

Service & Guarantee

All 4QD's products carry the normal 12 month guarantee. Outside the guarantee period, or when the fault is caused by misuse, we will repair the controller at a fixed price:

This price includes VAT & return carriage (UK only) only when the relevant payment is included with the controller and it is returned to the factory for service.

Eagle 40	£15.00
Eagle 80	£18.00
Hand Control box	£9.00

Other products

4QD manufacture a wide range of controllers for battery vehicles - a range covering golf caddies to small electric cars, and including such things as golf buggies, kiddie cars, wheelbarrows, conveyors etc... The controllers range from 12v to 48v and currents up to 300 amps.

We also supply have a range of accessories such as switches, wires, connectors, LED voltmeters for 12v and 24v,



"We're in Control"

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Instruction Manual

Eagle series controllers

Jack version

Introduction

4QD's Eagle series are cased, economy motor speed controllers for battery operation covering the range of currents up to 80 amps intermittent.

The controller is a high frequency chopper driver giving full motor control from zero to full speed. It uses MOSFETs in state-of-the-art high frequency circuitry to give best possible performance and battery economy. A special feature is the ultra low dissipation circuitry, unique to 4QD, and the smooth, linear acceleration ramp for smooth power take-up.

The usual version of the controller is supplied boxed with a battery connector and with tails coming from the box for the motor.

The circuitry is wide voltage range so the 12v, 23v and 36v versions are all very similar, with only a slight internal change. However because there is a slight internal change they must be used on the correct voltage.

A 48v versions is also possible - contact the factory.

Speed pot input is either via a 3 core wire or, optionally, via a standard 1/4" stereo jack connector.

Optionally, the 12v version only can be supplied matched to our own Eagle Hand Control Box. (-HCB option) instead of the standard 10K pot (-10K option).

The Hand control box (which is covered in this manual) includes a speed control pot, a 3 LED battery voltmeter and an on-off switch. It is suitable, as supplied, only for 12v operation - contact the factory for other voltages.

For board-only applications a version of the Eagle is available. This is called the Egret and is not covered by this manual.

Because this manual covers -HCB and -10K as well as hard-wired options we have marked the numbered paragraphs:

- # These paragraphs apply to the -HCB option controller and to the Hand Control box and must be read even for the simplest installation.
- § These paragraphs apply only to the -10K option.
- ¶ These paragraphs are more technical and may be ignored.

Unmarked paragraphs are of general interest.



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Models

2 basic models are available, for different current ratings: Eagle 40 and Eagle 80.

Both can be used from 12v, 24v or 36v but one resistor must be changed in the potentiometer circuitry.

On Jack connector versions this resistor is inside the box. On hard-wired controllers it may be fitted externally in the potentiometer.

Also available (and covered in this manual) is a hand control box: this is for 12v only operation.

Adjustments

¶ There are no adjustments on board but several performance parameters can be altered by value changes. Contact the factory for details.

¶ Sensitivity

The controller will reach full speed at about 3.5v on the pot slider. This could be increased.

¶ Current limit

This is pre-set but it can be altered by a component value change. The controller is quite safe at the value chosen but since it is more powerful than most golf caddy controllers there may be a tendency for the golfer to use the extra power to help him up hills - this will increase battery drain and may not be desirable.

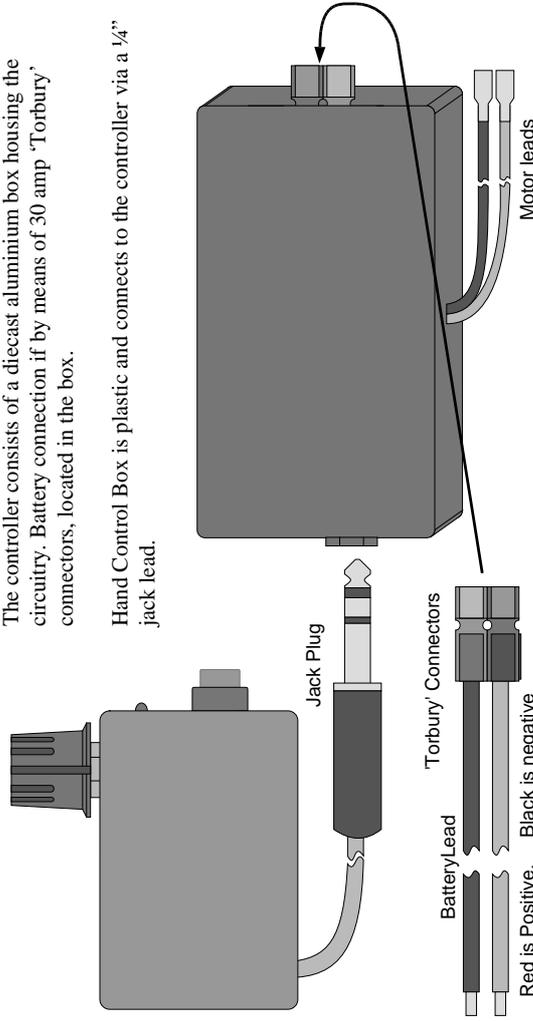
¶ Acceleration ramp

The Eagle has a sophisticated, linear, acceleration ramp to ensure smooth power take up. This ramp is also preset (standard value about 2.3 seconds) but it can be altered by a value change.

Features, boxed unit

The controller consists of a diecast aluminium box housing the circuitry. Battery connection is by means of 30 amp 'Torbury' connectors, located in the box.

Hand Control Box is plastic and connects to the controller via a 1/4" jack lead.



Connection between Hand Control Box and controller is via a standard 1/4" stereo jack plug which is commonly used on this type of controller.

If you do not have the -HCB option all that is necessary to operate the controller is a standard 10K pot - see section 8.01.

You should consider water when mounting the units: although they are not sealed (they need to breathe) they are unlikely to get water into them if you mount them sensibly. However water can be drawn into the joints between lid and base. It can also get in via mounting and other holes. Generally, once water is inside a box, gravity will cause it to run to the lowest point: perhaps you should put a drain hole here to avoid water collecting? Whilst running, what will the water touch? If it drips onto the circuit boards you will have a problem.

Hand Control Box

Water is unlikely to get inside via the pot or the switch. However if it gets into the switch it could sit inside the switch which will not do any immediate damage - unless you switch the controller off without removing the battery! It could get in past the LEDs - but this is quite unlikely. The most likely entrance will be the extra holes you add for mounting and leads.

Controller

Water has a nasty habit of running along motor, battery & jack leads so make a kink near the controller so that any water drips off the lead before it can reach the controller. The controller may get warm and breathe so if it sits in water it could suck this in. If you mount the controller with the lid at the bottom water could not build up inside the controller and would be expelled by any breathing action.

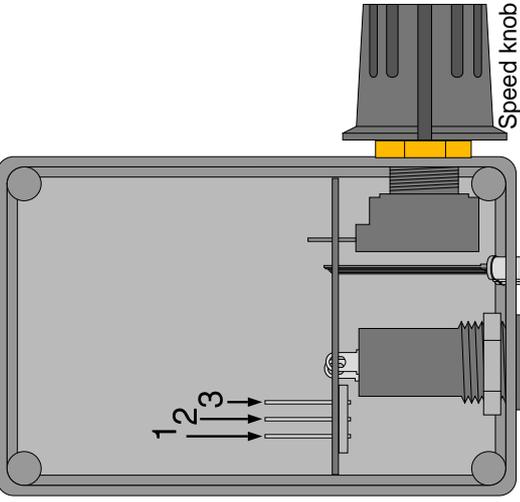
Water could get into the controller via Jack connector, battery connection or motor leads as well as by any mounting holes you make but the jack connector is the most likely entrance. With the lid at the bottom any water that gets in here is unlikely to get onto the circuit board.

Water & waterproofing

All electronic and electrical items object to water but most controllers which have water problems have either been hosed down or they have been for a swim in a pond! Neither will cause an immediate problem since the damage is done not by the water itself but by corrosion caused when the water conducts electricity. If ever you suspect water has got into the electronics (either the controller or the hand control box), disconnect the battery immediately and do not reconnect it until the insides have been thoroughly drained and dried. The circuit boards themselves are varnished and this gives adequate protection against normal humidity and condensation.

Hand Control box.

Straight	Coiled
white	red
red	white
screen	black



The left diagram shows how to fit the crimps into the housing.

Note the two 'tang's on each crimp which latch into the 'windows' on the housing. If you should make a mistake and fit a crimp in the wrong position you can gently bend each tang by using the tip of a ball-point pen (or similar object) through the windows.

The crimps may face east or west but the single one showing the tangs is rotated sideways to show them: they will not fit the housing in this orientation.

White must connect to pin 3, red to pin 2 and screen to pin 1.

Connections in the HCB are to 3 pins as shown in the right diagram, which is numbered as the pins mate with the crimps. The pins are at .1" spacing and will mate with many standard connectors.

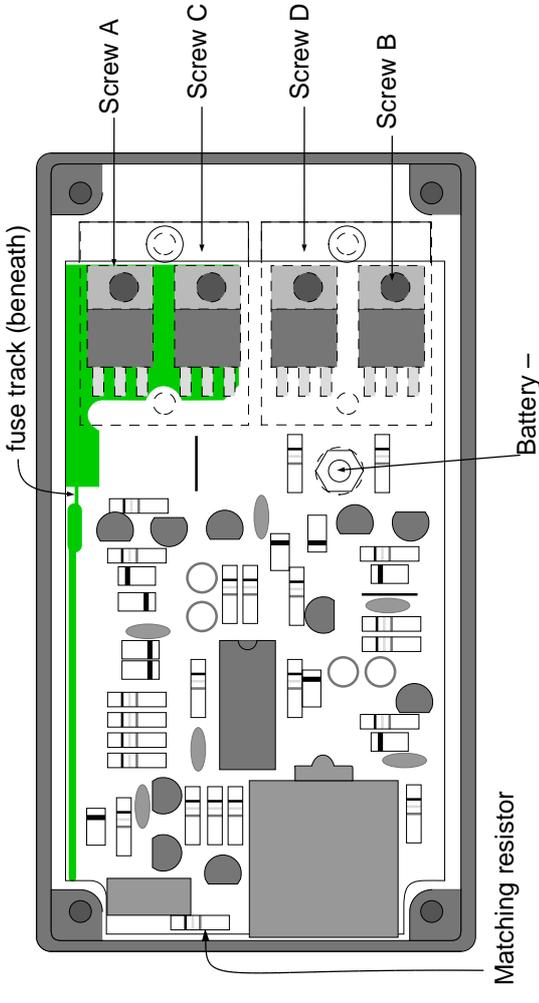
Pin 1 is battery negative and should connect via the screen of the jack lead to the body of the jack plug.

Pin 2 is the pot wiper, via red jack wire to the ring of the jack plug.

Pin 3 is battery +, via white wire to the tip of the jack plug.

When 4QD supply a prepared jack lead, we will crimp terminals onto the wires of the lead and supply

Features, internal



The diagram above shows the Jack input version of the cased controller with cover removed. The hard-wired version with no jack socket is slightly different and the matching resistor may be absent: in this case it must be fitted in the potentiometer circuitry.

Screw A (MOSFET fixing screw) is battery + and motor +ve.

Screw B is motor -ve.

Battery -ve connection should be made to the M3 screw connector.

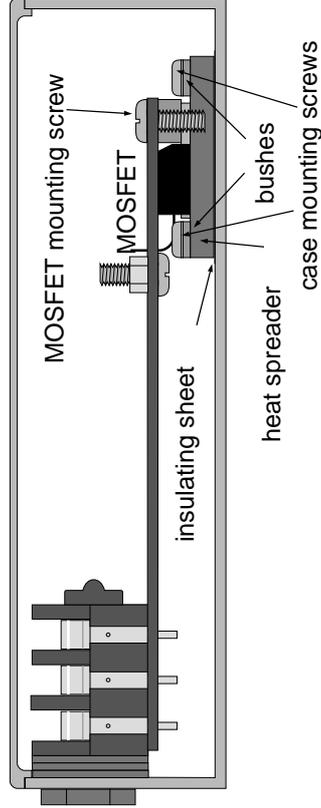
On the 80 amp version two sets of motor leads can be used in which case +ve connections can be to screw A or screw C and motor -ve may be to screw B or screw D as convenient.

The second diagram (below) shows a section through the controller to illustrate the internal construction.

The only component which needs to be changed for the various options is the 'Matching resistor' shown above. The table shows the values for the various versions

Volts	Pot	Resistor	Colour code
12v	HCB	47R	yellow - violet - black
12k	10K	10K	brown - black - orange
24v	10K	27K	red - violet - orange
36v	10K	39K	orange - white - orange
48v	10K	56K	green - blue - orange

See 'Controls' overleaf for fitting this resistor to the pot.



Specifications

Supply voltage	12v or 24v	see section 8.01.
Supply current	20mA	at zero speed
	1mA	standby, pot at zero
Output voltage	0 to 100%	of full speed
Output current	40 amps peak,	nominal
(typical)	Eagle 80	nominal
	Eagle 40	1 minute rating
Switching frequency	20kHz	approximately
Size:	11 1mm x 60mm x 3 1mm	box
hand control box:	71mm x 50mm x 27mm	without knobs,
	93mm x 52mm	board only
Weight	22.5g	Controller
	125g	Hand control box with jack lead,
Input	10k pot	or hand control box
Input volts for full speed	3.5v	approx
Overvoltage (pot fault detect)	6v	approx, at pot slider
Accelerate ramp time	2.3	Seconds to full speed

Mounting

Controller

Fixing holes are not provided in the boxed controller for the very simple reason that we do not know how you will wish to mount it. On quantity orders we can of course supply the box with suitable holes.

If you wish to drill mounting holes on the box, do so with care: remove the lid of the box so you can see what clearance is available inside.

When drilling the box be very careful not to damage the board and be careful to remove all drill swarf: if

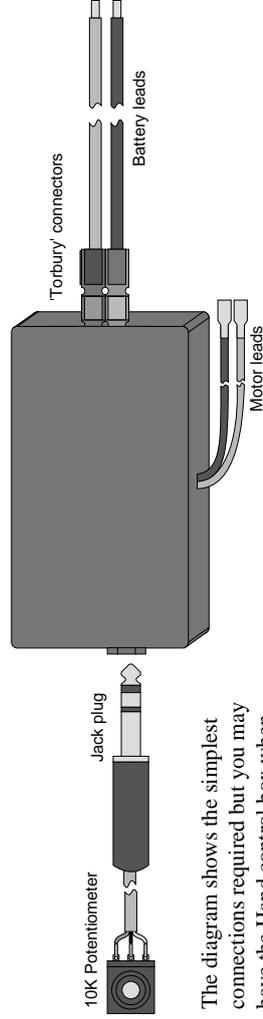
this remains behind it could get onto the board causing a short circuit and possible destruction.

Mounting by the lid may be safest as there is less danger of introducing drill swarf into the works.

Hand control box

For the same reason this has no mounting holes. As well as mounting holes you will need to drill a hole for the jack lead which you may wish to thread through existing metalwork first.

Connections



The diagram shows the simplest connections required but you may have the Hand control box when diagram 3 may be more useful.

Battery wiring

Battery connections to the controller are via a 30 amp Torbury connector, shown in the diagram above.

Beware! the controller is not protected against reversed battery which will instantly destroy the controller. The 'Torbury' connector is colour coded and polarised so you should not be able to reverse polarity at this point but this does not apply to the battery connections themselves - which are outside out control.

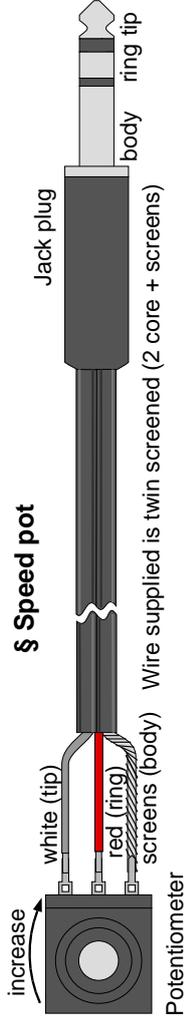
We suggest you do not use crocodile clips for battery connection - they are not good and are too easy to connect wrongly. You do not need quick release battery terminals since you will unplug the Torbury to disconnect controller from battery so permanent battery connections are fine.

Standard lead length supplied is 50cm. If you can shorten this, do so but we suggest you do not lengthen it: in common with all similar controllers the work the controller has to do depends strongly on the battery lead length. Leads which are too long can reduce the available power and can cause the controller to get slightly hotter, wasting battery power. Note that lead length is the important thing: using thicker wire will not compensate for the extra length.

Motor wiring

This is supplied attached to the controller and total lead length is 35cm (some of which is inside the box). Other lead lengths are available. Standard motor connections supplied are 9.5mm push-on blade connectors to suit EMD motors which are the commonest. Other connectors can be supplied by negotiation.

Controls



You should use a 10K linear pot. Other values from 1K to 100K, linear or log, can also be used, but will require a value change inside the controller.

The diagram above shows the wiring for a 12v controller using a 10K pot and jack lead (as supplied by 4QD).

The diagram, right, shows the pot with matching resistor as used on the hard-wired controllers. This resistor is the only change for 12, 24v and 36v operation.

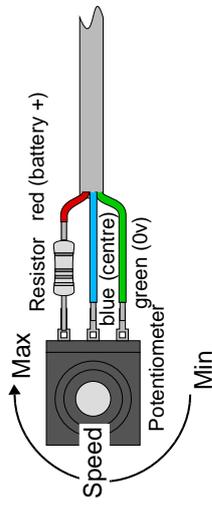
With this resistor, red and green are directly

\$ On/Off switch

When the pot is at zero speed the circuitry in the Eagle shuts it down so it draws no current - the only current drain will be that through the pot, less than 1mA, which is insignificant.

connected to the battery sp may also be used to drive a battery condition meter.

But beware: if you short these together, something must blow! There id a fuse track on the board, but it means dismantling the controller.



However you may if you wish fit a switch in series with the tip lead (white wire) to switch off the pot and controller. The advantage is that the speed pot can be left at its usual setting when it is switched off.