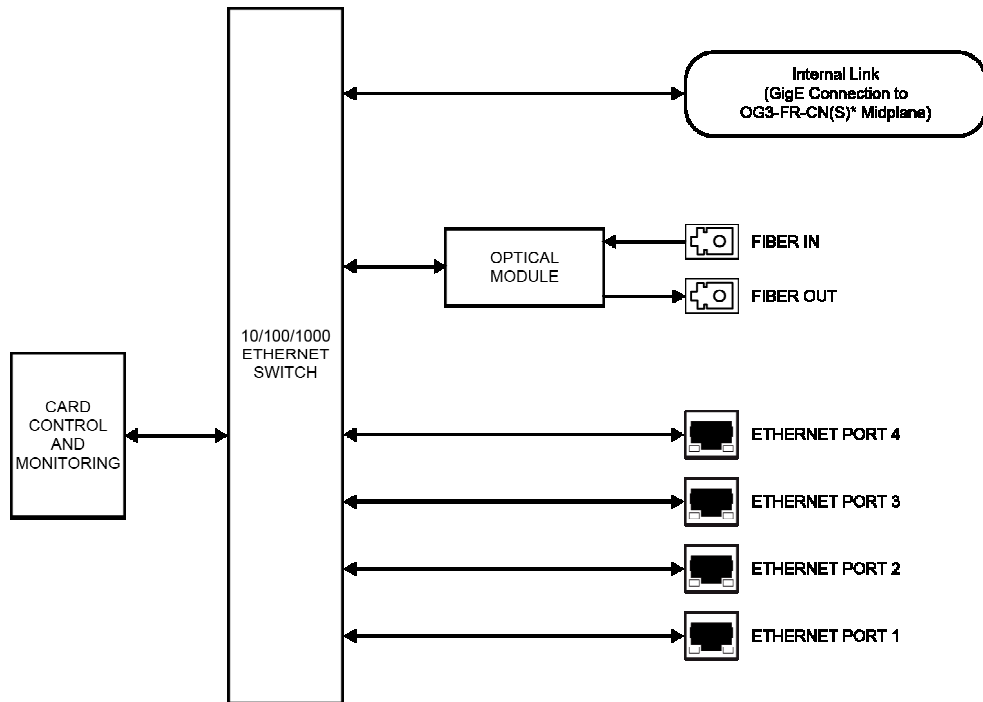
*Internal GigE connection requires the MFC-8322-N(S) network controller card for the OG3-FR frame.

Figure 3.1 *9450GT Series — Simplified Block Diagram*

Cabling for the 9450GT

This section provides information for connecting cables to the installed Rear Module on the openGear frames. The optical connector used to mate the card to the rear module is designed for blind mate optical connections.

⚠️

Caution — *Every time you are required to insert a connector into a device, or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.*

Connectors must always be inserted into a device or have a dust cap on.

9450GT Cabling Overview

The 9450GT is used with the Rear Module. Each rear module occupies two slots and accommodates one card. This rear module provides one single mode optical input, one single mode optical output, and four RJ45 Ethernet 10/100/1000 ports. (**Figure 3.2**)

- If your 9450GT is a CWDM model, the supported wavelength is indicated in the card product number. For example, the 9450GT-27 supports 1270nm wavelengths.
- If your 9450GT is a high sensitivity transceiver, the card product number includes an "H". For example, 9450GT-27H.

Note: Fiber I/O positions are unpopulated on model 9450GT-NF.
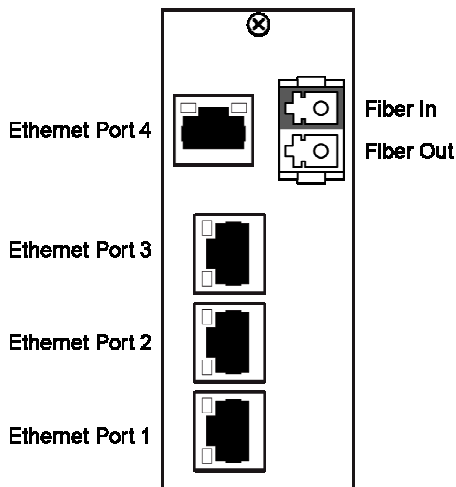
Figure 3.2 Cable Connections for the 9450GT

Optical Lengths

The optical distance the optical ports of your card support are dependent on the card model. The suggested distances are specified in **Table 3.3**. To calculate your fiber path link budget, refer to **Table 3.6** and **Table 3.7** for optical budget specifications.

Table 3.3 9450GT Supported Optical Distances

Model	Cable Length
9450GT-20	20km
9450GT-40	40km
9450GT-80	80km

Wavelengths

The wavelength of the optical ports of your card is dependent on the card model. The wavelength designations are specified in **Table 3.4**.

Table 3.4 9450GT Supported Wavelengths

Model	Fiber Out	Fiber In
9450GT-20	1310nm	1270-1610nm
9450GT-40	1310nm	1270-1610nm
9450GT-80	1550nm	1270-1610nm

9450GT Technical Specifications

This section provides the technical specifications for the 9450GT series.

9450GT-20/40/80 Series

This section provides the technical specifications for the 9450GT-20, 9450GT-40, and 9450GT-80.

Table 3.6 9450GT Technical Specifications

Category	Parameter	Specification
Optical	Number of Inputs	1
	Number of Outputs	1
	Nominal Wavelength	9450GT-20: 1310nm
		9450GT-40: 1310nm
		9450GT-80: 1550NM
	Tx Power	9450GT-20: -3dBm to -8dBm
		9450GT-40: +3dBm to -2dBm
		9450GT-80: +5dBm to 0dBm
	Rx Sensitivity	9450GT-20: -3dBm to -22dBm
		9450GT-40: -3dBm to -24dBm
		9450GT-80: -3dBm to -24dBm
	Optical Budget	9450GT-20: 14dB
		9450GT-40: 22dB
		9450GT-80: 24dB
	Receiver Overload	values above -3dBm
	Connector Type[a]	Single Mode, LC/UPC
	Laser Type	Fabry-Perot (FP)
Ethernet 10/100/1000	Number of Ports	4
	Cable Type	Standard straight-through CAT-5e
	Connector Type	RJ45
Environment	Operating Range	0°C to 40°C
Power	Power Consumption	7W

a. Receiver overload at values above -3dBm.

9450GT CWDM Series

This section provides the technical specifications for the 9450GT CWDM series.

Table 3.7 9450GT CWDM Series Technical Specifications

Category	Parameter	Specification
Optical	Number of Inputs	1
	Number of Outputs	1
	Nominal Wavelength	9450GT-27: 1270nm
		9450GT-29: 1290nm
		9450GT-31: 1310nm
		9450GT-33: 1330nm
		9450GT-35: 1350nm
		9450GT-37: 1370nm
		9450GT-43: 1430nm
		9450GT-45: 1450nm
		9450GT-47: 1470nm
		9450GT-49: 1490nm
		9450GT-51: 1510nm
		9450GT-53: 1530nm
		9450GT-55: 1550nm
		9450GT-57: 1570nm
		9450GT-59: 1590nm
		9450GT-61: 1610nm
	Tx Power	9450GT-xx CWDM series: +5dBm to 0dBm
		9450GT-xxH CWDM series: +7dBm to +2dBm
	Rx Sensitivity	9450GT-xx CWDM series: -3dBm to -24dBm
		9450GT-xxH series: -10dBm to -32dBm
	Optical Budget	9450GT-xx CWDM series: 24dBm
		9450GT-xxH series: 34dBm
	Receiver Overload	9450GT-xx CWDM series: -3dBm
		9450GT-xxH series:-10dBm
	Connector Type	Single Mode, LC/UPC, APD
	Laser Type	Distributed Feedback (DFB)
Ethernet 10/100/1000	Number of Ports	4
	Cable Type	Standard straight-through CAT-5e
	Connector Type	RJ45
Environment	Operating Range	0°C to 40°C
Power	Power Consumption	7W

Configuration

In This Chapter

This chapter provides a general overview of the user controls and configuration options available for your F iber Ethernet Switch Transceiver.

The following topics are discussed:

- Card Overview

- Control and Monitoring Features

- Configuring a VLAN

- Enabling Trunking

- Enabling Alarms

Card Overview

This section provides a general overview of the Fiber Ethernet Switch Transceiver card-edge components. For information on the available LEDs, refer to the section "**Control and Monitoring Features**". The card-edge components are the same regardless of the card model, but the number of optic connectors may differ.
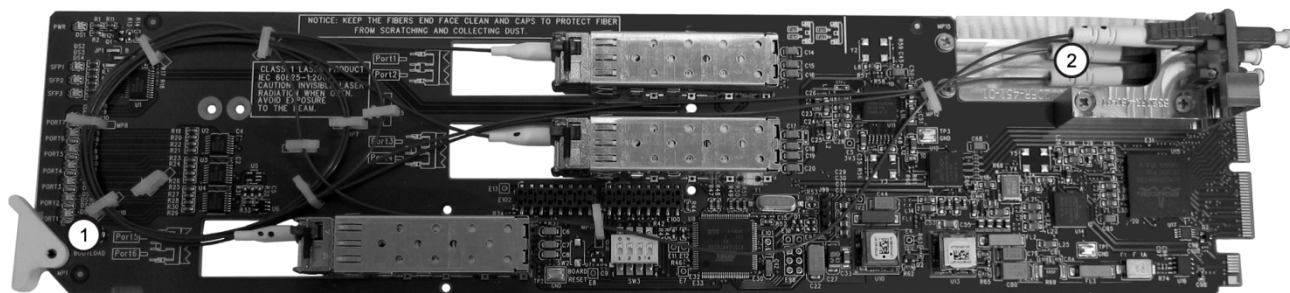
Figure 4.1 Typical Layout

1. Boot Load Button (SW3)

SW3 is used for factory service in the unlikely event of a complete card failure. The Bootload process is further described in the section "**Bootload Button**".

2. Fiber Optic Connectors

The Fiber Ethernet Switch Transceivers use a blind mate LC/UPC connector to interface with the Rear Modules. The rear module remains passive, while allowing for the Fiber Ethernet Switch Transceiver to be replaced without the need to remove any connected Ethernet or fiber optic cables. The blind mate connector is connected to the optical module via a single mode LC/UPC pigtail.

> **Note** — *The number of fiber optic connectors and SFPs on the card is dependent on your card model*

Each fiber optic connector for the card includes a dust cap. The dust cap must stay on at all times when the card is not installed in a frame. Ensure to keep the fibers end face clean and use the caps to protect the fiber from scratches and collecting dust. Refer to the section "**Important Laser Safety Measures and Notices**" at the beginning of this manual for safety information.

Control and Monitoring Features

This section provides information on the power status LED located on the card-edge and the LEDs on all rear modules for the Fiber Ethernet Switch Transceivers.

> ✎ **Note** — *The number of SFP and PORT LEDs that are implemented on the card-edge is dependent on your card model.*

Card-edge LEDs

The front edge of each Fiber Ethernet Switch Transceiver includes LED indicators for alarms, and communication activity. Refer to **Figure 4.2** for the location of these LEDs on the card-edge.
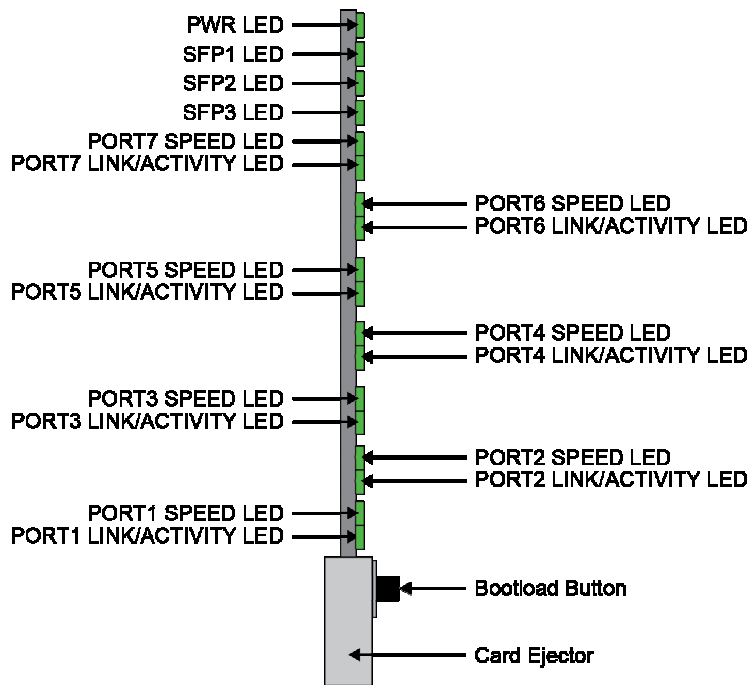
Figure 4.2 Fiber Ethernet Switch Transceiver — Card-edge LEDs

Each pair of PORT LEDs on the card-edge report on a specific fiber or RJ45 port for your card. **Table 4.1** outlines the mapping of the LEDs based on the card model.

Table 4.1 Port LED Mapping

LED	Reports Status of					
	9450GT	**9450GT**				
PORT 7	Internal Link	Internal Link				
PORT 6	Fiber A	Fiber A				
PORT 5	--	--				
PORT 4	RJ45 #4	RJ45 #4				
PORT 3	RJ45 #3	RJ45 #3				
PORT 2	RJ45 #2	RJ45 #2				
PORT 1	RJ45 #1	RJ45 #1				

Card-edge LEDs Overview

Basic LED displays and descriptions are provided in **Table 4.2**.

Table 4.2 Card-edge LEDs

LED	Color	Display and Description
PWR	Green	When lit green, this LED indicates that the card is functioning normal and that no anomalies have been detected.
	Flashing Green	When flashing green, this LED indicates that the bootloader is currently running.
	Yellow	When lit yellow, this LED indicates that the CPU is booting.
	Red	When lit red, this LED indicates that the card is powering on or there is a fault condition.
	Off	When unlit, this LED indicates a lack of power to the card.
SFP #[1]	Green	When lit green, this LED indicates that the Fiber signal on the specified SFP is functioning correctly and that no anomalies have been detected.
PORT # SPEED	Green	When lit green, this LED indicates the port speed is 1Gbps.
	Orange	When lit orange, this LED indicates the port speed is at 100Mbps.
	Off	When unlit, this LED indicates the port speed is at 10Mbps.
PORT # LINK/ACTIVITY	Green	When lit green, this LED indicates a valid link is established on the port.
	Flashing Green	When flashing green, this LED indicates communication activity is occurring.
	Off	When unlit, this LED indicates an invalid link is detected. Verify the cable connection on the rear module port and your network connections.

Card-edge LEDs Overview

Each RJ45 connector on the rear module includes two LEDs that report the Ethernet communication activity and speed for the card. Refer to **Figure 4.3** for LED locations.
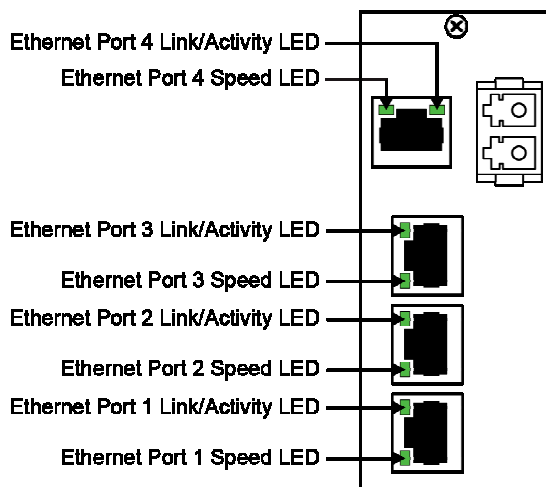
Figure 4.3 Rear Module LEDs

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[1] Refer to the section "**Card Overvew**" for SFP Optical Module locations.

Rear Module LEDs Overview

Basic LED descriptions are provided in **Table 4.3**.

Table 4.3 LEDs on the Rear Module

LED	Color	Display and Description
ETHERNET PORT# LINK/ACTIVITY	Green	When lit green, this LED indicates a valid link is established on the specified RJ45 port.
	Flashing Green	When flashing green, this LED indicates communication activity is occurring on the specified RJ45 port.
	Off	When off, this LED indicates an invalid link is detected on the specified RJ45 port. Verify the cable connection on the rear module port and your network connections.
ETHERNET PORT # SPEED	Green	When lit green, this LED indicates the Ethernet Port communication speed is at 1Gbps.
	Orange	When lit orange, this LED indicates the Ethernet Port communication speed is at 100Mbps.
	Off	When unlit, this LED indicates the Ethernet Port communication speed is at 10Mbps.

Enabling Trunking

Trunking, also known as link aggregation, is the use of two or more links between nodes (switches and/or servers) in parallel to increase the bandwidth. A side benefit is that a failure of a link will cause the traffic to be redistributed among the remaining links, though at reduced overall capacity.

A Word About Loops

> ✳ **Important** — *Each fiber Ethernet Switch Transceiver defaults as a basic switch where all ports are enabled and assigned to VLAN 1. If the card is wired for VLAN and/or trunking, but is not configured as such, you may create a possible network loop which will impact your network.*

If you have two or more Fiber Ethernet Switch Transceivers (Figure 4.9) or an MFC-8322-N with one or more Fiber Ethernet Switch Transceiver cards (Figure 4.10), there is potential to create multiple paths between devices, causing loops that can bring down a network. If one or more Fiber Ethernet Switch Transceivers are going to connect to the same network, ensure that the internal GigE ports to those cards are turned off at the MFC-8322-N. This Internal Loop issue cannot occur with an MFC-8322-S or DFR-8321 series frames.

Troubleshooting a Loop

When a loop is created, the Fiber Ethernet Switch Transceiver may automatically detect the loop and disable the appropriate ports. When this occurs, the LEDs on the rear module and the card-edge flash in unison for the affected ports. Note that the network may be able to avoid the loop if it has spanning tree capability.

Use one of the following methods to troubleshoot:

- Disable the ports in DashBoard and enable them one at a time to see which port is causing the loop.
- Disconnect the cables from the ports on the rear modules and then re-connect the cables one at a time.
- Disconnect the cables from the ports, re-configure the card, and then re-connect the cables one at a time. Use this method when DashBoard cannot connect to the card.

Exceptions

There are exceptions for permitting a looping system: multiple paths are created for redundancy or for high bandwidth traffic. In the case of the Fiber Ethernet Switch Transceivers, you can have two or more ports acting as a trunk group to increase the bandwidth between two points. The trunk appears as one port in the generic switch mode of operation. It also provides redundancy in that failure of one of the physical ports in the trunk group forces all the traffic to the remaining link(s).

Enabling Alarms

You can configure the Fiber Ethernet Switch Transceivers to report when one or more of the following error conditions occur:

- A link fails on the card switch
- An incompatible rear module is installed with the card
- Temperature of the Fiber Optical Module is not within range
- Optical power of the Fiber Optical Module is not within range

Error conditions are reported in the applicable fields of the **Status** tabs for each card in DashBoard. If you do not enable the card to report the alarm condition, the affected status field may report a green indicator (if applicable) with the message "`Suppressed Alarm`" even when a related alarm condition is occurring on the card.

For More Information on…

- the possible messages in the **Status** tab, refer to the section "**Status Tabs**".

Link Failure Alarms

You can choose which RJ45, fiber optic or Internal links the card monitors for link failures. Once an alarm is enabled, the applicable **Link Status** fields in the **Signal** tab will report when the card detects an invalid or absent connection for that link. To verify which connection to troubleshoot, refer to the rear module label.

To enable an alarm to report a link failure

1. From the **Device View**, select the **Alarm Enable** tab.
2. Select the required **RJ45 Link Fails** check box(es) to enable the card to report when the specified RJ45 connector on the rear module loses network connection.
3. Select the required **Fiber Link Fails** check box(es) to enable the card to report when the specified fiber optic connector on the rear module loses network connection.
4. Select the **Internal Link Fails** check box to enable the card to report when the GigE connection to the OG3-FR midplane loses network connection.

Power and Temperature Monitoring

Once an alarm is enabled, the applicable **Optical** status fields in the **Signal** tab and the **HW Status** field in the **Hardware** tab report when the power and/or temperature values of the Optical Module of the specific fiber connection are out of range.

To enable power monitoring

1. From the **Device View**, select the **Alarm Enable** tab.
2. Select the **Enable Fiber Power Monitoring** check box for the fiber optic connection you wish to monitor. The **Power High** and **Power Low** check boxes are now editable.
3. To monitor the optical transmitter power consumption of the card, select the applicable **Tx Power High** and **Tx Power Low** check boxes to enable the card to report when the transmitter power is not within the recommended range for the SFPs.
4. To monitor the optical receiver power consumption of the card, select the applicable **RX Power High** and **Rx Power Low** check boxes to enable the card to report when the receiver power is not within the recommended range for the SFPs.

To enable temperature monitoring

1. From the **Device View**, select the **Alarm Enable** tab.

2. Select the **Enable Fiber Abnormal Temperature** check box for the fiber optic connection you wish to monitor.

Incompatible Rear Module Monitoring

You can choose to enable the card to report when an unsupported rear module is installed with your card. This alarm is reported in the **HW Status** field in the **Hardware** tab.

To enable rear module monitoring

1. From the **Device View**, select the **Alarm Enable** tab.

2. Select the **Incompatible Rear Module** check box.

DashBoard Menus

In This Chapter

This chapter briefly summarizes the menus, items, and parameters available from the DashBoard Control System for the Fiber Ethernet Switch Transceiver. Note that default values are indicated with an asterisk (*).

The following topics are discussed:

- Status Tabs
- Port Stats Tab
- Setup Tab
- Alarm Enable Tab

Status Tabs

This section summarizes the read-only information displayed in the **Status** tabs. The fields in the **Status** tabs can vary in severity from green (valid), yellow (caution), to red (alarm). DashBoard reports the most severe alarm for a single field. Alarm colors are noted within the tables as text set in brackets next to the menu parameter name.

Note — *The number of Fiber sub-tabs, RJ45 Link Status fields, and Fiber Link Status fields in the status tabs is dependent on your card model.*

Signal Tab

Table 4.1 summarizes the read-only information displayed in the **Signal** tab.

Table 4.1 Signal Tab tems

Tab Title	Item	Parameters	Description
Ports	RJ45 # Link Status	OK (Green)	The link for the specified port is valid and passes information
		Suppressed Alarm (Green)	An alarm condition exists on the port but the corresponding alarm is disabled in the Alarm Enable tab
		Link Failure (Red)	The link for the specified port is invalid (fails) and the corresponding alarm is enabled in the Alarm Enable tab
	Fiber # Link Status	OK (Green)	The link for the specified port is valid and passes information
		Suppressed Alarm (Green)	An alarm condition exists on the port but the corresponding alarm is disabled in the Alarm Enable tab
		Link Failure (Red)	The link for the specified port is invalid (fails) and the corresponding alarm is enabled in the Alarm Enable tab
	Internal Link Status	OK (Green)	The GigE link to the OG3-FR midplane is valid and passes information
		Suppressed Alarm (Green)	An alarm condition exists on the GigE link to the OG3-FR midplane but the corresponding alarm is disabled in the Alarm Enable tab
		Link Failure (Red)	The GigE link to the OG3-FR midplane for is invalid and the corresponding alarm is enabled in the Alarm Enable tab
	RJ45 # Rate	# Mbps	Indicates the speed of the specified port
		# Gbps	
		N/A	The link has failed
		No Link	The link is invalid

Table 4.1 Signal Tab Items

Tab Title	Item	Parameters	Description
Ports	Fiber # Rate	# Mbps	Indicates the duplex and speed of the specified port
		# Gbps	
		N/A	The link has failed
		No Link	The link is invalid
	Internal Rate	# Mbps	Indicates the duplex and speed of the GigE connection to the OG3-FR midplane
		# Gbps	
		N/A	The GigE link to the OG3-FR midplane has failed
		No Link	The GigE link to the OG3-FR midplane is invalid
Fiber #	Optical Module Status	OK (Green)	Card is operating correctly and all optical signals are valid
		No Signal	Card does not detect a valid fiber optic signal
		Temp High[a]	Indicates when the temperature of the Optical Module does not fall within the SFP recommended range
		Temp Low[a]	
		Rx Power High (Red)[a]	The receiver component of the Optical Module is drawing power outside the SFP recommended range
		Rx Power Low (Red)[a]	
		Tx Power High (Red)[a]	The transmitter component of the Optical Module is drawing power outside the SFP recommended range
		Tx Power Low (Red)[a]	
		Not Detected	The Optical Module is not communicating with the ethernet switch.
	Optical Tx Power (dBm)[b]	#	Indicates the approximate optical transmit power of the Optical Module. This value is typically accurate to +/- 3dBm.
	Optical Tx Wavelength (nm)	#	Indicates the wavelength of the transmit signal
	Optical Rx Power (dBm)[a]	#	Indicates the power consumption of the Optical Module. This value is typically accurate to +/- 3dBm.
	Optical Module Temperature (C)	#	Indicates the internal temperature (in Celsius) as reported by the SFP

a. The check box for the corresponding alarm must be selected in the Alarms Enable tab in order for the card to report the error condition.

b. When operating at the upper or lower optical power limits, it is recommended to use an optical power meter to verify the received power.

Hardware Tab

Table 4.2 summarizes the read-only information displayed in the **Hardware** tab.

Table 4.2 Hardware Tab tems

Tab Title	Item	Parameters	Description
Hardware	HW Status	OK	Indicates the status of the hardware including the SFP module. Some messages displayed are dependent on the settings in the Alarms Enable tab.
		FPGA load invalid	
		Incomp I/O Module	
		Current out of spec	
		Internal Error	
		SFP Temp Low	
		SFP Temp High	
		SFP Power High	
		SFP Power Low	
		SFP Tx Fault	
		SFP Not Detected	
	Voltage (mV)	#	Measured input voltage
	Current (mA)	#	Measured current consumption of card
	CPU headroom	#	Processing power available
	RAM available	#/##	On-board processing memory available
	Uptime (h)	#	Displays the number of hours since the last reboot of the card
	Configuration Bank	#	Storage count

Product Tab

Table 4.3 summarizes the read-only information displayed in the **Product** tab.

Table 4.3 Product Tab Items

Tab Title	Item	Parameters	Description
Product	Product	#	Displays the card name
	Supplier	Cobalt Digital Inc.	
	Board Rev	##	Indicates the board revision
	Board S/N	######	Indicates the card serial number
	Rear Module	#	Indicates the Rear Module installed
	Software Rev	##.##	Indicates the software version

Port Stats Tab

Table 4.4 summarizes the read-only information displayed in the **Port Stats** tab.

> **Note** — *The number of RJ45 and Fiber Link Status fields in the Port Stats tab is dependent on your card model.*

Table 4.4 Port Stats Tab Items

Menu Title	Item	Parameters	Description
RJ45 # Stats, Fiber # Stats, Internal Stats	RX Packets	#	Reports the number of good packets received by the specified port This number also includes the number of packets received by the specified port that are greater than the standard maximum size and less than or equal to the jumbo packet size, regardless of CRC or alignment errors
	RX Errors	#	Reports the number of packets received by the specified port that have either an FCS error or an alignment error
	RX Dropped	#	Reports the number of good packets received by the specified port but were dropped due to a lack of resources or other reasons
	TX Packets	#	Reports the number of good packets transmitted by the specified port
	TX Dropped	#	Reports the total number of transmit packets that are dropped due to a lock of resources or other reasons
	TX Collisions	#	Reports the number of collisions experienced by the specified port during packet transmissions
Refresh Rate	Refresh Rate	#	Specifies how often the status fields in the Port Stats tabs are updated
		Disabled*	Disables this feature

Setup Tab

Table 4.5 summarizes the **Setup** options available in DashBoard. Note that the number of configurable Port fields in the Setup tab is dependent on your card model.

$\ast$ **Important** — *Contact your IT Department before connecting to your facility network to ensure that there are no conflicts or the possibility of creating a network loop.*

Table 4.5 Setup Menu Items

Menu Title	Item	Parameters	Description
	Enable Trunking	Selected	Enables the port trunking feature on the card
		Cleared*	Disables this feature
Trunking - RJ45 #, Fiber #	Trunk 1	Selected	Includes the specified ports into Trunk Group 1
		Cleared*	Excludes the port from Trunk Group 1
	Trunk 2	Selected	Includes the specified ports into Trunk Group 2
		Cleared*	Excludes the port from Trunk Group 2
VLAN - RJ45 #, Fiber #, Internal[a]	VLAN 1	Selected*	Includes the specified port into Virtual LAN Group 1
		Cleared	Excludes the port from VLAN 1
	VLAN 2	Selected	Includes the specified port into Virtual LAN Group 2
		Cleared*	Excludes the port from VLAN 2
	VLAN 3	Selected	Includes the specified port into Virtual LAN Group 3
		Cleared*	Excludes the port from VLAN 3
Port Enables	RJ45 #, Fiber #	Selected*	Enables the selected port
		Cleared	Disables the port. This is useful when troubleshooting to turn ports off that are connected to devices without disconnecting cables
Factory Default	Reset		Resets all configurable settings on the card to the factory default values

a.   Note that a minimum of two ports must be assigned to a VLAN in order to establish communications.

Alarm Enable Tab

Table 4.6 summarizes the **Alarm** setup options available in DashBoard.

Note — *The number of sub-tabs, RJ45 Link check boxes, and Fiber Link check boxes in the Alarm Enable tab is dependent on your card model.*

Table 4.6 Alarm Enable Menu Items

Menu Title	Item	Parameters	Description
Switch	RJ45 # Link fails	Selected*	Enables the corresponding RJ45 Link Status field in the Signal tab to report when the specified ethernet port on the rear module loses network connection
		Cleared	Disables this alarm for the specified port
	Fiber # Link fails	Selected*	Enables the corresponding Fiber Link Status field in the Signal tab to report when the specified fiber port loses network connection
		Cleared	Disables this alarm for the specified port
	Internal Link Fails	Selected*	Enables the Internal Link Status field in the Signal tab to report when the GigE connection to the OG3-FR midplane experiences an error condition
		Cleared	Disables this alarm
	Incompatible Rear Module	Selected*	The HW Status field in the Hardware tab reports when an unsupported rear module is installed with the card
		Cleared	Disables this alarm
Fiber #	Fiber # Abnormal Temperature	Selected*	The applicable Optical Module Temperature field in the Signal tab reports when the temperature of the SFP module is not in range (high/low)
		Cleared	Disables this alarm for the specified port
	Enable Fiber # Power Monitoring	Selected*	Enables you to configure the power monitoring alarms for the specified fiber port. Corresponding check boxes in the tab are now editable.
		Cleared	Disables all monitoring of power consumption on the specified port. The corresponding check boxes on this tab are now read-only.
	TX Power High	Selected*	Enables the corresponding Optical Tx Power field in the Signal tab to report when the optical transmit power of the Optical Module reaches **X#dBm**
		Cleared	Disables this alarm for the specified port

Table 4.6 Alarm Enable Menu Items

Menu Title	Item	Parameters	Description
Fiber #	TX Power Low	Selected*	Enables the corresponding Optical Tx Power field in the Signal tab to report when the optical receiver power of the Optical Module is less than **X#dBm**
		Cleared	Disables this alarm for the specified port
	RX Power High	Selected*	Enables the corresponding Optical Rx Power field in the Signal tab to report when the optical receiver power of the Optical Module reaches **X#dBm**
		Cleared	Disables this alarm for the specified port
	RX Power Low	Selected*	Enables the corresponding Optical Rx Power field in the Signal tab to report when the optical receiver power of the Optical Module is less than **X#dBm**
		Cleared	Disables this alarm for the specified port

Service Information

In This Chapter

This chapter contains the following sections:

- Troubleshooting Checklist
- Warranty and Repair Policy

Troubleshooting Checklist

Routine maintenance to this openGear product is not required. In the event of problems with your Fiber Ethernet Switch Transceiver, the following basic troubleshooting checklist may help identify the source of the problem. If the frame still does not appear to be working properly after checking all possible causes, please contact your openGear products distributor, or the Technical Support department at the numbers listed under the "**Contact Us**" section.

⚠️ **Caution** — *Every time you are required to insert a connector into a device, or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.*

Connectors must always be inserted into a device or have a dust cap on.

1. **Visual Review** — Performing a quick visual check may reveal many problems, such as connectors not properly seated or loose cables. Check the card, the frame, and any associated peripheral equipment for signs of trouble.

2. **Power Check** — Check the power indicator LED on the distribution frame front panel for the presence of power. If the power LED is not illuminated, verify that the power cable is connected to a power source and that power is available at the power main. Confirm that the power supplies are fully seated in their slots. If the power LED is still not illuminated, replace the power supply with one that is verified to work.

3. **Input Signal Status** — Verify that source equipment is operating correctly and that a valid signal is being supplied.

4. **Output Signal Path** — Verify that destination equipment is operating correctly and receiving a valid signal.

5. **Unit Exchange** — Exchanging a suspect unit with a unit that is known to be working correctly is an efficient method for localizing problems to individual units.

Bootload Button

In the unlikely event of a complete card failure, you may be instructed by a Technical Support specialist to perform a complete software reload on the card.

To reload the software on a card

1. Eject the card from the frame.

2. Press and hold the **Bootload** button, while re-inserting the card into the frame.

3. Release the button.

   - The **PWR** LED flashes green while the card is waiting for a new software load.

   - If a new software load is not sent to the card within θ seconds, the card will attempt to restart with its last operational software load.

   - Software loads can be sent to the Fiber Ethernet Switch Transceiver via the ethernet connection on the rear of the frame.

Warranty and Repair Policy

Cobalt Digital Inc. Limited Warranty

This product is warranted to be free from defects in material and workmanship for a period of five (5) years from the date of shipment to the original purchaser, except that 4000, 5000, 6000, 8000 series power supplies, and Dolby® modules (where applicable) are warranted to be free from defects in material and workmanship for a period of one (1) year.

Cobalt Digital Inc.'s ("Cobalt") sole obligation under this warranty shall be limited to, at its option, (i) the repair or (ii) replacement of the product, and the determination of whether a defect is covered under this limited warranty shall be made at the sole discretion of Cobalt.

This limited warranty applies only to the original end-purchaser of the product, and is not assignable or transferrable therefrom. This warranty is limited to defects in material and workmanship, and shall not apply to acts of God, accidents, or negligence on behalf of the purchaser, and shall be voided upon the misuse, abuse, alteration, or modification of the product. Only Cobalt authorized factory representatives are authorized to make repairs to the product, and any unauthorized attempt to repair this product shall immediately void the warranty. Please contact Cobalt Technical Support for more information.

To facilitate the resolution of warranty related issues, Cobalt recommends registering the product by completing and returning a product registration form. In the event of a warrantable defect, the purchaser shall notify Cobalt with a description of the problem, and Cobalt shall provide the purchaser with a Return Material Authorization ("RMA"). For return, defective products should be double boxed, and sufficiently protected, in the original packaging, or equivalent, and shipped to the Cobalt Factory Service Center, postage prepaid and insured for the purchase price. The purchaser should include the RMA number, description of the problem encountered, date purchased, name of dealer purchased from, and serial number with the shipment.

Cobalt Digital Inc. Factory Service Center

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