



NOVUSUN

MACH3 USB port 6 axis Controller

Card NVCM

Manual

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Chapter 1. Introduction

1.1 Product Introduction

Novusun CNC has engaged in the Numerical control industry for 7 years, specialized in the research, development and production of various CNC controller systems with high quality and high reliability. We produce the Brushless DC motor, Stepper motor driver, and also 1 to 6 axis CNC motion controllers.。

NVCM is the 6 axis motion controller we spend 1 years to design.

NVCM support Mach3 software, through USB port to communicate with computer.

This manual introduces operation, connection and usage schedule of our professional motion controller for engraving machine. Through a lot of the drawing the users can learn quickly how to use this motion controller.

1.2 Products specification

- ◆ Support USB;
- ◆ 16 ports photoelectric isolated input interface;
- ◆ 16 ports photoelectric isolated output interface;
- ◆ 1 port 0-10V spindle speed analog output interface(can change to PWM output);
- ◆ can support 6 axis stepper systems maxisim,125KHz pulse output for every axis;
- ◆ ARM motion control chip;
- ◆ main device is 12V-32VDC power supply input,current should higher than 1A;

1.3 Products Appearance and size

NVCM motion controller is with the sealed open structure, there are 4pcs setting holes at the bottom. We can fix 2pcs 3mm diameter holes at the cabinet, and install the controller into the cabinet. The controller appearance as the Figure 1-1 and Figure 1-2 show:

The products overall size is 150mm*84mm*20mm;

The bottom install size is 125.5mm*71.5mm。

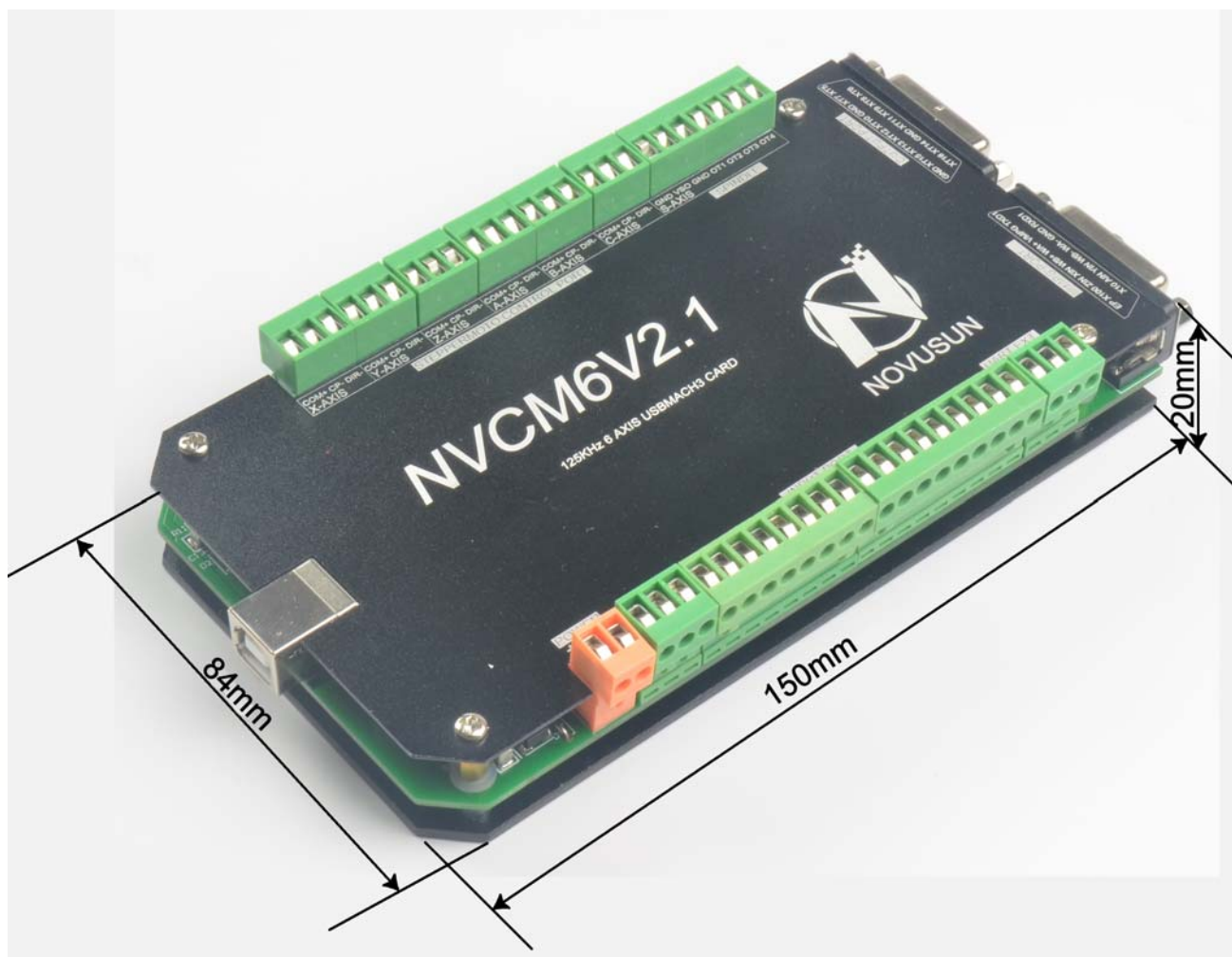


Figure1-1. NVCM front appearance and size



Figure1-2. The other side of NVCM and installation dimensions

1.4 substantial explanation

When operate the NVCM, where will be a lot of English abbreviation, now we list all .

FRO: Feeding adjust: During the operating process, the F value already set, and need to adjust the current feeding speed, then we can adjust FRO value to realize it.

SRO: Spindle speed adjust: During the operating process, the S value already set, and need to adjust the current spindle speed, then we can adjust SRO value to realize it :

Current Speed $S\# = \text{setting } S * SRO$.

SRJ: speed adjust manually, During the operating process, as the manual speed already set, and we need to adjust the current speed, and impossible to fix the value during it is working, then we can revise the SRJ value to realize it. Current manual speed $FS\# = \text{Setting manual speed} * SRJ$.

F: Feedingspeed, the unit is mm/min. For example $F=200$, means every minute feeding 2000mm.

S: Spindle Speed. Unit is rad/min. For example $S=20000$, means 20000 revolution/Minute.

X axis Coordinate Y axis Coordinate Z axis Coordinate A axis Coordinate

B axis Coordinate C axis Coordinate

Ready: Ready Mode. In the mode we can do any operation, include processing or values modification or starting 2nd mode.

Reset: Reset mode. In this mode, it should stop every operation.

“Step”: Manual Step Mode. Every axis can conduct the manual step operation at this mode.

MPG: MPG mode. Every axis can conduct the MPG operation at this mode.

1.5 Noting and Waring



Free from exposure to the electronics without waterproof function. Please environment as dry as possible. This is the icon.



Wiring warning, the IO input terminal of this equipment support the equipment with source switch (such as Inductive proximity switch.) When using such kind of switch, attention please: avoid the +terminal and -terminal of power supply to connect with GND. This equipment's analogy quantity output terminal of spindle control also have a certain load capacity. Please avoid this terminal connect with GND. In case that the interior components and parts be broken down.



Operation warning, Please do the security measures well when connecting with the machine tools. The ESTOP, limit and other things must be perfected. When comes across the emergency, please press the ESTOP key at once or cut off the power directly, thus avoiding the equipment damage and casualty.



High voltage danger, the primary device is 18-32VDC power supply. Voltage equipment. Pls pay attention to the electricity, safety when conducting the operation

Chapter 2 | Connection

2.1 Device Power supply Solution

The power supply solution in the field of the Industrial automation is always very complicated, there is a lot of the GND, now we descript the structure of the power supply as below:

The power supply structure as the Figure 2-1,main power supply input and MPG module and stepper control output module are common GND, Limited and Estop input module and Spindle speed adjust M3/M8/M1 module are common GND, between main power supply and output module there are photoelectric isolation. The inputs of limited switch and Estop and so on are Common anode, inside of the device, there is +12VDC as common+, no need to connect external power supply. Based on the reference of output GND interface, output a 0-10V adjustable voltage to adjust the spindle speed,M3/M8/M10 digital output interface is open-GND. If connect an external relay, need to output GND to refer to, and give the relay an external power supply.

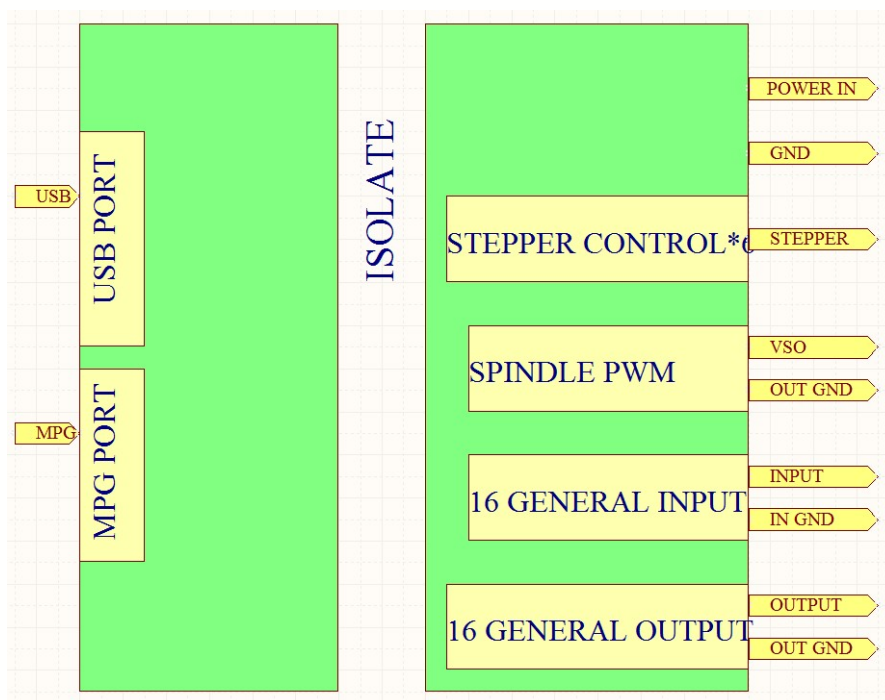
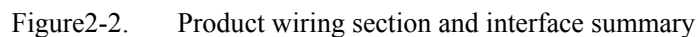


Figure2-1. Power supply structure of NVUM



As the Figure 2-2 showed, the connection of the controller includes power supply interface, USB connection interface, Stepper/Servo control output interface, spindle control output interface, Estop and limited switch and tool setting input interface and so on. Now we descript them in details as below.

2.2.1 USB port

As the Figure 2-2 showed, Marked No. 1 position is the USB port. Mach3 connect to this board through the USB port.

2.2.2 Main power input

As Figure 2-2 showed, No.1 terminal block is Main power input interface, need input 12-40V/above 20W. There is silkprint "+" and "-", See as figure 2-2, left terminal is "+" and right

terminal is "-".

2.2.3 Limit/Home/Estop/Probe input port

As the Figure 2-2 showed, Marked No. 3 position is the input port. they are the optical isolated Input interface. The silkprint INP1 INP2 GND INP3 INP4 INP5 INP6 INP7 INP8 INP9 GND IN10 IN11 IN12 IN13 IN14 IN15 IN16 GND 12V on the board connect to PIN1-16 of the mach3. Internal structure see as Figure2-3. 2 lines Proximity Switch/ordinary fretting switch / drawing see as Figure2-4.

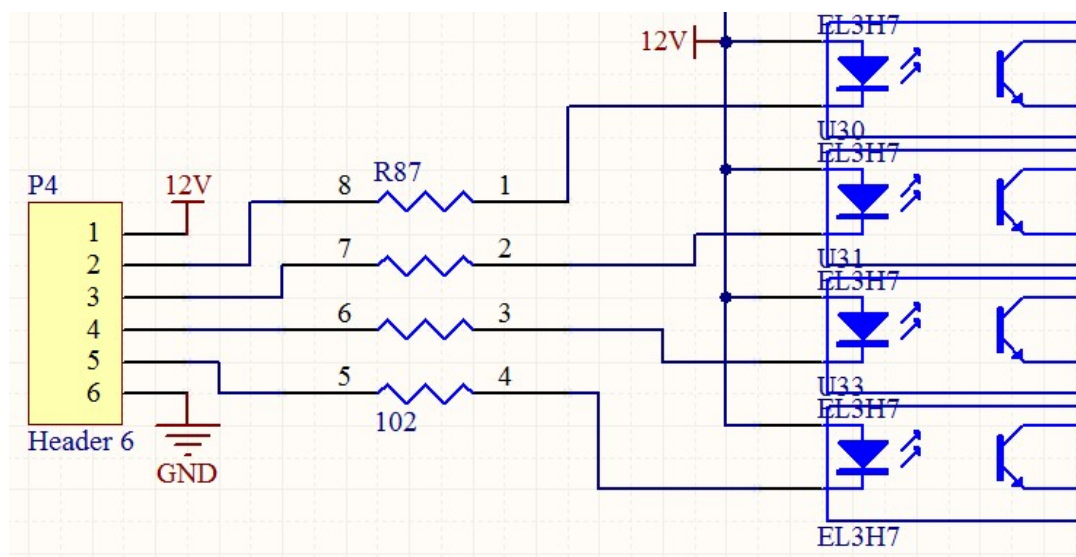


Figure2-3. Internal structure drawing of Input interface



Figure2-4. Probe/Estop/ ordinary fretting switch input connection

3 lines Proximity Switch connection Figure 2-5, brown cable for Proximity switch connect with 12V, Black cable connect channel, blue cable connect with GND1.

Only support NPN 3lines proximity switch.

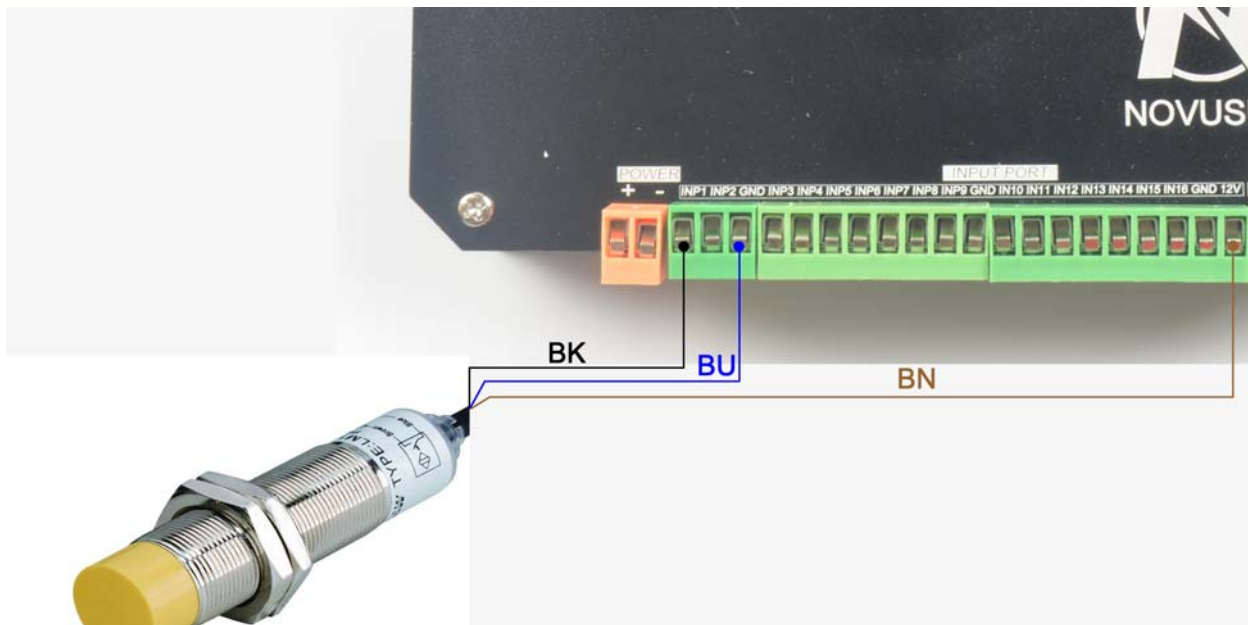


Figure2-5. NPN 3 lines Proximity Switch connection drawing

2.2.4 Serial expansion interface

As the Figure 2-2 showed, Marked No. 4 position is Serial expansion interface . We can extend some other equipment from this interface. Definition of the port is RXD, TXD, GND from left to right.

2.2.5 MPG port

As the Figure 2-2 showed, the marked No.5 position interface is MPG port . The pin order see as Figure 2-2. Definition of the PIN see as table 2-1.

No.	Mark	Definition
1	T10UT	TXD of Serial port (only for NVMPG)
2	VMPG	Power supply + for MPG (5V)
3	WHA+	A phase positive of the encoder

4	WHB+	B phase negative of the encoder
5	XIN	X axis select input
6	ZIN	Z axis select input
7	X100IN	100 rate select input
8	EP	Estop port
9	R1IN	RXD of Serial port(only for NVMPG)
10	GND	Ground and common end
11	WHA-	A phase positive of the encoder
12	WHB-	B phase negative of the encoder
13	YIN	Y axis select input
14	AIN	A axis select input
15	X10IN	10 rate select input

Table 2-1. MPG port definition

2.2.6 Universal output interface 2

As the Figure 2-2 show, The marked No. 6 is Universal output interface 2. This port type is DB15. OUT5-OUT16 are fixed on this port. Internal structure see as Figure2-6. Definition see as table 2-2.

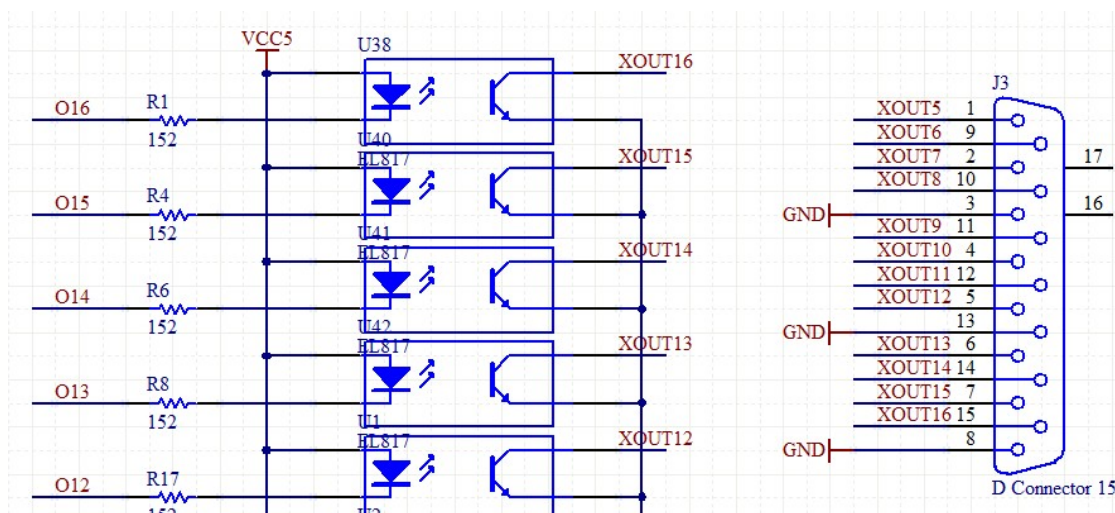


Figure2-6. Internal structure of output interface

No.	Mark	Definition
1	XT5	Output5
2	XT7	Output7
3	GND	Ground and common end
4	XT10	Output10
5	XT12	Output12
6	XT13	Output13
7	XT15	Output15
8	GND	Ground and common end
9	XT6	Output6
10	XT8	Output8
11	XT9	Output9
12	XT11	Output11
13	GND	Ground and common end
14	XT14	Output14
15	XT16	Output16

☞Output in mach3 should be configured to PORT 2

Table 2-2. Definition of Output

2.2.2 Spindle control output/ Universal output interface 1

We define the interface from left are: GND1(Output GND),VSO(0-10V adjustable speed output),OT1,OT2,OT3,OT4.

Take Nowforeuer inverter as the example. Spindle control output and the inverter connection showed as Figure 2-7.If ACM and DCM are closed,only need to connect one port.

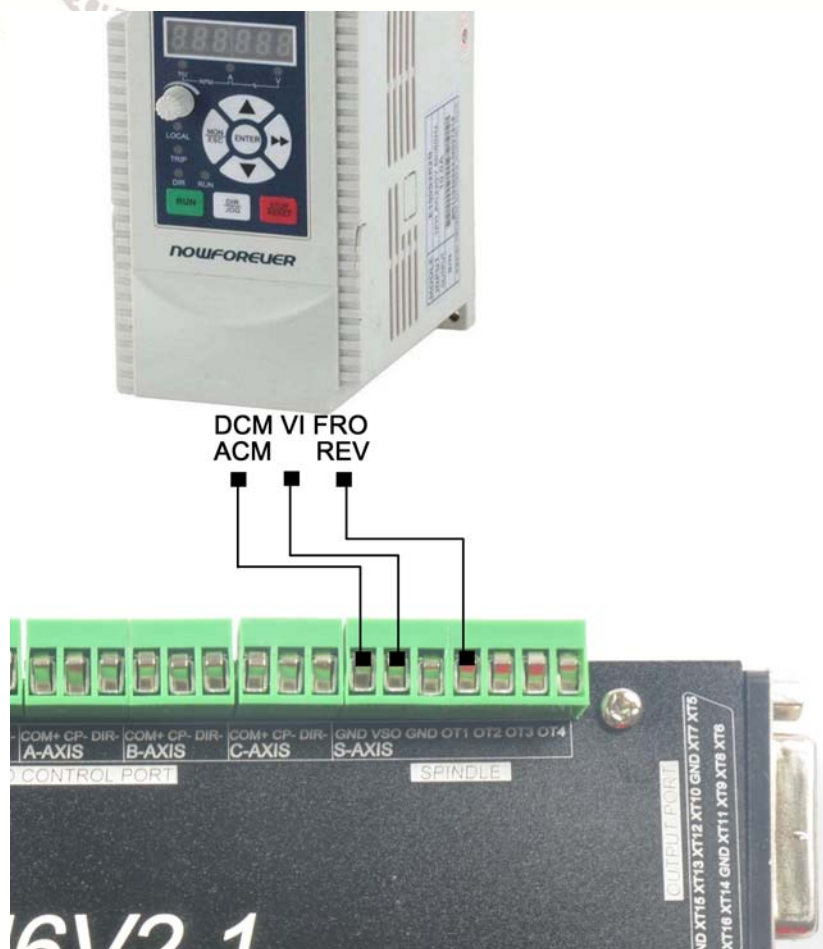


Figure2-7. spindle control output and inverter connection

VSO real output voltage=10V*s spindle setting speed/max spindle speed. Foreexample, if max spindle speed is 24000, current spindle speed is S=18000, so the VSO output voltage=10*18000/24000=7.5V.

Max. spindle speed setting ports as showed sa Figure 2-4, open it from Pulley from Menu config. The current spindle speed can be set by S directive or Mach 3 spindle setting speed module.

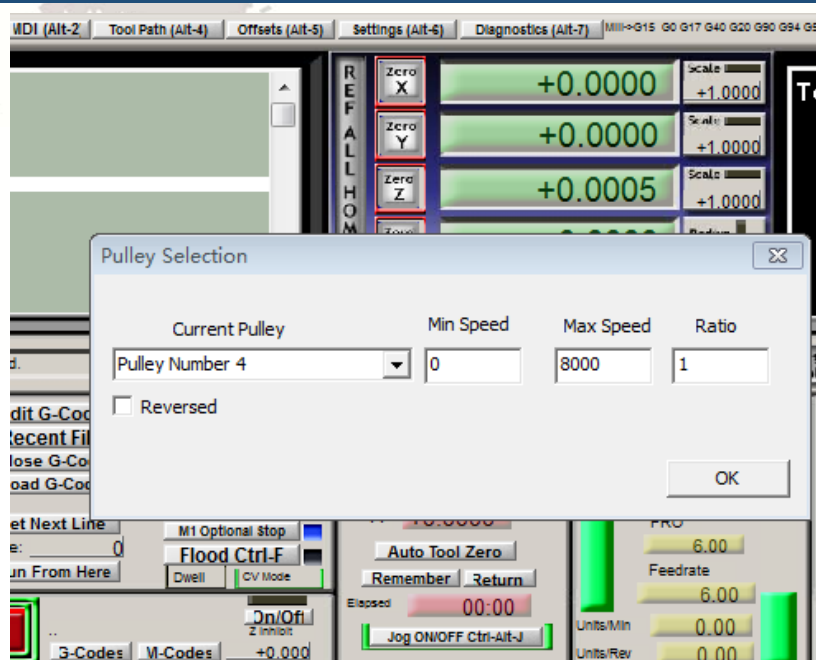


Figure2-8. Max spindle speed setting position

2.2.8 Stepper motor port.

As the Figure 2-2 show, The marked No. 8 are 6 axis stepper motor controller port. They are X/Y/Z/A/B/C from left to right. Each axis's pin is defined as COM+/CP-/DIR- from left to right.

Wiring method see as figure 2-9.

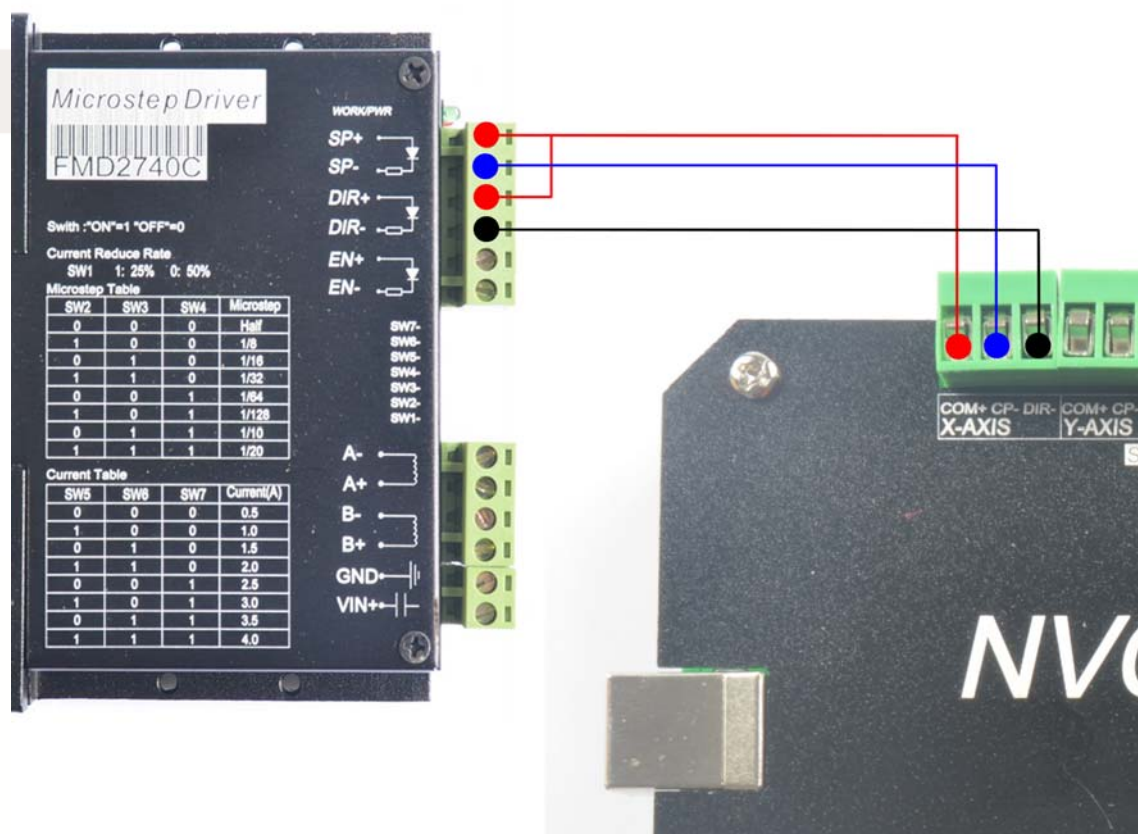


Figure2-9. Wire method of Stepper motor driver connecting to NVCM



Chapter 3.

Software Installation

3.1 MACH3 Install

MACH3 installation, registration, and USB plug-ins. See as Figure 3-1

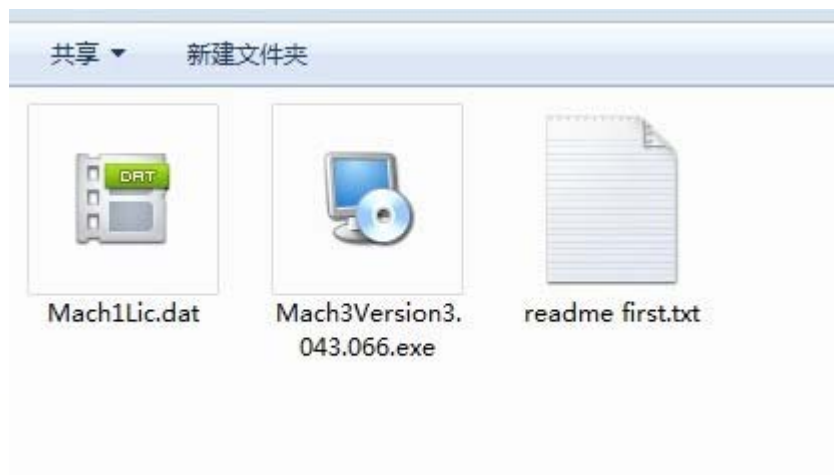


Figure3-1. MACH3 soft installation

First run the installation Mach3Version3.043.066



Mach3Version3.043.066
Setup Application

.Into the first

page. See as Figure 3-2.

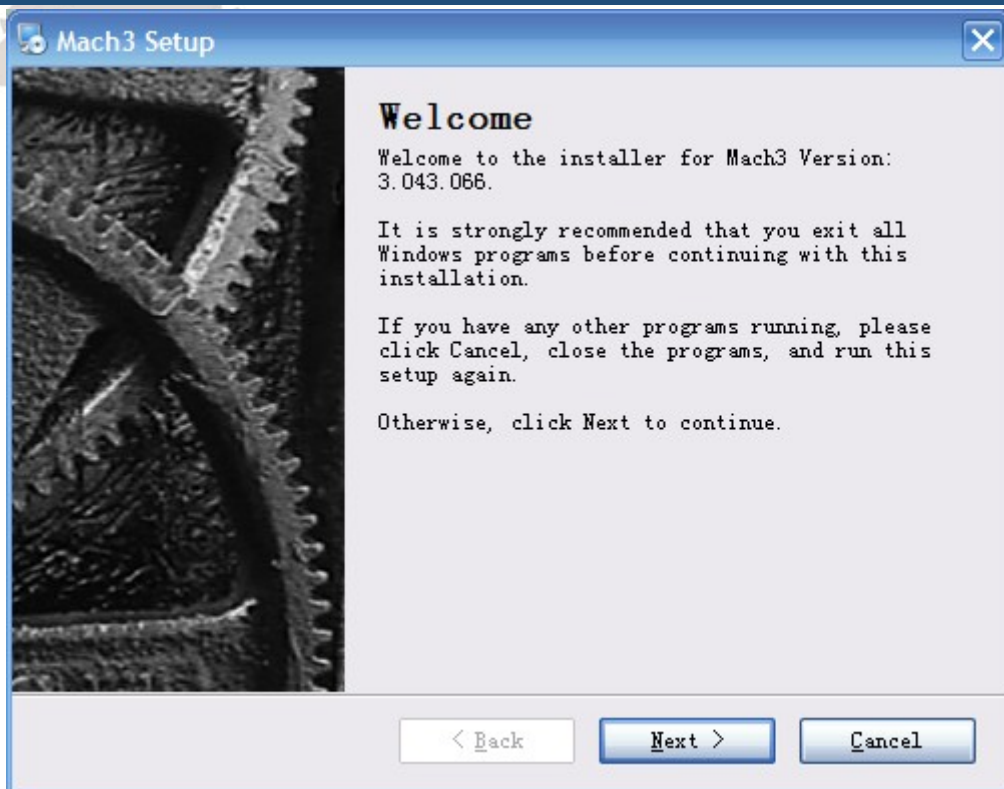


Figure3-2. MACH3 installation process 1

Click Next and then enter the page shown in Figure 3-3

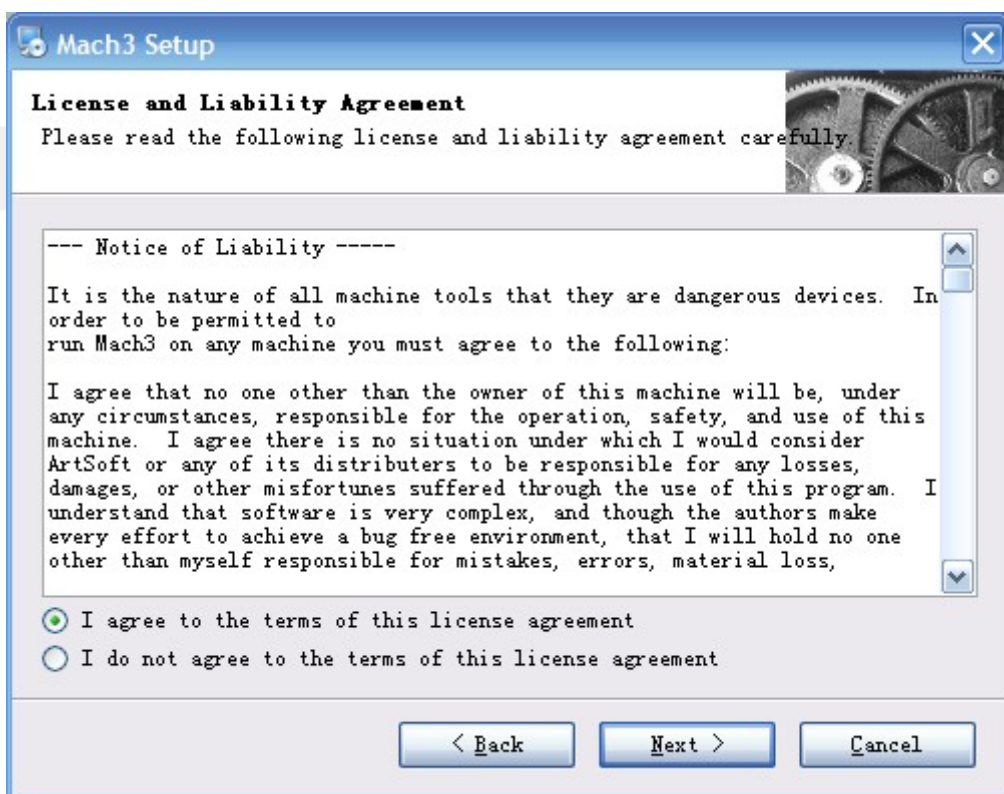


Figure3-3. installation process 2

Select I agree and click Next, See as Figure 3-4.



Figure3-4. MACH3 installation process 3

Select the installation path, click Next (it can be installed on any disk, and recommended to install the C drive or the D drive) See as Figure 3-5



Figure3-5. MACH3 installation process 4

Click Next until completion. Then restart the computer.

3.2 Plugin Install



Copy the file NOVUSUN.DLL **NOVUSUN.dll** to X:/mach3/plugin, X is installation disk of mach3.

Chapter 4. | Setting of software

4.1 Open software

Double-click the mach3mill



. Start mach3 software. We enter plugin

select dialog box. See as Figure 4-1. You should copy NOVUSUN.DLL to plguin folder first, then you can see this dialog box.

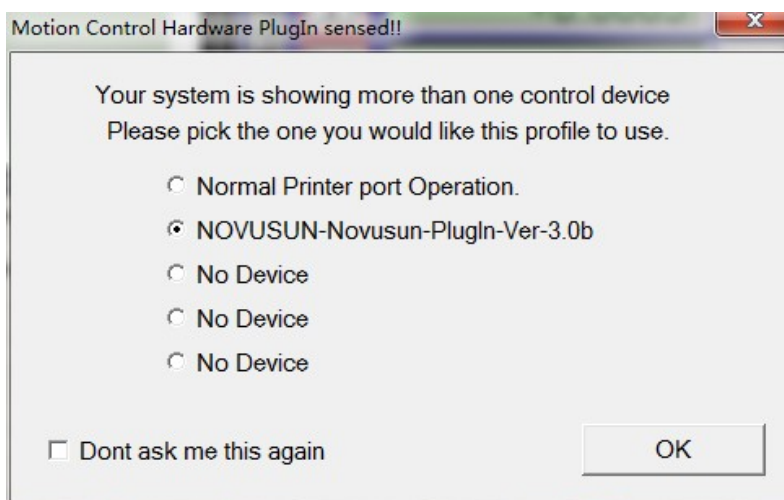


Figure4-1. Plguin select dialog box

Choose Novusun-Novusun-Plugin_ver-3.0b, then click "OK". Then we enter main page of mach3. See as Figure 4-2.

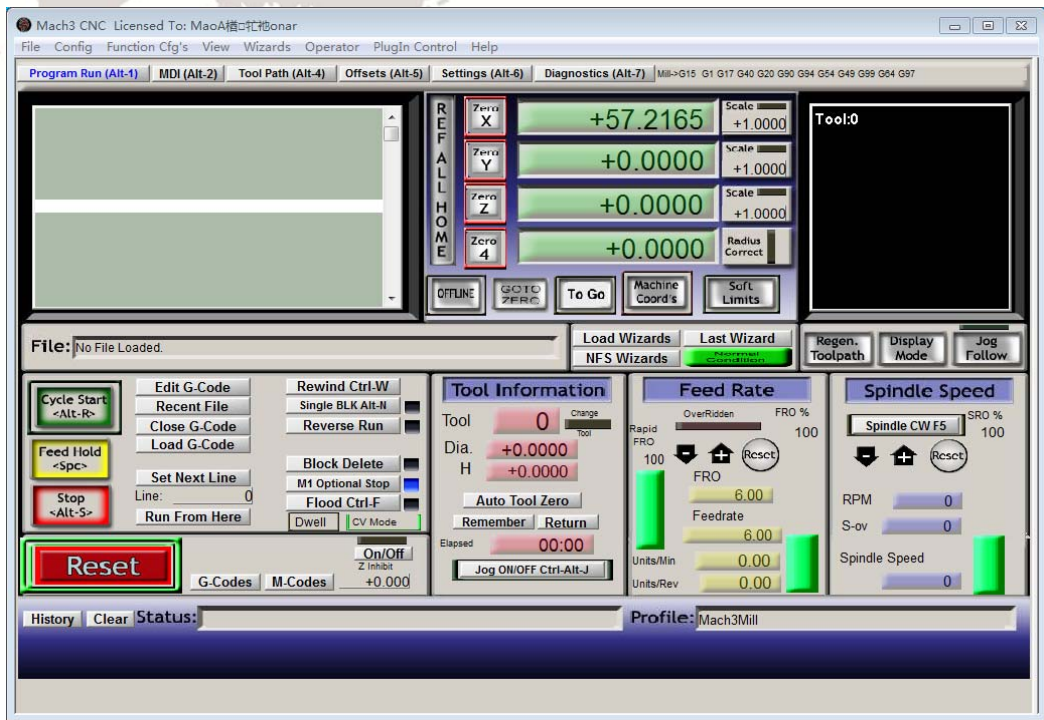


Figure4-2. Open mach3 software

4.2 Software Common settings

4.2.1 Motor operating parameters setting

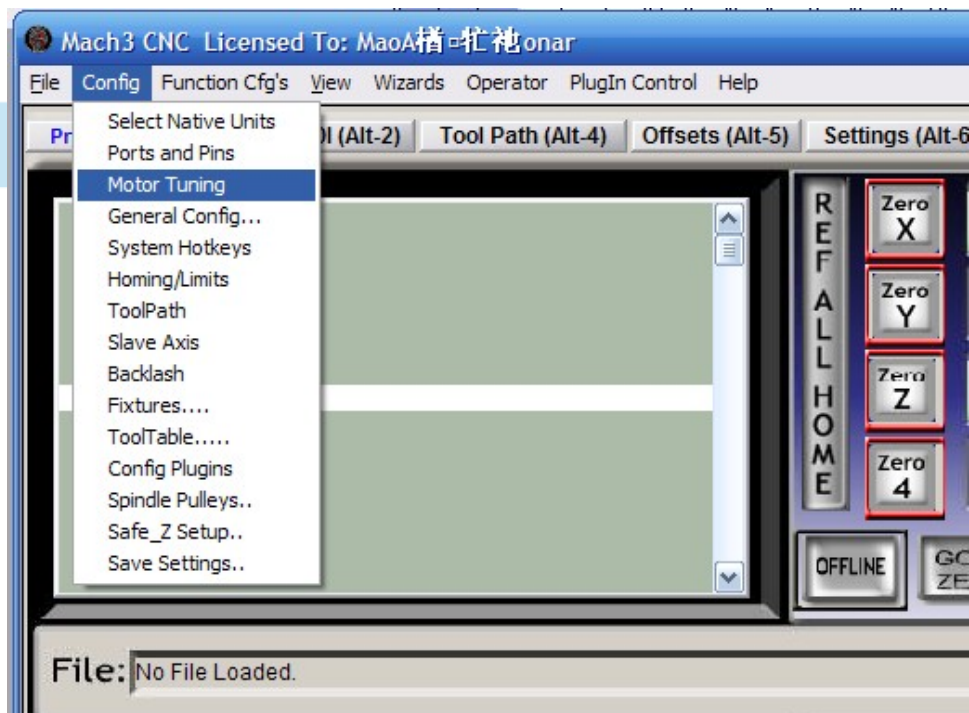


Figure4-3. Motor operating parameter setting menu entry

See as Figure 4-2.From submenu "motor tuning" of the menu "config" into the motor

parameter settings dialog. See as Figure 4-3

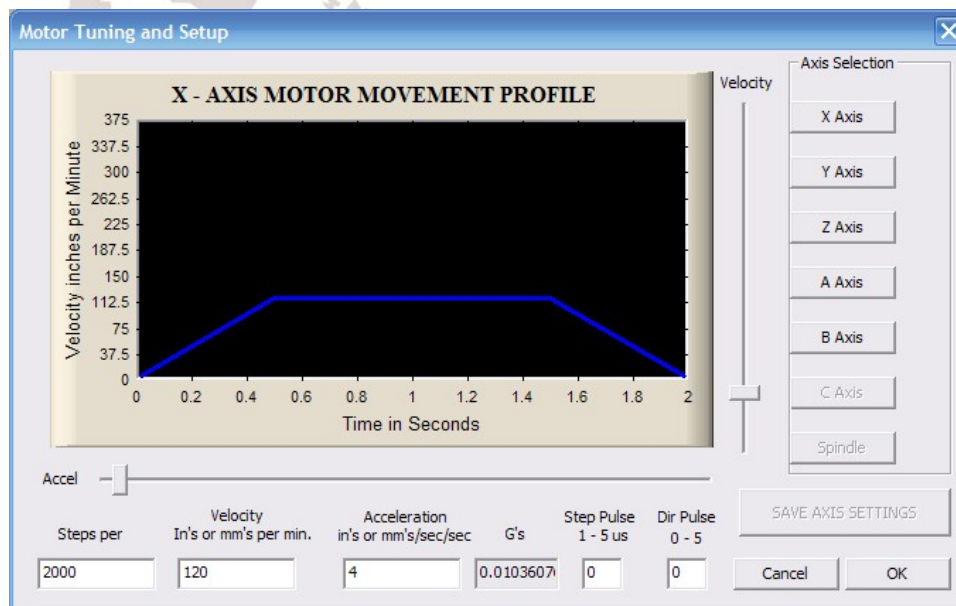


Figure4-4. Motor operating parameter settings dialog

The parameters are defined as follows:

Steps per: Pulse equivalent, it is number of pulses required with axial movement 1mm, This can be calculated by lead screw pitch and motor drive segment. Such as pitch 2.5mm, 2-phase motor 8 segments, Calculation method is $8 \times 200 / 2.5 = 640$.

Velocity: The speed is the axial velocity, Units is mm/s, Recommended settings 1500.

Acceleration: Units is mm/s², Recommended settings 200.

Step Pulse: Step Pulse Cannot be set, it's 2.5us in default.

Dir Pulse: Dir Pulse Cannot be set, it's 2.5us in default.

Attention: The parameters for each axis is not necessarily the same, To select the axis, and then set parameters. You should click “SAVE AXIS SETTINGS” After setting.

4.2.3 Port Settings

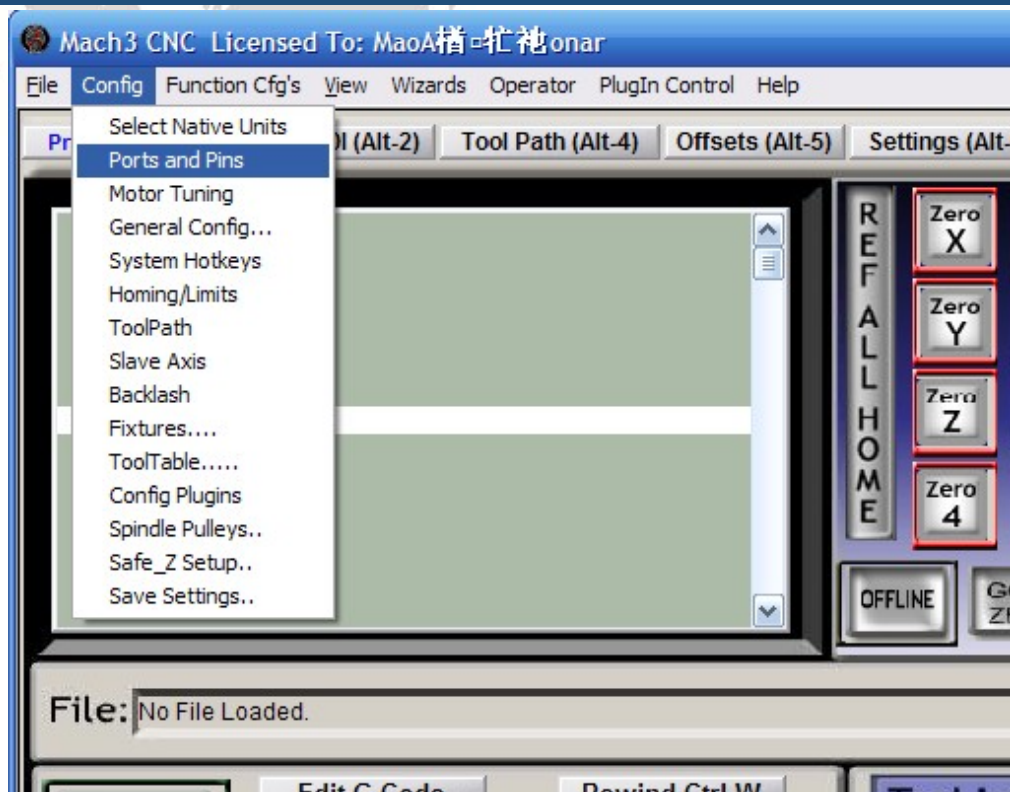


Figure4-5. Port setting entry

See as Figure 4-5, Click the sub-menu “ports and pins” of menu “Config” into Port Settings

dialog box.

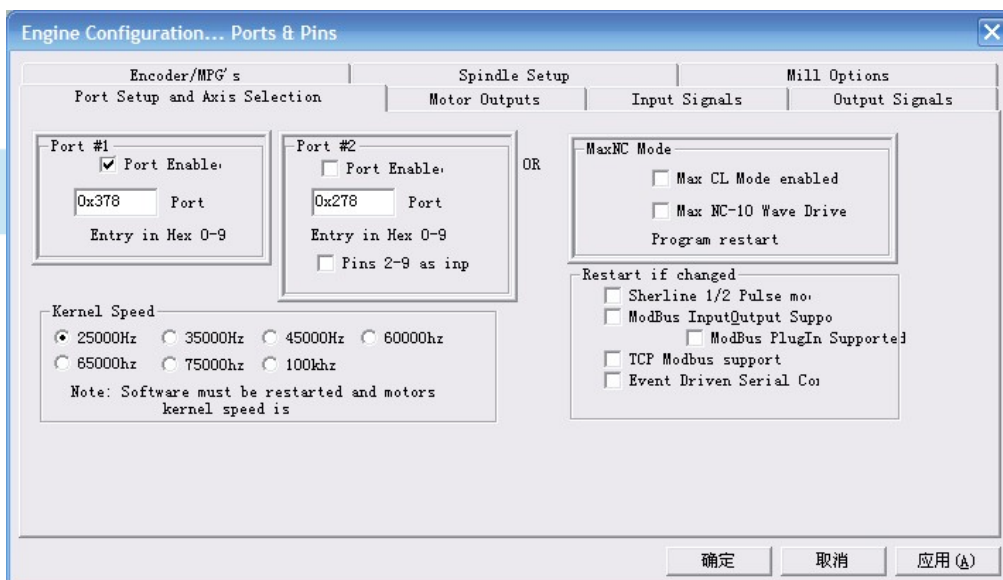


Figure4-6. Pin&Port Dialog

The sub-pages you need to set include “Motor Outputs”, “Input Signals”, “Output Signals” and “Spindle Setup”. First Click to enter “Motor Outputs”. This page is to select the stepper motor control pin. Because our usbmach3 interface board stepper motor signals are fixed, So here only need to Select, no need to select the specific pin. See as Figure4-7

To make the Z axis to the same direction, Z axis's "Dir low" should be set to "√". Other axes's should be set as system need.

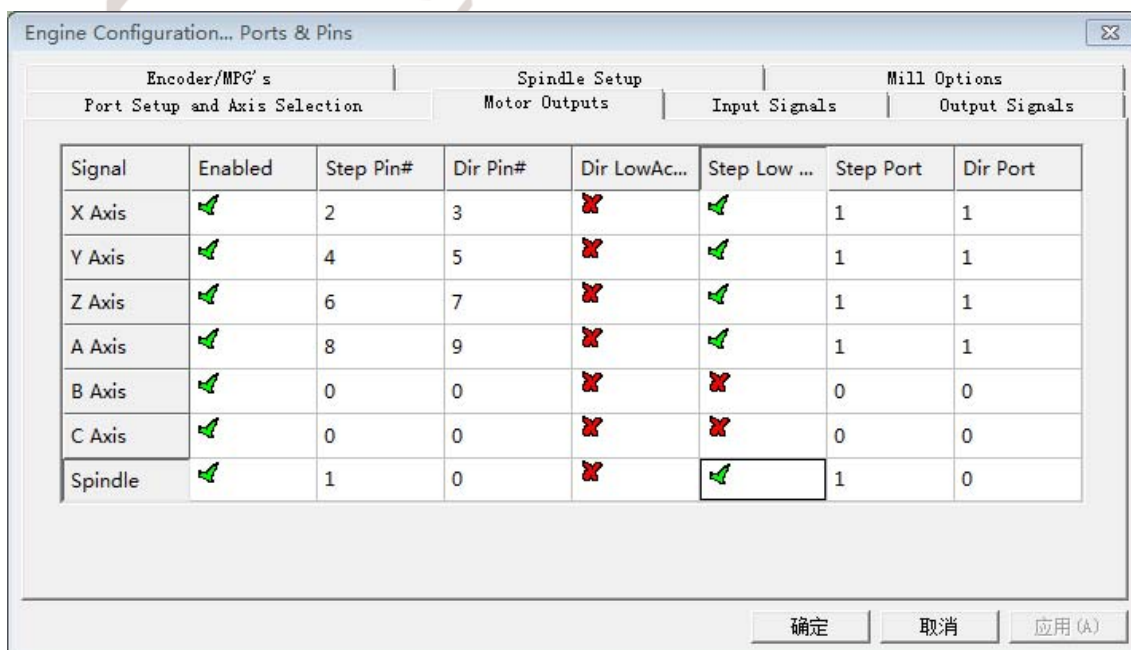
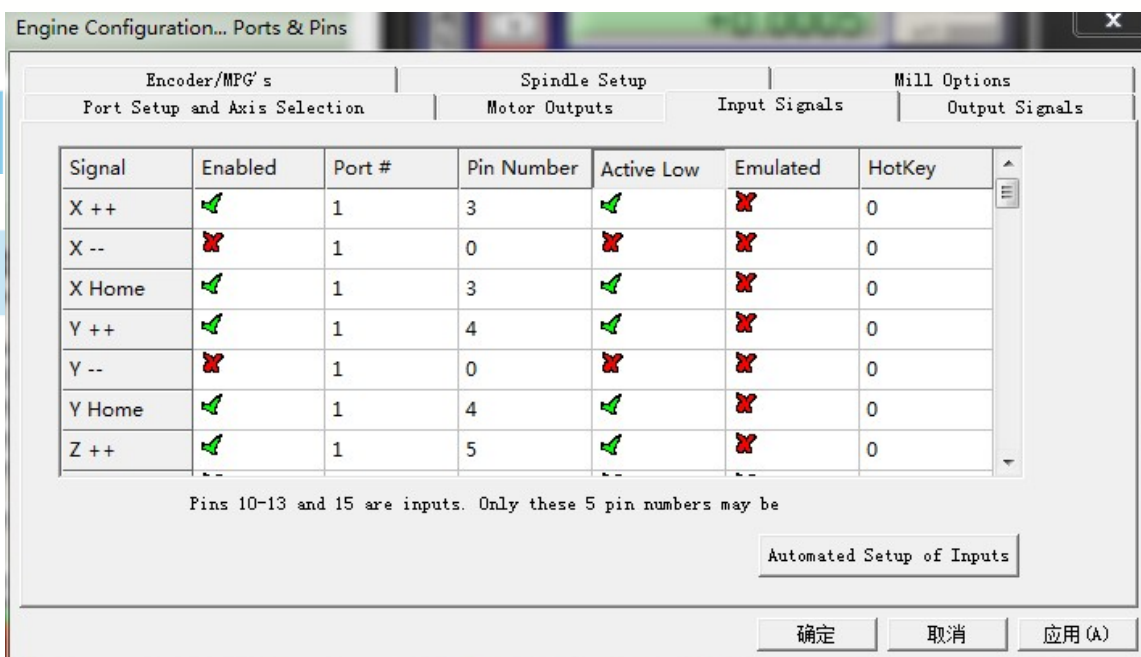


Figure4-7. Stepper motor port settings dialog

Click "Input Signals" Into the input signal settings page. See as Figure4-8



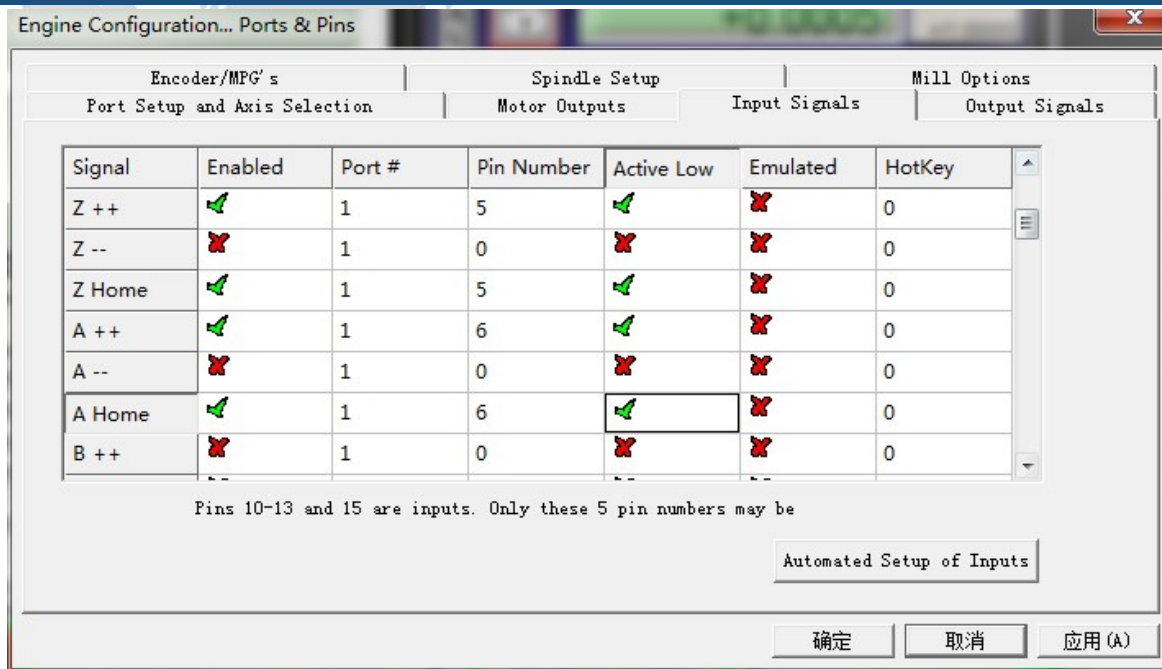


Figure4-8. limited Input Settings dialog

Here you can configure according to your actual needs the corresponding function. Optional Function include XYZABC6axis's Upper and lower limit、XYZABC6axis's HOME point. We set upper limit and home of XYZA to 3456 corresponding IN3IN4IN5IN6 of the board.

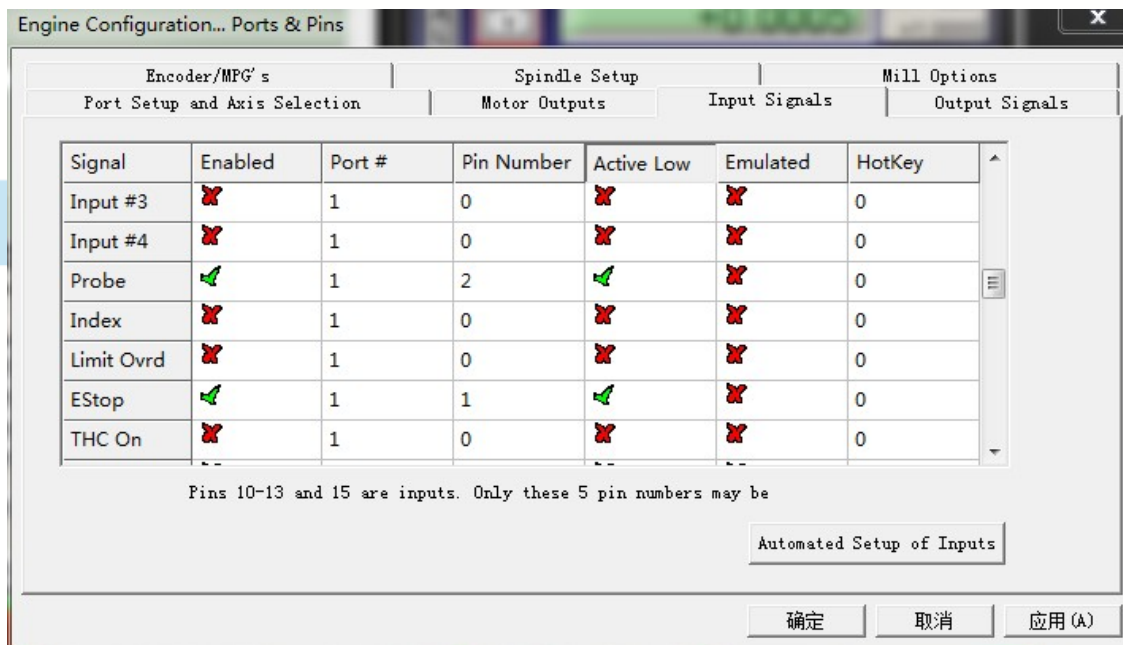


Figure4-9. Estop and Probe dialog

ESTOP and probe Setting see as Figure 4-9, estop's pin number is 1, and probe's is 2.

Click "Spindle Setup" switch to the spindle settings page. See as Figure4-10.

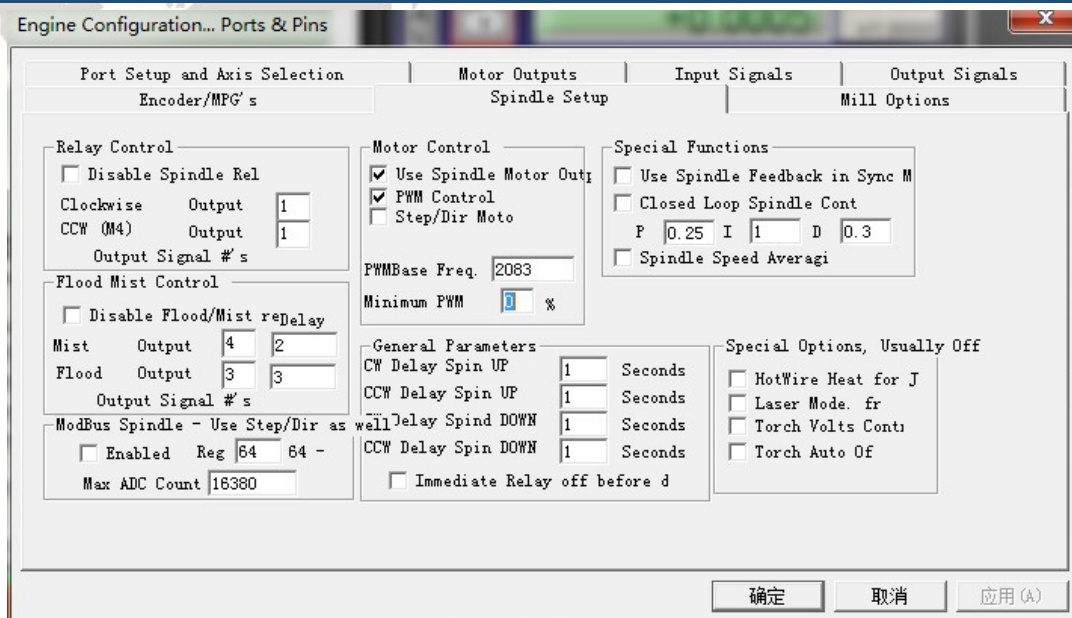


Figure4-10. Spindle Settings dialog

Here we can configure the spindle rotates CW、Reverse CCW、Mist、Flood pin, See as Figure4-10, They have been configured as 1、2、3、4. Corresponding to output#1~output#4 in Figure4-11.output#1~output#6 in Output Signal Setup dialog can be Configured into these 4 signals. Here we only configure CW/MIST/FLOOD. CW is controlled by OUT1. MIST is controlled by OUT2. Flood is controlled by OUT3. Here we note correspondence between 2 page. Please select “use spindle motor output” if required PWM speed spindle. And select “ PWM Control”. Our PWM pin fixedly arranged on a special pin on Stepper motor setting dialog.

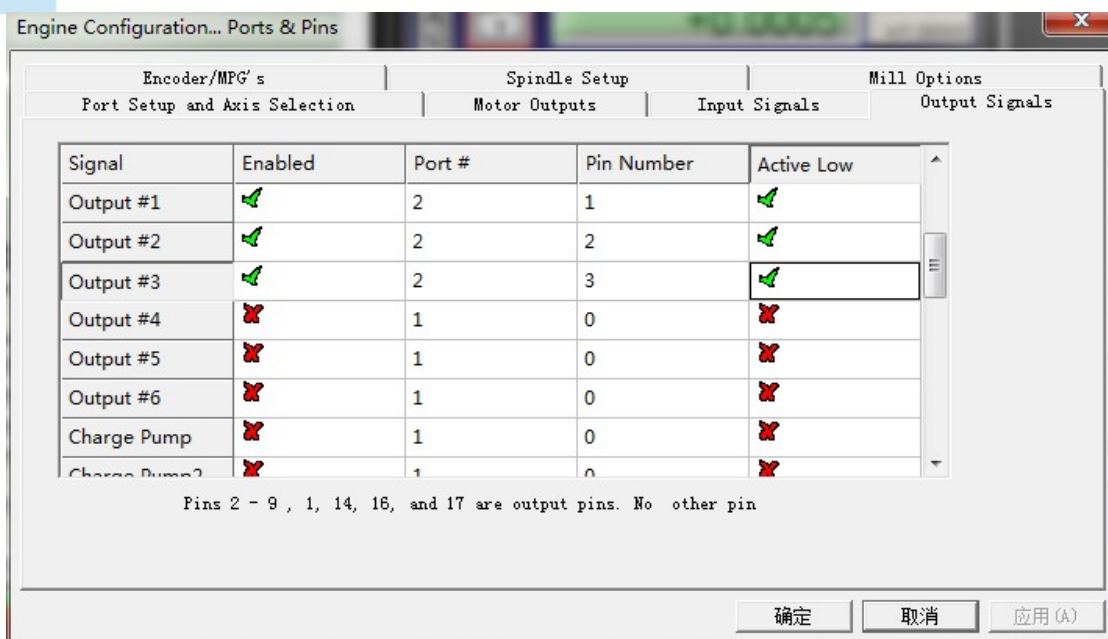


Figure4-11. Spindle setting corresponds to the output configuration

Chapter 5. Using of software

5.1 Set Machine Coordinate system

Firstly Open the software,as the drawing 5-1 shows,at this time,the software can operate the machine movements,but before the setting machine coordinate system,there is no connection between the software and machine.So first step is to set the machine coordinate system.

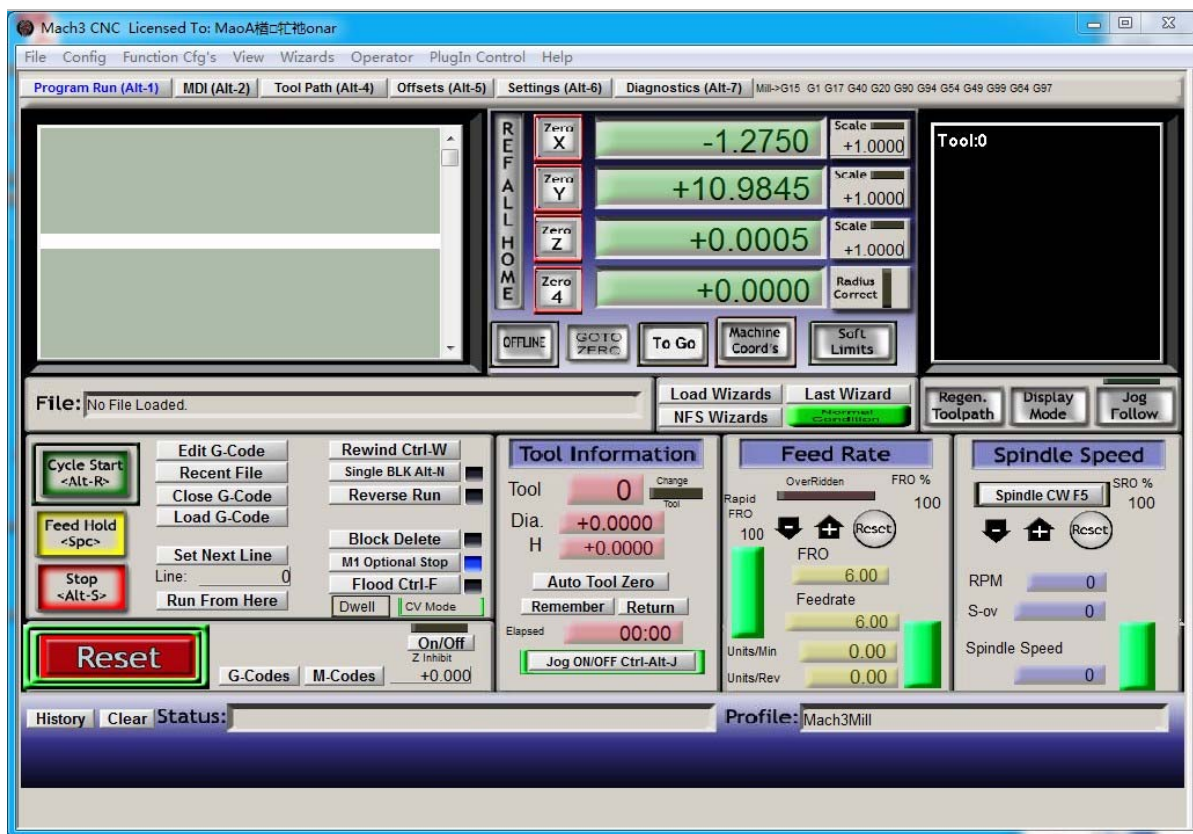


Figure5-1. Main Screen of mach3

1、Set the machine original position switch

As our request,some machine set the original point at the coordinate positive direction,some machines set the original point at the coordinate negative direction.Mach 3 can search out the machine original point direction by the software setting.As the pic 5-2 shows,open Homing on the config menu.Then as pic 5-3 shows.On this page,Home Neg is for searching for the machine

original point direction, × means searching original point at negative direction; √ means searching original points at the positive direction. As the picture 5-3 shows, X axis's original position is at the negative direction, Y and Z's original points are at the positive direction.

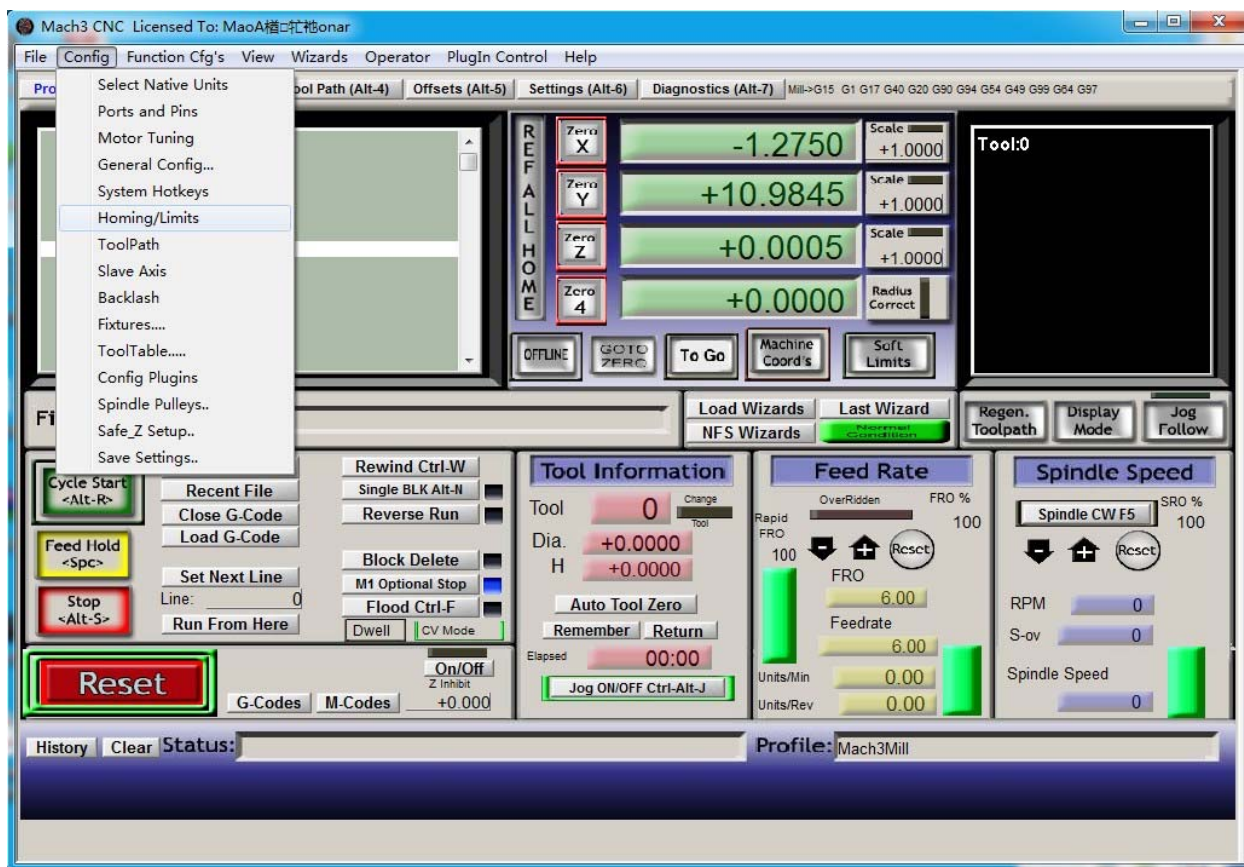


Figure5-2. Click homing of Config

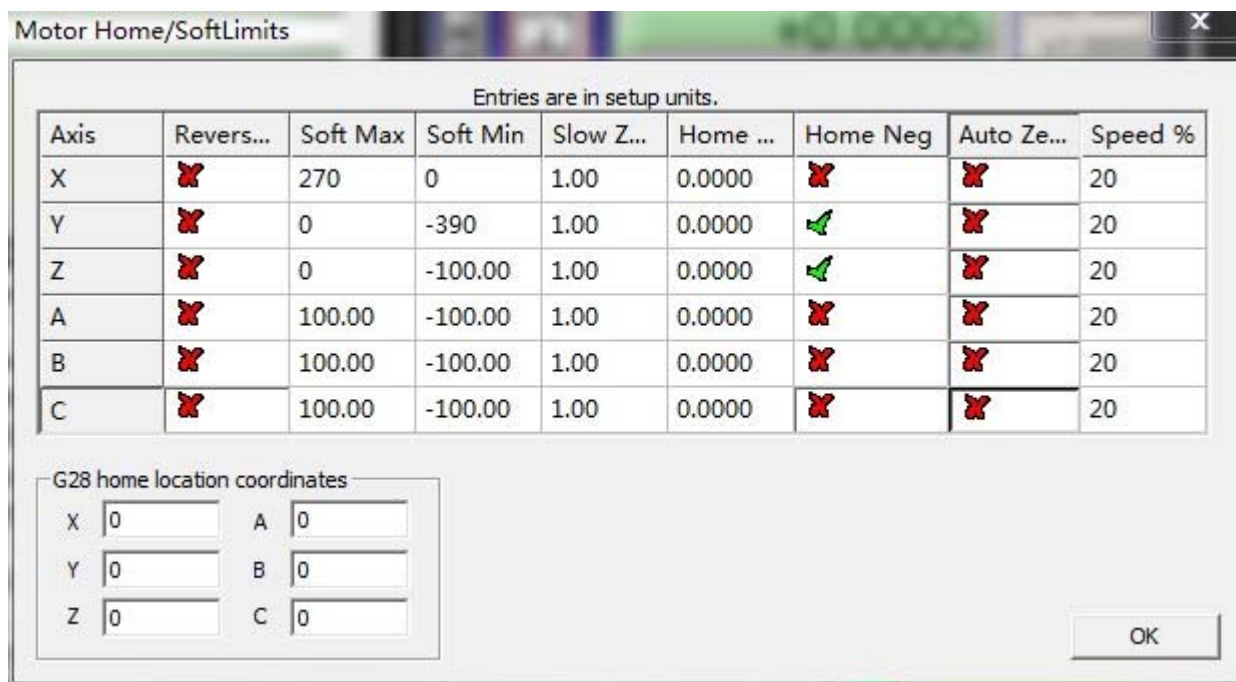


Figure5-3. Motor Home and Softlimits dialog

2、Set soft limits

As Figure 5-3 shows, this page also can set machine soft limit points. Soft Max is positive direction soft limited points, soft Min is negative direction soft limited points. The soft limited points values are according to the references to the machine coordinate system, so as this example shows, Y and Z axis's max value is 0, all the effective coordinate data is less than 0. As the Figure shows, according to our current request, we set our XYZ axis soft limited points area as [0,270] [-390,0] [-100,0].

3、Searching for machine original points

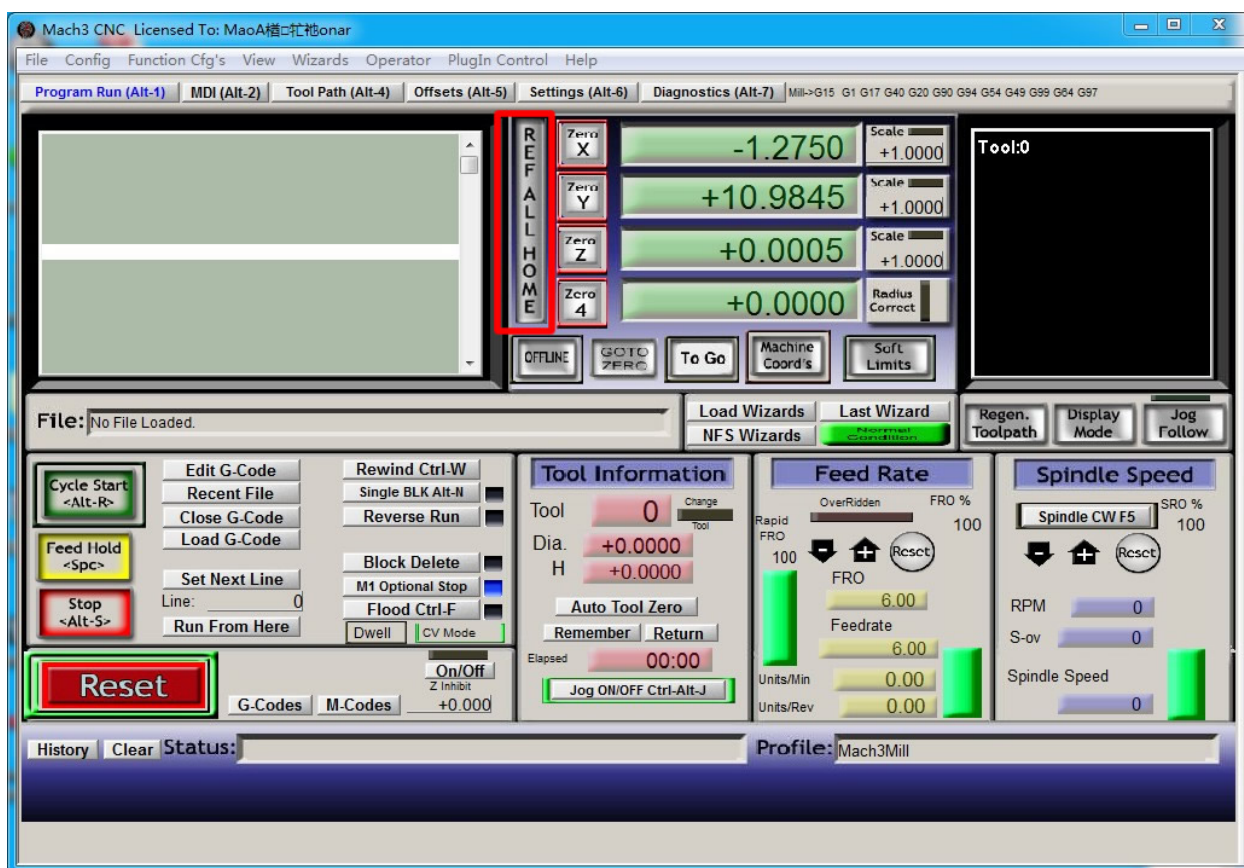


Figure 5-4. Click REF ALL HOME to HOME all axis

As Figure 5-4 shows, press REF ALL HOME at main display page, then XYZ A4 start to search for the original points. If you need more axis's operation, edit macro command, or press Alt+7 into Diagnostics display page, you can search original point for every axis. Diagnostics

5.2 Set workpiece coordinate system

Because every working material is hold in different position on the machine, we need to set

one or more workpiece coordinate system.

1、Move to current working piece 0 point

Firstly hold down the material, use keyboard or pendant to move tool tip at the 0 point, so this 0 point is the working piece 0 point, it related with the working G code file, so the user must be very familiar to his own working G code. As our example shows, the 0 point is on the center of the working piece surface, so we just move the tool tip to this position.

2、clear Coordinate

As 5-5 shows, press Zero button on each axis, then clear to 0 for each axis. After operation, the result shows as Figure 5-6.

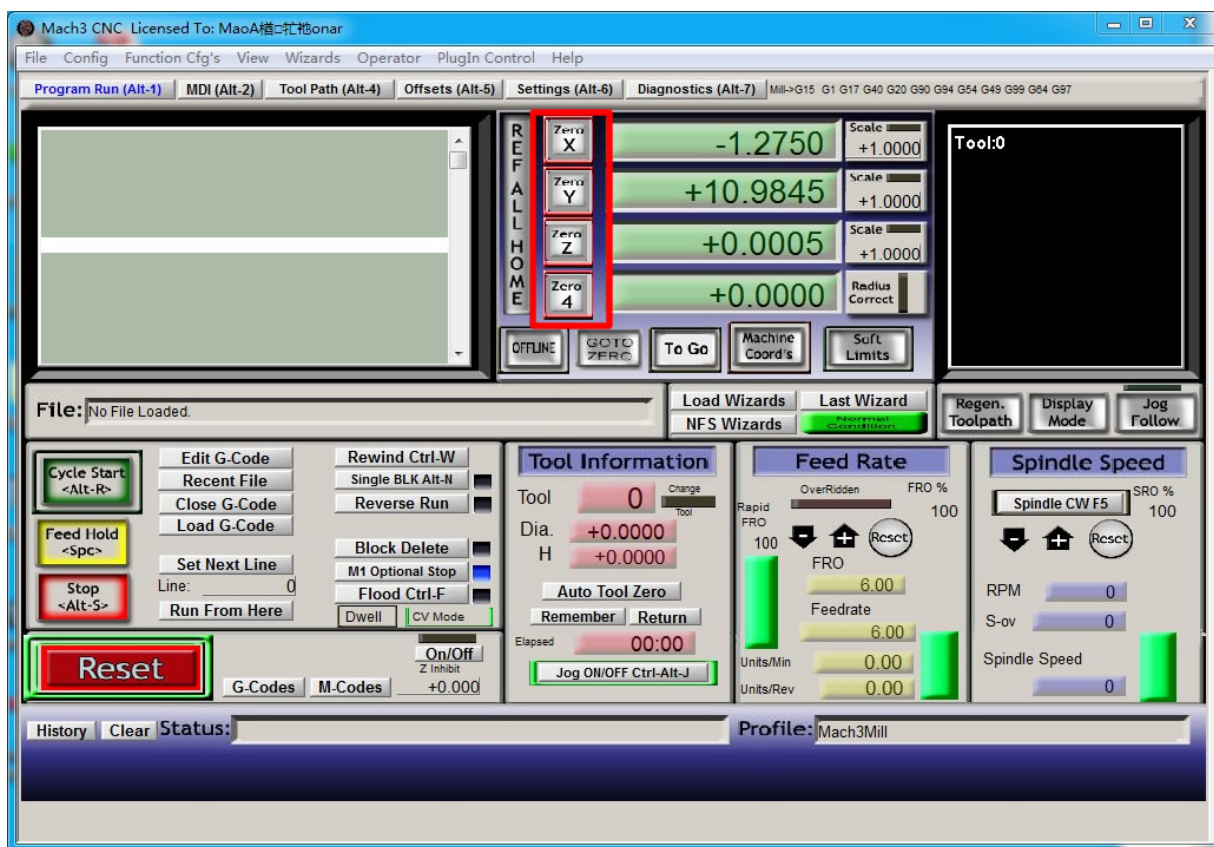


Figure5-5. Press Zero on each axis, all clear to 0

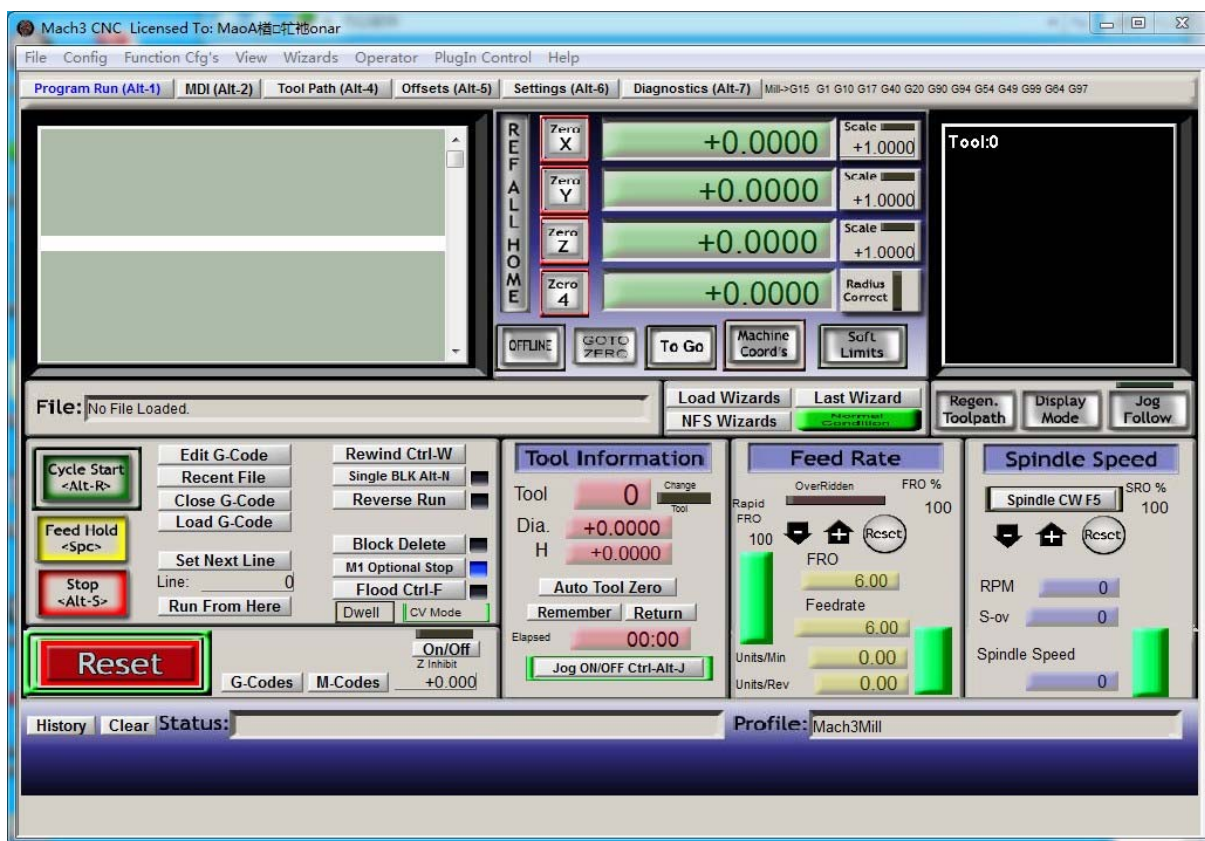


Figure5-6. Main Screen after ZERO all axis

5.3 Open G code file and run

As Figure 5-7 shows, press “load G code” button at the main page or open “Load G code” at main menu “File”, open your G code. It displayed as Figure 5-8 showing, then press button “cycle start” then machine start to work.

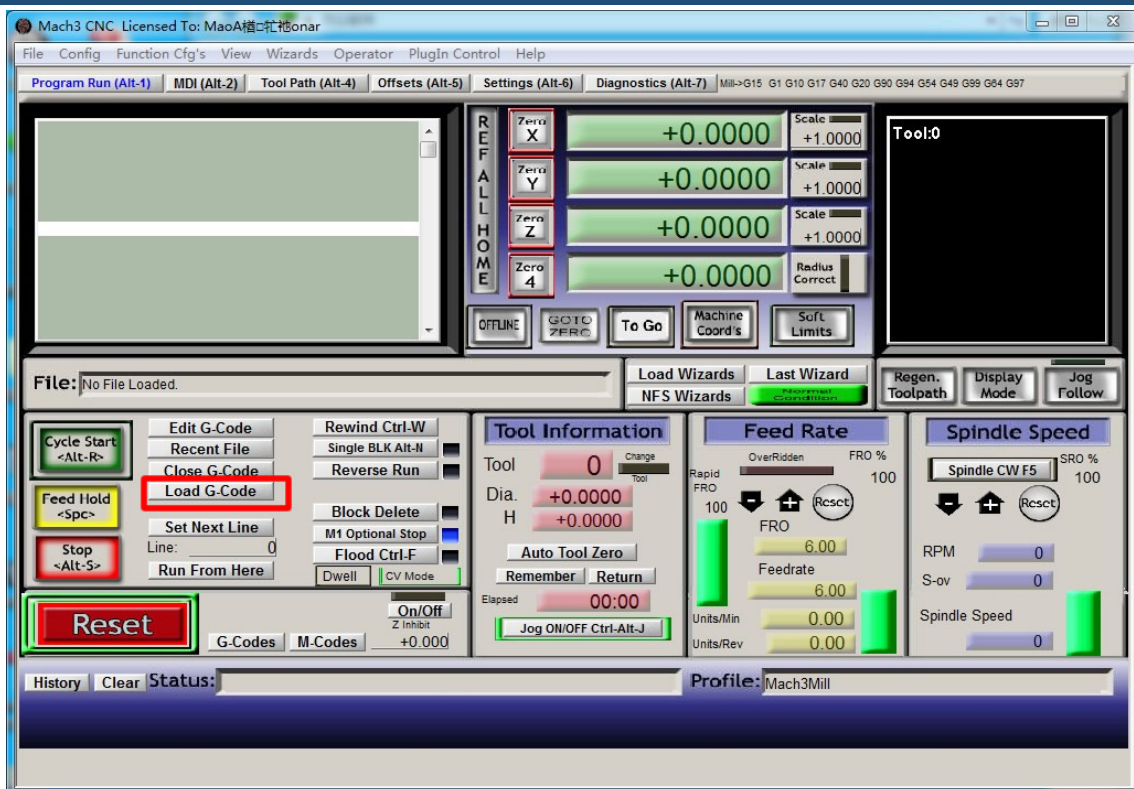


Figure5-7. Press Load G-Code and open your G code

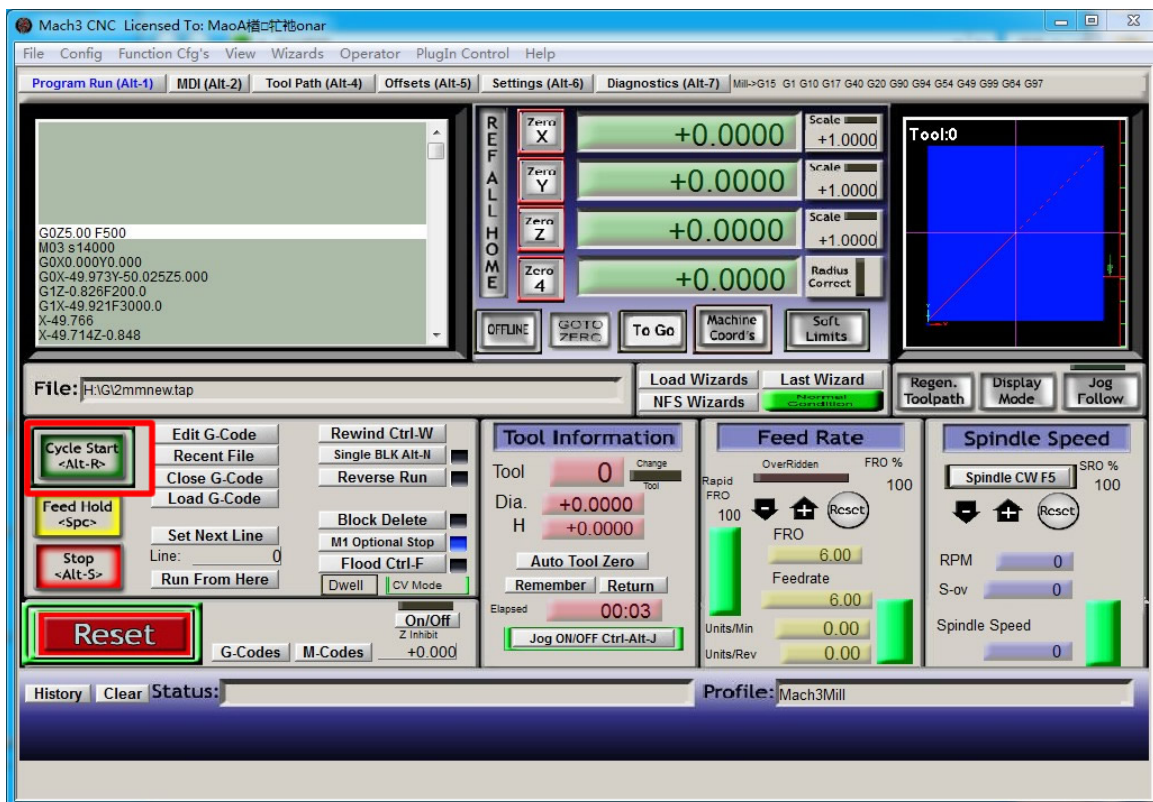


Figure5-8. After opening G code,press "Cycle Start" and start to work