

## Product Features

Laser diode current source with integrated 32W temperature controller

Three models available with up to 4A laser drive current

GPiB/IEEE-488 remote interface

High stability, low noise laser current source operating in constant power or constant current modes.

Analog modulation capability to 1MHz

4-wire laser forward voltage measurement and adjustable voltage limit

Temperature controller compatible with thermistor, IC, and RTD temperature sensors

Temperature stability of  $\pm 0.004^{\circ}\text{C}$

TE voltage measurement

The LDC-3700B Series Laser Diode Controllers are an industry-leading family of high performance, microprocessor-based instruments that offer a high stability, low noise current source with an integrated 32W temperature controller specifically designed for controlling the current and temperature of laser diodes. These controllers are known throughout the industry for their reliability, precision, and ease-of-use.

Three models cover a wide range of low to medium power laser diode testing and control applications. The LDC-3714B and 3724B are targeted specifically for precision control of low to medium power laser diodes with dual range current sources of 50/100mA and 200/500mA respectively. For higher power laser diodes, the LDC-3744B provides a dual range current source of 2/4A. All three models come with an integrated 32W temperature controller.

Independent power supplies for laser and TE current provide clean, isolated power for laser protection and stability. All of ILX Lightwave's proven laser diode protection strategies including slow start, adjustable current limit and compliance voltage, intermittent contact protection, and output shorting relays are incorporated into each model.

# LDC 3700B Series

## Laser Diode Controllers



## The Standard for High-Performance Laser Diode Control

 **ILX Lightwave**  
Laser Diode Instrumentation & Test Systems

# LDC 3700B Series

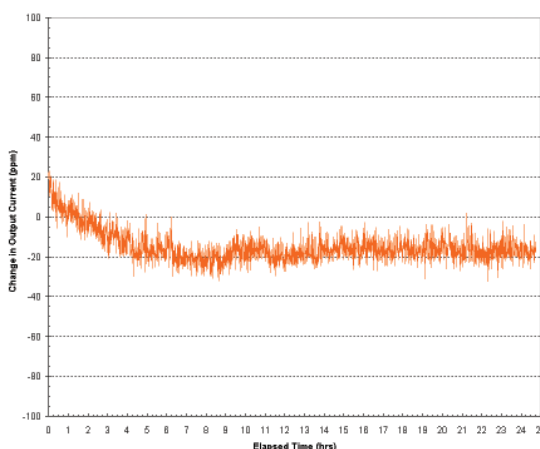
## Laser Diode Controllers

Remote instrument operation in an R&D or production environment is afforded through the GPIB/IEEE-488 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. For virtual instrument programming, LabView® instrument drivers can be downloaded from the ILX website.

### High Stability, Low Noise Laser Control

Laser diodes act as a gain medium. Small drive current fluctuations due to noise and drift are amplified optically. Because of this, a controller with a low noise and stable output is required to ensure stable optical output. The LDC-3700B Series of controllers make this possible.

Each LDC-3700B Controller offers a precision 16-bit current source with 0.05% accuracy. Careful attention to design delivers as low as 20ppm stability and 1.5 $\mu$ A of noise so component measurements can be made with confidence.



*Output Current Stability of an LDC-3724B*

### Fine Tuned for Protection of Your Laser Diode

The LDC-3700B Controllers provide all of ILX Lightwave's laser diode protection features such as independent current limits, slow start turn-on, isolated laser and temperature control power supplies, and adjustable compliance voltage. A

feature not found in most laser diode controllers - fast output shut-off - provides an additional level of protection from intermittent contacts between the laser diode and the current source. These protection features all work in conjunction with all instrument modes of operation, providing worry-free, fail safe control of your laser diode.

### A Choice of Laser Current Control Modes

With the LDC-3700B Series Controllers, you can easily control the current to your laser diode in one of three operating modes:

- Constant current, low bandwidth
- Constant current, high bandwidth
- Constant optical power

The constant current, low bandwidth mode offers improved laser protection and noise performance and is optimized for DC operation. This mode supports external modulation up to 15kHz.

In constant current high bandwidth mode, the output stage supports higher modulation frequencies up to 1MHz for dithering the laser current for power and wavelength tuning. For laser protection, the modulation input is implemented as a differential input, allowing the modulation control voltage and laser outputs to use different grounds.

The constant power mode provides constant optical power operation of your laser diode by using the photocurrent from its rear facet photodiode or from an external photodiode measuring front facet light in a feedback control loop to the current source.

### Precision Temperature Control

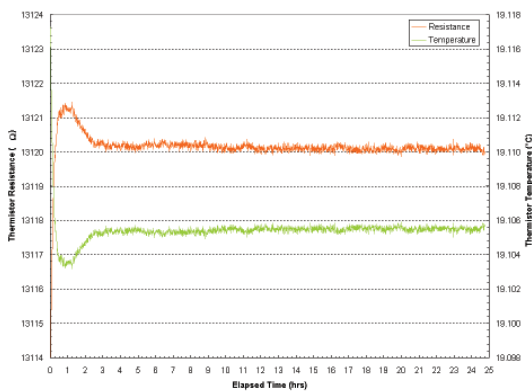
The LDC-3700B Series Controllers include an integrated precision 32W temperature controller for quick temperature response of the laser diode's chip temperature. For precise wavelength control during component testing, the LDC-3700B Series' control algorithm maintains temperature with a stability of 0.004°C.

Sixteen-bit control and measurement allows you to set temperature with 0.01°C resolution with

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## Laser Diode Controllers

a measurement accuracy of 0.05°C (with a calibrated sensor). In addition, the LDC-3700B series supports TEC forward voltage measurement for monitoring the total power consumption of your laser diode module.



*Temperature Control Stability of an LDC-3724B*

## Wide Temperature Control Range

These controllers offer extended temperature control from -100°C to 199.9°C with a choice of thermistor, IC, or RTD temperature sensors. Temperature can be controlled in one of three modes: constant temperature, constant sensor, or constant TE current.

As an added precaution, if the temperature sensor or TE module circuit should open during operation, the laser diode current source output will be shut off and the appropriate fault indicator LED will illuminate.

In addition to the normal control modes, the TEC output of the LDC-3700B Controllers is bounded by a fully independent hardware current limit to protect the laser diode's internal TE module. These limits cannot be exceeded in any mode of operation. The controller can also be bounded by a high temperature limit setting.

## Ease of Operation

Divided into two sections, TEC and LASER, the front panel offers quick, easy operation and information display without confusing multi-layer menus. Each bright, 5-digit, green LED display is easy to read from a distance, even with laser

safety goggles. Each channel is directly addressable from the front panel "adjust" section with LASER and TEC parameters and modes easily selected or adjusted through discrete pushbuttons and a rotary digital encoder.

## Save and Recall Instrument Settings

For multiple instrument test configurations, the LDC-3700B Controllers offer a SAVE and RECALL feature. The SAVE function allows you to store all the front panel settings for any given instrument condition. The RECALL function allows you 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.

## Simplify Routine Maintenance

The LDC-3700B architecture simplifies routine maintenance; calibration of the laser current source and TE controller can be performed via the front panel or through the GPIB/IEEE-488 interface, without opening the instrument up or manual adjustments. A calibration mode is entered through unique push button combinations or GPIB commands, and all calibration data is easily entered via the front panel or GPIB. Calibration data is automatically stored in on-board non-volatile memory.

## Put Our Expertise to Work

ILX Lightwave is a recognized world leader in Laser Diode Instrumentation and Test Systems. Our products are not only renowned for their reliability, quality, and value, they're backed by industry-leading after-sales support. For more information about the LDC-3700B Series Controllers and our complete family of Laser Diode Instrumentation and Test Systems, call us today or visit us at [www.ilxlightwave.com](http://www.ilxlightwave.com).

## Specifications<sup>1</sup>

### LASER CURRENT SOURCE

| MODEL NUMBER                                  | LDC-3714B        |                  | LDC-3724B        |                  | LDC-3744B        |                  |
|---|------------------|------------------|------------------|------------------|------------------|------------------|
| DRIVE CURRENT OUTPUT                          |                  |                  |                  |                  |                  |                  |
| Output Current Range:                         | 0–50mA           | 0–100mA          | 0–200mA          | 0–500mA          | 0–2000mA         | 0–4000mA         |
| Setpoint                                      |                  |                  |                  |                  |                  |                  |
| Resolution:                                   | 1µA              | 2µA              | 4µA              | 10µA             | 40µA             | 80µA             |
| Accuracy:                                     | ±0.05% of FS     | ±0.05% of FS     | ±0.05% of FS     | ±0.05% of FS     | ±0.05% of FS     | ±0.05% of FS     |
| Compliance Voltage:                           | 0–10V adjustable | 0–10V adjustable | 0–10V adjustable | 0–10V adjustable | 0–10V adjustable | 0–10V adjustable |
| Temperature Coefficient:                      | <50ppm/°C        | <50ppm/°C        | <50ppm/°C        | <50ppm/°C        | <100ppm/°C       | <100ppm/°C       |
| Short-Term Stability (one-hour): <sup>2</sup> | <20ppm           | <20ppm           | <20ppm           | <20ppm           | <20ppm           | <20ppm           |
| Long-Term Stability (24-hour): <sup>3</sup>   | <40ppm           | <40ppm           | <40ppm           | <40ppm           | <40ppm           | <40ppm           |
| Noise and Ripple (rms) <sup>4</sup>           |                  |                  |                  |                  |                  |                  |
| High Bandwidth Mode (rms):                    | <1.5µA           | <1.5µA           | <4µA             | <4µA             | <15µA            | <20µA            |
| Low Bandwidth Mode (rms):                     | <1.5µA           | <1.5µA           | <2µA             | <2µA             | <10µA            | <10µA            |
| Transients                                    |                  |                  |                  |                  |                  |                  |
| Operational: <sup>5</sup>                     | <2mA             | <2mA             | <3mA             | <3mA             | <4mA             | <4mA             |
| 1 kV EFT:                                     | <5mA             | <5mA             | <8mA             | <8mA             | <10mA            | <10mA            |
| Surge: <sup>6</sup>                           | <8mA             | <8mA             | <12mA            | <12mA            | <8mA             | <8mA             |

### COMPLIANCE VOLTAGE ADJUST

|             |       |       |       |       |       |       |
|-------------|-------|-------|-------|-------|-------|-------|
| Range:      | 0–10V | 0–10V | 0–10V | 0–10V | 0–10V | 0–10V |
| Resolution: | 50mV  | 50mV  | 50mV  | 50mV  | 50mV  | 50mV  |
| Accuracy:   | ±2.5% | ±2.5% | ±2.5% | ±2.5% | ±2.5% | ±2.5% |

### DRIVE CURRENT LIMIT SETTINGS

|             |          |         |         |         |          |          |
|-------------|----------|---------|---------|---------|----------|----------|
| Range:      | 1–50.5mA | 1–101mA | 1–202mA | 1–505mA | 1–2020mA | 1–4040mA |
| Resolution: | 0.25mA   | 0.5mA   | 1mA     | 2.5mA   | 10mA     | 20mA     |
| Accuracy:   | ±0.5mA   | ±1mA    | ±2mA    | ±5mA    | ±20mA    | ±40mA    |

### PHOTODIODE FEEDBACK

|                                |                 |                 |                 |                 |                 |                 |
|--------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Type:                          | Differential    | Differential    | Differential    | Differential    | Differential    | Differential    |
| Photodiode Reverse Bias:       | 0–5V adjustable | 0–5V adjustable | 0–5V adjustable | 0–5V adjustable | 0–5V adjustable | 0–5V adjustable |
| Photodiode Current Range:      | 5 to 5000µA     | 5 to 5000µA     | 5–5000µA        | 5–5000µA        | 5–10,000µA      | 5–10,000µA      |
| Output Stability: <sup>7</sup> | 0.02%           | 0.02%           | 0.02%           | 0.02%           | 0.02%           | 0.02%           |
| Setpoint Accuracy:             | ±0.05% of FS    | ±0.05% of FS    | ±0.05% of FS    | ±0.05% of FS    | ±0.05% of FS    | ±0.05% of FS    |

### EXTERNAL ANALOG MODULATION

|                              |             |             |             |             |              |              |
|------------------------------|-------------|-------------|-------------|-------------|--------------|--------------|
| Input:                       | 0–10V, 10kΩ | 0–10V, 10kΩ | 0–10V, 10kΩ | 0–10V, 10kΩ | 0–10V, 10kΩ  | 0–10V, 10kΩ  |
| Transfer Function:           | 5mA/V       | 10mA/V      | 20mA/V      | 50mA/V      | 200mA/V      | 400mA/V      |
| Bandwidth (3dB) <sup>8</sup> |             |             |             |             |              |              |
| High Bandwidth:              | DC to 1MHz  | DC to 1MHz  | DC to 1MHz  | DC to 1MHz  | DC to 250kHz | DC to 250kHz |
| Low Bandwidth:               | DC to 15kHz | DC to 15kHz | DC to 15kHz | DC to 15kHz | DC to 10kHz  | DC to 10kHz  |

### TRIGGER OUTPUT

|              |      |      |      |      |      |      |
|--------------|------|------|------|------|------|------|
| Type:        | TTL  | TTL  | TTL  | TTL  | TTL  | TTL  |
| Pulse Width: | 13µs | 13µs | 13µs | 13µs | 13µs | 13µs |
| Delay:       | 12ms | 12ms | 12ms | 12ms | 12ms | 12ms |

### MEASUREMENT (DISPLAY)

|                         |                   |                   |                   |                   |                   |                   |
|-------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Output Current          |                   |                   |                   |                   |                   |                   |
| Range:                  | 0–50.000mA        | 0–100.00mA        | 0–200.00mA        | 0–500.00mA        | 0–2000.0mA        | 0–4000.0mA        |
| Resolution:             | 0.001mA           | 0.002mA           | 0.01mA            | 0.01mA            | 0.1mA             | 0.1mA             |
| Accuracy:               | ±0.05% FS         | ±0.05% FS         | ±0.05% FS         | ±0.05% FS         | ±0.1% FS          | ±0.1% FS          |
| Photodiode Current      |                   |                   |                   |                   |                   |                   |
| Range:                  | 0–5000µA          | 0–5000µA          | 0–5000µA          | 0–5000µA          | 0–10,000µA        | 0–10,000µA        |
| Resolution:             | 1µA               | 1µA               | 1µA               | 1µA               | 1µA               | 1µA               |
| Accuracy:               | ±2µA              | ±2µA              | ±2µA              | ±2µA              | ±4µA              | ±4µA              |
| Photodiode Responsivity |                   |                   |                   |                   |                   |                   |
| Range: <sup>9</sup>     | 0.00–1000.00µA/mW | 0.00–1000.00µA/mW | 0.00–1000.00µA/mW | 0.00–1000.00µA/mW | 0.00–1000.00µA/mW | 0.00–1000.00µA/mW |
| Resolution:             | 0.01µA/mW         | 0.01µA/mW         | 0.01µA/mW         | 0.01µA/mW         | 0.01µA/mW         | 0.01µA/mW         |
| Optical Power           |                   |                   |                   |                   |                   |                   |
| Range:                  | 0.00–101.00mW     | 0.00–101.00mW     | 0.00–505.00mW     | 0.00–505.00mW     | 0.00–5050.0mW     | 0.00–5050.0mW     |
| Resolution:             | 0.01mW            | 0.01mW            | 0.01mW            | 0.01mW            | 0.1mW             | 0.1mW             |
| Forward Voltage         |                   |                   |                   |                   |                   |                   |
| Range:                  | 0.000–10.000V     | 0.000–10.000V     | 0.000–10.000V     | 0.000–10.000V     | 0.000–10.000V     | 0.000–10.000V     |
| Resolution:             | 1mV               | 1mV               | 1mV               | 1mV               | 1mV               | 1mV               |
| Accuracy: <sup>10</sup> | ±2mV              | ±2mV              | ±2mV              | ±2mV              | ±2mV              | ±2mV              |

### CURRENT SOURCE NOTES

- 1 All values after a one-hour warm-up period at room temperature, 25°C.
- 2 Over any one-hour period, half-scale output.
- 3 Over any 24-hour period, half-scale output.
- 4 Measured optically, evaluating noise intensity of a laser diode into a photodetector with 150kHz 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).
- 6 Maximum output current transient resulting from a 1000V power-line transient spike. Tested to ILX Lightwave Technical Standard #LDC-00196.
- 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 Responsivity value is user-defined and is used to calculate the optical power.
- 10 Four-wire voltage measurement. Voltage measurement accuracy while driving calibration load. Accuracy is dependent upon load used and length of cable.

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## Laser Diode Controllers

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### Specifications<sup>1</sup>

#### TEMPERATURE CONTROL

##### MODEL NUMBER

Temperature Control Range:<sup>2</sup>  
Thermistor Setpoint:  
Resolution and Accuracy  
–20°C to 20°C:  
20°C to 50°C:  
AD590 & LM335 Setpoint<sup>4</sup>  
–20°C to 50°C:  
Short-Term Stability (one-hour):<sup>5</sup>  
Long-Term Stability (24-hours):<sup>6</sup>

##### ALL MODELS

–100°C to 199°C  
–100°C to 199°C  
**Resolution** **Accuracy<sup>3</sup>**  
0.1°C ±0.2°C  
0.2°C ±0.2°C  
0.01°C ±0.1°C  
±0.004°C or better  
±0.01°C

#### TEC OUTPUT<sup>7</sup>

Output Type: Bipolar, constant current source  
Compliance Voltage: >8V DC  
Maximum Output Current: 4.0A  
Maximum Output Power: 32W  
Current Noise and Ripple:<sup>8</sup> <1mA rms  
Current Limit  
Range: 0–4A  
Setpoint Accuracy: ±50mA  
Control Algorithm: Smart Integrator, Hybrid PI

#### TEMPERATURE SENSOR

Types  
Thermistor: 2-wire NTC  
IC Temperature Sensor: AD590/LM335  
RTD Sensor:<sup>9</sup> Pt 100/Other 100Ω RTD  
Thermistor Sensing Current: 10/100μA  
Sensor Bias: AD590=8V,  
LM335=1mA  
RTD=0.8mA<sup>9</sup>

#### TEMPERATURE CONTROL NOTES

- All values relate to a one-hour warm-up period.
- Software limits of range. Actual range possible depends on the physical load, thermistor type, and TE module used.
- Accuracy figures are quoted for a typical 10kΩ thermistor and 100μA current setting. Accuracy figures are relative to the calibration standard. Both resolution and accuracy are dependent upon the user-defined configuration of the instrument.
- Accuracy depends upon the sensor model selected, the calibration standard, and the user-defined configuration of the instrument.
- Over any one-hour period, half-scale output, controlling an LDM-4412 mount at 25°C, with 10kΩ thermistor, on 100μA setting.
- Over any 24-hour period, half-scale output, controlling an LDM-4412 mount at 25°C, with 10kΩ thermistor, on 100μA setting.
- Into a 1Ω load.

In keeping with our commitment to continuing improvement, ILX Lightwave reserves the right to change specifications without notice and without liability for such changes.

Usable Thermistor Range: 25–450,000Ω  
Typical Sensor Output<sup>10</sup>  
AD590 Current Output: I(25°C)=298.2μA,  
I<sub>t</sub>=1μA/K  
LM335 Voltage Output: V(25°C)=2.73V,  
V<sub>t</sub>=10mV/K  
RTD (Pt100) Resistance: R(25°C)=109.73Ω  
User Calibration: Thermistor=Steinhart-Hart  
IC Sensors, RTD=Two-point

#### TEC MEASUREMENT (DISPLAY)

|                               | Range <sup>11</sup> | Resolution | Accuracy |
|-------------------------------|---------------------|------------|----------|
| Temperature:                  |                     |            |          |
| 10 μA Setting: <sup>12</sup>  | –100.0°C to 199.9°C | 0.01°C     | ±0.1°C   |
| 100 μA Setting: <sup>13</sup> | –100.0°C to 199.9°C | 0.01°C     | ±0.05°C  |
| Thermistor Resistance         |                     |            |          |
| 10 μA Setting:                | 0.00 to 450.00kΩ    | 0.01kΩ     | ±0.05%   |
| 100 μA Setting:               | 0.000 to 45.000kΩ   | 0.001kΩ    | ±0.05%   |
| TE Current:                   | –4.000 to 4.000A    | 0.001A     | ±0.04A   |

#### TEC VOLTAGE MEASUREMENT<sup>14</sup>

Voltage Range: –10.0 to 10.0V  
Voltage Resolution: 1mV  
Voltage Accuracy: ±30mV<sup>15</sup>

- Measured at 1A over bandwidth of 10Hz to 10MHz
- When ordered with TSC599 RTD Temperature Sensor Converter.
- Nominal temperature coefficients, I<sub>t</sub> and V<sub>t</sub>, apply over the rated temperature sensor range.
- Software limits of display range.
- Using a 100kΩ thermistor controlling an LDM-4412 mount over –30°C to 25°C.
- Using a 10kΩ thermistor, controlling an LDM-4412 mount over 0°C to 90°C.
- Voltage measurement is available only through the GPIB interface.
- Voltage measurement accuracy while driving calibration load. Accuracy is dependent upon load use.

 **ILX Lightwave**  
Laser Diode Instrumentation & Test Systems

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For information call

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REV01.060605



# LDC 3700B Series

## Laser Diode Controllers

### Specifications

#### GENERAL

|                                  |  |
|----------------------------------|--|
| Chassis Ground:                  | 4mm Banana jack  |
| GPIO Connector:                  | IEEE-488   |
| Power Requirements<br>(50-60Hz): | 100-120 VAC ( $\pm 10\%$ ),<br>220-240 VAC ( $\pm 10\%$ )                                      |
| Size (HxWxD):                    | 127mm x 353mm x 345mm<br>5in x 13.4in x 16.3in   |
| Weight:                          |  |
| LDC-3714/24B                     | 10.2kg (22.5lbs)   |
| LDC-3744B                        | 11.3kg (25lbs)   |
| Operating Temperature:           | 0°C to 40°C  |
| Storage Temperature:-            | -40°C to 70°C  |
| Humidity:                        | <90% relative, noncondensing   |
| Laser Safety Features:           | All instruments utilize a<br>Keypress, Interlock and Output<br>delay (Meets US 21 CFR 1040.10) |
| LASER Display Type:              | 5-Digit, Green LED   |
| TEC Display Type:                | 5-Digit, Green LED   |
| Output Connectors                |  |
| Laser Drive Current:             | 9-pin, D-sub, female   |
| TEC Control:                     | 15-pin, D-sub, female  |
| External Modulation:             | BNC  |
| Chassis Ground:                  | 4mm Banana jack  |

#### NOTES

All controllers include ILX model TS-510 calibrated 10k $\Omega$  thermistors. Laser diode mounts and other accessories are also available. Contact an ILX Lightwave sales engineer for more information.

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In keeping with our commitment to continuing improvement, ILX Lightwave reserves the right to change specifications without notice and without liability for such changes.

#### ORDERING INFORMATION

|            |  |
|------------|--|
| LDC-3714B  | Laser Diode Controller<br>(50/100mA Current Source, 16W TEC)       |
| LDC-3724B  | Laser Diode Controller<br>(200/500mA Current Source, 16W TEC)      |
| LDC-3744B  | Laser Diode Controller<br>(2000/4000mA Current Source, 16W TEC)    |
| CC-305S    | Current Source/Laser Diode Mount<br>Interconnect Cable             |
| CC-306S    | Current Source/Unterminated Interconnect<br>Cable                  |
| CC-501S    | TE Controller/Unterminated Interconnect<br>Cable                   |
| CC-505S    | TE Controller/Laser Diode Mount Interconnect<br>Cable              |
| LNF-320    | Low Noise Filter   |
| LDM-4982   | DIL Laser Diode Mount  |
| LDM-4982M  | Mini-DIL Laser Diode Mount with TE-550 Case<br>Temperature Control |
| LDM-4984   | Butterfly Laser Diode Mount  |
| LDM-4984RF | Hi-Frequency Butterfly Laser Diode Mount                           |
| LDM-4986   | Connectorized Laser Diode Mount                                    |
| LDM-4407   | Temperature-Controlled TO-Can Laser Diode<br>Mount                 |
| LDM-4412   | Temperature-Controlled Laser Diode Mount<br>with Collimating Lens  |
| TS-510     | Calibrated 10k $\Omega$ Thermistor                                 |
| TS-520     | Uncalibrated 10k $\Omega$ Thermistor                               |
| TS-523     | Uncalibrated 20k $\Omega$ Thermistor                               |
| TS-525     | Uncalibrated 100k $\Omega$ Thermistor                              |
| TS-530     | Uncalibrated AD590LH IC Temperature<br>Sensor                      |
| TS-540     | Uncalibrated LM335AH IC Temperature<br>Sensor                      |
| TSC-599    | RTD Temperature Sensor Converter                                   |
| RM136      | Rack Mounting Kit<br>(LDC-3714B, LDC-3724B, LDC-3744B)             |
| UCA-350    | Unipolar Heater Control Adapter                                    |
| LabVIEW®   | Instrument Driver  |



*The LDC-3714B and LDM-4407 mount: Ideal for precision control of low power laser diodes.*



*The LDC-3724B and LDM-4980 mount: An unbeatable combination for controlling low to medium power laser diodes.*

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