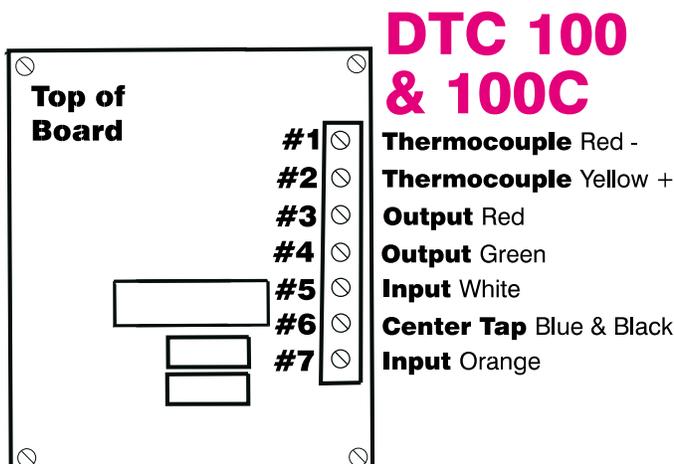
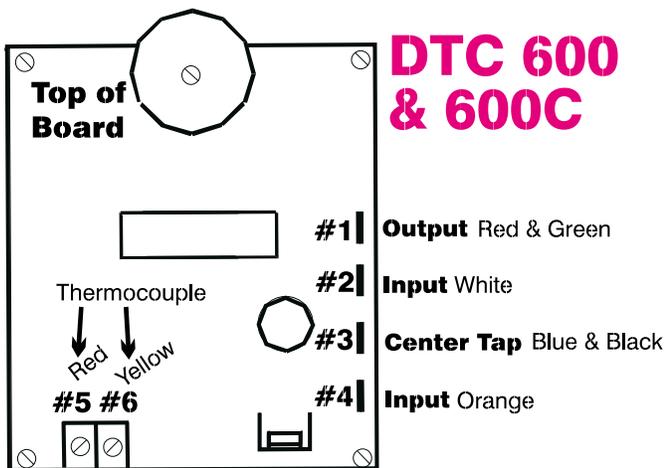
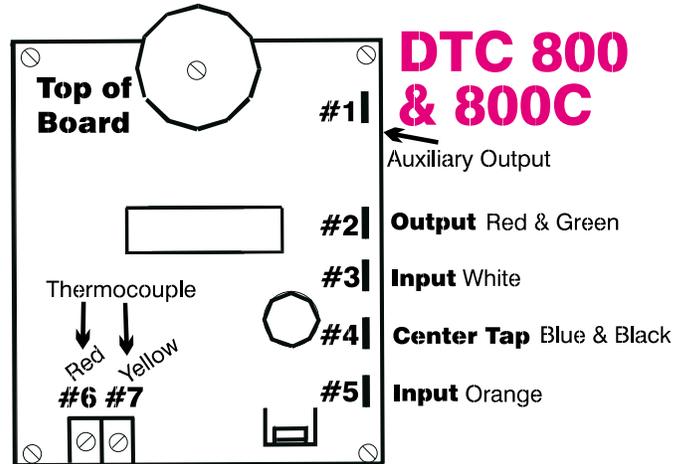
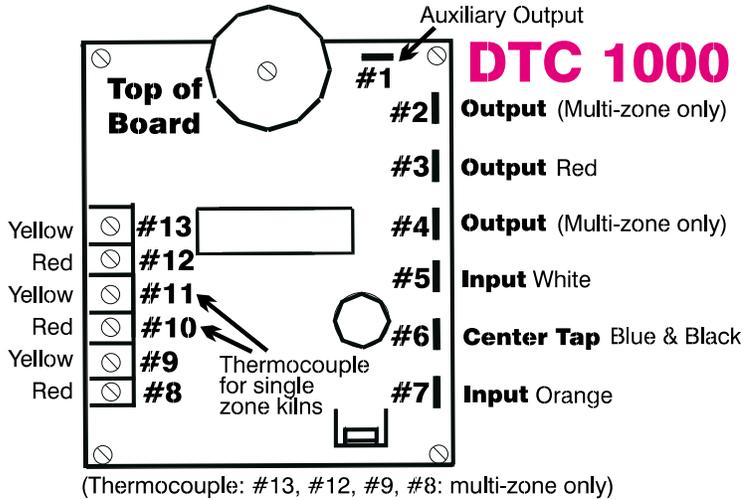


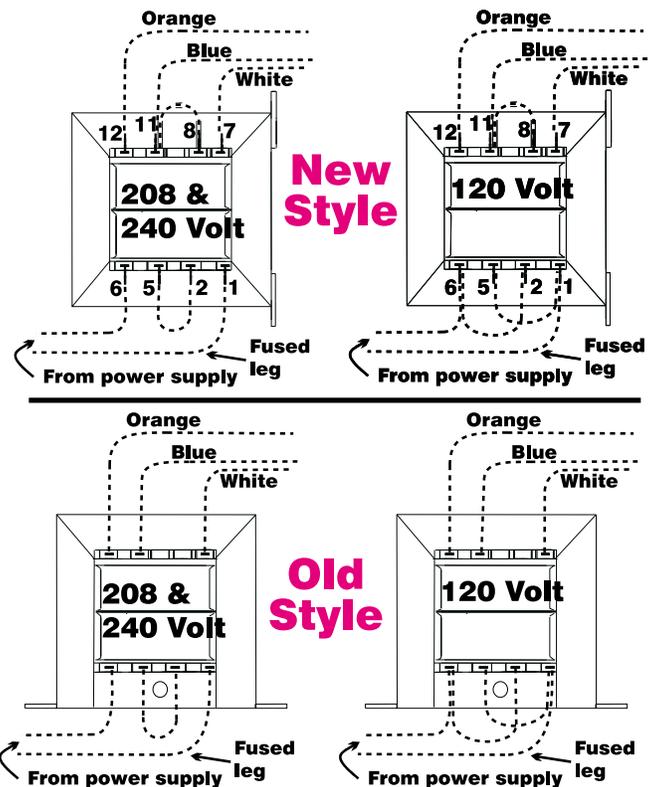
DTC 1000, 800, 600 & 100 Series Controller Troubleshooter

CAUTION: Attaching the INPUT wires (white, orange) to the controller's OUTPUT connectors can destroy the controller! Use care when connecting wires.



Transformers

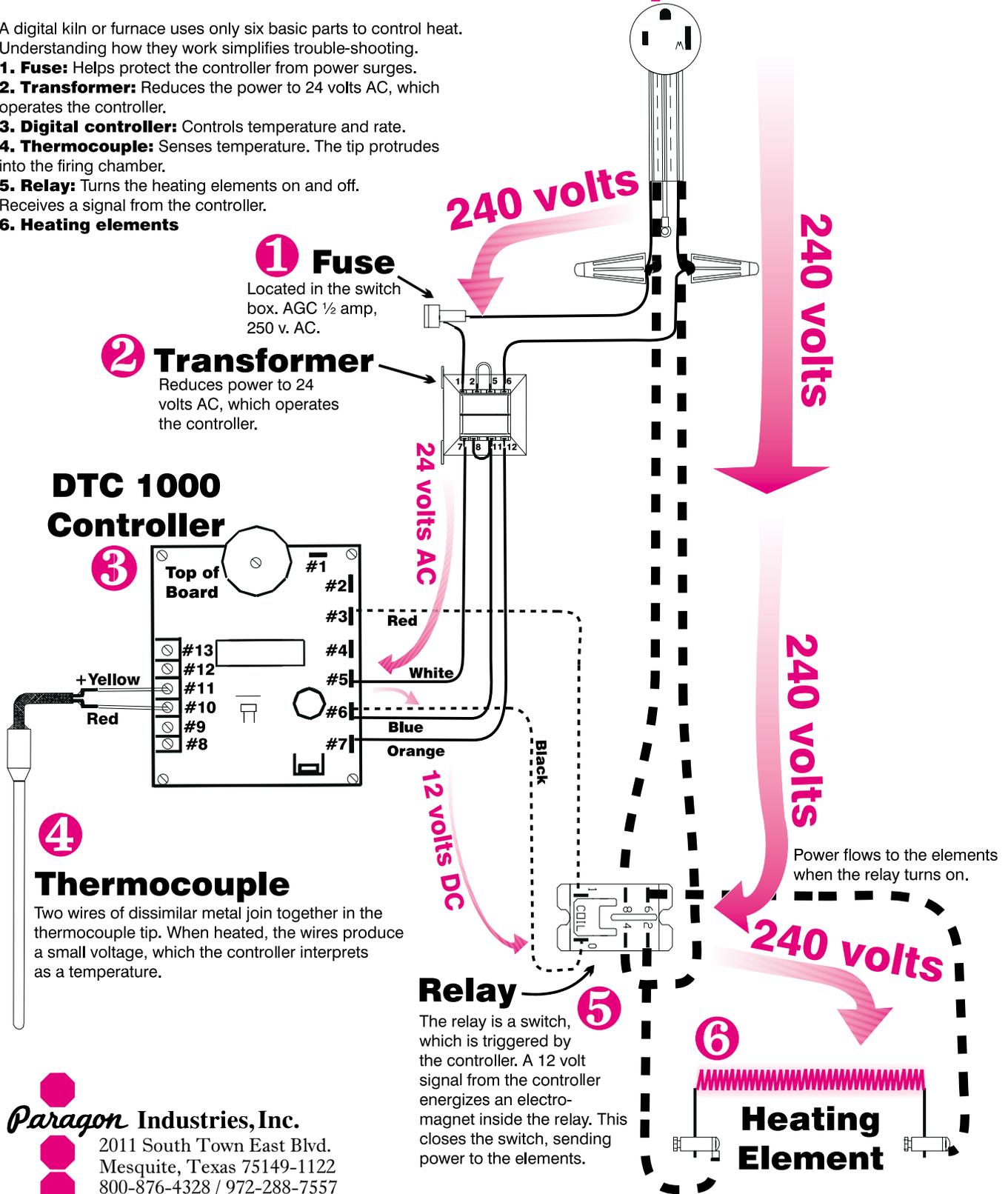
Using a transformer of the wrong voltage or connecting the wrong wires to the transformer terminals can damage the controller and cause the relays to chatter. Always make sure your new transformer is the correct voltage before installing. You can tell by looking at the jumper wires attached to the terminals.



Paragon Digital Temperature Control Made Simple

A digital kiln or furnace uses only six basic parts to control heat. Understanding how they work simplifies trouble-shooting.

- 1. Fuse:** Helps protect the controller from power surges.
- 2. Transformer:** Reduces the power to 24 volts AC, which operates the controller.
- 3. Digital controller:** Controls temperature and rate.
- 4. Thermocouple:** Senses temperature. The tip protrudes into the firing chamber.
- 5. Relay:** Turns the heating elements on and off. Receives a signal from the controller.
- 6. Heating elements**



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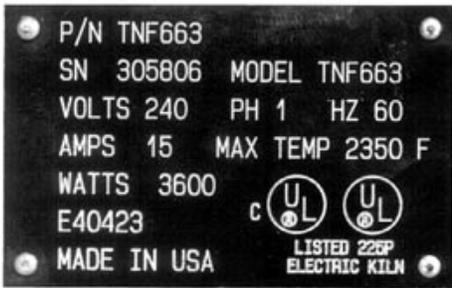
Contents

Dear Customer:

Paragon kilns have proven to be very dependable. However, as with all mechanical devices, kilns do occasionally need maintenance.

We have packed this guide with information from the minds of our top engineers and technicians. If you are ever under deadline to get your kiln running, you will be glad you had this guide.

If your local dealer does not have a repair technician, feel free to call the Paragon factory with questions. But first, try to find the answer in this trouble shooter. This is usually faster than a phone inquiry. When calling, please have in front of you the information on your kiln's electrical data plate. You will find this on the side of the kiln switch box.



Please have all of the information from you kiln's electrical data plate in front of you before calling us.

Make a record of all your firings. Include firing time, temperature, witness cones, and firing results. These records will be a valuable trouble-shooting aid. Firing record blanks are available from Paragon.

The controller is easy to remove from the switch box. It is held in place with four screws. Before removing, please disconnect the power from the kiln. Certain components on the back of the controller can be damaged if they touch a grounded object while the kiln is plugged in.

Please follow the diagrams on page one carefully when connecting wires to the controller. Attaching input wires to output terminals can damage the controller.

Most of the error messages shown in this manual do not apply to the DTC 100 series.

Periodically we hold an in-plant kiln maintenance seminar in Mesquite, Texas. Call for the next scheduled dates.

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Electrical Power Problems

Controller display does NOT turn on. No heat in kiln.

■ Is the kiln connected to the power?

Make sure the kiln is plugged in. If the kiln's wall circuit includes a power disconnect lever, make sure the lever is in the on position.



Be sure the power disconnect switch is in the on position.

■ Has the circuit breaker tripped or fuse blown?



Know the location of the circuit breaker panel. Label the breaker that controls your kiln's circuit.

■ Is power reaching the wall receptacle? Test with a voltmeter.



Wall Receptacle No-Load Test

This test should be performed only by an experienced repair person. Touch only the plastic or rubber handle of the voltmeter probes during this test. Do not remove the receptacle faceplate.

Follow the instructions that came with your voltmeter, setting it to the AC mode. Insert the voltmeter probes in the receptacle's two slotted, hot connections.



6-30R
2" dia.



6-50R
2" dia.



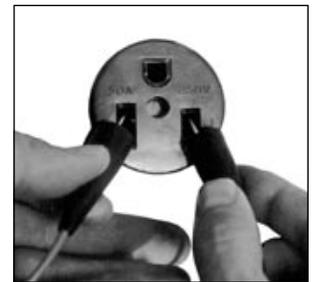
6-20R
1 3/8" dia.



5-20R
1 3/8" dia.



5-15R
1 3/8" dia.



Place voltmeter probes in the two slotted, hot connections of the outlet. The round connection is the safety ground.

■ Has the kiln switch box 1/2 amp fuse blown?



Switch Box 1/2 Amp Fuse Ohmmeter Test

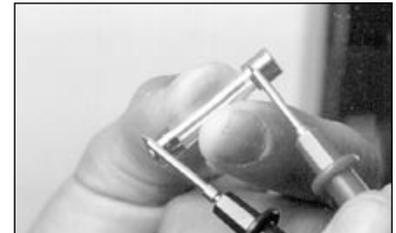
The kiln's 1/2 amp fuse is located in the switch box. Remove by pressing on the fuse holder and turning counter-clockwise half a turn. Check the fuse by placing the probes of an ohmmeter on the ends of the fuse. If the ohmmeter reads less than an ohm (digital meter) or reads 0 ohms (analog meter), the fuse is okay. If the reading is OPEN (digital meter) or infinity/no needle movement (analog meter), the fuse is bad. Replacement fuse:

AGC 1/2 A 250V AC

If replacement kiln fuses keep blowing, see "Kiln switch box 1/2 amp fuses keep blowing," page 10.



The fuse holder is on the side of most kiln switch boxes.



Use an ohmmeter to test the switch box fuse.

■ Is the controller receiving power? Test INPUTS with a voltmeter.



Controller Power Input Test

Make sure the kiln is unplugged, and remove the 4 screws holding the controller board faceplate to the switch box. Lift faceplate out of box and let the board hang on the box with the back of the board facing you.

Plug the kiln back in. Touch voltmeter probes (in AC mode) to both INPUT connections (the white and orange wires). See diagrams, page 1.

Do not let the back of the board touch a grounded object. Make sure the voltmeter is in the AC mode when placing the probes on INPUT connections.



Disconnect power before removing the board from the switch box.

➤ Controller Input Test Result: the controller is not getting power.

UNPLUG kiln. Check the switch box for disconnected wires between the cord, transformer, and controller. If wiring is okay, replace the transformer.



› **Controller Input Test Result: the controller is getting 20 - 24 volts AC.**

If you find 20 - 24 volts, correct current is reaching the board from the transformer. But since the board is not lighting up, it is probably defective. Try turning off the power to the kiln for ten seconds. The board may light up when you turn the power back on. If it does not light up, return the controller for repair or replacement.

› **Controller Input Test Result: the controller is getting less than 20 volts AC.**

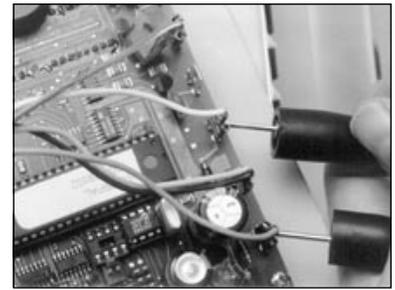
Did you recently replace the transformer? It may be the wrong voltage. (See diagrams, page 1.) The voltage is below 20, which is not enough power for the controller. To find out the cause of low voltage, continue below:

The back of the board is still facing you. Unplug/disconnect the kiln. Remove the white and orange wires from the board INPUT terminals. Clamp a voltmeter probe to the white wire and the other probe to the orange wire. Use alligator clip probes. Do not let the wires touch a grounded object. Plug the kiln back in.

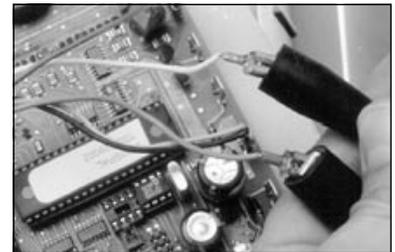
Result: voltage at disconnected INPUT wires is less than 20: There are two possible reasons: 1) Low voltage at the wall receptacle; 2) defective transformer. If wall receptacle voltage is correct, replace the transformer.

Result: voltage at disconnected INPUT wires is 20 - 24: The transformer is sending correct voltage to the controller. Yet when the input wires were connected to the controller, voltage was less than 20. This means the controller is draining the voltage and is defective. Return the controller for repair or replacement.

CAUTION: Attaching the INPUT wires (white, orange) to the controller's OUTPUT connectors can destroy the controller! Use care when connecting wires.



Testing for voltage at the controller's INPUT terminals.



Use alligator clips to test for voltage at the disconnected INPUT wires.

Controller display turns on. No heat in kiln.

■ **Has a delay been programmed?**

The elements will not fire until the delay time has elapsed.

■ **Is the relay making its normal clicking sound?**

› **Yes, the relay is clicking.**

Test the elements with an ohmmeter:



Element Ohmmeter Test

1 UNPLUG kiln/disconnect the power. Open the kiln's switch box. Make sure the wires connecting the relays to the elements are secure. If connections are okay, check the elements with an ohmmeter as follows:

2 Touch the ohmmeter leads to the two element connectors of each element. A no-needle-movement reading on an analog meter, or OPEN on a digital meter, indicates a broken element.

3 If your elements are wired in parallel, temporarily disconnect the lead wires from one end of the element you are testing. Hold element connector with pliers as you remove the screw. Be gentle to avoid breaking the element. Do not disturb the screw holding the element, only the one holding the lead wires.

Rule of thumb: if both lead wires of an element connect to another element, the elements are wired in parallel. Disconnect the lead wire(s) from one end of the element you are testing.

If the elements check out okay, perform the "Relay 12 Volt Battery Test," page 14.

› **No, the relay is not clicking.**

We know the controller is receiving voltage, because the display is lit. But the voltage from the transformer may be too low to power the relays. Perform the "Controller Power Input Test," page 4. If your controller passes the input test, perform the "Controller Power Output Test" on the next page:



The ohmmeter sends an electric current through the element. If the element is broken, the meter will show an OPEN circuit.

Disconnect Power before opening kiln switch box or removing the controller.


Disconnect Power before opening kiln switch box or removing the controller.



Controller Power Output Test

Is the controller sending voltage to the relays? Test OUTPUT with a voltmeter:

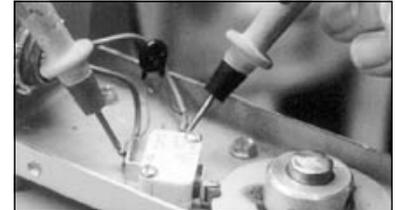
- 1 UNPLUG** the kiln/disconnect the power. Remove the 4 screws holding the controller board faceplate to the switch box. Lift faceplate out of box and let the board hang on the outside of the box with the back of the board facing you. Then plug the kiln back in. Program the controller to fire to 1000°F at 9999° rate in Ramp-Hold mode. Press **START**.
- Put the voltmeter in DC mode. (It *must* be in DC mode when testing OUTPUT voltage.) Touch probes to OUTPUT and CENTER TAP connections (red wire and blue/black wire) for at least 12 seconds. (See diagrams, page 1.)

› Output Test Result: No voltage at OUTPUT and CENTER TAP.

The controller is not sending power to the relays. Return the controller for repair or replacement.

› Output Test Result: 10 - 12 volts at OUTPUT and CENTER TAP.

The controller is sending correct power to the relays. Unplug kiln/disconnect power. Remove the kiln switch box. Look for disconnected wires between the controller, relays and elements. Check the wiring diagram to be sure wires are connected to the correct terminals. Be sure connections are tight. If the wiring is okay, perform the “Relay 12 Volt Battery Test,” page 14.



Testing a door switch with an ohmmeter: this type of switch mounts on top of the kiln.

■ Does the kiln have a door or lid switch?

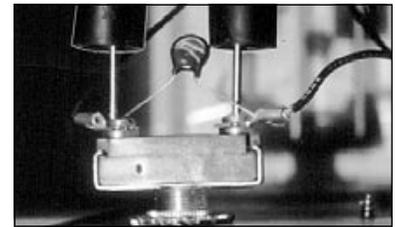
If the controller is sending correct voltage to the relays, test the door or lid switch.


Disconnect Power before removing switch cover.



Door/Lid Switch Test

First, UNPLUG kiln/disconnect power. Remove door or lid switch cover. Place ohmmeter leads across the switch terminals. Open and close the door. Replace or adjust the switch if you get a no continuity reading with the lid or door closed (no-needle-movement on an analog ohmmeter, OPEN reading on a digital meter).



Testing a door switch with an ohmmeter: this switch mounts inside the main switch box.

Kiln fires too slowly or will not reach temperature.

■ Is your kiln model rated to fire hot enough for the ware?

■ Does kiln voltage match circuit voltage?

Be sure your 240 volt kiln is not plugged into a 208 volt outlet, and vice versa.

■ Check wall outlet voltage with a voltmeter during firing.

Low voltage can double firing time. Sometimes voltage is correct, but drops when the kiln turns on.

Receptacle Under Load Test



Only an experienced repair person should perform this test. Pull the kiln plug ¼” from the wall receptacle. Start the kiln. Place a voltmeter probe against each of the two “hot” blades of the cord plug to measure voltage. If voltage is low, try firing the kiln during periods of low demand when voltage is higher. If low voltage is persistent and the utility company cannot correct it, we can make elements to compensate for low voltage.



While the kiln is firing, measure voltage at the cord plug. Be sure not to touch the metal part of the voltmeter probes.

■ Are you using Cone-Fire or Ramp-Hold?

› Cone-Fire

In DTC 1000 slow speed, the last segment is a cool-down segment. It is possible that the kiln fired to completion and you are observing the kiln during cool-down. (Does not apply to DTC 800, 600 and 100 series.)

If you have inadvertently programmed a pre-heat, the kiln will not heat past 200°F. (Does not apply to the DTC 800, 600 and 100 series.)

› Ramp-Hold

Check to see if you have programmed a long hold time in one of the early segments.

■ Do you see water dripping from the kiln or condensing on the case?

Dripping water means the ceramic greenware is wet, which slows the kiln to a crawl. The greenware should be bone dry before loading.

Vent the lid and fire no hotter than 200°F until moisture no longer fogs a mirror held near the top peephole. (Be careful to avoid burns.) The mirror must be at room temperature, not hot, so hold it near the peephole for only several seconds.



With a mirror, you can detect moisture escaping from the kiln. Keep the lid in the vented position until the mirror no longer fogs.

■ Did firing time suddenly, or gradually, become longer?

› Suddenly:

This indicates a drop in voltage during peak demand, a bad relay or a broken element. See page 5 to test elements; page 14 to test relays.

› Gradually:

This is usually caused by worn elements. Keep a record of firing time. When elements begin to wear, firing time will gradually increase.

■ Does firing time vary depending on time of day or season?

This indicates low voltage during peak demand.

■ Is the kiln on its own circuit, or does it share the circuit with other appliances?

The kiln should be on its own circuit. Other appliances on the circuit can slow down the firing.

■ Is the circuit wire gauge heavy enough for the kiln's amperage?

See catalog specifications for your kiln, or the instruction manual. Consult a qualified electrician.

■ How far away is the breaker panel from the kiln?

If it is over 50 feet, the wire gauge should be one gauge heavier than the catalog recommendation.

■ Check kiln amperage with an ammeter at wall receptacle.

TROUBLE SHOOTING TEST

Wall Receptacle Ammeter Test

The ammeter measures the amps that the kiln draws. If an element is burned out or a relay is broken, the kiln will draw less amperage. See the electrical data plate for your kiln's rated amperage. Before checking amps, check voltage under load, page 6.

Only a qualified repair person or electrician should perform this test.

- 1 Shut off circuit breaker for the kiln's wall receptacle.
- 2 Remove the receptacle cover. Remove the receptacle from the wall outlet box.
- 3 Place the ammeter around either of the two hot wires.
- 4 Plug kiln into the receptacle. Turn on the breaker. Start the kiln.

Before unplugging the kiln and reinstalling the receptacle and cover, be sure to shut off the breaker.

› Result: Amperage is a little below normal.

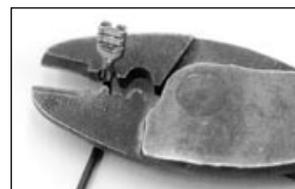
Consider replacing elements.

› Result: Amperage is way below normal.

The problem is most likely a broken element or relay, or elements of the wrong resistance. See next section, "Some elements do not fire."



The ammeter attaches to only one hot wire. Be sure breaker is shut off before you remove the receptacle cover.



The indent on the crimping tool goes on the side opposite the seam of the connector. Test the crimp by pulling on the wire firmly.



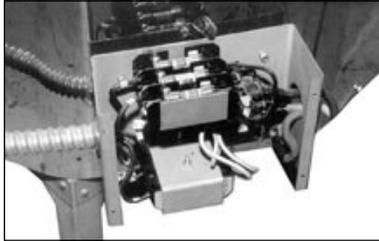
Tighten loose push-on connectors by squeezing gently with pliers.



■ Have you checked the kiln for loose connections?

UNPLUG kiln/disconnect the power. Open the kiln's switch box. Look for loose, corroded or discolored element connectors and wire terminals. They will appear dark, greenish-turquoise and sometimes white. Cut off over-heated wire terminals and crimp on new terminals. Remove the damaged element connector and inspect the element end. If the element is damaged, replace the element. Otherwise sand the element end and install a new element connector.

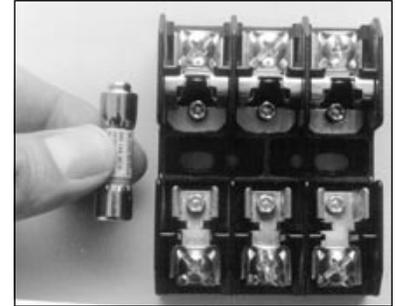
■ Does the kiln have a power connection fuse box?



High amperage fuses are usually located inside the fuse box or junction box on the kiln.



Test a high amperage fuse with an ohmmeter. You can test the fuse without removing it from the fuse holder.



The fuse must be aligned as shown above. If it is inserted upside-down, it will blow.



Kiln Power Connection High Amperage Fuse Test

This fuse box is used only on high amperage kilns such as the Viking-24 & 28. The fuse box usually contains six fuses. If a fuse blows, one relay will stop working. To test fuses, disconnect the power.

Place the leads of an ohmmeter on each end of a fuse. (It is okay to leave the fuse you are testing in the fuse holder.) An OPEN reading on a digital meter, or no-needle-movement of an analog meter, indicates a blown fuse. If fuses are inserted upside-down, they will be loose and will blow.

Some elements do not fire.

■ What is the kiln model? Which element is not firing?

See your wiring diagram. Perform the element glow test:



Element Glow Test

- 1 The kiln should be empty. Close the lid or door.
- 2 In Ramp-Hold, fire at a rate of 9999 to 500°F/260°C. While the kiln is firing, study your kiln's wiring diagram. It will show which elements are wired to each relay.

- 3 At around 400°F/204°C, carefully lift the lid or open the door slightly until you can see the glowing elements.

Use a protective glove. Keep your face well away from the firing chamber. Do not reach inside the chamber. DO NOT TOUCH THE ELEMENTS WITH ANYTHING. Lift the lid for only a moment, then close.

The center elements in most 7, 8, 10 and 12 sided kilns will not glow brightly, but there should be a faint redness. It is easier to see the elements with room lights turned off. Some kilns take 40 minutes before the elements glow red.

› Test result: All the elements for one relay remain dark.

If all the elements on the same relay are out, try connecting that bank of elements to a different relay. If the elements fire on a different relay, unplug kiln and open the switch box. Look for a disconnected wire between controller, relay and elements. If wiring is okay, replace the relay the elements were originally connected to.

If the bank of elements do not fire after connecting to a different relay, test elements with an ohmmeter. See page 5.

› Test result: Some, but not all, elements for one relay glow.

If more than one element is wired to the relay, the dark element is probably burned out. The problem is not the relay. Open the switch box. Look for a disconnected wire between the relay and element. If wiring is okay, test the elements with an ohmmeter (see page 5).

■ Does the kiln have an infinite control switch wired to the elements that do not fire?

If the relay and elements have tested okay, replace the switch.

Kiln heats unevenly.

■ How uneven is the temperature in the firing chamber?

› If only slightly uneven:

Load more ware in the hot section and less ware in the cool section. This balances the load.

› If very uneven:

Check for burned out elements and bad relays. See “Some elements do not fire,” page 8.

■ Does the kiln have a power connection fuse box?

This fuse box is used only on high amperage kilns such as the Viking-24 & 28. The fuse box usually contains six fuses. If a fuse blows, one relay will stop firing. See “Kiln Power Connection High Amperage Fuse Test,” page 8.

Circuit breaker trips or circuit fuse blows.

■ Does the circuit breaker/fuse shut off immediately after the kiln is plugged in or turned on?

› Breaker trips immediately after the kiln is plugged in.

The kiln plug or wall receptacle has a short-circuit. Check the plug for discoloration and heat damage. Replace the cord and wall receptacle when the plug shows heat damage.

› Breaker trips immediately after the kiln is turned on.

The kiln has a short-circuit. Unplug the kiln/disconnect the power, remove the kiln’s switch box and check for disconnected wires. Keep the kiln unplugged until you have found the problem.

■ Does the circuit breaker/fuse shut off after the kiln has fired for awhile?

› Is the breaker the recommended size for the kiln’s amperage?

Check the electrical requirements for your kiln in the instruction manual.

› Have you had hotter elements than the standard elements installed in your kiln?

This could increase the kiln’s amperage, causing the breaker to shut off.

› Is the kiln too close to the circuit breaker or fuse panel?

Heat from the kiln may shut off the circuit breaker or blow a fuse.

› Check electrical connections for tightness.

Loose connections over-heat, build resistance, and trip the breaker/blow the fuse. Does the circuit breaker panel or wall outlet feel hot? If so, have repaired by an electrician.

Unplug kiln/disconnect the power. Open the kiln’s switch box and check for loose wires. Loose or corroded element connectors and wire terminals will appear black or greenish-turquoise. See “Have you checked the kiln for loose connections,” page __.

› If the above checks out okay, replace the breaker.

As circuit breakers age, they sometimes weaken and trip too easily. Even a new circuit breaker can be defective. (A circuit breaker should be replaced only by a licensed electrician.)



Kiln connection box fuse blows. (Heavy amperage kilns.)

Kilns with a power connection fuse box: This fuse box is used only on high amperage kilns such as the Viking-24 & 28. The fuse box usually contains six fuses. If a fuse blows, one relay will stop firing. (See page 8.)



■ Does the fuse blow immediately after the kiln is turned on?

The kiln has a short-circuit. Disconnect the power, remove the switch box and check for disconnected wires. Keep the kiln disconnected until you have found the problem.

■ Does the fuse blow after the kiln has fired for awhile?

Disconnect the power. Open the kiln’s switch box and check for loose wires. Make sure the fuses in the fuse holder are tight and aligned properly. (Upside-down fuses will over-heat and blow. See photo, page 8.)

Kiln switch box ½ amp fuses keep blowing.

■ What size fuse are you using?

Correct fuse: AGC ½ A 250V AC.

■ Test the switch box fuse.



Kiln Switch Box ½ Amp Fuse Power Test

1 UNPLUG the kiln/disconnect the power. Remove the 4 screws holding the controller board faceplate to the switch box. Lift faceplate out of box and let the board hang on the outside of the box with the back of the board facing you. Then plug the kiln back in. Disconnect the orange, white, blue and black wires (INPUTS and CENTER TAP) from the back of board. Apply power to kiln. If fuse blows, replace the transformer. (If the fuse does not blow, the problem is a board or relay. Go to step 2.)

2 Connect the wires to the board again. Disconnect the OUTPUT wire(s) (red or red/green). Program the controller to fire to 1000°F at 9999° rate in Ramp-Hold mode. Press **START**. If the fuse blows, replace or service the board. (If the fuse does not blow, the problem is caused by a short in the coil of a relay. Go to step 3, below.)

3 UNPLUG kiln/disconnect power. Reconnect the OUTPUT wire. Reinstall the board in the switch box. Open switch box. If your kiln has one relay connected to the controller, replace the relay. Kilns with more than one relay: perform the next test:

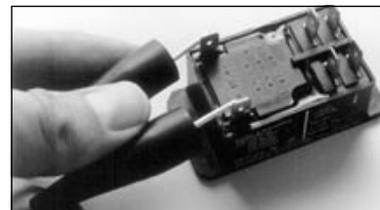


Relay Coil Test

Disconnect the two controller-to-relay lead wires from the first relay. Touch ohmmeter probes to the same two terminals on the relay. A good relay reads about 80 ohms. A relay with a short in its electromagnet will read 0 - 2 ohms, which will blow the kiln's switch box fuse. Test each relay.



The kiln switch box fuse holder.



The ohmmeter probes are placed on the relay terminals that power its 12 volt electromagnet coil. See relay diagram, page 2.

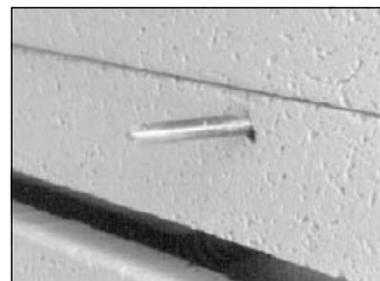


Disconnect Power before removing switch box!

Wall outlet gets too hot.

■ Replace the wall outlet.

If you smell burning plastic, turn off the breaker immediately. Touch the wall receptacle faceplate. If it feels hot, replace the receptacle. Replace the kiln cord if it has been damaged by heat from the outlet. **DO NOT FIRE THE KILN UNTIL THE RECEPTACLE AND CORD ARE REPAIRED!**



The 1/8" thermocouple should protrude into the firing chamber ½" - 5/8". The ¼" thermocouple should protrude 1" into firing chamber.

Temperature Problems

Controller reads wrong temperature.

■ Has a hold been inadvertently programmed?

If the temperature remains steady when it should be getting hotter or cooler, you may have programmed a hold.

■ Has the thermocouple been pushed out of the firing chamber?

The 1/8" diameter thermocouple should protrude into the chamber at least ½" to 5/8". The ¼" new-style thermocouple should protrude 1". Sometimes a shelf nudged against the thermocouple will push it out of the firing chamber.

■ What happens when you move the thermocouple tip?

Reach inside the firing chamber and wiggle the thermocouple tip. If the display makes a sizable jump in temperature, or the temperature becomes erratic, replace the thermocouple.

■ Are thermocouple connections tight?

Inspect the thermocouple connections on the back of the board. (See page 4 for instructions on removing the board.) Tighten if necessary, grasping the connection block to prevent it from twisting. Does the thermocouple have a ceramic block? (It would be located on the other side of



The thermocouple should not touch anything metallic, such as a heat shield.

the wall where the thermocouple tip appears in the firing chamber. Be sure to unplug the kiln before removing switch box.) The screws in the ceramic block must be tight.

■ Is the thermocouple touching the metal case of kiln?

That can cause erratic temperature readings. Remove switch box to inspect.

■ How far off is the temperature?

Ceramics: Pyrometric shelf cones are the best calibration standard for ceramic firings. If all your cones consistently under- or over-fire, adjust the Controller temperature using the methods below. Use witness cones in every firing. Keep a record of every firing. Blank firing records are available from Paragon.

DTC 1000 Cone-Fire: Use cone offset to adjust the temperature for each individual cone. Or use thermocouple offset to adjust the temperature for all the cones.

DTC 1000 Ramp-Hold: Use thermocouple offset to adjust the controller temperature.

DTC 800C: Use Fine Tuning to adjust the cone temperature.

DTC 800: Enter a temperature that will compensate for the thermocouple temperature drift.

DTC 600C: Enter a different cone number, or use hold, to compensate for temperature drift.

DTC 600 & 100C: Enter a temperature that will compensate for the thermocouple temperature drift.

The kiln overfires.

See “Controller reads wrong temperature,” page 10.

■ Do the elements stay on after you press STOP?

If so, the electrical contacts inside a relay are stuck in the closed position. Replace relay. See “Relay 12 Volt Battery Test,” page 14.

The display shows erratic temperature readings.

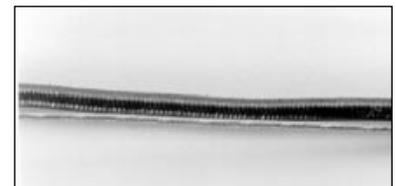
It is normal for the temperature to jump up or down a few degrees during firing. As temperature rises, the readout will not show a steady climb, but rather minor jumps up and down. This section of the troubleshoot is for readouts that are erratic by 10 - 15 degrees and more.

■ Does erratic temperature display start at around 1600°F?

A poor circuit ground can cause high temperature erratic readings. So can a thermocouple that touches a grounded object such as the kiln case.

■ Is temperature erratic only when the elements are on?

Power wires (cord-to-relay and relay-to-element wires) placed near the controller and thermocouple wire cause this type of fluctuation. Fire the kiln to around 600°F. Press STOP. This will shut off the elements. If the temperature display is no longer erratic at IDLE, try rearranging the wires inside the switch box.



The thermocouple lead wire shown here is too close to the other wire.

■ Do the relays chatter? Does the temperature fluctuate in time with the clicking of the relays?

A relay with a short in the electromagnet can cause an erratic display. The relay draws too much current, draining voltage from the board and interfering with normal display. Another cause is a bad transformer that produces low voltage. See “Controller Power Input Test,” page 4.

Electrical “noise,” which is random electromagnetic signals, can cause the controller temperature to become erratic. Common sources of noise are a chattering relay, defective lid or door switch, and nearby arc welding machines. See “The relay chatters or buzzes,” page 12.

■ Is the temperature display erratic at room temperature?

Perform the “Controller Paperclip Test,” page 13. If the display at room temperature is still erratic with the paperclip in place on the back of the board, the thermocouple is not the cause.

■ **Has the thermocouple been installed correctly? Is the thermocouple worn out?**

Make sure the thermocouple remains out of contact with the kiln case or anything metallic. Position thermocouple lead wires away from other wires inside the switch box. Though protected by insulation, the thermocouple wires are sensitive to electromagnetic waves from other wires. Make sure thermocouple wires are attached to the correct terminals on the ceramic block (if any) and controller board. Be sure the thermocouple wire ends are separated where the insulation has been stripped. A worn thermocouple can cause erratic temperature readings. Wiggle the thermocouple tip. If the temperature jumps by a wide margin, replace the thermocouple.

■ **What is the condition of the wall receptacle?**

A damaged, over-heated wall receptacle can destroy the grounding connection to the kiln, making the display more prone to erratic temperatures. Replace a damaged receptacle. If the cord shows heat damage, replace it also.

■ **Have you recently changed circuit wiring (new location or new circuit)?**

If erratic temperatures appear momentarily each time the relays click on, have an electrician check the electrical circuit for a poorly connected grounding wire.

■ **Did you recently change the transformer?**

A transformer of the wrong voltage can cause an erratic temperature display and missing display digits. See page 1.

The display remains stuck.

■ **Stuck key.**

Return the controller for replacement of key pad.

■ **Electrical noise.**

Sometimes a chattering relay or other source of electrical noise freezes the display message. Turn off the power for ten seconds. If that does not correct the problem, return the board for servicing.

Display digits burn out (parts of display missing).



■ **Has the transformer been replaced recently?**

Crossing the white wire with a blue/black wire on the controller connectors can burn out display digits. Before the digits burn out, the display will light up brighter than normal. A 120 volt transformer installed on a 240 volt kiln can also burn out display digits. (See transformer diagrams, page 1.)

Noises

The relay chatters or buzzes.

■ **Are the relays receiving enough voltage?**

Voltage at controller OUTPUT and CENTER TAP connections should be 12 volts DC. Voltage below 9 volts DC may not be enough to drive the relays, or may cause a relay to chatter. See “Controller Power Output Test,” page 6, and “Controller Power Input Test,” page 4. If these controller tests check out okay, replace the relay.

The controller keeps beeping.

■ **Alarm Set to 0000**

Error Messages

PF or ErrP during firing.

■ Have you had a power failure?

› PF or ErrP due to power failure.

PF alternates with the temperature display during firing: this means the power went off for a moment during firing. Then firing resumed. To go back to a normal temperature display, press **ENTER**.

Steady **ErrP**, no temperature display: the firing has been interrupted by a longer power failure.

› PF or ErrP, no power failure.

Low voltage can also cause the kiln to shut off and display either **PF** **ErrP** or a blank display. If this happens and you did not have a power failure, check the wall receptacle, while the kiln fires, for low voltage. (See “Receptacle Under Load Test,” page 6.) Sometimes there is just enough voltage to program the board. But when the relays turn on, the voltage from the transformer drops below the minimum operating level, and the display goes blank.

A corroded kiln cord plug or wall receptacle can cause a **PF** or blank display. Pull the plug from the wall. Clean the prongs on the plug with fine emery paper or a pencil eraser until the prongs are bright. If the plug or wall receptacle is blackened, replace. A loose wall receptacle screw or loose circuit breaker screw can also cause a power failure display.

Check transformer if the wall receptacle voltage is okay. See “Controller Power Input Test,” page 4.

■ Does your kiln have a door or lid switch?

If **ErrP** appears when you open or close the lid, replace the lid/door switch.

FAIL

■ Are thermocouple wires connected to the board correctly?

UNPLUG kiln. Remove the 4 screws holding the controller board faceplate to the switch box. Lift faceplate out of box. Look at the back of the board. You should see a yellow wire and a red wire connected to thermocouple screw connections on the back of the board. (See diagrams, page 1.) If one of these wires is disconnected or loose, reconnect or tighten. (Grasp connector block to prevent block from twisting.) The controller should work now.

› Test the controller with a paperclip.

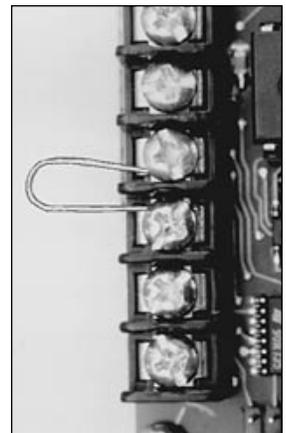
If the wires were attached securely to their connectors, perform this test:



Controller Paperclip Test

- 1 Remove thermocouple wires from their screw connections.
- 2 Cut a paperclip in half. Insert a U-shaped paperclip piece, or other piece of wire, between the thermocouple connectors. Tighten screws.
- 3 Place the faceplate back into the switchbox with a couple of screws.
- 4 Plug in the kiln/connect the power. If the board reads room temperature, replace the thermocouple. If it reads **Fail**, replace the board.

If you still get a **Fail** message after replacing the thermocouple, watch for an erratic temperature display. The problem may be due to electrical noise. See “The display shows erratic temperature readings,” page 11.



Half a paper clip being used to test the thermocouple circuit on the controller.

■ Multiple Zone kilns

Fail will alternate with the thermocouple that failed. **TC 1** is connected to #12 and #13 terminals on the back of the DTC 1000 board; **TC 2** is connected to #10 and #11; **TC 3** is connected to #8 and #9. See page 1.

Err 0

■ Reset the controller.

Electrical spikes or noise can cause the processor to jump a step or malfunction. When **Err 0** appears, unplug the kiln or furnace for 10 seconds. This will reset the system. The display should go back to **ErrP**. Check your program

to make sure it wasn't corrupted. Then fire your kiln again. If **Err0** persists, have the controller serviced or replaced.

Err 1

When **Err1** appears, the heating elements will shut off. After **Err1** appears, press **1**. The display will show the last temperature the kiln reached and the hours fired before it shut off. Then it will go back to **IdLE**.

■ Was the firing too slow?

Err1 appears when temperature rise is slower than 12°F/ 12°C per hour in Cone-Fire and Ramp-Hold. (In Ramp-Hold, the temperature must also be below the local set point, which is the temperature the board is trying to reach to maintain correct rate. Ramp-Hold can be programmed for a rate slower than 12° per hour without setting off the **Err1** message.) If **Err1** appears well below the target temperature, such as 1000°F for an 1800°F firing, you probably have a burned out element or relay. See "Kiln fires too slowly or will not reach temperature," page __.

■ Is the thermocouple worn out?

A worn thermocouple can cause an **Err1** display. Grasp the thermocouple, which protrudes into the firing chamber. Gently move the thermocouple back and forth. If the temperature reading jumps, replace the thermocouple. (This test does not apply to a thermocouple inside a protective ceramic tube.)

■ Were the relays chattering or buzzing?

Electrical noise from a chattering or buzzing relay can cause an **Err1** message. See page 12.

■ Multiple zone kilns: is the lag temperature set too low?

"Lag" is the difference in temperature that the controller will allow between zones. You can adjust temperature lag. The lower the temperature lag, the closer the temperature between zones. A low temperature lag can slow the firing, because the controller stops firing progress to wait for the zone temperatures to even out. This can cause an **Err1** code. Use a higher lag temperature, or use a delayed temperature lag. (See the multiple-zone instructions.)

■ Kilns with a power connection fuse box: has a fuse blown?

A blown fuse in the power connection fuse box will shut down one of the relays and its elements. This could slow the kiln down and cause an **Err1** code. See page 8.

■ Does your kiln have a door or lid switch?

The door/lid switch shuts off power to the relays when the door/lid is opened. Electrical noise from a door or lid switch can cause an **Err1** message. If **Err1** appears when you open or close the lid, replace the door/lid switch.

Err 2

■ Check the relay(s).

Err2 appears when the temperature rises over 50° above a Hold temperature. It must remain over 50° for 18 seconds. It appears only during a Hold.

Err2 is caused by a stuck relay or defective controller. If the elements remain on after **Err2** appears, check the relays as follows:



Relay 12 Volt Battery Test

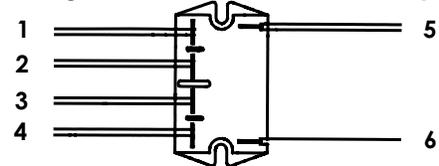
You will need an ohmmeter, 12 volt battery and 2 clip wires.

WARNING: You must disconnect the controller-to-relay wires to test the relay(s) with a battery. Leaving the wires connected could damage the controller.

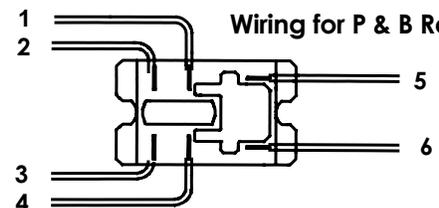
- 1 **UNPLUG** kiln/disconnect the power and remove switch box. Find the two wires going from the controller to the relay you are testing. Disconnect these wires from the relay. Then connect a 12 volt lantern battery to the same relay terminals (#5 and #6 on the diagrams above) using clip wires. You should hear a click

Sometimes a replacement relay will be of a different brand than the relay in your kiln. If so, transfer the wires from the old relay to the new one by the numbers on this chart. Ignore the terminal numbers printed on the relay bodies when using this chart.

Wiring for Omron & Arowmat Relays

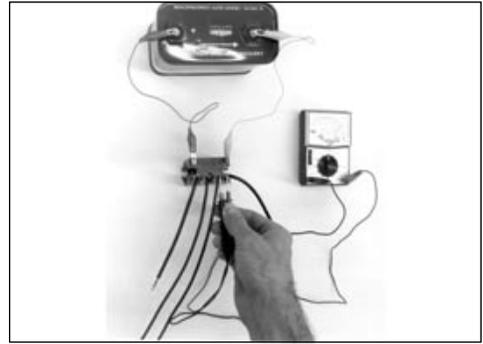


Wiring for P & B Relay



when you make the connection. If there is no click, the relay is probably defective. Make sure your battery is good before assuming the relay is bad.

- 2 Touch ohmmeter lead wires to relay terminals marked #1 and #2 in the diagrams. With the battery still connected, you should get a continuity reading (0 ohms) on the ohmmeter. (This is the same reading you would get if you touched the ohmmeter leads together.) If you get a no-needle movement when the battery is connected, replace the relay. Place the ohmmeter wires on relay terminals marked 3 and 4 on the diagrams and test the same way.
- 3 If the ohmmeter reading at terminals #1 and #2, and then #3 and #4, is 0 ohms when the battery is removed, the relay contacts are stuck. Replace the relay.



Testing a relay with a 12 volt lantern battery.

If the relays are okay and the elements turn on when you reconnect the controller wires to the relays, replace the controller.

Err 3

■ Did you leave the lid or door open?

Err3 appears when the temperature falls more than 50° below the Hold temperature during a Hold segment.

■ Test elements and relays.

See “Kiln fires too slowly or will not reach temperature,” page 6.

Err 4

■ See Err2.

Err4 is the same as **Err2** except temperature rises 50° above a cool-down Ramp temperature instead of a Hold temperature. If the last segment of your firing is a cool-down, an **Err4** means your kiln fired to maturity, then became too hot during the cool-down.

Err 6

■ Are the thermocouple lead wires hooked up correctly?

UNPLUG kiln and remove the controller from the switch box. Make sure the yellow and red wires are attached to the correct terminals (see diagram, page 1). If the wires are reversed, the controller will show temperature going down when it should be going up.

■ Are you experiencing cold weather?

If room temperature is below 0°F or 0°C, raise temperature.

■ Test the board with a paperclip.

Perform the “Controller Paperclip Test” described under “FAIL,” page 13. When the paperclip is in place, the board should show room temperature. If it shows a negative number, replace or repair the board.

Err 8

Err8 appears when the temperature drops for 18 seconds during the last phase of firing in Cone-Fire. See “Kiln fires too slowly or will not reach temperature,” page 6, and “Some elements do not fire,” page 8.

■ Did the Kiln Sitter® shut off?

This applies to the TnF2 controller that is powering a kiln with a Kiln Sitter.

Err A

■ Software Error

Reprogram the controller. If the error returns, have the controller repaired.

Err B

■ Is room temperature unusually high?

Err B appears when the temperature at the circuit board is above 250°F. Open windows and use a fan to circulate air. If you have more than one kiln in the room, place them farther apart. Never allow the firing room temperature to exceed 110°F/43°C. (Measure room temperature 3' away from the kiln.)

■ Defective controller

If **Err B** appears when the room temperature is normal, return the controller.

Err d

Errd appears when the temperature is more than 100°F too high during a heating-up ramp.

■ Stuck relay.

Test relays. See “Err 2,” page 14.

■ Did you fire to a low temperature?

If you fire to a low temperature, such as 300°F/149°C, **Errd** may appear due to a temperature over-shoot. Fire at a slower rate.

■ Multiple zone kilns.

On a multiple zone kiln, **Errd** usually means the thermocouples or relays are connected to the wrong controller terminals. Thus, a thermocouple is turning on the elements to the wrong zone. For instance, if the top thermocouple turns on the bottom elements, the kiln will fire out of balance. When a zone gets over 100°F hotter than the programmed temperature, **Errd** appears.

To solve the problem, compare the switch box wiring with the wiring diagram for your kiln. Trace thermocouple and relay lead wires to the back of the DTC 1000 board. Each thermocouple should be matched to the correct relay. See DTC 1000 diagram, page 1.

Kiln Section	Thermocouple Connections	Relay Connection
Top	#13 & #12	#2
Middle	#11 & #10	#3
Bottom	#9 & #8	#4

Two zone kilns: do not use thermocouple connections #9 and #8 and relay connection #4.

■ Does your kiln have a door or lid switch?

If **Errd** appears when you open or close the lid, replace the door/lid switch.

Err E, Err H, Err t

■ Defective controller.

Err -

■ Power loss during processing.

There was a power loss to the controller while sending data to a memory chip. Use “Program Review” to be sure your program is still in memory. If you get an **Err -** regularly, the controller may need servicing.

StUC

■ Stuck key or solder joint failure.

Return the controller for servicing.

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