



**DIGITALDREAM**  
**MACH3 ETHERNET CONTROLLER**  
**EC500V5**

Manual



# Contents

Chapter 1.	Introduction.....	- 1 -
1.1	Product Introduction .....	- 1 -
1.2	Products specification.....	- 1 -
1.3	Products Appearance and size.....	- 2 -
1.4	substantial explanation.....	- 3 -
1.5	Noting and Waring.....	- 4 -
Chapter 2.	Connection.....	- 5 -
2.1	Product connection define and method.....	- 5 -
Chapter 3.	Software Installation.....	- 15 -
3.1	MACH3 Install .....	- 15 -
3.2	EC500V5 Plug-in installation.....	- 18 -
Chapter 4.	Setting of software.....	- 19 -
4.1	Open software.....	- 19 -
4.2	Software Common settings.....	- 20 -
Chapter 5.	Using of software.....	- 29 -
5.1	Set Machine Coordinate system.....	- 29 -
5.2	Set workpiece coordinate system.....	- 31 -
5.3	Open G code file and run.....	- 33 -

# Chapter 1. Introduction

## 1.1 Product Introduction

Digitaldream CNC has engaged in the Numerical control industry for 10years, 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 aixs CNC motion controllers.◦

EC500V5 is the 6 axis motion controller ,we spend 4 years to design.This controller's control cycle is 2ms. The maximum pulse frequency of each axis is 300KHz. The highest division is 256.The highest current is 6A.

EC500V5 support Mach3 software and serial port MPG, through ethernet to communicate with computer.

EC500V5 motion controller adopts the ARM design framework. The ARM design includes communication,codeanalytic, underlying algorithm and pulse gneration. Rational design, reliablecontrol, convenient operation.

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 EtherNET;
- 16 ports input interface for ordinary digital data;
- 16 ports output interface for ordinary digital data;

- 1 port 0-10V spindle speed analog output interface(can change to PWM output);
- can support 6 axis stepper systems at most, 460KHz pulse output for every axis;
- ARM motion control chip;
- Compatible with MPG input, support standard MPG & the digital display MPG of our company.

### 1.3 Products Appearance and size

EC500V5 motion controller is with the plastic shell structure. The controller appearance as the Figure 1-1 show: The products overall size is 171mm\*106mm\*20.5mm; Install size is 116mm\*119mm

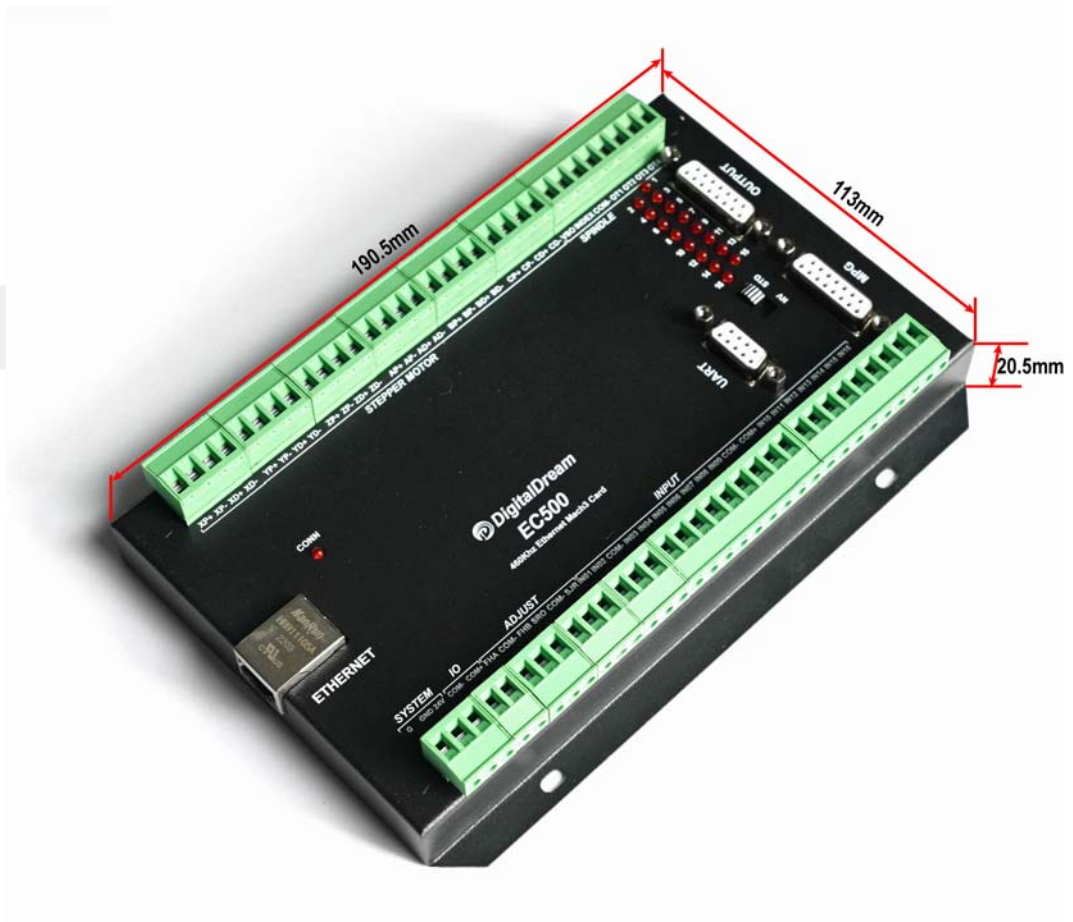


Figure1-1. EC500V5 front appearance and size



Figure1-2. Install size

### 1.4 substantial explanation

When operate the EC500V5, there will be a lot of English abbreviations, now we list all of them for your kind reference:

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: Feeding speed, 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 : X axis Coordinate,Y :Y axis Coordinate

Z :Z axis Coordinate, A :A axis Coordinate

### 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 spindlecontrolalos have a certain load capacity. Please avoid this terminal connect with GND.in case that the interior components and parts be brokendown.



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 emergancy, 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 24VDC power supply.Voltage equipment.Pls pay attention to the electricity, safety when conducting the operation

# Chapter 2 Connection

## 2.1 Product connection define and method

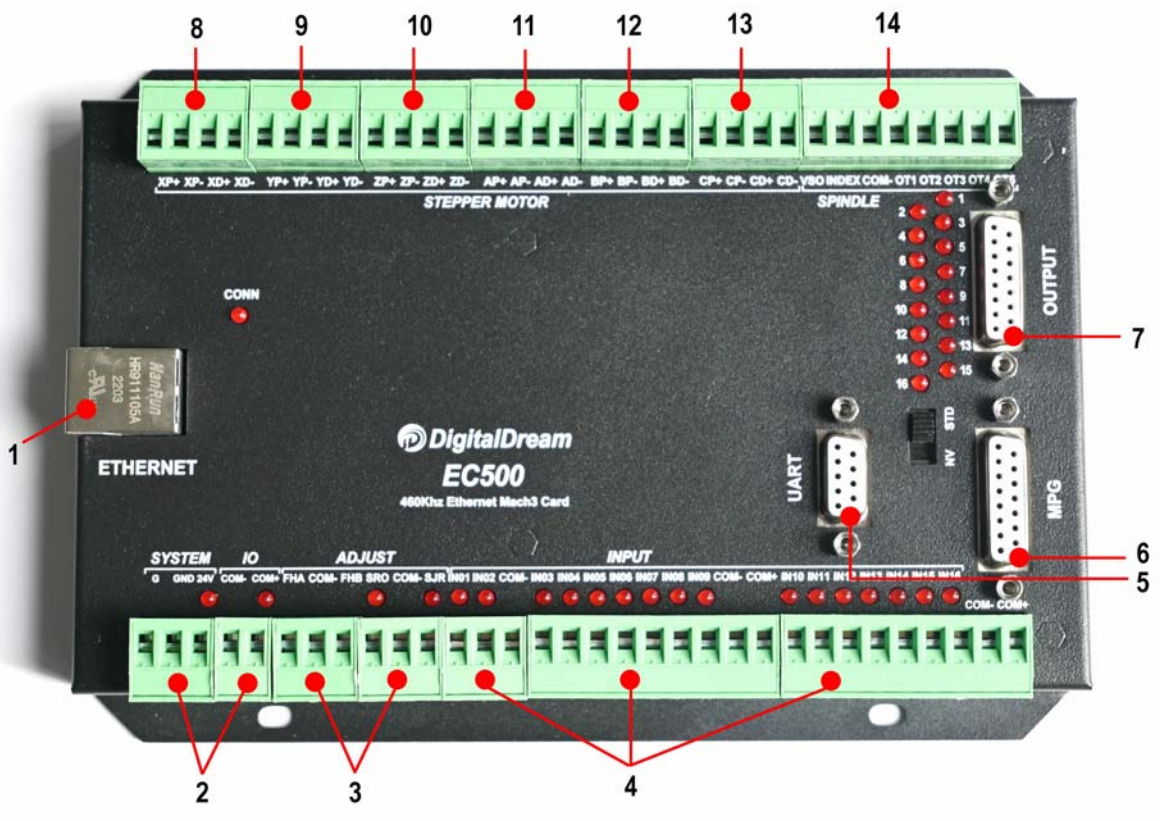


Figure2-1. Product wiring section and interface summary

As the Figure 2-1 showed,the connection of the controller includes Ethernet connection interface, MPG interface and Power input port etc. Now we descript them in details as below.

### 2.2.1 Ethernet port

As shown in Figure 2-1, the position marked with 1 is the Ethernet interface, through which the controller can be connected to the computer. The controller supports both router mode and network cable direct connection mode. This will be described in detail in later chapters.

### 2.2.2 Power input port

As shown in Figure 2-2, the port marked with GND/24V/COM -/COM+, where GND/24V is the system power interface and COM -/COM+is the IO power interface. The power supply voltage range is 24V. The power supply is recommended to be no less than 50W. The system power supply

and IO power supply can share a 24V switching power supply, or they can be powered separately by two 24V switching power supplies.

**2.2.3 FRO/SRO/SJR adjust interface**

As shown in Figure 2-1, the interface marked with 3 is the FRO/SRO/SJR quick parameter adjustment interface. This adjustment interface can adjust the FRO/SRO/SJR 3 parameters by using 2 gear switches+a digital potentiometer, which is original to our company. For the wiring method, refer to Figure 2-2. Among them, the potentiometer adjusts the SRO value when SRO and COM are short circuited, the potentiometer adjusts the SJR value when SJR and COM are short circuited, and the potentiometer adjusts the FRO value when SRO/SJR are disconnected.

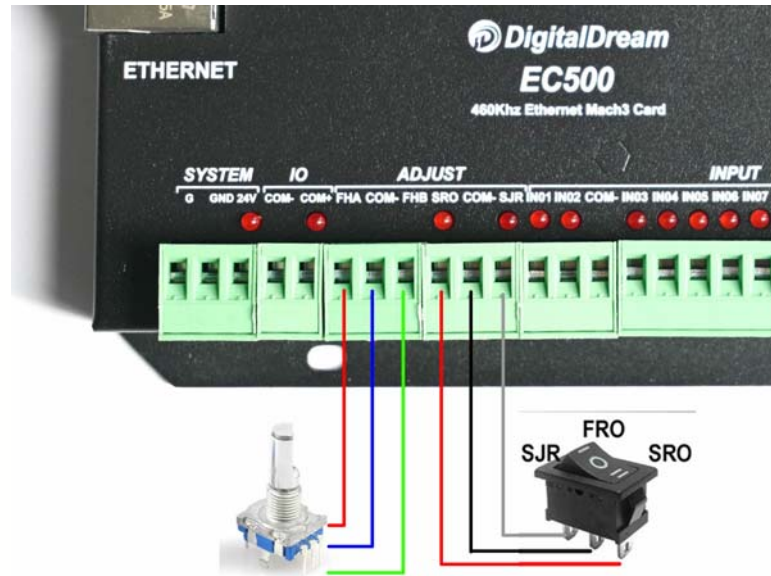


Figure2-2. Product wiring section and interface summary

**2.2.4 Universal input interface**

As shown in Figure 2-1, the position marked with 4 is a universal input interface, which is composed of a 3P2edg terminal and two 9P2edg terminal. The specific definition is printed on the housing. Now, the detailed definition of the interface is described as follows.

NO.	MARK	Definition
1	IN01	INPUT PIN1
2	IN02	INPUT PIN2



3	COM-	Common terminal-
4	IN03	INPUT PIN3
5	IN04	INPUT PIN4
6	IN05	INPUT PIN5
7	IN06	INPUT PIN6
8	IN07	INPUT PIN7
9	IN08	INPUT PIN8
10	IN09	INPUT PIN9
11	COM-	Common terminal-
12	COM+	Common+, External supply 24V
13	IN10	INPUT PIN10
14	IN11	INPUT PIN11
15	IN12	INPUT PIN12
16	IN13	INPUT PIN13
17	IN14	INPUT PIN14
18	IN15	INPUT PIN15
19	IN16	INPUT PIN16
20	COM-	Common terminal-
21	COM+	Common+, External supply 24V

Table 2-1. Detailed Description of Definition of General Input Interface

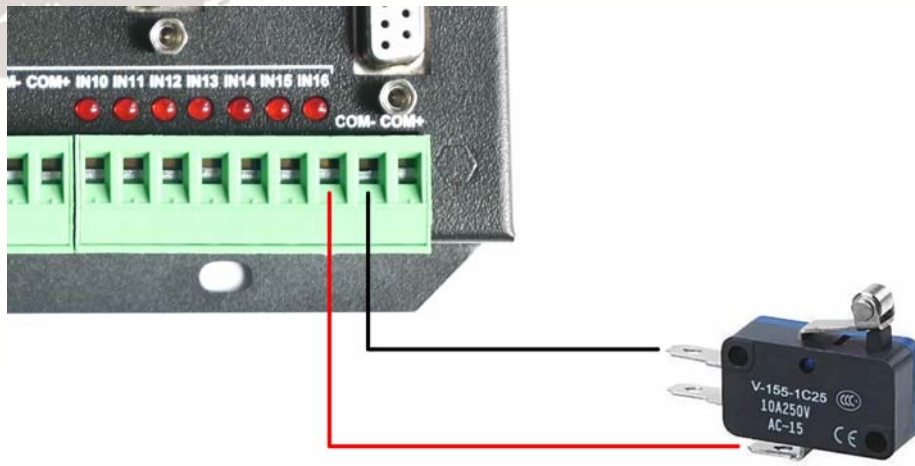


Figure2-3. Wiring mode of two-wire switch

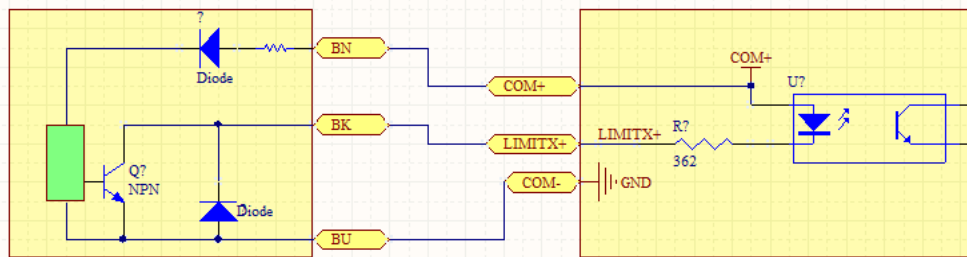
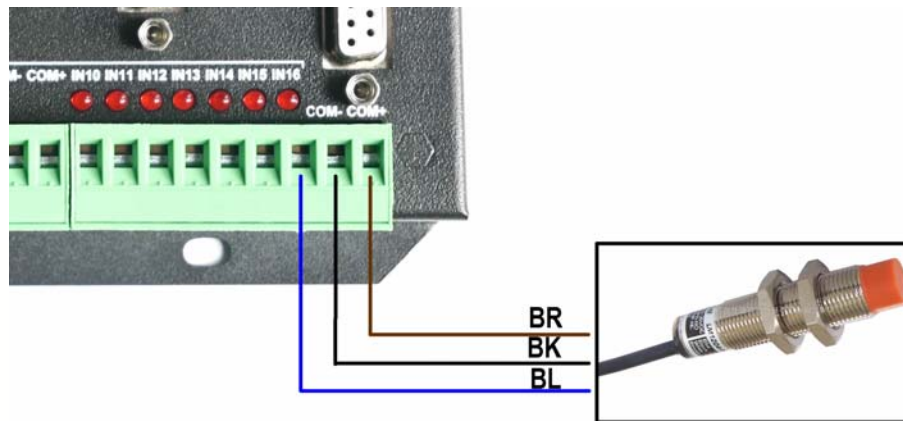


Figure2-4. Wiring mode of 3-wire NPN proximity switch

### 2.2.5 Extended serial port

As shown in Figure 2-1, the position marked with 5 is the extended serial port position, and the position marked with RXD/TXD/GND is the serial port receiving/serial port sending/public ground respectively. The extended serial port can be used to extend the HMI coordinate display. Definition see as Figure 2-5

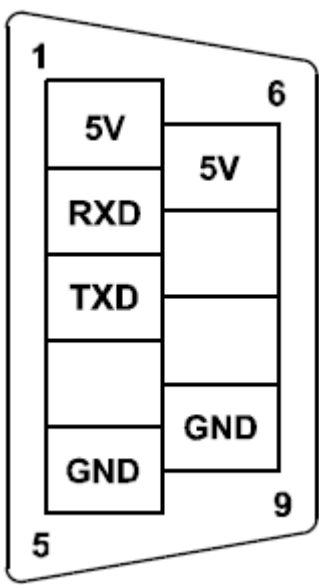


Figure2-5. sequence of MPG port

2.2.6 MPG Port

As shown in Figure 2-1, the position marked with 6 is the MPG interface. The MPG interface is a three row DB15 interface. The interface definition is printed on the cover. Now, the detailed definition of the interface is described as follows

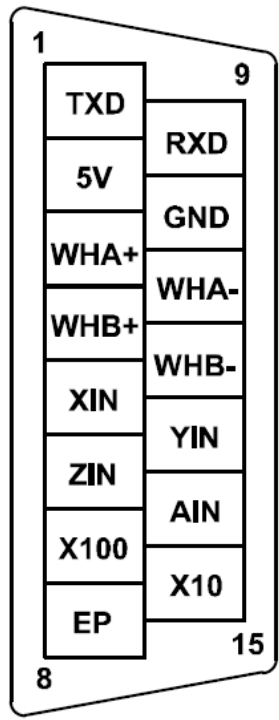


Figure2-6. sequence of MPG port

No.	Mark	definition
1	TX/BIN	Serial port sending pin / B axis select pin
2	5V	5V power pin
3	A+	encoder A+
4	B+	encoder B+
5	X	X axis select pin
6	Z	Z axis select pin
7	100	X100 rate select pin
8	EP	Estop
9	RX/CIN	Serial port receiving pin/ C axis select pin
10	0V	COM ground
11	A-	encoder A-
12	B-	encoder B-
13	Y	Y axis select pin
14	A	A axis select pin
15	10	X10 rate select pin

Table 2-2. MPG interface define

Note: When the level switch next to the MPG interface is selected to STD, it means that the MPG is connected to the universal MPG. At this time, PIN1 and PIN9 are the B channel selection and C channel selection functions respectively. When the level switch is selected to NV, it means that the MPG interface is connected to the NVMPG serial port hand pulse. At this time, PIN1 and PIN9 are the serial port communication TXD/RXD functions respectively.

**2.2.7 Universal output port**

As shown in Fig. 2-1, the DB15 interface marked with 7 is a universal output interface. The housing silk screen is marked OUTPUT, and the specific definition is shown in Figure 2-7. In addition, there is an indicator on the right side of the universal output interface, and each channel corresponds to one indicator. When the output is connected, the corresponding indicator is on.

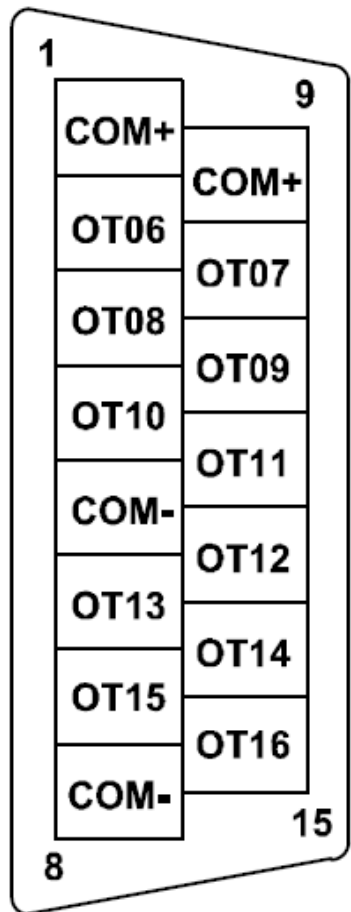


Figure2-7. sequence of OUTPUT port

**2.2.8 stepper motor port**

As shown in Figure 2-1, the ports marked 8/9/10/11/12/13 are stepper motor control interfaces, which respectively correspond to XYZABC axis stepper motor control signals. EC500 has a total of 4 3/4/5/6 axis products, which share a set of hardware and are limited to 3/4/5/6 axis only in software. Each axis is a 4PIN terminal, and the maximum output frequency of each channel is 460K. EC500 only supports stepping motor driver with differential input signal. Refer to Table

2-3 for the definition of stepping motor interface

No.	Mark	definition
XP+	X	X axis pulse signal+
XP-	X	X axis pulse signal-
XD+	X	X axis direction signal+
XD-	X	X axis direction signal-
YP+	Y	Y axis pulse signal+
YP-	Y	Y axis pulse signal-
YD+	Y	Y axis direction signal+
YD-	Y	Y axis direction signal-
ZP+	Z	Z axis pulse signal+
ZP-	Z	Z axis pulse signal-
ZD+	Z	Z axis direction signal+
ZD-	Z	Z axis direction signal-
AP+	A	A axis pulse signal+
AP-	A	A axis pulse signal-
AD+	A	A axis direction signal+
AD-	A	A axis direction signal-
BP+	B	B axis pulse signal+
BP-	B	B axis pulse signal-
BD+	B	B axis direction signal+
BD-	B	B axis direction signal-
CP+	C	C axis pulse signal+

CP-	C	C axis pulse signal-
CD+	C	C axis direction signal+
CD-	C	C axis direction signal-

Table 2-3. Stepper driver interface define

### 2.2.9 Spindle Port

As shown in Figure 2-2, the port marked with 14 is the spindle control interface. The definition of spindle control connection is shown in Table 2-3 .

MARK	definition
VSO	Spindle speed regulation output, regulating range 0-10V
INDEX	Spindle speed feedback signal, one pulse per cycle
COM-	Spindle common -, shared ACM/DCM
OT1	Universal output 1, which can be configured as spindle forward rotation
OT2	Universal output 2, which can be configured for spindle inversion
OT3	Universal output 3
OT4	Universal output 4,
OT5	Universal output 5,

Table 2-4. Detailed Description Spindle Interface

OT1 can be used to control the starting and stopping of the spindle forward rotation, OT2 can control the starting and stopping of the spindle reverse rotation, and VSO can be used to control the spindle speed. The configuration of the spindle will be described in detail in the following chapters. For the connection method between the spindle control interface and the frequency converter, refer

to Figure 2-7. GNDS connects the frequency converter ACM/DCM, OT1 connects the frequency converter FWD, OT2 connects the frequency converter REV, and VSO connects the frequency converter AVI. INDEX can be connected to ordinary NPN type 2-wire Hall switch. Refer to Figure 2-8 for connection mode of EC500 and frequency converter

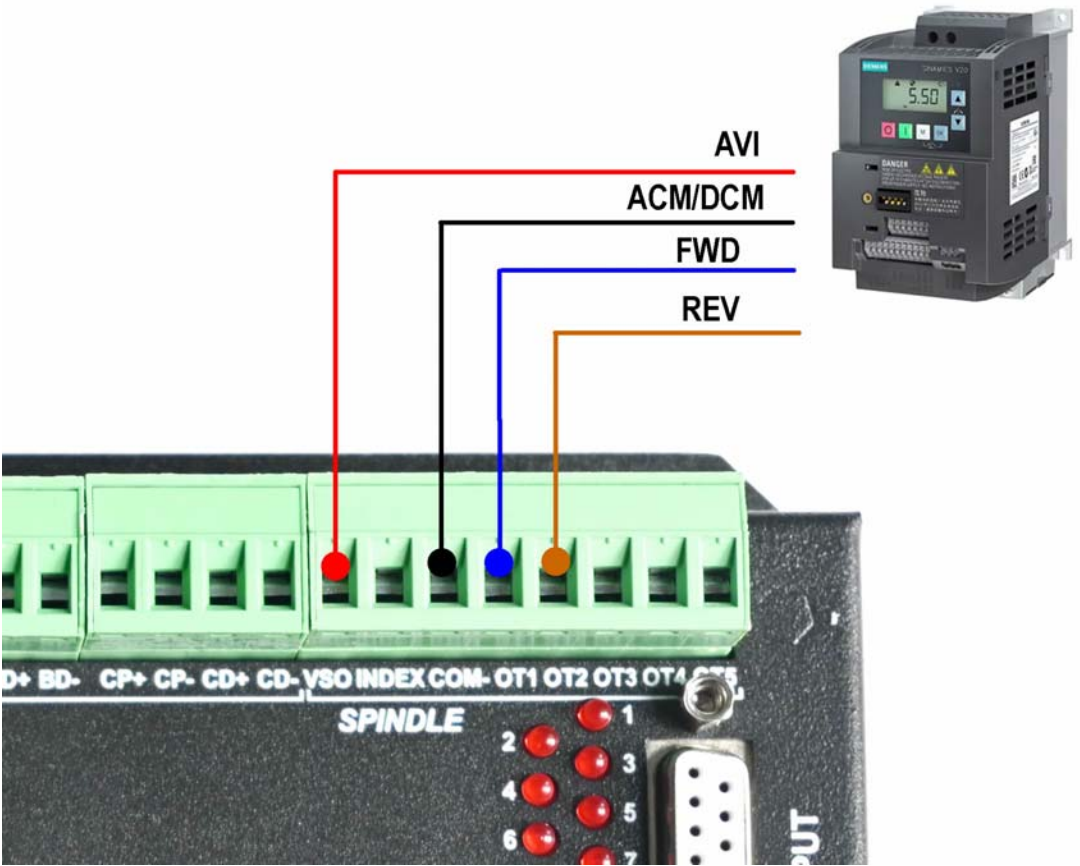


Figure2-1. Connection between EC500V5 and inverter




# Chapter 3. Software Installation

## 3.1 MACH3 Install

When you purchase our product, we will supply a CD-ROM, which contains the MACH3 installation, registration, and USB plug-ins. See as Figure 3-1



Figure3-1. MACH3 soft installation

First run the installation Mach3Version3.043.066  .Into the first page. See as Figure 3-2.

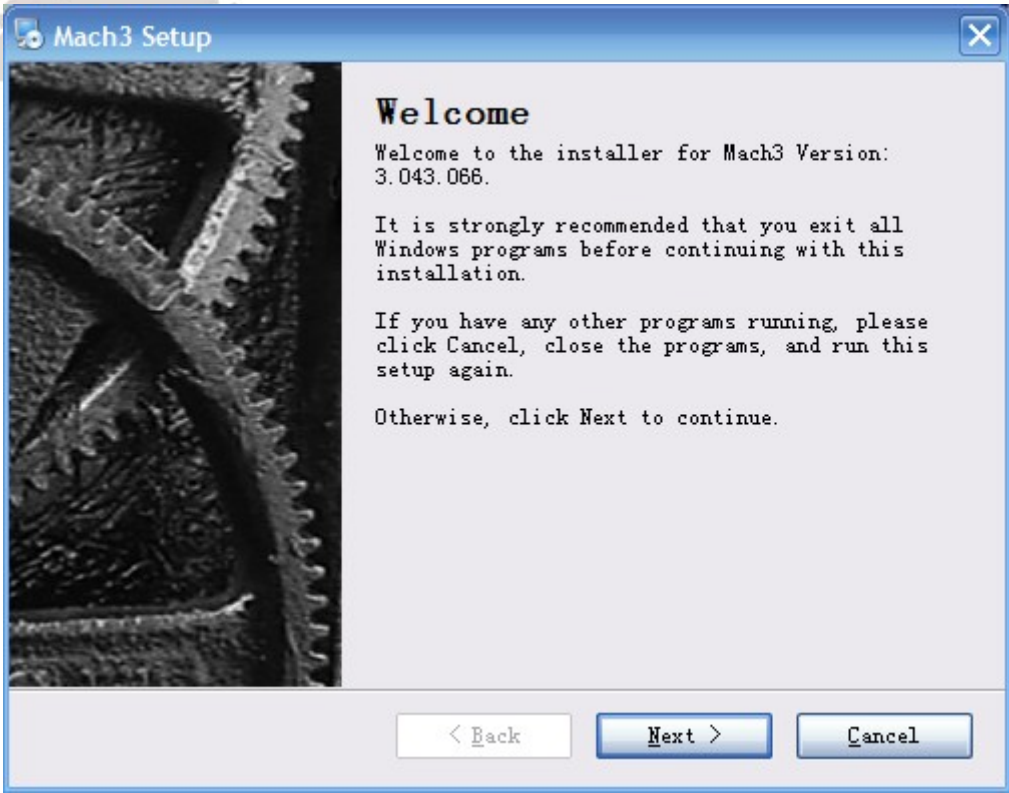


Figure3-2. MACH3 installation process 1

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

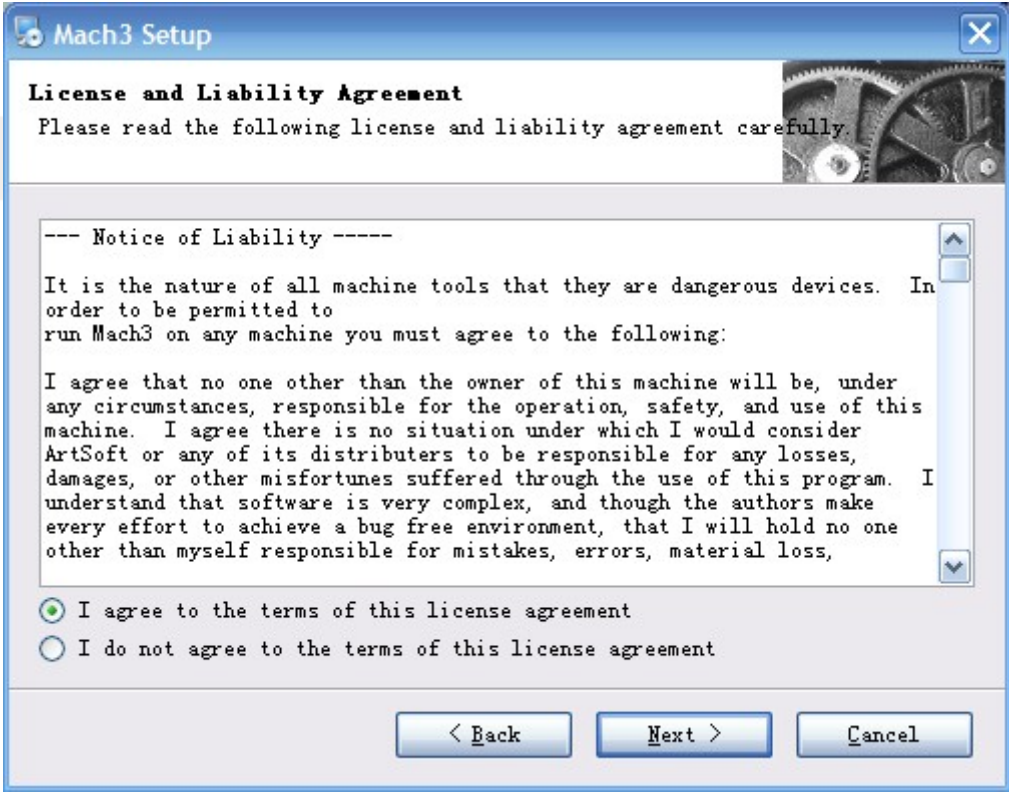


Figure3-3. installation process 2

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

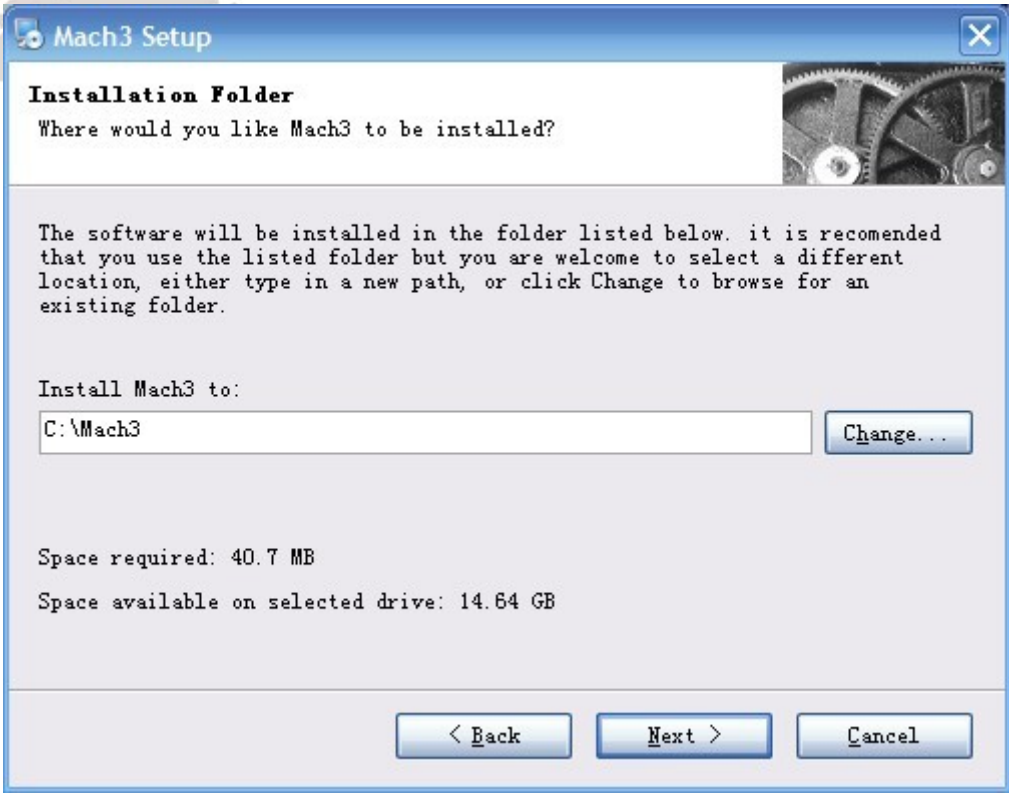


Figure3-4. MACH3 installation process 3

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

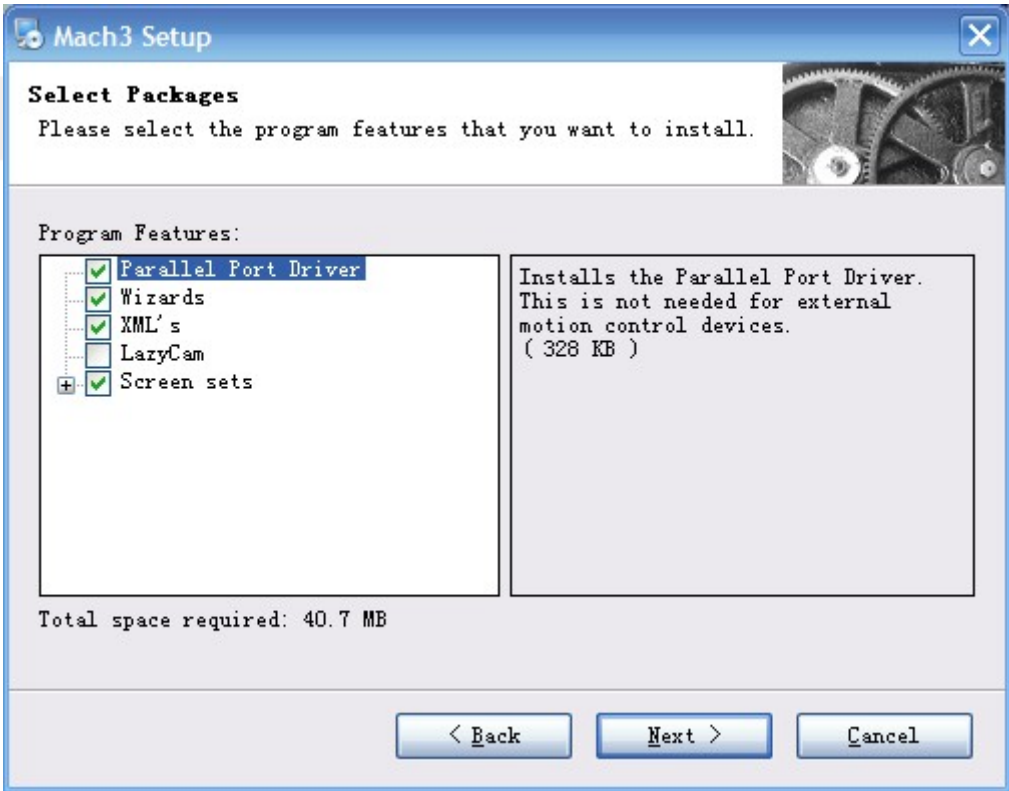


Figure3-5. MACH3 installation process 4

Click Next until completion. Then restart the computer.

## 3.2 EC500V5 Plug-in installation



DIGITALDREAM  
\_20220920.dll

Copy the file DIGITALDREAM.dll \_20220920.dll to X:\Mach3\PlugIns, X is the disk where the soft is installed.

## 3.3 IP Setting

EC500V5 supports fixed IP and router connection. Under fixed IP, please set the local IP to 192.168.4.X (X=7~254) and turn off the firewall

In router mode, please set the address of the router to 192.168.4.1

## Chapter 4. | Setting of software

### 4.1 Open software

Double-click the mach3mill



Enter mach3 software. Pop-up the plug-in dialog box. See as Figure 4-1.



Figure4-1. Plugin selection dialog

Choose our plugin DIGITALDREAM. Then press OK. If you do not want to the dialog box appear again next time, you can select Don't ask me this again .If the connection is successful, the connection indicator light (blue light) will be on. On the plugin page, you can see the connection device (config ->config plugins ->DIGITALDREAM\_CONFIG). See as Figure4-2.

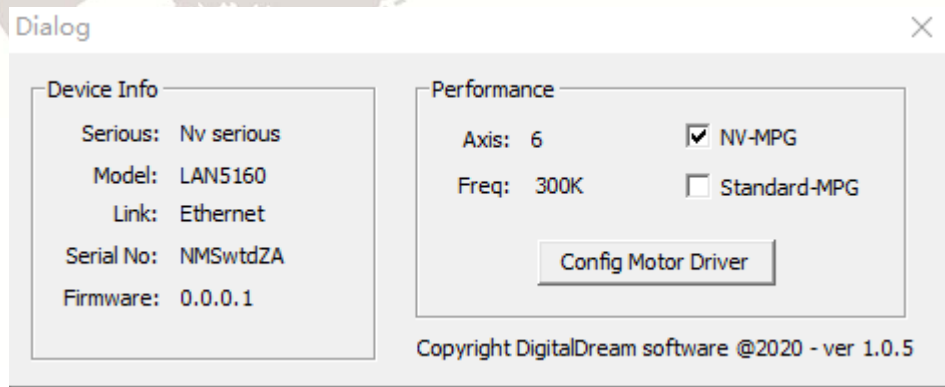


Figure4-2. connect successfully

## 4.2 Software Common settings

### 4.2.1 Check EC500V5 plugin

Click config plugins to input PluginConfig,you can seeEC500V5. See as Figure4-4.

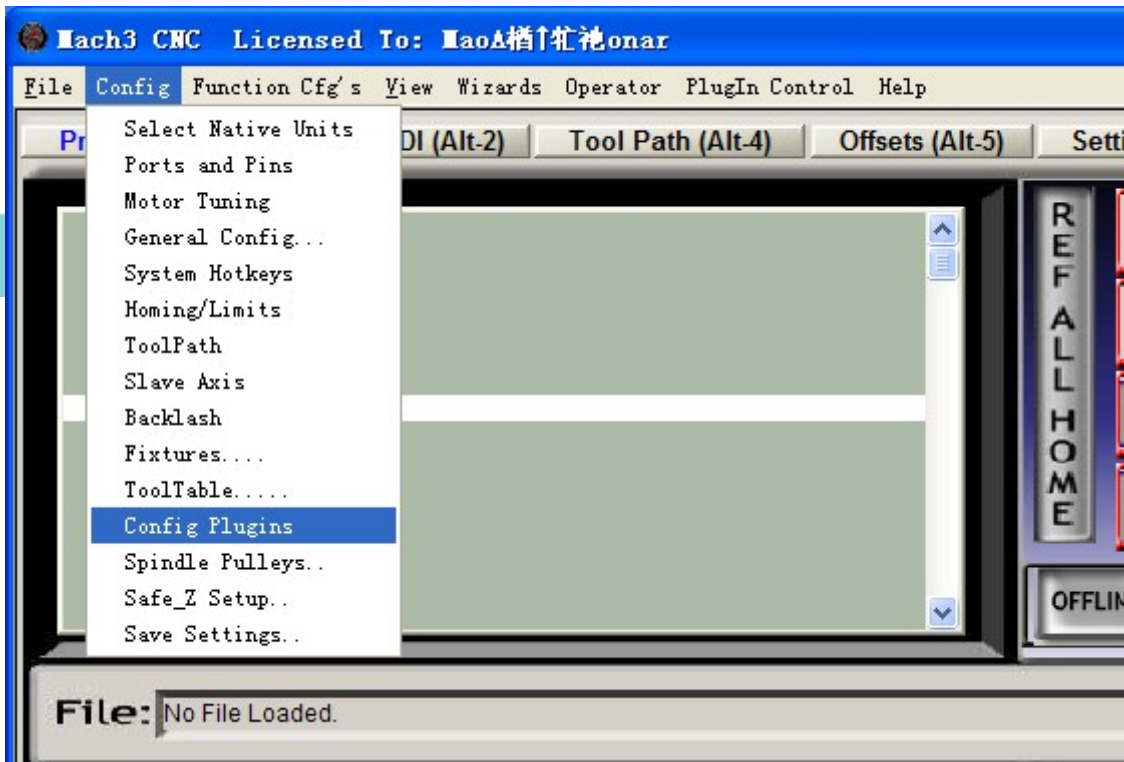


Figure4-3. Input Config plugins

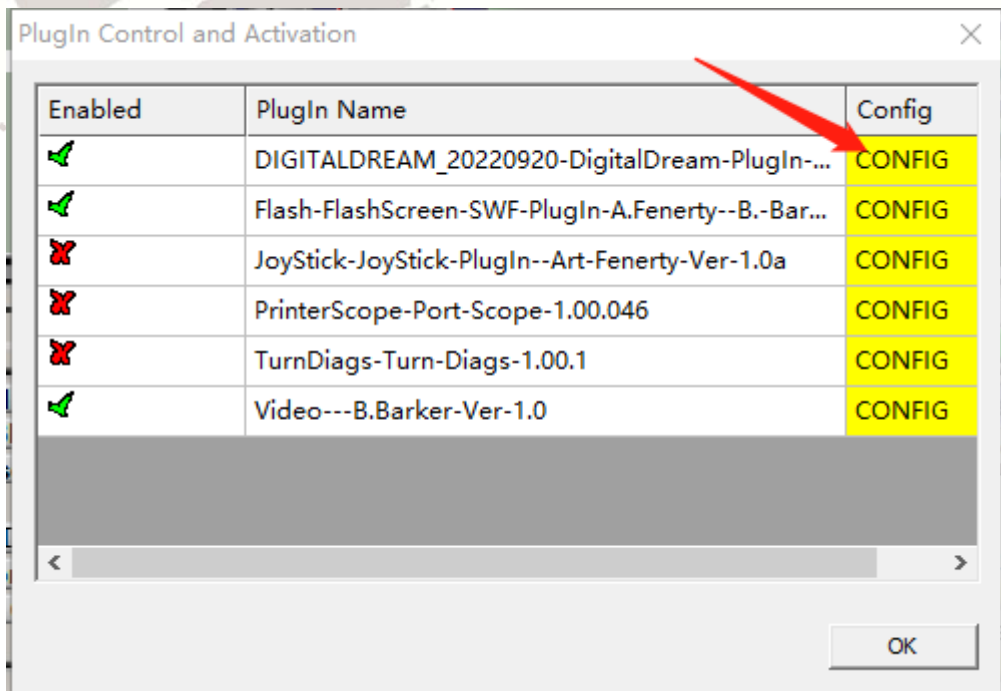


Figure4-4. LAN5160 Plugin

4.2.2 Motor operating parameters setting

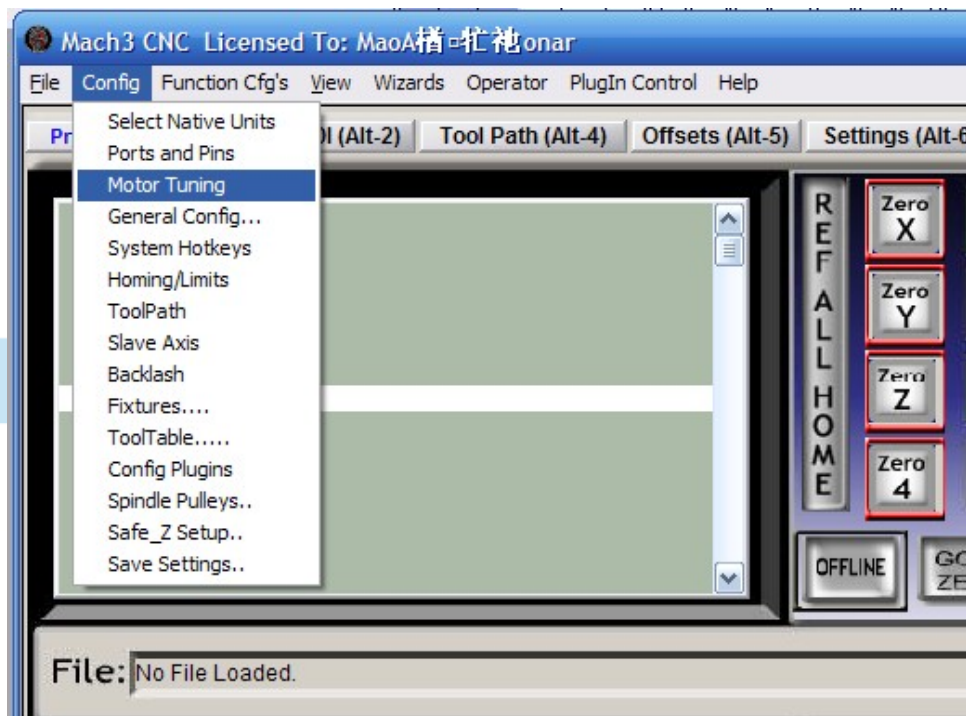


Figure4-5. Motor operating parameter setting menu entry

See as Figure 4-5. From submenu “motor tuning” of the menu “config” into the motor parameter settings dialog. See as Figure 4-6

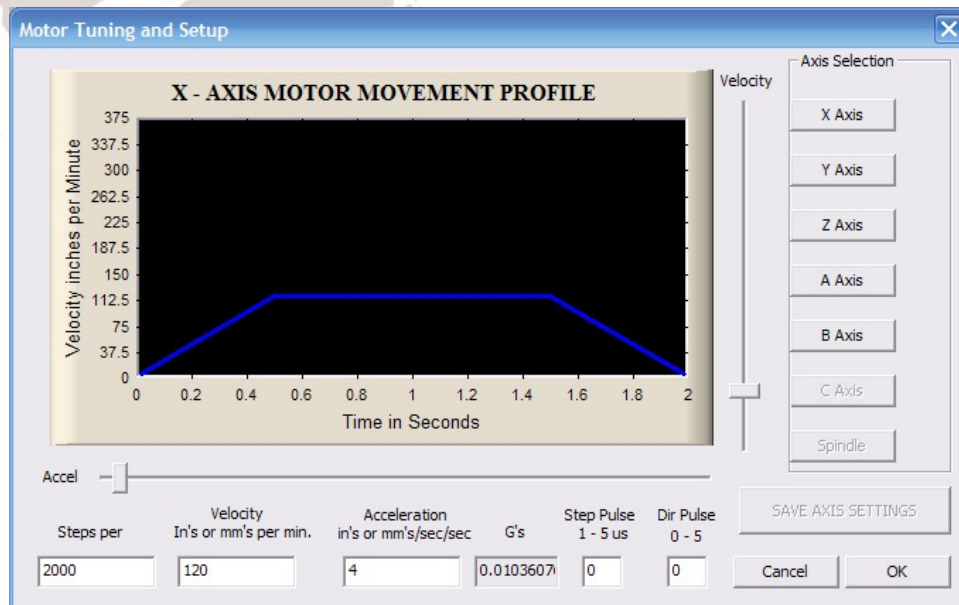


Figure4-6. Motor operating parameter settings dialog

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/s<sup>2</sup>, 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



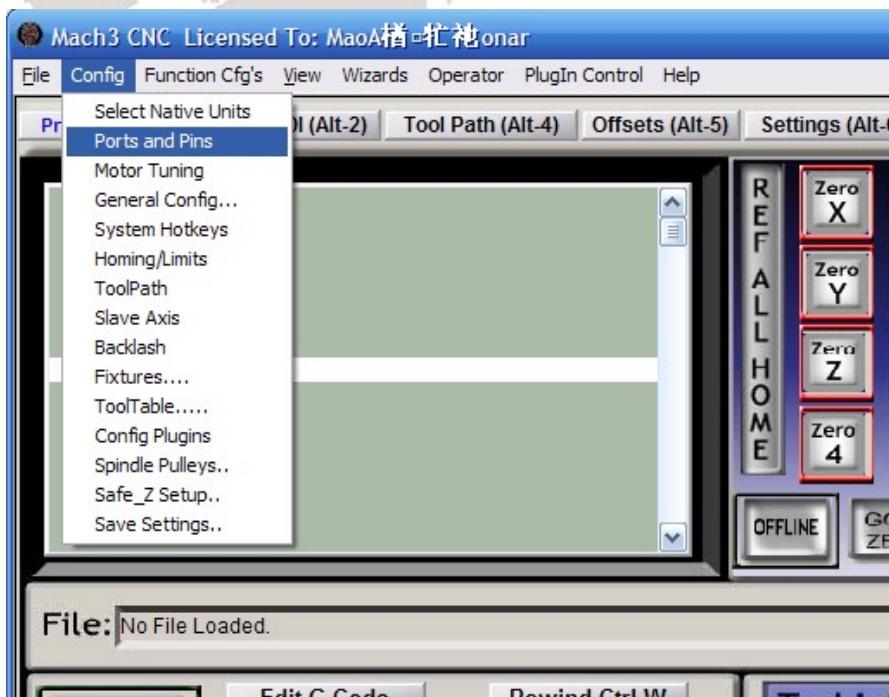


Figure4-7. Port setting entry

See as Figure 4-7, Click the sub-menu “ports and pins” of menu “Config” into Port Settings dialog box.

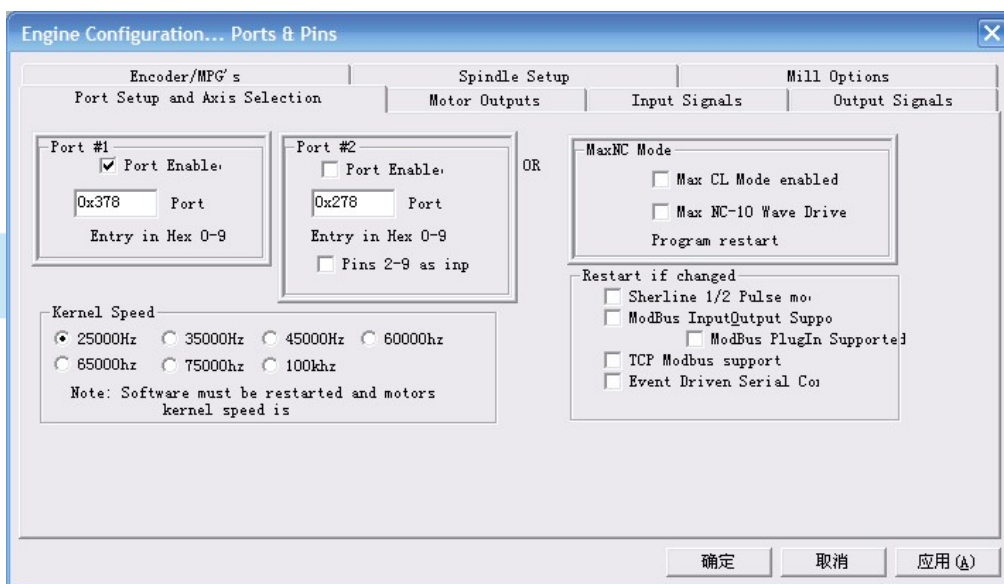


Figure4-8. Pin&Port Dialog

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. See as Figure4-9. You only need to check Enabled is √ here.

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.

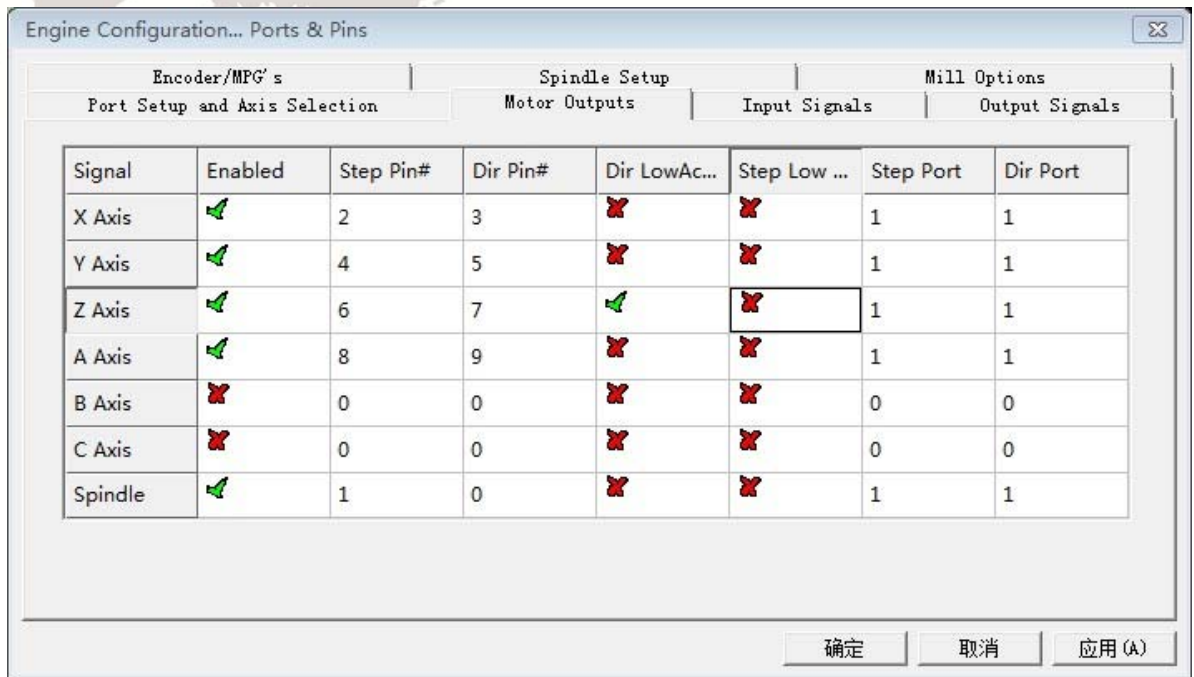
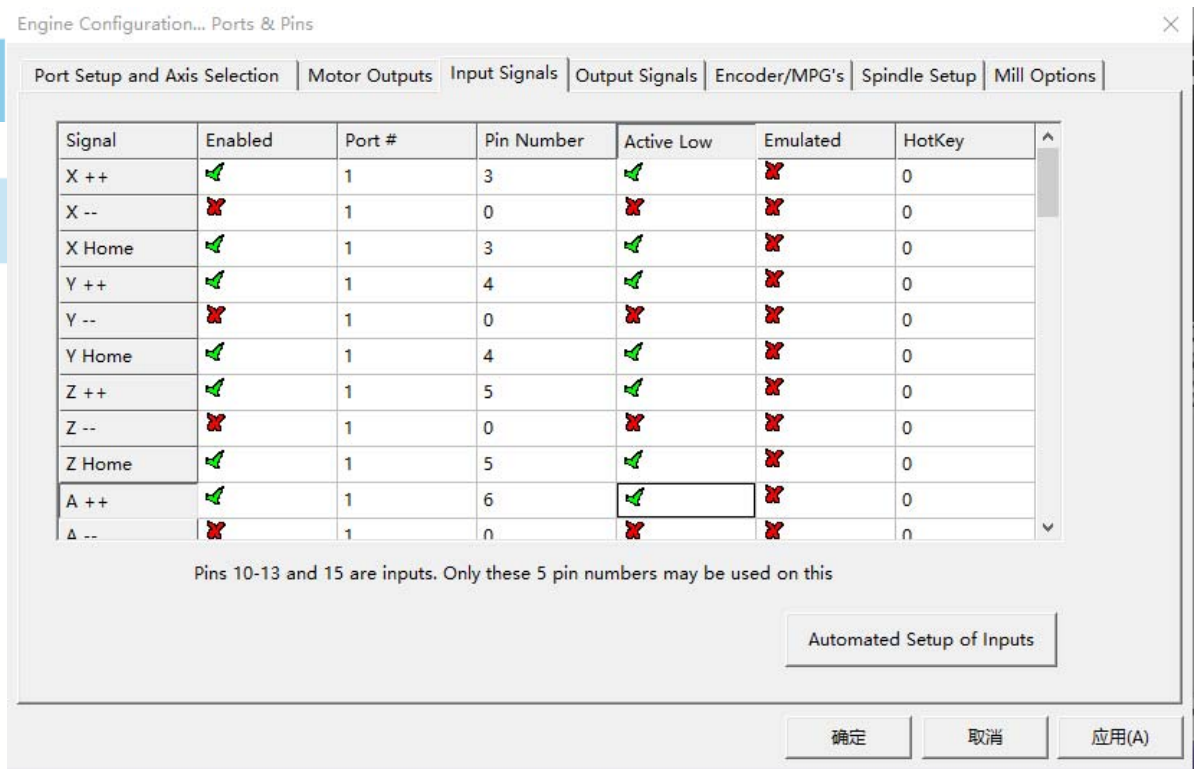


Figure4-9. Stepper motor port settings dialog

Click Input Signals to enter the input signal setting page. We assume IN1 as the emergency stop, IN2 as tool setting, and IN3-IN6 as the positive limit and origin of XYZA axis, as shown in Figure 4-10.



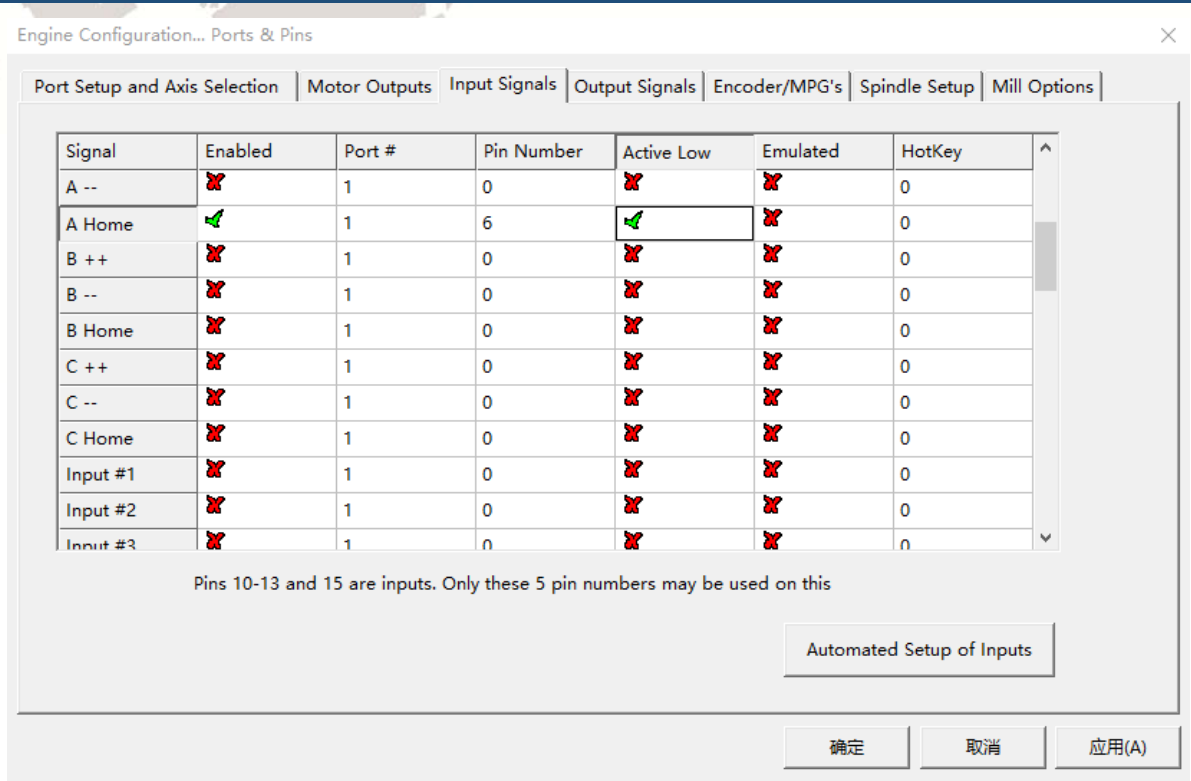


Figure4-10. Input Settings dialog

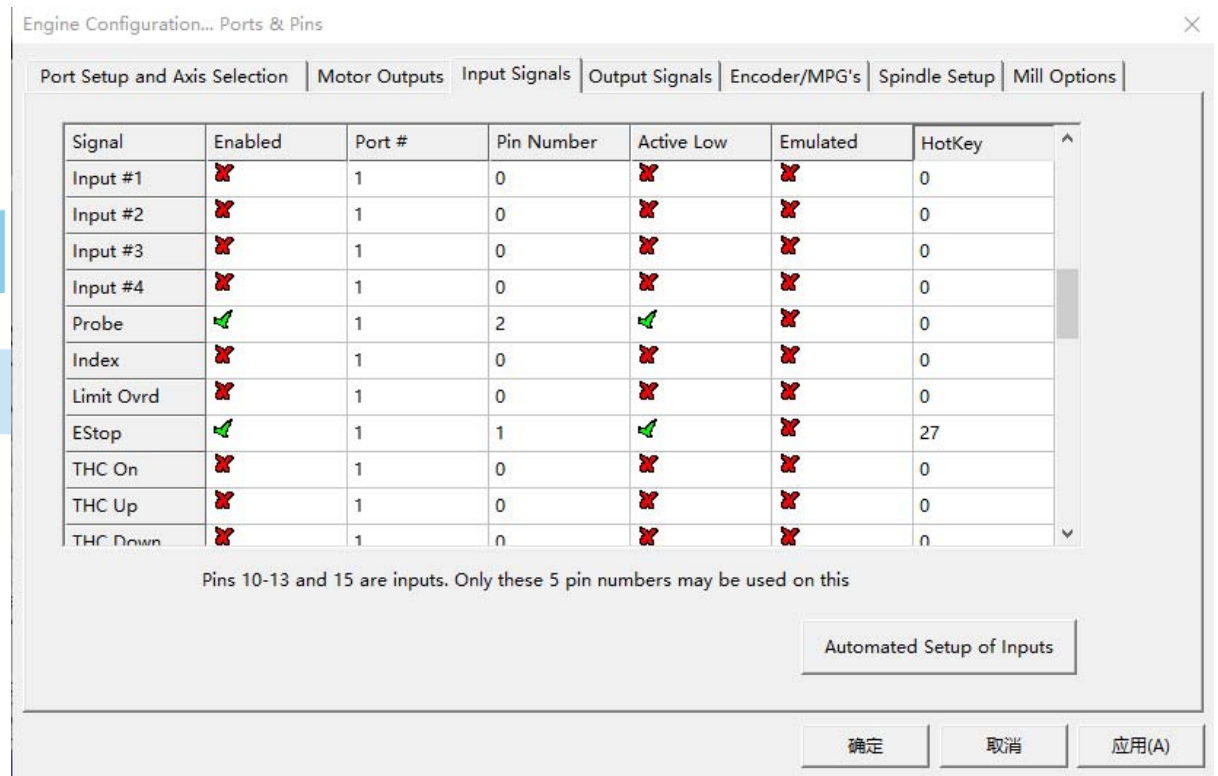


Figure4-11. Estop Probe and index Setting dialog

PROBE、ESTOP and Spindle speed back index Setting see as Figure 4-11,

Click “Spindle Setup” switch to the spindle settings page. See as Figure4-12.

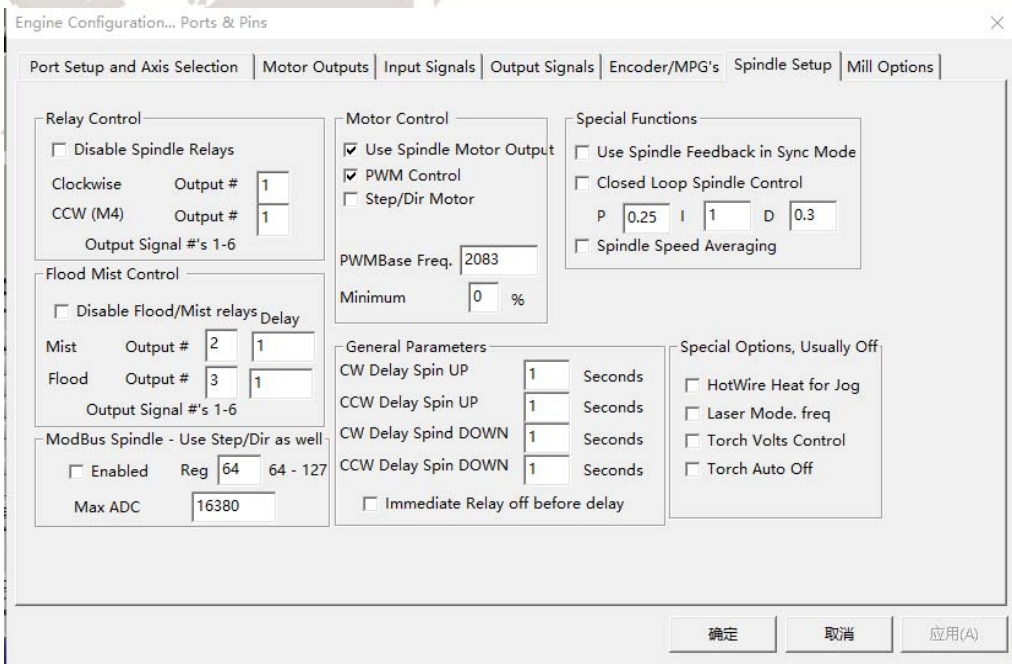


Figure4-12. Spindle Settings dialog

Here we can configure the spindle rotates CW、Reverse CCW、Mist、Flood pin, See as Figure4-13, They have been configured as 1、2、3、4. Corresponding to output#1~output#4 in Figure4-14.output#1~output#6 in Output Signal Setup dialog can be Configured into these 4 signals. Here we only configure CW \MIST\FLOOD. They are M3\M7 and M8 in G-code file. CW is controlled by OUT1 and MIST is controlled by OUT2 and 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 on stepper motor config page see as figure 4-9.

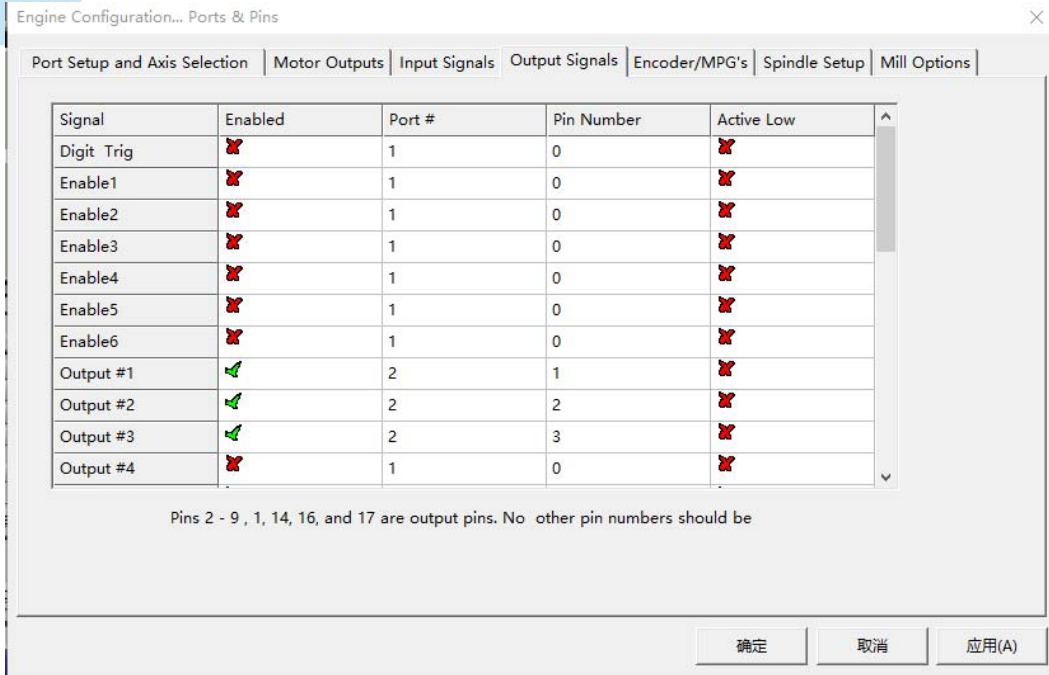


Figure4-13. Spindle setting corresponds to the output configuration

4.2.4 MPG Setting

Open the plug-in page. Path Config ->Config plugin ->DIGITALDREAM\_ CONFIG

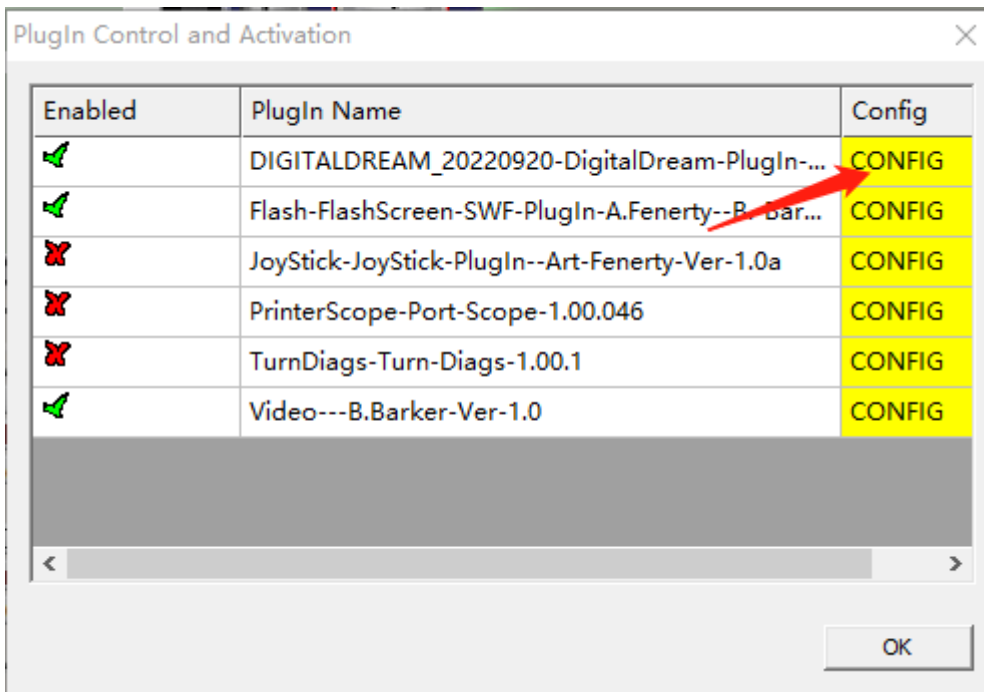


Figure4-14. Open the plug-in page

On the plug-in page, you can select the serial port MPG and the standard MPG.. NV-MPG is the serial port MPG of our company, and Standard MPG is the standard MPG.

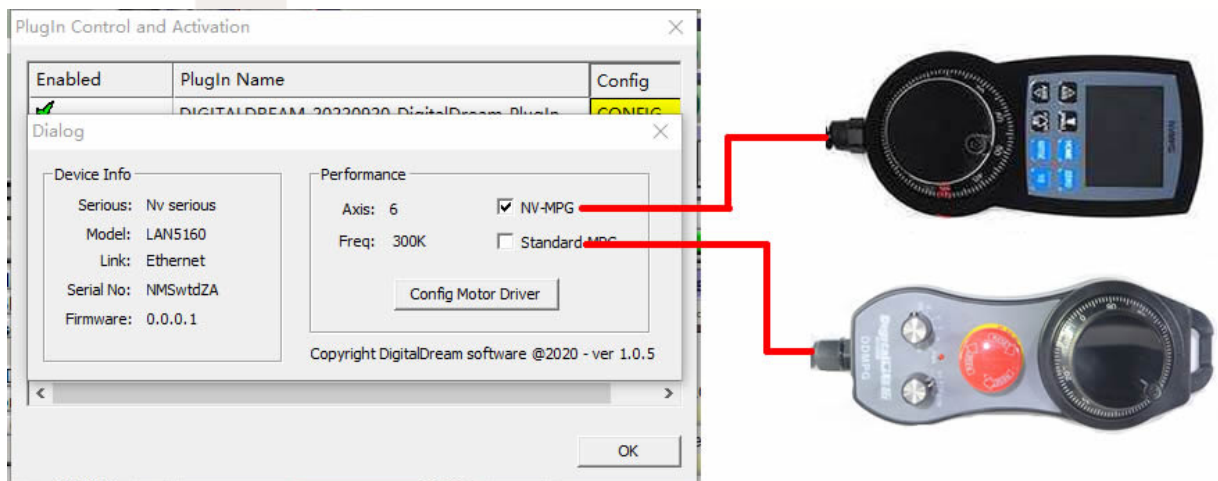


Figure4-15. Select MPG Type

Check the MPG on the MPG configuration page. The path is Port&Pins ->Encoder/MPG's, as shown in Figure 4-19. After configuration, close the window to use the MPG normally

Port Setup and Axis Selection							
		Motor Outputs	Input Signals	Output Signals	Encoder/MPG's	Spindle Setup	Mill Options
Signal	Enabled	A -Port #	A -Pin #	B -Port #	B -Pin #	Counts/Unit	Velocity
Encoder1		0	0	0	0	1.000000	100.000000
Encoder2		0	0	0	0	1.000000	100.000000
Encoder3		0	0	0	0	1.000000	100.000000
Encoder4		0	0	0	0	1.000000	100.000000
MPG #1		0	0	0	0	1.000000	100.000000
MPG #2		0	0	0	0	1.000000	100.000000
MPG #3		0	0	0	0	1.000000	100.000000

Figure4-16. Check MPG

## 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.

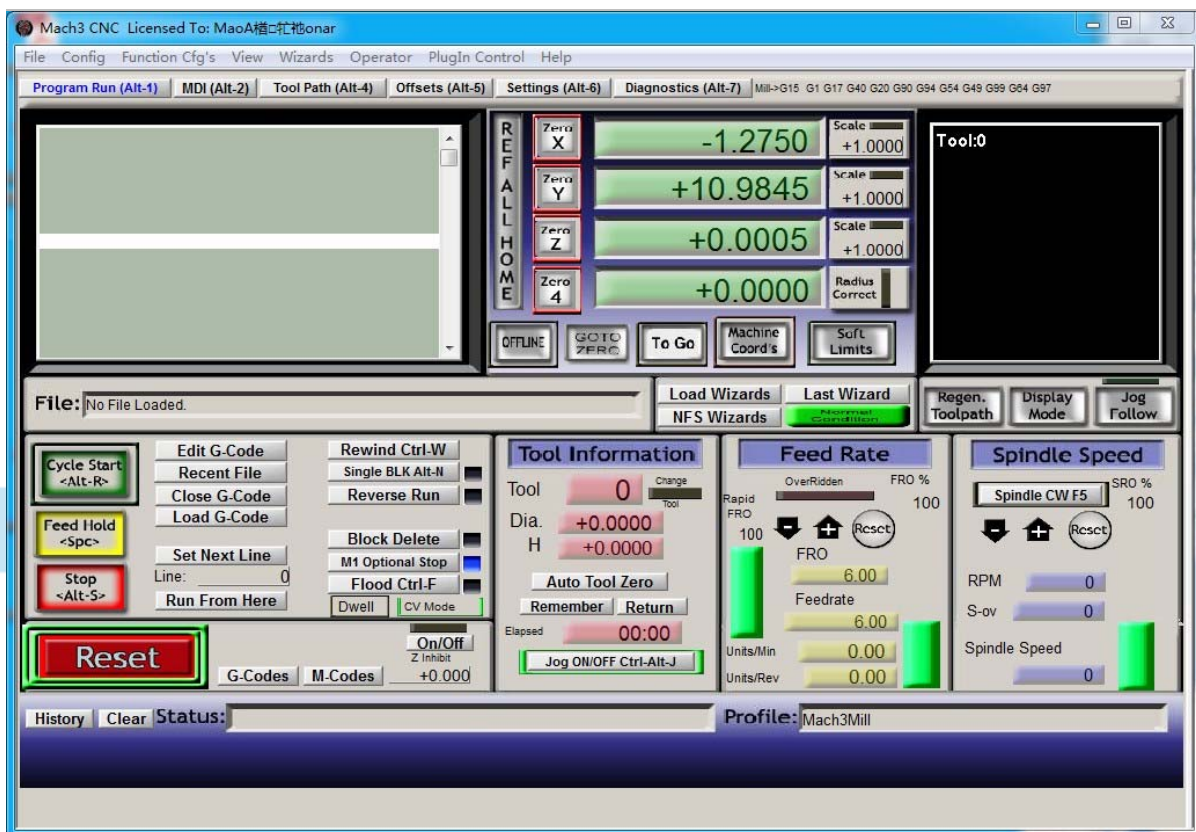


Figure5-1. Main Screen of mach3

#### 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.

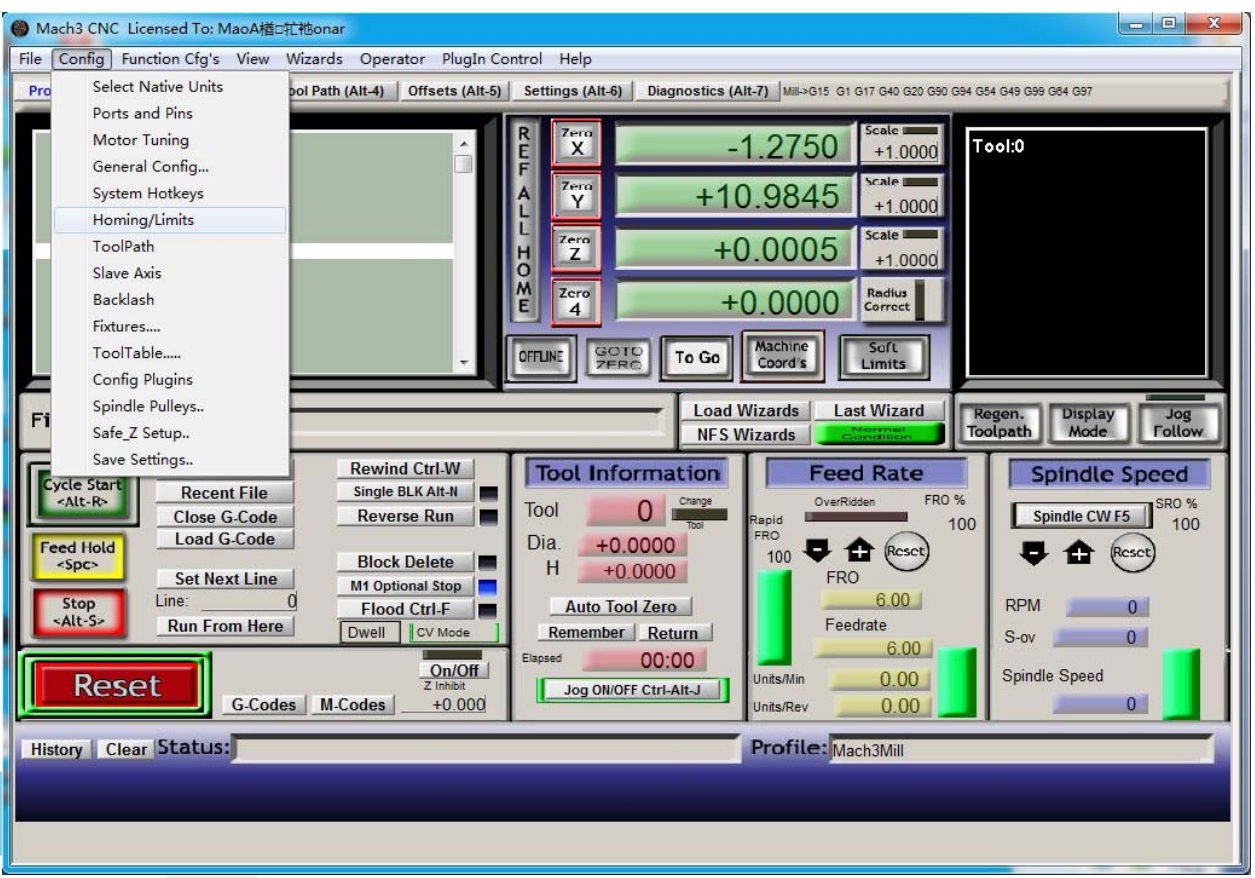


Figure5-2. Click homing of Config

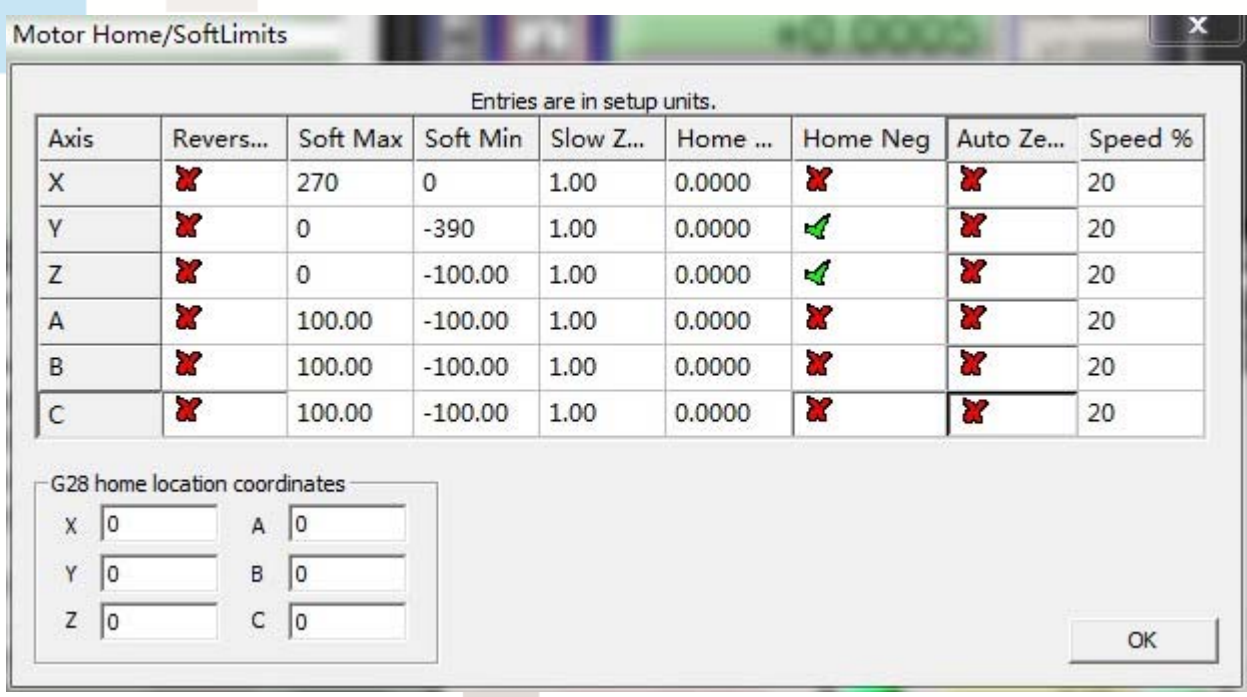


Figure5-3. Motor Home and Softlimits dialog

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 is according 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

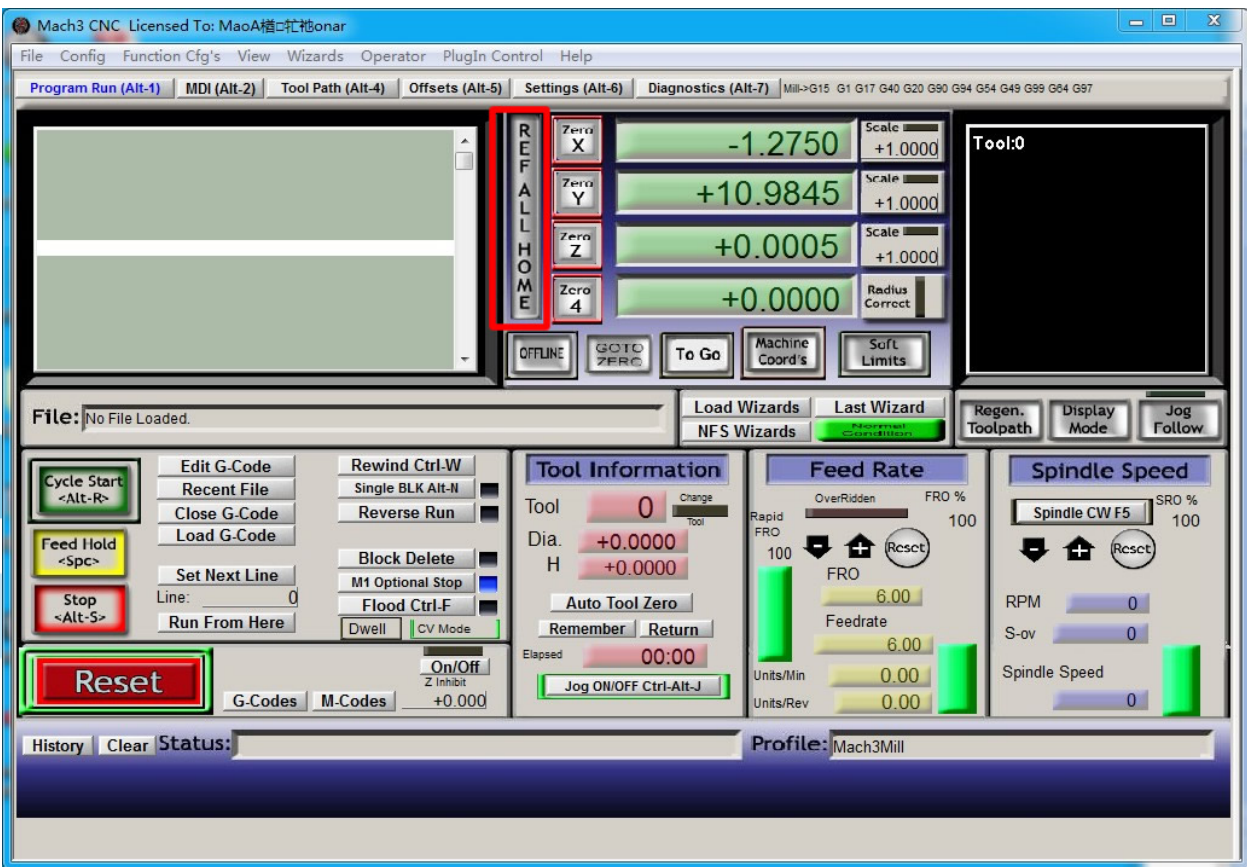


Figure5-4. Click REF ALL HOME to HOME all axis

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.

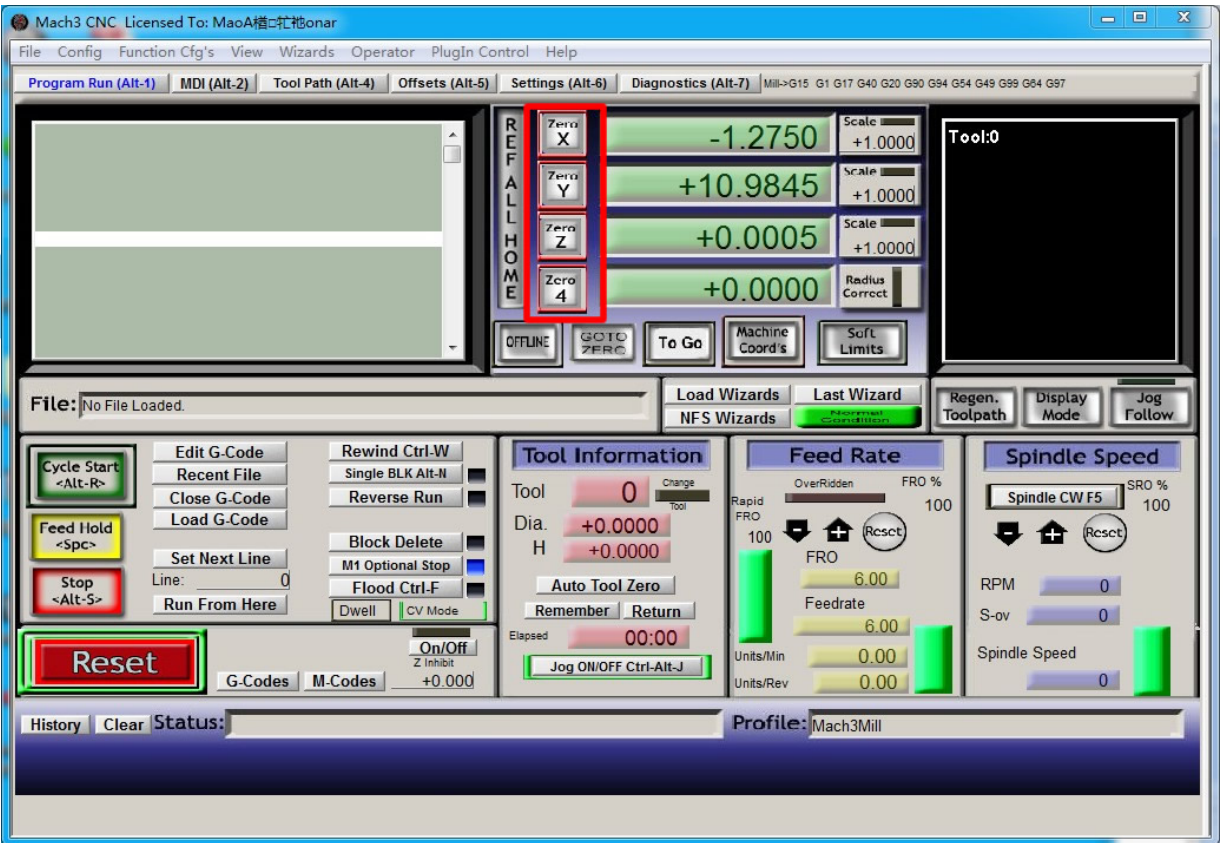


Figure5-5. Press Zero on each axis,all clear to 0

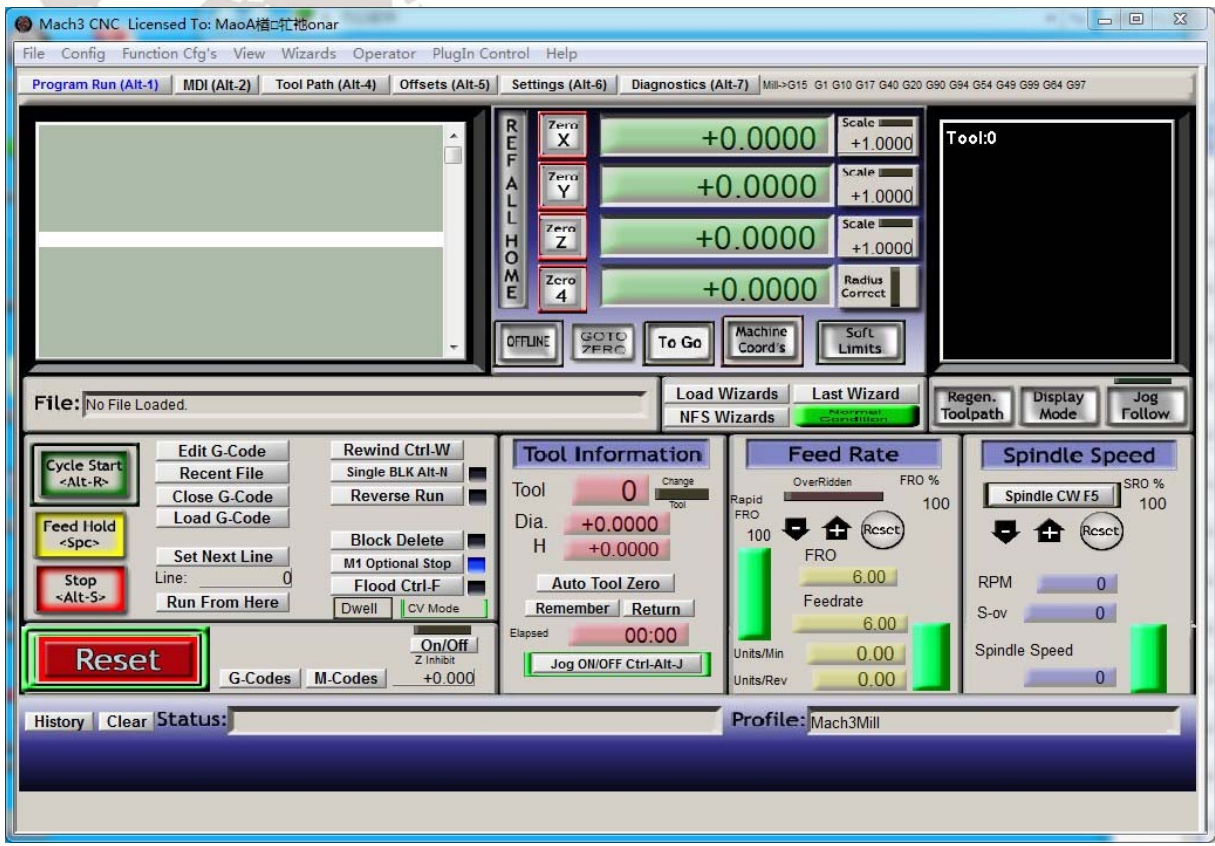


Figure5-6. Main Screen after ZERO all axis

### 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.

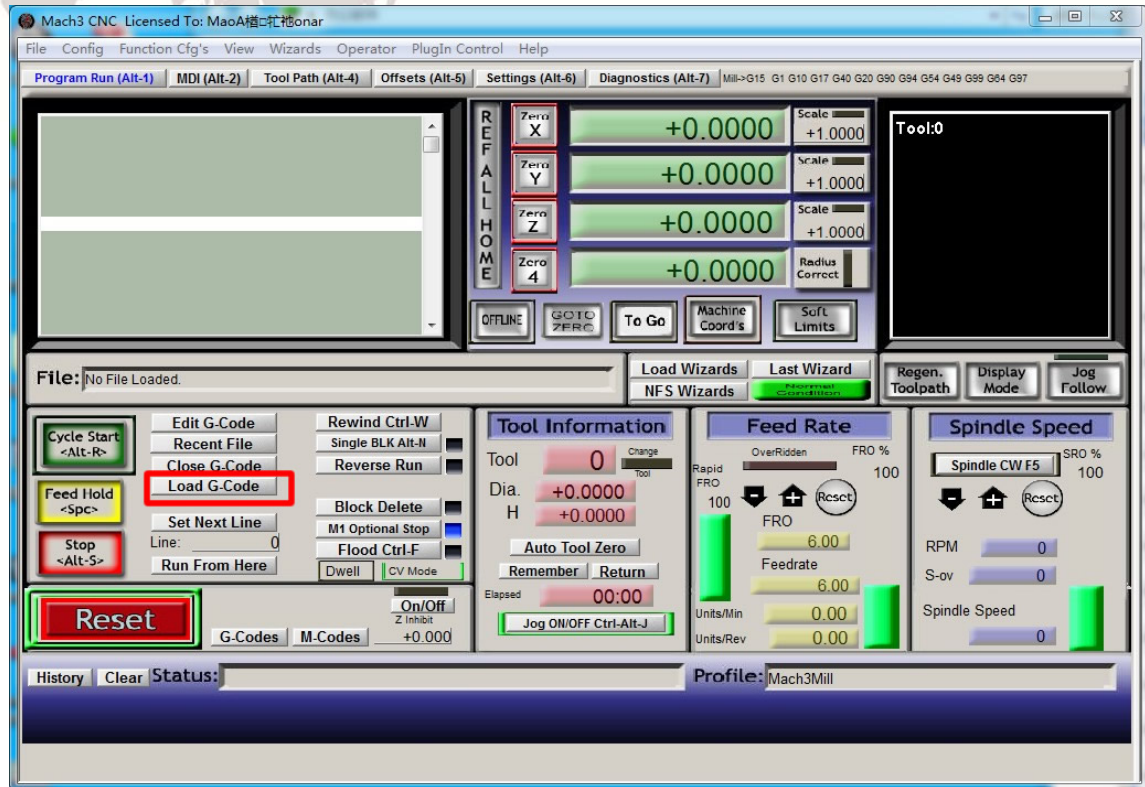


Figure5-7. Press Load G-Code and open your G code

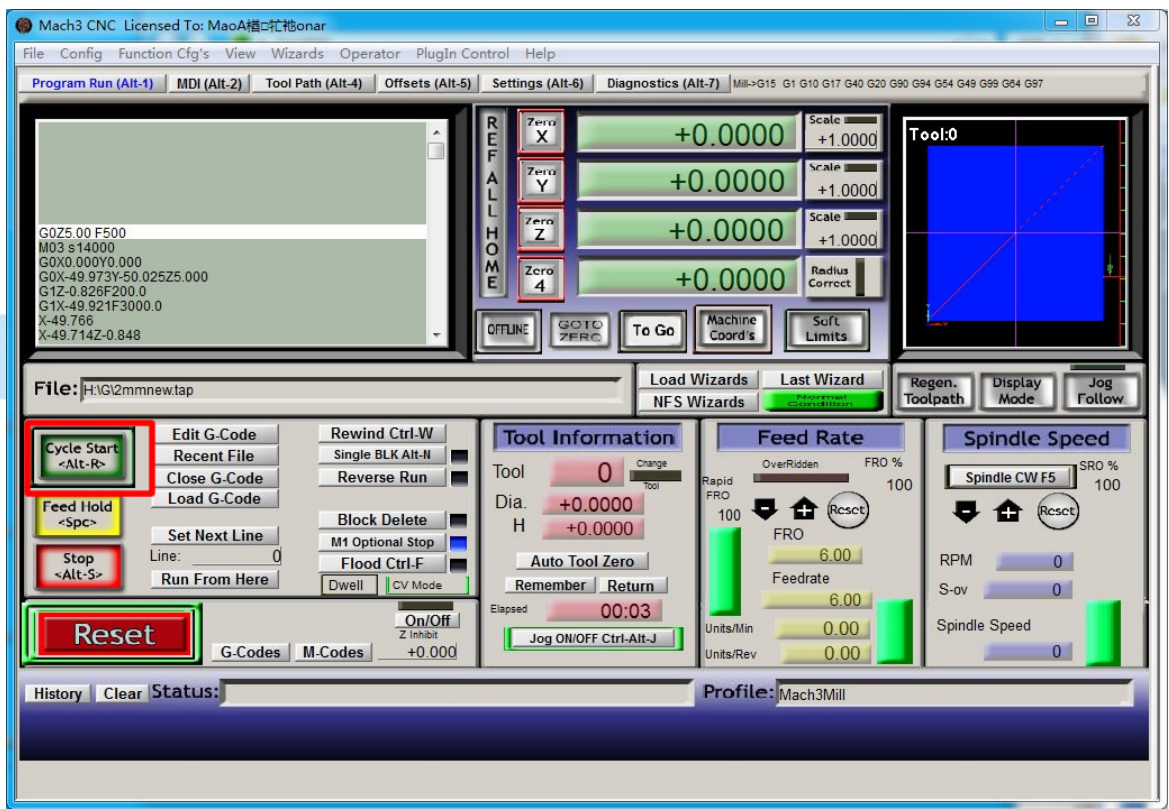


Figure5-8. After opening G code,press "Cycle Start" and start to work