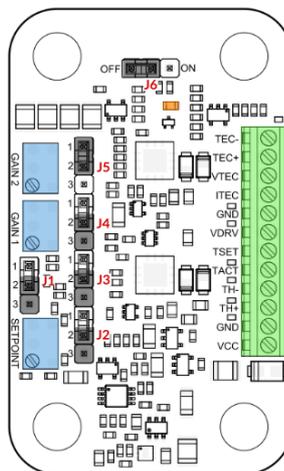


TEC100L User Guide



Quickstart

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

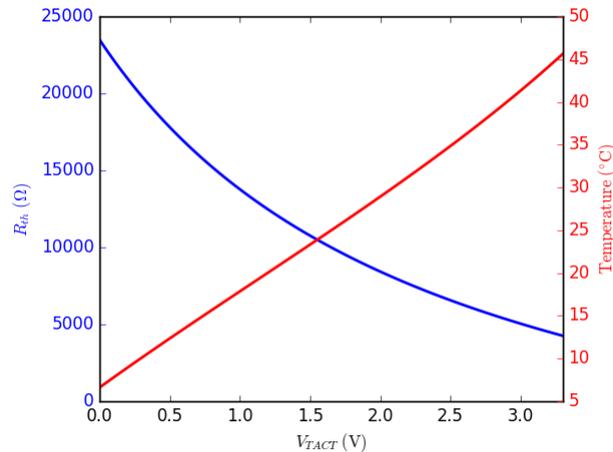


TEC100L jumper configuration

- J1: 2-3
- J2: 2-3
- J3: 2-3
- J4: 2-3
- J5: 1-2
- J6: OFF

2. Connect the thermistor between TH+ and TH- pins.
3. Connect the Peltier element between TEC+ and TEC- pins.
4. Supply the board with 5 V between the VCC and GND pins.
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:

$$R_{th} = 10 \text{ k}\Omega * (4.096 \text{ V} - (V_{TACT} - 1.65 \text{ V})) / (4.096 \text{ V} + (V_{TACT} - 1.65 \text{ V}))$$



TEC100L-50 thermistor vs V TACT

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 k Ω thermistor at 25 $^{\circ}C$, adjust V_{TSET} to 1.65 V.
7. Monitor the voltages V_{ITEC} and V_{VTEC} at the ITEC and VTEC pins. The current I flowing between the pins TEC+ and TEC- is given by the formula:

$$I = 0.5 \text{ A/V} * (V_{ITEC} - 2.5 \text{ V})$$
 The voltage $V = V_{TEC+} - V_{TEC-}$ is given by:

$$V = 2 * (V_{VTEC} - 2.5 \text{ V})$$
 For the TEC100L with serial number lower than 6200, the formula for the TEC current is $I = 1.0 \text{ A/V} * (V_{ITEC} - 2.5 \text{ V})$. For the TEC100L with serial number lower than 1600, the formula is $V = V_{VTEC} - 2.5 \text{ V}$.
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 SETPOINT 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.

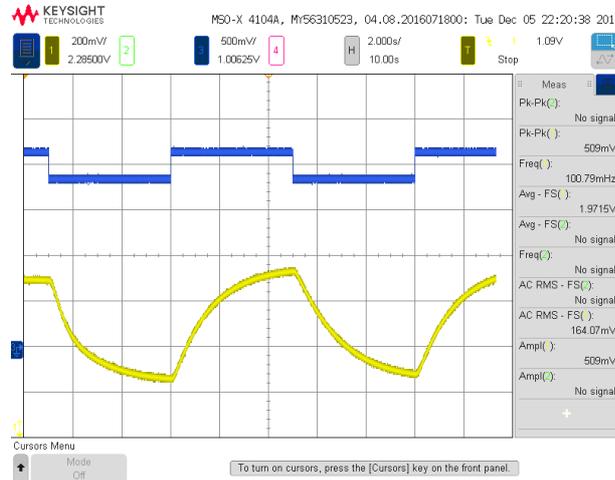
Adjusting the PID gains

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 set the jumpers J3 and J4 in position 1-2 and adjust the gains with the GAIN1 and GAIN2 trimmer. The integrator gain is inversely proportional to GAIN1. The proportional gain is proportional to GAIN2/GAIN1.

Below is a proposed procedure to adjust the gains:

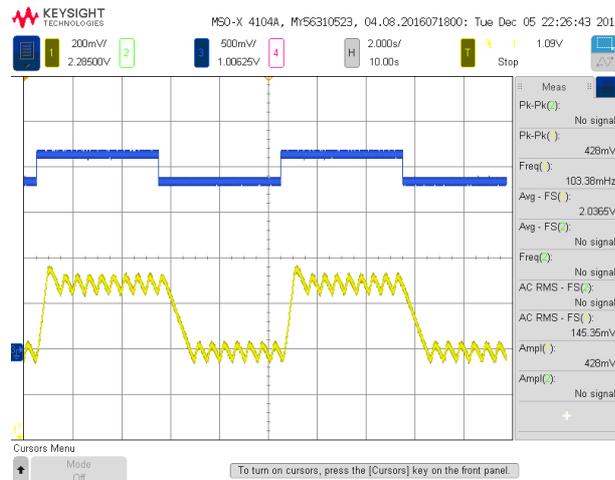
1. Turn off the board.
2. Set the jumpers J3 and J4 in position 1-2 for manual gain adjustment.

3. Set the gains to a minimal value by turning GAIN1 and GAIN2 trimmers counter clockwise.
4. Set J1 in position 1-2. Apply a square wave on TSET with a 10-second period and an amplitude of 0.3 V peak-peak around 2 V. If needed, use a longer period to give the system enough time to respond.
5. Monitor TACT on an oscilloscope.
6. Turn on the board. You should observe something similar to the figure below (TSET: blue, TACT: yellow).

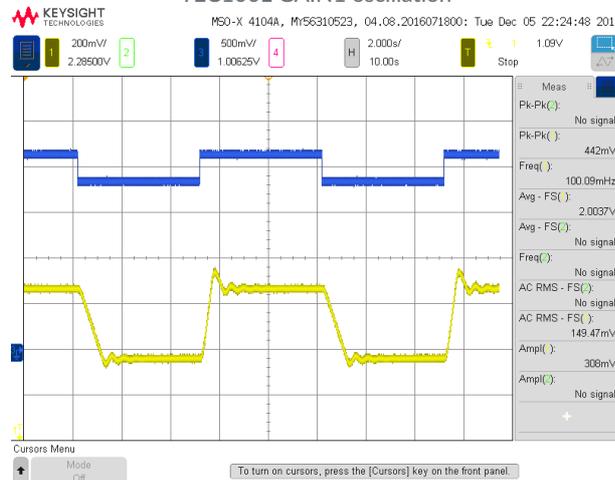


TEC100L no gain

7. Increase GAIN1 until TSET oscillates:

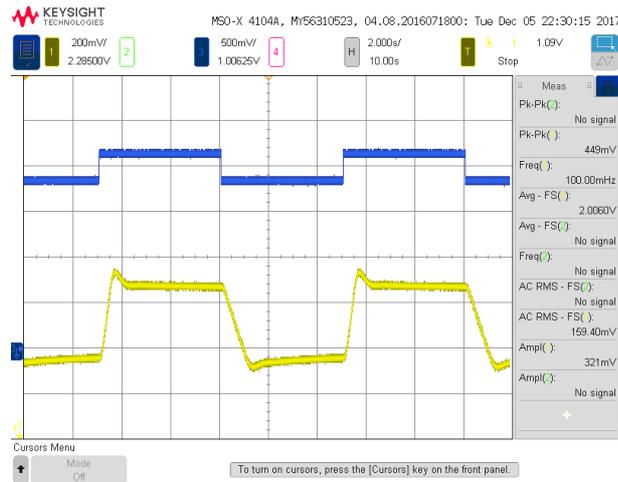


TEC100L GAIN1 oscillation



TEC100L GAIN1 damped

8. Increase GAIN2 to optimize the settling time:



TEC100L GAIN2 optimized

Drive the output amplifier from an external voltage

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

$$V = 5.05 \text{ V} - 3.05 V_{VDRV}$$

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.