Laser Diode Controller

LDC501 — Laser diode controller with integrated temperature controller

LDC501 Laser Diode Controller

Laser Diode Controller

- ***500 mA low-noise current source***
- ***Low drift (<10 ppm/°C)***
- ***1.1 MHz modulation***
- ***CC & CP mode dynamic switching***
- ***GPIB, RS-232 and Ethernet***

TEC Controller

- ***36 W output power***
- ***High stability 0.0005 °C/°C***
- ***Thermistor, RTD and IC sensors***
- ***Auto-tuning of loop parameters***
- ***CC & CP mode dynamic switching***

Introducing the LDC501 Laser Diode Controller: a highly stable, low-noise current source, with an integrated temperature controller — all at a very affordable price.

The LDC501 is the ideal instrument for controlling the current and temperature of your laser diodes. It has the performance and features you expect from instruments costing twice as much.

With a low-noise current source that delivers up to 500 mA, a 36 W high-precision temperature controller, and standard computer interfaces including Ethernet, the LDC501 is the right choice for your laser diode testing and control applications.

Easy-To-Use Interface

The LDC501 has an intuitive user interface, and many first time users will be able to operate the instrument without having to crack open the manual (although we do recommend reading the manual). Unlike competitive models, the LDC501 has a dedicated front-panel display for parameter entry. You don't have to sacrifice monitoring temperature or current to simply change an instrument setting — you have a separate two-line, blue alpha-numeric display for that. In addition, bright 5-digit green LED displays constantly monitor current and temperature, and are large enough to easily read from anywhere in the lab.

Laser Diode Protection

Multiple laser diode protection features, including slow start turn-on, adjustable current limits, and adjustable compliance voltage, keep your laser diodes safe when unexpected events occur. Fast clamping and shut down provide extra protection against intermittent contact with the laser. Combined, these features provide trouble-free, safe control of your laser diode.

Linear Power Supplies

Independent linear power supplies are used for the laser diode controller and the temperature controller. The supplies are designed with a magnetically shielded toroidal transformer, and provide ultra-clean, stable isolated power.

Computer Control

Remote operation of the LDC501 is supported with GPIB, RS-232 and Ethernet interfaces. All instrument functions can be controlled and read over any of the interfaces. Up to nine complete instrument configurations can be saved in non-volatile RAM and recalled at any time.

Stable Laser Diode Controller

To ensure a stable optical output from your laser diode, the LDC501's LD controller was designed to deliver noise-free, precision operation. It's accurate to ±0.01 %, noise is less than 4 µA rms, and it meets a drift specification of 10 ppm/°C.

Two modes of operation are available for the laser diode current source: constant current mode (CC) programs the source to a precise DC amplitude. Alternatively, the constant optical power mode (CP) servos the current source to maintain a constant signal on a monitor photodiode. Both control modes allow you to add an external modulation signal, with adjustable bandwidth up to 1.1 MHz (in CC mode) or 10 kHz (in CP mode).

A unique feature of the LDC501 is Dynamic "Bumpless" Transfer between CC and CP modes. This feature means you don't have to shut down your laser to switch modes — simply press the *Current/Power* button.

Another convenient feature that the LDC501 offers is a fully programmable photodiode bias voltage. You can set the bias between 0 and 5 V from the front panel, or remotely using one of the computer interfaces.

36 W Temperature Controller

The LDC501's integrated 36 W temperature controller lets you adjust temperature with 0.001 °C resolution, and measure temperature with 0.01 °C accuracy (with a calibrated sensor). It maintains a typical stability of 0.0005 °C/°C with respect to room temperature, and has a very wide temperature control range.

The TEC controller also has two modes of operation: constant temperature mode (CT) controls the TEC current to maintain a fixed temperature (or raw sensor value), while constant current mode (CC) operates the TEC at a fixed current. Thermistor, RTD and IC sensors are all supported.

The LDC501 has an auto-tuning feature which automatically optimizes the PID loop parameters of the controller. Of course, full manual control is provided too. Dynamic transfer between CT and CC modes for the TEC is also easy — just press the *Temp/Current* button.

LDC501 Rear Panel

Laser Diode Current Source

Current Source

Range	0 to 500 mA
Setpoint resolution	10 µA
Accuracy	±0.01 % of full scale
Output impedance	>1 MΩ (DC)
Stability	
Thermal	<10 ppm/°C
Short-term (1 hr.)	<5 ppm full scale
Long-term (24 hr.)	<20 ppm full scale
Noise	<3.5 nA/√Hz
	<3 µA rms (10 Hz to 100 kHz)
Compliance voltage	
Range	0 to 10 V, programmable
Resolution	10 mA
Accuracy	±0.5 %
Current Limit	
Range	0 to 501 mA
Resolution	1 mA
Accuracy	±2 mA

Analog Modulation

Input range	0 to 10 V
Input impedance	4 kΩ
Gain	
CC mode	50 mA/V (LD current)
CP mode	500 µA/V (PD current)
Bandwidth (3 dB)	
CC mode	DC to 1.1 MHz (high)
	DC to 10 kHz (low)
CP mode	DC to 10 kHz (high)
	DC to 90 Hz (low)

Monitor Photodiode

Bias voltage	0 to 5 V, programmable
PD current range	3 to 5000 µA
Setpoint resolution	1 µA (CP mode)
Setpoint accuracy	±2 µA
Drift	±0.03 % (CP mode)

Measurement & Display

Output current	
Range	0 to 501 mA
Resolution	0.01 mA
Accuracy	±0.03 % FS
Photodiode current	
Range	0 to 5010 µA
Resolution	0.1 µA
Laser diode forward voltage	
Range	0 to 12 V
Resolution	1 mV
Accuracy	±2 mV (4 wire)

Temperature Controller

Temperature Control

Control range	
Firmware limits	−150 °C to +250 °C
Setpoint resolution	0.001 °C
Setpoint accuracy	0.01 °C, sensor dependent
Stability (using a 10 k NTD thermistor), typ.	
Thermal	0.0005 °C/°C (vs. ambient)
Short-term (1 hr.)	±0.001 °C
Long-term (24 hr.)	±0.004 °C
Control algorithm	PID, with autotuning & antiwindup

TEC Output

Source type	Linear, bipolar current source
Current range	−4.5 A to +4.5 A
Setpoint resolution	1 mA
Setpoint accuracy	±10 mA
Max. power	36 W
Compliance voltage	>8 VDC
Current noise	<1 mA rms @ 4 A output
Current limits	
Range	−4.5 A to +4.5 A, low & high
Accuracy	±5 mA

Temperature Sensors

Thermistors	10 to 500 kΩ (sensor bias at 10 µA, 100 µA, 1000 µA)
RTD	Pt-100, Pt-1000 (1 mA sensor bias)
IC voltage sensors	LM335 and equivalent
IC current sensors	AD590, TMP17, and equivalent

Measurement & Display

Temperature	
Range	−150 °C to +250 °C
Resolution	0.001 °C
Thermistor	
Range	0 to 500 kΩ
Resolution	0.01 %
Accuracy	0.03 %
TEC current	
Range	−4.5 A to +4.5 A
Resolution	1 mA
Accuracy	±10 mA
TEC voltage	
Range	−9 V to + 9 V
Resolution	1 mV
Accuracy	±10 mV (4 wire)

General

Instrument connectors	DB9-F (laser diode), DB15-F (TEC)
	BNC (modulate, trigger output)

Remote interfaces	GPIB (IEEE488.2), RS-232, Ethernet
Power	100 to 120 VAC, 220 to 240 VAC, 50 Hz/60 Hz, 100 W
Dimensions	7" × 5" × 15" (WHL)
Weight	15 lbs.
Warranty	One years parts and labor on defects in material and workmanship

Ordering Information

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About Thermal Stability

Temperature fluctuations in a typical laboratory environment can often exceed several degrees Celsius over the course of a day. Small temperature changes can mean significant current changes in your laser diode if your controller is not up to the task.

The LDC501 has a temperature coefficient of 10 ppm/°C, which is a factor of five better than competing models, making it the ideal controller for precision laser diode experiments.

The graphs below demonstrate the temperature performance of the LDC501. Over a 24 hour period, the ambient temperature change in the laboratory exceeds two degrees Celsius. Note that the output current deviation of the LDC after warm-up is stable to better than ±10 ppm.