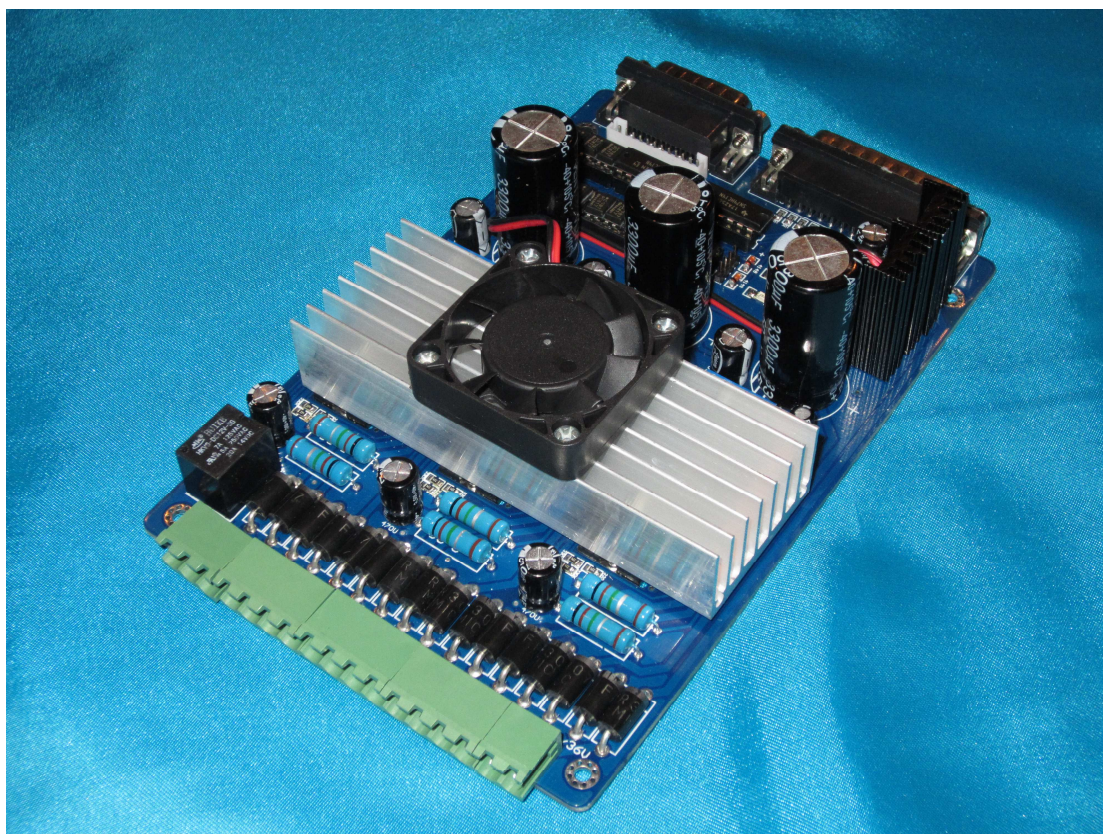# TB6560 DRIVER
BOARD 3 AXIS USER GUIDE

Introduction about CNC machining

CNC engraving can be a great activity for anyone who likes wood, metals or other materials engraving. However, most of the times, people are failing to complete the necessary operations because they do not use the right CNC engraver machines. Additionally, some of these machines are functioning based on special CNC engraver software which has to be purchased accordingly to the tasks' specifications.

Metal *CNC Engraving*

You probably are aware that most of the times metal requires other processing procedures. Engraving the metal implies a different procedure than simple dragging or burnishing on metal pieces. You are able to use various CNC engraving machines that deliver different options that are to be considered prior to starting the engraving process. Some of these considerations are listed in the next few paragraphs.

Holding Device: CNC engraving into metal requires a solid hold of the pieces which are to be engraved. For this reason, you have to make sure that the holding mats present the right capacity of holding the pieces properly. The holding mats should keep the metal in place without becoming loose during the CNC engraving process.

Jigs: This is another important aspect in using various CNC engraver machines. If you use professional machines in competitive projects, then you should probably consider obtaining custom jigs. The jigs are very important in any CNC engraving task as if they are not the right ones, the results will be compromised. Even more, the right jigs are going to allow you to complete any CNC engraving tasks more accurate, easier and faster. For this reason, the time and money you spend in creating the best jigs are definitely worthy.

Spindles, Cutting Fluids and Cutters: Getting the right spindles for your CNC engraving machines is also very important. This is mostly because the common spindles do not provide the necessary support for the pieces that have to be processed. This way, the CNC engraving tool is going to chatter larger engraving loads. This thing does not only limit the engraving quality but it can also damage the machine.

The cutting fluid is essential in CNC engraving as it lubricates the surfaces involved into engraving process. This provides protection for both cutters and metal pieces by cooling the surfaces. Additionally, the cutting fluid helps in obtaining a smooth edge and a perfect finishing. One of the best cutting fluids is Mystic Metal.

Some decisive elements that you need to consider in CNC engraving are the cutters. These are the most important tools because thanks to them you are able to perform the CNC engraving. You have to know that engraving metal is going to require many different cutters such as double end mills and double-ended cutters. The end mills are very easy to be used and they can provide the best results that are enhanced by the highest quality. However, make sure that you have the right re-sharpening tools as the metal CNC engraving is going to ask for many sharp cutters.

It is essential that prior to using an engraving tool to understand that one of the most important stages of the engraving process is to create a detailed production plan. This way, you will obtain the best results as you are going to use the proper tools and strategies which will bring highly efficient results.

The 3-axis engraving machine drive, using high-performance dedicated micro-step away from the computer control chip TB6560, Open microcomputer control according to user requirements to functional design to the driver board, the composition of the minimum control system. control panel is suitable for any small and medium-driven two-phase or four-phase hybrid stepper motor. And have current 0.6A, 1.2A, 1.8A, 2.5A 4 stalls adjustable function, support MACH2, MACH3 Series software, support KCAM4 Series software, extensive application and mold machining, engraving and other graphic applications. As a result of new bipolar constant-current chopping technique, high precision, the motor is running, little vibration, low noise, smooth operation, safe and convenient, the vast number of DIY enthusiasts and engraving machine manufacturers product of choice.

A CNC wood router is a Numerical control tool that creates objects from wood. Parts of a project can be designed in the computer with a CAD/CAM program, and then cut automatically using a router to produce a finished part.

The CNC router works like a printer. Work is composed on a computer and then the design or drawing is sent to the CNC router for the hard copy. This outputs a 3-dimensional copy of the work. The CNC router uses a cutting tool instead of an ink jet. The cutting tool is generally a router but other cutters can be used as well.

The CNC works on the Cartesian coordinate system (X, Y, Z) for 3D motion control. CNC stands for computer numerical control. This gives the computer a printer-like ability to drive a CNC machine to make parts.

The CNC Router is ideal for hobbies, engineering prototyping, product development, art, robotic education, and production work.

Operation

A CNC wood router uses CNC (computer numerical control) and is similar to a metal CNC mill with the following differences:

The wood router typically spins faster — with a range of 13,000 to 24,000 RPM

Professional quality machines frequently use surface facing tools up to 3" in diameter or more, and spindle power from 5 to 15 horsepower. Machines capable of routing heavy material at over a thousand inches per minute are common.

Some machines use smaller tool holders MK2 (Morse taper #2 - on older machines), ISO-30, HSK-63 or the tools just get held in a collet tool holder affixed directly to the spindle nose. ISO-30 and HSK-63 are rapid-change tool holding systems. HSK-63 has begun to supplant the ISO-30 as the rapid change standard in recent years.

A wood router is controlled in the same way as a metal mill, but there is a lot of CAM and CAD software like Artcam, Mastercam, Bobcad, and Featurecam specifically for wood routers.

Wood routers are frequently used to machine other soft materials such as plastics at high speed.

Typical three-axis CNC wood routers are generally much bigger than their metal shop counterparts. 5' x 5', 4' x 8', and 5' x 10' are typical bed sizes for wood routers. They can be built to accommodate very large sizes up to, but not limited to 12' x 100'. The table can move, allowing for true three axis (xyz) motion, or the gantry can move, which requires the third axis to be controlled by two slaved servo motors.

Features

Separate heads

Some wood routers have multiple separate heads that can come down simultaneously or not. Some routers have multiple heads that can run complete separate programs on separate tables all while being controlled by the same interface.

Dust collection

The wood router typically has 6"-10" air ducts to suck up the wood chips/dust created. They can be piped to a stand-alone or full shop dust collection system.

Some wood routers are specialized for cabinetry and have many drills that can be programmed to come down separately or together. The drills are generally spaced 32 mm apart on centers - a spacing system called 32 mm System. This is for the proper spacing of shelving for cabinets. Drilling can be vertical or horizontal (in the Y or X axis from either side/end of the work piece) which allows a panel to be drilled on all four edges as well as the top surface. Many of these machines with large drilling arrays are derived from CNC point-to-point borers.

Securing the work piece

Suction systems

A typical CNC wood router with suction holes visible

The wood router typically holds wood with suction through the table or pods that raise the work above the table. Pods may be used for components which require edge profiling (or undercutting), are manufactured from solid wood or where greater flexibility in production is required. This type of bed requires less extraction with greater absolute vacuum.

A second type hold down uses a spoil board. This allows vacuum suction through a low density table and allows the placement of parts anywhere on the table. These types of tables are typically used for nest-based manufacturing (NBM) where multiple components are routed from a single sheet. This type of manufacturing precludes edge drilling or undercut edge work on components.

Vacuum pumps are required with both types of tables where volume and "strength" are determined based on the types of materials being cut.

DISCLAIMER

TB6560AHQ driver chip's advantages:

The TB6560AHQ/AFG is a PWM chopper-type stepping motor driver IC designed for sinusoidal-input microstep control of bipolar stepping motors. The TB6560AHQ/AFG can be used in applications that require 2-phase, 2-phase, 2W 1-2-phase and 4W 1-2-phase excitation modes. The TB6560AHQ/AFG is capable of low-vibration High-performance forward and reverse driving of a two-phase bipolar stepping motor using only a clock signal.

Features

• Single-chip motor driver for sinusoidal microstep control of stepping motors
• High output withstand voltage due to the use of BiCD process:
  Ron (upper and lower sum) TB6560AHQ: 0.6 Ω (typ.)
• Forward and reverse rotation
• Selectable phase excitation modes (2, 1-2, 2W1-2 and 4W1-2)
• High output withstand voltage: VDSS = 40 V
• High output current: IOUT = TB6560AHQ: 3.5 A (peak)
• Internal pull-down resistors on inputs: 100 kΩ (typ.)
• Output monitor pin: MO current (IMO (max) = 1 mA)
• Reset and enable pins
• Thermal shutdown (TSD)

TB6560 driver board 3 axis driver board introduction

Toshiba TB6560AHQ chip high power, maximum 3.0A (3.5A pick) drive current chip set

1 to 1/16 micro step setting - Higher accuracy and smoother operation than standard 1, 1/2 step

Current overload and over temperature safety features, providing full protection for your computer and peripheral equipment

Full closed type optical isolation to protect the user's computer and equipment

On board current switching, power output can be set according to specific user requirement; each axis can be set to 25%, 50%, 75%, 100%

Relay spindle interface, the max output is 36VDC 7.5A for spindle motors or coolant pump **(only one device can be powered by this output)**

4 channel inputs interface- Can be used for XYZ limit and emergency stop *(limit switch sold separated)*

Professional design - Two stage signal processing with super anti jamming

Bipolar constant current chopper drive with non-resonant region - Controls motors smoothly through range without creep effect

Four control inputs (divided into pairs of knives), Allows setting of limit and emergency stop!

Universal architecture supports most parallel software MACH3, KCAM4, EMC2 etc!

Driver output is compatible with 2 or 4 phase and 4, 6 or 8 lead stepper motors *(See Step Motor Wiring Diagram)*

Suitable for unipolar or bipolar stepper motors.

Voltage regulated spindle speed controlled by parallel interface as function of supply voltage.

Important:

Power supply input range is 12-36VCD, a 24V is recommended *(**Power supply sold separated**)*

12-16V DC power supply for Nema 17 stepper motors
16-24V DC power supply for Nema 23 stepper motors
24-36V DC power supply for Nema 34 stepper motors

(Ensure to use a high quality regulated power supply is used with this PCBA, a higher voltage or intermittent voltage spikes will burn up the stepper motors chip driver!)

The power output of the coolant fan is 12VDC

Parallel Port Interface Pin Out *(25 pin)*

PIN9	PIN14	PIN7	PIN1	PIN2	PIN3	PIN8	PIN6	PIN4	PIN5	PIN16	PIN17
Spindle	X Enable	X Dir	X Step	Y Enable	Y Dir	Y Step	Z Enable	Z Dir	Z Step	Expand output 1	Expand output2

4 Channel Inputs Interface Pin Out (*part of parallel port used for limit and E-Stop switch*)

Input 1	Input 2	Input 3	Input 4
Corresponding Pin10 (X limit)	Corresponding Pin11(Y limit)	Corresponding Pin12 (Z Limit)	Corresponding Pin13 (E-Stop)

Manual Interface Port Pin Out *(15 pin)*

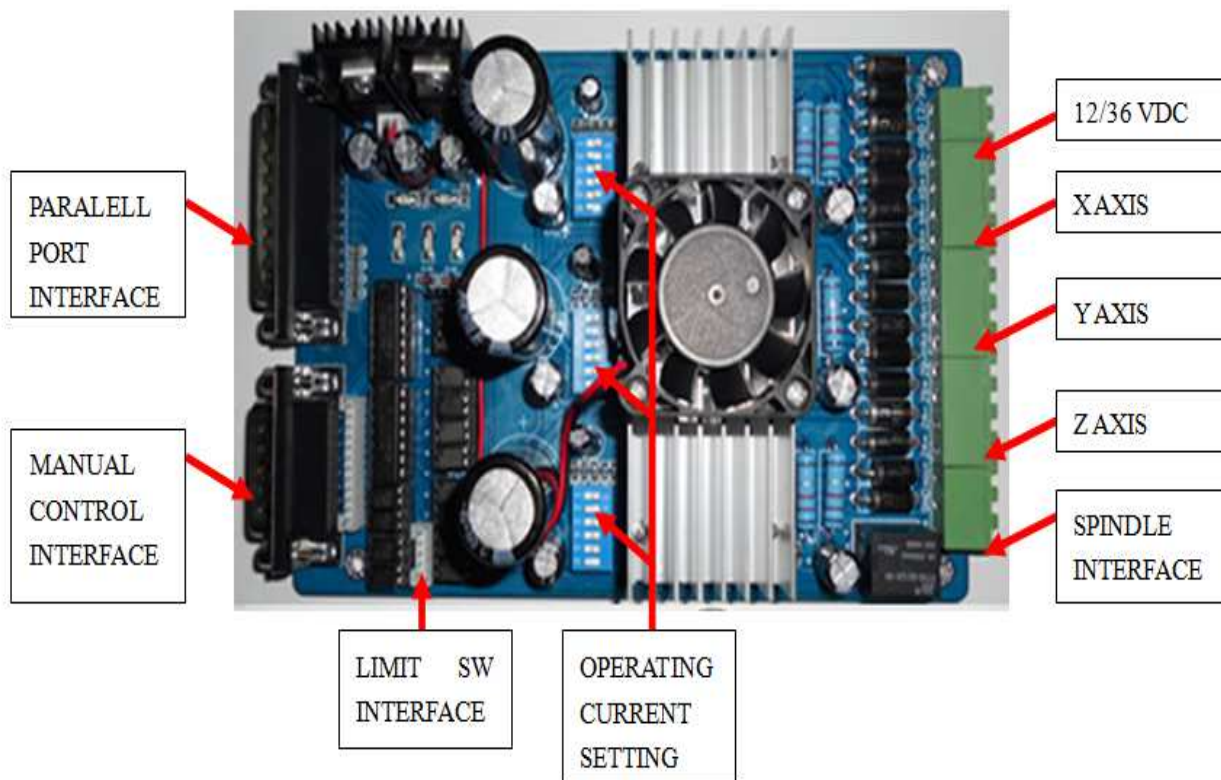| P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
X Step	X Enable	Spindle	X Dir	Y Enable	Z Dir	Z Step	Z Enable	Y Limit	Z Limit	Y Dir	Y Step	STOP	GND	5v/VDD

Parallel Port Interface Pin Out Reference *(25 pin)*
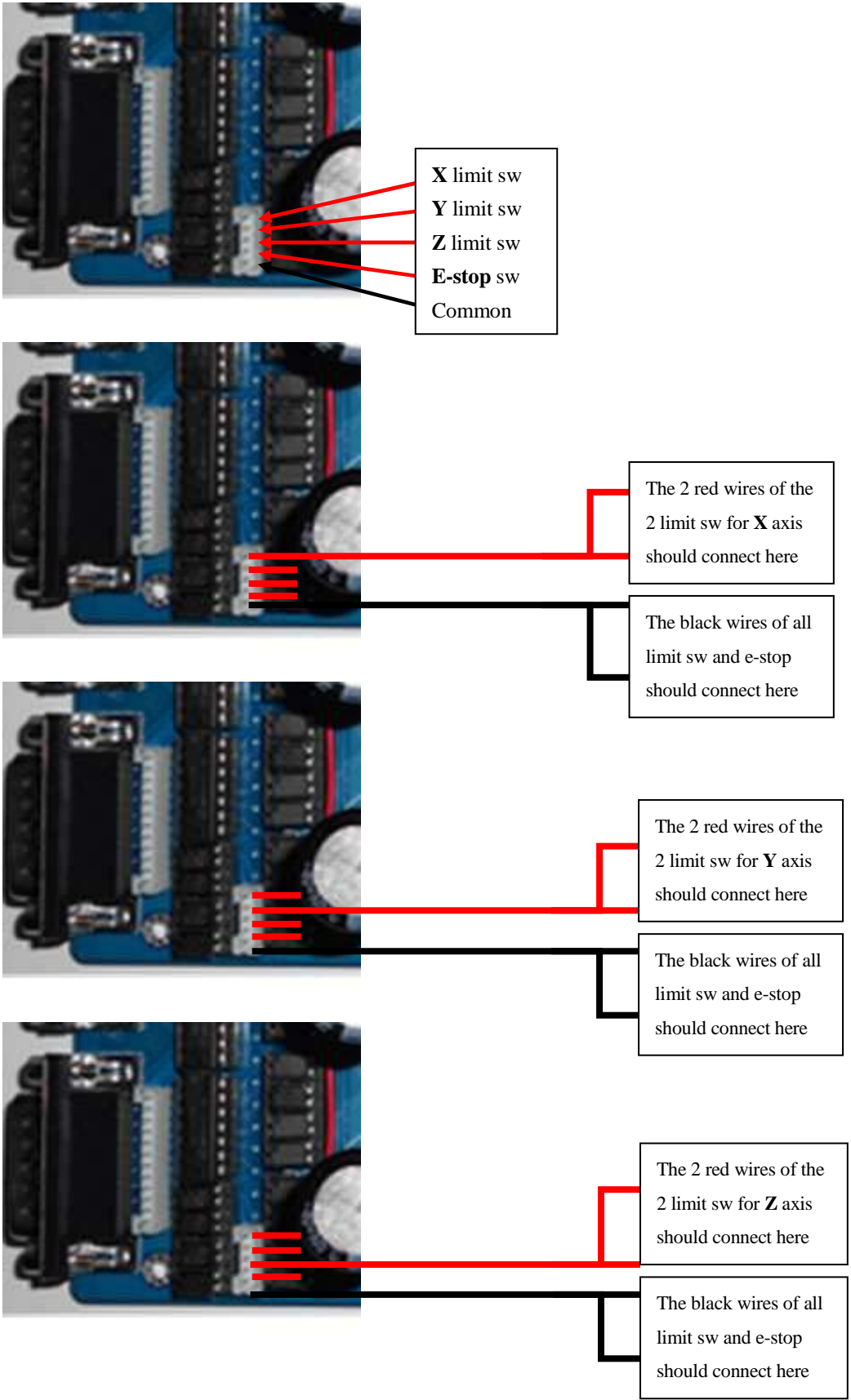

Step Motor Wiring Diagram

6
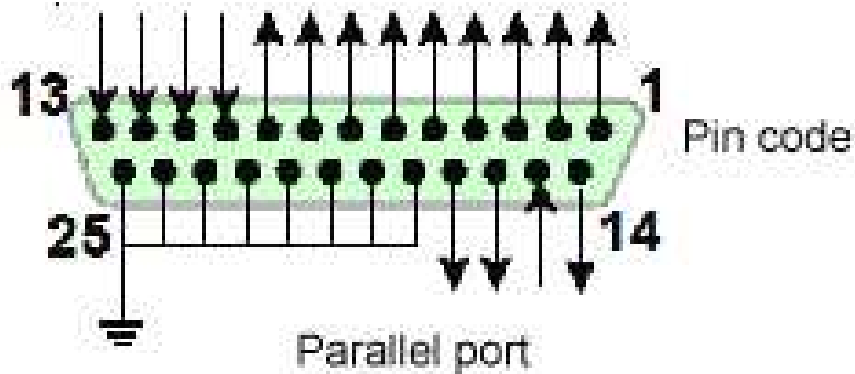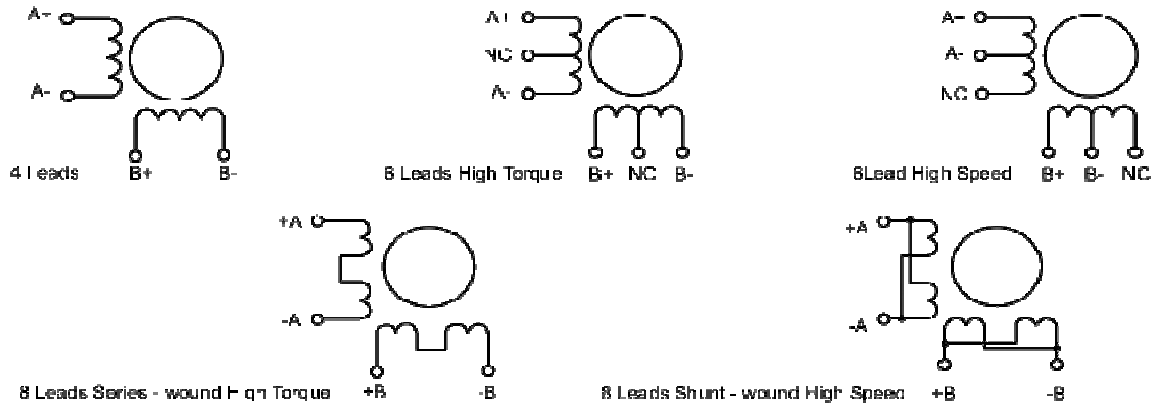
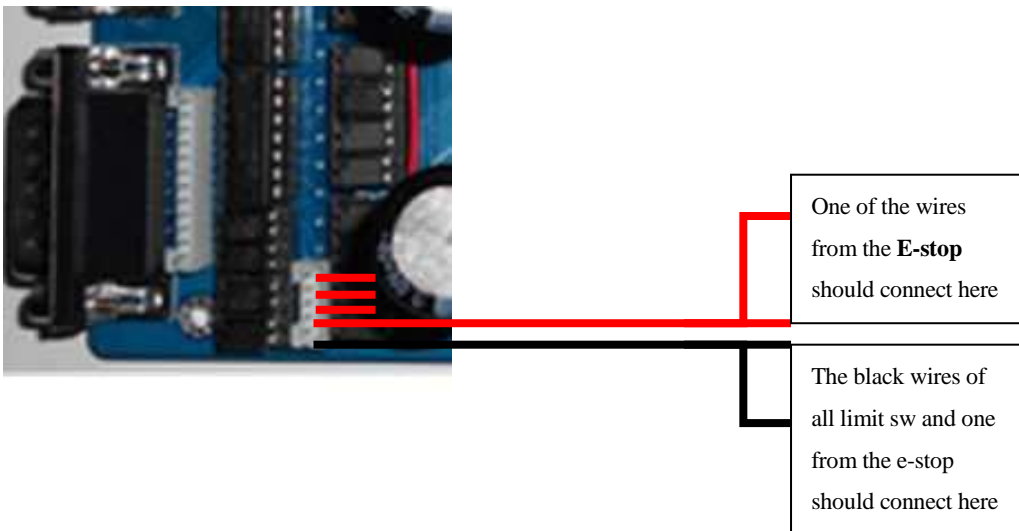## 3 Axis TB6560 Driver Board PCBA Appearance

Operating Current Dip Switch Settings *(repeat set up on all 3 axis as desired)*

Current Setting (SW1,2)	sw1	sw2	Decay Mode Settings (SW3,4)	sw3	sw4	Micro Step Settings (SW5,6)	sw5	sw6
100%	ON	ON	FAST	ON	ON	1	ON	ON
75%	ON	OFF	25%	ON	OFF	1/2	ON	OFF
50%	OFF	ON	50%	OFF	ON	1/8	OFF	ON
25%	OFF	OFF	SLOW	OFF	OFF	1/16	OFF	OFF

Connecting limit switch and E-Stop switch *(E-Stop switch, limit switch and limit switch harness are sold separately)*
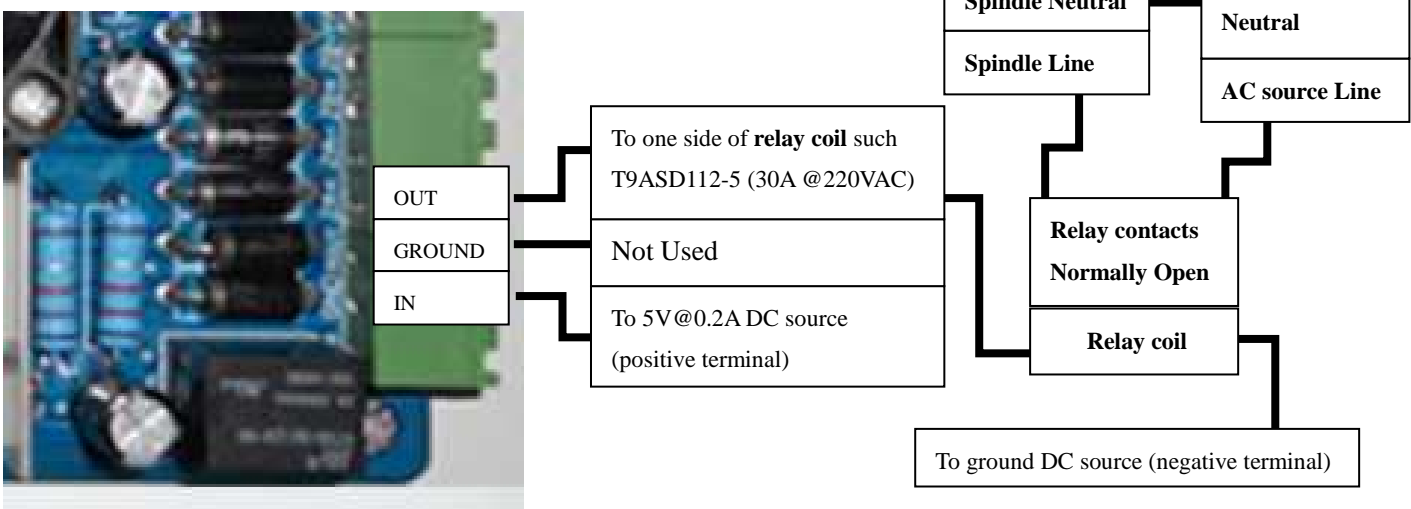

X limit sw
Y limit sw
Z limit sw
E-stop sw
Common

The 2 red wires of the 2 limit sw for **X** axis should connect here

The black wires of all limit sw and e-stop should connect here

The 2 red wires of the 2 limit sw for **Y** axis should connect here

The black wires of all limit sw and e-stop should connect here

The 2 red wires of the 2 limit sw for **Z** axis should connect here

The black wires of all limit sw and e-stop should connect here

One of the wires from the **E-stop** should connect here

The black wires of all limit sw and one from the e-stop should connect here

Connecting spindle *(Spindle sold separately)*

Option A: Using a DC Spindle (Spindle max voltage should not exceed 36V, 7Amps)

OUT	To spindle positive terminal
GROUND	To spindle power supply ground
IN	To spindle power supply: 12 to 36 VDC, 7Amps MAX
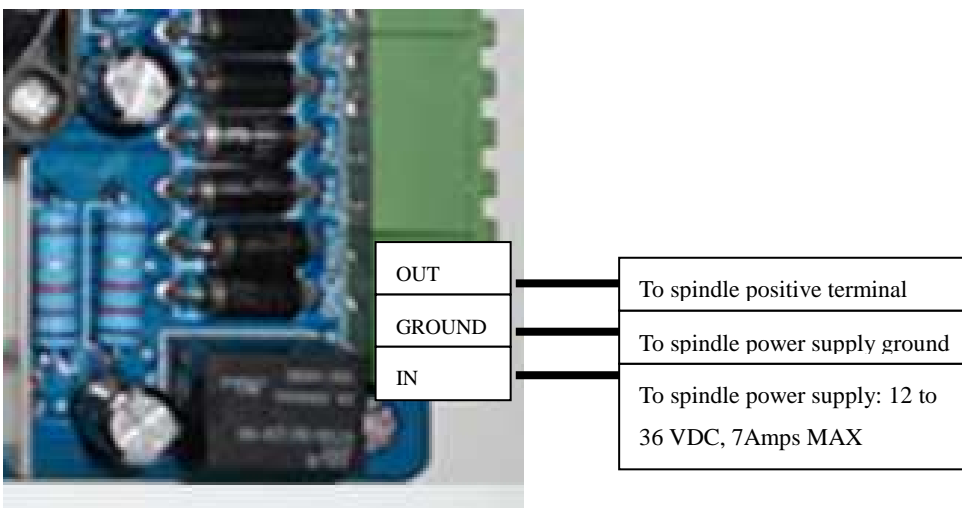
Option B: Using an AC Spindle (Only for testing purposes)

OUT	To one side of **relay coil** such T9ASD112-5 (30A @220VAC)
GROUND	Not Used
IN	To 5V@0.2A DC source (positive terminal)

Spindle Neutral

Spindle Line

AC source Neutral

AC source Line

Relay contacts
Normally Open

Relay coil

To ground DC source (negative terminal)

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Option C: Using an AC Spindle (The correct way)
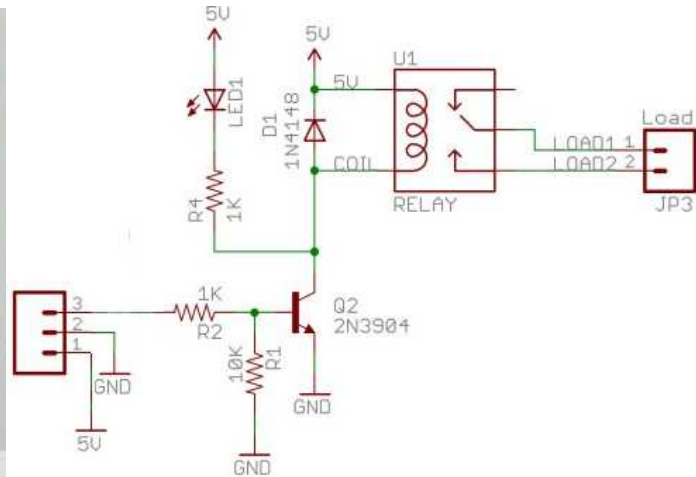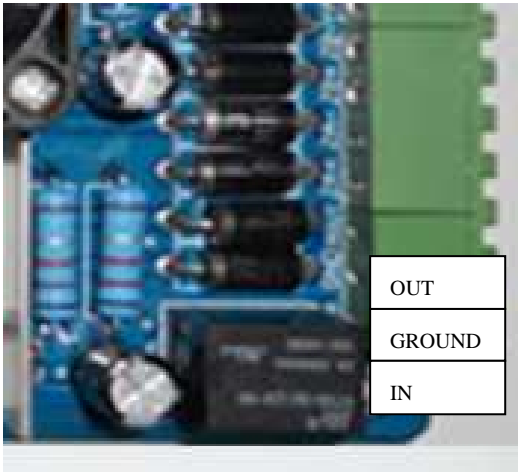
For example, if your spindle is a 15A@120VAC, **DON'T** use a relay rated for 15A@120VAC, instead use a bigger one, (about twice as much needed, such as 30A@220VAC). Remember, P=I*V (Power = current * voltage) so a 30A@220V relay can handle up to a 6,600W device (about two hair dryers), such the one depicted below

Quick set up guide for *MACH3*

To install MACH3 software follow screen instructions, program can be found on provided CD, Once installation is finished, open *MACH3* software, select **Mach3MILL**, and then click *OK*. Please refer to Fig.1
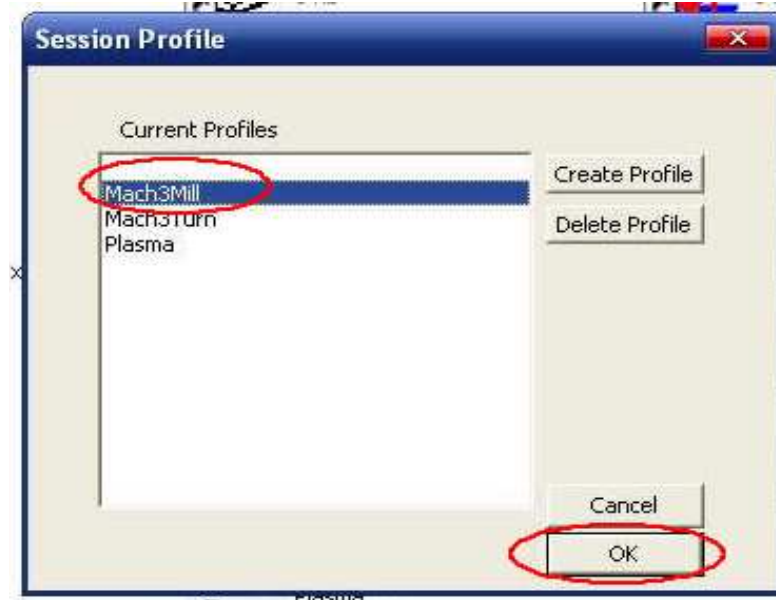
Fig.1

MACH3 Interface should open as shown in Fig 2.

Fig.2

11
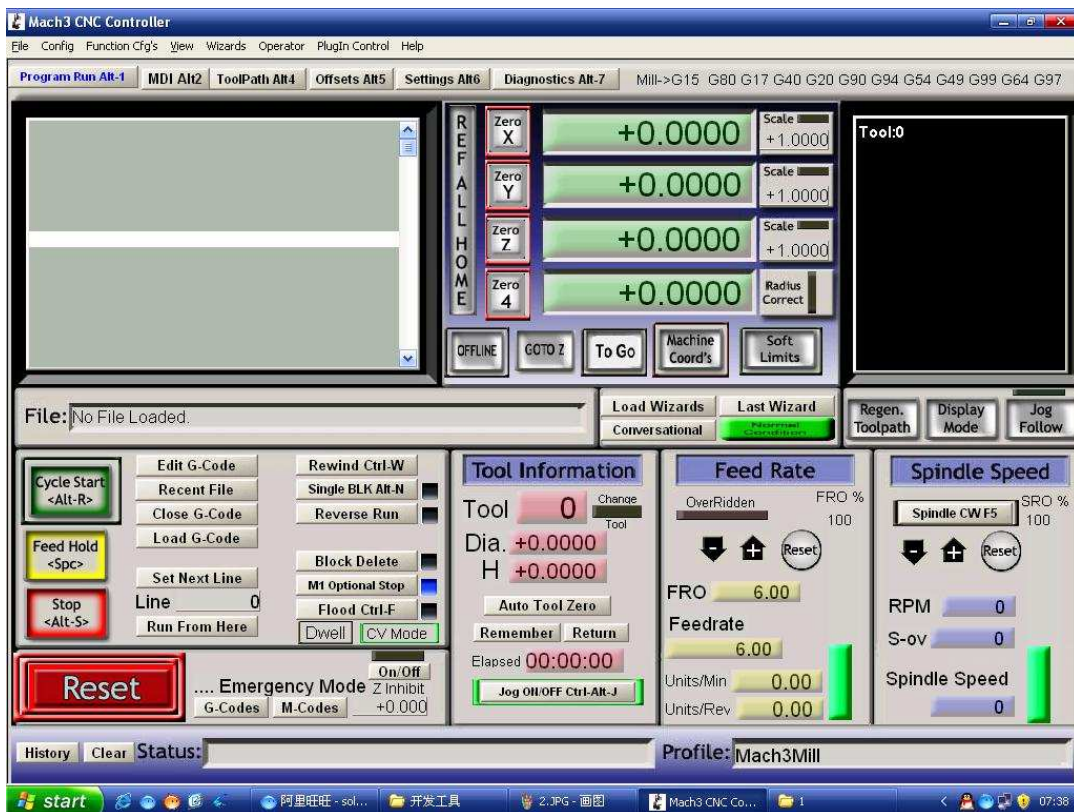
Click *config* menu *and then **ports and pin*** sub-menu of. Please refer to Fig.3.
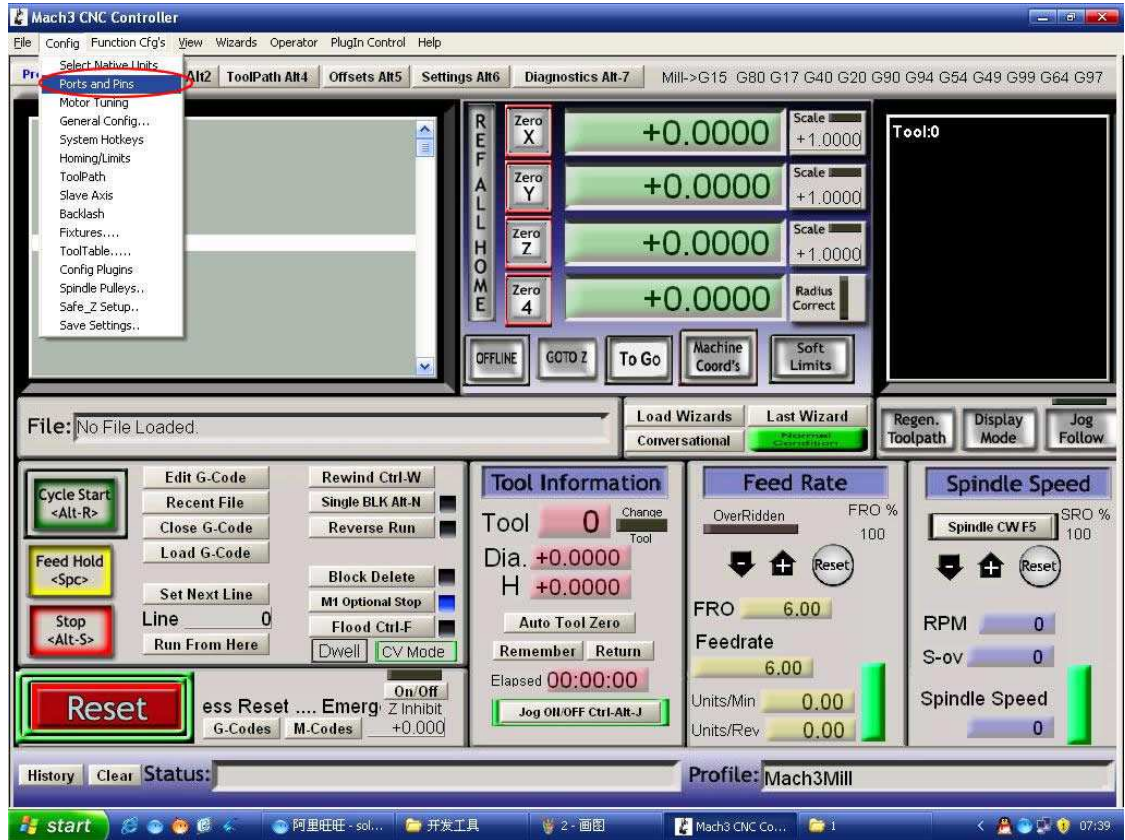
Fig.3

Set up *Kernel Speed*, this is the basic frequency as shown on Circle 1 Fig.4. This parameter will affect the rotational speed of the motor.

Fig.4

12
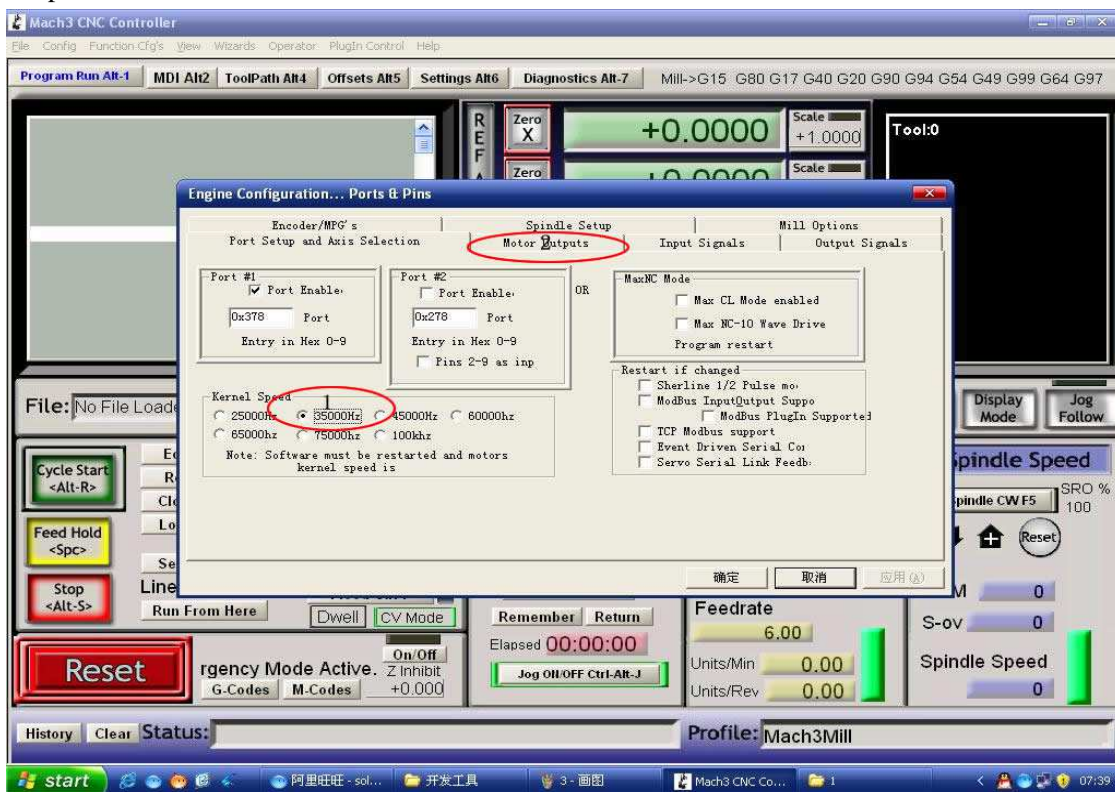
After the setup of basic frequency, select Circle 2 on Fig 4 for **Configuration Scripting** set up, please refer to Fig.5 for set up
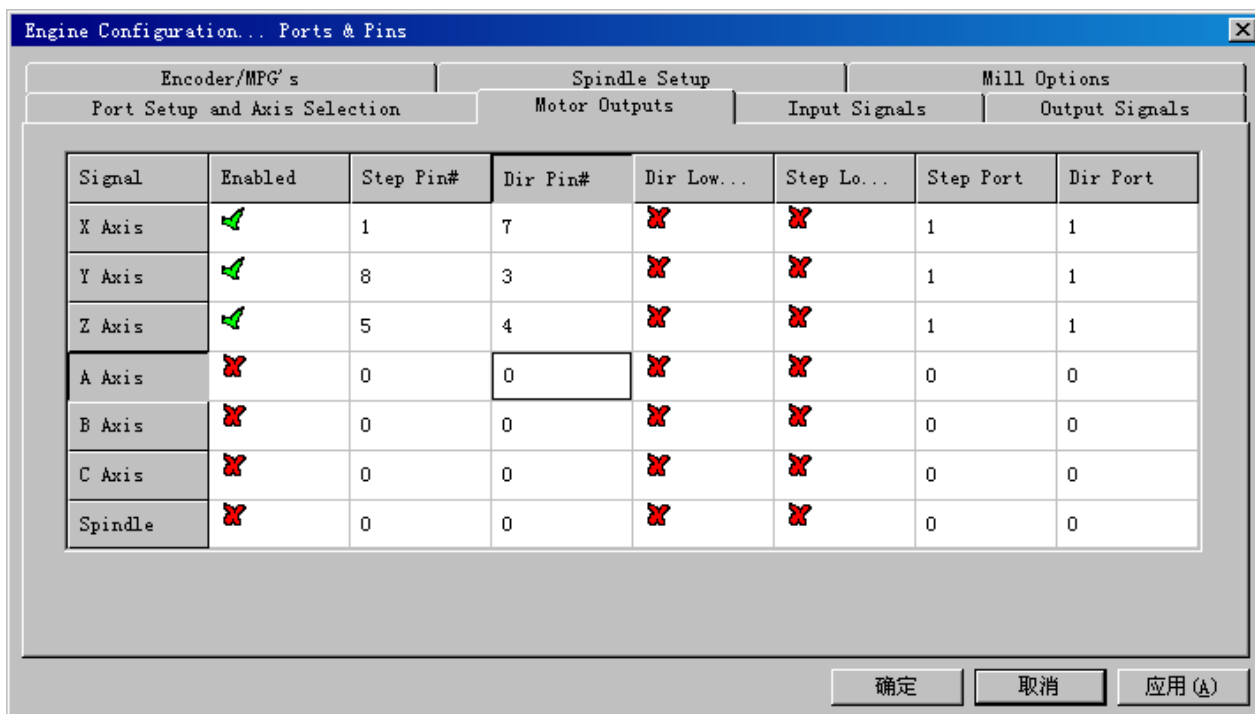
Fig.5

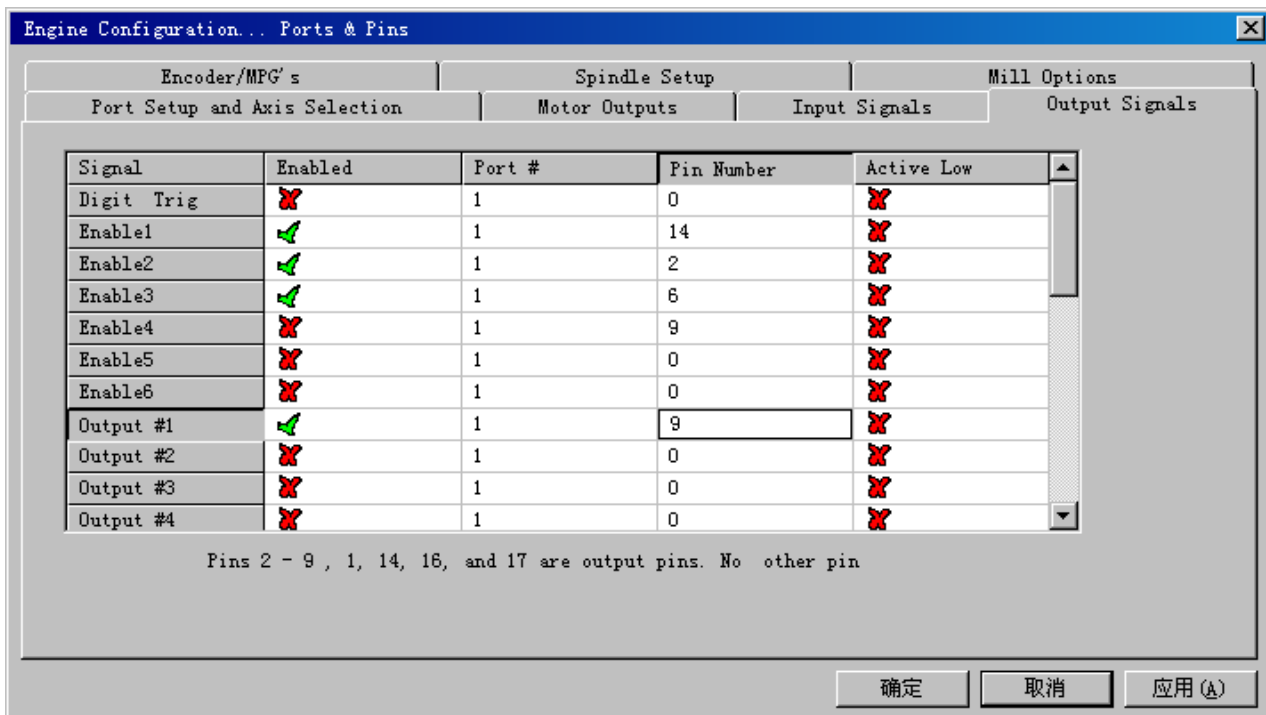Then select the *output signals* tab, and set up the corresponding items as shown below in Fig.6

Fig.6

Select *Input Signals* tab and set up as shown on Fig7a and 7b
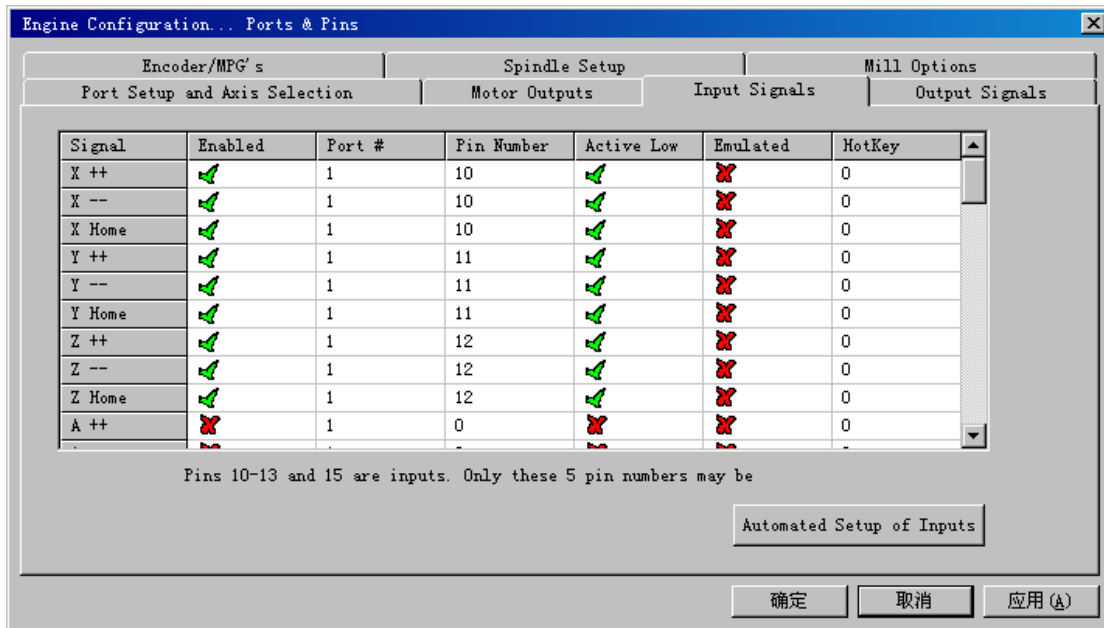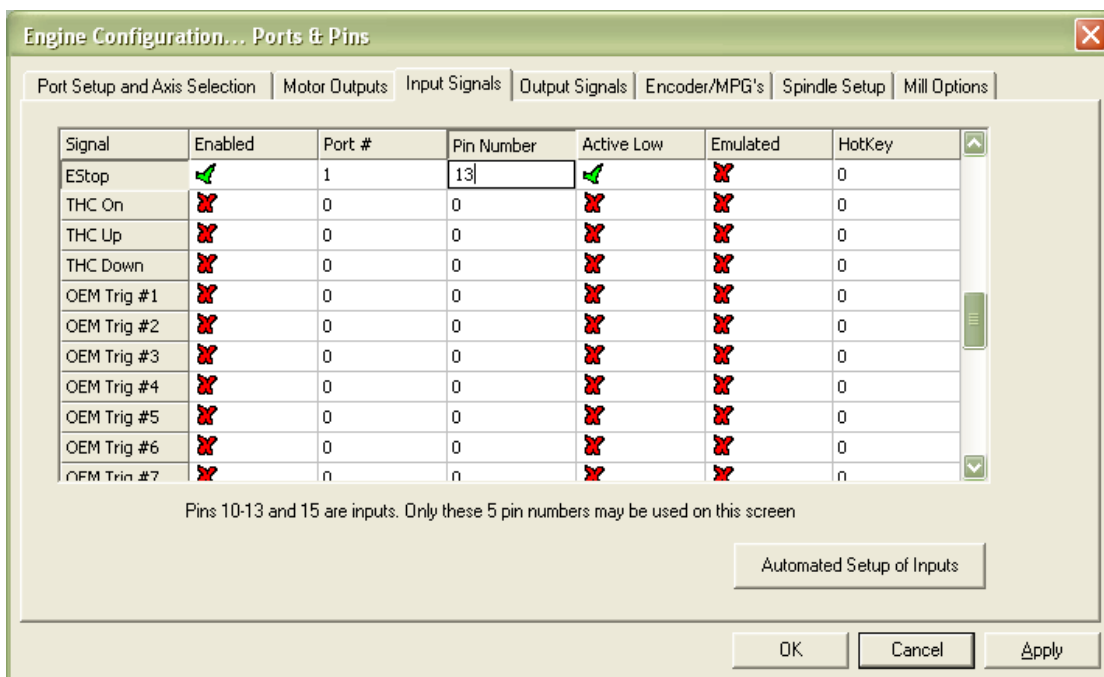

Fig7a

Fig7b

Important:

You still need to tune up your step motor, *this set up depends greatly on the combination of the acme or ball screw and the step motor used, also on the speed and torque and speed desired on your machine*

To tune up your machine, go to *config* menu and then sub menu *motor tuning,* a window as show on Fig8 should open

Set up shown below is the default set up on MACH3 and it might not be what is recommended for your machine, again, this set up depends greatly on the combination of the acme or ball screw and the step motor used, also on the speed and torque desired on your machine

Remember that after making any changes to desired axis you need to click on *SAVE AXIS SETTINGS* for each motor in order to save the changes

On my machines with 425 Oz-in motors, 96 Volts power supply and ½" diameter acme screws and 5 TPI (turns Per Inch), I set it up as listed below *(I'm not responsible for any damage caused to yours machine, this settings are provided as mere sample and most probably are different from any other machine):*

Step per: 6666.66

Velocity: 25
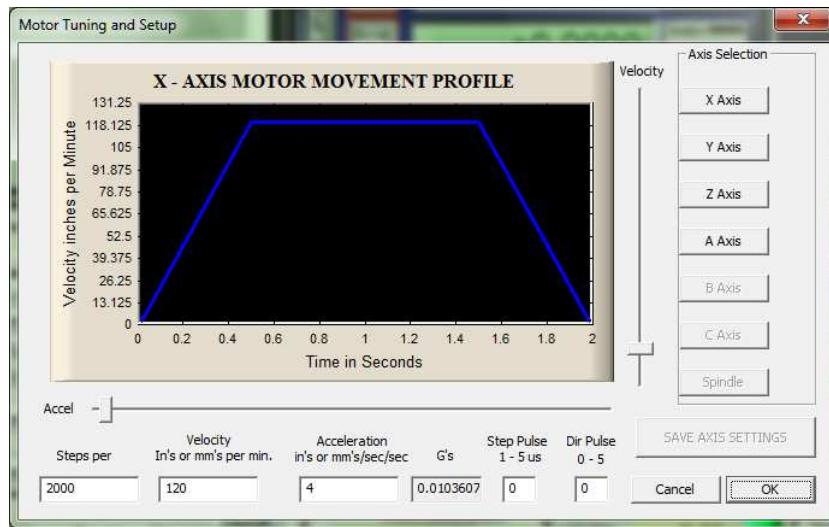
Acceleration: 5

Step Pulse: 1

Dir Pulse: 1

Fig8

Once you have tune up your machine you are ready to load a G-code and test your set up, follow steps below
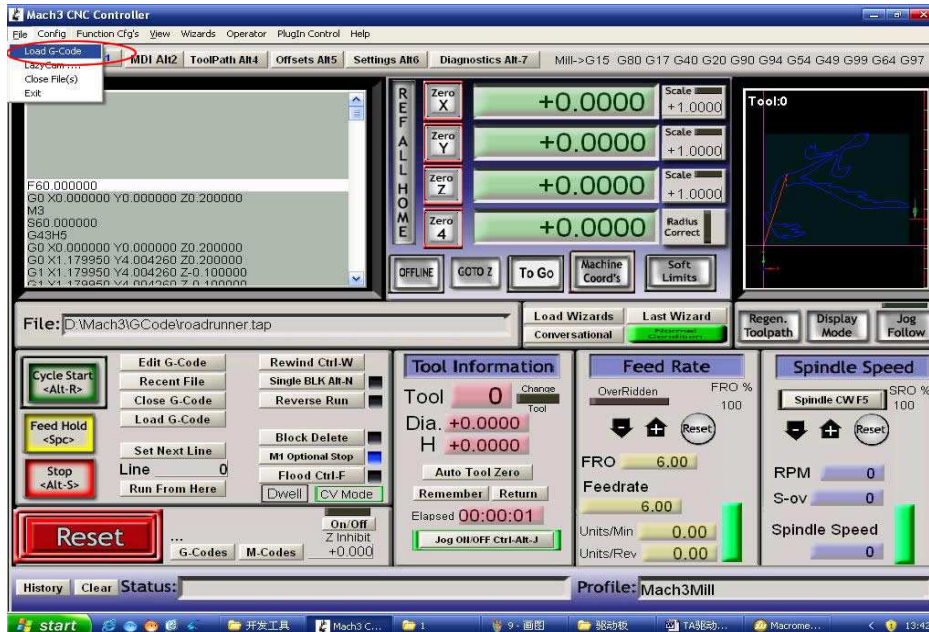Click on *File* menu and then *Load G-Code* menu as shown in Fig.7

Fig.7

15

Typical G-Code sample location is C:\Mach3\GCode, on *Files OF Type* select *All* as shown on Fig8, or choose any other G-code of your preference
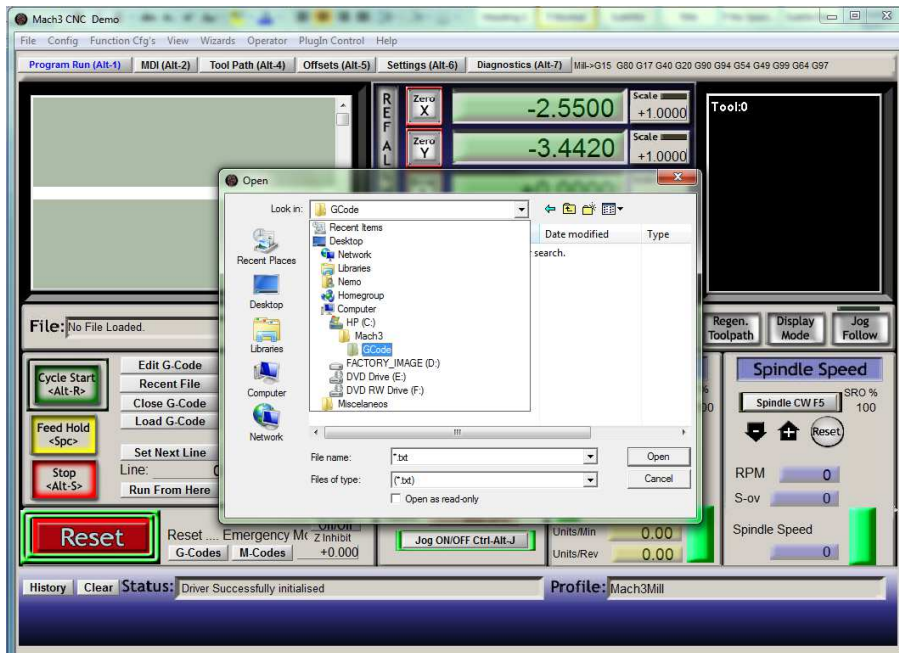
Fig.8

After selecting a G-code in the folder shown previously, it should open, and a previous of it should be displayed on your main window

Set up your X, Y and Z location

DO NOT PROCEDE TO THE NEXT STEP UNLESS YOU HAVE SET UP X, Y AND Z AXIS REFERENCE POINTS, failure to do so will cause a crashing of your machine and/or personal injury

You may see the red button RESET flashing. Click *RESET* to stop the flashing and then press *CYCLE START* at the location of Circle 2
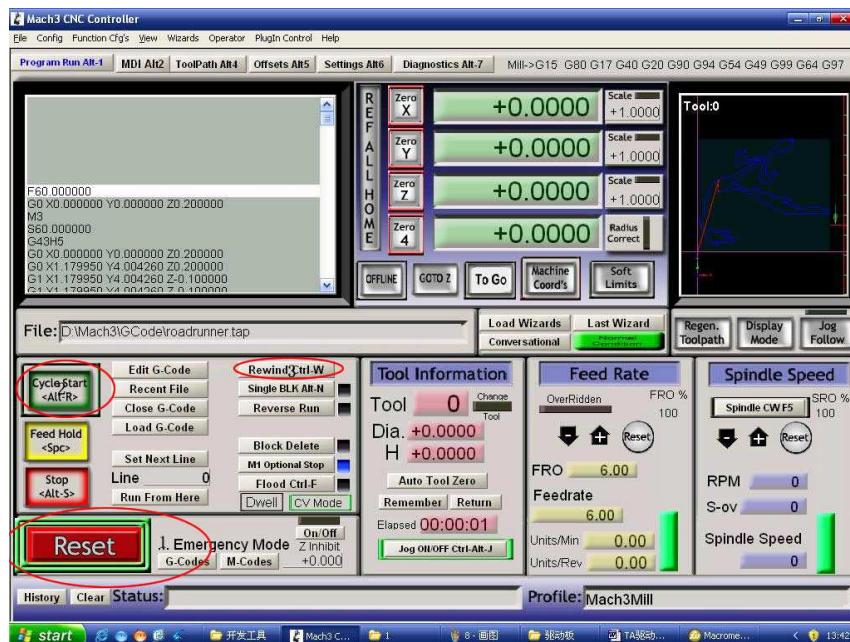
To stop machine just click on *STOP* or **ALT+S**

Fig.9

16