High Power Pendulum Driver System

About

A modular system for driving a heavy pendulum or other mechanism requiring a large force to keep it maintained.

SPC3 drive coil assembly

Drive coil. Contains an ironless electromagnet coil and a magnetic sensor potted in epoxy resin. The entire assembly is fitted into a convenient housing for surface mounting below the pendulum.

P-Drive module

An electronic circuit which works in conjunction with an SPC3 drive coil. Runs on 4 to 15 volts. A control to adjust output pulse width is provided. This directly affects the amount of power applied to the pendulum bob. Pulse width control is by a 22 turn trimmer. It has no hard end-stops, a friction clutch slips at the end points. Increase pulse with by turning anti-clockwise (like opening a tap). The pulse produced is highly stable against temperature changes.

Setting up

A magnet is attached to the bottom of the pendulum bob. SPC3 is arranged to sit directly below. Recommended clearance 3mm. White centre spot on the SPC3 casing top should be directly below the pendulum when at rest. When correctly aligned, the swing can be in any plane (eg Foucault's Pendulum demo) without affecting performance. Correct magnet polarity is essential otherwise the system will not trigger at all. Marked surface of the magnet faces the SPC3. Test by pushing the magnet across the drive face. LED on the P-Drive circuit should flash as the magnet leaves centre. Magnet will probably flip or jump away.

Casing is produced as a 3D print in PET-G material. It is somewhat soft therefore care should be taken when screwing down. Use brass or non-magnetic stainless steel screws.

P-Drive cover and wiring

An optional screw-down enclosure with cover and DC input socket is available.
For access to the LED and timing control, lift cover away at the cable end. It can then be released where the other end fits around the DC power connector. Case may be removed if it is inconvenient and the cable may be shortened as desired. A 0.4mm "jewellers" screwdriver is needed for both the screw terminals and the timing adjuster. See connection diagram.

How it works

Just after the bob leaves its equilibrium point, a signal is sent from the SPC3 to the P-Drive circuit. A timed pulse is generated and sent back to the SPC3, energising its coil and sending the bob on its way. A red LED on the P-Drive flashes in time with each pulse. See drawing.

Future enhancements

A version of P-Drive having a crystal controlled timebase is in development. The pendulum will be frequency locked in a closed-loop by modulating its amplitude which is intended to improve timing accuracy. A serial data interface for programming and setting of operating parameters from a computer will be added in due course.

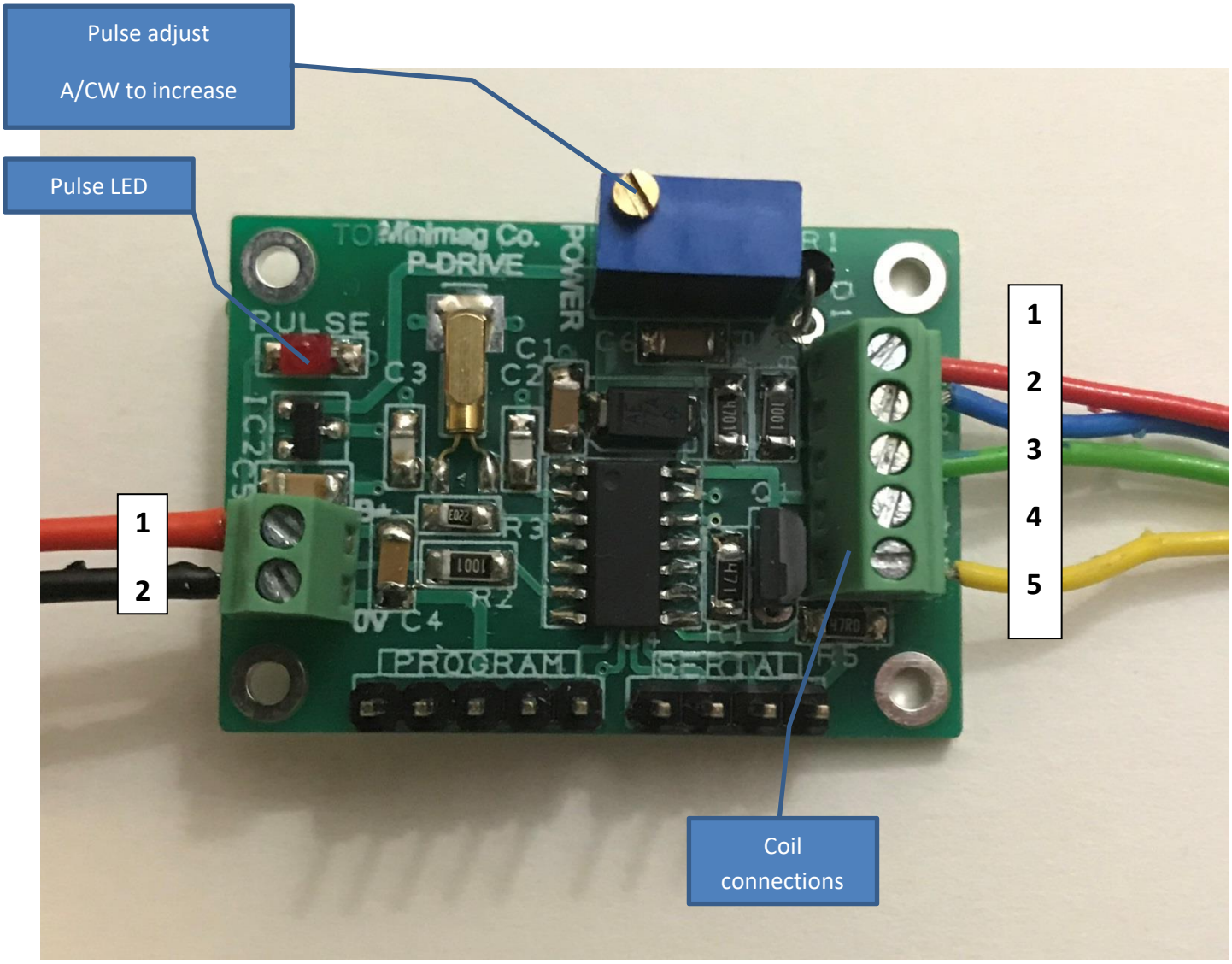

Photo showing connections to the P-Drive circuit board.

Terminal No.	Colour	Function
1	RED	Power +
2	BLACK	Power GND

Terminal No.	Colour	Function
1	**RED**	**Coil power positive (4 to 15 volts)**
2	**BLUE**	**Ground**
3	**GREEN**	**Pendulum sense**
4	**-------**	**Sensor power (not used)**
5	**YELLOW**	**Coil drive pulse**

The system will run on batteries (Recommend a 6V battery pack eg. 4x “D” alkaline cells) although for best stability and for all high power applications a regulated plug-in power supply should be used.
Choice of supply voltage directly affects available drive power and may require some experimentation. Size of bob magnet will affect drive power too. As a very rough guide:
Free-running clock, all metal construction, bob mass up to 500gm, use 4.5 volts and an 8x1 neodymium magnet.
Large wooden clock use 9 volts and an 8x4 neodymium magnet
Foucault Pendulum with a 3Kg bob use 15 volts and a 15x5 Neodymium magnet