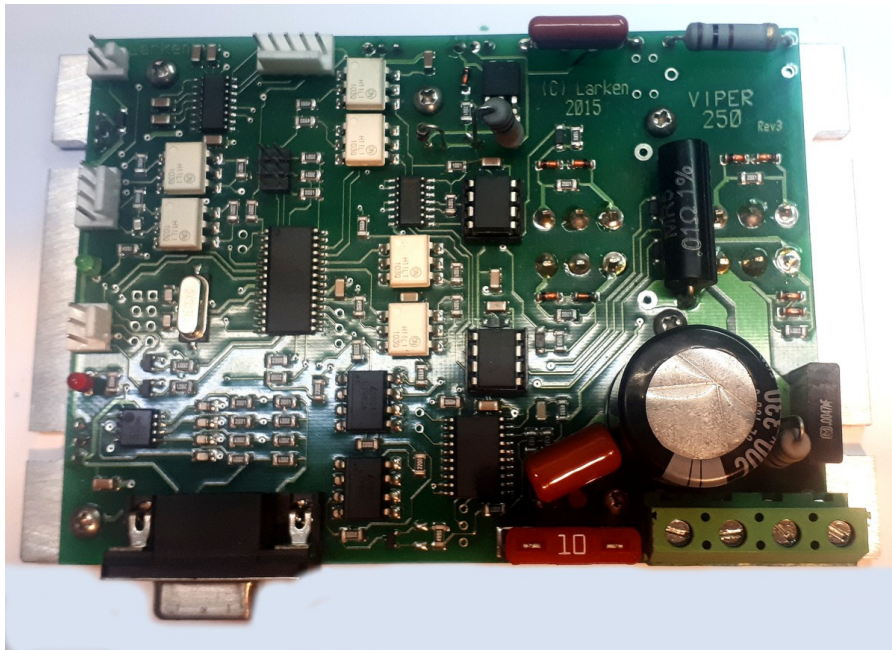


# Viper 200H DC servomotor drive Manual V2.5

Last edited Oct 30 2022



## Full featured Industrial DC servodrive

**Viper 200H 60-170 Volt @ 20 amp model**  
**Viper 200HD 60-170 Volt @ 30 amp model**  
**Viper 260H 60-240 Volt @ 25 amp model**

- 32 bit PID control with 16 bit RISC processor
- 200Khz Step rate
- Opto-Isolated Step / Direction inputs
- Opto isolated power and control sections
- Feed forward command
- 1024 bit pwm resolution
- Fault output signals drive has tripped
- On-board fuse (protect motor and for safety)
- 4X or 2X quadrature encoder counting
- Replaceable Power Mos-Fets and drivers
- 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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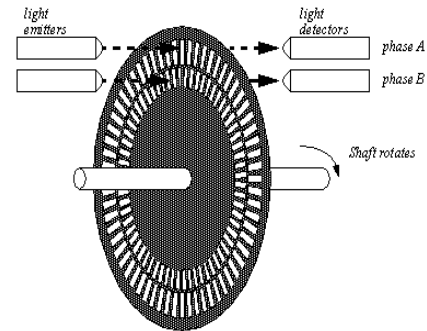
**Website:** [www.Viperservo.com](http://www.Viperservo.com)

**Website:** [www.LarkenCNC.com](http://www.LarkenCNC.com)

## 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 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. Within 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.

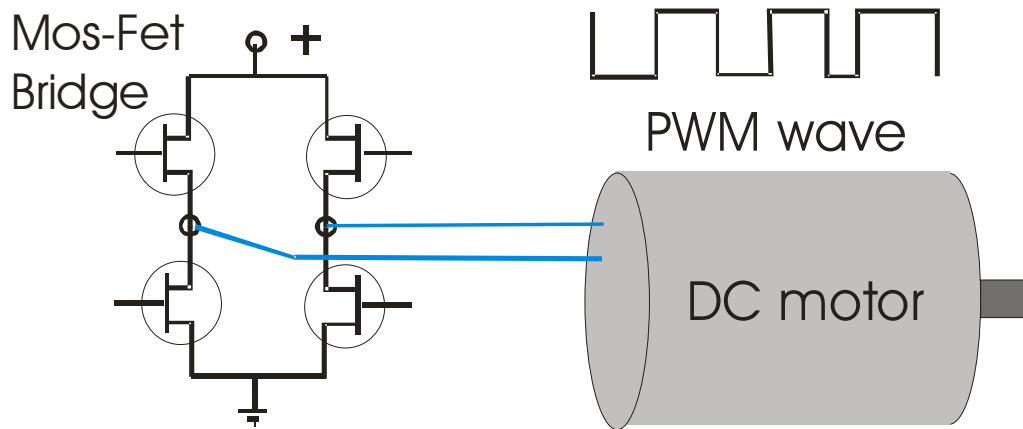
*With a step multiplier of 1 you would have 4000 steps/turn, but don't be fooled thinking your machine will be more accurate. A servo system always runs with a error of at least a few encoder counts. Also it would require a very high input step rate to make the motor spin fast.*

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 cabling )

A good source for encoders is [US-Digital.com](http://US-Digital.com)

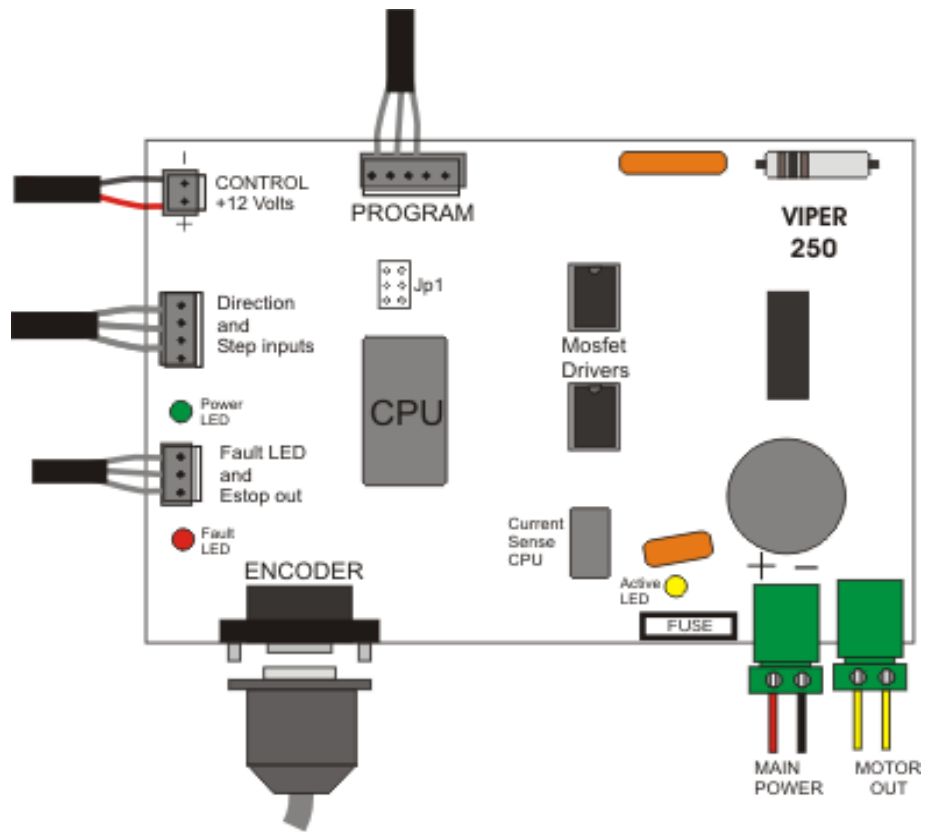
The **DC servo motor** has a Permanent Magnet outside (stator) and a wire wound armature. Carbon brushes connect the electrical power to the rotating armature. They can either have 2 or 4 brushes. A motor with 4 brushes gives a smoother motion.

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.

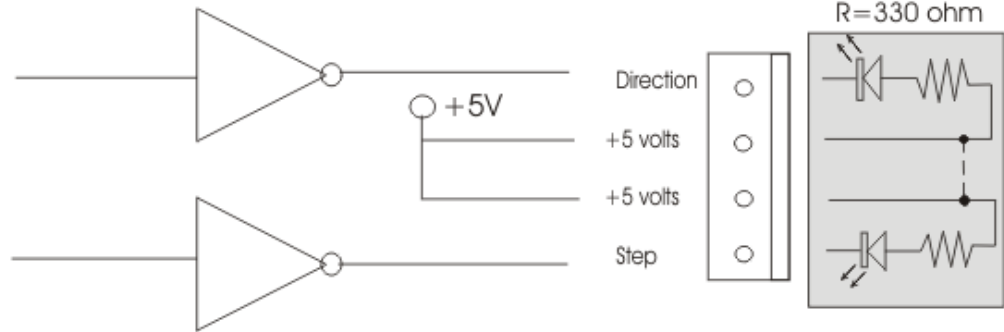


The Viper drive uses a Mos-Fet or an IGBT bridge to drive the servo motor. The signal is Pulse Width Modulation or PWM with a frequency of 20,000 HZ

# Viper 200 Drive Connections

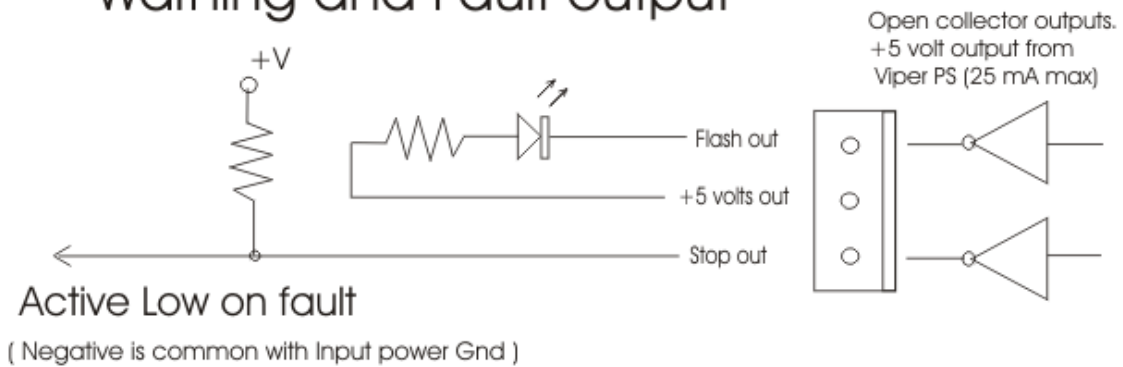


## Step and Direction interface

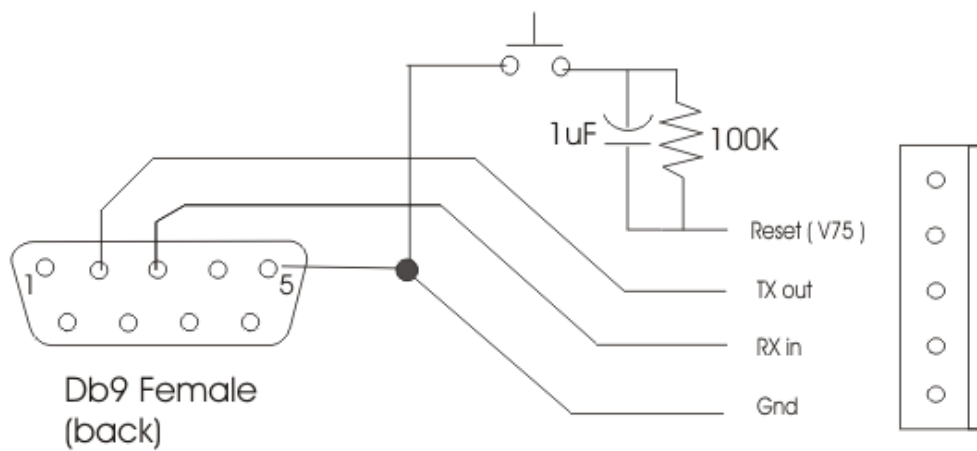


**Note: This was incorrectly labeled in version 1.6**

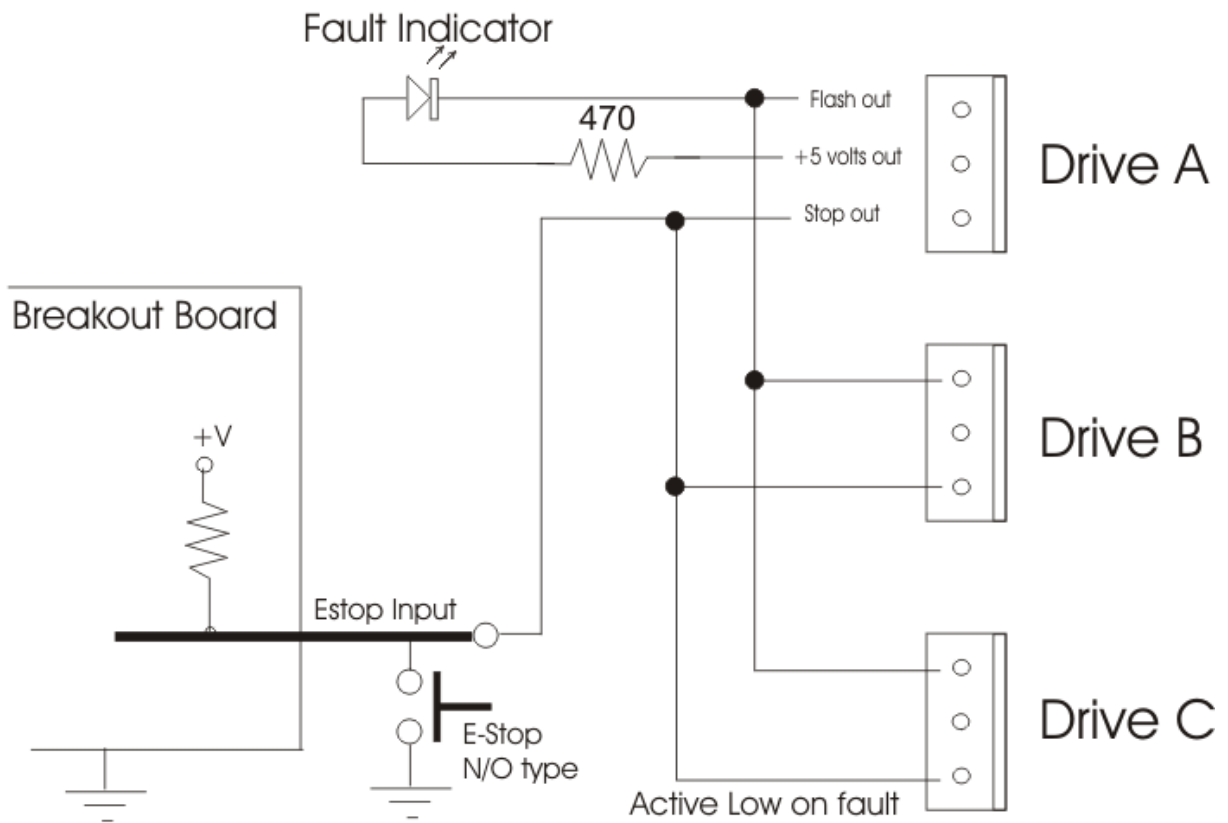
## Warning and Fault output



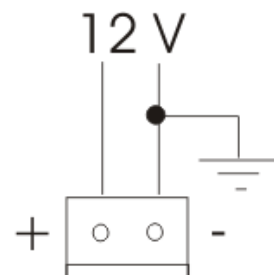
## Rs232 serial interface and V75 reset



# Fault output for multiple Drives



BOB should share common Negative or Gnd with Viper



Viper can be grounded by mounting encoder connector in a chassis or by grounding the NEG wire of 12V power

## Selecting a Powersupply Voltage

The maximum continuous supply voltage for the Viper 200 is 170 volts. However, the drive will fault with a Over voltage error if the supply reaches 185 volts for more than 1/4 second. This can happen under deceleration because the motor generates power back into the drive.

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-supplies can output 1.5 times their 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** 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, in case of a possible drive failure. (This may put full power supply voltage to the motor and cause a dangerous situation)

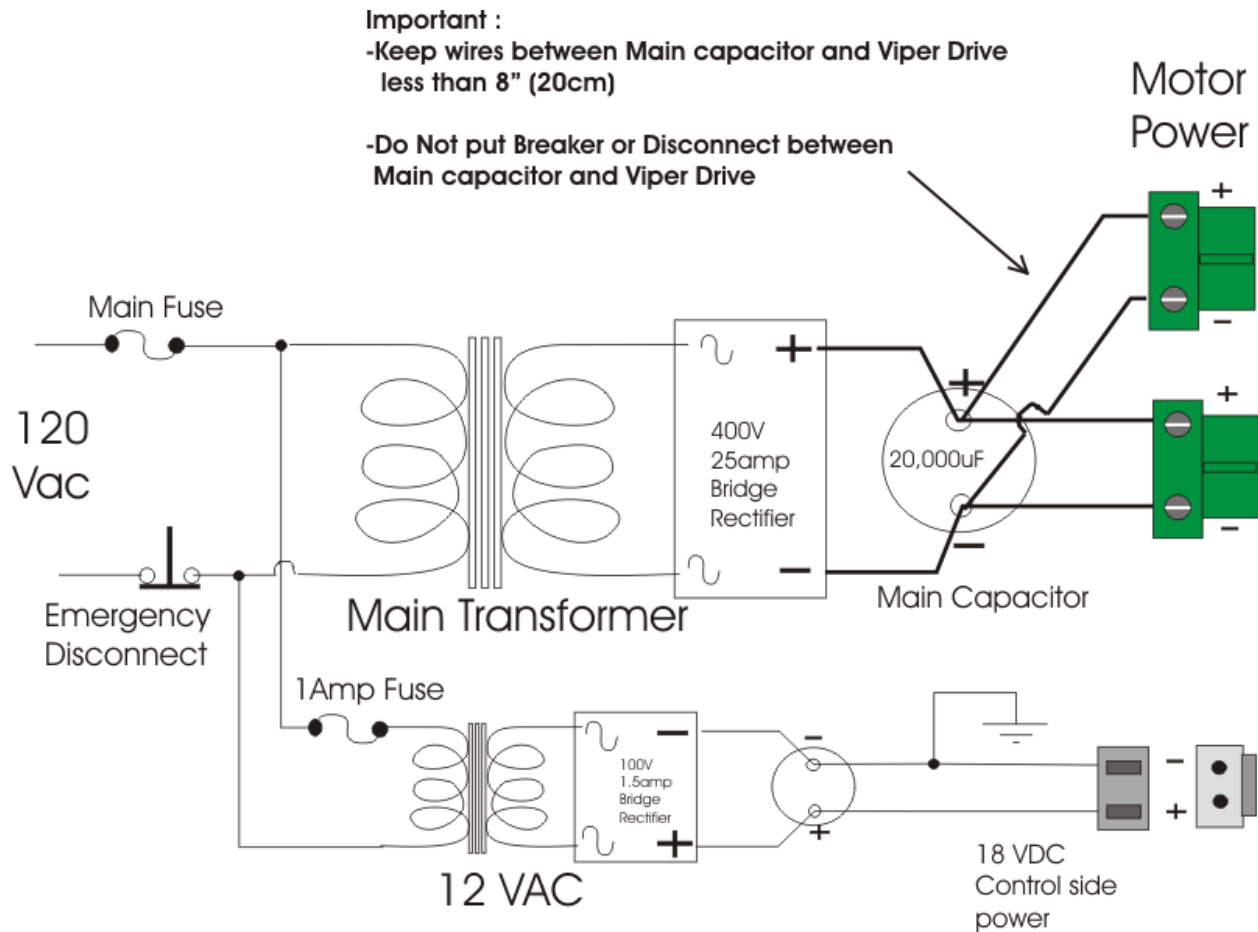
As a rule, set your power-supply voltage to only about 10-20% higher than what you would need for your maximum rapid feed rate.

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



# Power supply recommended layout

The Maximum DC powersupply voltage to the Viper 200 is **170 volts**.

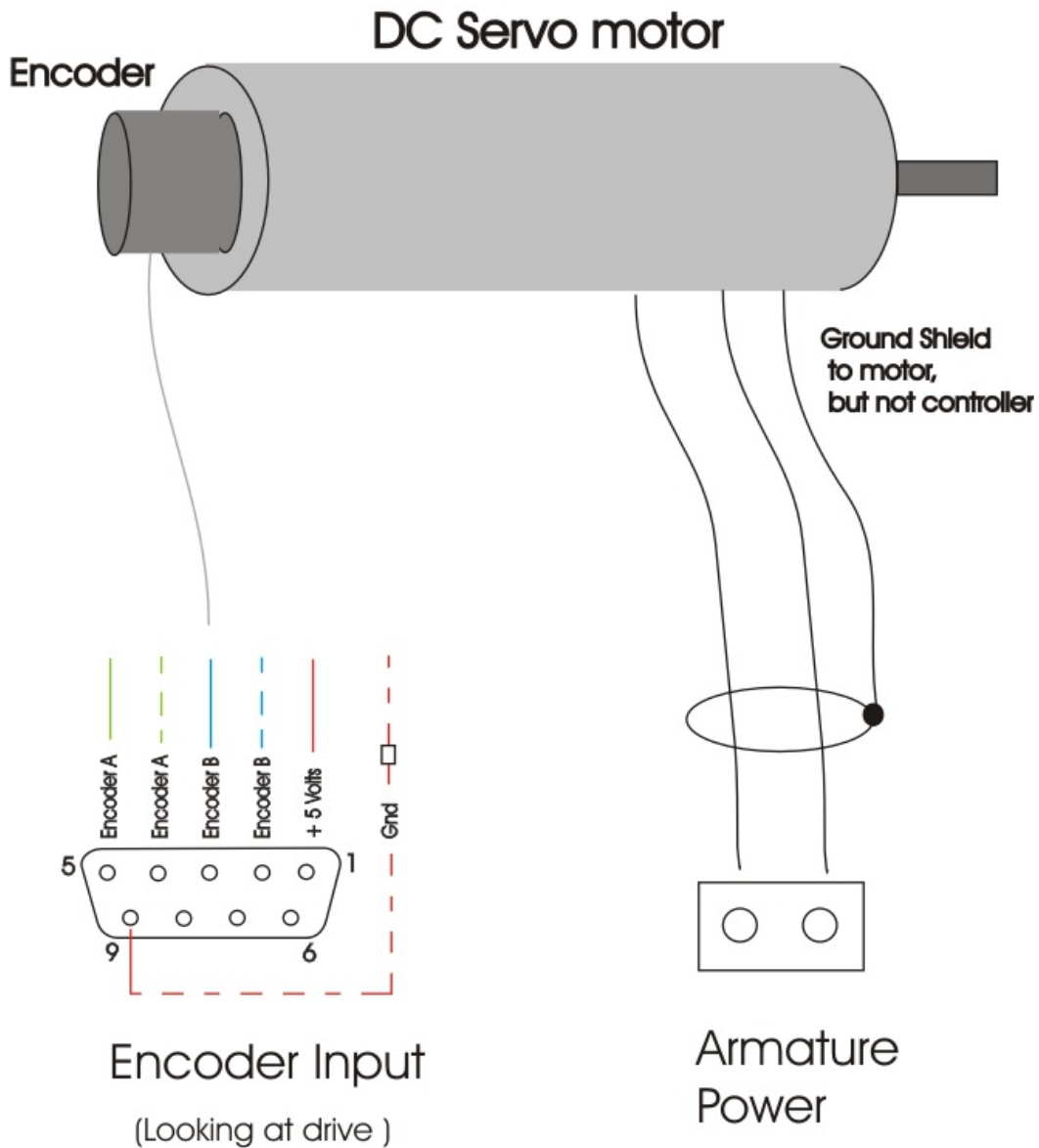


- The main transformer voltage is to match motor voltage requirements.  
(  $DC\ volts = AC\ voltage \times 1.414$  )
- Keep the main DC power wires short, typically 8" (20cm) or less. This is necessary because the drive is switching a 20 KHz power signal to the motor. This frequency is present on the 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 size of the Fuse should be the motors continuous current rating.

**The fuse is to protect the expensive motor from burnout !**

# Motor Encoder and Power connections



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

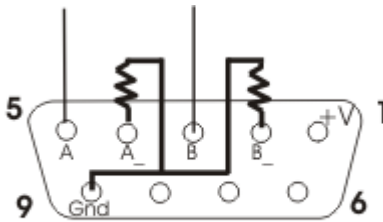
**Note :** Diagram shown for a differential encoder. For a single ended encoder, use just one connection per channel. Use (stranded) twisted pair cable for encoder wire. Use shielded wire if available. Connect the shield on *one end only* to avoid current flowing in shield.

## DB 9 Encoder connections

Pin 1	+5 volts out for encoder power
Pin 2	Channel B input (inverted)
Pin 3	<b>Channel B input</b>
Pin 4	Channel A input (inverted)
Pin 5	<b>Channel A input</b>
Pin 9	Power negative ( encoder power )

### 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).



Single Ended Connections

### 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..

## READ FIRST BEFORE CONNECTING MAIN POWER

- 1) Download Viper tune from [www.viperservo.com](http://www.viperservo.com) and install it on a laptop ( preferably because of the isolated ground ) with a RS232 port .. or use a USB to RS232 converter . You only need the 12v connected to the Viper for it to talk to vipertune.
- 2) Watch the YouTube setup videos ( the YT channel is “Larken558” search for it ) on making sure the Encoder is working . DO NOT Connect main power if the viper can't read the Encoder !!
- 3) With just the 12V connected the drive will flash a “lowvoltage” 4 flash fault ... this is normal
- 3) After you verify the drive can read the encoder, connect the motor armature and main power . When you power up the main power the Yellow 'active' LED should flash indicating that the power side is communicating with the control side. This LED should do a quick burst of flashes whe power is first applied, then flash at a stead slower rate.
- 4) Make sure **Motor is be Holding** before you can proceed to tuning . If motor spins and stops when you power up .. try reversing the motor armature wires .
- 4) Watch the other Viper and Step2linear YT videos on Tuning . Start off with KP and KD parameters low until you get familiar with tuning.

## Setting Motor Current

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

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

When the drive sees 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 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 using Vipertune

### PWM Limit

When first testing the motor, you can set the PWM limit lower to 25% to protect the drive. Then after you have done successful testing you can increase the PWM limit to a level where you are happy where your machine performs.

## 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

- 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 automotive fuse , These are available at the auto part stores  
Note: The power conversion characteristics of a pwm drive can output more current to the motor winding than the rating of the fuse. The fuse is only to protect the motor winding if the drive fails. Be sure to use a fuse rated lower than the continuous stall current rating of the motor.

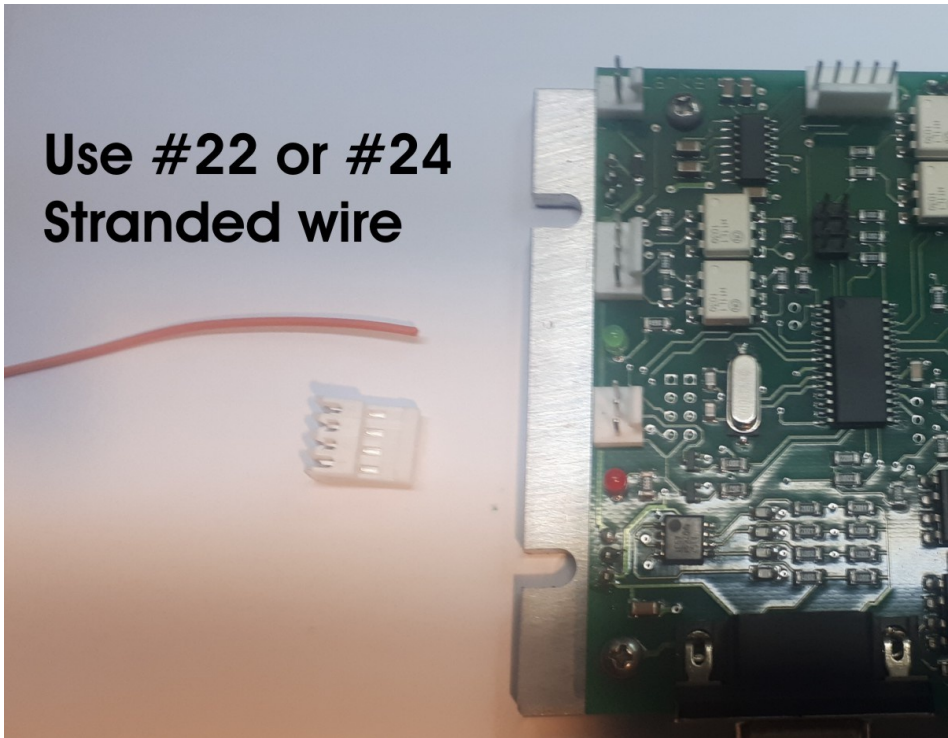
## Connectors

Parts supply  
( Available from Digikey [www.Digikey.com](http://www.Digikey.com) 1-800-344-4539 )

### Small connectors

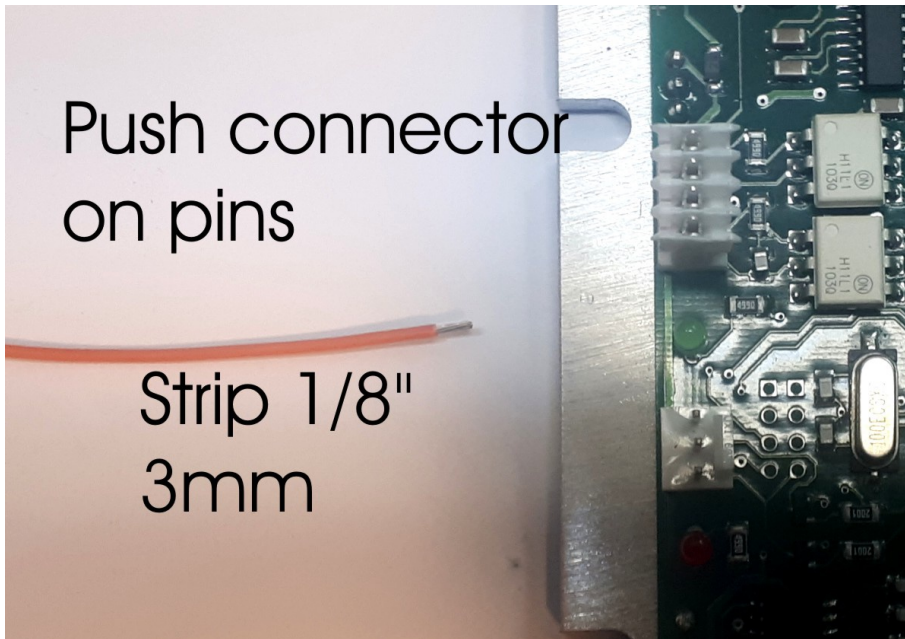
Digikey Part #	Description
A31003-ND	Connector 3 Pin 24 gauge wire (for fault output)
A31004-ND	Connector 4 Pin 24 gauge wire (for step/ direction)
A31006-ND	Connector 6 Pin 24 gauge wire ( for encoder )

## How to connect wire to small connectors

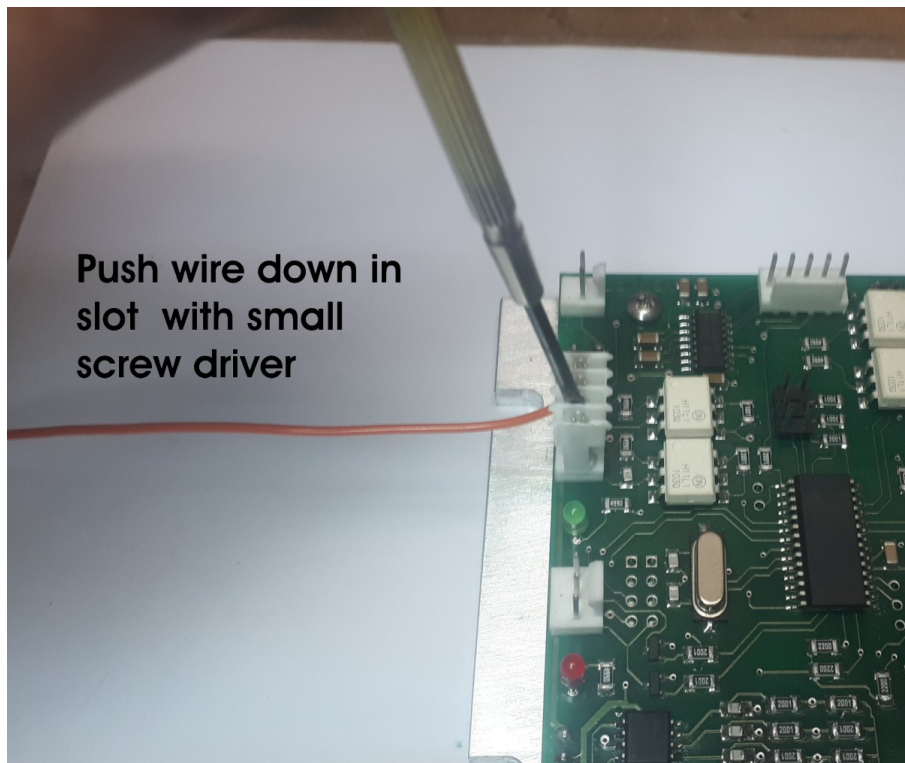


Push connector  
on pins

Strip 1/8"  
3mm

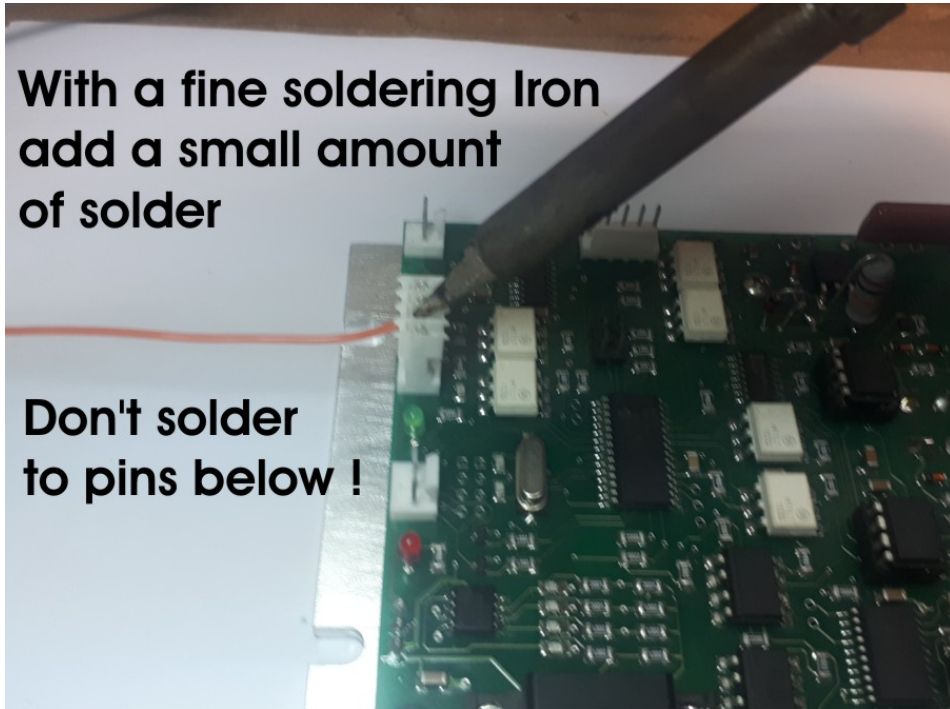


Push wire down in  
slot with small  
screw driver

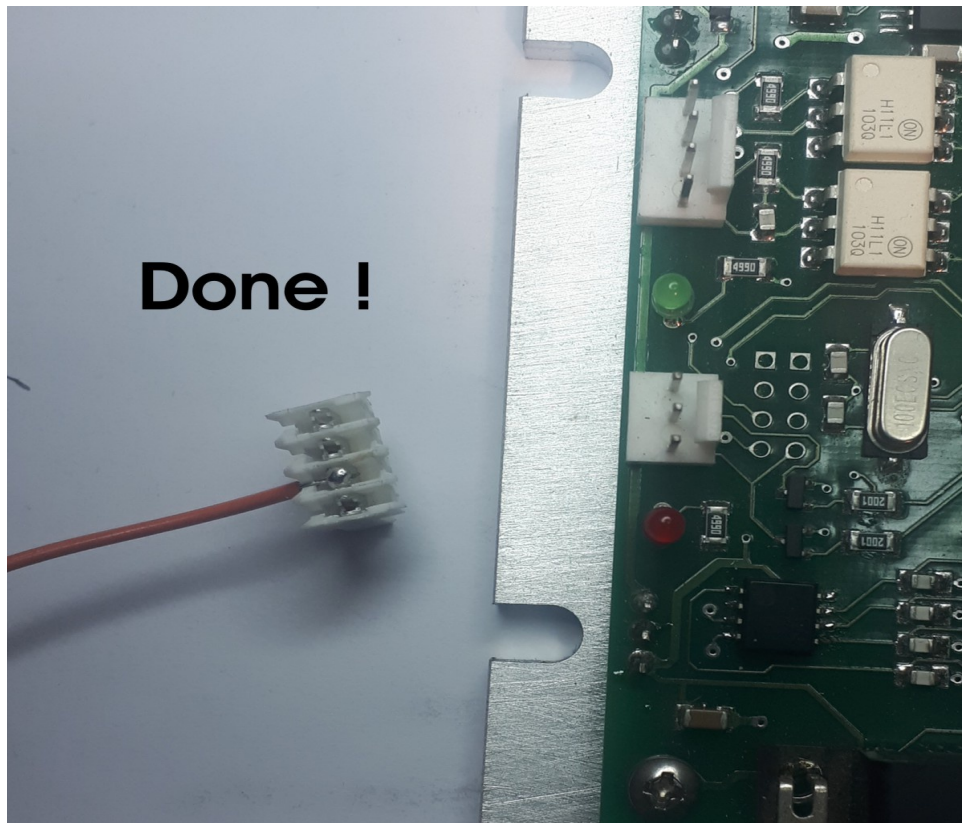




**With a fine soldering Iron  
add a small amount  
of solder**



**Don't solder  
to pins below !**



**Done !**