Universal Laser Controller
User's Guide

Manufactured by

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1 Introduction

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Wenn andere als die hier angebenen Kontrollfunktionen oder Einstellungen oder die Ausführung von Abläufen erfolgen, kann zu einer Aussetzung von gefährlicher Strahlung führen.

1.1 About this manual

This manual contains all the information required to operate CVI Melles Griot's Universal Laser Controller.

If you have any questions or comments about this manual or the laser system itself, please call your local sales or service office, or contact our Customer Service staff at (760) 438-2131.

1.1.1 Conventions used in this manual

Throughout this manual you will find information that is separated from the regular text by lines and labeled by an icon in the margin. Lasers are potentially dangerous devices, and some of this information is vital for your safety. The significance of the notations is explained below.

Lasers are electrical devices and improper use can expose the operator or others to potentially lethal voltages. The "Hazard" icon, represented by a triangle with a lightning bolt, identifies precautions needed to avoid *electrical* injury or damage to the equipment.

Skin and eyes may be damaged if exposed to laser beams. The "Caution" icon, represented by a triangle with laser burst, identifies precautions needed to avoid *eye and/or skin* injury to anyone in the area.

The "Note" icon, represented by a triangle with an exclamation point, indicates information that is particularly important to the optimum performance of the laser system or information about the procedure or topic under discussion.

To designate the controls, indicators, and connectors in this manual, the following conventions are used:

Hardware labels: These are written as they appear on the hardware (e.g., if a control is labeled POWER on the hardware, it will be called the POWER control in this manual; if it is labeled Power on the hardware, it will be referred to as the Power control).

Item names: Controls, connectors, and other items that do not have labels will be referred to by initial capitals (e.g., Laser Emission Indicator)

The abbreviations, acronyms and symbols used in this manual are listed below.

Table 1: Abbreviations, Acronyms and Symbols

	Description
"	inch
°C	degrees Celsius
μrad	microradian
A	amp (ampere)
ac	alternating current
c	speed of light
CDRH	Center for Devices and Radiological Health
cm	centimeter
cw	continuous wave
dc	direct current
FCC	Federal Communications Commission
Hz	Hertz (cycles per second)
IEC	International Electrotechnical Commission
in	inch
kg	kilogram

	Description
lb	U.S. pound
LED	light-emitting diode
MHz	megahertz
mA	milliamps
mm	millimeter
mrad	milliradian
msec	milliseconds
mV	millivolts
mW	milliwatt
nm	nanometer
OEM	original equipment manufacturer
p-p	peak-to-peak
V	volts
Vac	volts ac
Vdc	volts dc
Ω	ohms

2 For Your Safety

2.1 Introduction

Please read this chapter carefully before installing or operating your product as it includes important safety information.

This chapter includes information about:

- Safety instructions to follow to avoid accidental beam exposure
- References on laser safety

2.2 Safety

Please be advised that CVI Melles Griot laser products have intentional safety and protective features incorporated in them to meet safety, CDRH, IEC, CE and other regulatory standards. Any third party accessories used with these products must maintain the proper use of and access to these features. Use of any third party accessories that have not been approved in writing by CVI Melles Griot for use with our lasers will void all warranties and may not meet the requirements of CE, CDRH and other standards. The products meet requirements "as shipped" and CVI Melles Griot will not be held responsible for any damage, injury or loss incurred in any manner whatsoever as a result of unapproved accessories used with our products.

All maintenance or service requiring access to the interior of the laser or power supply must be performed by an authorized CVI Melles Griot representative. In addition, removal of any warranty labels will void your warranty.

Be advised that there are potential hazards to personnel or equipment if the specific precautions and instructions described in this manual are not adhered to.

With any laser system there are two major safety issues—electrical safety and laser safety. These issues are discussed in the following sections.

2.3 Laser Safety

Laser light can be hazardous to the skin or the eye, causing burns, eye damage, and even blindness. The CVI Melles Griot CDRH compliant laser systems meet all of the requirements of 21 CFR 1040.10

subchapter J as set forth by the U.S. Food and Drug Administration, Center for Devices and Radiological Health (CDRH). The systems also comply with all applicable European laser safety standards.

Never look into the laser beam or into the laser aperture (even when the laser is off), with or without appropriate safety goggles. Permanent eye damage or blindness may result!

In addition, keep all parts of the body and reflective materials out of the beam path.

CVI Melles Griot laser system should not be operated unless all appropriate safety precautions are taken. These include, but are not limited to:

- Providing enclosed paths for laser beams whenever possible.
- Wearing appropriate certified laser safety glasses when working around a functioning laser device.
- Designating a controlled area specifically for laser operation. Access to this area should be limited to those individuals who have been instructed in the safe operation of lasers.
- Posting warning signs in conspicuous locations near the laser area.
- Setting up laser equipment so that the beam is not at eye level.
- Setting up a target covered with flat black paint or other anti-reflective coating and using shields as necessary to prevent strong reflections from going beyond the area where the laser is being used.

Adjustments, use of controls, or performance of procedures other than those specified in this manual may result in exposure to hazardous laser radiation.

For more information on laser safety, the following sources are available:

Safe Use of Lasers (Z136.1), published by:
The American National Standards Institute (ANSI)
11 West 42nd Street
New York, NY 10036
Phone: (212) 642-4900

A Guide for Control of Laser Hazards, published by:
The American Conference of Governmental and Industrial Hygienists (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Phone: (513) 742-2020

Laser Safety Guide, published by:
The Laser Institute of America
12424 Research Parkway, Suite 125
Orlando, FL 32826
Phone: (407) 380-1553

3 Initial Installation

3.1 Introduction

This chapter includes information about:

- Unpacking the system
- Inspecting the system for damage and completeness
- Connecting the components of the system and mounting.

3.2 Unpacking your system

Retain the shipping container, which is designed to protect the laser system during shipment and storage. The container should always be used to ship and store the system.

Immediately upon receipt of your CVI Melles Griot laser system, inspect the packaging for obvious signs of damage. The laser's packaging is quite substantial and will protect the equipment from normal shipping stresses. If the packing cartons are significantly damaged and you suspect damage has occurred to one of the components, file a claim with the shipper and have a representative from the shipper present when the unit is unpacked.

When unpacking the laser system, look for dents, scratches and other signs of damage to the components. If damage is evident, immediately file a claim with the shipper and contact your nearest CVI Melles Griot representative.

Save the original shipping container and packaging materials for use in storage or if product return is required. CVI Melles Griot cannot honor the warranty for improperly packaged equipment.

4 System Description

4.1 Introduction

This chapter describes Universal Laser Controller and gives a functional description of all user-accessible controls, indicators and connectors.

4.2 Controls, indicators, fuses and connectors

4.2.1 Laser Controller, Power/Signal

This connector is used to supply dc voltage to the system and to control the laser remotely via external inputs.

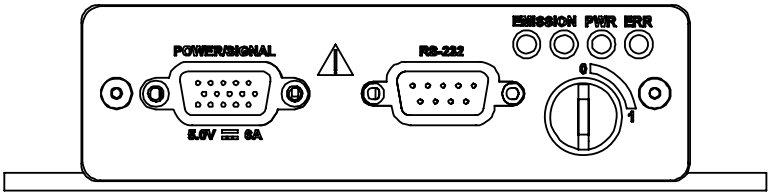

Figure 1: Universal Laser Controller Front Panel

4.3 System Installation

Connect all system components per the instructions in the Laser User's Guide.

4.3.1 Electrical Connections

- Connect the laser head/controller interface cable to the LASER HEAD connector on the rear of the laser head.

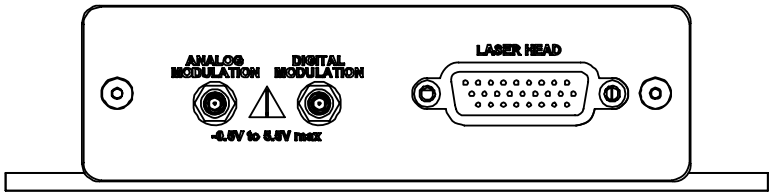

Figure 2: Laser Controller Rear Panel

Note

The ANALOG MODULATION and DIGITAL MODULATION connectors are functional only for specific laser systems. Refer to the Laser User's Manual for detail.

- For remote control, connect an appropriate cable to the POWER/SIGNAL connector on the front of the laser controller. See Table 3 for connector pinout.
- For computer control, connect a serial cable to the RS-232 serial port connector on the controller to enable computer control of the laser system.
- Before continuing, ensure that the dc power source is *off*.
- Connect the cable from the dc power source to the POWER/SIGNAL connector on the laser controller.
- If user supplied, the dc power source must satisfy the specifications listed in Section 7.1 "Universal Laser Controller Specifications".

Note

Before connecting the ac power cord to the dc power supply, ensure that the power rating on the supply and the cable supplied with the system are appropriate for your location.

- If using an optional CVI Melles Griot dc power supply, connect the ac power cord to the dc supply and plug it into a properly grounded and tested power (mains) receptacle.
- The laser system is now ready for operation.

5 Universal Laser Controller Operation

5.1 Introduction

The Universal Laser Controller can be controlled and monitored using a number of methods:

- Manual operation via the front and rear panel controls
- RS-232 operation using serial commands issued from a computer.
- Remote operation using pins on the POWER/SIGNAL connector.

After dc voltage is first applied, the Universal Laser Controller will not allow the laser to be turned on for 45 seconds. All laser on events are ignored during this 45 second time period.

After this time, a 5 second safety delay will occur between initiating a laser on event and laser emission.

Before proceeding, all safety precautions as outlined in the Laser User Manual must be implemented and functional.

5.2 dc power

If using a CVI Melles Griot provided dc power supply, the safety interlock pins (pins 10 and 11) are already connected within the dc supply.

If dc power is user supplied, connect pins 10 and 11 though the interlock loop, connect pin 15, Chassis Ground and provide the appropriate power to the necessary pins as listed in Table 3. A minimum of 20 AWG wire should be used to connect dc power to reduce voltage drop between the dc power source and the Universal Laser Controller.

5.3 Manual Operation

To control the Universal Laser Controller manually, use the controls on the front panel.

Table 2: Manual Operation

To	Do this
Turn the laser on	Turn the keyswitch to the on (I) position. The laser will turn on after a 5 second safety delay.
Turn the laser off	Turn the keyswitch to the on (O) position. The laser will turn off immediately.

5.4 Remote Operation

The Universal Laser Controller can be controlled remotely via pins on the POWER/SIGNAL connector.

Table 3: Power/Signal Connector Pinout

Pin	Function	Description
1	Thermo-electric cooler voltage supply	Input, dc voltage +5.00±0.25 Vdc, 5.0 A
2	Thermo-electric cooler voltage supply	Input, dc voltage +5.00±0.25 Vdc, 5.0 A
3	Laser diode voltage supply	Input, dc voltage +5.00±0.25 Vdc, 2.0 A
4	Auxiliary Vdc Output	Output, +5.00±0.25 Vdc, 200 mA maximum
5	Laser On	Normally open (see **Error! Reference source not found.**)
6	Laser On	Normally closed (see **Error! Reference source not found.**)
7	Laser Off	Transition state to turn laser off
8	Internal Modulation Signal	Not currently implemented
9	VLASER Return	dc voltage return
10	Safety Interlock	Connect pins 10 and 11 through interlock loop for laser safety interlock
11	Ground, Signal	Ground (return) for all signals
12	Ground, Signal	Ground (return) for all signals
13	VLASER Return	dc voltage return
14	System Fault	Output, TTL Level Note: Behavior dependant on value set via SET:FLT:MODE serial command
15	Chassis Ground	Earth ground. Note: *Must* be connected for proper system operation.

Table 4: Remote Operation

To	Do this
Turn the laser on	Connect a single-pole, double-throw (SPDT) switch as shown in Figure 3 to the POWER/SIGNAL connector. Initiate a laser on event as shown in Figure 4 by actuating the switch for a minimum of 100 msec. Laser emission will occur after a 5 second safety delay.
Turn the laser off	Momentarily connect Pin 7 to Pin 11 on POWER/SIGNAL connector.
Supply voltage to auxiliary equipment	Use the dc voltage output from pin 4 on the POWER/SIGNAL connector.

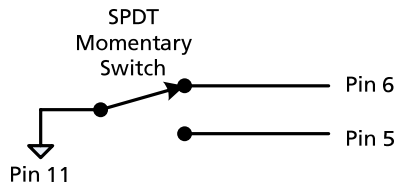

Figure 3: Remote Laser On Connection Diagram

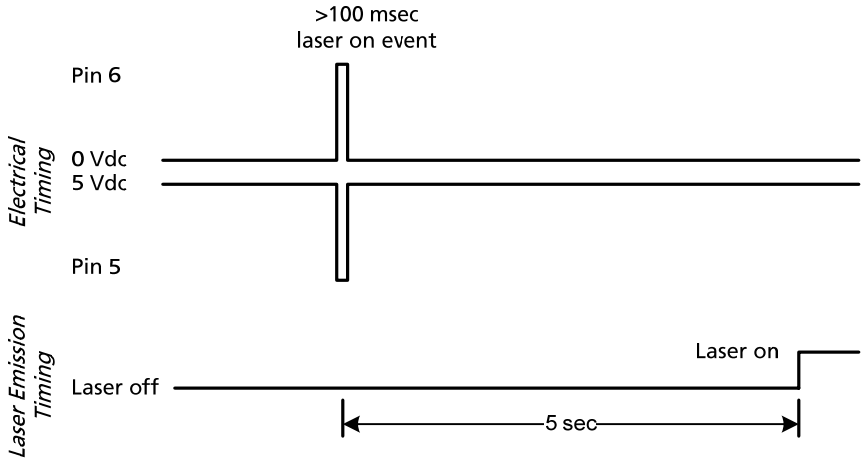

Figure 4: Remote Laser On Timing Diagram

5.5 RS-232 Operation

The Universal Laser Controller can be controlled and a variety of system information can be accessed through the RS-232 interface connector.

Connect a properly configured serial cable per the pinout shown in Table 5**Error! Reference source not found.** and configure the computer serial port with the settings shown in Table 6**Error! Reference source not found.**.

Table 5: RS-232 Pinout

Pin Number	Function	Description
1		No connection
2	RxD	RS-232 transmitter
3	TxD	RS-232 receiver
4	DTR	Connected to DSR
5	GND	Signal ground
6	DSR	Connected to DTR
7		No connection
8		No connection
9		No Connection

Table 6: RS-232 Communication Settings

Parameter	Setting
Baud Rate	19200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

5.6 RS-232 Commands

Table 7: RS-232 Syntax

To	Do this
Issue a "set" command	Eliminate the [?] from the command. For example: LAS:MODE 0 Will place the laser system in ACC mode.
Issue a "read" command	Include a ? after the command. For example: LAS:MODE? Will return a 0 if the laser is in ACC mode or a 1 if the laser is in APC mode.

Table 8: Serial Communication Commands

To	Issue the command
Set or read serial port baud rate.	COM:BAUD:RATE[?]
Set or read serial port communication echo.	ECHO:TYPE[?] 1 = Echo on 0 = Echo off
Set or read serial communications end-of-line type (carriage return (CR), linefeed (LF) or carriage return/linefeed (CRLF))	COM:TERM:TYPE[?] 0 = CRLF 1 = CR 2 = LF 3 = CRLF?
Set/query serial communication prompt state	PROMPT[?] 0 = Off 1 = On
Clear terminal display	CLS

Table 9: System Control Commands

To	Issue the command
Set or read laser output power (mW)	LAS:POW:REF[?]
Set or read laser diode current setpoint (mA)	LAS:CURR:REF[?]
Set or read keyswitch mode	KS[?] 0 = Keyswitch turn laser on and off 2 = Keyswitch acts as safety interlock. Laser must be turned on remotely or via RS-232.
Set or read laser state	LAS:STAT[?] 0 = Turn laser off 1 = Turn laser on. The laser will start after a 5 second safety delay.
Turn laser and TECs off in case of emergency	ABOR
Set or read laser TEC status	LTEC:STAT[?] 0 = TECs on 1 = TECs ramping 2 = TECs and laser off
Set or read laser control mode	LAS:MODE[?] 0 = Automatic Current Control (ACC) 1 = Automatic Power Control (APC)

Table 10: System Configuration Commands

To	Issue the command
Read laser part number	HEAD:MOD:NUMB?
Read laser serial number	HEAD:SER:NUMB?
Read laser date of manufacture	HEAD:MFG:DATE?
Read laser EEPROM programming software revision	HEAD:SFWR:REV?
Read controller part number	CTRL:PART:NUMB?
Read controller serial number	SER:NUMB?
Read controller hardware revision	CTRL:REV?
Read controller calibration date.	CTRL:CAL:DATE?
Read controller firmware part number	SFWR:PART:NUMB?
Read controller firmware revision	SFWR:REV?
Read laser on time	LAS:ON:TIME?

Table 11: Operating Parameter Commands

To	Issue the command
Read laser output power limit (mW)	LAS:POW:LIM?
Read laser diode current limit (mA)	LAS:CURR:LIM?
Read laser initialization time (msec)	LAS:INIT:TIME?
Read µamps/milliwatt setting	HEAD:POW:RATE?
Read laser diode current range setting	LT? L = Low current D = High current
Read actual laser diode temperature (Ω)	READ:LTEC:TEMP?
Read laser diode temperature setpoint (Ω)	LTEC:TEMP:REF?
Read laser diode under temperature setpoint (Ω)	LTEC:UND:TEMP?
Read laser diode over temperature setpoint (Ω)	LTEC:OVER:TEMP?
Read laser diode TEC current (milliamps)	READ:LTEC:CURR?
Read actual non-linear crystal temperature (Ω)	READ:XTEC:TEMP?
Read non-linear crystal temperature setpoint (Ω)	XTEC:TEMP:REF?
Read non-linear crystal under temperature setpoint (ohms)	XTEC:UND:TEMP?
Read non-linear crystal over temperature setpoint (ohms)	XTEC:OVER:TEMP?
Read non-linear crystal TEC current (milliamps)	READ:XTEC:CURR?
Read actual baseplate temperature (Ω)	READ:BASE:TEMP?
Read baseplate under temperature setpoint (Ω)	BASE:UND:TEMP?
Read baseplate over temperature setpoint (Ω)	BASE:OVER:TEMP?
Read laser output power (mV)	READ:LAS:POW?
Read laser diode voltage (mV)	READ:LAS:VOLT?
Read laser ramp time (mV)	LAS:RAMP:TIME?

Table 12: Troubleshooting Commands

To	Issue the command
Read error code log	ERR:CODE:LOG
Clear error condition	*CLR
Set or read front panel ERR LED mode	SET:FLT:MODE[?] 0 = LED remains lit during error condition 1 = LED flashes to indicate specific error condition

6 Troubleshooting

If a system error occurs, or an external safety interlock is open, the red ERR LED on the front of the laser controller will indicate the error.

Table 13: Troubleshooting

To	Do this
Interpret ERR LED flashes	Count number of flashes and see Table 14.
Have ERR LED remain illuminated constantly as a general error indicator	Send a SET:FLT:MODE 0 command via RS-232
Have ERR LED flash to indicate the specific error	Send a SET:FLT:MODE 1 command via RS-232
See the last 17 errors experienced by the controller	Send a ERR:CODE:LOG command via RS-232

Table 14: Error Codes

Number of Flashes	Error Description
1	Safety interlock open
2	Laser diode over or under temperature
3	Baseplate over or under temperature
4	Laser cavity over or under temperature
5	Laser diode over or under voltage
6	Laser head read error
7	dc power supply error
8	Controller over temperature

7 Specifications

7.1 Universal Laser Controller Specifications

Table 15: Environmental Specifications

Heat Dissipation, Controller	<13 W
Temperature, Storage/Transport	–20 to +60 °C
Temperature, Operating	+10 to +40 °C
Humidity, Storage/Transport/Operating	< 95% non-condensing
Shock, Storage/Transport	<25 g, <11 msec
Vibration, Storage/Transport	<3 g (5 to 500 Hz, sinusoidal)
Vibration, Operating	<0.3 g (5 to 500 Hz, sinusoidal)

Table 16: Electrical Specifications

Input Power, Laser Controller	<30 W
Input Voltage, Laser Controller	+5.00 ± 0.25 Vdc <5% peak-to-peak ripple <0.5% line regulation
Input Voltage (with optional CVI MG dc supply)	90 to 240 Vac
Input Frequency (with optional CVI MG dc supply)	50 to 50 Hz, single phase

7.2 Laser Controller Dimensions

Dimensions are in mm [inch]

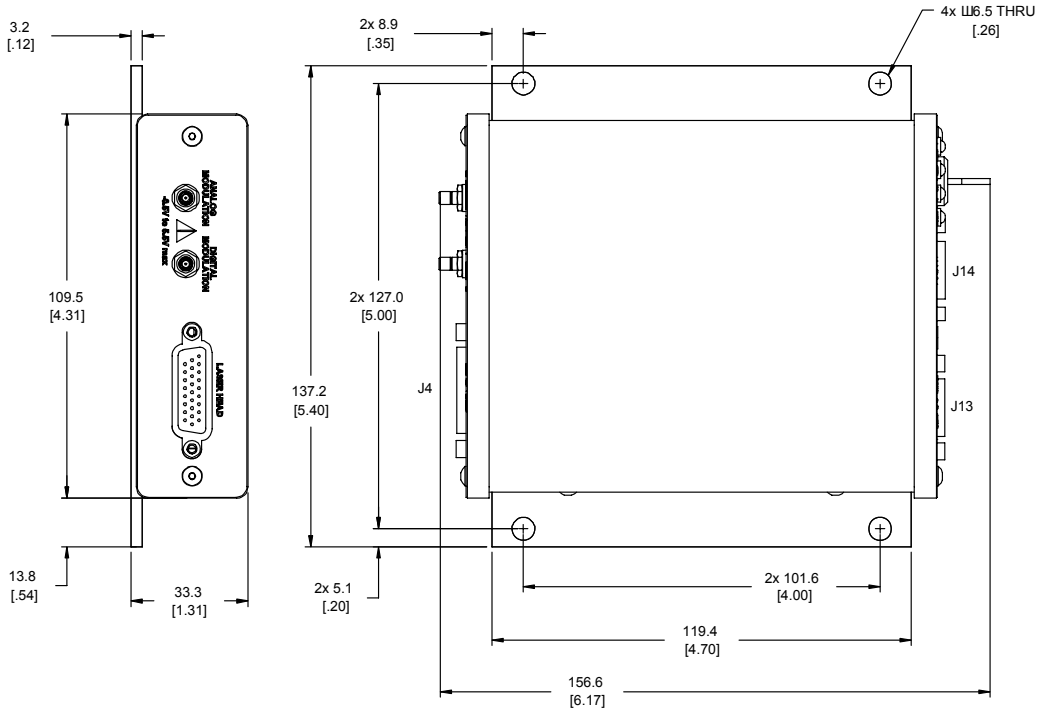

Figure 5: Laser Controller Dimensions

8 In Case of Difficulty

8.1.1 Introduction

There are no user serviceable parts in Universal Laser Controller or the dc power supply.

If a problem occurs with the system itself, it must be corrected or repaired by an authorized CVI Melles Griot service representative or returned to a CVI Melles Griot service center.

8.2 Reporting information

When contacting CVI Melles Griot, please have the following information ready for the Customer Service representative:

- Laser head and controller model numbers and serial numbers
- Approximate purchase date and hours in service
- Accessories, options or modifications installed
- All information from the laser head data label
- Symptoms of the malfunction, including any error message

9 Service, Support, and Warranty

CVI Melles Griot lasers contain no user-serviceable parts and, depending upon usage rate, should give years of trouble-free service. Nonetheless, if you should experience problems, CVI Melles Griot is committed to providing the best possible support and service.

9.1 Sales and Service Offices

To find an authorized CVI Melles Griot service facility near you, contact the CVI Melles Griot office listed below.

CVI Melles Griot
2051 Palomar Airport Road, 200
Carlsbad, California 92011, U.S.A.
Phone: (760) 438-2131
Fax: (760) 438-5208
Email: lasers@cvimellesgriot.com
Web: http://www.cvimellesgriot.com/

9.2 Warranty

All CVI Melles Griot lasers and controllers, unless otherwise specified, are covered by the comprehensive warranty described below..

9.2.1 Basic Warranty

For a period of 12 months, unless otherwise stated, CVI Melles Griot warrants the Universal Laser Controller to be free from defects in materials and workmanship, hereinafter called the “Nonconformity”. These warranties do not apply to systems that CVI Melles Griot determines, upon inspection, to have failed, or have become defective or unworkable due to abuse, mishandling, misuse (including but not limited to: optical feedback into laser cavity, improper mounting, exceeding recommended temperature range, contamination by particulates or chemicals), alteration of laser or power supply or opening of cover (unless approved in writing by CVI Melles Griot), negligence, improper installation, use which is not in accordance with the information and precautions described in this operator’s manual, or other causes beyond the control of CVI Melles Griot.

This warranty does not apply to any products or components not manufactured by CVI Melles Griot.

EXCEPT FOR THE FOREGOING WARRANTY, CVI MELLES GRIOT SPECIFICALLY DISCLAIMS AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF NONINFRINGEMENT,

MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.

Buyer shall notify CVI Melles Griot of any nonconformity during the warranty period, obtain a return authorization for the nonconforming products, and return the nonconforming products, freight prepaid, to a facility designated by CVI Melles Griot, along with a written statement describing the nonconformity. The sole and exclusive obligation assumed by CVI Melles Griot under this warranty is to use reasonable commercial efforts to repair, replace, or refund the purchase price for any products that are returned to CVI Melles Griot as set forth above and which are determined, at the reasonable discretion of CVI Melles Griot, to be nonconforming product.

Products that are repaired or replaced within the warranty period are warranted only for the remaining unexpired portion of the original warranty period. However, the warranty period does not include the time period between when CVI Melles Griot receives the nonconforming products and when CVI Melles Griot returns the repaired or replacement products to Buyer. Buyer agrees that the foregoing provisions constitute the sole and exclusive remedies available to Buyer for breach of warranty by CVI Melles Griot with respect to the products.

IN NO EVENT WILL CVI MELLES GRIOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR BENEFITS, EVEN IF CVI MELLES GRIOT HAS BEEN INFORMED OF THE POSSIBILITY THEREOF IN ADVANCE. IN NO CASE WILL THE AGGREGATE LIABILITY OF CVI MELLES GRIOT BE GREATER THAN THE PURCHASE PRICE PAID BY BUYER TO CVI MELLES GRIOT FOR THE PRODUCTS THAT ARE THE SUBJECT OF BUYER'S CLAIM.

Directory of CVI Melles Griot Worldwide Sales Offices

United States
2051 Palomar Airport Road, 200
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(760) 438-2131
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12 Avenue Jean Bart
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Fax: 01 30 60 08 51

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D-64625 Bensheim
(0 62 51) 84 06-0
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3F Pine Building
3-11-2 Shibuya
Shibuya-ku
Tokyo, Japan 150
3-3407-3614
Fax: 3-3486-0923

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