METROLink™ HLD 7105T Forward Path Transmitter Product Manual

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Appendix A   Technical Specifications

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1
Overview

1.1　About This Manual

This product manual is a complete guide to installing, configuring, and operating the METROLink™ HLD 7105T Forward Path Transmitter. Please read the entire document before beginning installation or operation.

- Chapter 1 provides a description of the HLD 7105T transmitter.
- Chapter 2 describes the installation procedures.
- Chapter 3 introduces the user interfaces.
- Chapter 4 describes how to set up the transmitter.
- Chapter 5 outlines maintenance procedures.
- Chapter 6 provides instructions on what to do in the event of problems.
- Appendix A provides complete technical specifications.
- Appendix B provides a list of Harmonic's offices.

1.2　Description

Harmonic's METROLink family of transmitter modules is optimized for high-performance transmission of digital information over optical fiber networks. The METROLink™ HLD 7105T Forward Path Transmitter is a compact, plug-in module for use in the Harmonic HLP 4200 equipment platform. The HLD 7105T can be used to transport quadrature amplitude modulated (QAM) digital signals for Internet, telephony, and video-on-demand applications.

The HLD 7105T transmitter has the following key features:

- Transmission bandwidth of 40 to 1003 MHz
- 40 wavelengths available on the ITU grid (for details, see Table A-1, *DWDM Wavelengths*, on page A-1)
- Ability to combine multiple wavelengths on a single fiber for cost-effective use of fiber and space
- Electronic dispersion compensation for high channel loads with minimal fiber-induced, second-order distortion
- Compensation up to 100 km, with up to 300 MHz total RF load
- Microprocessor control of all key parameters for consistent and optimal performance and monitoring
- Internal monitoring and control using 32-bit microprocessor

- Local control of operating parameters—provided by the HLP 4200 Platform
- Remote control and monitoring—provided by NETWatch Site Controller
- Simple plug-and-play operation that reduces installation time

Figure 1-1 shows the front and rear panel features of the HLD 7105T transmitter module.
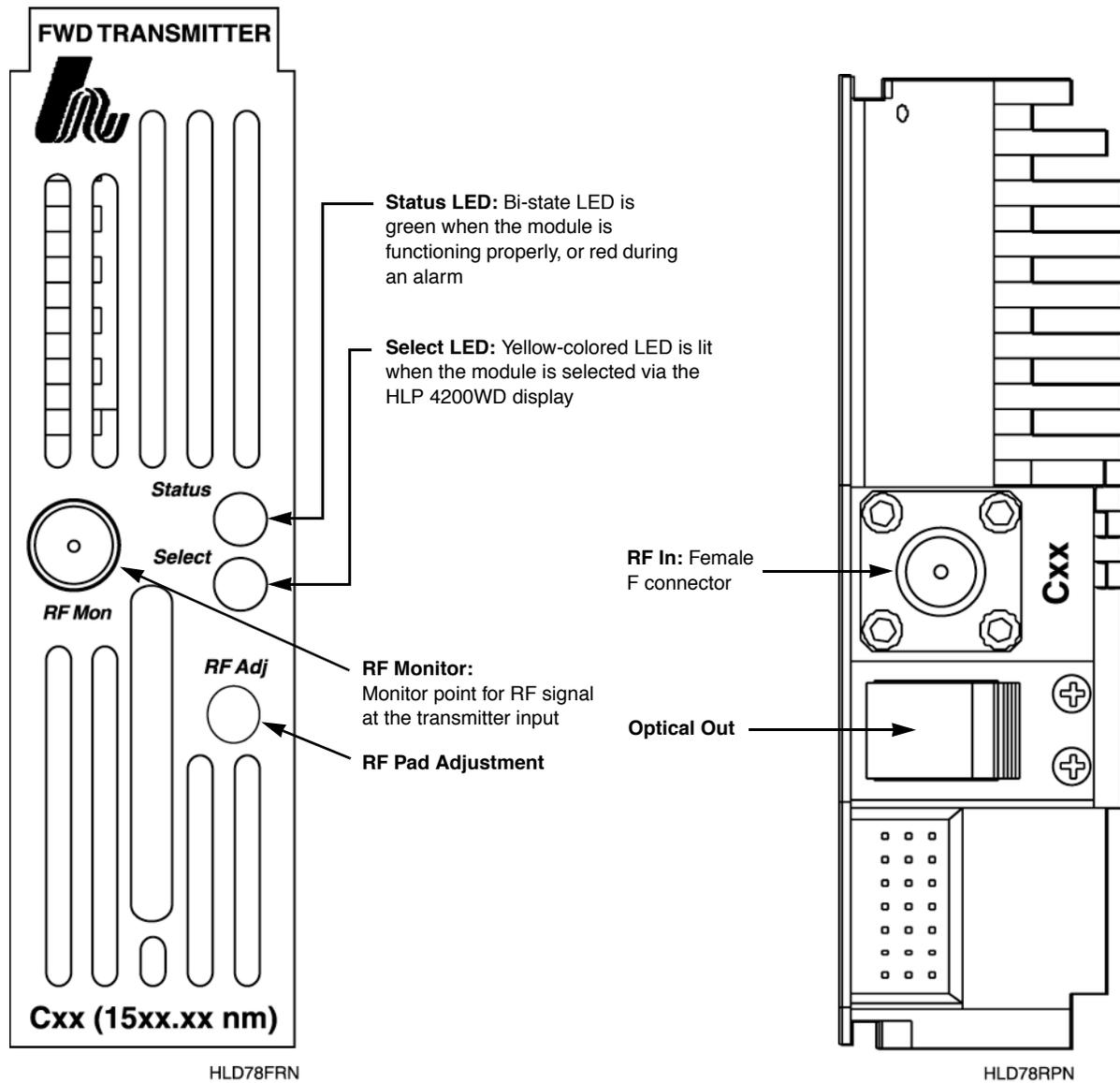
Figure 1-1. Front and rear panel features

Figure 1-2 is a block diagram of the transmitter.
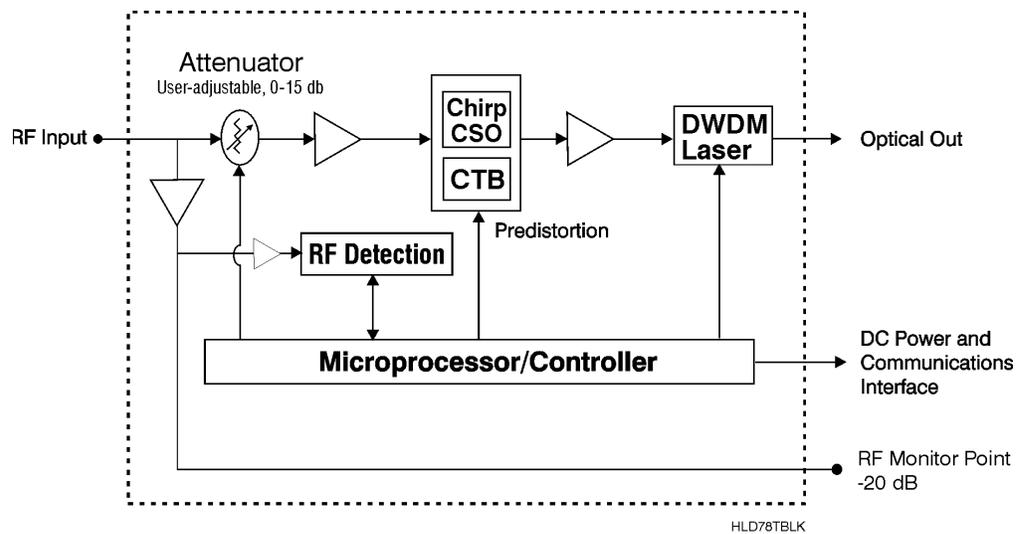
Figure 1-2. HLD 7105T block diagram

The HLD 7105T transmitter is a compact, half-size, plug-in module that mounts easily in Harmonic's HLP 4200 Platform via the HMC 4000 module carrier. Figure 1-3 is a functional diagram of the HLP 4200 Platform. The transmitter module draws power from the platform's 24 VDC power bus and communicates with the platform controller via the platform communication bus.
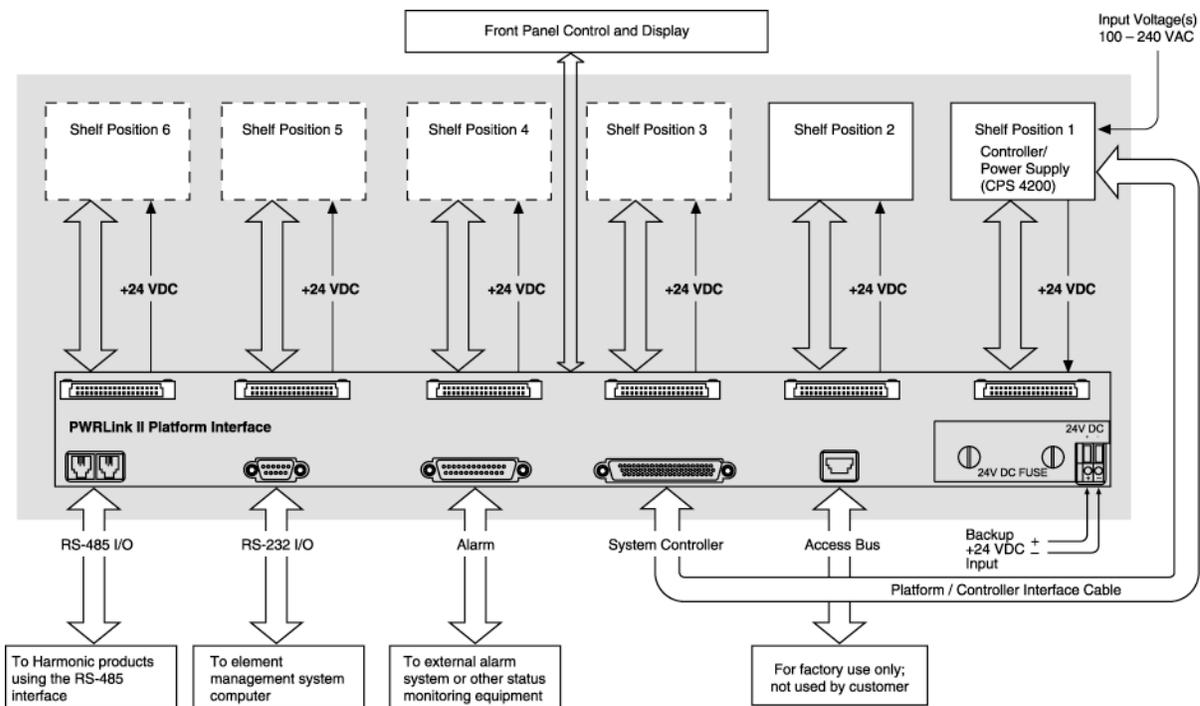
Figure 1-3. HLP 4200 functional diagram

For additional information on the platform and associated communication and power buses, see the *HLP 4200 Platform Product Manual*. For additional information on the platform controller and power supply options, see the *CPS 4200/4248 Controller/Power Supply Product Manual.*

1.3 Applications

The HLD 7105T can be used in various applications:

- Transport of digital information in QAM format for Internet, telephony, and video-on-demand applications
- Transport of analog channels for local channel insertion

Figure 1-4 shows three typical applications of the HLD 7105T. QAM signals from a cable modem termination system (CMTS), cable telephony, or video-on-demand server are used to drive the HLD 7105T. The optical outputs from multiple HLD 7105T transmitters are combined into a single fiber using a dense wavelength division multiplexer (DWDM).

In the first application, the combined optical wavelengths are transported to the hub, where they are demultiplexed and fed into multiple receivers (RF output 1).

The HLD 7105T can also be used in conjunction with Harmonic's HLT 7xxx broadcast video transmitter. In such an application, the QAM channels are transmitted by an HLD 7105T, and transported from the headend to the hub via a dedicated fiber. At the hub, the broadcast signal can be split and combined with one of the narrowcast wavelengths. It is then transported to the node over a single fiber (RF output 2).

Broadcast and narrowcast optical signals can also be transported on separate fibers and received on two dedicated receivers in the node (RF output 3).
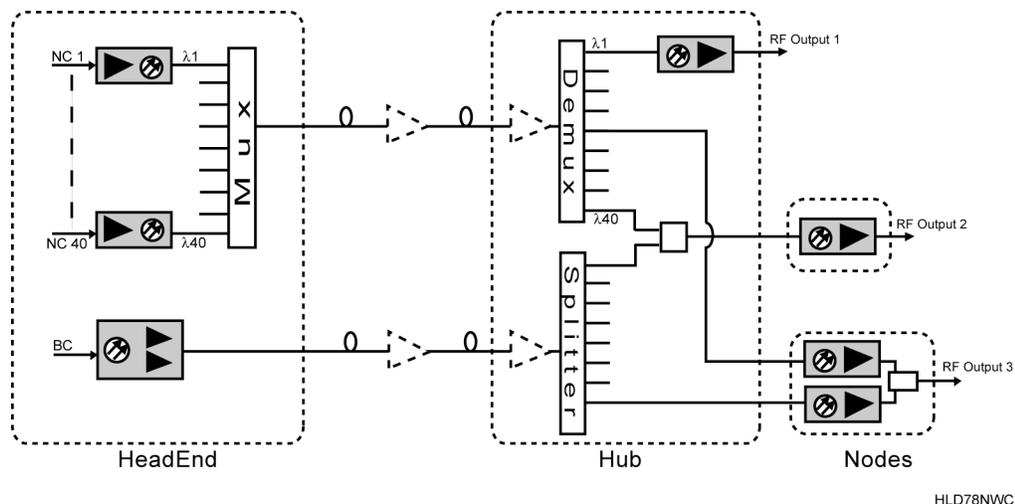
Figure 1-4. QAM transport using HLD 7105T in the forward path

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2
Installing the HLD 7105T Transmitter

This chapter describes how to:

- Receive and inspect the METROLink™ HLD 7105T Forward Path Transmitter
- Mount the HLD 7105T module in the HLP 4200 Platform
- Connect the output fiber cable
- Connect the RF 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 Appendix B, *Harmonic Inc. – Offices*, for contact information.

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.

2.2   Mounting the Transmitter Module

The HLD 7105T transmitter module plugs into the HMC 4000 module carrier, shown in Figure 2-1. 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 4000 carrier into any desired position in the HLP 4200 Platform.

You can plug the HLD 7105T module into the HMC 4000 module carrier either before or after you mount the carrier in the HLP 4200 Platform. The modules and carriers are hot-swappable. They are designed to be inserted and removed from an operational HLP 4200 Platform.
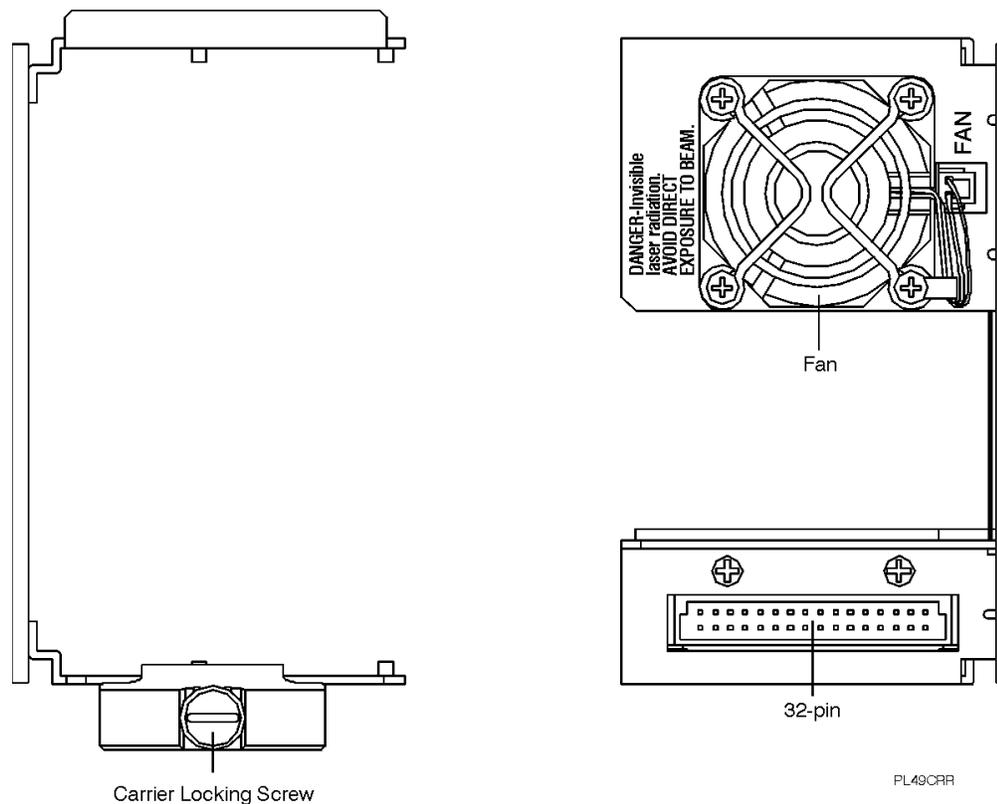
Figure 2-1. HMC 4000 module carrier front and rear panel features

To install the HLD 7105T transmitter module in the HMC 4000 carrier:

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

To remove the HLD 7105T transmitter module from the HMC 4000 carrier:

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

To install the HMC 4000 carrier in the HLP 4200 Platform:

1. Lower the HLP 4200 Platform's control/display panel.
2. Slide the HMC 4000 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.

2.3   Connecting the Output Fiber Cable

Connect the fiber optic cable to the transmitter output. The optical output connector of the HLD 7105T transmitter is located on the rear panel of the module, as shown in Figure 1-1 on page 1-2.

DANGER: The fiber carries invisible laser radiation. **AVOID DIRECT EXPOSURE TO THE BEAM**. Never operate the unit with a broken fiber or with a fiber connector disconnected.

To connect a fiber optic cable to the transmitter output:

1. Verify that the transmitter module has been mounted into the HLP 4200 Platform, as described in Section 2.2.
2. Determine the connector type on the HLD 7105T. 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 that of the HLD 7105T transmitter (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 *5.1.1 Cleaning Patch Cord or Pigtail Fiber Optical Connectors* on page 5-2.
5. Verify that the HLD 7105T 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 connector), follow the cleaning procedure outlined in *5.1.2 Cleaning Transmitter Module Optical Connectors* on page 5-2.

NOTE: Any contamination of either the fiber cable or the HLD 7105T transmitter 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 HLD 7105T transmitter until the connector clicks into place.
7. 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 HLD 7105T transmitter and tighten the rotating sleeve of the connector until secure. Do not overtighten!

2.4 Connecting the RF Broadband Input

The broadband RF connector of the HLD 7105T transmitter is located on the rear panel of the module, as shown in Figure 1-1 on page 1-2.

The HLD 7105T 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 to 0.8 mm.

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.

To connect the RF broadband input:

• Insert the signal source connector into the HLD 7105T module RF input connector, and tighten securely.

For an explanation of the proper RF level, see Chapter 4, *Transmitter Setup*.

2.5 Testing RF Signal Input

Once you have connected the RF signal source, you can use the RF monitor point 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 1-2.

The RF monitor port is fed from an RF pickoff immediately after the RF input to the transmitter, as shown in Figure 1-2 on page 1-3. The RF monitor signal level is approximately 20 dB below the signal level at the input to the transmitter.

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3
User Interface Options

This chapter describes:

- HLP 4200WD display
- NETWatch Site Controller
- HLD 7105T front panel RF adjustment
- HLD 7105T front panel LED indicators

Each HLD 7105T transmitter 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 4200WD push buttons and display**
  The HLP 4200WD interface provides the most comprehensive means of monitoring and controlling HLD 7105T performance. The Return to Factory Settings command is available only through this interface. For initial setup of the transmitter, Harmonic recommends using the HLP 4200WD display, if available.
- **NETWatch Site Controller**
  Once installed and configured, the NETWatch Site Controller provides a straightforward way to monitor and control a network of multiple HLD 7105T transmitters, either locally or remotely.
- **HLD 7105T front panel RF adjustment**
  The RF adjustment potentiometer on the front panel of each HLD 7105T transmitter module (shown in Figure 1-1 on page 1-2 as RF Pad Adjustment) can be used to set the internal RF pad level. Use this interface only if the first two interface options are not available.

3.1 HLP 4200WD Display

You can configure and monitor the HLD 7105T transmitter conveniently via the push buttons and LCD display of the HLP 4200WD equipment platform.

On the HLP 4200WD front panel:

- Use the ▲ and ▼ buttons to scroll through the menus
- Use the Enter button to make a selection
- Use the ESC button to escape any menu

3.1.1 HLP 4200WD Main Menu

Figure 3-1 provides a flowchart of the commands and messages in the main menu, which is at the top of the HLP 4200WD 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. The main menu also allows you to set the platform address for communication with NETWatch Site Controller.
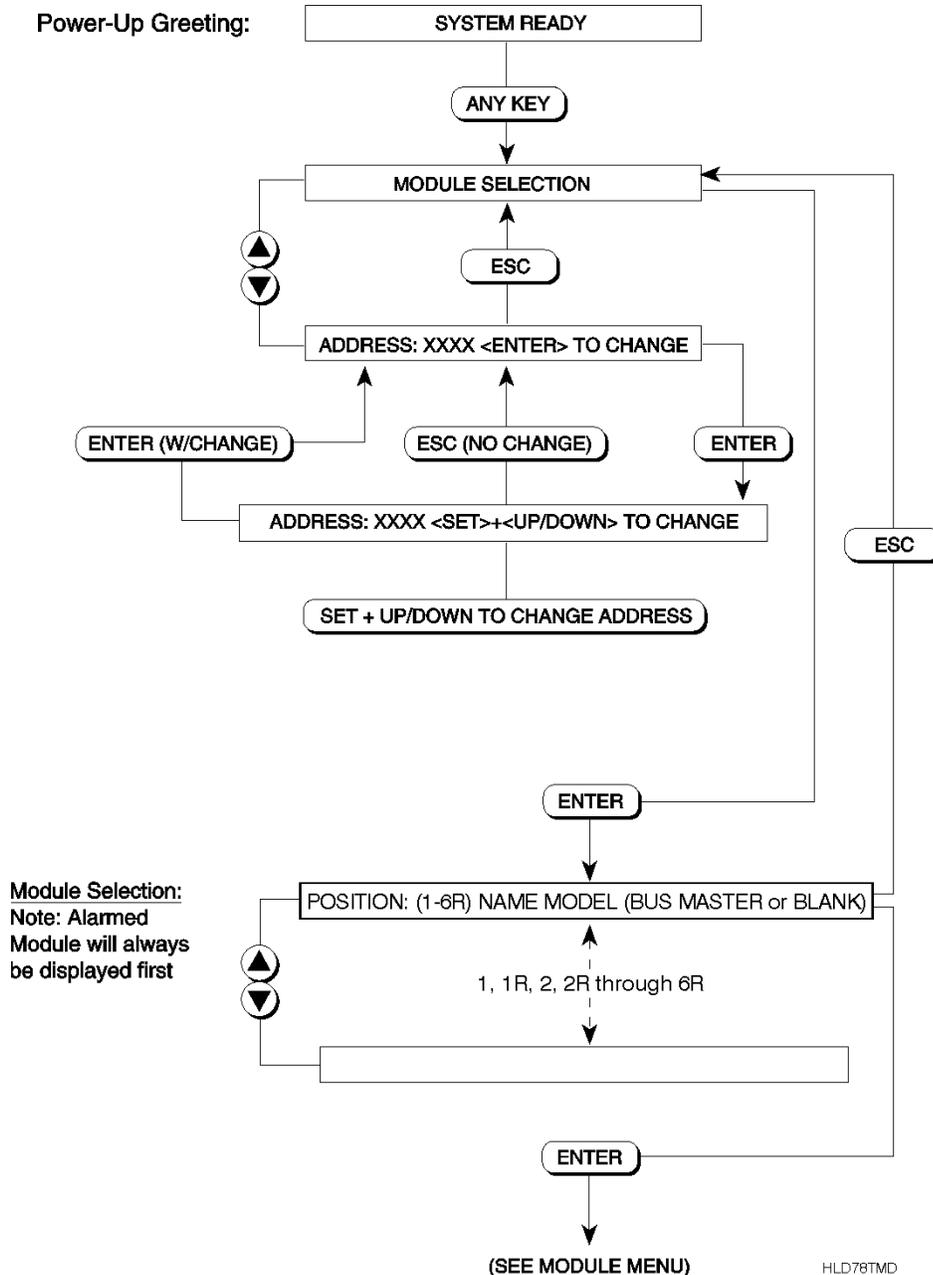
Figure 3-1. HLP 4200WD platform main menu display flowchart

3.1.2 Transmitter Menu

After you navigate the HLP 4200WD's main menu and select a specific HLD 7105T transmitter module, the Transmitter menu appears. Figure 3-2 shows the navigation options available in the Transmitter menu.
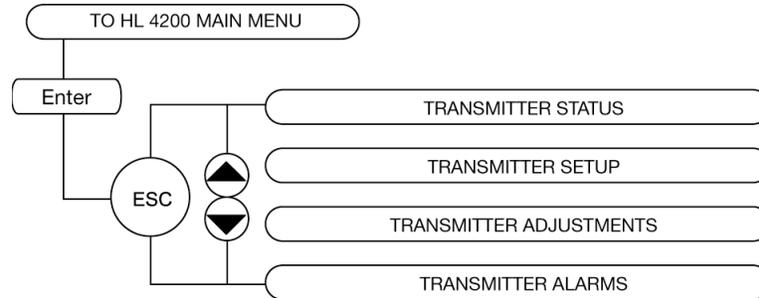
Figure 3-2. Transmitter menu

The Transmitter menu is organized into four submenus:

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

These submenus are described below in Sections 3.1.3 through 3.1.6.

The status and control parameters in the Transmitter menu and its four submenus apply only to the specific transmitter module that is selected.

3.1.3 Transmitter Status Menu

The Transmitter Status menu lets you obtain basic and current diagnostic information about the transmitter. Figure 3-3 shows the Transmitter Status menu.
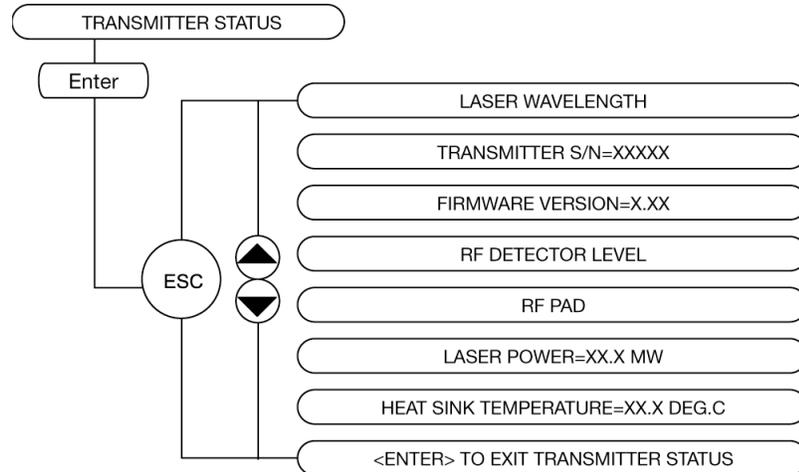
Figure 3-3. Transmitter Status menu

3.1.4 Transmitter Setup Menu

The Transmitter Setup menu allows you to choose whether or not to enable the 3 dB power reduction when the RF input is low (below 22 dBmV). When this function is enabled, it reduces the optical output power by 3 dB to avoid any stimulated Brillouin scattering effects that could occur without the laser being chirped by an RF signal. You should also set the fiber length for the laser chirp compensation. Figure 3-4 shows the Transmitter Setup menu.
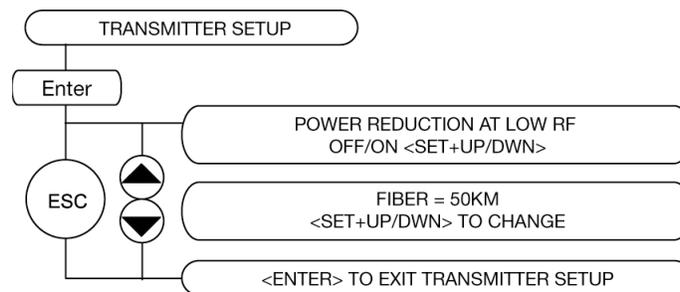
Figure 3-4. Transmitter Setup menu

3.1.5 Transmitter Adjustments Menu

The Transmitter Adjustments menu allows you to adjust the RF pad and restore all transmitter parameters to their original Harmonic factory settings. Figure 3-5 shows the Transmitter Adjustments menu.
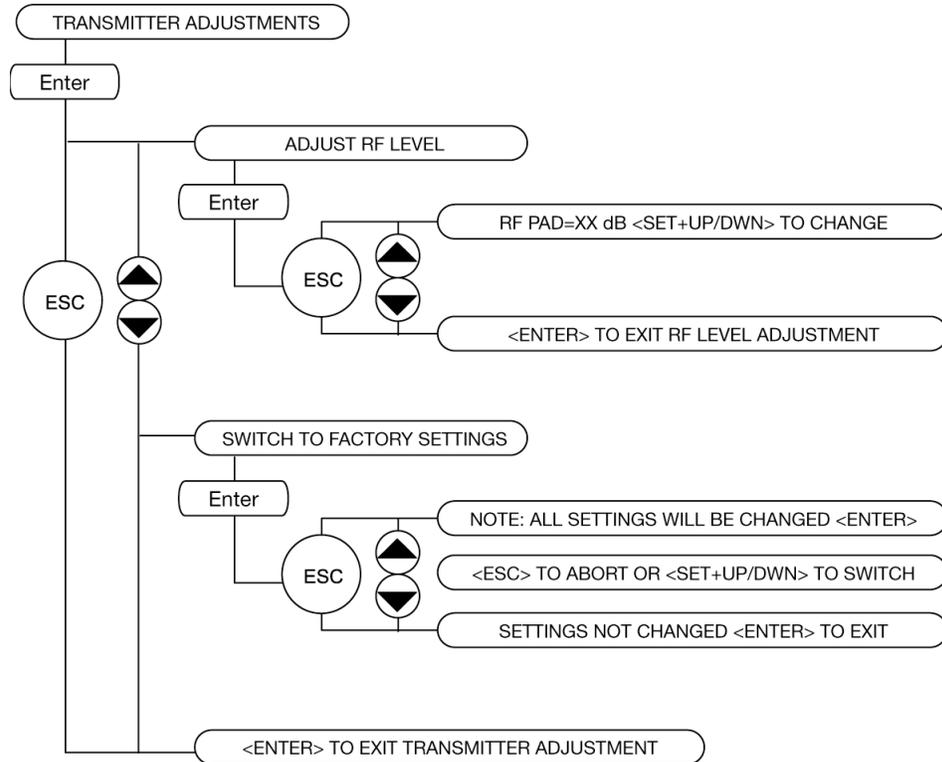
Figure 3-5. Transmitter Adjustments menu

3.1.6   Transmitter Alarms Menu

The Status LED on the front panel of the HLD 7105T indicates when the HLD 7105T has active alarms. You can check the alarms through the Transmitter Alarms menu of the HLP 4200WD. Figure 3-6 shows all the possible alarms; however, only the active alarms are displayed on the front panel.

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

TRANSMITTER ALARMS

Enter

NOTE: IF UNIT IS IN ALARM, THE HIGHEST PRIORITY ALARM WILL APPEAR FIRST AND BYPASS THE MAIN (LEVEL 0) MENU

ESC

LASER SYSTEM OFF, TEMP. TOO HIGH

LASER SYSTEM OFF, TEMP. TOO LOW

LASER POWER BELOW NORMAL

LASER TEMP. ERROR OUT OF TOLERANCE

LASER CURRENT ERROR OUT OF TOLERANCE

FAN ALARM, CHECK FAN

SYSTEM TEMP, TOO HIGH

5 V DC SUPPLY ALARM

-3 V DC SUPPLY ALARM

+15 V DC SUPPLY ALARM

-15 V DC SUPPLY ALARM

12 V DC SUPPLY ALARM

SWITCHERD 24 V ALARM

RF SIGNAL LOW, CHECK RF INPUT

NO ALARMS

<ENTER> TO EXIT TRANSMITTER ALARMS

POSSIBLE ALARM MESSAGES

Figure 3-6. Transmitter Alarms menu

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 HLD 7105T transmitters either remotely or locally. For information on installing and using this system, see the *NETWatch Site Controller Product Manual.*

3.3 HLD 7105T Front Panel RF Adjustment

> **NOTE:** Harmonic recommends that you use the front panel RF adjustment control only if the interface options described in Section 3.1 and Section 3.2 are not available.

To set the RF pad levels, you can use the RF adjustment control on the front panel of each HLD 7105T transmitter module, as shown in Figure 1-1 on page 1-2. The RF adjustment potentiometer provides screwdriver-adjustable control of the input signal RF pad.

The RF adjustment control provides the following options:

- Each clockwise-turning step increases the RF attenuation by 0.1 dB.
- Each counterclockwise step decreases the RF attenuation by 0.1 dB.
- Each full turn has 10 steps, equal to 1.0 dB.

The RF adjustment control works by communicating with the microprocessor, which in turn adjusts the pad value.

3.4 HLD 7105T Front Panel LED Indicators

The HLD 7105T transmitter front panel includes two LEDs, as shown in Figure 1-1 on page 1-2.

- The *Status* LED is red if an alarm condition exists within the transmitter, or green if no alarm condition exists and the transmitter is operating normally.
- The *Select* LED is yellow when the module is selected via the front panel of the HLP 4200WD.

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4
Transmitter Setup

This chapter describes how to set up a METROLink™ HLD 7105T Forward Path Transmitter for optimum performance. Any of the three user interface options described in Chapter 3, *User Interface Options*, can be used for transmitter setup.

This chapter describes:

- Factory-optimized settings of the HLD 7105T transmitter
- How to set up via the HLP 4200WD display
- How to set up via the NETWatch Site Controller
- How to set up via the transmitter's front panel controls

NOTE: For initial setup of the transmitter, Harmonic recommends using the HLP 4200WD Platform's push buttons and display, if available. If you are using another platform (such as the HLP 4200ND) that does not have a display, you can use the NETWatch Site Controller for transmitter setup. In the event that neither of those interface options is available, you can adjust the RF level via the front panel of the HLD 7105T.

Before proceeding with the instructions outlined in this chapter, ensure that you have installed the transmitter properly into the HLP 4200 Platform, as described in Chapter 2, *Installing the HLD 7105T Transmitter*.

4.1 Factory-Optimized Settings

Harmonic's factory optimizes the performance of each HLD 7105T transmitter prior to shipment.

The transmitter is preset and tested in the factory to provide a CNR > 48 dB with a channel loading of 33 CW carriers in 4 MHz noise bandwidth, a CSO < –56 dBc, and a CTB < –54 dBc. The RF drive level is 19.3 dBmV/channel. The received optical power into the HRM 3811 receiver is –6 dBm. Figure 4-1 describes the factory test setup.
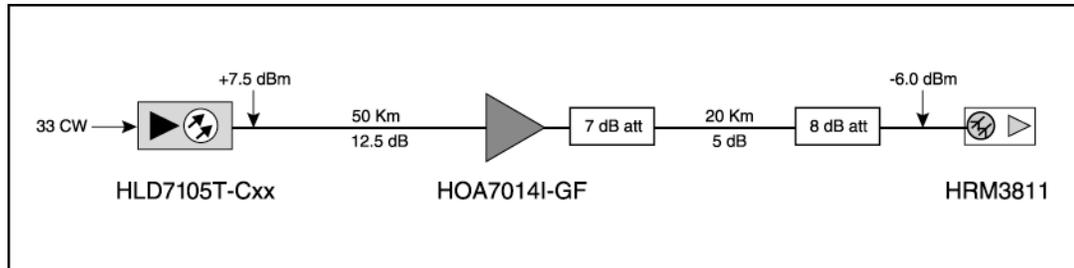
Figure 4-1. HLD 7105T factory test setup

When loaded with QAM channels, the HLD 7105T's optimum drive level can be derived as shown in Table 4-1.

Table 4-1:   HLD 7105T Performance at Factory Settings

Channel Loading	RF Drive Level per QAM Channel	RF Drive Level per Hz	
		6 MHz Bandwidth	8 MHz Bandwidth
9 QAM channels	25 dBmV	-42.8 dBmV	-41.6 dBmV
18 QAM channels	22 dBmV	-45.8 dBmV	-44.6 dBmV
33 QAM channels	19.3 dBmV	-48.5 dBmV	-47.3 dBmV
50 QAM channels	17.5 dBmV	-50.3 dBmV	-49.1 dBmV

Once the HLD 7105T is optimized in the factory, the factory settings are written into the transmitter's memory. If at any time the transmitter's settings are changed, you can always reset the transmitter to the original factory settings through the HLP 4200WD display interface by following the procedure in *4.2.1.1 Resetting the Transmitter to Factory Defaults* on page 4-4.

4.2 Setting Up via the HLP 4200WD Display

This section provides instructions for setting up the HLD 7105T transmitter via the push buttons and LCD display of the HLP 4200WD equipment platform. Using the HLP 4200WD display is the quickest and easiest way to initially set up and review HLD 7105T transmitter monitoring and control parameters.

See *3.1 HLP 4200WD Display* on page 3-1 for a description of this interface.

Follow the instructions in one of the sections below based on your application:

- Section 4.2.1, *Using the HLD 7105T in a Standalone Application*
- Section 4.2.2, *Using the HLD 7105T with a Broadcast Transmitter*

4.2.1 Using the HLD 7105T in a Standalone Application

In most applications, the HLD 7105T is used to transport digital information in QAM format.

To set up the transmitter:

1. Make sure the transmitter is properly installed in the HLP 4200 Platform.
2. Make note of the number of QAM channels you are going to transport on this transmitter.
3. From Figure 4-2, determine the maximum RF drive level you can use per QAM channel for the number of QAM channels determined in Step 2. For example, if you are going to transport 9 channels, the RF drive level per channel should not exceed 25 dBmV.
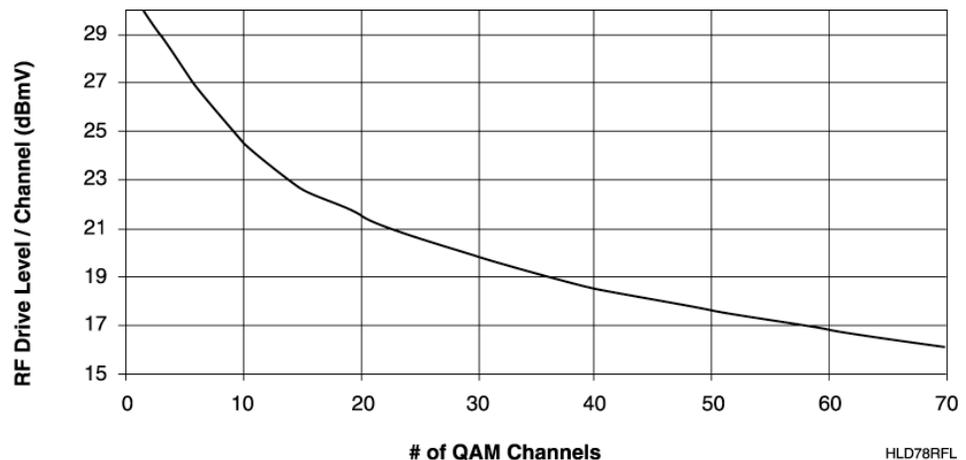
Figure 4-2. Maximum RF drive level per channel

NOTE: The total RF drive level should not be less than 22 dBmV. If the total RF drive level drops below 22 dBmV, an RF Signal Low Alarm is activated. Also, if the Power Reduction at Low RF feature is enabled, the optical output is decreased by 3 dB.

> **NOTE:** When you select the initial RF drive level per channel, Harmonic recommends considering the future channel loading, if performance allows. This will make the system easy to upgrade when you add more channels.

> **NOTE:** Please contact your Harmonic representative to determine the expected performance and constraints for your particular DWDM system.

4. Determine the optical power level at the receiver. If Harmonic has done a design for your specific application, then this information should be available from the design.

5. If the CNR performance is lower than you need for your application, you will have to either lower the number of QAMs you are loading or increase the optical power on the receiver by using a higher-power EDFA.

6. Set the RF drive level per channel to the value determined in Step 3, and connect the RF input to the HLD 7105T.

7. Invoke the Return to Factory Settings command. Detailed instructions for doing this are provided in Section 4.2.1.1.

8. If the RF drive level available to you is higher or lower than the maximum drive level determined in Step 3, you can compensate for it by setting the RF pad higher or lower, as described in Section 4.2.1.2.

9. If the HLD 7105T is optically combined with HLT 7xxx broadcast transmitters, set the fiber length of the chirp CSO precompensation parameter as described in Section 4.2.1.3.

4.2.1.1   Resetting the Transmitter to Factory Defaults

Use the following procedure to return the transmitter to factory settings:

1. Press the ESC button until the HLP 4200WD Platform display reads `MODULE SELECTION`. Press Enter.

2. Press ▲ or ▼ until the display indicates the HLD 7105T module you wish to set up. Press Enter.

3. Press ▲ or ▼ until the display reads `TRANSMITTER ADJUSTMENTS.` Press Enter.

4. Press ▲ or ▼ until the display reads `SWITCH TO FACTORY SETTINGS.` Press Enter.

5. A message appears, telling you that all settings will be changed. Press Enter.

6. A confirmation message appears. Hold down the Set button, and press ▲ or ▼. Then press Enter.

4.2.1.2 Setting the RF Pad

Use the following procedure to adjust the RF pad setting for the HLD 7105T:

1. Press ESC until the HLP 4200WD Platform display reads `MODULE SELECTION.` Press Enter.
2. Press ▲ or ▼ until the display indicates the HLD 7105T module you wish to set up. Press Enter.
3. Press ▲ or ▼ until the display reads `TRANSMITTER ADJUSTMENTS.` Press Enter.
4. Press ▲ or ▼ until the display reads `ADJUST RF LEVEL.` Press Enter.
5. Press ▲ or ▼ until the display reads `RF PAD = XX.X dB <SET+UP/DN> TO CHANGE.`
6. Hold down the Set button, and press ▲ or ▼ until the value you want is displayed. Then press Enter.

4.2.1.3 Setting Fiber Length

Use the following procedure to adjust the fiber length of the chirp CSO precompensation parameter if the output of the HLD 7105T is optically combined with the output of broadcast transmitters.

1. Press ESC until the HLP 4200WD Platform display reads `MODULE SELECTION.` Press Enter.
2. Press ▲ or ▼ until the display indicates the HLD 7105T 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 `FIBER = XX.X km <SET+UP/DN> TO CHANGE.` Hold down the Set button, and press ▲ or ▼ until the fiber length is set closest to the actual fiber length in the HLD 7105T path.

4.2.2 Using the HLD 7105T with a Broadcast Transmitter

The HLD 7105T may be used in conjunction with Harmonic's HLT 7xxx broadcast video transmitter. However, if both the broadcast and the narrowcast wavelengths are transported over the same fiber from the hub to the node, you must limit the number of channels.

A maximum of 50 64-QAM channels or 33 256-QAM channels can be transported over the HLD 7105T when both the broadcast and the narrowcast wavelengths are transported over the same fiber. The HLD 7105T's chirp compensation solved the problem of CSO beats in the analog band, enabling the use of up to 50 channels.

4.3   Setting Up via the NETWatch Site Controller

If you are using a platform (such as the HLP 4200ND) that does not have a display, you can use the NETWatch Site Controller for transmitter setup.

> **NOTE:** For initial setup of the transmitter, Harmonic recommends that you use the HLP 4200WD Platform display interface, if available, and that you follow the setup procedure in Section 4.2.

To set up the HLD 7105T transmitter via the NETWatch Site Controller:

1. Verify that the HLD 7105T transmitter module is properly installed in the HLP 4200 Platform. Instructions are provided in Section 2.2.
2. Verify that the HLP 4200 is powered on and that there are no alarm conditions for the transmitter module; make sure the HLD 7105T module's icon in the NETWatch display is green.
3. Set the RF input level as described in Section 4.2.
4. Verify that the RF input signal has been properly connected to the HLD 7105T.
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.

For further information on the use of the NETWatch Site Controller, see the *NETWatch Site Controller Product Manual.*

4.4   Setting Up via the Transmitter's Front Panel Controls

This section provides the instructions for setting up the HLD 7105T via the control found on the front panel of the HLD 7105T module, as shown in Figure 1-1 on page 1-2.

The HLD 7105T front panel control can be used only to set the RF pad level. Use of this interface is recommended only if the first two setup options described in Section 4.2 and Section 4.3 are not available.

> **NOTE:** For initial setup of the transmitter, Harmonic recommends that you use the HLP 4200WD Platform display interface, if available, and that you follow the setup procedure in Section 4.2.

If you are using an equipment platform (such as the HLP 4200ND) that has been configured without a display, and the NETWatch Site Controller is not available, follow the procedure below.

To set up the HLD 7105T using only the manual RF pad adjustment control on the front panel of the module:

1. Verify that the HLD 7105T module is properly installed in the platform (see Section 2.2 for details).

2. Set the RF input level as described in Section 4.2.

3. Verify that the RF input signal has been connected properly to the HLD 7105T (see Section 2.4 for details).

4. Turn the RF pad adjustment control to increase or decrease the RF pad. One clockwise turn of the switch increases the RF pad by 1 dB. One counterclockwise turn reduces the RF pad by 1 dB. For further details on how to use the RF pad adjustment control, see *3.3 HLD 7105T Front Panel RF Adjustment* on page 3-7.

5. The chirp compensation is preset at the factory to a fiber length of 50 km. If the fiber length in your application is less than 25 km or greater than 70 km, you should request that a specific distance be set as the default by the factory when you purchase the transmitter.

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5
Maintenance

This chapter describes how to:

- Clean fiber optic connectors
- Replace the fan in the HLD 7105T transmitter

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.

Dirty optical connectors are the leading source of poor performance in a broadband 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 transmitter.

In addition, if you suspect that the optical connector of an HLD 7105T module may have been exposed to contamination (by a dirty fiber cable connector, for example), you should properly clean the HLD 7105T optical connector before connecting optical fiber.

NOTE: Improper cleaning of an optical connector can do more harm than good. Never use a clean-air product to spray air 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

For cleaning 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 to clean the optical connector of a patch cord or pigtail.

1. Fold a piece of unused dry lens cleaning paper twice, for a 4-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 across the paper from the wet part to the dry part.

5.1.2 Cleaning Transmitter Module Optical Connectors

To properly clean the optical connector of a METROLink transmitter module:

1. Remove the transmitter module from the HLP 4200 Platform.
2. Remove the optical connector plate, including the Optical Out shutter, by unscrewing the two screws, as shown in Figure 5-1 on page 5-3.
3. Pull the connector plate away, moving it no more than 3 inches from the back plate of the unit, and release the internal optical connector from the internal bulkhead adaptor. Pulling the connector out more than 3 inches may break the fiber.
   The end of the internal fiber connector can now be cleaned.
4. Fold a piece of unused dry lens cleaning paper twice, for a 4-ply thickness.
5. Use a drop of high-grade isopropyl alcohol to wet part of the paper.
6. Lay the connector on the lens cleaning paper with the tip touching the paper.
7. In one continuous motion, pull the connector across the paper from the wet part to the dry part.
8. Once the cleaning is complete, reinsert the internal fiber connector into the bulkhead adaptor, and press the two parts together carefully.
9. Carefully replace the connector plate.
10. Screw the two plate screws back in the Optical Out shutter.

Cxx

Optical Connector Plate

Optical Connector Plate
Retaining Screws

Optical Out Shutter

HLD78RPN
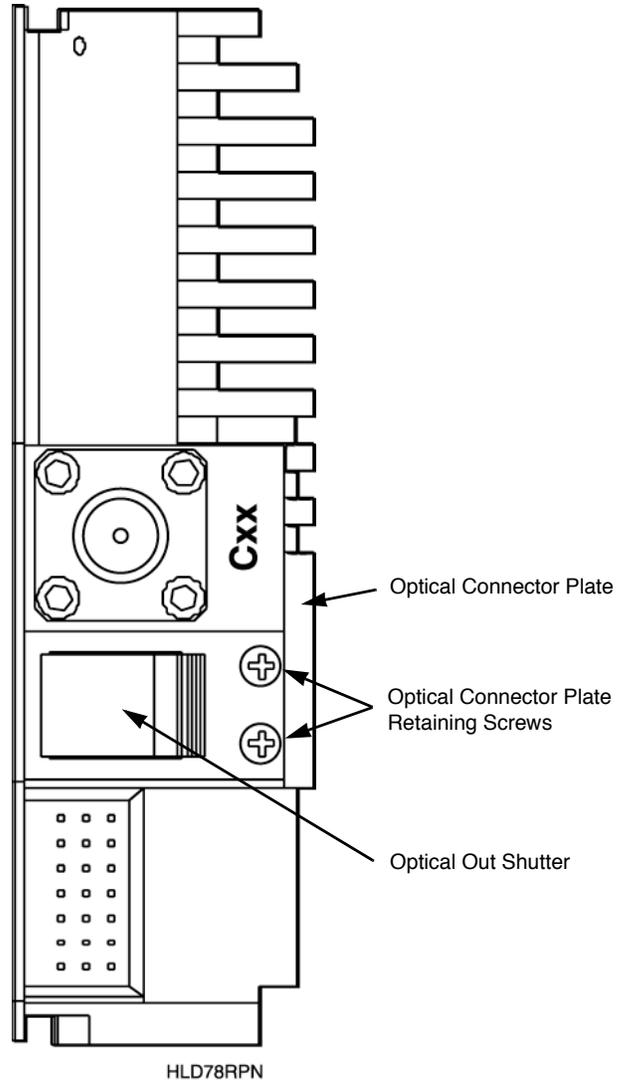
Figure 5-1. HLD 7105T optical connector plate

5.2   Replacing the Fan

NOTE: You can remove and replace the fan assembly mounted on the HMC 4000 carrier without removing or disabling the METROLink transmitter module. Under normal headend and central office environmental conditions, the HLD 7105T transmitter can operate without fan cooling for a limited time.

Should a fan fail, contact Harmonic's technical service (see Section 6.2).

To replace the fan:

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

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6
Troubleshooting

This chapter describes:

- How to troubleshoot the HLD 7105T transmitter
- How to return the unit for service
- Manufacturer disclaimer

6.1 Troubleshooting

DANGER: The fiber carries invisible laser radiation. **AVOID DIRECT EXPOSURE TO THE BEAM.** Never operate the unit with a broken fiber or with a fiber connector disconnected.

Should a problem occur:

1. Confirm that the HLD 7105T transmitter is receiving power.
2. Confirm that the input RF drive is at the proper level (see Section 4.2.1) and that the RF connector is secure.
3. Confirm that the optical connectors are clean and secure.
4. Reset the transmitter to factory defaults (see Section 4.2.1.1).

6.2 In Case of Problems

If you continue to have a problem, contact the Harmonic Customer Service department (see Appendix B, *Harmonic Inc. – Offices*). 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 Appendix B, *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.

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Appendix A
Technical Specifications

A.1   Optical Output

Output Power[1, 2]: 7.5 dBm ±0.25 dBm (5.3 to 6.0 mW)

RF Flatness: < 1 dB peak-to-valley

Laser shutdown: disable/enable switch

Eye protection: Safety shutter

Table A-1:   DWDM Wavelengths

Transmitter Model	ITU Channel	Wavelength (nm)	Harmonic Number
HLD 7105T-C20	C20	1561.42	
HLD 7105T-C21	C21	1560.61	W08
HLD 7105T-C22	C22	1559.79	
HLD 7105T-C23	C23	1558.98	W07
HLD 7105T-C24	C24	1558.17	
HLD 7105T-C25	C25	1557.36	W06
HLD 7105T-C26	C26	1556.56	
HLD 7105T-C27	C27	1555.75	W05
HLD 7105T-C28	C28	1554.94	
HLD 7105T-C29	C29	1554.13	W04
HLD 7105T-C30	C30	1553.33	
HLD 7105T-C31	C31	1552.52	W03

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1.   If total RF input drops to 22 dBmV or below, optical output will drop by 3 dB. This feature helps suppress noise effect due to stimulated Brillouin scattering.

2.   Please contact your Harmonic Applications Engineer to determine the expected performance and constraints for your DWDM system.

Table A-1: **DWDM Wavelengths** *continued*

Transmitter Model	ITU Channel	Wavelength (nm)	Harmonic Number
HLD 7105T-C32	C32	1551.72	
HLD 7105T-C33	C33	1550.92	W02
HLD 7105T-C34	C34	1550.12	
HLD 7105T-C35	C35	1549.32	W01
HLD 7105T-C36	C36	1548.51	
HLD 7105T-C37	C37	1547.72	
HLD 7105T-C38	C38	1546.92	
HLD 7105T-C39	C39	1546.12	WE8
HLD 7105T-C40	C40	1545.32	
HLD 7105T-C41	C41	1544.53	WE7
HLD 7105T-C42	C42	1543.73	
HLD 7105T-C43	C43	1542.94	WE6
HLD 7105T-C44	C44	1542.14	
HLD 7105T-C45	C45	1541.35	WE5
HLD 7105T-C46	C46	1540.56	
HLD 7105T-C47	C47	1539.77	WE4
HLD 7105T-C48	C48	1538.98	
HLD 7105T-C49	C49	1538.19	WE3
HLD 7105T-C50	C50	1537.40	
HLD 7105T-C51	C51	1536.61	WE2
HLD 7105T-C52	C52	1535.82	
HLD 7105T-C53	C53	1535.04	WE1
HLD 7105T-C54	C54	1534.25	
HLD 7105T-C55	C55	1533.47	
HLD 7105T-C56	C56	1532.68	
HLD 7105T-C57	C57	1531.89	
HLD 7105T-C58	C58	1533.11	
HLD 7105T-C59	C59	15350.33	

A.2   RF Input

Input level range: 23 to 40 dBmV

Operational bandwidth: 40 to 1003 MHz

RF attenuator adjustment range: 15 dB in 0.1 dB steps

Chirp compensation adjustment range: 0 to 100 km in 10 km steps (up to 300 MHz RF bandwidth)

Impedance: 75 ohms

Return loss: > 16 dB

Element management system: NETWatch Site Controller

Interface: RS-485, RS-232C connectors (in HLP 4200)

A.3   User Interface

Front panel

Bi-state status LED: Normal = green, Alarm = red

Module selection indicator: Yellow LED

RF attenuation adjustment

Monitor point:

Laser RF drive monitor

Flatness: ± 1.5 dB

Return loss: > 16 dB

Connector type: Female F

Rear panel

RF input connector type: Female F

Optical output connector

A.4   Power

Nominal: +24 VDC; supplied by HLP 4200 bus

Maximum: +28 VDC

Consumption: 22 Watts maximum

A.5 Environmental

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

Storage temperature range: -40° to +70° C (+32° to 158° F)

Automatic three-speed fan adjustment at 40° and 50° C (104° and 122° F)

Relative humidity: Maximum 85% noncondensing

Over-temperature laser protection: Software and hardware

A.6 Physical

Dimensions: 1.3 in W x 4.4 in H x 12.7 in D / 3.3 cm W x 11.2 cm H x 32.2 cm D

Weight: 2.1 lbs / 0.95 kg

Mounting: HLP 4200 Platform; one half-module slot, via HMC 4000

Optical connector type: SC/APC (Other connectors available on request)

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

A.7 Models Available

HLD 7105T-Cxx-zz

Cxx = ITU channel number (see Table A-1); 40 wavelengths available

zz = Connector type: AS, AF, or AE
    AS = SC/APC
    AF = FC/APC
    AE = E2000

A.8   Laser Radiation Warning

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001) as applicable to Class 1M Laser Products.

This light emission device is classified to IEC 60825-1:1993 + A1 + A2.

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

WARNUNG: UNSICHTBARE LASERSTRAHLUNG. NICHT DIREKT MIT LUPE BETRACHTEN. KLASSE 1M LASER PRODUKT. 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.

A.9   Agency Certifications

UL60950, CSA60950 (cTUVus)

FCC Part 15 Class A, VCCI, CDRH

EN60950, EN60825-1 (TUV GS-mark)

EN55022 Class A, EN55024 (TUV EMC-mark, CE)

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) for additional and updated information on this process.

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Appendix B
Harmonic Inc. – Offices

Assistance

For technical support and customer service, call toll free: 800.730.4099.

Harmonic's web address is www.harmonicinc.com.

Worldwide Technical Support and Return Materials Authorization
Tel: 1.800.730.4099 (inside U.S.)
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Fax: +1.408.490.6770
E-mail: rma@harmonicinc.com

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