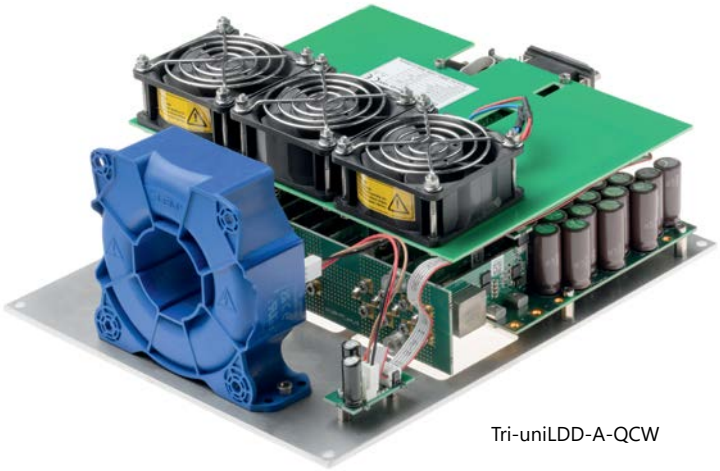
Laser Diode Drivers

uniLDD SERIES



Tri-uniLDD-A-QCW

uniLDD is the 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.

Our 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.

Ekspla's laser diode controllers can provide currents from 10 A to 1200 A while maintaining 0.1% pk-pk current ripple and amplitude stability. Compliance voltages of our laser diode drivers vary from 1 V to 600 V.

In the vast majority of cases we either partially customize or fully tailor our laser diode drivers for an optimal performance at customer's required regimes. For high-volume OEM customers we also tailor our laser diode controllers by removing excessive components to make sure drivers are optimal parameter, cost and size wise.

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.

MODEL CODING SCHEME

uniLDD-A-QCW-30-70-T2

- Driver series
- Cooling type
  - C → conductive
  - A → forced-air
- Operation mode (hardware based)
  - CW → continuous-wave
  - QCW → quasi-continuous-wave (pulsed)
- Maximum output compliance voltage, V
- Maximum output current, A
- Amount of enabled TEC channels
  - T1 → one-channel bidirectional TEC control
  - T2 → two-channel bidirectional TEC control

FEATURES

- *Current range* ***from 10 A to 1200 A***
- *Compliance voltage range* ***from 1 V to 600 V***
- *Current stability of* ***0.1%*** *pk to pk*
- *Current ripple of* ***0.1%*** *pk to pk*
- *Output power up to* ***6 kW***
- *Protections:*
  - *current transient (overload) protection;*
  - *open circuit shut-down;*
  - *over temperature shut-down;*
  - *power voltage brownout (voltage dip) shut-down;*
  - *interlock shut-down*
- *Drivers can function simultaneously as TEC controllers and LDD current sources*
- *Can be controlled via analog and digital (CAN, RS232) interfaces.*
- *Uniquely customizable modular design ensures drivers can be tailored to precisely meet OEM customer's needs*
- *Fast turnaround times between inquiry, prototyping and high-volume manufacturing stages*

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. Most popular fields of applications are:

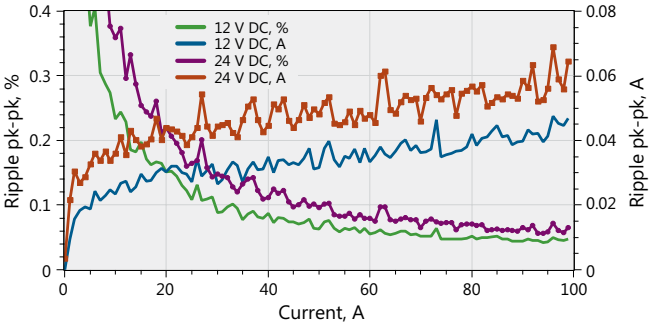
- Industrial lasers
  micromachining, welding and cutting
- Medical lasers
  ophthalmology, dermatology and surgery
- Scientific lasers
  fusion research, spectroscopy, and high-energy physics

Model	uniLDD-C-CW		uniLDD-C-QCW		uniLDD-A-CW	
						
OUTPUT SPECIFICATIONS						
Operation mode	CW [1]	QCW [2]	CW	QCW [2]	CW	QCW
Compliance voltage range, min-max [3]	1 – 70 V [4]	–	1 – 70 V	1 – 65 V	1 – 50 V	–
Current range, min-max	10 – 100 A [5]		10 – 100 A	10 – 160 A	10 – 100 A	
Power, max	3 kW [6]		3 kW	3 kW	2 kW	
Power conversion efficiency	90 – 98 %					
Current pulse amplitude stability	0.1 % pk to pk [7]					
Current ripple	0.1 % pk to pk [8]					
Current drift	< 0.2 % [9]					
Duty cycle	–			≤ 20 %	–	
Repetition rate, max				≤ 5 kHz		
Current rise time, typical				5 – 100 µs [10]		
Current pulse duration, typical				up to 100 ms [11]		
RMS current, max				100 A		
Amount of functioning internal TEC control channels	0, 1 or 2 [12]					
TEC control current, min-max per channel	1 – 25 A					
TEC control voltage, min-max per channel	1 – 36 V					
TEC control power, max per channel	350 W					
INPUT SPECIFICATIONS						
Power supply requirements (power stage), min	$U_{PS\ in\ min}$ (V) = $U_{LDD\ out\ max}$ + 5 $P_{PS\ in\ min}$ (W) = $I_{LDD\ out\ max}$ * $U_{LDD\ out\ max}$ * duty cycle $_{max}$ / 100 % * 1.2					
Power supply requirements (control stage)	12 V, 10 W				12 V, 15 W	
Control interfaces	analog, CAN & RS232 by default. USB ,LAN & WLAN upon request [13]					
Software	Ekspla's control software & protocol description included by default					
Protections	current transient (overload) protection; open circuit shut-down; over temperature shut-down; power voltage brownout (voltage dip) shut-down; interlock shut-down					
PHYSICAL CHARACTERISTICS						
Dimensions (L x W x H) [14]	130 x 90 x 30 mm		130 x 90 x 54 mm		208 x 65 x 103 mm	
OPERATING REQUIREMENTS						
Cooling method	Conductive				Forced-air	
Operating ambient temperature	≤ 40 °C					
Operating baseplate temperature	≤ 50 °C				–	
ACCESSORIES						
CAN-USB adapter	Ekspla's CAN-USB adapter is required at evaluation stage if communication via CAN interface is needed					
Communication board	Ekspla's communication board which allows to control driver via RS232, USB, LAN, WLAN interfaces. Can be provided upon request					
Voltage booster board	Ekspla's booster board which allows to extend output compliance voltage of certain uniLDD versions. In certain cases output compliance voltage can be increased up to 600 V. Can be added at factory upon Ekspla's recommendations					
Baseplate	copper, included by default				aluminum, included upon request	
Output power cables	included upon request, custom dia and length					
Input power cables	included upon request, custom dia and length					
Control cables	included by default					
External capacitors	included upon Ekspla's recommentadion. Custom mounting solutions for external capacitor are availabe upon request					

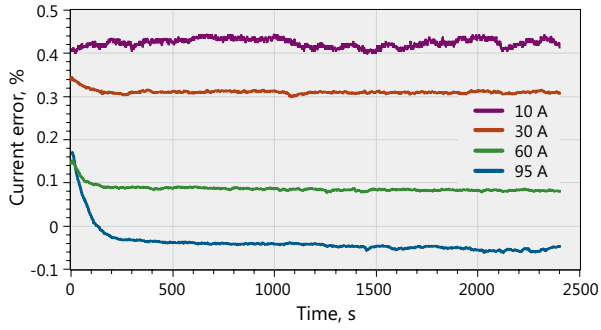
Model	uniLDD-A-QCW		Bi-uniLDD-A-QCW		Tri-uniLDD-A-QCW	
						
OUTPUT SPECIFICATIONS						
Operation mode	CW	QCW	CW	QCW	CW	QCW
Compliance voltage range, min-max [3]	1 – 50 V	1 – 85 V	1 – 50 V	1 – 85 V	1 – 50 V	1 – 85 V
Current range, min-max	10 – 100 A	10 – 360 A	20 – 200 A	20 – 800 A	30 – 300 A	30 – 1200 A
Power, max	2 kW	2 kW	4 kW	4 kW	6 kW	6 kW
Power conversion efficiency	90 – 98 %					
Current pulse amplitude stability	0.1 % pk to pk [7]					
Current ripple	0.1 % pk to pk [8]					
Current drift	< 0.2 % [9]					
Duty cycle	–	≤ 20 %	–	≤ 20 %	–	≤ 20 %
Repetition rate, max		≤ 5 kHz		≤ 5 kHz		≤ 5 kHz
Current rise time, typical		5 – 100 µs		5 – 100 µs		5 – 100 µs
Current pulse duration, typical		up to 100 ms		up to 100 ms		up to 100 ms
RMS current, max		80 A		160 A		240 A
Amount of functioning internal TEC control channels	0, 1 or 2 [12]		0			
TEC control current, min-max per channel	1 – 25 A		–			
TEC control voltage, min-max per channel	1 – 36 V					
TEC control power, max per channel	350 W					
INPUT SPECIFICATIONS						
Power supply requirements (power stage), min	$U_{PS\ in\ min}$ (V) = $U_{LDD\ out\ max}$ + 5 $P_{PS\ in\ min}$ (W) = $I_{LDD\ out\ max}$ * $U_{LDD\ out\ max}$ * duty cycle $_{max}$ / 100 % * 1.2					
Power supply requirements (control stage)	12 V, 15 W		12 V, 20 W		12 V, 25 W	
Control interfaces	analog, CAN & RS232 by default. USB, LAN & WLAN upon request [13]					
Software	Ekspla's control software & protocol description included by default					
Protections	current transient (overload) protection; open circuit shut-down; over temperature shut-down; power voltage brownout (voltage dip) shut-down; interlock shut-down					
PHYSICAL CHARACTERISTICS						
Dimensions (L x W x H) [14]	208 x 65 x 103 mm		250 x 146 x 98 mm		250 x 200 x 98 mm	
OPERATING REQUIREMENTS						
Cooling method	Forced-air					
Operating ambient temperature	≤ 40 °C					
ACCESSORIES						
CAN-USB adapter	Ekspla's CAN-USB adapter is required at evaluation stage if communication via CAN interface is needed					
Communication board	Ekspla's communication board which allows to control driver via RS232, USB, LAN, WLAN interfaces. Can be provided upon request					
Voltage booster board	Ekspla's booster board which allows to extend output compliance voltage of certain uniLDD versions. In certain cases output compliance voltage can be increased up to 600 V. Can be added at factory upon Ekspla's recommendations					
Baseplate	aluminum, included upon request		aluminum, included by default			
Output power cables	included upon request, custom dia and length					
Input power cables	included upon request, custom dia and length					
Control cables	included by default					
External capacitors	included upon Ekspla's recommentadion. Custom mounting solutions for external capacitor are availabe upon request					

1) Continuous-wave.
2) Quasi-continuous-wave (also known as pulsed).
3) Range between minimum and maximum limits. Not all maximal limits can be reached simultaneously.
4) Maximum compliance voltage can be extended for certain versions by using booster board layout. More – in section "Accessories"→"Booster board".
5) Maximum current can be extended for certain versions by connecting drivers in parallel.
6) Maximum power can be extended for certain versions by using booster board layout. More information in section "Accessories"→"Booster board".
7) In ×0.5...×1 of max current range.
8) DC...100 kHz bandwidth, in ×0.5...×1 of max current range.
9) Cold start, 8 h period, after 5 min. warm up.
10) Factory software tuned upon customer's request.
11) Factory software & hardware tuned upon customer's request.
12) Amount factory enabled upon customer's request.
13) USB ,LAN & WLAN control interfaces are available upon customer's request while using Eksplа's external communication board.
14) External driver dimensions can vary ± 20 mm due to the minor hardware variations like fans and current sensors.

PERFORMANCE



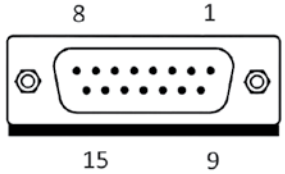
uniLDD ripple current.
12 V and 24 V DC power, 2 V junction + 10 MΩ series R load



uniLDD current drift and long term stability.
From cold start for different currents

ANALOG INTERFACE PINOUT

Pin	Signal name	Direction	Voltage level	Description
1	Enable	Input	TTL (LVTTL) 200 µA pull up to 3.3 V	The Enable function gives permission to operate for TEC driver and consequently for LDD driver.
2	Ready To Operate (RTO)	Input/Output through 330 Ω resistor	> 2.4 V driver output is active, < 0.5 V 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	10 kΩ pull up to 3.3 V, LOW = < 0.4 V	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	V_{out} Monitor	Output	V_{out}, driver output voltage	The output voltage monitor. Vout = Diode compliance voltage + voltage drop on connection wires
6	I_{out} Monitor	Output	0 - 10 V* = 0 - I_{outmax}	The output current monitor
7	$I_{program}$	Input	0 - 10 V* = 0 - I_{outmax}	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			
10	+5V	Output	Auxiliary 200 mA	
11	+5V	Output	Auxiliary 200 mA	
12	-15V	Output	Auxiliary 100 mA	
13	+15V	Output	Auxiliary 200 mA	
14	+15V	Output	Auxiliary 200 mA	
15	GND			



D-sub 15-pin female analog interface connector.

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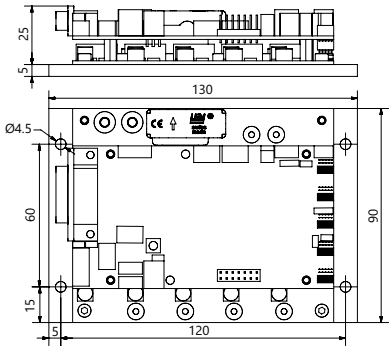
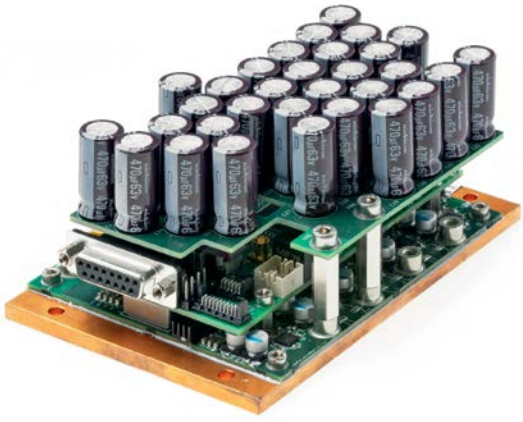
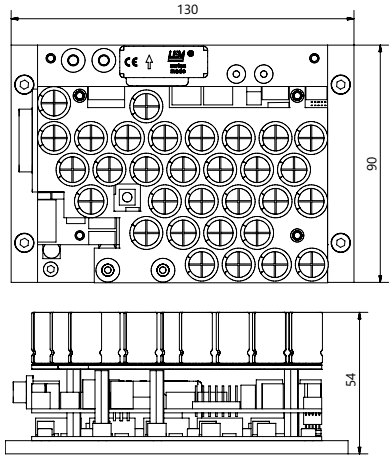
DRAWINGS & IMAGES

uniLDD-C-CW

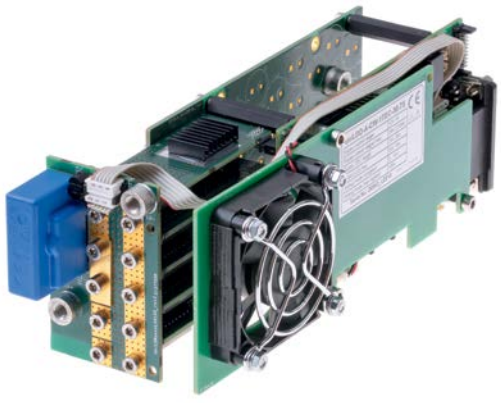


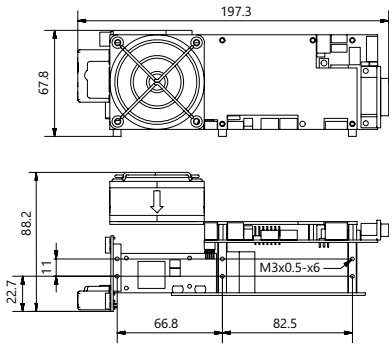
uniLDD-C-QCW



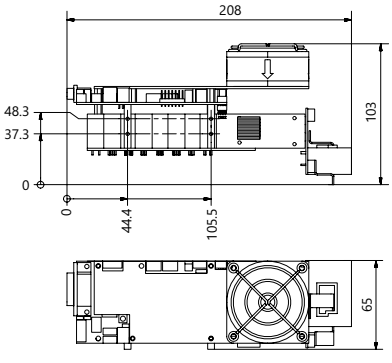


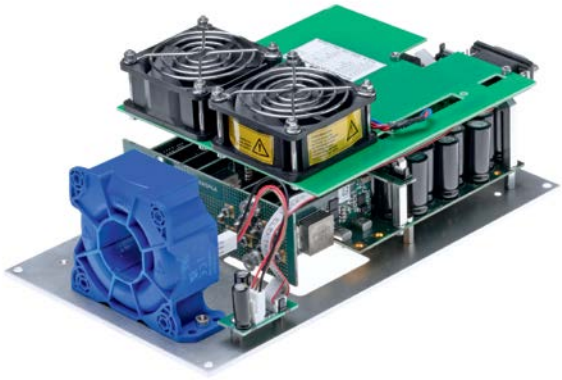
uniLDD-A-CW

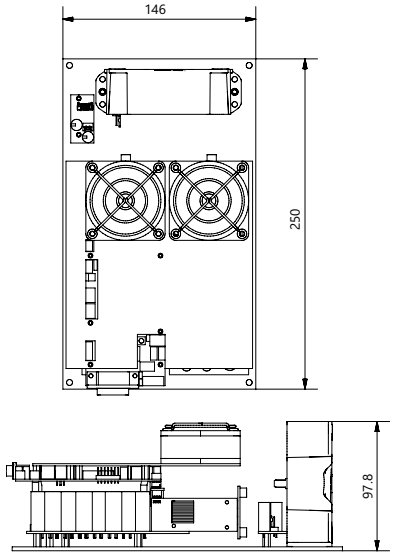




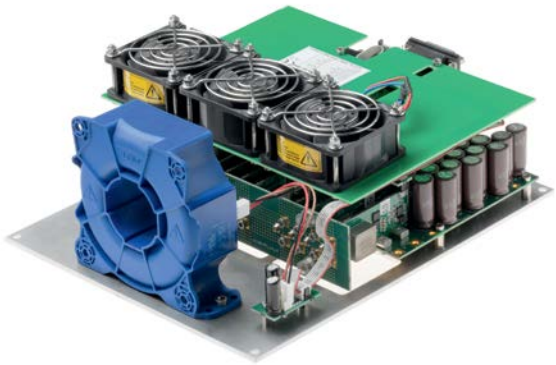
uniLDD-A-QCW

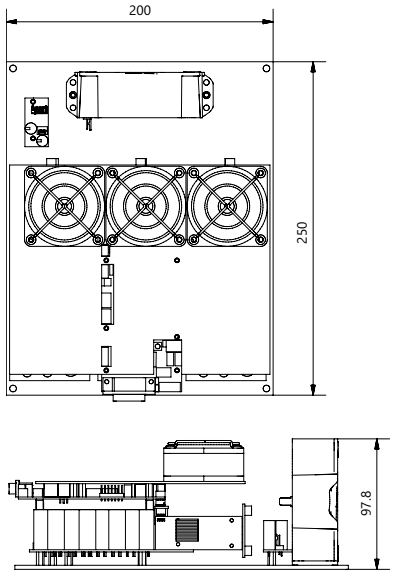






Bi-uniLDD-A-QCW

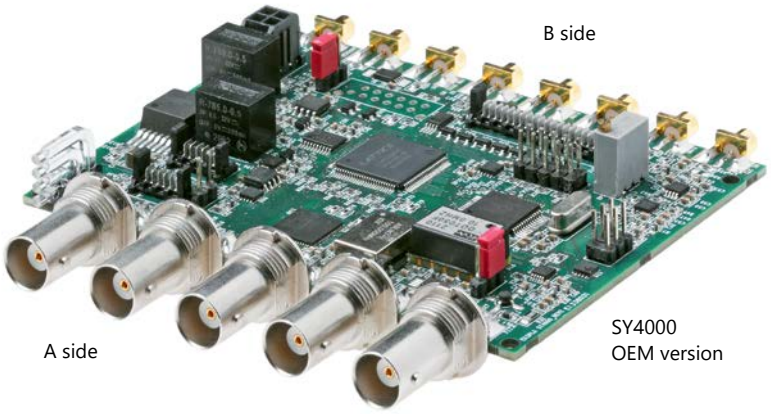




Tri-uniLDD-A-QCW

Digital Delay Generator

SY4000



The Ekspla's digital delay generator SY4000 is designed to create up to 8 delayed output pulse sequences precisely synchronized with the internal or external clock. Digital delay generators can provide precise delays for triggering, syncing, delaying, and gating events.

Our SY4000 digital delay generator is mainly employed for synchronization and control of different laser components: AOM drivers, Pockels cell drivers, laser diode drivers, flash lamp drivers, photodetectors, data acquisition systems, etc.

Ekspla can provide both encased and OEM versions of SY4000 digital delay generator. The encased digital delay generator version can be controlled via RS232, USB, LAN, WLAN and also contains a user-friendly configuration software as well as an internal power supply. These communication options as well as software are also available in SY4000 digital delay generator's OEM version and can be reached by adding additional Ekspla's OEM communication board upon customer's request. The encased digital delay generator is an optimal solution for laboratory use while SY4000 OEM version is ideal for integration and is frequently paired with an additional Ekspla's OEM communication board.

FEATURES

- *8 independent output channels*
- *Ultra-stable internal clock 0.2 ppm*
- *Precise delay/pulse width control in range 2 ns to 150 ms*
- *25 ps timing resolution*
- *Hi-accuracy synchronization (locking) to external pulse train*
- *Jitter < 30 ps*
- *DAC/AWG output*
- *Both 50 Ω (6 outs) and differential (8 outs) outputs present*
- *Frequency divider / Burst (software and hardware triggered) / Gating / Single shot*
- *Communications:*
  – OEM version – CAN BUS
  – Encased version – LAN, WIFI (optional), RS232, USB (VCP) – via REST API or DLL's.

APPLICATIONS

- *Mode locked and Q-switched fs, ps & ns lasers*
- *Triggering of a data acquisition system*
- *General purpose pulse generator*
- *Precise system clock source*
- *Laser pulse train conversion into a clean clock source*
- *All functions above at once*

SY4000 desktop version

SPECIFICATIONS [1)]

Model	SY4000
OUTPUT SPECIFICATIONS (GENERAL)	
Channel modes	Single shot, burst, normal, duty cycle, frequency divider
Delay range	0 to 150 ms
Negative delay	-150 ms
Pulsewidth	2 ns to 150 ms
Resolution	25 ps
Accuracy	25 ps + 0.000001 × delay
Time base	100 MHz, 0.2 ppm
Jitter	< 30 ps
Burst mode	1 to 65535
Output level	2.5 V, 4 V
Impedance	50 Ω
Slew rate	1.5 V/ns
OUTPUT SPECIFICATIONS (INTERNAL GENERATOR)	
Mode	Duty cycle
Rate	50 ns to 100 sec
Resolution	10 ns or 300 ps
Accuracy	5 ns + 0.000001 × period
Jitter	100 ps RMS
Burst	0 ... 65535
INPUT SPECIFICATION (EXTERNAL TRIGGER)	
Rate	DC to 20 MHz
Threshold	1.3 V
Input level	LVTTL, TTL
Slope	rising
Jitter	< 100 ps RMS
Delay	< 13 ns; < 70 ns
COMMUNICATION OPTIONS	
Control interfaces (OEM board)	CAN by default. RS232, USB, LAN, WLAN with additional communication board, provided upon request
Control interfaces (encased version)	CAN, RS232, USB, LAN, WLAN
POWER REQUIREMENTS	
Power supply requirements (OEM board)	12 V DC, 500 mA
Power supply requirements (encased version)	90...264 V, 50–60 Hz
DIMENSIONS (NOT INCLUDING CONNECTOR)	
OEM board (L × W × H)	100 × 77 × 20 mm
Encased version (L × W × H)	105 × 86 × 85 mm
ACCESORIES	
CAN-USB adapter	Ekspla's CAN-USB adapter is required at evaluation stage for SY4000 OEM version board if communication via CAN interface is needed. Cable between adapter and board and beetween adapter and PC are included by default
Communication board	Ekspla's communication board which allows to control SY4000 OEM board via RS232, USB, LAN, WLAN interfaces. Can be provided upon request
Input power cables	Included by default

[1)] Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture.

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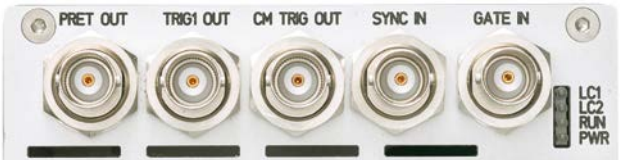
REV. 260107

HIGHLIGHT FUNCTIONS OF EKSPLA'S SY4000 DIGITAL DELAY GENERATOR

- **Locking to an external clock source** (typically photo-diode pulse train). Triggering system is locked to the laser oscillator and trigger time is always in phase with the optical pulse.
- **Trigger rate control and limiter circuit.** It helps to protect laser components from damage due to exceedingly high/low triggering rates.
- **Single ended and differential outputs.**
- **Instant switch between two configurations in delay blocks.** Burst counter, gate input, frequency divider or software commands may serve as the configuration switching signal sources. Configuration switch is used to control optical pulse pickers (EO or AOM) in a highly flexible manner.
- **Low jitter sync pulse output** used for high-speed acquisition systems like streak camera triggering. Typical jitter is 3...5 ps with the respect to the optical pulse.
- **Control connector.** Software-controllable multiplexer may divert any of the output signals to this connector to monitor what is on other connectors without disturbing them.
- **Clock output: 1:1, 1:2 frequency.**
- **Up to 4 pulse outputs can be combined** to single signals by OR, AND, NOT logical operations.
- **DAC output,** controlling, e.g. AOM pass though.

INPUT/OUTPUT SIGNAL DESCRIPTION



COAXIAL CONNECTORS, A-SIDE, BNC TYPE

Name	Description	Amplitude	Pulse parameters	Shape
PRET OUT	Precise trigger, locked to the optical clock. Delay is adjustable in optical clock period time units. Jitter in respect to the optical pulse is ~4 ps RMS, almost independent on delay	>1 V on 50 Ω, AC output, capacitor @ output	Rise time ~200 ps, width adjustable >100 ns	Positive pulse
TRIG1 OUT	General purpose or control sync out	2.5 V @ 50 Ω	Select-able multiplexer to OUT0...OUT8 blocks, Optical clock, Optical clock/2	Logic level or pulse with programmable timing
CM TRIG OUT	Common trigger, general purpose output	2.5 V @ 50 Ω	OUT0 block, programmable pulse parameters	Logic level or pulse with programmable timing
SYNC IN	External synchronization input. Trigger or Configuration switch source	LVTTL 0.1 mA pull down to low level	Frequency ≤ 100 MHz, PW ≥ 10 ns	Positive pulse
GATE IN	Burst trigger or configuration switch control functions	LVTTL, 0.1 mA pull down to low level	Level or pulse with PW > 20 ns	Level or pulse

A-SIDE BNC CONNECTORS

Name	Direction	Logic levels	Impedance	Function
PRET OUT	Output	>1.5 V @ 50 Ω	50 Ω	Precision trigger, configurable source
TRIG1 OUT	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	General trigger, configurable source
CM TRIG OUT	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	Master trigger, OUT0 signal
SYNC IN	Input	LVTTL, tolerates 5 V	0.2 mA pull down	Trigger input
GATE IN	Input	LVTTL, tolerates 5 V	0.2 mA pull down	Configuration switch and burst control input

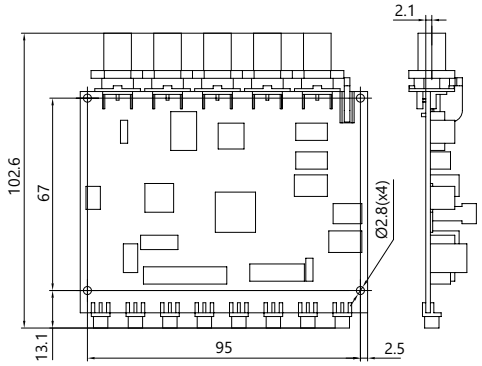
COAXIAL CONNECTORS, B-SIDE, MCX TYPE

Name	Description	Amplitude	Pulse parameters	Shape
AN OUT	DAC output	0...1 V	N/A	Two programmable analog levels
CM TRIG OUT	Common trigger, general purpose output	2.5 V @ 50 Ω	OUT0 block	Logic level or pulse with programmable timing
CM TRIG OUT1	Common trigger, general purpose output	2.5 V @ 50 Ω	OUT0 block	Logic level or pulse with programmable timing
OUT2	General purpose output	2.5 V @ 50 Ω	OUT2 block, AND+OR+NOT logic with OUT1	Logic level or pulse with programmable timing
OUT3	General purpose output	2.5 V @ 50 Ω	OUT3 block, AND+OR+NOT logic with OUT2	Logic level or pulse with programmable timing
OUT4	General purpose output	2.5 V @ 50 Ω	OUT4 block, AND+OR+NOT logic with OUT3	Logic level or pulse with programmable timing
OUT5	General purpose output	2.5 V @ 50 Ω	OUT5 block, AND+OR+NOT logic with OUT4	Logic level or pulse with programmable timing
CLC IN	External clock input	>100 mV	PW >300ps, input frequency 10...100 MHz	Sine, Meander to pulse train from photodiode

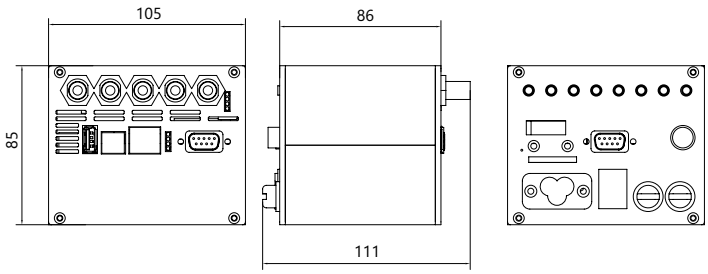
B-SIDE MCX CONNECTORS

Name	Direction	Logic levels	Impedance	Function
AN OUT	Output	1 V @ 50 Ω max	50 Ω	DAC analog output signal
CM TRIG OUT	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	Master trigger, OUT0 signal
CM TRIG OUT1	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	Master trigger, OUT0 signal
OUT2	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	General purpose trigger, OUT2 signal
OUT3	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	General purpose trigger, OUT3 signal
OUT4	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	General purpose trigger, OUT4 signal
OUT5	Output	2.5 V @ 50 Ω, 4.5 V @ 50 Ω jumper configurable	50 Ω	General purpose trigger, OUT5 signal
CLC IN	Input	0.5 V...3.3 V pk-pk, sine or pulses	50 Ω	Clock input

DRAWINGS



Outline drawings of SY4000 OEM version



Outline drawings of SY4000 desktop version

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