



LASER 2000

LaserSource™

4200 SERIES

USER'S MANUAL



**LASER DIODE
DRIVER**

Introduction

Thank you for choosing the **LaserSource** from Arroyo Instruments. Your **LaserSource** is a combination of leading edge technology combined with years of experience in the field of current control.

With a crystal clear VFD display, both RS232 and USB computer interfaces, and small footprint, the **LaserSource** will fit into almost any laser diode control application.

A key feature of the **LaserSource** is its optical isolation of both modulation and photodiode inputs. By isolating these inputs, it prevents unwanted ground loop problems. No other laser diode driver in the industry has this feature.

The **LaserSource** also operates in constant voltage control mode, allowing you to use it in precision voltage applications, such as EML devices, or for doing V-I measurement graphs.

The **LaserSource** includes another feature not found in other products: the ability to program the photodiode bias level from the front panel or over the computer interface, to any voltage from 0 to -5V. No more tweaking a potentiometer with a screwdriver and a DMM. Simply dial in the voltage you need.

Unlike other laser diode drivers in its class, which use inexpensive 7-segment LEDs, the **LaserSource** takes advantage of its large VFD display to simultaneously show the set point, laser voltage, and photodiode read back.

The user interface of the **LaserSource** is engineered to make using the instrument straightforward. With its text-based menus, there is never any confusion over which setting is being changed, and parameters are displayed in clear English (no cryptic numbers or LEDs to decode).

The **LaserSource** offers all the features you would expect from a modern precision laser diode driver, including:

- 10ppm current stability over one hour
- 7V compliance for 100mA and 500mA **LaserSources**.
- Comprehensive laser protection circuitry, include hardware voltage and current limits, and fast transient shutdown.
- External modulation up to 250 kHz (high bandwidth mode)
- Power mode control, both in photodiode current (AMC) or computed photodiode power (APC) modes.
- Simultaneous reading of current set point, voltage measurement, and photodiode current or power measurement.

What's in the Box

Along with the **LaserSource** itself, a CD with electronic copies of this manual, the **Computer Interfacing Manual**, and USB drivers are included. For USA customers, a power cord is included. For non-USA customers, an IEC-60320-C13 rated AC power cord must be provided.

Accessories

Arroyo Instruments also sells several accessories designed to work with the **LaserSource**. These include:

- **LaserSource Cable, 2m (p/n 1220)**
This cable has DB-9 male/female connectors for interfacing to the LaserMount or other connectorized fixtures.
- **LaserSource Cable, 2m, Pigtailed (p/n 1221)**
This cable has a female DB-9 connector for plugging into the **LaserSource** and tinned leads for wiring into custom solutions.
- **2U Rack Mount Kit, 2 Bay (p/n 1400-RM)**
For installing your **LaserSource** or **TECSource** into a standard 19" rack. The rack mount kit has space for two instruments, but if you plan to only install a single instrument, also order a **1 Bay Blank (p/n 1400-BL)** to fill the unused opening.
- **RS-232 NULL Cable, 3m (p/n 1200-NULL)**
- **USB Cable, 3m (p/n 1201)**

Safety Terms and Symbols

The following safety-related terms are used in this manual:

- **Warnings** (noted by the WARNING heading) explain dangers that could result in physical injury or death;
- **Cautions** (noted by the CAUTION heading) explain conditions that could result in damage to the instrument, other equipment, or your device.
- **Notes** (noted by the NOTES heading) are **not** safety-related, and are intended simply to point out important information.

If, at any time, any of the following conditions exist, or are suspected of existing, discontinue use of the unit until it can be inspected by qualified service personnel:

- Visible damage to the unit, including damage or stress caused during product shipment;
- Storage of the unit outside the standard storage temperature or humidity rating, or prolonged storage under harsh conditions;
- Failure to operate properly.

If needed, contact your distributor or Arroyo Instruments for service or repair to ensure the safety of the product is maintained.

Symbols



Power Off



Power On



Caution, refer to manual



Earth ground



Caution, risk of electric shock

General Warnings

WARNING

Potentially lethal voltages exist within this instrument. This instrument is intended for use by qualified personnel who understand the shock and laser hazards and are familiar with safety procedures required to avoid injury. Read this manual completely before attempting to use this product.

WARNING

To avoid electrical shock, ensure a 3-prong power cord is used, and is plugged into a earth-grounded receptacle. Failure to do so can result in severe injury or death.

CAUTION

There are no user-serviceable parts inside. All service and repair work shall be done by Arroyo Instruments or personnel authorized by Arroyo Instruments. Modifications done by non-authorized personnel will void the warranty. Please see the Service section later in this manual for instructions on how to obtain service for this instrument.

Quick Start

The **LaserSource** was designed with ease of use in mind, and you will likely have little need for this manual for almost all of the features the unit offers. This section will show how you can quickly get the unit up and running in almost no time.

After unpacking the unit, ensure that the voltage selection on the Input Power Connector (IPC) on the back of the unit is set to the correct voltage. This is critical, as incorrect voltages can damage the unit. The **LaserSource** is shipped in the 120V configuration from the factory. Change the voltage as needed. For more information, refer to the IPC section below.

Once the voltage selection has been completed, plug the AC cord into the unit and into the wall outlet. Turn on the power switch located on the IPC, and the unit will power up, displaying the model information, serial number, and firmware version number.

Press the **Menu** button to enter the menu, and using the knob, turn to the right until the **Io Lim** setting is displayed. Press the knob to edit the setting, and adjust the limit as appropriate to your laser diode. Press the knob again to save the value. Make the same adjustments to the voltage limit (**Vf Lim**), as appropriate for your application. Once you have made all your adjustments, press the **Menu** button to exit the menu.

Next, connect the cable between your **LaserMount** or other fixture and the **Output** connector of the **LaserSource**. We recommend using our cables as they have been designed to work well with the **LaserSource**. If using your own cables, ensure they have been properly wired according to the pin-out of the **LaserSource** and your fixture.

Finally, set the set point to an appropriate current and press the **Output** button. The output will turn on and you will see the actual voltage and photodiode current displayed on the second line.

It's that simple. For more detailed operating and installation instructions, read on.

Installation

Installation of the **LaserSource** is very straightforward, as the quick start section above illustrated. This section will provide additional details and considerations for installing your **LaserSource**.

After unpacking the unit, make sure all packing materials have been removed and nothing obscures the ventilation ports on the back and bottom of the unit.

Changing the Voltage Selection

Before powering on the unit, ensure that the voltage selection on the IPC is set correctly. Improper voltage selection can easily damage the unit. Changing the voltage selection requires that you remove the selection tumbler from the IPC.



Input Power Connector (IPC)

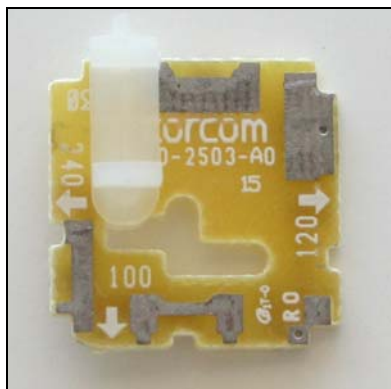
Remove the power cord from the unit. Using a small flat blade screwdriver, open the fuse panel. Remove the voltage selection printed circuit board on the right side of the IPC (you may need needle nose pliers to do this).

CAUTION

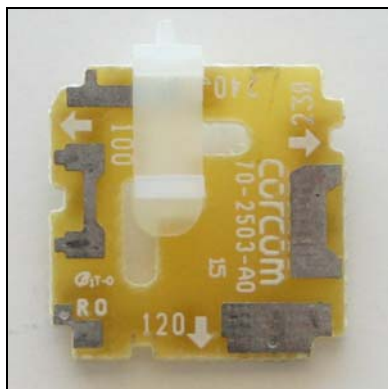
Do not exceed 250VAC on the line input.

It is critical to select the proper voltage selection prior to applying power to the unit. If the actual voltage exceeds the voltage selection by +/-10%, damage to the unit may occur.

Change the plastic guide to select the appropriate voltage. The selection is counter-intuitive: you must place the plastic piece opposite the edge marked with the voltage you wish to select:



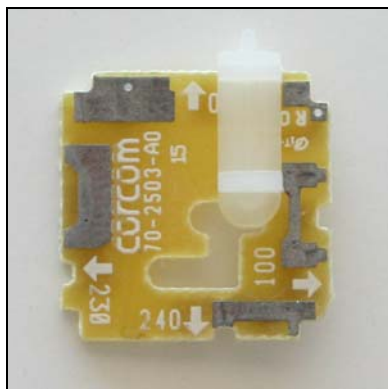
100V Setting



120V Setting



230V Setting



240V Setting

Reinsert the voltage selector and replace the fuse cover.

Powering Up the Unit

Once the correct voltage selection has been made, connect the AC power cord to the unit. You must properly ground the unit by plugging the supplied power cord into a three prong grounded outlet, or using a three-to-two prong adapter and connecting the ground tab to earth ground.

Turn the power switch, located on the IPC, into the on (I) position. The unit will display the model, serial number, and firmware version, go through a quick power-up self-test, and return to the last known operating state.

Ventilation

The **LaserSource** has vent holes on the rear and bottom of the unit. You must not block these vent holes, or overheating may occur, causing damage to the unit.

CAUTION

Do not operate the unit above +40°C ambient, and ensure the instrument is properly ventilated, or the unit may overheat and possible damage to the instrument may occur.

Rack Mounting

A rack mount kit (**p/n 1400-RM**) for standard 19" racks is available for the **LaserSource**, and supports rack mounting of one or two units in a 2U (3.5") high opening. The rack mount kit provides sufficient clearance below the units for ventilation, so units can be rack mounted immediately above other equipment (no rack spacers required). Because the unit draws air from the bottom, and therefore inside the rack housing, be sure that the internal rack ambient temperature (which will typically be several degrees higher than room ambient) does not exceed the unit's operating temperature. If only racking one instrument, you will also need a bay blank (**p/n 1400-BL**) to cover the second opening in the rack mount kit.

Warm-up and Environmental Considerations

In order to achieve the highest level of accuracy, the **LaserSource** should be powered on for at least one hour prior to taking measurements. In addition, ensure that the unit is not operating outside the ambient temperature range or humidity conditions.

Operation

The Front Panel

Operation of the **LaserSource** is very straightforward. The sections below will help familiarize you with the front panel, the display, and the menu structure.



The front panel is designed for simplicity in operation. There are three buttons on the front panel: **Output**, **Menu**, and the adjustment knob.

The output is controlled via the **Output** button. When turning the output on, there is a programmable delay (factory default of 3 seconds) where the unit will indicate that the output is on (the blue output LED will be lit), but the output stage is in fact not on. This is a CDRH safety feature required for some laser applications. The output will be energized once the delay has expired.

The **Menu** button is used to enter the **LaserSource** menu. When in remote mode, it acts as a **Local** button, returning the instrument to local mode.

The large adjustment knob located on the right hand side of the unit is used to change the set point or parameters in the menu. It also acts as a push button, primarily as an enter button, when making changes in the menu.

There are four LEDs: a green power LED that is lit whenever the AC power is turned on; the blue **Output** on LED that indicates the **LaserSource** is actively controlling the laser diode; a red **Error** LED that indicates an error has occurred; and a yellow **Remote** LED that indicates the unit is being controlled via a computer.

Whenever an error is generated, the red Error LED will light, and the error will be displayed on the VFD display. There may be one or more errors, but only the first error will be displayed. To display the next error, press **Menu** button. To clear all errors, press the knob. A list of error codes can be found in the **Error Messages** section below.

When the unit is in remote mode, the yellow Remote LED will be lit. More information about how the instrument behaves in remote mode can be found in the Remote Mode Operation section below.

Main Display Screen

On the main display you will find the set point and two measurements. Which set point and measurements are displayed will depend on the control mode you have selected. An example display is shown below:



Sample Display

Measurements

One of the advantages of the **LaserSource** is its ability to display both the set point and two measurements simultaneously. The table below shows which values will appear on the display depending on the mode selected:

Mode	Setpoint	Displayed Measurements
Io	Current (mA)	PD current or power and voltage
Im	PD current (μ A)	Current and voltage
Po	PD power (mW)	Current and voltage
Vf	Voltage (V)	Current and PD current or power

The instrument will show photodiode current or photodiode power, depending on the value of **PD Resp**. Photodiode current is shown whenever **PD Resp** is zero, while photodiode power will be shown whenever **PD Resp** is non-zero. See the Control Modes section below for more information on the various modes.

Status Messages

The instrument will display status messages in the upper-right corner of the display indicating several different conditions that may be of interest to the user. If multiple conditions exist simultaneously, then the instrument will cycle through each condition, displaying each status message for approximately one second.

Possible condition messages are:

Lock The interlock is open and the unit cannot be turned on.

Shrt	A short circuit has been detected on the output.
OutT	The unit is out-of-tolerance. See the Tol Time and Tol Io settings for more information.
ILim	The unit is in current limit.
MLim	The unit is in photodiode current limit.
PLim	The unit is in photodiode power limit.

Settings and Menus

All parameters of the **LaserSource** can be viewed and changed within the menu. The menus are constructed with the most used parameters first. To change any setting, press **Menu** to enter the menu then rotate the knob to select the parameter to change. Press the knob to begin changing the value. As a visual indication that you are in edit mode, you will see an asterisk appear next to the value. Once you have made your change, press the knob or **Menu** button to store the value. Pressing the **Menu** button will store and exit the menu, while pressing the knob will store the value but leave you in the menu to make additional changes.

Some settings are contained inside a sub menu, such as communications settings. To access the sub menu, simply press the knob to enter the sub menu when its name is displayed.

Below is a complete list of settings:

Menu	Description	Factory Default
Root Menu	Top Level Menu	
Mode	As described in the section above, Control Modes, the unit offers five control modes: Io (ACC), Io HiBW (ACC), Im (AMC), Po (APC), and Vf (AVC). Change this setting to select a new mode.	Io (ACC)
Io limit	This setting controls the maximum amount of forward current that can be delivered to the laser diode. This limit is implemented in hard for immediate response. For more information about limits, see the section entitled "Hardware and Software Limits".	Maximum

Menu	Description	Factory Default
Im limit	This setting controls the maximum amount of monitor photodiode current the unit will allow. This limit is implemented in software. For more information about limits, see the section entitled "Hardware and Software Limits".	Maximum
Po limit	This setting controls the maximum amount of monitor photodiode power the unit will allow. This limit is implemented in software. For more information about limits, see the section entitled "Hardware and Software Limits".	Maximum
Vf limit	This setting controls the maximum amount of forward current that can be delivered to the laser diode. This limit is implemented in hardware for immediate response. For more information about limits, see the section entitled "Hardware and Software Limits".	Maximum
PD Resp	This factor is used by the unit to convert from monitor photodiode current into optical power. The value is in terms of microamps per milliwatt ($\mu\text{A}/\text{mW}$), such that power = photodiode current divided by the factor.	0.00 $\mu\text{A}/\text{mW}$
PD Bias	This is the photodiode bias voltage, which is applied to the PD+/PD- pins of the output connector.	5.0V
Tol Time	Tolerance time is the amount of time, in seconds, that the measured value (current, voltage, etc.) must be within the set point +/- the tolerance for the unit to be considered in tolerance. In Io modes, the tolerance is defined by Tol Io . For Im/Po modes, the tolerance is fixed at 50 μA . For Vf mode, the tolerance is fixed at 50mV.	5 seconds
Tol Io	Tolerance current is a band (in mA) around the set point. When the actual current is within this band for longer than the Tol Time setting, then the unit is considered to be in tolerance.	10.0mA

Menu	Description	Factory Default
On Delay	The delay, from the time the Output button is pressed to when the output is actually energized.	3000ms
Comm Menu	Communications Menu	
Baud	This sets the baud rate for the RS232 serial port. See the <i>Computer Interfacing Manual</i> which is included on the CD that accompanied this product.	9600
Err While Rmt	To turn off the display of errors while in remote mode, set this value to "No". To display errors while in remote mode, set this value to "Yes".	Yes
Terminal Mode	Terminal mode simply echoes any characters received over the serial or USB interfaces.	No
Msg Term	This controls the output message termination, and can be set to CR/LF, CR, LF, or None.	CR/LF
Sys Menu	System Settings Menu	
Brightness	The vacuum florescent display can be set to one of eight brightness levels.	100%
Audible Beep	This setting controls when the unit produces audible feedback. Set to No to prevent sound, or Yes or audible alerts such an error messages.	Yes
Lockout Knob	Lockout knob allows you to disable knob operation from the main display. This prevents accidental changes of the set point. The knob will always work in the menus regardless of this setting.	No

Control Modes

The **LaserSource** offers five laser control modes: **Io (ACC)**, **Io HiBW (ACC)**, **Im (AMC)**, **Po (APC)**, and **Vf (AVC)**.

Changing the control mode is done through the menu by changing the **Mode** parameter in the menu to one of these values.

Io and **Io HiBW** modes (referred to collectively as ACC, or automatic current control, modes) are used to drive a specific current through the laser diode. When in this mode, the set point will be in milliamps, and the **LaserSource** will drive the desired current through the laser diode as long as the voltage at the chosen set point does not exceed the voltage limit. In **Io** mode, you will be limited to approximately 10Hz modulation. To modulate above that rate, use the **Io HiBW**, which is a high bandwidth current mode supporting modulation up to 250kHz (depending on model).

Im mode (also referred to as AMC, or automatic monitor photodiode control, mode) is used to control the laser diode using the monitor diode feedback. You select the target monitor diode current, and the **LaserSource** will drive exactly enough forward current through the laser diode to generate the selected monitor diode current. Only low frequency modulation (10Hz or less) is possible in **Im** mode due to the feedback latencies of the photodiode itself.

Po mode (also referred to as APC, or automatic power control, mode) is simply **Im** mode with a mathematical constant applied to the set point, providing a convenient way of operating in milliwatts. Using the **PD Response** factor (in $\mu\text{A}/\text{mW}$), a **Po** set point is internally converted to an equivalent **Im** set point by the driver, which is then used to control the photodiode feedback. For example, if the **PD Response** factor was 10, then a set point of 1mW would be the same as a set point of 10 μA .

Vf mode (also referred to as AVC, or automatic voltage control, mode) is used to control the voltage driven through the device. Unlike ACC mode, AVC mode allows the current to drive to whatever level is necessary to achieve the voltage set point, so long as it does not exceed the current limit. As with **Im** mode, only low frequency modulation (10Hz or less) is possible in **Vf** mode.

Modulation

The instrument supports external analog modulation using the modulation BNC on the back panel of the instrument. Modulation rates vary by model, so see your model's specification for the maximum modulation rates. Only **Io HiBW** mode supports high speed modulation. All other modes of operation have a maximum modulation rate of approximately 10Hz.

Remote Mode Operation

Remote mode operation is when the **LaserSource** is being controlled by a computer over the USB or RS232 interfaces. When in remote mode, the **LaserSource** behaves differently, preventing you from affecting the operation of the instrument. Some of the primary differences are you will not be able to change the set point, you cannot enter the menu without taking the unit out of remote mode, and the knob is disabled.

You can exit remote mode at any time by pressing the **Menu** button, which has a secondary function to return the **LaserSource** to local operation.

While in remote mode, the Remote LED also acts as an activity indicator, and will flash whenever there is communication with the computer.

Details on how to communicate with the **LaserSource** can be found in the **Computer Interfacing Manual** which is included on the CD that accompanied this product.

Installing the USB Drivers

Using the **LaserSource** via USB is just as simple as using the serial port. In fact, once you have installed the USB drivers, the instrument will appear as a virtual serial port that you can use just like a normal serial port.

To install the drivers, simply plug in the instrument to your computer. When the **Add New Hardware** wizard appears, insert the CD you received with the **LaserSource** and follow the on-screen instructions.

During the installation you may receive a dialog that warns the driver is not Windows certified. If you do, click **Continue Anyway**.

Once the drivers are installed, to determine the COM port number, go to **Control Panel** and select **System**. Once the **System Properties** dialog appears, choose the **Hardware** tab then click on the **Device Manager** button. When the **Device Manager** appears, click on the plus sign to the left of **Ports**. The port identified as an **Arroyo Instruments Virtual COM Port** is the **LaserSource**. In the event you have multiple **LaserSource** instruments plugged in simultaneously, you will need to experiment to see which instrument was assigned to which port. For example, you could change the set point when the output was off to see which unit's set point changed.

Rear Panel

In addition to the input power connector described above, there are four connectors and one push button on the rear panel of the **LaserSource**: the output connector, modulation input BNC, reset button, USB connector, and RS232 connector.



LaserSource Rear Panel

Laser Output Connector

The **Output** connector is a female DB-9, and has the following pin-out:

DB-9 Pin	Description
1	Interlock +
2	Interlock -
3	Earth Ground
4 & 5	Laser Cathode
6	Photodiode (PD) Cathode
7	Photodiode (PD) Anode
8 & 9	Laser Anode
Shell	Earth Ground

Output Connector (DB-9 Female)

Arroyo Instruments has followed industry conventions for laser DB-9 connections, and is likely compatible with pin-outs from other vendors.

Modulation Input

The modulation input BNC accepts a 0V to 10V input signal for analog set point control of the driver. The modulation input is optically isolated from the rest of the control circuits in the **LaserSource** and electrically isolated from ground, so you should not need to be concerned about ground interference from any modulation source.

Reset Button

The reset button is not normally used, but if the unit fails to respond after power cycling, pressing the reset button while applying power will cause the unit to

reset to factory defaults. Calibration will not be affected, but all settings will be returned to their factory default values.

USB Connector

The USB connector is a standard Type B female connector, and can be plugged into any USB 1.1 or USB 2.0 port. For more information on using the USB interface, see the ***Computer Interfacing Manual*** which is included on the CD that accompanied this product.

RS232 Connector

The RS232 connection is male DB-9 connector wired in a NULL modem configuration.

Pin	Description
2	Receive
3	Transmit
5	Ground
1,4,6	Commoned together
7,8	Commoned together
9	No connection
Shell	Earth ground

RS232 Connector (DB-9 Male)

For more information on using the RS232 interface, see the ***Computer Interfacing Manual*** which is included on the CD that accompanied this product.

Connecting to the LaserSource

A laser diode is very sensitive to electro-static discharge (ESD), over-voltage, and over-current conditions. When connecting a laser to the **LaserSource**, make sure proper ESD procedures are taken. In addition, it is critical that the proper current limit and voltage limit be set for the laser diode. Exceeding the laser diode's rated current or voltage can damage or destroy the laser diode, and the **LaserSource's** hardware protection features can only protect the laser diode if these limits are properly set.

NOTE

While connecting to only one of the DB-9's cathode (pins 4 and 5) and anode (pins 8 and 9) connections is required, you should connect cathode to both pins 4 and 5, and anode to both pins 8 and 9 to provide the best connection through the DB-9 connector.

CAUTION

The interlock connections must be kept isolated from all other connections and from earth ground. Failure to do so may damage the instrument.

The Laser anode and cathode outputs are electrically isolated from ground, as are the photodiode inputs. In addition, the photodiode inputs are optically isolated from the laser outputs, ensuring complete electrical isolation of the drive circuit and photodiode measurement circuit.

NOTE

Connections to the **LaserSource** and the laser diode fixture must be secure. Tighten any screws on the DB-9 connectors, and make sure all connections are in good condition. Poor or intermittent connections can damage or destroy the laser diode.

Arroyo Instruments carries two cables specifically designed for this application. **Part number 1220** is a two meter cable designed for use with Arroyo Instruments mounts, such as the 202 and 204 Butterfly **LaserMounts**, and has DB-9 connectors on both ends, one male and one female. For custom

applications, **part number 1221** is a two meter cable with a male DB-9 on one end and stripped and tinned leads on the other. Both cables common pins 1/2 and 3/4 into 18 gauge wires.

See the manual for your laser (and fixture) for additional safety and operational information.

Grounding Considerations

A key feature of the **LaserSource** is the optical isolation of both the photodiode and modulation inputs. By isolating these inputs, earth grounding of the photodiode anode or cathode, or earth grounding the modulation input, cannot cause a ground loop through the instrument. Likewise, the laser anode and cathode connections are also isolated from earth ground.

However, if you use the earth ground pin of the **Output** connector (pin 3), it is possible to create a ground loop if the instrument's earth ground is connected to a fixture or optical table that is also earth grounded. Make sure that from your laser diode package there is only a single path to earth ground.

Using Limits

The **LaserSource** provides several limit features for protection of the laser diode. These include current, voltage, photodiode current, and photodiode power limits.

Both the current and voltage limits are implemented in hardware, providing for fast response to changes in laser diode operation. When a voltage limit is detected, the output is immediately shutdown. Because of the sensitivity of the voltage limit, operating near the limit (within one to two hundred millivolts) is not recommended. In general, you should set the voltage limit to 0.1V to 0.2V higher than any anticipated operating point.

Unlike the voltage limit, the current limit simply prevents the **LaserSource** from delivering more current than the limit is set to. When the current limit engages, the output will remain on. Because of the relative inaccuracy of the current limit set point, the **LaserSource** may detect a current limit condition a few milliamps before the hardware limit actually engages.

The photodiode current and photodiode power limits are implemented in software and may take up to one second to trigger when these conditions occur, and therefore should not be relied on to provide fast protection of the laser diode.

Specifications

Description	Specifications		
LASER CURRENT (ACC)			
Range (mA)	0 – 100	0 – 500	0 – 1000
Resolution (mA)	0.01	0.1	0.1
Accuracy (±[% reading + mA])	0.05% + 0.07	0.05% + 0.1	0.05% + 0.2
Stability (ppm, time)	< 10, 1 hour		
Temperature Coeff (ppm/°C)	50		
Noise/Ripple (µA rms)	< 3	< 4	< 8
Transients (µA)	< 50	< 100	< 200
Compliance Voltage (V)	7	7	4
PHOTODIODE CURRENT (APC)			
Range (µA)	5 – 5000		
Resolution (µA)	0.1		
Accuracy (±[% reading + µA])	0.05% + 1		
Stability (ppm, time)	< 200, 24 hours		
Temperature Coeff (ppm/°C)	< 200		
PD Bias (V)	0 to -5V programmable		
LASER VOLTAGE (AVC)			
Range (V)	0 – 7	0 – 7	0 – 4
Resolution (V)	0.001		
Accuracy (±[% reading + V])	0.05% + 0.005		
Stability (ppm, time)	< 50, 1 hour		
Temperature Coeff (ppm/°C)	< 100		
EXTERNAL MODULATION			
Input Range	0 – 10V, 10kΩ		
Modulation Bandwidth	250kHz	250kHz	160kHz
MEASUREMENT CHANNELS			
LASER CURRENT			
Resolution (mA)	0.01	0.1	0.1
Accuracy (±[% reading + mA])	0.05% + 0.1	0.05% + 0.2	0.05% + 0.4
LASER VOLTAGE			
Resolution (V)	0.001		
Accuracy (±[% reading + V])	0.05% + 0.001		
PHOTODIODE CURRENT			
Resolution (µA)	0.1		
Accuracy (±[% reading + µA])	0.05% + 1		
LIMITS			
LASER CURRENT			
Resolution (mA)	1		
Accuracy (±[% reading + mA])	2	5	10
LASER VOLTAGE			
Resolution (V)	0.1		
Accuracy (±% FS)	2.5%		
GENERAL			
Display Type	2x20 VFD		
TEC Connector	DB-9, female		
Computer Interface	USB 2.0 Full Speed RS-232 (DB-9, male)		
Power (50/60 Hz)	100V / 120V / 230V / 240V		
Size (H x W x D) [inches (mm)]	1.82(47) x 8.5(215) x 11(280)		
Operating Temperature	+10°C to +40°C		
Storage Temperature	-20°C to +60°C		

Error Messages

Error Code	Description	Cause
E-100	General Error	The error code is non-specific, and is generally used when no other error code is suitable.
E-102	Message too long	The message is too long to process (USB/Serial only).
E-123	Path not found	The message used an invalid path command (USB/Serial only).
E-124	Data mismatch	The message contained data that did not match the expected format (USB/Serial only).
E-201	Data out of range	The message attempted to set a value that was outside the allowable range (USB/Serial only).
E-202	Invalid data type	When trying to parse the message, the data was in an invalid format (USB/Serial only).
E-204	Suffix not valid	An invalid number base suffix (radix) was encountered when parsing a number (USB/Serial only).
E-501	Interlock shutdown output	The interlock input (pins 1 and 2 of the output connector) were not shorted when the output was on.
E-504	Laser current limit disabled output.	The laser output was turned off because a current limit was detected and the corresponding bit in the OUTOFF register was set.
E-505	Laser voltage limit disabled output	The laser voltage exceeded the voltage limit and the output was turned off.
E-506	Laser photodiode current limit disabled output	The laser output was turned off because a photodiode current limit was detected and the corresponding bit in the OUTOFF register was set.
E-507	Laser photodiode power limit disabled output	The laser output was turned off because a photodiode power limit was detected and the corresponding bit in the OUTOFF register was set.
E-509	Laser short circuit disabled output	The laser output was turned off because a short condition was detected and the corresponding bit in the OUTOFF register was set.

E-510	Laser out of tolerance disabled output	The laser output was turned off because an out-of-tolerance condition was detected and the corresponding bit in the OUTOFF register was set.
E-511	Laser control error disabled output	A hardware control error was detected which forced a shutdown of the laser output.
E-512	Power failure	A power failure was detected.
E-514	Laser mode change disabled output	A change in the operating mode of the LaserSource while the output was on shutdown the output.
E-516	Incorrect configuration for calibration to start	The LaserSource was not configured properly, including the mode and output on state, to be able to start the desired calibration process.
E-517	Calibration must have the output on to start	The laser output must be on for the calibration process to start.
E-534	Po mode selected with PD Response set to zero	Attempted to select Po mode and PD Response was zero, or LaserSource was in Po mode and PD Response was set to zero.
E-535	Calibration cancelled	The active calibration process was cancelled.
E-998	Command not supported	A command was recognized but not supported by the LaserSource.
E-999	Non-specific error	A non-specific error was encountered.

Maintenance and Service

Maintenance

The **LaserSource** requires no regular maintenance other than product calibration. To clean the instrument, use cotton cloth that is only damp (not wet) with a light solution of soap and water.

Fuses

Under normal operation, you should never need to replace a fuse. However, if either fuse does blow, use only T 250V, 1.0A, IEC 60127-2 5x20mm metric fuses as replacements.

If, after replacing the fuse, it continues to blow, immediately discontinue use of the instrument and contact service for support.

Service

Service and repair for the **LaserSource** can be obtained by contacting the distributor from where you purchased the instrument, or directly from Arroyo Instruments. A complete list of distributors is available on the Arroyo web site.

You can contact Arroyo Instruments through one of these methods:

By mail:	Arroyo Instruments 373 Front Street, Suite B Grover Beach, CA 93433 USA
By phone:	+1 (805) 481-6684
By fax:	+1 (805) 481-6628
By email:	support@arroyoinstruments.com
On the web:	http://www.arroyoinstruments.com

In all cases, Arroyo Instruments requires a return materials authorization (RMA) number. You must contact Arroyo Instruments and obtain an RMA number prior to returning your instrument, or the shipment may be rejected and sent back to you.

European Community Declaration of Conformity

EC Declaration of Conformity



I/We

Arroyo Instruments

of

373 Front Street, Suite B
Grover Beach, CA 93433
USA

declare that

4200 Series LaserSource Laser Diode Driver

In accordance with the following directives

EMC Directive: 89/336/EEC

Low Voltage Directive: 73/23/EEC

RoHS Directive: 2002/95/EC89/336/EEC

has been designed and manufactured to the following specifications:

EMC Directive Test Standards

EN 61326 Electrical Equipment for Measurement, Control and Laboratory Use EMC Requirements. This encompasses 10 individual Tests


Low Voltage Directive Test Standards

EN 61010 Electrical Equipment for Measurement, Control and Laboratory Use Safety Requirements.

This Certificate is the Manufacturer's Declaration which states that the **4200 Series LaserSource Laser Diode Driver** is Compliant to the above noted EU Directives and are therefore, eligible to bear the CE MARK. This Declaration is further validated by an Investigation and Testing conducted by **Garwood Laboratories Inc.**, an Independent and Competent 3rd Party Test Lab with facilities in San Clemente, California, USA. The Evaluations and Test Data are documented in the Technical Construction File, **AI 070501-1** which is available on request. This equipment, as of the listed Date of Manufacture, is technically exempted from the RoHS Directive Requirements, not being classified as consumer electronics equipment.

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

Paul Corr
(NAME OF AUTHORIZED PERSON)


(SIGNATURE OF AUTHORIZED PERSON)

President
(TITLE OF AUTHORIZED PERSON)

3 May 2007
(DATE OF ISSUE)

Notes:

Notes:

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