

**Liquid Nitrogen Pressure:
25 psi or 1.7 bar (1.7 x10⁵ Pa)
NO More than 50 psi or 3.5 bar**

(1) Turn on power, make sure "Heat" light on

(2) Push green "shift" button, light on

(3) Push "SET=" button, display "SET=", then type the temperature you want

(4) For example, type "55", then push "ENTER" blue button

(5) Now "HEAT" light under the display is on. Chamber heat to 55 C.

Please Read Manual Carefully

Understand the color of the key labels

Although this chamber can go to 315 deg C, there is a safety limit on the back of the chamber. You can set a temperature lower than 315 deg C for safety concern. It will also affect the low temperature setting.

IF "FAILSAFE" LIGHT IS ON & display is off, it means the temperature of heater is higher than the safety limit, you can adjust the safety limit use a screw driver. You shall also reset the failsafe breaker on the back of the chamber.

You can use this hole to feed dry gas or electrical cables into the chamber for your special test



This hole/rubber costs \$125



In certain models, there is N2 gas inlet port on the back of the chamber, you can feed dry N2 or air if you see moisture condensation below 0 deg C. If you do not have this, you can use the hole on the side of the chamber²

Please Read Manual Carefully. This is a high quality chamber with lifetime over 20 years.

By default, the chamber controls to the chamber probe reading. The chamber probe reading is shown on top line of LCD. The chamber probe is located on top right of inside of chamber and measures air temp.

The user probe is the probe located near center of chamber and is represented on second line of LCD. If you need to control to the USER probe, then you can do so using the PIDA command.

The PIDA can be set to 0-4. PIDA = 0, will control to chamber probe and PIDA = 3 will control to user probe.

To set the PIDA remotely, you issue the command:

PIDA=3

To set the PIDA from front panel (and since there is no PIDA key), you need to press the PIDC (or PIDH) key, then backspace over the C (or H) and insert an A. At this point, the LCD will show PIDA. Then you just insert '=' followed by '3', then press the ENTER key.

To find out what PIDA value the controller is set to, you use the PIDA? command. Use the above steps to get the PIDA, then press the ? key followed by the ENTER key.

So as an example of the key press sequence to set PIDA to 3, you would press the following keys:

RED SHIFT

PIDC KEY

GREEN SHIFT

LEFT ARROW KEY

RED SHIFT KEY

A KEY

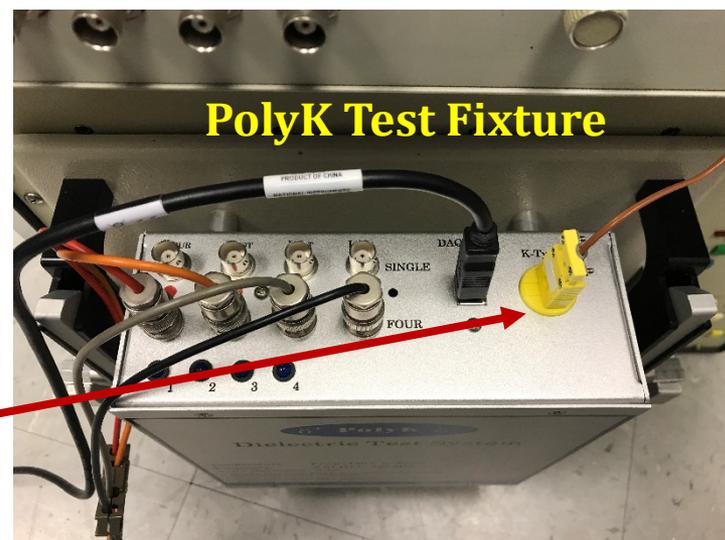
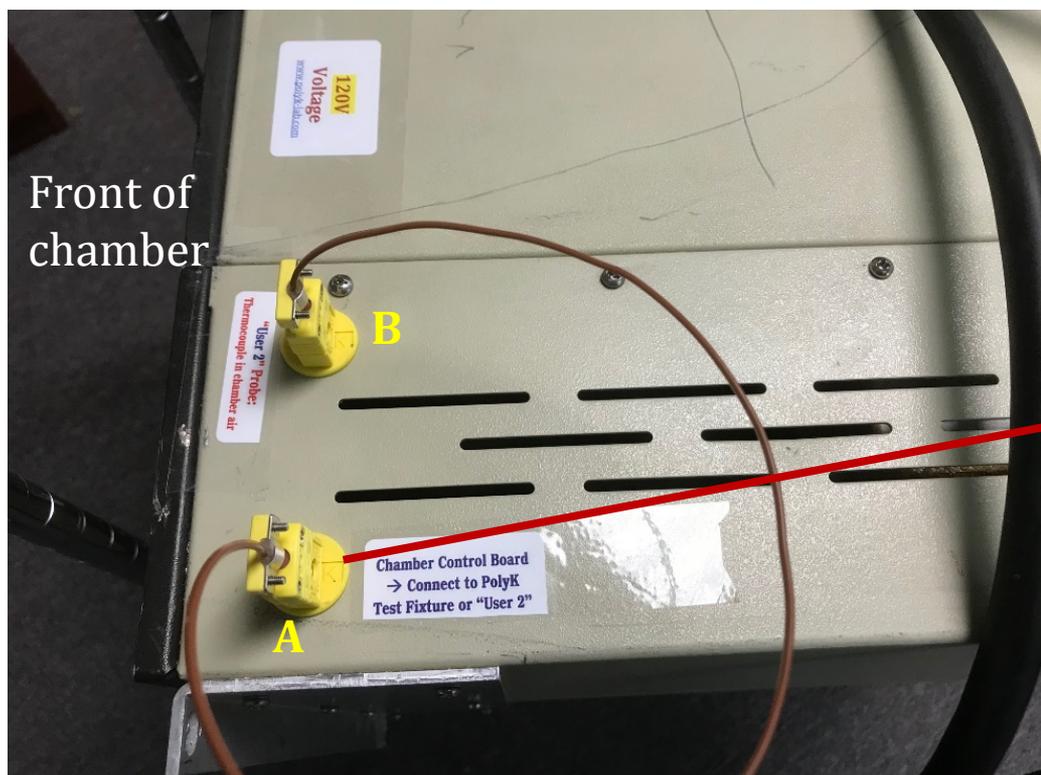
= KEY

3 KEY

ENTER KEY

1. The chamber has two thermocouples (Probes): Chamber Probe 1 and User Probe 2.
2. The chamber probe 1 is located close to the heater behind the stainless steel
3. The user probe 2 is in the chamber to measure the air temperature.
4. The temperature controller displays both temperatures and it can also control either one of them.

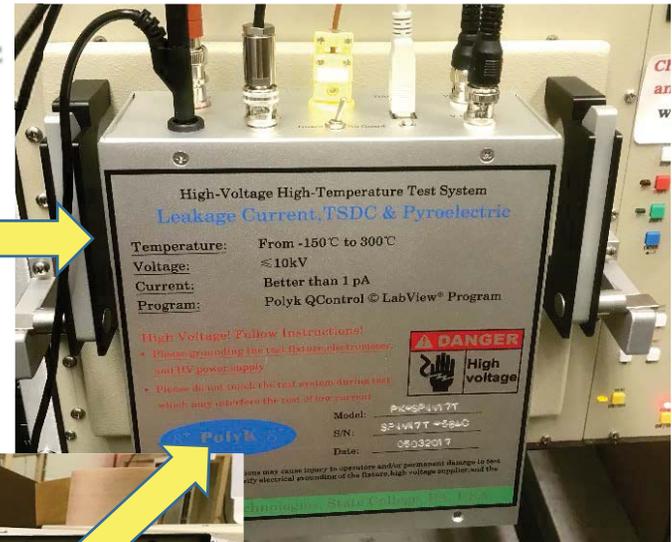
1. To accurately measure the temperature of the test sample, we modified the User Probe #2.
2. On top (or right) of the chamber, there are two female plugs of thermocouples (K-type).
3. One is connected to the control board of User Probe 2
4. The other is connected to the thermocouple in the chamber.
5. If you use the male-male K-type thermocouple directly connect the two plugs A & B, you can use the chamber as normal chamber.
6. If you use the PolyK male-male K-type thermocouple connect the Control Board A plug and the female connector on top of PolyK Test Fixture, you will be able to control the air temperature very close to your samples (the K-type thermocouple inside PolyK Test Fixture)



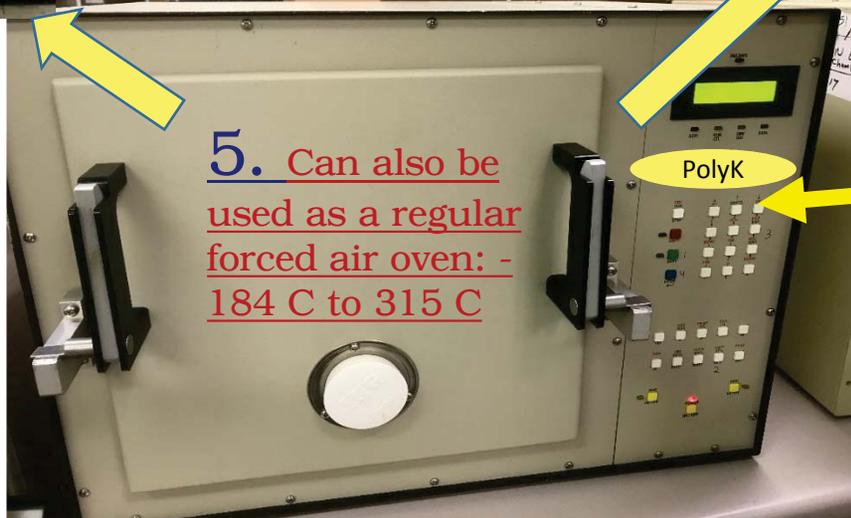
If you see "Probe #2 error" on the display, double check whether "A" is connected to any thermocouple.

Multi-Function

2. Leakage Current Test, TSDC, and Pyroelectric Test Fixture: need Keithley 6514 or 6517 electrometer and a high voltage power supply



1. Dielectric Test Fixture
[Need LCR meter such as HP/Agilent/Keysight 4284A, E4980A, or other brand]



Front Panel Keyboard:
manual temperature control, manual temperature program, Or Computer software control

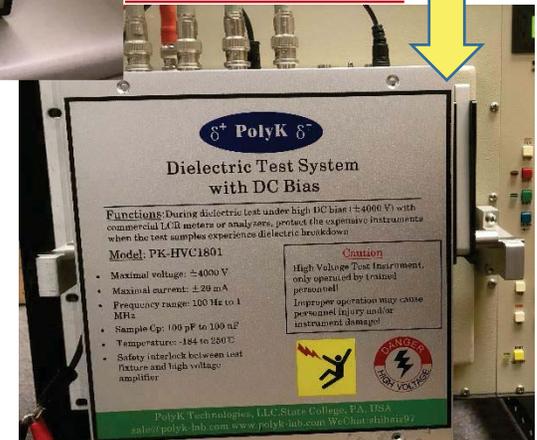
5. Can also be used as a regular forced air oven: -184 C to 315 C

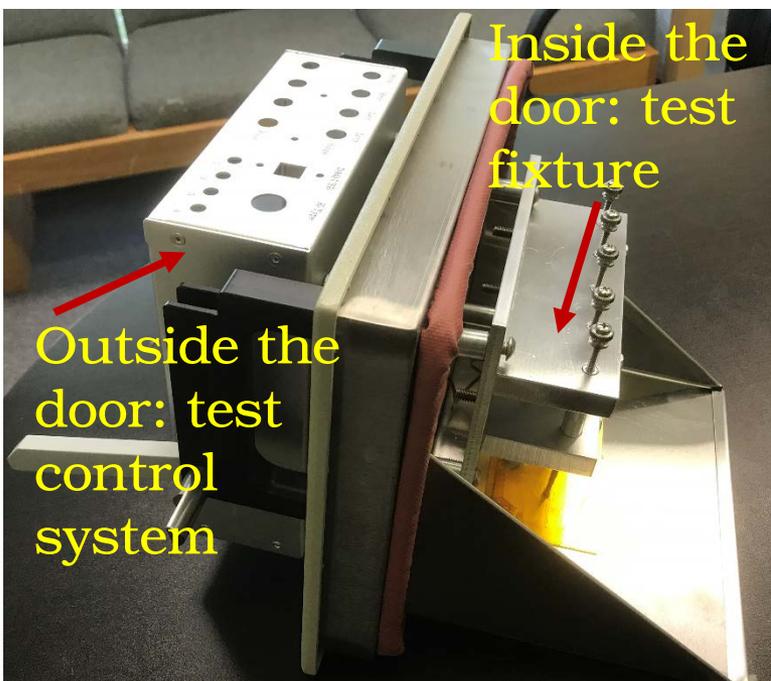
4. Dielectric under 4 kV DC Bias

Easy Fixture Change
[No Tool Required]

50 mm hole for designing other test systems

3. High voltage (10 kV) test fixture: work with PolyK Ferroelectric PE Loop and dielectric breakdown test system





Inside the door: test fixture

Outside the door: test control system

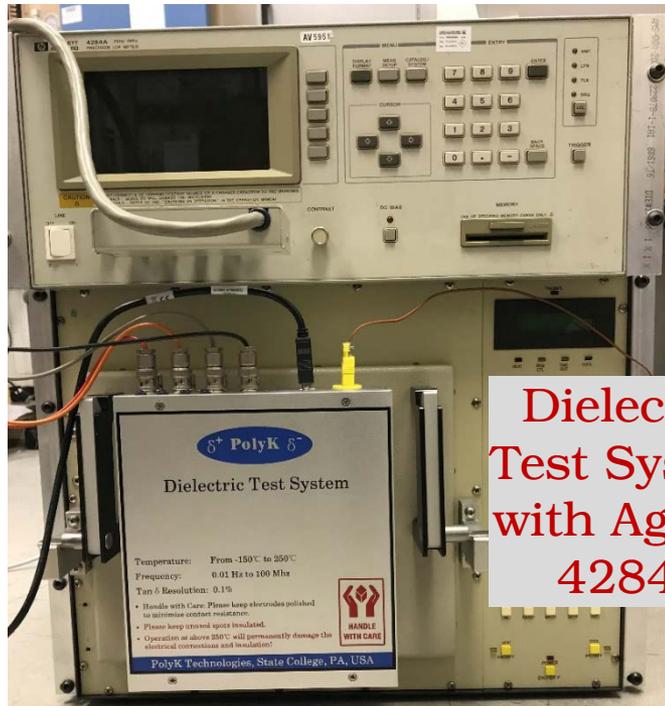
Test Fixture for Dielectric

Control Circuit

- T: -180 C to 250 C
- Tan δ : < 0.1%



Test fixture for dielectric: five channels, measure four samples simultaneously (compatible with Agilent LCR meters)



Dielectric Test System with Agilent 4284A

Temperature: From -150°C to 250°C
 Frequency: 0.01 Hz to 100 MHz
 Tan δ Resolution: 0.1%

• Handle with Care: Please keep electrodes polished to minimize contact resistance.
 • Please keep stored spots insulated.
 • Operation at above 250°C will permanently damage the electrical connections and insulation!

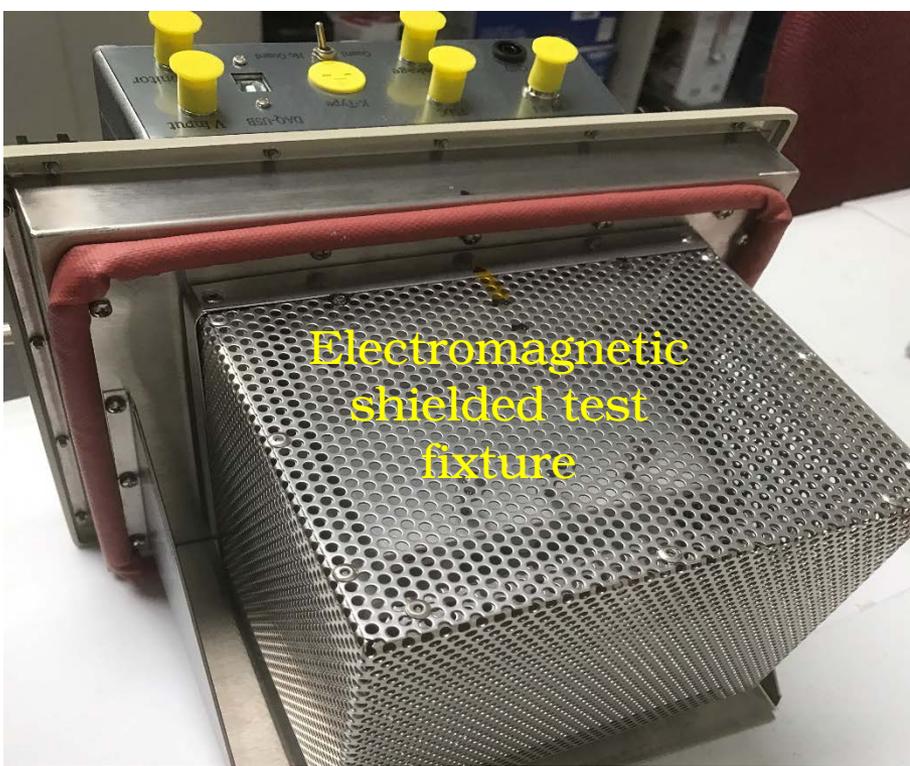


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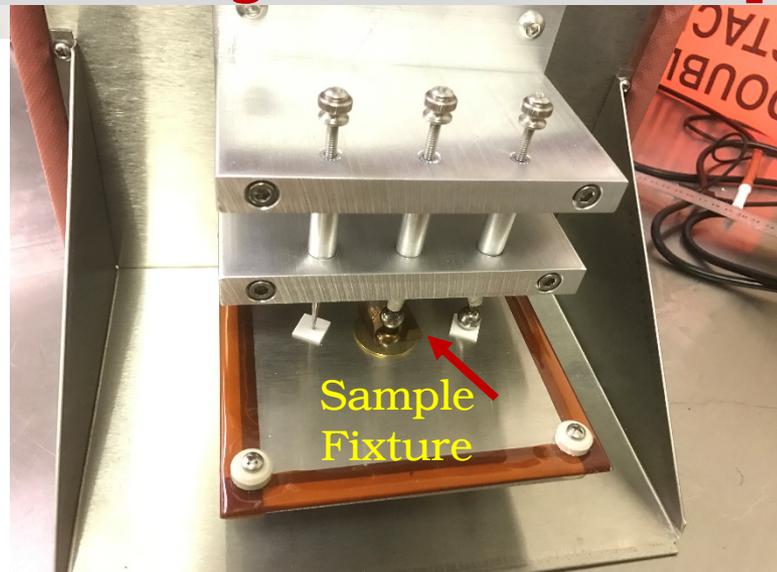


Test Fixture for **Pyroelectric**, **High Voltage Leakage**, **TSDC**

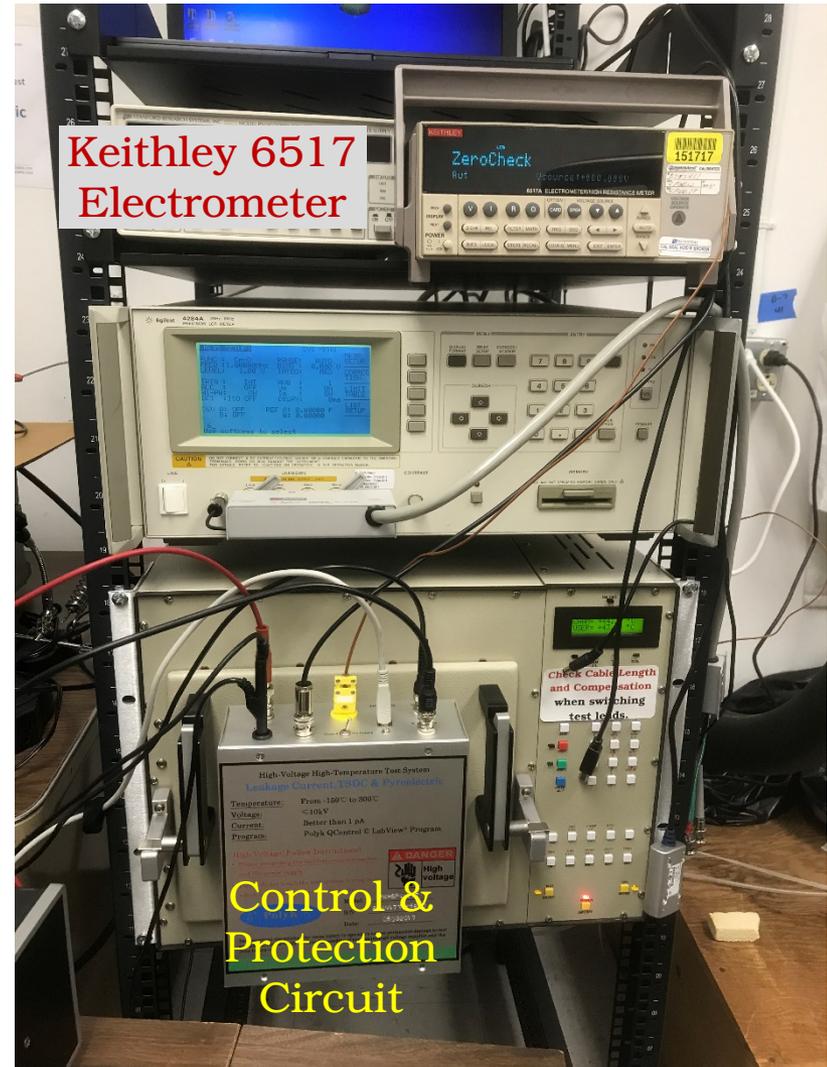


Electromagnetic
shielded test
fixture

Measuring low current of 1 pA



Sample
Fixture



Keithley 6517
Electrometer

Control &
Protection
Circuit

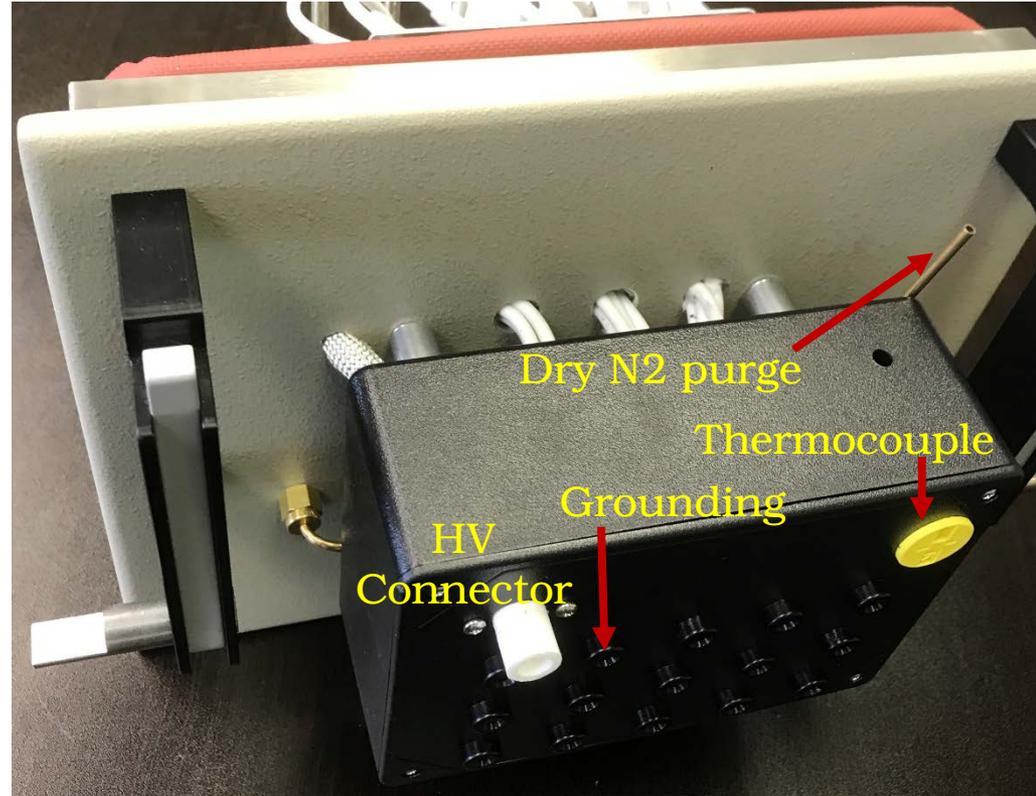
- Voltage: 10 kV
- Current: 1 pA
- T: -180 C to 300 C

Test Fixture for High Voltage, Dielectric Breakdown & Polarization Loop



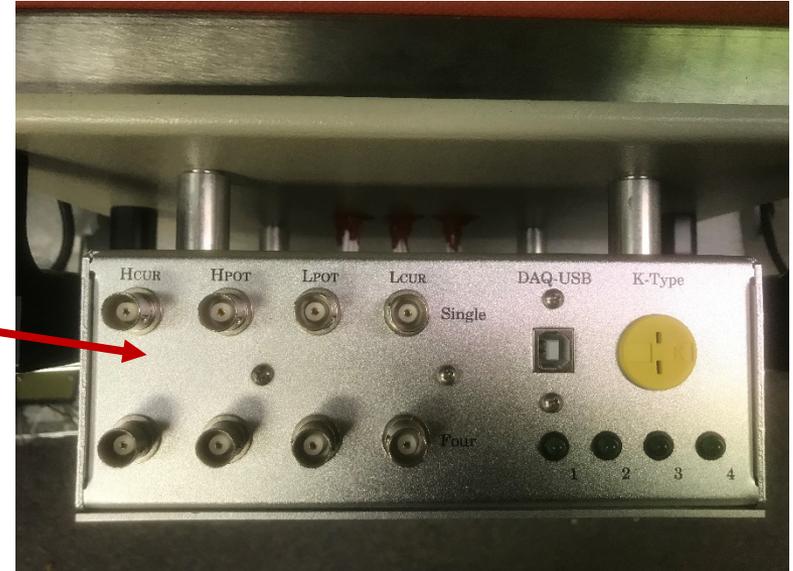
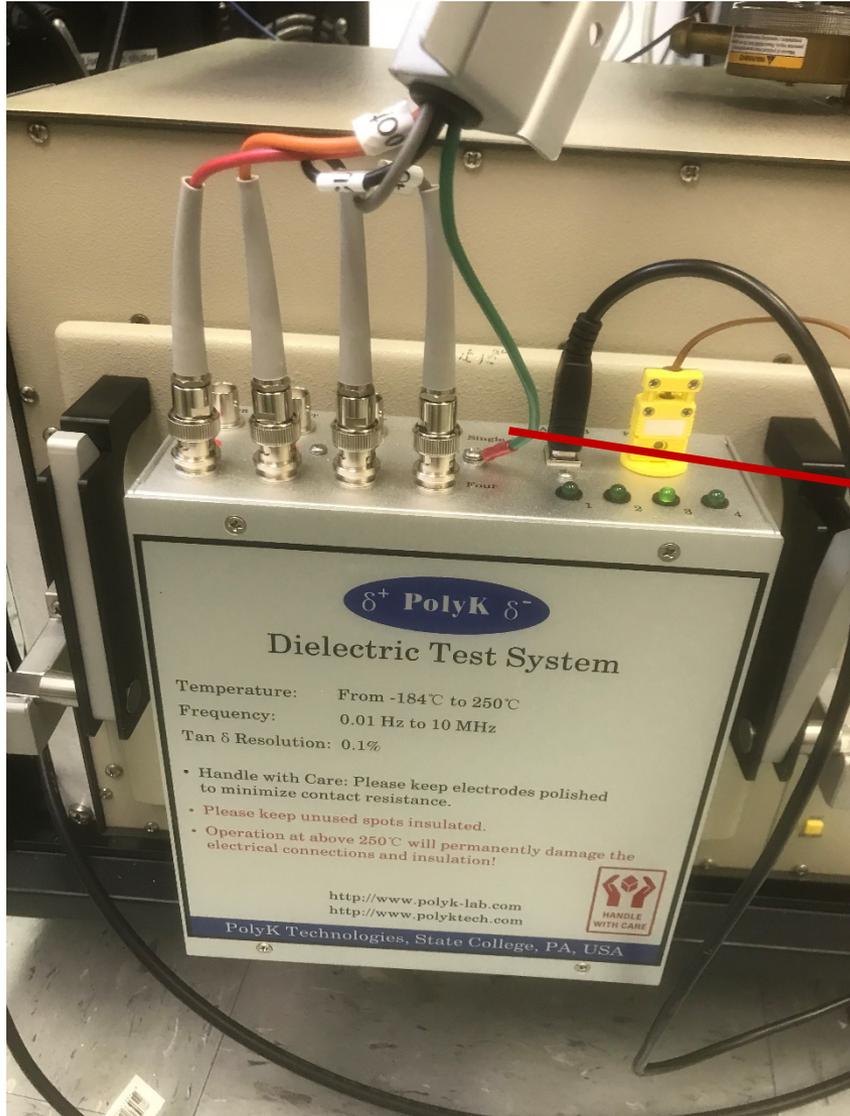
Sample Fixture: 15 specimens, soaked in silicone oil for HV test, built-in thermocouple, N2 gas purging

1. **Voltage: 10 kV**
2. **Temperature: -180 C to 250 C**
3. **Soak in oil to prevent the dielectric breakdown of air and ensure uniform temperature**



External: after testing one specimen, change connection to next specimen without opening the oven to prevent moisture condensation.

Easy to change test fixtures: **Dielectric Test**



Easy to change test fixtures: **TSDC**



Liquid Nitrogen Connection

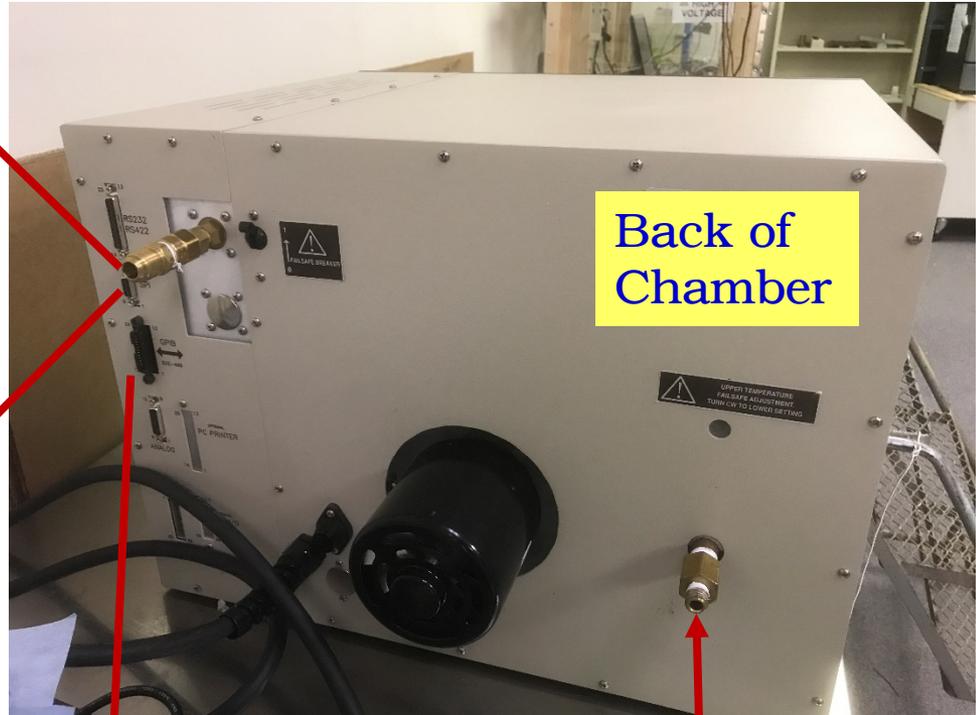
With a 2 m LN2 hose to connect chamber to external liquid nitrogen tank



There is a cryogenic valve inside. When cooling is required, the valve is open and pressured liquid nitrogen is feed in from external 1.3 bar tank.

Connector is international standard (1/2 inch female flange) and compatible with common liquid nitrogen tank with 1.3 bar pressure.

Connect to liquid nitrogen (1.3 bar pressure) or compressed air for cooling



GPIB/RS232 Connector for computer control

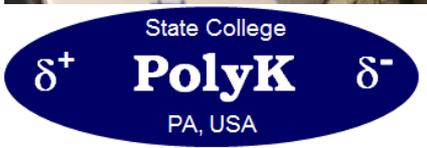
Dry Nitrogen or Air purge for test < 0 C (avoid moisture)

No intermedium liquid nitrogen storage dewar. The chamber is directed connected to large liquid nitrogen tank (which is provided when you buy liquid nitrogen)

**Liquid Nitrogen
Outlet**

**Nitrogen Gas
Outlet**

**USA 180L Liquid
Nitrogen Tank
(Pressure 25 psi
(1.7 bar) to 100
psi (6.9 bar))**



TROUBLESHOOTING AN EC1X CHAMBER WITH HEATING AND COOLING ISSUES

TROUBLESHOOTING A CHAMBER NOT HEATING

If the chamber is not heating :

- Make sure that the red heat LED turns on when a HOT set point is entered and heat is enabled. If the red heat LED is not turning on, try the software reset command: **STOPE9 <ENTER>** to reset controller to factory default settings, then power on chamber and enter a hot set point to see if problem has cleared.

If the red heat LED IS coming on and chamber is not heating up:

- Separate control section from chassis by removing screws along top/bottom of right side of chamber.
- Separate control section from rest of chamber and verify that the gray ribbon cable from motherboard to I/O board is securely seated on both ends.
- Verify that red/black twisted pair from bottom terminal strip labeled HEAT is connected securely to the 25A heater SSR installed on firewall next to I/O board.
- With the red heat LED on, the DC voltage to 3&4 of the 25A heater SSR should be between 3 and 5 VDC. If no voltage is present, problem is either with ribbon cable or motherboard. Swap out ribbon cable with known good cable. Ribbon cable from front panel may be used. If problem persists, motherboard is faulty. Contact Sun for an RMA or replacement part.
- If the voltage is present on the heater SSR, then with voltmeter set to AC, the AC voltage measured on terminal 1 & 2 across heater SSR should be close to 0VAC.
 - If the voltage across 1&2 of the 25A heater SSR is not approximately 0VAC when the RED heat LED is on, then SSR could be faulty or there could be an open heater element or poor connection to one or more heater elements.
- To verify that heater elements are OK, you can measure the total equivalent resistance at the points listed in the table. The value measured should be within a few ohms of the value listed in the table.

MODEL	VOLTAGE	MEAST. TERMINALS	OHMS	HEATER ELEMENTS
EC0A/1A/01/10	110 VAC	11 & 9 ON I/O BOARD	10	(2) 600 WATTS
EC0A/1A/01/10	220 VAC	11 & 10 ON I/O BOARD	40	(2) 600 WATTS
EC02/12	110 VAC	11 & 9 ON I/O BOARD	8	(2) 800 WATTS
EC02/12	220 VAC	11 & 10 ON I/O BOARD	32	(2) 800 WATTS
Etx	110 VAC	SSR (2) & 12	10	(2) 600 WATTS
Etx	220 VAC	SSR (2) & 14	40	(2) 600 WATTS

EC11	220 VAC	11 & 10 ON I/O BOARD	17	(2) 600 WATTS (2) 800 WATTS
EC03/13	220 VAC	11 & 10 ON I/O BOARD	20	(4) 600 WATTS
EC1.3W	220 VAC	11 & 10 ON I/O BOARD	20	(4) 600 WATTS
EC127	110 VAC	SSR(1) & BRK B2	16	(2) 400 WATTS
EC127	110 VAC	SSR(1) & BRK B2	64	(2) 400 WATTS
EC13HA/15/16/HA	220 VAC	11 & 10 ON I/O BOARD	8	(4) 600 WATTS (4) 800 WATTS

- If the correct resistance is measured, then SSR is at fault. Contact Sun for replacement part.
- If a much higher resistance is measured, then a poor connection to a heater element exists or there is an open heater element.

To determine if a poor connection exists:

- Remove the chamber back plate and set aside fiberglass insulation. Inspect wiring to heater elements and check that nuts are tight, there are no charred connectors, or cracked/broken ceramic insulators. Contact Sun for replacement part (s).

To determine if a heater element is open:

- Remove wiring to heater element and use ohmmeter to measure resistance of each heater element.
- Contact Sun for replacement heater elements.

TROUBLESHOOTING A CHAMBER HEATING ALL THE TIME

With chamber powered on and the RED heat LED off, the chamber should not heat up at a fast ramp rate. The residual heat from motors, however, will cause a very slow increase in temperature of the chamber.

If the chamber is heating at all times:

- Separate control section from chassis by removing screws along top/bottom of right side of chamber.
- Measure the DC voltage across 3&4 of the 25A heater SSR. It should be approximately 0vdc when RED heat LED is off.

- If a voltage is present, then either there is short in gray I/O ribbon cable or main motherboard is faulty. You can rule out the ribbon cable by temporarily using the ribbon cable used by the front panel. If problem clears, then problem is a faulty ribbon cable. If problem persists, then motherboard is faulty and should be sent in for repair. Call Sun for an RMA or replacement part.
- **If no voltage is present on 3&4 of the 25A heater SSR, then measure the AC voltage across 1&2. With the red heat LED off, the voltage should be approximately that of the line voltage. If the voltage measured is close to zero, the SSR is most likely shorted internally. Otherwise, there is most likely a heater terminal shorted to ground via a broken ceramic insulator or has opened up and making contact with chamber (ground).**
- To determine if a short from terminal to ground exists, remove the backplate of the chamber and set aside fiberglass insulation. Inspect for broken ceramic insulators, charred or loose wiring. Measure the resistance from each terminal to ground (inner chamber). It should read a very high resistance. If not, then heater element is faulty and should be replaced. Contact Sun for replacement part (s).

TROUBLESHOOTING A CHAMBER WITH DC VALVE * THAT IS NOT COOLING

* Almost ALL chambers mfg after 2004 come equipped with DC valves

If the chamber is not cooling:

- Verify the green cool LED turns on when a COLD set point is entered and cooling is enabled. If it does not, try the software reset command: **STOPE9 <ENTER>** to reset the controller to factory default settings. Power on chamber and enter a cold set point to see if problem has cleared.

If the green cool LED IS coming on and the chamber is not cooling:

- If your chamber is equipped with an optional REDUNDANT valve, you will need to verify that it is ENABLED in the SDEF menu by setting this option to YES. If you are not sure if your chamber is equipped with a redundant valve, detach control section to see if there are a pair of valve wires connected to terminals A3 and A4 (redundant valve output) on the top terminal strip of the I/O board. You may also contact Sun with the chamber's serial number and we may be able to determine if that chamber is equipped with a redundant valve.

If chamber does not have a redundant valve, or this setting is enabled for chambers with a redundant valve and the chamber is still not cooling:

The chamber requires a LIQUID supply for the chamber to cool. **It will not cool with gas.** Verify that the correct coolant is being used for the chamber. This information is located on the serial label listed on the back of the chamber. If you are using an LN2 or LCO2 Dewar (tank), verify:

- The supply hose is connected to the LIQUID port.
- The tank is not empty.
- The supply pressure is within 25 psi of the stated pressure listed on the label located on the back of the chamber.
- The supply hose should be as short as possible (6' is ideal) and insulated to minimize vaporization of the liquid before it gets to the chamber.

If you are using 850 psi LCO₂, verify that you are using a SIPHON cylinder to ensure that liquid CO₂ is drawn and that the tank is not empty.

If you are confident that the chamber is receiving a liquid supply:

- Separate control section from chassis.
- Verify that the gray ribbon cable from motherboard to I/O board is securely seated on both ends.
- The coil resistance of the DC valve can be measured (AC valve coil resistance cannot be measured due to presence of bridge rectifier). To do this, remove the black valve wires from terminals 15&16. Set meter to measure resistance. The value should be approximately 18 OHMS. If an open resistance is measured, the coil is faulty and needs to be replaced.
- If the resistance is OK, reconnect valve wires to 15 and 16.
- Set chamber to cool. When the green cool LED is on, the driver board sends out a 20-25 volt pulsed signal that can be viewed on a scope OR the **average DC voltage** of this can be measured with a voltmeter.
- Set the voltmeter to measure DC volts and measure the voltage to 15 & 16. The voltage should be between 4 Vdc and 7 Vdc. Optional valves such as line purge and redundant valves, will receive this same voltage if enabled in the SDEF menu.
- If this voltage is not present (0Vdc measured), then either the motherboard, ribbon cable or the valve driver board are at fault. Verify that the 3-5Vdc cool control voltage from the motherboard is getting to this driver board. This control signal is present between the pins labeled + and – (on the I/O board shown below) next to the leads on the cool driver board. If this signal present and no voltage is present on 15 & 16, then most likely the cool driver board is faulty. If no 3-5Vdc signal is present at the input of the driver board, then either ribbon cable or motherboard is faulty. Swap out the ribbon cable with a known working cable. The ribbon cable used by the front panel may be used. If problem persists with a known working cable, then it is likely that the motherboard is at fault. Contact Sun for an RMA.
- If a voltage IS present on 15 & 16 of the I/O board, verify LN₂ supply pressure is within 25 psi of the rated pressure listed on back of chamber. If the valve continues to not open, valve is most likely faulty. Contact Sun for an RMA or replacement part.

TROUBLESHOOTING A CHAMBER WITH AN AC VALVE THAT IS NOT COOLING

If the chamber is not cooling:

- **Verify that green cool LED turns on when a COLD set point entered and cooling is enabled. If it does not, try the software reset command: **STOPE9 <ENTER>** to reset the controller to factory default settings. Power on chamber and enter a cold set point to see if problem has cleared.**

If the green cool LED IS coming on and the chamber is not cooling:

- **If your chamber is equipped with an optional REDUNDANT valve, you will need to verify that it is ENABLED in the SDEF menu by setting this option to YES. If you are not sure if your chamber is equipped with a redundant valve,**

detach control section to see if there are a pair of valve wires connected to terminals A3 and A4 (redundant valve output) on the top terminal strip of the I/O board. You may also contact Sun with the chamber's serial number and we may be able to determine if that chamber is equipped with a redundant valve.

If chamber does not have a redundant valve, or this setting is enabled for chambers with a redundant valve and the chamber is still not cooling:

The chamber requires a LIQUID supply for the chamber to cool. **It will not cool with gas.** Verify that the correct coolant is being used for the chamber. This information is located on the serial label listed on the back of the chamber. If you are using an LN2 or LCO2 Dewar (tank), verify:

- The supply hose is connected to the LIQUID port.
- The tank is not empty.
- The supply pressure is within 25 psi of the stated pressure listed on the label located on the back of the chamber.
- The supply hose should be as short as possible (6' is ideal) and insulated to minimize vaporization of the liquid before it gets to the chamber.

If you are using 850 psi LCO2, verify that you are using a SIPHON cylinder to ensure that liquid CO2 is drawn and that the tank is not empty.

If you are confident that the chamber is receiving a liquid supply:

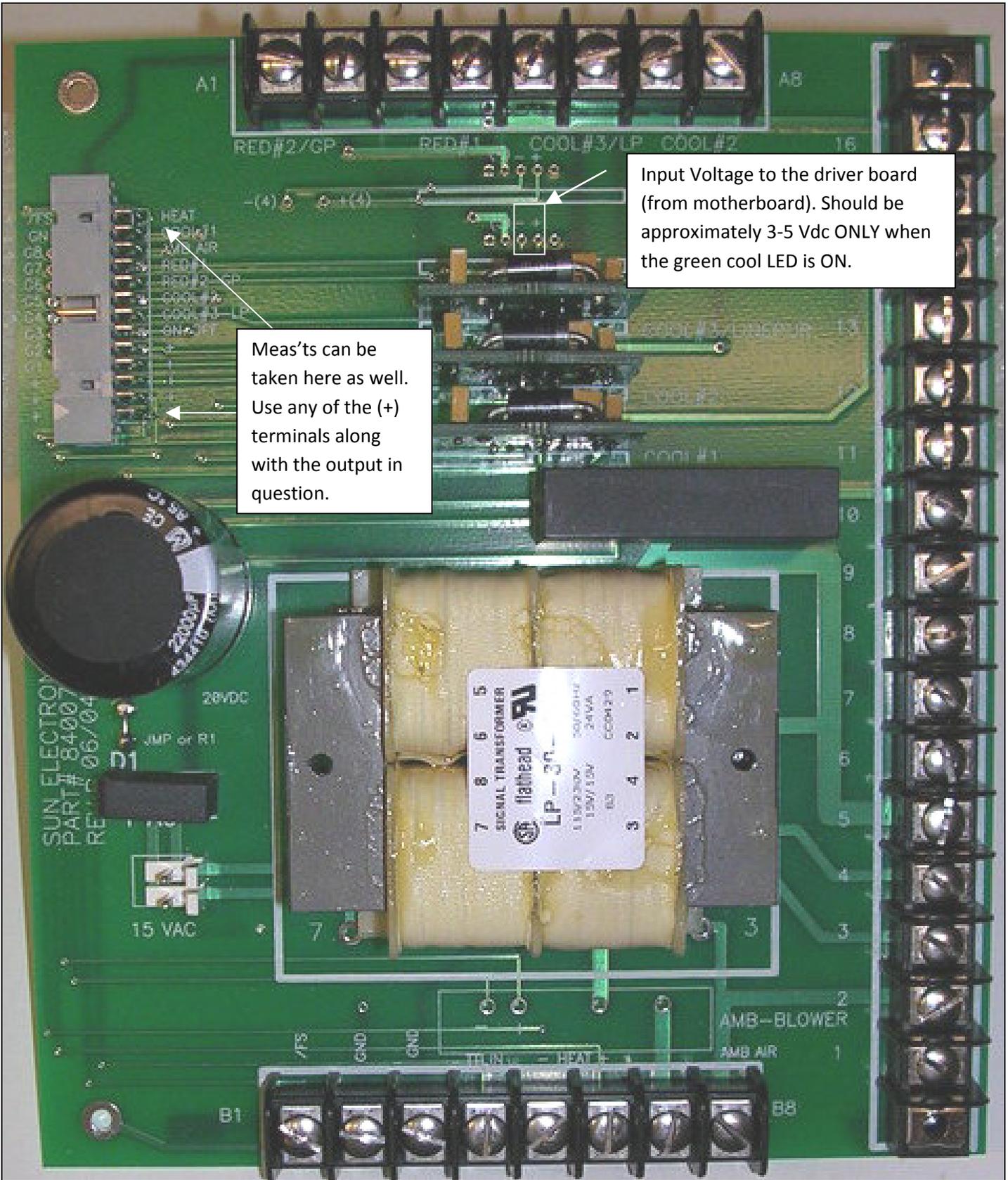
- **Separate** control section from chassis.
- Verify that the gray ribbon cable from motherboard to I/O board is securely seated on both ends.
- Set chamber to cool. When the green cool LED is on, the cool SSR should send out an AC voltage approximately equal to the line voltage supplied to chamber (110VAC or 220VAC) on terminals 15 and 16 of the I/O board. Optional valves such as line purge and redundant will receive this same voltage if enabled in the SDEF menu.
- If no voltage is present, then the SSR, motherboard or gray I/O ribbon cable could be at fault. To verify if which one is at fault, verify that the 3-5Vdc cool control voltage from the motherboard is getting to the cool relay. This control signal is present between the SSR + and – leads. If the signal is present, then cool SSR is most likely at fault. If this signal is not present, then replace ribbon cable to see if problem clears. If not, the main motherboard is most likely at fault and should be sent in on an RMA. Contact Sun at 321-383-9400 to get an RMA number.

TROUBLESHOOTING A CHAMBER WITH A VALVE STUCK OPEN

If the green cool LED is off, the chamber's valve should not allow coolant into the chamber. If it is off and continues to allow coolant into the chamber, UNPLUG the chamber from the outlet. If coolant continues to rush into the chamber with no power applied to the chamber, then the valve is at fault (Contact Sun for replacement part). If problem clears then electronics is at fault. To determine if problem lies with motherboard, I/O flat ribbon cable or DC driver board (AC SSR):

- Separate control section from chassis.

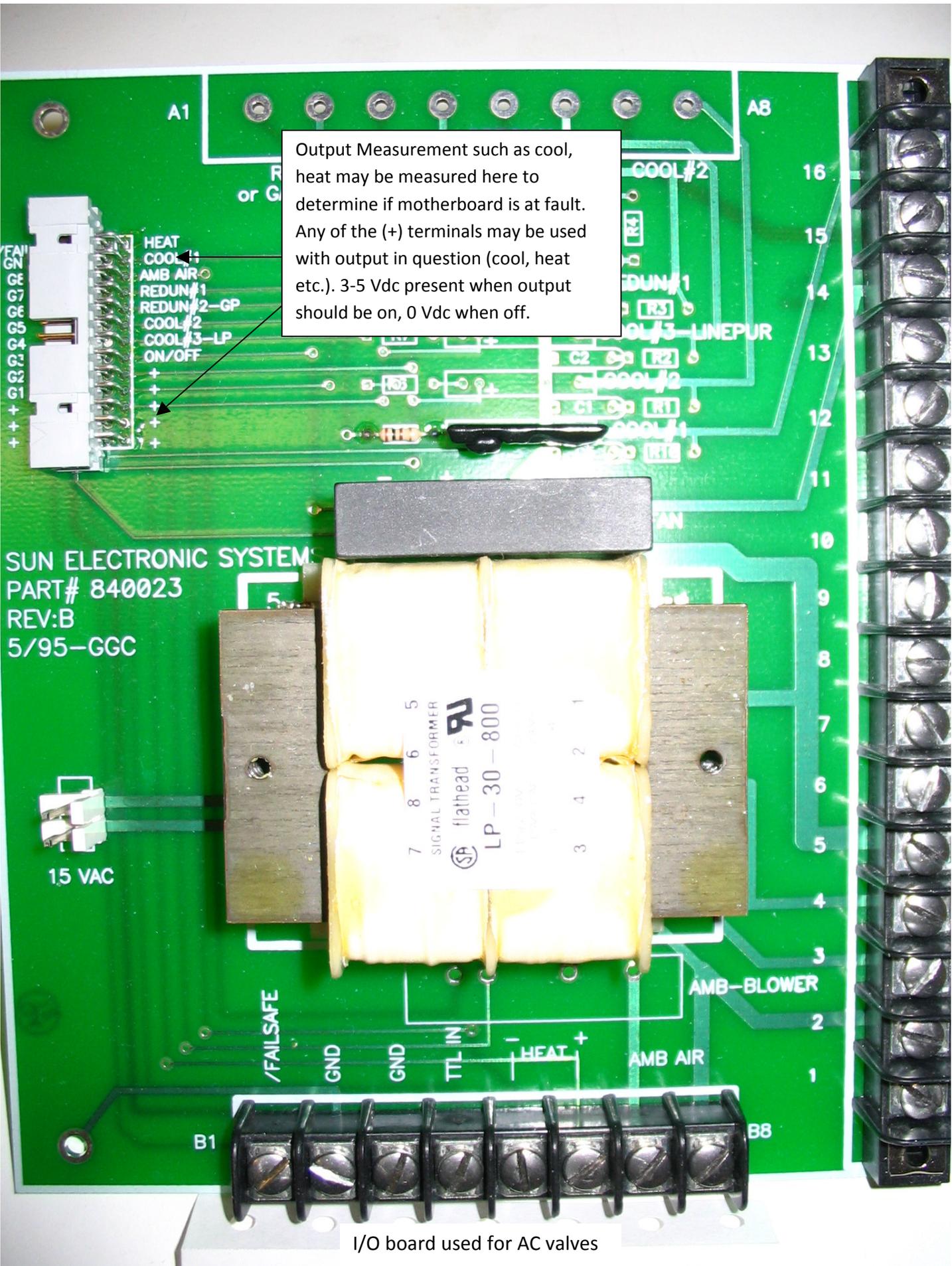
- Swap out ribbon cable with known good ribbon cable. The ribbon cable used by the chamber's front panel may be used. If problem clears, ribbon cable was faulty. Contact Sun for replacement part. If problem persists:
- Verify that NO voltage is present on terminals 15 & 16 (or on optional valves, terminal strip is labeled). For DC valves you should measure close to 0VDC and for AC valves, close to 0VAC. If a voltage is present, then either the DC driver board (SSR) or the motherboard is at fault. To determine if the motherboard is erroneously sending out a voltage to the driver board (SSR), measure the DC voltage to the input of the driver board (SSR) See I/O photo below. Measurement should be taken from the (+,-) pads for the driver board in question. The measurement may also be taken from the 26-pin gray connector. Use any of the (+) leads along with the output in question. If no voltage is present from motherboard then driver board (SSR) is at fault. If a voltage is present at the input to the DC driver board (or AC SSR), then motherboard is at fault. Contact Sun for an RMA or replacement part (s).



Input Voltage to the driver board (from motherboard). Should be approximately 3-5 Vdc ONLY when the green cool LED is ON.

Meas'ts can be taken here as well. Use any of the (+) terminals along with the output in question.

I/O board used for DC valves



Output Measurement such as cool, heat may be measured here to determine if motherboard is at fault. Any of the (+) terminals may be used with output in question (cool, heat etc.). 3-5 Vdc present when output should be on, 0 Vdc when off.

SUN ELECTRONIC SYSTEM
PART# 840023
REV:B
5/95-GGC

15 VAC

B1

B8

I/O board used for AC valves

EC1X Software Reset

Please issue a software reset to the chamber and see if that helps: STOPE9

From the front panel, press STOP,

press green shift #8 for E,

press 9.

The display should read **STOPE9**, press **enter**.

The chamber will shut down. Turn back on and press enter until the chamber and user probe temperatures are displayed again.