MANUAL

ARES laser diode driver

Hardware revision 2026-10
As of 17 November 2026

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1 Safety

ARES is a laser diode driver for integration into laser systems. Installation and operation by qualified personnel only, within the specifications (chapter 3).

WARNING

Laser radiation. Depending on the laser diode connected, the system emits class 3B or class 4 radiation. Direct and scattered radiation can cause permanent eye damage, skin burns and fire. Wear laser safety goggles suitable for the wavelength and power, and classify and label the laser system according to IEC 60825-1.

WARNING

Automatic start. ARES is delivered in ARM mode: the laser output becomes active approx. 5 s after power-up and approx. 5 s after the interlock loop closes, without a start signal (chapter 8).

WARNING

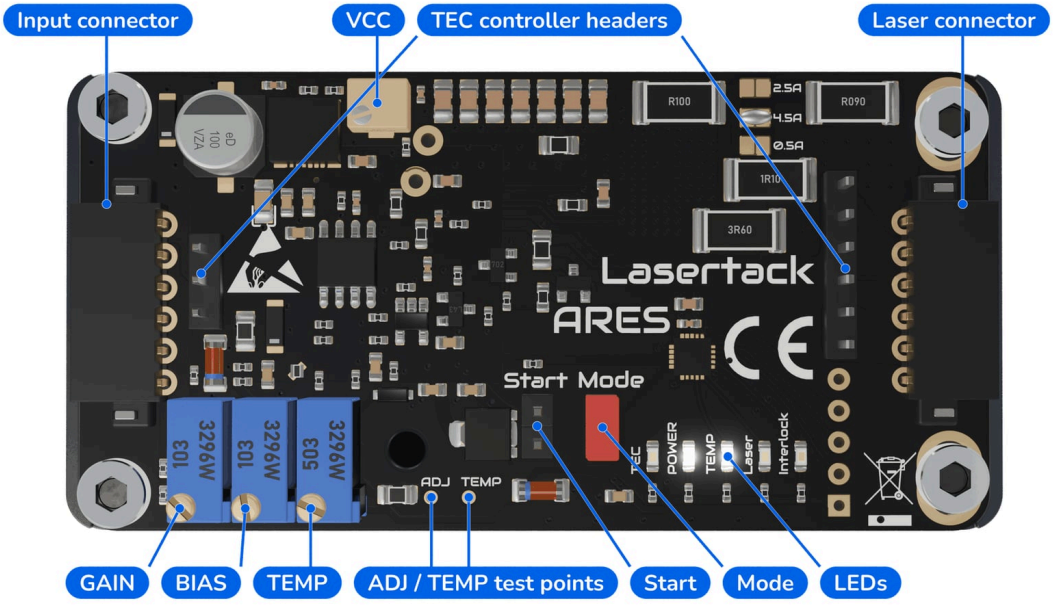
Interlock. The interlock and the temperature monitoring are evaluated by the driver's microcontroller on a single channel (shutdown < 0.1 s). They are therefore not a safety function according to EN ISO 13849-1. If the risk assessment of your system requires one, disconnect the supply voltage via a safety relay.

NOTE

- Connect or disconnect the laser diode only with the supply voltage switched off.
- Supply voltage 25 V maximum; the input is not protected against reverse polarity.
- Pin 5 of the input connector is a 5 V output: never apply an external voltage.
- Laser diodes are sensitive to ESD: work only at an ESD-protected workstation.
- The power loss is dissipated through the bottom side: mount ARES on a heat sink (chapter 6).

2 Overview

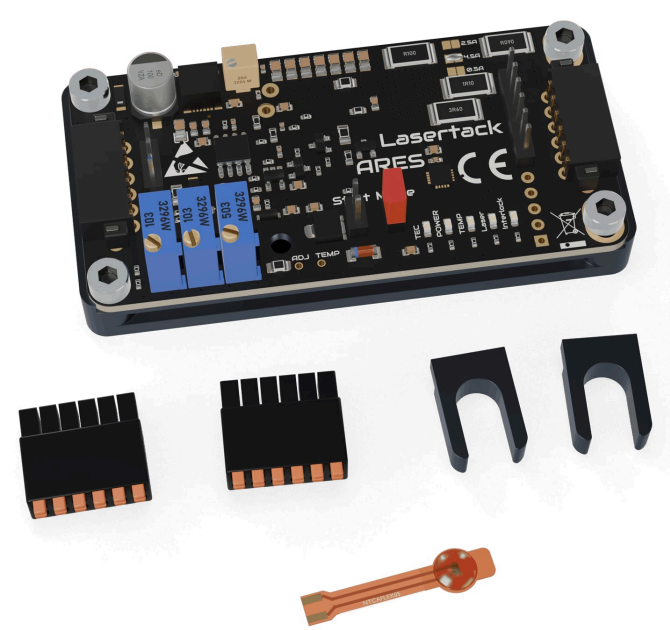
ARES is a linear regulator for laser diodes up to 4.5 A. An integrated step-down converter lowers the supply voltage (7–25 V) to the driver voltage VCC. VCC is set to the forward voltage of the laser diode plus 2 V, so only this voltage drop appears across the linear regulator and the thermal load stays low.



ARES, top view

Versions: maximum diode current 125 mA, 500 mA, 2.5 A or 4.5 A, set at the factory.

Scope of delivery: ARES, 2 plugs (6-pin), 2 mounting clamps, foil NTC 10 kΩ.



Scope of delivery

Factory setting: an ARES delivered together with a Lasertack laser is set up for that laser; do not change the potentiometers. Set up an ARES delivered on its own as described in chapter 7.

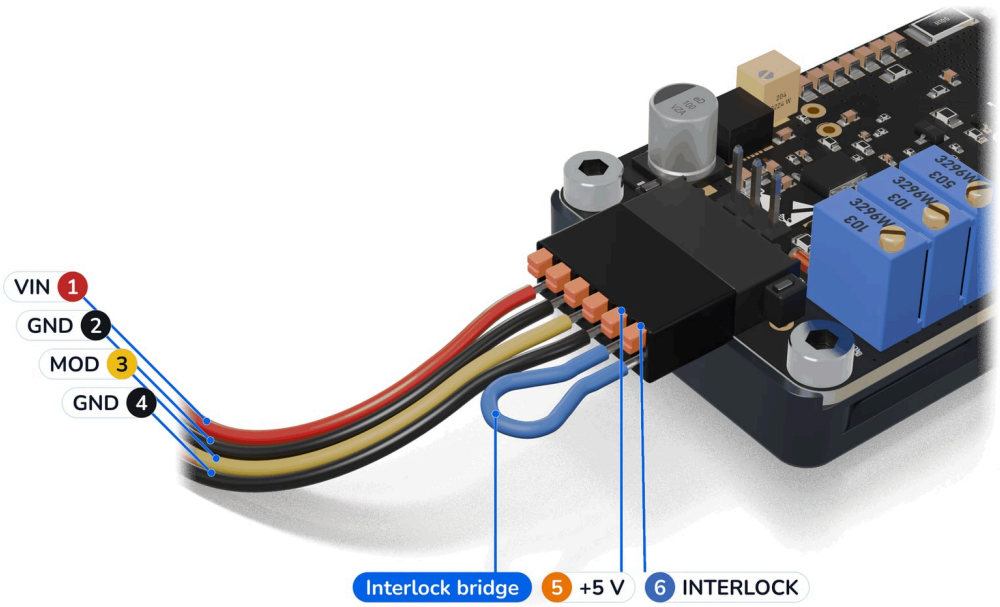
3 Specifications

Diode current	up to 125 mA, 500 mA, 2.5 A or 4.5 A (version)
Regulation	linear regulator
Supply voltage	7–25 V DC, at least VCC + 2 V
Driver voltage VCC	5.1–14.1 V, adjustable
Voltage drop	at least 2 V
Laser diode forward voltage	up to 11 V
Modulation voltage	0–5 V, analog or TTL
Modulation input impedance	≥ 20 kΩ
Threshold voltage	0.22 V
Modulation frequency	analog up to 600 kHz, TTL up to 50 kHz
Switching time	on 2–5 µs, off 0.2–1.5 µs
Power-up delay	approx. 5 s
Interlock and over-temperature shutdown	< 0.1 s
Temperature sensor	NTC 10 kΩ, B25/85 = 3960 K
Connectors	2 × 6-pin, pluggable, 2.54 mm pitch
Dimensions	75 × 37 mm
Mounting	2 clamps, M6, 50 mm spacing
Conformity	CE, EMC Directive 2014/30/EU

4 Connectors

Two pluggable 6-pin terminals, 2.54 mm pitch: the input connector on the left, the laser connector on the right. The supplied plugs have spring terminals for wires up to 0.5 mm². Plug and unplug only with the supply voltage switched off.

Input connector



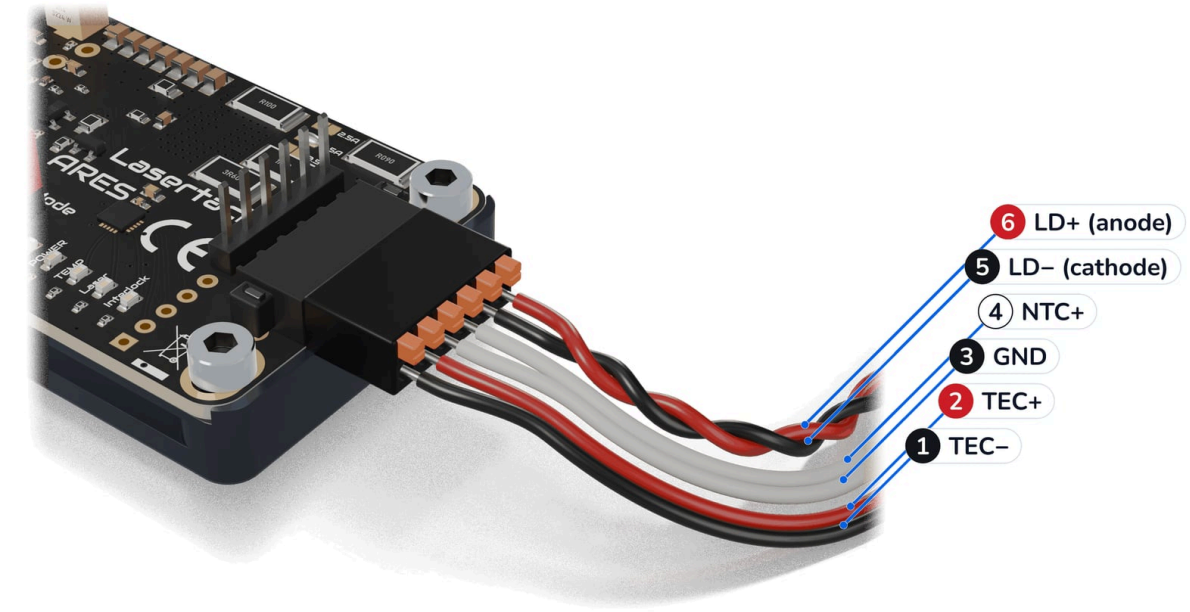
Input connector, wired

Pin	Signal	Function
1	VIN	supply voltage, 7–25 V DC
2	GND	supply ground
3	MOD	modulation input, 0–5 V
4	GND	modulation ground
5	+5 V	5 V output for the interlock loop
6	INTERLOCK	interlock input

Interlock loop: connect pins 5 and 6 through a normally closed contact (door switch, key switch), or through a wire jumper for operation without an interlock. With the loop open, the laser output is off. Alternatively, pin 6 can be driven by a 5 V signal referenced to pin 4.

Power supply: 12 V or 24 V; the supply voltage must be at least 2 V above VCC.

Laser connector



Laser connector, wired

Pin	Signal	Function
1	GND	TEC –
2	TEC+	TEC + (with TEC controller only)
3	GND	NTC
4	NTC+	NTC (either polarity)
5	GND	laser diode cathode
6	LD+	laser diode anode

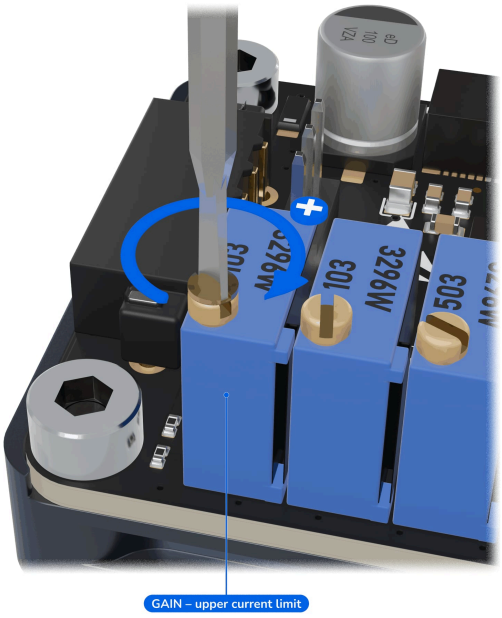
Laser cable: twist LD+ and LD– and keep the cable short; the inductance of long cables causes the diode current to overshoot at switch-on.

5 Controls

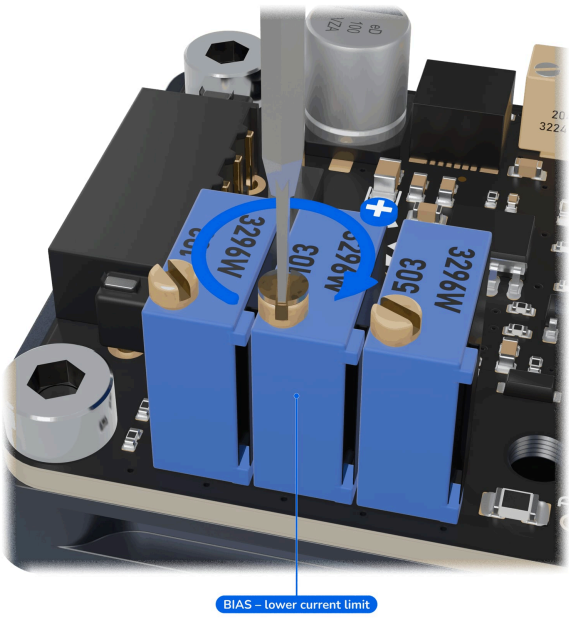
Potentiometers

Potentiometer	Function	Range	Turns
GAIN	upper current limit (diode current at 5 V)	0 to maximum current	25
BIAS	lower current limit (BIAS current)	0 to maximum current	25
TEMP	shutdown temperature	9 °C to off	25
VCC	driver voltage	5.1–14.1 V	11

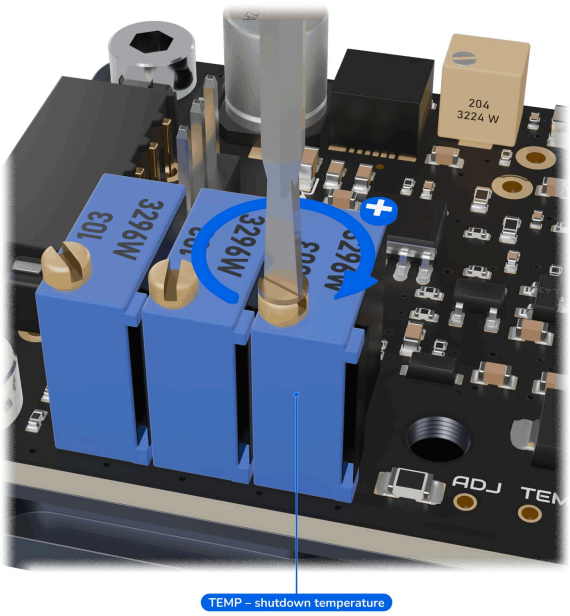
Turning clockwise increases the value. GAIN, BIAS and TEMP are the three blue potentiometers, VCC is the beige one.



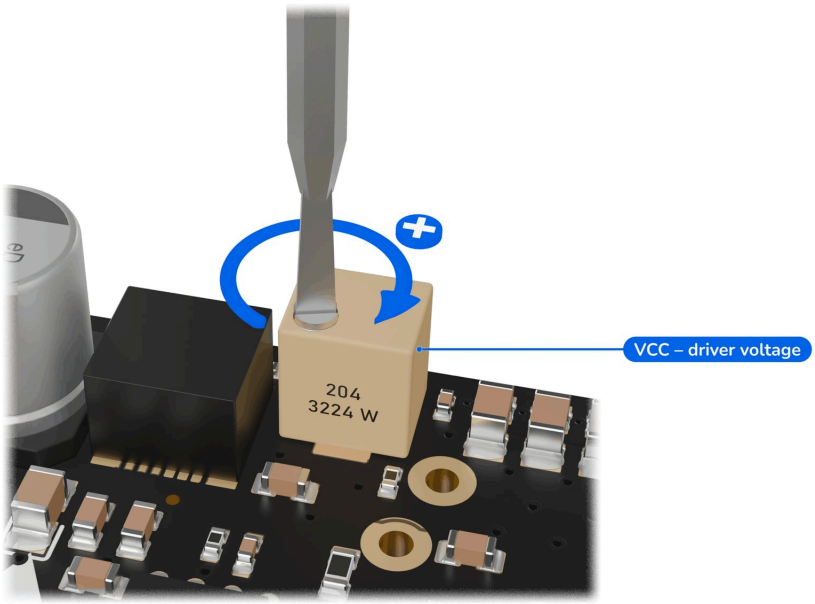
GAIN



BIAS



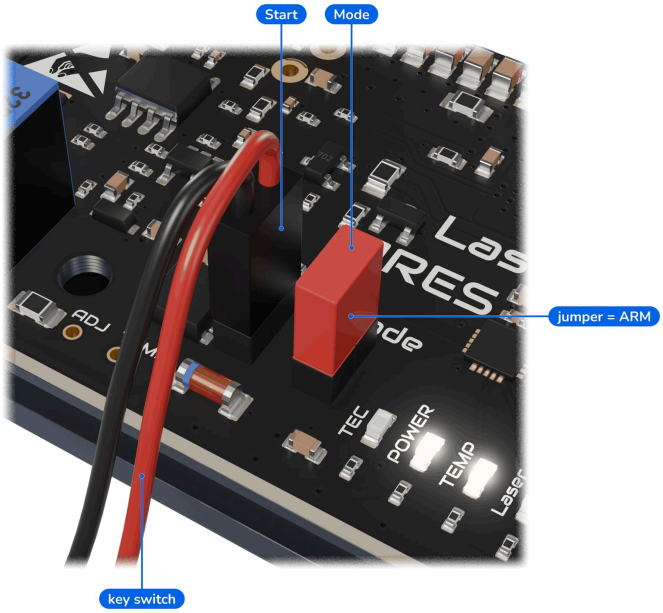
TEMP



VCC

Diode current: between the threshold voltage (0.22 V) and 5 V, the diode current rises linearly from the lower to the upper current limit. GAIN thus sets how many mA flow per volt of modulation voltage. The maximum current of the version cannot be exceeded.

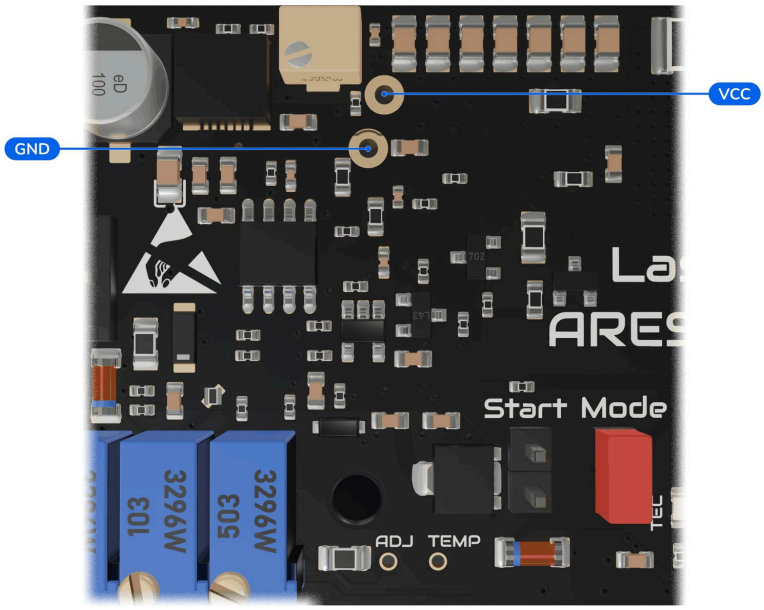
Start and Mode



Start and Mode

- **Start:** connection for a start switch (key switch or latching switch). The laser output is active only while the switch is closed.
- **Mode:** jumper fitted = ARM mode (factory setting), open = Standard mode (chapter 8). Read at power-up only.

Test points

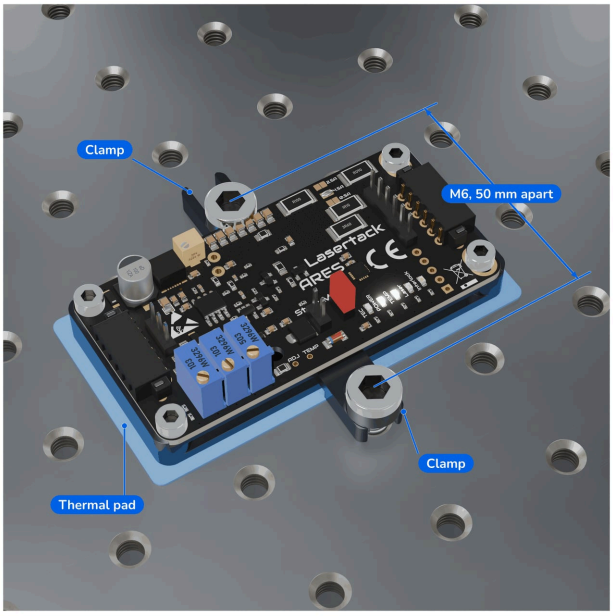


Test points

- **ADJ–TEMP:** resistance of the TEMP potentiometer; measure with the supply voltage off and the NTC disconnected.
- **VCC–GND:** driver voltage VCC.

6 Mounting

The power loss of the linear regulator, voltage drop × diode current, is dissipated through the bottom side. Mount ARES with the two clamps and a thermal pad on a heat sink or another heat-dissipating surface, e.g. an optical table (M6, 50 mm spacing).



ARES mounted with clamps and thermal pad

7 Set-up

Only for an ARES delivered on its own; an ARES delivered with a Lasertack laser is set up at the factory.

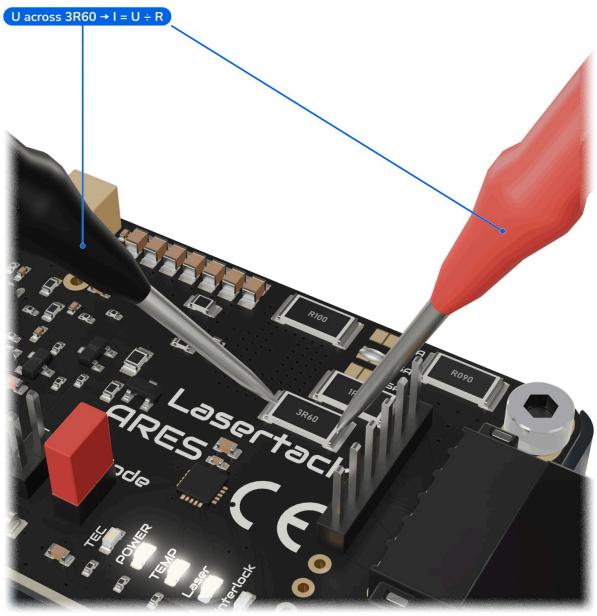
Required: multimeter, a modulation source for 0.3 V and 5 V (lab power supply or function generator), the data sheet of the laser diode (forward voltage, threshold current, maximum operating current) and laser safety goggles.

Measuring the diode current

The voltage across the resistor marked **3R60** is proportional to the diode current. Divide it by the value for your version:

Version	Divide by
125 mA	3.6 Ω
500 mA	0.90 Ω
2.5 A	0.18 Ω
4.5 A	0.097 Ω

Example, 4.5 A version: 0.291 V ÷ 0.097 Ω = 3.0 A. Accuracy ±2 %.



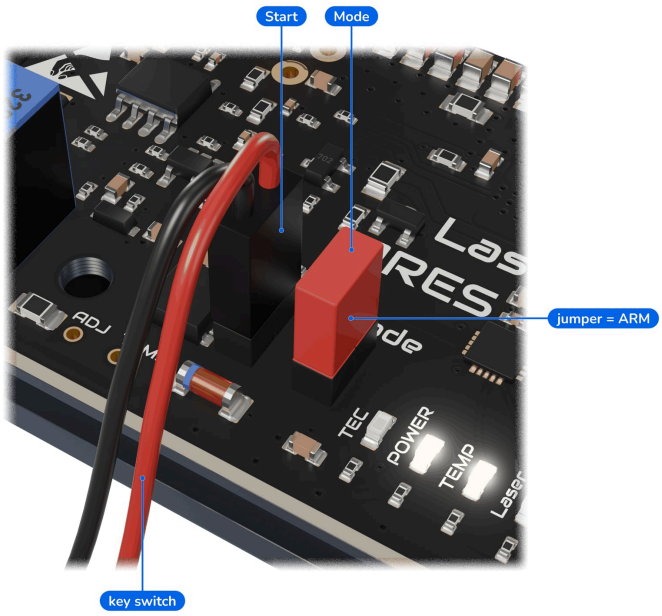
Measuring the voltage across 3R60

Alternatively, measure with an ammeter in series with the laser diode. With the TEC controller fitted, 3R60 is covered: use the ammeter.

Setting

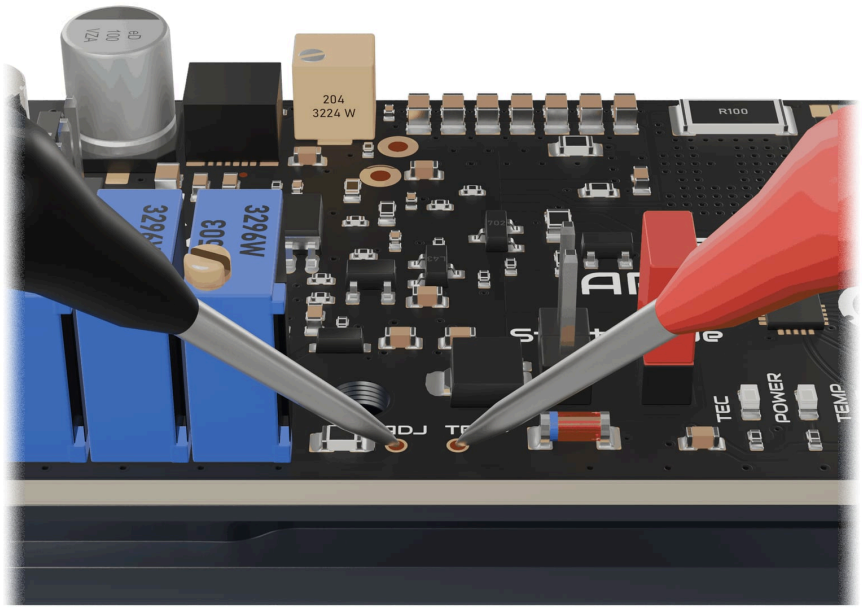
Supply voltage off:

1. Remove the Mode jumper (Standard mode).



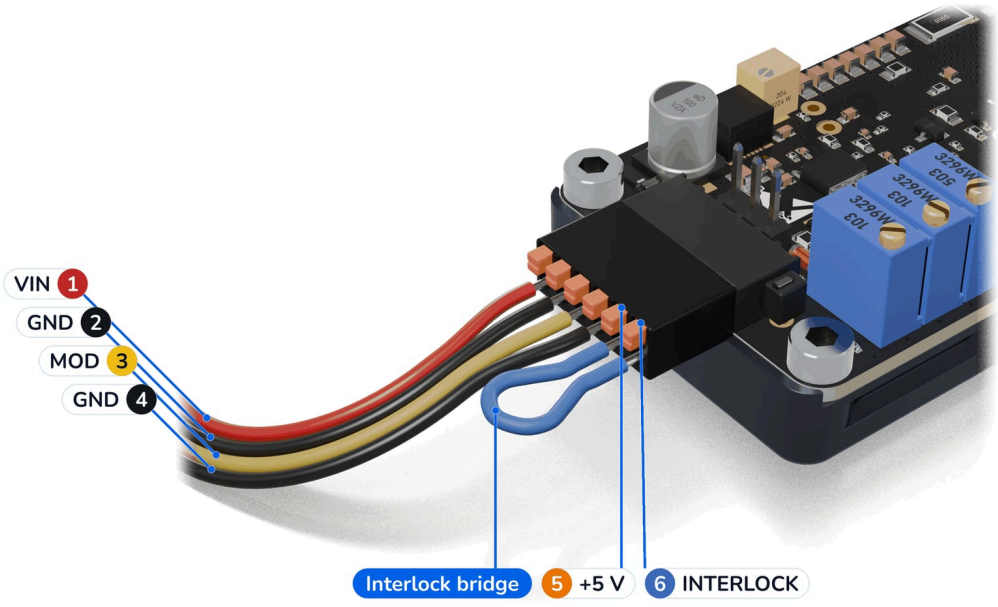
Start and Mode

2. Disconnect the NTC. Set the shutdown temperature with TEMP via the resistance ADJ–TEMP (chapter 9; with TEC controller, chapter 10). Reconnect the NTC.



Measuring ADJ–TEMP

3. Turn GAIN and BIAS fully counter-clockwise (25 turns).
4. Wire the input connector: supply voltage on pins 1/2, interlock jumper 5–6, modulation source on pins 3/4 at 0 V. Connect the start switch (open) to Start.

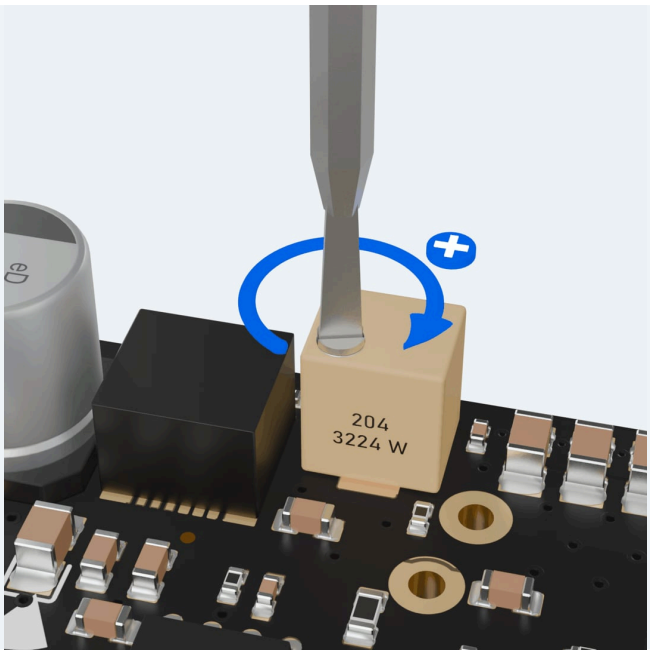


Input connector, wired

Without laser diode:

5. Switch on. POWER lights; after the power-up delay (approx. 5 s), POWER and TEMP light.

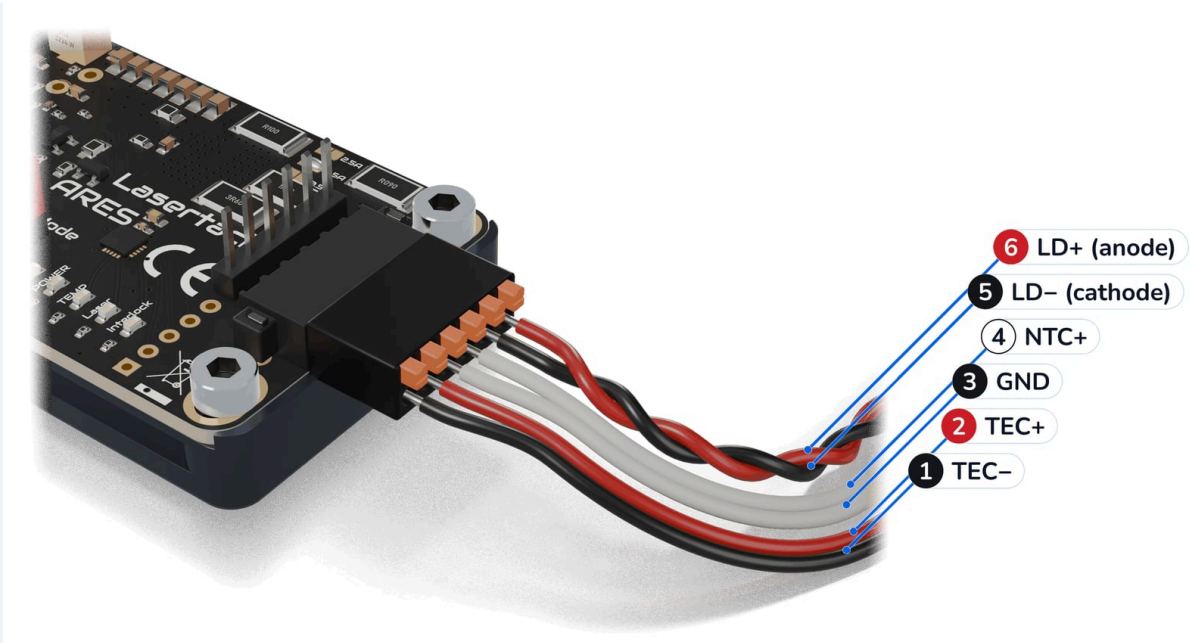
6. Measure VCC at VCC–GND and set it with the VCC potentiometer to the forward voltage of the laser diode + 2 V.[1] Switch off.



Setting VCC

With laser diode:

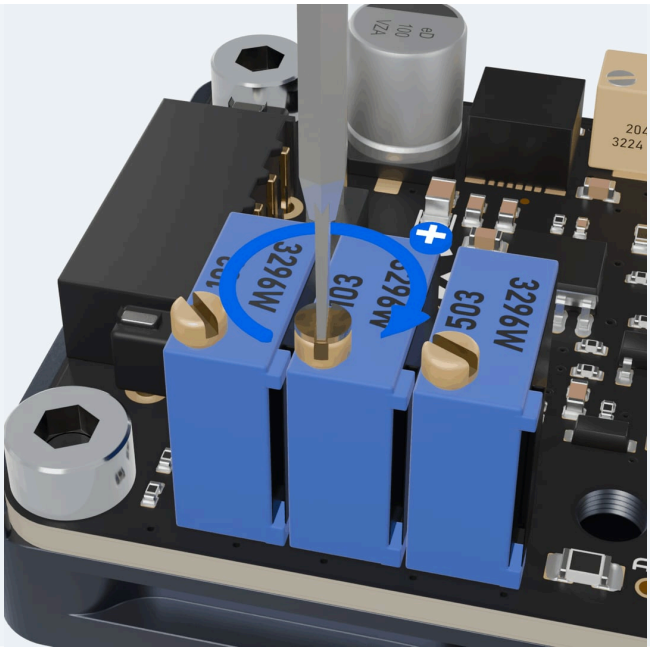
7. Connect the laser diode to the laser connector: anode to pin 6, cathode to pin 5. Put on the laser safety goggles.



Laser connector, wired

1. The linear regulator needs a voltage drop of at least 2 V to regulate the current. Less limits the current; more only increases the power loss.

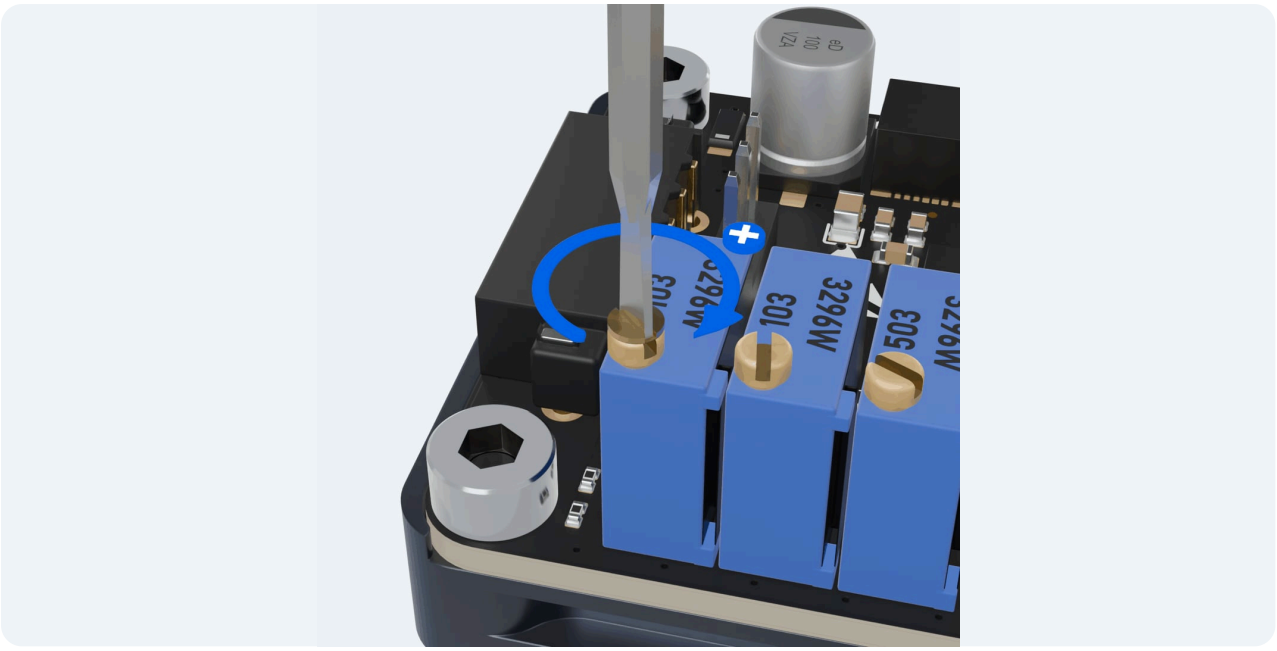
8. Switch on and wait for the power-up delay.
9. Close the start switch. The Laser LED flashes for approx. 5 s, then the laser output is active.
10. Set the modulation voltage to 0.3 V.[2] Turn BIAS clockwise until the threshold current of the laser diode is reached.



Setting BIAS

11. Set the modulation voltage to 5 V. Turn GAIN clockwise until the required operating current is reached; do not exceed the maximum current of the laser diode.

2. Below the threshold voltage of 0.22 V the laser output is off; 0.3 V is just above it.



Setting GAIN

12. Repeat steps 10 and 11 once.
13. If the diode current drops at 5 V, increase VCC slightly.
14. Open the start switch. For ARM mode, refit the Mode jumper with the supply voltage off.

8 Operation

Operating modes

	Standard mode (jumper open)	ARM mode (jumper fitted, factory setting)
Power-up delay	approx. 5 s	none
Start signal	must remain set during operation	no function
Laser output active	approx. 5 s after the start signal is set	approx. 5 s after power-up
After a fault	off until the fault is cleared and the start signal is reset and set again	active again approx. 5 s after the fault is cleared

If the start signal is already set at power-up, the driver in Standard mode starts only after the start signal has been reset once.

WARNING

In ARM mode the laser output becomes active again automatically as soon as an opened interlock loop is closed again.

Interlock and over-temperature

An open interlock loop or an over-temperature switches the laser output off within 0.1 s; the LEDs show the fault (table below). Temperature setting: chapter 9.

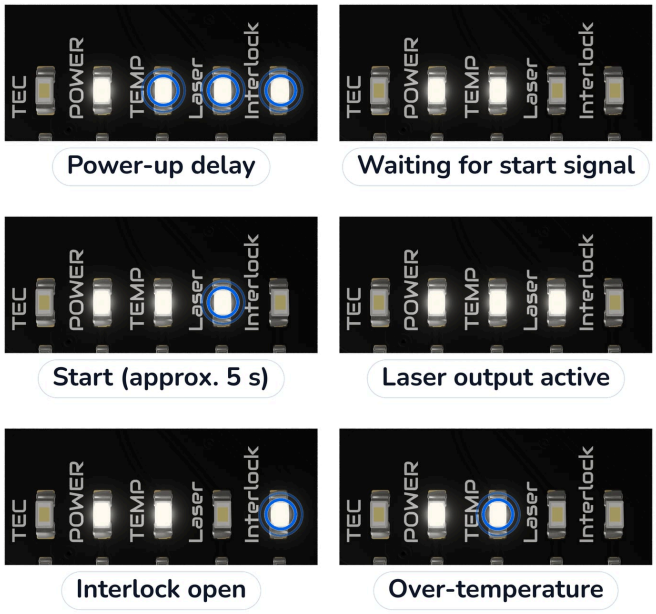
Modulation

Below the threshold voltage of 0.22 V the laser output is off; above it, the diode current follows the modulation voltage linearly up to 5 V. TTL: low switches the laser off, high switches it on at the set current. For pulsed operation, modulate via the modulation input with the start signal set, not via the start signal (power-up delay).

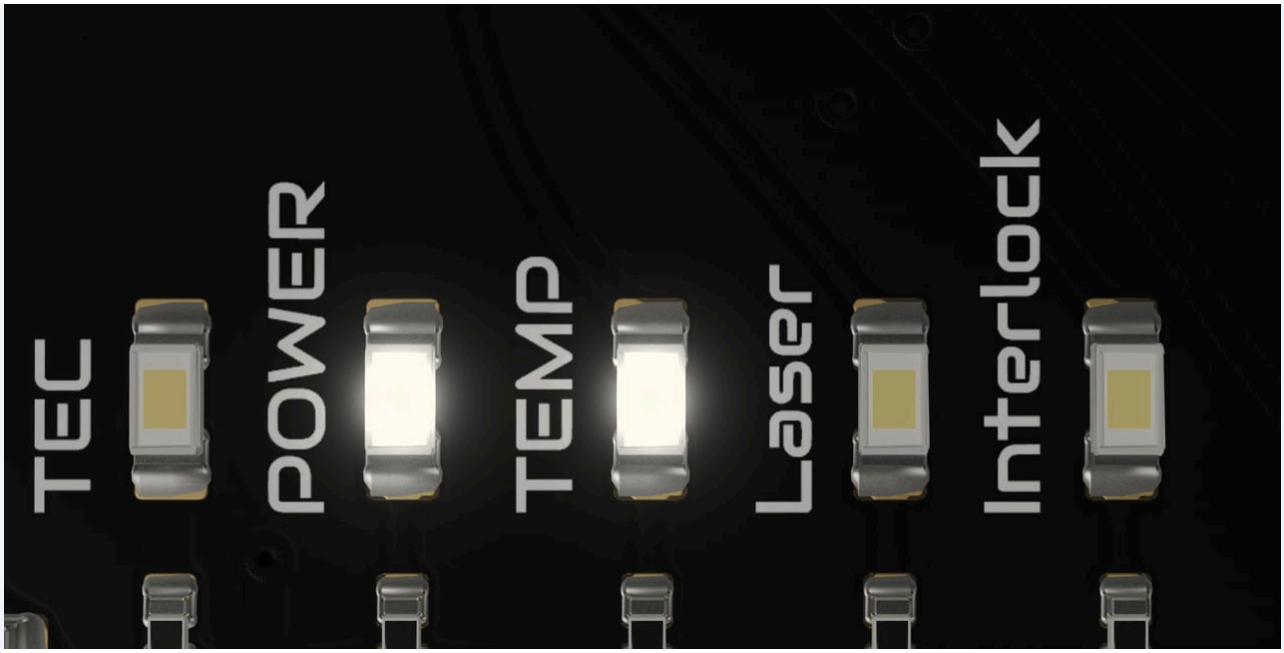
LED indicators

Flashing: approx. 1 Hz.

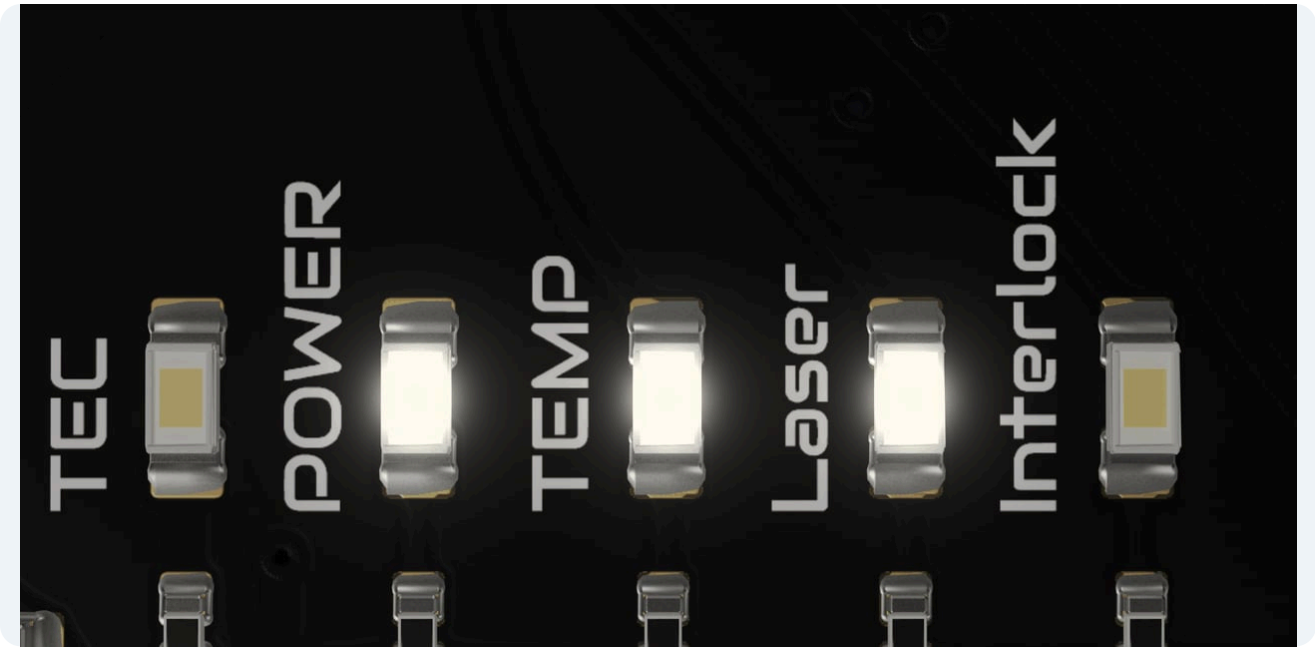
Operating state	POWER	TEMP	Laser	Interlock
Power-up delay (Standard)	on	flashing	flashing	flashing
Waiting for start signal	on	on	off	off
Start (approx. 5 s)	on	on	flashing	off
Laser output active	on	on	on	off
Interlock open	on	on	off	flashing
Over-temperature	on	flashing	off	off



LED states



Power-up



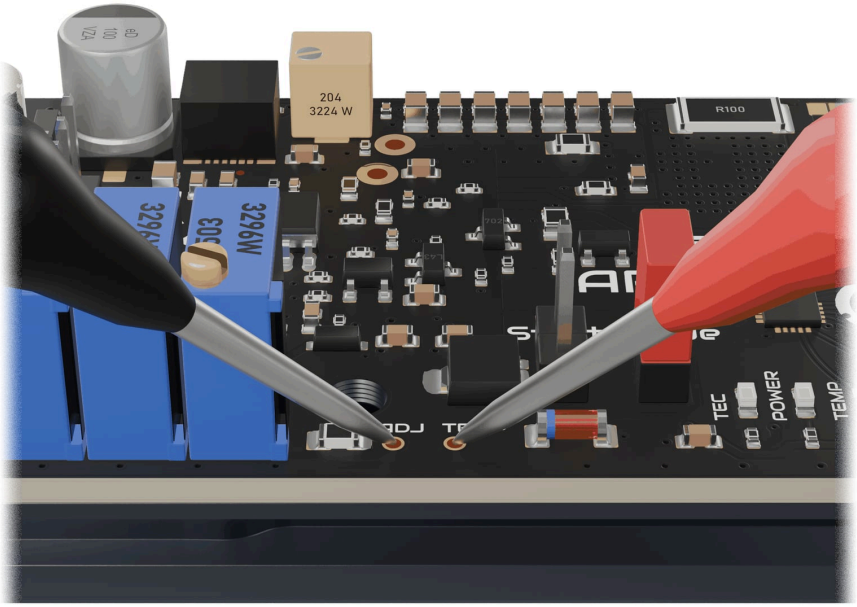
Start

- **Laser:** shows the active laser output, not the emission of the laser diode.
- **TEC:** lights while the TEC controller operates; its brightness follows the TEC voltage.
- **TEMP:** also lights without an NTC connected; the temperature monitoring is then inactive.

9 Temperature monitoring

The NTC measures the temperature at the laser diode. If it exceeds the shutdown temperature set with TEMP, the driver switches the laser output off and TEMP flashes. Once the NTC has cooled by approx. 4 K, the fault is cleared; in Standard mode, then reset and set the start signal again, in ARM mode the driver restarts automatically.

Setting: supply voltage off, NTC disconnected. Measure the resistance ADJ–TEMP and turn TEMP to the value for the required shutdown temperature. Values for the supplied foil NTC (10 kΩ, B25/85 = 3960 K), tolerance ±1 K.



Measuring ADJ–TEMP

Shutdown temperature	ADJ–TEMP
20 °C	29.8 kΩ
25 °C	23.8 kΩ
30 °C	19.1 kΩ
35 °C	15.5 kΩ
40 °C	12.6 kΩ
45 °C	10.3 kΩ
50 °C	8.5 kΩ
55 °C	7.1 kΩ
60 °C	5.9 kΩ

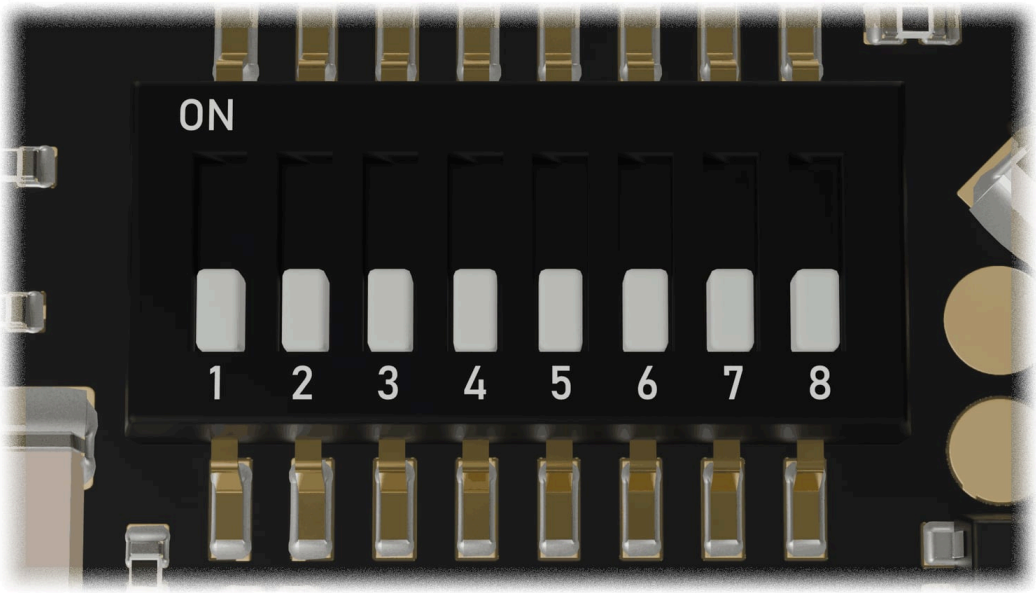
With the TEC controller fitted, TEMP sets the set temperature of the TEC controller: chapter 10.

10 TEC controller

The plug-on TEC controller (item PD-01360) extends the temperature monitoring with temperature control: it cools the laser diode via a Peltier element (TEC) to a set temperature. It uses the supply voltage, the NTC and the TEMP potentiometer of ARES.

DIP switch

The DIP switch is on the bottom side of the TEC controller: set it before fitting.



DIP switch on the bottom side

Voltage limit

ON	1	2	3	4	5	6	7	8
6 V	▢	▢	▢	▢	▢	▢	▢	▢
12 V	■	▢	▢	▢	▢	▢	▢	▢
22 V	■	■	▢	▢	▢	▢	▢	▢

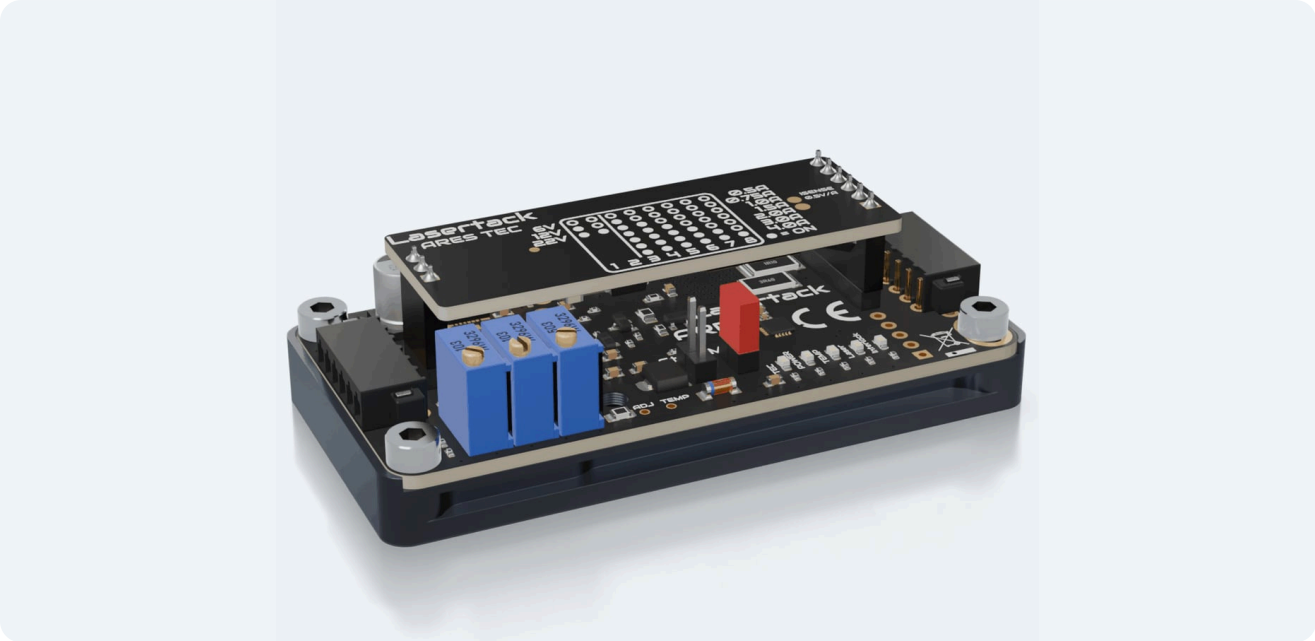
Current limit

ON	1	2	3	4	5	6	7	8
500 mA	▢	▢	▢	▢	▢	▢	▢	▢
750 mA	▢	▢	■	▢	▢	▢	▢	▢
1.0 A	▢	▢	■	■	▢	▢	▢	▢
1.5 A	▢	▢	■	■	■	▢	▢	▢
2.0 A	▢	▢	■	■	■	■	▢	▢
3.0 A	▢	▢	■	■	■	■	■	▢
4.0 A	▢	▢	■	■	■	■	■	■

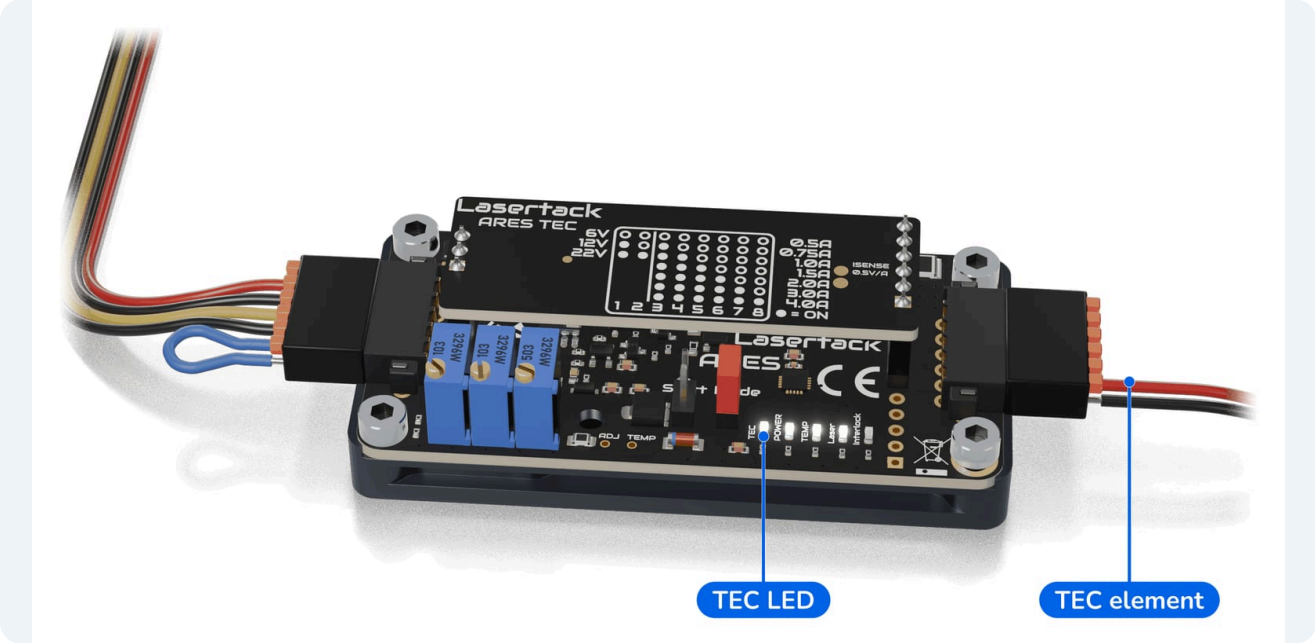
- **Current limit:** the maximum current of the TEC element, or the next lower step.
- **Voltage limit:** 12 V for most TEC elements; 6 V for small elements up to 3 W; 22 V for high-voltage or stacked elements (24 V supply voltage).

Fitting the TEC controller

1. Supply voltage off; set the DIP switch.
2. Plug the TEC controller, components down, onto the 3-pin header next to the input connector and the 6-pin header next to the laser connector.
3. Connect the TEC element to the laser connector: + to pin 2, – to pin 1.



Fitting the TEC controller



TEC controller fitted

Set temperature

TEMP sets the set temperature. Set it with the supply voltage off and the NTC disconnected, via the resistance ADJ–TEMP; tolerance ±1 K.

Set temperature	ADJ–TEMP
5 °C	44.5 kΩ
10 °C	34.3 kΩ
15 °C	26.7 kΩ
20 °C	21.0 kΩ
25 °C	16.7 kΩ
30 °C	13.4 kΩ
35 °C	10.8 kΩ
40 °C	8.8 kΩ
45 °C	7.2 kΩ

- **Lowest set temperature:** 3 °C, TEMP fully counter-clockwise.
- **Shutdown temperature:** approx. 9 K above the set temperature; not separately adjustable.

11 Appendix

Validity: ARES from October 2026, with a step-down converter (recognisable by the beige VCC potentiometer). For older boards (iLD, ARES before 10/2026), ask Lasertack for the matching manual.

Conformity: EMC Directive 2014/30/EU. The declaration of conformity is available on request.

Disposal: not with household waste; take ARES to a collection point for electrical equipment.

Manufacturer: Lasertack GmbH, www.lasertack.com, info@lasertack.com