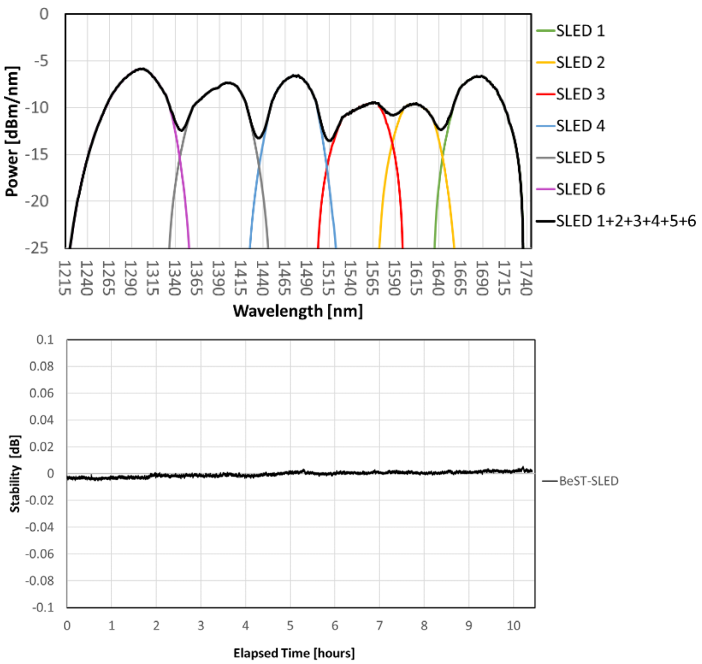
BeST-SLED®

Integrated Spectral Bench (ISB) - Datasheet

Description: Integrated Spectral Bench: 6 SLED's: 1300nm, 1390nm, 1480nm, 1550nm, 1615nm, 1680nm, PM Fiber
Spectral Coverage: 1265nm-1725nm, FWHM: 460nm, CW: 1495nm, Fiber Output Power > 40mW

The Luxmux Broadband source (BeST-SLED®) can be configured with up to 6 light sources combined as a single spectrum product. The system provides individual control of light sources through a digitally controlled interface. The ISB is designed to offer up to 19 spectral combinations, which creates a compact and powerful unit that can widen the performance of its intended application use. Individual SLED performance dashboards are provided for optimum set up calibration as required. The light source is integrated with a high-performance SLED driver and temperature control electronics in a rugged compact package. Power meters can be added for additional monitoring capability.



Luxmux's Spectral Stitching technique of integrating multiple wavelengths into a single broad spectrum is designed for optimum coupling efficiency into a single mode fiber. This brings exceptional flexibility and usability to the sensing marketplace. The BeST-SLED® product lines can be spectrally tailored to suit specific application needs and offer excellent back reflection immunity, better than 35dB. This provides extremely high stability, making these sources ideal for:

- Optical component Testing
- Telecom Test Equipment
- Optical Coherence Tomography
- Optical Sensing
- White Light Interferometry
- Research and Development

KEY FEATURES

- 6 Superluminescent Diodes (SLEDs) in a single package
- All SLEDs can be run from 0 - 100% of maximum rating
- Fiber Coupled Output Power > 40mW
- Bandwidth FWHM > 460nm, @10dB > 490nm
- The best combination of power and spectrum width in multi-SLED modules
- Each SLED comes with a built-in independent monitor photodiode
- Optional: Integrated InGaAs Power Meter
- Internally Optimized for maximum coupling efficiency with PM1550-XP Fiber
- Integrated Optical Isolation (35dB)
- Light Output: FC/APC Connector (Optional FC/PC or SMA)
- CW operation (Excellent Stability < 0.1dB)
- Intensity modulation available
- Custom API available
- USB, RS-232, Ethernet communication
- Spectrum Ripple:
  - Standard Performance < 0.45dB
  - Enhanced Performance < 0.30dB
  - High Performance < 0.15dB
- RIN typical -130dB/Hz
- Operating temperature 0 to 35˚C without additional Heatsink. Provides over temperature protection with internal optical bench temperature monitor
- 12 VDC powered
- Remote operation from a PC/laptop or manual dip switches

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A. ABSOLUTE MAXIMUM RATINGS[1]

Parameter Symbol	Symbol	Condition	Min	Max	Unit
Input Power Supply Voltage	V_S	CW	10	14	V
Input Power Supply Current	I_S	CW	5	-	A
Operating Current SLED 1 – 1680nm SLED 2 – 1615nm SLED 3 – 1550nm SLED 4 – 1480nm SLED 5 – 1390nm SLED 6 – 1300nm SLED 1+2+3+4+5+6 – 1495nm	I_{OP}	CW T_{OP} = 25˚C T_{TEC} = 21˚C	-	 450 350 550 400 450 550 2750	mA
Case Temperature[2]	T_{Case}		0	60	°C
SLED Temperature[2]	T_{SLED}	I_{OP}	0	60	°C
Ambient Operating Temperature[3]	T_{OP}		0	50	°C
TEC Temperature	T_{TEC}	I_{OP}	0	40	°C
TEC Current	I_{TEC}	I_{OP}	-	5	A
Storage Temperature[4]	T_{stg}	No condensation, Unbiased	-40	85	°C
Storage Humidity[4]	RH_{stg}		5	85	%RH
Electro Static Discharge (ESD)	V_{ESD}	Human Body Model	-	500	V

Notes:

1. *Please note that exceeding the Absolute Maximum Ratings above may cause device failure. Luxmux does not bear responsibility for laser power damage that is attributed to electrostatic discharge, excessive current levels, and current spikes (transients).*

   Any attempts to increase the laser drive current above the pre-set limits or recommended specification limits, can damage the device, and nullify the warranty period. It should be emphasized that the current limit set points cannot be exceeded.

2. *T_{Case}, T_{SLED} and T_{TEC} are monitored by internal thermistor with external readout. T_{SLED} thermistor is located only on SLED 6.*

3. *For optimum performance of the Integrated Spectral Bench (ISB), the ISB must be operated within the specified temperature ranges. The BeST-SLED® has an internal thermoelectric coolers (TEC) to remove heat from the light source and dissipate it through the ISB case. It is required to provide free air circulation around the ISB device. It is always recommended to cool down the unit with a fan, and/or to mount the ISB on an appropriate heatsink, capable of dissipating up to 15W. The thermal resistance between ISB metal case and heatsink can be minimized by applying thermal grease, thermal glue or thermal pad between the contact surfaces.* ***When the BeST-SLED® is used without a heatsink, maximum ambient operating temperature is 35˚C.***

4. *Storage temperature and relative humidity should be chosen so the dew point of the humid air around the package is below the storage temperature of the package, to avoid condensation on the package*

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B. OPTICAL AND ELECTRICAL SPECIFICATIONS[5]

Parameter Symbol	Symbol	Condition	Min	Typ	Max	Unit
Input Power Supply Voltage	V_S	CW	10	12	14	V
Input Power Supply Current	I_S	CW	5	-		A
Input Power Supply Voltage Ripple and Noise	γ	CW	-	-	200	mVpp
Center wavelength[6] SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	CWL	CW T_{OP} = 25˚C T_{TEC} = 21˚C	 1670 1605 1540 1470 1380 1290 1485	 1680 1615 1550 1480 1390 1300 1495	 1690 1625 1560 1490 1400 1310 1505	nm
Operating Current SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	I_{OP}	CW T_{OP} = 25˚C T_{TEC} = 21˚C	-	-	 400 300 500 350 400 500 2450	mA
PMF Fiber Coupled Power[7] SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	P	CW T_{OP} = 25˚C T_{TEC} = 21˚C I_{OP}	-	 7.0 5.0 6.0 7.0 7.0 8.0 40.0	 12.0 5.5 6.5 10.5 11.0 16.5 62.0	mW
Bandwidth FWHM[8] SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	B_{FWHM}	CW T_{OP} = 25˚C T_{TEC} = 21˚C I_{OP}	-	 55 45 55 50 60 60 460	-	nm
Bandwidth @-10dB SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	$B_{@10dB}$	CW T_{OP} = 25˚C T_{TEC} = 21˚C I_{OP}	-	 85 70 85 75 95 105 490	-	nm
Spectrum Ripple	R	CW T_{OP} = 25˚C T_{TEC} = 21˚C	< 0.15	< 0.30	< 0.45	dB

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Parameter Symbol	Symbol	Condition	Min	Typ	Max	Unit
Polarization Extinction Ratio[9] SLED 1 SLED 2 SLED 3 SLED 4 SLED 5 SLED 6 SLED 1+2+3+4+5+6	PER	CW T_{OP} = 25˚C T_{TEC} = 21˚C I_{OP}	 20.3 21.0 20.2 20.1 18.3 17.8 19.0	-	-	dB
RIN	RIN		-	< -130	-	dB/Hz
Power Stability (After 1h warm up)		CW T_{OP} = 25˚C T_{TEC} = 21˚C I_{OP}	-	< 0.1	-	dB
Case Temperature[2]	T_{Case}	I_{OP}	0	-	60	°C
SLED Temperature[2]	T_{SLED}	I_{OP}	0	-	60	°C
Ambient Operating Temperature[3, 10]	T_{OP}		0	-	50	°C
TEC Temperature	T_{TEC}	I_{OP}	0	-	40	°C
TEC Current	I_{TEC}	I_{OP}	-	1.5	10	A

Notes:

5. *There may be differences in typical values of output power, power stability, wavelength and bandwidth, due to coupling efficiency. These values are references and there is no guarantee that each particular ISB module will have EXACTLY the typical values shown on the previous chart.*
6. *Center Wavelength is defined as the center point of the 3dB bandwidth of each induvial SLED.*
7. *The ISB – Integrated Spectral Bench uses a Dual Stage Isolator for back reflection protection. Isolators are used to protect a source from back reflections or signals that may occur after the isolator. Back reflections can damage a laser source or cause it to amplitude modulate, or frequency shift. In high-power applications, back reflections can cause instabilities and power spikes. Luxmux does not bear responsibility for laser power damage that is attributed to hot spots in the beam.*
8. *BeST-SLED® FWHM is defined as the bandwidth from the lowest spectral dip, when all the SLEDs are on.*
9. *Polarization Extinction Ration is defined as the ratio of optical powers of perpendicular polarizations, expressed in decibels (dB).*
10. *The specification lists the operating temperature for the electrical/optical characteristics, which is the temperature of the ISB during the time that the specifications were measured. Variation in temperature beyond what is specified can have a significant effect on the optical characteristics, like changes in wavelength or drop in output power.*

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C. PLOTS – Test performed at T_{OP}=25°C and T_{TEC}=21°C

FIG. 1: ISB SPECTRUM

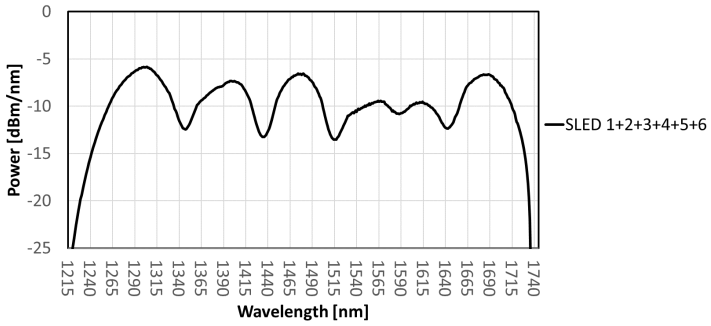


FIG. 2: ISB POWER STABILITY

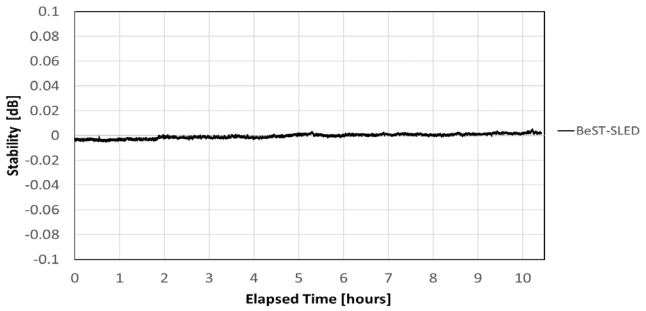


FIG. 3: SLED 1 SPECTRUM

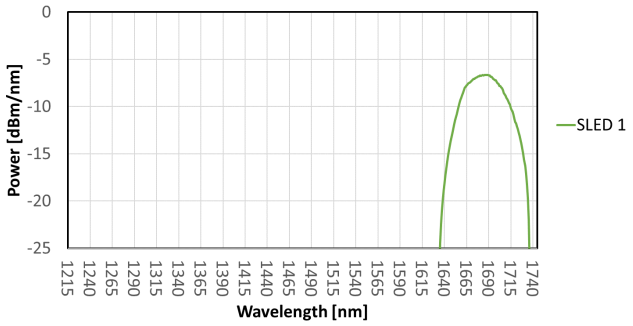


FIG. 4: SLED 2 SPECTRUM

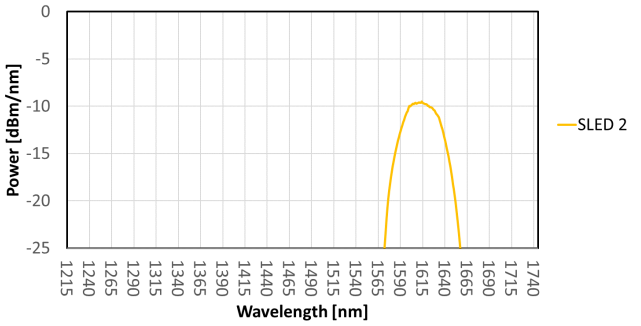


FIG. 5: SLED 3 SPECTRUM

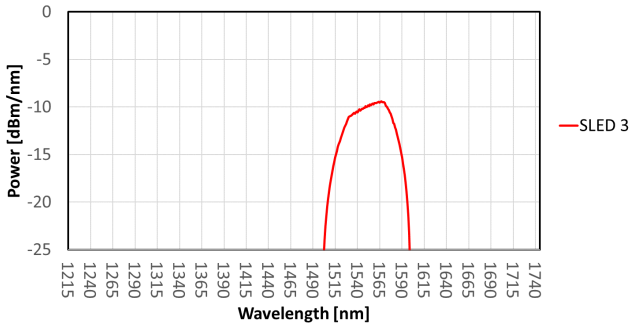


FIG. 6: SLED 4 SPECTRUM

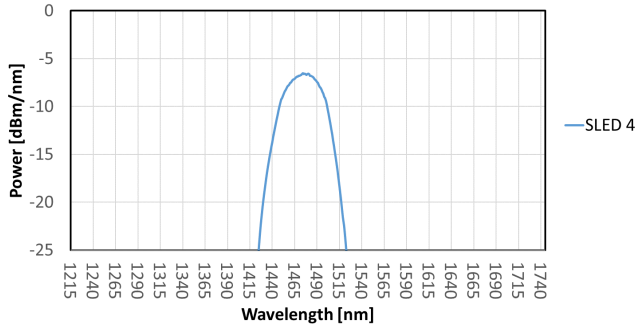


FIG. 7: SLED 5 SPECTRUM

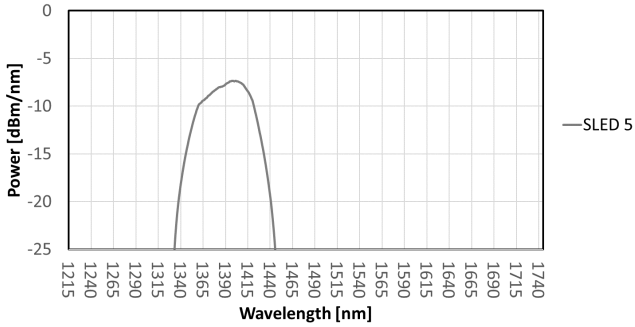


FIG. 8: SLED 6 SPECTRUM

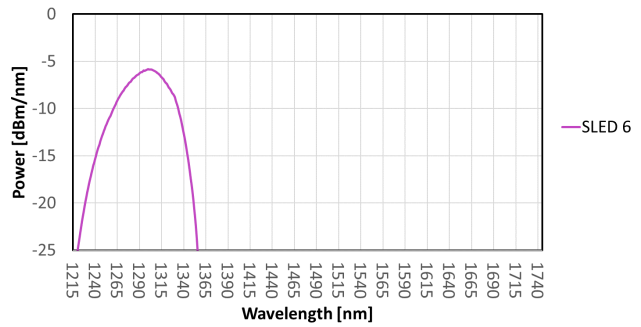


FIG. 9: SLED 1 OUTPUT POWER VS CURRENT

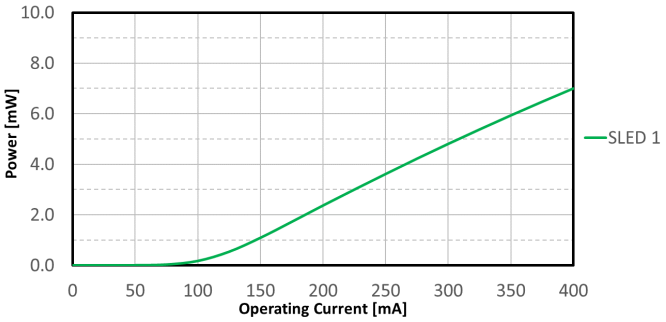


FIG. 10: SLED 2 OUTPUT POWER VS CURRENT

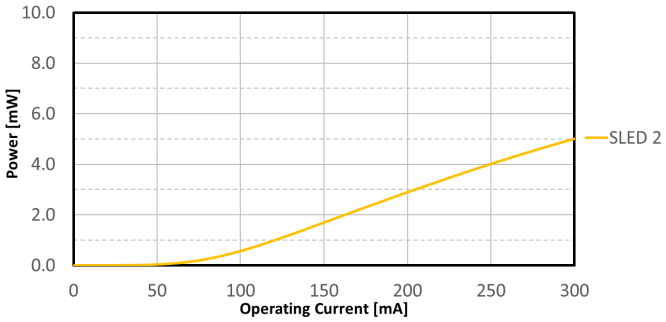


FIG. 11: SLED 3 OUTPUT POWER VS CURRENT

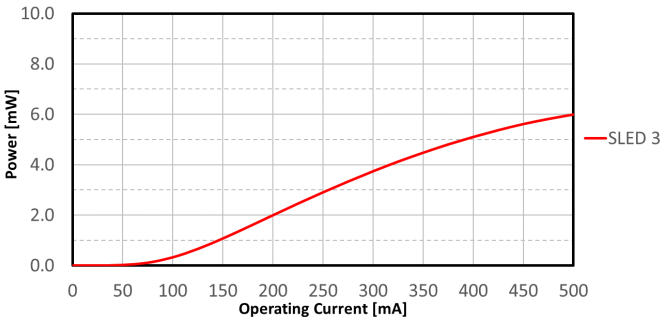


FIG. 12: SLED 4 OUTPUT POWER VS CURRENT

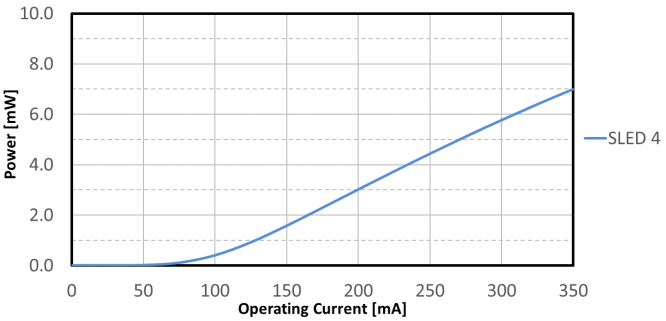


FIG. 13: SLED 5 OUTPUT POWER VS CURRENT

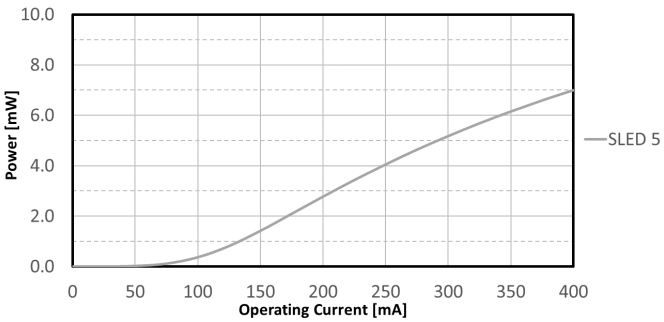
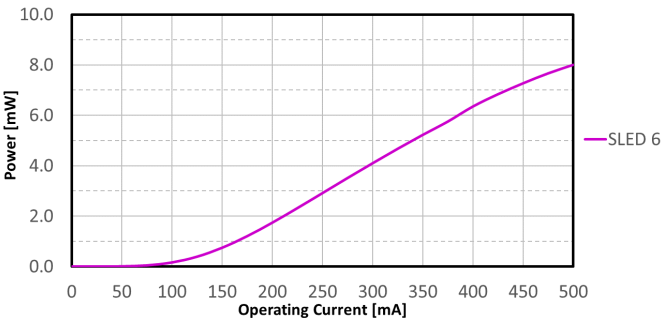
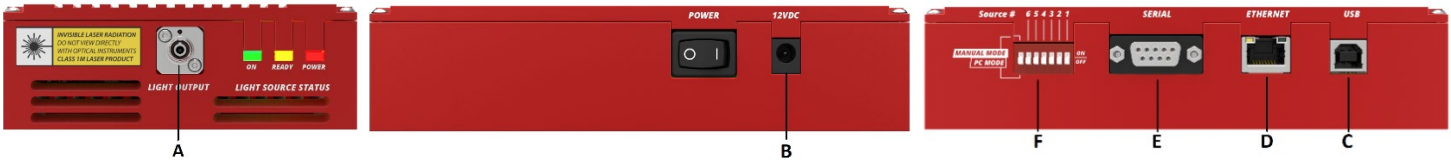


FIG. 14: SLED 6 OUTPUT POWER VS CURRENT

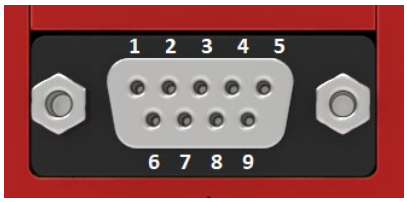


D. CONNECTORS



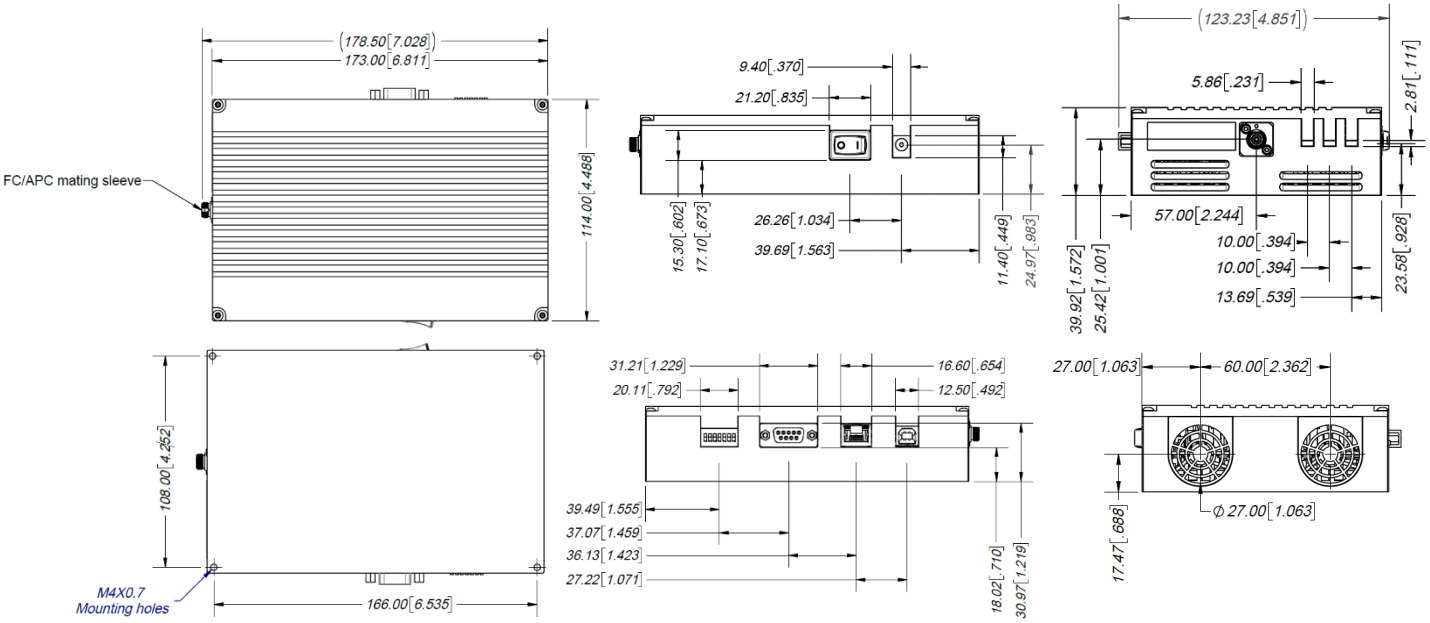
Item	Description
A	FC/APC Connector (Optional: FC/PC, SMA)
B	Power Barrel Connector Jack 2.00mm ID, 5.50mm OD, 9.5 mm Length. Center Positive ⊖—◉—⊕ Input: AC 100-240V Output: 12V 5V min
C	USB 2.0 Type B
D	RJ45 for MODBUS TCP/IP Communication
E	D-SUB 9 Positions for RS-232 Communication
F	Switches to change between PC Mode - Manual Mode and to turn SLEDs on when operating in Manual Mode

D-Sub Connector Pin Out



Pin #	Function RS-232
1	Not used
2	Tx
3	Rx
4	Not used
5	GND
6	Not used
7	Not used
8	Not used
9	Not used

E. MECHANICAL DIAGRAM



F. SAFETY

All statements regarding safety of operation and technical data will only apply when the unit is operated correctly.

The driver must not be operated in environments susceptible to explosion hazards. Do not obstruct the air ventilation slots. If any parts of the driver, or electronics are broken or exposed, contact Luxmux technical support and do not attempt to operate the unit.

The BeST-SLED® Integrated Spectral Bench (ISB) is a Class 1M laser product. It is safe for all conditions of use except when passed through magnifying optics such as microscopes and telescopes. It produces a beam that is divergent. If light is re-focused use protective eye wear.

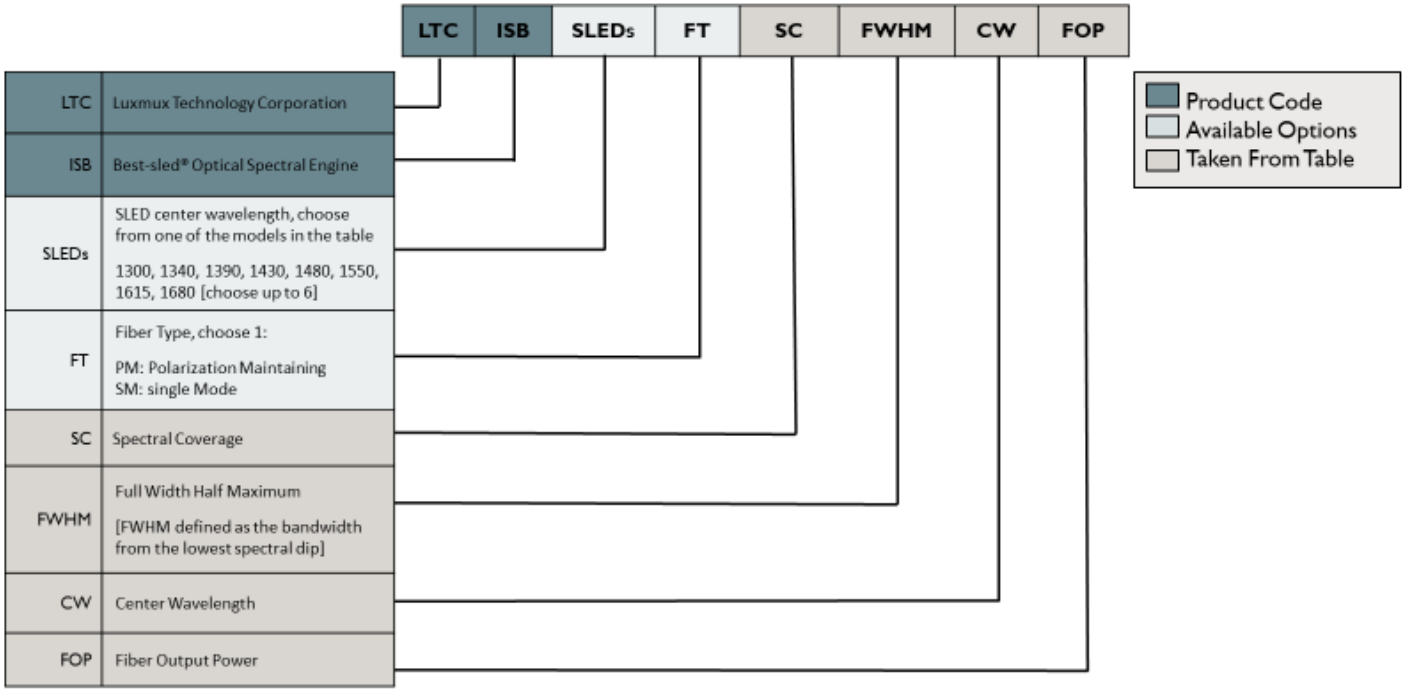
G. APPLICATION PROTOCOL INTERFACE (API)

Luxmux's driver utilizes the MODBUS Protocol for communications. Users can find numerous detailed specifications for the protocol on the internet. MODBUS is used widely in industrial applications. The driver is designed to use this protocol over all of its communication interfaces, MODBUS – RTU is a master/slave protocol and is employed by the USB or RS232 port, and MODBUS - TCP/IP is a client/server protocol and is employed by the Ethernet Interface.

The MODBUS specification has outlined how a user can adapt the overall packet structure to suit each interface requirement. The primary section of a MODBUS packet is known as the Protocol Data Unit (PDU) and it is independent of the underlying communication interface. The PDU includes additional byte fields for the MODBUS transaction per the Application Data Unit (ADU).

A high-level overview of MODBUS Protocol can be found on the BeST-SLED® Integrated Spectral Bench User Manual. If users want to develop their own API, the ISB Register Map is available upon request. Please contact technical support: techsupport@luxmux.com

H. ORDERING CODE



Ordering Code: LTC-ISB-(SLEDS)-(FT)-(SC)-(FWHM)-(CW)-(FOP)	SLEDs [nm]	FT	SC [nm]	FWHM [nm]	CW [nm]	FOP [mW]
LTC-ISB-1615_1680-PM-1575_1725-150-1650-12	1615, 1680	PM	1575 - 1725	150	1650	12
LTC-ISB -1480_1550_1615-PM-1435_1640-205-1538-18	1480, 1550, 1615	PM	1435 - 1640	205	1538	18
LTC-ISB-1340_1390_1430-PM-1310_1465-155-1388-20	1340, 1390, 1430	PM	1310 - 1465	155	1388	20
LTC-ISB-1300_1340_1390_1430-PM-1265_1465-200-1365-25	1300, 1340, 1390, 1430	PM	1265 - 1465	200	1365	25
LTC-ISB-1480_1550_1615_1680-PM-1435_1725-290-1580-25	1480, 1550, 1615, 1680	PM	1435 - 1725	290	1580	25
LTC-ISB-1300_1340_1390_1430_1480-PM-1265_1500-235-1383-35	1300, 1340, 1390, 1430, 1480	PM	1265 - 1500	235	1383	35
LTC-ISB-1340_1390_1430_1480_1550-PM-1305_1605-300-1455-35	1340, 1390, 1430, 1480, 1550	PM	1305 - 1605	300	1455	35
LTC-ISB-1300_1390_1480_1550_1615_1680-PM-1265_1725-460-1495-40	1300, 1390, 1480, 1550, 1615, 1680	PM	1265 - 1725	460	1495	40
LTC-ISB-1480_1550-PM-1435_1605-170-1520-10	1480, 1550	PM	1435 - 1605	170	1520	10
LTC-ISB-1340_1390_1430_1480_1550_1615-PM-1310_1640-330-1475-40	1340, 1390, 1430, 1480, 1550, 1615	PM	1310 - 1640	330	1475	40
LTC-ISB-1300_1340_1390_1430_1480_1550-PM-1265_1605-340-1435-40	1300, 1340, 1390, 1430, 1480, 1550	PM	1265 - 1605	340	1435	40
LTC-ISB-1430_1480_1550-PM-1410_1605-195-1508-15	1430, 1480, 1550	PM	1410 - 1605	195	1508	15
LTC-ISB-1300_1340_1390-PM-1265_1420-155-1343-15	1300, 1340, 1390	PM	1265 - 1420	155	1343	15
LTC-ISB-1390_1430_1480-PM-1355_1500-145-1428-15	1390, 1430, 1480	PM	1355 - 1500	145	1428	15
LTC-ISB-1550_1615_1680-PM-1515_1725-210-1620-15	1550, 1615, 1680	PM	1515 - 1725	210	1620	15
LTC-ISB-1300_1340-PM-1265_1365-100-1315-10	1300, 1340	PM	1265 - 1365	100	1315	10
LTC-ISB-1390_1480_1550-PM-1340_1610-270-1475-15	1390, 1480, 1550	PM	1340 - 1610	270	1475	15
LTC-ISB-1300_1390_1480-PM-1265_1500-235-1383-15	1300, 1390, 1480	PM	1265 - 1500	235	1383	15
LTC-ISB-1390_1480_1550_1615_1680-PM-1340_1725-385-1533-35	1390, 1480, 1550, 1615, 1680	PM	1340 - 1725	385	1533	35

Ordering Code: LTC-ISB-(SLEDS)-(FT)-(SC)-(FWHM)-(CW)-(FOP)	SLEDs [nm]	FT	SC [nm]	FWHM [nm]	CW [nm]	FOP [mW]
LTC-ISB-1615_1680-SM-1575_1725-150-1650-12	1615, 1680	SM	1575 - 1725	150	1650	12
LTC-ISB -1480_1550_1615-SM-1435_1640-205-1538-18	1480, 1550, 1615	SM	1435 - 1640	205	1538	18
LTC-ISB-1340_1390_1430-SM-1310_1465-155-1388-20	1340, 1390, 1430	SM	1310 - 1465	155	1388	20
LTC-ISB-1300_1340_1390_1430-SM-1265_1465-200-1365-25	1300, 1340, 1390, 1430	SM	1265 - 1465	200	1365	25
LTC-ISB-1480_1550_1615_1680-SM-1435_1725-290-1580-25	1480, 1550, 1615, 1680	SM	1435 - 1725	290	1580	25
LTC-ISB-1300_1340_1390_1430_1480-SM-1265_1500-235-1383-35	1300, 1340, 1390, 1430, 1480	SM	1265 - 1500	235	1383	35
LTC-ISB-1340_1390_1430_1480_1550-SM-1305_1605-300-1455-35	1340, 1390, 1430, 1480, 1550	SM	1305 - 1605	300	1455	35
LTC-ISB-1300_1390_1480_1550_1615_1680-SM-1265_1725-460-1495-40	1300, 1390, 1480, 1550, 1615, 1680	SM	1265 - 1725	460	1495	40
LTC-ISB-1480_1550-SM-1435_1605-170-1520-10	1480, 1550	SM	1435 - 1605	170	1520	10
LTC-ISB-1340_1390_1430_1480_1550_1615-SM-1310_1640-330-1475-40	1340, 1390, 1430, 1480, 1550, 1615	SM	1310 - 1640	330	1475	40
LTC-ISB-1300_1340_1390_1430_1480_1550-SM-1265_1605-340-1435-40	1300, 1340, 1390, 1430, 1480, 1550	SM	1265 - 1605	340	1435	40
LTC-ISB-1430_1480_1550-SM-1410_1605-195-1508-15	1430, 1480, 1550	SM	1410 - 1605	195	1508	15
LTC-ISB-1300_1340_1390-SM-1265_1420-155-1343-15	1300, 1340, 1390	SM	1265 - 1420	155	1343	15
LTC-ISB-1390_1430_1480-SM-1355_1500-145-1428-15	1390, 1430, 1480	SM	1355 - 1500	145	1428	15
LTC-ISB-1550_1615_1680-SM-1515_1725-210-1620-15	1550, 1615, 1680	SM	1515 - 1725	210	1620	15
LTC-ISB-1300_1340-SM-1265_1365-100-1315-10	1300, 1340	SM	1265 - 1365	100	1315	10
LTC-ISB-1390_1480_1550-SM-1340_1610-270-1475-15	1390, 1480, 1550	SM	1340 - 1610	270	1475	15
LTC-ISB-1300_1390_1480-SM-1265_1500-235-1383-15	1300, 1390, 1480	SM	1265 - 1500	235	1383	15
LTC-ISB-1390_1480_1550_1615_1680-SM-1340_1725-385-1533-35	1390, 1480, 1550, 1615, 1680	SM	1340 - 1725	385	1533	35

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