"We're in Control"

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Instruction Manual

Porter 5 and Porter 10 controllers

This manual applies to Porter boards issue 30-54-01

The Porter is a simple controller designed for electric bicycles, golf caddies, small material handling machines, electric wheelbarrows and similar machines.

It has extremely simple wiring and operates over a wide battery voltage range (12v to 48v) so it is a very versatile controller as well as being economical and simple. It also accepts either a Hall effect throttle or a resistive potentiometer.

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Contents

Dos and Donts

Do read the instructions thoroughly before installing the controller.

Do use proper 6.3mm push-on connectors. 4QD can supply a suitable lead set.

Do read the www site for anything not covered in these instructions.

Do be aware that motor current is (sometimes much) greater than battery current: such controllers operate like transformers and deliver all battery *power* to the motor.

Do be aware that pot and hall maximum and minimum values are dependant on battery voltage. Contact us if in doubt.

Do not solder to the battery and motor tabs or pot connector.

Do not allow the pot wires to touch any other item: if these are accidentally connected to anything this could blow the controller.

Do not allow water to enter the controller or contact the board.

Do not turn acceleration or deceleration adjustments fully clockwise (fast), We suggest no further than 9 o'clock (diagram shows them central at 6 o'clock).

Dismantling

Remove the two cover fixing screws (shown on page 3). Pull the cover away from the heatsink. The cover can now be slid off the 5 way connector.

Re-assembly is the reverse of this. Make sure the cover is correctly aligned with its plastic base and push firmly together at the heatsink end - the board is a close tit into the cover.

Service

In the event of any problem, please contact us by email (esupport@4qd.co.uk) before returning the controller.

Specifications

Bracketed values are for Porter 10.

Operating voltage:	12 - 48v battery
	10v to 60v operating
	68v absolute maximum
	9v absolute minimum
Motor current:	with suitable heatsink (depends on motor.)
	50a (100a) continuous
	75 amps (120amps) for one minute
	95A (190A) typical limit into suitable motor
Battery current:	100 amps maximum allowable.
Ramps:	linear, adjustable, 0-5 seconds (adjustable model)
	fixed rates are possible.
Throttle type:	variable potentiometer (3 wire) or Hall effect
Potentiometer	10K (other values may be used)
	750 Ohm min on 48v.
	500 Ohm min on 36v
Hall effect throttle	1v min, 4v max.
	6mA max current on 48v
	10mA max on 36v
or voltage input:	1v-4v typical
Pot fault detect:	50KOhm approx
Quiescent current	values will depend on operating voltage
when switched off:	typically 2mA at 24v
at zero speed:	15mA typically at 24v with 10K pot.
Reverse polarity protection:	Automatic, electronic
Max reverse voltage	60V

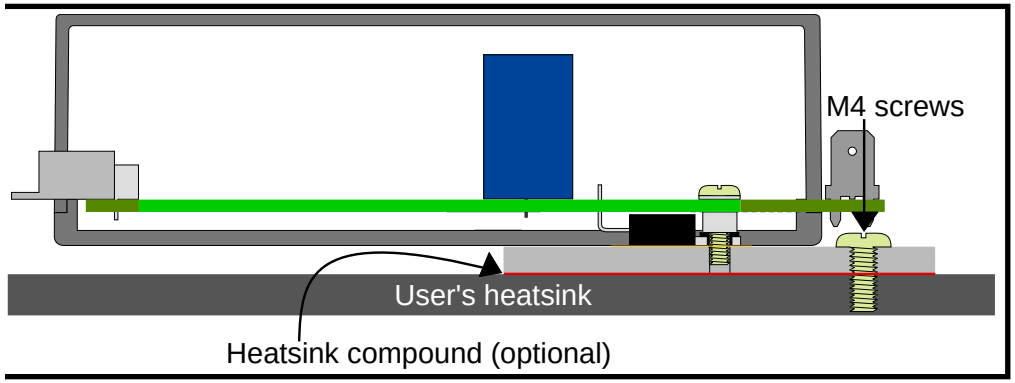
Adjustments

There are two adjustments as shown on page 3. These control the rates at which the motor accelerates and decelerates. Optimum setting depends on your machine but do not choose too fast a rate or you may get jerky and unsafe performance.

Pot fault protection

The Porter incorporates protection such that it will not fail to full speed if the pot goes faulty or a wire brakes. However if the pot zero wire breaks, then the controller will ramp down very slowly to zero speed and, as it does this, the speed pot will have little effect. If this happens, use the ignition switch to ramp down at whatever rate you have the deceleration ramp set to.

Mounting



Mounting of the Porter is the same for the standard version or the board version. The flat aluminium plate should be bolted onto the metalwork of the machine to act as an additional heatsink.

This is shown above.

Mounting holes are 43.2mm apart and are 4.2mm diameter for M4 screws.

The current the Porter gives reduces as the MOSFET (heatsink) temperature increases, so a large, thick heatsink, with good air-flow, will increase the length of time high current can be used. Heatsink compound (thermal paste) should be used between the Porter's own heatsink and your additional one to increase heat flow between them, especially at high currents.

The length of time for which maximum current can be drawn is limited by the speed with which heat can be removed from the integral heatsink to the extra heatsink. As a rule-of-thumb, the heatsink should not be allowed to get too hot to touch.

Water resistance

The box is not sealed, so some thought must be given to mounting it if water is likely to get at it. The box is best mounted horizontally but guard against water falling on the connectors or running down leads and thus into the connectors.

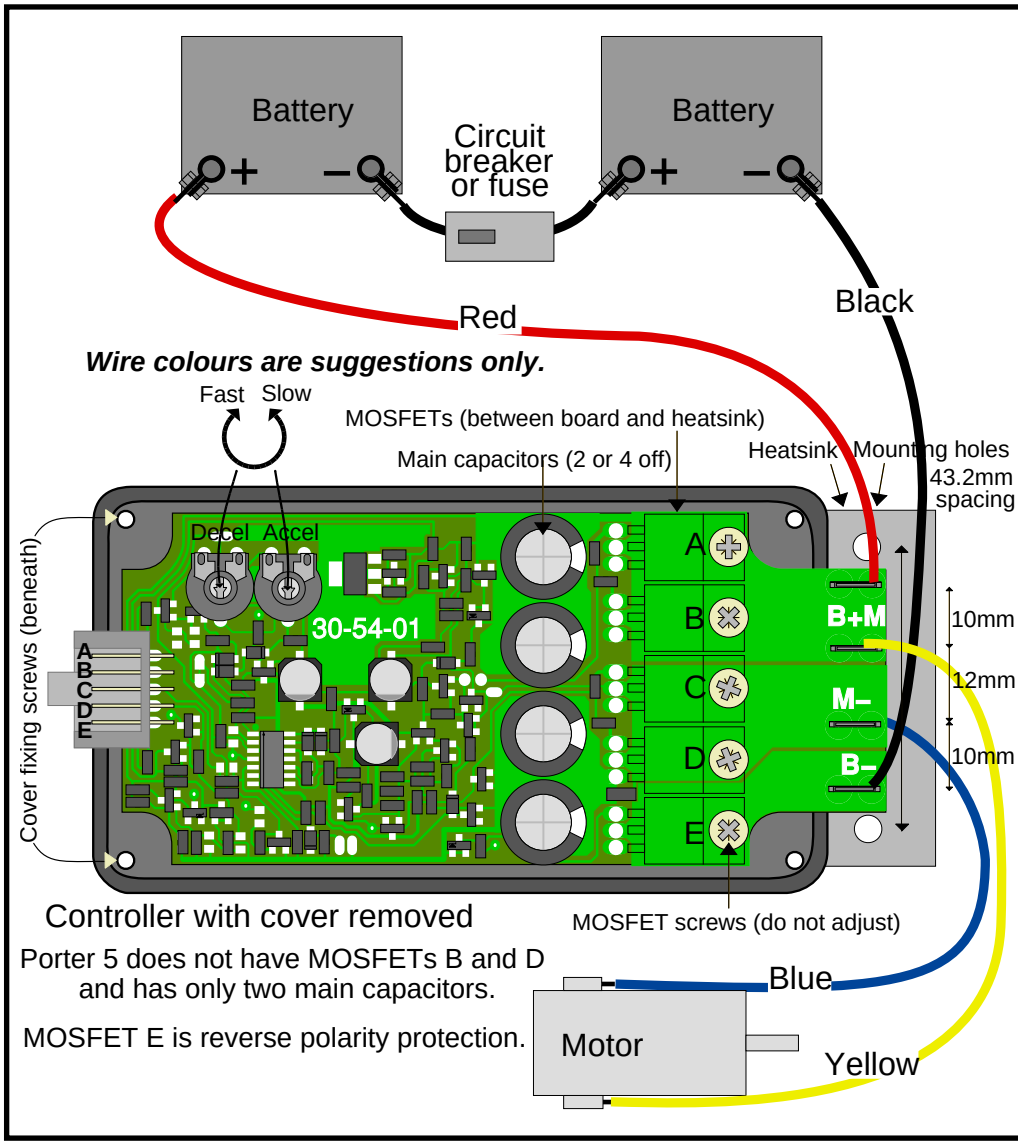
Wiring

Wiring could not be any simpler. Just seven connections as shown in the diagram below.

The seven connections are:
Motor + (internally connected to Battery +)
Motor -
Battery +
Battery -

3 wires for speed pot and ignition.

The controller is available in two versions: the standard version is boxed as shown below. The alternative version is a circuit board only.



Power wiring

2.5mm² cable is adequate for most applications of the Porter 5, but 4mm² or 6mm² may be preferred, especially for the motor and for the Porter 10.

Caution *Take care not to muddle the battery and motor wiring - connecting a battery wire to a motor terminal can destroy the controller.*

Motor Wiring:
If the motor rotates in the wrong direction, exchange yellow and blue wires.

Battery Wiring
Keep battery wiring as short as possible. The Porter is protected against reversed battery (60v max) but will not work with the battery reversed.

Battery Circuit breaker or fuse
A circuit breaker or fuse is advised in the battery connections, to act as an emergency disconnect in the event of a fault in wiring or any other component. In some applications such a circuit breaker is a legal requirement.

A sensible rating for this breaker is the same as the motor's continuous current. Otherwise 30 amp breaker should be adequate for most uses with the Porter 5 or 60 amp with the Porter 10.

Battery and motor current

Be aware that, except at full speed, battery current is always less than motor current. This is because power taken from the battery is all delivered to the motor.

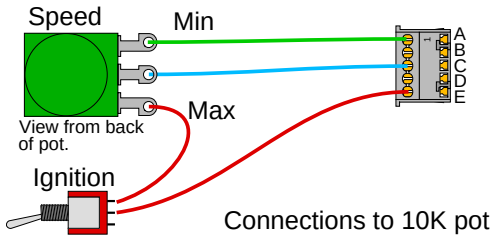
So motor amps times motor current is the same as battery current times battery volts. Motor voltage is less than battery voltage except at full speed!

Therefore at full speed, motor current should not exceed 100 amps, and that not for long, or the reverse battery MOSFET will be destroyed, damaging the circuit board. Actual motor current limit is far higher than this on the Porter 10.

Throttle wiring

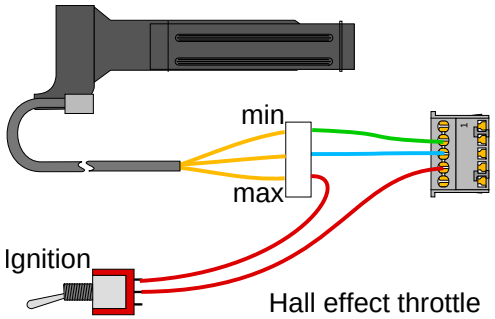
10K pot
connects to pins A, C and E.
The ignition switch may be separate or a switched pot can be used.

This wiring can be used with other pot values, but there may be an increased 'dead' area at top and bottom of pot movement where the pot has no effect, or with values below about 7K, the pot rotation will not quite reach full speed and there may be creep at minimum pot rotation.

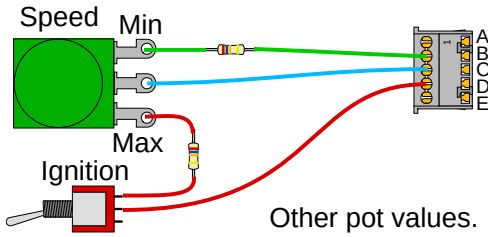


Hall effect throttle
connects to pins B, C and D
It should be the type than gives 1v at zero speed and 4v at full speed. Some throttles are reversed and will not be suitable. Max Hall current 10mA, **for use on 12v and 24v only.**

There are many makes of Hall effect throttle and wiring colours are not standardised.



Other pot values
For values other than 10K the scheme, right, may be used. Minimum pot resistance of 1K.



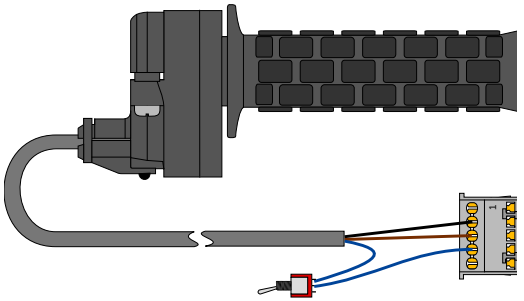
The extra resistors at top and at bottom are optional, but without them there will be a 'dead' area at top and bottom of pot movement where the pot has no effect.

A suggested value for the extra resistors is 1/3 of the pot resistance, so a 5K pot would use 1K5, Exact value is usually not critical - use the next highest value.
Remember that some pots can be ±20% of the stated value. If resistors are too low, you will get some dead travel at top and bottom. If resistors are too high you will loose zero and full speed

If dead travel at top and bottom of pot is not a problem, leave out the extra resistors.

Magura throttle
The Magura throttle, as supplied by 4QD, is 5K so for best control needs two resistors (suggested value 1K5) wired as above.

Be aware that the wires on the Magura are slightly oversize for the supplied connector so there is a small chance of the pins of the connector shorting out.



Ignition switch

An ignition switch should be connected in the pot or throttle circuit to switch off the controller when not in use. Without this switch the controller is still powered up and drains about 17mA from the battery.

When ignition is switched off, the controller will ramp the motor down to zero speed (at whatever deceleration rate you have set) and then switch itself off.

Voltage input

The Porter may be fed from a voltage. This may be a d.c. voltage or it may be p.w.m, supplied from a microcontroller or even 4QD's own DMR-203 radio control interface. The controller will react to the d.c. average value of the applied waveform. This should vary between 1 and 4 volts.

A 10K resistor is required to activate the internal ignition, connected as shown.