



Enabling Your Ideas

Technical Document

PCNC Series 3 Upgrade

Product Identification:

- Series 3 Motion Upgrade Kit for PCNC 1100 (PN 32010) with Leadshine Drivers (Serial Numbers 1-999)
- Series 3 Motion Upgrade Kit for PCNC 1100 (PN 31999) with Leadshine Drivers (Serial Numbers 1000-1999)

Purpose: This document details installation of the PCNC 1100 series 3 upgrade kit in five sections:

Control Board Installation Driver Installation
 DC Bus Board Installation Brake Relay Wiring
 Motor Installation

IMPORTANT! Mills with serial number 001-1325 require installation of the Spindle Drive Upgrade Kit (PN 31090) before performing the series 3 upgrade.



Series 3 Motion Upgrade Kit for PCNC 1100 (PN 31999)			Series 3 Motion Upgrade Kit for PCNC 1100 (PN 32010)		
Qty.		PN	Qty.		PN
3	Axis Driver	32000	3	Axis Driver	32000
1	Z-axis Motor with Brake	32002	1	Z-axis Motor with Brake	32002
2	X- and Y-Axis Motors	32001	2	X- and Y-Axis Motors	32001
1	Machine Control Board	31045	1	Machine Control Board	31045
1	Wire w/ 326 printed on both ends and one crimp-on connector	–	1	Wire w/ 326 printed on both ends and one crimp-on connector	–
1	Wire label, #330	–	1	Wire label, #330	–
				Driver mounting brackets and fasteners (machine serial numbers 1-999 only)	32273
				DC Bus Board (machine serial numbers 1-999 only)	32005
			2	Discrete wires used for brake control (numbered 328 and 329, machine serial numbers 1-999 only)	–

NOTE: If any of these items are missing, contact Tormach Customer Service for a replacement at (608) 849-8381.

NOTE: Perform gib adjustment procedure before performing this upgrade. For more information, refer to Operator Manual chapter 9, Maintenance.

NOTE: Mills serial number 001-036 may require an additional ribbon cable to complete upgrade. If you have a mill in this serial number range, contact Tormach to receive a new J6 Cable (PN 30686).



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The instructions in section two (DC Bus Board Installation) only need to be performed if the DC Bus Board on your mill does not have wiring for a Z-axis brake and brake relay. Newer mills (serial numbers 1000 and above) or mills that previously had a Z-axis brake upgrade kit installed do not require this procedure.

Control Board Installation

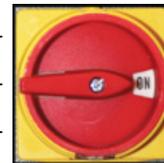
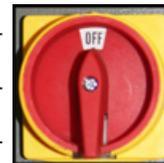
1. Move the machine table to a position where you can open the electrical cabinet, and move the Z-axis to a position where you can block it with a piece of wood.
2. Power off mill according to *Power Off/On Procedure* detailed below.



WARNING! Electrical Shock Hazard: Be sure to power off machine before making any electrical modifications. Failure to do so may result in serious injury or death.

Power Off/On Procedure

Power Off	1. Push red <i>E-stop</i> button in
	2. Click <i>Exit</i> on screen; when prompted click <i>OK</i> to power off
	3. Turn Main Disconnect <i>Off</i> (see image at right)
Power On	1. Turn Main Disconnect <i>On</i> (see image at right)
	2. After software loads, turn red <i>E-stop</i> clockwise to release
	3. Press green <i>Start</i> button
	4. Click <i>Reset</i> on screen



3. Remove all wire harnesses from the control board including three ribbon cable connectors and three green connection headers. Note the position of these connections, especially the two 25-pin ribbon cables at the bottom.

NOTE: Green connector headers come off control board as a unit; do not remove individual wires from board (see **Figure 1**).

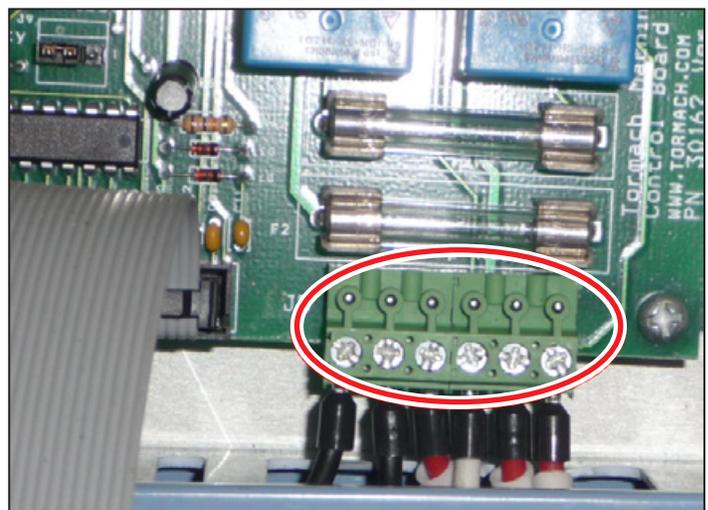


Figure 1

- Remove four *Mounting Screws* located in the four corners of the control board; remove control board (see **Figure 2**).

NOTE: To receive core refund, please wrap the old control board in the same bubble wrap that the new board came in, place in the shipping box and mail back to Tormach.

- To install the replacement board, reverse the above procedure. Take care to properly seat all connections without putting undue stress on the control board. The new board has the same part number, but one of the main circuit chips has a *Series 3* label on it (see **Figure 2**).

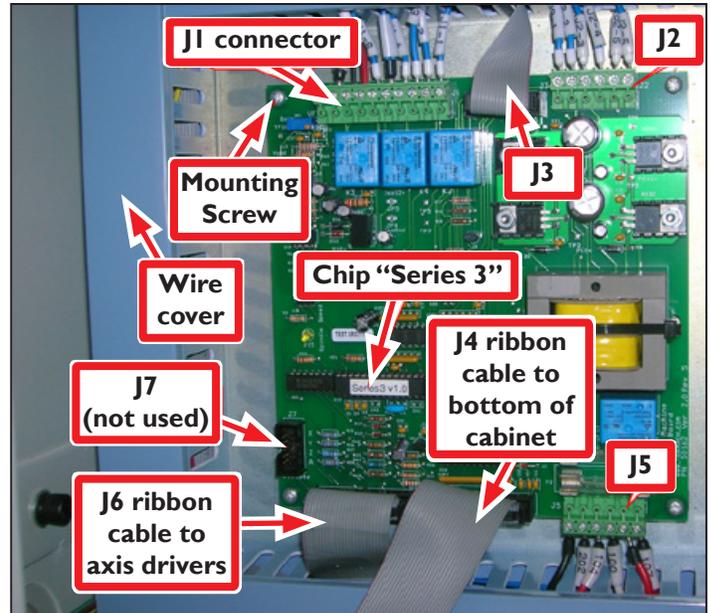


Figure 2

DC Bus Board Installation

NOTE: This step only needs to be performed if the DC bus board on your mill does not have wiring for a Z-axis brake and brake relay. Owners of newer mills – serial numbers 1000 and above – or mills that previously had a Z-axis brake upgrade kit installed, can skip this section.

- Remove DC bus board; set aside standoffs and screws.
- Replace with new board using standoffs and screws.

NOTE: Tacking standoffs in place with a hot glue gun before mounting board makes replacement easier. To do this, put a dab of glue on fasteners before inserting them through board holes and standoffs (see **Figure 3**).



Figure 3

3. Transfer wires as shown in **Figure 4** for series 3 mills and **Figure 5** for series II mills. For now, leave wires 326-329 unconnected. These connections will be covered in the section five.
4. Double check the polarity of the CAP and axis driver connections.

IMPORTANT! Reversed polarity will destroy the axis drivers.

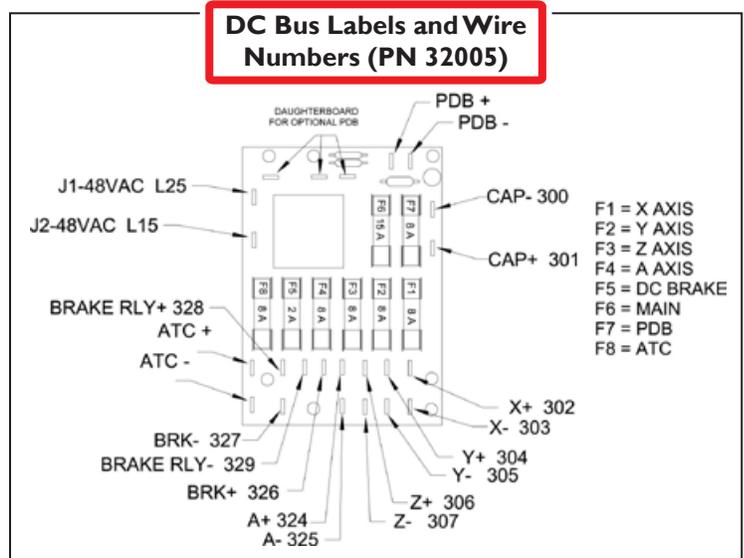


Figure 4

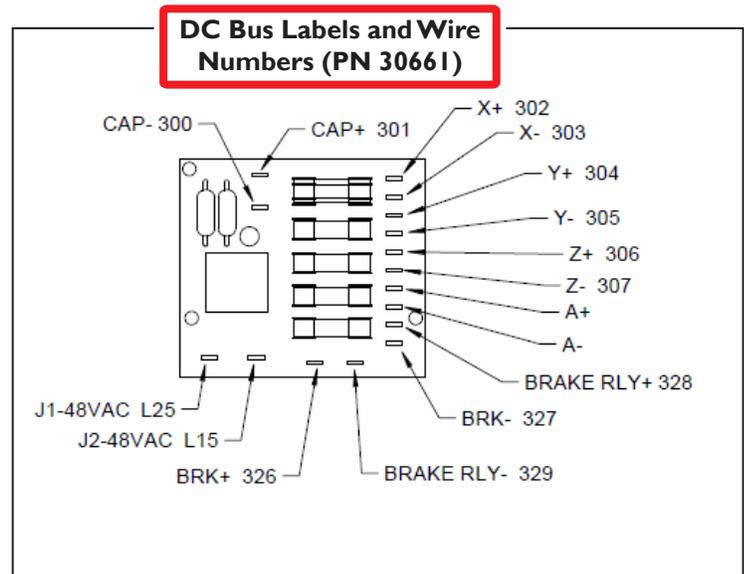


Figure 5

Motor Installation

1. If necessary, move mill to allow access to back of mill.
2. If mill is fitted with Deluxe Machine Stand (PN 30297), remove backsplash from coolant tray.
3. Remove *Motor Mount Cover Plates* from X-, Y-, and Z-axis motors (see **Figure 6**).

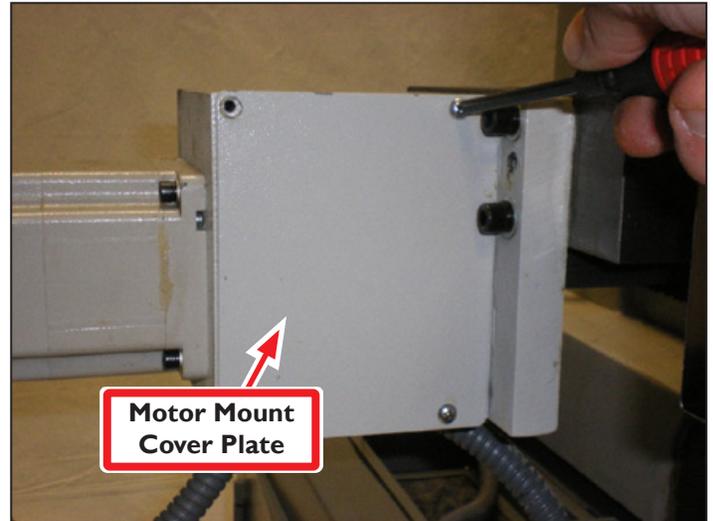


Figure 6

4. Remove *Z Column Cover Plate* (see **Figure 7**).



Figure 7

5. Complete the following procedures for each axis:

A. Loosen motor coupler socket head cap screws with a 4 mm hex wrench.

IMPORTANT! Z-axis must be blocked up or it may fall under its own weight when motor coupler is loosened or Z-axis brake is manually disengaged (see **Figure 8**).

B. Remove motor by loosening and removing four socket head cap screws attaching motor to mount.

C. Loosen conduit fitting on back of motor and pull back the *Flexible Metal Conduit* slightly to expose motor wires (see **Figure 9**).

D. Inspect *Flexible Metal Conduit* (PN 30627) for cracks, breaks, or sharp edges; damaged conduit can lead to motor wire failure.

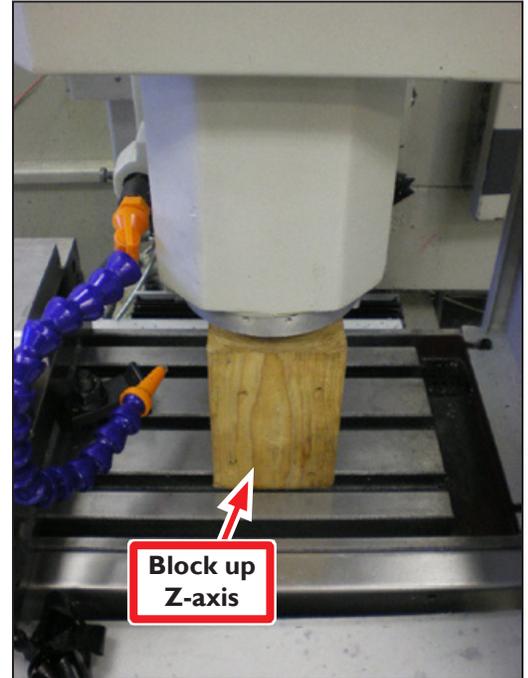


Figure 8

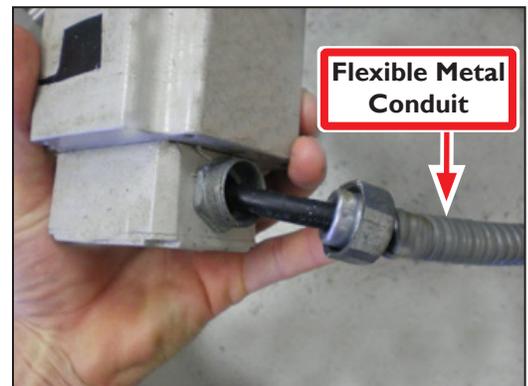


Figure 9

E. Remove motor back cover plate and disconnect or cut wires coming out of back of motor (see **Figure 10**).

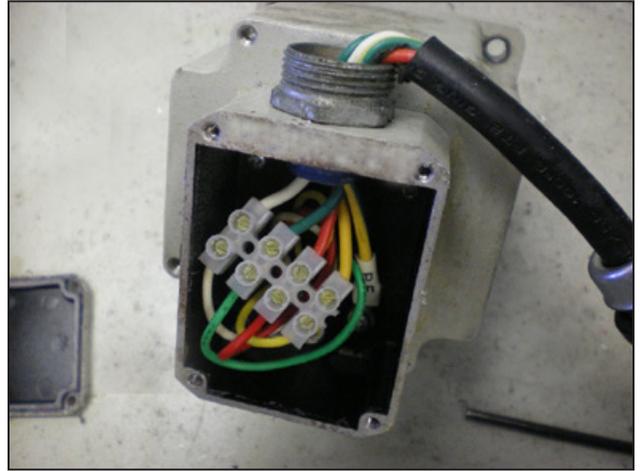


Figure 10

F. Remove old conduit coupling, rubber grommet, and conduit insert and replace with new parts (see **Figure 11**). Note that old conduit coupling may not have same thread pitch as new motors' conduit couplings. It is best to use the new parts instead of trying to reuse the old.

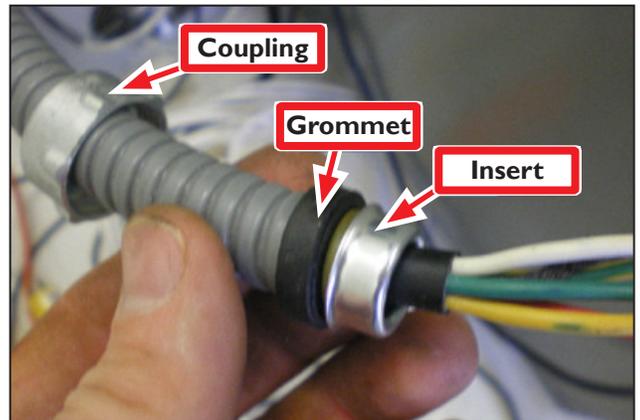


Figure 11

G. Splice new motor wires to old wires with electrical tape as shown in **Figure 12**. Use old wires to pull new wires through flex conduit and into mill column.

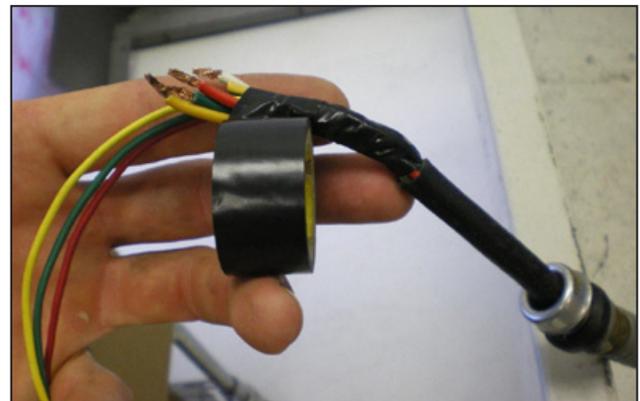


Figure 12

H. Pull wires into electrical cabinet, guiding them through column. Take care not to damage wire insulation as they are pulled through column.

I. After wires have been pulled through to the electrical cabinet, remove splice by unwrapping electrical tape. Leave wires loose in the electrical cabinet; this is covered in *Driver Installation* section.

J. Attach motor to motor mount using the four socket head cap screws removed in step B.

K. Tighten motor coupler. It is a good practice to align the flat on motor with keyway on ballscrew, and to position coupler so that the gap in the coupler is over the flat and keyway. This maximizes contact area of the surfaces being gripped.

L. Replace motor mount cover.

6. Repeat steps A through L for remaining motors.

NOTE: Ensure Z-axis brake is engaged after installing the Z-axis motor. Brake is engaged when brake lever is parallel to X-axis as shown in **Figure 14**.

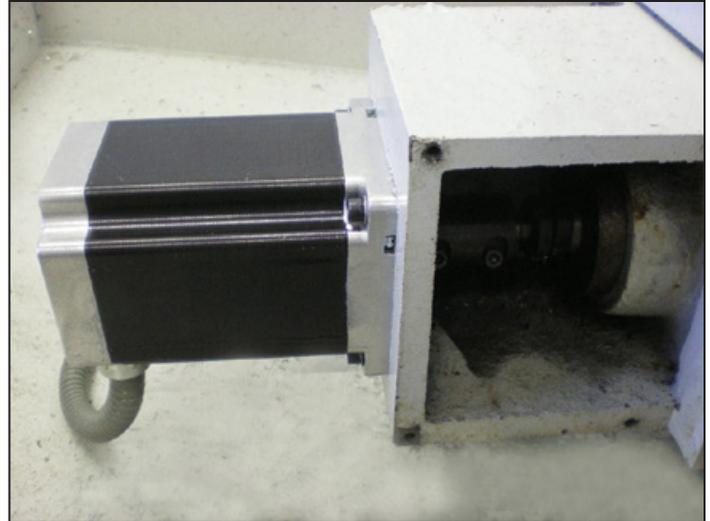


Figure 13

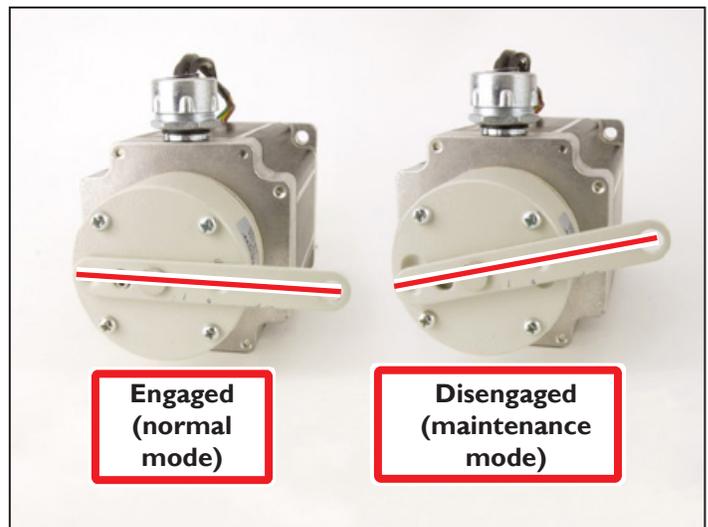


Figure 14

Driver Installation

When all three motors have been installed and the motor wires are run through the conduit into the cabinet, install the new drivers. Mills with serial numbers 001-999 also require mounting brackets installation to adapt the mounting hole pattern of the new drivers to the pre-existing tapped holes in the electrical cabinet.

1. Remove appropriate wire tray covers and remove the old motor wires from the axis driver terminal blocks. Then remove old motor wires from the cabinet. This includes removing Z-axis brake wires (#326 and #327 on mills with serial numbers 1000-2000) from their terminals on the DC bus board.
2. Unplug power and control cables from the old axis drivers, then remove the old axis drivers.
3. Remove power wires (302/303, 304/305, or 306/307 depending on axis) from the old terminal blocks.
4. Install new drivers. 3-digit mill require installation of driver mounting brackets included with upgrade kit.
5. Ensure dip switch settings are correct: Switches 6 and 8 should be off, all others should be on (see **Figure 15**).
6. Connect ribbon cable to driver.
7. Connect power leads to driver. Wires 303, 305, 307 go to GND on X, Y and Z drivers respectively. Wires 302, 304, and 306 go to VDC on X, Y and Z drivers respectively (see **Figure 15**).

IMPORTANT! Getting polarity right is critical; reversing VDC and GND connections will destroy driver. When in doubt, check with a multimeter before connecting power to driver.

8. Strip back 1/4" of the motor leads, and connect motor leads to the driver: Red to U, Green to V, Yellow to W.

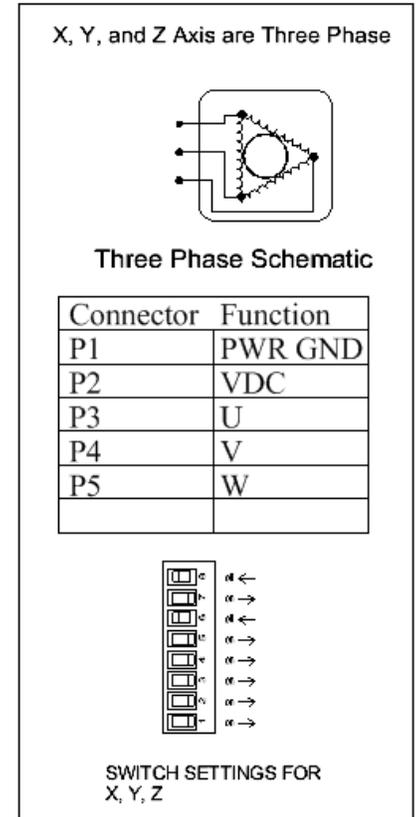


Figure 15

Brake Relay Wiring

For mills with serial numbers 001-999

1. The series 3 upgrade kit for mills serial numbers 001-999 comes with three pre-labeled wires: 326, 328, and 329. Connect the spade terminal ends of #328 and #329 to the DC bus board. #328 should be connected to "BRAKE RLY +" and #329 should be connected to "BRAKE RLY -" (see Figure 4).
2. These two wires need to be run over to contactor C1 and connected to one of the contactors normally open contacts.
 - A. Using a screwdriver, insert the U-shaped terminal of wire #328 into L1 of contactor C1 (see Figure 17).

NOTE: On some early mills, L1 may be occupied by another wire. In this instance, use any open terminal on C1.

- B. Insert the U-shaped terminal (line #329) T1 of contactor C1.

NOTE: If you used a terminal other than L1, use the corresponding T terminal.

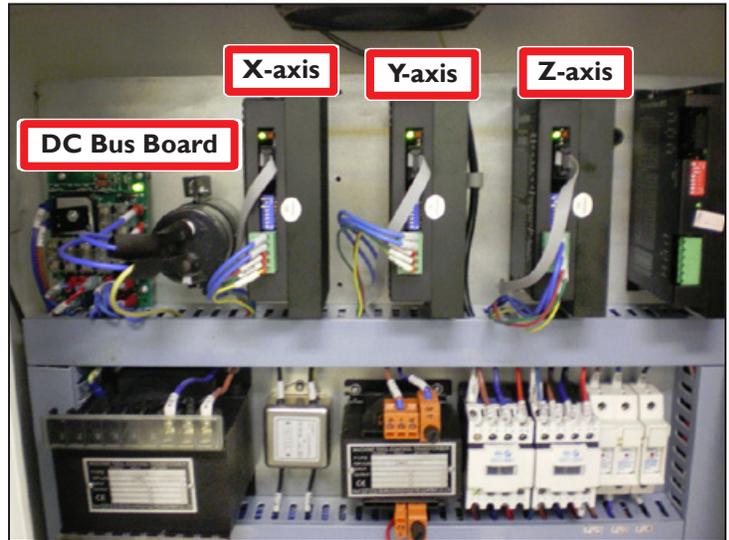


Figure 16



Figure 17

For all mills

1. Connect the spade terminal end of wire #326 to the DC bus board BRK+ terminal (see **Figure 18** and **Figure 19**).



Figure 18

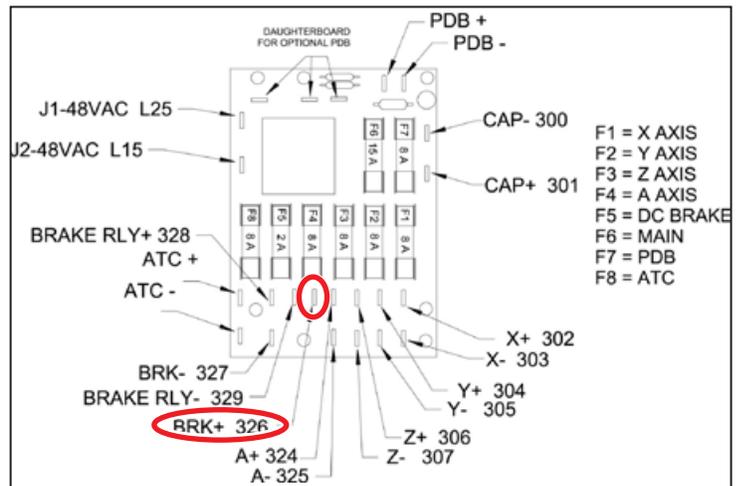


Figure 19

2. Route wire #326 through the cable tray to the J1 connector on the machine control board. Insert it in the J1-7 position (see **Figure 20**) and tighten the screw terminal with a small flat blade screwdriver.
3. Route the Z-axis brake wire labeled #330 through the wire trays to the J1 connector, and insert it into position J1-8 (see **Figure 20**). Tighten the screw terminal.
4. Connect Z-axis brake wire #327 to the BRK-terminal on the DC bus board.

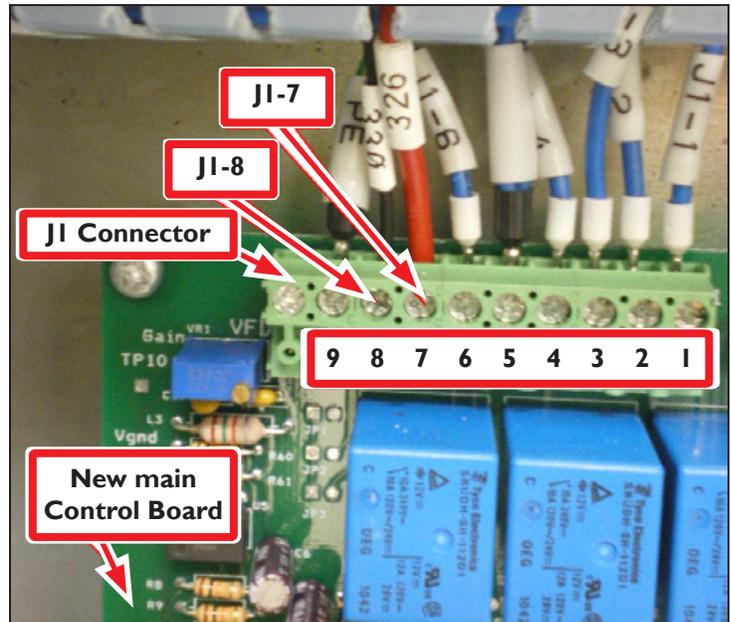
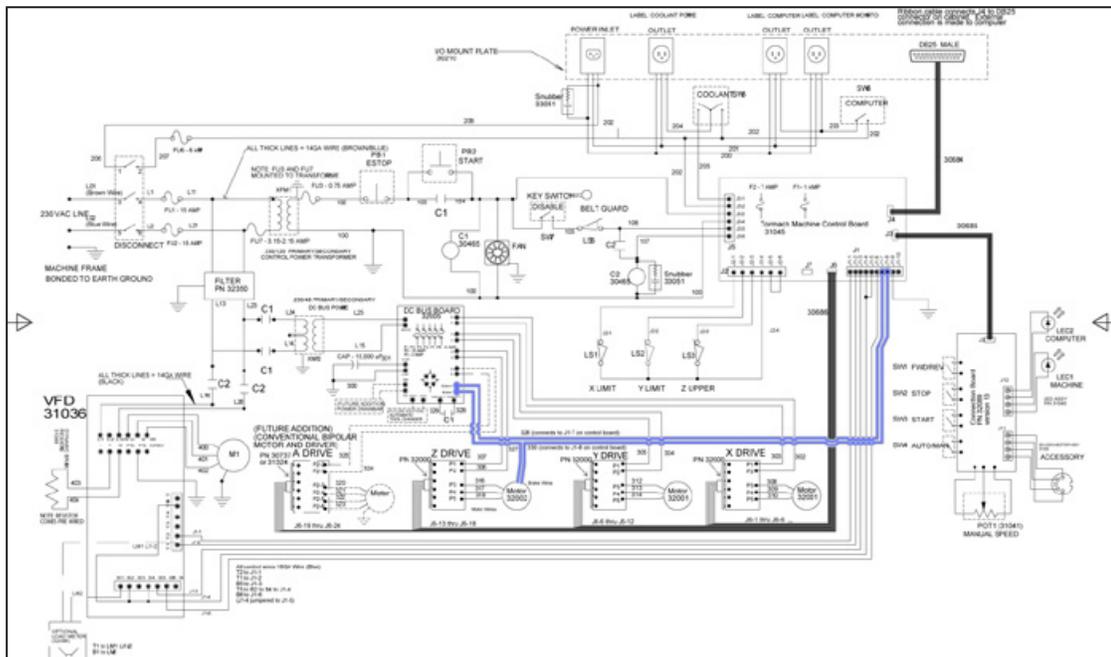


Figure 20



Once the hardware installation is complete, you will need to change the machine software configuration to match the hardware change. Type *ADMIN CONFIG* into the MDI line on your PathPilot interface and follow on-screen instructions to choose the appropriate configuration.