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# User's Guide

## Silicon Power / Wavehead
## OMH-6722B




ILX Lightwave
Laser Diode Instrumentation & Test Systems

ILX Lightwave Corporation · P. O. Box 6310 · Bozeman, MT, U.S.A. 59771 · U.S. & Canada: 1-800-459-9459 · International Inquiries: 406-556-2481 · Fax 406-586-9405

**ilx.custhelp.com · www.ilxlightwave.com**

70023303 March 2003

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




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




**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 xiii).

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 xi for more information.



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# SAFETY SYMBOLS

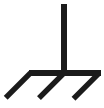
This section describes the safety symbols and classifications.

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 ±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 °C to 40 °C
- Storage and transportation temperature of –40 °C to 70 °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 |
|  or (I) On: In position of a bistable push control. The slash (I) only denotes that mains are on. | |  or (O) Off: Out position of a bistable push control. The circle (O) only denotes that mains are off. | |



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# 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.



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## 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.



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## 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



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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!



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CHAPTER 1

# INTRODUCTION AND SPECIFICATIONS

This manual contains operation and maintenance information for the OMH-6722B Silicon Power / Wave Head. The OMH-6722B may be used in conjunction with either the OMM-6810B Optical Multimeter or the LWM-6500B Laser Wavelength Meter. To get started immediately, first read Appendix B of the OMM-6810B Instruction Manual.

## Product Overview

The OMH-6722B Silicon Power/WaveHead, when coupled to an OMM-6810B Optical Multimeter, provides the capability to accurately measure the power and wavelength of laser sources between 400 and 1100 nm. The OMH-6722B is calibrated to NIST traceable power and wavelength standards to ensure accuracy. The OMH-6722B can also be used with the LWM-6500B to measure wavelength only.

Easy mounting, quick setup and alignment, and a two meter cable make the ILX Lightwave Optical Measurement Head easy to integrate into an experiment. The instrument can be integrated with other equipment via the optional GPIB/IEEE-488.2 interface. The 6722B 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.



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For more information concerning lasers 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-6722B must be coupled to the OMM-6810B Optical Multimeter. Other options and accessories available with the OMM-6810B are listed in the OMM-6810B manual.



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# Specifications

| **Input Specifications** | |
|---|---|
| Power Measurement | |
| Range | 100 nW ~ 1 W[2]; -40 dBm ~ + 30 dBm[2] |
| Accuracy | ±3.5% (450 to 990 nm)[1,3,4] |
| Wavelength Measurement | |
| Range | 400 to 1100 nm[2] |
| Accuracy | ± 1.0 nm[3] |
| Temperature coefficient | < ± 0.03 nm / °C |
| Linearity with power change | < ± 0.5 nm |
| *(Maximum change in measured wavelength due to power change)* | |
| 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) | |
| Units<br>Linear Power<br>Log Power | <br>pW, nW, µW, mW, W, ΔP<br>dBm, dB |
| Range<br>Linear Power<br>Log Power | <br>0.000 nW to 999.999 W<br>-99.999 to 99.999 dBm / dB |
| Resolution (Slow Update Rate)<br>Linear Power<br>Log Power | <br>0.001 pW<br>0.001 dB |
| Resolution (Medium / Fast Update Rate)<br>Linear Power<br>Log Power | <br>0.01 pW<br>0.01 dB |



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| | |
|---|---|
| Right Display (Wavelength) | |
| Units<br>Range<br>Resolution | nm, $cm^{-1}$, $\Delta\lambda$<br>500.0 to 1000.0 nm, 20,000 to 10,000 $cm^{-1}$<br>.1 nm, .1 $cm^{-1}$Right Display (Wavelength) |
| Bargraph | Percent of full scale power |
| Brightness | 5 settings |
| **General Specifications** | |
| Operating Temperature | + 15 °C to +35 °C |
| Storage Temperature | -40 °C to +70 °C |
| Humidity (non-condensing) | ≥ 100 µW: <85% RH<br>≤ 100 µW: <70% RH |
| Overall Dimensions | 68.6 mm diameter x 30.1 mm |
| Weight | < 0.5 kg |
| Input Port Diameter | 6 mm |
| Input Type | Integrating sphere |
| Optical Stand Accommodations | 8/32 tapped hole centered |
| Fiber Optic Adapter | FC, SC, ST |
| Connector to Main Unit | 26 pin high-density sub-D |

1. Add ± 0.5% from 400 to 450 nm and from 990 to 1100 nm.
2. Minimum optical power required for accurate wavelength measurement:
   400 nm ~ 500 nm
   100 uW (-10 dBm)

   500 nm ~ 1100 nm
   10 uW (-20 dBm)

   For power measurement below these levels, use MANUAL wavelength mode.
3. For input power > 100 mW:
   Add ±0.05% / 100 mW to power accuracy
   Add ±0.05 nm / 100 mW to wavelength accuracy
   Example: 500 mW, 850 nm, accuracy = ±4.2%, ±1.2 nm
4. MANUAL wavelength mode: Add ±0.5% for automatic wavelength correction.

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 out products. We invite you to contact us at any time with your suggestions.



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CHAPTER 2

# OPERATION

This chapter describes how to install and operate the OMH-6722B Silicon Power/WaveHead in conjunction with a OMM-6810B Optical Multimeter. It is divided into sections covering installation, power-up, front panel and rear panel controls, and general operation. A detailed familiarization of the main unit features are presented in Chapter 2 of the OMM-6810B Instruction Manual.

## Installation

The OMH-6722B must be connected to the 6810B. Make sure the power to the main unit is turned off and connect the cable from the 6722B to the **INPUT** connector on the rear panel of the 6810B.

**WARNING**

**Do not attach or remove the Optical Measurement Head while power is applied to the OMM-6810B. 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.**



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## Power-Up

Connect the main unit 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, error message E-720 is displayed. The Meter then loads personality and calibration data from the measurement head. The left display indicates -6722- 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, error message E-713 is shown. If the measurement head is not connected the display shows "------" until a measurement head is attached.

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

## Front Panel Controls

The OMM-6810B/OMH-6722B 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-6722B are outlined later in this Chapter.

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

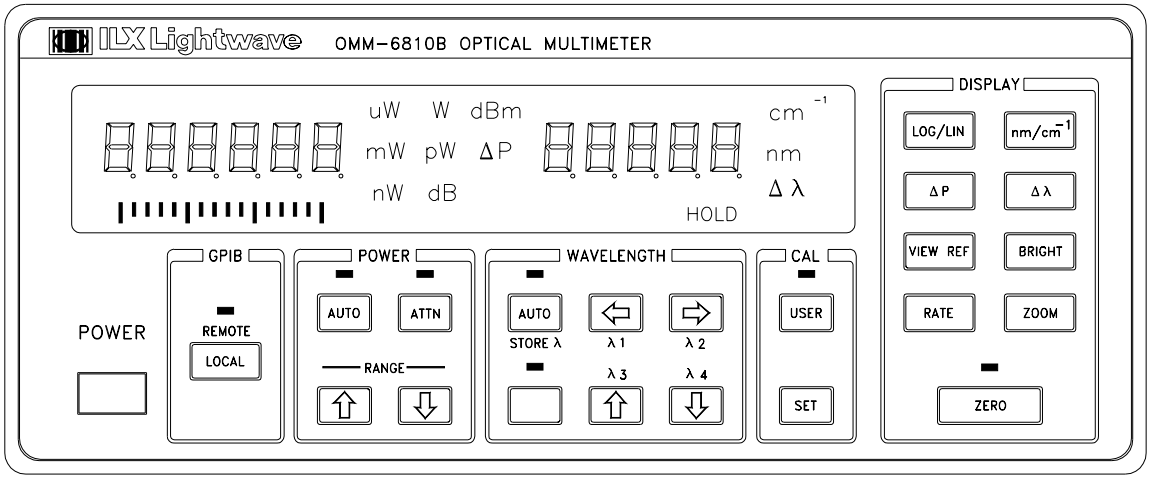


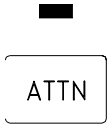

**Figure 2.1** OMM-6810B Front Panel



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## Unused Functions

The Multimeter function that is not utilized (disabled) when the OMH-6722B is attached are shown to the right. If a disabled button is pushed, the 6810B will display the error code E-715.




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-6722B interfaces with the rear panel of the multimeter as described in the following paragraphs.

## Input Connector

The OMH-6722B interfaces the Multimeter 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.

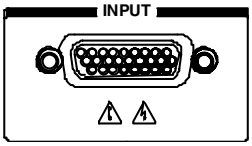



**Figure 2.2** Rear Panel Input



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## 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.

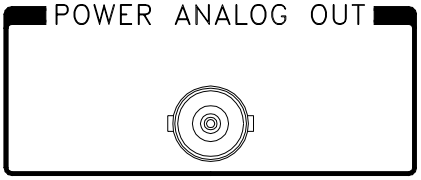



**Figure 2.3** Power Analog Out



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# General Operating Procedures

The following sections present some guidelines for operating the OMM-6810B with the OMH-6722B. More detailed instructions are found in the OMM-6810B Instruction Manual. Remote operation is discussed in Chapter 4.

## Warm-up and Environmental Considerations

The main unit and Optical Measurement Head should operate at an ambient temperature between 10 and 35 °C and a relative humidity less than 70%. 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-6722B is designed to provide a simple operating format. The beam from the source should be directed perpendicular to the face of the 6722B and directly into its aperture. Be sure the entrance angle does not exceed the specified ± 10° 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:

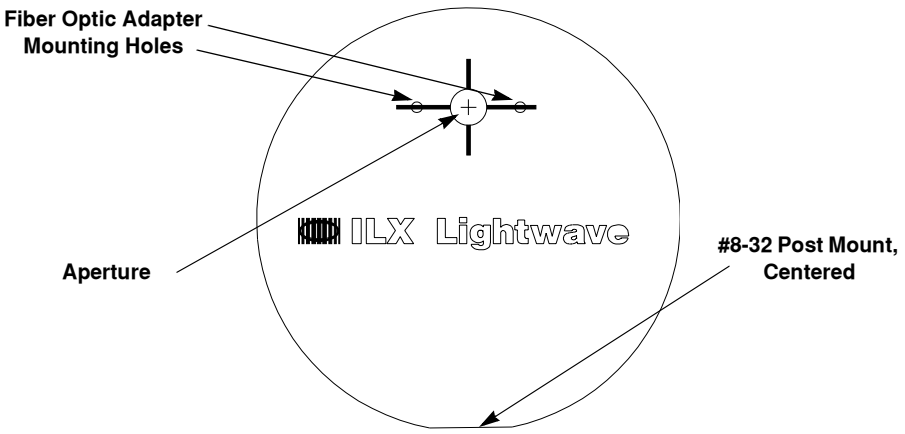



**Figure 2.4** OMH-6722B Optical Measurement Head



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### Diverging Beams (Laser Diodes)

The OMH-6722B can measure the wavelength and power of laser diodes without the need for complicated coupling optics. For low powered lasers and laser diodes, position the package as close as possible to the 6722B to insure that all of the light enters the integrating sphere.

### Collimated Beams

The OMH-6722B is capable of measuring the wavelength and power of narrow beam lasers. As with other lasers, collimated beams should enter the aperture perpendicular to the face of the 6722B. To maintain accuracy, do not allow the beam to strike the edge of the entrance aperture.

### Focused Beams

The OMH-6722B 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-6722B 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.

## Measuring or Setting the Wavelength

For automatic wavelength compensation of power measurements, press the WAVELENGTH **AUTO** button so that the indicator above the button is lighted. The wavelength of the source can also be manually programmed into the OMM-6810B using the procedure below.

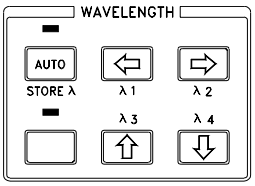


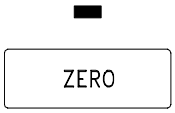

**Figure 2.5** Wavelength Setting



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- Use the WAVELENGTH **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, λ1 ,λ2 ,λ3, and λ4 buttons as described in Chapter 2 of the OMM-6810B manual.

## Zeroing




The **ZERO** function is used to remove the effects that erroneous room light has on the wavelength and power measurement. It is important to zero the OMM-6810B with the OMH-6722B 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 DISPLAY **ZERO** indicator is not lighted starts the zeroing process. While zeroing the "0" digit *walks* across both displays and the DISPLAY **ZERO** indicator flashes. When zeroing is complete the DISPLAY **ZERO** indicator is illuminated. 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-6722B 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 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 flashes. When zeroing is complete the DISPLAY **ZERO** indicator is lighted. The process takes about 15 seconds.
- Allow the beam to enter the aperture of the head. Accurate measurements are displayed.

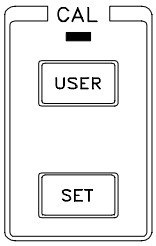
  **Note:** If the ambient environmental conditions change, e.g. the room lights are turned on or off, the instrument must be re-zeroed to maintain its accuracy.

- Pressing the DISPLAY ZERO button again disables the compensating factors and the DISPLAY ZERO indicator is turned off.



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## User Calibration




It is possible to calibrate the OMH-6722B using a laser source of known power and wavelength. The calibration procedure is described in Chapter 6 of this manual.

Press the CAL **USER** button to toggle 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 lighted 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.



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# Installing Fiber Optic Adapters

Use the following procedure to install Fiber Optic Adapters onto the OMH-6722B 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.



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CHAPTER 3

# COMMAND REFERENCE

## Introduction

This chapter is a guide to the usage of the device-dependent GPIB commands for the OMM-6810B Optical Multimeter when the OMH-6722B Silicon Power Head is attached. This chapter is of primary interest to users who wish to utilize the GPIB option. A complete reference describing the syntax and usage of each device-dependent command is provided in Chapter 4 of the OMM-6810B Instruction Manual. Refer to the LWM-6500B Instruction Manual if the OMH-6722B is being used in conjunction withe the Laser Wavelength Meter.

## Common Commands

The GPIB Common Commands which are defined by the ANSI/IEEE-488.2-1987 standard are described in Chapter 3 of the OMM-6810B Instruction Manual. These commands do not necessarily reflect front panel operations and are not unique to the measurement head connected to the meter. In other words, the common commands listed in the 6810B Instruction Manual are all valid when using the OMH-6722B.

### Device-Dependent Commands

Chapter 4 of the OMM-6810B Instruction Manual contains the complete set of device-dependent GPIB commands. Table 4.1 on the next page outlines the subset of commands which are valid when the OMH-6722B is attached. The command path *tree* structure is illustrated in Figure 4.1.

**Note:** The usage and syntax of each device dependent command is best described in Chapter 4 of the OMM-6810B Optical Multimeter Instruction Manual.



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# Error Messages

Error messages may appear on the right display. In remote operation, the current error list can be read by issuing the **ERR?** query. When this is done, a string is returned containing the previously unread error messages (up to ten). When the error queue is active, bit #7 of the Status Byte is also set to one.

Appendix A of the OMM-6810B Instruction Manual contains an explanation of the error messages which may be reported by the 6810B on the display or via remote operation.

## Programming Examples

Two examples of programming the 6810B via GPIB are shown in the 6810B Instruction Manual, Chapter 4.

| Command Name | # Parameters Expected | Description |
|---|---|---|
| BRIght | 1 | Sets the brightness of the front panel |
| BRIght? | None | Returns the level of the display brightness |
| CAL: POWERSET | 2 | Sets the user calibration power |
| CAL: RECall | None | Resets the user calibration |
| CAL:USER | None | Starts the user calibration |
| COND? | None | Returns the condition status register |
| ENAB:COND | 1 | Sets the enable register for conditions |
| ENAB:COND? | None | Returns the condition enable register |
| ENAB:EVENT | 1 | Sets the enable register for events |
| ENAB:EVENT? | None | Returns the event enable register |
| ERRors? | None | Returns errors generated since last ERR? |
| EVEnt? | None | Returns the event status register |
| HEAD:IDN? | None | Returns the head identification string |
| HOLD? | None | Returns the hold status |
| POWer? | None | Returns the power measurement |
| POWer:AUTO | 1 | Sets the power autoranging mode on or off |
| POWer:AUTO? | None | Returns the status of power autoranging |
| POWer:MODE | 2 | Sets the power display units |
| POWer:MODE? | None | Returns the power display units |
| POWer:OFFSET | 1 | Sets the power offset multiplier |
| POWer:OFFSET? | None | Returns the power offset multiplier |



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| | | |
|---|---|---|
| POWer:REFerence | 2 | Sets the reference for AP measurements |
| POWer:REFerence? | None | Returns the power reference level |
| PREselect:CHAN | 1 | Selects on of four preselected wavelengths |
| PREselect:CHAN? | None | Returns the preselected wavelength channel being used |
| PREselect:SAVE | 2 | Sets one of the four preselected wavelengths |
| RANge | 1 | Sets the gain range (manual) |
| RANge? | None | Returns the gain range (auto/manual) |
| RANge:AUTO | 1 | Sets the autoranging mode on or off |
| RANge:AUTO? | None | Returns the status of the autoranging |
| RATE | 1 | Sets the measurement rate |
| RATE? | None | Returns the measurement rate string |
| SECURE | 1 | Used by service personnel to access PUB |
| TERM | 1 | Sets the program message terminator |
| TERM? | 1 | Returns the program message terminator |
| TIME? | None | Returns elapsed time since power up |
| TIMER? | None | Returns elapsed time since last TIMER? |
| WAVE | 2 | Sets the wavelength |
| WAVE? | None | Returns the set wavelength |
| WAVE:AUTO | 1 | Sets the auto wavelength feature on or off[1] |
| WAVE:AUTO? | None | Returns the status of auto wavelength[1] |
| WAVE:MODE | 1 | Sets the wavelength display units |
| WAVE:MODE? | None | Returns the wavelength display units |
| WAVE:OFFSET | 2 | Sets the wavelength offset |
| WAVE:OFFSET? | None | Returns the wavelength offset |
| WAVE:REFerence | 2 | Sets the reference for $\Delta\lambda$ |
| WAVE:REFerence? | None | Returns the wavelength reference point |
| ZERO | None | Starts the zeroing function |
| ZERO? | None | Returns the status of the zeroing. |

**Table 3.1** Device-Dependent Commands valid with the OMH-6722B



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| Command Name | # Parameters Expected | Description |
|---|---|---|
| ATTen | 1 | Enables/disables the attenuation function |
| ATTen? | None | Returns the status of the attenuator |

**Table 3.2** Device-Dependent Commands which are not usable with the OMH-6722B

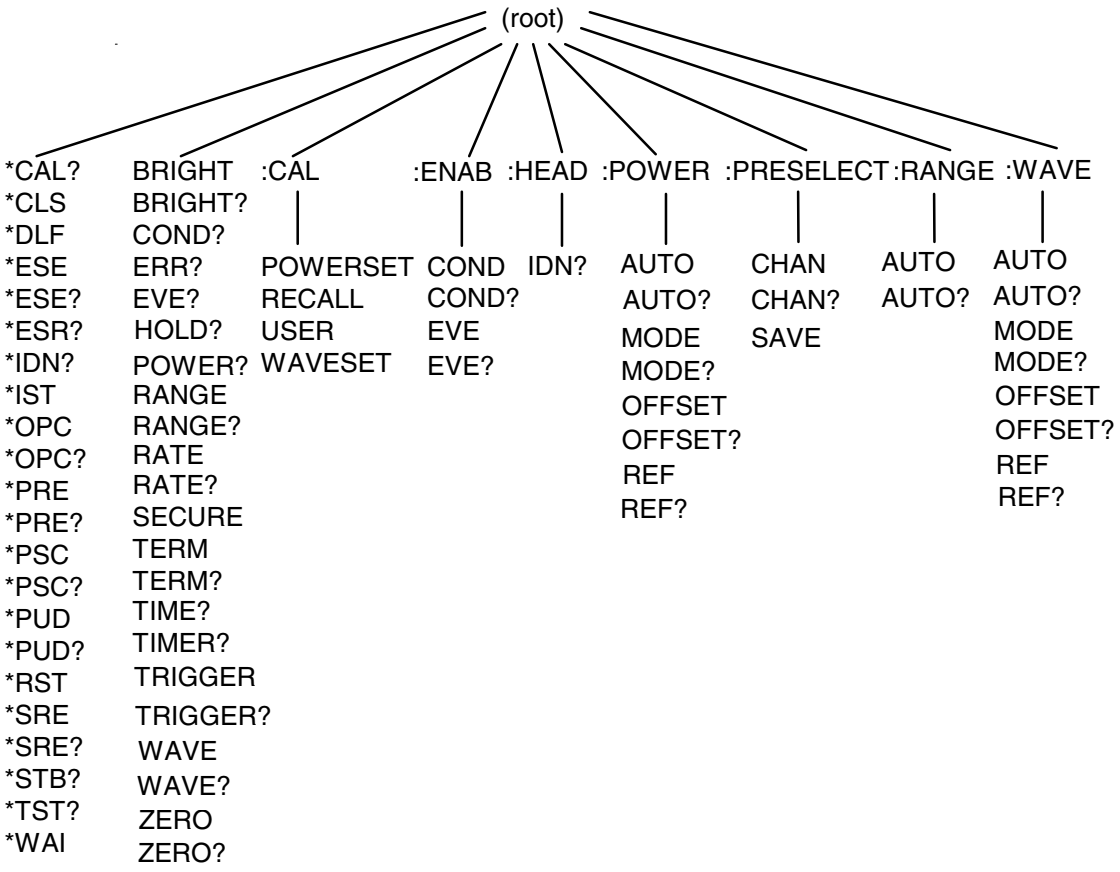



**Figure 3.1** Command Path Structure



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CHAPTER 4

# CALIBRATION

This chapter describes how to calibrate the OMH-6722B Silicon Power/WaveHead.

**The OMH-6722B Silicon Power/WaveHead has been sealed to protect internal components from damage and to maintain the factory calibration. Do not attempt to disassemble the Optical Measurement Head.**

## Calibration Overview

It is possible to calibrate the OMH-6722B using a source of known wavelength and power. Calibrate the 6722B whenever performance verification indicates that calibration is necessary. The wavelength calibration consists of one point which shifts future measurements by the amount of the calibration. 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. Laser diodes should not be used since current and temperature can affect the output wavelength. 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

Before attempting calibration, the OMH-6722B should be allowed to warm up for at least 1 hour after being connected to the main unit.



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## Manual Operation User Calibration

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

- Identify ambient conditions and zero the instrument as described in Section 2.6.4.
- Launch a laser of known wavelength and power into the OMH-6722B.
- 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-λ"**.
- The measured wavelength is shown on the right display. Adjust the displayed wavelength to match the laser's known wavelength using the WAVELENGTH **LEFT** and **RIGHT** buttons to select a digit and then use the WAVELENGTH **UP** and **DOWN** arrow buttons to change the wavelength.
- Press the CAL **SET** button to complete the wavelength calibration.
- The right display will now indicate **"CAL-P"**. The measured power will be 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 wavelength and power measurements.

## Remote (GPIB) Operation User Calibration

Remote controlled User Calibration is described in the following procedure. It may help to be familiar with the manual calibration in Section 6.3 before attempting it remotely.

- Identify ambient conditions. Block the laser beam from entering the aperture of the OMH-6722B.
- Start the calibration by clearing the status registers, then zeroing the instrument by issuing the following GPIB commands:

  *CLS

  RANGE:AUTO ON

  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 into the aperture of the 6722B. Start the calibration by sending the following commands.

  CAL:USER ON

  CAL:USER START



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- Enter the known wavelength using the 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 **ss** is the units (pw, nw, µw, mw, w or dbm).

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

## Programming a Fixed Offset to Wavelength and Power Measurements

Rather than performing a User Calibration it is possible to enter offset values which are applied to future wavelength and power measurements. For more information refer the **POWER:OFFSET** and **WAVE:OFFSET** GPIB commands in Chapter 4 of the OMM-6810B Instruction Manual.

## 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 on the 6810B so that the CAL **USER** indicator is off or by sending the GPIB command **CAL:USER OFF.**



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CHAPTER 5

# TROUBLESHOOTING

## Introduction

This chapter is intended to be used as a guide when the OMM-6810B and OMH-6722B 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 6722B, 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.



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| Symptom | Causes and Corrective Actions |
|---|---|
| Measurement will not stabilize | • The OMH-6722B is designed to accurately measure the wavelength of a CW source with an amplitude instability of up to 40% depth of modulation. Ensure the laser source's wavelength is stable and that any modulation is minimized. This condition may occur if the laser has not warmed up. Most gas laser cavities expand when first turned on which can cause intensity and wavelength fluctuations.<br>• Check for tight connections between the main unit and the 6722B and ensure other "noisy" electronic devices are not located near the Optical Measurement Head.<br>• 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 "-----" | • The 6722B is not connected to the main unit. |
| Display shows "HI-P" | • This condition occurs when the laser's input power exceeds the maximum allowed for the selected gain range. Measurements at this level are invalid. If in manual mode, press the **DOWN** switch to select the next lower gain range. |
| Display shows "HI-λ" | • This condition occurs when the instrument interprets the laser's wavelength as greater than 1100 nm which is beyond the capability of the OMH-6722B. |
| Display shows "LO-λ" | • This condition occurs when the instrument interprets the laser's wavelength as less than 400 nm which is beyond the capability of the OMH-6722B. |
| Measurements are not accurate at a known wavelength or power standard | • Be certain the zeroing procedure has been performed correctly.<br>• It may be necessary to perform the User Calibration.<br>• The source may be too close to the WaveHead and is emitting non-lasing radiation into the aperture. |
| Measurement seems erratic with a pulsed source input | • Change update rates. Best results with pulsed sources are usually in the SLOW update rate.<br>• Work in MANUAL gain ranging mode; the AUTORANGING algorithm may have difficulty with some pulsed sources, especially those with duty cycles less than 50%. |



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