Index

1. Operation of the machine

1.1 Software setup

If you don't have a copy of mach3 first download a copy at

http://www.machsupport.com/downloads.php,

make sure to download the newest version * Lockdown: * Mach3 R2.63.

After downloading and installing the software it is vital to reboot the computer as the installer will prompt. Do not start up mach3 without this vital reboot, if you do not do this you will have to manually remove mach3 from your system and reinstall. It is best to install mach3 in to the default directory , C drive as this can make things easier for trouble shooting.

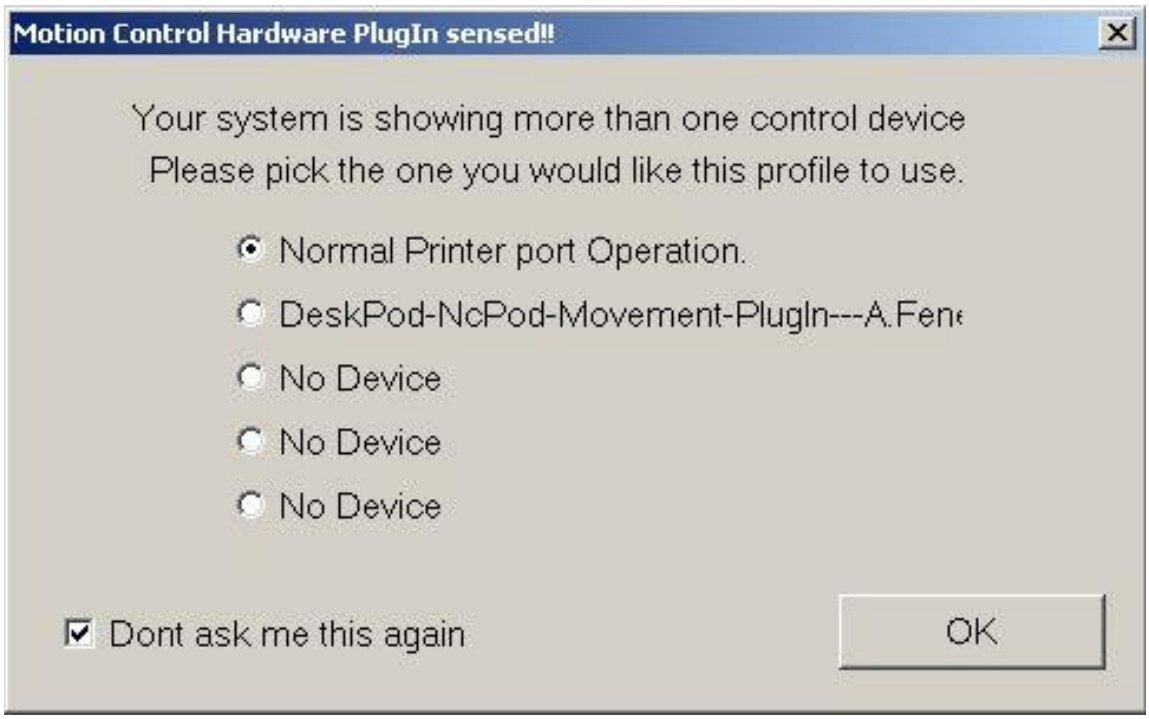


Figure 1-1

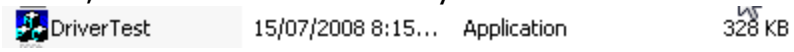
After install you may see this screen as Figure 3-1, if you don't see this screen, don't worry about it.
Printer port operation will be set as then click OK and Don't ask me this again.

1.1.1 Mach3 driver

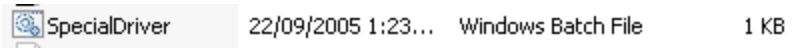
Figure 1-2

After you have completed the installation of mach3，see mach3 driver 'MACH3 DRIVER' in device manager(as Figure 1-2)，or the machine will be out of control.

To check to see if the drive installed properly you then can confirm this by, "C drive", "mach3", look down the list until you see:



By opening this software Mach3 will do a test on the driver, if this fails you must reinstall Mach3 or use In the same directory.



1.1.2 Interface of mach3

After you start the software ,the interface of mach3 is as Figure 1-3

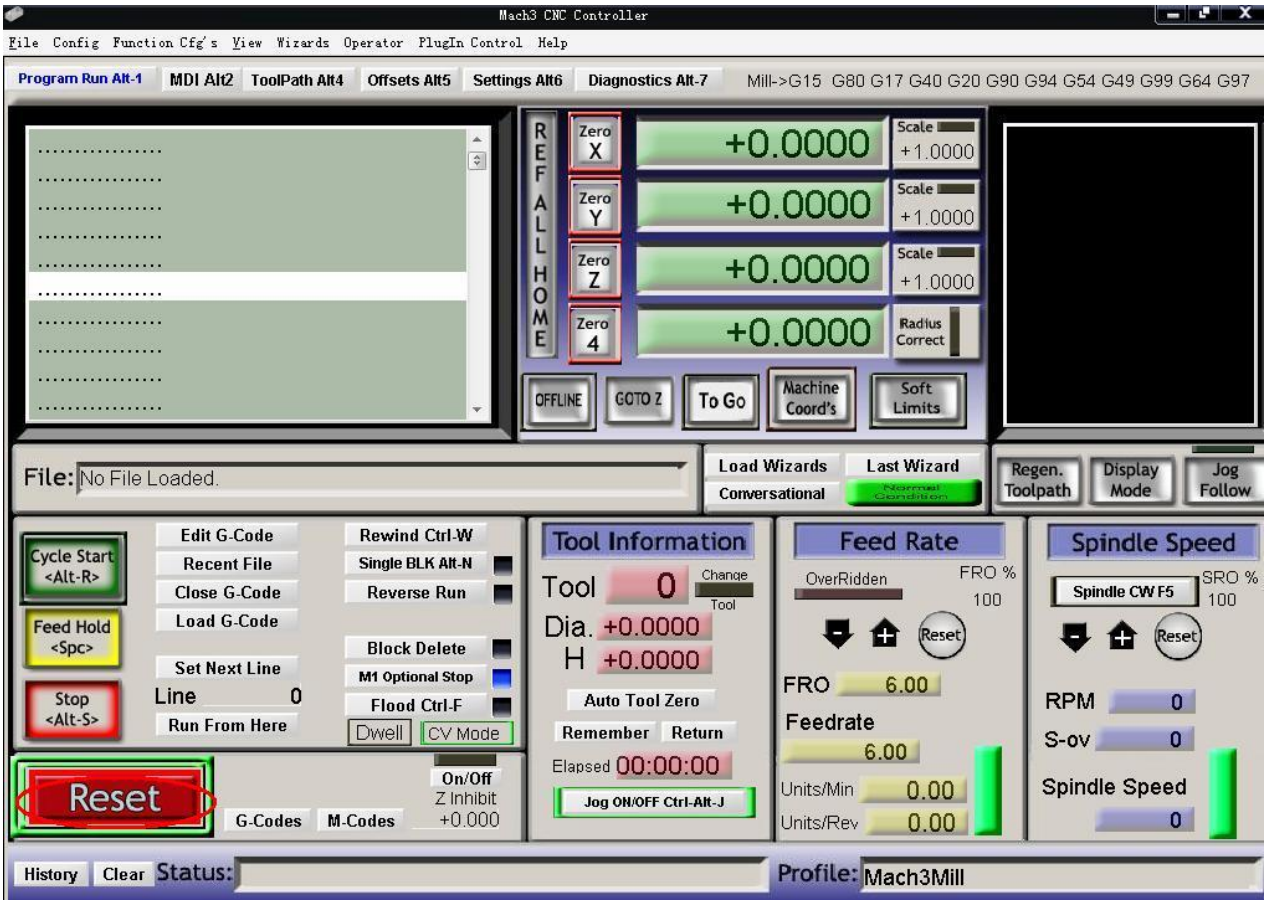


Figure 1-3

Attention: Before you attempt to control the machine with mach3,the button of RESET must be inactive.

1.1.3 how to use xml file

Your syil distributor should have provided you with a syil .XML file, this file is a setup file for mach3. This file will make your installation plug and play. locate this .xml file and copy it by right clicking and select COPY. Open "MY COMPUTER" select the ``C DRIVE``, `mach3``. Paste this .xml file in to a open place in the directory, do not paste in to any internal mach3 folders.

MACH3 LOADER

Open the mach3 loader and select the x5 profile(as Figure 1-4)

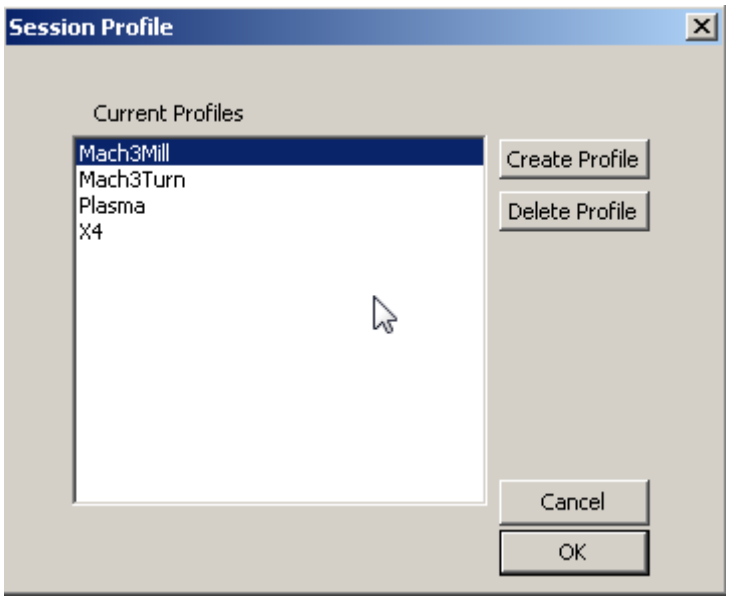


Figure 1-4

1.1.4 pin config of mach3

After get into the mach3 interface, please check the pin config, make sure they are right, the pin of x5 is as Figure 1-5

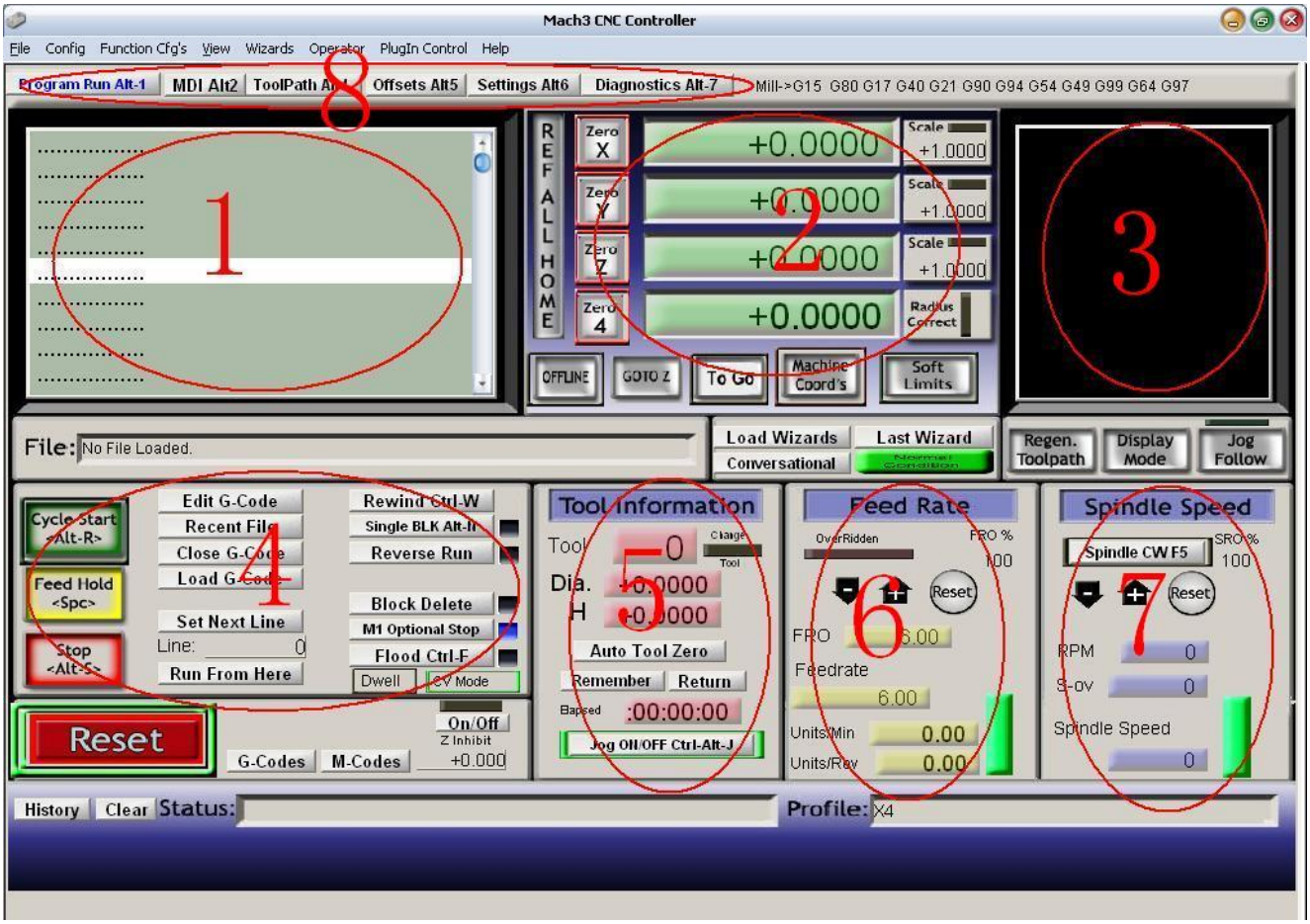
Signal name	pin	I/O of the Signal
X pulse	7	output
X dir	17	output
Y pulse	6	output
Y dir	8	output
Z pulse	5	output
Z dir	16	output
A pulse	4	output
A dir	14	output
Spindle pulse	2	output
Spindle dir	1	output
Signal 1	3	output
Signal 2	9	output
X home	12	input
Y home	13	input
Z home	10	input
A home	15	input
E-stop	11	input

Figure 1-5

The information should all ready be pre set in the (x5).xml file

1.2 Instruction of mach3

1.2.1 The Mach3 interface screen



1: Mach3 Gcode window, user this will display the current active gcode program, the white bars shows the line that is currently active.

2: (DRO) this digital read out shows the current location of each axis, in either work piece coordinates or machine coordinates
3: this will display the tool cutting path, this window can be very useful. If your program is loaded you should see the similar part. (if you do not you might not want to push the start button).
The mouse can be used to change the perspective.

4: interface procedures:
Cycle start: To run current loaded program
Feed hold: program suspended
Stop: stop program (do not use as estop) in emergency use ESTOP
Edit G-code: Edit current program
Recent file: the recent run-off procedures document
Close G-code: Close the program

Load G-code: loading program files
Set next line: a set of enforcement procedures
Line: is currently running a number of
Run from here: from the current line running show that in the white bar
Rewind: re-start procedures
Single BLK: a single operation (this will advance 1 line each time cycle start button is pushed)
Reverse run: repeat run
Block delete: delete breakpoint
M1 optional stop: to stop the use of M1 code
Flood: turn on coolant

5: Tool information:
This information is crucial to proper tool changes and setting up tools in the tool table. The tool displayed is the tool that is currently active, as well as the current height offsets.

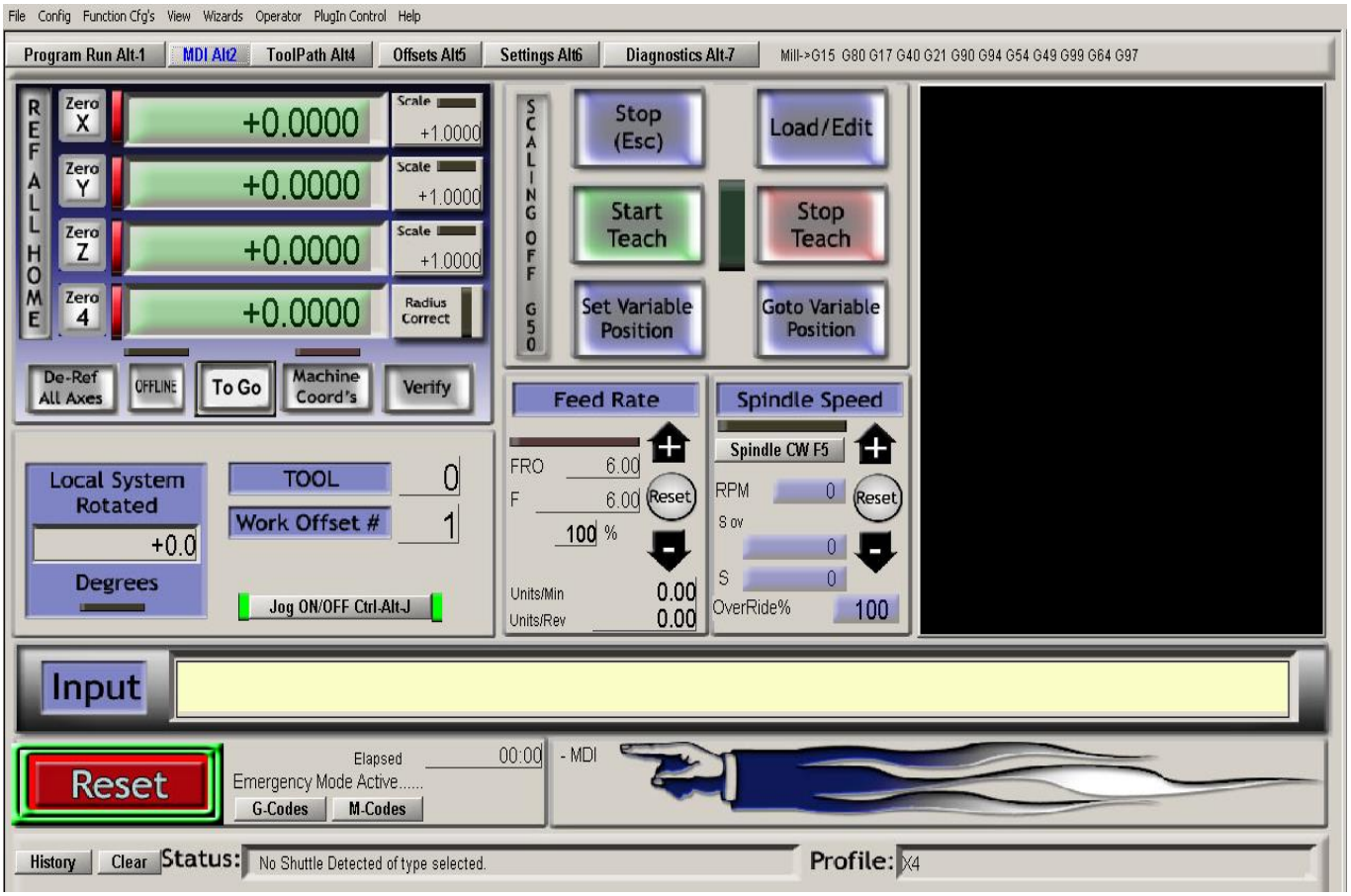
6: Feed interface:
FRO: this displays the current programmed feed. This number can be manually changed only if a M48 is used in your starting lines of code.

7: spindle speed control interface:
Spindle F5 CW: this butto is used to start the spindle manually.

RPM: spindle speed feedback display interface. In the absence of spindle speed feedback, which will appear as 0.
S-ov: Theory should reach spindle speed, RPM and that can be compared.
Spindle speed: spindle speed manual adjustment interface.
You can also manually enter the spindle speed.

8: Mach3 Tabs.
Program run: Comprehensive program control interface.
MDI: manual data Input.
Toolpath: tool path control interface.
Offsets; used to set up work piece cords (g54) and tool length offsets .
Settings: Alter mach3 settings
Diagnostic: Used to diagnose mach in case of problems.

1.2.2 MDI screen



MDI (manual data input)
This screen is very helpful, simply type in the a code command in to the white line this allow for quick and easy manoeuvrability. (eg) to move all axis to work piece home just type in (g00 x0y0z0) or to send machine to home position type in (G28)

This is a complete list of MACH3 gcodes

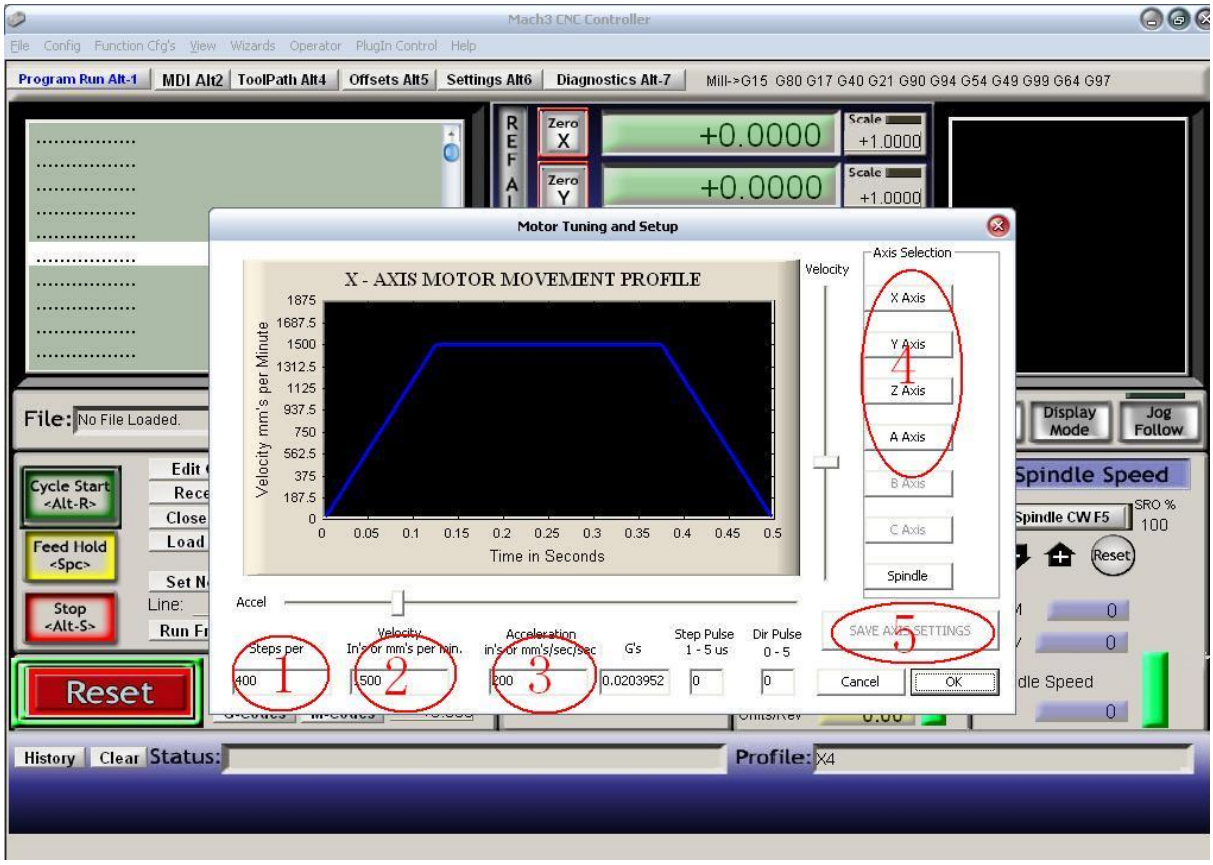
G-code	*Functions*	*G-code*	*Functions*
G0	Rapid positioning	G53	Move in absolute machine coordinate system
G1	Linear interpolation	G54 à G59	Use fixture offset 1 to 6, G59 to select a general fixture number
G2	Clockwise circular / helical interpolation	G61	Exact Stop mode
G3	Counterclockwise circular / helical interpolation	G64	Constant Velocity mode
G4	Dwell	G73	Canned cycle - drilling - fast pullback
G10	Coordinate system origin setting	G80	Cancel canned cycle mode
G12	Clockwise circular pocket	G81	Canned cycle - drilling
G13	Counterclockwise circular pocket	G82	Canned cycle - drilling with dwell
G15	Polar Coordinate moves in G0 and G1	G83	Canned cycle - peck drilling
G16	Cancel polar Coordinate moves in G0 and G1	G84	Canned cycle - right hand rigid taping (not yet implemented)
G17	XY plane select	G85	Canned cycle - boring, no dwell, feed out
G18	XZ plane select	G86	Canned cycle - boring, spindle stop, rapid out
G19	YZ plane select	G87	Canned cycle - back boring (not yet implemented)
G20	Inch unit	G88	Canned cycle - boring, spindle stop, manual out
G21	Millimeter unit	G89	Canned cycle - boring, dwell, feed out
G28	Return machine home (parameters 5161 to 5166)	G90	Absolute distance mode
G30	Return machine home (parameters 5181 to 5186)	G91	Incremental distance mode
G28.1	Reference axis	G92	Offset coordinates and set parameters
G31	Straight Probe	G92.1	Reset G92 offset and parameter
G40	Cancel cutter radius compensation	G92.2	Reset G92 offset but leave parameters untouched
G41	Start cutter radius compensation left	G92.3	Recall G92 from parameters
G42	Start cutter radius compensation right	G93	Inverse time feed mode
G43	Apply tool lenght offset (plus)	G94	Feed per minute mode
G49	Cancel tool lenght offset	G95	Feed per revolution mode
G50	Reset all scale factors to 1.0	G98	Initial level return after canned cycles
G51	Set axis data input scale factors	G99	R-point level return after canned cycles

This a complete list of mach3 M codes

M-code	*Functions*
M0	Program stop
M1	Optional program stop
M2	Program end
M3 / M4	Rotate spindle clockwise/counterclockwise
M5	Stop spindle rotation
M6	Tool Change (by two macros)
M7	Mist coolant on
M8	Flood coolant on
M9	All coolant off
M30	Program end and rewind
M47	Repeat program from first line
M48	Enable speed and feed override
M49	Disable speed and feed override
M98	Call subroutine
M99	Return from subroutine/repeat

1.2.3 X, Y, Z axis motor Tuning interface

-



This is the X, Y, Z axis adjust the speed of the interface, located in the motor tuning config settings,

1: Pulse settings,

this drives the need to set for the syil products, the default setting is for 400 metric and 10160 for imperial. These numbers are imperative to the proper operation of your machine.

2: velocity,

This directly controls the inches or mm per min, in your rapid movements (G00)

If you tune this to quickly this can result in lost steps and damage to your work piece and can result in a major crash. Contact your distributor prior to changing this setting.

3: Acceleration adjustment:

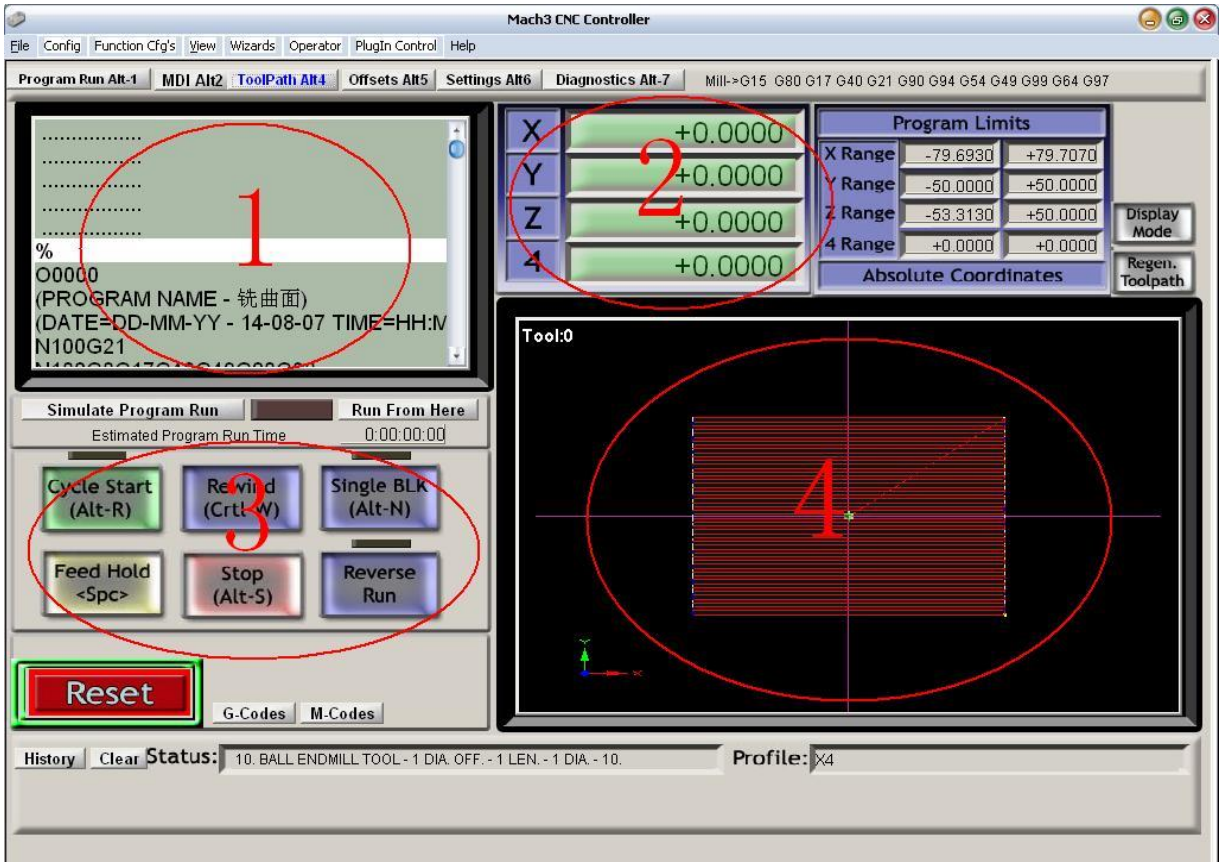
This setting controls how fast the stepper motor get to the designated Velocity, again too fast and this can result in lost steps.

4: Switch-axis:

This allows you select each individual axis to tune, you must select save axis in order to use the changed parameters. This must be done on each axis.

NOTE: Motor tuning is like tuning a guitar, it is a perfect balance between, steps, velocity, and acceleration. If you do not know what you are doing, we do not suggest altering these setting without contacting a dealer.

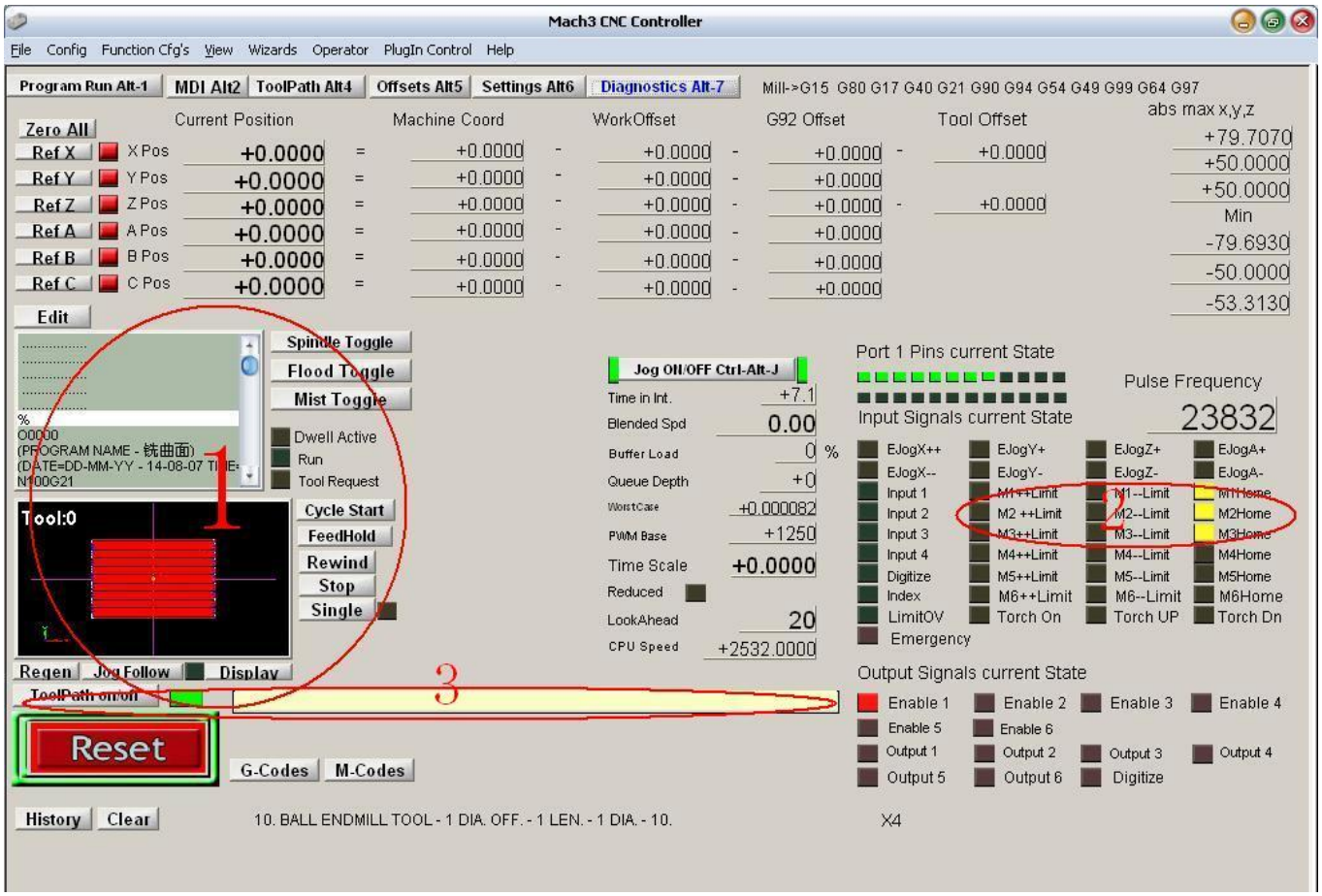
1.2.4 Tool path Display interface



This is the tool path observation interface, integrated interface corresponding to 1,2,3,4.

This screen is larger and can aid in observation of the current program, also the simulate program is helpful as I can give a estimated program run time.

1.2.5 Mach3 Diagnostics



Digonstic interface,

This screen is very useful in knowing what your machine is doing, this is extremely helpful in case you are having issues with the machine. This screen is set up to allow you to still run your program and see exactly what you machine is doing.

1: Displays current gcode program.
2: Shows input and out put signals from your machine and computer.
3: MDI (manual data input) line allows for manual input of gcode.

This screen can be very useful to check communication between the machine and the computer, simply depress one of the x or y homing switches and you will see the corresponding light illuminate.

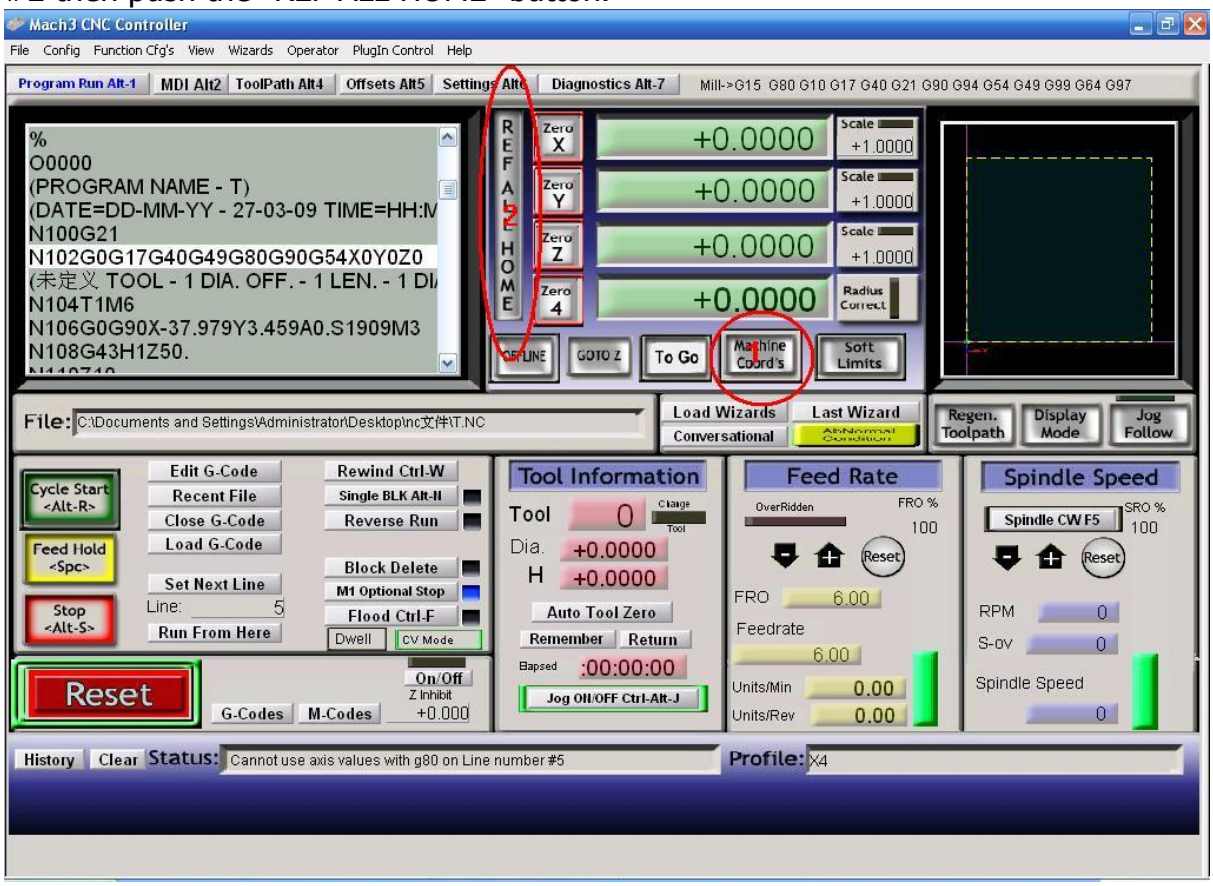
1.2.6 home the machine

Homing the machine is when you send the X,Y and Z to the homing switches, this crucial the producing precise parts and components. The machine knows is positioning in space due to mathematical calculations, on how far away it is from its homing switch. It is extremely important to home the machine every time you power up the machine, and or the computer.

This is achieved by going to the main mach3 screen set,

#1 push the machine crord's button, you will know it is active when the light around it is red.

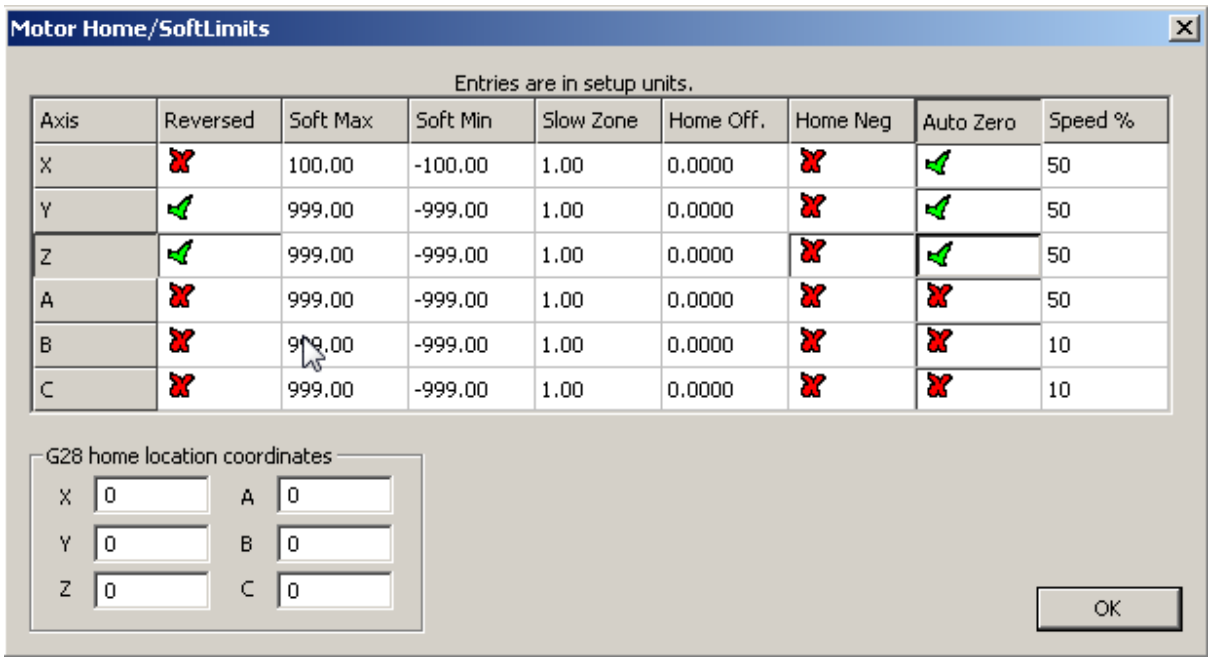
#2 then push the "REF ALL HOME" button.



This will send all axis home to the switches, for this function to work properly you must have the auto Zero set under 'config', - homing and limits.

NOTE: it is always best to make sure that your tool is completely clear of the work piece prior to homing the machine.

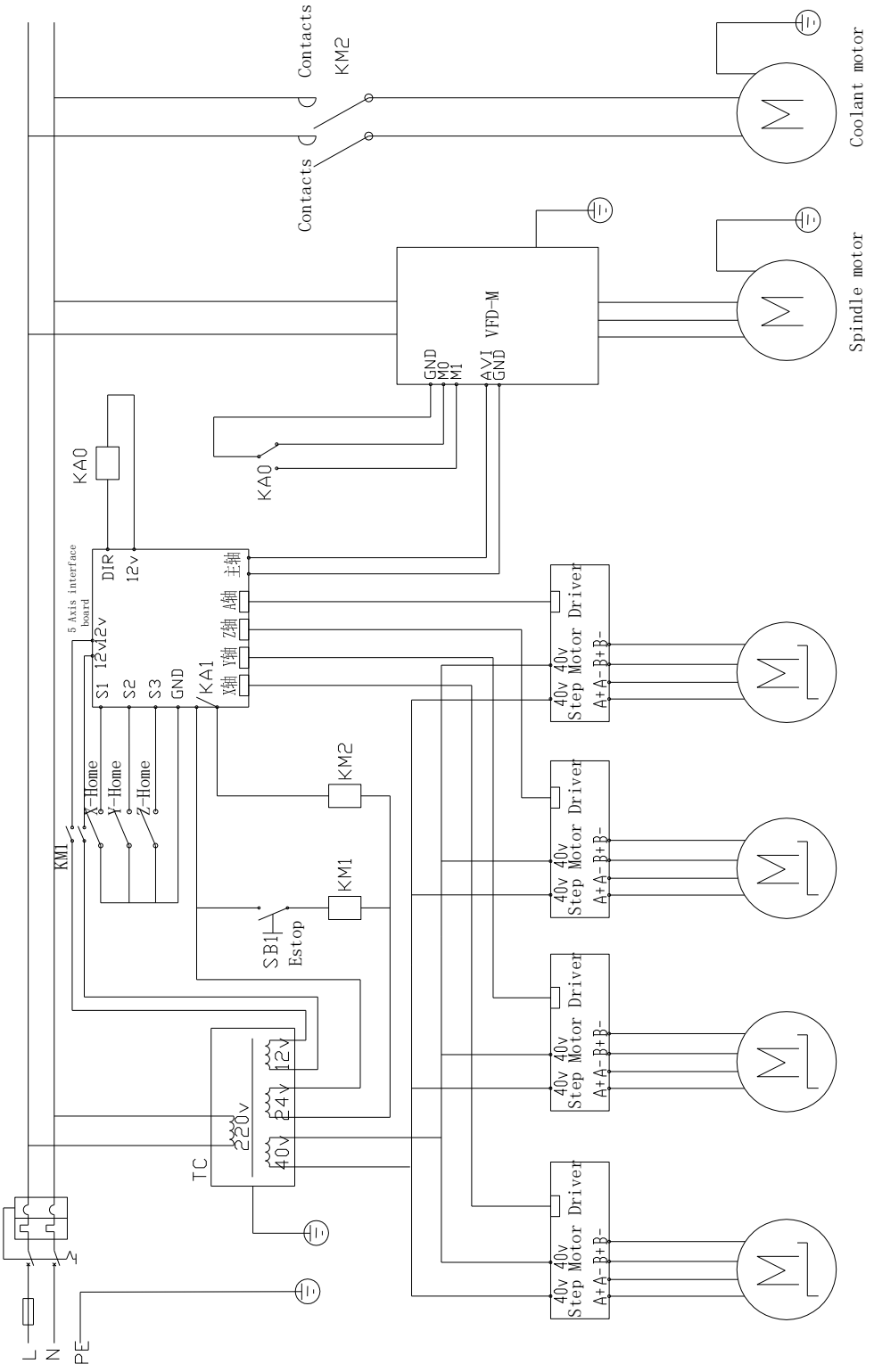
You can change the direction of axis and home axis in the following screen:



2. Electricity instruction

2.1 Electricity schematic

- Schematic for x5



2.2 Electricity parts list

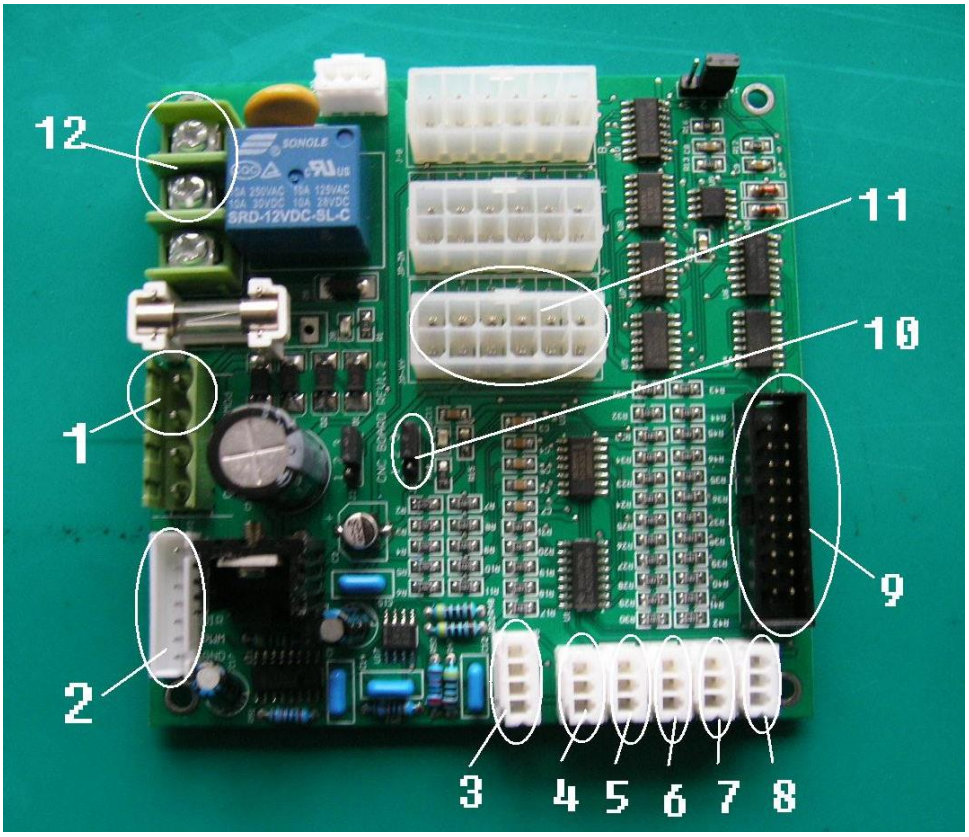
• Parts list for x5

NO.	parts	Num	Remark
1	VFD-M	1	
2	1100W AC motor	1	
3	220v Transformer	1	40v output，24v output， 12v output, TC
4	5 axis interface board	1	
5	step motor driver	3	
6	step motor	2	For X axis and Y axis
7	750w servo motor with brake	1	For Z axis
8	Leakage circuit breaker	1	QF0
9	home/limit switch	3	X-home, Y-home, Z-home
10	plug	1	
11	power wire	1	
12	Trunking		Use 3m
13	switch	1	
14	Switch for 4th axis	1	
15	24V A.C Contactor	2	KM1,KM2
16	24vdc relay	1	KA0

2.3 Circuit board reference

2.3.1 Five axis interface board

This board is for x5 series



1：12VAC/VDC power input
2：Spindle control port
3：0~10v output signal
4：X-ref(+5V,S,GND)
5：Y-ref(+5V,S,GND)
6：Z-ref(+5V,S,GND)
7：A-ref(+5V,S,GND)
8：E-stop port(S,GND)
9：Connect to parallel port
10：Jumper: use pin 1、2, open charge pump; use pin 2、3: close charge pump
11：Port for X,Y,Z,A,B step motor driver
12：Relay for coolant pump

2.3.2 Spindle control board

2.3.2.1 Interview

1, the product must be installation, commissioning, operation and maintenance by professional and technical person. the product is electrical equipment, incorrect using or wiring will cause electrical shock, fire, explosion or other dangerous!

2.3.2.2 Spindle driver

Model	Parameter
Voltage	220V
Power	1.5KW

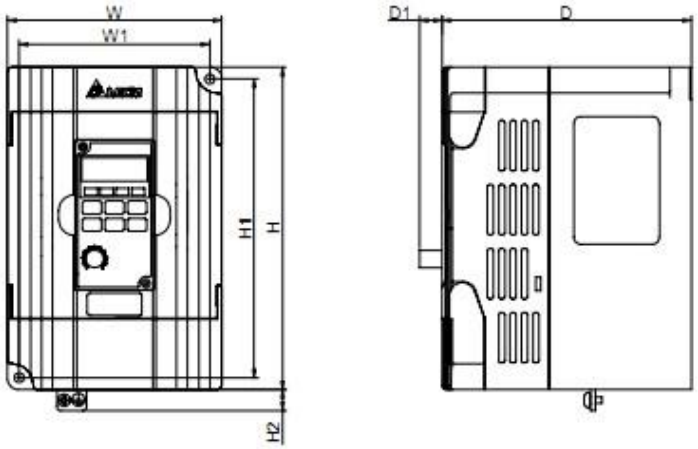
You can get more detail from VFD-M manual.

2.3.2.3 Motor Features

Model	Parameter
Type	MAV3 80-4
Frequency	50hz
Output	1.5HP, 1.1KW
Poles	4
Voltage	220v/380v
AMP	1.1A
Max Frequency	200HZ

RPM	1450
Weight	13.5kg
P.F.	65%

2.3.2.4 mounting dimensions



Unit: mm [inch]

Model Name	W	W1	H	H1	H2	D	D1
VFD004M21A/23A, VFD007M21A/23A, VFD015M21A/23A	85.0 [3.35]	74.0 [2.91]	141.5 [5.57]	130.5 [5.14]	10.0 [0.39]	113.0 [4.45]	10.0 [0.39]
VFD002M11A, VFD004M11A/21B, VFD007M11A/21B/43B/53A, VFD015M21B/43B/53A, VFD022M23B/43B/53A	100.0 [3.94]	89.0 [3.50]	151.0 [5.94]	140.0 [5.51]	10.0 [0.39]	116.5 [4.59]	10.5 [0.41]

2.3.5 4th Axis instruction

The 4th axis is Optional Accessories, and it's for x5 series

The rotary table are mainly accessories for milling machine, boring machine and drilling machine, they can be used for listing things:

1. circular cutting, the table in graduated with a 360° scale
2. angle setting
3. boring
4. spot facing operations
5. similar work in conjunction with a milling machine
6. indexing
7. in a vertical position to enable to carry out center work with the help of tailstock
8. the dividing plate accessory allows the operator to accurately divide the 360° rotation of the clamping surface into divisions of all divisible of 30′

Specifications:

Diameter of rotary table:	¢100 mm
Height of center for horizontal mounting:	73 mm
Taper of center bore:	MT#2
Width:	8mm
Width of locating key:	8mm and 10mm
Angle of T-slot:	90°
Height of center for ver.Mounting:	68mm
Driving ratio of worm gear:	1:72
Module of worm gear:	1
Graduation on table circumference:	360°
Max feedrate:	600mm/min

3. Troubleshooting

3.1 Overview

This section is very important, if your machine has issues.

3.1.1 Attention

Our machine is an intergration of mechanical components, Digital components, electrical components, personal computer and software.

The following are some events which may cause the machine not work correctly.

- The machine was transported, and wiring may have come loose
- There was a thunderstorm w/ lightning since the machine was last used and now the electronics do not work.
- There has been water in the area where the machine is located
- The machine is in unheated outside building.

3.1.2 Troubleshooting overview

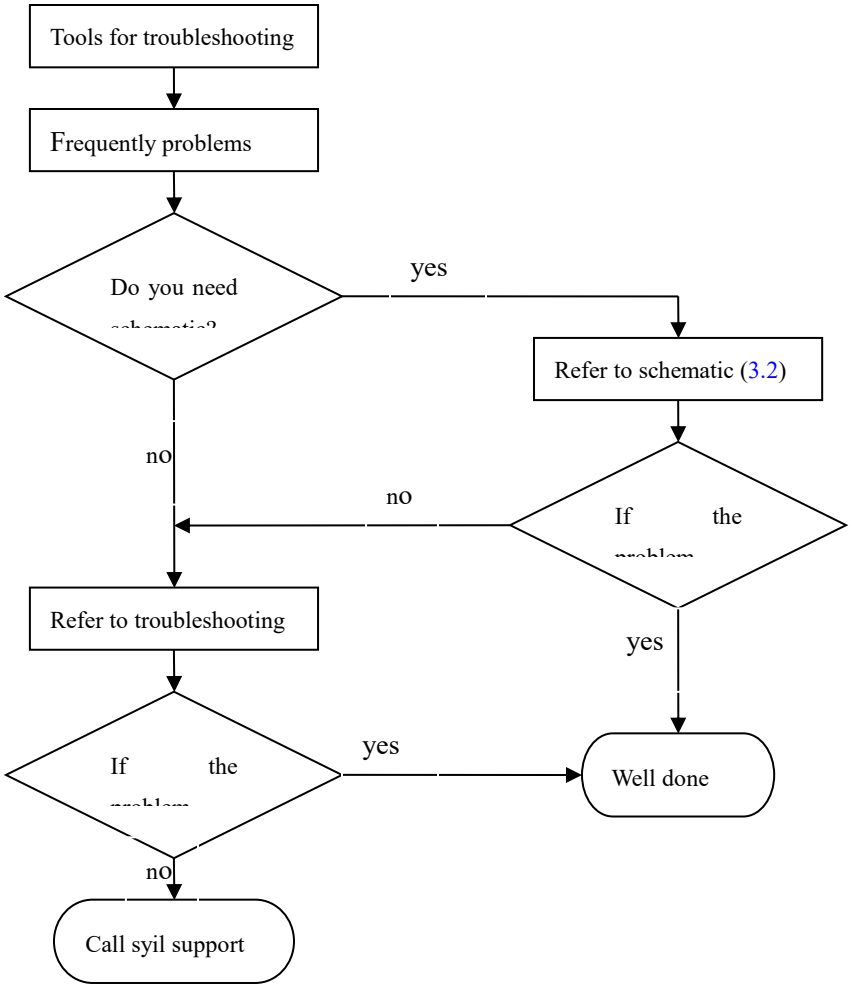


Figure 3-1

This is the troubleshooting overview, as Figure 3-1,you can try to solve the problem as above, the next will instruct the all process detailed.

Attention for troubleshooting:

- Have knowledge of how machine is supposed to work.

- Divide and conquer—focus on one area
- Analyze what has changed
- Work smart—do the easy and obvious tests first
- Complete one test before starting another.

3.1.2.1 Tools for troubleshooting

3.1.2.1.1 Safety

- ***Never do anything with machine power on*** **that can be done with machine power off.**
- **Wear eye protection and use appropriate protective clothing such as gloves**
- **Don't wear loose clothing**
- **Don't wear jewelry as this can contact electrical componants.**
- **Do not do any electrical testing if the floor is wet.**
- **Do not plug machine in to receptacle if floor is wet.**
- **Be very cautious on which electrical components your are going to touch, as capacitors can hold a charge even with the machine powered off.**
- **Think about each move you are going to make prior to doing so, and if you are unsure do not proceed.**
- **Focus on the specific task, as working on electrical components can be very dangerous.**

3.1.2.1.2 Tools for troubleshooting

- Good lighting (trouble light or a headlamp or flashlight)
- A digital multi-meter that can test AC volts, DC volts and resistance.
- Assorted non magnetic rubberized screwdrivers.
- A wire stripper
- Measuring tools: Tape measure, Calipers, Dial Indicator(Optional).

3.1.2.1.3 Frequently problems

There are several problems frequiently, if your machine has issues, you can try to solve the problem by doing the following.

- *Loose wires*:

  There are many wiring connections, it only takes one loose connection to cause the whole machine to fail. Syil has ensured the wiring connections are tight at the factory, but when the machine is shipped to you ,the connection may come loose. The first thing to always check is the wiring connections, tighten all harnesses.

- Poor cable connections:

  As the same reasons for above, the cable also may become broken or loose, if

the machine cannot function normally, please check all cables(include all the cables inside of the control box and the parallel port cable), if you find that a wiering harness is broken contact your local regional dealer or Sales@syil.com.cn

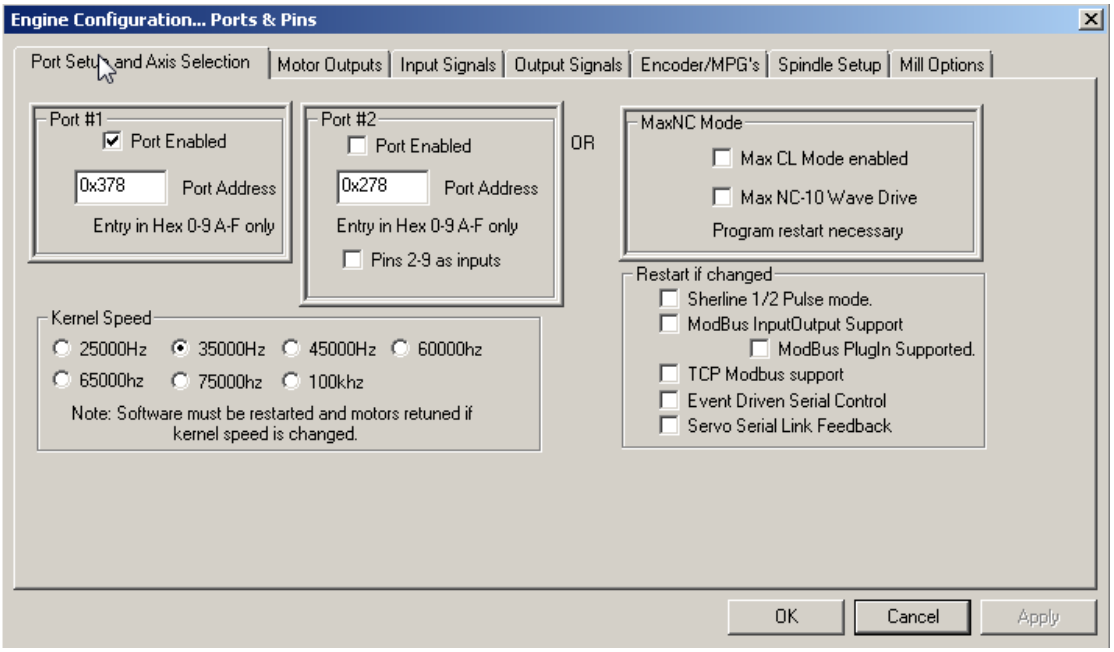
• Software and parallel port problem:

It is best to, restart software or reinstall mach3, the problem may be solved ,if you change any setting in mach3 ,this may also cause a mach3 error.

If mach3 works and the machine works but there is still no communication to the machine, You should check your computers parallel port. It is possible for the personal computer port to be broken ,there is two ways to solved the problem:

1.Change the mother board of your computer or change another computer and test again.

2.Purchase a PCI-Parallel board and install it on the PCI port of your motherboard. Be aware that the port address will change, you will need to change this address in the (ports and pins) settings in mach3.



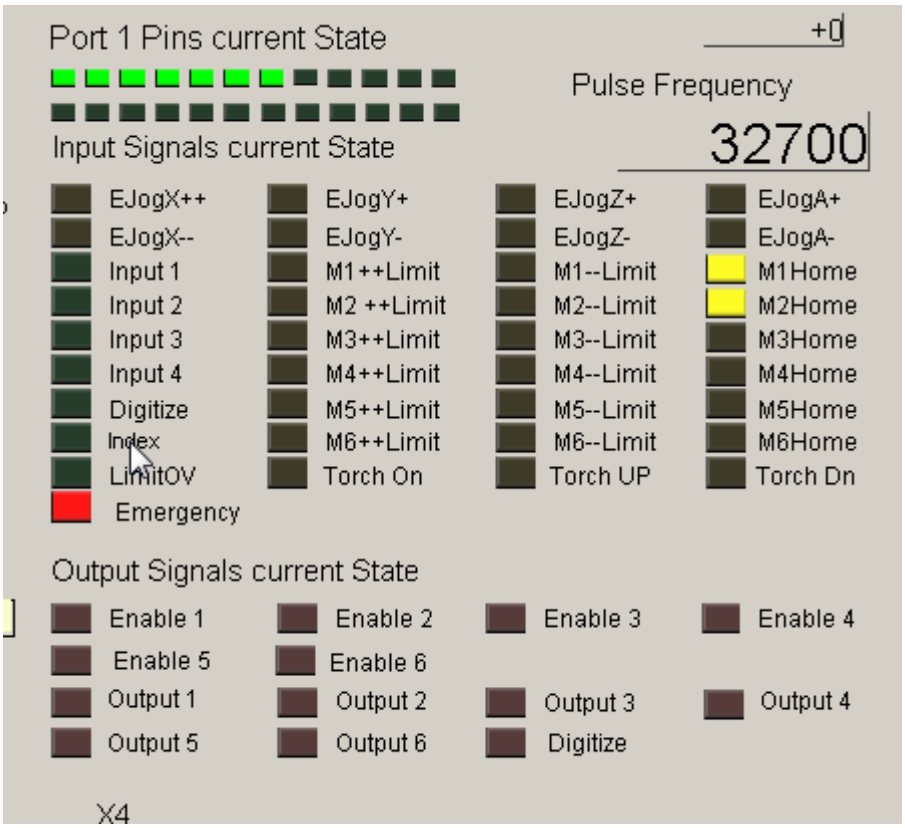
SYIL DOES NOT ADVISE USING A LAPTOP COMPUTER TO RUN MACH3, AS LAPTOP COMPUTERS PARELLEL PORTS CAN HAVE ISSUES WITH KEEPING THE PROPER 5V SIGNAL REQUIRED. You will see the same warning on the mach3 web site.

• Sensors

The homing sensors are install on each axis, these switches are used for homing the machine, if the sensors is broken, the machine will loose the homing function. To Test go to the diagnostic screen in mach3, depress the switch on the x or y axis. You will see the lights light up.

These are not limit switches and by default will not stop you machine from going past them. Mach3 has a function called (soft limits) this function can be turned on from the main screen for mach3 and set up in the homing/limits settings. This is found under the "Config" menu in mach3. For more reference please check the

mach3 manual, this can be found @
http://www.machsupport.com/documentation.php



This is also a good way to test the communication to the computer.

• Computer

The recommended configuration of computer: CPU is 1GHZ, EMS memory is 256MB, hard disk space is 150MB,if the computer is old, mach3 may not will run.

• unlicensed software

When you run program in mach3,the program may limited in 999 lines, because yours is demo version, you will need to buy the license, and there will no line limiting.

• Unexplained stop

This may be caused by electrical noise, this can be caused by the homing

switch, it is important to use good quality shielded cables.

3.1.2.1.4 Syil support

support@syil.com.cn
sales@syil.com.cn
0086-574-62735995

You can send email for troubleshooting in anytime, or call us in work time, the work time is 8:00-17:00(GMT+08:00),prior to contacting us ,be sure you have the following information.

- Serial number of your machine.(Located on the top of column)
- If you have found a problem the machine, and may need to replace some parts from Syil, we will need to know the date of purchase you, the syil Machines carry a One-year warranty. If the warranty has expired you will need to purchase new components.
- Analyze what might have changed since the machine worked properly.
- Make sure you can repeat the problems.
- Describe the problem as detailed as possible, it will help us to diagnose what will need to be fixed.

3.2 Troubleshooting

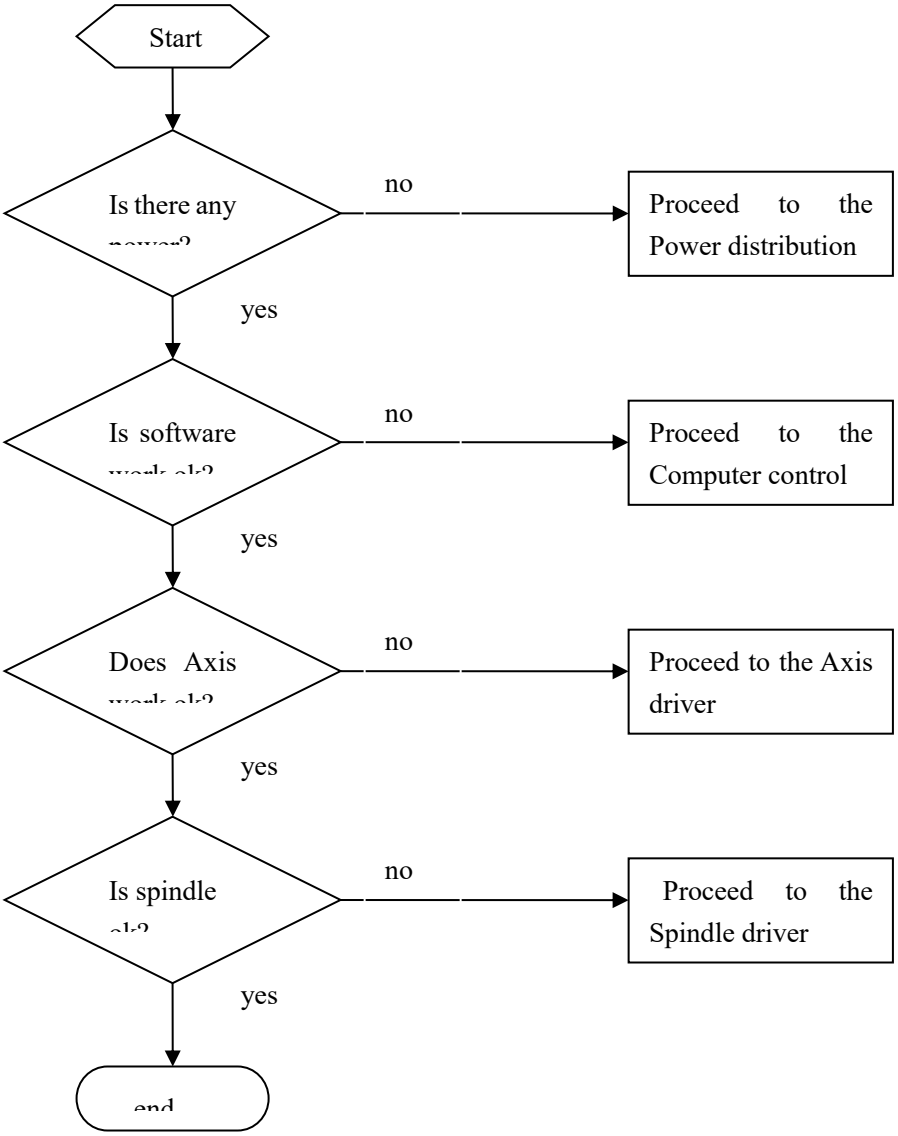


Figure 3-2

The flowchart in figure 9.18 will guide you where to start troubleshooting the electrical system.

This is the power switch, when it switch to "0",the power is disconnect, and when the switch is on "1", the machine will get power supply.(as Figure 3-3)

Most problem of the power supply is caused by the switch.

The following is power distribution check list:

Figure 3-3

3.2.1 Power distribution

parts	Input power	Output power	Remark
Power supply (x5 plus only)	220vac(110vac)	5vdc:supplies power to the x5 plus control board	
Transformer (x5 series)	220vac(110vac)	40vac:Supplies power to the stepper motor driver 24vac:supplies power to the A.C.contactor 12vac:supplies power to the interface board	
Power supply (x5 speed master only)	220vac(110vac)	12vdc:supplies power to the x5 plus control board	

3.2.1.2 Problem resolution checklist for power distribution

Problem	Action to identify cause of problem	How to solve	Remark
•After turning on the power, there is no power in circuit	1. Check the power plug..	1. make sure the connection is good. If the power plug have any problems, replace it immediately.	

	2.Check the switch.	2.if the switch is broken replace the switch. This can be confirmed via volt meter	
• Loose wires in circuit	1.Remove power from machine ,than check ALL connections wires.	1. Find loose wires, and re insert.	
The boards have no power.	1. the spindle control board has no power .	1.Check the fuse or filter, if the board is broken, replace it.	
	2.the five axis board in no power.	2.check the fuse on the board or the power supply to the board,. if the board is broken, replace it.	
Coolant pump is no power supply	1.Check the power plug..	1.if the plug is loose ,tight it.	
	2. Check the second relay.	2.If the relay is not working, replace it.	

3.2.2 Computer control

3.2.2.1 Overview

Mach3 can work well in windows xp.

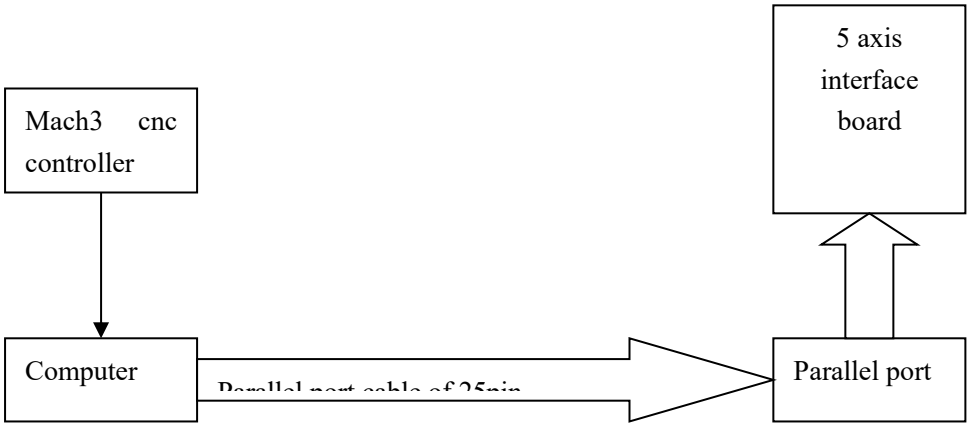
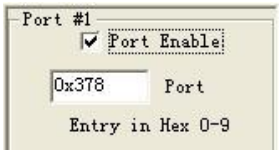


Figure 3-4

3.2.2.2 Problem resolution checklist

Problem	Action to identify cause of problem	How to solve	Remark
The machine can't be controlled by computer	1.check the parallel cable between computer and machine.	1. make sure the connection is good. If the cable has problems, replace it with high quality shielded cable.	
	2.check the parallel port	2. If the parallel port on the machine is broken replace it.	
Mach3 can works, but machine will not work.	1. check the parallel cable	1.Make sure all connections are tight. If the parallel cable appears to have issues, replace it.	

	2. Check that if the mach3 Driver has install properly.	2. Make sure the mach3 driver installed. In the mach3 folder there is a test program ,for the driver	
	3.Make sure that mach3 is working correctly.	3.if suspected that mach3 is not working properly reinstall	
If the machine and the computer is ok, but the machine is still not able to be controled	1.check the power for interface board .	1.if there is no power, check the power supply.(as 3.3.1)	
	2. check the charge pump.	2 make sure the charge pump is working, if the charge pump is not working refer to 3.3.1 as the entire machine will not work	
	3.if you are using a parallel port card, check the address of port1	3.make sure your address is as same as the parallel port card.	

3.2.3 Axis driver

3.2.2.1 Overview

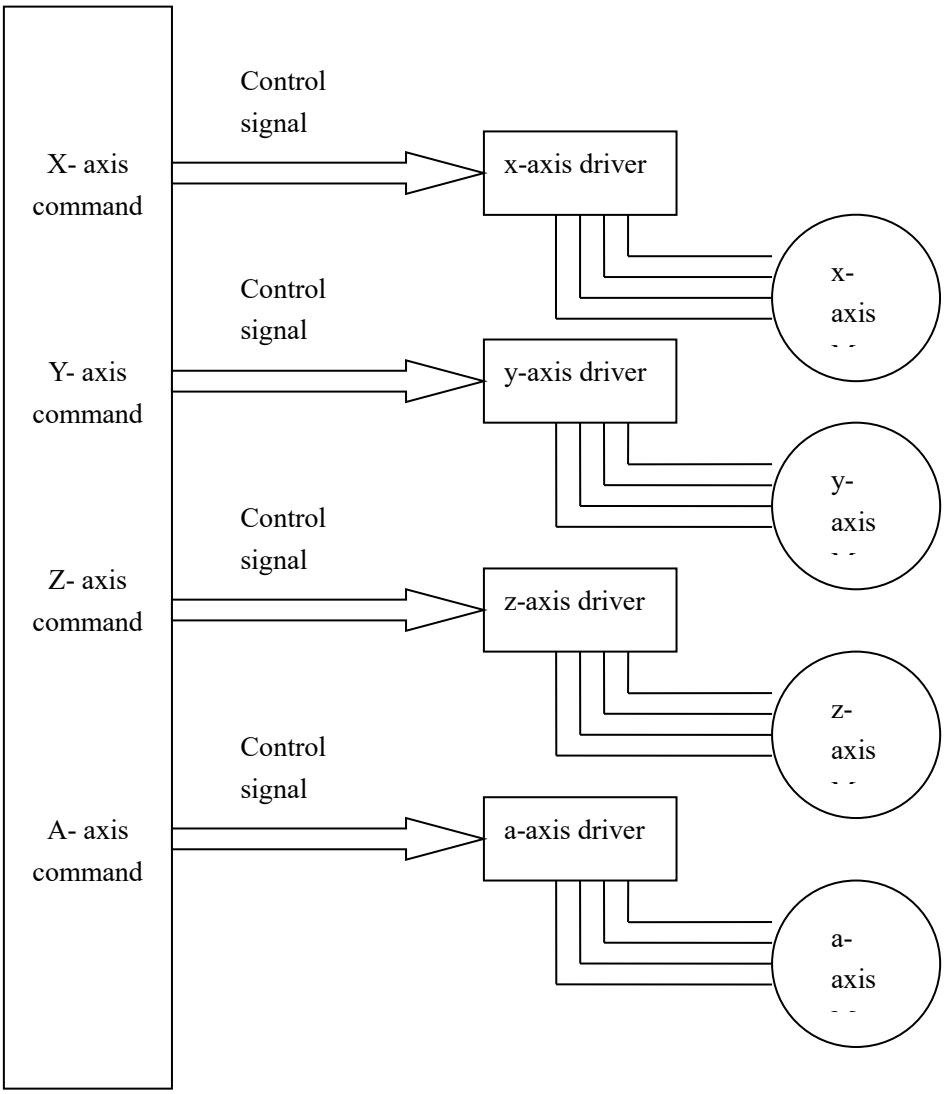


Figure 3-4

3.2.2.2 Problem resolution checklist

Problem	Action to identify cause of problem	How to solve	Remark
A specific axis can't be controlled by computer	1.check the parallel cable between computer and machine.	1. make sure the connection is good. If the cable has issues, replace it.	
	2.check the parallel port	2. if the parallel port is broken replace it.	
	3.check mach3	3.if the software is broken by unknown problem, reinstall it	
stepper motor looses steps when machining.	1. check mach3	1.check mach3, and reinstall.	
	2.check step motor and wiring, For example, x, axis have some problem, you can do as Figure 3-6	2. if stepper motor have having issues, replace it. Do not unplug stepper motor with machine on and computer on. This will cause 5 axis card to not work	
stepper motor driver is not work.	1.check the power supply for driver	1.if the driver is no power, check the wiring.(refer to 3.3.3)	
	2. do as Figure 3-5 to check the cable of control signal.	2 .if the cable is broken, replace it	

The driver and the stepper motor are working, but the axis is not moving.	1. Check the coupling on the motor.	1. if the coupling is broken, replace it.	
axis is limited by limit switch or e-stop switch	1.check the homing switch	1.If the homing switch not working replace it. Refer to *3.1.2.1.3 Frequently problems*	
	2.check the e-stop switch	2. if the e-stop switch is not working replace immediately, **do not change settings in mach3 to disable switch!**	
Mechanical problem	1.Gibbs are too tight or too loose	1.Adjust Gibb set screws	
	2.oil not getting to the ways	2.investigate oiling system for lack of oil and/or plugged lines	
	3.debris on ballscrew.	3.clean ballscrew	

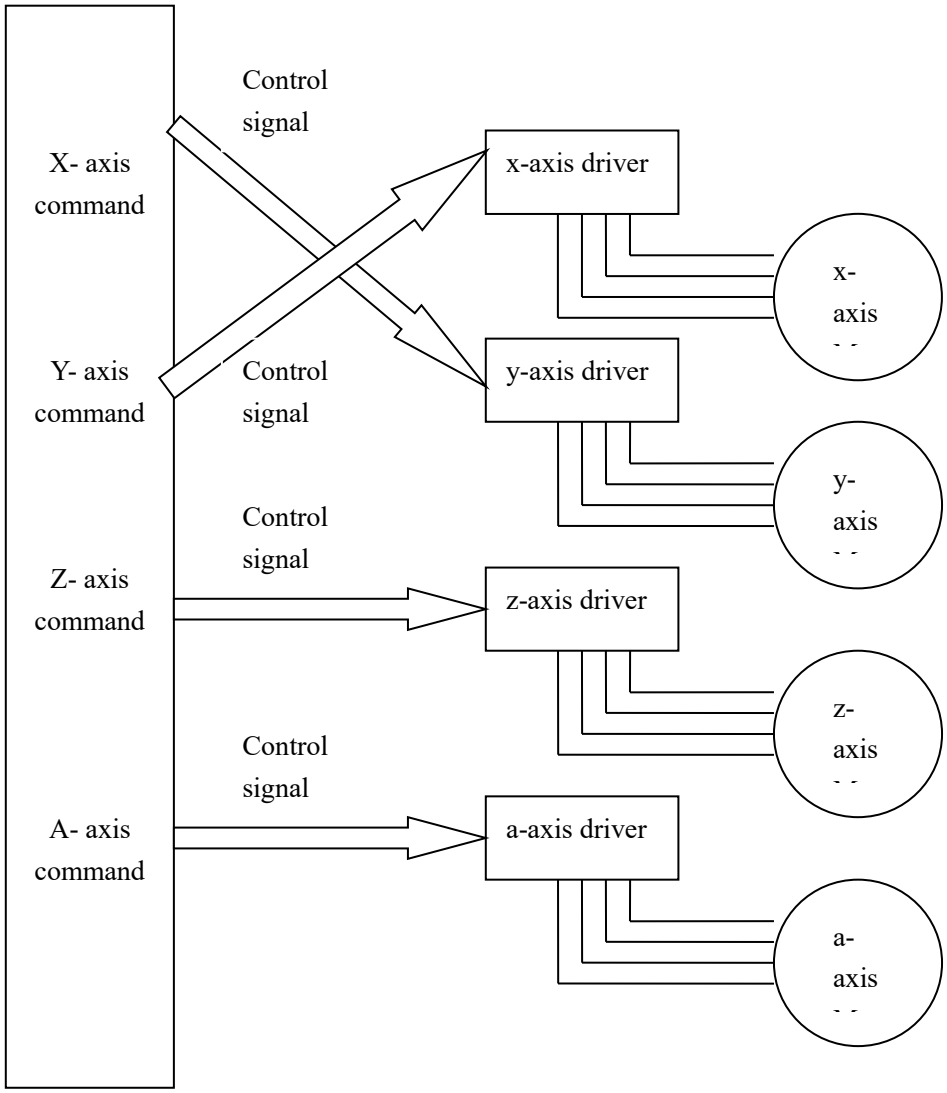

X- axis
command
Y- axis
command
Z- axis
command
A- axis
command
Control
signal
Control
signal
Control
signal
Control
signal
x-axis driver
y-axis driver
z-axis driver
a-axis driver
x-
axis
y-
axis
z-
axis
a-
axis

Figure 3-5

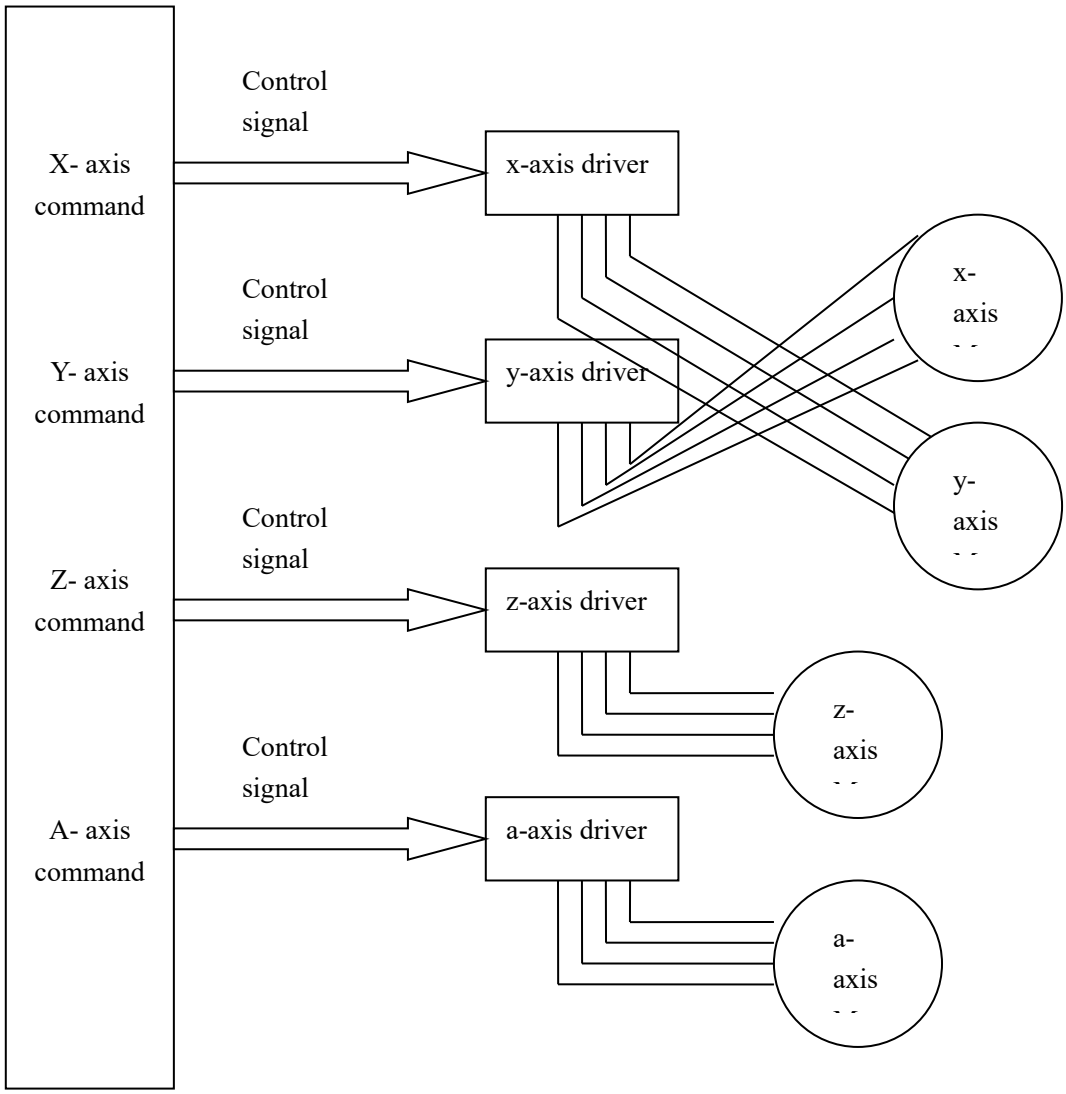

X- axis command
Control signal
x-axis driver
x- axis
Y- axis command
Control signal
y-axis driver
y- axis
Z- axis command
Control signal
z-axis driver
z- axis
A- axis command
Control signal
a-axis driver
a- axis

Figure 3-6

3.2.4 Spindle driver

3.2.4.1 Overview

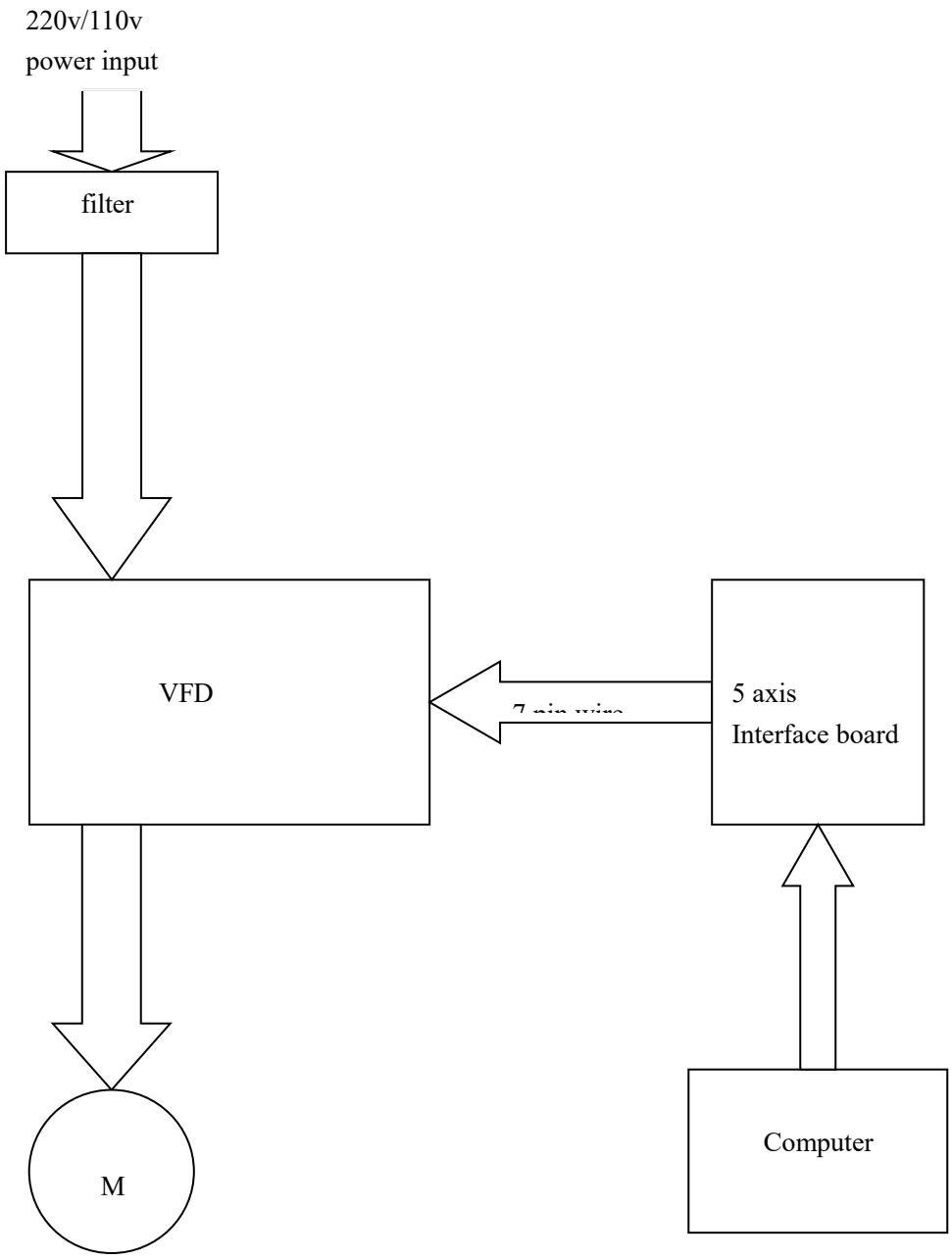
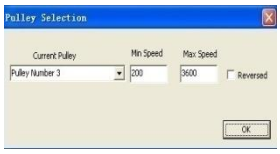


Figure 3-7

3.2.4.2 Problem resolution checklist

Problem	Action to identify cause of problem	How to solve	Remark
The spindle can't be controlled by computer.	1.check the parallel cable between computer and machine.	1. make sure the connection are good. If the cable have suspected problems, replace it.	
	2.check the parallel port	2. if the parallel port is broken replace it.	
	3.check mach3	3.if the software is broken by unknown problem, reinstall it	
	4.check the spindle control board	3.if the spindle control board is broken, replace it. To test check that the board is getting power.	
	2.check the spindle motor	7.if the motor is broken ,replace it	
The spindle does not achieve programmed RPM. For example, use"m3s1500", but the true RPM is only 1000	1. check set of pulleys in mach3	1.Make sure the pulley is 200 to 5000	
	2.check motor control in mach3	2.Make sure the PWMbase freq. is 100