

ETx Chamber Troubleshooting Guide

This guide addresses common issues with the ET1-2 and ET2-2 model chambers that incorporate the PC100-2 controller.

Controller powers on, but does not advance beyond the “SELF TEST OK” message. Controller is not heating/cooling (red heat LED or green cool LED not turning on) with a valid setpoint entered, and with both heat/cool enabled.

Issue the STOP-9 software reset command as follows:

Press the STOP key, followed by the “-” key, followed by the number 9 key, then press ENTER. The controller should power off if performed correctly. Turn the unit back on to see if the issue clears.

If problem persists, contact Sun (info@sunelectronics.com) for assistance or for an RMA number to send the controller in for an evaluation/repair. Please provide the serial number listed on the serial tag on the back of the chamber.

Controller displaying faulty temperature reading or probe#1 or probe#2 error.

Try performing the STOP-9 software reset command by pressing the STOP key, “-” key, 9 key, then ENTER. The controller should power off. Turn unit back on and see if the issue clears within one minute.

If problem persists, it's possible the calibration has become corrupted and needs to have factory default calibration restored. This can be done as follows:

Enter the command MENU-9, then press ENTER.

The probe types the controller is set up for will be displayed for several seconds. The top line is channel#1 and should say .392 RTD and the second line is channel#2 and should say K thermocouple.

Press YES, ENTER to CAL-MODE PROBES? prompt.

Press 9, ENTER, to ENTER CAL ACCESS CODE?

Press YES, ENTER to CAL-MOD CH#1?

The probe type for channel #1 will now be selected. ETx chambers use .392 on channel#1 and K t/c on channel#2.

Press ENTER until RTD .392 PROBE is displayed, then press YES, ENTER.

Press NO, ENTER to PROBE AT 0 DEG C?

Select the desired scale (1 for C, 2 for F, 3 for K), then press ENTER.

Answering NO to this prompt will install factory default calibration values.

To enter calibration defaults for channel #2, press YES, ENTER to CAL-MOD CH_2 prompt.

Press ENTER until K THERMOCOUPLE is displayed, then press YES, ENTER.

Press NO, ENTER to PROBE AT 0 DEG C? To enter calibration default values for channel #2.

Select the desired scale (1 for C, 2 for F, 3 for K), then press ENTER to exit menu.

Controller should now have factory default calibration values and display readings close to room temperature.

If the controller is still displaying faulty reading or probe error, then check to see if probes are faulty.

If channel #1 is displaying the faulty reading or probe error, unplug chamber and remove the top cover of white controller chassis to gain access to probe connectors.

Locate the 8 position green connector and verify that it is fully seated into the connector on the back of PC100-2 controller. On REV G controllers (built around 2016 and later) the red wire connects to terminal 2 (with terminal #1 on the right end of the connector as viewed from top). The two remaining white wires of the RTD connect to terminals 3 and 4. On REV D controllers, the red wire connects to terminal 1 and the two remaining white wires to terminals 3 and 4. See PC100-2 manual for a probe wiring diagram if needed. With the 6 ft. DB25 cable connected from controller to chamber, measure the resistance of the RTD probe by taking a measurement between from the green connector terminal that the red RTD probe wire connects and either one of the white wires. You should get a value close to 110 ohms if the probe is at room temperature. A reading much higher or OL (out of limit) indicates a break in probe wire from controller to chamber or a faulty RTD probe. Check probe wiring on the chamber end by removing the back plate on the chamber and inspecting the red,white,white wires of the RTD probe and verifying they are soldered to pc board with 25 pin connector. Measure the resistance of the RTD between the red and one of the white wires at this point. Once again, a value close to 110 ohms should be measured at room temperature. If much higher, then it's possible probe is faulty. Part number for a replacement .392 RTD probe is: 190001.

If channel #2 is displaying a faulty reading or a PROBE#2 error, check the K thermocouple probe. With the chamber unplugged and the top of white controller chassis removed, locate the 8 position green probe connector and verify it is firmly seated into the connector on the back of PC100-2. On REV G controllers, the yellow lead of the K t/c connects to terminal #6 and the red lead to terminal #7. On REV D controllers, the yellow lead of the K t/c connects to terminal #7 and the red to terminal #6. Verify both leads are securely connected to the 8 position probe connector.

With the DB25 cable attached from controller to chamber, measure the resistance of K t/c. You should measure a value less than 20 ohms. If an OL (out of limit) or much higher resistance is measured, then there could be a poor connection in one of the yellow thermocouple connectors, a cut in the t/c wire or poor connection at probe tip.

Check that probe leads are secure in all of the yellow thermocouple connectors. Verify that yellow lead connects to + or positive terminal and red lead connects to - or negative terminal. Remove the back plate and check the connection to the yellow thermocouple connector on the back plate. Measure the resistance at this point as well to confirm a value less than 20 ohms. If an OL or high resistance reading is measured at this point, the thermocouple could have a cut or there is a poor connection at the tip. Contact Sun for a replacement channel #2 K thermocouple. To check 6' K thermocouple extension wire, short one end of extension wire and measure resistance to verify a value of less than 20 ohms. If a much higher reading is obtained, contact Sun for a replacement thermocouple extension wire.

Chamber not powering on

Measure line voltage from the outlet the chamber is plugged into and verify approximately 120VAC for 120VAC chambers and 220VAC for 220VAC chambers is present.

Unplug chamber from wall and check fuse(s) on back of chamber. 120VAC chambers use one 15A fast blow fuse while 220VAC chamber use two 15A fast blow fuses. On 220VAC chambers, the second fuse holder is recessed and can be accessed after removing backplate.

If one or more fuses are blown, check for shorts to ground before replacing and plugging the chamber back in. Part number for 15A fuse is: 650023.

If fuse(s) are ok, remove backplate, plug chamber back in and check for line voltage to the input of the I/O board located on the two position terminal strip on the right side of the I/O board. With the voltmeter set to VAC, you should measure approximately line voltage. If no voltage is present, check fuses, wiring to fuse holder and outlet.

For chambers with AC I/O board (part# 840065), If line voltage is present to the input of the I/O board, measure raw voltage to the voltage regulator. Attach black wire from meter to ground, which is available on terminal 2 of the 8 position terminal on left side of I/O board and with meter set to Vdc, measure the input voltage present on the middle terminal of the voltage regulator. Voltage measured should be approximately 15-25Vdc. If voltage is out of range, verify that the switch on the I/O board is set to proper line voltage. Output of the voltage regulator can be measured from the terminal on the right side of the regulator to ground. For chambers with firmware version [5.xx](#), we used a 12V regulator (so ~ 12Vdc should be measured) and for chambers with firmware version [10.xx](#) and higher we used a 5V regulator (~5Vdc should be measured).

If no voltage is present, unplug the chamber and check 1A fuse on the I/O board. If the fuse is ok and there is still no voltage present to the voltage regulator, it's possible the I/O board is faulty. Replacement part for the AC I/O board with (part number 840065) is 980504-ET.

If voltages at the regulator are ok, then it's possible the controller is faulty. Contact Sun for an RMA. Please provide the serial number listed on the back of the chamber.

For chambers with DC I/O board (part# 840084), If line voltage is present to the input of the I/O board, measure raw voltage to the voltage regulator. There are pads located above the voltage regulator labeled +20 and GND. Measure the voltage here to verify 15-25Vdc is present. If voltage is out of range, verify that the correct jumpers (120VAC or 220VAC) are installed. Output of the 5V regulator can be measured from pad labeled +5V.

If no voltage is present, unplug the chamber and check 2A fuse on the DC I/O board. If the fuse is ok and there is still no voltage present to the voltage regulator or from the output of the regulator, it's possible that one or more components on the I/O board is faulty. Replacement part for the DC I/O board is 980504-ET-DC.

If all voltages at the regulator are ok,, then it's possible the controller is faulty. Contact Sun for an RMA. Please provide the serial number listed on the back of the chamber.

Controller displaying “FAILSAFE” message

The controller should only display the FAILSAFE message when the circuit breaker on the back of the chamber is flipped to the left in the “tripped” position. If the breaker is in the tripped position, reset by flipping back to the right. Unplug chamber and plug chamber back in to see if issue clears.

If the breaker trips back to the left, it's possible that the adjustable bi-metal thermostat needs to be raised. The chamber has a N.O thermostat switch that closes when the temperature it is set to is reached. When this temperature is reached, the thermostat switch closes and trips the circuit breaker to the left position.

To raise the temperature that the thermostat closes (and therefore trips the breaker), use a flat-head screwdriver to adjust the thermostat ¼ turn at a time in the counterclockwise direction. The thermostat is accessible via the thermostat access hole on the backplate directly above the circuit breaker.

Turning the thermostat clockwise, will lower the temperature that the thermostat trips the breaker. If the breaker continually trips even after the thermostat is raised to max, then it's likely that the thermostat is faulty. The part number for the thermostat is: 800008. To replace this thermostat requires disassembly of most of the chamber. If you would like to send the chamber in for an evaluation/repair, contact Sun for an RMA. Please provide the serial number listed on the back of the chamber.

Chamber not heating or heating slow (with red heat LED on).

If after entering a hot set point and with heat enable LED on, the red heat LED should turn on allowing the controller to turn on the heater SSR. If red heat LED is not turning on, see issue #1. If the chamber is not heating or heating slow. Unplug chamber and remove back plate. Locate the 25A heater SSR. It is normally located on the right side of the firewall. For 220VAC chambers the two 600W (20 ohm) heaters are wired in series and should measure approximately 40 ohms between terminal 2 of the 25A heater SSR and terminal 12 of the top terminal strip.

For 110VAC chambers the two 600W (20 ohm) heater elements are wired in parallel and should measure approximately 10 ohms between terminal 2 of the 25A heater SSR and terminal 14 of the top terminal strip.

If much higher resistance readings are found, then wiring to heater terminals can be checked or heater elements replaced. The white outer chassis will need to be removed to access heater terminals and the inner baffle inside chamber will need to be removed as well if heater elements need replacing.

If heater element resistance values are reasonable, then check that the 25A heater SSR is receiving the heater control voltage. Plug chamber back in, make sure K thermocouple wire is connected from controller to back plate, power on chamber, enable the heat LED and enter a hot set point. When the red heat LED is fully on, you should measure approximately 3-5VDC on terminals 3 and 4 on 25A heater SSR. If voltage is present and heater elements are measuring the proper values as stated above, then it's possible the 25A heater SSR is faulty. Part number for this SSR is 800003. If no voltage is present on terminals 3 and 4 of heater SSR, verify that

the gray ribbon cable on the I/O board is fully seated on both ends and has no visible cuts. It's possible that either the controller is faulty or the heat signal is not getting to SSR due to a faulty 6' DB25 cable or poor connection along the path from the controller to the chamber. Check the gray ribbon cable inside the controller chassis to verify that it is fully seated on both ends as well. Contact Sun for an RMA if you would like us to evaluate the controller and 6' DB 25 cable or if you would like to send both chamber and controller in for an evaluation. Please provide the serial number listed on the back of the chamber.

Chamber always heating

If the chamber is always heating, especially if the controller was recently swapped onto a different chamber, then there could be a compatibility issue. Chamber's built around 2016 and earlier or REV D chambers used a 12Vdc regulator on the I/O board. REV G controllers (built around 2016 and later) were designed to be used with a 5V regulator and therefore REV G chambers use a 5Vdc regulator on the I/O board. The REV of the chamber should be listed on the serial tag on the back of the chamber. REV D controllers (with versions [5.xx](#) and lower displayed on front panel after powering unit on) will work properly on both REV D and REVG chambers but REV G controllers (with version [10.xx](#) and higher) must be used with REVG chambers using the 5Vdc regulators.

If a REV G controller is connected to a REV D chamber using a 12V regulator on the I/O board, the controller outputs, including the heat, will always be on. This will cause the chamber to heat immediately after being plugged in. If a REVG controller needs to be used with a REV D chamber, you can replace the 12V regulator on the I/O board with a 5V regulator. The part number for our 5V regulator is: 510097 Or you can send the I/O board or chamber to Sun on an RMA and we can replace the regulator. Alternatively, if you send in the REV G controller, there is a fix that we can perform (lift pin 14 of U32 on middle board of PC100-2) to allow the controller to work with both 5V and 12V regulators.

If there is no compatibility issue (i.e a REV G controller is not connected to a REV D chamber), then the issue could be either a shorted 25A heater SSR, or a heater element has opened up and is making contact with ground (chamber chassis). Remove the inner baffle inside the chamber to expose both heater elements. Look for one or more open elements making contact with ground. Replace faulty element(s) as needed. Part number for 600W heater element is: 980201. If heaters look ok, plug the chamber in to see if both heater elements glow orange. If both elements are turning on, then it's possible that the 25A heater SSR is faulty. Unplug chamber and remove backplate to expose the 25A heater SSR installed on the right side of the firewall. Plug chamber in, set meter to Vdc and measure the voltage across terminals 3 and 4 of heater SSR. With no set point, the voltage should be ~ 0Vdc. If a voltage is present, then verify that REV G controller with version [10.xx](#) is not installed on a REV D chamber (see serial tag on back of chamber for REV) as described above. If not, then the controller could be faulty. Contact Sun for an RMA and we can evaluate/repair controller. If no voltage is present on terminals 3 and 4 of the 25A heater SSR and both heaters are always on when the chamber is plugged in (with no set point), then it's likely the 25A heater SSR is faulty. Part number for heater SSR is: 800003.

If you would like to send the chamber in for repair, contact Sun for an RMA number. Please provide the serial number listed on the back of the chamber.

Chamber not cooling or cooling slow

If after setting a valid cold set point and with cool enable LED on, the green cool LED should turn on and the “clicking” sound of the solenoid opening can be heard. You can also disable and re-enable the cool enable by pressing the cool enable button on the bottom right of front panel. Toggling the cool enable LED should toggle the green cool LED and therefore the solenoid causing a clicking sound. If a clicking sound can be heard, with the cool valve open (with green cool LED on), you should hear the sound of coolant entering the chamber. If the sound of coolant can be heard entering the chamber but there is little to no drop in temperature, then it’s possible that N2 gas, rather than liquid, is entering the chamber. The chamber will only cool when liquid is available to the solenoid. Verify that the LN2 hose connected to the chamber is connected to the “LIQUID” port on the LN2 dewar. The length of the LN2 hose should also be as short as possible (ideally less than 12’) and insulated with tubing insulation. If too long of a supply line is used, the chamber will not start cooling until all the N2 gas is purged from the hose. The ETx chamber cannot be equipped with an auto-line purge valve, and therefore it’s not recommended to be used with bulk supply systems that use extremely long LN2 lines. The LN2 supply pressure should also be approximately 25-50psi for most ETx chambers. See serial tag on back of chamber for supply pressure that chamber was set up for. Make sure the supply pressure of dewar matches the pressure listed on the back of the chamber. If pressure drops too low, this will result in a slow cooling rate. Most dewars come with a valve that allows the user to increase the supply pressure. As the pressure increases, the cooling rate will increase. If you are sure that liquid is available to the solenoid and the supply pressure is within the range listed on the back of the chamber and the solenoid can be heard opening but there is still little to no cooling, there could be blockage in either solenoid or LN2 filter assembly. The filter assembly connected to the input of the valve consists of 3 brass fittings. The middle fitting contains a cylindrical screen to prevent debris from entering the solenoid. Remove and inspect this screen for debris. Use compressed air to clean out the screen if debris is present. When re-assembling use several layers of teflon tape on each fitting to prevent leaks. After reassembly, verify that air can pass through filter assembly before reinstalling onto the solenoid. The part number for a new LN2 filter assembly is: 980241.

If the filter assembly was not clogged with debris, it’s possible debris is inside LN2 solenoid. The solenoid can be removed once the white outer chassis of the chamber is removed. Remove the solenoid by removing the two screws and nuts holding the solenoid (attached to mounting plate) to the firewall. Remove nut securing coil to solenoid and slide coil off and set aside. Install solenoid into a vice and using a large flat-head screwdriver, remove solenoid stem from solenoid base and inspect solenoid as well as screen on input for debris. Use compressed air to blow out solenoid as needed.

To determine if the chamber is using an AC or DC valve, with backplate removed, locate the LN2 solenoid. If the solenoid has either red wires OR if the solenoid has black wires with a heat-shrink coated bridge rectifier spliced into the valve wires, it is an AC valve. The AC valves

are driven using line voltage (~120VAC for 120VAC chambers and ~220VAC for 220VAC chambers).

If the solenoid has black wires with no bridge rectifier and the resistance of the valve coil is approximately 18 ohms, then this is a DC valve. DC valves use a 3-7Vdc signal to drive the valve.

For chambers using an AC valve:

If the solenoid cannot be heard clicking when green cool LED is toggled on/off by enabling/disabling cooling, then check to see if the controller is sending out cool signal to cool SSR assembly. To do this, unplug the chamber and remove the backplate. Locate the I/O board (board with transformer). Verify that the gray ribbon cable to the I/O board is fully seated on both ends. Plug chamber back in, power on chamber, enable cooling (press cool enable button on bottom right) and enter a valid cold set point. When the green cool LED turns on, go to the back of the chamber and using a meter set to Vdc, measure the voltage on terminals 3 and 4 on the top terminal strip. With green cool LED on, you should measure approximately 3-12Vdc. If no voltage is present, then it's possible controller is faulty and can be sent in on an RMA for evaluation/repair. Contact Sun for an RMA and provide the serial number of the chamber.

If controller voltage is present, then either SSR assembly or solenoid is faulty. With green cool LED on, set meter to VAC and measure voltage to solenoid on terminals 1 and 2 of top 16 position terminal strip. You should measure line voltage when green cool LED is on and approximately 0VAC when green cool LED is off. If no AC voltage is present when green cool LED is on, cool SSR assembly is most likely faulty. See ETx manual for wiring diagram to verify wires from cool SSR assembly are connected properly. Part number for AC valve cool SSR is: 980067-220.

If line voltage is present to cool the valve with green cool LED on and the valve is not opening, then most likely the LN2 solenoid is faulty. Contact Sun for assistance.

For chambers using a DC valve:

If the solenoid cannot be heard clicking when green cool LED is toggled on/off by enabling/disabling cooling, then check to see if the controller is sending out a cool signal to the cool driver board assembly. To do this, unplug the chamber and remove the backplate. Locate the I/O board (board with transformer). Verify that the gray ribbon cable to the I/O board is fully seated on both ends. Plug chamber back in, power on chamber, enable cooling (press cool enable button on bottom right) and enter a valid cold set point. When the green cool LED turns on, go to the back of the chamber and using a meter set to Vdc, measure the voltage to the pins labeled + and - on the 5 pin connector of the small 1"x1" cool driver board. With green cool LED on, you should measure approximately 3-5 Vdc. If no voltage is present, then it's possible controller is faulty and can be sent in on an RMA for evaluation/repair. Contact Sun for an RMA and provide the serial number of the chamber.

If controller voltage is present to the driver board, then either the cool driver board or solenoid is faulty. Disconnect solenoid wires and measure resistance of valve coil. You should measure approximately 18 ohms. If coil resistance is ok, reconnect valve wires to wires from I/O. With

green cool LED on and meter still set to Vdc, measure the voltage on the 2 pads labeled "DC COOL OUT". You should measure approximately 3-7Vdc when green cool LED is on and approximately 0 Vdc when green cool LED is off. If no voltage is present when green cool LED is on, then the cool driver board is most likely faulty. Part number for the cool driver board is: 980047.

No remote communication

If unable to communicate via RS232 or GPIB, make sure the controller is powered on. Check the front panel of the controller to see if the REM LED is turning on when attempting to communicate.

If the REM LED is not turning on, verify GPIB or RS232 cable is connected properly from controller to PC. Verify cable is not faulty by swapping cable with cable used on a system that is functional if possible. If using GPIB, verify that the GPIB card/adaptor is functioning properly. Remove top cover of controller chassis and verify that the gray 26 conductor ribbon cable from controller to remote board is firmly connected on both ends.

If no GPIB communication and cables/GPIB card/adaptor has been checked and ruled out, go into PC100-2 menu to verify that the GPIB address of the controller is set to proper value. See PC100-2 manual for instructions on checking/changing GPIB address.

Issue the STOP-9 software reset command by pressing the STOP key, - key, 9 key then ENTER. The controller should power off if entered properly. Turn the controller back on to see if the issue is resolved. If still unable to communicate over the GPIB, contact Sun for an RMA and send the controller in for evaluation/repair. Please provide the serial number listed on the back of the chamber.

If no RS232 communication, verify cable is wired as shown below:

DB9 connector (female)	DB9 connector (male)
on PC end	on controller end

Pin #3 (TXD)	>----->	Pin #2 (RXD)
Pin #2 (RXD)	<-----<	Pin #3 (TXD)
Pin #5 (GND)	<----->	Pin #5 (GND)

If cables and PC's COM port is ok, check RS232 settings (such as baud rate, RS232 ECHO, etc) in MENU and verify they are set to proper values as required by the application communicating with the controller. Contact the vendor that created the RS232 application for assistance in determining what settings are required.