



## SHC-8932-F User Guide

# Thank You for Choosing Ross

You've made a great choice. We expect you will be very happy with your purchase of Ross Technology.

Our mission is to:

1. Provide a Superior Customer Experience
  - offer the best product quality and support
2. Make Cool Practical Technology
  - develop great products that customers love

Ross has become well known for the Ross Video Code of Ethics. It guides our interactions and empowers our employees. I hope you enjoy reading it below.

If anything at all with your Ross experience does not live up to your expectations be sure to reach out to us at [solutions@rossvideo.com](mailto:solutions@rossvideo.com).



David Ross  
CEO, Ross Video  
[dross@rossvideo.com](mailto:dross@rossvideo.com)

## Ross Video Code of Ethics

Any company is the sum total of the people that make things happen. At Ross, our employees are a special group. Our employees truly care about doing a great job and delivering a high quality customer experience every day. This code of ethics hangs on the wall of all Ross Video locations to guide our behavior:

1. We will always act in our customers' best interest.
2. We will do our best to understand our customers' requirements.
3. We will not ship crap.
4. We will be great to work with.
5. We will do something extra for our customers, as an apology, when something big goes wrong and it's our fault.
6. We will keep our promises.
7. We will treat the competition with respect.
8. We will cooperate with and help other friendly companies.
9. We will go above and beyond in times of crisis. *If there's no one to authorize the required action in times of company or customer crisis - do what you know in your heart is right. (You may rent helicopters if necessary.)*

# SHC-8932-F · User Guide

- Ross Part Number: 8932DR-004-01
- Release Date: July 5, 2022.
- Software Version: v1.1

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

## Copyright

©2022 Ross Video Limited, Ross®, and any related marks are trademarks or registered trademarks of Ross Video Limited. All other trademarks are the property of their respective companies. PATENTS ISSUED and PENDING. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, mechanical, photocopying, recording or otherwise, without the prior written permission of Ross Video. While every precaution has been taken in the preparation of this document, Ross Video assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein.

## Patents

Patent numbers US 7,034,886; US 7,508,455; US 7,602,446; US 7,802,802 B2; US 7,834,886; US 7,914,332; US 8,307,284; US 8,407,374 B2; US 8,499,019 B2; US 8,519,949 B2; US 8,743,292 B2; GB 2,419,119 B; GB 2,447,380 B; and other patents pending.

## Notice

The material in this manual is furnished for informational use only. It is subject to change without notice and should not be construed as commitment by Ross Video Limited. Ross Video Limited assumes no responsibility or liability for errors or inaccuracies that may appear in this manual.

## Safety Notices

Refer to the **"Important Regulatory and Safety Notices"** document that accompanied your product.

## Statement of Compliance

This product has been determined to be compliant with the applicable standards, regulations, and directives for the countries where the product is marketed.

Compliance documentation, such as certification or Declaration of Compliance for the product is available upon request by contacting [techsupport@rossvideo.com](mailto:techsupport@rossvideo.com). Please include the product; model number identifiers and serial number and country that compliance information is needed in request.

## EMC Notices

### US 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 his own expense.



**Notice** — *Changes or modifications to this equipment not expressly approved by Ross Video Ltd. could void the user's authority to operate this equipment.*

#### Canada

This Class "A" digital apparatus complies with Canadian ICES-003 and part 15 of the FCC Rules.

Cet appareil numérique de la classe "A" est conforme à la norme NMB-003 du Canada.

#### European Union

This equipment is in compliance with the essential requirements and other relevant provisions established under regulation (EC) No 765/2008 and Decision No 768/2008/EC referred to as the "New Legislative Framework".



**Warning** — *This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.*

#### Australia/New Zealand

This equipment is in compliance with the provisions established under the Radiocommunications Act 1992 and Radiocommunications Labeling (Electromagnetic Compatibility) Notice 2008.

#### Korea

This equipment is in compliance with the provisions established under the Radio Waves Act.

Class A equipment (Broadcasting and communications service for business use)

This device is a business-use (Class A) EMC-compliant device. The seller and user are advised to be aware of this fact. This device is intended for use in areas outside home.

Type of Equipment	User's Guide
A급 기기 (업무용 방송통신기자재)	이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
Class A Equipment (Industrial Broadcasting & Communication Equipment)	This equipment is <b>Industrial (Class A) electromagnetic wave suitability equipment</b> and seller or user should take notice of it, and this equipment is to be used in the places except for home.

#### International

This equipment has been tested under the requirements of CISPR 22:2008 or CISPR 32:2015 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 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.

## Environmental Information

The equipment 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, Ross Video encourages you 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 wheeled bin symbol invites you to use these systems.



If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration. You can also contact Ross Video for more information on the environmental performances of our products.

## Security and Privacy

If you would like more information on how Ross Video security and privacy practices have been applied to the SHC-8932-F, what you should know about maintaining security of this product, and how we can partner with you to ensure security throughout this product's life-cycle, contact [techsupport@rossvideo.com](mailto:techsupport@rossvideo.com).

Ross Video has implemented reasonable administrative, technical, and physical safeguards to help protect against security incidents and privacy breaches involving a Ross Video product provided those products are used in accordance with Ross Video instructions for use. However, as systems and threats evolve, no system can be protected against all vulnerabilities and we consider our customers the most important partner in maintaining security and privacy safeguards. If you have any concerns, we ask that you bring them to our attention, and we will investigate. Where appropriate, we will address the issue with product changes, technical bulletins and/or responsible disclosures to customers and regulators. Ross Video continuously strives to improve security and privacy throughout the product life-cycle using practices such as:

- Privacy and Security by Design
- Product and Supplier Risk Assessment
- Vulnerability and Patch Management
- Secure Coding Practices and Analysis
- Vulnerability Scanning
- Access Controls appropriate to Customer Data
- Incident Response
- Clear paths for two-way communication between customers and Ross Video

If you would like to report a potential product related privacy or security issue (incident, breach, or vulnerability), contact [techsupport@rossvideo.com](mailto:techsupport@rossvideo.com).

## Company Address



### **Ross Video Limited**

8 John Street  
Iroquois, Ontario, K0E 1K0  
Canada

### **Ross Video Incorporated**

P.O. Box 880  
Ogdensburg, New York  
USA 13669-0880

General Business Office: (+1) 613 • 652 • 4886

Fax: (+1) 613 • 652 • 4425

Technical Support: (+1) 613 • 652 • 4886

After Hours Emergency: (+1) 613 • 349 • 0006

E-mail (Technical Support): [techsupport@rossvideo.com](mailto:techsupport@rossvideo.com)

E-mail (General Information): [solutions@rossvideo.com](mailto:solutions@rossvideo.com)

Website: <http://www.rossvideo.com>

# Contents

<b>Introduction</b>	<b>9</b>
Related Publications .....	9
Documentation Conventions .....	9
Interface Elements .....	9
User Entered Text .....	10
Referenced Guides .....	10
Menu Sequences .....	10
Important Instructions .....	10
Contacting Technical Support .....	10
<b>Before You Begin</b>	<b>11</b>
Overview .....	11
Features .....	11
Notes on Configuring the HDMI Outputs .....	11
Closed Captioning .....	12
<b>Hardware Overview</b>	<b>13</b>
Overview .....	13
Main PCB .....	13
BOOTLOAD Button .....	13
Monitoring via the Card-edge .....	13
Supported Rear Module .....	14
<b>Physical Installation</b>	<b>15</b>
Before You Begin .....	15
Working with Fiber Optic Connectors .....	15
Removing the Blank Plates from the Rear Panel .....	15
Installing the Rear Module into the openGear Frame .....	16
Installing the SHC-8932-F Card into an openGear Frame .....	16
<b>Cabling</b>	<b>17</b>
Cabling the Ethernet Port on the openGear Frame .....	17
SDI Video Cabling .....	17
SFP Cabling .....	18
Working with Fiber Optic Connectors .....	18
Cabling the SFP Ports .....	18
HDMI® Output Cabling .....	19
Before You Begin .....	19
Cabling an HDMI® Port .....	19
Securing the Cable to the Rear Module .....	20
<b>Getting Started</b>	<b>23</b>
Launching DashBoard .....	23
Accessing the SHC-8932-F Interfaces in DashBoard .....	23
<b>Video Configuration</b>	<b>25</b>
Configuring the Loss of Input Failover Mode .....	25
Configuring the Auto Return Feature .....	26

Configuring the 2SI Mode	27
Before You Begin .....	27
2SI Mode Overview on the SHC-8932-F .....	27
Configuring 2SI Mode for the SHC-8932-F .....	27
Audio Setup	29
HDR Metadata	31
Specifying the Payload ID Colorimetry for an Output .....	31
Specifying the Bit Range .....	32
Customizing the Master Display Values .....	32
Upgrading the Software	35
DashBoard Menus	37
Signal Tab .....	37
Product Tab .....	38
Hardware Tab .....	39
Configuration Tab .....	40
Alarms Tab .....	42
Settings Tab .....	44
Technical Specifications	45
Supported Video Formats .....	45
SDI Inputs Specifications .....	45
SDI Outputs Specifications .....	46
HDMI Ports Specifications .....	47
Environment .....	47
Power .....	47
Supported SFP Modules	49
SFP-FIBER-12G .....	49
Features .....	49
Simplified Block Diagram .....	49
Technical Specifications .....	49
Physical Channel Position .....	50
Service Information	51
Troubleshooting Checklist .....	51
Bootload Button .....	51
Warranty and Repair Policy .....	51
Software Licenses	53
BSD .....	53
Dual GPL .....	53
GPL .....	53
LGPL .....	58
MIT .....	59
zlib .....	59
Glossary	61



# Introduction

This guide covers the installation, configuration, and use of the SHC-8932-F SDI to HDMI® Converter. The following chapters are included:

- **“Introduction”** summarizes the guide and provides important terms, and conventions.
- **“Before You Begin”** provides general information to keep in mind before installing and configuring your card.
- **“Hardware Overview”** provides a basic introduction to the hardware features including the cabling and monitoring features of the rear module.
- **“Physical Installation”** provides instructions for the physical installation of the card and its rear module.
- **“Cabling”** provides information on connecting the SHC-8932-F to your external devices.
- **“Getting Started”** provides a general overview of navigating the SHC-8932-F interfaces in DashBoard.
- **“Video Configuration”** outlines the video configuration options for the SHC-8932-F outputs.
- **“Configuring the 2SI Mode”** outlines how to assign a specified 2SI sub-image for the HDMI output.
- **“Audio Setup”** outlines how to map the audio channels to the SHC-8932-F outputs.
- **“HDR Metadata”** provides information on the HDR settings for the HDMI outputs of the SHC-8932-F.
- **“Upgrading the Software”** provides instructions for upgrading the software for your SHC-8932-F using DashBoard.
- **“DashBoard Menus”** summarizes the SHC-8932-F menus, items, and parameters in DashBoard.
- **“Technical Specifications”** provides the technical specifications for the SHC-8932-F.
- **“Supported SFP Modules”** outlines on the warranty and repair policies for your SHC-8932-F.
- **“Service Information”** outlines on the warranty and repair policies for your SHC-8932-F.
- **“Software Licenses”** provides the third-party software license information for your SHC-8932-F.
- **“Glossary”** provides a list of terms used throughout this guide.

## Related Publications

It is recommended to consult the following Ross documentation before installing and configuring your card:

- ***DashBoard User Guide***, Ross Part Number: 8351DR-004
- ***MFC-OG3-N and MFC-8322-S User Guide***, Ross Part Number: 8322DR-004
- ***OGX-FR Series User Guide***, Ross Part Number: 8322DR-204

## Documentation Conventions

Special text formats are used in this guide to identify parts of the user interface, text that a user must enter, or a sequence of menus and sub-menus that must be followed to reach a particular command.

### Interface Elements

Bold text is used to identify a user interface element such as a dialog box, menu item, or button. For example:

In the **Network** tab, click **Apply**.

## User Entered Text

Courier text is used to identify text that a user must enter. For example:

In the **Language** box, enter **English**.

## Referenced Guides

Text set in bold and italic represent the titles of referenced guides, manuals, or documents. For example:

For more information, refer to the ***DashBoard User Manual***.

## Menu Sequences

Menu arrows are used in procedures to identify a sequence of menu items that you must follow. For example, if a step reads "**File** > **Save As**," you would click the **File** menu and then click **Save As**.

## Important Instructions

Star icons are used to identify important instructions or features. For example:

- ★ Contact your IT department before connecting to your facility network to ensure that there are no conflicts. They will provide you with an appropriate value for the IP Address, Subnet Mask, and Gateway for your device.

## Contacting Technical Support

At Ross Video, we take pride in the quality of our products, but if problems occur, help is as close as the nearest telephone.

Our 24-hour Hot Line service ensures you have access to technical expertise around the clock. After-sales service and technical support is provided directly by Ross Video personnel. During business hours (Eastern Time), technical support personnel are available by telephone. After hours and on weekends, a direct emergency technical support phone line is available. If the technical support person who is on call does not answer this line immediately, a voice message can be left and the call will be returned shortly. This team of highly trained staff is available to react to any problem and to do whatever is necessary to ensure customer satisfaction.

- **Technical Support:** (+1) 613-652-4886
- **After Hours Emergency:** (+1) 613-349-0006
- **E-mail:** [techsupport@rossvideo.com](mailto:techsupport@rossvideo.com)
- **Website:** <http://www.rossvideo.com>

# Before You Begin

If you have questions pertaining to the operation of your card, contact us at the numbers listed in **“Contacting Technical Support”**. Our technical staff is always available for consultation, training, or service.

## Overview

The SHC-8932-F SDI-to-HDMI Converter is a high-quality signal conversion solution within the openGear family. The SHC-8932-F is the ideal solution for converting an SDI input signal to output an HDMI 2.0 signal to another device.

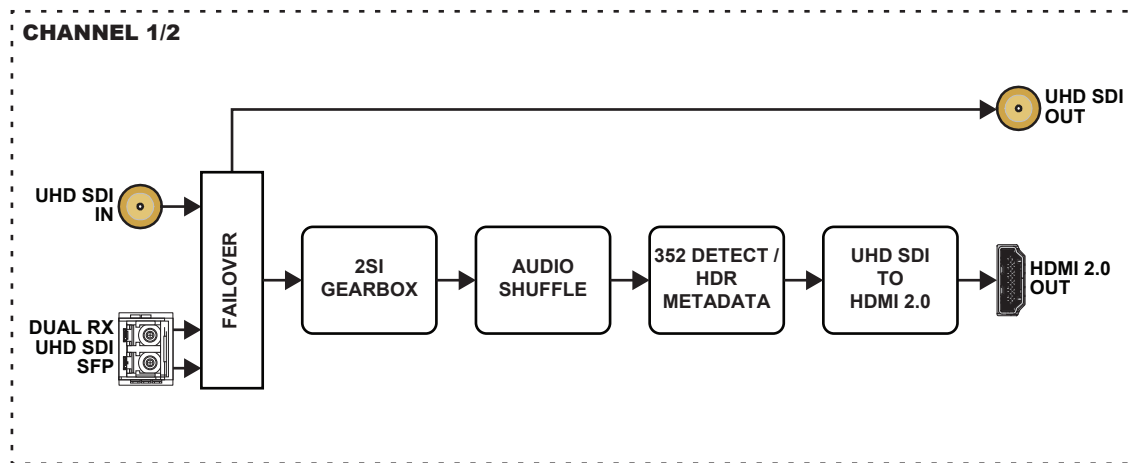


Figure 1 SHC-8932-F — Simplified Block Diagram

## Features

The following features are standard for the SHC-8932-F:

- 2 x HDMI® 2.0 connections with up to 2160p 60Hz in 4:2:2
- Single link UHD SDI support
- Generate HDR10 metadata from the embedded SMPTE ST352 data in SDI with the option to override/force the settings
- Integrated SDI gearbox allows multiple UHD/HD/3G streams to be transported over a single link
- Map up to 16 channels of embedded audio from SDI to HDMI
- Reports status and configuration remotely via the DashBoard Control System
- Can be installed in an OG3-FR or OGX-FR series frame
- 5-year transferable warranty

## Notes on Configuring the HDMI Outputs

Keep the following in mind when configuring the HDMI outputs of the SHC-8932-F:

- The SHC-8932-F produces the same video format at its HDMI output as you apply to the SDI input. It performs no scaling or other modification of the image. If there is no image displayed on your HDMI monitor, or the image is unstable, the most likely cause is that the monitor is incapable of displaying the video format that is present in your SDI signal.

- The input video (3G, 6G,12G) must include a valid 352 Packet Header to support HDR Metadata and 2SI.
- An incompatible 6G/12G 2SI signal will not produce any output (black or distorted output), even if the Active Input status field reports "OK" (a green indicator).

## **Closed Captioning**

If you wish to review open captions in the HDMI output of the SHC-8932-F, you need to install an SDI VANC caption decoder in the SDI path leading to the SHC-8932-F. The SHC-8932-F will display the captions that are already keyed into the video by the decoder.

# Hardware Overview

This chapter presents information on the SHC-8932-F hardware components and features.

## Overview

The SHC-8932-F is an openGear modular system composed of two sub-systems.

- a main PCB which connects to a rear module and the openGear frame midplane
- a rear module and daughter card assembly (P/N 8322AR-336) that provides physical connectors



**Notice** — Installing the SHC-8932-F in a frame other than the OG3-FR or OGX-FR could damage the card, the rear module, or both.

## Main PCB

The main PCB is a typical openGear card. An ejector on one end secures the module to the slot inside the openGear frame, and the other end inserts into a connector on the back of the rear module.

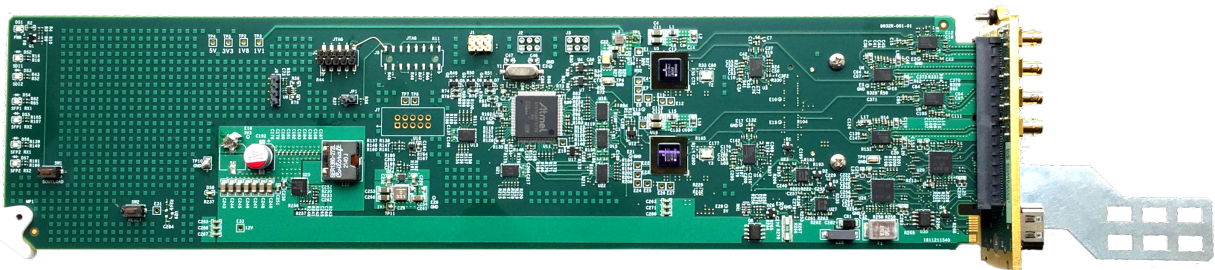


Figure 2 SHC-8932-F Card with Rear Module

## BOOTLOAD Button

This button is used for factory service in the unlikely event of a complete card failure. Do not use this button unless advised by Ross Video Technical Support.

## Monitoring via the Card-edge

The front-edge has LED indicators to indicate alarms, and communication activity. (**Figure 3**)

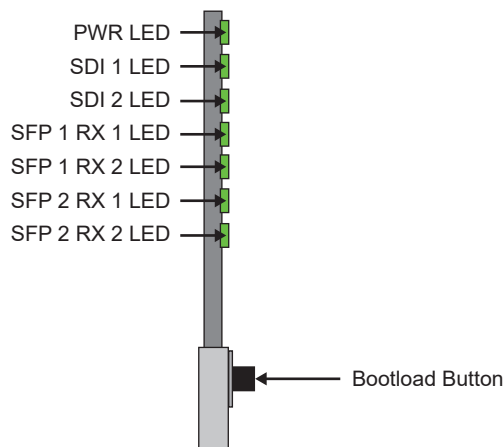


Figure 3 Card-edge Features

**Table 1** provides information on the LED displays.

**Table 1 SHC-8932-F LED Descriptions**

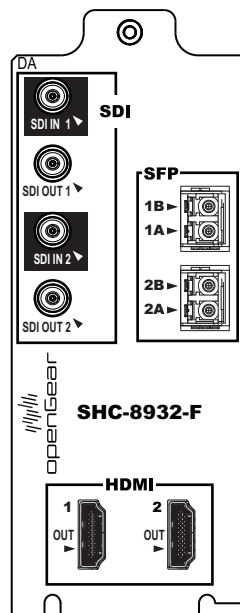
LED	Color	Description
PWR	Green	The card is powered on and is operating correctly
	Flashing	The card software is updating
	Red	When lit red, this LED indicates: <ul style="list-style-type: none"> <li>the card is booting, or</li> <li>a major alarm condition is occurring on the card</li> </ul>
	Off	The card is not powered on
SDI #	Green	A valid signal is detected on the SDI BNC
	Red	The signal connected to the SDI BNC is not valid
	Off	The SDI port is not in use
SFP # RX #	Green	A valid signal is detected on the specified SFP port
	Red	The signal connected to the specified SFP port is not valid
	Off	The SFP port is not in use

## Supported Rear Module

The SHC-8932-F requires the 8322AR-336 rear module. The following connections are implemented:

- 2 SDI input BNCs
- 2 SDI output BNCs
- 2 SFP dual-receiver (RX) ports
- 2 HDMI® 2.0 output ports

Each rear module occupies two slots in the openGear frame and accommodates one SHC-8932-F card. **Figure 4** represents the implemented cabling designations.



*Figure 4 Cabling Designations*

# Physical Installation

Installing an SHC-8932-F card into an OG3-FR or OGX-FR series frame requires you to remove the blank plates in the designation frame slots, install the required rear module into the frame rear panel, and then install the SHC-8932-F card into the required frame slot.

If you have questions pertaining to the installation of your card, contact us at the numbers listed in **“Contacting Technical Support”**. Our technical staff is always available for consultation, training, or service.

## Before You Begin

These installation guidelines assume the openGear frame is properly installed. Refer to the **User Guide** for your frame.

### 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.*

### Working with Fiber Optic Connectors

The SHC-8932-F supports up to two optical Small Form-factor Pluggable (SFP) modules. Refer to **“SFP Cabling”** for more information on using fiber optic connectors.

## Removing the Blank Plates from the Rear Panel

When a frame slot is not populated with an openGear card, a blank plate must be installed to ensure proper frame cooling and ventilation. Before installing the rear module, you must remove the blank plate covering the required slots.



**Notice** — *Installing the rear modules in a frame other than an OG3-FR or OGX-FR could damage the card, the rear module, or both.*

★ A Phillips screwdriver is required for this procedure.

### To remove a blank plate from the openGear frame

1. Locate the slots in the openGear frame you wish to install the SHC-8932-F into. It is recommended to use the following slot combinations:
  - Slots 1, 2                      • Slots 7, 8                      • Slots 13, 14                      • Slots 19, 20
  - Slots 3, 4                      • Slots 9, 10                      • Slots 15, 16
  - Slots 5, 6                      • Slots 11, 12                      • Slots 17, 18
2. Use a Phillips screwdriver to unfasten each blank plate from the openGear frame backplane.
3. Remove each blank plate from the chassis and set aside.

## Installing the Rear Module into the openGear Frame

A Phillips screwdriver is required for this procedure.

### To install a rear module into the openGear frame

1. For each retaining screw on the rear module, push the o-ring to the end of the screw (but not off the screw). This will help to align the rear module to the frame backplane in step 3.
  2. Seat the bottom of the rear module in the seating slots at the base of the openGear frame's backplane.
  3. Align the top holes of the rear module with the screw holes on the top-edge of the frame backplane.
  4. Using a Phillips screwdriver and the provided screw, fasten the rear module to the backplane.
- ★ Do not fully tighten the screws until after installing the card and you have verified that the SHC-8932-F card aligns with the rear module.

## Installing the SHC-8932-F Card into an openGear Frame

The slot that the SHC-8932-F installs into depends on the slot combination you installed the rear module in. This allows adequate spacing to avoid damaging the card, the cards installed in the neighboring slots, or both.

★ A Phillips screwdriver is required for this procedure.

### To install the SHC-8932-F into the openGear frame

1. Locate the slot the SHC-8932-F card will slide into.

Refer to **Table 2** for valid slot combinations.

**Table 2 Card Slot Combinations**

Rear Module is Installed in	Card Installs into Slot
Slots 1, 2	2
Slots 3, 4	4
Slots 5, 6	6
Slots 7, 8	8
Slots 9, 10	10
Slots 11, 12	12
Slots 13, 14	14
Slots 15, 16	16
Slots 17, 18	18
Slots 19, 20	20

2. Verify that the SHC-8932-F card aligns with the rear module.
  3. Using a Phillips screwdriver fasten the rear module to the backplane using the provided screws.
- ★ Do not over tighten the screws.
4. Hold the card by the edges and carefully align the card edges with the slot rails in the frame.
  5. Fully insert the card into the frame until the card is properly seated in the rear module.



# Cabling

If you have questions pertaining to the installation of SHC-8932-F, contact us at the numbers listed in “**Contacting Technical Support**”. Our technical staff is always available for consultation, training, or service.

## For More Information on...

- the specifications, refer to “**Technical Specifications**”.
- the SFP modules that can be installed in the rear module, refer to “**Supported SFP Modules**”.

## Cabling the Ethernet Port on the openGear Frame

The SHC-8932-F is connected to your network via the Network Controller Card in the openGear frame. This enables the SHC-8932-F to interface with other cards in the frame, and the computer running the DashBoard client. After a physical connection is established, DashBoard is used to configure the network settings for the SHC-8932-F. Keep the following in mind:

- Contact your IT department before connecting to your facility network to ensure that there are no conflicts.
- You must provide an Ethernet connection to the openGear frame as outlined in the manual that accompanied your frame.

## For More Information on...

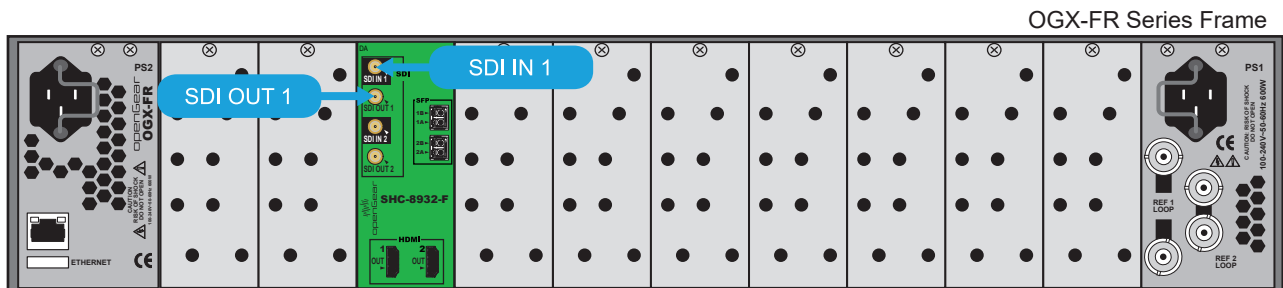
- downloading and installing DashBoard, refer to the ***DashBoard User Guide***.
  - configuring the Ethernet port on the openGear frame, refer to the frame’s ***User Guide***.
- ★ Contact your network administrator if you experience problems when connecting to a network hub.

## SDI Video Cabling

The SHC-8932-F provides two pairs of HD-BNCs that can be connected to SDI sources or downstream devices as required.

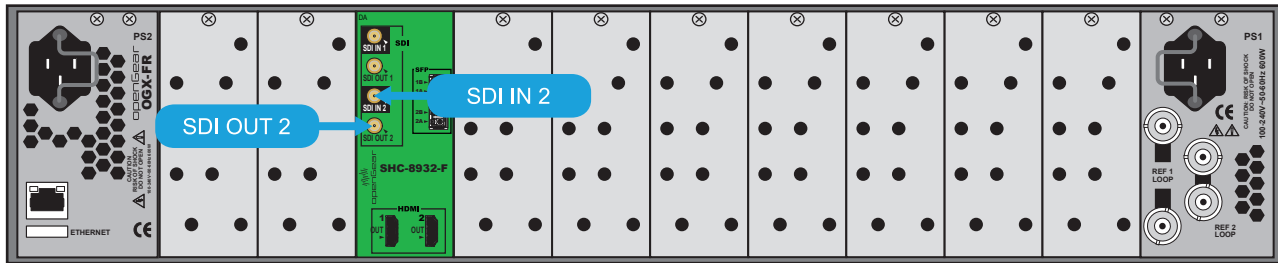
### To cable the SDI 1 input and output

1. Connect the first SDI source device to the **SDI IN 1** HD-BNC on the rear module.
2. Connect the first downstream SDI device to the **SDI OUT 1** HD-BNC on the rear module.



### To cable the SDI 2 input and output

1. Connect the second SDI source device to the **SDI IN 2** HD-BNC on the rear module.
2. Connect the second downstream SDI device to the **SDI OUT 2** HD-BNC on the rear module.



## SFP Cabling



**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.*

## Working with Fiber Optic Connectors

The SHC-8932-F supports up to two optical Small Form-factor Pluggable (SFP) modules. 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.
- 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.

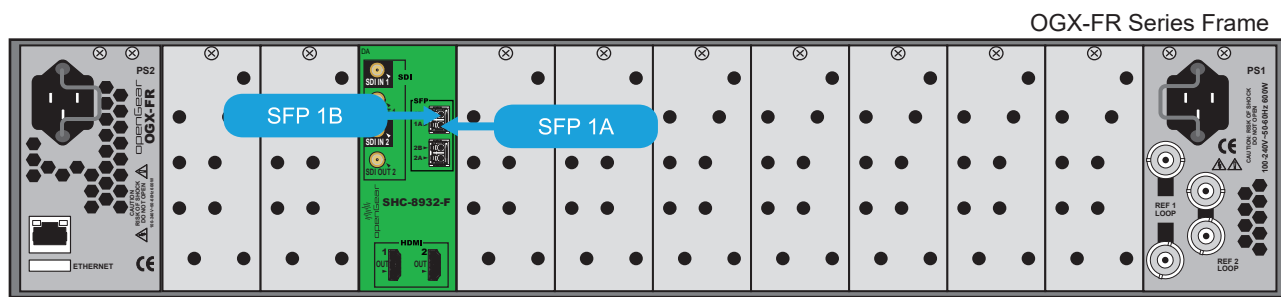
## Cabling the SFP Ports



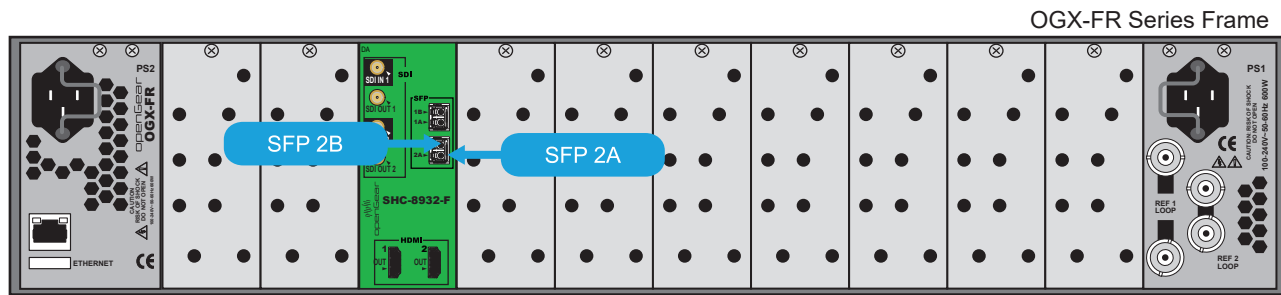
**Caution** — *Every time you are required to insert a connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors. Connectors must always be inserted into a device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

### To cable a SFP port on the rear module

1. Remove the dust caps from each SFP port connector on the SHC-8932-F rear module.
- ★ Refer to the document **Important Regulatory and Safety Notices** that shipped with your card, for safety information when handling fiber optic components.
2. Ensure that the exposed surface of the ceramic ferrule of each connector is clean. Refer to **“Working with Fiber Optic Connectors”** for cleaning tips.
3. Cable the first SFP port as required.



4. Cable the second SFP port as required.



## HDMI® Output Cabling

This section outlines how to connect each HDMI OUT port to an external device, and secure the cables to the rear module using the provided bracket.

### Before You Begin

You will need:

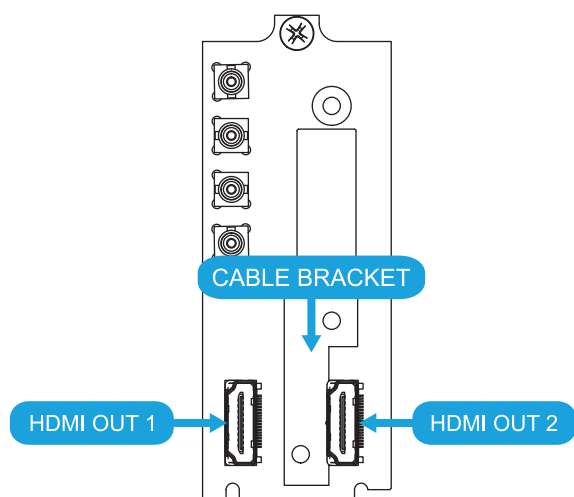
- One nylon tie-wrap
  - One HDMI 2.0 cable for each port
  - Two supplied bumper pads
- ★ Ross Video does not supply the tie-wrap or cables.

### Cabling an HDMI® Port

Ensure the HDMI cable does not come out at an undue angle or is otherwise pinched.

#### To cable an HDMI port on the rear module

1. Connect one end of the cable to the HDMI OUT 1 port on the rear module.
2. Connect the other end of the cable to your external device.



3. Repeat steps 1-2 for the HDMI OUT 2 port (if required).

### Securing the Cable to the Rear Module

The cable bracket works with any HDMI cable and device. Use the bracket to retain a good cable connection and avoid placing excess stress on the HDMI output port, the cable, or both.

★ A bad cable connection may result in experiencing instability of signal, high loss, or a noisy signal.

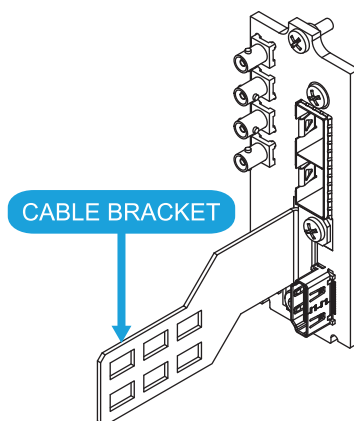


Figure 5 Cable Bracket on Rear Module

#### To secure the cable to the rear module via the cable bracket

1. Thread the nylon tie-wrap around the HDMI cable and through one of the openings of the cable bracket.

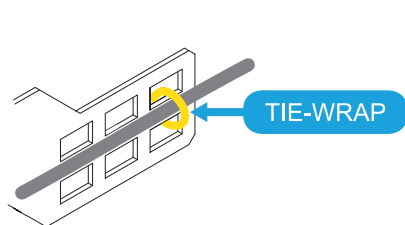


Figure 6 HDMI OUT 1 Cabling

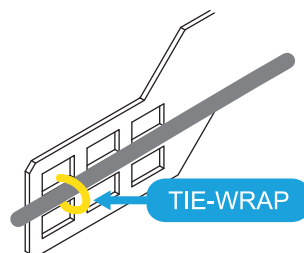
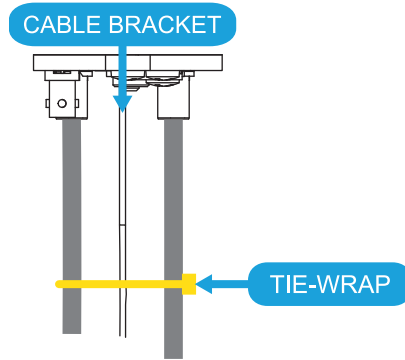


Figure 7 HDMI OUT 2 Cabling

2. Ensure the tie-wrap is secured just beyond the housing to avoid slipping.



*Figure 8 Top View of HDMI Cabling*

3. Secure the tie-wrap to the cable bracket so that it is not unduly tight around the cable.
4. If required, apply the supplied bumper pads to the cable bracket to insure that the cables does not come out at an undue angle.



# Getting Started

The DashBoard Control System enables you to monitor and control openGear frames and cards from a computer. DashBoard communicates with other cards in the frame through the Network Controller Card. The DashBoard Control System software and manual are available for download from our website. This chapter provides instructions for launching DashBoard, and accessing the SHC-8932-F interfaces.

## For More Information on...

- on the SHC-8932-F interfaces in DashBoard, refer to “**DashBoard Menus**”.
- using DashBoard, refer to the ***DashBoard User Manual***.

## Launching DashBoard

DashBoard must run on a computer that has a physical wired Ethernet connection. Wireless connections do not allow device discovery.

### To launch DashBoard

1. Ensure that you are running DashBoard software version 9.4.0 or higher.
2. Launch DashBoard by double-clicking its icon on your computer desktop.

## Accessing the SHC-8932-F Interfaces in DashBoard

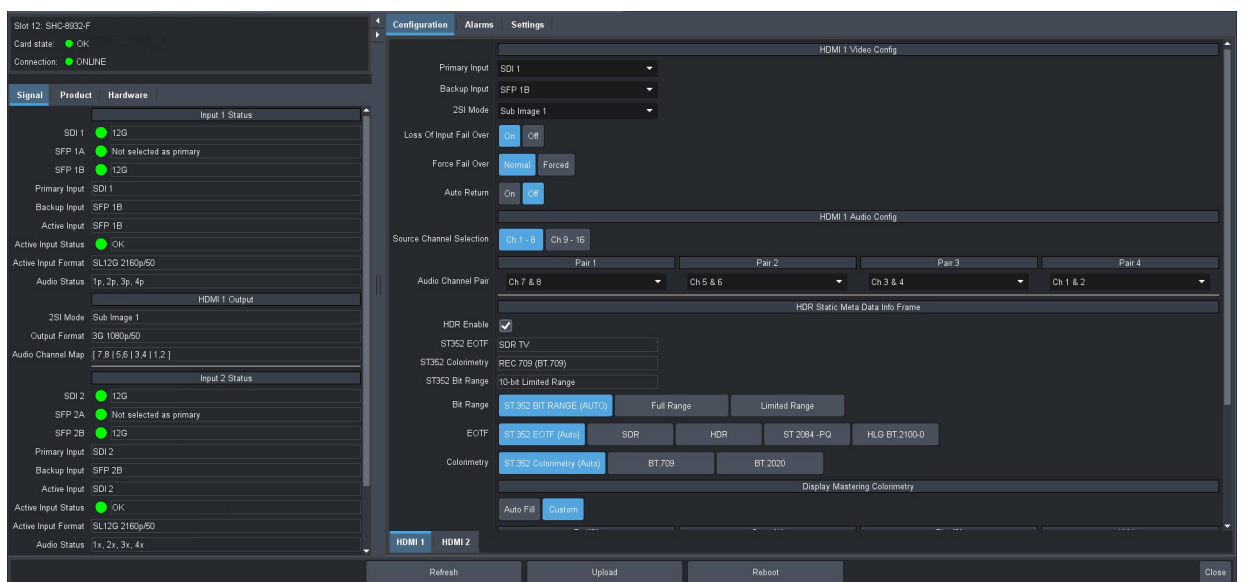
The interfaces are accessed by double-clicking the SHC-8932-F node in the DashBoard Tree View.

### To access the SHC-8932-F interfaces in DashBoard

1. In the Basic Tree View of DashBoard, locate the openGear frame the SHC-8932-F is installed in.
2. Expand the openGear frame node to display a list of sub-nodes.

Each sub-node represents a slot in the frame that is populated with an openGear card.

3. Double-click the **SHC-8932-F** sub-node to display its interface in the DashBoard window.







# Video Configuration

This chapter outlines the video configuration options for the HDMI outputs of the SHC-8932-F. Each HDMI output is configured independently.

If you have questions pertaining to the operation of SHC-8932-F, contact us at the numbers listed in **“Contacting Technical Support”**. Our technical staff is always available for consultation, training, or service.

## For More Information on...

- generating static HDR metadata, refer to **“HDR Metadata”**.
- the 2SI mode options, refer to **“Configuring the 2SI Mode”**
- configuring the audio options, refer to **“Audio Setup”**.

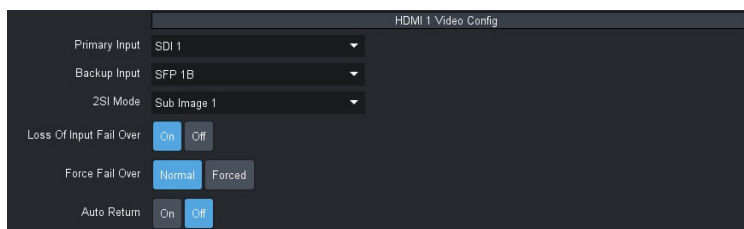
## Configuring the Loss of Input Failover Mode

By default, the SHC-8932-F card provides a Loss of Input Failover feature where a user can manually switch from the primary SDI input signal to a secondary (backup) SDI input signal. The card stays on the backup SDI input signal until the user manually switches the card back to the primary signal. You can choose to enable an option that allows the card to automatically switch to the primary input when a valid signal is detected again.

The user defines which SDI video signal is the primary and backup using the options in the Configuration tab. This tab also displays the buttons used to manually switch the signals from primary to backup (and vice versa).

### To define the primary SDI signal for the Loss of Input Failover mode

1. Display the **SHC-8932-F** interface as outlined in **“To access the SHC-8932-F interfaces in DashBoard”**.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Locate the **Video Config** area of the tab.



5. Use the **Primary Input** menu to assign an input signal as the primary signal for the Loss of Input Failover mode. Choose from the following:
  - SDI # — Assigns the specified SDI IN BNC as the primary input signal.
  - SFP # — Assigns the specified SFP channel as the primary input signal.
- ★ You cannot assign the same signal as the **Primary Input** and the **Backup Input**.
6. Use the **Backup Input** menu to assign an input signal as the backup signal for the Loss of Input Failover mode. Choose from the following:
  - SDI # — Assigns the specified SDI IN BNC as the backup input signal.
  - SFP # — Assigns the specified SFP channel as the backup input signal.

★ It is recommended to assign **SFP 1B** as the **Backup Input** when **SDI 1** is assigned as the **Primary Input**.

7. Use the **Force Fail Over** options to determine when the failover occurs. Choose from the following:
  - **Normal** — When a loss of input occurs, the card automatically switches from the primary to the backup video source.
  - **Forced** — The user manually switches to the other video source by clicking the Loss of Input Failover buttons.
8. In the **Loss of Input Fail Over** area, click **ON**.

The **ON** button automatically is lit (active) and the card switches from the primary signal to the backup as defined in steps 5 to 7.

#### To verify the current active SDI input signal

1. Display the **SHC-8932-F > Signal** tab in DashBoard.
2. Locate the **Input # Status** area of the tab for the input signal you wish to monitor
3. Use the **Primary Input** field to determine which input signal is the Primary Input Video Source.
4. Use the **Backup Input** field to determine which input signal is the Backup Video Source.
5. Use the **Active Input Status** and **Active Input Format** fields to verify if the input signal is currently active and in use.
6. Use the **SDI** and **SFP** fields to verify the signal status of the required port(s).

## Configuring the Auto Return Feature

The Auto Return feature enables the SHC-8932-F to automatically switch from the backup to the primary input signal when a valid primary signal is detected again. The user is notified of the automatic switch via a message in the Signal > Active Input field.

#### To configure the auto return feature

1. Display the **SHC-8932-F** interface as outlined in “**To access the SHC-8932-F interfaces in DashBoard**”.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Use the **Auto Return** options to configure the auto return feature. Choose from the following:
  - **On** — when a valid signal is detected on the primary input, the SHC-8932-F automatically switches from the backup signal. The primary input signal is now the active input signal.
  - **Off** — disables this feature. The backup stays as the active input even if a valid primary signal is detected.

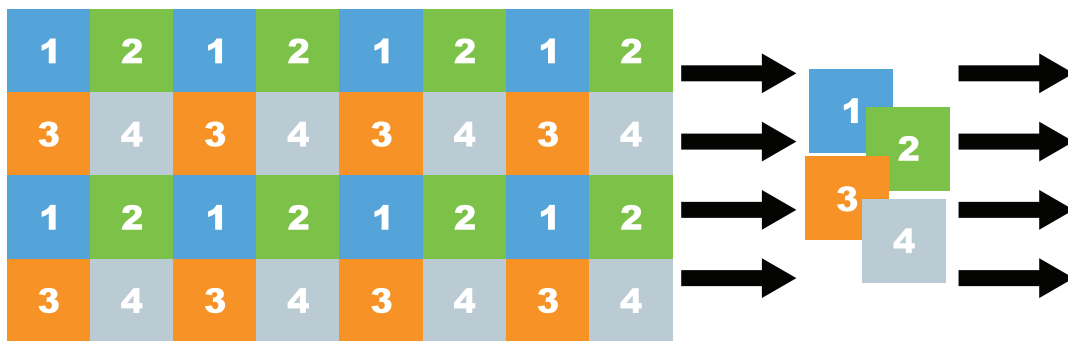
# Configuring the 2SI Mode

The SHC-8932-F is compatible with multiple transport methods commonly used to carry UHD video content. The SHC-8932-F accepts 11.88Gbps SDI as per SMPTE 2082-10. The SHC-8932-F ingests an 12G UHD single-link and then enables you to specify which of the four 3Gbps 2SI quad-link UHD signals for the HDMI output. This chapter outlines how to assign a specified 2SI sub-image to the HDMI output.

★ This feature requires a valid 2160p input signal.

## Before You Begin

The SHC-8932-F supports the 2 Sample Interleave (2SI) method where four sub-images (1-4) are used to alternate sampling every 2 pixels and every line. This method is defined in all UHDTV specifications.



Image

Figure 9 Representation of 2SI Sampling

## 2SI Mode Overview on the SHC-8932-F

The 2SI Mode provides the option to select and display one of four 1080p 2SI sub-images present in the 2160p input signal. Using this feature, two SHC-8932-F cards could be used to extract and display those sub-images to different monitors. The reclocking output can be used to pass the 2160p stream containing all the sub-images to each SHC-8932-F as shown in **Figure 10**.

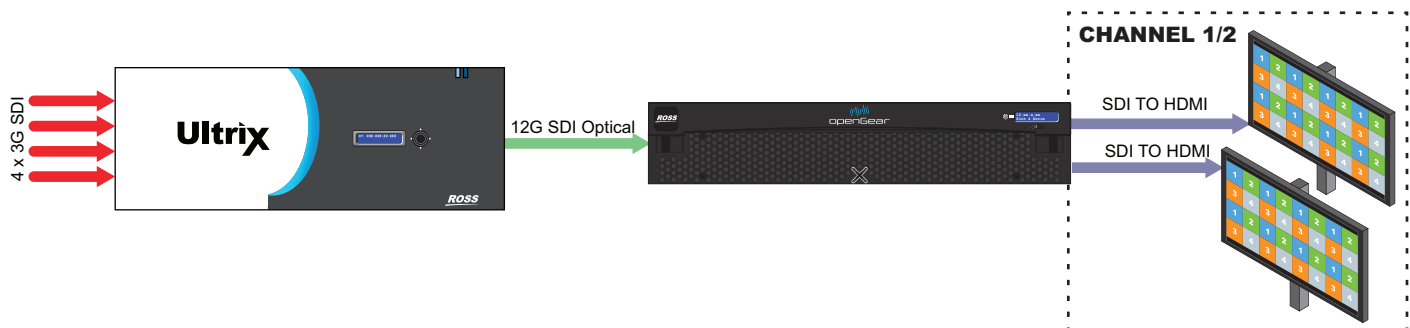


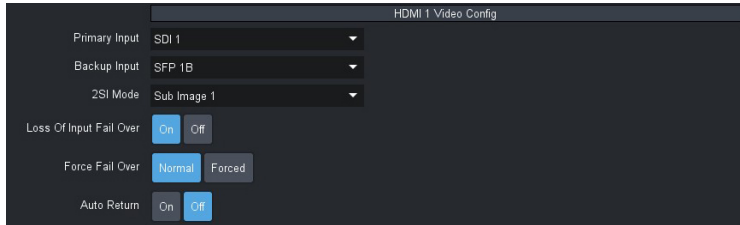
Figure 10 Workflow Example of Two SHC-8932-F Cards with 2SI Mode

## Configuring 2SI Mode for the SHC-8932-F

By default, the 2SI Mode is disabled for each HDMI output of a card. Selecting a sub-image enables the mode and automatically assigns it to that HDMI output. This section outlines how to assign a sub-image from a 12G input signal to one HDMI output for a single card.

### To assign a sub-image to an HDMI output

1. Display the **SHC-8932-F** interface as outlined in **"To access the SHC-8932-F interfaces in DashBoard"**.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.



4. Use the **2SI Mode** menu to assign a sub-image to the HDMI output:
  - **Off** — disables this feature.
  - **Sub Image #** — assigns the specified sub-image to the HDMI output.
5. Repeat steps 3 and 4 for the other HDMI output.

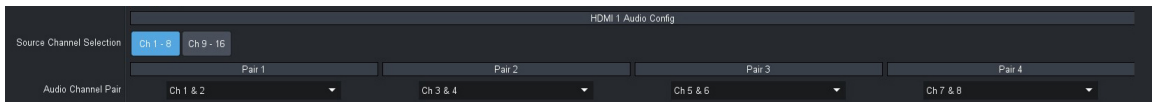
# Audio Setup

The embedded output channels are configured per processed input to allow different audio mapping that will track the currently processed input. The SHC-8932-F organizes the audio channels into two groups of 8 channels each (1-8, and 9-16) and you can map the channels of embedded audio within a group for an HDMI output.

★ The SHC-8932-F does not support the mapping of audio channels from one group to another.

## To map a channel

1. Display the **SHC-8932-F** interface as outlined in “**To access the SHC-8932-F interfaces in DashBoard**”.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Locate the **HDMI Audio Config** area of the tab.



5. Use the **Source Channel Selection** options to assign an audio group to the HDMI output.  
In the example above, the user selected **Ch 1-8**.

★ If the selected source is not present on the input video, silence is embedded.

★ Channel status bits are only passed when a left/right pair are not separated. Otherwise, a standard channel status will be inserted. When channel status is passed, it may not reflect a change between 20bit and 24bit.

6. Use the **Audio Channel Pair** options to map the channels from the selected audio source to the output channels.



# HDR Metadata

The SHC-8932-F provides the option to generate HDR10 metadata from the embedded ST.352 data in an SDI signal. You can also override/force the settings to customize the colorimetry as required. This chapter provides information on the HDR10 metadata options for the SHC-8932-F.

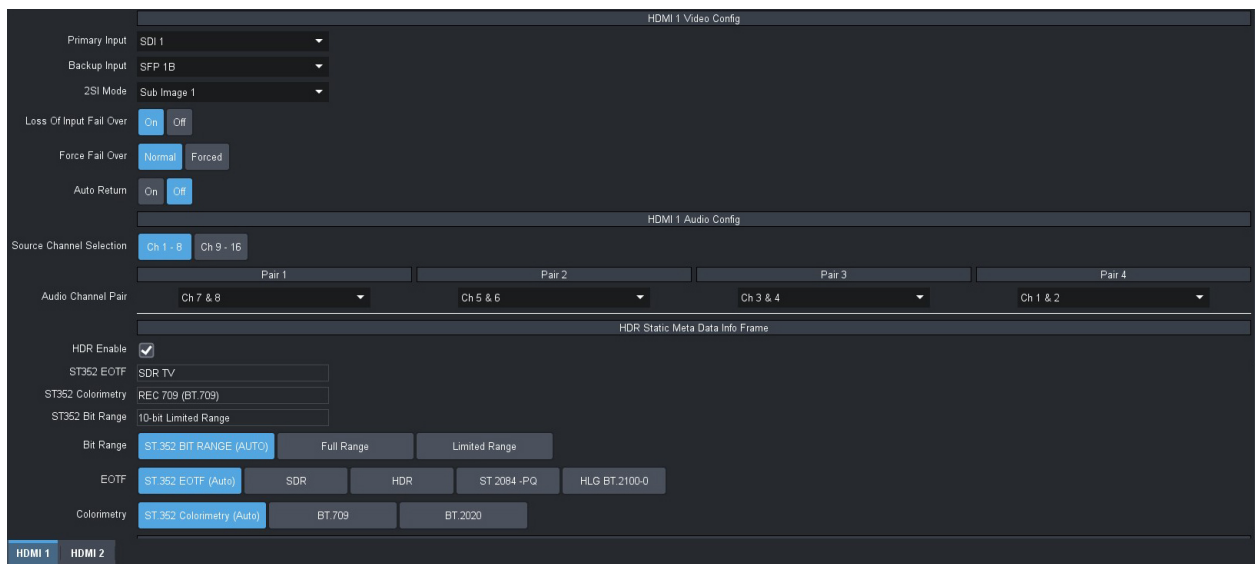
## Specifying the Payload ID Colorimetry for an Output

The HDR metadata options in DashBoard are used to specify the content of the HDR metadata info frame. You can choose to have the metadata manually specified or auto detected using the ST.352 payload ID information if present. Ensure to set this value to match the input value.

### for an HDMI output signal

1. Display the **SHC-8932-F** interface as outlined in “**To access the SHC-8932-F interfaces in DashBoard**”.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Locate the **HDR Static Meta Data Info Frame** area of the tab.
5. Select the **HDR Enable** box.

The HDR options are now editable.



6. Use the **Colorimetry** options to select the color gamut for the output signal. In the example above, the user selected ST.352 Colorimetry (Auto). Choose from the following:
  - **ST 352 Colorimetry (Auto)** — automatically applies the ST.352M payload ID from the SDI input.
  - **BT.709** — for HD video signals within the Standard Dynamic Range (SDR) color gamut.
  - **BT.2020** — for video signals within the BT.2020 color gamut.
- ★ When a Colorimetry ID is selected, the mastering range information in the HDR area are automatically set to the applicable values for that ID.
7. Use the **EOTF** menu to specify the Electrical to Optical Transfer Function (EOTF) method for specifying the display light values. Choose from the following:

- **ST.352 (EOTF Auto)** — automatically applies the display light values from the ST.352M payload ID of the active SDI input.
- **SDR** — applies the Standard Dynamic Range display light values.
- **HDR** — applies the High Dynamic Range display light values.
- **ST.2084-PQ** — applies the SMPTE ST 2084:2014 Perceptual Quantizer dynamic range for display light values.
- **HLG BT.2100-0** — applies the BT.2100 HLG display light values.

★ The new settings are automatically applied and included in the HDR metadata of the specified HDMI output.

## Specifying the Bit Range

If your downstream equipment requirements differ from the default Bit Range, you can specify a different range for each HDMI output.

### To specify the bit range for an HDMI output

1. Display the **SHC-8932-F** interface as outlined in “**To access the SHC-8932-F interfaces in DashBoard**”.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Choose from the following **Bit Range** options:
  - **352 Range** — select this option to apply limited or full range as defined by the ST.352-packet information.
  - **Full Range** — select this option if the signal is outside the range of 4-1019 bits.
  - **Limited Range** — select this option when the signal is within the legal TV level of 64-940 bits.

★ The new setting is automatically applied and included in the Info Frame of the specified HDMI output.

## Customizing the Master Display Values

This section is applicable if you wish to define the master display values outside of the defaults as defined by the EOTF standard selected. This is useful when your downstream equipment signal conversion.

### To customize the color values for the master display

1. Display the **SHC-8932-F** interface as outlined in “**To access the SHC-8932-F interfaces in DashBoard**”.
2. Select the **Configuration** tab.
3. Select the sub-tab for the HDMI output you wish to configure.
4. Locate the **Display Mastering Colorimetry** area of the tab.
5. Select **Custom**.




6. Use the **X** and **Y** fields to adjust the percentage of the full black to white signal amplitude with an adjustment range from -20% to +20%, in steps of four decimal places.
  7. Use the **Display Mastering Luminance** fields to set the minimum and maximum luminance values for the master display.
    - **MIN Luminance** — sets the minimum master display luminance to a value between 0.0001 and 5.0000nits (cd/m2).
    - **MAX Luminance** — sets the maximum master display luminance to a value between 5 and 10,000nits (cd/m2).
  8. Use the **Display Mastering Light Level** fields as follows:
    - **MAX CLL** — specifies the Maximum Content Light Level (in number of nits) for a single pixel within the coded HDR video signal.
    - **MAX FALL** — specifies the Maximum Frame Average Light Level (in number of nits) of the playback sequence.
- ★ The new settings are automatically applied and included in the HDR metadata of the specified HDMI output.



# Upgrading the Software

The SHC-8932-F can be upgraded in the field via DashBoard.

## To upgrade the software on a card

1. Contact Ross Technical Support for the latest software version file.
  2. Ensure the Ethernet cable is connected to the **Ethernet** port on the openGear frame.
  3. From the **Tree View**, expand the node for the SHC-8932-F you want to access.
  4. Double-click the **Global** sub-node to display the interface in the right-half of DashBoard.
  5. Select **Upload**, located near the bottom of the interface, to display the **Select file Upload** dialog.
  6. Navigate to the **\*.bin** file you want to upload.
  7. Click **Open**.
  8. If you are upgrading a single card:
    - a. Click **Finish** to start the upgrade.
    - b. Proceed to step 10.
  9. If you are upgrading multiple cards:
    - a. Click **Next >** to display the **Select Destination** menu. This menu provides a list of the compatible cards.
    - b. Specify the card(s) to upload the file to by selecting the check box(es) for the cards you want to upload the file to.
    - c. Verify the card(s) you want to upload the file to. The **Error/Warning** fields indicate any errors, such as incompatible software or card type mismatch.
    - d. Click **Finish**.
  10. Monitor the upgrade.
    - An **Upload Status** dialog enables you to monitor the upgrade process.
    - Notice that each card is listed in the dialog with a  button. This button is replaced with a **Reboot** button once the software file is loaded to that card.
- ★ Avoid clicking the individual Reboot buttons until all cards have successfully completed the file upload process and the OK button, located in the bottom right corner of the dialog, is enabled.
- Click **OK** to reboot all the cards listed in the **Uploading to Selected Devices** dialog.
  - The **Reboot Confirm** dialog displays, indicating the number of cards that will reboot. Click **Yes** to continue the upgrade process. Note that clicking **Cancel** or **No** returns you to the **Uploading to Selected Devices** dialog without rebooting the card(s).
  - The card(s) are temporarily taken off-line during the reboot process. The process is complete once the status indicators for the **Card State** and **Connection** return to their previous status.



# DashBoard Menus

This chapter briefly summarize the menus, items, and parameters available in the DashBoard Control System for the SHC-8932-F. Parameters marked with an asterisk (\*) are the factory default values.

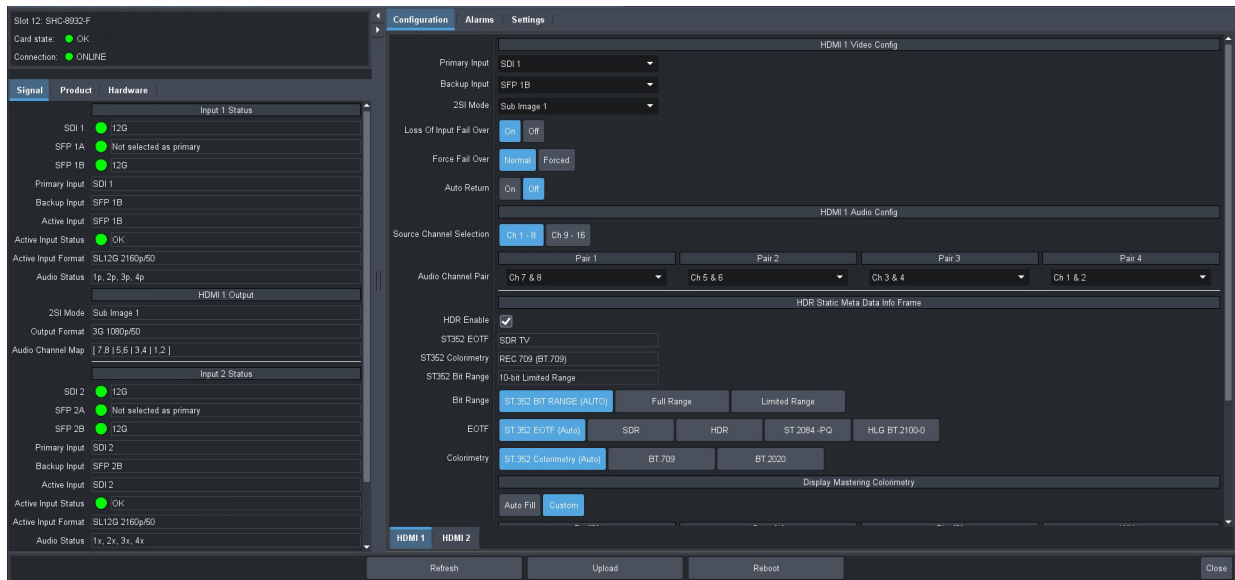


Figure 11 Example of the SHC-8932-F in DashBoard

## Signal Tab

Table 3 summarizes the read-only fields displayed in the **Signal** tab.

Table 3 Signal Tab

Item	Parameters	Description
<b>Input # Status</b>		
SDI #	# (Green)	A valid SDI signal is detected on the specified SDI port
	Incompatible Video (Yellow)	The input signal is detected but it is in an unsupported format or an error has occurred
	No Signal (Red)	No signal detected on the specified input
SFP #	# (Green)	A valid SDI signal is detected on the specified SFP port
	Incompatible Video (Yellow)	The input signal is detected but it is in an unsupported format or an error has occurred
	No Signal (Red)	No signal detected on the specified input
Primary Input	#	Indicates the video format detected on the active input signal
Backup Input	#	Indicates the video format detected on the backup SDI input signal

**Table 3 Signal Tab**

Item	Parameters	Description
Active Input	#	Indicates that the Primary Input Source is the active input signal for the card
	#	Indicates that the Backup Input Source is the active input signal for the card
Active Input # Status	OK (Green)	No errors are detected on the video signal of the currently configured and active input
	CRC Errors (Yellow)	Indicates that CRC errors are detected on the current Active Input
	Unsupported Format (Yellow)	A signal is detected on the Active Input but the video is not supported by the card
	No Signal (Red)	One of the following issues is occurring: <ul style="list-style-type: none"> <li>• the SDI input signal assigned to the Active Input is not detected</li> <li>• the frame rate of the current Active Input does not match the output frame rate</li> </ul>
Active Input Format	#	Indicates the video format of the Active Input signal
	N/A	An invalid signal is detected on the Active Input
Audio Status	#p #x	Indicates the input audio status where: <ul style="list-style-type: none"> <li>• # represents the audio group (e.g. 1, 2)</li> <li>• p represents a detected audio group</li> <li>• x represents a missing audio group</li> </ul>
<b>HDMI # Output</b>		
2SI Mode	#	Indicates the selection made in the Configuration > HDMI # > 2SI Mode menu
Output Format	#	Indicates the video format of the output signal assigned to the specified HDMI port
Audio Channel Map	#, #   #, #   #, #   #, #	Indicates the audio channel mapping as defined in the Configuration > HDMI # > Audio Config setting

## Product Tab

**Table 4** summarizes the read-only information displayed in the Product tab.

**Table 4 Product Tab**

Item	Parameters	Description
Product	SHC-8932-F	
Supplier	Ross Video Ltd.	
Board Rev	#	Indicates the hardware version
Rear Module	#	Summarizes the rear module installed with the card

**Table 4 Product Tab**

Item	Parameters	Description
Board S/N	#	Indicates the serial number of the card
Software Rev	#. #-#	Indicates the software version running on the card

## Hardware Tab

**Table 5** summarizes the read-only information displayed in the **Hardware** tab.

**Table 5 Hardware Tab**

Item	Parameters	Description
Voltage (mV)	#	Measured input millivolts
Current (mA)	#	Current consumption in milliamperes
CPU Headroom	#	Displays the CPU Load average
RAM Available	# / # MB	CPU Memory Used / Total CPU Memory
Configuration Bank	#	Storage count
Uptime (h)	#	Reports the number of hours since the last reboot of the card
<b>SFP #</b>		
SFP # Vendor	#	Reports the vendor details of the module installed in the specified SFP port
SFP # P/N	#	
SFP # Status	OK (Green)	A supported SFP module is detected in the specified SFP port and a valid signal is detected
	Not Present (Yellow)	No SFP Module is detected in the specified SFP port or
	Unsupported (Red)	The SFP Module is unsupported
Temperature	#C	Internal temperature (in Celsius) as reported by the specified SFP port
Rx Power #	#dBm	Indicates the power at the optical input. This value is accurate to $\pm 3$ dBm. Note that if a signal is not present on the SFP port, this field may appear invalid.

## Configuration Tab

The Configuration tab provides a sub-tab for each HDMI output of the SHC-8932-F. **Table 6** summarizes the options displayed in each Configuration > HDMI sub-tab.

**Table 6 Configuration > HDMI #**

Item	Parameters	Description
<b>HDMI # Video Config</b>		
Primary Input	SDI #	Assigns the specified SDI port as the primary input signal when the Loss of Input Failover mode is enabled
	SFP #	Assigns the specified SFP channel as the primary input signal when the Loss of Input Failover mode is enabled
Backup Input	SDI #	Assigns the specified SDI port as the backup input signal when the Loss of Input Failover mode is enabled
	SFP #	Assigns the specified SFP channel as the backup input signal when the Loss of Input Failover mode is enabled
2SI Mode	Off	Disables this feature. This is the default.
	Sub Image #	Assigns a sub-image of the 12G input (2SI) signal to the HDMI output
Loss of Input Fail Over	On	<ul style="list-style-type: none"> <li>Enables the feature where one input video signal (as defined by the Primary Input menu) is the primary source and a second SDI source is defined as the Backup Input for the specified HDMI output.</li> <li>If the Primary Input is lost, the card automatically switches to the Backup Input.</li> </ul>
	Off	Disables this feature
Force Fail Over	Normal	The card switches input video sources when a loss of input signal is detected
	Forced	The user has manually switched between the input video sources by clicking this button
Auto Return	On	The card automatically returns to the Primary Input when a valid signal is detected
	Off	Disables this feature
<b>HDMI # Audio Config</b>		
Source Channel Selection	Ch 1-8	Assigns the audio input that is inserted into the embedded pair (if present) for the HDMI output
	Ch 9-16	



**Table 6 Configuration > HDMI #**

Item	Parameters	Description
Pair # > Audio Channel Pair	Ch 1 & 2	Enables you to map the audio channels as required by your system
	Ch 3 & 4	
	Ch 5 & 6	
	Ch 7 & 8	
HDR Static Meta Data Info Frame		
HDR Enable	Selected	The card processes the video input through the HDR module, and performing the target transform
	Cleared	The card passes the video input without modifications
ST352 EOTF (read-only)	#	Reports the Electrical to Optical Transfer Function method currently applied to this HDMI output
ST352 Colorimetry (read-only)	#	Reports the Payload ID Colorimetry currently applied to this HDMI output
ST352 Bit Range (read-only)	#	Reports the bit range assigned to this HDMI output
Bit Range <sup>a</sup>	352 Range	Select this option if the signal is within the legal TV level of 64-940 bits
	Full Range	Select this option if the signal is outside the range of 4-1019 bits
	Limited Range	Select this option if the signal is within the range of 4-1019 bits
EOTF	ST.352 EOTF (Auto)	Automatically applies the display light values from the 352M payload ID of the active SDI input
	SDR	Applies the Standard Dynamic Range display light values
	HDR	Applies the High Dynamic Range display light values
	ST 2084-PQ	Applies the SMPTE ST 2084:2014 High Dynamic Range EOTF for display light values
	HLG BT.2100-0	Applies the BT.2100 HLG display light values
Colorimetry	ST 352 Colorimetry (Auto)	Automatically applies the 352M payload ID from the active SDI input
	BT.709	Applies the HD color gamut to the output payload ID
	BT.2020	Applies the UHD wide color gamut to the output payload ID
Display Mastering Colorimetry (Red / Green / Blue / White)		
Auto Fill	The Display Mastering values are automatically set as defined by the Colorimetry selections	

**Table 6 Configuration > HDMI #**

Item	Parameters	Description
Custom	The user can edit the display mastering values as required	
X	#	Adjusts the X value of the color space, as specified in <b>ISO 11664-3:2012</b> , to a value between 0.0001 and 0.7400
Y	#	Adjusts the Y value of the color space, as specified in <b>ISO 11664-3:2012</b> , to a value between 0.0001 and 0.8400
<b>Display Mastering Luminance</b>		
MIN Luminance	#	Sets the minimum master display luminance to a value between 0.0001 and 5.0000nits (cd/m2)
MAX Luminance	#	Sets the maximum master display luminance to a value between 5 and 10000nits (cd/m2)
<b>Display Mastering Light Level</b>		
MAX CLL	#	Specifies the Maximum Content Light Level (in number of nits) for a single pixel within the coded HDR video signal
MAX FALL	#	Specifies the Maximum Frame Average Light Level (in number of nits) of the playback sequence

- a. This value is automatically set when the EOTF mode is specified.

## Alarms Tab

**Table 7** summarizes the options and read-only fields displayed in the Alarms tab.

**Table 7 Alarms Tab**

Item	Parameters	Description
<b>Input # Status</b>		
SDI # (read-only)	OK (Green)	No errors are detected on the video signal of the specific SDI BNC
	Alarm Suppressed (Green)	The card is not monitoring the input signal
	Unsupported Format (Yellow)	An input signal is detected on the specific SDI BNC but the video is not supported by the card
	Incompatible Video (Yellow)	An input signal is detected on the specific SDI BNC but its format is not compatible with the output video format
	Not time to Ref (Yellow)	An input signal is detected on the specific SDI BNC but the detected reference signal is incompatible with this input signal

**Table 7 Alarms Tab**

Item	Parameters	Description
SDI # (read-only)	No Signal (Red)	Indicates one of the following issues is occurring: <ul style="list-style-type: none"> <li>• the SDI input signal is not detected</li> <li>• the system frame rate does not match the input frame rate</li> </ul>
SFP # (read-only)	OK (Green)	No errors are detected on the video signal of the specific SFP channel
	Alarm suppressed (Green)	The card is not monitoring the SFP channel
	Unsupported Format (Yellow)	A signal is detected on the specific SFP channel but the video is not supported by the card
	Incompatible Video (Yellow)	A signal is detected on the specific SFP channel but its format is not compatible with the output video format
	Not time to Ref (Yellow)	A signal is detected on the specific SFP channel but the detected reference signal is incompatible with this input signal
	No Signal (Red)	Indicates one of the following issues is occurring: <ul style="list-style-type: none"> <li>• the SFP channel is not detected</li> <li>• the system frame rate does not match the input frame rate</li> </ul>
SDI # Alarm Enable	Selected*	The card reports a loss of the specified input or if the format is incompatible for the specified input
	Cleared	Disables this alarm
SFP # Alarm Enable	Selected*	The card reports a loss of the specified input or if the format is incompatible for the specified input
	Cleared	Disables this alarm
Active Input # Status (read-only)	#	Reports which input signal (Primary or Backup) is the currently active input signal
Active Input # Alarm Enable	Selected*	The card reports
	Cleared	Disables this alarm
SFP # Status (read-only)	#	Reports if there is an error condition occurring with the specified SFP channel
SFP # Hardware Alarm Enable	Selected*	Reports when the SFP port is populated with an unsupported module or there is an error occurring with the module
	Cleared	Disables this alarm

## Settings Tab

**Table 8** summarizes the options displayed in the Settings tab.

***Table 8 Settings Tab***

Item	Parameters	Description
Edit Permission	Unlocked	All editable parameters in DashBoard can be modified by a user
	Locked	The DashBoard interface is locked. The editable parameters in DashBoard can no longer be modified by the user. To unlock the interface, select the box again
Factory Defaults	Reset	All editable parameters in DashBoard are reset to the factory default values

# Technical Specifications

This chapter provides technical information for SHC-8932-F.

★ Specifications are subject to change without notice.

## Supported Video Formats

**Table 9 Technical Specifications — Supported Video Formats**

Video Format
<b>HD Formats</b>
720p 50Hz
720p 59.94Hz
1080i 50Hz
1080i 59.94Hz
1080p 23.98Hz
1080p 24Hz
1080p 25Hz
1080p 29.97Hz
1080p 30Hz
1080p 50Hz
1080p 59.94Hz
1080p 60Hz
<b>UHD Formats</b>
2160p 23.98Hz
2160p 24Hz
2160p 25Hz
2160p 29.97Hz
2160p 30Hz
2160p 50Hz
2160p 59.94Hz
2160p 60Hz

## SDI Inputs Specifications

**Table 10 Technical Specifications — SDI Inputs**

Item	Specifications
Number of Inputs	2 dedicated
Connector Type	HD-BNC

**Table 10 Technical Specifications — SDI Inputs**

Item	Specifications
Standards Accommodated	1.485Gbps Component, SMPTE 292M
	2.97Gbps Component, SMPTE 424M
	5.94Gbps Component, SMPTE 2081
	11.88Gbps Component, SMPTE 2082
Impedance	75ohm
Return Loss	>15dB to 1.5GHz
	>10dB to 3GHz
	>7dB to 6GHz
	>4dB to 12GHz
Equalization (Belden 1694A cable)	>180m (590ft) @ 1.485Gbps
	>150m (492ft) @ 2.97Gbps
	>70m (229ft) @ 5.94Gbps
	>50m (164ft) @ 11.88Gbps

## SDI Outputs Specifications

**Table 11 Technical Specifications — SDI Outputs**

Item	Specifications
Number of Outputs	2 dedicated
Connector Type	HD-BNC
Impedance	75ohm
Return Loss	>15dB to 1.5GHz
	>10dB to 3GHz
	>7dB to 6GHz
	>4dB to 12GHz
Signal Level	± 800mV 10%
DC Offset	0V +/- 50mV
Rise and Fall Time (20-80%)	1.485Gbps: <270ps, <100ps difference
	2.97Gbps: <135ps, <50ps difference
	5.94Gbps: <80ps, <30ps difference
	11.88Gbps: <45ps, <18ps difference

**Table 11 Technical Specifications — SDI Outputs**

Item	Specifications	
Jitter	1.485Gbps:	<1.0UI 10Hz-100kHz, <0.2UI above 100kHz
	2.97Gbps:	<1.0UI 10Hz-100kHz, <0.3UI above 100kHz
	5.94Gbps:	<2.0UI 10Hz-100kHz, <0.3UI above 100kHz
	11.88Gbps:	<2.0UI 10Hz-100kHz, <0.3UI above 100kHz, band limit @1188MHz
Overshoot	<10%	

## HDMI Ports Specifications

**Table 12 Technical Specifications — HDMI Ports**

Item	Specifications
Number of Inputs	0
Number of Outputs	2
HDMI Version	2.0
Output Color Space	4:2:2 YCbCr
Connector Type	HDMI 2.0

## Environment

**Table 13 Technical Specifications — Environment**

Item	Specifications
Maximum Ambient Temperature	40°C (104°F)

## Power

**Table 14 Technical Specifications — Power**

Item	Specifications
Maximum Power Consumption	5W





# Supported SFP Modules

This chapter summarizes the supported SFP modules for the SHC-8932-F.

## SFP-FIBER-12G

The SFP-FIBER-12G is a dual optical receiver module that supports data rates up to 12Gbps for single fiber communications.

### Features

- SMPTE 297-2006 compatible for SD-SDI, HD-SDI, 3G-SDI, and 12G-SDI
- Compliant with SFP MSA (Small Form-Factor Pluggable Multi-Source Agreement) and SFS-8472
- Compliant with SMPTE 297, SMPTE 259, SMPTE 292, SMPTE 424, SMPTE 2081, and SMPTE 2082
- 1310 DFB laser diode with CML logic interface
- Duplex LC receptacle
- Up to 10km on 9/125μm SMF
- Single 3.3V power supply
- Operating temperature range: 0°C to 70°C
- SFP package size: 56.5mm x 13.4mm x 8.6mm

### Simplified Block Diagram

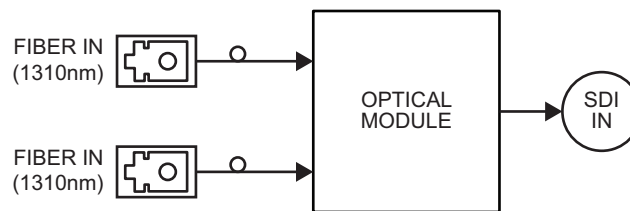


Figure 12 SFP-FIBER-12G — High Level Block Diagram

### Technical Specifications

Note that specifications are subject to change without notice.

### Absolute Maximum Ratings

Exceeding any of these ratings may permanently damage the module. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Table 15 Absolute Maximum Ratings**

Parameter	Min.	Max.
Supply Voltage	0V	+3.6V
Storage Temperature	-40°C	+85°C
Relative Humidity	5%	95%

## Recommended Operating Environment and Electrical Ratings

**Table 16 Recommended Ratings**

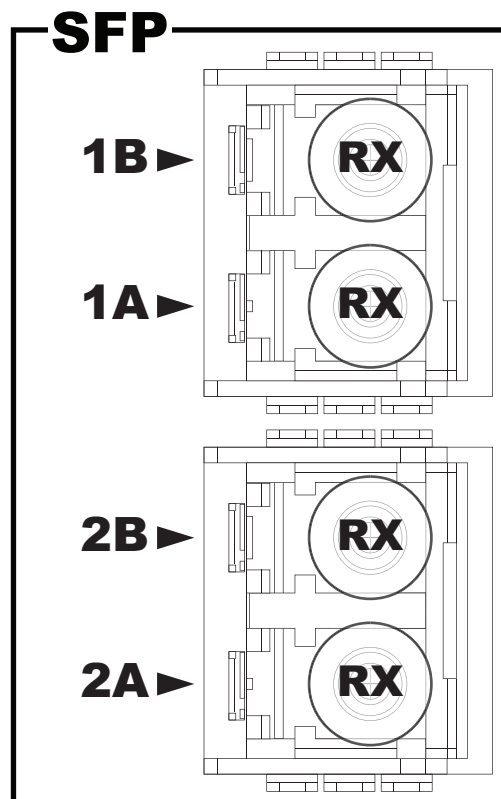
Parameter	Min.	Typical	Max.
Supply Voltage	+3.2V	+3.3V	+3.4V
Supply Current	-	-	300mA
Operating Case Temperature	0°C		+70°C
Data Rate	-	11.88Gbps	-

## Optical Specifications

**Table 17 Optical Specifications — Receiver**

Parameter	Min.	Typical	Max.	Notes
Receiver Sensitivity			-11dBm	With a PRBS 223-1 test pattern @ 11.88Gbps
Maximum Input Power	-3dBm			
Operation Center Wavelength	1260nm		1360nm	
Loss of Signal	Assert	-25dBm		
	De-assert		-11dBm	
LOS Hysteresis	0.5dB			

## Physical Channel Position



*Figure 13 SFP Package Outline, Front View — Channel Position*

# Service Information

## Troubleshooting Checklist

Routine maintenance to this openGear product is not required. In the event of problems with your SHC-8932-F, 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 in “**Contacting Technical Support**”.

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 Ross Technical Support specialist to perform a complete software reload on the SHC-8932-F.

### To reload the software on a SHC-8932-F

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 **OK/ERROR** 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 60 seconds, the card will attempt to re-start with its last operational software load.
  - Software loads can be sent to the SHC-8932-F via the connection on the rear of the frame.

## Warranty and Repair Policy

The SHC-8932-F is warranted to be free of any defect with respect to performance, quality, reliability, and workmanship for a period of FIVE (5) years from the date of shipment from our factory. In the event that your SHC-8932-F proves to be defective in any way during this warranty period, Ross Video Limited reserves the right to repair or replace this piece of equipment with a unit of equal or superior performance characteristics.

Should you find that this SHC-8932-F has failed after your warranty period has expired, we will repair your defective product should suitable replacement components be available. You, the owner, will bear any labor and/or part costs incurred in the repair or refurbishment of said equipment beyond the FIVE (5) year warranty period.

In no event shall Ross Video Limited be liable for direct, indirect, special, incidental, or consequential damages (including loss of profits) incurred by the use of this product. Implied warranties are expressly limited to the duration of this warranty.

This SHC-8932-F User Manual provides all pertinent information for the safe installation and operation of your openGear Product. Ross Video policy dictates that all repairs to the SHC-8932-F are to be conducted only by an authorized Ross Video Limited factory representative. Therefore, any unauthorized attempt to repair this product, by anyone other than an authorized Ross Video Limited factory representative, will automatically void the warranty. Please contact Ross Video Technical Support for more information.

### In Case of Problems

Should any problem arise with your SHC-8932-F, please contact the Ross Video Technical Support Department. (Contact information is supplied at the end of this publication.)

A Return Material Authorization number (RMA) will be issued to you, as well as specific shipping instructions, should you wish our factory to repair your SHC-8932-F. If required, a temporary replacement frame will be made available at a nominal charge. Any shipping costs incurred will be the responsibility of you, the customer. All products shipped to you from Ross Video Limited will be shipped collect.

The Ross Video Technical Support Department will continue to provide advice on any product manufactured by Ross Video Limited, beyond the warranty period without charge, for the life of the equipment.

# Software Licenses

This chapter provides third-party software license information for your SHC-8932-F. This product includes multiple software components which are individually licensed under one or more of the following licenses included in this chapter.

## BSD

Copyright (c) 1991,1993, The Regents of the University of California. All rights reserved.

This code is derived from software contributed to Berkeley by Kenneth Almquist.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. <BSD Advertising Clause omitted per the July 22, 1999 licensing change <ftp://ftp.cs.berkeley.edu/pub/4bsd/README.Impt.License.Change>> California, Berkeley and its contributors.
4. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

## Dual GPL

Portions of this software are copyright (C) 1996-2002 The FreeType Project ([www.freetype.org](http://www.freetype.org)). All rights reserved.

This project is also covered under the GPL v2.

## GPL

GNU GENERAL PUBLIC LICENSE  
Version 3, 29 June 2007  
Copyright (C) 2007 Free Software Foundation, Inc. <<http://fsf.org/>>  
Preamble

The GNU General Public License is a free, copyleft license for software and other kinds of works.

The licenses for most software and other practical works are designed to take away your freedom to share and change the works. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change all versions of a program—to make sure it remains free software for all its users. We, the Free Software Foundation, use the GNU General Public License for most of our software; it applies also to any other work released this way by its authors. You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for them if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you these rights or asking you to surrender the rights. Therefore, you have certain responsibilities if you distribute copies of the software, or if you modify it: responsibilities to respect the freedom of others.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps: (1) assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If

such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

## TERMS AND CONDITIONS

### 0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

### 1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

### 2. Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

### 3. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

### 4. Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

## 5. Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

- a. The work must carry prominent notices stating that you modified it, and giving a relevant date.
- b. The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".
- c. You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.
- d. If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

## 6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

- a. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.
- b. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.
- c. Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.
- d. Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.
- e. Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

## 7. Additional Terms.

"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions. Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.

When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.

Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

- a. Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or
- b. Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or
- c. Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or
- d. Limiting the use for publicity purposes of names of licensors or authors of the material; or
- e. Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or
- f. Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered "further restrictions" within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.

If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.

Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

## **8. Termination.**

You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

## **9. Acceptance Not Required for Having Copies.**

You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

## **10. Automatic Licensing of Downstream Recipients.**

Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.

An "entity transaction" is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

## **11. Patents.**

A "contributor" is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's "contributor version".

A contributor's "essential patent claims" are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, "control" includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.

Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.

In the following three paragraphs, a "patent license" is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To "grant" such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.

If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. "Knowingly relying" means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.



If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.

A patent license is "discriminatory" if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

## **12. No Surrender of Others' Freedom.**

If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

## **13. Use with the GNU Affero General Public License.**

Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

## **14. Revised Versions of this License.**

The Free Software Foundation may publish revised and/or new versions of the GNU General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies that a certain numbered version of the GNU General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that numbered version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.

If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.

Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

## **15. Disclaimer of Warranty.**

THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

## **16. Limitation of Liability.**

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

## **17. Interpretation of Sections 15 and 16.**

If the disclaimer of warranty and limitation of liability provided above cannot be given local legal effect according to their terms, reviewing courts shall apply local law that most closely approximates an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption of liability accompanies a copy of the Program in return for a fee.

# LGPL

GNU LESSER GENERAL PUBLIC LICENSE  
Version 3, 29 June 2007  
Copyright (C) 2007 Free Software Foundation, Inc. <<http://fsf.org/>>

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

## 0. Additional Definitions.

As used herein, "this License" refers to version 3 of the GNU Lesser General Public License, and the "GNU GPL" refers to version 3 of the GNU General Public License.

"The Library" refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An "Application" is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A "Combined Work" is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the "Linked Version".

The "Minimal Corresponding Source" for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The "Corresponding Application Code" for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

## 1. Exception to Section 3 of the GNU GPL.

You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

## 2. Conveying Modified Versions.

If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

- a. under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or
- b. under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

## 3. Object Code Incorporating Material from Library Header Files.

The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

- a. Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.
- b. Accompany the object code with a copy of the GNU GPL and this license document.

## 4. Combined Works.

You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

- a. Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.
- b. Accompany the Combined Work with a copy of the GNU GPL and this license document.
- c. For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.
- d. Do one of the following:
  - 1) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.
  - 2) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.
- e. Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

## 5. Combined Libraries.

You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

- a. Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.
- b. Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

## 6. Revised Versions of the GNU Lesser General Public License.

The Free Software Foundation may publish revised and/or new versions of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.

## MIT

Copyright 1987, 1988 by MIT Student Information Processing Board.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose is hereby granted, provided that the names of M.I.T. and the M.I.T. S.I.P.B. not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. M.I.T. and the M.I.T. S.I.P.B. make no representations about the suitability of this software for any purpose. It is provided "as is" without express or implied warranty.

## zlib

Copyright (C) 1995-1998 Jean-loup Gailly and Mark Adler

This software is provided 'as-is', without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution. Jean-loup Gailly Mark Adler [jloup@gzip.org](mailto:jloup@gzip.org) [madler@alumni.caltech.edu](mailto:madler@alumni.caltech.edu)

The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files <ftp://ds.internic.net/rfc/rfc1950.txt> (zlib format), [rfc1951.txt](ftp://ds.internic.net/rfc/rfc1951.txt) (deflate format) and [rfc1952.txt](ftp://ds.internic.net/rfc/rfc1952.txt) (gzip format).



# Glossary

The following terms are used throughout this guide:

**Card** — refers to the SHC-8932-F unless otherwise noted.

**DashBoard** — the DashBoard Control System.

**Dynamic Range** —

**EDID** — Extended Display Information Data as defined by the Consumer Technology Association (CTA). The EDID specifies the display characteristics of an input signal (e.g. resolution, frame rate, etc.) to the DVI or HDMI compliant device ingesting that signal.

**EOTF** — Electrical (Y'CbCr) to Optical display light (cd/m<sup>2</sup>) Transfer Function as defined by SMPTE ST 2084. This mathematical function specifies how an image is displayed by downstream devices (e.g. monitors).

**Frame** — the openGear frame that houses the SHC-8932-F unless otherwise noted.

**HDMI** — High Definition Multimedia Interface.

**HDR** — High Dynamic Range.

**Network Controller Card** — the MFC-OG3-N, MFC-OGX-N, MFC-8322-S, and any available options unless otherwise noted.

**openGear Frame** — refers to the OG3-FR and OGX-FR series frames unless otherwise noted.

**System** — the mix of interconnected production and terminal equipment in your environment.

**User** — the person who uses the SHC-8932-F.

