



**TELEDYNE
INSTRUMENTS**

Advanced Pollution Instrumentation

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Service Note

**96-005 Rev B
2 May, 2007**

TROUBLESHOOTING COOLER CIRCUITS FOR MODEL 100, 150, 152, 200, 250, 251, 252

NOTE: ALL THERMISTORS USE A TWISTED PAIR OF YELLOW WIRES. ANYTIME YOU SEE A TWISTED PAIR OF YELLOW WIRES, THAT IS A THERMISTOR CIRCUIT.

- 1. The cooler circuit uses thermistors to sense temperature. The thermistor is a resistor which varies resistance with temperature. Higher temperature equals lower resistance.**
- 2. The trick to troubleshooting this circuit is to divide it into two parts; a temperature sensing circuit and a control circuit. Essentially, the sensing circuit consists of the thermistor, the DCPS, and the A/D board. The control circuit consists of the cooler, the power supply for the cooler, the switch to turn the cooler on, and the I/O card which sends a signal to the switch.**
- 3. In troubleshooting the sensing circuit, the easiest way is the resistor substitution method. This consists of disconnecting the thermistor in question and substituting a resistor of known value into the circuit. Then, observing the display, verify that the expected temperature is displayed as follows:**
 - A. If a cooler failure, remove the top connector from the end of the barrel assembly and place a 47K Ohm resistor into the connector on the two pins with yellow wires. The front panel PMT TEMP display should read 15 degrees C. A failure of this test indicates a faulty DCPS card.**
 - B. If the correct reading is obtained, make the following measurements:**
 - 1. Measure Ohms across the two yellow wires of the thermistor. The reading should be between 5K and 49K ohms. If the indication is a short or open, replace the thermistor.**
 - 2. Measure Ohms from either side of the thermistor to one of the screws on the barrel end-plate which holds a green grounding wire, (see attached drawing).**

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- 4. When troubleshooting the cooler, keep in mind that the power supply for the cooler is not regulated. Typical voltages for the power supply are 10-11 volts with an open cooler/cooler turned off, and 8-9 volts with a working cooler when on. The power supply is located on a small vertical bracket in the M100 M150, M200, M250, and M251. In all others it is located in the Power Supply Module.**
 - A. The cooler is located in the PMT barrel assembly. Measure the voltage on the red wire of the top connector on the end of the barrel. It should read 8-9 Volts when on. Measure the voltage on the green wire on the end of the same connector, it should be 1.2 to 1.5 Volts. If the green and red wires both read 10-11 Volts, the FET is open or not on. Measure the voltage on both sides of the resistor on the FET, (the FET is located on the cooler bracket). When the front panel PMT temp is more than 15 degrees, you should have ground on one side and 4.7-5.1 VDC on the other. If not, there is a bad connection, short or the I/O card isn't functioning properly.**
 - B. If the Voltage on the green wire of the top connector reads 0-.5 Volts and the red wire has 10-11 volts, the cooler is open and should be replaced.**
- 5. If you are unable to resolve the problem, please call the Service Department for assistance.**

