



## mLC miniature Laser Controller



The Santec mini Laser Controller uses the latest high-density electronic components to provide fully digital control of ECDL or DFB/DBR lasers in an ultra-miniature form factor. The board includes a temperature controller and current source with low noise, high current and high compliance voltage. It includes a high voltage piezo driver, a high bandwidth analogue to digital signal input, and two analogue inputs for direct modulation of both piezo and current for external locking to an atomic transition, wavemeter or high finesse optical cavity. Electrical power is through a USB-C connection, compatible with most power delivery adapters. It can be operated from a host computer via USB or LAN either with the Windows app provided, or user code using simple text-based commands.

The mLC is designed for applications in quantum computing, quantum sensing, time and frequency standards, gas sensing, and spectroscopy.

### Features

- Ultra miniature package
- Oscilloscope functionality built-in
- Ultra-low noise current source
- Temperature controller
- High voltage piezo driver
- Sweep ramp generator
- TCP/IP, USB 2.0 (via USB-C port)
- LabVIEW, MATLAB and python drivers

# mini Laser Controller

## Specifications mLC 1.0 (preliminary)

### Current

Output current	0 to 1024 mA $\pm 15$ uA setpoint; 200 mA optional
Noise*	1.4 nA/VHz @ 1 kHz, 880 nA (rms) 1 Hz – 1 MHz
Stability and accuracy	$\pm 0.2$ ppm/ $^{\circ}$ C and 0.1 % from setpoint
Compliance voltage	8 V at 500 mA, 7.5 V at 1024 mA
Current modulation	$\pm 25$ mA sweep, $\pm 1$ mA analogue IN
Current modulation bandwidth	Direct analogue mode: 12 MHz ( $-3$ dB)

### Temperature

Range	7.5 – 70 $^{\circ}$ C $\pm 0.01$ $^{\circ}$ C resolution
Stability	Better than $\pm 10$ mK
TEC power	$\pm 3$ A, $\pm 4.5$ V (13.5 W)
Sensor	NTC 10 k $\Omega$
Control	PID with variable sample rate, bandwidth 20 Hz
Protection	TEC over current, open/short circuit

### Piezo

Piezo output	0 – 180 V, 15 mA (charge and discharge)
Piezo Sweep/Control DAC	Direct analogue, and 16-bit digital
Resolution	2.7 mV resolution at maximum range
Noise*	790 nV/VHz @1 kHz
Sweep	Internal 1 Hz to 50 Hz
Bandwidth	Internal 16 kHz; external 100 kHz
Protection	PCB over temperature

### Signal input/output

Signal input	2 SMA connectors
Analogue inputs (2)	Signal range $\pm 4.096$ V protected to $\pm 12$ V <i>Photodetector</i> AC/DC: 3.1 MHz > 110 dB dynamic range <i>Piezo mod</i> : analogue direct to piezo <i>Current mod</i> : analogue direct to diode current

### Front panel user interface

Interlock & Key	3.5 mm headphone jack 3-pin connector
Communications	TP 10/100 ethernet (RJ-45); USB-C

### Connectivity

Laser/piezo/TEC	14-pin butterfly PCB footprint 5 MOLEX Pico-EzMate connectors 1 Hirose BK13 32-pin connector
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### Power and dimensions

Input	USB-C Power Delivery adapter
Power	4 W standby, 30 W peak
Dimensions	WxLxH = 56 × 67 × 17.6 mm (board) WxLxH = 87 × 120 × 34 mm (chassis)
Operating Temperature	10 – 35 °C



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