Peta-pico-Voltron

Compact 5 kV high-voltage power supply for dielectric elastomer actuators

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Abstract

Dielectric elastomer actuators (DEAs) require high voltage power supplies (HVPS). However, commercial units are often not well-suited to drive these actuators. They are heavy, costly, or not optimised for rapid on/off switching. Here, we present a HVPS specifically designed to drive DEAs. Peta-pico-Voltron is a small portable unit which can actuate DEAs between 1 mHz and 1 kHz, at voltages up to 5kV and with a slew rate higher than 15 V/µs. The hardware and software have been released as an open source project so that other laboratories can easily build, use, and adapt them. Each unit weighs 60 g for a 120x55x25 mm³ footprint, and can be assembled for less than USD 400.

Switching at frequency

onstant OV output

Operating principle	3 main output modes	1	Components
	HV Constant DC output		



Main characteristics

- Available voltage range: 5 kV, 3 kV, 2 kV, 1.2 kV, 500 V
- Voltage setting resolution: 0.1 % of voltage range.
- Voltage control modes: Internal Regulated (PID), open-loop, or external
- Square signal generation: Internal (1 mHz to 1 kHz, with a slew rate higher than 15 V/ μ s), Manual push button, or external TTL signal.









Open source project

http://www.petapicovoltron.com

USB

PCB files with detailed assembly and testing instructions





CLOSE

Easy to use graphic user interface

LabVIEW library for easy integration with other

Additional features

Trigger output: trigger signal synchronized with output with settable duration and position. Can be used to drive a stroboscopic light source to freeze the actuation at high frequency.





instruments or for data acquisition. Commands can Nige also be sent via a serial connection. Timer **R** Switching Image: Section and Amage: Se R 2502 10 $\infty \bigcirc$ HVPS interface 2.7 GNU GPLv3

Calibration/Characterisation routines and instructions (requires a HV probe and a NI-DAQ)





Enclosures (with assembly instructions) to protect the user from the High Voltage







fixed location (frozen motion) 2) Trigger pulse shifting (slowed-down motion)

Multi-channel: Possibility to group up to 4 HVPS together in a multi-channel configuration with synchronized switching between channels (at frequencies up to 1 kHz). Possible applications: rotary motors, peristaltic pumping, and other applications requiring multichannels (either dependent or completely independent).





Conclusions

Project Peta-pico-Voltron is an easy-to-assemble high voltage source specifically designed to drive DEAs. It is compact (i.e. truly portable), easy to use, and packs a lot of functionalities on a small footprint. It is able to generate square signals from 1 mHz to 1 kHz, and is thus suitable for all DEA applications, from slow biological processes, to fast silicone actuators.

The graphic user interface provides an easy way to access all the functions of the HVPS. A labVIEW library enables the integration of the device in automated setups. Direct control via simple text commands on a serial link makes it possible to use the HVPS with any programming language.

Project Peta-pico-Voltron is an open-source project. The PCB layout, the firmware for the microcontroller, and the code for the GUI are available on www.petapicovoltron.com for anyone to use and to modify. Detailed instructions are also provided to assemble, test, calibrate and characterise the HVPS.

Feeback or questions: petapicovoltron@gmail.com



Multi-channel configuration driving a multi-phase DEA motor