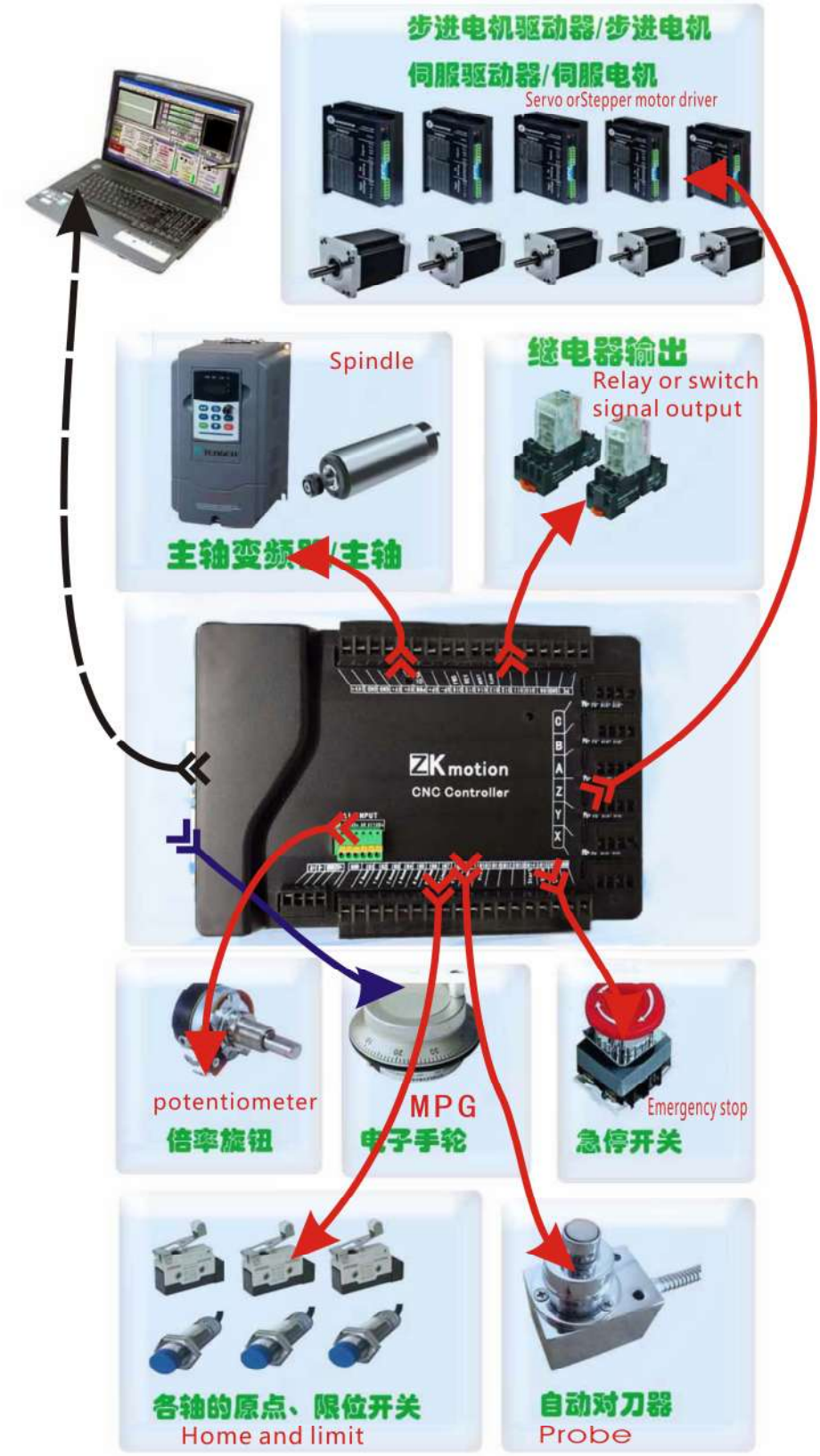
nMotion Mach3 USB Motion Card Installation Manual

Features:

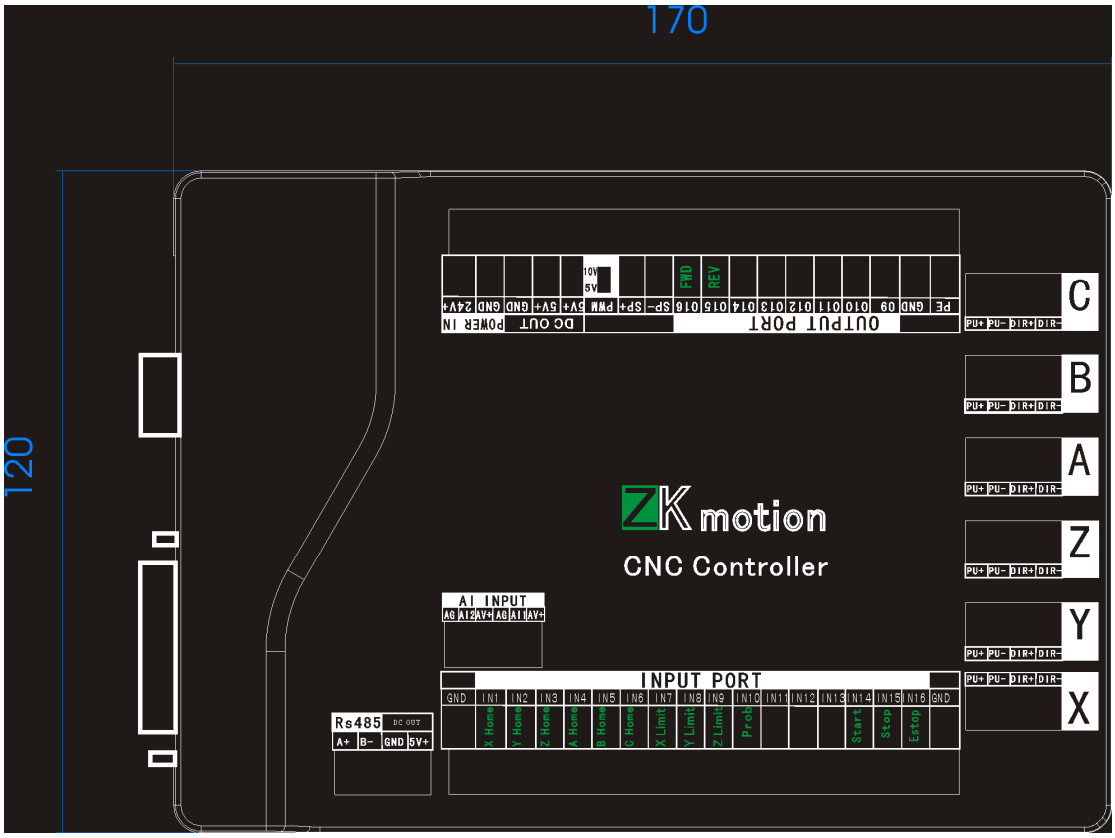
- Fully supporting all Mach3 versions, including the Mach3 R3.043.066 version.
- Supporting Windows series, including Windows2000/XP/Vista/Win7/Win8/Win10.
- No need to install any USB drivers,it can be used aftr plugging in the computer.
- USB bus is the use of magnetic coupling isolation, isolation of real value, different from the general control card optocoupler input and output, do high reliability, absolute guarantee the safety of the computer USB. At the same time to ensure that the strong anti-interference ability of EMC.
- The single chip, the system stability is more streamlined, multi chip processing generally incomparable
- Dual core ultra - high speed CPU (the maximum single core frequency 204MHz), operation processing ability has great redundancy, and ensure the realization of four axis linkage under1500KHz frequency of the pulse output, 6 axis pulse output frequencies up to 800kHz, connected to the servo / step
- Motion control buffer size can be set and ensure the fast interpolation cycle can stable operation, computer running overload can also smooth operation and interpolation cycle adjustable, can adapt to a variety of different needs.
- Has 16 input port, input interface more simple, port of wet and dry contact can be, wiring is simple, dry contact method for as long as the external connected to a physical switch to the wire can be, all 16 input port are indication signal, for low power usually indicating lamp is bright, debugging simple and clear.
- With 8 output ports, a single output drive capability of 170mA max, can be directly driven by DC relay.
- The PWM speed output port can be set, the frequency of PWM, pulse width 0~1000 continuously adjustable.
- With the function of the speed, the actual speed of the spindle in the Mach3 interface, real-time display, accurate and stable measurement.
- With 256 bytes of NVRAM space, can save the coordinates of the 6 axes, the next power without the need to find the mechanical origin.
- The circuit board is made by the engineer, the design level is clear at a glance.

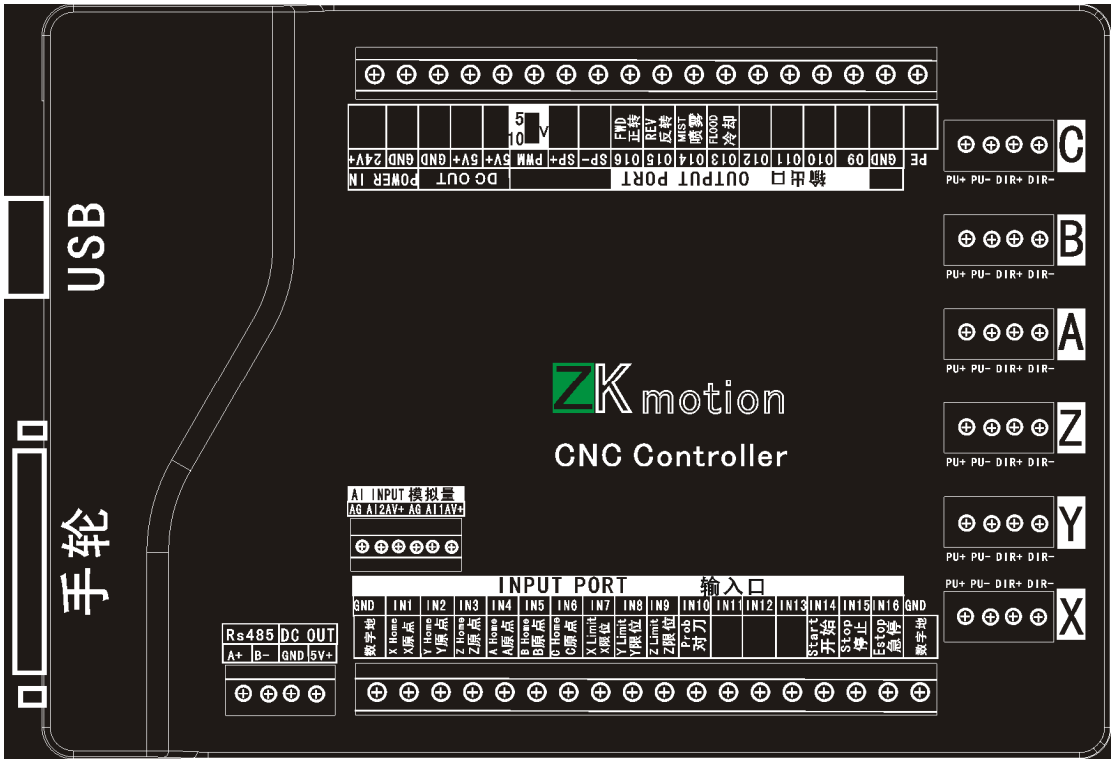
Revisions List

- **Basic connection diagram (an Overview)**



- **Mechanical dimensions diagram**





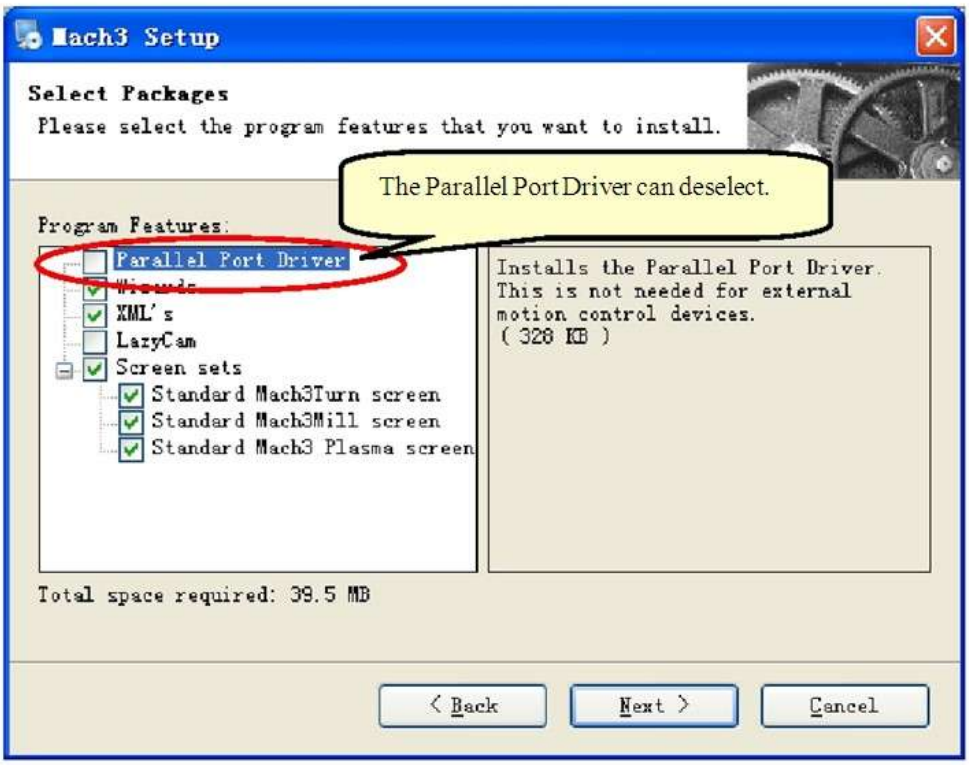
● Prepare Mach3 software

This card is a Mach3 USB interface 3/6 axes external motion card。

The latest version of Mach3 official website:
http://www.machsupport.com/downloads.php

Mach3 download: as shown below:

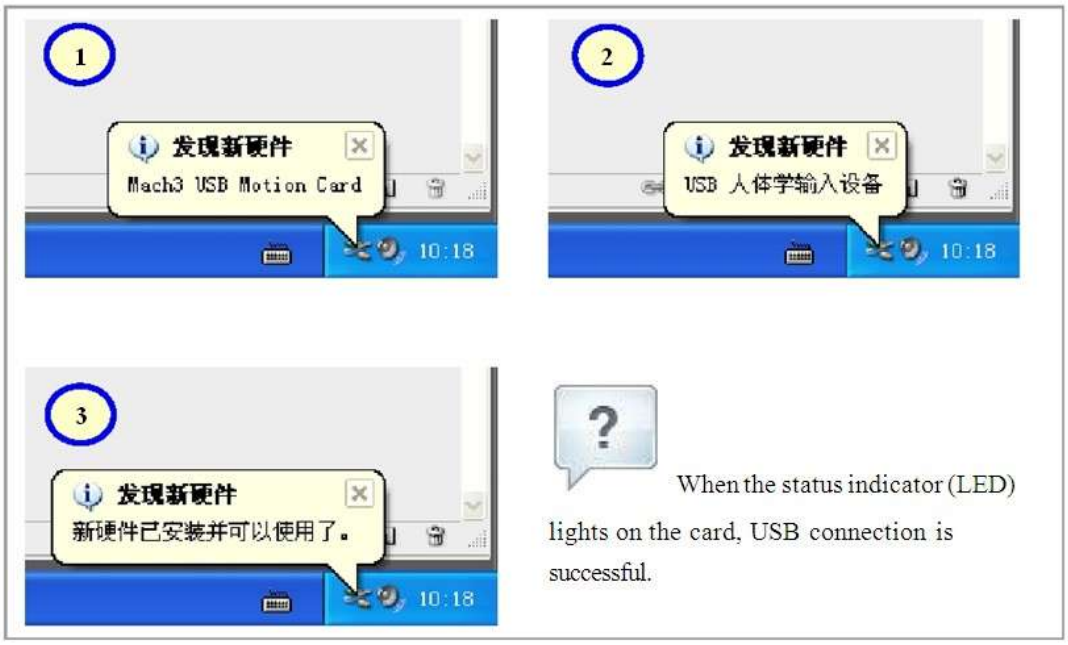
Installation the Mach3:
The Parallel Port Driver does not require.



Installation the software of the USB motion card

This USB motion card does not need install any USB driver， Windows2000/Xp/Vista/Windows7 can directly identify.

1. Connecting the USB cable to the PC and the motion card.

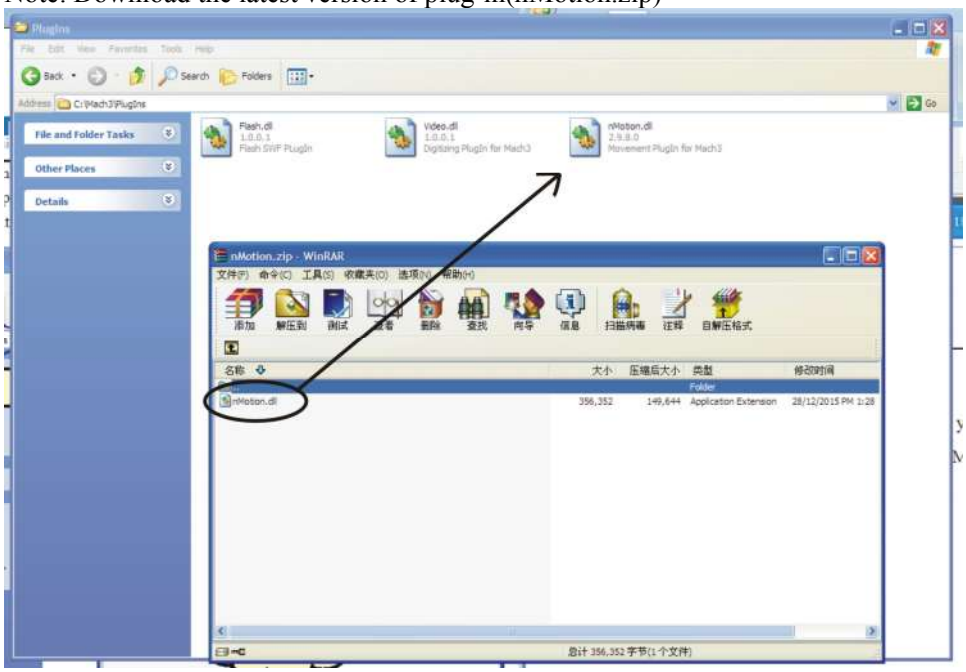


When the status indicator (LED) lights on the card, USB connection is successful.

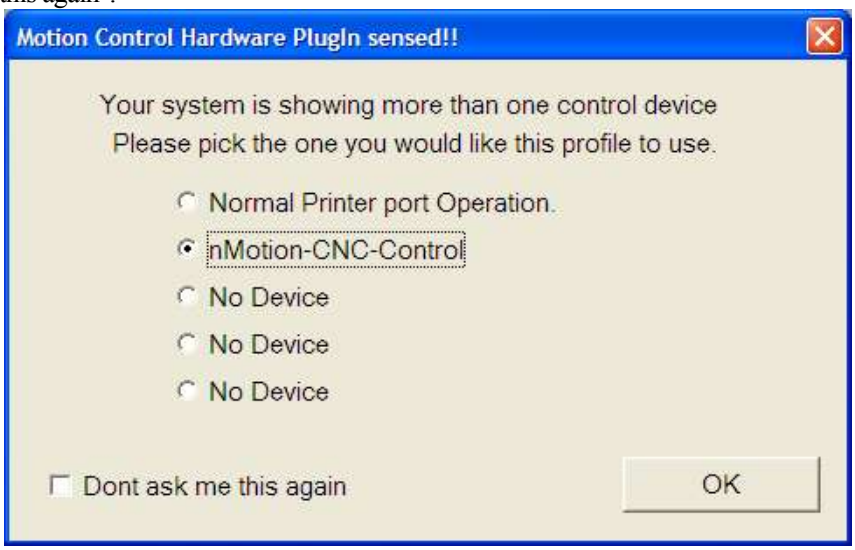
A. Installing the motion card plug-in.

Unzip the usbmove.zip, copy or drag usbmove.dll into your Mach3\PlugIns folder.

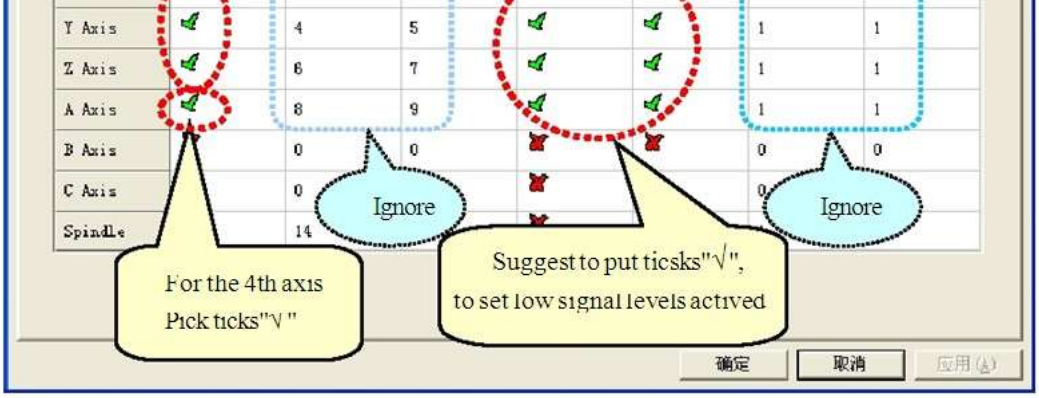
Note: Download the latest version of plug-in(nMotion.zip)

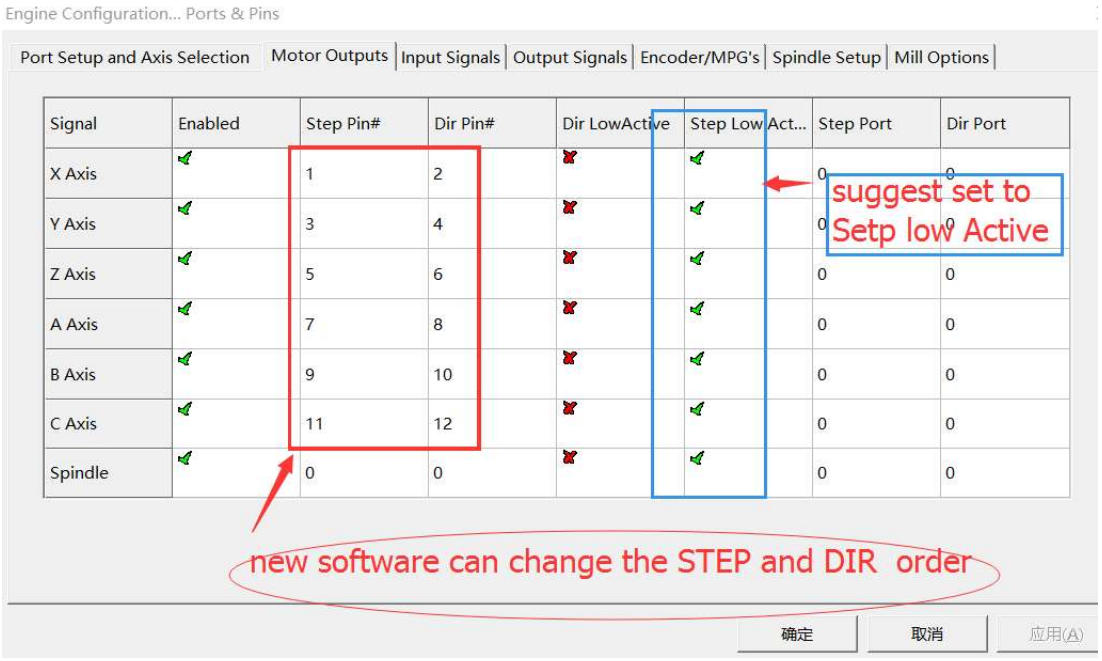


Start the Mach3 software, a dialogueof "Motion Control Hardware PlugIn sensed!!"is shown. Please select the"Mach3-USB-Motion-Card" you can also check"Don't ask me ， this again".



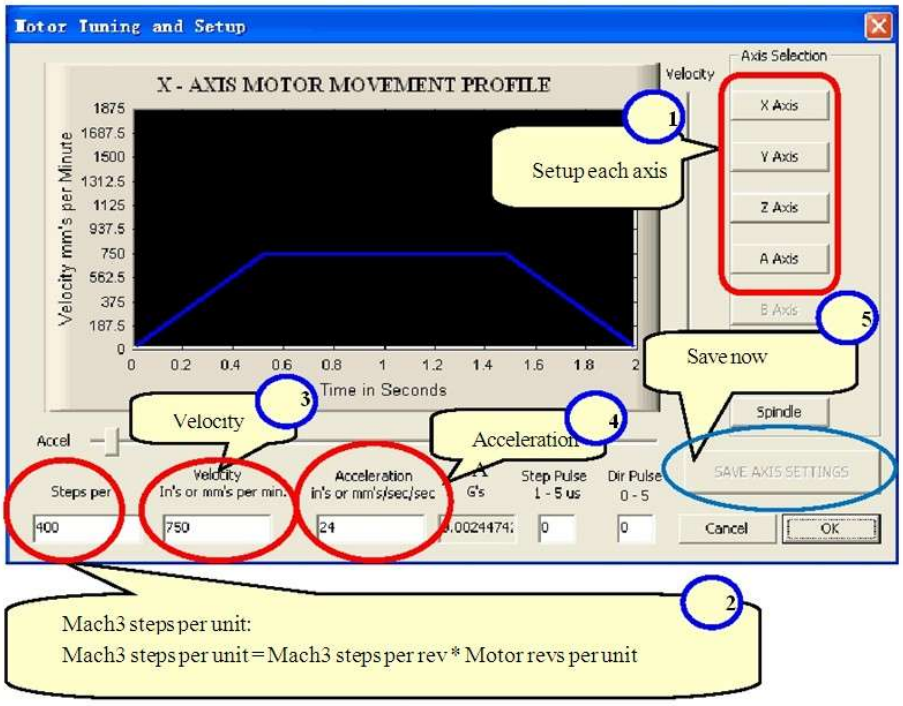
B.



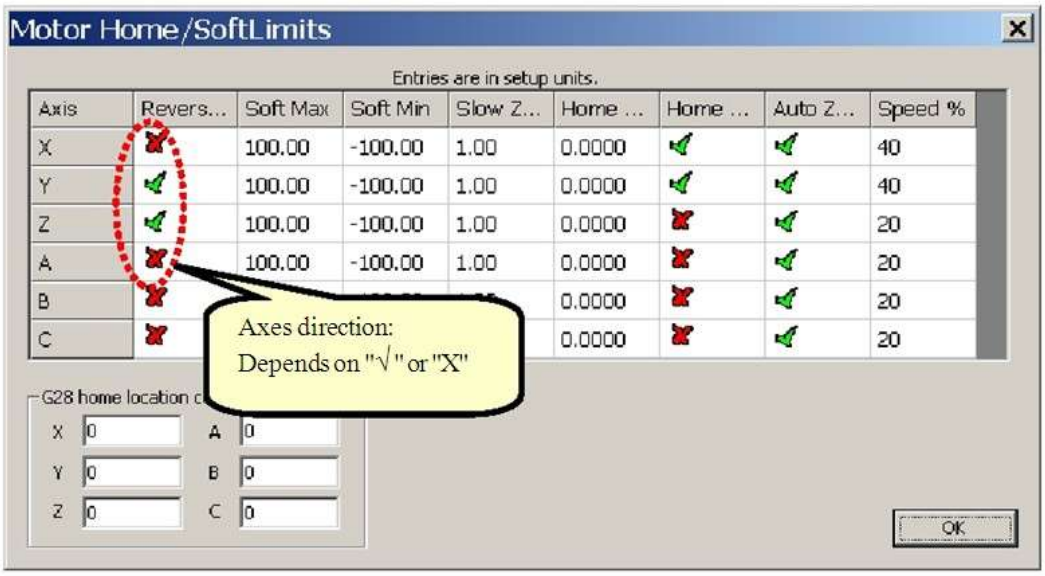


Signal	Enabled	Step Pin#	Dir Pin#	Dir LowActive	Step Low Act...	Step Port	Dir Port
X Axis	✓	1	2	✗	✓	0	0
Y Axis	✓	3	4	✗	✓	0	0
Z Axis	✓	5	6	✗	✓	0	0
A Axis	✓	7	8	✗	✓	0	0
B Axis	✓	9	10	✗	✓	0	0
C Axis	✓	11	12	✗	✓	0	0
Spindle	✓	0	0	✗	✓	0	0

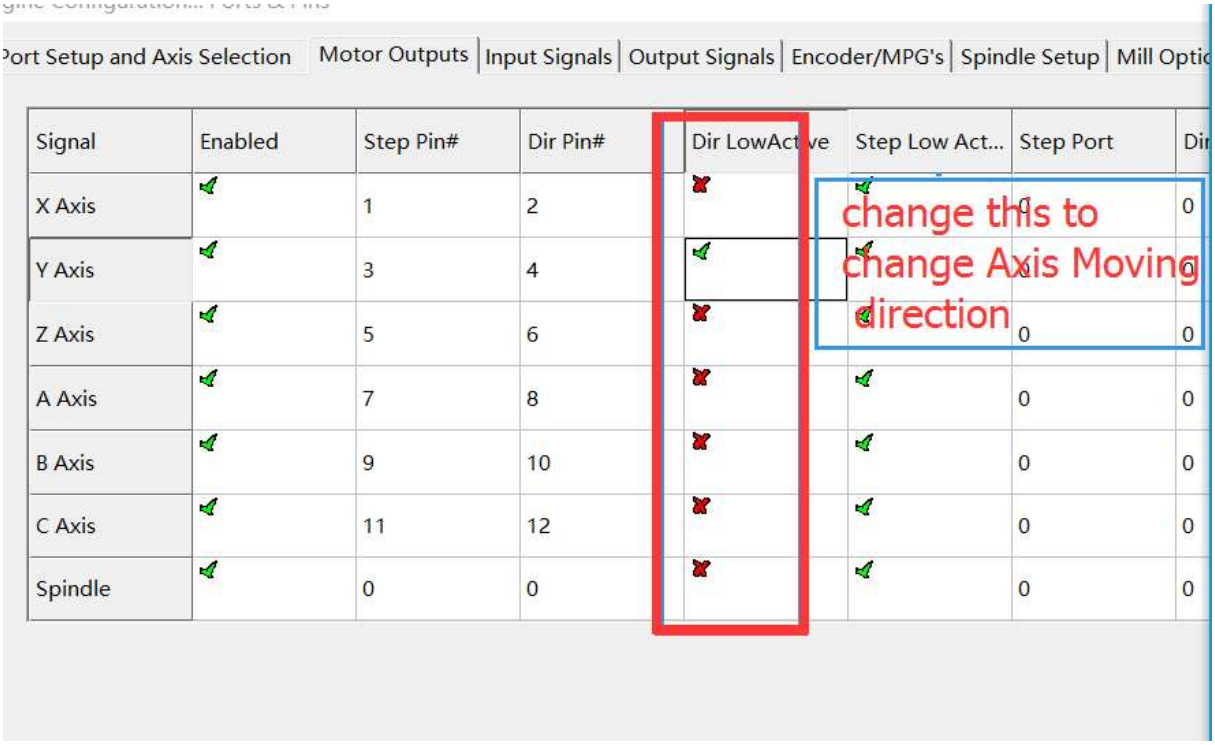
Motor config like this:(config=>Motor Tuning)



The Mach3 Menu => Config => Homing/Limits dialog Axes direction, depends on the "Reversed". if you have a MPG ,please let “Reversed” as “X” .



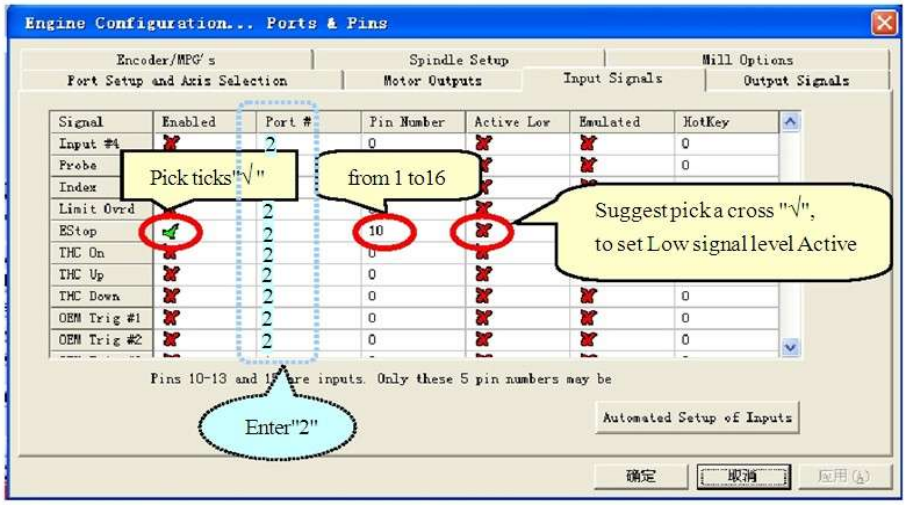
Or you can chang the direction on this page: Dir Low selet “X” or “√”



b) Setup the input singles.

There are 16 general-purpose input channels. The channels number is from 1 to 16 ,Port Number is 2.

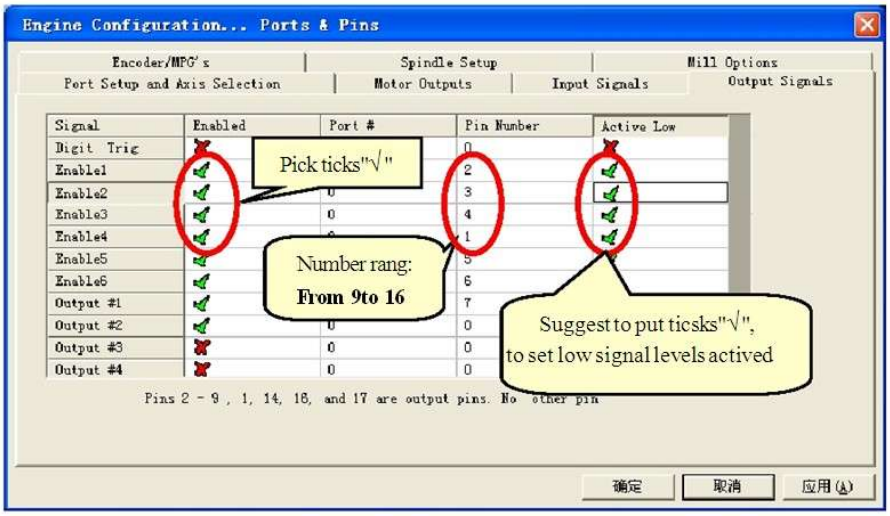
Suggest Active Low ="√" (Set Low signal Level for Inputs)



c) Setup the Output signals.

There are 8 general-purpose (open-drain) output channels, The channels number is from 9to 16 . Port Number is 2.

Suggest Active Low =" √" (Set Low signal Level for outputs)



- # Hardware installation of motion control card

PIN function description

6 Axis Output Port

Index	Pin Name	Function	Electrical characteristics	note
1	PU+	Plus +	Differential signal	AM26LS31 output
2	PU-	Plus-	Differential signal	AM26LS31 output
3	Dir+	Dir+	Differential signal	AM26LS31 output
4	Dir-	Dir-	Differential signal	AM26LS31 output

16 input terminals (Port Input) pin function description

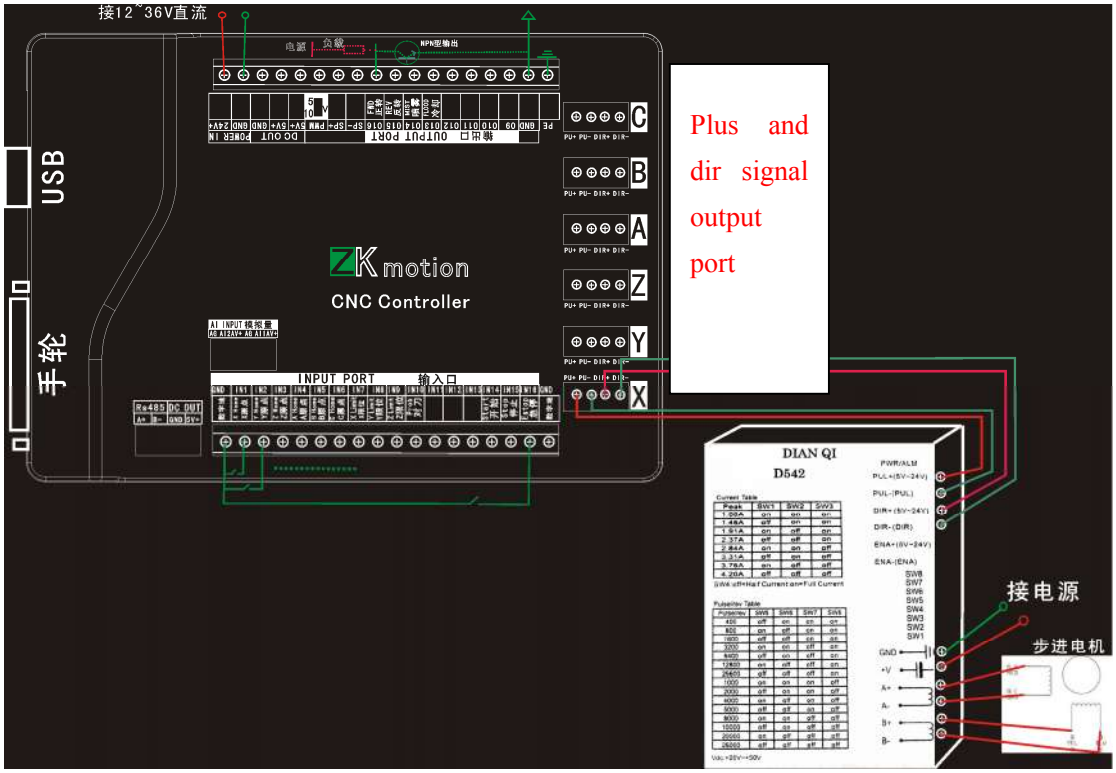
index	Pin Name	Function	Electrical characteristics	Note
1	GND	Digital signal ground wire		
2	IN1	Input Port	Type NPN switch or contact switch	In the MACH3 menu “配置”=“端口和引脚” "Configuration" = >"port and pin" =>“Input Signals”中配置功能 = > "Input Signals" in the allocation of functions Mach3中端口号（Port Number）为2，针脚号（Pin Number）为1~16号。 Mach3 in the port number (Number Port) for 2, the pin number (Number Pin) for the 1~16 number.
3	IN2			
4	IN3			
5	IN4			
6	IN5			
7	IN6			
8	IN7			
9	IN8			
10	IN9			
11	IN10			
12	IN11			
13	IN12			
14	IN13			
15	IN14			
16	IN15			
17	IN16			
18	GND	Digital signal ground wire	Digital ground , and 24V power supply ground is the same	

Output terminal (Port Out) pin function description

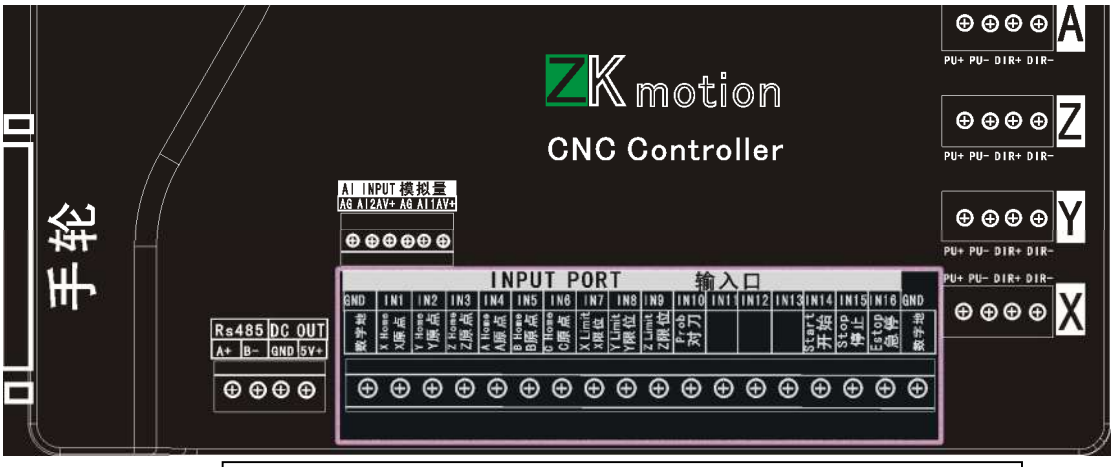
index	Pin Name	Function	Electrical characteristics	Note
1	24V+	9~36V DC Power	Minimum power 10W	Power input terminal
2	GND	9~36V DC GND	Minimum power 10W	
3	GND	Signal ground	Input power EGND and control output DGND are isolated	Input power EGND and control output DGND are isolated
4	5V+	output out:5V	max:600mA	Output from 24V to 5V linear power supply
5	5V+			
6	PWM	PWM pulsewidth	OC，50V/170mA	The spindle speed output, output can be 0~5V or
7	SP+	Speed Signal +	6~15mA	LED Positive input
8	SP－	Speed Signal-	6~15mA	LED Negative input
9	O16	general-purpose (open-drain) output channels	OC (open-drain)，50V /50mA	In the MACH3 menu "Configuration" = >"port and pin" = > "Output Signals" Configuration function, port number (Number Port) for 2, pin number (Number Pin) for the 8~16 number.
10	O15			
11	O14			
12	O13			
13	O12	general-purpose (open-drain) output channels	OC (open-drain)，100V /170mA	
14	O11			
15	O10			
16	O9			
17	GND	Signal ground	Signal ground	Signal ground
18	PE	Grounding wire	Grounding wire	Grounding wire

The card supplied by USB, has installed a power module, the maximum output power of up to 1A.

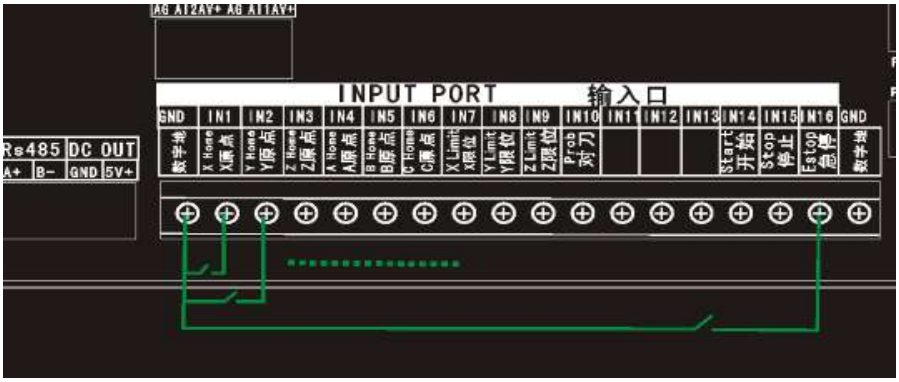
All output, including 6 axis pulse / output / control output / spindle speed output, USB connection after the default output impedance. In the Mach3 after the start level is controlled by Mach3, suggested that all the output signal in Mach3 is set to low level effective.



Input port wiring instructions

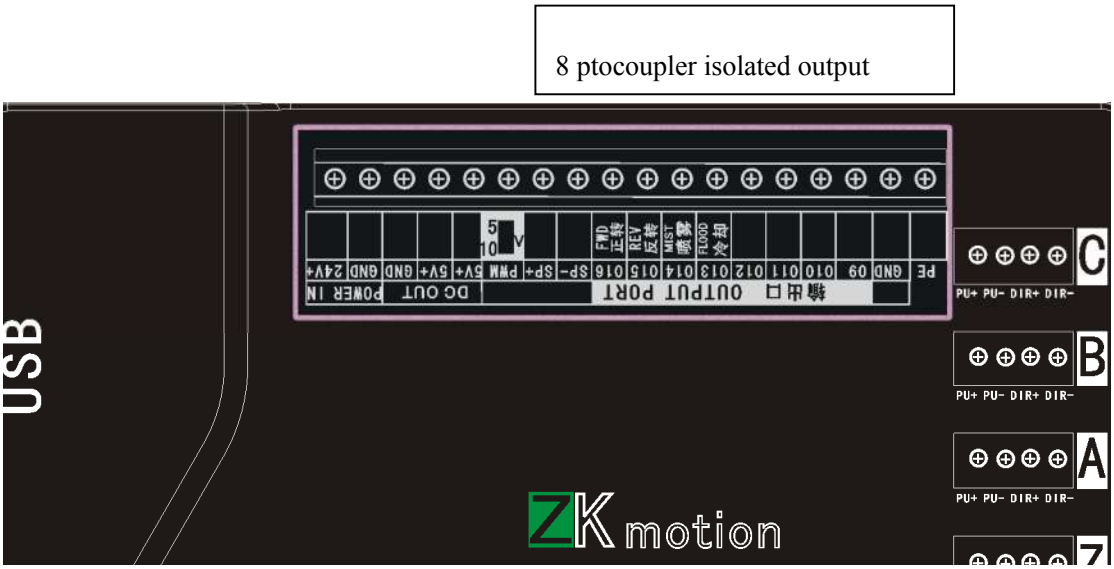


There are 16 input port ,can use NPN , or Contact switch

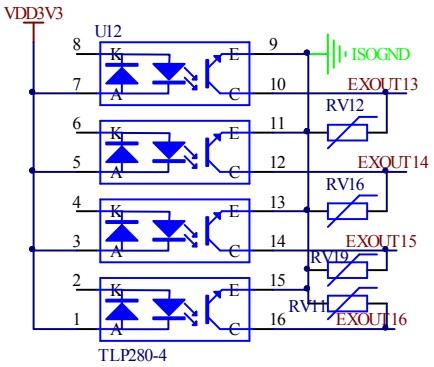


8 way control output pin position diagram

NPN type low level output mode, O9~12 have the maximum drive current 170mA.O13~16 50mA max.



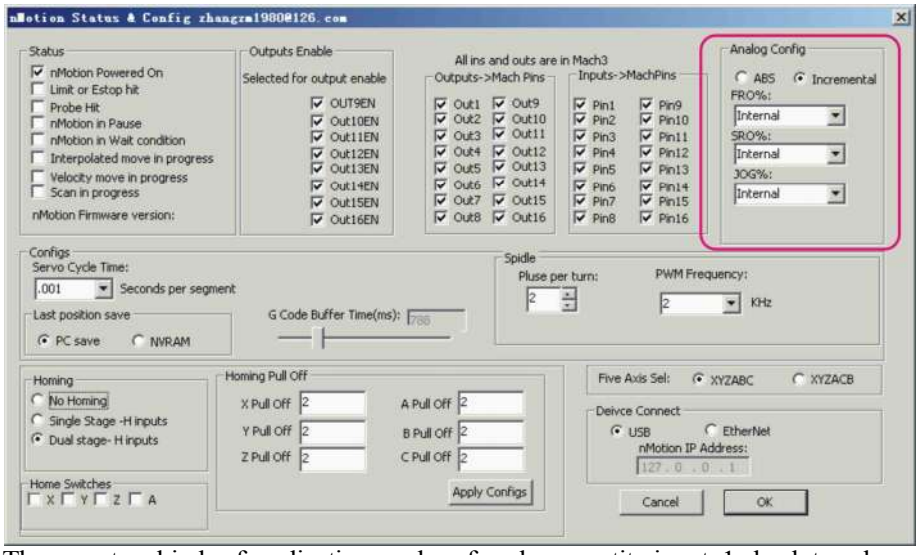
Principle diagram of Isolate Output



External power knob

Two AI input port, the voltage input range of 0~3.3V, can be used to set the rate of FRO/SRO/JOG

Mach3 menu “Plugins Config”=>”Config”, enter “PlugIn Control and Activation”.



There are two kinds of application modes of analog quantity input: 1 absolute value model, 2 increment value model

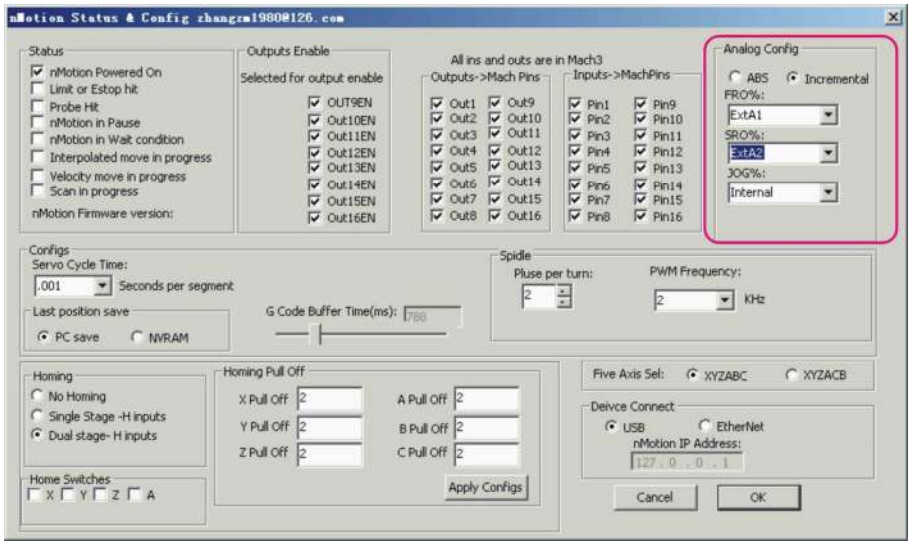
As follows:

a. The absolute value of FRO%, SRO%, Jog% under the mode of the value of a linear relationship with the AI, AI level is higher, the greater the value of the corresponding rate.

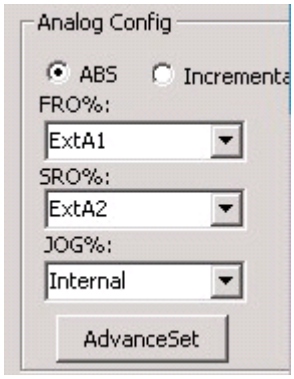
b. Incremental value mode FRO%, SRO%, Jog% value with the relative change in volume changes, mainly referring to the last moment of external AI voltage value and present current AI voltage value comparison, if the voltage is relatively higher, corresponding to the rate value is increased, otherwise reduce.

c. General incremental value model.

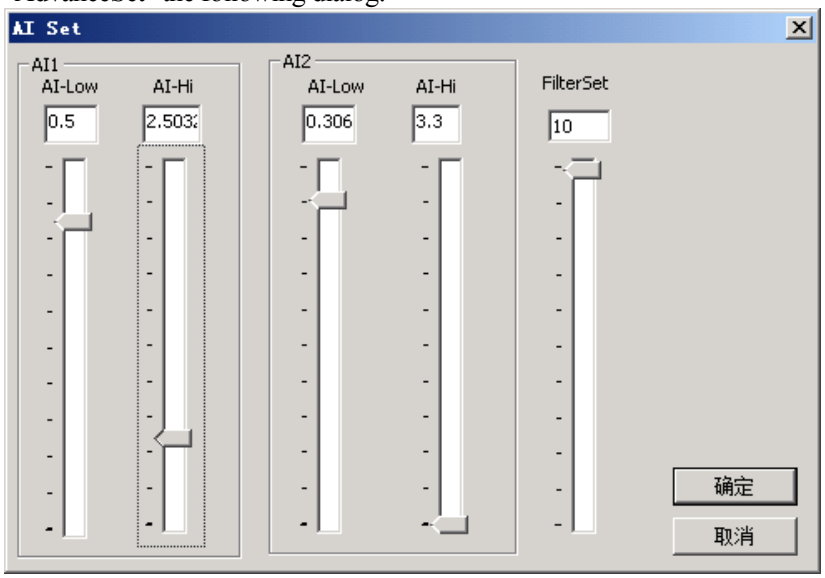
d. FRO% (feed rate of F). SRO% (spindle speed ratio), Jog% (dynamic magnification) set external rate "ExtA1" or "ExtA2



After the completion of the configuration, click "OK"". Rotation rate knob Mach3 interface corresponding to the SRO%, FRO% numerical immediately change.
Rotation rate knob, Mach3 interface corresponding to the Jog Rate% Slow value immediately change.

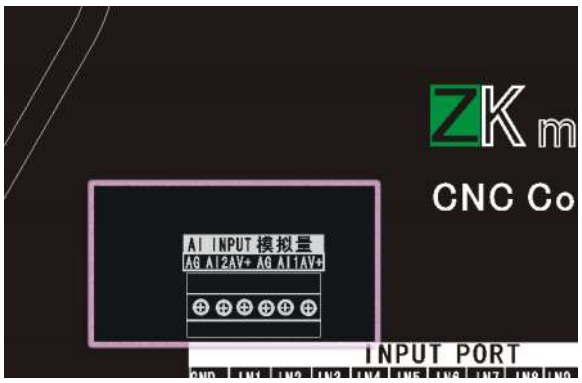


In absolute value mode will be more of a button, used to set the initial voltage of low level and high level at the end of the voltage, such as external input voltage range is 0.5V~2.5V, to rate value by the change of 0-300, low starting level voltage is 0.5V, the high level end voltage 2.5V. Click on the "AdvanceSet" the following dialog:



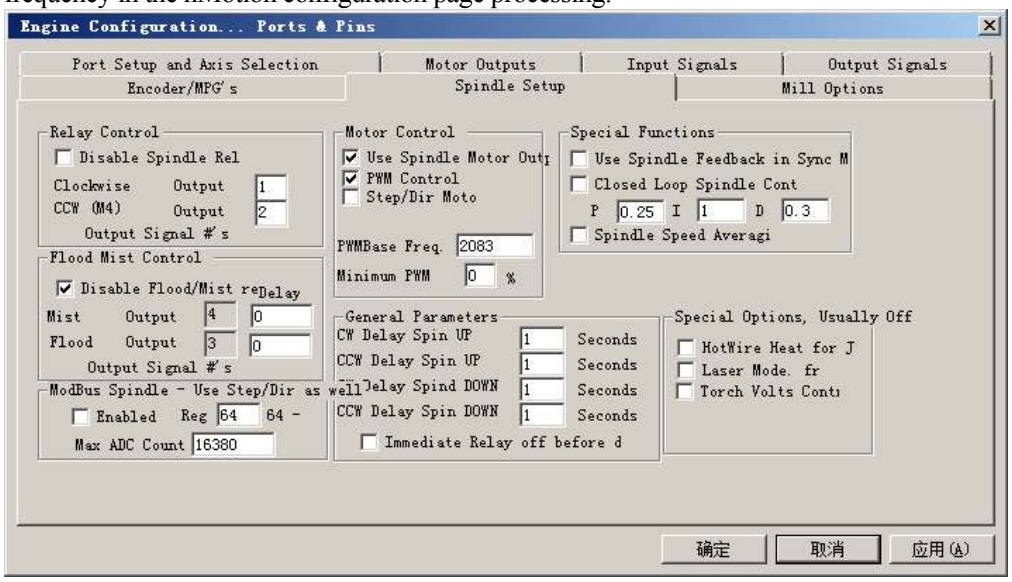
And a filtering coefficient, filter coefficient is small, rate value response faster, smoothing less, whereas response is slower, the change was more smooth. Generally do not move, set to 10~20 can be.

AI input port as shown below, not marked red terminal 4.4V about power, this power only potentiometer power supply, please don't external use.

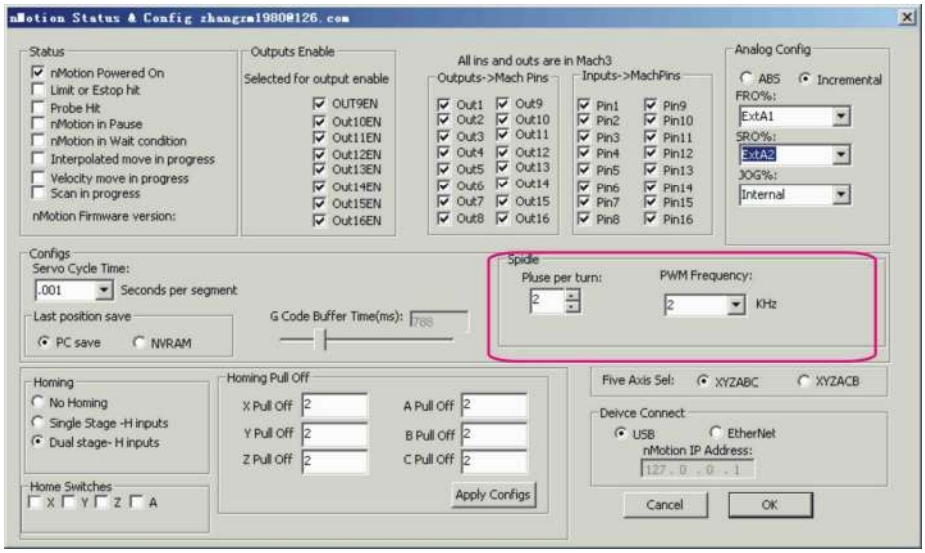


Spindle speed PWM analog output

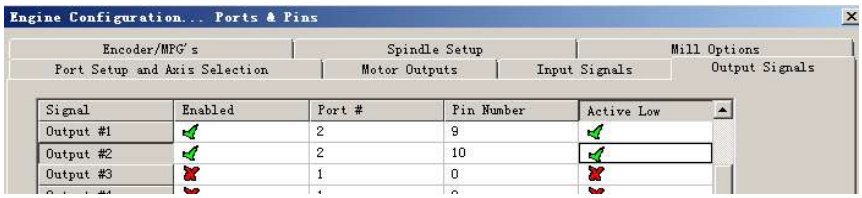
Click on the main menu "config" = > "port and pins into the spindle spindle setup settings, tick the" use spindle motor output. In Freq. PWMBase, there is no need to fill in the required frequency. PWM frequency in the nMotion configuration page processing.



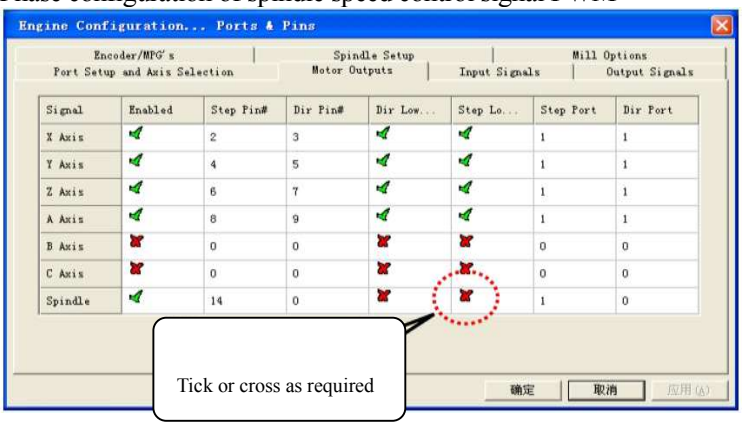
Spindle PWM (pulse width modulation output frequency in the Mach3 menu Config=>Config plugins into plugin control and selection of activation nMotion card to control the, click on the "config" after USB card configuration dialog.



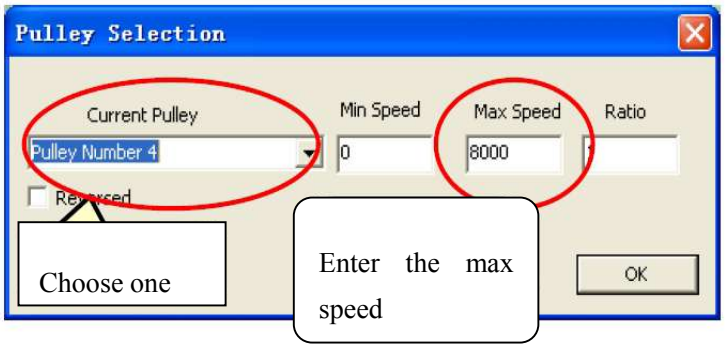
spindle relay configuration



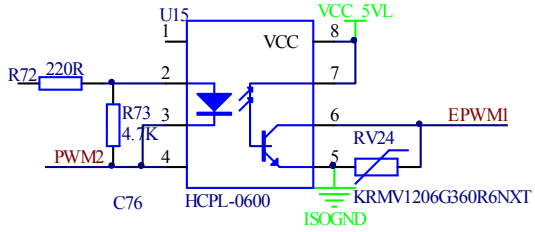
Phase configuration of spindle speed control signal PWM

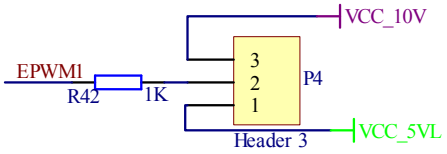


Mach3 menu " Config=> Spindle Pulleys ", enter " Pulley Selection "

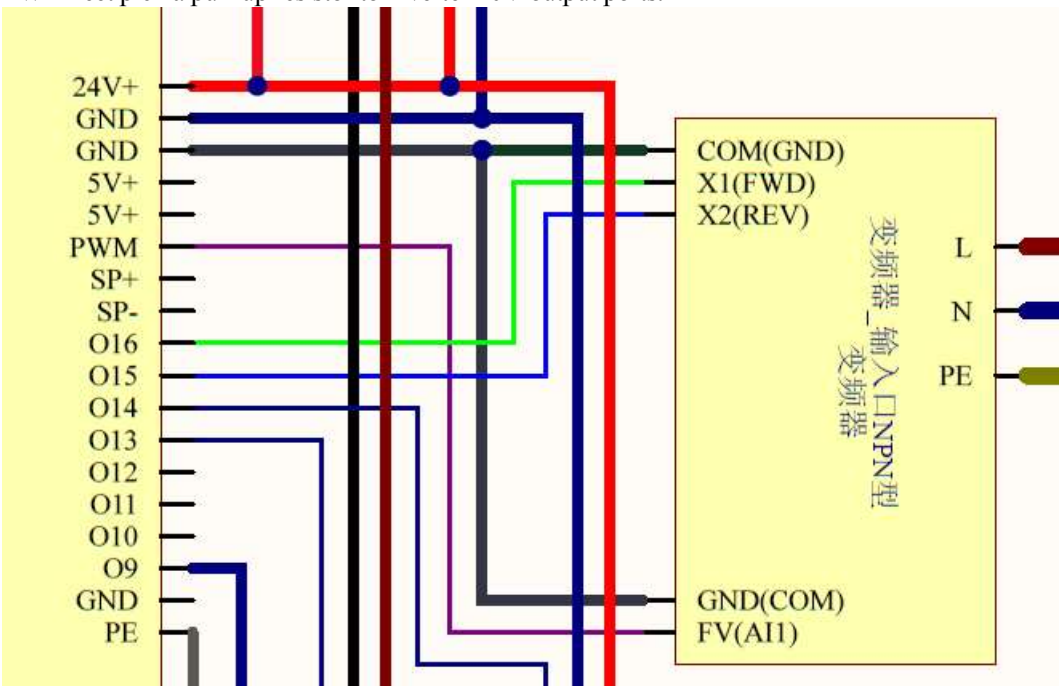


Principle diagram of the spindle speed control analog output interface

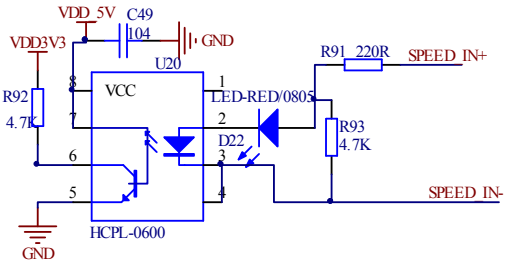


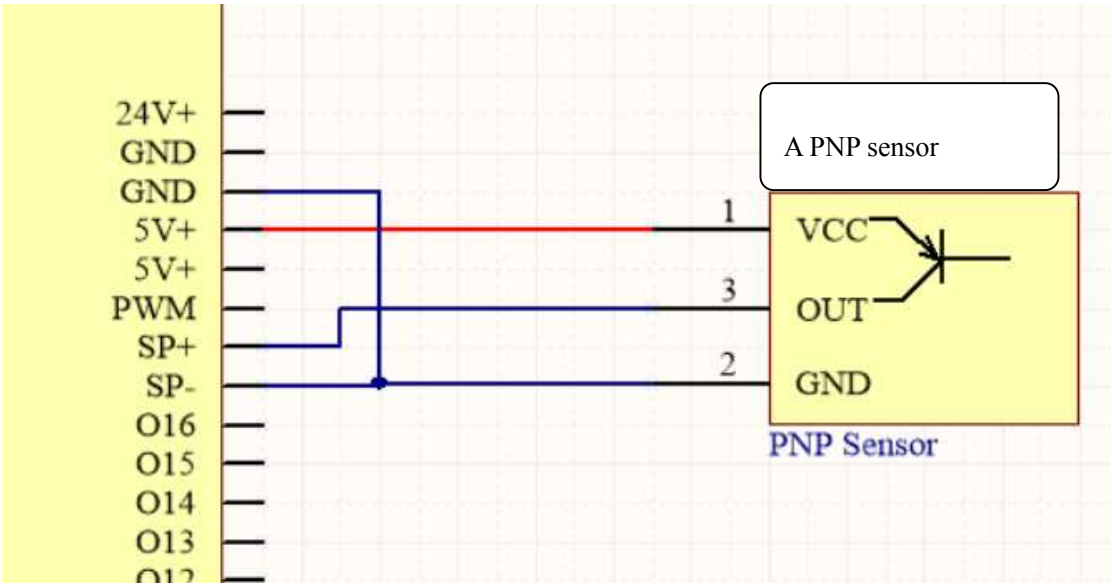


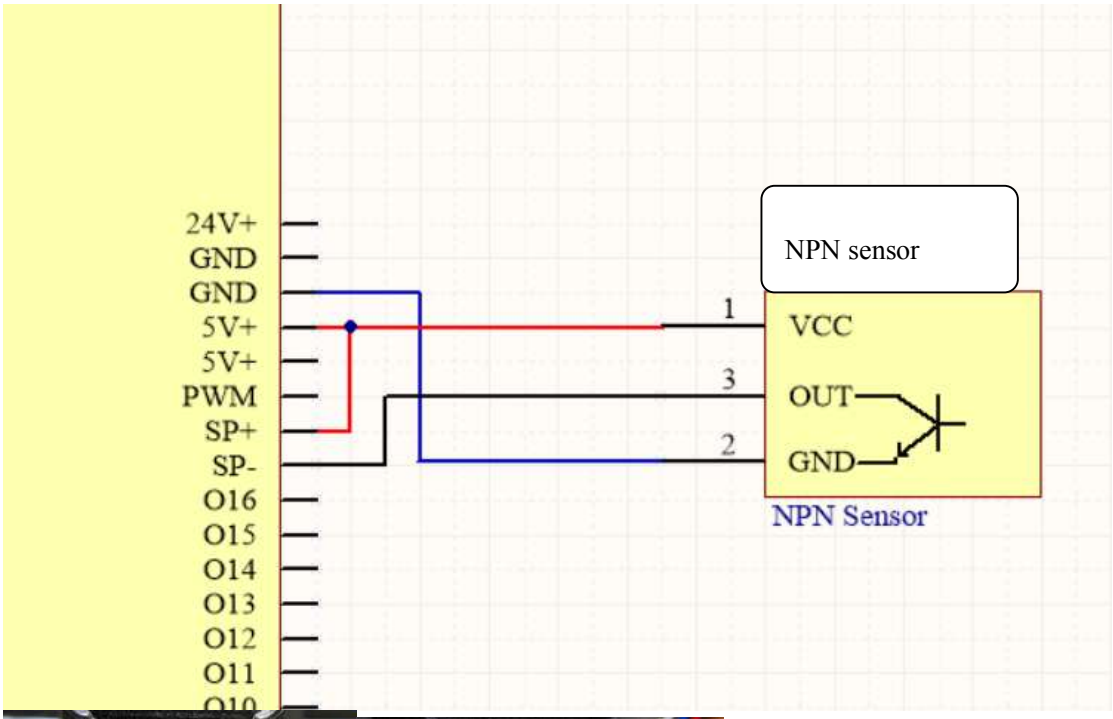
VCC_10V have not served , if you use a variable frequency speed control of the spindle and need in PWM feet pick a pull-up resistor to inverter 10V output ports.

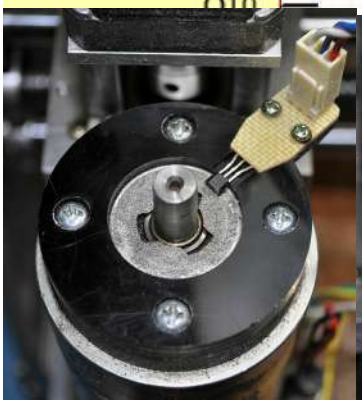


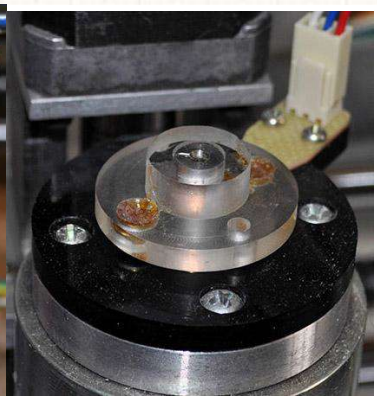
nMotion control card of the speed of the input interface schematic



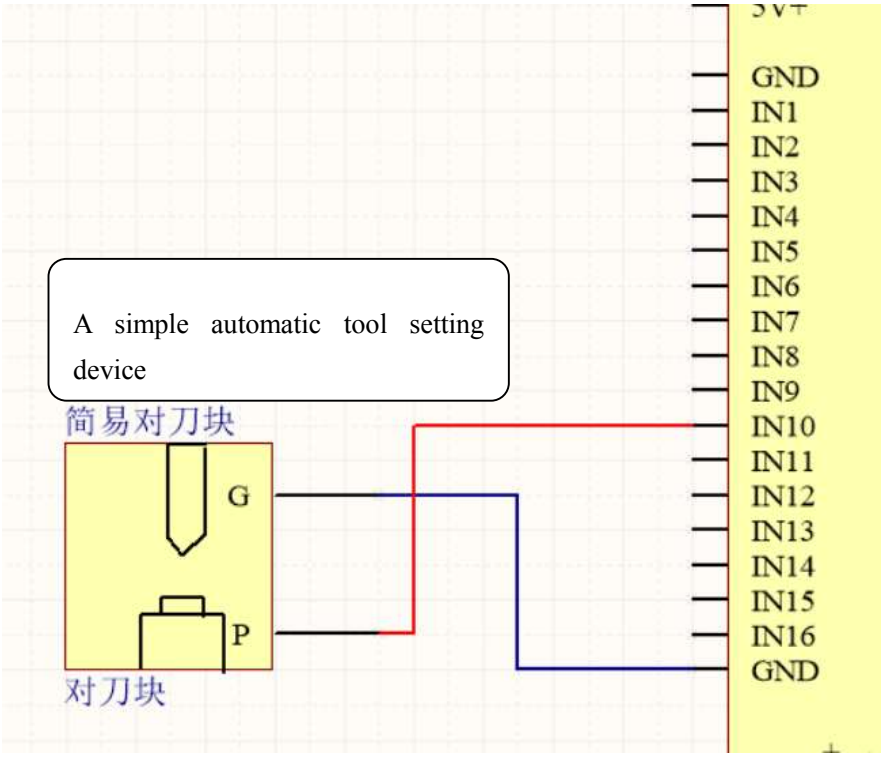

24V+
GND
GND
5V+
5V+
PWM
SP+
SP-
O16
O15
O14
O13
A PNP sensor
1
3
2
VCC
OUT
GND
PNP Sensor


24V+
GND
GND
5V+
5V+
PWM
SP+
SP-
O16
O15
O14
O13
O12
O11
NPN sensor
1
3
2
VCC
OUT
GND
NPN Sensor

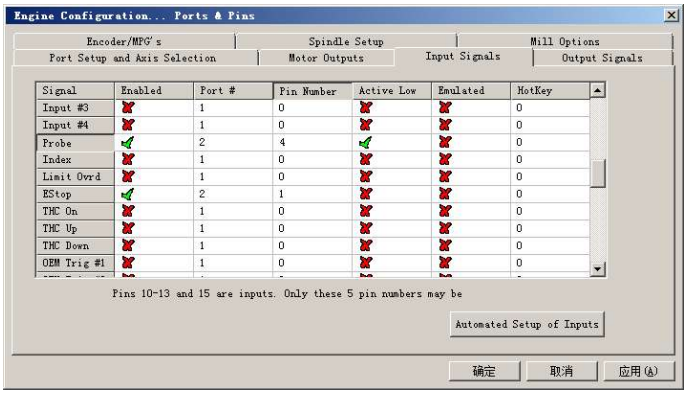




Probe connection



Config (Config => Ports and Pins)



Probe script like this:

```
FeedCurrent = GetOemDRO(818)        'Get the current settings, OEM DROs (818)=Feedrate DRO
ZCurrent = GetOemDro(802) 'OEM DROs (802)=Z DRO
GageH = GetOEMDRO(1001)      'OEMDRO(1001)=Gage Block Height
ZNew = ZCurrent - 20          'probe down 20 mm

Code "G90F100"                'slow feed rate to 100 MM/MIN
Rem Code "G4 P1"              'Pause 1 second to give time to position probe plate
Code "G31 Z" &ZNew
While IsMoving()
Sleep(10)
Wend
Call SetDro (2,GageH)         'DRO(2)=Z DRO
```

```
FinalMove = GageH + 10
Code    "G0 Z" &FinalMove
Code "F" &FeedCurrent                'restore starting feed rate
```

● MPG Setting

MPG use the input pin IN15 and IN16 , connect to Encode A and B signal.

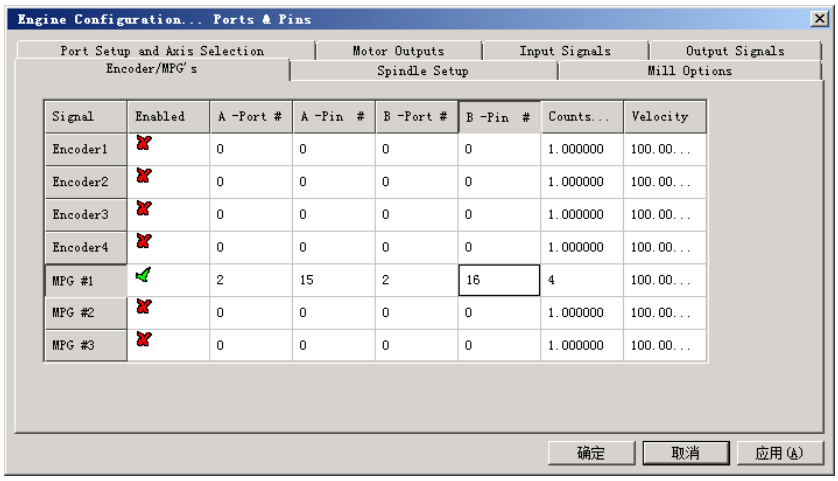
If you use a full function MPG with Rate switch and Axis select,

The DB15 head PIN order is like this :

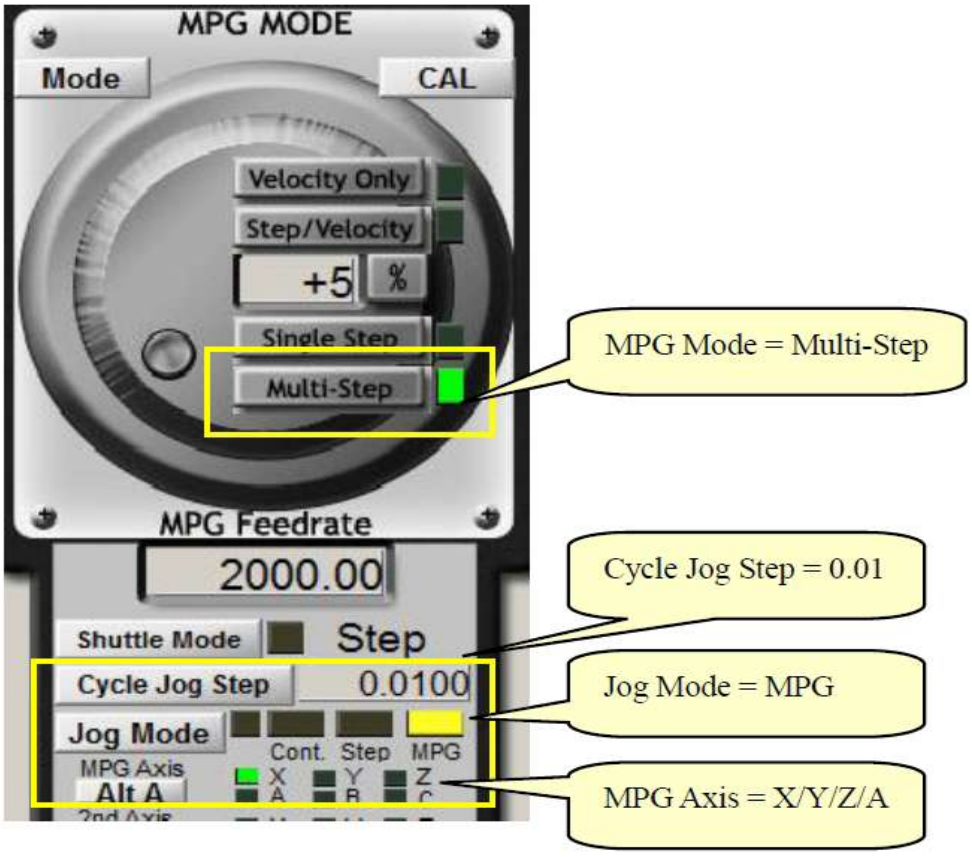
1	+5V	9	Encoder A
2		10	Encoder B
3	C axis SEL	11	GND
4	ESTOP	12	A axis SEL
5	B Axis SEL	13	Z axis SEL
6	X1	14	Y axis SEL
7	X10	15	X axis SEL
8	X100		

Software configuration

Mach3 electronic hand wheel configuration, as shown below: (Config => Ports and Pins)



Press “TAB” key,like this



MPG soft mode:（no longer use）

This mode fix the MPG with Mach3, so all this need mach3 to do MPG work.

Press “Shuttle Mode” button, Shuttle Mode LED is off, the MPG woke on Soft mode.

MPG hard mode

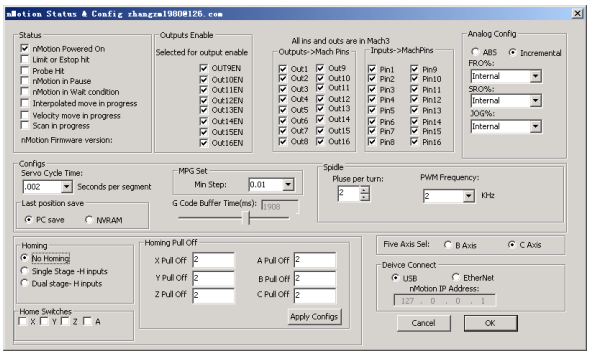
Press “Shuttle Mode” button, Shuttle Mode LED is on, the MPG woke on Hard mode.

If your MPG have a white button as Enable, please hold the white button all the time when you use the MPG to control the machine.

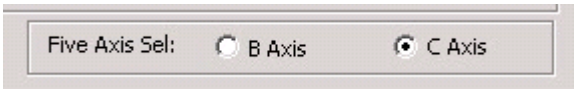
In hard mode, the plugin set need to set something.

1. MPG Mini Step, in “X1” ,the MPG 1 step need to move a short distance, this need to set the “Config Plugins” , and there is a setting like this , “MPG Set” ->”Min Step”.

2. fifth Axis selection (no longer use)

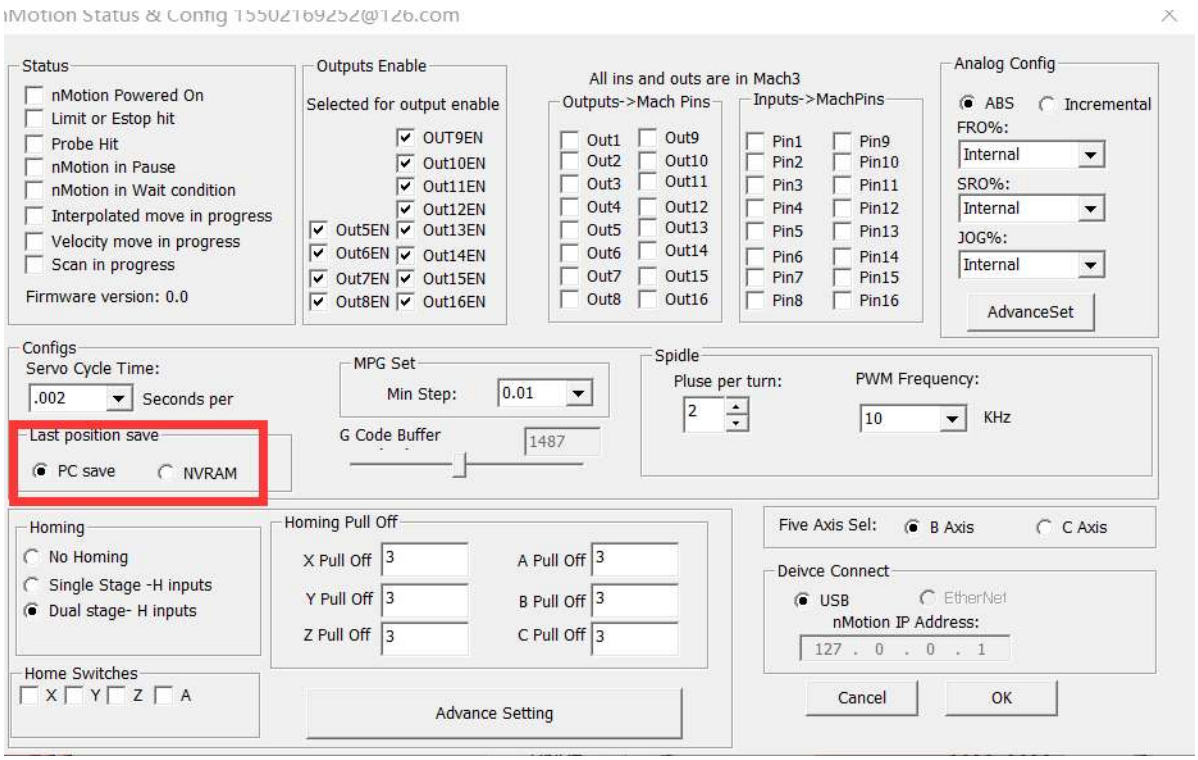


If you want to use the BSEL pin to select C Axis ,you can set the config like this below.

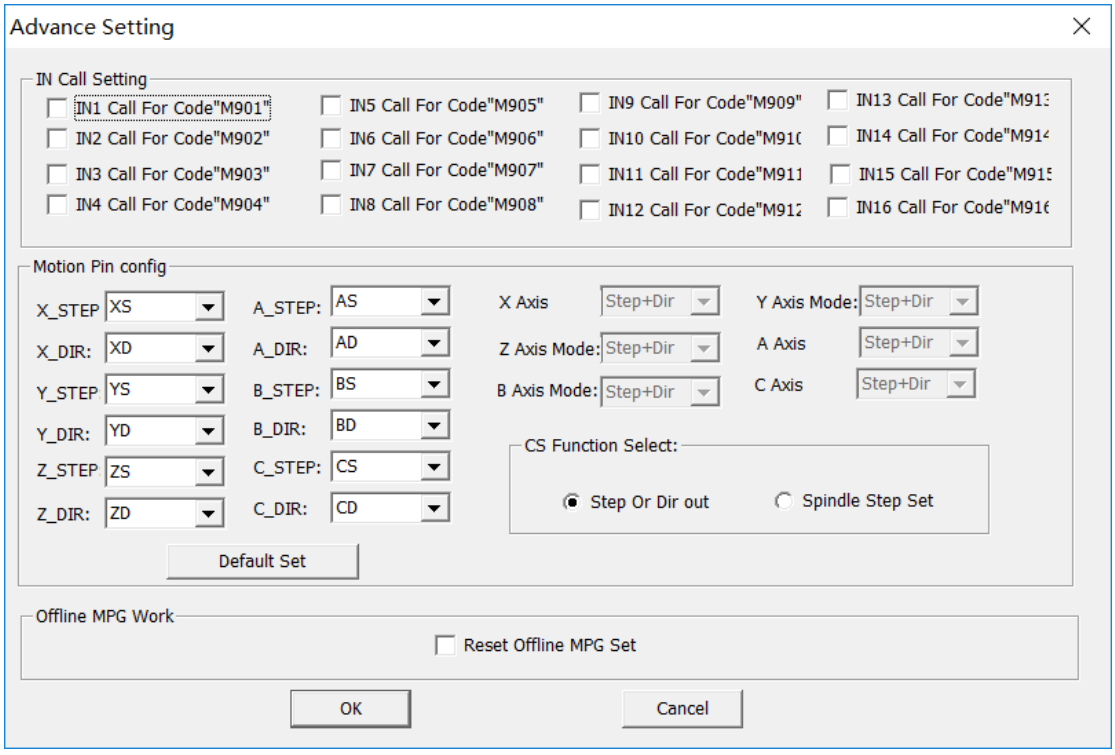


● Using NVRAM

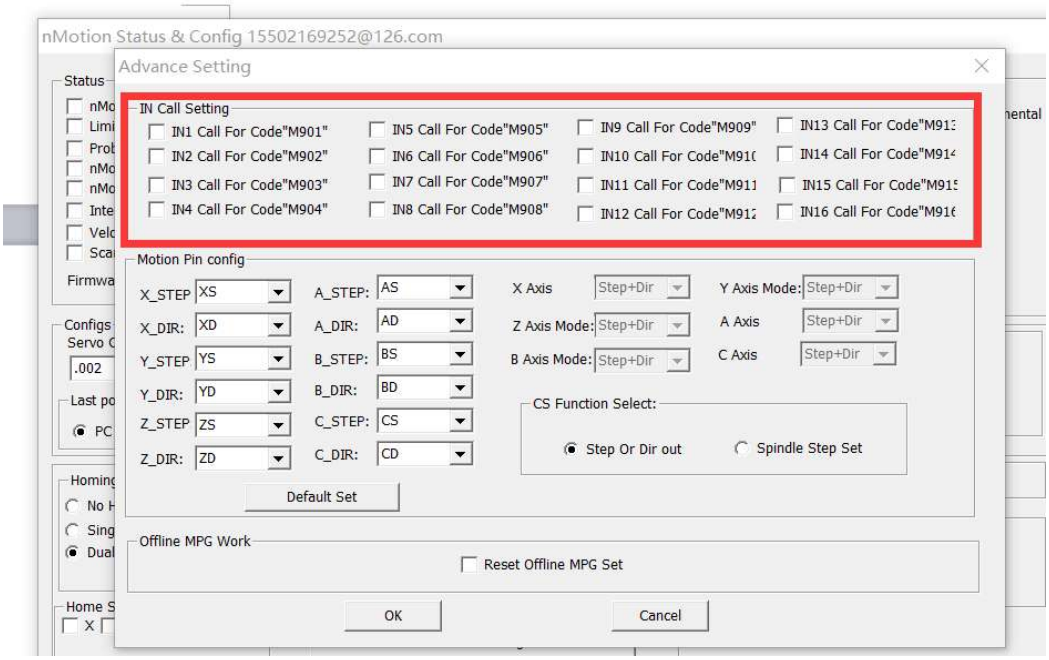
Select “PC save”, the position is saved in PC ,and Select”NVRAM”, the Mechanical position saved in NVRAM.



● Advance Setting

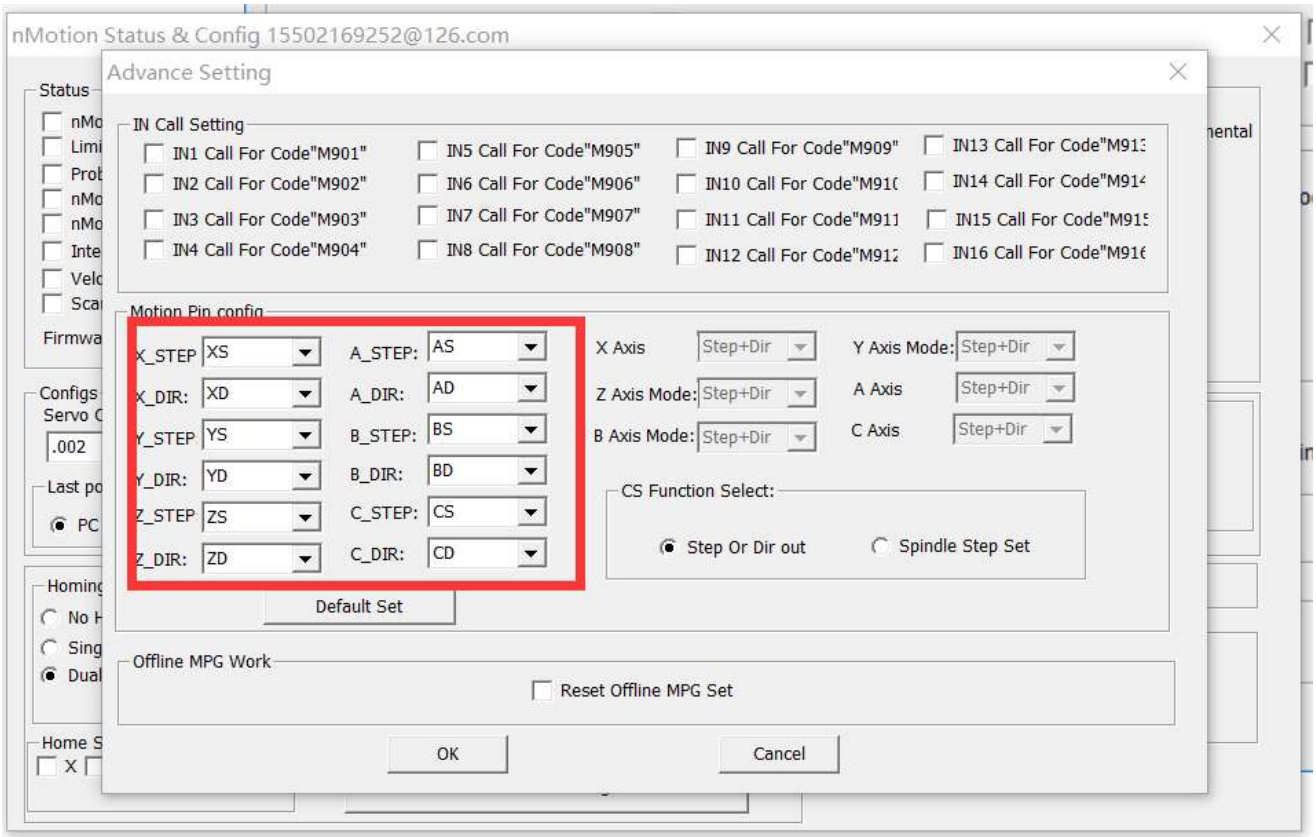


1.use INPUT pin to call a M Code run:(this only work when mach3 is in stop statue),M901~M916 is write by your self.



2. change the STEP and DIR pin order

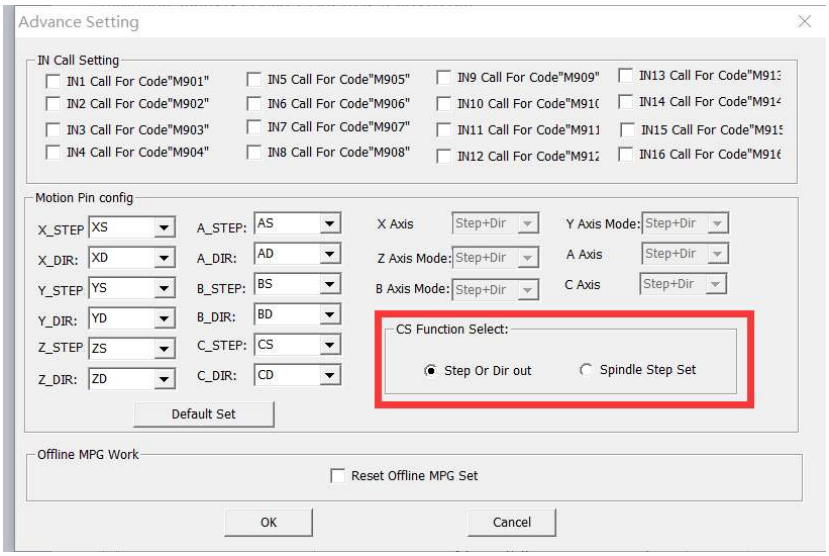
You can change the X axis step to any pin of XS, XD, YS.....CS, CD. Use this configure function.



3.change CS pin function

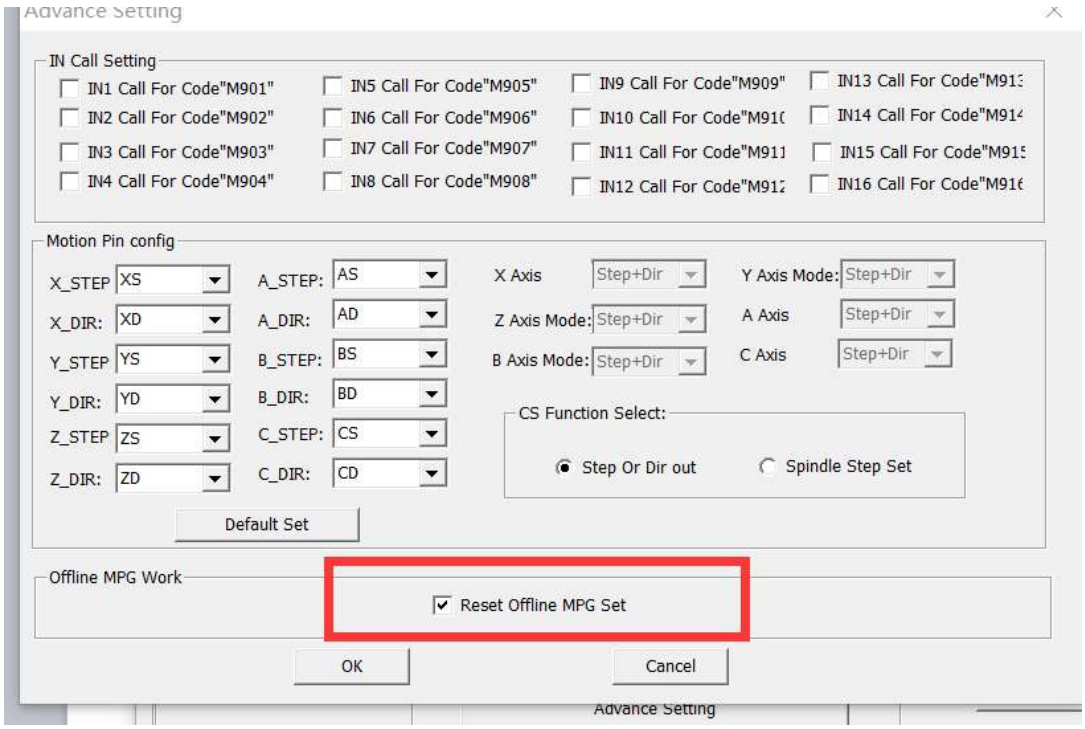
CS pin of step and dir prot can set to Step or DIR out for Motion axis ,or as spindle step out.

If you use a servo as spindle .

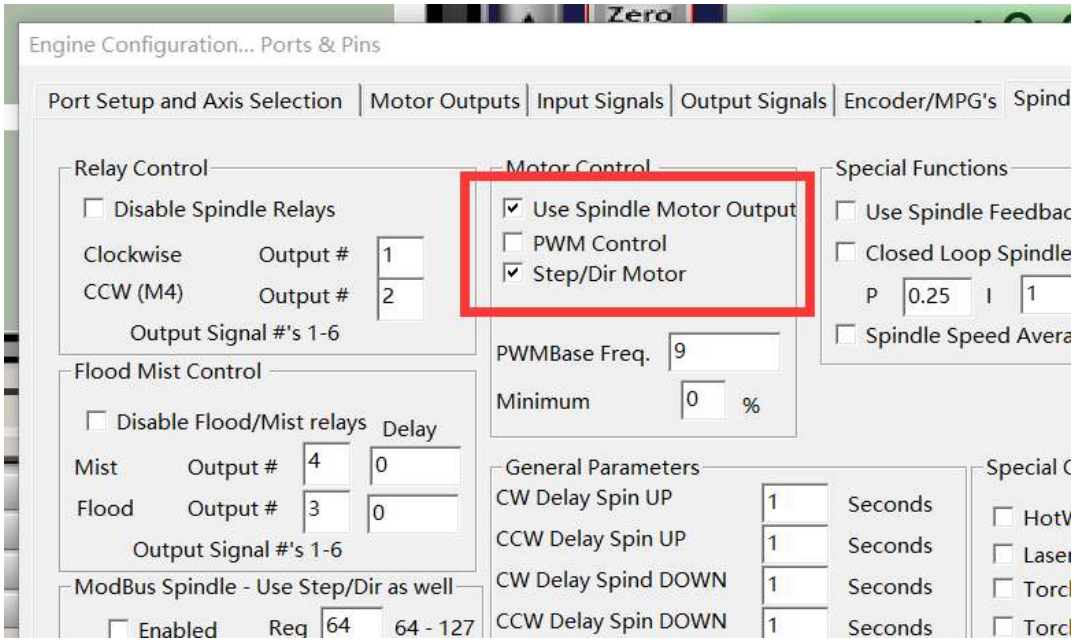


4. offline MPG work function

If you want to use MPG to control machine to move with out start the computer, you can use this function , set all the configure as your machine work, and then, select the function, press “OK” button, some data will write to nMotion card. and then the nest time , you no need to open the computer, you can also use MPG to move axis. This can only work when your MPG ESTOP button was press down, or your MPG have no ESTOP button.



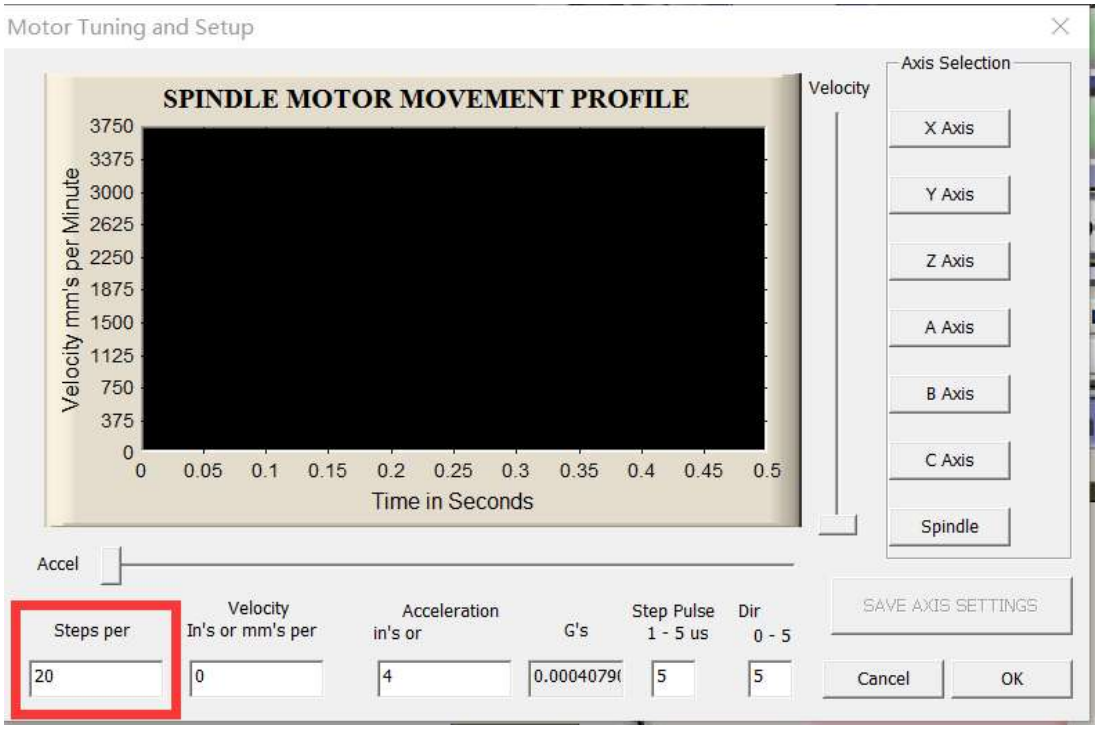
5. nMotion CNC controller support Step/Dir Motor as spindle.



When you select to use Step/dir Motor like this above, the spindle speed control by step speed, if CS function is not set to spindle mode, '09' will be the step pin for spindle, '010' will be the direction of spindle.

And us ‘CS’ function as Spindle mode, ‘CS’ will be the step pin for spindle. ‘CD’ will be the Dir pin for spindle.

Spindle motor configure as below,



"Step per" refers to the number of pulses required for each rotation of the spindle. This is different form X, Y, Z or A, B, C axis. And Acceleration of spindle also need to set.