新特光电
Sintec Optronics

Operation and Installation Manual

HVR-DRIVE

OEM Pockels Cell Driver for
Pockels Cell Laser Pulse Selection

MAY 2021

Contents

WARNINGS

This equipment must only be used by qualified personnel. This device produces high voltage pulses. Normal precautions for working with high voltage circuits must be followed.

When operating in a laser, this equipment is part of a system that generates high energy pulses of laser light that can cause serious injury.

The pulses produced by the driver are very fast – the wiring between the driver and the Pockels cell, and the Pockels cell itself, can be expected to produce a great deal of EMI. It is the user's responsibility to ensure that systems incorporating this driver do not cause interference.

I Introduction

Description

The HVR-Drive is a compact OEM Pockels cell driver for inclusion in regenerative amplifiers and other pulse selection applications. The unit drives BBO at 1/4 λ or 1/2 λ, producing pulses at up to 7.5 kV and up to 200 kHz. The driver produces a top-hat waveform from 250 ns–3 µs wide with fast rising and falling edges.

Specifications

Output voltage	0–7.5 kV (2 x high voltage input)
Output risetime	10 nS–20 nS depending on output voltage and load capacitance
Output waveshape	Differential +/- pulses, balanced with respect to ground
Output pulse width	100 ns–5.0 µs (determined by time between ON and OFF triggers)
Repetition rate	0-200 kHz (5kV @ 200 kHz max, water cooled) 7.5 kV @ 25 kHz max, convection cooled 7.5 kV @ 100 kHz, water cooled
Power input	21-28 VDC @ 300 mA ±1875 VDC for 7.5 kV output @ 80 mA
Trigger input On/Off	5 V nominal TTL (one for ON, one for OFF)
Output wiring	Flying leads to Pockels cell, min. 5 kV rated

II Installation

Power Requirements

A regulated +21-28 VDC power supply with a minimum rating of 300 milliamps must be supplied via the 2-pin connector (mating connector Amp part no. 3-644563-2) with pin 2 positive and pin 1 ground. See Figure 1 for connector locations.

A regulated high voltage power supply capable of positive and negative 0-1875 VDC with a minimum rating of 80 milliamps (7.5 kV @ 100 kHz PRR, 10 pF load).

Please note that the driver must be water cooled when operating at high voltage and high rep rates. It is recommended that the chiller be set to 25°C at 1.0 gal/minute minimum.

Trigger Inputs

Two trigger inputs (one ON, one OFF) must be supplied via the corresponding 2-pin connectors with pin 2 high and pin 1 low (GND). See Appendix A for a simple circuit capable of producing the ON/OFF pulses with a single trigger input. The ON/OFF pulses should be a nominal 5 volts, each should be 50-100 ns wide with at least 100 ns of separation (measured from the start of each) so that there is no overlap.

Caution: Do not allow the ON and OFF pulses to overlap or damage to the driver will occur.

See Appendix B for the trigger timing diagram.

Pockels Cell Leads

The Pockels cell leads should be rated 5 kV minimum and kept as short as possible.

DO NOT connect either output lead to ground or damage to the driver will occur. Pomona 18 AWG, 5 kV rated, part nos. 6734-0 (black) and 6734-2 (red) are recommended.

Grounding

For safety, the HVR-Drive chassis should be connected to earth ground and common to the power supply ground. This can be done via a chassis mounting screw or via the on-board connector.

Caution: Do not connect either of the output leads to ground.

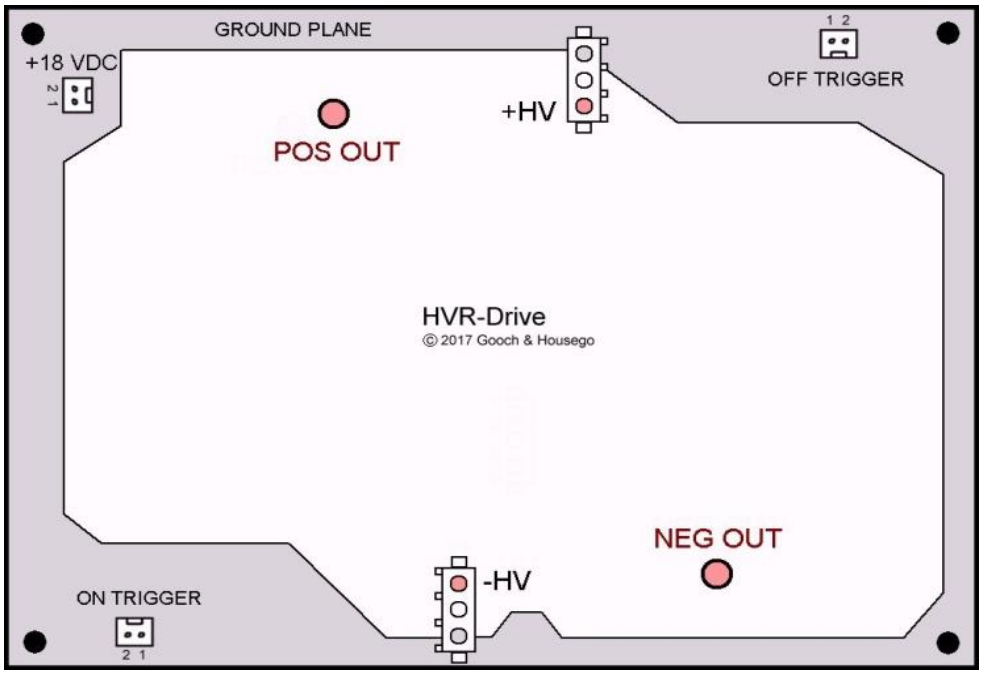


Figure 1 - HVR-Drive Board Layout (top side)

III Operation

Setting the Output Voltage

The HVR-Drive output voltage pulse amplitude is determined by the external high voltage being supplied. The output voltage pulse is always double the high voltage input when the HVR-Drive is triggered. For example, ±1000 VDC input produces 4000 VDC output. In the absence of a trigger signal, the output is at zero volts.

Supplying Trigger Signals

Two trigger signals are required to produce the top-hat output pulse from the HVR-Drive. The ON trigger turns the high voltage on, and the OFF trigger turns the high voltage off. Rise time and fall time of the output pulse can be as low as 10 ns, depending on the load capacitance and the output voltage. Lower output voltages produce faster rise times.

The ON and OFF triggers should be a 5 volt signal with a pulse width of 50-100ns separated by a minimum of 100ns (this determines the output pulse width). The trigger rise time should be as fast as practicable. A slow rise time will result in increased output jitter. See Appendix A for a simple circuit capable of producing both of the ON/OFF pulses with a single trigger input.

Measuring the Output Waveform

Caution: These procedures should only be undertaken by personnel qualified to work with very high voltages at high frequencies.

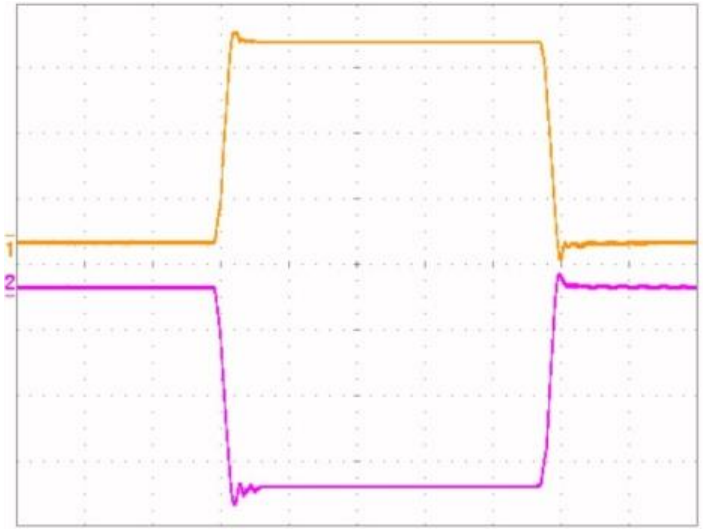
Equipment needed:

- 400 MHz oscilloscope with 2 inputs
- 2 of 100x scope probes
- Pulse generator
- Pulse splitter

Measuring the electrical output performance of the driver requires a 400 MHz or faster oscilloscope and a pair of low capacitance, high speed 100x high voltage probes. The probe tip capacitance adds to the load capacitance, and this needs to be accounted for when making measurements.

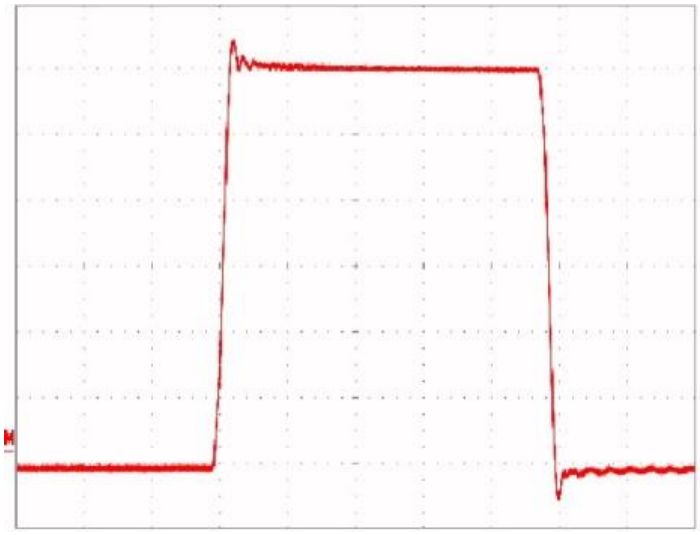
Connect the probe tips to the output leads and connect the probe ground clips to the circuit ground. Keep the ground connections as short as possible to reduce ringing on the waveform. Set the pulse generator to produce a 5 V pulse 500 ns wide at a repetition rate of 1 kHz.

Apply 18 V power to the HVR-Drive. While observing the scope display, adjust the high voltage power supplies to output ±500 V. You should see one channel go from 0 to +1000 V and the other channel go from 0 to -1000 V. The driver pulse width will be the same as the trigger pulse width. (See screenshot 1)



Screenshot 1 - ±1000 V 500 nS wide

Adjust your scope to show channel 1 added to channel 2 (Math function) and you should see the following waveform (Screenshot 2).



Screenshot 2 - 2000 V pulse 500 ns wide

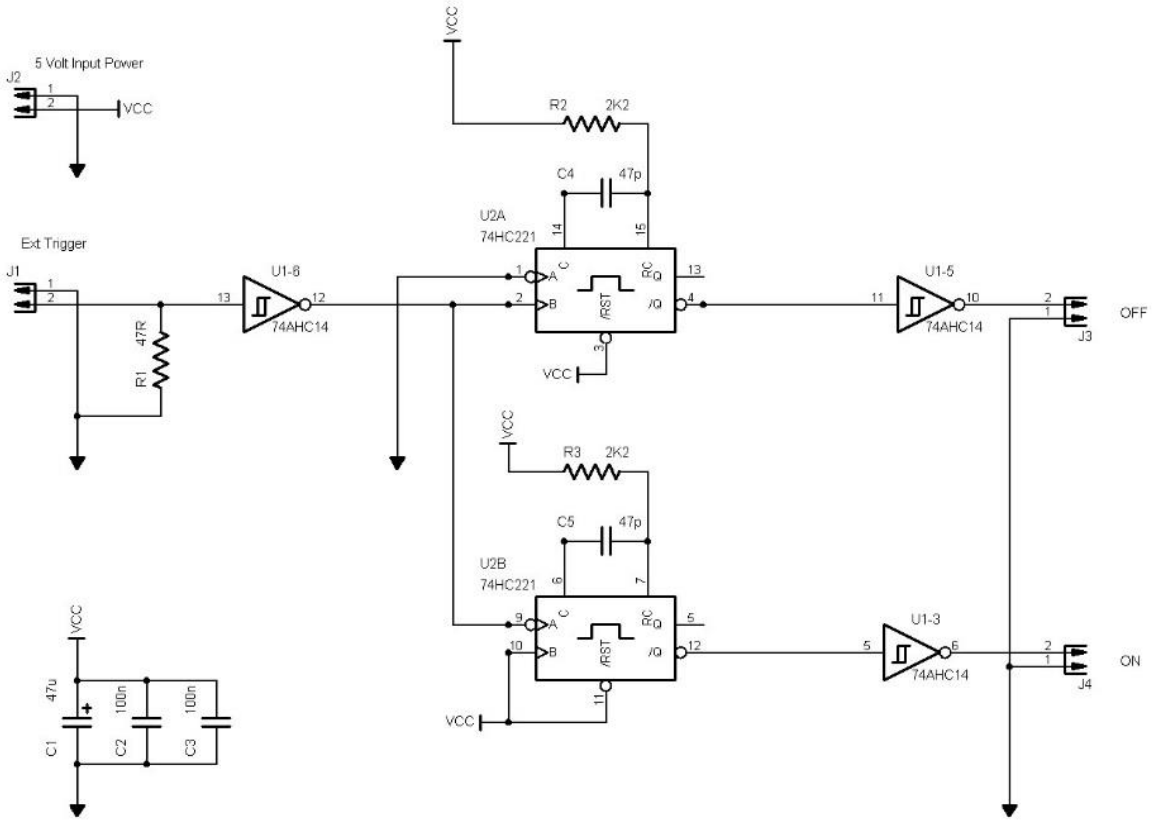
Turn off the high voltage power supply and input power to the driver upon completion of this test.
Do not leave the unit operating while unattended.

Caution: Do not allow the ON and OFF trigger pulses to overlap or damage to the driver will occur. Do not connect either of the output leads to ground or damage to the driver will occur.

Appendix

A: Designing a Trigger/Pulse Splitter Circuit

Shown below is a basic pulse splitter capable of producing the both the ON and OFF pulses from a single trigger input. This circuit will accept a 5 V trigger input from a compatible pulse generator and produce ON and OFF pulses of the same width as the input trigger pulse. Use shielded cables between this pulse splitter and the ON/OFF inputs of the driver.



B: ON/OFF Trigger Timing Diagram