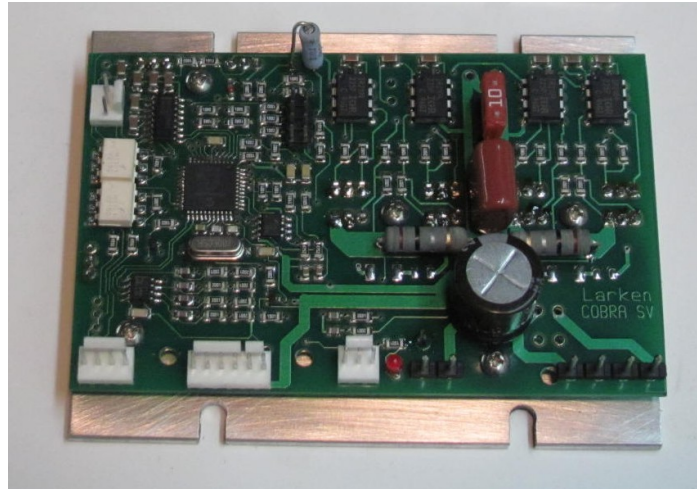


Cobra SV 60 Manual V1.0

Last edited Jan 11 2016



Cobra SV 60 Closed loop stepper drive

- 16 bit DSP processor
- Closed loop “step correcting” algorithm
- Opto-Isolated Step / Direction inputs
- Fault output signals drive has tripped
- Onboard fuse (protect motor and for safety)
- 500 or 1000 line encoder compatible
- Separate internal voltage regulator for encoder
- Settings are programmable by RS232 by CobraTune

DISCLAIMER

Larken Automation assumes no responsibility for any personal injury or damage caused by use of its products. Only electrically qualified personal should attempt to install the Viper drive.

High voltage can be lethal and proper safety procedures must be followed. Motors and drives should be properly grounded to prevent electrical shock.

Safety glasses should be worn ,since electrical components can explode causing injury or blindness

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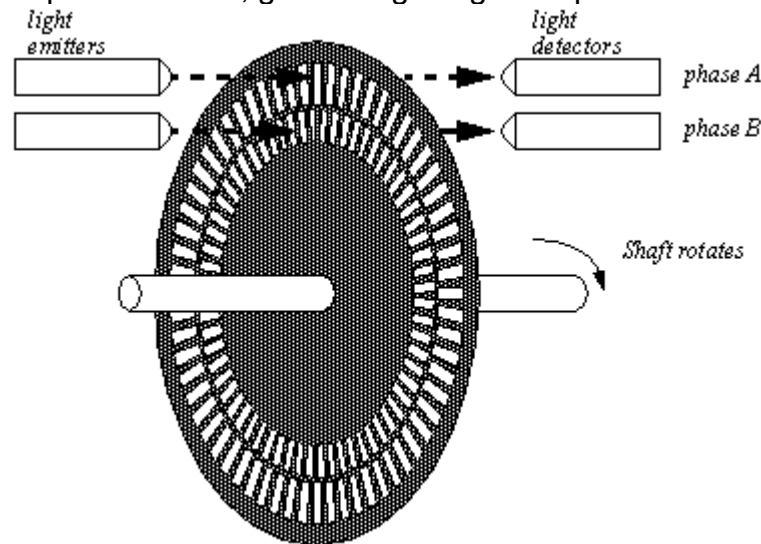
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Encoder Basics

The Closed loop motor needs an optical encoder that provides feedback to the controller. The cobra sv can use encoders that have 500 or 1000 lines per turn. The most popular type of encoder is the optical encoder, which consists of a rotating disk, a light source, and a 2 photodetectors (light sensor). The disk, which is mounted on the rotating shaft, has many slots in it. As the disk rotates, these slots interrupt the light emitted onto the photodetector, generating a digital or pulse train.



The encoder has 2 square wave outputs. They are staggered at 90 deg. This way one is leading the other when turning CW and then trailing the other when turning CCW. These are Channel A and B. The controller can tell which way the motor is turning by the A-B sequence

There may be an optional Index output also. (The index is not used by the Viper)

A **differential encoder** has 2 outputs for A channel and 2 outputs for B channel. The second output is an inverted version of the original and is designed to drive a twisted pair cable to cancel noise. Differential encoders are recommended for motors with cables longer than 4-6 feet.

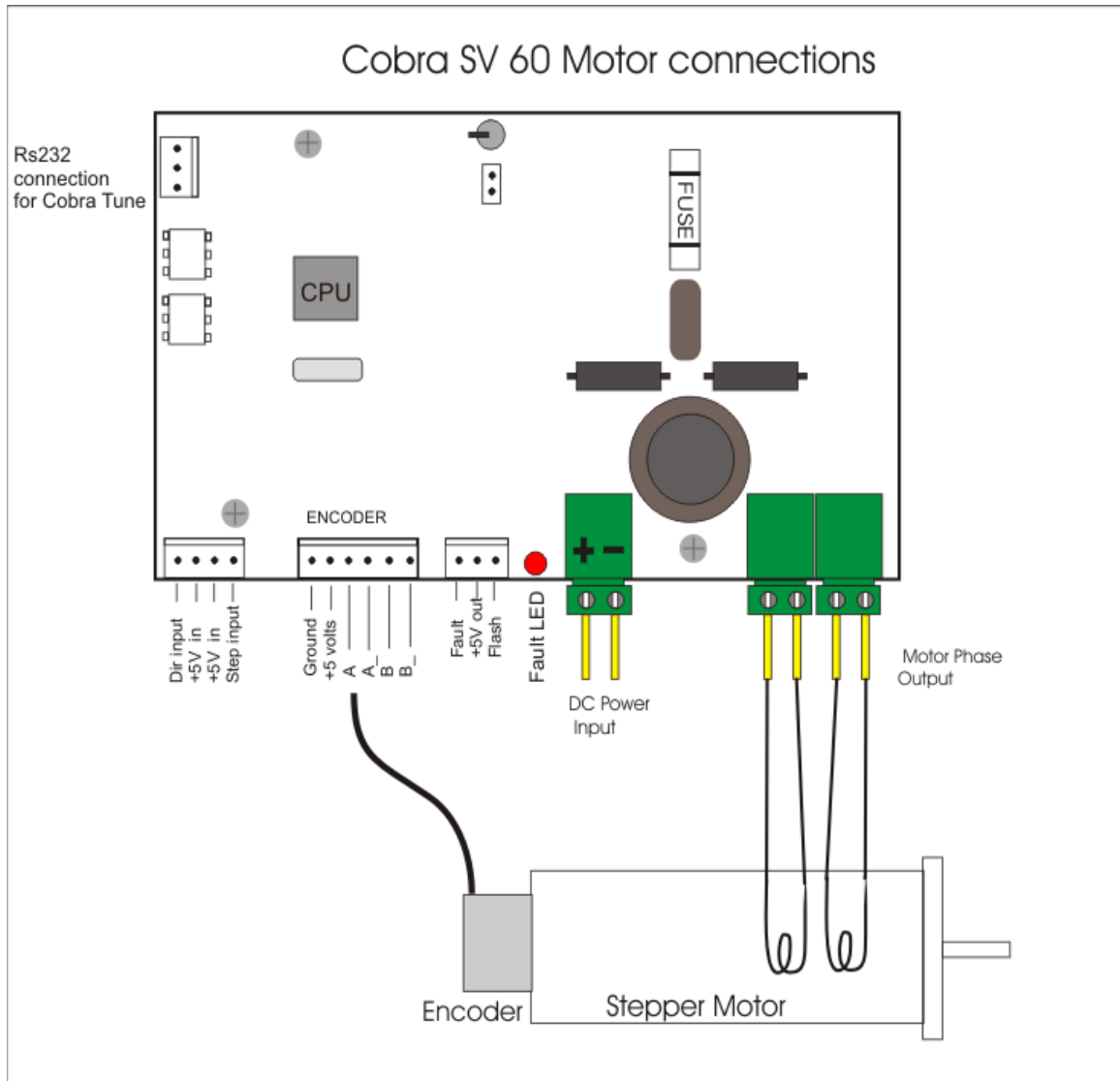
Encoder Line count is the number of lines per turn. With-in the viper drive the line count is decoded 4 times finer (quadrature), so with a 1000 line encoder, the viper drive sees 4000 counts/turn. This is not to increase machine resolution, but to give the drive more counts to reduce error.

The cobra can use a 500 or 1000 line encoder, because the internal resolution is rendered to 2000 counts. With a 1000 line, it uses 2X decoding. And with a 500 line it used 4X decoding.

A differential encoder is always recommended because it rejects noise.

A good source for encoders is US-Digital.com

Viper 60 Connections



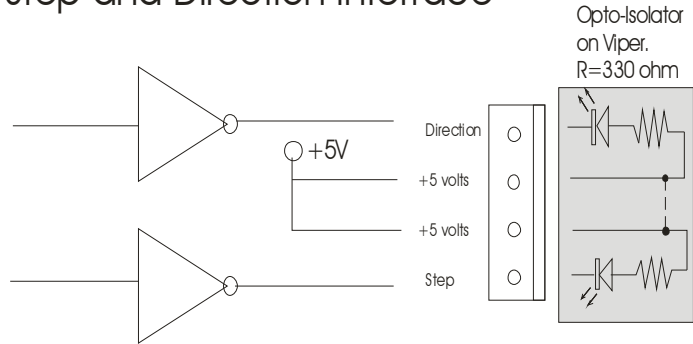
The cobra is recommended to be used with standard (1.8 deg) size 23 or size 34 stepper motors with a 500 or 1000 encoder attached.

The current is selectable with 8 levels between 2 and 5.5 amps. (motors with less than 2 amps per phase are low performance and are not a good choice anyway)

Be careful not to short any of the motor phase wires to each or ground or the drive can be damaged.

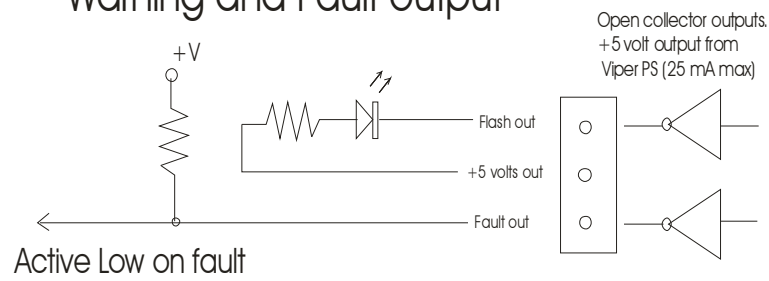
You will need test that the encoder is counting up when the step pulses are counting up. Use the viper tune to check this. If the Encoder is counting down when the motor is counting up, Either use the **Reverse Encoder wires** checkbox in software or switch one phase of the encoder wires in the encoder cable. The count on the Cobratune screen will roll over at 1999 counts back to zero.

Step and Direction interface



Note: This was incorrectly labeled in version 1.6

Warning and Fault output



Active Low on fault

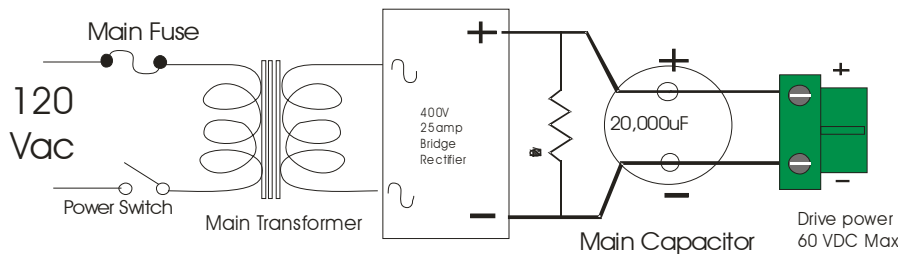
(Negative is common with Input power Gnd)

Cobra 60 Power supply recommended layout

Important :

-Keep wires between Main capacitor and Viper Drive less than 8" (20cm)

-Do Not put Breaker or Disconnect between Main capacitor and Viper Drive



The Cobra 60 uses a single supply voltage of 60 volts maximum. Also we recommend a powersupply voltage not lower than 35 volts. Lower than 35 volts will produce poor performance.

The drive uses a internal voltage stepdown regulator to get its +5 voltage for cpu and encoder. This can generate a lot of heat so the drive should be **well heat sinked**.

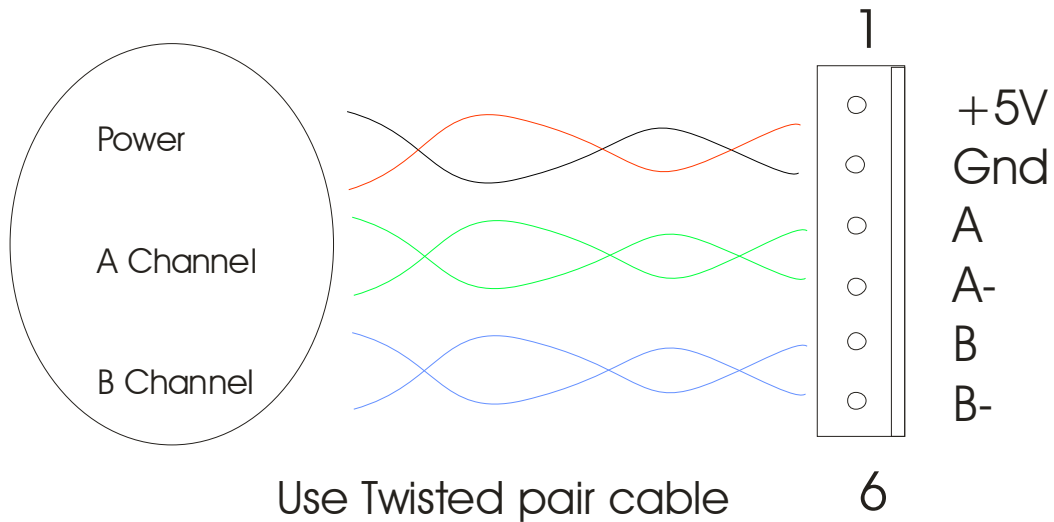
- The main transformer voltage is to match motor voltage requirements.
($DC\ volts = AC\ voltage \times 1.414$)
- Keep the main DC power wires short, typically 10" (25cm) or less. This is necessary because the drive is switching a 20 Khz power signal to the motor. This frequency is present on the incoming power wires and the longer they are the more inductance there is. This can cause voltage spikes to exceed ratings of the mosfets and capacitors reducing component life.

The Cobra 60 CPU will stay active until its voltage goes below 3.5 volts. This means that when you turn off the power supply and turn it back on before the voltage has decayed below 2-3 volts the viper may not have reset. The Viper 60 also has a under-voltage Fault to protect the mosfets incase the power supply goes below 15 volts and an over-voltage fault if the voltage exceeds 62 volts.

The Discharge Resistor is required to drain the power supply faster to allow the Viper 60 to get below its 2 volt reset voltage.

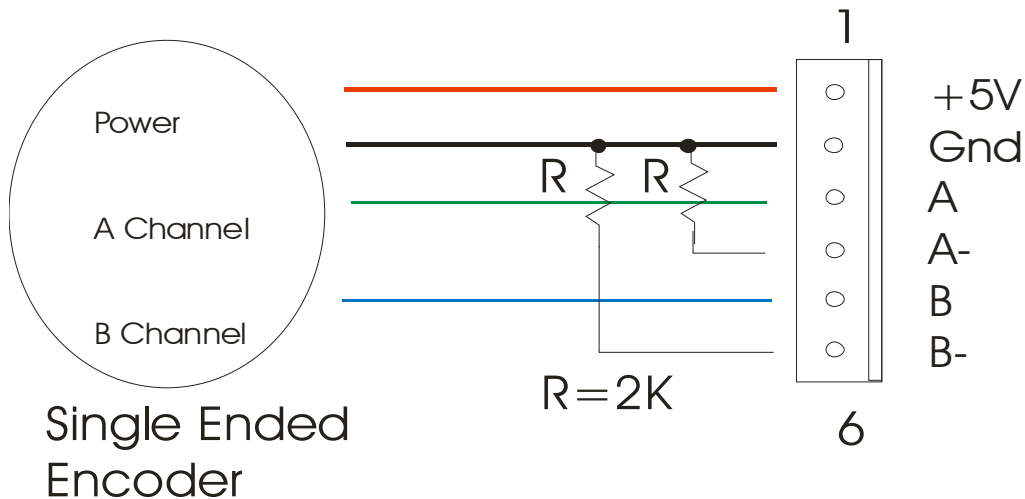
The Fuse is a mini Automotive type and should be 5-10 amps depending on your motor current. Note: A stepper drive never draws as much current as is going to the stepper motor, because of the switching conversion ratio. If your motor is rated at 5 amps per phase(10 amps total) , the drive will probably never draw $\frac{1}{2}$ of this value. The fuse is a safety requirement to protect the motor windings from burnout and protect external wiring in case the drive fails .

Differential Encoder Connections



Note : Diagram shown for a differential encoder. For a single ended encoder, use just one connection per channel. Use (stranded) twisted pair cable for encoder wire. Use shielded wire if available. Connect the shield on *one end only* to avoid current flowing in shield.

Single Ended Encoder Connections



Encoder Current

Note: Encoder current is limited to **75ma on the Viper 60** due to heat caused by the internal voltage regulator dropping the Main voltage down to 5 volts

Encoder connections

Pin 1	Common Gnd
Pin 2	+5 volts out for encoder power
Pin 3	Channel A input
Pin 4	Channel A input (inverted)
Pin 5	Channel B input
Pin 6	Channel B input (inverted)

Single Ended encoders

When connecting a single ended encoder, the unused input should be pulled to ground with a 2K ohm resistor (2000 ohm 1/4 watt).

Terminating long cables

A differential encoder is recommended for any cable longer than 6 feet (2 meters). For very long cables it is sometimes necessary to put a terminator resistor across the differential pairs . The resistor value is usually 150 ohms (1/4 watt), A 0.05uF capacitor may be put in series with the resistor to reduce power consumption..

Error Indicator LED

When an error is flashed, the Cobra will hold down the Estop signal until the error is removed. You can add a Fault override switch (normally closed) in this estop line to allow the operator to jog the machine while holding the switch to recover from a warning error.

It will flash the RED led a count indicating the error number

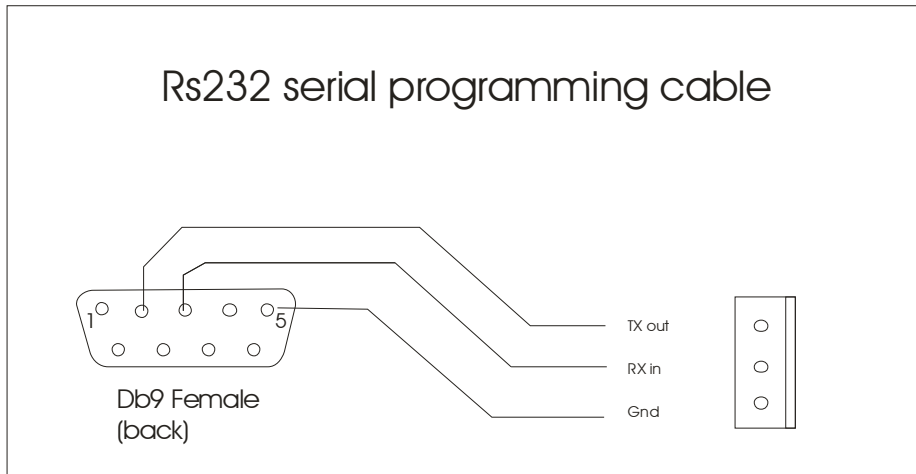
LED error count

- 6 Encoder Trip (e setting)**
- 7 Encoder Trip (400 counts exceeded)**
- 8 Under voltage fault**
- 9 Over voltage fault**

Errors can be reset by holding the reset line low then high or using the 'x' command through the terminal.

The reset line will also disable the drive, and the drive will soft restart when the reset is released.

Programming using RS232 interface and Vipertune

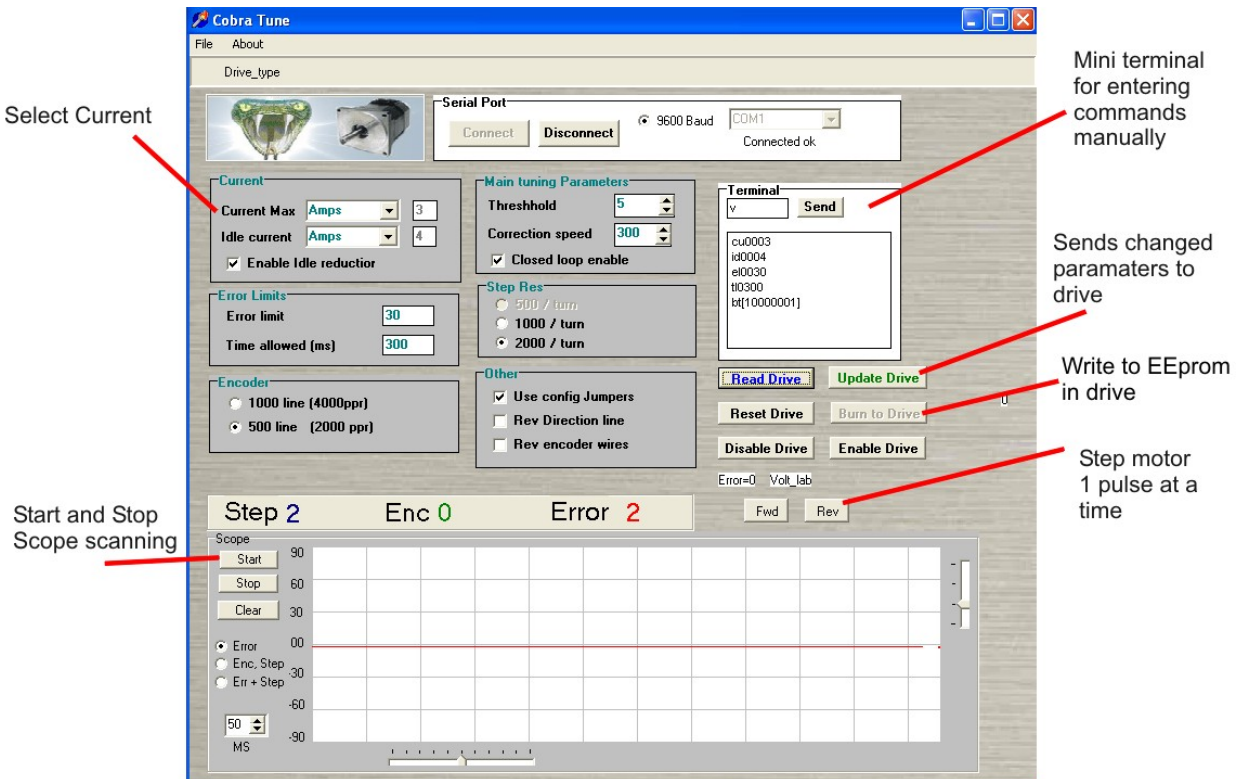


The programming cable can be supplied by Larken Automation.

If your computer doesn't have a RS232 port, you can be used with a USB serial converter. If it requires settings, they are 9600 baud, 8 bit 1 stop bit and no parity.

Using Cobra Tune

You can download the Cobra tune software free from www.Viperservo.com Unzip the file and click on the Cobratune.exe file.



With the RS232 cable connected and power to the Cobra drive, click on the connect button. You should see "SV60" (sent from the drive) appear in the terminal window. If you click on the send button (with v in the data box beside the button) you should see a response from the drive, displaying the firmware version such as " V1.2 "

Click "**Read Drive**" to read the drives stored settings.

If you change settings on the screen, use the **Update Drive** button to send the parameters to the drive, then if you want to keep the setting, use **Burn to drive** to store them in the EEPROM.

Programming

The drive can be run in open-loop an a regular stepper drive is no encoder is connected. If it is, uncheck the closedloop enable check box

Select the current form the **Current Max** drop down menu . The viper has 8 selectable current levels. You can also enable/disable current reduction on Idle and set it to 3 levels.

Select whether you are using a 500 or 1000 line encoder. Note: this setting is only read when the drive powers up, so if you change it, you must update drive, burn to drive and reset the power to the drive.

Programming continued..

The **Use config Jumpers** check box allows you to either use the on-board jumpers to set the Motor Current and Step resolution or have them set by programming.

The **Rev Direction line** checkbox allows you to reverse the motor direction. This can be used for easier connecting to controllers that don't have programmable pin control on their step/dir output.

The **Rev Encoder wires** checkbox allows you to reverse the encoder counting direction without switching encoder channel wires.

You can select the step resolution between 1000 or 2000 counts per turn with the 1000 or 2000 radio buttons.

Error limits (closed loop only)

The **Error Limit** parameter is the number of error counts the drive will fault at, if the error exceeds this parameter for a specific time. (Note: when drive faults, it activates the Fault output line on the fault connector and also turns off closed loop correction)

The **Time Allowed (ms)** parameter is the time the *Error Limit* setting has to be exceeded before a fault happens. (Note: This number is a uncalibrated timer by a software loop, so try different settings to see which produces the desired time. The higher the number the longer the time.)

Settings for Closed loop correction

When the Cobra see's a difference between the commanded step position sent by CNC controller and where the encoder show the motor shaft to be. This is called error. The CobraSV will try to correct the position by adding steps to turn the motor shaft back reduce the error. Note: 1 error count is 1 / 2000th or a motor revolution.

All the closed loop correcting is done based on the 2000 steps per turn, no matter what the step resolution is set to (500,1000 or 2000) If the error ever exceeds 400 counts, the drive will fault instantly (ignoring the Time Allowed parameter).

The **Threshold** setting is the number of counts of error allowed before the drive will start add pulses to reduce the error. Note: If the setting is too low,(less that 5 counts) the drive may be constantly correcting and produce a rough motion.

The **Correction Speed** parameter is the pulse speed that the drive will send correcting pulses at. The lower the number the faster the stepping speed will be. Too fast and the motor may stall at faster speeds, since they drive is trying to correct as well at run at the speed on the incoming step pulses. The combined speed may be too fast.

To test the settings, with the motor stopped and holding give it a twist or about 1/8th of a turn and watch it return to zero. Then try it at different step speeds. You would need a step pulse generator such as Mach3 in jog mode

Component Data

Fuse Use a 5 - 10 amp mini-automotive fuse , These are available at the auto part stores

Power Mosfets for Cobra SV 60 are IRF540

Mosfet driver chips IR 2104 s 8 pin dip

Connectors

Parts supply

(Available from Digikey www.Digikey.com 1-800-344-4539)

Small connectors

Digikey Part #	Description
A31003-ND	Connector 3 Pin 24 guage wire (for fault output)
A31004-ND	Connector 4 Pin 24 guage wire (for step/ direction)
A31006-ND	Connector 4 Pin 24 guage wire (for encoder)
ED2657-ND	4 pos Motor connector.