Viper 60/80 DC servomotor drive Manual V1.2

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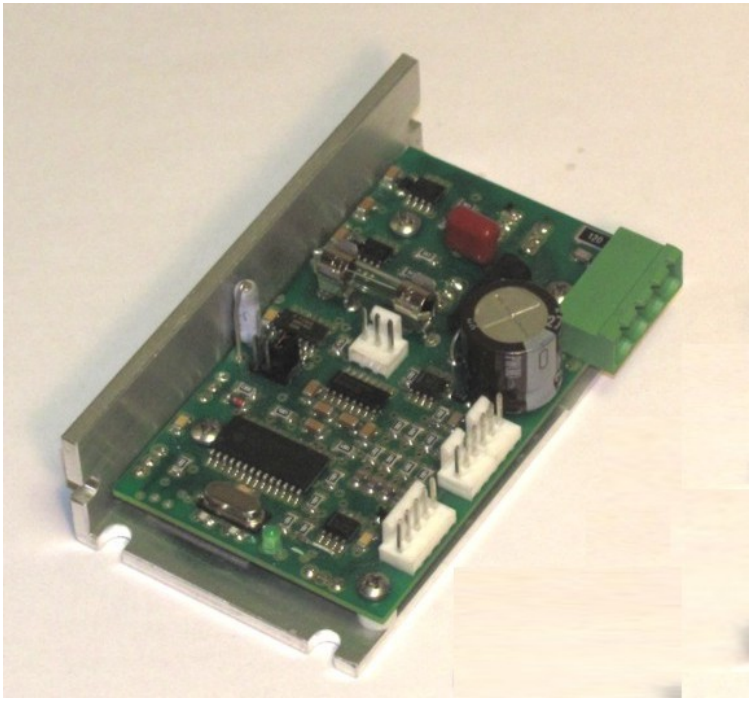

Full featured Industrial quality DC servodrive

Viper 60 25-60 Volt @ 8 amp model
Viper 80 25-80 Volt @ 9 amp model

- 32 bit PID control with 16 bit RISC processor
- 150Khz Step rate
- Opto-Isolated Step / Direction inputs
- Feed forward command
- Fault output signals drive has tripped
- Onboard fuse (protect motor and for safety)
- 4X quadrature encoder counting
- Separate voltage regulator for encoder power
- 1,2,4,8 step multiplier (or any size)
- Settings are programmable by RS232

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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Tech support

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DC Servo Motor Basics

The DC servo motor has an optical encoder that provides feedback to the controller. This typically can have from 100-5000 counts 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 origional 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 **Step Multiplier** setting in the viper sets the ratio of incoming Step/direction pulses from the control software to the 4X encoder counts.
So with a 1000 line encoder and a step-multiplier of 4 you would have 1000 steps/turn. With a step multiplier of 8 you would have 500 steps/turn.

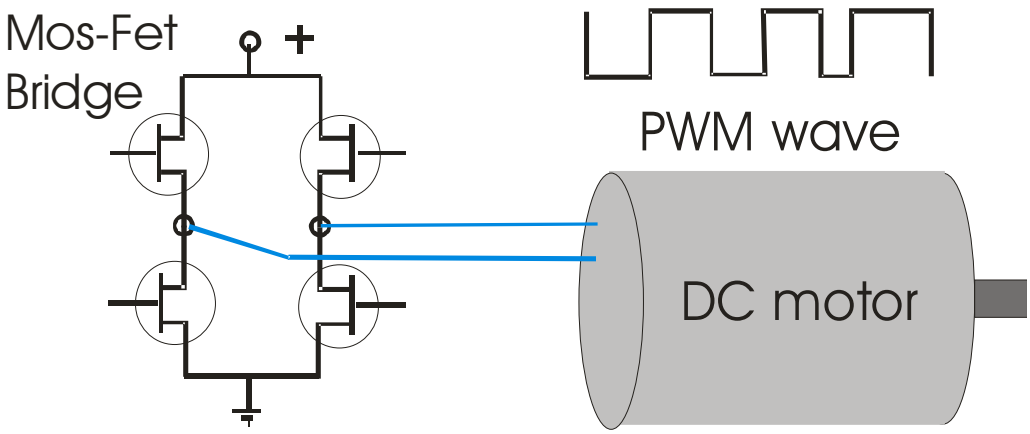
With a step multiplier of 1 you would have 4000 steps/turn, but don't be fooled thinking your machine will be more accurate. A servo system always runs with a error of at least a few encoder counts. Also it would require a very high input step rate to make the motor spin fast.

We recommend a 1000 line differential encoder for most applications. Encoders with less than 400 counts/turn should be avoided. The viper can handle up to 625Khz encoder frequency (assuming good cableing)

A good source for encoders is US-Digital.com

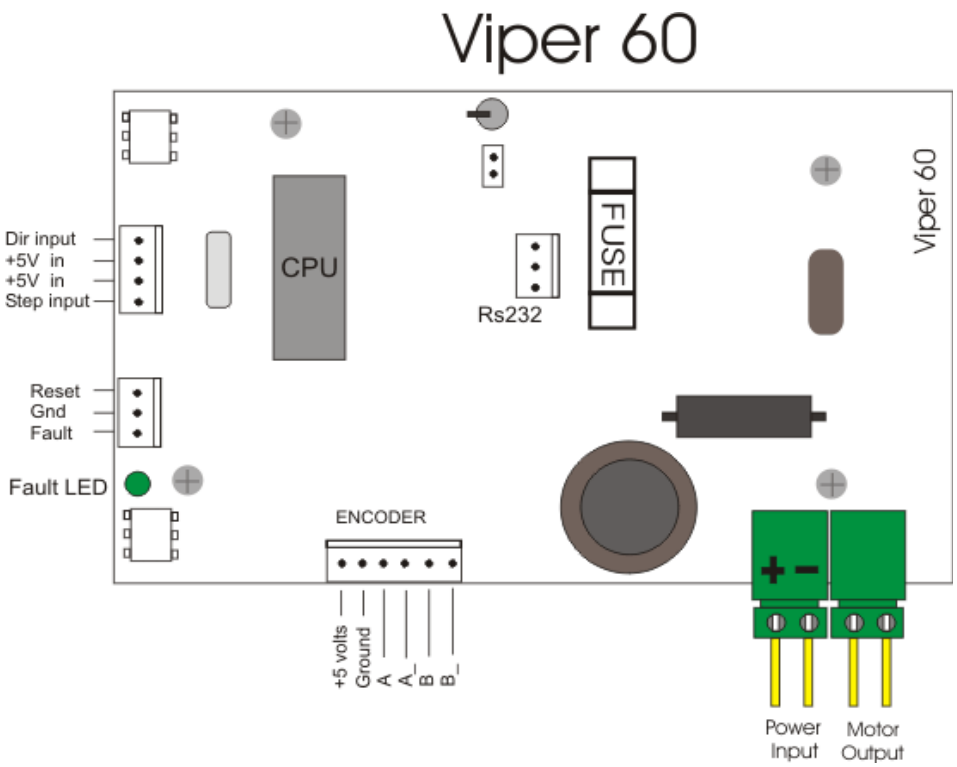
The **DC servo motor** has a Permanent Magnet outside (stator) and a wire wound armature. Carbon brushes connect the electrical power to the rotating armature. They can either have 2 or 4 brushes. A motor with 4 brushes gives a smoother motion.

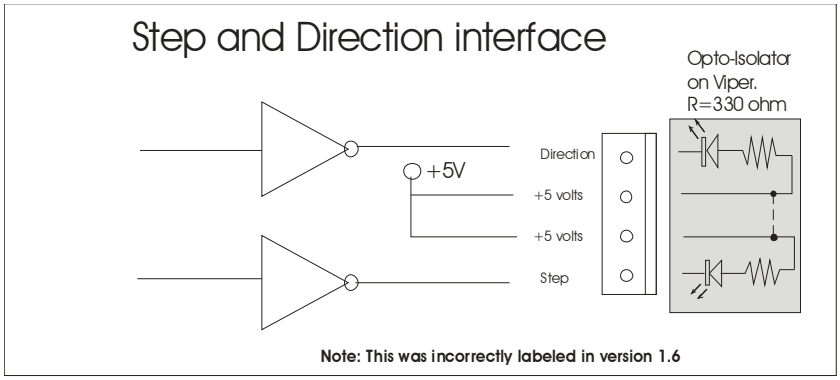
The motor also acts as a generator while spinning and under deceleration can force power back into the drive . A fast decelerating motor or a load pushing the motor can increase the power-supply voltage. Viper drives have at least a 25% voltage headroom and can handle moderate over voltage.

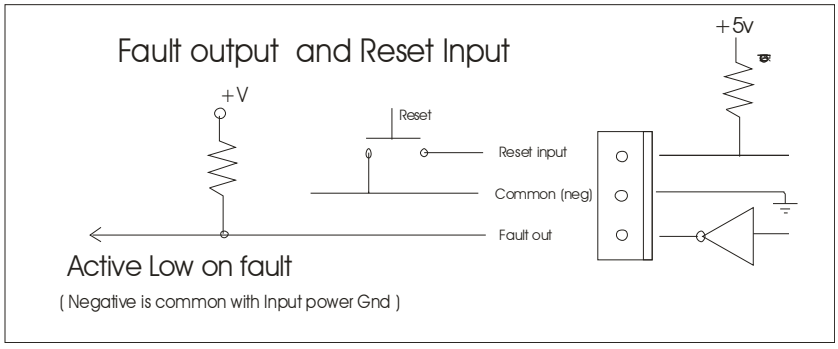


The Viper drive uses a Mos-Fet or an IGBT bridge to drive the servo motor.
The signal is Pulse Width Modulation or PWM with a frequency of 20,000 HZ

Viper 60 Drive Connections

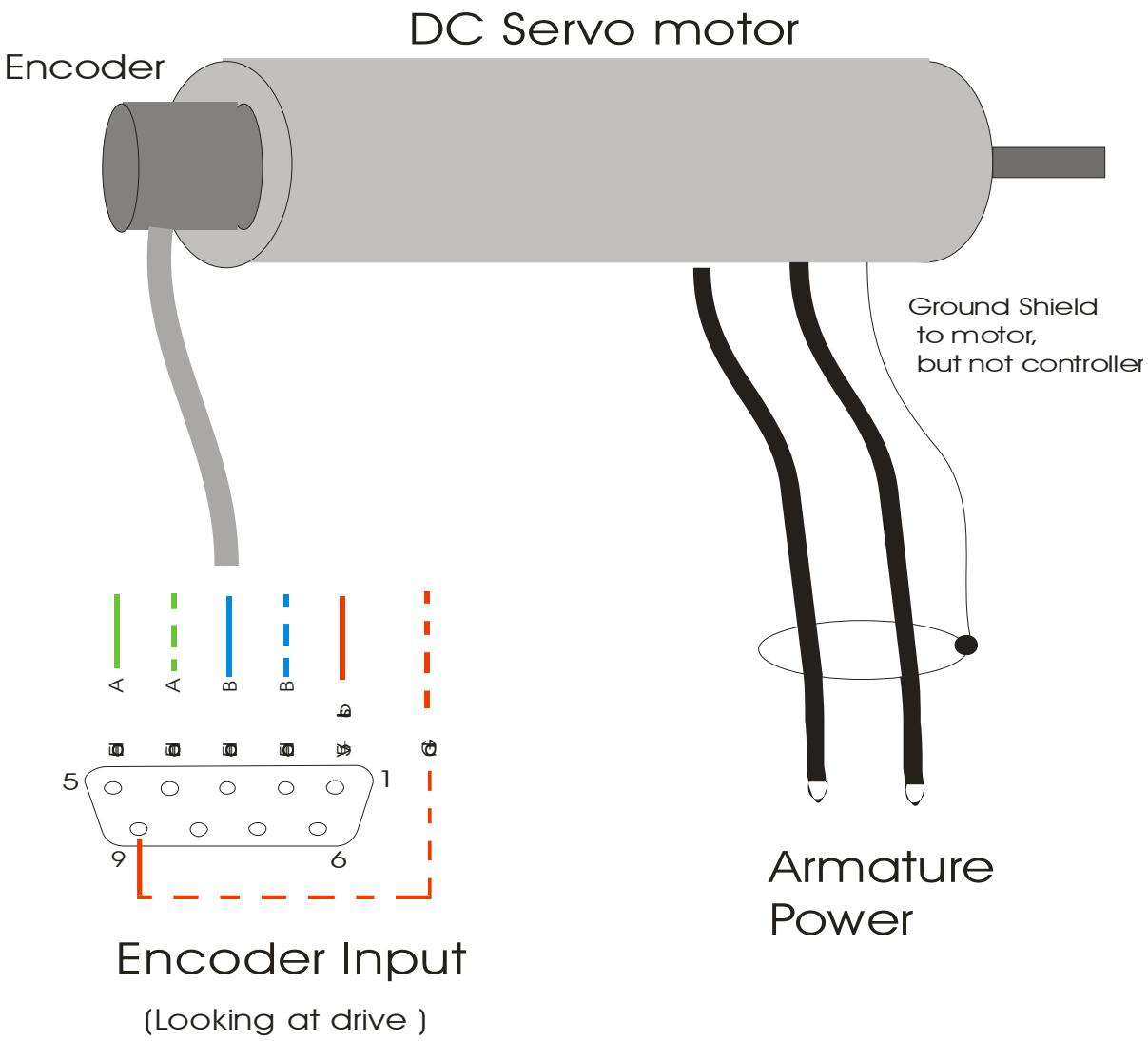






Viper 80 encoder (D9) connector

Motor Encoder and Power connections



- Use twisted pair network cable
for encoder cable. Stranded wire (not solid)

Selecting a Powersupply Voltage

The maximum continious supply voltage for the Viper 60 is 62 volts. However, the drive will fault with a Over voltage error if the supply reaches 68 volts for more than /14 second. This can happen under deceleration.

Motors typically specify a maximum DC voltage and maximum RPM. EG: and MCG ID34002 servo motor has a max DC voltage of 90 volts and runs 5000 rpm at 90 volts. These are maximum ratings, however you can set the powersupply lower than this to run the motor slower.

In a motor, the **voltage** determines the **RPM** and the **current** determines the **Torque** When the motor is running with no load, the current is small. As the load increases the motor draws more current from the power supply.

Current in motors are rated by **Continuous stall current**. This is the maximum current the motor can take continuously without overheating. You probably won't be running the motor this hard all the time, so the power supply can be rated at a lower current, maybe 60% of this value.
Most power-supplys can output 1.5 times there rated power for a short time, and since the average power used by the servo system is usually low, you can usually use a power supply with a lower VA rating than total calculated power.

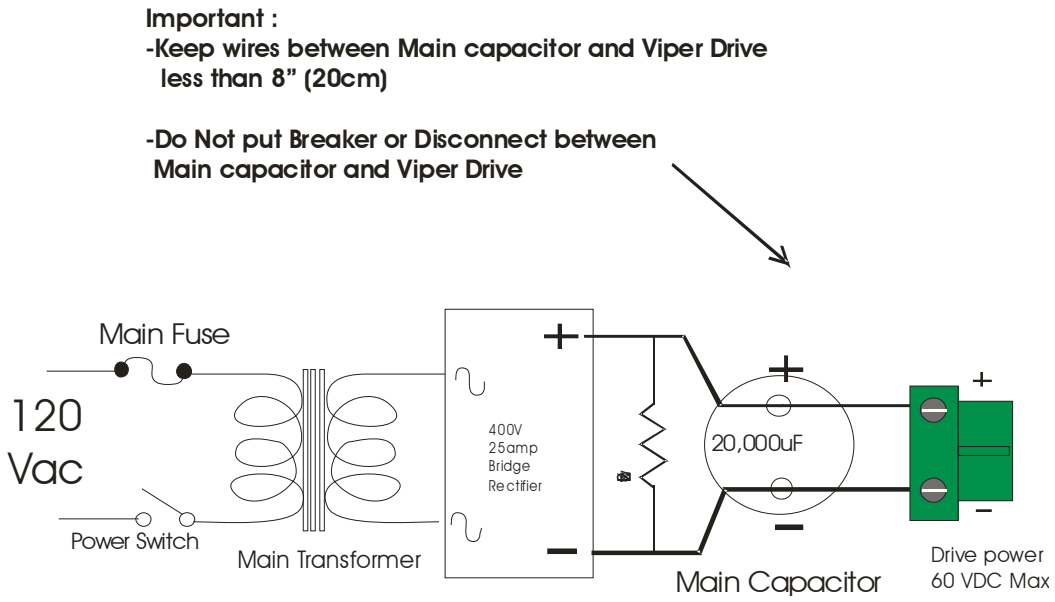
The **Fuse** in the Viper drive should be the value of the continuous stall current or slightly above to **protect the motor.**
The other current-rating of the motor is the pulsed peak current. This is the current that motor damage can occur if exceeded.
The Viper drives can output peak currents at 200% of their rated current for less than 1 second.

Setting a Safe Maximum RPM
You must decide what is the maximum RPM that you want the motor to run on your machine, incase of a possible drive failure. (This may put full power supply voltage to the motor and case a dangerous situation)

As a rule, set your power-supply voltage to only about 10-20% higher than what you would need for your maximum rapid feed rate.

Running the motors at a lower voltage also reduces heat in the motor and drive and increases motor and brush life.

Viper 60 Power supply recommended layout



The Maximum DC powersupply voltage to the Viper 60 is **60 volts.**

The viper 60 uses a single supply voltage. The drive uses a 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 x* 1.414)
- Keep the main DC power wires short, typically 8" (20cm) or less. This is necessary because the drive is switching a 20 Khz power signal to the motor. This frequence 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.

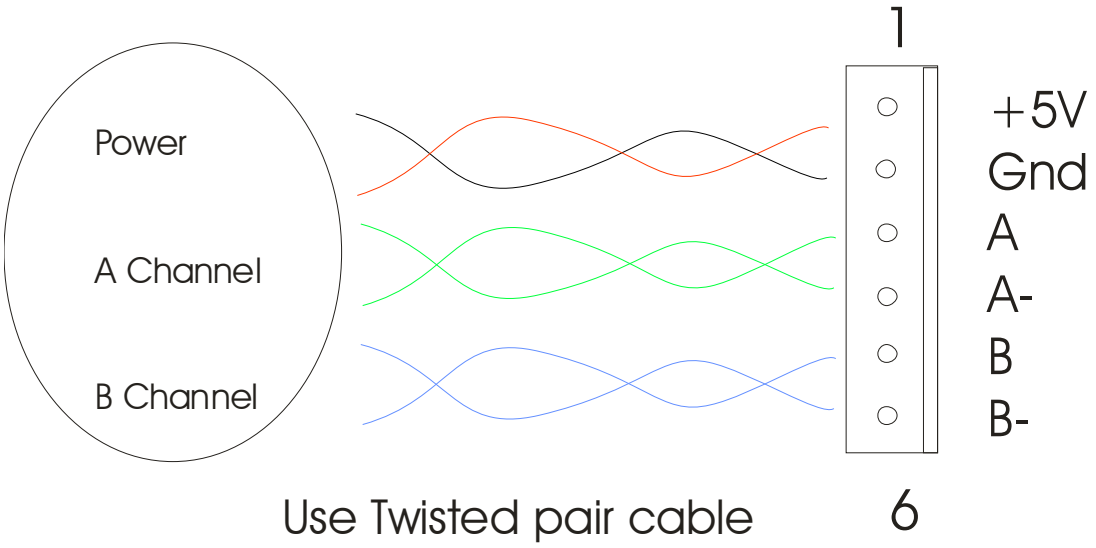
The Viper 60 CPU will stay active until its voltage goes below 3.5 volts. This means that when you turn off the power supply and turn it back on before the voltage has decayed below 2-3 volts the viper may not have reset.

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

Also the Viper 60 has a **Brown-out Voltage Fault** to protect the mosfets incase the power supply goes below 15 volts.

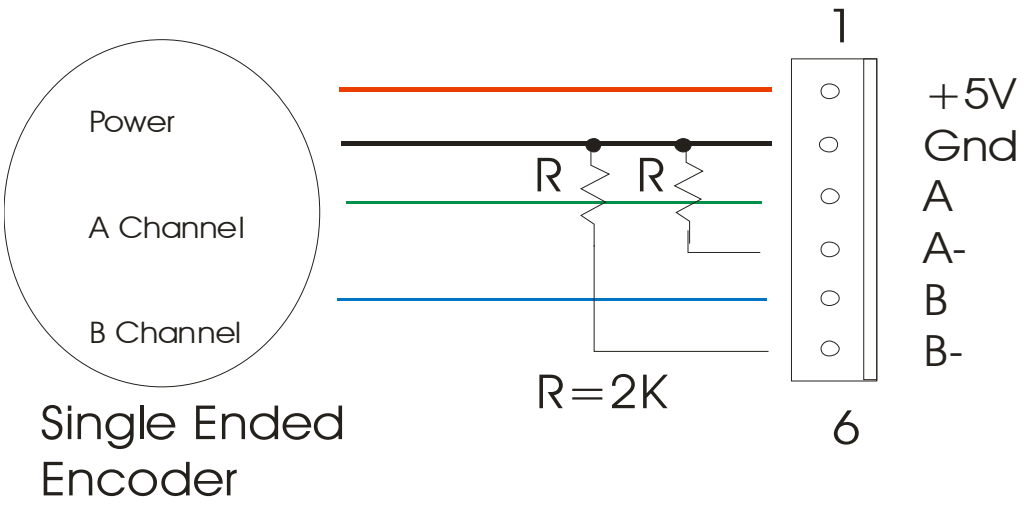
The size of the Fuse should be slightly above the motors continuous current rating.
The fuse is to protect the motor from burnout !

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..

Setting Motor Current

(on New Viper F series with advanced current control)

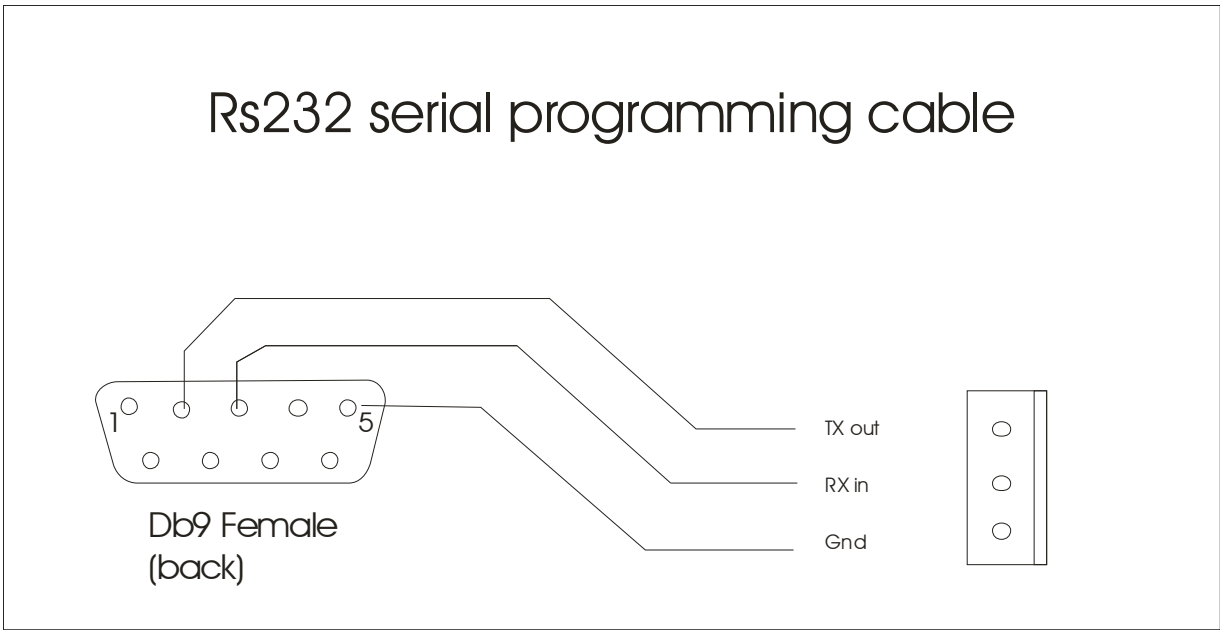
The Viper can control the current to the motor to protect it from burnout. Motors are rates with 2 ratings **Continuous Stall** current and **Peak Current**. The peak current is the absolte maximum momentary amount of current the motor can take for before damage to brushes or windings occur.

The rating thats important is the Continuous stall current. This is the maximum continuous current the motor can take before windings overheat and destroy them selves. The drive needs to know this rating to be able to protect the motor against heavy overloads. If the drive sees this cuurent exceeded for more than 2-3 seconds, it will shut down the drive and cause a overcurrent error(error 6)

When the drive see's very high current, it automatically reduces the current to the continuous rating. If this current stays for 2-3 seconds, the drive shuts down. It allows peak currents up to 18 amps under acceleration/ decel but reduces it quickly to the safe limit and holds it there.

To set the current first you need to know the **Continuous Current rating** (stall) of the motor. The drive can't accept the actual number, but you enter a lookup value from the table below. EG to set the Viper 60 to 4 amps, enter the command a61

Use the table below to get the correct value to enter in the Viper and enter it using the 'a' command. (This value is used by the ADC converter on the PIC chip.).



Viper Error Indicator LED

When an error is flashed, the Viper 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 (Version 3.0 + firmware)

2 Encoder Range warning (r command)
3 Current warn (Pot adjustment)
4 Under voltage on main power
5 Encoder Trip (t setting)
6 Current Trip (exceeded motor current)
7 Encoder fail (no pulses)
8 Short circuit protection
9 Over voltage

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.

Component Data

Fuse Use a 3, 5 or 7.5 or 10 amp mini-automotive fuse , These are available at the auto part stores

Select the fuse amperage to protect motor winding or machine from damage incase of drive failure.

Power Mosfets for Viper 60 are IRF540
Mosfet driver chips IR 2104 s 8 pin sop

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 6 Pin 24 guage wire (for encoder)
ED2908-ND	Green 2 pos power connector