



DIGITALDREAM
MACH3 ETHERNET
CONTROLLER& DRIVER 2IN1
LAN5160T4

Manual

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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.。

LAN5160T4 is the 4 axis motion controller & driver,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.

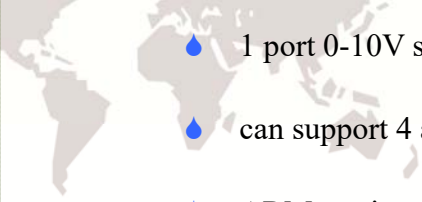
LAN5160T4 support Mach3 software and serial port MPG, through ethernet to communicate with computer.

LAN5160T4 motion controller adopts the ARM design framework. The ARM design includes communication,codeanalytic, underlying algorithm and pulse gerneration. 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;
- 7ports input interface for ordinary digital data;
- 3 ports output interface for ordinary digital data;

- 
- 1 port 0-10V spindle speed analog output interface(can change to PWM output);
 - can support 4 axis stepper systems,300KHz pulse output for every axis;
 - ARM motion control chip;
 - Compatible with MPG input, support standard MPG & the digital display MPG of our company.
 - Each axis driver supports 256 subdivisions at most
 - Each axis driver supports 6A current
 - The static current, running current and subdivision of the driver can be adjusted.The adjustment position is on the plug-in page of mach3.

1.3 Products Appearance and size

LAN5160T4 motion controller is with the plastic shell structure. The controller appearance as the Figure 1-1 show: The products overall size is 98mm*89mm*40mm; Install size is 47.6mm*17mm*17mm.

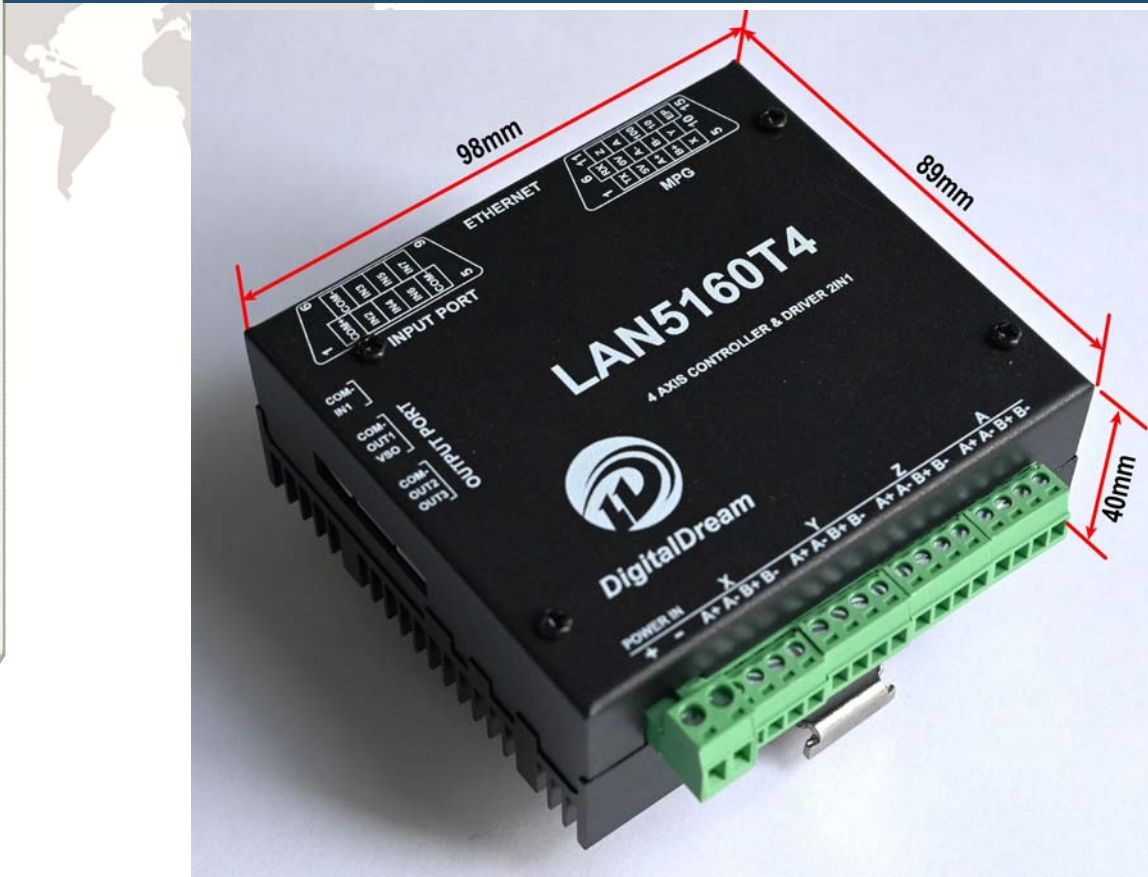


Figure1-1. LAN5160T4 front appearance and size

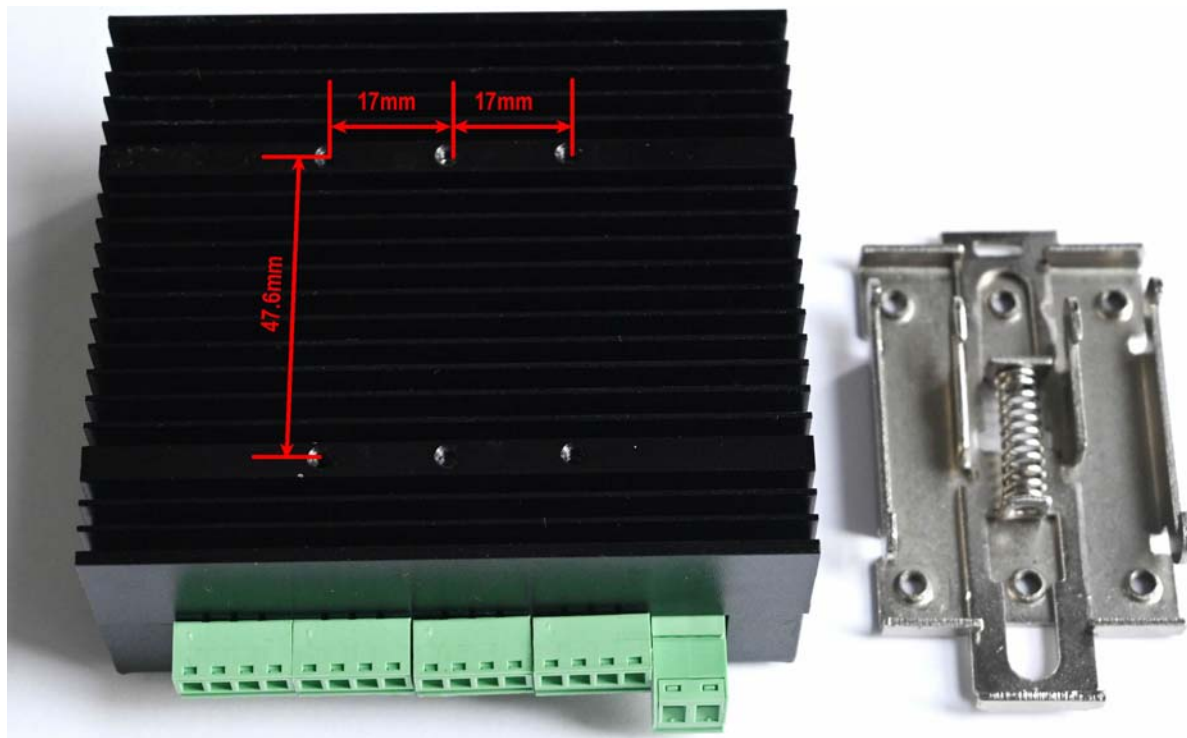


Figure1-2. Install size

As shown in Figure 1-2, the LAN5160 can be connected to the DIN35 card holder by screws, which is convenient for quick assembly to the DIN35

1.4 substantial explanation

When operate the LAN5160T4,where will be a lot of English abbreviation,now we list all of them for your kindly references:

FRO:Feedingadjust: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

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 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

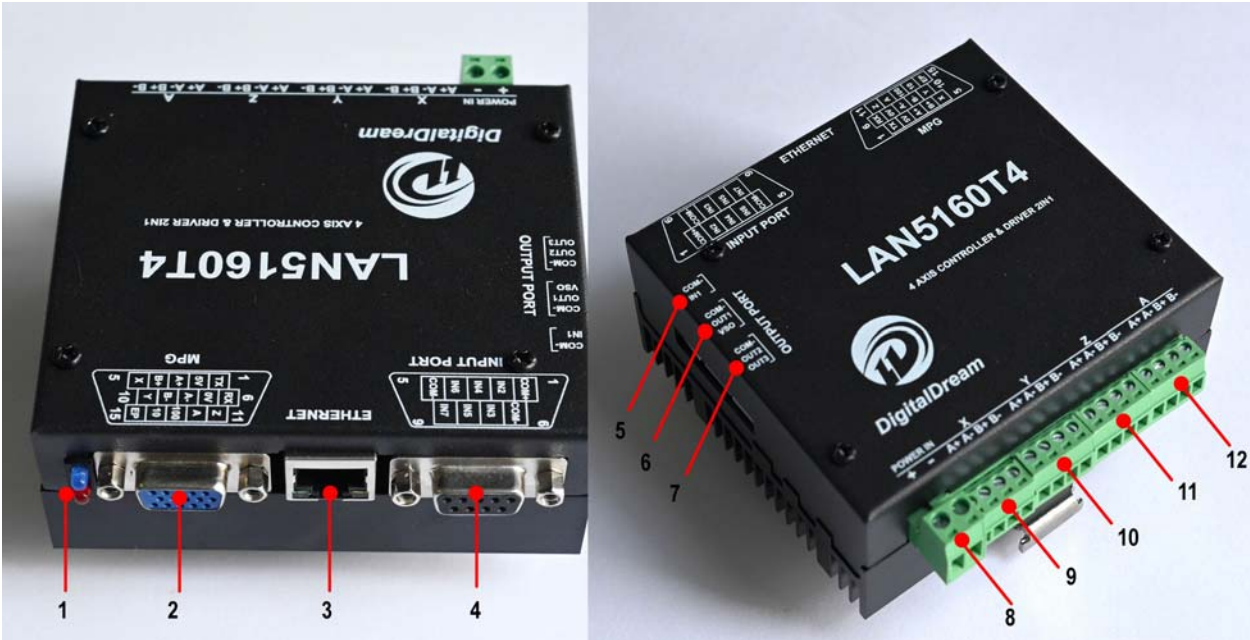


Figure2-1. Product wiring section and interface summary

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 indicator light

As shown in Figure 2-1, the LED marked as 1 is the power indicator and the link indicator. The two lamps are arranged vertically, with the red one at the bottom, the blue one at the top, and the red one as the power indicator. When the power is turned on, it will light up; The blue indicator is the link indicator. When the mach3 is turned on and the mach3 software and the board are connected normally, the blue indicator is on. When the mach3 software is turned off, the blue indicator is off.

2.2.2 MPG Port

As shown in Figure 2-1, the position marked with 2 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

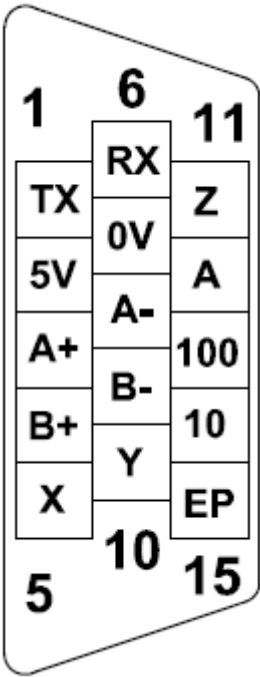


Figure2-2. sequence of LPT port

No.	Mark	definition
1	TX	Serial port sending pin
2	5V	5V power pin
3	A+	encoder A+
4	B+	encoder B+
5	X	X axis select pin
6	RX	Serial port receiving pin
7	0V	COM ground
8	A-	encoder A-
9	B-	encoder B-
10	Y	Y axis select pin
11	Z	Z axis select pin
12	A	A axis select pin

13	100	X100 rate select pin
14	10	X10 rate select pin
15	EP	Estop

Table 2-1. MPG interface define

2.2.3 Ethernet port

As shown in Figure 2-2, the position marked with 3 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.

2.2.4 Input interface

As shown in Figure 2-2, the position of mark 4 is a general input interface, which is a DB9 interface. The specific definition is printed on the shell. Now, the detailed definition of the interface is described as follows.

LAN5160T4 can replace computer's LPT port, and performs better than computer's LPT port. This port connect to stepper driver board see as figure 2-3.

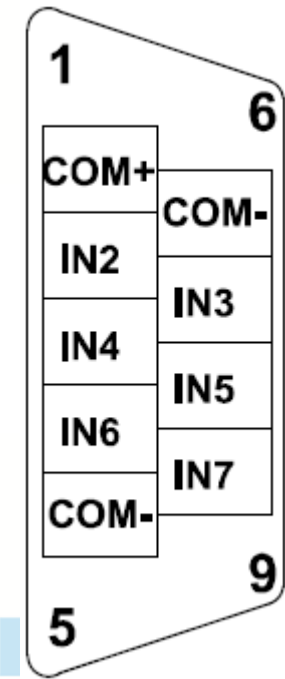


Figure2-3. Definition of LAN5160T4 Universal Input Interface

NO.	MARK	Definition
1	COM+	Common+, External supply 24V
2	IN2	INPUT PIN2
3	IN4	INPUT PIN4
4	IN6	INPUT PIN6
5	COM-	Common terminal-
6	COM-	Common terminal-
7	IN3	INPUT PIN3
8	IN5	INPUT PIN5
9	IN7	INPUT PIN7

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

The wiring mode of two wire NPN proximity switch or ordinary microswitch is shown in

Figure 2-4.

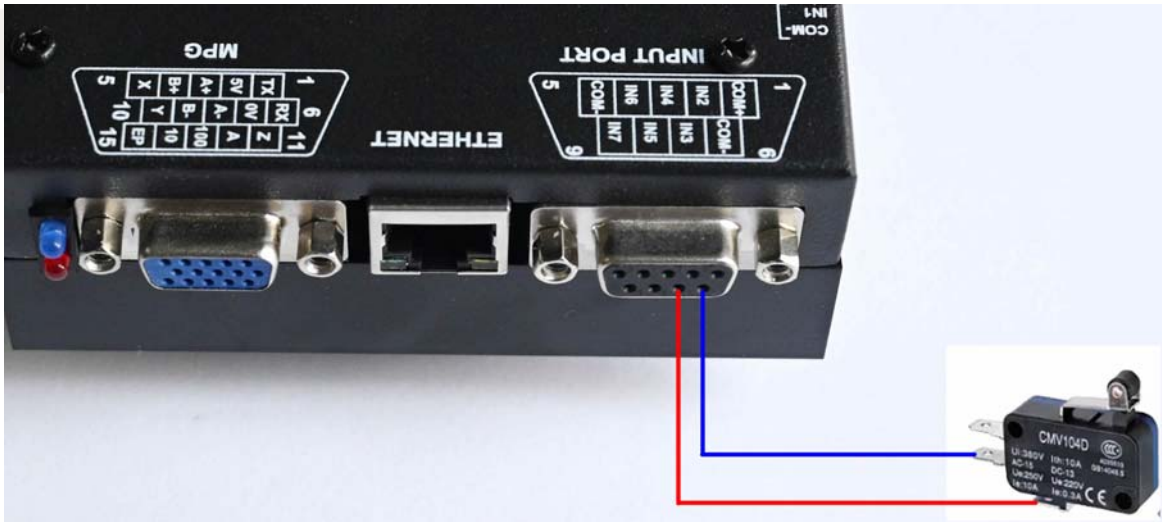


Figure2-4. Wiring mode of two-wire switch

The wiring mode of three wire NPN proximity switch is shown in Figure 2-5

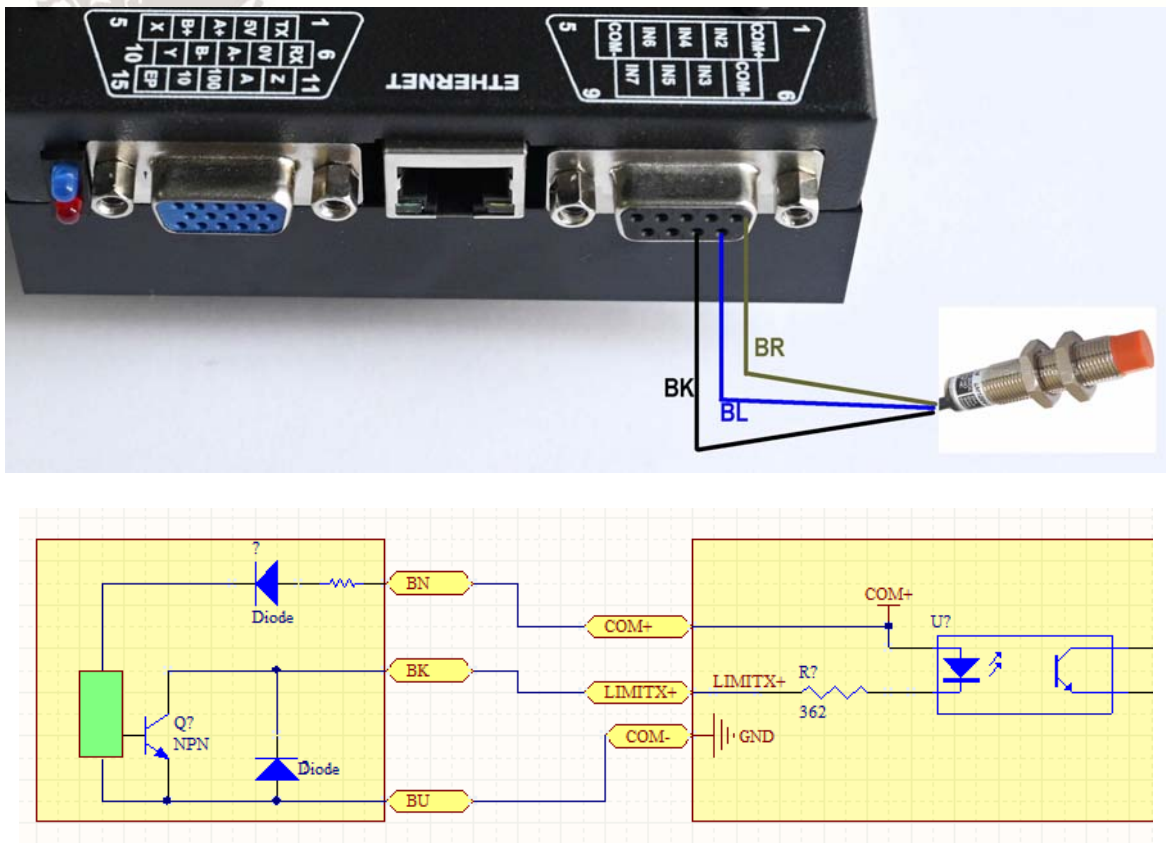


Figure2-5. Wiring mode of 3-wire NPN proximity switch

2.2.5 ESTOP input port

As shown in Fig. 2-5, the position marked with 2 is the emergency stop input interface. The interface form is an XH2P terminal. The specific definition is marked on the shell, which is defined as COM -/IN1 respectively. When using, connect the two terminals of the emergency stop switch to COM - and IN respectively.Refer to Figure 2-6 for wiring mode

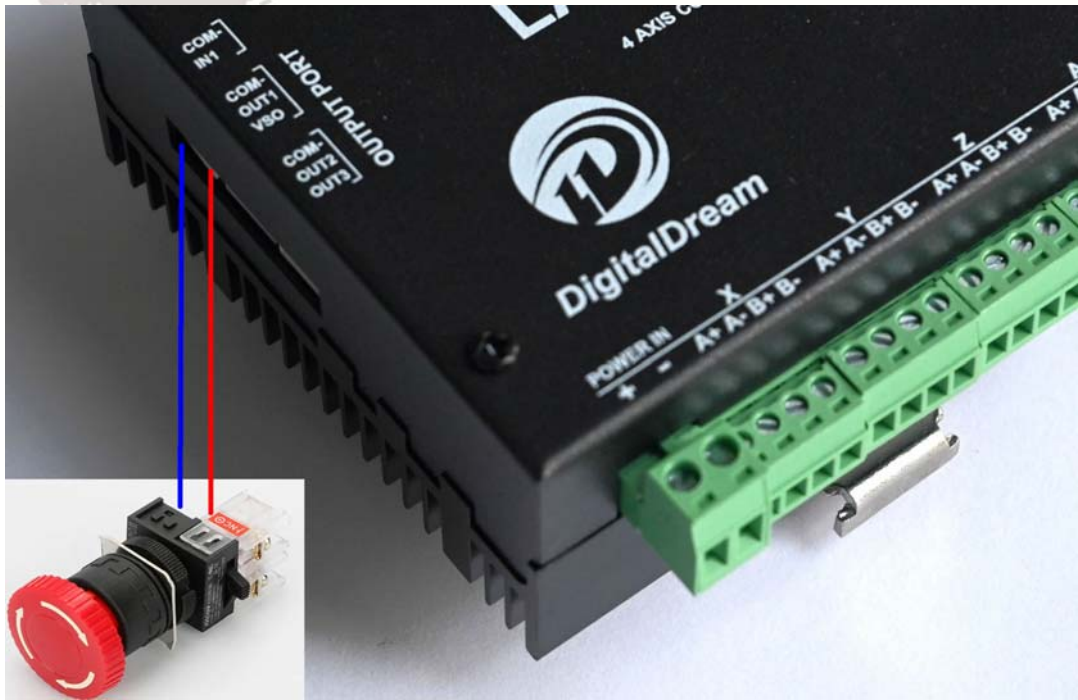


Figure2-6. Estop wiring mode

2.2.6 Spindle Port

As shown in Figure 2-2, the port marked with 6 is the spindle control interface. The definition of spindle control connection is shown in Table 2-3 .

NO.	MARK	Definition
1	COM-	Common terminal-
2	OUT1	Output PIN1
3	VSO	Spindle speed regulation output, output 0-10V

Table 2-3. Detailed Description Spindle Interface

Spindle speed regulation output, output 0-10V, OUT1 can be used to control the start and stop of the spindle, and VSO can be used to control the speed of the spindle. The configuration of the spindle will be described in detail in the following chapters. Refer to Figure 2-7. COM - to connect the inverter ACM/DCM, OUT1 to connect the inverter FWD, and VSO to connect the inverter AVI.

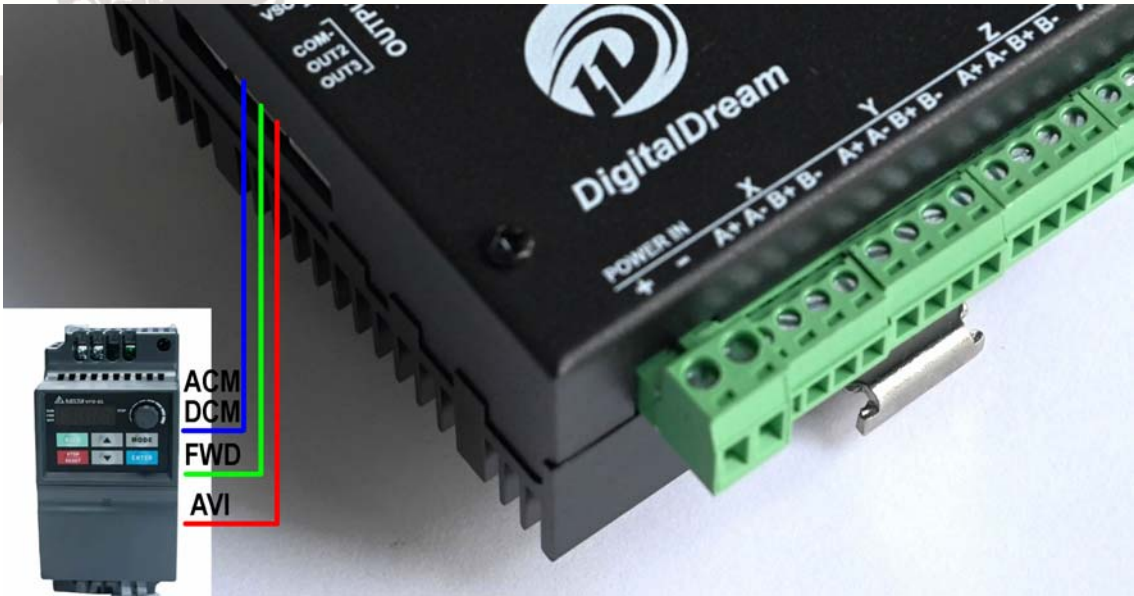


Figure2-7. Connection between LAN5160 and inverter

2.2.7 relay control port

As shown in Figure 2-2, the port marked with 7 is the relay control interface. The relay output interface is also in the form of XH3P interface, which is defined as COM -/OUT2/OUT3. It can be connected with two relays, which can output the ground opening signal and the maximum absorption current is 50mA. If a relay with a control current of more than 50mA is used, an external amplifier circuit is required. Refer to Figure 2-8 for connection mode

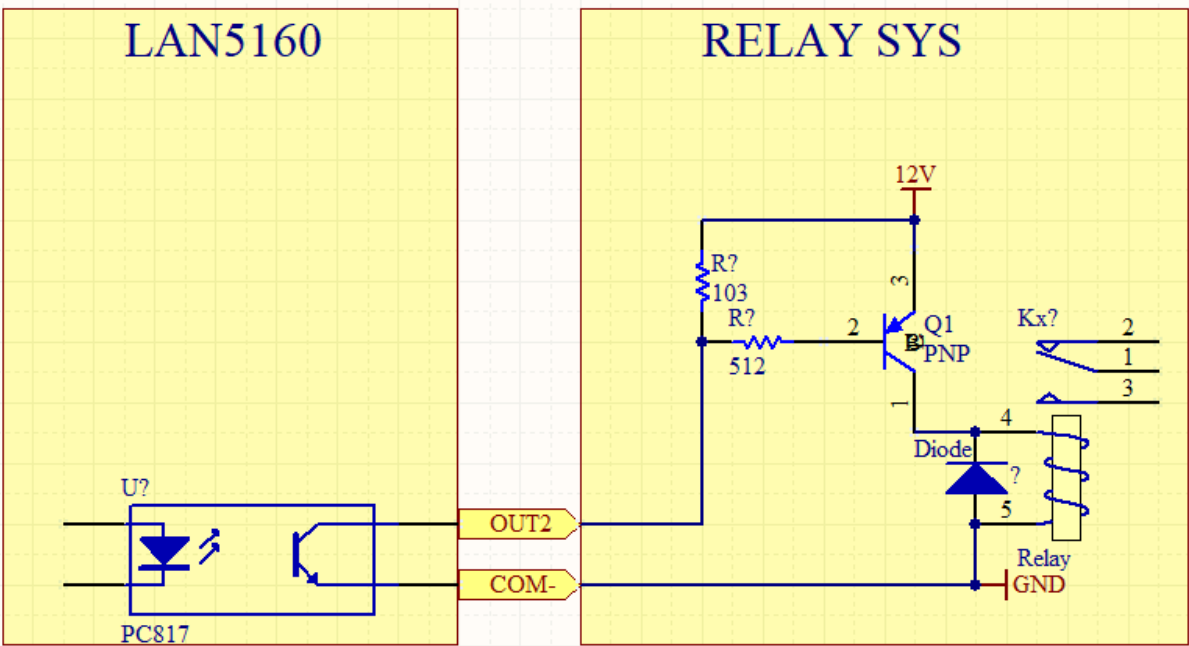


Figure2-8. Connection mode of LAN5160 external relay

2.2.8 Power input port

As shown in Figure 2-2, the port marked with 8 is the power interface. Power IN (+-) is marked on the silk screen of the housing. The power supply voltage range is 12V-36V, and 24V is strongly recommended. It is recommended that the power supply should not be less than 200W (determined according to the actual control stepping motor power). The label+interface is connected to the power supply+terminal, and the label - interface is connected to the power supply terminal.

2.2.9 stepper motor port

As shown in Figure 2-2, the ports marked 9/10/11/12 are stepper motor interfaces, which correspond to XYZA axis stepper motors respectively. Each axis is a 4PIN terminal, defined as A+A - B+B -, which is respectively connected to A+A - B+B - of the stepper motor. The minimum support is 0.5A current 2-phase stepping motor, and the maximum support is 6A current 2-phase stepping motor.

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

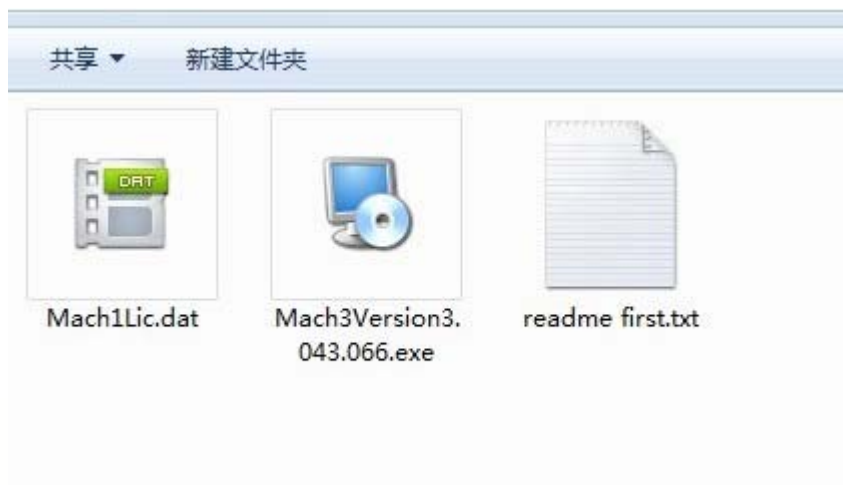


Figure3-1. MACH3 soft installation

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

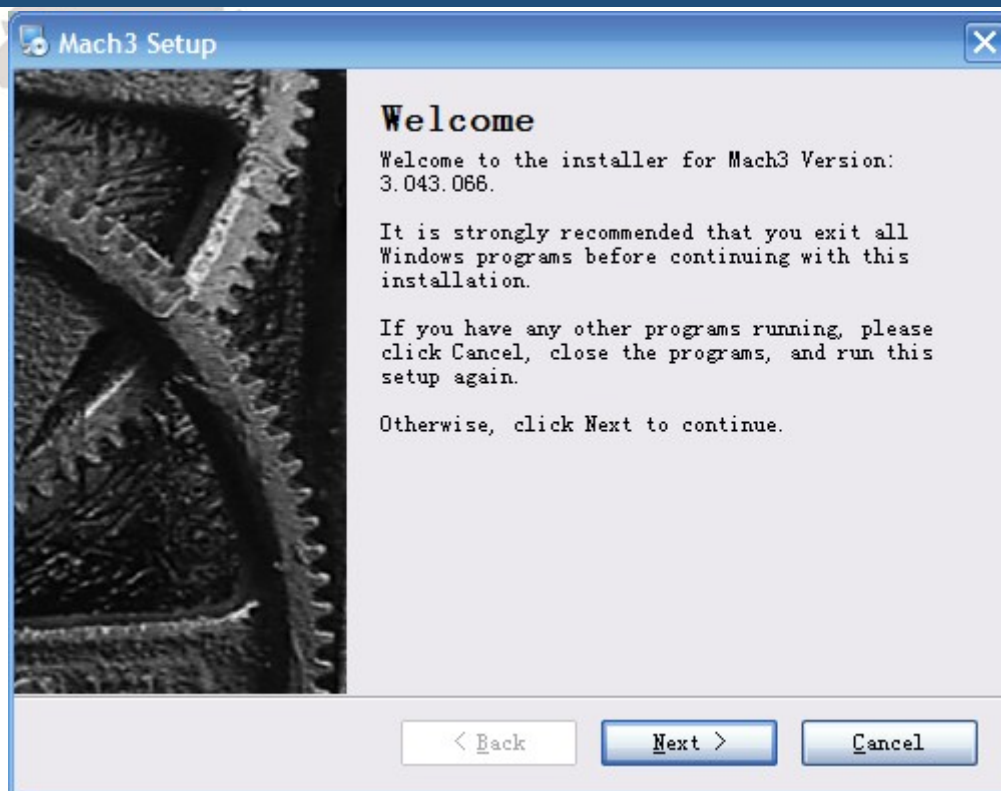


Figure3-2. MACH3 installation process 1

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

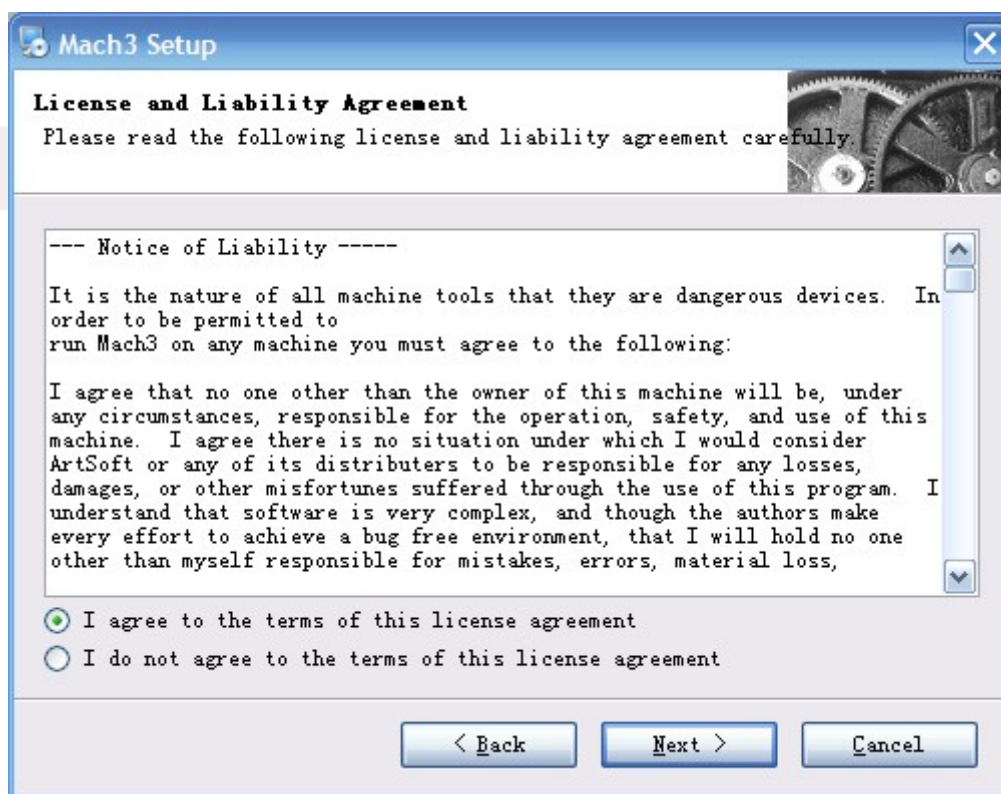


Figure3-3. installation process 2

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

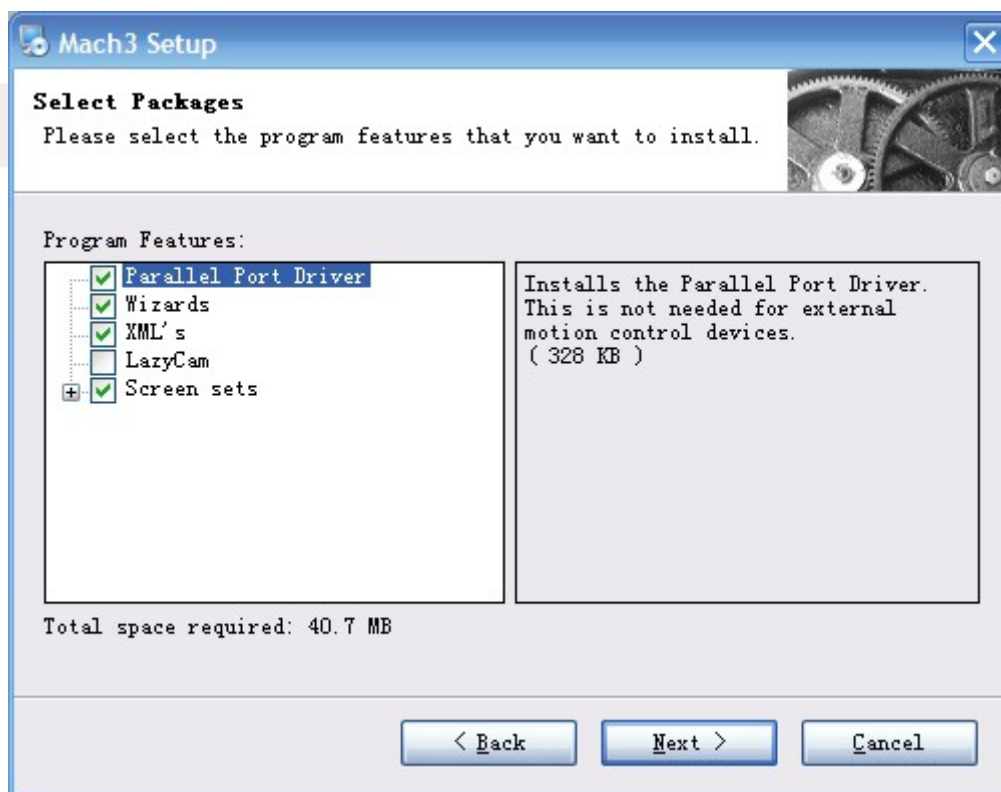


Figure3-5. MACH3 installation process 4

Click Next until completion. Then restart the computer.

3.2 LAN5160T4 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.

3.3IP Setting

LAN5160T4 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.

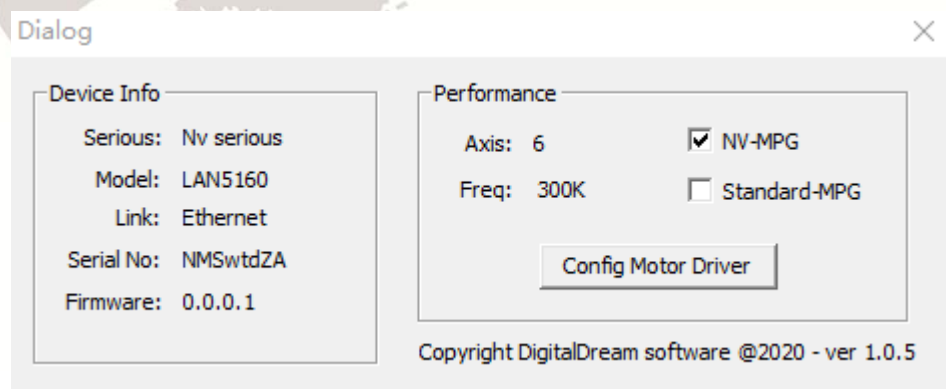


Figure4-2. connect successfully

4.2 Software Common settings

4.2.1 Check LAN5160T4 plugin

Click config plugins to input PluginConfig,you can seeLAN5160T4. See as Figure4-4.

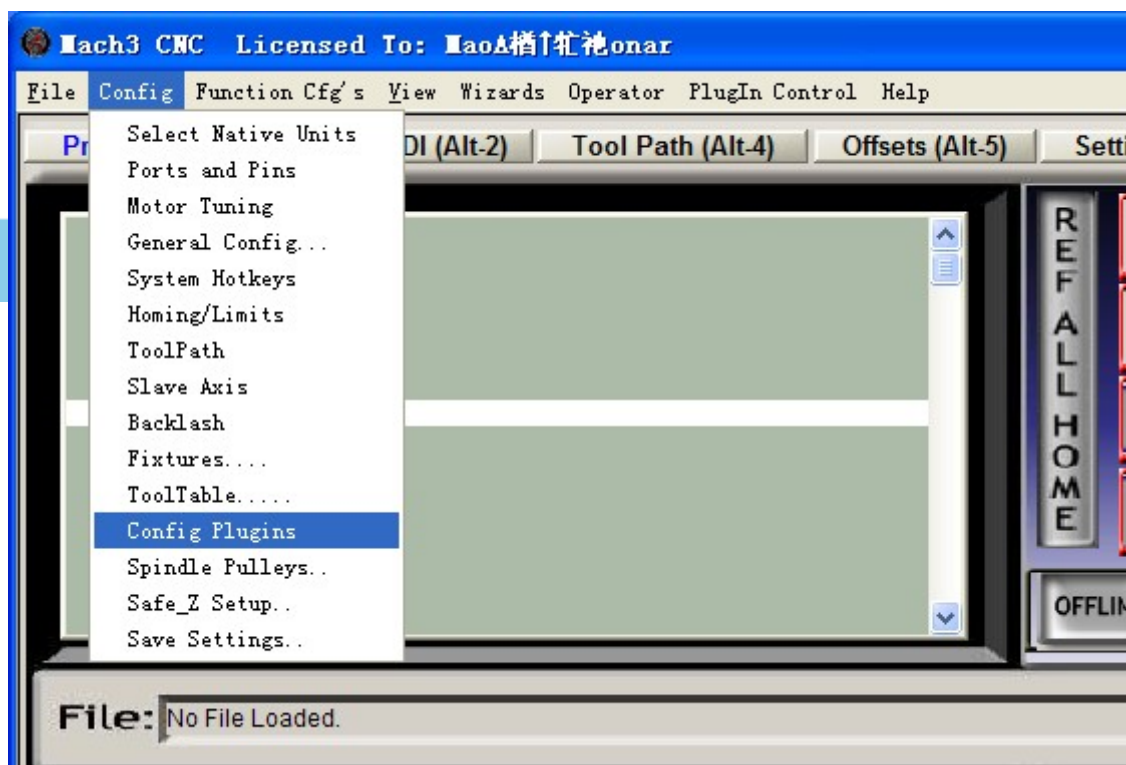


Figure4-3. Input Config plugins

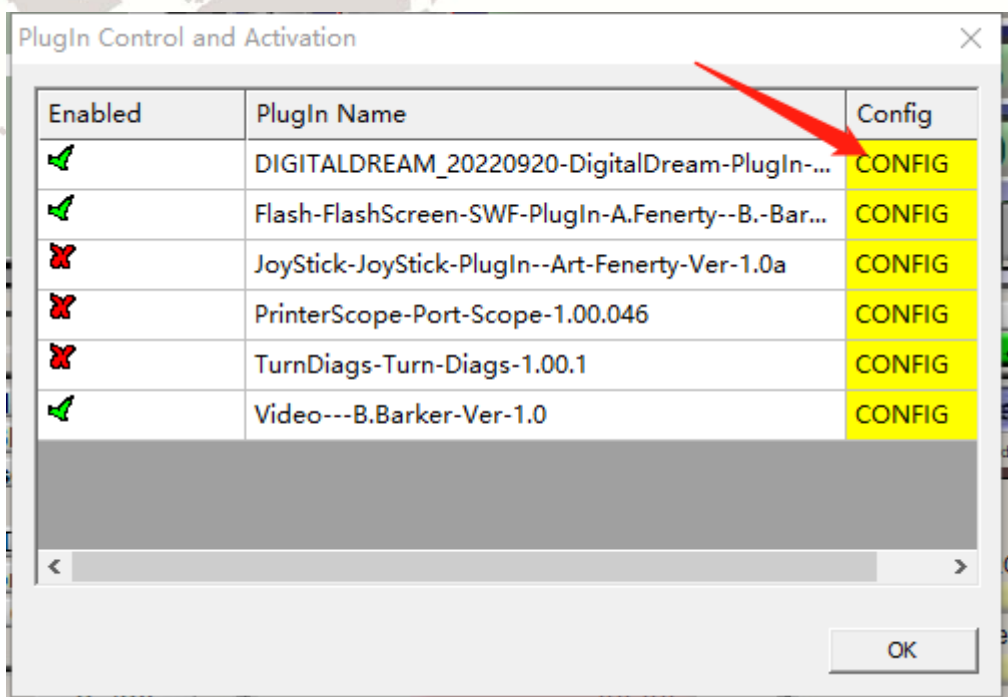


Figure4-4. LAN5160 Plugin

4.2.2 Motor operating parameters setting

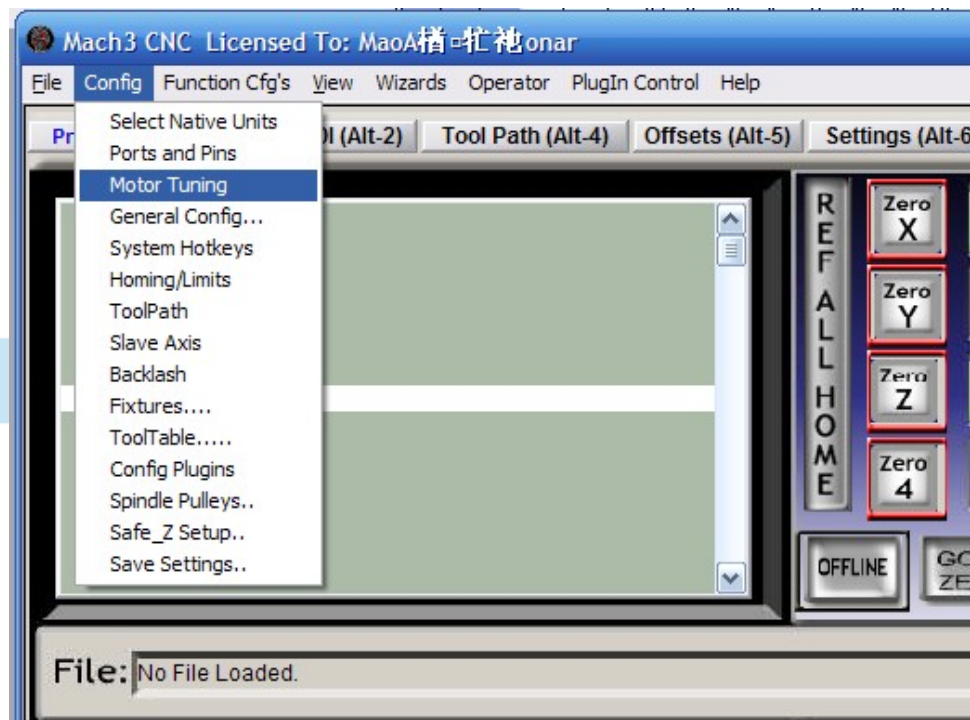


Figure4-5. Motor operating parameter setting menu entry

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

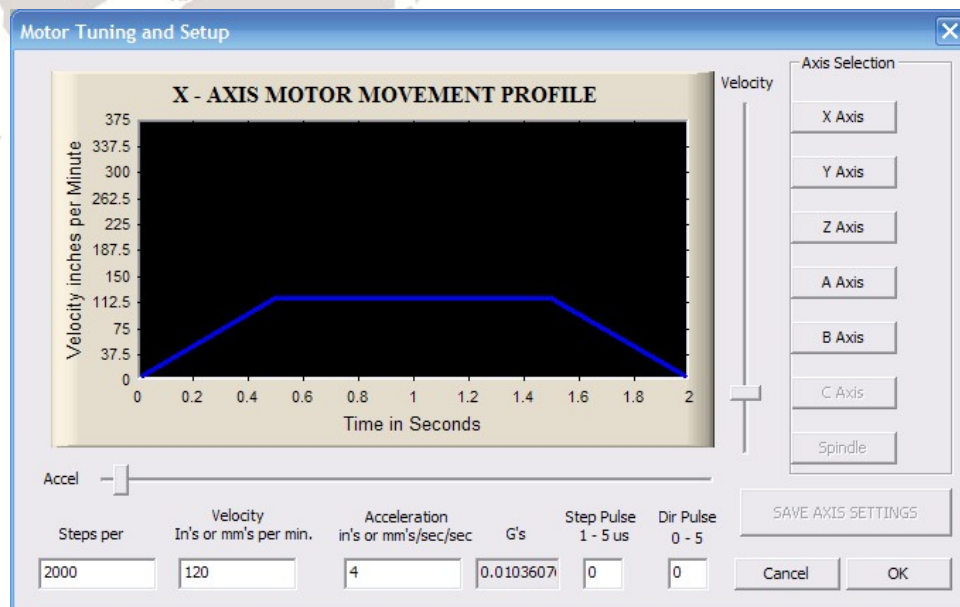


Figure4-6. Motor operating parameter settings dialog

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/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

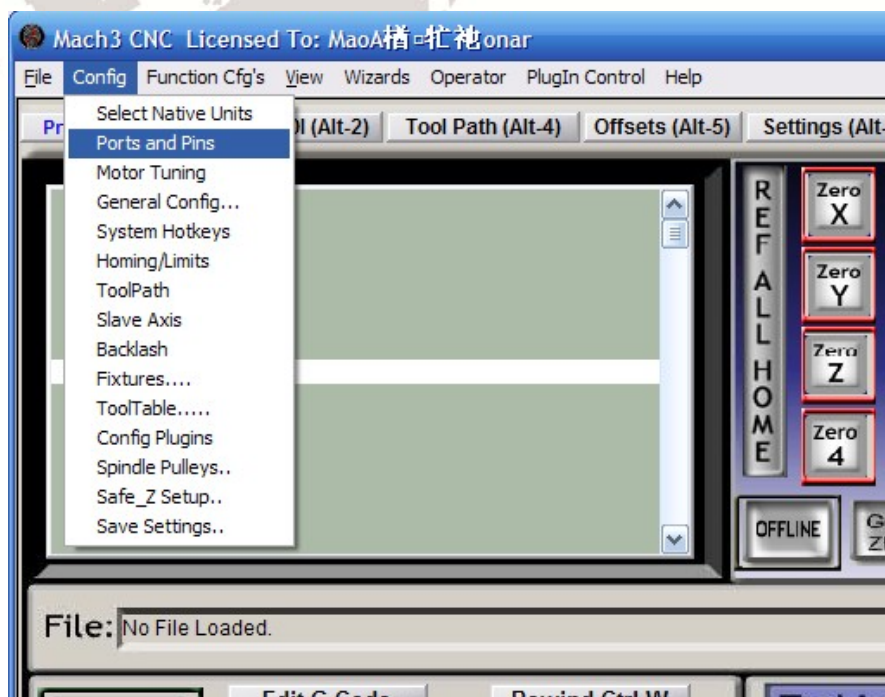


Figure4-7. Port setting entry

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

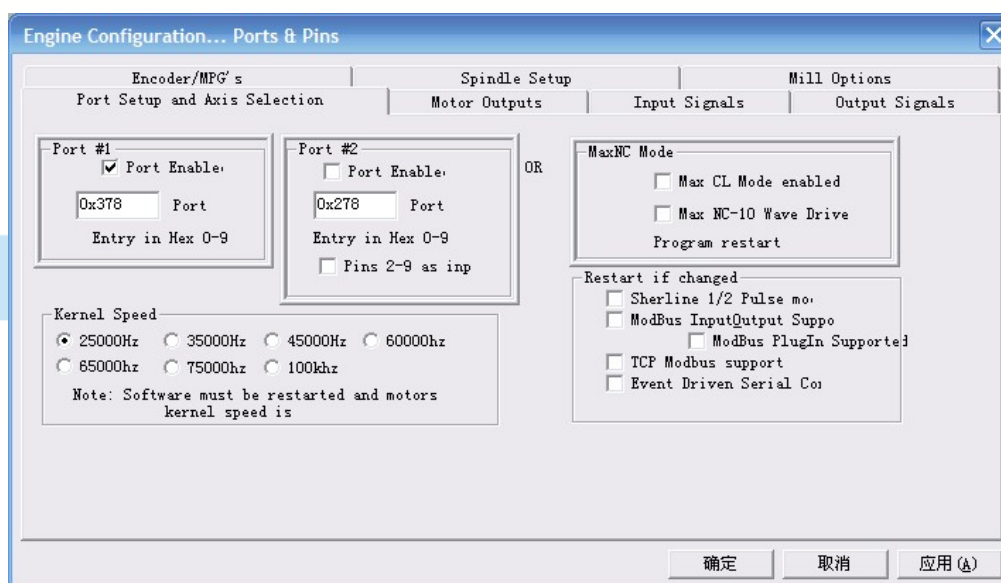


Figure4-8. Pin&Port Dialog

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 $\checkmark$ here.

To make the Z axis to the same direction, Z axis’s “Dir low” should be set to “ $\checkmark$ ”. Other axes’s should be set as system need.

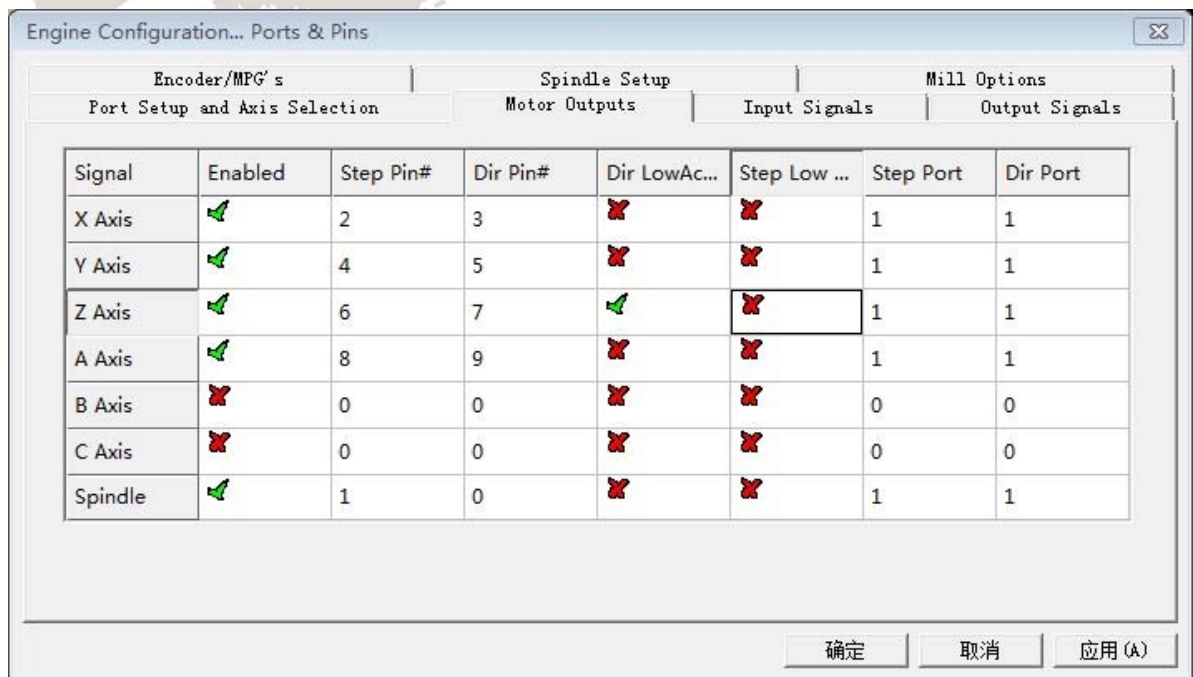
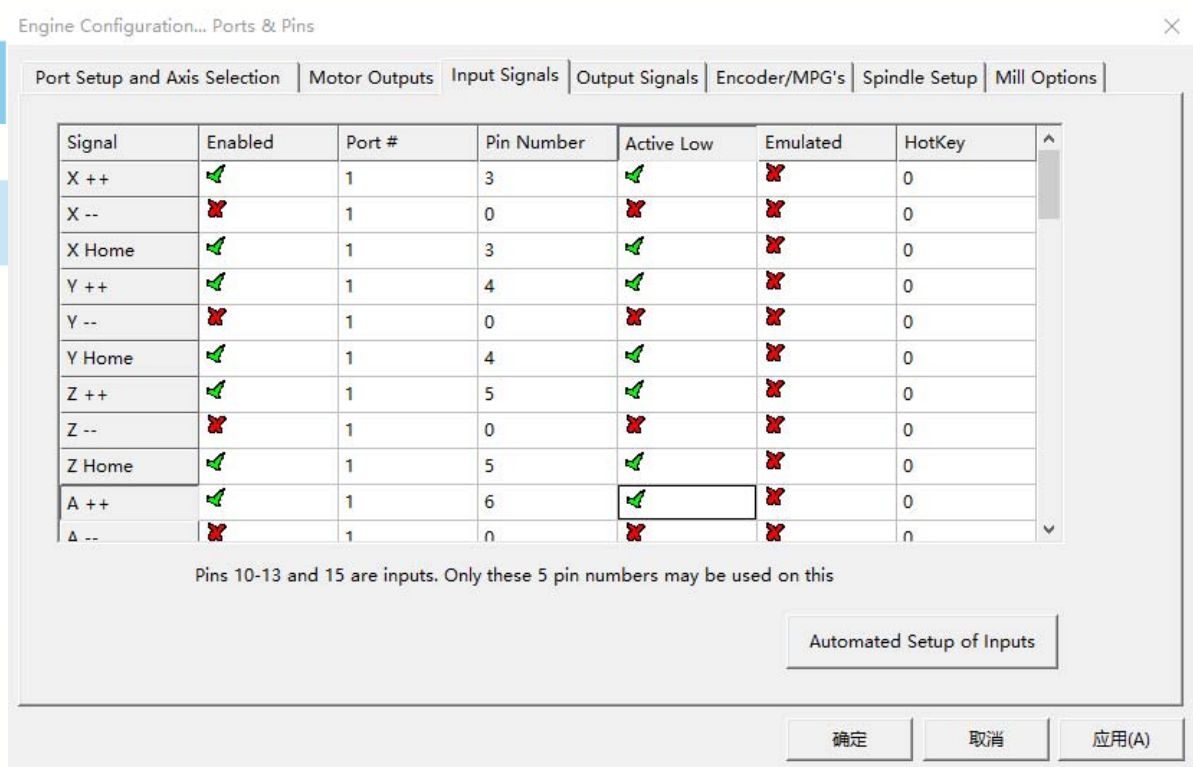


Figure4-9. Stepper motor port settings dialog

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.



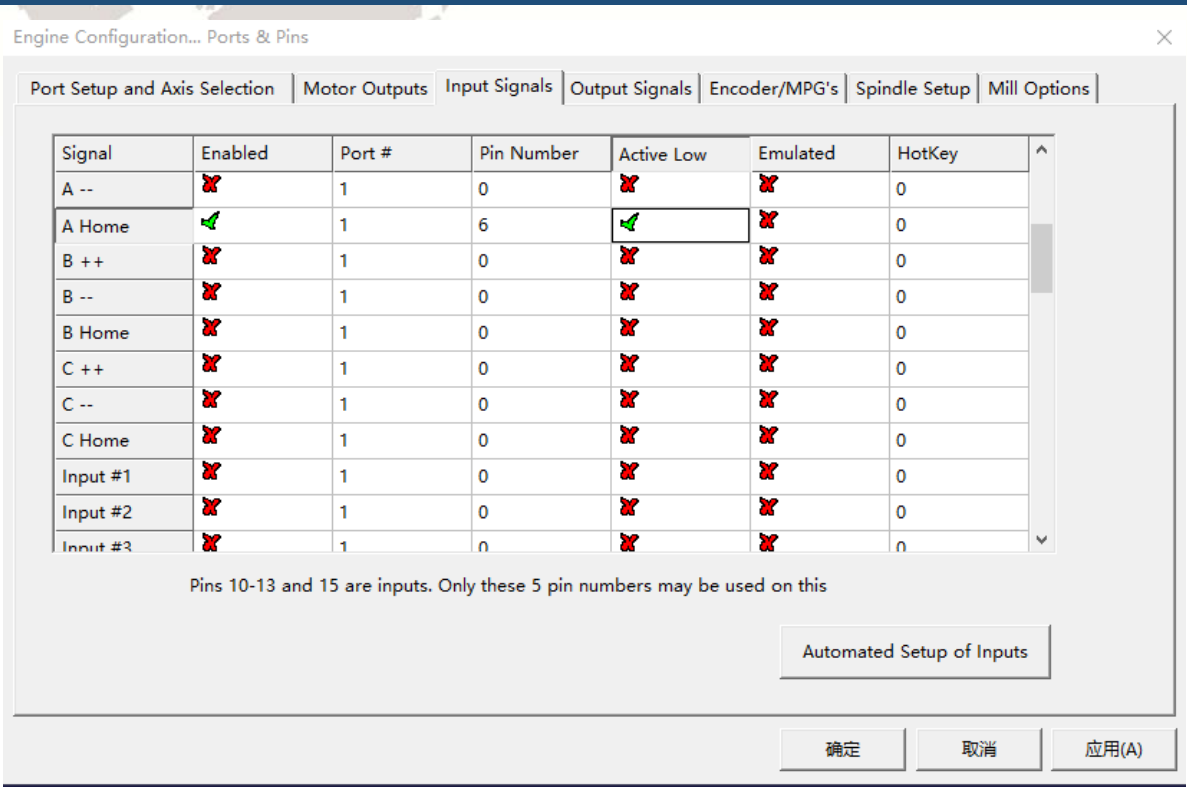


Figure4-10. Input Settings dialog

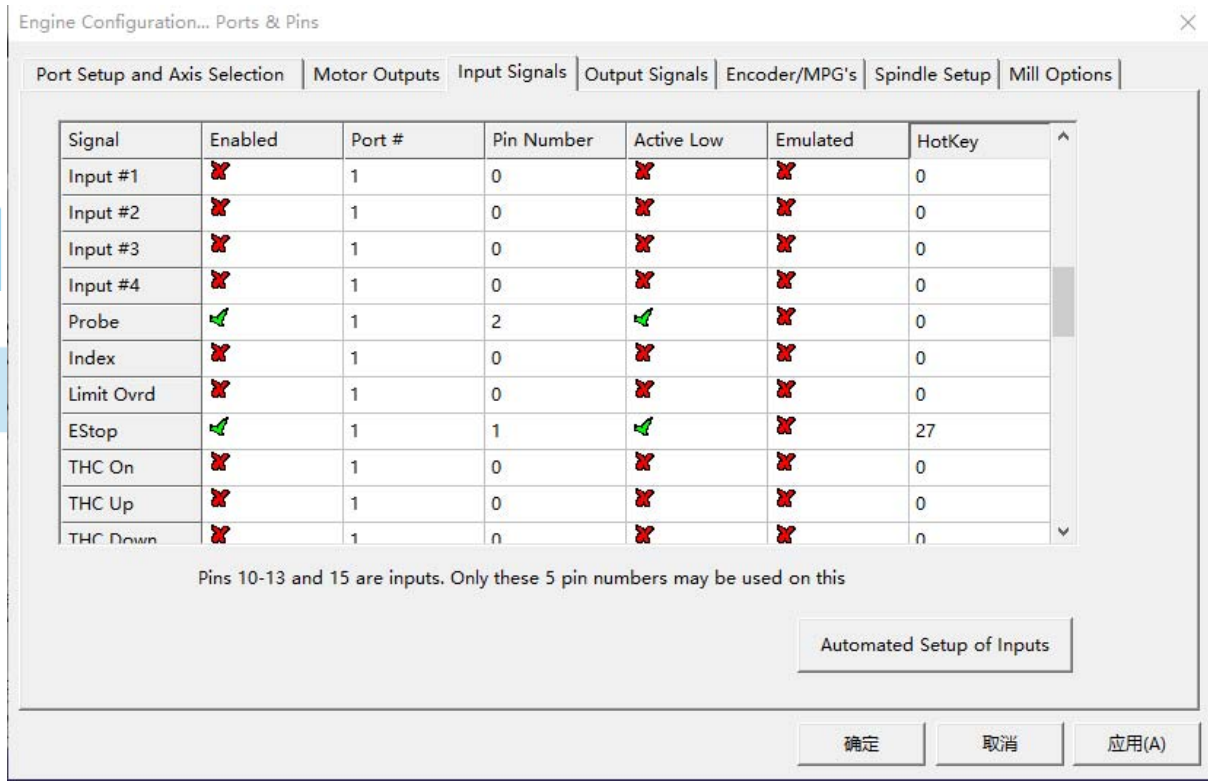


Figure4-11. Estop Probe and index Setting dialog

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.

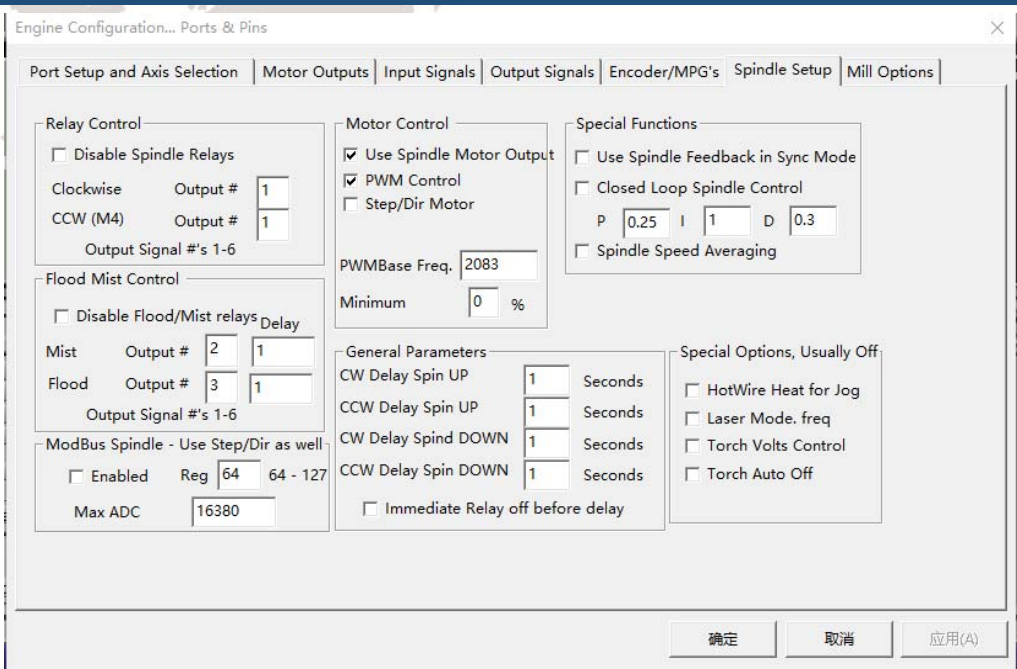


Figure4-12. Spindle Settings dialog

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.

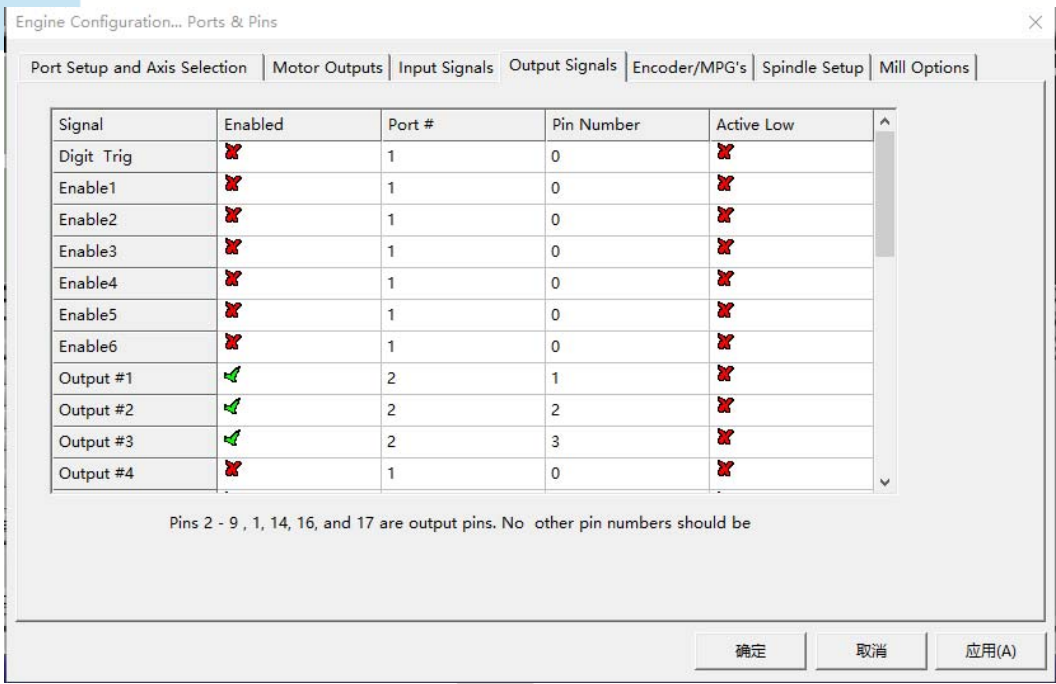


Figure4-13. Spindle setting corresponds to the output configuration

4.2.4 Steppermotor setting

Click the menu Config ->Config plugins ->DIGITALDREAM_CONFIG under the main page to enter the plug-in page, and click Config motor Driver under the plug-in page to enter the stepping motor drive configuration page. As shown in Fig. 4-14

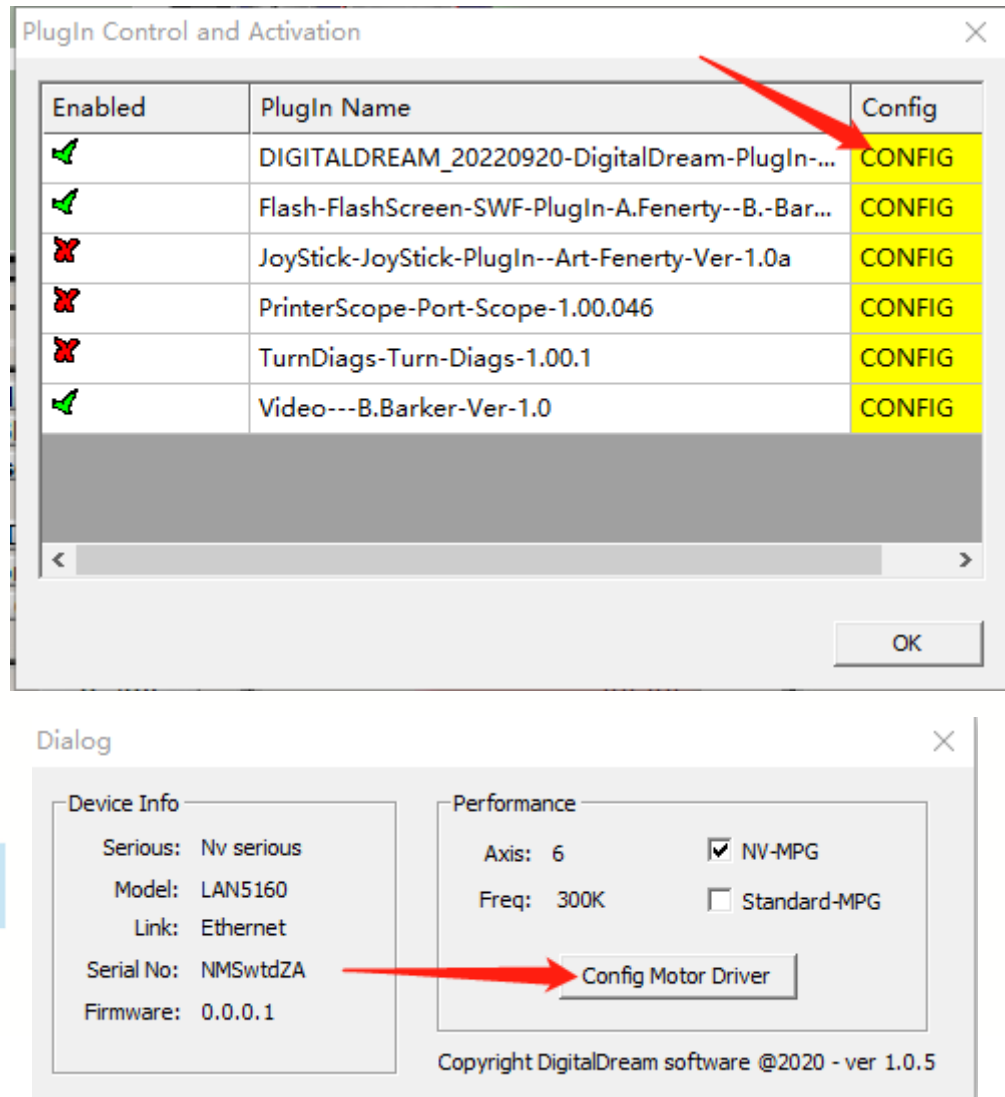


Figure4-14. Enter the stepper motor drive configuration page
On the motor driver page, click Modify to enter the editing status, as shown in Figure 4-15.

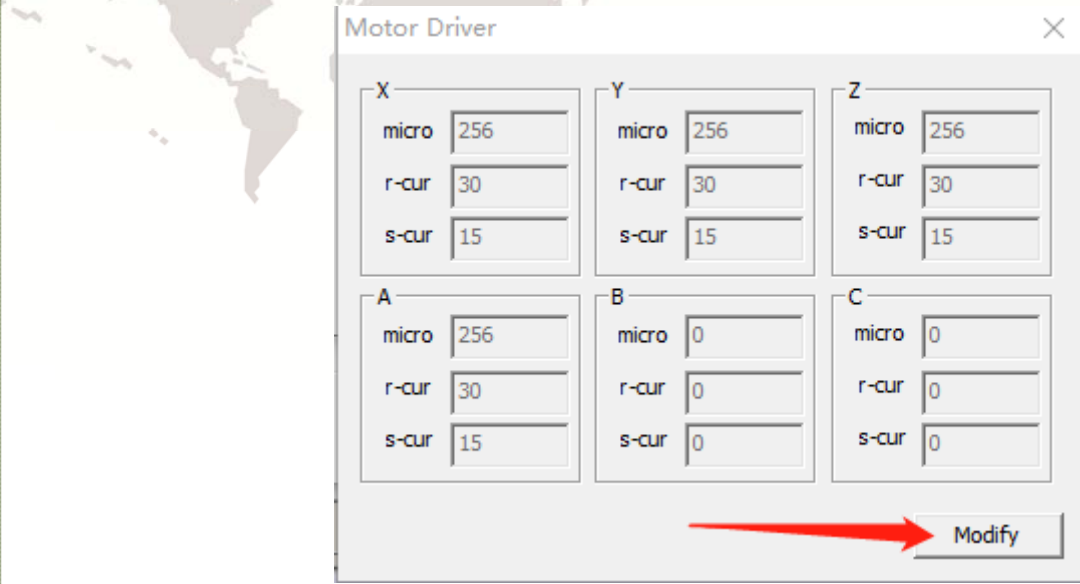


Figure4-15. Enter editing status

The system provides 6 axis motor configuration. We only need to adjust the XYZA channel, and the BC channel can be ignored. Micro is the subdivision setting, r-cur is the running current setting, and s-cur is the quiescent current setting.see as form 4-1 & 4-2

Settable value	Specific definitions
1	One cycle of stepping motor requires 200 * 1=200 pulses, and the pulse equivalent is 200/d (d=pitch)
2	One cycle of stepping motor requires 200 * 2=400 pulses, and the pulse equivalent is 200/d (d=pitch)
4	One cycle of stepping motor requires 200 * 4=800 pulses, and the pulse equivalent is 200/d (d=pitch)
8	One cycle of stepping motor requires 200 * 8=1600 pulses, and the pulse equivalent is 200/d (d=pitch)
16	One cycle of stepping motor requires 200 * 16=3200 pulses, and the pulse equivalent is 200/d (d=pitch)
32	One cycle of stepping motor requires 200 * 32=6400 pulses, and the pulse equivalent is 200/d (d=pitch)

64	One cycle of stepping motor requires $200 * 64 = 12800$ pulses, and the pulse equivalent is $200/d$ ($d = \text{pitch}$)
128	One cycle of stepping motor requires $200 * 128 = 25600$ pulses, and the pulse equivalent is $200/d$ ($d = \text{pitch}$)
256	One cycle of stepping motor requires $200 * 256 = 51200$ pulses, and the pulse equivalent is $200/d$ ($d = \text{pitch}$)

Table 4-1 Stepper motor driver Micro-step table

Settable value	Specific definitions (static current and running current standards are the same)
5	0. 5A
10	1. 0A
15	1. 5A
20	2. 0A
25	2. 5A
30	3. 0A
35	3. 5A
40	4. 0A
45	4. 5A
50	5. 0A
55	5. 5A
60	6. 0A

Table 4-2 Stepper motor current setting table

After setting, click Save to save the parameters and then close the window. The motor parameters do not need to be modified every time the machine is started up. The motor parameters

can be directly saved in the system after each modification. As shown in Fig. 4.16, the subdivision setting of XYZA stepping motor driver is 256, the running current is set to 3.0A, and the static current is set to 1.5A.

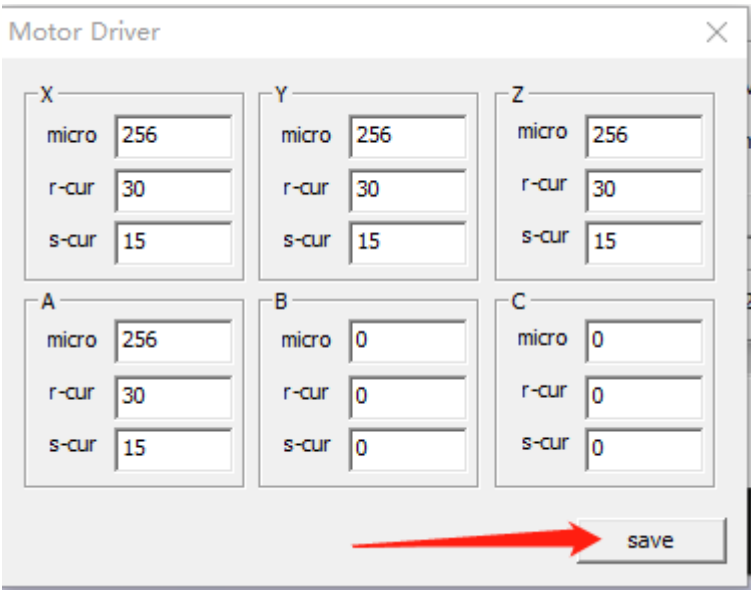


Figure4-16. Save after setting the stepper motor driver

4.2.5 MPG Setting

Open the plug-in page. Path Config ->Config plugin ->DIGITALDREAM_ CONFIG

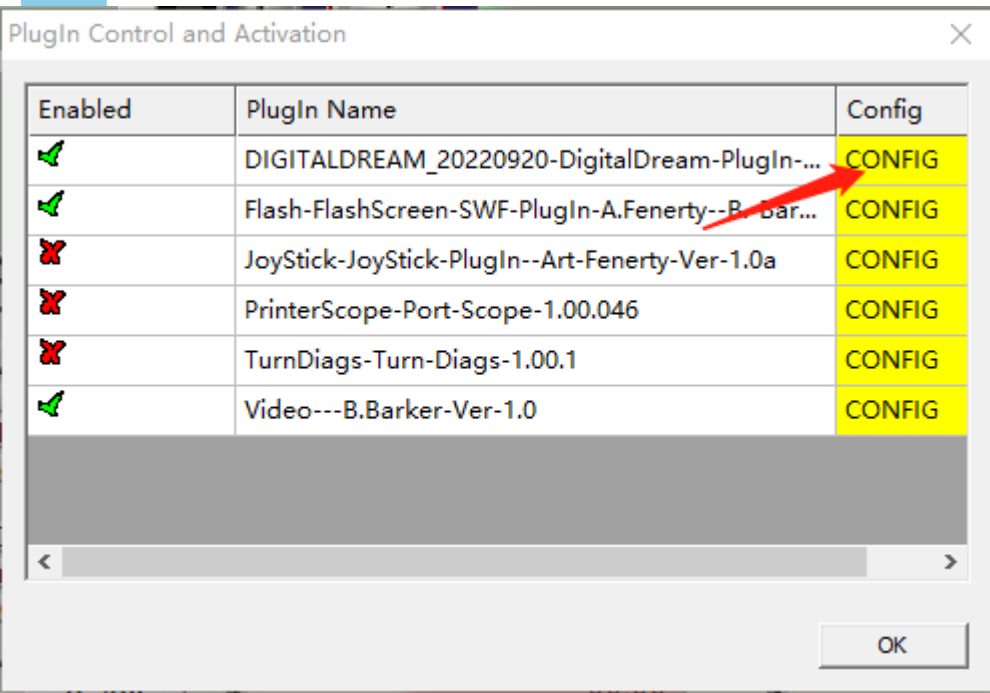


Figure4-17. Open the plug-in page

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.

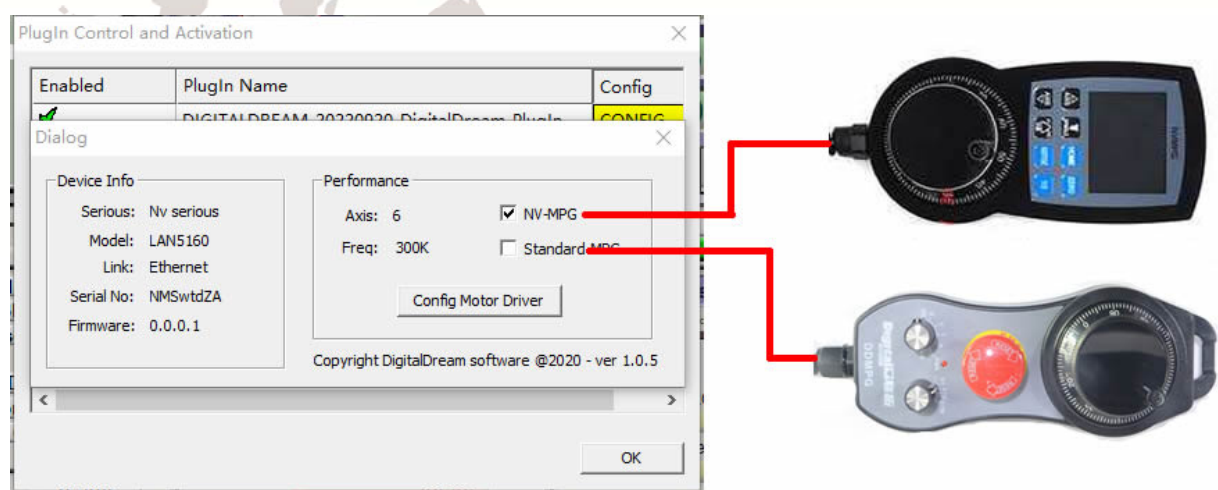


Figure4-18. Select MPG Type

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

Figure4-19. 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.

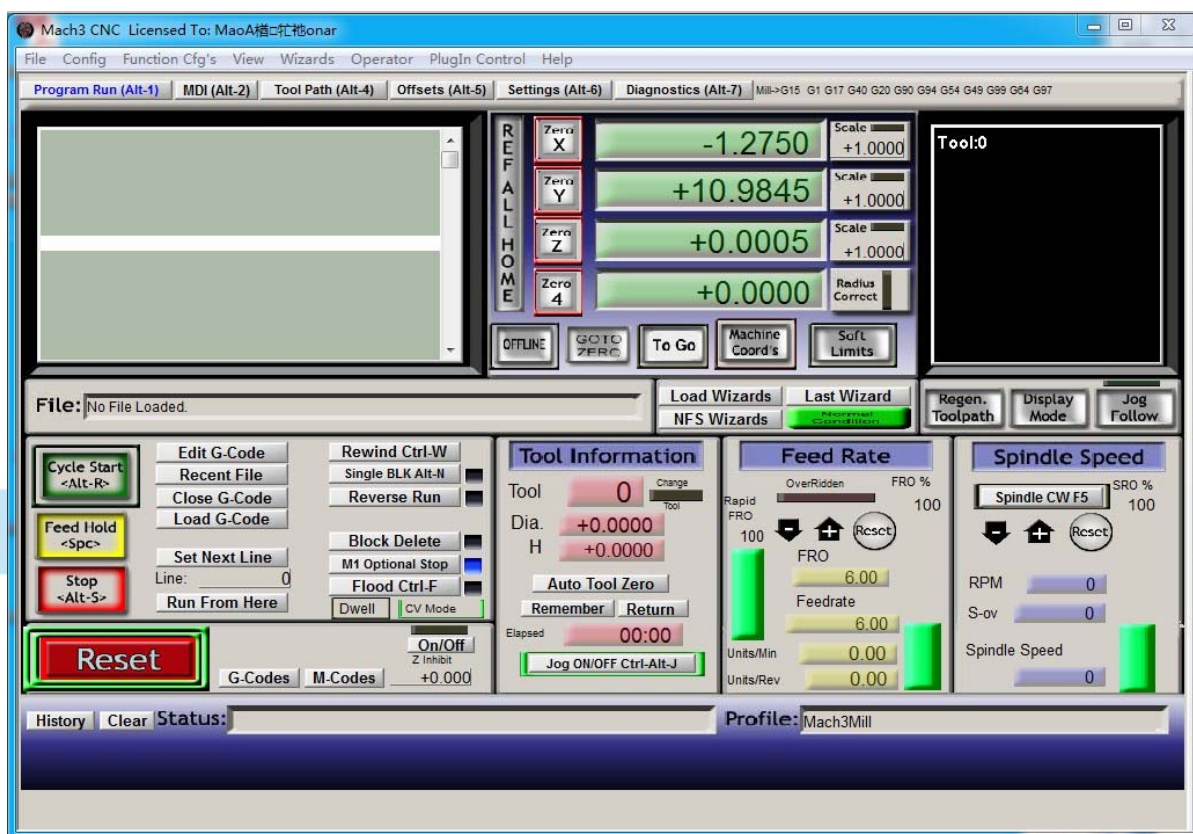


Figure5-1. Main Screen of mach3

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.

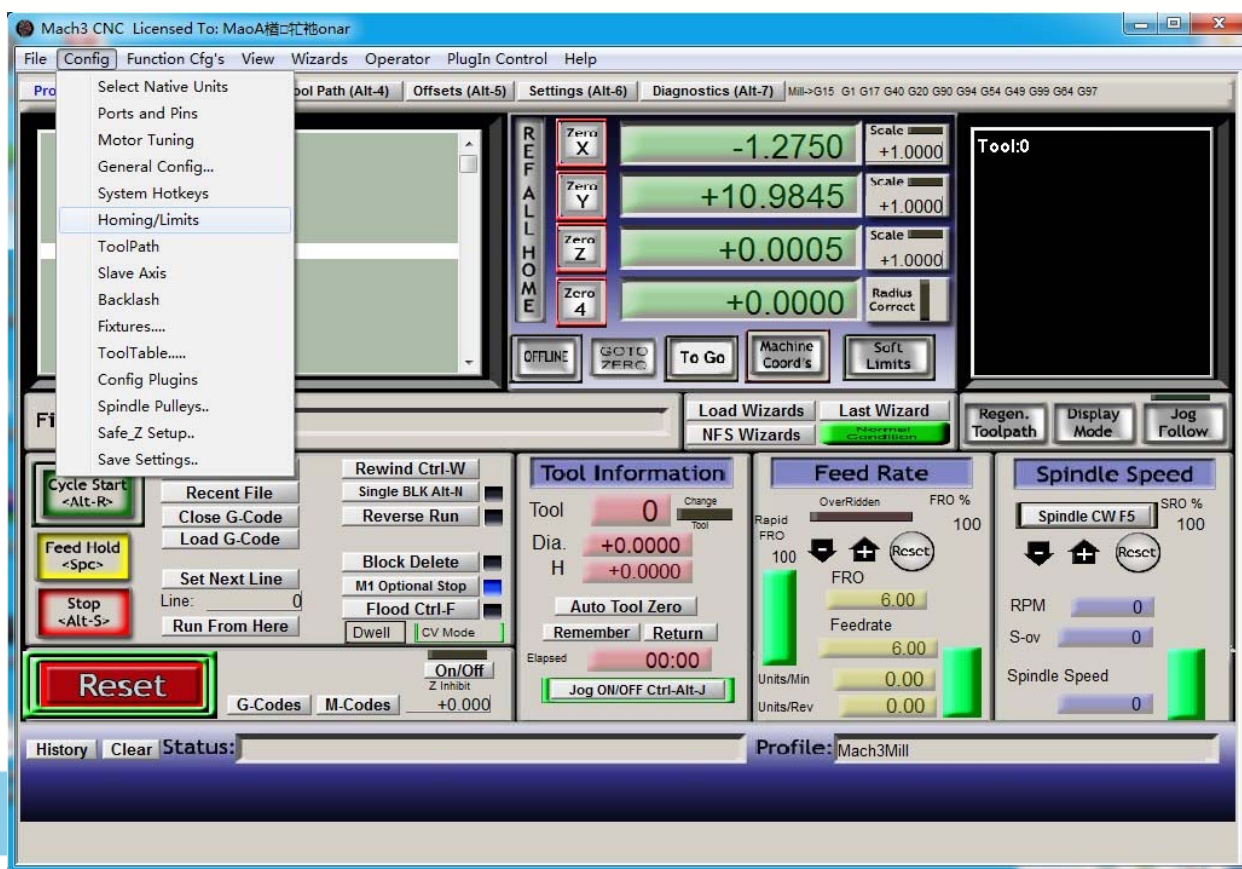


Figure5-2. Click homing of Config

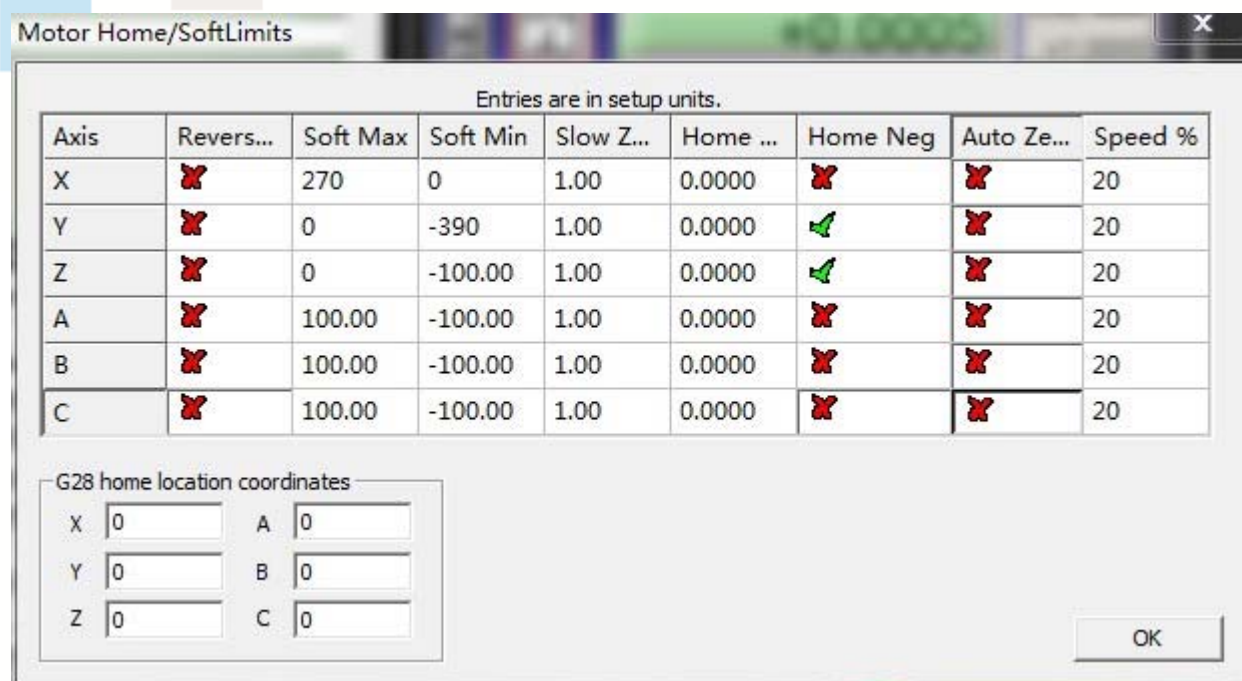


Figure5-3. Motor Home and Softlimits dialog

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 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

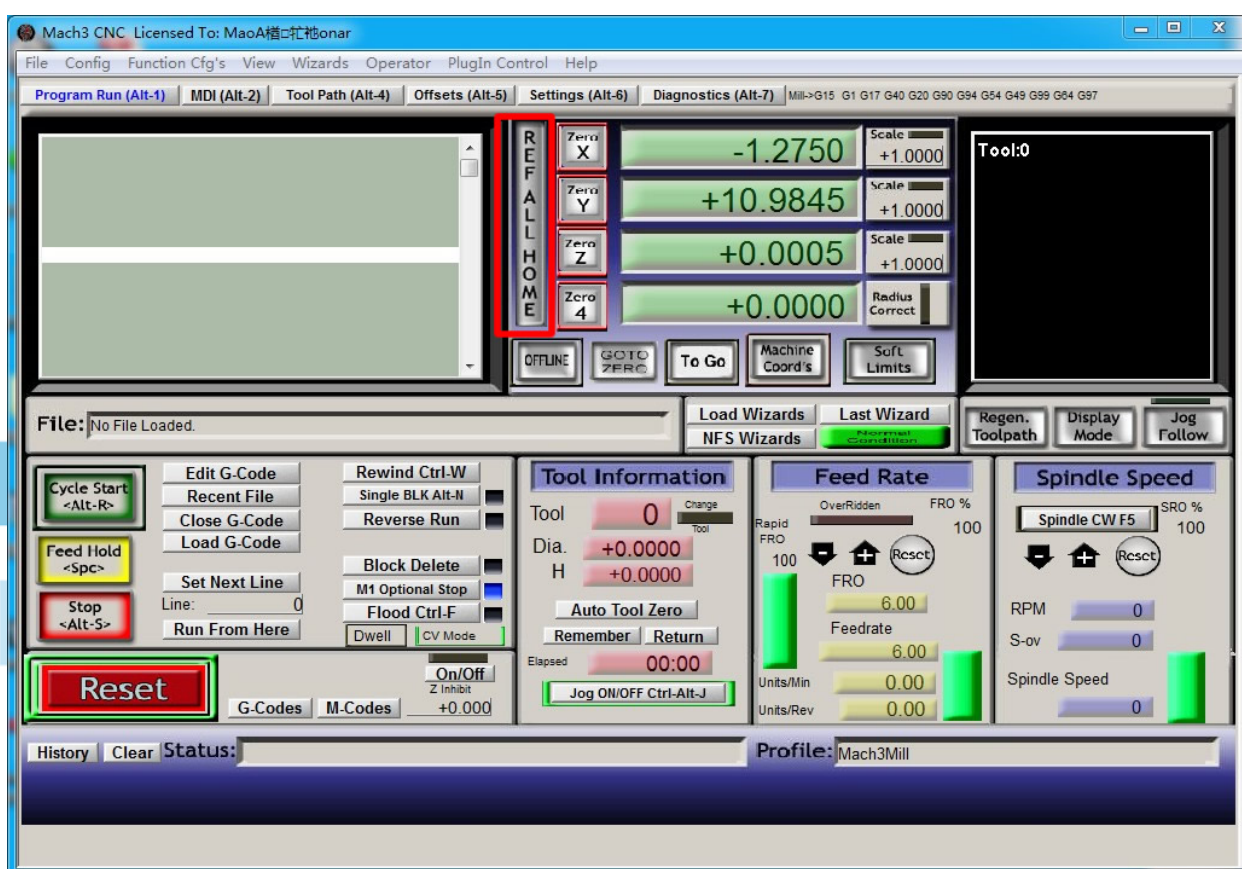


Figure 5-4. Click REF ALL HOME to HOME all axis

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.

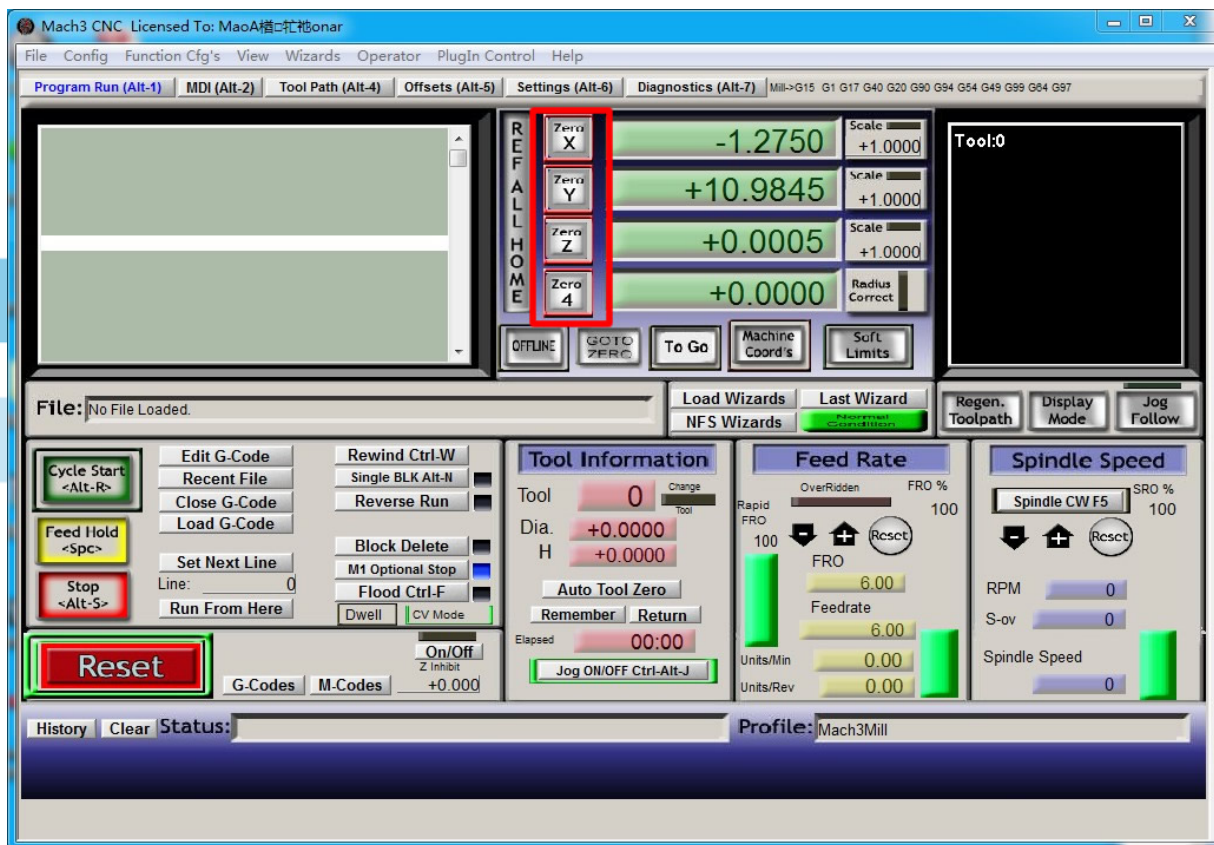


Figure5-5. Press Zero on each axis,all clear to 0

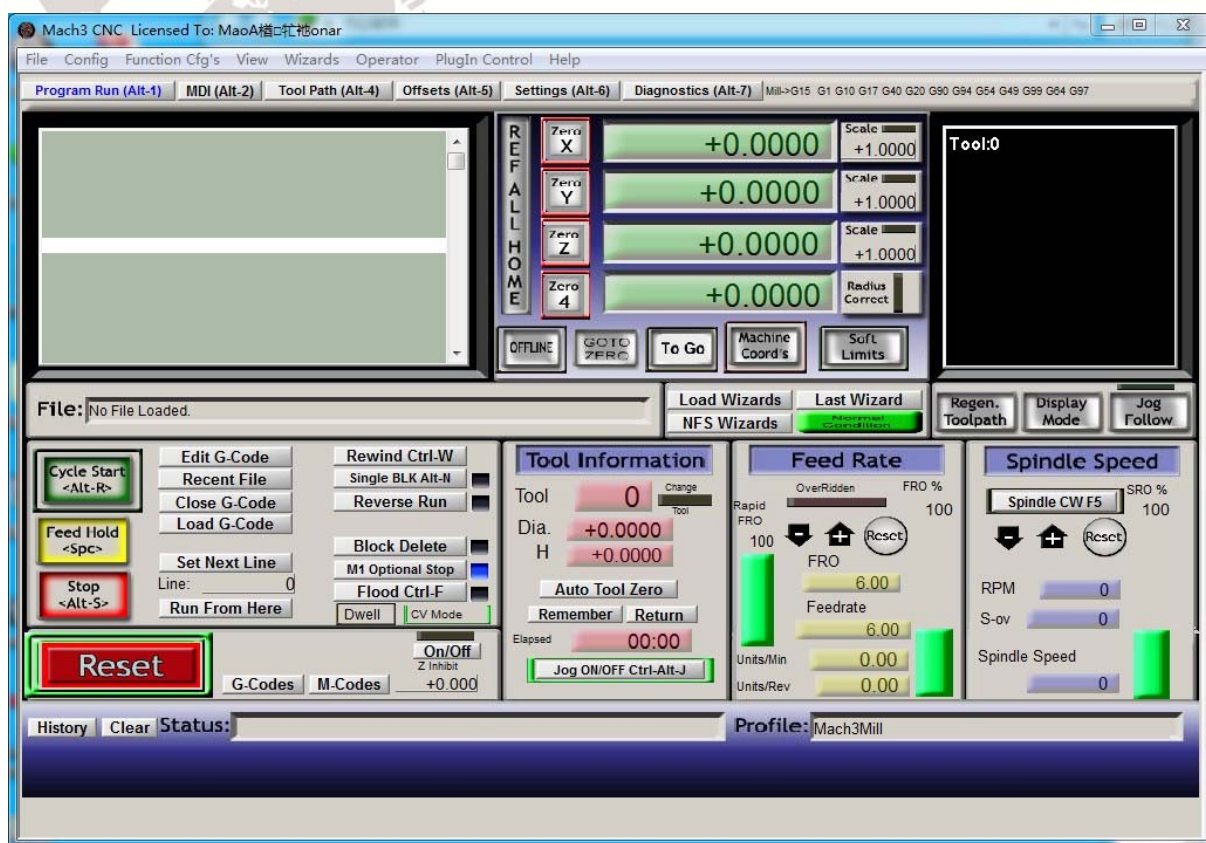


Figure5-6. Main Screen after ZERO all axis

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.

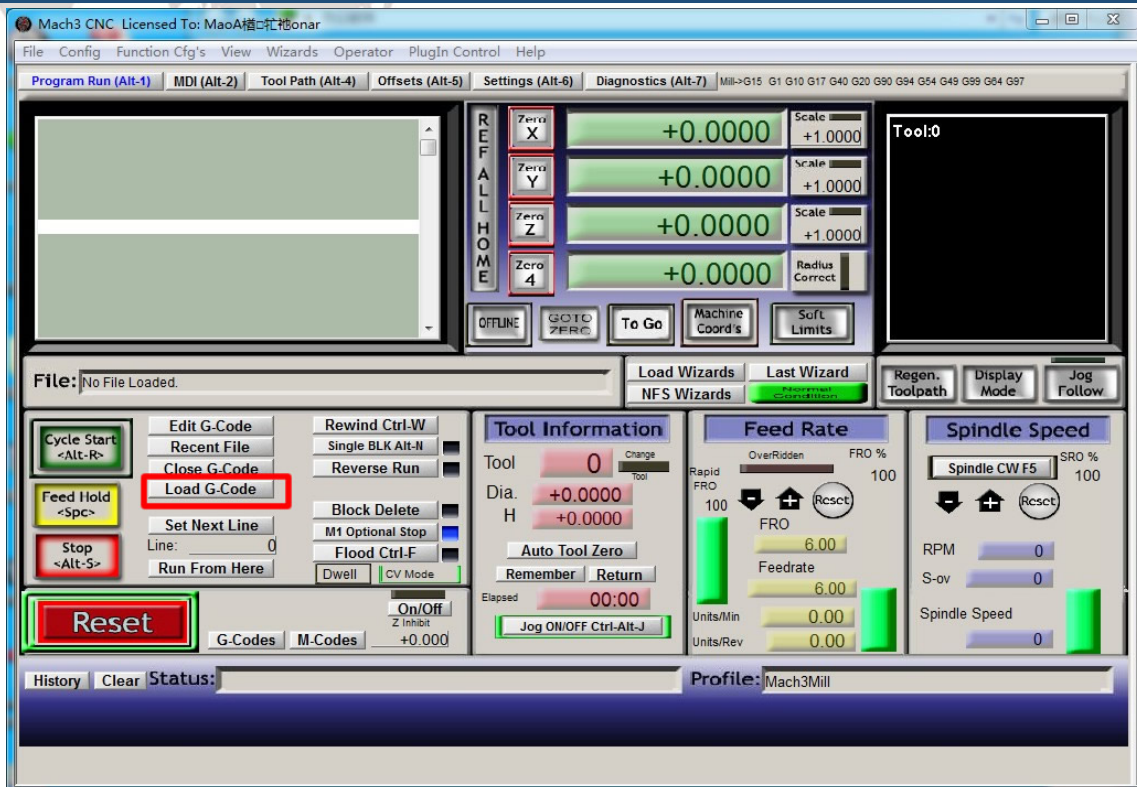


Figure5-7. Press Load G-Code and open your G code

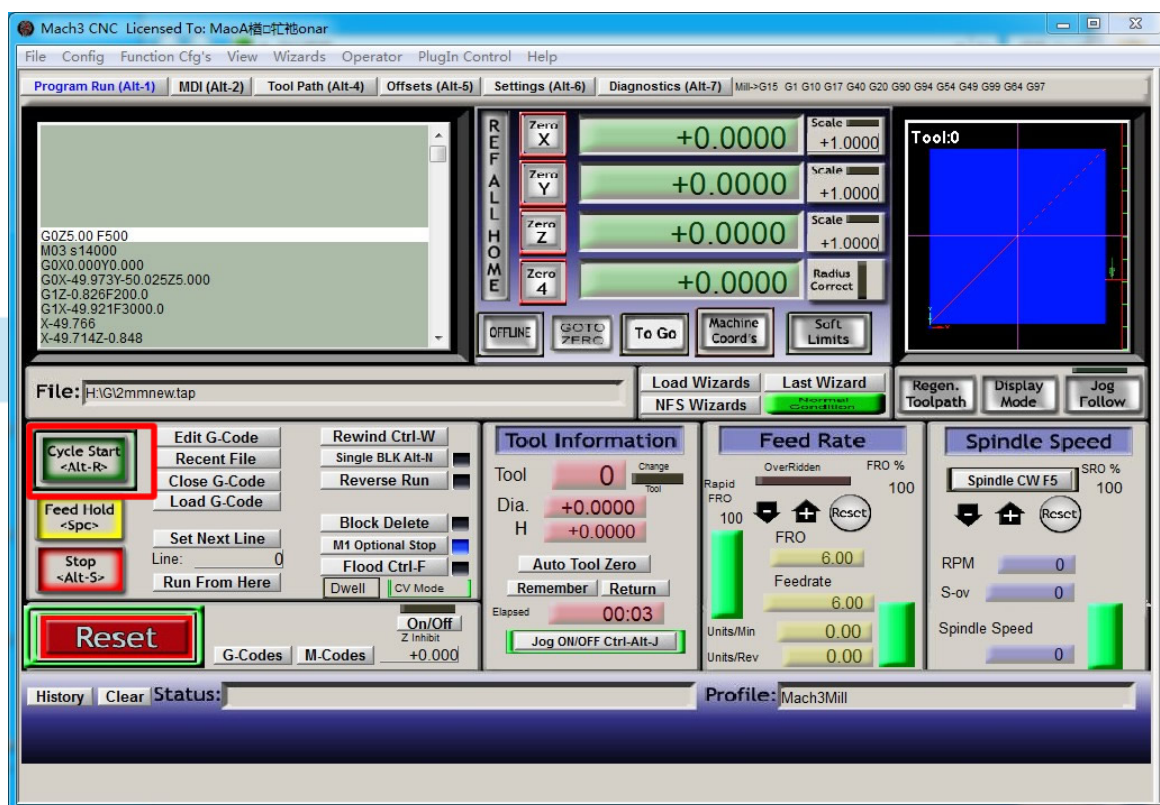


Figure5-8. After opening G code,press “Cycle Start” and start to work