



# **OEM Master Oscillator Power Amplifier SLD Light Sources User Manual**



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**GENERAL WARNING**

Before using this Light Source, ALL users should read this manual and fully understand how to operate this Light Source.

**ABSOLUTE MAXIMUM RATINGS WARNING**

Failure to comply with the following requirements may result in the catastrophic failure of the Light Source.

Parameter	Min	Typ	Max
DC supply voltage, V	9.0	12.0	15.0
DC supply current, A	–	–	3
Remote Port input voltage, V	0	5	8
Remote Port input current, mA	–	8	15
Remote Port output voltage, V	–	5	20
Remote Port output current, mA	–	–	10

**LASER SAFETY WARNING**

**MOPA SLD Light Sources emit invisible light that have a potential hazard associated with CLASS 3B Laser of IEC 60825-1 for sources at 800-900 nm and Class 3R for sources at 1000-1100 nm.**



**MOPA SLD OEM light sources are designed for use as a component for integration into photonics equipment and it is, therefore, out of scope of applicable standards related to laser safety, such as IEC 60825-1. Note, however, that any equipment incorporating this component may be subject to these standards. MOPA SLD OEM modules do not have ALL the laser safety features (like remote interlock, key operated master control, warning signals and labels). However, these features can be implemented using “Remote” or USB interfaces**

For further information regarding laser safety and laser classification of the Light Source please contact SUPERLUM.

**Warranty**

Superlum products are guaranteed for a period of one year from date of delivery, against any faults caused by manufacturing errors or proven intrinsic material faults as long as the products have NOT been transformed, incorrectly installed, wrongly used or repaired by the buyer/user. Superlum will conduct analysis of the failures and undertake to repair or replace any product failing under the above-mentioned conditions. Notification of any Claim under this warranty must be submitted in writing within 1 week from discovery to Superlum giving specific details of the fault. The product must be returned to Superlum not later than the expiry date of the warranty. Shipping costs incurred, are not covered by this warranty. Failure Root Cause analysis is carried out free-of-charge after warranty expiry date.



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## 1 Light Source Description

### 1.1 General Description

The OEM-MOPA (Master Oscillator Power Amplifier) SLD broadband light source combines an extremely high output power with a wide optical spectrum. This is achieved by amplifying the Master SLD source's emission with a spectrally-matched optical power booster.

The OEM MOPA-SLD light source features compact outline dimensions 110x31x190 mm (WxHxD) and capability of operation in a voltage range of 9-15 VDC (1.5 A max.). The device supports pulse modulation (ON/OFF switching) at a frequency rate up to 5 kHz. The electrical pulses are to be supplied externally from an external pulse generator.

Due to the renewed internal electronics, the OEM-MOPA light source provides three types of the optical power control:

- manually, by pressing the top-cover pushbutton
- remotely, by applying logic signals to the back-side Remote control port
- remotely, from a PC (or laptop) via the side-back USB virtual serial port

All OEM-MOPA light sources are supplied with the USB- and Remote-port interfaces as standard options.

Please note that the OEM-MOPA light source is intended for integration into the end-user's equipment and is to be considered as an optical component. For this reason, the device is **NOT** equipped with all required protective measures for safety operation. Before running the instrument, please check Safety Considerations section in this document.

Please note that the OEM-MOPA light source has unique optical characteristics. Their sensitivity to optical feedback is **NOT** completely studied yet. For that reason, we strongly recommend **NOT** exceeding the back reflection level of  $10^{-3}$ . If it is not possible to fulfill, you **MUST** install a fiber-optic isolator at the device's output.

### 1.2 Optical Performance

Standard models of the OEM MOPA-SLD light sources are listed in the table below. Customization of the OEM-MOPA SLD characteristics is available upon request – please contact sales@superlum.ie.

The optical design is based on PM fiber. The optical output can be a 500mm-long FC/APC terminated fiber pigtail in a 3mm reinforced tube, or an FC/APC mating sleeve for external connection of FC/APC patch cables.

Parameter	MOPA-SLD-850-P100W12-OEM	MOPA-SLD-840-P40W40-OEM	MOPA-SLD-910-P40W60-OEM
Output power (PMF), mW	100	40	40
3 dB spectral width, nm	12	40	60
Center wavelength, nm	850	840	910

### 1.3 Package Contents

The OEM-MOPA light source is coming with the following accessories as standard ones:

- 1 x connector for the DC Power input port
- 1 x connector for the remote input port
- 1 x flat cable (0.5 meters length)
- 1 x USB cable
- 1 x optical patch cable
- 1 x USB card containing Superlum Companion Software and a copy of this Manual
- 1 x Acceptance test report (ATR)



### 1.4 Outlines and Dimensions

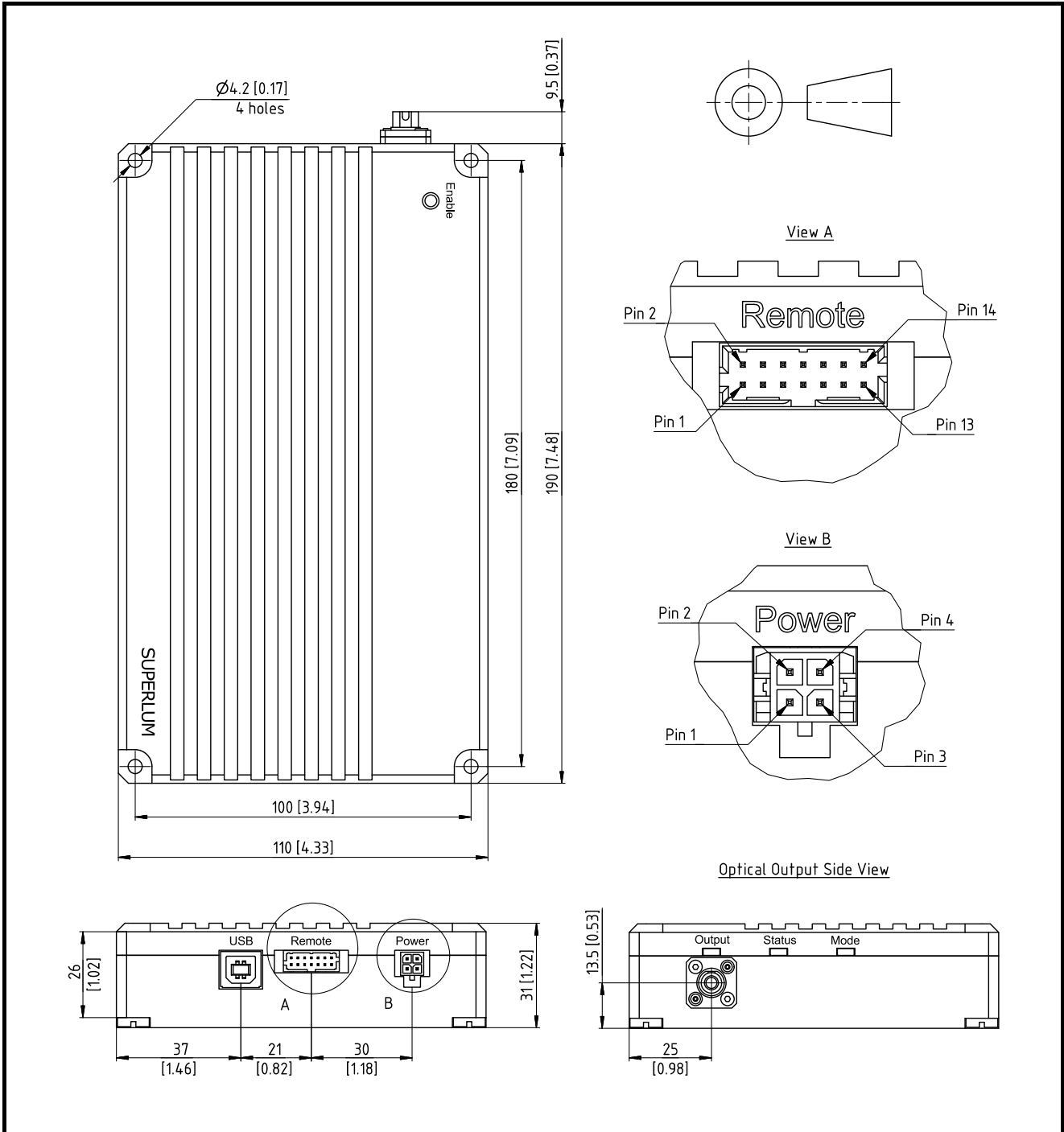


Figure 1. Drawings of Light Source. Dimensions are in millimeters [inches]

## 1.5 Control LEDs

The OEM-MOPA light source is equipped with three LEDs on the front side. They are intended for visual indication of the device current status. Refer to Table 1 for the most comprehensive explanation of the LEDs' status.

Table 1. Statuses of control LEDs

LED Name	LED State	System status
"OUTPUT" *	No light	The optical output is off.
	Flickering green	The optical output is starting (soft start).
	Green	The optical output is on.
	Yellow	SLD current limit reached – SLD degradation; time to service.
"STATUS"	No light	No power. No active SLDs.
	Flickering green	Temperature stabilization is in process.
	Green	SLD temperature is stabilized at the pre-set level on all channels. The optical output can be switched on. No errors detected.
	Flickering red	The optical output and all controls are disabled once the interlock has been actuated (correspondent terminals on the REMOTE port are open circuited). Interlock is only operable, if the correspondent option is computer activated ("Configuration" area in the SUPERLUM's companion software – see Sec. 4.3 below).
	Red	Common Error. Failure of the temperature controller.
"MODE"	No light	The unit is in manual operation. Remote control option is not activated
	Green	The unit is in REMOTE port operation (manual operation is disabled)
	Yellow	The unit is in computer remote operation (manual operation is disabled). USB mode.
	Flickering yellow	The unit is in computer remote operation (manual operation is disabled). USB SERVICE mode.

\* – LED reflects the status of the combined optical output, i.e. all "active" SLD channels together (that user pre-selected in the companion software, or all channels as factory preset). Failure of, at least, one of the channels will result in the failure status of the combined optical output.

## 1.6 Remote Control Features

Refer to the companion software for remote control of the OEM-MOPA light source from a PC (or laptop) using a USB connection. The device is fitted with a USB virtual serial port located on the back side of the device.

Short summary of the most relevant remote-control features (also those available with SUPERLUM's companion software) are given in Table 2. See Sec. 4.2-4.4 of this document for more information on this subject.

Table 2. Remote control features

USB (virtual COM port)	REMOTE port
<ul style="list-style-type: none"> <li>- ON/OFF control of the optical output;</li> <li>- Pre-selection of certain SLD-channels for ON/OFF controlling;</li> <li>- Monitoring of relevant driving parameters of SLD-channels;</li> <li>- Self-test option – remote diagnostics feature;</li> <li>- Enabling/disabling the option of analog remote controlling via the REMOTE port (does not apply to the interlock control). Activation of this option disables a manual ON/OFF control of the optical output from the front device panel;</li> <li>- Controlling of optical performance.</li> </ul>	<p><i>The REMOTE port is operable only if the correspondent option has been computer activated.</i></p> <ul style="list-style-type: none"> <li>- ON/OFF control of the optical output by analog remote signals;</li> <li>- Monitoring of device statuses (e.g. on/off statuses of the optical output, service status);</li> <li>- Remote interlock control: interlock is actuated when correspondent terminals on the REMOTE port are open circuited.</li> <li>- Interlock is only operable, if the correspondent option is activated in the computer control software.</li> </ul>



## 2 Technical Specification

### 2.1 Electrical Connections

Diagrams of electrical connections of the Light Source are shown in Fig. 2 below. Electrical Inputs/Outputs are described in Table 3 below.

There are three separate connectors (ports): first – for 12V DC power supply, second – for REMOTE control (external switching of SLDs on and off by analog signal triggering, and remote interlock control) and third – for USB interfacing.

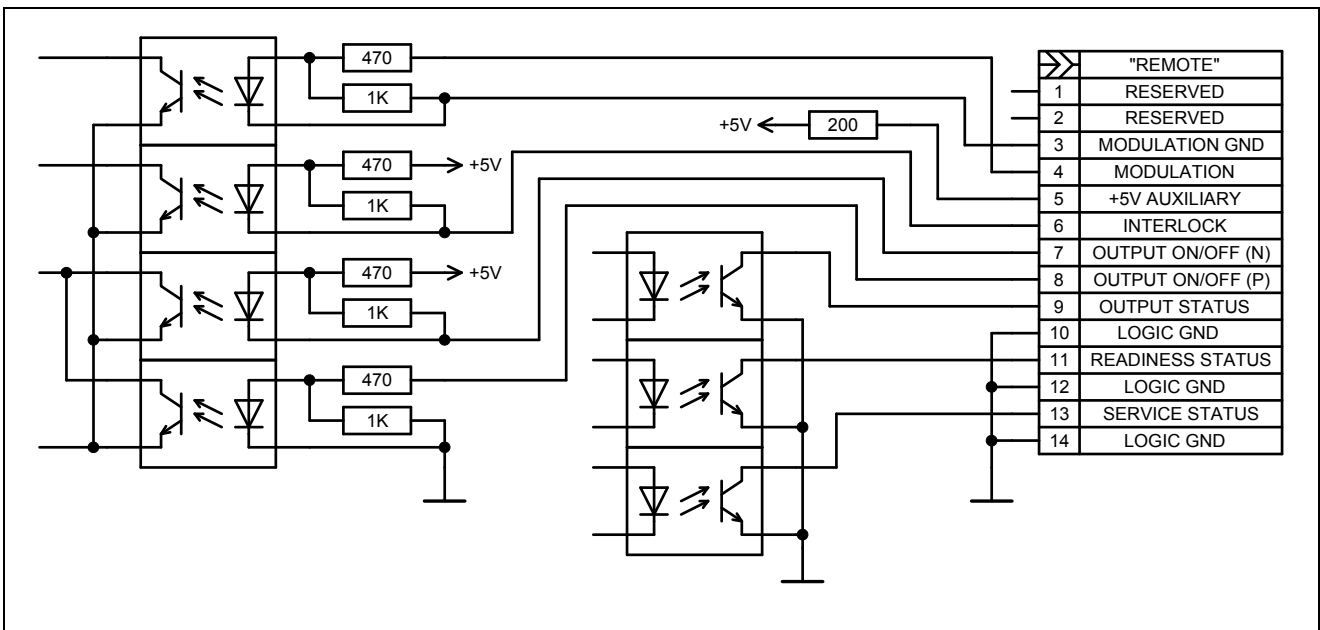


Figure 2. The electrical circuit of REMOTE port



Table 3. Description of Light Source control inputs/outputs

Pin number	Name	IN/OUT	Description/structure
<b>POWER port:</b>			
2,4	+12 V INPUT	IN	Input DC supply
1,3	GND	IN	DC supply GND
<i>NOTE – GND terminals and the case of the Light Source are not connected inside.</i>			
<b>REMOTE port:</b>			
1, 2	RESERVED		Reserved for additional TTL-level UART interface
3	EXTERNAL MODULATION GND		External modulation signal common wire
4	EXTERNAL MODULATION	IN	External modulation signal
5	INTERNAL +5V (200Ohm)	OUT	
6	INTERLOCK CONTROL	IN	Interlock is actuated when the control terminals are open circuited – optical output and controls are disabled in this case. 10mA (max) current. To de-actuate the earlier actuated interlock, device power resetting is required. Interlock is operable, only if the correspondent option is activated in remote control software (“ <i>Configuration</i> ” area in SUPERLUM’s companion software – see Sec. 4.3 below).
7	OUTPUT ON/OFF (N)	IN	Allows switching the optical output. Connect this pin to any LOGIC GND pin to switching optical output ON.
8	OUTPUT ON/OFF (P)	IN	Allows switching the optical output. Apply +5VDC voltage from external power supply between this pin and any LOGIC GND pin to switching optical output ON
9	OUTPUT STATUS	OUT	Open collector. Goes to low impedance state in case of the optical output is ON. Recommended to load externally by ballast resistor of $\geq 10k\Omega$
11	READINESS STATUS	OUT	Open collector. Goes to low impedance state in case of the optical output is ON. Recommended to load externally by ballast resistor of $\geq 10k\Omega$
13	SERVICE STATUS	OUT	Open collector. Goes to low impedance state in case of service is required. Recommended to load externally by ballast resistor of $\geq 10k\Omega$
10, 12, 14	LOGIC GND		Logic common wire
<p><i>NOTE – To enable the controls of the REMOTE port, prior activation is required via USB / Ethernet interface (with use of SUPERLUM’s companion software). The interlock is the only control option, computer activated separately from other controls of the REMOTE port.</i></p> <p><i>Activation of REMOTE controls (except the interlock control) disables a manual ON/OFF control of the optical output from the front device panel.</i></p> <p><i>Controlling via REMOTE port (except the interlock control) is possible only if the Light Source is not computer controlled in parallel.</i></p> <p><i>Refer to Sec. 4.4 below for more details about controlling via REMOTE port.</i></p>			



## 2.2 General Specification

Table 4

Parameter	Condition	Min	Typ	Max	Unit
Storage temperature		-20	–	+50	°C
Operating temperature		+15	–	+40 <sup>(1)</sup>	°C
Humidity, non-condensing		–	–	90	% RH
Weight	With no shipping package	–	1000	–	gram
DC supply voltage		10.0	12.0	13.0	V
DC supply current <sup>(2)</sup>		–	–	1.5	A
DC supply ripples	1 kHz...200 kHz frequency range	–	–	60	mVpp

(1) Refer to Sec. 3.1 for more details.

(2) The power supply requirements indicated in Table 4 above are critical for the correct operation of the light source and must be strictly complied with. The power supply should ideally be capable of supplying up to 2A current, however a less powerful unit may be used but it will limit the operating temperature range. A power supply with a maximum current of less than 1.5A cannot be used.  
 NOTE: For compliance with the EMC standard EN61000-4-5 it is recommended that the 12V power cable be less than 3m. When installing the Light Source into an application where the 12 V DC power cable is over 3m Superlum advise that a ferrite of the type "Würth 742 701-5 with 6 loops" or similar, is placed on the cable.

## 2.3 Fiber and Optical Connection Specification

Table 5

	Type	Comments
Fiber type	PM	PANDA PM850 fiber for 750-1000nm spectral range
Connector type	FC/APC	Depending on the ordered device configuration, the optical output is a FC/APC terminated fiber pigtail in a 3mm reinforced tube, or a FC/APC mating sleeve for external connection of FC/APC patch cables

## 2.4 Other Electro-Optical Characteristics

Table 6

Parameter	Condition	Min	Typ	Max	Unit
Temperature dependent optical drift in the specified operating temperature range	Optically not isolated Light Source	–	TBD	TBD	ppm/°C
Relative Intensity Noise (RIN)	10 kHz...2 MHz	–	-135	-125	dB/Hz
Long-term optical power stability	8 h after 60 min warming up	–	TBD	TBD	ppm
"Ready-to-work" time	From the moment of DC power application	–	–	10	s
Cold start settling time (system warm-up)		20 <sup>(1)</sup>	30	90 <sup>(2)</sup>	min
Rise time of optical signal		50	100	200	ms
Fall time of optical signal		1	–	3	µs

(1) at +25 °C;

(2) at high and low extremes of the operating temperature range.



## 3 General Information

### 3.1 Mounting

Temperature control is an important factor when considering where and how you will integrate this light source to your application. Ideally in order to ensure effective heat dissipation the Light Source should be mounted to an appropriate heatsink in any spatial orientation with 25mm of free space around the sides and cover to allow air circulation. The Lightsource should be anchored to a flat plate heatsink large enough to accommodate the entire footprint of the lightsource base, (see section 1.4 above; Figure 1. Drawing of Light Source) using the Four (4) anchoring holes. Mounting and using without a heatsink is possible, but this approach will reduce the operating temperature range. Forced air circulation system around the enclosure is in this case strongly recommended.

### 3.2 Safety Considerations

Superlum OEM light source modules are sold as components and therefore are not required to conform to European or U.S. safety regulations, as well as regulations in force in any other country/destination. It is the responsibility of the buyer/user to design and certify any equipment incorporating any OEM source of Superlum to meet all local safety regulations prior to sale to the public. The texts of these regulations are available from the respective governing bodies of the countries the equipment is to be sold into.

All Superlum OEM light source modules except the models with emission wavelength below 690 nm emit invisible radiation. They have a potential laser safety hazard classified as CLASS 3R or 3B under IEC 60825-1:2014. Superlum OEM light source modules may not have ALL the required laser safety features in terms of IEC 60825-1 like remote interlock, key operated master control, warning signals and labels. Superlum OEM light source modules are designed for the integration into other equipment. It is the responsibility of the Buyer/User to design and certify any equipment incorporating any OEM source of Superlum to meet all local safety regulations and applicable standards.

The Light Source is designed for integration into an OEM application and as such, is outside the scope of laser safety standards. The Light Source is not supplied with laser safety devices e.g. - key operated master control. However, these features can be implemented at the OEM application level by using the REMOTE port or USB interface.

Please contact Superlum for more details about laser safety and other safety issues of each particular light source module P/N.



## 4 Installation and Using the Light Source

### 4.1 Getting Started

It is recommended that the following procedures are completed prior to using the lightsource for the first time.

**4.1.1** Fix the Light Source onto an appropriate heat sink firmly (refer also to Sec. 3.1 of the document for more details).

**4.1.2** Apply 12 V DC power. Ensure that the DC power supply unit in use fulfills the requirements of the “Absolute Maximum Ratings” (Table 4) above, including the ripple requirement. Do not make other connections at this stage (USB, etc.).

The “STATUS” LED on the device panel will flicker for a short time on startup (for approximately 15 sec), and will light constant green when startup period is complete.

**4.1.3** Push the “ENABLE” button on the front panel to switch the optical output on – the “OUTPUT” LED will then light green (a short delay is acceptable due to the soft start of the optical output). All SLDs installed will be powered on.

Measure output power with a dedicated power-meter, and compare the result with the power value specified in the individual Acceptance Test Report sheet provided (ATR). Make sure that output power you obtain is comparable to that on the datasheet i.e. within  $\pm 10\%$ .

**4.1.4** Connect the light source to a spectrum analyzer. Compare the spectrum with that depicted in ATR. There should be no perceptible differences between the two spectrums. Polarization insensitive spectrum analyzers (OSAs), e.g. ANDO AQ6317B / Yokogawa AQ6370 OSAs are recommended for this task. Polarization sensitive OSAs, or OSAs with MM fiber optical inputs may disturb the measurement results, i.e. introduce misbalances, distortions and artifacts to measured spectral shapes.

**4.1.5** If no abnormality was found on the preceding stages the lightsource is now ready for use also when the Light Source has been run successfully for the first time it can now be controlled via the USB port, or analog signals via the remote port (see Fig. 1, 2, and Sec. 4.4). To prolong the device lifetime, it is recommended to switch off the optical output when the lightsource is not in use.

## WARNING

Optical output in fibre-coupled light sources is achieved by the use of an FC /APC mating sleeve and FC/APC connectors (optical output port). FC/APC connectors are sensitive to even the slightest contamination. Failure to comply with the following operating requirements may result in contamination entering the optical output port severely reducing the performance of the unit and may result in permanent damage to the optical output port. Any such occurrence is the responsibility of the user and is **NOT covered by the warranty**.

**DO NOT:** Insert any FC/APC connector into the optical output port without first ensuring it is clean. It is vital that you clean the fiber ferrule before each insertion. *No known cleaning methods are 100% effective therefore it is imperative that inspection is included as part of the cleaning process.*

**Cleaning FC/APC connectors:** *using a lint free cloth and isopropyl alcohol (Min 99%) and clean compressed air to dry off the connector is recommended.*

**Cleaning the optical output port:** *Using an Improper cleaning method may result in permanent damage to the optical output port. ONLY users who have the knowledge, training and equipment should attempt cleaning the optical output port. For further information please contact Superlum.*



**DO NOT** remove the optical dust cap until a clean FC/APC connector is immediately ready to insert into the unprotected optical output port.

**IMPORTANT!**

If discrepancies are found when comparing the observed optical output or spectrum to the ATR please contact SUPERLUM before further using the Light Source. Using the lightsource without identifying the cause of the observed discrepancies may result in a reduction of the expected lifetime of the device.

**The user should regularly compare actual device performances to those originally specified in ATR while using the Light Source.**



## 4.2 Establishing Computer Communication

Manual control of the Light Source from the front device panel becomes disabled once the Light Source has established computer communication

### 4.2.1 Minimum System Requirements for SUPERLUM's Companion Software for remote control of the Light Source:

**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 megabytes (MB) for Windows 9x and ME, 64 MB for Windows NT, 128 MB for Windows 2000 and XP, 1 gigabyte (GB) (32-bit) or 2 GB (64-bit) for Windows Vista and Windows 7.

**Processor:** 100-megahertz (MHz) or faster processor for Windows 9x and ME, 300-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:** 5 MB of free hard disk space (not including disc space required for associated USB drivers – see below).

### 4.2.2 Communication Interface

This Light Source incorporates an embedded Serial-to-USB converter that allows internal serial interface commands to be transmitted over USB. The converter comes with device drivers that create a virtual COM port on the computer to communicate with the Light Source.

The virtual COM port (VCP) drivers for the Serial-to-USB converter can be found on the FTDI web site: <http://www.ftdichip.com/Drivers/VCP.htm>

Refer to APPENDIX A at the end of this document for more details about establishing computer communication.



### 4.3 Computer Control of Light Source with SUPERLUM's Companion Software

Software allows basic remote computer controlling of the Light Source via USB port.

You can create your own control software using the provided command protocol (see APPENDIX B at the end of the document). However, it is recommended that in the first instance to use SUPERLUM's Companion Software.

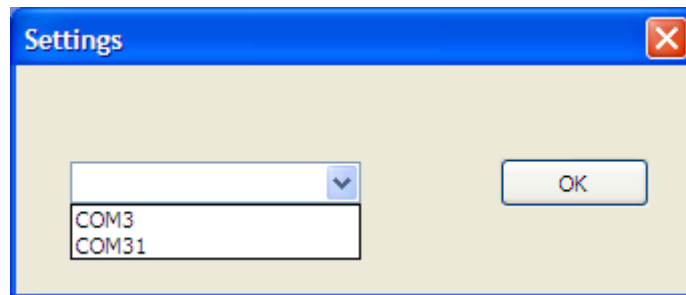
**4.3.1** Using the USB cable supplied connect the Light Source to the computer.

**4.3.2** Using the CD supplied install the software.

**4.3.3** Switch on the Light Source.

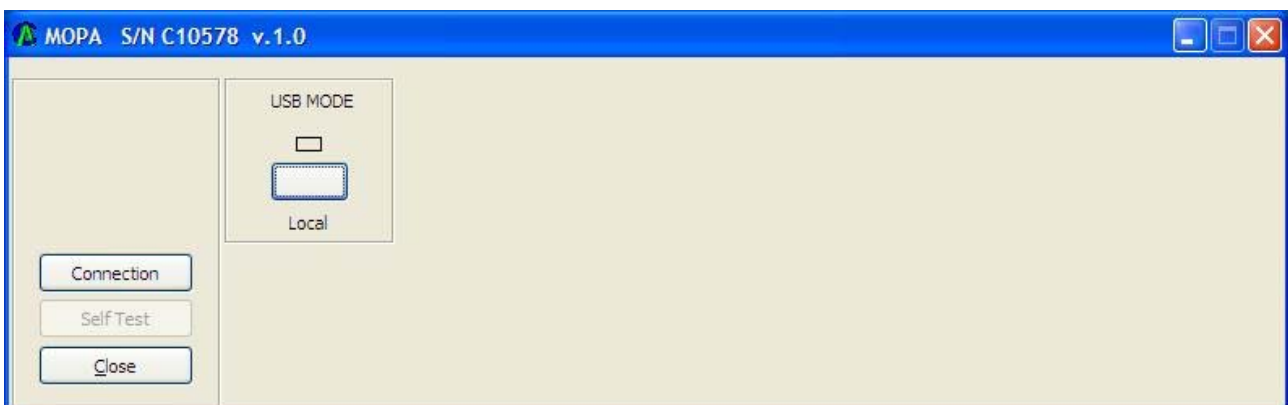
#### 4.3.4 Brief description of software operation

Run the software. When starting the software for the first time, the following window for selecting of COM port # will appear.



If the drop-down list for setting COM port number is not available, or if this list does not contain the COM port number the Light Source is connected to, it may indicate that there is either no DC power applied to the Light Source, or the Light Source is not connected to the computer.

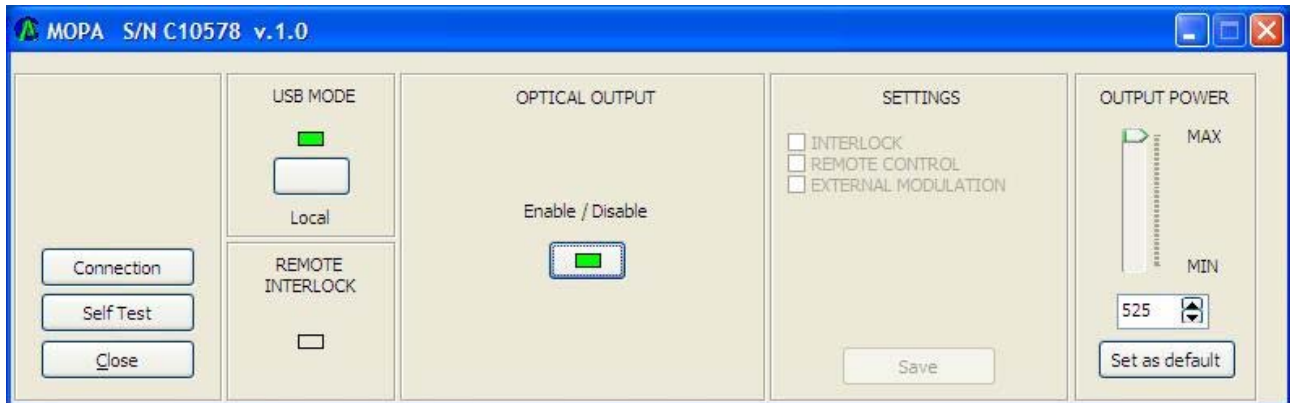
Select COM port # to which the Light Source is connected. The next window will then appear, as shown below. You can change COM port # when required by clicking on the "Connection" display button.



The selected COM port # will be stored. All future times of connecting the Light Source to the same computer and to the same computer communication port, the initial "Settings" window will no more appear at starting the software.



Once the “**USB MODE**” button has been clicked on the software display, the Light Source turns to remote operation, and the following window appears (indicator turns from blank to green). **Manual control of the Light Source from the front device panel becomes disabled once the Light Source has established computer communication.**



“Enable / Disable” display indicator in the “**OPTICAL OUTPUT**” area - show actual status of the optical output. Optical output can be toggled on and off with the “Enable / Disable” display button.

“**Self Test**” option is used for internal self-testing of the Light Source. It is initiated by clicking on the “**Self Test**” display button. This procedure may take a few minutes after being initiated. Upon completion, the program will automatically generate a test file, which should be e-mailed to SUPERLUM for further processing and verification of actual device statuses. You can add your comments before saving and e-mailing the generated self-test file.

The “**SETTINGS**” area of the software display allows the following control features:

- **Activate / deactivate the remote interlock.** The interlock is activated – the optical output and all controls become disabled, and the correspondent indicators (“Remote” LED indicator on the device panel, and “REMOTE INTERLOCK” software display indicator) lit red – when the correspondent control terminals on the REMOTE port are open circuited (see Sec. 2.1 for more details).
- **Activate /deactivate analog controls of the REMOTE port** (does not apply to the remote interlock control, which is computer activated separately). Manual control of the Light Source remains disabled when analog controls of the REMOTE port are activated.
- **Activate / deactivate the external modulation input.**

Any changes to the “**SETTINGS**” area are possible only when the optical output is switched off. Changes are applied immediately once correspondent boxes are ticked in the “**SETTINGS**” area.

To save changes introduced to the “**SETTINGS**” area, the “**Save**” display button in the “**SETTINGS**” area must be clicked. In this case the introduced changes are stored even after device power re-setting. Otherwise, the changes introduced are in place only during the current work session.



### 4.4 Controlling the Light Source via Remote port

This section concerns to all control options available with the REMOTE port, except the interlock control. The latter is activated and controlled separately from other controls of the REMOTE port.

4.4.1 Connect the Light Source to a computer via USB.

4.4.2 Power on the Light Source.

4.4.3 Run companion software. Establish communication with the Light Source.

4.4.4 Check the “REMOTE CONTROL” box in the “SETTINGS” area of the software display, and click “Save” display button to apply changes. It activates the option of controlling via the REMOTE port.

Analog control via the REMOTE port will be user-available once the computer session has been interrupted (click “USB MODE” display button to toggle computer control on and off).

Manual control of the Light Source from the front device panel becomes disabled when the “REMOTE CONTROL” box has been checked on the software display.

4.4.5 Control the Light Source by applying control signals to the terminals of the REMOTE port. Possible example is shown on Figure 3. More details about electrical connections to the REMOTE port can be found in Sec. 2.1 of the document.

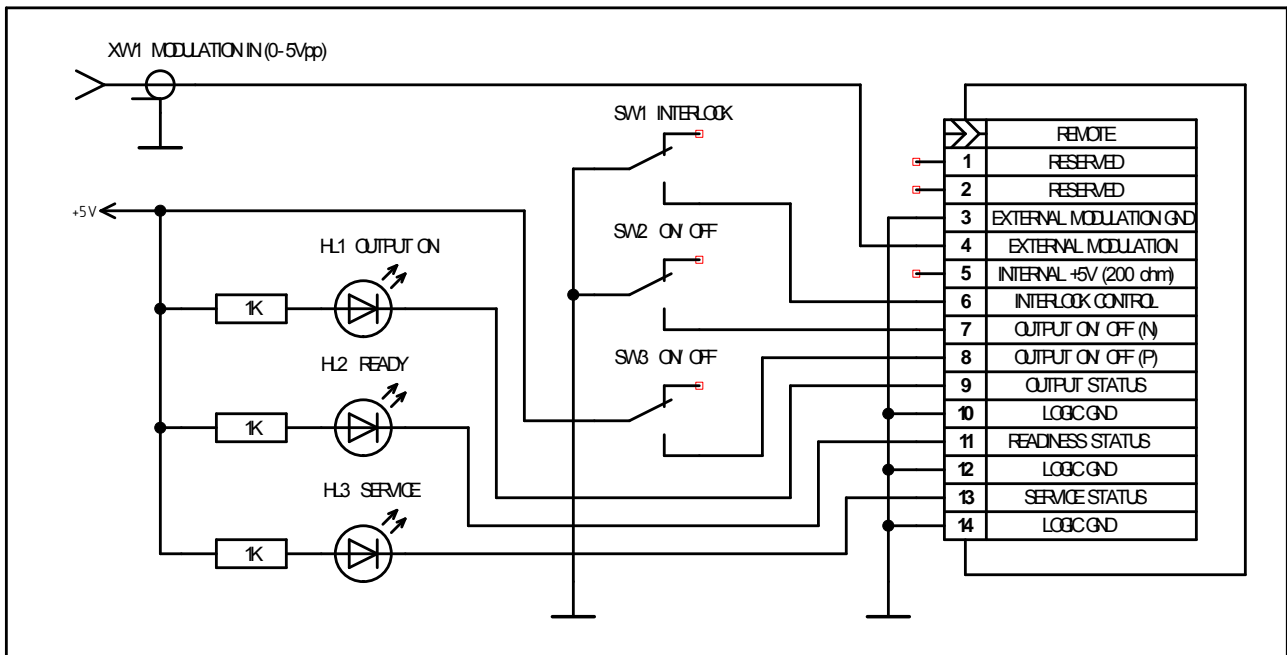


Figure. 3 Example of basic controlling of the Light Source via REMOTE port

4.4.6 Uncheck the “REMOTE CONTROL” box of the “SETTINGS” area of the software display to disable the REMOTE port, and to return to manual controlling of the Light Source.





## **APPENDIX A**

### **Downloading and Installing Procedures to Establish Computer Communication and Control**

#### **Connecting to Light Source via USB**

When the Light Source is connected via USB for first time, the OS driver installer will automatically run the process of device initialization (assigning COM port). It may take few minutes until the process will be completed. Corresponding icon of the installer must appear in the system tray.

Upon completion of the process COM port number will be automatically assigned to the device. Port number can be checked by clicking on the installer icon on the system tray.

If the automatic initialization process failed on the computer in use, please refer to a manual installing of drivers as recommended by FTDI, the manufacturer of the embedded Serial-to-USB converter (<http://www.ftdichip.com/Drivers/VCP.htm>).



**APPENDIX B  
USB Command Protocol**

**UART configuration:**

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

**1 SYSTEM COMMANDS**

**1.1 Read Light Source type, firmware version and serial number**

Request: [!] [CR] [LF]  
Acknowledge: [!] [:] [TYPE] [:] [VH] [VL] [:] [SN] [CR] [LF]  
Error message: [!] [E] [CR] – common error message.

[CR] [LF] – line termination sequence ([CR] – ASCII13, [LF] – ASCII10)

[TYPE] – Light Source type, five ASCII printable chars:  
“MOPA” – two channels Light Source;

[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.

**1.2 Set Light Source operation mode. Read current mode.**

Request: [M] [CMD] [CR] [LF]  
Acknowledge: [M] [MODE] [CR] [LF]  
Error message: [!] [E] [CR] [LF] – common error message.

<b>[CMD]</b>	<b>DESCRIPTION</b>
[?]	Read current mode
[L]	Set LOCAL mode
[U]	Set USB CTRL mode
[C]	Set USB CTRL mode

<b>[MODE]</b>	<b>DESCRIPTION</b>
[L]	Device operated in LOCAL mode
[U]	Device operated in USB CTRL mode
[E]	FATAL ERROR mode

**2 USB CTRL MODE COMMANDS [U]**

**2.1 Switch SLD ON/OFF. Read Channel status data**

Request: [U] [C] [CH] [CR] [LF]  
 Acknowledge: [U] [C] [IL] [ST1] [ST2] [CR]  
 Error message: [!] [E] [CR] [LF] – common error message;  
 [!] [M] [CR] [LF] – wrong mode set message.

[CH]	DESCRIPTION
[?]	Read CH status data
[9]	Switch all SLDs ON/OFF

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

[0] – output disabled;

[1] – output enabled.

[ST1] ...[ST2] – Channel [1...2] 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

**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)
[5]	Enabling / Disabling Interlock
[6]	Enabling / Disabling REMOTE port
[7]	Enabling / Disabling External Modulation
[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	Reserved, reads as null
Bit#3	Reserved, reads as null
Bit#4	'1' – Interlock enabled '0' – Interlock disabled
Bit#5	'1' – REMOTE port enabled '0' – REMOTE port disabled
Bit#6	'1' – External Modulation enabled '0' – External Modulation disabled
Bit#7	'1' – Output Power Monitor enabled '0' – Output Power Monitor disabled

**2.3 Measure optical module parameter (read data from ADC)**

Request: [U] [M] [CH] [PN] [CR] [LF]  
 Acknowledge: [U] [M] [CH] [PN] [ADATA] [CR] [LF]  
 Error message: [!] [E] [CR] [LF] – common error message;  
 [!] [M] [CR] [LF] – wrong mode set message.

[CH] – Channel number [1...2], one ASCII character;  
 [PN] – Parameter number [1...8], one ASCII character;  
 [ADATA] – Parameter value [0000...FFFF], four ASCII characters in hexadecimal code.

[PN]	DESCRIPTION	ADATA RANGE
1	Real TEC current	[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

Note - ADATA overload string is [FFFF].

**2.4 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;  
 [!] [M] [CR] [LF] – wrong mode set message.

[MN] – Optical module number, [1...2] (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
7	Optical module photo-diode current maximum value	[0000...270F], four ASCII chars	[0000] = 0 µA [270F] = 9999 µA
9	Optical module operating time	[00000000]- [FFFFFFFF], Eight ASCII chars	00000000 – 0 s; 0000000A – 10 s; ....

**2.5 Read optical module parameter (factory data)**

Request: [U] [F] [MN] [PN] [CR] [LF]  
 Acknowledge: [U] [F] [MN] [PN] [DATA] [CR] [LF]  
 Error message: [!] [E] [CR] [LF] – common error message;  
 [!] [M] [CR] [LF] – wrong mode set message.

[MN] – Optical module number, [1...2] (One ASCII character);  
 [PN] – Parameter number, [0...8] (One ASCII character);  
 [DATA] – Parameter data. See table 2.4 above for details.

**2.6 Adjust optical module parameter**

Request: [U] [J] [MN] [PN] [DATA][CR] [LF]  
Acknowledge: [U] [J] [MN] [PN] [DATA] [CR] [LF]  
Error message: [!] [E] [CR] [LF] – common error message;  
[!] [M] [CR] [LF] – wrong mode set message.

[MN] – Optical module number, [1] or [2] (One ASCII character);  
[PN] – Parameter number, [5] (One ASCII character);  
[DATA] – Parameter data. See table 2.4 above for details.

**2.7 Store adjusted optical module parameters in EEPROM**

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

[Y] – Result of data storing:  
‘1’ – all right;  
‘0’ – data storing error.