LDC 3736

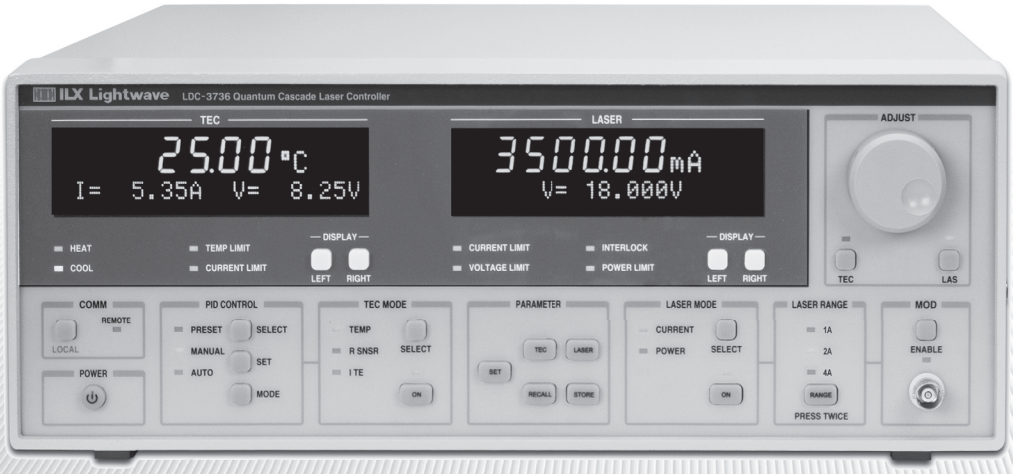
High Voltage Precision Laser Controller

Product Features

- Precision, low noise current source with integrated 128W temperature controller
- Compliance voltage of 18V
- Multiple levels of laser protection
- Analog modulation up to 250 kHz
- 4-wire laser forward voltage and TEC voltage measurement
- Temperature controller compatible with thermistor, IC, and RTD temperature sensors
- TTL trigger output
- USB and GPIB computer interfaces
- LabVIEW® drivers

The LDC-3736 High Voltage Precision Laser Controller is an industry leading combination laser current source and temperature controller specifically designed to control high voltage lasers. Careful attention to the design allows the LDC-3736 to deliver up to 4A at 18V of lower noise current with stability better than 20 ppm. The integrated high power temperature controller is designed to provide up to 128W of cooling power while maintaining the TEC noise and ripple below 2.5 mA.

Integrated redundant laser protection circuits ensure safe operation of high voltage lasers even during unforeseen power surges. In addition, the standard features of the LDC-3736 High Voltage Precision Laser Controller include three current ranges, analog current modulation, 4-wire voltage measurement of the laser and TEC, and USB and GPIB remote interface. Furthermore, all of ILX Lightwave's proven laser protection strategies have been designed into each model including slow start, adjustable current limits and compliance voltage, intermittent contact protection, and shorting relays.



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HIGH STABILITY, LOW NOISE LASER CONTROL

Small drive current fluctuations due to noise and drift are amplified optically. Due to this, a controller with a low noise and stable output current is required to ensure stable optical output current. Since current noise scales with maximum current output, the LDC-3736 includes three current ranges: 1A, 2A, and 4A. This flexibility allows users to select a range close to their maximum output to reduce current noise and provide future expansion when working with different lasers. This feature allows the LDC-3736 to deliver current stability as low as 20 ppm and <10µA noise and ripple to ensure stable operation in sensitive applications.

Careful attention to the design of the thermoelectric temperature controller allows high power operation with low TEC current RMS noise. This reduces the chance for TEC noise coupling into the laser, which could potentially cause unstable operation.

SETTING THE STANDARD IN LASER PROTECTION

ILX Lightwave's internal testing and protection standards ensure protection for lasers under abnormal operating conditions, such as intermittent contact or severe power spikes. These standards have led to advanced protection features such as clamping current limits, even under modulated conditions. In addition, exclusive braid-shielded cables have been specifically designed to suppress radiated noise and transients commonly found in laboratory or production environments.

During AC power-up, careful turn-on sequencing and redundant output shorting circuits protect the laser from current transients. When the output is enabled, the slow-start circuit gradually opens the shorting circuits. Current is shunted through the shorting switch until the control circuits are fully active and all circuit transients have died out.

A feature not found in most controllers - fast output shutoff - provides an additional level of protection from intermittent contacts between the laser and the current source. Intermittent contact can occur by loose or worn cables causing a momentary open in the circuit or by pogo-pins momentarily losing connection to the laser. If intermittent contact is left undetected, a severe voltage transient can occur which will damage sensitive lasers.

These protection features all work in conjunction with all instrument modes of operation, providing worry free, fail-safe control of lasers.

EASE OF OPERATION

The front panel of the LDC-3736 High Voltage Precision Laser Controller was designed for ease of use and readability. The front panel features two large 7-segment displays that also have an integrated dot matrix display. Instrument controls are grouped by mode and function to allow for easy setup. The displays allow for easy viewing of multiple parameters including laser current output, laser voltage, photodiode measurement, measured temperature, set temperature, TEC current, and TEC voltage. Each display can be easily configured to display the most relevant measurements in your application.

Laser control is directly addressable from the front panel "adjust" section. Instrument modes are easily selected or adjusted through discrete push buttons and a rotary digital encoder. Configuration of parameters is quickly accomplished through the "parameter" section.

REMOTE OPERATION

Remote instrument operation in an R&D or production environment is available through a USB or GPIB interface. A trigger output is provided for integration into an automated measurement system where the TTL level output indicates a current step change for initiation of a measurement. A robust and easy to modify LabVIEW® driver is available for download.

SAVE AND RECALL SETTINGS

For multiple instrument test configurations, the LDC-3736 High Voltage Precision Laser Controller offers a STORE and RECALL feature. The STORE function allows the user to store all the front panel settings for any given instrument condition. The RECALL function allows the user to retrieve any of the saved conditions at any time. This saves time in instrument re-configuration for different production runs or R&D experiments.

LASER CURRENT SOURCE

LDC-3736

DRIVE CURRENT OUTPUT [1]

Output Current Range:	0–1000mA	0–2000mA	0–4000mA
Setpoint Resolution (Display):	0.1mA	0.1mA	0.1mA
Setpoint Resolution (Remote):[12]	20µA	40µA	80µA
Setpoint Accuracy (% of FS):	±0.15% of SP ± 1mA	±0.15% of SP ± 1mA	±0.15% of SP ± 1mA
Compliance Voltage:	0–18V adjustable	0–18V adjustable	0–18V adjustable
Temperature Coefficient:	<50ppm/°C	<50ppm/°C	<50ppm/°C
Short-Term Stability (one-hour):[2]	<20ppm	<20ppm	<20ppm
Long-Term Stability (24-hour):[3]	<40ppm	<40ppm	<40ppm
Noise and Ripple (rms)[4]			
High Bandwidth Mode (rms):	30µA	60µA	100µA
Low Bandwidth Mode (rms):	30µA	50µA	90µA
Low Bandwidth Mode (with LNF-320):	10µA	15µA	50µA
Transients			
Operational:[5]	<4mA	<4mA	<4mA
1 kV EFT/Surge: [6]	<15mA/<8mA	<15mA/<8mA	<15mA/<8mA

COMPLIANCE VOLTAGE LIMIT ADJUST

Range:	0–19.8V	0–19.8V	0–19.8V
Setpoint Resolution (Display):	0.1V	0.1V	0.1V
Setpoint Resolution (Remote):	60mV	60mV	60mV
Accuracy:	±2.5% FS	±2.5% FS	±2.5% FS

DRIVE CURRENT LIMIT SETTINGS

Range:	1–1010mA	1–2020mA	0–4040mA
Resolution:	5mA	10mA	20mA
Accuracy:	±10mA	±20mA	±40mA

PHOTODIODE FEEDBACK

Type:	Differential	Differential	Differential
Photodiode Reverse Bias:	0–5V adjustable	0–5V adjustable	0–5V adjustable
Photodiode Current Range:	5 to 10000µA	5 to 10000µA	5–10000µA
Output Stability:[7]	0.02% of SP	0.02% of SP	0.02% of SP
Setpoint Accuracy:	±0.05% of FS	±0.05% of FS	±0.05% of FS

EXTERNAL ANALOG MODULATION

Input:	0–10V, 1 kΩ	0–10V, 1 kΩ	0–10V, 1 kΩ
Transfer Function:	100mA/V	200mA/V	400mA/V
Bandwidth (3dB)			
High Bandwidth:[8]	DC to 250 kHz	DC to 250 kHz	DC to 250 kHz
Low Bandwidth:[9]	DC to 17 kHz	DC to 17 kHz	DC to 17 kHz

TRIGGER OUTPUT

Type:	TTL	TTL	TTL
Pulse Width:	10 µs	10 µs	10 µs
Delay:	2.5 mS	2.5 mS	2.5 mS

MEASUREMENT (DISPLAY)

Output Current			
Range:	0–1000.0mA	0–2000.0mA	0–4000mA
Resolution:	0.1mA	0.1mA	0.1mA
Accuracy:	±0.1% FS	±0.1% FS	±0.1% FS
Photodiode Current			
Range:	0–10000µA	0–10000µA	0–10000µA
Resolution:	1µA	1µA	1µA
Accuracy:	±4µA	±4µA	±4µA
Photodiode Responsivity [10]			
Range (µA/mW):	0.00–1000.00	0.00–1000.00	0.00–1000.00
Resolution:	0.01µA/mW	0.01µA/mW	0.01µA/mW
Optical Power			
Range (mW):	0.00–20000.0	0.00–20000.0	0.00–20000.0
Resolution:	0.1mW	0.1mW	0.1mW
Forward Voltage			
Range:	0.000–18.000V	0.000–18.000V	0.000–18.000V
Resolution:	1mV	1mV	1mV
Accuracy:[11]	±2mV	±2mV	±2mV

GENERAL

I/O Connectors	
TEC I/O:	Female, 25-pin, D-sub
Analog Input:	BNC
Remote Interface:	GPIB IEEE 488.1; USB 2.0 (B-Type)
Power Requirements[1]	AC Input Selector; 115/230 VAC; 100-120 VAC / 220-240 VAC; 500W; 50-60 Hz
Size (HxWxD):	5.0" x 13.9" x 13.6"; 127 mm x 353 mm x 345 mm
Weight:	26.3 lbs.; 11.93 kg.
Operating Temperature:	10°C to 40°C
Storage Temperature:	-30°C to 70°C
Humidity:	<85% relative, non-condensing
Compliance:	CE

1 Output de-rating = 0.3 Volts and 0.04 Amps per input Volt AC below 100 VAC to a minimum of 90 VAC

CURRENT SOURCE NOTES

1 All values relate to a one-hour warm-up period.
2 Over any one-hour period, half-scale output.
3 Over any 24-hour period, half-scale output.
4 Measured electrically with a frequency range of 100Hz to 340kHz (High Bandwidth), 100Hz to 17kHz (Low Bandwidth).
5 Maximum output current transient resulting from normal operational situations (e.g. power on/off, current on/off), as well as accidental situations (e.g. power line plug removal). To protect the laser in all conditions, it is recommended to set both the current and voltage limit just above typical operating conditions.
6 Maximum output current transient resulting from a 1000V power line transient spike. Tested to ILX Technical Standard #LDC-00196; request ILX App Note #13.
7 Maximum monitor photodiode current drift over any 30 minute period. Assumes zero drift in responsivity of photodiode.
8 50% modulation at mid-scale output. Higher bandwidth is possible with smaller modulation signal.
9 Small signal specification is for typical 10% modulation depth. Large signal specification assumes 50% modulation depth at mid-scale output.
10 Responsivity value is user-defined and is used to calculate the optical power.
11 Four wire voltage measurement at the load. Voltage measurement accuracy while driving calibration load. Accuracy is dependent upon load and cable used.
12 Based on resolution of digital to analog converts used in circuit.

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Specifications

TEMPERATURE CONTROL[1]

LDC-3736

Temperature Control Range:[2]	
Thermistor Sensor:	–100°C to +200°C
IC Sensor:	–100°C to +150°C
RTD Sensor:	–100°C to +200°C
Temperature Setpoint and Measurement Repeatability and Accuracy:[3]	
0°C:	±0.001°C / ±0.01°C
25°C:	±0.002°C / ±0.04°C
50°C:	±0.007°C / ±0.15°C
75°C:	±0.05°C / ±0.9°C
Temperature Stability:[4]	
1 Hour:	±0.002°C
24 Hours:[4]	±0.003°C

TEMPERATURE SENSOR

Types:	
Thermistor:	NTC (2-wire)
IC-V Semiconductor IC Sensor:	LM-335 voltage output; 5 to 14 mV/K
IC-I Semiconductor IC Sensor:	AD-590 current output; 1 µA/K
RTD Sensor	Platinum 100Ω / 1000Ω (2-wire)
Thermistor Sensor Resistance	
10 µA Bias Setting	
Range:	0 to 450 kΩ
Resolution (Display):[6]	0.01 kΩ
Accuracy:	±180 Ω
100 µA Bias Setting	
Range:	0 to 45 kΩ
Resolution (Display):[6]	0.001 kΩ
Accuracy:	±18 Ω
IC-V Sensor Voltage	
Nominal Bias:	1 mA
Range:	0 to 6V
Resolution (Display):[6]	0.0001 V
Accuracy:	±2 mV
IC-I Sensor Current	
Nominal Bias:	5 to 15 V
Range:	0 to 600 µA
Resolution (Display):[6]	0.001 µA
Accuracy:	±0.18 µA
RTD Sensor Resistance	
1 mA Bias Setting	
Range:	0 to 1500 Ω
Resolution (Display):[6]	0.01 Ω
Accuracy:	±0.8 Ω
2.5 mA Bias Setting	
Range:	0 to 200 Ω
Resolution (Display):[6]	0.001 Ω
Accuracy:	±0.1 Ω
User Sensor Calibration	
Thermistor:	Steinhart-Hart, 3 constants
IC Sensors:	Slope, Offset
RTD	R_0, A, B, C

TEC OUTPUT

Output Type:	Bi-directional, switching
Isolation:	Floating with respect to earth ground
Current Setpoint	
Range:	-8.00A to +8.00A
Resolution (Display):[6]	0.01A
Accuracy:	±0.05A
Current Limit	
Range:	-8.05A to +8.05A
Accuracy:	±0.05A
Voltage Measurement [7]	
Range:	-16.00V to +16.00V
Resolution (Display):[6]	0.01V
Accuracy:	±0.01V
Compliance Voltage:	±16V
Maximum Output Power:	128W
Current Noise and Ripple:[5]	<2.5 mA rms

AUXILIARY I/O SPECIFICATIONS

Analog Control Input	
Input Voltage Range:	-5V to +5V
Input Resistance:	>100 kΩ
Gain:[9]	2 °C/V
Bandwidth:	5 Hz
External Fan Control Output [8]	
Output Voltage Range:	0 to +12V
Maximum Current:	500 mA

TEMPERATURE CONTROL NOTES

1 All values are specified for an ambient temperature of 23±5°C after a 1 hour warm up unless otherwise specified.
2 Software limits of range. Actual range depends on the physical load, sensor type, and TEC module used.
3 Accuracy figures represent the uncertainty that the LDC-3706 series adds to the measurement. This figure does not include the sensor calibration uncertainties. Thermistor accuracy figures are quoted for a typical 10 kΩ thermistor and 100 µA current setting for -5°C to 50°C.
4 Temperature stability measurements made in a stable, ambient environment ±0.5°C with a 10 kΩ thermistor on the 100 µA setting after a 2 hour warm up period. Stability is defined as ±(Tmax-Tmin)/2 over the measurement period.
5 Measured over the full DC current range into a 1Ω load.
6 Maximum resolution available when operating in the control mode (using the 7-segment display) resolution will be reduced when displayed on the lower display. In remote operation, six significant digits of resolution are reported.
7. Measured at the output connector. Users may enter in cable resistance to provide an accurate voltage measurement at the load.
8. Unregulated output and requires a minimum of a 120mA current draw.
9. Transfer function is applicable to linear sensors only. Use of non-linear sensors, such as thermistors, may result in a non-linear transfer function which varies over the temperature modulation range.

ORDERING INFORMATION

LDC-3736	High Voltage Precision Laser Controller
LDM-4409	Laser Diode Mount, C-Mount
LDM-4990	Laser Diode Mount, TO-Can
CC-305H	Driver to Mount Cable, 6A, 7W2M to DB9M
CC-305S	Driver to Mount Cable, 5A, DB9M to DB9M
CC-306S	Driver to Unterminated Cable, 5A, DB9M to Bare Wire
CC-594H	TEC to Unterminated Cable, 10A, DB25M to Bare Wire
CC-595S	TEC to Mount, 5A, DB25M to DB9F
CC-596H	TEC to Mount, 10A, DB25M to 7W2F

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