Adjustments

There is one adjustment on board. This should be set to suit supply voltage and pot.

To set it, chock up the machine so that the wheels are free to rotate and turn your speed pot to maximum and adjusting the preset whilst listening to the motor. Turn the preset so that the motor is at full speed and will not go any faster.

The correct setting is slightly above the point where the motor stops increasing speed.

Several performance parameters can be altered by value changes. Contact the factory for details.

¶ Current limit

This is pre-set but it can be altered by a component value change (reduce the resistor marked c/l). 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 Egret 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.

on the features diagram (page 2) a capacitor and a resistor are marked 'ramp' . Standard value is 1µ0 and 330K. Reducing the value of either component will reduce the ramp time pro-rata, so reducing the capacitor to 0.47µ will approximately halve the ramp time as will reducing the resistor to 150K.

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.

Egret 20-I	£12.00
Egret 40	£12.00
Egret 40-I	£16.00
Egret 80	£16.00
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"

4QD

Office
30 Reach Road,
Burwell
Cambridgeshire, CB5 0AH
Fax: 01638 744 080

Stores
Unit 6A
Heath Road Industrial Estate
Burwell
Cambridgeshire, CB5 0AP

"We're in Control"

See us via the Internet: http://www.4QD.co.uk Email to: support@4QD.co.uk

"We're in Control"

4QD

Office
30 Reach Road,
Burwell
Cambridgeshire, CB5 0AH
Fax: 01638 744 080

Stores
Unit 6A
Heath Road Industrial Estate
Burwell
Cambridgeshire, CB5 0AP

"We're in Control"

See us via the Internet: http://www.4QD.co.uk Email to: support@4QD.co.uk

Instruction Manual

Egret series controllers

Introduction

4QD's Egret series are bare board, 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 as a bare board with 6.3mm push-on blades for battery and motor connections. A base and cover are also available.

The standard controller will work on 12v, 24v 36v and 48v , with only one adjustment needing to be made.

Speed pot input is via a 3 pin connector (supplied).

A fully cased version of the controller is available. This is called the Eagle and is not covered by this manual.

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

¶' These paragraphs are more technical and may be ignored.

Unmarked paragraphs are of general interest.

Safety

The Eagle is very reliable. However no electronic equipment is ever 100% reliable and if a failure does occur, it is theoretically possible for the controller to fail to full speed. The Eagle does not contain any internal emergency battery disconnect device. It is therefore up to the user to determine what will happen in the event of such a failure and to take appropriate action.

This is the reason why the Eagle is not suitable for passenger carrying machines.

The Eagle also has no main capacitor in it, relying on the battery as a large capacitor. The leads between battery and controller must therefore be as short as possible or performance and reliability nay degrade.

3rd February 2003

Contents

Models

4 basic models are available, for different installation and current ratings:
Egret-20-II
Egret-40-I
these have insulated MOSFETs (power devices)

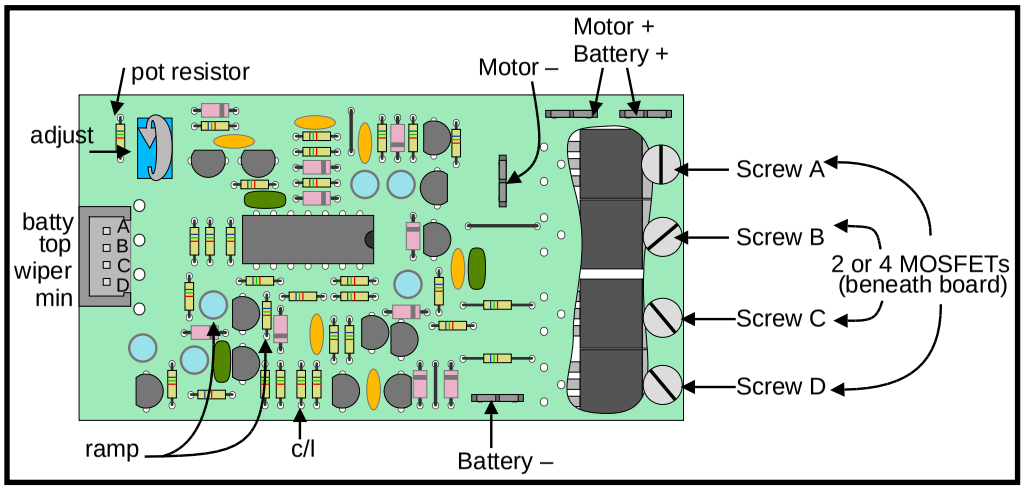
Egret-40-S
Egret-80-S.
which have non-insulated MOSFETs (power transistors)

The standard versions of them all can be used from 12v, 24v, 36v or 48v - the undervoltage cutback is around 10.5v.

For quantity orders undervoltage level can be supplied suitable for the appropriate battery.

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

Features



The only change to be done is to adjust the preset (marked ‘adjust’) so that the motor reaches full speed on the desired battery voltage slightly before the throttle pot reaches maximum rotation.

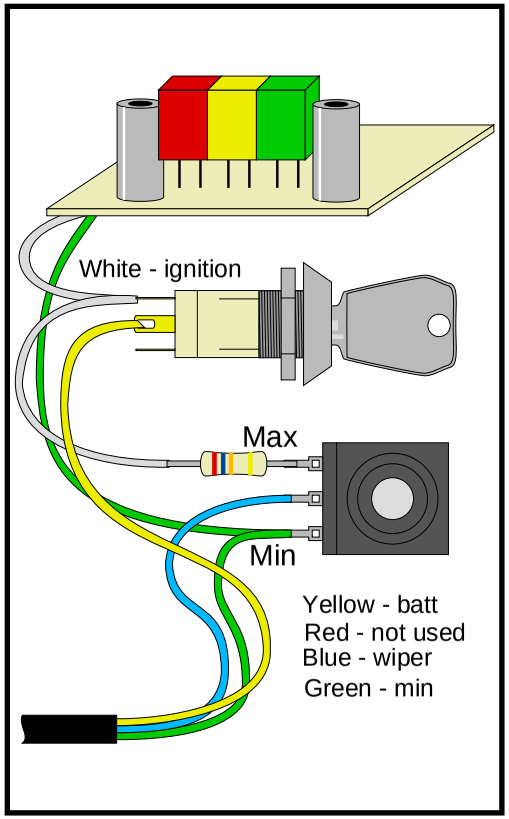
Undervoltage
This feature is intended to stop the controller from over-discharging the battery. However in practise can cause as many problems as it cures. Therefore the standard board has it set to a level suitable for a 12v system and it is usually not necessary to alter it for higher voltages.

Battery Condition meter

A Battery Condition Meter can easily be fitted between pin A of the connector and pin D (green wire to pot). However you will probably want to fit an ignition switch to turn this off.

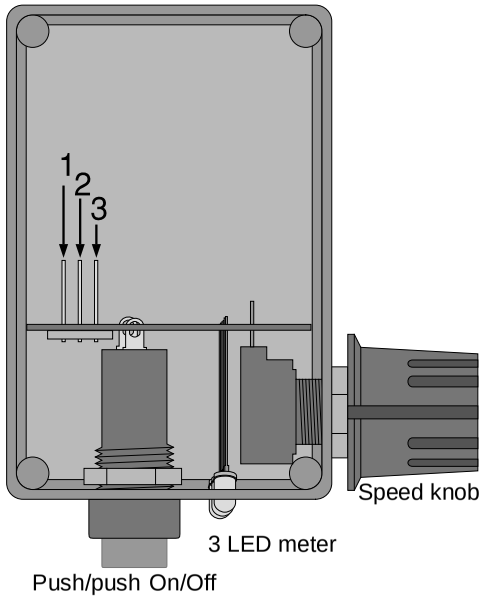
If you want the ignition switch also to disconnect the pot, then the pot’s max connection can be connected from the battery positive, via the ignition switch as shown below.

Note that a resistor (10K) is now fitted in the top end of the pot. If this resistor is not fitted, the pot fault detection circuit in the controller will be disabled and the controller could go to full speed if the pot or wiring becomes faulty.



With the Magura on 12v,- **do not** fit the 10K resistor, connect the top of the pot direct to the white wire from the ignition switch. You need the resistor for other voltages.

Hand Control box.



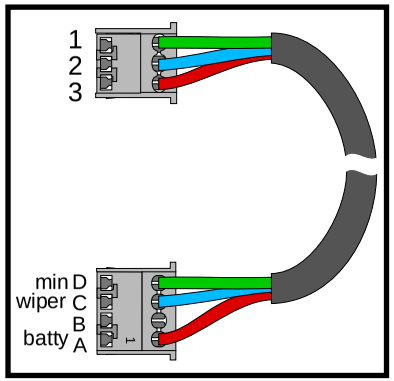
Connections in the HCB are to 3 pins as shown. These are at .1” spacing and will mate with many standard connectors.

Pin 1 is battery negative and should connect to the 'min' pin of the features diagram. Usually this is a green wire..

Pin 2 is the pot centre (blue) to the 'wiper' pin.

Pin 3 is battery +, via red wire to pin 4.

A made up lead would look like the drawing below.



Battery

Beware! the controller is not protected against reversed battery which will instantly destroy the controller. For this reason you should not use crocodile clips for battery connection - they are not good and are too easy to connect wrongly.

Standard length of leads supplied by 4QD with the boxed version (the Eagle) 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

The controller is designed for a common permanent magnet type of motor. Some other types can be used but you should seek advice is necessary.

We suggest you fit a motor suppression capacitor across the brushes. This should be a ceramic capacitor, value around 10nF and should ideally be fitted inside the motor at time of manufacture. However, if one is not present fit it between the brushes, as close as possible to the motor body.

This will help suppress motor noise, which is necessary to pass E.E.C. legislation and which may on rare occasion actually cause controller failure.

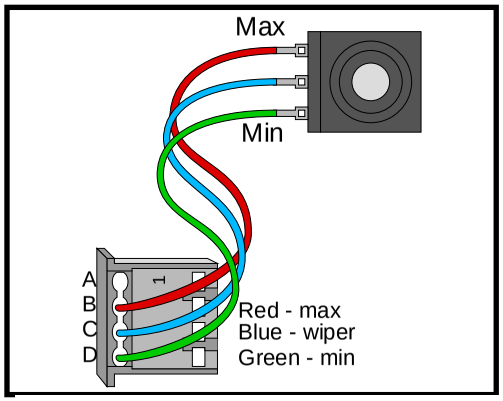
Controls

Speed pot

You should use a 10K linear pot. Other values from 1K to 100K, linear or log, can also be used, but you should not use low value pots on higher voltage systems.

The diagram below shows the wiring for a standard 10K pot (as supplied by 4QD).

The 'Adjust' preset should be adjusted so that you just get full motor speed at full throttle, with a nearly discharged battery.



Magura Twist Grip

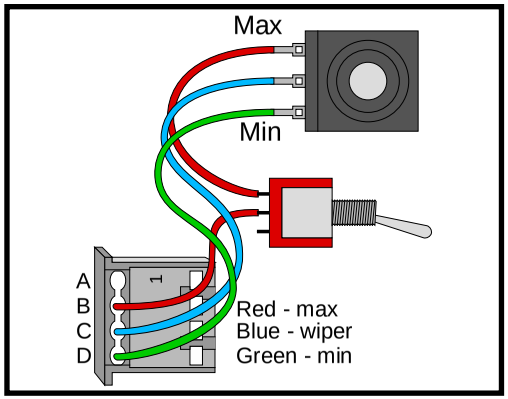
For 24v operation, connect the Magura as shown above for a standard pot. Wire colours as on the sheet supplied with the Magura.

On/Off switch

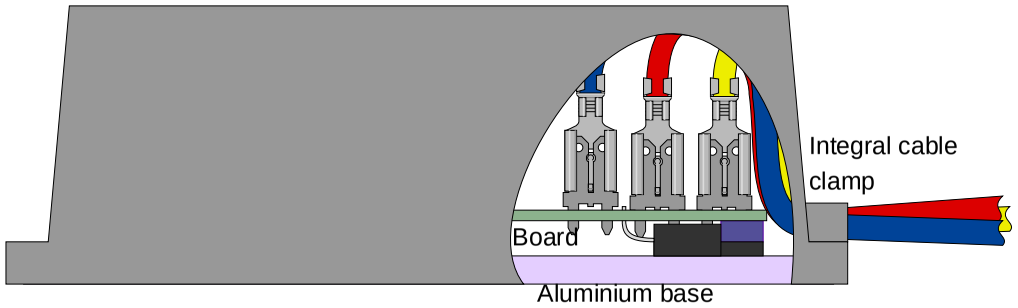
Do not switch off the controller by disconnecting the battery..If the motor is moving when you do this, you may damage the controller.

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

However you may if you wish fit a switch in series with the red lead to switch off the pot and controller as shown in the diagram below. The advantage is that the speed pot can be left at its usual setting when it is switched off and when off, not even the pot draws current.



¶ Features, optional boxed version.



The diagram above shows the cased controller with cover cut away to show the board.

Specifications

Supply voltage		12v , 24v, 36v and 48v	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	Egret-20-I	15A continuous	no heatsink
(typical)	Egret-40-S	15A continuous	no heatsink
	Egret-40-S	40 amps peak,	nominal
	Egret-80-S	80 amps peak,	nominal
	Egret-40-S	37 amps typical	1 minute rating on suitable heatsink
Switching frequency		20kHz	approximately
Size:		111mm x 60mm x 31mm	box
hand control box:		71mm x 50mm x 27mm	without knobs.
		93mm x 52mm	board only
Weight		75g	Controller
Input		10k pot	or hand control box
Input volts for full speed		3.5v	approx
Overvoltage (pot fault detect) (feature must be enabled)		6v	approx, at pot slider
Accelerate ramp time		2.3	Seconds to full speed
Undervoltage		10.5v	12v and standard version
		21v	24v version to order, subject to quantity.
		32.5v	36v version to order, subject to quantity.
		42v	48v version to order, subject to quantity.

Mounting and heatsinking

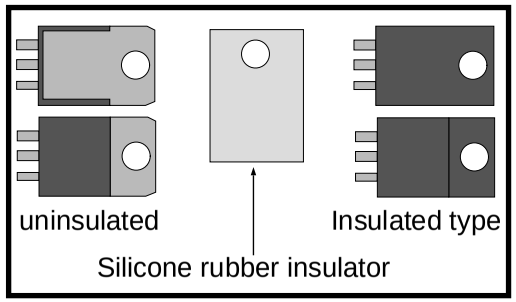
There are two basic versions of the Egret board. one (-I versions) use all plastic insulated MOSFETs (shown on the right of the diagram) and the other (-S versions) uses non insulated MOSFETs (shown on the left). Note the metal pad in the base of the non insulated ones.

This metal pad is electrically live so insulators must be used between these MOSFETs and the base used for mounting. An insulator is shown in the centre of the diagram and they are supplied with the metal MOSFETs and are not needed with the plastic ones.

These MOSFETs do a lot of work and therefore can get very hot. This heat must be removed from the MOSFETs or they will overheat and not work efficiently. The all insulated MOSFETs are clearly easier to mount as they don't require insulators - but heat doesn't get out of them as well as through the metal based ones, so they will give less current.

For best performance therefore (with either version) the MOSFETs should be in firm contact with an aluminium base-plate which will remove the heat. Essentially, the thicker this plate the better the performance. a 3mm thick aluminium plate is suggested, or better, 4mm.

The diagram below shows the -I version mounted on such a plate. The lower diagram shows the -M version with screws and silicone rubber sheet insulators in place ready for mounting.



Both versions are to be mounted by M3 screws through the circuit board, plastic bushes and MOSFETs into the base-plate.

Tightening the screws will clamp the MOSFETs against the metal base to allow cooling.

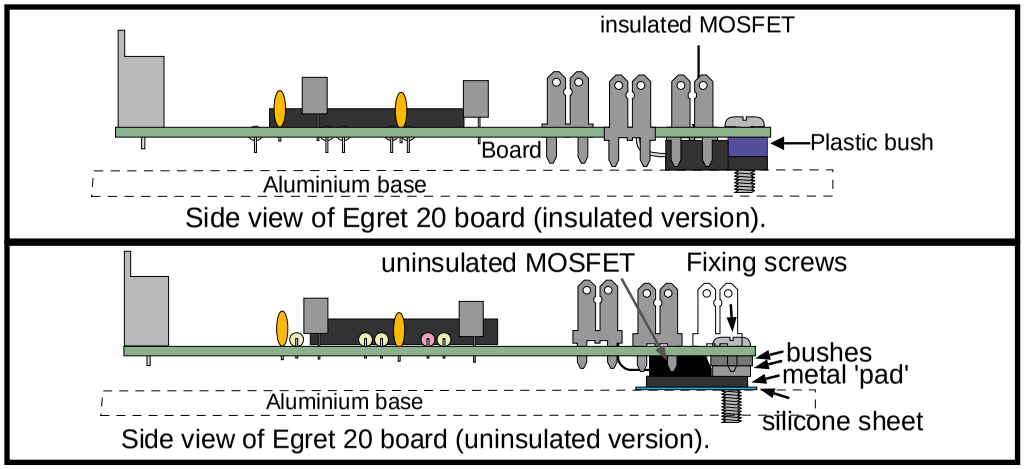
Make sure you don't dislodge the plastic spacing bushes between circuit board and MOSFETs: these are captive so won't easily be dislodged.

The two MOSFET version require holes A and D, 4 MOSFET versions naturally require all 4 holes.

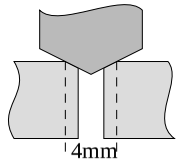
Warning: If operated without a heatsink the MOSFETs can get hot enough to cause severe burns. **Do not touch them!**

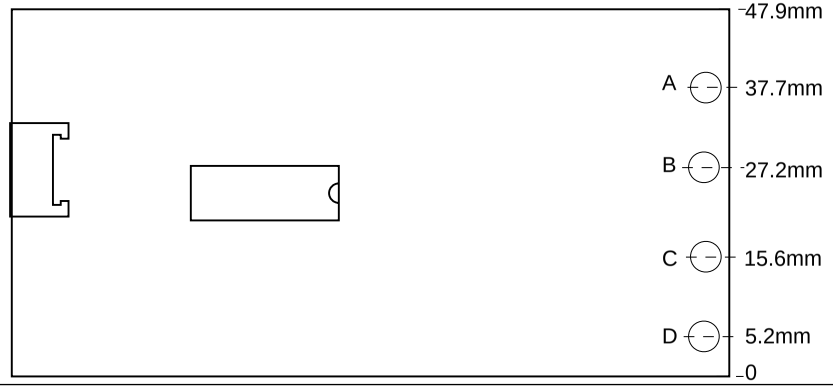
All mounting holes must be carefully de-burred and cleaned: aluminium swarf trapped beneath the MOSFET will degrade performance.

When installing the -M version. take care to position the insulators squarely beneath the MOSFETs and not to tear the holes when inserting the screws. Also keep the insulators clean: swarf or dirt can easily puncture the insulators and destroy them. This may damage the controller!



On the Eagle 80-M (which uses 4 MOSFETs) space is tight so it may be easier to use a piece of un-pierced silicone insulator. If a small counter-bore is made is the base plate as shown, this will centre the screws so that they cleanly punch their own holes through the insulating sheet.





Water and waterproofing

All electronic and electrical items object to water so you should consider this when you chose a mounting position or housing for the board.

Usually water does not cause an immediate problem but will cause damage 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 re-connect 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

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 & other leads so make a kink near the controller so that any water drips off the lead before it can reach the controller.

Connections

Wire size

For the -20I and -40, 2.5mm² cable is usually adequate though 4mm² may be preferable for the -40 versions.
For the -80 version, 4.0mm² or even 6.0mm² is definitely indicated.