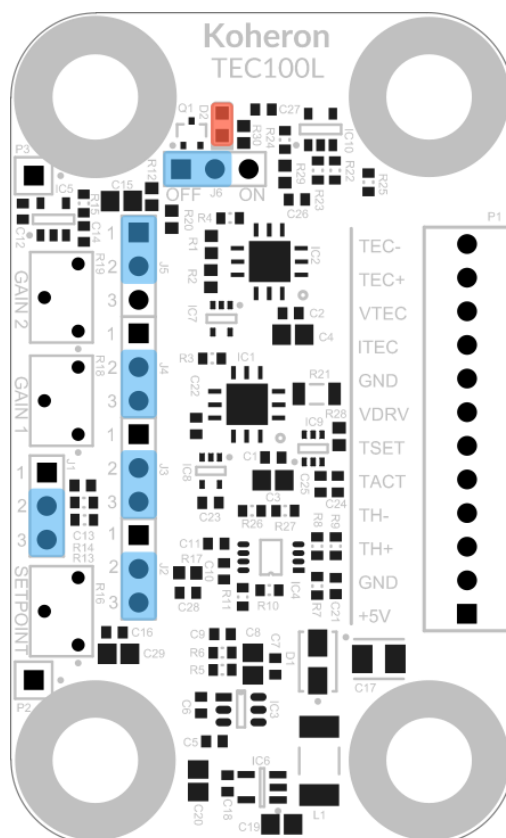# TEC100L-50
# User Guide



Set up to control a narrow-linewidth Thorlabs (SFL1550P) laser with the TEC100L temperature controller and the DRV100 laser diode driver.

## Quickstart

1  Make sure the TEC100L is in default jumper configuration as shown in blue in the image below:

1. Connect the thermistor between TH+ and TH− pins.

2. Connect the Peltier element between TEC+ and TEC− pins.

3. Supply the board with the +5V and GND pins.

4. The thermistance is measured with a Wheatstone bridge followed by an instrumentation amplifier. Measure the voltage $V_{TACT}$ at the amplifier output (TACT pin).

5. The thermistance is measured with a Wheatstone bridge followed by an instrumentation amplifier. Measure the voltage $V_{TACT}$ at the amplifier output (TACT pin). The thermistor value $R_{th}$ is given by the formula:
$R_{th}=10k\Omega \times \{4.096V+(V_{TACT}-1.65V)\}/\{4.096V-(V_{TACT}-1.65V)\}$
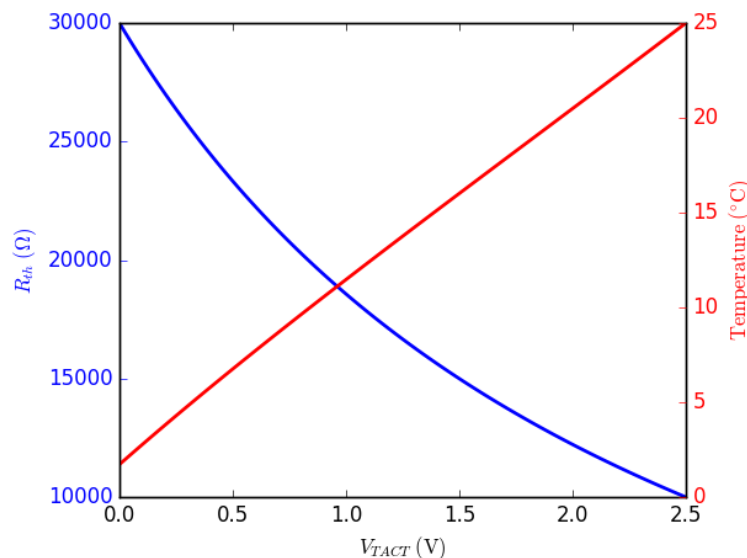


6. The analog PID control loop tries to make the voltage $V_{TACT}$ equal to the setpoint $V_{TSET}$. Monitor the TSET pin and adjust the setpoint with the R16 potentiometer to obtain the desired value of $V_{TSET}$. For a standard 10 kΩ thermistor at 25 °C, adjust $V_{TSET}$ to 1.65 V.

7. Monitor the voltages $V_{ITEC}$ and $V_{VTEC}$ at the ITEC and VTEC pins. The current II flowing between the pins TEC+ and TEC− is given by the formula:
$I=1A/V \times (V_{ITEC}-2.5V)$.
The voltage $V=V_{TEC+}-V_{TEC-}$ is given by:
$V=V_{VTEC}-2.5V$.

8. Enable the current output stage by setting the jumper J6 on the ON position. The current output stage is current limited to 1.15 A. The LED D2 turns ON when the system reaches the current limit.

### Control the setpoint from an external voltage
When the jumper J1 is in position 2−3, $V_{TSET}$ is adjusted with the R16 potentiometer and can be monitored on the TSET pin. When J1 is in position 1−2, the voltage $V_{TSET}$ can be controlled externally at the TSET pin.

## Adjusting the PID gains

The PID controller gains are adjusted to work out-of-the-box with a typical laser in butterfly package. If the preset gains do not work for your laser, you can use the following procedure:

1   Turn off the board.

2   Set the jumpers J3 and J4 in position 1-2 for manual gain adjustment.

3   Set the gains to a minimal value by turning GAIN1 and GAIN2 counter clockwise.

4   Set J1 in position 2-3. Apply a square wave on TSET with a 10-second period and an amplitude of 0.3 V peak-peak around 2 V.

5   Monitor TACT on an oscilloscope.

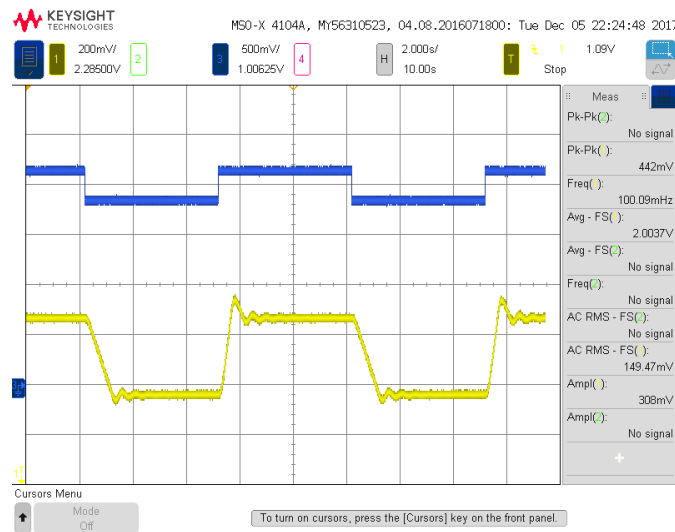6   Turn on the board. You should observe something similar to the figure below (TSET: blue, TACT: yellow).
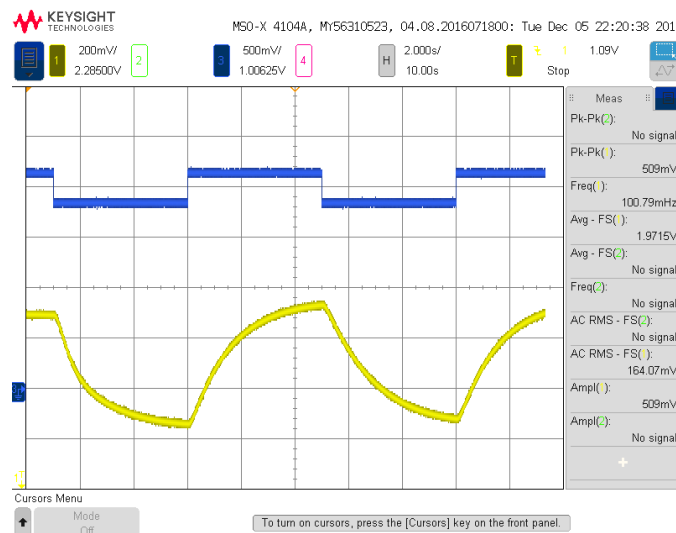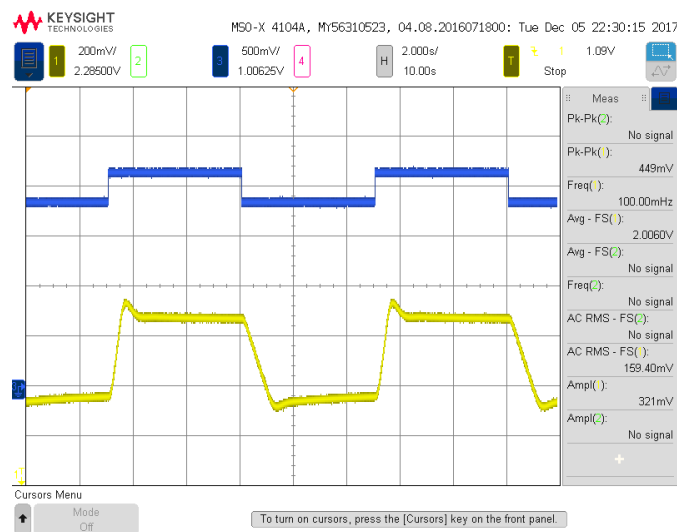


7   Increase GAIN1 until TSET oscillates:
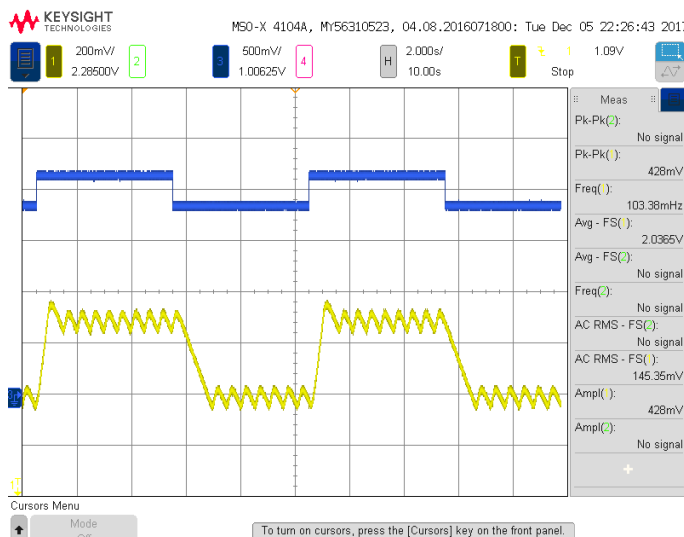
and then slowly lower GAIN1 to get damped oscillations:



Increase GAIN2 to optimize the settling time:



## Drive the output amplifier from an external voltage

In the standard jumper configuration (J5 on position 1-2), the output amplifier creates a voltage VV between the pins TEC+ and TEC- from the output $V_{DRV}$ of the PID control loop:

$V = 2 \times (1.65V - V_{VDRV})$.

You can bypass the PID control loop and control directly the output amplifier from the VDRV pin by setting the jumper J5 on position 2-3.