Mach3 USB Motion Board (NPN) Installation Manual

(Model: LF77-AKZ250-USB3-NPN)

Doc Ver: 1.0.5



- ♦ USB Full-speed connection.
- Up to 5 axes, 500kHz pulsing engine, which is suitable for the servo or stepping motor.
- ♦ 16 general-purpose input, with particular indicators, the input signal states can clearly shows.
- & general-purpose output, It can be configured as: spindle clockwise / CCW / Mist / Flood / VB script programming control.
- ♦ PWM signal spindle control or Step/Dir signal spindle control.
- 2 analog input ports for adjusting the machining speed / jog speed / spindle speed.
- Status indicator LED can be useful to show the USB connection, and working statuts by flashing.
- ♦ 5 high-speed optocouplers (Dual Channel) with 10MHz, 26 general optocouplers for isolating all of the input/output signals, this high-cost design can be provided high performance and stable system.
- Fully supporting all Mach3 versions, including the Mach3 R3.043.066 version.
 Supporting Windows series, including Windows XP-Windows10(32bit/64bit).

- No need to install any USB drivers, it can be used after plugging in the computer.
- \diamond Easy firmware update.



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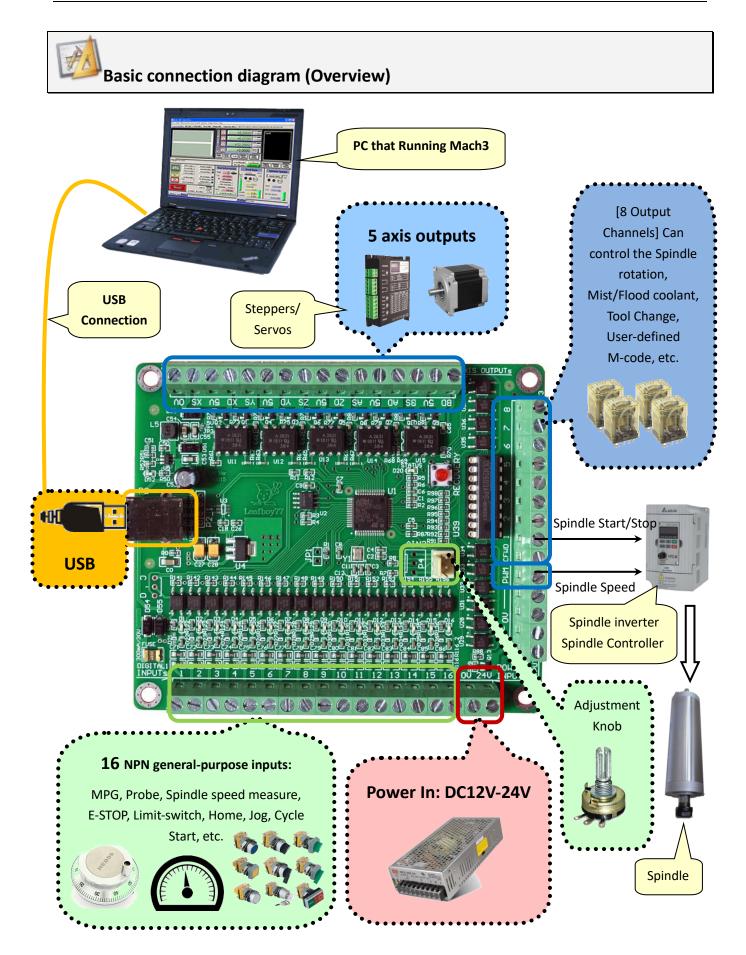


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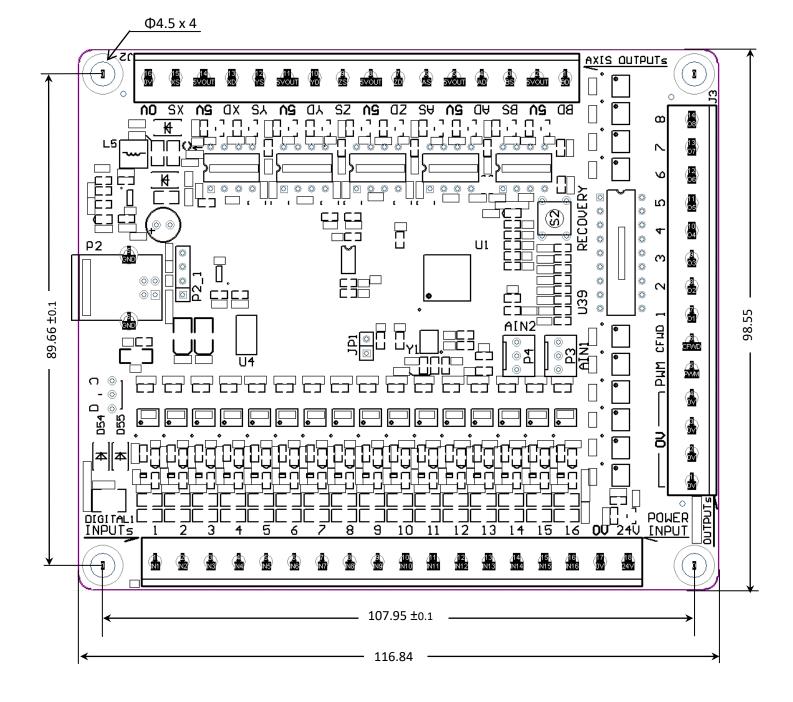


Revisions List

Date/Version	Info	
2019-9-27	Init	
Ver1.0		
2019-10-12	Added warning description: <u>"CFWD" terminal cannot be used</u> when the output	
Ver1.0.1	controls both inductive loads (such as relays, solenoid valves) and other devices	
Ver1.0.1	(such as inverter control).	
2019-10-12	Modify: <u>Restore factory firmware</u> steps	
Ver1.0.2	Modify: Hard reset operation steps	
2019-10-21	Power Input: DC12V 24V	
Ver1.03	Power Input: DC12V-24V	
2019-11-28	Modify parameters: PWM output maximum current 10mA	
Ver1.0.4	Change photo: Photo of the external Adjustment Knob	
2021-4-27	Added: MDC Enable Putton wiring and description	
Ver1.0.5	Added: MPG Enable Button wiring and description	







1. Prepare

1.1 Mach3 download and install

The latest version of Mach3 official website download URL: <u>https://www.machsupport.com/</u>

After entering the official website, click DOWNLOADS & UPDATES => MAIN PROGRAMS as shown in the blue circle below

Newfangled Solutions CNC So	× +		- 0	×
$\leftarrow \rightarrow C$ \square Newfangled	Solutions, LLC. [US] https://www.m	achsupport.com	☆ 🕕	:
Newfangled				^
	rs 🗿 Art	Soft Q F CART	\$0.00	
"Origination of Innovati	LLC. Drysion of Newfangle	Sournews		
			UDDODT	
HOME SOFTWARE	DOWNLOADS & UPDATES BUY H	ELP & LEARNING PARTNERS & RESELLERS ABOUT US S	UPPORT	
	MAIN PROGRAMS	ACT US		
	PLUGINS	RIBUTOR/OEM LOGIN		
	SCREENSETS	nUL		
		S READY		
	CAM POST PROCESSORS	for free now		4
https://www.machsupport.com/downlo	oads-updates/main-programs/	ew Details		-

After entering the download page, find MACH3 and download it, as shown in the blue circle below.







Note:

After the download is complete, install Mach3

The Parallel Port Driver does not require. 🌄 Iach3 Setup Select Packages Please select the program features that you want to install. The Parallel Port Driver can deselect. Program Features: Parallel Port Driver Installs the Parallel Port Driver. 1.00 Π. This is not needed for external 🔽 XML's motion control devices. (328 KB) LazyCam 🖃 🔽 Screen sets ✓ Standard Mach3Turn screen ✓ Standard Mach3Turn screen 🔽 Standard Mach3 Plasma screen Total space required: 39.5 MB $\leq \underline{B}ack$ \underline{N} ext > Cancel

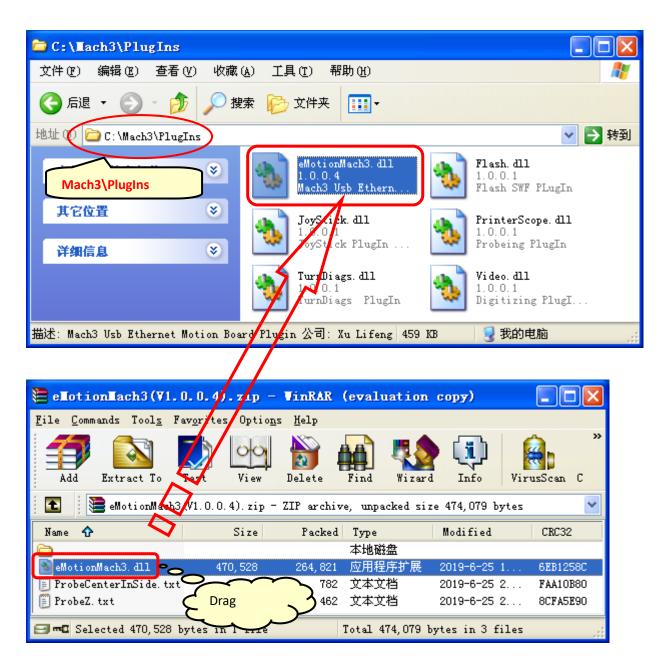
1.2 Download and install the Mach3 plugin



In order to enable MACH3 to recognize and drive this motion control board, you need to install a mach3 plugin.

Copy or drag eMotionMach3.dll (Unzip the eMotionMach3.zip) into Mach3\PlugIns folder.

For example, if your Mach3 software is installed in C:\Mach3, place eMotionMach3.dll into C:\Mach3\PlugIns



Mach3 Plugin eMotionMach3.zip

Please go to the following URL to download the latest version. http://leafboy77.com/



Mach3Mill After completing the Mach3 plugin installation, start the Mach3 software.

A dialogue of "Motion Control Hardware PlugIn sensed!!" is shown. Please choose the option "USB.Ethernet-Motion-board". You can also check "Don't ask me this again".

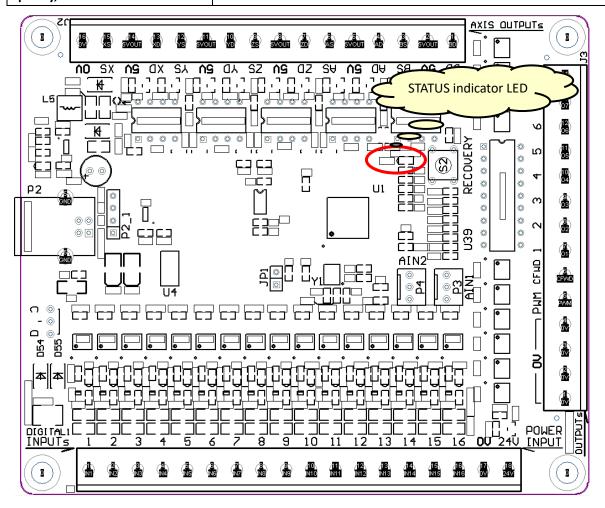
Motion Control Hardware PlugIn sensed!! 🛛 🛛 🔀				
Your system is showing more than one control device Please pick the one you would like this profile to use.				
O Normal Printer port Operation.				
Xu.Lifeng-USB.ETHERNET-Motion-Board				
© No Device				
No Device				
O No Device				
Dont ask me this again	ок			

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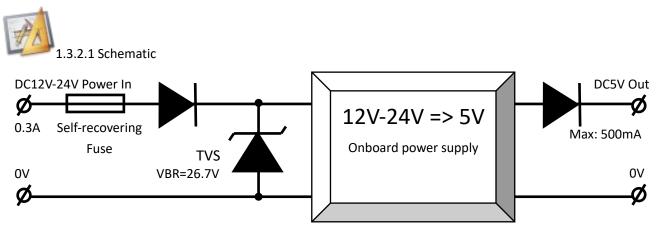


1.3 Status indicator(LED) of motion control board, External power supply

1.3.1 The motion board has a status indicator LED that indicates the current status by different blinking modes.			
LED flashing mode Status			
Always bright Standby (POWER ON)			
Slow flashing	Connection (has already established a connection with MACH3 via USB)		
Fast flashing	5-axis operation (eg running G code, jog, but not pulse spindle)		
Slow flashing, gradually flashing	After pressing the RECOVERY button for 5 seconds, the Motion Board soft		
quickly, turn off after 5 seconds	reset.		



1.3.2 External power supply







1.3.2.2 Wiring

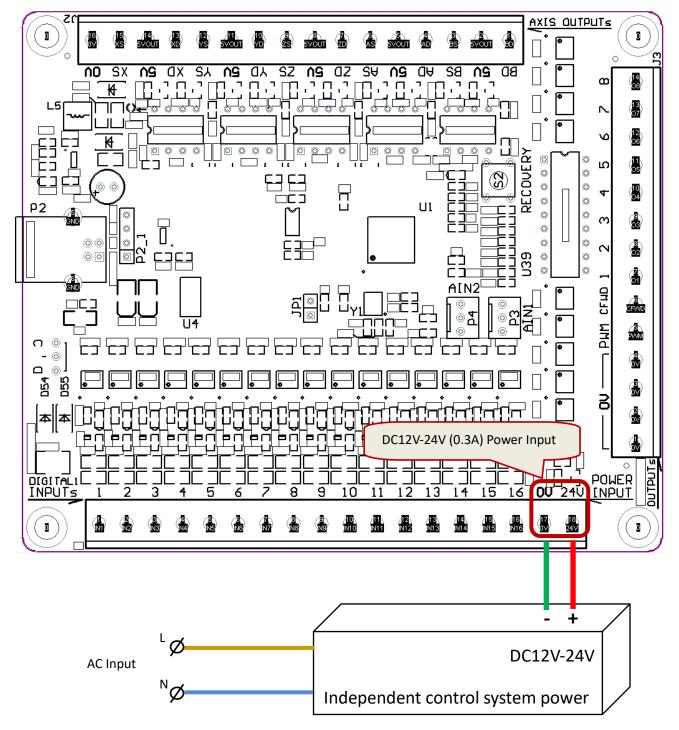
Motion control board, requiring DC12V-24V (0.3A) power supply



Warning: The control panel input voltage (peak) cannot exceed 26V.

The board requires an independent power supply (control system power supply) that can be shared with sensors, handwheels, and the like.

Because the motor has a back EMF, the control board cannot share a power supply with the motor to ensure safety and reliability.





2. Motion control board and PC connection

Note:

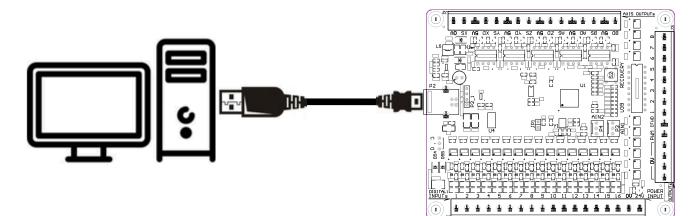
First: complete the Mach3 plugin installation, start Mach3 and select the external motion control board



Magnet ring installed in the USB cable at both ends



The motion control board is connected to the PC using a USB cable and is powered on (DC12V-24V)



This motion board does not need install any USB driver, Windows XP - Windows 10 can directly identify



Start Mach3 and <u>select external motion control board</u>. Right click on the CNC icon, pop up the settings dialog, select "USB" and press OK to save the settings.

🎴 Xu Lifeng Motion Board (Config (Plugin Version 10.0.2) 🛛 🛛
Infomation http://leafboy77.com Hard 2 Choose "USB" Firmware Ver 2019-4-20 AxisFreq(KHz) 511 AxisOutput(Port) 6 DigitalInput(Port) 2 DigitalOutput(Port) 1 AnalogInput(Port) 2 AnalogOutput(Port) 1 EncoderInput(Port) 2 RpmInput(Port) 1	Connect USB Setup Motion Board Ethernet ETHERNET IP 192.168.1.77 Port 5000 Spindle Step and Direction spindle controller None Number of pulses per revolution - for speed measurement 1 Ratio Feed% Internal Spindle% Internal Jog% Internal Cancel
	······································

When the Mach3 is successfully connected to the motion control board (USB), the STATUS-LED indicator flashes slowly.





The chip firmware of this motion control board supports upgrades, and users can continuously get the latest feature support. The firmware is stored in the Mach3 plugin (the latest version of the Mach3 plugin, please download it from http://leafboy77.com). When Mach3 is launched and connected to the motion control board, the firmware version is checked and automatically upgraded.



Normally, the upgrade can be completed successfully. If the upgrade fails in a special situation and the board fails to start, the motion board provides the function of **restoring the factory firmware**. The steps are as follows:

- i. Unplug the USB plug from the Motion Control Board
- ii. Press and hold the RECOVERY button of the Motion Control Board
- iii. Plug in the USB plug to the Motion Control Board (and make sure the other end of the USB cable is plugged into the PC)
- iv. Release the RECOVERY button
- v. The STATUS LED is always on (standby status), indicating that the recovery operation is complete (It takes about a few seconds)

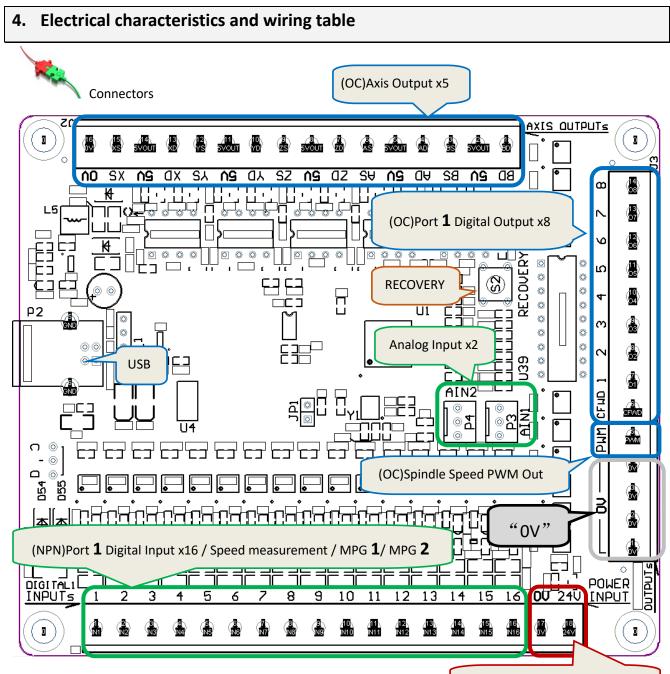


SOFT RESET Motion Control Board, the steps are as follows:

- i. The USB plug is plugged into the Motion Control Board (and the other end of the USB cable is plugged into the PC), and the STATUS-LED is on.
- Press and hold the RECOVERY button for more than 5 seconds, STATUS-LED flashes slowly => fast flashing => off
- iii. Release the RECOVERY button, the STATUS-LED is always on (standby), SOFT RESET completed.



- HARD RESET Motion Control Board, the steps are as follows:
- Unplug the USB plug from the Motion Control Board.
- Plug in the USB plug to the Motion Control Board (and make sure the other end of the USB cable is plugged into the PC)



4.1 Power Input

DC12V-24V (0.3A) Power Input

Connector	FUNCTIONS	ELECTRICAL	Description
0V	power input negative	0V	Common ground:
			(axis/digital input/digital output/PWM)
24V	power input positive	DC12V-24V / 0.3A	Independent power supply required
			(separate from motor)

4.2 Power Output

The Motion board has a 5V output power supply for the interface of the 6 stepper drives and the PNP-5V MPG 2.

Connector	FUNCTIONS	ELECTRICAL	Description
5V	power output positive	DC5V / 500mA	All 5V Connectors, a total output of 500mA



4.3 (NPN) Port 1 Digital Input x16 / Speed measurement /MPG 1/MPG 2

Connector	FUNCTIONS	ELECTRICAL	Description
1	Digital Input Pin 1		
	Speed measurement		
2	Digital Input Pin 2		
3	Digital Input Pin 3		
4	Digital Input Pin 4		
5	Digital Input Pin 5		
6	Digital Input Pin 6	NPN	
	MPG 2 Input A	Opto coupler isolation v1C	
7	Digital Input Pin 7	Optocoupler isolation x16	Port ${f 1}$ Digital Input
	MPG2 Input B	Interface voltage = power input	Speed measurement
8	Digital Input Pin 8	(12V-24V)	MDC 1 Innut
9	Digital Input Pin 9	(120-240)	MPG 1 Input
10	Digital Input Pin 10	Min trigger current: 3mA	MPG 2 Input
11	Digital Input Pin 11	Max operating current (12V): 5mA	MPG Z Input
12	Digital Input Pin 12	Max operating current (24V): 9mA	
13	Digital Input Pin 13	Wax operating current (240). Shirt	
14	Digital Input Pin 14		
15	Digital Input Pin 15		
	MPG 1 Input A		
16	Digital Input Pin 16		
	MPG 1 Input B		

4.4 Analog Input x2

Analog input for external potentiometer control speed, electrical characteristics are **non-isolated**

Connector	FUNCTIONS	ELECTRICAL	Description
AIN1	Analog Input Port 1	Non-isolated x2 Input voltage: 0V-3.3V Input current: <0.1mA	For external speed control:
AIN2	Analog Input Port 2		Spindle speed / jog speed / Feed



Connector	FUNCTIONS	ELECTRICAL	Description	
XD (Xdir)	Xaxis Direction signal			
XS (Xstep)	Xaxis Step signal			
YD (Ydir)	Yaxis Direction signal			
YS (Ystep)	Yaxis Step signal	High speed optocoupler isolation x10 Max: 24V / 13mA OC=Open collector output	er Used to connect: Stepper drive server Driver	
ZD (Zdir)	Zaxis Direction signal			
ZS (Zstep)	Zaxis Step signal			
AD (Adir)	Aaxis Direction signal			Server Driver
AS (Astep)	Aaxis Step signal			
BD (Bdir)	Baxis Direction signal			
BS (Bstep)	Baxis Step signal			

4.6 Axis Output x5

4.7 (OC) Port 1 Digital Output x8

Connector	FUNCTIONS	ELECTRICAL	Description
1	Digital Output Pin 1		Digital output pin for driving inductive loads
2	Digital Output Pin 2		(eg relay / solenoid valve)
3	Digital Output Pin 3	Optocoupler isolation x8	In order to prevent the back EMF from
4	Digital Output Pin 4		breaking through the driver chip (ULN2803),
5	Digital Output Pin 5	Max: 24V / 500mA	the CFWD terminal must be connected to the
6	Digital Output Pin 6	OC=Open collector output	(loaded) power supply positive terminal.
7	Digital Output Pin 7		Or need an external independent
8	Digital Output Pin 8		freewheeling diode
CFWD	Common freewheeling diode	Connected (loaded) power supply positive	The CFWD terminal must be connected when driving an inductive load (or need an external freewheeling diode)

4.8 (OC) Spindle Speed control signal (PWM) output

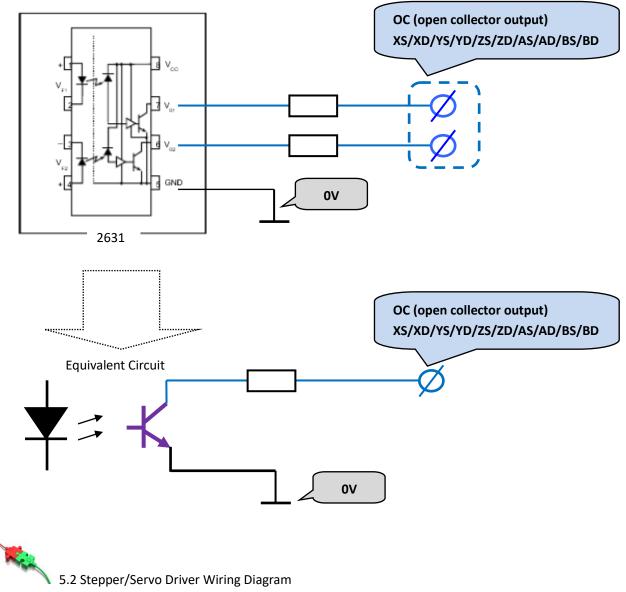
Connector	FUNCTIONS	ELECTRICAL	Description
PWM	Spindle Speed signal output	Optocoupler isolation x1	Spindle pulse width speed regulation, can also be used for inverter 0-10V speed
	(PWM = Pulse-Width Modulation)	Max: 24V / 10mA OC=Open collector output	regulation

5. Wiring and configuration with stepper (or servo) drives



5-axis outputs interface schematic

6 axis output of the control board (10 channels): open collector output, high speed optocoupler isolation



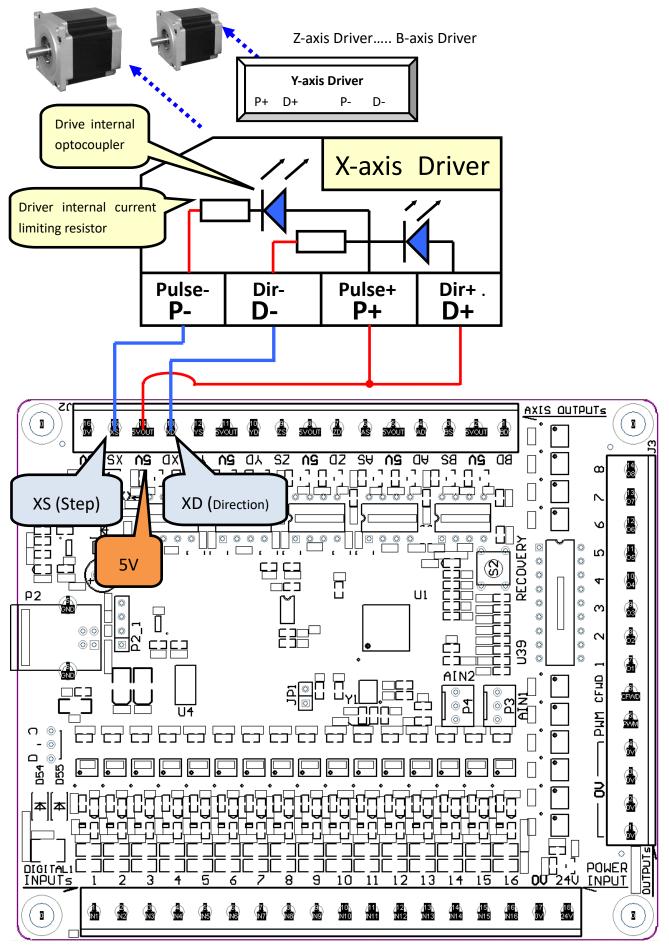
The interface of the stepper/servo drive uses the following two power supply methods:

- > Internal power supply 5V (suitable for stepper drive)
- External power supply 5V-24V (suitable for servo drive)

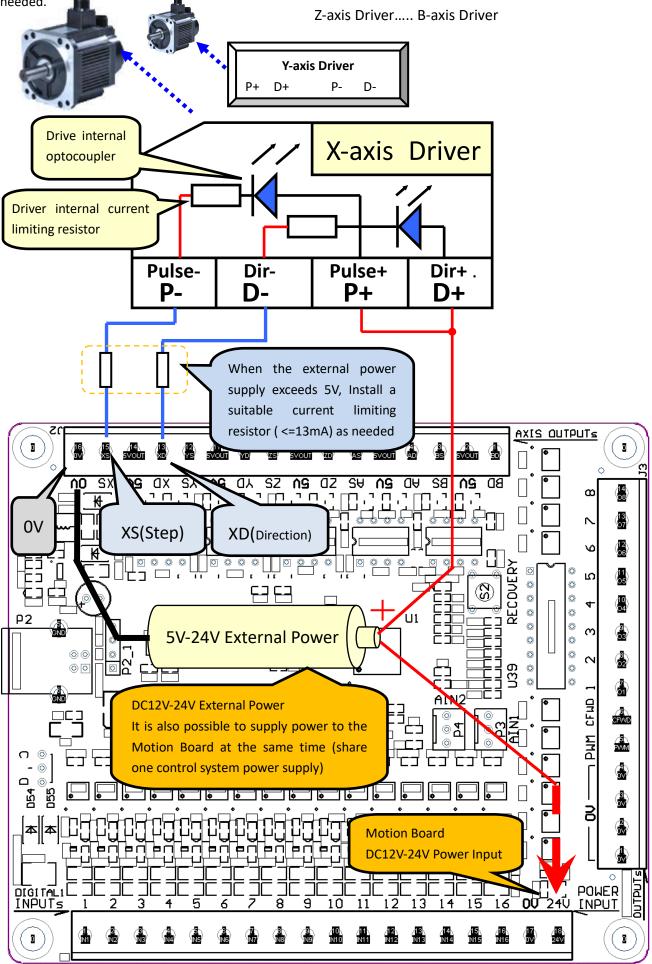
Note:

External power supply 12V-24V, this power supply can also supply power to the control board at the same time (share one control system power supply)

5.2.1 Use the 5V power supply inside the motion control board, suitable for stepper drivers, please install suitable current limiting resistors as needed.



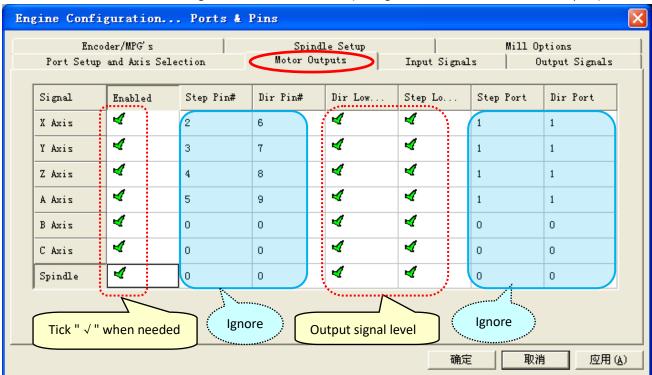
5.2.2Use 5V-24V external power supply, suitable for servo drive, please install suitable current limiting resistor as needed.



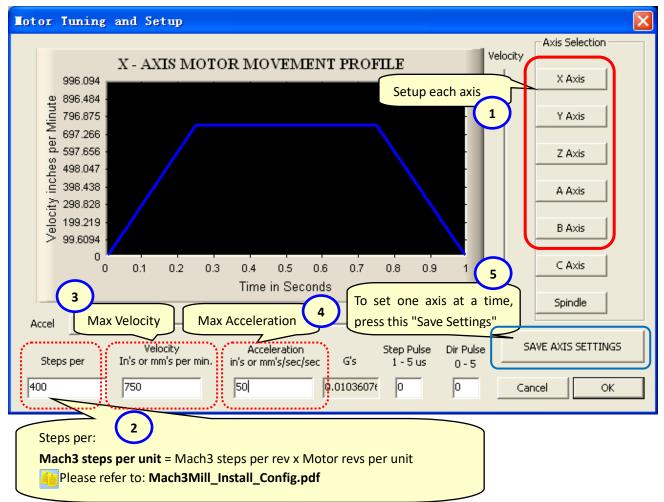


5.3 Motor parameter configuration

5.3.1 Mach3's X,Y,Z,A,B,C axis configuration, as shown below: (Config => Ports and Pins => Motor Outputs)



^{5.3.2} Mach3 tuning setup as shown below: (Config => Motor Tuning)



5.3.3 Mach3's axis running direction is recommended as shown below:

Mach3 Main menu => Config => Homing/Limits

Entries are in setup units.									
Axis	Reversed	Soft Max	Soft Min	Slow	Home	Home Neg	Auto	Speed %	
X	X	100.00	-100.00	1.00	0.0000	X	4	20	
Y	4	100.00	-100.00	1.00	0.0000	X	4	20	
Z	4	100.00	-100.00	1.00	0.0000	X	4	20	
Å	X	100.00	-100.00	1.00	0.0000	X	4	20	
В	X	100.00	-100.00	1.00	0.0000	X	4	20	
с	X	100.00	-100.00	1.00	0.0000	X	4	20	
	rection: ds on ″√″ or	"x"	Ignore	setting Accord	OME direct g of the axis ding to ac , hit "√" or	s: ctual	OME spee		

5.4 Pulse Spindle Configuration

You can set any one axis of the motion control board as the pulse spindle output, and specify the B axis as an example: Right click on the CNC icon, pop up the settings dialog, select "B-Axis", press OK to save the settings.(Turn off the pulse spindle function Select "None")

Xu Lifeng Motion Board	Config (Plugin Version: 1.0.0.2) 🛛 🔀
Infomation http://leafboy77.com Hardware Ver N/A Firmware Ver N/A	Connect © USB Setup Motion Board Ethernet D ETHERNET IP 192 .168 . 1 . 77 Port 5000
AxisFreq(KHz) 0	
AxisOutput(Port) 0	Spindle 2
DigitalInput(Port) 0	Step and Direction spindle controller B-Axis
DigitalOutput(Port)	Number of pulses per revolution X-Axis - for speed measurement Y-Axis
AnalogInput(Port) 0	Z-Axis A-Axis
AnalogOutput(Port) 0	Feed% Internal
EncoderInput(Port) 0	Spindle% Internal OK
RpmInput(Port) 0	Jog% Internal Cancel
	i (22:39

Jos B



Confirm that the B axis is turned on (as a pulse spindle), and confirm that the spindle function (Spindle) is turned on, as shown in the figure below:

(Config => Ports and Pins=>Motor Outputs)

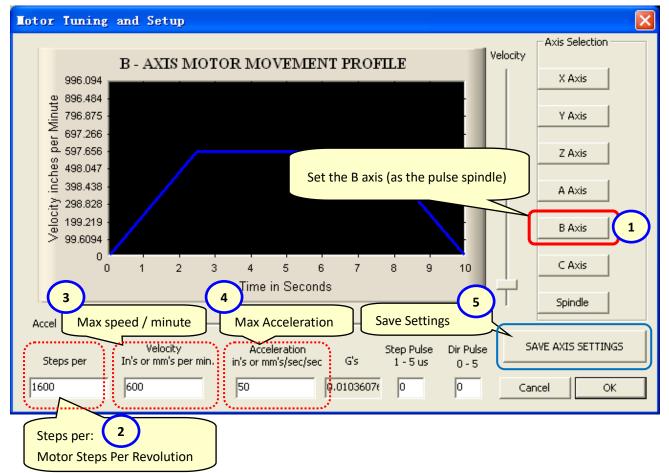
Engine Confi	ngine Configuration Ports & Pins									
	Encoder/MPG's Mill Options Port Setup and Axis Selection Motor Outputs Input Signals Output Signals									
Signal	Enabled	Step Pin#	Dir Pin#	Dir Low	Step Lo	Step Port	Dir Port			
X Axis	4	2	6	4	4	1	1			
Y Axis	🖌 🖌 🖌 🖌 🖌	s " √ ":		4	4	1	1			
Z Axis	🗹 🛛 as a	oulse spindle	2	4	4	1	1			
A Axis	4	5	9	4	4	1	1			
B Axis	4	0	0	4	4	0	0			
C Axis	4	0	0	4	4	0	0			
Spindle	4	0	0	4	4	0	0			
	Spindle " √ ": turn on the Mach3 spindle function 确定 取消 应用 (▲)									

The spindle is set to: pulse / direction motor

(Config => Ports and Pins=>Spindle Setup)



Motor operating parameter setting of B axis (as pulse spindle), as shown below: (Config => Motor Tuning)



The direction of rotation of the pulse spindle is recommended as shown in the following figure: Mach3 main menu => Config => Homing/Limits

	Lotor Home/SoftLimits Entries are in setup units.										
	Axis	Reversed	Soft Max	Soft Min	Slow	Home	Home Neg	Auto	Speed %		
	X	X	100.00	-100.00	1.00	0.0000	X	4	20		
	Y	4	100.00	-100.00	1.00	0.0000	X	4	20		
	Z	4	100.00	-100.00	1.00	0.0000	X	4	20		
_	A	X	100.00	-100.00	1.00	0.0000	X	4	20		
	В	X	100.00	-100.00	1.00	0.0000	X	4	20		
•	C		100,00	-100.00	1.00	0.0000	X	4	20		
C The direction of rotation of the B axis (as the pulse spindle): $\begin{array}{c} G28 \\ X \\ Y \\ 0 \\ Z \\ 0 \\ \end{array}$ C $0 \\ \hline OK \\ \hline OK$											



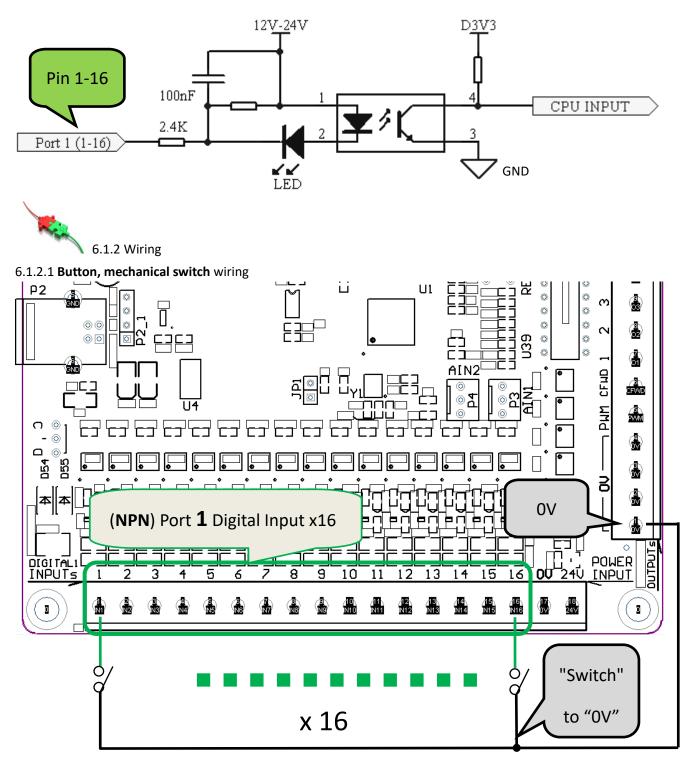
6. Digital input

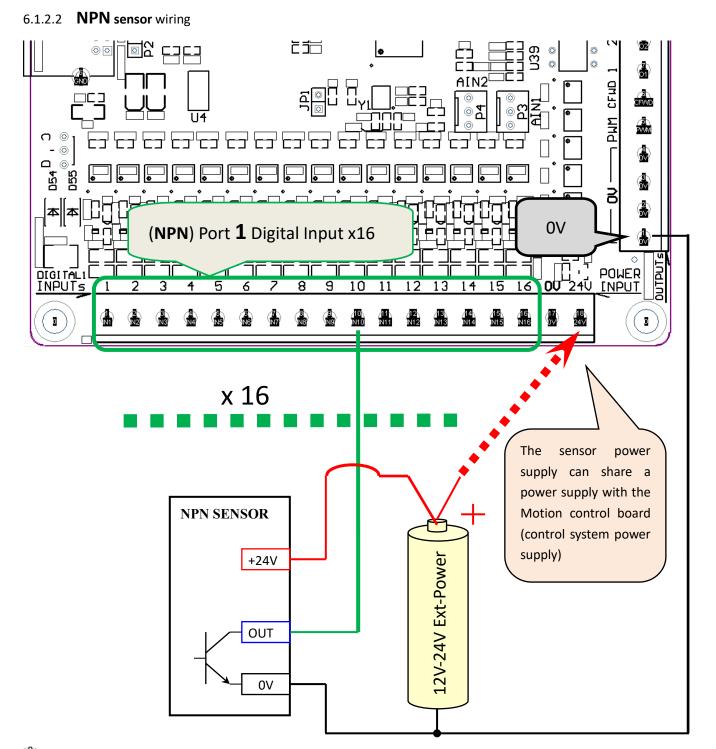
6.1 NPN input interface characteristics, wiring and configuration

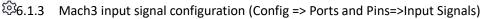


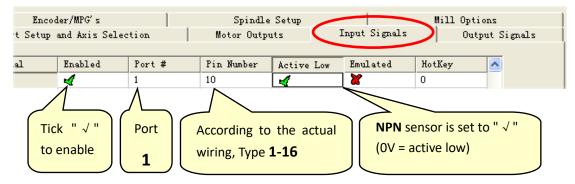
6.1.1 Interface schematic

Port **1** Digital Input: **NPN** Input x16, optocoupler isolation









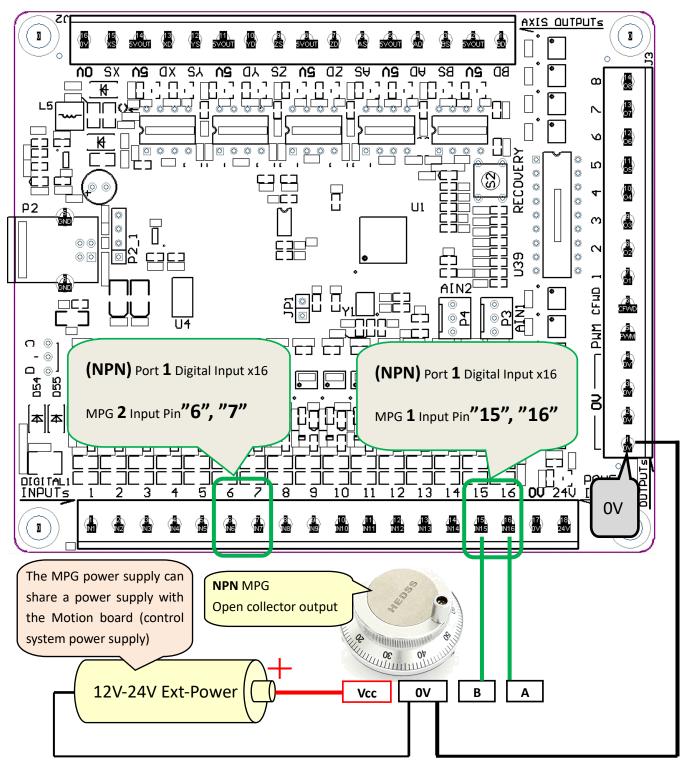
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6.2 **NPN** MPG(Manual Pulse Generation) wiring

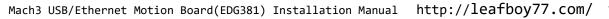
Output type of NPN MPG: Open collector output (OC)

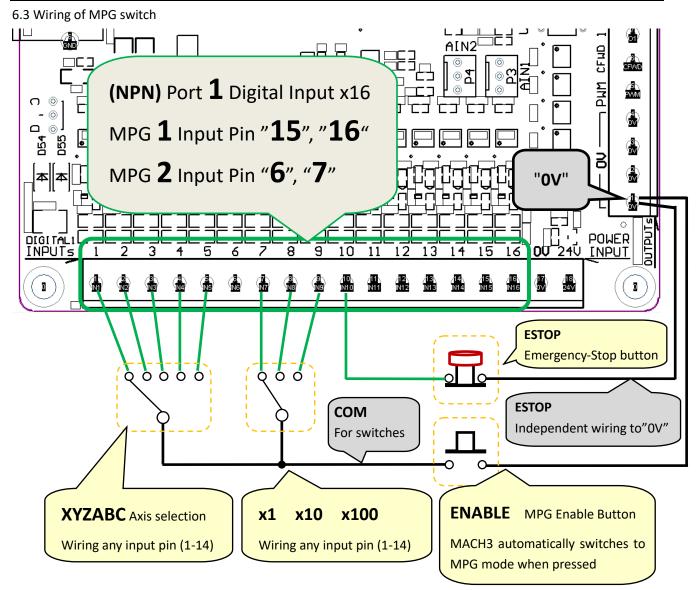




Usually the MPG rotates clockwise, the coordinates increase; counterclockwise rotation, the coordinates decrease.

If the direction of rotation of the electronic handwheel is opposite to the direction of the MACH3 coordinate, exchange the wiring of the electronic handwheels "A" and "B".





"Switch" and "Emergency Stop button" are connected to any input pin and then configured in Mach3.

When the "Enable Button" is pressed, the Jog Mode of Mach3 automatically switches to MPG mode, and automatically switches back to the original mode when the button is released.

The "Enable Button" automatically switches the JOG mode. The control board plug-in v1.3.1.2 (or later) version is required. See "<u>Download and install the Mach3 plugin</u>" to download the latest version.

If the "Enable Button" is not needed, please short-circuit it (the common terminal "**COM**" of the switches is directly connected to the "**0V**" terminal of the control board).



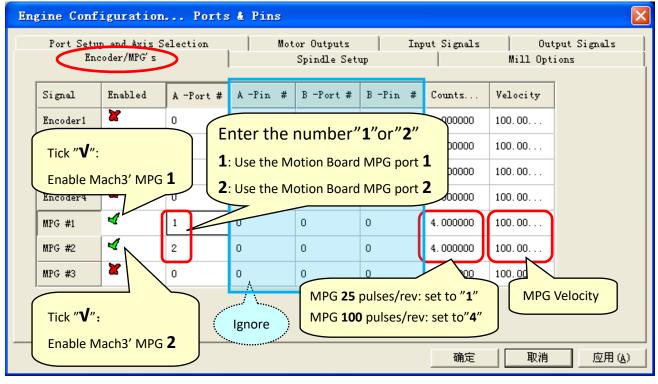
Attention:

"Emergency-Stop button" It is recommended to use the "normally closed" contact. If a fault occurs in the disconnection of the wiring, an emergency stop will be triggered.

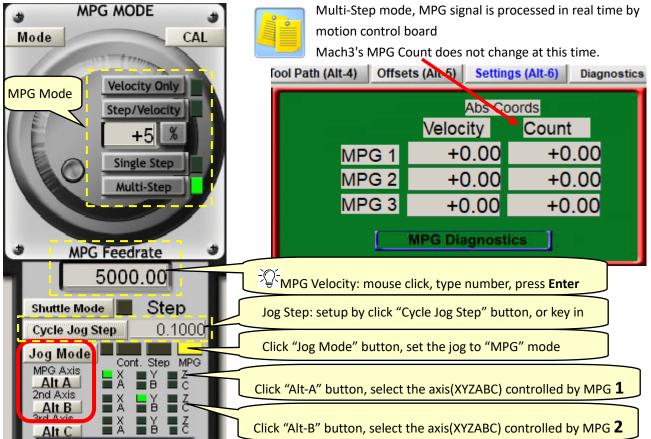


6.4 Configuration of the MPG

6.4.1 Mach3 MPG configuration, as shown below: (Config => Ports and Pins => Encoder/MPG's)



In Mach3, press the keyboard "TAB" and set it as shown below.



Mach3 USB/Ethernet Motion Board(EDG381) Installation Manual http://leafboy77.com/

Engine Configuration... Ports & Pins 1 Encoder/MPG's Spindle Setup Mill Options Input Signals Port Setup and Axis Selection Motor Outputs Output Signals Port # Signal Pin Number Active Low Emulated HotKey ^ Enabled OEM Trig #1 1 1 X 0 ď 3 4 X 0 OEM Trig #2 4 1 2 4 X OEM Trig #3 4 1 3 4 0 1 4 0 OEM Trig #4 4 4 X 5 X 0 OEM Trig #5 -1 ŝ 4 X 0 X 8 0 OEM Trig #6 1 4 7 4 X 0 OEM Trig #7 1 X ď OEM Trig #8 1 8 0 4 9 X OEM Trig #9 4 1 0 4 UEM rig... X И Þ x × 0 ¥ **.**... -Tick "**√**" Tick "**V**" According to the actual Port Inputs (OV = active low) Enable"OEM Trig" 1 wiring, Type 1-16 确定 取消 应用(A)

6.4.2 Mach3 electronic MPG switch configuration, as shown below: (Config => Ports and Pins=>Input Signals)

Configure the functions performed by "OEM Trig" as shown below: (Config => System Hotkeys)

System HotKeys Setup	×
Jog Hotkeys ScanCode ScanCode X++ 39 X 37 Y++ 38 Y 40 Z++ 33 Z 34 A / U ++ 999 A / U 999 B / V ++ 999 C / W 999	External Buttons - OEM Codes Trigger # OEM Code 1 185 2 186 3 187 4 188 5 189 6 -1 7 193 14 -1 15 -1
System Hotkeys ScanCode DRO Select 999 Code List	ScanCode 999 Configure the OEM code corresponding to OEM Trig 1-9
MDI Select 999 Reset On	999
Load G-Code 999	ОК





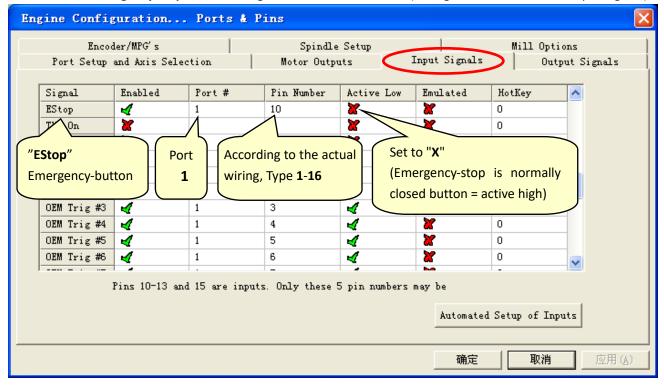
Mach3 axis selection for MPG / Jog step select OEM Buttons code table

Function	OEMCode
Select X for MPG 1	185
Select Y for MPG 1	186
Select Z for MPG 1	187
Select A for MPG 1	188
Select B for MPG 1	189
Select C for MPG 1	190
Select Jog Increment 1	191
Select Jog Increment 2	192
Select Jog Increment 3	193



Complete OEM Buttons code table, please search online

6.4.3 Mach3's emergency-stop button configuration, as shown below: (Config => Ports and Pins => Input Signals)

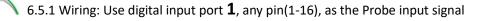


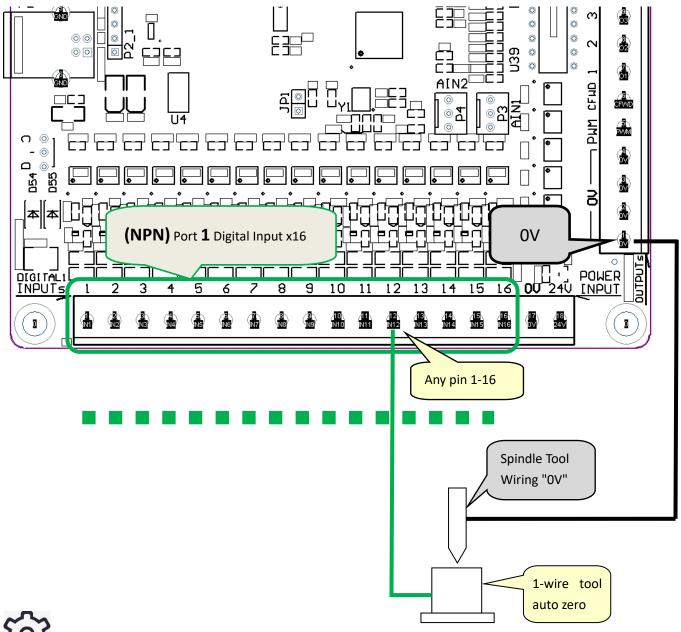


Attention:

"Emergency-stop button" It is recommended to use the "normally closed" contact. If a fault occurs in the disconnection of the wiring, an emergency stop will be triggered.

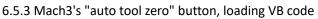
6.5 Probe (Auto Tool Zero) wiring and configuration





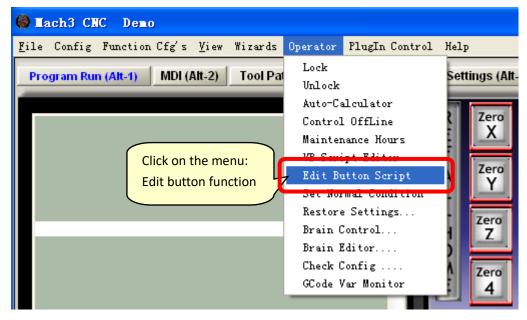
6.5.2 Mach3 Probe input signal configuration, as shown below: (Config => Ports and Pins=>Input Signals)

Encoder/MPG's	l l	Spindle	Setup	Ĩ	Mill (Options
Port Setup and Axis Selec	Motor Outputs		Input Signals		Output Signals	
		D: 17 1			17 . 77	
Signal Enabled	Port #	Pin Number	Active Low	Emulated	HotKey	^
Probe 🖌	1	12	\checkmark] 💥	0	
Index 💥	1	0	X	×	0	
Tick " √ " Enable Probe Input	Port 1	According to t wiring, Type 1		Tick " V " (0V = active lov	v)	

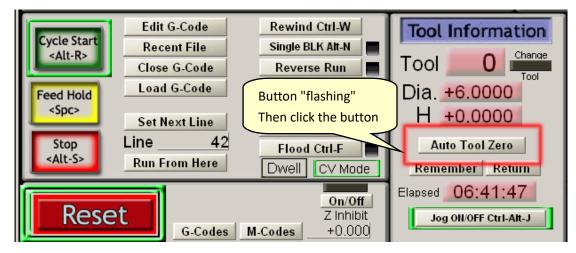


Mach3 can customize the function of some existing buttons on the screen, such as the "Auto Tool Zero" button, set the VB script.

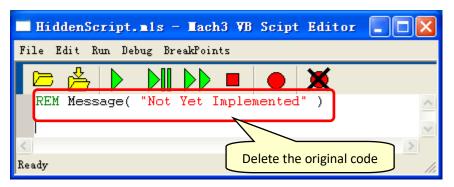
6.5.3.1 Mach3 menu (Operator => Edit Button Script)



6.5.3.2 Click the "Auto Tool Zero" button in the flashing

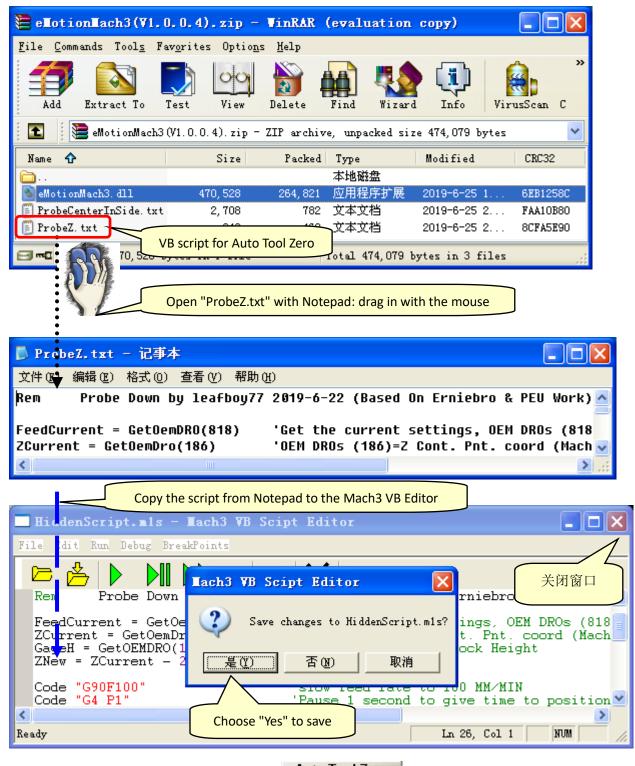


6.5.3.3 Pop up the VB editor and delete the code



6.5.3.4 Enter the VB script in the VB editor

The VB "Auto Tool Zero" demonstration script "**ProbeZ.txt**" is provided in **eMotionMach3.zip** attached to the motion control card. Please open it with Notepad.



6.5.3.5. Test: Click the "Auto Tool Zero" button Auto Tool Zero to test the tool zero action.



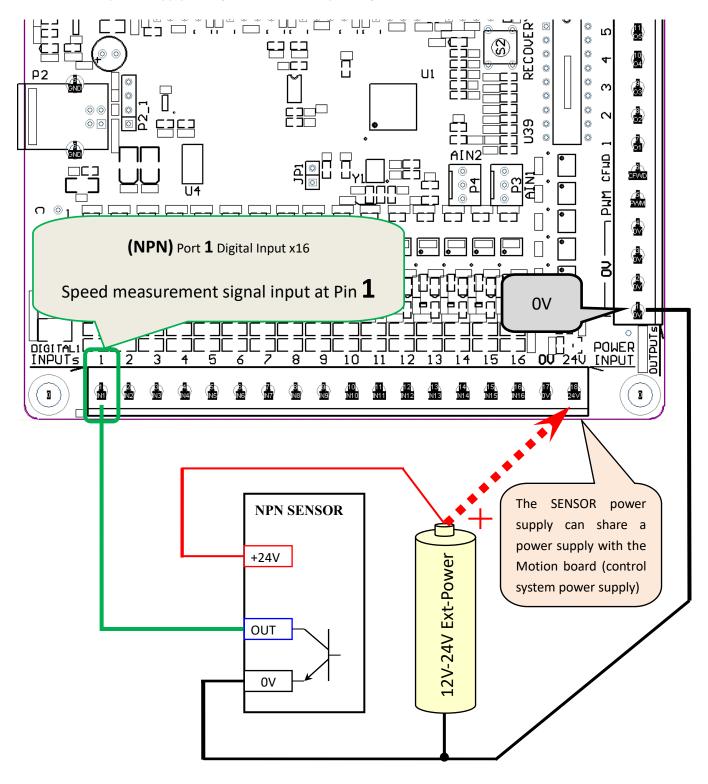
The VB "Auto Tool Zero" demonstration script "ProbeZ.txt", can be changed according to actual needs.

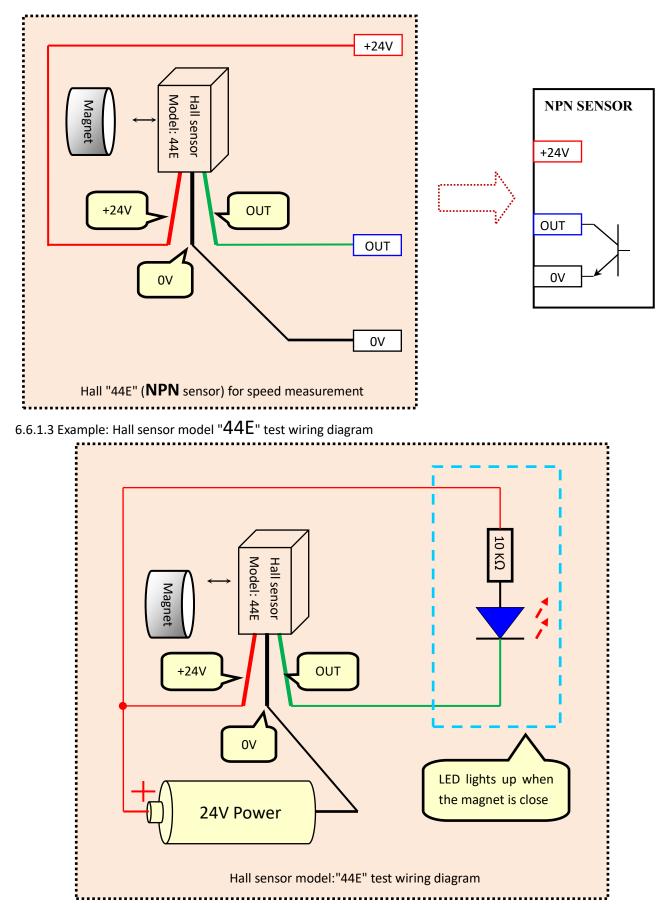
J.J.S.

6.6 Wiring and configuration of spindle speed measurement signal input

6.6.1 Wiring: Speed measurement signal input fixed wiring at Pin **1** of digital input port **1**.

6.8.1.1 External power supply, wiring of **NPN** sensor speed signal:



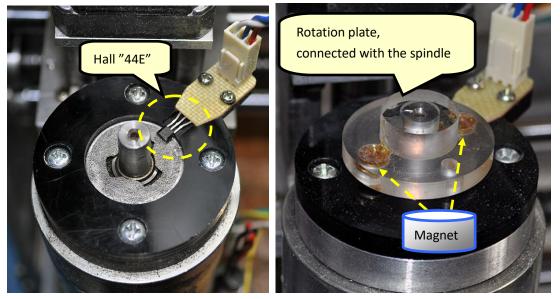


6.8.1.2 The equivalent circuit of the Hall device "44E" and the **NPN** sensor:



Hall sensor / Rotation plate installation diagram

Note: The magnet has a SN pole and should be adjusted during installation.





6.6.2 Mach3 measurement speed configuration Start Mach3 and select the external motion board, right click on the CNC icon, type the "Number of Pulses" in the settings dialog box, press OK to save the settings.

😐 Xu Lifeng Motion Board	l Config (Plugin Version: 1.0.0.2) 🛛 🔀	
Infomation <u>http://leafboy77.com</u> Hardware Ver 2019-4-8 Firmware Ver 2019-4-20	Connect C USB C ETHERNET IP IP IP IP C DSB Setup Motion Board Ethernet Port 5000 Source	Spindle Speed Spindle CW F5 SR0 9 100 Spindle CW F5 Reset
AxisFreq(KHz)511AxisOutput(Port)6DigitalInput(Port)2DigitalOutput(Port)1AnalogInput(Port)2AnalogOutput(Port)1EncoderInput(Port)2	One revolution per spindle, Sensor pulse number: Range: 1-65535 Step and Content of pulses per revolution - for speed measurement 2 Ratio Feed% Internal Content of Cancel	RPM 6480 S-ov 6500 Spind Speed 6500 RPM: The measured speed will be displayed in Mach3
RpmInput(Port) 1	Jog% Internal 1	

Mach3 measures the speed signal configuration as shown below: (Config => Ports and Pins=>Input Signals)

En	gine Config	uration	Ports & P	ins					
E		ler/MPG's and Axis Selec	tion	Spindle Motor Outpu		Input Signals	Mill Option Output	t Signals	
	Signal	Enabled	Port #	Pin Number	Active Low		HotKey	^	
	Input #1	X	1	0	X	X	0		
	Input #2	X	1	0	X	X	0		
	Input #3	X	1	0	X	X	0		
	Input #4	X	1	0	X	×	0		
	Probe	X	1	0	X	X	0		
	Index	4	1	0	X	X	0		
	Limit Ovrd		1	0 🔨	X		0	'	
	EStop		1	10	·	X	0		
	тис о	T : 1. (-!)		0 Ignoi	re	X	0		
	1100 0	x: Tick " √ "		0		X	0	~	
	Enat	ole Measures		-	h.n	h.a	1 - 18	-	
			hputs	s. Only these S	5 pin numbe:	rs may be			
	Automated Setup of Inputs								
						确定	取消	应用 (<u>A</u>)	

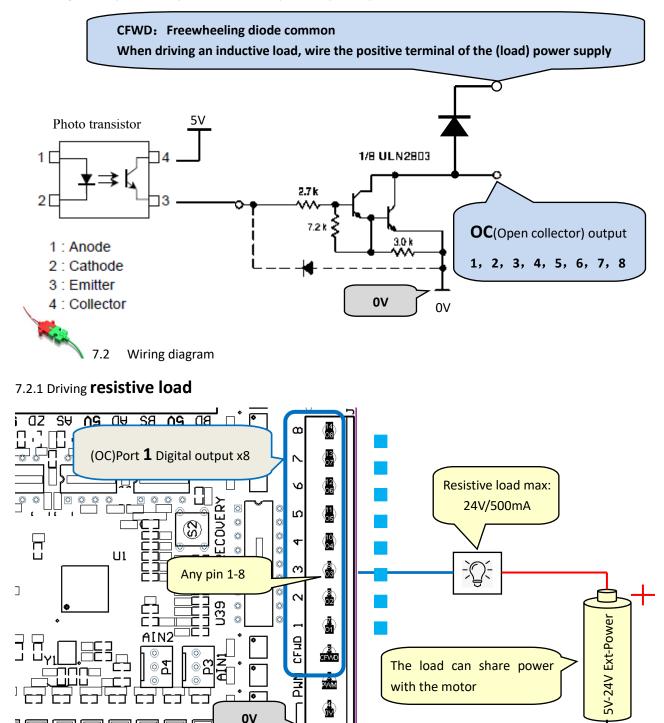
7. Digital output

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7.1 Interface characteristics of general digital output

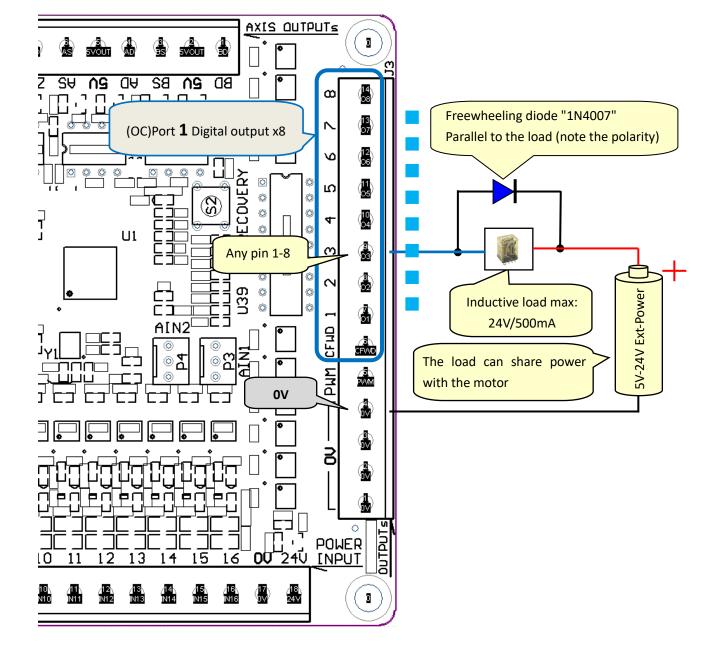
Port **1** Digital Output: **OC**(Open collector) output x8, optocoupler isolation.



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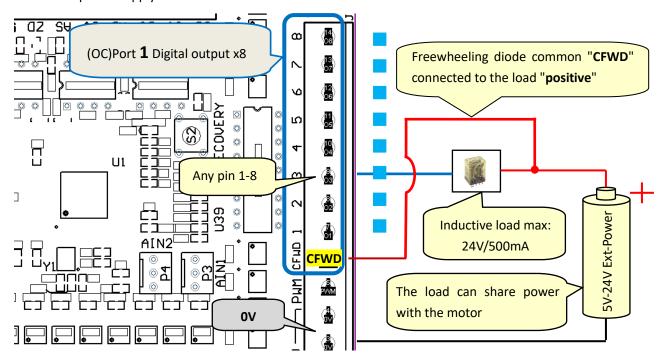
7.2.2 Driving inductive loads (such as relays, solenoid valves): installing an external freewheeling diode

7.2.3 Driving **inductive loads** (such as relays, solenoid valves): use the internal freewheeling diode common terminal "**CFWD**" on the motion board



With the "CFWD" terminal, all loads can only be connected to the same external power supply.

With the "CFWD" terminal, the "inverter" cannot be connected because there is an additional separate power supply inside the "inverter" interface.



1

Note: There are 2 or more external power supplies for the loads. You cannot use "CFWD". An external freewheeling diode must be installed.

See: 7.2.2 Driving inductive loads: installing an external freewheeling diode

For example, the two output terminals of the Motion-board are connected to the inverter and the relay,

In this case, an external freewheeling diode must be installed for the relay (or inductive load).

Reasons for explanation: There is one independent power supply inside the inverter interface, and the relay also has one external power supply. There are two power supplies in total.

When the power is turned off, or when the power is suddenly turned off, the voltage drop speeds of the two power supplies are different, which may cause the inverter to trigger the operation by mistake, which may cause danger! (For example, changing a Tool). Install an external freewheeling diode (you cannot use "CFWD") to avoid malfunction caused by the interaction of the two power supplies.

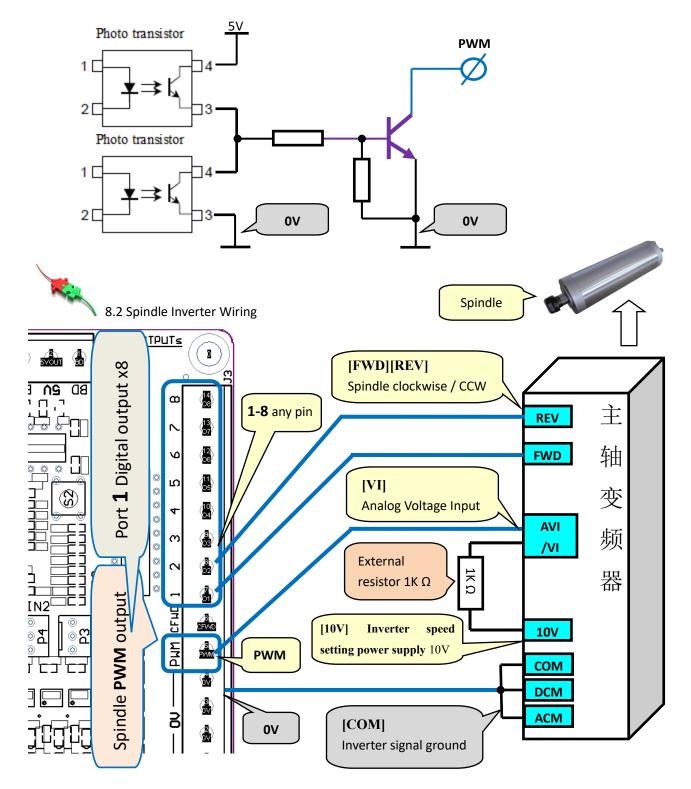
⁽²⁾7.3 Mach3 output signal configuration, as shown below: (Config => Ports and Pins => Output Signals)

Eng	ine Configura	tion Ports	& Pins			
Tick " √ " when needed Port 1			_]]	ording to the actu e 1-8	al wiring	Mill Options Output Signals
	Signal	Enabled	Port #	Pin Number	Active	Generally set to " \checkmark "
	Output #1	4	1	1	\checkmark	(active low output)
r	Output #2	4	1	2	4	

8. Spindle speed control analog output



PWM Analog (Pulse Width Modulation) output: **OC**(Open collector) output x1, optocoupler isolation.







8.3.1 Mach3's Spindle configuration, as shown below: (Config => Ports and Pins=> Spindle Setup)

Tick "Use Spindle Motor Output" and "PWM Control", type the required frequency in "PWMBase Freq.", the unit is Hz.

Engine Configuration Ports & Pins	X
Port Setup and Axis Selection Motor Outputs Input Signals Output Signals Encoder/MPG's Spindle Setup Mill Options	
Relay Control Disable Spindle Rel Clockwise Output CCW (M4) Output Output Signal #'s Flood Mist Control WMBase Freq. 4166 PWMBase Freq. 4166 PWMBase Freq. 4166 PWM frequency (Hz) When using the inverter, set the maximum value allowed for Mach3: 4166 Spindle Relay Control: Type "1"-"20" The configuration in the figure is: M3: "Output #1" M4: "Output #2"	
Output signal configuration "Output Signals", Set the corresponding "Output #1—Output #20"	

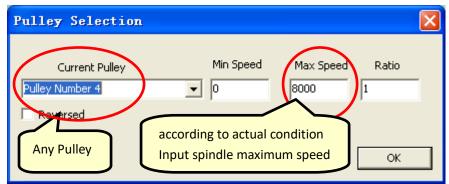
8.3.2 Spindle relay donfiguration, as shown below: (Config => Ports and Pins=>Output Signals)

Eng	Engine Configuration Ports & Pins									
E	Encoder/MPG's Port Setup and Axis Selection			Spindle Setup Motor Outputs Input			Mill Options Signals Output Signals			>
	Signal Output #1 Output #2		Enabled	Port # 1 1	Pin 1 2	Number	Active Low	<u>^</u>		
	Tick " √ Output Output	#1	en needed	Port 1	According t wiring, Typ	o the actual e 1-8	Tick "V (active	low out	put)	

8.3.3 The **phase configuration of the spindle speed control signal PWM** is shown in the figure below: (Config => Ports and Pins => Motor Outputs)

Encoder/MPG's Port Setup and Axis Selection			Spindle Setup Motor Outputs I		Mill Options Input Signals Output Signal		
Signal	Enabled	Step Pin#	Dir Pin#	Dir Low	Step Lo	Step Port	Dir Port
X Axis	4	2	6	X	X	1	1
Y Axis	4	3	7	X	X	1	1
Z Axis	4	4	8	X	X	1	1
A Axis	4	5	9	X	X	1	1
B Axis	4	0	0	X	X	0	0
C Axis	4	0	0	X	X.	0	0
Spindle	4	0	0	X	X	0	0
According to the required phase, hit "X"or " √ " 确定 取消 应用							

8.3.4 Mach3 menu "Config => Spindle Pulleys..", "Pulley Selection"



8.3.5 For other configurations of the spindle, please refer to "Mach3Mill_Install_Config.pdf"

8.3.6 Spindle test

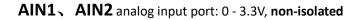
In Diagnostics (Alt-7) or MDI(Alt-2):

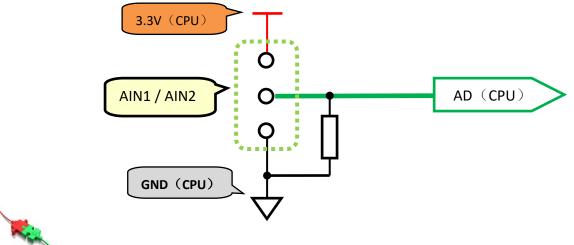
- Keyboard input "M3".
- Keyboard input "S10000", spindle starts to rotate. (When testing, it is recommended to use half of the maximum speed to avoid the phase setting error and the spindle does not rotate. After the spindle is running, adjust the speed. Adjust the <u>spindle phase setting</u> when the spindle speed is opposite to the set speed)
- Keyboard input "M5", the spindle will stop rotating.





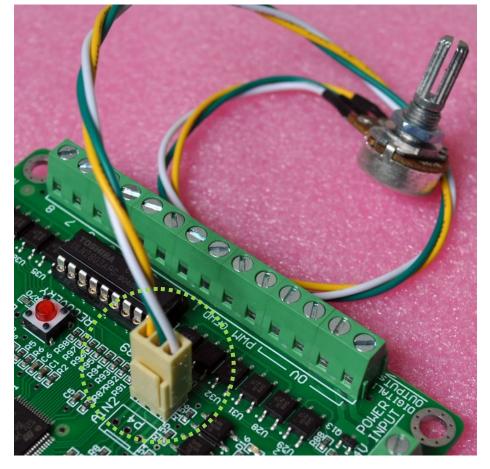
9.1 Interface characteristics of analog input





9.2 Wiring diagram

Connecting the adjustment-knob with the AIN1 of Motion board





9.3 Configuration

Start Mach3 and select the external motion board. Right click on the CNC machine icon, setting dialog will be shown. You can select one of the functions which is able to controlled by the external knob. Please select "External AIN1" in your particular setting.

🛄 Xu Lifeng 🔳 Iotion Board	Config (Plugin Version: 1.0.0.2) 🛛 🔀
Infomation <u>http://leafboy77.com</u> Hardware Ver N/A Firmware Ver N/A	Connect C USB Setup Motion Board Ethernet ETHERNET IP 192.168.1.77 Port 5000
AxisFreq(KHz) 0	
AxisOutput(Port)0DigitalInput(Port)0DigitalOutput(Port)0	Spi Ratio Config: Internal External AIN revolution ment
Ar FRO% (Feed Rate) Analogeocpactroncy	Ratio 2 Feed% External AIN1 OK 3
Spindle% (Spindle speed Rate) RpmInput(Port) 0	Spindle% Internal Jog% Internal Cancel
Jog % (Slow Jog Rate)	
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Then, click "OK" to exit.

Now, you can try to turn the knob to adjust your selected function.

