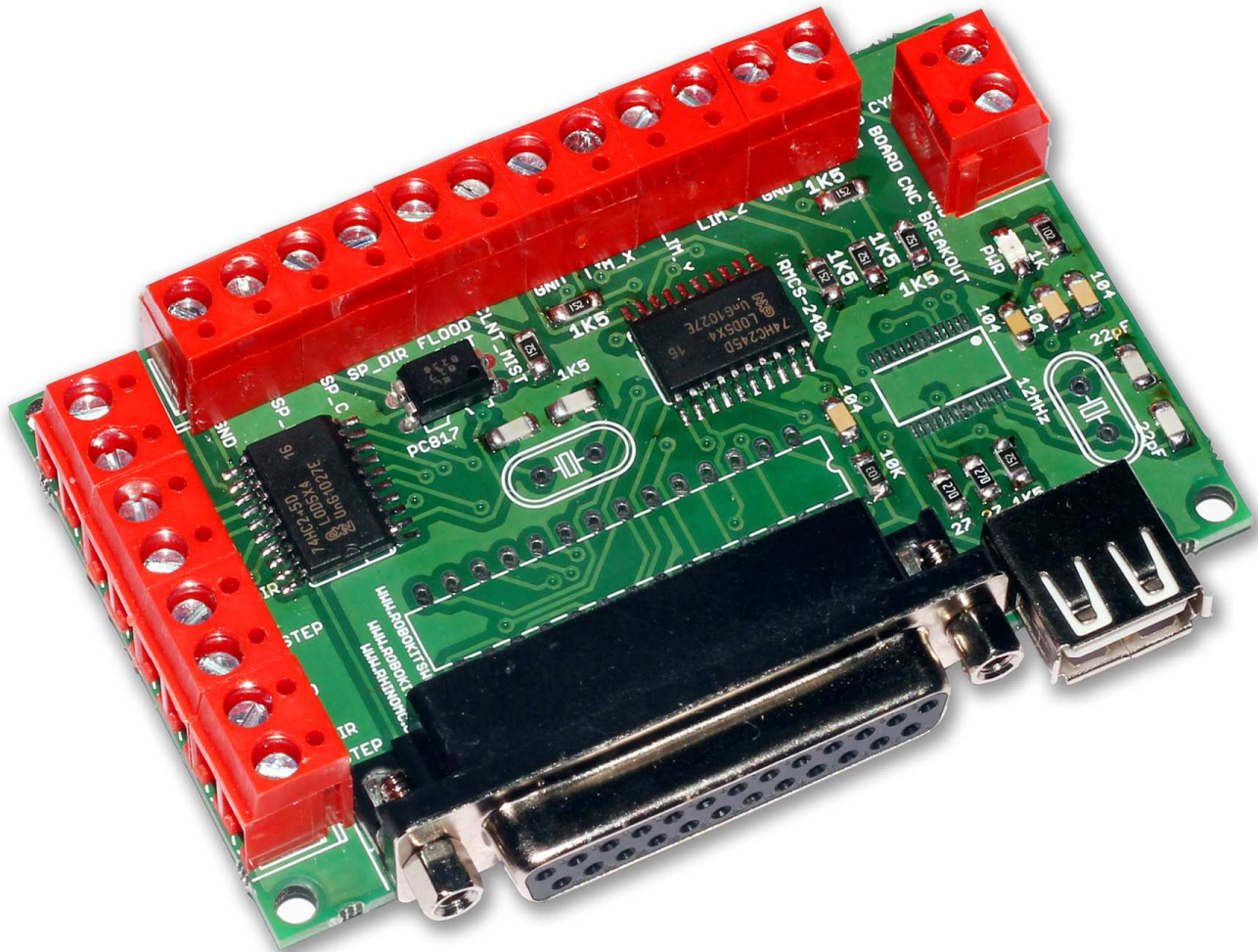


RHINO MOTION CONTROLS

RMCS-2401

Parallel Port Buffered Breakout Board for 3 or 4 Axis CNC

Usable with Mach3, EMC2, TurboCNC and other CNC softwares



Installation Manual and Datasheet

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Key Features

- All inputs and outputs are buffered
- Optoisolated Spindle control capable of taking PWM input
- Both terminals of spindle optocoupler are available on screw terminal
- USB power input- No special power needed for operation
- All inputs and outputs except spindle can be used for other operations by software settings
- Simple but efficient and cost effective solution for PC based CNC control
- Inbuilt resistor for limit/proximity switch input
- NPN type proximity switch/Reed switch/Limit switch can be used for inputs
- Suitable for small and medium size 3 and 4 axis machines
- No settings on hardware level, everything can be set from software
- Small form factor
- Multiple boards can be used with multiple parallel ports by adding PCI cards in PC for expanding IOs

Description

Thank you for purchasing RMCS-2401, Parallel Port Breakout Board for CNC applications. This board can be used to control CNC machines which use 3 or 4 Stepper or Servo motors. The drives for steppers or servos must have impulse (step & direction) input. Only 3 connections are required for each drive – Step, Direction and GND.

The RMCS-2401 is completely buffered and can control the machine at distance of upto 4 meters away from PC without any problem at maximum pulse rate possible. No external power is required as USB power is used as power input. So to make a CNC working you need just 3 or 4 drives + RMCS-2401 + Limit switches + Power supply for drives.

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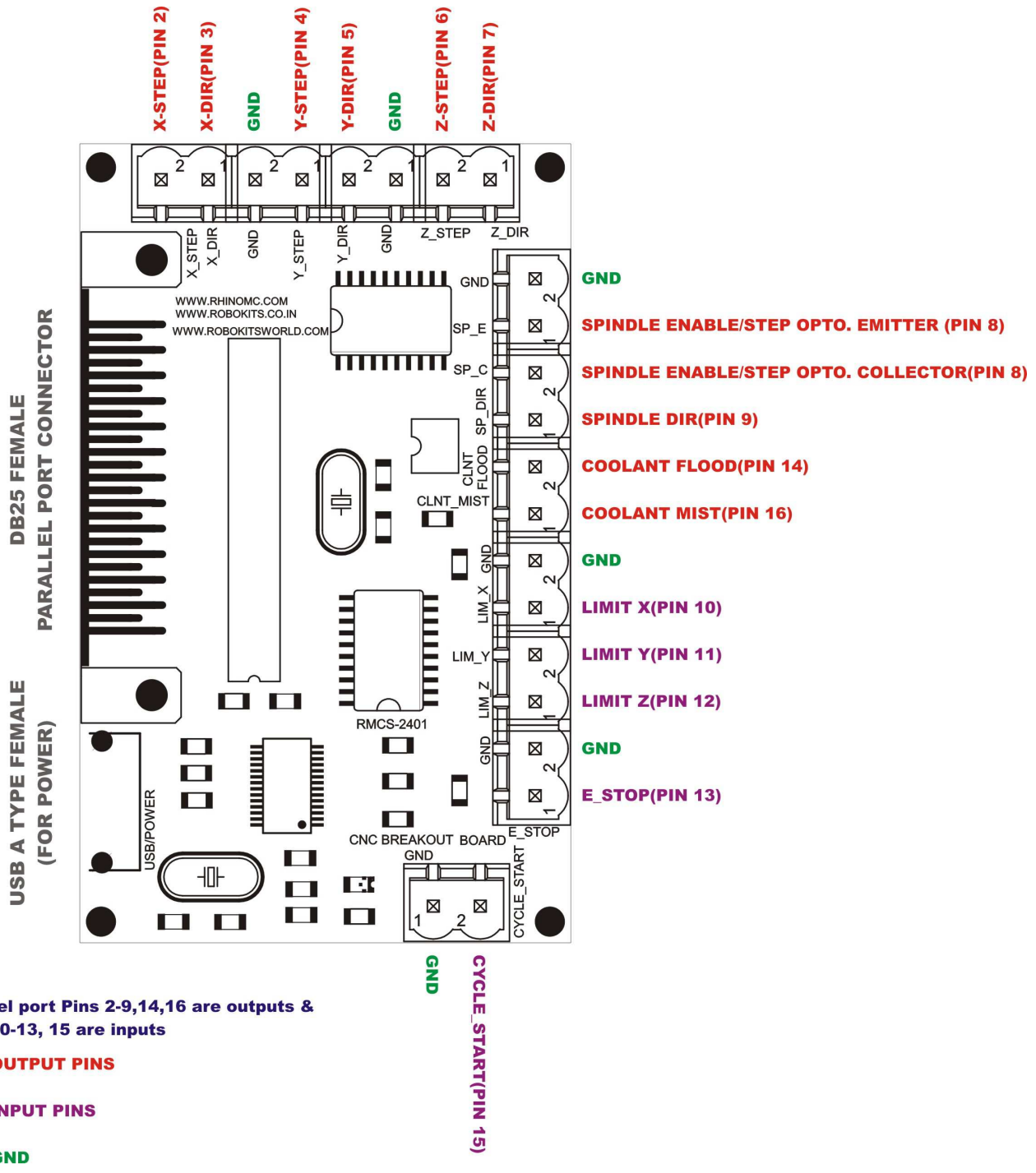
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Board Pinouts and Connections



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Connections : Connecting Stepper/Servo drives

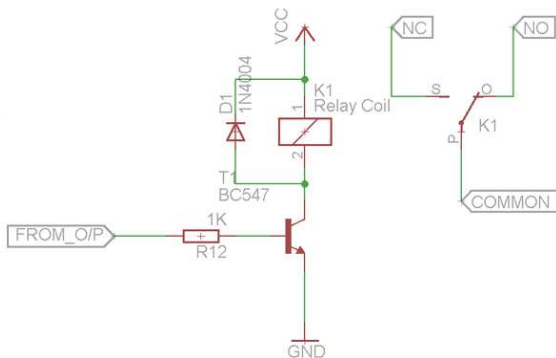
Stepper or Servo drive can be connected with Step & Direction input interface.

Connect Step(step+/Pulse+) and Direction(Dir+) pin to output pin i.e. X_Step & X_Dir
Connect Common/-Ve/Step-/Pulse- or Dir- pin to GND

Connections : Connecting Relays

Relay can be connecte to any output pin i.e. Coolant_Flood for switching of high loads like pumps, motor or lights etc.

External power supply for powering up relay is required in this case. Rating depends on type of relay.
A 1K Ω resistor and an NPN transistor (BC547,TIP122,2N3904) is required to switch relay from board signal.



Connections : Connecting Limit Switches

Limit switches can be connected directly between input pin and GND pin. Switches can be paralleled to get multiple inputs on one axis. As the pins are internally buffered and pulled up, no optoisolation or power is required. Switches should be connected to NO config. If you are using NC Active Low should be disabled in input signal.

Connections : Connecting Proximity Switches/Sensors

Any NPN proximity switch or sensor can be connected between Input pin and GND. Output of sensor should be given to input pin and GND should be connected to GND of proxy. Proximity switch requires external power supply. You may put a 1K resistor in series between output of sensor and input pin.

Multiple proximity switches may be paralalled to get multiple input on single Input line.

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Connections : Connecting Spindle (PWM/Non PWM mode)

This board directly supports VFD drives for spindle control. An optoisolated output is connected to Spindle_E and Spindle_C terminals. Many drives also support step and direction input or speed input through PWM signal. Softwares like Mach3 can generate PWM signal for controlling spindle speed. For more information see your VFD drive documentation and Mach3 documentation (available here : <http://www.machsupport.com/help-learning/product-manuals/>)

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Configuring Mach3

To demonstrate normal functionality of board we have chosen Mach3 software as standard demo software to demonstrate the features and configurations of this board.

Mach3 trial version is available here : <http://www.machsupport.com/software/mach3/>

It's also available for purchase. Trial version can process only 500 lines of G-Code.

It's very important to make your parallel port working with Mach3 or other software.

Mach3 doesn't support 64 bit windows and some version of Windows after Windows 7. You may try to run it in compatibility mode. Its required to check that parallel port driver is installed and functioning properly.

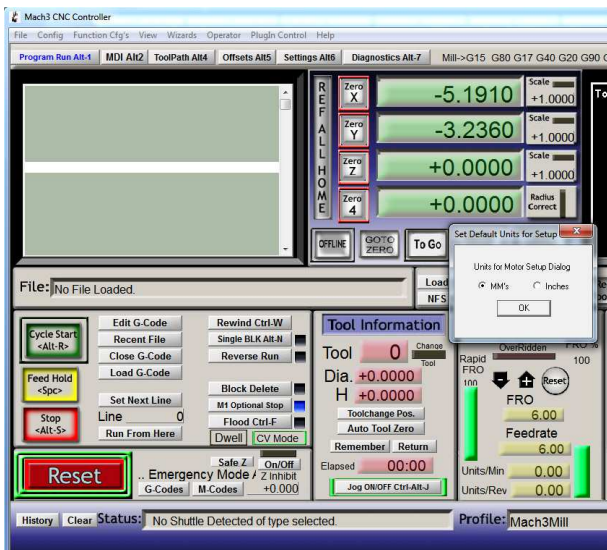
To check wheather mach3 can access your parallel port or not connect a LED between Pin2 and GND of parallel port, Pin2 should be +ve of LED. When step input is given the LED should glow depending on the speed of pulses. If this is not happening board will not work as there will be no input from parallel port. There may be several reasons for this but mainly it may be because of driver or configuration of Mach3.

Note that USB to parallel port cables will not work with Mach3. If you don't have parallel port in your pc you may use a PCI parallel port card.

After installing Mach3 and restarting PC (if it's asked to do) you can start configuring Mach3.

Step 1: Set native units

Start with Mach3 Mill profile. Go to Config menu -> Set native units and select mm or inches whatever you prefer



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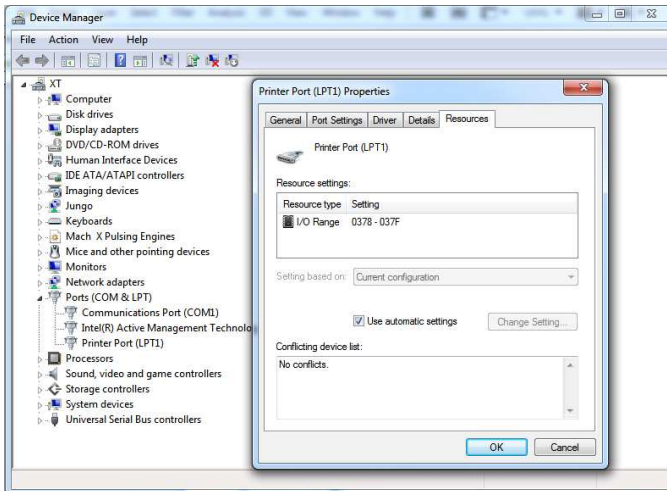
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Step 2: Set parallel port address

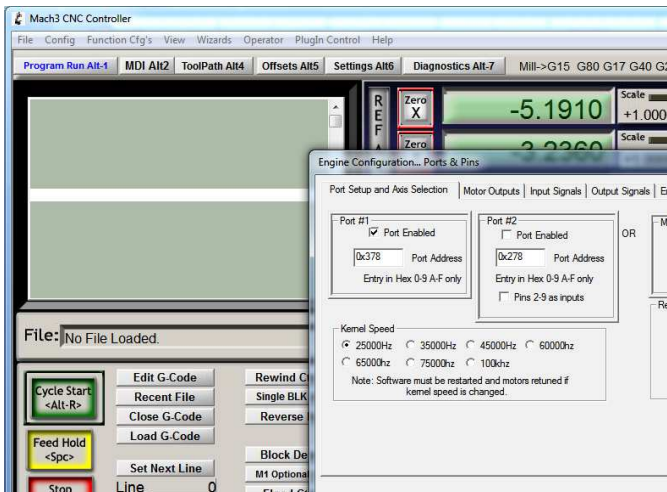
If your pc has parallel port by default it should be LPT1 and address 0x378. But if you have more than 1 parallel port or no parallel port and you have added PCI card you may need to see the address of your port. BIOS setting may also change parallel port number. To see address of parallel port -

Go to Control Panel -> System -> Device Manager -> Ports (COM & LPT) -> Double click Parallel/Printer Port, goto resources tab



The first number in I/O range parameter is your parallel port address.

In Mach3 Go to Config Menu -> Ports and Pins set the parallel port address in Port 1. Default is 0x378.



Also set the Kernel Speed to 100Khz.

<http://www.rhinomc.com>

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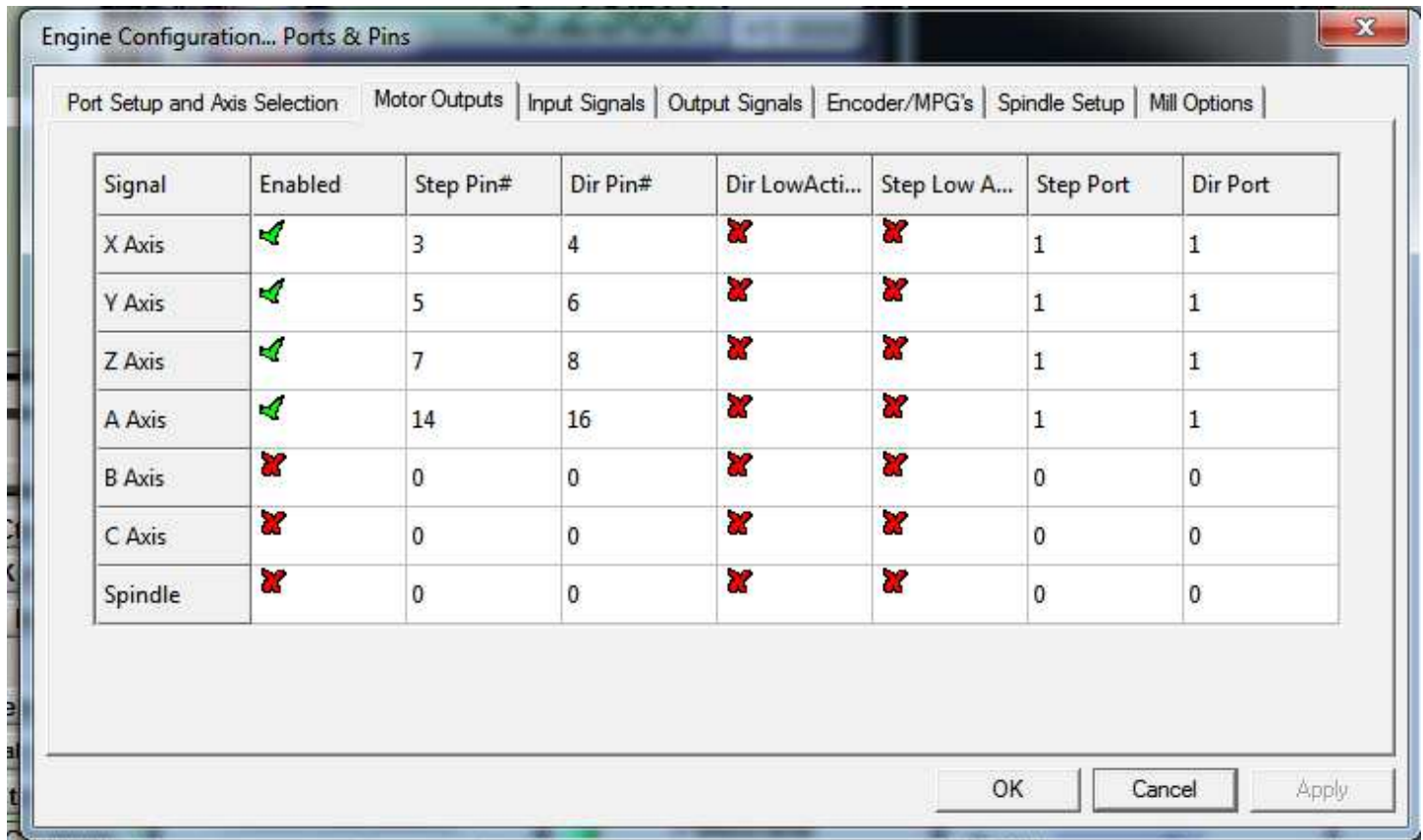
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Step 3: Set Pin mappings for board (Motor Outputs)

Goto motor output tab in Ports and Pins. For 3 axis machine enable X,Y and Z axis and enter addresses as shown in figure. For 4 axis enable A axis, use Coolant_Flood and Coolant_Mist outputs as step and dir.



Shown screenshot is for 4 axis machine where 4th axis is connected to pin 14 for step and 16 for direction. For 3 axis machine keep it 0,0 and axis disabled.

This is just for showing application but you can assign any pin for any output and connect output connections from board accordingly.

Also spindle step can be set to Pin 8 and Direction to Pin 9 to enable direction and speed control for spindle. More options for spindle can be found in Spindle Setup. See Mach3 user manual for detailed description.

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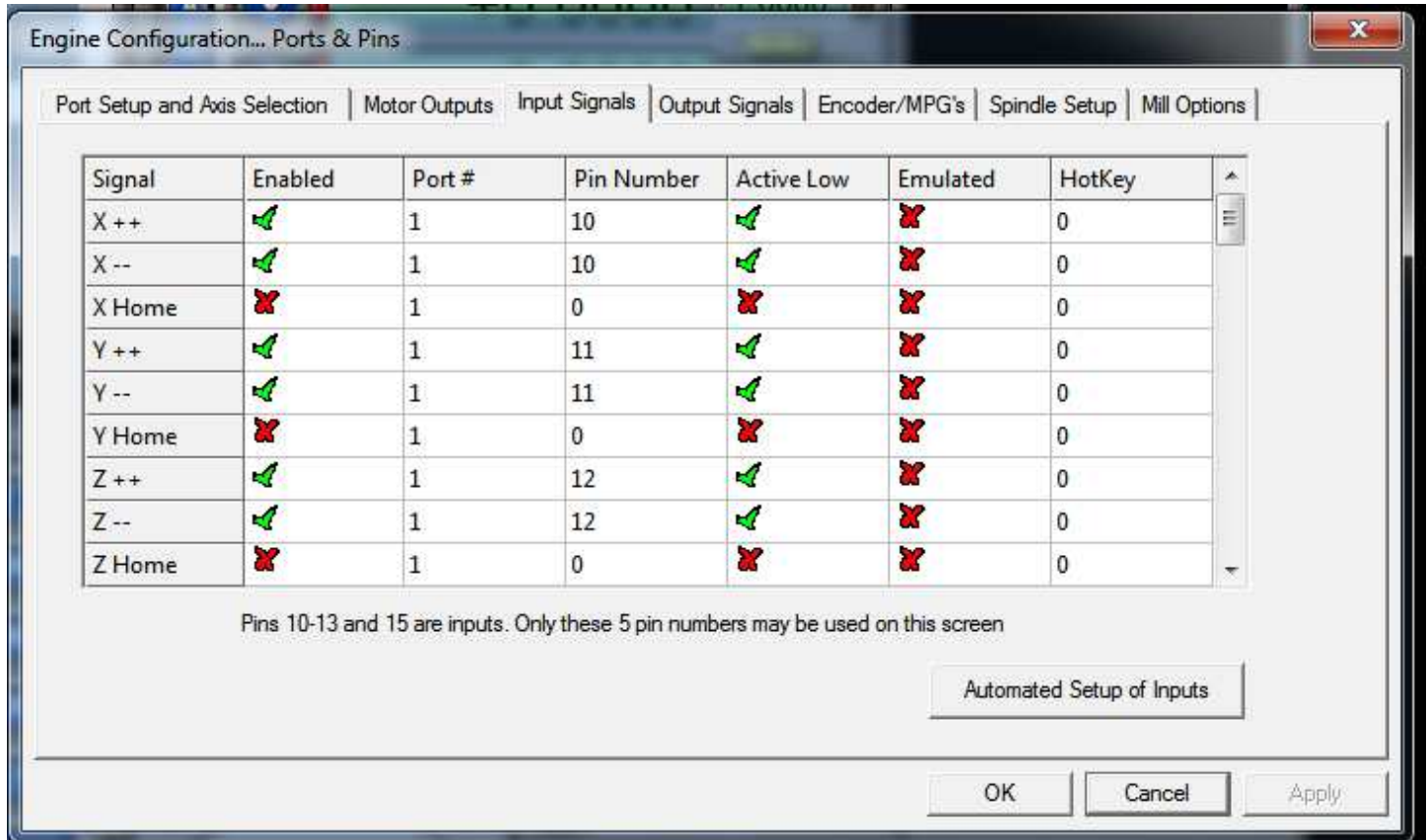


Step 3: Set Pin mappings for board (Other Outputs)

Output signals tab can be used to configure extra outputs like Enable and other outputs which include spindle, coolant or extra relays. Detailed settings can be found in Spindle setup. See mach3 guide for more details.

Step 4: Set Pin mappings for board (Switch Inputs)

Limit switches or Proximity switches/sensors can be used to sense machine limits. When these inputs are detected Mach3 will stop giving pulses to motor. This will stop motors from damaging machine if its going out of mechanical limits. Set the inputs as per figure below. Make sure that you make it Active Low enabled. You can also go to automated setup of inputs and trigger each switch manually to configure.



In the same screen, Estop and other inputs can be configured.

There are many more other settings in Mach3 which are out of scope of this document. You can see Mach3 forums and guides for detailed instructions or troubleshooting.

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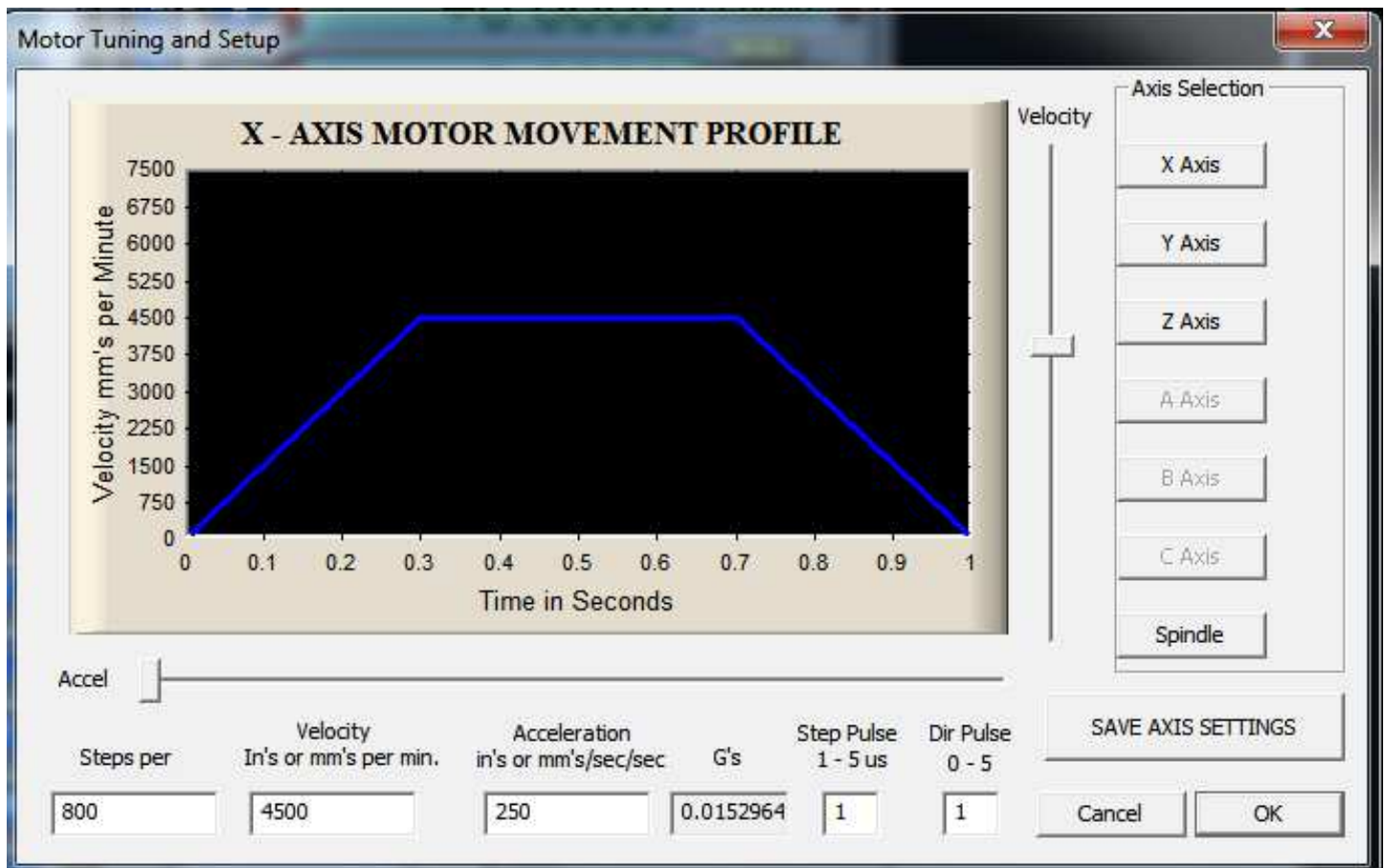
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Step 5: Motor tuning

Now when all outputs and Limit switches are connected its time to configure that motors are moving perfectly as per input from software. To tune this you can go to Config -> Motor tuning.



First important step is to set Steps per Unit. If you have a linear axis with ball screw of pitch 5 mm, in one rotation of your motor guide will go 5 mm further. Same way if you have set microstepping of 800 steps per revolution, 800 steps will give you 1 rotation = 5 mm of travel.

Maximum velocity is the maximum possible speed of motor with some margin, you can set this upto 80% of maximum speed of motor to avoid accidents. Maximum velocity and acceleration should be checked with trial and error of your setup.

Don't forget to click SAVE AXIS SETTINGS before quitting the menu or switching to other Axis. Configure all Axis properly and you are ready to go.

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Mach3 is an extremely complicated software with hundreds of more features shown in this document. See http://www.machsupport.com/wp-content/uploads/2013/02/Mach3Mill_1.84.pdf for more information.

The RMCS 2401 can be used with any other software which gives step and direction output for CNC control on parallel port. Config can be found in help of the software.

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