MACHMOTION

X15-250

Quick Start Manual

5/1/2011

Everything you need to know to get started with your MachMotion X15-250 control.

www.MachMotion.com
http://www.machmotion.com
14518 County Road 7240, Newburg, MO 65550
(573) 368-7399 • Fax (573) 341-2672

Congratulations!

Congratulations on purchasing your MachMotion CNC control. All our controls have been designed to be plug-in-play as much as possible to make it easy for you to install. In this Quick Start Manual we give you all the tools you need to setup your control.

We hope that this installation can be as quick and easy for you as possible. If you have any questions, please do not hesitate to give us a call.

Sincerely,

The MachMotion Team
http://www.machmotion.com
14518 County Road 7240, Newburg, MO 65550
(573) 368-7399 • Fax (573) 341-2672

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Getting Started

Reviewing Your Package

If you have not already, begin by opening up the package containing your control. You should see the following:

Figure 1 CNC Control Package

Remove all the contents from the plastic bag.

Figure 2 Power Cable

Next locate the following items:

- X15-250 Control
- Power Cable
- White Envelope

  The envelope contains the keys to turn on your control and backup copies of the software installed on your control. Make sure to store the envelope in a safe location for future use in case something ever goes wrong.

Figure 3 Envelope

Mounting Your Control

If you purchased a mounting arm with your control, begin by assembling the arm using the Arm Assembly Instructions Manual. The manual can be found on the web at www.machmotion.com under **Support**, then **Documentation**.

However, if you did not receive a mounting arm, begin by mounting the control securely to your machine.

Starting Your Control

Supplying Power

To power your control, plug the black cable found in the control box into 115VAC. The other end of the cable should be plugged into the connector inside the hole on the top of the control as shown below.

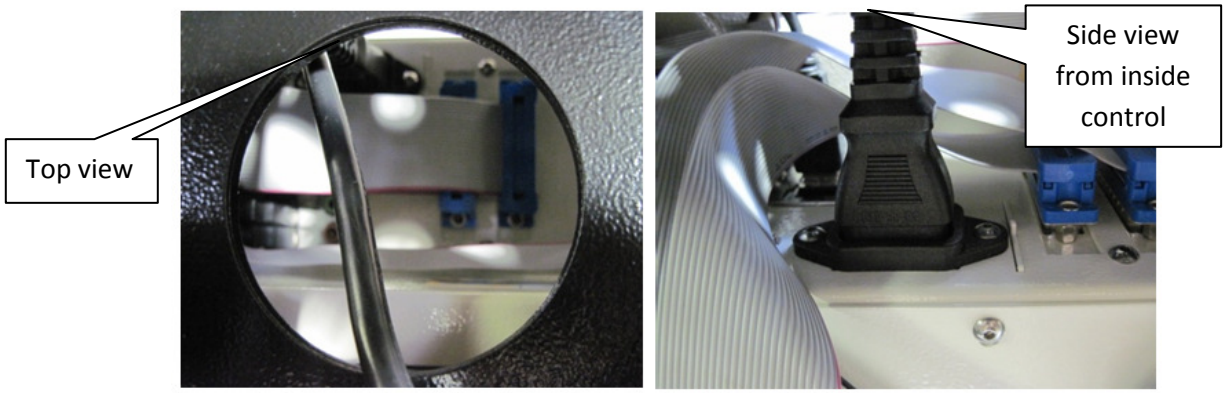

Figure 4 Power Cable

Turning on Your Computer

Locate the keys inside the white envelope that came with your control.

Figure 5 Keys

Place one key into the keyhole at the back right hand side of the control as pictured below. Turn on your computer by rotating the key and then quickly releasing it.

Figure 6 PC Start

Starting the Mach3 Software

The Mach3 software comes with three profiles, Mach3 Mill, Mach3 Plasma, and Mach3 Turn. Depending on what kind of machine you have, double click on the correct shortcut. Below are pictures of each profile's shortcut:

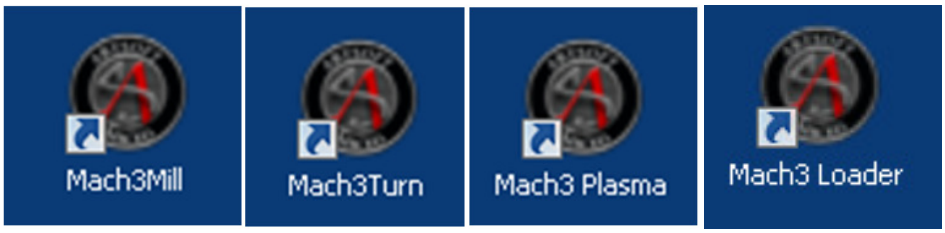

Figure 8 Profiles

Figure 7 Mach3 Loader

On your desktop you will also find a shortcut for Mach3 Loader. This allows you to load any of the profiles from one location. Double clicking on the Mach3 Loader shortcut opens the following window:

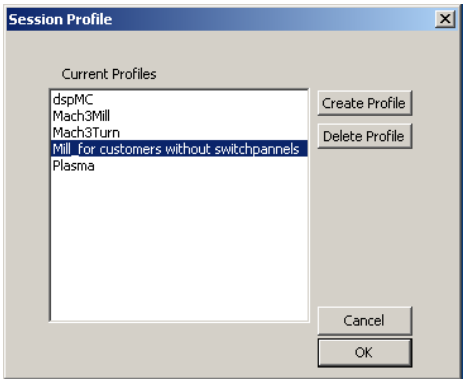

Figure 9 Loader

After double clicking on a profile or opening a profile from Mach3 Loader, a window will come up asking you to agree to its legal notice.

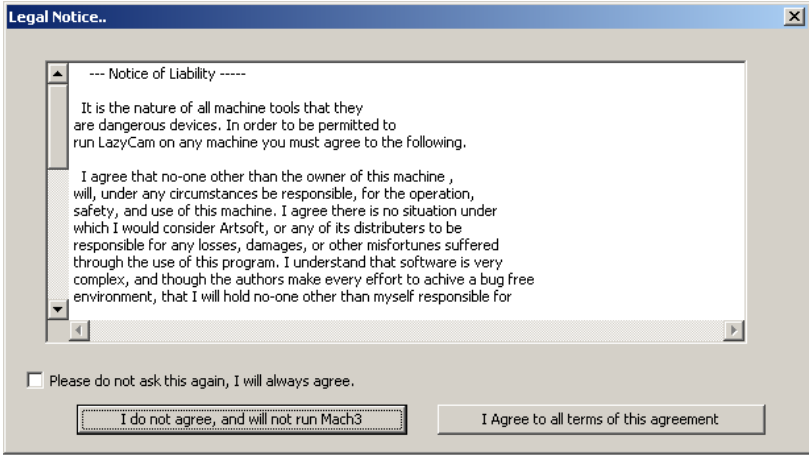

Figure 10 Legal Notice

Read the legal notice and click on the check box "*Please do not ask this again, I will always agree.*" Then press **I agree to all terms of this agreement**.

Next you will see Mach3 loading.

Figure 11 Mach3 Software

If you loaded Mach3 Mill and if you had purchased our mill screen set, you will see the following window:

Figure 12 Mach3 Mill

Make sure to click the RESET button before continuing.

Figure 13 RESET

Note: For more information on how to run the Mach3 software, please see page 57 on Documentation.

Exploring Your Control

Now with your control up and running, it is time to examine some of its features.

Operator Panel (X15-10-01)

On the right hand side of your control there is the operator panel with jog buttons, selector knobs, and a few buttons. See the picture below:

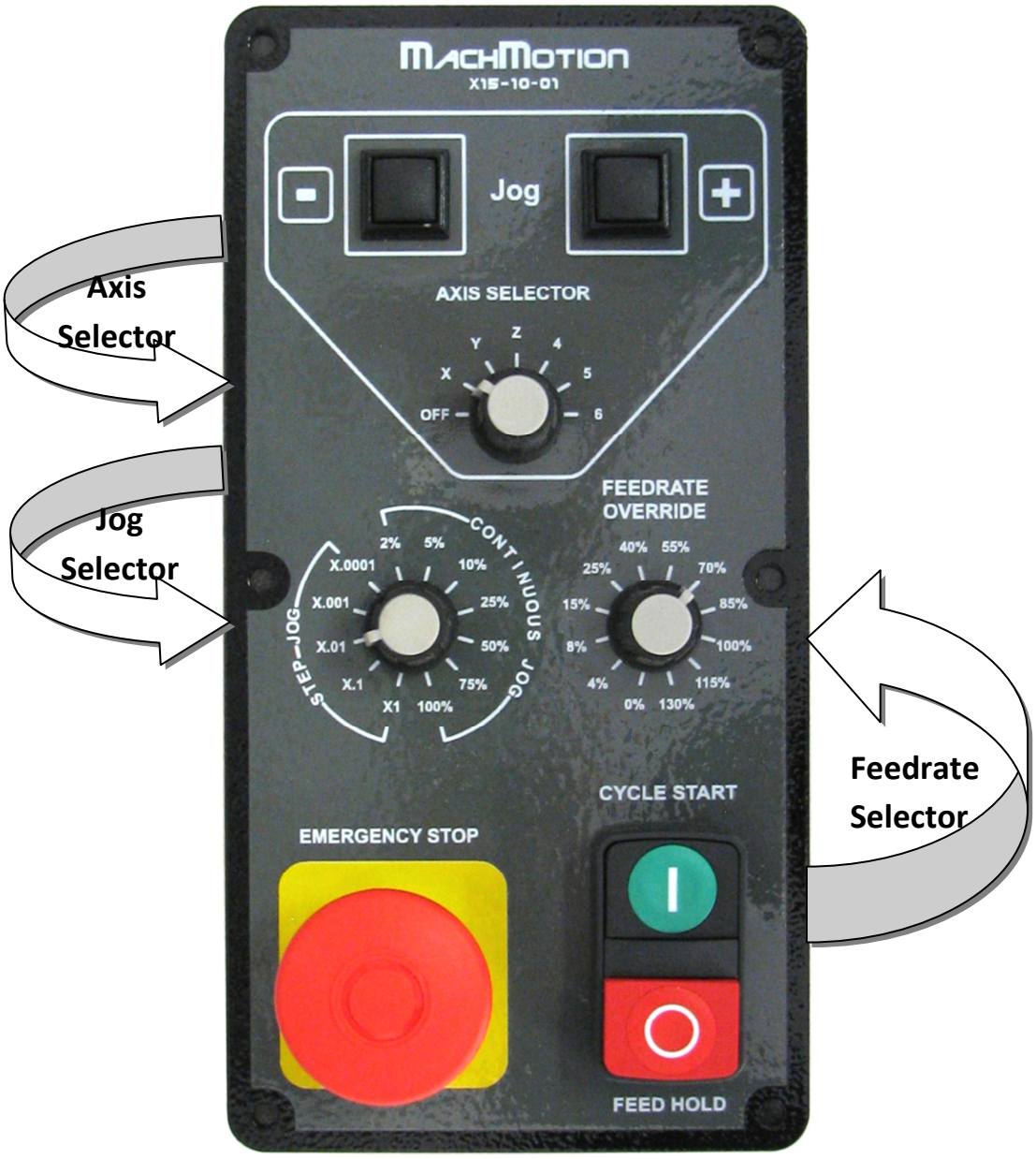

Figure 14 Operator Panel

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Emergency Stop

In case of an emergency, press the large red Emergency Stop button on the operator panel. All motion will stop immediately. DO NOT PRESS FEED HOLD!

****

You can use the jog buttons to move your axes manually. Use the Axis Selector to switch between which axis you want to jog. If the Axis Selector is in the off position, the jog buttons are disabled (See Figure 15).

Figure 15 Jog Buttons and Axis Selector

Note: If the jog buttons do not work, make sure that the Axis Selector on the pendant is turned off.

To change the jogging speed or the jog increments adjust the Jog Selector. The selections labeled **Step Jog** allow you to jog a predefined step or increment each time a jog key is pressed. You can jog 1 or 0.0001 of an inch at a time by selecting X1 and X.0001 respectively. See Figure 16 below.

Figure 16 Jog Selector

If you want to jog continuously rather than incrementally, turn the Jog Selector over into the **Continuous Jog** section. You can jog your machine at the full jog rate (100%) or slow it down to 2%.

Your machine is setup so that the up and down arrow keys move the Y axis, the left and right keys move the X axis, and the plus and minus keys move the Z axis.

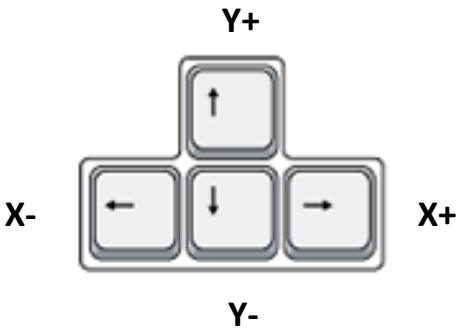


Figure 17 Jog Keys

With the Feedrate Selector you can adjust the feedrate override from 0% all the way to 130%. You can use it to slow your machine down while running a program. Also, in step jog mode the speed of the axis is regulated by the Feedrate Selector.

Figure 18 Feedrate Selector

The green button is a cycle start button which starts a file and the small red button is a feed hold which pauses the file.

Figure 19 Cycle Start and Feed Hold Buttons

Pendant (X15-20-01)

If your control came with a pendant, read this section. The pendant is mounted on the right side of the control near the operator panel. See Figure 20 below.

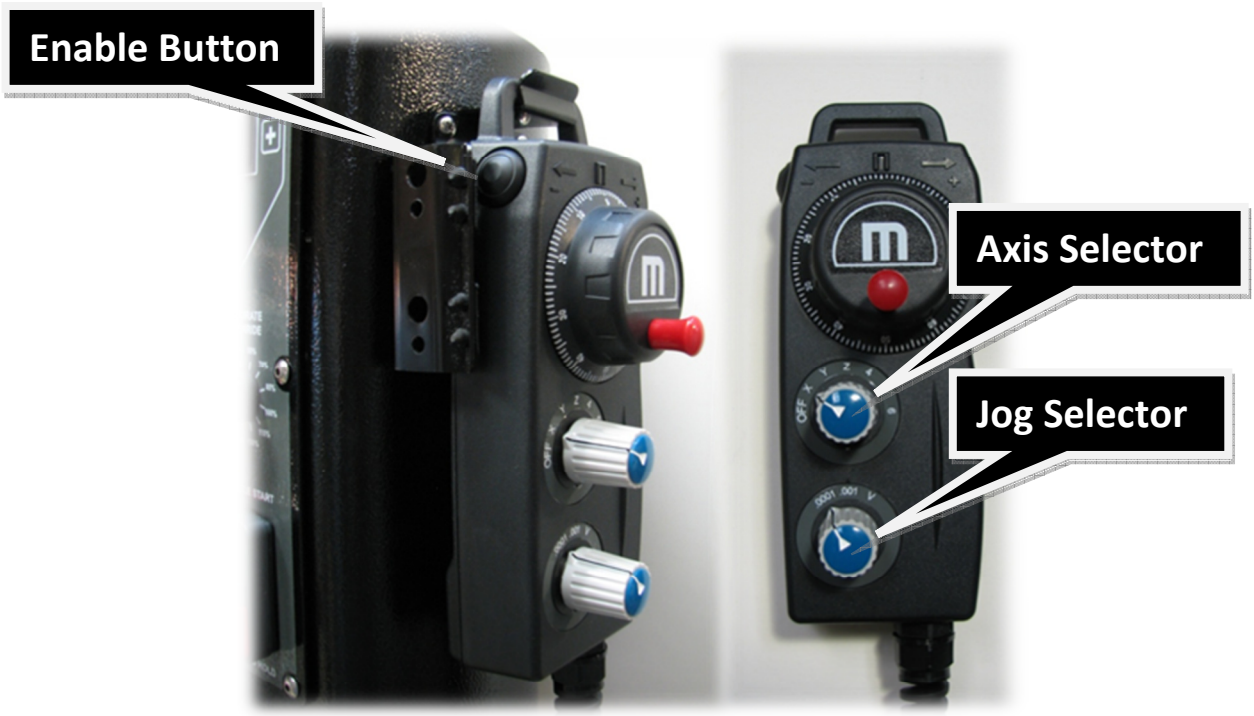


Figure 20 Pendant

To use the pendant you must switch the Axis Selector to the axis you want to jog. The pendant will not work if the Axis Selector is in the **OFF** position. While holding down the enable button (see Figure 20), you can rotate the hand wheel (also called the MPG) and the selected axis will move. Change axes by switching the Axis Selector to a different axis.

Figure 21 Axis Selector

The Jog Selector on the pendant allows us to switch between either 0.0001 or 0.001 inch increments. Each click of the MPG will move the selected increment. However, if the Jog Selector is on **V** then the MPG is in velocity

mode. In velocity mode the axis moves as long as the MPG is turning and the speed of the axis is regulated by the speed of the hand wheel. In other words, turning the hand wheel very fast will make your axis move very quickly.

Figure 22 Jog Selector

When you are finished using the pendant, make sure to turn the Axis Selector to **OFF.** Otherwise the operator panel will not allow you to jog.

Mouse

Below the operator panel is a ball mouse. You can use this for navigating around on your control.

Figure 23 Mouse

Keyboard

The keyboard is located at the bottom of the control in a flip-out tray. For security and safety reasons there is a lock hole in the back left hand side of the keyboard tray to prevent the tray from opening. The lock is not supplied with your control.

Figure 24 Keyboard

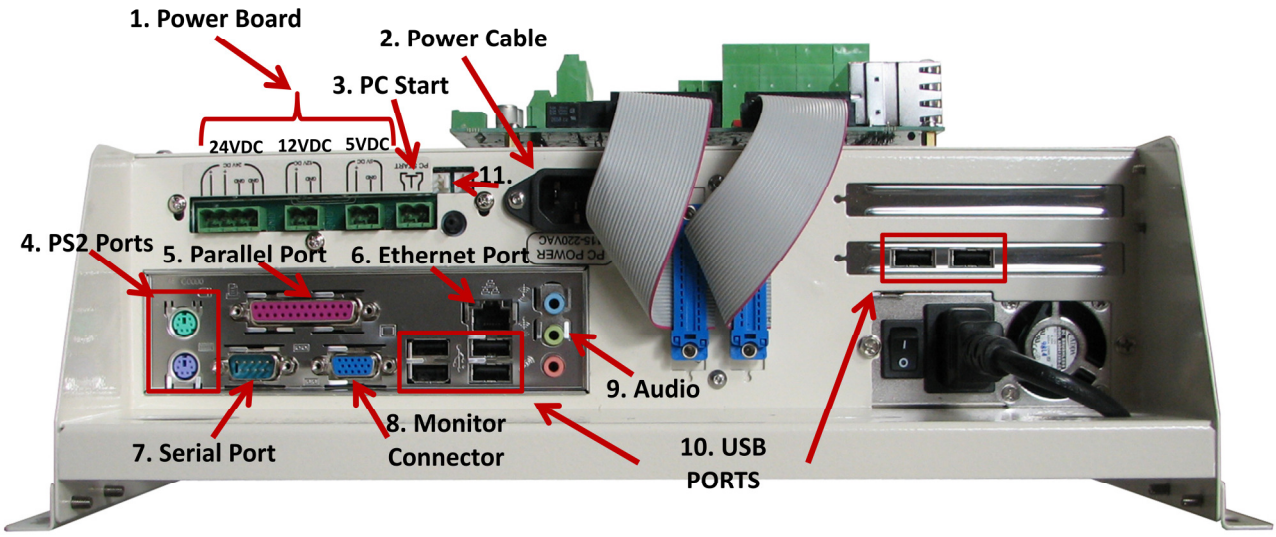
External USB Port

On the right side of the keyboard there is a USB port. Use this for transferring programs, files, or any other data to and from your control.

Figure 25 USB Port

Computer Port Diagram

Below is a diagram of all the different ports on your control with a brief description of each.



1. **Power Board**
   Three power supplies (24VDC, 12VDC, & 5VDC) for any application. The 24VDC supply powers the MachMotion IO6 Breakout Board.
2. **Power Cable**
   115VAC-220VAC power for the control.
3. **PC Start**
   To start the control, connect these two pins together with a momentary push button switch.
4. **PS2 Ports**
   These can be used to plug in an older keyboard and mouse.
5. **Parallel Port**
   This can be used for any application.
6. **Ethernet Port**
   This port is used to connect to the Interpreter 1000 or to a local Ethernet Network.
7. **Serial Port**
   This can be used for any application. However, in many of our systems this is used to communicate with a PLC.
8. **Monitor Connector**
   This is used to connect your control to a monitor with a standard XXX cable.
9. **Audio**
   These are your standard audio outputs.
10. **USB Ports**
    These ports are used for your keyboard, mouse, operator panel, file transfer, and more.
11. **Fan Connectors**
    These connectors supply 12VDC for two small fans.

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Configuring Your Control

Removing the Back Panel

To plug in your drives and all your I/O, you must begin by removing the back panel of the control. Take out the 10 Phillip screws. Four screws are located on the face of the back panel and six are on the sides.

After removing the cover, you should see the following:

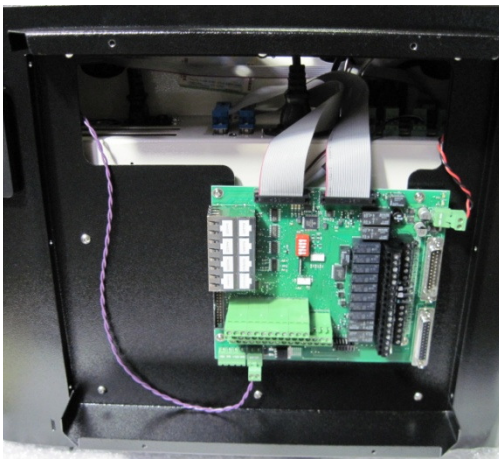

Figure 26 Back Panel Removed

All your drives and external I/O will be wired into the breakout board shown in the picture below.

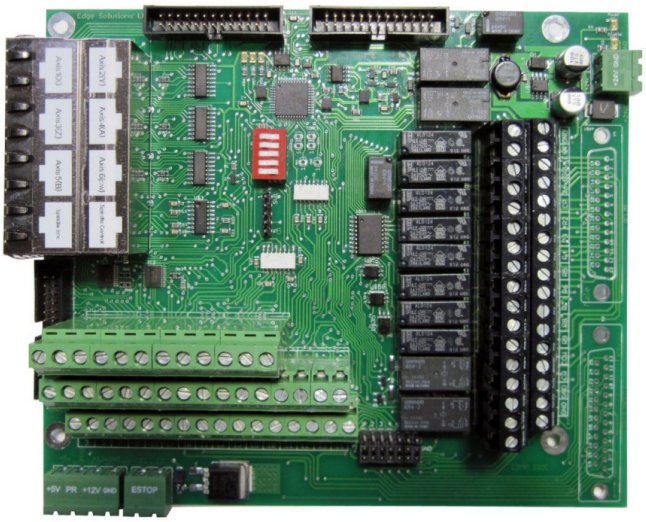

Figure 27 Breakout Board

Note: For more information about the breakout board see the section **Documentation** *on page 57.*

Setting up Your Axes

Begin by plugging in your drives. The first 6 mod jacks labeled **Axis 1(X)** – **Axis 6(c/w)** of the 8 jack module provide differential step and direction outputs for your drives. The mod jack for axis 1 is located on the bottom row of jacks as shown below.

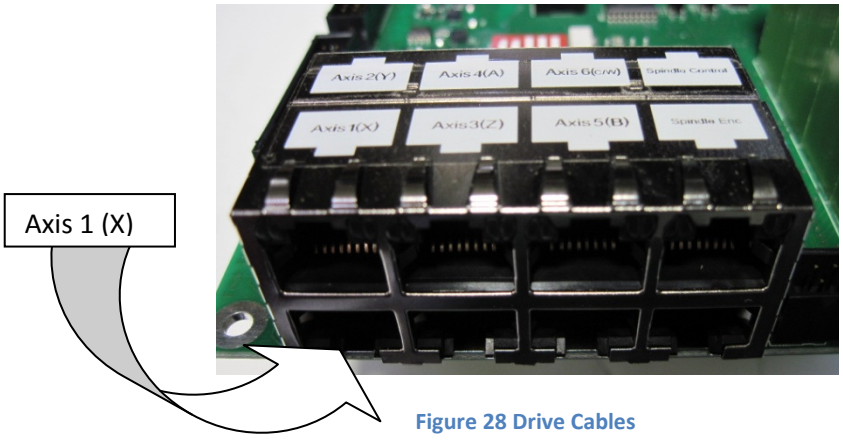

Figure 28 Drive Cables

Plug in your drive cables into the desired mod jacks. The cables can be plugged into any mod jack as long as you configure the Mach3 software accordingly.

Enabling Axes

After your drives are plugged in, enable your axes in the following way:

1. On the menu bar, click **Config** and then **Ports and Pins** as shown below. A window called *Engine Configuration… Ports and Pins* will pop up.

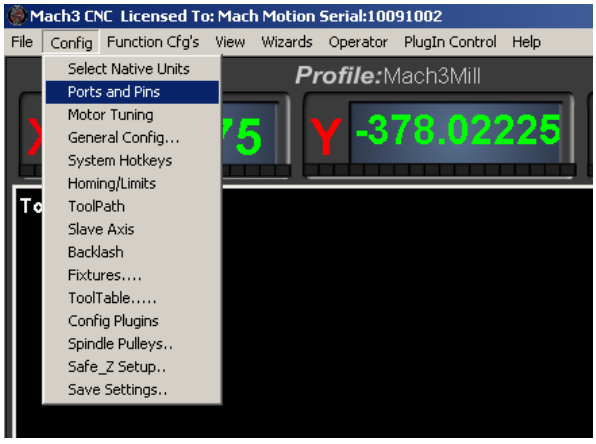

Figure 29 Ports and Pins

2. Select the **Motor Outputs** tab and you will see the axis setup as pictured below.

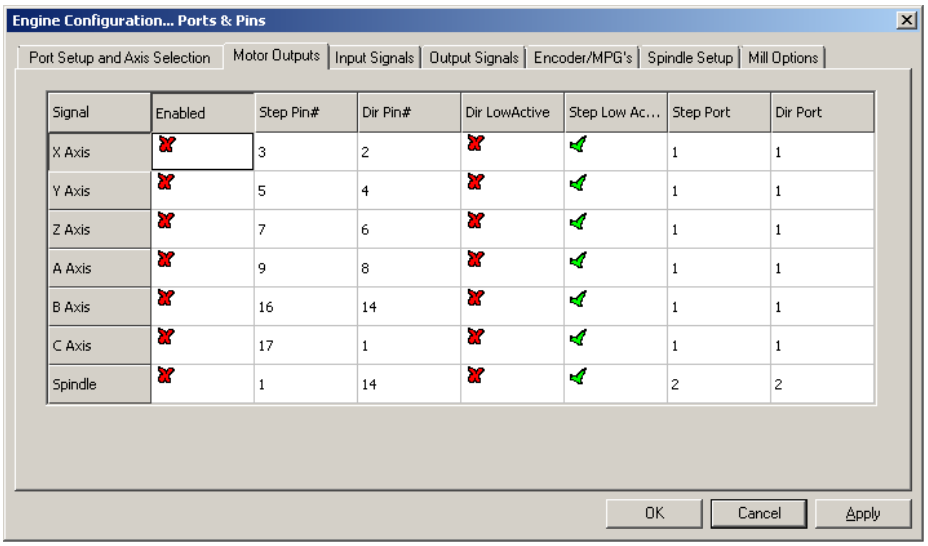

Figure 30 Axis Setup

3. Click on the red "**X**" to enable an axis. If there is a green check mark next to the axis, the axis is enabled already.

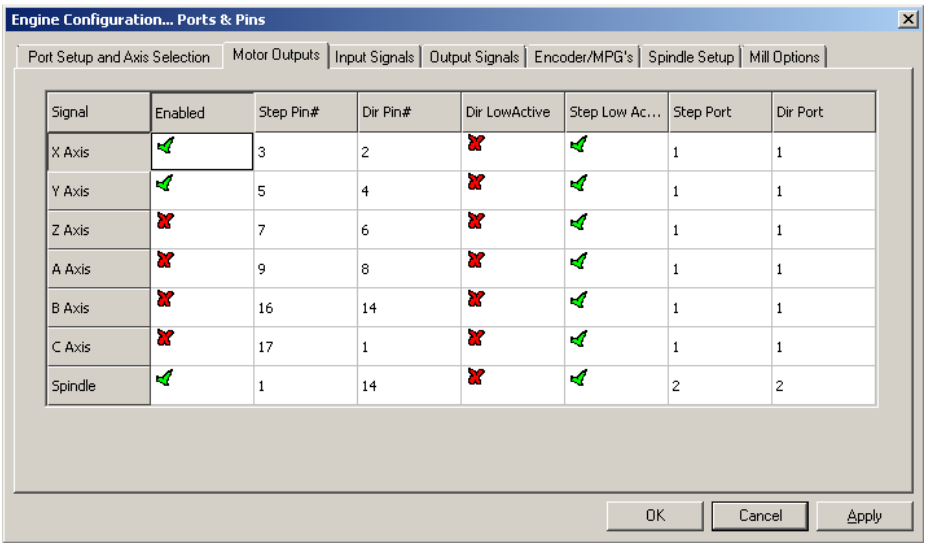

Figure 31 Axes Enabled

4. Press **Apply** and then **OK**. Your motors should now be able to run!

For example, in Figure 31 the X and Y axes and the spindle are enabled. You should not have to change the Step Pin#, Dir Pin# or any of the other fields.

Just for a reference, you can use the table below to make sure that your axes' ports and pins are configured correctly.

Axis Name	Step Pin #	Dir Pin #	Dir Low Active	Ste Low Active	Step Port	Dir Port
X	3	2	Red	Green	1	1
Y	5	4	Red	Green	1	1
Z	7	6	Red	Green	1	1
A	9	8	Red	Green	1	1
B	16	14	Red	Green	1	1
C	17	1	Red	Green	1	1
Spindle	1	14	Red	Green	2	2

****

Warning

You could crash your machine very easily. No limit switches have been setup and your units have not been configured yet.

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Reversing Direction

If an axis moves the wrong direction, you can reverse the direction in the Mach3 software.

1. Navigate to the menu bar and click **Config -> Homing/Limits**.

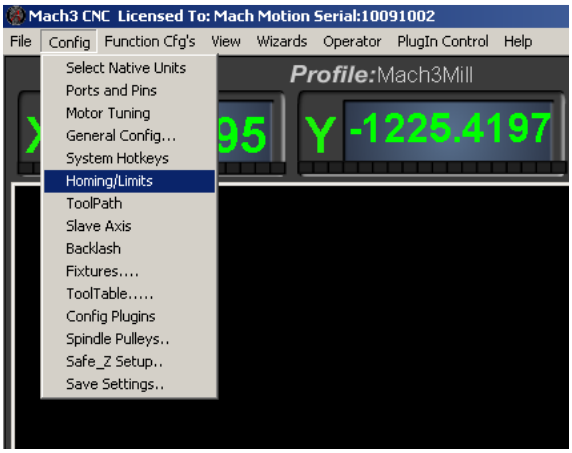

Figure 32 Homing & Limits

You will see the following window come up:

2. Under the **Reversed** column click on the red "**X**" if the axis needs to be reversed.

3. After making all your changes, press **OK.**

Your axis will now move the opposite direction than it did before.

Setting up Your Machine Units

To set up your machine units contact our tech team at MachMotion by calling 573-368-7399 or emailing us at sales@machmotion.com .

Setting up Your Spindle

In this section you will learn how to wire and configure your spindle. The MachMotion breakout board provides a number of different methods to control your spindle.

Wiring up Your Spindle

With VFD from MachMotion

If you purchased a VFD from MachMotion, setting up your spindle is extremely simple. Plug the control cable into the Spindle Control mod jack and the spindle feed back into the Spindle Encoder (Enc) mod jack.

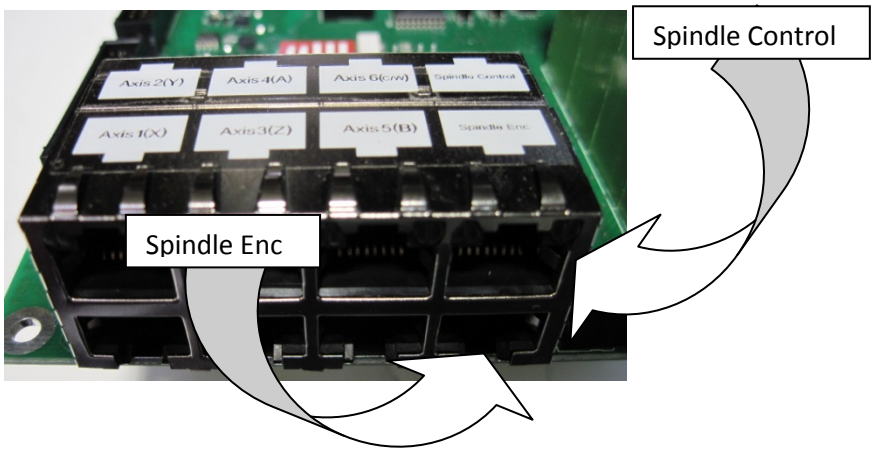

Figure 33 Spindle Mod Jacks

Now you are ready to setup the maximum speed. See *Setting Max Pulley Speed* below.

Note: Spindle feedback is only needed if you will be threading. If you will not be threading, do not worry about the Spindle Encoder mod jack.

With VFD Other Than from MachMotion

Begin by wiring the CW and CCW connections on the black connector to the common on the VFD. Then wire up analog, analog ground, forward and reverse into the black connector. See Figure 34 below.

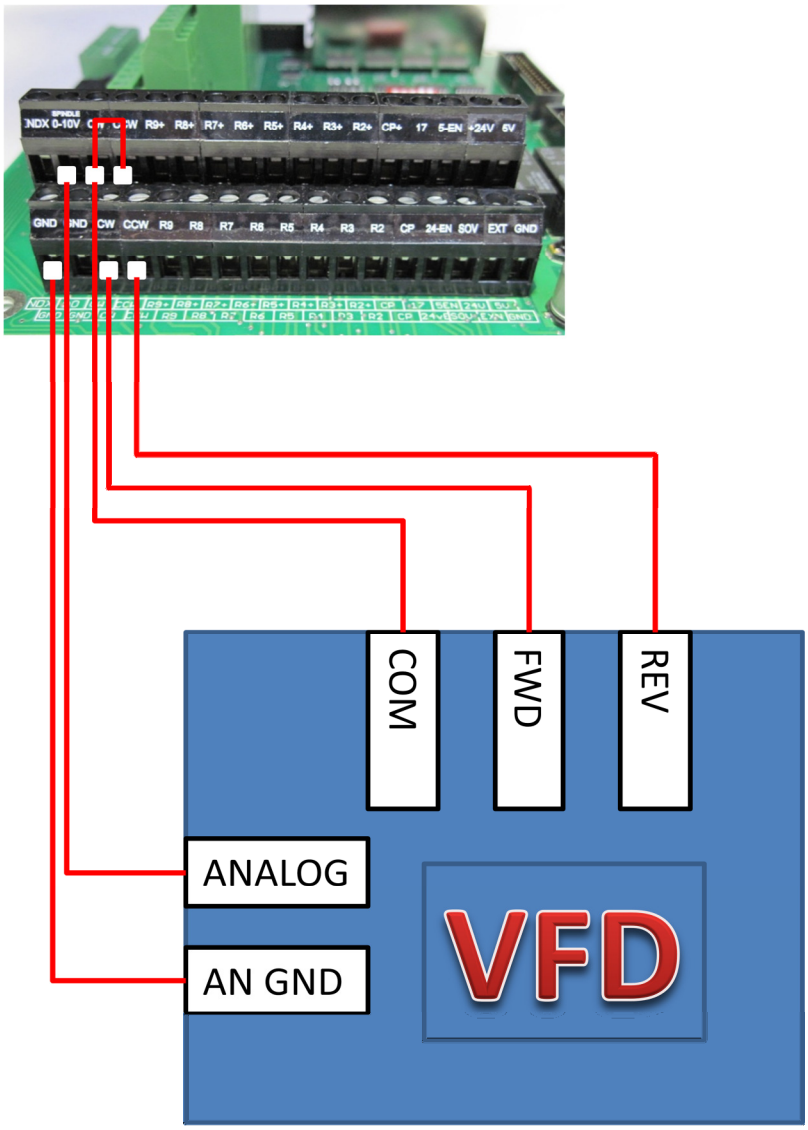

Figure 34 VFD Not from MachMotion

Without VFD

If you do not have a VFD, wire the spindle into the big black connecter as shown in Figure 35 below. Notice that 24V is wired to the CW and CCW relay contacts on the top row of the black connector.

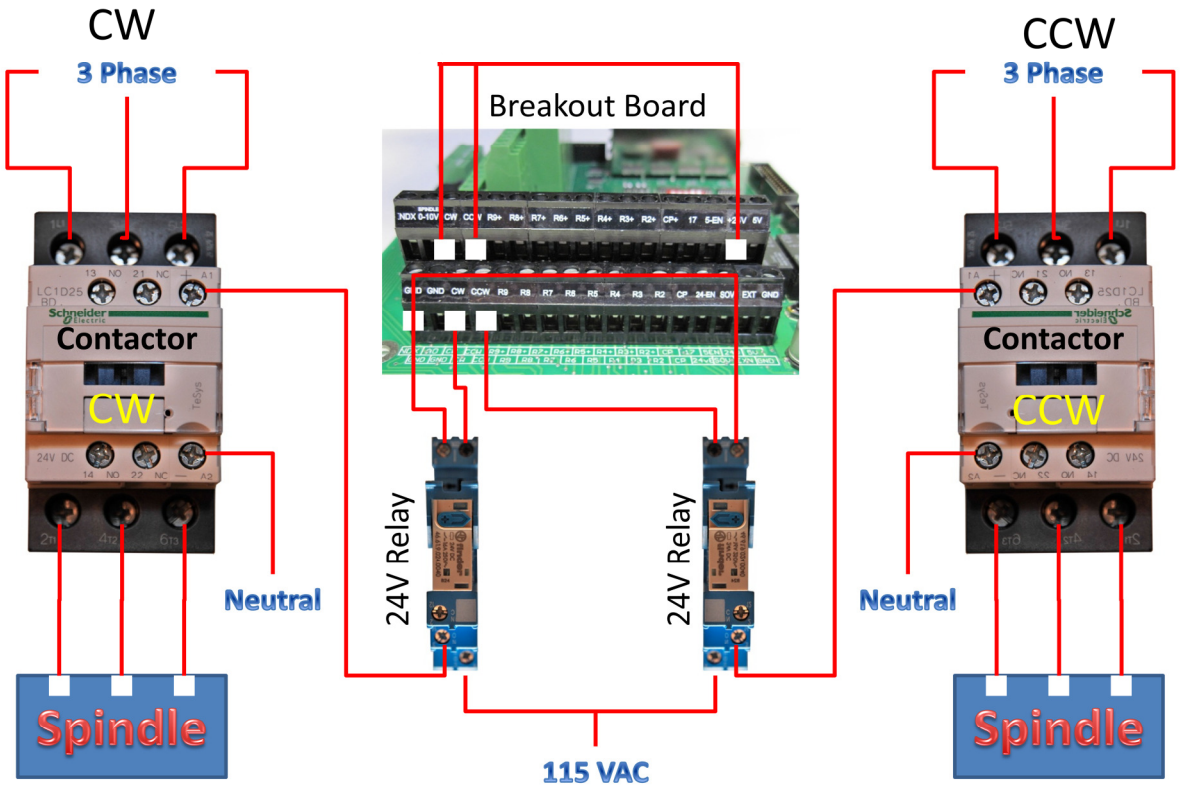

Figure 35 Spindle

Now you are ready to setup the max spindle speed. See *Setting Max Pulley Speed* below.

Note: For a lathe with spindle feedback use INDX on the big black connector.

Setting up Pulleys

The Mach3 software has many different pulleys for different gears on your spindle. If you are using a VFD, choose a separate pulley for low, medium, and high speeds. You can use as many pulleys as you want.

For example, pulley one could be set to 75 to 300 RPM for low speed. The medium could go from 300 to 1200 RPM and high speed could be from 1200 to 2400 RMP.

To setup the spindle speed or to change pulleys, go to **Config -> Spindle Pulleys.** The *Pulley Selection* window will appear as shown in Figure 37.

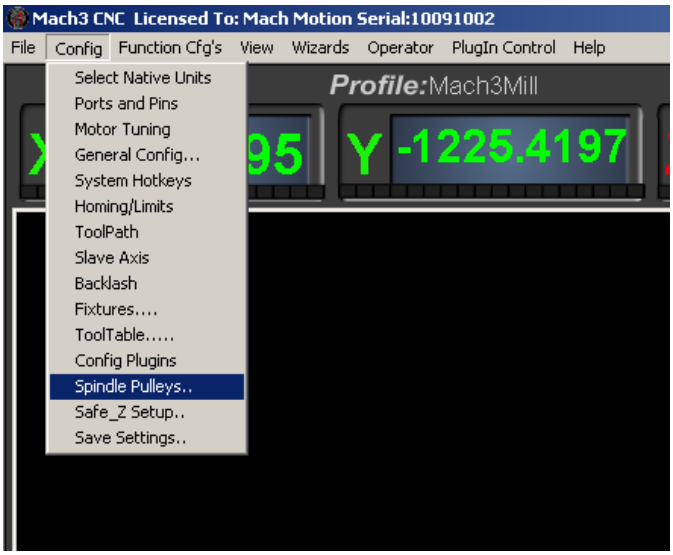

Figure 36 Spindle Pulleys

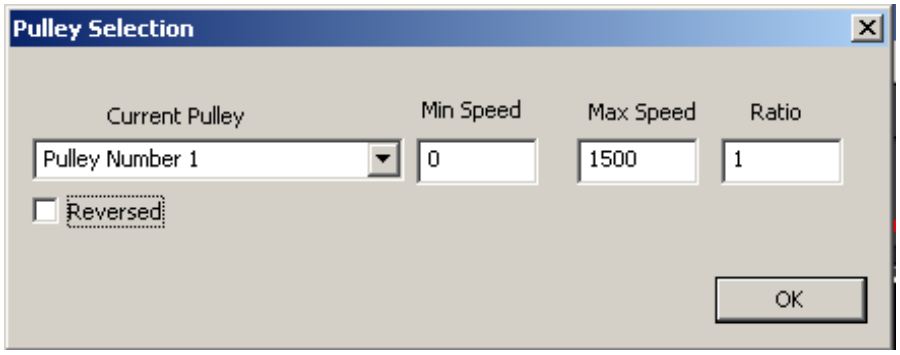

Figure 37 Pulley Speed Setup

Use the drop down menu titled **Current Pulley** to select the pulley you want to update. Enter in your maximum and minimum speeds for each pulley. Then select the pulley you want to load and press **OK**.

You can also change pulleys by using M41-M45. The macros can be used to just change pulleys in Mach3 or you could use them to automatically change gears on your machine. Outputs 12-16 are configured to shift between gears 1 and 5. To shift your machine into neutral, run M40. Open up the macros with the VB Script Editor for more details.

Turning on Your Spindle

To turn on your spindle, begin by setting up your spindle speed. Navigate to **Prog Run** and click on the Spindle **S:** user input. Enter your speed and press **Send** as shown in Figure 38.

Figure 38 Setting up Spindle Speed

Note: If you don't have the MachMotion screen set, spindle speed can be changed right on the main screen of the Mill profile. Click on the user input, enter a new number, and then press enter.

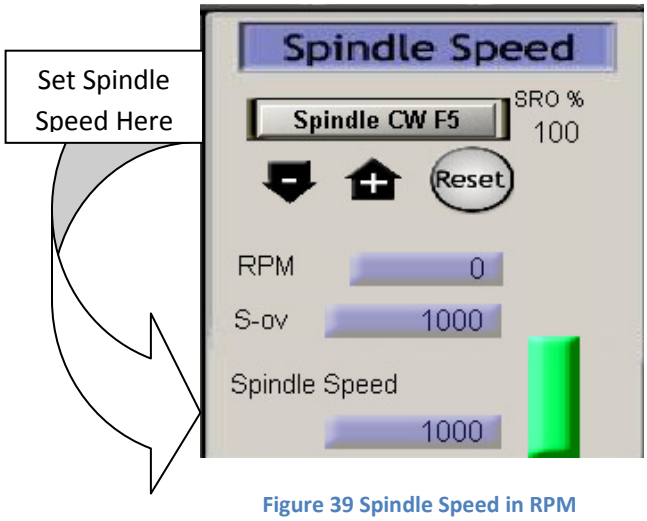

Figure 39 Spindle Speed in RPM

Control the spindle by pressing the **FWD** and **REV** buttons. The button will turn red when you press it once. Pressing the button again turns the spindle back off.

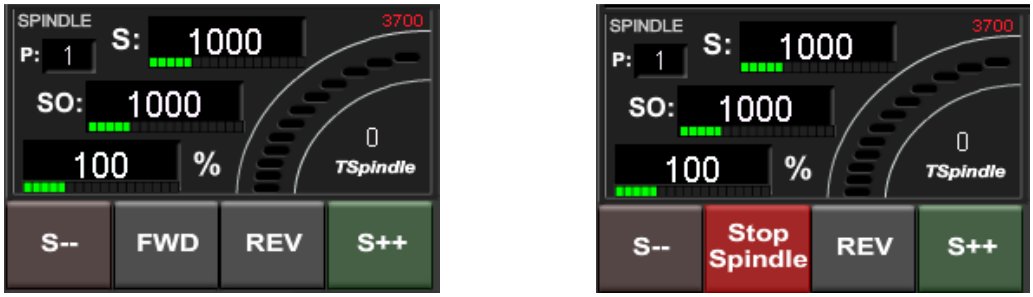

Figure 40 Spindle Buttons

*Note: If you don't have the MachMotion screen set, turn on the spindle by pressing the button **Spindle CW F5**. When the button is flashing, the spindle should be on.*

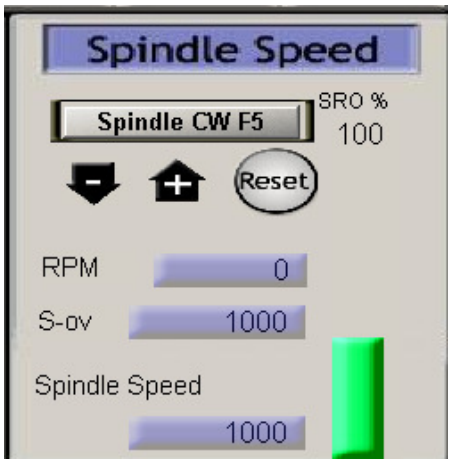

Figure 41 Spindle Speed

You can also control the spindle by using M-codes. As a reference use the table below.

M-Code	Function
M3	Clockwise
M4	Counter/Clockwise
M5	Stop

Calibrating Your Spindle

Now you are ready to calibrate your spindle so it actually goes the correct speed. There are two different methods to use depending on if you know the spindle speed or not. It is simpler to calibrate your spindle if you know the speed.

Begin by finding the current velocity of your spindle. On the top menu bar select **Config**, then **Motor Tuning**. You should see the *Motor Tuning and Setup* window as shown below.

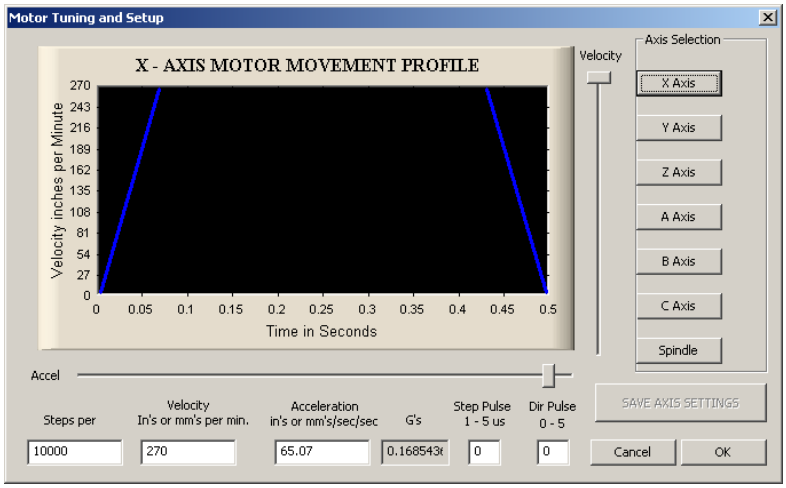

Figure 42 Motor Tuning and Setup

On the right column titled **Axis Selection**, press the **Spindle** button. The spindle parameters will be loaded. Now record the **Velocity** value located on the bottom right of the window. See the figure below.

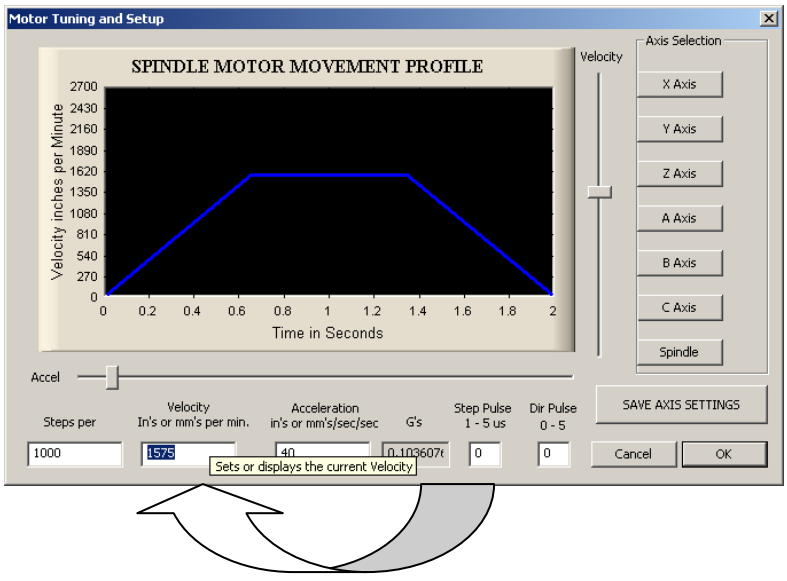

Figure 43 Spindle Velocity Value

In Figure 43 the spindle's current velocity is 1575.

With Spindle Feedback

If you have spindle feedback or a tachometer, you can use the shorter method to calibrate your spindle. Simply find the values shown below.

Current Velocity

Use the velocity value found above from the *Motor Tuning and Setup* window.

Commanded RPM

Enter in a spindle speed as shown in Turning on Your Spindle on page 30. Then turn the spindle on.

Actual RPM

Record the actual speed either using a tachometer or another method of spindle feedback.

Now plug these values into this formula:

New Velocity = **Current Velocity***(**Commanded RPM** / **Actual RPM)**

With your new velocity calculation, go to the *Motor Tuning and Setup* window by selecting **Config**, then **Motor Tuning**. Press the **Spindle** button and enter in your new velocity. Press **SAVE AXIS SETTINGS** before pressing **OK**. Your spindle should now be calibrated.

Without Spindle Feedback

If you do not have a method to calculate your spindle speed, you can calibrate your spindle by using the frequency of your variable frequency drive (VFD). However, you need to find the five different values as shown below.

Current Velocity

Use the velocity value found above from the *Motor Tuning and Setup* window.

Pulley Max

Go to **Config** on the main menu bar, then select **Spindle Pulleys**… You will see the following window:

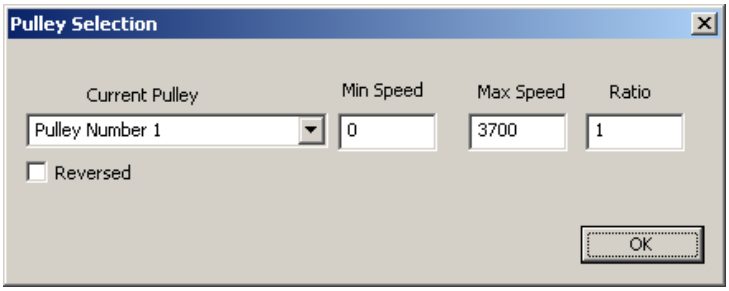

Figure 44 Max Pulley Speed

Your current pulley will be selected. Your **Max Speed** value is your pulley max needed for the spindle calibration.

Max VFD Hz
Now you need to look in your VFD documentation to find the maximum frequency. This is your Max VFD Hz.

Commanded RPM
Simply enter a spindle speed as shown in Turning on Your Spindle on page 30. This is your Commanded RPM. Now turn the spindle on.

Actual Hz
Your VFD should display the current frequency in Hz, which is the Actual Hz value.

With the above information, you are ready to calculate your new velocity. Use the formula below:

New Velocity = **Current Velocity***(**Max VFD Hz *Commanded RPM**/**Pulley Max**)/**Actual Hz**.

Now go to the *Motor Tuning and Setup* window by selecting **Config**, then **Motor Tuning**. Press the **Spindle** button and enter in your new velocity. Press **SAVE AXIS SETTINGS** before pressing **OK**. Your spindle should now be calibrated.

Setting up Your Limits and Homing

The breakout board has 6 24VDC inputs for the limit and home switches. Each axis can use one input as shown below.

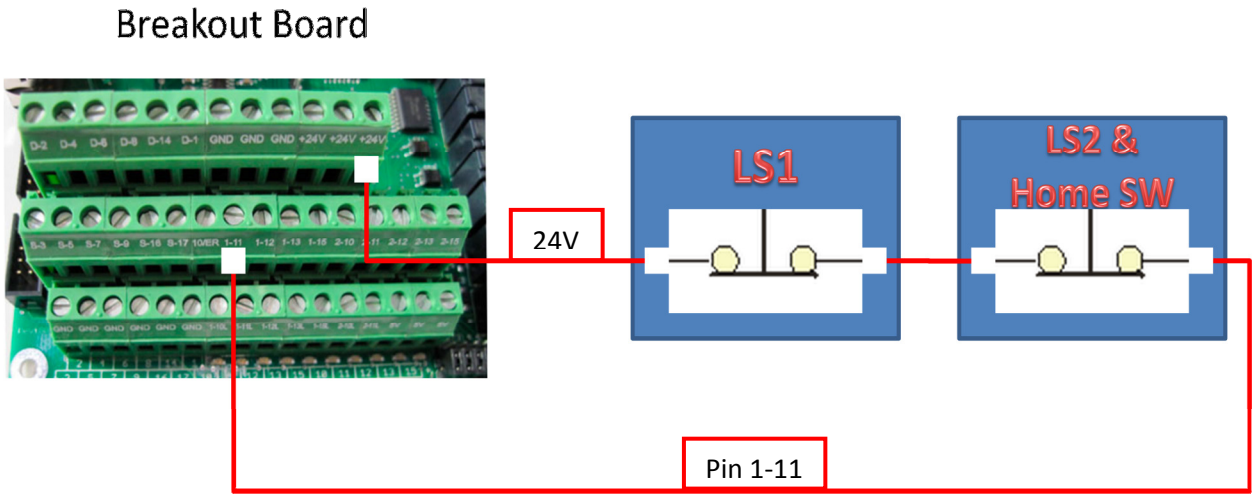

Figure 45 Limit Switches in Series

Note: Make sure to wire your limit switches ***Normally Closed****.*

The inputs are 1-11 through 2-11 on the big green terminal block. Each input corresponds to an axis.

Axis	Pin Number	Axis	Pin Number
X	1-11	A	1-15
Y	1-12	B	2-10
Z	1-13	C	2-11

Figure 46 Limit Switch Input Pins

To wire up 24V limit/home switches, follow the steps outlined below.

1. Pick two limit switches closest to the end of the axis' maximum and minimum travel.

2. Wire the two switches together in series as shown in Figure 45. Make sure to wire the switches using their normally closed contacts.

3. Wire the remaining side of the first switch to 24V from the breakout board (see 24V Supply on Figure 47).

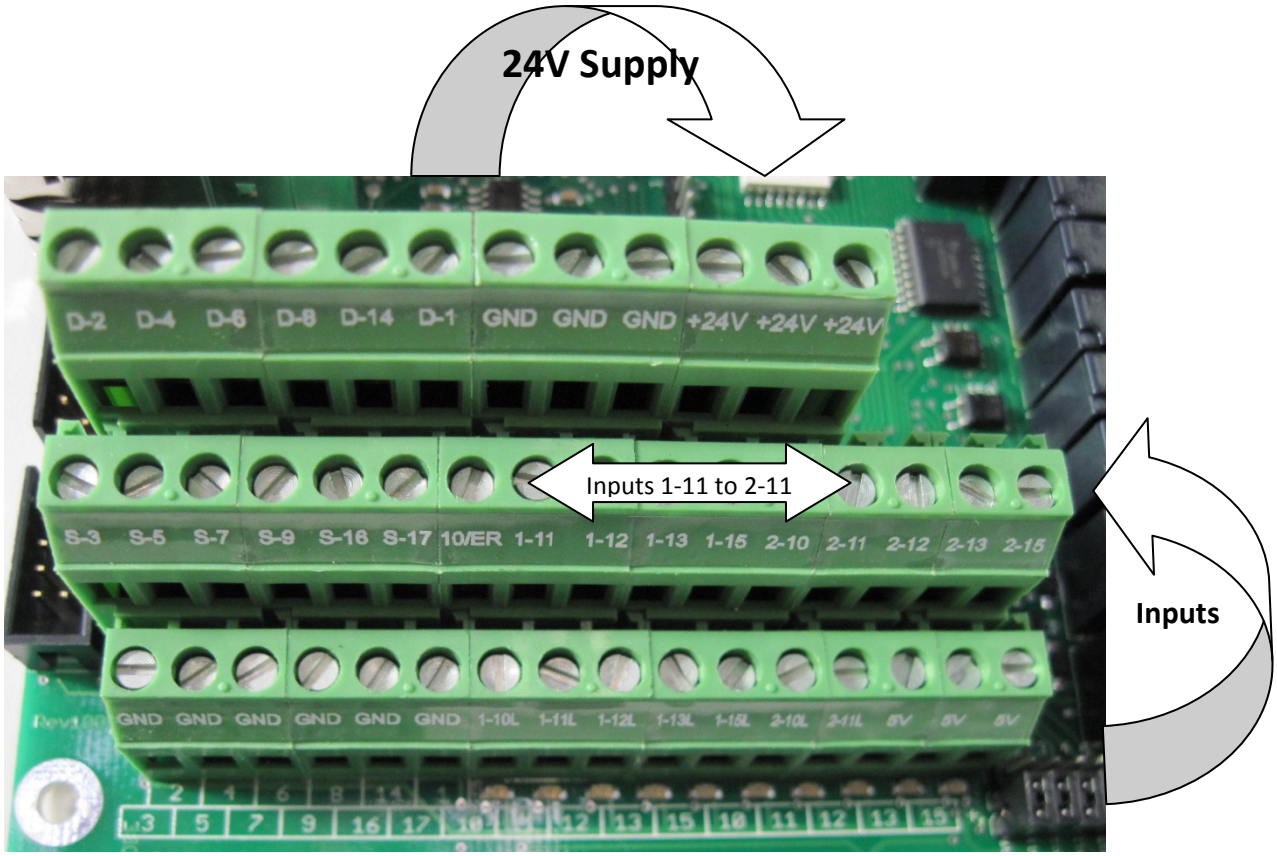

Figure 47 Where to Wire up Your Limit Switches

4. Wire the remaining side of the limit/home switch into the correct input (see Figure 46) depending on which axis you are wiring.

5. On the menu bar at the top of the screen select **Config -> Ports and Pins** (see Figure 29).

6. Click on the **Input Signals** tab (See Figure 49).

7. Enable your limit and home switches by clicking the red "**X**" by the signal. The input is enabled when there is a green check mark. X++ is the forward limit, X—is the backwards limit, and X Home is the homing switch (Figure 49).

   For example, to enable the Y forward limit switch, click on the red "**X**" in the first column on the Y++ row. The "**X**" will change to a green check mark showing that the limit is enabled. You can also scroll down to view more input signals.

8. Check to make sure your port and pin number for that signal is correct. If the input is labeled 1-12, the pin is 12 and the port is 1 (Figure 48). The first column to the right of the Enabled column is the Port number and the next column is the Pin Number.

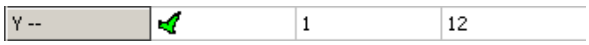

Figure 48 Limit Switches Ports and Pins Configuration

9. Setup the active state. Under the active low column you can change the active state by clicking on the "**X**" or check mark. For normally open, the green check mark should be used. Accordingly, for normally closed switches, the red "**X**" should be selected. If your limits are wired as shown in Figure 45 then this column should have the red "**X**".

10. When you are finished setting up your limit and home switches, press **Apply** and then **Ok**.

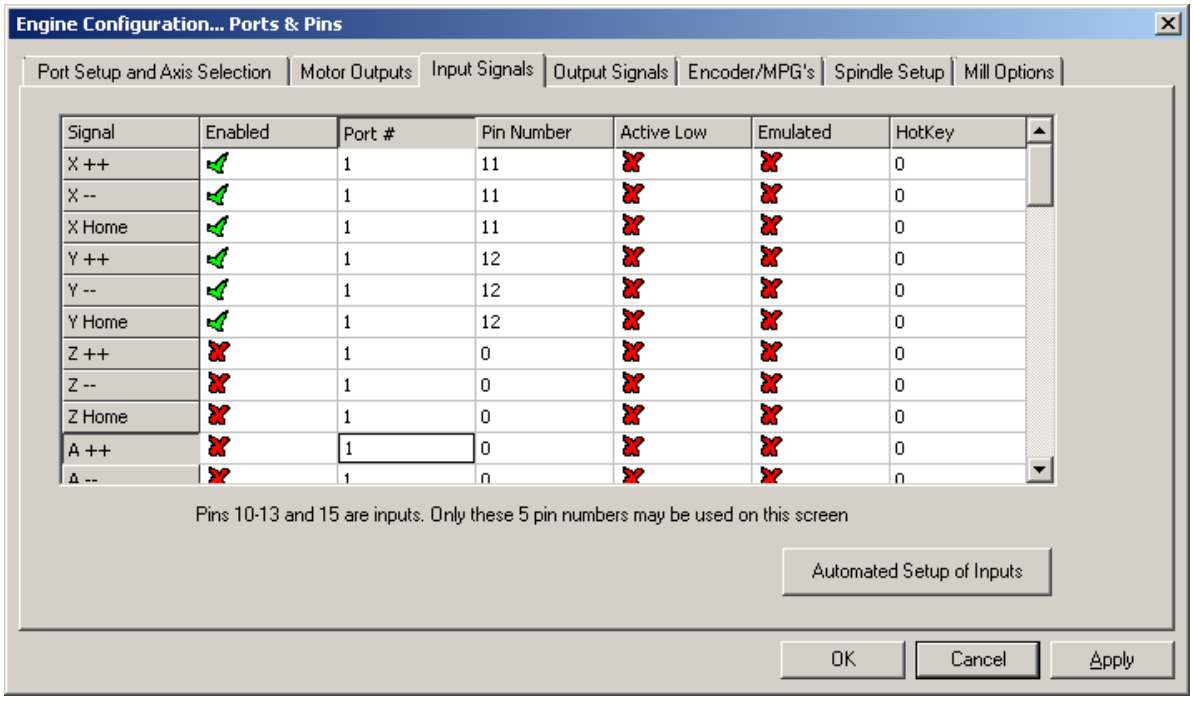

Figure 49 Input Signals

For example, the configuration above only has X and Y limit and home switches enabled. All of them are wired normally closed. The port and pin for X is port 1 pin 11 and for Y it is port 1 pin 12. Notice that all the limit switches and the home switch for an axis have the same port and pin numbers.

Setting up Homing

Now your limit and homing switches are setup correctly. It is time to finish setting up homing.

1. On the sub menu click the **Ref Home** button as shown below.

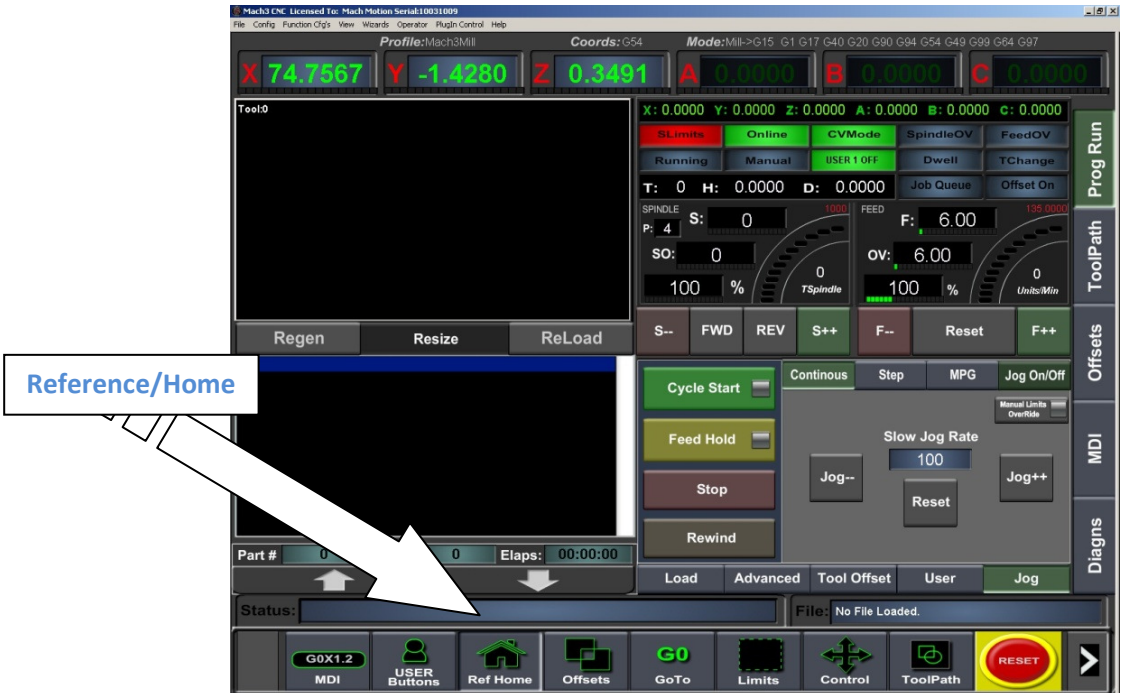

Figure 50 Home Machine

2. Home your machine. You can either select **Ref Home** which will reference all the axes at once or you can individually reference each axis. Notice which axes home in the wrong direction.

Figure 51 Reference Buttons

****

Warning

If your limit switches are not setup correctly or if an axis moves in the opposite direction of the home switch, you could crash your machine. Make sure to keep your hand on the Emergency Stop button the first time you home your machine.

****

When an axis is homed, the label (X, Y, Z, etc) at the top of the **Prog Run** screen will turn green.

3. Open to the menu bar and click **Config -> Homing/Limits** (Figure 32). The *Motor Home/Soft Limits* window will come up as shown below.

Figure 52 Motor Home/Soft Limits

4. If any of the axes homed in the wrong direction, click on the red "**X**" next to the axis.

5. Set the speed of the axis by changing the percentage under the **Speed %** column.

6. Enter in the distance that the machine will move after it hits a limit switch by adjusting the **Home Off** column. If you want the machine to stop on the switch, leave that value to zero.

Homing on your machine should now be completely set up. Press the **Ref Home** button again to make sure that everything works correctly.

Setting up Your Soft Limits

Soft limits are utilized to keep your machine from crashing. If the soft limits are setup correctly, you will never be able to hit a physical limit switch on your machine unless the machine is not homed properly. If at any time you command your machine to move outside of the soft limits (while they are enabled), an error will appear in the status line or a window will pop up asking you if you want to continue. To setup the soft limits, follow the procedure outlined below.

1. Jog your machine to the maximum distance from your homing switches. Make sure to stay inside your physical limit switches. If you jog outside of your limit switches, you completely defeat the purpose of soft limits.

Figure 53 Offsets Screen

2. Navigate to the **Offsets** screen as shown above. Record the exact position for each axis as shown by the *Machine Coordinates* arrow (See Figure 53).

   Note: If you don't have the Ultimate Screen, just view the machine coordinates on the Diagnostics page.

3. Open the menu bar and click **Config -> Homing/Limits** (Figure 32). The Motor Home/Soft Limits window will come up (See Figure 52).

   *Note: DO NOT try to edit your soft limits in the **Offsets** screen. You must use the Motor Home/Soft Limits window.*

4. For each axis enter in your recorded values. If the value is positive, place it into the Soft Max limit and set the Soft Min limit to zero. Otherwise, with a negative value, set the Soft Max to zero and the Soft

Min to the recorded value.

5. Press **OK**

Figure 54 Soft Limits

In the figure above the X axis soft limits go from 26.45 to 0, the Y axis from 16.75 to 0, and the Z axis from 0 to negative 3.65. If at any time the machine attempts to move past these limits, there will be an error. Also the X & Z axes are reversed.

6. Go to the **Offsets** page and click on the **Soft Limit** button. The button will turn green. This enables the soft limits. See Figure 55 below. Now when you are jogging or running a G-code file, your machine will stop when it hits a soft limit.

Figure 55 Soft Limits on MachMotion Screen

*Note: If you don't have the MachMotion Ultimate Screen, click on the **Soft Limits** button on the main screen. The LED behind the button will turn on.*

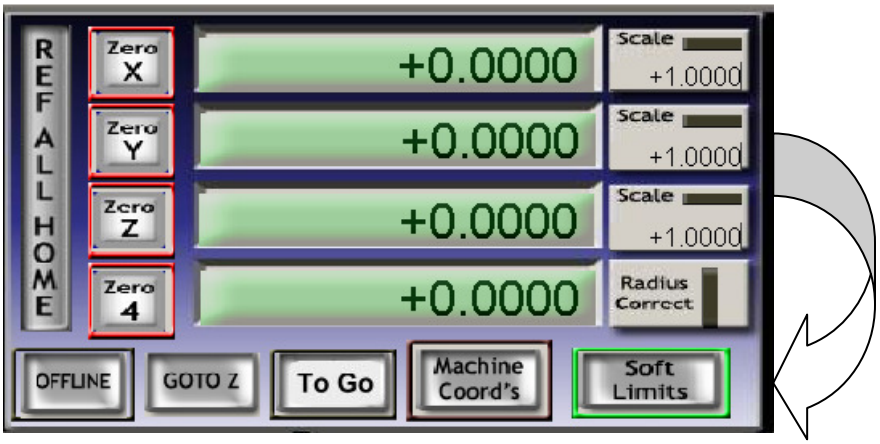

Figure 56 Soft Limits Old Screen Set

Test your soft limits by jogging your axes in all directions. As long as your machine is homed, you should never be able to hit a hard limit switch.

Setting up Inputs

Generic Inputs

The MachMotion breakout board has 6 - 24V inputs and 3 - 5V inputs. The inputs are often just used for limit switches. To learn how to setup your limit switches, go to Setting up Your Limits and Homing on page 35. However, read this section to learn how to setup generic inputs. The inputs are located on the green three tier terminal block as shown below.

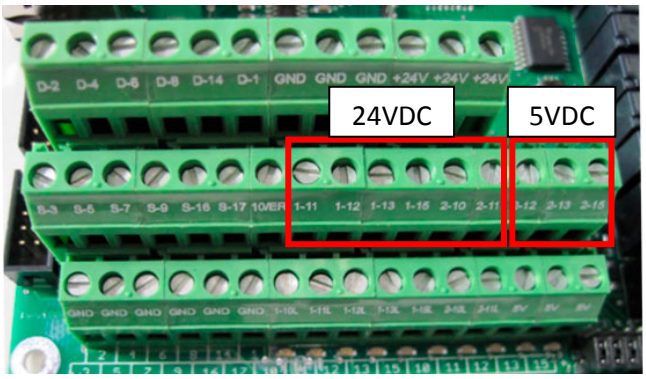

Figure 57 Inputs

The input name corresponds to the port and pin number of the input. For example, input 1-11 is addressed by using port 1 pin 11 and input 2-12 uses port 2 pin 12.

Inputs 2-12, 2-13, and 2-15 are always 5V inputs. The rest of the inputs can be configured many different ways. For 24V inputs, make sure the jumpers are on the ground row (in the bottom position) as shown below.

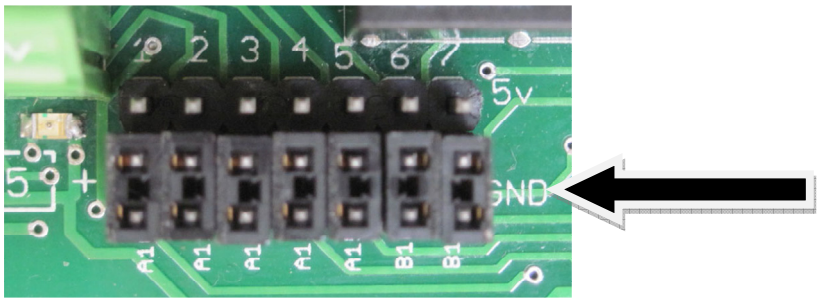

Figure 58 Jumper Configuration

With the jumpers configured correctly, you are ready to wire in your input.

Note: For more details on wiring up your inputs, please consult the IO6 Breakout Board manual which can be found at www.machmotion.com.

To configure an input, follow the procedure below.

1. On the menu bar click on **Config,** then **Ports and Pins**.

2. Select the **Input Signals** tab. Scroll down to the desired input. There are 4 inputs and 15 OEM triggers. An OEM trigger acts exactly like an input.

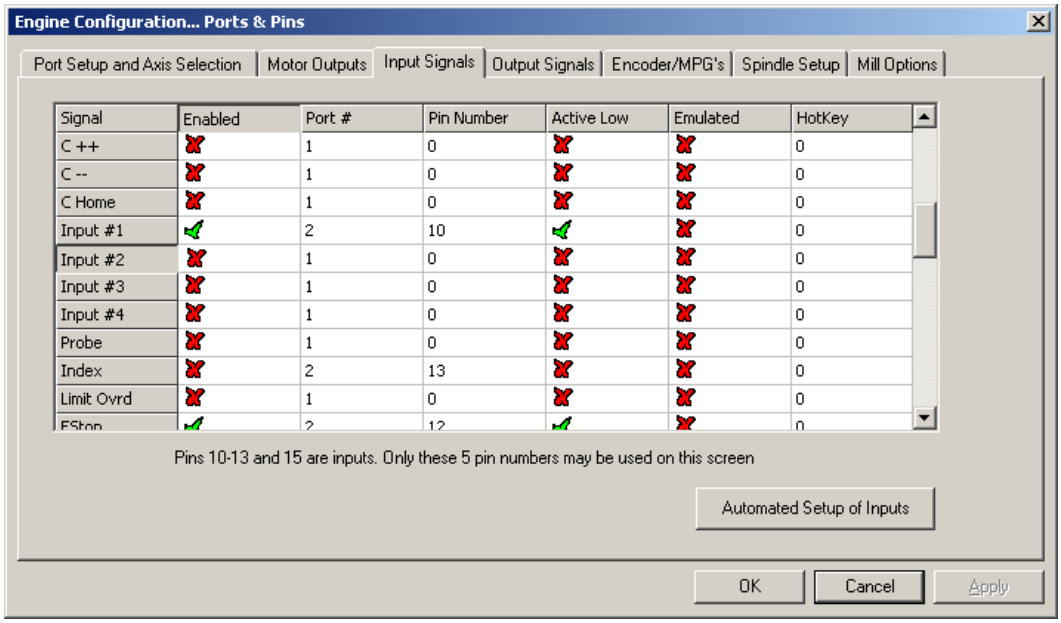

Figure 59 Input Configuration

3. Enable the input by clicking on the red **X**. If it is a green check mark, it is already enabled.

4. Set the **Port Number** and **Pin Number** to the desired input. Remember, the first part of the input name gives the port number and the second part gives the pin number.

5. To change when the input is active, click on the **Active Low** column. A green check mark means that the input is active low and a red X means that the input is active high.

Your input should now be setup.

Setting up Outputs

Generic Outputs

The MachMotion breakout board has 8 – 2 amp relay outputs labeled R2 – R9. They are located on the black terminal block as shown below.

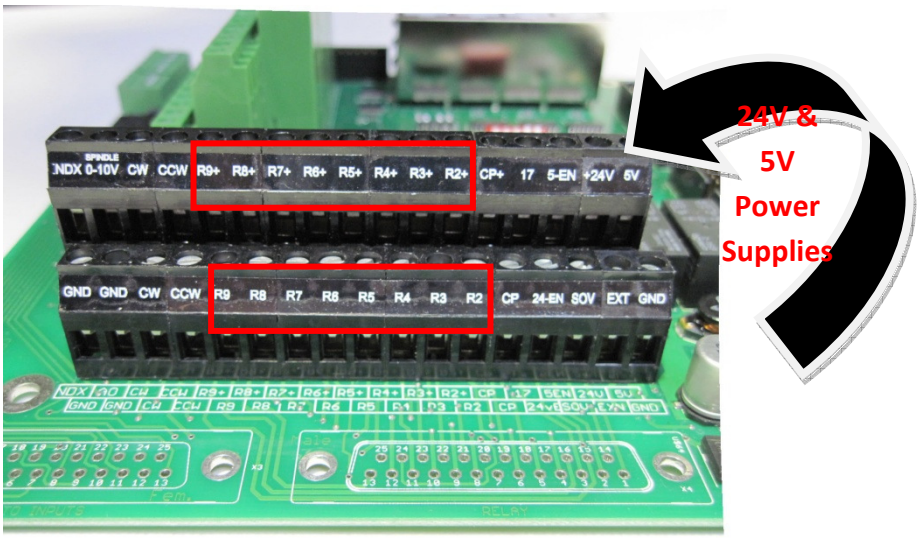

Figure 60 Relay Outputs

The relays' coils are connected to the Mach3 software on Port 2 Pin X, where X is the relay number (2-9). The terminal block allows you to connect to both sides of the contact. Simply connect your voltage supply (24V, 5V, etc.) to one side of the relay (RX+) and then connect your signal to the other side (RX). Examine at the relay schematic below.

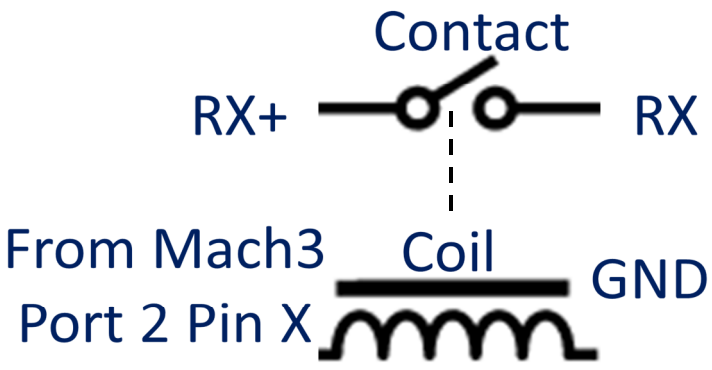

Figure 61 Relay Schematic

Each relay number corresponds to a pin number in the Mach3 software. See the table below for the port and pin configuration.

Relay Name	Port Number	Pin Number
R2	2	2
R3	2	3
R4	2	4
R5	2	5
R6	2	6
R7	2	7
R8	2	8
R9	2	9

To configure an output, follow the procedure below.

1. On the menu bar click on **Config,** then **Ports and Pins**.

2. Select the **Output Signals** tab. Scroll down to the desired output. There are 20 outputs that you can use.

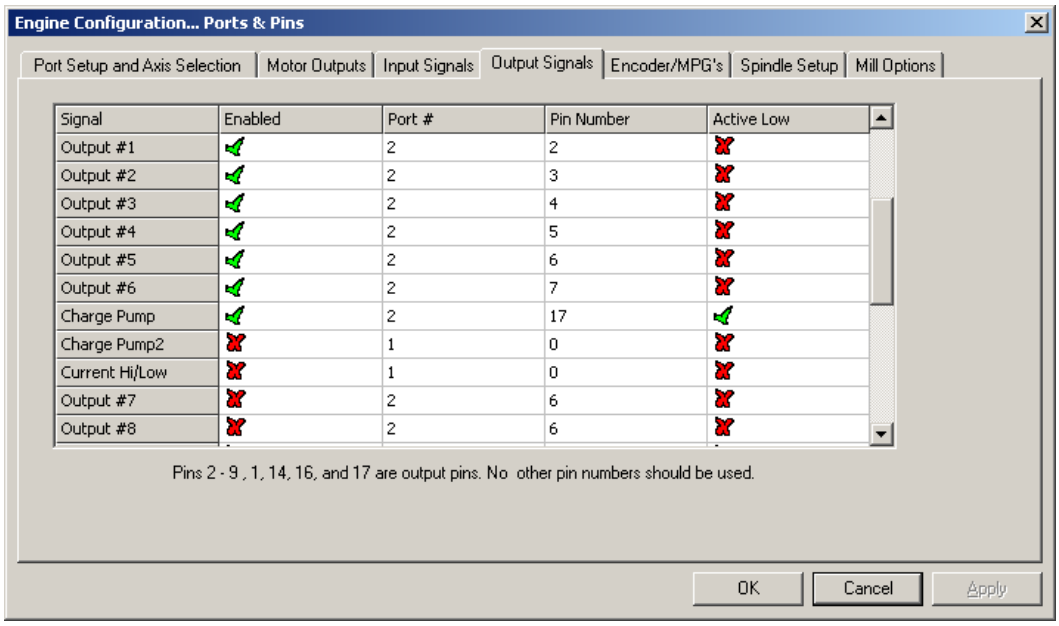

Figure 62 Output Configuration

3. Enable the output by clicking on the red **X**. If it is a green check mark, it is already enabled.

4. Set the **Port Number** to 2 and the **Pin Number** to the desired relay. See the table above for more details.

5. Finally, to setup the relay as normally closed, click on the red **X** under the **Active Low** column to turn it into a green check mark. Otherwise leave this as a red X (normally open contact). If configured with a red **X**, the relay will activate (close) only when the output is on.

Now your output should be setup.

There are a few ways to control an output. First you can turn them on and off in a visual basic (VB) script such as a macro. Use the following visual basic statements:

ActivateSignal(OutputX)

DeActivateSignal(OutputX)

Also, outputs 5-12 can be controlled with M-Codes. One M-Code turns an output on and the other M-Code turns the output off. Use the table below for a reference.

Custom M-Codes	Functions
M200	Output 5 on
M201	Output 5 off
M202	Output 6 on
M203	Output 6 off
M204	Output 7 on
M205	Output 7 off
M206	Output 8 on
M207	Output 8 off
M208	Output 9 on
M209	Output 9 off
M210	Output 10 on
M211	Output 10 off
M212	Output 11 on
M213	Output 11 off
M214	Output 12 on
M215	Output 12 off

Mist Control

Mist is already preconfigured in Mach3 to be wired into the R2 relay contacts on the big black connector. Below is a schematic of the actual R2 relay.

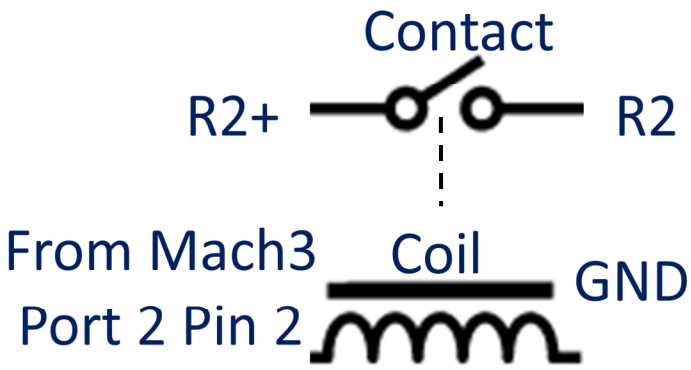

Figure 63 R2 Relay Contact

Follow the steps below to wire up your mist control.

1. Wire up your power signal into R2+. You can use whatever voltage you need, but +24V and +5V are supplied on the black connector. See the picture below:

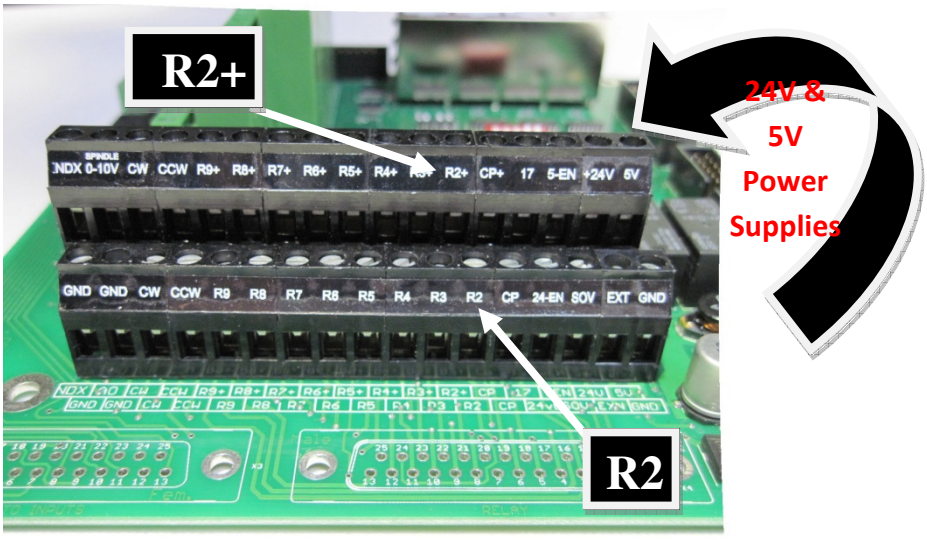

Figure 64 Wiring up Your Mist Control

2. Wire up your mist signal into R2 on the back connector as show above.

To turn on your mist you can use M7 and to turn it off you can use M9. Also, on the Ultimate screen under the **Prog Run-> Advanced** tab, there is a Mist button. Toggle it by pressing the button. If the button is green, your mist should be working!

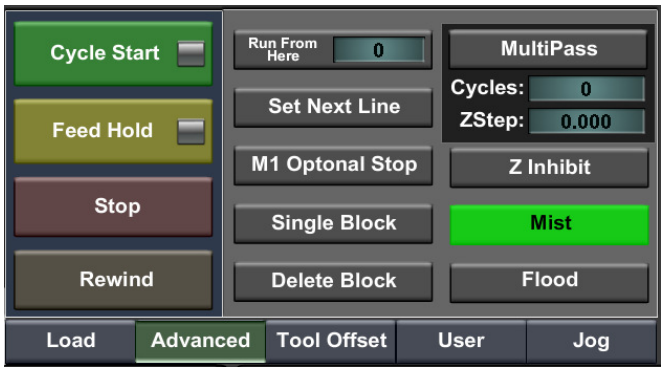

Figure 65 Mist Button

Note: M9 turns off both mist and flood.

Flood Control

Flood is already preconfigured in Mach3 to be wired into the R3 relay contacts on the big black connector. Below is a schematic of the actual R3 relay.

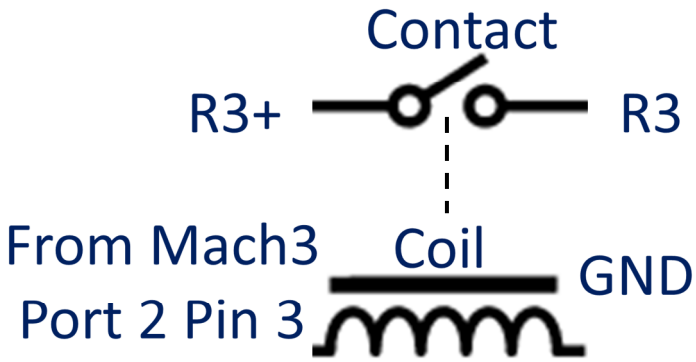

Figure 66 R3 Relay Contact

Follow the steps below to wire up your flood control.

1. Wire up your power supply into R3+. You can use whatever voltage you need, but +24V and +5V are supplied on the black connector. See the picture below:

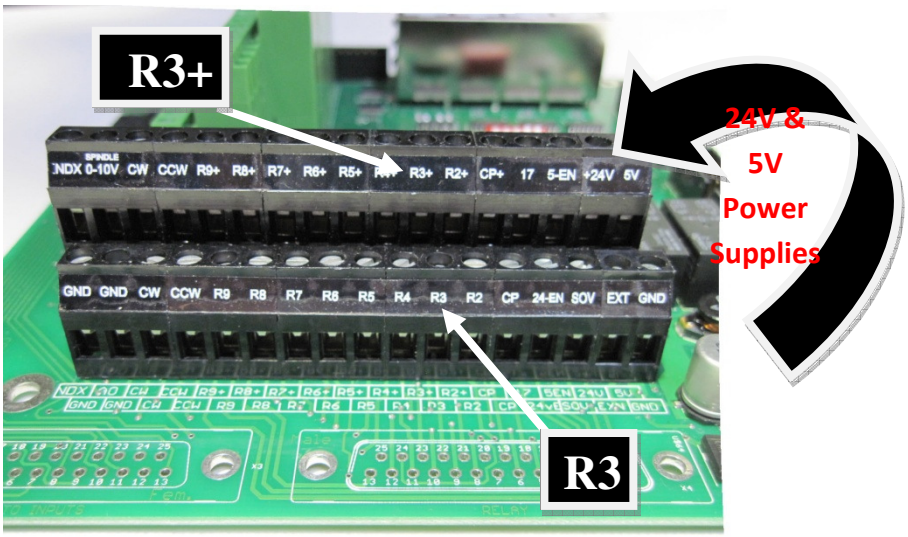

Figure 67 Wiring up Your Mist Control

2. Wire up your flood signal into R3 on the back connector as show above.

To turn on your flood you can use M8 and to turn it off you can use M9. Also, on the Ultimate screen under the **Prog Run-> Advanced** tab, there is a Flood button. Toggle it by pressing the button. If the button is green, your flood should be working!

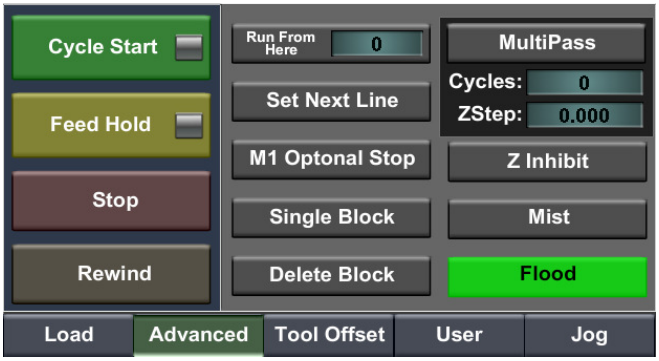

Figure 68 Mist Button

Note: M9 turns off both mist and flood.

Setting up Hot Keys

The Mach3 software allows you to configure keys on your keyboard as shortcuts for jogging different axes. Follow the steps below to setup your jog keys.

1. On the menu bar at the top of the screen select **Config -> System HotKeys.** The *System HotKeys Setup* window will appear.

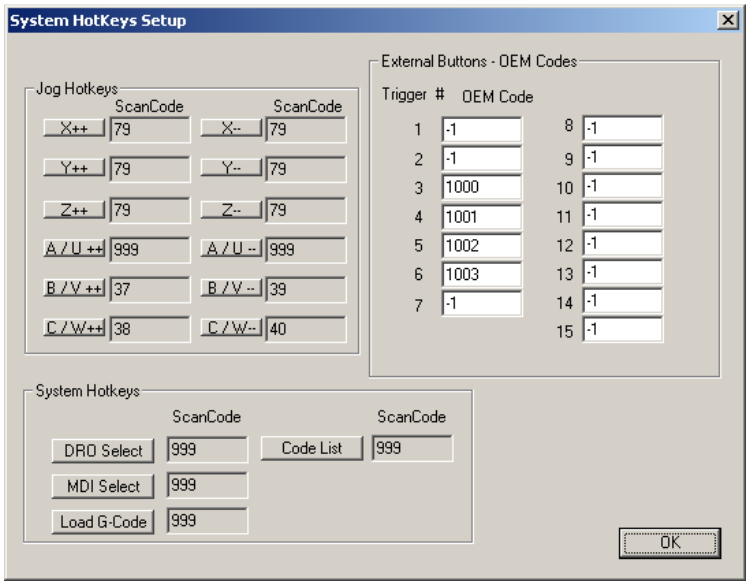

Figure 69 System HotKeys

2. Click on the axis you want to configure. The X++ is the forward X axis button and the X—is the reverse button. A small window will pop up.

Figure 70 Set HotKey

3. Press whatever key you want to control that function and the little window will disappear and load the value of that key into the *System HotKeys Setup* window.

4. Repeat this process until all your buttons are configured. Press **OK.**

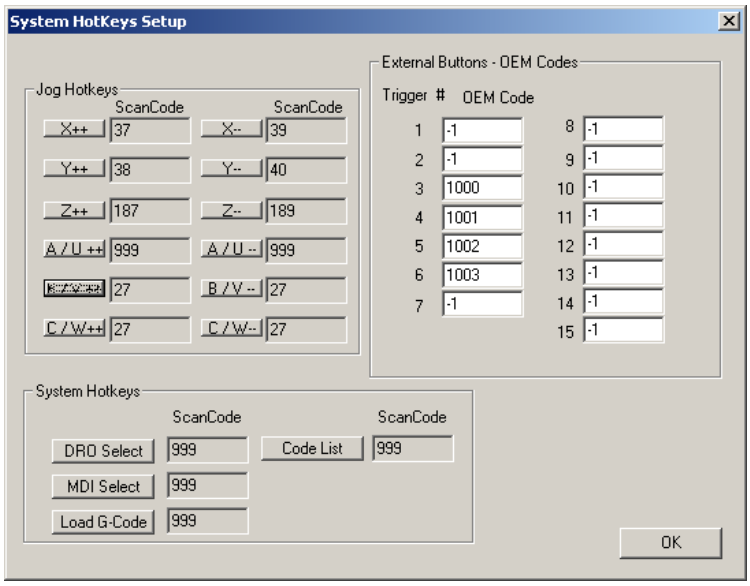

Figure 71 HotKeys Example

For example in Figure 71 the right and left arrow keys control the X axis and the up and down arrow keys control the Y axis.

Advanced Options

Under the system configuration window you can setup external inputs, an oiler, and user messages. Begin by clicking **Config** on the menu bar. Then select **Config Plugins**. The *PlugIn Control and Activation* window will appear. On the farthest right column, click on the yellow **CONFIG** button of the MachMotion plugin as shown below.

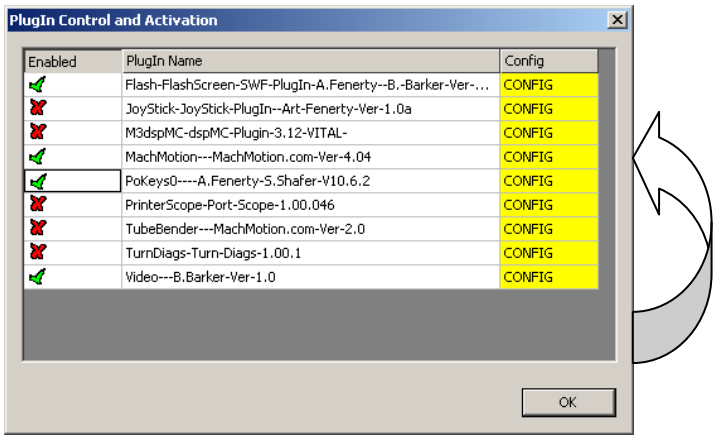

Figure 72 Plugin Control

A new window called *Configure ModIO and Mach3* will appear. Select the **System Configuration** button.

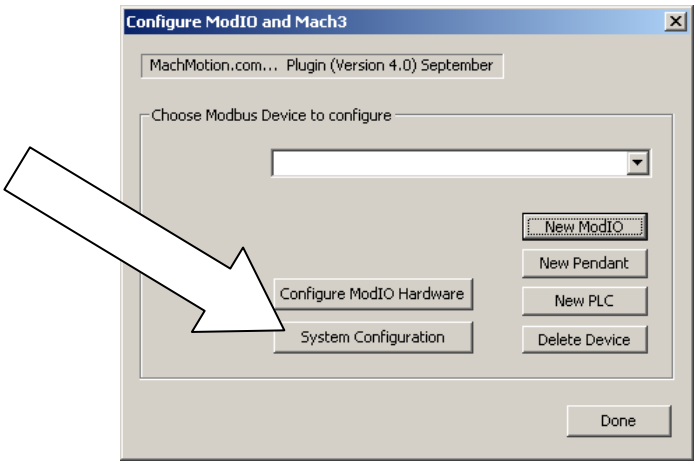

Figure 73 Configure ModIO and Mach3

Now you should see the *System Configuration* window as shown below.

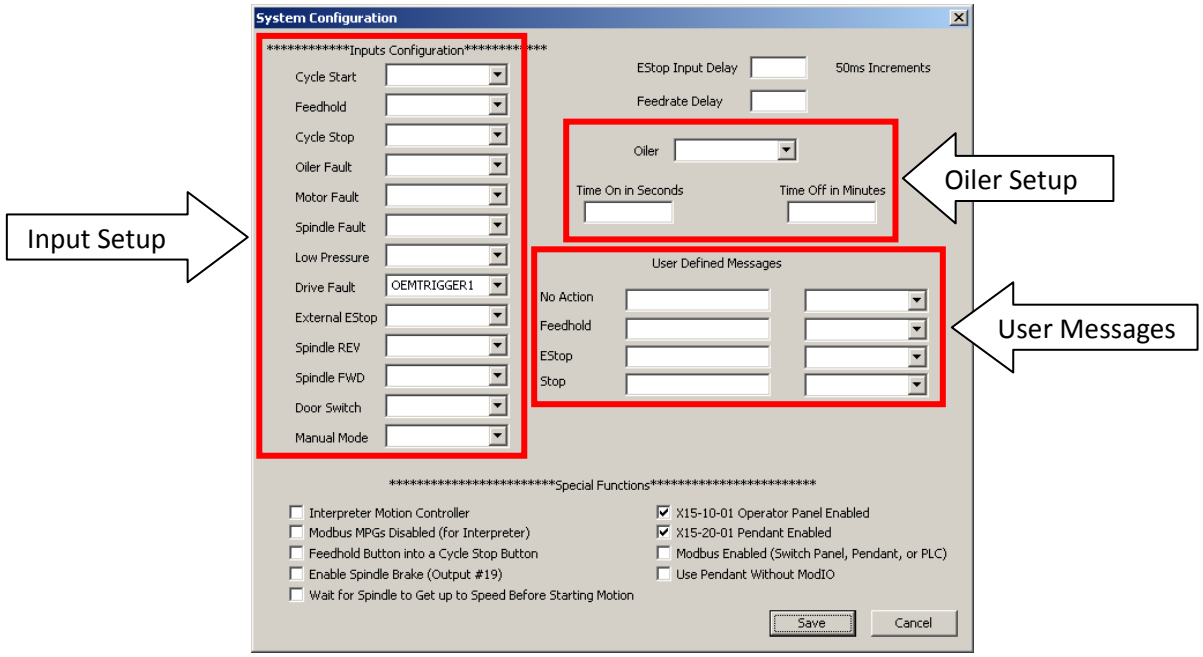

Figure 74 System Configuration

You should only ever touch the input configuration, the oiler setup, and the user defined messages. The special functions are used to setup your control at the factory. Please do not change these settings.

The Input Setup section allows you to have an input turn on a function. The functions are listed in the left side such as Cycle Start, Feedhold, Cycle Stop, etc. The input in the drop down menu turns on the corresponding function. In the figure above, OEM trigger 1 (OEMTRIGGER1) turns on the drive fault.

For example, to setup an external EStop, configure a normal input in ports and pins (See Setting up Inputs). Let's assume we setup Input 4. Then use the drop down menu in the System Configuration window to select the input as shown below.

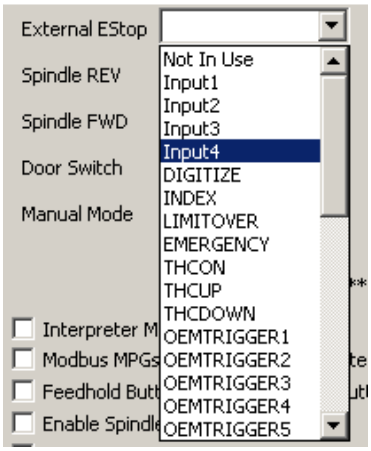

Figure 75 External Estop

Now whenever Input4 is active, EStop will be flagged.

You can configure the User Messages to have a custom messages displayed. Each input will do a specific function (estop, feedhold, stop) and write to the status bar except the No Action option. The No Action just displays the message on the status bar whenever the input is active. In the example below, when OEM trigger 4 is activated, the message "**MCR Reset!!**" will be displayed on the status bar.

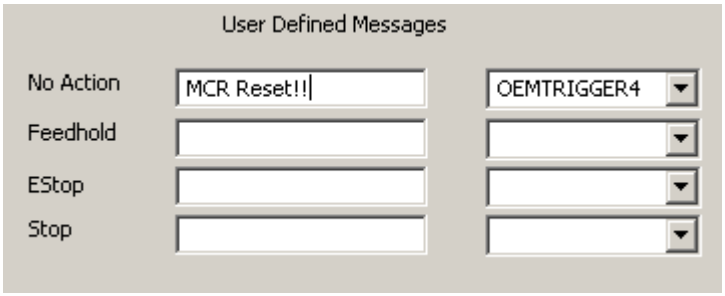

Figure 76 User Messages

You may also need to setup an oiler. Just define an output, set the time you want the oiler on, and the time you want it off. In the example below the oiler is attached to output 6. It is turned on for 10 seconds every 1 minute. The spindle has to be one for the oiler to turn on.

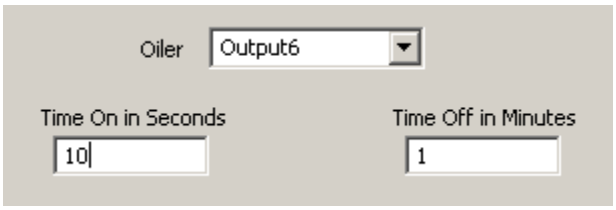

Figure 77 Oiler

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Finding Information for Your Control

Documentation

For further reference you can view all our other manuals under our **Manuals** folder on your desktop.

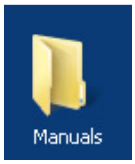

Figure 78 Manuals

Below is a list of our manuals and a brief note on what they are about. The label in parentheses is the folder the manuals are located under on your computer. For example, **"(Using Mach3)"** is a sub-folder in the Manuals folder. You can find all our latest manuals plus other information online at www.machmotion.com .

There are also wiring diagrams located in the Manuals folder under the sub-folder Wiring Diagrams.

For even more manuals and documentation besides what is on your computer and on our website, see More Information on page 59 below.

For setting up your control:

Arm Assembly Instructions

Leads you through a simple step by step procedure to assemble your mounting arm.

IO6 Board V4.0

Gives you all the details you need about the breakout board. This is great for wiring up different types of I/O.

Ultimate Screen Installation

Step by step guide to install the Ultimate Screen.

For learning how to use the Mach3 software (Using Mach3):

Mach3 Install Config

Gives a general overview of how to setup and use the Mach3 software. If you are unfamiliar with Mach3 this would be a fantastic resource.

Mach3Mill

Using Mach3Mill A user's guide to installation, configuration and operation

Gives pretty much everything you need to know about the software. Much of the configuration is already complete, but you can still learn a lot about the power of Mach3.

Using3Turn

Using Mach3Turn A user's guide to installation, configuration and operation

Gives pretty much everything you need to know about the software. Much of the configuration is already complete, but you can still learn a lot about the power of Mach3.

Tool Setup Guide

Shows how to setup your machine's tooling.

M-Codes

For a list of M-codes, visit our website www.machmotion.com and select the CNC Info tab.

G-Codes

For a list of G-codes, visit our website www.machmotion.com and select the CNC Info tab.

For customizing/programming your control (Programming):

Mach3 V3 Programmer Reference

Presents all the different VB commands that you can use in Mach3 and lists all the LEDs and DROs for programming.

Cypress VB Language Manual

Gives a detailed explanation of visual basic and windows.

Ultimate Screen Customization

Shows some ways to customize the Ultimate Screen provided by MachMotion.

For your servo drives (Servo Drives):

Mitsubshi Quickstart

TECO Quickstart

For your stepper drives(Stepper Drives):

Stepper Drive Setup Guide 1.0.1

For interfacing with a PLC(PLC):

Programmable Logic Controllers

If you need to interface with a PLC, this manual tells you everything you need to know.

Setting Up Your Tool Changer

Leads you through a step by step process to setup a PLC tool changer.

D0-06 Volume 1 & D0-06 Volume 2

Shows how to program the D0-06 PLCs.

More Information

Below are many other resources to help you learn everything you need to know about Mach3. They cover everything from programming in VB to setting up homing and offsets in your machine.

For the Mach3 Software Documentation:

- A host of videos on how to use and even configure the Mach3 software are found at http://www.machsupport.com/videos.php. Click on the **Artsoft Video Tutorials** for even more videos.
- For manuals and information on the Mach3 software visit http://www.machsupport.com/documentation.php .
- The Mach3 Wiki (http://www.machsupport.com/MachCustomizeWiki/index.php?title=Main_Page) also offers a lot of support for configuring mach3.

For Screen Information:

- For MachMotion's Ultimate Screen, tutorial videos can be found on www.machmotion.com under **Support** and then **Ultimate Screen Support Videos**.

- For customizing without the Ultimate Screen, you can download the Mach3 screen editor at http://www.kd-dietz.de/index_eng.htm. Go to the Mach Screen Videos for information on how to use the editor under the Downloads tab from the same website.

Finding a Post Processor

For a list of post processors for the Mach software visit http://www.machsupport.com/posts.php. If your CAM package is not listed, contact your CAM producer and ask for a Mach post processor. If they do not have a Mach-specific post processor, a standard Fanuc post should work fine for most applications.

If you are using BobCAD-CAM, go to the following website. Download the post processor specific for your machine type.

http://www.bobcadsupport.com/posts/index.php?start=/kunden/homepages/17/d229444852/htdocs/bobcadsupport/posts/BobCAD_V22_Mill_Posts/Mach&parent=/kunden/homepages/17/d229444852/htdocs/bobcadsupport/posts

Note: NoATC means No Automatic Tool Changer.

FREE Version of BobCAD CAM

To receive your free version of BobCAD CAM, contact Josh at 877-262-2231. You can use your sales order number from MachMotion or call us and ask for a promotional code.

MachMotion
(573) 368-7399
Ask for BobCAD CAM promotional code

Josh at BobCAD CAM
(877) 262-2231
Ask for your free version of BobCAD CAM

Shutting Down the Control

To power down your control, follow the steps outlined below.

1. Shut down the Mach3 software by clicking the exit button at the top right of the control. A window will pop up asking you if you are sure you want to end the session.

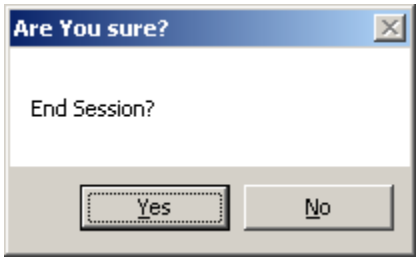

Figure 79 End Session

2. Click **Yes**. If another window pops up and asks you if you want to save the fixture, click **Yes**.

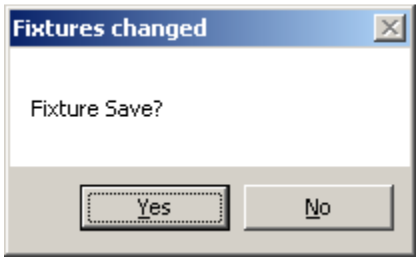

Figure 80 Fixture Save

3. Rotate and release the key on the back right hand side of the control. You can also click on the **Start** menu and then press **Shut Down**.
   The Mach Motion control will turn off.

Note: Do not turn the key until the control's software has completely shut down. Also, do not remove the power of the machine until the control is completely off.

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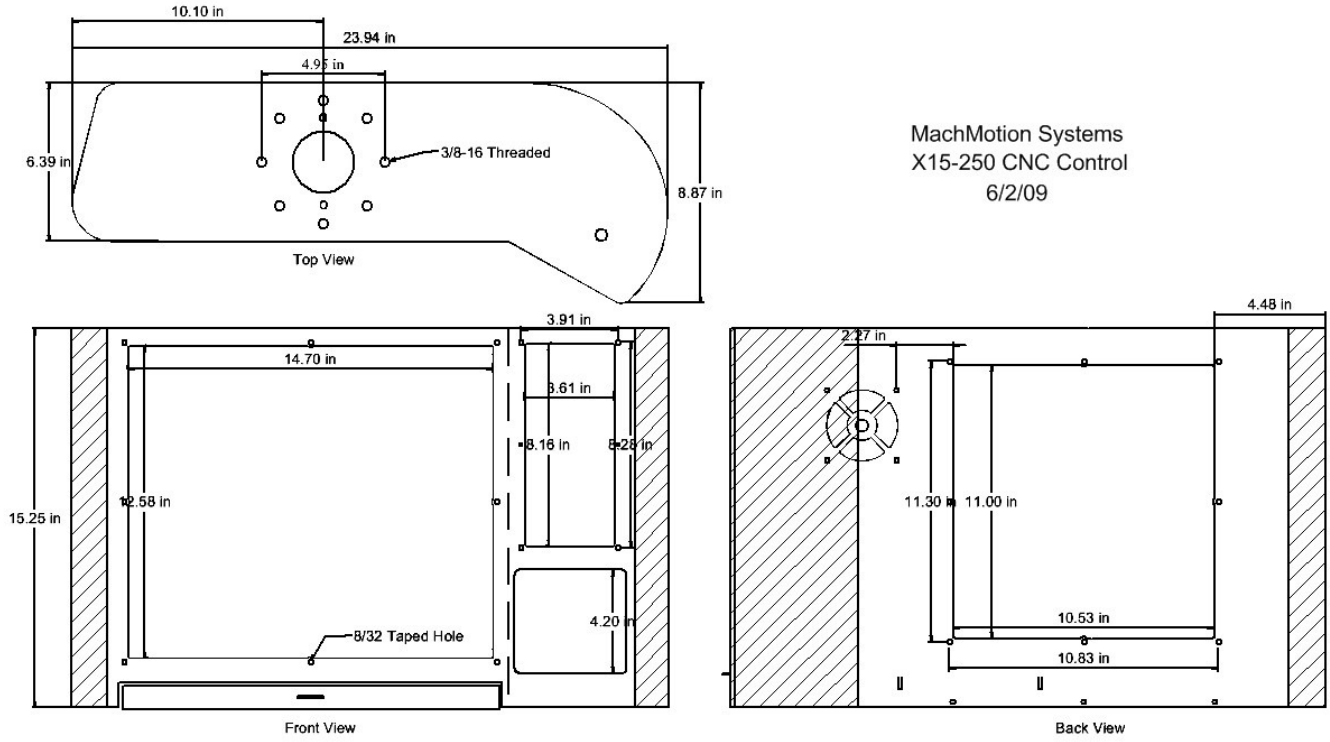
Specification

Below is the specification for a standard X15-250 CNC control.

Item	Specification
Power Source	AC 115VAC – 220VAC 50/60 Hz
Max Power Consumption	350W
Computer	X15-110 PC
Operating System	Windows 7
Processor	Intel® Pentium® Dual-Core 2.6GHz
RAM	1 GB
I/O Ports	
PS/2 Keyboard & PS/2 Mouse	1
VGA Port	1
Serial Port	1
Parallel Ports	3
Ethernet LAN (RJ45) Port	1
USB Ports	6 (2 Available)
6 Channel Audio I/O	1
Monitor	17” Color LCD
Keyboard	Retractable
Power Supply	5VDC, 12VDC, & 24VDC
CNC Control Software	Mach3
Axes	X, Y, Z, A, B, C
Enclosure	
Dimensions	24"(W) X 15.5"(H) X 6.5"(D)
Material	18 Gauge Steel, Powder Coated
Operator Interface	
Operator Panel	Jog Buttons, Selector Switches, Emergency Stop, Cycle Start, & Cycle Stop Buttons
Optional Pendant	Hand-wheel & Selector Switches
Motion & I/O Interface	IO6 Breakout Board

Below is the X15-250 CNC Control drawing.



Warranty Information

MachMotion warrants all products to be free from manufacturer defects for a period of one year from the date of purchase. Products which prove to be defective under normal conditions and proper use during the warranty period will be replaced without charge. For warranty service, send the defective product to MachMotion, 14518 County Road 7240, Newburg, MO 65550. If the defect is found to be caused by improper use, then this warranty does not apply. Otherwise the product will be repaired or exchanged and shipped to the address located on the Product Return\Repair Form. MachMotion will cover the return UPS ground shipping for the replaced/repaired product. When a product or part is exchanged, any replacement item becomes your property and the replaced item becomes MachMotion's property.

Congratulations on completing the user's manual for your X15-250! We hope that you have found this manual very helpful.

Please let us know if you have any questions.

Sincerely,

The Mach Motion Team
http://www.machmotion.com
14518 County Road 7240, Newburg, MO 65550
(573) 368-7399 • Fax (573) 341-2672