Rockcliff MACHINE INC. V10

High Performance 4 Axis CNC Motor V10 Driver

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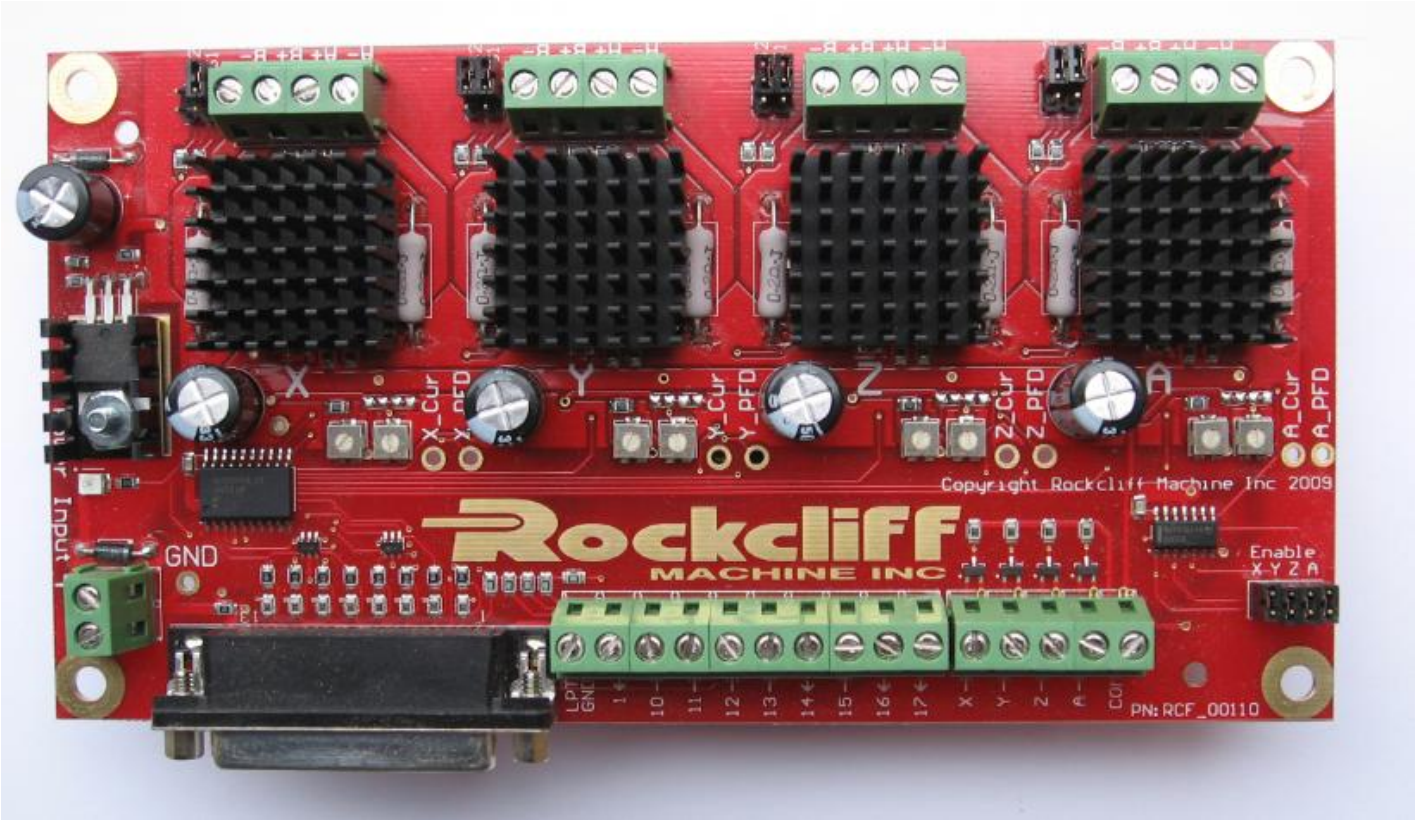


PART No. RCF00110 **© 2010 Rockcliff Machine Inc.** www.rockcliffmachine.com

Bipolar 4X Axis Micro Stepper Motor PWM Control A Bipolar Motor Drives are by far preferred by most for best overall performance and compatibility, and with Pulsed Width Modulation Technology with give superior motor performance while running, and stay cooler while idle.

Resolution FULL 1/2 1/4 1/8 Step Mode On board jumpers enables any individual axis's to be easily set to any step resolution

2.5AMP Adjustable On-Board Motor Current Control Any combination of motor size can be used, so if you only need a small motor on one and a larger motor on a different axis, the current can be set to match exactly what motor size you're using

4 ,6 or 8 WIRE NEMA Motor Frame 17, 23, and some 34 Compatible The features with using a bipolar drive is that 4, 6, or 8 wire stepper motors can be used, in any combination, Bipolar or Unipolar motors can be used.

PFD (Percent Fast Decay) Adjustable for optimal low resonance performance.

Integrated DB25 Breakout Board We completely removed the need for a separate breakout board, this total elimination of a separate breakout board design replaces on average 75 to 100 non permanent connection points, with a permanent fail safe soldered connection,

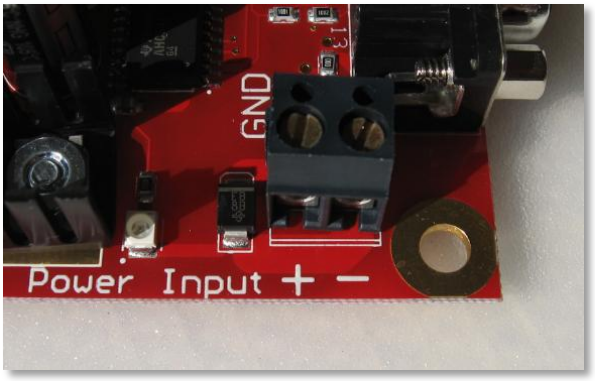
Integrated I/O Screw terminals for limit, home and any external device you want to connect

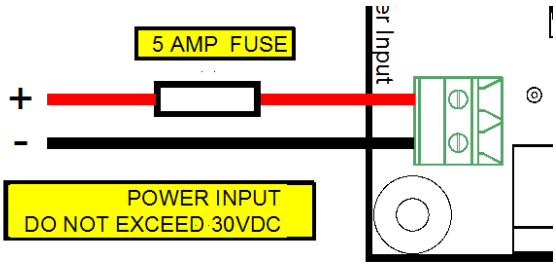
SMT Components

ROHS Compliant

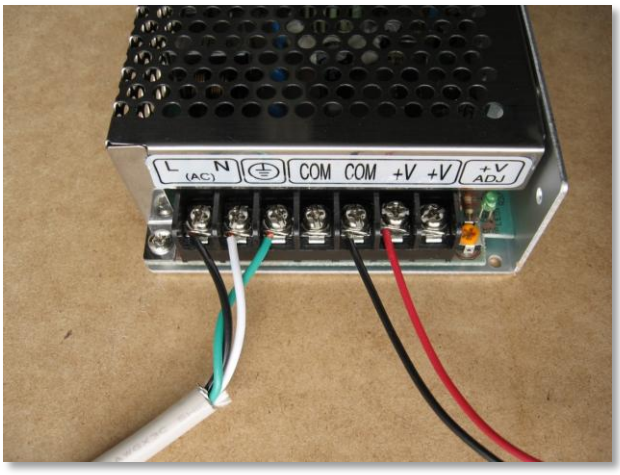
Mach3, EMC, Turbocnc, EMC KellyWare, Compatible Device

Power Requirements The designed system motor drive circuit can handle up to 30 VDC which includes Back EMF which can occur if a motor is manually spun beyond it's commanded pulsed rate, the motor can act like a generator, generating Voltage and Current back into the circutry, To be on the safe side, the recommended maximum running voltage applied to the board should be set to provide less then 30VDC **Caution:** Exceeding the absolute maximum voltage of (35 VDC) will 100 % destroy the circuitry! Also overheating the device will lower the life of the circuitry as well as cause motor position losses, and or complete board or motor failure CAUTION: Do not switch the DC supply voltage ON/OFF to the V10 Board or it can be damaged. Always Switch the AC side of the power supply for ON/OFF.





12 Volt and 24 volt power supplies are the most common power sources with voltage outputs safely under the maximum 24VDC will provide better performance. 24VDC will charge the motor coils twice as fast as 12VDC. This means reaching the required speed and torque much sooner. The minimum motor supply voltage is 8.0 volts, always check for your countries power input supply, the power supply is selectable for dual input voltage of 115vac or 220vac, you must set the switch for your input voltage, North Amerca is normally 115, with other parts of world at 220, this switch is normally located inside the power supply, with access thru one the grill holes, or can be loacated on the side of the power supply, and will be clearly labeled.



Stepper Motor Wire Styles for Bi-Polar Operation Identify all connections correctly and insure proper wiring of your motor style, a true bi-polar stepper motor will only have 4 wires, other styles of stepper motors can be wired for bi-polar operation. Extreme Caution must be taken to insure the wiring is identified and connected correctly to the controller; any incorrect connection will destroy the controller, always double and triple check your connections before applying power to the board, The best advice is, if you do not know or understand your wiring connections, **Do Nothing**, and contact us for help.

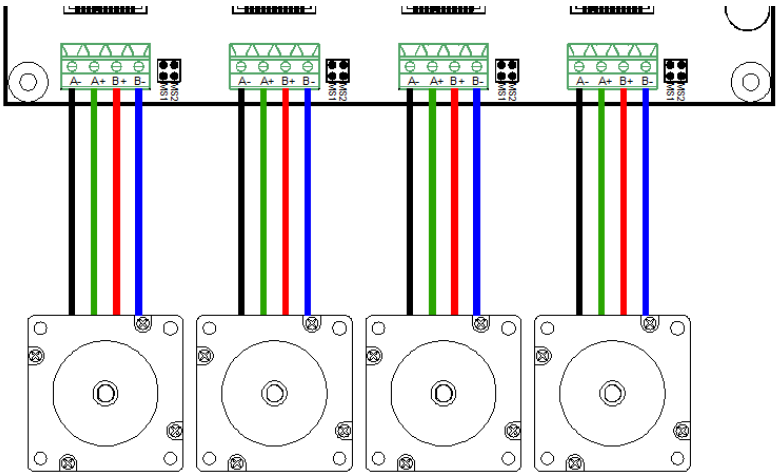
If you purchased our motors use the following color code

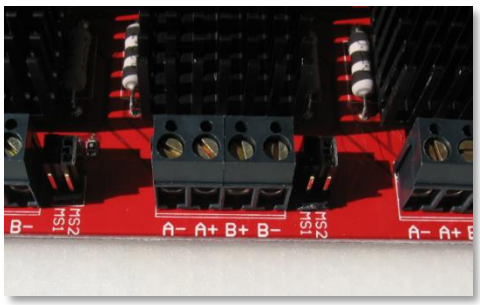
BLACK A-

GREEN A+

RED B+

BLUE B-

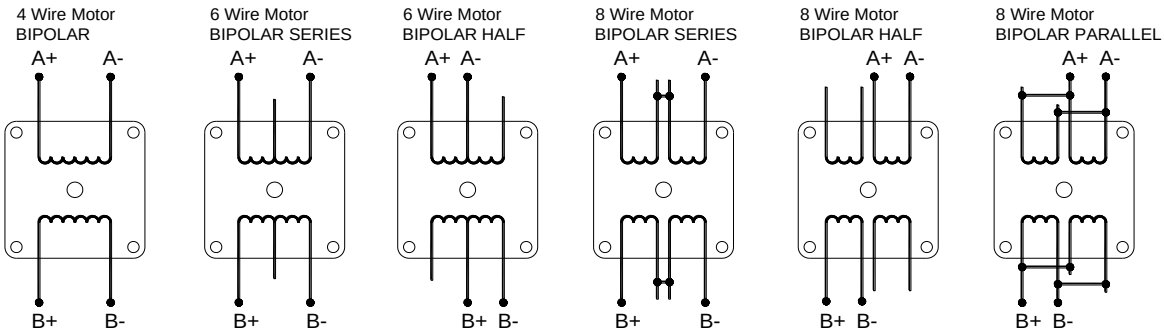




Stepper Motors with 4 wires is a true Bipolar motor and can only be used with a Bipolar control driver. Each of the two phase coils / windings have a pair of wires. Using a multi meter, you can identify the pairs of coils

A 6 wire stepper motor has a pair of wires for each coil like the 4 wire motor, but it also has a center-tap for each winding. It can be wired as either Unipolar or Bipolar. Use a meter to divide the wires into sets of three wires that have continuity to each other. Then identify the center taps. The resistance from the center tap to one of the end wires is half of the resistance between the end wires. For connection to a Bipolar driver, like our Rockcliff board, wiring in half coil mode is more common and can increase the speed of the motor but will lower the torque by approx. 30% to wire in half coil mode, use only one end wire and one center tap of each winding, as shown in our diagram, You can also use the full winding in Bipolar mode by not using the center tap wire, this will increase the torque and but the overall maximum speed will be reduced,

An 8 wire stepper motor is similar to a 6 wire motor, except that each of the two phases is split into two separate windings. This allows the stepper to be connected as a Unipolar motor as well as three different bipolar combinations. In addition to the bipolar half and full winding modes, you can also connect the two halves of each phase in parallel. You will need to consult the motor's data sheet for this one in order to get each coil properly phased with the other.



Motor Current Adjustment All four axis channels should be factory set to approx 50% current, which is good for start-up, with our motor kits, The current level can be individually set , by adjusting an on-board steel shielded potentiometer (Trim Pot) The potentiometer creates a voltage which is input to the drivers IC, which converts the set voltage to motor output current, the motor current adjustment is made using a small flat screwdriver and adjusting the provided Trim Pot for each axis, by taking a voltage reading using the provided test points (**GND** Test Point and **X_CUR** Test Point) the formula is X_CUR (Volts) / 1.6 turn the trim pot clockwise to increase current or counterclockwise to decrease, Although it is possible to adjust the current level to run motors without using a multimeter, it is not recommended, but if a multimeter is not available, start with the absolute lowest setting, for startup trials, as too high of a current setting, could easily permanently damage your driver board or motors.

Example Current Table

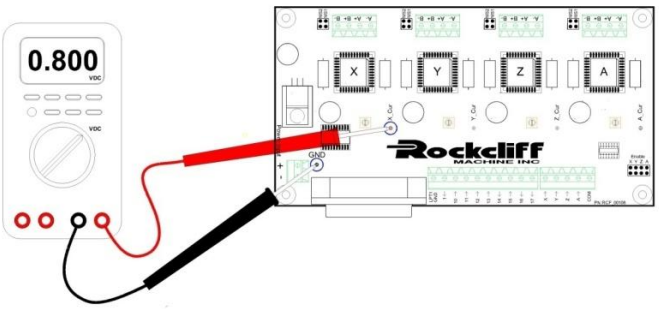
Vref 0.80 VDC= **0.5 Amp**

Vref 1.60 VDC = **1.0 Amp**

Vref 2.40 VDC = **1.5 Amp**

Vref 3.20 VDC = **2.0 Amp**

Vref 4.00 VDC = **2.5 Amp**



A voltage reading of 0.8 vdc is equal to 0.5 Amps to the motor

CAUTION: Most board failures occur from wiring errors during initial setup; it is important that the wiring is 100% correct, and that the motor phase information/ wiring are correct, and tight before you power the board You should be familiar with, and ready to use your signal generator (i.e. software such as Mach3, or a similar step generator like Turbocnc, EMC, and KellyWare etc.) (Ground yourself before handling the driver board) Static electricity can damage digital circuitry and you must take standard precautions before handling the board, avoid touching any bare contacts without proper protection.

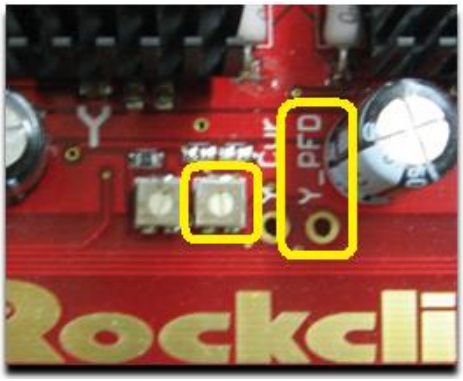
Quick Setup Mach3 Control Software Settings

A Mach3 XML file, is the startup file that stores the configuration settings for Mach3, for a quick setup, we have provided our **Mach3Mill**.**xml** file which will automatically configure Mach3 settings to our motor driver board.

To use, copy our **Mach3Mill**.**xml** file into the main Mach3 directory, which is located and installed on your PC, Mach3 control software will now startup with some pre-installed settings, enough to get jog movement from the arrow keys, although we provide this setup file, for a quick startup, You will still need to adjust Mach3 settings, like units, motor tuning, estop, etc. specific to your machine style, We are registered OEM Mach3 distributer and this board is 100% Mach3 compliant, and certified by us to operate correctly with our boards, please visit our Builders Group for any additional help or questions

Motor Tuning When tuning a stepper motor system there are many factors such as , step resolution, maximum speed, and friction of the mechanics, that will affect the way your system performs, most stepper systems including ours are open loop, which means there is no feedback loop sent back to the computer of actual position, so if a motor skips, stalls or mis-steps, there is no way for the computer to know the correct position, when tuning a stepper motor, It's best to experiment with different settings of step resolution, speed settings, current, and voltage to find the best performance of the motors and mechanics, to run smooth and without mis-steps, Keep in mind that all stepper motors will lose power as the speed increases, and a speed setting that is too fast will be very un-reliable, it's best to back off on the maximum speed, to keep the system reliable, if the current is set too high or low, a motor can vibrate too much or not spin at all, Stepper motor systems are slow, as compared to Servo type systems, and to really gain speed in the mechanics, the use of coarse drive screws is a much better way to get higher machine travel speeds, rather than to try and push the motor beyond its limits.

PFD (Percent Fast Decay)

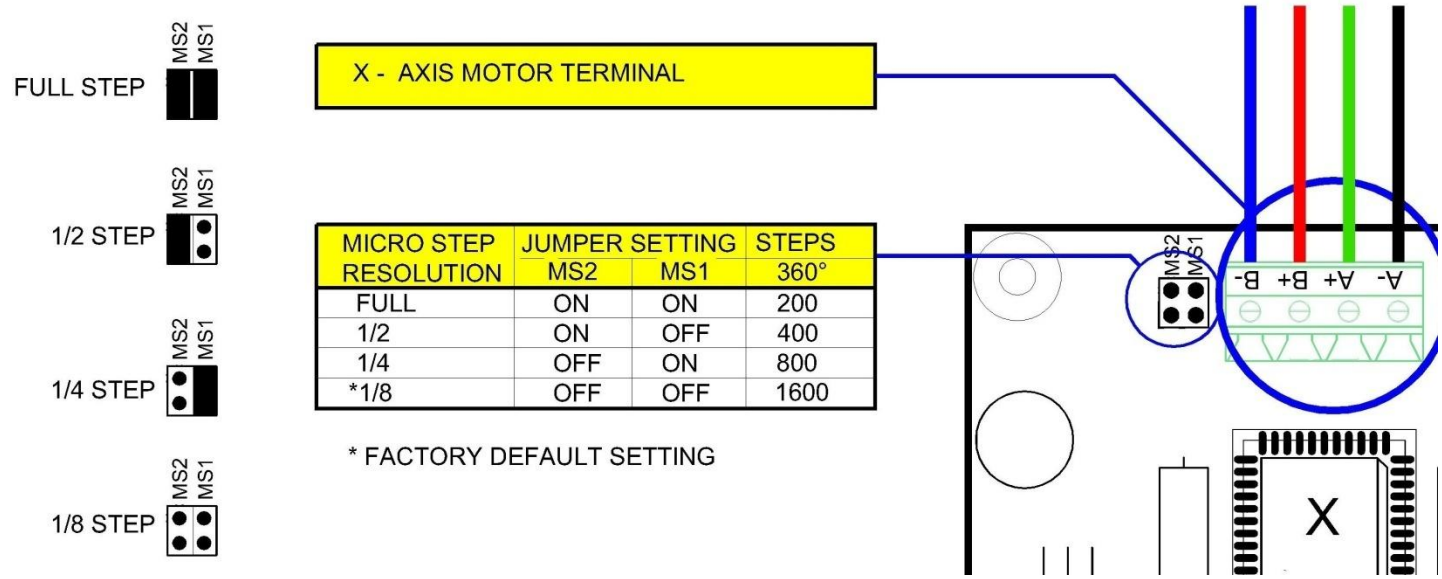


Stepper motors are exactly doing what the name says stepping, from one position to the next, with this start / stop sequence, all stepper motors are very prone to resonance / vibration as the coils are continually energizing and de-energizing, resonance most commonly called vibration or rough running, can occur at certain speeds, for example a motor might run great at higher or lower speeds but might have a lot of extra vibration at certain mid range speeds, this is called resonance, and is very common with stepper motors, sometimes a higher or lower acceleration setting can help, to drive the motor thru a resonance zone, also the use of a motor damper is used in stepper motor system to remove vibration resonance is recommended. The Rockcliff board uses whats called a **PFD** adjustment which is located to the right of the current trim pot, after your motors are installed into the machine with the final wire length,and drive with slides, this setting can be used to help with removing resonance.

Heat Sinks and Cooling Fans Heat Sinks are provided for additional cooling to the motor driver IC chips, and power transistor, a heat sink should always be used when the current setting is set above 50% of the maximum setting.

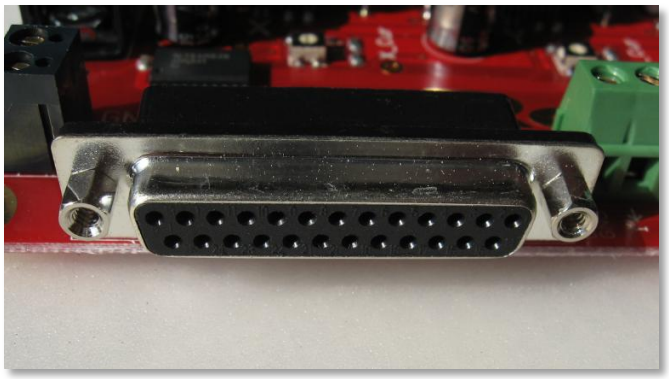
The motor IC heat sinks are attached with a thermally conductive adhesive pad, we recommend the board be mounted in the horizontal position. In an application where a vertical position is required, insure the adhesive has fully cured, which will generally taken place within a few days. A cooling fan is also highly recommended, when current settings are set past 50% , a cool running IC will extend the life of your driver board, and an overheated IC will be will be the end for your driver board

Micro Step Resolution Setting Can be applied to each axis individually, with an on board dip switch, this setting will multiply the actual step rate of a typical 200 step per turn motor, micro-stepping increases resolution



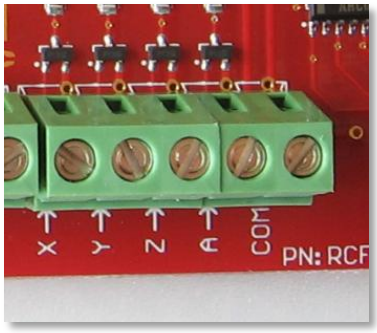
MICRO STEP RESOLUTION	JUMPER SETTING MS2	MS1	STEPS 360°
FULL	ON	ON	200
1/2	ON	OFF	400
1/4	OFF	ON	800
*1/8	OFF	OFF	1600

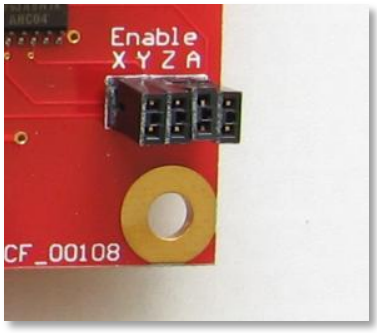
* FACTORY DEFAULT SETTING



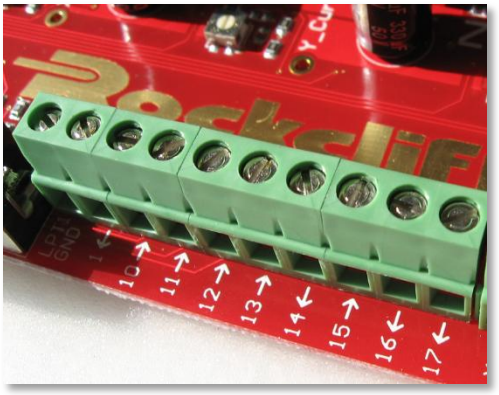
Parallel Port (DB25 Printer Port) connection cable used is a DB25 Cable straight thru male ended connector, the cable length should be as short as possible, and shielded , which will maximize signal strength and lower the chances of EMI (electro-magnetic interference), Most newer PC's do not install a DB25 port, but the use of a PCMIA card in a laptop or a parallel port expansion card in a desktop is acceptable,

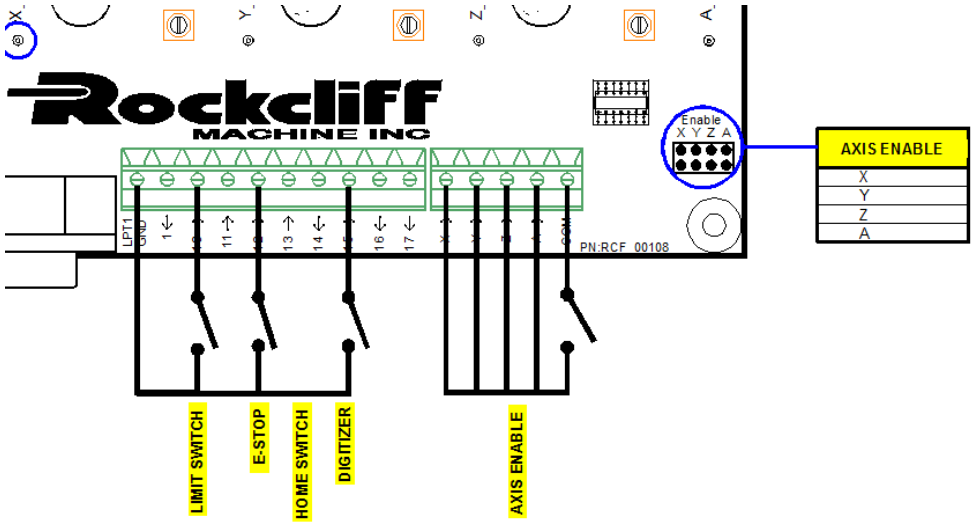
Enable Connections can be hard wired for multiple X, Y, Z, A, or can be set by jumper, The drive is shipped with all axis's enabled (**all jumpers on**) if any axis's are not used you can disable the axis by removing the appropriate jumper, the screw terminals x, y, z, a and com can be used for a remote switch if needed.

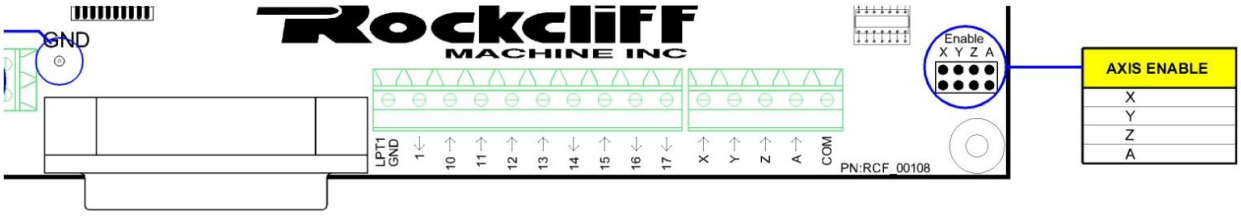




Parallel Port Breakout Screw INPUT / OUTPU Terminals LPT-GND, 10, 11,12,13,14, 15, 16, 17 Are Parallel Port inputs and outputs and can be accessed via on-board Screw Terminals, the I/O's may be used for any functions such as **e-stop, limit switches, home switches, spindle control, coolant control, MPG** , **etc**. Refer to your software package Mach3 etc. to properly setup and use functions





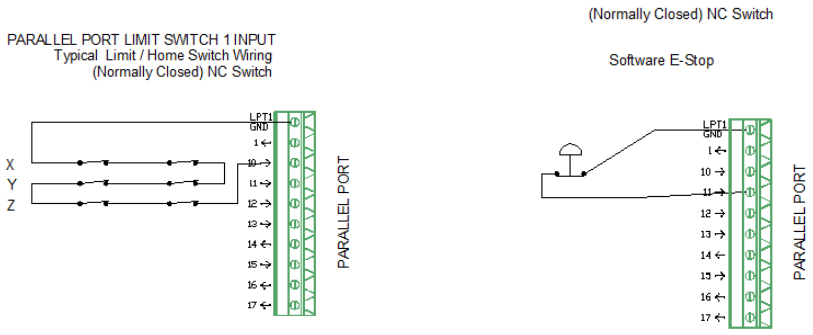


DB25 CONNECTOR PIN ASSIGNMENT	
1	STROBE
2	X - AXIS - STEP
3	X - AXIS - DIRECTION
4	Y - AXIS - STEP
5	Y - AXIS - DIRECTION
6	Z - AXIS - STEP
7	Z - AXIS - DIRECTION
8	A - AXIS - STEP
9	A - AXIS - DIRECTION
10	INPUT
11	INPUT
12	INPUT
13	INPUT
14	OUTPUT
15	INPUT
16	OUTPUT
17	OUTPUT
18	GROUND
19	GROUND
20	GROUND
21	GROUND
22	GROUND
23	GROUND
24	GROUND
25	GROUND

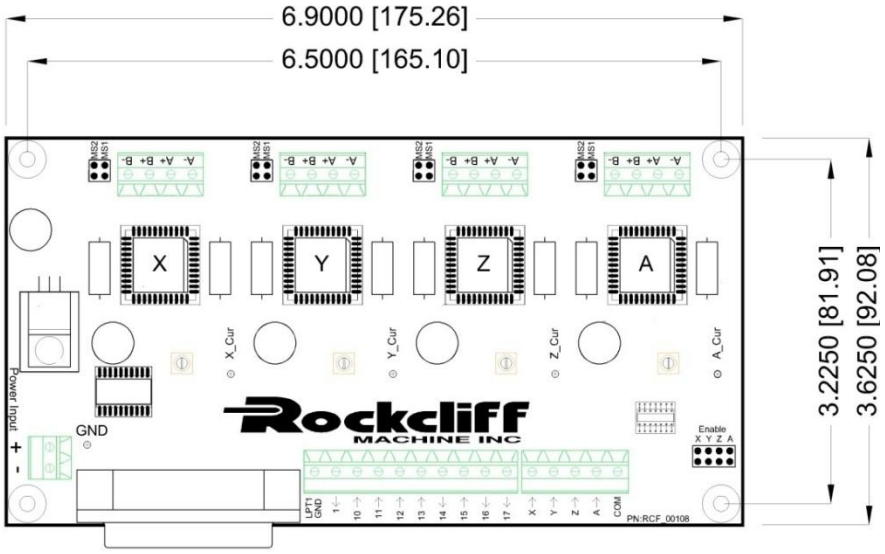
INPUT / OUTPUT
LPT GND
1 STROBE - OUTPUT
10 INPUT
11 INPUT
12 INPUT
13 INPUT
14 OUTPUT
15 INPUT
16 OUTPUT
17 OUTPUT

AXIS DISABLE
X
Y
Z
A
COM

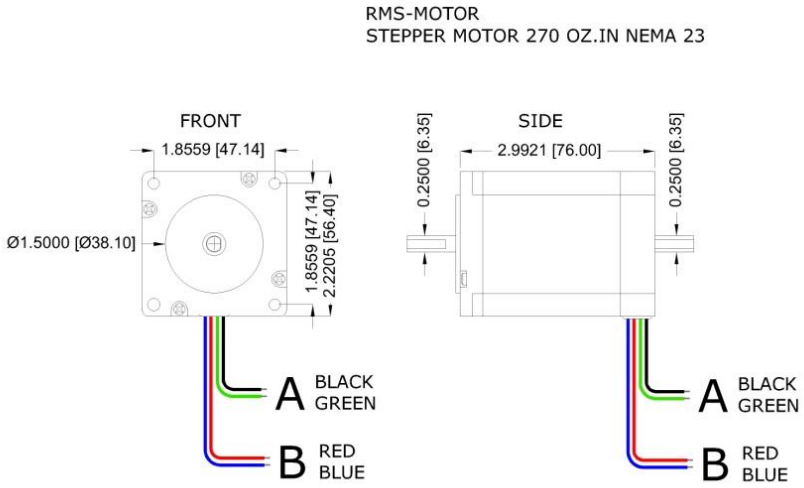
SAMPLE PARALLEL PORT WIRE DIAGRAM

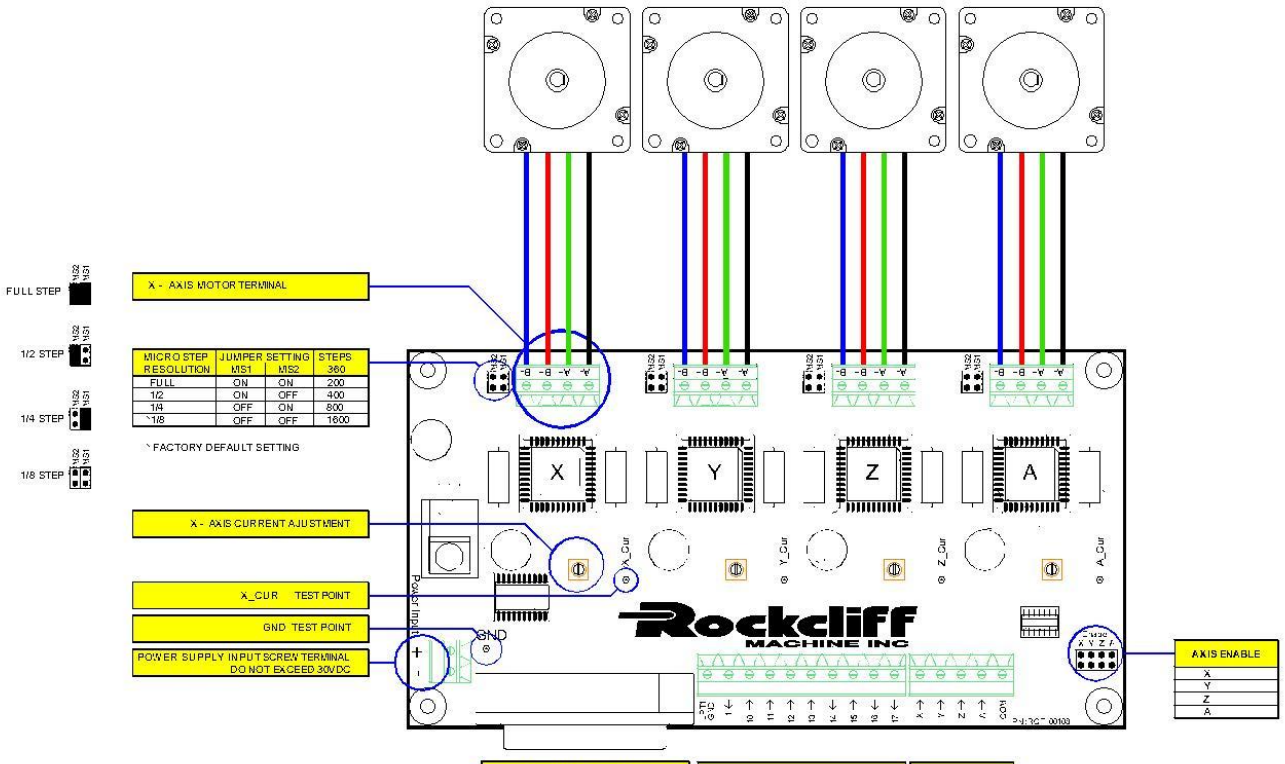


Mounting Dimensions When mounting your board always use circuit board stand-off fasteners, to raise the board slightly up off the mounting surface, this will insure adequate space is maintained above the solder connections and will also provide some additional ventilation



Motor Dimensions



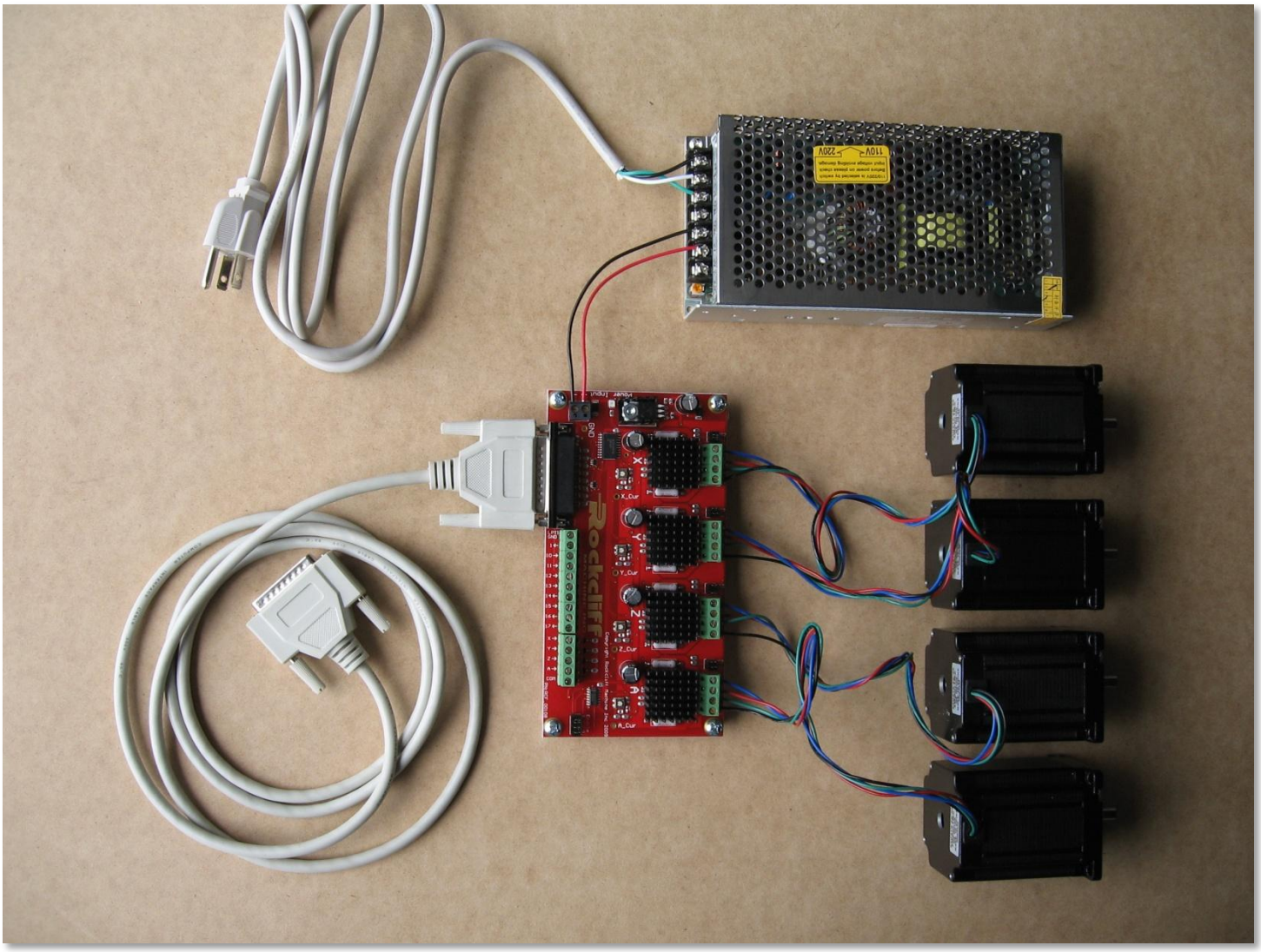


MICRO STEP RESOLUTION	JUMPER SETTING MS1	MS2	STEPS 360
FULL	ON	ON	200
1/2	ON	OFF	400
1/4	OFF	ON	800
1/8	OFF	OFF	1600

DB25 CONNECTOR PIN ASSIGNMENT	
1	STROBE
2	X - AXIS - STEP
3	X - AXIS - DIRECTION
4	Y - AXIS - STEP
5	Y - AXIS - DIRECTION
6	Z - AXIS - STEP
7	Z - AXIS - DIRECTION
8	A - AXIS - STEP
9	A - AXIS - DIRECTION
10	INPUT
11	INPUT
12	INPUT
13	INPUT
14	OUTPUT
15	INPUT
16	OUTPUT
17	OUTPUT
18	GROUND
19	GROUND
20	GROUND
21	GROUND
22	GROUND
23	GROUND
24	GROUND
25	GROUND

INPUT / OUTPUT
LPT GND
1 STROBE - OUTPUT
10 INPUT
11 INPUT
12 INPUT
13 INPUT
14 OUTPUT
15 INPUT
16 OUTPUT
17 OUTPUT

AXIS DISABLE
X
Y
Z
A
COM



SAFETY IS MOST IMPORTANT

AS WITH ANY MACHINE AND FABRICATION THERE IS NO MORE IMPORTANT RULE THAN SAFETY FOLLOW ALL SAFETY RULES FOR THE MANUFACTURE OF YOUR MACHINE AND FOLLOW ALL SAFETY RULES WHEN USING THIS SYSTEM ROCKCLIFF MACHINE INC. WILL NOT BE HELD RESPONSIBLE FOR ANY DAMAGES, LIABILITIES OR INJURIES RELATED TO BUILDING A MACHINE, THE USE OF THIS SYSTEM AND TO ANY PARTS THE MACHINE CAN PRODUCE. THE CONSTRUCTION AND USE OF THIS SYSTEM CAN CAUSE **SERIOUS INJURY**, IT'S UP TO YOU TO BUILD IT AND USE IT SAFELY AND RESPONSIBLY,