

TECHNICAL DOCUMENT

SPINDLE DRIVE UPGRADE

Product Identification: Spindle Drive Upgrade Kit (PN 31090)

Purpose: This document details installation, spindle calibration, and operation of the PCNC 1100 Spindle Drive Upgrade Kit.

IMPORTANT! This upgrade kit will not work with ground fault interrupters (GFI or RCCB in Europe).

Qty.	Spindle Drive Upgrade Kit	PN
4	M4 × 10 mm Spacer	31088
4	M4 × 10 mm Screw	30537
4	M4 Flat Washer	31087
1	VFD Motor Drive Assembly	31036
1	Machine Control Board	31045
1	D40194 VFD Upgrade Assy	—

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

Tools Required:

- #2 Phillips Screwdriver
- 1/4 in. Flat-Blade Screwdriver
- 1/8 in. Flat-Blade Screwdriver
- Wire Cutter
- Wire Stripper

Installation

Removing Existing Drive



1. Power off mill according to *Power On/Off Procedure* detailed on the next page.



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⚠ 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 E-stop clockwise to release	
	3. Press green <i>Start</i> button	
	4. Click <i>Reset</i> on screen	

3. Remove the cover of the upper and lower wire trough inside the electrical cabinet (see **Figure 1**).
4. Detach and remove all wires from the existing drive.

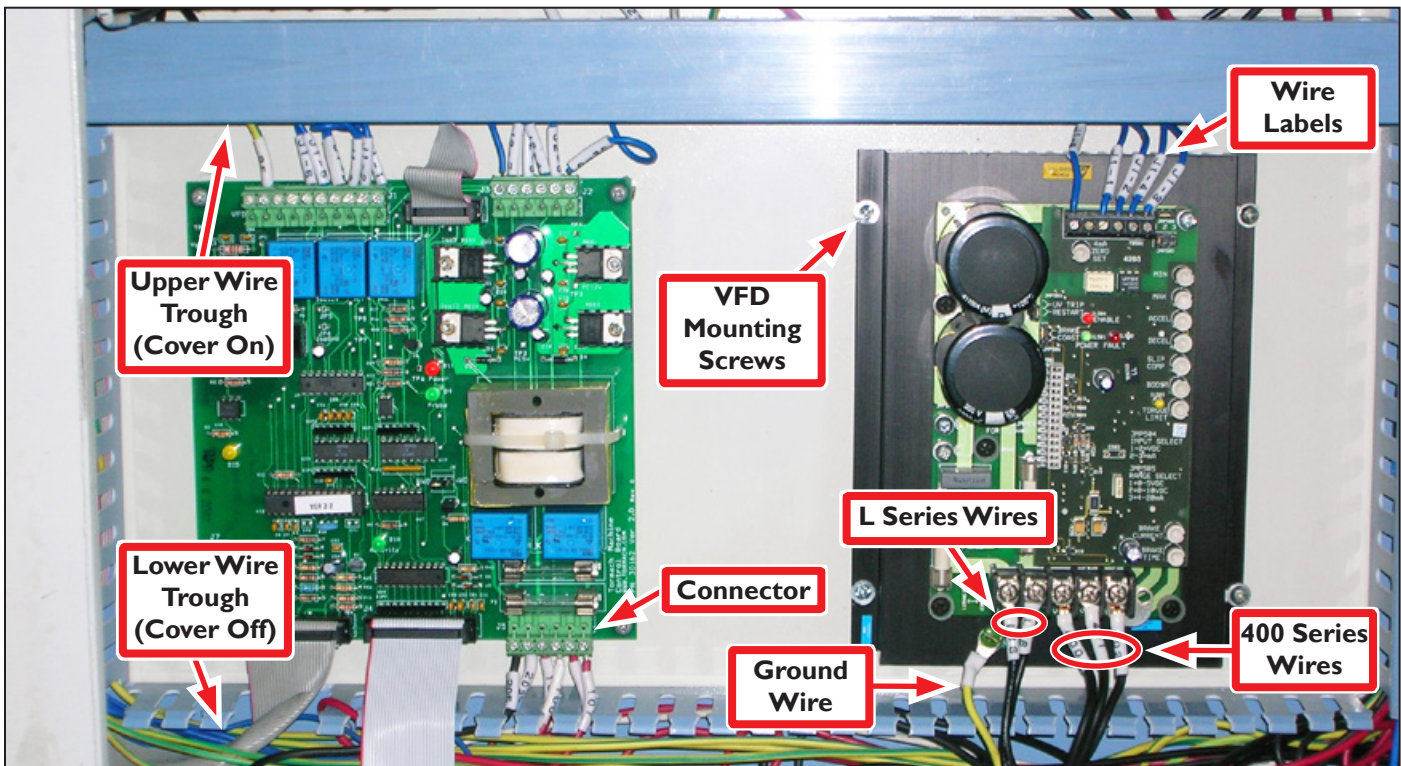


Figure 1

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NOTE: If any wires are missing wire labels (see **Figure 1**), note their connection labels as shown in **Figure 2** and tag them with the extra wire labels (included).

5. Remove and discard four VFD mounting screws that secure the drive to the back panel of the electrical cabinet (see **Figure 1**).

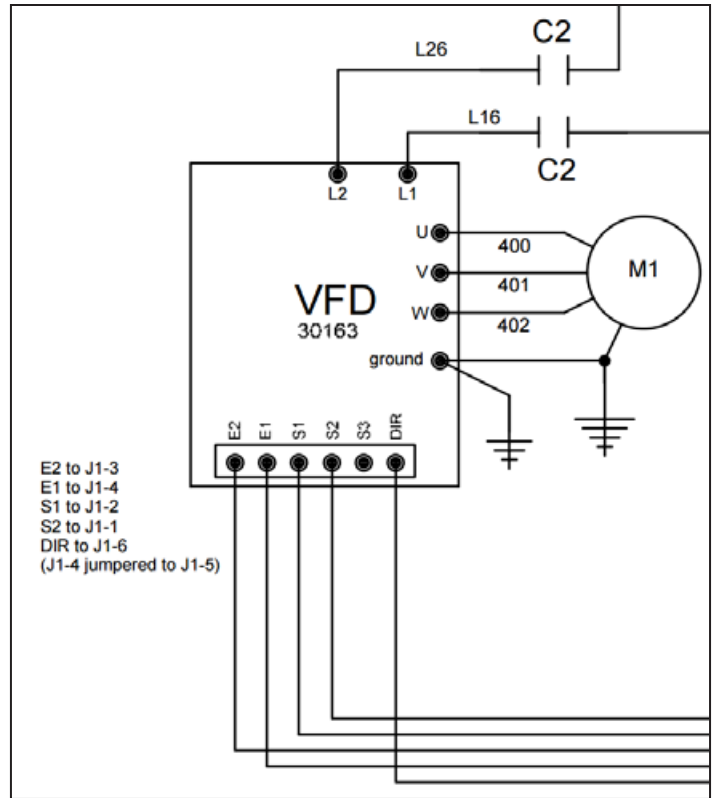


Figure 2

Re-labeling Lower Drive Wires

1. Identify wire L16, L26, 400, 401, and 402 in the lower wire trough (see **Figure 1**).
2. Match each wire label (included) to each wire; put the new wire label below the existing label, as shown in **Figure 3**.
3. Using a wire cutter, remove existing fork crimps at the location indicated in **Figure 3**.

NOTE: Do not to remove any more wire than is needed.

4. Remove the original wire label and strip the wire 1/4 in. from its end (see **Figure 3 inset**).

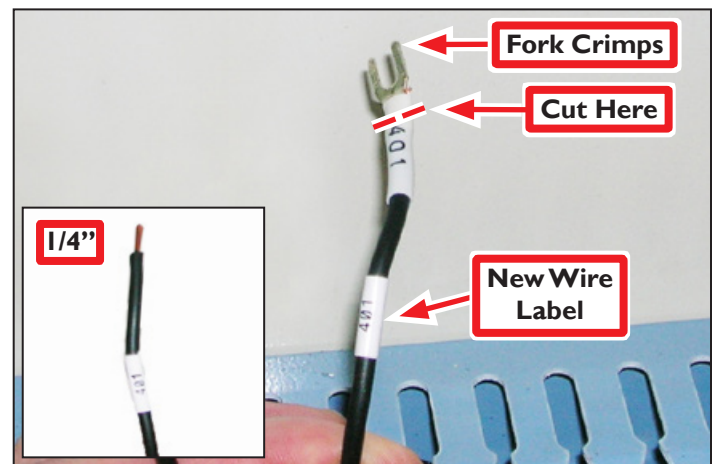


Figure 3

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Mounting VFD Motor Drive Assembly

1. Put four M4 × 10 mm spacers (included) into the four mounting holes that were previously used for the original drive (see **Figure 4**).

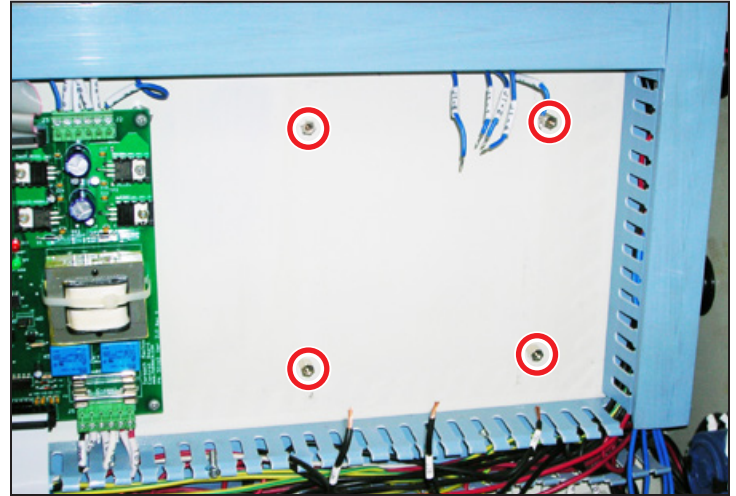


Figure 4

2. Using four M4 × 10 mm screws and four M4 flat washers (both included), mount the VFD motor drive assembly onto the spacers that you installed in Step 1 (see **Figure 5**).

NOTE: On some mills, the vertical space between the wire troughs may be too tight to fit the VFD motor drive assembly. In this case, adjust the lower wire trough and remount.

IMPORTANT! Be careful to not damage any wires in the wire trough.



Figure 5

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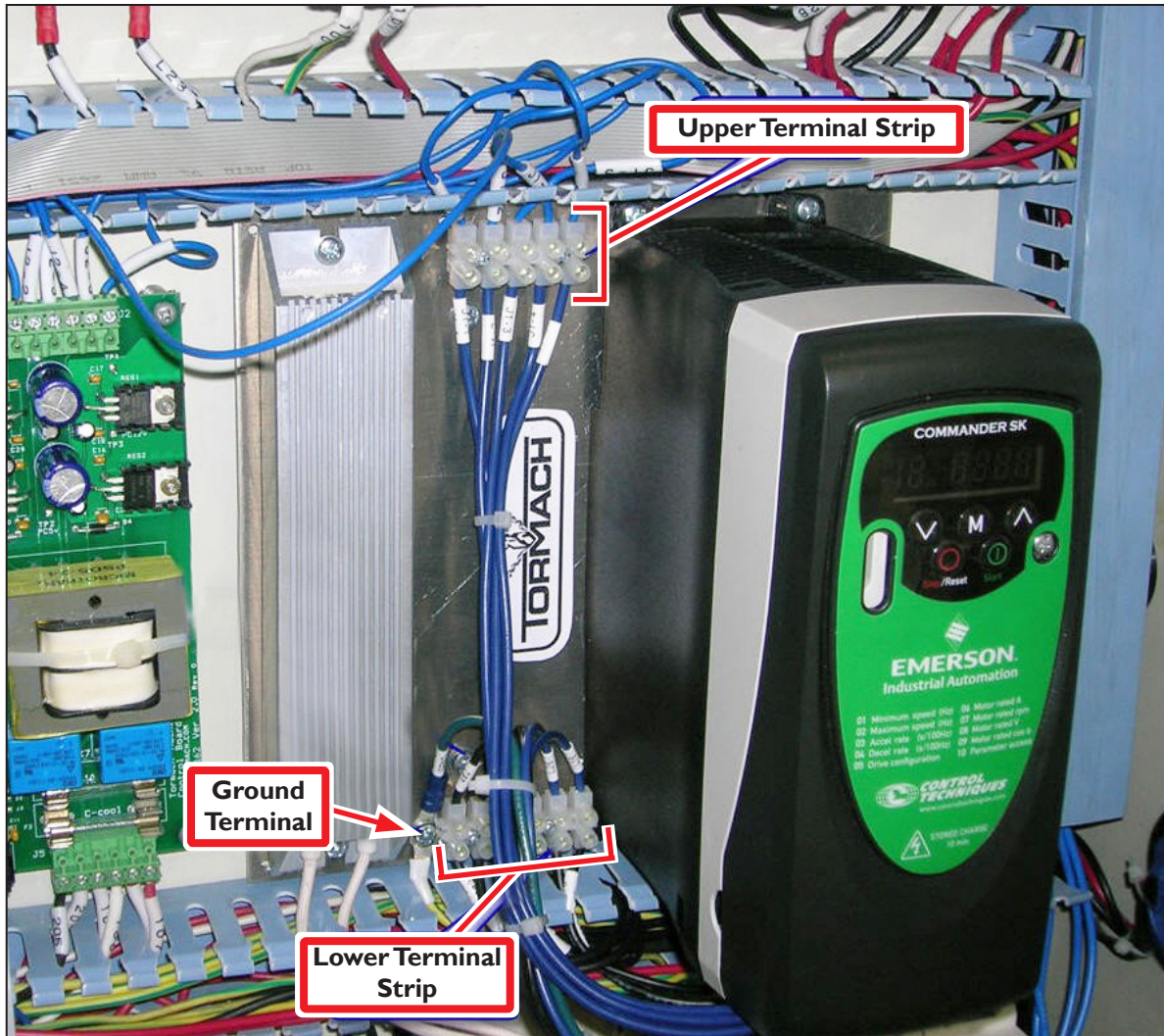


Figure 6

Wiring VFD Motor Drive Assembly

1. Identify wires from the upper wire trough; these connect to the upper terminal strip on the VFD motor drive assembly (see **Figure 6**).
2. Refer to the included drawing (D40194) to make specific wiring connections on the upper terminal strip.
3. Repeat Steps 1 through 2 for the lower wire trough and its corresponding wiring connections on the lower terminal strip (see **Figure 6**).

NOTE: If the space is too tight to connect the wires, remove the two screws holding down each terminal strip and make the wiring connections. Remount both terminal strips when wiring is complete.

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4. Some older mills may have wire numbers that do not correspond to wires labeled J1 in this upgrade kit. Refer to the table below for correct wiring on older mills:

Original Spindle Drive Wire Number	Spindle Drive Upgrade Kit Wire Number
S2	J1-1
S1	J1-2
E2	J1-3
E1	J1-4
DIR	J1-6

5. Using the included drawing (D40194), make the correct ground wire connection (see **Figure 6**).

IMPORTANT! Ensure there are no loose wire strands at the terminal strip that may come in contact with another wire.

Mounting New Machine Control Board

1. Remove all wire harnesses from the existing control board.

NOTE: Discrete wires are connected through the use of multi-terminal connectors that mount to the control board. Do not remove individual wires; remove the entire connector from the control board (see **Figure 1**).

2. Remove the four mounting screws and the original control board from the electrical cabinet. Replace it with the included machine control board, and reconnect the wire harnesses.
3. To receive your core refund deposit (that you made when purchasing the Spindle Drive Upgrade Kit), you must return the original control board to Tormach.

New Configuration

The VFD motor drive requires a different machine configuration in PathPilot.


1. Power on the mill according to the *Power On/Off Procedure* detailed earlier in this document.
2. Set the spindle mode switch to **AUTO** on the operator panel.
3. From the PathPilot interface, type **ADMIN CONFIG** in the MDI line.
4. Following on-screen instructions, select correct configuration for your specific machine.

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Spindle Calibration

To improve spindle speed accuracy, calibrate the controller to the Spindle Drive Upgrade Kit. This procedure is not necessary for mill operation.


This procedure requires access to the electrical cabinet while the mill is powered on.

 **CAUTION! Electric Shock Risk:** Points within the electrical cabinet contain high voltage. Do not make contact with any part of electrical cabinet unless specifically instructed to do so. Failure to do so could result in serious injury.

1. From the PathPilot interface, toggle the spindle belt position: click **Spindle Range** until the LED light is illuminated next to **LO**.

IMPORTANT! Ensure the spindle belt is in the low position. A mismatch between the spindle range button and actual spindle belt position will result in the commanded speed being different from the indicated RPMs.

2. Set the spindle speed to 500 RPM:
 - a. In the MDI line, type **S500** and press Enter.
 - b. In the Spindle DRO, type **500** and press Enter.

 **WARNING! Moving Parts Hazard:** Keep hands, feet, hair, and clothing away from moving parts. Failure to do so could result in serious injury or death.

3. Ensure there are no tools in the spindle; start the spindle.
4. Inspect the value displayed on the front panel of the VFD. The recommended range is 34-36 Hz (see **Figure 7**).



Figure 7

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- If the value is outside of the 34-36 Hz range, use a small, flat-blade screwdriver to adjust the trim potentiometer screw on the machine control board (see **Figure 8**) until the value is within range.

NOTE: If better accuracy is needed, use a tachometer to measure actual spindle speed.

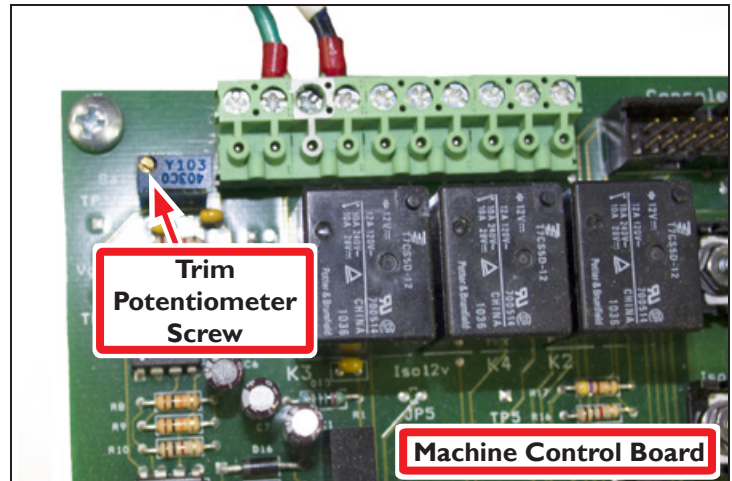


Figure 8

Operation

The VFD motor drive functions similarly to the original VFD, with some important differences:

- The VFD motor drive allows the spindle to run both slower and faster than the original VFD. The scale printed around the spindle speed dial on the operator panel will not match the new speed range.
- In addition to a wider operating speed window, acceleration and deceleration is significantly faster. However, the drive will take an additional few seconds to power on after a drive reset (drive powered off). The drive is powered off under any one of the following conditions:
 - System power off
 - Spindle door opened (i.e., tool changes)
 - Spindle lockout key turned to Off position
 - E-stop depressed
 - Power Drawbar, if equipped, is activated

NOTE: When running G-code programs, ensure the VFD motor drive has a chance to spin up to top speed before beginning.

- If the spindle is rotating in the opposite direction than commanded in either manual mode or auto mode, swap wires 401 and 402 at the drive.

NOTE: After Spindle Drive Upgrade Kit is installed, attached drawing (D40194) supersedes VFD wiring diagrams in original Operator Manual.