User's Guide

Ultra Low Noise Current Source
LDX-3620B

ILX Lightwave® A Newport Company

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

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

Visible and/or invisible laser radiation. Avoid direct exposure to the beam.

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 later in this section.)

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 ix 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)
- Mains supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.
- Pollution Degree II
- Installation (overvoltage) Category II for transient overvoltages
- Maximum Relative Humidity: <80% RH, non-condensing
- Operating temperature range of 0 °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.

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

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

We look forward to serving you even better in the future!

CHAPTER 1

INTRODUCTION AND SPECIFICATIONS

This chapter is an introduction to the LDX-3620B Ultra Low Noise Laser Diode Current Source. It contains unpacking information, instructions on how to install and apply power, and safety considerations and instructions. It also contains specifications and information on options and accessories.

WARNING

If any of the following symptoms exist, or are even suspected, remove the LDX-3620B from service. Do not use the LDX-3620B 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-3620B to ILX Lightwave for service and repair to ensure that safety features are maintained.

Product Overview

The LDX-3620B is a battery powered, ultra low noise current source, optimized for narrow linewidth or stable wavelength laser diode applications. Instrument features include:

- Low noise, battery based design
- Built-in battery charger and front panel battery charge indicator
- High output stability, (<10 ppm)
- Current limit protection
- Two output current ranges (200 mA and 500 mA)
- Photodiode feedback input for constant optical power operation

- Two current control inputs with up to 1 MHz bandwidth for precise laser tuning
- Low battery shutdown protection

Initial Inspection

When you receive your LDX-3620B, verify that the following items were shipped with the instrument:

- LDX-3620B Ultra Low Noise Laser Diode Current Source
- User's Manual
- DC Power Supply
- Power Cord

Verify the line voltage indicated on the rear panel is correct for your facility. Check for damage from shipping.

Installing Your LDX-3620B Ultra Low Noise Current Source

Power Requirements

The LDX-3620B is a battery powered current source. It can be operated for up to 16 hours before recharging the batteries. A low voltage DC power supply (supplied with the instrument) is required to charge the batteries. The DC power supply can be plugged into a single phase AC power source delivering nominal line voltages in the range of 100 to 240 VAC ±10% (all values RMS), from 50 to 60 Hz. This power supply is intended for indoor use only.

WARNING

To avoid electrical shock hazard, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury or death.

Grounding Requirements

The LDX-3620B Ultra Low Noise Current Sources comes with a low voltage DC power supply and a three conductor AC power cable. The power cable must either be plugged into an approved three contact electrical outlet or used with a three-contact or two-contact adapter with the grounding wire connected to an electrical ground (safety ground). The LDX-3620B's DC power supply and power cable meet IEC safety standards.

Tilt Foot Adjustment

The LDX-3620B can be tilted for easier viewing using the extensions on the front feet of the unit. These extenders can be extended 90 degrees until they lock into position.

WARNING

The supplied low voltage DC power supply is for use with the LDX-3620B Ultra Low Noise Current Source only. Do not use this power supply for any purpose other than running the LDX-3620B.

Operating the LDX-3620B Ultra Low Noise Current Source

Now that the LDX-3620B is installed and ready for use, you can begin to learn about its operation. The following figures show the front and rear panel controls and inputs. Use these figures to familiarize yourself with the LDX-3620B. After that, use Chapter 2 for fundamentals of operating your instrument.

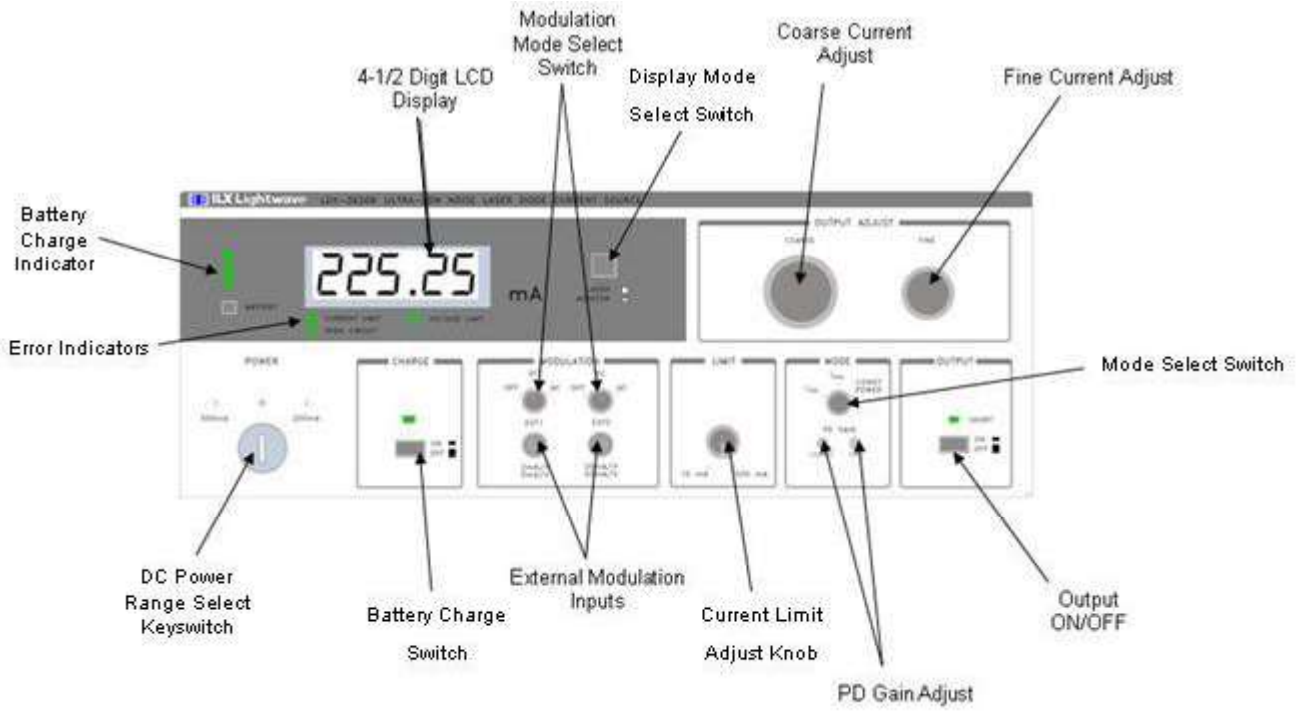


Figure 1.1 LDX-3620B Front Panel

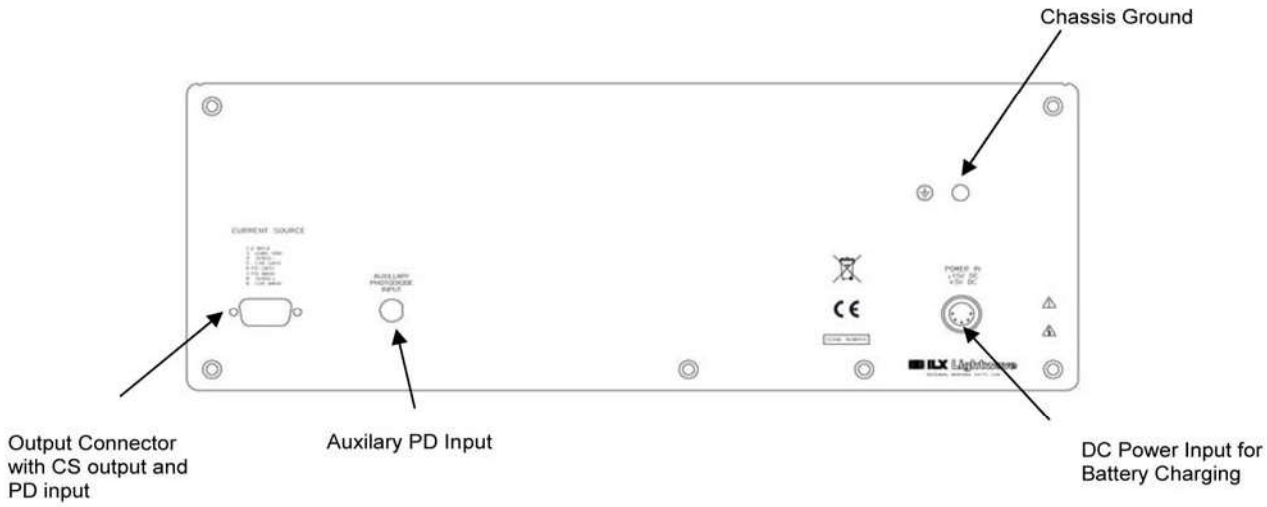


Figure 1.2 LDX-3620B Rear Panel

Rear Panel Controls and Connectors

OUTPUT Connector

The rear panel 9-pin D-sub connector pin-outs are shown in Figure 2.5 in Chapter 2. The LDX-3620B output current is sourced (+) from pins 8 and 9 and the current returned (-) to pins 4 and 5. The monitor photodiode feedback current is input to pin 7 (+) and returned from pin 6 (-). The feedback leads should be shielded with an earth-ground shield available on pin 3. Pins 1 and 2 of the rear panel OUTPUT can be connected to an external safety interlock switch to disable the LDX-3620B current output when the switch is opened.

PHOTODIODE Feedback Input Jack

The photodiode feedback current may optionally be input through a rear panel BNC jack. This jack is connected in parallel with pins 6 and 7 of the rear panel 9 pin D subminiature connector.

CHASSIS GROUND Connector

Chassis ground is available on the rear of the unit through a banana jack connected to the LDX-3620B chassis. When a three-wire line cord with earth ground is used, the chassis of the LDX-3620B is connected to the ground lead of the power cord.

DC POWER Input

A input is provided for charging the internal batteries from a DC desktop 50W power supply provided with the LDX-3620B. An IEC 320-C14 receptacle is required for AC input to the power supply. The plug is a standard type R1B: DIN 5-pin which connects directly to the receptacle on the rear panel. The power supply provides 5V, +15V, and -15V to the instrument.

The instrument can be operated in any mode with the DC power supply connected.

Specifications

DRIVE CURRENT OUTPUT[1]

Output Current Range:	0 to 200 mA	0 to 500 mA
Compliance Voltage:	< 5V	< 5V
Temperature Coefficient:	< 20 ppm / °C	< 20 ppm / °C
Short Term Stability:[2]		
5 minutes:	< 4 ppm	< 4 ppm
30 mintues:	< 10 ppm	< 10 ppm
1 hour:	< 10 ppm	< 10 ppm
Long Term Stability (12 hours): [2]	< 50 ppm	< 50 ppm
Noise and Ripple (rms):[3]		
Charge Mode Operation		
Low Bandwidth Mode (100 Hz):	< 1.0 µA	< 1.0 µA
Low Bandwidth Mode (100 KHz):	< 2.0 µA	< 2.0 µA
High Bandwidth Mode (100 KHz):	< 3.0 µA	< 3.0 µA
High Bandwidth Mode (1 MHz):	< 5.0 µA	< 7.0 µA
Battery Operation		
Low Bandwidth Mode (100 Hz):	< 70 nA	< 120 nA
Low Bandwidth Mode (100 KHz):	< 250 nA	< 400 nA
High Bandwidth Mode (100 KHz):	< 600 nA	< 900 nA
High Bandwidth Mode (1 MHz):	< 750 nA	< 2.0 µA
Transients: [4]		
Operational (output on/off):	< 10 µA	< 10 µA
Operational (power on/off):	< 1mA	< 1 mA

DRIVE CURRENT LIMIT SETTINGS

Range:	10 to 500 mA
Accuracy (% of FS):	±5 mA

PHOTODIODE FEEDBACK

Type:	Differential	Differential
PD Current Input Range:	20 to 2000.0 µA	20 to 2000.0 µA

EXTERNAL ANALOG MODULATION

Input 1:	10V	10V
Transfer Function:	2 mA/V	5 mA/V
Bandwidth (3dB; DC coupled)[6]		
High Bandwidth Mode:	DC to 1 MHz	DC to 1 MHz
Low Bandwidth Mode:	10 kHz	10 kHz
Bandwidth (3dB; AC coupled)[6]		
High Bandwidth Mode:	100 Hz to 1 MHz	100 Hz to 1 MHz
Low Bandwidth Mode:	100 Hz to 10 kHz	100 Hz to 10 kHz
Input Impedance:	1 KΩ	1 KΩ
Input 2:	10V	10V
Transfer Function:	20 mA/V	50 mA/V
Bandwidth (3dB; DC coupled)[6]		
High Bandwidth Mode:	DC to 1 MHz	DC to 1 MHz
Low Bandwidth Mode:	10 kHz	10 kHz
Bandwidth (3dB; AC coupled)[6]		
High Bandwidth Mode:	100 Hz to 1 MHz	100 Hz to 1 MHz
Low Bandwidth Mode:	100 Hz to 10 kHz	100 Hz to 10 kHz
Input Impedance:	1 KΩ	1 KΩ

MEASUREMENT

Output Current Range:	0 to 199.99 mA	0 to 500.0 mA
Output Current Resolution:	0.01 mA	0.1 mA
Output Current Accuracy:	0.1% FS	0.2% FS
Photodiode Current Range:	0 to 1999.9 µA	0 to 1999.9 µA
Photodiode Current Resolution:	0.1 µA	0.1 µA
Photodiode Current Accuracy:	±4 µA	±4 µA

INPUT/OUTPUT CONNECTORS

Photodiode:	9-pin d-sub rear panel; BNC, rear panel
Modulation (Input 1):	BNC, front panel
Modulation (Input 2):	BNC, front panel
Laser Current Source:	9-pin d-sub rear panel
DC Power Supply:	Standard Type R1B: DIN 5-pin

GENERAL

DC Input Power Requirements:	100VAC - 120VAC ±10%, 47 to 63 Hz 220VAC - 230VAC ±10%, 47 to 63 Hz
Maximum Current Draw	
100VAC to 120VAC:	1.6A
220VAC to 240VAC:	1.6A
Batteries	
Battery Operation Time:[7]	16 hours
Battery Charge Time:	15 hours
+12V Supply	
Type:	Lead acid
Capacity:	12 amp-hour
Charge Operating Temperature:	0 - 40°C
Discharge Operating Temperature:	-20°C - 50°C
Weight:	3.94 kg (8.68 lbs)
-12V Supply	
Type:	Lead acid
Capacity:	2.2 amp-hour
Weight:	0.94 kg (2.07 lbs)
Size (HxWxD):	5" x 13.4" x 16.3" 127mm x 340mm x 414mm
Weight:	25.4 lbs.; 11.11 kg
Operating Temperature:	0°C to 40°C
Storage Temperature:	-40°C to 60°C
Humidity:	Up to 80%, non-condensing
Regulatory Compliance:	CE Certified; EMC Directive 2004/108/EC per standard EN61326-1:2006; Low Voltage Directive 2006/96/EC per standard EN61010-1:2001

NOTES

1. Unless otherwise noted, all specifications measured at 23°C ±3°C after one-hour warm-up period.
2. Over the specified period, half-scale output into a temperature controlled resistive load.
3. Measured electrically, with a 24Ω load evaluating AC coupled rms value over the specified bandwidth.
4. 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).
5. Internal specification only, not to be published.
6. Sine wave with 5V peak to peak modulation at half scale output
7. Battery operating time is the same for both 200 mA and 500 mA ranges, instrument circuitry draws 500 mA in either current range.
8. Measurement accuracy specification becomes non-linear after 180mA in 200mA range and at 1800uA for photodiode current measurement. Total non-linearity error not to exceed ±0.2% of current measurement full scale or ±4uA of photodiode measurement current.

ORDERING INFORMATION

LDX-3620B	Ultra Low Noise Current Source
CC-305S	Current Source/LD Mount Interconnect Cable
CC-306S	Current Source Unterminated Interconnect Cable
LDM-4412	Temperature Controlled TO-can Laser Diode Mount with Collimating Lens
LDM-4405	Low Cost TO-Can Laser Diode Mount
LDM-4407	Temperature Controlled TO-can Laser Diode Mount
LDM-4982	DIL Laser Diode Mount
LDM-4984	Butterfly Laser Diode Mount

Other laser diode mounts are available; contact sales@ilxlightwave.com for more information.

Options and Accessories

Options and accessories available for the LDX-3620B Ultra Low Noise Current Source include the following:

MODEL NUMBER	DESCRIPTION
CC-305S	Current Source Interconnect Cable, terminated, 6’
CC-306S	Current Source Interconnect Cable, unterminated, 6’
CC-355S	Current Source Cable, terminated, 5m
LDM-4405	Temperature Controlled Low Cost TO-Can Laser Diode Mount
LDM-4407	Temperature Controlled TO-CAN Laser Diode Mount
LDM-4412	Temperature Controlled TO-Can Laser Diode Mount with Collimating Lens
LDM-4990	TO-Can Laser Diode Mount with Measurement Head Option
LDM-4982	DIL Laser Diode Mount
LDM-4984	Butterfly Laser Diode Mount
402529	2.2A Amp-hr Battery Replacement
402530	12 Amp-hr Battery Replacement

Other laser diode mounts and accessories are available. Please contact ILX Lightwave for information or visit www.ilxlightwave.com.

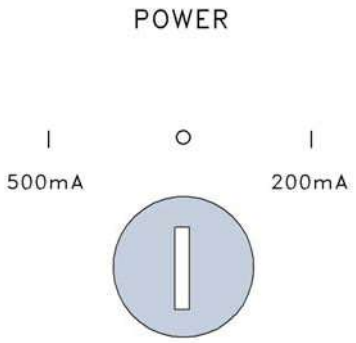
Our goal is to make the best laser diode instrumentation available anywhere. To achieve this, we need your ideas and comments on ways we can improve out products. We invite you to contact us at any time with your suggestions.

CHAPTER 2

OPERATION

This chapter introduces you to the operation of the LDX-3620B Laser Diode Current Source. It offers instructions for connecting your laser to the current source, and describes powering up the instrument. This chapter also contains step by step procedures that teach you how to operate the current source in Constant Current Mode and Constant Power Mode. We recommend that you review the contents of this chapter at a minimum before operating the instrument.

Applying Power to Your LDX-3620B



A three position key switch on the front panel of the LDX-3620B controls the power to the current source.

- OFF - center position
- 200 mA range - clockwise (CW)
- 500 mA - counter-clockwise (CCW)

The front panel power key switch enables the instrument to operate from the internal batteries and selects the current source output full scale range. The center position disables power from the instrument. Turning the switch clockwise enables power to the instrument and selects the 200 mA range. Turning the switch counter-clockwise enables power to the instrument and selects the 500 mA range.

Battery Charging

The batteries of the LDX-3620B are re-chargeable lead-acid batteries. To charge the batteries, make sure the DC power supply is connected to the instrument and plugged into an AC source. A switch on the front panel of the instrument enables or disables battery charging. For lowest noise operation, the CHARGE switch should be disabled.

The instrument can be operated on battery only or with the batteries charging.

Low Battery Condition and Shutdown

In a low battery condition, shutdown circuits will turn off the output of the LDX-3620B. Use of the instrument will be disabled until the batteries have been recharged and the DC POWER key switch has been turned off and then on again. Continued operation of the instrument in a low battery condition will result in the display becoming fully inoperative by showing random characters or going blank. Repeated operation of the instrument in a low battery condition greatly reduces the battery life and is not recommended. See Chapter 3 for recommended battery maintenance.

It is recommended that throughout use of the instrument in battery mode to periodically check the charge level of the batteries with the battery level indicator. Illumination of all four indicators represent fully charged batteries, each LED represents a 25% charge level. If the lowest indicator does not illuminate when the BATTERY push button is pushed, the batteries are in a low battery condition. Continued operation of the instrument in this condition is not recommended.

The LDX-3620B uses two batteries; a large +12V battery for output current and driving active components and a second, smaller -12V battery for active components. The battery status LED only provides information for the +12V battery.

Connecting to the Laser

When connecting your laser or any other sensitive devices to the LDX-3620B Laser Diode Current Source, we recommend that the instrument be powered up and the laser output off. In this condition, a low impedance shunt is active across the output terminals. When disconnecting devices, it is only necessary to disable the current source output. It is also recommended that the connections to the current source output be made using twisted wire pairs with an earth-grounded shield (see Figures 2.1 - 2.4). The output terminals of the instrument are left floating relative to earth ground to suppress transients that may occur through an earth ground path. If the output circuit is earth-grounded at some point (such as through the laser package, laser diode mount, or modulation input through a

function generator), the user must be careful to avoid multiple earth grounds in the circuit. Multiple earth grounds may provide circuit paths that induce spurious currents in the photodiode feedback circuit and output leads.

CAUTION

Experience indicates that should an open circuit occur during laser operation (while the LASER is ON), the laser may be damaged by a momentary circuit break and remake before the final circuit break. The cable connections to the laser must be secure enough that they will not open-circuit, should they be jostled or bumped. Should an open circuit occur during laser operation, do not attempt to remake the circuit or connection until the instrument output is disabled (the front panel output switch in the OFF/SHORT position).

Figures 2.1 through 2.4 show the possible configurations of connecting laser diodes and photodiodes with the LDX-3620B Ultra Low Noise Laser Diode Current Source.

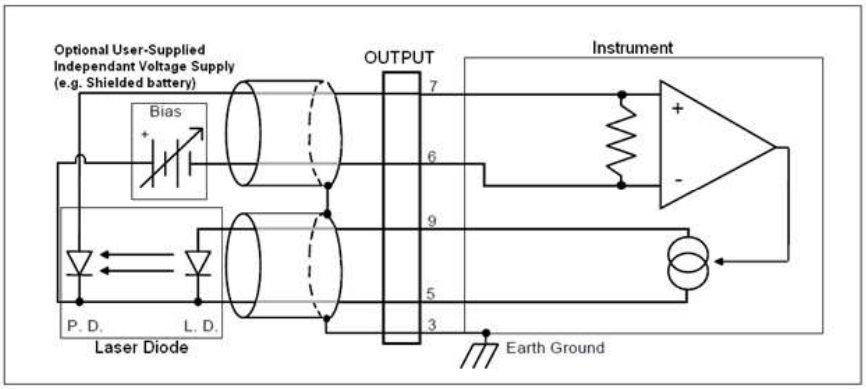


Figure 2.1 Common Laser Cathode - Photodiode Cathode

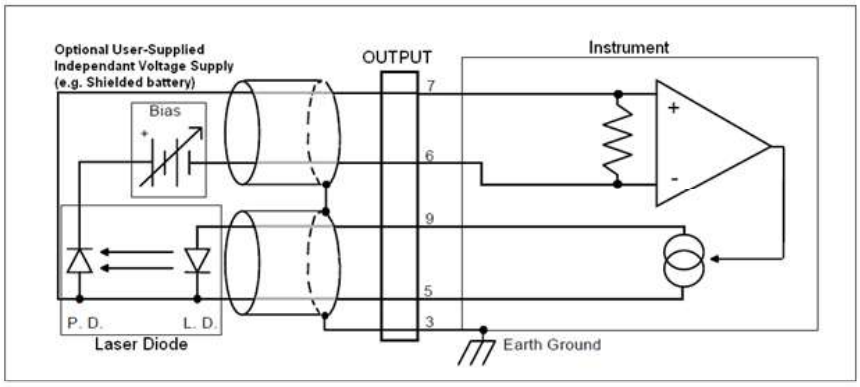


Figure 2.2 Common Laser Cathode - Photodiode Anode

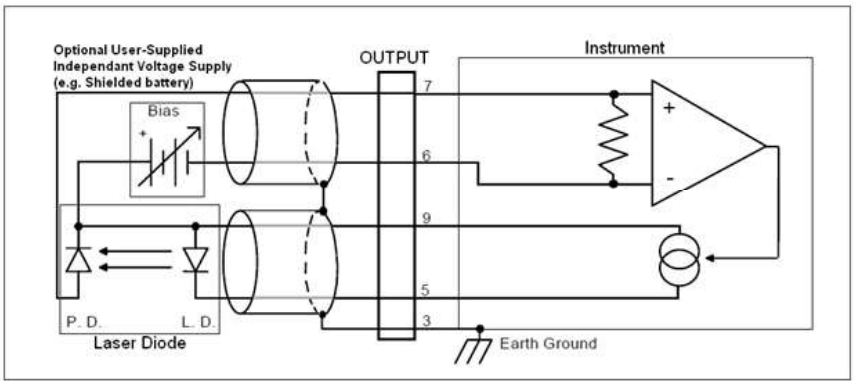


Figure 2.3 Common Laser Anode - Photodiode Cathode

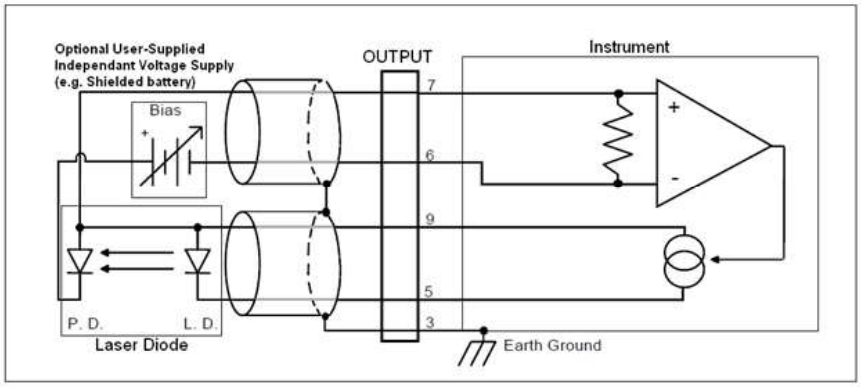


Figure 2.4 Common Laser Anode - Photodiode Anode

The 9-pin connector marked Current Source on the back panel is used to connect your laser diode to the LDX-3620B. there are connections provided for laser cathode and anode, photodiode cathode and anode, chassis ground and interlock. The pinout diagram for this connector is shown in Figure 2.5.

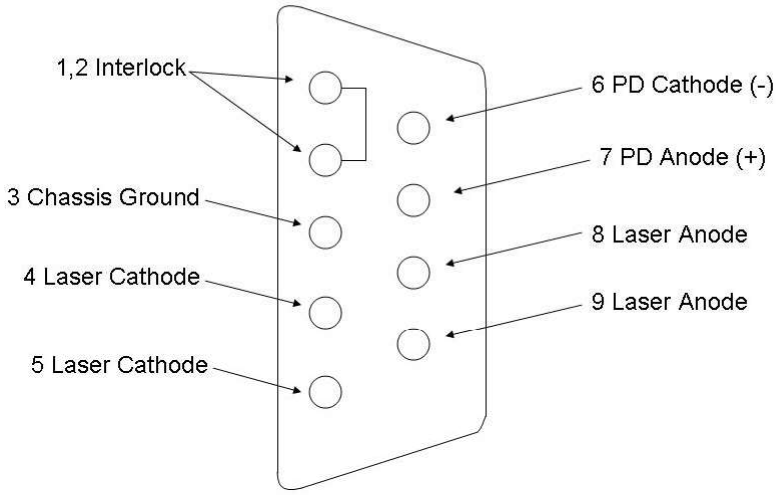


Figure 2.5 Rear Panel Laser Output Connector

Load Considerations

The LDX-3620B is intended as a current source for laser diode loads. When it is used with a resistive load, the resistance value of the limiting resistor should be selected so that the compliance voltage of the instrument is not exceeded. For example, a laser diode which has a voltage drop of 1.8 volts may be connected in series with a limiting resistor. In the 200 mA range, the compliance voltage is 5 volts. If the current limit is set to 100 mA, the maximum resistance value of the limiting resistor can be found using OHM's Law:

R = V/T = (5 - 1.8 V) / 0.1A = 32 ohms.

CAUTION

If the LDX-3620B is to be used with an inductive load, such as a bias "tee" network, the instrument mode should be set to constant current, low bandwidth. This is done to prevent possible oscillation of the current source.

Interlock Connections

In order for the laser output to be enabled, a short circuit must exist between the Interlock pins (pins 1 and 2) of the 9-pin current source connector on the rear panel of the LDX-3620B. The short can be a direct short across the pins or a switch to prevent laser operation until the switch is closed. When this circuit is opened, the interlock disables the current source and the output short LED indicator is illuminated. The interlock connections must be electrically isolated from all other circuits. If you are using an ILX Current Source Interconnect Cable to connect the laser to the LDX-3620B, the interlock pins are shorted together inside the connector at the end of the cable. If you want to use the interlock feature through an external relay or switch, this connection in the cable will have to be severed.

CAUTION

The interlock terminals on the laser connector, pins 1 and 2, must be kept isolated from all other connections including earth ground.

Photodiode Connections

Many laser diode modules contain an internal photodiode that monitors the backfacet emission of the laser. This photodiode is usually internally connected to either the laser anode or cathode. Figures 2.1 - 2.4 show the recommended connections and shielding for the various configurations of laser diode modules and photodiode feedback schemes.

The feedback photodiode reverse-biasing supply shown in these figures must be supplied by the user. It is located in the circuit where it will not cause the common

mode voltage of the feedback inputs to exceed their specified maximum of +6 volts, relative to the "-" current output terminal (pins 4 and 5 of Figure 2.5). Noise from this biasing supply may contribute to the output noise levels; therefore, a battery with shielded connections is recommended.

If a feedback photodiode is used, which is electrically isolated from the laser, the feedback circuit must be resistively "tied" at some point to the output circuit. A large resistance of 1 M?, connected from the laser cathode to the photodiode anode, may be used in place of the direct connection. This is done to keep the feedback inputs within the specified maximum +6 volt common mode voltage, relative to the " - " laser current output (pins 4 and 5 of Figure 2.5).

Front Panel Operation

This section describes fundamentals of operation for your LDX-3620B.The instructions presented in this section assume that the instrument is powered up with the POWER switch in 200 mA range or the 500 mA range. See the section "Applying Power to the LDX-3620B" at the beginning of this chapter for information on the power switch and selecting the current source output range.

Initial Front Panel Settings

Before turning DC power on, the front panel controls should be set to a safe configuration. The table below lists the recommended settings.

Front Panel Control	Recommended Setting
OUTPUT Switch	OFF (out)
MODE	I_{LBW}
MODULATION	OFF
DISPLAY Switch	LASER (out)
OUTPUT ADJUST Knobs	Fully counter-clockwise
LIMIT Knob	Fully counter-clockwise
CHARGE Switch	OFF (out)
PD Gain Coarse	Minimum gain
PD Gain Fine	Minimum gain

DISPLAY

The LDX-3620B output current and monitor photodiode current are displayed on a 4-1/2 digit liquid crystal display in the upper left of the front panel. When the DISPLAY push button is in the LASER position (out), the display reads either the set-point current with the output disabled or the actual (measured) current with the output enabled. In either constant current mode the display reads the DC current level. If the current source output is modulated, the display may oscillate depending on the frequency of the modulation signal. The resolution of the

display depends on the range selected by the POWER key switch: 0.01 mA in the 200 mA range and 0.1 mA in the 500 mA range.

When the DISPLAY switch is in the MONITOR position (in), the display reads the photodiode current level in milliamps if a photodiode is connected to the input terminals on the rear panel. The resolution of the display in MONITOR mode does not change with the output range selected by the POWER key switch.

DISPLAY Selector

The LASER/MONITOR switch selects the parameter being indicated on the LCD. With the switch in the out position, the display indicates laser diode current in milliamps when the instrument is in either constant current mode or constant power mode.

With the switch pushed in, the display indicates photodiode current in milliamps if a photodiode is connected to the instrument.

BATTERY Charge Indicator

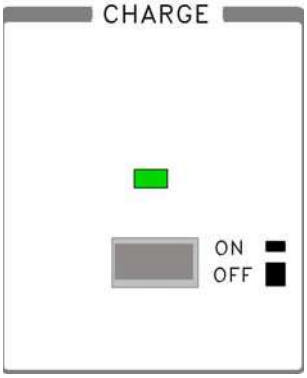
The LDX-3620B includes an LED battery life indicator on the front panel. To check approximate battery life, press the BATTERY button located underneath the four LED's on the left of the display. The LED bars will illuminate based on measured battery voltage. All four indicators represent fully charged batteries, each LED represents a 25% charge level. If the lowest indicator does not illuminate when the BATTERY push button is pushed, the batteries are in a low battery condition. It is recommended that throughout use of the instrument in battery mode to periodically check the charge level of the batteries with the battery level indicator.

CAUTION

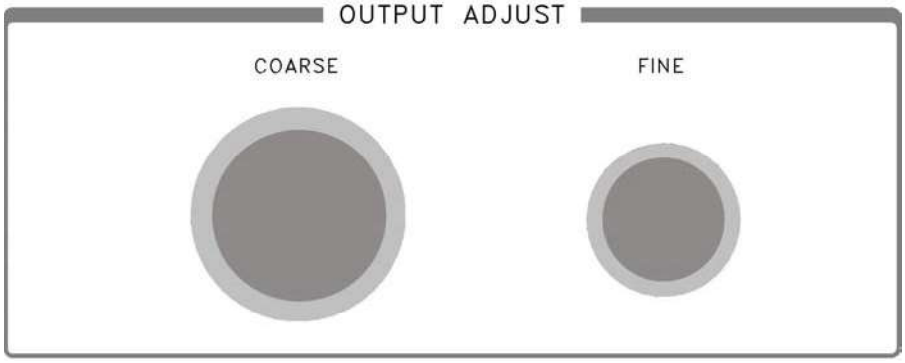
If the lowest indicator does not illuminate when the BATTERY push button is pushed, the batteries are in a low battery condition. Continued operation of the instrument in this condition is not recommended as it will result in damage to the batteries.

CHARGE Switch

Battery charging is accomplished by enabling the CHARGE switch on the front panel. With the CHARGE switch enabled, the LED above the switch will light up indicating that the batteries are charging. With this switch disabled, the LDX-3620B draws power from its internal batteries. For lowest noise operation, the CHARGE switch should be disabled. The instrument can be operated in any mode on battery only or while the batteries are charging.



OUTPUT Adjust



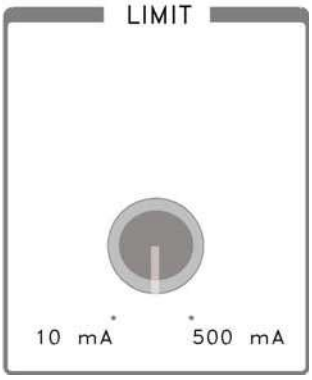
Two control knobs, one labeled COARSE, and one labeled FINE are used to set the current source output level depending on the range selected with the POWER switch. The COARSE adjust is a 10 turn trim-pot for adjustment from 0 to full scale or 20 mA/turn in the 200 mA range and 50 mA/turn in the 500 mA range. The FINE adjust is also a 10 turn trim-pot in a ratio with the COARSE control and the setpoint. The current source output level can be adjusted in both constant current instrument operating modes (ILBW and IHBW) with the output disabled or enabled.

Adjust the output current level as follows:

1. Ensure that the DISPLAY push button switch is in the LASER position and the output is disabled. Turn the power switch to 200mA or 500 mA.
2. Rotate either or both the COARSE and FINE adjust knobs until the display indicates the desired output current level.

Note: The maximum current level that can be displayed in the 200 mA range is 199.9 mA. When adjusting the current level in this range above 199.9 mA, an A/D overload condition occurs which will be exhibited by displaying a "1" on the front panel LCD display.

LIMIT Current Adjustment



The LIMIT control knob sets the maximum current source output level. Turning the knob fully clockwise (CW) limits the LDX-3620B output current to approximately 500 mA. Turning it fully counter-clockwise (CCW) limits the output to approximately 11 mA. The current limit is active in all operating modes. Before enabling the current source output the current limit should be adjusted to a safe level respective to the laser diode connected to the instrument. Refer to the maximum current rating for the laser diode from the specifications sheet. Adjust the current limit as follows:

1. Ensure that the OUTPUT switch is in the OFF position. The SHORT LED indicator will be illuminated indicating that the output is off and a short is present across the laser diode anode and cathode terminals.
2. Ensure that the DISPLAY push button switch is in the LASER position.
3. Rotate the COARSE output adjust knob clockwise to its maximum setting.
4. Adjust the LIMIT control knob until the display reads the desired current limit value.
5. Rotate the COARSE output adjust knob counter-clockwise to its minimum setting.

CAUTION

Be sure that the OUTPUT switch is in the OFF position and the SHORT LED is illuminated before attempting to adjust the current limit.

Instrument MODE Selection

The front panel MODE switch selects the current source mode in two constant current modes, I_{LBW} and I_{HBW} and constant (laser) optical power mode, CONST POWER. In I_{LBW} (constant current, low bandwidth) and I_{HBW} (constant current, high bandwidth) modes, the LDX-3620B is a voltage controlled current source that outputs a current proportional to the sum of the modulation input and set-point control signals. In CONST POWER mode, the LDX-3620B uses a feedback signal from a photodiode to set the output current level to maintain a constant optical power at the load.

In I_{LBW} mode, a 10 uF and 1 uF capacitor is switched in across the current source output terminals acting as a low pass filter. Lowest noise performance is achieved

in this mode. With the switch in the I_{LBW} position, the bandwidth of the current source output is limited to 10 kHz.

In the I_{HBW} position, the capacitor is switched out of the circuit and the current source output bandwidth is 1 MHz. The output current noise increases in this mode as there is no filtering of the current source. The current source output bandwidth is 1 MHz. See the MODULATION section for information on modulating the current source output.

In CONST POWER mode, the output current increases until the photodiode feedback current equals a value proportional to the sum of the modulation input and set-point control signals. If the control signal is a DC level, then the output optical power is held constant. If the control signal is modulated, then the output optical power is modulated. In constant power mode, the current output is in low bandwidth mode.

OUTPUT On/Off

The OUTPUT switch enables or disables the current source output in any of the instrument operating modes. With the switch in the out position, the current output of the LDX-3620B is shorted by a mechanical switch and a FET. In this condition, the OUTPUT SHORT LED on the front panel is illuminated.

When the OUTPUT switch is set to the ON position, the short is removed and the shorting FET is turned off slowly. This brings the output current up slowly to the level determined by the OUTPUT ADJUST and MODULATION control signals.

Photodiode Feedback Gain Adjustments

Setting the gain of the photodiode feedback signal allows the LDX-3620B to operate in a closed loop fashion in constant power mode to maintain any operating power point (within the safe operating limits of the laser) by controlling laser current to the laser diode. The input for the photodiode feedback is expected to be a current input from either the back facet monitor from the laser module or from an external (to the laser diode) photodiode.

The LDX-3620B operates differently than other ILX current sources in constant power. When the LDX-3620B is operated in constant power (constant photodiode feedback) mode, the user can adjust the gain for the feedback of the back facet monitor along with the gain for the setpoint. These two adjustments allow the instrument to have a maximum setpoint equivalent to the maximum output power of the laser diode.

In constant power mode, the setpoint is gained down by using the trim-pot labeled GAIN 2. By gaining the setpoint down, the user can change the full scale setpoint on the front panel (Coarse and Fine knobs turned completely CW) to be between 20 uA and 2mA. For example, if the maximum back facet monitor current from the laser diode was 400 uA, the maximum set point could be adjusted to be 400 uA. By providing the gain adjustment the LDX-3620B is an ideal instrument for maximum setpoint resolution when operating in constant current mode.

Using the trim-pot labeled GAIN 1 the user can increase the gain of the current from the back facet monitor by a factor of 1 to a factor of 1000. Both trim-pots (GAIN 1 and GAIN 2) are fed into an integrator which compares the setpoint to the actual back facet monitor measurement. This means that the two gain adjustments have a strong correlation with each other and minute adjustments between the two trim-pots may be necessary.

The photodiode feedback gain is adjustable to accept feedback signals from 20 uA to 2 mA through the trim-pots labeled GAIN 1 and GAIN 2 in the MODE section. See Figure 2.6 for a block diagram of the feedback circuit. As shown, the trim-pots adjust the feedback gain for the photodiode current (GAIN 1) and the monitor photodiode current setpoint gain (GAIN 2) when the instrument is in Constant Power Mode. GAIN 1 is adjustable from 1 to 0.001 where gain GAIN 2 is adjustable from 1 to 100. Low feedback signals require high gain while high feedback signals require low gain.

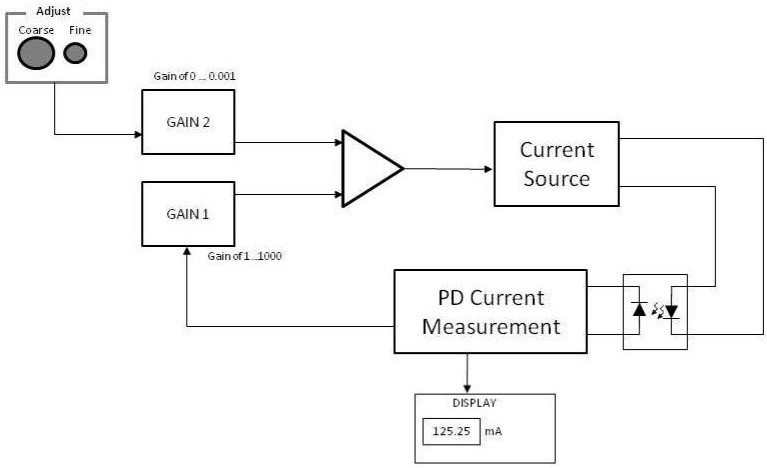


Figure 2.6 Photodiode Feedback Block Diagram

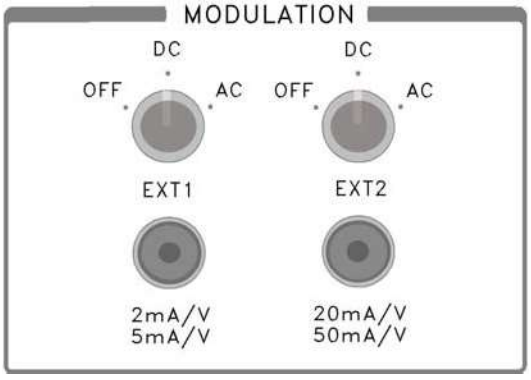
CAUTION

The current limit level must be correctly set before switching the MODE selector to CONST POWER and enabling the current source output. Laser diode damage will result if the current level is not safely set.

To adjust the photodiode feedback gain, follow the procedure listed below.

1. Set the front panel controls of the LDX-3620B to the safe initial settings summarized in Table 2.1. Including setting the LDX-3620B initially in a constant current mode of operation.
2. Set the current limit slightly above the setpoint required for the desired operating power level of the laser as outlined in the LIMIT Current Adjustment section found earlier.
3. Determine and record the photodiode current set-point for the desired operating power level of the laser. This can be accomplished with the instrument in constant current mode by enabling the laser diode output, and with an optical power meter setting the current to achieve the desired optical power. Once the optical power is achieved, press the "LASER/MONITOR" push button to the "MONITOR" position. The instrument will display current measured from either of the photodiode input terminals in milliamps. Record the photodiode current. Turn the output OFF.
4. Turn the "COARSE" adjust knob fully clockwise and the "FINE" adjust knob clockwise several turns. Turn both the "GAIN 1" and "GAIN 2" adjust screws five turns counterclockwise, note the adjust screws do not have a hard stop.
5. Turn the mode switch to the "CONST POWER" position.
6. Enable the current source output. The instrument is now controlling laser current to the laser with the photodiode current as the feedback. At this point, with minimal gain, there should be little or no monitor current measured.
7. Start by adjusting "GAIN 2" first getting close to the monitor current set point. Then alternating between the monitor current reads the recorded value from Step 3. If the set point cannot be reached with the " GAIN 2" adjust, increase the " GAIN 1" slightly and follow by adjusting the " GAIN 2".
8. Once the gain is adjusted to achieve the desired operating point, the laser is now operating in constant power mode. The laser can be operated at any operating power point by rotating the "ADJUST" knobs.

Modulating the Output Current



The current output of the LDX-3620B can be controlled by an external voltage source; either a DC signal or an alternating waveform. One or two external voltage wave forms can be used to modulate the output current through the input ports labeled EXT1 and EXT2. Both inputs can be AC or DC coupled through the switch above the input port.

The transconductance of the input is determined by the selected instrument current range and the input port. The EXT1 input has a transfer function of 2 mA/V in the 200 mA range and 5 mA/V in the 500 mA range. The EXT2 input has a transfer function of 20 mA/V in 200 mA range and 50 mA/V in 500 mA range. Under all modes of operation, the output is clipped at the level set by the current limit.

To modulate the current source output:

1. Connect an external voltage signal to either or both BNC inputs labeled EXT1 and EXT2 (see note below).
2. Select the AC or DC coupling for each input with switches located above the BNC connectors.
3. Set any desired offset output current with the OUTPUT ADJUST control knobs.
4. Enable the current source output by pressing the OUTPUT push button in. The SHORT LED will not be illuminated when the current source output is enabled.

The output is the sum of the level set by the current source set-point signal set by the OUTPUT ADJUST knobs and the external voltage input signal.

Note: When a voltage signal is applied through EXT1 input only, the EXT2 coupling switch must be in the AC coupling or DC coupling position. If it is in the OFF position, the input at EXT1 will not be summed into the current drive circuit.

CAUTION

Be sure that the current limit is set correctly before enabling the current source output. The current limit may clip the output waveform if the sum of the resulting waveform exceeds the limit.

Output Error Indicators

CURRENT LIMIT Indicator

The CURRENT LIMIT indicator is illuminated whenever current set point exceeds the current limit as set by the LIMIT knob. Output will remain on, but the output current will not exceed the limit setting.

OVER VOLTAGE Indicator

The OVER VOLTAGE indicator will illuminate whenever the load voltage exceeds 5V on the output of the laser diode. The output will remain on..

OPEN CIRCUIT Indicator

The OPEN CIRCUIT indicator will illuminate whenever current source output is enabled and the load circuit is open.

CHAPTER 3

MAINTENANCE AND CALIBRATION

This chapter discusses the recommended procedures for maintaining the LDX-3620B in good operating condition.

Battery Maintenance

The battery life of the LDX-3620B depends on the frequency and degree of discharge of the batteries during use. With light use and proper maintenance, the batteries should last for more than 1100 recharge cycles (about four years of daily use). With heavy use the battery lifetime can be degraded by as much as 60%. The batteries are continuously charged whenever the LDX-3620B is connected to a power source and the front panel CHARGE power switch is turned on. Full recharge of the batteries takes about 15 hours.

Long battery life results from maintaining the batteries as fully charged as possible and short battery life will result from the practice of waiting until a low-battery condition is indicated before recharging the batteries. If the LDX-3620B is to be stored for long periods, the batteries should be fully recharged for eight hours every 6-9 months to prevent a permanent loss of capacity due to self-discharge.

WARNING

Potentially lethal voltages exist within the LDX-3620B Ultra-Low Noise Current Source. To avoid electric shock, never remove the cover without first disconnecting the instrument from the external power source. Always wear protective eyeglasses and anti-static wrist bands while working on the LDX-3620B with the cover removed.

Battery Replacement

The batteries may be replaced by removing the top chassis cover, which is held in place with 4 6-32 machine screws. For replacement batteries in the US please contact ILX Lightwave. For regions outside of the US please contact your local ILX distributor. See the following sections for disassembly instructions.

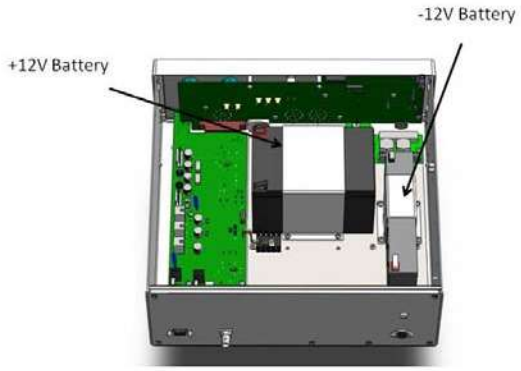


Figure 3.1 Battery Replacement

Once the top chassis cover is removed the large +12V 12.0AH battery can be replaced by removing the battery bracket. This can be accomplished by unscrewing the 4 machine screws holding the large battery in place. Disconnect the battery harness cabling on the battery, and pull the battery out of the chassis. Insert the replacement battery and the large battery harness. The large battery must be connected to the 12A Hour connector. Reconnect the power tabs in the following order:

1 Red wire - connect to red tab.

2 Black wire - connect to black tab.

The -12V (long and skinny battery) can be replaced by again removing the battery bracket from the battery. Replace the battery with the red tab closest to the back of the instrument and the black tab towards the front panel. The small battery must be connected to the 2.3A Hour connector. Reconnect the power tabs in the following order:

1 Red wire - connect to red tab.

2 Black wire - connect to black tab.

Fuse Replacement

Power fuses are located inside the instrument and in-line with each battery connection. Should replacement be necessary, first turn the keyswitch to the off position, turn the CHARGE switch to OFF and disconnect the power cord. Remove the top cover as described later on in this section. Identify the four fuse holders (black cylindrical containers) that are inline with the wires coming from the batteries. Please note that with the "Long Life" option there are six fuse holders. Open the fuse holders by pushing together the ends and twisting. The +12V battery (large square battery) uses two in-line fuses. These fuses are 5x20mm, 3.15A 250V slow blow fuses. The -12V battery uses two in-line fuses as well, and are 5x20mm, 1.6A, 250V slow blow fuses.

There are also two TR5 fuses located on the mainboard, located at F1 and F2. These fuses can be seen in Figure 3.2. The TR5 fuses are rated for 1.25A, 250V

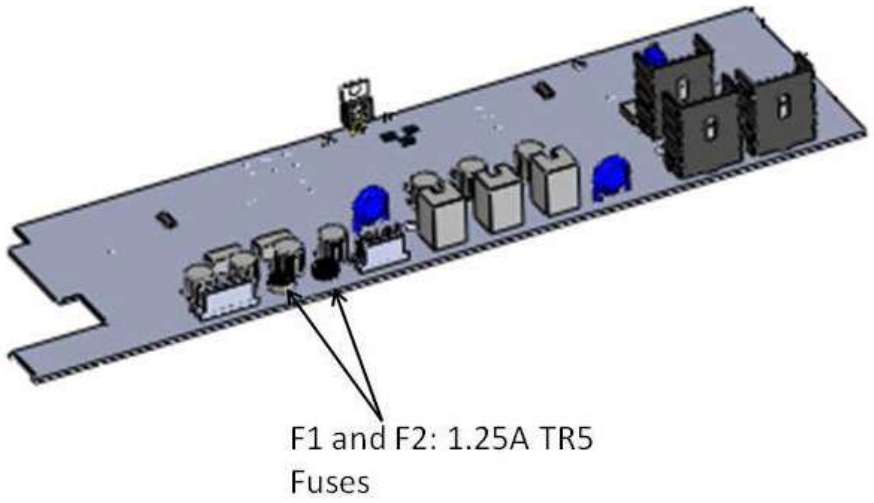


Figure 3.2 TR5 Fuse Replacement Position

If you are unable to obtain replacement fuses, please contact ILX Lightwave or your local distributor for replacements.

Calibration

The following paragraphs outline the procedures for calibrating the instrument. Access to the adjustment trimpots on the circuit boards will require that the top of the instrument be removed. The removal procedure is discussed later in this chapter.

The equipment required for the calibration procedures must be capable of measuring a current of 500mA to an accuracy of approximately 0.01mA and measuring 2mA to an accuracy of 0.00005mA. A good digital multimeter with 6-1/2 digit resolution is usually adequate for this purpose.

For 200mA calibration, a 10-25 ohm test load should be connected to the output of the instrument. For 500mA calibration, a 5-8 ohm test load should be used. Each test load should be able to withstand at least 3W of power.

For photodiode calibration, a 9 pin D-SUB connector will need to be used to connect the output of the laser diode instrument (Pins 8 and 9) to the input of the photodiode (Pin 7). The output of the photodiode (Pin 6) will need to be connected to a 6-1/2 digit ammeter that can measure an accuracy of 0.00005mA . The ammeter will then need to laser diode cathode (Pins 4 and 5) on the D-SUB connector. This will allow the instrument to calibrate itself.

An alternative would be to utilize a low noise current supply, and inject current into the auxiliary photodiode BNC connector. Please note that the supply will need to be extremely stable to calibrate nanoamps of current with 1mA of full scale, and an external ammeter will need to be used to verify actual current.

Refer to the component layout diagrams, Figures 3.3 and 3.4 to find the locations of the adjustment trimpots referred to in these procedures. Each trimpot that is used for calibration is pointed out in each figure.

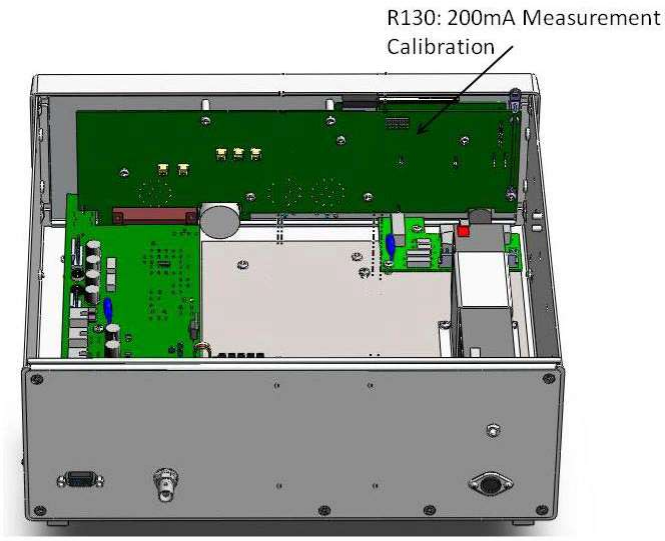


Figure 3.3 200 mA Calibration Potentiometer Position

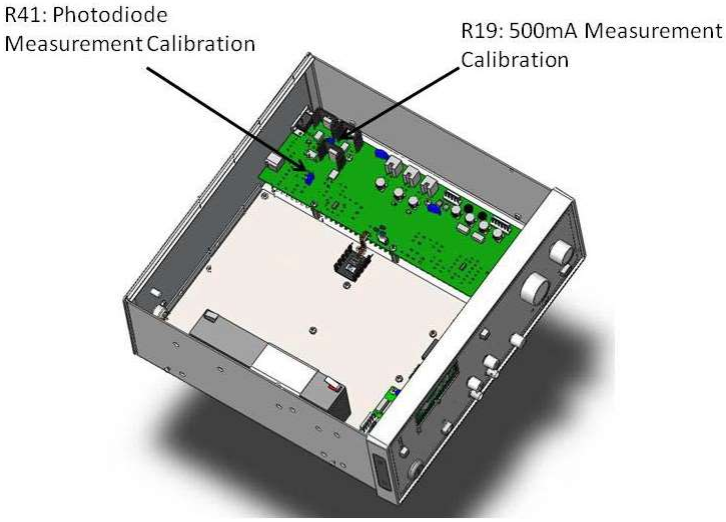


Figure 3.4 Photodiode and 500 mA Measurement Calibration Position

Laser Diode Measurement Calibration

To calibrate the laser diode measurement, perform the following after the instrument has been on and warmed up for at least 1 hour (the instrument can be calibrated in DC or AC mode of operation):

1. Connect a 20-25 ohm load resistor on the output of the LDX-3620B. Connect a digital ammeter discussed earlier in this section in series with the output of the laser diode and the test load.
2. Put the instrument into 200mA range, low bandwidth mode. Set the current setpoint to 153mA and turn the output on. Ensure the current limit is turned to the maximum.
3. Allow the output to settle (approximately 10 seconds). Slowly adjust R130 on the front panel (this can be seen in Figure 3.3) until the front panel measurement matches the actual output current of the instrument measured from the ammeter.
4. Turn the output off.
5. Swap the load resistor with a 5-8 ohm load.
6. Put the instrument into 500mA range, low bandwidth mode. Do not change the setpoint from the 200mA range.
7. Turn the output on.
8. Allow the output to settle (approximately 10 seconds). Slowly adjust R19 on the mainboard (this can be seen in Figure 3.4) until the front panel measurement matches the actual output current of the instrument measured from the ammeter.
9. Adjust the setpoint to approximately 5mA. Ensure the actual output matches the measured value on the front panel (within 0.2% of FS). Adjust the setpoint to approximately 499mA. Ensure the actual output matches the measured value on the front panel (within 0.2% of FS).

Photodiode Measurement Calibration

To calibrate the photodiode measurement, perform the following after the instrument has been on and warmed up for at least 1 hour (the instrument needs to be calibrated in DC mode and not in AC mode of operation):

1. Connect the modified 9-pin D-SUB connector to the LDX-3620B (or alternatively connect the low noise current source to the photodiode auxiliary input). If using an external current source, set the output to 1mA and turn the output on. Skip to step 3.
2. Configure the instrument to operate in 200mA range, Low Bandwidth mode. Set the output to 1mA and turn the output on.
3. Switch the front panel to display monitor photodiode measurement. With 1mA of measured current on the ammeter, adjust R41 on the mainboard (this can be seen in Figure 3.4) until the front panel measurement matches the measurement taken from the ammeter.
4. Adjust the current output of the instrument to 1.9990mA. Ensure the front panel matches the measured current (within 2 A). Perform the same test at 5 A.

Disassembly

The top cover of the LDX-3620B can be removed after extracting the four countersunk screws on the sides of the instrument. The cover is then removed by sliding it rearward and lifting it off. Removal of the top chassis cover can be seen in Figure 3.5.

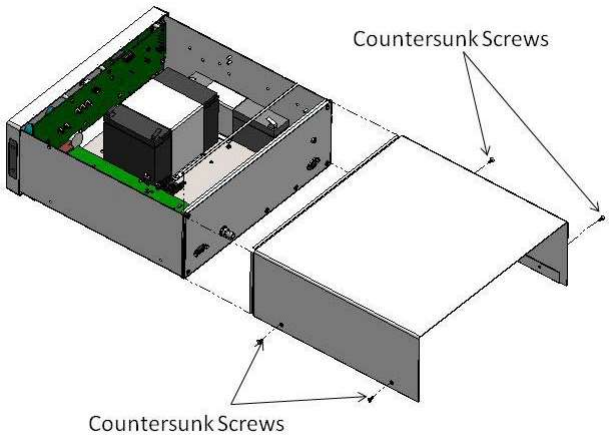


Figure 3.5 Top Chassis Cover Removal

APPENDIX A

TROUBLESHOOTING

This appendix is a guide to troubleshooting the LDX-3620B Ultra Low-Noise Current Source. Some of the more common symptoms are listed here, and the appropriate troubleshooting actions are given. We recommend that the user start at the beginning of this guide. Read the symptom descriptions, and follow the steps for the corrective actions which apply. If you encounter problems which are beyond the scope of this guide, contact your ILX Lightwave representative.

Symptom	Corrective Action
LDX-3620B unit will not power up.	Ensure that the instrument is charged by using the charge indicator button. If no LEDs are on, charge the instrument.
Instrument is fully charged by the display shows a battery indicator.	Ensure that the +12V battery is charged by using the charge indicator button. If the +12V battery is charged, this is an indication that the -12V battery is low and that it needs to be charged. If the instrument has been charged and the instrument still displays a battery indicator, the instrument needs servicing.
Output is turned on but there is no current output.	Ensure that the instrument is charged by using the charge indicator button. If no LEDs are on, charge the instrument.
Output goes off intermittently	Check the interlock circuit; an intermittent interlock will turn the output on/off.
Current limit LED remains on with no output in both battery operation and AC operation	One of the two batteries may be discharged to a point where the instrument is no longer operation, even in AC mode. Connect the instrument to AC and begin charging the batteries. To begin using the instrument in AC mode, the instrument must be charged for one hour. To operate in battery mode, the instrument must be charged for 5 to 8 hours.

CHAPTER A