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Laser Diode Current and Temperature Controller

Operation Manual

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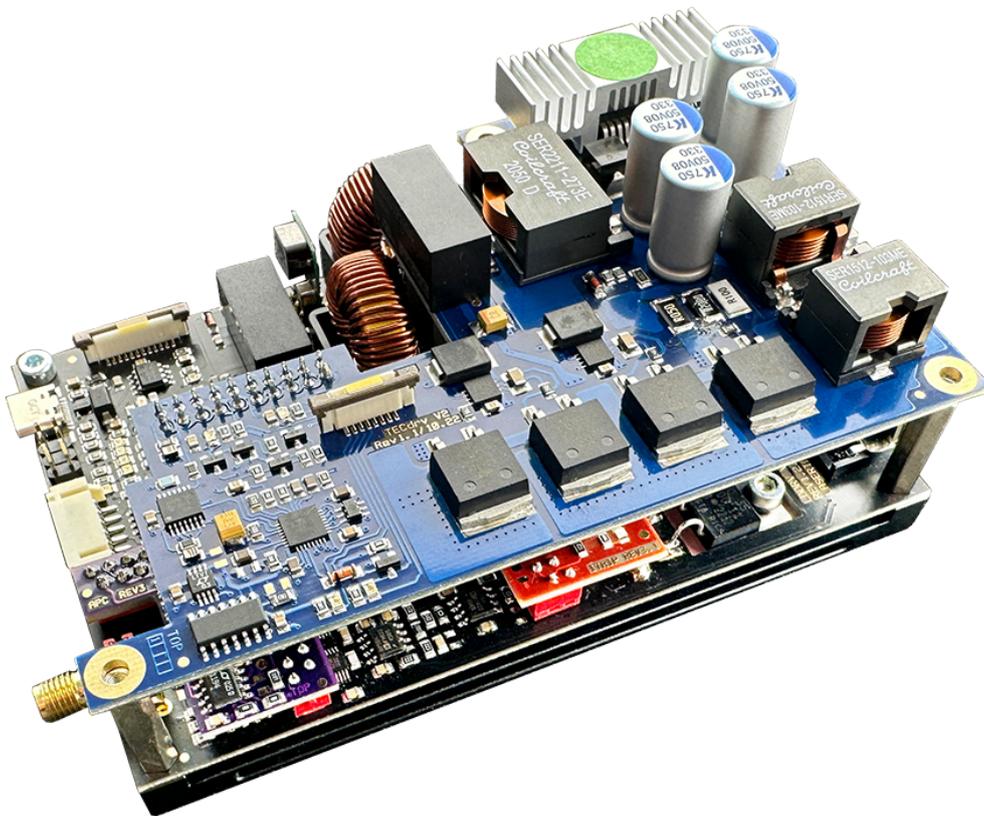
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Contents

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Lasertack GmbH aims to develop and provide highly reliable, state of the art equipment.
You, our customer, can help us to improve our products and services.
Please let us know your ideas, suggestions and possible criticism.

Warning

Sections marked by this symbol explain dangers and might result in personal injury or death. Always read the associated information carefully, before performing the indicated procedure.

Attention

Paragraphs preceded by this symbol explain hazards that could damage the instrument and the connected equipment or may cause loss of data.

NOTE

This manual also contains „NOTES" and „HINTS" written in this form.

1   General information

The Sirius Series is a high current, fast modulatable laser diode and temperature controller. It is equipped with a USB 2.0 interface and is capable to driver LDs of up to 5 A and TECs with up to 180 W.

Special highlights of the Sirius Laser Diode Driver Series are:

- Operation with anode-grounded lasers.
- Current (photo diode) feedback input.
- Constant mode and modulated mode operation.
- Automatic Power Control and Automatic Current Control operation.
- CW mode and modulation of up to 800 kHz.
- Internal CW modulation signal source.
- External modulation input with BNC connector.
- Interlock for automatic switch off by an external emergency switch or by a cable interruption.
- Active Fiber safety support.
- High Power TEC Controller with a PID regulator.
- Temperature protection for Laser Diode and Driver board.
- Temperature loop monitoring for laser protection.
- USB interface for remote operation.
- LabVIEW™ based user interface.
- DLL library for implementation.

1.1 Safety

Attention

The safety of any system incorporating the equipment is the responsibility of the assemble of the system.

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly as it was designed for.

The Sirius Series must not be operated in explosion endangered environments!

Do not obstruct the air ventilation slots in the housing of LAB version of this driver! For OEM version fresh air and mounting on a heat dissipating surface is required for cooling.

Do not remove covers of the LAB version!

Do not open the cabinet of the LAB version. There are no parts serviceable by the operator inside!

This precision device is only serviceable if properly packed into the complete original packaging including the plastic foam sleeves. If necessary, ask for replacement packaging.

Refer servicing to qualified personnel!
Only with written consent from Lasertack GmbH may changes to single components be made or components not supplied by Lasertack GmbH be used.

Attention

Prior to applying power to the Sirius Driver Series, make sure that the protective conductor of the power supply of the 3 conductor mains power cord is correctly connected to the protective earth ground contact of the socket outlet! Improper grounding can cause electric shock resulting in damage to your health or even death!

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Attention

The following statement applies to the products covered by this manual, unless otherwise specified herein. The statement for other products will appear in the respective accompanying documentation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Standard ICES-003 for digital apparatus.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/T.V. technician for help.

Users that change or modify the product described in this manual in a way not expressly approved by Lasertack GmbH (party responsible for compliance) could void the user's authority to operate the equipment.

Lasertack GmbH is not responsible for any radio television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Lasertack GmbH. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

Attention

Mobile telephones, cellular phones or other radio transmitters must not be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC61326-1. This product has been tested and found complying with the limits according to IEC61326-1 for using connection cables shorter than or equal to 3 meters (9.8 feet).

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Warning

Laser modules can deliver up to several Watts of (maybe) invisible laser radiation! When operated incorrectly, this can cause severe damage to your eyes and health! Be sure to pay strict attention to the safety recommendations of the appropriate laser safety class!

This laser safety class is marked on your external laser source used.

1.2 Protection of Laser Diodes

To protect the user and the connected setup, the Sirius Series includes the following protective features:

Key switch option (two pin connector for a key switch)

The key switch, if connected, will shut off the laser output. This feature complies with the CDRH (Center for Devices and Radiological Health) requirements and prevents an unauthorized usage of the laser driver.

If the key switch pins are shorted, the driver may not comply the CDRH rules.

Switch on delay

The Sirius controllers are CDRH compliant with the user programmable switch on delay. The default setting is 5 seconds.

Soft Start

The soft start function protects the laser diode against undesired peaks.

Laser current limit (hardware limit)

The maximum laser current can be adjusted by the laser current limit. The threshold can be set in the LD Source Setup menu (Please refer to section Setting the LD source parameters).

Interlock

The interlock input provides several protection functions simultaneously:
· Safety lock to prevent unintentional use
· Cable damage monitoring
· An external emergency switch may be connected
· To connect your external automatic protection equipment, e.g. for temperature monitoring
· Laser ON/OFF LED (Please refer to section Connecting the interlock and LD ON monitoring)

The laser can only be operated with the interlock input being closed.

1.3 Models and Accessories

Models:

- **Sirius 500**   0-500 mA
- **Sirius 5000**   100-5000 mA

Accessories:

- 250 W Power Supply 90-240 VAC.
- 450 W Power Supply 100-240 VAC.
- Output Adapter Board D-Sub25 to push terminals with current memory chip.
- Power Supply Input Adapter from MOLEX 10-pin (Sirius board) to push terminals.
- OCP board. It monitors the current of the LD independently from the driver and shuts down the laser when set max. current is exceeded.
- APC board for automatic power control by using an external PD.
- 180 W Bidirectional PID TEC Controller for cooling and heating.

2.1 Preparation

Inspect the shipping container for damage.
If the shipping container appears to be damaged, keep it until you have checked the contents and you have inspected the Sirius LD driver mechanically and electrically.
Verify that you have received the following items:

- Sirius Laser Diode Controller
- Optional boards (APC, ITRIP, TEC Controller, Adapter for input/output)
- USB-C to USB-A connecting cable

Connect the Sirius driver with the power supply.

2.2.1 Operating Elements of the Software Interface
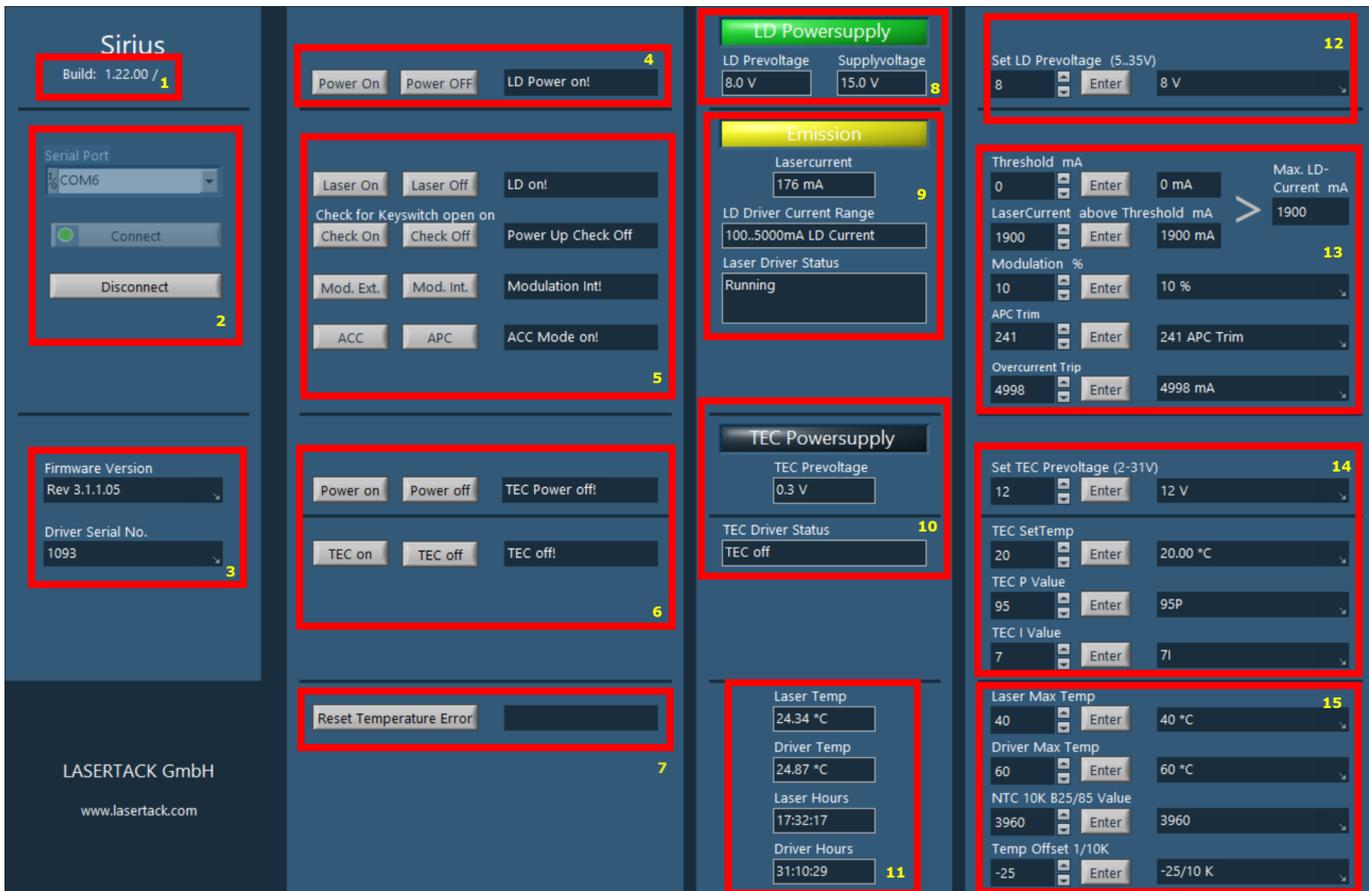
1   Build number of the software (read only)
2   Connecting status
3   Firmware version and SN of the driver (read only)
4   Power status of the Laser Driver Circuit (NOT THE OUTPUT STATE)
5   Laser Control Interface
6   TEC Control Interface
7   Temperature Error Reset
8   Supply voltage of the Laser Driver (read only)
9   Laser Emission Status (read only)
10   TEC Driver Status (read only)
11   Laser Module information (read only)
12   Setting of the supply voltage of the LD Driver circuit and reading
13   LD current, internal modulation, APC and ITRIP (OCP) settings
14   TEC voltage, temperature, I and D parameter settings
15   Temperature settings

Software and firmware are always subject to be changed without prior notice to provide the best functionality.

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2.2.2 Basic Elements on the Sirius Board

USB-C

SMA
Modulation Input

Key Switch
Key Switch
VCC

GND
Interlock –

Interlock Input + (3.3...12V, 10mA @12V)

1	TEC Peltier +
2	TEC Peltier +
14	TEC Peltier +
3	TEC Peltier -
15	TEC Peltier -
16	TEC Peltier -
4	Laser Anode
5	Laser Anode
17	Laser Anode
18	Laser Anode
6	Laser Cathode
7	Laser Cathode
19	Laser Cathode
20	Laser Cathode
8	+5Vanalog / APC PD Cathode
21	APC Input / APC PD Anode
9	+3V3digital
22	GND
10	DS18B20 Baseplate I/O
23	I2C SCL
11	I2C SDA
24	TXD / Digital I/O
12	RXD / Digital I/O
25	NTC 10K (Laser Temp.)
13	NTC 10K (Laser Temp.)

D-SUB 25

13   1
25   14

+
–

Molex 44130-0030
6 positions Power Connector

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2.3 Before First Operation

Warning

Prior to switch on the Sirius Driver, please read this safety instructions carefully.

The safety of any system incorporating the equipment is the responsibility of the assembler of the system.
All statements regarding safety of operation and technical data in this
instruction manual will only apply when the unit is operated correctly as it was designed for.
The Sirius Driver Series must not be operated in explosion endangered environments!
Do not block the airflow or ventilation slots in the housing (lab version)!
Do not remove covers (lab version)!
Do not open the cabinet (lab version). There are no parts serviceable by the operator inside!
This precision device is only serviceable if properly packed into the complete original packaging including the plastic foam sleeves. If necessary, ask for replacement packaging.
Refer servicing to qualified personnel!
Only with written consent from Lasertack GmbH may changes to single
components be made or components not supplied by Lasertack GmbH be used.

Ensure to use only grounded power supplies.

The driver needs to be operated with duly shielded connection cables only.

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3.1 Connecting components

Available connecting components are as follows:

- Sirius Laser Diode Driver
- APC Board
- OCP Board
- TEC Controller Board
- Output Adapter Board

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3.1.1 Pin Assignmen of the Laser Controller

Input

USB-C

SMA Modulation Input

Key Switch
Key Switch
VCC

GND
Interlock −
Interlock Input + (3.3...12V, 10mA @12V)

Output

1	TEC Peltier +
2	TEC Peltier +
14	TEC Peltier +
3	TEC Peltier −
15	TEC Peltier −
16	TEC Peltier −
4	Laser Anode
5	Laser Anode
17	Laser Anode
18	Laser Anode
6	Laser Cathode
7	Laser Cathode
19	Laser Cathode
20	Laser Cathode
8	+5Vanalog / APC PD Cathode
21	APC Input / APC PD Anode
9	+3V3digital
22	GND
10	DS18B20 Baseplate I/O
23	I2C SCL
11	I2C SDA
24	TXD / Digital I/O
12	RXD / Digital I/O
25	NTC 10K (Laser Temp.)
13	NTC 10K (Laser Temp.)

D-SUB 25

+
−

Molex 44130-0030
6 positions Power Connector

3.1.2 Connecting the Laser Diode

4	**Laser Anode**
5	**Laser Anode**
17	**Laser Anode**
18	**Laser Anode**
6	**Laser Cathode**
7	**Laser Cathode**
19	**Laser Cathode**
20	**Laser Cathode**

ATTENTION

The maximum laser output current for the Sirius LD Driver is 5A. Use at least 0.5 mm² cables at contacts 1, 2, 14, 15, 16, 4, 5, 17, 18, 6, 7, 19, 20 rated for at least 6A current.

If using a custom-made cable, we recommend to use a shielded cable for the sensor inputs with twisted pairs.

Use a separate shielded cables Photo Diode measurement line.

The Laser current lines should be as short as possible and as close together as possible (e.g. twisted) to minimize inductance.

3.1.2 Connecting the Laser Diode

ATTENTION

Before connecting the laser diode make sure that the power supply is turned off. Never connect the laser diode to the driver while power supply is on.

To achieve high output current several pins of the output connector are connected in parallel.
Even if the current requirement is below 2A we suggest to use cables where all the pins are connected.

For Anode: 4, 5, 17, 18
For Cathode: 6, 7, 19, 20

3.1.3 Connecting a Photodiode

The Sirius Laser Diode Controllers support optical current sensors (e.g. photo diodes or PD) for monitoring the laser power output. A PD can be used as a feedback source for a constant power loop to stabilize the laser output power.

The photo diode input circuit design is a trans-impedance amplifier with virtual ground (input impedance ~0 W).
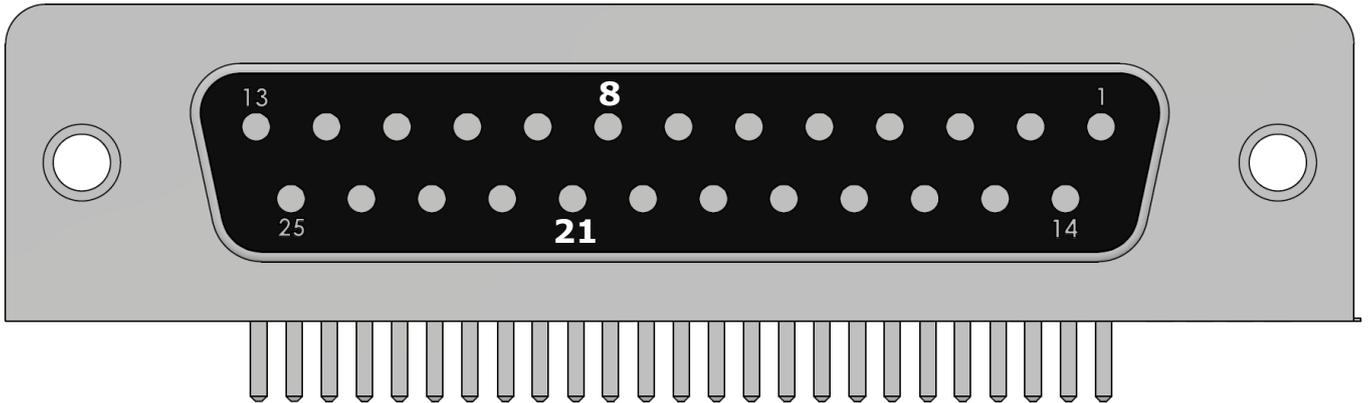
8   +5V analog / APC PD Cathode
21   APC Input   / APC PD Anode

A photo diode is connected to Pin 8 and Pin 21.

We recommend using shielded "twisted pair" wiring for the monitor diode current measurement.

Note

The PD needs to be mounted in reverse. The Cathode of the PD needs to be connected to +5V of the pin 8.

3.1.4 Connecting Interlock
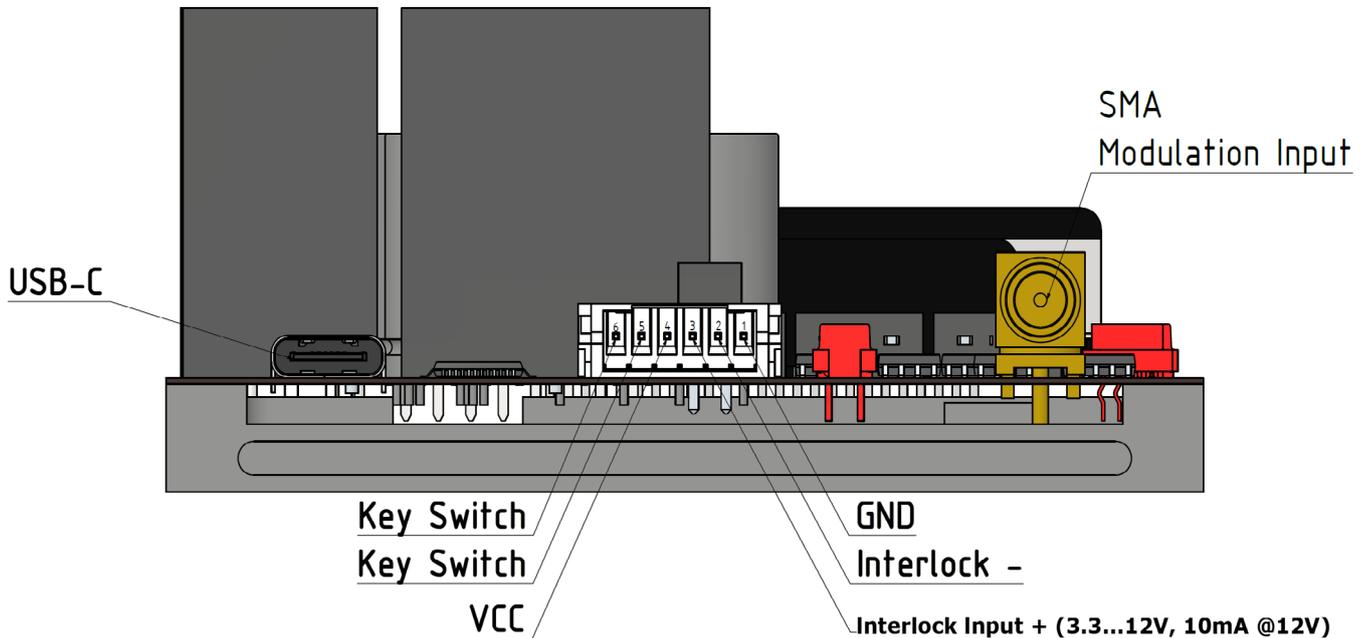
The interlock function uses pins that must be connected to each other as a precondition for switching on the laser.

The Sirius Driver is equipped with an active interlock feature. There are two options to use it:

1. Using the internal voltage signal

Connect the pins „Interlock -" and „GND" as first pair and „Interlock +" and „VCC" as second pair. In this case you only simulate a closed interlock loop what might be useful in few cases. However, this may not be compliant to the local regulations.
For a real interlock operation connect the pins „Interlock-" and „GND" together and connect a door switch or similar to „VCC" and „Interlock+".

2. Using an external voltage signal

When you already use an interlock system which provides own power supply you can connect the positive pin of the interlock circuit to „Interlock +" and the negative pin to „Interlock -". Make sure that the supply voltage is between 3.3 VDC and 12 VDC.

In case the interlock loop gets opened, the laser diode is switched off immediately. Furthermore, the interlock LED on the LD Driver will change from solid state (interlock closed) to blinking state (interlock open).
The LD output cannot be activated when the interlock loop is open.

3.1.5 Pin Assignment of the TEC Controller
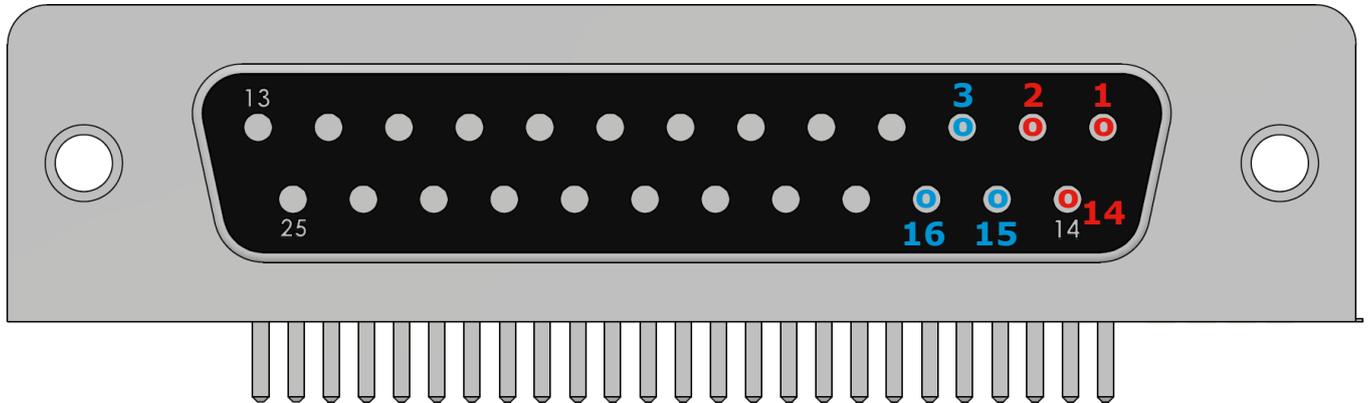
1	**TEC+**	
2	**TEC+**	
14	**TEC+**	
3	**TEC-**	
15	**TEC-**	
16	**TEC-**	

ATTENTION

Do not connect TEC- to Ground!
Otherwise the driver and TEC can be damaged!

ATTENTION

The maximum TEC output current for the Sirius Series is 5A. Use only the 1mm² cables.
It is highly suggested to use shielded cables. Temperature sensor should be used with shielded twisted pair cables.

3.1.6 Connecting the TEC Element

ATTENTION

The TEC element output of the Sirius Driver is a ground-free output. Do not connect the TEC element pins to ground.

A TEC element connected with wrong polarity may lead to thermal runaway and damage of the connected components.

When the Temperature controller is in cooling mode, current flows from TEC+ to TEC. This is defined as positive current, and with the TEC element connected correctly, its active surface (which is in contact with the tempered object) gets colder.

Check the TEC polarity as follows:

- Connect the TEC element and the temperature sensor to the D-SUB25 connector or the corresponding ports of the Output Adapter Board.
- The sensor and the TEC element must be in good thermal contact to the thermal load.
- The use of thermal conducting grease is recommended.
- Turn on the Sirius Driver.
- Adjust a suitable voltage limit for the TEC element by selecting it in field 14 of the Software Interface and press „enter".
- Activate the TEC output by pressing „TEC POWER ON" and „TEC ON" in field 6. The TEC ON LED on the driver board lights up.

If the TEC module is connected with correct polarity, the difference between the temperature set point and the actual temperature will decrease. Provided that the control loop parameters are set properly (refer to section PID control loop), the actual temperature should be in accordance with the temperature set point rather quickly.
If the TEC module is connected with reversed polarity, the difference between the temperature set point and the actual temperature will increase continuously. In this case, switch off the TEC by pressing key „TEC OFF" in field 6 and correct the TEC module wiring.

3.1.7 Connecting the Temperature Sensor

The temperature controller in the Sirius Driver can be used with 10k NTC sensors.

The measurement range is -10 °C to +50 °C.

The temperature sensor to the D-Sub25 connector.
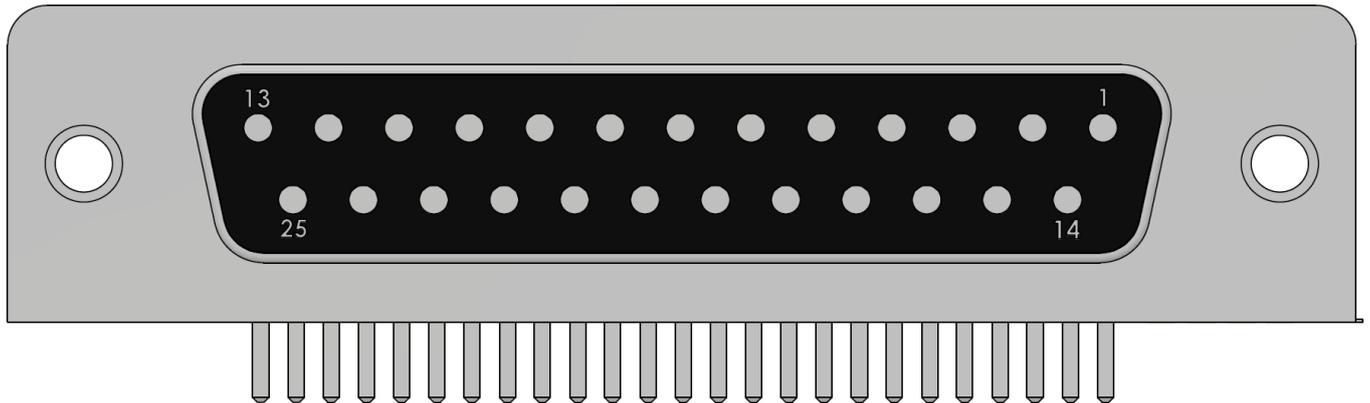
13   NTC
25   NTC

The NTC sensor has no polarity.

3.1.7.1 NTC Thermistor

The thermistor is connected between pin 13 and pin 25 of the D-Sub25 connector. The polarity is unimportant.

With a thermistor as temperature sensor, the resistance can be converted into the temperature by using the Exponential calculation method.

Using the exponential method, the relation between temperature and NTC thermistor resistance (and vice versa) is approximated by the formula:

$$R(T) = R_0 * e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)} \Leftrightarrow T(R) = \frac{\beta * T_0}{T_0 * \ln\left(\frac{R}{R_0}\right) + \beta}$$

with:
- R_0 - Thermistor nominal resistance at temperature T0
- T_0 - Nominal temperature (usually 298.15 K = 25° C)
- β - Thermistor constant (sensitivity index, B value)
- T - temperature in K (Kelvin)

For R_0, T_0 and β please refer to the data sheet of the thermistor.
Using linearization series resistors, the thermistor measurement circuit of the instrument is optimized for best resolution with R_0 = 10 kΩ.

Thermistors with other R_0 values can be used at the expense of a degraded resolution, depending on the actual sensor resistance.

If the exponential method parameters given in the thermistor data sheet are stored in the Sirius Driver setup, the thermistor temperature can be shown in field 11 of the software.

3.1.8 Connecting a Key Switch

USB-C

SMA
Modulation Input

Key Switch
Key Switch
VCC

GND
Interlock –
Interlock Input + (3.3...12V, 10mA @12V)
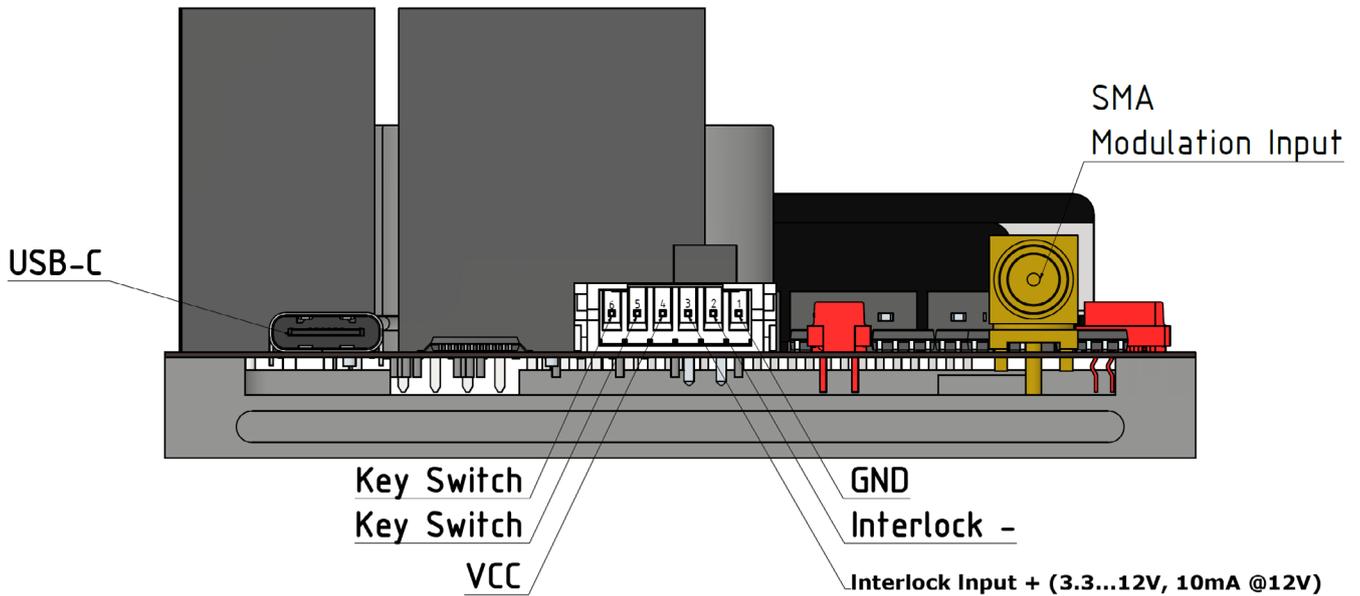
If a key switch needs to be used, connect it to pin 5 and pin 6 of the 6 pin connector.

Note

During the startup procedure, the driver checks if the option „Check the Key Switch open" in field 5 is in „Check on" or „Check off" state. If the option is in „Check on" state, the driver checks if the Key Switch is open or closed. If it is open, the output power of the driver cannot be activated. Close the Key Switch to activate the output. If the Key Switch is closed, it needs to be opened and closed again.

If the option „Check the Key Switch open" is off, the driver ignores the state of the switch.

3.2 Power-up

Turn on the unit by applying the supply voltage to the 6 pin power connector.
After switching on the unit, the board LEDs will show the device status.

Connect the driver to a PC using the provided USB-C to USB-A.
Once the driver was recognized by Windows, start the Sirius Software.

Note

LabView Runtime Environment needs to be installed before starting the software.

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3.3 LD output configuration

ATTENTION

Check the polarity of the laser diode and the connector. There is no reverse polarity protection for the LD output. A wrong polarity may damage the laser diode.

3.4 LD Source configuration

Set the LD Pre-voltage to a value of ~3V above the LD rated operating voltage.
Enter „Threshold current" value in mA and click „Enter".
Enter the „Laser current above threshold" and click „Enter".
The maximum current is shown to the right in the window „Max. LD Current ma".
For full modulation speed, the LD pre-voltage should be set about 5V above the LD operating voltage.

ATTENTION

The „Laser Current above Threshold" is the difference between the set „Threshold" value and the maximum operating temperature stated in the data sheet of the laser diode. DO NOT ENTER the maximum operating current according to the LD data sheet in this field. Otherwise the LD can be „overdriven" and get destroyed.

3.4 LD Source configuration

Press „Power On" in the Field 4.
Chose the operation condition of the „Key Switch" option in field 5.
To enable the laser output press „Laser on" button in field 5.
Select „Mod. Ext." or „Mod. Int." for external or internal modulation.

Note

External modulation provides a DC signal to the analog LD Driver circuit.
Shaped signal modulation is not possible in this mode.

3.4 LD Source configuration
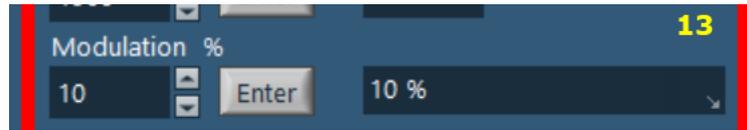
When internal modulation is selected, the output can be set in the field 13 by entering a value in „Modulation" in % between 0% (off) and 100% (full output power).

When external modulation is selected, a 0V to 5V needs to be applied to the BNC connector. The case of the BNC connector need to be connected to the GND of the modulation source.

3.5 Setting the Photo Diode Mode (APC)
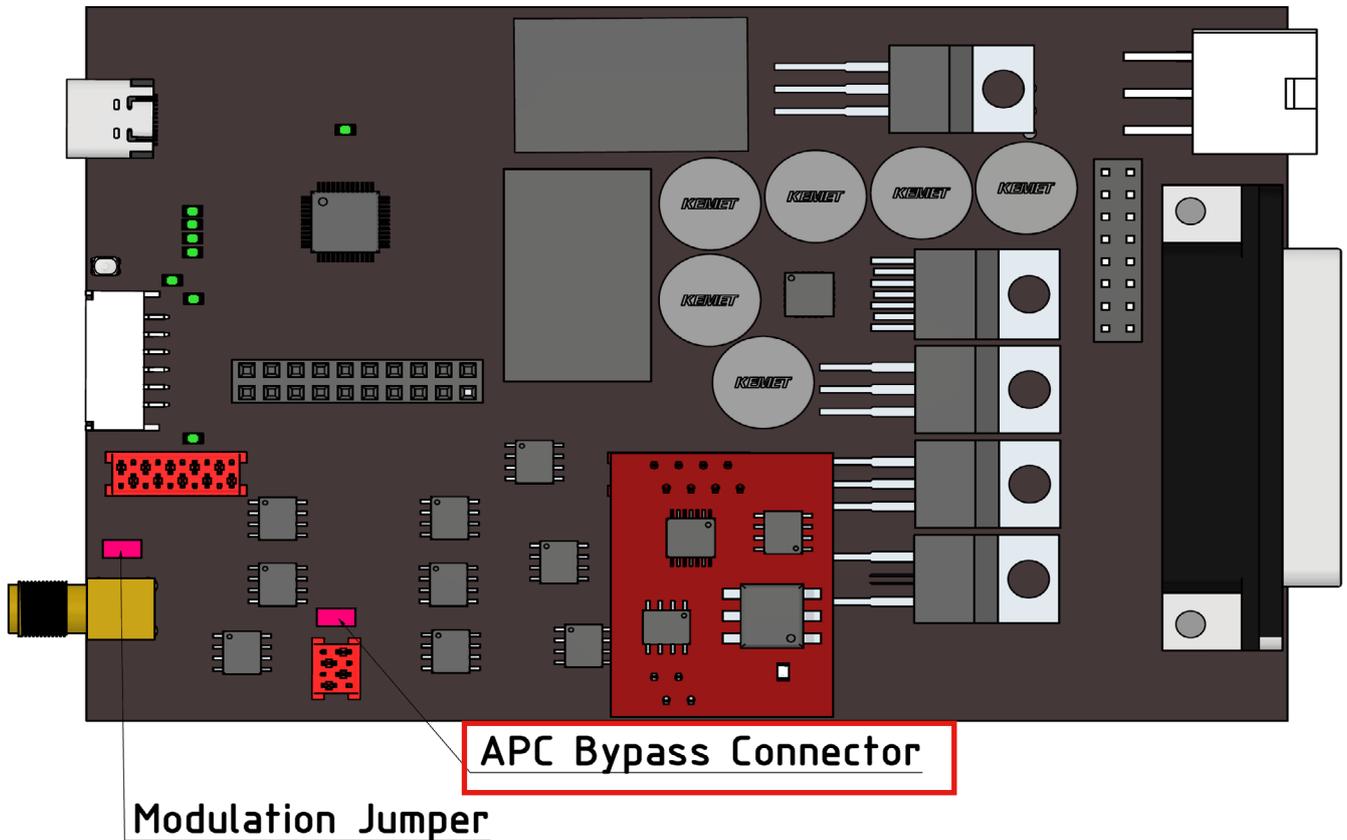
In order to be able to use APC, the jumper shown in the graphic needs to be removed. Otherwise, the APC circuit is bypassed.

The APC Board can be purchased separately.

3.5 Setting the Photo Diode Mode (APC)

APC operation mode allows to operate the laser diode in constant power mode.

Note

For accurate operation it is crucial to choose the right PD with a peak sensitivity wavelength as close as possible to the laser wavelength.
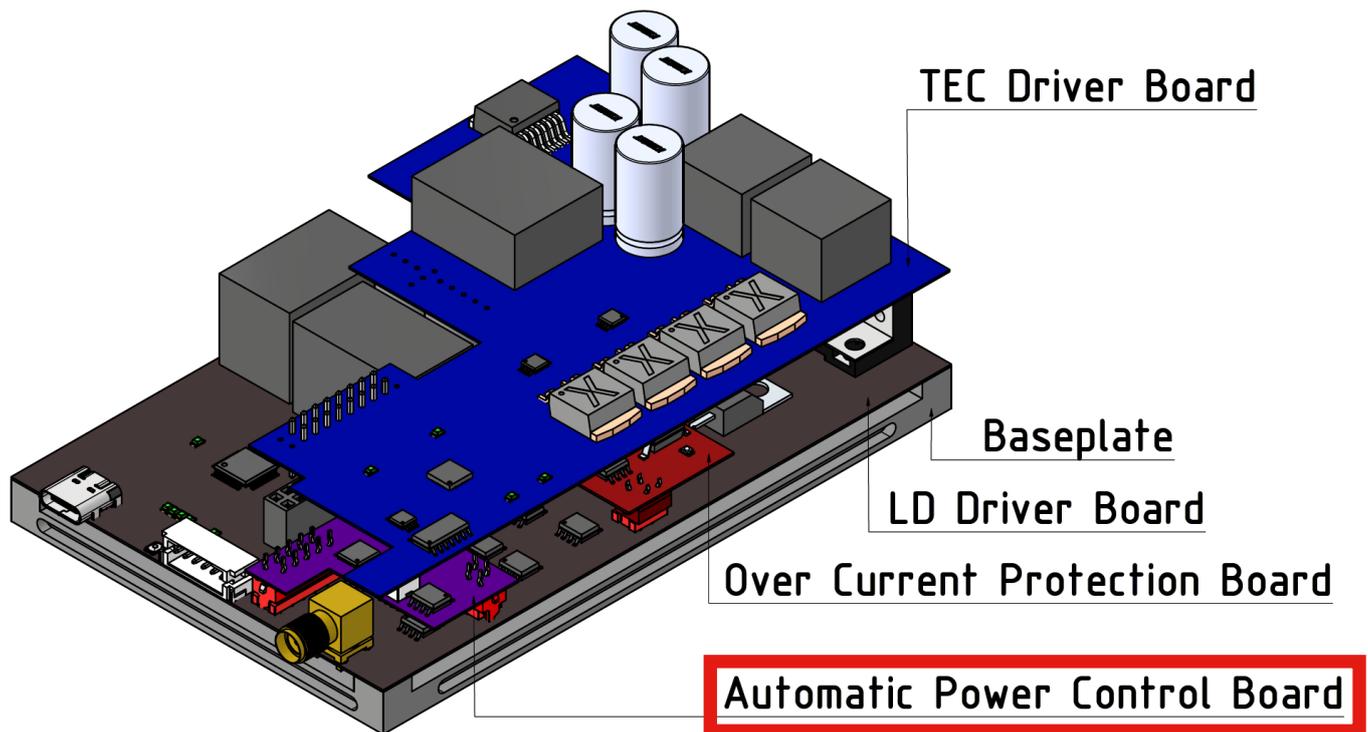
Connect the purple APC Board to the main board of the LD Driver.

Note

All cables including power supply need to be disconnected from the LD Driver Board before connecting the APC Board.

3.5 Setting the Photo Diode Mode (APC)
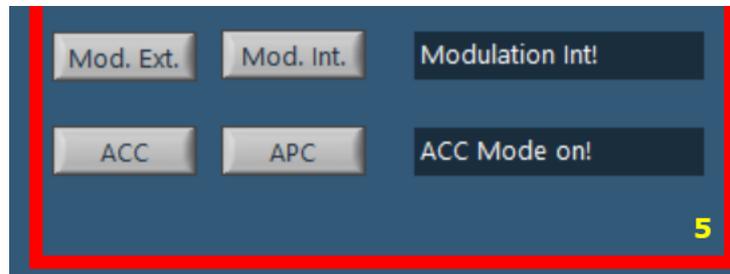
Set the operating mode in the Software Interface to „APC" and Mod.Ext. (field 5).
Connect an external power supply (adjustable between 0 VDC and 5 VDC) to the Modulation Input BNC connector.
Set the modulation voltage to 0 V.
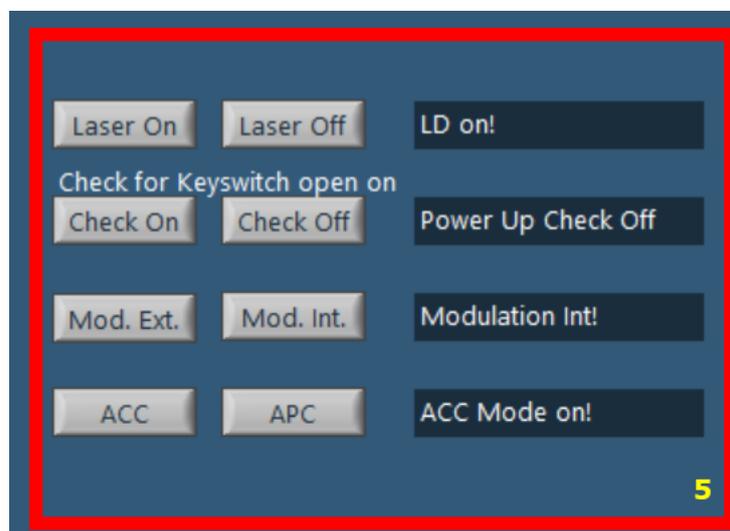
Enable the laser by clicking the button „Laser On".

3.5 Setting the Photo Diode Mode (APC), optional with APC Board

Now the laser may emit light. In order to use the APC feature as precise as possible the zero point needs to be adjusted. Two different adjustment steps are required to set the zero point.

Zero Point Adjustment

Case of the Modulation Input BNC Connector
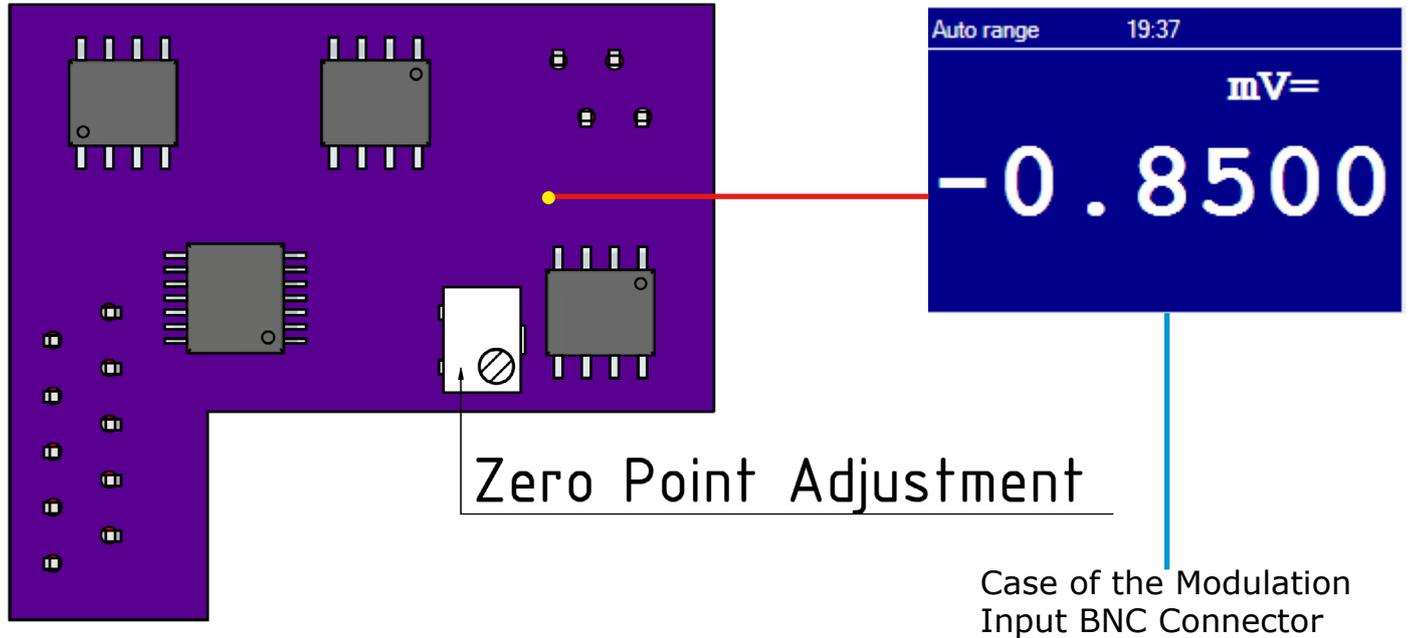
1. When the laser is enabled and emits light with 0 V modulation voltage applied to modulation input, turn the potentiometer until the light turns off completely.

Note

Some diodes emit diffuse LED like light below their threshold current. Turn the potentiometer until there is no light, not only the coherent laser emission.

2. Connect a multimeter with the positive cable to the through hole point (yellow) shown in the graphic above. Connect the negative cable of the multimeter to case of the modulation input BNC connector. The reading should be negative of few mV.
   If the reading is positive, turn the potentiometer in same direction as above until the reading is negative and is about -0.5 mV and -4 mV.
   In case the reading is already negative after Procedure 1, no further setting is required.

Attention

The PD needs to be fully blocked from ambient light. Otherwise accurate setting of the APC Circuit is not possible.

3.5 Setting the Photo Diode Mode (APC), optional with APC Board
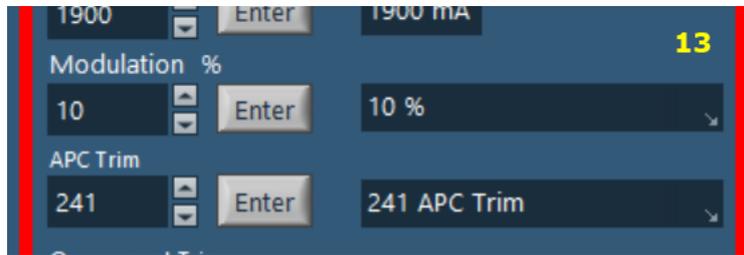
As the next step the APC Trim value needs to be set. This value depends on the sensitivity of the PD.

1. Set the modulation voltage of the external modulation source to 5 VDC. The laser should emit 100% output power now.

Warning

The laser now may put out high energy. Take all necessary precautions to avoid any risk of personal injury or damage of equipment.

2. Set the „APC Trim" value to 255.
    Decrease the value by 10 until the current begins to drop. The current is shown in the field 9.
3. Once the current dropped by small amount, start to increase the value by small steps (1-2) until the max. set current is reached.

Attention

Although it is possible to use photo diodes built-in into laser diodes, we highly suggest to use external photo diodes. Internal photo diodes are usually not suitable for long term operation and tend to degrade over time what will lead in instable operation and wrong values.

3.6 LD Modulation Settings

The Sirius Driver Series supports two modulation ways.

1.   External modulation via a DC or modulated signal between 0V and 5V.
2.   Internal modulation between 0% and 100% of the set output current.
      Internal modulation regulates the output power only. Shaped signal modulation
      is only available from external sources.
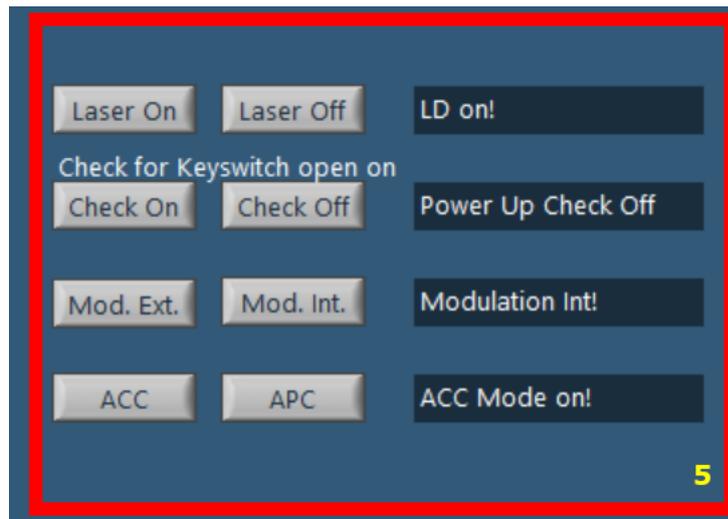
The modulation option is selected in field 5.

Attention

The modulation speed depends on the LD circuit pre-voltage. The higher the differen-ce, the higher the modulation speed.
In to order to achieve the max. modulation frequency, the LD circuit pre-voltage needs to be about 3V above the LD operation voltage at nominal output power.

Note

The higher the difference between LD operation voltage and LD circuit pre-voltage, the higher is the temperature load across the power transistor.
Proper cooling of the Sirius driver board is required in order to prevent overheating of the board and thermal shutdown.
For slow speed or CW modulation the pre-voltage should be set ~0.5 V above the LD operating current at nominal output power.

3.6 LD Modulation Settings

APC Bypass Connector
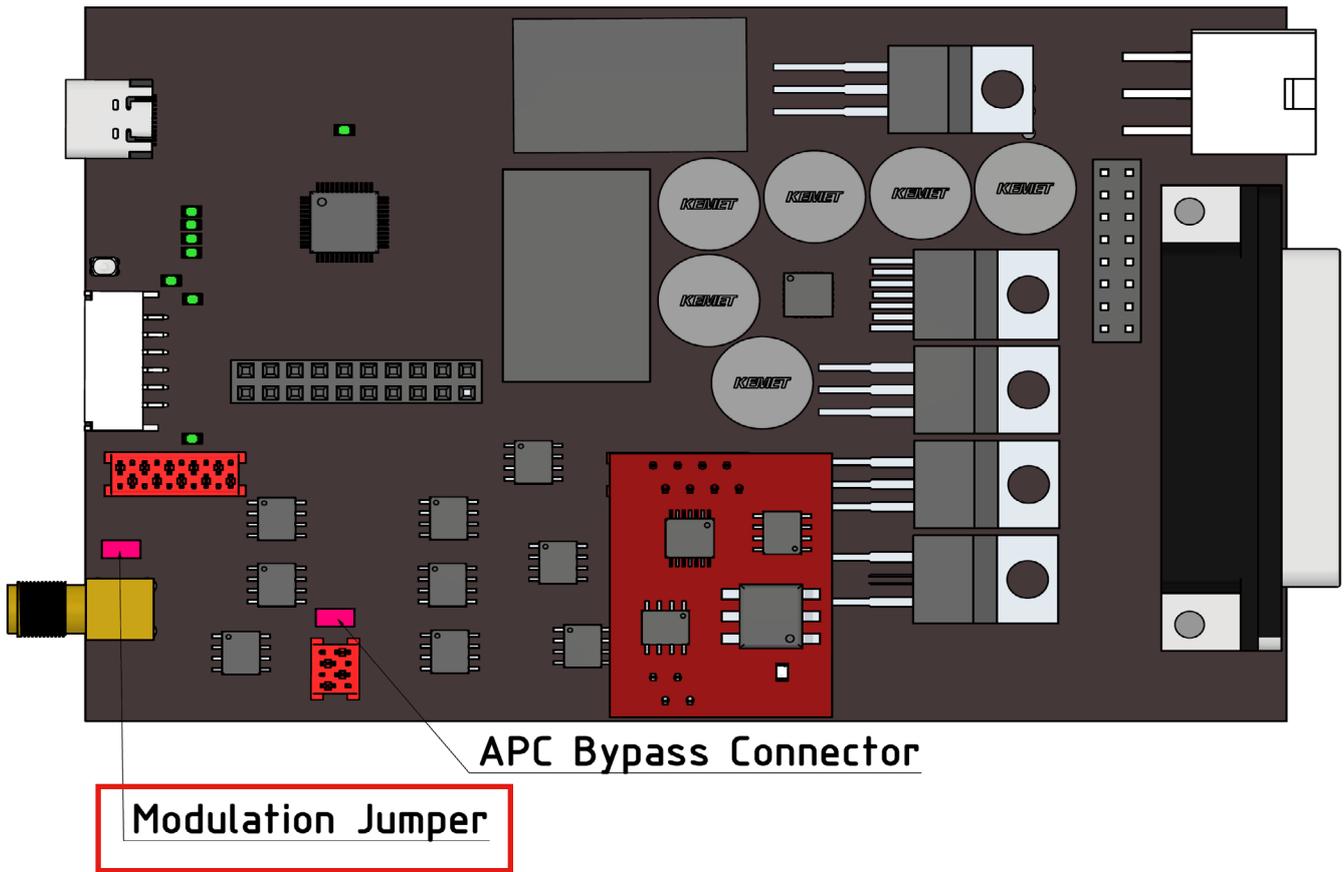
Modulation Jumper

External modulation input accepts two different signals:

1. Single ended signal.
2. Differential signal.

For single ended signal (99% of the cases) the jumper „Modulation Jumper" needs to be set.

For operation with a differential signal, the jumper needs to be removed.

When delivered, the jumper „Modulation Jumper" is always set.

Note

When operating in differential signal mode, the GND from the BNC connector is disconnected from the GND of LD driver circuit.
Make sure to use shielded twisted pair signal cables to reduce signal distortion and induction noise.

3.7 Overcurrent Protection Board (optional)

The OCP Board provides and additional safety level to the laser diode.
It is a dedicated analog circuit permanently monitoring the LD current.
In case of failing component or any short on the board caused by touch the driver
board with a screwdriver or similar, the set max. operating current may be exceeded and
result damaging the laser diode.
If the OCP Board detects overcurrent, it shuts down the LD within a few ns preventing
the diode from being damaged or destroyed.

The OCP Board can be purchased separately.
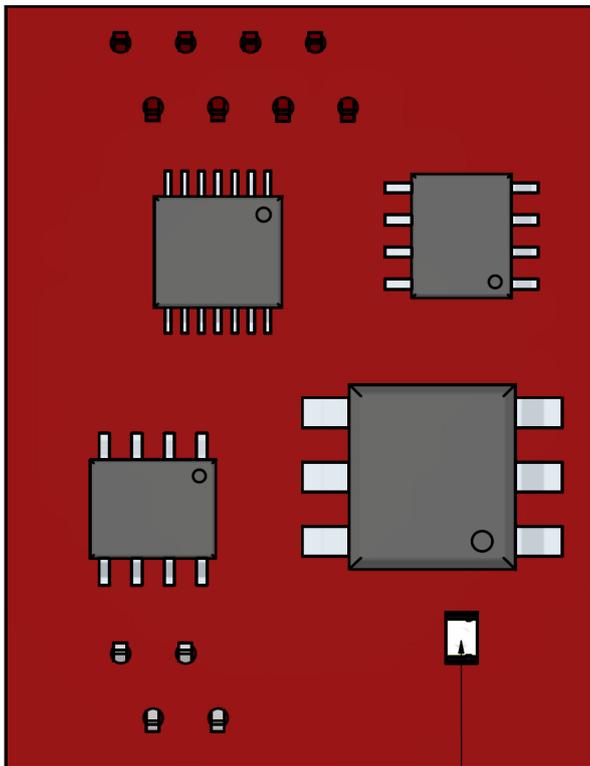
LD Overcurent Indicator (red)

3.7 Overcurrent Protection Board (optional)
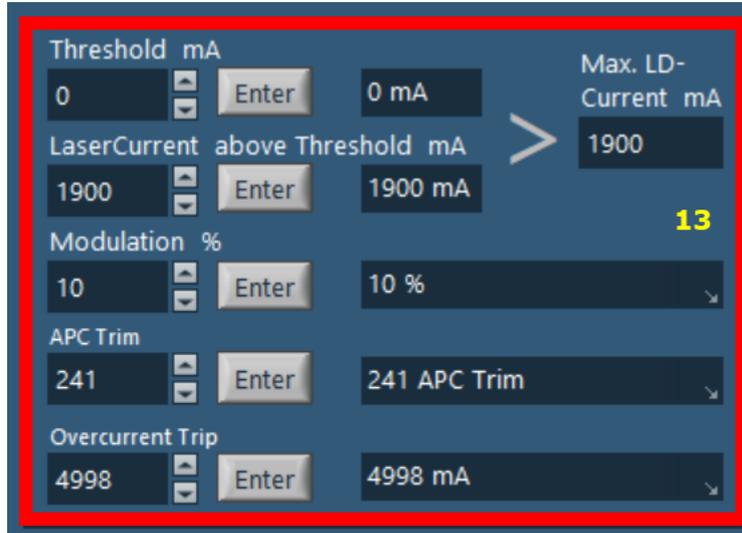
You can specify the overcurent value in mA in field 13 „Overcurrent Trip".

Note

Make sure to press „Enter" after the overcurrent value was defined.
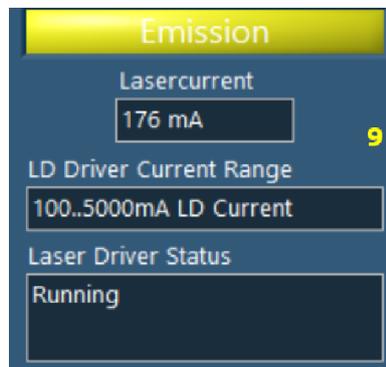
Once overcurrent has been detected, the driver shuts down the laser diode and an error message is
displayed within the software in field 9 „Driver Status" and a red LED on the OPC board light up.

In order to reset the overcurrent error, the driver needs to be disconnected from the power suppl and connected again. For safety reasons, as software based reset is not available.

3.8 TEC Source Setup

The Sirius Driver provides a 180W full bridge (heating and cooling) TEC Controller. The TEC Controller Board can be purchased separately.

TEC Connector Sockets
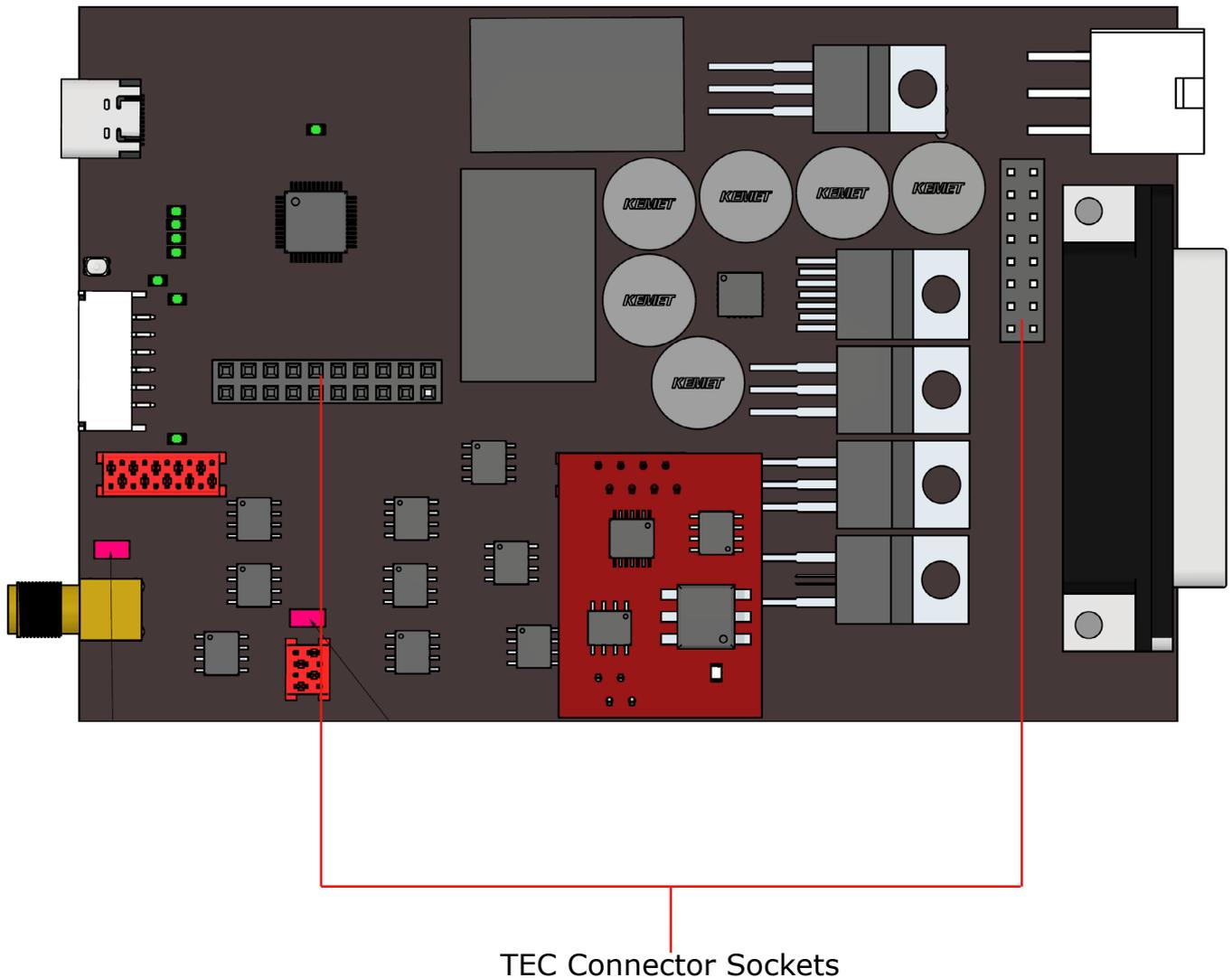
Connect the blue TEC Controller Board with its connectors on the bottom side of the board to the TEC Connector Sockets on the Sirius Driver Board.

Attention

Disconnect all cables from the Sirius Driver board before connecting the TEC Controller Board. Connecting the TEC Controller Board to the Sirius driver while power supply is connected may cause malfunction or damage to both boards and/or the connected TEC element.

3.8 TEC Source Setup

The TEC Controller provides bi-directional operation of a TEC with max. 5A and 36V.
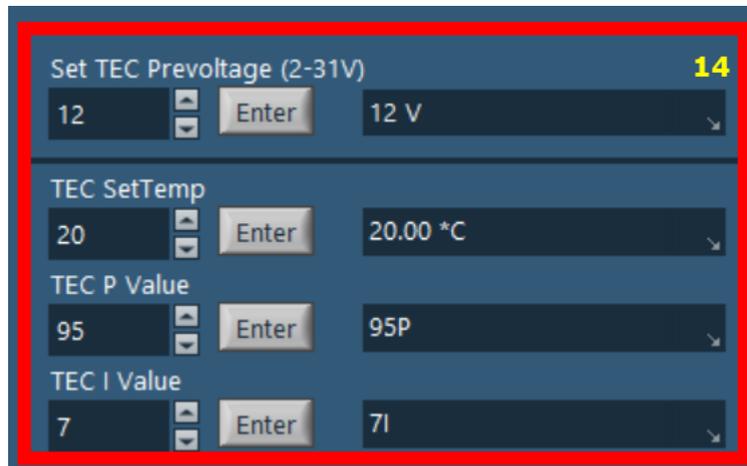
The TEC and operating temperature parameters for the LD can be defined in field 14 „Set TEC Prevoltage" and „TEC SetTemp".
„TEC SetTemp" defines the operating temperature of the laser diode.

Attention

Select the right operation voltage for the TEC element. Exceeding its rated operating voltage may damage the TEC element.
The TEC Current can only be modified by changing the operating voltage. The operating current is then defined by Ohm´s Law.

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3.9 Temperature Sensor setup

The temperature sensor needs to be placed as close as possible to the TEC element. When an additional heatsink is used between the TEC element and the laser, try to keep it as thin as possible and place the NTC Sensor as close as possible to the TEC.

Placing the temperature sensor too close to the laser will lead in oscillating temperature.
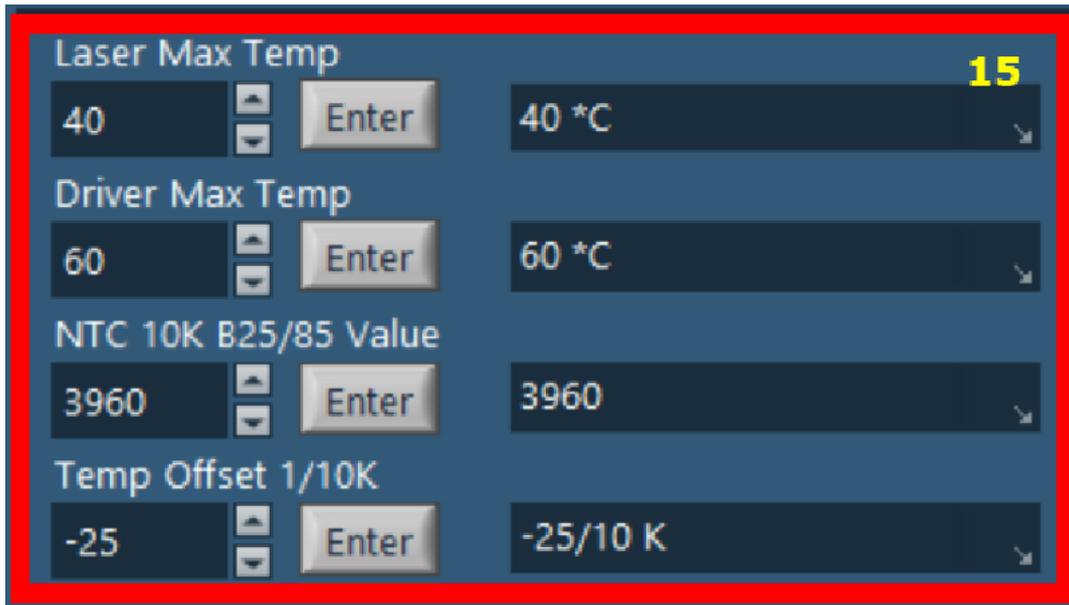
Note

„NTC 10K B25/85 Value" needs to be defined. Refer to the NTC datasheet to get this value.

„Temp Offset 1/10K" allows to enter a correction value when the temperature is regulated stable but differs from the entered value.

Example: The set temperature is 25 °C. The reading at an external temp. sensor (external device, not the driver NTC) is 24 °C. To correct it, enter a correction value of 10 to adjust the temperature.

To insure the most precise temperature regulation, place an external temperature measurement device as close as possible to the laser during setup of the PID operation.

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3.10 Temperature Protection of the Laser Diode and Sirius Driver
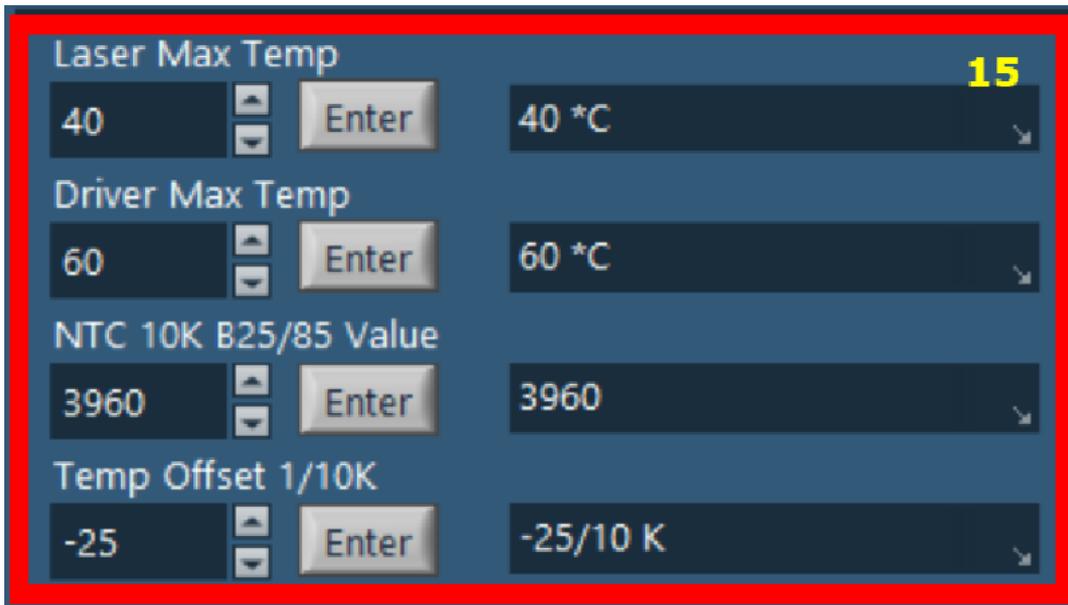
In field 15 the „Over Temperature Protection" temperature can be set. Exceeding this temperature will cause the driver to shut down the laser and an error message in the software will be displayed.

The driver is also protected against overheating. Set the max. operating temperature of the driver in „Driver Max. Temp" windows.
it will shut down the whole circuit and display a message indicating overheating.

Note

The driver has a max. operating temperature of 84 °C. When the driver reaches 85 °C the temperature safety shutdown is triggered and an error message is displayed within the software.
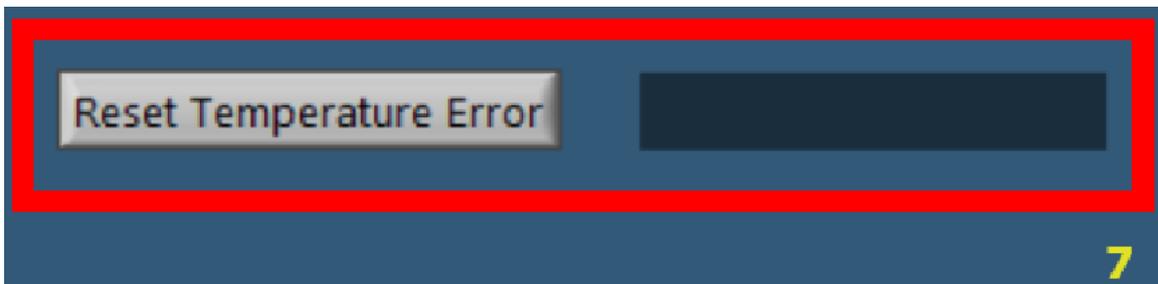
Once the laser has reached its operating temperature, the temperature error can be reset and the laser returns to normal operating.
To reset the temperature error, press „Reset Temperature Error" in field 7.

3.10 Temperature Protection of the Laser Diode and Sirius Driver

Temperature information of both the laser diode and the driver baseplate are shown in field 11.

3.11 PID Control Loop

The TEC Controller of the Sirius Driver is equipped with a PID control loop.
P and I settings can be user defined. The D value is controlled by the driver and cannot be changed.
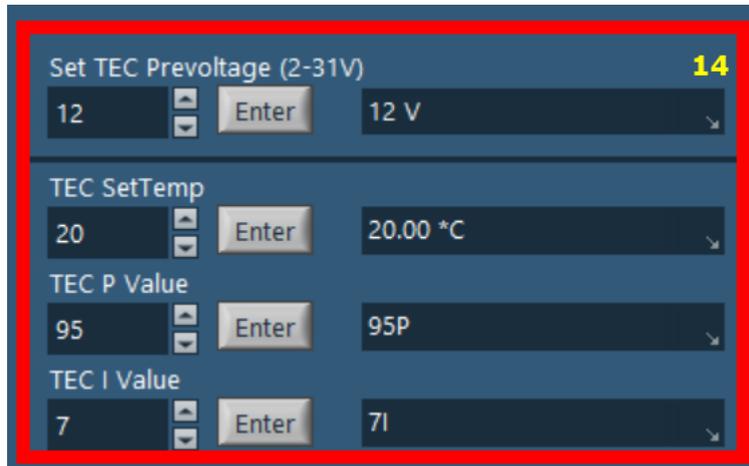
P and I values can be entered in field 14 „TEC P Value" and „TEC I Value".

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3.11 PID Control Loop

Note

Start always with both values set to 0 (zero).

Activate the laser and tec controller output. Observe the temperature regulation.
At this point the regulation will not be precise and you may see over- and undershoots around the temperature setpoint.

P value

Increase the P parameter gradually by entering the values into the corresponding field within the software. Higher values will increase the settling speed. Too high values will increase the amplitude and number of overshoots. This may lead to an unstable system (continuous oscillation or even increasing amplitude), which should be avoided. The P parameter is set correctly when the oscillation is recognizably damped, this means the actual temperature approaches the set point with each overshoot having about half the amplitude of the previous overshoot. Due to the disabled Integral constant, a temperature deviation may remain.

I value

Increase the P parameter gradually by entering the values into the corresponding field within the software.
Higher values will accelerate the settling to the set temperature. Too high values will increase the amplitude and number of overshoots or will even make the system instable. The I parameter is set correctly when the actual temperature reaches the set temperature in a short time with a minimum of overshoots.

D value

Is set by the controller and cannot be changed.

Note

When all values are set correctly, the setpoint temperature should be stable with a deviation of <0.1 °C or better.
The theoretical precision of the TEC controller is 0.05 °C. To achieve this value accurate setting procedure is required.

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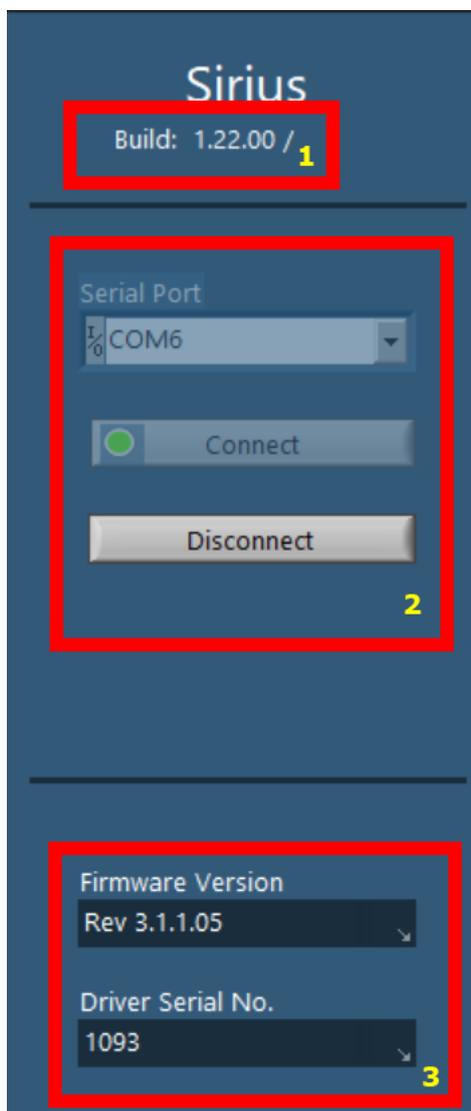
3.12 Information

Field 1 and 3 show basic information for the release version of the software, firmware and the device serial number.

4.1 Using the USB Interface

The instrument provides a USB 2.0 Full Speed link according to the USB 2.0 specification, the USBTMC specification and the USBTMC USB488 specification. It allows sending commands from a host computer to the instrument. The connection to the PC is accomplished by a USB cable with a type 'A' connector at the PC side and a type 'C' connector on the instrument side.

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4.2 Instrument Driver Installation

When connecting the instrument to the PC the first time, on Windows systems the „New Hardware Found" wizard will be displayed. Proper installation requires a VISA library with USBTMC support to be installed on your system in advance (e.g. NI-VISA available at the National Instruments).

The Sirius Driver Software doesn´t require installation. It comes as an „exe" file.
When NI Runtime Environment is not installed on the PC the driver is connected to, an error message will appear and offer you to download the Runtime from NI website.

Via the instrument's USB interface you may easily connect to third party data logging, data acquisition and data analysis software (e.g. MATLAB, NI LabVIEW Signal Express, Agilent VEE).

4.3 Firmware Updates

LD Firmware Operation Status (green)
LD Laser Running (blue)
For future use (no function, yellow)
LD Fault Indicator (red)
Restart/Software Update Switch
LD Driver Ready (green)

LD Key Switch On (yellow)
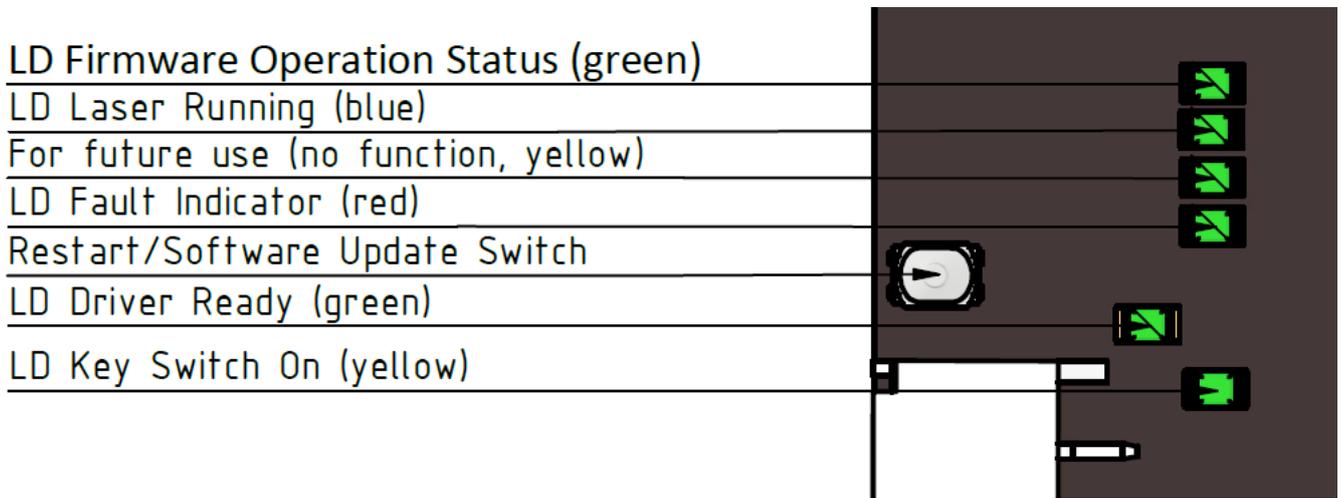
Firmware updates will be released as new functions become available.

To perform a firmware update, connect the Sirius Driver to the PC and wait until it was recognized by Windows.

Starting the Sirius Software is not required for the update.

Once the driver has booted, double click the „Restart/Software Update Switch". The corresponding LED starts to fade.

Execute the batch file provided on our website. A new window opens. Simply press any button to continue. When the updated was completed, press the update switch ONCE to reboot the driver and finish the update.

4.4 Communication Protocol

For integration in other environments the Sirius Driver supports a data exchange protocol via USB Serial connection.
Command for setting different parameters can be sent to or receiving information from the driver can be done using the commands below.

Command	Parameter 1	Parameter 2	Reading	Description
?serialno			Serial Number	Read Serial Number
?rev			Revision	Read Firmware Version
?checkitrip			0 or 1	iTrip (0=not available, 1=available)
?checkapc			0 or 1	APC (0=not available, 1=available)
?checktec			0 or 1	TEC (0=not available, 1=available)
?status			LD Status	Read LD status
?tecstat			TEC Status	Read TEC Status
?uptime			hh:mm:ss	Read total operating time for driver
?ldtime			hh:mm:ss	Read total operating time for LD
?pwrupchk			Power Up Check On/off	Read Key Switch status
!pwrupchkon			Power Up Check On	Set Keys Switch option on
!pwrupchkoff			Power Up Check Off	Set Keys Switch option off
?basetemp			xx.xx *C	Read for current baseplate temp.
?bmtemp			xx.xx *C	Read set max. baseplate temp.
!bmtemp	1	xx	xx.xx *C	Set max. temp. of the board temp.
?lmtemp			xx.xx *C	Read max. set LD temp.
!lmtemp	1	xx	xx.xx *C	Set. max. temp. for LD
?tempcorr			xx/10K	Read temp. offset LD +/- 1/10 Kelvin
!tempcorr	1	xx/10K	xx/10K	Set temp. offset for LD +/- 1/10 Kelvin
?tecvoltage			xx.x V	Read TEC pre-voltage
!tecvoltage	1	xx	xx V	Set TEC pre-voltage
?ldvoltage			xx.x V	Read LD circuit pre-voltage
!ldvoltage	1	xx	xx V	Set LD circuit pre-voltage
?itrip			xxxx mA	Read set overcurrent value
!itrip	1	xxxx	xxxx mA	Set LD overcurrent value
?lrtrim			xxx APC Trim	Read trim value for photodiode
!lrtrim	1	xxx	xxx APC Trim	Set trim value for photodiode
?i	1		xxxx mA	Read max. set LD Current above threshold current
!i	1	xxxx	xxxx mA	Set max. set LD Current above threshold current
?th	1		xxxx mA	Read LD threshold current
!th	1	xxxx	xxxx mA	Set LD threshold current
?mod	1		xxx %	Read internal modulation value
!mod	1	xxx	xxx %	Set internal modulation value
?modstatus			Modulation Int/Ext!	Read Modulation setting
!modint			Modulation Int!	Set Modulation input to Internal
!modext			Modulation Ext!	Set Modulation input to External
!acc			ACC Mode on!	Set current regulation to ACC Mode
!apc			APC Mode on!	Set current regulation to APC Mode
?regstatus			ACC/APC Mode on!	Read current regulation mode

4.4 Communication Protocol

Command	Parameter 1	Parameter 2	Reading	Description
?lc	1		xxxx mA	Read actual laser current
?lcadcvalue	1		xxxx	Read Shunt resistor value
?tecp			xxx P	Read TEC P value
!tecp	1	xxx	xxx P	Set TEC P value
?teci			xxx I	Read TEC I value
!teci	1	xxx	xxx I	Set TEC I value
?ntcbcoefficient			xxxx	Read NTC B25/85 value
!ntcbcoefficient	1	xxxx	xxxx	Set NTC B25/85 value
?tect			xx *C	Read set TEC temperature
!tect	1		xx *C	Set TEC temperature
?tt	1		xx.x *C	Read actual LD temperature
?ub			xx.x V	Read power supply voltage
?uld	1		xx.x V	Read LD circuit pre-voltage
?utec	1		xx.x V	Read TEC circuit pre-voltage
?ldstatus			LD on/off!	Read state of the LD
!ldon			LD on!	Set LD state to ON
!ldoff			LD off!	Set LD state to OFF
!powon			LD Power on!	Set LD circuit power to ON
!powoff			LD Power off!	Set LD circuit power to OFF
?powstatus			LD Power on/off!	Read LD circuit power state
?ldpowstatval			0/1	Read LD circuit power state 0=off / 1=on
!tecpowon			TEC Power on!	Set TEC circuit power to ON
!tecpowoff			TEC Power off!	Set TEC circuit power to OFF
?tecpowstatus			TEC Power on/off!	Read TEC circuit power state
?tecpowstatval			0/1	Read TEC circuit power state 0=off / 1=on
!tecon			TEC on!	Set TEC circuit to ON
!tecoff			TEC off!	Set TEC circuit to OFF
?tecstatus			TEC on/off!	Read TEC circuit state
!tempreset			Temp. error reset!	Reset temperature error
?ldcurrentrange	1		10..500/100..5000mA	Read drver current configuration

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5.1 General Remarks

The Sirius Driver controllers does not need regular maintenance by the user. It does not contain any components that could be repaired by the user himself. If a malfunction occurs, the whole unit must be sent back to Lasertack GmbH. Do not remove any components from the board!

General care

Protect the unit from adverse weather conditions. The Sirius Driver controllers are not water resistant.

Attention

To avoid damage to the Sirius controller, do not expose it to spray, liquids or solvents!

Cleaning

The board can be cleaned by using dry compressed air.

5.2 Supply Voltage

The supply voltage is 12 VDC and 36 VDC. The input voltage must not exceed 36 VDC as otherwise the driver board and/or the laser diode can be damaged.

6.1 Technical Data

Sirius 500 / Sirius 5000	
Auto Current Control	
LD Current Range	0-500 mA / 500-5000 mA
Compliance Voltage	30 V
Setting Resolution	1 mA
Setting Accuracy	<1 %
Ripple Noise - Range 0.5 A / 5 A	1 mA / 3.5 mA
Power Monitor Input (Photo Diode)	
Photo Current Measurement Ranges	7 µA - 3600 µA
Photo Current Accuracy	0.1 %
Photodiode reverse BIAS voltage	5 V
External Modulation Input	
Input Impedance	1 kΩ
Modulation Speed	800 kHz
Modulation Voltage	0-5 VDC
Modulation Signal	TTL, analog
Rising Time - Range 0.5 A / 5 A	90 ns / 380 ns
Falling Time - Range 0.5 A / 5 A	130 ns / 400 ns
TEC Controller	
Controller Type	Full bridge (heating / cooling)
Output Power	180 W max.
Sensor	10k NTC
Output Current	5 A max.
Output Voltage	36 VDC max.
Regulation Accuracy	0.005 °C max.
Power Supply	
Supply Voltage	12-36 VDC
Operating Conditions	
Temperature	0-60 °C
Humidity	50 ± 20% non-condensing
Dimensions	
Sirius Driver Basic Board	124.2 x 81.3 x 35.7 mm³
Sirius Driver with TEC Board	124.2 x 81.3 x 48.0 mm³

6.2 Dimensions

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6.3 Certificate

EU Declaration of Conformity

in accordance with EN ISO/IEC 17050-1:2010

We: Lasertack GmbH

Kasseler Str. 62
34277 Fuldabrueck
Germany

in accordance with the following Directives:

2014/35/EU   Low Voltage Derective

hereby declare that:

Product name: Sirius xxxx Laser diode driver

is in conformity with the applicable requirements of the following documents:

EN 61010-1   Safety Requirements for Electrical Equipment for   2010
             Measurement, Control and Laborotory use.

Place/Date: Fuldabrueck / 01.09.2023

Name and position: Alex Schatalow - CEO

Sign: *Alex Schatalow*

6.4 Warranty

Lasertack GmbH warrants material and production of the Sirius Laser Driver Series for a period of 12 months starting with the date of shipment. During this warranty period Lasertack GmbH will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to Lasertack GmbH. The customer will carry the shipping costs to Lasertack GmbH, in case of warranty repairs Lasertack GmbH will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer. Contact Lasertack GmbH before shipment for Customs declaration instructions.

Lasertack GmbH warrants the hard- and/or software determined by Lasertack GmbH for this unit to operate fault-free provided that they are handled according to our requirements. However, Lasertack GmbH does not warrant a fault free and uninterrupted operation of the unit, of the software or firmware for special applications nor this instruction manual to be error free. Lasertack GmbH is not liable for consequential damages.

Restriction of Warranty

The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient stated by us or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. Lasertack GmbH does explicitly not warrant the usability or the economical use for certain cases of application.

Lasertack GmbH reserves the right to change this instruction manual or the technical data of the described unit at any time.

6.5 Exclusion of Reliability

Lasertack GmbH has taken every possible care in preparing this document. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this document is regularly updated and adapted to reflect the current status of the hardware and/or software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.

Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this document is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of Lasertack GmbH result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this document. Should you require further information on this product or encounter specific problems that are not discussed in sufficient detail in the document, please contact Lasertack GmbH or system installer.

Our contact:

Company: Lasertack GmbH
Street: Kasseler Str. 62
Zip & City: 34277 Fuldabrueck
Country: Germany
Email: info@lasertack.com
Phone: +49 561 92017707

6.6 „End of Life" Policy

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Lasertack GmbH offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for Lasertack GmbH electrical and electronic equipment

- sold after January 1, 2016
- sold to a company, institute or individual within the EC
- currently owned by a company, institute or individual within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self-contained operational electrical and electronic products, this "end of life" take back service does not refer to other Lasertack GmbH products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM
- laser driver cards
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

Waste treatment on your own responsibility

If you do not return an "end of life" unit to Lasertack GmbH, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological background

It is well known that waste treatment pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS Directive is to reduce the content of toxic substances in electronic products in the future.
The intent of the WEEE Directive is to enforce the recycling of WEEE. A controlled recycling of end-of-life products will thereby avoid negative impacts on the environment.