

HPLD-1000

HIGH POWER CONSTANT CURRENT LASER DIODE DRIVER



Key Features

- Wide input voltage range up to 48 Vdc
- Output Current up to 25 A
- Compliance voltage up to 40 V
- Efficiency up to 97%
- Low current ripple
- Triggering up to 3 kHz
- Analog modulation up to 30 kHz
- Overcurrent protection
- Reverse current protection
- Crowbar circuit protection
- External interlock function
- CAN interface
- Integrated heatsink
- Compact Size 70 mm × 56 mm × 34mm

Description

The HPLD-1000 is a compact non-isolated DC/DC switch mode power supply with constant current output. Driver produces high stability, low ripple current for powering laser diode modules. The output current value can be varied from 0 to 25 A. Driver can be controlled by CAN interface or external modulation signals.

Driver has three modes for use in various applications.

- Mode 1 – CW – is continuous current mode with parameters set by PC control software.
- Mode 2 – Trigger – allows to set current value by PC control software and to trigger output current by external TTL signal.
- Mode 3 – Analog – allows to modulate current by external modulation signal and to turn driver ON/OFF by external TTL trigger.

Protection features include an overcurrent protection, reverse current protection, crowbar clamp protection and over-temperature shutdown.

Powering

The driver requires a DC power supply. PSU's output characteristics must cover the driver output power and laser diode voltage. The power supply output voltage must be at least 15% higher than the laser diode voltage drop. We recommend to use a low voltage power supply (for example 12VDC) for powering low power laser diode with voltage drop $2 \times 10V$.

Cooling

The HPLD-1000 PCB is completed by heatsink for easy thermal management. The driver produces up to 42W of power losses. Thus the driver heatsink has to be mounted on a thermal conductive surface to ensure proper operation and prevent an over-temperature shutdown. If the conduction cooling is not enough cooling can be improved by adding a fan.

Software

We offer own PC control software to control the driver.

Operating modes

Driver has three operating modes, that allows use it as independent driver for powering single laser or use it in system of powering lasers with external control.

#	Mode	Description
1	CW	Driver is controlled by PC control software. Constant current value is set from control software. "ON/OFF" button starts / stops driver with soft start function, that allows rise and fall current within 10 mS for safe laser turning ON / turning OFF. See details on figure 1.
2	Trigger	Current value is sets by PC control software. External trigger starts and stops driver with 50 μ S rise / fall time. The frequency of external trigger can be from single pulse to 3 kHz. The mode is characterized by bias current 40mA between pulses. See trigger to current pulse delay details on figures 2.
3	Analog	Current is modulated by external analog (eg. sinusoidal) signal. Current wave form replicates external sinusoidal signal up to 10 kHz with full amplitude. Current modulation amplitude is reduced up to 30% for frequencies from 10 kHz to 30 kHz. It is not recommended to apply signal with rise / fall time less than 10 μ S. Accuracy of current amplitude setting is not more 20%. Use current sensing monitor for reading actual amplitude, frequency and form of laser current. Driver ON/OFF is done by PC control software.

Keep the connection between driver and laser diode as short as possible, not more than 200 mm, especially for modes 2, 3.

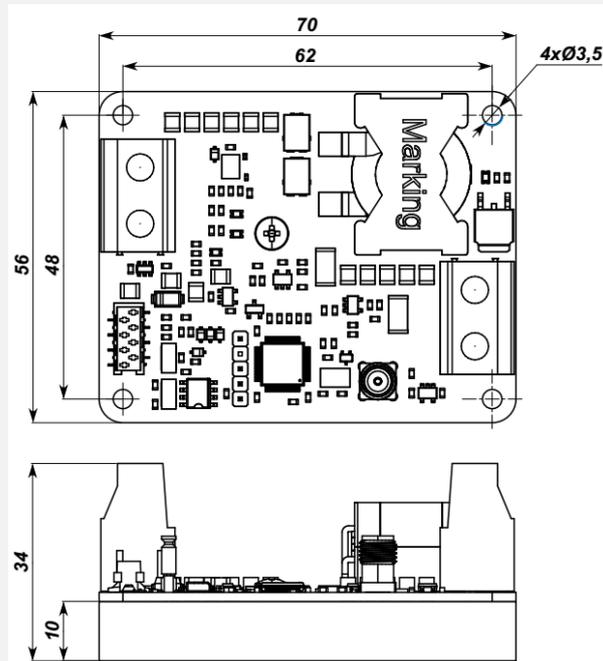
Specifications

Parameter	Min.	Typ.	Max.	Units
Parameter	Min.	Typ.	Max.	Units
INPUT				
Voltage	12	-	48	Vdc
Current	-	-	22	A
OUTPUT				
Power	-	-	1000	W
Compliance Voltage ¹⁾	2	-	40	V
Current range	0.0	-	25.0	A
Current ripple amplitude	-	40	60	mA
Current ripple frequency	-	425	-	kHz
Current set accuracy	-	-	1.5	%
Overcurrent value ²⁾	5	26	30	A
Soft start rise time ³⁾	-	-	11	ms
Soft start fall time ³⁾	-	-	16	ms
Rise/Fall time ⁴⁾	-	50	70	µs
Current setting monitor	-	50	-	mV/A
MODULATION				
Trigger input voltage	3.3	-	5	V
Trigger input impedance	-	500	-	Ω
Trigger pulse frequency	-	-	3	kHz
Trigger pulse width	150	-	-	µs
Trigger to current delay	-	-	20	µs
Analog input voltage	0	-	10	V
Analog input impedance	-	4	-	kΩ
Current setpoint	-	2.5	-	A/V
Analog input frequency ⁵⁾	-	-	30	kHz
POWER DISSIPATION				
Efficiency ⁶⁾	-	-	97	%
Maximum power losses	-	-	42	W

Parameter	Min.	Typ.	Max.	Units
TEMPERATURE				
Operating	+10	-	+40	°C
Storage	-20	-	+70	°C
Humidity, Non-Condensing	-	-	95	%
CONNECTIONS				
Power	2-pin Terminal Block (393900102 Molex)			
CAN interface	8-pin Ribbon Cable Connectors (7-188275-8 TE Connectivity)			
Interlock				
Trigger				
Modulation				
Current monitor	SMA (5-1814832-2 Molex)			
MECHANICAL				
Size	70 × 56 × 34 mm			
Weight, not more	200 g			

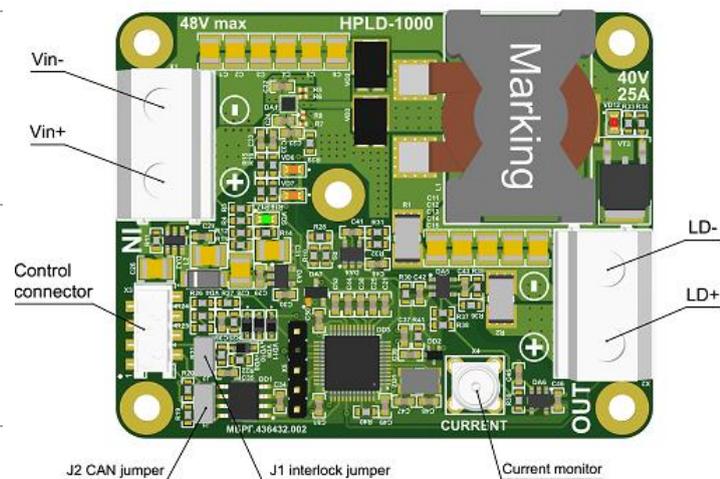
- 1) Output voltage cannot be more than $0.85 \cdot V_{in}$.
- 2) Default value is 26A. Can be programmed from 5 A to 30 A.
Overcurrent will cause immediately stop driver with crowbar protection.
- 3) For mode 1.
- 4) For mode 2, 3. Depends on wires length from driver to laser.
- 5) See details on figure 5.
- 6) Depends on input voltage, output voltage, output current. See details on figure 6.

Dimensions



Terminal functions

Terminal	Description	
Vin+	Connect to the positive and negative terminals of power supply. Note polarity. Use wires sizes AWG#13 or 2.5mm ² with length not more 1m.	
Vin-		
LD+	Connect to the laser diode anode (+) and cathode (-). Note polarity. Use wires sizes AWG#13 or 2.5mm ² with length not more 2m for mode 1 and not more 200mm for modes 2, 3.	
LD-		
Control Connector	1 CANH Connect to the CAN interface. Note polarity. Use onboard jumper J1 to connect one driver to CAN device. Delete all onboard jumper J1 except the last driver, if you connect several drivers to CAN device.	
	2 CANL	
	3 Interlock+	Connect to the external interlock circuit. Open: locked, Low: operational. Internally pulled up to 3.3V by 1 kΩ resistor. Use open collector or dry contact. Note polarity.
	4 Interlock-	Use onboard jumper J2 to imitate interlock function. Delete onboard jumper J2 to activate interlock function.
	5 Trigger+	Connect to the external pulse signal generator for modes 2, 3. Note polarity.
	6 Trigger-	
	7 Modulation+	Connect to external analog voltage or external sinusoidal signal generator for mode 3. Note polarity.
	8 Modulation-	
Current monitor	Connect to 50Ω oscillography input for current monitoring. 50mV correspond 1A. Use SMA connector.	



Typical Performance Characteristics

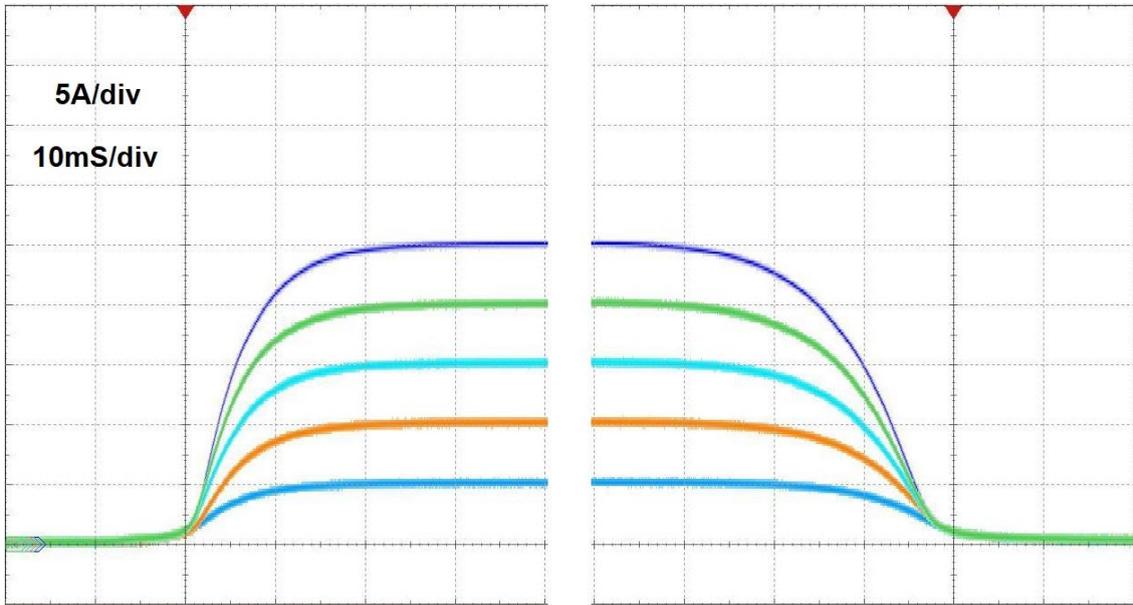


Figure 1. Typical current rise/fall time for Mode 1

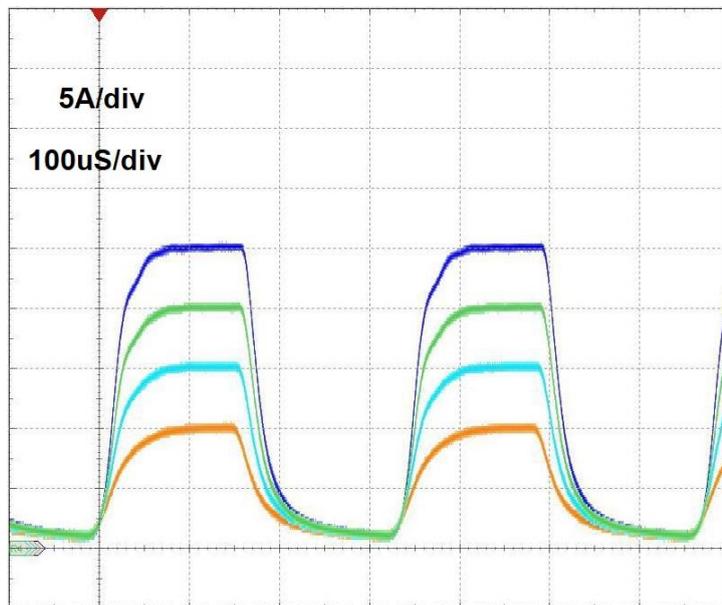


Figure 2. Typical current pulses fore Mode 2, triggering by $F = 3\text{kHz}$, $T_p = 150\mu\text{s}$

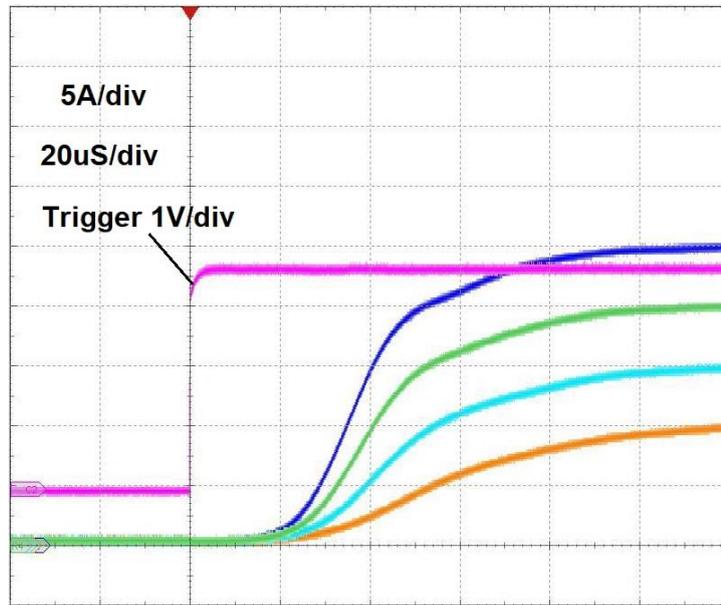


Figure 3. Typical trigger to current delay for Mode 2

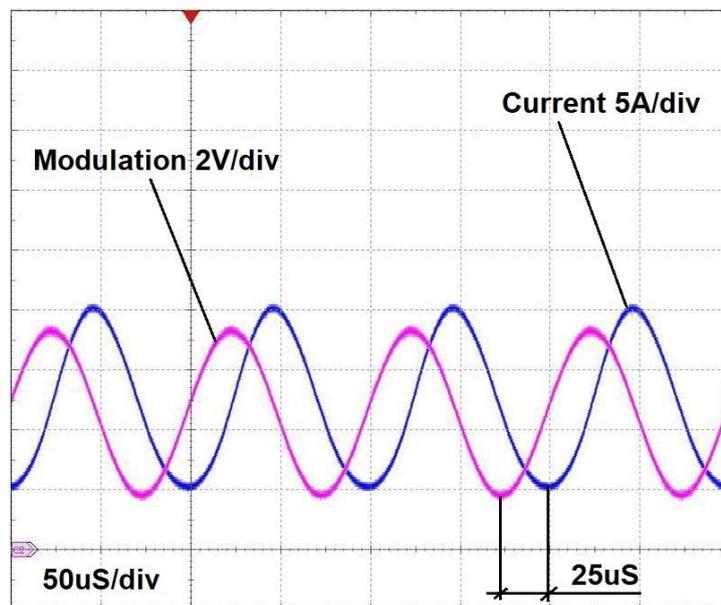


Figure 4. Typical current for Mode 3, analog modulation by sinusoidal 10kHz.

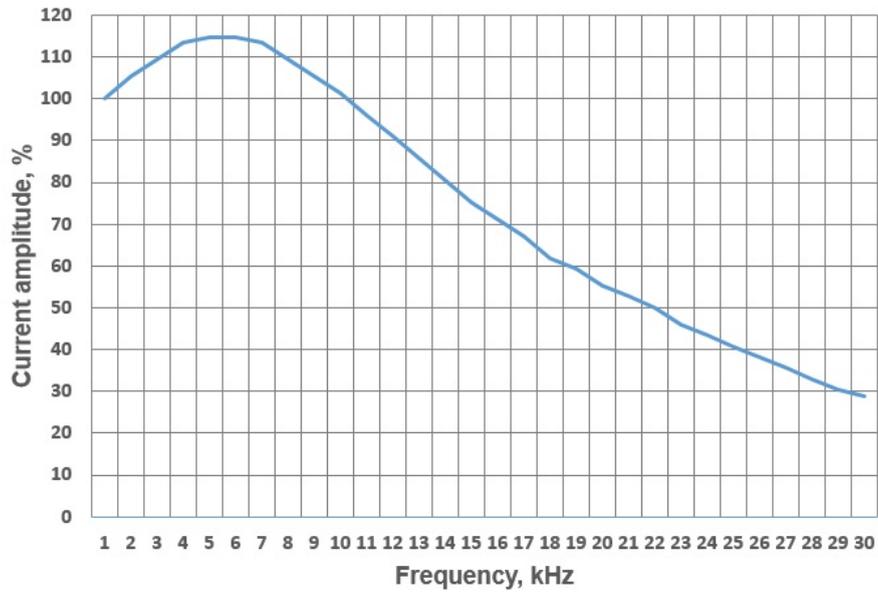


Figure 5. Current amplitude vs Frequency for Mode 3

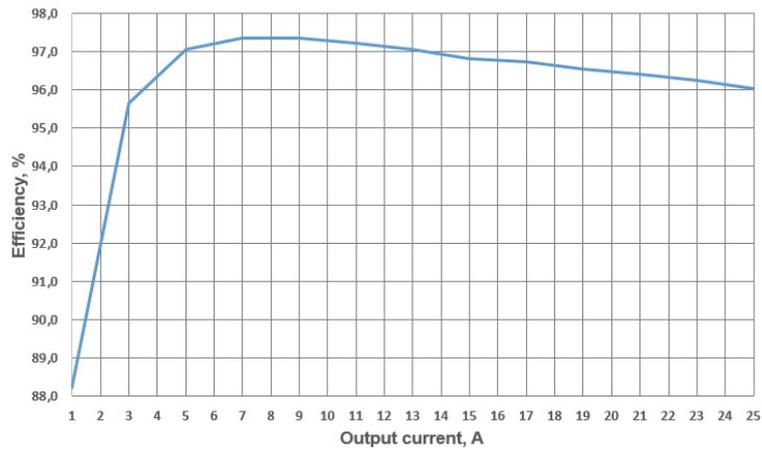


Figure 6. Efficiency vs. output current at Vin=48V, Vout=30V

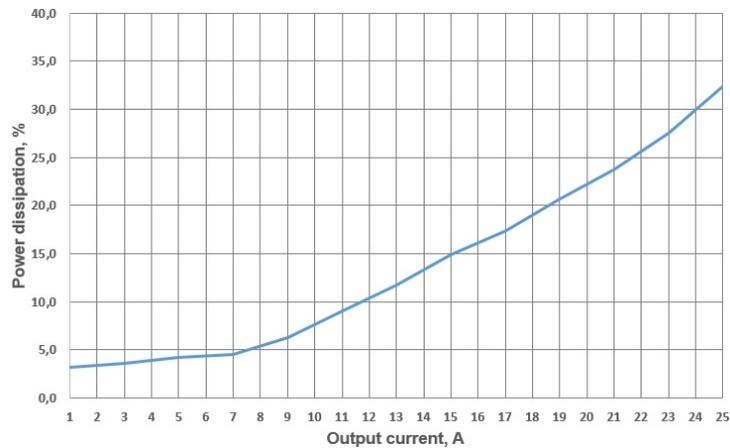


Figure 7. Power dissipation vs. output current at Vin=48V, Vout=30V

Control Center Driver Software

Connecting the driver

1. Connect the laser diode to the driver. Note polarity. Use wires sizes AWG#13 or 2.5mm² with length not more 2m for CW mode and not more 200mm for external modes.
2. Connect the driver to CAN network. Note polarity. Use onboard jumper J1 to connect one driver to CAN device. Delete all onboard jumper J1 except the last driver, if you connect several drivers to CAN device.
3. Connect to the positive and negative terminals of power supply. Note polarity.
Note: Output voltage cannot be more than 85% of supply voltage.
4. If there is the external interlock circuit the driver can be connected to it. Delete onboard jumper J2 to activate interlock function.
5. To operate in the External TTL mode, connect the driver to the TTL pulse signal generator. Note polarity.
6. To operate in the External Analog mode, connect the driver to external analog voltage or external sinusoidal signal generator. Note polarity.
7. To monitor the current in external modes, connect to 50Ω oscillography output, using the SMA connector.

Initial startup (setting CAN for the driver)

1. Connect the driver to the CAN hub. **Note:** Only this driver should be connected to the CAN hub.
2. Power the driver board according to its datasheet. Power the CAN hub according to its datasheet.
3. Connect the can hub to PC.
4. Run Id_control_center_vXXX.exe.
5. Click “Settings” to enter the program configuration menu (fig. 8).
6. Untick the “mini USB mode” box.
7. Press icon to refresh the list of COM ports and select the COM port the CAN hub is connected to from the drop down menu.
8. In the "channel 1" line, enter the value 250 in the CAN ID window (access to all modules connected to the network at the same time) and select the "enable" checkbox.
9. Click “Connect”. Click “Main” menu panel. The control panel corresponding to the type of CAN connected. The driver should appear in the first channel.
10. Click icon located in the control panel’s upper right corner to enter the driver setting mode. The driver setting mode allows entering the driver CAN ID and the maximum output current (fig. 9).

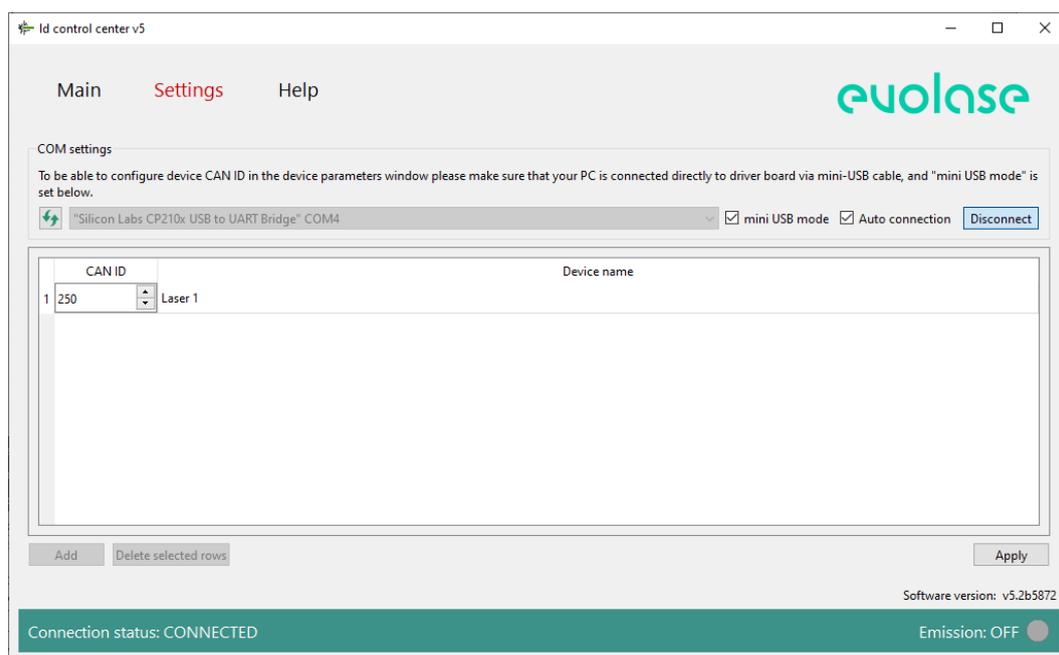


Figure 8: The system configuration menu

11. Enter the desirable CAN ID for the driver. Click “Write”, confirm your choice.
12. Reset the device. To do this, turn off the driver power, wait 10 seconds, turn on the power again.

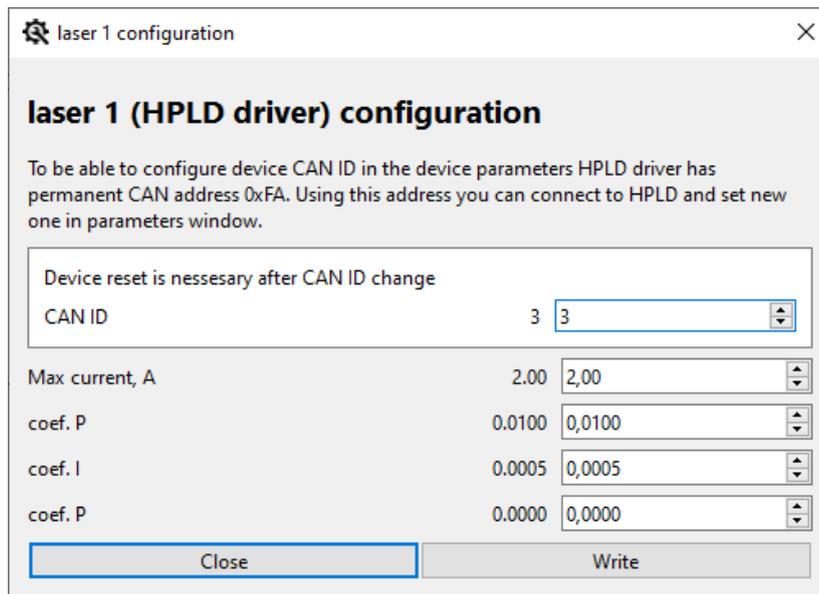


Figure 9: The laser diode setting menu

13. Click “Settings” to enter the program configuration menu.
14. In the "channel 1" line, enter the selected value in the CAN ID window.
15. Tick the “Auto connection” box to select the “Auto connection” mode; otherwise click “Connect”.
16. Click “Main” menu panel. Make sure that the driver appears in the first channel.
17. The driver is now configured and ready for operation in CAN network.

Laser diode setting and system configuration

The system configuration window is accessed by pressing “Settings” in the navigation bar. In this window (fig. 8) the user can set the number of channels, CAN network ID and the names for the connected drivers.

The user can access the laser diode settings menu by pressing the wrench icon in the expanded main control view. The wrench icon will open a new individual menu for each of the connected diodes, and the software applies the new settings only to that single diode. The user can specify a range of laser parameters. The available settings for HP drivers are shown in Figure 9.

The user can set CAN ID of the driver, maximum laser current and the coefficients of the PID controller of the TEC. The middle column shows the current value of the parameters. To change the parameter value, enter each parameter in the settings window or change by up and down arrows and click “Write” to apply the value.

Basic controls and operation

The main software window implements controls (fig. 10), control panel can be collapsed. The software supports up to 200 devices connected to a PC through a USB/CAN adapter. Each laser diode’s operating parameters can be entered into parameter window or changed by up and down arrows. The user needs to confirm the value by pressing Enter for changes to take effect.

Note: All settings are not available for all driver types. The software will show only the available controls based on the recognized driver type.

Selection of driver operation mode:

The high power driver can operate in three modes:

Mode CW – conventional CW operation mode. Current can be set with 0,1 A precision. Suitable regulation step can be defined in the corresponding “Stepsize” control window.

External TTL – TTL modulation mode. The output current is switch on from zero to the value set in “Drive current” window by an externally applied TTL signal (refer driver manual for TTL modulation pin of the interface connector).

External ANALOG – analog modulation mode. The output current is controlled within 0..25 A range by an externally applied analog modulation voltage within 0..10 V range (refer driver manual for analog modulation pin of the interface connector). The window “Drive current” shows average over time value of the output current.

To set the operating mode of the laser diode, select the required operating mode from the drop-down menu.

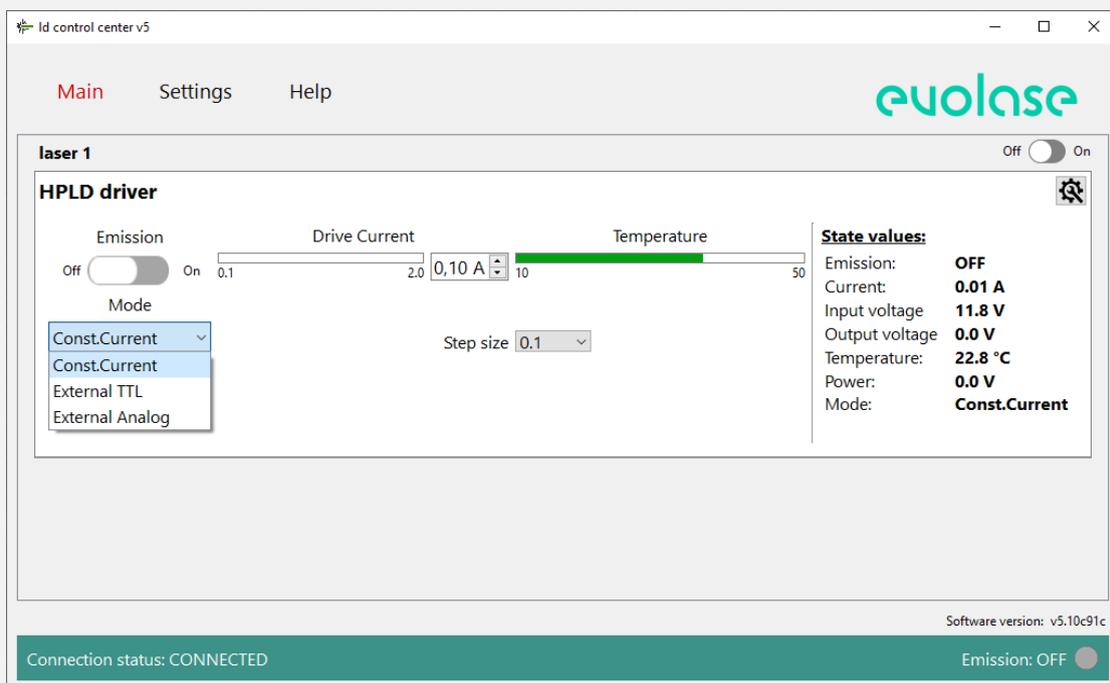


Figure 10: The main control menu.

Setting up operation parameters of laser diode:

In the HP driver, the user can only set the current of the laser diode. To set the laser diode current, enter the required current value in the current setting window and press “Enter” on PC keyboard. The “Stepsize” window sets the step of adjusting these parameters when using the up and down arrows. Green indicator bars show the actual set value relative to the minimum and maximum allowed. The user can change the allowed range in the driver settings menu (⚙️).

To turn on the laser diode emission, click the “Emission” switch. The switch will move to the “On” position and change the color to green, the indicator LASER LED will light up. To turn off the laser diode emission, click the “Power Status” switch. The switch will move to the “Off” position and change the color to grey, the indicator LASER LED will go off. The laser diode emission can be turned on and off even when the main control panel is collapsed.

The table “State values” on the right side of the main panel displays the current state of the driver.

The driver stores the settings in the onboard memory, and after reconnection, the software reads driver settings and displays them in the control panel. When trying to close the software with at least one laser running, a dialog window opens prompting the user to select whether to switch off the laser or to keep it running.

Possible malfunctions:

In cases of a break in the interlock circuit, overheating of the driver or exceeding the maximum current, the protection is triggered and the output current is turned off and the software gives a warning (fig.11). To clarify the cause of the fault, click “Details” button and the window with a description of the error will appear (fig.12). To restore the operation, fix the trouble and click the “Clear” button.

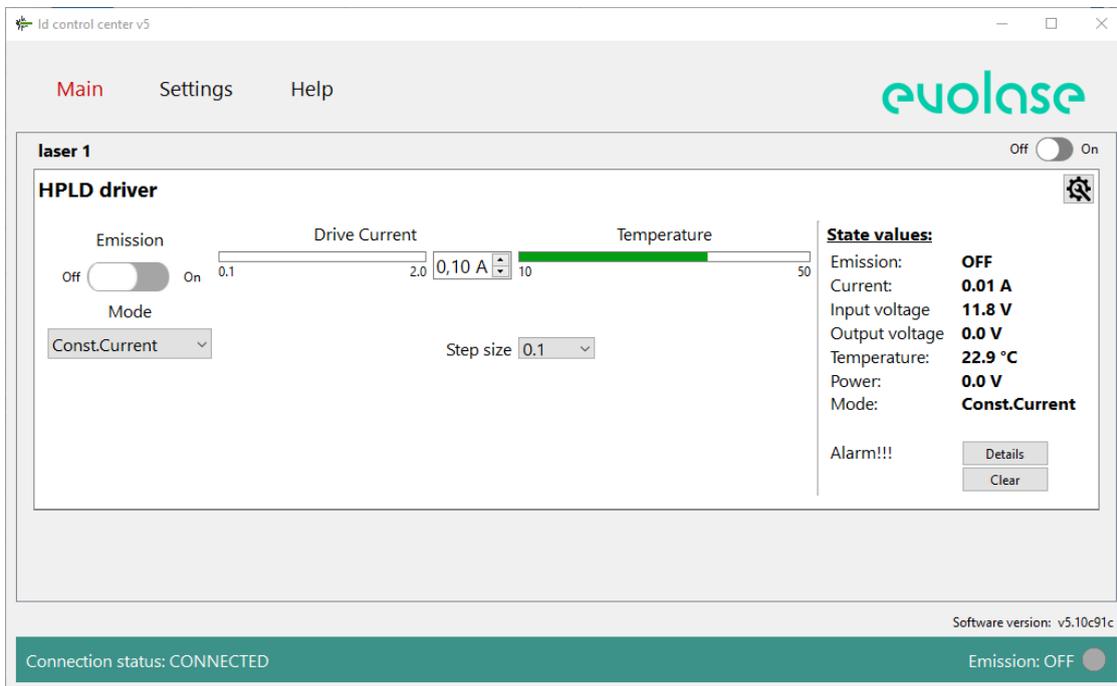


Figure 11: The main control menu

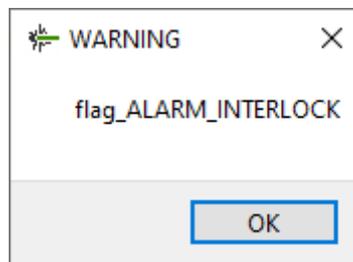


Figure 12: The warning window

Operating in CAN network

1. Before connecting several drivers into a CAN network, the user needs to set a CAN ID for each driver following the procedure described in the Initial startup section. The set CAN ID for each driver should be recorded.
2. Connect up to 200 drivers into the CAN network (fig. 14) by using the CAN hub (fig. 15).
3. Click “Settings” to enter the program configuration menu (fig. 13).
4. Press  icon to refresh the list of the COM ports and select from the drop down menu the COM port the driver board is connected to.
5. Untick the “mini USB mode” box.
6. Tick “Auto Connection” box to select the “Auto Connection” mode. Otherwise, click “Connect”.

7. The software has a lot of channels for connecting and controlling devices. To connect a new driver, click "Add", enter the CAN ID of the driver in the appeared row. You can rename the drivers to better keep track of them. Click "Apply" to apply system configuration.
8. To remove drivers, select the rows with these devices and click "Delete selected rows", then click "Apply" to apply system configuration.

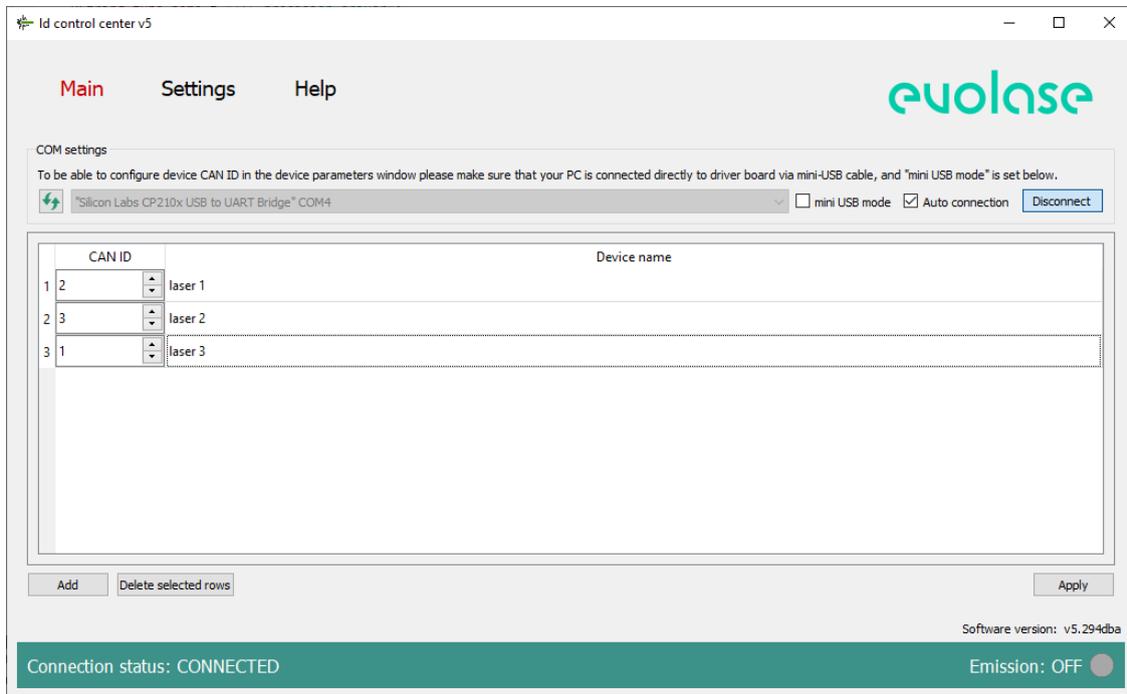


Figure 13: The system configuration menu

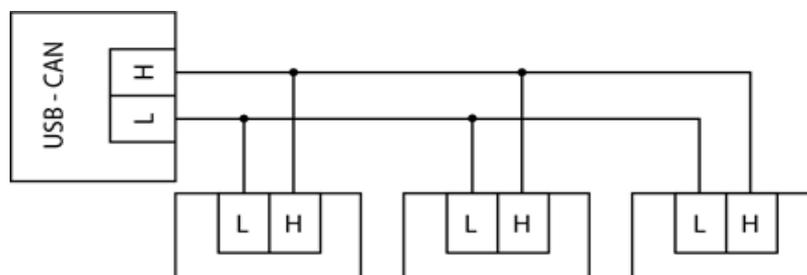


Figure 14: CAN interface connection scheme

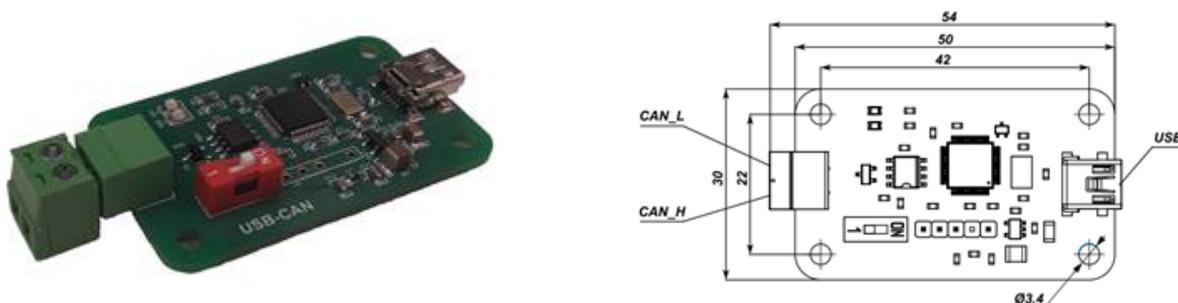


Figure 15: USB-CAN hub