Mach3 USB Card Installation Manual

Ver1.17

Features:

- Fully supporting all Mach3 versions, including the Mach3 R3.042.040 version.

- Supporting Windows series, including Windows2000/XP/Vista/Windows7.

- No need to install any USB drivers,it can be used aftr plugging in the computer.

- Full support for USB hot-swappable, the card is Monitoring USB connection status at any time.

- Fully suypporting Mach3 software limitation and backlash functions.

- Maximum step-pulse frequency is 200KHz,which is suitable for the servo or stepping motor.

- Status indicator LED can be useful to show the USB connection, and working stauts by flashing.

- 16 general-purpose input, with particular indicators, the input signal states can clearly shows.

- Feed rate, spindle speed rate, or jog rate can by controlled by the adjustment-knob.

- With on-board isolated power supply, external power supply is not requested. Simplifying power requirements of electronic control system for easy using. in addition, external power can also be applied for reduce USB load.

- 10 high-speed optocouplers whth 10MHz, 24 general optocouplers for isolating all of the input/ output signals, this high-cost dsign can be porvided high performance and stable system.

- With a real-time speed chart and spindle speed changes can be observed

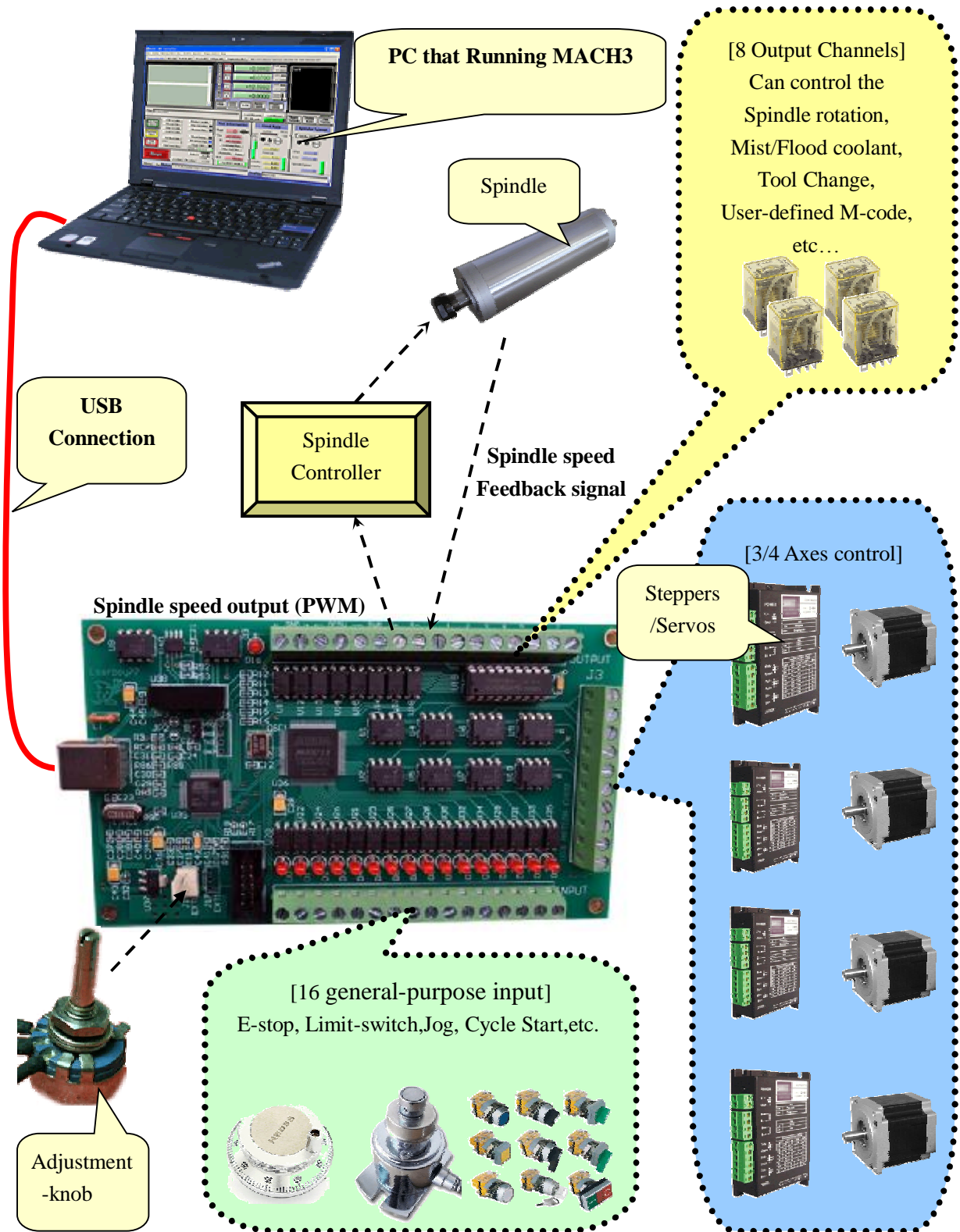PDF 文件使用 "pdfFactory Pro" 试用版本创建 www.fineprint.cn

Contents

Basic connection diagram (an Overview)

PC that Running MACH3

Spindle

[8 Output Channels]
Can control the
Spindle rotation,
Mist/Flood coolant,
Tool Change,
User-defined M-code,
etc…

USB Connection

Spindle Controller

Spindle speed Feedback signal

Spindle speed output (PWM)

[3/4 Axes control]

Steppers /Servos

[16 general-purpose input]
E-stop, Limit-switch,Jog, Cycle Start,etc.

Adjustment -knob

3

Mechanical dimensions diagram
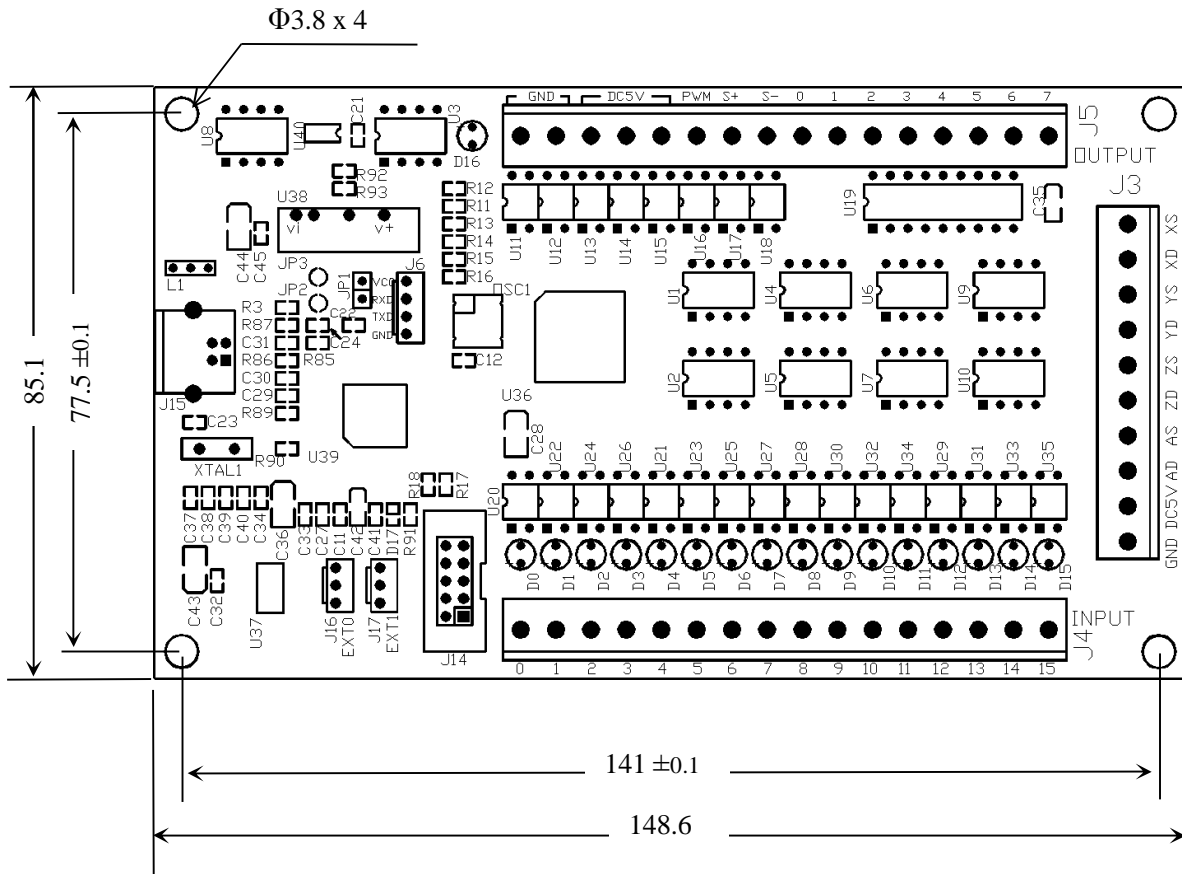
1. Prepare

1.1 Prepare Mach3 software

This card is a Mach3 USB interface 3/4 axes external motion card。

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

Mach3 download: as shown below:

Home | Downloads ˅ | Purchase | Support ˅ | Resources ˅

Downloads

For previous versions of Mach and LazyCam, XML's, and other Extra Information: Click Here

(Some of the older files are linked directly from the FTP server in order to avoid redundancy. If your download does not start immediately, please give it a few seconds - it's probably trying to contact/login to the FTP server.)

Mach

Mach3 is the flagship of the ArtSoft products. It is released in two versions: a Lockdown version, and a Development version. The Lockdown is a stable, static release recommended for new users, or people trialing the software. The Development version contains developing features and is released quite often so people can obtain new (but untested) features and capabilities. Both releases are limited to 500 lines of Gcode until licensed. Mach3 has a limit of 10,000,000 lines of Gcode even after licensing.

You must use a Desktop PC running a 32-bit version of Windows if you are using the Mach3 Parallel Port Driver. Laptops are not supported because the power saving features of the chipsets disrupt the pulse stream. Mach3 will only be supported on laptops running an external motion controller, such as one of those found on the Plugins page.
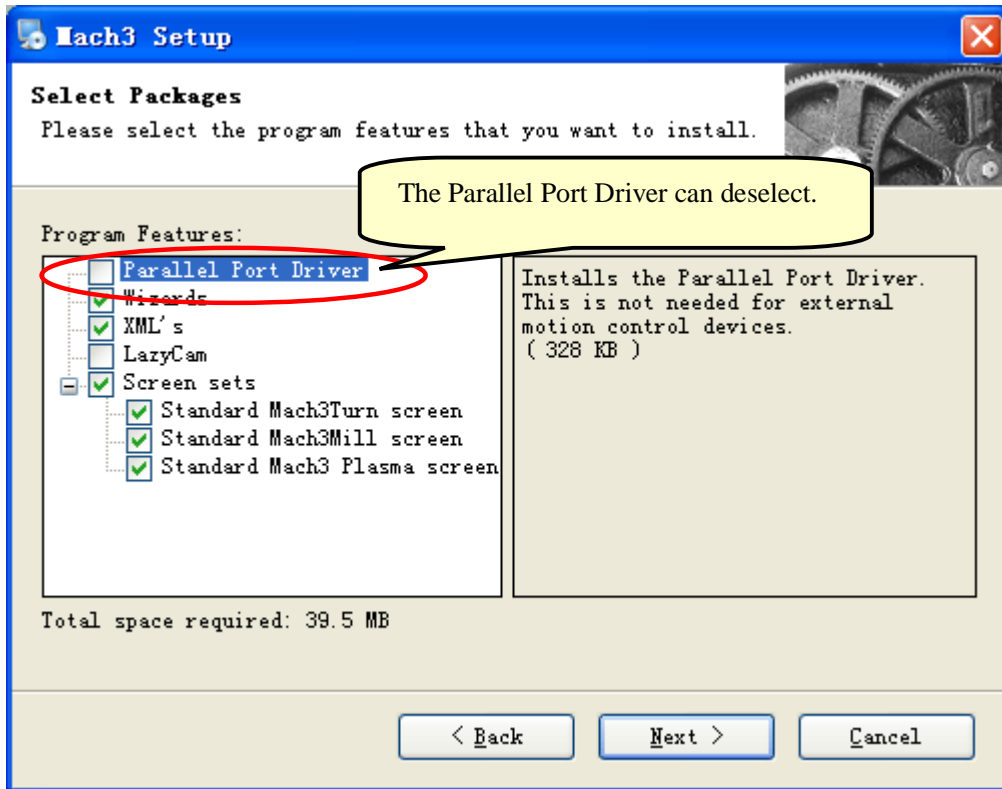
Lockdown:

Mach3 R3.042.040

Mach3 Changelog

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Installation the Mach3:

The Parallel Port Driver does not require.

Mach3 Setup

Select Packages
Please select the program features that you want to install.

The Parallel Port Driver can deselect.

Program Features:

- ☐ Parallel Port Driver
- ☑ Wizards
- ☑ XML's
- ☐ LazyCam
- ☑ Screen sets
  - ☑ Standard Mach3Turn screen
  - ☑ Standard Mach3Mill screen
  - ☑ Standard Mach3 Plasma screen

Installs the Parallel Port Driver.
This is not needed for external
motion control devices.
(328 KB)

Total space required: 39.5 MB

[< Back]   [Next >]   [Cancel]

1.2　USB cable Prepare

Magnet ring installed in the USB cable at both ends
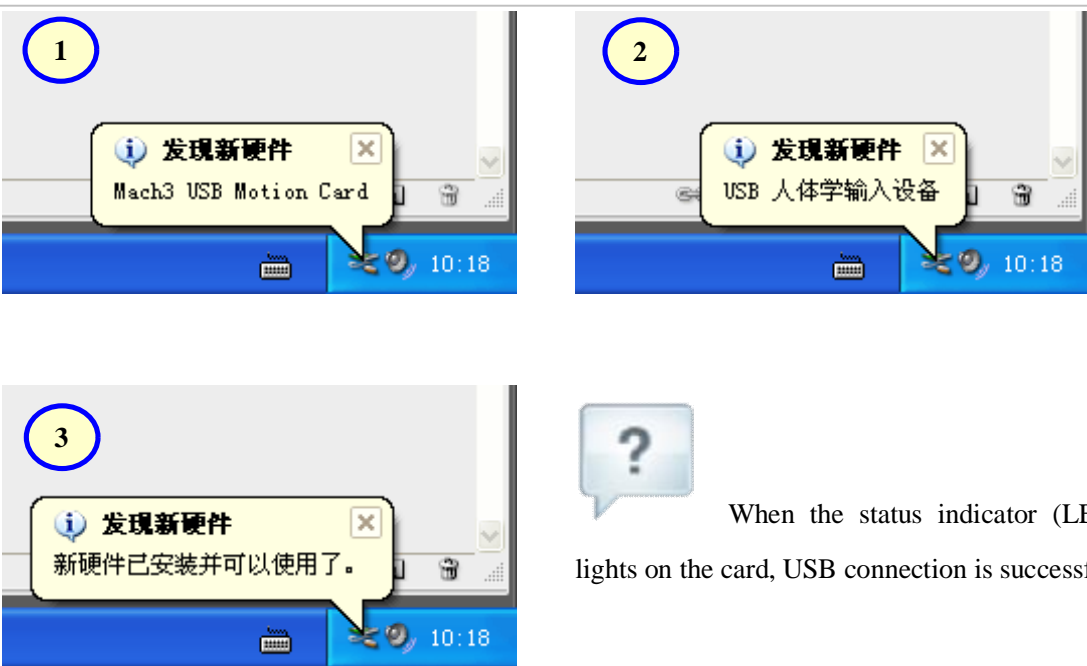
Attention

Use of acceptable quality USB cable

1.3　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.

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

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

1.3.1   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(usbmove.zip) in http://leafboy77.com/
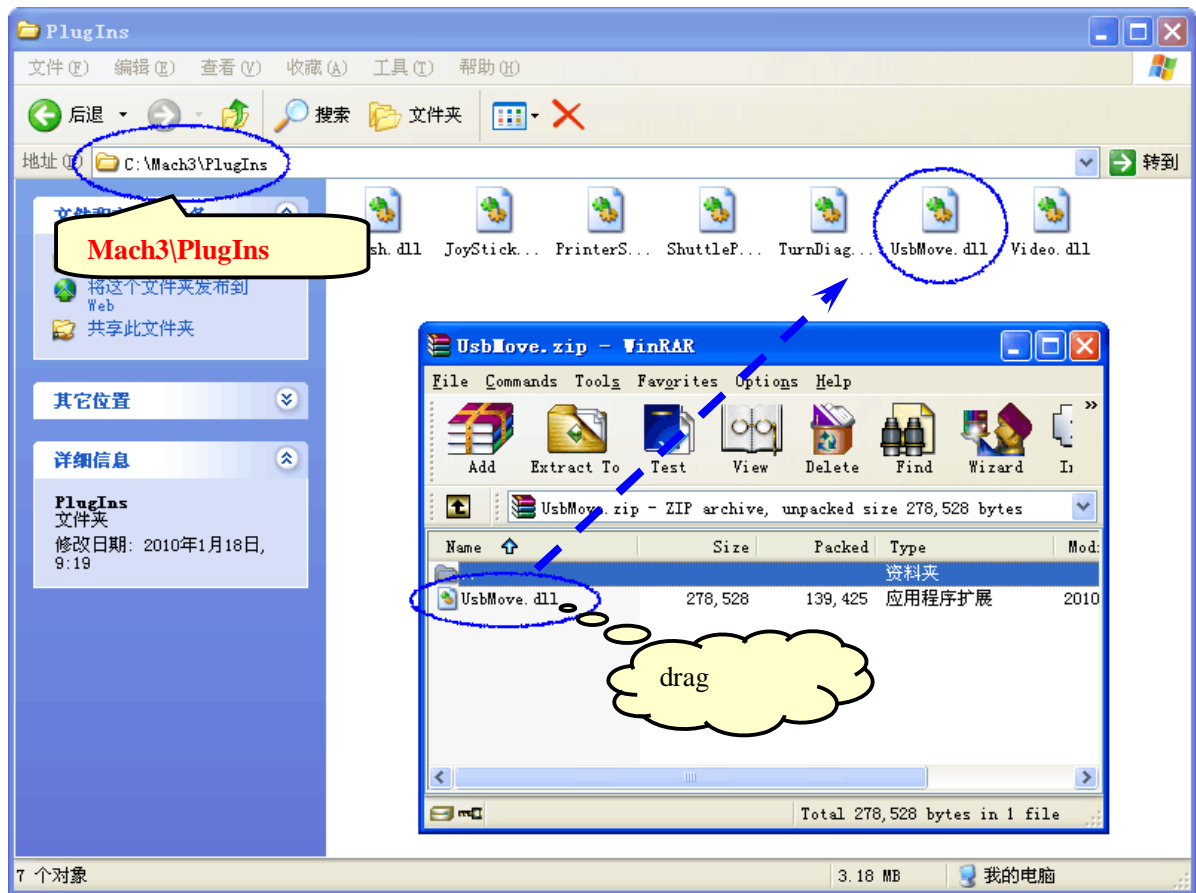
1.3.2   Start the Mach3 software, a dialogueof "Motion Control Hardware PlugIn sensed!!"is shown. Please select the "Mach3-USB-Motion-Card", you can also check"Don't ask me this again".
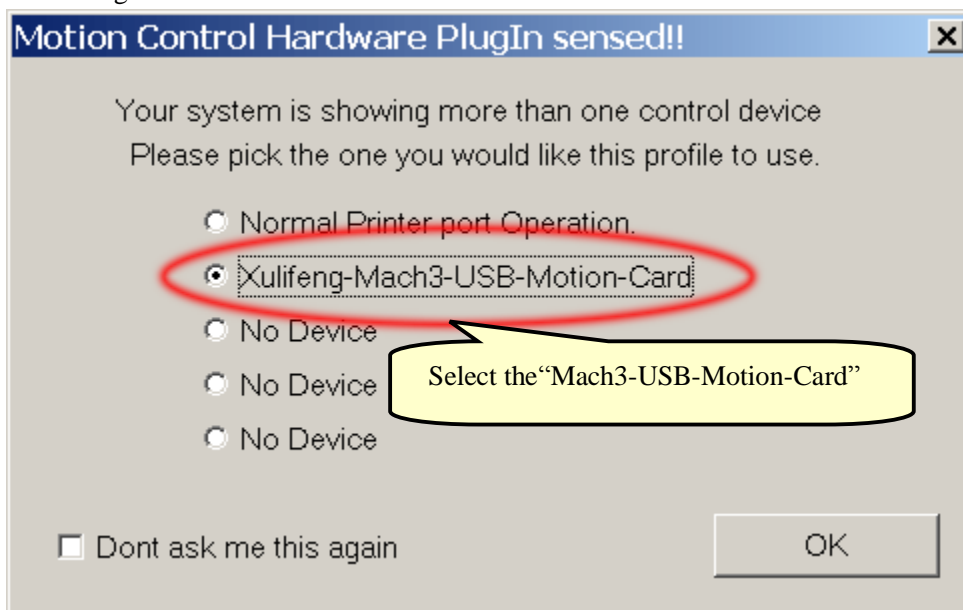
When the Mach3 is connecting with the card, the Status indicator (LED on the card) is flashing.

8

2. **Setup for Mach3**

1.1   Mach3 X、Y、Z、A Axis config as shown below: (Config => Ports and Pins)

2.2 Motor tuning setup as shown below: (Config => Motor Tuning)

2.3   The Mach3 Menu   => Config   => Homing/Limits dialog

Axes direction, depends on the "Reversed".

Axes direction:
Depends on "√" or "X"
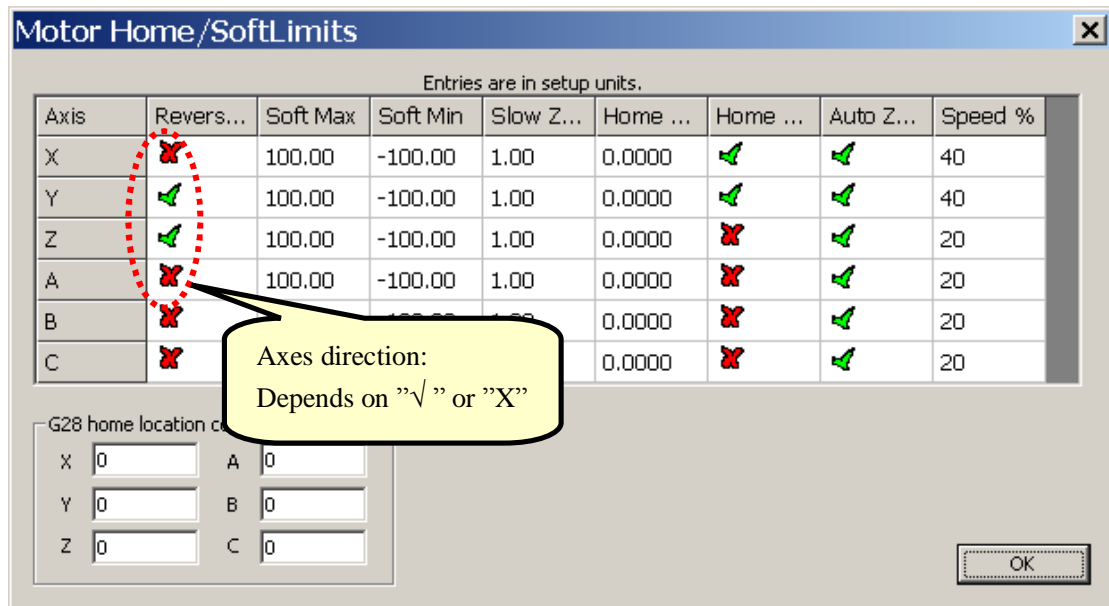
2.4 Setup the input singles.

There are 16 general-purpose input channels. The channels number is from 0 to 15(at J4).
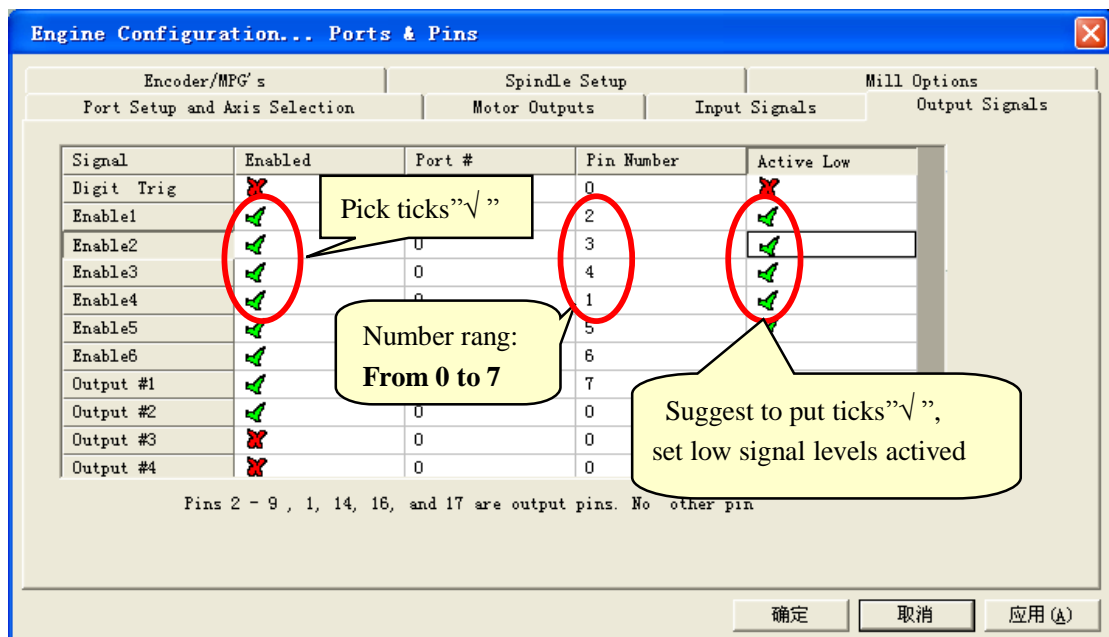
Suggest Active Low ="X" (Set High signal Level for Inputs)
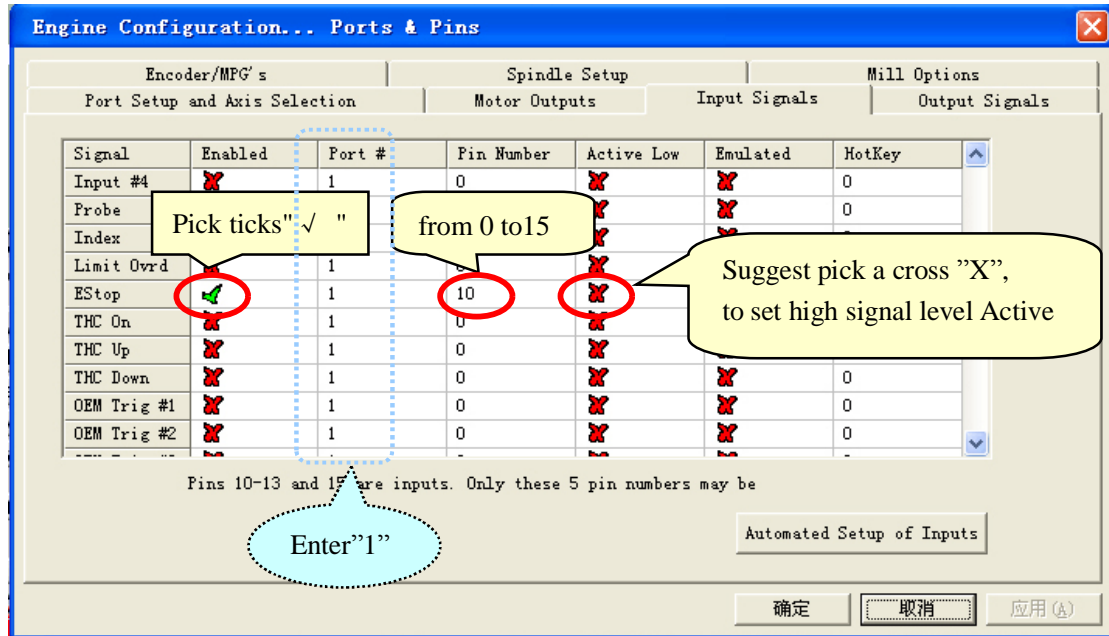
2.5 Setup the Output signals.

There are 8 general-purpose (open-drain) output channels,

The channels number is from 0 to 7 (at J5).

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

3. Setup motion card Hardware

The board is used USB power source, with isolated power source module, external power supply is not requested.

All outputs, including 4 axes pulse/DIR/8 output controls/Spindle-speed PWM output, are set to be high-impedancestate (Hi-Z) when USB is connected. When running Mach3, Level is controlled by Mach3.

Suggest: All output signals in Mach3 can be set to be Active Low.

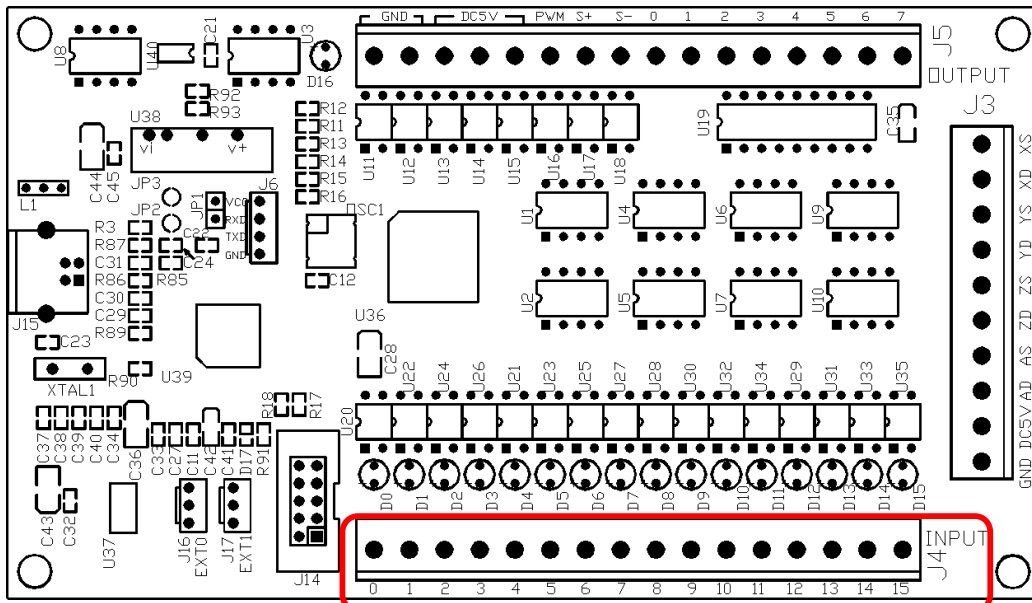3.1   4 axis output signals, please refer to J3signals indicating.
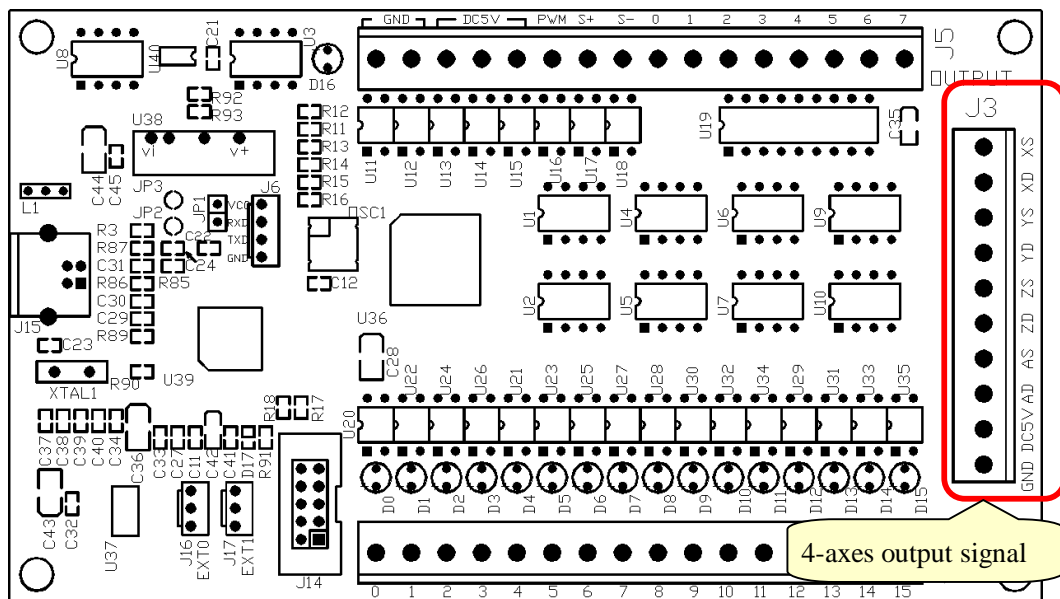
4-axes and Spindle PWM outputs

Schematic

6N137
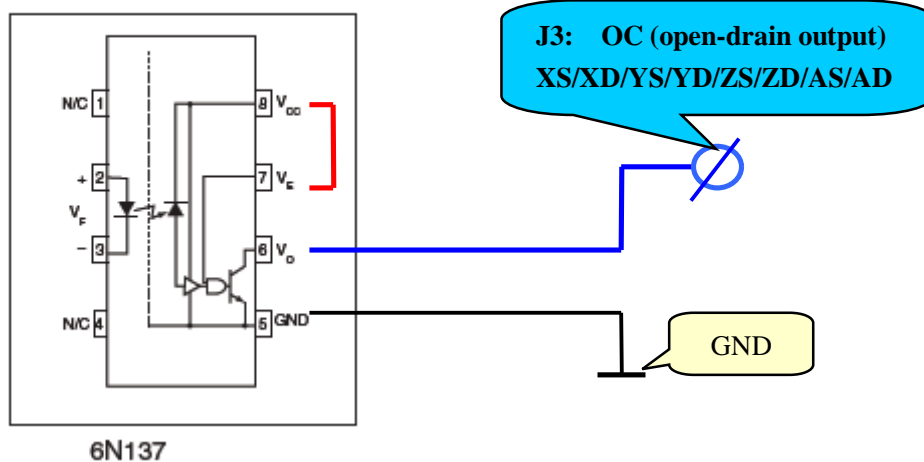
3.2   16 general-inputs, input valtage 5V(current:7mA). Wired on J4.
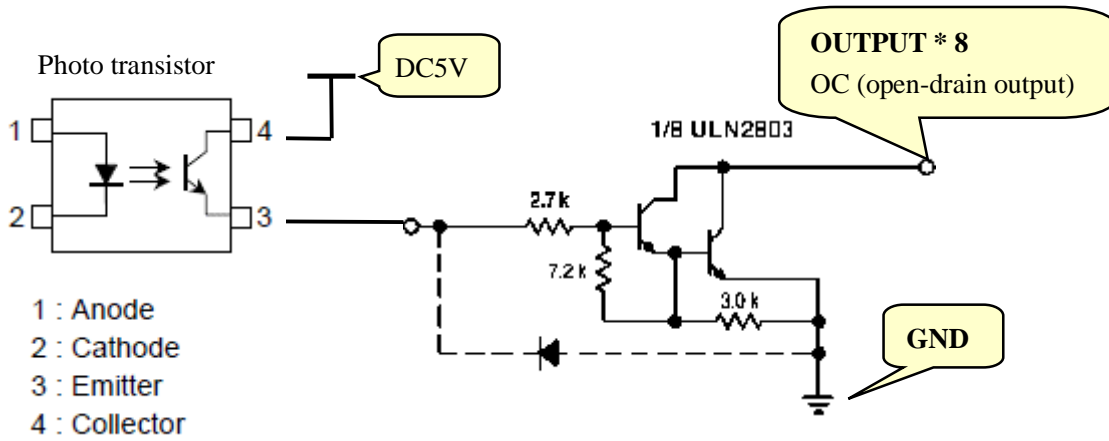
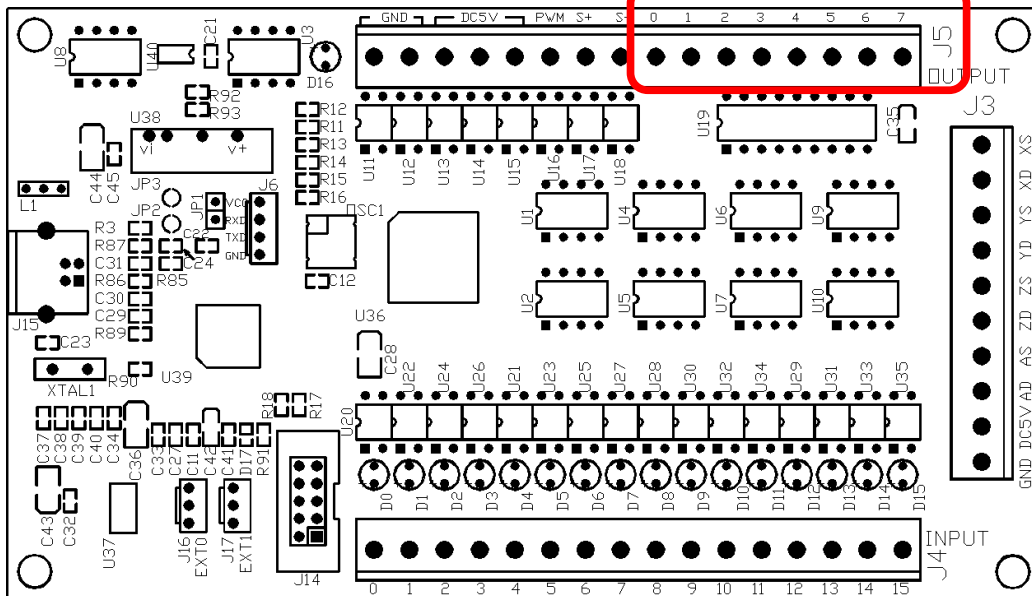16 general-inputs, 330Ω resistor onboard

16-general-inputs Schematic

INPUT * 16

330

USB Motion card:
330 Ω resistor+LED

GND

Photo transistor

1 : Anode
2 : Cathode
3 : Emitter
4 : Collector

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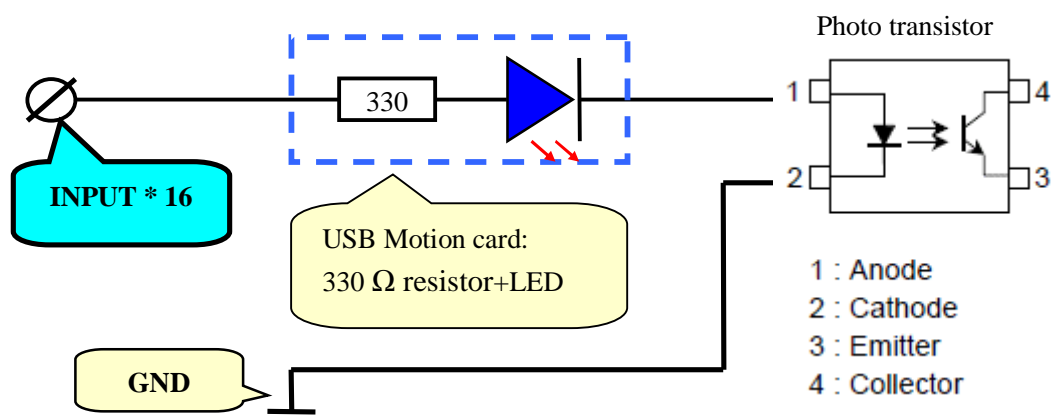
3.3   8 general-outputs, wiring of the **0、1、2、3、4、5、6、7 on J5.**

Maximum Load voltage=24V / current=500mA, When output Low (turn on),

otherwise the output is high-impedancestate (Hi-Z).

Photo transistor

DC5V

OUTPUT * 8
OC (open-drain output)

1/8 ULN2803

2.7k

7.2k

3.0k

GND

1 : Anode
2 : Cathode
3 : Emitter
4 : Collector

8 general-outputs, wiring of the 0、1、2、3、4、5、6、7 on J5.

4 Motion card connection Table

4.1 4-axes

J3

GND	DC5V	AD	AS	ZD	ZS	YD	YS	XD	XS

Pin Name	Function	Electrical	Description
GND	GND	GND	Signal Ground
DC5V	5V DC Output	Max=120mA	On-board isolated power module output
AD	A Direction	OC，12V/13mA	A axis Direction Signal
AS	A Stepping	OC，12V/13mA	A axis Stepping (Pulse) Signal
ZD	Z Direction	OC，12V/13mA	Z axis Direction Signal
ZS	Z Stepping	OC，12V/13mA	Z axis Stepping (Pulse) Signal
YD	Y Direction	OC，12V/13mA	Y axis Direction Signal
YS	Y Stepping	OC，12V/13mA	Y axis Stepping (Pulse) Signal
XD	X Direction	OC，12V/13mA	X axis Direction Signal
XS	X Stepping	OC，12V/13mA	X axis Stepping (Pulse) Signal

4.2 16-Inputs

J4

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pin number	Function	Electrical	Description
0	General-purpose Input / MPG Input	5V Max:7mA	general-purpose "0","1" Input / or Manual Pulse Generator (AB) Input
1			
2	General-purpose Input		Functions are set by Mach3 "Config"=>"Ports and Pins" =>"Input Signals"
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

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4.3 Output

J5

GND	GND	DC5V	DC5V	DC5V	PWM	S+	S-	0	1	2	3	4	5	6	7

Pin Name	Function	Electrical	Description
GND	GND	GND	Signal Ground
GND			
DC5V	5V DC output	Max=120mA	On-board isolated power module output
DC5V			
DC5V			
PWM	Pulse-Width Modulation	OC，12V/13mA	Spindle speed Control (Output)
S+	LED Positive input	6mA	Spindle speed Measure (Input)
S-	LED Negative input		
0	8 general-purpose (open-drain) output channels	Max=24V /500mA OC (open-drain)	Functions are set by Mach3 "Config"=>"Ports and Pins" => "Output Signals"
1			
2			
3			
4			
5			
6			
7			

Note:
1. "DC5V" is on-board isolated power module output. Voltage:5V, max current **120mA**.
2. " OC ": open-drain output

5 Motion card connection Diagram

5.1 X、Y、Z、A axes output. Optical power supply: Internal(on board) or External.

5.1.1 Using Internal(on board) power supply to drive.

Please install suitable resistance according to your setpping/servo driver need.

A axis driver

Z axis driver

Y axis driver

P+   D+   P-   D-

Optocoupler inside driver

X axis driver

Resistor inside dirver

Pluse+	Dir+	Pluse-	Dir-
P+	D+	P-	D-

Refer to:
J3

X => XS,XD
Y => YS,YD
Z => ZS,ZD
A => AS,AD

DC5V
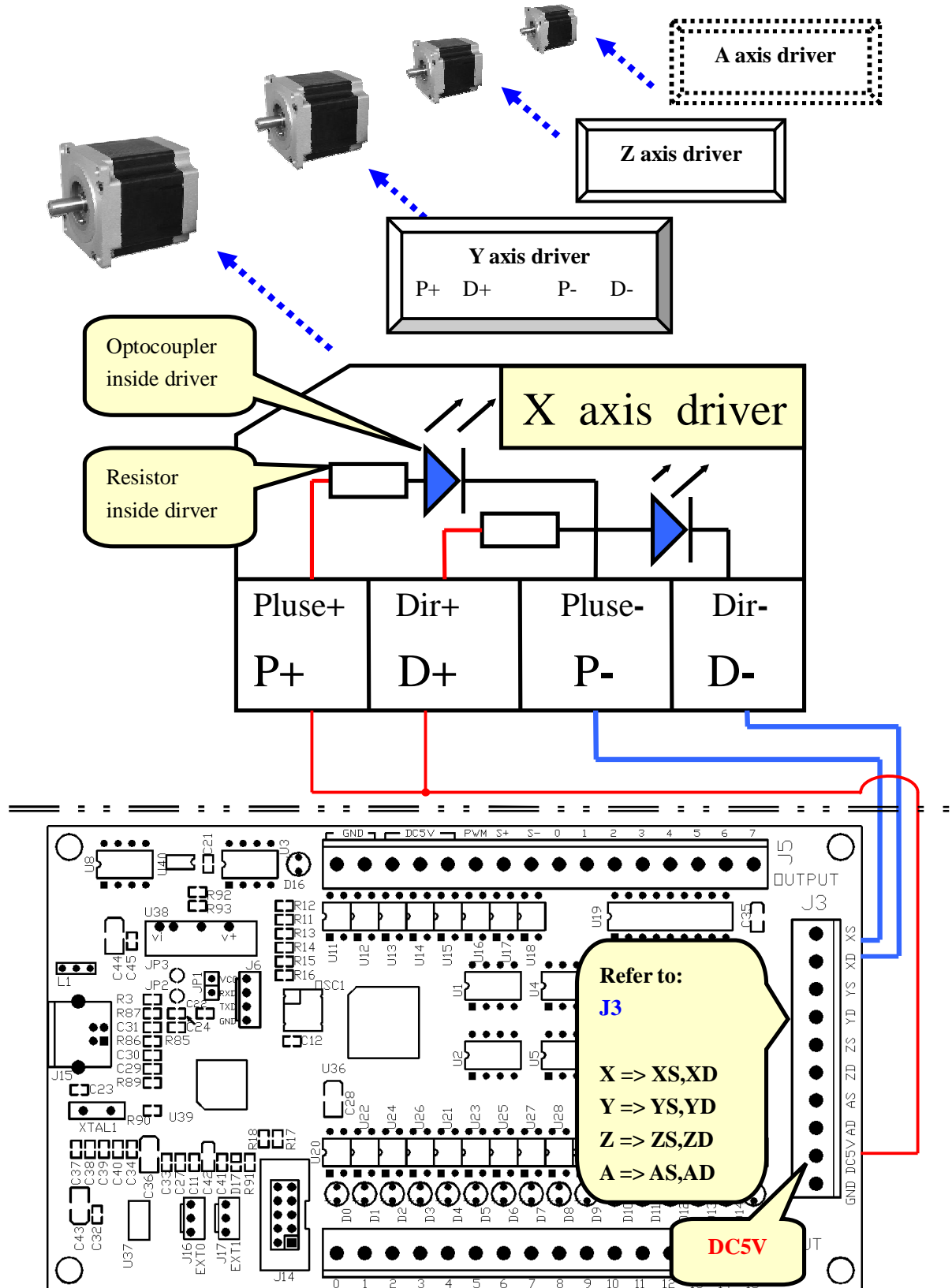
5.1.2 Using External power supply to drive.
Please install suitable resistance according to your setpping/servo driver need.

A axis driver

Z axis driver

Y axis driver

Optocoupler
inside driver

X axis driver

Resistor
inside dirver

Pluse+	Dir+	Pluse-	Dir-
P+	D+	P-	D-

5V
External power supply

+

参见：
J3 接线表

X 轴接 XS、XD
Y 轴接 YS、YD
Z 轴接 ZS、ZD
A 轴接 AS、AD

GND
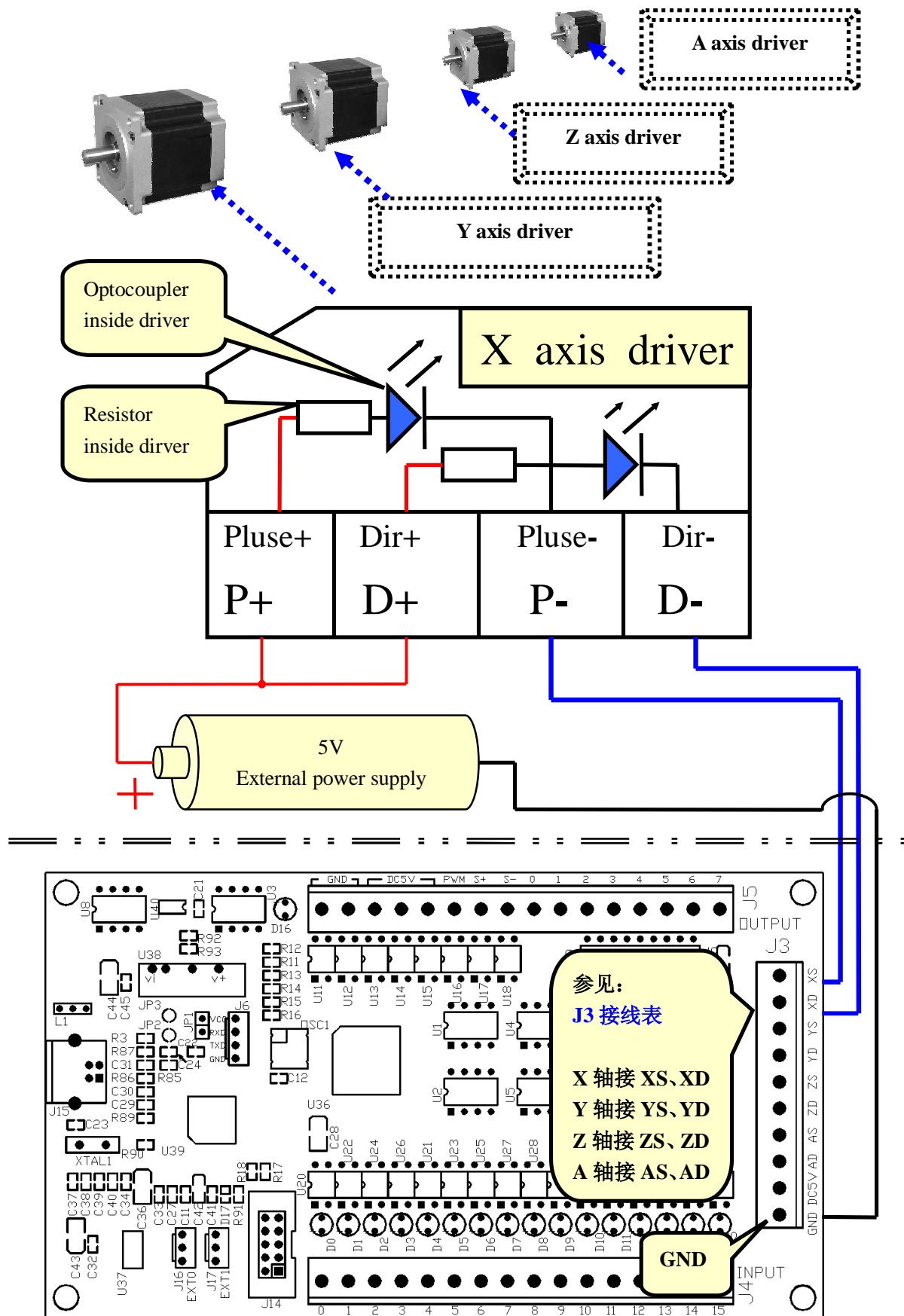
5.2 Input Channels:

There are two methods of voltage power supply: Internal or External

5.2.1 Internal voltage power supply

5V / 7mA per each input channel

DC5V
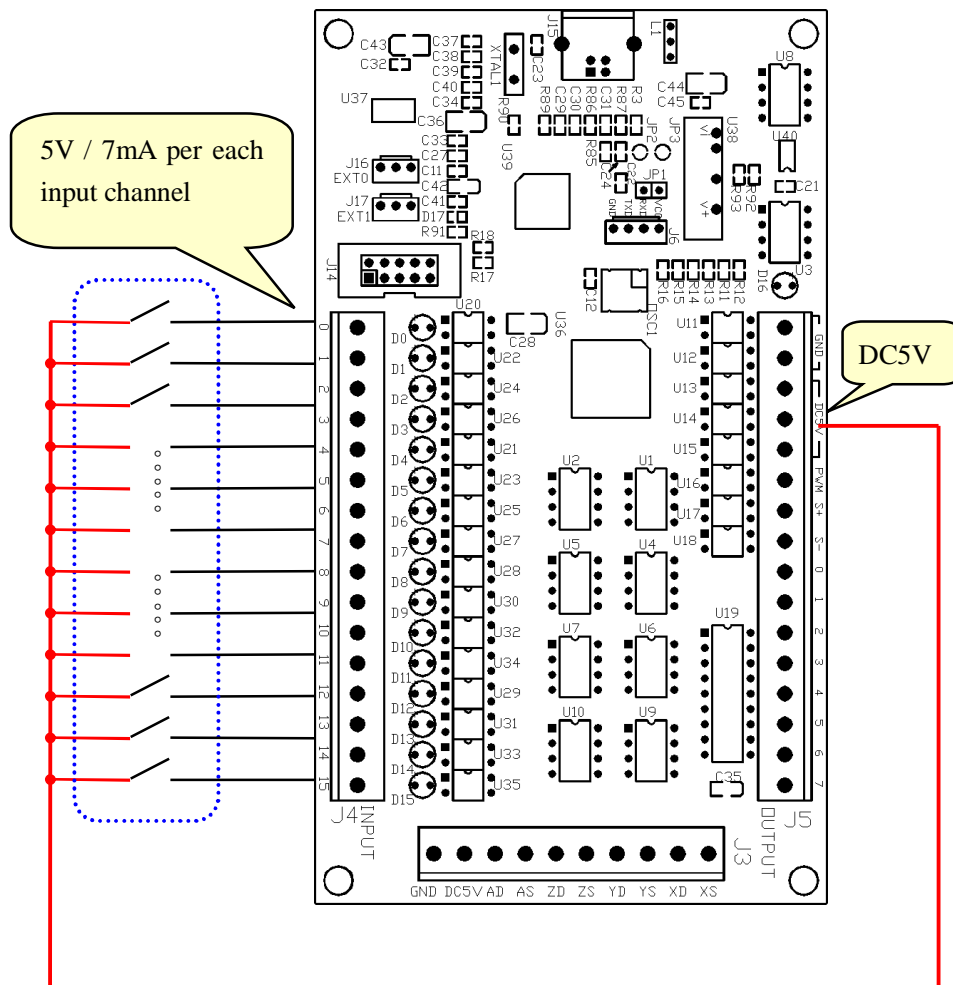
5.2.2 External voltage power supply for input.

If external power voltage is over 5V, a resistor must be installed.

5V / 7mA per each input channel

5-24V Ext-POWER

GND COM
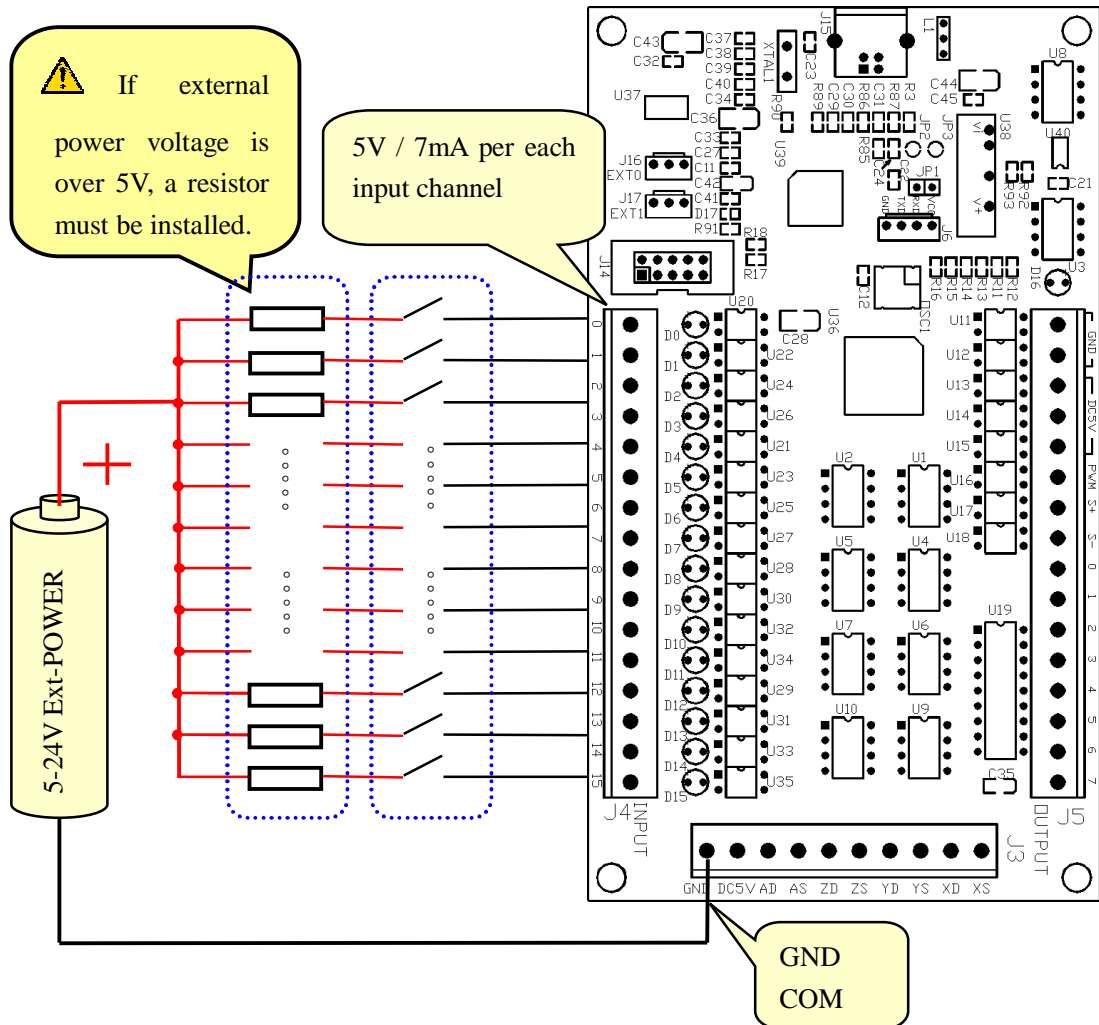
ATTENTION：

If the external power voltage is over 5V, a resistor must be installed between the power source and each input channel!

For the external power voltage is 24V, 3K Ω resistor must be used,

And for the external power voltage is 12V, 1.5K Ω resistor must be used,

5.3 Sensor's wiring and setting

5.3.1   PNP sensor

⚠️ Use the external power supply for the sensor!

A resistor:
Input Max=7mA
24V：3.3KΩ
12V：1.5KΩ
5V：0 Ω

LED lights up when the sensor signal

Input #
"0"-"15"

GND:
Signal Ground

PNP SENSOR

+24V

OUT

GND

5-24V External Power supply

Mach3 Input Signals Setting

	Enabled	Port #	Pin Number	Active Low	Emulated	HotKey	
	✔	1	10	✘	✘	0	

Encoder/MPG's   Spindle Setup   Mill Options
Setup and Axis Selection   Motor Outputs   Input Signals   Output Signals

Pick ticks " √ "

From 0 to 15 according to the wiring

⚠️Suggest pick a cross "X" when using a PNP sensor

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5.3.1 NPN sensor

⚠ Use the external power supply for the sensor!

A resistor:
Input Max=7mA
24V：3.3KΩ
12V：1.5KΩ
5V： 330 Ω

the LED does not light when the sensor signal

Input #
"0"-"15"

NPN SENSOR

+24V

OUT

GND

5-24V External Power supply

GND:
Signal Ground

⚠
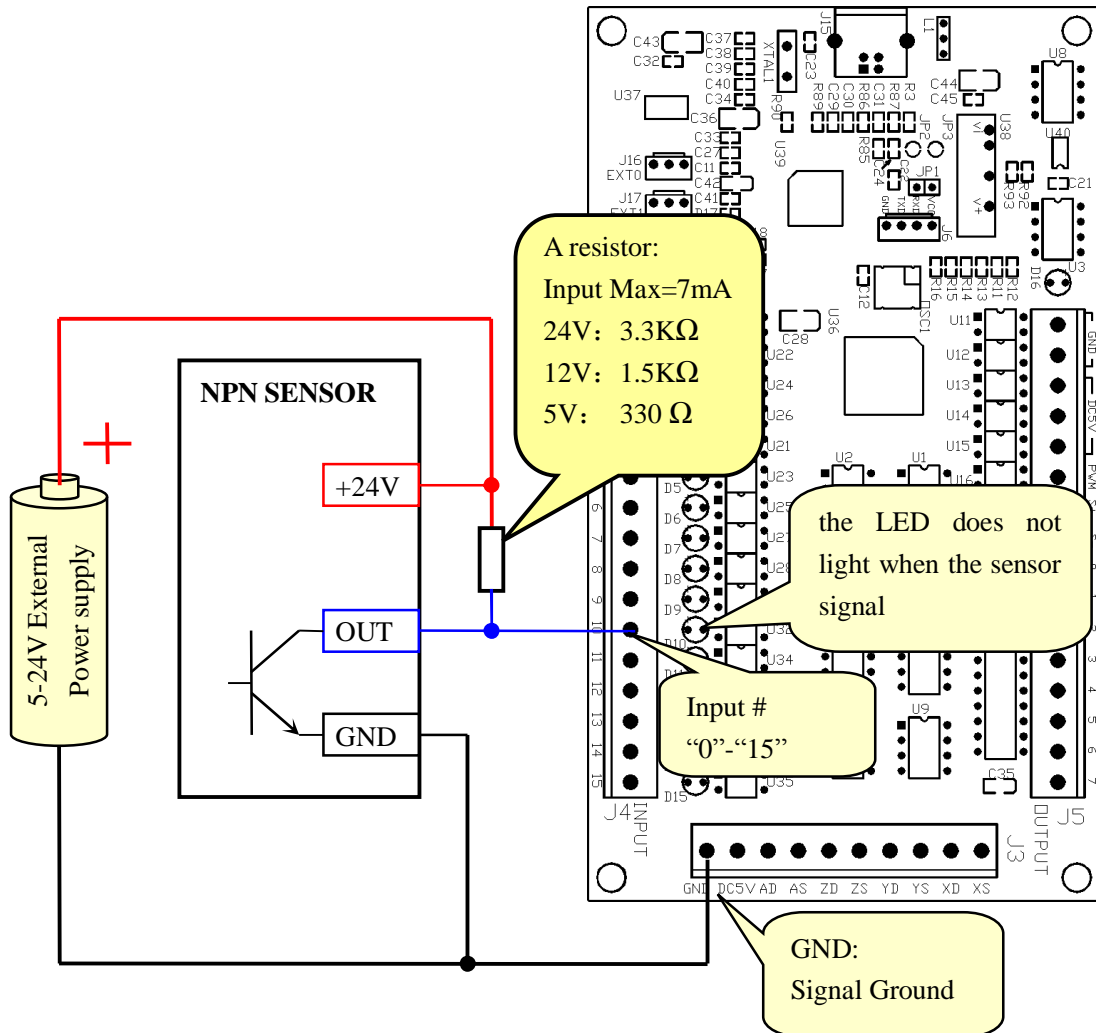
Mach3 Input Signals Setting

	Encoder/MPG's		Spindle Setup		Mill Options	
t Setup and Axis Selection			Motor Outputs	Input Signals	Output Signals	

al	Enabled	Port #	Pin Number	Active Low	Emulated	HotKey	
	✓	1	10	✓	✗	0	

Pick ticks " √ "

From 0 to 15 according to the wiring

⚠Suggest to put tick "√" when using a NPN sensor

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5.4 output: 8-general-outputs,

　　　Maximum Load voltage=24V / current=500mA, When output Low (turn on),

otherwise the output is high-impedancestate (Hi-Z).

| 5.4.1 | Drive LED with Internal(On-board) power |

When drive tiny current loads like LED, driver enable signal etc, internal (on-board) power supply can be used directly.
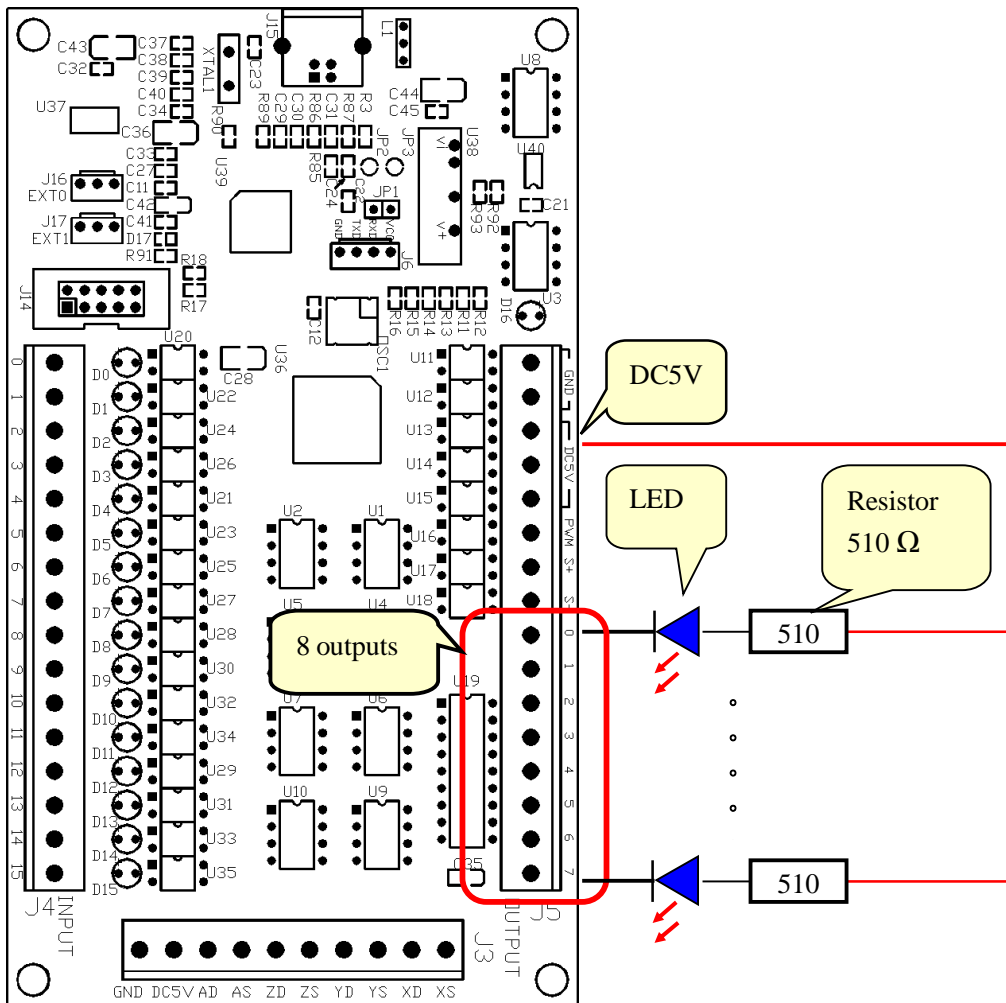
Drver high loading devices, must use external power supply

Diode must be installed for protection the electronic device. (1N4007 / 1N4148 / etc)
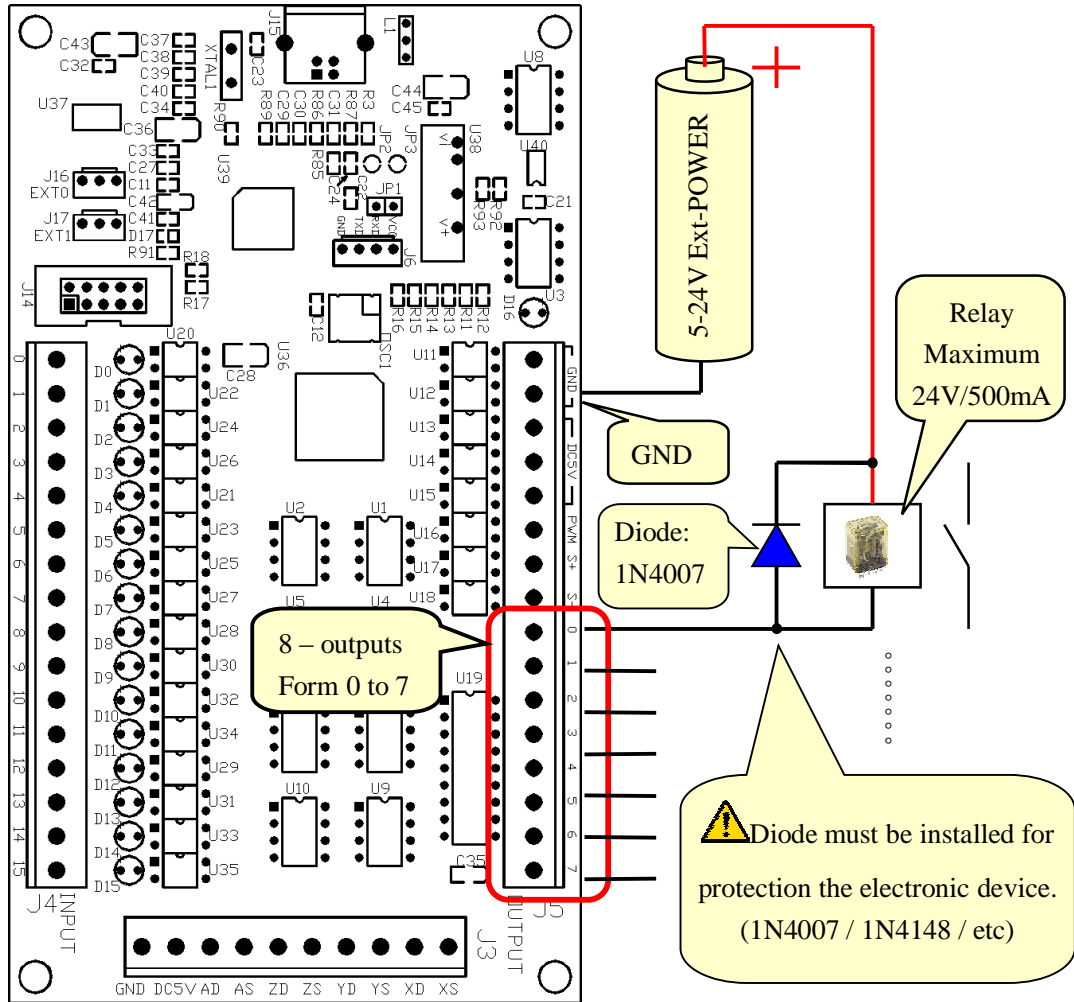
6 Adjustment-knob

6.1 Please complete the step in Chapter 1 (Prepare).

6.2 Connecting the adjustment-knob with the EXT0(J16) of USB Motion Card.

6.3 Go to "Config Plugins" under "Config" to go into "PlugIn Control and Activation".
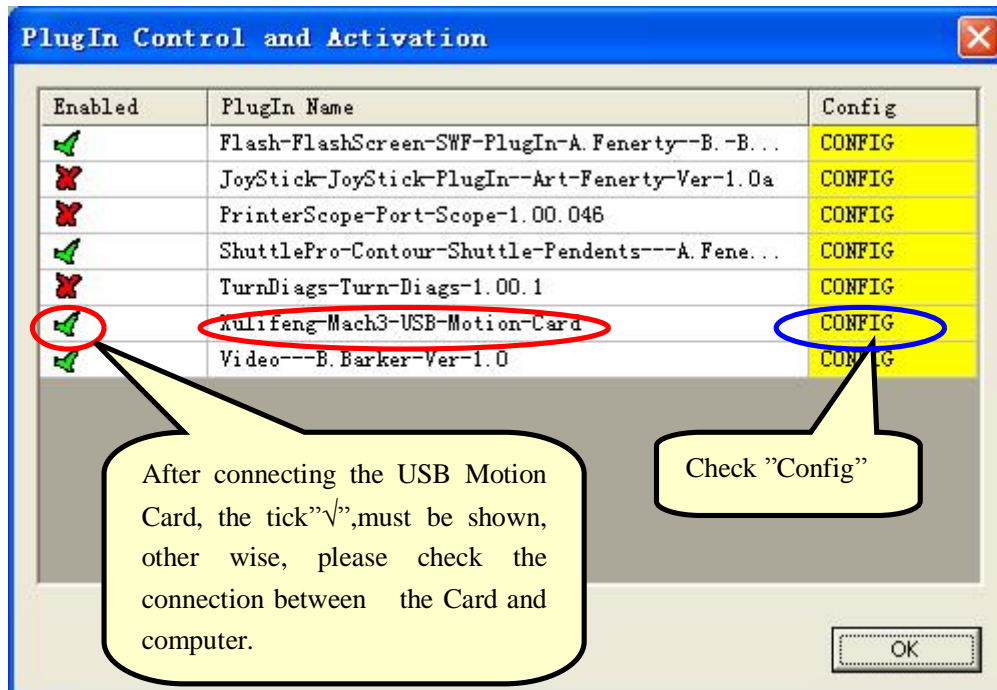
6.4 After check the "Config", USB Motion Card setting will be shown. You can select one of the functions which is able to controlled by the external knob. Please select "External 0" in your particular setting. Then, click "OK" to exit.
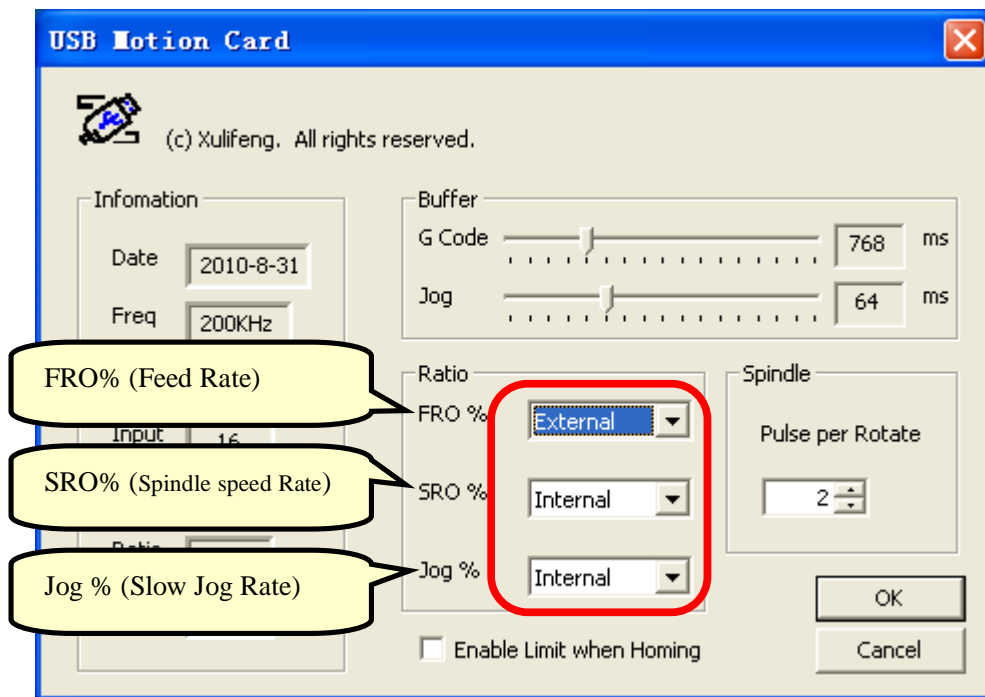
6.5 Now, you can try to turn the knob to adjust your selected function.
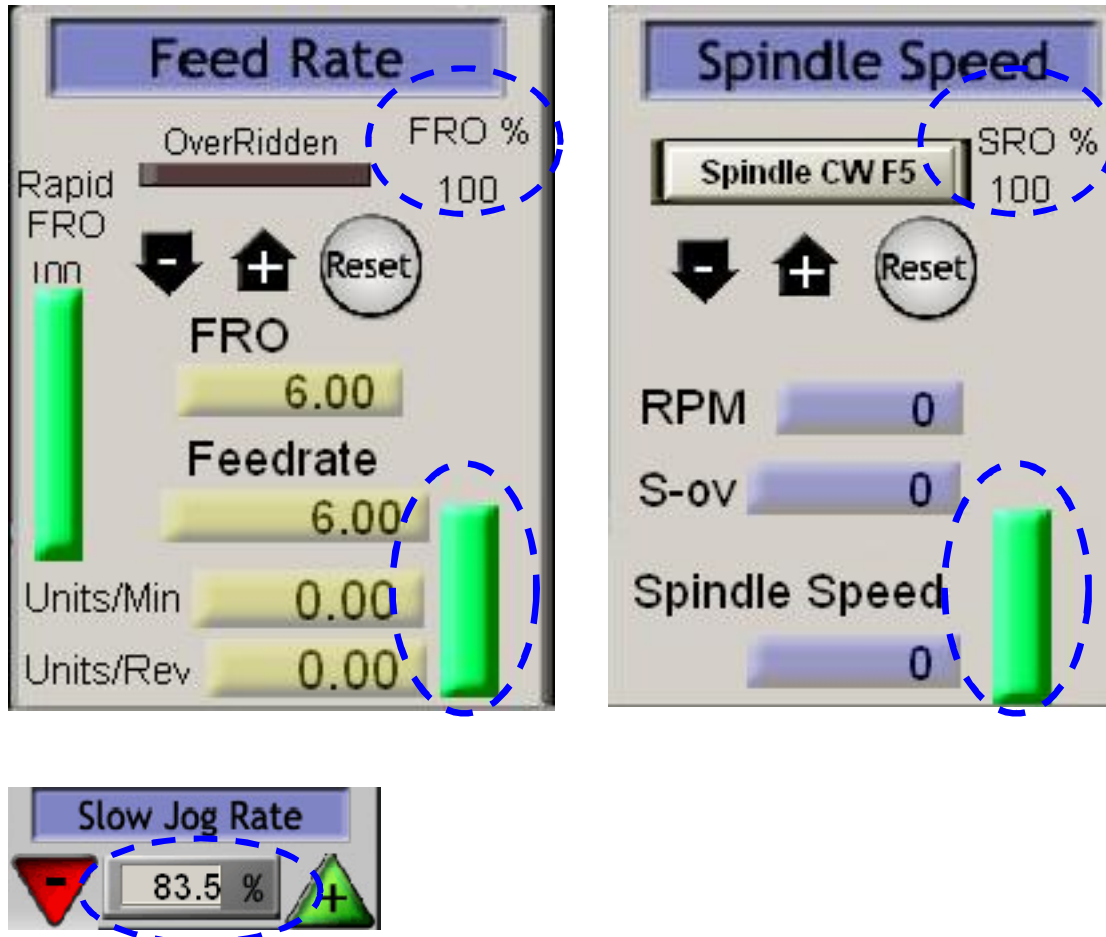
7 spindle speed output

7.1 software setting

7.1.1 find "Spindle Setup", choose "Use Spindle Motor Output"、"PWM Control"。
Write the frequency needed in PWMBase Freq. Unit is Hz.
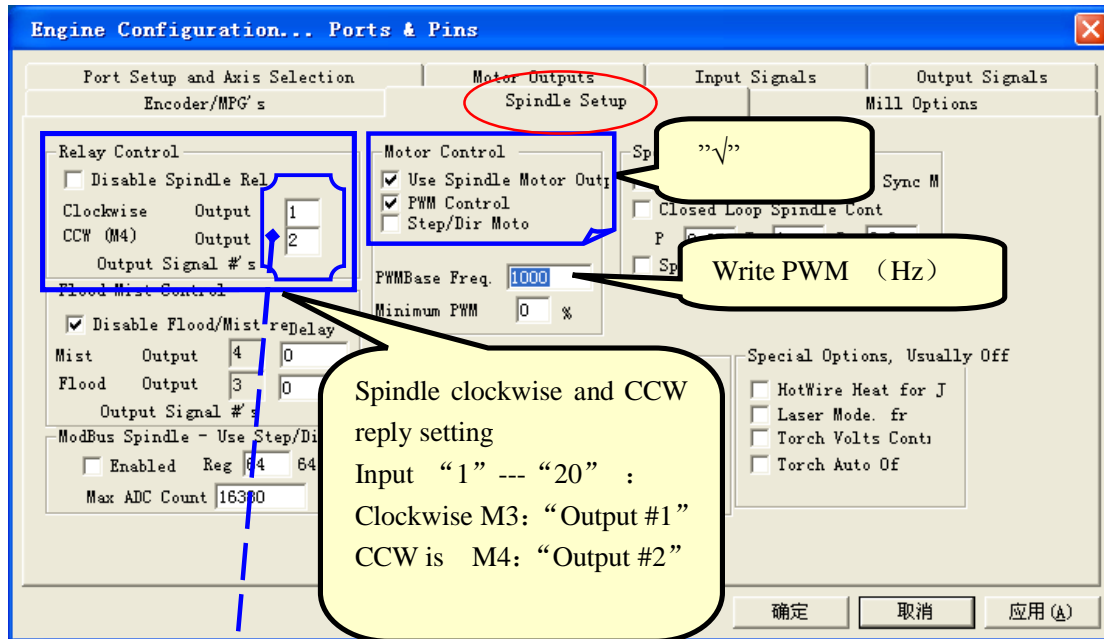
Please find "Output Signals",
Set "Output #1—Output #20"

7.1.2 spindle reply setting:

Output #1
Output #2

"√" means work

Write the pin number according to the wiring: 0—7

" √ " (recommend)
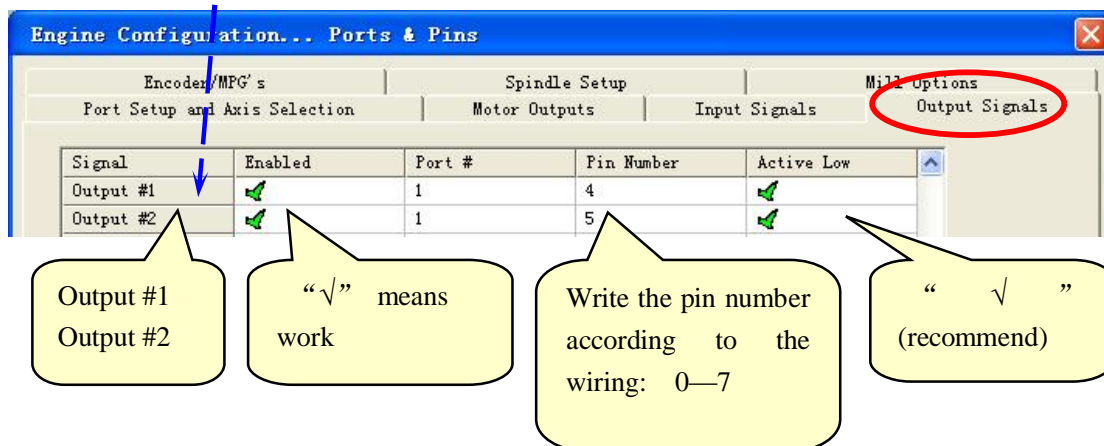
7.1.3   spindle speed signal : PWM
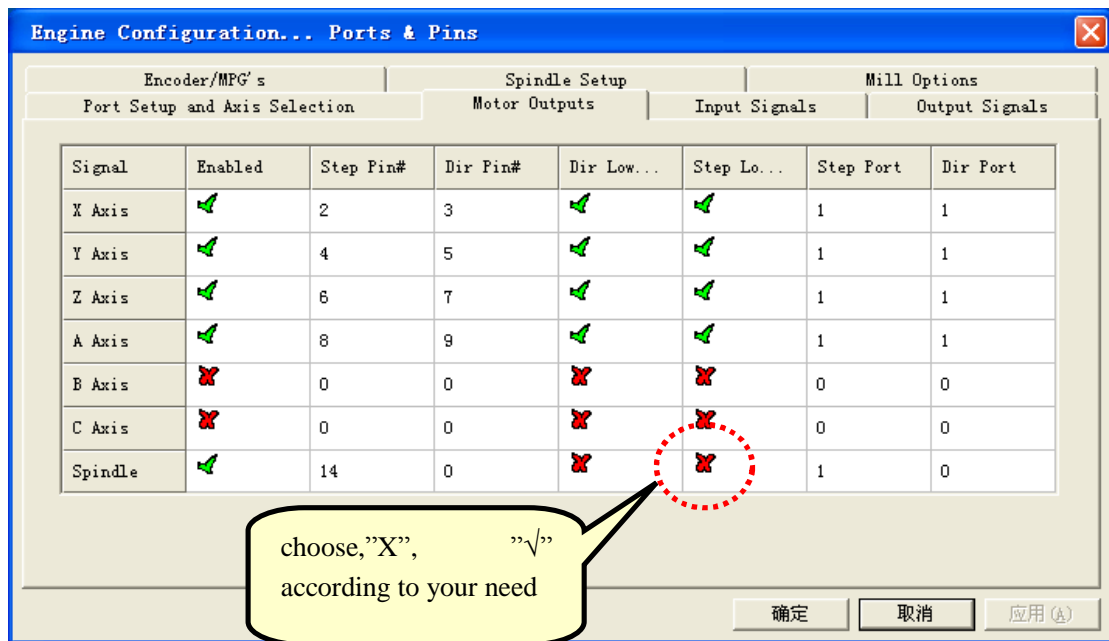
7.1.4 Mach3 "Config=>Spindle Pulleys..", choose "Pulley Selection"
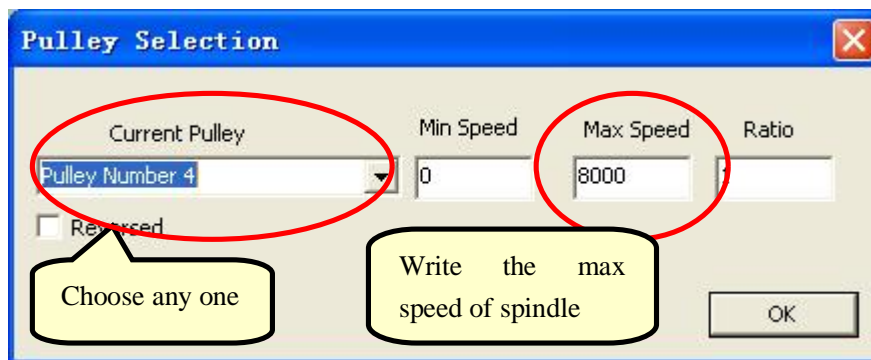
7.2 spindle test

Find MDI ALT2, ：

Write "M3", then reply will be contact. (if reply is installed)\

Write "S10000", spindle run in clockwise。

write "M5", spindle stop running。

GND

[GND]

Inner power DC5V

PWM:

0-5V

1K

resistance

[0—5V]
Spindle speed adjust PWM
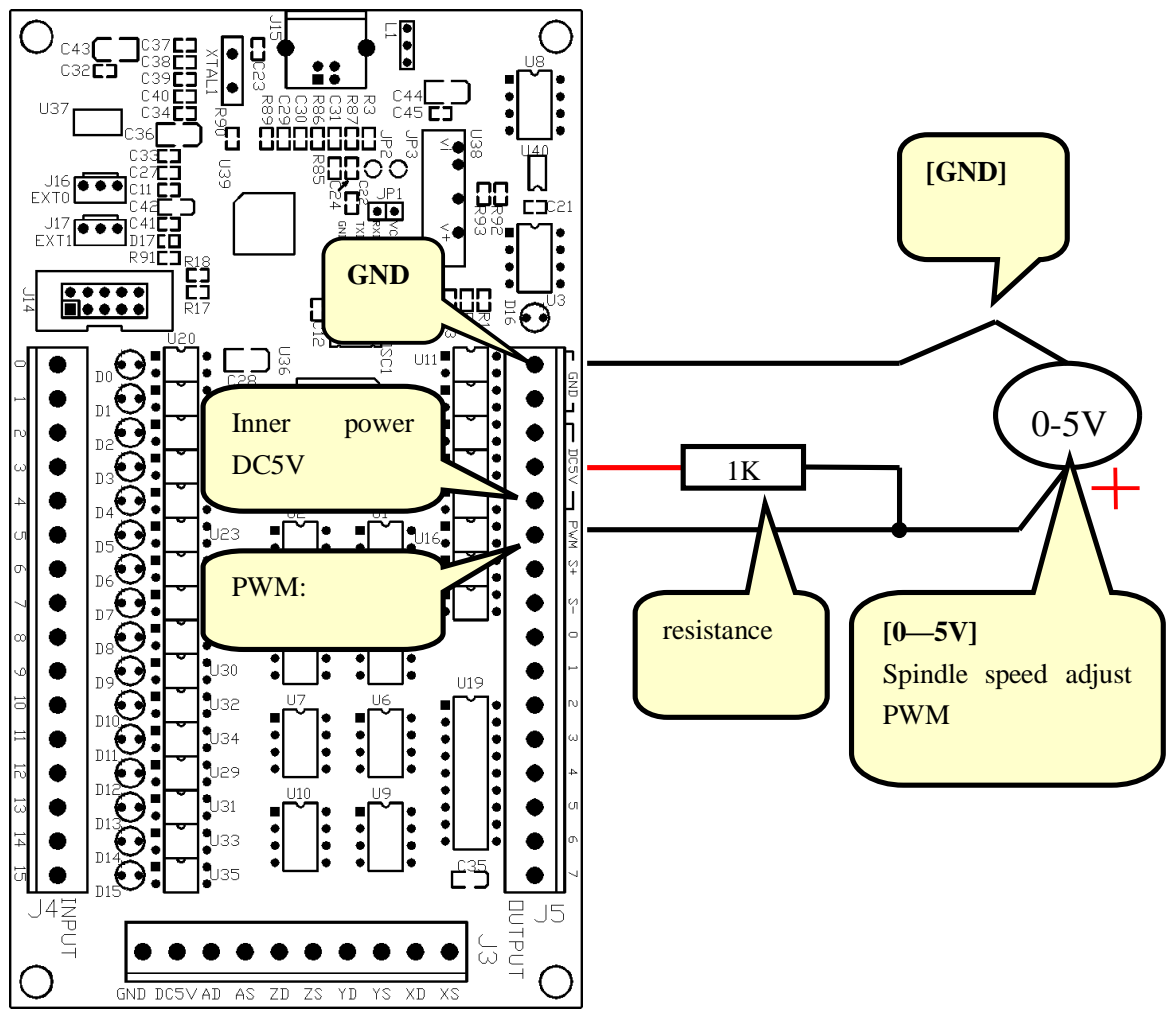
4 wires are needed ： 1GND，2 clockwise ， 3 un-clockwise，4. adjust。

Ø "GND"和"clockwise" signal wire is needed。

Ø " un-clockwise"和"adjust" is optional。

Spindle

[COM]

COM

DCM

ACM

[VI] speed regulation output

AVI /VI

resistance

1K

GND

PWM:

10V

FWD

REV

[FWD][REV]

I N V E R T E R
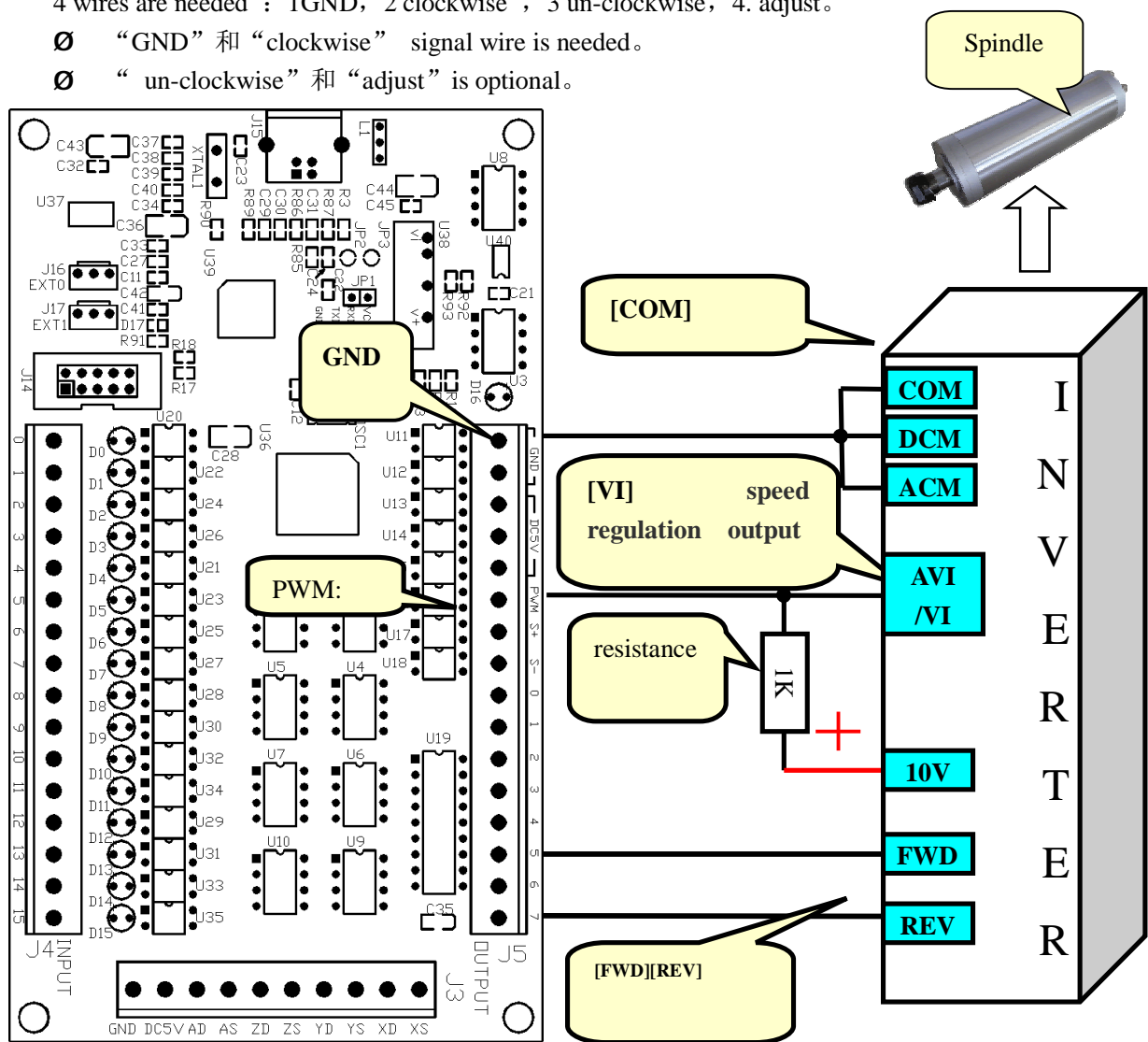
8   Measure the rotating speed of the spindle

8.1 USB Motion Card Configuration dialog

Go to "Config Plugins" under "Config" to go into "PlugIn Control and Activation".
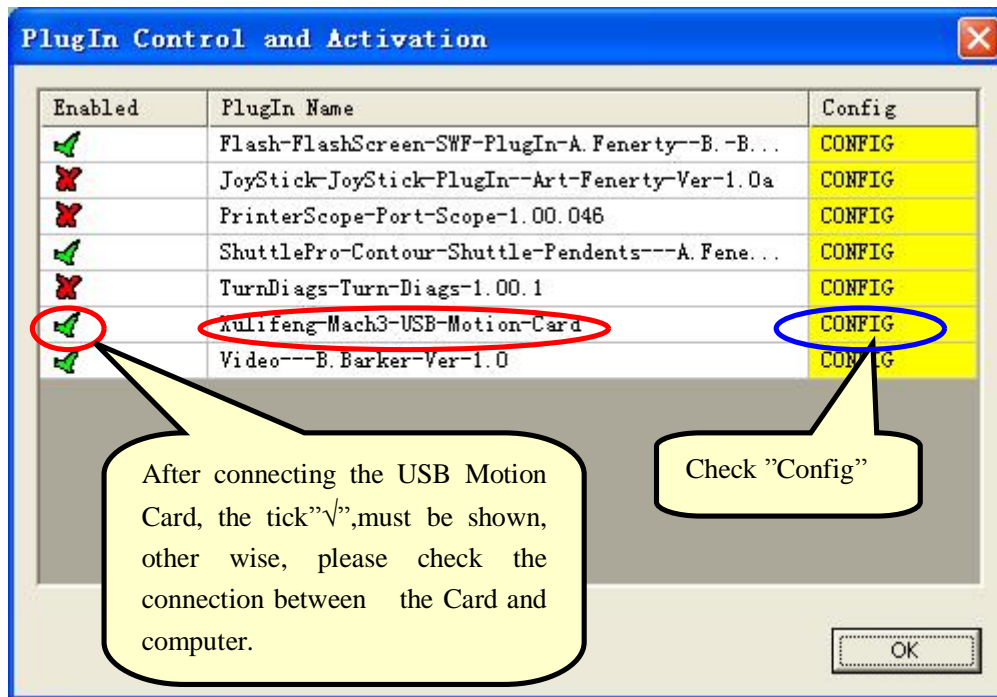
Check the "Config" to entry the "USB Motion Card"
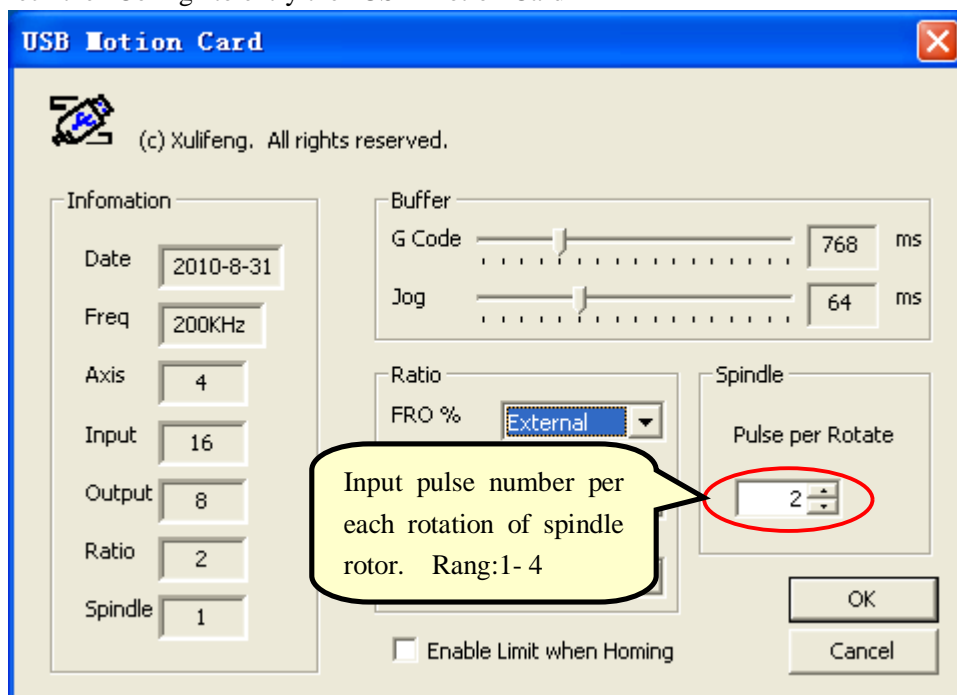
8.2 Show Spindle Speed

Measured speed will be displayed in the Mach3 as shown below
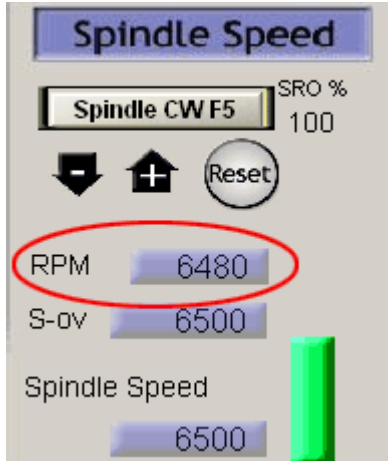
In addition, you can open the spindle speed real-time waveform display

Right click the mouse

Wave form always on top

Start/Stop waveform
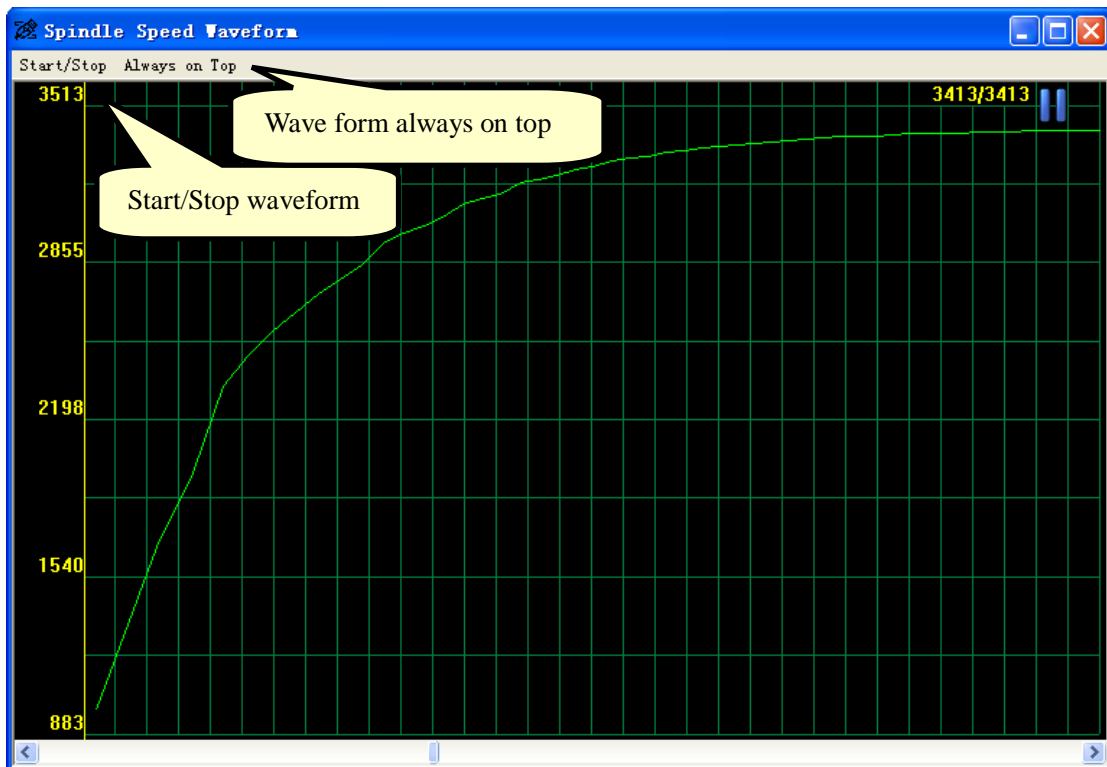
Hall sensor Model"44E", open-drain output (OC).

Magnet

Hall sensor Model 44E

510

+5V

GND

When the magnet is closed to the hall sensor, the LED will light.
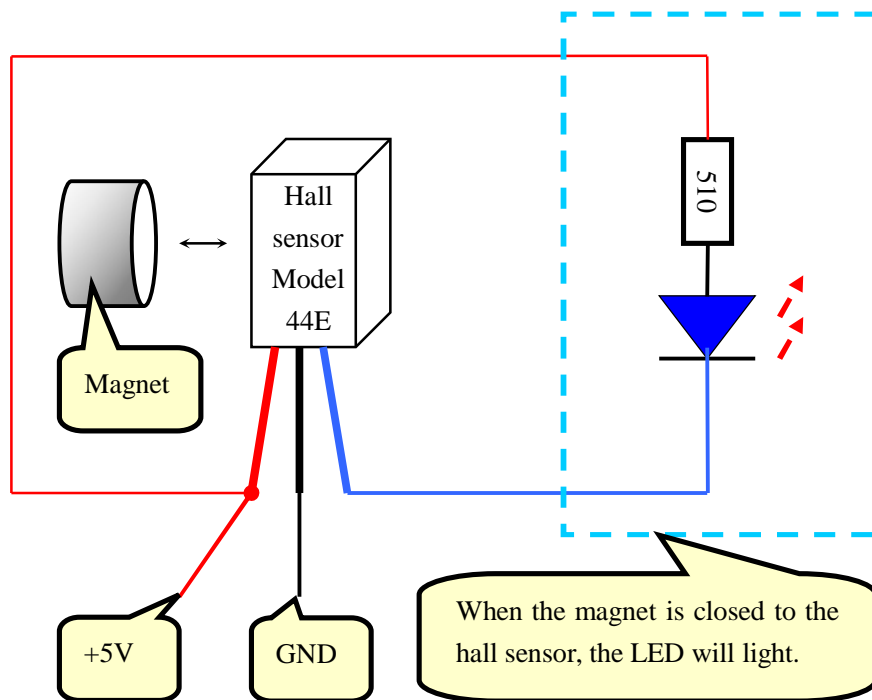
Note: Be carefully about the direction of the magnetic poles of the magnet.
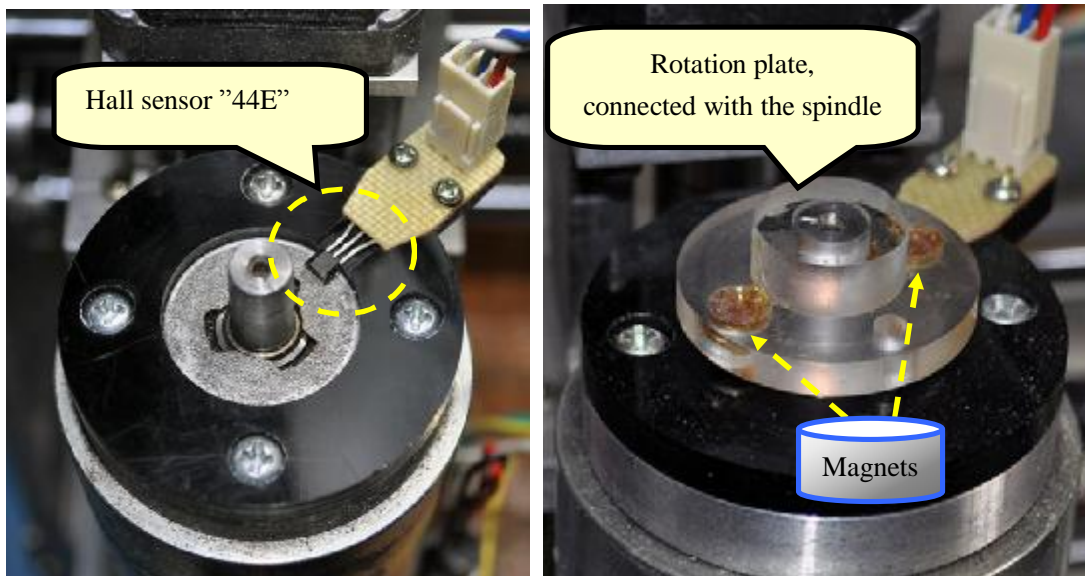
Hall sensor "44E"

Rotation plate, connected with the spindle

Magnets

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Schematic

USB Card: **S+**
Positive input

USB Card:
Resistor 330 Ω + LED

330

USB Card: **S+**
Negative input

USB Card:
high-speed optocoupler

N/C 1		8 V_{DD}
+ 2	V_F	7 V_E
− 3		6 V_O
N/C 4		5 GND

6N137

When the magnet is closed to the hall sensor, the LED (D16) will light.

Magnet

Hall Sensor Model 44E

GND

Connecting the "S+"with "DC5V"

Connecting the "S-" with the ouput of the hall sensor.

GND DC5V AD AS ZD ZS YD YS XD XS
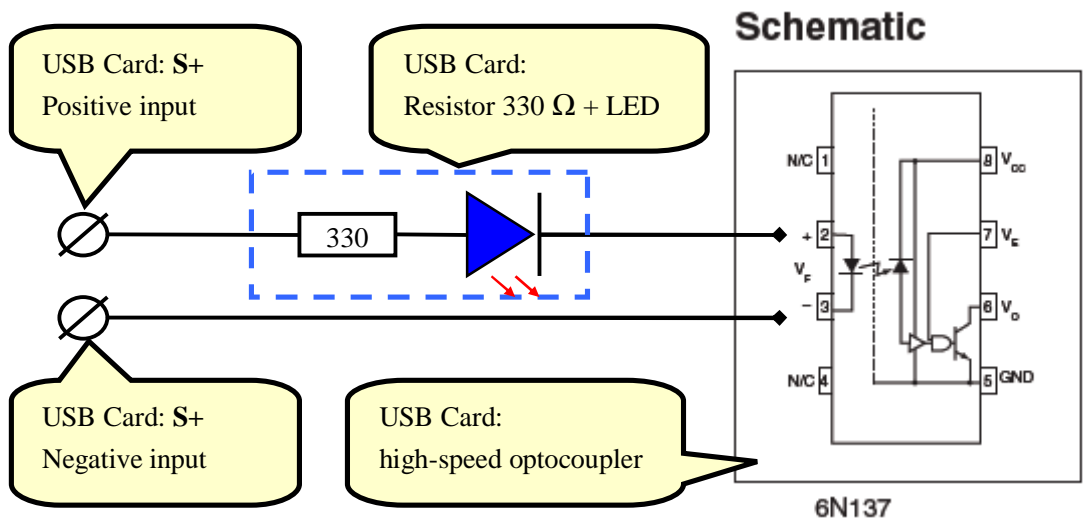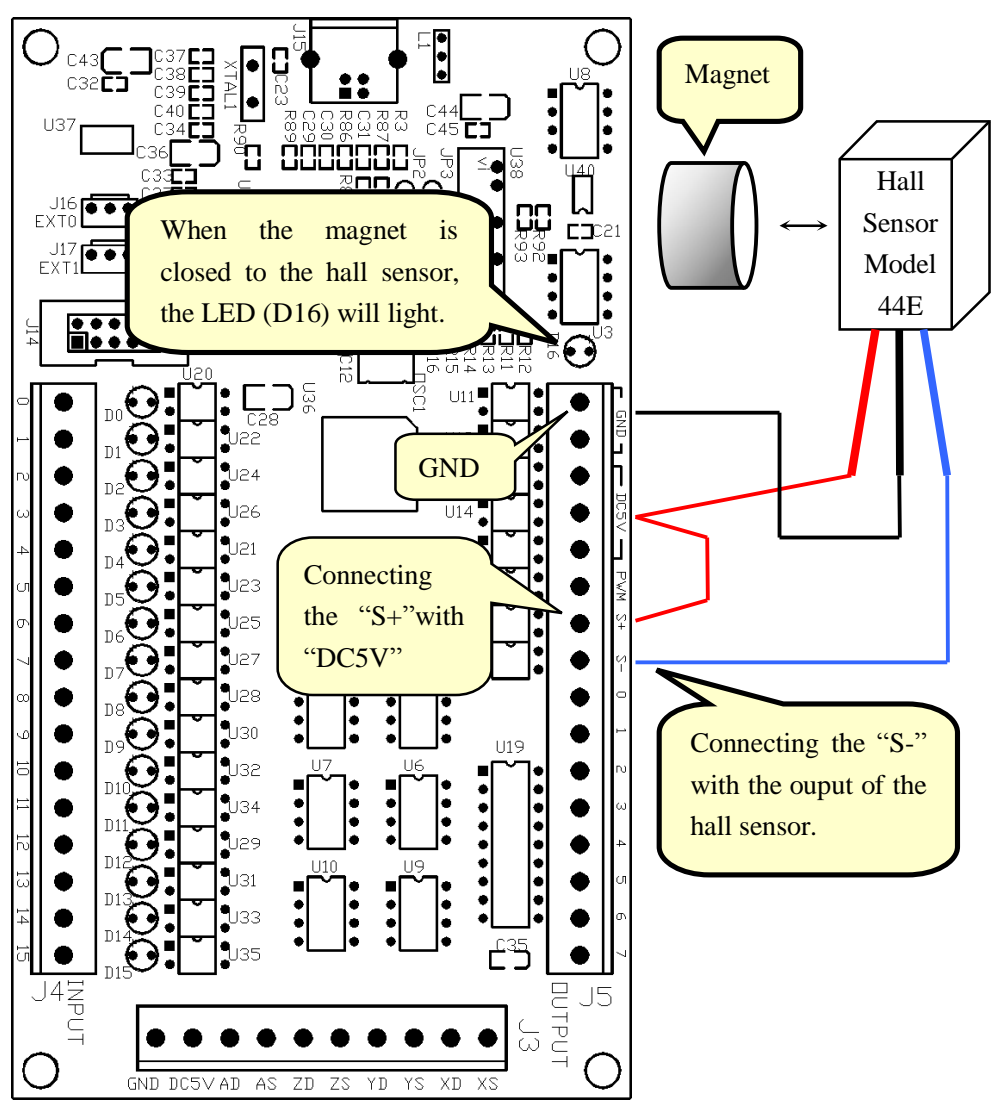
9 Auto tool zero

9.1 Tool touch sensor wires

9.1.1 "one wire" simple tool touch sensor:

Setup Probe input signal, as shown below: (Config => Ports and Pins)

9.1.2 "two-wire" Tool touch sensor:

The Probe Input Pin Number "0"—"15"

on-board isolated power supply. "DC5V"

Setup Probe input signal, as shown below: (Config => Ports and Pins)

Pick ticks" √ " Turn on Probe

"0"—"15" Depend on wires

Pick a cross "X"

9.2 Loading the VB Script to the Auto Tool Zero Button

That Mach3 provides for customizable, user-defined button macros on some of the existing screen buttons is what makes this possible without having to do Mach3 screen designs to add new buttons. The Auto Tool Zero button on the Programs Run screen is the one used for this purpose.

9.2.1　From the Mach3 Program Run screen, click "Operator" on the Menu bar
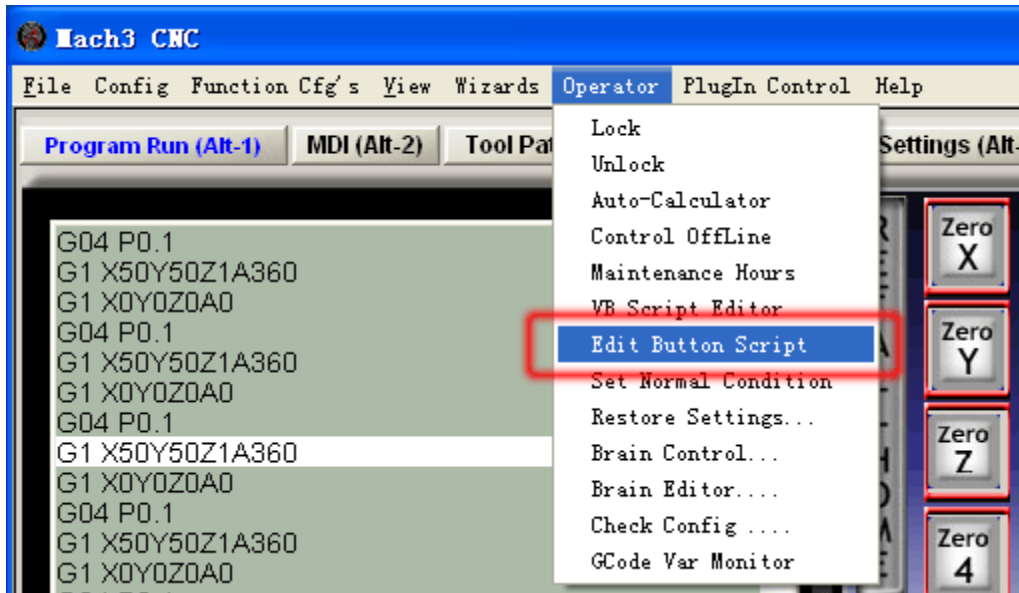
9.2.2　then click "Edit Button Script". The buttons that are editable will start flashing.
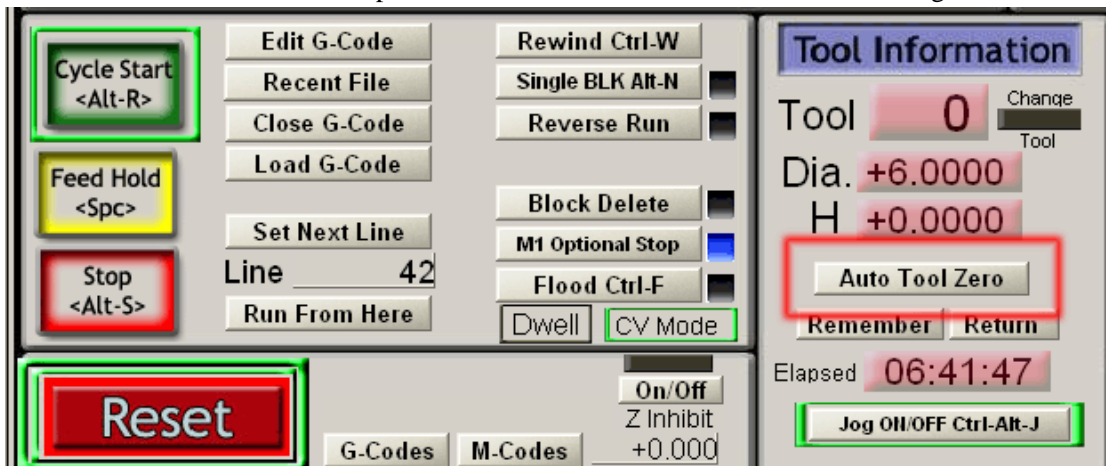

9.2.3　click the flashing Auto Tool Zero button. The Mach3 VB Script Editor window will open. By default this file will always be named "HiddenScript.m1s and at first there is one line of code in the edit window that may have a "Not Implemented" message in it.

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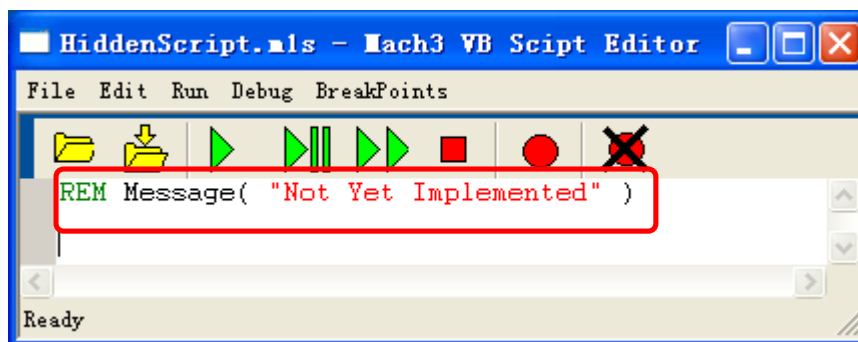
9.2.4   Click any where in the edit window's white space. Highlight any lines by typing Ctrl+A and press the Delete key or click Edit > Select All > press Delete key.

Demo code of auto tool zero
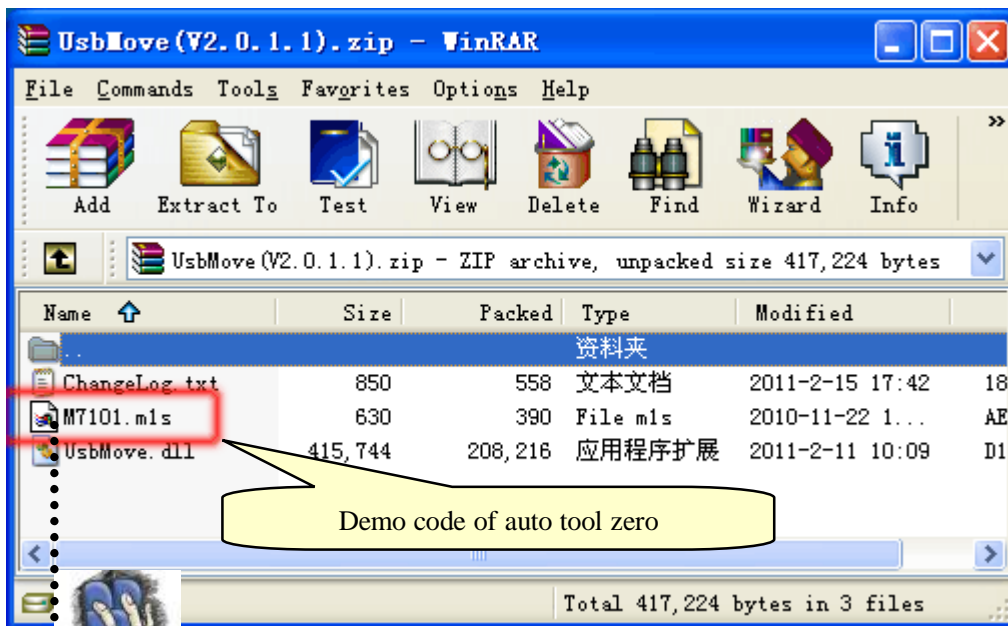
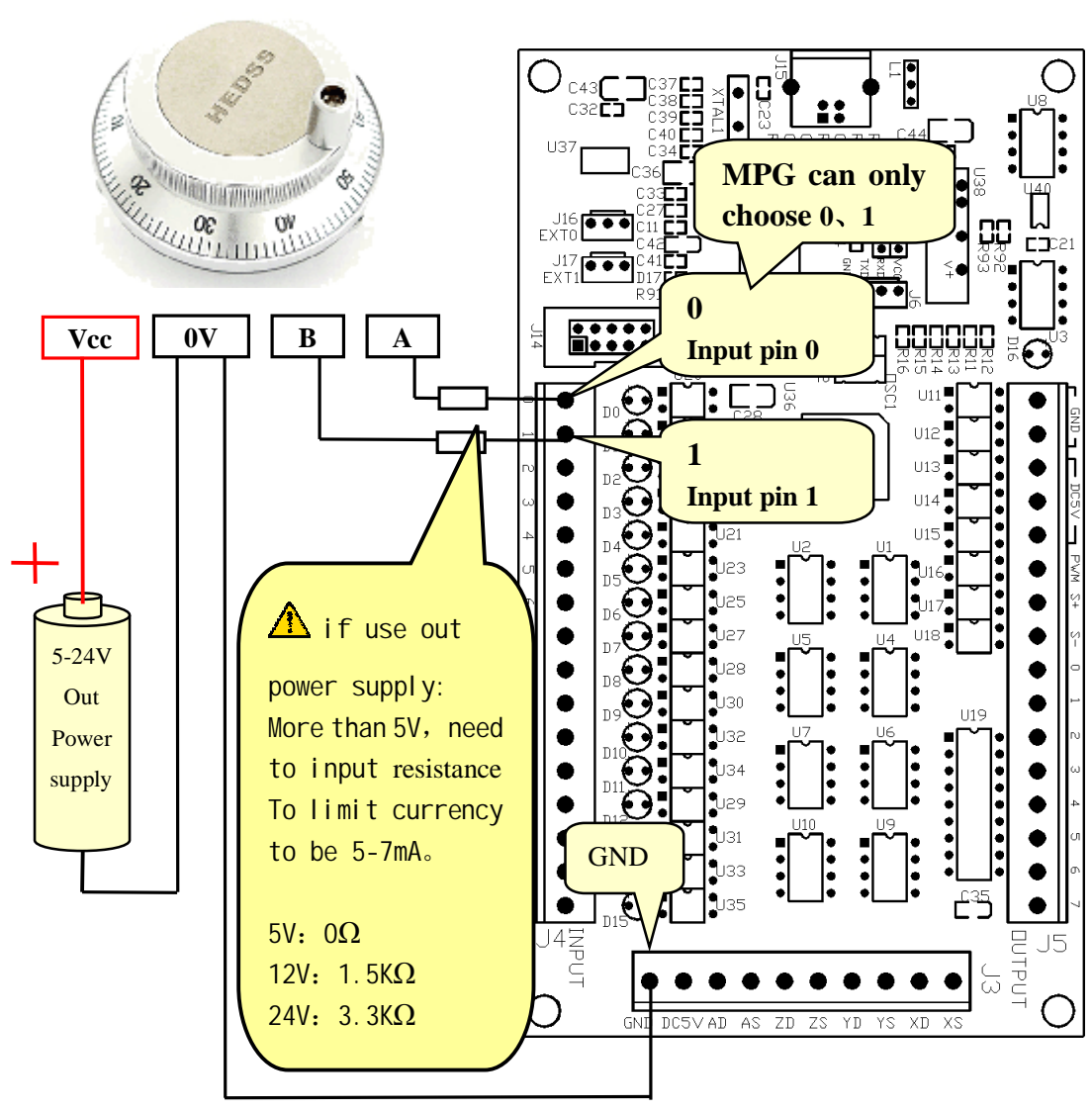Drag "M7101.m1s" to Notepad
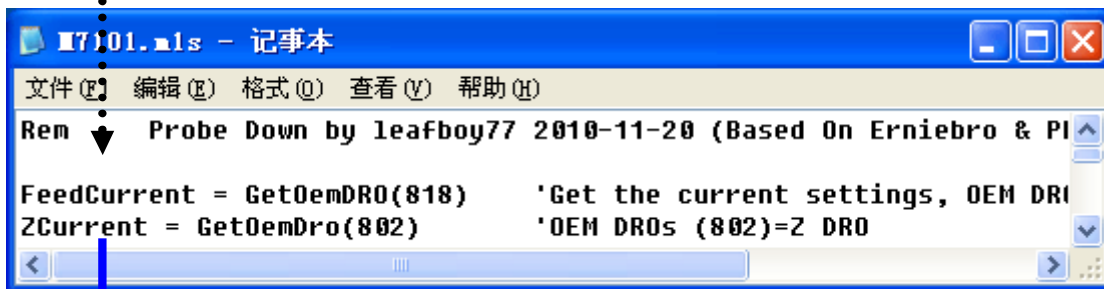
Copy all of the lines in the script from this document

Paste them into the VB Script Editor window then click File > Save.

9.2.5   Note:

10. MPG

10.1 Out power supply (recommend)

Vcc | **0V** | **B** | **A**

5-24V
Out
Power
supply

⚠ **if use out**

power supply:
More than 5V, need
to input resistance
To limit currency
to be 5-7mA。

5V：0Ω
12V：1.5KΩ
24V：3.3KΩ

MPG can only
choose 0、1

0
Input pin 0

1
Input pin 1

GND

10.2.1 Mach3 MPG setting is as follows: ： (Config => Ports and Pins)

No need to

"√"，MPG works。

MPG can make **25** plus，set "**1**"。
MPG can make **100** plus，set "**4**"。。

MPG speed：
Bigger number lower speed

10.2.2 press "TAB"

MPG Mode = Multi-Step

Cycle Jog Step = 0.01

Jog Mode = MPG

MPG Axis = X/Y/Z/A

11   Read-ahead buffer setting

11.1 Go to "Config Plugins" under "Config" to go into "PlugIn Control and Activation".
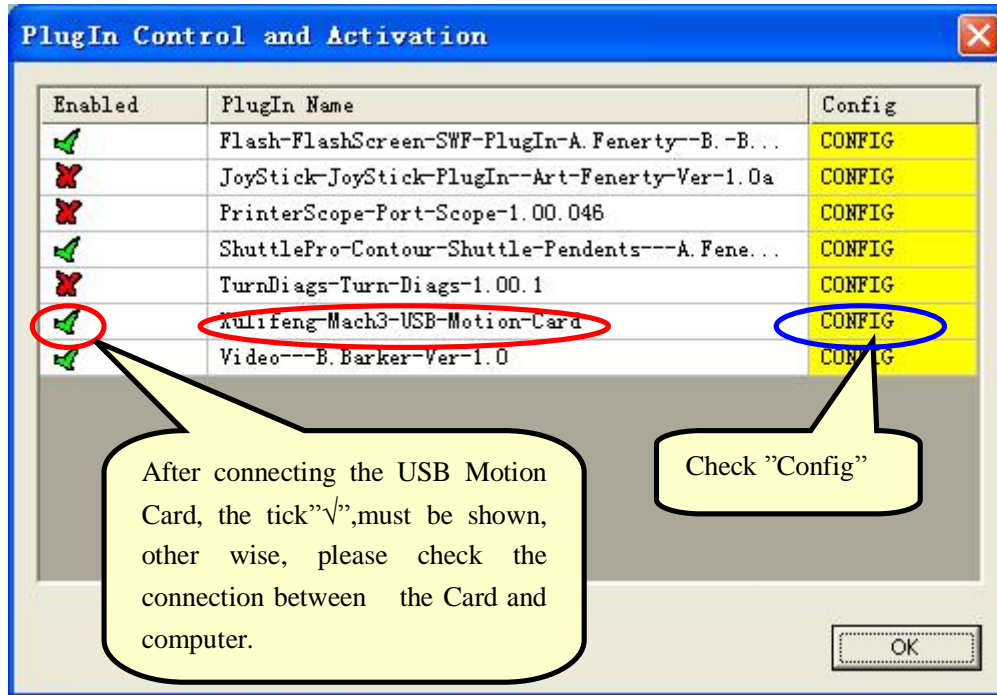
11.2 In accordance with the performance of a PC, set the read-ahead buffer. Adjust the buffer time to run smoothly.