LDD-14pin-2A-SFF

PRECISION CONSTANT CURRENT LASER DIOIDE DRIVER

Key Features

- **Special Design for 10/14 pin Butterfly Laser Diode**
- **High Precision Constant Current Mode**
- **Output Current up to 2000 mA**
- **High Current Stability: 0,01 mA**
- **Computer Interface USB, RS-232, CAN**
- **On-Board TEC Controller**
- **Regulated Maximum TEC Current**
- **Hi precision temperature stability: 0.01 deg**
- **5Vdc Input Power**
- **Completed by Heatsink**
- **Compact Size 100 mm x 85 mm x 31 mm**

Description

The LDD-14pin-2A-SFF is a constant current laser diode driver for powering 10/14-pin butterfly laser diode modules for applications, which require high precision low ripple constant current regulation.

The driver circuitry operates from a single 5Vdc power source. The driver supplies a bidirectional proportional-integral-derivative (PID) thermoelectric cooler controller (TEC) with current capability of 4A and voltage capability of 4V. Maximum TEC current is regulated by user.

The main parameters of LDD-14pin-2A-SFF (output current, temperature set, maximum TEC current, monitor photodiode signal) are controlled by computer interface. The GUI can control multiple drivers connected by CAN/USB hub.

The driver supports full amplitude modulation of drive current by an external analog 0…5V and TTL signals.

Driver has special push-in connector for easy connecting butterfly laser diode directly into driver board and large heat sink for stable heat dissipation.

Specifications

Parameter	Min.	Typ.	Max.	Units
INPUT				
Voltage	4.8	5.0	5.2	Vdc
Current	-	-	3	A
OUTPUT				
Current	-	-	2000	mA
Current regulation step	-	0.01	-	mA
Current ripple amplitude	-	-	0.1	%
Current stability	-	-	0.1	%
Current set accuracy	-	-	1	%
Compliance voltage	1	-	3	V
TEC current setting range	-4	-	+4	A
TEC voltage	1		4	V
TEC temperature set	5	25	50	ºC
TEC temperature step	-	0.01	-	ºC
TEC temperature accuracy	-	-	0.1	%
MODULATION				
Trigger input voltage	3.3	-	5	V
Trigger input impedance	-	500	-	Ω
Trigger pulse frequency	-	-	3	kHz
Trigger pulse width	150	-	-	µS
Current rise time	100	-	140	µS
Current fall time	80	-	160	µS
Analog input voltage	0	-	5	V
Analog input impedance	-	400	-	Ω
Current setpoint	-	400	-	mA/V
Analog input frequency	-	-	3	kHz
TEMPERATURE				
Operating	+10	-	+50	ºC
Storage	-20	-	+70	ºC
Humidity, Non-Condensing	-	-	95	%
CONNECTIONS				
Power	2 mm / 5.5 mm Jack (PJ-05AH Cui Devices)			
USB	Mini-USB, Type B (1734035-1 TE connectivity)			
Interface connector	Terminal block (1-282834-0 TE connectivity)			
MECHANICAL				
Size	100 mm x 85 mm x 31 mm			
Wight, not more	200 g			

Dimensions and Connections
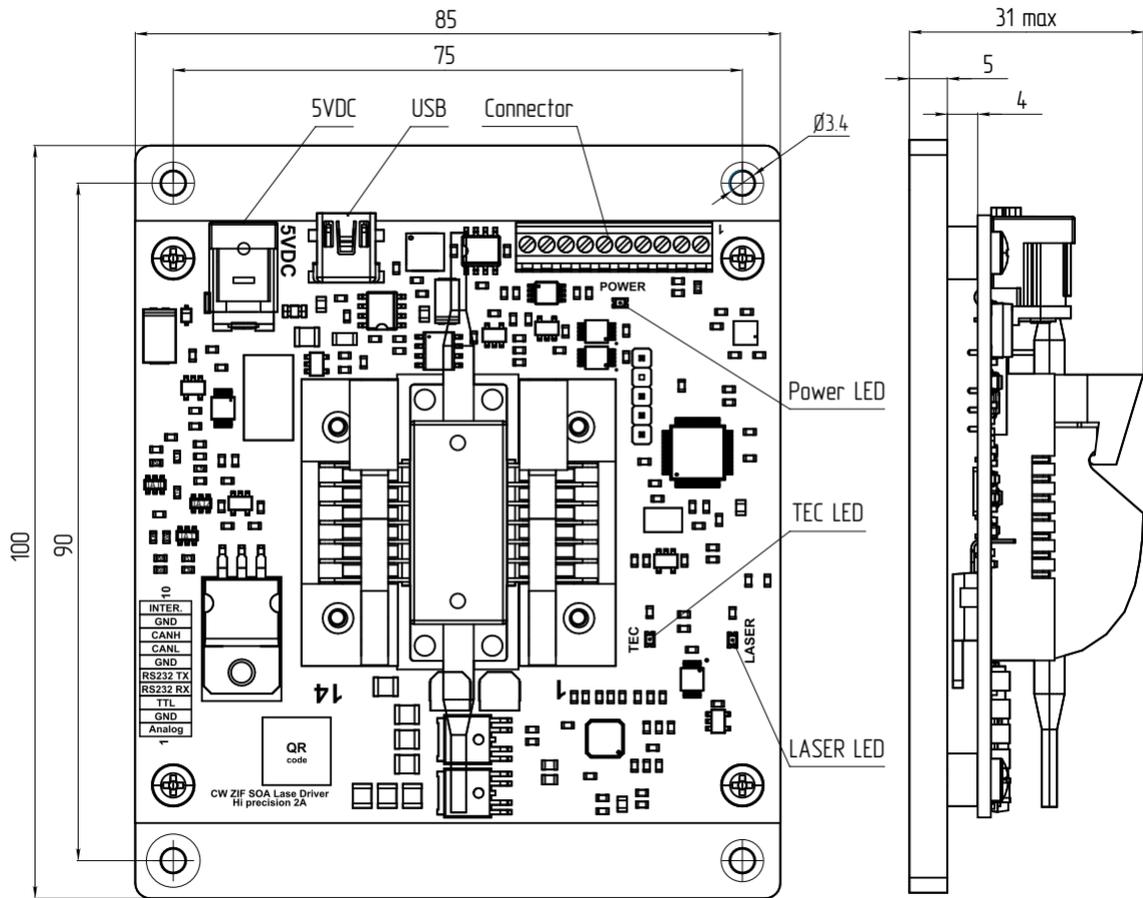
Compatible Laser Pinout

14 pin butterfly package
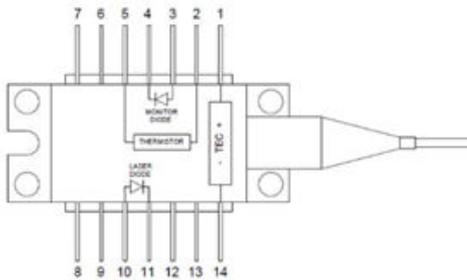
№	Description	№	Description
1	TEC Anode	14	TEC Cathode
2	Thermistor	13	n/c
3	Monitor PD Anode	12	n/c
4	Monitor PD Cathode	11	LD Cathode
5	Thermistor	10	LD Anode
6	n/c	9	n/c
7	n/c	8	n/c

10pin butterfly package
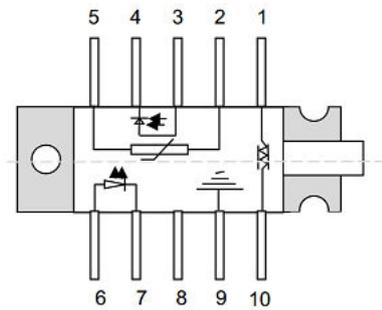
Pin	Description	Pin	Description
1	TEC (+)	6	Laser anode (+)
2	Thermistor	7	Laser cathode (-)
3	Monitor anode (-)	8	NC
4	Monitor cathode (+)	9	Package ground
5	Thermistor	10	TEC (-)

Interface connector pinout

| PIN	Function	Description
1	ANALOG	Analog modulation input. Connect to the external analog voltage or external sinusoidal signal generator for control output current. 0÷5V analog input correspond to 0÷2A output current. Current setpoint is 400mA/V. Input impedance is 400 Ω. Choose "ANALOG" mode by PC software and press "ON/OFF" button to activate output current and control it by analog input. Maximum frequency of external sinusoidal signal is 3 kHz, that supports 2A modulation amplitude. The modulation amplitude gets smaller at higher frequency.
2	GND	Device ground.
3	TTL	Trigger input. Connect to the external TTL signal generator for triggering output current. The amplitude of external trigger must be 3.3V to 5V range. Input impedance is 500 Ω. Choose "External" mode by PC software and press "ON/OFF" button to activate triggering output current by external input. Current amplitude sets by PC software. Maximum frequency of external triggering signal is 3 kHz.
4	RS232 RX	RS232 interface port RX
5	RS232 TX	RS232 interface port TX
6	GND	Device ground
7	CANL	CAN bus high
8	CANH	CAN bus low
9	GND	Device ground
10	INTERLOCK	Connect to the external interlock circuit. Open: device is locked, Closed: device is operational. Internally pulled up to 3.3V by 1 kΩ resistor. Use open collector or dry contact. **Note:** The laser emission can only be started when the interlock circuit is closed

Power supply

Recommended type of power supply unit MEAN WELL RS-25-5. It is possible to use other power sources with an output voltage of 5 V and a current of up to 5 A.

Typical Performance Characteristics

1. Output current waveform, modulated by external sinusoidal signal generator with frequency 1kHz.

Current 200mA/div

Modulation 1V/div

400uS/div
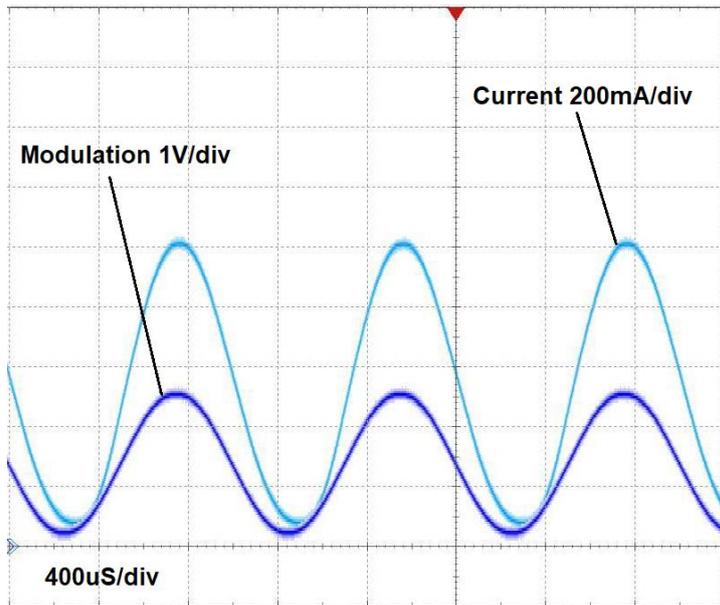
2. Output current waveform, modulated by external trigger signal generator with frequency 1kHz. Current amplitude is set at 1A by PC software.

Current 200mA/div

Trigger 1V/div

200uS/div
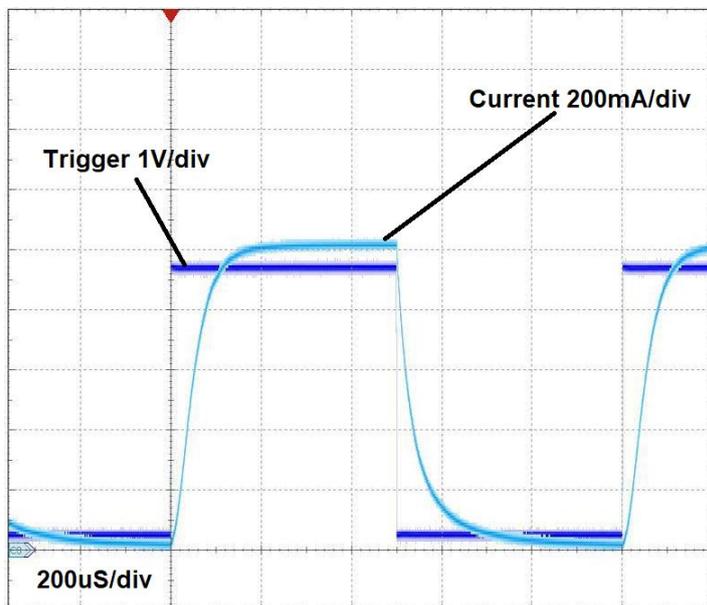
Control Center Driver Software

Quick start (mini USB mode, only one driver)

1.   Install the laser diode into the ZIF socket: Open the ZIF socket clams. Insert the laser into the mount in such way, that the pins fit easily into the slots of the ZIF socket. **Note:** Make sure, the laser pin numbering matches with the imprint on the laser socket. Close the clamps of the ZIF socket.

2.   Power the driver board according to its datasheet. After the power is applied, the Power LED will light up

3.   Connect the mini USB cable.

4.   Run ld_control_center_vXXX.exe.

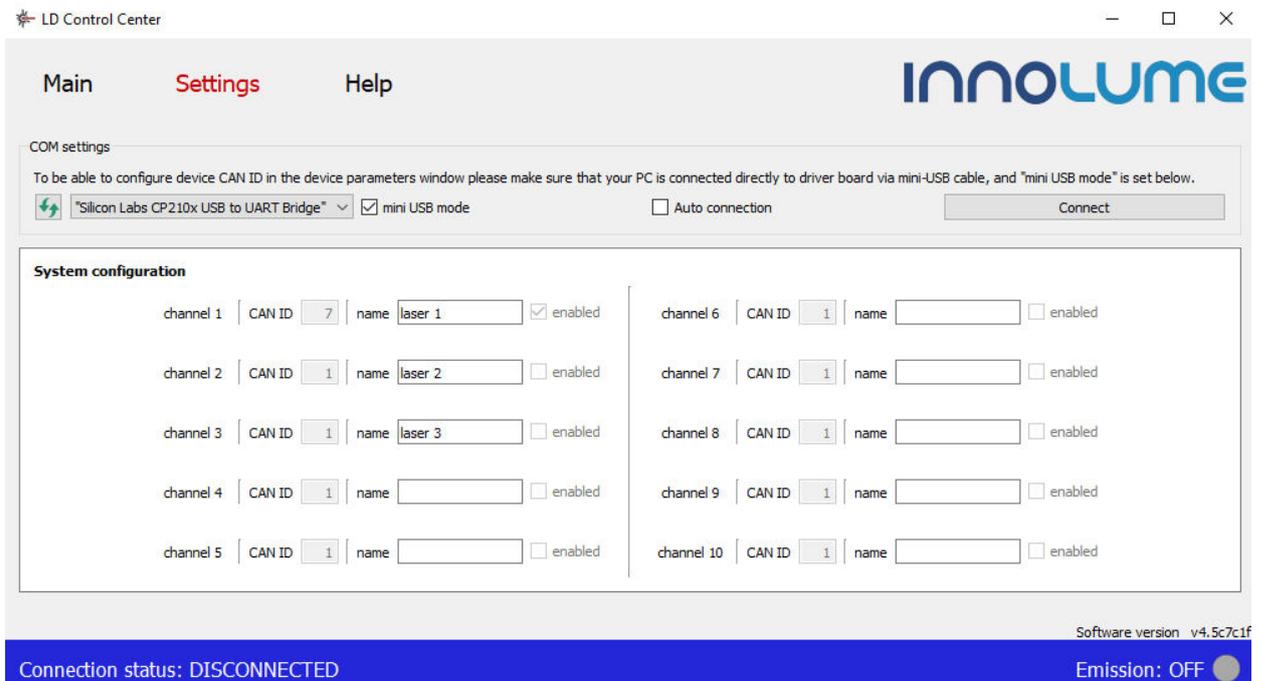5.   Click "Settings" to enter the program configuration menu (fig. 1).

Figure 1: The system configuration menu.

6.   Press ⚡ icon to refresh the list of COM ports and select the COM port the driver is connected to from the drop down menu.

7.   Tick the "mini USB mode" box.

8.   Tick the "Auto connection" box to select the "Auto connection" mode; otherwise click "Connect".

9.   Click "Main" menu panel. The control panel corresponding to the type of USB connected

10.   The driver should appear in the first channel. Click the "Main" menu panel. The shown control panel matches the connected driver type.

11.   Click ⚙ icon located in the control panel's upper right corner to enter the driver setting mode. The driver setting mode allows entering laser diode parameters and the permitted range of laser operating conditions (fig. 2).

12.   Enter each parameter into the setting window and click "SET" to apply the value. CAN ID for the driver could also be set here for operation as part of the CAN network. The new CAN ID value will be applied only after resetting the driver power supply. See more about the CAN network in the relevant section.

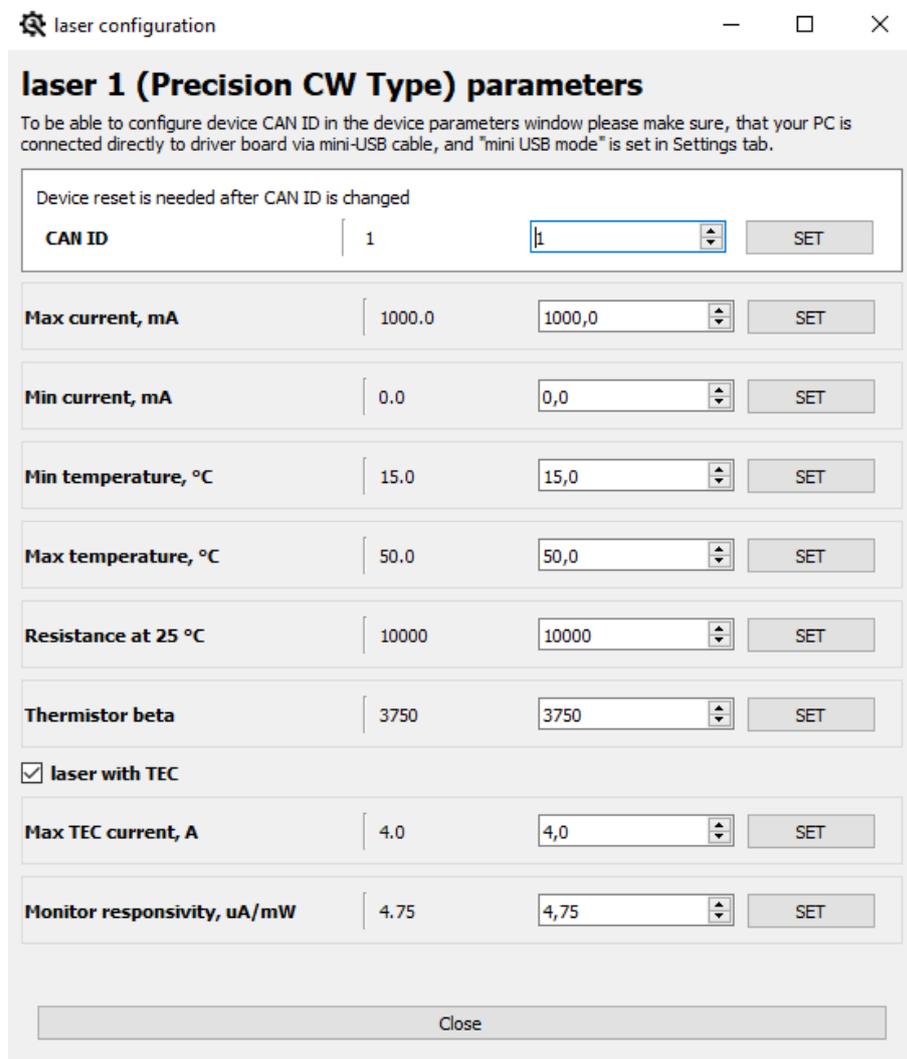13.   The driver is now configured and ready for operation.

Figure 2: The laser diode setting menu

Basic controls and operation

The main software window implements controls (fig. 3), control panel can be collapsed. The software supports up to 10 devices connected to a PC through a USB/CAN adapter. Each laser diode's drive current, temperature, drive voltage, repetition rate, and pulse duration 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.
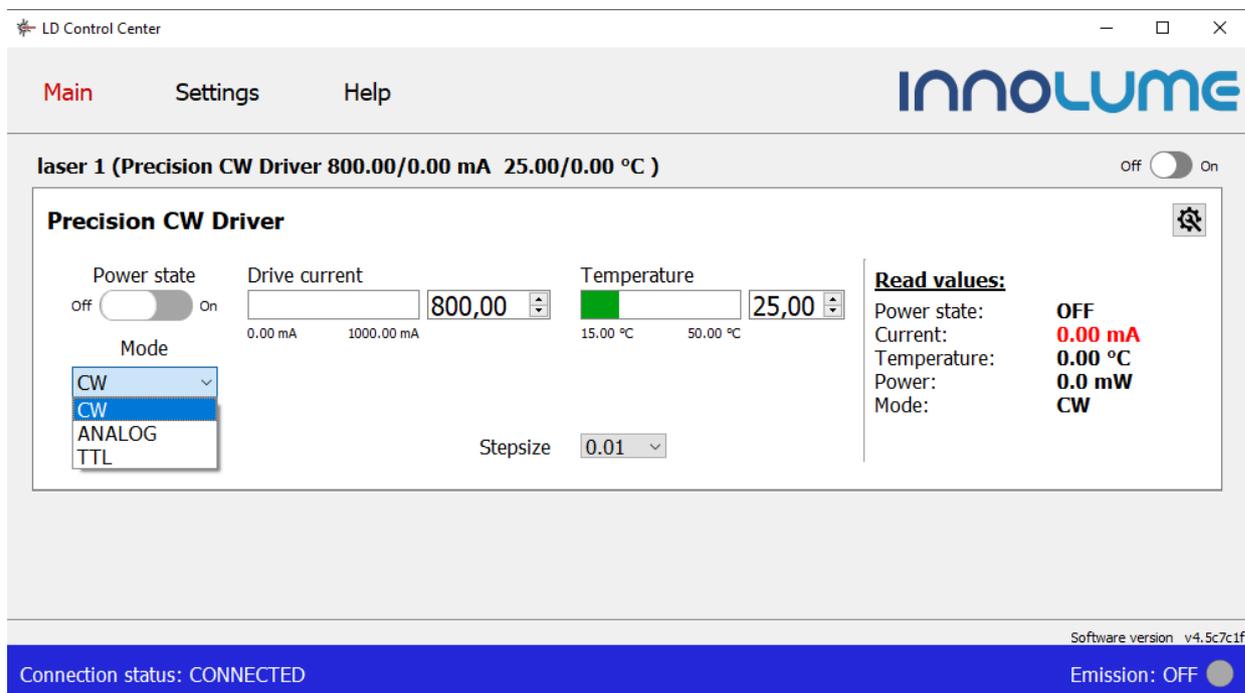

Figure 3: The main control menu.

The CW driver can operate in three modes:

CW - conventional CW operation mode. Temperature can be set with 0,01 deg C precision and current can be set with 0,1 mA precision. Suitable regulation step can be defined in the corresponding "Stepsize" control window.

ANALOG – analog modulation mode. The output current is controlled within 0..2A range by an externally applied analog modulation voltage within 0..5 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.

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).

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

In the CW driver, the user can only set the current and temperature of the laser diode. To set the laser diode temperature, enter the required temperature value in the temperature setting window and press "Enter" on PC keyboard. After that, the thermoelectric cooler (TEC) will turn on, bringing the temperature of the laser diode to the set temperature, and the indicator TEC LED

will light up. 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 "Power Status" 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 "Read values" on the right side of the main panel displays the current state of the laser diode.

The driver can be disconnected from the USB port during operation and the device will preserve the last known status.

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.

Laser diode setting and system configuration

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 set the allowed ranges for the voltage and temperature and apply some other diode specific settings such as thermistor resistance values. The available settings for CW drivers are shown in Figure 2.

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

Operating in CAN network

1. Before connecting several drivers into a CAN network, the user needs to set a CAN ID for each driver by connecting the driver through the mini USB port and following the procedure described in the Quick Start section. The set CAN ID for each driver should be recorded.

2. Connect up to 10 drivers into the CAN network by using the CAN hub.

3. Click "Settings" to enter the program configuration menu.

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 ten channels for connecting and controlling devices. Enter the CAN ID of the

8. driver you want to control in Channel X. You can rename the drivers to better keep track of them. Tick "Enabled" box to activate the selected channel.

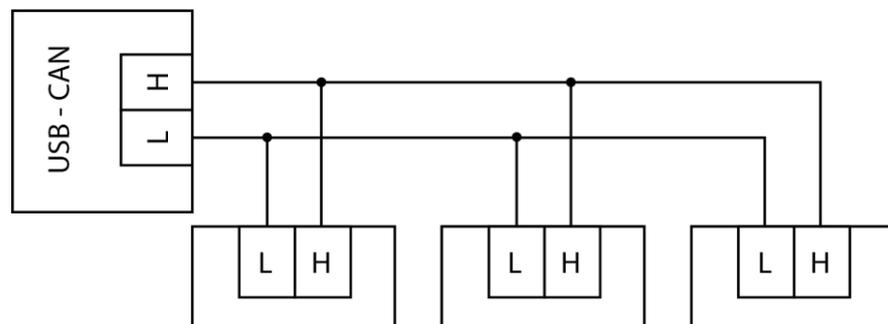9. Click "Apply system configuration" to apply the settings.

Figure 4: CAN interface connection scheme

LDD-14pin-2A-SFF RS232 protocol description

The driver can be controlled via the RS 232 protocol. The corresponding connector PINs are used for this.

RS232 configuration

Baud rate: 57600 baud/sec

Data bits: 8 bit

Parity: no parity

Stop bits: 1 bit

Command format description

Command and response is a text string that has the following structure:

<Message header><data><CR> … 100 milliseconds timeout …

Where:

- Message header is "t0018" for command and "t0228" for response
- Data – is a packet of Ascii characters with hexadecimal values; For example "01000000fffefdfc". Numbers of characters must be equal to 16 (8 pairs of characters).
- <CR> - carriage return byte

NOTE: 100 milliseconds timeout between commands is necessary to provide stable device work.

Data format description

<cmd><id><res><res><value_4><value_3><value_2><value_1>

Where:

- <cmd> - set/get command byte (HEX) or response byte (HEX)
- <id> - device ID if response data, if command – "00"
- <res> - reserved byte (HEX)
- <value_4> - value byte 4 (HEX)
- <value_3> - value byte 3 (HEX)
- <value_2> - value byte 2 (HEX)
- <value_1> - value byte 1 (HEX)

Response description

Most of the commands has two types. The SET type and GET type. GET type forms from SET type <cmd> byte plus 0x80.

For example if SET type <cmd>=0x10, then same GET type <cmd+0x80>=0x90.

If device received SET command type <cmd>, it will send ACK response with the same <cmd> byte with empty value bytes.

If device received GET command type <cmd+0x80>, it will send ACK response with the same <cmd+0x80> with corresponding value bytes

Command description

On/Off laser emitting command

<cmd> = 0x10 SET command byte

<value_1> = 0x00 to turn emitting off

<value_1> = 0x01 to turn emitting on

Example:

Turn on laser emitting command:

```
"t0018100000000000001\r"          - SET command
"t0228100000000000000\r"          - ACK response
```

Get on/off laser emitting state command:

```
"t0018900000000000000\r"          - GET command
"t0228900000000000001\r"          - ACK response with value 1;
```

Laser current command

<cmd> = 0x11 SET command byte

<value_4><value_3><value_2><value_1> - current value bytes multiplied with 100;

Example:

Set laser current 50 mA command

(value = 50*100 = 5000 = 0x00001388):

```
"t0018110000000001388\r"          - SET command
"t0228110000000000000\r"          - ACK response
```

Get on/off laser current state command:

```
"t0018910000000000000\r"          - GET command
"t0228910000000007A120\r"          - ACK response with value 1;
```

NOTE: In GET command the response value 0x0007A120 (500000) is multiplied with <u>10000</u>, so the result value is 500000/10000 = 50 mA,

Laser temperature command

<cmd> = 0x12 SET command byte

<value_4><value_3><value_2><value_1> - temperature value bytes multiplied with 10000;

Example:

Set laser current 32°C command

(value = 32*10000 = 320000 = 0x0004E200):

```
"t0018120000000004E200\r"          - SET command
```

```
"t0228120000000000000000\r"              - ACK response
```

Get on/off laser emitting state command:

```
"t0018920000000000000000\r"              - GET command
"t0228920000000000004E200\r"             - ACK response with value 1;
```

NOTE: Value 0x0004e200 (320) is multiplied with 10000, so the result value is 320000/10000 = 32°C.

Get current output power

This command is only for GET type

<cmd> = 0x94 GET command byte

<value_4><value_3><value_2><value_1> - power value bytes multiplied with 10;

Example:

Get output power command:

```
"t0018940000000000000000\r"              - GET command
"t0228940000000000004f3\r"               - ACK response with value 1;
```

NOTE: Value 0x000004f3 (1267) is multiplied with 10, so the result value is 1267/10 = 126.7 mW

TEC on/off command

TEC on/off command works only if laser diode has TEC.

<cmd> = 0x21 SET command byte

<value_1> = 0x00 to turn TEC off

<value_1> = 0x01 to turn TEC on

Example:

Turn on TEC command:

```
"t0018210000000000000001\r"              - SET command
"t0228210000000000000000\r"              - ACK response
```

Get on/off TEC state command:

```
"t0018A10000000000000000\r"              - GET command
"t0228A10000000000000001\r"              - ACK response with value 1;
```

Mode command

<cmd> = 0x24 SET command byte

<value_1> = 0x00 CW mode

<value_1> = 0x01 ANALOG mode

<value_1> = 0x02 TTL mode

Example:

Set TTL mode command:

```
"t0018240000000000000002\r"              - SET command
```

"t02282400000000000000\r"   - ACK response

Get current mode command:

"t0018A400000000000000\r"   - GET command

"t0228A400000000000002\r"   - ACK response with value 2 –
TTL mode;

NOTE: In ANALOG mode, the current value is set from an external analog signal; the measured value should be obtained using the current GET command (see Chapter 2.).

NOTE: in TTL mode, the current value must be set using the current SET command (see Chapter 2.). and the laser emission is activated from an external TTL signal.