

Pockels Cells Selection Guide



POCKELS CELLS

POCKELS CELLS DRIVERS & HIGH VOLTAGE SUPPLIES

PULSE PICKING & Q-SWITCHING



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KD*P Pockels Cells
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for Pockels Cells
of Ø25.4 mm**
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**Mounting Stages
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**DPD Cavity Dumping
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**DPB High Voltage
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**DP Cavity Dumper
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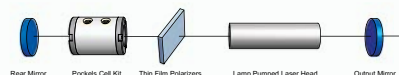
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Pockels Cells

PCK

KTP POCKELS CELLS



PCK4

- More than twice smaller HV requirement comparing to double BBO Pockels cells
- Operates at high duty cycles
- Very low piezo-electric resonances
- Standard available apertures: 4×4, 6×6 and 8×8 mm

New PCK series KTP Pockels developed at EKSMA OPTICS are based on specially grown high resistivity KTP crystals. KTP crystals have better optical homogeneity and higher damage threshold comparing to RTP crystals. The outstanding feature is possibility to operate KTP Pockels cells at high duty cycles or even to keep at high voltage for the longer time.

APPLICATIONS

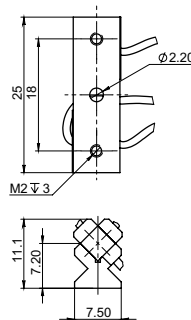
- Q-switching for high repetition rate lasers 1 kHz – 1 MHz
- Pulse picking of high repetition rate lasers

SPECIFICATIONS

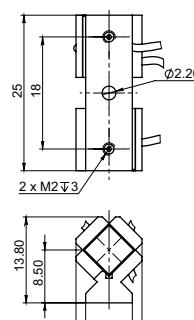
Model	PCK4	PCK4-O	PCK6	PCK6-O
Clear aperture diameter, mm	3.5		5.5	
Crystal size (W×H×L), mm	4×4×10		6×6×10	
Quantity of crystals		2		
Half-wave voltage (@ 1064 nm), kV DC	<1.8		<2.5	
Capacitance, pF	4		<6	
Optical transmission, %		> 98		
Contrast ratio		>1:500		
Cell size, mm	Ø25.4×42.2	25×11.1×7.5	Ø25.4×42.2	25×13.8×10.6



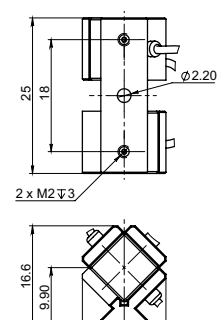
For drawings of other standard KTP Pockels Cells please visit www.eksmaoptics.com



PCK4-O



PCK6-O



PCK8-O

RELATED PRODUCTS

Mounting Stages for Pockels Cells of Ø25.4 mm

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DQ High Repetition Rate Pockels Cell Driver for Q-Switching

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DPD Cavity Dumping & Pulse Picking Pockels Cell Drivers

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PC • D-compact

KD*P POCKELS CELLS



D-compact/12



D-compact/9



PC10S

- Economically priced
- Compact size
- Low absorption
- Transmission from 400 nm to 1100 nm

APPLICATIONS

- Q-switching of the laser cavity
- Cavity Dumping

Pockels cells are used to change the polarization state of light passing through it when a voltage is applied to the electrodes of electro-optic crystals such as KD*P. When used in conjunction with polarizer, Pockels cells can be used as fast optical switches.

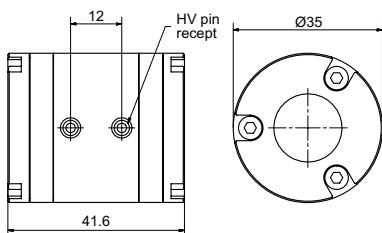
Typical applications include Q-switching of the laser cavity, laser cavity dumping and coupling light into and from regenerative amplifiers. KD*P based Pockels cells are routinely used for Q-switching applications

from the 400 nm to about 1.1 μ m. Most of commercial flashlamp pumped Nd:YAG lasers and low repetition rate DPSS Nd:YAG lasers are equipped with KD*P based Pockels cell for laser cavity Q-switching. Electro-optical KD*P crystals have high laser power resistant dielectric AR coatings. Additionally PC12SR and D-compact series Pockels cells have AR coated windows for improved lifetime and protection in less user friendly environment.

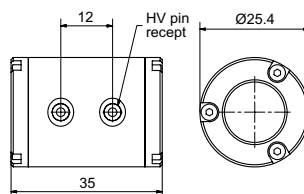
Model	PC5S	PC5D	PC10S	PC12SR	D-compact/9	D-compact/12
Clear aperture, mm	4.5×4.5	4.5×4.5	9.5×9.5	Ø11	Ø8	Ø11
Crystal size, (W×H×L) mm	5×5×16	5×5×16	10×10×25	Ø12×24	Ø9×20	Ø12×24
Quantity of crystals	1	2	1	1	1	1
$\lambda/2$ voltage (@ 1064 nm), kV DC	<6.5	<3.4	<6.8	<6.8	<6.8	<6.8
Capacitance, pF	1.5	3	4	6	6	6
Optical transmission, %				>97		
Contrast ratio ¹⁾	> 1:2000	>1:1000	>1:2000	>1:2000	>1:2000	>1:2000
Cell size, mm	18×14×25	23×16×52	22×18×33	Ø35×41.6	Ø25.4×35	Ø25.4×39

¹⁾ Measured by crossed polarizers method. Specifications are subject to change without advance notice.

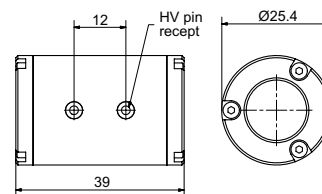
All crystals are coated AR/AR@1064 nm. Other antireflection coatings are available under request. Damage threshold >5 J/cm² for 10 ns pulses at 1064 nm.



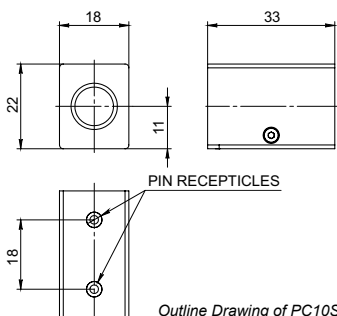
Outline drawing of PC12SR



Outline drawing of D-compact/9



Outline drawing of D-compact/12



Outline Drawing of PC10S

RELATED PRODUCTS

Mounting Stages for Pockels Cells of Ø25.4 mm.

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Mounting Stages for Pockels Cells of Ø35 mm.

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DQ High Repetition Rate Pockels Cell Driver for Q-Switching

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DQF Pockels Cell Driver for Q-Switching for Flashlamp Pumped Lasers

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PCB

BBO POCKELS CELLS



PCB3D

PCB3D-C

- Minimal piezoelectric ringing
- Low absorption
- Broad transmission range from 200 nm to 2000 nm
- Compact size

APPLICATIONS

- High repetition rate DPSS Q-switch
- High repetition rate regenerative amplifier control
- Cavity dumping
- Beam chopper

Pockels cells are used to change the polarization state of light passing through it when a voltage is applied to the electrodes of electro-optic crystals such as BBO. When used in conjunction with polarizer, Pockels cells can be used as fast optical switches. Typical applications include Q-switching of the laser cavity, laser cavity dumping and coupling light into and from regenerative amplifiers.

BBO based Pockels cells can be useful at wavelengths from the UV to more than 2 μm . Low piezoelectric ringing makes these Pockels cells attractive for the control of high-power and high pulse repetition rate lasers. Fast switching electronic drivers properly matched to the cell are

available for Q-switching, cavity dumping and other applications.

Pockels cells of PCB series are transverse field devices. Low electro-optical coefficient of BBO results in high operating voltages. The quarter-wave voltage is proportional to the ratio of electrode spacing and crystal length. As a result, smaller aperture devices have lower quarter-wave, however even for 2.5 mm aperture devices the quarter-wave voltage is as high as 4 kV @ 1064 nm.

Double crystal design is employed to reduce required voltages and to allow operation in half-wave mode with fast switching times.

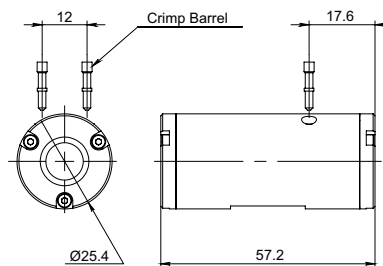
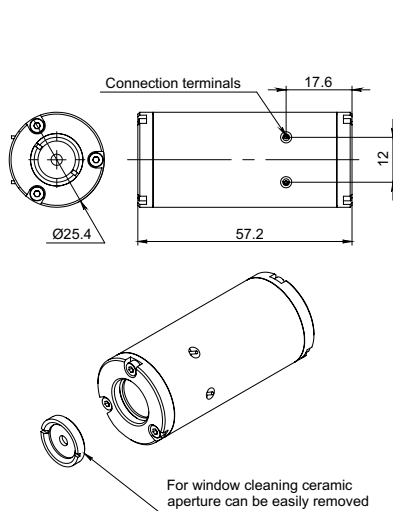
SPECIFICATIONS

Model	PCB3S	PCB3D	PCB4S	PCB4D
Clear aperture diameter, mm	2.5	2.5	3.5	3.5
Crystal size (W×H×L), mm	3×3×20	3×3×20	4×4×20	4×4×20
Quantity of crystals	1	2	1	2
$\lambda/4$ voltage (@ 1064 nm), kV DC	<3.5	<1.8	<4.6	<2.3
Capacitance, pF	4	6	3	6
Optical transmission, %	>98	>98	>98	>97
Contrast ratio ¹⁾	>1:1000	>1:500	>1:1000	>1:500
Dimensions, mm	Ø25.4×37.2	Ø25.4×57.2	Ø25.4×37.2	Ø25.4×57.2

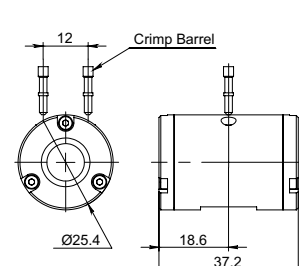
¹⁾ Measured by crossed polarizers method.

Specifications are subject to changes without advance notice.

All crystals are coated AR/AR@1064 nm.
Other antireflection coatings are available on request.
Damage threshold >5 J/cm² for 10 ns pulses at 1064 nm.



PCB3D, PCB4D outline drawing



PCB3S, PCB4S outline drawing

BBO Pockels Cells with ceramic aperture are available. Please append letter C to code for ceramic aperture.

An example:
PCB3S-C – BBO Pockels cell with ceramic aperture

RELATED PRODUCTS

Mounting Stages for Pockels Cells of Ø25.4 mm
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DQ High Repetition Rate Pockels Cell Driver for Q-Switching
See page 3.6



DPD Cavity Dumping & Pulse Picking Pockels Cell Drivers
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PCH1

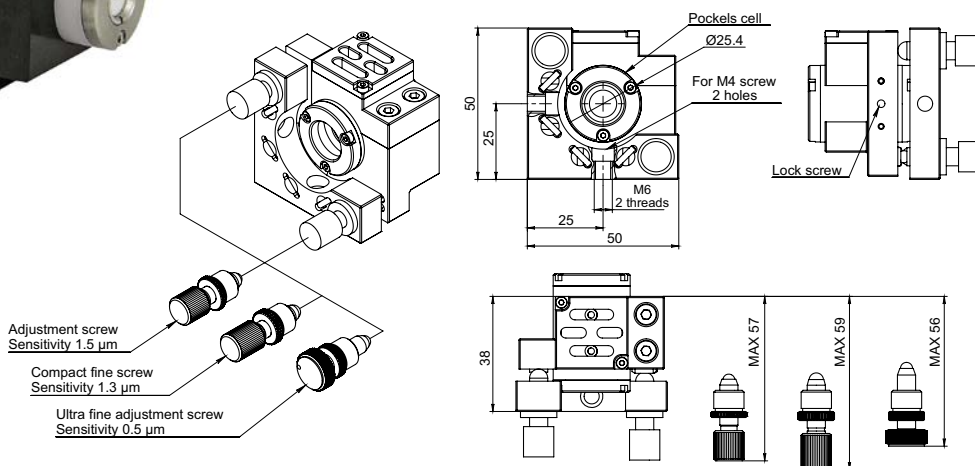
MOUNTING STAGES FOR POCKELS CELLS OF Ø25.4 mm



PCH1 series mounting stage for Pockels cells of 25.4 mm of diameter.

SPECIFICATIONS

Adjusting angle along X and Y axis	8°
Rotation angle along Z-axis for D-Compact series Pockels cells	22°
Rotating angle along Z-axis for BBO Pockels cells	12°



PCH1 standard mounting stage includes adjustment screws of 1.5 µm sensitivity. Compact fine screws or Ultra fine adjustment screws are available on request.

Catalogue Number	Amount of Adjustment Screws	Adjustment Screw Thread	Screw Sensitivity, µm	Price, EUR
PCH1-2-0.5	2	M6x0.5	1.5	230
PCH1-2-0.35	2	M6x0.35	1.3	265
PCH1-2-0.25	2	M6x0.25	0.5	292
PCH1-3-0.5	3	M6x0.5	1.5	250
PCH1-3-0.35	3	M6x0.35	1.3	306
PCH1-3-0.25	3	M6x0.25	0.5	349

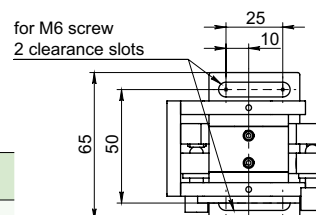
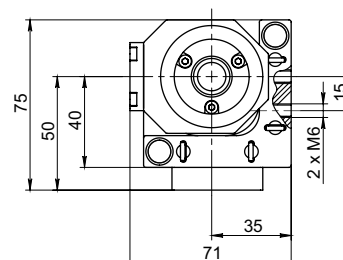
HPR

MOUNTING STAGES FOR POCKELS CELLS OF Ø35 mm



HPR series mounting stage for pockels cell is used for housing of Pockels cells in diameter of 35 mm.

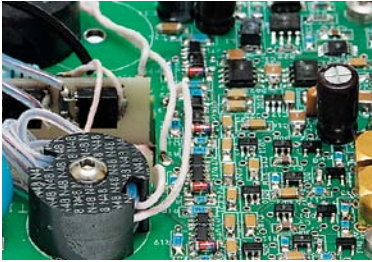
*HPR series mounting stage for Pockels cell.
KDP Pockels cell (available additionally) is mounted.*



SPECIFICATIONS

Model	HPR-35
Suitable for pockels cells housing diameters, mm	Ø35
Adjusting angle along X and Y axis, deg	9
Rotating angle along Z-axis, deg	20
Beam high above breadboard, mm	50

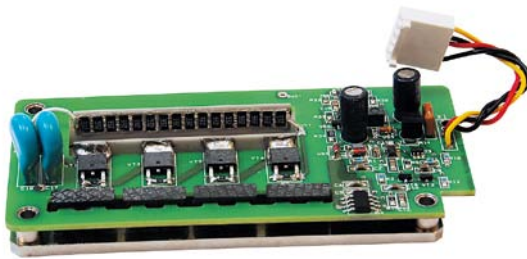
Catalogue Number	Price, EUR
HPR-35	250



Pockels Cells Drivers

DQ

HIGH REPETITION RATE POCKELS CELLS DRIVER FOR Q-SWITCHING

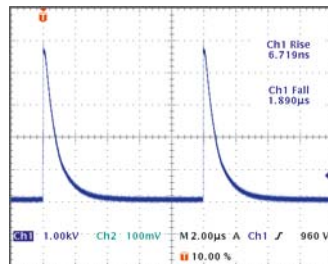


- Pulse repetition rate up to 100 kHz
- Fast HV rise time <7 ns for 4 kV pulse
- HV pulse amplitude up to 4 kV

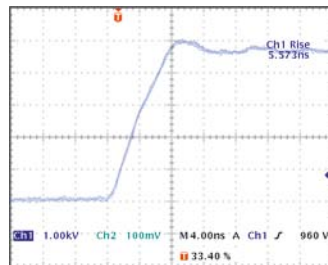
DQ series high repetition rate Pockels cell driver has been designed for use in mode-locked lasers for cavity dumping or for cavity Q-switching of solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

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.



Oscillogram of DQ-100-4 driver operation



Fast edge of HV pulse in detail

SPECIFICATIONS

Catalogue Number	DQ-100-4
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.

DPS/DPD Series DP-SP Series

CAVITY DUMPING & PULSE PICKING POCKELS CELL DRIVERS



Fig. 1. OEM version
of DPS/DPD series Pockels cell driver



Fig. 2. Encased version
of DPS/DPD series Pockels cell driver

- Fast HV rise/fall time $< 4 - 8$ ns
- HV pulse amplitude up to 3.6 kV
- Pulse repetition rate up to 3.5 MHz



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



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

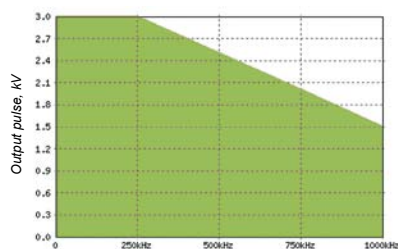


Fig. 5. Operating possibility chart for DPS/DPD
standard and enhanced rate drivers.
You may easily choose version of customized driver
for inquiry within green area of chart

DPD 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 μ s. It can be extended to infinity using pulse regeneration technique. 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.

Most of DPS/DPD 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. DP-SP 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 higher repetition rate lasers.

GENERAL SPECIFICATIONS FOR DPS/DPD AND DP-SP SERIES DRIVERS ¹⁾

Driver model	DPS/DPD series	DP-SP series
Maximal HV rated voltage (for testing only)	3.8 kV	
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	120 – 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 V (50 Ω load)	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	40 – 50 ns	30 ns typical
External powering requirements: ²⁾		
– high voltage supply	depends on modification	
– low voltage DC supply	12 \pm 0.5 V, < 150 mA 14 – 25 V, < 150 mA, on request	24 \pm 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.

²⁾ Driver needs to be mounted on the heatsink (excluding water cooled versions). Heat sink temperature needs to be lower than 35 $^{\circ}$ C (95 $^{\circ}$ F) in all regimes of operation.

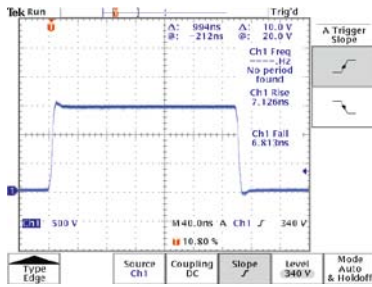


Fig. 6. Typical output pulse shape

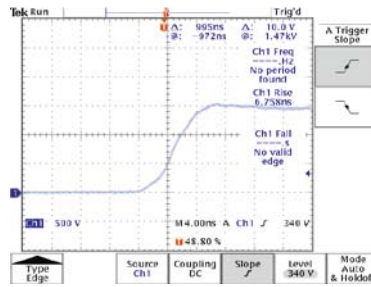


Fig. 7. Typical rising front of output pulse in detail

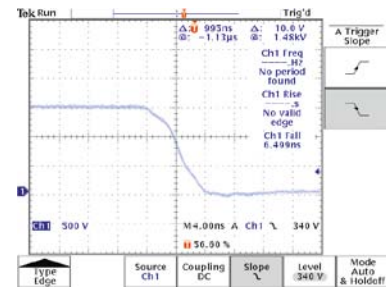


Fig. 8. Typical falling front of output pulse in detail

OEM version

CONFIGURATION SAMPLES OF OEM VERSION OF DPS/DPD SERIES DRIVERS

Catalogue Number of Driver	DPS-50-3.6 DPD-50-3.6	DPS-400-1.5 DPD-400-1.5	DPS-200-3.6 DPD-200-3.6	DPS-250-2.5 DPD-250-2.5	DPS-500-2.5 DPD-500-2.5	DPS-1000-1.8 DPD-1000-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.8 kV	2.6 kV	2.6 kV	2 kV
Maximal HV operating voltage	3.6 kV	1.5 kV	3.6 kV	2.5 kV	2.5 kV	1.8 kV
Maximal HV repetition rate	50 kHz	400 kHz	200 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration	120 – 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	<65 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. 13	see Fig. 12	see Fig. 12	see Fig. 12	see Fig. 12	see Fig. 12
Cooling	conductive	conductive or water	conductive or water	conductive or water	conductive or water	conductive or water

DPS in code indicates that driver is controlled by 1 sync pulse, DPD in code indicates that driver is controlled by 2 sync pulses.

HV output voltage to Pockels cell is equal to HV power supply voltage.

Heat sink temperature needs to be lower than 35 °C (95 °F) in all regimes of operation.



Fig. 10. OEM version of DPS/DPD series driver with general purpose pad



Fig. 11. OEM version of DPS/DPD series driver with conductive pad. Suitable for repetition rate up to 50 kHz

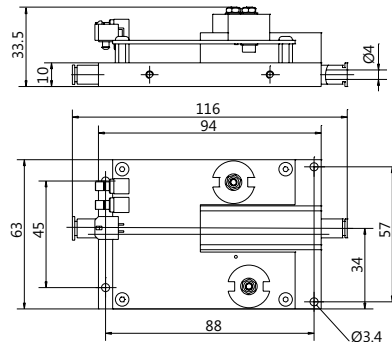


Fig. 12. Outline drawing of DPS/DPD series driver with general purpose pad

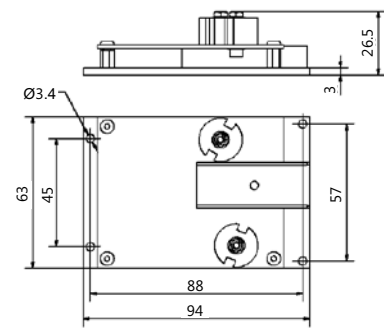


Fig. 13. Outline drawing of DPS/DPD series drivers with conductive pad

ENCASED Short-pulse version

Specific features of DP-SP drivers

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

CONFIGURATION EXAMPLES OF ENCASED VERSION OF DP-SP SERIES SHORT-PULSE DRIVERS

Catalogue Number of Driver	DP-SP-200-3.6-C	DP-SP-250-2.5-C	DP-SP-600-2.5-C
Maximal HV rated voltage	3.8 kV	2.6 kV	2.6 kV
Maximal HV operating voltage	3.6 kV	2.5 kV	2.5 kV
Maximal HV repetition rate	200 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	<65 W	<40 W	<100 W
12V/24V power consumption	4 W	4.5 W	7 W
Dimensions	see Fig. 15		
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. 14. Encased version of driver DP-SP

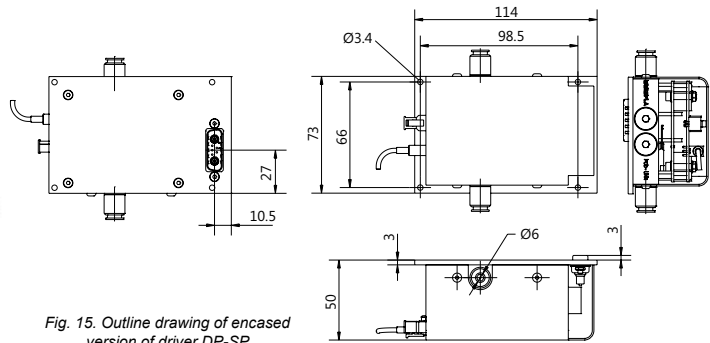


Fig. 15. Outline drawing of encased version of driver DP-SP

OEM Short-pulse version

CONFIGURATION EXAMPLES OF OEM VERSION OF DP-SP SERIES SHORT-PULSE DRIVERS

Catalogue Number of Driver	DP-SP-50-3.6	DP-SP-400-1.5	DP-SP-200-3.6	DP-SP-250-2.5	DP-SP-600-2.5	DP-SP-600-1.8
Maximal HV rated voltage	3.8 kV	1.6 kV	3.8 kV	2.6 kV	2.6 kV	2 kV
Maximal HV operating voltage	3.6 kV	1.5 kV	3.6 kV	2.5 kV	2.5 kV	1.8 kV
Maximal HV repetition rate	50 kHz	400 kHz	200 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	<65 W	<40 W	<100 W	<35 W
12V/24V power consumption	1 W	5.5 W	4 W	4.5 W	7 W	7 W
Dimensions	see Fig. 17			see Fig. 18		
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. 16. OEM version of DP-SP series driver with general purpose pad

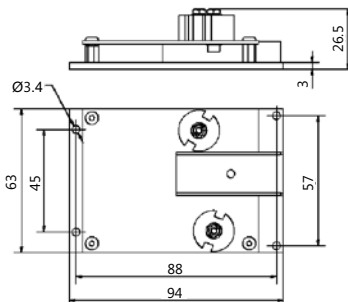


Fig. 17. Outline drawing of DP-SP series drivers with conductive pad

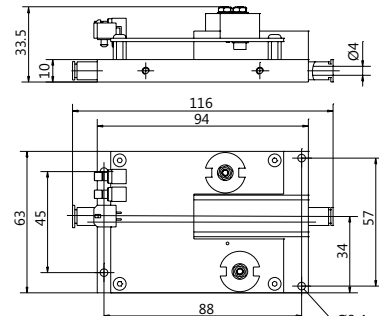


Fig. 18. Outline drawing of DP-SP series driver with general purpose pad

ENCASED version (unipolar drivers)

CONFIGURATION SAMPLES OF ENCASED VERSION OF DPS/DPD SERIES UNIPOLAR DRIVERS

Catalogue Number of Driver	DPS-200-3.6-AI DPD-200-3.6-AI	DPS-250-2.5-AI DPD-250-2.5-AI	DPS-500-2.5-AI DPD-500-2.5-AI	DPS-1000-1.8-AI DPD-1000-1.8-AI
Maximal HV rated voltage	3.8 kV	2.6 kV	2.6 kV	2 kV
Maximal HV operating voltage	3.6 kV	2.5 kV	2.5 kV	1.8 kV
Maximal HV repetition rate	200 kHz	250 kHz	500 kHz	1000 kHz
Pulse duration	120 – 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	<65 W	<40 W	<90 W	<80 W
12V/24V power consumption	4 W	4.5 W	6 W	9 W
Dimensions	see Fig. 20			
Cooling	water			



Fig. 19. Encased version of driver DPS/DPD models
DPS/DPD-200-xx, DPS/DPD-250-xx, DPS/DPD-500-xx,
DPS/DPD-1000-1.8

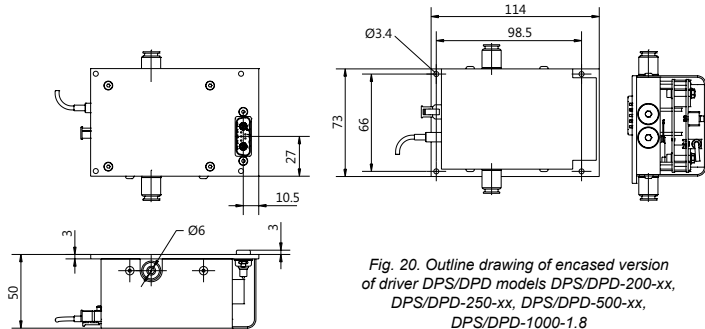


Fig. 20. Outline drawing of encased version
of driver DPS/DPD models DPS/DPD-200-xx,
DPS/DPD-250-xx, DPS/DPD-500-xx,
DPS/DPD-1000-1.8

ENCASED version (bipolar drivers)

CONFIGURATION SAMPLES OF ENCASED VERSION OF DPS/DPD SERIES BIPOLAR DRIVERS

Catalogue Number of Driver	DPS-250-5.2-AI DPD-250-5.2-AI	DPS-300-4.6-AI DPD-300-4.6-AI	DPS-350-4-AI DPD-350-4-AI	DPS-1000-2.9-AI DPD-1000-2.9-AI
Maximal HV rated voltage	5.3 kV	4.8 kV	4.2 kV	3.0 kV
Maximal HV operating voltage	5.2 kV	4.6 kV	4.0 kV	2.9 kV
Maximal HV repetition rate	250 kHz	300 kHz	350 kHz	1000 kHz
Pulse duration	120 – 5000 ns			
HV pulse rise time, typical	<8.2 ns	<7.5 ns	<7 ns	<7.5 ns
HV pulse fall time, typical	<8.2 ns	<7.5 ns	<7 ns	<7.5 ns
Output polarity	bipolar			
HV power consumption	<100 W	<100 W	<100 W	<120 W
12V/24V power consumption	9 W			
Dimensions	see Fig. 22			
Cooling	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.

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.

* Bipolar HV power supply HV2x60Wm is specifically designed for these drivers.



Fig. 21. Encased version of driver DPS/DPD models.
Water cooled version

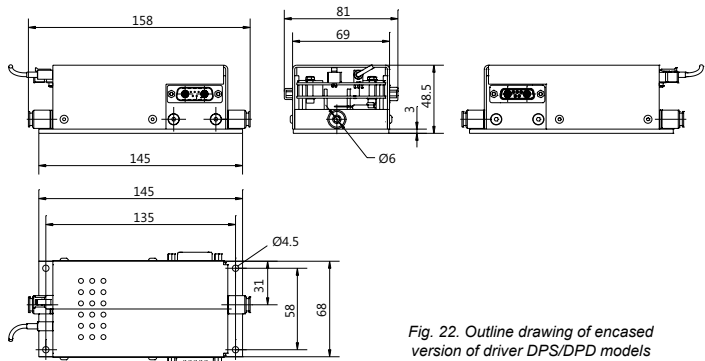


Fig. 22. Outline drawing of encased
version of driver DPS/DPD models

FULL-BRIDGE version

CONFIGURATION EXAMPLES OF FULL-BRIDGE CONFIGURATION DRIVERS

Catalogue Number of Full-Bridge Driver	2DPS-1000-2.5-AI 2DPD-1000-2.5-AI	2DPS-2000-1.6-AI 2DPD-2000-1.6-AI
Base driver	DPS-500-2.5 DPD-500-2.5	DPS-1000-1.6 DPD-1000-1.6
Maximal HV operating voltage	2.4 kV	1.6 kV
Maximal HV repetition rate	1000 kHz	2000 kHz
HV pulse duration range	0 – 5000 ns	
HV pulse rise time	<6.5 ns	<6 ns
HV pulse fall time	<6.5 ns	<6 ns
Maximal capacitance of Pockels cell	<6 pF	
HV power consumption	<160 W	
Case	see Fig. 26	
Cooling	water	

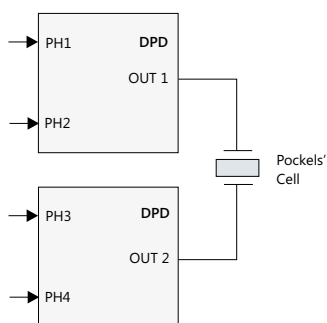


Fig. 23. Diagram of Pockels cell full-bridge connection to driver



Fig. 24. External view of full-bridge driver

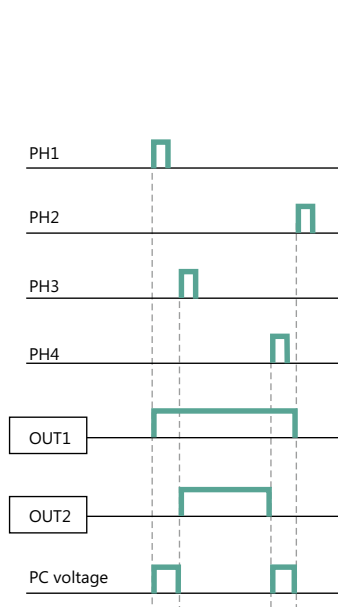


Fig. 25. Principle of 4-phase control of full-bridge driver configuration

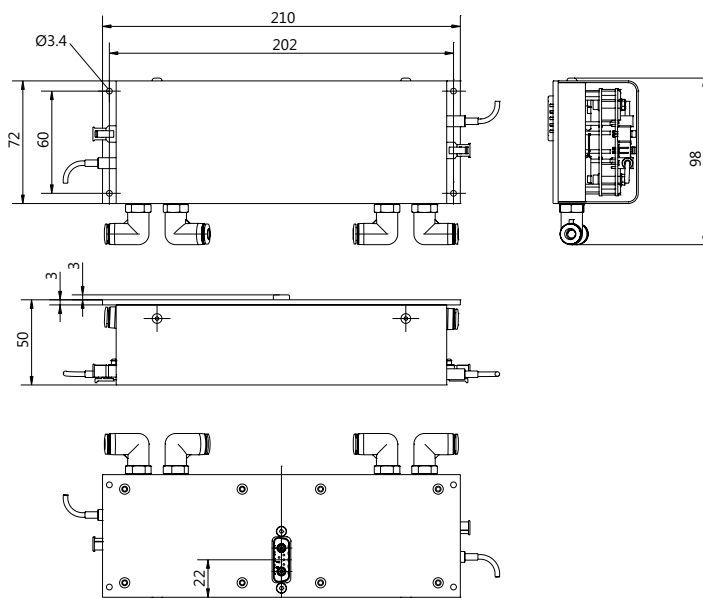


Fig. 26. Outline drawing of case for full-bridge drivers

DPB

HIGH VOLTAGE POCKELS CELL DRIVER



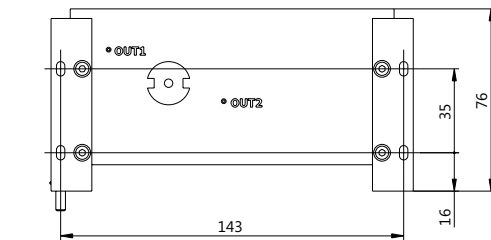
DPB series driver
mounted with HV power supply PS-5

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

SPECIFICATIONS

Catalogue Number	DPB-10-4.2	DPB-5-5.6
Maximum high voltage (HV) pulse amplitude to cell	4.2 kV	5.6 kV
Output polarity	bipolar	
HV pulse rise time, typical	6.5 ns	7.5 ns
HV pulse fall time, typical	6.5 ns	7.5 ns
HV pulse duration	15 – 3000 ns	
Maximal HV pulse repetition rate	10 kHz	5 kHz
External triggering pulse duration requirement (for DPB-10-4.2D & DPB-5-5.6D – controlled by two sync pulses)	> 50 ns	
External triggering pulse amplitude requirement	3 – 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	14 – 25 V, 150 mA or 12 V, 220 mA (0.5 A inrush current)	14 – 25 V, < 150 mA (0.5 A inrush current)
Dimensions (L × W × H):		
driver board	135 × 70 × 25 mm	
driver board mounted with PS-5 power supply	135 × 70 × 55 mm	

* Typical voltage control limits for PS-5 are 1.8 to 2.8 kV. We accept other limits on your request.



Outline drawing

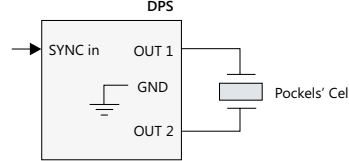


Diagram of pockels cell connection to driver and timing charts of driver controlled by 1 sync pulse DPB-10-4.2S or DPB-5-5.6S

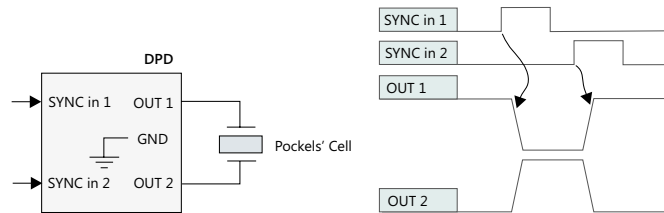
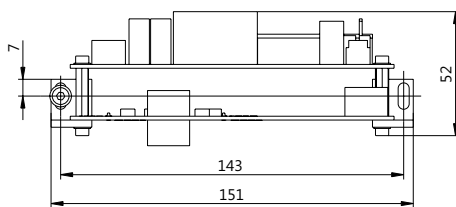


Diagram of pockels cell connection to driver and timing charts of driver controlled by 2 sync pulses DPB-10-4.2D or DPB-5-5.6D

ORDERING INFORMATION

Catalogue Number	Description
DPB-5-5.6S	Controlled by 1 sync pulse; Maximal HV pulse amplitude to cell 5.6 kV; Maximal HV pulse repetition rate 5 kHz
DPB-5-5.6D	Controlled by 2 sync pulses; Maximal HV pulse amplitude to cell 5.6 kV; Maximal HV pulse repetition rate 5 kHz
DPB-10-4.2S	Controlled by 1 sync pulse; Maximal HV pulse amplitude to cell 4.2 kV; Maximal HV pulse repetition rate 10 kHz
DPB-10-4.2D	Controlled by 2 sync pulses; Maximal HV pulse amplitude to cell 4.2 kV; Maximal HV pulse repetition rate 10 kHz

DP

CAVITY DUMPER DRIVER



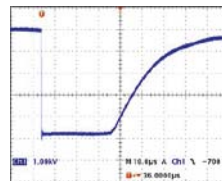
DP has been designed for use in mode-locked lasers for cavity dumping or for cavity Q-switching of solid-state nanosecond lasers. Fast HV (less than 7 ns) edge ensures excellent pre- and post-pulse contrast.

Two versions are available: DP-3-4.2 and DP-3-5.2.

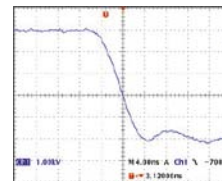
SPECIFICATIONS

Catalogue Number	DP-3-4.2	DP-3-5.2
Maximum high voltage (HV) pulse amplitude	4.2 kV	5.2 kV
HV pulse fall time	< 7 ns	< 9 ns
HV pulse rise time	~ 0.1 ms	
HV pulse duration	from 5 to 100 μ s ¹⁾	
Maximum HV repetition rate	3 kHz	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	5.5 kV, 0.2 mA max
low voltage DC supply	24 – 28 V, 50 mA max	
Size	100 × 50 × 40 mm	

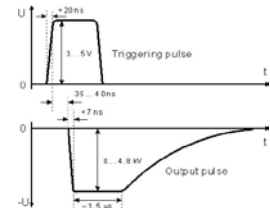
¹⁾ According to customers request.



Oscilloscope of DP driver operation: whole HV pulse



Oscilloscope of DP driver operation: HV pulse fall



Time diagram of DP cavity dumping driver

DQF

POCKELS CELLS DRIVER FOR Q-SWITCHING FOR FLASHLAMP PUMPED LASERS



DQF-0.2-5 is 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.

SPECIFICATIONS

Catalogue Number	DQF-0.2-5
Maximum high voltage to cell (HV) pulse amplitude (U1 + U2)	5 kV
U1 value (Fig 1)	equal to HV powering voltage
U2 value (Fig 1)	equal to 0.25×U1 (optionally 0 V)
HV pulse fall time (a)	< 15 ns
HV pulse rise time, typical (b)	60 μ s
HV pulse duration, typical (c)	300 μ s ¹⁾
HV pulse repetition rate	≤ 250 Hz
HV pulse delay	40 ns
External triggering pulse duration requirement	100 – 1200 μ s
External triggering pulse amplitude requirement	3 – 5 V (50 Ω)
External triggering pulse rise & fall time	< 20 ns
Board dimensions	92 × 70 × 22 mm ²⁾
Ø3.2 mm mounting holes location	84 × 62 mm
External powering requirements	
DC supply	12 – 24 V, max 200 mA
HV supply	4 kV, 1 mA

¹⁾ Can be modified to 1200 μ s for lower repetition rates.

²⁾ Keep safety distance at least 5 mm from any side of board to other conductive parts.

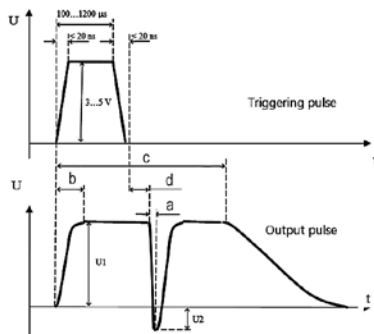
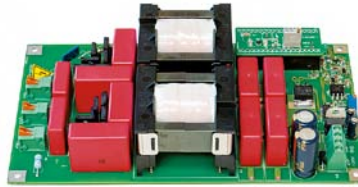


Fig. 1. Time diagram of DQF-0.2-5 driver

Specifications are subject to changes without advance notice.

PS**HIGH VOLTAGE POWER SUPPLY**

PS-40 power supply



PS-120, PS2-60 power supply

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

SPECIFICATIONS

Catalogue Number	PS-5	PS-40	PS-80	PS-120	PS2-60
Maximal output high voltage*	4 kV	4 kV	4 kV	4 kV	+ 2 kV; -2 kV
Voltage control limits	-1 kV from maximal value				
Maximal output power at maximal output voltage	5 W	40 W	80 W	120 W	2x60W
External powering requirements	24 V, <15 W **	24 V, <50 W	24 V, <90 W	24 V, <150 W	24 V, <150 W
Dimensions (L × W × H)	135×70×30 mm	160×70×40 mm	175×110×45 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

* Matching to pockels driver voltage requirement is desirable by ordering

** Optionally 12 V, <15 W

ORDERING INFORMATION

Catalogue Number	Description
PS-5	5W HV supply, controlled by internal trimmer
PS-5C	5W HV supply, controlled by CAN*
PS-40	40W HV power supply, controlled by internal trimmer
PS-40C	40W HV power supply, controlled by CAN*
PS-80	80W HV power supply, controlled by internal trimmer
PS-80C	80W HV power supply, controlled by CAN*
PS-120	120 W HV supply, controlled by internal trimmer
PS-120C	120 W HV supply, controlled by CAN*
PS2-60	2x60W HV supply, controlled by internal trimmer
PS2-60C	2x60W HV supply, controlled by CAN*

* Requires USB-CAN converter for computer control that is sold separately



PS-80 power supply



Pulse Picking & Q-Switching

ULTRAFAST PULSE-PICKING SOLUTIONS

new

pMaster 4.0H – Digital synchronization and delay pulse generator with built-in HV power supply



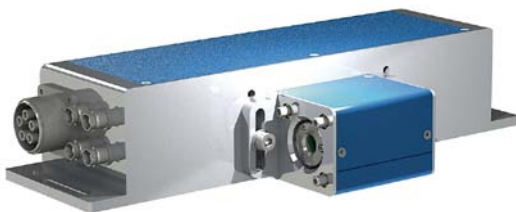
For synchronization your laser with Pockels cell driver and triggering of Pockels cell driver used for pulse picking from the train of picosecond or femtosecond pulses. **pMaster 4.0H** has built-in High Voltage power supply. Can be used with **UP1** pulse picker for pulse picking at up to 1 MHz rate.

pMaster 4.0 – Digital synchronization and delay pulse generator



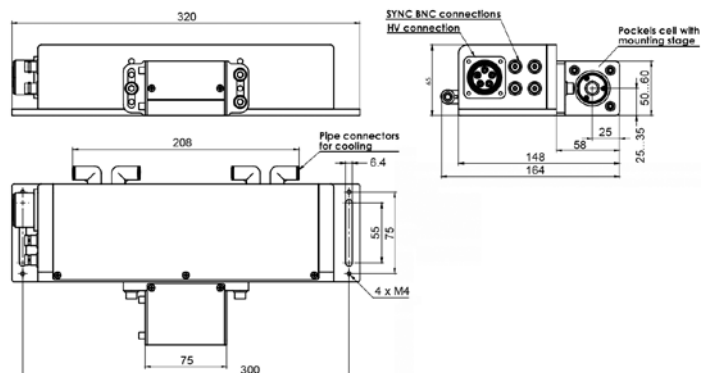
For synchronization your laser with Pockels cell driver and triggering of Pockels cell driver used for pulse picking from the train of picosecond or femtosecond pulses. Can be used with **FP1** pulse picker.

UP1 – Ultrafast pulse picker



The pulse picker **UP1** consists of built-in full bridge Driver and Pockels cell attached to the unit. The **UP1** pulse picker in setup with **pMaster 4.0H** generator is able to select pulses at up to 1 MHz rate from max 100 MHz repetition rate pulse train.

The dual crystal BBO Pockels cell is set for quarter wave voltage operation or dual KTP Pockels cell for $\lambda/2$ operation. KTP Pockels cells usage is limited by average power of the laser beam – up to 2 W and contrast ratio is typically $>1:500$. While BBO Pockels cells operate at much higher power levels and features higher contrast ratio – typically $>1:1000$.



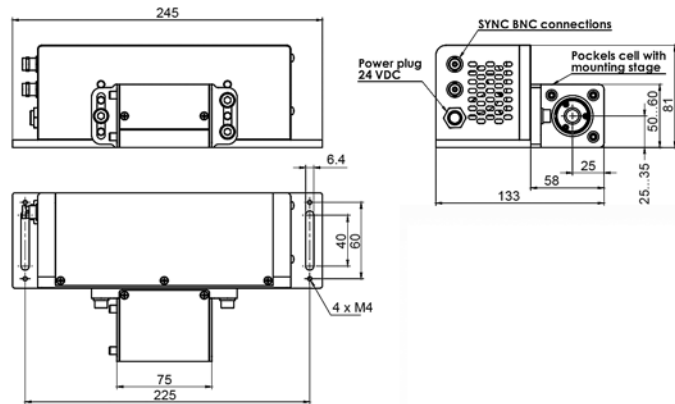
FP1 – Fast pulse picker



The pulse picker **FP1** consists of built-in Driver with HV power supply and Pockels cell attached to the unit.

This unit is able to select pulses at up to 10 kHz rate. **FP1** requires sync pulses from the laser for the driver control or can be used with **pMaster 4.0** generator.

Standard **FP1** pulse picker has DKDP Pockels cell and is set for quarter wave voltage operation. On special requests DKDP cell can be changed to BBO or KTP Pockels cell for half wave voltage operation.



Specifications

SPECIFICATIONS OF DIGITAL SYNCHRONIZATION AND DELAY PULSE GENERATOR pMASTER

Model	pMaster 4.0H	pMaster 4.0
PROGRAMMABLE TIMING GENERATOR		
Channel modes	Single shot, burst, normal, duty cycle	
Control modes	Internally triggered, externally triggered and external gate	
Delayed output	0 to 9.999.999 pulses	
Delay range	0 to 1000 s	
Delay accuracy	1.5 ns + 0.0001 delay	
Delay resolution	250 ps	
Delay Jitter	<400 ps RMS	
Pulse inhibit delay / output inhibit delay	120 ns / 50 ns	
TRIGGER INPUT MODULE		
Trigger input rate	DC – 5 MHz	
Trigger insertion delay	<180 ns	
Trigger jitter	<800 ps RMS	
Minimal pulse width	2 ns	
Trigger threshold	0.2 – 15 V DC	
Maximum input voltage	60 V Peak	
Input impedance	1.5 k ohms + 40 pF	
Resolution	10 mV	
EXTERNAL CLOCK INPUT MODULE		
External clock input rate	10 MHz – 100 MHz	
Minimal pulse width	100 ps	
Pulse amplitude	1 V rms (min) – 5 V rms (max)	
Input impedance	102 ohms	
PHYSICAL SPECIFICATIONS		
High voltage power supply for PC driver	Built-in	–
Dimensions W × D × H	482 × 387 × 88 mm	482 × 283 × 44 mm

SPECIFICATIONS OF PULSE PICKER UNIT

Pulse picker	UP1 - BBO	UP1 - KTP	FP1 - DKDP
Built-in driver	operates at up to 1 MHz rep. rate		operates at up to 10 kHz rep. rate
HV power supply	requires ¹⁾		built-in ²⁾
Operation	quarter wave, $\lambda/4$	half-wave, $\lambda/2$	quarter wave, $\lambda/4$
HV pulse duration	0 – 5000 ns		120 – 3000 ns
HV pulse rise and fall time	<6.5 ns		<6.5 ns
Pockels cell contrast ratio, VCR ³⁾	>1:500		>1:2000
Pockels cell transmission ⁴⁾	>98 % at 1030 nm	>98 % at 1064 nm	>97% at 1064 nm
Clear aperture	Ø3.5 mm	Ø5 mm ⁵⁾	Ø11 mm
Cooling	water		conductive heat sink
Dimensions L × W × H	320 × 164 × 65 mm		245 × 133 × 81 mm

Notes:

- UP1-BBO unit has dual BBO crystal Pockels cell.
- UP1-KTP unit has dual KTP crystal Pockels cell.
- FP1-DKDP unit has DKDP crystal Pockels cell however on special request it can be changed to BBO or KTP Pockels cell.

¹⁾ Requires two HV power supplies with max 4 kV output and maximal output power 120 W each. Optimal HV power supplies are provided in generator pMaster 4.0H.

²⁾ Requires only 24 V, 15 W external power supply. Can be supplied separately by EKSMA Optics.

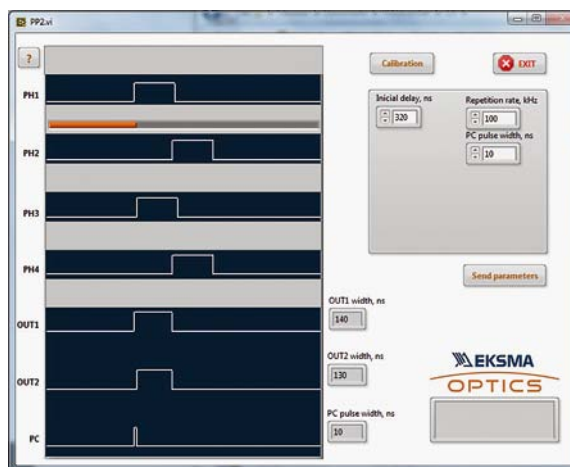
³⁾ VCR – contrast ratio when voltage is applied to the cell.

⁴⁾ Other particular laser wavelengths or wavelength ranges are available on request.

⁵⁾ Max clear aperture for KTP Pockels cell can be up to Ø9 mm.

Control software

pMaster features 4 independent programmable channel outputs and communication via USB, RS232 and Ethernet ports with LabView compatible drivers for full control over all parameters.



Suggested configurations of pulse pickers and sync pulse generator pMaster

Ultrafast pulse picking
at up to 1 MHz rate

pMaster 4.0H → Pulse picker UP1

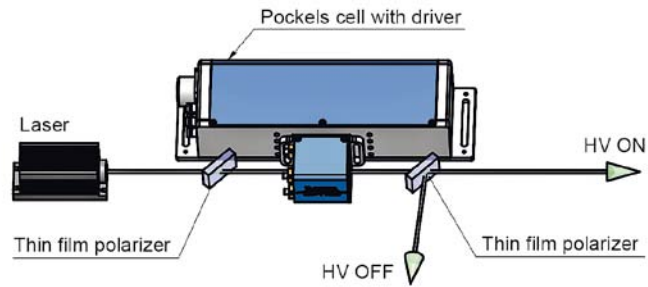
Pulse picking at up to 10 kHz rate

pMaster 4.0 → Pulse picker FP1 ← 24 V DC, 15 W

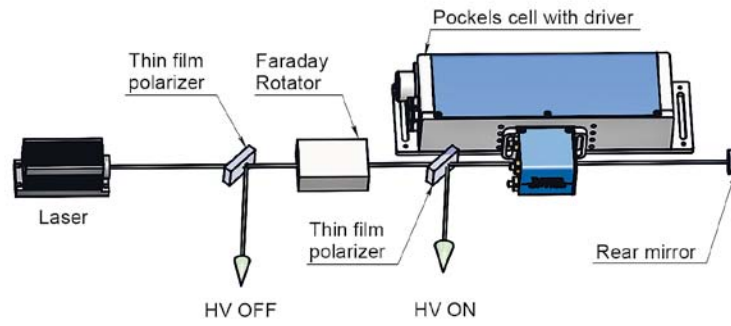
Pulse picking at up to 10 kHz rate

1 or 2 sync pulses from the laser → Pulse picker FP1 ← 24 V DC, 15 W

Suggested Half-wave voltage operation scheme



Suggested Quater-wave voltage operation scheme



ORDERING INFORMATION

Code	Description
pMaster 4.0	Pulse synchronization and delay generator, 4 output channels for trigger pulses
pMaster 4.0H	Pulse synchronization and delay generator, 4 output channels for trigger pulses with built-in High Voltage supply
UP1-BBO-3.5	Ultrafast pulse picker for up to 1 MHz operating rate, BBO clear aperture 2.5 mm, $\lambda/4$ operation at 1030-1064 nm
UP1-BBO-2.5	Ultrafast pulse picker for up to 1 MHz operating rate, BBO clear aperture 3.5 mm, $\lambda/4$ operation at 1030-1064 nm
UP1-KTP-5.5	Ultrafast pulse picker for up to 1 MHz operating rate, KTP clear aperture 5.5 mm, $\lambda/2$ operation at 1030-1064 nm
FP1-DKDP-11	Pulse picker with built in HV supply for up to 10 kHz operating rate, DKDP clear aperture 11 mm, $\lambda/4$ operation at 1064 nm

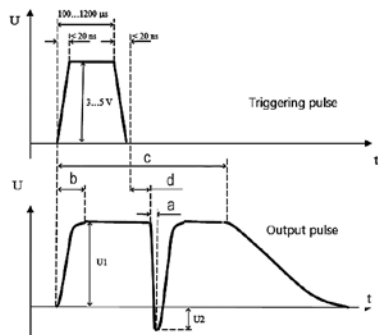
OEM DKDP POCKELS CELLS KIT FOR Q-SWITCHING OF FLASH LAMP PUMPED LASERS

- Pulse repetition rate up to 200 Hz
- Q-switching without retardation plate

EKSMA OPTICS offers Pockels cells kit for lamp pumped nanosecond lasers. High voltage through Pockels cell driver DQF is applied to Pockels cell in order to inhibit oscillation. Pockels cell is opened by negative polarity pulse allowing laser to radiate.

DKDP POCKELS CELLS Q-SWITCHING KIT INCLUDES:

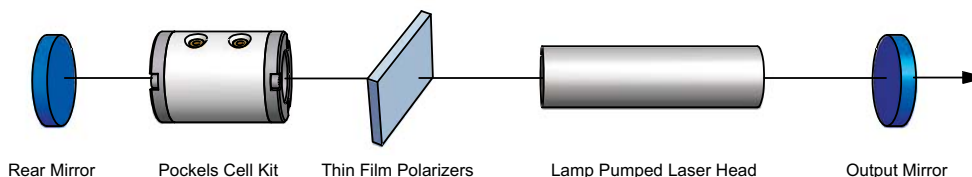
- Low repetition rate Pockels Cell driver *see page 3.12*
- High voltage power supply for Pockels Cell driver *see page 3.13*
- DKDP Pockels cells *see page 3.3*



Time diagram of DQF Pockels cell driver

OEM DKDP POCKELS CELL KITS

Code	Description
QKD-01	for 1064 nm, $\lambda/4$ operation; clear aperture 4.5×4.5 mm; repetition rate up to 200 Hz
QKD-02	for 1064 nm, $\lambda/4$ operation; clear aperture 9.5×9.5 mm; repetition rate up to 200 Hz
QKD-03	for 1064 nm, $\lambda/4$ operation; clear aperture Ø11 mm; repetition rate up to 200 Hz
QKD-04	for 1064 nm, $\lambda/4$ operation; clear aperture Ø8 mm; repetition rate up to 200 Hz
QKD-05	for 1064 nm, $\lambda/4$ operation; clear aperture Ø11 mm; repetition rate up to 200 Hz



OEM BBO POCKELS CELL KIT FOR Q-SWITCHING OF DPSS LASERS

- Pulse repetition rate up to 100 kHz
- Up to 10 kHz no external cooling is required
- Fast HV rise time <7 ns

EKSMA OPTICS offers BBO Pockels cell kit for Q-Switching of high repetition rate nanosecond lasers and mode locked lasers.

BBO POCKELS CELLS Q-SWITCHING KIT INCLUDES:

- High repetition rate Pockels Cell driver *see page 3.6*
- High voltage power supply for Pockels Cell driver *see page 3.13*
- BBO Pockels cell *see page 3.4*

OEM BBO POCKELS CELLS KITS

Code	Description
QKB-01	for 1064 nm, $\lambda/4$ operation; clear aperture 2.5 mm; repetition rate up to 100 kHz
QKB-02	for 1064 nm, $\lambda/4$ operation; clear aperture 3.5 mm; repetition rate up to 100 kHz

Pockels cells and Drivers



BBO Pockels Cells
for 1064 nm and 1020–1040 nm

KD*P Pockels Cells
for 694 nm, 1064 nm and broadband 740–840 nm

KTP Pockels Cells for 1064 nm

Drivers and HV Power Supplies

Pulse Picking Solutions

Q-Switching Kits

