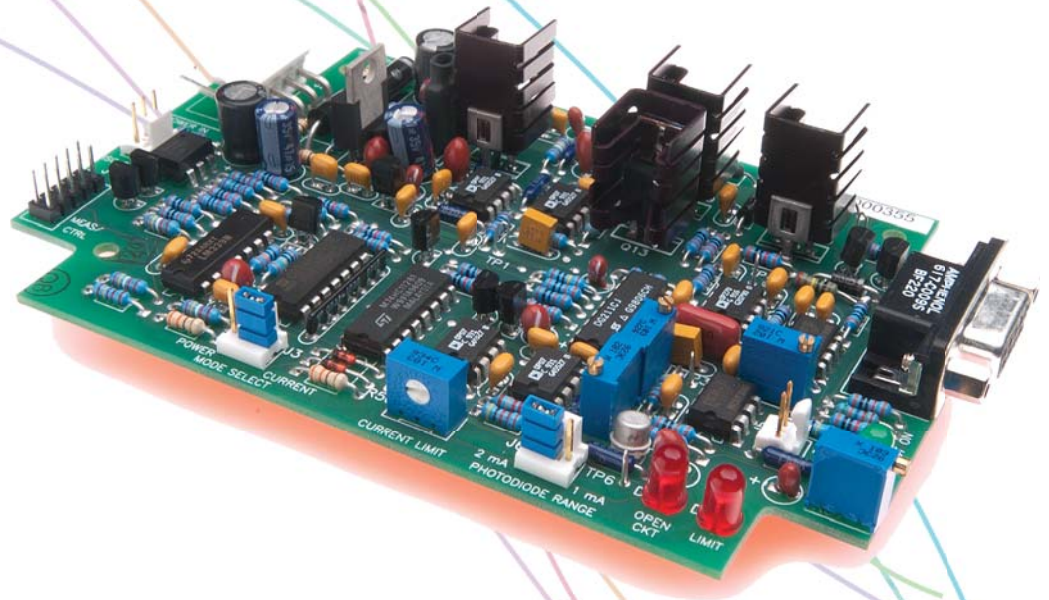


User's Guide

Laser Diode Current Source LDX-3100



 **ILX Lightwave**
Photonic Test and Measurement

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SAFETY AND WARRANTY INFORMATION

The Safety and Warranty Information section provides details about cautionary symbols used in the manual, safety markings used on the instrument, and information about the Warranty including Customer Service contact information.

Safety Information and the Manual

Throughout this manual, you will see the words *Caution* and *Warning* indicating potentially dangerous or hazardous situations which, if not avoided, could result in death, serious or minor injury, or damage to the product. Specifically:

CAUTION

Caution indicates a potentially hazardous situation which can result in minor or moderate injury or damage to the product or equipment.

WARNING

Warning indicates a potentially dangerous situation which can result in serious injury or death.

General Safety Considerations

If any of the following conditions exist, or are even suspected, do not use the instrument until safe operation can be verified by trained service personnel:

- Visible damage
- Severe transport stress
- Prolonged storage under adverse conditions
- Failure to perform intended measurements or functions

If necessary, return the instrument to ILX Lightwave, or authorized local ILX Lightwave distributor, for service or repair to ensure that safety features are maintained (see the contact information on page vii). All instruments returned to ILX Lightwave are required to have a Return Authorization Number assigned by an official representative of ILX Lightwave Corporation. See Returning an Instrument on page v for more information.











SAFETY SYMBOLS

This section describes the safety symbols and classifications. Technical specifications including electrical ratings and weight are included within the manual. See the Table of Contents to locate the specifications and other product information. The following classifications are standard across all ILX Lightwave products:

- Indoor use only
- Ordinary Protection: This product is NOT protected against the harmful ingress of moisture.
- Class I Equipment (grounded type)
- Electrical Rating: 100 - 240 V; ~ 2.5A; 225W; 50/60 Hz
- Mains supply voltage fluctuations are not to exceed $\pm 10\%$ of the nominal supply voltage.
- Pollution Degree 2
- Installation (overvoltage) Category II for transient overvoltages
- Maximum Relative Humidity: <80% RH, non-condensing
- Operating temperature range of 10 °C to 40 °C
- Storage and transportation temperature of -40 °C to 70 °C
- Maximum altitude: 3000 m (9843 ft)
- This equipment is suitable for continuous operation.

Safety Marking Symbols

This section provides a description of the safety marking symbols that appear on the instrument. These symbols provide information about potentially dangerous situations which can result in death, injury, or damage to the instrument and other components.

| | | | |
|--|---|--|---|
|  <p>Caution, refer to manual</p> |  <p>Earth ground Terminal</p> |  <p>Alternating current</p> |  <p>Visible and/or invisible laser radiation</p> |
|  <p>Caution, risk of electric shock</p> |  <p>Protective Conductor Terminal</p> |  <p>Caution, hot surface</p> |  <p>Frame or chassis Terminal</p> |
|  <p>On: In position of a bistable push control. The slash (/) only denotes that mains are on.</p> <p>or (/)</p> |  <p>Off: Out position of a bistable push control. The circle (O) only denotes that mains are off.</p> <p>or (O)</p> | | |

WARRANTY

ILX LIGHTWAVE CORPORATION warrants this instrument to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, ILX will repair or replace the unit, at our option, without charge.

Limitations

This warranty does not apply to fuses, lamps, defects caused by abuse, modifications, or to use of the product for which it was not intended.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose. ILX Lightwave Corporation shall not be liable for any incidental, special, or consequential damages.

If a problem occurs, please contact ILX Lightwave Corporation with the instrument's serial number, and thoroughly describe the nature of the problem.

Returning an Instrument

If an instrument is to be shipped to ILX Lightwave for repair or service, be sure to:

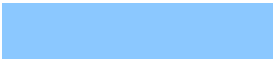
- 1 Obtain a Return Authorization number (RA) from ILX Customer Service.
- 2 Attach a tag to the instrument identifying the owner and indicating the required service or repair. Include the instrument serial number from the rear panel of the instrument.
- 3 Attach the anti-static protective caps that were shipped with the instrument and place the instrument in a protective anti-static bag.
- 4 Place the instrument in the original packing container with at least 3 inches (7.5 cm) of compressible packaging material. **Shipping damage is not covered by this warranty.**
- 5 Secure the packing box with fiber reinforced strapping tape or metal bands.
- 6 Send the instrument, transportation pre-paid, to ILX Lightwave. Clearly write the return authorization number on the outside of the box and on the shipping paperwork. ILX Lightwave recommends you insure the shipment.

If the original shipping container is not available, place your instrument in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

Repairs are made and the instrument returned transportation pre-paid. Repairs are warranted for the remainder of the original warranty or for 90 days, whichever is greater.

Claims for Shipping Damage

When you receive the instrument, inspect it immediately for any damage or shortages on the packing list. If the instrument is damaged, file a claim with the carrier. The factory will supply you with a quotation for estimated costs of repair. You must negotiate and settle with the carrier for the amount of damage.



Comments, Suggestions, and Problems

To ensure that you get the most out of your ILX Lightwave product, we ask that you direct any product operation or service related questions or comments to ILX Lightwave Customer Support. You may contact us in whatever way is most convenient:

Phone (800) 459-9459 or (406) 586-1244

Fax (406) 586-9405

On the web at: www.ilxlightwave.com

Or mail to:

ILX Lightwave Corporation
P. O. Box 6310
Bozeman, Montana, U.S.A 59771
www.ilxlightwave.com

When you contact us, please have the following information:

Model Number: _____

Serial Number: _____

End-user Name: _____

Company: _____

Phone: _____

Fax: _____

Description of what is connected to the ILX Lightwave instrument:

Description of the problem:

If ILX Lightwave determines that a return to the factory is necessary, you are issued a Return Authorization (RA) number. Please mark this number on the outside of the shipping box.

You or your shipping service are responsible for any shipping damage when returning the instrument to ILX Lightwave; ILX recommends you insure the shipment. If the original shipping container is not available, place your instrument



SAFETY AND WARRANTY INFORMATION

Warranty

in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

INTRODUCTION



This manual contains operation, calibration and specification information for the LDX-3100. It is recommended that the user become thoroughly familiar with this information prior to operating the LDX-3100.



WARNING

If any of the following symptoms exist, or are even suspected, remove the LDX-3100 Laser Diode Current Source from service. Do not use until trained service personnel can verify safe operation.

Visible damage

Severe transport stress

Prolonged storage under adverse conditions

Failure to perform intended measurements or functions

If necessary, return the LDX-3100 Laser Diode Current Source to ILX Lightwave for service and repair to ensure that safety features are maintained. Follow the “Returning an Instruments” process described on page xi.

Product Overview

The LDX-3100 Laser Diode Current Source is a device which, when powered by the appropriate supply, delivers stable, low-noise current to drive a laser diode or LED. Two methods, or “modes”, of laser current control are provided in the LDX-3100; constant current mode and constant power mode.

In constant power mode, the photocurrent from the laser’s back facet monitor is used in a feedback loop to maintain stable optical power.

External power supplies are required to power the LDX-3100’s control and monitoring circuits. Please refer to the specifications on page 3 for power supply requirements.

Voltage outputs are provided for laser current, current limit and photodiode current monitoring. LED indicators are also provided for power on, current output on and open circuit error.

Laser Diode Current Control

More information about laser diodes and driving them safely is available in ILX Lightwave Application Notes, which are available at www.ilxlightwave.com.

Specifications¹

| INPUTS | |
|--|---|
| Power Supply | + 12 to 18 volts at 350 mA - 12 to - 18 volts at 50 mA |
| Control | Output On (Default) when power supplied; user can control output on / off with TTL line |
| Isolated Control ² | TTL Signal (V_{EC} required) |
| Mode Select ³ | Jumper selectable; Constant I / Constant I_{PD} |
| I Set External Supply On-Board | 0-5V, 50 mA/V 25-turn pot |
| I Limit Set | 1-turnpot adjustable; 0 to 250 mA (minimum) |
| Modulation Bandwidth Transfer Function | 2 KHz ⁴ 50 mA/V |
| Photodiode Feedback Type | Differential, zero-bias |
| PD Range | 20 μ A to 2 mA |
| Stability ⁵ | $\pm 0.1\%$ |
| OUTPUTS | |
| Laser Output | |
| Current | 0 to 250 mA (minimum) |
| Compliance Voltage | > 5.5 volts |
| Temperature Coefficient | < 50 ppm / °C |
| Short-Term Stability (1 hour) | < 50 ppm |
| Long-Term Stability (24 hours) | < 100 ppm |
| Control Transients ⁶ | < 100 μ A |
| Noise | < 2 μ A rms |
| Laser Current Measurement | 0 to 5 V buffered output |
| Transfer Function | 50 mA / V |
| Accuracy | $\pm 0.1\%$ of FS (± 0.25 mA) |
| Photodiode I Measurement | 0 to 5 V buffered output |
| Transfer Function | 0.4 mA / V |
| Accuracy | $\pm 0.1\%$ of FS (± 2 μ A) |
| Limit Current Measurement | 0 to 5 V buffered output |
| Transfer Function | 50 mA / V |

| | |
|------------------------|--|
| Accuracy | $\pm 1.5\%$ of FS (± 3.75 mA) |
| Laser Diode Protection | |
| ESD | JFET (normally closed) shorting output |
| Power | Current supply regulated onboard; overvoltage protection; transient suppression |
| Indicators | |
| Power On | Green LED |
| Current On | Pads for external LED (10 mA) |
| Error (open circuit) | Pads for external LED (10 mA) |
| GENERAL | LDX-3100 |
| Size | 0.5" x 3.5" x 5.5" (12mm x 88mm x 139mm) (Printed Circuit Board - includes four 1.25" mounting standoffs) |
| Operating Temperature | 0 to 50 °C |
| Storage Temperature | -40 to 70 °C |

1. All values measured after a one-hour warm-up period.
2. Isolated control is provided to turn output off and on depending on input (such as TEC error status from LDT-5100). No connection disables this control.
3. To insure laser safety, mode must be changed only when output is off.
4. In constant power mode, the bandwidth is reduced to approximately 200 Hz, depending on the photodiode used.
5. Maximum monitor photodiode drift over a 30 minute period, after warm up; assumes zero drift in responsivity of photodiode.
6. Maximum output current transient generated from normal operational (ON/OFF) situations.



See Figure 2.1 for location and identification of control connectors and jumpers.

Mode Select

Two modes of laser current control are provided in the LDX-3100; constant current mode and constant power mode.

In constant current mode, the output current is held constant, while constant power mode varies the output current to maintain the set optical power. The Mode Select jumper (J3) must be set to the desired mode prior to applying power to the unit. The right and center pins determine constant current mode, while the left and center pins determine constant power mode. The jumper must be present in one of the positions for the LDX-3100 to function.

The laser current output must be disabled when switching between modes.

Current Limit

To ensure safe laser operation, the current limit must be set below the maximum operating current of the laser, as specified by the laser manufacturer. The current limit adjust allows the user to set the upper limit of the laser drive current. This limit will not be exceeded by the LDX-3100, regardless of the operating mode. The laser current limit is adjustable up to the maximum output current.

The current limit value is adjusted by turning the “CURRENT LIMIT” trimpot (R50), where fully clockwise represents the highest limit (approximately 270 mA) and fully counter clockwise represents a limit of nearly zero.

The current limit value can be monitored with a 0-5V buffered output through pin 8 of the control connector J1.

Photodiode Gain Range Select

For a greater range of usable monitor photodiodes, two photodiode amplifier gain ranges are provided on the LDX-3100 - 1 mA and 2 mA (maximum photodiode current). They are selectable on the “PHOTODIODE RANGE” jumper (J6).

Note: If the jump is removed, the 2 mA range (default) is selected. The choice of gain range will depend on the specifications of the photodiode used and the resolution desired.

Laser Current / Power Set

The desired drive current level (or laser power level) is adjusted with the “I/P SET” trim pot (R57). When adjusted fully clockwise, the I/P SET is in the MAX position. This corresponds to a laser drive current of 250 mA, or a photodiode current of 1 or 2 mA, (depending upon the mode and photodiode gain range selected). The drive current set point can also be set with a constant external voltage at input J5. The transfer function is 50 mA/V.

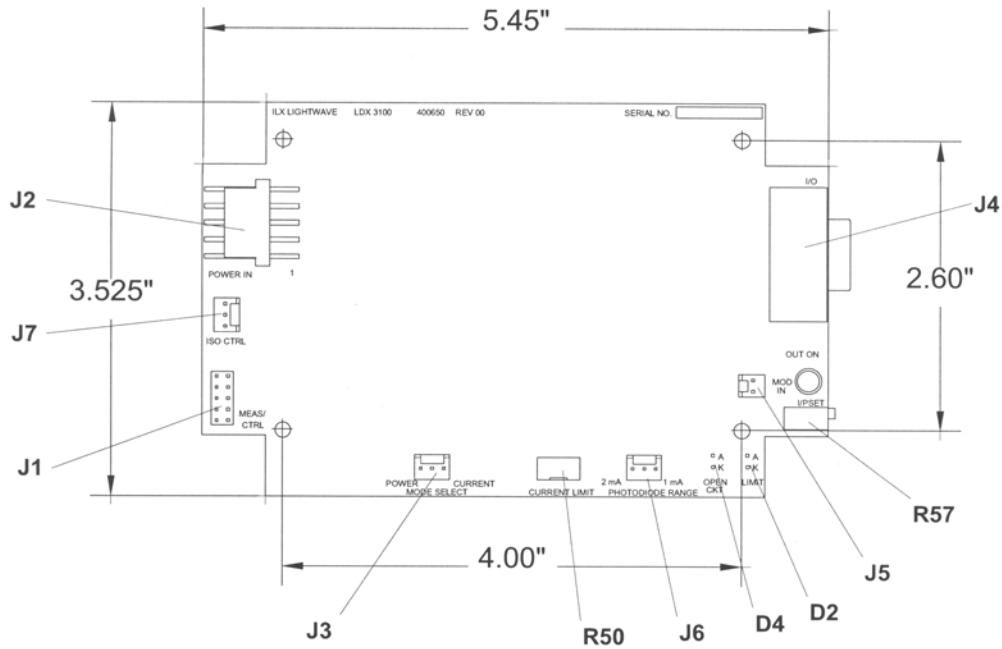
Analog Modulation

An external voltage can also be used to modulate the output current through the Modulation input (J5). In constant current mode, this input has a transfer function of 50 mA/V and a bandwidth of 2 kHz. In constant power mode, the bandwidth is reduced to approximately 200 Hz, depending on the photodiode used.

Isolated Control

A isolated input connector, “ISO CONTROL” (J7) is provided to turn the output off and on depending on a isolated input control (such as the TEC error status from the LDT-5100). An isolated TTL signal along with its VCC voltage is required. A logic low level on the ISO control pin turns the output off. A high impedance on this pin or no connection to the connector J7 disables this control.

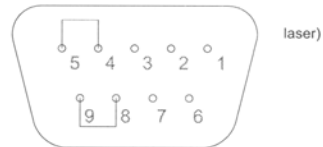
Measurement / Control



CONNECTORS

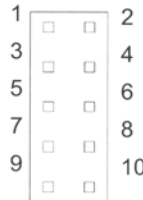
LASER CURRENT, PHOTODIODE, I/O CONNECTOR (J4):
9-pin, standard D-sub

- | | |
|-----|--|
| 1,2 | Safety Interlock (Connect pins with zero-ohm jumper to enable) |
| 3 | N/C |
| 4,5 | Laser Diode Cathode (-) (Connect only when output is off) |
| 6 | Photodiode + (Connect monitor photodiode cathode) |
| 7 | Photodiode - (Connect monitor photodiode anode) |
| 8,9 | Laser Diode Anode (+) (Connect only when output is off) |



MEASUREMENT / CONTROL CONNECTOR (J1):
10-pin, 0.1" centers, IDC-compatible

- | | |
|------|----------------------------|
| 1 | Output on |
| 2 | Output status |
| 3 | +5 V |
| 4 | Open circuit error |
| 5, 9 | Ground |
| 6 | Photodiode current monitor |
| 7 | Limit sense |
| 8 | Limit current monitor |
| 10 | Laser current monitor |

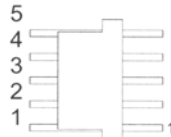


MODULATION INPUT CONNECTOR (J5):



POWER INPUT CONNECTOR (J2):
5-pin, Right-angle, 0.156" centers

- | | |
|---|---------|
| 1 | N/C |
| 2 | GND |
| 3 | -15 VDC |
| 4 | GND |
| 5 | +15 VDC |



ISOLATED CONTROL CONNECTOR (J7):

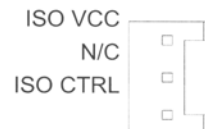


Figure 2.1 LDX-3100 Control/Monitor Connectors

Output On

An output on control line is provided at pin 1 of the measurement / control connector (J1). When no connection is made, this line is internally pulled high, and the output is turned on (current is provided to the output). This is also the condition at power-up. If the control line is grounded, the output will be off (no current provided to the output).

Output Monitors

The LDX-3100 has three buffered output monitors present on the measurement / control connector (J1). These monitor the actual laser current, limit current and photodiode current.

Actual Laser Current

The actual laser current monitor (pin 10) provides an output voltage which is proportional to the laser current. The transfer function is indicated in the specifications. The accuracy is specified to 5V although higher output voltages can be measured.

Limit Current

A monitor of limit current (pin 8) is also provided as a buffered output on the measurement / control connector (J1). This output is proportional to the limit current as set using trim pot R50. This monitor is continuously available (whether the output is on or off). It is recommended to adjust the limit current to the proper setting prior to turning on the output in order to insure safe laser operation.

Photodiode Current

A monitor of photodiode current (pin 6) is also provided as a buffered output on the measurement / control connector (J1). This output is proportional to the photodiode current and is active in either mode setting. The transfer functions are indicated in the specification.

Status Monitors

The LDX-3100 measurement / control connector (J1) includes three status lines which provide information about the instrument operation. They are output status, limit indicator and open circuit error.

Output Status (pin 2)

This control line is an open collector output. A logic low indicates that the output is OFF. A high impedance (logic high through user provided pull-up resistor) indicates that the output is ON.

Limit Indicator (pin 7)

This control line indicates whether the current source is operating in current limit (the limit current is being provided to the output). A logic low indicates that this condition exists and the current source is delivering the limit current to the output. A logic high indicates that the current source is operating under normal linear control.

Note: This line is NOT an open collector output.

Open Circuit Error (pin 4)

This control line is an open collector output. A high impedance (logic high through user provided pull-up resistor) indicates that the output is ON and the current source is operating under a normal load condition. A logic low indicates that the output has been turned off due to an open circuit or high impedance load. This error is latched and is reset whenever the output is turned on.

LED Indicators

A green LED indicator (OUT ON) is provided to indicate whether the output is turned ON. This LED turns ON approximately three (3) seconds prior to current flow from the output, and stays on as long as the output is on. In addition, pads are provided for both limit status and open circuit error (D2 and D4) to allow direct connection of indicator LEDs. These pads are internally referenced (with limiting resistors) and do not require external supply connection. The LIMIT STATUS LED is ON when the current source is operating in a current limit condition. The OEN CIRCUIT ERROR LED is on when the output has been turned off due to a high impedance or open circuit on the output.

Note: If status LEDs are used, the current requirement for the +12 V supply should be increased accordingly.

Laser I/O Connector

The I/O 9-pin D-sub connector pinout is illustrated in Figure 2.1. With the output disabled, simply connect your laser diode to the proper pins (observing the polarity of ANODE and CATHODE) and connect the monitor photodiode, if applicable.

DC Power-In Connector

The pinout of this connector is provided in Figure 2.1.

CALIBRATION**Laser Current Monitor Calibration**

To calibrate the laser current monitor, connect an ammeter across the laser output (J4). Connect a voltmeter to the laser current monitor (J1 pin 10).

- 1 Set the MODE jumper (J3) for constant current and turn the output on.
- 2 Adjust the setpoint (R57) until 125.00 mA is measured on the ammeter.
- 3 Adjust R22 until the voltmeter reads 2.500 Volts.

Modulation Transfer Function Calibration

To calibrate the modulation input transfer function, connect an ammeter across the laser diode output (J4).

- 1 Set the MODE jumper for constant current mode and turn the output on.
- 2 Adjust the setpoint (R57) so that 125.00 mA is measured on the ammeter.
- 3 Apply a 1.000 V signal to the modulation input connector (J5).
- 4 Adjust R74 until the ammeter reads 175 mA.

Photodiode Monitor Calibration

To calibrate the photodiode monitor, a photodiode feedback test fixture if required. Please contact ILX for test fixture schematics and procedures.

