MELLES GRIOT

The Practical Application of Light

Barloworld Scientific

Diode Laser Driver User Manual

NOTICE: This manual contains specifications, descriptions, and drawings of the diode laser drivers provided by Melles Griot.

Product specifications contained in this manual are subject to change by Melles Griot without prior notice. Melles Griot will not be responsible for errors or omissions in this manual, or for incidental or consequential damages in connection with the furnishing or use of this information.

Comments or suggestions regarding this manual are appreciated and should be sent to the following address:

Melles Griot Photonics Components Group
2051 Palomar Airport Road, 200
Carlsbad, California 92011, USA
Attention: Customer Service
Phone (760) 238-5131
Fax (760) 804-0049
E-mail: sales@catalog.mellesgriot.com

Publication date: February 2006

TABLE OF CONTENTS

INTRODUCTION 1

1 GENERAL DESCRIPTION 2

1.1 Packing list 2
1.2 Safety 2
1.3 Warranty 2
1.4 Features 3
1.5 Technical data 4
1.5.1 Individual data 4
1.5.2 Common data 5
1.6 Ordering codes and accessories 5
1.7 Operating elements 6
1.7.1 Operating elements on the front panel 6
1.7.2 Operating elements on the rear panel 7
1.8 Initial settings 7
1.9 Connecting components 8
1.9.1 9-pole sub-D output jack 8
1.9.2 Interlock and control LED for LASER ON 8
1.9.3 Connecting the laser diode and photodiode 9
1.9.4 Analog control output for the laser current 10

2 OPERATING INSTRUCTIONS 11

2.1 Setting the Current Limit I_{LIM} 11
2.2 Selecting the diode laser polarity 11
2.3 Constant current mode (CONST I) 12
2.4 Constant power mode (CONST P) 12
2.4.1 Changing the "IPD" setting range 13
2.5 Calibrating the optical power display 14
2.6 Analog modulation of the diode laser 14

3 REMOTE CONTROL 15

4 MAINTENANCE 16

4.1 Line voltage 16
4.2 Replacing the line fuse 16
4.3 General care 17
4.4 Cleaning 17
4.5 Repair 17
4.6 Troubleshooting 17

5 LISTINGS 18

5.1 List of acronyms 18
5.2 List of figures 18
5.3 Certifications and compliances 19
5.4 Addresses 20

Introduction

This instruction manual contains all the specific information necessary to operate the 06 DLD 3xx series of diode laser drivers. Chapter 1 provides a general description of the laser driver. Chapter 2 provides complete instructions for operating the system manually. Chapter 3 outlines a simple method for remotely controlling the driver. Chapter 4 describes the routine maintenance functions that should be performed by the operator. Chapter 5 contains a listing of the acronyms used in this manual, along with a listing of figures, compliance data, and pertinent addresses.

Warning! This manual contains WARNING labels, in this form, to indicate personal danger or possible damage to equipment. Please read these carefully!

NOTE: This manual also contains notes and hints written in this form.

Chapter 1 General Description

1.1 Packing List

When unpacking the diode laser driver, the following items should be found:

- The 06 DLD 3xx diode laser driver
- The power cord with a connector corresponding to the ordering country
- The user manual
- The 06 DLH 301 connection cable

If any of these items are missing, contact your nearest Melles Griot representative.

1.2 Safety

Warning! All statements regarding safety of operation and technical data in this instruction manual will apply only when the unit is operated in accordance with this user's manual.

Before applying power to your 06 DLD 3xx diode laser driver, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective ground contact of the socket outlet, as improper grounding can cause a potentially fatal shock. The line voltage setting marked on the rear panel must agree with your local supply, and corresponding line fuses must be used. If the voltage setting is incorrect, contact Melles Griot to request a service technician change the voltage. The customer can change the line fuse.

Laser and photodiodes must be connected only with shielded connection cables.

Warning! Improper grounding can cause a potentially fatal electric shock. The unit must not be operated in an explosive environment!

Caution! Use of mobile telephones, handy phones, or other radio transmitters within three meters of the diode laser drive could cause the electromagnetic field intensity to exceed the maximum values allowed by EN 50 082-1.

1.3 Warranty

Melles Griot warrants the 06 DLD 3xx series of diode laser drivers against defects in material and workmanship for a period of twelve months from the date of purchase. Melles Griot will, at its own option, repair or replace without charge any item found to be defective within this period. Melles Griot standard terms and conditions of sale apply during the warranty period.

To authorize a return, contact Melles Griot to obtain a return material authorization (RMA) number. The customer is responsible for all shipping costs to Melles Griot. For warranty

repairs, Melles Griot will pay the return shipping costs. For nonwarranty repairs, the customer is responsible for shipping costs in both directions. In the case of international shipments, the customer is responsible for all applicable duties, taxes, and fees.

The diode laser driver must be returned to Melles Griot in its *complete* original packaging, including the plastic foam parts. If necessary, ask for a replacement package.

This warranty is void if

- The driver is exposed to extraordinary environmental extremes including but not limited to the following: excessive heat or cold; accumulated dust; water damage; excessive input voltage; exposure to electrostatics; excessive shock or vibration; improper return packing, shipping or handling; or improper operation or application.
- The customer attempts to adjust laser power components.
- The customer attempts to repair or replace components beyond the scope described in the maintenance section of this manual.

1.4 Features

The 06 DLD 3xx-series diode laser drivers from Melles Griot are extremely precise current controllers for diode lasers and LEDs. Both the injection current and the optical output power output of a diode laser can be controlled simultaneously by using a Melles Griot temperature controller in conjunction with the driver.

To protect the diode laser against damage, the 06 DLD 3xx diode laser drivers provide the following protection features:

- Softstart function
- Adjustable limitation of injection current
- Interlock (open-circuit monitoring of the laser diode mount connection)
- Electronic short circuit for the laser diode in off-mode
- Separate control to switch the laser diode current on and off
- Monitoring LED for LASER ON mode

The 06 DLD 3xx-series diode laser drivers are easy to use because of the intuitively structured front panel. Operating parameters are shown on an illuminated 4½-digit LCD display. The parameter to be displayed is selected with UP and Down buttons.

An on/off delay and the softstart function protect the diode laser against undesired transients. An independent hardware limit for the injection current, set with a 20-turn potentiometer, protects the diode laser from operating errors. With the output open the laser diode is short circuited electronically so that no voltage is applied to the diode laser.

When turned on, the 06 DLD 3xx diode laser driver automatically defaults to the LASER OFF mode. The laser current can then be switched on and off with a separate button located in the front panel.

The diode laser or photodiode is connected to the driver via a 9-pin sub-D socket at the rear of the unit. Because the output for the diode laser and the input for the photodiode are bipolar, all polarities of commercially available diode lasers can be used. A control signal located at the output jack can operate an external LED to indicate a LASER ON condition.

The injection current or the optical output power of the diode laser can be modulated via a modulation input at the rear of the unit. For monitoring purposes, a voltage proportional to the diode laser current is provided at an analog control output at the rear. If an error occurs or if the limit for the laser current is reached, the corresponding LED lights up and a short warning beep sounds.

A line filter coupled with careful transformer shielding provides low ripple and noise at the output, and internal cooling of the diode laser driver with a fan protects the unit against overheating in case of high environmental temperature. With free air circulation, safe operation of the unit is guaranteed up to 40°C ambient temperature.

Warning! Do not obstruct the air-ventilation slots in the housing!

1.5 Technical Data

1.5.1 Individual Data

	06 DLD 301	06 DLD 302	06 DLD 303
Constant current mode:			
Control range (continuously variable)	0–200 mA	0–500 mA	0–2 A
Setting accuracy	0.1 mA	0.1 mA	2 mA
Resolution	0.01 mA	0.1 mA	0.1 mA
Compliance voltage	> 6 V	> 4 V	> 4 V
Noise (10 Hz–10 MHz)	< 1.5 μA	< 3 μA	< 15 μA
Ripple (50 Hz, rms)	< 1.5 μA	< 2 μA	< 5 μA
Transients	< 200 μA	< 500 μA	< 100 μA
Short-time fluctuations (15 sec, 0–10 Hz)	< 10 μA	< 10 μA	< 2 mA
Temperature coefficient	50 ppm/°C	50 ppm/°C	50 ppm/°C
Drift (30 min, 0–10 Hz)	20 μA	50 μA	200 μA
Constant power mode:			
Control range photodiode current	5 μA–2 mA	5 μA–2 mA	5 μA–2 mA
Setting accuracy	2 μA	2 μA	2 μA
Resolution photodiode current	0.1 μA	0.1 μA	0.1 μA
Resolution optical power	1 μW	1 μW	0.1 μW
Laser current limit:			
Setting range	0–200 mA	0–500 mA	0–2 A
Setting accuracy	0.5 mA	1.5 mA	5 mA
Resolution	0.01 mA	0.1 mA	0.1 mA
Analog modulation/voltage control:			
Input resistance	10 kΩ	10 kΩ	10 kΩ
Bandwidth (CC)	dc–250 kHz	dc–150 kHz	dc–50 kHz
Modulation coefficient (CC)	20 mA/V ± 5%	50 mA/V ± 5%	200 mA/V
Modulation coefficient (CP)	0.2 mA/V ± 5%	0.2 mA/V ± 5%	0.2 mA/V ± 5%
Control output:			
Load resistance	10 kΩ	10 kΩ	10 kΩ
Transfer coefficient	50 V/A ± 5%	20 V/A ± 5%	10 V/A ± 5%

1.5.2 Common Data

Connectors:	
Laser diode, photodiode, LD ON signal interlock (0–5 V) LD OUTPUT	9-pin D-type
Modulation input (–10 V to +10 V) MOD IN	BNC
Control output (0–10 V) CTL OUT	BNC
Chassis ground	4-mm banana
Line input	IEC 320
General data:	
Line voltage	100 V / 115 V / 230 V (+15/–10%) (fixed)
Line frequency	50–60 Hz
Power consumption (max)	06 DLD 301 25 VA 06 DLD 302 30 VA 06 DLD 303 60 VA
Line power overvoltage	Category II (Cat II)
Operating temperature[1]	0° to 40°C
Storage temperature	–40°C to +70°C
Relative humidity	Max. 80% up to 31°C, decreasing to 50% at 40°C
Pollution degree (indoor use only)	2
Operation altitude	< 3000 m
Warm-up time for rated accuracy	10 min
Weight	≤3 kg
Dimensions W × H × D	147 × 73 × 317 mm

[1] *Non-condensing*

1.6 Ordering Codes and Accessories

Ordering Code	Short Description
06 DLD 301	Diode laser driver, current range 0–200 mA / 6 V
06 DLD 302	Diode laser driver, current range 0–500 mA / 4 V
06 DLD 303	Diode laser driver, current range 0–2 A / 4 V
06 DLM 301	Temperature-controlled diode laser mount for 3- and 4-pin diodes in 9 mm (TO18) and 5.6 mm (TO46) packages
06 DLM 302	Diode laser mount for laser modules in a 14-pin butterfly package (programmable pinning)
06 DLH 301	Shielded cable to connect the diode laser driver 06 DLD 3xx to a diode laser mount

1.7 Operating Elements

1.7.1 Operating elements on the front panel

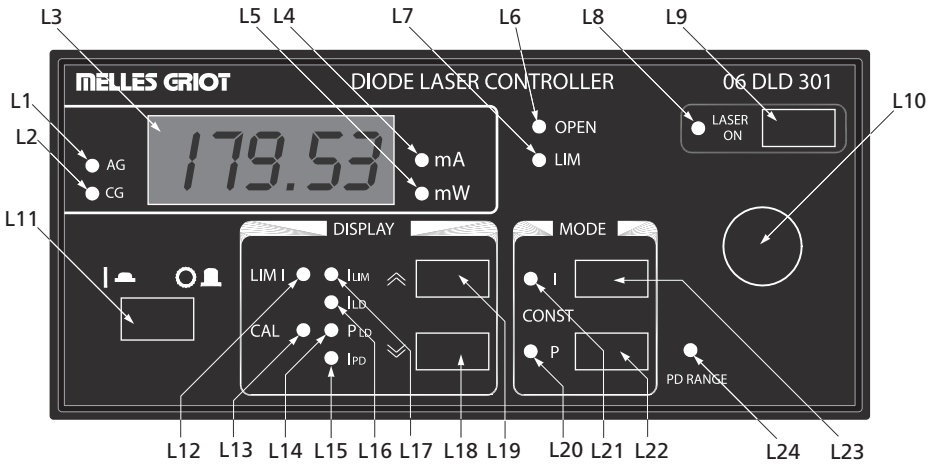


Figure 1: Operating and display elements on the front panel

Element	Type	Label	Function
L1	LED	AG	Selected polarity of the laser: anode grounded
L2	LED	CG	Selected polarity of the laser: cathode grounded
L3	LCD	Display	Displays performance parameters
L4	LED	mA	Current display in mA
L5	LED	mW	Power display in mW
L6	LED	OPEN	No diode laser connected
L7	LED	LIM	Adjusted current limit reached
L8	LED	ON	Laser current is switched on
L9	Switch	ON	On/off switch for the laser current
L10	Knob		Enter setting values
L11	Switch	LINE	Line switch
L12	Pot	LIM I	Potentiometer for setting the current limit
L13	Pot	CAL	Potentiometer for calibrating the power display
L14	LED	P_{LD}	Displaying optical output power
L15	LED	I_{PD}	Displaying photodiode current
L16	LED	I_{LD}	Displaying laser current
L17	LED	I_{LIM}	Displaying current limit
L18	Button	DOWN	Select the displayed value
L19	Button	UP	Select the displayed value
L20	LED	P	Constant power mode
L21	LED	I	Constant current mode
L22	Button	P	Select constant power mode
L23	Button	I	Select constant current mode
L24	Pot	PD RANGE	Potentiometer for setting the photodiode current range

1.7.2 Operating elements on the rear panel

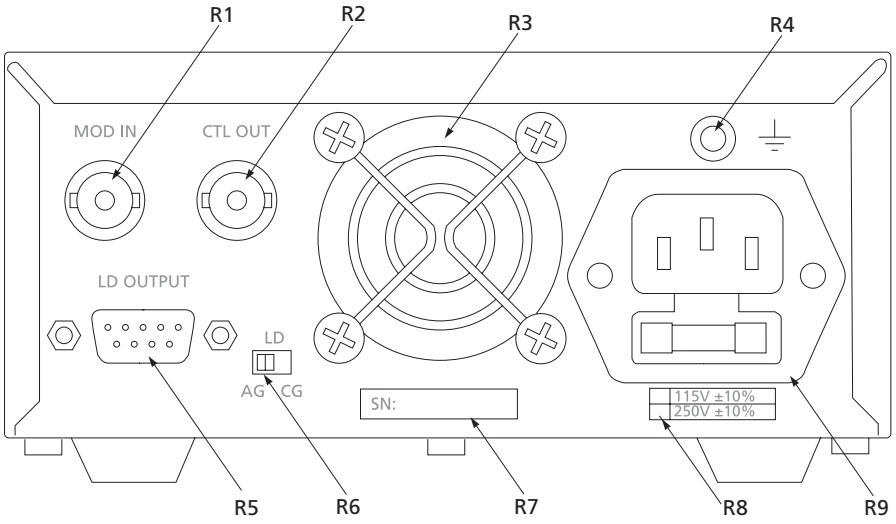


Figure 2: Operating elements on the rear panel

Element	Type	Label	Function
R1	BNC connector	MOD IN	Modulation input analog control input, -10 V to +10 V
R2	BNC connector	CTL OUT	Analog control output, 0 to ±10V
R3	Fan		
R4	Banana jack	GND	Connector for chassis ground
R5	Sub-D 9 socket	LD OUTPUT	Connector for diode laser, photodiode, interlock, status LED
R6	Slide switch	LD AG/CG	Switch for selecting the laser diode polarity (anode or cathode ground)
R7	Label		Serial number of the unit
R8	Label		Allowed and set line voltage ranges
R9	Plug		Line connector and fuse holder

1.8 Initial Settings

Prior to starting operation with the 06 DLD 3xx diode laser driver, check to make sure that the line voltage specified on the letterplate agrees with your local supply and that the appropriate fuse is inserted. If the line voltage is incorrect, contact Melles Griot immediately. If the fuse is missing or incorrect, change the fuse according to the instructions given in the maintenance section.

Connect the unit to the line with the provided line cable. Turn the unit on using the LINE switch (L11).

External components can be grounded to the chassis via the GND connector jack (R4). The ground pin of the diode laser is internally connected to chassis ground.

After switching on the unit, the LCD display (L3) will illuminate, and the appropriate indicator LEDs (L14–L17) will light up to indicate the selected parameters. Using the DOWN and UP keys (L18 and L19) select the parameter value to be displayed.

Once turned on, the 06 DLD 3xx is immediately ready for use. Rated accuracy, however, is only reached after a warm-up time of approximately 10 minutes.

1.9 Connecting Components

1.9.1 9-pin sub-D output jack

Depending upon the version, 06 DLD 3xx diode laser drivers from Melles Griot can drive all diode lasers up to a maximum current rate of 2 A.

If the 06 DLD 3xx driver is used with a Melles Griot diode laser mount, use an 06 DLH 301 cable to connect the LD OUTPUT (R5) connector on the back panel of the driver to the LD DRIVER connector on the laser mount.

NOTE: If the Melles Griot 06 DLM 301 diode laser mount is used, the polarity of the diode laser and photodiode must be set *in the mount* (refer to the individual operation manual).

If other diode laser mounts are used, connect the diode laser and, if provided, the photodiode with shielded cables to the LD OUTPUT (R5) jack, using the pin assignment shown in Figure 3.

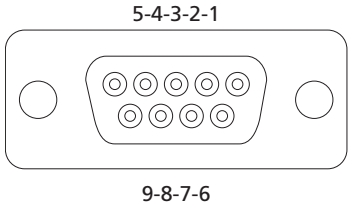


Figure 3: Pin assignments for the LD OUTPUT connector

Pin	Connection
1	Interlock and status LASER ON/OFF
2	Photodiode cathode
3	Diode laser ground
4	Photodiode anode
5	Digital ground for pin 1
6	Not used
7	Diode laser cathode voltage (at anode ground)
8	Diode laser anode voltage (at cathode ground)
9	Not used

1.9.2 Interlock and control LED for LASER ON

Pin 1 and pin 5 of the LD OUTPUT jack (R5) are test contacts which are used to determine whether a diode laser is connected or whether the connection to the diode laser has been interrupted during operation.

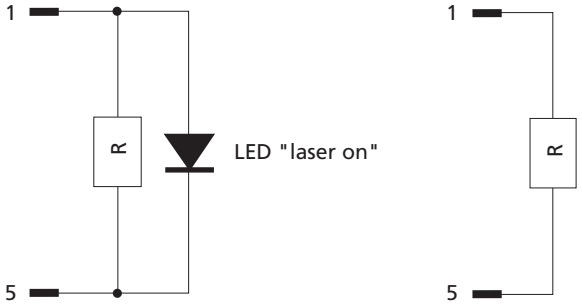


Figure 4: Connecting the interlock (with and without monitoring LED)

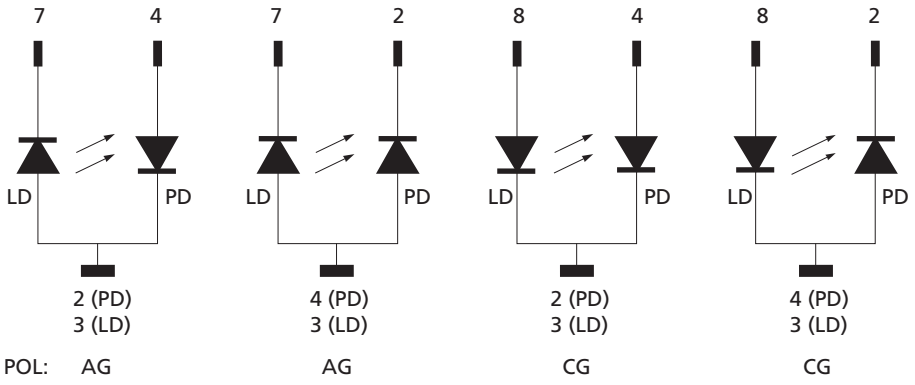
Pin 1 and pin 5 must be connected externally by a wire (total resistance <430 Ω). When this connection is open, the 06 DLD 3xx automatically switches into the LASER OFF mode.

An LED can be connected in parallel with a resistor of <470 Ω between pin 1 and pin 5. The LED lights up when the laser current is switched on (LASER ON).

1.9.3 Connecting the diode laser and photodiode

Connect the diode laser and the photodiode according to Figure 5.

Figure 5: Connecting the diode laser and the photodiode



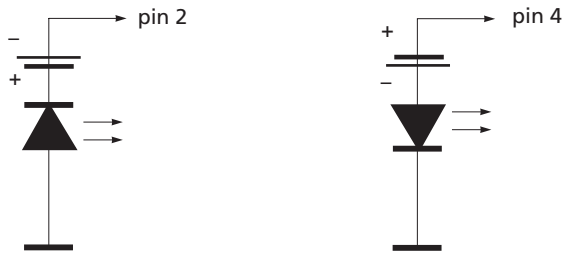
The ground connection of the diode laser (pin 3) may be connected to the anode of the photodiode (pin 4) or to the cathode of the photodiode (pin 2). This connection should be as close as possible to the diode laser to avoid measuring errors.

If the polarity selected with the switch LD AG/CG (R6) and the connection of the laser diode do not agree, no current will flow through the diode laser.

The diode laser is always powered with respect to ground. Compared to a floating driver stage, this operation mode has the advantages of higher security for the diode laser and better stability of the laser current.

To operate the photodiode with a bias voltage, connect a battery in series with the photodiode as shown in the Figure 6.

Figure 6: Biasing schemes



AG with bias CG with bias

With anode ground polarity, connect the positive terminal of the battery to the cathode of the photodiode and the negative terminal of the battery to pin 2. With cathode ground polarity, connect the negative terminal of the battery to the anode of the photodiode and the positive terminal of the battery to pin 4.

Warning! Connecting the battery with the wrong polarity may destroy the photodiode.

1.9.4 Analog control output for the laser current

An analog voltage proportional to the laser current (I_{LD}) is available at the CTL OUT jack (R2). The voltage can be used to drive a recorder, oscilloscope, or an A/D converter card. When the laser polarity is set to CG (cathode ground), the output is 0 to +10 Vdc. When the polarity is set to AG (anode ground) the output is 0 to –10 Vdc.

The barrel of the CTL OUT connector is grounded. Devices connected to this output should have an input resistance ≥10 kΩ.

When connecting a load, avoid ground loops.

Chapter 2 Operating Instructions

2.1 Setting the Current Limit (I_{LIM})

Before operating a diode laser always set the limit for the injection current, using the following procedure, to protect the diode laser against destruction by operating errors.

1. Switch on the unit with the LINE switch (L11). If the unit had already been switched on, switch off the laser current with the ON switch (L9).
2. Select the parameter ILIM using the UP and DOWN buttons (L18 and L19). Use a screwdriver to set the potentiometer LIM I (L12) at the desired current.

Note

NOTE: The current limit can be displayed at any time by selecting the parameter ILIM.

If the laser current reaches the set current limit ILIM during operation, the LIM LED (L7) lights up and a short warning beep is sounded.

The current limit can also be adjusted when the output laser current switched on; however, avoid an adjustment when the LIM LED is lit.

2.2 Selecting the Diode Laser Polarity

With the 06 DLD 3xx diode laser driver, all possible polarities of the diode laser and the monitor diode can be used. The diode laser will always be powered with respect to ground. Compared to a floating driver stage this operation mode provides greater security for the diode laser as well as higher laser current stability and lower noise.

Prior to turning on the laser current, the correct polarity of the diode laser must be selected by switching off the diode laser current (L9) and selecting the desired polarity with the LD AG/CG switch (R6). The selected polarity is then indicated by the AG or CG LED (L1 or L2). For safety reasons, the LD AG/CG switch has a mid position. In this position, neither the AG nor the CG LED is lit, and the laser current cannot be switched on.

Note

NOTE: For diode lasers with a built-in monitor diode, the common pin of the diode laser and the photodiode is the ground pin.

If the diode laser is connected correctly but the selected polarity of the diode laser is incorrect, the diode laser current cannot be switched on. If the position of the LD AG/CG switch is changed while the laser current is switched on, the diode laser current will be switched off automatically.

Note

NOTE: For safety reasons, select the polarity for the laser diode only when the laser diode current (L9) is switched off.

2.3 Constant Current Mode (CONST I)

Use the following procedure to operate the 06 DLD 3xx driver in constant current mode.

1. Switch on the 06 DLD 3xx.
2. Select a suitable current limit I_{LIM}.
3. Select the appropriate laser polarity.
4. Connect the diode laser.
5. Select the display I_{LD} with the UP and DOWN buttons (L18 and L19).
6. Turn the adjust knob (L10) completely counterclockwise.
7. Select the constant current mode by pressing the I button (L23).
8. Switch on the output with the ON switch (L9). The ON LED (L8) will light, the output will be activated and the current will slowly rise (over ~1 second) to the value set with the adjust knob.

NOTE: The current output can be switched on only after the LD OUTPUT connector (R5) has been connected correctly.

The display now shows the injection current I_{LD}. The adjust knob (L10) can be used to set the laser current anywhere between 0 mA and the selected current limit I_{LIM}. If the injection current (I_{LD}) reaches the set current limit (I_{LIM}) during operation, the LIM LED (L7) lights, a short warning beep is sounded, and the laser current is limited to the value of the current limit.

If the LIM LED lights up, noise and ripple no longer correspond to the specifications for normal operation.

If the connection to the diode laser is interrupted during operation, the diode laser current is switched off automatically, the ON LED (L8) extinguishes, the OPEN LED (L6) lights up, and a short warning beep is sounded.

If the output is switched on while the interlock is closed and there is no diode laser connected, the ON LED (L8) lights up and the output is switched on. Immediately afterwards, the 06 DLD 3xx driver recognizes that the diode laser is missing and switches the output off; the ON LED extinguishes and the OPEN LED (L6) lights up. Pressing the ON switch (L9) extinguishes the OPEN LED. Pressing the ON switch again turns on the output.

If a photodiode is connected to the diode laser, the display can show the photodiode current I_{PD} or the optical power P_{LD} by pressing the UP and DOWN buttons (L18 and L19).

The laser current can be modulated via the MOD IN connector (R1). This is discussed in detail later in this chapter.

2.4 Constant Power Mode (CONST P)

If a photodiode is connected, the diode laser can be operated in constant power mode using the following procedure:

1. Start operating the 06 DLD 3xx in constant current mode.
2. Using the UP and DOWN buttons (L18 and L19), set the display to I_{PD} and observe the current from the photodiode. For stable power in constant power mode, the photodiode current must be at least 5 μA.

NOTE: If the photodiode current (I_{PD}) is negative, the polarity of the photodiode must be reversed.

3. Switch off the laser current by pressing the ON switch (L9).
4. Press the MODE button P (L22) to select the constant power (CONST P) mode.
5. Set the adjust knob (L10) completely counterclockwise.
6. Switch on the laser current by pressing ON again. The ON LED (L8) will light. The current will slowly increase, over approximately 1 second, to the value set with the adjust knob.
7. By using the adjust knob, the photodiode current, and thus the optical power of the laser diode, can be increased until the laser current (I_{LD}) reaches the selected current limit I_{LM}.

If the desired photodiode current I_{PD} cannot be reached with the adjust knob, the range of the adjust knob can be changed by adjusting the PD RANGE potentiometer (L24).

If a photodiode is not connected or the polarity of the photodiode is incorrect, the laser current increases to the set current limit I_{LIM} as soon as the output is switched on. Likewise, if the photodiode current is interrupted in constant power mode, the laser current increases to the set current limit. At the current limit, the output power is no longer regulated, and output ripple and noise will exceed the product specifications.

If the connection to the diode laser is interrupted during operation, or if no diode laser is present, the output is switched off automatically. The ON LED (L8) extinguishes, the OPEN LED (L6) lights up, and a short warning beep is sounded. Pressing the ON button (L9) extinguishes the OPEN LED. Once the fault has been corrected, press the ON button again to switch on the laser current.

The laser current can be modulated via the MOD IN (R1) connector.

2.4.1 Changing the I_{PD} Setting Range

Set the operating point in constant power mode, using the following procedure. The full scale of the adjust knob (L10) can be set from 600 μA to 2 mA by adjusting the PD RANGE potentiometer (L24).

1. Turn the PD RANGE potentiometer (L24) completely counterclockwise (i.e., full scale = 600 μA).
2. Turn the adjust knob (L10) completely counterclockwise.
3. Select constant power mode (CONST P), connect the laser diode and the photodiode, and switch on the laser current.
4. Set the desired photodiode current with the adjust knob.
5. If, by turning the adjust knob fully clockwise, the desired photodiode current I_{PD} cannot be reached, turn the PD RANGE potentiometer clockwise until the desired setting range is reached.

NOTE: In the constant power mode, changing the setting of the PD RANGE potentiometer (L24) changes the set value. In the constant current mode, the PD RANGE potentiometer does not function.

2.5 Calibrating the Optical Power Display

In addition to displaying the photodiode current (I_{PD}), the actual output power of the diode laser can be displayed. To accomplish this, the driver display must be calibrated using the following procedure:

1. Select constant current mode (CONST I).
2. Set the laser current (I_{LD}) or the photodiode current (I_{PD}) to a value at which the optical output power of the laser diode is known. The power can be obtained from the diode laser data sheet, or, preferably, by measuring the diode laser output with an external optical power meter.
3. Using the UP and DOWN buttons (L18 and L19), select the P_{LD} display.
4. Adjust the CAL PD potentiometer (L13) until the display value matches the actual optical power.

2.6 Anolog Modulation of the Diode Laser

The output of the diode laser can be modulated in either the constant current (CONST I) or the constant power (CONST P) mode by applying an analog voltage to the MOD IN connector (R1) on the rear panel of the driver. The maximum allowed modulation voltage is ± 10 V, and the input impedance of the MOD IN connector is >10 kΩ.

The output of the laser in constant current and constant power is controlled, respectively, by the laser current, I_{LD}, or the photodiode current I_{PD}. These are calculated by the following formulas:

$$I_{LD} = I_{LD\ SET} + I_{MAX} \times V_{MOD} / 10\ V$$

and

$$I_{PD} = I_{PD\ SET} + 0.2\ mA \times V_{MOD}$$

where $I_{LD\ SET}$ or $I_{PD\ SET}$ are the values set by the adjust knob (L10), I_{MAX} is the maximum output current of the driver, and V_{MOD} is the voltage at the MOD IN connector (R1).

To modulate the laser output, use the following procedure:

1. Start operation in constant current or constant power and adjust the desired set value with the adjust knob (L10).
2. Connect the modulation source to the MOD IN connector (R1) on the rear panel of the driver. Avoid ground loops when connecting the modulation source.
3. The actual diode laser current I_{LD} can be monitored at the CTL OUT connector (R2) on the rear panel of the driver.

If the injection current I_{LD} reaches the set current limit I_{LIM}, the LIM LED (L7) lights up, a short warning beep sounds, the laser current is limited to I_{LIM}, and ripple and noise may no longer meet specifications.

Chapter 3 Remote Control

06 DLD 3xx-series drivers do not include a standard computer interface. Simple semiautomatic systems can be created, however, by coupling the analog modulation capability with the interlock system.

After the laser has been turned on, a relay contact or an open-collector transistor inserted in the interlock line can be used to switch the unit off at any time. It is not possible however to turn the laser current on remotely.

The current can be set remotely via a D/A converter using the MOD IN function. If the adjust knob (L10) is set fully counterclockwise ($I_{PD\ SET} = 0$), the laser current can be varied from 0 to I_{LIM} by applying a 0 to +10 Vdc signal to the MOD IN connector (R1). Inversely, by turning the adjust knob fully clockwise ($I_{PD\ SET} = I_{LIM}$), a 0 to –10 Vdc signal at the MOD IN connector varies the laser current from I_{LIM} to 0. The input resistance of the MOD IN connector is >10 kΩ.

By connecting an A/D converter to the output CTL OUT connector (R2), the laser current can be easily be monitored. The output voltage is 0 to +10 Vdc with a grounded cathode and 0 to –10 V with a grounded anode. Load resistance should be >10 kΩ.

NOTE: All operating elements of the 06 DLD 3xx are active at any time. For automatic tests make sure that the manual settings are not changed during operation.

Chapter 4 Maintenance

4.1 Line Voltage

The 06 DLD 3xx diode laser driver operates at fixed line voltages: 90–115 Vac, 104–132 Vac, or 207–264 Vac. Prior to starting operation, make sure that the line voltage specified on the information label agrees with your local supply. If it does not, a qualified service person is required to change the operating line voltage. Contact Melles Griot for assistance.

4.2 Replacing the Line Fuse

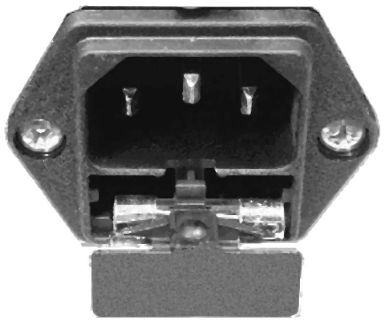
If the line fuse has opened as a result of line distortions, incorrect line voltage, or other causes, it can be easily replaced from the rear without opening the unit using the following procedure:

! Warning

Warning! To avoid risk of fire, use only the appropriate fuse for the corresponding line voltage.

1. Turn off the 06 DLD 3xx and disconnect the line cable.
2. Open the fuse drawer in the line connector (R9) with a screwdriver.
3. Replace the defective fuse (one spare fuse is included in the fuse holder) and close the drawer.

Figure 7: Changing the line fuse



The fuse ratings and part numbers are shown in the tables below.

06 DLD 301

100 V	250 mA, Slow, 250V	T0.25A250V
115 V	250 mA, Slow, 250V	T0.25A250V
230 V	160 mA, Slow, 250V	T0.16A250V

06 DLD 302/303

100 V	500 mA, Slow, 250V	T0.5A250V
115 V	500 mA, Slow, 250V	T0.5A250V
230 V	250 mA, Slow, 250V	T0.25A250V

Note: All fuses are to be IEC 60127-2/III.

4.3 General Care

Protect the 06 DLD 3xx diode laser driver from adverse weather conditions. The 06 DLD 3xx is not water resistant.

Do not store or leave the 06 DLD 3xx where the LCD display will be exposed to direct sunlight for long periods of time.

Attention! To avoid damage to the 06 DLD 3xx diode laser driver, do not expose it to spray, liquids, or solvents!

4.4 Cleaning

The unit and the LCD display can be cleaned with a cloth dampened with water or a mild, 75%, isopropyl alcohol solution.

4.5 Repair

The 06 DLD 3xx diode laser driver does not contain any user-repairable or user-replaceable modules. It must be returned to Melles Griot for service.

To guarantee the factory specifications over a long period, it is recommended that the instrument be calibrated by Melles Griot every two years.

4.6 Troubleshooting

If your 06 DLD 3xx system malfunctions, check the items in the table below.

Fault	Probable Cause	Remedy
Module does not work at all (no display)	Unit unplugged	Connect to line power, making sure that voltage is correct
	Unit not turned on	Press LINE switch (L11)
	Line fuse open	Replace line fuse
No laser current	Interlock open or interlock impedance too high	Short interlock with connection that is <430 Ω
	Laser current not turned on	Press ON button (L9)
	Current limit I_{LIM} set to 0	Increase I_{LIM} by turning the LIM I potentiometer (L12) clockwise
	Laser diode not installed or improperly installed	Correct laser diode installation
	Incorrect laser diode polarity	Change laser diode polarity or change polarity using the LD AG/CG switch (R6)
	Photodiode connected improperly	Check photodiode connection, bias, and polarity
Cannot get expected current and/or power in CONST P mode	I_{LIM} set too low	Increase I_{LIM} by turning LIM I potentiometer (L12) clockwise
	Adjust knob control range set too low	Increase adjust knob range by turning PD RANGE potentiometer (L24) clockwise

Chapter 5 Listings

5.1 List of Acronyms

The following acronyms are used in this manual.

ac	Alternating Current
A/D	Analog to Digital Converter
AG	Anode Ground
CC	Constant Current mode
CG	Cathode Ground
CP	Constant Power mode
dc	Direct Current
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
PD	Photodiode
TEC	Thermoelectric Cooler (Peltier element)
RMA	Return Material Authorization

5.2 List of Figures

Figure 1	Operating and display elements on the front panel
Figure 2	Operating elements on the rear panel
Figure 3	Pin assignments for the LD OUTPUT connector
Figure 4	Connecting the interlock (with and without monitoring LED)
Figure 5	Connecting the diode laser and the photodiode
Figure 6	Biasing schemes
Figure 7	Changing the line fuse

5.3 Certifications and Compliances

Category	Standards or description	
EC Declaration of Conformity - EMC	Meets intent of Directive 89/336/EEC for Electromagnetic compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European communities:	
	EN 61326	Requirements for Class A electrical equipment for measurement, control, and laboratory use, including Class A Radiated and Conducted Emissions [1,2,3] and Immunity.[1,2,3,4]
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance criterion C)
	IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance criterion B)[5]
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance criterion C)
	IEC 61000-4-5	Power Line Surge Immunity (Performance criterion C)
	IEC 61000-4-6	Conducted RF Immunity (Performance criterion B)
	IEC 61000-4-11	Voltage Dips and Interruptions Immunity (Performance criterion C)
	EN 61000-3-2	ac Power Line Harmonic Emissions
Australia/ New Zealand Declaration of Conformity - EMC	Complies with the Radiocommunications Act and demonstrated per EMC Emission Standard.[1,2,3]	
	AS/NZS 2064	Industrial, Scientific, and Medical Equipment 1992
FCC/EMC Compliance	Emissions comply with the Class A limits of FCC Code of Federal Regulations 47, Part 15, Subpart B.[1,2,3]	
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC, amended by 93/68/EEC.	
	EN 61010-1/A2:1995	Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing	UL3111-1	Standard for electrical measuring and test equipment.
	ANSI/ISA S82.01:1994	Safety standard for electrical and electronic test, measuring, controlling, and related equipment.
Canadian Certification	CAN/CSA C22.2 No. 1010.1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC61010-1/A2:1995	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 61010-1, Annex H) - grounded product	

[1] Compliance demonstrated using high-quality shielded interface cables.
[2] Compliance demonstrated with 13 DLH 301 cable installed at the LD Output port.
[3] Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.
[4] Minimum Immunity Test requirement.
[5] MOD IN port capped at IEC 61000-4-3 test.

5.4 Addresses

North America

Melles Griot Photonics Components Group
2051 Palomar Airport Road, 200
Carlsbad, CA 92011
Tel. 800-835-2626, 760-268-5131
Fax. 760-804-0049
E-mail: techsupport@catalog.mellesgriot.com
Internet: http://www.mellesgriot.com

Europe

Melles Griot BV.
Aalsbergen 2 6942 SE Didam
6900 AG Zevenaar
The Netherlands

Tel.: +31 316 - 333 041
Fax: +31 316 – 528 187
Email: info.holland@catalog.mellesgriot.com
Internet: http://www.mellesgriot.com

Asia

Melles Griot KK.
Pine Building, 3F
3-11-2 Shibuya, Shibuya-Ku,
Tokyo 150-0002, Japan

Tel.: +81 3-3407-3614
Fax: +81 3-3486-0923
Email: sales@mgkk.com
Internet: http://www.mgkk.com