SLD-MS-series. Miniature SLD based Light Source Modules.

Technical Product Specification

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Product description

SLD-MS-series are miniature broadband SM fiber light source modules at different wavelengths in 670-1630 nm spectral range for applications requiring reliable, powerful, stable and low noise SLD light source with a broad and flat spectrum and a short coherence length.

SLD module inside a light source is powered up by a high-precision miniature current and temperature controller. Controller should be supplied by a 15-24 V DC voltage. Low noise internal DC-DC converter protects SLD and controller from possible variation and a short-term instabilities of external DC supply. Controller allows easy control of main SLD parameters via “ANALOG” I/O connector. Monitoring of overall status of a light source is easy possible via “LOGIC” I/O connector. It also provides a number of SLD protection means, including independent limiting of maximum possible SLD drive current. SLD current may be changed either by a built-in potentiometer or by applying analog voltage to corresponding pin of “ANALOG” I/O. In a standard version, SLD may be modulated (ON/OFF) up to 50 kHz. Modulation rate may be extended to 100 kHz upon request. Indicating LEDs on a top cover of a light source allow easy visual control of light source status.

Standard models have FC/APC finished, 50 cm long single mode fiber pigtail. Fiber is protected by 3 mm tube. 900 microns loose tube may be used upon request.

Light source modules must be put onto an appropriate heat sink for getting a widest possible operating temperature range. However, it is also possible to use SLD-MS without heatsinking, although in a limited range of ambient temperatures. Particularly, highest operating temperature without external heatsinking is +40 °C for all models and up to +50 °C for selected models (free air circulation around the package is required).

Applications

- Optical Fiber Sensing
- Optical Coherence Tomography
- Optical Metrology
- Testing of Optical Components
- Biomedical Imaging
- Low Coherence Interferometry

Features

- Easy use – just apply DC voltage
- Stable optical output
- Different center wavelengths in 670-1630 nm window
- 15-24 V DC supply
- External or internal control of SLD power
- Easy control of main SLD parameters and overall status
- Independent limiting of SLD drive current
- ACC driving mode
- APC driving mode - optional
- Operating temperature range −20…+55 °C
- Fast modulation
- Excellent stability
- Low noise

Mechanical specifications

Drawing of a standard SLD-MS light source is presented in Figure 1.

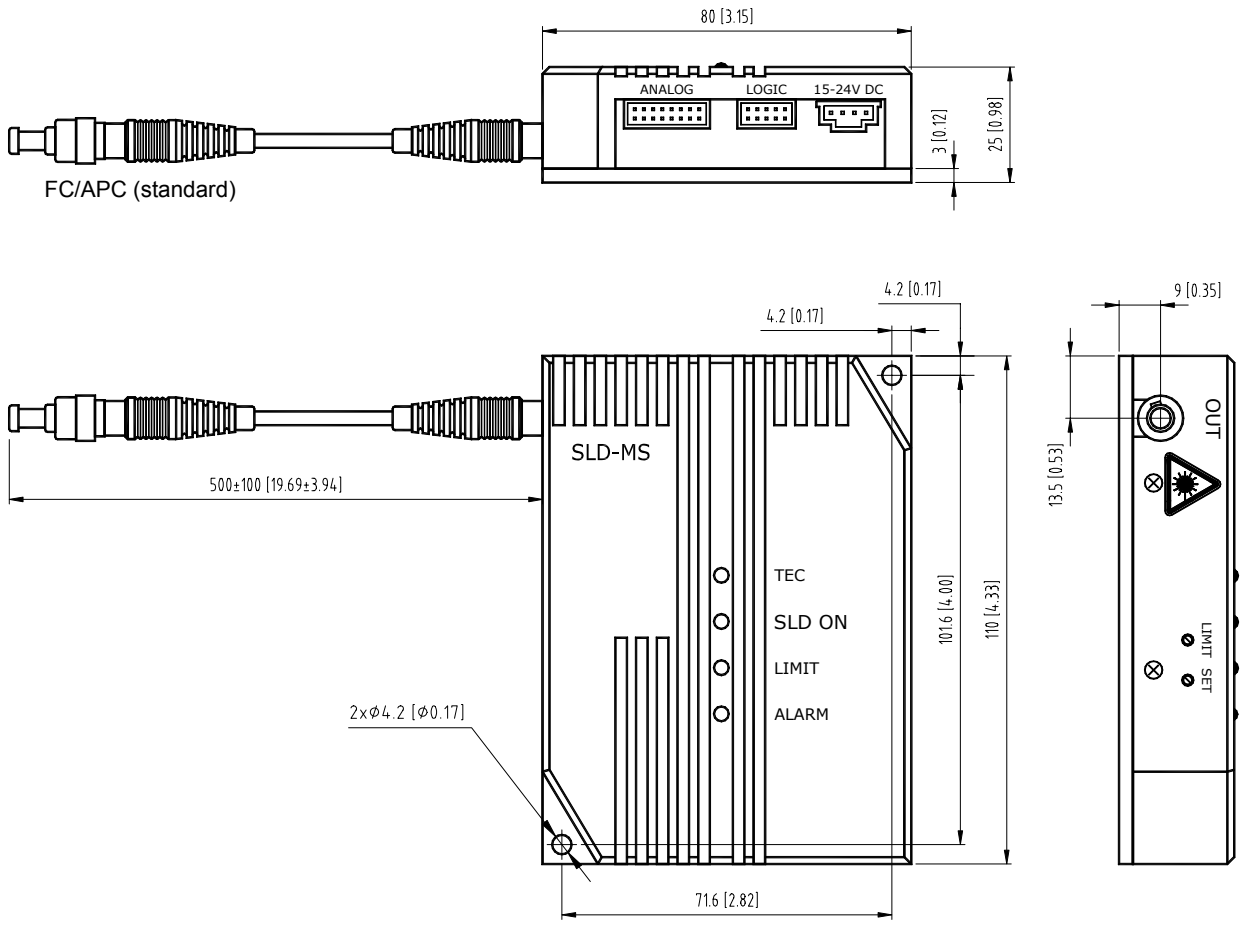


Figure 1. Drawing of SLD-MS light source module. All dimensions are in millimeters [inches]. SET – potentiometer for setting SLD drive current/power in “internal mode”. LIMIT – potentiometer for setting SLD current limit. “TEC”, “SLD ON”, “LIMIT”, “ALARM” – SLD-MS status LEDs.

Electrical connections

Electrical connections of a standard SLD-MS light source are shown in Figure 2 below. Electrical Inputs/Outputs are described in Table 1 below.

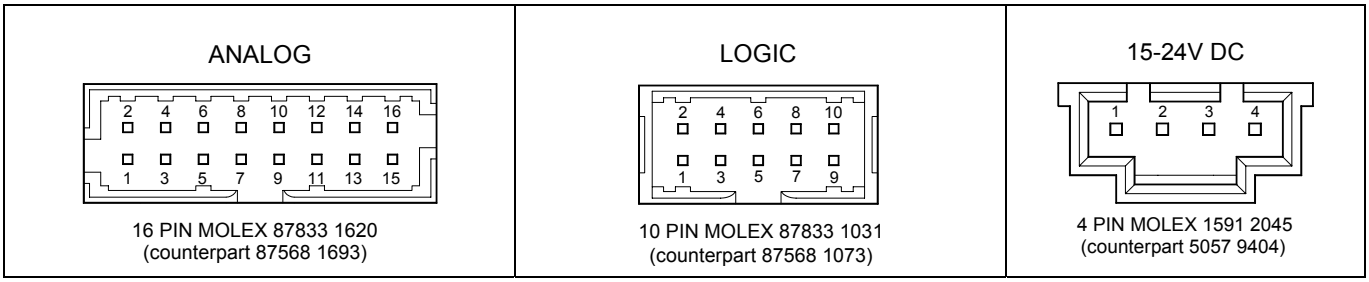


Figure 2. Pin configurations for SLD-MS control ports and power supply connectors.

Detailed description of input/output control and power supply connectors is presented in Table 1 below.

Table 1. Pin function descriptions.

Pin number	Name	IN/OUT	Description/structure
DC power supply input 4 pins MOLEX 1591 2045			
1,2	+15…+24 V	IN	Input DC supply.
3,4	GND		DC supply ground.
***Attention*:** DC supply ground, analog ground and case of SLD MS light source module are connected inside SLD MS unit.			
10 pins MOLEX 87833 1031 "LOGIC CONTROL"			
1	STATUS TEC	OUT	Open collector. Goes to low impedance state when the SLD temperature setpoint is ***NOT*** reached.
3	STATUS SLD	OUT	Open collector. Goes to low impedance state when SLD is ON.
5	STATUS LIM	OUT	Open collector. Goes to low impedance state when the SLD current limit is reached.
7	SLD ON/OFF	IN	SLD ON/OFF; 5 – 15 V, ≥10 mA, SLD is on if 0 V is applied; 200 Ω and LED of optocoupler in series.
9	ALARM	OUT	Open collector. Goes to low impedance state in case of system error
2,4,6,8,10	LOGIC GND		Logic ground.
***Attention*:** It is not recommended to connect logic ground to analog ground as it may result in increased noise.			
16 pins MOLEX 87833 1620 "ANALOG CONTROL"			
1	+5 V STAB	OUT	+5 V indicates that DC power is supplied to SLD MS module; R=10 Ω.
3	SLD I LIMIT	OUT	Analog output — control of set SLD limit.
5	REF OUT	OUT	Output, reference voltage 4.096 V; R= 50 Ω.
7	PD OUT	OUT	Backfacet PD monitor, control of PD monitor current.
9	SLD I SET	IN	SLD set current (ACC), analog input 0-5 V; 1 MΩ.
11	SLD I REAL	OUT	Analog output, control of real SLD current.
13	SLD I SETC	OUT	Analog output, control of set SLD current.
15	TEC I	OUT	Analog output, control of TEC.
2,4,6,8,10,12,14,16	ANALOG GND		Analog ground.
***Attention*:** DC supply ground, analog ground and case of SLD MS light source module are connected inside SLD MS unit.			

Absolute Maximum Ratings

Table 2 below presents absolute maximum ratings of SLD-MS light sources.

Table 2. Absolute maximum ratings*.

Parameter		Value
DC supply voltage		27 V
DC supply peak current		1 A
Optical power		Depends on SLD and pre-set current limit
Voltages -"ANALOG" I/O	"ANALOG" pin 1	4.5 to 5.5 V
Voltages - "ANALOG" I/O	"ANALOG" pins except pin 1	−0.3 to 7 V
Voltages - "LOGIC" I/O	Pin 7 SLD ON/OFF	−5 to 30 V
Voltages - "LOGIC" I/O	Open collectors	50 V
Electric current – "Analog" I/O		10 mA
Electric current – "LOGIC" I/O	Open collectors	100 mA
Electric current – "LOGIC" I/O	Pin 7 SLD ON/OFF	30 mA
Short circuit – "Analog" I/O		2 s maximum
Operating temperature (case)		−20 to +55 °C
Storage temperature		−40 to +85 °C
Relative humidity		75%

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical and Optical Characteristics

Optical parameters of SLD-MS light sources are determined by SLD module used. Optical characteristics of standard models are shown in Table 3 below. Corresponding SLD P/N is referred in the last column. Typical examples of output spectrum are available in the chapter "Performance examples" below. More examples, including coherence functions, may be checked by checking the ratings of corresponding SLD module at http://www.superlumdiodes.com/slds_overview.htm. **Note that any SM-fiber coupled temperature controlled SLD of Superlum may be used in SLD-MS if SLD current does not exceed 250 mA.**

Table 3. Standard models of SLD-MS light sources – optical performance parameters.

Model number	Power, mW	Wavelength, nm	Spectrum width, nm	Ripple, %	Based on SLD-
SLD-MS-261-MP-SM	1.0	680 ± 10	≥ 8	≤ 5	SLD-261-MP2
SLD-MS-381-MP-SM-795	2.0	795 ± 5	≥ 15	≤ 2	SLD-381-MP at 795 nm
SLD-MS-381-MP-SM-830	2.0	830 ± 10	≥ 15	≤ 2	SLD-381-MP at 830 nm
SLD-MS-381-MP-SM-850	2.0	850 ± 10	≥ 15	≤ 2	SLD-381-MP at 850 nm
SLD-MS-371-MP-SM	2.0 min.	840 ± 10	≥ 45	≤ 2	SLD-371-MP
SLD-MS-351-MP-SM	2.0 min.	845 ± 10	≥ 60	≤ 2	SLD-351-MP
SLD-MS-571-MP-SM	1.0	1270 ± 10	≥ 60	≤ 5	SLD-571-MP
SLD-MS-761-MP-SM-1520	1.0	1520 ± 10	≥ 60	≤ 5	SLD-761-MP-1520
SLD-MS-761-MP-SM-1620	1.0	1620 ± 10	≥ 45	≤ 5	SLD-761-MP-1620
Other parameters – all models					
Long-term power stability (8 h)	Better than ±2000 ppm after 0.5 h warming-up at +25±0.1 °C case temp				
Modulation rate	50 kHz; optional up to 100 kHz (TTL ON/OFF)				
Weight	260 g				

Electrical parameters are described in Table 4 below. Scaling coefficients of control outputs are described in Table 5 below.

Table 4. Electrical parameters of SLD-MS sources.

Parameter	Note	Min.	Typ.	Max.	Unit
DC supply voltage *		15	18	24	V
DC supply current**		-	-	0,7	A
DC supply peak current***		-	-	1.0	A
SLD ON/OFF via "LOGIC" I/O	10 mA min.	4.0	5.0	15.0	V

SLD drive current set via “ANALOG” I/O (input)	ACC mode	0.0	-	4.0	V
ANALOG I/O - control of set value of SLD current		0.0	-	4.0	V
ANALOG I/O - real SLD current control (output)		0.0	-	0.4	V
ANALOG I/O – SLD current limit control (output)		0.0	-	4	V
ANALOG I/O – TEC current control (output)		0.0	-	1.5	V
ANALOG I/O – control of real PD monitor current (output)		0.0	-	4.0	V
ANALOG I/O - Reference voltage for control of SLD current	10 mA max.	4.091	4.096	4.100	V
ANALOG I/O – 5 V DC output	10 mA max.	4.9	5.0	5.1	V

* Recommended voltage is 18 V DC.

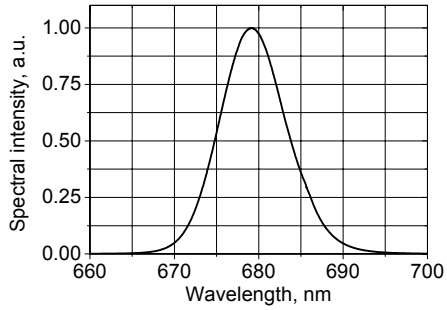
** Different SLDs with different SLD drive current and heat generation may be used in SLD-MS light source modules. 0.7 A maximum current of DC power supplied is required to get stable performance over widest possible range of ambient temperatures when SLD drive current is around 250 mA. Less powerful DC power supplies may be used in case of lower SLD drive currents. 0.3 A is typically required if SLD drive current does not exceed 150 mA, and 0.5 A is typically required for SLDs with drive current around 200 mA.

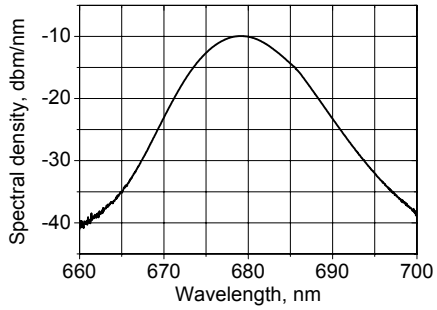
*** Short-term peak current to assure rapid switching-on at temperature extremes.

Table 5. Detailed description of analog outputs (“ANALOG” I/O connector)

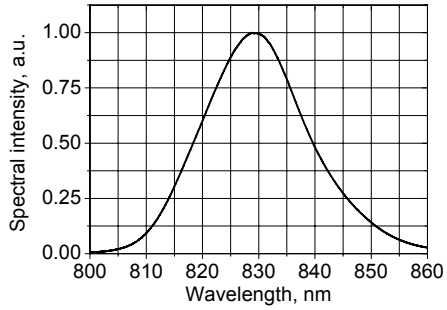
PIN & name	Description	Scale	Voltage	Note
Pin 1, +5 V STAB	+5V DC output	-	5 V	± 2%
Pin 3, SLD I LIMIT	SLD current limit	1 V= 100 mA	0 – 4 V	
Pin 5, REF OUT	Reference output voltage		4.096 V	± 0.5%
Pin 7, PD OUT	PD monitor photocurrent	1 V=1 mA	0 – 4 V	
Pin 11, SLD I REAL	Real current through SLD	1 mV= 1mA	0 – 0.4 V	
Pin 13, SLD I SETC	Set SLD current (ACC)	1 V= 100 mA	0 – 4 V	
Pin 15, TEC I	TEC current	1 V= 1 A	0 – 1.5 V	

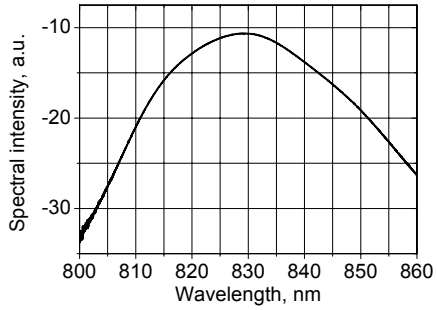
Performance Examples



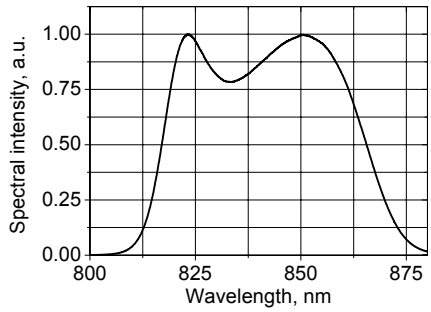


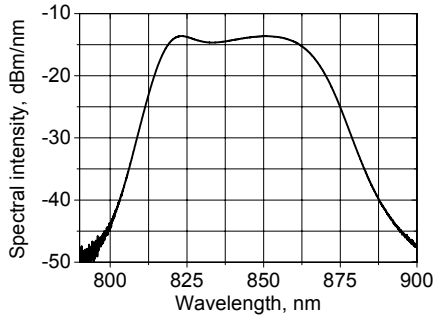
SLD-MS-261-MP. Typical spectrum examples – linear and logarithmic plots of spectral density



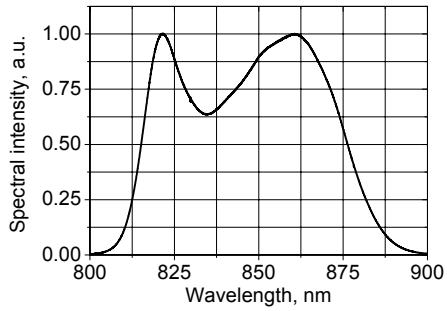


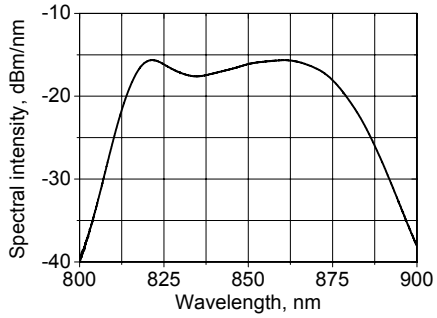
SLD-MS-381-MP-830. Typical spectrum examples – linear and logarithmic plots of spectral density. SLD-MS-381-MP-795 and SLD-MS-381-MP-850 have similar spectra centered around 795 and 850 nm, correspondingly.



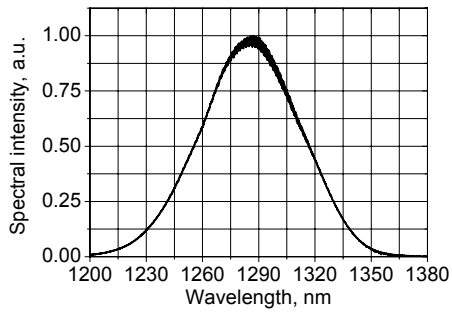


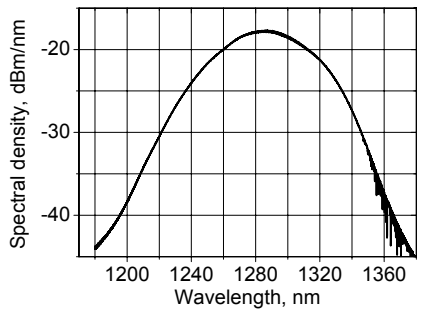
SLD-MS-371-MP. Typical spectrum examples – linear and logarithmic plots of spectral density



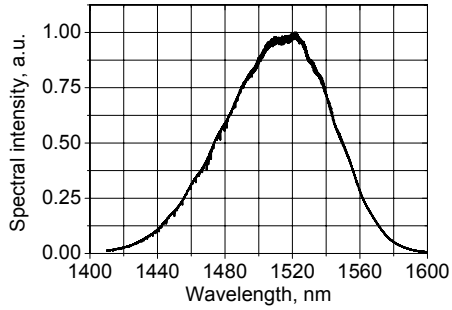


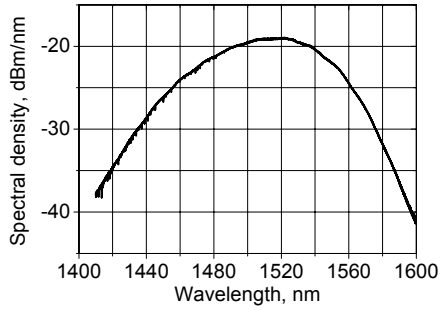
SLD-MS-351-MP. Typical spectrum examples – linear and logarithmic plots of spectral density



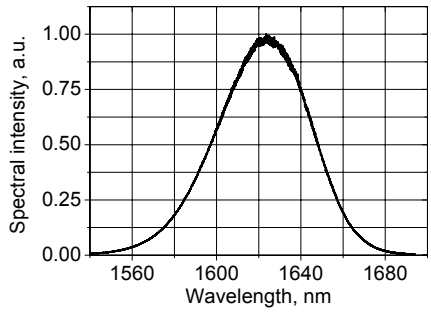


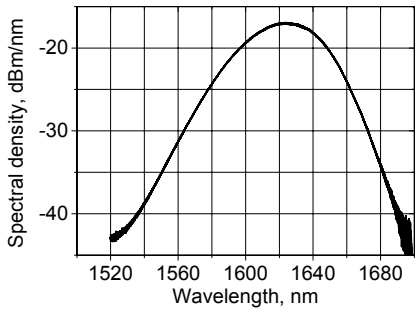
SLD-MS-571-MP. Typical spectrum examples – linear and logarithmic plots of spectral density





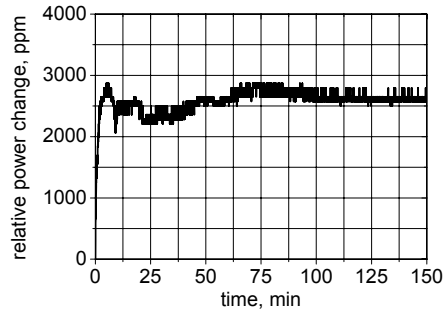
SLD-MS-761-MP-1520. Typical spectrum examples – linear and logarithmic plots of spectral density



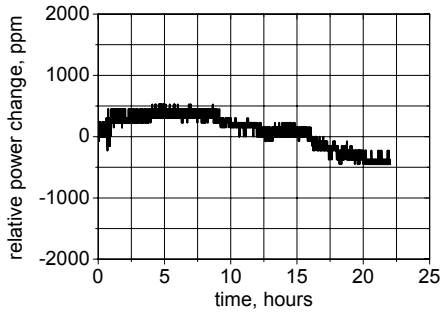


SLD-MS-761-MP-1620. Typical spectrum examples – linear and logarithmic plots of spectral density

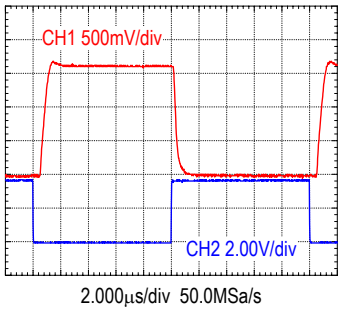
Other performance examples



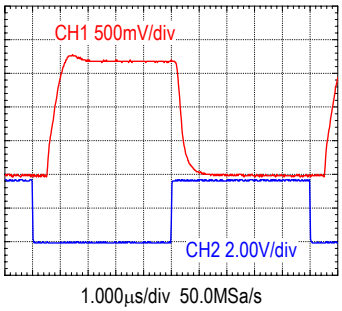
Typical settling – cold start at +25 °C



Typical long-term stability at +25 °C after warming-up



Modulation wavefront 50 kHz (red line – optical power)



Modulation wavefront 100 kHz ("fast modulation" option)

Recommended external control circuits

Standard SLD-MS sources are set to ACC mode and "internal" SLD control, unless other settings are not agreed upon by related documents. It is only necessary to apply DC voltage to get them up and running in this case. SLD drive current and current limit are pre-set at Superlum to ensure optical parameters as specified in Table 3 above. Note that it is recommended to use remote SLD switching on and off as suggested by the circuit diagram shown in Figure 3 below. This allows faster warm-up after DC voltage is applied for the first time, and minimizes SLD switch-on time. It is also recommended to use external control of SLD-MS status as suggested by the diagram shown in Figure 4.

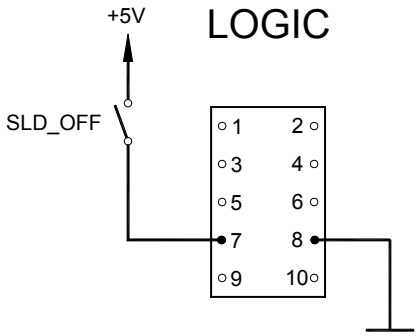


Figure 3. Circuit diagram for remote SLD ON/OFF. "LOGIC" – 10 pin I/O connector of SLD-MS source.

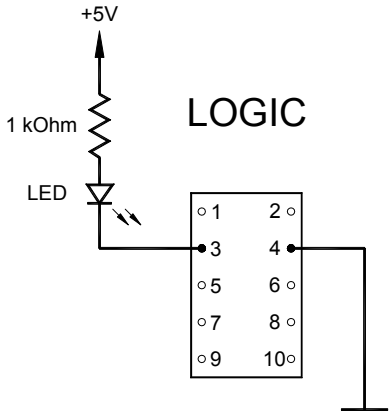


Figure 4. Circuit diagram for remote control of SLD-MS status. "LOGIC" – 10 pin I/O connector of SLD-MS source.

SLD power may be controlled externally by applying voltage to pin 9 of "ANALOG" I/O. Figure 5 shows suggested circuit diagrams for "external" SLD power control by (a) using 5 V DC output of SLD-MS module and (b) applying an external DC voltage. Note that switching to "external mode" requires removing the top cover and changing the position of a switch inside the SLD-MS. It is recommended that the type of setting (INTERNAL or EXTERNAL) is agreed before ordering. Note that fast modulation is not possible via pin 9 of "ANALOG" I/O. Fast modulation is possible only through pin 7 of "LOGIC" I/O.

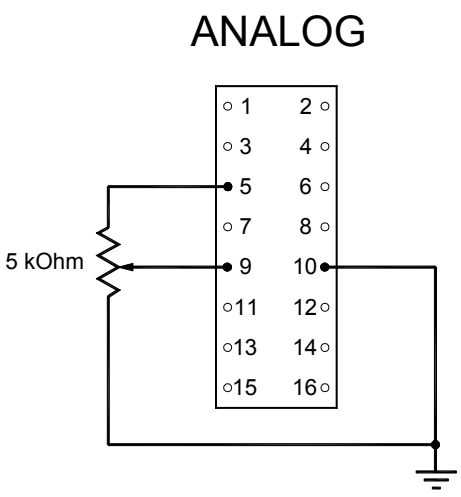


Figure 5 (a). External control of output power using stabilized 4.096 V DC output of SLD-MS.

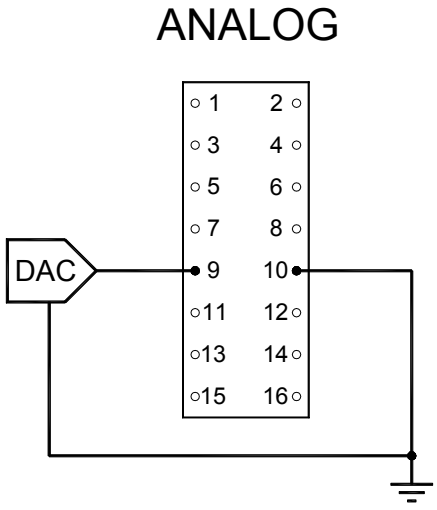


Figure 5 (b). External control of output power using external DC voltage.

Mounting

SLD-MS sources require mounting to an appropriate heatsink and free air circulation around top cover for getting the specified range of operating temperatures. SLD-MS source may be used without a heatsink, but this will reduce operating temperature range. Free air circulation around SLD-MS is required in this case; use of fan-air cooling or other similar measures is a plus in case if SLD-MS is used without any heatsink.

Laser hazard classification

All standard SLD-MS sources except models at 680 nm emit invisible light that may have a potential hazard associated with CLASS 3R of IEC 60825-1 (Edition 2.0; 2007-03). **Non-standard models may be CLASS 3B classified. Please contact Superlum for more details about laser safety classification of custom SLD-MS light sources not referred in Table 3 above before using.**