SUPERLUM ™

Users Manual

Driver Pilot4-PCB

Board Level Current and Temperature Controller.

SUPERLUMINESCENT DIODE DRIVING KIT

General Information

This manual contains Operation, Specifications and Installation guidelines of Pilot4-PCB driver.

The Pilot4-PCB driver offers precise low-noise, high stability current and temperature control for SLD modules with built-in peltier cooler. The Pilot4-PCB provides the flexibility of a mountable circuit board and is valid, efficient solution for customized OEM applications.

IMPORTANT: Pilot4-PCB is developed exclusively for driving of cooled (i.e. with internal cooler and thermistor) SLD modules of Superlum. Use with other types of modules, or with modules from other manufacturers may result in catastrophic failure of such modules. Superlum has no liability for any damages of this kind.

General Description

Pilot4-PCB provides:

- Driving of all types of cooled modules of Superlum.
- Stabilization of SLD temperature at any value within 0°C to +40°C range (no water condensing),
- Stabilization of SLD current in the range from 5 mA to 400mA.
- Readout of set and real values of SLD stabilization temperature, SLD current, SLD current limit, and PD monitor photocurrent.
- High power and low power operation modes.

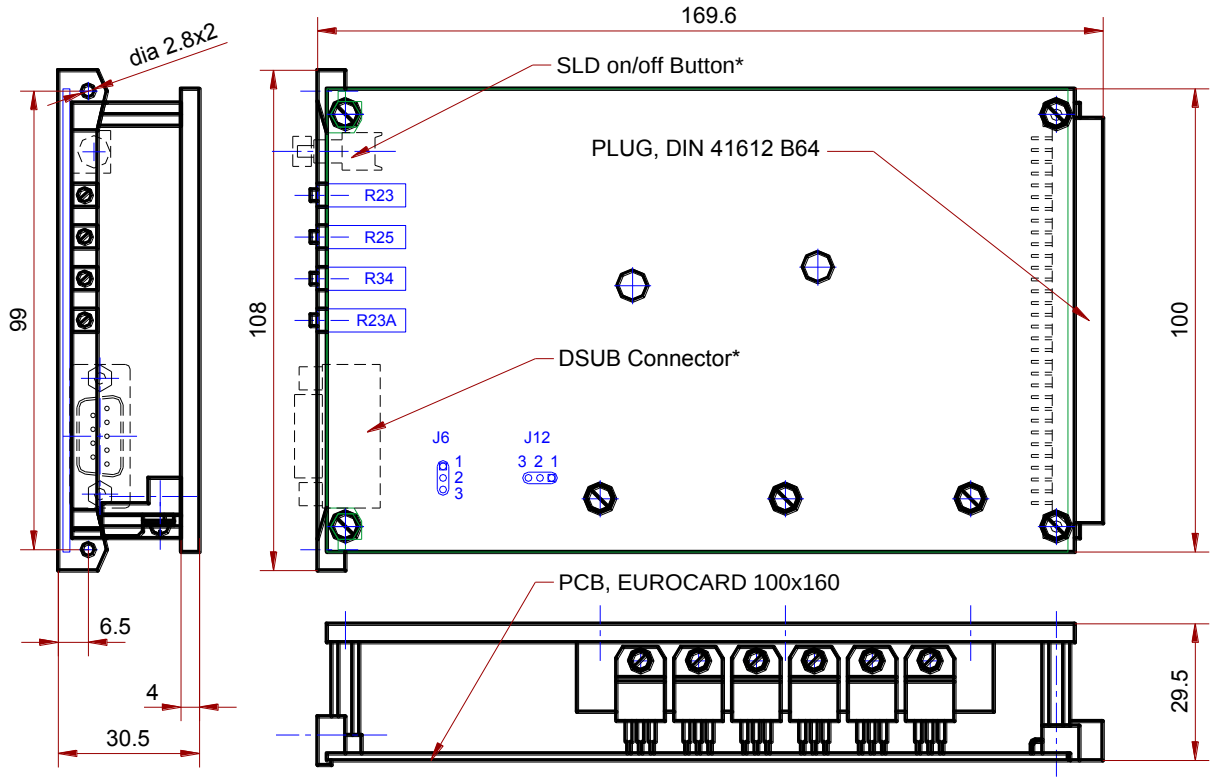


Fig. 1

Connection

Driver and SLD control is done via connector X1 (type DIN 41612 B64).
Elements marked by asterisk (front D-SUB connector and SLD on/off pushbutton) can be added upon request.

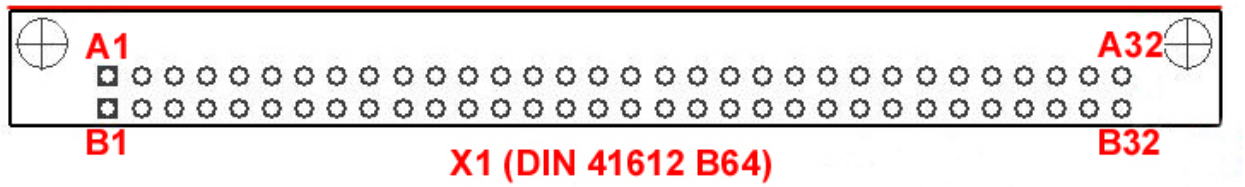


Fig. 2. X1 connector

Table 1. Pinning of X1 connector

pin	Marking	Description
A1, B1, A2, B2	+9V	“+” input for 9,0 ± 0,5 V supply.
A3, B3	I_SLD_SET	Output, set SLD current (ACC mode)/set value of PD monitor photocurrent (APC mode)
A4		Do not use for external connections
B4	TEC_GOOD	Output, temperature control status (OK or failure)
A5	IPWR	”+” Power supply to control inputs/outputs
B5	SLD_GOOD	Output – SLD status; (0 V – SLD on, +U – SLD off)
A6	MODE	Output – SLD mode (High Power/Low Power) (0 V – Low power, +U – High Power)
B6	SLD_LIMIT	Output – SLD current limit status (+U – SLD current below limit, 0 V – SLD current limited by current limit)
A7		Do not use for external connections
B7	SLD_ERROR	SLD overall status (0 V – system fine, +U – error)
A8, B8	LIMIT_SET	Control output, SLD current limit
A9, B9	ICOM	Common: Power supply to control Inputs/Outputs
A10, B10	I_SLD_REAL	Control output, real SLD current value
A11, B11	SLD_ANODE	To SLD module - SLD anode
A12, B12	SLD_CATHODE	To SLD module - SLD cathode
A13, B13		Do not use for external connections
A14, B14	PD_ANODE	To SLD module: PD monitor anode
A15, B15		Do not use for external connections
A16, B16	PD_CATHODE	To SLD module: PD monitor anode
A17, B17	PD_REAL	Control output, PD monitor photocurrent
A18, B18	T_SET	Control output – thermistor set value
A19, B19	T_REAL	Control output – thermistor set value
A20, B20	THERM	To SLD module - thermistor
A21, B21	TEC_ANODE	To SLD module – TEC anode
A22, B22	SLD_ON/OFF	Control input, SLD on/off triggering
A23, B23	MODE_SW	Control input, SLD power switching (High Power ←→ Low Power)
A24, B24	THERM_GND	To SLD module - thermistor
A25, B25	MGND	Ground to be used for measurement
A26, B26	TEC_CATHODE	To SLD module – TEC cathode
A27-A30, B27-B30		Do not use for external connections
A31, B31, A32, B32	COM	COMMON – 9 V DC power supply

*DSUB female connector allows operating SLD module from the front panel. See drawing and pin-outs of connector on fig.3.

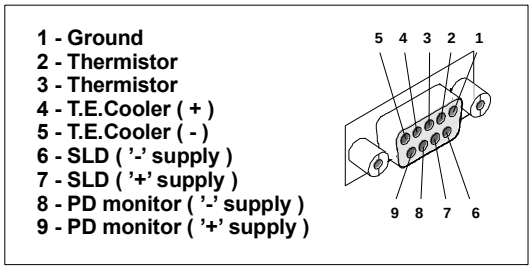


Fig.3.

Recommended typical connection to control circuit via X1.

Recommended connection of PILOT-4-PCB to external control circuit is shown on the Fig.4. It allows "SLD on/off" and "Low Power/High power" switching and control of SLD+driver system status.

SLD is triggered on/off by applying NEGATIVE pulse with 50 ms duration and amplitude not exceeding -5V applied to "SLD_ON/OFF" pins A22, B22 of X1 as shown on Fig.4.

Switching across "Low Power/High Power" mode is done by NEGATIVE pulse with 50 ms duration and amplitude not exceeding -5V applied to "MODE_SW" as shown on Fig.4.
Important: Switching across "Low Power/High Power" mode is possible ONLY when SLD is OFF.

System status may be checked in accordance with the Table 2 below.

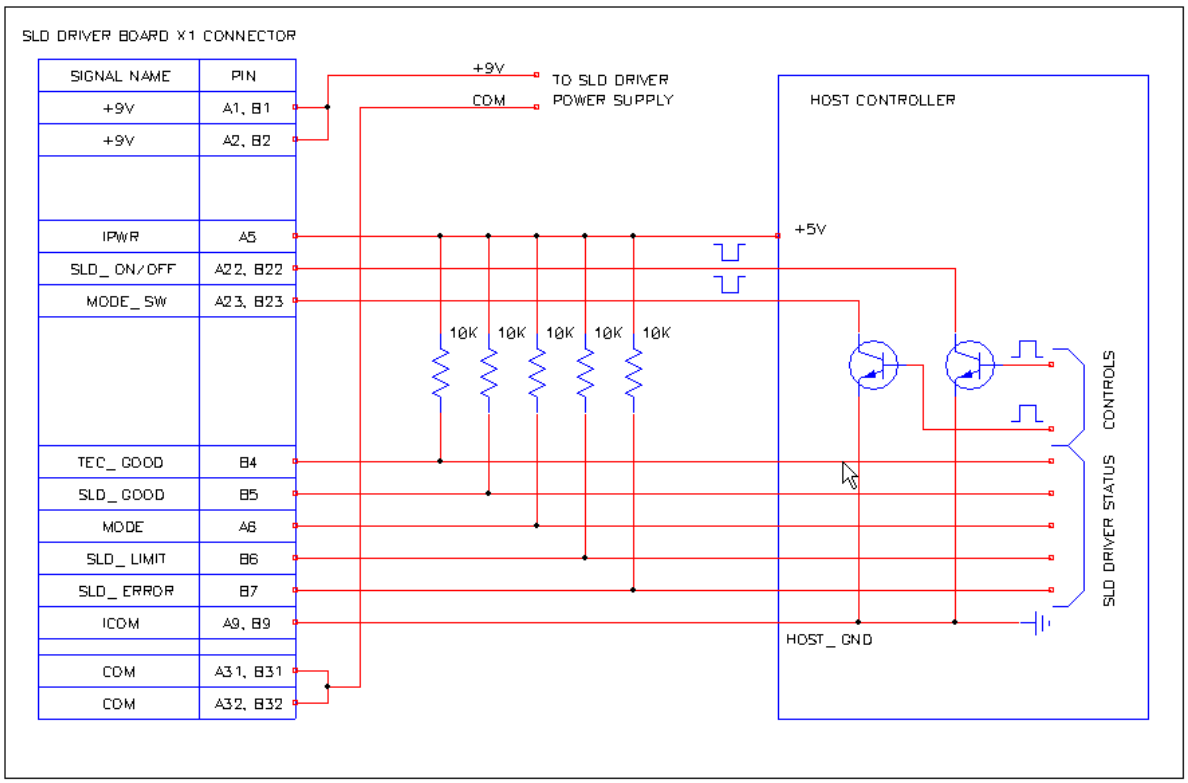


Fig. 4. Recommended connections to control circuit via X1

Table 2: system status signals.

Signal	Status	Description
TEC_GOOD	0 V + 5 V	SLD temperature OK SLD temperature is not OK
SLD_GOOD	0 V + 5 V	SLD emitter ON (direct current applied to SLD) SLD emitter OFF (direct current not applied to SLD)
MODE	+ 5 V 0 V	“High Power” SLD operation mode “Low Power” SLD operation mode
SLD_LIMIT	0 V + 5 V	SLD current equals to set value of SLD current limit SLD current below set value of SLD current limit
SLD_ERROR	0 V + 5 V	System alarm* (see para 8 of this manual for details) System OK (note SLD emitter may be either ON or OFF)

Operation.

Set of Pilot4-PCB operation mode

Pilot4-PCB allows both constant current (ACC) and constant power (APC) SLD emitter operation. Standard operation mode is ACC.
Important: APC mode is possible only in SLD modules with integrated PD monitor.

Pilot4-PCB operation mode is switched by jumpers J6 and J12 (see Fig. 1) accordingly to Table 3 below.

Table 3 – Positions of Jumpers for selection of Pilot4-PCB operation mode.

Operation mode	Jumper J6	Jumper J12
ACC	2-3	2-3
APC	1-2	1-2

Control of set and real SLD parameters.
In Pilot4-PCB SLD module parameters are set by potentiometers R23, R23A R25 and R34 and may be controlled via correspondent outputs (See Fig. 1 and Table 1). All measurements must be done by DC multimeter with input resistance 10 MOhm minimum.

Measurement of SLD current set value (ACC mode)
Connect multimeter to A3 (B3) and A25 (B25) of X1 (be sure in proper polarity). Use R23 to set SLD current for “High power” SLD operation mode and R23A to set SLD current for “Low Power” SLD operation mode.
1 mV corresponds to 1 mA of SLD current [set I_{sld} (mA) = U(A3) (mV)]

Measurement of PD monitor photocurrent set value (APC mode)
Connect multimeter to A3 (B3) and A25 (B25) of X1 (be sure in proper polarity). Use R23 to set PD monitor current for “High power” SLD operation mode and R23A to set PD monitor current for “Low Power” SLD operation mode.
1 mV corresponds to 10 μA of PD monitor photocurrent [set I_{pd} (μA)=U(A3)(mV)$\times$10]

Measurement of real SLD current set value
Connect multimeter to A10 (B10) and A25 (B25) of X1 (be sure in proper polarity).
1 mV corresponds to 1 mA of SLD current [real I_{sld} (mA) = U(A10) (mV)]

Measurement of SLD current limit set value
Connect multimeter to A8 (B8) and A25 (B25) of X1 (be sure in proper polarity). Use R25 to set SLD current limit.
1 mV corresponds to 1 mA of SLD current limit [Limit I_{sld} (mA) =U(A8) (mV)].

Measurement of thermistor set value
Connect multimeter to A18 (B18) and A25 (B25) of X1 (be sure in proper polarity). Use R34 to set thermistor value required.
1 V corresponds to 10000 Ohm thermistor set value [set R_{th}(Ohm)=10000×U(A18) (V)]

Measurement of real thermistor value
Connect multimeter to A19 (B19) and A25 (B25) of X1 (be sure in proper polarity).
1 V corresponds to 10000 Ohm thermistor value [real R_{th} (Ohm)=10000×U(A18) (V)]

Measurement of PD monitor photocurrent real value
Connect multimeter to A17 (B17) and A25 (B25) of X1 (be sure in proper polarity). Use R23 to set SLD current for “High power” SLD operation mode and R23A to set SLD current for “Low Power” SLD operation mode.
1 mV corresponds to 10 μA of PD monitor photocurrent [real I_{pd} (μA)= U(A3)(mV)×10]

Recommended setup.

1. Obtain X1 connections to control circuit as recommended on the Fig.3 or similar.

2. Obtain connections to SLD control outputs.

Important: DO NOT OBTAIN CONNECTIONS TO SLD MODULE.

3. Apply 9 V DC.

ATTENTION! Pilot4-PCB must be powered by 9+/-0,5 V, 2 A maximum DC supply. Supply pulsations at 2 A supply current must not exceed 20 mV (amplitude) at 0-20 MHz. It is not recommended to use SMPS power supply. Recommended DC supply is power transformer with linear stabilizer.

4. Set stabilization temperature.

Make sure that the set value of thermistor corresponds to the nominal SLD stabilization temperature as indicated on Acceptance Test Report (ATR) supplied with every SLD module. If necessary, change set value by potentiometer R34.

Resistance vs. Temperature (Celsius) dependence on 10K3CG2 type thermistor of BetaTherm Ltd. (standard used in Superlum modules).

T,°C	10	12	15	20	25	30
R, kΩ	19.90	18.09	15.71	12.49	10.00	8.06

5. Set current limit for particular module using potentiometer R25.

6. Set “Low power” and “High power” SLD currents.

Recommended “Low power” SLD current should not exceed ½ from maximum SLD current of MP (Medium Power) category.
Recommended “High power” SLD current should not exceed 0.1 from maximum SLD current of HP (High Power) category.
High power SLD current is preset in accordance with particular application but should not exceed maximum operating current listed in ATR for SLD module.
Use R23 for “High power” SLD operation mode and R23A to set SLD current for “Low Power” SLD operation mode.

7. Obtain connections to SLD module ensuring correct fit.

8. Check system status signals according with Table 2 of this description. Be sure that:

- SLD temperature is good. The “TEC_GOOD” signal should be “0 V”.
- SLD operation mode is “Low Power”. The “MODE” signal is “0 V”.
- “SLD_ERROR” signal is “5 V” (System OK).

Important: send one “SLD_ON/OFF” pulse to driver if “SLD_ERROR” signal is “0 V” (system alarm). After this procedure “SLD_ERROR” signal should goes to “5 V” (system OK)

***** “System Alarm” signal always appears after you apply 9 V DC supply to non-powered driver. This is normal. If it appears due to any other reason, especially when drive current was supplied to SLD, this indicates on system problems. More likely, the reason is lost connections to SLD module, or instability of supply voltage or similar. The reason for “System Alarm” MUST be clarified and fixed BEFORE you start SLD next time.

9. Send the second “SLD_ON/OFF” pulse to turn on SLD module. After applying the second “SLD_ON/OFF” pulse “SLD_GOOD” signal goes to “0 V” (direct current applied to SLD emitter)

Check output power and PD monitor photo current (if available). If you see more than 5 percent difference between actual values of either output power or PD monitor current with respect to ATR values, switch SLD off and find out the reason. **Never switch SLD to “High Power” mode till the reason of difference will be clear as it may damage SLD module.**

If measured values are the same as on the ATR, apply “High power” current to SLD module.

Note, if you run SLD at current less than maximum current shown on the ATR it is recommended set SLD current limit to actual SLD driving current.

Important: It is not recommended to run SLD at full power when not necessary.

Switching off

- switch off SLD current;
- switch off Pilot4-PCB.

Additional information

Recommended “typical” X1 connection to control circuit as shown on Fig 4 above is not the only possible connection to control Pilot4-PCB status. Other configurations are possible. Below, we describe structure of “system control inputs” and “system status outputs” of Pilot4-PCB.

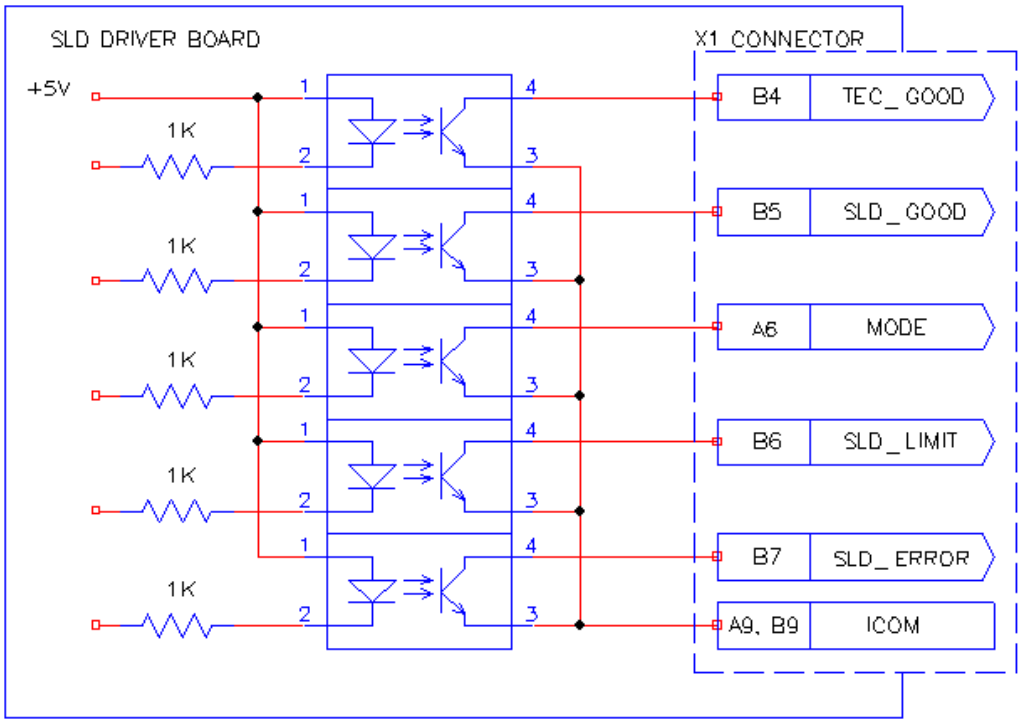


Fig 5. Structure of system status outputs

Maximum voltage collector-emitter of transistor in optron 50 V
Maximum current through transistor in optron 2 mA

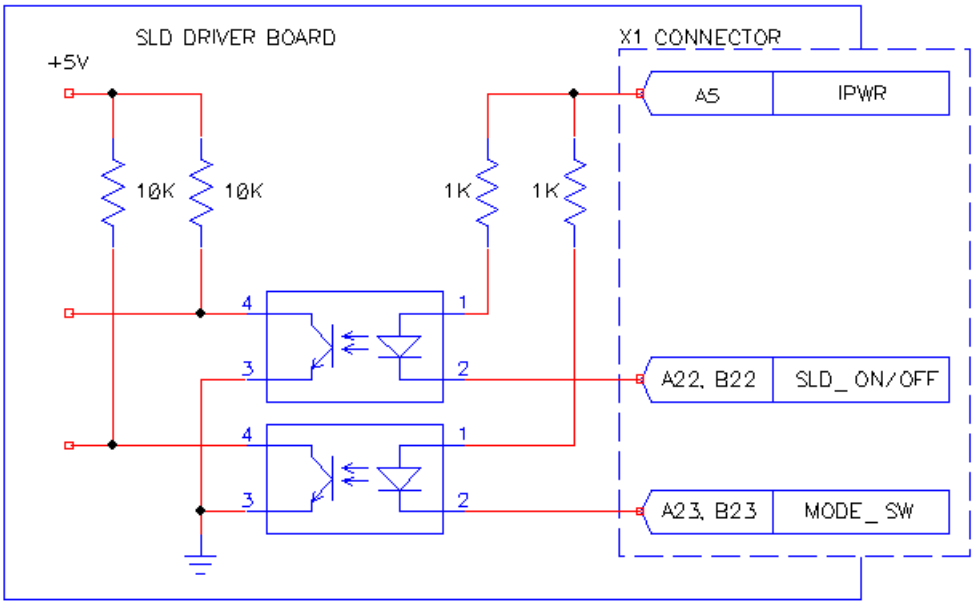


Fig.6. System control inputs structure.

Minimum current through LED in optron 2 mA.
Maximum current through LED in optron 15 mA.
Maximum reverse voltage of LED in optron 5 V.
Optron LED voltage 1 V
Switching must be done by negative pulses with minimum duration 50 ms.

Specifications

Technical parameters

Current source, constant current mode	
SLD current range**	0 – 400 mA
SLD voltage, maximum	3V
Accuracy (50 – 400 mA)	0.5 mA
Temp. coefficient	< 120 ppm/°C
Short term stability, (1 hr)	< 100 ppm
Noise (DC-20 MHz, peak-to peak)	< 10 µA
Current source, constant power mode	
Photodiode current range	0.05 – 4.00 mA
Accuracy	0.1 µA
Temp. coefficient	< 120 ppm/°C
Short term stability, (1 hr)	< 100 ppm

PD monitor section	
PD monitor reverse voltage	5 V
PD monitor current range	0 – 20 mA
SLD protection section	
SLD current limit range**	5 – 400 mA
Accuracy (50 – 400 mA)	1 mA
TEC controller section	
Maximum TEC current	1200 mA
Maximum TEC voltage	5.0 V
Stabilization T range***	10 °C to +40 °C
Accuracy	± 0.1 °C
Short term stability R set (20 °C)	± 0.01 °C
Thermistor current	100 µA

** - up to 500 mA upon request
*** - it is considered that 10K3CG2 of BetaTherm Ltd. NTC Thermistors are used in SLD modules.

General Data

Size (Printed circuit board with integrated heat-sink)	170 x 100 x 30 mm
Supply voltage	9.0 V ± 5%
Supply voltage pulsations (DC 20 MHz)	20 mV (peak-to-peak) max.
Maximum supply current	2.0 A
Operating temperature	0 °C to +40 °C (no water condensing)
Weight	0.3 kg

Additional options.

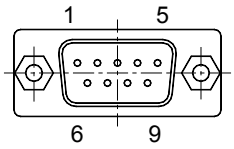
In certain cases Superlum can ship PCB drivers with front panel with indicating LEDs and DSUB connector on it. Indicating LEDs work similar to standard PILOT-4 controllers, namely :

“TEC” LED status : *green* – SLD T stabilized, *red* – error;
“LIMIT” LED status: *yellow* - set value of SLD drive current is equal to set “”SLD current limit” or higher;
“SLD” LED status : - *red* – not ready or error, *no light* – SLD “ready”, *green* – SLD is on.

For pinning of DSUB female connector of PILOT please check fig. 3 above.

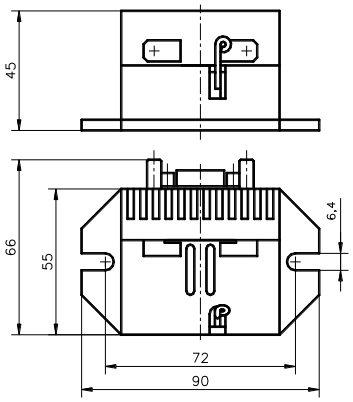
Related items. Mounts for SLD modules

Superlum offers a range of mounts to suit the different types of SLD packages available. Types of mount include DIL, DBUT and TOW. All mounts have a 9 pin D-SUB male connector for connection.

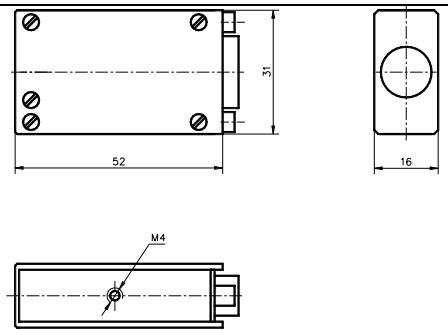


PINNING	
1	case
2	thermistor
3	thermistor
4	anode Cooler (+)
5	cathode Cooler (-)
6	cathode SLD (-)
7	anode SLD (+)
8	anode PD (-)
9	cathode PD (+)

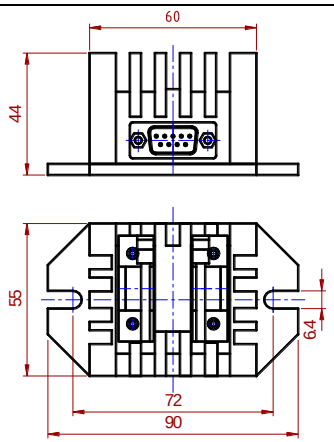
D-SUB male connector



Mount for DIL module



Mount for TOW module



Mount for DBUT module