Protostation
HP512

Advanced Breadboard

User Guide
HP8410-60-01

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Please note: all specification quoted in this document assume that the Protostation is powered from our HP8405 power supply, or from one of our Electronic Workstations.

We cannot guarantee the performance or safety of the Protostation if any alternative to these recommended power sources is used.

Maximum ratings

Power rails	+12 VDC, 2 A
	+5 VDC, 5 A
	+3.3 VDC, 100mA
	-12 VDC, 800 mA
Variable voltage source	-10V to +10V, 50mA
Relay contacts	240 VAC/DC, 6 A

Safety Notice: In order to prevent the danger of electrocution from exposed conductors on the Protostation, we advise you not to use the Relay for switching >30V.

Storage temperature	-10°C to +70°C
Operating temperature	0°C to +40°C

Certification

CE certification:
EN 60950-1: 2001+A11:2004
EN 55022: 2006 Class B
EN 55024: 1998+A1: 2001+A2: 2003

FCC certification:
ANSI C63.4 (2003)
CISPR 22: 1997+A1: 2000
ICES-003: 2004

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Introduction
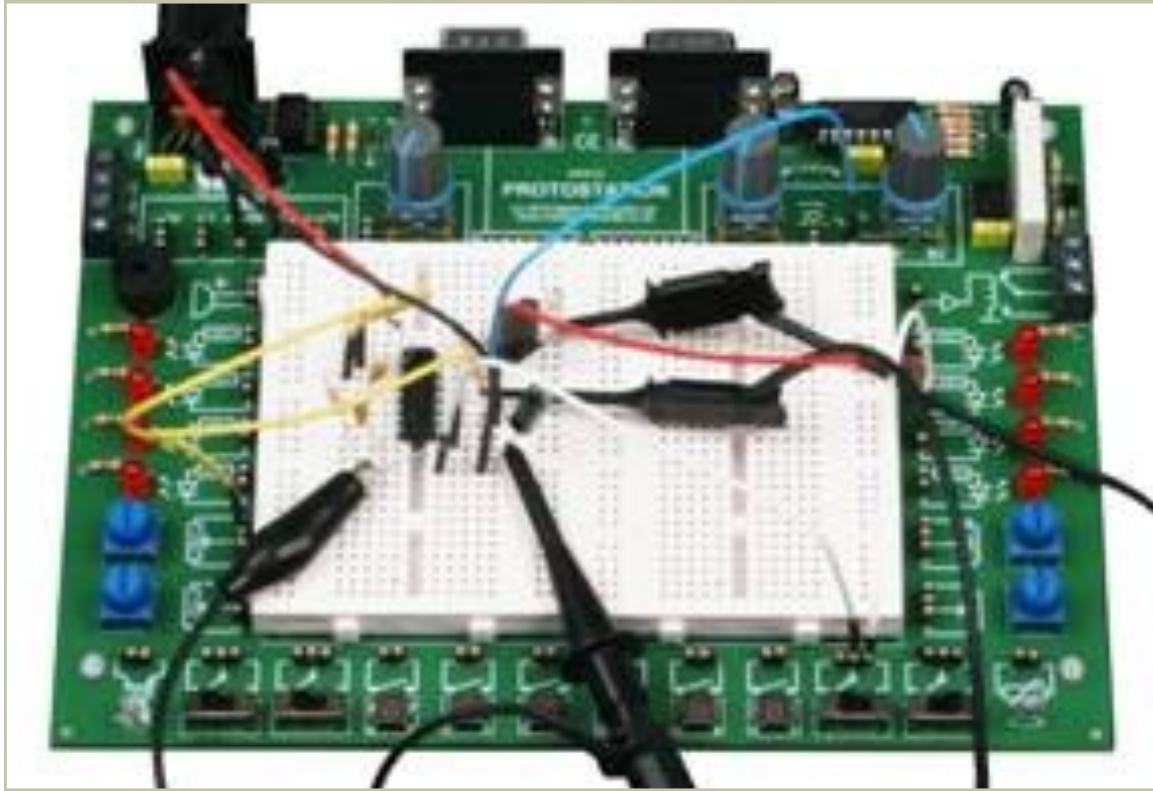
What does it do?

The Protostation is a versatile platform for developing and testing prototype circuits. It has a wide variety of built in sensors, controls and signal sources which are easily connected using standard breadboard patch cables.

Benefits

- Prototype your designs without requiring PCBs, soldering or tools.
- Many common input and output devices immediately to hand.
- On board generation of test signals.
- Easy integration with E-blocks and the Electronic Workstation.

Features

- Large breadboard area with 0.1" pitch holes to take standard IC packages.
- Switches, potentiometers, light sensor and thermistor provide inputs to your test circuit.
- LEDs and a buzzer for indicating circuit outputs.
- 6A relay for switching high power loads.
- Low impedance variable voltage source.
- Multiple power rails.
- Sine and square wave signal generator.
- E-block ports and screw terminals for easy connection of outboard devices.

Description

The Protostation is designed to be the ideal compact solution when you need to build and test a circuit in a hurry.

Everything you need is provided on one board - power, sensors, control hardware, output indicators and even a function/clock generator.

The multiple power rails make it as suitable for modern low-power 3.3V ICs as it is for classic dual power rail op-amp work. The signal generator also has both digital and analogue in mind - be it a pure sine for audio testing or a crisp square wave for clocking digital ICs.

You have the choice of a variable voltage source, a dozen switches, four potentiometers, heat and light sensors to provide your circuit with input - and then see (or hear) the results with the LEDs and buzzer. There is even a 6 A relay for those hard-to-drive transducers.

All of these on-board devices will save time hunting down and preparing components - especially those awkward ones that don't easily plug into a breadboard.

The Protostation is also designed to integrate with the Matrix range of E-blocks and with our new Electronic Workstation. These can provide you with a complete suite of circuit analysis tools, and a host of ready-made modular building blocks - prototyping has never been easier (or taken up so little space on your bench!)

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The Protostation hardware
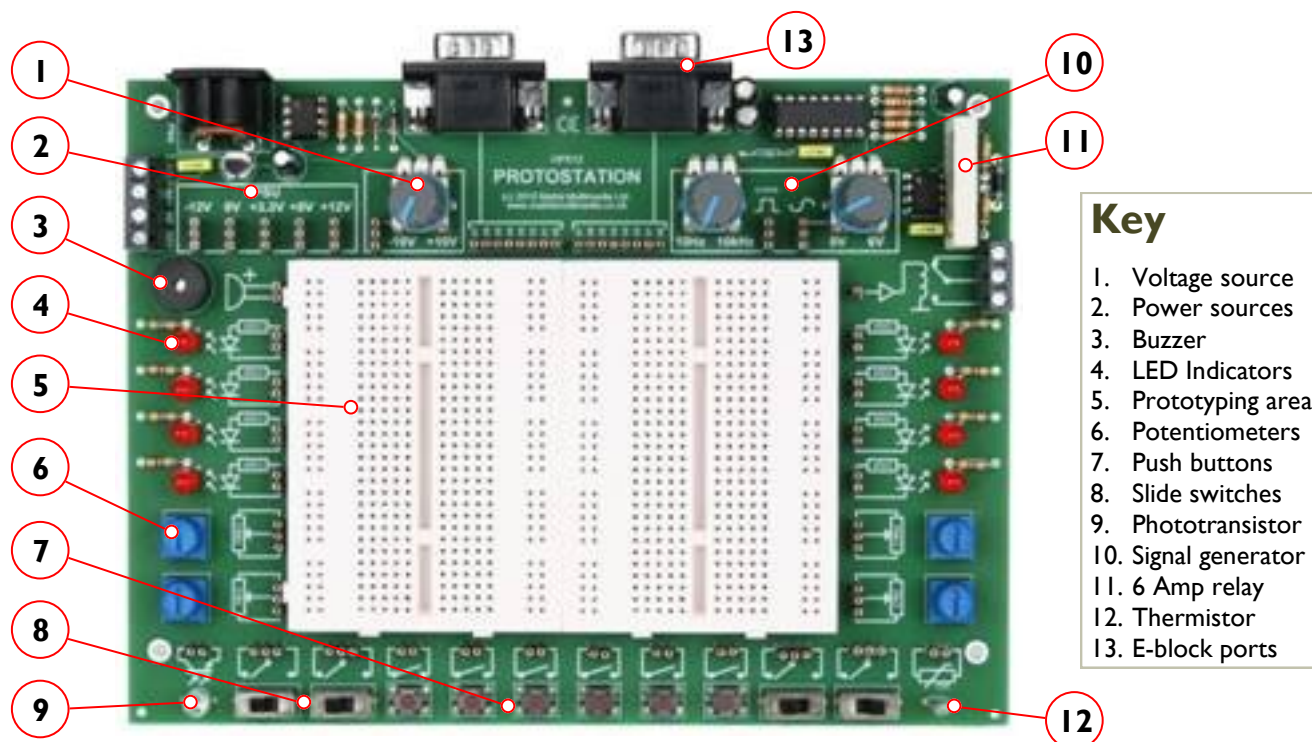
Key

1. Voltage source
2. Power sources
3. Buzzer
4. LED Indicators
5. Prototyping area
6. Potentiometers
7. Push buttons
8. Slide switches
9. Phototransistor
10. Signal generator
11. 6 Amp relay
12. Thermistor
13. E-block ports

1. Voltage source

The voltage source is continuously variable from -10V to +10V relative to the 0V terminal. It uses a buffer circuit so that it is stable when loaded; this also protects it against short circuits. Maximum current output is 50mA.

2. Power sources

Power rails are provided for -12 V, 0 V, +3.3 V, +5 V and +12 V. This provides for powering everything from digital ICs to dual power rail audio circuits. These voltages can all be sourced from our HP8405 triple rail power supply. When using the Protostation with our Electronic Workstation, they can share a PSU using a short umbilical cable.

3. Buzzer

The buzzer will sound at any voltage from 3 V to 9 V, and consumes only 20 mA (5 V source).

4. LEDs

Eight LEDs give plenty of scope for indicating the status of digital outputs. Current limiting resistors are already in place, ensuring that the current drain is no more than 20 mA (at 12V).

5. Prototyping area

Over 100 groups of five nodes, plus eight 25-way bus rails give plenty of scope for working with larger

circuits. The hole pitch is 0.1" (2.54 mm), suitable for standard DIL and SIL packages. Each of the on-board components is also brought out to terminal sockets that will accept standard jumper wires.

6. Potentiometers

Two 10 kΩ and two 100 kΩ potentiometers with easy to adjust thumbwheels. Each has all three of its terminals available so that they can be used as voltage dividers.

7. Push buttons

Eight normally open, momentary push buttons.

8. Slide switches

There are four slide switches, all with single pole, changeover contacts .

9. Phototransistor

The TEPT5700 phototransistor has been chosen as it is sensitive to the same light spectrum as the human eye and has a wide angle of acceptance. Output current varies from a few nA (dark) to 150 µA (200lux, 5V collector-emitter voltage).

10. Signal generator

The signal generator has two outputs.   The 5 V pk-pk square wave output is ideal for clocking digital circuits. The sine wave output is perfect for testing analogue

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electronics, and has a fully variable amplitude from zero to 6 V pk-pk. The frequency of both outputs can be set to any value from 10 Hz to 10 kHz.

11. Relay

The relay has single-pole changeover contacts rated at up to 6 A, available on screw terminals. The relay coil is activated by a buffer requiring less than 1 mA and with hysteresis to avoid 'chattering' .

12. Thermistor

The thermistor has a nominal resistance of 4.7 kΩ at

a room temperature of 20°C. It has a negative temperature coefficient - the resistance decreases by approximately three percent per degree of temperature rise.

13. E-blocks ports

These two 9 way D-sub plugs are wired to the same standard as our range of E-block products. They are spaced so that ports C and D of our EB006 Multiprogrammer can be directly connected, enabling easy integration of microcontroller circuits. Alternatively, use ribbon cables to connect our downstream E-blocks - sensors, displays, wireless connections, GPS and many more...

Integration with other Matrix products

The Protostation has been designed to integrate perfectly with other Matrix products. Our range contains all of the circuit analysis tools you could need for fault finding and fine tuning your designs. With the E-blocks system, your designs also have access to a huge range of ready made modules - from adding a few extra switches and indicators, right the way up to mobile phone communications, GPS, and wireless networking.

E-blocks

The Protostation has mounting holes enabling it to be securely attached to an E-blocks backplane.

The two D-sub connectors are placed so that they can access ports C and D of our EB006 microprogrammer - opening up huge possibilities for using programmable microcontrollers with your designs. Alternatively, E-blocks downstream boards can be attached via ribbon cables. Using screw terminals, it is also possible to take power for the e-blocks from the Protostation's power rails.

See our E-blocks catalogue or website for complete descriptions of the huge variety of e-blocks available.
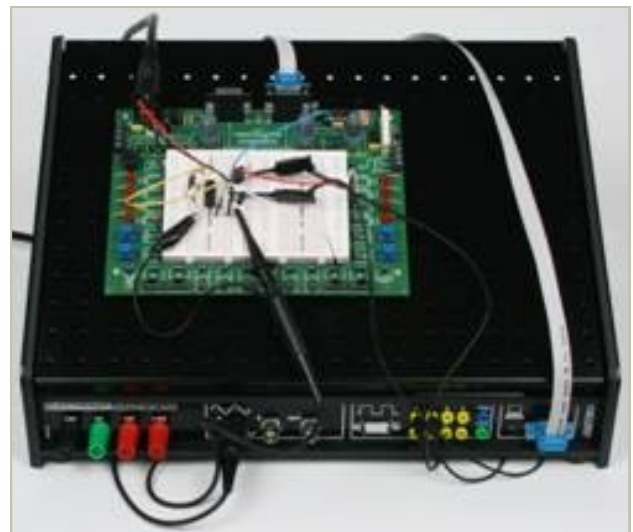
Electronic Workstation

The Electronic Workstation is the perfect complement to the Protostation. It provides an eight channel digital analyser with serial bus decoding, a USB oscilloscope and a customisable USB interface - thus giving you all of the tools required to analyse and de-bug your prototype circuits.

When the Protostation and Workstation are used together, the Protostation can be securely mounted on the Workstation's sloping top panel, and the two units can share a single HP8405 power supply (requires power cable HP655).

Protostation as part of an E-blocks project secured to a backplane.

Protostation in use with an Electronic Workstation.

Protostation accessories

Power options

Power is input to the Protostation via a rear-mounted 5pin DIN socket or four screw terminals. While the Protostation can be powered from a typical multi-output bench supply, we recommend our **HP8405 triple output power supply**. The HP8405 offers full protection against short circuits and overloads, and can be used worldwide when used with an appropriate IEC main cable.

The power rails can be accessed from screw terminals and breadboard sockets to provide power for peripheral circuits such as E-blocks, transducers, motors etc.

If you are using the Protostation with an Electronic Workstation, the Protostation can take its power from the Workstation using an umbilical cable **(HP655)** - thus saving you the cost of a second power supply.

Please note: All electrical specifications in this document assume that the Protostation is powered by an HP8405 power supply or from an Electronic Workstation. Matrix cannot guarantee the performance or safety of the Protostation if you choose to use any other power source.

HP8405 Triple output power supply unit

HP655 Protostation/Workstation umbilical power cable.

Jumper wires

Connections between breadboard sockets can be made using solid cored wire from 0.3 mm to 0.8 mm diameter. However, we recommend using our purpose designed jumper leads - solid core wire all too easily succumbs to metal fatigue, leaving blocked breadboard sockets when the wire ends break off.

Our jumper wires are made from flexible stranded cable, each end of which is terminated with a sturdy metal pin. Not only are these less prone to breakage, but they are also much easier to insert into the breadboard sockets.

Jumper wires are available in packs of ten in a choice of two different lengths; 75 mm **(FLLPCK)** or 150 mm **(HP654)** - each pack contains two each of five different colours.

FLLPCK 100mm jumper wires

Mounting pillars

Clip-on mounting pillars **(HP6219)** enable you to attach the Protostation to one of our E-block backplanes or the top panel of an Electronic Workstation. The Protostation and E-blocks are designed to attach securely to the backplane even when plugged together - but can still be easily removed when required for a new project.

Mounting pillars are available in packs of 25.


HP6219 Backplane mounting pillars

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Technical specifications

| Power Rails (when powered by HP8405 PSU)	
-12V	800 mA
+3.3V	100 mA
+5V	5 A
+12V	2 A
Variable voltage source	
Output	-10 V to +10 V (relative to 0V rail), 50 mA
Signal Generator	
Square wave	10 Hz to 10 kHz, Low 0 V, High 5V, DC coupled, 50 % duty cycle
Sine wave	10 Hz to 10 kHz, 0 V to 6 V max. pk-pk, DC coupled
Relay	
Contacts	SPDT, max. 6A at 250 V AC/DC *(see footnote)*
Coil driver	Always on at min. 3.3 V, always off at max. 1.55V, input impedance 100 kΩ
Light Sensor	
Light spectrum	Peak 570 nm, bandwidth 440 nm to 800 nm (half sensitivity)
Acceptance angle	Half sensitivity at 50° off axis
Dark current	min. 3 nA, max. 50 nA
Light current	140 µA (200 lux, collector-emitter voltage 5V)
Thermistor	
Nominal resistance	4.7 kΩ at 20°C
Temperature Coefficient	-3 % / °C
LEDs	
Series resistance	470 Ω
Current	20 mA at 12 V
Buzzer	
Voltage	min. 3 V, max. 9 V
Current	20mA at 5 V
Input controls	
Potentiometers	50 mA, 12 V
Push buttons	50 mA, 12 V
Slide switches	300 mA, 125 V
Physical	
Breadboard	Pitch 2.54 mm (0.1"), contacts Ø0.3 mm to Ø0.8 mm, max. 2 A, 25 V
Overall dimensions	Width 195 mm , Depth 155 mm, Height 35 mm
Weight	250 g
Operating temperature	0°C to +50°C
Storage temperature	-10°C to +70°C

Safety Notice: In order to prevent the danger of electrocution from exposed conductors on the Protostation, we advise you not to use the relay for switching voltages greater than 30V.

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Circuit diagrams

Signal generator
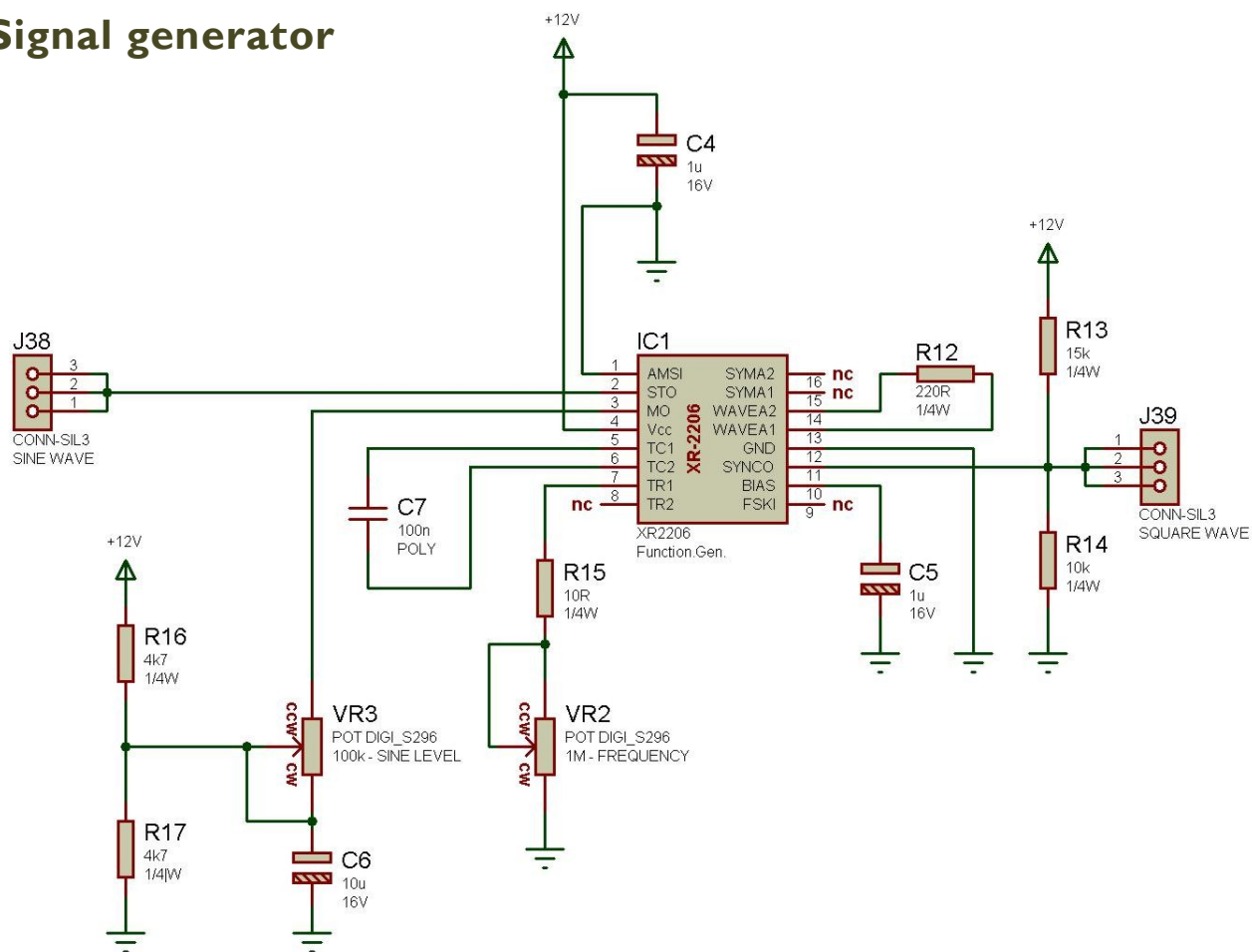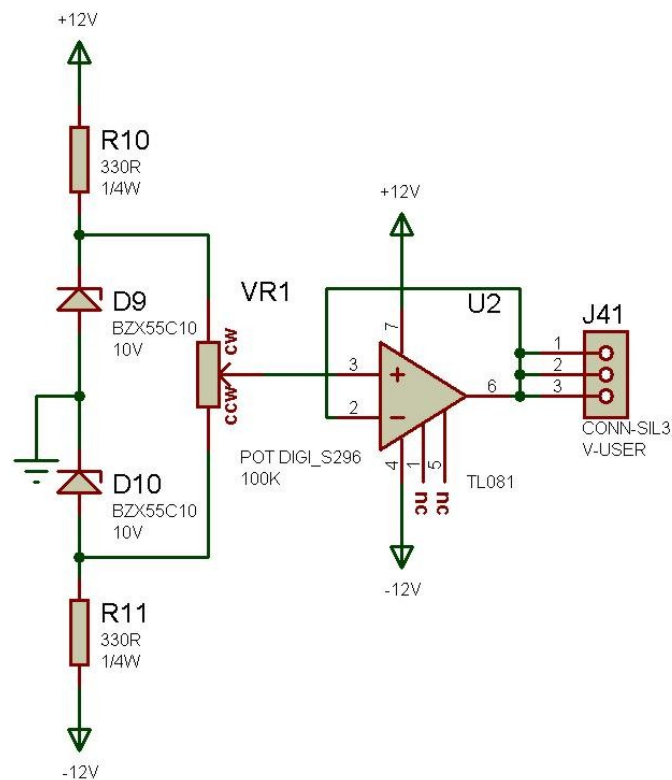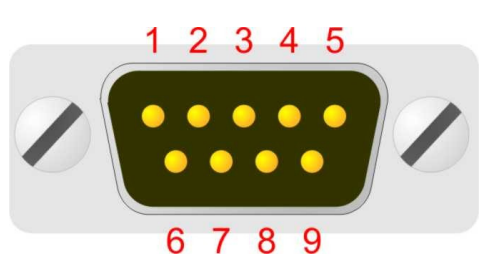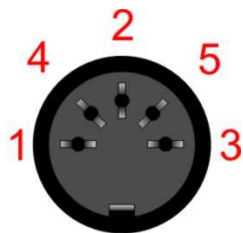

Relay driver
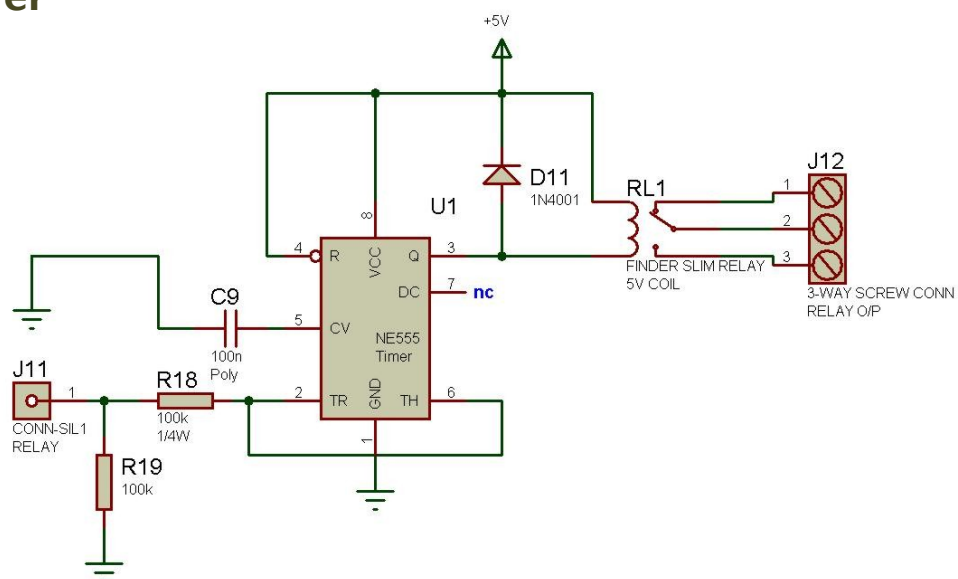
Variable voltage source

Connector pinouts

E-blocks ports

1. Data 0
2. Data 1
3. Data 2
4. Data 3
5. Data 4
6. Data 5
7. Data 6
8. Data 7
9. 0 V

Power input

1. Not connected
2. 0 V
3. +5 V
4. -12 V
5. +12 V
Shield. 0 V

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Ordering your Protostation and accessories

Product description	Order code
Protostation advanced breadboard	HP512
Triple output power supply	HP8405
Protostation/Workstation umbilical power cable	HP655
IEC mains cable (UK)	HP3701
IEC mains cable (Europe)	HP3702
IEC mains cable (USA)	HP3703
Jumper leads 75 mm (pack of ten)	FLLPCK
Jumper leads 150 mm (pack of ten)	HP654
Backplane mounting pillars (pack of 25)	HP6219

Please visit our website www.matrixtsl.com to see the most up to date prices and product information.

Contact details

Matrix Technology Solutions Ltd.
The Factory
33 Gibbet Street
Halifax
West Yorkshire
HX1 5BA
UK

Telephone: 01422 252380
Fax: 01422 252381

Web: www.matrixtsl.com
Email: sales@matrixtsl.com

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