Laser Diode Controller

LDC501 — Laser diode controller with integrated temperature 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.
**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)
    - CP mode: DC to 10 kHz (high)
  - 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**
  - Thermometer:
    - 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 V AC, 220 to 240 V AC, 50Hz/60Hz, 100 W
Dimensions: 7" x 5" x 15" (WHL)
Weight: 15 lbs.
Warranty: One year parts and labor on defects in material and workmanship

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.

Ordering Information
LDC501 Laser Diode Controller