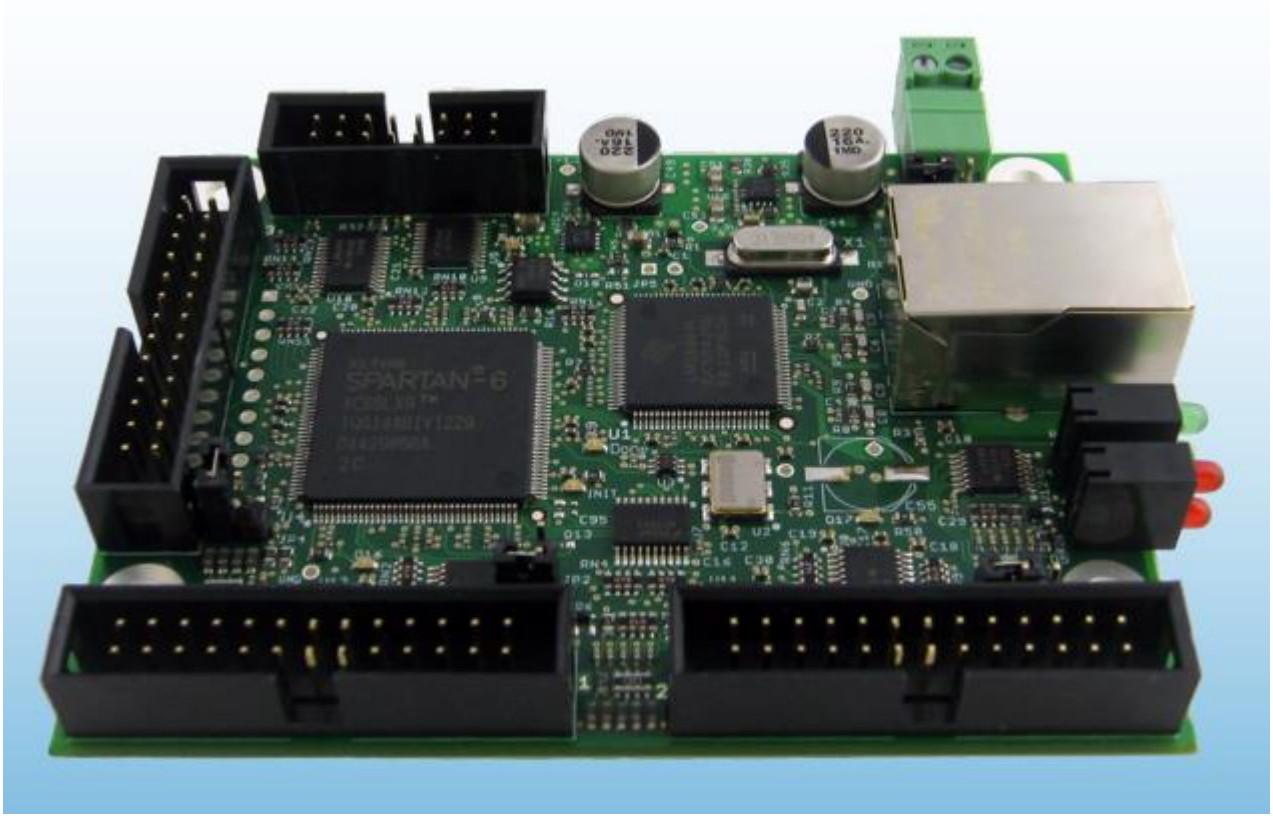
Novakon

Ethernet SmoothStepper Installation/Owner's Manual



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THANK YOU FOR YOUR ORDER

Thank you for purchasing the Ethernet SmoothStepper for the Novakon CNC Mill. With proper setup and maintenance, the ESS will deliver uncompromising performance, reliability, and many years of enjoyment. The ESS greatly enhances the motion control of the Novakon CNC mill X, Y, Z and A axis movement and spindle rotation.

IMPORTANT

This manual covers general instructions regarding the ESS set-up, Mach3 programing, operation and troubleshooting.

Carefully read this instruction manual and any accompanying instruction manuals before installing the ESS and operating your Novakon CNC Mill. Instruction manuals should be kept in a safe place where they are always easily accessible for reference while operating the Novakon CNC Mill.

While this manual has been compiled to give detailed description and usage of the ESS, changes are possible due to continuous design and development efforts.

Remember safety comes above all else. Carefully read, follow and understand the safety information outline in chapter 2 of this manual and always let common sense be your guide.

SUGGESTIONS / COMMENTS

We are interested in any suggestions and comments you might have to improve our products, Operator's Manual and services. Feel free to contact Novakon International Corporation with your suggestions and comments by e-mail to sales@novakon.net.

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Check the www.novakon.net website periodically for the latest updates and revisions to this manual.

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1 CUSTOMER INFORMATION

Please record the information below about your ESS kit. Having this information readily available will save time if you need to contact Novakon for questions, service, accessories or replacement parts.

_____

Novakon Invoice Number:

_____

ESS Purchase Date:

_____

ESS Delivery Date:

We look forward to a long working relationship with you, and thank you again for putting your trust in Novakon International Corporation.

2 SAFETY GUIDELINES

OVERVIEW

1) This is a preliminary draft manual, and is likely to contain minor errors or omissions. In addition, the design details of the Novakon CNC Mill itself have changed over time, and the design of the ESS itself is also likely to change over time. The photos in this manual are intended to provide general guidance on the installation of the ESS, but your particular machine may vary from what is depicted in the photographs.

2) This manual describes general operational techniques and safety procedures. The Novakon CNC Mill includes various safety devices to protect the operator and the machine. However, these cannot cover all aspects of safety. Therefore, the operator must thoroughly read and understand the content of this manual before operating the ESS. The operator should also take into consideration these and other aspects of safety related to his/her particular environmental conditions, materials and tools.

3) Operating the ESS in accordance with the manufacturer's instructions, will provide you with reliable service. However, with equipment of this nature, serious accidents may occur due to improper or careless operation. It is mandatory that you read this manual and other documentation to become thoroughly familiar with CNC machines prior to operating the ESS. ESS operations which are not documented in this manual, should be considered potentially dangerous. Do not perform undocumented ESS operations before consulting Novakon for advice.

4) Novakon emphasizes that it is the operator's sole responsibility to perform all operations using the ESS in a safe manner.

5) This manual tries to give you guidance on safety precautions/techniques in using the ESS. We accept no responsibility for the performance of this ESS or any damage or injury caused by its use. In other words, it is your responsibility to ensure that you understand the implications of using the ESS, and to comply with any legislation and codes of practice applicable to your country or state.

GENERAL GUIDELINES FOR SAFE OPERATION

1) The Novakon CNC Mill and ESS have various mechanical and electrical safety devices to protect the operator and the machine. The safety devices include interlock devices and emergency stop switches. However, all machine tools are potentially dangerous, and computer controlled machines are potentially more dangerous since CNC machines start, stop and move automatically. Therefore, it is extremely important that you are aware of the machine's moving parts, chips projectiles and fluid while operating the machine.

2) Neither the manufacturer nor its representative or dealers can assume responsibility for any mishaps, damage or personal injury, which may occur because of improper operation or from failure to observe the safety precautions mentioned in this manual.

3) Do not under any circumstances attempt to operate this ESS prior to reading and understanding this manual. Neglecting these instructions and warnings can cause serious injury to you and/or damage to the machine.

4) Familiarize yourself with the position of the EMERGENCY STOP BUTTON on the machine so that you can press it immediately from any position in case of an emergency.

5) Use extreme care when engaging fellow workers in conversations and running the machine at the same time. Do not proceed to the next step without informing the other personnel that you are about to do so.

SAFETY CHECK PRIOR TO APPLYING POWER TO THE MILL

1) Learn the control functions of the ESS before turning ON the Novakon Novakon CNC Mill.

2) Make sure that all safety covers are fitted and electrical boxes are closed and secured before the power is switched to ON.

3) Check to make sure that the cutting tool will clear the table, fixture, vise and clamps.

4) Make sure to anchor all items placed on the machine's table before starting the machine.

5) Learn to use the correct spindle speed, feed and depth of cut suitable for the work piece and material. Do not operate the spindle above the rated speed of the accessories mounted in it. Replace worn tools prior to a milling operation. Make sure that the tool length to diameter ratio is proper to prevent chatter. Make sure that the tool holders are tightened properly before actual cutting operations.

ELECTRICAL SAFETY

1) There are high voltage terminals in the electrical control panel, motors, junction boxes and other equipment. When the power supply is on, take extreme care to avoid contact with these components. After the power has been switched off, high voltage remains in various electrical components. Prior to touching any component, carefully check for voltage with a multi-meter or equivalent instrument to make sure that any residual voltage has dissipated.

2) Check all electrical cables for damage prior to applying electrical power to the machine.

3) Shut down Mach3 and turn off the computer prior to switching off the power to the Novakon CNC Mill.

BASIC POINTS OF SAFETY

1) To prevent incorrect operation of the ESS, carefully check the position of switches before operation. If in doubt, consult this manual or a Novakon technician for advice.

2) Do not use compressed air to blow chips away from the spindle, parts, the machine or the floor around the machine.

3) All work platforms used around the machine should be sturdy, safe and include anti-slip surfaces.

4) Always be mentally alert, well rested, sober, and never under the influence of drugs that can affect the safe operation of the machine. Do not operate the machine if you suffer from dizziness.

5) Avoid unnecessary touching of the operator controls while the machine is running.

6) Keep the area around the machine free of oil/coolant, chips, debris and other obstructions.

7) Remove chips as often as necessary to prevent them from over accumulating in the machine.

8) Use an exhaust fan to control smoke and toxic fumes generated during machining operations. Always wear a protective mask when machining items that can create a toxic atmosphere.

9) Do not attempt to measure the work piece while the machine is running.

CLOTHING AND SAFETY

1) Always keep safety in mind. Wear eye protection at all times. Do not wear long sleeve shirts, loose or baggy clothes, neckties, wristwatches, rings, jewelry, etc., when operating this machine. Tie back long hair to prevent entangling with rotary tools.

2) Do not operate the ESS if any machine guards, interlocks and other safety devices have been removed or any of these safety items are not functioning correctly. Never run the machine with the electrical cabinet open.

3) Do not use gloves when typing on the computer keyboard.

4) Do not handle chips, cutters and coolant with bare hands.

SAFETY ASPECTS RELATED TO TOOLS, FIXTURES, ETC.

1) Take time to properly secure fixtures, work piece and tools.

2) Let the machine and spindle come to a complete stop before accessing the machine, parts, tools or spindle.

3) Use the legs not the back for lifting. Use a hoist or other lifting device to move heavy items.

4) Use proper tools for the job.

5) Always use gloves when loading or unloading work pieces. Use the proper tools when removing chips from the work area to protect your hands from sharp chips and burns generated during machining operations.

6) Do not remove chips when the machine is in operation. Lockout the machine by initiating the E-Stop switch before removing chips, fixtures, parts and cutting tools. Stop all machine operations before cleaning the machine or any of the peripheral equipment.

7) Always use proper cutting tools and work holding clamps suitable for the work and within the specifications of the machine. Do not exceed the machine table rating of 870 pounds. The maximum weight rating includes all items placed on the table, including fixtures, vises, clamps, parts, etc.

SAFETY ASPECTS RELATED TO TOOLING

1) Tools and miscellaneous equipment should be kept away from the moving parts of the machine.

2) Exercise caution when using fixtures, vises and parts that extend beyond the work table. These items could interfere with other machine parts or the machine enclosure.

SAFETY ASPECTS RELATED TO MAINTENANCE

1) If any components or safety covers are to be removed, first switch off or disconnect the main plug.

2) Only qualified personnel should use and/or perform programming changes to the ESS. The operator and programmer should be thoroughly familiar with the ESS.

3) Do not modify the ESS in any way that will affect safety.

4) In case the Novakon CNC Mill crashes, do not operate it again until the cause and any damage have been evaluated and corrected.

3 INSTALLATION

RECOMMENDED TOOLS FOR ASSEMBLY

Small Flat Head Screw Driver

Philips Head Screw Driver

Flashlight

Voltmeter

Safety Goggles

ESS KIT CONTENTS

1) Unpack the ESS kit and familiarize yourself with its contents shown in Figure 3-1 ESS Board.

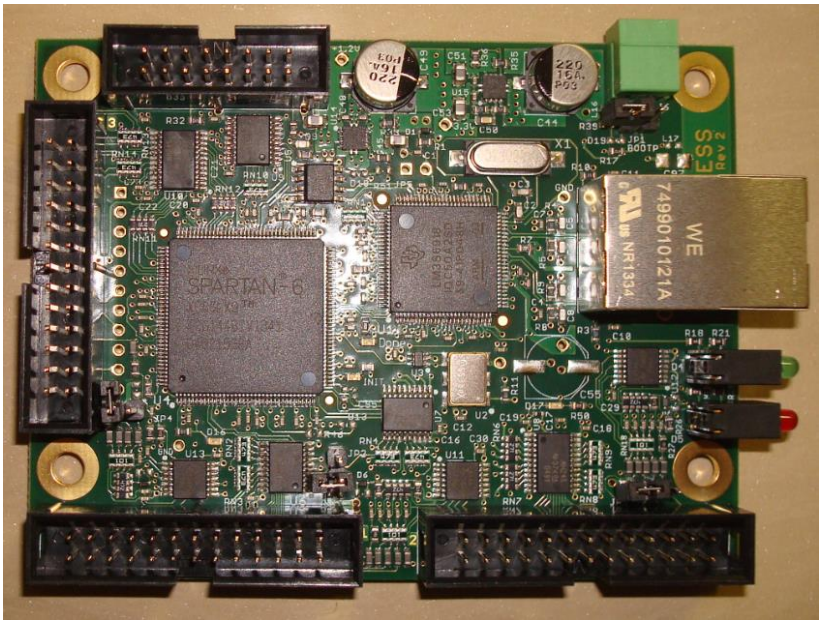

Figure 3-1 ESS Board

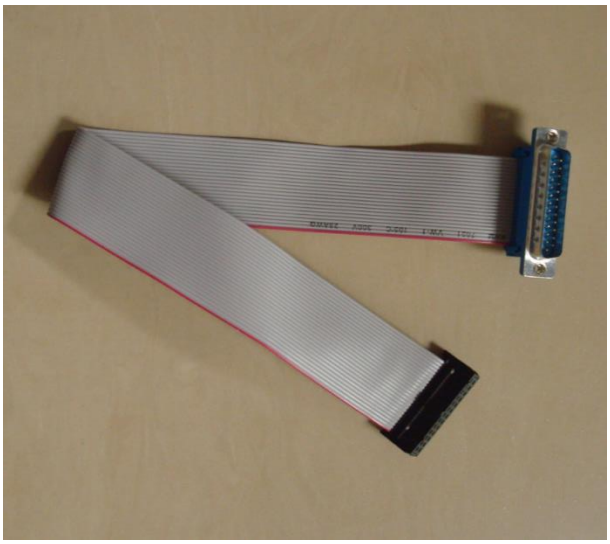

Figure 3-2 Ribbon Cable

Figure 3-3 Ethernet Cable

Figure 3-4 Long Standoff Nuts

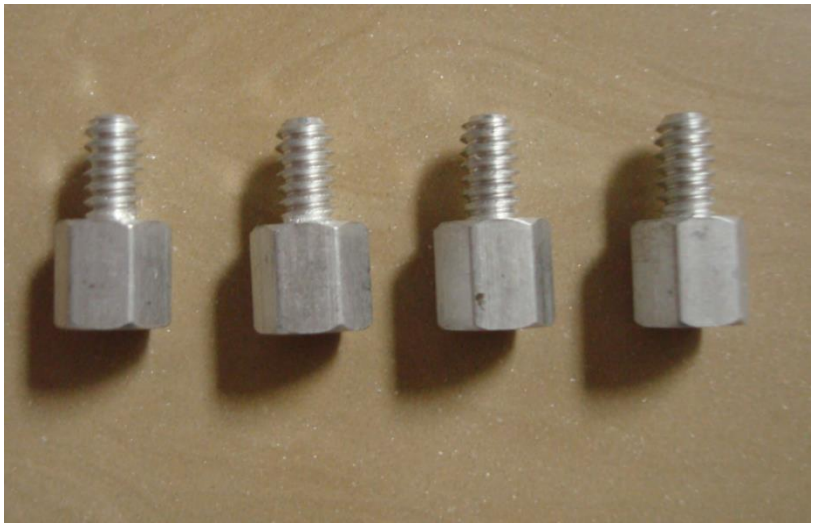

Figure 3-5 Short Standoff Nuts

Figure 3-6 (2) 4-40 Philips Screws

Figure 3-7 (4) 6-32 Philips Screws

INSTALLING THE ESS

1) Turn off the Novakon CNC Mill and disconnect the 220 volt power cable from the electrical control panel cabinet.

There are high voltage terminals in the electrical control panel cabinet, motors, junction boxes and other equipment. Extreme care should be taken when working around the aforementioned items.

Figure 3-8

Figure 3-9

2) Loosen the two thumb screws that secure the parallel cable to the main computer board. Remove the parallel cable connector from the PC Board.

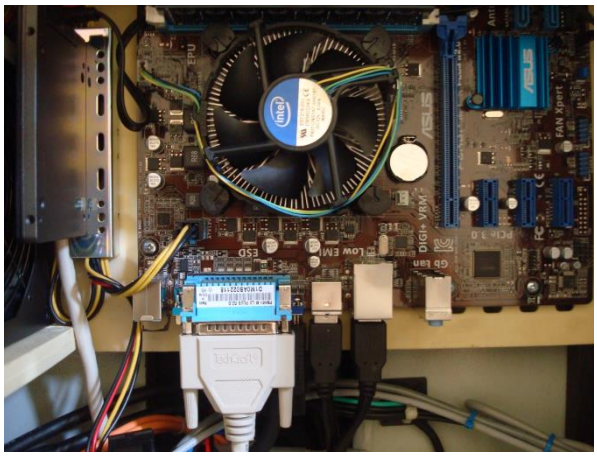

Figure 3-10

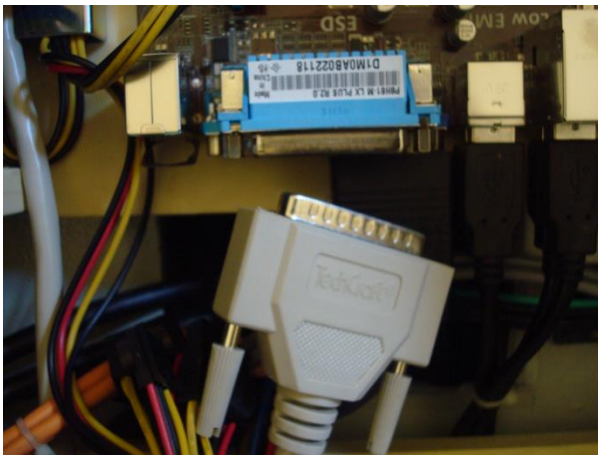

Figure 3-11

3) Loosen the two thumb screws that secure the parallel cable to the Novakon BOB. Remove the parallel cable connector from the BOB.

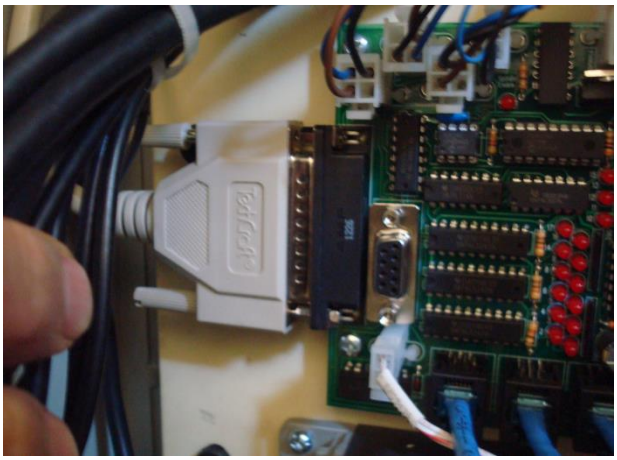

Figure 3-12

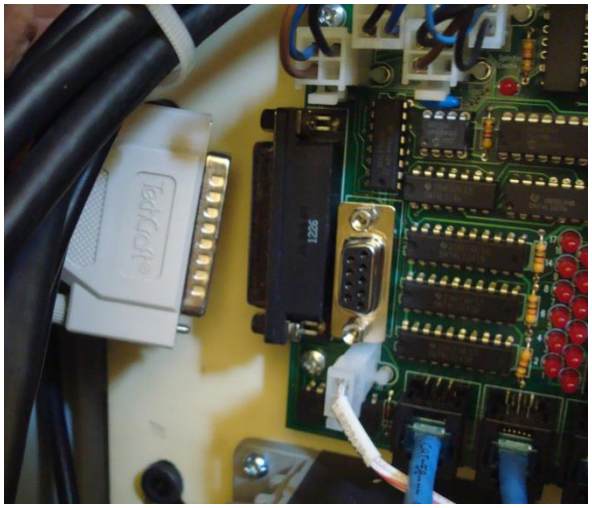

Figure 3-13

4) Remove the parallel cable from the electrical cabinet. The cable is no longer needed.

Figure 3-14 Discarded Parallel Cable

5) The BOB shown in Figure 3-15 include connections for a fourth axis and a PDB installation. Obviously, you will be disconnecting only the cables that apply to your BOB. Unplug the RJ126P6C Y, X, Z and A axis connectors, the two pin white connector for coolant pump, the 12 VDC two pin white connector and the power supply cable from the BOB. Make sure the cables that you remove are properly labeled so that they can be reinstalled later. Note that the Y-Axis cable is left of the X-Axis cable.

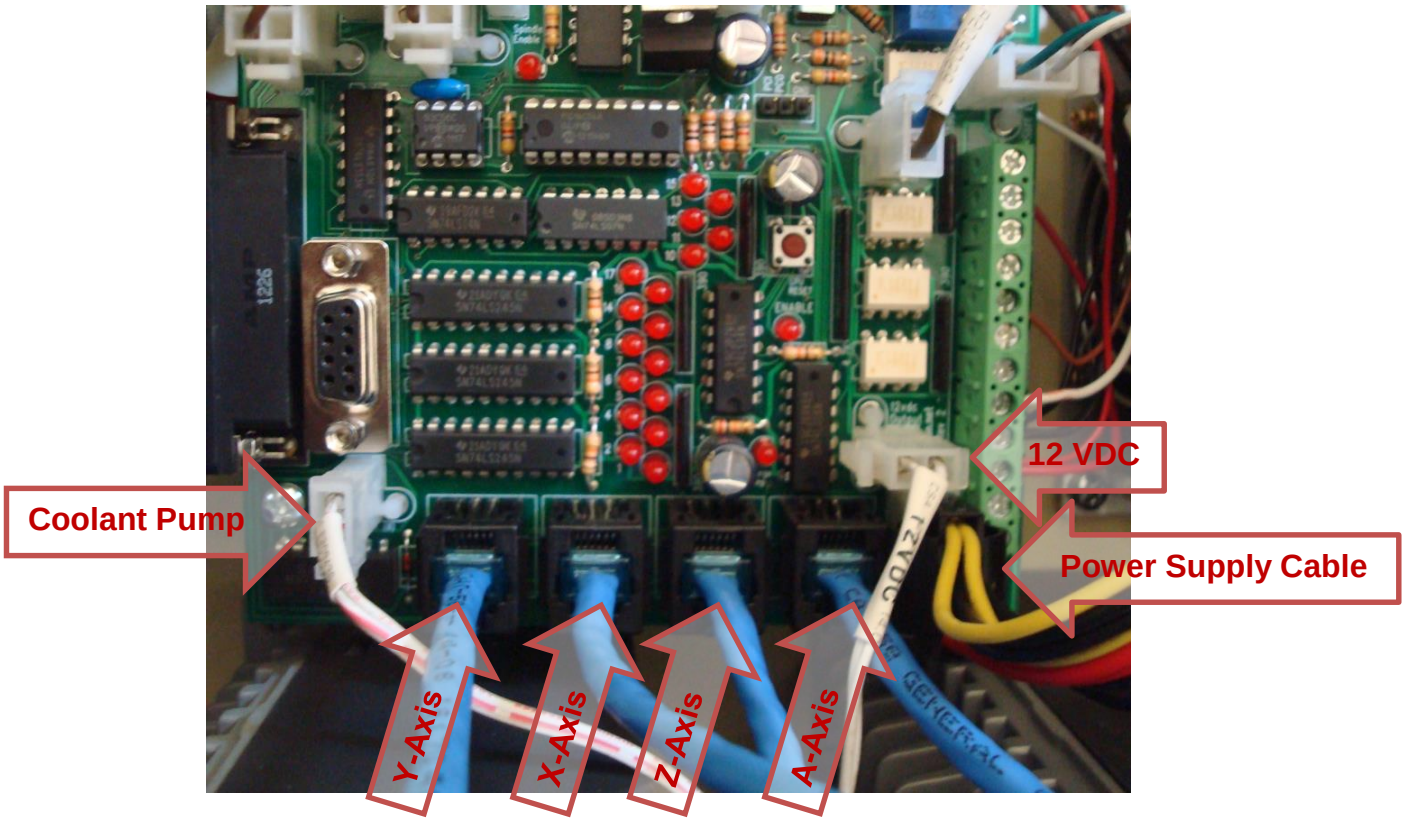

Figure 3-15

6) Remove and save the four screws that secure the BOB to the electrical panel.

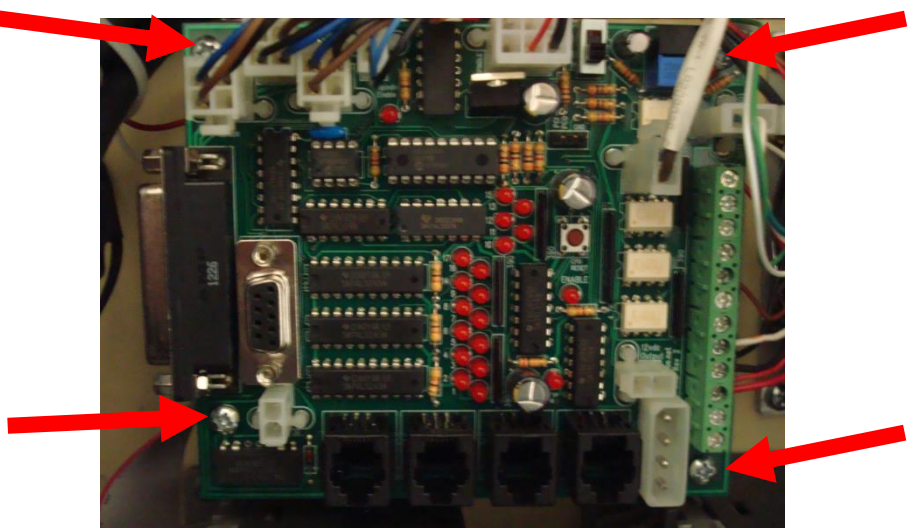

Figure 3-16 BOB

7) Set the BOB aside inorder to access the mounting hardware initialy use to secure the BOB to the electrical panel. Remove and save the four short standoff studs.

Be carefull to not damage the wiring still attached to the BOB.

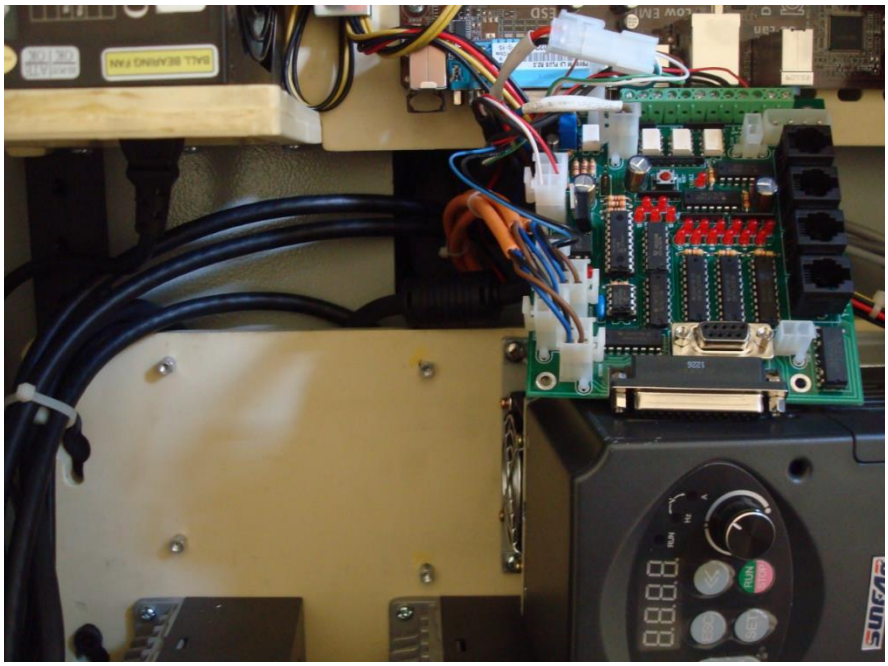

Figure 3-17

8) Place the ESS circuit board near the top of the electrical mounting panel board centered between the previously used mounting holes that secured the BOB. Center punch or mark the location of the top right mounting hole. Use a number 36 drill bit to drill a hole through the board. Be carefuel not to damage any wiring located behind the board. Thread the hole using a 6-32 hand tap. Mount the ESS board to the electrical panel using one of the previously remove Phillips screw. Do not tighten the screw – only use the screw to secure the ESS board while marking the location of the top left mounting hole.

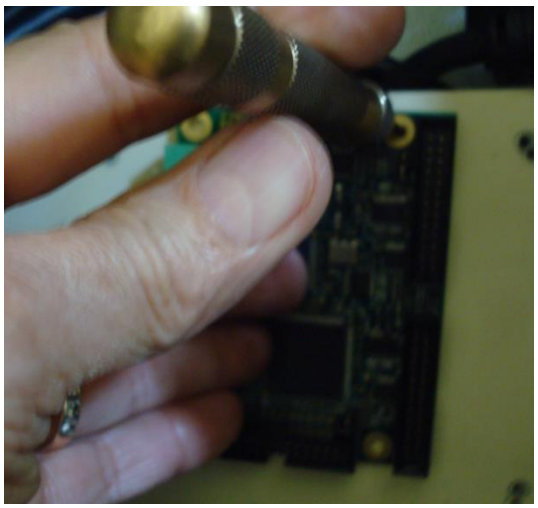

Figure 3-18 Center Punch Mounting Hole

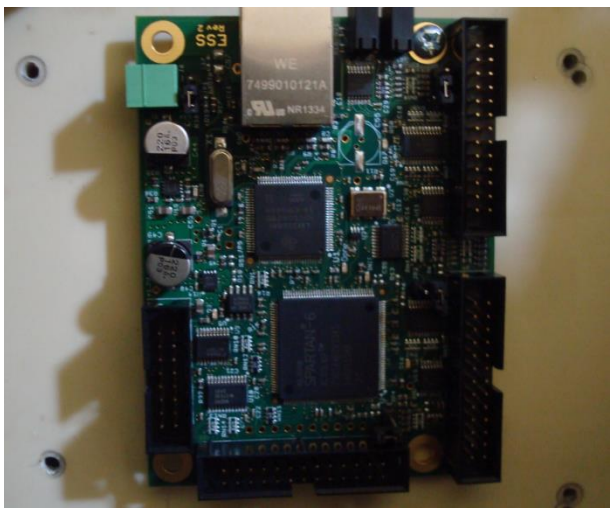

Figure 3-19

9) Use a number 36 drill bit to drill the top left hole through the board. Thread the hole using a 6-32 hand tap. Insert one of the previously remove Phillips screw into this hole.

10) Mark, drill and thread the two bottom holes. Remove the ESS board from the electrical panel and install the four short standoff nuts into the newly tapped holes. Use four short Phillips screws to mount the ESS circuit board to the electrical panel.

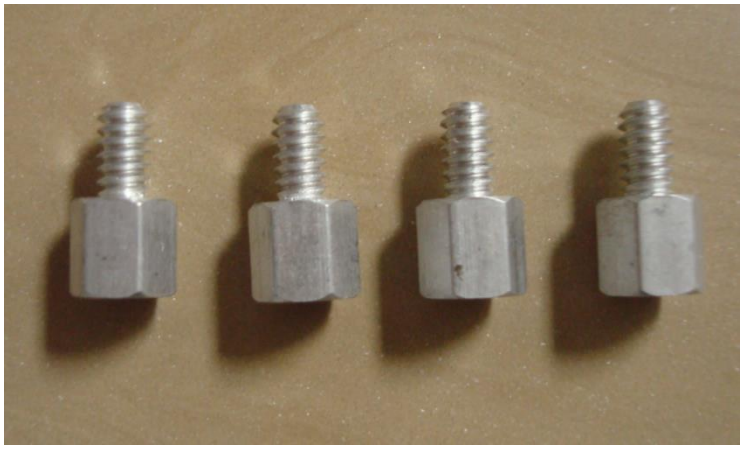

Figure 3-20 Short Standoff Nuts

Figure 3-21 Phillips Screws

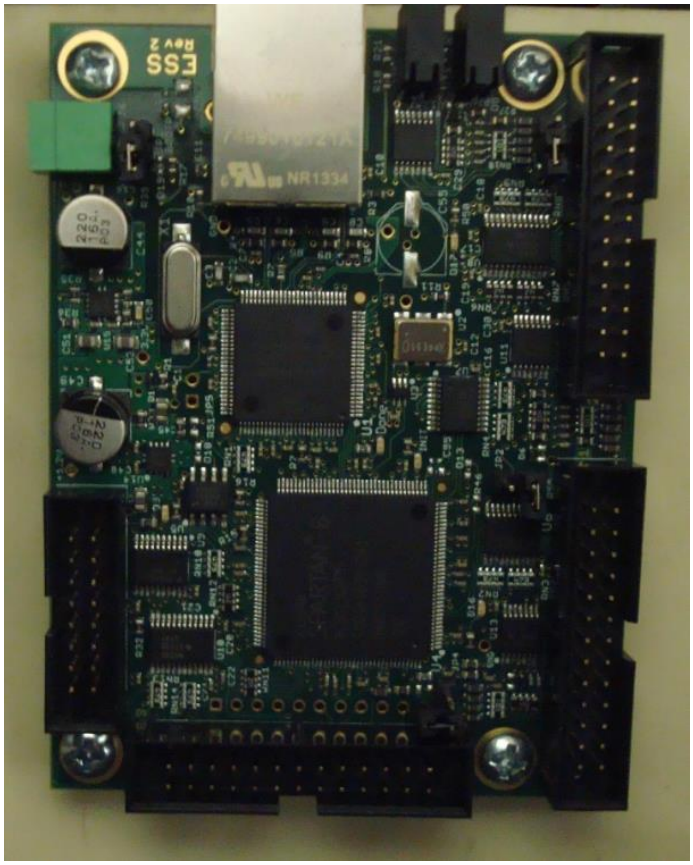

Figure 3-22 ESS Board

11) Install the four long standoff nuts into the tapped holes previously use to secure the BOB to the electrical panel.

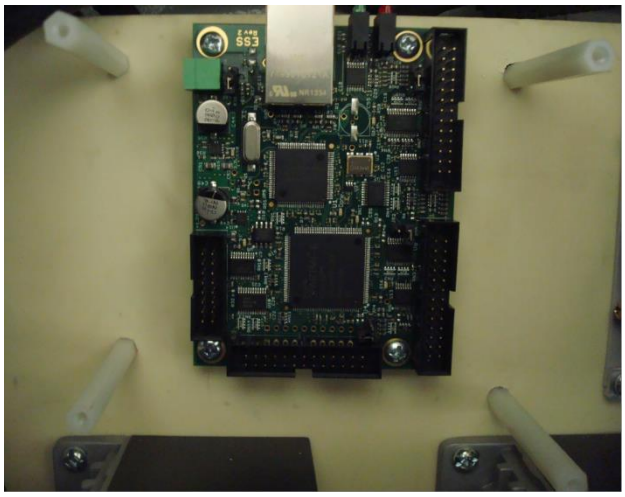

Figure 3-23

12) Insert the black end of the ribbon cable into the Port #1 connector located on the lower right hand side of the ESS board. The red markings on the ribbon cable should be at the bottom of the board

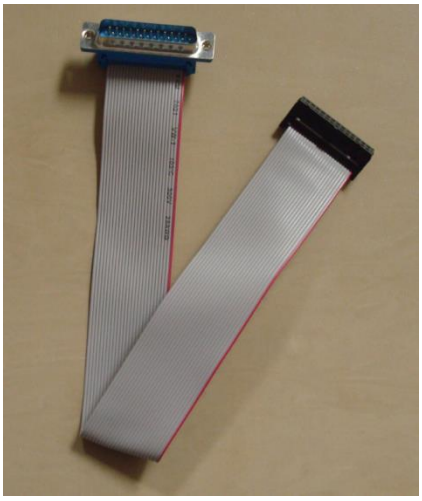

Figure 3-24 Ribbon Cable

Figure 3-25

13) Plug one end of the Ethernet cable into the EES board and the other end into the PC board.

Figure 3-26

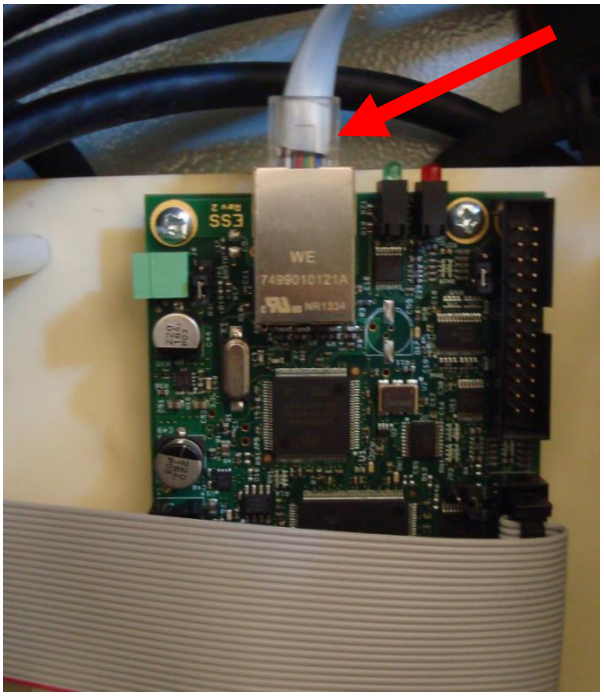

Figure 3-27

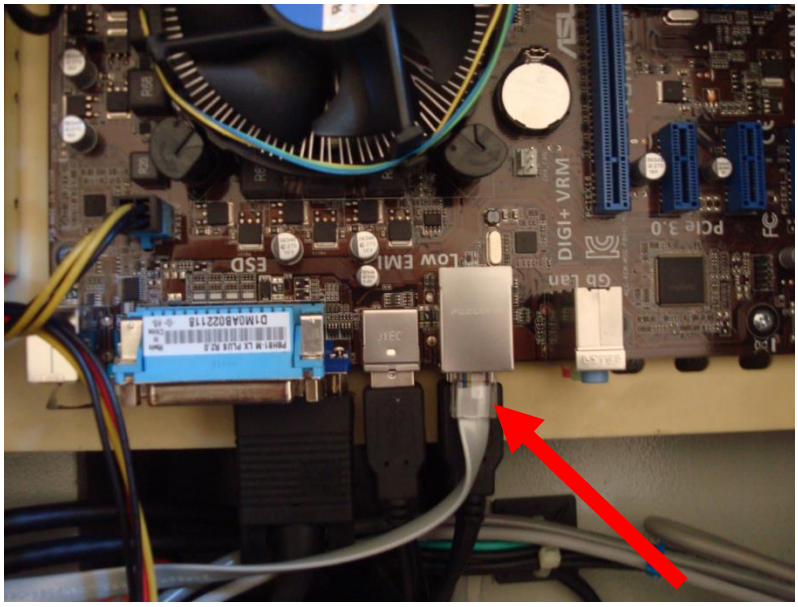

Figure 3-28

14) The remaining wiring harness has a 2-pin green connector on one end and bare wires on the other end. Connect the 2-pin connector to the mating connector on the ESS board.

The ends of the wires connected to the green terminal strip on the ESS board must be as shown in Figure 3-30.

THE RED (POSITIVE) WIRE IS INSERTED IN THE LOWER TERMINAL AND THE WHITE (GROUND) WIRE IS PLUGGED INTO THE UPPER TERMINAL. REVERSING THESE WIRES WILL DAMAGE THE ESS ELECTRONICS WHICH WILL NOT BE COVERED UNDER THE ESS WARRANTY.

15) Route the flat ribbon cable behind the BOB and mount the BOB to the long standoff nuts using four Phillips screws.

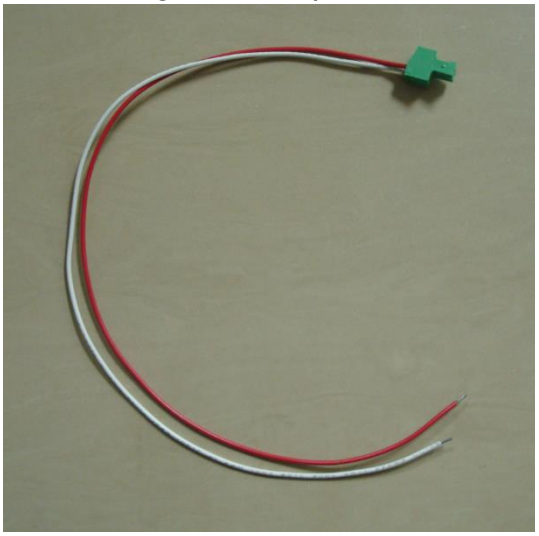

Figure 3-29 5V Power Cable

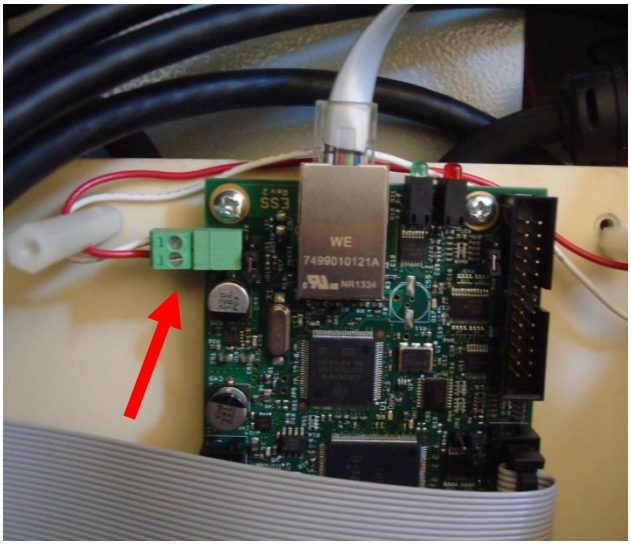

Figure 3-30

16) Plug the blue end of the flat ribbon cable into the parallel port located on the BOB and secure it with two 4-40 screws..

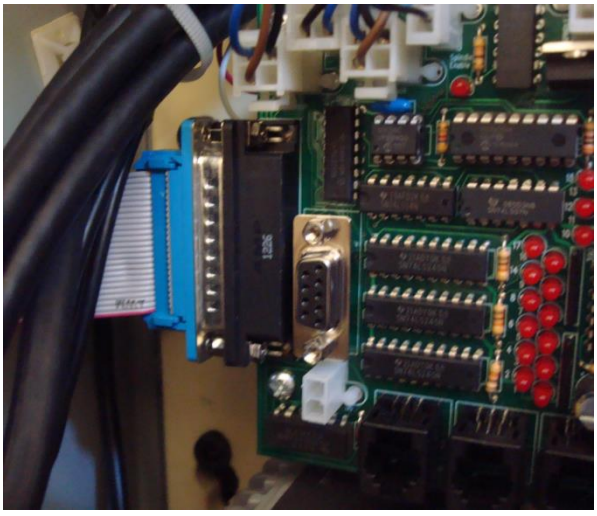

Figure 3-31

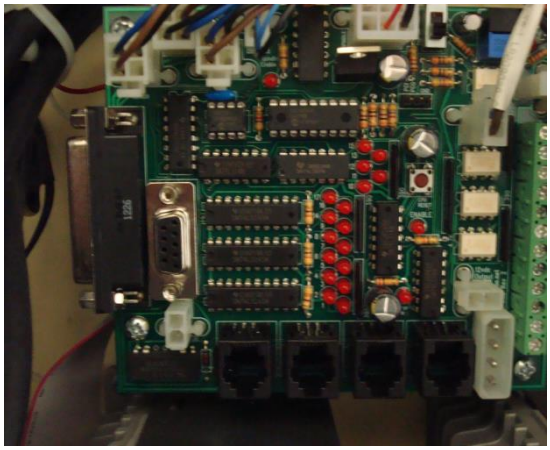

Figure 3-32

17) Locate the white and red wires coming from the two pin green connector on the ESS board. Install the white wire into the GND terminal slot and the red wire into the 5V terminal slot on the BOB's long green terminal block. Depending on the version of the BOB there are one or two 5V connections. If your terminal block only has one 5V connection, you will have two wires inserted into the 5V terminal.

The ends of the wires connected to the green terminal strip on the ESS board must be as shown in Figure 3-33.

REVERSING THESE WIRES WILL DAMAGE THE ESS ELECTRONICS WHICH WILL NOT BE COVERED UNDER THE ESS WARRANTY.

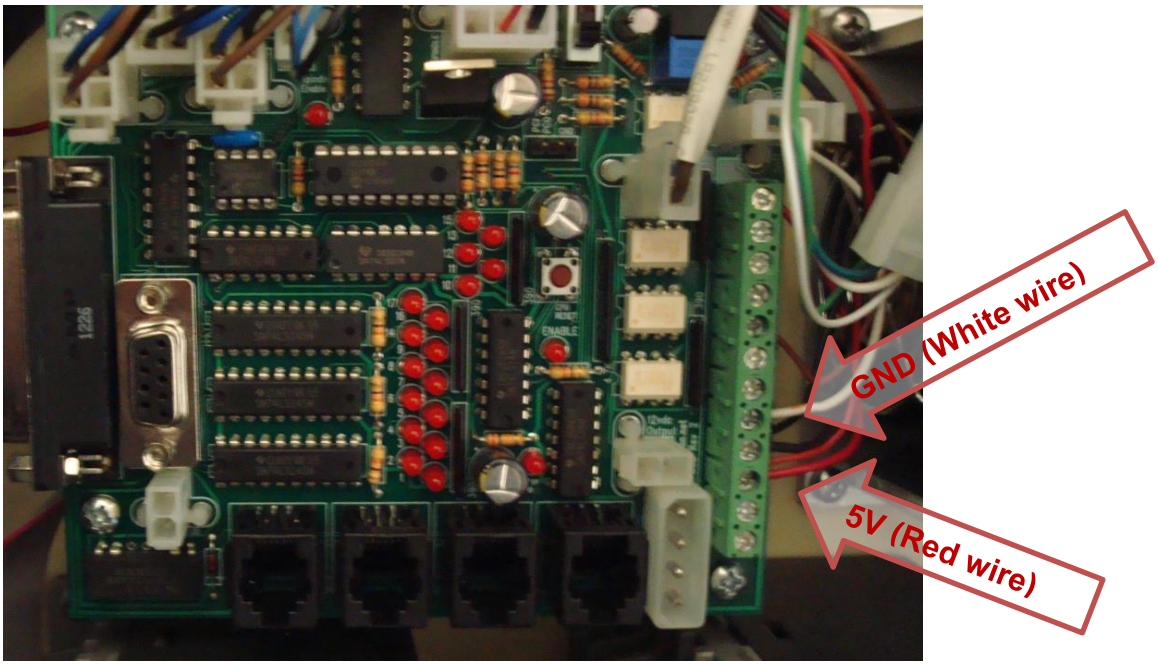

Figure 3-33

18) Reinstall the RJ126P6C Y, X, Z and A axis connectors, the coolant pump two pin white connector, the 12 VDC two pin white connector and the power supply cable for the BOB. **Again note that the Y-Axis cable is left of the X-Axis cable.**

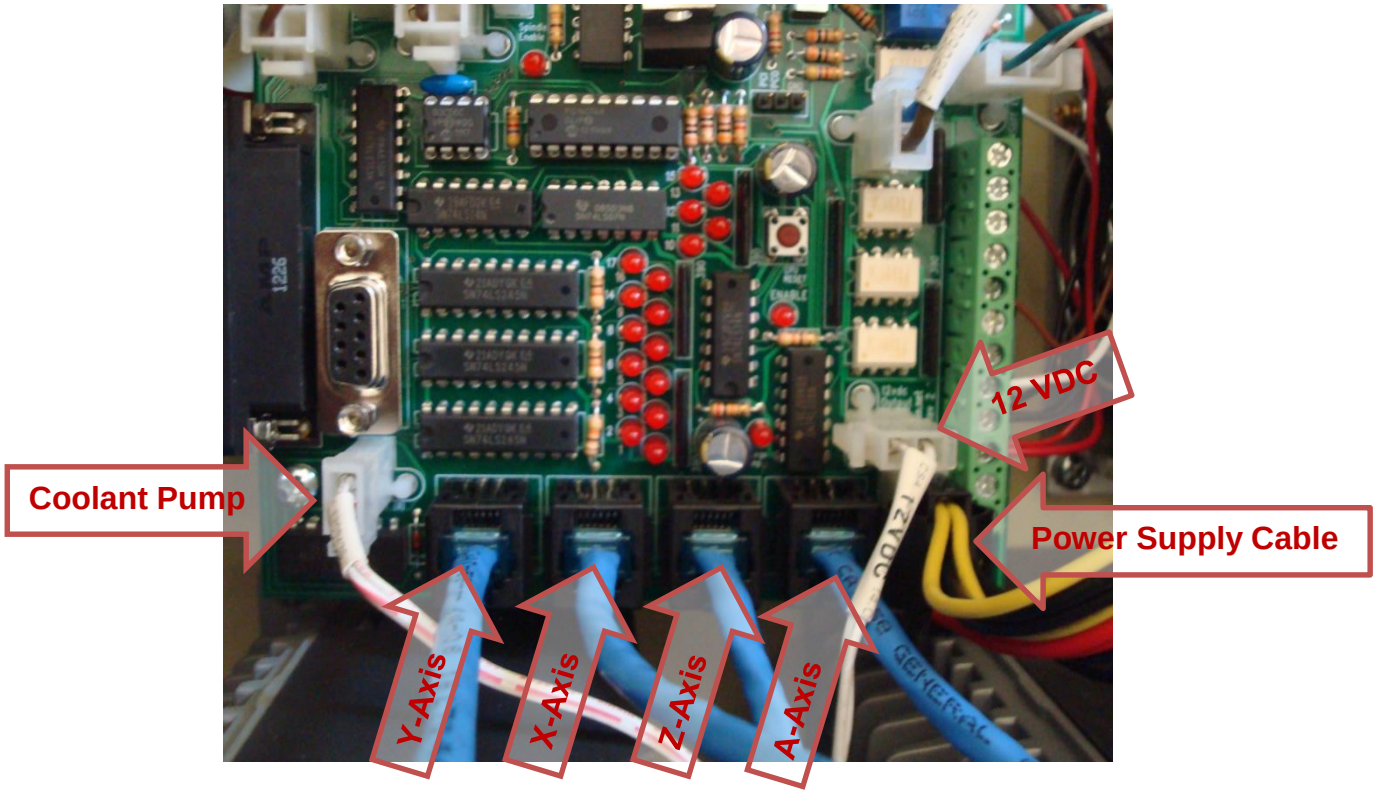

Figure 3-34

19) The installation of the ESS is complete. Plug the 220 volt plug back into the side of the electrical cabinet.

Figure 3-35

4 PROGRAMMING

CONFIGURING THE WINDOWS NETWORK SETTINGS.

1) Turn on the Novakon Power and Drive switches. Press the red or green button to start the PC and load the Windows operating system. **Do not load Mach3 at this time.**

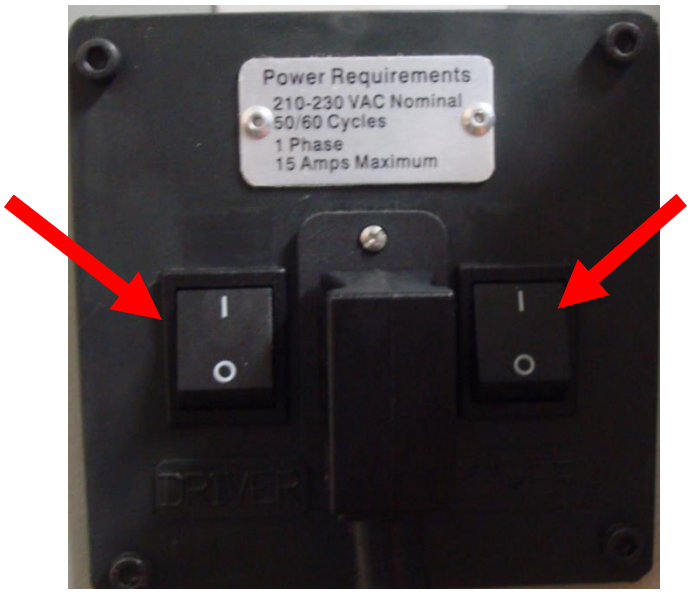

Figure 4-1

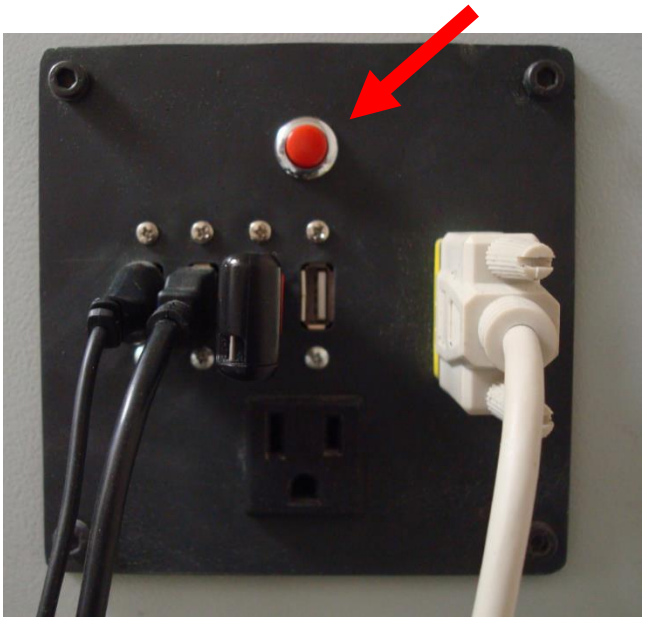

Figure 4-2

2) Check to make sure that the yellow LED light located on the ESS Ethernet connector is on. This LED indicates that the ESS board and the PC are communicating with each other.

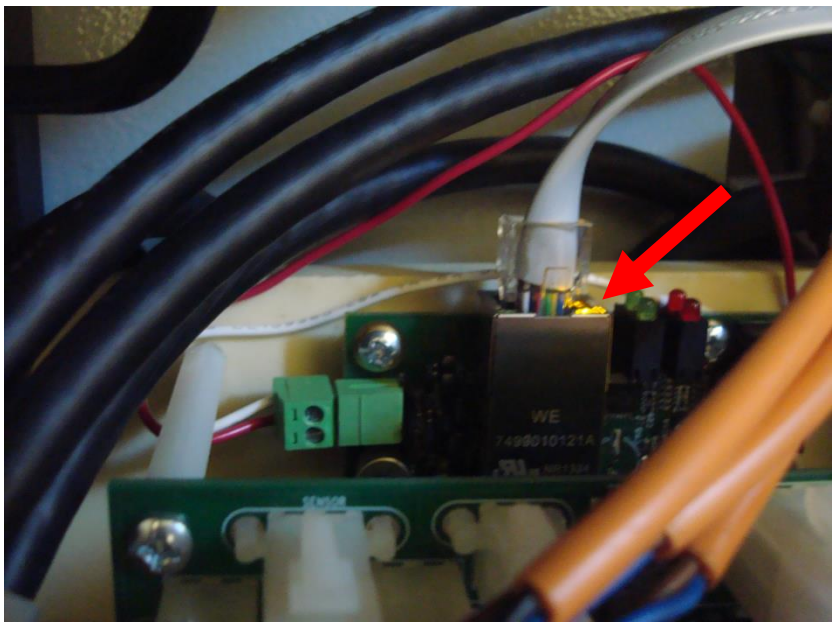

Figure 4-3

3) Click the Windows “Start” icon. Depending on your Windows layout, the “Start Icon” can appear in different formats. Two of these formats are shown below.

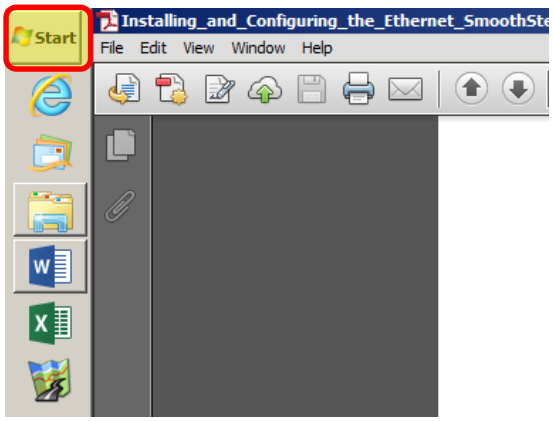

Figure 4-4

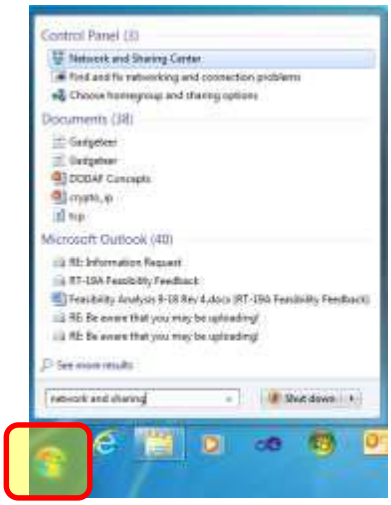

Figure 4-5

4) Type “network and sharing” into the search box that appears after clicking on the start button. Select the ‘Network and Sharing Center’ to access the “Control Panel\Network and Sharing Center” application shown in Figure 4-6. Next, select ‘Change adapter settings” to display the “Control panel\Network and Internet\Network connections” screen. This will open up a window that shows you all of the networking adapters installed on your PC.

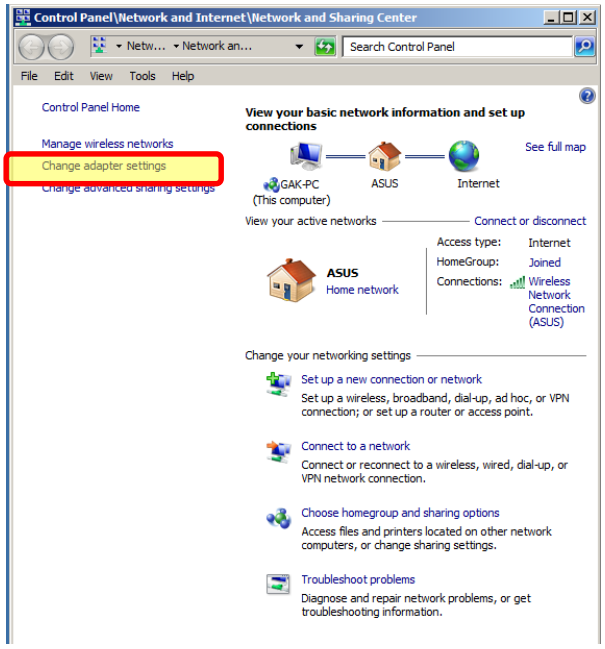

Figure 4-6

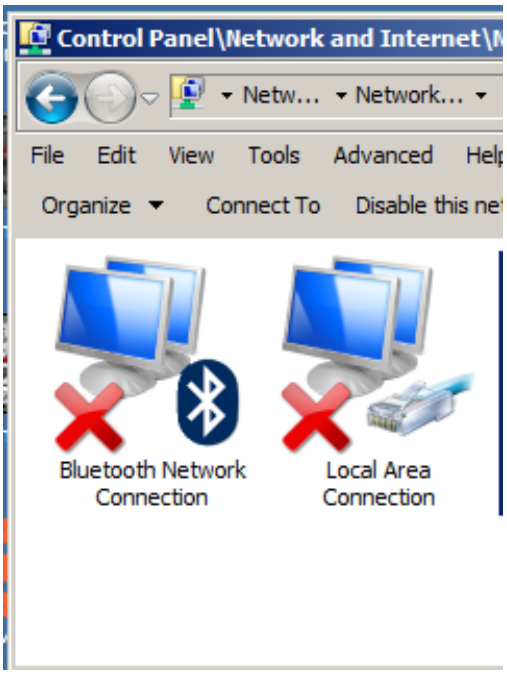

Figure 4-7

5) Double click the “Local Area Connection” icon highlighted in yellow and shown in Figure 4-8. Choose “Internet Protocol Version 4 (TCP/IPv4)” and click the “Properties button”. **The Novakon CNC computer must not be connected to any other networks. In other words, the Novakon CNC Mill network must be the only network loaded.**

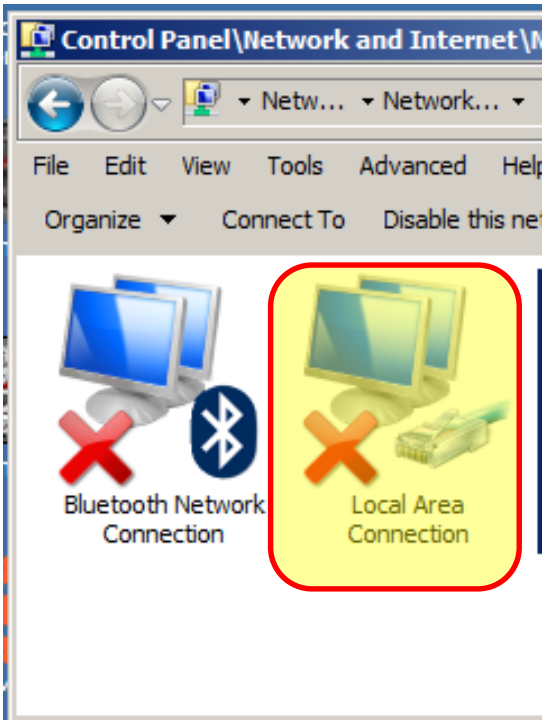

Figure 4-8

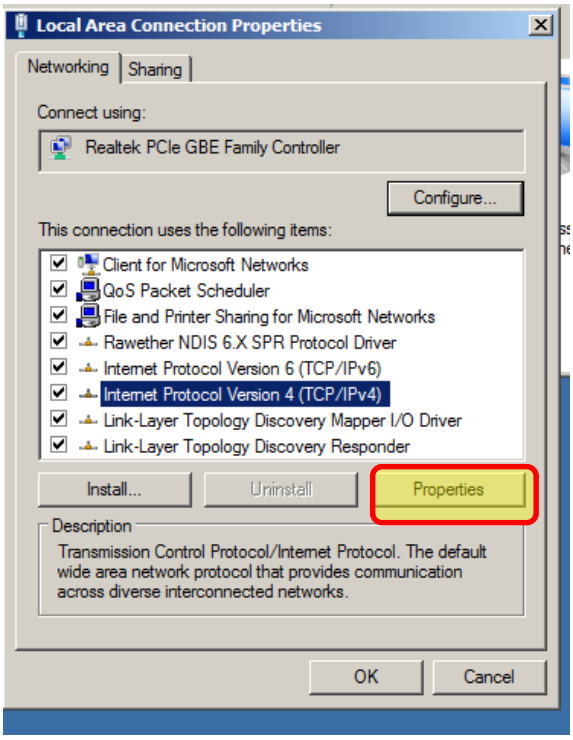

Figure 4-9

6) Select “Use the following IP address” and enter `10.9.9.1` in the “IP address” field and `255.255.255.0` in the “Subnet mask” field. **The Subnet mask must be `255.255.255.0` not the default `255.0.0.0`.** Click the “OK” button.

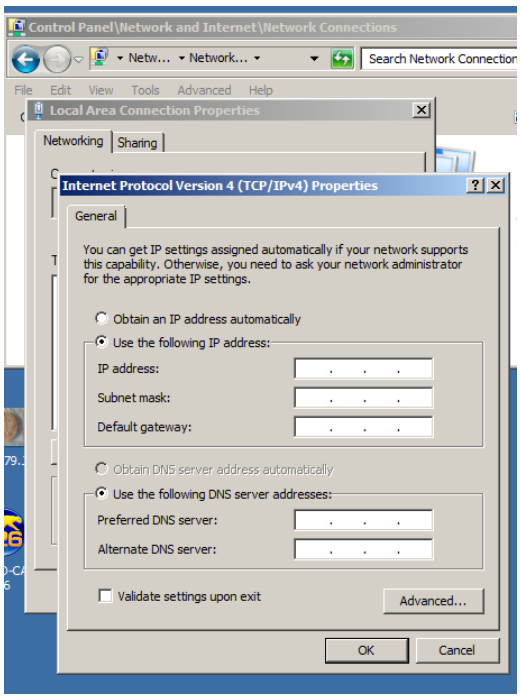

Figure 4-10

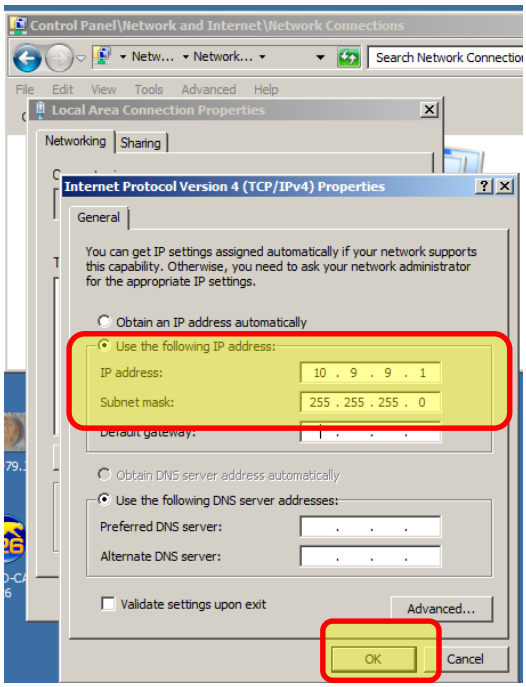

Figure 4-11

7) Click the “Close” button. Also close any other windows that are opened.

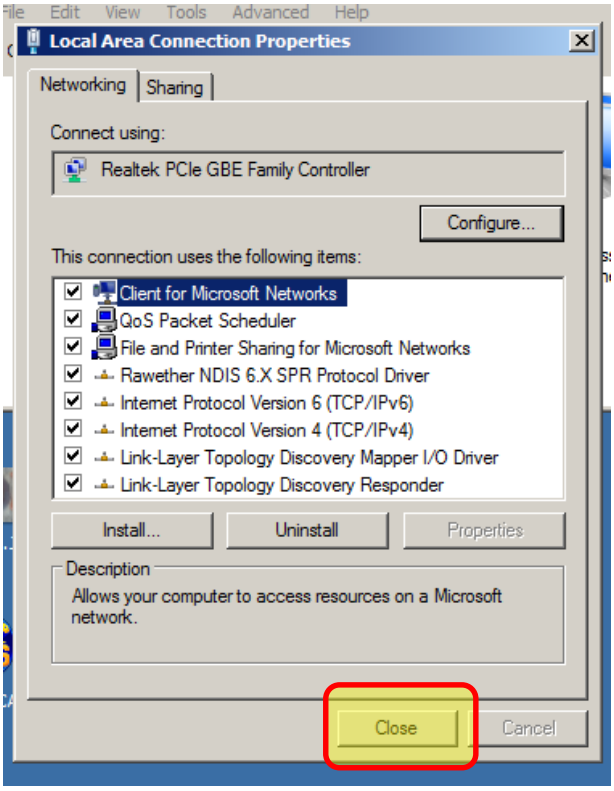

Figure 4-12

8) The next step is to set the Windows Firewall to allow the ESS and Mach3 programs through. The easiest way to get to the firewall is to go to “Start” and choose “Control Panel” and then search for “firewall” and click “Windows Firewall”. Now click on ‘Allow a program or feature through Windows Firewall’ and the “Firewall Utility: will open up.

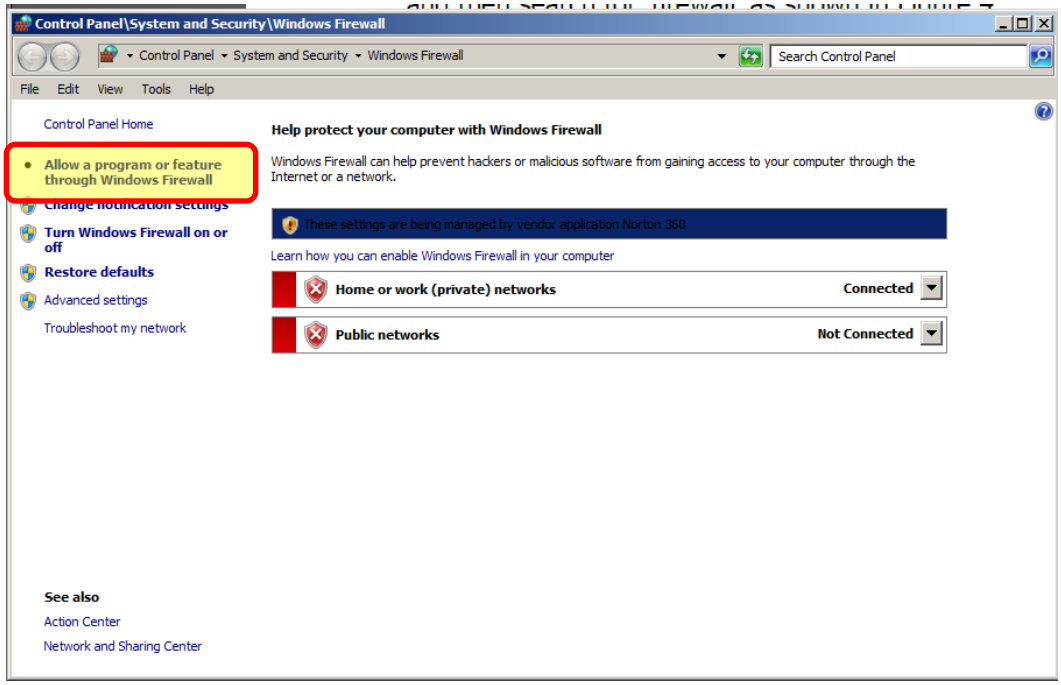

Figure 4-13

9) Choose the ESS and Mach3 programs and Click the “Allow Access” button. The Mach3 program might already have access through the Windows Firewall.

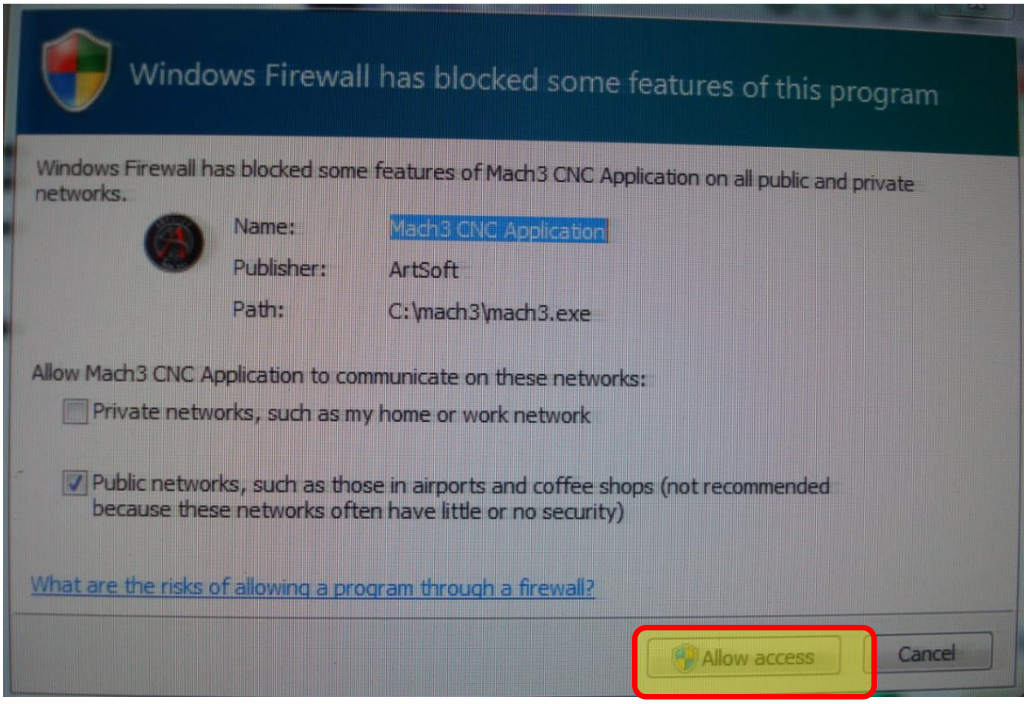

Figure 4-14

10) Click the “Start” button and select “Control Panel” to display the following screen. Click on “Hardware and Sound”.

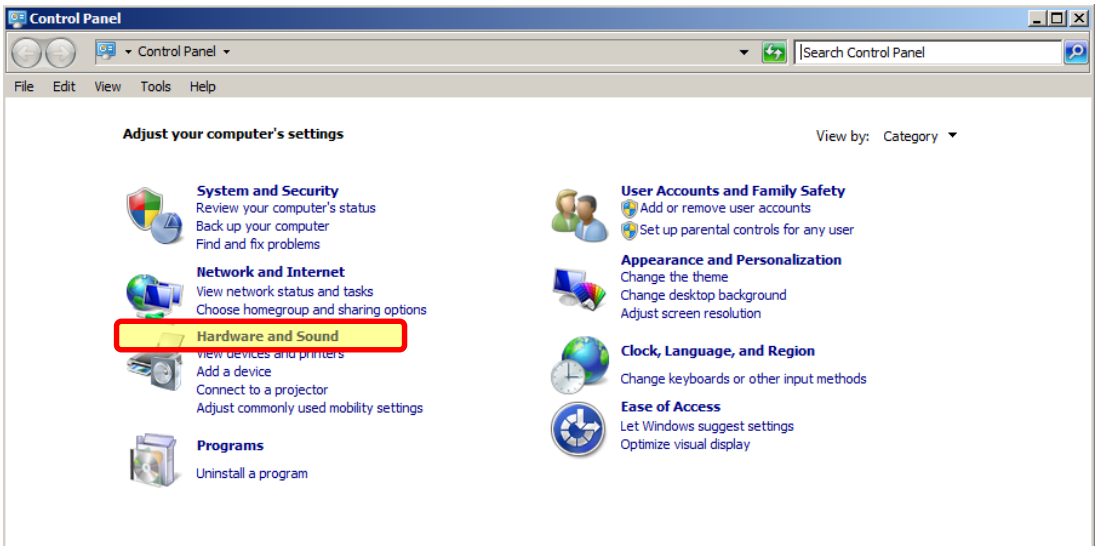

Figure 4-15

11) Choose “Power Options”.

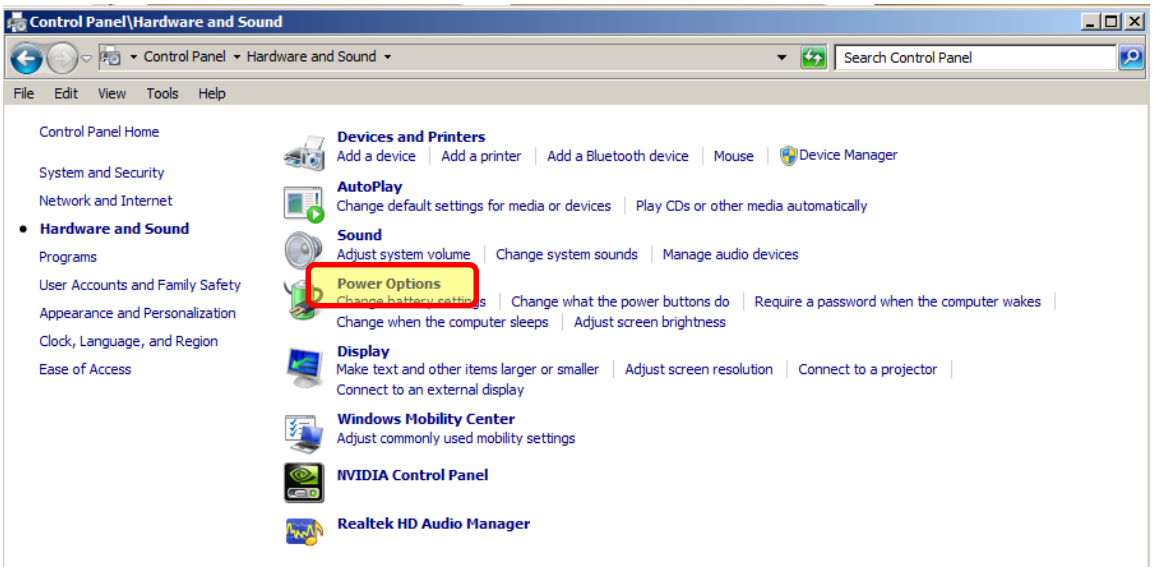

Figure 4-16

12) Select High Performance and close the popup window

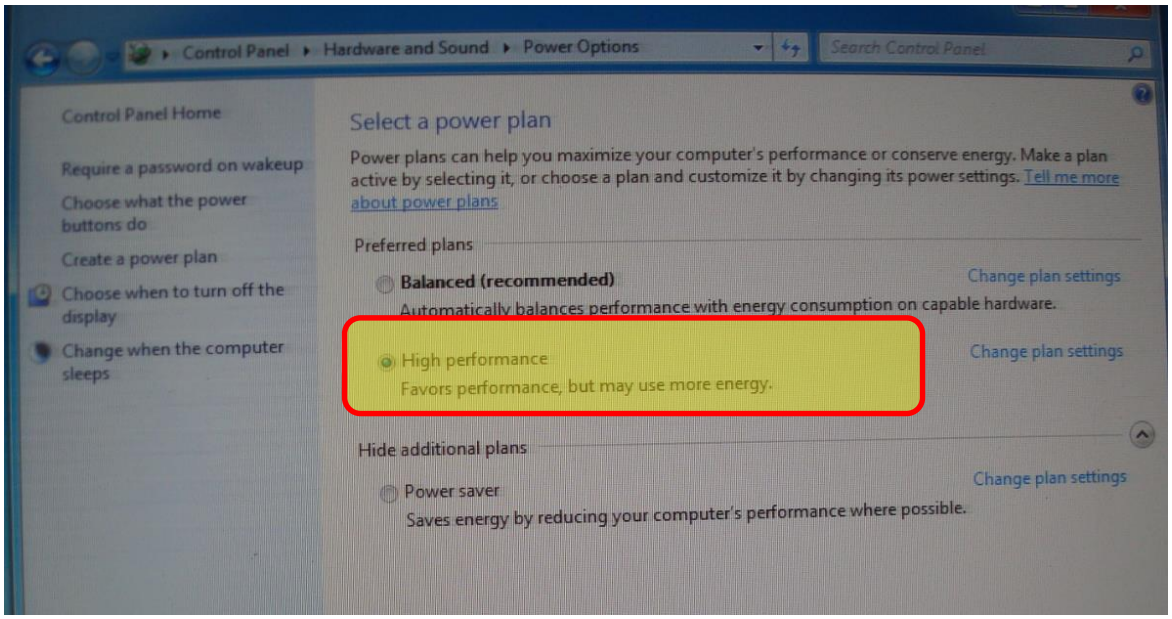

Figure 4-17

INSTALLING THE ESS PLUG-IN FOR MACH3

1) Go to Novakon.net web site and click on DOWNLOADS.

2) Select the “Download” tab and download the ESS_v10hd2.m3p file and save it to a USB flash drive.

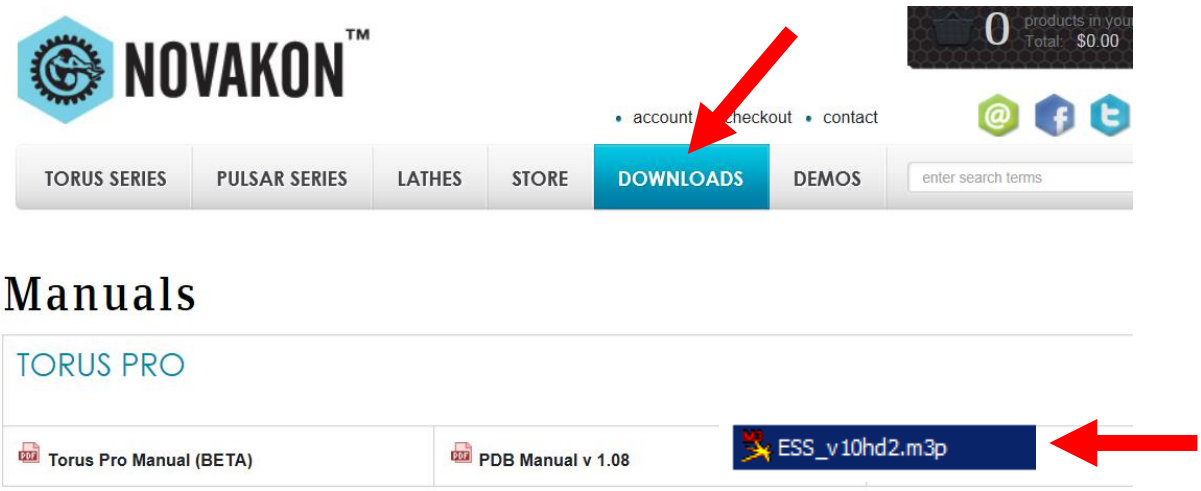

Figure 4-18

3) Plug the USB flash drive into one of the four USB slots located on the side of the Novakon CNC Mill electrical control panel.

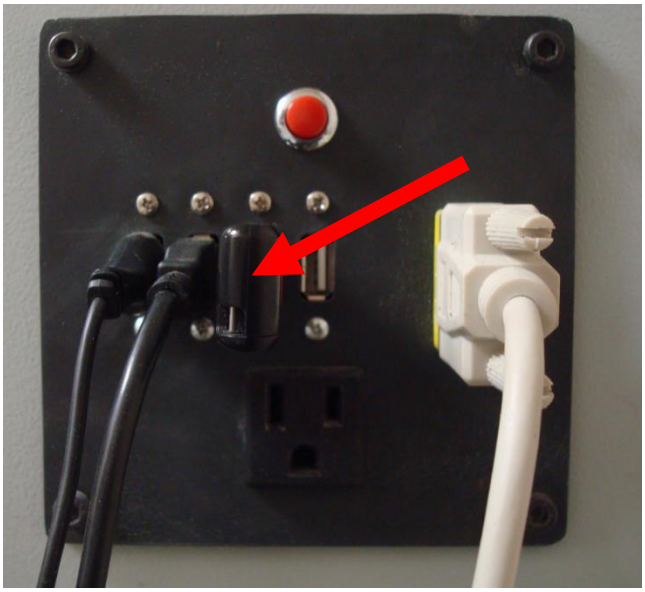

Figure 4-19

4) Copy and paste the “ESS_v10hd2.mp3” file into the “Mach3/PlugIns” file.

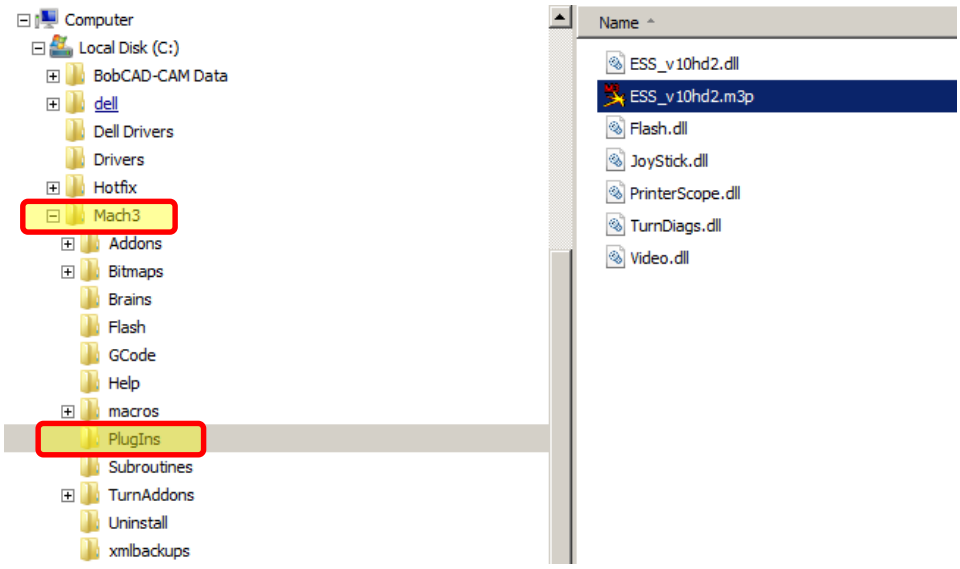

Figure 4-20

5) Install the ESS plug-in for Mach3 by double clicking the ESS_v10hd2.mp3 file. The M3 PlugIn Control screen will appear indicating that the Mach3 PlugIn installed successfully and has created the “ESS_10hd2.DLL” file. Click the “OK” button to close the pop up. The “ESS_v10hd2.m3p” will disappear but leave the newly created “ESS_10hd2.DLL” file.

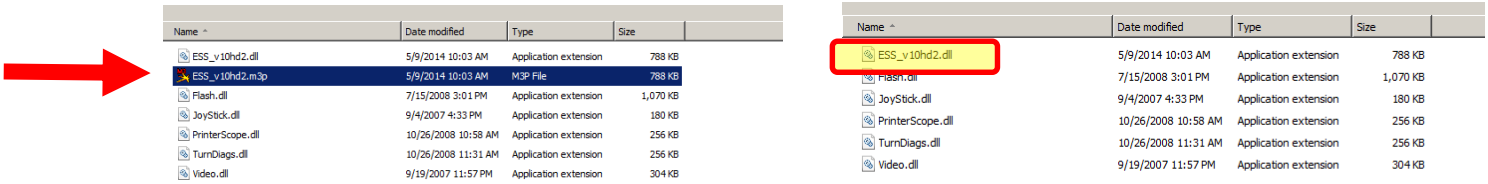

Figure 4-22

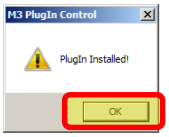

Figure 4-21

6) Start the Mach3 program. When the “Motion Control Hardware PlugIn sensed” screen pops up, choose the “ESS-v10hd2” motion control device and click the “OK” button.

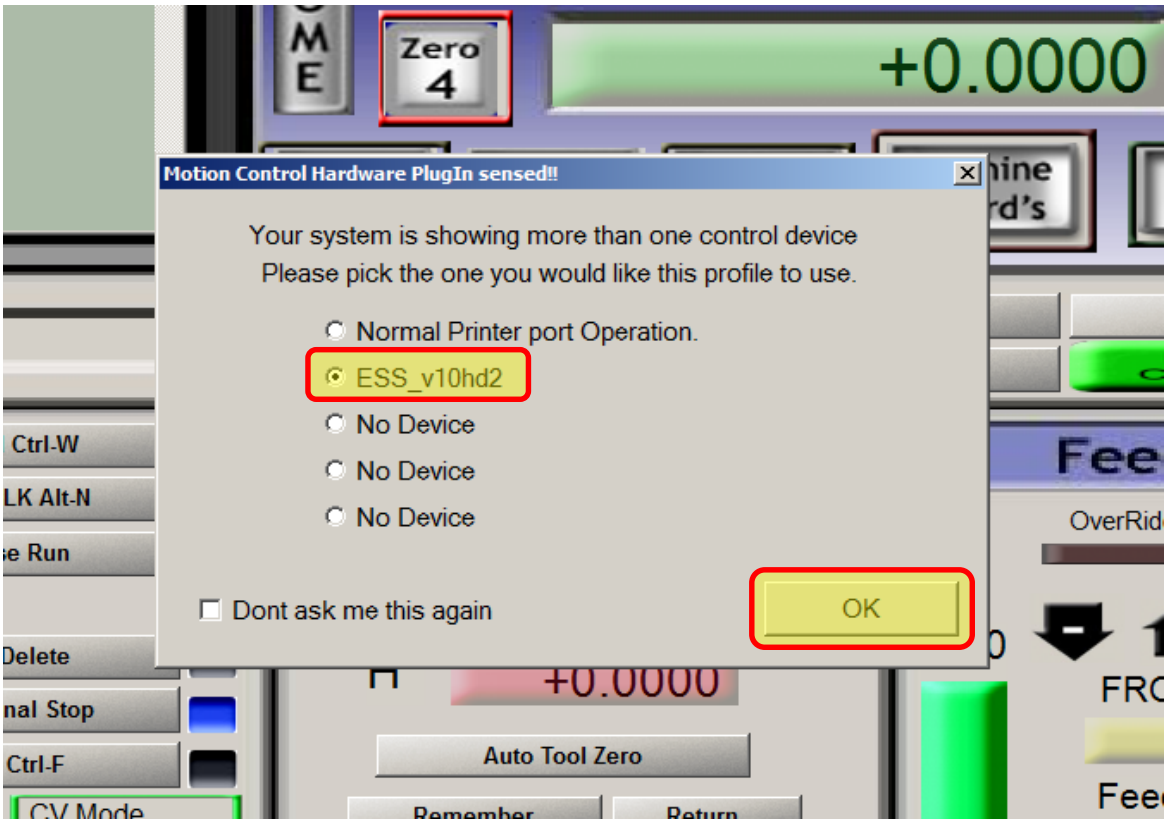

Figure 4-23

7) Click the “No” button to display the Dialog pop up window. button.

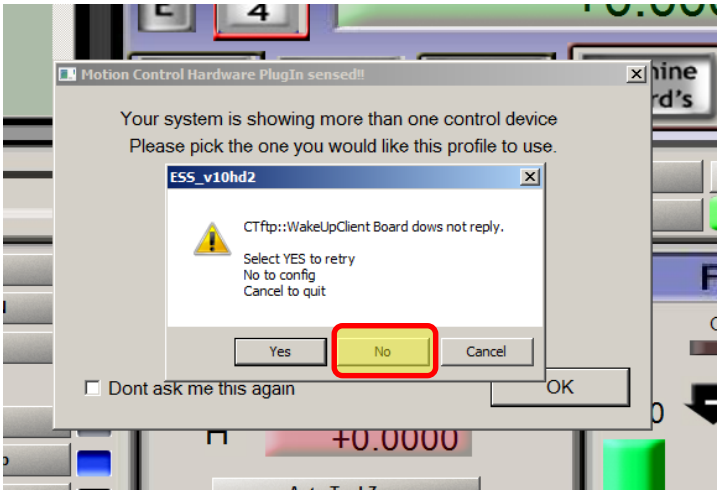

Figure 4-24

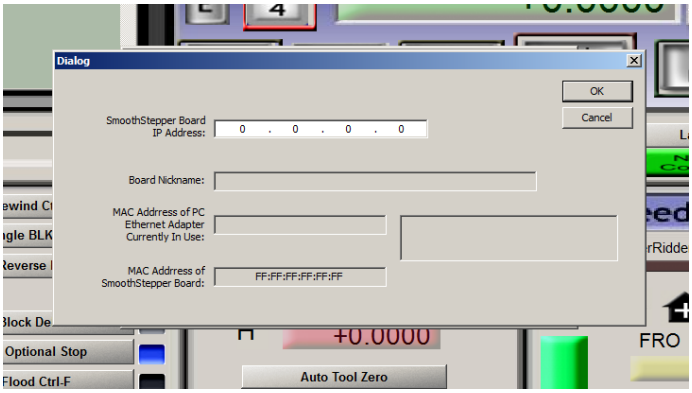

Figure 4-25

8) Enter 10.9.9.9 for the SmoothStepper Board IP Address and Click the “OK” button. Click the “Cancel button when the “ESS_v10hdv” popup appears.

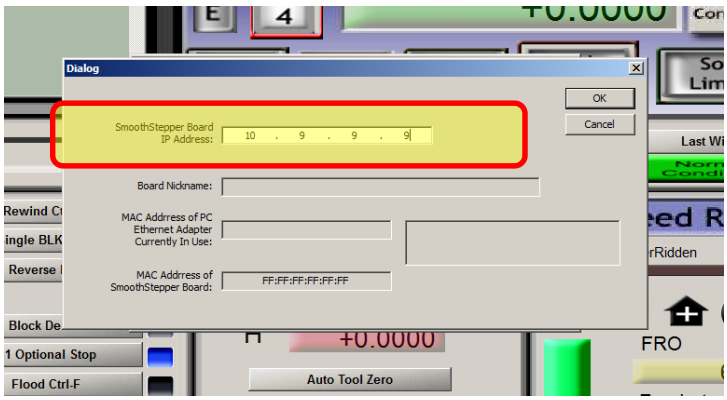

Figure 4-26

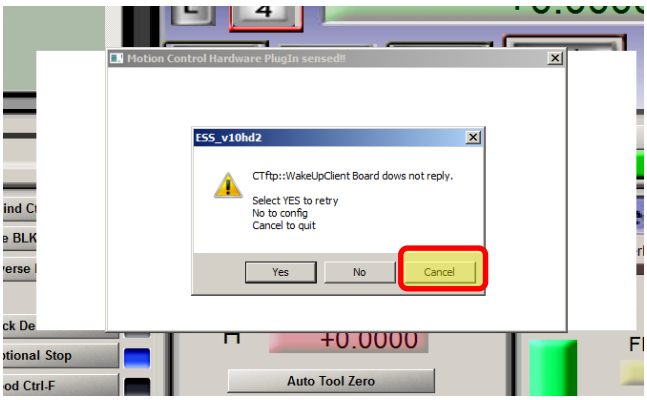

Figure 4-27

9) When the “Motion Control Hardware PlugIn sensed!!” appears, select “ESS_v10hd2” and “Don’t ask me this again”. Click the “OK” button. Close and restart Mach3.

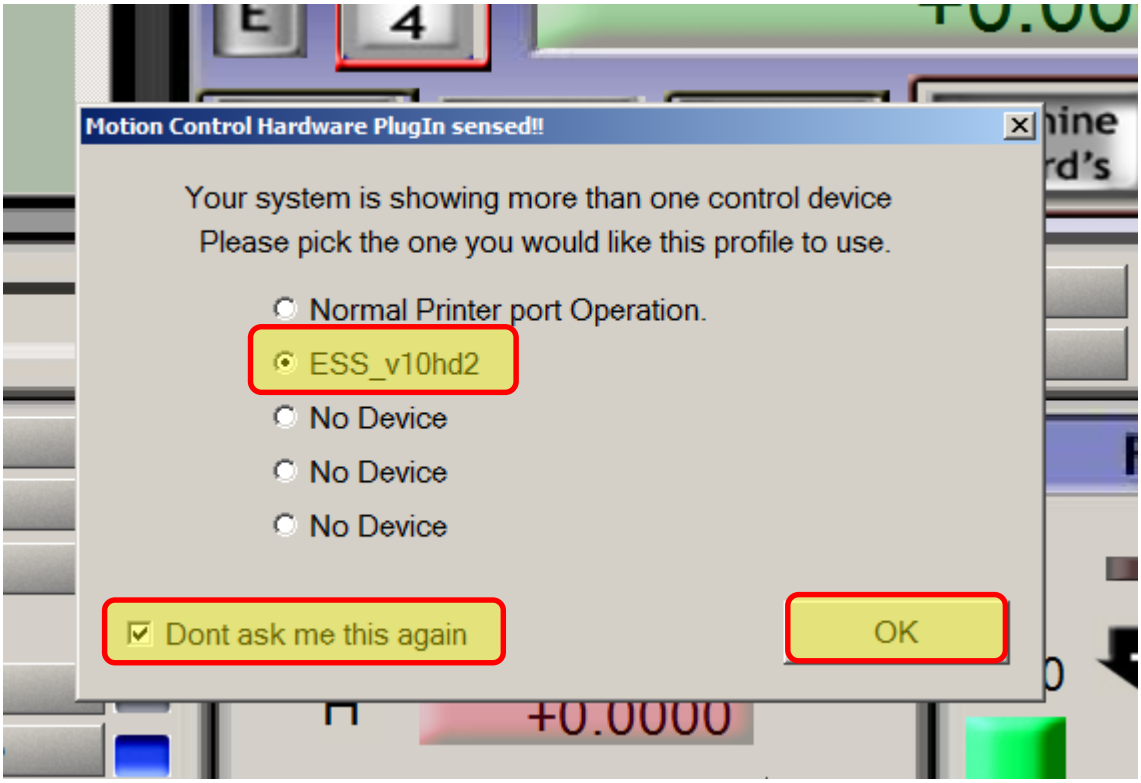

Figure 4-28

10) After clicking the “OK” button, the ESS plug-in is likely to complain about some of the settings not being set properly, just press the button to have the plug-in set all the new ESS profile settings to their **default** state.

1) Click “PlugIn Control” and select the “ESS_v10hd2” tab.

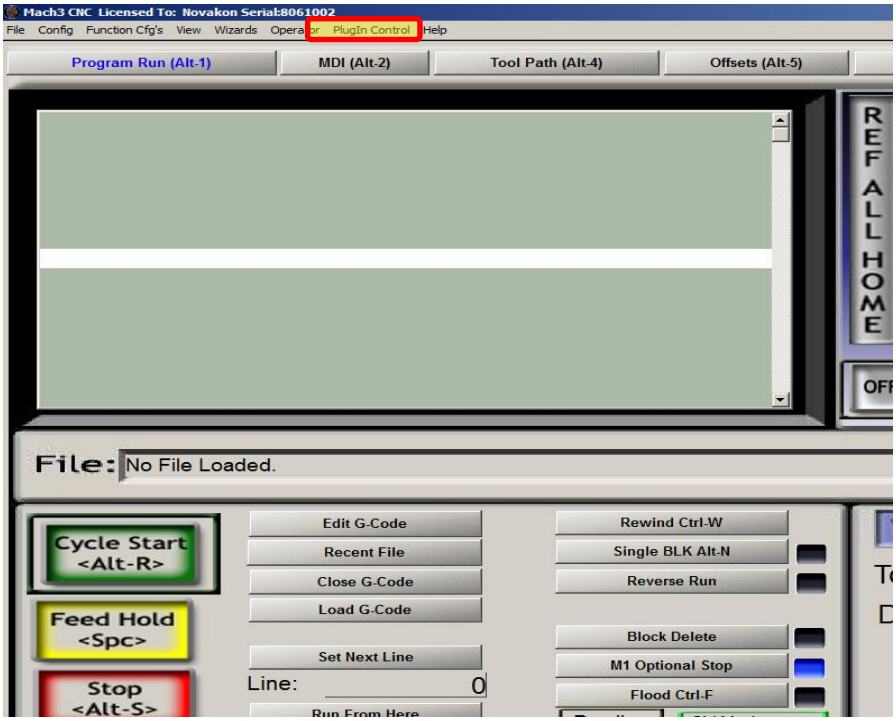

Figure 4-29

2) TORUS PRO ONLY - Change the entries noted in yellow below and click the “OK” button.

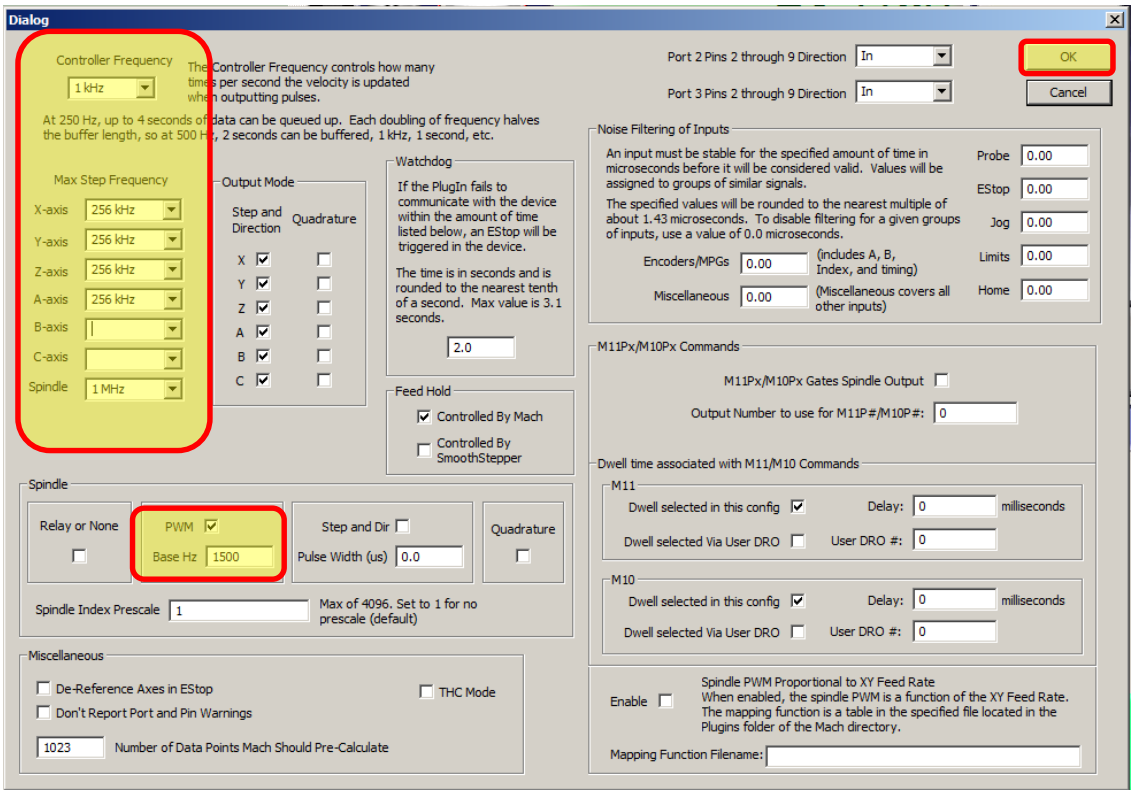

Figure 4-30

PULSAR ONLY - Change the entries noted in yellow below and click the “OK” button.

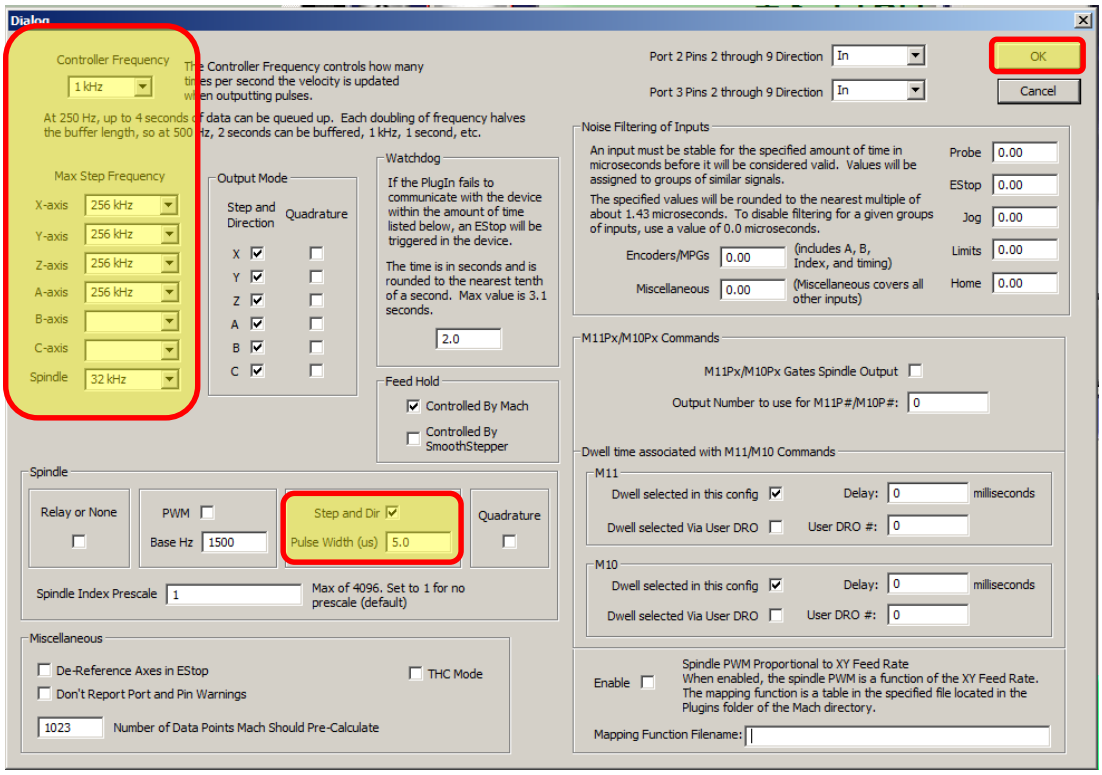

Figure 4-31

3) Click the “OK” button (Note: The Pulsar will have the Step and Dir box checked instead of the PWM box).

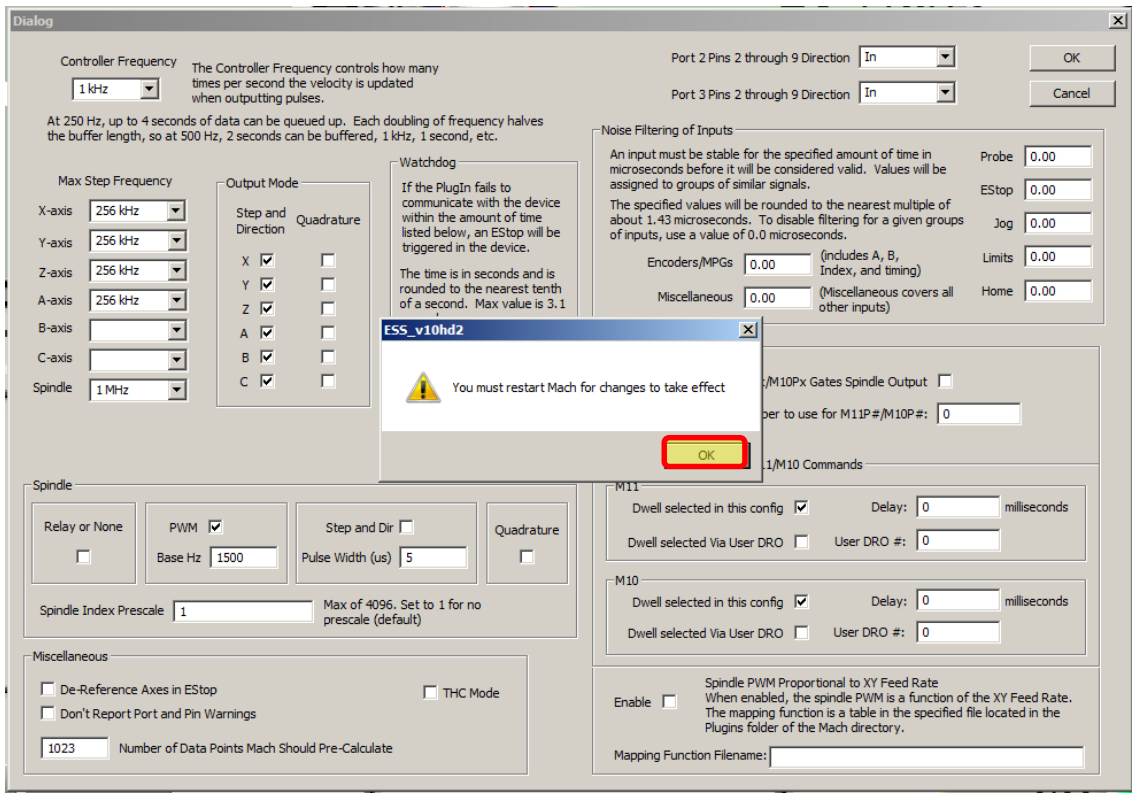

Figure 4-32

4) Click the next “OK” button. Close and restart the Mach3 program button (Note: The Pulsar will have the Step and Dir box checked instead of the PWM box).

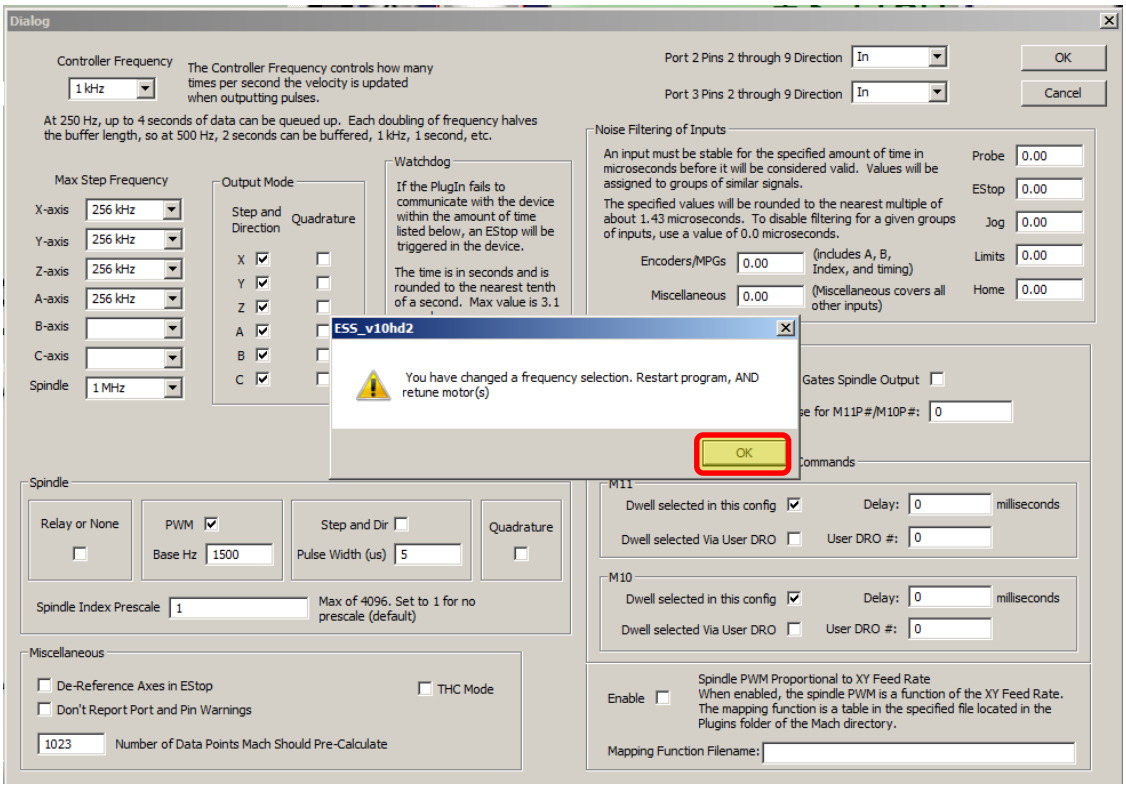

Figure 4-33

5) After restarting Mach3, if the following screen appears, click the “Cancel” button.

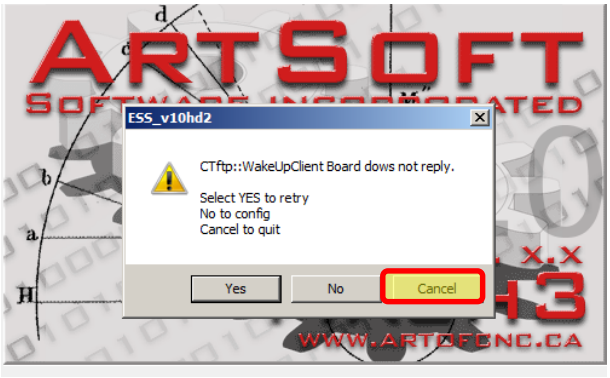

Figure 4-34

6) After Mach3 loads, select “Config” and choose the “Ports and Pins” tab. Select “Motor Outputs”.

Figure 4-35

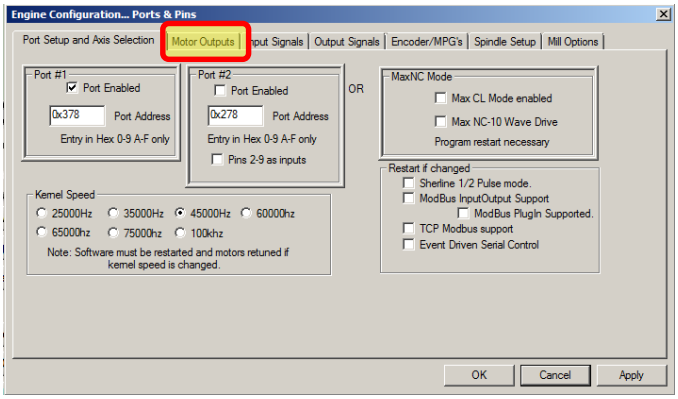

Figure 4-36

7) Choose the “Dir Low Active” selections as shown below. **If any of the axis move in the wrong direction or the spindle rotates in the wrong direction when running a G-code program, change the affected “Dir Low Active” setting from a green check mark to a red X or from a red X to a green check mark.**

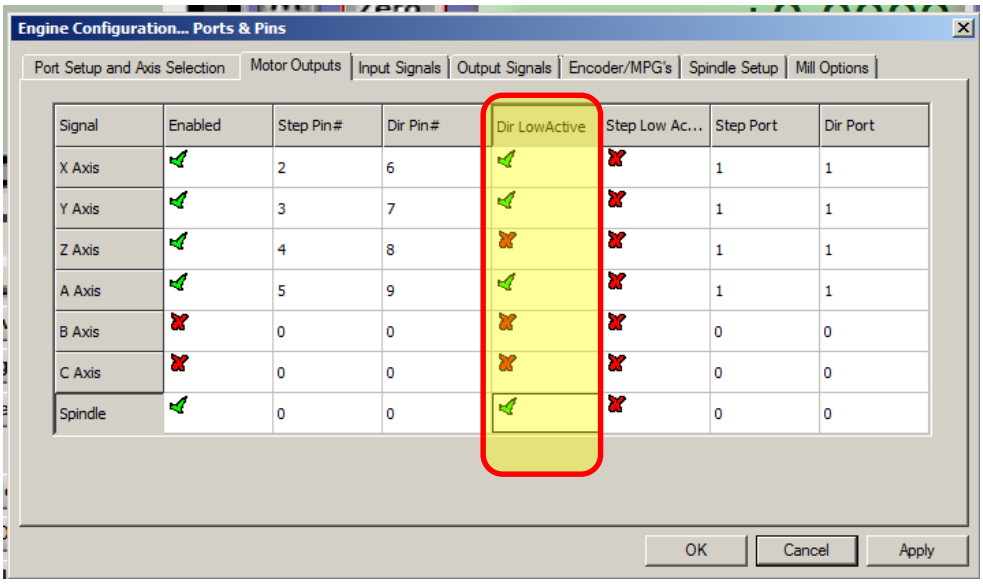

Figure 4-37

8) If you are unable to change the “Reset” button in Mach3 from a flashing red/green to steady green boarder, select “Config” in Mach3 and choose the “Ports and Pins” tab. Select the “Input Signals” tab to display the following pop up window. Scroll down to the “Estop” Signal and change the affected “Estop Dir Low Active” setting from a green check mark to a red X or from a red X to a green check mark. Click the “OK” button.

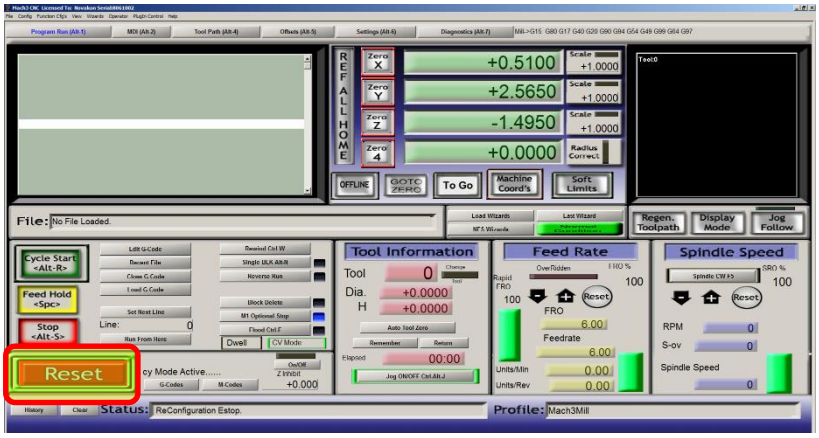

Figure 4-38

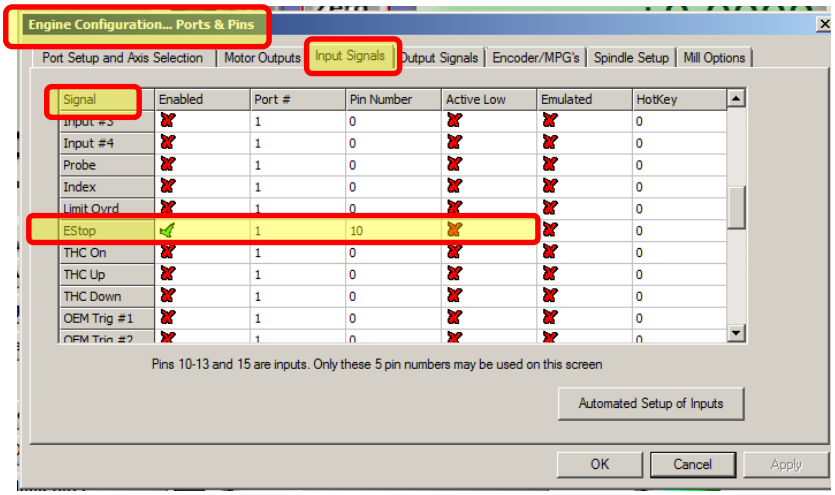

Figure 4-39

9) Choose the “Port Setup and Axis Selection” tab. Select “45Khz Kernel Speed” as shown in Figure 4-40. Click the “OK” button to close the popup window.

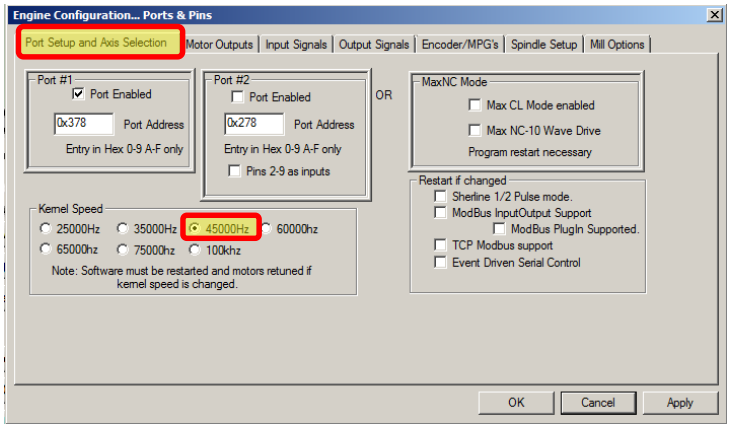

Figure 4-40

10) Close the Mach3 program and shutdown the computer. After the computer shuts down, turn off the Driver and Power switches located on the main electrical control panel. Wait thirty seconds and restart the Novakon CNC Mill. The ESS and Mach3 programing is now complete.

Figure 4-41

5 ESS TROUBLE SHOOTING GUIDE

WARP9 TECH DESIGN, INC.

Warp9 Tech Design, Inc. offers generic help via the following web addresses to assist the user in trouble shooting the ESS board installation and programing Mach3.

http://www.soigeneris.com/Document/Warp9/Installing_and_Configuring_the_Ethernet_SmoothStepper.pdf

http://warp9td.com/documentation/ESS-TroubleshootingGuide.pdf

6 WIRING SCHEMATICS and OTHER INFO

ETHERNET SMOOTHSTEPPER BOARD

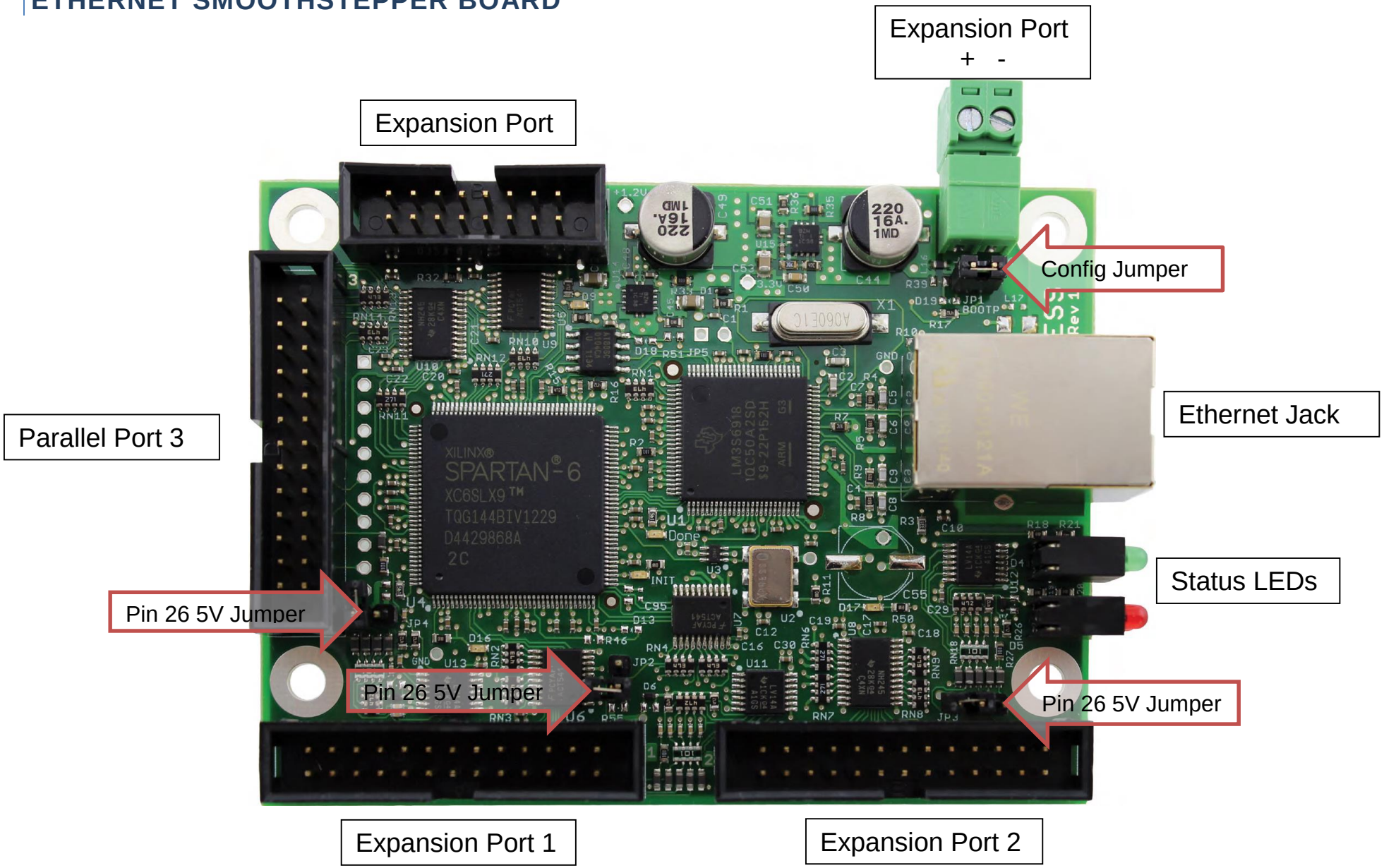

Figure 6-1 ESS Board

Ports 1, 2, and 3	Parallel Port connectors. These connectors are standard 26-pin low-profile male headers. If a ribbon cable is connected that has a DB25 on the other end, the DB25 will have the pinout of the Parallel Port of a PC.
External 5V Input	Power input for the board. This supply must be a regulated supply with a tolerance of ± 10% (± 5% is preferable).
Pin 26 5V Jumper for each port	Pin 26 of each header may be connected to the 5V power rail of the ESS board. Some breakout boards also have this feature, which enables one of the two boards to supply power to the other. This is a simple connection without any electronics involved. Multiple breakout boards with their own power supplies may be connected to the ESS. Be careful not to bridge the supplies!
Ethernet Jack	Connect a standard Ethernet twisted pair cable (CAT5 or better) with RJ45 connectors to this jack. Connect the other end to the computer or a network switch.
Status LEDs	Displays connection and fault status
Expansion Port	This connector will be used to connect to expansion boards that provide additional I/O. High-speed I/O will need to be on the main Port 1, 2, or 3 pins. The Expansion Port I/O will be suitable for slow-speed signals such as tool changers, relays, etc.
Config Jumper	This jumper is for programming the static IP address into the board. It may also be used for updating the boot loader in the microcontroller. For normal operation this jumper should be off.

Pins 1, 14, 16, and 17 of all 3 ports, plus pins 2 through 9 of Port 1

.

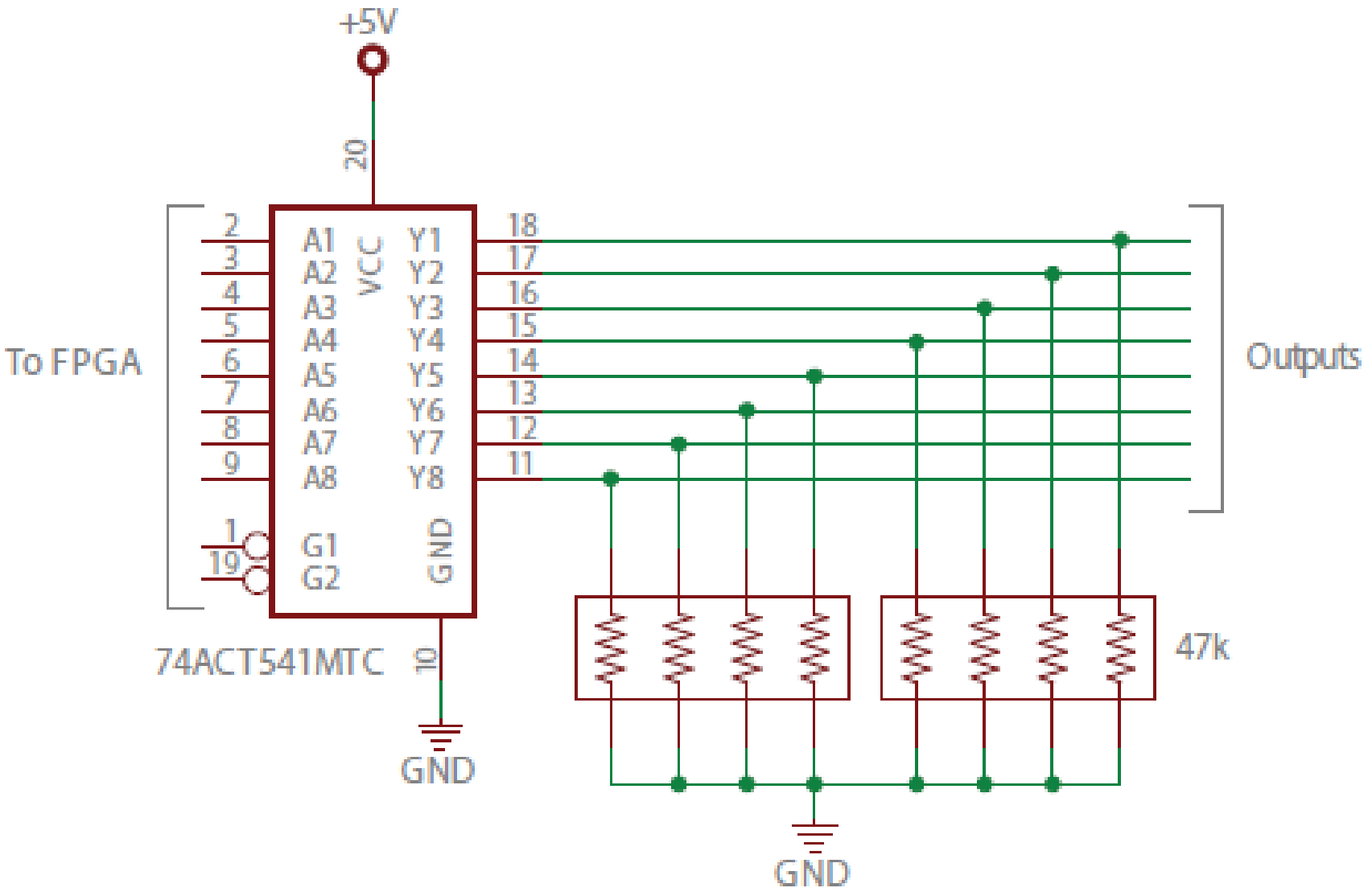

Figure 6-2 Pins 1, 14, 16, and 17 of all 3 ports, plus pins 2 through 9 of Port 1

Pins 2 through 9 of Ports 2 and 3

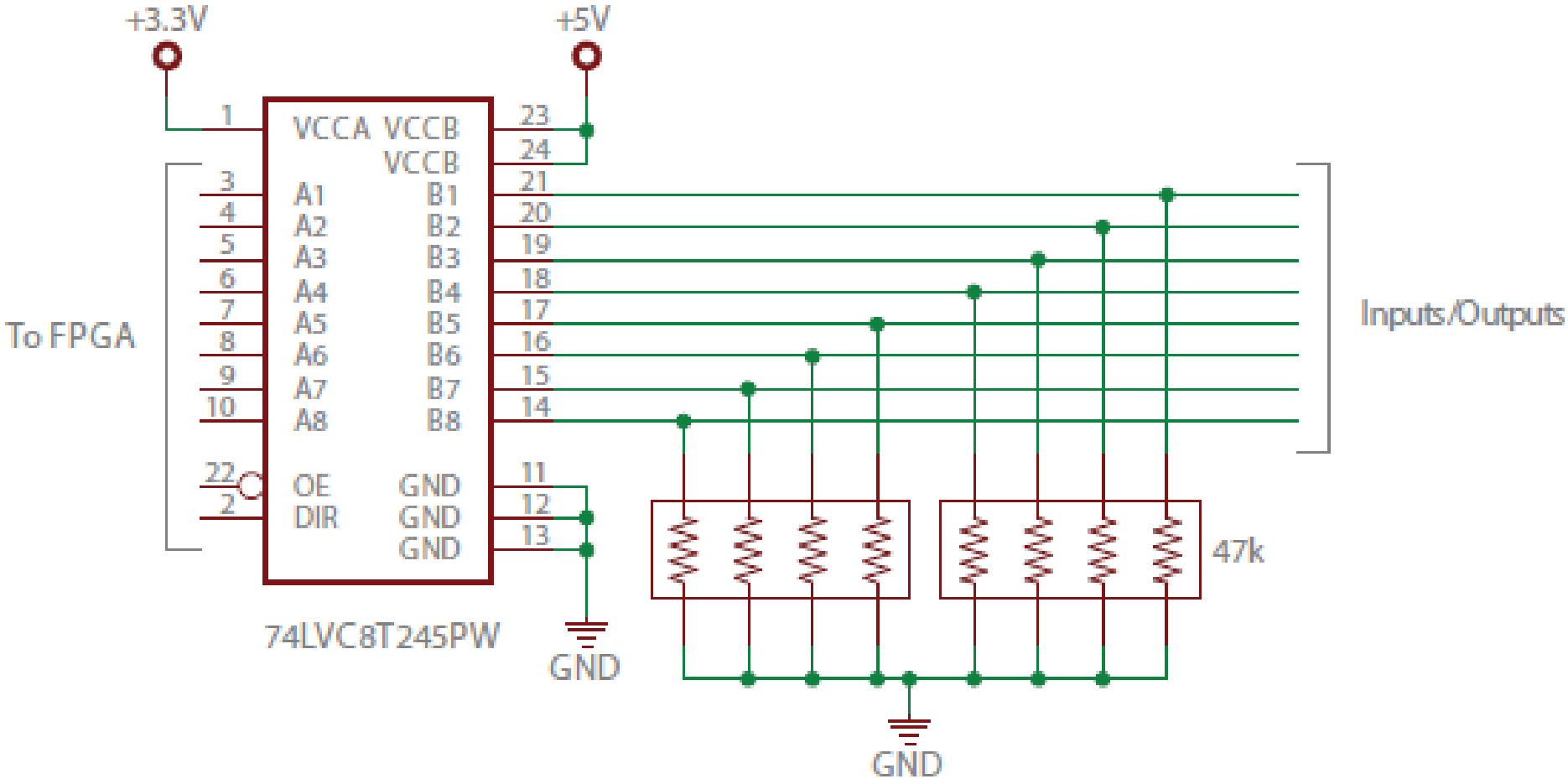

Figure 6-3 Pins 2 through 9 of Ports 2 and 3

The Expansion Port header is not operational this time.

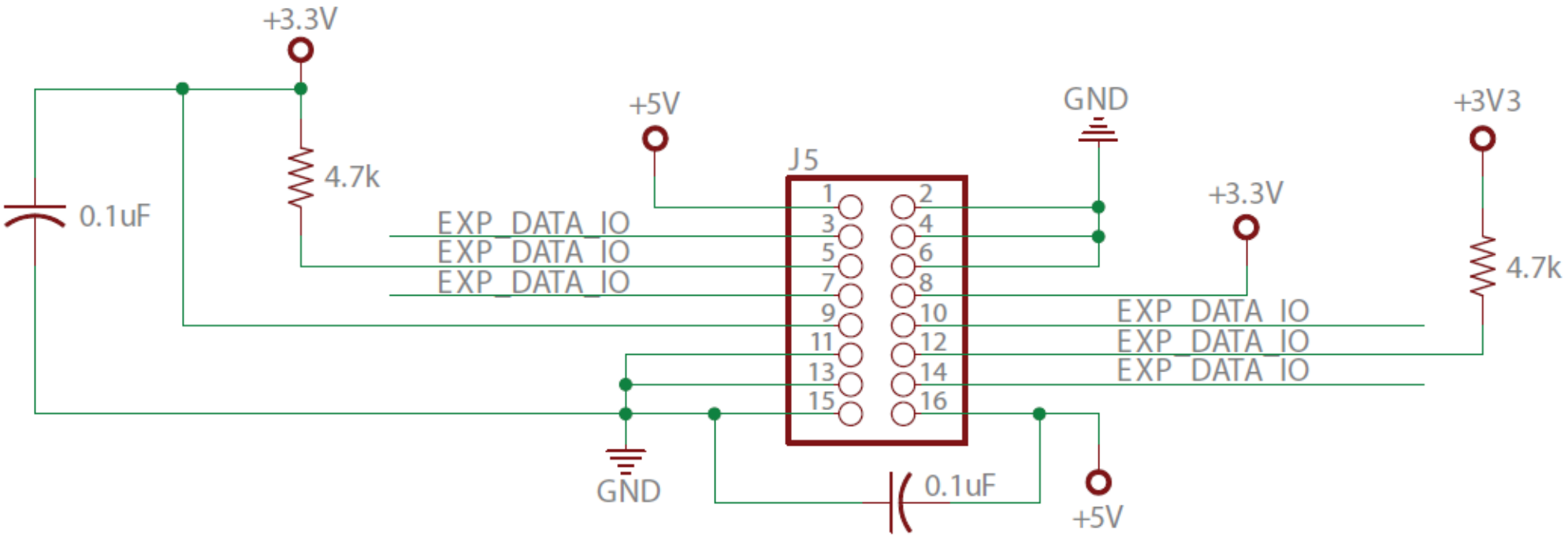

Figure 6-4 Expansion Port Header

DB25 TO 26-PIN LOW-PROFILE HEADER RIBBON CABLE

This schematic shows pictorially how the wires are oriented in a DB25 to 26-pin header ribbon cable. The pin numbering for the header is the unconventional numbering that matches the DB25.

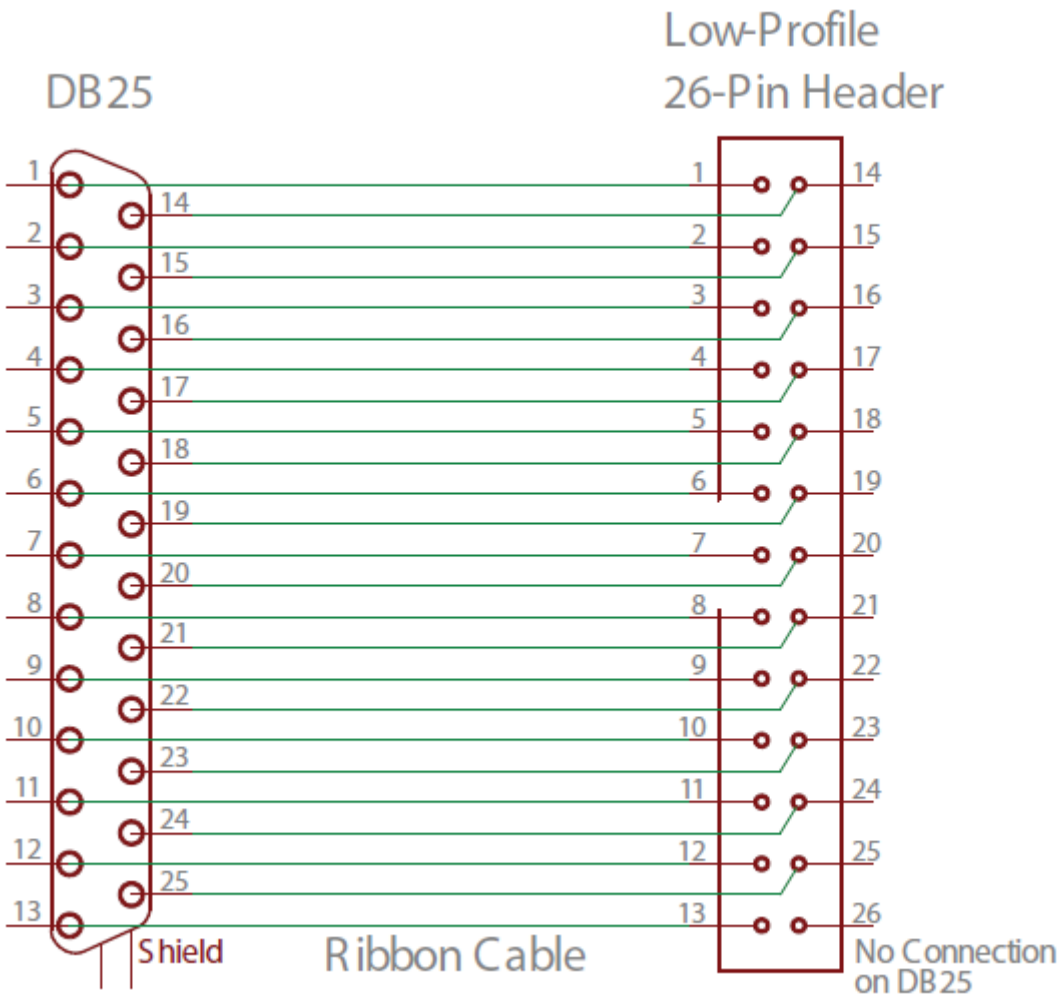

Figure 6-5 Ribbon Cable

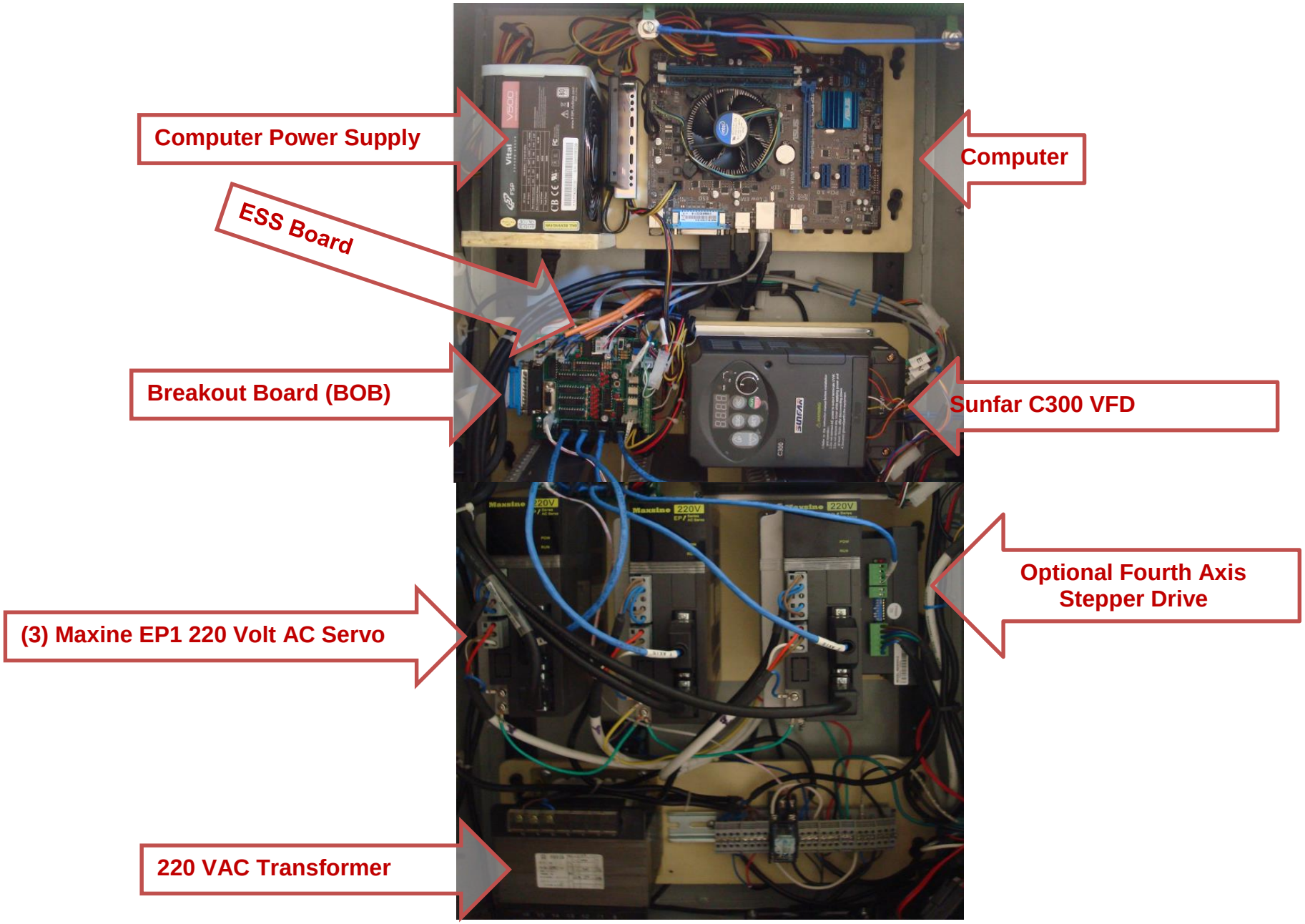

Figure 6-6 Typical Torus PRO Electrical Control Panel

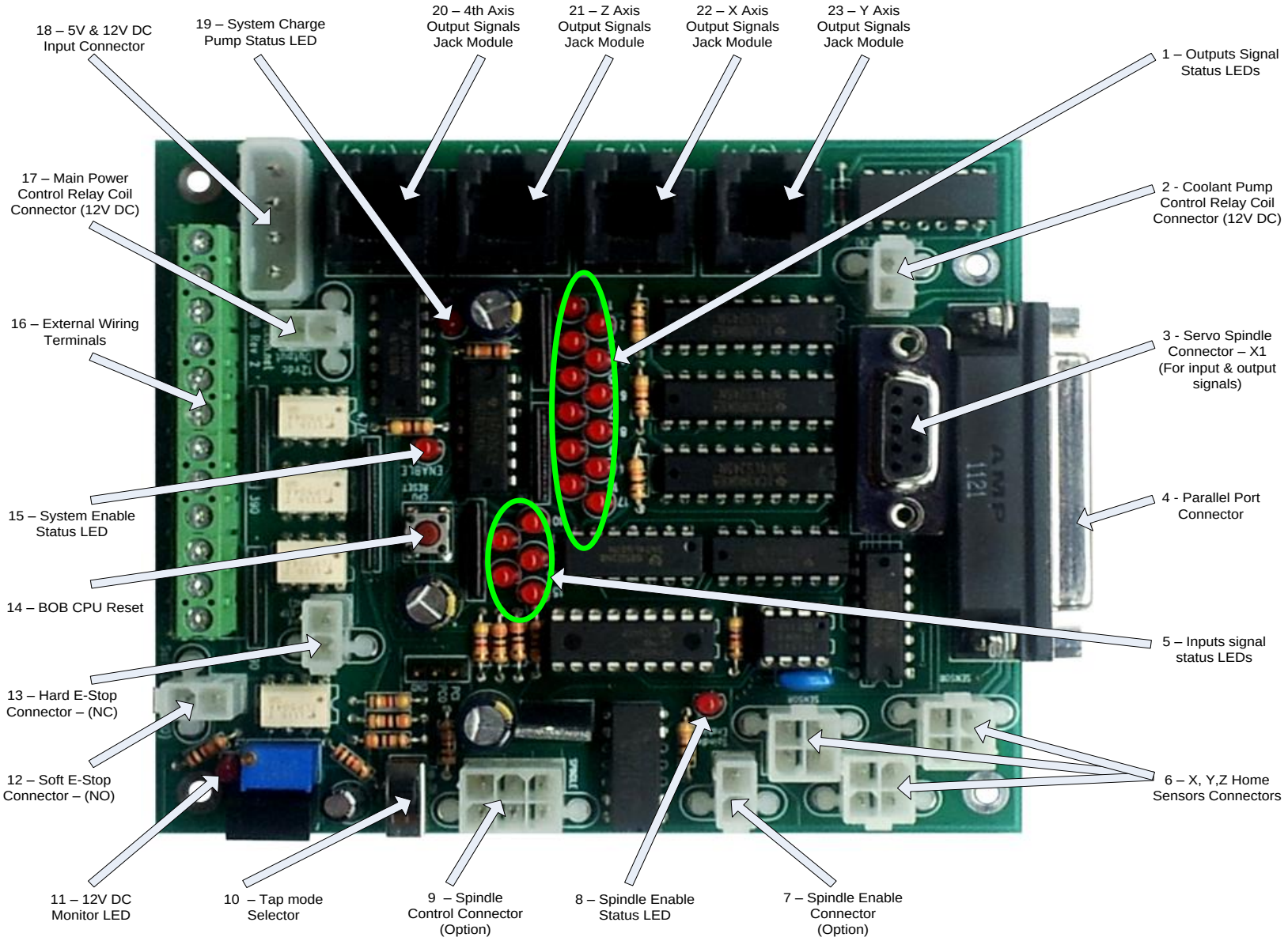

Figure 6-7 Novakon BOB Revision 2

Novakon BOB Rev 2 Item Description			
NO.	**Item**	**Description**	
Connectors			
2	Coolant Pump Control Relay Coil Connector	Output 9 controls 12 VDC output for relay coil to turn on/off coolant pump 220 VAC power	2 Wires
6	X, Y, Z Axis Home Sensors Connectors	The sensors share Input 11 to monitor HOME position. Any one of 3 axes reaches their home position will trigger the input	3 Wires (GND, 12 VDC, Signal)
7	Spindle Enable Connector (Option)	This connector can be used on some VFDs that have ENABLE terminals to enable/disable the VFD	2 Wires
9	Spindle Control Connector	Used by the VFD for signal input/output except for Servo Drive	3 Wires for Torus PRO Mill
12	Soft E-Stop Connector (N.O.)	Input 10 monitors E-stop status to enable/disable Mach3 Reset	2 Wires
13	Hard E-Stop Connector (N.C.)	Connector is used to cut off the machine's main power when E-stop is pressed through the main power relay	2 Wires
17	Main Power Control Relay Coil Connector	Provides 12 VDC for main power relay coil when BOB becomes activated	2 Wires
18	5 &12 VDC Input Connector	This power comes from the PC power supply	

MOD JACK 6P6C			
20	4th Axis Output Signals Jack Module	The Jack module outputs signals to stepper drivers (Puls+, Puls-, Dir+, Dir-) through Outputs 7 & 8	Pin 7: Puls+; Pin 8: Dir+; GND: Puls-, Dir-
21	Z-Axis Output Signals Jack Module	The Jack module outputs signals to stepper drivers (Puls+, Puls-, Dir+, Dir-) through Outputs 5 & 6	Pin 5: Puls+; Pin 6: Dir+; GND: Puls-, Dir-
22	X-Axis Output Signals Jack Module	The Jack module outputs signals to stepper drivers (Puls+, Puls-, Dir+, Dir-) through Outputs 1 & 2	Pin 1: Puls+; Pin 2: Dir+; GND: Puls-, Dir-
23	Y-Axis Output Signals Jack Module	The Jack module outputs signals to stepper drivers (Puls+, Puls-, Dir+, Dir-) through Outputs 3 & 4	Pin 3: Puls+; Pin 4: Dir+; GND: Puls-, Dir-
Button & Switch			
10	Tap Mode Selector	When selected Tap ON	
14	BOB CPU Reset	Press the reset button; the BOB will reset the CPU program	
Terminals			
16	External Wiring Terminals	The terminal can accept external inputs and be used for input/output source for +12DC, +5VDC and GND	
D-sub Connectors			
3	Servo Spindle Connector – X1	For servo spindle drive (if available), the connector is used for input and output signals	DB9 Female
4	Parallel Port Connector	The parallel port connector is used for communicating between the computer and Mach3	DB25 Female

Status LEDs			
1	Outputs Signal Status LEDs	Indicates the status of all the outputs (High or Low)	
5	Inputs Signal Status LEDs	Indicates the status of all the inputs (High or Low)	
8	Spindle Enable Status LED	Indicates the spindle VFD; Enable: light is ON; Disable: light is OFF	
11	12 VDC Monitor LED	Indicates that the 5 to 12 VDC converter is working; Good: light is ON; Failing: light is OFF	
15	System Enable Status LED	Indicates Mach3 is in control of the system; Yes: light is ON; No: light is OFF	Depressing the Mach3 Reset button, the LED should be ON
19	System Charge Pump Status LED	When BOB is power ON, the LED will blink at a SLOW rate; When the PC is communicating properly, the LED will blink at a FAST rate; When the LED is OFF or steady ON, the BOB will need resetting	

Note: BOB VER 2 input voltage:

Computer power supply 5 VDC & 12 VDC

5 VDC load current; 400-420mA

12 VDC load current; 80-90mA without running coolant pump relay; 160mA when coolant pump is on