MOTOROLA

User Guide

GX2 EA1000C*/*

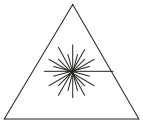
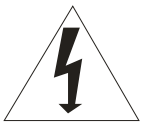
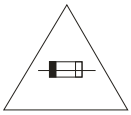
Multi-Wavelength DWDM 1550 nm Laser Transmitter

Compliance/Regulatory

Caution

These servicing instructions are for use by qualified personnel only. To reduce the risk of electrical shock, do not perform any servicing other than that contained in the Installation and Troubleshooting Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Special Symbols That Might Appear on the Equipment

	This is a class I product that contains a class IIIb laser and is intended for operation in a closed environment with fiber attached. Do not look into the optical connector of the transmitter with power applied. Laser output is invisible, and eye damage can result. Do not defeat safety features that prevent looking into the optical connector.
	This product contains a class IIIb laser and is intended for operation in a closed environment with fiber attached. Do not look into the optical connector of the transmitter with power applied. Laser output is invisible, and eye damage can result. Do not defeat safety features that prevent looking into optical connector.
	This symbol indicates that dangerous voltage levels are present within the equipment. These voltages are not insulated and may be of sufficient strength to cause serious bodily injury when touched. The symbol may also appear on schematics.
	The exclamation point, within an equilateral triangle, is intended to alert the user to the presence of important installation, servicing, and operating instructions in the documents accompanying the equipment.
	For continued protection against fire, replace all fuses only with fuses having the same electrical ratings marked at the location of the fuse.

Caring for the Environment by Recycling

When you see this symbol on a Motorola product, do not dispose of the product with residential or commercial waste.

Recycling your Motorola Equipment

Please do not dispose of this product with your residential or commercial waste. Some countries or regions, such as the European Union, have set up systems to collect and recycle electrical and electronic waste items. Contact your local authorities for information about practices established for your region. If collection systems are not available, call Motorola Customer Service for assistance.

FCC Compliance

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 Installation 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/her own expense.

Caution: Any changes or modifications not expressly approved by Motorola could void the user's authority to operate this equipment under the rules and regulations of the FCC.

Canadian Compliance

This Class A digital device complies with Canadian ICES-003
Cet appareil numérique de la classe A est conforme **à** la norme NMB-003 du Canada.

FDA Compliance

This product meets the requirements of the Code of Federal Regulations, Title 21, Chapter I, Subchapter J, Sections 1010.2, 1010.3, 1040.10, and 1040.11

CLASS 1 LASER PRODUCT

Declaration of Conformity

We — Motorola Mobility, Inc.
101 Tournament Drive
Horsham, PA 19044, U.S.A.

declare under our sole responsibility that the

Multi-Wavelength DWDM 1550 nm Laser Transmitter — Model GX2 EA1000C*/*

to which this declaration relates is in conformity with one or more of the following standards:

EMC Standards

EN55022	EN55024	EN50083-2	CISPR-22	CISPR-24

Safety Standards

EN60065	EN60825	EN60950	IEC 60950 + A1: 1992 + A2: 1993 + A3: 1995 + A4: 1996

following the provisions of the Directive(s) of the Council of the European Union:

EMC Directive 89/336/EEC	Low Voltage Directive 73/23/EEC	WEEE Directive 2002/96/EC

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1 Introduction

The OmniStar® GX2 is a fiber optic broadband transmission platform for headend and hub locations that supports advanced broadband hybrid-fiber/coax telecommunications systems. The OmniStar GX2 platform includes a complete line of headend fiber optic products designed to transport video and data signals in CATV systems and related applications. The OmniStar GX2 platform is flexible in its application and includes a series of modules and options that you can select to accommodate system requirements.

This manual describes the GX2-EA1000C*/* RoHS compliant, high-performance, Multi-Wavelength DWDM 1550 nm distributed feedback (DFB) laser transmitters. This series has a range of wavelength options to accommodate various systems designs. The output power is 9 dBm and can be optically amplified through an EDFA for higher launch powers.

The GX2-EA1000C*/* has one primary RF input for broadcast and one secondary RF input for narrowcast applications. It is capable of transmitting a mix of analog and digital channels from 52 MHz to 1 GHz through a front-panel optical output connector. It also has a front-panel RF test point and a front-panel LED that provides status and alarm information.

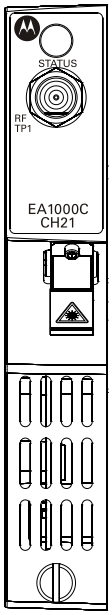


Figure 1: GX2-EA1000C*/* Transmitter Front Panel

An internal microprocessor controls and monitors the GX2-EA1000C*/*. Remote control is implemented through the GX2-HSG* backplane by the GX2-CM100B control module, which can receive input from a variety of sources. Using status monitoring software, you can electronically update the firmware without removing the GX2-EA1000C*/* from the equipment shelf.

Different OmniStar GX2 application modules can be intermixed in the 16-slot GX2-HSG*. For illustrative purposes, Figure 2 depicts a GX2-HSG* populated with 16 GX2* modules, and a GX2-CM100B control module.

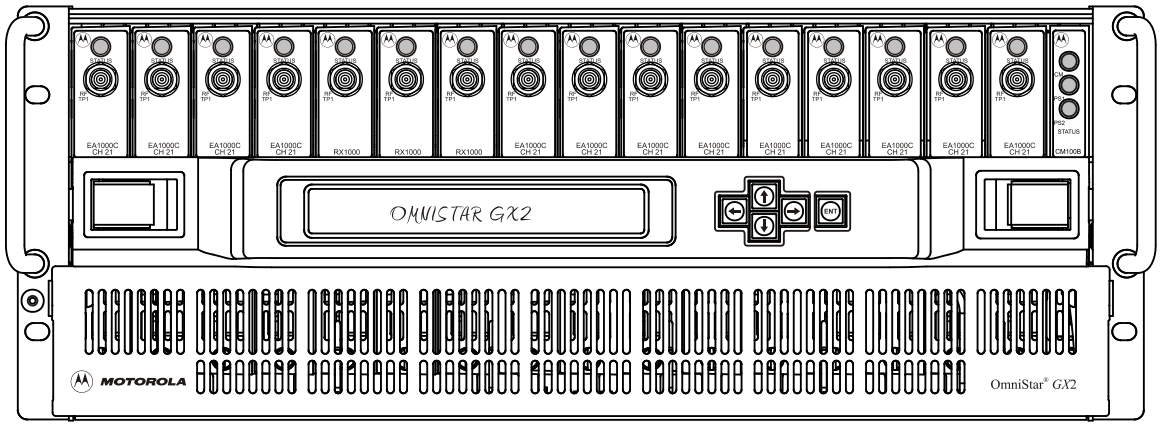


Figure 2: Fully populated GX2-HSG* equipment shelf

For more information regarding this product or other OmniStar GX2 modules, consult the Motorola product catalog or visit the web site: http://www.motorola.com/broadband.

Related Documentation

The following documents provide information that is required for products that can be used with the GX2-EA1000C*/*:

- GX2-HSG* Equipment Shelf Installation and Operation Manual
- GX2-CM100B Control Module Installation and Operation Manual
- GX2-PSAC10*-R AC Power Supply Installation and Operation Manual
- GX2-PSDC10*-R DC Power Supply Installation and Operation Manual

Although these documents provide information that may be of interest to you, they are not required to install or operate the GX2-EA1000C*/*:

- GX2-RX1000C Forward Path Receiver Installation and Operation Manual
- GX2-RX200BX2 Dual Return Path Receiver Installation and Operation Manual
- GX2-RX200BX4 Quad Return Path Receiver Installation and Operation Manual
- GX2-SDU100B Shelf Door Unit Installation and Operation Manual
- GX2-OA100* Optical Amplifier Installation and Operation Manual
- GX2-EM1000C* Externally Modulated Broadcast Transmitter Installation and Operation Manual
- GX2-DM1000C* Directly Modulated Forward Path Transmitter Installation and Operation Manual
- GX2-RSW200B RF Switch Installation and Operation Manual
- GX2-OSW10B Optical Switch Installation and Operation Manual
- GX20OA508B21 Gain Flattened Optical Amplifier Installation and Operation Manual
- Web Browser Interface Instruction Sheet

Getting Help

To get assistance with your Motorola product or solution, or to access learning materials, use one of the following channels:

Technical Assistance Center (TAC) provides access to technicians 24 hours a day, 7 days a week for all products. Contact the TAC at 888-944-HELP (888-944-4357) or dial direct 847-725-4011. For specific toll-free numbers when calling from outside the United States, please refer to the table in this manual or our Web page.

Motorola On-Line at http://mobilityonline.motorola.com provides access to order entry, repair status, warranty tracking, and your portal to Motorola's Customer Care. There you can view and create cases online as well as search, view, and download customer documentation, such as user manuals and installation guides, or search our knowledge database for common solutions to today's problems**.**

Learning Portal provides self-paced product training and course descriptions of instructor-led training classes at http://www.motorolatraining.com. In many cases training can be given at your location.

Digital Configuration Management provides access to software downloads and release notes. Or you can order from our digital configuration management servers by going to http://digitalcm.motorola.com.

Country	Phone Number		Country	Phone Number
Belgium	0-800-72-163		**Luxembourg**	0-800-2-5310
Denmark	80-88-6748		**Netherlands-Holland**	0-800-022-0176
Finland	0-800-114-263		**Norway**	800-15-670
France	0-800-90-7038		**Poland**	00-800-111-3671
Germany	0-800-18-73019		**Portugal**	800-81-3461
Hungary	06-800-18164		**Spain**	900-99-1771
Ireland	1-800-55-9871		**Sweden**	020-79-0241
Israel Golden Lines **Israel Bezeq** **Israel Barak**	1-809-25-2071 1-809-42-9181 1-809-31-5435		**Switzerland**	0-800-561-872
Italy	800-788-304		**United Kingdom**	8-800-404-8439
			All other countries	+1 847 725 4011

Customer Service (order entry)

800-523-6678

Replacement Parts

Distribution Products: NCS http://www.ncsind.com 800-523-2342

Terminal Products: 800-227-0450

Repair

If repair is necessary, call the Motorola Technical Support Call Center for assistance in verifying that the item is defective. The TSCC will create an RSA for repair or an RA for replacement if equipment qualifies.

When shipping equipment for repair:

1. Pack the unit securely.
2. Enclose a note describing the exact problem. Complete and enclose the checklist provided with the unit.
3. Enclose a copy of the invoice that verifies the warranty status.
4. Ship the unit **PREPAID** to the address supplied in your RSA or RA.

2 Overview

OmniStar GX2 equipment is designed for increased rack density, reliability, ease of operation, and computer-aided troubleshooting through extensive network management. All OmniStar GX2 modules are accessible and replaceable from the front of the GX2-HSG* equipment shelf, resulting in low time-to-repair. An installed module mates with the equipment shelf connectors for signal interfacing and power. Fiber connections are made at the front of a module.

The OmniStar GX2 housing incorporates blind-mate connectors that enable all modules to be hot swapped without removing the RF cables. *When modules are replaced with power applied to the equipment shelf, ensure that all laser hazard warnings provided in Section 3, "Installation" are strictly enforced.*

You can install the GX2-EA1000C*/* in any of the sixteen universal slots in the equipment shelf. The narrow slot on the far right is reserved for the GX2-CM100B control module.

Although the GX2-HSG* can have a mix of different OmniStar GX2 modules, Figure 3 illustrates an equipment shelf populated with sixteen GX2-EA1000C*/* modules, a GX2-CM100B control module, and an optional shelf door unit (SDU) with display.

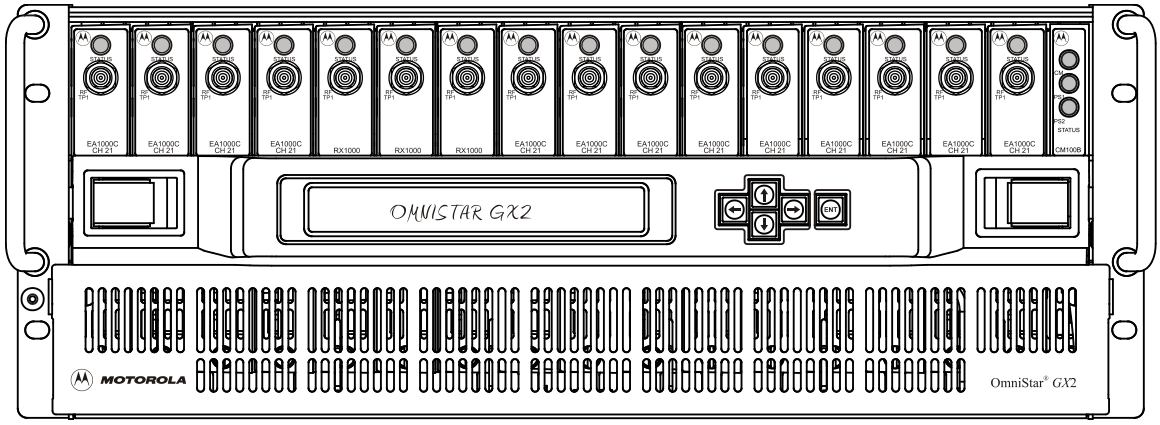


Figure 3: GX2-HSG*

Table 1 describes a minimum GX2-HSG* equipment shelf configuration required for operating a GX2-EA1000C*/*:

Table 1: Minimum GX2-HSG* Equipment-Shelf Configuration

Component	Model	Function
Equipment-shelf	GX2-HSG*	Rack-mountable shelf that houses up to sixteen modules, AC or DC power supplies, and a control module
Power supply module	GX2-PSAC10* or GX2-PSDC10*	The GX2-PSAC10*provides shelf power in an AC powered system; the GX2-PSDC10* provides shelf power in a DC system
Control module	GX2-CM100B	Provides status monitoring and control functions
Laser module	GX2-EA1000C*/*	Laser transmitter, available in different output powers to fit any system requirement

Module Description

The GX2-EA1000C*/* provides an optical output used to transport video and data signals on a broadband HFC network. The GX2-EA-1000C*/* family of transmitters operate in the C-band wavelength range. These broadcast/narrowcast transmitter modules support DWDM multi-wavelength downstream transport, providing multiple optical signals for segmented or fiber deep applications over a single fiber. Each wavelength carries unique broadcast and narrowcast content and feeds a separate optical receiver. This solution is intended to accommodate Analog, Digital QAM or a mix of both full loading.

The GX2-EA1000C*/* occupies one application module slot in the GX2-HSG universal housing. The module is designed for use in broadcast/narrowcast transport applications, where it accepts Analog and/or QAM-based digital signals and modulates these signals onto an optical carrier for transmission through a fiber medium. The GX2-EA1000C*/* is intended for use in a GX2-HSG housing and may be placed either at a headend or hub location.

The optical output is produced in the module by a DWDM ITU externally modulated laser. The GX2-EA1000C*/* has a single optical output that can be optically amplified if needed by application requirements. The trailing digits that replace the asterisks (*/*) in the model number differentiate the laser module output-power levels and SBS threshold. Table 7 in Appendix A, “Specifications” identifies the various models of the GX2-EA1000C*/* and their respective optical outputs.

Each GX2-EA1000C*/* features a state-of-the-art pre-distortion circuit to provide excellent composite second order (CSO) and composite triple beat (CTB) distortion performance. During the manufacturing process, the performance of each laser is characterized and its optimal operating point is stored in non-volatile memory (NVM) within the unit.

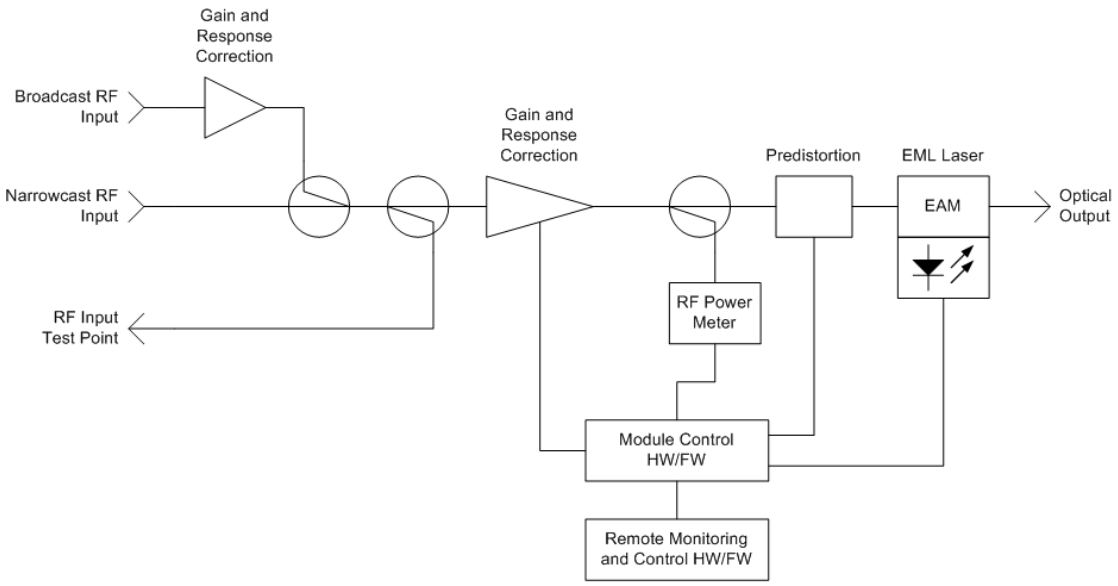


Figure 4: GX2-EA1000C*/* Block Diagram

A single front-panel mounted RF test point is provided for setup and maintenance of the module. The test point directly monitors the combined RF input. The rear panel contains two RF inputs and two cooling fans. Complete descriptions of the front and rear panel features are provided later in this section.

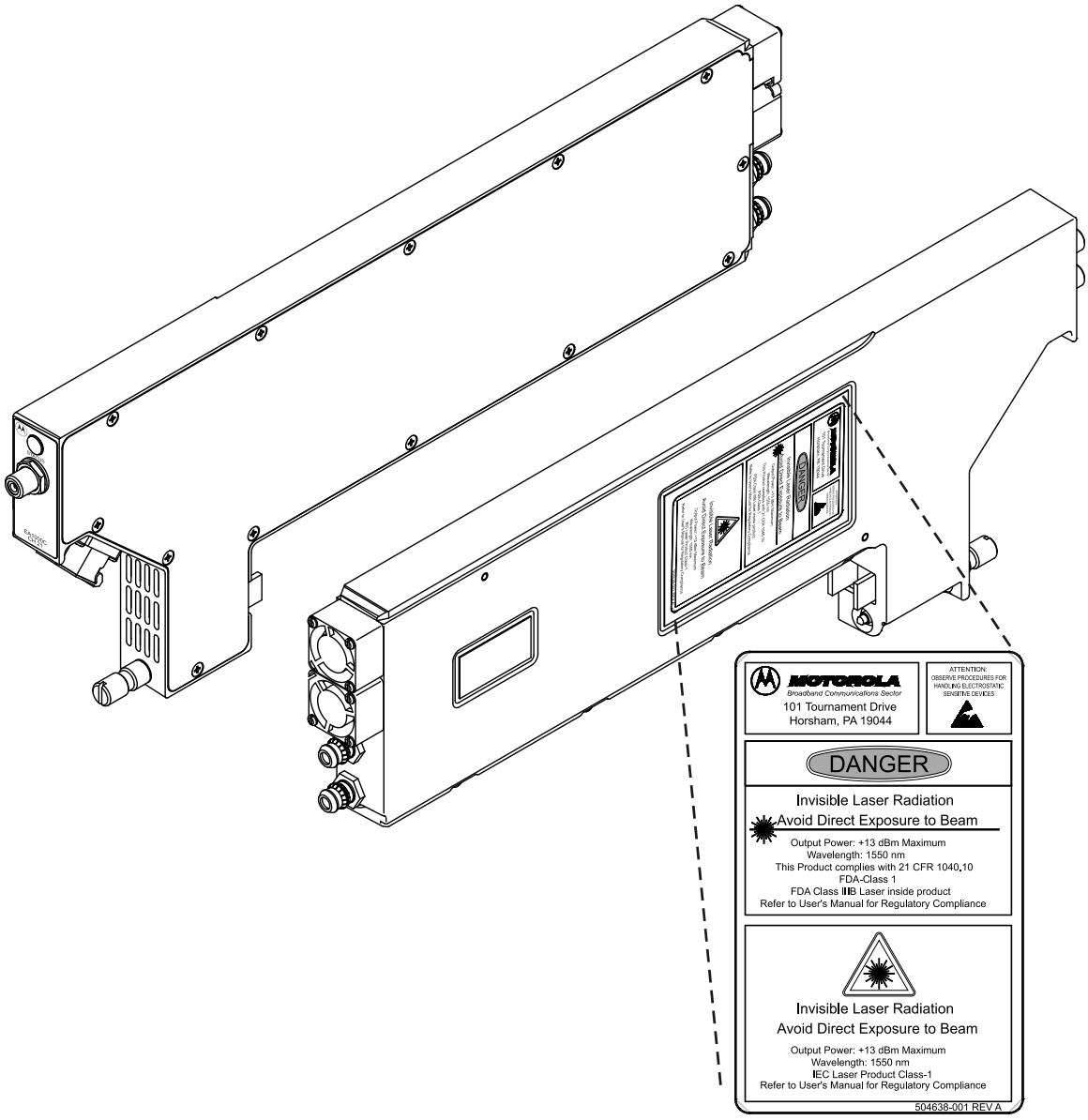


Figure 5: GX2-EA1000C*/* Front and Rear Side Views

Operating Modes

The user can select one of several operating modes depending on the application. The modes are characterized as either Automatic Gain Control (AGC) or Manual Gain Control (MGC):

AGC Modes

Each of the following modes uses the AGC function of the module. The specific mode determines the laser drive level relative to the factory-set reference point:

- Preset — initiates AGC using factory settings for optimal laser performance.
- Set — enables the user to adjust the AGC reference point for specific product applications or performance requirements.
- Set Equate — places the transmitter in Set mode with the same laser drive level as Preset. This is useful in resetting the Set mode operating point to a known level.
- CW/Video — this is a variable back-off from the level used to proof the system. This mode is not a separate mode from Preset or Set but is used in conjunction with these modes.

MGC Modes

In Manual mode, the attenuator setting is controlled directly and changes the laser drive level.

- Manual — MGC is a fixed gain that is adjusted by the user.
- Manual Equate — places the module in Manual mode with the attenuator setting remaining the same as the previous mode. After setting the Preset mode, you can use manual equate to find the optimum laser drive level before you switch to Manual mode.

Mode settings are stored in NVM. When powering up, a module reverts to the last operating mode settings.

Quick-Swap Module Configuration

The quick-swap module configuration saves operators time when replacing application modules. When selected, the system saves all previous settings for a module and then automatically downloads those settings to a new module of the same type when it is installed in the same housing slot. This feature works in conjunction with the GX2-CM100B module.

Detailed information regarding operating the GX2-EA1000C*/* is provided in Section 4, “Operation.”

Additional Features

Functions performed by the GX2-EA1000C*/* include:

- Provides local alarm indication by changing the color of the front-panel STATUS LED
- Stores module identity, laser operating parameters, and set-up information in NVM
- Downloadable firmware to support field upgrades
- Factory birth certificate stored in NVM and accessible through local interfaces

RF Section

The RF input signals are applied to the GX2-HSG* equipment-shelf rear panel. The upper connector is the main-broadcast input and the lower connector is provided for narrowcast. The narrowcast input is a convenient method of adding channels to serve select areas of the cable plant. *The narrowcast input must be terminated in 75 ohms when not in use*. Both inputs provide full bandwidth. Gain through the narrowcast input is -6 dB relative to the main input.

The RF input test point is located on the common path after the main and narrowcast inputs are combined. This enables verification of the input signals.

Low noise, low distortion gain stages amplify the input signal to the optimum drive level required for the laser. A programmable attenuator, located midway in the amplifier chain, is controlled by the microprocessor and, in turn, controls the drive level.

A sample of the RF level is detected after the final gain stage. The output of the RF level detector is a DC voltage level that corresponds to the total signal power applied to the laser. There is also a pre-distortion circuit and some equalization in the RF path to help with distortion levels and signal response.

When in Preset mode, the microprocessor references laser characteristics stored in the NVM and adjusts the attenuator to apply the optimum RF level to the laser. The power meter is constantly monitored and the attenuator is adjusted to maintain a constant drive level into the laser.

Other AGC modes operate in a similar manner but use different laser drive level reference points, as set by the user. These are described in the previous subsection, “Operating Modes.”

Embedded Section

The microprocessor section controls and monitors the laser module. The main and local microprocessors:

- Control the RF level into the laser, the laser temperature, and its optical-output power.
- Monitor laser module status and alarm conditions.
- Provide an interface to the GX2-CM100B control module through the GX2-HSG* backplane to enable status monitoring. This interface is also used by the GX2-CM100B to control the GX2-EA1000C*/*.
- Provide the ability to download new firmware code into the GX2-EA1000C*/* through the status-monitoring and control interface.
- Ensure that the module continues to operate normally with minimal interruption from the firmware download. When the download has completed, it resets the module, as commanded by the operator, to start the new firmware.
- Reset the module to start new firmware if you switch firmware banks using the status-monitoring software.
- Retain all settings in NVM and maintain operating conditions after a power cycle.
- Provide the ability to change settings using the network management interfaces.

Communication Interfaces

The GX2-EA1000C*/* can be monitored and controlled locally using the GX2-CM100B, in conjunction with network management software. A PC interface is available through an Ethernet port on the front of the GX2-CM100B. Using a standard Web browser, the graphical user interface (GUI) provides a point-and-click method of monitoring and controlling the shelf.

For higher-level management, the GX2-EA1000C*/* can be easily connected to a remote network management system using the standard Ethernet SNMP interface.

See Table 4 in Section 4, “Operation” for specific information on alarm parameters.

Front-Panel

The GX2-EA1000C*/* front panel includes an optical connector, a tri-color STATUS alarm indicator, and one RF test point.

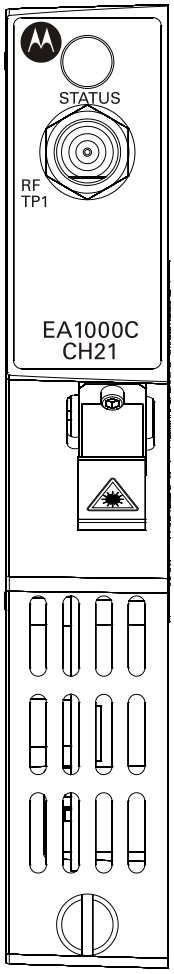
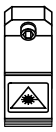


Figure 6: GX2-EA1000C*/*front panel

Table 2: GX2-EA1000CC*/* Front Panel Features

Key	Feature	Function
1		There are three status LED colors: Green indicates normal operation with no alarms reported. Yellow indicates a minor alarm is detected. A minor alarm signals an out-of-tolerance monitored parameter value, but the system can operate. Red indicates a significant error occurred or a major alarm limit was violated. Blinking status LED indicates that the transmitter is being accessed locally.
2		The RF TP1 F-type connector provides a sample of the RF input level relative to the main and secondary RF input ports on the rear of the GX2-EA1000C*/*.
3		Optical bulkhead fitting that has a protective shutter for the optical output fiber connection.
4		Slotted thumbscrew that secures the GX2-EA1000C*/* to the GX2-HSG*. Torque to 7 ±3 in-lbs.

Rear Panel

The GX2-EA1000C*/* rear panel includes cooling fans, the main (broadcast) RF input, secondary (narrowcast) RF input, and power/signal connector.

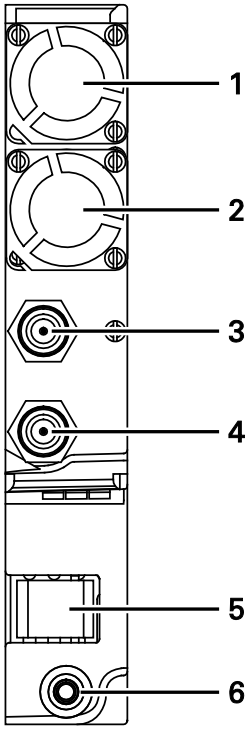


Figure 7: GX2-EA1000C*/* Rear Panel

Table 3: GX2-EA1000C*/* Rear Panel Features

Key	Feature	Function
1		Forced air fan that is required to circulate cooling air.
2		Additional forced air fan that is required to circulate cooling air.
3		G-type connector for main (broadcast) RF input to the GX2-EA1000C*/*. This connector mates with the G- to F-type adapter on the GX2-HSG*.
4		G-type connector for secondary (narrowcast) RF input to the GX2-EA1000C*/*. This connector mates with the G- to F-type adapter on the GX2-HSG*.
5		This 24-pin connector provides the interface for DC power, ground, remote control, and monitoring functions to the GX2-EA1000C*/*. While this is a rear facing connector, it is located in a more forward location immediately above the slotted thumbscrew as illustrated in Figure 7.
6		The guide pin and thumbscrew secures the GX2-EA1000C*/* to the GX2-HSG*.

3 Installation and Setup

This section provides instructions on how to install the GX2-EA1000C*/*, connect it to other equipment, select the operating mode, and verify its operation. To function, the GX2-EA1000C*/* requires a GX2-HSG* equipment shelf configured with a GX2-PSAC10D-R or GX2-PSDC10D-R power supply and a GX2-CM100B control module. These modules are shipped with documentation; follow the installation instructions in each manual to populate the GX2-HSG* equipment shelf.

Installing the GX2-EA1000C*/* in the equipment shelf requires:

- Unpacking the GX2-EA1000C*/* and recording the model number, serial number, and other related information
- Installing the RF interface connectors on the rear of the GX2-HSG*
- Cleaning the GX2-EA1000C*/* optical bulkhead and interface fiber connectors
- Inserting the optical interface connector in the GX2-EA1000C*/*
- Installing the GX2-EA1000C*/* in the GX2-HSG*
- Powering up and initializing reset
- Measuring and checking the optical output power
- Measuring and checking the input signal levels
- Implementing the GX2-EA1000C*/* MGC and AGC operating modes

DANGER!

OmniStar GX2 application modules can be damaged by electrostatic discharge (ESD). The use of an appropriate wrist ground strap is strongly recommended. A ground connection is provided on the front of the GX2-HSG*.

Before You Begin

Before performing the installation, acquire a fiber maintenance kit (Alcoa Fujikura part number C008812, ACT-1, or equivalent). See the instructions to properly use the kit. The following items are required for proper fiber maintenance:

- 99% isopropyl alcohol
- Lint-free, anti-static wipes
- Compressed, filtered air
- Lint-free swabs

Unpacking the GX2-EA1000C*/*

1. Unpack the GX2-EA1000C*/* and inspect it for damage. If damaged, set it aside in its original packing material and contact the Motorola Customer Service department for further instructions. See Section 1, "Introduction."
2. Record the model number, serial number, and related information for future reference. This information is on a label on the side of the module.

Installing the RF Interface Connectors (if required)

The GX2-HSG* enables you to install the GX2-EA1000C*/* in any application module slot. To accommodate this feature, you need to install RF interface connectors.

Note: The RF interface connectors are not provided with the GX2-EA1000C/* but are available upon request.*

To install the two RF G-to-F connectors on the rear of the GX2-HSG*:

1. Locate the plate containing the two G- to F-type connectors and the two mounting screws included in the GX2-EA1000C*/* shipping carton.
2. Identify the slot that the GX2-EA1000C*/* will occupy in the GX2-HSG*.
3. Hold the connector plate so that the F side of the G- to F-type connectors face outward and the tabs are in the up position.
4. Insert the tabs on the mounting plate into the slots on the rear of the GX2-HSG* that correspond to the location of the GX2-EA1000C*/*.
5. Secure the plate with the two screws provided.

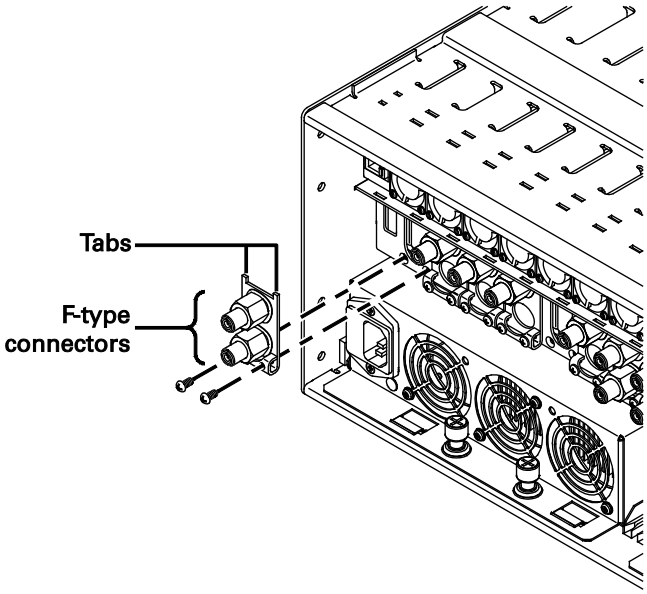


Figure 8: Installing the RF interface connectors on the rear of the GX2-HSG*

The GX2-HSG* is now ready to accept the GX2-EA1000C*/*. However, before you insert the GX2-EA1000C*/* into the GX2-HSG*, you need to perform some basic cleaning procedures on the optical interfaces.

It is highly recommended that the following cleaning procedures be performed prior to installing the GX2-EA1000C*/* in the GX2-HSG*. GX2-EA1000C*/* installation and routine maintenance should be performed by properly trained personnel. In all cases they should be aware of and observe the following warnings associated with fiber optic transmitters:

DANGER!

Laser Hazard! Invisible laser radiation when the module is operating and the interlock defeated. Avoid direct exposure to the beam. Do not look into the optical connector or a fiber connected to the output of a laser module. Laser output is invisible and eye damage can result.

CAUTION!

Handle fiber carefully and avoid sharp bends, strain, or pinching. Avoid contacting the highly polished end of the exposed fiber at the connector by keeping the protective boot in place when practical.

CAUTION!

Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous laser radiation exposure.

While some models of the GX2-EA1000C*/* do not have SC/APC type connectors, cleaning procedures similar to the following are recommended as appropriate for the connector type installed.

Cleaning the GX2-EA1000C*/* Optical Bulkhead Fitting

To ensure the specified output power of the GX2-EA1000C*/* is achieved out of the optical bulkhead fitting, it is important to clean all the optical interfaces.

To clean the barrel of the optical bulkhead fitting:

1. Set the GX2-EA1000C*/* on a clean flat surface.
2. Carefully open the shutter of the optical bulkhead fitting.
3. Gently clean the barrel of the optical bulkhead fitting with a lint-free swab as illustrated in Figure 9.

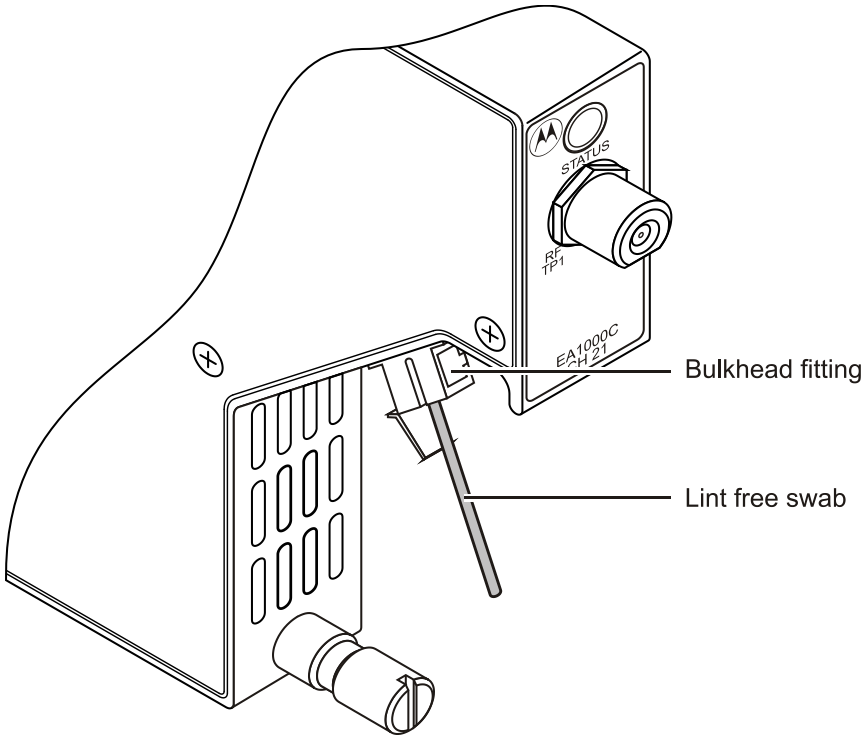


Figure 9: Cleaning the Barrel of the Optical Bulkhead Fitting

Cleaning the Interface Fiber Jumper SC/APC Connector

In addition to cleaning the optical bulkhead on the GX2-EA1000C*/*, it is also important to clean the interface fiber jumper optical connector(s). This cleaning should be performed before you insert the GX2-EA1000C*/* into the GX2-HSG*.

To clean the interface fiber jumper SC/APC connector(s):

1. Remove the protective boot from the end of the SC/APC connector.
2. Clean the tip gently with lint-free wipes moistened with 99% isopropyl alcohol.

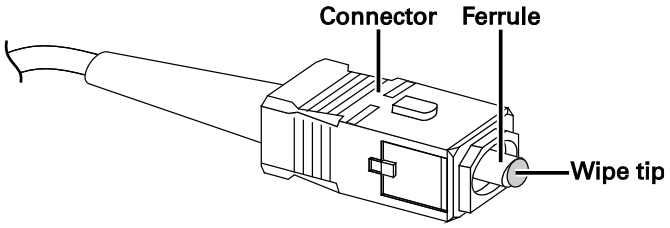


Figure 10: Cleaning the SC/APC connector tip

3. Dry the SC/APC connector with compressed, filtered air or use a dry, lint-free wipe.

Inserting the SC/APC Connector

Before inserting the GX2-EA1000C*/* into the GX2-HSG*, insert the interface fiber jumper SC/APC connector into the optical bulkhead fitting. It is recommended that you use a short optical jumper for initial GX2-EA1000C*/* installation. This provides greater flexibility for installation and can be used to verify the optical output power after the unit is installed.

To insert the SC/APC connector into the optical bulkhead fitting:

1. Carefully open the shutter of the optical bulkhead fitting.
2. Align the key on the SC/APC connector with the mating key slot of the optical bulkhead fitting. Figure 11 illustrates proper SC/APC alignment with the optical bulkhead fitting:

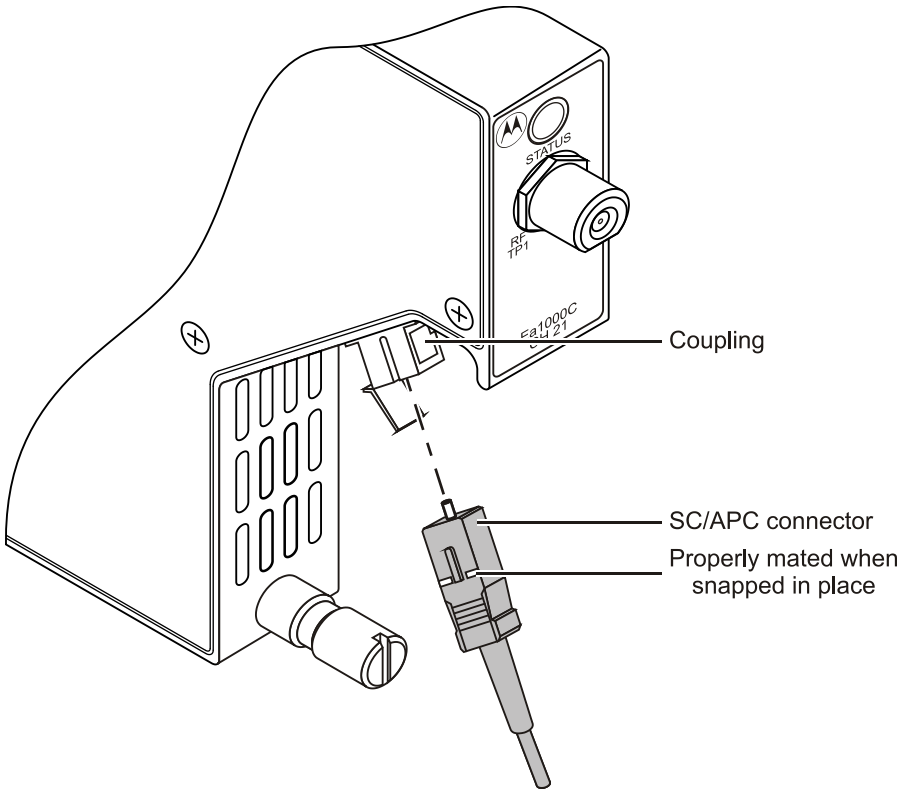


Figure 11: Inserting the SC/APC connector

3. Insert the SC/APC connector into the optical bulkhead fitting.
4. Push the SC/APC connector into the optical bulkhead fitting until it snaps in place.

DANGER!

Subsequent to the initial installation, when any of the above optical cleaning procedures are performed, it is recommended that power be removed from the GX2-EA1000C*/* transmitter for your protection.

Installing the GX2-EA1000C*/* in the GX2-HSG*

You are now ready to insert the GX2-EA1000C*/* into the GX2-HSG*. All slots in the GX2-HSG* are universal and intended for the Omnistar GX2 application modules, except the narrow, right-most slot, which is reserved for the control module. All GX2 application modules can be installed or removed in a powered-on or powered-off GX2-HSG*.

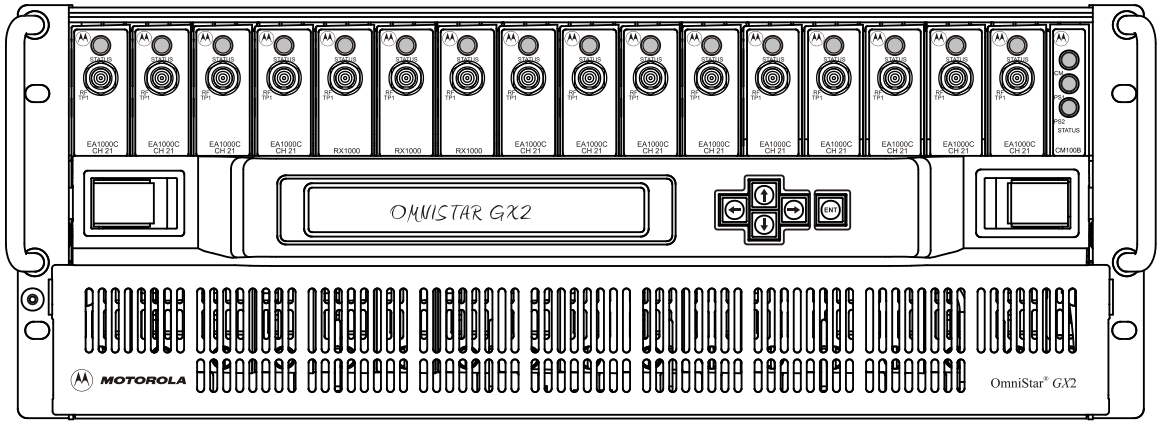


Figure 12: Typical GX2-HSG* Configuration

To insert and power-up the GX2-EA1000C*/*in the GX2-HSG*:

1. Slide the GX2-EA1000C*/* fully into the designated shelf slot that contains the previously installed G- to F-type connectors mounted on the GX2-HSG*.
2. Ensure that a firm connection is achieved with the GX2-HSG* backplane. Power is automatically applied when contact is made with the backplane connectors.
3. Tighten the thumbscrew at the bottom of the GX2-EA1000C*/* to secure it in the GX2-HSG* slot. You can tighten the thumbscrew firmly with your fingers or torque to 7 ±3 in-lb.

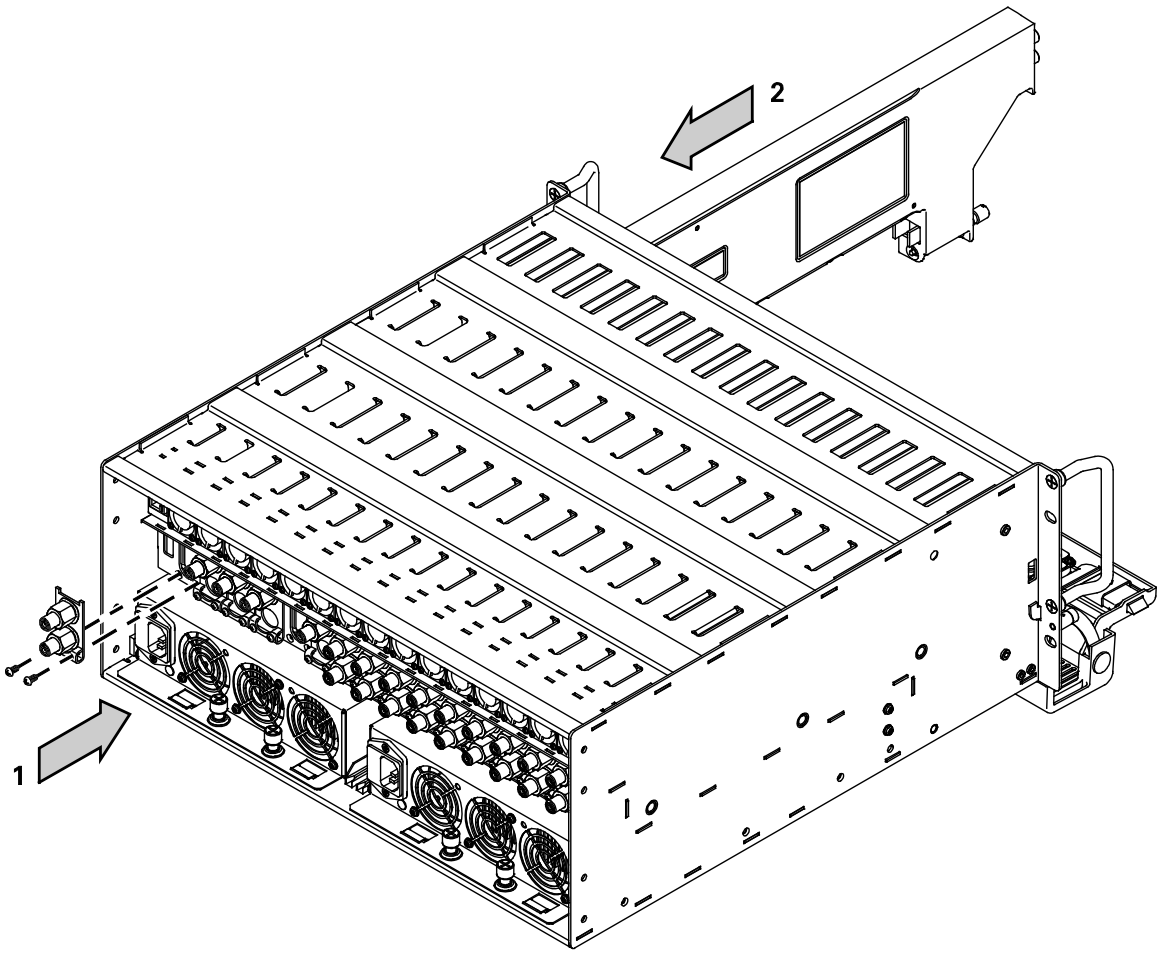


Figure 13: GX2-EA1000C*/* installation in a GX2-HSG*

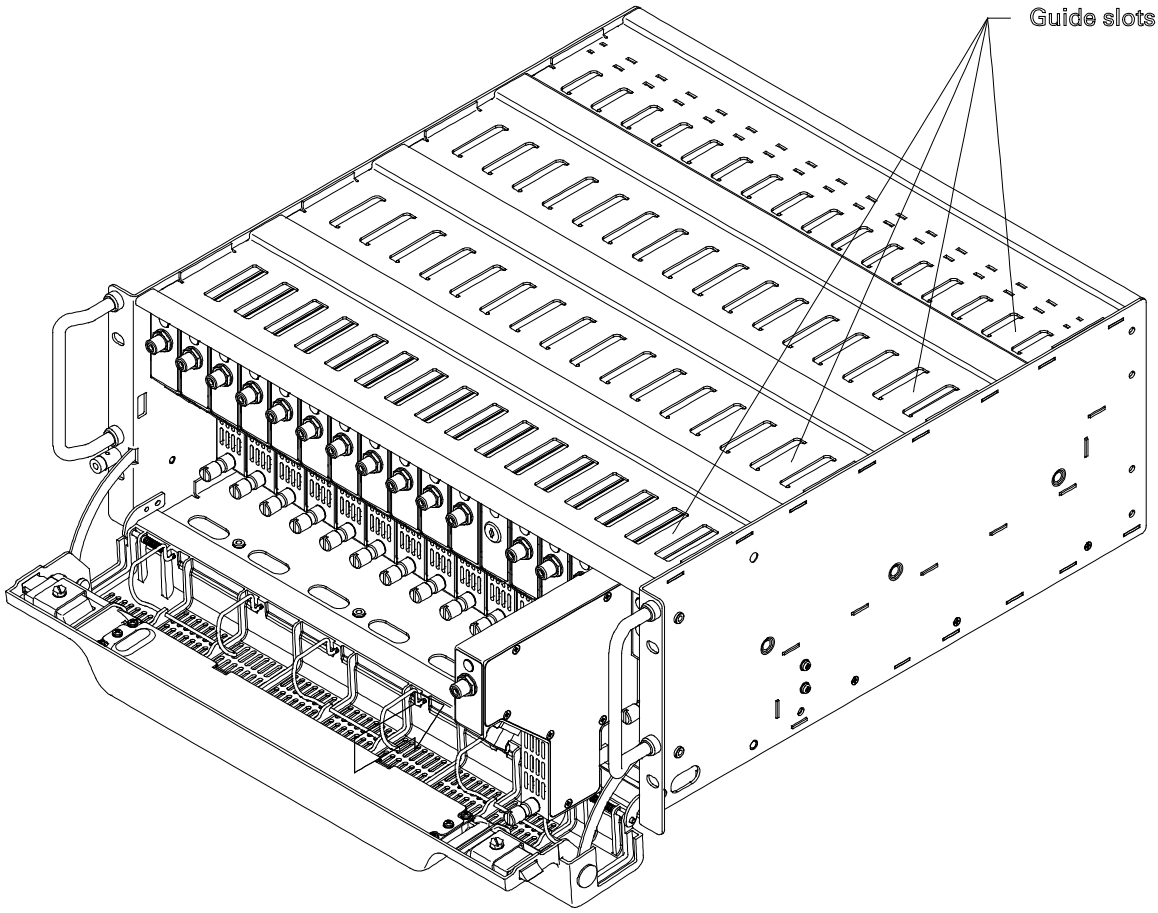


Figure 14: Inserting the GX2-EA1000C*/* in the GX2-HSG*

Power-Up and Reset Initialization

When the GX2-EA1000C*/* is fully installed in the GX2-HSG* and power is applied, the initialization process begins. The GX2-EA1000C*/* STATUS LED completes a red–yellow–green cycle. Upon initial power-up of a new unit, the GX2-EA1000C*/* conforms to the factory default *Preset/Video* mode with a 4 dB video mode offset from CW.

With subsequent power-ups, the status LED completes its power-on cycle, information stored in the GX2-EA1000C*/* NVM is recalled, and the unit defaults to the last stored operating mode before power was disrupted.

After initial power-up or subsequent power-ups, you can return the GX2-EA1000C*/* to the factory default settings. You can do this through the SDU, the network management system, or the local access port.

Measuring and Checking the Optical Output Power

The following procedures for measuring optical output power and routine maintenance of the GX2-EA1000C*/* should be performed by properly trained personnel. In all cases they should be aware of and observe the following warnings associated with fiber optic transmitters:

DANGER!

Laser Hazard! Invisible laser radiation when the module is operating and the interlock defeated. Avoid direct exposure to the beam. Do not look into the optical connector or a fiber connected to the output of a laser module. Laser output is invisible and eye damage can result.

CAUTION!

Handle fiber carefully and avoid sharp bends, strain, or pinching. Avoid contacting the highly polished end of the exposed fiber at the connector by keeping the protective boot in place when practical.

Once the initialization process is complete, verify the optical output power of the GX2-EA1000C*/*. Perform this verification using an optical power meter, the SDU, the network management system, or the local access port. However, for initial installation, it is recommended that you use the previously installed short optical interface jumper in combination with an optical power meter to verify the optical output power.

To measure and check the optical output power from the GX2-EA1000C*/*:

1. Verify that the GX2-EA1000C*/* is correctly seated in the GX2-HSG* and that power has been applied for at least five minutes.
2. Verify that the previously installed end of the optical interface jumper remains in the GX2-EA1000C*/*.
3. Connect the other end of the optical interface jumper to an optical power meter.
4. Observe the optical output power in dBm or mW.
5. Verify the optical power of the unit in use by referring to Appendix A, “Specifications.”
6. If the measured power is less than the optical power noted in Appendix A, you may need to repeat the cleaning procedure or reverify the optical power using an alternative method.
7. After you verify the optical output power, disconnect the optical power meter and make the appropriate fiber connections to close the transmission link.

Measuring and Checking the RF Input Signal Levels

Following verification of the optical output power, you need to confirm the levels of the RF input signal being applied to the GX2-EA1000C*/*.

To measure and check the RF input signal levels:

1. Verify that the GX2-EA1000C*/* is correctly seated in the GX2-HSG* and that power has been applied for at least five minutes.
2. Before you connect the input cable to the main (broadcast) input or secondary (narrowcast) input on the GX2-HSG* rear panel, use a signal level meter, RF power meter, or a spectrum analyzer to measure the RF input signal level.
3. Compare the RF input signal level to the specified RF input level noted in Appendix A, "Specifications." It may be necessary to adjust the RF input-per-channel level to be within the noted specification.
4. You can calculate this level based on the equation: 10 x $\log_{10}$ (ratio of channels). Avoid varying from the nominal input, as higher levels cause degraded distortion performance and lower levels can approach the AGC range limit and add additional noise to the link.

Reminder—the gain of the narrowcast RF input port is 6 dB less than the broadcast RF input port.

5. After you correctly set the RF signal level, connect the corresponding RF cable to the preferred RF input port G- to F-type connector (broadcast and/or narrowcast) on the rear of the GX2-HSG*. Confirm that it is connected to the slot occupied by the GX2-EA1000C*/*.
6. Install a 75-ohm terminator on any unused RF input ports. A 75-ohm terminator is provided with the GX2-EA1000C*/*.

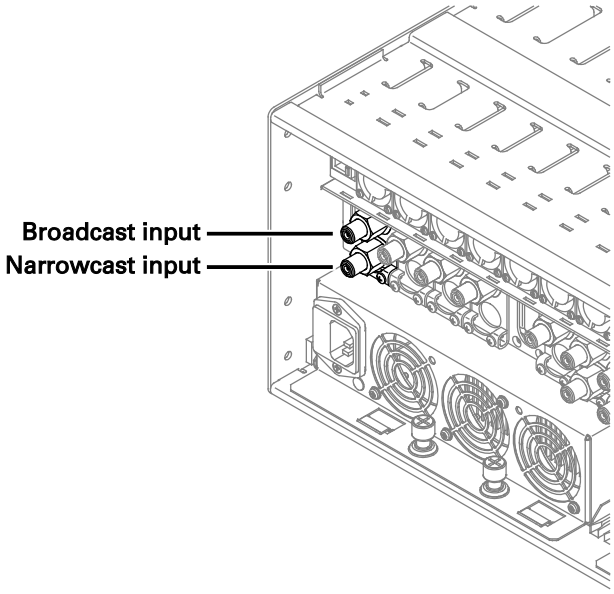


Figure 15: GX2-HSG*rear-panel RF connections

Upon receipt of an acceptable RF input signal level, the GX2-EA1000C/* front panel STATUS LED illuminates green.*

With RF input signals applied to the GX2-EA1000C/*, you can monitor the broadcast RF input level using RF TP1 on the front panel without removing the RF signal from the rear of the GX2-HSG*.*

RF TP is -20 dB down from the Broadcast input and -26 dB down from the Narrowcast input.

Protecting the Laser

The GX2-EA1000C*/* microprocessor and RF circuitry act to protect the laser diode if any of the following are detected:

- The GX2-EA1000C*/* optical output is turned off. If you turn the optical output off, the RF drive level to the laser diode is also turned off and the RF attenuator is set to maximum attenuation to protect the laser from damage. When the GX2-EA1000C*/* optical output is turned on, the RF drive level is restored to the previously set RF level.
- The GX2-EA1000C*/* laser TEC temperature acceptable operating range is not achieved. If the microprocessor determines that the TEC temperature is not set properly, it disables the laser. A TEC temperature alarm is sent to the network management system to inform the user that the TEC temperature is not operating in the specified range.

Operating Modes

Select the preferred GX2-EA1000C*/* operating mode, MGC or AGC.

Reminder—on initial power up, the factory default is Preset/Video mode with a 4 dB Video mode offset from CW.

The following subsections describe how to set up the GX2-EA1000C*/* based on the operating mode selected. For more detailed information on operating modes, refer to Section 4, "Operation."

MGC Modes

To implement MGC mode:

1. Adjust the input signal levels, as previously described in this section.
2. If the BC and NC signals are both applied to the main input, the total CW input signal power should be approximately –14 dBm total power or +34.75dBmV. This is the sum of the main and narrowcast input signals (NC -6dB below BC).
3. Confirm that appropriate RF input signal connections to the G- to F-type interface connectors on the rear of the GX2-HSG* are complete.
4. Measure the RF levels at RF TP1 (RF input level) on the GX2-EA1000C*/* front panel.
5. Select Preset mode and allocate time for the AGC to adjust the RF signal levels to the laser diode to the optimum operating point.
6. The RF drive level is optimized during manufacturing to achieve the link performance required for each laser. The factory-default, laser-drive level, is the operating point in Preset mode.
7. Select Manual Equate mode. This sub-mode equates the Preset Mode RF-drive-level (to the laser diode) to Manual mode and enables you to perform any additional level adjustments from a known good operating point.
8. Manual Equate is a momentary sub-mode and, after the microprocessor configures the RF parameters, the GX2-EA1000C*/* is automatically switched to Manual mode.
9. If it is necessary to optimize for C/N or distortion, use the RF attenuator to adjust the RF drive level to the laser diode.

Increasing the drive levels more than 0.5 dB above the Preset mode optimum drive level may result in the appearance of clipping artifacts in analog video signals.

AGC Modes

To implement AGC modes:

1. Adjust the input signal levels per the GX2-EA1000C*/* specification, as described previously in "Measuring and Checking the RF Input Signal Levels."
2. If the BC and NC signals are both applied to the main input, the total CW input signal power should be approximately –14 dBm or +34.75 dBmV. This is the sum of the main and narrowcast input signals (NC -6dB below BC).
3. Make the appropriate RF input signal connections to the G- to F-type interface connectors on the rear of the GX2-HSG*.
4. Measure the RF levels at RF TP on the GX2-EA1000C*/* front panel.
5. Choose which AGC mode you prefer to use—Preset or Set.
6. If you choose Preset mode, allocate time for the AGC to adjust the signal levels to the laser diode to the optimum operating point. Additional level adjustments are not required.
7. If you choose Set mode to optimize C/N or distortion, then select Set Equate. This sub-mode equates the Preset Mode RF-drive-level (to the laser diode) to Set mode and enables you to perform any additional level adjustments from a known good operating point.
8. Set equate is a momentary sub-mode and, after the microprocessor configures the RF parameters, the GX2-EA1000C*/* is automatically switched to Set mode.
9. If necessary, adjust the OMI offset from the Preset level to optimize for C/N or distortion.
10. If you want to proof the system using CW carriers, set the Video/CW mode to CW.
11. For normal video operation, select the appropriate video mode offset (2, 3, 4, or 5 dB) from CW.

4 Operation

This section describes the GX2-EA1000C*/* embedded section, user selectable operating modes, and network management system, and provides information necessary to properly use the optional SDU. It also provides information on increasing and decreasing channel loading and, if necessary, how to download new GX2-EA1000C*/* firmware.

Embedded Section

The GX2-EA1000C*/* microprocessor section contains NVM, which stores the operating firmware, factory-programmed module information, and calibration data.

Additionally, this section contains digital-to-analog (D/A) and analog-to-digital (A/D) converters that control and monitor module operation. The backplane communication interface is provided for communication to the GX2-CM100B control module through the GX2-HSG* equipment-shelf backplane.

Boot Operation

When the GX2-EA1000C*/* is powered on or reset, the microprocessor boots up and begins operating. It first performs a cyclic redundancy check (CRC) to verify the integrity of the firmware. If the CRC indicates error-free firmware, the microprocessor begins operating.

After the boot up completes successfully, the front-panel LED communicates an initialization sequence: *Red, Yellow, Green*.

If an error occurs during the boot up, the STATUS LED illuminates red. An alarm message indicating that the boot up failed is also sent to the network management system.

If the firmware fails the CRC test, the microprocessor stops operating and the STATUS LED blinks red to indicate the boot up failed.

Operating Modes

The following subsections describe the operating modes available and offer suggestions regarding their application and implementation. The two basic modes are AGC and MGC. Information on additional settings and functionality is also included. Details on how to select and implement the operating modes using the SDU are described in a later subsection.

AGC Modes

The following settings (submodes) are available in AGC:

Preset

Preset is a primary mode that establishes the factory default setting and maintains an ideal RF input level to the laser. The laser RF input level is maintained by (1) sampling the main RF-path power through an internal RF power meter, (2) comparing it to a factory-calibrated default AGC power level stored in NVM, and (3) adjusting the RF attenuator until the factory calibrated default AGC power level is achieved. This process provides the ideal RF input level to the laser. The internal microprocessor is responsible for AGC control of the RF attenuator and constant monitoring of the RF power meter level.

Preset is most useful when you need to ensure optimal performance regardless of the number of channels applied. A lower number of channels results in a higher signal level per channel into the laser and out of each receiver. This improves carrier-to-noise (c/n), while second and third order distortion products remain approximately constant.

Set

Set is a primary mode setting that enables you to adjust the AGC reference point for specific product applications or performance requirements. In Set, you can increase or decrease the OMI offset by 0.5 dB steps from the preset value through the backplane communication interface. When the new offset (from the preset value) is set, AGC maintains the laser OMI at the newly selected level and the OMI offset value is stored in NVM.

Set is most useful if you need to compromise c/n for distortion. You can do this by decreasing the RF drive level to the laser, which improves distortion and reduces c/n performance. Additionally, you can use Set when you plan to increase the channel load over time and prefer not to re-adjust the GX2-EA1000C* after initial setup. Increasing the RF drive level increases the OMI to the laser and increases the output level of each receiver. This increase in RF drive level improves c/n but degrades distortion.

Set Equate

Set Equate is a primary submode that equates the laser RF drive level to the factory-default, optimum RF drive level established in Preset. You can choose Set Equate from any other primary submode. As this is a momentary submode, after the RF parameters are configured by the microprocessor, the GX2-EA1000C*/* is automatically switched to Set. You can now make RF level adjustments as described previously in "Set." When you select Set Equate the RF drive level setting, previously stored in Set, is overwritten.

Set Equate is most useful in resetting the Set mode operating point to a known level.

CW/Video

CW is a secondary mode that uses unmodulated channels for a proof-of-performance rating. Video is also a secondary mode that is used when modulated channels are applied to the input of the GX2-EA1000C*/*. CW and Video are used in conjunction with Preset and Set. When in Set or Preset, you can toggle between CW and Video using the backplane communication interface. CW and Video are not applicable in Manual mode. When switching from CW to Video, the RF level decreases by the amount of offset selected—2 dB, 3 dB, 4 dB, or 5 dB. You can select the offset value using the SDU, the network management system, or the local access port. This decrease in RF level is provided to compensate for the difference in average power between CW channels and modulated video channels.

On initial power up, the factory default mode for the GX2-EA1000C*/* is Preset/Video mode with a Video mode offset of 4 dB from CW.

MGC Modes

The following settings (submodes) are available in MGC:

Manual

Manual is a primary mode setting that enables you to adjust the RF level in 0.5 dB steps through the backplane communication interface. Because the gain of the GX2-EA1000C*/* is not adjusted by the microprocessor after you set the RF level, this mode is referred to as the "fixed-gain mode". When you select Manual, the previously stored Manual mode RF attenuator setting is recalled from NVM.

Manual is most useful if the input load is fixed and you prefer to control the RF drive level to the laser to achieve a certain performance. Reducing the RF attenuation level from the optimum setting may result in improved CNR, but degrades second and third order distortion products depending on the channel load. Conversely, increasing the RF attenuation level from the optimum setting may result in degraded CNR, but slightly improves second and third order distortion products depending on the channel load. When you use Manual mode, you must adjust the RF attenuator setting to meet your specific performance requirements.

Manual Equate

Manual Equate is a primary submode that equates the RF attenuator setting to the previously selected (Preset, Set, or Manual) RF attenuator setting. You can select Manual Equate from any mode. As this is a momentary submode, after the RF parameters are configured by the microprocessor, the GX2-EA1000C*/* is automatically switched to Manual. You can now make RF level adjustments, as described previously in "Manual." When you select Manual Equate, the RF attenuator value, previously stored in Manual mode, is overwritten.

Manual Equate is useful in resetting the Manual mode operating point to a known level. Its most common use is to equate the Preset mode RF attenuator setting to Manual mode.

Additional Controls and Configurations

The following subsections describe additional features of the GX2-EA1000C*/*.

Optical Output Control

You can turn the optical output power from the laser diode ON and OFF using the local interface port, the network management system, or the optional SDU. The factory default setting is ON.

RF Drive Level Control

You can turn the RF drive level to the laser diode ON and OFF. The factory default setting is ON.

When using the optical output or RF drive level ON/OFF controls, the following actions ensure that the laser is not damaged:

- If you turn the optical output power OFF, the RF drive level to the laser is automatically turned OFF and the RF drive level control is disabled.
- If the RF drive level to the laser is ON when you turn the optical output power OFF, it comes on automatically when the optical output power is restored.
- If the RF drive level to the laser is OFF when you turn the optical output power OFF, it remains off when the optical output power is restored.

Quick Swap

The quick-swap feature reduces down time by eliminating the need to manually reconfigure replacement application modules of the same type in the same housing slot. Replacement modules are recognized and updated with settings pre-stored by the GX2-CM100B control module. This feature is particularly useful in the event of module failure.

The following module-specific parameters are contained in the quick-swap message sent from the GX2-CM100B to the GX2-EA1000C*/*:

- Module alias
- RF input on/off control setting
- Optical output on/off control setting
- Primary operating mode
- Secondary operating mode
- CW/Video mode offset
- Laser RF input level control (OMI offset)
- RF attenuator setting

The GX2-EA1000C*/* reads the quick-swap message from the GX2-CM100B, automatically resets, and re-initializes itself to the same configuration as contained in the message.

- If the GX2-EA1000C*/* is in Preset mode, it uses the factory default optimum OMI setting to determine the RF level at the laser.
- If the GX2-EA1000C*/* is in Set mode, the laser RF input level control (OMI offset) determines the RF level at the laser. If the GX2-EA1000C*/* is in Manual mode, the attenuator setting determines the RF level at the laser.
- If the quick-swap message intended for the GX2-EA1000C*/* is sent to another type of module, the command is rejected and the module information is not replaced.

Instructions for selecting and implementing the quick-swap mode are provided in the GX2-CM100B Control Module Installation and Operation Manual.

Implementing a Reduced Channel Load

The GX2-EA1000C*/* performance is optimized during manufacturing for a full load of 79 NTSC channels (52 through 550 MHz) and 450 MHz of digital at –6 dBc (550 through 1002 MHz). However, some CATV systems begin optical-link operations with a reduced channel load and later add additional channels.

Operating with a reduced channel load can be advantageous, as it improves the c/n ratio. This is the method used in supertrunk applications. The c/n ratio improvement is approximately 10 x $\log_{10}$ (ratio of channels). For example, a 79-channel laser operating with a 40-channel input improves the c/n ratio by approximately 3.0 dB [10 x $\log_{10}$ (40/79)] and requires a 3.0 dB higher input level.

By carefully implementing the GX2-EA1000C*/* and additional distribution equipment, you can avoid costly field trips to reset node levels after adding channels. The following subsection presents several options to meet individual system requirements.

Implementing an Increased Channel Load

Many systems operate under a reduced channel load with the capacity to add additional channels as required. If the system initially operated with less than a full load (79 NTSC channels from 52 through 550 MHz and 450 MHz of digital at –6 dBc from 550 through 1002 MHz) and you need to increase the channel load, you may have to decrease the RF input level per channel accordingly in order to maintain an optimum drive level to the laser. The controlling factor here is total power. For a full channel load, the minimum input specification is +15 dBmV per analog channel and +9 dBmV per digital channel. This equates to a minimum total power of 34.91 dBmV. Total power is calculated for analog and digital channels separately because they are normally at different levels. These total powers are calculated using the following formulas:

$P_a = I_a + 10 \times \log_{10}(\#\text{ of analog channels})$

$P_d = I_d + 10 \times \log_{10}(\#\text{ of digital channels})$

Where:

P_a = Total Power of Analog Channels

P_d = Total Power of Digital Channels

I_a = Analog Input Level Per Channel

I_d = Digital Input Level Per Channel

These powers must now be combined to yield a total power (P_t) that will drive the laser. However, the total analog power (P_a) and the total digital power (P_d) cannot simply be added together. They must be added using power addition with the following formula:

$P_t = 10 \times \log_{10}[10^{(P_a/10)} + 10^{(P_d/10)}]$

The result of this formula should be within +/- 1dB of the minimum total power specification. If it falls outside this window, change the input levels per channel and re-calculate. Repeat this process until the answer falls within the +/- 1dB window.

To increase the channel load, you must perform *one* of the following procedures:

Using Set Mode

To implement an increased channel load using Set mode:

1. Operate the GX2-EA1000C*/* in Preset mode and apply the preferred initial channel load.
2. Allocate time for the AGC to adjust the RF drive level to the laser.
3. Select Set Equate mode to equate the Preset mode OMI setting to Set mode.
4. Set equate is a momentary mode and the GX2-EA1000C*/* soon proceeds to Set mode automatically. Based on the additional channel load required, you need to adjust the OMI [based on the equation: 10 x $\log_{10}$ (ratio of channels)] from the Preset OMI set point.
5. Perform the calculation and make the appropriate OMI offset adjustment in Set mode to maintain the same per channel power to the laser as was applied with the initial channel load.
6. The benefit of using Set mode for an increase in channel load is that you eliminate the need to re-adjust levels to each fiber node in the field.
7. Apply the planned additional channel loading.

Using Manual Mode

To implement an increased channel load using Manual mode:

1. Operate the GX2-EA1000C*/* in Manual mode.
2. Apply the preferred initial channel load.
3. Adjust the RF attenuator setting to achieve the preferred performance.
4. Apply the additional channel load.
5. Manually adjust the RF attenuator to again achieve the preferred performance.
6. Manual mode does not compensate for incidental changes in the RF input signal level and continuous monitoring and RF attenuator adjustments may be required.

Using Preset Mode (with AGC control in the GX2-EA1000C*/* and each node)

Implementation using Preset mode requires AGC control in the GX2-EA1000C*/* and in each node.

To implement an increased channel load using Preset mode:

1. Operate the GX2-EA1000C*/* in Preset mode.
2. Install an AGC option in the systems' nodes to compensate for the expected signal-level change within the dynamic range of the equipment. Allow for adequate gain reserve at the optical node during installation.
3. Apply the preferred initial channel load.

4. Allocate time for the AGC to adjust the RF drive level to the laser and to adjust the levels at the nodes.
5. Apply the additional channel load.
6. Allocate time for the AGC to adjust levels to the new channel load.
7. Additional adjustments to the GX2-EA1000C*/* should not be necessary because the node AGC maintains a constant per-channel level at the node output.

The benefit of using Preset mode with AGC for an increase in channel load is that you eliminate the need to re-adjust levels to each fiber node in the field.

Using Preset Mode (with AGC control in the GX2-EA1000C*/* only)

Implementation using Preset mode requires AGC control in the GX2-EA1000C*/* but not in each node.

To implement an increased channel load using Preset mode:

1. Operate the GX2-EA1000C*/* in Preset mode.
2. Apply the preferred initial channel load.
3. Allocate time for the AGC to adjust the RF drive level to the laser.
4. Apply the additional channel load.
5. With the GX2-EA1000C*/* in Preset mode, visit each fiber node in the field and adjust the drive levels as necessary.
6. Additional adjustments to the GX2-EA1000C*/* should not be necessary because the AGC maintains a constant total power level to the laser diode.

Network Management

The GX2-EA1000C*/* monitors selected parameters during operation and compares the measurements to a table stored in NVM. This table defines high and low limits, as well as the STATUS LED indication if a fault occurs. When a measurement exceeds the alarm limit, the STATUS LED displays the appropriate color and the fault is reported to the GX2-CM100B. You can use the network management system to further isolate fault conditions.

Table 4 identifies the default alarm limits and describes the status LED indication for given parameters.

Table 4: GX2-EA1000C*/* Alarm Conditions

Alarm Description	Status LED
RF Input Loss-of-Signal:	
Minor Low Alarm	Yellow
Optical Output Power:	
Major High Alarm	Red
Major Low Alarm	Red
TEC Temperature Deviation:	
Major High Alarm	Red
Minor High Alarm	Yellow
Minor Low Alarm	Yellow
Major Low Alarm	Red
Laser Bias Current:	
Major High Alarm	Red
Major Low Alarm	Red
TEC Current:	
Major High Alarm	Red
Major Low Alarm	Red
Module Temperature:	
Major High Alarm	Red
Minor High Alarm	Yellow
Minor Low Alarm	Yellow

Alarm Description	Status LED
Major Low Alarm	Red
Fan Speed (report for each fan):	
Minor Low Alarm	Yellow
Major Low Alarm	Red

Alarm Description	Limit	Status LED	Action
NVM CRC Error:			
Factory Data Minor Alarm	Fail	Yellow	R
Alarm Data Major Alarm	Fail	Red	R
Calibration Data Major Alarm	Fail	Red	R, S
Flash Memory Status Error:			
Major Alarm	Fail	Red	R
Boot Status:			
Major Alarm	Fail	Red	R
Hardware Error:			
Major Alarm	Fail	Red	R

Operating the GX2-EA1000C*/* with the Optional SDU

You can control and operate the GX2-EA1000C*/* using the optional SDU with display. This includes selecting any of the previously referenced control modes and the ability to monitor the numerous parameters and alarm conditions within the GX2-EA1000C*/*.

Appendix B, "Menus" provides the GX2-EA1000C*/* SDU menu structure and information on how to use the optional SDU with display.

Downloading New Firmware

The GX2-EA1000C*/* can store up to two sets of firmware programs, which you can download through the network management system. When the download is complete, the GX2-EA1000C*/* uses the new firmware for each subsequent boot up. The operator also has the option of selecting and using any stored set of firmware code at each boot up.

The network management system enables the operator to view the following information about the firmware programs stored in the GX2-EA1000C*/*:

- Firmware revision level
- Firmware code CRC
- Which set of firmware will run at the next boot up

The operator has the option of selecting a specific module or all modules of the target type for download. After all options are selected, the operator can initiate the download.

To download firmware, the network management system must be running and communicating with the GX2-CM100B. The GX2-CM100B and the network management system perform the following tasks to download the new firmware:

- The network management system reads the firmware download file selected by the operator and verifies the program code CRC. The software reads the target module type and firmware revision to be downloaded from the file and displays this information for operator verification.
- The network management system transfers the download firmware and selected options to the GX2-CM100B. The GX2-CM100B verifies that the firmware was transferred correctly and that the selected options are valid. If the GX2-CM100B detects any errors it responds with an error message to the network management system. From this point on, the firmware download is handled exclusively by the GX2-CM100B.
- Following firmware verification, the GX2-CM100B begins the firmware download to the target modules. It monitors the programming of new firmware and reports any errors. It also sends a message informing the network management system that the firmware download was successful.
- The GX2-CM100B is now ready to reset the GX2-EA1000C*/* to run the new firmware program. The operator can determine whether the reboot is immediate or occurs at a later time following the issuance of a reset command. This option enables the operator to choose between immediate, delayed, or scheduled reboots.

The GX2-EA1000C*/* continues to operate normally during a firmware download, which is transparent to the operator and the network management system.

Refer to the GX2-CM100B Control Module, "Installation and Operation Manual" and the Network Management System, "Instruction Manual" for additional information regarding the downloading of firmware.

Full Spectrum Multi-Wavelength Application

When using the GX2-EA1000C*/* for full spectrum multi-wavelength applications, it is necessary to use the recommended wavelength plan to maintain performance and to eliminate four-wave mixing products produced in the fiber optical cable. Four-wave mixing (FWM) is a third order non-linearity comparable to the CTB intermodulation exhibited in electrical systems that is caused by the power sensitive refractive index of optical fiber. FWM occurs when multiple wavelengths interact and generate mixing products that fall at one or more of the existing channels, which in turn generates crosstalk and distortion at those channels. Four-wave mixing is most troublesome in systems that launch at high powers and utilize a large number of densely packed wavelengths in low dispersion environments.

Motorola recommends the following channel plan when doing multi-wavelength applications:

- For 2 wavelengths over a single fiber use Channels 29, 31
- For 4 wavelengths over a single fiber use Channels 29, 31, 33, 35
- For 8 wavelengths over a single fiber use Channels 21, 22, 24, 27, 29, 31, 33, 35
- For 12 wavelengths over a single fiber use Channels 21, 22, 24, 27, 29, 31, 33, 35, 41, 45, 50, 54
- For 16 wavelengths over a single fiber use Channels 21, 22, 24, 27, 29, 31, 33, 35, 41, 45, 50, 54, 55, 56, 57, 59

With this recommendation, it would make sense for pay-as-you grow systems to start with Ch 29 or Ch 31 as a single wavelength and grow from there.

Understanding the impacts of FWM, Motorola has incorporated functionality into the GX2-EA1000C*/* product line to reduce these issues by offsetting select channels within the ITU channel bandwidth. This offset does not impact the ability to use standard filter MUX and DEMUXES.

Dispersion Compensation

With the technology used in the GX2-EA1000C*/* there is no need to have internal or external dispersion compensation. In some rare instances of very long distance links there have been cases where a DCM module has helped out with performance, but we recommend you consult your sales representative to help you with your system design to ensure the GX2-EA1000C*/* is giving you the best performance possible.

5 Troubleshooting

This section provides troubleshooting procedures for the GX2-EA1000C*/*. You can use the procedures to correct minor problems or better define the malfunction. If the error condition cannot be corrected, contact the TRC at 1-888-944-HELP (1-888-944-4357). Before you call, record the input signal levels, optical output power, operating mode(s), and ambient temperature. This information is most useful to the TRC and repair facility in troubleshooting and repairing your GX2-EA1000C*/*.

The GX2-EA1000C*/* is a self-contained unit; therefore, when a problem is diagnosed within the module, the entire GX2-EA1000C*/* must be returned for repair. See Section 1, "Introduction" for information on equipment return.

Using the Status LED

Table 5 lists the troubleshooting checks you can perform using the STATUS LED only. It is assumed that an SDU, network management system, or local access port are not available. If these additional options are available, this table can be used in conjunction with Table 6.

To use Table 5, identify the symptom and then perform the checks in the order listed under that symptom. For example:

- If the front-panel STATUS LED is yellow, indicating a minor alarm, go to the yellow column.
- Find ① and perform that check (Verify SC/APC connector . . .)
- Continue performing all checks in the yellow column, in the order given, to help identify the cause of the minor alarm and if possible, fix the problem.

Table 5: Troubleshooting using the status LED only

Symptom					Corrective Action
Status LED Indication				Poor RF Response	
Flashing Red	Red	Yellow	Not Lit		
①					Microprocessor boot up failure. Reseat the GX2-EA1000C*/* in the GX2-HSG* slot or in a known good slot. If still flashing red, return the GX2-EA1000C* for repair.
			①		Check the status LEDs on other GX2 application modules in the GX2-HSG*. If they are not lit, verify that power is applied to the system.
	①				Check the status LEDs on other GX2 application modules in the GX2-HSG*. If they are also red, a possible GX2 system-powering problem may exist. Perform the following checks before contacting the TRC.
		①			Check the STATUS LEDs on other GX2 application modules in the GX2-HSG*. If they are also yellow, a possible system powering problem may exist. Perform the following checks before contacting the TRC.
				①	Verify that the interface connector and optical bulkhead connector on the GX2-EA1000C*/* are clean. See Section 3, "Installation and Setup" for the cleaning procedure. Ensure that you follow all safety precautions when cleaning the interface connector and optical bulkhead.
	②				A red LED indicates that the signal level may be too high. Measure the input signal level at RF TP1 and verify that it is within the acceptable specification limit noted in Appendix A, "Specifications." Readjust the input signal as required.
		②			A yellow LED indicates that the signal level may be too low. Measure the input signal level at RF TP1 and verify that it is within the acceptable specification limit noted in Appendix A, "Specifications." Readjust the input signal as required.
	④				Measure the optical output power using an optical power meter. If marginal compared to the appropriate module specification in Appendix A, "Specifications" then verify that the interface connector and optical bulkhead connector are clean. See Section 3, "Installation and Setup" for the cleaning procedure. Ensure that you follow all safety

Symptom					Corrective Action
Status LED Indication				Poor RF Response	
Flashing Red	Red	Yellow	Not Lit		
					precautions when cleaning the interface connector and optical bulkhead. If the optical level is still low contact the TRC.
	⑤	④			Observe the ambient operating temperature. Verify that the fans on the rear panel are running. This may specifically indicate a problem within the GX2-EA1000C*/*. Contact the TRC.
	⑥	⑤	②		Verify that the GX2-EA1000C*/* is seated correctly in the equipment shelf and the thumbscrew is fully tightened.
	⑦	⑥	③		Reseat the GX2-EA1000C*/* by removing it and reinstalling it in its designated GX2-HSG* slot.
				②	Check for proper input-signal flatness using RF TP.
			④		Relocate the GX2-EA1000C*/* to a known good GX2-HSG* slot.
②	⑧	⑦	⑤	③	Contact the TRC for additional support.

Using Available Options

Table 6 lists the troubleshooting checks available and identifies the reported alarm condition displayed through the optional SDU, network management system, or local access port.

To use Table 6, refer to the appropriate row and column in the table. Perform the necessary checks and make any suggested adjustments to resolve the problem. If the problem persists, note the value in the "Reported Value" column. This information is useful when seeking additional help from the TRC.

Table 6: Troubleshooting — Using Available Options

Alarm Condition	Status LED	Reported Value	Corrective Action
RF Input Loss-of-Signal:			
Minor Low Alarm	Yellow		
Optical Output Power:			
Major High Alarm	Red		
Optical Output Power:			
Major Low Alarm	Red		
TEC Temperature Deviation:			
Major High Alarm	Red		
TEC Temperature Deviation:			
Minor High Alarm	Yellow		
TEC Temperature Deviation:			
Minor Low Alarm	Yellow		
TEC Temperature Deviation:			
Major Low Alarm	Red		
Laser Bias Current:			
Major High Alarm	Red		
Laser Bias Current:			
Major Low Alarm	Red		
TEC Current:			
Major High Alarm	Red		

Alarm Condition	Status LED	Reported Value	Corrective Action
TEC Current:			
Major Low Alarm	Red		
Module Temperature:			
Major High Alarm	Red		
Module Temperature:			
Minor High Alarm	Yellow		
Module Temperature:			
Minor Low Alarm	Yellow		
Module Temperature:			
Major Low Alarm	Red		
Fan 1 Speed:			
Minor Low Alarm	Yellow		
Fan 1 Speed:			
Major Low Alarm	Red		
Fan 2 Speed:			
Minor Low Alarm	Yellow		
Fan 2 Speed:			
Major Low Alarm	Red		

Specifications

Specifications for the GX2-EA1000C*/* are valid over the given bandwidth and operating temperature range listed in this section. The current Motorola Product Catalog may contain additional information not listed below.

RF

RF bandwidth	52 through 1003 MHz
RF input impedance	75 Ohms
RF input return loss	16 dB minimum
Broadcast input-analog	+15 ±0.5 dBmV/ch for 79 NTSC channels plus 450 MHz of digital at –6 dBc
Narrowcast input	Gain is -6 dB relative to Broadcast input
Main RF input test point	–20 ±0.5 dB relative to main RF input port
AGC range	12 dB (2 dB below the nominal input to 10 dB above the nominal input)

Optical

Optical wavelength	ITU Grid Channels 18 – 62
Laser shutdown	Enable/disable through the control module, SDU, or network management software
Eye protection	Optical safety shutter
Optical power	9-11 dBm

Power

Power consumption	13.5 W typical / 17 W maximum

Environmental

Operating temperature range	0°C to +50°C (32°F to +122°F)

Storage temperature range	–40°C to +80°C (–40°F to +176°F)
Over temperature laser protection	Software and hardware active

Physical

Dimensions	1″W × 5.9″H × 14.6″D (2.5 cm × 15 cm × 37.1 cm)
Weight	2.0 lbs. (1 kgs)

GX2-EA1000C*/* Models

Figure 16 identifies the conventions for the model numbers of the GX2-EA1000C*/*.

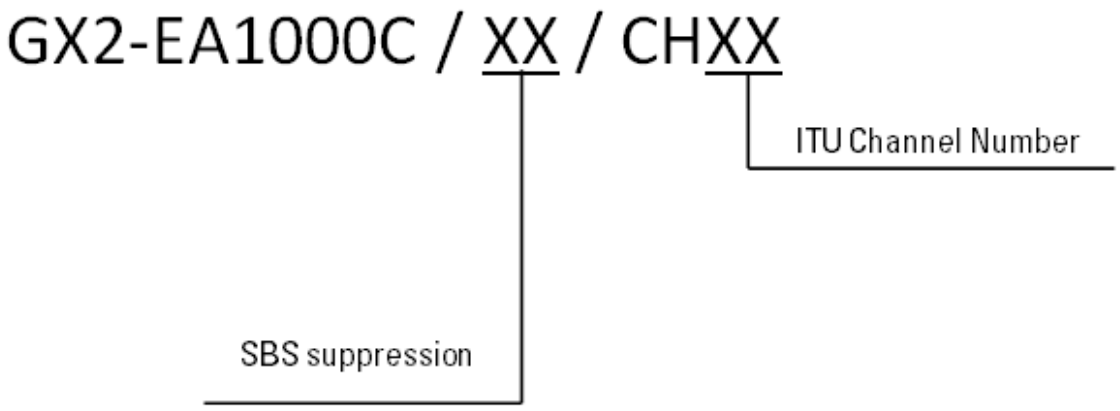


Figure 16: GX2-EA1000C*/* Model Number Conventions

B Menus

This appendix provides information about:

- Using the GX2-EA1000C*/* menus
- The menu structure
- Using the optional SDU with display

Table 7: Using the GX2-EA1000C*/* Menus

Action	How To
Scroll through the top-level menu	Press the up or down arrows to scroll through RF/OPTICAL, MODULE STATUS, MODULE INFO, and REMOTE.
Enter a level two menu from the top-level menu	Press the right arrow. Then press the up and down arrows to scroll through the level two menu.
Change a parameter value	Press the right arrow to enter edit mode. Use the up and down arrows to change the value. Press ENTER to save the new value or press the left arrow to exit edit mode without changing the value. If you press no key for 10 to 15 seconds, you exit edit mode with the value unchanged.
Go up from level two to level one	Press the left arrow.

The following subsections provide the menu structure.

RF/OPTICAL Menu

MODE	PRESET|SET|SET EQUATE|MANUAL| MANUAL EQUATE	
SIGNAL TYPE	CW|VIDEO	
CW / VIDEO OFFSET	1dB|2dB|3dB|4dB|5dB	
OPTICAL OUTPUT	ON|OFF	
RF INPUT	ON|OFF	
ATTENUATOR SETTING	xx.y dB	Can only be changed in manual mode.
OMI OFFSET CONTROL	xx.yy dB	Can only be changed in set mode.
OMI OFFSET MONITOR	xx.yy dB	
OPTICAL POWER	*xx.y* dBm	
LASER BIAS CURRENT	xx.y mA	
LASER TEMP	xx.y C	
TEC CURRENT	xxx.y mA	
FACTORY DEFAULT RESET	OFF|ON	

MODULE STATUS Menu

MODULE TEMP	xx.y C
12V CURRENT	xxx.y mA
FAN 1 SPEED	xxxxx.y RPM
FAN 2 SPEED	xxxxx.y RPM

MODULE INFO Menu

ALIAS	THIS-ALIAS (OMNISTAR GX2-EA1000C LASER MODULE)
MODEL	GX2-EA1000C*
SERIAL NUMBER	0123456789ABCDEF
DATE CODE	mm/dd/yyyy
FIRMWARE REVISION	XX
HARDWARE REVISION	XX

C Status Reporting

This appendix provides information on status reporting messages for the Element Management System and shelf display. The event and display messages on the GX2-EA1000C* are listed in Table 9.

Table 8: Event/Alarm messages for the GX2-EA1000C*/* Transmitter

EMS Event Message	SDU Display Message	Status LED	Event
RF Input Loss-of-Signal:			
Minor Low Alarm	Yellow		
Optical Output Power:			
Major High Alarm	Red		
Optical Output Power:			
Major Low Alarm	Red		
TEC Temperature Deviation:			
Major High Alarm	Red		
TEC Temperature Deviation:			
Minor High Alarm	Yellow		
TEC Temperature Deviation:			
Minor Low Alarm	Yellow		
TEC Temperature Deviation:			
Major Low Alarm	Red		
Laser Bias Current:			

EMS Event Message	SDU Display Message	Status LED	Event
Major High Alarm	Red		
Laser Bias Current:			
Major Low Alarm	Red		
TEC Current:			
Major High Alarm	Red		
TEC Current:			
Major Low Alarm	Red		
Module Temperature:			
Major High Alarm	Red		
Module Temperature:			
Minor High Alarm	Yellow		
Module Temperature:			
Minor Low Alarm	Yellow		
Module Temperature:			
Major Low Alarm	Red		
Fan 1 Speed:			
Minor Low Alarm	Yellow		
Fan 1 Speed:			
Major Low Alarm	Red		
Fan 2 Speed:			
Minor Low Alarm	Yellow		

EMS Event Message	SDU Display Message	Status LED	Event
Fan 2 Speed:			
Major Low Alarm	Red		

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