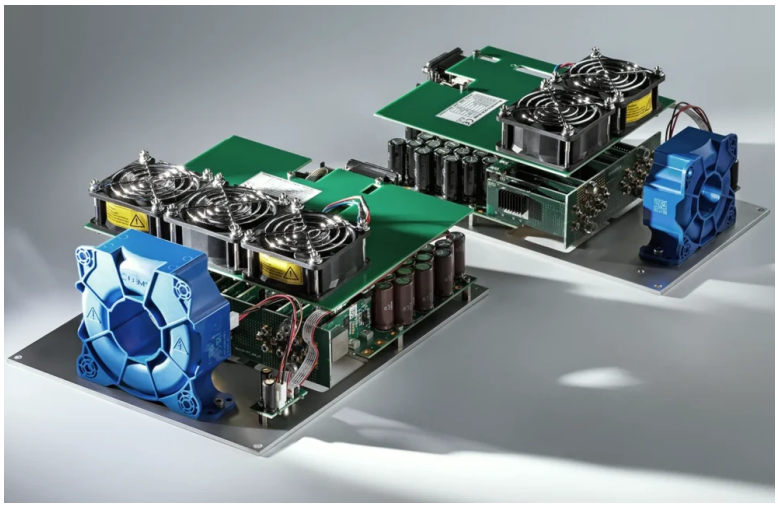
DATASHEET AND OPERATING GUIDE
uniLDD-A Laser Diode Driver
Forced-Air Cooled High-Power Laser Driver with TEC Controller



FEATURES

- Current range from 10 A to 360 A
- Compliance voltage range from 1 V to 90V
- CW or QCW operation modes
- Output power up to 2 kW
- TEC controller option available
- Analog and digital (CAN, RS232) interfaces
- Uniquely customizable modular design
- Safety features protect your laser
  - » current transient (overload) protection
  - » open circuit shut-down
  - » over temperature shut-down
  - » power voltage brownout (voltage dip) shut-down
  - » interlock shut-down

STABLE, HIGH POWER DRIVERS

uniLDD is EKSPLA's product line of laser diode drivers, also known as laser diode controllers, used in diode-pumped solid state lasers (DPSSL). The main purpose of laser diode drivers is to ensure precise current and temperature control of laser diodes. These laser diode drivers are compatible with a wide range of diodes (single emitters, bars, stacks, VCSELs, LEDs) and support both pulsed (QCW) and continuous (CW) operation modes.

Within this product family, the uniLDD-A models are specifically distinguished by a forced-air cooling system to effectively manage heat and ensure stable operation.

OPTIONAL TEC CONTROL

Certain uniLDD laser diode driver versions can simultaneously function as current sources for laser diodes and TEC controllers, also known as Peltier element thermocontrollers. Noted laser diode driver versions can contain up to two output channels, which can be utilized as two independent TEC controllers.

HIGH PERFORMANCE SPECS

Ekspla's laser diode controllers can provide currents from 10 A to 360 A while maintaining 0.1% pk-pk current ripple and amplitude stability. Compliance voltages of the laser diode drivers vary from 1 V to 90 V. Booster boards can extend output compliance voltage of certain uniLDD models. The vast majority of laser diode drivers are either partially customized or fully tailored for an optimal performance at customer's required regimes. For high-volume OEM customers, laser diode controllers can be tailored by removing excessive components to make sure drivers have optimal parameters, costs, and sizes.

LEADING EDGE APPLICATIONS

EKSPLA laser diode drivers are optimal for pumping of femtosecond, picosecond, nanosecond and CW solid state lasers based on crystal, fiber or direct-diode technology: industrial, medical, and scientific lasers.

ORDERING INFORMATION

PART NO	DESCRIPTION
uniLDD-A	Forced-Air Cooled Laser Diode Driver
uniLDD-C	Conductively Cooled Laser Diode Driver

TECHNICAL DESCRIPTION
Revision 2410

Contact Wavelength Electronics for custom product ordering

EKSPLA

406-587-4910
www.teamWavelength.com

CE

WAVELENGTH ELECTRONICS

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Chapter 1 PREFACE

This document describes the uniLDD series laser diode driver.

Version:

- Cooling type: built-in fan cooled
- Operation mode: CW and QCW, bidirectional TEC control

1.1. Warranty Statement

The uniLDD series laser diode drivers are protected by a two-years warranty covering labor and parts. The warranty enters into validity since the shipment date. Any evidence of improper use or unauthorized repair attempts voids the warranty.

1.2. Contacts

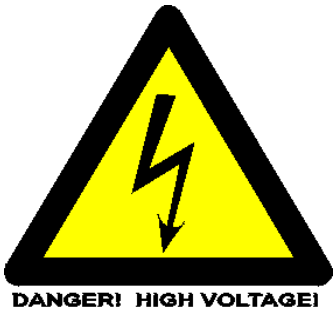
1.2.1. Manufacturer

EKSPLA
Savanoriu Ave 237
02300 Vilnius, Lithuania
Phone: +370 5 2649629
Fax: +370 5 2641809
E-mail: ekspla@ekspla.com
Web: https://ekspla.com/products/laser-electronics/

1.2.2. Service

We have a responsive Customer Service staff that will be pleased to help you. Please do not hesitate to contact them at:

Phone: +370 5 2649623
Fax: +370 5 2641809
E-mail: service@ekspla.com



SAFETY WARNING

Depending on the output configuration of the laser diode driver, the output voltage may exceed 48 VDC. Voltages higher than 48 VDC must be considered extremely dangerous, and as such, care must be taken to not touch the input or output terminals and other components of the electronics boards.

Equipment is designed to be safe under normal environmental conditions according to 1.4.1. 61010-1@IEC:2010 (Safety requirements for electrical equipment, control and laboratory use):

1. indoor use;
2. altitude up to 2000 m;
3. temperature 5ºC to 35ºC;
4. maximum relative humidity 80% for temperatures up to 31ºC decreasing linearly to 50% relative humidity at 35ºC;
5. POLLUTION degree 1: no POLLUTION or only dry, non-conductive POLLUTTION occurs.

Warning:
The safety of the system incorporating driver and HV power supply is the responsibility of the assembler of the system.

Do not remove unit covers while power cable is connected to the mains (if applicable).

Do not touch any parts of the system when voltage is applied, as it may dangerous for operator or cause unit operation malfunction.

Do not operate the unit until it is **grounded** and the load is connected.

Do not use the unit if any defects have been detected.

3.1. General Information

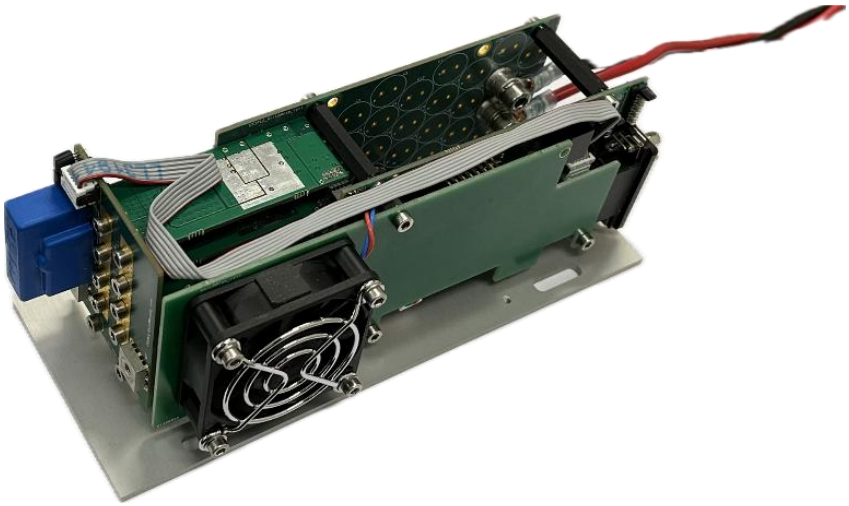
The universal laser diode driver, uniLDD, is capable of supplying most mid- and high-power laser diodes in both continuous and pulsed operation modes. It is a DC input power converter designed to provide CW (continuous wave) or pulsed (QCW) current for single emitters, bars, stacked laser diodes, or high-power VCSELs in constant current mode.

Various software and hardware configurations enable the uniLDD driver to adapt to different types of laser diodes and operating modes. The driver is based on DSP technology, ensuring high performance specifications. Available versions include air-cooled and conductive-cooled options.

3.1.1. Overview of driver versions

The uniLDD driver can be finished using different hardware component and software versions.

a) CW mode driver



Distinctive features

- Current sensor with a 100A peak current limit.
- Hardware components rated up to 55VDC power stage supply voltage.
- Capacitors board with reduced total capacitance.
- Internal fan height above the PCB can be optionally 10mm, 15mm or 25mm depending on the average output power.

b) QCW mode driver

Distinctive features

- Current sensor options with 100A or 360A peak current limit.
- Options for hardware component ratings with power stage supply voltages up to 58 VDC and 95 VDC.
- Internal capacitors battery to store energy for current pulse.
- Internal fan height above PCB can be optionally 10mm, 15mm or 25mm depending on output power.

c) CW mode driver with TEC control

Distinctive features

- Single TEC bipolar control.
- Current sensor with 100A peak current limit.
- Capacitors board with reduced total capacitance.
- Internal fan height above PCB can be optionally 10mm, 15mm or 25mm depending on output power.

d) QCW mode driver with TEC control

Distinctive features

- Optionally one or two independent TEC control outputs.
- Current sensor options with 100A or 360A peak current limit.
- Internal capacitors battery
- Internal fan height above PCB can be optionally 10mm, 15mm or 25mm depending on output power.
- QCW mode drivers are suitable for CW mode operation. The output characteristics in this case are consistent for each case.

3.1.2. Model Sticker

A sticker on top indicates part number (model code) serial number and key specifications of the driver.

Table 1. Model code description

Item	*Description*
Driver series	uniLDD
Cooling type	C – conductively cooled
	A – air cooled
Operation mode	CW – continuous wave
	QCW - quasi-continuous wave
Maximum output (diode compliance) voltage to laser diode	*Value, depends on model*
Maximum output current to laser diode	*Value, depends on model*
Options	T1 – one-channel bidirectional TEC control
	T2 – two-channel bidirectional TEC control

Key specifications of the driver are presented the sticker with specifications table. Models with TEC control include an additional sticker indicating the maximum output to Peltier element.

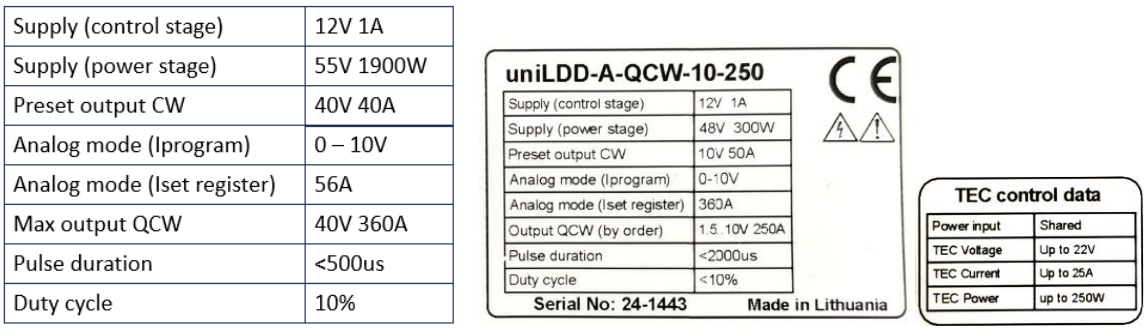


Figure 1. Information example provided on model sticker

Table 2. Model specifications explanation

Item	*Description*
Supply (control stage)	Power supply requirements for the control stage
Supply (power stage)	Power supply requirements for the power stage (supply source for laser diode)

Item	Description
Preset output CW	Maximum output (diode compliance) voltage and maximum current to the laser diode in CW mode
Analog mode (Iprogram)	Iprogram input range limits, e.g. “0-10V” means that Iprogram input is set for 0-10V analog current control or modulation range. The limits can be modified via CAN.
Analog mode (Iset register)	This value indicates the required “Iset” register value to be set in CANBrowser to achieve maximum preset output current (e.g. 40A) at maximum (10V in this example) analog mode control signal. For more information, see 5.2.3 CONTROL (p.19).
Max output QCW	Maximum output (diode compliance) voltage and maximum current to the laser diode in QCW mode.
Pulse duration	Maximum pulse duration at maximum output.
Duty cycle	Duty cycle at maximum output.

3.2. General Specifications

Below tables are general specifications of driver’s family. Final specifications of specific driver are found on **Model sticker** and **Test data** certificate.

Table 3. General specifications

Parameter	Value(s) uniLDD-A-CW	Additional information
INPUT		
Supply voltage, power stage[1]	<58 VDC <2.2 kW	Power supply output protection should be with current limiting
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, CW MODE		
Diode compliance voltage	Up to 50 V[2]	
Max current	100 A[2]	
Current ripple	0.1% pk-pk	DC…100kHz bandwidth, in x0.5…x1 of max current range
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up
Bandwidth of $I_{programm}$ control input frequency	>10kHz	At minimal connection cable inductance
Power conversion efficiency	92…98%	At maximal output specified

[1] Maximal voltage and power that can be delivered and consumed by the driver. Finaly, it depends on output requirements by taking in account conversion efficiency. E.g. sufficient power for CW mode 50A/40V is 2.2 kW.

[2] The parameters cannot be achieved at the same time. See your driver specifications on the “Model sticker” and “Test data” sheet.

Parameter	Value(s) uniLDD-A-QCW-50	Additional information
INPUT		
Supply voltage, power stage[1]	<58 VDC <2.2 kW	Power supply output protection should be with current limiting
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, QCW (PULSE) MODE		
Diode compliance voltage	Up to 50 V[2]	
Max pulse current	100A or 360A[2]	Depending on current sensor installed
Current pulse raise	>10 µs[3]	@ minimal connection cable inductance and sufficient power stage voltage above diode voltage,
Max RMS current	≲100A	
Duty cycle	<20%	
Recommended pulse repetition rate	Single pulse to 5 kHz	
Current pulse amplitude stability	0.1% pk-pk	In x0.5…x1 of max current range
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up

Parameter	Value(s) uniLDD-A-QCW-80	Additional information
INPUT		
Supply voltage, power stage[1]	<95 VDC <1.3 kW	Power supply output protection should be with current limiting
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, QCW (PULSE) MODE		
Diode compliance voltage	Up to 80 V[2]	
Max pulse current	100A or 360A[2]	Depending on current sensor installed
Current pulse raise	>10 µs[3]	@ minimal connection cable inductance and sufficient power stage voltage above diode voltage,
Max RMS current	≲80A	
Duty cycle	<20%	
Recommended pulse repetition rate	Single pulse to 5 kHz	
Current pulse amplitude stability	0.1% pk-pk	In x0.5…x1 of max current range
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up

[1] Maximal voltage and power that can be delivered and consumed by the driver. Finaly, it depends on output requirements by taking in account conversion efficiency.

[2] The parameters cannot be achieved at the same time. See your driver specifications on the "Model sticker" and "Test data" sheet.

[3] Customizable parameter. See your driver specifications on the "Test data" sheet.

Parameter	Value(s) uniLDD-A-CW-…-1T	Additional information
INPUT		
Supply voltage, power stage[1]	<58 VDC <2.2 kW	Power supply output protection should be with current limiting. The power input is shared with TEC stage.
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, CW MODE		
Diode compliance voltage	Up to 50 V[2]	
Max current	75 A[2]	
Current ripple	0.15% pk-pk	DC…100kHz bandwidth, in x0.5…x1 of max current range
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up
Bandwidth of $I_{programm}$ control input frequency	>10kHz	At minimal connection cable inductance
Power conversion efficiency	92…98%	At maximal output specified
OUTPUT to TEC		
Output voltage	Up to 50 V	Or up to 90% of supply voltage
Output current	Up to 25A	
Output power	Up to 250W	

Parameter	Value(s) uniLDD-A-QCW-50-…-1T	Additional information
INPUT		
Supply voltage, power stage[1]	<58 VDC <2.2 kW	Power supply output protection should be with current limiting. The power input is shared with TEC stage.
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, QCW (PULSE) MODE		
Diode compliance voltage	Up to 50 V[2]	
Max pulse current	100A or 300A[2]	Depending on current sensor installed
Current pulse raise	>10 µs[3]	@ minimal connection cable inductance and sufficient power stage voltage above diode voltage,
Max RMS current	≲75A	
Duty cycle	<20%	
Recommended pulse repetition rate	Single pulse to 5 kHz	
Current pulse amplitude stability	0.15% pk-pk	In x0.5…x1 of max current range

[1] Maximal voltage and power that can be delivered and consumed by the driver. Finaly, it depends on output requirements by taking in account conversion efficiency.

[2] The parameters cannot be achieved at the same time. See your driver specifications on the "Model sticker" and "Test data" sheet.

[3] Customizable parameter. See your driver specifications on the "Test data" sheet.

Parameter	Value(s) uniLDD-A-QCW-50-…-1T	Additional information
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up
OUTPUT to TEC		
Output voltage	Up to 50 V	Or up to 90% of supply voltage
Output current	Up to 25A	
Output power	Up to 250W	

Parameter	Value(s) uniLDD-A-QCW-80-…-1T	Additional information
INPUT		
Supply voltage, power stage[1]	<95 VDC <1.5 kW	Power supply output protection should be with current limiting
Supply voltage, control stage	12 VDC 10 W	
OUTPUT, QCW (PULSE) MODE		
Diode compliance voltage	Up to 80 V[2]	
Max pulse current	100A or 360A[2]	Depending on current sensor installed
Current pulse raise	>10 µs[3]	@ minimal connection cable inductance and sufficient power stage voltage above diode voltage,
Max RMS current	≲60A	
Duty cycle	<20%	
Recommended pulse repetition rate	Single pulse to 5 kHz	
Current pulse amplitude stability	0.1% pk-pk	In x0.5…x1 of max current range
Current drift	<0.2%	Cold start, 8h period, after 5min. warm up
OUTPUT to TEC		
Supply voltage, TEC stage	<58 VDC <300W	Separate power supply input for TEC stage
Output voltage	Up to 50 V	Or up to 90% of supply voltage
Output current	Up to 25A	
Output power	Up to 250W	

ENVIRONMENT		
Way of cooling	Internal fan	
Operating ambient temperature	0 to 40°C	De-rate current at higher temperature

[1] Maximal voltage and power that can be delivered and consumed by the driver. Finaly, it depends on output requirements by taking in account conversion efficiency.

[2] The parameters cannot be achieved at the same time. See your driver specifications on the "Model sticker" and "Test data" sheet.

[3] Customizable parameter. See your driver specifications on the "Test data" sheet.

PROTECTIONS
Current transient protection and shut-down
Open circuit shut-down
Power voltage brownout shut-down
Over temperature shut-down
Interlock shut-down

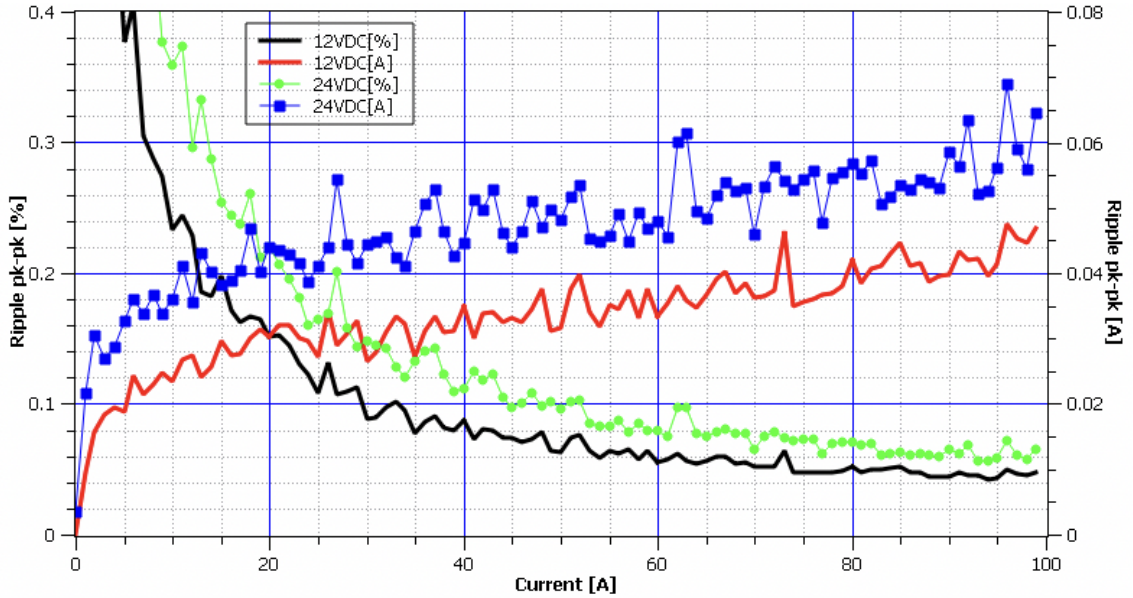


Figure 2. Ripple current, 12V and 24V DC power, 2V junction + 10 mΩ series R load

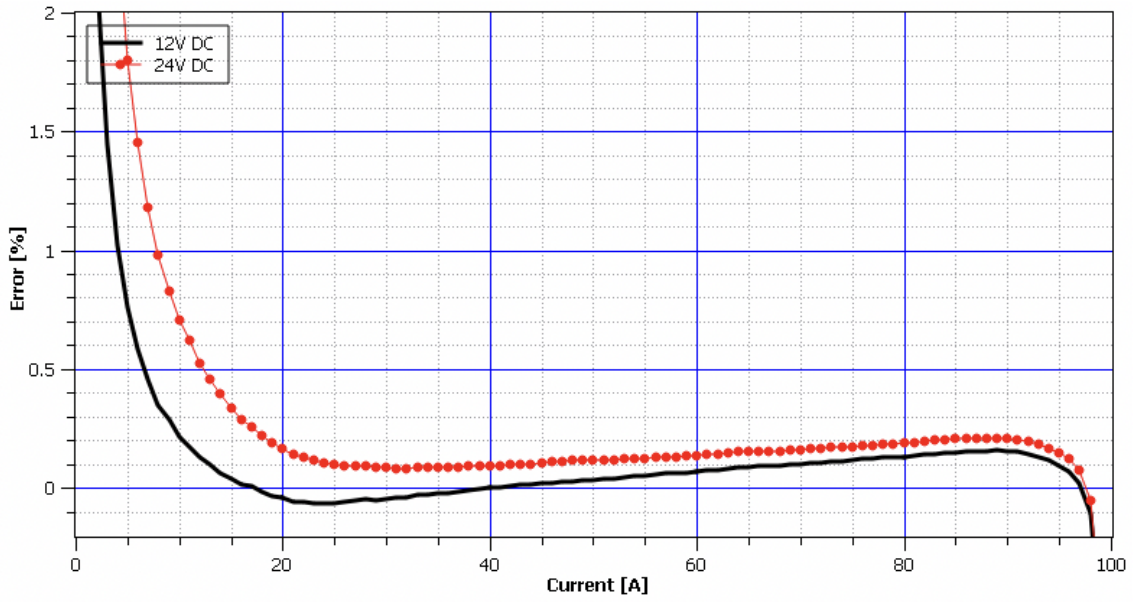


Figure 3. Current error, 12V and 24V DC power, 2V junction + 10 mΩ series R load

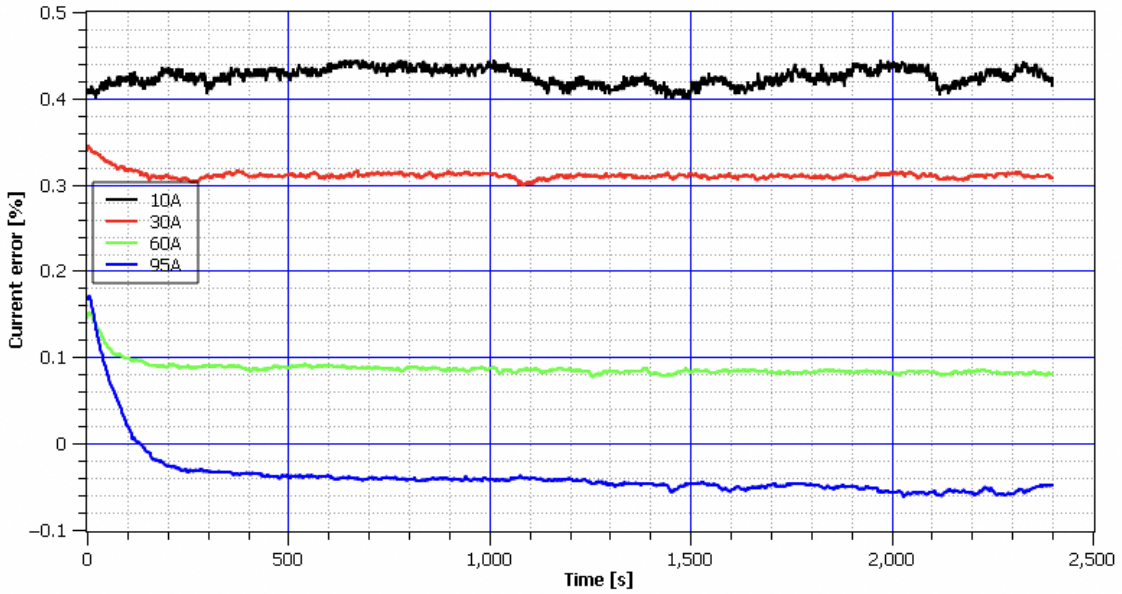


Figure 4. Current drift, cold start @ different currents

3.2.1. Digital Control Interface

CAN bus. Protocols:

- proprietary Ekspla protocol. Protocol description, control application, libraries and programming samples are provided on request.
- 'CAN Open' stack may be added on request.

RS232 port. Protocols:

- ASCII text command protocol.
- Proprietary Ekspla CAN messages tunnel over RS232 protocol. Control application, libraries and programming samples are provided.

3.2.2. Physical Characteristics

- Size, see below drawings for details
- Weight 680 g.
- Connectors:
    - Analog control - DSUB-15.
    - Digital control - Molex Picoflex series 6pin and 10pin connectors.
    - Trigger input – MCX coaxial connector.
    - DC power stage – M5 screws.
    - Output to laser diode – M5 screws.

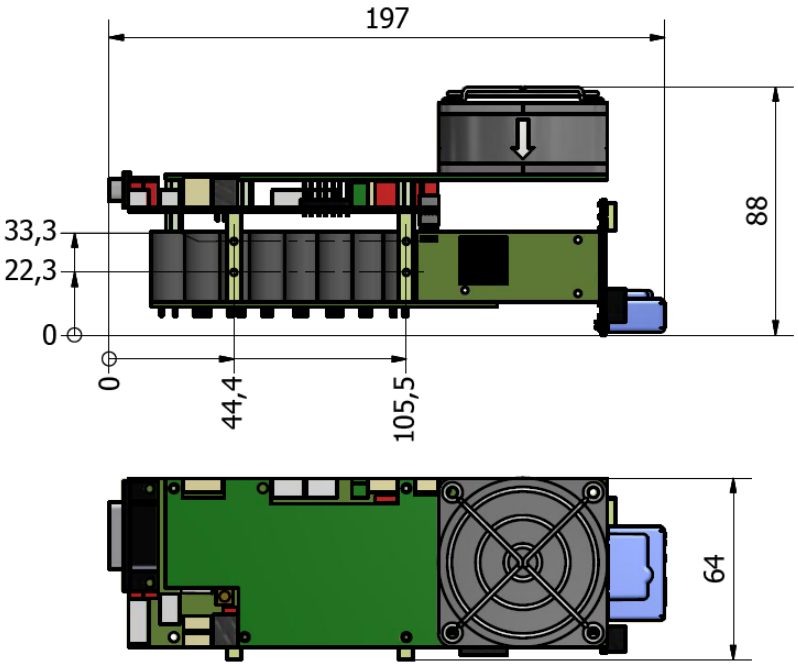


Figure 5. uniLDD series driver with 100A current sensor and 25mm fan installed

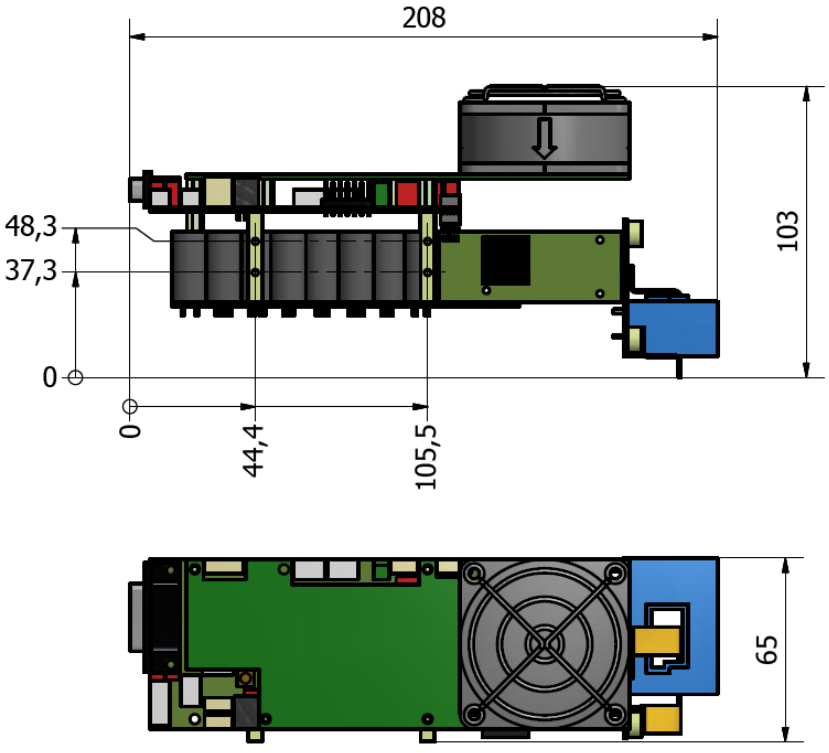


Figure 6. uniLDD series driver with 360A current sensor and 25mm fan installed

4.1. Connection Layout

The uniLDD series driver can be controlled via analog, RS232 or CAN interfaces. There are also connections for power supply, analog control, sensors, etc. The figures below show the main interfaces and power connection points. More detailed information is available in the accompanying delivery documents.

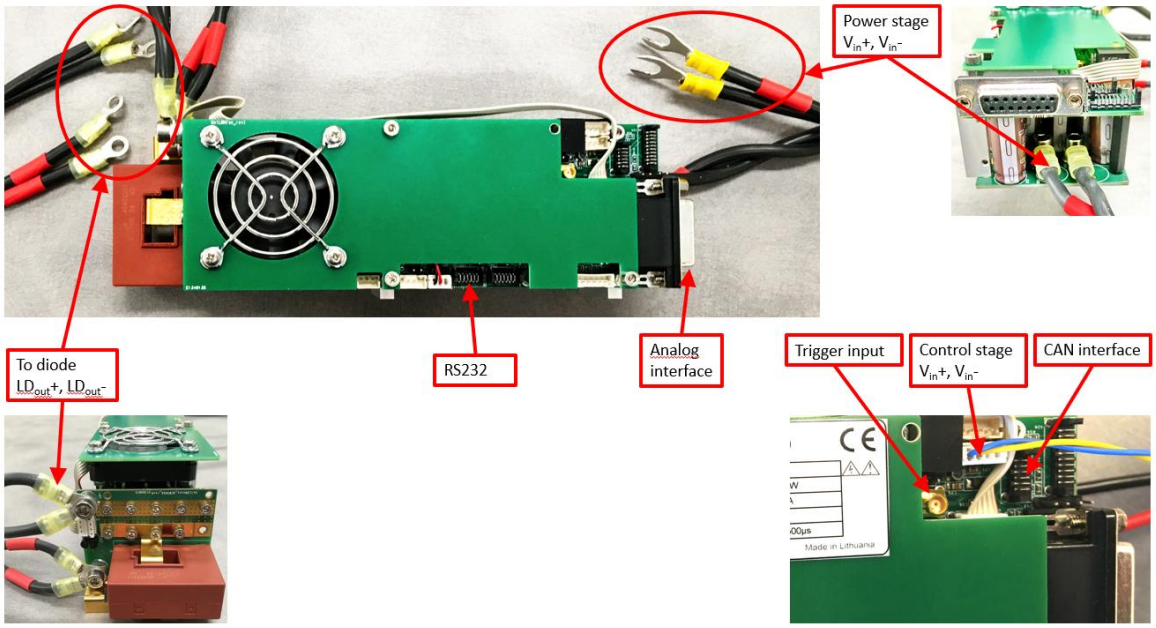


Figure 7. Connections on the driver with 360A current sensor

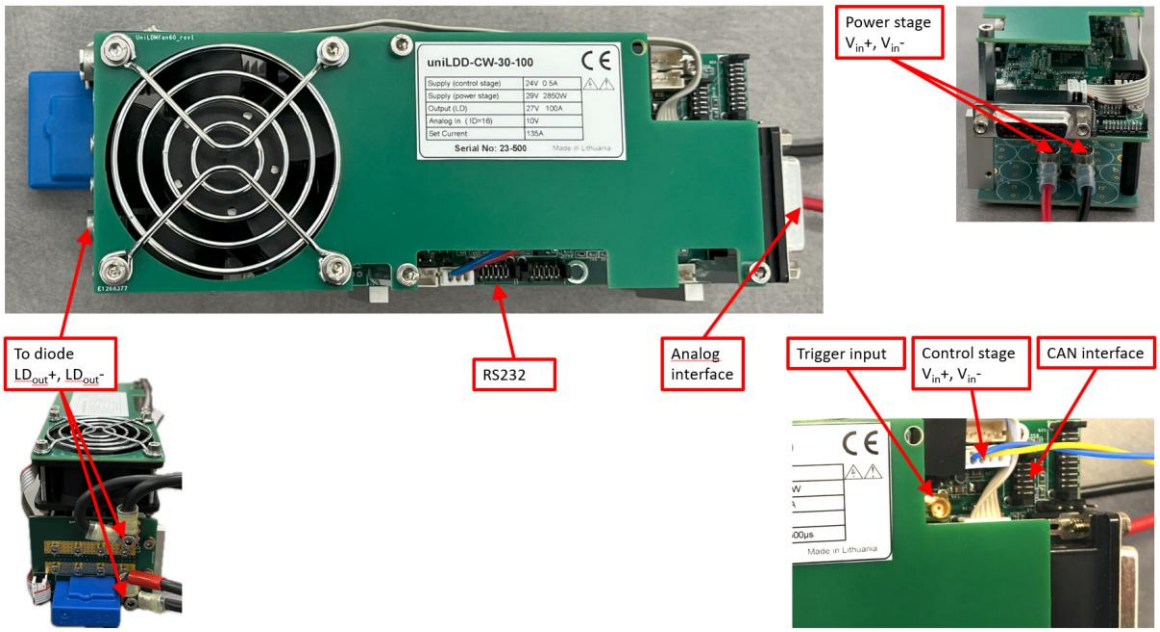


Figure 8. Connections on the driver with 100A current sensor

Depending on specifications, for some of QCW drivers in order to extend pulse duration, manufacturer recommends an extra capacitor to be installed. Below picture shows the best way of extra capacitor connection. Electrically it is inserted at the power stage supply point using as short as possible >6 mm^2 CSA wires using an existing M3 screws.

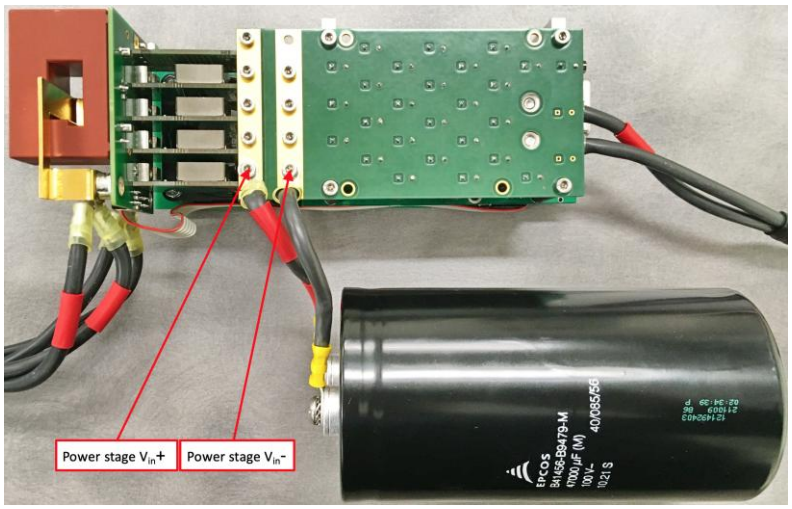


Figure 9. Connection of external energy storing capacitor

Control stage supply voltage +12VDC can be connected using CAN interface connector as alternative. Below picture is an example of possible wiring alternative.

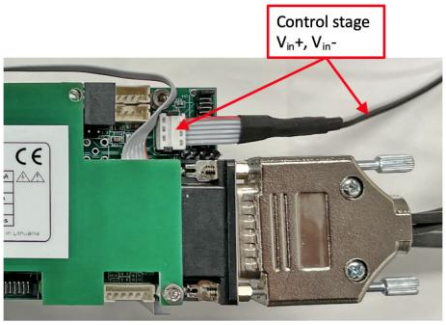


Figure 10. Possible alternative way to connect control stage supply +12VDC

Table 4. Connections on the driver

Connection	*Description*
Analog interface	D-sub 15-pin female analog interface connector. See **Table 5** in 4.3 ANALOG INTERFACE PINOUT (p.14) for pinout.
To diode LD_{out}-	Output to diode -
To diode LD_{out}+	Output to diode +
RS232	RS232 interface connector
Trigger input	In TriggerIN mode: trigger input. A rising pulse provided to this connector will trigger an output current pulse of a preset width. In Time-gated mode: input to start/stop the output current. ***Pin 8 of Analog interface performs the same function.***
CAN interface	CAN interface connector. Requires EKSPLA CAN-USB converter ("grey box") or USB-CAN-LAN-RS232 Converter for connection.
Control stage V_{in}+/V_{in}-	Input for control stage voltage +/-
Power stage V_{in}-	Input for power stage voltage +
Power stage V_{in}+	Input for power stage voltage -

See additional documents, particularly "Doc_inputs.pdf" and "UniLDMcpu_layout.pdf" for more details.

4.2. Connections for Basic Operation

The minimal connections required for basic operation are:

- Power stage V_{in}+/V_{in}-
- Control stage V_{in}+/V_{in}-
    - Alternative connection for control stage supply voltage +12VDC: CAN interface connector (pin 4 to +12VDC, pin 5 to GND).
- To diode LD_{out}+/LD_{out}-

Usually, the wires for power and control stages are provided together with the driver. Contact the manufacturer if the wires need to be replaced - **the wire lengths and cross-section areas are tailored for a particular configuration.**

Use separate power supplies for power and control stages. See clause 3.1.2 for power supply requirements.

4.3. Analog Interface Pinout

Table 5. Analog interface pinout

Pin	*Signal name*	*Direction*	*Voltage level*	*Description*
1	Enable	Input	TTL (LVTTL) 200µA pull up to 3.3V	The Enable function gives permission to operate for TEC driver and consequently for LDD driver.
2	Ready To Operate (RTO)	Input/Output through 330Ω resistor	>2.4V driver output is active, <0.5V output is clamped	RTO is tied to 'High' by the driver when 'Active RTO ' is enabled and the driver is in active state. Alarms clamp RTO low and disable driver output. External device may clamp RTO to GND and disable driver output. RTO allows to join fault circuits of several drivers connected in parallel
3	Interlock	Input	10kΩ pull up to 3.3V, LOW = <0.4V	The Interlock function can be connected to external safety or machine protection switches such as door or temperature switches. Open = OFF Connect to GND = RUN
4	GND			
5	Vout Monitor	Output	Vout, driver output voltage	The output voltage monitor. Vout = Diode compliance voltage + voltage drop on connection wires
6	Iout Monitor	Output	0-10V* = 0-Ioutmax	The output current monitor
7	Iprogram	Input	0-10V* = 0-Ioutmax	Output current setting or modulating by applying a voltage, CW and Pulse mode
8	Pulse Control	Input	TTL, LVTTL positive pulse	In TriggerIN mode: trigger input. A rising pulse provided to this connector will trigger an output current pulse of a preset width. In Time-gated mode: input to start/stop the output current." ***Connection "Trigger input" performs the same function***
9	GND			
15	GND			
10, 11	+5V	Output	Auxiliary 200mA	
12	-15V	output	Auxiliary 100mA	
13, 14	+15V	Output	Auxiliary 200mA	

5.1. CANBrowser Software

CANBrowser is a utility software used to connect to and control CAN devices. Your uniLDD driver is also a CAN device.

Use a EKSPLA CAN-USB converter (“grey box”) or USB-CAN-LAN-RS232 Converter to connect to the “CAN interface” connector on the driver”.

Install CANBrowser on your PC. Please note that CANBrowser is delivered in “User mode” with only basic functionality. If required, contact EKSPLA for instructions to unlock “Advanced mode”. Alternatively, the user may develop a piece of custom software using the provided descriptions of CAN interface and control registers.

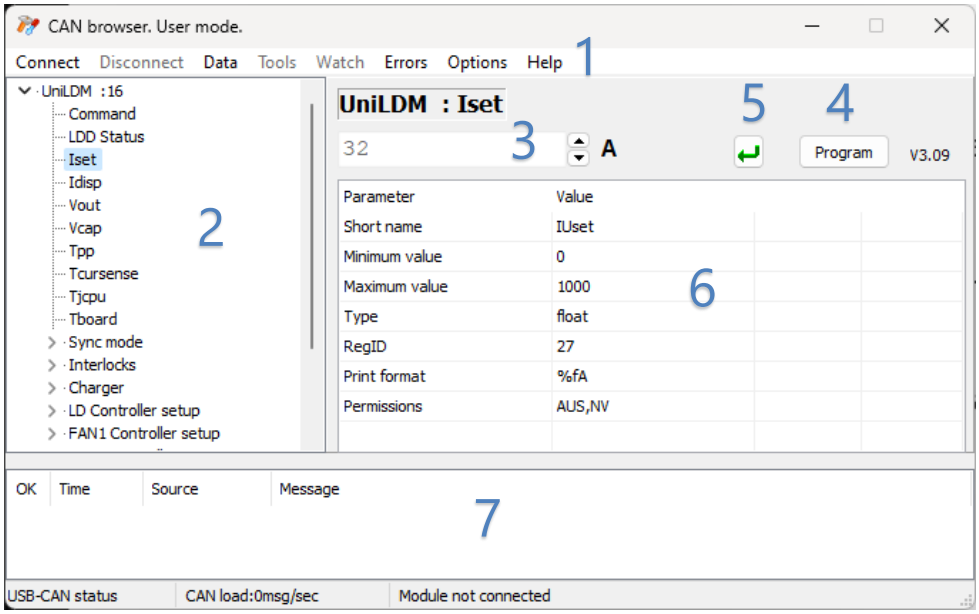


Figure 11. CANBrowser main window (example)

In figure above: 1 – Top menu; 2 – Tree view of CAN modules; 3 – Edit area; 4 – “Program” button; 5 – “Enter” button; 6 – watch area; 7 - message area

To monitor more than one value at a time, select the desired register and click “Watch” in the top menu – the register name and value will be added to the watch area. Values cannot be edited in the watch area.

System messages, including error messages, appear in the message area.

5.2. Operation Modes

Warning:

It is strongly recommended that the output limits to the laser diode be correctly set before use. That will save the laser diode from possible accidental damage due to incorrect operation. The limits may be preset at the factory when ordered, if not, follow the instructions below.

5.2.1. Setting of Operation Limits

1. Run CANBrowser and connect to the driver:
    a. Run CANBrowser.
    b. In the top menu, click "Options" and set the connection type.
    c. Click "Connect" in the top menu. Choose "Load all" – all available CAN modules will be shown in the tree view.
2. Set "Iout max" to maximum current value specified for your laser diode, or the value you do not want to be exceeded:
    a. In the tree view, select "Interlocks", then "Iout max"
    b. In the edit area, enter the desired current value.
    c. Click "Program".
3. Set "Vout max" to maximum compliance voltage value specified for your laser diode:
    a. In the tree view, select "Interlocks", then "Vout max"
    b. In the edit area, enter the desired voltage value.
    c. Click "Program".

The CANBrowser need to be set either on Service or Advanced mode. Check with the manufacturer or retailer for instructions on how to enable the software.

5.2.2. CW Mode

1. Run CANBrowser and connect to the driver:
    a. Run CANBrowser.
    b. In the top menu, click "Options" and set the connection type.
    c. Click "Connect" in the top menu. Choose "Load all" – all available CAN modules will be shown in the tree view.
2. Set "Sync mode" to "Continuous":
    a. In the tree view, select "Sync mode", then "Sync mode".
    b. In the edit area, select "Continuous".
    c. Click "Program".
3. Set the "Iset" current value:
    a. In the tree view, select "Iset".
    b. In the edit area, enter the desired current value.

For the first run, it is recommended to set the current at 10...20% of the nominal specified value.

c. Click "Program" to save permanently, or click "Enter" symbol to save the value temporarily.

4. Use the driver. To start and stop:
    a. In the tree view, select "Command".
    b. In the edit area, select "ON" or "OFF".

To check the electrical current value measured by the driver, in the tree view, select "Idisp".

5.2.3. Control via "Analog interface" DB15 connector

The sticker shown in **Figure 1** indicates the basic information about electrical parameters required to run the driver using analog control.

If ordered during purchase of the driver, analog control mode is pre-configured at the factory and no configuration needs to be performed by the user.

Otherwise, apply the following settings in CANBrowser and *save each setting by clicking the "Program" button*:

1. Set "Analog control" to "ON" in order to control output current via Iprogram 0-10V input. Leave it "OFF" if you still use current setting via "Iset" register:
    a. In the tree view, select "LD Controller setup", then "Analog control".
    b. In the edit area, select "ON".
    c. Click "Program".
2. Set "Sync mode" to "Continuous":
    a. In the tree view, select "Sync mode", then "Sync mode".
    b. In the edit area, select "Continuous".
    c. Click "Program".
3. Set "Interlock1 on off" to "ON":
    a. In the tree view, select "Interlocks", then "Interlock on off".
    b. In the edit area, select "ON" (or "Defeat" if interlock is not used).
    c. Click "Program".
4. Set "Active RTO" to "ON":
    a. In the tree view, select "Interlocks", then "Active RTO".
    b. In the edit area, select "ON".
    c. Click "Program".
5. Set the "Iset" current value:
    a. In the tree view, select "Iset".
    b. If you chose "Analog control" set to "ON", in the edit area, enter exactly the same value as on the model sticker (**Figure 1**). If "Analog control was set to "OFF" then enter output current value you need for your diode.
    c. Click "Program".
6. Set "Command" to "ON":

a. In the tree view, select “Command”.
b. In the edit area, select “ON”.
c. Click “Program”.

To use the driver in analog control mode:

1. Apply voltage in range 0-10V to set required current (“Iprogram”) to laser diode if your setting is “Analog control” to “ON”.
2. To check the electrical current value measured by the driver, in the tree view, select “Idisp”.

The timing diagram below illustrates the algorithm of operation.

Note!
“Enable” input is pulled-up.

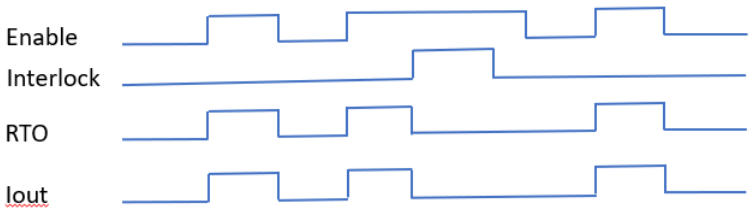


Figure 12. Timing diagram by control via “Enable”

Alternatively, current control may be performed via RTO (instead of the “Enable” signal). While RTO is pulled down, the “Enable” signal is used to reset any errors (e.g. after interlock line break down). The figure below shows the connections using control via RTO signal.

The following settings need to be applied for current control via RTO:

1. Set “Analog control” to “ON” in order to control output current via Iprogram 0-10V input. Leave it “OFF” if you still use current setting via the “Iset” register:
   a. In the tree view, select “LD Controller setup”, then “Analog control”.
   b. In the edit area, select “ON”.
   c. Click “Program”.
2. Set “Sync mode” to “Continuous”:
   a. In the tree view, select “Sync mode”, then “Sync mode”.
   b. In the edit area, select “Continuous”.
   c. Click “Program”.
3. Set “Interlock1 on off” to “ON”:
   a. In the tree view, select “Interlocks”, then “Interlock on off”.
   b. In the edit area, select “ON” (or “Defeat” if interlock is not used).
   c. Click “Program”.
4. Set “Active RTO” to “ON”:
   a. In the tree view, select “Interlocks”, then “Active RTO”.
   b. In the edit area, select “ON”.
   c. Click “Program”.

5. Set “Command” to “ON”:
    a. In the tree view, select “Command”.
    b. In the edit area, select “ON”.
    c. Click “Program”.

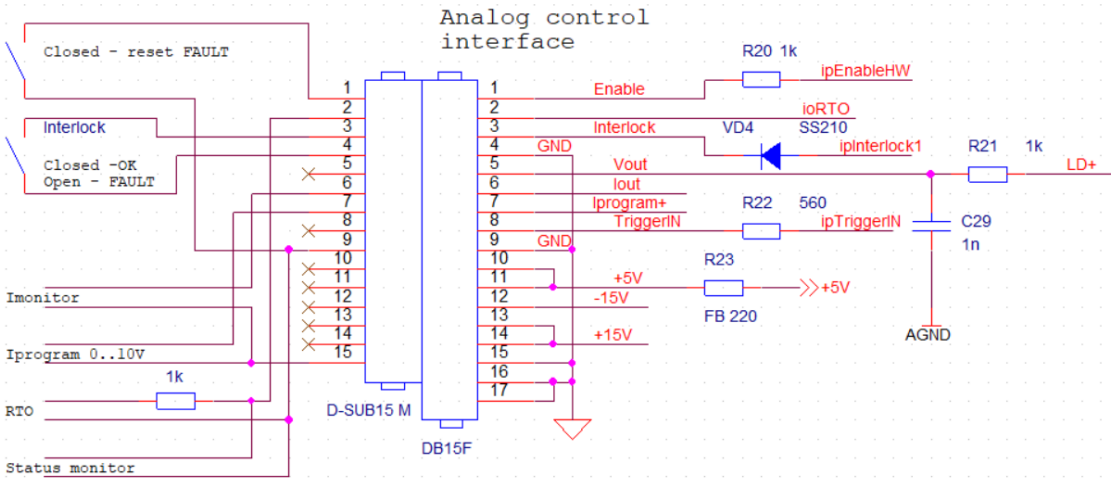


Figure 13. Connections using control via RTO signal

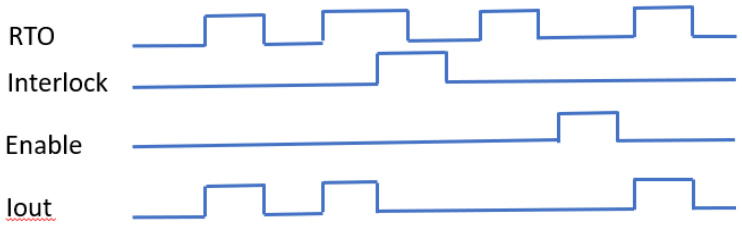


Figure 14. Timing diagram by control via “RTO”

“Iprogram” input can be used to modulate output current – this allows achieving QCW operation by external analog signal.

Note that in both Enable and RTO control modes, the output current is significantly delayed (up to 10-20 ms). This is generally suitable for pure CW mode. If precise control of output current start/stop moments is needed, the Time-gated operation mode is recommended.

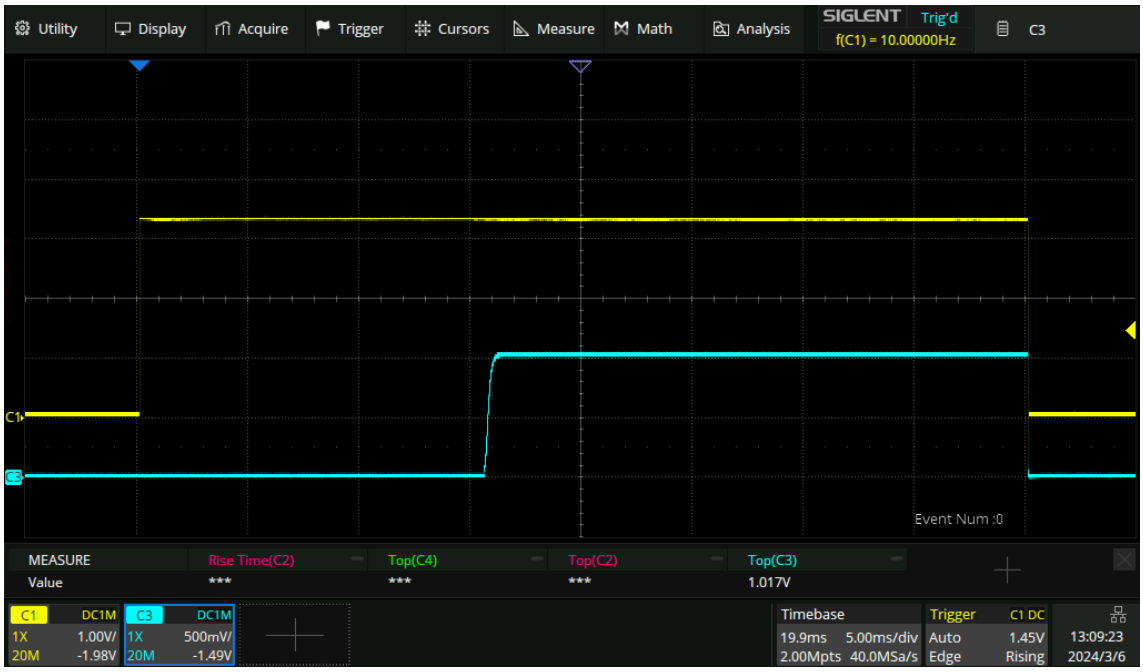


Figure 15. Current delay in control via Enable or RTO inputs. Traces: Yellow - control input, blue – output current. The current starts after ~16 ms delay.

5.2.4. Time-gated Operation Mode

Time-gated mode allows you to turn on the output current at the beginning of the control pulse and turn it off at its end at a precise time. Following settings need to be applied:

1. Set “Analog control” to “ON” in order to control output current via Iprogram 0-10V input. Leave it “OFF” if you still use current setting via” Iset” register:
    a. In the tree view, select “LD Controller setup”, then “Analog control”.
    b. In the edit area, select “ON”.
    c. Click “Program”.
2. Set “Sync mode” to “Continuous”:
    a. In the tree view, select “Sync mode”, then “Sync mode”.
    b. In the edit area, select “Continuous”.
    c. Click “Program”.
3. Set “TriggerIn function” to “LD on/off”:
    a. In the tree view, select “Sync mode”, then “TriggerIn Function”.
    b. In the edit area, select “LD on/off”.
    c. Click “Program”.
4. Set “Interlock1 on off” to “ON”:
    a. In the tree view, select “Interlocks”, then “Interlock on off”.
    b. In the edit area, select “ON” (or “Defeat” if interlock is not used).
    c. Click “Program”.
5. Set “Active RTO” to “ON”:
    a. In the tree view, select “Interlocks”, then “Active RTO”.
    b. In the edit area, select “ON”.
    c. Click “Program”.

6. Set “Command” to “ON”:
    a. In the tree view, select “Command”.
    b. In the edit area, select “ON”.
    c. Click “Program”.

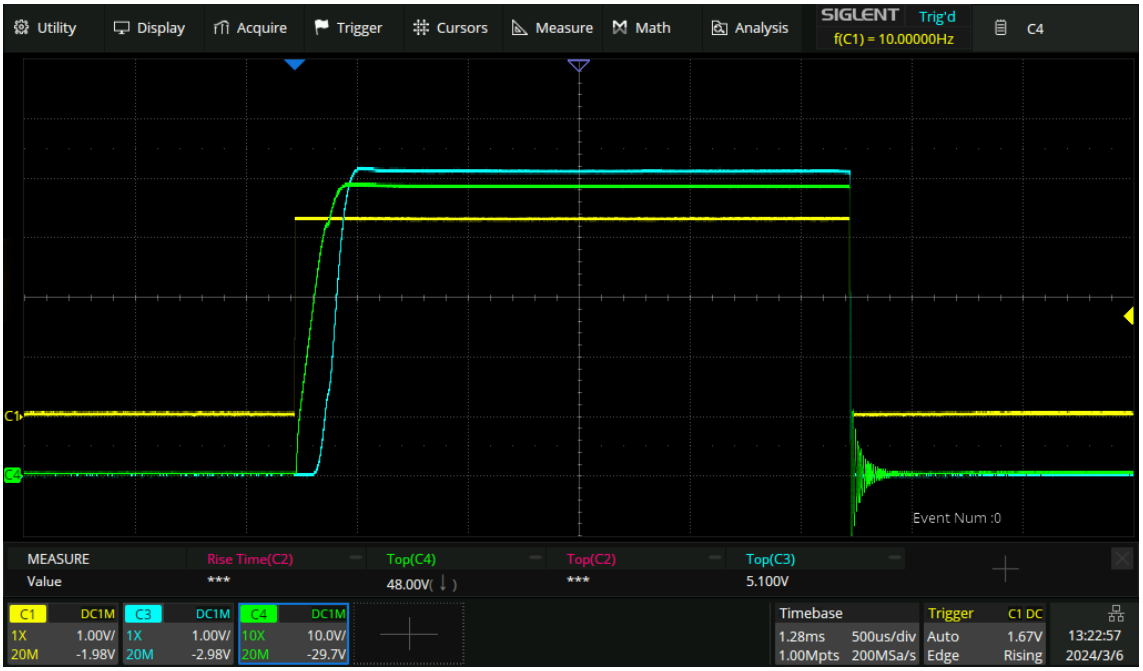


Figure 16. Current on/off control in Time-gated operation mode. Traces: Yellow – trigger input, green - output voltage, blue – output current.

5.2.5. QCW Mode

The driver can run in QCW mode in the following ways:

- Internal synchronization
- External synchronization (Pulse control on Analog interface)
- Analog current control (with 0-10V control signal)

1. Run CANBrowser and connect to the driver:
    a. Run CANBrowser.
    b. In the top menu, click “Options” and set the connection type.
    c. Click“Connect” in the top menu. Choose “Load all” – all available CAN modules will be shown in the tree view.
2. In the tree view, expand “Sync mode”. The following parameters can be changed here:
    a. Sync mode
        i. Int sync
        ii. Ext sync
    b. Repetition rate

c. Pulse width
d. Pulse delay (only in external synchronization)

3. Set the "Iset" current value:
   a. In the tree view, select "Iset".
   b. In the edit area, enter the desired current value.
      For the first run, it is recommended to set the current at 10...20% of the nominal specified value.
   c. Click "Program" to save permanently, or click "Enter" symbol to save the value temporarily.
4. Use the driver. To start and stop:
   a. In the tree view, select "Command".
   b. In the edit area, select "ON" or "OFF".
5. To check the electrical current value measured by the driver, in the tree view, select "Idisp".

Analog control in QCW mode is available and is accessible in a similar way as the "Continuous" mode. "Iprogram" input 0-10V controls the current value. Repetition rate, Pulse width and Pulse delay are set by corresponding registers values.

Note that if your driver is made generally for CW mode operation, current rise time may be relatively long and maximall output current specifications can be limited. Check "Test data" sheet for more details.

5.3. RS232 Interface Control

Optionally, the driver can be controlled using the RS232 interface.

The supplied RS232 cable should be connected to X2 connector on uniLDMcpu board – see documents "Cables _ RS232toPanel.pdf", "Doc _ Inputs.pdf" and "UniLDMcpu_rev4_SST_1.pdf" for more information.

RS232RestTest.exe software is included to run the driver for evaluation.

The majority of CAN settings and registers are available in RS232 mode. Send command "list" to see all accessible registers on your particular device.

Short RS232 command syntax examples:

- Register list: /list()
- Device ID: /id()
- Read: /UniLDM/17/Iset
- Write: /UniLDM/17/Iset/87
- Write to NVRAM: /UniLDM/17/Iset/NV

5.4. CW and QCW uniLDD series driver with TEC control

The uniLDD series driver can be supplied with either one or two channels of bidirectional TEC control. Specific firmware is installed and some hardware differences are applied that case. All laser diode control features are preserved as per above description but the output current is lower.

5.4.1. Basic connections

All the control connections are the same as in CW/QCW mode drivers. Only specific LD and TEC connections are presented in Figure 17 where left photo is related to the driver with single TEC control "uniLDD-A-CW-...-1T" and "uniLDD-A-QCW-50-...-1T", right – with two TEC's "uniLDD-A-CW-...-2T" and "uniLDD-A-QCW-50-...-2T".

Figure 17. Connections on the driver with TEC control

The drivers 'uniLDD-A-QCW-80-...-1T" and "uniLDD-A-QCW-80-...-2T" have separate power inputs for LD and TEC stages.

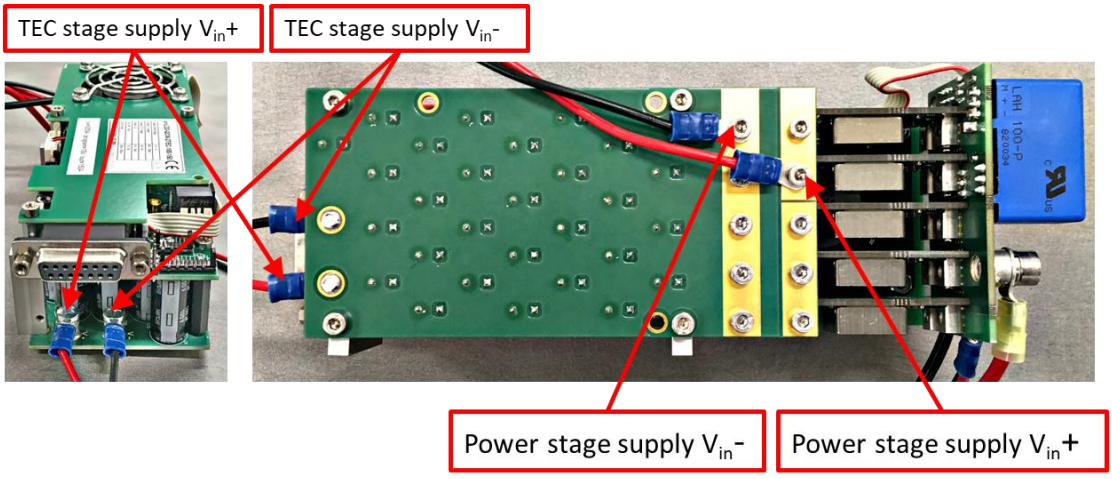


Figure 18. Connections on the driver with TEC control and separated power inputs

Output connections of the drivers equipped with 360A current sensor have slightly different layout that is presented in Figure 19.

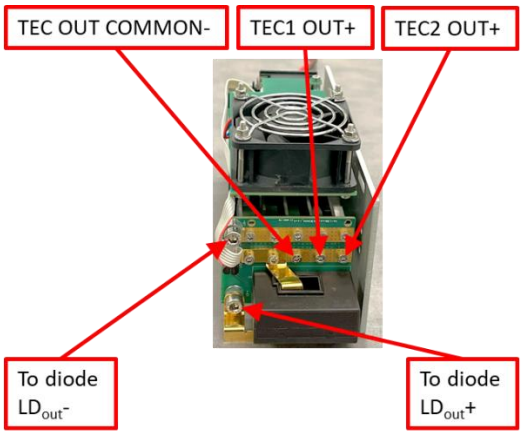


Figure 19. Output connections on the driver with 360A current sensor

5.4.2. Laser diode section settings

All the settings related to laser diode control are done as per chapters 4 and 5.1 to 5.3.

5.4.3. TEC control section settings

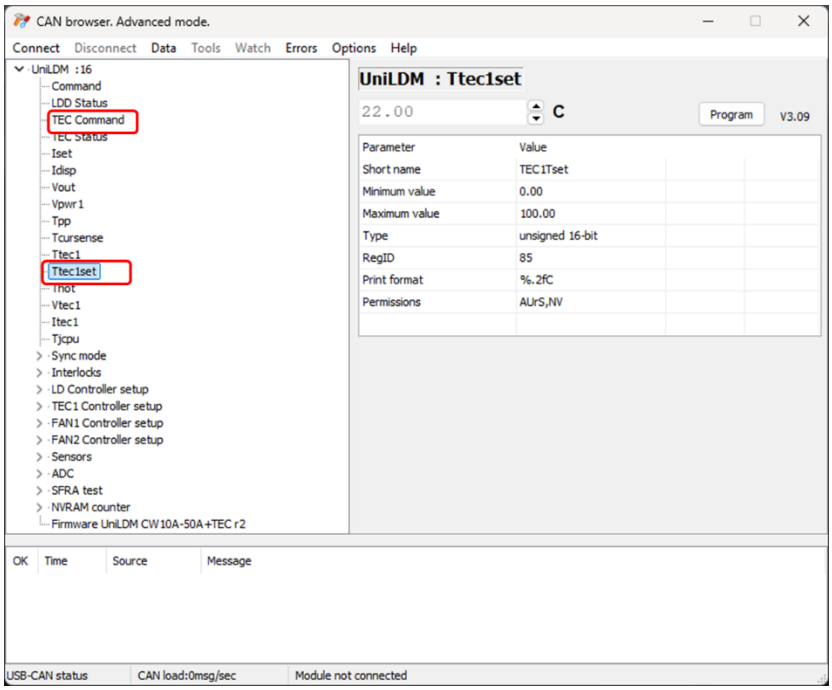


Figure 20. CANBrowser main window (example). uniLDD software with TEC control.

Use register Ttec1set to set cold side temperature for desired value. It must be programmed by pressing “Program” button after entered.

Register “TEC Command” is to switch on for temperature stabilization. Values can be as next: OFF - TEC controller is disabled, ON - TEC controller is controlled by 'Enable' hardware signal, Force ON - TEC controller is enabled.

Refer to the provided descriptions of CAN interface and control registers for more control details.