
Cloud Condensation Nuclei (CCN) TEC Servicing

for S/N 022 and above

Operator Manual

DOC-0110 Revision A



2545 Central Avenue
Boulder, CO 80301-5727 USA

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**2545 CENTRAL AVENUE
BOULDER, COLORADO, USA 80301-5727
TEL: +1 (303) 440-5576
FAX: +1 (303) 440-1965
WWW.DROPLETMEASUREMENT.COM**

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information on replacement of a TEC element refer to Section 2 TEC Element Replacement in CCN.

When both sides of the TEC element are at or very near the same temperature, the resistance measured across the unit will be low, approximately 10 ohms. Since good TEC elements can produce a voltage when there is a temperature difference between the two sides, this will cause the polarity of the resistance reading to reverse.

1. If at all possible make sure that the CCN instrument has not operated for the previous few hours so that there are no temperature differences between the sides of the TEC elements.
2. Disconnect the in-line connector, located near the rear of the CCN, just above the drain bottle for the temperature zone that is not functioning. There will be three connectors, each one for the top (T1), middle (T2), and bottom T3.
3. Using a standard digital volt meter (DVM) measure the resistance across the pins going to the temperature zone under test. Reverse the leads and retake the temperature measurement. If the resistance is nearly the same with the polarity switched, the zone is good. If the resistance stays the same with the same polarity this zone has a bad TEC element. If no bad TEC element is found, contact DMT for further information.
4. If a zone is found to have a bad TEC element. Use a DVM probe and measure the resistance across each of the TEC elements. The elements are labeled on the quick connects as TEC1, TEC2, TEC3, and TEC4.
5. When the defective TEC element is located, Unplug the bad TEC and plug in the good TEC to the other good TEC, leaving the bad TEC unplugged. Refer to Section 2 TEC Element Replacement in CCN for replacement of TEC elements.
6. Check the resistance of the TEC elements measuring at the Molex connector (CON-0256) to insure that the string is good.
7. Reconnect the in-line connector.
8. Start the CCN instrument and run a supersaturation scan to verify that the temperature zone is controlling properly.

2.0 TEC Element Replacement

1. Run CCN instrument with the supply pump turned off for about 30 minutes to drain water from the instrument.

2. Disconnect exhaust tube from OPC at bottom of column
3. Disconnect the connector from the OPC detector board at the front of the OPC.
4. Disconnect the drain line from the chiller at the solenoid pump. This will be on the lower left of the CCN cage.
5. Disconnect the three in-line connectors for the TEC power just above the drain bottle.
6. Disconnect the in-line ground wire connector (blue) that is to the right of the OPC electronics boards
7. Disconnect the TEC fan leads, J3, J4, J5 which are on the lower right of the power supply board. See Figure 2 and 3 for the location of the connectors on the power supply and CCN control boards (need to use the silkscreen for series 3 boards).

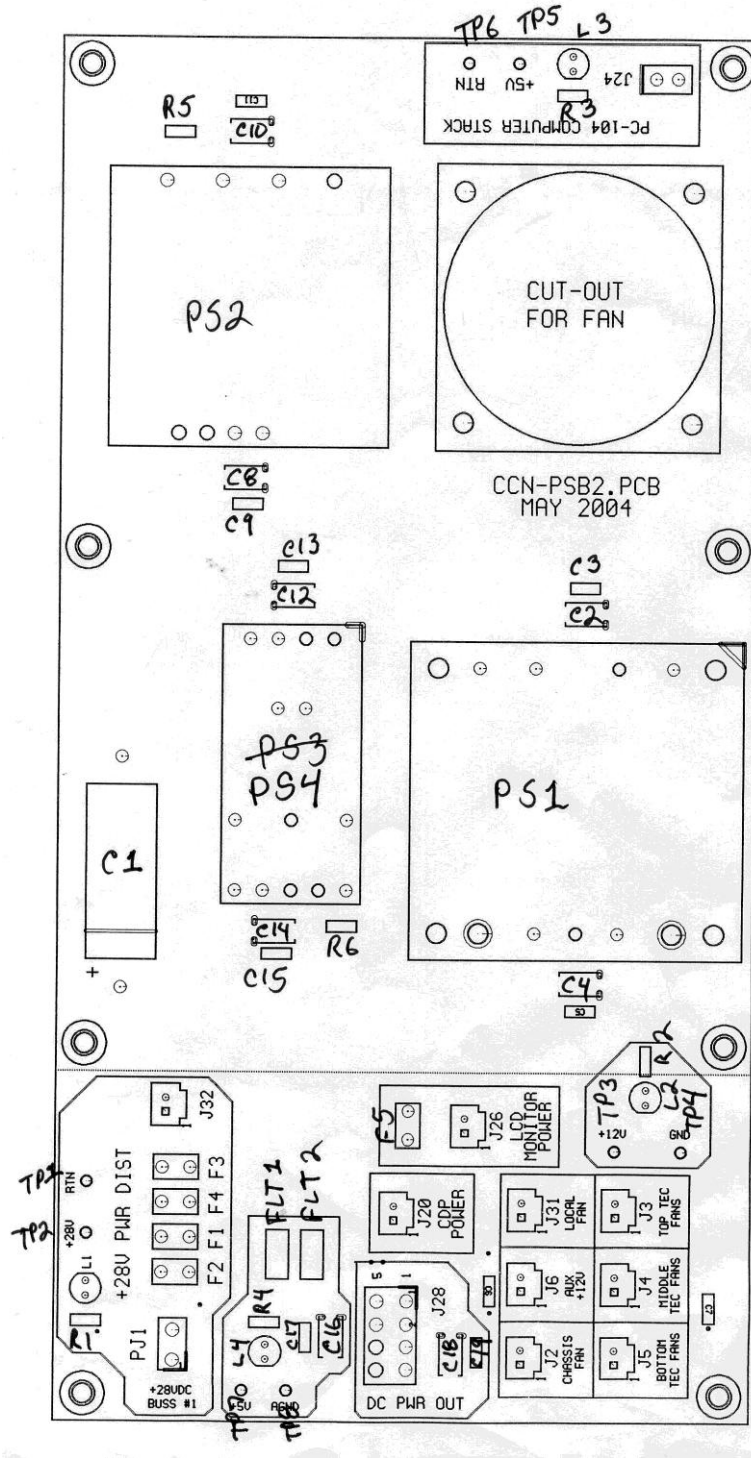


Figure 2: Power Supply Printed Circuit Board (ABD-0084)

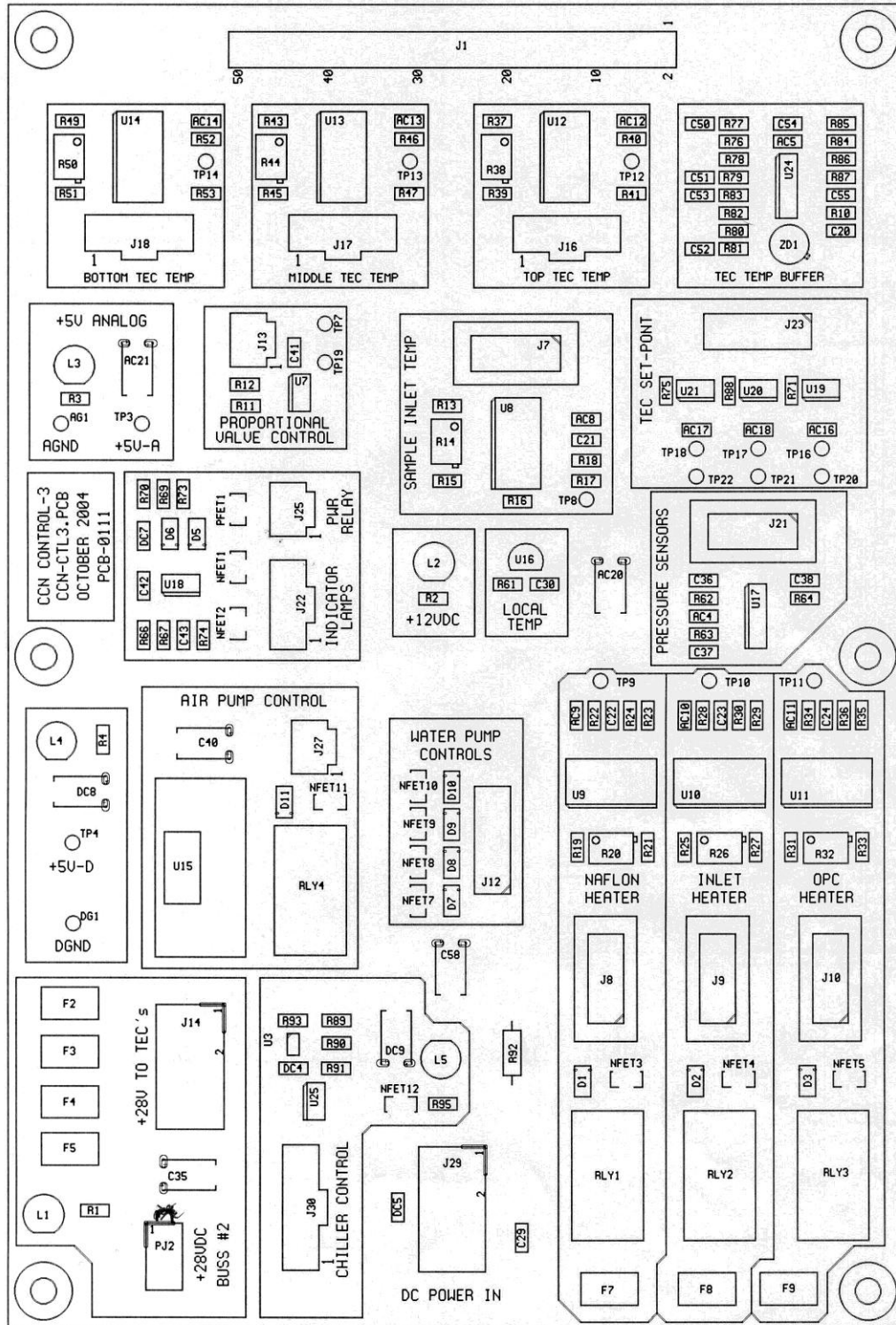


Figure 3: CCN Controller Board Rev 3 (ABD-0110)

8. Disconnect the Nafion heater, inlet heater, and OPC heater J8, J9, J10, which are on the lower right of the CCN control board.
9. Disconnect the pressure sensor cable, J21, which is at the middle right of the CCN control board.
10. Disconnect the three TEC temperature cables, which are at the top of the CCN control board, J16, J17, and J18.
11. Disconnect the solenoid valve driver cable J12, located at the middle of the CCN control board.
12. Disconnect the conductive tubing from the tube at the bottom of the flow manifold.
13. Remove the three hex drive capscrews at the bottom left (when viewed from the back) of the back panel as viewed from the back of the instrument.
14. Have someone support the CCN column cage and remove the three hex drive capscrews at the top left of the back panel.
15. The CCN cage can now be removed from the instrument.
16. Remove the screws holding the fan brackets to the cage that are located with the defective TEC units. Just move the fans and brackets off to the side.
17. Find the splice on the paper covering for the insulation between the temperature zones. If there is tape on the splice, gently cut the tape with a razor knife. Remove the insulation cover.
18. Remove the two center sections of insulation. If the top section stays in place leave it, otherwise remove it.
19. Lift the bottom sections of insulation and remove them.
20. See the TEC assembly drawing, Figure 4, for details on the next steps. Remove the yellow rectangular sections of insulation next to the defective TEC units.

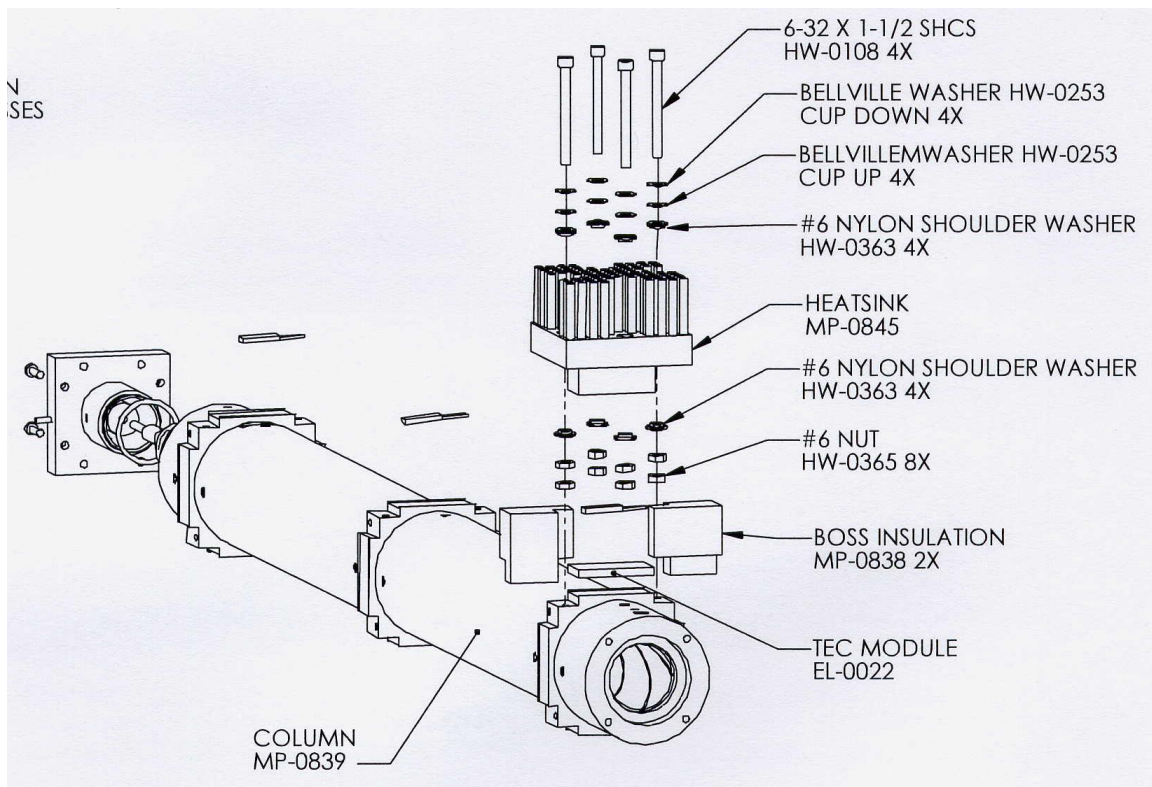


Figure 4: CCN Column Assembly (4 screw mounting version)

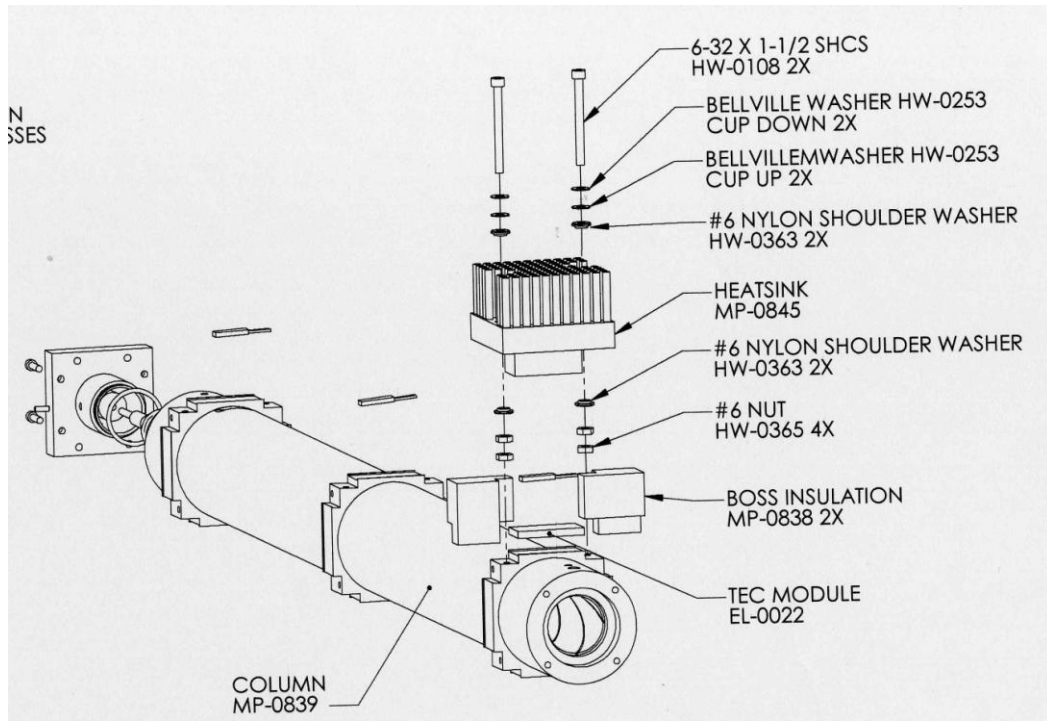


Figure 5: CCN Column Assembly (2 screw mounting version)

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21. Using wrench MISC-0105 provided, loosen the 6-32 nuts (4 X) that are on the screw next to the column.
 22. Loosen the 6-32 nuts (4 X) that are at the bottom of the heat sink.
 23. **NOTE THE DIRECTION OF THE TEC UNIT LEADS**, with the OPC at the bottom of the column, the TEC leads should face to the right, with the red lead on the bottom.

If this is not the case, CONTACT DMT IMMEDIATELY.

24. Remove the four 6-32 screws holding the heat sink to the column. If the TEC leads have not been unplugged do that at this point.
25. Remove the excess heat sink compound from the flat area on the column where the TEC mounts with some isopropyl alcohol. If the heat sinks are to be used, clean the TEC contact area the same way.
26. Consult Figure 1 for the proper assembly of the mounting hardware for the heat sinks. ***Note that the shoulder on HW-0363 goes into the hole in the heat sink.*** A complete set of hardware for each heat sink will be provided. Set the 6-32 nuts near the center of the screw to start.
27. Spread a small amount of heat sink compound (LUB-0004) on each side of the TEC. It is best to apply compound directly to the TEC unit from the tube and then use a razor blade edge to spread the compound to a very thin layer.

THE LEADS ON THE TEC UNITS ARE SOMEWHAT DELICATE. USE CARE TO INSURE THAT THEY DO NOT BEND EXCESIVELY.

28. Place the TEC on the column mounting area. There are ridges on the top and bottom of this area and it is important that the TEC be located between these ridges. Wiggle the TEC gently to make sure it is properly seated.

29. Carefully install the heat sink to the column. Press it down by finger tension flat on the TEC. Alternating between the four screws, gradually torque the screws to 2 inch pounds (32 inch ounces). Suggested is to torque in 4-ounce inch increments.
30. Remove any heat sink compound that squeezes out of the surfaces between the TECs and the heat sink and column.
31. Wait four hours and retorque the screws holding the heat sinks to 32 ounce inches.
32. Put a small amount of low or medium strength Loctite or other thread locker on the 6-32 nuts.
33. Finger tighten the two nuts that go against the bottom of the heat sink.
34. Without letting the 6-32 mounting screws turn, lightly tighten the two 6-32 nuts against the column.
35. Repeat steps 18-35 if more than one TEC element needs to be replaced.
36. Plug in the TEC leads in series. Make sure that red lead of one heat sink connects to the black lead of another heat sink.
37. Check the resistance of the TEC section just serviced. Refer to Section 1 for details on checking TEC resistance
38. Install the yellow insulation blocks between the heat sinks.
39. Install the bottom blue insulation sections.
40. Install the top blue insulation sections if they have been removed.
41. Install the center insulation sections.
42. Install the insulation cover and tape the splice.

43. Install the CCN cage on the back panel, first installing the three cap screws at the top of the column and then the three screws at the bottom of the column.
44. Reconnect the exhaust tube to the OPC at the bottom of the column.
45. Reconnect the chiller drain line to the solenoid pump
46. Reconnect the three in-line connectors for the TEC power just above the drain bottle.
47. Reconnect the in-line ground wire connector.
48. Reconnect the three TEC fan leads J3, J4, and J5.
49. Reconnect the Nafion heater, inlet heater, and OPC heater J8, J9, and J10.
50. Reconnect the pressure sensor cable, J21.
51. Reconnect the three TEC temperature cables, J 16, J17, and J18.
52. Reconnect the solenoid valve driver cable, J 12.
53. Reconnect the conductive tubing to the bottom of the flow manifold.
54. Review all connections.
55. Restart the CCN.

Appendix A: Revisions to Manual

| Rev. Date | Rev No. | Summary | Section |
|-----------|---------|---|---------|
| 8-9-05 | 1.0 | New Release | All |
| 10-28-05 | 1.1 | Added two screw column mount | Fig 5 |
| | | Changed/reformatted headings in calibration section | 5.0 |
| 4-27-10 | A | Reformatted manual and updated DMT address | All |