HVSW-04
high voltage high repetition rate
Pockels cell driver

Preliminary datasheet

Warning! This equipment produces high voltages that can be very dangerous. Please read user manual before starting operations.

Important note: please measure the output with symmetrical (differential) high voltage probe only. Measurement made with inappropriate equipment is a common cause of driver's failure.

Description / Appearance

HVSW-04 is a specialized Pockels cell driver that performance is optimized for pico- and femtosecond lasers. Main applications are pulse picking and regenerative amplifier control.

Maximal output voltage is 4kV; maximal repetition rate is 4MHz at approx. 1.6kV output voltage and 1MHz at approx. 3.2kV output voltage. Target performance is as below:

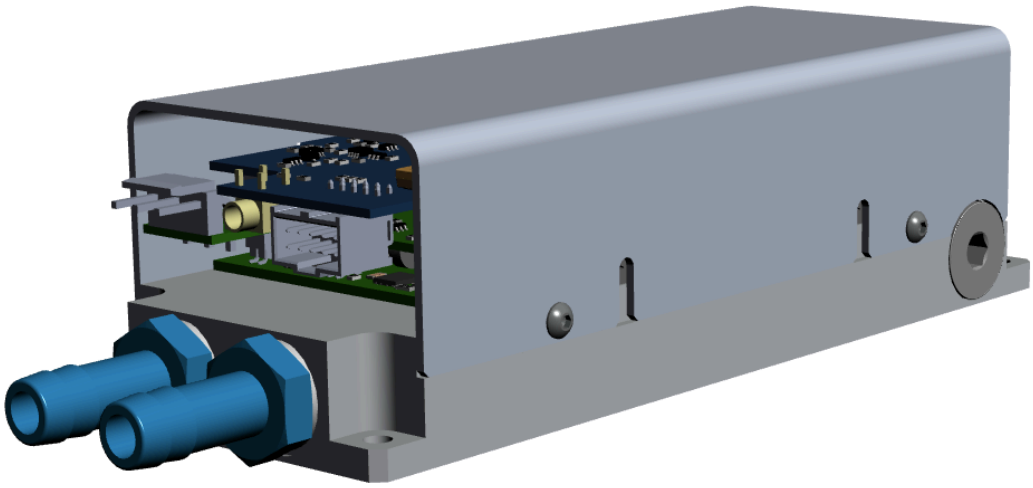
- 1.6kV, 4MHz, <300W power consumption
- 3.2kV, 1MHz, <300W power consumption

Transition times are as fast as 5-7ns in dependence on load capacitance and driver's configuration (see also *Software description* section). Pulse width is <15ns (fixed), then 100-2000ns (adjustable by the customer), see also *Software description* section.

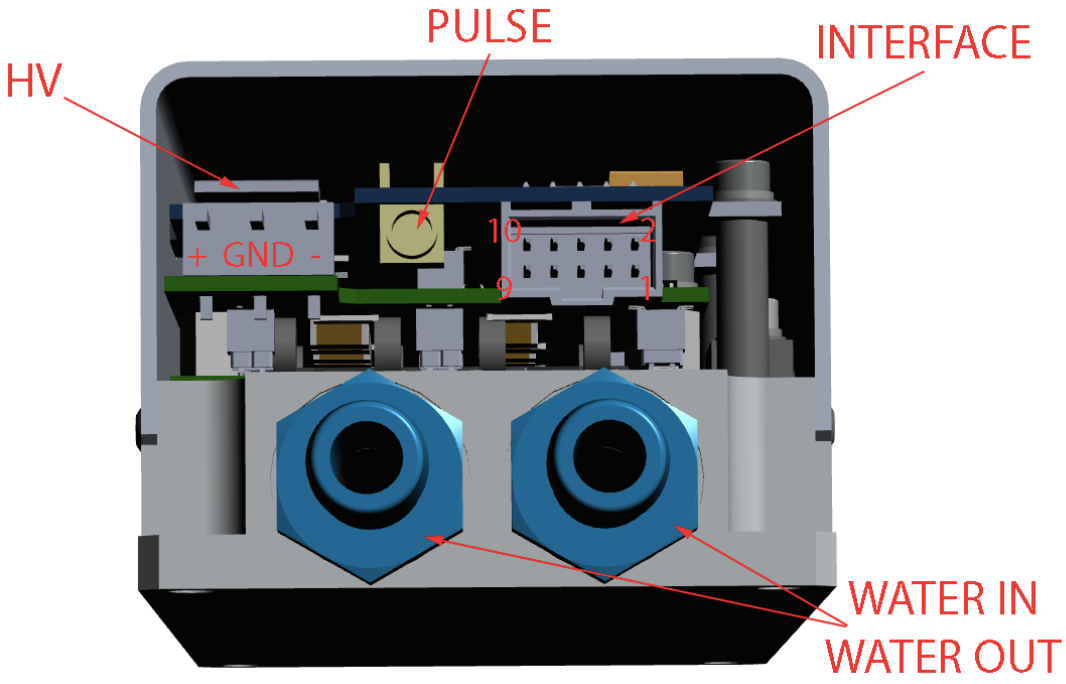
For operations the driver needs both HV and LV power. HV DC input should be bi-polar. LV power is 24VDC, <2A.

Module is water cooled. Different configurations of water inlets available on request.

Interfaces are analogue and RS-485. Configuration software for Windows® 7 is available.



Connectors, pins, interface signals



HV INPUT (1744048-3 TE Connectivity):

PIN (color)	DESIGNATION	DESCRIPTION
1 (red)	**HV Positive**	To produce 4kV pulses at the output of the driver, +2kV DC should be supplied to this pin.
2 (black)	**GND**	Grounding pin
3 (blue)	**HV Negative**	To produce 4kV pulses at the output of the driver, -2kV DC should be supplied to this pin.

INTERFACE (Molex 901303110):

PIN (color)	DESIGNATION	DESCRIPTION
1, 2 (red)	**+24V DC**	+24V DC power supply positive. Rated current – 1.5A max.
3, 4 (black)	**+24V DC Return**	+24V DC power supply negative
5 (black)	**Interface Return**	Return of Interface signals (Enable, Pulse, Fault). Grounding of RS-485 interface to be used in the case of high level of EMI affecting quality of RS-485 connection and the need to equalize the potentials of receiver and transmitter.

6 (orange)	**Gate limit fault**	Gate limit is a hardware protection of laser optics from too long pulses applied to the Pockels cell controlling the regenerative amplifier. If pulse width applied to Pulse pin exceeds Gate limit value driver forcibly cuts off the pulse and sets up the Gate limit fault (TTL high – fault, low – no fault). Despite the fault state driver continues the operations. To remove fault state driver should be disabled and enabled again.
7 (violet)	**RS-485 "+"**	RS-485 «+» to be applied here
8 (blue)	**Enable**	+5V applied to this pin enables the output. This pin is also used to reboot the driver in the case of overheating and other faults. To remove fault state driver should be disabled and enabled again.
9 (green)	**RS-485 "–"**	RS-485 «–» to be applied here
10 (red)	**Fault**	In the case of overheating driver sets up the fault on this pin (TTL high – fault, low – no fault) and stops the operations till fault reason is eliminated and driver is rebooted (disabled and enabled again).

PULSE (Linx Technologies CONMCX002**):**

PIN (color)	DESIGNATION	DESCRIPTION
1 (black)	**Pulse**	**In Fixed pulse width mode (see also *Software description* section):** TTL signal applied to this pin initiates HV pulse at driver's output. Rising edge triggered. Trigger level is 3V. HV pulse width is fixed and <15ns. **In Variable pulse width mode (see also *Software description* section):** Driver's output repeats TTL signal applied to this pin. Minimal pulse width is 100ns, maximal pulse width is 2000ns or Gate limit (what's less). Minimal inter-pulse interval is 100ns. **Input impedance is 50Ohm.** **Signal amplitude delivered to the switch should be +5V DC assuming divider of switch's input impedance and pulse generator output impedance.**

HV OUTPUT (flying leads):

Two wires, each of 70mm length

Other wire's length and termination are available on request. Shielded output wires reducing EMI, but slightly decreasing the performance are available on request.

MOUNTING AND GROUNDING:

Driver to be mounted with 4pcs M4 screws (recommended screws are DIN 912, M4x10 or longer).

Grounding policy

By default all grounds (of HV power supply, LV power supply, Interface and Pulse connectors) are connected to each other inside HVSW-04 and then to its chassis.

Other grounding policies could be discussed.

WATER COOLING:

Driver is water cooled. Recommended water temperature – 20-30C. Water temperature must be above ambient condensing point.

Technical notes

- **Performance of the module greatly depends on load capacitance.** Full performance is achievable at load capacitance typical to Pockels cells used in laser industry (5-7pF).

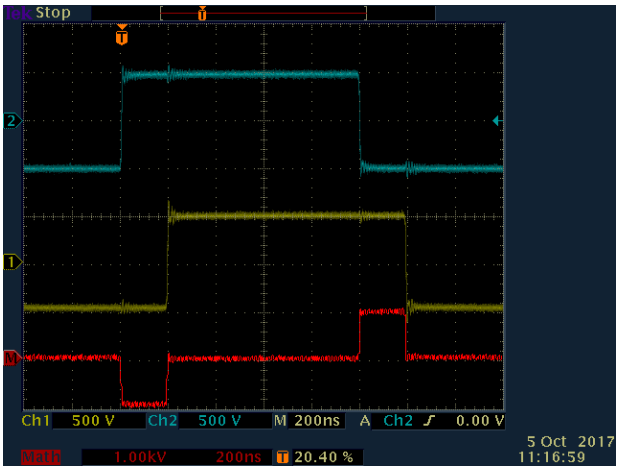
Higher load capacitance decreases maximal allowed repetition rate

- **Module's output is bipolar.** This means that e.g. 2kV pulse is physically formed by applying +1kV to one output wire and -1kV to the other (see figure)

Nevertheless, all descriptions of HV output are given in terms of voltage differences. Please keep this in mind!

- **Module's input is bipolar.** This means that to produce e.g. 2kV pulse driver must be fed with +1kV by one input wire and -1kV by the other

- **Sequential pulses have opposite polarity.** Since driver is built on full bridge schema, every output wire switches its potential between +V and –V values (blue and yellow curves below). As a result, the voltage difference between two wires can be either positive or negative (red curve on the picture below).



Specifications

ELECTRICAL SPECIFICATION

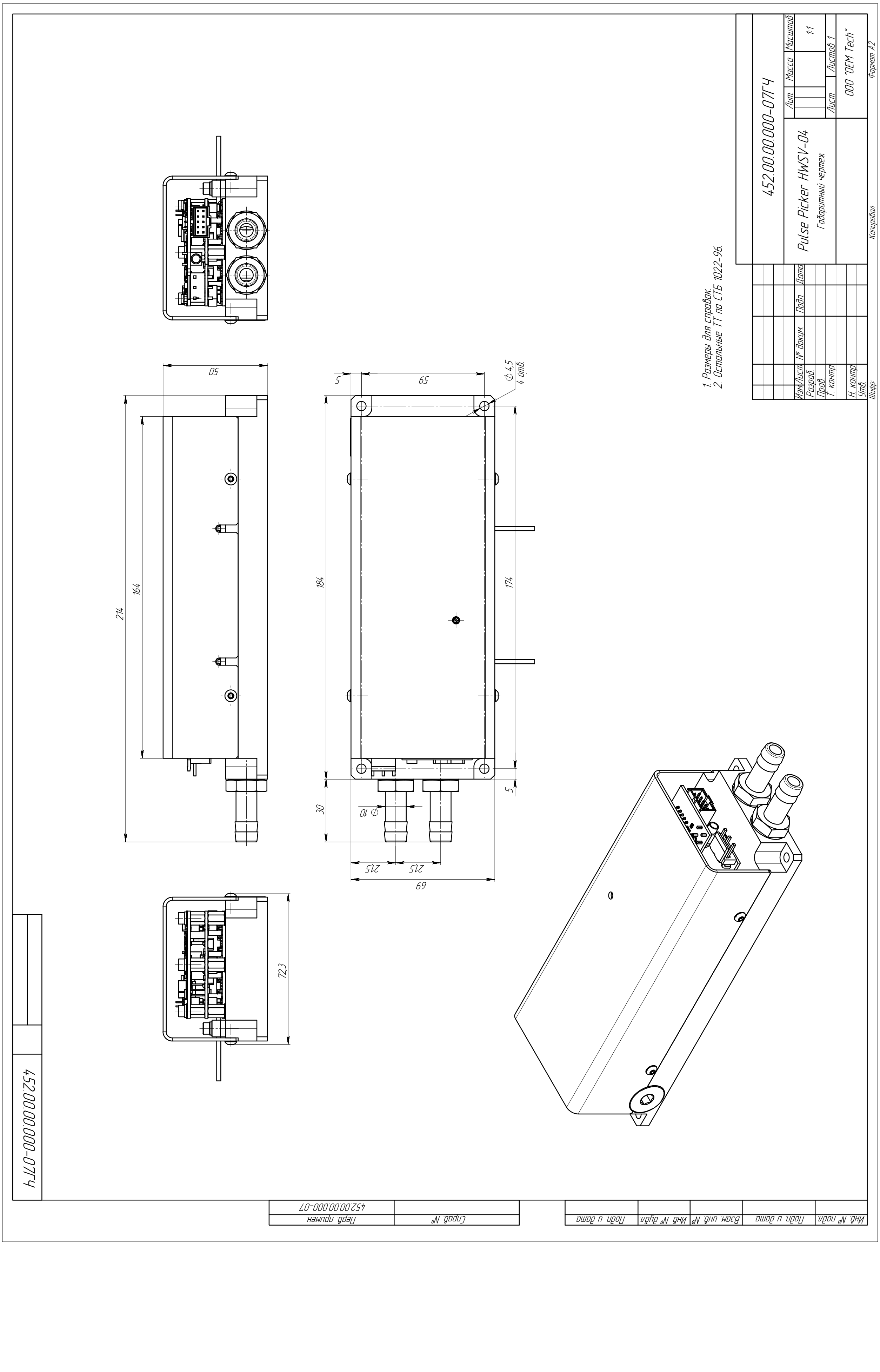
LV input	+24V DC; 1.5A max
HV input	+HV/2 by one wire; -HV/2 by another wire
Output	Pulses of high voltage and high repetition rate delivered to the capacitive load (e.g. to the Pockels cell)
Output type	Bipolar (see also *Technical notes* section)
Pulse basement [1]	0V, fixed
Pulse amplitude [1, 2]	adjustable in 0-4kV range
Maximal repetition rate [2]	Up to 4MHz (see also *Performance* section)
Minimal repetition rate	Single shot (there is an internal restriking circuit which makes the operations at such a low repetition rate possible)
Pulse width	Fixed, about 15ns in Fixed pulse width mode (see also *Software description* section) 100ns-2000ns adjustable (other on request) in Variable pulse width mode (see also *Software description* section)
Interpulse interval	>100ns
Risetime/falltime [3]	5-7ns
Delay time	<50ns
Jitter	<0.5ns (±250ps)
Load capacitance	5-7pF typically
Protections	- From too long pulses (Gate limit), adjusted by the customer in 200ns to 2200ns range [3] - From overheating
Environment	
Operation temperature	+10...+40 °C
Storage temperature	-20...+60 °C
Humidity	90%, non-condensing

[1] In terms of bipolar output (see also *Technical notes* section)
[2] Maximal pulse repetition rate depends on pulse amplitude, pulse amplitude and pulse repetition rate cannot achieve their maximums at the same time
[3] 10-90% level, warranted at load capacitance 11pF and below
[4] These and other parameters might be changed upon request

MECHANICAL SPECIFICATION

Size (LxWxH)	176x69x50mm (without inputs and outputs)
Weight	<0,5kg

Dimensions



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Pulse Picker HWSY-04
Габаритный чертеж
ООО "OEM Tech"
1. Размеры для справок.
2. Остальные ТТ по СТБ 1022-96.
Формат А2