

CTL100 - Low noise butterfly laser diode controller



Koheron CTL100 is a low noise current driver with modulation combined with a temperature controller. It is designed to drive narrow-linewidth laser diodes in **Type 2 butterfly package**. It is compatible with **floating diodes**, which means that neither the anode nor the cathode should be connected to the case. It drives up to 400 mA laser current with a current noise density of only 450 pA / $\sqrt{\text{Hz}}$. The CTL100 fits in a 75 mm x 75 mm square, uses a single 5 V supply, and can operate between 0 and 50°C. The CTL100 is conduction-cooled. It comes with an aluminum base plate and a zero insertion force socket for easy mounting.

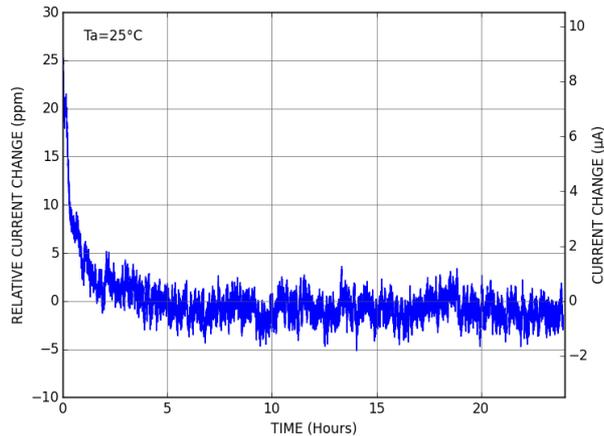
Specifications

	CTL100-B-400	CTL100-A-400
Current driver		
Laser current	5 - 400 mA	5 - 400 mA
Compliance voltage at 400 mA	2.3 V	2.3 V
RMS noise (10 Hz - 1 MHz)	510 nA _{rms} at 20 mA/V modulation	386 nA _{rms} at 20 mA/V modulation
Current noise density (1 kHz)	450 pA/√Hz	450 pA/√Hz
1/f corner noise	20 Hz	20 Hz
Temperature coefficient	15 ppm/°C	15 ppm/°C
Current limit	420 mA	420 mA
Slow start (90 % setpoint)	1000 ms	1000 ms
Modulation gains	2 mA/V, 20 mA/V, 200 mA/V	2 mA/V, 20 mA/V, 200 mA/V
3 dB modulation bandwidth	11 MHz	150 kHz
AC modulation cutoff frequency	1.5 MHz	70 kHz
TEC controller		
Maximum current	1.2 A	1.2 A
Temperature range	12 °C to 25 °C (standard 10 K thermistor)	12 °C to 25 °C (standard 10 K thermistor)
Compliance voltage	3.4 V when cooling, 0.7 V when heating	3.4 V when cooling, 0.7 V when heating
Temperature stability	0.0015 °C/°C	0.0015 °C/°C
Laser power monitor		
Photodiode current	0 - 1 mA	0 - 1 mA
Gain	3.9 V/mA	3.9 V/mA
Frequency range	DC - 50 MHz	DC - 50 MHz
Other		
Outside Dimensions	75 mm x 85 mm x 27 mm	75 mm x 85 mm x 27 mm
Weight	103 g	103 g
Supply voltage	4.9 V to 5.5 V	4.9 V to 5.5 V
Operating temperature	0 °C - 50 °C	0 °C - 50 °C
Compatible lasers	Type 2, Floating diodes / anode-grounded	Type 2, Floating diodes / anode-grounded

Current driver

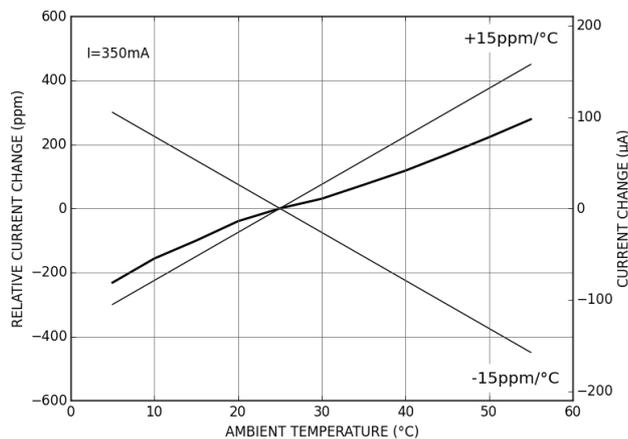
Current stability

Current stability is depicted in the following figure showing a 24-hour long evolution of current, set to 350 mA at 25 °C ambient temperature. After a 2 h warm-up time, current is stable within ± 5 ppm.



Evolution of current, set at 350 mA. Measured with a Keysight 34470A digital multimeter across a 5 Ω resistor.

The figure below shows the current variation for different ambient temperatures between 5 and 55 °C. Temperature coefficient is below 15 ppm/°C.



Current modulation

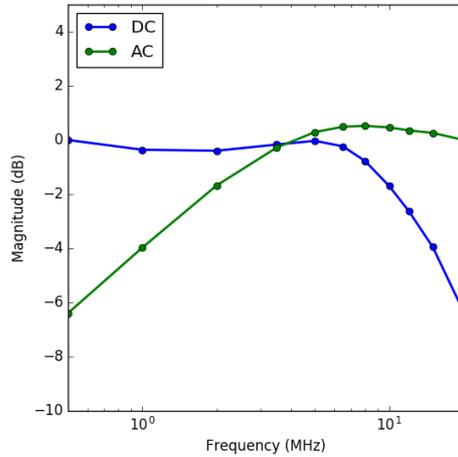
DC current modulation input

A modulation input from DC to 100 kHz is available (10 MHz for the CTL100-A-400).

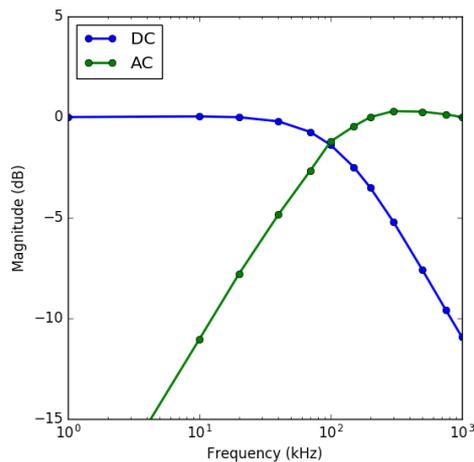
A jumper allows to choose between 3 modulation gains (2 mA/V, 20 mA/V or 200 mA/V).

AC modulation input

An AC modulation input using a bias-tee is available for modulation frequencies above 100 kHz for the 100 kHz bandwidth version (A-400) and above 3 MHz for the 10 MHz bandwidth version (B-400). The actual modulation gain depends on the value of the resistor integrated in the laser.



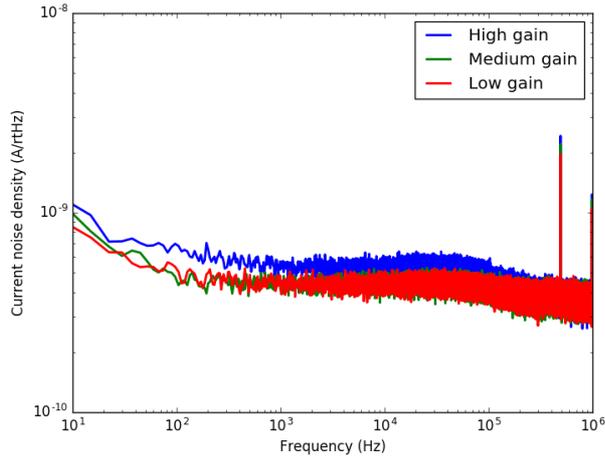
Transfer functions of the modulation inputs with **10 MHz** bandwidth (B-400)



Transfer functions of the modulation inputs with **100 kHz** bandwidth (A-400)

Current noise

The power spectral density of the 100 kHz bandwidth version (A-400) current noise was characterized for the 3 modulation gains.



Current noise integrated between 10 Hz and 1 MHz is 385 nA, 386 nA and 406 nA RMS at the low, medium and high gain settings respectively.

Temperature controller

The temperature controller consists of a precision Wheatstone bridge, an analog PID controller and a linear current driving stage. PID gains are fixed and have been adjusted for a typical butterfly laser diode. Temperature setpoint is adjusted with an ultra high precision trimming potentiometer.