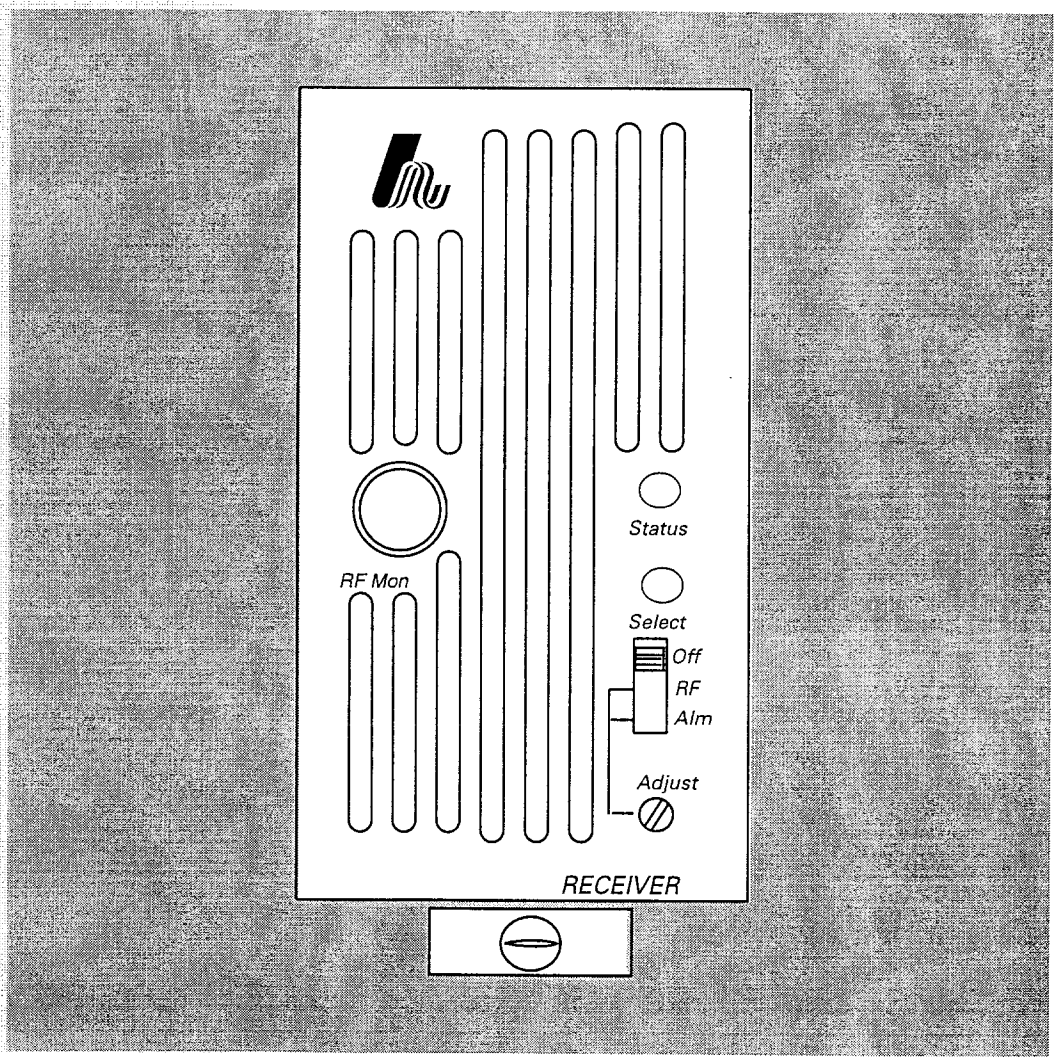
HRM 3810
Preliminary
Instruction Manual



Harmonic *Lightwaves*

ATTENTION

Pursuant to the pertinent sections of Title 21, (United States) Code of Federal Regulations (CFR), Chapter I, Subchapter J, and administered by the Center for Devices and Radiological Health (CDRH), operating under the Food and Drug Administration (FDA), this product, which produces or receives an optical signal, composed of Laser Radiation, complies with 21 CFR Chapter I, Subchapter J, as applicable to Class I Laser Products.

DANGER: Invisible Laser Radiation, when open or when operating with fiber disconnected. AVOID DIRECT EXPOSURE TO BEAM. Never operate unit with a broken fiber or with a fiber connector disconnected.

DANGER: la source laser émet une radiation invisible. EVITER UNE EXPOSITION DIRECTE AU FAISCEAU.

CAUTION: There are no user serviceable parts inside, refer all servicing to qualified service personnel. Other than those specific measurements, adjustments and tests specified in this manual, make NO attempt to modify or alter any circuit or assembly in any manner.

CAUTION: Toute intervention sur cet équipement est formellement déconseillée par le fabricant. En dehors des réglages décrits dans le manuel, l'utilisateur doit contacter une personne qualifiée par le fabricant pour toute modification ou réparation.

Warranty Summary*

This Harmonic Lightwaves product is warranted against defects in material and workmanship for thirty-six (36) months from the date of shipment. Harmonic Lightwaves will, at its option, either repair or replace products that prove to be defective.

For warranty or repair, return this product to a service facility designated by Harmonic Lightwaves. Buyer shall prepay shipping charges to Harmonic Lightwaves, and Harmonic Lightwaves shall pay shipping to return the product to the Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Harmonic Lightwaves from another country.

Harmonic Lightwaves warrants that its software, as well as firmware designated by Harmonic Lightwaves for use with the product, will execute its programming instructions when installed properly. Harmonic Lightwaves does not warrant that the operation of the product or software or firmware will be uninterrupted or error-free.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from abuse, neglect by Buyer, improper installation or application by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site penetration or maintenance.

Note: No other warranty is expressed or implied. Harmonic Lightwaves specifically disclaims the implied warranties or merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are the buyer's sole and exclusive remedies. Harmonic Lightwaves shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based upon contract, tort, or any other legal theory.

Assistance

For assistance, contact your nearest Harmonic Lightwaves Sales and Service office.

Harmonic Lightwaves, Inc.
549 Baltic Way
Sunnyvale, CA 94089
Tel. 408-542-2500
Fax 408-542-4099

Part Number: 700-0005053-1
Rev.: A- April 1997

*See Order Acknowledgment for complete warranty details.

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1.0 General Information

This section provides information about this manual, a description of the product, suggested applications for the product, and a list of the product's specifications.

1.1 About this Manual

This instruction manual is a complete guide to installing and operating the HRM 3810 receiver module. Please read the entire manual before beginning installation.

1.2 Product Description

The HRM 3810 plug-in module is used with the HLP 4000 equipment platform. Key features include:

- Adjustable RF and alarm levels, with front panel LED indication
- Support for a broad range of optical input levels, up to +5 dBm
- Automatic redundant backup when two receivers are interfaced
- High output gain
- Local control of operating parameters via the HLP 4000 platform control and display
- Remote control and monitoring via the Harmonic Lightwaves NETWatch™ element management system
- Compact design and packaging

1.3 Product Application

The HRM 3810 receiver is used with the PWRLink™ series HLP 4000 equipment platform. The PWRLink product is designed to meet the economic and technical requirements of broadband service providers.

The modular design of the PWRLink product offers the user a number of advantages:

- The flexibility to add other plug-in modules as network requirements change, without the need to replace equipment shelves, power supplies, or status monitoring equipment.
- The economic advantage of maintaining spare plug-in modules rather than entire subsystems.
- Reduced network downtime because of plug-in module replacement.

1.4 System and Block Diagrams

Figure 1. HLP 4000 Platform Functional Diagram
Figure 2. HRM 3810 Block Diagram

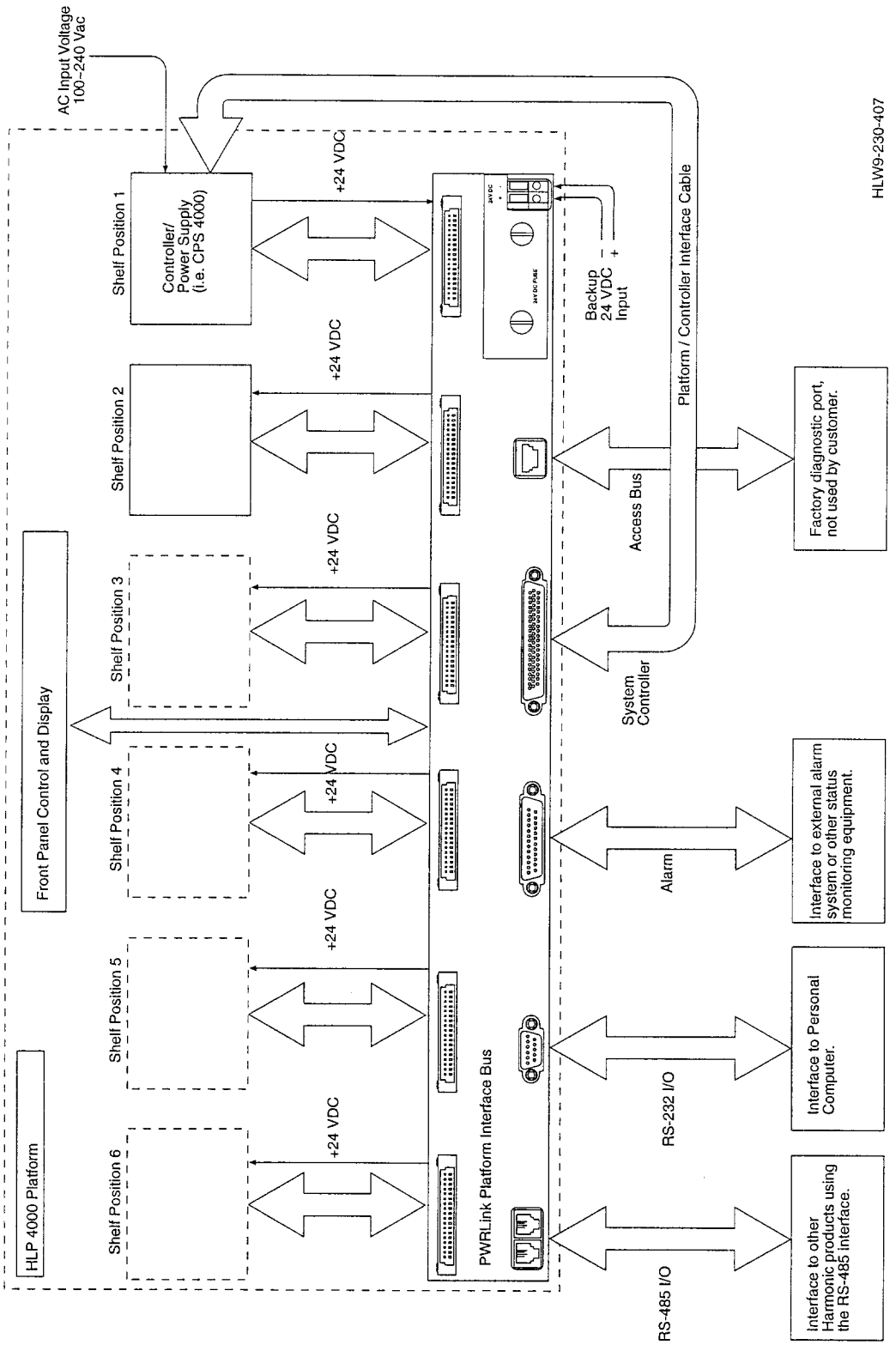


Figure 1 - HLP 4000 Platform Functional Diagram

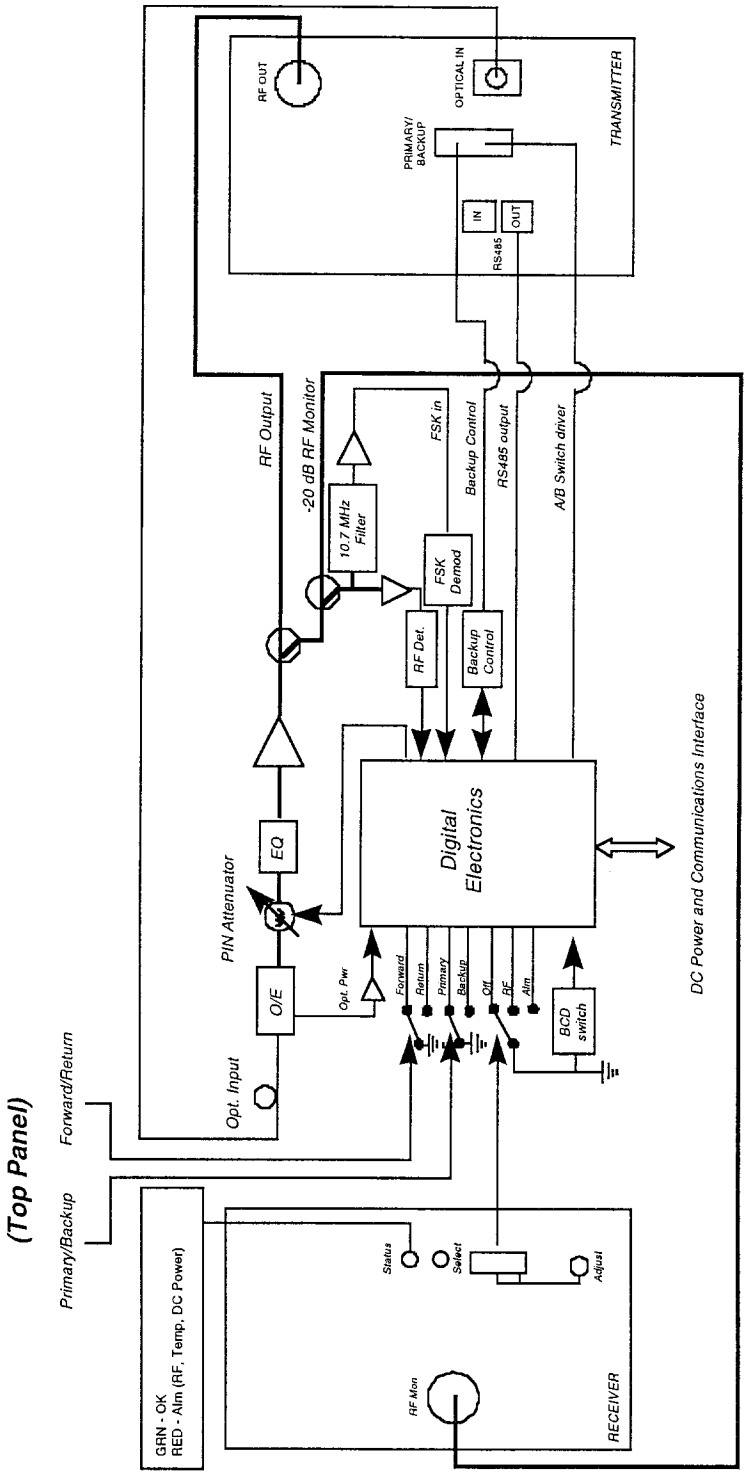


Figure 2 - HRM 3810 Block Diagram

1.5 Technical Specifications

Optical Receiver

Wavelength range:	1300–1560 nm
Optical input power range:	≤ +5 dBm
Responsivity, 1300nm:	≥ 0.85 A/W
Responsivity, 1550nm:	≥ 0.9 A/W
Optical return loss:	≥ 45 dB (without optical connector)
Noise equivalent current:	≤ 7 pA/√Hz, 45-870 MHz
Optical alarm threshold:	–10 dBm, at 1300 nm

Entire Unit

Bandwidth:	45–870 MHz
Frequency response, 45-550MHz:	±0.5 dB
Frequency response, 550-870MHz:	+0.75/–0.5 dB
Relative response at 10.7MHz:	–2 dB, relative to response at 45 MHz
RF output level:	≥ 32 dBmV [1]
Output level control range, manual:	≥ 10 dB [2]
Output level stability, over operating temperature:	±1 dB
Output level stability, at constant temperature:	±1 dB/day
CSO:	≤ –65 dBc [3]
CTB:	≤ –71 dBc [4]
Hum modulation:	–70 dB maximum
RF output return loss:	16 dB at 45–870 MHz
Group delay, all channels:	≤ 5 ns
Power consumption, per module:	≤ 30 W

RF Monitor Point

Coupling loss:	20 dB
Accuracy:	±0.5 dB
Return loss, 45-550MHz:	16 dB
Return loss, 550-870MHz:	14 dB
CSO degradation:	≤ 1 dB relative to main output
CTB degradation:	≤ 1 dB relative to main output

Environmental

Operating temperature:	0 to +50° C
Storage temperature:	–40 to +70° C
Mechanical shock:	30 cm drop, no damage
Vibration:	1.5 g, 10–500 Hz, full performance

[1] At –3 dBm received optical power, 4% OMI, per channel
[2] Pin attenuator will allow 32–22dBm variation at –3 dBm received optical power, 4% OMI
[3] 77 System M (NTSC), 23° C, 36 dBmV output per channel with a transmitter with a CSO of –65 dBc
[4] 77 System M (NTSC), 23° C, 36 dBmV output per channel with a transmitter with a CTB of –75 dBc

2.0 Installation

Before mounting the receiver into the HLP 4000, inspect for damage and set the module personality switch as described in Section 2.2.

2.1 Receiving and Inspection

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 Lightwaves (800/730-4099). To protect the operator from potential injury, and to protect the equipment from further damage, do not perform any operational tests.

2.2 Personality Switch Setting

The two slide switches on top of the module are used to configure the receiver for one of four personality types: Forward/Primary (default factory setting); Forward/Backup; Return/Primary; and Return/Backup.

2.2.1 Forward/Primary

Modules with Forward/Primary personality can be set for one of three modes: Auto, Forced Primary (default factory setting), or Forced Backup. Modes are selected either via the HLP 4000WD front panel controls or through the EMS.

In Auto mode, the primary unit switches an external A/B switch to B when the RF level is below the threshold level. When the RF level is restored, the A/B switch returns to A. Communication is switched between the primary and backup unit based on received optical power.

In Forced Primary mode, the A/B switch is always in the A position. In Forced Backup mode, the A/B switch is always in the B position.

2.2.2 Forward/Backup

Modules with Forward/Backup personality do not have any mode settings, thereby allowing the primary unit to be the master controlling the backup.

2.2.3 Return/Primary

Modules with Return/Primary personality can be set for one of three modes: Auto, Forced Primary, or Forced Backup. Mode selection occurs either via the HLP 4000WD front panel controls or through the EMS.

In Auto mode, the primary unit switches an external A/B switch to B when the optical signal is below the threshold level. As soon as the signal is restored, the A/B switch returns to A.

In Forced Primary mode, the A/B switch is always in the A position. In Force to Backup mode, the A/B switch is always in the B position.

2.2.4 Return/Backup

Modules with Return/Backup personality do not have a mode setting. Therefore, if a loss of optical signal occurs on the primary unit, communication switches to the backup unit. Upon restoration of the optical signal, communication switches back to the primary unit.

2.3 Mounting the Unit in the HLP 4000

The HRM 3810 is a plug-in module which is easily inserted into any desired shelf position in the HLP 4000WD/ND platform.

For the HLP 4000WD:
Lower the control/display panel of the platform and slide the module into any available slot.

For the HLP 4000ND:
Slide the module into any available slot.

Once the module is seated, lock the unit into position by using the module locking screw.

3.0 External Connections

All of the external connections to the rear panel of the module are described in this section (refer to Figure 3).

3.1 Fiber Cable Connection

IMPORTANT: Before connecting the fiber cable to the optical input of the module, measure the output power of the cable using an optical power meter.

If the measurement exceeds +5 dBm, the signal must be attenuated with an optical attenuator before connecting the cable to the module.

3.2 RF Out Connection

The receiver output ("RF Out" on the rear of the module) is connected to the rest of the system by means of a 75 ohm impedance coaxial cable, terminated with an F type connector.

Connect the prepared coaxial cable to the F connector marked "RF Out" on the rear of the module.

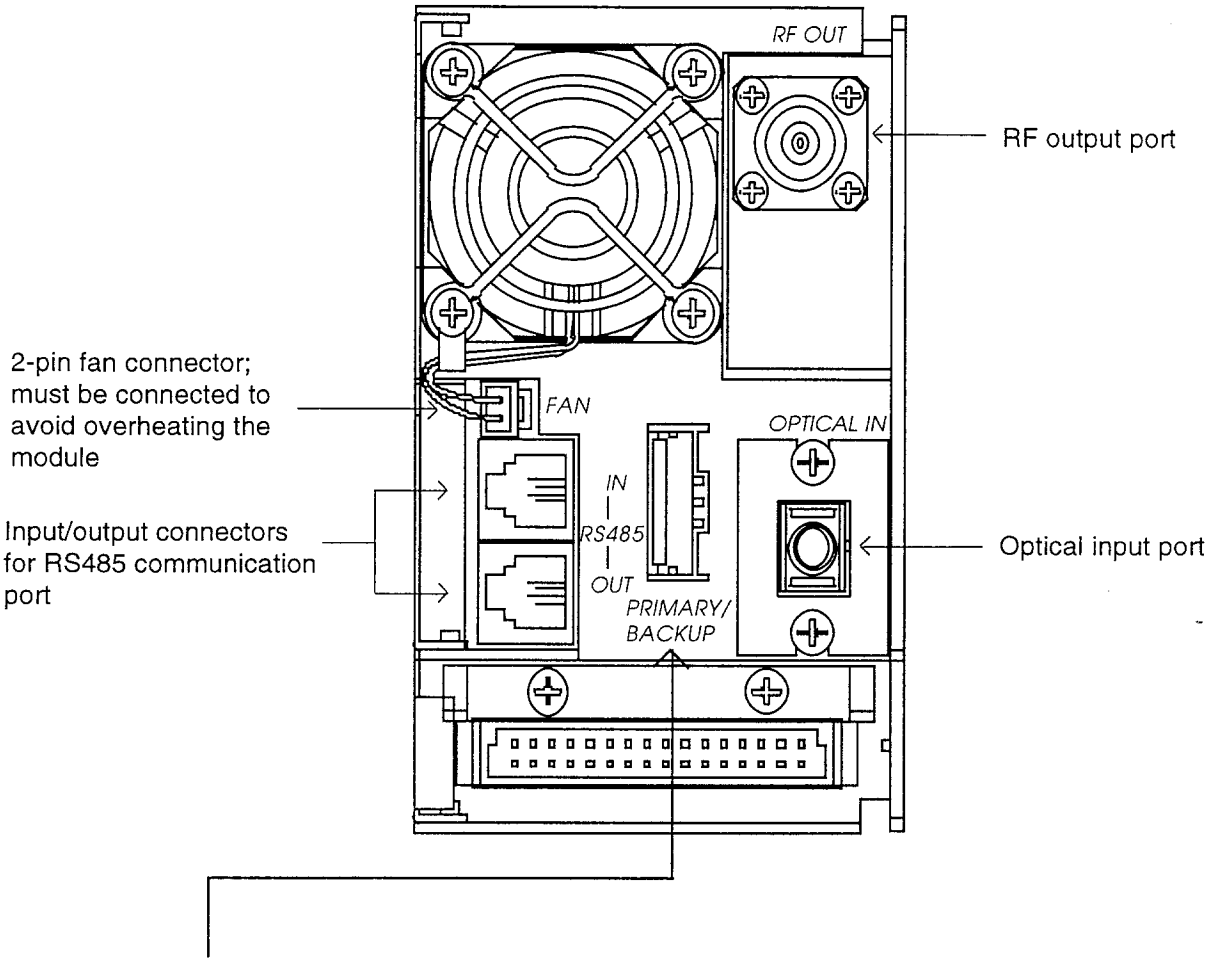
NOTE: To ensure performance integrity, use coaxial cable with a 0.025" to 0.032" center conductor diameter.

3.3 Element Management System (EMS) Connection

From the EMS computer, connect the serial port to one of the DB9 pin connectors on the HLP 4000 platform or the 25-pin connector on the HTR 2000 platform.

Then, connect the RJ-11 telephone cord between the HLP 4000 platform and other Harmonic Lightwaves equipment that supports the RS-485 data interface.

Refer to the HLP 4000 instruction manual for further information.



4-pin connector, with the following pin assignments (1 = top pin):
1. Primary/Backup +
2. Primary/Backup –
3. A/B Switch Control
4. +24 VDC

Pins 1 and 2 carry RS485 driver levels and are used to control the network management communication switching of the backup unit.

When the primary unit is carrying the communication signal, they shut off communication in the backup unit. When the primary unit's communication fails, they switch the communication path to the backup unit.

When connected to the backup unit, pin 1 of the primary should be connected with pin 1 of the backup, and pin 2 should be connected with pin 2.

Pins 3 and 4 are used to drive the A/B switch. Pin 3 is driven low by the digital electronics in the module if the A/B switch needs to be switched to the backup route.

Pin 4 (+24 V) should be connected to the other end of the A/B switch control line.

Figure 3 - HRM 3810 Rear Panel

4.0 Operation

This section describes the power up and user interface options for the HRM 3810.

Figure 4 illustrates the front panel controls and indicators for the module.

4.1 Power Up

To verify that the HRM 3810 is operating normally, perform the following:

1. Press the power button on the power supply (normally, this would be the CPS 4000).
2. If the unit is operating normally, the status LED on the front panel should illuminate green.

If your system has the HLP 4000WD option installed, the display will greet the operator with a "HL 4000 SYSTEM READY" message.

4.2 User Interface Options

The receiver provides three user interface options:

- Front panel adjustments
- HLP 4000WD adjustments
- NETWatch user interface

4.2.1 Front Panel Adjustments

The interface from the front panel of the receiver is limited to the capability of setting up the RF and alarm levels of the receiver. Front panel controls and indicators are as follows:

Off: In this position, the Step Adjust is disabled. The system gain control is left on and can be changed through the display or the EMS.

RF: This position is used in conjunction with the Step Adjust during initial setup of the system. This allows the RF input signal to be optimized for a given set of system performance requirements.

Alm: The Alarm position is used in conjunction with the Step Adjust during initial setup of the system. The alarm level threshold is adjusted by the user to set the red illumination point of the Status LED. This position also forces the system to manual mode.

Step Adjust Switch: Screwdriver adjustable step attenuation. Used to adjust RF and alarm levels.

The front panel also supports two LEDs: status and select.

The status LED is illuminated red if there is an alarm on the unit. Otherwise it is illuminated green.

The select LED is illuminated whenever the module is selected via the front panel of the HLP 4000WD.

4.2.1.1 RF Level Adjustment

To manually set the value of the RF level, move the slide switch to the RF position and use the step adjuster to change the RF value to the desired attenuation.

Each clockwise movement of the step adjust switch increases the attenuation by 0.1 dB. Each counterclockwise movement decreases the applicable attenuator as determined by the position of the setup switch, by 0.1 dB.

Once the desired setting has been realized, move the switch back to the off position. This will disable the setup function and prevent any inadvertent changes.

4.2.1.2 Alarm Adjustment

To manually set the value of the alarm, first set the RF level (as described above) to the desired threshold level.

Then, move the slide switch to the *Alm Lvl* and adjust the step adjuster to the point at which the alarm LED first illuminates.

Move the slide switch back to the RF level position, and readjust the RF level to its original setting. Return the slide switch to the *Off* position.

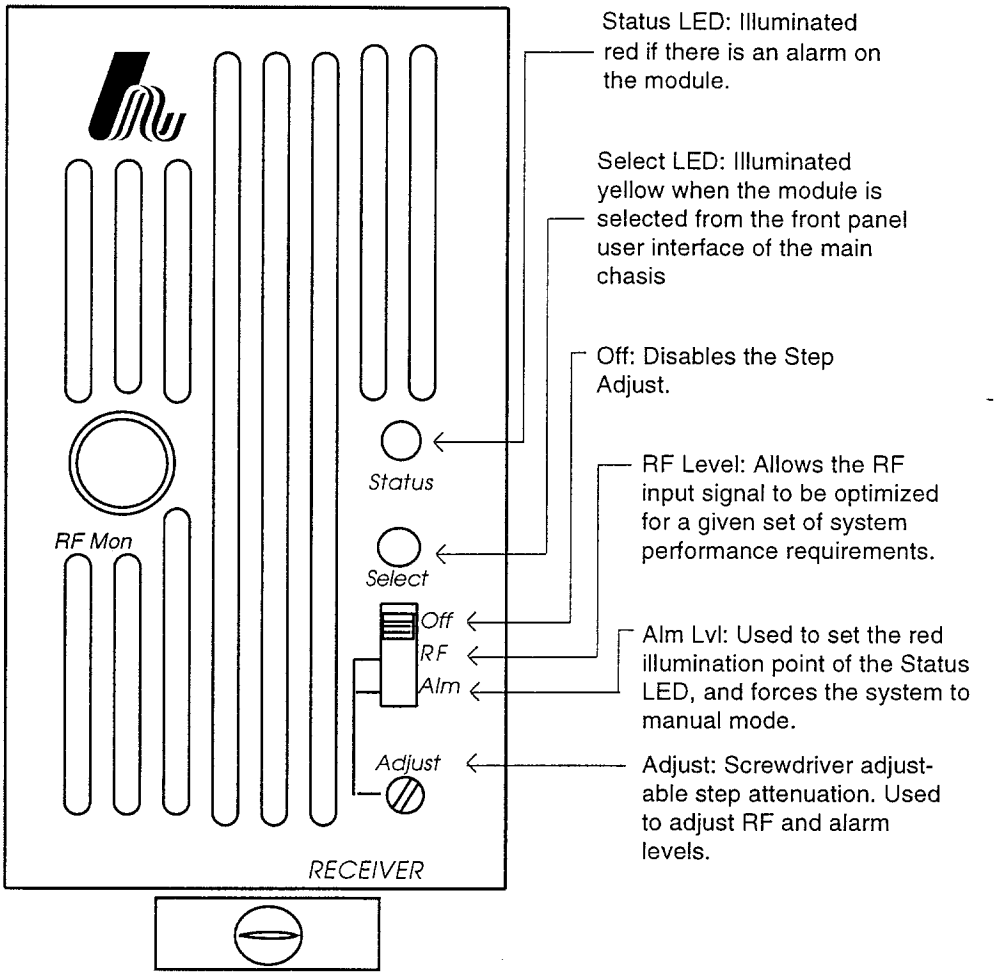


Figure 4 - HRM 3810 Front Panel

4.2.2 HLP 4000WD Adjustments

HRM 3810 module operation can be conveniently set up, monitored, and modified via the HLP 4000WD display.

Figure 5 illustrates the menu navigation for the HLP 4000WD, using the ESC, SET, ENTER and up and down arrow keys located on the front panel of the unit. Pressing any key on the front panel will show the "MODULE SELECTION" message on the front panel.

Pressing <ENTER> will then lead the operator to a menu displaying a list of connected modules, via the <UP> and <DOWN> keys on the keyboard. The module messages show the module position as the first field in the message, the left most being number 1, and the select LED of the currently selected module is illuminated.

Once the receiver under installation is the focus of the front panel display, pressing <ENTER> will lead the operator to the receiver menus.

The four user interfaces to the HRM 3810 are as follows: Receiver Status, Receiver Diagnostics, Receiver Adjustments, and Receiver Alarms.

4.2.2.1 Receiver Status

This menu enables the operator to obtain serial number, firmware version, and other information regarding switch positions and operating mode parameters. Menu items appear in the following order:

RECEIVER MODEL: HRM3810-XX-Y

RECEIVER SERIAL NUMBER: XXXXXXX

FIRMWARE VERSION: V1.00

RECIEVED OPTICAL POWER: X.X dBm(1310/1550)

RF PAD: XX.X dB

RF DETECTOR LEVEL: X.XX V

RF ALARM THRESHOLD: X.XX V

IN RFROUTE (USE): YES/NO

IN NMS ROUTE: YES/NO

DIRECTION IS: FORWARD/RETURN

UNIT IS: PRIMARY/BACKUP

ROUTE MODE: AUTO/FORCED PRIMARY/FORCED BACKUP [1]

<ENTER> TO EXIT RECEIVER STATUS

4.2.2.2 Receiver Diagnostics

This menu enables the operator to diagnose the power system and thermal operating conditions of the module. Menu items appear in the following order:

OPTICAL SYSTEM

RECIEVED OPTICAL POWER: X.X dBm

WAVELENGTH 1310/1550mm

<ENTER> TO EXIT OPTICAL DIAGNOSTICS

POWER SYSTEM

POWER SUPPLY (24 V) : 22.7 V

POWER SUPPLY (12 V) : 11.7 V

POWER SUPPLY (5 V) : 4.75 V

<ENTER> TO EXIT POWER SYSTEM DIAGNOSTICS

TEMPERATURE CONTROL SYSTEM

FAN SPEED LEVEL: LOW/ MEDIUM/HIGH/MAX

UNIT TEMPERATURE: 25.2 DEG. C

<ENTER> TO EXIT TEMP. CONTROL DIAGNOSTICS

<ENTER> TO EXIT RECEIVER DIAGNOSTICS

[1] Only the primary receiver should display this item

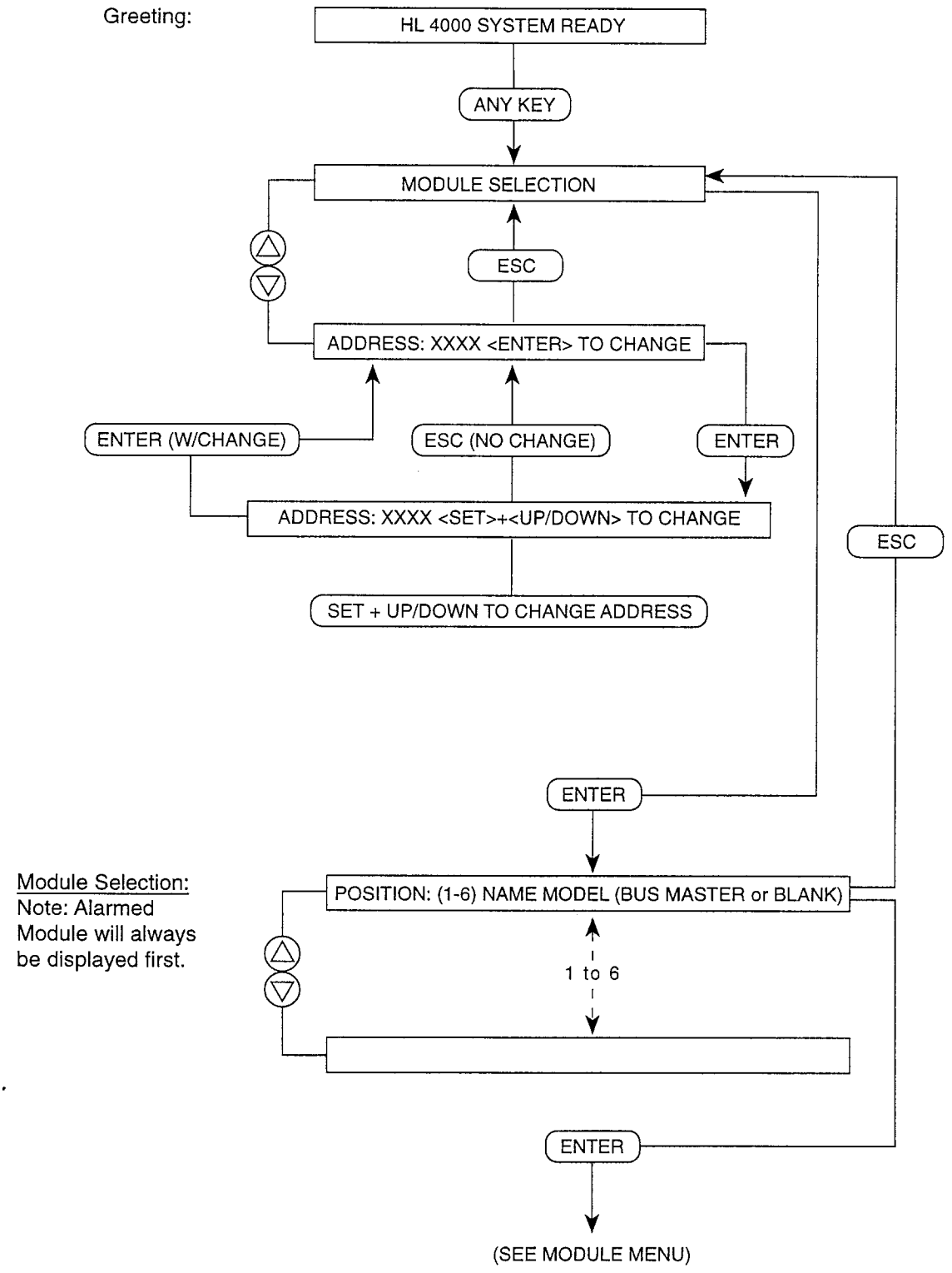


Figure 5 - HLP 4000WD Navigation

4.2.2.3 Receiver Adjustment

This menu allows the operator to adjust the receiver to different operation conditions to suit the special customer needs. Menu items appear in the following order:

SELECT ROUTE MODE [2]

MODE: AUTO/FORCED PRIMARY/FORCED BACKUP, <SET+UP/DN> TO SWITCH [3]

<ESC>:ABORT,<ENTER>:MODE=AUTO/FORCED PRIMARY/FORCED BACKUP

<ENTER> TO EXIT ROUTE MODE SELECTION

ADJUST RF LEVEL

RF PAD = XX.X dB, <SET+UP/DN> TO CHANGE

<ENTER> TO EXIT RF LEVEL ADJUSTMENT

ADJUST ALARM THRESHOLD

ALARM LEVEL = X.XX V, <SET+UP/DN> TO CHANGE

<ENTER> TO EXIT ALARM THRESHOLD LEVEL

WAVELENGTH SELECTION

WAVELENGTH: 1550 nm, <SET+UP/DN> TO SWITCH

<ENTER> TO EXIT WAVELENGTH SELECTION

SWITCH TO FACTORY SETTINGS

NOTE: SETTINGS WILL BE CHANGED <ENTER>

<ESC> TO ABORT OR <SET+UP/DN> TO SWITCH

<ENTER> TO EXIT SETTINGS' ADJUSTMENT

<ENTER> TO EXIT RECEIVER ADJUSTMENTS

[2] Primary unit only

[3] Scrolls through

4.2.2.4 Receiver Alarms

This menu displays the active alarms in the receiver. Menu items appear in the following order:

24 V DC SUPPLY ALARM
RECEIVED OPTICAL POWER LOW ALARM
12 V DC SUPPLY ALARM
5 V DC SUPPLY ALARM
RF LEVEL ALARM
FAN ALARM, CHECK FAN
SYSTEM TEMPERATURE TOO HIGH
NO ALARMS

<ENTER> TO EXIT RECEIVER ALARMS

4.2.3 NETWatch User Interface

Harmonic Lightwaves provides a complete element management system–NETWatch System–for the HRM 3810. All controls and parameters can be monitored and controlled either locally or remotely. Refer to the NETWatch manual for complete details.

5.0 Performance Testing

Once the receiver has been installed, performance testing can be conducted according to the NCTA Recommended Practices for Measurements on Cable Television Systems, Revision of Section 1 of FCC Technical Standards.

6.0 Maintenance

Information on cleaning the fiber optic connector and replacing the fan is provided below.

6.1 Cleaning the Fiber Optic Connector

WARNING: **Never use a clean air product to spray air into the optical adapter or on the connector end surface. The air causes dust to condense on top of the optics waveguide which is very difficult to remove. Never clean a connector when laser light is passing through it.**

You should always clean the mating connector before connecting it to the receiver. You should also clean the receiver connector as follows:

1. Remove the optical connector plate by unscrewing the two screws.
2. Pull the plate away (3" max to prevent breakage of the fiber) and release the optical connector from the adaptor.
3. Fold a piece of dry lens cleaning paper in half twice, for a 4-ply thickness.
4. Lay the connector on the lens cleaning paper with the tip touching the paper. Pull the connector across the paper to wipe the tip.
5. If necessary, use one drop of high grade acetone to wet part of the paper. Drag the connector across the wet area to reduce residue on the connector surface, then drag the connector tip across the dry area.
6. Assemble the connector back to the adaptor plate. Assemble the plate back to the receiver back panel. The mating optical connector has to be cleaned as described in steps 4 and 5.

6.2 Fan Replacement

Should a fan failure occur, disconnect the power cable and remove the four Phillips head screws securing the fan to the module housing. Replace the failed fan unit with a new fan unit. Secure the new unit with the Phillips head screws and reconnect the power cable.

7.0 In Case of Problems

Should a problem occur, check the following:

1. Confirm that the HRM 3810 is receiving power.
2. Check that the Controller Cable is connected to the HRM 3810 and the HLP 4000WD/ND.

Should a problem persist, contact the Harmonic Lightwaves Customer Service Department at (800) 730-4099. 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, he or she will issue you a Return Material Authorization Number. Please make note of this number. You will need to include it on the shipping container when returning the unit, and with all correspondence regarding the unit.

The return address is:

Harmonic Lightwaves, Inc.
549 Baltic Way
Sunnyvale, CA 94089
Attn: Customer Service
RMA no. _____

Sales Office Listing

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Harmonic Lightwaves, Inc.
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Tel: 800/730-4099
Fax: 408/542-2511

International Sales
Tel: 408/542 2500 ext. 2782
Fax: 408/542-2514

Technical Support
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Customer Service
800/730-4099

Return Materials Authorization
408/542-2650

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