



User Manual

LDP-CWL 06-20

LDP-CWL 12-20

- Preliminary Manual -



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LDP-CWL 06-20 / LDP-CWL 12-20

Rev.2101

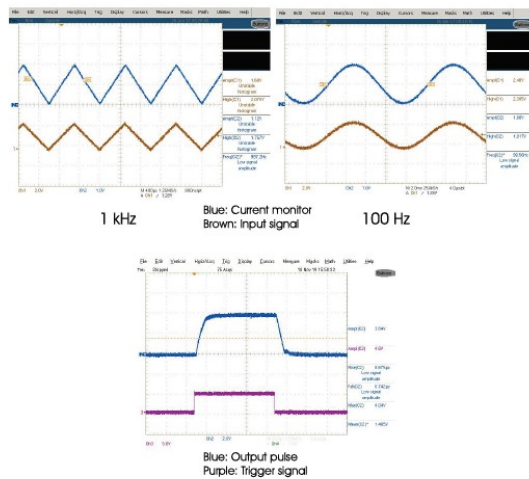
Laser diode driver with high performance and low noise



- Output current: 0 .. 6 A / 0 .. 12 A
- Compliance voltage: 0 .. 20 V
- Coverage of CW range
- Very low current ripple < 20 mA
- Analog modulation up to 230 kHz
- Load protection included
- High efficient combination of switch mode and linear regulator

Technical Data*

Output current	0 .. 6 A ¹ , 0 .. 12 A ²
Max. compliance voltage	20 V ^{1,2}
Current noise	< 20 mA ; < 0.77 %
Current overshoot	< 1 %
Analog modulation	260 kHz @ 3 A ^{1,2} 140 kHz @ 12 A ²
Current settling time (full-scale)	< 4,8 μs ^{1,2}
Manual mode (for pulses)	
Current setting input scale	0 .. 4.8 V ² ; 0 .. 2.4 V ¹ 0.4 V/A ^{1,2}
Current monitor/output scale	3 A/V ^{1,2}
Trigger	Analog
Supply voltage	15 .. 48 V min. 10 V above compliance voltage
Power dissipation (cw)	
CW mode	Max. typ. 20.4 W
Modulation mode	Max. typ. 65 W
Manual mode	Max. 108 W
Dimensions in mm	60.9 x 57.8 x 30
Weight	158 g



Product Description

The LDP-CWL is a fast driver for typical laser diodes. With its high output voltage range it is suitable for IR, blue laser diodes and all kinds of LED's.

The combination of a switching and linear regulator yields a high performance, high efficiency with excellent low noise behavior. The LDP-CWL has an exceptional linearity characteristic with a low output ripple. Depending on the operating point the LDP-CWL generates a low drop-out independent of laser diode load.

- Innovative current regulation concept actively prevents laser diode from overcurrent
- Very low current ripple
- Over temperature shutdown
- Shunt MOSFET short the output clamps in case of an error
- Protection of the laser diode against reverse currents
- High efficient combination of a switch mode and a linear regulator

Optional Accessories: LDP-C BOB

How to use this Manual



Remark: The LDP-CWL 06-20 and LDP-CWL 12-20 described in this manual are base plate cooled laser diode drivers. Improper cooling may cause an internal overtemperature shutdown (max. 80 °C).

Base plate cooling: Depending on the final application and operation mode, this unit may stay non-cooled or must be assembled onto a heat sink. Please refer to section "Working Areas and Power Dissipation" for more details about the thermal power losses during operation.

Before powering on your unit, read this manual thoroughly and make sure you understood everything!



Please pay attention to all safety warnings.

If you have any doubt or suggestion, please do not hesitate to contact us!

Dos and Don'ts



Keep the cable connection between power supply and laser diode driver and the connection between driver and laser diode as short as possible to minimize the stray inductance.

Please set the laser diode driver only in the scheduled working area and only while the power supply is turned off. Therefore please have a look at the section "Description of the Connectors of the LDP-CWL 06-20 / LDP-CWL 12-20".

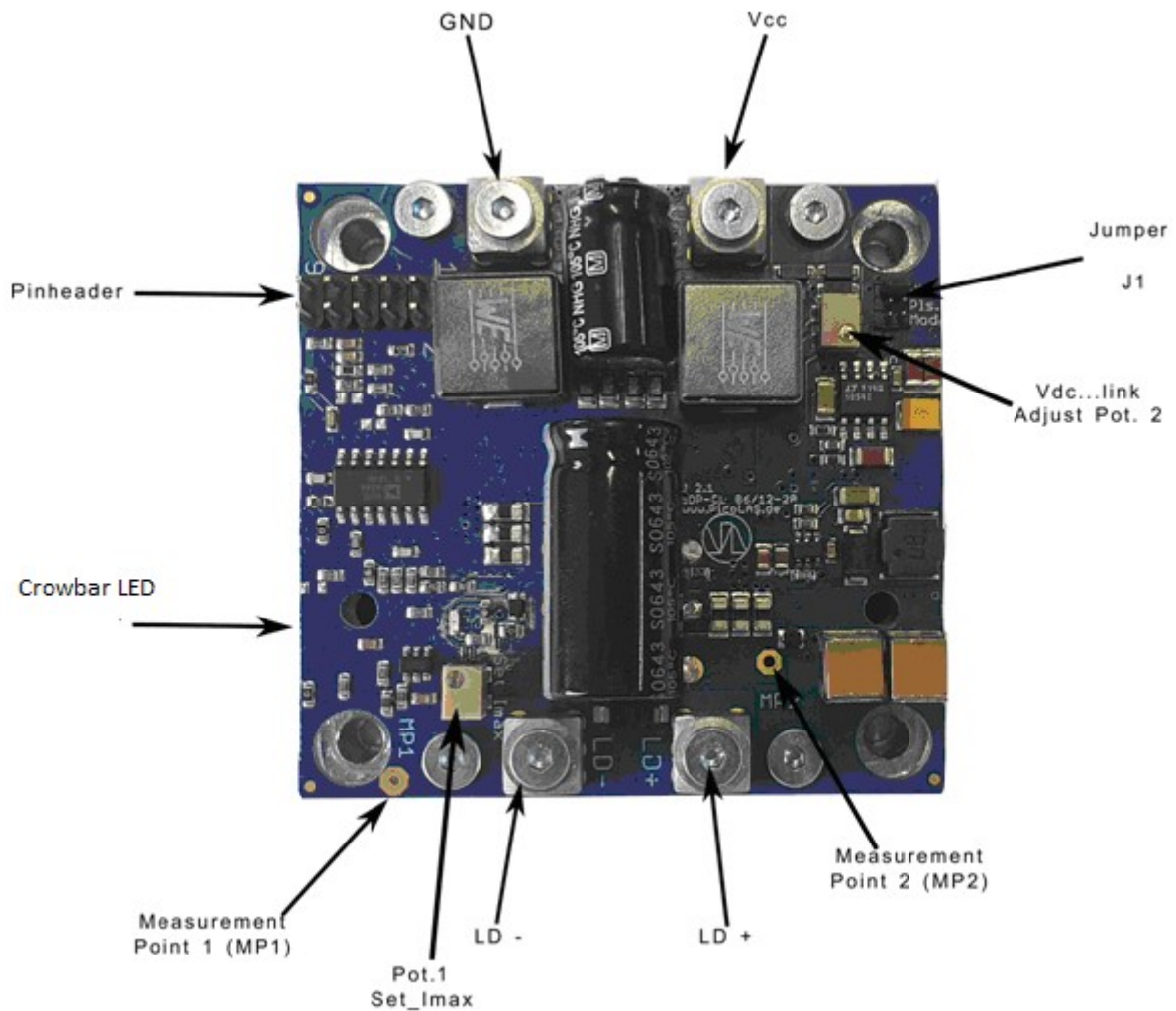
Never disconnect or connect the load while the driver is operational, as it destroys the driver and/or the connected load. Make sure that the control ground is connected to the supply ground. Any unexpected current flow through the control board may damage the driver.

Mount the driver on an appropriate heat sink.



Please be aware that there might be hot surfaces, be careful not to touch them!

How to get started



Picture 1: LDP-CWL driver with connectors, jumper and measurement points



The basic settings such as output current limit setting for the crowbar can be adjusted by the Potentiometer 1. The actual adjusted maximum output current limit can be measured at MP1 (measurement point 1).



An additional waveform generator might be needed which has to be connected to the input terminal. There is no AWG (arbitrary waveform generator) included within the driver!



GND and LD- are internally directly connected!

Step	What to do	Check
1	Connect a dummy diode between LD+ and LD-. Alternatively make a short circuit there.	Refer to section "Test Load". Range of compliance voltage 0 V .. 20 V.
2	Set the working point of the LDP-CWL to modulation mode (Mod.).*	There are three different working points: CW mode, modulation mode and manual mode.* Refer to the section "Description of the Connectors of the LDP-CWL 06-20 / LDP-CWL 12-20"
3	Connect GND, V _{cc} on power connector (power source yet disabled).	Range of V _{cc} 15 V .. 48 V. Minimum 10 V above compliance voltage. Required max. current is about 7 A - 13 A.
4	Connect waveform generator on input terminal (no pulse before power supply enabled, 0 V at current set pin (10. pin of the pin header).	Refer to all sections referencing input (connector #2).
5	Enable the power source.	Crowbar LED is on (red)
6	Adjust max. current scaling of the crow-bar.	Use the Set_I _{max} potentiometer 1 (refer to the picture 1 above) for scaling of the crowbar. Scale: 3 A/V (example: 4 V at MP1 would limit the output current to 12 A).
7	Disable (reset) the crowbar by toggling the 7. pin of the pin header (set low and then high 7. pin; "Disable / reset crowbar").	Crowbar LED is off (no light)
8	Feed a signal on the input terminal (current set pin (10. pin). For example 1 kHz sine wave with 1 V amplitude and 0.5 V DC offset while	Make sure not to overload the laser diode or the driver. Range of input signal 0 V .. 4.8 V. (0.4 V/A)

	the LDP-CWL is in the "modulation mode".	
9	Monitoring of the output current.	On current monitor you can measure a signal comparable with the input signal. Use an oscilloscope with a 1 MEG ohm termination. Scale 3 A/V. (example: 4 V at current monitor read means 12 A at the output)
10	Disable the input signal and turn off the power source. Remove the test diode or bypass and assemble the final laser diode.	
11	Turn the power supply for the V_{cc} back on.	Range of V_{cc} 15 V .. 48 V. Minimum 10 V above compliance voltage.
12	Feed a signal to the input terminal.	Make sure not to overload the laser diode!

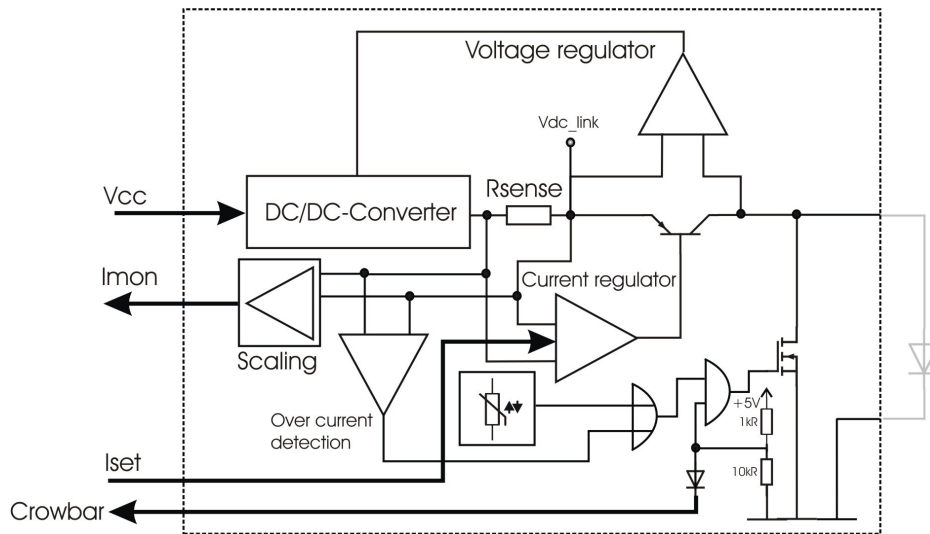


*Important: Please refer to the position of the jumper as in the Picture 4, the printing on the board may be different. However, it does not have any impact on the functionality of the driver itself.

Required Laser Diode Pin Out

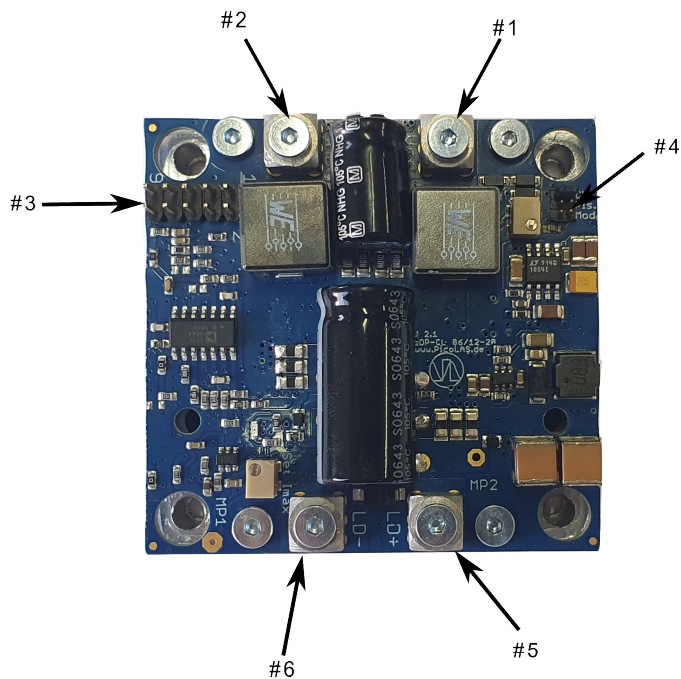
The LDP-CWL 06-20 / LDP-CWL 12-20 is designed for the direct connection of almost any kind of laser diode with a maximum compliance voltage of 20 V. The pitch of the LD- and LD+ connectors is 15.5 mm.

Laser Driver Block Diagram



Picture 2: Block diagram of the laser driver

Description of the Connectors of the LDP-CWL 06-20 / LDP-CWL 12-20



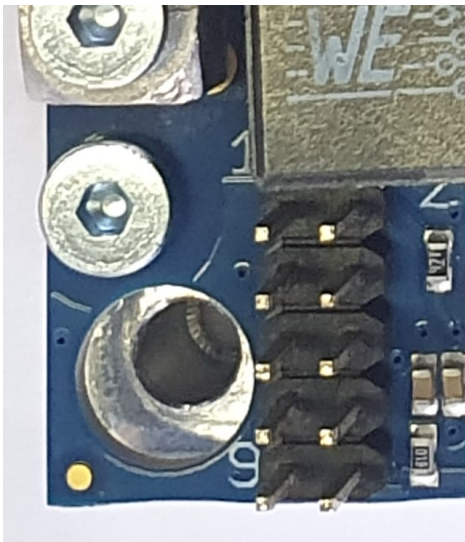
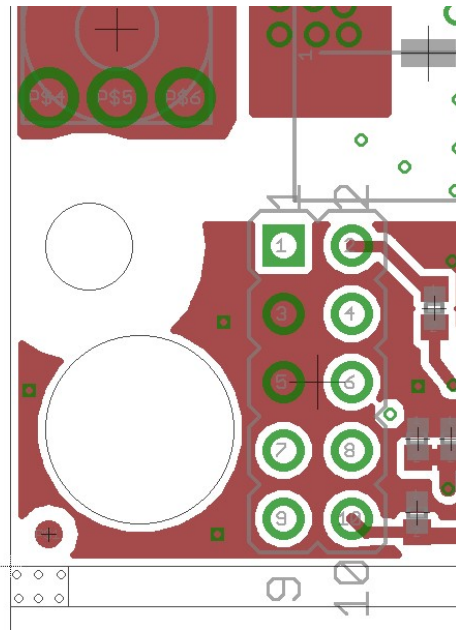
Picture 3: Connectors of the laser driver

Connector	Function	Description
1	Power connector: V_{CC}	Screw terminal M3
2	Power connector: GND for V_{CC} and input signal	Screw terminal M3
3	Pin header	See section "Connection Pin header"
4	Jumper J1	Set the working area. See section "Modes and Power Dissipation"
5	Laser diode connector (anode)	LD+
6	Laser diode connector (cathode)	LD-

#1 and #2. Power Supply absolute maximum Ratings

Pin	Allowed range	Best performance	Destroying limit
1 V_{CC} (laser supply)	15 V .. 48 V	10 V above compliance	49 V
2 (GND)	GND	GND	

#3. Connection Pin header (for LDP-CWL 12-20)



Pin number	Function
1	N.C.
2	+5 V
3	GND
4	V compliance (output voltage)
5	GND
6	N.C.
7	Disable / reset crowbar (connect to GND to disable/reset)
8	N.C.
9	Current monitor output (3 A/V, ± 5%) (example: 4 V at current monitor output corresponds to 12 A at the output)
10	Set output current (0.4 V/A) (example: 4.8 V reference voltage corresponds to 12 A at the output)

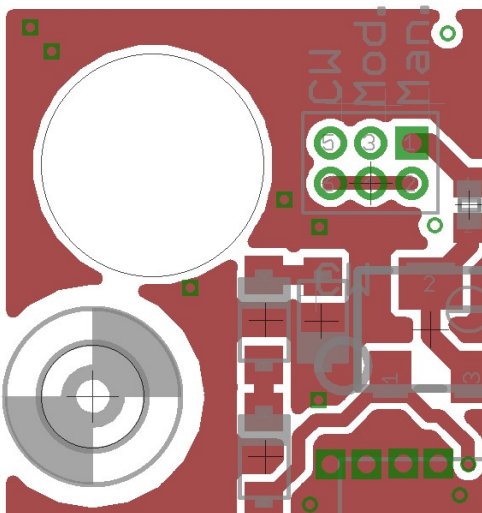
Set Output Current:

The analog current setpoint signal is provided via pin #10. The output current follows the input signal proportionally within the driver's limitations (bandwidth, max. current, rise time). The scaling of this pin is **0.4 V/A** (example: 4.8 V reference voltage corresponds to 12 A at the output).

Current Monitor Output:

The current monitor output has a scale of **3 A/V (± 5%)** (example: 4 V at current monitor output corresponds to 12 A at the output). To achieve the correct scaling this pin has to be terminated with a high termination such as an oscilloscope and 1 MEG Ohm input impedance. Due to the scaling amplifier and the quiescent current, current flows through the output from up to 150 mA, the current monitor output has an offset of approximately 50 mV.

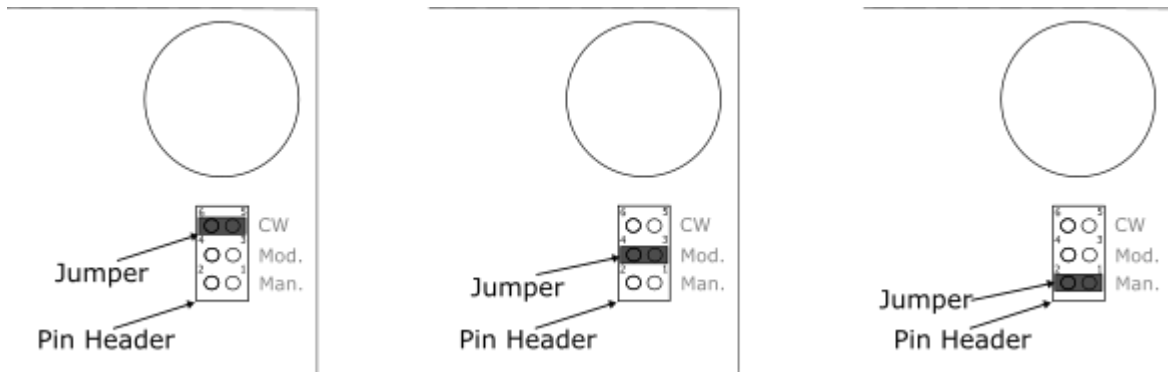
#4. Connection Jumper J1



Jumper connection	Working area of the LDP-CWL XX/20
Short circuit between pin 5 and 6	Continuous wave mode (CW)
Short circuit between pin 3 and 4	Modulation mode (Mod.)
Short circuit between pin 2 and 1	Manual mode (Man.)



Security Advice: Please jumper only the scheduled pins and while the power supply is turned off.



Picture 4: Jumper positions for different modes

With Jumper J1 it is possible to set the working area of the LDP-CWL. Please set the working area while the power supply and the input signal of the LDP-CWL are turned off. Furthermore, please only set the working area as represented in the upper pictures.

⚠ Important: Please refer to the position of the jumper as in the Picture 4, the printing on the board may be different. However, it does not have any impact on the functionality of the driver itself.

#5 and #6. Laser Diode Connection

Many elements and parasitic "stray" components may affect the performance of the LDP-CWL. The stray inductance of the load connected to the driver is very important. "Load" means not only the diode itself but also the packaging (bond wires!) and leads between the driver and the diode. However, PicoLAS has no influence on these parts. Thus, all measurements have been performed into a short instead of a laser diode.

Refer to the PicoLAS Application notes "Impedance of Diodes" and "LD-Connections" to get more information about parasitic elements and their effect on the pulse shape (<https://picolas.de/downloads/>).

Modes and Power Dissipation



Important: The names of the modes on the board may differ in earlier versions of this circuit. Please refer to this updated manual for the order and the names of the modes.

To cover many different working areas of the LDP-CWL, the driver has the possibility to change the internal working area for the most suitable operation. The LDP-CWL can be set in three different working areas continuous wave mode (CW), modulation mode (Mod.) and manual mode (Man.).

In every working area the driver achieves the best combination of a switching and a linear regulator. This technique allows high energy consumption, great linearity characteristics with a low output current ripple.



Mount the driver on an appropriate heat sink.

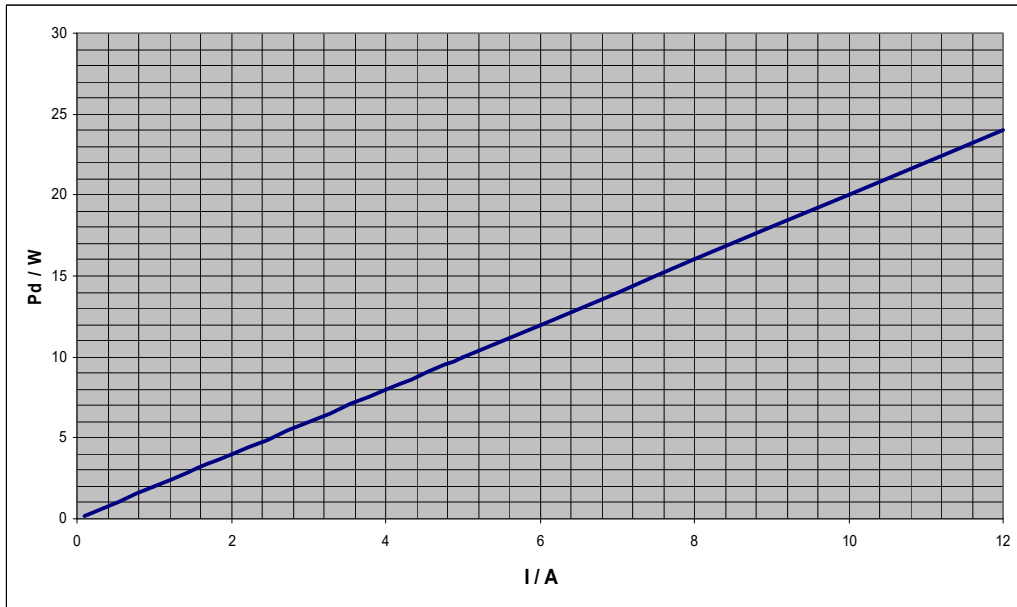


Please be aware that there might be hot surfaces, be careful not to touch them!

Modes

In the *continuous wave mode* (CW) it is possible to set the LDP-CWL for continuous signals with high efficiency. Independent of the load and according to the output current, the driver has linear power consumption.

The following graph shows the typical power consumption of the LDP-CWL against the output current.

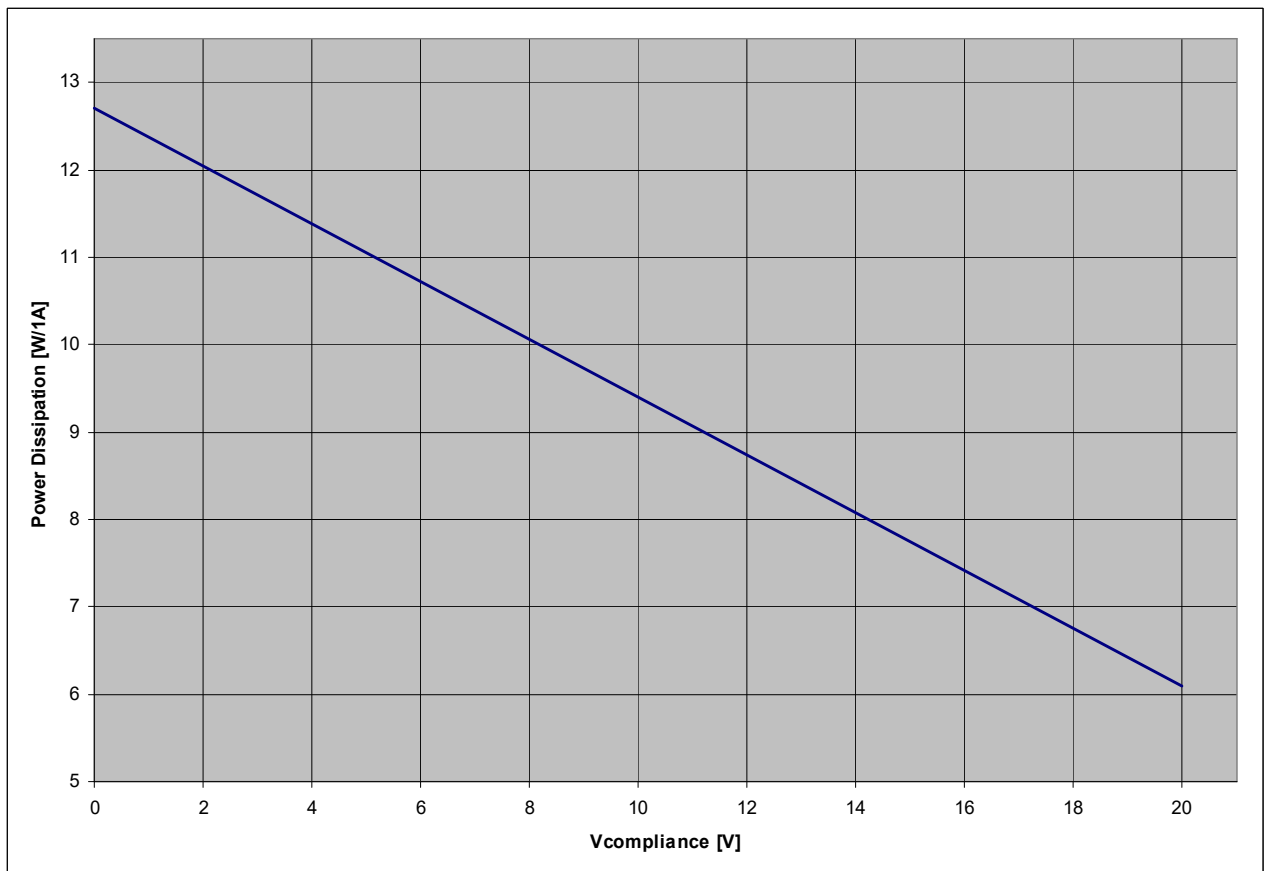


In the **modulation mode** (Mod.) the LDP-CWL can modulate any periodic signals (sine, triangular etc) according to its specifications e.g. bandwidth, linearity, output current. The LDP-CWL provides a step response with rise times more than 10 μ s at an output current of 12 A in modulation mode. To achieve a higher bandwidth and slew rate and to avoid distortion, please use the Manual Mode.



Picture 5: Blue: current monitor
Purple: output current set (pin #10 of pin header #3)

The graph below represents the power dissipation against the output current while the LDP-CWL is used with a continuous wave signal in the modulation mode.



To estimate the power consumption of your system, you have to read the power dissipation at the desired output current. Afterwards this value has to be multiplied with the duty cycle.

Example:

Rectangle wave with a duty cycle of 20 %

- ➔ Desired output current = 5 A
- ➔ Desired compliance voltage = 10 V (Resulting Pd from the graph is 8 W/1A)
- ➔ Power dissipation = 8 W/1 A * 5 A * 0.2 = 8 W

The **manual mode** (Man.) is appropriate for pulsed signals such square wave. In this mode, LDP-CWL 12-20 can achieve rise times less than 4.8 μ s at an output

current of 12 A and LDP-CWL 06-20 can achieve rise times less than 4.8 μs at an output current of 6 A.

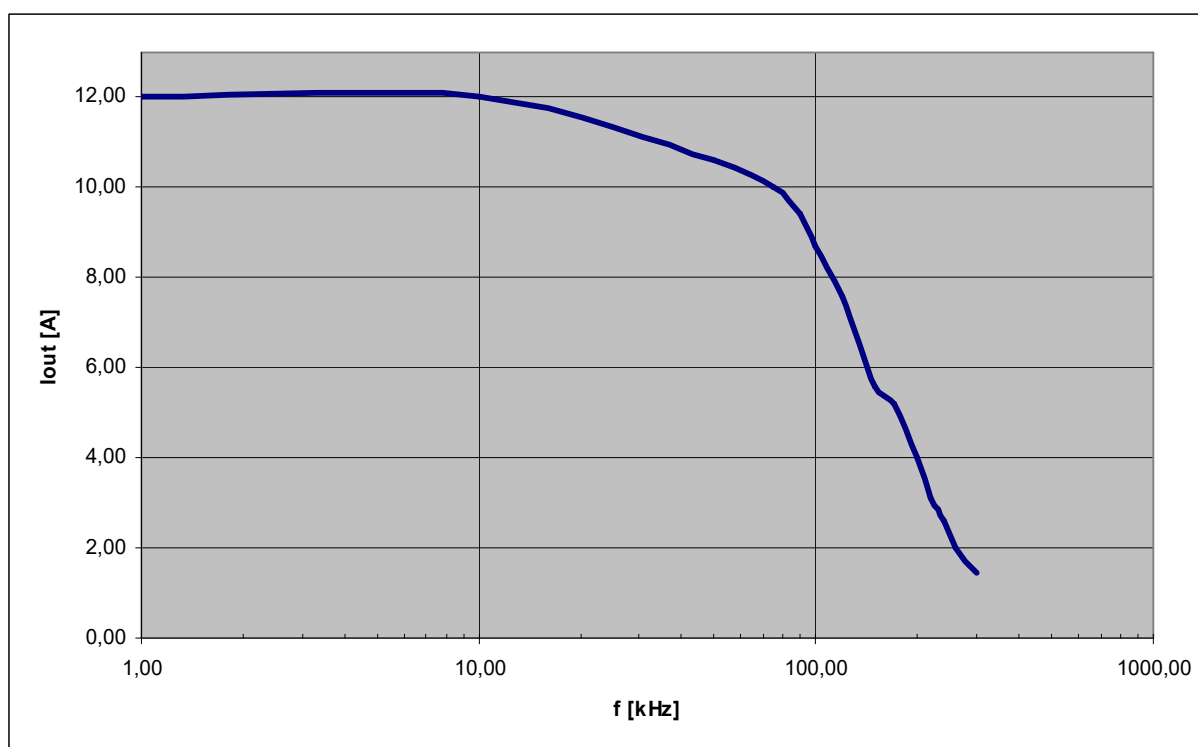
With the potentiometer 2 (adjust $V_{\text{dc_link}}$, measurement point 2; refer to section "How to get started"), the DC link voltage can be adjusted (refer to section "Laser Driver Block Diagram") to increase the collector emitter voltage of the transistor of the linear regulator, to achieve higher bandwidths for waveforms such as pulsed or rectangle waves.



DC link voltage has to be less than $V_{\text{cc}} - 10 \text{ V}$ and more than $5.5 \text{ V} + V_{\text{compliance}}$ to achieve higher bandwidths.

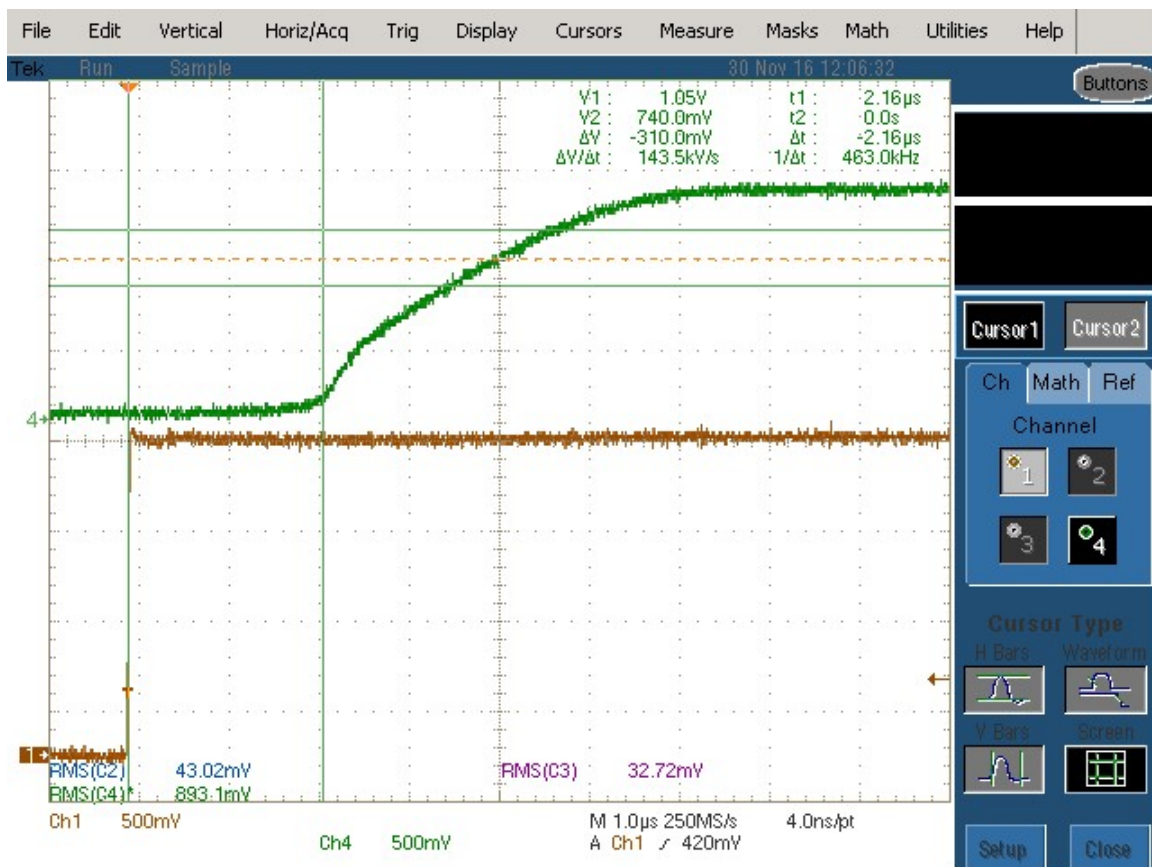
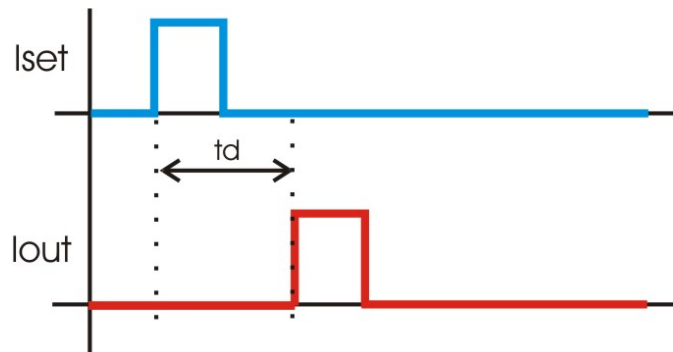
Frequency Response

The following graph demonstrates the 3dB bandwidth for increasing output current values of the LDP-CWL 12-20 in manual modus. The following measurement results are made on a dummy diode with a compliance voltage of 12 V.



Trigger Delay

The delay between the triggering signal and the load-current is typically $t_d = 2.2 \mu\text{s}$.



Picture 6: Trigger delay

Test Load

For the first test, an appropriate test load may be assembled instead of the laser diode. This test load can either be a short circuit or a dummy diode load. Please connect the test load only between anode and cathode (LD+ and LD-) and prevent contacts to any other parts of the circuit.

Power Supply

The power supply must be able to cover the output power plus the internal power losses (please see next section).

Crowbar

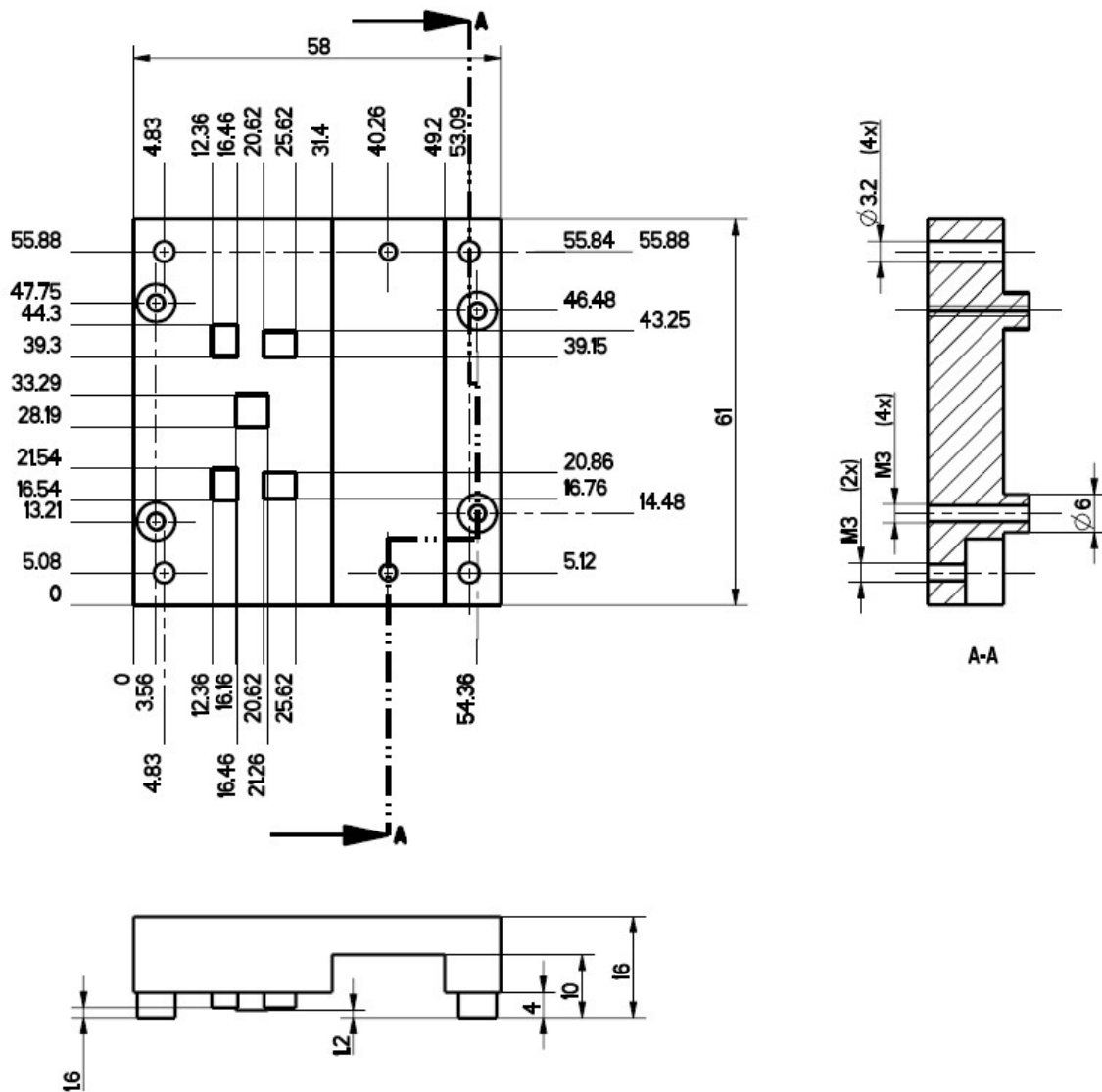
After supplying the LDP-CWL XX-20 with appropriate voltage source, the red LED of the crowbar will be on, indicating that the crowbar is active. At this point there can be no output current flowing. To activate the output current so that it can the output current set pin (10. pin of the pin header) crowbar has to be toggled (set low and then high) (7. pin of the pin header).

For inherent protection, the LDP-CWL automatically shuts down itself if an error occurs. Firstly **if temperature rises above 80 °C**, secondly **if no load is connected** and thirdly **if the output current is higher than the set current**. This condition is **latched**. To re-enable the LDP-CW the ENABLE pin must be toggled (set low and then high).

Current Limiter

The LDP-CWL XX-20 is equipped with a current limiter. This can be used to configure a maximum valid current set point which cannot be overstepped. To configure the maximum output current use the measuring point 1 (MP1) on the PCB (See Picture 1). The scaling of the current limiter is **3 A/V** and can be set by the potentiometer. If you want to disable the current limiter then set the voltage to 3 V. Watch out because you might damage or destroy your load.

Mechanical Dimensions



Picture 7: Mechanical dimensions

Absolute maximum Ratings (limits that can destroy the unit)

- V_{cc} limit: The input voltage is in the range of 15 V .. 48 V but at least 10 V above compliance voltage
- Output current: 6.0 A (LDP-CWL 06-20) / 12.0 A (LDP-CWL 12-20)
- Operating temperature range: 0 °C .. +55 °C
- Operating temperature range for best performance: +10 °C .. +35 °C
storage temperature range: -20 °C .. +70 °C