



SUPERLUM

BroadLighter-M

USER MANUAL



BroadLighter-M Series Broadband Superluminescent Diode Benchtop Light Source

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Superlum reserves the right to change or make corrections to this manual further without notice.

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Declaration of Conformity

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Superlum Diodes Ltd.
Manufacturer's Address: Unit B3, Fota Point Enterprise Park
Carrigtwohill, Co Cork
Ireland

Declares that,

Product Name: Broadband Superluminescent Diode Benchtop Light Source

Product Number: BroadLighter-M

Product Options: This declaration covers all options of the above product(s).

This product complies with the following standards/ requirements:

EMC	Standard	Limit
	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	Group 1 Class A
	CISPR 11:1990 / EN 55011:1991	4kV CD, 8kV AD
	IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995	3 V/m, 80-1000 MHz
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	0.5kV signal lines, 1kV power lines
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV line-line, 1 kV line-ground
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	3V, 0.15-80 MHz
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	0.5 kV line-line, 1 kV line-ground
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	Dips: 30% 10ms; 60% 100ms
	The product was tested in a typical configuration	Interrupt > 95% @ 5000ms

Safety IEC 61010-1:1990+A1:1992+A2:1995 / N 61010-1:1993+A2:1995

Laser Safety IEC 60825-1:2014

Certificate Exclusions

This Declaration, and all documentation, and all equipment cited herein, shall cease to conform to and/or be compliant with the above Directives, Standards and Specifications unless the following conditions are complied with and applied by the Purchaser /User:

- This Product shall be installed, used and maintained as directed by Superlum.
- The Product shall not be modified and/or changed without prior written approval of Superlum.

Although every effort is made by Superlum to comply with the above Directives and Standards, it is the responsibility of the Purchaser and/or User of the equipment to ensure that all claims and assurances with regards to such directives and Standards are complete, correct and satisfied.

Warranty

Warranty

Superlum warrants the BroadLighter-M Broadband SLD Benchtop Light Source for a period of 12 months from the date of shipment. During this warranty period Superlum will repair / exchange any unit proven to be defective. Repairs are warranted for the balance of the original warranty period or at least 90 days.

For warranty repairs or service the unit must be returned to Superlum at the customer's expense.

Limitation of Warranty

Superlum will not accept liability for any incidental damage caused by the failure of this product. This warranty does NOT cover:

- Any defect/damage caused by improper operation.
- Accompanying accessories, e.g. fiber optical patchcables, AC power cords, etc.

Dismantling any part of the unit without prior approval from Superlum will void the warranty.

Statement of Calibration

Superlum certifies that this product has been inspected, tested, and calibrated to meet its published specifications.

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Safety Symbols and Terms

This section deals with information on the safety symbols and terms which are used on the instrument or in the manual, and gives explanations about what they stand for. These symbols and terms indicate precautions you must strictly follow to safely operate the instrument.

Before you begin using your BroadLighter-M, please read the following explanations:

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of the entire product or part thereof. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Safety Symbols and Terms

NOTE

The NOTE sign denotes important information. It calls attention to procedures, practice, condition, or the like, which is essential to highlight.



The CE mark shows that the product complies with all relevant European Legal Directives.



The warning label denotes visible and/or invisible laser radiation.



This label means the compliance with the requirement of COMPLIANT the RoHS Directive (Directive 2002/95/EC).

General Safety Information

WARNING

- **High voltage inside. To avoid electrical shock, before powering unit, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock resulting in severe injury or even death. Do not operate without cover installed.**
- **This unit must not be operated in an explosive environment.**

The general safety precautions must be observed during all phases of operation, service, and repair of the instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Superlum assumes no liability for the customer failure to comply with these requirements.

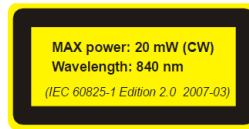
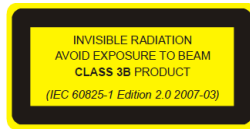
Before Applying Power, verify that the product is set to match the available line voltage.

General Safety Information

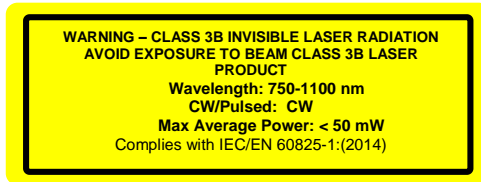
WARNING

Avoid Exposure – Laser Radiation emitted from optical aperture. BroadLighter-M contains one of the following sets of Laser Safety Information Labels¹.

Set 1:



Set 2:



CAUTION

Depending on the configuration of the BroadLighter-M, the instrument can be assigned to Class 1, Class 3R or Class 3B laser product in accordance with IEC 60825-1:2014. Refer to Laser Safety label placed on the top panel and read the safety information related to the safety class of your instrument. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

¹ The labels shown are the examples and for reference only. The actual labels and their position may differ.

NOTE

Output Aperture for BroadLighter-M is a single mode optical fiber with numerical aperture² (NA) = 0.14.

Laser Safety Labeling

Depending on configuration, BroadLighter-M can be attributed to different classes of Laser Safety according to IEC 60825-1:2014. The interior of BroadLighter-M contains Laser Safety labels. Laser safety information label is located on the lid of the instrument. Laser aperture label is located next to FC/APC connector on the front panel of an instrument. Laser Hazard label is located on the lid of an instrument.

CLASS 1 Laser Product

Light sources assigned to Class 1 are safe during the use, including the long-term direct intrabeam viewing, even if the exposure with optical viewing instruments (e.g. eye loupes or binoculars) occurs. Extra care must be taken to the following: Using controls, adjustments, or operating procedures that are different from those specified in this manual may result in radiation exposure hazardous to the user.

When the instrument is used with certain optical elements—such as optical amplifiers, lenses, collimators, and the like—which are not supplied with the product as original accessories, or the product is integrated into a high-level system, it is strictly

² Parameter may vary for a custom version of BroadLighter-M

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recommended to reclassify the final optical system in order to determine its total degree of optical radiation hazard. The reason for this is that the Class may increase under these conditions. It is the responsibility of a person (or organization) who performs such integration to provide correct reclassification for the optical system at the final stage.

It must be noted that it is the user who is responsible for being aware of possible risk associated with using Class 1 laser products as well as being adequately trained for working with such light sources. Superlum is not liable for any personal injury, property damage, or other (direct or indirect) damage of any nature caused by personal faults, improper and/or inadequate using of the instrument coming from disregarding the necessary aspects of laser safety.

NOTE

According to IEC 60825-1, this product has been classified for an exposure duration of up to 100 ms. For other practical applications in which the exposure duration is greater than 100 ms, the product must be reclassified.

CLASS 3R Laser Product

Light sources assigned to Class 3R emit optical radiation that can exceed the MPE (Maximum Permissible Exposure) under

the direct intrabeam viewing, but in most cases the risk of injury is relatively small because the AEL (Accessible Emission Limit) for Class 3R is only 5 times greater than the AEL for Class 1, which is safe for the user. The risk of injury rises as the exposure duration increases. The exposure will be safe for the user unless it is a deliberate ocular exposure.

The risk of injury is actually minimized due to the following facts:

- Unintentional exposures would rarely reflect worst-case conditions, for example, of beam alignment with the pupil or worst-case accommodation.
- The inherent safety margin in the MPE.
- Natural aversion behavior for exposure to bright light for the case of visible radiation and by the response to heating of the cornea for far infrared radiation.

The direct intrabeam viewing is supposed to be unlikely for possible practical applications of this instrument. Otherwise, the user should reclassify the instrument. If you are unsure about providing the correct reclassification, contact Superlum on this issue.

Using controls, adjustments or operating procedures that are different from those specified in this manual may result in radiation exposure hazardous to the user. When the instrument is used with certain optical elements, such as optical amplifiers, lenses, collimators, etc., which are not supplied with the product as original accessories, or the product is integrated into a high-

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level system, it is strictly recommended to reclassify the final optical system. The reason for this is that the Class may increase under these conditions. It is the responsibility of an end-user who performs such integration to provide correct reclassification for the optical system at the final stage. It must be noted that it is the user who is responsible for being aware of possible risk associated with using Class 3R laser products as well as being adequately trained for working with such lighter sources. Superlum is not liable for any personal injury, property damage, or other (direct or indirect) damage of any nature caused by personal faults, improper and/or inadequate using of the instrument coming from disregarding the necessary aspects of laser safety. These features are as follows:

- Key-operated master control
- Remote interlock connector
- Illuminated indicator on the pushbutton for the output emission activation
- Audible and visible warning signals for the output emission activation
- Protective metal cap for the optical output
- Laser safety labeling

This manual contains the most comprehensive information on the laser safety controls (and measures) built into the instrument.

NOTE

According to IEC 60825-1, this product has been classified for an exposure duration of up to 100 ms. The product must be reclassified for practical applications in which the exposure duration is greater than 100 ms.

CLASS 3B Laser Product

Light sources assigned to Class 3B are always hazardous for the intra beam ocular viewing even if an accidental short-time exposure occurs. Viewing them through optical elements with diffuse-reflecting properties is usually safe for the user. Pay close attention to the following information: Using controls, adjustments, or operating procedures that are different from those specified in this manual may result in radiation exposure hazardous to the user.

When the instrument is used with certain optical elements such as optical amplifiers, lenses, collimators, etc., which are not supplied with the product as the original accessories, or the product is integrated into a high-level system, it is strictly recommended to reclassify the final optical system in order to determine its total degree of optical radiation hazard.. It is the responsibility of an end user who performs such integration to provide correct reclassification for the optical system. It must be noted that it is the end-user who is responsible for being aware

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of possible risk associated with using Class 3B laser products as well as being adequately trained or working with such lighter sources. Superlum is not liable for any personal injury, property damage, or other (direct or indirect) damage of any nature caused by personal faults, improper and/or inadequate using of the instrument coming from disregarding the necessary aspects of laser safety. Incorporated into BroadLighter-M are the following laser safety features:

- Key-operated master control
- Remote interlock connector
- Illuminated indicator on the pushbutton for the output emission activation
- Audible and visible warning signals for the output emission activation
- Protective metal cap for the optical output
- Laser safety labeling

This manual contains the most comprehensive information on the laser safety controls (and measures) built into the instrument. Please read thoroughly this manual to acquaint yourself with all features and functions for laser safety before you start working with the BroadLighter-M.

NOTE

According to IEC 60825-1, this product has been classified for an exposure duration of up to 100 ms. The product must be reclassified for practical applications in which the exposure duration is greater than 100 ms.

General Safety Information

Safety Earth Ground

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the AC power line through a three-conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

- **DO NOT** operate the instrument in an explosive atmosphere or in the presence of flammable gases or fumes.
- **DO NOT** perform procedures involving cover or shield removal unless you are qualified to do so. Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are to be performed by service-trained personnel only.
- **DO NOT** operate damaged equipment. Whenever it is possible that the safety protection features built into this product have been impaired, either through physical

damage, excessive moisture or any other reason, remove power and do not use the product. Return the product to Superlum to ensure the safety features are operational.

- **DO NOT** substitute parts or modify equipment. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to Superlum for service and repair.

Acronyms and Abbreviations

The necessary information on acronyms and abbreviations is summarized in the following table:

TABLE A. Acronyms and Abbreviations Used

Abbreviation	Definition
°C	Degree Celsius
mW	Milliwatt
nm	Nanometre
dB	Decibel
AC	Alternating Current
AEL	Accessible Emission Limit
APC	Automatic Power Control
BLS	Broadband Light Source
CW	Continuous Wave
DC	Direct Current
LED	Light Emitting Diode
MPE	Maximum Permissible Emission
NA	Numerical Aperture
PC	Personal Computer
SLD	Superluminescent Diode
TEC	Thermoelectric Cooler

NOTE

If you see a term for which the definition is not given here, refer to special reference books for the necessary explanations or consult with Superlum on this issue.

1. General Information

This chapter contains general information concerning the BroadLighter-M Broadband SLD Benchtop Light Source. Included in this chapter are a description of the instrument, an outline of this manual, general specifications, information on the Laser Class to which your BroadLighter-M is assigned, and a description of the laser safety measures employed in this equipment.

1.1 In This Manual

This manual contains the most comprehensive information required to install, operate, and clean your Superlum BroadLighter-M Broadband SLD Benchtop Light Source.

The goal of this section is to give a short overview of the chapters and sections comprising this document. Knowing the layout of the manual helps you find answers to the vast majority of questions you may have about installing, using, programming, cleaning, and servicing your BroadLighter-M. The manual consists of six chapters. Detailed information about the principles of operation, installing, and using the BroadLighter-M is provided in four chapters which are placed at the beginning of the manual. At the end of the document there are two chapters containing additional information (i.e. detailed

instructions) about cleaning and obtaining service. Use the manual as a reference book when you are installing and operating with the instrument.

Please, carefully read this manual before using your BroadLighter-M. You should pay attention to the warnings and cautions presented in this manual. If necessary, refer to section "Safety Symbols and Terms" for definitions of these terms. If, after reading this manual, some of the explanations remain unclear to you or you need extra information on a particular issue, do not hesitate to contact Superlum for more details or additional explanations.

The chapters in this manual are set out as follows:

Chapter 1, "General Information", begins with outlining the scope of this manual. After that, you will find background information concerning the BroadLighter design and the principles of operation. Following this are technical specifications on the product and laser safety information, which are provided in the corresponding sections of the chapter.

Chapter 2, "Installation", takes you through unpacking and inspection procedures and explains how to prepare the BroadLighter-M for use.

1. General Information

Chapter 3, "Local Mode of Operation", introduces front- and rear-panel features and provides detailed operating instructions to demonstrate how to use the BroadLighter-M.

Chapter 4, "Remote Mode of Operation", explains how to control the instrument remotely via a PC. It provides a full description of each command and query supported by the instrument and the most comprehensive information on the Superlum BroadLighter-M Companion Software, which comes with the instrument.

Chapter 5, "Cleaning Instructions", deals with a description of the proper cleaning procedures that you should regularly apply to both the BroadLighter-M and optical accessories, such as optical patchcables, adapters, optical connectors, etc.

Chapter 6, "Service and Support", explains what you should do if you encounter a problem with the instrument. It also gives detailed recommendations for repacking the instrument before returning it to Superlum for servicing.

1.2 Instrument Description

For a number of optical applications, such as optical coherence tomography, optical metrology, characterization of optical components etc., broadband light sources based on the use of SLD modules are considered to be best suited. The reason for choosing these optical modules is related to their remarkable performance parameters. Among all types of modules presented on the market, the SLD modules best combine high optical power similar to that emitted by laser diodes with broadband optical spectra characteristics of LEDs. These advantages of SLDs allow the user to avoid unwanted interference effects, like speckle or ghost signals. In contrast, narrowband light sources such as laser diodes often give rise to such effects due to a high temporal coherence of their output emission.

The BroadLighter-M is an advanced SLD-based broadband light source intended for a benchtop applications. Among other broadband light sources of this kind, it features excellent performance parameters, easy-to-use front-panel operation, and long-term stability of its technical characteristics, high reliability, minimal maintenance, and many others. The instrument can be controlled either manually by using its front-panel controls or remotely via PC. For remote control, the instrument is equipped with USB and REMOTE CONTROL interface. Superlum BroadLighter-M Companion Software,

1. General Information

which is supplied with the instrument, has a user-friendly interface that permits the user to put the instrument under remote control immediately after its installation.

In comparison to a standalone SLD module, the BroadLighter-M demonstrates the extended optical spectrum with an extremely wide -3 dB bandwidth, which in turn corresponds to very low temporal coherence. This occurs due to combination of the optical emissions of up to four spectrally matched SLD modules. The actual number of SLDs depends on your instrument configuration. Figure 1.1 sketches the principle of light combining in the BroadLighter-M. To combine broadband emissions of the SLDs broadband fiber-optic couplers are utilized. The couplers feature low insertion losses and small changes in the coupling ratio for the necessary range of wavelengths.

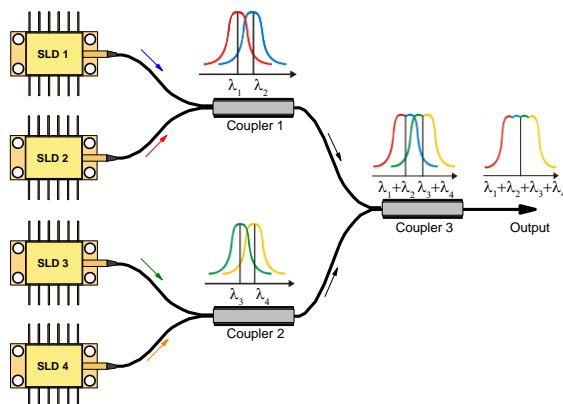


Figure 1.1. Schematic of the Principle of Light Combining in the BroadLighter-M. The actual number of SLDs depends on your instrument configuration.

The internal structure of the BroadLighter-M has a modular design. The instrument consists of an optical unit, driver unit and a main unit. Optical unit has optical components comprising the optical scheme of the instrument. It also stores the information about the SLD operating parameters, the driver unit has an integrated DC power supply, as well as driving electronics and temperature control for SLDs. The main unit acts as a motherboard for optical and driver units. This design principle provides the possibility for a flexible exchange of unit and the ability to adapt and upgrade the instrument to a particular customer application.

1. General Information

Superlum SLD modules used in the BroadLighter-M are fiber-coupled optical modules with a built-in thermoelectric cooler (TEC) and a temperature sensor which are both necessary for active temperature control. Superlum current-and temperature controller is used to control the driving current and operating temperature of an SLD module.

The instrument has a wide-range voltage power supply suitable for the 100-240 V AC power lines. All essential information about AC power requirements is shown on the rear panel of the instrument. It is important to note that the BroadLighter-M is intended for indoor use only. For more information on environmental conditions, refer to section "Specifications".

This equipment is intended for fiber-optic applications. To serve this purpose, it is equipped with FC/APC fiber output. Each BroadLighter-M is shipped with an individual optical patchcable which is used to deliver the optical output power of the instrument to the user measuring equipment. It is important to note that the patchcable provided with the instrument is specially selected to best match the optical output of the instrument. With the patchcable attached, a low-loss connection between the BroadLighter-M and the patchcable is obtained. Connecting user-selected patchcables to the BroadLighter-M output is permitted but not recommended,

because in this case the minimum optical losses in the instrument-to-patchcable connection can hardly be ensured. FC/APC connectors of its ends is the crucial requirement for the patchcable to be used. Contact Superlum first if you would like to use other types of optical connections.

The BroadLighter-M incorporates the following safety features required by IEC 60825-1:

- **Key-operated master control** — located on the front panel of the instrument, this switch provides access to activation of the optical output. The BroadLighter-M is inoperable when the key is removed. Using the key-operated master control prevents unauthorized activation of the optical output emission.
- **Emission indicator** — the LED integrated with SLD emission activation ON/OFF button, lights up green when the optical power is enabled, thereby warning the user about the output emission. The LED will switch to red when the SLD emergency switch-off occurs.
- **Emission time delay** – there is a 3 second time delay between pressing the emission ON/OFF button and the emission activation.

1. General Information

- **Remote Interlock connector** — this feature is located on the rear panel of the instrument. It allows the instrument to be connected to your local external controls for laser safety. In order to enable the BroadLighter-M, a short circuit must be applied across the terminals of the Remote Interlock connector. The instrument remains inoperable unless the Interlock connection is made. BroadLighter-M is shipped with a shorting device installed in the Interlock connector. If you are not going to use this feature then you can leave the shorting device installed. With this device installed, you will be able to use the instrument independently of your local laser safety system. If you wish to make use of the Interlock feature you will need to acquire the appropriate connector mate and wire it your remote Interlock switch. Next, remove the shorting device by carefully unscrewing it from the socket and install the connector into the Interlock input. The BroadLighter-M interlock input only accepts a 2.5 mm monophonic jack.
- **Visual and audible warning about optical output emission** — these features start to operate when the user activates the optical output by

pressing the ON/OFF button. Remote IF connection can be used to transfer a warning signal from BroadLighter-M to the external warning system.

- **Optical radiation hazard labeling** — the cabinet of each BroadLighter-M contains a set of warning labels informing the user about the Class of radiation hazard to which the instrument is assigned. Classification is based on the rules specified in standard IEC 60825-1:2014 "Safety of laser products — Part 1: Equipment classification and requirements". Each BroadLighter-M that is assigned to this Class of laser products carries on the instrument's cabinet a set of warning labels with the necessary information according to its laser hazard.
- **Overshooting protection** — BroadLighter-M contains a safety circuit preventing the signal from overshooting by shutting down the output.

CAUTION

Using controls, adjustments, or operating procedures that are different from those specified in this manual may result in radiation exposure that is hazardous to the user.

1. General Information

NOTE

Each BroadLighter-M is assigned to a particular Class only if it completely meets the requirements specified in IEC 60825-1:2014 for that Class. According to IEC 60825-1, Class 1, Class 3R and Class 3B products have been classified for an exposure duration of 100 ms, which is estimated to be a worst-case scenario. For other practical applications in which the exposure duration is greater than 100 ms, the product must be reclassified.

1.3 Product Specifications

Contained in this section are general specifications for the BroadLighter-M which are summarized in the tables below. Note that the information given here covers general and mechanical specifications only. For the technical information concerning optical characteristics for your BroadLighter, please refer to its Acceptance Test Report or contact Superlum on this issue.

TABLE 1.1 General and Mechanical Specifications

Parameter	Value or Description
General:	
Power Requirements	100-240VAC, 50/60Hz 40 VA MAX
AC Power Cord Plug	IEC 320 compatible
Operating Temperature Range	+5 to +35 °C
Storage Temperature Range	-30 to +70 °C
Humidity	< 80% relative humidity, non-condensing
Warm-up Time	30 min
Mechanical:	
Dimensions (WxHxL)	251×112×192 mm
Weight (max)	4 kg
Enclosure	Metal case
Applicable Optical Connector	FC/APC
USB Interface Connector	USB 2.0 Type B
Remote Control Interface Connector	9-pin DSUB for external logic
Remote Interlock Connector	2.5 mm mono phono jack

1. General Information

Included in the package is one of each of the following:

TABLE 1.3

List of Contents

Item	Qty.
BroadLighter-M Broadband SLD Light Source	1 pc.
AC Power Cord	1 pc.
Master Key	1 pc.
Remote interlock jack connector	1 pc.
Optical Patchcable	1 pc.
Quick Start Guide	1 pc.
Acceptance Test Report	1 pc.
USB Cable	1 pc.
CD-ROM with User Manual and Software	1 pc.

NOTE

Optical performance parameters including 3 dB bandwidth, central wavelength, output power, etc., are specified and measured for each instrument individually. For detailed information on this issue, refer to the Acceptance Test Report (ATR) provided with an instrument. Specifications are subject to change without notice.

2. Installation

This chapter will guide you through the unpacking and initial preparation required in order to set-up your BroadLighter-M.

2.1 Unpacking and Initial Inspection

2.1.1 Unpacking the Instrument

To unpack the instrument, proceed as follows:

1. Place the shipping container on a flat rigid surface.
2. Cut the adhesive tapes over the top of the carton exterior with a sharp knife and open the top flap.
3. Remove the cushioning material around the instrument.
4. Lift the instrument and set it aside.
5. Lift the accessories and set them aside.

After unpacking the instrument, verify the receipt of the BroadLighter-M Broadband SLD Benchtop Light Source. Refer to the list of contents in section "Specifications" if necessary.

2. Installation

2.1.2 Initial Inspection

To perform the initial inspection, proceed as follows:

1. After unpacking the instrument, check the shipping container and its contents thoroughly to be certain nothing was damaged during shipment.
2. If the contents are damaged or defective, contact Superlum immediately. Keep the shipping materials for the carrier inspection.

CAUTION

After transiting or handling the container in cold weather, it must be stored at room temperature for about two hours before being opened. Avoid sharp changes in temperature that might cause water condensation on the internal parts of the instrument. Any amount of water condensation can be destructive for optical components inside the BroadLighter-M.

NOTE

1. The BroadLighter-M is a sophisticated optical instrument containing delicately aligned optical equipment; consequently, it should be handled with great care.
 2. Retain the original container for possible future use. If the instrument is to be sent to Superlum for servicing and the original container is not available, use an equal replacement for repacking. Refer to section "Service and Support" for further instructions.
-

2. Installation

2.2 Preparation for Use

Your BroadLighter-M has been configured to operate with the AC power supply specified on the rear panel of the instrument. The instrument is supplied with a 3-conductor detachable power cord which grounds the instrument cabinet when it is connected to an appropriate receptacle. The type of possible plugs acceptable for the AC power cord are specified in the section titled "Specifications". Before connecting the instrument to your AC power source, check that the power line/power supply supports the ground terminal.

To perform preparation for use, proceed as follows:

1. Place the BroadLighter-M on a flat surface, e.g. on a table or in a rack, close to your measurement equipment in a location with sufficient ventilation. Make sure that no obstructions are provided for ventilation openings of the instrument and the optical patchcable can be easily attached to the instrument without strain.
2. Connect AC power cord to the rear-panel power receptacle. Use the power cord supplied with instrument.
3. Insert the key provided with the instrument into the MASTER KEY lock and leave it in position "O".
4. The instrument is plugged in.

CAUTION

1. **Do not block cooling vents at the rear panel of the instrument. Failure to do so may result in device malfunction.**
 2. **Before applying AC power to the BroadLighter-M, check the rear-panel label for the line voltage. If it does not meet your power source requirements, contact Superlum on this issue. Failure to obey this rule may cause permanent damage to the instrument.**
-

3. Local Mode of Operation

This chapter details the front- and rear-panel features of the BroadLighter-M and provides step-by-step instructions on how to operate the instrument in the local operating mode.

3.1 Front-Panel Features

To feel at ease with the instrument, familiarize yourself with its front-panel and rear-panel controls, connectors, and indicators shown in the figures which follow. Refer to Figure 3.1 for the illustration of the front-panel controls of the BroadLighter-M.

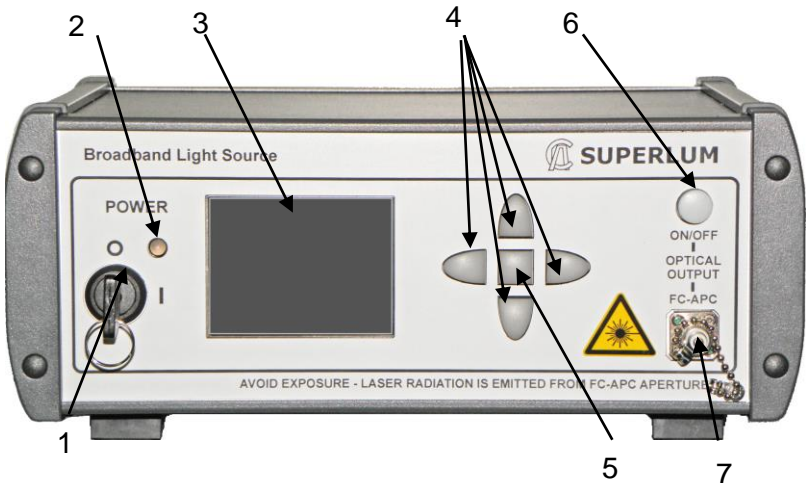


Figure 3.1. Front-Panel Features.

1—KEY OPERATED POWER SWITCH. This is a key-operated master control used as a laser safety measure specified in IEC 60825-1 (Edition 2.0 2007-03). Turning the key to position "I" allows the operator to power on the instrument and get access to SLD emission activation. When the key is in "O" position, the instrument is OFF and the output emission of the instrument cannot be enabled.

2—POWER LED. This LED illuminates green when the instrument is turned ON. When the instrument is turned OFF, the LED goes blank. The LED illuminates RED during self-test start running if an error is present.

3—MULTIFUNCTIONAL LCD DISPLAY. This display provides the status information for the instrument: connection status, SLD status, output power, etc.

4—NAVIGATION BUTTONS. They are used to navigate through the interface on the LCD screen. LCD screen menu is described in Section 5 of this Guide.

5—MENU BUTTON. This button is used to enter the instrument interface menu or to select the feature.

6—ON/OFF BUTTON. This button is used to enable/disable the instrument emission. When the emission is activated, the button LED illuminates green.

3. Local Mode of Operation

7—FC/APC OUTPUT CONNRCTOR WITH A PROTECTIVE CAP. This socket is an optical output of the instrument. The patchcable supplied with the instrument is connected here. The cap is used to protect the optical output (FC/APC adapter) from dust and dirt. Always recap the optical output, when the instrument is not in use and has no patchcable attached.

3.2 Rear-Panel Features

Refer to Figure 3.2 for the illustration of the rear-panel controls of the BroadLighter-M.

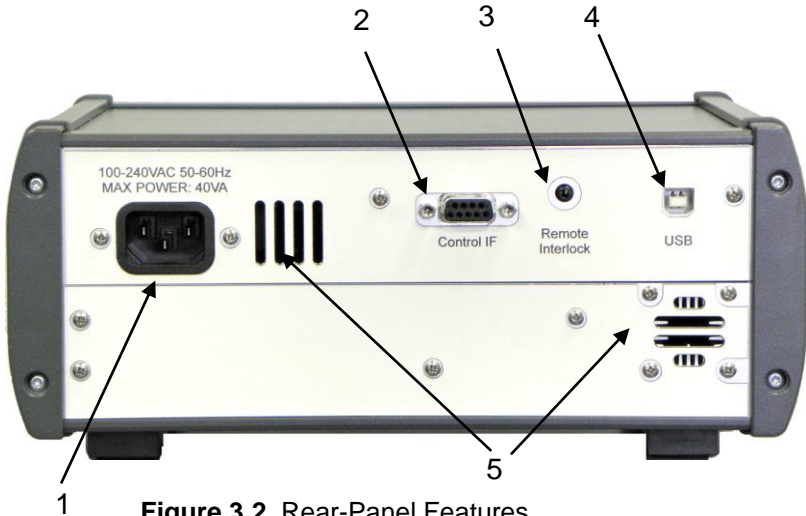


Figure 3.2. Rear-Panel Features.

1—AC POWER INPUT RECEPTACLE. It accepts a 3-conductor power cord used to connect the instrument to your local AC power line.

2—CONTROL IF CONNECTOR. Remote monitoring of the instrument status and turning the output power on/off by external logic. Connection cable can be provided by request.

3—REMOTE INTERLOCK (Laser Safety Measure). This is an audio monophonic jack that is used to connect the instrument to your local external controls for laser safety. Refer to page 23 of this Manual for more details.

4—USB CONNECTOR. It is used to connect the BroadLighter-M to a PC.

5—COOLING VENTS. The temperature control system utilizes the air from the cooling vent holes.

CAUTION

Do not block cooling vents at the rear panel of the instrument. Failure to do so may result in device malfunction.

3. Local Mode of Operation

3.3 Operating Instructions

To get started with your BroadLighter-M, carry out the following steps in the following order:

1. Perform preparation for use. Consult section "Preparation for Use" for more information if necessary.
2. If you have the external controls for laser safety in your local area, connect the BroadLighter-M to your local external controls for laser safety. Use the REMOTE INTERLOCK jack on the rear panel of the instrument for this connection.
3. Connect the optical patchcable supplied with the BroadLighter-M to the front-panel FC-APC socket. The other end of the patchcable goes to your measuring equipment, e.g. an optical power meter. To obtain low insertion optical losses in the instrument-to-patchcable connection, always keep the connectors clean.
4. Turn the MASTER KEY control clockwise to position "I". Once the key has been turned, the instrument boots and runs an internal test to verify the statuses of the internal components. It also checks whether the remote interlock connection or shortening device installation is made or not. If the test passes, POWER LED glows green and you are able to activate the optical output of the instrument. If the test fails, the instrument POWER LED glows red. In this case turn the MASTER KEY to

position “O”. Please, contact Superlum if the error remains.

5. Enable the optical output power by pressing the ON/OFF button. The internal speaker produces a beep signal. There is a 3 second delay between pressing the button and the emission activation. The button LED switches to steady green light and the audible signal is automatically cut off; the output emission appears at the optical output of the instrument.
6. Verify the output power of the BroadLighter-M to be certain that the current reading of your power meter corresponds to the value stated in the acceptance test report.

CAUTION

In order to keep the end faces of the optical patchable clean and protected, it is highly recommended to avoid unnecessary disconnections of the patchcable from the BroadLighter-M and your measuring equipment.

3. Local Mode of Operation

CAUTION

NEVER connect optical connectors different from those specified for your BroadLighter-M, because they are not intended for use with the instrument and can seriously damage its optical output.

NOTE

1. If there is no connection between your laser safety controls and the instrument, remote interlock circuit will ignore any attempt to activate the output power.
 2. Once the BroadLighter-M is turned on, the optical output power of the instrument can slightly drift over time. In order to achieve greater stability of the output power, a 30-minute warm-up period is highly recommended.
-

NOTE

By default, the ON/OFF button enables ALL the SLDs installed in your instrument. You can also select the particular SLDs to lase by using the instrument interface menu or via remote control software.

3.4 Power OFF Instructions

To turn off the instrument, proceed as follows:

1. If the optical output of the instrument is active, disable the output by pressing ON/OFF button or via remote control if connected. The LED on the button will go blank.
2. Turn the MASTER KEY control counterclockwise to position "O".
3. POWER LED will go blank. The instrument is now off.

NOTE

Always disable the optical output before turning the instrument off.

3. Local Mode of Operation

3.5 Interface Menu

LCD screen of BroadLighter-M enables the interface menu that allows access to the instrument features. To feel at ease with the instrument, familiarize yourself with its main interface screen elements and menu screen elements shown in the figures that follow. Explanations for each feature are in the order that they are indexed in the corresponding figures.

3.5.1 Main Interface Screen

Interface screen may vary depending on your configuration of BroadLighter-M: standard version (Figure 3.3.1) and a version with variable optical attenuator (VOA) / output power control (Figure 3.3.2).

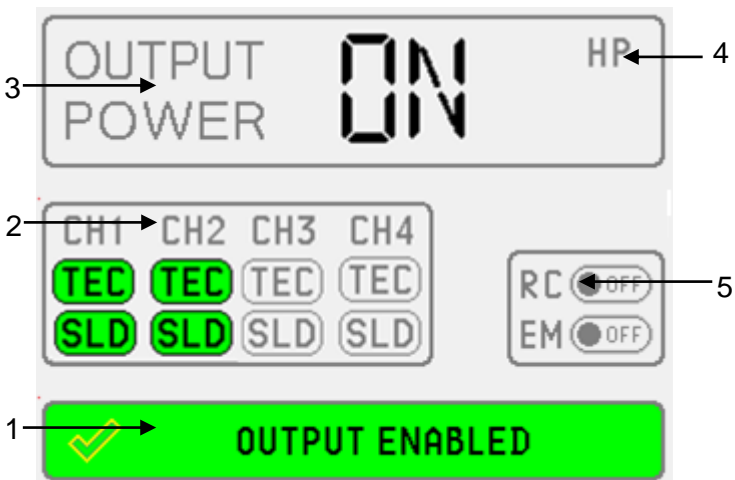


Figure 3.3.1 BroadLighter-M main interface screen. Standard version.

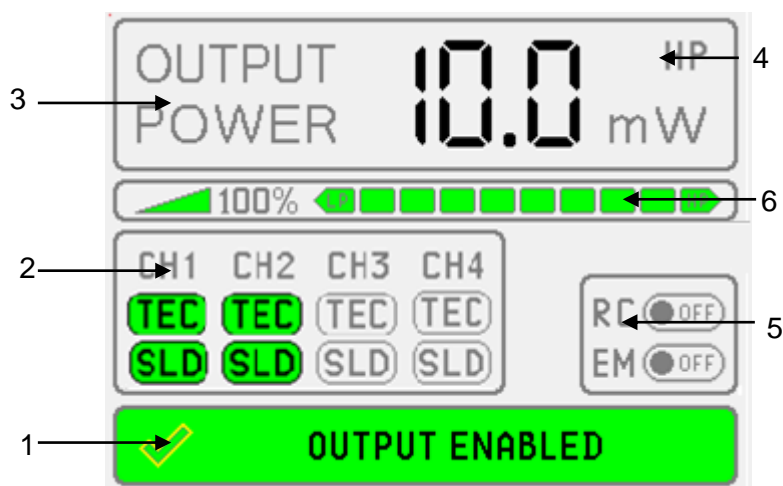


Figure 3.3.2 BroadLighter-M main interface screen. Version with variable optical attenuator / output power control.

1 - INSTRUMENT STATUS BAR. This tells you the current status of the instrument. If BroadLighter-M is ready for emission in the local mode, status bar will display “OUTPUT ENABLED”. Please refer to Section 3.5.2.

2 - CHANNEL STATUS. This tells you the current status of the SLDs installed in the instrument. “SLD” refers to the light emission by corresponding SLD. “TEC” refers to the thermal stabilization status of the particular SLD. The actual number of the installed SLDs depends on your particular configuration. BroadLighter-M supports up to four SLDs. Please refer to Section 3.5.3.

3. Local Mode of Operation

3—OUTPUT POWER. Displays the status of the output emission. Can be “ON” or “OFF”. Version with VOA/power control shows the output power value measured with an integrated optical power monitor.

4—EMISSION LEVEL STATUS. This indicator is available if your BroadLighter-M is configured with variable optical attenuator. If the maximum output power level is reached, the “HP” indicator will appear. If the minimum output power level is reached, “LP” indicator will appear.

5—REMOTE CONTROL STATUS. Indicates if REMOTE CONTROL feature is enabled.

6—OUTPUT LEVEL STATUS BAR. This indicator is available if your BroadLighter-M is configured with variable optical attenuator (VOA) or output power control options. Optical output level of the output is controlled with discrete 10% steps. Power level is controlled with NAVIGATION CONTROL BUTTONS “Left” and “Right”. Full green bar corresponds to the maximum output emission level. Power level can be also controlled via remote software – see the corresponding section in this Manual.

NOTE

The BroadLighter-M version with VOA/power control is preset to start in low power mode. If you wish to modify that, use Remote Control Software. Refer to Section 4.3 of this Manual for more details.

NOTE

1. The actual number of the installed SLDs depends on your particular configuration. BroadLighter-M supports up to four SLDs.
 2. BroadLighter-M has one SLD per channel.
 3. The readings of the integrated optical power monitor are for reference purpose only.
-

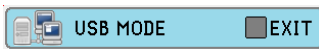
3. Local Mode of Operation

3.5.2 Main Screen Status Messages

Following status messages may appear on the BroadLighter-M screen:



Instrument is ready for emission



Device is connected to PC via USB.



Emission is disabled. Check TEC indicator in section 3.5.3.



Emission is disabled. Check interlock connection.



Device malfunction. Contact Superlum if the error persists and reboot doesn't help.



Temperature error. Turn off the device and let it cool down. Contact Superlum if the error persists.

3.5.3 Main Screen Status Indicators

Following status indicator may appear on the BroadLighter-M main screen:



SLD is on. Status is ok.



SLD is on. Service is required. The emission may remain, though performance parameters may degrade. Contact Superlum if this indicator remains.



SLD malfunction. Contact Superlum if this indicator remains.



SLD is disabled.



TEC is on. Temperature is stabilized



TEC is on. Temperature is being stabilized Please wait until TEC is stabilized. Contact Superlum if this indicator remains on permanently.



TEC malfunction. Contact Superlum if this indicator remains and instrument OFF/ON doesn't help.



TEC is disabled.



Feature is enabled.



Feature is disabled.

3. Local Mode of Operation

NOTE

The actual indicators and statuses are subjects to change without notice.

Please, contact Superlum if you notice status messages or indicators not described in this manual.

3.5.4 Main Menu

From the main screen you can get access to the menu screen by pressing the MENU BUTTON. You can select the interface elements with the MENU BUTTON.

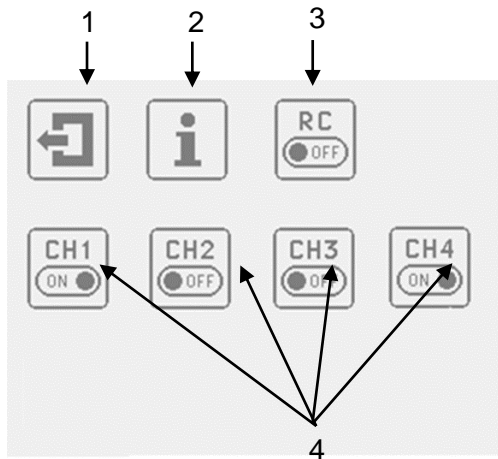


Figure 3.4. BroadLighter-M main menu.

1 - EXIT TO MAIN SCREEN. This brings you back to the main interface screen.

2 - INFORMATION MENU. This provides you information about your particular BroadLighter-M.

3 - REMOTE CONTROL. This enables or disables REMOTE CONTROL feature.

4 - CHANNEL CONTROL. This enables or disables particular SLDs. The number of active CHANNEL CONTROL buttons will depend on the number of SLDs installed in your particular BroadLighter-M.

Information Menu allows you to read the status of the components of your BroadLighter-M:

3. Local Mode of Operation

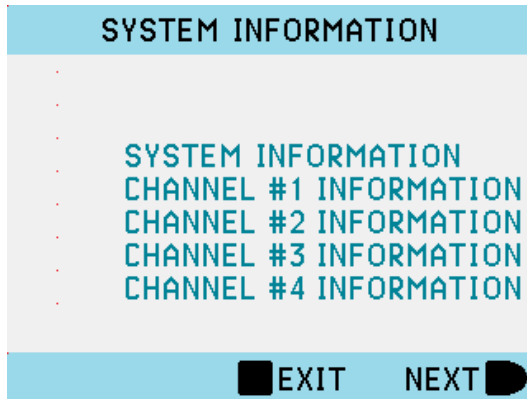


Figure 3.5. BroadLighter-M System Information menu.
It shows the information on SLDs installed in your
BroadLighter-M.

NOTE

MENU CONTROL BUTTON is disabled when the BroadLighter-M emits light. Always turn off light emission before modifying features in the instrument interface.

Menu elements are subject to change without notice. Please, contact Superlum if you notice menu elements not described in this manual.

Front panel controls are typically disabled in Remote mode.

4. Remote Mode of Operation

Your BroadLighter-M Broadband Light Source is designed to communicate with a PC or terminal via USB 2.0 or Remote Control interfaces. This chapter discusses information that explains how to control the BroadLighter-M using these interfaces. At the end of this chapter, you will find a description of the Superlum BroadLighter-M Companion Software, which is supplied with the Instrument. To best serve these purposes, this chapter has been split up into four sections covering the following topics:

- Description of Data Communication via Remote Control Interface
- Description of Data Communications via USB Interface
- Remote Command Set
- Superlum BroadLighter-M Companion Software

Section "Remote Command Set" includes subsections that detail each command and query supported by this equipment.

4. Remote Mode of Operation

CAUTION

Switch OFF the BroadLighter-M before connecting or disconnecting the REMOTE CONTROL or USB cables.

Use only USB 2.0 Type B compatible cable when using USB interface.

4.1 Remote Control Interface

The BroadLighter-M is equipped with the Control IF connector located on the rear panel of the instrument. This allows the user to operate the instrument remotely by using Logic Level discrete signals.

The BroadLighter-M uses a female 9-pin DSUB connector for communication via Remote Control interface.

DSUB Pin No.	Signal name	Description	Electrical Circuit
1	SCOM	Remote SLD ON/OFF input, common wire	
2	SI	Remote SLD ON/OFF input, positive wire	
3	EN	Output Enabled. If this signal is active – instrument is ready for emission	
4	COM	Outputs common wire	
6	PG	Power Good. If this signal is active – instrument is turned on and no errors detected.	
7	ON	Emission ON. If this signal is active – the emission is activated	

4. Remote Mode of Operation

The Figure below illustrates the circuit diagram of simple remote control terminal. This unit should be powered from external power supply with 5 VDC output.

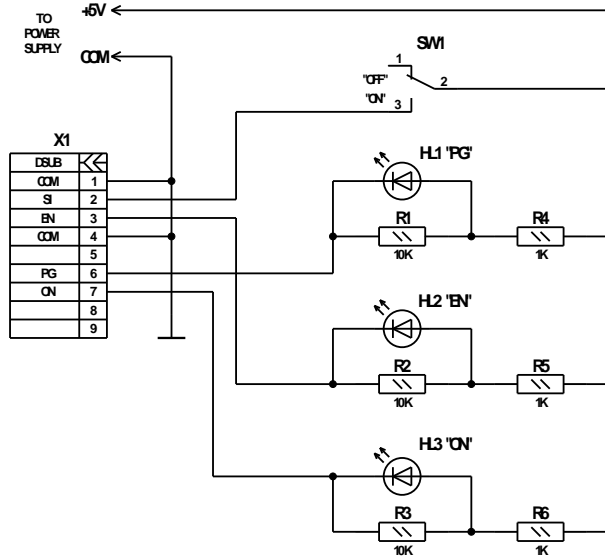


Figure 4.1. BroadLighter-M sample remote control circuit diagram.

4.2 USB interface

To verify the functionality of the BroadLighter-M through the USB interface, you can use the commands for Hyper Terminal program commonly available on a PC. The commands are described later in this Chapter.

USB connection is accomplished via virtual COM port. The BroadLighter-M uses the FT230X USB to Serial converter chip made by FTDI Company. Necessary drivers for common operating systems can be downloaded using the link:

Before operating the instrument with your PC, you need to configure the following parameters for terminal configuration/UART configuration:

- Baud Rate = 57600;
- Start Bits = 1;
- Stop Bits = 1;
- Parity = None;
- Flow Control = None.

4. Remote Mode of Operation

4.2.1 System Commands

4.2.1.1 Read BroadLighter-M type, firmware version and serial number.

Request: [I] [CR] [LF]

Acknowledge: [I] [:] [TYPE] [:] [VH] [VL] [:] [SN] [CR] [LF]

Error message: [!] [E] [CR] – common error message.

Where:

[TYPE] – Device Type, five ASCII printable chars:

“BLM-S” - one channel BroadLighter-M;

“BLM-D” - two channels BroadLighter-M;

“BLM-T” - three channels BroadLighter-M;

“BLM-Q” - four channels BroadLighter-M.

“BLM-E” – one channel BroadLighter-M with electronic output power control option.

[VH] – Major part of firmware version [0...9], one ASCII chars;

[VL] – Minor part of firmware version [0...9], one ASCII chars;

[SN] – Serial number, six ASCII printable chars.

4.2.1.2 Set device operation mode. Read current mode.

Request: [M] [CMD] [CR] [LF]

Acknowledge: [M] [MODE] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message.

[CMD]	DESCRIPTION
[?]	Read current mode
[L]	Set LOCAL mode
[U]	Set USB CTRL mode
[S]	Set SERVICE mode

[MODE]	DESCRIPTION
[L]	Device operated in LOCAL mode
[U]	Device operated in USB CTRL mode
[E]	FATAL ERROR mode
[S]	Device operated in SERVICE mode

[ACCESS CODE] – [?] [?] [?] [?] Four ASCII chars needed for entering to USB SERVICE mode only.

4. Remote Mode of Operation

4.2.2 USB Mode Commands

4.2.2.1 Switch SLD ON/OFF. Read Channel status data

Request: [U] [C] [CH] [CR] [LF]

Acknowledge: [U] [C] [IL] [ST1] [ST2] [ST3] [ST4] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[CH]	DESCRIPTION
[?]	Read Channel status data
[1]	Switch SLD#1 ON/OFF
[2]	Switch SLD#2 ON/OFF
[3]	Switch SLD#3 ON/OFF
[4]	Switch SLD#4 ON/OFF
[9]	Switch all SLDs ON/OFF

[IL] – Remote interlock data [0] or [1]:

[0] – output disabled by interlock;

[1] – output enabled.

[ST1]...[ST4] – Channel [1...4] status, [00...FF], two ASCII chars in hexadecimal code. See table below for signal identification.

SIGNAL	BIT	DESCRIPTION
OME	0	'1' – Optical module enabled '0' – Optical module disabled
TON	1	'1' – TEC ON; '0' – TEC OFF
TGD	2	'1' – Optical module temperature stabilized '0' – Optical module temperature not stabilized
TER	3	'1' – TEC (Thermistor) error
SMD	4	'1' – SLD operated in ACC mode '0' – SLD operated in APC mode
SON	5	'1' – SLD ON; '0' – SLD OFF
SLM	6	'1' – SLD current limit reached
SER	7	'1' – SLD error

4. Remote Mode of Operation

4.2.2.2 Switch control

Request: [U] [S] [CMD] [CR] [LF]

Acknowledge: [U] [S] [SWDATA] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[CMD]	DESCRIPTION
[?]	Read current Switch Data
[1]	Switch Channel #1 (CH1)
[2]	Switch Channel #2 (CH2)
[3]	Switch Channel #3 (CH3)
[4]	Switch Channel #4 (CH4)
[5]	Reserved
[6]	Switch Remote Control (RC)
[7]	Switch External Modulation (EM)
[8]	Switch power meter mode (Service mode only)
[S]	Store current Switch Data to EEPROM

[SWDATA] – Switch status, [00...FF], two ASCII chars in hexadecimal code. See table below for signal identification.

[SWDATA]	DESCRIPTION
Bit#0	'1' – Channel #1 (CH1) enabled '0' – Channel #1 (CH1) disabled
Bit#1	'1' – Channel #2 (CH2) enabled '0' – Channel #2 (CH2) disabled
Bit#2	'1' – Channel #3 (CH3) enabled '0' – Channel #3 (CH3) disabled
Bit#3	'1' – Channel #4 (CH4) enabled '0' – Channel #4 (CH4) disabled
Bit#4	Reserved, reads as null
Bit#5	'1' – Remote Control (RC) enabled '0' – Remote Control (RC) disabled
Bit#6	'1' – External Modulation (EM) enabled '0' – External Modulation (EM) disabled
Bit#7	'1' – Output power mode '0' – ON/OFF mode

4. Remote Mode of Operation

4.2.2.3 Read measurable parameters

Read data from ADC

Request: [U] [M] [CH] [PN] [CR] [LF]

Acknowledge: [U] [M] [CH] [PN] [PDATA] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[CH] – Channel number [1...4], one ASCII character

[PN] – Parameter number [1...8], one ASCII character

[PDATA] – Parameter value [0000...FFFF], four ASCII characters in hexadecimal code.

[PN]	DESCRIPTION	PDATA RANGE
1	Real TEC current value	[0000] = 0,00A [00FF]=+2,55A [01FF]=-2,55A
2	SLD current (maximum current) set value	[0000]=0,00 mA [FFFE]=655,34mA
3	Optical module photo-diode current (HP) set value	[0000]=0,0μA [FFFE]=6553,4μA
4	Optical module photo-diode current (LP) set value	[0000]=0,0μA [FFFE]=6553,4μA
5	Real Optical module temperature value	[0000]=0Ω [FFFE]=65534Ω
6	Real SLD current value	[0000]=0,00 mA [FFFE]=655,34mA
7	Real PD current value	[0000]=0,0μA [FFFE]=6553,4μA
8	Optical module temperature set point value	[0000]=0Ω [FFFE]=65534Ω

4. Remote Mode of Operation

Note: PDATA OVELOAD VALUE IS 0xFFFF!

Temperature:

Request: [U] [T] [CR] [LF]

Acknowledge: [U] [T] [TV] [PV] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[TV] – Temperature value [00...FF], two ASCII chars in hexadecimal code in two's complement form:

[7F] = +127 °C;

[00] = 0 °C;

[FF] = -1 °C;

[80] = -128 °C.

[PV] – Output power value [00...FF], two ASCII chars in hexadecimal code.

[00] = 0 mW;

[FF] = 25.5 mW.

4.2.2.4 Attenuator and output power control

If VOA option is installed, the VOA transmission is controlled. Otherwise SLD output is controlled.

Request: [U] [A] [CMD] [CR] [LF]
 Acknowledge: [U] [A] [POS] [CR] [LF]
 Error message: [!] [E] [CR] [LF] – common error message;
 [!] [M] [CR] [LF] – wrong mode set message.

[CMD]	DESCRIPTION
[?]	Read current attenuator position
[0...9]	Set attenuator position
[S]	Store current position as default
[T]	Switch HP/LP mode (not implemented)

ATTENUATOR POSITION [POS]	OUTPUT POWER	NOTE
0	Max Power (100 %)	"HP ³ "
1	90 %	--
2	80 %	--
3	70 %	--
4	60 %	--
5	50 %	--
6	40 %	--
7	30 %	--
8	20 %	--
9	Min Power (10 %)	"LP ⁴ "

Command not implemented in REV_1.X
 BroadLighter-M.

³ HP – high power mode

⁴ LP – low power mode

4. Remote Mode of Operation

4.2.2.5 Read Optical unit type, firmware version and serial number

Request: [U] [O] [CR] [LF]

Acknowledge: [U] [O] [TYPE] [WL] [VERSION] [SN] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[TYPE] – Optical unit type [00...FF] two ASCII chars in hexadecimal code, see table below:

Bit #7	Bit #6	Bit #5	Bit #4	Bit #3	Bit #2	Bit #1	Bit #0
MOD	ATT	OPM	ISO	OM4	OM3	OM2	OM1

OM [4...1] – optical module presence sign:

– ‘0’ – module not installed;

– ‘1’ – module installed;

ISO – optical isolator presence sign:

– ‘0’ – isolator not installed;

– ‘1’ – isolator installed;

OPM – output power monitor presence sign:

– ‘0’ – OPM not installed;

– ‘1’ – OPM installed;

ATT – optical attenuator presence sign:

– ‘0’ – attenuator not installed;

– ‘1’ – attenuator installed;

MOD – optical modulator presence sign:

– ‘0’ – modulator not installed;

– ‘1’ – modulator installed;

[WL] – Central wavelength value [00...FF], two ASCII chars in hexadecimal code:

[00] = 0 = 0 nm;

[FF] = 255 = 2550 nm;

[VERSION] – Firmware version, [01...99] two ASCII chars;

[SN] – Optical unit serial number, six ASCII printable chars.

4.2.2.6 Read Optical Module parameter

Request: [U] [P] [MN] [PN] [CR] [LF]

Acknowledge: [U] [P] [MN] [PN] [DATA] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

4. Remote Mode of Operation

[!] [M] [CR] [LF] – wrong mode set message.

[MN] – Optical module number, [1...4] (One ASCII character);

[PN] – Parameter number, [0...9] (One ASCII character);

[DATA] – Parameter data, see table below.

[PN]	Description	DATA Range	Comments
0	Optical module serial number	[XXXXXX]	Six ASCII printable characters
1	Optical module operation mode	[0] or [1], one ASCII char	[0] – APC mode [1] – ACC mode
2	Optical module temperature set point value	[0000...FFFE], four ASCII chars	[0000] = 0 ohm [FFFF] = 65534 ohm
3	Optical module maximum current value	[0000...270F], four ASCII chars	[0000] = 0,0 mA [270F] = 999,9 mA
4	Optical module current value	[0000...270F], four ASCII chars	[0000] = 0,0 mA [270F] = 999,9 mA
5	Optical module photo-diode current value (HP)	[0000...270F], four ASCII chars	[0000] = 0 µA [270F] = 9999 µA
6	Optical module photo-diode current value (LP)	[0000...270F], four ASCII chars	[0000] = 0 µA [270F] = 9999 µA
9	Optical module operating time	[00000000]-[FFFFFFF], Eight ASCII chars	00000000 – 0 s; 0000000A – 10 s;

Note: Switch off SLD before reading the optical module operating time value.

4.2.2.7 Read temperature and output power

Request: [U] [T] [CR] [LF]

Acknowledge: [U] [T] [TV] [PV] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set message.

[TV] – Temperature value [00...FF], two ASCII chars in hexadecimal code in two's complement form:

[7F] = +127 °C;

[00] = 0 °C;

[FF] = -1 °C;

[80] = -128 °C.

For Rev_1.X BroadLighter-M ONLY:

[PV] – Output power value [00...FF], two ASCII chars in hexadecimal code.

[00] = 0 mW;

[FF] = 25,5 mW.

For Rev_2.X BroadLighter-M:

[PV] – Output power value [000...FFF], three ASCII chars in hexadecimal code.

[000] = 0 mW;

[FFF] = 409,5 mW.

4. Remote Mode of Operation

4.2.2.8 Read output power limit

Request: [U] [L] [CR] [LF]

Acknowledge: [U] [L] [PL] [CR] [LF]

Error message: [!] [E] [CR] [LF] – common error message;

[!] [M] [CR] [LF] – wrong mode set
message

[PL] – Output power LIMIT value, [00...FF], two ASCII
characters in hexadecimal code: [00] = 0 mW;
[FF] = 255 mW.

4.3 Superlum Companion Software

The interface of this program includes the same features which you can find on the front panel of the instrument. Using these features of the program allows you to control the BroadLighter-M remotely from your PC system instead of standing in front of the instrument.

By using this program, you can do the following:

- Activate and deactivate each SLD module individually.
- Activate and deactivate several SLD modules simultaneously.
- Monitor the current status of the instrument controls
- By clicking on the necessary button in the program window, automatically measure and save all current values of the instrument performance parameters to a separate file on your PC which must be forwarded to Superlum when you suspect problems with the BroadLighter-M.

4. Remote Mode of Operation

It is important to note that the last feature in the list above is accessible through the program only.

The program features very simple installation, non-severe system requirements, and a user-friendly interface. Use this program whenever you want to do the following:

- To begin to control the BroadLighter-M remotely as soon as you receive it and do not want to waste much time for developing the program of your own.
- *In the case of a problem:* to test the instrument performance and report the results of the test to Superlum for getting the necessary assistance.

4.3.1 Minimum System Requirements

Minimum system requirements are as follows:

- **Operating system:** Windows 95, 95 OSR2, 98, or 98 SE, Windows ME, Windows NT Workstation 4.0 Service Pack 3, Windows 2000 Professional, Windows XP, Windows Vista, Windows 7.
- **Memory:** 32 MB for Windows 9x and ME, 64 MB for Windows NT and 128 MB for Windows 2000

and XP, 1 gigabyte (GB) (32-bit) or 2 GB (64-bit) for Windows Vista and Windows 7/8/8.1.

- **Processor:** 100-megahertz (MHz) or faster processor for Windows 9x and ME, 300-megahertz (MHz) or faster processor for Windows 2000 and XP, 1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor for Windows Vista and Windows 7,
- **Hard disk space:** 10MB of free hard disk space.
- **Miscellaneous:** USB 2.0 interface.

4.3.2 Installing the USB drivers

Prior to connecting BroadLighter-M to PC via USB and/or installing the Companion Software, the USB drivers must be installed. Necessary drivers for common operating systems can be downloaded using the link:

<http://www.ftdichip.com/Drivers/VCP.htm>

BroadLighter-M must not be connected to the PC while installing the drivers. Insert the CD that was supplied with your unit into your PC. Select the driver software and run it. Follow the onscreen prompts to install the driver. After the driver is installed, connect BroadLighter-M to the PC and power it on.

4. Remote Mode of Operation

Your PC will detect the new hardware and will prompt you when the installation is complete.

NOTE

If you experience problems installing the USB drivers, please contact your system administrator.

4.3.3 Installing Companion Software

Copy the executable file from the CD provided with your BroadLighter-M to the destined folder on your PC. Some systems may require Administrative rights to run Superlum software. Contact your system administrator for more information.

BroadLighter-M uses virtual COM-port connection for PC communication via USB interface. During the first run of the software, virtual COM port associated with your BroadLighter-M has to be selected. After COM port is selected, software Start Screen will appear.

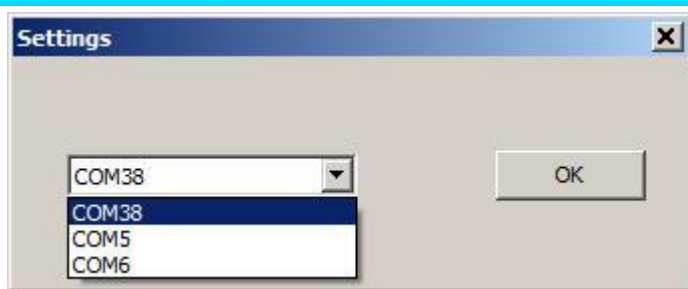


Figure 4.1. BroadLighter-M Companion Software. COM port selection associated with BroadLighter-M.

4.3.4 User Interface

Companion Software for BroadLighter-M enables the interface menu that allows access to the instrument features. To feel at ease with the software interface, familiarize yourself with its main interface elements shown in the figures that follow. Explanations for each feature are organized as they are indexed in the corresponding figures.

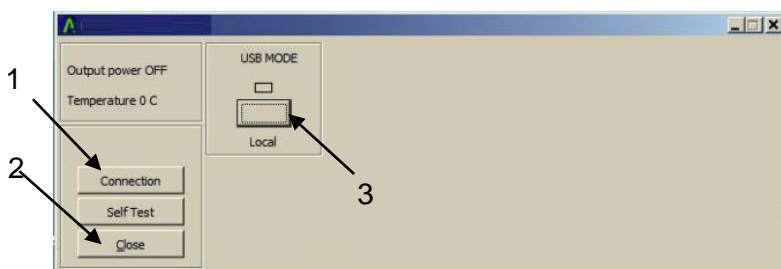


Figure 4.2. BroadLighter-M Companion Software Start Screen.

4. Remote Mode of Operation

1—Connection. It is used to select the virtual COM port.

2—Close. It is to quit Companion Software.

3—USB mode. It is used to connect to BroadLighter-M and switch between Local and USB modes.

Connect to BroadLighter-M by pressing USB mode button. Once BroadLighter-M is successfully connected, Start Screen will be replaced with the Interface Screen. The new interface elements are:

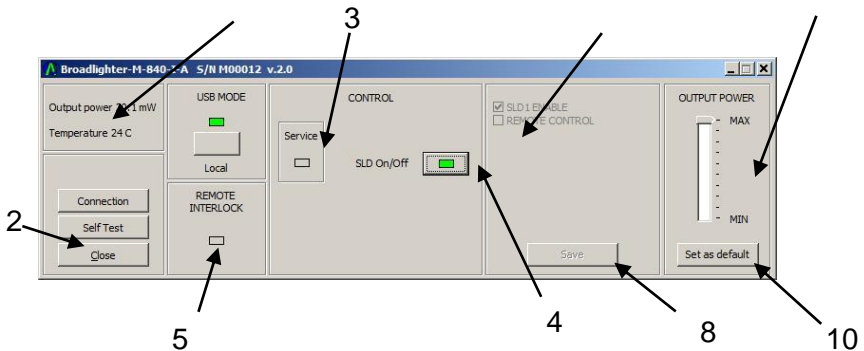


Figure 4.3. BroadLighter-M Companion Software Interface Screen.

1—Device information. Information screen that shows you the instrument temperature and the output optical power readings.

2—Self Test. Automatic Diagnostic Procedure which is normally required only when the device doesn't work properly.

In this unlikely scenario, Superlum will provide you with more information on the topic. Please be aware that once selected, the Self Test Procedure can't be cancelled.

3—Service Indicator. It is on when there is a service required for the SLDs installed in your BroadLighter-M. Please contact Superlum if this indicator is permanently on. The actual number of indicators will depend on a number of SLDs installed in your BroadLighter-M.

4—SLD ON/OFF. Allows you to turn the emission on for all the enabled SLDs simultaneously. The indicator is green when the emission is on. There is a 3 second time delay between pressing the emission ON/OFF button and the emission activation.

5—Remote Interlock Indicator. Shows you whether the Interlock is activated.

6—Features Menu. Allows you to enable and disable the features available for your BroadLighter-M. This menu is only available when the emission is off.

8—Save. Saves the current configuration selected in Features Menu. The menu is only available when the emission is off.

9—Output level control bar. FOR BROADLIGHTER-M VERSIONS WITH VOA / POWER CONTROL ONLY. Allows for output level control with 10 discrete steps. Each step represents 10% change in output power.

4. Remote Mode of Operation

10—Set as Default. Saves current power level setting as a default for the next instrument start up.

NOTE

By default, BroadLighter-M with VOA / power control option is preset to start with 10% of output power. Using Remote Control Software User can select default start output level by selecting appropriate control bar position and pressing “Set as Default” button.

This is only for BroadLighter-M instruments with VOA / power control option. Standard versions operate at 100% output power by default.

4.3.5 Self Test Procedure

Self test generates BroadLighter-M diagnostics report file that can be used for instrument status analysis. If the self test procedure is selected, the following warning window will appear:

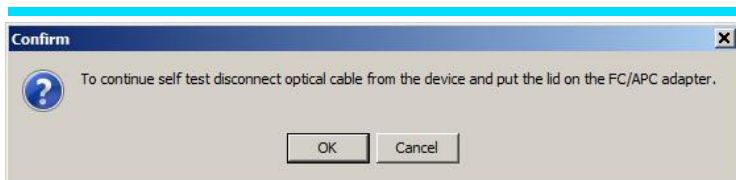


Figure 4.4. BroadLighter-M Companion Software self test warning.

Disconnect the optical patchcable from the instrument and put a protective cap on FC/APC connector. Press OK to continue.

The self test procedure will start automatically. Do not disturb it or shut down the instrument during the automatic self test procedure. You will see the self-updated window:

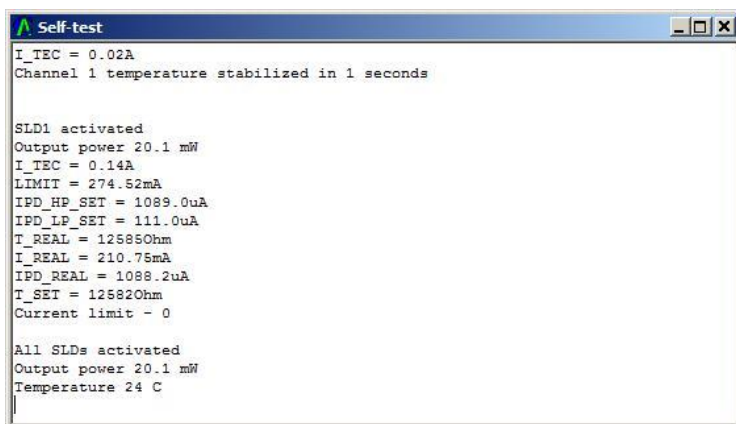


Figure 4.5. BroadLighter-M Companion Software self test window.

4. Remote Mode of Operation

Once the self test is complete the software will inform you. Save the file in the folder of your choice. The procedure is now complete.

4.3.6 Uninstalling the Program

To uninstall the Superlum BroadLighter-M companion software from your PC, just remove its files from the folder created during the installation.

5. Cleaning Instructions

This chapter will advise you on the cleaning procedures acceptable for the BroadLighter-M Broadband SLD Benchtop Light Source. With regular cleaning you will be able to keep your BroadLighter-M in the best operating conditions, thereby ensuring its excellent performance.

5.1 Safety Precautions

This section details the general safety precautions you need to observe during all phases of operating and cleaning the BroadLighter-M.

First of all, you should pay close attention to following common recommendations:

- Whenever possible, use physical contact connectors and dry connections.
- Clean the connectors, interfaces, and sleeves regularly after use.
- If you are unsure of the correct cleaning procedure for your optical device, it is highly recommended that you first try cleaning a dummy or test device.

Before you begin cleaning the BroadLighter-M, please read the following safety rules:

5. Cleaning Instructions

1. Do not remove instrument covers when cleaning.
2. Make sure that you disable the optical output of the instrument before cleaning any optical interfaces.
3. Under no circumstances look into the end of an optical patchcable attached to the optical output of the BroadLighter-M when the instrument is operated. Instrument emission is not visible to the human eye, but it may seriously damage your eyesight.
4. When cleaning, always do the following:
 - To prevent electrical shock, disconnect the instrument from AC power line before cleaning.
 - To clean external parts of the instrument cabinet, use a dry cloth or a cloth slightly dampened with water.
 - Do not attempt to clean internally.
5. Do not open the BroadLighter-M to perform any servicing to the instrument.
6. Do not install parts or perform any unauthorized modification to the BroadLighter-M.
7. In case of some problems with the instrument, contact Superlum for assistance. (Refer to the chapter 6 for more information on obtaining service.)

5.2 Cleaning

This section advises on the cleaning procedures for BroadLighter-M. Optical connectors may require at least two cleanings. The initial cleaning gently removes any grit and oil. If filmy deposits are still present at an optical interface, the second cleaning should be performed. It is not uncommon for a patchcable or connector to require more than one cleaning.

WARNING

1. **Never look into the end of an optical aperture or optical patchcable when the BroadLighter-M is operational.**
 2. **Always disable the optical output of the instrument before cleaning the optical connectors.**
-

5. Cleaning Instructions

CAUTION

1. To clean optical fiber ends, use natural cotton swabs or specialized fiber-optic cleaning equipment.
 2. If you use compressed air for the cleaning, make sure that compressed air is free from dust, water, and oil.
 3. Be especially careful when inserting the ferrule of a patchcable into a connector or adapter. Make sure that it does not touch the outside of the mating connector or adapter.
 4. Never use a cotton swab to dry the adapter inside, because it may damage internal parts of the optical adapter.
-

NOTE

1. **If possible, avoid using denatured alcohol because it usually contains additives. Instead, apply alcohol that is used for medical purposes.**
 2. **Always recap the optical output of the BroadLighter when it is not in use.**
 3. **Apply as little alcohol as needed for cleaning. This allows you to avoid getting any amount of alcohol inside the optical adapter. If, after all, the adapter contains some alcohol after cleaning, use compressed air for drying it.**
-

6. Service and Support

This chapter contains detailed information on what you should do if you need to have your BroadLighter-M serviced.

6.1 Returning the Instrument for Servicing

The instructions in this section will explain to you how to properly return the instrument for repair or calibration. Always call or email Superlum to initiate service before returning your instrument. This ensures that the time for the repair or calibration is reserved and that your instrument will be returned to you as quickly as possible. If the instrument is still under warranty, it will be repaired under the terms of the warranty. Please see section "Warranty" at the beginning of the manual. If the BroadLighter-M is no longer under warranty, Superlum will notify you of the cost of the repair after examining the device.

When the instrument is returned to Superlum for servicing, it must be adequately packaged and have a complete description of the failure symptoms attached. When describing the failure, please be as specific as possible about the nature of the problem. Include copies of additional failure information - such as the instrument failure settings, data related to instrument failure, etc., along with the instrument being returned.

6.2 Preparing the Instrument for Shipment

To properly prepare the instrument for shipment, observe the following instructions:

1. Write a complete description of the failure and attach it to the instrument. Include any specific performance details related to the problem.
The following information should be returned with the instrument:
 - Type of service required: repair or calibration
 - Date of the failure
 - Description of the problem:
 - Whether problem is constant or intermittent
 - Whether instrument is temperature-sensitive
 - Whether instrument is vibration-sensitive
 - Instrument settings required to reproduce the problem
 - Performance data
 - Your Company name and return address
 - Name and phone number of a technical contact person
 - Model number and serial number of the returned instrument
 - List of any accessories returned with the instrument
2. Cover all front or rear-panel connectors that were originally covered when you first received the instrument.

6. Service and Support

3. Pack the instrument in the original shipping container, or use an adequate replacement following the directions below:
 - Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
 - Use a double-walled, corrugated cardboard carton to pack the instrument.
 - The carton must be large enough to allow approximately 7 cm on all sides of the instrument for packing material, and strong enough to accommodate the weight of the instrument.
 - Surround the equipment with packing material to protect the instrument and prevent it from moving in the carton. The best solution is to use Air Cap™. Air Cap™ looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the instrument several times in this material will protect the instrument and prevent it from moving in the carton.
4. Seal the carton with strong nylon adhesive tape.
5. Mark the carton "FRAGILE, HANDLE WITH CARE".
6. Retain copies of all shipping papers.

NOTE

1. **Cover optical connectors to protect them from damage caused by physical contact or dust.**
 2. **Never use styrene pellets as packaging material. They do not adequately cushion the instrument or prevent it from shifting in the carton. They may also cause instrument damage by generating static electricity.**
-

6.3 Instrument Disposal

If you wish to dispose the instrument, you must hand it to a specialized waste recovery company. Do not dispose of the unit in a litter bin or at a public waste disposal site.