

Load Meter Installation

Product Identification: Tormach Spindle Drive Load Meter Accessory (PN 31101)

Background:

This load meter aids the machinist with a visual display of how hard the spindle motor and drive are working relative to the limits of the drive system. This accessory can be used to predict tool wear, or modify programs to improve material removal rates while limiting the risk of tool breakage.

NOTE: The load meter will only function on Tormach mills equipped with a digital variable frequency drive. This includes all PCNC 770 mills (31190), all PCNC 1100 Series II mills (31095), or mills with the Spindle Drive Upgrade kit (31090) installed. If you are unsure of what machine you have, please contact Tormach. The first few batches of Series II mills and spindle drive upgrades did not have a VFD program installed that supports the load meter, for this reason, a VFD programming stick is provided to some customers to allow them to update the program in the VFD. See note * below for more information.

What Comes With Your Kit:

- 1 Meter assembly
- 1 variable frequency drive (VFD) programming stick*
- This install document
- Electrical Schematic D40197

What You Will Need:

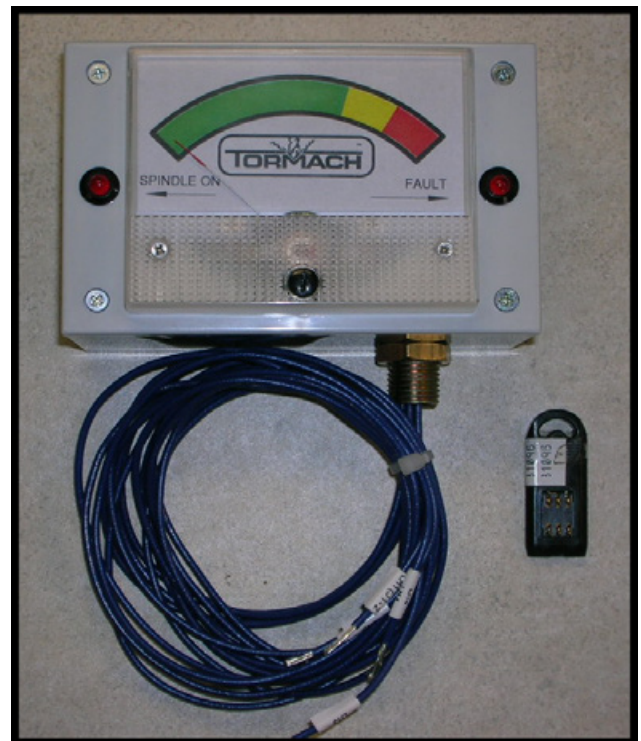
- Electric drill
- 9/16 drill bit or punch
- Small terminal screw driver
- 11/16 wrench

Before You Start:

It is best when working with electricity to power down the entire mill and un-plug it from the wall. Note: to program the drive in step 4 you will need power on your machine.

CAUTION!!

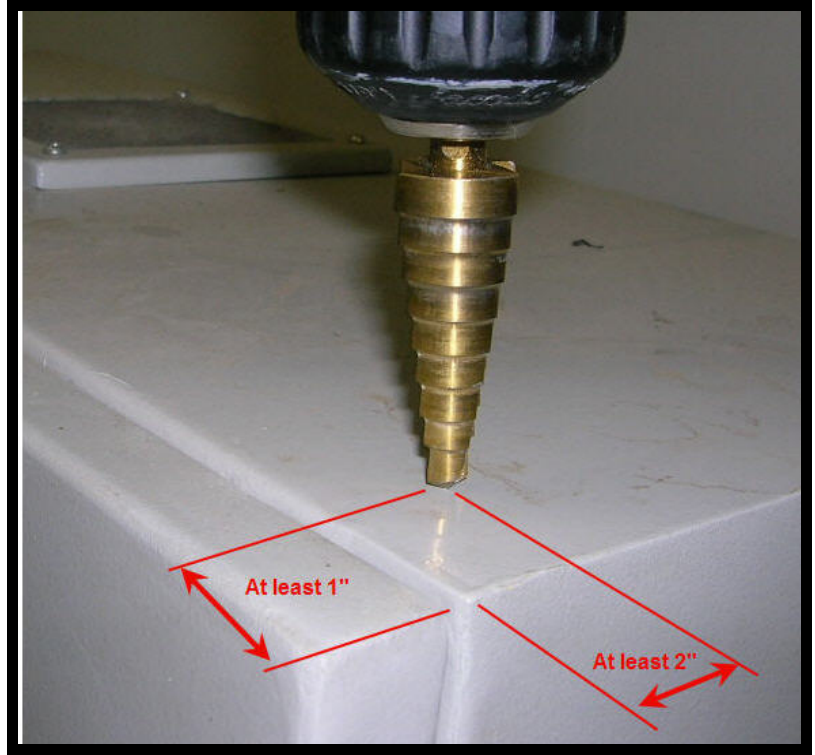
Working around electricity can be dangerous. High voltage is present! Use caution and be safe. NEVER touch a bare wire or other electrical component with any body part or with any tool unless power is cut from the machine.



***Some Kits will not come with the programming stick. If Tormach has pre-determined that your VFD is already loaded with the correct program, you will not receive a programming stick. To determine if you need to update the program in your VFD, follow these steps: With VFD powered ON, push the "M" button on the VFD. Press the up ▲ or down ▼ arrow on the VFD until the left digits on the display read 02. If the digits on the right read 170.2 or higher, you have the correct program already installed, you will not need the programming stick and you may skip step 4. NOTE: This applies to PCNC 1100's only. PCNC 770's are already compatible with the load meter.**

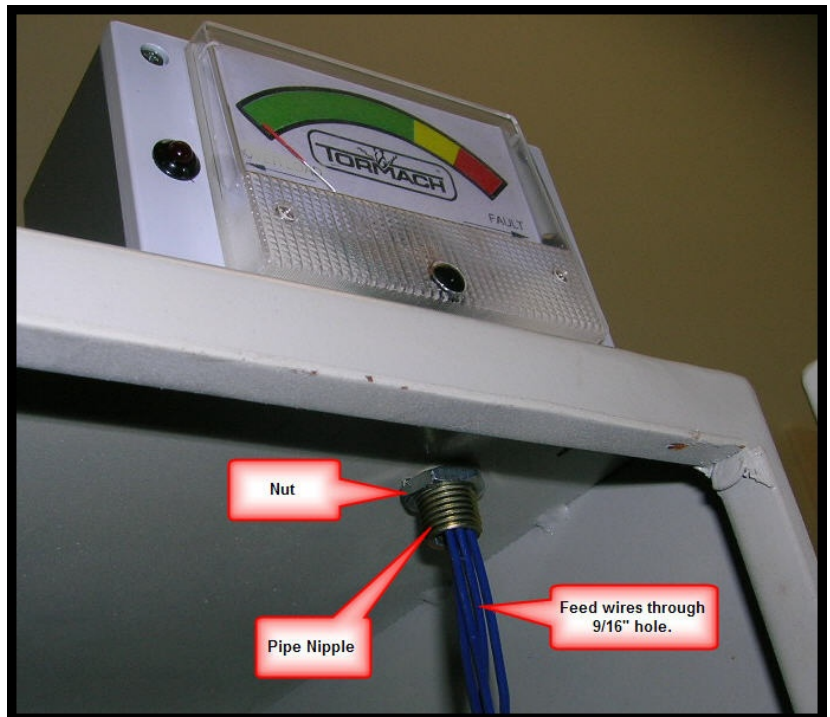
Instructions:

- I. Drill/punch your mounting hole. (Note: some machines may already come with this hole predrilled.)
 - A) Make a mark on the top of the electrical cabinet at least 1" from the right edge and 2" from the front. Or you may want to choose a different mounting point.
 - B) Drill or punch a 9/16" hole on the mark. A uni-bit (shown here) works well. A 9/16" chassis punch also works well. Be sure to contain the metal chips falling on the inside of the cabinet as they could cause an electrical short.



2. Mount the Meter

- A) Remove the bottom nut from the pipe nipple.
- B) Feed the 4 wires through the hole in the top of the cabinet, and insert the nipple through the hole.
- C) Remount the pipe nipple nut. You may need to remove the front face panel of the meter to gain access to the pipe nipple from the inside of the meter box in order to tighten the nuts securely. This can be done by removing the 4 screws on the face plate.

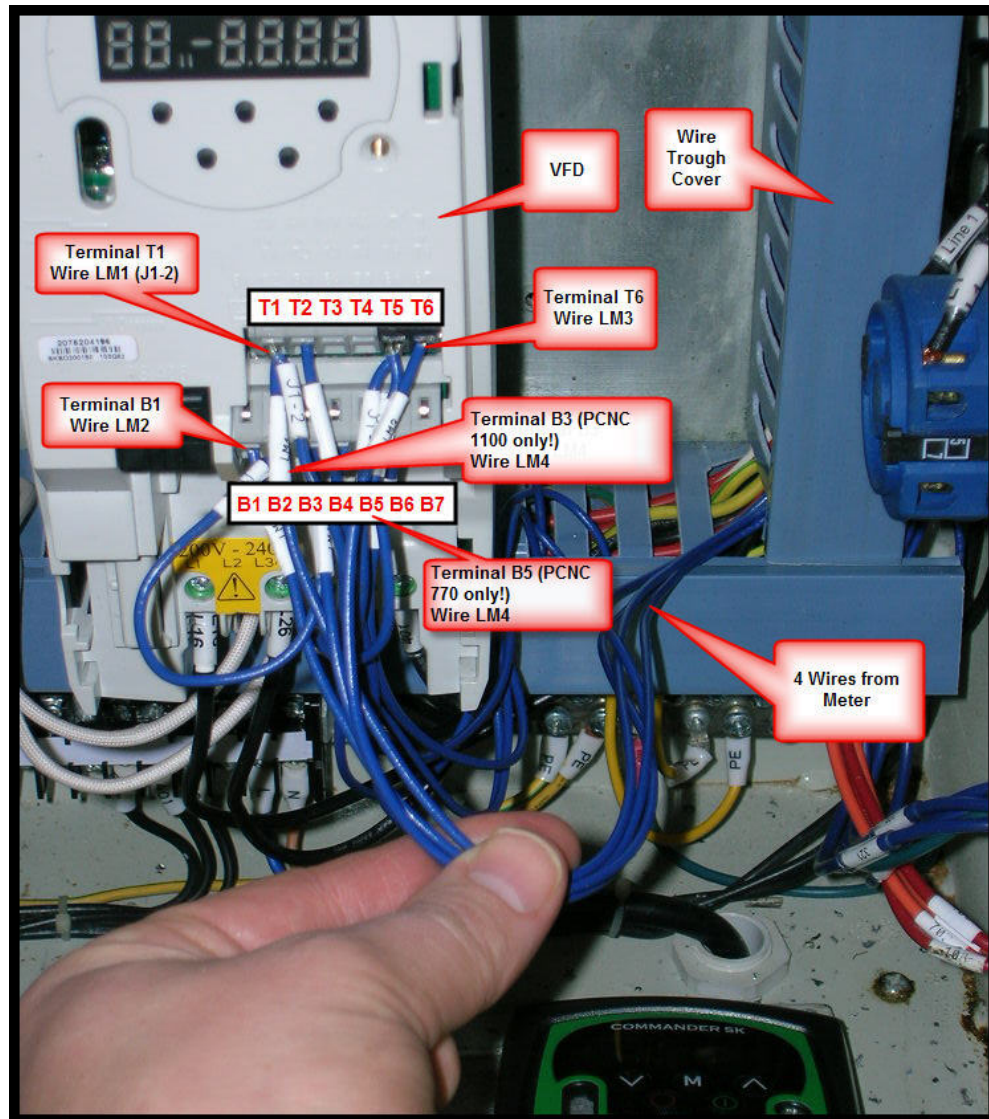


3. Connect the wires

- A) Remove the vertical wire trough cover on the right hand side of the cabinet.
- B) Run the wires in the trough, going in at the top, and out at the bottom. (770 owners can route wires directly from the load meter to the VFD)
- C) Re-install the wire trough cover.
- D) Remove the front face cover of the VFD.
- E) Following the connections on the wiring schematic D40197, connect the 4 wires to the appropriate terminals on the drive. A small bladed screw driver should be inserted into the slot above the wire and pried upward to allow the bare wire to be inserted, and then removed to make the termination.

-Note that LMI uses the same terminal as J1-2. Be sure that both wires are secure in the T1 terminal of the VFD.

-Check your work. Look for wire hairs that might make a short at the terminal blocks and that all connections are secure.

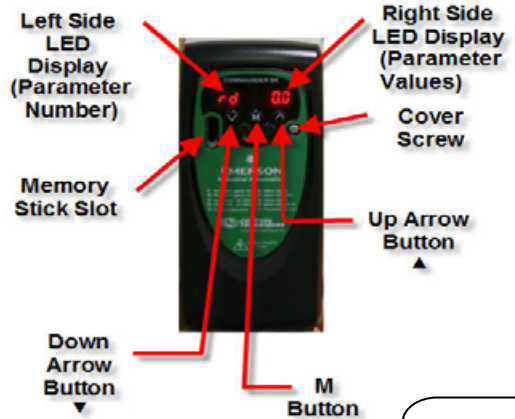


Some machines may vary from image shown, but wire connection will be the same.

4. Program the drive (PCNC 1100 owners only, PCNC 770 owners should skip this step)

NOTE: This step is only required if your drive did not come with the current drive program. See page 1* for more details.

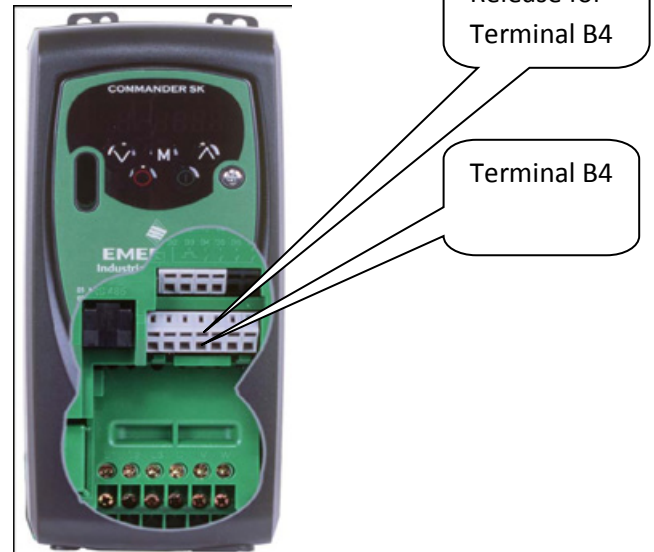
- A) If you have not already done so, remove the cover from the drive by loosening the screw adjacent to the up arrow ▲.



- B) Remove the wire from terminal B4 on the on the drive.

NOTE: Be cautious of the other wires.

There is a wire clamp release above each wire connection point. Place a small flat bladed screwdriver into wire clamp release for terminal B4. Push down the tab in the wire clamp release to open the wire clamp and allow the wire(s) to be released. Pull the wire(s) from the terminal and tape off to prevent them from shorting out.



- C) Power up the drive by turning on the machine as is done normally, select manual spindle mode, and press the manual START button for the spindle drive, then push the manual STOP button. The LED display will illuminate when the drive is powered up. Replace the cover if desired to improve visibility of the display and to identify the buttons on the face of the drive used in programming.

- D) Insert the memory stick in the drive in the slot adjacent to the down arrow ▼.



- E) Momentarily (1 second or less) press the **M** button on the drive until the left digits flash a 2 digit code, usually **01**.

NOTE: If during the procedure you find that the left side digits are flashing when the right side digits should be, or the right side digits are flashing when the left side digits should be, momentarily press the **M** button to switch to the proper side digits.



- F) Use the up arrow ▲ to increase the numerical value of the left digits to **10**.

- G) Press the **M** button to cause the right side values of the display to flash.



- H) Press the or down arrow ▼ until the right digits on the display read **L2**.

- I) Press the **M** button to store the selection and cause the left side digits to flash.



- J) Use the up arrow ▲ to increase the numerical value of the left digits to **28**.

- K) Press the **M** button to cause the right side values of the display to flash



- L) At this point you will see **Code** flash on the right.

- M) Use the up arrow ▲ or down arrow ▼ to change the numerical value of the right digits to **129**.

- N) Press the **M** button to accept the code.



- O) Press the up ▲ or down arrow ▼ until the right digits on the display **rEAd**.

Caution: If the right side of the display is set to **prog the memory stick will be written over in step O) below. You will have lost the ability to update your drive.**



Don't Do This!!

- P) Momentarily press the **M** button to store the selection and cause the left side digits to flash and cause the right side digits to display **no**. There may be a short pause as the drive down loads the program from the stick.

- Q) Use the down arrow ▼ to decrease the numerical value of the left digits to **10**.



- R) Press the M button to cause the right side values of the display to flash.
- S) Press the up ▲ or down ▼ arrow until the right digits on the display read **LoC**.
- T) Press the **M** button to store the selection and cause the left side digits to flash.



- U) Press the up ▲ or down ▼ arrow until the left digits on the display read **02**.



- V) The right side display should now read **170.3** (this value only applies to PCNC 1100 owners). This is an indicator that the program downloaded correctly. Note; if **170.0** is indicated, than the program did not load properly. Power down the drive and re-start with step A). If **60.0** or any other code is shown, than please contact Tormach support for further assistance.
- W) Remove the memory Stick and keep in a safe place in case you ever need to re-program your drive.
- X) Power down the drive by pushing the red STOP button, or turning the key switch to the OFF position.
- Y) The last step is very important. **Be sure to re-connect the wire on terminal B4.**



This is the intended mounting position of the load meter. It is certainly conceivable that alternate locations may suit a given user better.

Tips for using your new Load Meter:

The colored scale on the meter is meant mostly as a reference. Actual numbers here would be meaningless. When turning on the spindle, the needle on your new Load Meter will spike a bit as the spindle accelerates, and then back off a bit after the spindle speed stabilizes. It is normal to see this surge when accelerating or decelerating the spindle. When powering down the drive, the Fault LED will light briefly. This is also normal since the drive registers an under-voltage fault as the internal capacitors dissipate their charge. If the drive experiences any other fault, and remains powered, the LED will remain lit. Note the fault code on the display of the VFD and contact Tormach at info@tormach.com.

When cutting, if the meter's needle is in the red zone, then this indicates that the drive is pushing 100% current and is in "fold-back" mode. Tormach's *fold-back* logic prevents spindle faults and avoids cutter stall by internally reducing the commanded speed when the drive is overloaded in exchange for more torque to the cutter. Please note, fold-back logic only applies to the PCNC 1100.

While the digital drive will allow you to run in an otherwise overloaded condition (red zone), it should not be held in this condition for extended operation. It is usually fine to briefly load your system in this manner, but extended running of the spindle in the red zone mode increases the chances of breaking a cutter or causing a thermal fault on the drive. Setting your feeds and speeds so that you are just under this over loaded state is the ideal operating condition.

The second LED is lit any time the spindle is rotating under power. NOTE: if the drive has lost input voltage while running (shutting down the drive), than it is possible that this LED will turn off before the spindle has finished coasting to a stop.