



# SUPRALink™ 7110-Exx

Optical Transmitter

Installation Guide

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15, Subpart B of the Federal Communications Commission (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. It may cause harmful interference to radio communications if it is not installed and used in accordance with the instructions in this manual. Operation of this equipment in a residential area is likely to cause harmful interference. If this occurs, the user will be required to correct the interference at his or her own expense.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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Harmonic will ensure that its products will be either reused or recycled in compliance with the WEEE Directive. For the latest information concerning Harmonic's WEEE/RoHS Compliance Policy and its Recycling and Take-Back process, please visit our web site.



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部件名称 (Part name)	有毒有害物质或元素 (Hazardous Substance)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (CrVI)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (Printed Circuit Assemblies)	X	O	O	O	O	O
机械组件 (Mechanical Subassemblies)	X	O	O	O	O	O
光学组件 (Optical Subassemblies)	X	O	O	O	O	O
电源 (Power Supplies)	X	O	O	O	O	O
缆线 / 线束 (Cables, harnesses)	X	O	O	O	O	O
屏幕 / 显示器 (Screens, Monitors)	X	O	O	O	O	O
金属零件 (Metal Parts)	O	O	O	O	O	O
塑料 / 发泡材料 (Plastics, foams)	O	O	O	O	O	O
电池 (Batteries)	X	O	O	O	O	O

O: 表示在该部件的所有均质材料中，此类有毒有害物质的含量均小于 SJ/T11363-2006 标准所规定的限量。

O: Indicates the content of the toxic and hazardous substances at the homogeneous material level of the parts is below the limit defined in SJ/T11363 2006 standard.

X: 表示至少在该部件的某一均质材料中，此类有毒有害物质的含量超出 SJ/T11363-2006 标准规定的限量。

X: Indicates that the content of the toxic and hazardous substances in at least one of the homogeneous materials of the parts is above the limit defined in SJ/T11363 2006 standard.

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## Standards and Agency Approval

The following tables list regulatory standards and agency approvals:

### North America

Standards
EMI: FCC Part 15, Subpart B; Class AICES-003, Issue 2, Class A
Safety: UL 60950-1, CSA 60950-1, 21 CFR 1040 (CDRH)

### Europe

Standards
EMI/EMC: EN55022, EN55024, EN 6100-3-2, EN6100-3-3
Safety: EN 60950-1, EN 60825-1

### Japan

Standards
EMI: VCCI V-3 / 2007.04

### Australia and New Zealand

Standards
EMI: AS/NZS- CISPR 22:2205

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## Documentation Conventions

This manual uses some special symbols and fonts to call your attention to important information. The following symbols appear throughout this manual:



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**DANGER:** The Danger symbol calls your attention to information that, if ignored, can cause physical harm to you.

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**CAUTION:** The Caution symbol calls your attention to information that, if ignored, can adversely affect the performance of your Harmonic product, or that can make a procedure needlessly difficult.

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**LASER DANGER:** The Laser symbol and the Danger alert call your attention to information about the lasers in this product that, if ignored, can cause physical harm to you.

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**NOTE:** The Note symbol calls your attention to additional information that you will benefit from heeding. It may be used to call attention to an especially important piece of information you need, or it may provide additional information that applies in only some carefully delineated circumstances.

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**TIP:** The Tip symbol calls your attention to parenthetical information that is not necessary for performing a given procedure, but which, if followed, might make the procedure or its subsequent steps easier, smoother, or more efficient.

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In addition to these symbols, this manual uses the following text conventions:

- `Data Entry`: indicates text you enter at the keyboard.
- `User Interface`: indicates a button to click, a menu item to select, or a key or key sequence to press.
- `Screen Output`: shows console output or other text that is displayed to you on a computer screen.
- **Bold**: indicates the definition of a new term.
- *Italics*: used for emphasis, cross-references, and hyperlinked cross-references in online documents.

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## **Appendix B HLP 4200 and HLP4800 Menu Display**

### 1.1 About This Manual

This instruction manual is a complete guide to installation, configuration and operation of the SUPRALink SPL 7110-Exx. The models that are covered by this manual are listed in Appendix A, Section A.8.

- Chapter 1, *Overview* provides a description of the SPL 7110-Exx.
- Chapter 2, *Installing the SPL 7110-Exx Transmitter* describes the installation procedure.
- Chapter 3, *User Interface Options* introduces the user interfaces.
- Chapter 4, *Transmitter Setup* describes how to set up and configure the transmitter.
- Chapter 5, *Maintenance* outlines maintenance procedures.
- Chapter 6, *Troubleshooting* provides instructions on what to do in the event of problems.
- Appendix A, *Technical Specifications* provides complete technical specifications.
- Appendix B, *HLP 4200 and HLP4800 Menu Display* shows additional user interface details.

### 1.2 Description

The SPL 7110-Exx transmitter is a compact plug-in module designed for use in the Harmonic HLP 4200 and 4800 equipment platform. An HMC 4001 module carrier is needed to mount the transmitter in the platform. Harmonic has optimized the SUPRALink family of transmitter modules for high-performance transmission of RF broadband information over optical fiber networks.

The SPL 7110-Exx has the following key features:

- Selection of eight DWDM wavelengths
- Transmission bandwidth from 50 to 1003 MHz
- Electronic dispersion compensation for high channel loads with minimal fiber-induced, second-order distortion
- Compensation up to 40 km, with up to 950 MHz total RF load
- SPL7110S-EXX is optimized for NTSC channel loading: 78 NTSC (System M) analog channels plus 75 channels of QAM256 digital loading
- SPL7110C-EXX is optimized for Cenelec channel loading: 41 Cenelec analog channels plus 56 channels of QAM256 digital loading
- Internal monitoring and control using 32-bit microprocessor
- Local control of operating parameters—provided by the HLP 4200 and 4800 platform
- Remote control and monitoring—provided by NETWatch Site Controller
- Autosetup feature that adjusts RF pad for optimum modulation performance
- Automatic gain control and manual gain control modes of operation

Figure 1-1 shows front and rear panel features of the SPL 7110-Exx transmitter module.



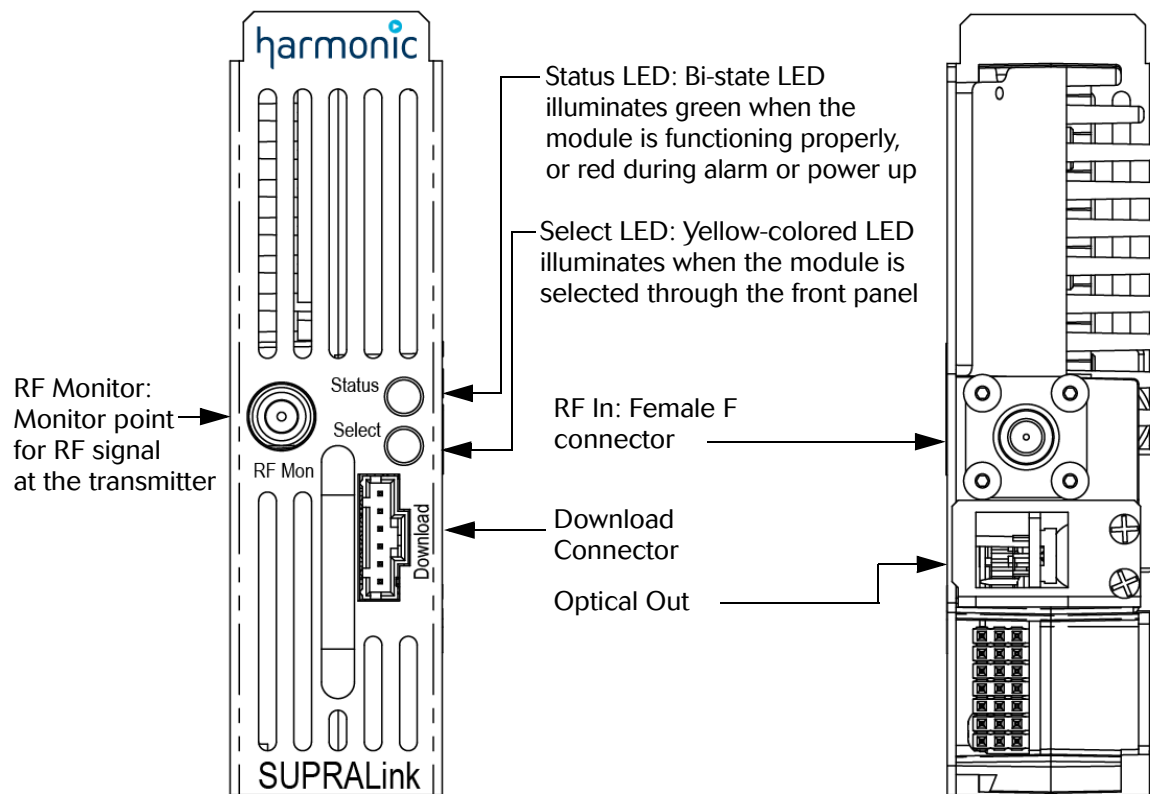
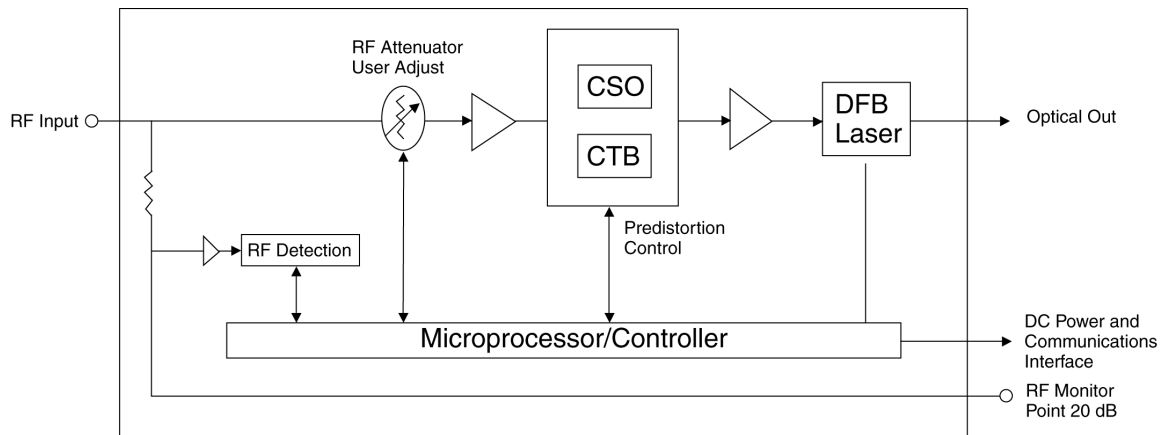


Figure 1-1: SPL 7110-Exx front and rear panel features

Transmitter performance is optimized by combining state-of-the-art 1550 DWDM distributed feedback (DFB) laser technology and patent pending, pre-distortion linearization circuitry. Harmonic has designed the SUPRALink family for integration into networks with advanced element management systems; each transmitter module employs a microprocessor-based communication and monitoring architecture. Figure 1-2 is a block diagram of the SPL 7110-Exx transmitter.

The transmitter's microprocessor continuously monitors and controls all critical transmitter parameters in order to optimize performance over both time and temperature changes. The microprocessor-controlled parameters include:

- Input signal attenuation pad
- Laser power, temperature, and bias
- Electrical circuit temperature and setpoints



SPLBLD\_rev01.ai

Figure 1-2: SPL 7110-Exx block diagram

The SPL 7110-Exx transmitter is a compact plug-in module that mounts easily in Harmonic's HLP 4200 and HLP 4800 platform via the HMC 4001 module carrier.

For additional information on the HLP 4200 platform and HLP 4800 platform and its associated communication and power buses, see the *HLP 4200 Instruction Manual* or the *HLP 4800 Users's Guide*.

## 1.3 Applications

The SPL 7110-Exx transmitter is designed to operate in multi-wavelength systems allowing fiber conservation or reclamation. The 1550nm DWDM optical signal transmitted by a SUPRALink DWDM module must be combined and separated using Harmonic passive multiplexor and demultiplexor optical modules. A complete family of passive optical products is available for network design.

Figure 1-3 and Figure 1-4 show two typical applications of the SPL 7110-Exx. Broadcast signals and QAM signals from a cable modem termination system (CMTS), cable telephony, or video-on-demand server are combined and used to drive the SPL 7110-Exx. The optical outputs from multiple SPL 7110-Exx are combined into a single fiber using a dense wavelength division multiplexor (DWDM).

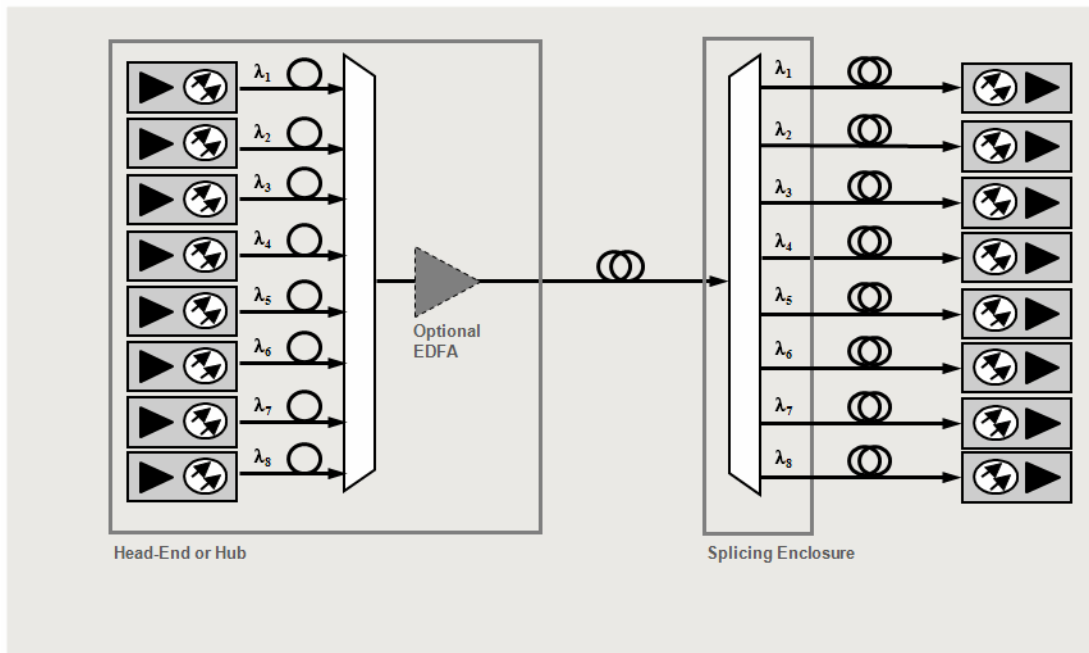


Figure 1-3: Application Example 1

In both applications, the combined optical wavelengths are transported to the hub, where they are demultiplexed and fed into multiple nodes. In Figure 1-3, the return path signal is carried on a separate fiber (not shown) from the forward path signal. In Figure 1-4, the return signal is carried on the same fiber as the forward path signal.

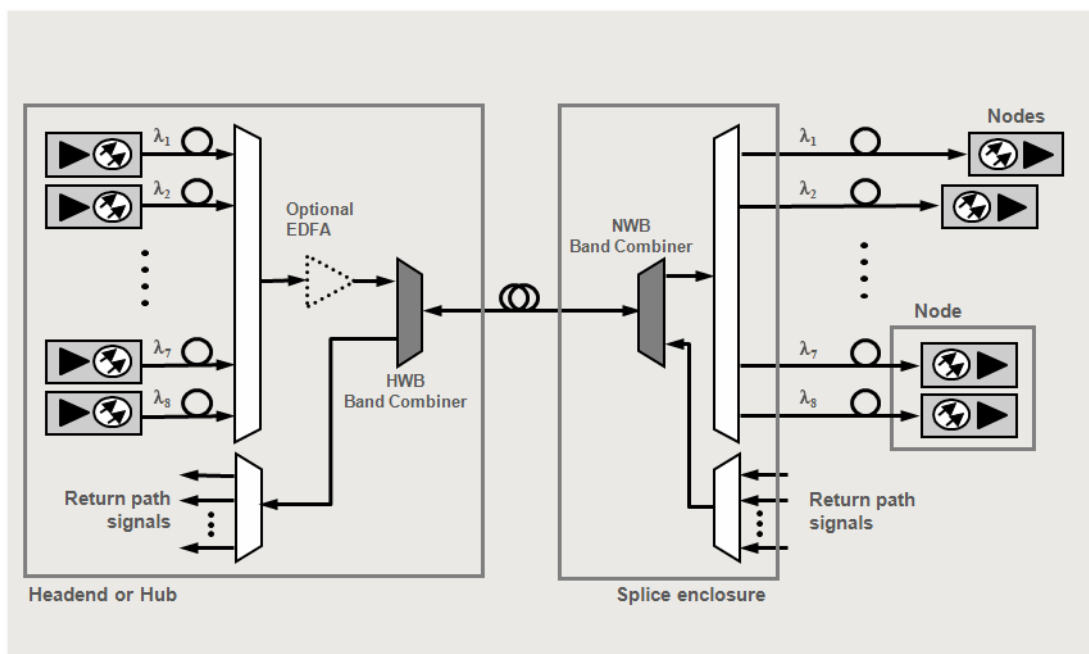


Figure 1-4: Application Example 2

In multiwavelength applications, the launch power into the fiber and the total fiber distance may need to be limited and the analog content on each wavelength must be identical to avoid detrimental non-linear fiber optic effects. Consult your Harmonic applications engineer for more details.

# Installing the SPL 7110-Exx Transmitter

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This chapter describes how to:

- Receive and inspect the SUPRALink 7110-EXX Series
- Install the transmitter module in the HLP 4200 and HLP 4800 platform
- Connect the fiber cable
- Connect the RF broadband input
- Test RF signal input

## 2.1 Receiving and Inspecting

As you unpack your unit, inspect the shipping container and equipment for damage. Save the shipping material for future use.

If the container or the equipment is damaged, notify both the freight carrier and Harmonic. (see [Contacting Harmonic Support](#) on page 31 for contact information).




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**CAUTION:** Before removing equipment from its antistatic bag, touch a ground point for several seconds. A suitable ground point is an unpainted part of the chassis of a grounded piece of equipment.

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## 2.2 Installing the Transmitter Module



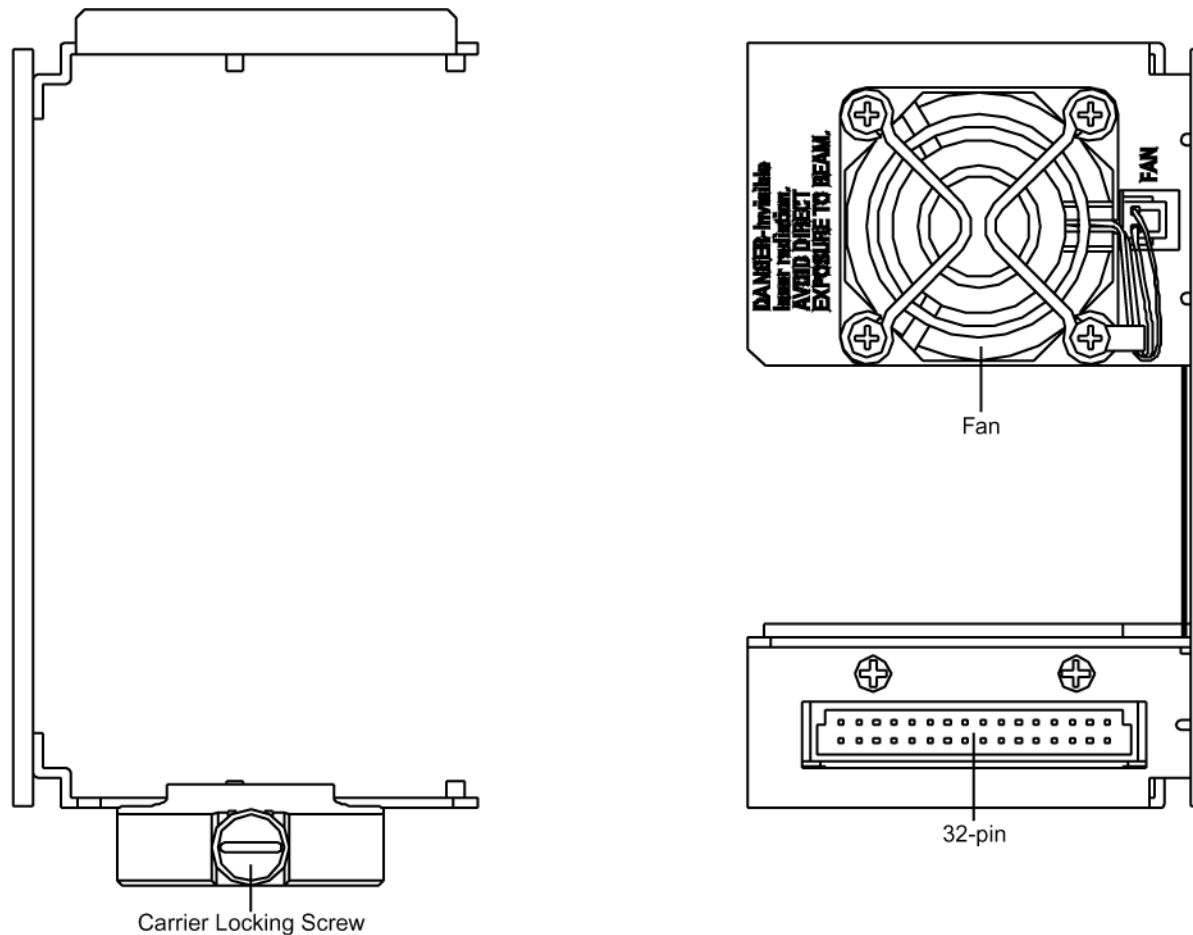

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**CAUTION:** To protect yourself from potential injury and to protect the equipment from further damage, do not perform any operational tests if the equipment appears to be damaged.

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The SPL 7110-Exx transmitter module plugs into the HMC 4001 module carrier, shown in [Figure 2-1](#) on page 14. The transmitter module is held in the carrier by a spring-loaded tab on the front handle of the carrier. You can place the HMC 4001 carrier into any desired position in the HLP 4200 and HLP 4800 platform.

The SPL 7110-Exx module can be plugged into the carrier either with the carrier already mounted in the HLP 4200 and HLP 4800 platform, or prior to mounting the carrier into the platform. The HLP 4200 and HLP 4800 platform can be powered and operational during the plug-in process.



**Figure 2-1: HMC 4001 module carrier front and rear panel features**

To install the transmitter module in the HMC 4001 carrier:

- Insert the transmitter into the carrier until it locks into position.

To remove the transmitter module from the HMC 4001 carrier:

- Press down the spring-loaded tab on the carrier, then pull out the module.

To install the HMC 4001 carrier in the HLP 4200 and HLP 4800 platform:

1. Lower the HLP 4200 platform's control/display panel.
2. Slide the HMC 4001 carrier into any available slot in the platform until it is properly seated.
3. Lock the carrier into position with the carrier locking screw, shown in Figure 2-1.

The SPL 7110-Exx receives power from the HMC 4001 carrier. The carrier is powered by the +24 VDC bus of the HLP 4200 and HLP 4800.

For additional information on the HLP 4200 platform and HLP 4800 platform and its associated communication and power buses, see the *HLP 4200 Instruction Manual* or the *HLP 4800 User's Guide*.

## 2.3 Connecting the Fiber Cable

To proceed with installation, connect the fiber optic cable to the transmitter output. The optical output connector of the SPL 7110-Exx is located on the rear of the module, as shown in [Figure 1-1](#) on page 9.



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**DANGER:** Invisible Laser Radiation. **AVOID EXPOSURE TO BEAM.** Never operate unit with a broken fiber or with a fiber connector disconnected.

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To connect fiber optic cable to the transmitter output:

1. Verify that the transmitter module has been mounted into the HLP platform, as described in Section 2.2..
2. Determine the connector type on the SPL 7110-Exx. The standard optical connector recommended by Harmonic is SC/APC. Other connector types can be special ordered.
3. Verify that the type of connector on the fiber cable is the same as what is on the SPL 7110-Exx, for example, SC/APC.
4. Verify that the fiber cable connector has been cleaned properly. If the fiber cable connector needs to be cleaned, follow the cleaning procedure outlined in Section [5.1.1 Cleaning Patch Cord or Pigtail Fiber Optical Connectors](#) on page 28.
5. Verify that the SUPRALink optical connector has not been exposed to any contamination. If you suspect that the connector may have been exposed to contamination (for example, by a dirty fiber cable connector), follow the cleaning procedure outlined in Section [5.1.2 Cleaning Transmitter Module Optical Connectors](#) on page 28.



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**NOTE:** Any contamination of either the fiber cable or SPL 7110-Exx connector can significantly degrade optical link performance. This degradation will most likely manifest itself as poor carrier-to-noise (CNR) performance.

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6. For SC-type optical connectors, note the key characteristics of the mating connectors and align them accordingly. Gently insert the fiber cable connector into that of the SPL 7110-Exx until the connector clicks into place.

For FC-type optical connectors, note the key characteristics of the mating connectors and align them accordingly. Gently insert the fiber cable connector into that of the SPL 7110-Exx and tighten the rotating sleeve of the connector. *Do not overtighten!*

## 2.4 Connecting the RF Broadband Input

The SPL 7110-Exx broadband RF connector is located on the rear panel of the module, as shown in [Figure 1-1](#) on page 9.

The SPL 7110-Exx female F connector accepts a 75 ohm impedance coaxial cable terminated with a male F-type connector. The male F connector on the cable should have a center pin diameter in the range of 0.64 mm to 0.8 mm.



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**NOTE:** To ensure performance integrity, use RG-59 coaxial cable. Use of a connector with a center pin diameter greater than 0.8 mm can damage the input RF connector.

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Insert the signal source connector into the SPL 7110-Exx module RF input connector and tighten securely.

For the SPL7110S-EXX, the input video signal level must be between 15 and 20 dBmV per analog video channel based on 78 NTSC channels with 450 MHz digital QAM channels.

For the SPL7110C-EXX, the input video signal level must be between 16 and 20 dBmV per analog video channel based on 41 Cenelec channels with 56 digital QAM channels..

## 2.5 Testing RF Signal Input

Once you have connected the RF signal source, you can use the RF monitor to verify the presence of the RF signal input to the transmitter. The RF monitor is a test connector (female F-type) located on the front panel of the transmitter module, as shown in [Figure 1-1](#) on page 9. The monitor level is 20 dB below the input level to the transmitter  $\pm 1.0$  dB.



This chapter describes:

- HLP 4200 or 4800 display
- NETWatch Site Controller
- Front panel LED indicators

Each SUPRALink 7110-Exx Series module employs a microprocessor, which makes it easy for you to communicate with and control the transmitter. This chapter describes three options for such communication and control. The options are:

- **HLP 4200 and HLP 4800 push buttons and display**

The HLP 4200 and HLP 4800 interface provides the most comprehensive means of monitoring and controlling SPL 7110-Exx performance. The Autosetup and Reset to Factory Settings commands are available only through this interface. For initial setup of the transmitter, Harmonic recommends using the HLP 4200 or HLP 4800 display, if available.

- **NETWatch Site Controller Element Management System**

Once installed and configured, NETWatch Site Controller provides a straightforward way to monitor and control a network of multiple SPL 7110-Exxs, either locally or remotely.

### 3.1 HLP 4200 and HLP 4800 Display

The SPL 7110-Exx can be configured and monitored conveniently via the push buttons and LCD display of the HLP 4200 and HLP 4800 equipment platform.

Figure 3-1 provides a flowchart of the commands and messages in the Main menu, which is at the top of the HLP 4200 and HLP 4800 platform interface hierarchy. In this figure, push-button commands are framed in ovals, and resultant display messages are framed in rectangular boxes.

Use the Main menu to scan through platform positions and select a specific transmitter module to monitor and control. Instructions for navigating the Main menu are provided in Section [4.4.1 Step-by-Step Setup Instructions](#) on page 24.2

After you navigate the HLP 4200 and HLP 4800's Main menu and select a specific SPL 7110-Exx module, the Transmitter menu appears. The Transmitter menu is organized into four sub-menus:

- Transmitter Status
- Transmitter Setup
- Transmitter Adjustments
- Transmitter Alarms

These sub-menus are described below in Section 3.1.1. through Section 3.1.4..

[Figure 3-1](#) on page 19 shows the information and controls available in the Transmitter menu. For further details, see Appendix B, *HLP 4200 and HLP4800 Menu Display*, which contains a fully detailed chart of the menu display.

The status and control parameters in the Transmitter menu apply only to the specific transmitter module that is selected. Use the HLP 4200 and HLP 4800's ▲ and ▼ buttons to scroll through the menus. Use the Enter button to make a selection. Use the Esc button to escape any menu.

For additional information on the HLP 4200 platform and HLP 4800 platform and its associated communication and power buses, see the *HLP 4200 Instruction Manual* or the *HLP 4800 User's Guide*.

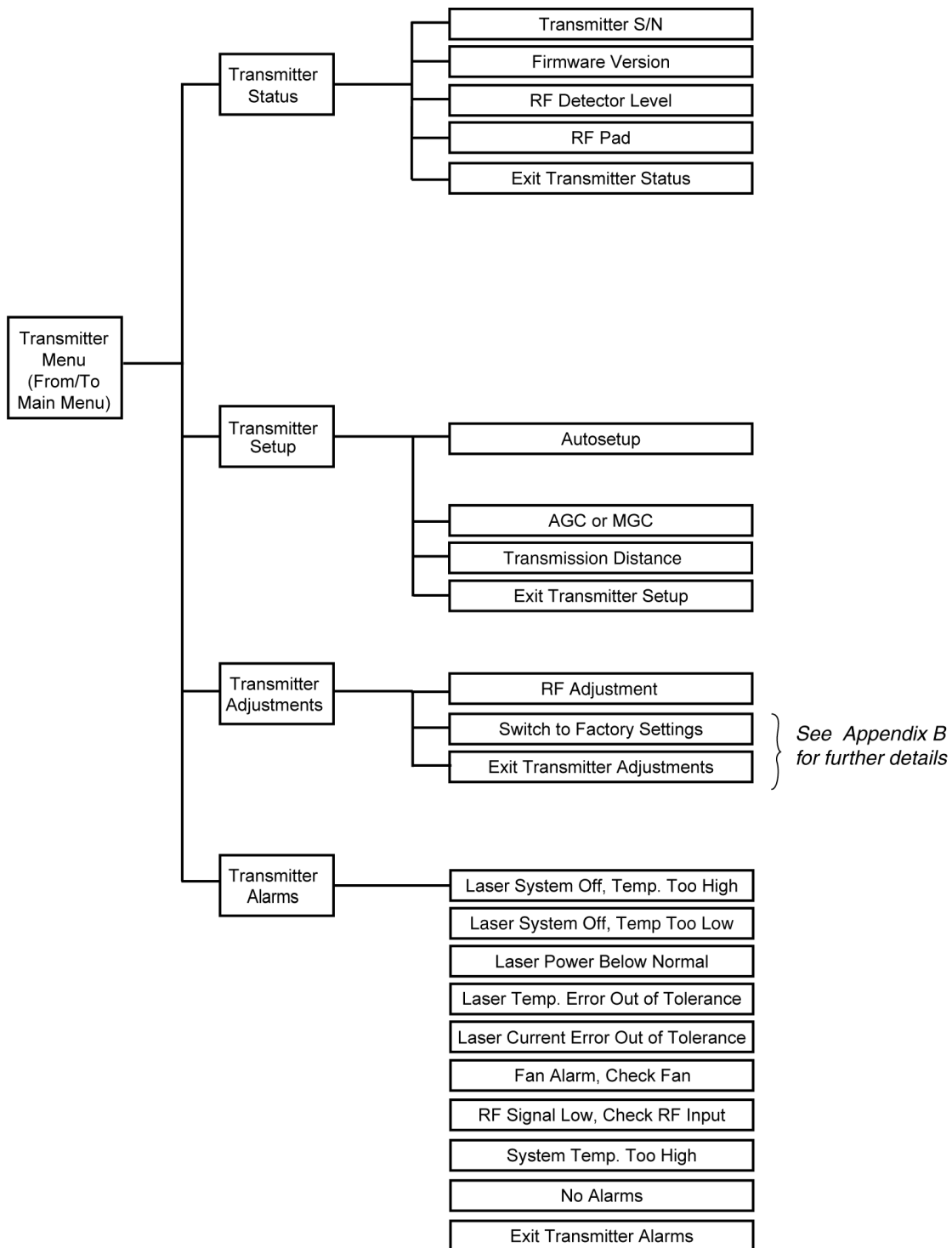


Figure 3-1: HLP 4200 and HLP 4800 platform Transmitter menu display chart

### 3.1.1 Transmitter Status

The Transmitter Status menu lets you obtain the transmitter serial number, firmware version, and basic operating mode parameters.

### 3.1.2 Transmitter Setup

The Transmitter Setup menu allows you to:

- Run the Autosetup routine
- Select Manual Gain Control (MGC) or Automatic Gain Control (AGC) mode of operation
- Enter the transmission distance

### 3.1.3 Transmitter Adjustments

The Transmitter Adjustments menu allows you to:

- Adjust and optimize the RF pad settings
- Set the RF input low level alarm limit
- Restore all transmitter parameters to the original factory settings

### 3.1.4 Transmitter Alarms

The Transmitter Alarms menu displays the active alarms in the transmitter.



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**NOTE:** If an alarm condition is triggered in a specific transmitter module, when that transmitter is selected through the HLP 4200 and HLP 4800 interface, the display automatically jumps to the alarm message within the Transmitter Alarms menu.

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## 3.2 NETWatch Site Controller

Harmonic's NETWatch Site Controller provides a complete element management system, including a Windows™-based GUI and communications package for monitoring and controlling a network of multiple SPL 7110-Exx transmitters either remotely or locally. For information on installing and using this system, consult the *NETWatch Site Controller Instruction Manual*.

## 3.3 Front Panel LED Indicators

The SPL 7110-Exx front panel includes two LEDs, as shown in [Figure 1-1](#) on page 9.

- The *Status* LED illuminates red if an alarm condition exists within the transmitter, and for a short period during power up. The *Status* LED illuminates green if no alarm condition exists and the transmitter is operating normally.
- The *Select* LED illuminates yellow when the transmitter module is selected via the front panel controls of the HLP 4200 and HLP 4800.

This chapter describes how to set up a SUPRALink 7110-Exx Series for optimum performance. Any of the user interface options described in Chapter 3, *User Interface Options*, can be used for transmitter setup. The first half of this chapter describes transmitter features and setup options. The second half of the chapter details the setup procedure for each of the user interface options.

This chapter describes:

- Factory-optimized settings of the SPL 7110- Exx
- Fine-tuning the transmitter
- Autoseup, Automatic Gain Control, and Manual Gain Control
- How to set up via the HLP 4200 and HLP 4800 display
- How to set up via NETWatch Site Controller

**NOTE:** For initial setup of the transmitter, Harmonic recommends using the HLP 4200 and HLP 4800 platform's push buttons and display, if available. If you are using another platform (such as 4200ND) that does not have a display, the NETWatch Site Controller can be used for transmitter setup.

Before proceeding with the instructions outlined in this chapter, ensure that you have installed the transmitter properly into the HLP 4200 and HLP 4800 platform, as described in Chapter 2, *Installing the SPL 7110-Exx Transmitter*.

## 4.1 Factory-Optimized Settings

The Harmonic factory optimizes the performance of each model in the SPL 7110- Exx series prior to shipment. The factory setup for the SPL7110S-EXX is listed in Table 4-1.

**Table 4-1: Factory Setup for SPL7110S-EXX**

Loading	78 unmodulated System M (NTSC) channels from 55 to 550 MHz; 450 MHz digital information above 550 MHz -6 dBc down from analog channels
RF input level	+15 dBmV per video channel

The factory setup for the SPL7110C-EXX is listed in Table 4-2.

**Table 4-2: Factory Setup for SPL7110C-EXX**

Loading	41 unmodulated Cenelec channels from 119 to 855 MHz; digital channels from 87 to 847 MHz -6 dBc down from analog channels
RF input level	+ 16 dBmV per video channel

The Harmonic factory-optimized setup procedure balances:

- CNR (carrier-to-noise) performance
- CSO (composite second order) distortion performance
- CTB (composite triple beat) distortion performance

- BER (bit error rate) performance

Once the Harmonic factory optimizes a SPL 7110- Exx transmitter, the factory settings are written into the transmitter's memory. These settings allow the transmitter to achieve the optimal performance at factory setup for any model in the SPL 7110- Exx series of transmitters.

These factory settings include:

- Internal RF pad value (user adjustable)
- Laser bias (not user adjustable)
- Laser current (not user adjustable)
- Laser temperature (not user adjustable)
- Others

### 4.1.1 Returning to Factory Settings

If at any time the transmitter's settings are changed, you can always return the transmitter to the original factory settings through the HLP display interface. In the Transmitter Adjustments menu, select the Switch to Factory Settings option. Follow the procedure in Section [4.4.4 Resetting the Transmitter to Factory Defaults](#).

When the transmitter reverts to the factory-optimized settings:

- If the transmitter is in AGC mode, the internal RF pad level automatically adjusts to get the adequate drive level to the laser for optimized performance.
- If the transmitter is in MGC mode, the transmitter reverts to factory settings based on Table 4-1, regardless of the actual RF input level. For the best performance, you must adjust the input level to 15 dBmV per channel. For instructions, see Section [4.4.3 Fine-Tuning the Transmitter](#) on page 25.

#### Example

In the case of a transmitter with the following setup:

- Loading: 78 unmodulated NTSC channels from 50 to 550 MHz and 450 MHz digital loading from 550 MHz to 1000 MHz -6 dBc down
- NTSC carriers RF input level: +18 dBmV per channel
- Factory optimized pad value at 15 dBmV per channel: 0 dB

In this example, the input level at 18 dBmV per channel is higher than the factory setting of 15 dBmV per channel.

There are two options for resetting the factory settings:

- If you use MGC ⊕ Reset to Factory Settings ⇒ Pad value will be 0 dB.
- If you use AGC ⊕ Reset to Factory Settings ⇒ Pad value will be 0 + (18-15) = 3 dB.

If you use MGC ⊕ Reset to Factory Settings, the pad value will be 0 dB.

The laser is overdriven. To optimize the transmitter's performance, you need to adjust the RF input level to the factory setting, 15 dBmV per channel.

Using AGC ⊕ Reset to Factory Settings provides the adequate drive level to the laser with a pad value of 3dB.

## 4.2 Fine-Tuning Each Transmitter

Harmonic recommends fine-tuning each transmitter to fit your specific requirements and preferences precisely. You can modify the transmitter configuration to trade off CNR performance for improved CSO and CTB distortion performance.

If you increase the RF pad by 1 dB, the following results occur:

- Transmitter CNR decreases by 1 dB
- CSO decreases by approximately 1 dB
- CTB decreases by approximately 2 dB

You can adjust the RF level by using any of the two interface options.

For the RF adjustment procedure using each of the interface options, see:

- [4.4.3 Fine-Tuning the Transmitter](#)
- [4.5 Setup via NETWatch Site Controller](#)

## 4.3 Autsetup, Automatic Gain Control, and Manual Gain Control

The *Autosetup* feature enables you to quickly set the internal drive level to the laser as close as possible to the optimal value determined at the Harmonic factory. The transmitter operates in either the Automatic Gain Control (AGC) mode or the Manual Gain Control (MGC) mode.

### 4.3.1 Autosetup

**What does Autosetup achieve?**

The Autosetup feature calibrates and automatically adjusts the internal RF pad for very close-to-optimum modulation performance.

**How does Autosetup operate?**

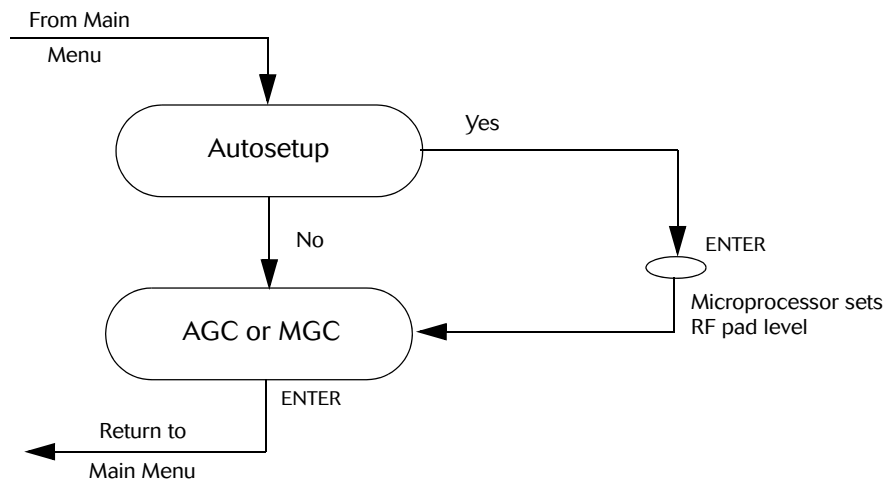


Figure 4-1: Autosetup via the HLP 4200 and HLP 4800 front panel

The Autosetup procedure works in two steps:

1. When you enter the Autoseup command via the HLP front panel, the transmitter's internal microprocessor measures the input drive level to the transmitter. Then, it sets the attenuator pad so that the average RF drive level to the laser is at the same optimal value determined at the Harmonic factory using CW carriers.
2. Finally, you need to select AGC or MGC mode of operation. See Section [4.3.2 Automatic Gain Control and Manual Gain Control](#).

#### What if the loading is less than factory setup?

The Autoseup procedure will measure the RF input level and adjust the pad value for operation as close as possible to optimum performance. When the number of analog or digital channels is less than the factory setup and you require better CNR, you can increase the input level by decreasing the internal RF pad value as described in section 4.2.

If you plan to add more channels in the future, Harmonic recommends that you use the following minimum input levels to ensure that the system is easy to upgrade .

- SPL7110S-EXX 15 dBmV per analog channel
- SPL7110C-EXX 16 dBmV per analog channel

### 4.3.2 Automatic Gain Control and Manual Gain Control

The AGC function operates by measuring the input RF level to the transmitter and continuously adjusting the RF pad to maintain constant drive level to the laser. When you select AGC, the input level to the transmitter laser remains at its previously established value.

When you use AGC mode with the SPL 7110- Exx, Harmonic recommends that you drive the transmitters 3 dB harder so that they can better compensate for the increased variation in the RF input signal. For example, for 78 NTSC (System M) channels, use an RF input level of 18 dBmV/channel.

In MGC mode, the internal RF pad value of the transmitter is kept at a fixed value regardless of the input RF level variation.



**NOTE:** You can adjust the drive level of the laser in either AGC or MGC mode by changing the RF pad. For instructions, see Section [4.2 Fine-Tuning Each Transmitter](#) on page 23. After you have adjusted the pad, the transmitter will continue to operate in the same mode (AGC or MGC).

## 4.4 Setup via HLP 4200 and HLP 4800 Display

This section provides instructions for setting up the SPL 7110- Exx via the push buttons and LCD display of the HLP 4200 and HLP 4800 equipment platform. To quickly and easily set up and review the SPL 7110- Exx monitoring and control parameters, use the HLP 4200 and HLP 4800WD front panel. For a detailed description of this interface, see Section [3.1 HLP 4200 and HLP 4800 Display](#) on page 17.

### 4.4.1 Step-by-Step Setup Instructions

1. Verify that the SPL 7110- Exx module is properly installed in the HLP platform. Instructions are provided in Section [2.2 Installing the Transmitter Module](#) on page 13.
2. Verify that the HLP 4200 and HLP 4800 is powered on and that no alarm conditions exist within the transmitter module; make sure that the Status LED on the front panel is green.
3. Verify that the RF input level per analog carrier is within the range set in Table 4-1 and Table 4-2.



4. Verify that the RF input signal has been properly connected to the transmitter. See Section [2.4 Connecting the RF Broadband Input](#) on page 15.
5. On the HLP 4200 and HLP 4800WD, press the Esc button until the display reads `MODULE SELECTION`, then press Enter.
6. Press the ▲ or ▼ button until the display indicates the transmitter module you wish to set up, then press Enter.
7. Press ▲ or ▼ until the display reads `TRANSMITTER SETUP`, then press Enter. The message appears, `RUN AUTOSETUP? YES <SET+UP/DN> TO CHOOSE`.
8. Hold down the Set button and press ▲ or ▼ until the value you want is displayed—YES to run Autoseup or NO to skip Autoseup—then press Enter. For details of the Autoseup feature, see Section 4.3.1.. If you choose NO to Autoseup, skip to Step 9.
9. The message appears, `AGC CONTROL <SET+UP/DN> FOR AGC`. Hold down the Set button and press ▲ or ▼ until the value you want is displayed—AGC or MGC— then press Enter. For details of the AGC feature, see Section [4.3.2 Automatic Gain Control and Manual Gain Control](#).
10. To exit the Transmitter Setup menu, press Enter.

## 4.4.2 Setting Fiber Length

To adjust the fiber length of the chirp CSO precompensation parameter:

1. Press ESC until the HLP Platform display reads `MODULE SELECTION`. Press Enter.
2. Press ▲ or ▼ until the display indicates the `SPL7110-EXX` module you wish to set up. Press Enter.
3. Press ▲ or ▼ until the display reads `TRANSMITTER SETUP`. Press Enter.
4. Press ▲ or ▼ until the display reads `TRANSMISSION DISTANCE = XX.X km <SET+UP/DN>`

To change the values.

- Hold down the Set button, and press ▲ or ▼ until the fiber length is set closest to the actual fiber length in the `SPL7110-EXX` path.

## 4.4.3 Fine-Tuning the Transmitter

The setup instructions described in Section 4.4.1. will normally bring the transmitter to optimal operating conditions. Harmonic recommends fine-tuning each transmitter to your specific requirements and preferences.

If the factory-optimized RF level is not suitable for your particular application, you can use the following procedure to adjust the internal RF pad.

You can adjust the RF level while in either AGC or MGC mode. See the appropriate section. Pad adjustment does not alter the current mode of operation (AGC or MGC).

For details of the results of the RF adjustment, see Section [4.2 Fine-Tuning Each Transmitter](#) on page 23.

To adjust the RF level via the HLP push buttons and display:

1. Press the ▲ or ▼ button until the display reads `MODULE SELECTION`, then press Enter.
2. Press ▲ or ▼ until the display indicates the transmitter module you wish to adjust, then press Enter.
3. Press ▲ or ▼ until the display reads `TRANSMITTER ADJUSTMENTS`, then press Enter.

4. Press ▲ or ▼ until the display reads `ADJUST RF LEVEL`, then press Enter. The current RF pad setting is displayed with the instruction `<SET+UP/DN> TO CHANGE`.
5. Hold down the Set button and press ▲ or ▼ until the RF pad value you want is displayed, then press Enter.
6. To exit RF adjustment, press Enter.

#### 4.4.4 Resetting the Transmitter to Factory Defaults

The factory-optimized settings are described in Section [4.1 Factory-Optimized Settings](#) on page 21.

To return the transmitter to factory settings:

1. On the HLP, press the ▲ or ▼ button until the display reads `MODULE SELECTION`, then press Enter.
2. Press ▲ or ▼ until the display indicates the transmitter module you wish to reset, then press Enter.
3. Press ▲ or ▼ until the display reads `TRANSMITTER ADJUSTMENTS`, then press Enter.
4. Press ▲ or ▼ until the display reads `SWITCH TO FACTORY SETTINGS`, then press Enter.
5. A message appears, telling you that all settings will be changed. Press Enter.
6. A message appears, `<ESC> TO ABORT OR <SET+UP/DN> TO SWITCH`. Hold down the Set button and press ▲ or ▼, then press Enter.
7. A confirmation message appears. Press Enter.

The transmitter reverts to the factory-optimized settings:

- If the transmitter is in AGC mode, the internal RF pad level adjusts to get the adequate drive level to the laser for optimized performance.
- If the transmitter is in MGC mode, the transmitter reverts to factory settings based on [Table 4-1](#) on page 21, regardless of the actual RF input level. For the best performance, you must adjust the input level to 15 dBmV per channel. For instructions, see Section [4.4.3 Fine-Tuning the Transmitter](#) on page 25.

## 4.5 Setup via NETWatch Site Controller

If you are using a platform that does not have a display (such as the HLP 4200ND), you can use NETWatch Site Controller for transmitter setup. For details on communication with the SPL 7110- Exx through the NETWatch Site Controller element management system, consult the *NETWatch Site Controller Instruction Manual*.

To use NETWatch Site Controller to set up the SPL 7110- Exx:

1. Verify that the SPL 7110- Exx module is properly installed in the HLP 4200 platform. Instructions are provided in Section [2.2 Installing the Transmitter Module](#) on page 13.
2. Verify that the platform is powered on and that no alarm conditions exist within the transmitter module; make sure that the module icon in the NETWatch display is green.
3. Set the RF input level to the value given in [Table 4-1](#) on page 21.
4. Select manual gain control (MGC) mode of operation or AGC.
5. Set the chirp compensation level by changing the fiber length setting to the value closest to the total fiber length traversed by the light from this transmitter.
6. If further adjustment is needed, change the input pad level via the NETWatch Site Controller.

## 4.6 Using the SPL 7110- Exx in a Multiwavelength Application

The SPL 7110- Exx may be used in a multi-wavelength application with up to eight wavelengths on a single fiber as shown in Figure 1-3 and Figure 1-4. In these scenarios, the launch power into the fiber and the total fiber distance may need to be limited and the analog content on each wavelength must be identical to avoid detrimental non-linear fiber optic effects. Consult your Harmonic applications engineer for more details.

This chapter describes how to:

- Clean fiber optic connectors
- Replace the fan in the SUPRALink 7110-Exx Series

## 5.1 Cleaning Fiber Optic Connectors



**DANGER:** The fiber cable carries invisible laser radiation. **AVOID EXPOSURE TO THE BEAM.** Never operate a unit that has a broken fiber or a disconnected fiber connector. For further information, see [A.9 Laser Radiation Warning](#) on page 34.

Dirty optical connectors are the leading source of poor performance in an optical fiber network. Dirty optical connectors lead to optical signal loss and reflections, which in turn can seriously degrade carrier-to-noise (CNR) performance and, in some cases, distortion performance.

Therefore, Harmonic recommends that you clean all mating fiber connectors, before connecting them to an optical device.

In addition, if you suspect that the optical connector of a SUPRALink 7110-Exx may have been exposed to contamination (by a dirty fiber cable connector, for example), you should properly clean the SUPRALink 7110-Exx optical connector before connecting optical fiber.



**CAUTION:** Improper cleaning of an optical connector can do more harm than good. Never spray a clean-air product onto the surface of an optical connector. Spraying air onto an optical connector can cause condensation on the connector surface, leaving water spots and trapping dust. Failing to wipe a connector on dry lens paper immediately after wiping on paper wet with isopropyl alcohol can also lead to condensation on the connector. Using low-grade cleaning paper or other cloth to wipe an optical connector can leave microscopic fibers on the optical connector surface.

### 5.1.1 Cleaning Patch Cord or Pigtail Fiber Optical Connectors

To clean optical connectors, Harmonic recommends using a fiber optic connector cleaning cartridge (such as NTT Cletop). If a cleaning cartridge is not available, follow these steps.

1. Fold a piece of unused dry lens cleaning paper twice, for a four-ply thickness.
2. Use a drop of high-grade isopropyl alcohol to wet part of the paper.
3. Lay the connector on the lens cleaning paper with the tip touching the paper.
4. In one continuous motion, pull the connector from the wet part of the paper to the dry part.

### 5.1.2 Cleaning Transmitter Module Optical Connectors

To clean the optical connector of a SUPRALink 7110-Exx:

1. Remove the transmitter module from the HLP platform.
2. Inspect the bulkhead adapter for cleanliness with a video inspection scope, if available.

3. Clean the bulkhead adapter and internal connector with either a 2.5 mm optical connector swab or bulkhead adapter cleaning tools such as the Seikoh-Giken FerruleMate.
4. If alcohol is used in above step, finish with a dry swab or bulkhead adapter cleaning tools.
5. Inspect the bulkhead adapter for cleanliness with a video inspection scope, if available. Repeat steps 3 and 4 until the adapter and internal connector meet applicable cleanliness requirements.

## 5.2 Fan Replacement



**NOTE:** The fan assembly mounted on the HMC 4001 carrier may be replaced without removing or disabling the SUPRALink 7110-Exx module. Under normal headend and central office environmental conditions, the transmitter can operate without fan cooling for a limited time.

Should a fan failure occur, contact Harmonic's technical service (see [6.2 In Case of Problems](#) on page 30).

To replace the fan:

1. Disconnect the fan's power cable.
2. Remove the four Phillips head screws, shown in [Figure 5-1](#) on page 29, that secure the fan to the module housing.
3. Replace the failed fan unit with a new fan unit.
4. Secure the new fan unit with the four Phillips head screws.
5. Reconnect the power cable.

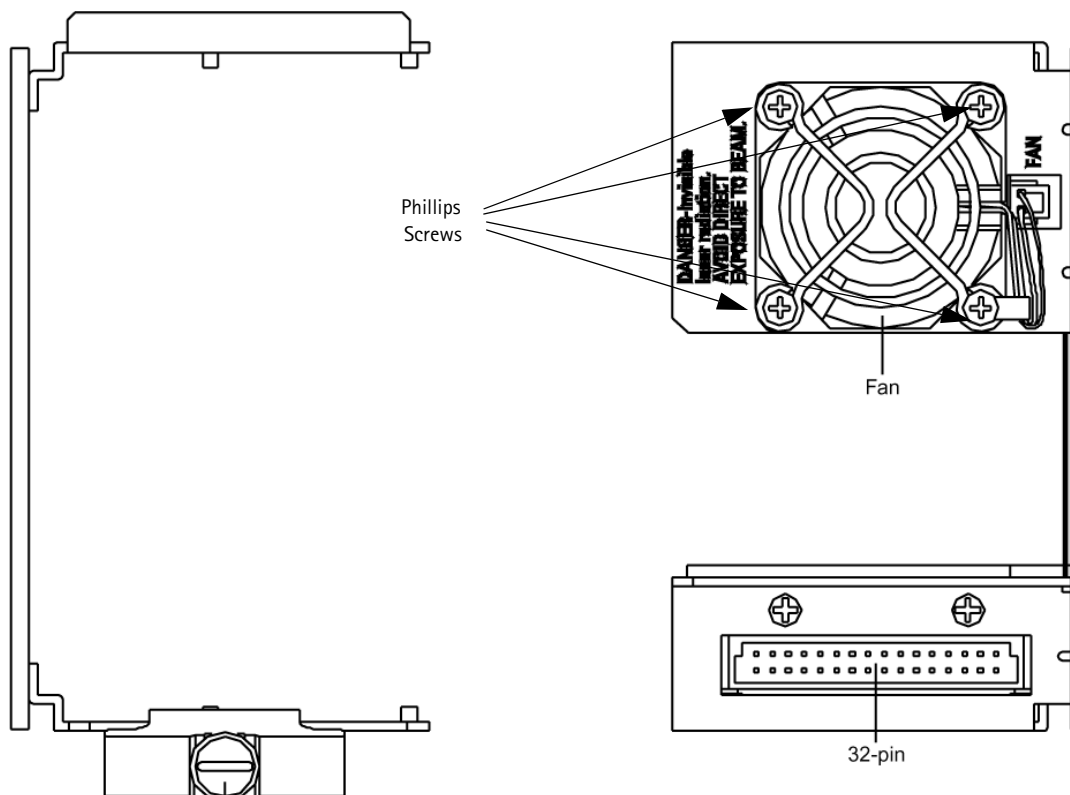


Figure 5-1: HMC 4001 fan replacement

This chapter describes:

- How to troubleshoot the SUPRALink SPL 711-Exx Series
- How to return the unit for service
- Manufacturer disclaimer

### 6.1 Troubleshooting

Should a problem occur, check the following:

1. View the Status LED on the transmitter's front panel to determine if an alarm condition is indicated. see [Front Panel LED Indicators](#) on page 20.
2. View the HLP front panel display to determine if an alarm condition is indicated.

### 6.2 In Case of Problems

If you continue to have a problem, contact the Harmonic Customer Service department (see [6.4 Contacting Harmonic Support](#) on page 31 ). A service technician will assist you in determining whether a fault exists with the unit.

If the service technician determines that you need to return the unit, she or he will issue you a Return Material Authorization (RMA) Number. You must include this RMA number on the shipping container when returning the unit, and with all correspondence regarding the unit.

To return the unit, send it to one of the Harmonic Headquarters addresses listed in D, *Harmonic Inc. – Offices*. Please add the note:

Attn.: Customer Service  
RMA no. \_\_\_\_\_

### 6.3 Disclaimer

Harmonic Inc. reserves the right to change any products described herein at any time, and without prior notice. Harmonic assumes no responsibility or liability arising from the use of the products described herein, except as expressly agreed to in writing by Harmonic. The use and purchase of this product does not convey a license under any patent rights, copyrights, trademark rights, or any intellectual property rights of Harmonic. Nothing hereunder constitutes a representation or warranty that using any products in the manner described herein will not infringe any patents of third parties.

## 6.4 Contacting Harmonic Support

The Harmonic Customer and Technical Support groups are available to help you with any questions or problems you may have regarding Harmonic products.

**For assistance from within the U.S. and Canada, call toll free:**

1.800.730.4099

**For assistance from outside the U.S. and Canada, call:**

1.408.542.2771

**The corporate address for Harmonic Inc. is:**

Harmonic Inc.  
549 Baltic Way  
Sunnyvale, CA 94089, U.S.A.  
Attn: Customer Support

The corporate telephone numbers for Harmonic Inc. are:

Tel. 1.800.788.1330 (from the U.S. and Canada)

Tel. +1.408.542.2500 (outside the U.S. and Canada)

Fax.+1.408.490.6708

The web address for Harmonic Inc. is [www.harmonicinc.com](http://www.harmonicinc.com).

### A.1 Optical Output

Wavelength: 1544 to 1560 nm DWDM

Eye protection: Safety shutter

Optical return loss:

### A.2 Optical Power

$9.5 \pm 1.0$  dBm

### A.3 RF Input

Input level range per unmodulated analog channel:

(SPL7110S-Exx) 15 to 20 dBmV

(SPL7110C-Exx) 16 to 20 dBmV

Operational bandwidth: 50 to 1003 MHz

Frequency response: <1.5 dB peak-to-valley

RF attenuator adjustment range: 5 dB

Impedance: 75 ohm

Return loss: >14 dB

Level control: manual (MGC)/automatic (AGC); auto setup feature

### A.4 User Interface

#### Front panel

Bi-state status LED: Normal = Green, Alarm = Red

Module selection indicator: Yellow LED

Monitor point:

Return loss: >16 dB

Connector type: Female F

Level:  $-20 \pm 1.0$  dB below input

#### Rear panel

RF input connector type: Female F

Optical output (for connector types available, see Section A.8.)



## A.5 Power Requirements

Nominal: +24 VDC, supplied by HLP bus

Maximum: +28 VDC

Consumption: 22 Watts maximum

## A.6 Environmental

Operating temperature: 0° to +50° C / +32° to +122° F

Storage temperature: -40° to +70° C / -40° to +158° F

Automatic fan adjustment at: 40° & 50° C / 104° & 122° F

Relative humidity: Maximum 85% non-condensing

Software over temperature laser protection

## A.7 Physical

Dimensions (W x H x D): 1.3" x 4.4" x 12.7" / 3.3 cm x 11.2 cm x 32.2 cm

Weight: 0.95 kg / 2.1 lbs

Mounting: HLP 4200 or HLP 4800 platform, one half-module slot; via HMC module carrier

Optical connector type: SC/APC<sup>1</sup>, FC/APC, SC/UPC, FC/UPC, E2000

RF connector type: Standard F, RG-59 cable type (accepts 0.64 to 0.8 mm center conductor diameter)

## A.8 Models Available

SPL 7110X-Eyy-zz

x = s for NTSC channel plan

x= c for Cenelec channel plan

yy = wavelength: 01 to 08

zz = Connector Type: AS, AF, or AE

AS = SC/APC

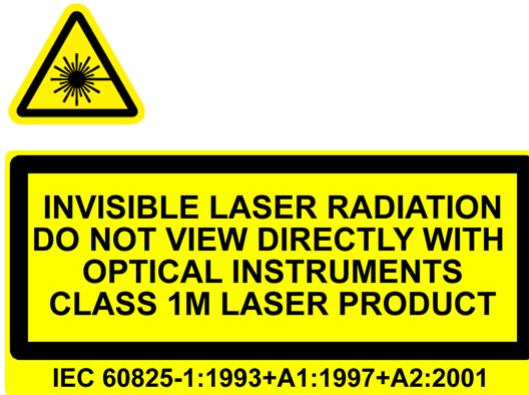
AF = FC/APC

AE = E2000

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1. SC/APC is the connector type recommended by Harmonic. Other connector types available upon request.

## A.9 Laser Radiation Warning



Complies with 21 CFR 1040.10 and 1040 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

---

**WARNING:** CLASS 1M LASER PRODUCT; INVISIBLE LASER RADIATION; DO NOT VIEW DIRECTLY WITH MAGNIFIER. Viewing the laser output with optical instruments (e.g. magnifier, microscopes) within a distance of 100mm may pose an eye hazard.

---

**WARNUNG:** KLASSE 1M LASER PRODUKT; UNSICHTBARE LASERSTRAHLUNG; NICHT DIREKT MIT LUPE BETRACHTEN. Das betrachten des Laser Ausgangs mit optischen Instrumenten (z.B. Vergrößerungsglas, Mikroskope) innerhalb eines Abstandes von 100mm kann eine Augenverletzungs-Gefahr darstellen.

---

**ATTENTION:** RADIATION LASER INVISIBLE. NE PAS OBSERVER À LA LOUPE DIRECTEMENT. PRODUIT LASER CLASSE 1M.

L'observation des effets lasers à l'aide d'un appareil optique (comme loupe, microscope...) à une distance jusqu'à 100 mm peut poser un danger à l'oeil.

---

When you work with this equipment, take the following precautions:

- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Never look at an optical fiber using a direct magnification fiber scope without verifying that all lightwave sources on the fiber are turned off.
- Never look directly into an optical connector.
- Install protective covers or caps over connectors when they are not being used.
- Always assume that exposed optical connectors and cables are energized.
- Always make an optical power measurement of the fiber or connector before cleaning or before visual inspection, to ensure that the fiber is not energized

## A.10 Compliance with WEEE

Harmonic will ensure that all products that cannot be re-used will be recycled in compliance with the WEEE Directive. To that end, users are advised that (1) Harmonic equipment is not to be discarded in household or office garbage, (2) customers may consult the Harmonic web site ([www.harmonicinc.com](http://www.harmonicinc.com)) for additional and updated information on this process.



## Appendix B

# HLP 4200 and HLP4800 Menu Display

Figure B-1 provides a flowchart of the commands and messages in the Transmitter Menu of the HLP 4200 and HLP4800 platform display.

In these figures, push-button commands are framed in ovals, and resultant display messages are framed in rectangular boxes. Use the HLP 4200 and HLP4800's ▲ and ▼ buttons to scroll through the menus. Use the Enter button to make a selection. Use the Esc button to escape any menu.

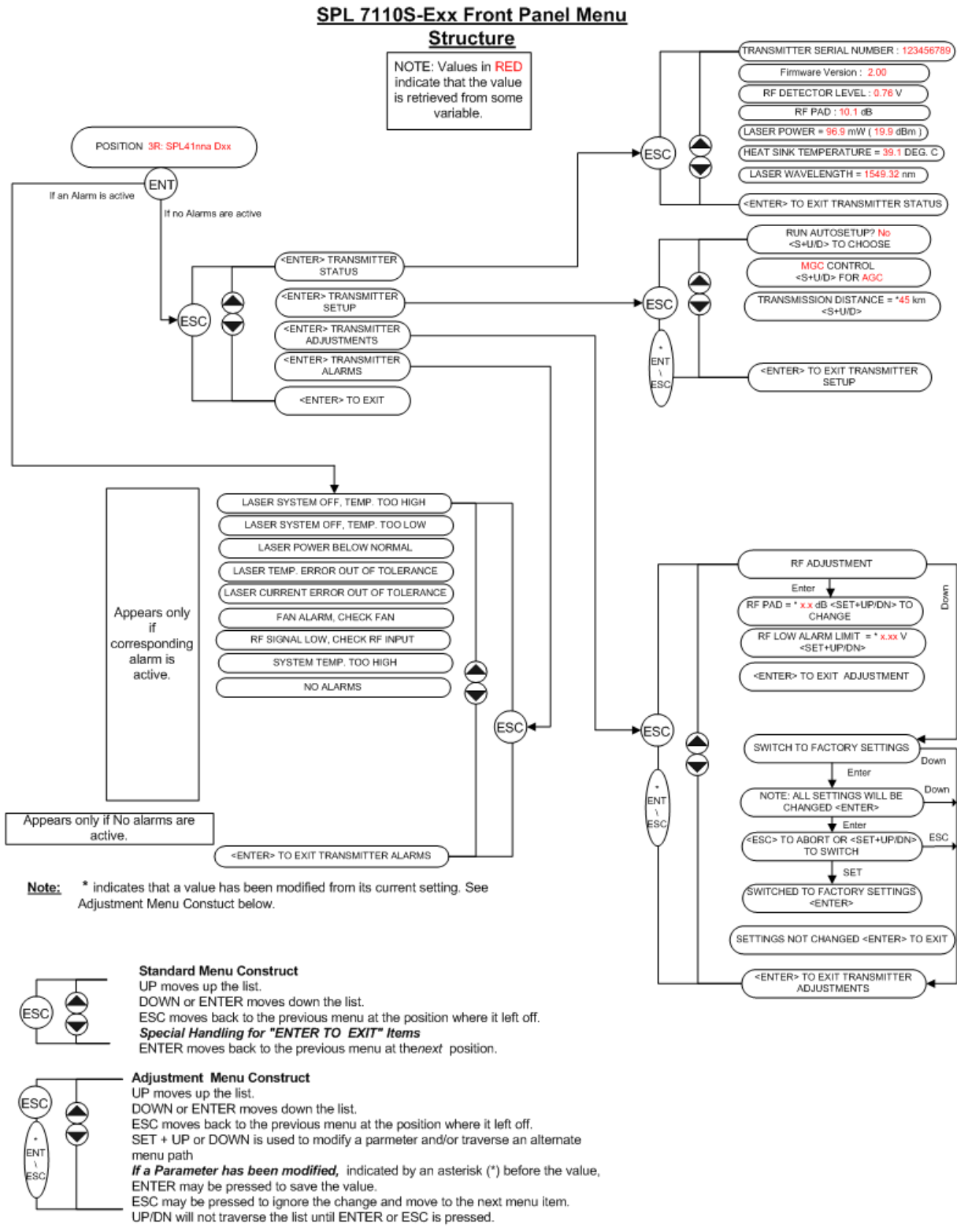


Figure B-1: HLP 4200 and 4800WD platform Transmitter menu display, levels 0 and 1



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