

## How to convert a Bridgeport Boss 6 to Mach3 using Darek 's (Hillbilly BOB) board.

Upgrading a Bridgeport Boss 3-6 series mill is relatively straightforward and can be done in an extended weekend. The results are excellent, as can be seen on my video. Go to [www.YouTube.com](http://www.YouTube.com) and search for LowryIndustries.

I also highly recommend the VistaCNC **iMach<sup>III</sup> P3 pendant**.



([www.vistacnc.com](http://www.vistacnc.com))

It just works.

As of this writing, Darek, the maker of the BOB (Break Out Board) used as the interface between Mach3 and the Bridgeport can be contacted at [ashburn@icx.net](mailto:ashburn@icx.net)

I also wish to note an invaluable resource on Bridgeport Repairs.

Gary Mauritz ([mauritzmachine@optonline.net](mailto:mauritzmachine@optonline.net) BptParts.com). He is excellent in troubleshooting anything Bridgeport. If you need help or a part, he's the guy.

This set of instructions works for Bridgeport Boss 3 -6 machines with only minor differences. The main difference being that Boss 3-5 machines stepped in.001 increments while the Boss 6 stepped in.0005 increments and the Boss 3-5 machines use an XDI board while the Boss 6 uses a ZDI board. This makes no difference because the installation of the BOB is identical in any case.

I have included the correspondence with Darek along with pictures and explanations.

I have also posted a video at [WWW.LOWRYINDUSTRIES.COM](http://WWW.LOWRYINDUSTRIES.COM). Scroll to the bottom of the page and click the link Bridgeport Manuals. A picture is worth a thousand words. A video – even more! Also at [WWW.LOWRYINDUSTRIES.COM](http://WWW.LOWRYINDUSTRIES.COM), under the Bridgeport Manuals page I have difficult to find manuals such as the Boss maintenance and operations manuals. These are invaluable to anyone who owns a Bridgeport Boss machine. The maintenance and operations are nearly identical throughout the entire Series 3-6.

Additionally, I have included the Mastercam Post I use to convert Mastercam output to Mach3.

First things first, the following section is a compilation of important information. This is taken from Darek's installation manual, email correspondence, and some of my observations.

## USING MACH3 WITH BRIDGEPORT STEPPER DRIVES

1. The software must be set to Max CL Mode (This is done under *Config, Ports and Pins, Port Setup and Axis Selection.*). When the software is in this mode you do not have to configure the motor outputs for the axis (Pins 2-9).
  - >> Make sure that the X, Y & Z axis have been enabled (They use to come that way, the newest version of Mach3 may have changed.) The PIN and PORT #'s assignment is automatic with MaxNC CL mode.
  - >> In MaxNC CL mode you are locked into pins 2 & 3 for the A axis. The signals will also be locked into phase drive. Most drives will accept this signal, also known as encoder following.
2. The one output that has to be setup is spindle forward (This is done under *Config, Ports and Pins, Spindle Setup.*). You will want the spindle relays enabled and M3 set to output #1. Then you will have to enable output #1 and assign it to port #1 pin#14 (This is done under *Config, Ports and Pins, Output Signals.*).
3. Pin #1's output is reserved for spindle speed and leaves pin #16 & 17 available for future use.
4. The inputs are setup next (This is done under *Config, Ports and Pins, Input Signals.*). E-Stop should be enabled, set to port #1 pin #10 and set to active low. Input #2 should be enabled, set to port #1 pin #11 and set to active low. Z Home should be enabled, set to port #1 pin #12 and set to active low.
5. Pin #13 is Z decel but is not used. That leaves pin #13 & 15 available for future use.
6. In order for the #2 input (spin run) to do anything code must be added to the *m3.MIS* and *m5.MIs* files. In addition a

*macropump.M1s* file must be created (These files will be located in the *Mach3/macros/Mach3Mill* folder or the profile you have selected instead of Mach3Mill.).

7. For the macropump to run you must turn it on (this is done under *Config, State* and requires a program restart afterwards.).

## START UP NOTES

1. Take all the safety precautions the original machine tool builder recommends for this machine.
2. Let the computer boot then start the Mach3 software. You should not be able to reset the software at this time.
3. Under *Config, Motor Tuning* set the steps per inch to **1000**, set the velocity to **30** and acceleration to **1** on all three axis. (These are conservative numbers to start with). (>>I found that my settings are a bit larger, more like 1200 for step and 45 for velocity. Don't be afraid to make the steppers work. They are built for it.)
4. Push the LIMIT OVERRIDE button on the original BOSS control panel to enable the machine. If all is correct on the machine side the drives will be enabled and the machine will send the NOT E-STOPPED signal to the software (Pin#10).
5. Now you should be able to reset the software. (Use the original red mushroom for E-STOP, not the software reset, and double check that the original red mushroom is not pressed in. >>Often machines in transit will have their E-STOP buttons depressed which will result in an E-STOP signal. Make sure the red mushroom button is pulled out all the way!)
6. You will now want to verify that all three axis move in the right direction and that an inch on the DRO in Mach3 = 1 inch on the machine. (The arrow keys are used to jog X & Y and the Z is jogged by the PGUP and PGDN keys.) Push and hold the shift along with the jog for rapid jog. (>>Here is where having a dial indicator will be your best friend. The

easiest way to set the steps per inch is to go to the *Settings* (*Alt-6*) screen and click the bar *Set Steps per Unit* under the *Axis Calibration* label. Now attach the dial indicator to the table and rotate the indicator so it is absolutely 90 degrees to the table and place the tip of the indicator against a flat spot on the spindle head. Now press the TAB key to bring up the Jog window. Set the Jog Mode to Step, and the Cycle Jog Step to 1.0000 Now move the table till the indicator has it's maximum travel distance and set the axis (X, Y, or Z, whichever you are calibrating) to zero. Now run the *Axis Calibration*. If your indicator has enough travel, jog 2 or 3 inches to achieve a better calibration.)

7. You can now start to experiment with the velocity and acceleration to match your machine. Once you find the limit of an axis, back off about 10% for some overhead.
8. Dry run some programs to check the machine operation. You can check the M3 logic also. Program a M3 in your program to make sure the program halts and prompts the operator. After the spindle is manually started there will be a delay for the spindle to come up to speed, then the program will resume. With the program continuing manually turn off the spindle to cause a spindle fault.
9. Once you feel comfortable with everything, move on to some real cuts!

## These are the \*.M1s files

### m3.M1s

```
DoSpinCW()  
Message "Spindle Start Requested"  
SystemWaitFor(Input2)  
While IsMoving ()  
Wend  
Message "Spindle Start Delay"  
Code "G4 P2"  
While IsMoving  
Wend  
Message ""  
Call SetUserLED(1010,1)
```

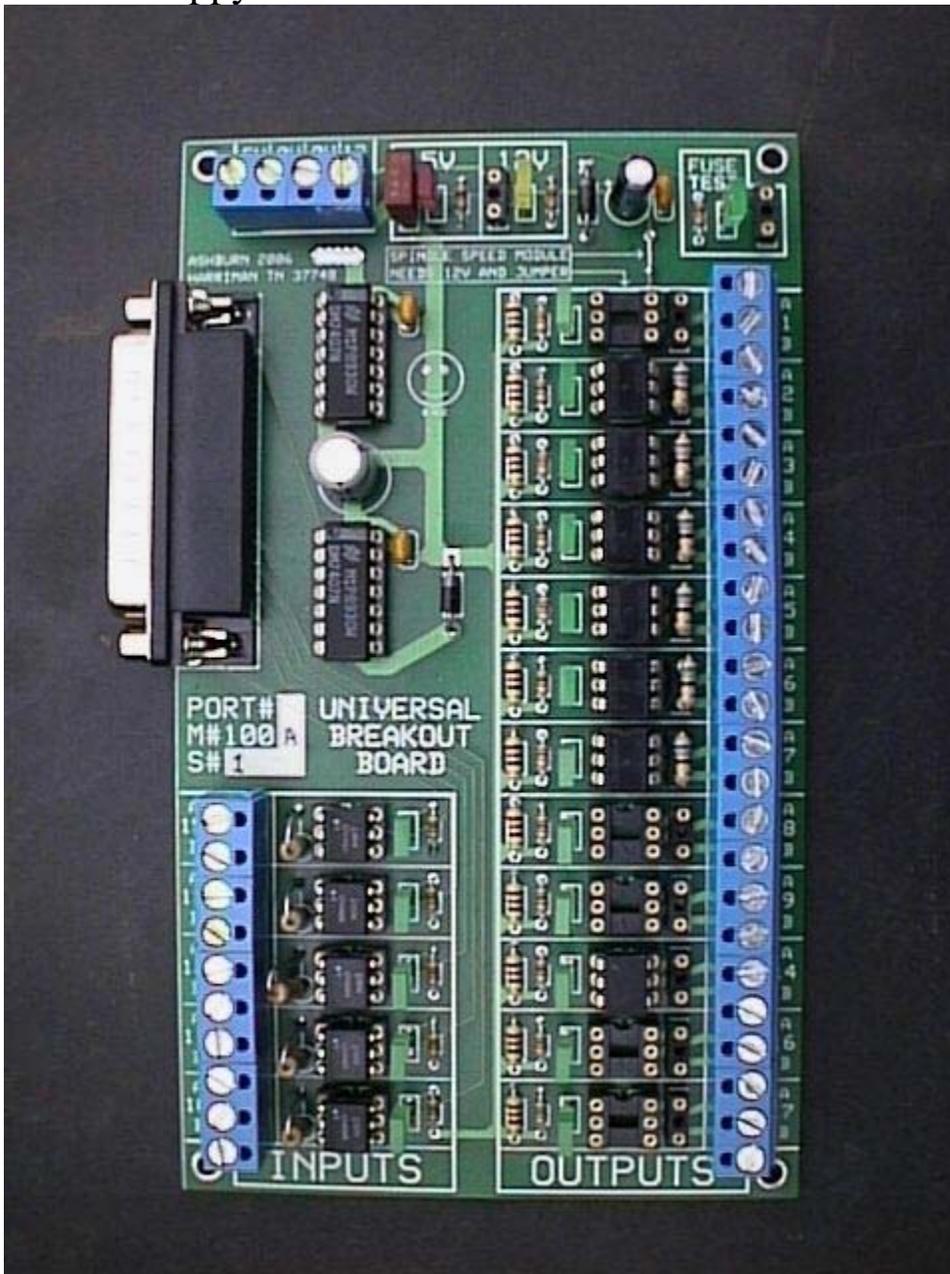
### m5.M1s

```
DoSpinStop()  
Call SetUserLED(1010,0)
```

### macropump.M1s

```
If GetUserLED (1010) Then  
  If Not IsActive (Input2) Then  
    DoOEMButton (1003)  
    Message "Program Stopped Spindle Fault"  
  End If  
End If
```

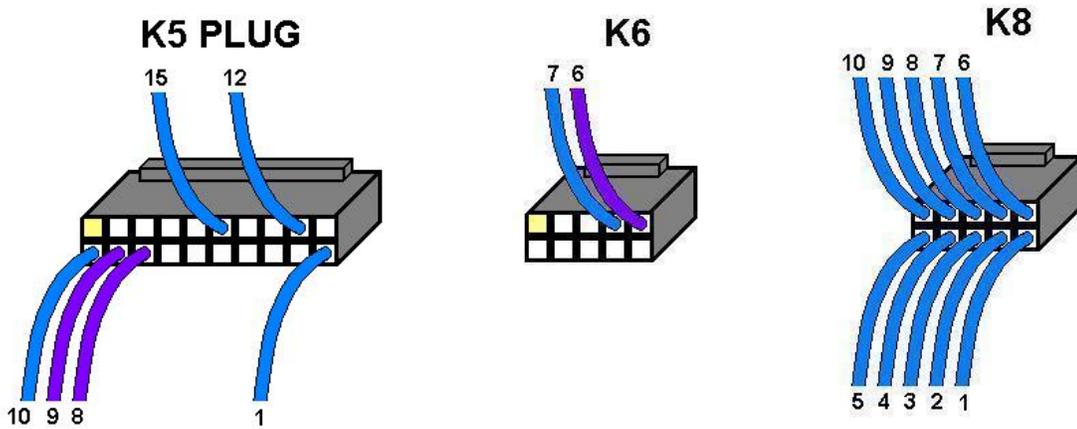
Darek's happy BOB.



On the Boss 6, the plugs are located on the ZDI board. The installation is exactly the same.

**These are the 3 plugs that interface the XDI board to the Machine**

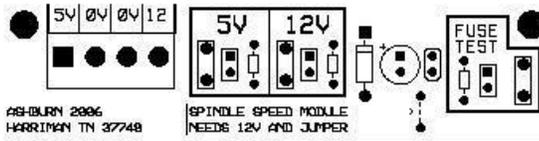
Any other plug either goes to the pendant, tape reader or com port and is of no concern.



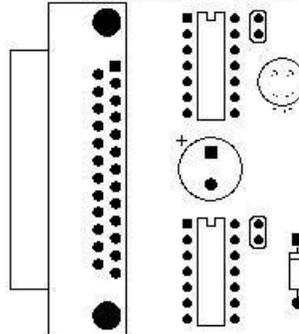
Label the wires as you cut them loose from the plugs with the included labels. These will be the numbers used to connect to the breakout board later. If your plugs have a different arrangement than the ones pictured contact me ([ashburn@icx.net](mailto:ashburn@icx.net)) for farther instructions.

12v is only required if a spindle speed module is used for 0-10v output.

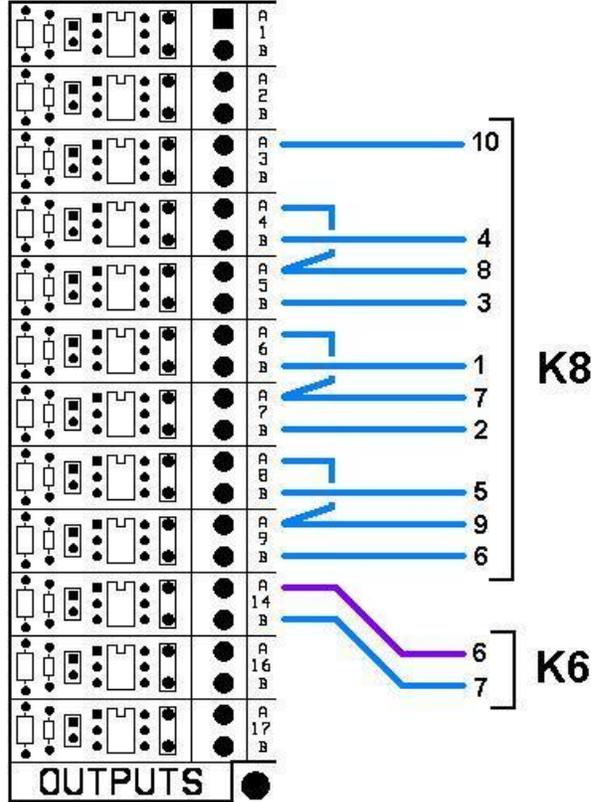
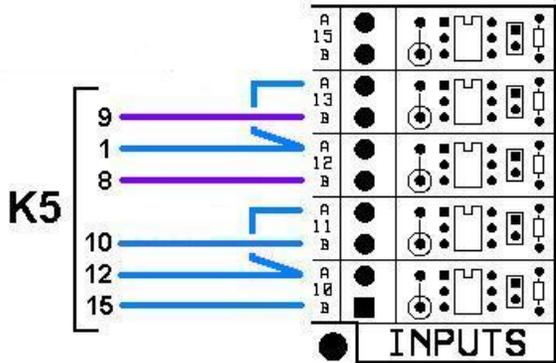
To PC power supply 5v

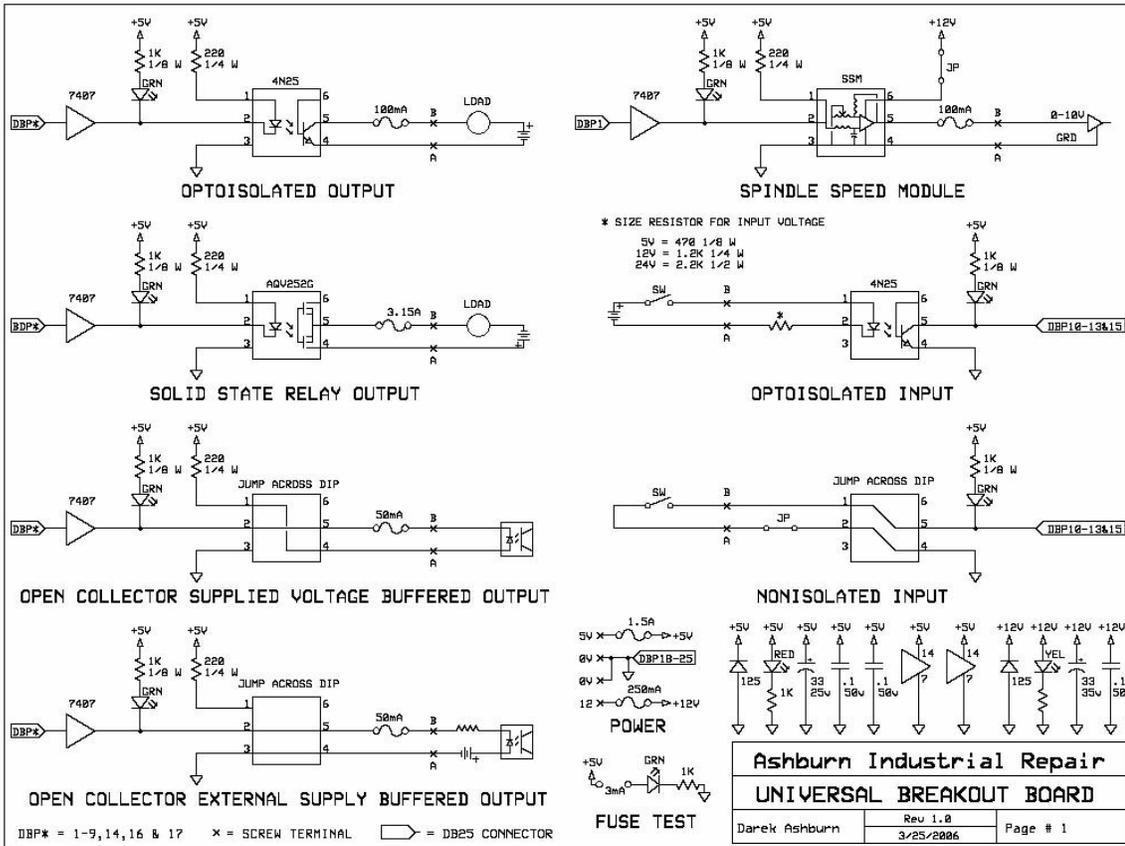


To PC printer port

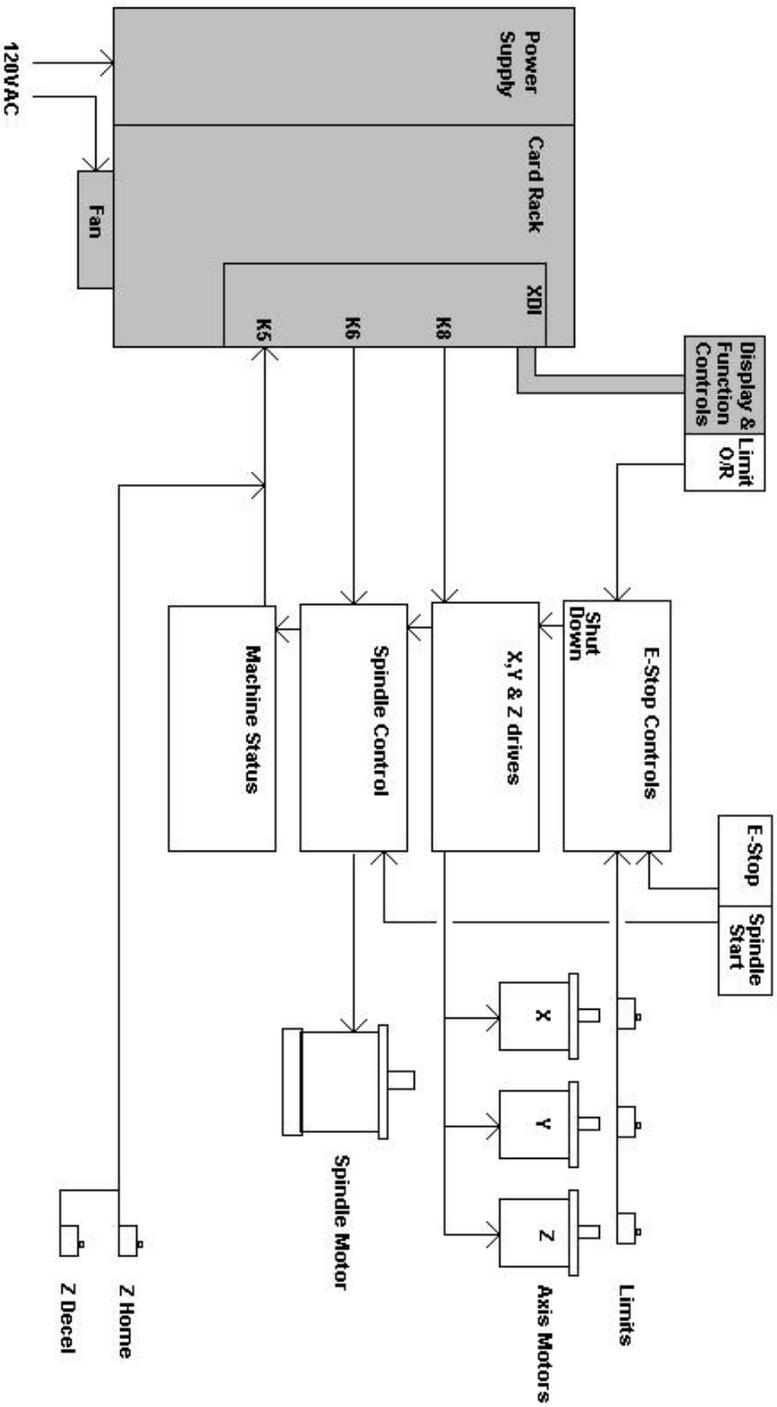


PORT# M#100 S# UNIVERSAL BREAKOUT BOARD



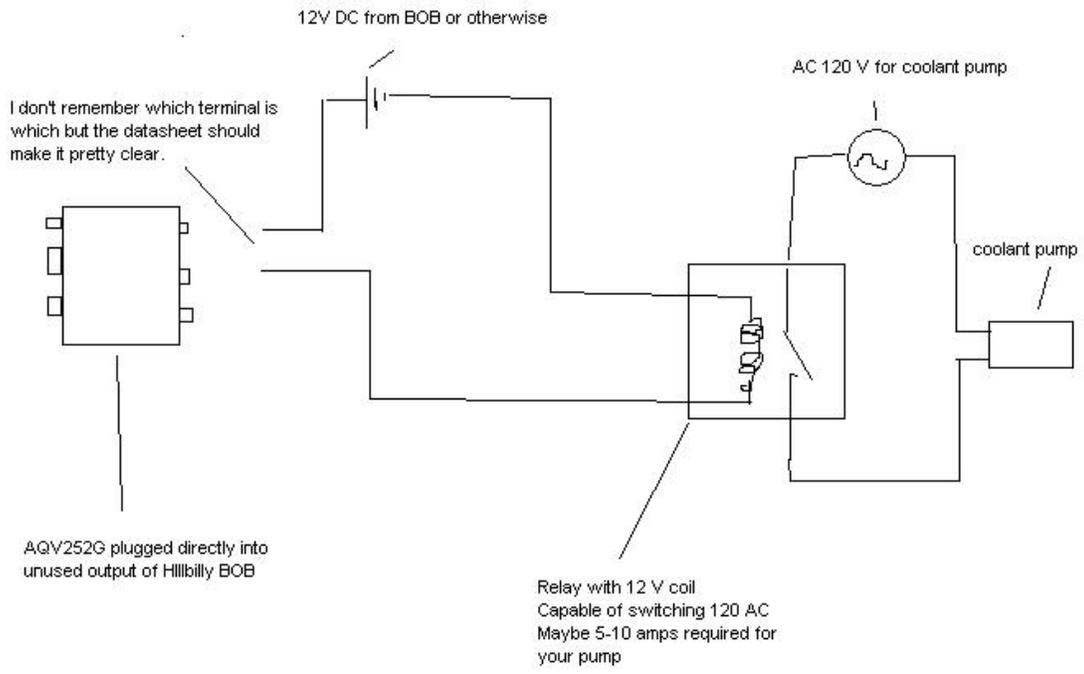


DBP\* = 1-9, 14, 16 & 17    \* = SCREW TERMINAL    □ = DB25 CONNECTOR



## Bridgeport BOSS Block Diagram

Shaded components will be replaced with PC, BOB & Mach3



### 3.1 POWER

Prime power to the system is 3-phase 50 Hz or 60 Hz AC. Input Voltage is selected by the customer when ordering the machine. Input voltage can be changed in the field by use of a voltage conversion kit. Available voltages are:

Voltage (Volts)	Frequency (Hertz)
208	60
230	50
230	60
380	50
416	50
420	50
460	50
460	60
575	60

Three-phase power enters the system through the main system disconnect located on the Power Equipment Enclosure, and feeds the three-phase distribution wiring.

Items connected to the three-phase distribution are:

1. Reversing contactor and spindle motor
2. 125V single phase 1KVA transformer (T1)
3. Axis drive power transformer (T2)

I included this because it is **VERY IMPORTANT** to note that many Boss mills came with the 208 volt option.

Mine did. If you don't reduce the voltage from 220 to 208 volts, you will certainly have problems.

The only way to do this is by using a pair of "Buck" transformers. Wiring the transformers isn't rocket science and whoever you purchase them from can walk you through it. **ALSO NOTE:** These transformers can get **VERY HOT** if they are used

continuously. It may be a good idea to keep a fan blowing on them if you intend to run the machine for more than a couple of hours.

The 230 volt mills will run ok on 220v power. Apparently putting a bit less power into the mill works ok, but too little power cannot be compensated for. Also, it may be possible to alter the input voltage requirement at the main transformer in the power cabinet for all Bridgeports except the 208 V system, which has a dedicated transforms, (hence the requirements for the buck transformers).

Also, and very importantly, examine your on/off switch to the main power cabinet. This switch may be a **BIG PROBLEM!** My switch was both worn and the spring which engages the blades was too weak. The only solution was to remove, clean, reinstall, and permanently set this switch to ON. Then install a new switch upstream of the power to turn on/off the mill.

If you are getting sporadic errors in the system, check the fuses. They may need to be replaced. One big problem with these mills is some fuses are held in by springs and not blades. The springs heat up and cool off under repeated use and may lose their temper making them relax. When they relax you may then lose proper contact and cause the power to drop in a circuit. Then the spring cools and often will re-contact, causing the circuit to come alive again. A troubleshooting nightmare. Just a warning.

## CABLES

As you can see in the video, (search LowryIndustries on YouTube), I mention that I do not trust the standard computer printer cable. This is for good reason. The wires used in these cheap cables is hair thin. Not something I would trust in an industrial environment. I built my own cables using AWG 20

wires. I consider AWG 24 a minimum and 20 as more durable. Don't skimp on the cabling! More problems are from bad cables than everything else put together, and mostly preventable by making your own.

## A FEW ADDITIONAL NOTES:

(From an Email exchange)

I have a quick question.

I don't believe this board uses 12 volts. It looks like the 12v jumper is not there. So do I just hook up the 5v?

Also, on the K5, K6, and K8 plugs. I was considering simply wiring your controller interface card directly to a set of plugs which would plug into the appropriate ports, thereby eliminating having to cut any wires. But I don't know if this will work because I don't know if there are other signals or controls such as the limit switch which may still be needed. Are there any other signals which feed through the original wires which are still needed or can I simply replace the plugs entirely with the plugs connected directly to your card, thereby not having to cut the original wiring harness at all?

(Response)

Pin 10 from the K8 plug is an extra ground, I have people put it on #3 to keep it out of the way. It can be disconnected just make sure it does not touch anything.

In MaxNC CL mode you are locked into pins 2 & 3 for the A axis. The signals will also be locked into phase drive. Most drives will accept this signal, also known as encoder following.

The SSM puts out 0-10v linked to the min and max S code in Mach. It can be used with a electronic spindle drive, not needed with your machine.

Darek

(Question)

I'm just curious. On your board and the Mach support forum you mention a spindle speed module.

What is that for and should I have one?

My machine is a Bridgeport II with a Boss 6 controller.

(Response)

The SSM puts out 0-10v linked to the min and max S code in Mach. It can be used with a electronic spindle drive, not needed with your machine.

(Question)

Just curious how much the spindle speed module costs.

Thanks!  
Charles.

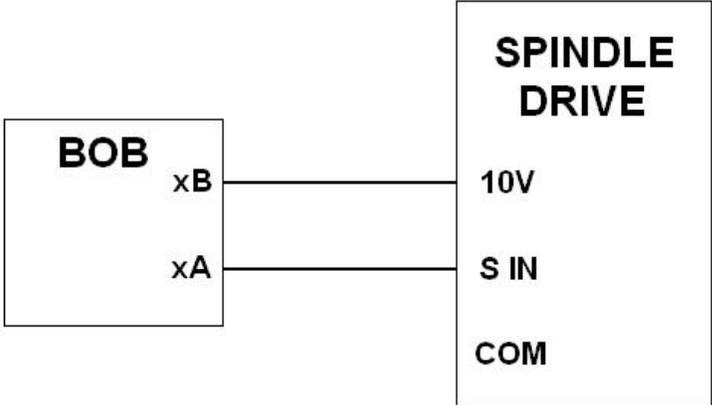
(Response)

Charles,

I charged \$19 for the 4 or 5 I have sold. That was pretty much labor, It was a major task to hand make them! Since they were non isolated they had to be used with high end equipment. I have found it works just as good to use one of the opto outputs, see attachment.

Kudos on the PDF and video!

Darek



(Question)

Please help me get this right because I'm just starting to look into this.

Although my Bridgeport is running fine right now, I am planning at some time in the future to upgrade to a variable speed reversible spindle motor.

So simply hooking up output #1 to the 10V line as shown gives the signal for speed, and that the module worked essentially as a buck down 12V to 10V transformer? If correct, this implies that the speed signal is a digital pulse and not a variable voltage signal like I thought.

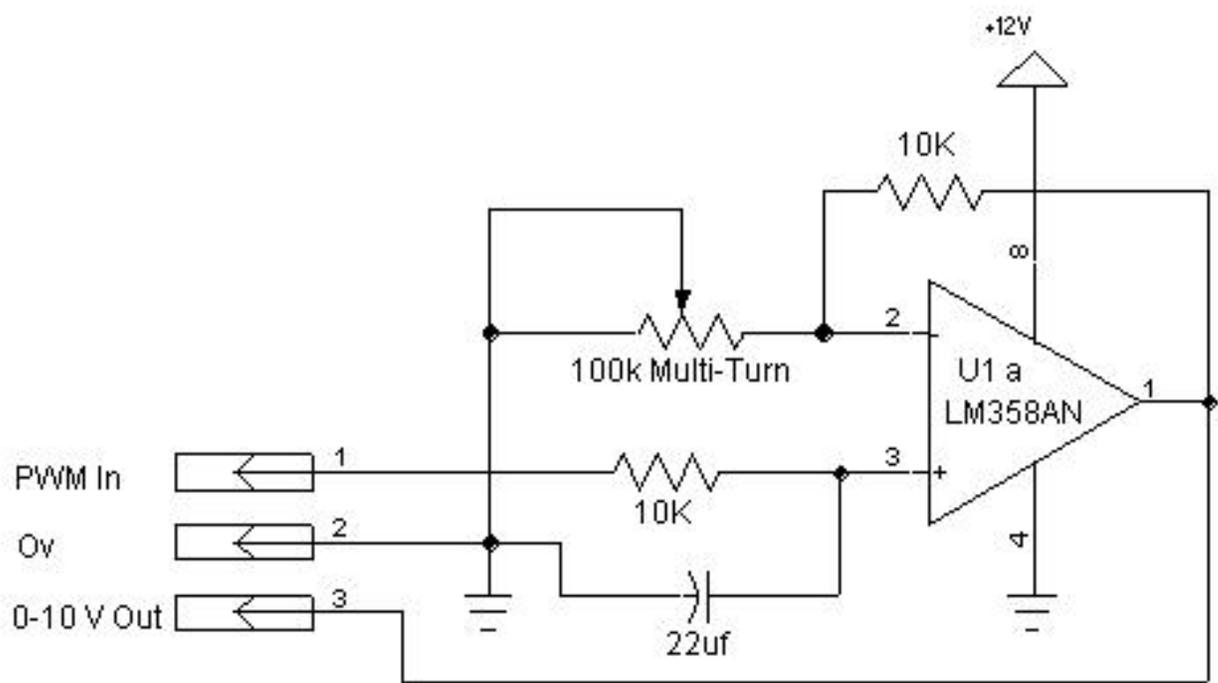
If this is true, then all I would need would be the two lines as shown. The 10V line for the digital speed signal and the S in line for direction?

Thanks,  
Charles.

(Response)

That is pretty much it. The module actually changes the 5V digital pulse to 10V and is powered by 12V. I have attached the circuit that is in the module and the setup information (which applies to using the opto also.). There is also a good explanation of the PWM signal in the Mach manual.

Darek



MACH1/2 PWM to DC 0-10 Volts Diagram

## Setting Mach3 up for the spindle speed module.

Under Config / Ports and Pins / Spindle Setup

Check Use Spindle Motor Output and PWM Control in the Motor Control box.

( You can also change the base PWM frequency here. The Mach3 manuals explains

the PWM frequency to speed resolution relationship.)

Use the Pulley Ratios box to set the speed range.

Under Config / Ports and Pins / Motor Outputs

Enable the Spindle, set the Step Pin# to 1, set the Step Port to 1.

## Wiring the SSM

On the breakout board pin 1A will be ground and pin 1B will be the 0-10v signal. The adjustment on the module sets the maximum output up to the 12v supply voltage.

( The SSM has been preadjusted to 9.5v maximum.)

## **--DANGER-----DANGER-----DANGER--**

Your VFD must have a isolated control input. Some VFD's control section is at line

voltage potential. This type of VFD is designed to be used with a potetiometer and not

a control signal. If connected this would at the very least destroy the SSM ( possibly the BOB and/or PC).

When people use my board with the original drives and the MaxNC CL setting in Mach 3, This is the pinout. This can also apply to standard knee mill using step and directions signals.

---

## PIN ASSIGNMENTS FOR THE MAXNC CL2 SOFTWARE

### PRINTER PORT PIN ASSIGNMENT

- 1..... M3 OUTPUT (LOW=ON, PULSE FOR PWM)
- 2..... A AXIS (quadrature)
- 3..... A AXIS (quadrature)
- 4..... Y AXIS (quadrature)
- 5..... Y AXIS (quadrature)
- 6..... X AXIS (quadrature)
- 7..... X AXIS (quadrature)
- 8..... Z AXIS (quadrature)
- 9..... Z AXIS (quadrature)
- 10..... INPUT, MOVE ENABLE (LOW=NORMAL OPERATION,  
HIGH=STOP, SEE NOTE)
- 11..... INACTIVE
- 12..... INPUT, HOME SWITCH (NORMAL OPERATION LOW)
- 13..... INPUT, G61 SWITCH SENSOR
- 14..... M8 OUTPUT (LOW=ON)
- 15..... NONE
- 16..... OUTPUT, DISABLE POWER TO MOTORS  
(LOW=NORMAL, HIGH=DISABLE)
- 17..... OUTPUT, RESET CONTROLLER (LOW=RESET,  
HIGH=NORMAL)
- 18..... ALL SIGNALS GROUND
- 19 TO 25 ..... NONE

NOTE: MOVE ENABLE IS USED TO STOP THE COMPUTER STREAM OF CODES UNTIL THE SERVO MOTORS CATCH UP. ON TIME-OUT IT WILL PRODUCE A SERVO ERROR

And one other quick note. Make sure the air filters in both the computer cabinet and Power cabinet are flowing unrestricted. I will bet you they need to be replaced. A good replacement is the reusable furnace filter material that you can purchase at most hardware stores. It usually resembles a porous or fibrous green mat and can be cut to size.

Ok, that's all I've got for now. Good luck!