

User's Guide

InGaAs Power Head OMH-6708B



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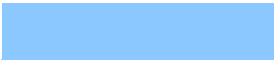
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SAFETY AND WARRANTY INFORMATION

The Safety and Warranty Information section provides details about cautionary symbols used in the manual, safety markings used on the instrument, and information about the Warranty including Customer Service contact information.

Safety Information and the Manual

Throughout this manual, you will see the words *Caution* and *Warning* indicating potentially dangerous or hazardous situations which, if not avoided, could result in death, serious or minor injury, or damage to the product. Specifically:

CAUTION

Caution indicates a potentially hazardous situation which can result in minor or moderate injury or damage to the product or equipment.

WARNING

Warning indicates a potentially dangerous situation which can result in serious injury or death.

WARNING

Visible and/or invisible laser radiation. Avoid direct exposure to the beam.

General Safety Considerations

If any of the following conditions exist, or are even suspected, do not use the instrument until safe operation can be verified by trained service personnel:

- Visible damage
- Severe transport stress
- Prolonged storage under adverse conditions
- Failure to perform intended measurements or functions

If necessary, return the instrument to ILX Lightwave, or authorized local ILX Lightwave distributor, for service or repair to ensure that safety features are maintained (see the contact information on page ix).

All instruments returned to ILX Lightwave are required to have a Return Authorization Number assigned by an official representative of ILX Lightwave Corporation. See Returning an Instrument on page vii for more information.

SAFETY SYMBOLS











This section describes the safety symbols and classifications.

Technical specifications including electrical ratings and weight are included within the manual. See the Table of Contents to locate the specifications and other product information. The following classifications are standard across all ILX Lightwave products:

- Indoor use only
- Ordinary Protection: This product is NOT protected against the harmful ingress of moisture.
- Class I Equipment (grounded type)
- Mains supply voltage fluctuations are not to exceed $\pm 10\%$ of the nominal supply voltage.
- Pollution Degree II
- Installation (overvoltage) Category II for transient overvoltages
- Maximum Relative Humidity: $< 80\%$ RH, non-condensing
- Operating temperature range of $0\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$
- Storage and transportation temperature of $-40\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$
- Maximum altitude: 3000 m (9843 ft.)
- This equipment is suitable for continuous operation.

Safety Marking Symbols

This section provides a description of the safety marking symbols that appear on the instrument. These symbols provide information about potentially dangerous situations which can result in death, injury, or damage to the instrument and other components.

	Caution, refer to manual		Earth ground Terminal		Alternating current		Visible and/or invisible laser radiation
	Caution, risk of electric shock		Protective Conductor Terminal		Caution, hot surface		Frame or chassis Terminal
	On: In position of a bistable push control. The slash (I) only denotes that mains are on.				Off: Out position of a bistable push control. The circle (O) only denotes that mains are off.		
	or (I)				or (O)		

WARRANTY

ILX LIGHTWAVE CORPORATION warrants this instrument to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, ILX will repair or replace the unit, at our option, without charge.

Limitations

This warranty does not apply to fuses, lamps, defects caused by abuse, modifications, or to use of the product for which it was not intended.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose. ILX Lightwave Corporation shall not be liable for any incidental, special, or consequential damages.

If a problem occurs, please contact ILX Lightwave Corporation with the instrument's serial number, and thoroughly describe the nature of the problem.

Returning an Instrument

If an instrument is to be shipped to ILX Lightwave for repair or service, be sure to:

- 1 Obtain a Return Authorization number (RA) from ILX Customer Service.
- 2 Attach a tag to the instrument identifying the owner and indicating the required service or repair. Include the instrument serial number from the rear panel of the instrument.
- 3 Attach the anti-static protective caps that were shipped with the instrument and place the instrument in a protective anti-static bag.
- 4 Place the instrument in the original packing container with at least 3 inches (7.5 cm) of compressible packaging material. **Shipping damage is not covered by this warranty.**
- 5 Secure the packing box with fiber reinforced strapping tape or metal bands.
- 6 Send the instrument, transportation pre-paid, to ILX Lightwave. Clearly write the return authorization number on the outside of the box and on the shipping paperwork. ILX Lightwave recommends you insure the shipment.

If the original shipping container is not available, place your instrument in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

Repairs are made and the instrument returned transportation pre-paid. Repairs are warranted for the remainder of the original warranty or for 90 days, whichever is greater.

Claims for Shipping Damage

When you receive the instrument, inspect it immediately for any damage or shortages on the packing list. If the instrument is damaged, file a claim with the carrier. The factory will supply you with a quotation for estimated costs of repair. You must negotiate and settle with the carrier for the amount of damage.



Comments, Suggestions, and Problems

To ensure that you get the most out of your ILX Lightwave product, we ask that you direct any product operation or service related questions or comments to ILX Lightwave Customer Support. You may contact us in whatever way is most convenient:

Phone (800) 459-9459 or (406) 586-1244

Fax (406) 586-9405

On the web at: ilx.custhelp.com

Or mail to:

ILX Lightwave Corporation
P. O. Box 6310
Bozeman, Montana, U.S.A 59771
www.ilxlightwave.com

When you contact us, please have the following information:

Model Number: _____

Serial Number: _____

End-user Name: _____

Company: _____

Phone: _____

Fax: _____

Description of what is connected to the ILX Lightwave instrument:

Description of the problem:

If ILX Lightwave determines that a return to the factory is necessary, you are issued a Return Authorization (RA) number. Please mark this number on the outside of the shipping box.

You or your shipping service are responsible for any shipping damage when returning the instrument to ILX Lightwave; ILX recommends you insure the shipment. If the original shipping container is not available, place your instrument



WARRANTY

in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

We look forward to serving you even better in the future!

INTRODUCTION AND SPECIFICATIONS

This manual contains operation and maintenance information for the OMH-6708B InGaAs Power Head. The OMH-6708B must be used in conjunction with the OMM-6810B Optical Multimeter or the LPA-9080 Laser Diode Parameter Analyzer. To get started immediately, read Appendix B of the OMM-6810B Instruction Manual first.

Product Overview

The OMH-6708B InGaAs Power Head, when coupled to the OMM-6810B Optical Multimeter or the LPA-9080 Laser Diode Parameter Analyzer, provides the capability to measure optical power from a laser source over a 70 dB dynamic range. The uniform InGaAs detector used in the OMH-6708B is calibrated to a NIST-traceable standard in 10 nm increments, ensuring highly accurate measurements.

Easy mounting, quick setup, a two meter cable and low-profile design makes the OMH-6708B InGaAs Power Head easy to integrate into an experiment. The 6708B can also be used for fiber optic measurement applications via an optional fiber optic adapter.

Safety Considerations

The high brightness, sometimes invisible light output of laser diodes and other laser sources poses a definite eye hazard. Direct viewing of the laser output can produce retinal or corneal damage. Absorption of the laser light by the eye causes localized heating and denaturing of tissue proteins. The ANSI publication Z-136.1, "The Safe Use of Lasers", lists Maximum Permissible Exposure (MPE) levels for direct, or intrabeam viewing of laser beams. From the MPE levels, a "hazard zone" may be computed for a particular laser and exposure time.

For more information concerning laser and laser diode safety, contact the Center for Devices and Radiological Health or ILX Lightwave.

**WARNING**

Refer Servicing only to qualified, authorized personnel.

Available Options and Accessories

The OMH-6708B must be coupled to the OMM-6810B Optical Multimeter or the LPA-9080 Laser Diode Parameter Analyzer. Other options and accessories available with the LPA-9080 and the OMM-6810B are listed in the instruction manual included with your 6810B or 9080.

Specifications

The electrical performance specifications for the Optical Multimeter are found in the OMM-6810B Instruction Manual. The Electro-Optic performance specs for the OMH-6708B when coupled to the OMM-6810B Optical Multimeter are described below. All parameters are measured at 25 °C.

Input Specifications	
Power Accuracy	±5% (800 to 1600 nm)
Power Range	10 nW to 100 mW; (-50 dBm + 20 dBm)
Wavelength Range	800 to 1600 nm
Sampling Rate	
Slow	16 samples @ 60 ms / sample
Medium	4 samples @ 60 ms / sample
Fast	1 sample @ 60 ms / sample
Input Bandwidth	
Slow	1 Hz
Medium	10 Hz
Fast	60 Hz
Analog Output Specifications	
Analog output representing the power measurement is available at the rear panel of the multimeter. Refer to the OMM-6810B Instruction Manual for details.	
Display	
Left Display (Power Display)	
Units	
Linear Power	pW, nW, μW, mW, W, ÅP
Log Power	dBm, dB
Range	
Linear Power	0.000 nW to 999.999 W
Log Power	-99.999 to 99.999 dBm / dB
Resolution (Slow Update Rate)	
Linear Power	0.001 pW
Log Power	0.001 dB
Resolution (Medium / Fast Update Rate)	
Linear Power	0.01 pW
Log Power	0.01 dB

Right Display (Wavelength Calibration Display)	
Units	nm, cm^{-1} , \AA
Range	800 to 1600 nm, 12500 to 6250 cm^{-1}
Resolution	1 nm, 1 cm^{-1}
Bargraph	Represents the percent of full scale power within the selected gain range
Brightness	5 settings incrementally spaced from dark to brightest
General Specifications	
Operating Temperature	+10 °C to +40 °C
Storage Temperature	-40 °C to +70 °C
Humidity (non-condensing)	< 70% RH, non-condensing, input power <100 nW < 85% RH, non-condensing, input power \geq 100 nW
Overall Dimensions	68.6 mm diameter x 30.1 mm
Weight	< 0.5 kg
Input Port Diameter	6 mm
Optical Stand Accommodations	8/32 tapped hole centered
Fiber Optic Adapter	FC
Connector to Main Unit ³	26 pin high-density sub-D

3. An anti-static cover is included on the connector to the Multimeter. To prevent damage from electro-static discharge this cover should remain in place when the Optical Measurement Head is not connected to the Multimeter.

Our goal is to design and produce the best optical test equipment available anywhere. To achieve this, we need your ideas and comments on ways we can improve our products. We invite you to contact us at any time with your suggestions.

OPERATION



This chapter describes how to install and operate the OMH-6708B InGaAs Power Head in conjunction with the OMM-6810B Optical Multimeter. It is divided into sections covering installation, power-up, front panel controls, rear panel, and general operation. A detailed familiarization of the Multimeter's features is presented in Chapter 2 of the OMM-6810B Instruction Manual.

Installation

The OMH-6708B must be connected to the OMM-6810B. Make sure the power to the Multimeter is turned off then connect the cable from the 6708B to the INPUT connector on the rear panel of the multimeter.

 **WARNING**

Do not attach or remove the power head while power is applied to the Multimeter. Please turn the power switch off when changing heads.

 **WARNING**

To avoid electrical shock hazard, connect the meter to a properly earth grounded, three prong receptacle only. Failure to observe this precaution can result in severe injury or death.

Power-Up

Connect the multimeter to an AC power source. Press the POWER switch to supply power to the device and start the power-up sequence.

The power-up sequence takes about six seconds. Initially, all LEDs and enunciators are illuminated and the seven-segment displays denote "8". Then, all LEDs and the displays are turned off while the microprocessor executes a device self-test. Should the self test fail, the error message E-720 is displayed. The multimeter then loads personality and calibration data from the measurement head. The left display indicates -6708- and the firmware version is shown on the right display. If an error occurs while loading data, message E-711 is displayed. If an incompatible head is connected, E-715 is displayed. If a measurement head is not connected both displays show "-----" until a head is attached. Appendix A in the OMM-6810B Instruction Manual describes the error messages.

At power up the multimeter is configured to the same state that was present when the power was last turned off.

Front Panel Controls

The OMM-6810B/OMH-6708B is intuitively operated from the front panel keypad, indicator LEDs and dual displays. A drawing of the front panel is shown in Figure 2.1. Front panel functions which are not available with the OMH-6708B are outlined later in this chapter.

Refer to the OMM-6810B Instruction Manual for descriptions of each front panel switch function.

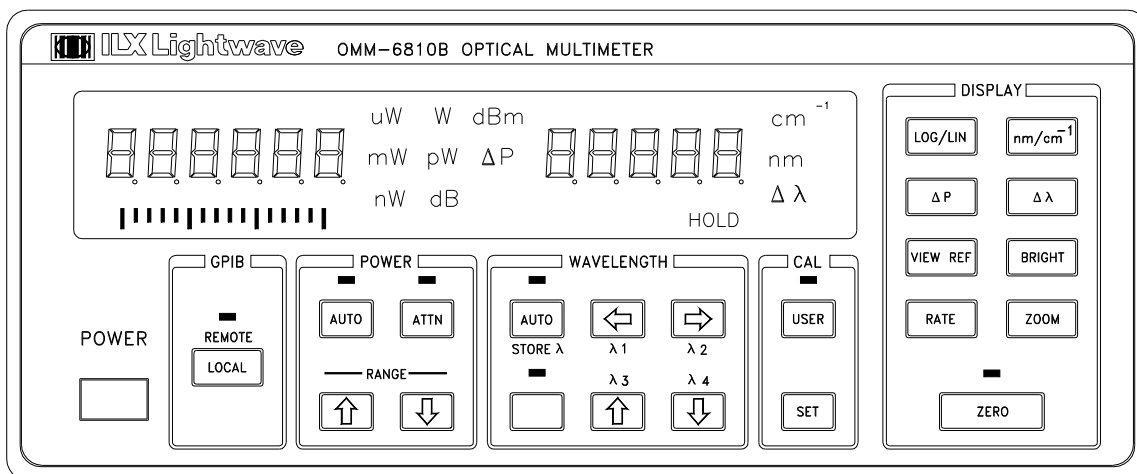
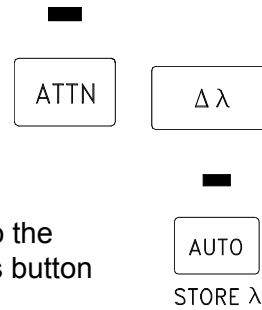


Figure 2.1 OMM-6810B Front Panel

Unused Functions

The Multimeter functions that are not utilized (disabled) when the OMH-6708B InGaAs Power Head is attached are shown to the right. If a disabled button is pushed, the 6810B will display the error code E-715.



The Multimeter function WAVELENGTH AUTO, shown to the right, will not work to measure wavelength. However, this button may still be used to store preselected wavelengths.

All other switch functions perform as described in the OMM-6810B Instruction Manual.

Error Display

Execution errors are indicated on the right display. Errors are shown as "E-xxx" where xxx is a three digit number representing the unique error. Errors are displayed for three seconds or until the error causing condition is remedied, whichever is longer. See Appendix A in the OMM-6810B Instruction Manual for a detailed list of error messages.

Rear Panel Connections

The OMH-6708B interfaces with the rear panel of the multimeter as described in the following paragraphs.

Input Connector

The OMH-6708B InGaAs Power Head interfaces the main unit via the 26-pin high density "D" connector located on the lower left side of the rear panel. Do not attach or remove the head while power is applied to the Optical Multimeter. Please turn the power switch off when changing optical measurement heads. Match the serial number on the BNC to 26 pin "D" adapter to the serial number on the head.

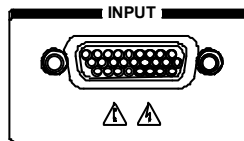


Figure 2.2 Rear Panel Input

Analog Output

Analog output representing the power measurement is located in the upper left corner of the 6810B rear panel.

The **POWER ANALOG OUT** is a non-calibrated value between 0 and 10 volts representing the measured power as a percent of full scale power within the selected gain range. For example, if the full scale power for gain range three is 10 μW and the displayed power is 5.000 μW , then 5.0 volts is present on the **POWER ANALOG OUT** connector.



Figure 2.3 Power Analog Out

General Operating Procedures

The following sections present some guidelines for operating the OMM-6810B with the OMH-6708B.

Warm-up and Environmental Considerations

The Multimeter and Measurement Head should operate at an ambient temperature between 10 and 40 °C and a relative humidity less than 85%. Storage temperatures should be between -40 and +70 °C, To achieve rated stability, let both devices warm up for at least one hour.

Beam Alignment Considerations

The OMH-6708B is designed to provide a simple operating format. The beam from the source should be directed perpendicular to the face of the 6708B and directly into its aperture. Be sure the entrance angle does not exceed the specified $\pm 10^\circ$ from perpendicular.

Be aware that certain lasers emit a significant amount of non-lasing radiation. This radiation can cause erroneous measurements if the source is placed too close to the measurement head. The innovative ILX Optical Measurement Head offers easy access for many different source types:

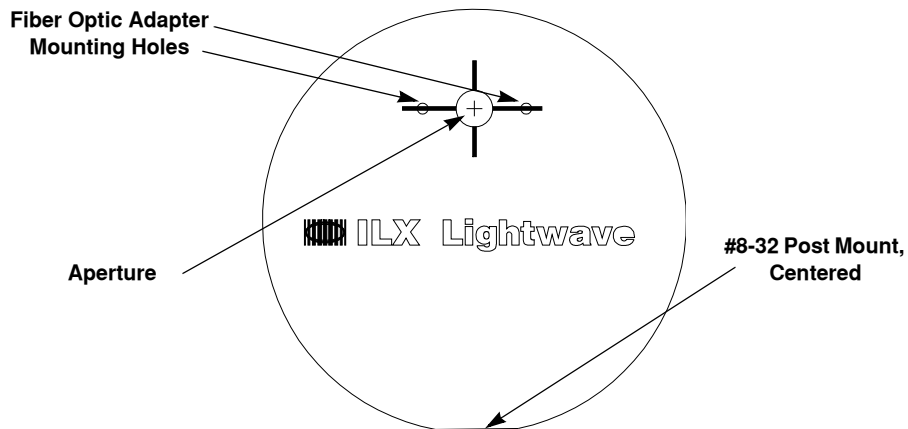


Figure 2.4 OMH-6708B Optical Measurement Head

Diverging Beams (Laser Diodes)

The OMH-6708B can measure the power of laser diodes without the need for complicated coupling optics. For diverging lasers and laser diodes, position the package as close as possible to the 6708B.

Collimated Beams

The OMH-6708B is capable of measuring the power of narrow beam lasers. As with other lasers, collimated beams should enter the aperture perpendicular to the face of the 6708B. To maintain accuracy, do not allow the beam to strike the edge of the entrance aperture.

Focused Beams

The OMH-6708B also accepts converging beams. In high power applications be sure that the focus of the beam does not occur at the rear of the integrating sphere. Again, perpendicular beam entry to the head is required.

Fiber Optic Cable

A fiber optic adapter (options AO271, AO272, AO273, and AO276,) can be mounted onto the face of the OMH-6708B Measurement Head. This threaded ring/adapter cap option accepts a variety of fiber optic connector styles for direct coupling of a fiber optic cable to the head.

Setting the Wavelength

It is important to program the 6810B with the wavelength of the laser being measured so the correct calibration factors are used to compute power. The wavelength may be entered via the front panel or GPIB. The 6810B will always be in Manual Wavelength Mode when using the 6708B. Use the following procedure to set the wavelength via the front panel.

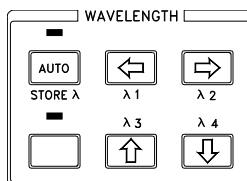
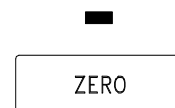


Figure 2.5 Wavelength Setting

- Use the **LEFT** and **RIGHT** arrow buttons to select the digit on the WAVELENGTH display that will be controlled by the WAVELENGTH **UP** and **DOWN** arrow buttons. The selected digit will flash.
- Use the WAVELENGTH **UP** and **DOWN** arrow buttons to increment or decrement the selected digit. If no buttons are pressed in three seconds, the displayed wavelength will be locked in and the digit will stop flashing.
- Commonly used wavelengths may be stored or retrieved by using the WAVELENGTH BLUE SHIFT, **STORE** λ , $\lambda 1$, $\lambda 2$, $\lambda 3$, and $\lambda 4$ buttons as described in Chapter 2 of the OMM-6810B manual.

Zeroing

The **DISPLAY ZERO** function is used to remove the effects that ambient light has on the power measurement. It is important to zero the multimeter with the OMH-6708B attached before taking measurements. This is especially true for low input power applications or in cases of high ambient light intensity. When measuring lower power levels, avoid letting background radiation into the measurement head.

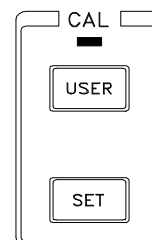


Pressing the **DISPLAY ZERO** button when the LED above the **DISPLAY ZERO** button is not lit starts the zeroing process. While zeroing the "0" digit *walks* across both displays, the LED above the **DISPLAY ZERO** indicator flashes. Pressing the **DISPLAY ZERO** button when the **DISPLAY ZERO** indicator is illuminated disables the effects of the zero. The procedure for zeroing the instrument is described below.

- The beam from the optical source should be blocked at the source or turned off.
 - Note:** If a beam stop is used, it should be positioned as close to the source as possible to allow the maximum collection of background "noise". If the entry aperture to the OMH-6708B is blocked instead, the zeroing function will not work properly. This is especially true for low power applications or in areas of high background light.
- If the LED above the **DISPLAY ZERO** indicator is illuminated, press the **DISPLAY ZERO** button once to disable the existing compensation factors.
- Press the **DISPLAY ZERO** button. While zeroing, the "0" digit *walks* across the display and the **DISPLAY ZERO** indicator above the button flashes. When zeroing is complete the **DISPLAY ZERO** button is lighted. The process takes about 10 seconds.
- Couple the optical source to the power head. Accurate power measurements are displayed.
 - Note:** If the ambient environmental conditions change (e.g. the room lights are turned on or off or the attenuator is added or removed), the instrument must be re-zeroed to maintain its accuracy.
- Pressing the **DISPLAY ZERO** button again disables the compensating factors and the LED above the **DISPLAY ZERO** button is turned off.

User Calibration

It is possible to calibrate the OMM-6810B/OMH-6708B using a laser source of known power and wavelength. Pressing the CAL **USER** button toggles the instrument in and out of the User Calibration Mode. When the LED above the CAL **USER** button is lighted, the unit employs the user defined calibration which has been stored in the Optical Measurement Head. Pressing the CAL **USER** button when the CAL **USER** LED is lit causes the instrument to revert to factory calibration and the LED to go out. Pressing the CAL **SET** button while the LED above the CAL **USER** button is lighted initiates the user calibration procedure.



Refer to Chapter 4 of this manual to enter a new user calibration.

Installing Fiber Optic Adapters

Use the following procedure to install Fiber Optic Adapters onto the OMH-6708B Measurement Head.

- Locate the model AO270 threaded ring adapter and the two #2-56 X 3/16" cap screws that secure it to the Measurement Head.
- Place the adapter onto the face of the Measurement Head and secure it using the two cap screws.
- The adapter is now ready to receive any AOXXX series screw on fiber optic adapter cap, e.g. AO271 (FC). Screw the cap on until it bottoms out on the face of the Measurement Head.

Care and Maintenance

The design of the Measurement Head is fairly robust, however it should be handled with care. Stress from dropping the Head or other mishandling could dislodge critical alignments within the Head, effectively changing its response and nullifying its calibration. It is also sensitive to electrostatic discharge. When not in use, replace the ESD-protective cap that came with the Head on the D connector and store the Head in the ESD-safe bag.

Cleaning

In general, avoid cleaning the interior of the Measurement Head, **especially by blowing into it or by using compressed air**. If minor dust or other particulates have entered the input aperture, remove the contaminant using canned air or dry nitrogen. Use short bursts while holding the head such that the aperture is directed downward.

CALIBRATION

This chapter describes how to calibrate the OMH-6708B InGaAs Power Head.

The OMH-6708B InGaAs Power Head has been sealed to protect internal components from damage and to maintain the factory calibration. Do not attempt to disassemble the head.

Calibration Overview

It is possible to calibrate the OMH-6708B using a source of known power and wavelength. Calibrate the 6708B whenever performance verification indicates that calibration is necessary.

The power calibration consists of one point which changes future power measurements by the percentage calculated during the calibration.

Recommended Equipment

It is recommended that gas-line sources, not laser diodes, be used for calibration. Ideal sources include gas lasers, such as HeNe at 632.8 nm, and spectral lamps with the proper line isolation filters, such as a Cesium Lamp and a 845 nm - 855 nm interference filter to isolate the 852.1 nm Cesium emission line. An extremely stable laser diode may be used if it is lasing in a single mode and the wavelength is first measured with a calibrated optical spectrum analyzer.

Warm-Up

The OMM-6810B/OMH-6708B should be allowed to warm up for at least 1 hour before calibration.

Manual Operation User Calibration

Front Panel execution of the User Calibration using the OMM-6810B is described in the procedure below:

- Program the wavelength of the calibrator laser source into the OMM-6810B using the procedure described in Chapter 2.
- Identify ambient conditions and zero the instrument as described in Chapter 2.
- Launch a laser of known power at the detector of the OMH-6708B.
- Start the calibration by pressing the CAL **USER** button to place the unit in User Calibration Mode. The LED above the CAL **USER** button will light. Press the CAL **SET** button to initiate the User Calibration Procedure. The left display will show "**CAL-P**".
- The measured power is shown on the left display. Adjust the displayed power to match the laser's known power using the POWER **UP** and **DOWN** arrow buttons. If large adjustments are necessary, hold down the **UP** or **DOWN** button to accelerate the change.
- Press the CAL **SET** button to complete the calibration. The unit returns to real time power measurements.

Remote (GPIB) Operation User Calibration Using the OMM-6810B

Remote controlled User Calibration is described in the following procedure. It may help to be familiar with the manual calibration procedure listed above before attempting it remotely.

- Identify ambient conditions. Block the laser beam from striking the detector of the OMH-6708B.
- Start the calibration by clearing the status registers, then programming the wavelength of the calibrator laser source into the OMM-6810B. Execute and following GPIB commands:

```
*CLS
```

```
RANGE:AUTO ON
```

```
ZERO
```

where xxx.x is the wavelength of the calibrator laser source.

- Zero the instrument by issuing the following GPIB command:
ZERO
- Wait for the zero to finish. The controlling software can monitor the status of zeroing by sending the following query in a loop. Exit the loop when the response is '1'.

```
ZERO?
```

- Launch a laser of known wavelength and power at the detector of the 6708B. Start the calibration by sending the following commands.

```
CAL:USER ON
```

CAL:USER START

- The right display shows “**CAL-P**” and the left display indicated the measured power. Enter the known power using the following command:

CAL:WAVESET xxxx.xx ss

where, **xxxx.xx** is the known wavelength and **ss** is the units (μm , nm or cm).

- Enter the known power using the command:

CAL:POWERSET xxxx.xx ss

where, **xxxx.xx** is the known power and **sss** is the suffix units (see **CAL:POWERSET** command in Chapter 4 of the OMM-6810B Manual).

- The calibration is complete and the 6810B is performing real time power measurements.

Resetting the User Calibration

The User Calibration is preset at the factory. The factory preset calibration can be restored by pressing the CAL **USER** button when the CAL **USER** indicator is on.

TROUBLESHOOTING



Introduction

This chapter is intended to be used as a guide when the OMM-6810B and OMH-6708B do not perform as expected. It is not a service manual, rather a guide to alleviate basic problems which may arise during operation. A more complete guide, including a GPIB troubleshooting guide, is provided in Chapter 7 of the OMM-6810B Instruction Manual.

Troubleshooting Guide

If you have difficulty using the 6708B, refer to the symptoms listed here. Common causes and corrective actions are listed here. If problems persist, contact your ILX Lightwave representative at (406) 586-1244.

Symptom	Causes and Corrective Actions
Measurement seems unstable	<ul style="list-style-type: none"> • Check for tight connections between the 6810B and the 6708B and ensure other “noisy” electronic devices are not located near the head. • In cases of low input power and/or high background light, try working in a dark environment and be sure to zero the instrument as described in Chapter 2.
Display shows "-----"	<ul style="list-style-type: none"> • The 6708B is not connected to the Multimeter.
Display shows "-OL-"	<ul style="list-style-type: none"> • This condition occurs when the laser’s input power exceeds the maximum allowed for the selected gain range. If in manual mode, press the DOWN switch to select the next lower gain range.
Measurements are not accurate at a known power standard	<ul style="list-style-type: none"> • Be certain the zeroing procedure has been performed correctly as described in Chapter 2. • It may be necessary to perform the User Calibration.

