



manufactured for Laser Lab Source by  **Amonics**
Specialist in Optical Amplifiers

PRODUCT MANUAL

LS-850-FP Benchtop Laser Light Source

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LS-850-FP

manufactured for Laser Lab Source by  **Amonics**
Specialist in Optical Amplifiers

Operation Manual

Laboratory Benchtop Fiber Coupled Laser Diode Source



CAUTION: USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.



THE USER MUST READ THIS MANUAL BEFORE OPERATING THE PRODUCT. OPERATIONS OTHER THAN THOSE DESCRIBED IN THIS MANUAL MAY RESULT IN PERSONAL INJURY AND DAMAGE TO THE PRODUCT.



Note that any attempt to open or fix this equipment without prior approval voids the warranty.

Revision History

Revision	Date (DD-MM-YYYY)	Summary
R7.00	09-10-2014	Manual introduced.
R7.01	20-07-2015	Replaced the picture of nameplate.
R7.02	04-09-2015	Add warning label for Class 4 on 3.1 Front Panel
R7.03	07-07-2016	Add Manual Release Date
R7.04	29-03-2017	Update laser safety label. Manual compliance to IEC 60825-1:2014.
R7.05	01-01-2019	Replaced the picture of rear panel and system page
R7.06	23-11-2020	Update 4.4 section name and remove description
R7.07	16-06-2021	Update section 3.2, update the description of “RS232 Female Socket” and “Ethernet Socket” Update section 4.4 Ethernet Description Update section 4.8 Remote Connection Mode Add section 5.1 Remote Connection

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Open Source License Acknowledgement

This product uses the following third-party open source software in addition to our proprietary software:

- FreeRTOS is an open-source project under the Modified GPL Licensing. Please visit <http://www.freertos.org> for details.
- uIP is an open-source project under the BSD-style Licensing. Please visit <http://www.sics.se/~adam/uip/index.php> for details.

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1. Precautions



CAUTION!

Read and follow this section before operation. Failing to following the instruction voids the warranty.

1.1 Operating Precautions



NEVER USE ADAPTOR OR CONNECTOR TYPE OTHER THAN SPECIFIED IN THE TEST REPORT. If measurement instruments accept different connector type, use hybrid patch-cords.



Avoid using any solvent or vaporizing chemical to clean the panel or case. It may result in damage to the surface and internal circuits.

1.2 Optical Emission Safety Precautions



This product emits medium power invisible laser radiation from the optical connector(s). It is classified as a **CLASS 3B** laser product according to IEC 60825-1:2014. **The optical output is hazardous to eyes. INVISIBLE LASER RADIATION - AVOID EXPOSURE TO BEAM.**



THE OPTICAL OUTPUT MUST BE DISABLED WHEN SWAPPING PATCH-CORD CONNECTIONS.



THE USER SHOULD NEVER OPEN THE EQUIPMENT CASE; any attempt will void the warranty and impose the risk of exposure to hazardous invisible laser radiation. **If the product is suspected to be defective, DO NOT USE THE UNIT,** and contact the manufacturer for service and repair arrangement. **NO SCHEDULED MAINTENANCE IS NECESSARY TO KEEP THIS PRODUCT IN COMPLIANCE.**

1.3 Electrical Safety Precautions



FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.



The equipment is certified for EMC requirements. **THE USER SHOULD NEVER OPEN THE EQUIPMENT CASE**; any such attempt will void the warranty and may result in electric shock and EMI attack to equipment in the vicinity.



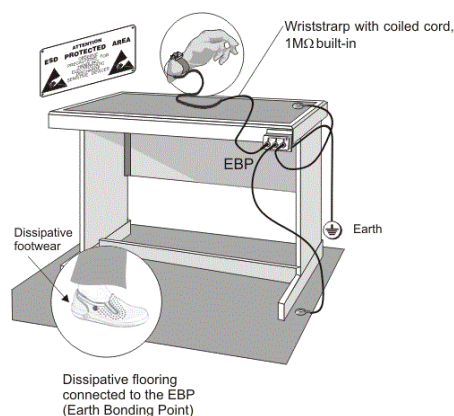
The unit must be connected to a three-pin AC power supply. If a two-pin AC power supply is used, ensure the Earth Ground Terminal at the rear panel (if presence) or at the AC power socket is properly connected to ground. Failing to connect the unit to the chassis ground may result in electrical shock, EMI problems, and unstable operation of the unit.



This product can be damaged by ESD. ESD damage can range from subtle performance degradation to complete device failure. The product should be handled with appropriate precautions. Failing to observe proper handling and installation procedures can cause damage.

Protection against electrostatic discharge (ESD) is vital when connecting/disconnecting accessories (e.g. end-cap, electrical cables, etc.) to/from the unit. Static electricity can build up on the human body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. To prevent damage to the unit, always:

- ground the unit by placing it on a grounded conductive table mat.
- ground the personnel by wearing a grounded wrist strap that is connected to a grounded conductive table mat and has a 1 MΩ resistor in series with it, and wearing dissipative footwear (e.g. heel strap) on a grounded conductive floor.
- ground the accessories before cleaning, inspecting, or making a connection or disconnection to/from the unit. For example, holding the metallic parts of the accessories while wearing a grounded wrist strap will ground the accessory.



2. General Information

2.1 Product Overview

This product is an ultra-stable light source unit designed for applications requiring high optical power and narrow laser linewidth. It is a self-contained, turn-key bench-top suitable for laboratory use.

2.1.1 Features

- High output power
- Narrow linewidth
- High power stability
- High spectral stability

In addition, for polarization maintaining (PM) models:

- High polarization extinction ratio

2.1.2 Product Specification and Test Report



When you receive this product, please verify that a product specification and a test report are included. These documents contain important parameters regarding to the optical and electrical specifications of the product.

2.2 Accessories

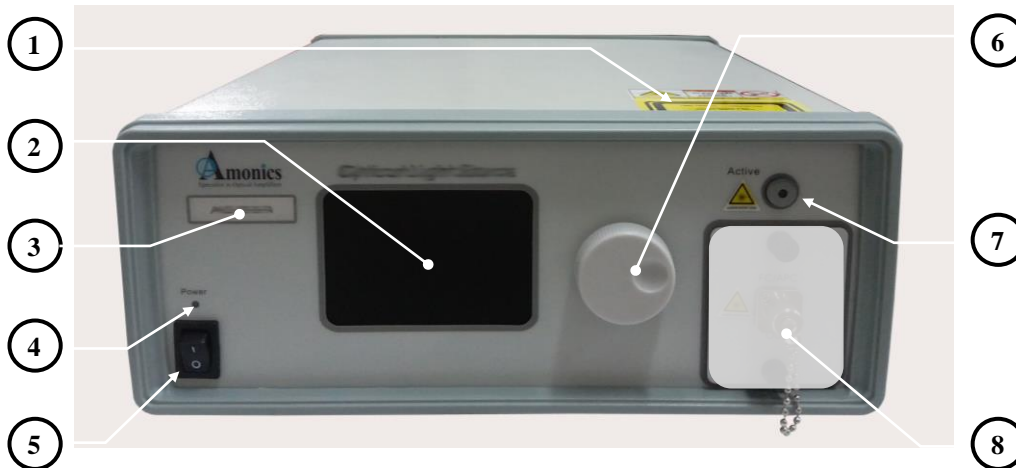


When you receive this product, please verify the accessories specified in the **product packing list** are included. If there are any discrepancies, please notify Amonics Limited promptly.

This product was carefully inspected before it was dispatched. It should be in proper working order upon receipt. You should, however, inspect the product for any damage that may have occurred in transit. If the shipping container or the packing material is damaged, keep it until the contents of the shipment have been checked to be free of mechanical and electrical damages. Notify Laser Lab Source promptly if any notable damage is found.

3. Product Description


3.1 Front Panel



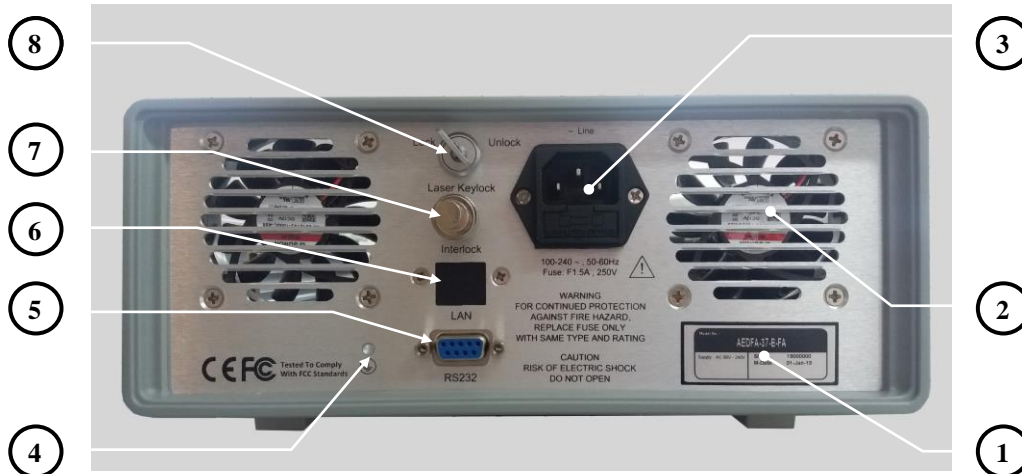
Feature	Function
---------	----------

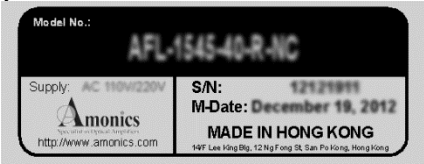


(1) Laser Explanatory Labels These labels describe the classification and potential hazards of the optical output.



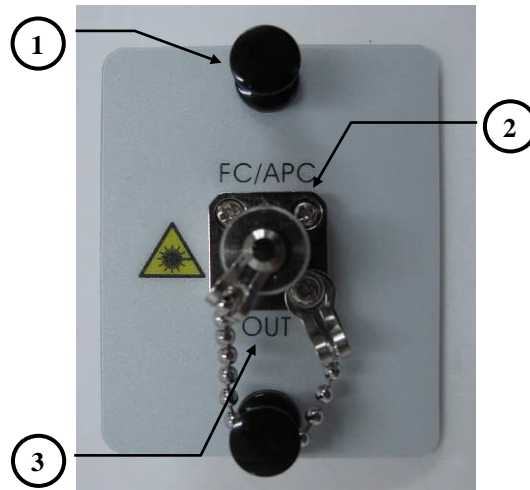
(2) Main Display	LCD for control and monitoring the unit.
(3) Model Number	This label displays the model number of the unit.
(4) Power Indicator	This indicator lights up when the power to the unit is turned on.
(5) Main Switch	The main switch is the master AC power switch for the unit, including the optical output. O is the OFF position; I is the ON position.
(6) Knob Button	The knob button allows the user to select and modify the control parameters of the unit.
(7) Emission Button	The emission button acts as a master switch and beam stop for optical output.  When the LED is ON, at least one optical driver is enabled. Otherwise, they are all disabled.
(8) Optical Receptacle Panel	This panel holds the optical receptacle(s) for optical output



3.2 Rear Panel



Feature	Function
(1) Nameplate / Manufacturer ID	<p>The nameplate records the equipment's model number, serial number, manufacture date, and power supply information.</p> 
(2) Ventilation Fan	<p>The ventilation fan ensures good ventilation inside the unit. The rear panel of this equipment should be placed at least 80mm from the wall to dissipate heat effectively.</p>
(3) AC Power Socket	<p>The AC power socket is the input for the AC power source. A three-pin standard power cord should be used to connect this equipment to the main supply. The fuse socket accepts a 5 x 20mm mini fuse. A Quick-acting fuse should be used for maximum protection.</p> <p> WARNING: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.</p>
(4) Earth Ground Terminal	<p>Use this terminal for connecting to the unit's metal frame or chassis ground.</p> <p> WARNING: This terminal must be grounded if the unit is not connected to a three-pin AC power supply. Failing to connect the unit to the chassis ground may result in electrical shock, EMI problems, and unstable operation of the unit.</p>
(5) RS232 Female Socket	<p>For remote control and monitoring, the user can plug in an RS232 direct cable or an RS232-to-USB cable to connect the unit to a computer. For remote control software operation, please refer to the Appendix A: PR-18 Remote Software Download Guide and download the "Remote Control Software" and "Software User Guide" according to the instruction.</p>
(6) Ethernet Socket	<p>For remote control and monitoring, the user can plug in an Ethernet cable to connect the unit to a router or switch. The light indicator on the left shows data activity, while the one on the right shows connectivity and connection speed (only orange = 10 Mb/s available). For detailed Ethernet setup and control, please refer to Appendix B: Ethernet Control User Guide. (Available in models with Ethernet option).</p>
(7) Remote Interlock Socket and Connector	<p>For emergency manual shutdown of the optical output, a remote interlock connector is provided. Removing the connector from the socket will disable the optical output.</p>
(8) Key Control	<p>For emergency manual shutdown of the optical output, a safety key control is provided. Turning the key to the "Lock" position will disable the optical output.</p>

3.3 Optical Receptacle Panel















Feature	Function
(1) Fastener	Fastener to secure the optical receptacle panel.
(2) Fiber-optic Connector Type Label and Receptacle	<p>Label to specify the fiber-optic connector type (Model dependent). The following options are available:</p> <p>FC/APC: Ferrule Connector with Angled Physical Contact. FC/UPC: Ferrule Connector with Ultra-polish Physical Contact. SC/APC: Subscriber Connector with Angled Physical Contact. SC/UPC: Subscriber Connector with Ultra-polish Physical Contact. LC/APC: Lucent Connector with Angled Physical Contact. LC/UPC: Lucent Connector with Ultra-polish Physical Contact. CL: Collimator. NC: No connector (bare fiber).</p>
(3) Function Label	<p> Proper cleaning and handling for the connectors and receptacles are required to keep the equipment operating properly.</p> <p>Label to specify the fiber-optic connector function.</p> <p>OUT: Receptacle for optical output.</p> <p> The optical output receptacles serve as apertures that emit Invisible Laser Radiation when the optical driver(s) is enabled.</p>

3.3.1 Optical Connectors and Receptacles



NEVER USE ADAPTOR OR CONNECTOR TYPE OTHER THAN SPECIFIED IN THE TEST REPORT. If measurement instruments accept different connector type, hybrid patch-cords are recommended.

	Angled Physical Contact (APC) [Green]		Ultra-polish Physical Contact (UPC) [Blue]	
Ferrule Connector (FC)				
Subscriber Connector (SC)				
Lucent Connector (LC)				

4. User Interface

4.1 Navigation

Within a navigation page on the screen, the cursor indicates the position of the parameter currently selected. To change the position of the cursor, rotate the knob button clockwise or counter-clockwise.

4.1.1 Read-only parameter

A read-only parameter is a parameter which cannot be edited by the user. Pressing upon a read-only parameter has no effect.

4.1.2 One-click parameter

A one-click parameter is a parameter which can be changed when pressing the knob button once. To edit a one-click parameter:

1. Move the cursor until it points to the desired parameter.
2. Press the knob button once to change the value of the parameter.

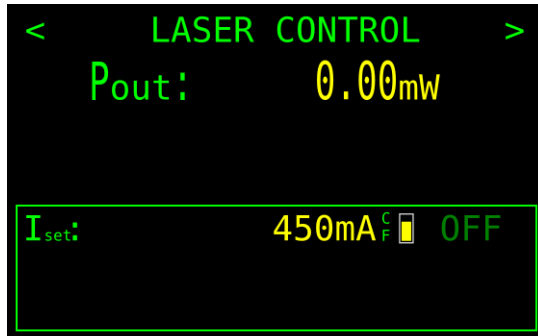
4.1.3 Edit-mode parameter

An edit-mode parameter is a parameter which can be changed in edit mode. To edit an edit-mode parameter:

1. Move the cursor until it points to the desired parameter.
 2. Press the knob button once to enter into edit mode. In edit mode, the cursor will blink.
 3. Turn the knob clockwise or counter-clockwise to change the value of the parameter.
 4. Press the knob button to exit from edit mode.
-

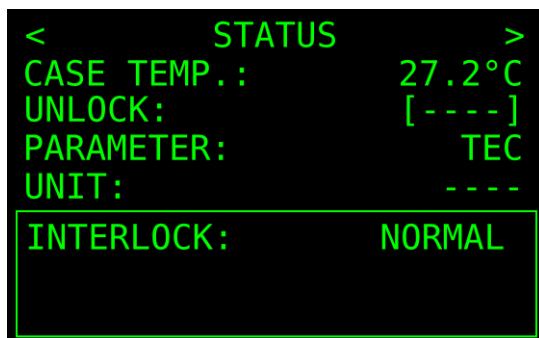
4.2 Laser Control Page

4.2.1 Laser Settings



Parameter	Description
LASER CONROL	Display the current page name. Press once to switch to next page.
Optical Power Display	Display the measured optical power. Value in selectable units of mW/dBm unless otherwise stated. P_{out} : Total Optical Output Power
Laser Setting	<p><u>Status</u> Display/Set the status of the indicated driving set-point. ON: Enable mode. STBY: Standby mode; Ready for emission when the Emission Button is pressed. OFF: Disable mode. LOCK: Lock mode; Protected from enabling, e.g. TEC Overheat, Interlock, etc.</p> <p><u>Set-point</u> Display/Set the driving set-point. I_{set}: Laser current set-point in Automatic Current Control (ACC) mode</p> <p>The level bar adjacent to the set-point indicates the percentage of the set-point relative to the maximum. When the set-point reaches maximum, the border of the level bar will turn green.</p> <p><u>C/F</u> Adjust mode of set-point. The adjust mode can be toggled by long pressing the control knob for 2 seconds during edit-mode of set-point.</p> <p>^C stands for coarse mode: The driving set-point can be increased rapidly. ^F stands for fine mode: The driving set-point can only be increased incrementally.</p>

4.3 Status Page



Parameter	Description
STATUS	Display the current page name. Press once to switch to next page.
CASE TEMP.	Display the measured case temperature in °C.
UNLOCK	Allow user to unlock laser(s) after a recovery from Interlock/TEC overheat, etc. This button is enabled only when the square brackets turn yellow.
PARAMTER	Display the parameter type. Press to change the parameter (if any).
UNIT	Available if the unit of the selected parameter can be changed (e.g. mW/dBm)
INTERLOCK	Display the remote interlock status as NORMAL / ACTIVE.
TEC	Display the measured TEC in °C.
CURRENT	Display the measured feedback current in mA/A.

4.4 Ethernet (Available in models with Ethernet option).



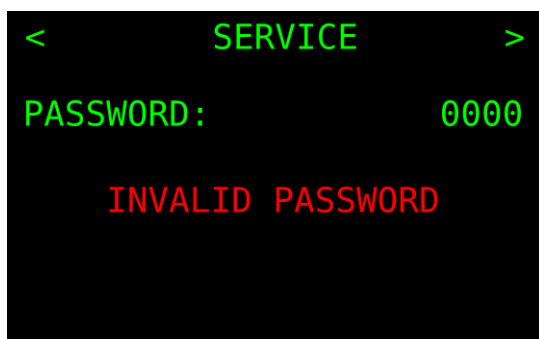
Please refer to the [Appendix B](#) for the Ethernet Control User Guide (Available in models with Ethernet option).

4.5 System Page



Parameter	Description
SYSTEM	Display the current page name. Press once to switch to next page.
MODEL	Display the model name of the unit.
SERIAL NO.	Display the serial number of the unit.
PROD. VER.	Display the PCB and Firmware version of the unit.
VOLUME	Display/Set the volume of buzzer to MUTE/ON. [Default: ON]
BRIGHTNESS	Display/Set the backlight brightness level of the Main Display from 0 to 100%. [Default: 50%] Note: the display may flicker momentary when the brightness is changed.
DIM LIGHT	Display/Set the waiting time in minutes before auto-dimming the backlight of Main Display. [Default: 5 min]
BAUD RATE	Display/Set the baud rate of serial port in bps. Available options include: 9600, 19200, 38400, 57600, 115200, 230400. [Default: 19200]
FACTORY RESET	Perform a factory reset of volume, brightness, dim light, and baud rate to default values.

4.6 Service Page



Parameter	Description
SERVICE	Display the current page name. Press once to switch to next page.
PASSWORD	Allow the operator to enter the password for maintenance service. Amonics Limited reserves the rights in the provision of password for the user.

4.7 Warning Messages

4.7.1 Interlock

When the remote interlock connector is removed from the socket, the **INTERLOCK!** message will flash on the Main Display to warn the user. **All** optical output will shut down immediately and become locked. In such a case, the remote interlock connector must be reinstalled. The unit is then unlocked on the Status Page, or the unit should be switched off and restarted.

```
<          STATUS          >
CASE TEMP.:          27.2°C
UNLOCK:             [ INTERLOCK ]
PARAMETER:          TEC
                    INTERLOCK!
INTERLOCK:          ACTIVE
```

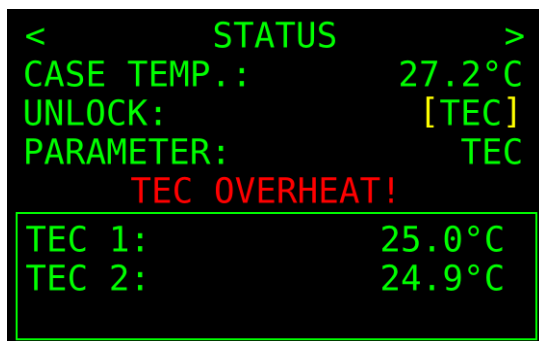
4.7.2 TEC Warning

When the optical driver temperature approaches the upper limit, the **TEC WARNING** message will flash on the Main Display to warn the user. The system will continue to operate normally, as long as the temperature does not go over the limit.

```
<          STATUS          >
CASE TEMP.:          27.2°C
UNLOCK:             [ ---- ]
PARAMETER:          TEC
                    TEC WARNING
TEC 1:              25.9°C
TEC 2:              24.9°C
```




4.7.3 TEC Overheat

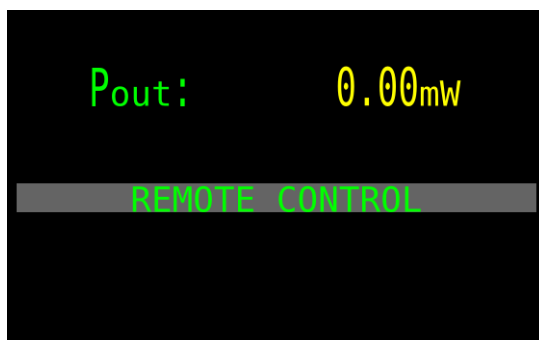
The **TEC OVERHEAT!** message appears on the Main Display when the optical driver temperature has exceeded the upper limit. The optical driver will shut down immediately and become locked. In such a case, the user should either go to the Status Page to unlock the optical driver, or the unit should be switched off and restarted.



4.8 Remote Connection Mode

The unit begins the Remote Connection mode when the RS232/Ethernet port is connected and the connection is initialized with the control software/web browser. The unit will indicate connection by displaying **REMOTE CONTROL** on the Main Display. Under this mode, all control actions (except the Emission Button) of the knob at the front panel are ignored. The user can only control the unit through the control software interface/web browser. Once the connection is terminated, the unit will resume local control. If the RS232/Ethernet cable is disconnected, the unit will automatically return to local control.

-  For detailed software control, please refer to the **Appendix A: PR-18 Remote Software Download Guide** and download the “Remote Control Software” and “Software User Guide” according to the instructions.
-  For detailed Ethernet connection setup and interface control, please refer to **Appendix B: Ethernet Control User Guide**.



5. Operation



CAUTION!

Read and follow the PRECAUTIONS in this manual before operation. Failing to following the instruction voids the warranty.

5.1 Remote Connection

1. Plug the CAT5 cable into the RJ-45 Ethernet Socket. (*Available in models with Ethernet option*).
2. Setup the Ethernet connection and interface control according to **Appendix B: Ethernet Control User Guide**. (*Available in models with Ethernet option*).
3. For remote control and monitoring, the user can plug-in an RS232 direct cable or an RS232-to-USB cable to connect the unit to a computer.
4. For remote control software operation, please refer to the **Appendix A: PR-18 Remote Software Download Guide** and download the “Remote Control Software” and “Software User Guide” according to the instructions.

5.2 Power-up

1. Connect the unit to the power supply with the power cord.
2. Turn the **Main Switch** at the front panel to the **ON** position to enable electrical power to the unit. The power indicator will light up and the Main Display will show a logo.
3. Wait for the Main Display to switch to the LASER CONTROL page.

5.3 Patch-cord Connection

Connect the optical output receptacle using the specified adapter and connectorized patch-cord to obtain the optical output signal.

5.4 Enable Optical Output




1. Set the optical status of driving set-point (**I_{set}**) to **STBY**.
2. Press the **Emission Button** at the front panel to change the optical output status to **ON**. The LED on the Emission Button should be turned on.
3. Increase the driving set-point (**I_{set}**) to increase the optical output power.

5.5 Disable Optical Output and Power-down

1. Press the **Emission Button** at the front panel to change the optical output status to **OFF**. The LED on the Emission Button should be turned off.
2. Turn the **Main Switch** at the front panel to the **OFF** position.

6. Maintenance and Care

6.1 Troubleshooting

Symptom	Possible Cause (C) and Solution (S)
Optical output power is not high enough.	<p>C: Driving set-point not turned all the way up. S: Increase the driving set-points until the values stop changing.</p> <hr/> <p>C: Optical connectors are dirty. S: Disable optical output and clean optical connectors.</p> <hr/> <p>C: Use of incorrect optical adapters or connectors. S: Use only the optical adapters and connectors indicated in the test report. If measurement instruments accept different connector type, then use hybrid patch-cords.</p> <hr/> <p>C: Optical output connector damaged. S: Measure optical output power with power meter and compare with the readout on Main Display. Contact Amonics Limited for repair arrangement if the difference is high and cannot be corrected by cleaning the optical connectors.</p>
Optical output power is unstable.	<p>C: Insufficient ventilation. S: Place unit in well ventilated area or supply additional fans for ventilation.</p> <hr/> <p>C: Insufficient optical output isolation. S: Connect isolator of corresponding wavelength to optical output connector.</p>
Unit does not power up.	<p>C: Blown fuse. S: Check fuse and replace if it is blown.</p> <div style="text-align: center;">  <p>WARNING: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.</p> </div> <hr/> <p>C: Insufficient electrical voltage. S: Check that the electrical supply is at the specified voltage on the label.</p>
Unit resets or blinks on and off.	<p>C: Power cord is loose. S: Plug power cord is firmly into the unit.</p> <hr/> <p>C: Insufficient electrical voltage. S: Check that the electrical supply is at the specified voltage on the label.</p>

6.2 Care of Connectors and Receptacles



Clean mating between optical connectors and receptacles prevents optical performance degradation. In addition, in high-power products, any contaminant (e.g. dust, oil, film residue, etc.) that blocks the fiber core can result in burning the optical end-face when the optical power is turned on.



There are two families of cleaning techniques depending on whether isopropyl alcohol is used. Dry-cleaning (without alcohol) is preferred over Wet-cleaning (with alcohol) because if the alcohol is allowed to evaporate slowly off the ferrule, it can leave residual material on the cladding and fiber core. This is extremely difficult to clean off and usually more difficult to remove than the original contaminant. Liquid alcohol can also remain in small cavities where it can re-emerge during fiber connection.



When cleaning optical connectors, the objective is to eliminate the contaminant and to provide a clean environment for the fiber-optic connection. **Remember that inspection, cleaning and re-inspection are critical steps which must be carried out before any fiber-optic connection is made.**

Single-mode Fiber (SMF)



Damaged: Replacement required



Dirty: Cleaning required



Clean: No cleaning required

Polarization-maintaining Fiber (PMF)



Damaged: Replacement required



Dirty: Cleaning required



Clean: No cleaning required

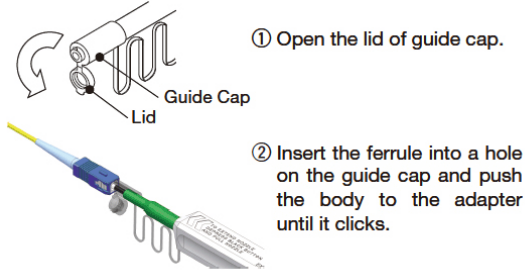
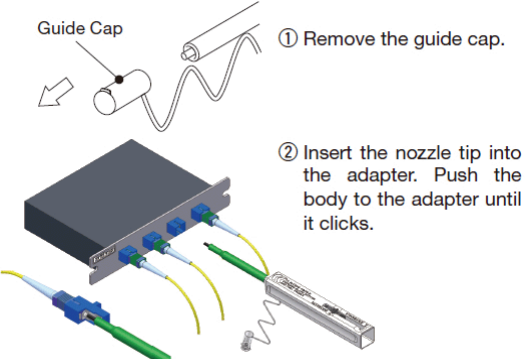
The use of One-Click™ Cleaners (<http://www.oneclickcleaner.com>) by Fujikura is recommended because it provides dry-cleaning for both connectors (patch-cords / pigtailed) and receptacles.

In case of difficulties obtaining a compatible One-Click™ Cleaner, other cleaning techniques are available, such as that recommended by CISCO. The details can be downloaded directly from <http://www.cisco.com> or via this link: http://www.amonics.com/amonics/php/en/Inspection_and_Cleaning_Connections_Cisco.pdf

6.2.1 Cleaning Procedure



1. **Ensure the optical output power is turned off before the inspection commences.**
2. Remove the protective end-cap and store it in a small re-sealable container.
3. Inspect the fiber connector or receptacle with a fiberscope.
4. If the connector is dirty, clean it with a compatible One-Click™ Cleaner.
5. Inspect the fiber connector or receptacle with a fiberscope again.
6. If the contaminant cannot be removed, repeat the cleaning procedure until the end-face is clean.

Using One-Click™ Cleaner to Clean Optical Connectors	Using One-Click™ Cleaner to Clean Optical Receptacles
 <p>① Open the lid of guide cap.</p> <p>② Insert the ferrule into a hole on the guide cap and push the body to the adapter until it clicks.</p>	 <p>① Remove the guide cap.</p> <p>② Insert the nozzle tip into the adapter. Push the body to the adapter until it clicks.</p>

7. Support and Warranty

7.1 Support



Your product has been designed to provide years of trouble-free operation. Apart from cleaning the optical connectors and receptacles, no internal service is required provided that the equipment is properly handled, operated and kept away from contamination. **THE USER SHOULD NEVER OPEN THE EQUIPMENT CASE**; any attempt will void the warranty. If the product is suspected to be defective, please contact Laser Lab Source / Amonics Limited for service and repair.

7.2 Warranty Policy

Amonics Limited warrants that each new product will be free from defective material and workmanship under normal use and service for a period of one (1) year for all products from date of shipment.

During the warranty, Amonics Limited will either repair or replace, at its discretion, any defective product (hereafter refer to as Product) within thirty (30) days after its receipt, and Amonics Limited shall return such repaired or replaced Product to the location from which it originated. Amonics Limited will be responsible for both material and labor required to effect all repairs under terms of the warranty, providing the Product is returned to Amonics Limited as specified in the warranty statement. The purchaser shall bear the freight charges incurred in returning the Product to Amonics Limited for examination, replace and / or repair of the Product.

The warranty does not apply if the Product has been modified by purchaser or subjected to misuse, neglect, or accident, or if the Product has been repaired or altered by an unauthorized service depot so that its performance or reliability has been impaired, or if the Product has had the serial number altered, effaced or removed; or if it has been damaged by accessories, peripherals, and other attachments not approved by Amonics Limited.
