

User's Guide

10W Power/Wave Measurement Head OMH-6795B



 **ILX Lightwave**
Photonic Test and Measurement

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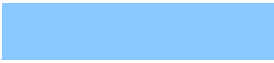


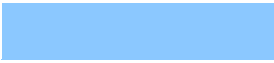
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SAFETY AND WARRANTY INFORMATION

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 x).

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 viii 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.

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

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 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!



WARRANTY

INTRODUCTION AND SPECIFICATIONS

This chapter provides an introduction to the OMH-6795B 10 Watt Power/Wave Measurement Head for the OMM-6810B Optical Multimeter and LPA-9080 Laser Diode Parameter Analyzer. It contains safety considerations, a product overview, and specifications.

Safety Considerations



WARNING

The high brightness and 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.



WARNING

If any of the following symptoms exist, or are even suspected, remove the OMH-6795B from service. Do not use the OMH-6795B 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 for service and repair to ensure that safety features are maintained.

Product Overview

The OMH-6795B 10 Watt Power/Wave Measurement Head, used in conjunction with the OMM-6810B Optical Multimeter or LPA-9080 Laser Diode Parameter Analyzer, accurately measures optical power in the 950 nm to 1650 nm range up to 10 Watts and wavelengths from 1200 nm to 1650 nm. The OMH-6795B measures over a 70 dB range from a maximum of +40 dBm to –30 dBm.

The OMH-6795B incorporates a fiber exit port that allows a simple connection to an Optical Spectrum Analyzer. The head provides measurements from single and multi-mode fiber with numerical apertures (NA) up to 0.3 and a fiber core size up to 110 μm .

The OMH-6795B is used in conjunction with the OMM-6810B Optical Multimeter and LPA-9080 Laser Diode Parameter Analyzer. Please refer to the respective instrument manual for specific operation instructions and test configurations.

CAUTION

Do not connect the OMH-6795B while the OMM-6810B or LPA-9080 power is turned on. Make sure to power off the instrument when changing heads.

Connecting or disconnecting the OMH-6795B may cause calibration and memory damage or loss.

The OMH-6795B is supplied with a certificate for NIST traceable calibration from the ILX Lightwave optical calibration laboratory.

For information about connecting, configuring, and troubleshooting the OMH-6795B Optical Measurement Head, see Chapter 2, *Configuration and Troubleshooting* on page 5.

Specifications

Specification ¹	Description
Wavelength Measurement	
Range	1200-1650 nm
Accuracy ²	±2.0 nm (typical ³ @ 1480 nm < ±1.0 nm)
Detection	-10 dBm
Power Measurement	
Range ⁴ (950-1650 nm)	-30 dBm to +40 dBm
Damage Threshold	42 dBm
Accuracy ⁵	
Reference conditions	±2.5%
Operating conditions	±5.0%
Polarization dependent response ⁶	±0.002 dB
Measurement repeatability ⁷	±0.003 dB
Compatible connector types	FC/PC, FC/APC, LC, SC, bare fiber holder
Numerical Aperture (NA)	0.1 to 0.3
Fiber Core Size	SMF to 110 μm
Sensor type	InGaAs
Noise ⁸	≤ 60 nW p-p (1200-1650 nm), typical ³ 30 nW p-p @ 1480 nm
Temperature coefficient ⁹	
Power	±0.1%/°C typical ³
Wavelength	-0.07 nm/°C typical ³ (10 °C to 25 °C) -0.03 nm/°C typical ³ (25 °C to 40 °C)
Linearity ¹⁰ (-30 dBm to +40 dBm)	±0.1 dB, ±60 nW
Fiber Exit Port	For 1 Watt of input power, ≥1 μW output (60 dB attenuation) Fiber Core: 62.5 μm, FC/PC receptacle
Environment	
Operating temperature	10 °C to 40 °C
Storage temperature	-30 °C to +70 °C
Humidity	<85% RH, non-condensing
Size (H x W x D)	86 mm x 86 mm x 100 mm (3.39" x 3.39" x 3.94")
Weight	2.95 lbs. (1.34 kg.)

1. All values are contingent upon a 30-minute warm-up period.
2. The OMH-6795B wavelength measurement technology provides *mean* wavelength; all spectral contributions to which detectors are sensitive are measured. Stability of wavelength measurement increases with source linewidth; wavelength measurements NOT stable for linewidths <1.0 GHz
3. Typical values provide supplemental information beyond guaranteed specification limits.
4. Typical photodiode response is linear over a 60-70 dB range between the effects of thermal noise and saturation of the diode. ILX power meter heads are calibrated above the noise threshold and linearity is verified in order to produce an accurate calibration for optical power measurements to 10 W.
5. 950 nm to 1650 nm. Includes traceability to NIST. Calibrated at 23 °C ±3° C at 10nm intervals. Uncertainty evaluated according to NIST Technical Note #1297: *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*. Accuracy specifications are verified with the wavelength entered manually (instrument not in auto-wavelength mode). For auto-wavelength mode add ±1.2% to the accuracy uncertainty.
6. Variation in meter response associated with changes in input polarization state. Specification is for flat endface (cleaved) fiber. Add PDL for connectors or angled-cleave measurements. For example, 8° cleave in SMF-28 fiber typically adds 0.015 dB PDL.
7. Variation in response after removing and replacing the fiber or connector. Includes the affects of variation in fiber orientation and bare fiber extension of 1-5 mm from the holder. Add ±0.003 dB for NA >0.20.
8. Measured over one minute, in medium filter mode.
9. Measured in gain range 4.
10. 950 nm to 1650 nm. Total variation from straight-line response. Valid across range limits if measured in auto-range mode. Measured at 23 °C ±5 °C, constant temperature. Add ±0.005 dB/dB for input power >20 dBm.

CONFIGURATION AND TROUBLESHOOTING

This chapter describes how to connect, configure, and troubleshoot the OMH-6795B 10 Watt Power/Wave Measurement Head.

Connecting to the Instrument

The OMH-6795B connects to the OMM-6810B Optical Multimeter or LPA-9080 Laser Parameter Analyzer through the 26-pin input connector on the rear panel of each instrument. The connector is a 26-pin high density D-sub connector.

Connect the cable from the OMH-6795B to the 26-pin input connector on the rear panel of the OMM-6810B or LPA-9080.

CAUTION

Do not connect the OMH-6795B while the OMM-6810B or LPA-9080 power is turned on. Make sure to power off the instrument when changing heads.

Connecting or disconnecting the OMH-6795B may cause calibration and memory damage or loss.

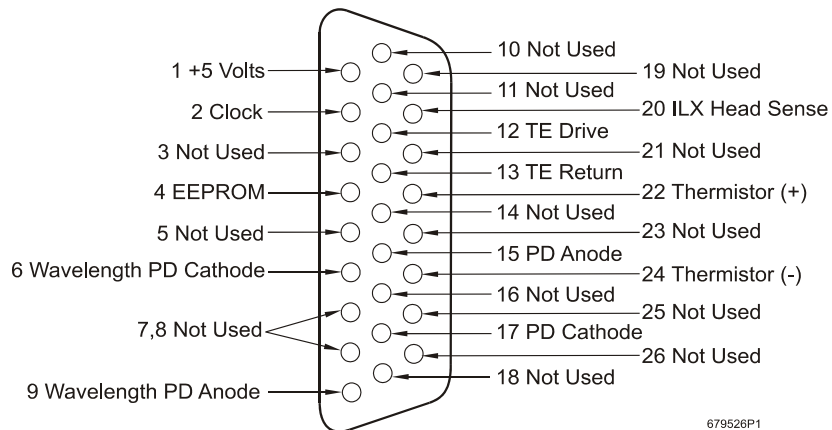


Figure 2.1 26-pin Input Connector Pin-out Diagram

Connecting an Optical Spectrum Analyzer

The OMH-6795B connects to an Optical Spectrum Analyzer (OSA) through the fiber exit port on the side opposite the input. The internal fiber has a core diameter of 62.5 μm . One (1) Watt of input power to the OMH-6795B provides $\geq 1 \mu\text{W}$ of output power to the FC/PC connector on the back of the head.

ILX Lightwave recommends using a 62.5/125 μm patch cord to connect the head to the OSA. Make sure the patch cord is clean before connecting it to the OMH-6795B (see *Cleaning the Fiber and Adaptor* on page 12).

CAUTION

Do NOT launch high power light into the fiber exit port! This is an exit port only.

Configuration of a Typical Test Setup

Typical uses of the OMH-6795B include characterization of lasers with high power requirements and other similar applications. Two typical test set-ups are illustrated using the OMM-6810B or LPA-9080.

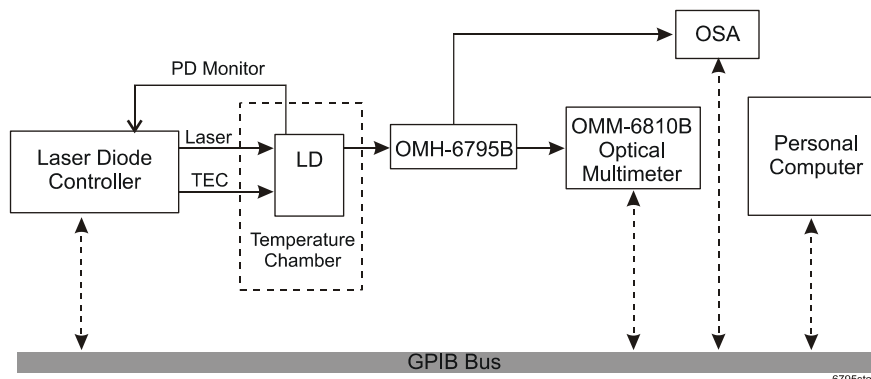


Figure 2.2 Typical Configuration with OMM-6810B

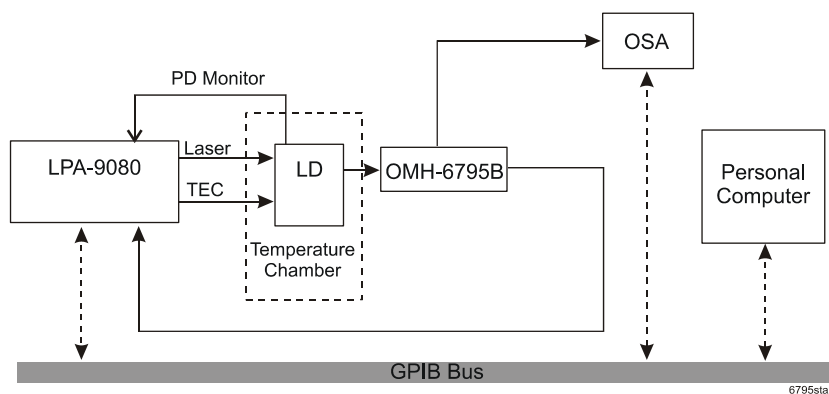


Figure 2.3 Typical Configuration with LPA-9080

Connecting the Fiber

This section provides instructions about installing fiber adaptors and connecting fiber. You can make measurements through most common fiber optic connectors, with adaptors available from ILX Lightwave. Once the adaptor is in place, you can connect patch cords repeatedly to the meter.

CAUTION

If the detector cavity is contaminated with debris, high power lasers can damage the head. When not in use, protect the detector cavity from contamination by covering the input aperture with the plastic shipping protector, or leave a connector or bare fiber holder in place.

- 1 Installing or removing an adaptor:
 - 1a Align the mating hole on the adaptor with the alignment pin on the head.
 - 1b Press it into place, then rotate it slightly until the alignment pin has seated. Make sure the adaptor is fully seated around its circumference. Small spring-loaded balls (ball plungers) around the adaptor mate with a channel in the OMH-6795B, holding the adaptor in position.
 - 1c To remove an adaptor, grasp its outer ring and pull it out of the head.

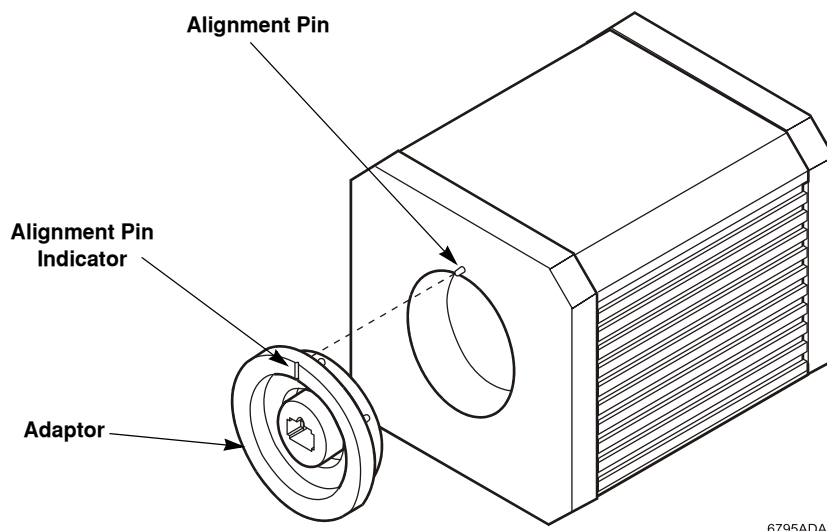


Figure 2.4 Seating the Alignment Pin

- 2 Connect an FC patch cord:

Always clean the end-face of the connector ferrule before a measurement, using proper tools and good technique. The core of a single-mode telecom-grade fiber is only about 9 μm in diameter; the smallest contaminant can cause significant errors. See *Cleaning the Fiber and Adaptor* on page 12 for information about cleaning the fiber or connector.

 - 2a Align the connector key on the fiber ferrule with the slot on the input connector.

- 2b Gently insert the fiber ferrule into the bulkhead and secure with the threaded cap.

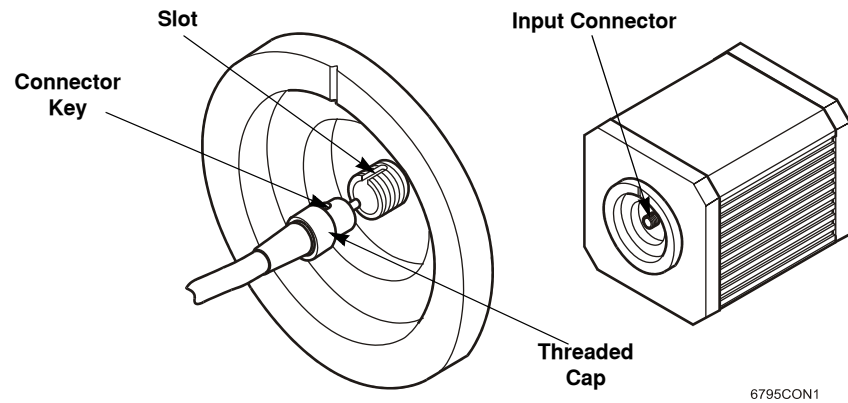


Figure 2.5 Connecting an FC/PC Bulkhead Patch cord

- 3 To connect a FC/PC or SC patch cord, insert the connector into the adaptor. Make sure the connector is properly seated into the adaptor.

Measurements Through Bare Fiber

The ILX Lightwave BF-820 Bare Fiber Holder allows you to accurately and repeatedly measure through bare fiber.

- 1 Press the CA-120 Bare Fiber Adaptor Ring into the head. The CA-120 has no alignment hole; alignment is *not* necessary.

The CA-120 bare fiber adapter ring accepts ILX Lightwave BF-820 or Agilent 81000BA bare fiber holders.

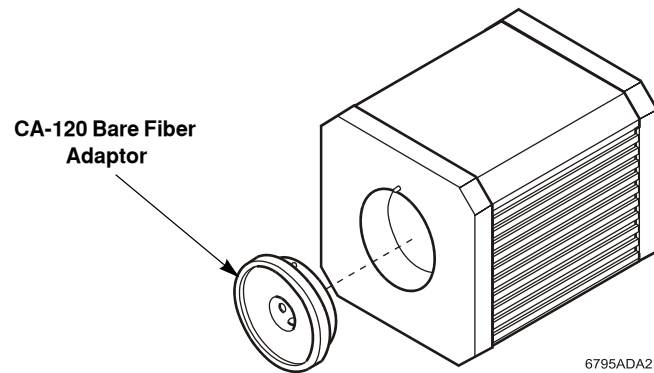


Figure 2.6 CA-120 Bare Fiber Adaptor Ring

- Strip the jacket, then strip at least 1.3 cm of buffer ($\frac{1}{2}$ -inch) from the fiber.
- Carefully clean and cleave the fiber using a high precision fiber cleaver.

If the fiber endface touches anything after cleaving, clean it and cleave it again. ILX Lightwave uses a Fujikura High Precision Fiber Cleaver.

Note: The BF-820 is designed for 125 μm clad fiber.

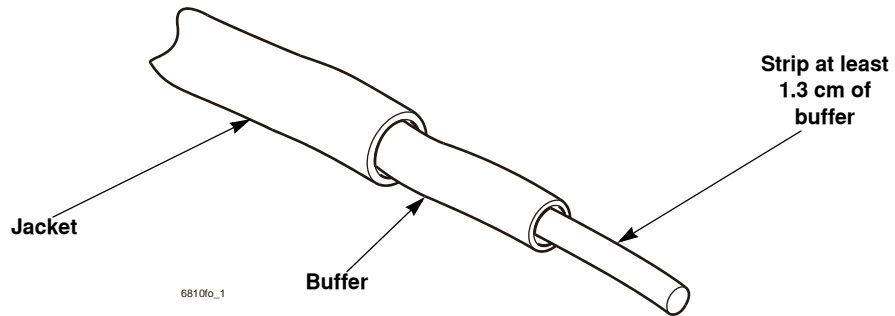


Figure 2.7 Strip and Cleave the Fiber

- Squeeze the BF-820 bare fiber holder by its feet to open the body and expose the alignment guides.

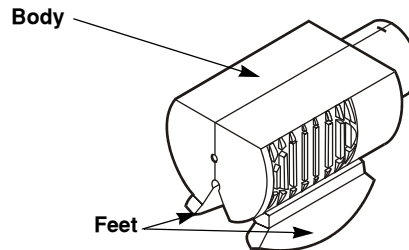


Figure 2.8 BF-820 Bare Fiber Holder

- Lay the fiber in the holder with the stripped and cleaved fiber extending from the nose (measurement head/adaptor side) of the holder.

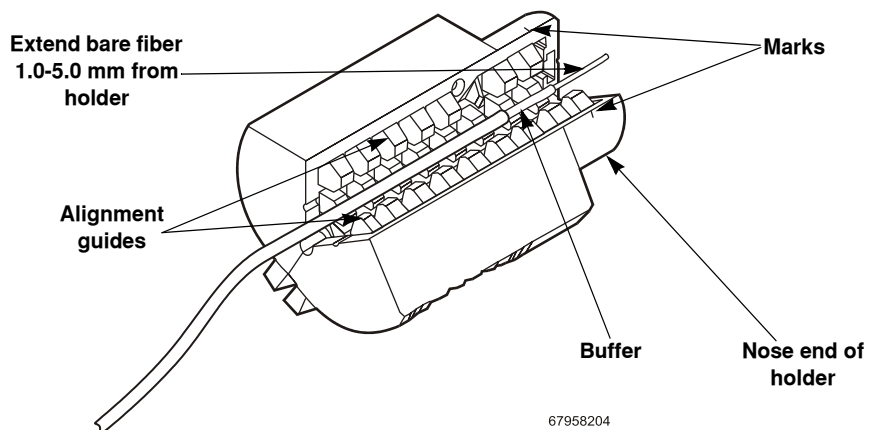


Figure 2.9 Place Fiber in BF-820 Fiber Holder

- 6 Gently pull the fiber away from the nose until the buffer is aligned with the marks on the holder. Make sure the buffer does not extend beyond the marks, toward the nose-end of the holder.

The fiber must extend between 1.0 mm and 5.0 mm from the holder to ensure accurate measurements from the OMH-6795B.

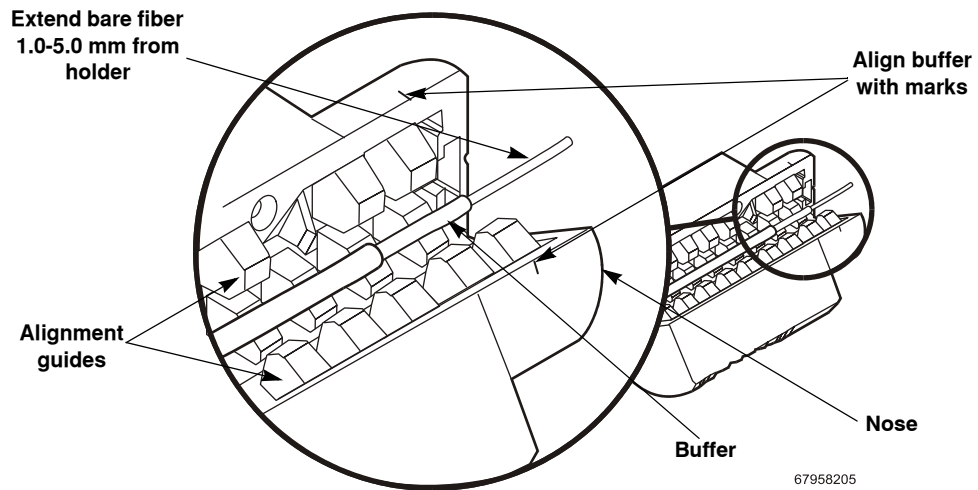


Figure 2.10 Place Fiber in BF-820 Fiber Holder

- 7 Release the feet and close the holder. The holder is held shut by its magnets and return springs.
- 8 Grasping the fiber holder by the body, insert the holder into the bare-fiber adaptor ring making sure the fiber endface avoids contact with anything. If the fiber endface makes contact with anything, it must be cleaned and recleaved.

Note: Make sure to grasp the holder by the body when inserting or removing it from the detector. Grasping the holder by the feet expands the nose, lodging it in the adaptor ring. Pulling the fiber holder by the feet can unseat the bare fiber adaptor ring.

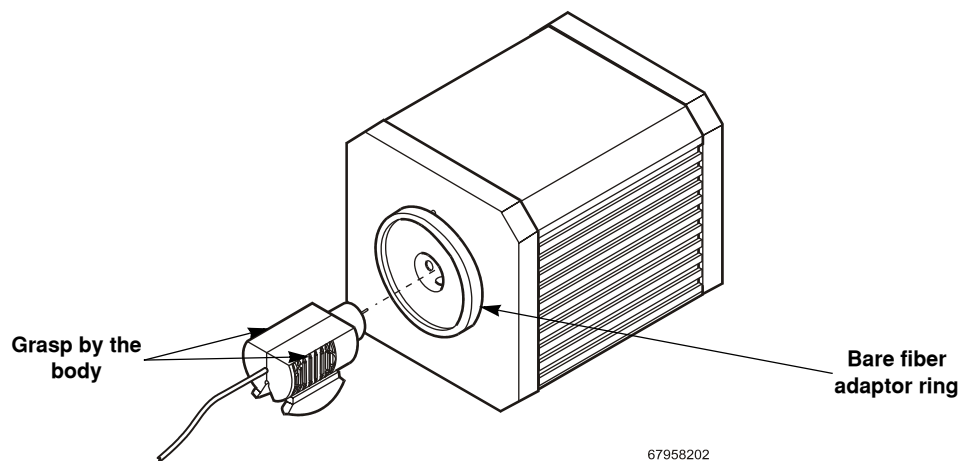


Figure 2.11 Inserting the BF-820

Measuring with the Agilent 81000BA Bare Fiber Holder

Refer to Agilent documentation for detailed instructions on use and care of the 81000BA.

The measurement procedure is basically the same as the BF-820 (see *Measurements Through Bare Fiber* on page 8). Be sure to strip enough fiber to allow 3.0 mm protruding from the front of the Agilent holder after you have the fiber in place.

Also, check that the fiber extension is straight from the front of the holder. If it is crooked, the holder is bending the fiber. Bending seriously affects measurement accuracy, and may cause the fiber end to break off.

Maintenance and Troubleshooting

This section provides information about general upkeep, troubleshooting potential problems, and calibration requirements. For further assistance with technical solutions and troubleshooting, visit the www.ilxlightwave.com Support page (www.ilxlightwave.com/support/index.html), and the Library page (www.ilxlightwave.com/library/index.html) for Application Notes and Technical Notes.

Maintenance Guidelines

Although the OMH-6795B is robust, handle the head with care. Stress from dropping the head or other mishandling can dislodge critical alignments within the head, thus nullifying its calibration.

The OMH-6795B is sensitive to Electrostatic Discharge (ESD). Store the head in an ESD-safe bag.

Detector Cavity Contamination

The detector cavity input aperture is small (~2.5 mm) making it difficult to pick up debris. However, over time dust and pollution in normal air can degrade measurement accuracy. The OMH-6795B has the capability to measure high power lasers; if the detector cavity is contaminated with debris, high power lasers can damage the head. After using the detector, protect the detector cavity by covering the input aperture with the plastic shipping protector, or leave a connector or bare fiber holder in place. Contact ILX Lightwave Customer Service for a replacement protective cap if needed. See *Comments, Suggestions, and Problems* on page x for contact information.

Cavity contamination can occur during environmental testing where humidity causes condensation. If you suspect the cavity has been contaminated, contact ILX Lightwave Customer Service (see *Comments, Suggestions, and Problems* on page x for contact information). In most cases, the head can be cleaned and recalibrated.

Cleaning the OMH-6795B

CAUTION

Do not blow into the OMH-6795B or blow compressed air into the head.

In general, avoid cleaning the interior cavity of the OMH-6795B. Follow the instructions provided to clean the fiber and adaptor. Do not insert or blow anything into the OMH-6795B cavity, including compressed air, canned air, or dry nitrogen.

If you suspect the cavity has been contaminated, contact ILX Lightwave Customer Service (see *Comments, Suggestions, and Problems* on page x for contact information). In most cases, the head can be cleaned and recalibrated.

Cleaning the Fiber and Adaptor

To clean the ferrule, fiber end-face, and adaptor, you need several cotton swabs and/or some clean, lint-free lens paper, and reagent grade methanol.

- 1 Dampen a small cotton swab or clean, lint-free lens paper with some reagent grade methanol.
- 2 Gently clean the ferrule with the swab or lens paper making sure to avoid touching the fiber end-face. Make sure no cotton fibers remain on the ferrule.
- 3 With a new, clean cotton swab or lens paper dampened with methanol, gently clean the adaptor. Make sure no cotton fibers remain on the adaptor.
- 4 With a new, clean cotton swab or lens paper dampened with methanol, carefully touch the end of the fiber. **Do not rotate the cotton swab when it is in contact with the fiber end. Dirt particles may scratch the fiber-end.**
- 5 Allow all of the surfaces to dry. Repeat the cleaning procedure as necessary to remove contamination.

Troubleshooting Optical Measurement Problems

Symptoms	Corrective Actions
Inconsistent Readings	<ul style="list-style-type: none"> • Make sure the connector adaptor is flush with the head. • For bare fiber measurements, verify the quality of cleave and the placement in the bare fiber holder. • Rotate the connector adaptor until alignment pin snaps into place to ensure the connector adaptor is properly seated. • Verify the fiber ferrule is clean. • Make sure the OMM-6810B or LPA-9080 is warmed up. Typically, a one-hour warm up is required. See the respective User's Guide for more information. • Verify that the OMH-6795B is connected and has been powered up for at least 15 minutes.
High PDR measurements	<ul style="list-style-type: none"> • Make sure the fiber end is clean and cleaved without angles. • If using a Fabry Perot source, use an isolator between the source and the device under test. • If using PDL paddles, make sure you are using good, low PDL paddles. • Make sure the bare fiber adaptor is properly seated. The adaptor must be flush against the face of the head.
Poor or incorrect power measurements	<ul style="list-style-type: none"> • Check if the input fiber is broken. • Check for laser damage. • Check for correct user calibration. • Verify that the OMH-6795B is connected and has been powered up for at least 15 minutes. • Dirty head: contact ILX Lightwave Customer Service (see <i>Comments, Suggestions, and Problems</i> on page x for contact information). The head needs to be sent to ILX for cleaning. • Make sure the fiber end-face is clean.
Noisy wavelength readings	<ul style="list-style-type: none"> • If you are using a very narrow linewidth laser source, turn on the coherence control option, if available.
Inaccurate wavelength readings	<ul style="list-style-type: none"> • Note that the OMH-6795B provides a power-weighted average wavelength measurement and is <i>not</i> necessarily coincident with a peak wavelength measurement. • Verify that the head has been calibrated within the last year. See <i>Calibration</i> on page 14 for more information or contact ILX Customer Support (see <i>Comments, Suggestions, and Problems</i> on page x for contact information)

Calibration

ILX Lightwave Corporation provides in-house and on-site calibration services for ILX instruments. Most ILX instruments, including the OMH-6795B, require yearly calibration to ensure performance to published specifications. ILX factory calibrations employ NIST traceable measurement instrumentation, and calibration engineers and technicians use automated test equipment to accurately and efficiently capture and record calibration data. An original certificate of calibration authenticity is provided with all instrument calibrations, and a detailed report showing any pre-calibration out-of-tolerance conditions is available upon request. Calibration turn-times are normally five business days or less. On-site calibrations can be performed around your production schedule, night or day, seven days a week. Please contact ILX Customer Support (see *Comments, Suggestions, and Problems* on page *x* for contact information) for additional calibration information.

For further assistance with technical solutions and troubleshooting, visit the www.ilxlightwave.com Support page (www.ilxlightwave.com/support/index.html), and the Library page (www.ilxlightwave.com/library/index.html) for Application Notes and Technical Notes.

For user-calibration, a laser source of known power and wavelength is required. For specific instructions about user-calibration, refer to the OMM-6810B or LPA-9080 User's Guides.



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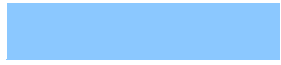
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