

PLD-PS-SYNC

SHORT PULSE LASER **DIODE** **DRIVER**



Key Features

- Special Design for 10/14 pin Butterfly Laser Diode
- Output current up to 2000 mA
- Compliance voltage up to 3 V
- Extra short 50 ps pulse width
- Repetition rate up to 30 MHz
- External trigger option
- External clock option
- Master/slave operation mode with the repetition rate jitter suppression
- USB, RS-232, CAN, UART interfaces
- On-Board TEC Controller
- 5Vdc Input Power
- Completed by Heatsink
- Compact Size 85 mm × 60 mm × 21 mm

Description

The PLD-PS-SYNC is a compact short-pulse seed laser diode driver for powering 10/14-pin butterfly laser diode modules for applications, which require pulse widths about 50 ps. The pulse repetition frequency can be varied from 1 kHz to 30 MHz.

The driver is specially designed to minimize jitter between external trigger signal and optical pulse by enabling external clock synchronization. The driver also supports operation in Master/Slave mode and synchronization of optical pulses between two lasers, one operates as Master and another one as Slave, with the optical pulse position jitter below 500 ps and tunable delay between the optical pulses from two lasers.

The driver circuitry requires a single 5 VDC power source. All other needed voltages are generated on the board by high-frequency switching power supplies. The driver supplies a bidirectional proportional-integral-derivative (PID) thermoelectric cooler controller (TEC) with current capability of 1.5 A and a voltage capability of 4 V.

The main parameters of PLD-PS-SYNC (power, repetition frequency, temperature set point, pulse delays in sync mode) are controlled by computer interface.

The PLD-PS-SYNC has an external TTL-compatible input for repetition rate control from single shot up to 30 MHz. The driver has an external output for synchronization with each current pulse. The PLD-PS-SYNC has an external input/output of the clock frequency for synchronous operation of two drivers with minimal period jitter between optical pulses.

Driver has landing pads for soldering a butterfly laser diode directly into driver board and large heat sink for stable heat dissipation.

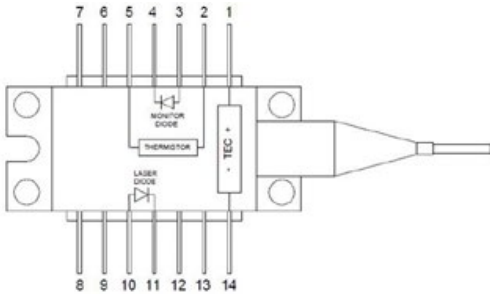
Specifications

Parameter	Min.	Typ.	Max.	Units
INPUT				
Voltage	4.8	5.0	5.2	VDC
Current	-	-	0.6	A
External trigger (50 Ω)	3.3	-	5	VDC
OUTPUT				
Current	-	-	2000	mA
Compliance Voltage	1	-	3	V
Pulse width *	40	50	150	ps
Repetition rate	0.001	-	30	MHz
Rise time *	40	50	60	ps
Fall time *	40	50	100	ps
TEC current	-1.5	-	1.5	A
TEC Voltage	1	-	4	V
TEC Temperature Set	15	25	50	°C
Repetition rate in sync mode	-	-	1	MHz
Pulse delay in sync mode	-50	-	+50	ns
TEMPERATURE				
Operating	+10	-	+50	°C
Storage	-20	-	+70	°C
Humidity, Non-Condensing	-	-	95	%
CONNECTIONS				
Power and interface connector	Terminal block (1-282834-0 TE connectivity)			
USB	Mini-USB, Type B (1734035-1 TE connectivity)			
External trig in/out	SMA (1-1478979-0 TE connectivity)			
Clock in/out	U.FL (U.FL-R-SMT-1(10) Hirose Electric)			
MECHANICAL				
Size	85 × 60 × 21 mm			
Weight, not more	160 g			

* Output performance depends upon laser diode characteristics. Performance cannot be guaranteed for all laser types. See optical output waveforms.

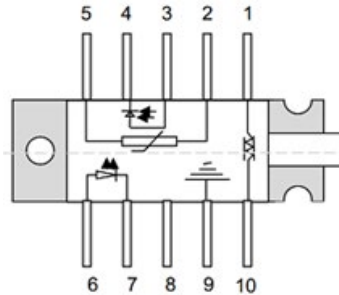
Compatible Laser Pinout

14-pin Butterfly package



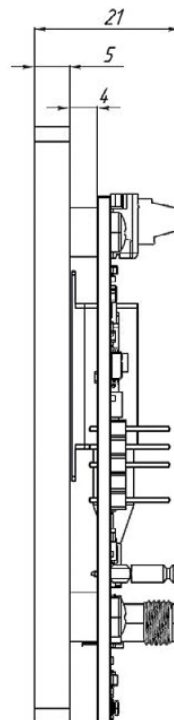
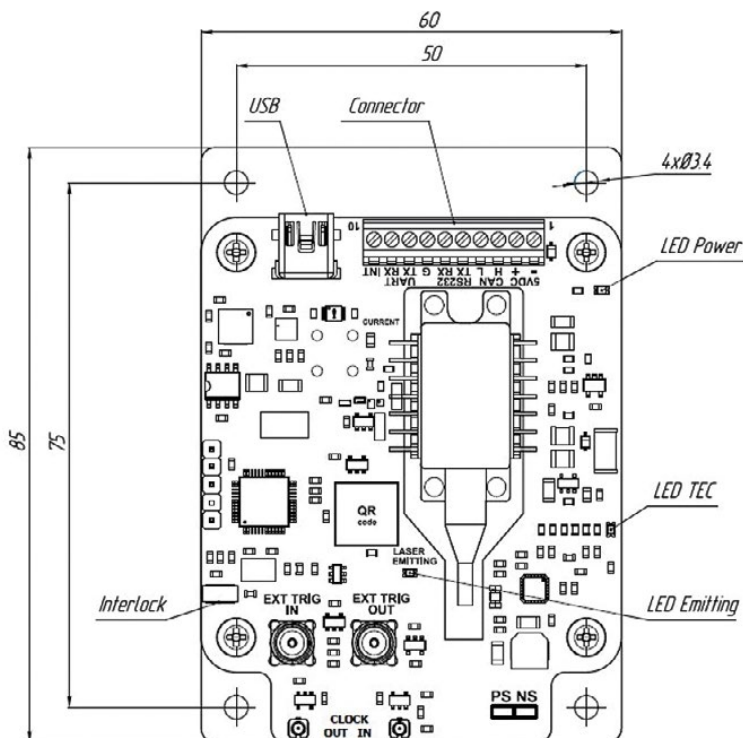
Nº	Description	Nº	Description
1	TEC Anode	8	n/c
2	Thermistor	9	n/c
3	Monitor PD Anode	10	LD Anode
4	Monitor PD Cathode	11	LD Cathode
5	Thermistor	12	n/c
6	n/c	13	n/c
7	n/c	14	TEC Cathode

10-pin Butterfly package



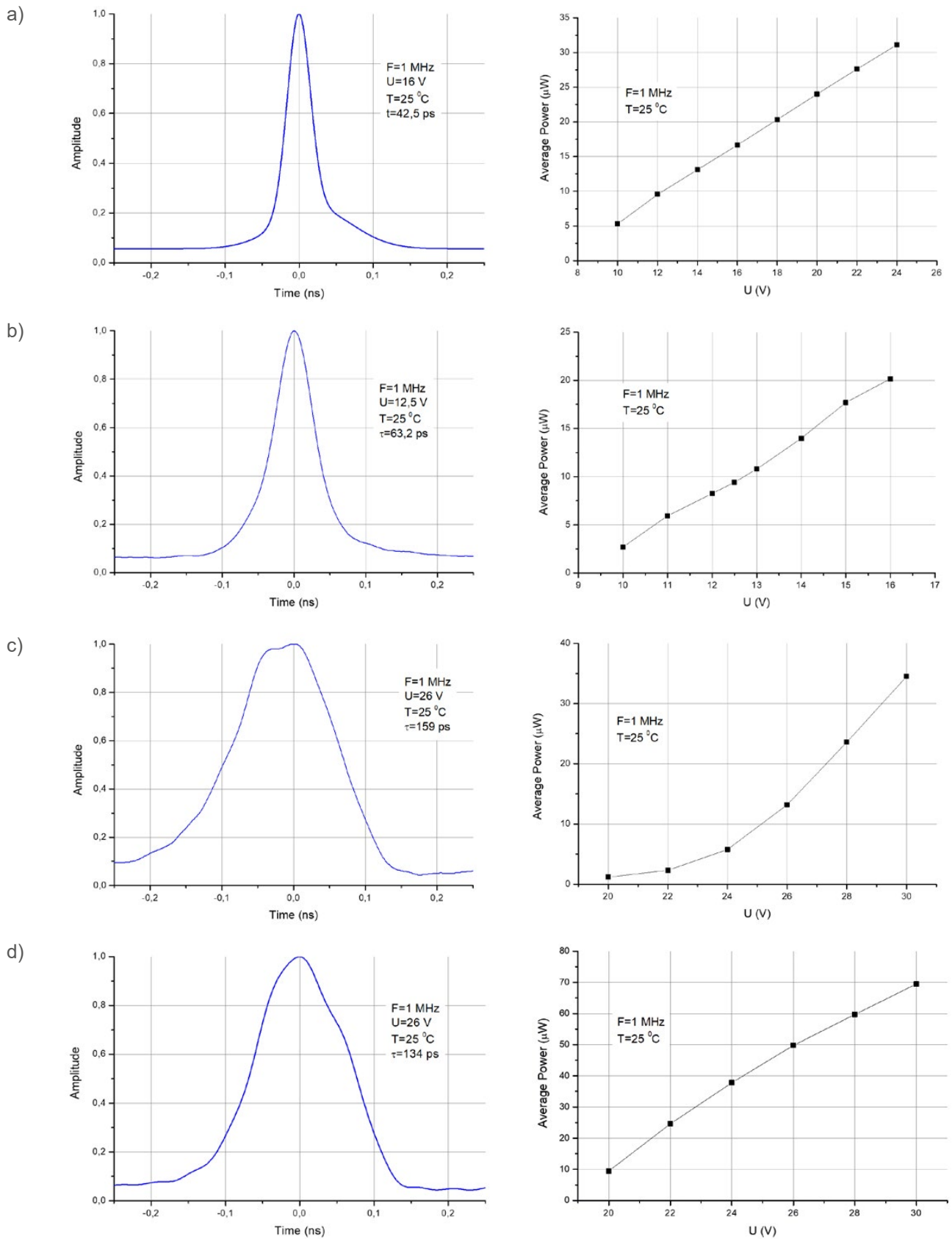
Nº	Description	Nº	Description
1	TEC (+)	6	Laser anode (+)
2	Thermistor	7	Laser cathode (-)
3	Monitor anode (-)	8	NC
4	Monitor cathode (+)	9	Package ground
5	Thermistor	10	TEC (-)

Dimensions and Connections



1	GND
2	+5VDC
3	CAN H
4	CAN L
5	RS232-TX
6	RS232-RX
7	GND
8	UART-TX
9	UART-RX
10	Interlock

Typical Performance Characteristics



Typical pulse form and dependence of average power on operation voltage for different types of laser diode.
a) DFB 1064 nm, b) FBG 1550 nm, c) FBG 1064 nm, d) FP 1030 nm

Control Center Driver Software

Quick start (mini USB mode, only one driver)

1. Solder the laser diode into the driver socket. Note: Make sure, the laser pins numbering matches with the imprint on the laser 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 Id_control_center_vXXX.exe
5. Click "Settings" to enter the program configuration menu (fig. 1)

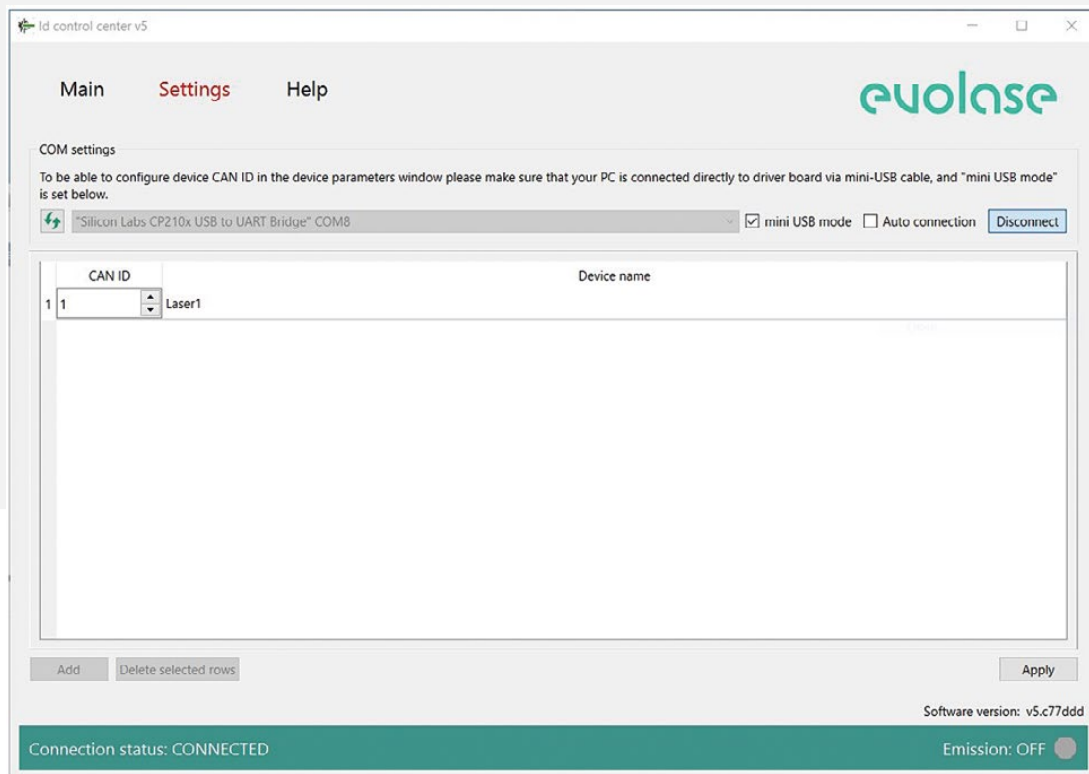


Figure 1: The system configuration menu

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. The laser diode used is displayed in the channel 1.
The user can set the name of the laser in the "Device name" window.
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. The middle column shows the current value of the parameters. To change the parameter value, enter each parameter in the settings window and click "Write" to apply the value.
13. 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.
14. After setting all the parameters, click "Close". The driver is now configured and ready for operation.

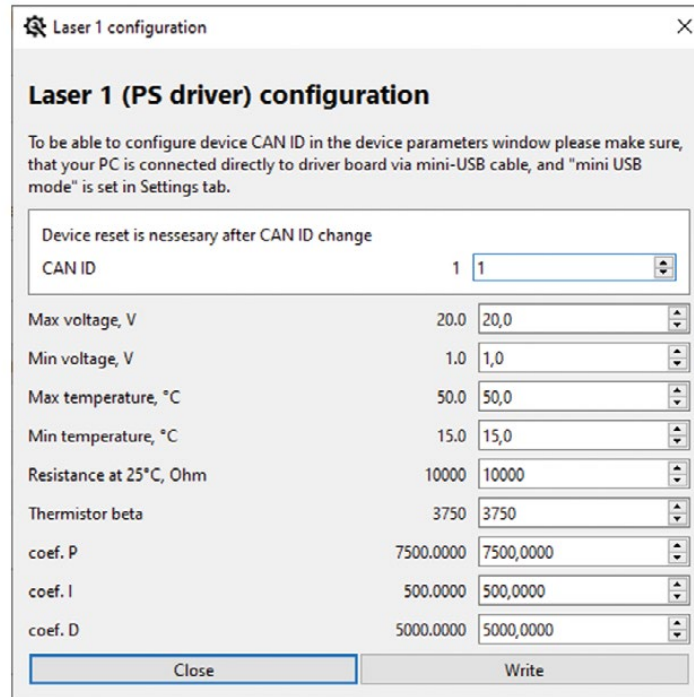


Figure 2: The laser diode setting menu

Laser diode setting and system configuration

The system configuration window (fig. 1) 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.

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 the connected laser diode, and the software applies the new settings only to that single diode. The user can set CAN ID of the driver, the allowed ranges for the operation voltage and temperature, the values of thermistor resistance at 25 0C and beta parameter and the coefficients of the PID controller of the TEC. Available settings for picosecond drivers are shown in Figure 2. 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 shows controls (fig. 3) available for the drivers connected to the PC. The control window could be collapsed (fig. 4). The software supports up to 200 devices connected to a PC through a USB/CAN adapter. Each laser diode 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: *Not all settings are available for each type of driver. The software will only show the available controls based on the recognized driver type.*

For PS driver, the user can select the operation mode, set the temperature of the laser diode, the driver voltage, pulse train repetition rate, the number of pulses in the bursts and the number of skipped pulses between the bursts in burst mode (fig. 3). The “Power state” toggle turns on and off the laser diode emission.

The section “State values” on the right side of the main panel displays the current measured values of the corresponding parameters of the laser diode. The same information is displayed in the status bar, when control window is collapsed. The number before the slash symbol “/” shows the value, set in the control window. The number after the slash symbol “/” shows the measured actual value from the driver. The power state toggle is also duplicated on the right side of the status bar. This allows the user to monitor the corresponding parameters of the laser diode and turn its radiation on and off while the main window is collapsed.

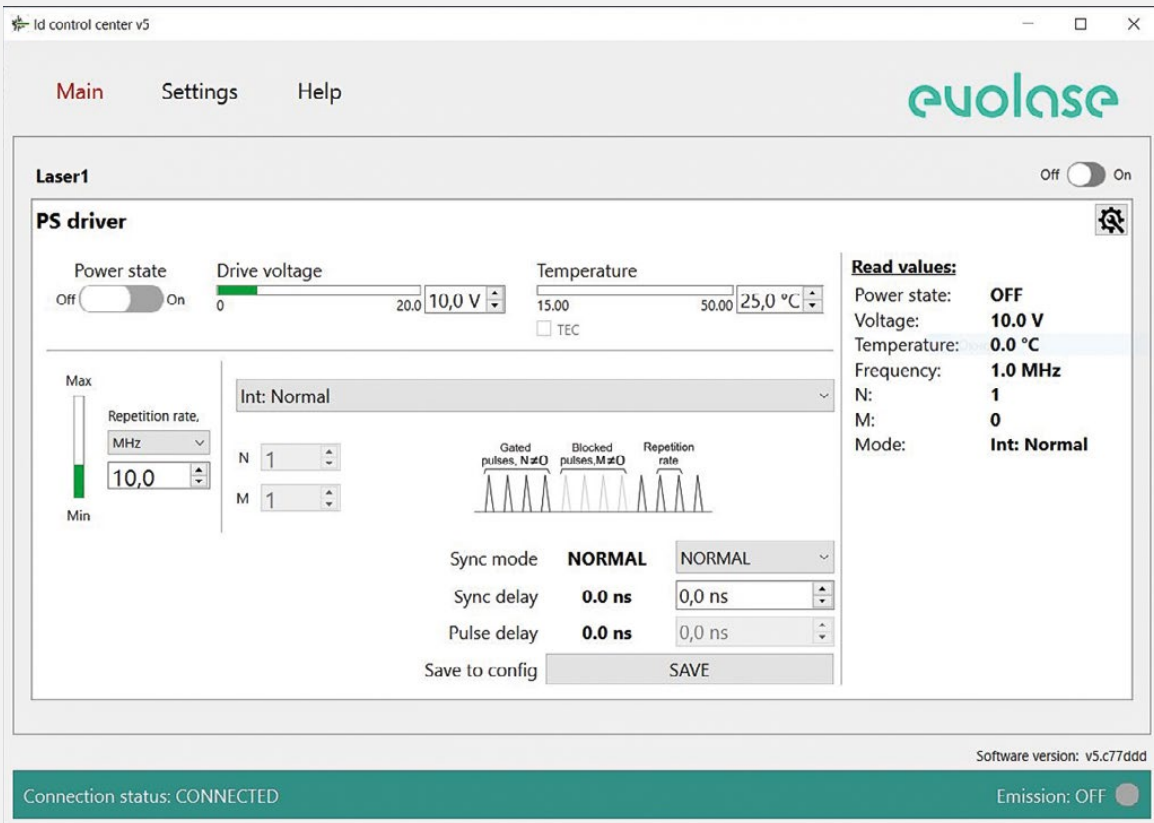


Figure 3: The main control menu

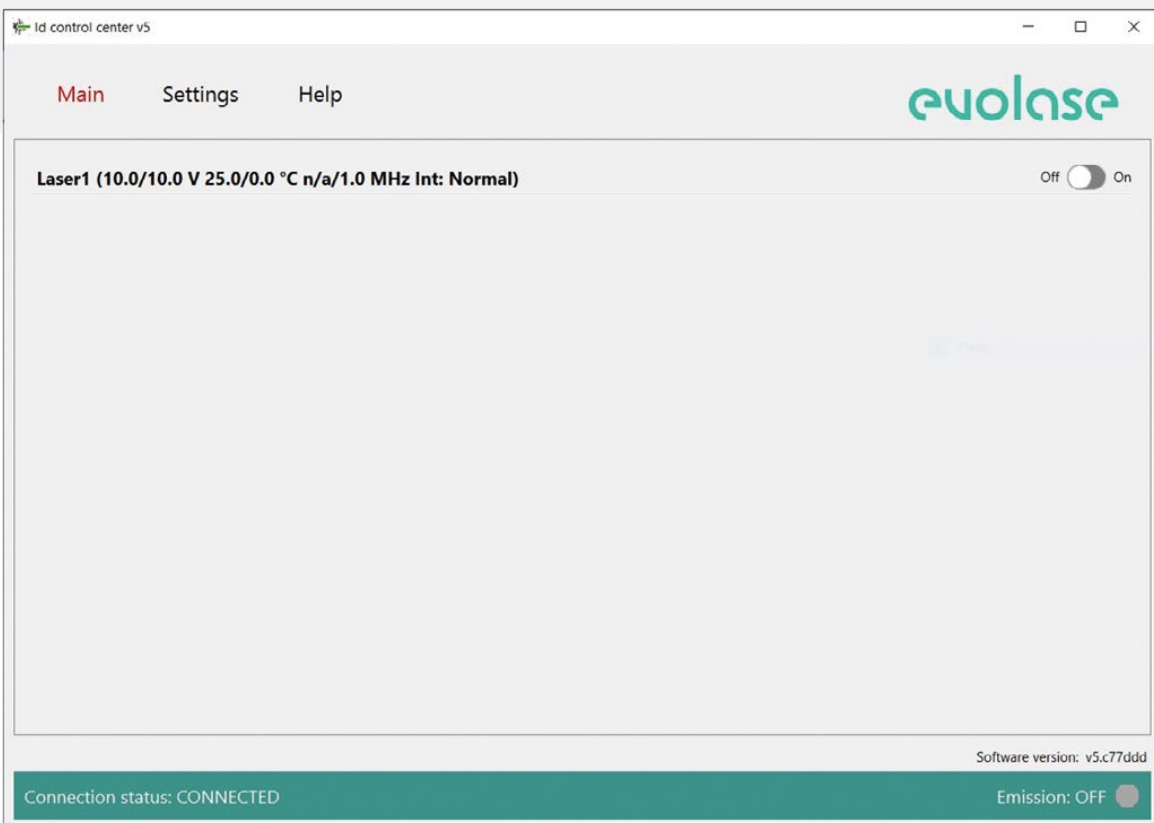


Figure 4: The main control menu

Selection of driver operation mode:

PS driver can operate in five modes:

- **Int: Normal** – the standard mode. The driver generates a pulse train with a constant repetition frequency set in the driver's control panel.
- **Int: Burst** – the internal burst mode. The driver generates bursts of pulses at a predefined frequency from the onboard pulse generator. The user can set the number of pulses in burst (N) and the number of pulses skipped between the bursts (M).
- **Ext: Normal** – the standard external mode. The driver starts to generate pulses at a preset frequency as a response to an external TTL trigger signal. The change of trigger signal level from LOW to HIGH starts pulse generation. Change of trigger signal from HIGH to LOW stops pulse generation.
- **Ext: Burst** – the same as Ext: Normal, but bursts of pulses are generated as a response to an external trigger signal.
- **Pulse on Demand** – external trigger signal (change of trigger signal level from LOW to HIGH) generates a single pulse.

To set the operating mode of the laser diode, select the required operating mode from the drop-down menu (fig. 5).

Note: In order the driver to work in external modes, it must be connected to an external source of synchronizing pulses via the SMA "EXT TRIG" connector using a coaxial cable.

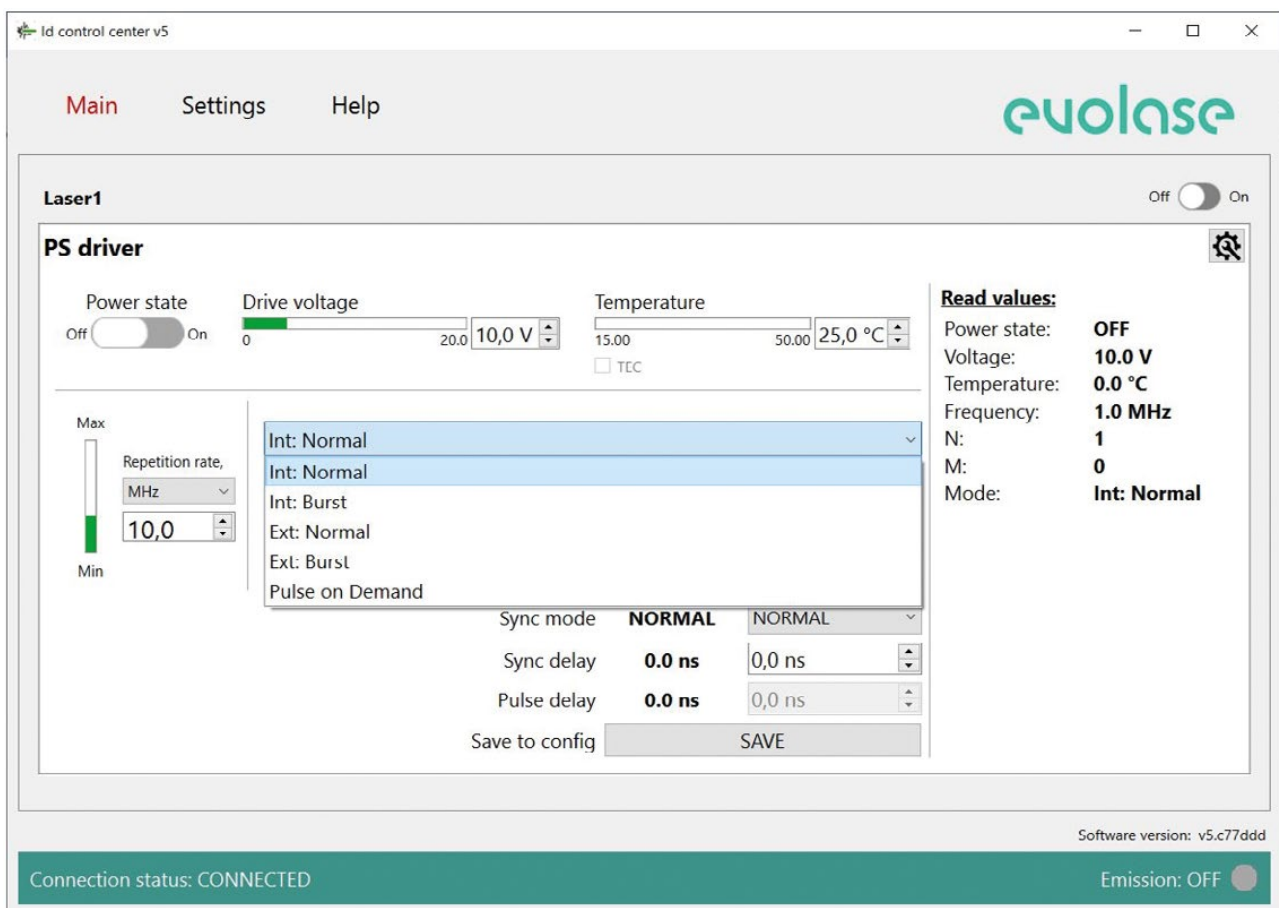


Figure 5: The main control menu. Operation mode

Setting up operation parameters of 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. 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 set the driver voltage, enter the required voltage value in the driver voltage setting window and press “Enter” on PC keyboard.
Note: *The driver voltage is not the laser diode bias. The driver voltage sets the laser diode current.*
- To set pulse train repetition rate, select the required repetition rate range from the drop-down menu, then enter the required repetition rate value in the repetition rate setting window and press “Enter” on PC keyboard.
- To set the parameters of the burst mode, select external or internal burst mode in the operating mode drop-down menu, after that enter the required number of pulses in the burst in the “N” setting window and press “Enter” on PC keyboard, then enter the required number of skipped pulses between bursts in the “M” setting window and press “Enter” on PC keyboard.
- To turn on the laser diode emission, click the “Power State” toggle. 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 State” toggle. 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, using the switcher on the right side of the status bar. 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.

Operating in Sync mode

Two drivers type SYNC (PLD-NS-SYNC/PLD-PS-SYNC) can operate in pulse synchronization mode with adjustable delay between optical pulses and minimal jitter. In this mode, each driver must be connected to a PC via USB and controlled by its own program.

1. Connect master driver clock-out to slave driver clock-in with U.FL cable
2. Connect master driver External Trigger Out to slave driver External Trigger In with SMA cable
3. Connect slave driver External Trigger Out to an oscilloscope or other sync pulse receiver (fig. 6).

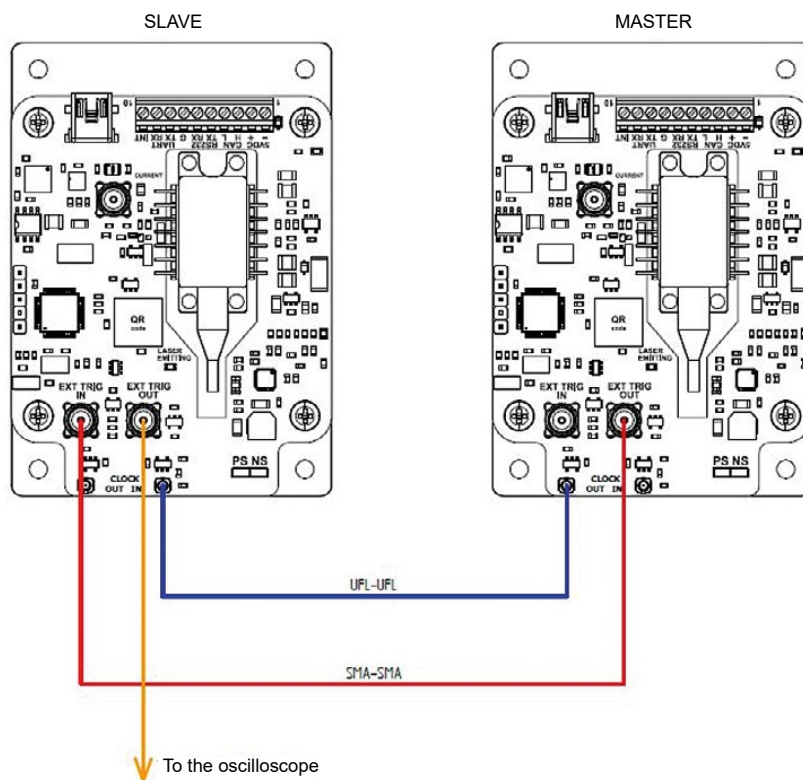


Figure 6: Driver's connections in sync mode

4. Power the drivers board according to its datasheet. After the power is applied, the Power LED will light up.
5. Connect the mini USB cable to the first driver. Run `Id_control_center_vXXX.exe`. Set the parameters of the first driver as described in the Quick start section.
6. Connect another mini USB cable to the second driver. Run `Id_control_center_vXXX.exe`. Set the parameters of the second driver as described in the Quick start section.
7. In the control program of the slave driver select Sync mode SLAVE (fig.7), and confirm the selection in the confirmation window that appears.

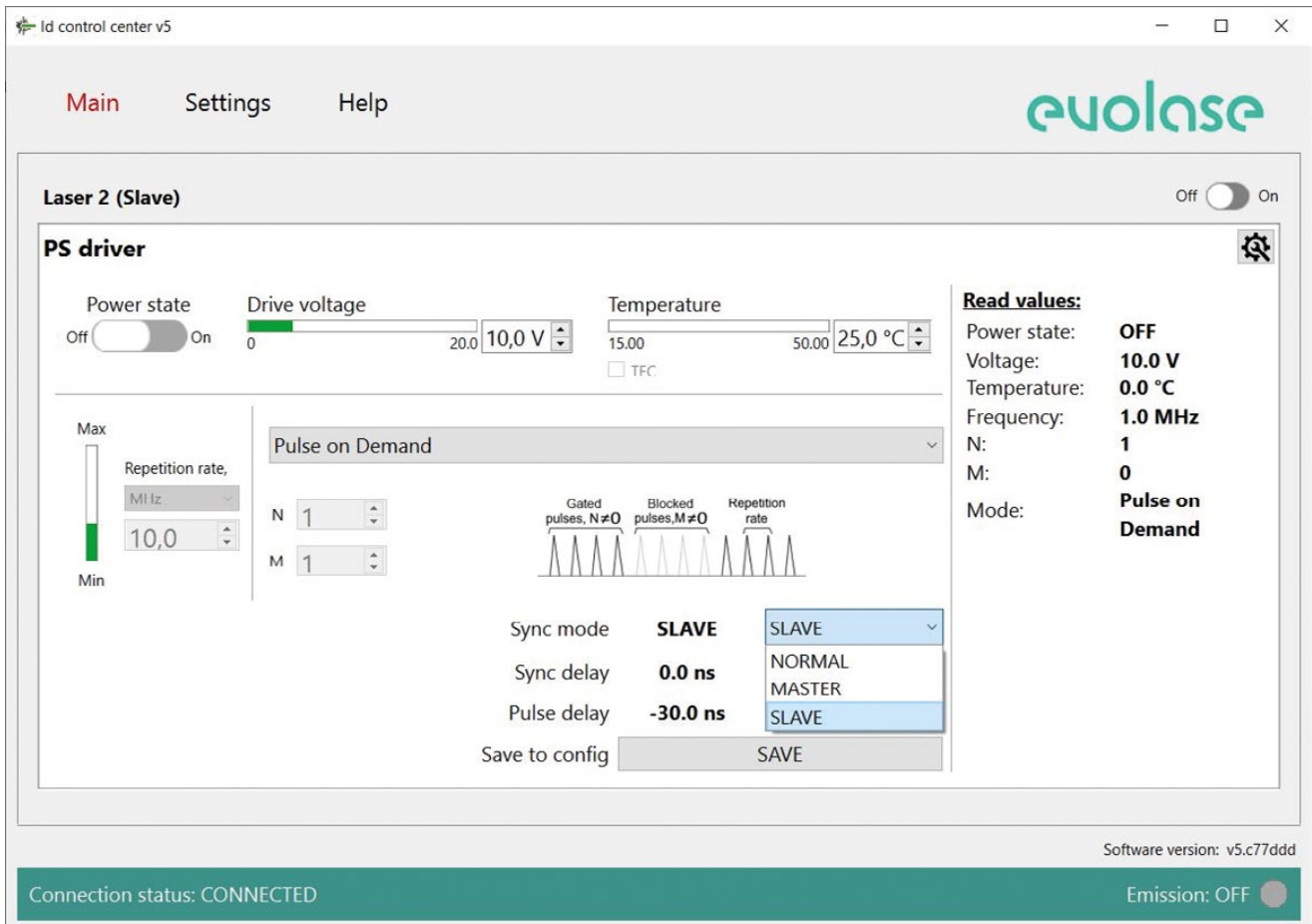


Figure 7: Sync mode slave driver

8. In the control program of the master driver select Sync mode MASTER (fig.8), and confirm the selection in the confirmation window which appears. **Note.** First, the sync mode is set for the slave driver, and only then for the master driver.
 9. In the control program of the master driver select Int: Normal mode in the control program of the slave driver select Pulse on Demand mode.
 10. Now the drivers are ready to operate in sync mode.
 11. Set the operational parameters for both laser diodes (temperature, driver current/voltage, electrical pulse duration) as described in the previous section.
 12. Set the repetition rate for the master laser diode, the repetition rate of the slave laser diode will be the same.
 13. To turn on the laser diode emission, click the “Power State” switch. The switch will move to the “On” position and change the color to green, the indicator LASER LED will light up.
- Note.** The emission of slave driver will start only if the emission of the master driver is turned on.
14. To turn off the laser diode emission, click the “Power State” 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.

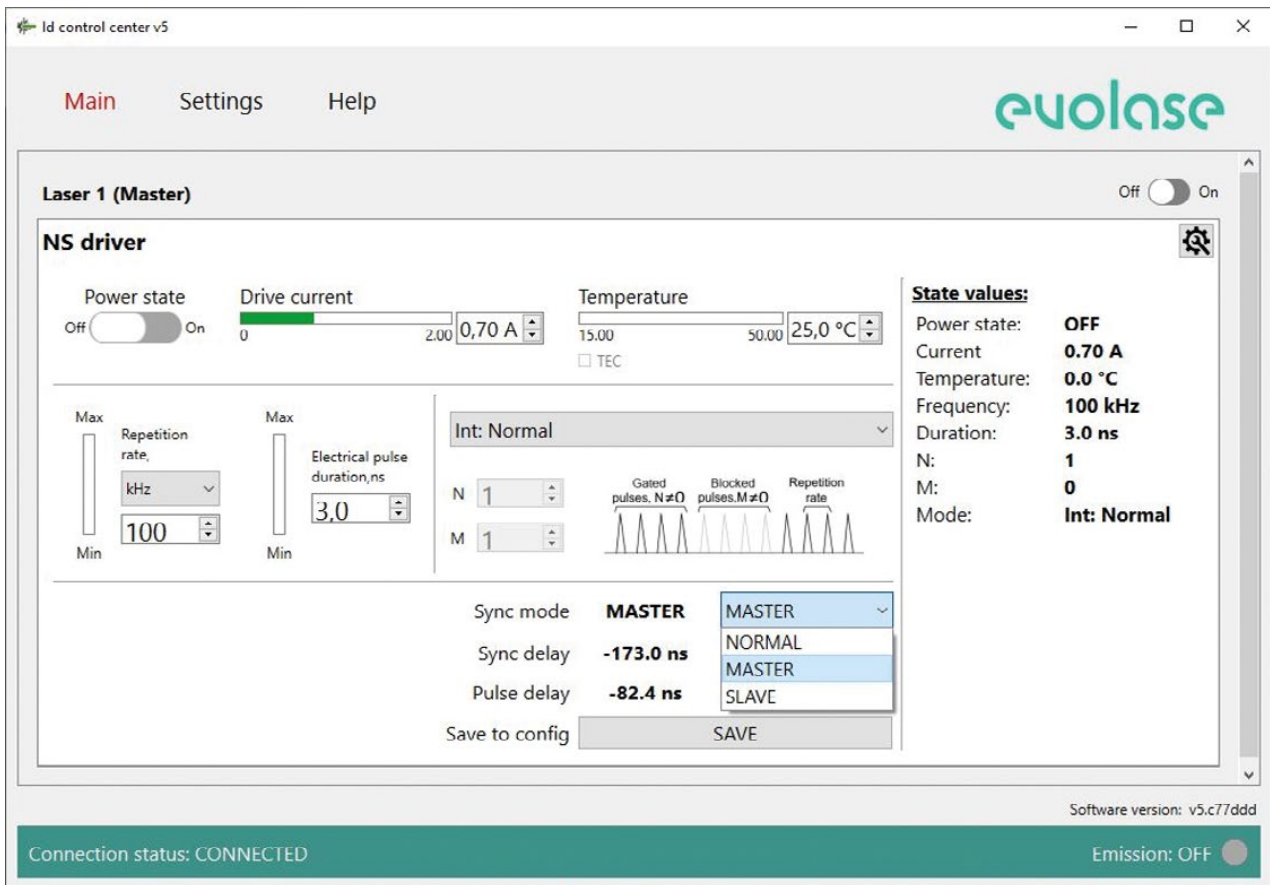


Figure 8: Sync mode master driver

15. Pulses delays are controlled in the slave driver control program. “Sync delay” moves slave’s optical pulse relative to the oscilloscope sync pulse. “Pulse delay” moves master’s optical pulse relative to the slave’s optical pulse (fig.9).
Note. “Sync delay” and “Pulse delay” value can be either positive or negative.
16. For the master driver the “Sync delay” and “Pulse delay” values cannot be changed. The set parameter values ensure the synchronicity of the optical pulses and the sync pulse to the oscilloscope. **Note.** The setup is carried out on specific wires. The default delays are changed when the length of the cables and optical fibers is changed
17. To finish the operation in sync mode, first select Sync mode NORMAL in the slave driver control program, then select Sync mode NORMAL in the master driver control program. Exiting the synchronization mode can also be done by rebooting the drivers.

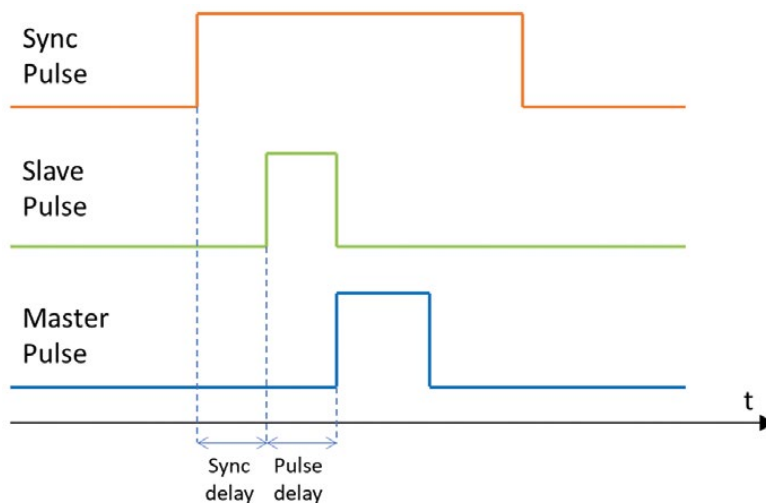


Figure 9: Pulse delay control

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 200 drivers into the CAN network (fig. 10) by using the CAN hub (fig. 11).

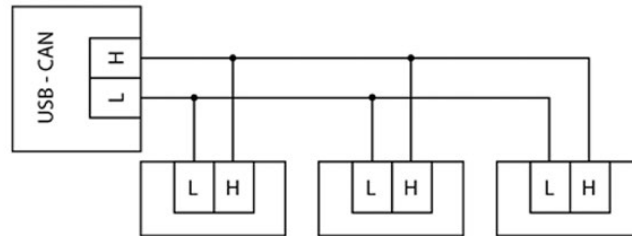


Figure 10: CAN interface connection scheme

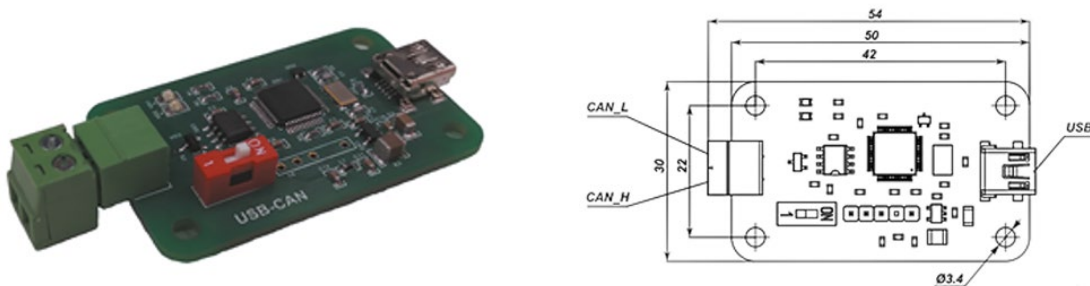


Figure 11: USB-CAN hub

3. Click "Settings" to enter the program configuration menu (fig. 12).
4. Press 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.

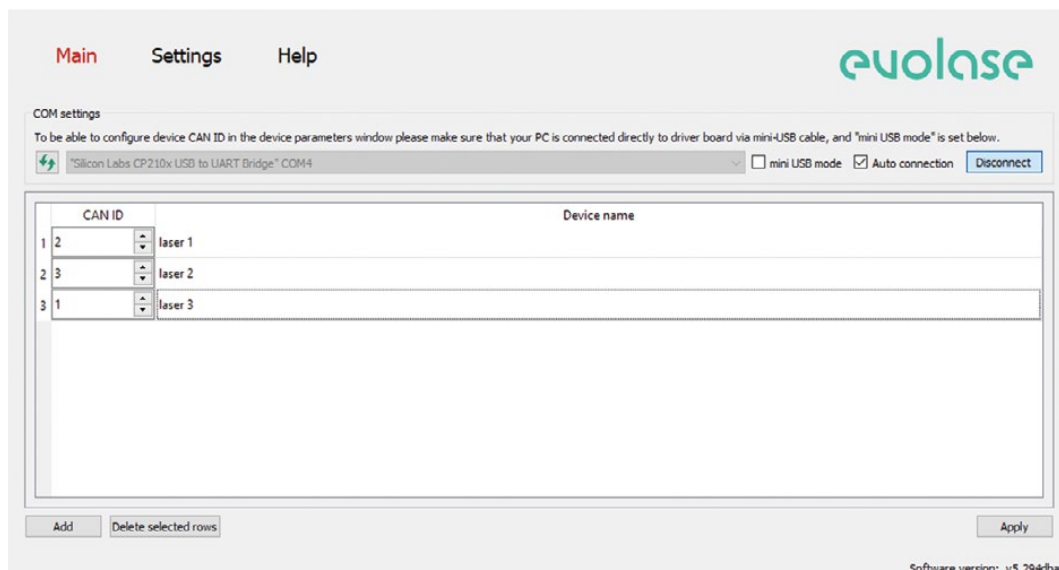


Figure 12: The system configuration menu