

Laser Electronics

Laser Synchronization Modules

Pockels Cell Drivers

Laser Diode Drivers

Flashlamp Drivers

Cooling Units

Pump Chambers

Crystal Ovens

2018

FEATURED

Universal Laser
Diode Driver
uniLDD series

See page 21



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Synchronization Module and Pulse Delay Generator SY4000
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Drivers for Pockels Cells

PCD-UHR SERIES OEM CAVITY DUMPER DRIVERS



Fig. 1. OEM version of PCD-UHR series Pockels cell driver



Fig. 2. Encased version of PCD-UHR series Pockels cell driver

FEATURES

- ▶ Fast HV rise/fall time <math>< 4-8 \text{ ns}</math>
- ▶ HV pulse amplitude up to 3.6 kV
- ▶ Pulse repetition rate up to 3.5 MHz
- ▶ Output pulse jitter <math>< 50 \text{ ps}</math> if trigger pulse rise time <math>< 0.5 \text{ ns}</math>

PCD-UHR series Pockels cell drivers are designed for wide range of applications and operating modes. Repetition rate can be up to 500 kHz for standard range of drivers, up to 1 MHz enhanced and up to 3.5 MHz high rate. Standard range of possible pulse durations is from 100 ns to 5 μs . It can be extended to infinity using pulse regeneration technique.

Next pages of the catalog presents tables of different versions of the drivers built as variations of voltage, repetition rate and rise/fall time. That three main parameters are mutually dependent. Higher voltage means longer rise/fall time, and higher repetition rate is limited by voltage. However, all the drivers can work at 1 MHz and even higher repetition rate in burst mode not exceeding specified average HV power. Connection diagram can be PUSH-PULL configuration using stand-alone driver, as well as FULL BRIDGE using two drivers for one Pockels cell. FULL BRIDGE configuration gives such advantages as repetition rate doubling to reach up to 7 MHz rate, pulse duration shortening down to zero or voltage doubling on pockels cell. Contact EKSPLA for more information and suggestions for Pockels cell driving solutions you need.

Most of PCD-UHR series units are available in two versions: „open frame“ which is ideal for OEM manufacturers incorporating drivers in their own systems and encased in aluminum housings. Encasing of Pockels cell driver in aluminum housing solves two problems: shields both humans and electronics from high voltage impact from operating Pockels cell driver, and protects driver itself from potentially harmful external contact – ensuring safe operation and driver longevity. The housed option is especially handy for researchers and custom product manufacturers who use these drivers during their own systems build-up.

PCD-UHRS modification has possibility to shorten output pulse duration down to 15 ns. Following they can be used for single pulse selection in pulse picker applications for high repetition rate lasers.

PCD-UHR series drivers has two modifications by control inputs. PCD-UHR1 drivers are controlled by one triggering pulse while rising edge turns on high voltage to Pockels cell and falling edge turns off – see Fig. 4. for reference. PCD-UHR2 drivers are controlled by two triggering pulses that are applied to separate inputs of the driver, see Fig. 3.



Fig. 3. Control timing charts for two-pulses controlled drivers

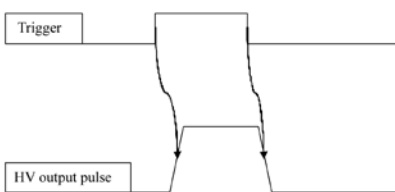


Fig. 4. Control timing charts for single pulse controlled drivers

PULSE REGENERATION TECHNIQUE

Gives possibility to operate push-pull drivers very long output pulse, and full bridge drivers get very low repetition rate. Pulse regeneration does not work with bipolar and short-pulse drivers.

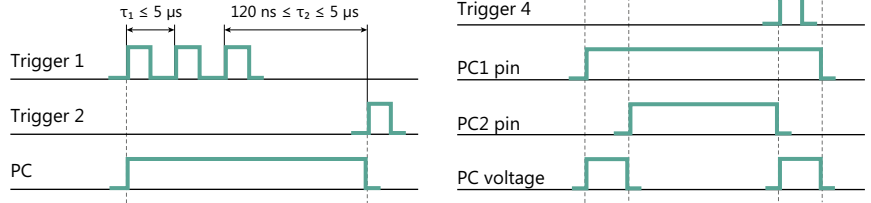


Fig 5. Principle and requirements for long output pulse forming – control way using pulse regeneration. Left diagram is related to PCD-UHR series, right for 2PCD-UHR series (Full-Bridge) drivers.

SELECTION CHART

Below chart presents summary of full line of PCD-UHR series drivers. This chart helps to choose optimal driver for your application. Horizontal axis

means repetition rate, vertical voltage. Lower voltage and lower repetition rate means lower price.

PCH-UHR SERIES DRIVERS' SELECTION CHART

kHz	50	250	300	350	400	500	600	1000	2000	kV
PCD-UHR1-					400-1.5					1.5
PCD-UHR2-					400-1.5					1.5
PCD-UHRS-									2000-1.6-C	1.6
2PCD-UHR1-							600-1.8	1000-1.8		1.8
2PCD-UHR2-								1000-1.8-C		1.8
PCD-UHR1-								1000-2.4-C		2.4
PCD-UHR2-		250-2.5					600-2.5			2.5
		250-2.5-C					600-2.5-C			2.5
		250-2.5								2.5
		250-2.5-C								2.5
						500-2.6				2.6
						500-2.6-C				2.6
								1000-2.9-C		2.9
Regural drivers	50-3.6	250-3.6								3.6
	50-3.6	250-3.6-C								3.6
Biolar drivers		250-3.6								3.6
		250-3.6-C								3.6
Short-pulse drivers				350-4-C						4.0
			300-4.6-C							4.6
Full-bridge drivers		250-5.2-C								5.2

GENERAL SPECIFICATIONS TABLE FOR PCD-UHR SERIES DRIVERS ¹⁾

Driver model	PCD-UHR series	PCD-UHRS series
Maximal HV rated voltage (for testing only)	See next tables for specific drivers	
Maximal HV operating voltage	<90 % from rated voltage	
HV pulse rise time	< 4–8 ns (Fig. 7)	
HV pulse fall time	< 4–8 ns (Fig. 8)	
HV pulse duration for single driver	100–5000 ns	15–5000 ns
Max HV pulse duration for full-bridge configuration	0–5000 ns	N/A
Maximal HV pulse repetition rate	3.5 MHz	600 kHz
External triggering pulse duration requirement	>100 ns	>10 ns
External triggering pulse amplitude requirement	3.5–5 V (50 Ω load)	
External triggering pulse rise & fall time	< 20 ns	< 5 ns
Maximal length of leads to Pockels cell	10 cm	
Control diagram options:		
– single triggering pulse control	Fig. 4	
– two trigger pulses control	Fig. 3	
HV pulse delay, typical	45 ns	30 ns
External powering requirements:	depends on modification	
– high voltage supply		
– low voltage DC supply	24 ⁺¹ ₋₁₀ V, <150 mA 12±0.5 V, <150 mA on request	24±1 V, <150 mA

¹⁾ Specifications are given for Pockels cell with capacity <6 pF. Not all combinations of parameters can be possible at the same time. Specifications are subject to changes without advance notice.

Driver needs to be mounted on the heatsink (excluding water cooled versions). Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.

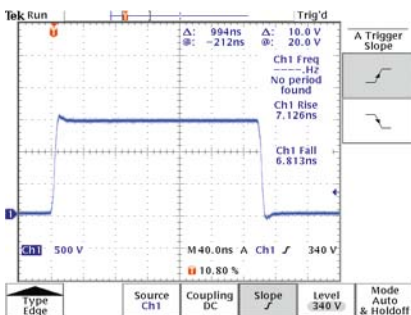


Fig. 6. Typical output pulse shape

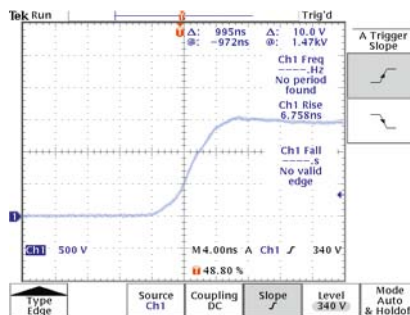


Fig. 7. Typical rising front of output pulse in detail

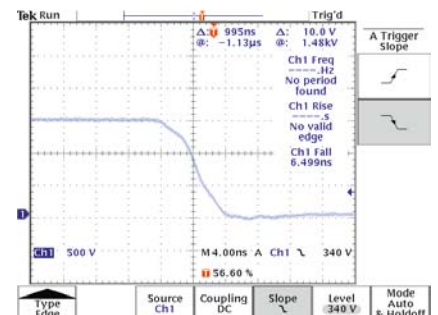
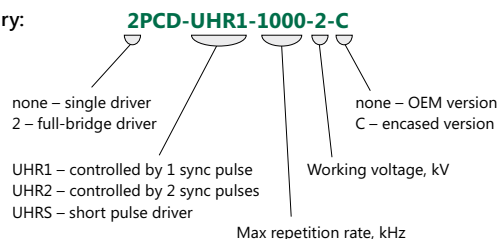


Fig. 8. Typical falling front of output pulse in detail

Ordering / Part number information

Please indicate following points by inquiry:

- Voltage
- Repetition rate
- Pulse duration (range)
- Capacitance of Pockels cell
- 24 V / 12 V option
- OEM / encased



OEM VERSION

CONFIGURATION EXAMPLES OF OEM VERSION OF PCD-UHR SERIES DRIVERS

P/N of driver	PCD-UHR1-50-3.6 PCD-UHR2-50-3.6	PCD-UHR1-400-1.5 PCD-UHR2-400-1.5	PCD-UHR1-250-3.6 PCD-UHR2-250-3.6	PCD-UHR1-250-2.5 PCD-UHR2-250-2.5	PCD-UHR1-500-2.6 PCD-UHR2-500-2.6	PCD-UHR1-1000-1.8 PCD-UHR2-1000-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.7 kV	2.6 kV	2.7 kV	2 kV
Maximal HV operating voltage	3.6 kV	1.5 kV	3.6 kV	2.5 kV	2.6 kV	1.8 kV
Maximal HV repetition rate	50 kHz	400 kHz	250 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration *	100–5000 ns					
HV pulse rise time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity	positive					
HV power consumption	<20 W	<20 W	<75 W	<40 W	<90 W	<80 W
12V/24V power consumption	1 W	5.5 W	4 W	4.5 W	6 W	9 W
Dimensions	see Fig. 10, 11			see Fig. 13, 14		
Cooling	conductive			conductive or water		

Driver needs to be mounted on the heatsink (excluding water cooled versions).
Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
Please specify working voltage and required tuning range by ordering.
HV output voltage to Pockels cell is equal to HV power supply voltage.

* Pulse duration of PCD-UHR2 series drivers can be extended using pulse regeneration.



Fig. 9. OEM version of PCD-UHR series driver with conductive pad. Suitable for repetition rate up to 50 kHz

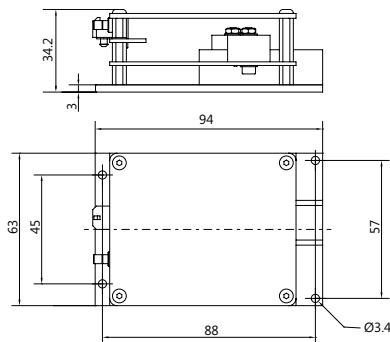


Fig. 10. Outline drawing of PCD-UHR1 series drivers with conductive pad

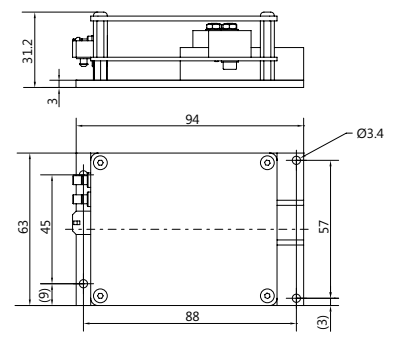


Fig. 11. Outline drawing of PCD-UHR2 series drivers with conductive pad



Fig. 12. OEM version of PCD-UHR series driver with general purpose pad

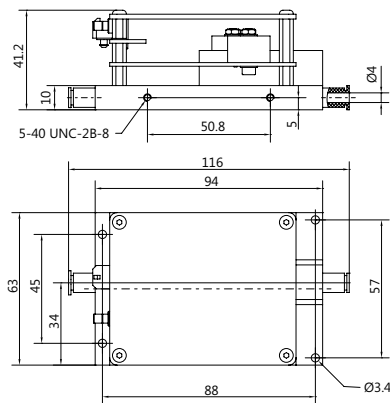


Fig. 13. Outline drawing of PCD-UHR1 series driver with general purpose pad

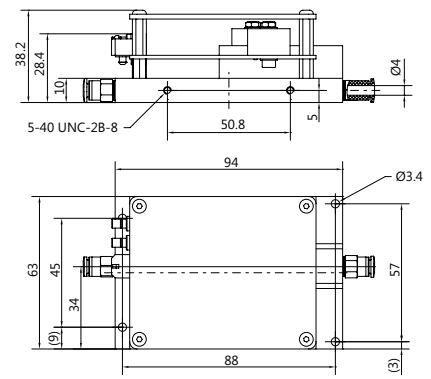


Fig. 14. Outline drawing of PCD-UHR2 series driver with general purpose pad

ENCASED VERSION

CONFIGURATION EXAMPLES OF ENCASED VERSION OF PCD-UHR SERIES DRIVERS

P/N of driver	PCD-UHR1-250-3.6-C PCD-UHR2-250-3.6-C	PCD-UHR1-250-2.5-C PCD-UHR2-250-2.5-C	PCD-UHR1-500-2.6-C PCD-UHR2-500-2.6-C	PCD-UHR1-1000-1.8-C PCD-UHR2-1000-1.8-C
Maximal HV rated voltage	3.7 kV	2.6 kV	2.7 kV	2 kV
Maximal HV operating voltage	3.6 kV	2.5 kV	2.6 kV	1.8 kV
Maximal HV repetition rate	250 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration *	100–5000 ns			
HV pulse rise time, typical	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity	positive			
HV power consumption	<75 W	<40 W	<90 W	<80 W
12V/24V power consumption	4 W	4.5 W	6 W	9 W
Dimensions	see Fig. 16			
Cooling	water			

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
 HV output voltage to Pockels cell is equal to HV power supply voltage.
 Please specify working voltage and required tuning range by ordering.

* Pulse duration of PCD-UHR2 series drivers can be extended using pulse regeneration.



Fig. 15. Encased version of driver
 PCD-UHR models PCD-UHRx-200-xx, PCD-UHRx-250-xx,
 PCD-UHRx-500-xx, PCD-UHRx-1000-1.8

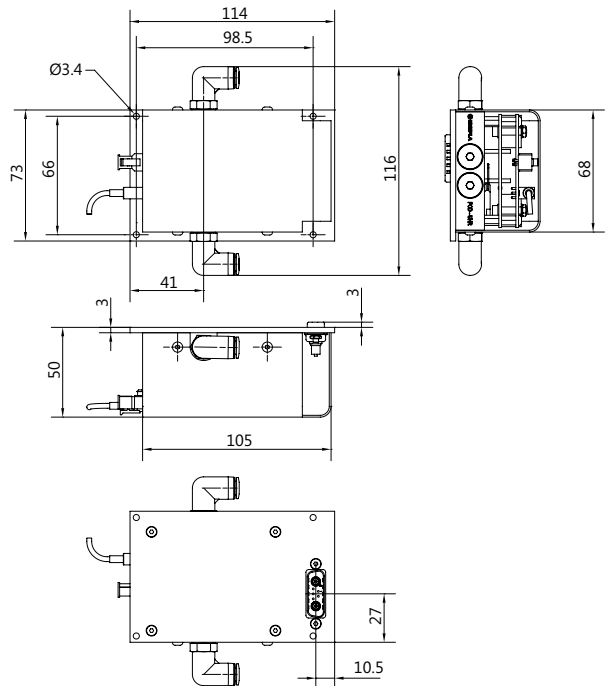


Fig. 16. Outline drawing of encased version of driver
 PCD-UHR models PCD-UHRx-200-xx, PCD-UHRx-250-xx,
 PCD-UHRx-500-xx, PCD-UHRx-1000-1.8

SPECIFIC FEATURES OF PCD-UHRS DRIVERS

- Short circuit protection at driver output
- Driver pad overheat sensor stops operation when overheated
- Overheat optocoupled output signal – open circuit means error state
- Switchable single pulse and two pulses control operation modes
- LED for error indication (green for overheat and red for short circuit)

OEM SHORT-PULSE VERSION

CONFIGURATION EXAMPLES OF OEM VERSION OF PCD-UHRS SERIES SHORT-PULSE DRIVERS

P/N of driver	PCD-UHRS-50-3.6	PCD-UHRS-400-1.5	PCD-UHRS-250-3.6	PCD-UHRS-250-2.5	PCD-UHRS-600-2.5	PCD-UHRS-600-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.7 kV	2.6 kV	2.6 kV	2 kV
Max/min HV operating voltage	3.6 kV / 1.8 kV	1.5 kV / 0.75 kV	3.6 kV / 1.8 kV	2.5 kV / 1.25 kV	2.5 kV / 1.25 kV	1.8 kV / 0.9 kV
Maximal HV repetition rate	50 kHz	400 kHz	250 kHz	250 kHz	600 kHz	600 kHz
Pulse duration	15–5000 ns	15–620 ns	15–1250 ns	15–1000 ns	15-400 ns	15-400 ns
HV pulse rise time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
HV pulse fall time, typical	<7 ns	<5.5 ns	<7 ns	<6 ns	<6.5 ns	<6 ns
Output polarity	positive					
HV power consumption	<20 W	<20 W	<75 W	<40 W	<100 W	<35 W
12 V / 24 V power consumption	1 W	5.5 W	4 W	4.5 W	7 W	7 W
Dimensions	see Fig. 18			see Fig. 19		
Cooling	conductive			conductive or water		

Driver needs to be mounted on the heatsink (excluding water cooled versions).
 Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
 Please specify working voltage and required tuning range by ordering.
 HV output voltage to Pockels cell is equal to HV power supply voltage.



Fig. 17. OEM version of PCD-UHRS series driver with general purpose pad

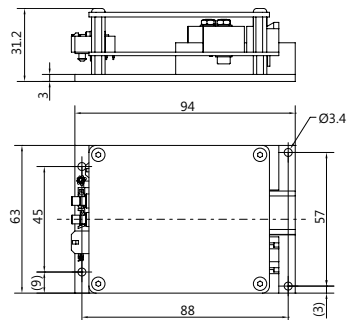


Fig. 18. Outline drawing of PCD-UHRS series driver with conductive pad

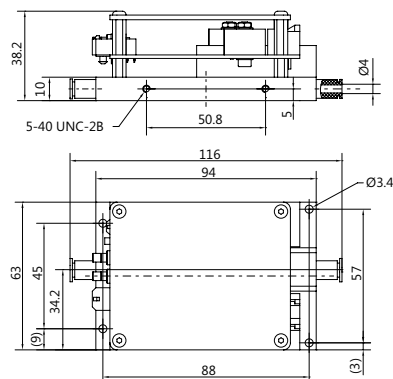


Fig. 19. Outline drawing of PCD-UHRS series driver with general purpose pad

ENCASED SHORT-PULSE VERSION

CONFIGURATION EXAMPLES OF ENCASED VERSION OF PCD-UHRS SERIES SHORT-PULSE DRIVERS

P/N of driver	PCD-UHRS-250-3.6-C	PCD-UHRS-250-2.5-C	PCD-UHRS-600-2.5-C
Maximal HV rated voltage	3.7 kV	2.6 kV	2.6 kV
Max/min HV operating voltage	3.6 kV / 1.8 kV	2.5 kV / 1.25 kV	2.5 kV / 1.25 kV
Maximal HV repetition rate	250 kHz	250 kHz	600 kHz
Pulse duration	15–1250 ns	15–1000 ns	15–400 ns
HV pulse rise time, typical	<7 ns	<6 ns	<6.5 ns
HV pulse fall time, typical	<7 ns	<6 ns	<6.5 ns
Output polarity	positive		
HV power consumption	<75 W	<40 W	<100 W
12V/24V power consumption	4 W	4.5 W	7 W
Dimensions	see Fig. 21		
Cooling	water		

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
 Please specify working voltage and required tuning range by ordering.
 HV output voltage to Pockels cell is equal to HV power supply voltage.



Fig. 20. Encased version of driver PCD-UHRS

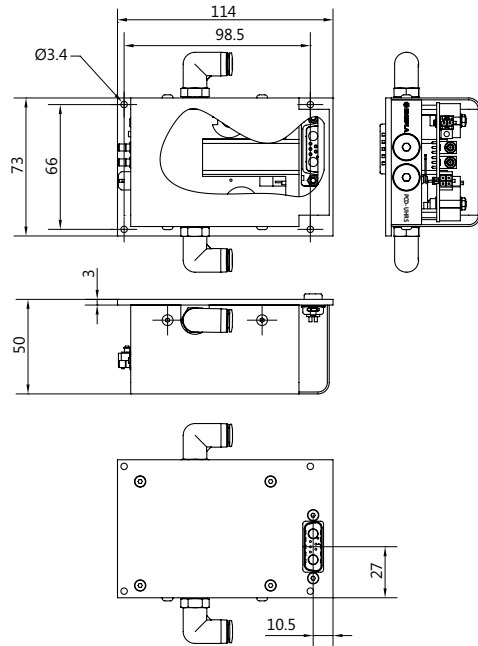


Fig. 21. Outline drawing of encased version of driver PCD-UHRS

ENCASED VERSION (bipolar drivers)

CONFIGURATION EXAMPLES OF ENCASED VERSION OF PCD-UHR SERIES BIPOLAR DRIVERS

P/N of driver	PCD-UHR1-1000-2.9-C PCD-UHR2-1000-2.9-C	PCD-UHR1-350-4-C PCD-UHR2-350-4-C	PCD-UHR1-300-4.6-C PCD-UHR2-300-4.6-C	PCD-UHR1-250-5.2-C PCD-UHR2-250-5.2-C
Maximal HV rated voltage	3.0 kV	4.2 kV	4.8 kV	5.3 kV
Maximal HV operating voltage	2.9 kV	4.0 kV	4.6 kV	5.2 kV
Maximal HV repetition rate	1000 kHz	350 kHz	300 kHz	250 kHz
Pulse duration *	100–5000 ns			
HV pulse rise time, typical	<7.5 ns	<7.5 ns	<8.0 ns	<8.5 ns
HV pulse fall time, typical	<7.5 ns	<7.5 ns	<8.0 ns	<8.5 ns
Output polarity	bipolar			
HV power consumption **	<120 W	<100 W	<100 W	<100 W
12 V / 24 V power consumption	9 W			
Dimensions	see Fig. 23			
Cooling	water			

Driver needs to be mounted on the heatsink (excluding water cooled versions).
 Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.
 HV output voltage to Pockels cell is equal to HV power supply voltage i.e. sum of positive and negative HV values.
 Please specify working voltage and required tuning range by ordering.

* Pulse duration of PCD-UHR2 series drivers can be extended using pulse regeneration.
 ** Bipolar HV power supply HV2×60Wm is specifically designed for these drivers.



Fig. 22. Encased version of bipolar PCD-UHR series drivers

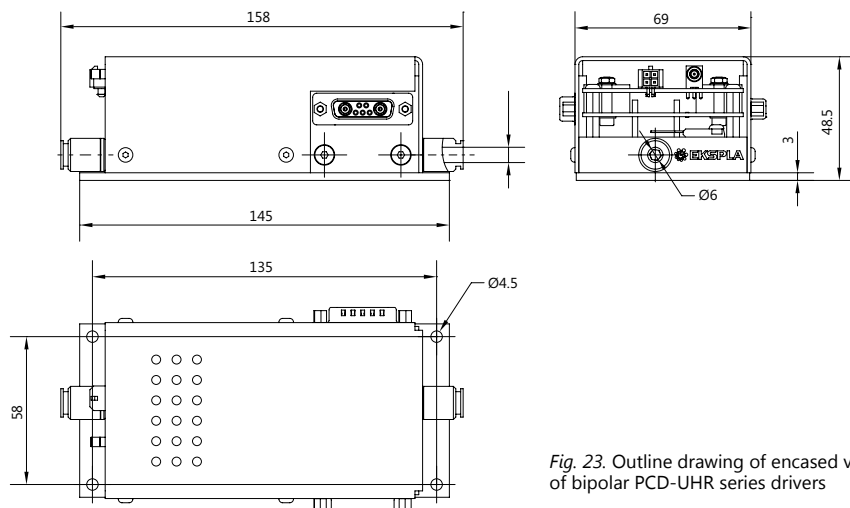


Fig. 23. Outline drawing of encased version of bipolar PCD-UHR series drivers

FULL-BRIDGE VERSION

CONFIGURATION EXAMPLES OF FULL-BRIDGE CONFIGURATION DRIVERS

P/N of FULL-BRIDGE driver	2PCD-UHR1-1000-2.4-C 2PCD-UHR2-1000-2.4-C	2PCD-UHR1-2000-1.6-C 2PCD-UHR2-2000-1.6-C
Base driver	PCD-UHR1-500-2.5 PCD-UHR2-500-2.5	PCD-UHR1-1000-1.8 PCD-UHR2-1000-1.8
Maximal HV operating voltage	2.4 kV	1.6 kV
Maximal HV repetition rate with frequency doubling *	1000 kHz	2000 kHz
HV pulse duration range for OUT1	100–5000 ns	
HV pulse duration range for OUT2	100–5000 ns	
HV pulse duration range to Pockel's cell	0–5000 ns	
HV pulse rise time	<6.5 ns	<6 ns
HV pulse fall time	<6.5 ns	<6 ns
Maximal capacitance of Pockel's cell	<6 pF	
HV power consumption	<160 W **	
Case	see Fig. 27	
Cooling	water	

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation. HV output voltage pulse to Pockels cell appears as difference of pulses OUT1 and OUT2 and is lower as HV power supply voltage. Contact Ekspla for technical details based on your request.

* Full-Bridge drivers are generally designed for operation at high repetition rate. However, low repetition rate pulsing can be achieved using pulse regeneration technique.

** Two HV power supplies HV80Wm are suggested.

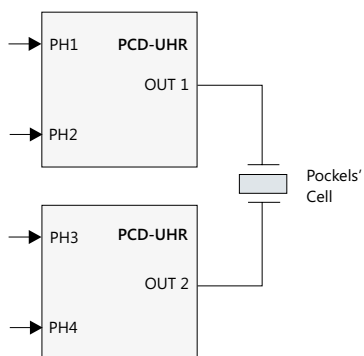


Fig. 24. Diagram of Pockels cell full-bridge connection to driver



Fig. 25. External view of full-bridge driver

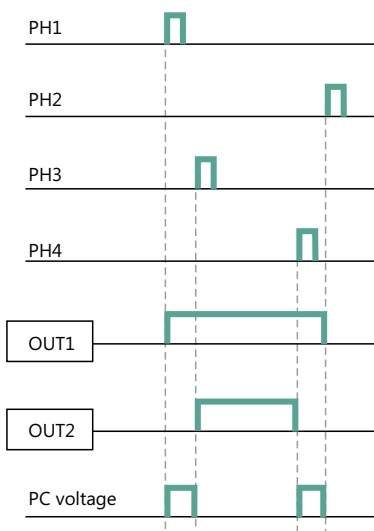


Fig. 26. Principle of 4-phase control of FULL-BRIDGE driver configuration

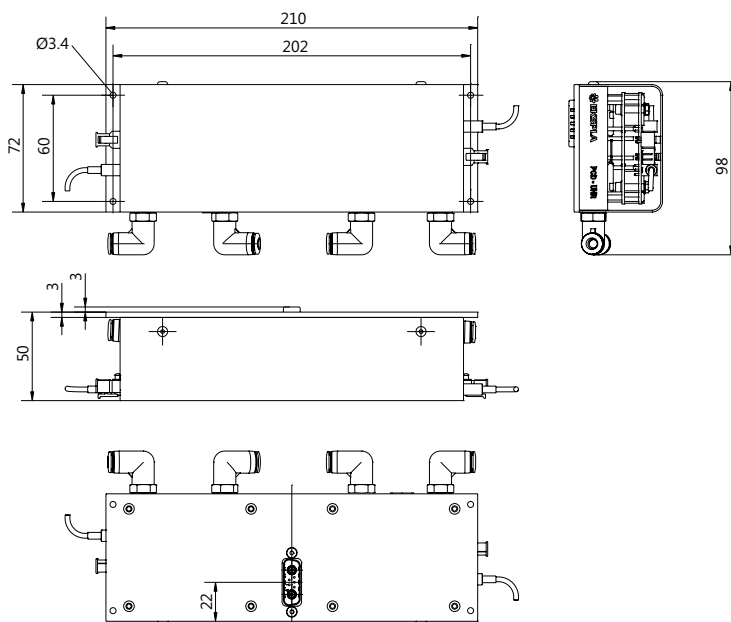


Fig. 27. Outline drawing of case for full-bridge drivers

PCD-UHV SERIES OEM POCKELS CELL DRIVER



PCD-UHV driver mounted with HV power supply **HV05Wm**

FEATURES

- ▶ HV pulse amplitude up to **5.6 kV**
- ▶ HV repetition rate up to **10 kHz**
- ▶ HV pulse duration down to **15 ns**
- ▶ HV pulse amplitude doubling layout
- ▶ Easy integration with HV power supply
- ▶ Switchable one/two trigger pulses control mode

SPECIFICATIONS

Operation regime	4.2 kV mode	5.6 kV mode
High voltage (HV) pulse amplitude to cell	4.2 kV	5.6 kV
Output polarity	bipolar	
HV pulse rise time, typical	7 ns	8 ns
HV pulse fall time, typical	7 ns	8 ns
HV pulse duration	30–3000 ns	
Maximal HV pulse repetition rate	10 kHz	5 kHz
External triggering pulse amplitude requirement	3.5–5 V (50 Ω load)	
External triggering pulse rise & fall time	< 5 ns	
HV pulse delay	30 ns	
External powering requirements:		
HV power supply *	≤ 2.1 kV, 5W	≤ 2.8 kV, 5 W
low voltage DC supply, switchable	15–25 V, 150 mA or 12 V, 220 mA (0.5 A inrush current)	
Dimensions (L × W × H):		
driver board	135 × 65 × 25 mm	
driver board mounted with HV05Wm power supply	135 × 65 × 55 mm	

* Typical voltage control limits for HV05Wm are 1.8 to 2.8 kV. Other limits are available on your request.

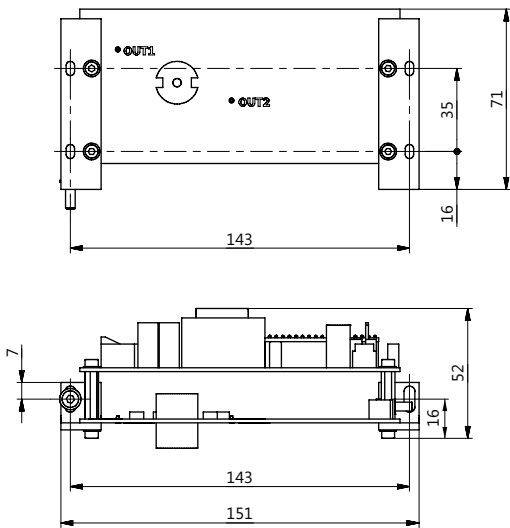


Fig. 1. Outline drawing of PCD-UHV

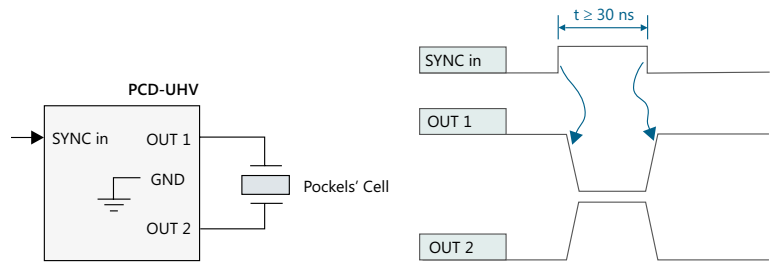


Fig. 2. Diagram of Pockels' cell connection to driver and timing charts for one-pulse control mode

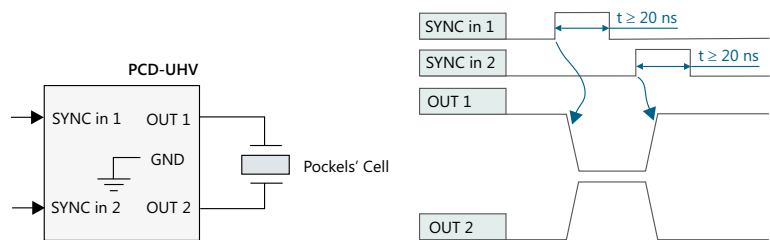
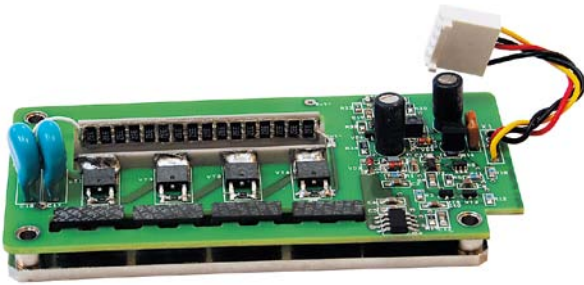


Fig. 3. Diagram of Pockels' cell connection to driver and timing charts for two pulses control mode

PCD-PHR SERIES HIGH REPETITION RATE POCKELS CELL DRIVER



PCD-PHR has been designed for use in mode-locked lasers for cavity dumping or for Q-switching of solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

Ability to operate at high pulse repetition rates makes this driver perfect fit for most of diode-pumped nanosecond lasers. For pulse repetition rates up to 10 kHz heatsink is not required. For high repetition rates the driver should be attached to the heatsink with thermal resistance of at least 0.4 °C/W for room temperature (25 °C) operation.

The driver should be mounted into dielectric box (not provided) providing electrical insulation. Low voltage power supply is required to internal triggering circuit, while tuning of HV power supply voltage.

FEATURES

- ▶ Pulse repetition rate up to **100 kHz**
- ▶ Fast HV rise time **< 7 ns** for 4 kV pulse
- ▶ HV pulse amplitude up to **4 kV**

SPECIFICATIONS

Model	PCD-PHR
Maximum high voltage (HV) pulse amplitude	4.0 kV
Polarity	Positive
HV pulse rise time	< 7 ns
HV pulse fall time	~2 μs ¹⁾
HV pulse duration	180 ns ¹⁾
Maximum HV pulse repetition rate	100 kHz
HV pulse jitter	< 0.5 ns
External triggering pulse duration requirement	100–1000 ns
External triggering pulse amplitude requirement	3–5 V (50 Ω)
External triggering pulse rise & fall time	< 10 ns
HV pulse delay	35–40 ns
External powering requirements:	
high voltage supply	0–4.0 kV, 9 mA max ²⁾
low voltage DC supply	9–24 V, 500 mA max ²⁾
Operating temperature	0–35 °C ³⁾
Size	104 × 52 × 25 mm

¹⁾ Typical value.

²⁾ Test conditions: PRR= 100 kHz, C= 6 pF, U= 4 kV.

³⁾ Heatsink temperature should be below 35 °C at 100 kHz pulse repetition rate.

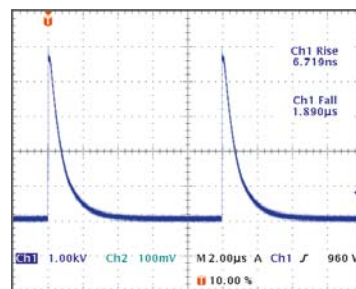


Fig. 1. Oscillogram of PCD-PHR driver operation

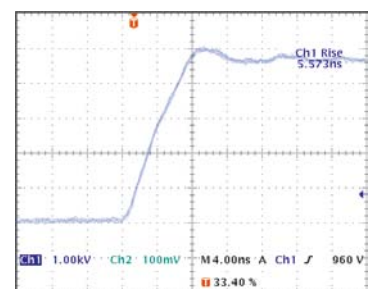


Fig. 2. Fast edge of HV pulse in detail

PCD-P SERIES CAVITY DUMPER DRIVER



PCD-P has been designed for use in mode-locked lasers for cavity dumping or for cavity Q-switching of

solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

SPECIFICATIONS

Model	PCD-P
Maximum high voltage (HV) pulse amplitude	4.2 kV
HV pulse fall time	< 7 ns
HV pulse rise time	~0.1 ms
HV pulse duration	from 5 to 100 μ s ¹⁾
Maximum HV pulse repetition rate	2.5 kHz
Jitter	< 0.5 ns
External triggering pulse duration requirement	100 – 1000 ns
External triggering pulse amplitude requirement	3 – 5 V (50 Ω)
External triggering pulse rise & fall time	< 20 ns
HV pulse delay	35 – 40 ns
External powering requirements:	
high voltage supply	4.4 kV, 0.2 mA max
low voltage DC supply	24 – 28 V, 50 mA max
Size	100 × 50 × 40 mm

¹⁾ According to request.

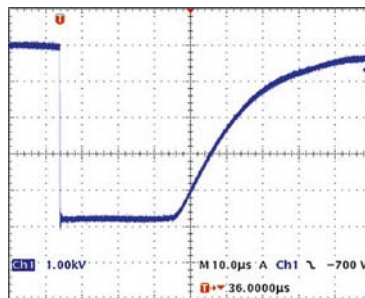


Fig. 1. Oscilloscope of PCD-P driver operation: whole HV pulse

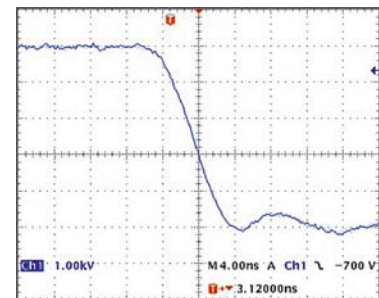


Fig. 2. Oscilloscope of PCD-P driver operation: HV pulse fall

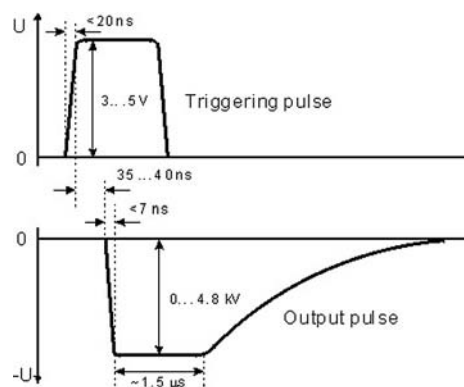


Fig. 3. Time diagram of PCD-P cavity dumping driver

PCD-N SERIES OEM POCKELS CELL DRIVER



Fig. 1. External view of PCD-N-2 driver



Fig. 2. External view of PCD-N-3x driver

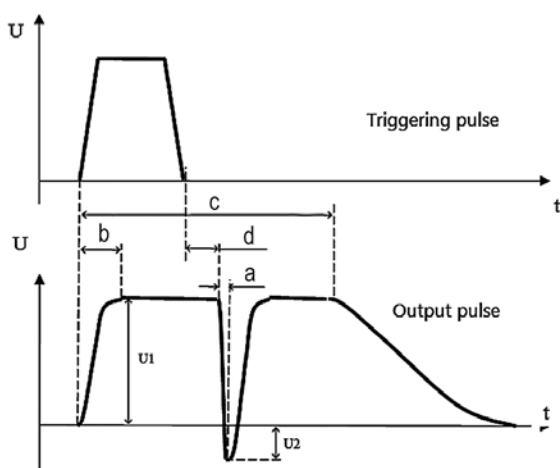


Fig. 3. Control time diagram of PCD-N series drivers

Drivers PCD-N-2 and PCD-N-3 are designed for Q-switching of nanosecond lasers without use of phase retardation plate. High voltage is applied to Pockels cell in order to inhibit oscillation. Pockels cell is opened by negative polarity pulse allowing laser to radiate. Driver need for external HV power supply, HV05Wm is suitable.

Drivers PCD-N-3D and PCD-N-3B is integrated with ± 4 kV HV power supply. Voltage control is done using CAN interface. EKSPLA suggest CAN-USB converter with Can browser software for Windows® operating system. Can browser can be kept disconnected after proper voltage value was set.

Drivers PCD-N-2D and PCD-N-3D are designed for operation with DKDP crystals, drivers PCD-N-2B and PCD-N-3B – for BBO.

SPECIFICATIONS

Model	PCD-N-2D	PCD-N-2B	PCD-N-3D	PCD-N-3B
Maximum high voltage to cell (HV) pulse amplitude (U1 + U2)	5 kV		8 kV	7.6 kV
U1 value (Fig. 3)	equal to HV powering voltage		equal to HV powering voltage	
U2 value (Fig. 3)	equal to $0.25 \times U1$	0 V	equal to $0.3 \times U1$	0 V
HV pulse fall time (a)	< 15 ns		< 12 ns	
HV pulse rise time, typical (b)	60 μ s		120 μ s	
HV pulse duration, typical (c)	300 μ s (1200 μ s optionally)		650 μ s	
HV pulse repetition rate	≤ 250 Hz		≤ 100 Hz	
HV pulse delay (d)	40 ns		25 ns	
External triggering pulse duration	100 – 1200 μ s		120 – 650 μ s	
External triggering pulse amplitude	3 – 5 V (50 Ω)		3.5 – 5 V (50 Ω)	
External triggering pulse rise & fall time	< 20 ns		< 20 ns	
Board dimensions	92 × 70 × 22 mm *		92 × 72 × 35 mm *	
Mounting holes location for M3 studs	84 × 62 mm		84 × 62 mm	
External powering requirements:				
DC supply	12 – 24 V, max 200 mA		12 V, max 100 mA	
HV supply	4 kV, 1 mA		n/a	

* Keep safety distance at least 5 mm from any side of board or any component to surrounding conductive parts.

OEM HV POWER SUPPLIES FOR POCKELS CELL DRIVERS



Fig.1. HV40Wm power supply

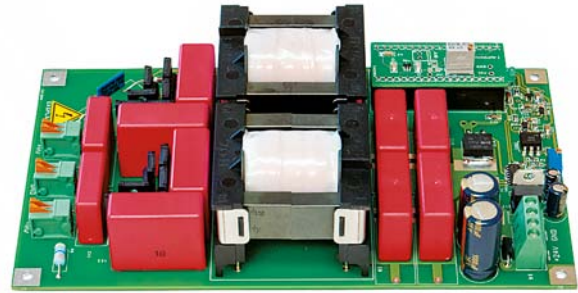


Fig.2. HV120Wm, HV2x60Wm power supply

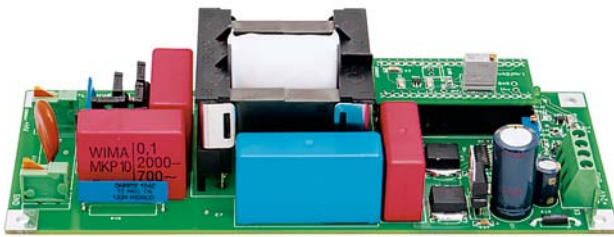


Fig.3. HV80Wm power supply

Power supply HVxxWm series is designed for powering pockels cell driver with appropriate power and voltage requirement. Due to its performance and reliable design, HVxxWm is good choice for OEM customers.

Table below shows general specifications of HV power supplies. Particularly "Maximal output high voltage" row gives reference of maximal achievable voltage for particular model limited by design. For specific driver this limitation is different. E.g. for the driver PCD-UHR1-1000-1.8 voltage control limits are made from 0.8 kV to 1.8 kV typically.

Power supplies HV120Wm and HV2x60Wm are equipped with overheat protection and LED indicator that stops operation and lights if ambient temperature exceeds 55 °C.

SPECIFICATIONS

Model	HV05Wm	HV40Wm	HV80Wm	HV120Wm	HV2x60Wm
Maximal high voltage output options ¹⁾	1.8 kV 2.8 kV 4.0 kV	1.3 kV 1.8 kV 2.5 kV 3.6 kV 4.0 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV	±1.4 kV ±2.6 kV
Voltage control limits	-1 kV from maximal value				
Maximal output power at maximal output voltage ²⁾	5 W	40 W	80 W	120 W	2×60 W
Output voltage control options ³⁾	CAN interface ⁴⁾ , internal trimmer				
External powering	24 V DC, <15 W ⁵⁾	24 V DC, <50 W	24 V DC, <90 W	24 V DC, <150 W	24 V DC, <150 W
Dimensions (L × W × H)	135 × 70 × 30 mm	160 × 70 × 40 mm	175 × 70 × 45 mm	175 × 110 × 45 mm	175 × 110 × 45 mm
Mounting holes Ø3.4 mm location	125 × 35 mm	150 × 60 mm	165 × 60 mm	165 × 100 mm	165 × 100 mm

¹⁾ Matching to Pockels cell driver voltage requirement is necessary by ordering.

²⁾ Maximal power is proportionally lower by tuning to lower HV output.

³⁾ Needs to be indicated by ordering.

⁴⁾ Requires USB-CAN converter for computer control that sold separately.

⁵⁾ Optionally 12 V DC, <15 W.

Output ripple is 0.5% typically at maximal power for all models of HV power supplies. External filter can be used to reduce that value if certain application requires smoother output. All Pockels cell drivers made by Ekspla have integrated ripple filter and usually do not require additional one. Contact Ekspla for suggestions if your specific application needs lower ripple voltage.

HIGH VOLTAGE POWER SUPPLY PS4012 FOR POCKELS CELL DRIVERS

FEATURES

- ▶ HV power supply and low voltage 24 V DC power supply in one box
- ▶ Tailored for use in laboratories
- ▶ HV tuning by multi-turn knob
- ▶ 3½ LCD display for voltage monitoring
- ▶ Various versions for different power requirement



Desktop HV power supply PS4012 is designed for powering Pockels cell drivers. It features internal HV power supply as well as low voltage 24 V DC power supply in one case. That approach gives possibility for convenient powering in your laboratory any Pockels cell driver

manufactured by Ekspla. Different pockels cell drivers needs different voltage and power. Line of HV power supplies meets that requirement by choosing best suitable modification from table. HV adjustment is made by multi-turn knob on front panel.

SPECIFICATIONS

Model	PS4012-05	PS4012-40	PS4012-80	PS4012-120	PS4012-150	PS4012-2×60
Maximal high voltage output options	1.8 kV 2.8 kV 4.0 kV	1.3 kV 1.8 kV 2.5 kV 3.6 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV	1.8 kV 2.6 kV 3.1 kV 3.6 kV 4.0 kV 4.4 kV	±1.4 kV ±2.6 kV
Maximal output power at maximal output voltage ¹⁾	5 W	40 W	80 W	120 W	150 W	2×60 W
Voltage control limits	40% U_{max} to U_{max}					
24 V DC remaining power for external needs (including PCD)	190 W	150 W	100 W	60 W	20 W	60 W
Mains voltage	90 to 264 V AC, 47–63 Hz					
Dimensions (W×L×H)	260 × 280 × 100 mm					
Weight	2.7 kg					

¹⁾ Maximal power is proportionally lower by tuning to lower HV output.

Output ripple is 0.5% typically at maximal power for all models of HV power supplies. External filter can be used to reduce that value if certain application requires smoother output. All Pockels cell drivers made by Ekspla have integrated ripple filter and usually do not require additional one. Contact Ekspla for suggestions if your specific application needs lower ripple voltage.

Laser Synchronization Modules

SY4000 SYNCHRONIZATION MODULE AND PULSE DELAY GENERATOR



SY4000 Synchronization module and pulse delay generator encased

FEATURES

- ▶ Compact design
- ▶ OEM (single board) and encased options
- ▶ 8 independent output channels
- ▶ Ultra-stable internal clock 0.2 ppm (optional)
- ▶ Precise delay control in range 2 ns to 150 ms
- ▶ 25 ps timing resolution
- ▶ Hi-accuracy synchronization to external pulse train
- ▶ DAC output
- ▶ Both 50 Ω and differential outputs present
- ▶ Measurement of
 - Optical clock frequency
 - Triggering frequency
 - Delay
- ▶ Frequency divider
- ▶ Frequency divider for photodetectors

Pulse synchronization module with delay generator is designed to create up to 8 delayed output pulse sequences precisely synchronized to internal or external clock. Photo detector or electrical signal can be used as input source to be synchronized with. Generator gives possibility to create different sequences like delayed triggering, or any delayed precisely timed series. Particularly, Ekspla recommend using SY4000 to create sets of pulses to control PCD-UHR series pockels cell drivers with one, two or 4 triggering inputs.

ENCASED VERSION

Preserves all specifications as SY4000 in additionally communication ports RS232, USB, LAN, WLAN are added. Powering from mains 90...264 V, 50–60 Hz or 12 V DC. Power consumption less than 15 W. Ideal solution for your lab and/or evaluation before switching to OEM version.



SPECIFICATIONS

Model	SY4000
PULSE GENERATION	
Channel modes	Single shot, burst, normal, duty cycle, frequency divider
Delay range	0 to 150 ns
Negative delay	-150 ns
Pulsewidth	2 ns to 150 ns
Resolution	25 ps
Accuracy	25 ps + 0.000001 × delay
Time base	100 MHz, 0.2 ppm
Jitter	< 30 ps
Burst mode	1 to 65535
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
INTERNAL GENERATOR	
Mode	Duty cycle
Rate	50 ns to 100 sec
Resolution	10 ns; 300 ps
Accuracy	5 ns + 0.000001 × period
Jitter	100 ps RMS
Burst	0 ... 65535
OUTPUTS	
Output level	2.5 V, 4 V
Impedance	50 Ω
Slew rate	1.5 V/ns
COMMUNICATIONS	
Communications	CAN
OPERATING REQUIREMENTS	
Power requirements	12 V DC, 500 mA
DIMENSIONS (not including connectors)	
OEM board (W × D × H)	100 × 77 × 20 mm
Encased version (W × D × H)	105 × 86 × 85 mm

Laser Diode Drivers

UNIVERSAL LASER DIODE DRIVER uniLDD

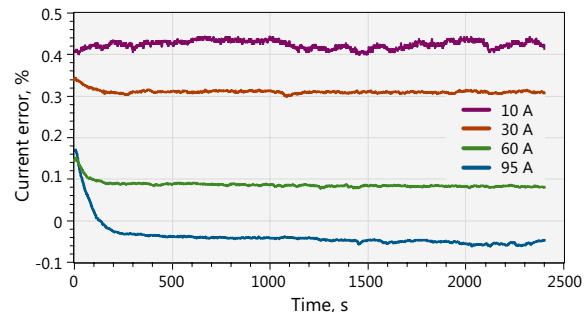


FEATURES

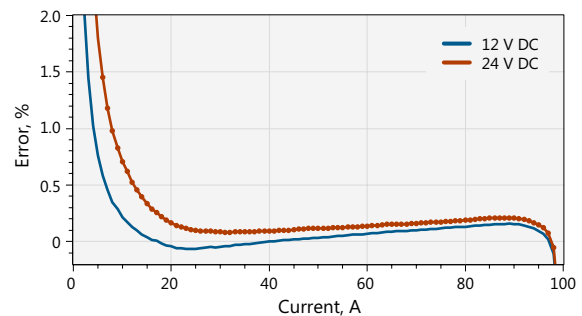
- ▶ Economical OEM module
- ▶ Wide current range
- ▶ Wide diode compliance voltage range
- ▶ Storage capacitor option for pulse mode
- ▶ Storage capacitor charger (current limit) option pulse mode
- ▶ Latest DSP based control technology
- ▶ Frequency response analysis feature allows easy compensation to achieve stable operation with any load and connection cables combination in both CW and QCW modes.
- ▶ High efficiency switching mode converter
- ▶ Multi-phase low ripple power stage
- ▶ Board fan and unit fan PWM controllers
- ▶ Low current ripple
- ▶ Low current drift
- ▶ TEC controller option
- ▶ Analog and digital control interfaces
- ▶ Easy configuration

uniLDD is DC input power converter designed to supply CW or pulsed current for single emitter, bar or stacked laser diode in Constant Current Mode (or CC mode). It can be installed either as unit assembled either as set of open PCB boards or as standalone unit. The standalone unit is uniLDD enclosed together with the power supply.

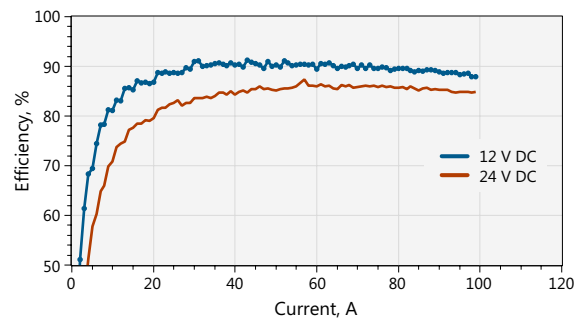
uniLDD current drift.
From cold start
for different currents



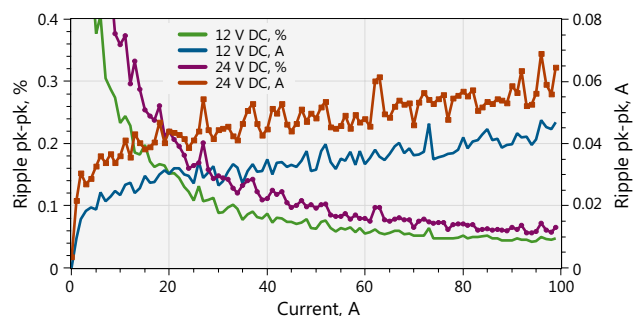
uniLDD current error.
12 V and 24 V DC power,
2 V junction + 10 M Ω
series R load



uniLDD efficiency.
12 V and 24 V DC power,
2 V junction + 10 M Ω
series R load



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



SPECIFICATIONS

Parameter	Value	Notes
INPUT		
Voltage, power stage	12 ... 90 V DC	Control and power stage may share single supply 12...30 V
Voltage, control stage	12 ... 30 V DC	
OUTPUT, CW mode		
Diode compliance voltage	1 ... 28 V	Up to 95% of power stage supply voltage
Max current	15 A – 100 A	See CONFIGURATION for max current values
Current ripple	0.1 % pk-pk	DC ... 100 kHz bandwidth, in $\times 0.5$... $\times 1$ of max current range
Current drift	< 0.2 %	Cold start, 8 h period, after 5 min warm up
Bandwidth of I_{programm} control input frequency	> 10 kHz	At minimal connection cable inductance
OUTPUT, OCW (Pulse mode)		
Diode compliance voltage	1 ... 80 V	
Max pulse current	60 A – 400 A	See CONFIGURATION for max current values
Current pulse raise	< 5 μs	At minimal connection cable inductance and sufficient power stage voltage
Max RMS current	100 A	80 A for diode compliance voltage >28 V
Current pulse amplitude stability	0.1% pk-pk	In $\times 0.5$... $\times 1$ of max current range
Current drift	< 0.2 %	Cold start, 8 h period, after 5 min warm up
ENVIRONMENT		
Operating temperature	0 to 40 °C	De-rate current at higher temperature
Cooling	Forced air, installed or external shared fan	Inquire for conduction cooled version
PROTECTIONS		
Current transient protection and shut-down		
Open circuit shut-down		
Power voltage brownout shut-down		
Over temperature shut-down		
Interlock shut-down		
AUXILIARY OUTPUTS		
+5 V @ 200 mA		
+15 V @ 100 mA		
-15 V @ 100 mA		
CONFIGURATIONS		
Operation mode	CW, QCW (pulse)	
Max current, CW mode	15 A, 25 A, 50 A, 100 A	
Max current, pulse mode	60 A, 100 A, 200 A, 400 A	$I_{\text{RMS}} \leq 100$ A, duty factor ≤ 20 %
Max power stage voltage	28 V (CW, QCW) and 90 V (QCW)	
PHYSICAL CHARACTERISTICS		
Assembly size long version (L×W×H)	190 × 68 × 55 mm	15 mm fan included
Assembly size short version (L×W×H)	120 × 63 × 50 mm	for currents < 50 A, fan excluded
Connectors	Analog control – DSUB-15	Pin-out resembles standard interface of LDN series diode drivers from Lumina Power
	Digital control – Molex Picoflex	6 pin and 10 pin connectors
	DC power input – Multiple	
DIGITAL CONTROL INTERFACE		
CAN bus	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	ASCII text command protocol	
	Proprietary Ekspla CAN messages tunnel over RS232 protocol	Control application, libraries and programming samples are provided

Notes:

- Max current is transient protection upper setting. Laser diode EOL nominal current should be 95% or less of this value.
- Parallel connection of several drivers can be used above 100 A in CW and 400 A in QCW.

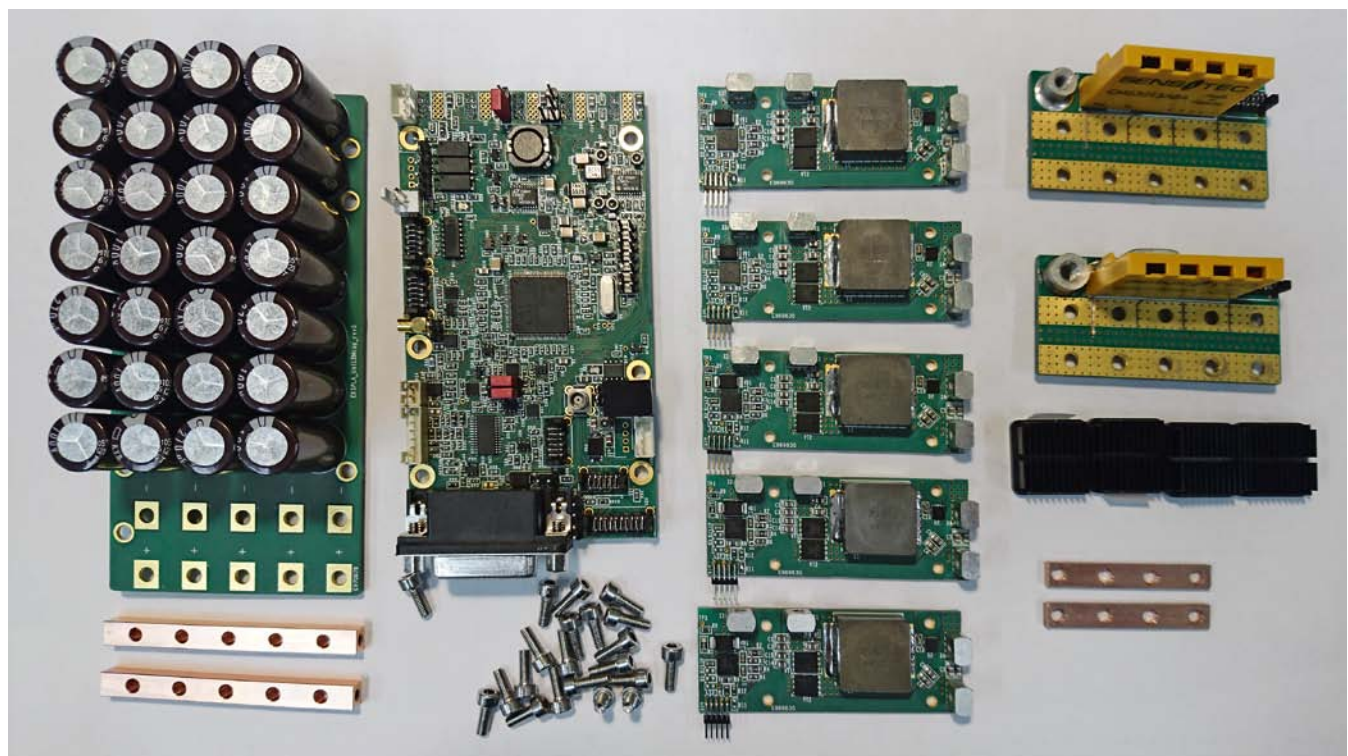
ANALOG INTERFACE PINOUT, 15-PIN D-SUB, FEMALE

Pin	Signal name	Direction	Voltage level	Description
1	Enable	Input	TTL, LVTTTL	The enable function pulls the RTO signal high
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 "Enable" input is High. 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. V _{out} = Diode compliance voltage + voltage drop on connection wires
6	I _{out} monitor	Output	0–12 V * = 0 – I _{out} max	The output current monitor
7	I _{program}	Input	0–9 V * = 0 – I _{out} max	Output current setting or modulating by applying a voltage, CW and Pulse mode
8	Pulse control	Input	TTL, LVTTTL positive pulse	Trigger input for pulse mode. Pulse rise will trigger current pulse of preset width
9	GND			
15	GND			
10, 11	+5V	Output	+5V	Auxiliary, 200 mA
12	-15V	Output	-15V	Auxiliary, 100 mA
13, 14	+15V	Output	+15V	Auxiliary, 200 mA

* Subject to change.



CW version. Capacitors bank is excluded



Modular design. Required features and specifications are achieved by combining different boards to one module





Laser Power Supplies

PRINCIPLE OF OPERATION OF PS5000 SERIES FLASHLAMP DRIVERS

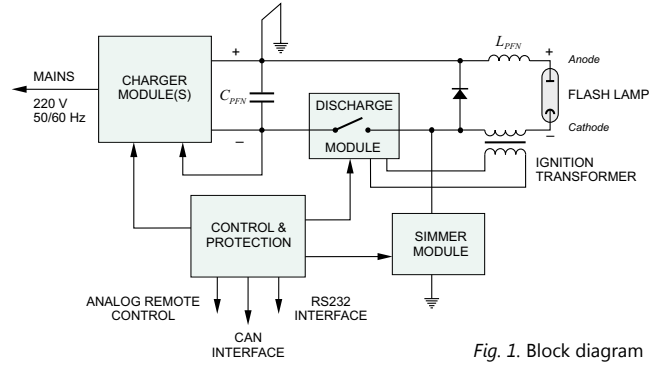


Fig. 1. Block diagram

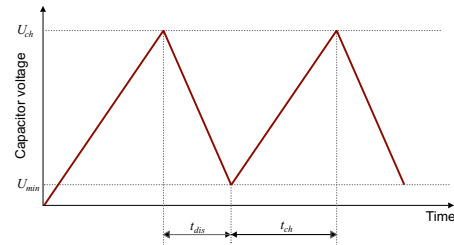


Fig. 2. Voltage waveform on capacitor C_{PFN}

The block diagram of PS5000 series power supplies is shown in Fig. 1. As can be seen from voltage waveforms (Fig. 2), two periods of operation can be distinguished.

During the first period, t_{ch} , the capacitor C_{PFN} is charged to pre-set voltage U_{ch} . During the second period of time t_{dis} energy stored in capacitor is discharged through flashlamp. At the end of discharge pulse the voltage on capacitors drops to U_{min} value.

The charger module charges the capacitor bank with constant current. The instant output power of the charger reaches the maximal value P_{peak} when the capacitor bank voltage is in proximity of U_{ch} . Peak output power of the charger depends on charger module design and is typically

1.7 kJ/s for a single module. By paralleling charger modules, the peak charger output can be increased to 6.8 kJ/s and more.

The discharge module is based either on SCR producing a fixed pulsewidth pulse or IGBT switch producing variable pulsewidth output.

The simmer module is used to keep a low power discharge during the period of time between main discharge pulses.

The control and protection module provides front panel and remote control as well as protection against capacitor overcharge, electronics overheat, and operation using damaged lamp.

FIXED PULSEWIDTH OUTPUT

The pulse duration of fixed pulsewidth flashlamp drivers is determined by parameters of PFN. Contact EKSPLA for determination of values of PFN components subject to required pulse energy and duration and flashlamp type.

The discharge switch is based on SCR and all energy stored in capacitor bank is discharged through the flashlamp.

The average power delivered to the flashlamp can be expressed as

$$P_{avg} = \frac{N \cdot P_{peak}}{2} (1 - f_{PRR} \cdot t_{dis}) \quad (1)$$

where N is number of charging modules, t_{dis} is discharge time equal to 5 ms, f_{PRR} – pulse repetition rate.

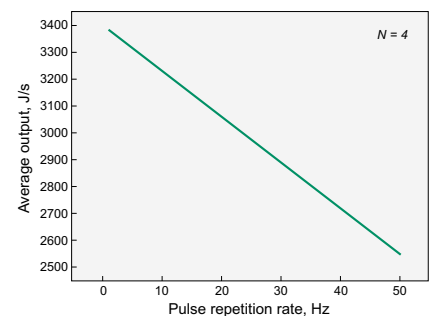


Fig. 3. Fixed pulse width driver average output power versus pulse repetition rate

VARIABLE PULSEWIDTH OUTPUT

The pulse duration of variable pulsewidth driver is controlled by electronic switch, based on IGBT transistor. The pulse shape is close to rectangular as can be seen from Fig. 4. The average power delivered to the flashlamp can be expressed as

$$P_{avg} = N \cdot P_{peak} \cdot \left(1 - \frac{\Delta U}{2 \cdot U_{ch}}\right) \cdot (1 - t_{dis} \cdot f_{PRR})$$

There are few other factors limiting average power, though. Since the capacitor bank is only partially discharged during the pulse, to avoid damage of electronic components the voltage drop during discharge period of time should be less than 20%, i.e. $\Delta U/U_{ch} < 0.2$, which in turn places limitation for maximum pulse energy:

$$E_{pulse} < \left(1 - \left(1 - \frac{\Delta U}{U_{ch}}\right)^2\right) \cdot E_C$$

where E_C is energy stored in capacitor bank, E_{pulse} is pulse energy.

The maximum possible pulse energy is 480 J for $C_{PFN} = 13.2$ mF version and 960 J for $C_{PFN} = 26.4$ mF one.

On the other hand, the energy E_{pulse} delivered to the flashlamp depends on the pulse duration and flashlamp impedance parameter K_0 :

$$K_0 = 1.28 \cdot \frac{l}{d} \cdot \left(\frac{p}{x}\right)^{0.2}$$

where l is arc length, d is bore diameter, p is fill pressure in Torr, and x is a constant, 450 for xenon filled flashlamps and 800 for krypton filled flashlamps.

For given pulse duration and flashlamp impedance parameter, the energy delivered to the flashlamp can be found from Fig. 6.

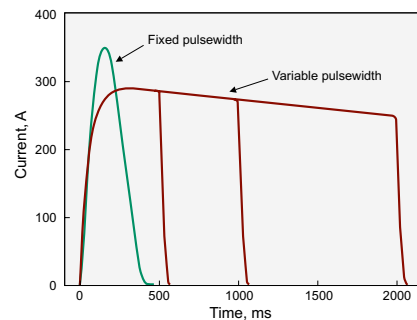


Fig. 4. Output pulse shape for fixed and variable pulsewidth drivers

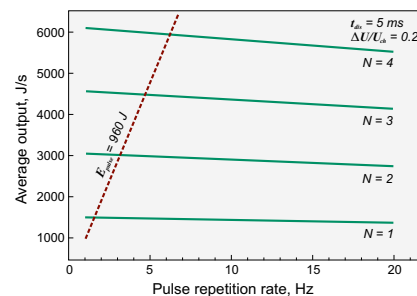


Fig. 5. Average power versus pulse repetition rate for variable pulsewidth drivers

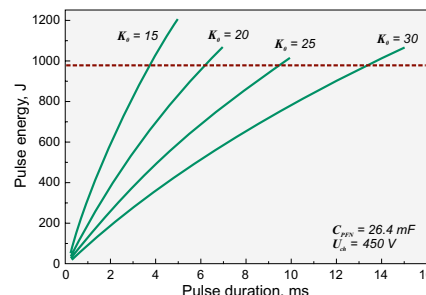
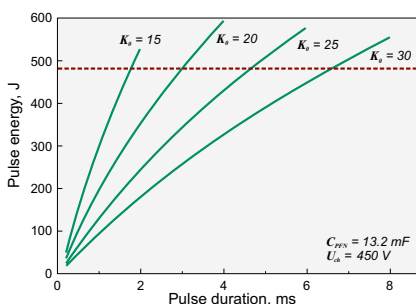


Fig. 6. Pulse energy versus pulse duration for variable pulsewidth drivers

REMOTE CONTROL & SEAMLESS INTEGRATION

Microprocessor based control allows seamless integration of the driver into sophisticated laser systems. The charge voltage, repetition rate, pulse duration can be controlled remotely through computer interfaces RS-232, CAN, Ethernet. In addition, digital interfaces allow monitoring of status and error messages as well as in some cases measure output pulse parameters.

The discharge pulse can be triggered from external pulse generator facilitating synchronisation of several units.

The driver can be easily integrated with EKSPLA cooling units (like PS1245CO and PS1223CO). Up to 6 units can be mounted into up to 25U height 19" racks providing powerful yet compact laser pumping cabinets.

Standard range includes racks of 9U, 12U, 16U, 20U, 25U, 34U height.



Flashlamp driver PS5053 and cooling unit PS1223CO mounted into a 9U rack

GUIDE ON OUTPUT CURRENT SHAPES USED IN DIFFERENT POWER SUPPLIES

COMPARISON TABLE OF FLASHLAMP POWER SUPPLIES

Model	Output current	Configuration	Simmer
PS5050	Shape №1	1 channel	Yes
PS5053	Shape №1	2 independent channels	Yes
PS514x	Shape №1	1 charging unit & 1 – 10 synchronous discharging channels	N/A
PS5023	Shape №2	1 channel	Yes

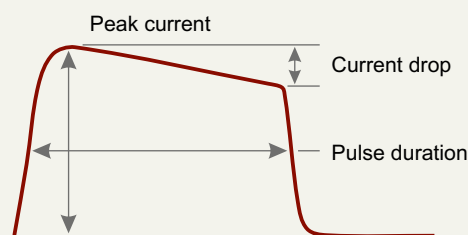
Output Current Shape № 2

FEATURES

- Tunable output pulse duration 0.1 ... 10 ms and even more
- Output is very sensitive to lamp type
- Maximal peak current up to 1 kA
- Used in model PS5023

APPLICATIONS

- Laser pumping
- Pulsed lighting



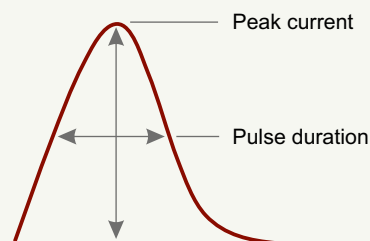
Output Current Shape № 1

FEATURES

- Fixed output pulse duration $\leq 500 \mu\text{s}$ typical
- High discharge energy during short discharge time
- Output sensitive to lamp type
- Peak current value can reach several kA
- Used in models PS5050, PS5053, PS514x

APPLICATIONS

- Laser pumping
- Pulsed lighting if high UV level is desirable



VARIABLE PULSE DURATION FLASHLAMP DRIVER PS5023



FEATURES

- ▶ Built-in serial ignition circuit
- ▶ Built-in simmer power supply
- ▶ Internal/external triggering
- ▶ Remote control through LAN / CAN / RS-232 interface

PS5023 flashlamp driver is designed for pumping solid-state lasers with variable or long pulsewidth lamp discharge. It features variable pumping pulse in 0.5 – 10 ms range and output voltage of up to 550 V. Custom versions can achieve tens of milliseconds pulse duration.

Excellent pulse-to-pulse voltage stability. The charger is based on resonant inverter topology which is most efficient way to charge capacitive loads. Innovative design of charger circuit allows to charge capacitor bank with an excellent precision of 0.2%.

Built-in serial ignition circuit. The driver features a built-in serial ignition circuit. It greatly simplifies the design of laser head since external triggering circuit is not required anymore.

The simmer module provides up to 900 V striking voltage. The flashlamp is ignited by 16 kV pulse of approximately 1 μ s duration, applied to the flashlamp cathode. The ignition circuit reliably ignites flashlamps with up to 200 mm arc length.

Remote control. Microprocessor-based control allows seamless integration of the driver into sophisticated laser systems. The charge voltage, repetition rate and pulse duration can be controlled remotely through LAN, CAN or RS-232 interface. In addition, the interface allows monitoring of status and error messages as well as measure output energy and current to the lamp. The discharge pulse can be triggered from external pulse generator facilitating synchronisation of several units.

GENERAL SPECIFICATIONS

Model	PS5023-1	PS5023-2	PS5023-3	PS5023-4
Number of independent outputs	1			
Number of charging modules	1	2	3	4
Max. average output power P_{avg} at 10 Hz PRR	1.2 kJ/s	2.4 kJ/s	3.6 kJ/s	4.8 kJ/s
Standard charging voltage U_{ch}	350 V, 450 V, 500 V			
Pulse duration	variable			
Max pulse repetition rate	250 Hz			
Pulse to pulse voltage stability	0.2 %			
Resolution	1 V			
Ignition pulse voltage	16 kV			
Ignition pulse duration	> 1000 ns			
Simmer current options	0.6 A; 1.2 A			
Simmer voltage	< 300 V			
Striking voltage	< 900 V			
Protection features	overvolt, overheat, overcurrent, interlock			
Error report	no simmer current, no charge, HV connectors			
Remote control	RS-232 / CAN (LAN on request)			
Standard C_{PFN} value	13200 or 26400 μ F			
Mains ¹⁾	single phase 230 V (-10%, +6%)			3-phase 380 V (-10%, +6%)
Power consumption, average	1.8 kW	3.2 kW	4.5 kW	5.6 kW
Power consumption, peak	2 kW	4 kW	6 kW	8 kW
Operation conditions	from 0 to +40 °C			
Ambient temperature	from 0 to +40 °C			
Humidity	from 10 to 90 % non-condensing			

¹⁾ 3-phase 200 V or 208 V mains are optional.

Specifications in table are given as reference. We always suggest to optimize power supply by customer's usage conditions.

Not all combinations of parameters can be possible at the same time. Specifications are subject to changes without advance notice.

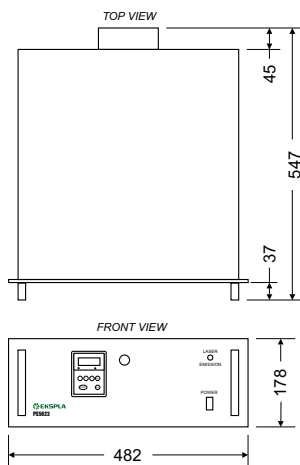


Fig. 1. Physical dimensions

Built-in simmer power supply. The simmer power supply improves pulse-to-pulse stability and flashlamp lifetime. It is a constant current source producing 600 mA current at up to 300 V output voltage. Other current values are available optionally. Linear xenon flashlamps of 4–6 mm bore diameter and arc length up to 200 mm are reliably simmered.

Modular design. The output parameters of power supply can be easily modified to meet customer needs subject to active lasing material, average output power or pulse energy. The average output power of the driver can be scaled up by paralleling several charger modules. Up to four modules with resulting 4.8 kJ/s peak charging rate can be fitted into a single 19" body.

Seamless integration. The driver can be easily integrated with EKSPLA cooling units of PS1223 or PS1245 series. Up to 6 units can be mounted into up to 25U height 19" racks providing powerful yet compact laser pumping cabinets.

CONFIGURATION EXAMPLES OF PS5023 SERIES POWER SUPPLIES

Ordering code	Discharge energy ¹⁾	Repetition rate ²⁾	Maximal charging rate	Maximum voltage / current	Flashlamp recommended	PFN specifications		
						Capacitance	Inductance	Pulse duration range
	J	Hz	kJ/s	V / A		mF	μH	ms
PS5023-2-13200-10-3.5	400	3	2.4	350 / 1000	9×62; Xe; 450 Torr	13.2	10	0.1 – 2
PS5023-2-26400-10-4.5	1000	2	2.4	450 / 600	5×90; Xe; 450 Torr	26.4	10	0.1 – 10
PS5023-1-13200-20-5.5	700	1	1.2	550 / 600	5×90; Xe; 450 Torr	13.2	20	0.1 – 3
PS5023-4-13200-10-4.5	400	10	4.8	450 / 500	5×75; Xe; 450 Torr	13.2	10	0.1 – 2

¹⁾ Discharge energy is specified at maximal voltage and maximal pulse duration.

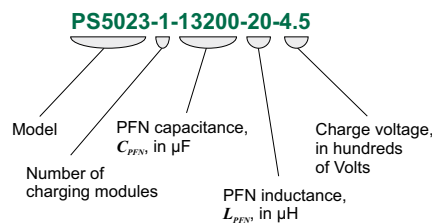
²⁾ Repetition rate is specified at maximal discharge energy and can be proportionally higher by reducing energy.

Contact Ekspla if your requirements are different as in this table. We will consult you and make suggestion best matching your requirements.

Ordering / Part number information

Please indicate following points by inquiry:

- Flash lamp type (bore diameter, gap length, gas type and pressure)
- Maximal pulse energy
- Pulse duration tuning range
- Maximal pulse repetition rate



FLASHLAMP DRIVER PS5050 FOR PULSED LASERS



FEATURES

- ▶ Output power up to **3.2 kJ/s**
- ▶ Output voltage accuracy better than $\pm 0.1\%$
- ▶ Output voltage up to **2500 V**
- ▶ Pulse repetition rate up to **150 Hz**
- ▶ Built-in serial ignition circuit
- ▶ Built-in simmer power supply
- ▶ Internal/external triggering
- ▶ LCD display
- ▶ RS232 / CAN or optionally LAN interface for remote control
- ▶ Single phase mains

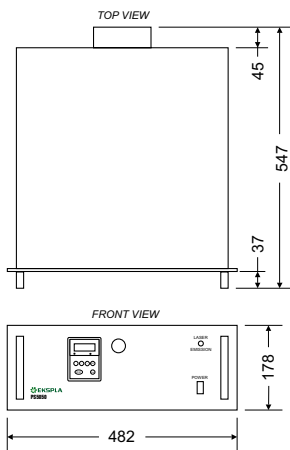


Fig. 1. Physical dimensions



Fig. 2. Front panel controls of PS5050 flashlamp driver

PS5050 model flashlamp driver is designed for flashlamp-pumped lasers and establishes itself as an updated version of PS5010 driver. PS5050 features microprocessor control and back illuminated LCD display where all output parameters of power supply are conveniently displayed. Flashlamp driver comprises one or several charging modules, a discharge and simmer module and a control circuit. Such design allows the unit to

be operated with the utmost ease and convenience. The unit is fitted into a 19" standard housing and may be comfortably mounted in your power supply stands. The unit is manufactured in conformity with EN61010 and EN55011 standards. Driver can be remotely controlled through RS-232 and CAN (Controller Area Network) interface. Ethernet interface can be ordered as option.

GENERAL SPECIFICATIONS

Model	PS5050-1	PS5050-2	PS5050-3	PS5050-4
Number of independent outputs	1			
Number of charging modules	1	2	3	4
Max. average output power P_{avg} at 10 Hz PRR ^{1, 2)}	0.8 kJ/s	1.6 kJ/s	2.4 kJ/s	3.2 kJ/s
Max charging voltage U_{ch}	1000–2500 V ³⁾			
Pulse duration	fixed			
Max pulse repetition rate	< 150 Hz			
Pulse to pulse stability	0.1 %			
Load regulation	0.1 %			
Resolution	1 V			
Ignition pulse voltage	16 kV ⁴⁾			
Ignition pulse duration	> 1000 ns			
Simmer current options	0.6 A; 1.2 A			
Simmer voltage	< 300 V			
Striking voltage	< 900 V			
Protection features	overvolt, overheat, flashlamp breakdown, interlock			
Error report	no simmer current, no charge, HV connectors			
Remote control	RS-232 / CAN (LAN on request)			
Maximum C_{PFN} value	< 240 μ F			
Mains	single phase 230 V (-10%, +6%) or 3-phase 380 V (-10%, +6%) ⁵⁾			
Power consumption, average	1.8 kW	3.2 kW	4.5 kW	5.8 kW
Power consumption, peak	2 kW	4 kW	6 kW	8 kW
Operation conditions	from 0 to +40 °C			
Humidity	from 10 to 90 % non-condensing			

¹⁾ For parallel operation of four charging modules

²⁾ See Fig. 3 for other pulse repetition rates

³⁾ Inquire for other voltages

⁴⁾ Optional 30 kV

⁵⁾ 3-phase 200 V or 208 V mains are optional

Specifications in table are given as reference.

We always suggest to optimize power supply by customer's usage conditions.

Not all combinations of parameters can be possible at the same time.

Specifications are subject to changes without advance notice.

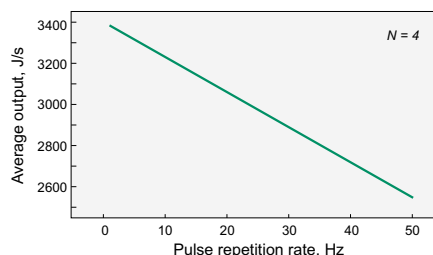


Fig. 3. Average output power versus pulse repetition rate

CONFIGURATION EXAMPLES OF PS5050 SERIES POWER SUPPLIES

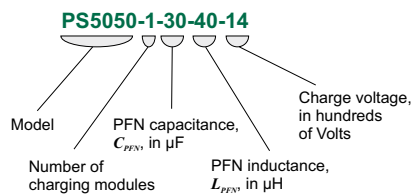
Ordering code	Discharge energy	Repetition rate	Maximal charging rate	Voltage	Flashlamp recommended	PFN specifications		
						Capacitance	Inductance	Pulse duration FWHM, typical
						μF	μH	μs
PS5050-2-60-40-6	10.8	60	648	600	5×58; 450 Torr	60	40	103
PS5050-4-30-80-13	25.4	60	1524	1300	2×5×58; 450 Torr	30	80	103
PS5050-1-30-60-16	38.4	10	384	1600	2×5×45; 450 Torr	30	60	89
PS5050-2-30-60-16	38.4	20	768	1600	2×5×58; 450 Torr	30	60	89
PS5050-4-30-60-16	38.4	50	1920	1600	2×5×58; 450 Torr	30	60	89
PS5050-3-80-60-11	48.4	30	1452	1100	5×90; 450 Torr	80	60	152
PS5050-3-100-80-10	50	30	1500	1000	5×90; 450 Torr	100	80	197
PS5050-2-60-100-16	76.8	10	768	1600	2×5×58; 450 Torr	60	100	163
PS5050-3-60-100-16	76.8	20	1536	1600	2×5×58; 450 Torr	60	100	163
PS5050-3-80-60-14	78.4	20	1568	1400	5×90; 450 Torr	80	60	146
PS5050-2-80-180-19	144.4	10	1444	1900	2×5×75; 450 Torr	80	180	264

Contact Ekspla if your requirements are different as in this table. We will consult you and make suggestion best matching your requirements.

Ordering / Part number information

Please indicate following points by inquiry:

- Flash lamp type (bore diameter, gap length, gas type and pressure)
- Maximal pulse energy
- Pulse duration
- Maximal pulse repetition rate



Customised flashlamp drivers are available upon request.

Depending on customer needs, we can produce flashlamp drivers with specific average charging power, output voltage, pulse duration, repetition rate values or/and specific application areas.

TWO-CHANNEL FLASHLAMP DRIVER PS5053 FOR PULSED LASERS



FEATURES

- ▶ Output voltage up to **2500 V**
- ▶ Single unit for oscillator-amplifier systems
- ▶ Built-in serial ignition circuit
- ▶ Built-in simmer power supply
- ▶ Internal/external triggering
- ▶ Output voltage accuracy $\pm 0.1\%$
- ▶ RS232/CAN or optionally LAN interface for remote control
- ▶ Single phase mains

Flashlamp driver PS5053 is designed for flashlamp-pumped lasers and presents a two-channel device consisting of two capacitor charging, simmer/trigger and pulse forming modules and control circuit. It is excellent choice for oscillator-amplifier laser systems.

This model is an updated version of flashlamp driver PS5012. PS5053 features microprocessor control and back illuminated LCD display where all output parameters of power supply are conveniently displayed. Driver can be remotely controlled through RS-232 and CAN (Controller Area Network) interface. Ethernet interface can be ordered optionally.

GENERAL SPECIFICATIONS

Model	PS5053-1/1	PS5053-1/2	PS5053-x/x
Number of independent outputs	2		
Number of charging modules for first and second channels	1+1	1+2	1+3 or 2+2
Max. average output power P_{avg} at 10 Hz PRR ^{1,2)}	1.6 kJ/s	2.4 kJ/s	3.2 kJ/s
Max charging voltage U_{ch}	1000–2500 V ³⁾		
Pulse duration	fixed		
Max pulse repetition rate	< 150 Hz		
Pulse to pulse stability	0.1 %		
Load regulation	0.1 %		
Linearity	0.2 %		
Resolution	1 V		
Ignition pulse voltage	16 kV ⁴⁾		
Ignition pulse duration	> 1000 ns		
Simmer current options	0.6 A; 1.2 A		
Simmer voltage	< 300 V		
Striking voltage	< 900 V		
Protection features	overvolt, overheat, flashlap breakdown, interlock		
Error report	no simmer current, no charge, HV connectors		
Remote control	RS-232 / CAN (LAN on request)		
Maximum C_{PFN} value	< 240 μ F ¹⁾		
Mains	single phase 230 V (-10%, +6%) or 3-phase 380 V (-10%, +6%) ⁵⁾		
Power consumption, average	3.2 kW	4.5 kW	5.8 kW
Power consumption, peak	4 kW	6 kW	8 kW
Operation conditions			
Ambient temperature	from 0 to +40 °C		
Humidity	from 10 to 90 % non-condensing		

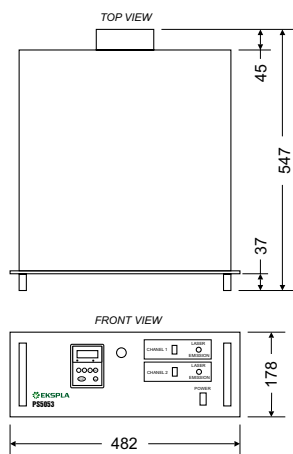


Fig. 1. Physical dimensions

¹⁾ Total for both channels 200 V or 208 V mains

²⁾ See Fig. 2 for other pulse repetition rates

³⁾ Inquire for other voltages

⁴⁾ Optional 30 kV

⁵⁾ 3-phase are optional

Specifications in table are given as reference. We always suggest to optimize power supply by customer's usage conditions.

Not all combinations of parameters can be possible at the same time. Specifications are subject to changes without advance notice.

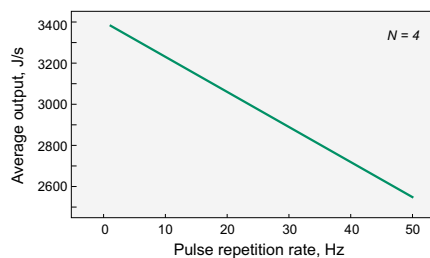


Fig. 2. Average output power versus pulse repetition rate

CONFIGURATION EXAMPLES OF PS5053 SERIES POWER SUPPLIES

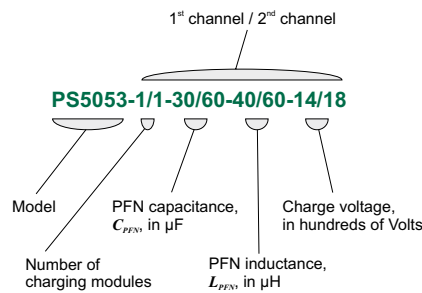
Ordering code	Channel	Discharge energy	Repetition rate	Maximal charging rate	Maximal voltage	Flashlamp recommended	PFN specifications			Mains	
							Capacitance	Inductance	Pulse duration FWHM, typical		
		J	Hz	J/s	V			μF	μH	μs	
PS5053-1/1-60/60-100/100-17/17	No 1	86.7	10	867	1700	2×5×58; 450 Torr	60	100	163	1-phase 230 V	
	No 2	86.7	10	867	1700		60	100	163		
PS5053-1/1-80/80-60/60-13/13	No 1	67.6	10	676	1300	5×90; 450 Torr	80	60	146	1-phase 230 V	
	No 2	67.6	10	676	1300		80	60	146		
PS5053-1/2-40/60-100/130-10/20	No 1	20	10	200	1000	5×45; 450 Torr	40	100	133	1-phase 230 V	
	No 2	120	10	1200	2000	2×5×75; 450 Torr	60	130	194		
PS5053-1/2-60/60-70/70-12/18	No 1	43.2	10	432	1200	5×90; 450 Torr	60	70	136	1-phase 230 V	
	No 2	97.2	10	972	1800	2×5×58; 450 Torr	60	70	136		
PS5053-1/2-80/60-60/100-12/18	No 1	57.6	10	576	1200	5×90; 450 Torr	80	60	152	1-phase 230 V	
	No 2	97.2	10	972	1800	2×5×58; 450 Torr	60	100	163		
PS5053-2/2-40/40-100/100-25/25	No 1	125	10	1250	2500	2×5×90; 450 Torr	40	100	139	3-phase 400 V	
	No 2	125	10	1250	2500		40	100	139		
PS5053-2/2-40/40-40/40-11/11	No 1	24.2	50	1210	1100	5×90; 450 Torr	40	40	84	3-phase 400 V	
	No 2	24.2	50	1210	1100		40	40	84		
PS5053-2/2-60/60-100/100-15/15	No 1	67.5	20	1350	1500	2×5×58; 450 Torr	60	100	163	3-phase 400 V	
	No 2	67.5	20	1350	1500		60	100	163		
PS5053-1/1-60/60-100/100-13/14	No 1	50.7	10	1300	1300	2×5×58; 450 Torr	60	100	163	1-phase 230 V	
	No 2	58.8	10	1400	1400		60	100	163		

Contact Ekspla if your requirements are different as in this table. We will consult you and make suggestion best matching your requirements.

Ordering / Part number information

Please indicate following points by inquiry:

- Flash lamp type (bore diameter, gap length, gas type and pressure)
- Maximal pulse energy
- Pulse duration
- Maximal pulse repetition rate



FLASHLAMP DRIVER PS5140 SERIES FOR HIGH ENERGY SYSTEMS

FEATURES

- ▶ 1 to 10 and more discharging channels with one charging channel
- ▶ Output voltage up to 4000 V
- ▶ Output voltage regulation better than $\pm 0.3\%$
- ▶ Up to two discharge channels per one 19" case
- ▶ LAN, RS232, CAN computer interface options.
- ▶ USB for software update
- ▶ Measuring of discharge current and voltage traces and last shot energy

PS514x series flashlamp drivers are designed for multi-lamp pumping of high energy pump chambers usually based on phosphate or silicate glass rods. This is highly-customizable power supply containing one-channel charging unit PS514xk and required quantity of one or two channel discharging units PS514xi. Each discharging channel is suited to drive one lamp. The PS514x has as many discharge channels as pump chamber has flashlamps. All discharging channels works synchronically. Usually, high energy systems work at very low repetition rate – not exceeding 1 Hz down to 1 shoot per hour. Hence

simmer option is not applicable and lamp igniting (triggering) appears with every discharge. We usually recommend external lamp igniting with separate igniting unit (one- or multi-channel). However internal serial igniting is possible in some cases as well.

Description of PS514x given here is only as one example of possibilities to built high energy powering system, and any time by ordering it can be flexibly changed. All set of charging and discharging units can be mounted to 19" standard racks (sold separately).

APPLICATIONS

- ▶ Glass amplifier pumping
- ▶ Intense pulsed lighting (IPL)

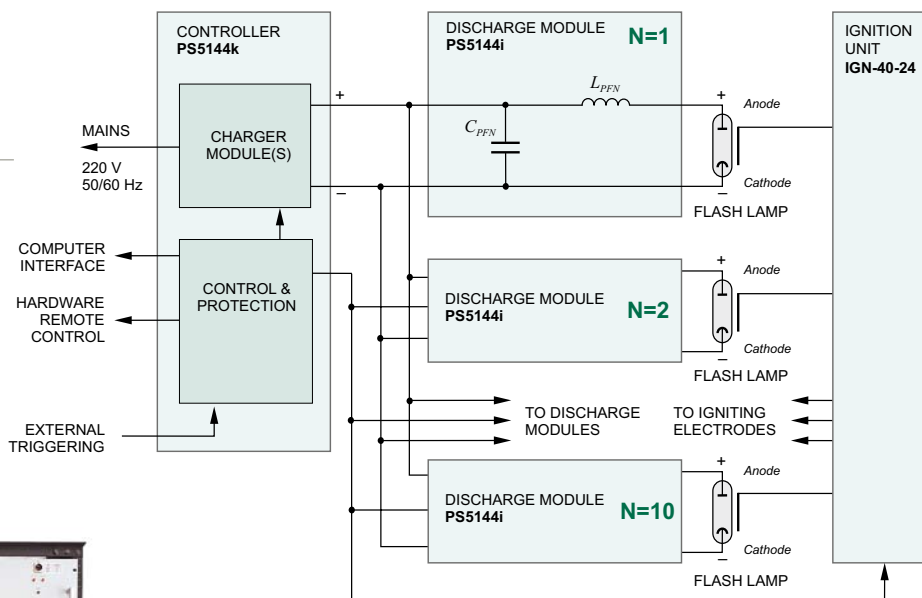


Fig. 1. Example of PS5144 based system for driving 10-flashlamps



Fig. 2. Set of rack mounted PS5144K and PS5144I units

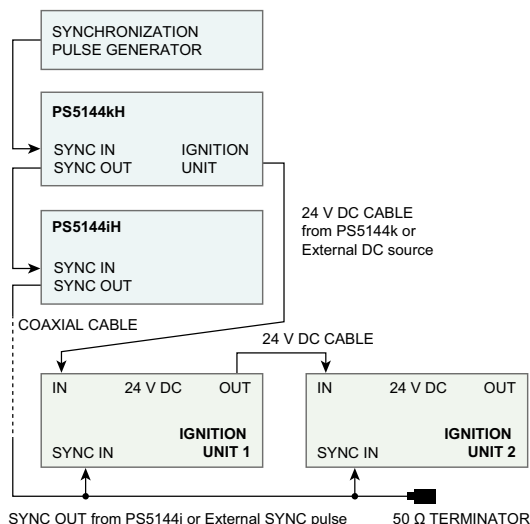


Fig. 3. Example of ready system connections

GENERAL SPECIFICATIONS

Charging unit	PS5144k
Number of independent outputs	1
Max. average output power P_{avg}	0.8; 1.6; 2.4; 3.2 kJ/s (options)
Internal capacitor at output	1 μ F
Capacitor bank charging voltage U_{ch}	4000 V
Load voltage regulation	0.3 %
Pulse to pulse stability	0.3 %
Voltage linearity	0.3 %
Protection features	overvolt, overheat, interlock
Computer interface	LAN / CAN
Triggering mode	external
Mains for options 0.8, 1.6, 2.4 kW of P_{avg}	Single phase, 230 V (-10 %, +6 %), 47–63 Hz
Mains for option 3.2 kW of P_{avg}	Three phase 210 V 3FD or 400 V AC 3FY
Power consumption, average	<1.8; <3.2; <4.5; <5.8 kW (as per options above)
Power consumption, peak	2; 4; 6; 8 kW (as per options above)
Dimensions	19" \times 4U front panel, 547(D) \times 440(W) mm case
Operation conditions	
Ambient temperature	0 to 40 °C
Humidity	up to 80 %, non-condensing

Discharging unit	PS5144i
Number of independent outputs	2 (1 as option)
Maximal capacitors bank voltage	4000 V
Maximal capacitors bank capacity @ 3 kV	700 μ F
Typical repetition rate	<1 Hz
Computer interface	LAN
Triggering mode	Controlled by charging unit
Simmer	N/A
Mains	N/A
Dimensions	19" \times 6U or 8U front panel, 547(D) \times 440(W) mm case
Operation conditions	
Ambient temperature	0 to 40 °C
Humidity	up to 80 %, non-condensing



Fig. 4. 9 and 14 channels ignition units



Fig. 5. 1 channel ignition unit

CONFIGURATION EXAMPLES OF PS514X SERIES POWER SUPPLIES

Capacitor charging units

Model	Charging rate	Maximal voltage	Control interface	Mains
PS5144k	1.5 kJ/s	3000 V	CAN, LAN	230 V 50/60 Hz
PS5144kH	3 kJ/s	4000 V	CAN, LAN	230 V 50/60 Hz

Capacitor discharging units

Model	Number of discharge channels	PFN specifications					Flashlamp recommended
		Capacitance	Inductance	Rated voltage	Maximal stored energy	Pulse duration FWHM	
		μ F	μ H	V	J	μ s	
PS5144i	2	700	40	3000	3150	350	\varnothing 15 \times 200 mm
PS5144iH	2	500	85	4000	4000	430	\varnothing 15 \times 300 mm

Ignition units

Model	Number of channels	Maximal output voltage for each channel	Supply voltage
IGN-40-24-1	1	>40 kV	+24 V
IGN-40-24-9	9	>40 kV	+24 V
IGN-40-24-14	14	>40 kV	+24 V

Laser Cooling Units

LASER COOLING UNIT PS1223CO



FEATURES

- ▶ Water-to-water cooling unit in 19" rack mount stainless steel case
- ▶ Cooling capacity 0–4 kW (at temperature difference 10 °C)
- ▶ PID controller based temperature regulation in range 15–35 °C, better than 0.1 °C stability
- ▶ Smooth supply water flow regulation by proportional valve
- ▶ Controlled deionizer maintains constant coolant conductivity (preset in range 1...100 µS/cm)
- ▶ Easy replaceable particle filter, accessed from front panel
- ▶ Coolant pressure can be reduced using Bypass valve
- ▶ Graphic display
- ▶ Overheat, overpressure, low flow, low coolant level warnings and error stop, error indication by LED, beeper, display, interlock connector, remote control interfaces
- ▶ Optional USB, Ethernet interface for installation adjustment and remote control
- ▶ Optional RS232, CAN interfaces

Cooling unit PS1223CO is second generation of water-to-water cooling units designed for flashlamp-pumped lasers. Microcontroller operated PS1223CO has better performance than PS1222CO while maintaining full backward compatibility.

PID controller smoothly regulates water flow thru heat exchanger maintaining high stability of output temperature in a wide range of removed heat (Fig. 1). Temperature of coolant at output, return, tank and water supply, coolant flow, pressure, tank water level and conductivity are measured. Using this data microcontroller stabilizes output

temperature, estimates removed heat, generates early warnings and errors. All data can be accessed by any of interface: USB, Ethernet or optional RS232, RS485, CAN. Test and adjustment utility program for Windows is included (for use with USB interface).

Coolant flow and output pressure can be adjusted manually using bypass valve, located inside unit (Fig. 2).

Maximum heat removal capability of the PS1223CO depends on temperature difference between coolant output temperature and supply water temperature (Fig. 3)

SPECIFICATIONS

Model	PS1223CO
Cooling capacity at $dT=10\text{ °C}^*$	4 kW
Output temperature regulation	$\pm 0.1\text{ °C}$, (typ. $\pm 0.05\text{ °C}$)
Stabilization temperature range	15–35 °C
Coolant flow range	1–6 l/min
Maximum output pressure with bypass valve closed, zero flow	3.0 Bar
Coolant	deionized or distilled water
Coolant reservoir capacity	3.5 l
Maintained coolant conductivity	1..100 µS/cm
Required water supply pressure	1–8 bar
Required water drain pressure	<0.3 bar
Mains	single phase 180–250 V, 50/60 Hz
Power consumption	<200 W
Size	19" 4U, depth 500 mm max
Weight	<20 kg

* Cooling capacity is limited by Supply water consumption.

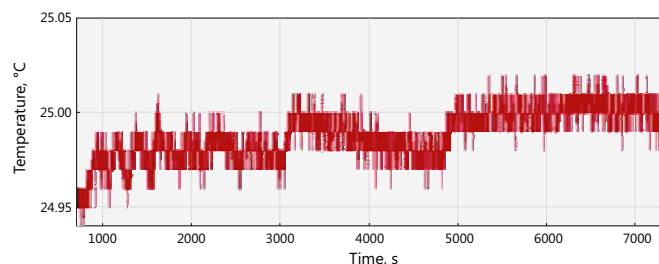


Fig. 1. Output temperature stability

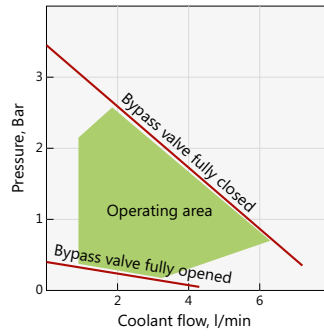


Fig. 2. Coolant pressure and flow – operating limits

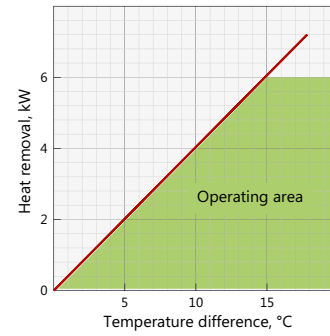


Fig. 3. Heat removal capability

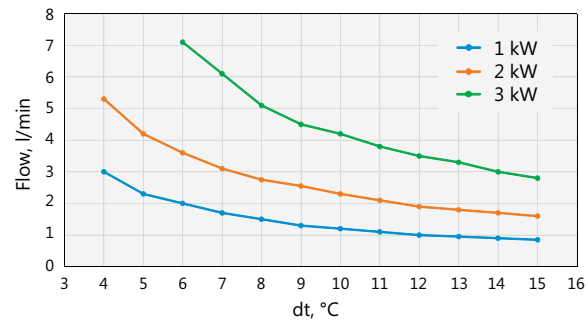
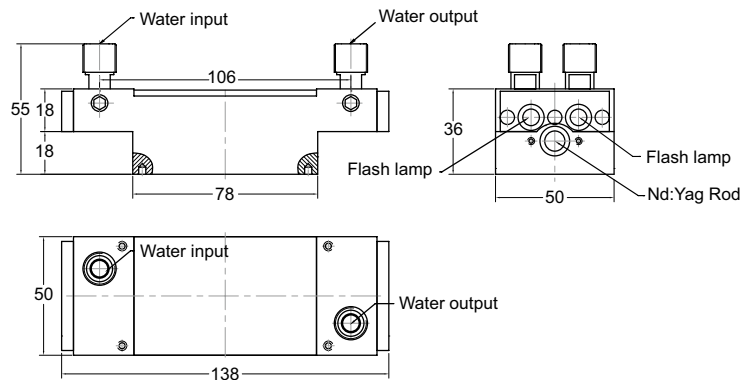


Fig. 4. Water supply requirement depending on cooling power and temperature difference

Pump Chambers

EKSPLA manufactures high efficiency pump chambers for pumping of various active elements (Er:YAG, Er: YLF, Nd:Glass, Nd:KGW, Nd:YAG, Nd:YLF, Nd:YVO, Yb:YAG, etc.). Uniform rod pumping is provided by close diffuse reflector design.

DFM PUMP CHAMBER



FEATURES

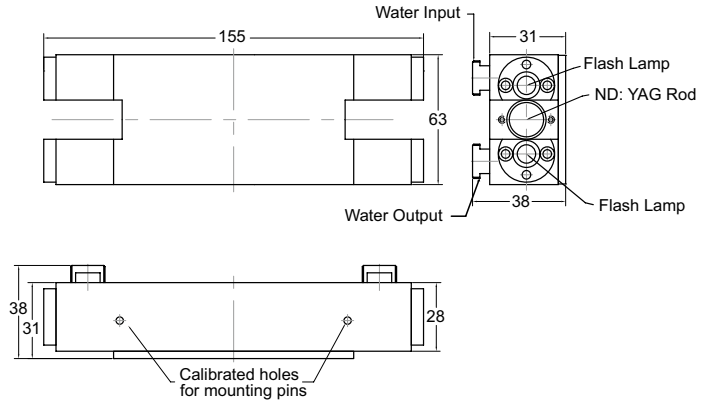
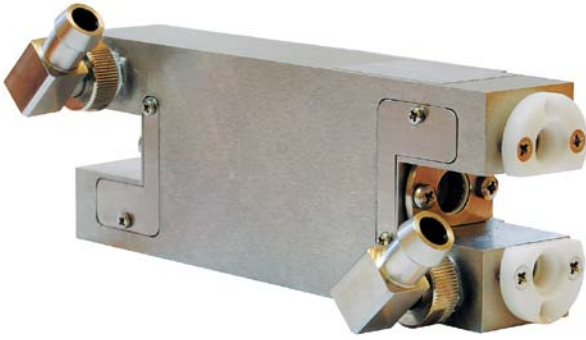
- ▶ Two FL type flashlamps for active element pumping
- ▶ O-ring type seals for flashlamps and active element
- ▶ Close coupling design for high pumping efficiency
- ▶ Diffuse high efficiency ceramics reflectors
- ▶ Active element – flashlamp sequential cooling scheme
- ▶ Sm-glass plate for removal of UV radiation
- ▶ Connectors for high voltage wires included
- ▶ Connectors for water hoses (9 (ID) × 12(OD)) included
- ▶ Typical efficiency (for 6 ns pulses at 1064 nm) approx. 1%

SPECIFICATIONS

Model	DFM-58-8	DFM-58-10
Active element dimensions	Ø8 × 85(min) mm	Ø10 × 85(min) mm

Specifications are subject to changes without advance notice.

TM3 PUMP CHAMBER



FEATURES

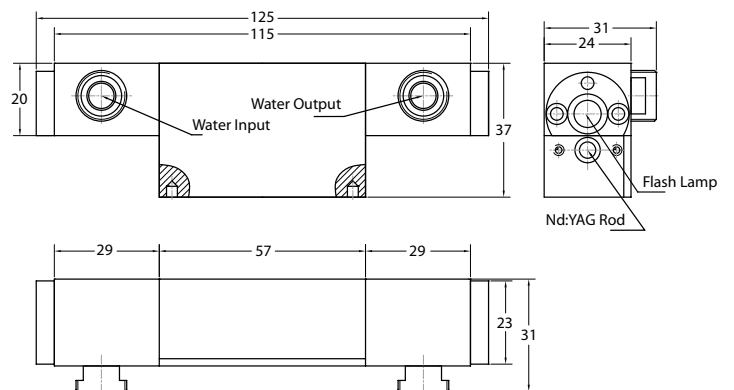
- ▶ Two FL type flashlamps for active element pumping
- ▶ O-ring type seals for flashlamps and active element
- ▶ Close coupling design for high pumping efficiency
- ▶ Diffuse high efficiency ceramics reflectors
- ▶ Active element – flashlamp sequential cooling scheme
- ▶ Sm-glass plate for removal of UV radiation
- ▶ Connectors for high voltage wires included
- ▶ Connectors for water hoses (9 (ID) × 12(OD)) included
- ▶ Typical efficiency (for 6 ns pulses at 1064 nm) approx. 0.7%

SPECIFICATIONS

Model	Active element dimensions
TM-3-75-6.3	Ø6.3 × 100 mm
TM-3-75-8	Ø8 × 100 mm
TM-3-75-10	Ø10 × 100 mm
TM-3-75-12	Ø12 × 100 mm

Specifications are subject to changes without advance notice.

MA1 PUMP CHAMBER



FEATURES

- ▶ One FL type flashlamp for active element pumping
- ▶ O-ring type seals for flashlamp and active element
- ▶ Close coupling design for high pumping efficiency
- ▶ Diffuse high efficiency ceramics reflectors
- ▶ Active element – flashlamp sequential cooling scheme
- ▶ Sm-glass plate for removal of UV radiation
- ▶ Connectors for high voltage wires included
- ▶ Connectors for water hoses (9 (ID) × 12(OD)) included

SPECIFICATIONS

Model	MA-1-45	MA-1-58	MA-1-75
Active element dimensions	Ø3 × 65 mm Ø4 × 65 mm	Ø4 × 85 mm Ø5 × 85 mm Ø6 × 85 mm	Ø4 × 100 mm Ø5 × 100 mm Ø6 × 100 mm

Specifications are subject to changes without advance notice.

NL301 PUMP CHAMBER



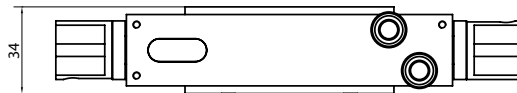
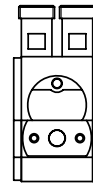
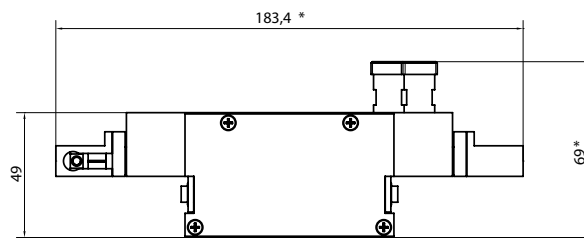
FEATURES

- ▶ One FL type flashlamp for active element pumping
- ▶ O-ring type seals for flashlamp and active element
- ▶ Close coupling design for high pumping efficiency
- ▶ Diffuse high efficiency ceramics reflectors
- ▶ Active element – flashlamp sequential cooling scheme
- ▶ Sm-glass plate for removal of UV radiation
- ▶ Connectors for high voltage wires included
- ▶ Connectors for water hoses (9 (ID) × 12(OD)) included
- ▶ Typical efficiency (for 6 ns pulses at 1064 nm) approx. 1%

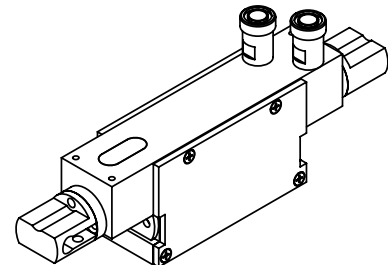
SPECIFICATIONS

Model	NL301-58-4	NL301-58-6.3
Active element dimensions	Ø4 × 85 mm	Ø6.3 × 85 mm

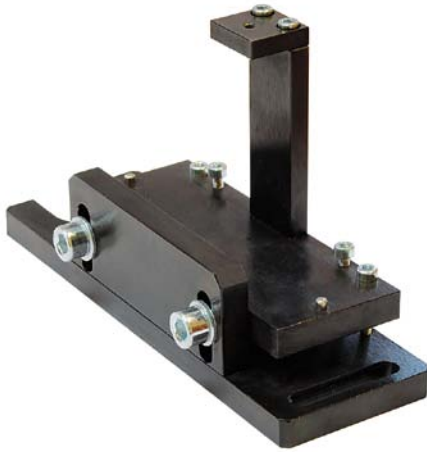
Specifications are subject to changes without advance notice.



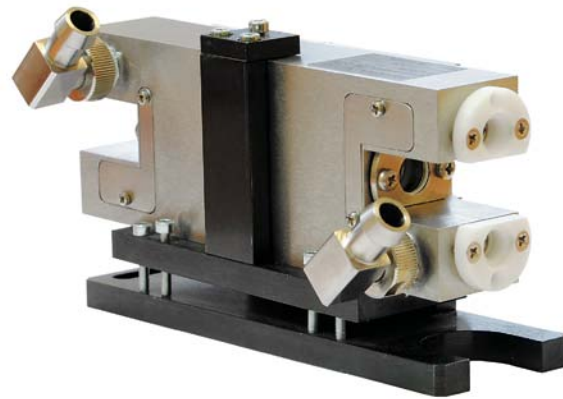
External dimensions of NL-58-6.3 series pump chamber



MOUNTING STAGE FOR PUMP CHAMBERS

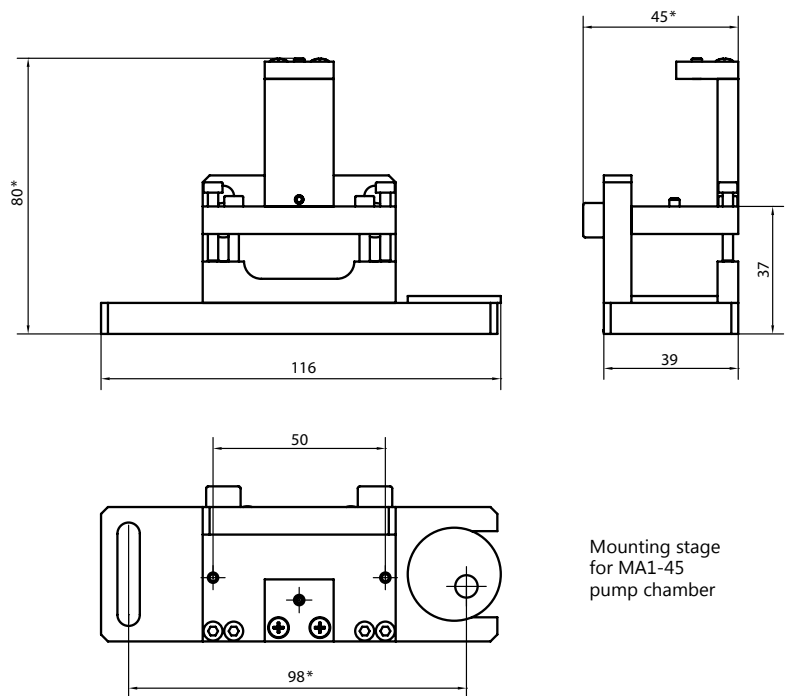


Mounting stage for pump chamber



Mounting stage with mounted TM-2-75 pump chamber

Each type of pump chamber can be mounted on suitable stage. Examples of stages for MA1-45, TM-2-75 and TM-3-75 chambers are shown. Inquire for different types of stages.



Mounting stage for MA1-45 pump chamber

MA SERIES PUMP CHAMBERS FOR Nd:YAG ACTIVE ELEMENTS

FEATURES

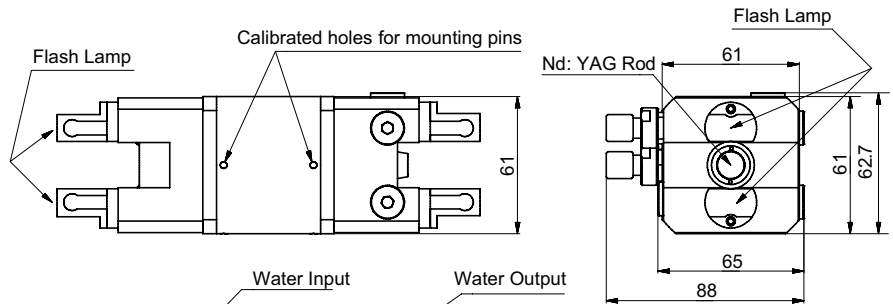
- ▶ FL-58 type flashlamps (5×58mm) for active element pumping
- ▶ O-ring type seals for flashlamp and active element
- ▶ Close coupling design for high pumping efficiency
- ▶ Diffuse high efficiency ceramics reflectors
- ▶ Active element – flashlamp sequential cooling scheme
- ▶ Sm-glass filter for removal of UV radiation
- ▶ Connectors for high voltage wires included
- ▶ Connectors for water hoses (9 (ID)×12(OD)) included
- ▶ Typical stored energy 1% of pump

SPECIFICATIONS

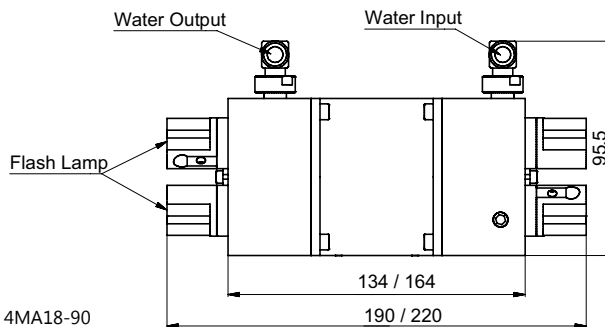
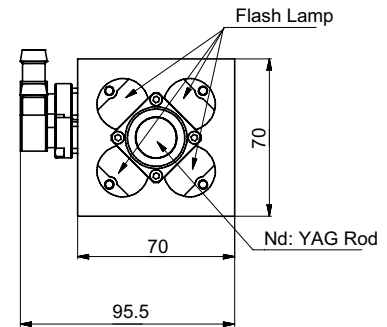
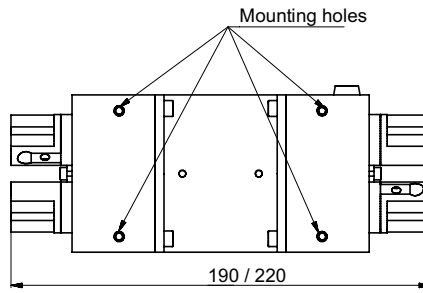
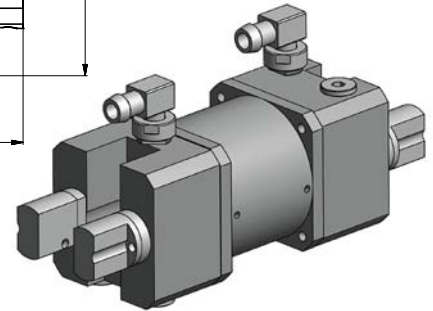
Model	2MA12-58	4MA18-58	4MA25-58
Active element dimensions	Ø12.2 × 85 mm	Ø18.2 × 85 mm	Ø25.2 × 85 mm
Quantity of Flashlamps (Ø5 × 58 mm)	2	4	4

Model	2MA12-90	4MA18-90	4MA25-90
Active element dimensions	Ø12.2 × 115 mm	Ø18.2 × 115 mm	Ø25.2 × 115 mm
Quantity of Flashlamps (Ø5 × 90 mm)	2	4	4

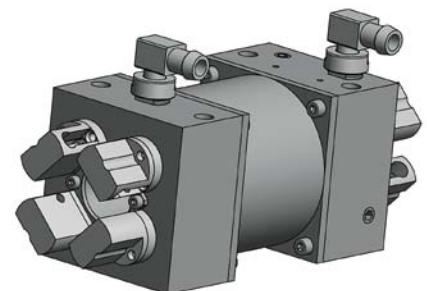
Specifications are subject to changes without advance notice.

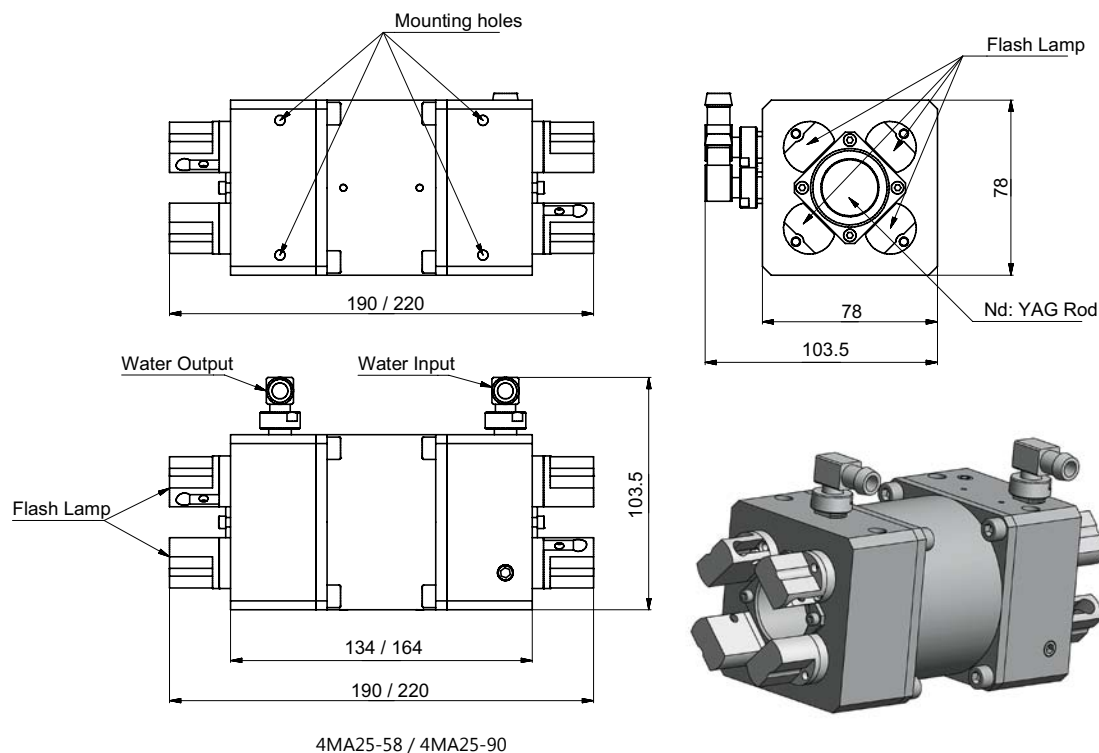


2MA12-58 / 2MA12-90

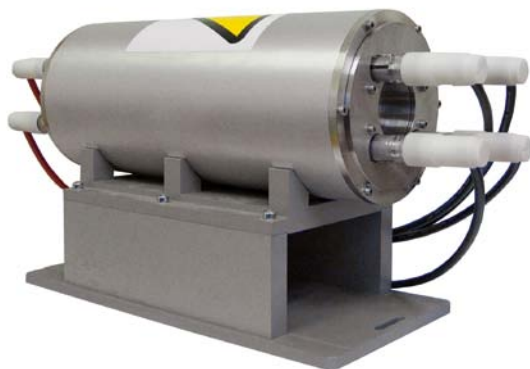


4MA18-58 / 4MA18-90





MA SERIES PUMP CHAMBERS FOR HIGH ENERGY GLASS AMPLIFIERS



Four lamp version of pump chamber for 40 × 300 rod size (type MA40-4).

MA series pump chambers for Nd:Glass rods are presented in table below. Customized versions can vary in rod sizes and quantity of flash lamps. PS5140 series power supplies are recommended for driving.

SPECIFICATIONS

Parameter	MA40-6	MA60-10
Rod size (diameter × length)	40×300 mm	60×300 mm
Type of flashlamp (bore × gap length)	16×250 mm	
Quantity of flashlamps	6	10
Recommended pumping energy (all lamps)	13000 J	22000 J
Beam height	180 mm	
Footprint size (including cable connections)	180×550 mm	
Chamber height (including mounting pad)	255 mm	265 mm

Ovens for Nonlinear Crystals

TEMPERATURE CONTROLLER TK2 WITH OVEN KK1



TK2 and KK1 is high temperature set (up to 200 °C) consisting of thermocontroller TK2 and crystal oven KK1. TK2 has two independent outputs and can control two KK1-30 ovens simultaneously. Controller is equipped by LAN and USB computer control interfaces.

The nonlinear crystal is mounted into adapter before insertion into oven KK1. Such design facilitates handling and replacement of the crystal. The nonlinear crystal can be sealed with fused silica windows in order to provide extra protection. The standard adapters are 30 and 50 mm length with apertures of 3×3, 4×4, 5×5, 6×6 mm ... 12×12 mm size. Oven is delivered with one, customer's specific size of adapter. Adapters for different sizes can be ordered separately.

Separately you can purchase adapter for KK1 mounting on tilt stage.

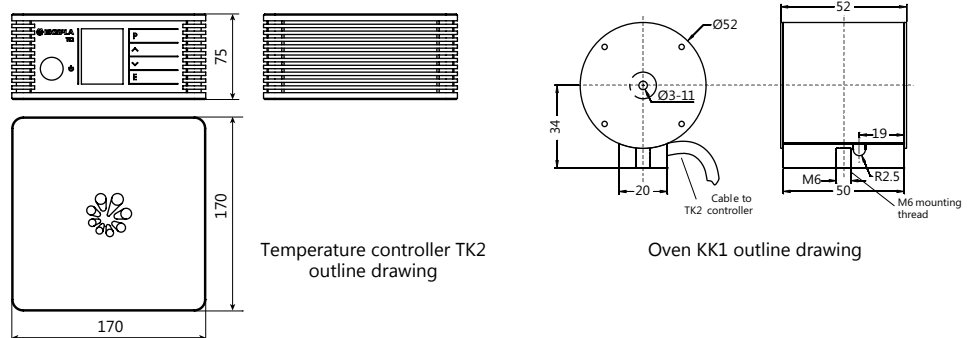


Adapter H1 for KK1 mounting on tilt stage

SPECIFICATIONS

Model	TK2 + KK1-30	TK2 + KK1-50
Quantity of ovens possible to connect to one controller TK2	2	1
Temperature tuning range	RT-200 °C	
Maximum crystals dimensions	12×12×30 mm	12×12×50 mm
Temperature tuning step	0.05 °C	
Accuracy	± 0.5 °C	
Long-term stability	± 0.05 °C	
Control interfaces	LAN, USB	
Mains	90 – 264 V, 47 – 63 Hz	
Power consumption	< 50 W	
Oven dimensions, Dia×D	Ø52×52 mm	Ø52×72 mm

Specifications are subject to changes without advance notice.



Temperature controller TK2 outline drawing

Oven KK1 outline drawing

NONLINEAR CRYSTALS OVEN TK8



TK8 is compact oven with built-in thermocontroller for nonlinear crystals to keep them at stabilized temperature in range 30...80 °C. The crystals with aperture up to 15×15 mm and length up to 20 mm can be mounted. TK8L and TK8XL ovens are designed for crystal length up to 30 mm and 50 mm accordingly.

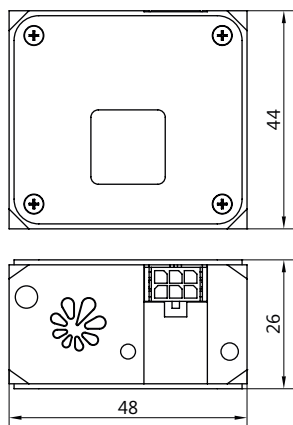
Each oven is made exactly for specific crystal aperture size, so it cannot be used for different size crystals.

Crystal oven can be used in two ways. First one is autonomic operation. This case temperature is preset in advance and stored in internal controller.

There is enough to connect DC power 12...24 V to keep crystal at preset temperature. LED indicator on top of oven shows that crystal temperature is reached preset value. Temperature setting can factory preset or customer can set it himself using CAN-USB converter (sold separately) and CanBrowser software.

Another way of operation gives possibility change crystal temperature any time as needed using CAN interface.

On request we can manufacture ovens for crystals with aperture up to 60×60 mm or even larger.



TK8 dimensions

SPECIFICATIONS

Model	TK8	TK8L	TK8XL
Maximum crystals dimensions	15×15×20 mm	15×15×30 mm	15×15×50 mm
Temperature range	30 – 80 °C		
Temperature stability	± 0.2 °C		
Power consumption	<6 W	<6 W	<9 W
Control interface	CAN		
Crystal center position above pad	16 mm		
Dimensions, W×H×D	48×44×26 mm	48×44×36 mm	48×44×56 mm

Specifications are subject to changes without advance notice.



Full family of TK8 crystal ovens

NONLINEAR CRYSTALS OVEN TK9

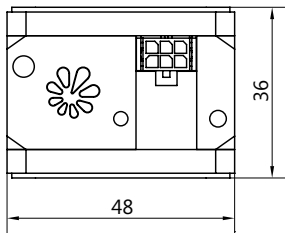
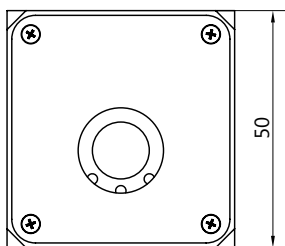


TK9 is compact oven with built-in thermocontroller for nonlinear crystals to keep them at stabilized temperature in range 30...80 °C. The crystals with aperture up to 12×12 mm and length up to 15 mm can be mounted. TK9L oven is designed for crystal length up to 30 mm.

Crystal oven is equipped with crystal adapters (holders), similar design as KK1, that can be easily replaceable for different crystal size. Crystal adapters can be ordered separately.

Crystal oven can be used in two ways. First one is autonomous operation. This case temperature is preset in advance and stored in internal controller. There is enough to connect DC power 12...24 V to keep crystal at preset temperature. LED indicator on top of oven shows that crystal temperature is reached preset value. Temperature setting can be factory preset or customer can set it himself using CAN-USB converter (sold separately) and CanBrowser software.

Another way of operation gives possibility to change crystal temperature any time as needed using CAN interface.



TK9 dimensions

SPECIFICATIONS

Model	TK9	TK9L
Maximum crystals dimensions	12×12×15 mm	12×12×30 mm
Temperature range	30 – 80 °C	
Temperature stability	± 0.2 °C	
Power consumption	<6 W	<9 W
Control interface	CAN	
Crystal center position above pad	23 mm	
Dimensions, W×H×D	48×50×36 mm	48×50×56 mm

Specifications are subject to changes without advance notice.

MOUNT FOR CRYSTALS OVENS



Mount for fine tuning of TK8 or TK9 crystal ovens angle. The tuning range is ± 2.5°.

Ordering Information

Delivery

Products are made and dispatched within agreed term. In most common cases shipping charges are prepaid and added as a separate item to your invoice.

Ordering

Orders may be placed by mail, fax or e-mail. All orders are object of General Sales Conditions, which can be found on www.ekspla.com. Mail orders should be sent to:

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LT-02300 Vilnius
Lithuania
Phone: +370 5 264 96 29
Fax: +370 5 264 18 09
E-mail: sales@ekspla.com

Ask for quotation online at www.ekspla.com.

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All products are guaranteed to be free from defects in material and workmanship. The warranty period depends on the product and is object of agreement between EKSPLA and customer. Warranty period can be extended by separate agreement. EKSPLA does not assume liability for improper installation, labour or consequential damages.

Specifications

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