

Pockels Cell Drivers & HV Power Supplies

PCD & HV SERIES



PCD-UHR-I-250-5.2-C

Pockels cell drivers, also known as fast HV switches, are designed to load and unload capacitance of Pockels cells which serve as an integral part of electro optic modulators (EOM's) used for pulse picking, mode-locking, cavity dumping and q-switching of solid state lasers. Ekspla's Pockels cell drivers are optimal for BBO, RTP, KD*P, KTP, LiNbO₃, CdTe Pockels cells.

Our Pockels cell drivers can provide high voltage output pulses up to 9.8 kV, repetition rates up to 6 MHz, electrical pulse rise times as short as 5.5 ns, minimal pulse durations as low as 0 ns and maximal pulse durations

with no limit. All specifications are measured at 6 pF load.

Ekspla's Pockels cell drivers require HV supply input typically equal to driver's HV output (the only exception is PCD-FAM series drivers that allow to modulate the amplitude of each individual driver's output pulse by analog voltage input). We provide complimentary HV power supplies for each Pockels cell driver version. For high-volume OEM customers we also tailor our Pockels cell drivers by removing excessive components to make sure products are optimal parameter, cost and size wise.

FEATURES

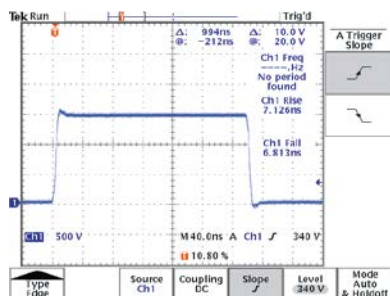
- ▶ HV repetition rates up to **6 MHz**
- ▶ HV output pulse amplitude up to **9.8 kV**
- ▶ Electrical HV rise / fall times typically as low as **5.5 ns** at 6pF load
- ▶ HV pulse durations **from 0 ns to infinity**
- ▶ Amplitude modulation of independent HV output pulses
- ▶ Designed for **BBO, RTP, KD*P, KTP, LiNbO₃, CdTe** Pockels cells
- ▶ Complimentary HV power supplies for each driver version
- ▶ Drivers can be tailored to precisely meet OEM customer's needs
- ▶ Fast turnaround times between inquiry, prototyping and high-volume manufacturing stages.

APPLICATIONS

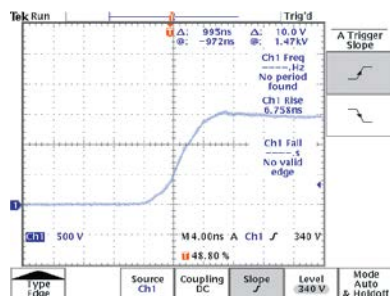
EKSPLA's Pockels cell drivers are optimal for pulse picking, mode-locking, cavity dumping and q-switching of the solid state femtosecond, picosecond and nanosecond lasers. Most popular fields of applications are:

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

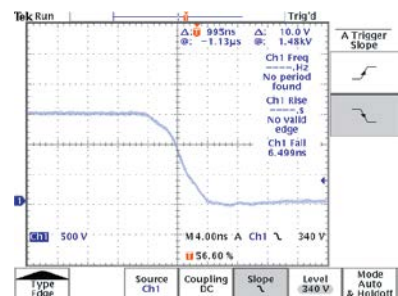
PERFORMANCE



Typical output pulse shape

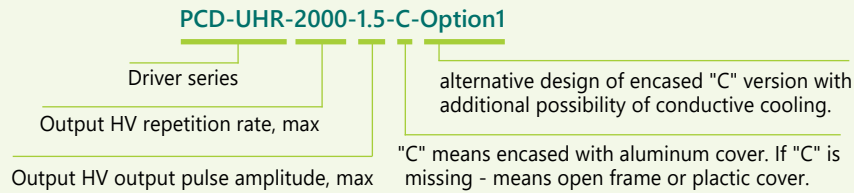


Typical rising front of output pulse in detail



Typical falling front of output pulse in detail

MODEL CODING SCHEME



GENERAL SPECIFICATIONS

| Model | PCD-UHR series | 2PCD-UHR series | PCD-UHRS series | PCD-UHV series | PCD-FAM series |
|---|--|------------------------------|-----------------|----------------|---------------------------------------|
| OUTPUT SPECIFICATIONS | | | | | |
| HV ¹⁾ pulse amplitude, max ²⁾ | 7.2 kV | 3.4 kV | 3.6 kV | 9.8 kV | 2.5 kV |
| HV repetition rate (without burst), max | 3 MHz | 6 MHz | 1 MHz | 10 kHz | 500 kHz |
| HV repetition rate (in burst mode), max | 4.8 MHz | – | 4.8 MHz | – | |
| HV pulse rise / fall times, min ³⁾ at 6 pF load | < 5.5 ns | < 6 ns | < 5.5 ns | < 6 ns | < 26 / 13 ns |
| HV pulse duration, min | 100 ns | 0 ns | 25 ns | 30 ns | 70 ns |
| HV pulse duration extension to infinity using pulse regeneration technique | YES | NO | | | |
| Modulation of an individual HV pulse amplitude | NO | | | | YES |
| Minimum pause between HV pulses | 100 ns | | 25 ns | 100 ns | |
| HV pulse delay | 25 – 30 ns, depends on model ⁴⁾ | 30 – 45 ns, depends on model | 30 ns | 30 ns | 45 ns |
| HV pulse jitter | < 100 ps | | | | |
| INPUT SPECIFICATIONS | | | | | |
| Power supply requirements (power stage) | $U_{HV\ PS\ in} (V) = U_{driver\ out}$ | | | | $U_{HV\ PS\ in} (V) = 2.65 - 2.7\ kV$ |
| | $P_{PS\ in} (W)$ according to section "Model selection table" | | | | |
| Power supply requirements (control stage) | 24 V | | | | |
| Amount of External triggering input pulses | 1 or 2 | | | | |
| Triggering pulse duration requirement (for two-pulses triggering mode only) | > 20 ns | | | | |
| Triggering pulse amplitude requirement | 3.5 – 5 V (50 Ω input) | | | | |
| Triggering pulse rise & fall time requirement | < 10 ns | < 5 ns | | < 10 ns | |
| Modulation voltage range | – | | | | 0.1 – 4.9 V |
| PHYSICAL CHARACTERISTICS | | | | | |
| Dimensions | according to section "Drawings" | | | | |
| OPERATING REQUIREMENTS | | | | | |
| Capacitance of load (Pockels cell) | typically ≤ 6 pF. If higher, please consult with Ekspla | | | | |
| Length of leads to load (Pockels cell), max | 10 cm | | | | |
| Cooling method | conductive, water or no cooling. According to section "Model selection table" | | | | |
| Operating ambient temperature | ≤ 35°C | | | | |
| Operating baseplate temperature | ≤ 35°C | | | | |
| ACCESSORIES | | | | | |
| HV output pins | 2 pc. of pins for HV wires included by default. HV wires between driver and a Pockels cell not included | | | | |
| HV input cables | included by default | | | | |
| Control cables | included by default | | | | |
| HV power supply | complimentary HV power supplies available according to section "HV power supplies" | | | | |
| CAN-USB adapter (for HV power supply) | Ekspla's CAN-USB adapter is required at evaluation stage if communication via CAN interface is needed | | | | |

¹⁾ High voltage.²⁾ Maximal limit. Not all maximal limits can be reached simultaneously.³⁾ Minimal limit.

MODEL SELECTION TABLE

| Model | HV repetition rate, max ¹⁾ | HV output pulse amplitude, max | Electrical HV pulse rise / fall times, typical ²⁾ | HV pulse duration range, min–max ³⁾ | HV power consumption, max ²⁾ | Cooling method | Dimensions (L×W×H) |
|-----------------------------------|---------------------------------------|--------------------------------|--|--|---|---------------------|--------------------|
| PCD-UHR SERIES | | | | | | | |
| PCD-UHR-50-3.6 | 50 kHz | 3.6 kV | < 7 ns | 100–5000 ns | 20 W | Conductive | 94×63×31 mm |
| PCD-UHR-50-3.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-50-3.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-250-2.6 | 250 kHz | 2.6 kV | < 6 ns | 100–3900 ns | 40 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-250-2.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-250-2.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-250-3.6 | 250 kHz | 3.6 kV | < 7 ns | 100–3900 ns | 75 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-250-3.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-250-3.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-400-1.5 | 400 kHz | 1.5 kV | < 5.5 ns | 100–2400 ns | 20 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-400-1.5-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-400-1.5-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-500-2.6 | 500 kHz | 2.6 kV | < 6.5 ns | 100–1900 ns | 90 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-500-2.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-500-2.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-1000-1.8 | 1 MHz | 1.8 kV | < 6 ns | 100–900 ns | 80 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-1000-1.8-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-1000-1.8-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-2000-1.5 | 2 MHz | 1.5 kV | < 7 ns | 100–400 ns | 120 W | Conductive or water | 116×63×38 mm |
| PCD-UHR-2000-1.5-C | | | | | | Water | 114×73×50 mm |
| PCD-UHR-2000-1.5-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHR-I-250-5.2-C | 250 kHz | 5.2 kV | < 8.5 ns | 100–5000 ns | 100 W | Conductive or water | 158×49×81 mm |
| PCD-UHR-I-300-4.6-C | 300 kHz | 4.6 kV | < 8 ns | 100–5000 ns | 100 W | Conductive or water | 158×49×81 mm |
| PCD-UHR-I-350-4-C | 350 kHz | 4 kV | < 7.5 ns | 100–5000 ns | 100 W | Conductive or water | 158×49×81 mm |
| PCD-UHR-I-1000-3.0-C | 1 MHz | 3 kV | < 7.5 ns | 100–5000 ns | 120 W | Conductive or water | 158×49×81 mm |
| PCD-UHR-II-150-7.0 | 150 kHz | 7 kV | < 9.5 ns | 100–5000 ns | 110 W | Conductive | 148×74×33 mm |
| PCD-UHR-II-250-7.0-C | 250 kHz | 7 kV | < 9.5 ns | 100–5000 ns | 200 W | Conductive or water | 172×77×51 mm |
| PCD-UHR-II-1000-3.8-C | 1 MHz | 3.8 kV | < 6 ns | 100–5000 ns | 230 W | Conductive or water | 172×77×51 mm |
| PCD-UHR-II-1000-4.0-C | 1 MHz | 4 kV | < 9.5 ns | 100–5000 ns | 210 W | Conductive or water | 172×77×51 mm |
| PCD-UHR-III-500-7.2-C | 500 kHz | 7.2 kV | < 8 ns | 100–1900 ns | 400 W | Water | 220×87×98 mm |
| PCD-UHR-III-2000-3.4-C | 2 MHz | 3.4 kV | < 8.5 ns | 100–400 ns | 360 W | Water | 220×87×98 mm |
| PCD-UHR-III-2500-3.1-C | 2.5 MHz | 3.1 kV | < 9.5 ns | 100–300 ns | 360 W | Water | 220×87×98 mm |
| PCD-UHR-III-3000-2.6-C | 3 MHz | 2.6 kV | < 8.5 ns | 100–233 ns | 325 W | Water | 220×87×98 mm |

¹⁾ Without burst.²⁾ At 6 pF load.³⁾ Without extension to infinity.

| Model | HV repetition rate, max ¹⁾ | HV output pulse amplitude, max | Electrical HV pulse rise / fall times, typical ²⁾ | HV pulse duration range, min–max ³⁾ | HV power consumption, max ²⁾ | Cooling method | Dimensions (L×W×H) |
|------------------------------------|---------------------------------------|--------------------------------|--|--|---|---------------------|--------------------|
| 2PCD-UHR SERIES | | | | | | | |
| 2PCD-UHR-500-3.4-C | 500 kHz | 3.4 kV | < 7 ns | 0–1900 ns | 150 W | Water | 210×98×53 mm |
| 2PCD-UHR-1000-2.4-C | 1 MHz | 2.4 kV | < 6.5 ns | 0–900 ns | 180 W | Water | 210×98×53 mm |
| 2PCD-UHR-2000-1.6-C | 2 MHz | 1.6 kV | < 6 ns | 0–400 ns | 130 W | Water | 210×98×53 mm |
| 2PCD-UHR-II-300-3.4 | 300 kHz | 3.4 kV | < 7 ns | 0–1556 ns | 110 W | Conductive | 148×74×33 mm |
| 2PCD-UHR-II-500-3.4-C | 500 kHz | 3.4 kV | < 7 ns | 0–900 ns | 200 W | Conductive or water | 172×77×51 mm |
| 2PCD-UHR-II-1000-2.5-C | 1 MHz | 2.5 kV | < 7 ns | 0–400 ns | 170 W | Conductive or water | 172×77×51 mm |
| 2PCD-UHR-II-2000-1.8-C | 2 MHz | 1.8 kV | < 7 ns | 0–150 ns | 210 W | Conductive or water | 172×77×51 mm |
| 2PCD-UHR-II-2000-1.5-C | 2 MHz | 1.5 kV | < 6 ns | 100–900 ns | 215 W | Conductive or water | 172×77×51 mm |
| 2PCD-UHR-III-4000-1.7-C | 4 Mhz | 1.7 kV | < 10.5 ns | 100–300 ns | 360 W | Water | 220×87×98 mm |
| 2PCD-UHR-III-6000-1.3-C | 6 MHz | 1.3 kV | < 9 ns | 100–233 ns | 350 W | Water | 220×87×98 mm |
| PCD-UHRS SERIES | | | | | | | |
| PCD-UHRS-50-3.6 | 50 kHz | 3.6 kV | < 7 ns | 25–5000 ns | 20 W | Conductive | 94×63×31 mm |
| PCD-UHRS-50-3.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHRS-50-3.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHRS-250-3.6 | 250 kHz | 3.6 kV | < 7 ns | 25–1000 ns | 75 W | Conductive or water | 116×63×38 mm |
| PCD-UHRS-250-3.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHRS-250-3.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHRS-250-2.6 | 250 kHz | 2.6 kV | < 6 ns | 25–1000 ns | 40 W | Conductive or water | 116×63×38 mm |
| PCD-UHRS-400-1.5 | 400 kHz | 1.5 kV | < 5.5 ns | 25–625 ns | 20 W | Conductive or water | 116×63×38 mm |
| PCD-UHRS-500-2.6 | 500 kHz | 2.6 kV | < 6.5 ns | 25–500 ns | 90 W | Conductive or water | 116×63×38 mm |
| PCD-UHRS-500-2.6-C | | | | | | Water | 114×73×50 mm |
| PCD-UHRS-500-2.6-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHRS-1000-1.8 | 1 MHz | 1.8 kV | < 6 ns | 25–250 ns | 80 W | Conductive or water | 116×63×38 mm |
| PCD-UHRS-1000-1.8-C | | | | | | Water | 114×73×50 mm |
| PCD-UHRS-1000-1.8-C-Option1 | | | | | | Conductive or water | 116×68×42 mm |
| PCD-UHV SERIES | | | | | | | |
| PCD-UHV-4.2 | 10 kHz | 4.2 kV | < 6 ns | 30–3000 ns | 5 W | Not needed | 140×60×29 mm |
| PCD-UHV-4.2-C | | | | | | | 192×81×75 mm |
| PCD-UHV-5.5 | 5 kHz | 5.5 kV | < 7 ns | 30–3000 ns | 5 W | Not needed | 140×60×29 mm |
| PCD-UHV-5.5-C | | | | | | | 192×81×75 mm |
| PCD-UHV10-8.6 | 3 kHz | 8.6 kV | < 10.5 ns / < 9.5 ns | 35–2000 ns | 5 W | Not needed | 140×75×29 mm |
| PCD-UHV10-8.6-C | | | | | | | 192×81×75 mm |
| PCD-UHV10-9.8 | 2.5 kHz | 9.8 kV | < 12 ns / < 10.5 ns | 35–2000 ns | 5 W | Not needed | 140×75×29 mm |
| PCD-UHV10-9.8-C | | | | | | | 192×81×75 mm |
| PCD-FAM SERIES | | | | | | | |
| PCD-FAM-250-2.5-C | 250 kHz | 2.5 kV | < 26 ns / < 13 ns | 70–3000 ns | 60 W | Conductive or water | 139×69×57 mm |
| PCD-FAM-500-2.5-C | 500 kHz | 2.5 kV | < 26 ns / < 13 ns | 70–1000 ns | 120 W | Conductive or water | 139×69×57 mm |

¹⁾ Without burst.²⁾ At 6 pF load.³⁾ Without extension to infinity.

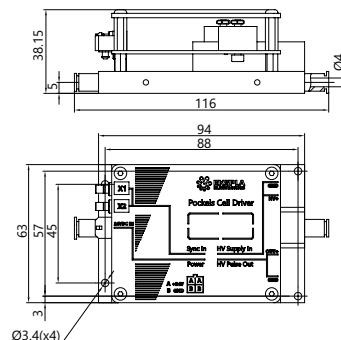
HV POWER SUPPLIES SPECIFICATIONS

| Model | Output power, max | High voltage output options, max | Dimensions (L x W x H) | |
|---|-------------------|----------------------------------|------------------------|---|
| ENCASED HV POWER SUPPLY | | | | |
| HV-200 | 200 W | 1.8, 2.6, 3.6, 4.0 kV | 200 x 119 x 76 mm | Input voltage: 48 V Output voltage (main): $U_{out\ range} (kV) = 0 - U_{out\ max}$ Output voltage (auxiliary): 24 V Control options: CAN, RS232, trimmer or analog (optional) |
| HV-400 | 400 W | | | |
| HV-2x200 | 2 x 200 W | ±1.5, ±2.0, ±2.6, ±3.6 kV | | |
| HV-170 | 170 W | 1.8, 2.6, 3.6 kV | 52 x 80 x 58 mm | Input voltage: 24 V Output voltage range: $U_{out\ range} (kV) = 0.4 \times U_{out\ max} - U_{out\ max}$ Control options: CAN, trimmer or analog (optional) |
| HV-2x85 | 2 x 85 W | ±1.5, ±1.8 kV | | |
| OPEN FRAME (PCB) HV POWER SUPPLY | | | | |
| HV05Wm | 5 W | 1.8, 2.8, 4.0, 4.4, 5.0 kV | 135 x 45 x 27 mm | Input voltage: 24 V Output voltage range: $U_{out\ range} (kV) = 0.4 \times U_{out\ max} - U_{out\ max}$ Control options: CAN, trimmer or analog (optional) |
| HV05Wm-CAN¹⁾ | | | | |
| HV40Wm | 40 W | 1.3, 1.8, 2.5, 3.6, 4.0 kV | 160 x 70 x 35 mm | |
| HV40Wm-CAN | | | | |
| HV80Wm | 80 W | 1.8, 2.6, 3.1, 3.6, 4.0 kV | 175 x 70 x 45 mm | |
| HV80Wm-CAN | | | | |
| HV120Wm | 120 W | 1.8, 2.6, 3.1, 3.6 kV | 175 x 110 x 42 mm | |
| HV120Wm-CAN | | | | |
| HV2x60Wm | 2 x 60 W | ±1.4, ±2.0, ±2.6, ±3.6 kV | 175 x 110 x 42 mm | |
| HV2x60Wm-CAN | | | | |

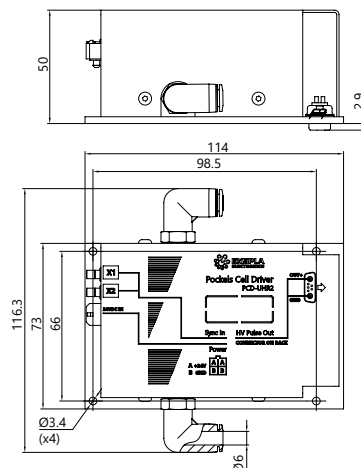
¹⁾ For CAN communication at evaluation stage Ekspla's CAN-USB adapter is required.

DRAWINGS & IMAGES OF POCKELS CELL DRIVERS

- PCD-UHR-50-3.6
- PCD-UHR-250-2.6
- PCD-UHR-250-3.6
- PCD-UHR-400-1.5
- PCD-UHR-500-2.6
- PCD-UHR-1000-1.8
- PCD-UHR-2000-1.5



- PCD-UHR-50-3.6-C
- PCD-UHR-250-2.6-C
- PCD-UHR-250-3.6-C
- PCD-UHR-400-1.5-C
- PCD-UHR-500-2.6-C
- PCD-UHR-1000-1.8-C
- PCD-UHR-2000-1.5-C



POCKELS CELL DRIVERS

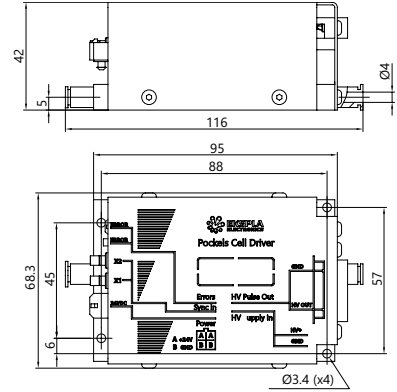
Laser diode drivers

Pockels cell drivers

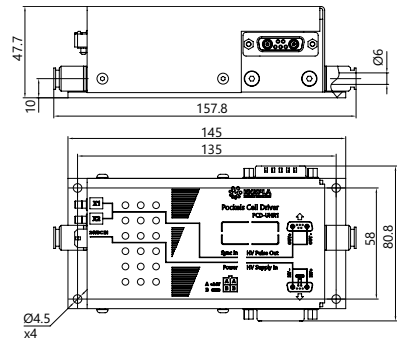
Pulse and delay generators

Crystal ovens and thermocontrollers

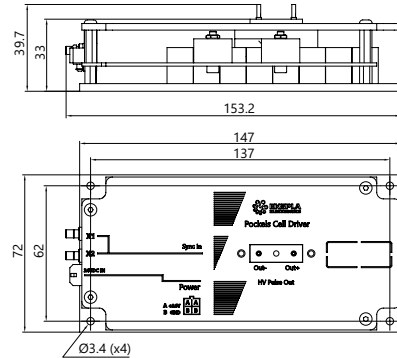
- PCD-UHR-50-3.6-C-Option1
- PCD-UHR-250-2.6-C-Option1
- PCD-UHR-250-3.6-C-Option1
- PCD-UHR-400-1.5-C-Option1
- PCD-UHR-500-2.6-C-Option1
- PCD-UHR-1000-1.8-C-Option1
- PCD-UHR-2000-1.5-C-Option1



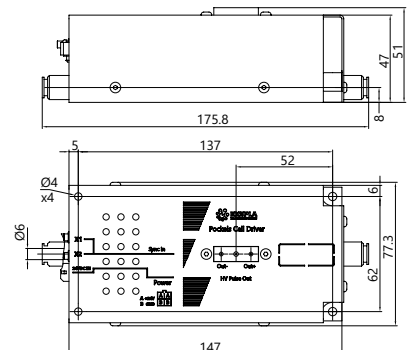
- PCD-UHR-I-250-5.2-C
- PCD-UHR-I-300-4.6-C
- PCD-UHR-I-350-4-C
- PCD-UHR-I-1000-3.0-C



- PCD-UHR-II-150-7.0
- 2PCD-UHR-II-300-3.4

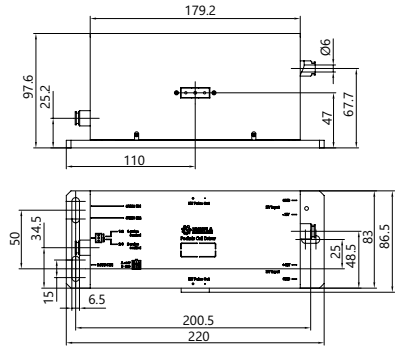


- PCD-UHR-II-250-7.0-C
- PCD-UHR-II-1000-3.8-C
- PCD-UHR-II-1000-4.0-C
- 2PCD-UHR-II-500-3.4-C
- 2PCD-UHR-II-1000-2.5-C
- 2PCD-UHR-II-2000-1.8-C
- 2PCD-UHR-II-2000-1.5-C

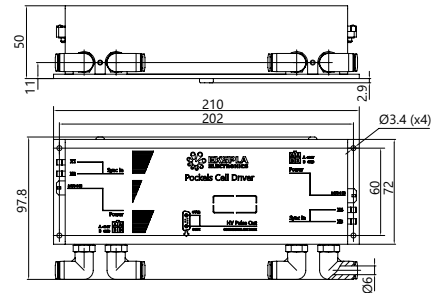


POCKELS CELL DRIVERS

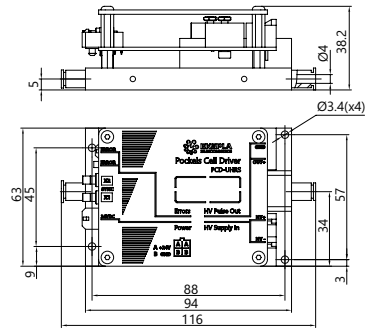
- PCD-UHR-III-500-7.2-C
- PCD-UHR-III-2000-3.4-C
- PCD-UHR-III-2500-3.1-C
- PCD-UHR-III-3000-2.6-C
- 2PCD-UHR-III-4000-1.7-C
- 2PCD-UHR-III-6000-1.3-C



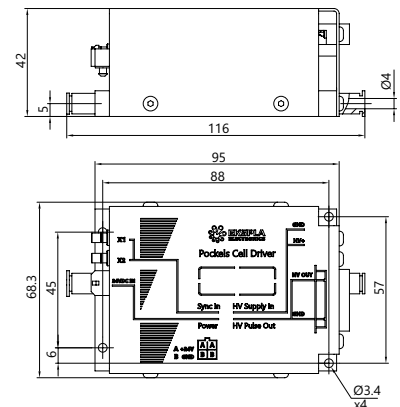
- 2PCD-UHR-500-3.4-C
- 2PCD-UHR-1000-2.4-C
- 2PCD-UHR-2000-1.6-C



- PCD-UHRS-50-3.6
- PCD-UHRS-250-3.6
- PCD-UHRS-250-2.6
- PCD-UHRS-400-1.5
- PCD-UHRS-500-2.6
- PCD-UHRS-1000-1.8



- PCD-UHRS-50-3.6-C-Option1
- PCD-UHRS-250-3.6-C-Option1
- PCD-UHRS-500-2.6-C-Option1
- PCD-UHRS-1000-1.8-C-Option1



Laser diode drivers

Pockels cell drivers

Pulse and delay generators

Crystal ovens and thermocontrollers

POCKELS CELL DRIVERS

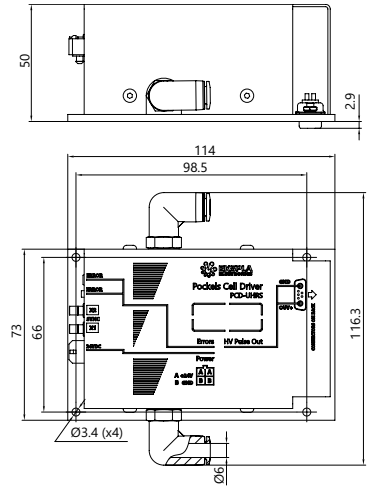
Laser diode drivers

Pockels cell drivers

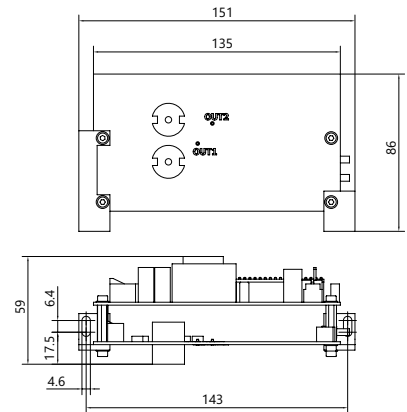
Pulse and delay generators

Crystal ovens and thermocontrollers

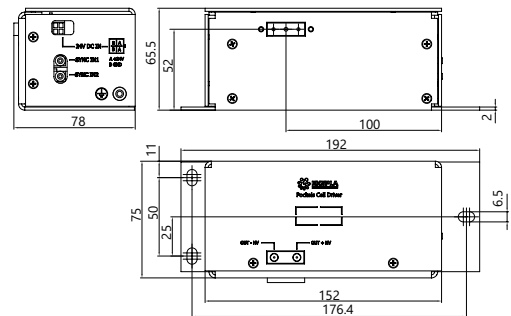
- PCD-UHRS-50-3.6-C
- PCD-UHRS-250-3.6-C
- PCD-UHRS-500-2.6-C
- PCD-UHRS-1000-1.8-C



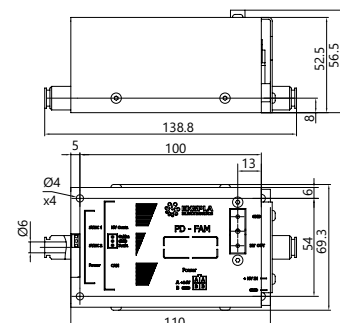
- PCD-UHV-4.2
- PCD-UHV-5.5
- PCD-UHV10-8.6
- PCD-UHV10-9.8



- PCD-UHV-4.2-C
- PCD-UHV-5.5-C
- PCD-UHV10-8.6-C
- PCD-UHV10-9.8-C

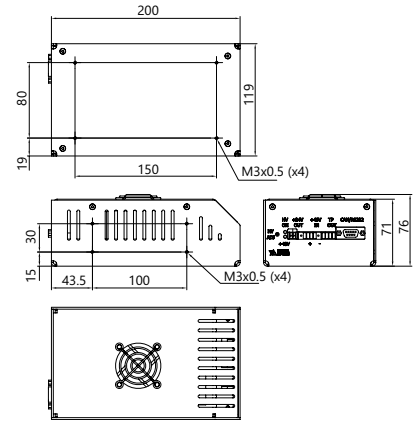


- PCD-FAM-250-2.5-C
- PCD-FAM-500-2.5-C

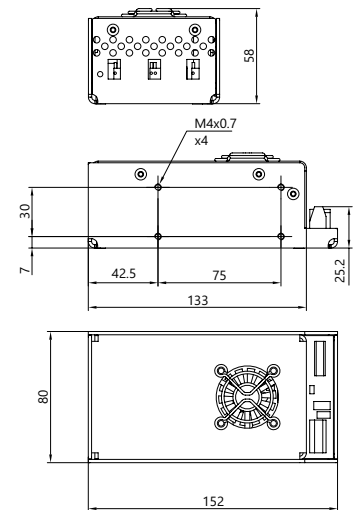


DRAWINGS & IMAGES
OF HV POWER SUPPLIES

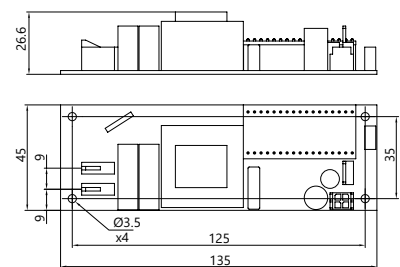
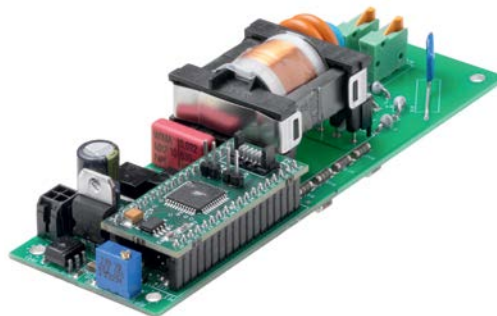
HV-200
HV-400
HV-2x200



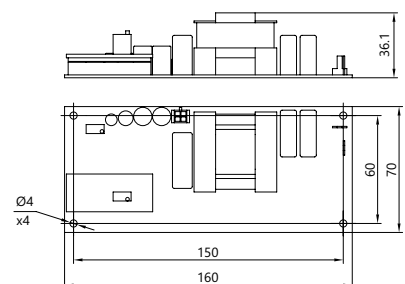
HV-170
HV-2x85



HV05Wm
HV05Wm-CAN



HV40Wm
HV40Wm-CAN



POCKELS CELL DRIVERS

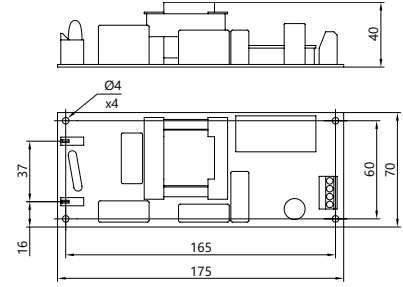
Laser diode drivers

Pockels cell drivers

Pulse and delay generators

Crystal ovens and thermocontrollers

HV80Wm
HV80Wm-CAN



HV120Wm
HV120Wm-CAN
HV2x60Wm
HV2x60Wm-CAN

