

1. Introduction

- 1.1. This document describes the procedure for measuring the NORM Torque Board voltages.

2. Procedure

- 2.1. Turn the NORM power off.
- 2.2. Set the dynamometer tilt to 0 degrees.
- 2.3. Position the input adapter at 6:00.
- 2.4. Set the ROM stops against the input adapter to hold it in-place.
- 2.5. Remove the set-screw from the side of the input adapter.
- 2.6. Loosen the large screw at the top of the input adapter. **Note:** *As you loosen the screw, the screw head will contact the pin. As you continue to loosen the screw the head will push-up against the pin and then act like a spreader to open-up the input adapter at the split and help remove the adapter from the shaft. After contacting the pin you should only need to turn the screw slightly to spread the input adapter enough to enable removal.*

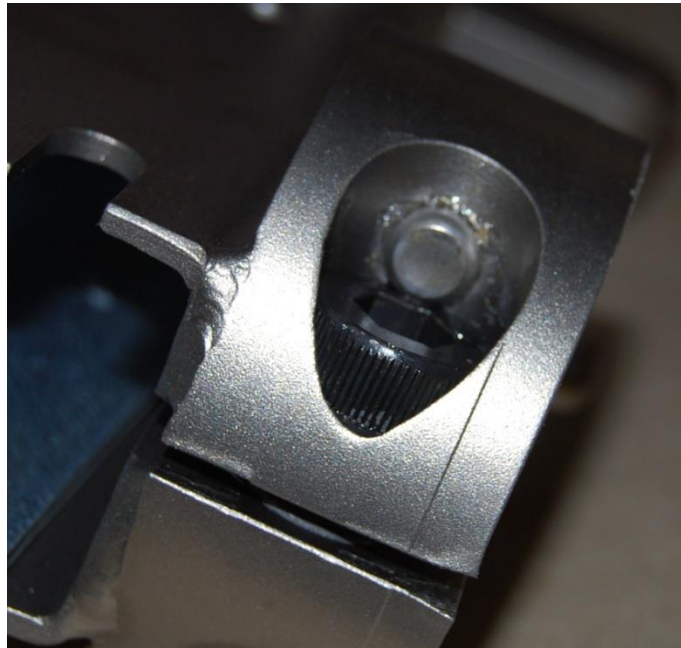


Figure 1 Input Adapter Main Bolt

- 2.7. Make sure the input adapter is oriented so the slot in the adapter is aligned with the red line on the ROM ring label. This aligns the safety hook at the bottom of the adapter with a cut-out in the ROM ring so the input adapter can be removed.
- 2.8. Install the knee-hip adapter on the system. You can either pull on the knee-hip adapter or gently tap the top and bottom of the adapter with a rubber mallet to

remove the input adapter from the shaft. If the adapter feels stuck on the shaft, loosen the large screw a bit more.



Figure 2 Removing the Input Adapter

- 2.9. After removing the input adapter, rotate the dynamometer tilt to 90 degrees (straight up).
- 2.10. Make sure the ROM stops are closed.
- 2.11. Remove the eight screws holding the ROM ring to the dynamometer housing and remove the ROM ring.
- 2.12. Remove the metal EMI Can (Figure 9 – Item 22) from the dynamometer.
- 2.13. Remove the Torque Board Shield (Figure 9 – Item 14).
- 2.14. Turn the NORM on. You do not need to start the computer or the HUMAC program.
- 2.15. Using the PIN 3 as GROUND, measure the following voltages at Test Connector (TC1). **Note:** When measuring the voltages be careful not to short-out between two pins.

PIN	SIGNAL	VOLTAGE
1	TORQUE	< $\pm 0.1\text{v}$
2	+15v	+14.5 to +15.5v
3	PWRCOM	0v
4	-15v	-14.5 to -15.5v
5	TORQERR	+2.5v to +7.5v

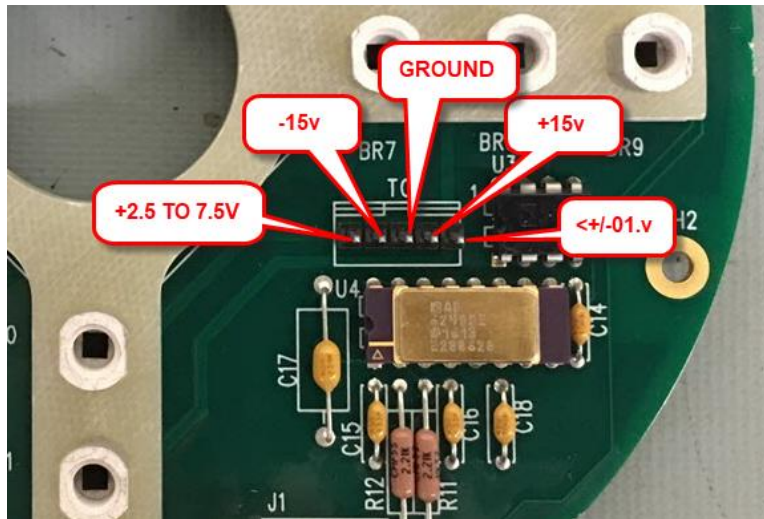


Figure 3 Torque Board Test Connector

- 2.16. Turn the NORM power off.
- 2.17. If the voltages are correct, proceed to step 2.29 to re-assemble the system.
- 2.18. If the voltages are not correct, continue with step 2.19.
- 2.19. Gently unplug the torque board connector by grasping the white connector body.
- 2.20. Loosen the two set-screws at the side of the torque board mounting piece.

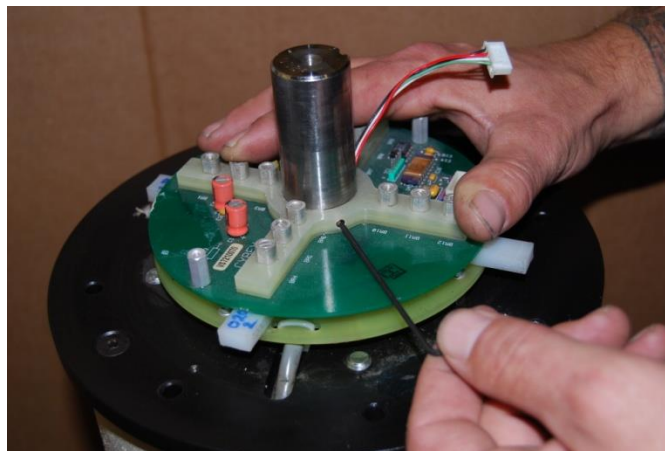


Figure 4 Torque Board Set Screws

- 2.21. Gently remove the torque board from the shaft. Be sure the torque sensor cable is lying in the channel as you lift the board off and that the cable is not pinched between the board and the shaft.
- 2.22. Place the torque board upside down on a table so the torque board brushes are not damaged.
- 2.23. Turn the NORM on.
- 2.24. Measure the voltages on the Stator board. You can touch the voltmeter tip to the small tab next to each trace. **IMPORTANT:** Be careful not to short the voltmeter between two traces or to scratch the surface of the stator board traces.

(+) DVM	SIGNAL	(-) DVM	SIGNAL	MEASUREMENT
4	TORQUE	6	TORQCOM	+15v
3	-15 VDC	5	PWRCOM	-15v
2	TORQERR	5	PWRCOM	0v
1	+15 VDC	5	PWRCOM	+15v

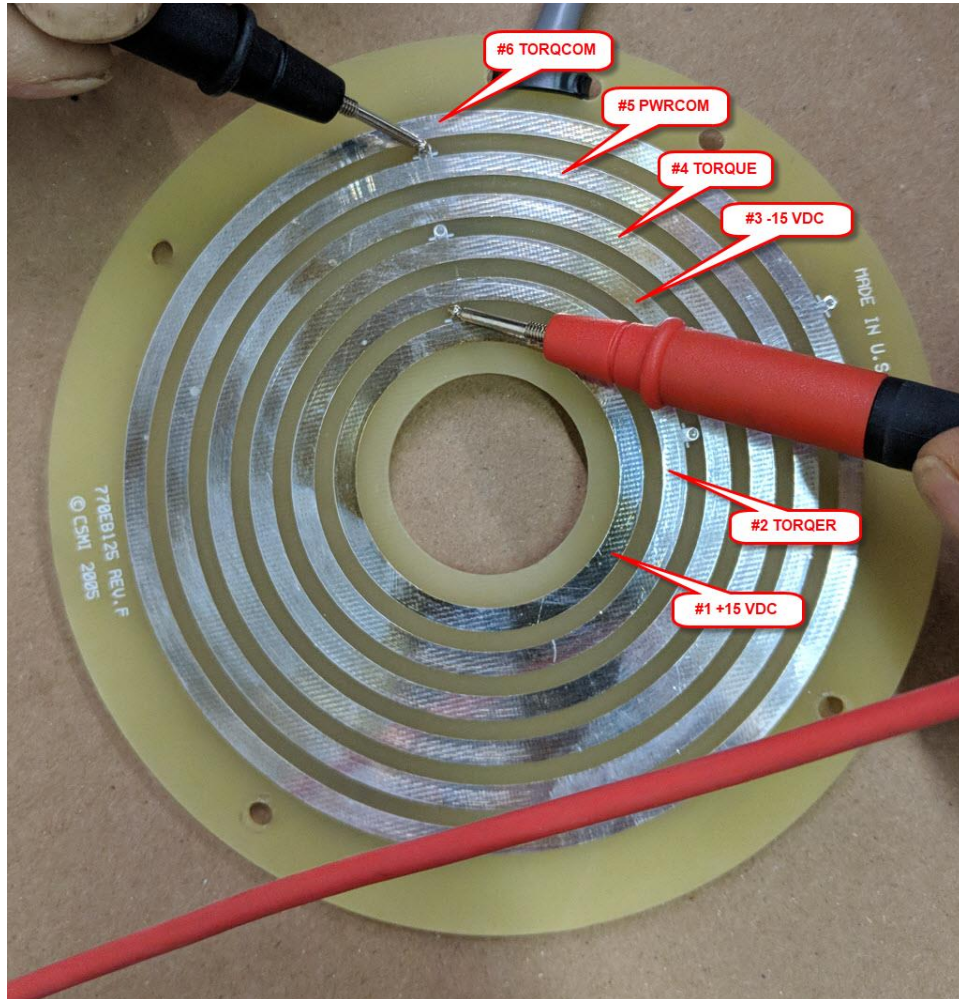


Figure 5 Measuring the Stator Board Voltages

- 2.25. If the voltages are not correct, unplug the torque cable (smallest of the three connectors) from the dynamometer and measure the voltages at the connector. The pins A-G are labeled on the connector face.

(+) DVM	SIGNAL	(-) DVM	SIGNAL	MEASUREMENT
E	TORQUE	F	TORQCOM	+15v
B	-15 VDC	D	PWRCOM	-15v
A	TORQERR	D	PWRCOM	0v
C	+15 VDC	D	PWRCOM	+15v

- 2.26. Re-install the torque board. **Note:** Make sure the torque sensor cable is laying in the shaft track and is not pinched by the board as the board is re-installed. Also, notice

the flats on the torque shaft. The torque board set screws must face the center of the flats.

- 2.27. The torque board should be installed approximately 0.370" above the stator board. As you tighten the set-screws, jiggle the board slightly to assure the set-screws are facing the center of the shaft flats. **Note:** CSMi uses custom spacing tools to install the torque board (white plastic spacer shown below). Contact CSMi Service if you would like a set of spacers.

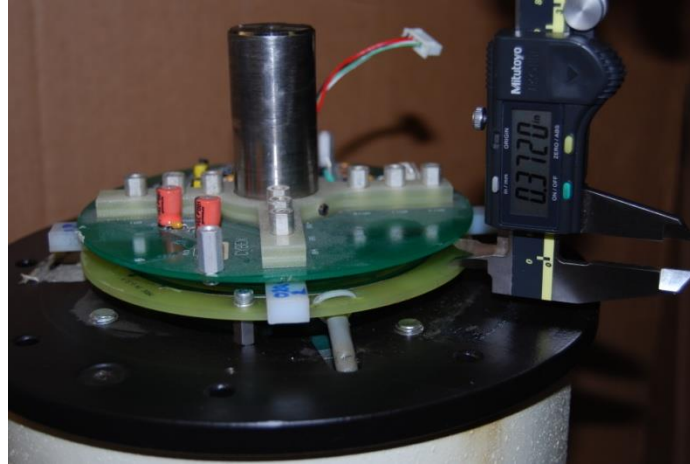


Figure 6 Torque Board Spacing

- 2.28. Plug the torque sensor connector back into the board. **Note:** There are alignment tabs on the connector to assure the correct orientation.
- 2.29. Re-install the Torque Board Shield (14).
- 2.30. Re-install the metal EMI Can (22).
- 2.31. Re-install the ROM ring. Apply blue Loctite to the ROM Ring Screws and tighten to 100 INCH-POUNDS (70 NEWTON-CENTIMETERS). (Figure 7, Items 33 and 41).

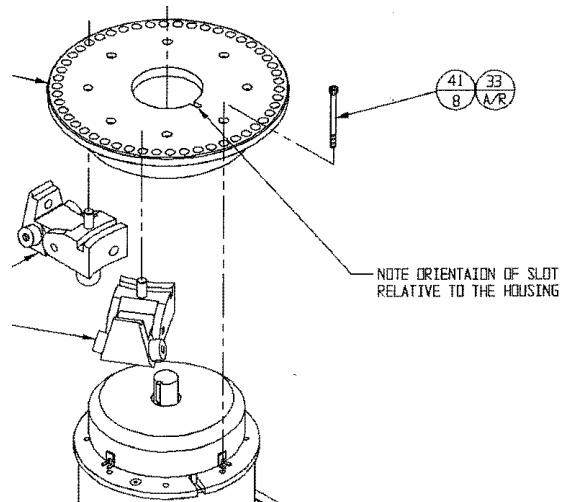


Figure 7 ROM Ring Installation Torque

- 2.32. Set the dynamometer tilt to 0 degrees.

- 2.33. Place the woodruff key fully in the input adapter notch and then re-install the adapter on the input shaft. If necessary, gently tap the adapter on using a rubber mallet. **Note:** When placing the woodruff key in the input adapter place the side which was contacted by the set-screw in the same location to assure the key fits onto the shaft.
- 2.34. Tighten the large input adapter bolt to 100 FOOT-POUNDS (135 NEWTON-METERS) (Figure 8).

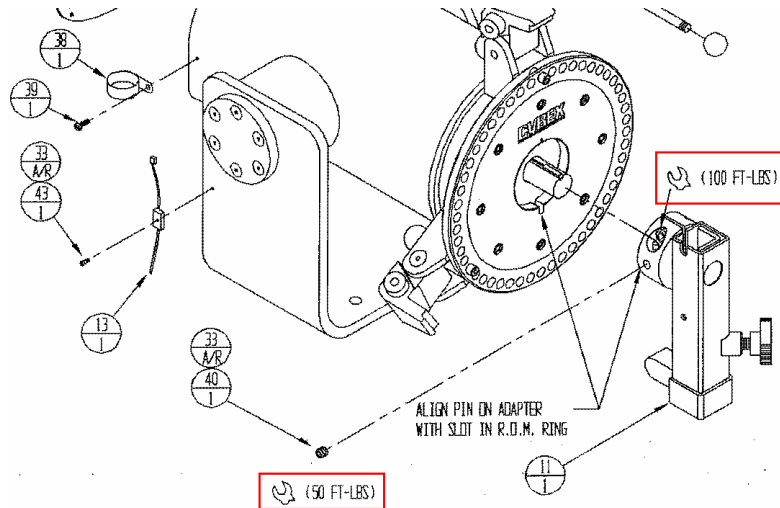


Figure 8 Input Adapter Installation Torque

- 2.35. Apply blue Loctite to the input adapter set-screw and tighten to 50 FOOT-POUNDS (67 NEWTON-METERS). (Figure 8, Items 33, 40).
- 2.36. The procedure is now complete.

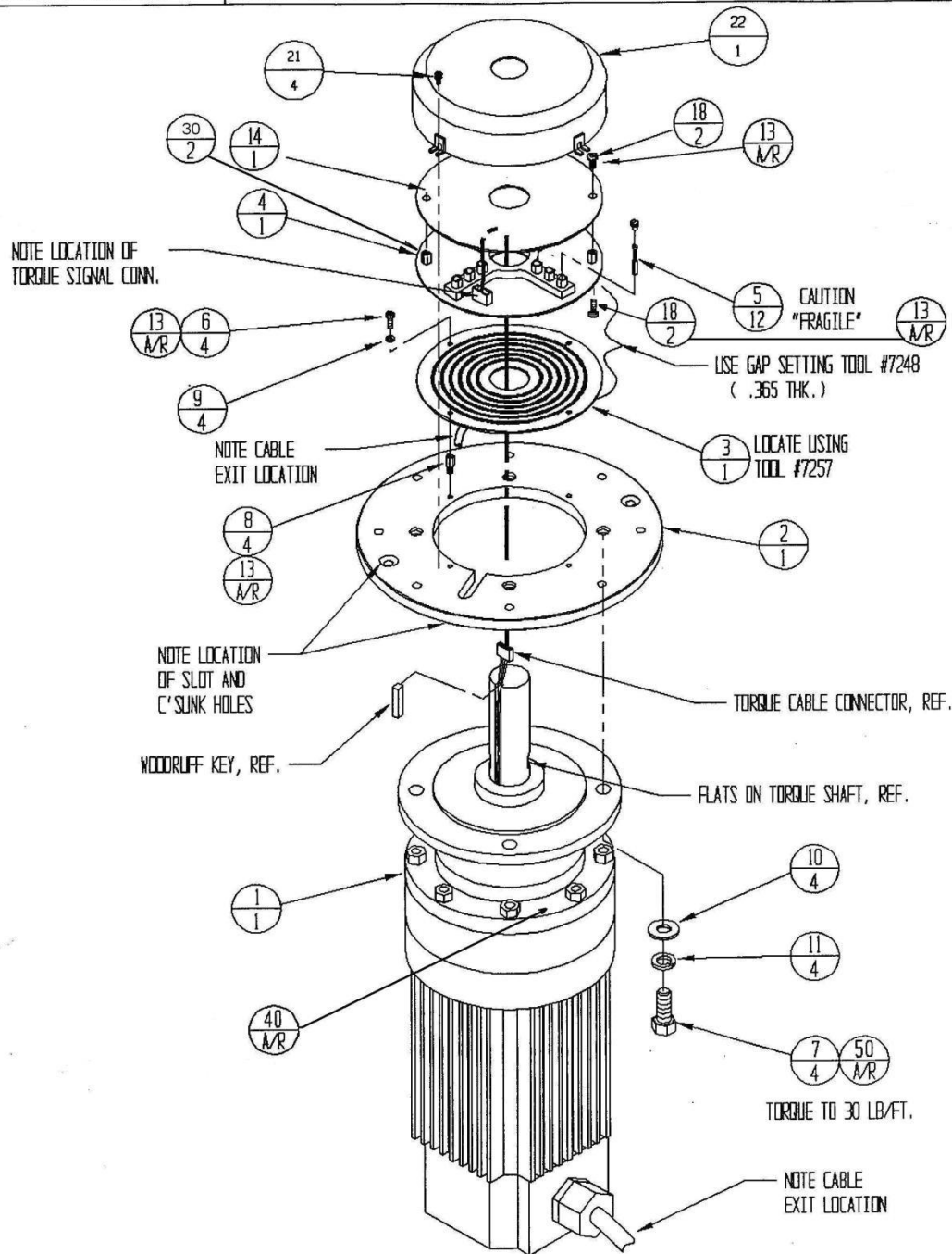


Figure 9 Dynamometer Exploded View