TROUBLESHOOTING AND REPAIR INSTRUCTIONS FOR L&L KILNS

TABLE OF CONTENTS

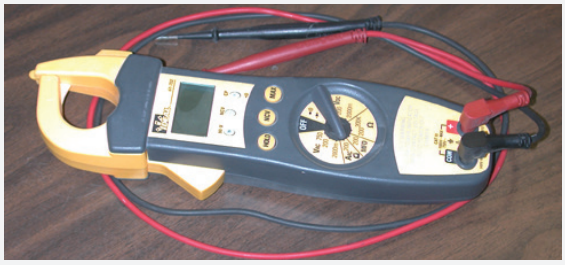
CAUTION - ELECTRICITY CAN KILL

Many of the tests described in here are performed under power. They should be done ONLY by someone who is familiar with electrical safety such as an electrician or trained maintenance person. We identify any test that is live with a CAUTION statement. We describe these tests in detail so that an electrically trained person who doesn't specifically understand kilns can do the troubleshooting - the level of simplicity described is not meant as an invitation to harm the untrained. AS LONG AS THE KILN IS UNPLUGGED YOU ARE SAFE.

GET A DIGITAL MULTIMETER!

If you want to do much of the troubleshooting described here and not be dependent on a kiln service person then get this tool. It is not hard to use! Without it you are only guessing at the origin and severity of an electrical problem based on how the kiln is acting. A slow-firing kiln may just have old elements, or the elements could be fine but the incoming voltage from your power supply could be low, or fluctuating. Unless you test with a multimeter, you could purchase new elements and run the risk that you might be wasting money and time without solving the problem. Be forewarned however: Testing electrical circuits is very dangerous and potentially deadly if you do it incorrectly. It could result in electrocution! If you don't feel comfortable doing this hire an electrician or get someone to do it who is qualified. That being said - many of the tests described in here just require testing for resistance - which is done with the kiln unplugged. **AS LONG AS THE KILN IS UNPLUGGED YOU ARE SAFE.**

You can buy an inexpensive digital multimeters for around $40-$50. The meter you buy should be digital simply because the analog type is not very accurate. **You must be able to see ohm (resistance) readings to the first decimal place.**



TROUBLESHOOTING GUIDE

This manual is meant to assist and educate kiln owners and service technicians. Our basic philosophy at L&L is to make kilns that last. No small part of having a reliable well-firing kiln is good maintenance. This information is provided as a service and is believed to be accurate. However, it is the reader's sole responsibility to interpret and use this information correctly. Please visit our web site to download the latest versions of all our instructional and technical information.

VIDEOS

ALSO WE ENCOURAGE YOU TO USE THE VIDEOS ON OUR WEB SITE (***hotkilns.com/video***).

TROUBLESHOOTING WEB TOOLS

The latest troubleshooting information is on the web. This is constantly updated. See ***hotkilns.com/knowledgebase***

RELATED L&L GUIDES

CAUTION INSTRUCTIONS

See CAUTION INSTRUCTIONS FOR L&L KILNS in the CAUTIONS section of your Instruction Manual. THIS IS SOMETHING YOU MUST READ. (Also ***hotkilns.com/cautions***)

REGULAR KILN MAINTENANCE

See REGULAR MAINTENANCE OF YOUR L&L KILN in the MAINTENANCE section of your Instruction Manual. THIS IS SOMETHING YOU MUST READ.

BASIC ELECTRICITY FOR TROUBLESHOOTING

See BASIC ELECTRICITY FOR TROUBLESHOOTING KILNS in the TROUBLESHOOTING section. Also see ***hotkilns.com/volts.pdf*** for more in-depth information about electricity for kilns.

TROUBLESHOOTING BRICK PROBLEMS

See TROUBLESHOOTING AND FIXING BRICK PROBLEMS in the TROUBLESHOOTING section for information on firebrick problems and instructions on how to repair firebrick problems.

TROUBLESHOOTING ELEMENT PROBLEMS

See ELEMENT TROUBLESHOOTING & INSTALLATION INSTRUCTIONS in the TROUBLESHOOTING section for information on elements problems and instructions on how to install elements and element holders.

TROUBLESHOOTING FIRING PROBLEMS WITH CONE PACKS

See TROUBLESHOOTING KILN FIRING WITH CONE PACKS in the LOG, CONES, TIPS section.

THE CERAMIC PROCESS

See THE CERAMIC PROCESS in the LOG, CONES, TIPS section.

REPLACEMENT PARTS

See the PARTS section.

SERVICE

See SERVICE section.

GENERAL TROUBLESHOOTING TOOLS AND METHODS

BASIC TOOLS REQUIRED

The minimal toolkit necessary for effective troubleshooting and fixing of electric kilns contains a digital multi-meter to measure ohms and AC voltage, and an assortment of screwdrivers, nutdrivers, wrenches, pliers, cutters, wire strippers and wire terminal crimpers. As you work on your kiln you will see what types of tools you need, like a 3/8" nut-driver, needle-nose pliers without the cutting part so the tips will close all the way. wire cutters heavy enough to cut the element terminals, wire strippers and wire terminal crimpers. No special tools are required for maintenance on L&L kilns.

KEYS TO GOOD TROUBLESHOOTING

SAFETY FIRST

Pay attention to electrical safety. Don't get electrocuted and don't guess.

DEFINE THE VARIABLES

Define all variables of the situation, and how they could potentially interact with and affect each other in each unique case you come across.

ELIMINATE VARIABLES ONE AT A TIME

Eliminate variables one by one to expose the problem variable(s). Asking questions can do this to some degree. Electrical testing, examining shards of ware or cone, or examining the interior of the kiln usually can supply the rest of the story. Good troubleshooting is based on logic.

Err1 (ERROR 1) - THE MOST COMMON ERROR

This is the most common troubleshooting problem we see. It generally means one of two things. 1) The elements have aged with increased resistance and therefor lower power. 2) A relay is not working. See The section in these instructions on Error Codes, CHECKING ELEMENT OHMS, and various paragraph on checking the relays.

CONTROL DISPLAY DOESN'T SHOW ANYTHING

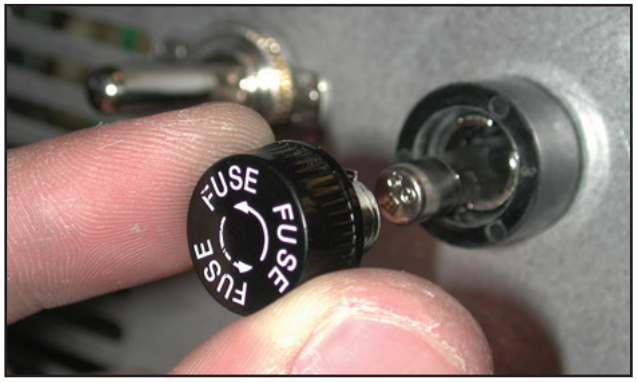
On/Off Switch

1) Make sure the On/Off Switch is turned on. Turn it on and off.

Fuse

1) Check control fuse in side of control box. Twist open the fuse holder and physically check the fuse. If the metal element inside is melted if it is blown. You can also use your digital multi-meter to check continuity across the fuse. Replace if faulty: ***hotkilns.com/control-panel-fuse***

Picture of the on/off switch and fuse holder opened.



Fuse Holder

If you notice that the fuse holder itself is damaged replace it. See: ***hotkilns.com/change-fuse-holder***

On/Off Switch

The on/off switch rarely needs replacing but if you have to replace that see this video: ***hotkilns.com/ replace-on-off-switch***

Plug & Cord (if you have one)

1) Make sure the power cord is plugged into the receptacle. Reseat plug. Make sure it is held firmly and that the springs inside the receptacle seem to be working.

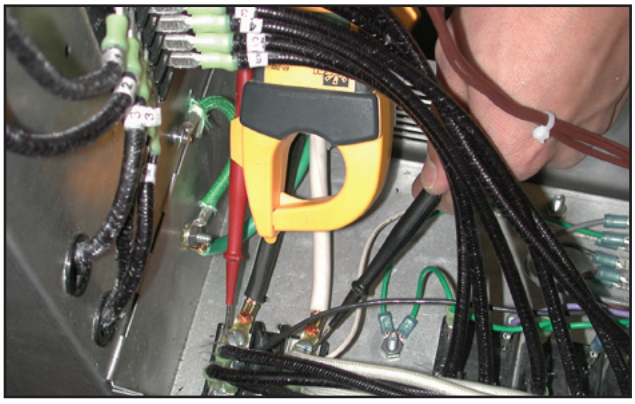
2) With power off examine the electrical cord. Look for burned or melted areas and breaks or pinched sections. Look closely at the head of the plug. If there is an internal problem with the wires and the plug parts you won't be able to see it but you may detect a softening or melting of the plastic at the plug head. Look for oxidation or substantial discoloration or even burnt spots on the prongs. Replace plug and cord if this is questionable.

3) With power turned on and panel open check voltage at the Power Terminal Block. If you see no voltage there then you know something is wrong with the power source.

CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.

If you have to replace the power cord see this video. It includes video of changing a power cord. ***hotkilns.com/ change-phase-easy-fire***

Checking voltage at the power terminal block.



Circuit Breaker / Power Source

1) Check voltage at the receptacle. **CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.**

A fused disconnect switch.

2) Check circuit breaker or fused disconnect switch to make sure they are turned on. Sometimes circuit breakers need to be turned on and off to reset them.

3) If you have a fused disconnect check the fuses with your voltmeter for continuity. **CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.**

4) Make sure fuses or circuit breaker are the proper amperage and type. See wiring diagram for details.

5) Test for voltage at the main power supply as close to the kiln as possible. **CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.**

Control Transformer

See this video: ***hotkilns.com/check-control-transformer*** and ***hotkilns.com/change-transformer.***

1) If none of these solve the problem then you could have a bad control transformer. To check the transformer operation test with your digital multimeter. It should read 240 (or 208) volts across terminals 1 & 4 (black and white wires) and 24 volts across terminals 5 & 8 (where the gray and brown wires come out). This is a live test so be very careful not to touch any of the wires - remember there is 240 volts in the panel and this can electrocute you. See photo below. If you are receiving 240/208 Volts in, but not getting the proper approximate 24 Volts out, then you need to replace the control transformer. See: ***hotkilns.com/ control-transformer-12-va***

2) If there is no voltage coming into terminals 1 & 4, white & black, then test for it at the Power Terminal Block where the power cord comes in. If there is power there then look for a bad connection or wire between the power connection block and the transformer, i.e. a bad toggle switch, wire, or ½ amp

fuse holder. If power is not there then go further back on the line and measure the voltage. Keep going until you find voltage, then look for the problem between that point with the voltage and the last point checked that had no voltage.

Control Board

1) If the transformer is OK and you know you have voltage going to the control board but the control still shows no display then the control board needs to be replaced.

DynaTrol: ***hotkilns.com/dynatrol-control-board***

Genesis: ***hotkilns.com/genesis-control-board***

One-Touch for School-Master kilns: ***hotkilns.com/one-touch-control-board-cone-6***

One-Touch for Doll, Liberty-Belle and Fuego kilns: ***hotkilns.com/one-touch-control-board-cone-10***

See this for how to replace: ***hotkilns.com/replace-dynatrol***

Internal Wiring

1) Unplug kiln or turn off at circuit breaker or fused disconnect and open up panel. CHECK VOLTAGE TO BE SURE. Make sure that all the wires inside the control panel are connected. See photograph on page 2 or page 3 and also the Wiring Diagram. Specifically look at the wires that go from the power connection block to the on/off switch, then to the control fuse and then to the control transformer.

Short Circuits

Do all the following with the kiln unplugged.

1) Check for short circuits. Look for any signs of burnt wires. This might indicate a short circuit. A way this might happen, as an example, is that frayed wires at the end of a wire connector might touch each other.

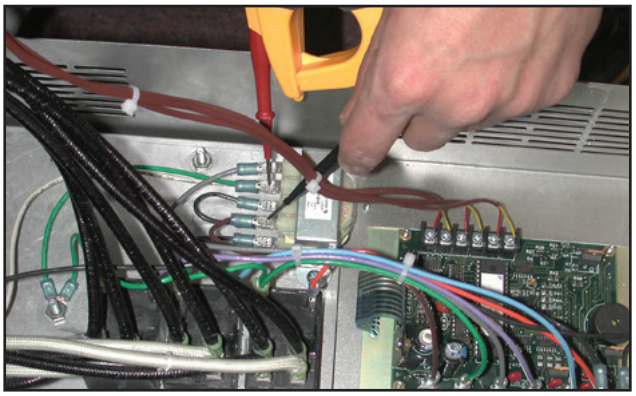
2) Check for worn wires that may have shorted against the case. Examine wire insulation. If the wire insulation has become frayed the wires could short to the metal casing which is electrically grounded.

3) Look for dirt. Some dirt (such as carbon compounds) are electrically conductive. This is generally not the case with ceramic materials but some can be. Vacuum out if you see dirt.

> NOTE: Usually a short circuit will trip either the circuit breaker for the kiln or the fuses in the fused disconnect switch, if you have one. You will then not see any display on the DynaTrol. Turn your circuit breaker on and off, and check fuses on the fused disconnect and control fuse.

> **CAUTION:** These tests should only be done by an experienced person familiar with electricity and its dangers.

Checking output of the Control Transformer (DANGER-live test).



EASY-FIRE DISPLAY READS FAIL

Usually FAIL will be seen flashing along with a tC1, tC2 or tC3 indicating which thermocouple circuit has failed.

Typically this will just mean that your thermocouple(s) need replacing. Overtime the thermocouple tip will corrode and cause a circuit to FAIL. We recommend replacing all thermocouples simultaneously rather than as they fail.

See this to replace thermocouple: ***hotkilns.com/change-thermocouple***

1) Unplug the kiln. Open the Control Panel. Remove the offending thermocouples connection wires from the Thermocouple Terminal Strip and bind the red and yellow wires together with electrical tape. Close up the panel and plug in the kiln. The control should read room temperature for that thermocouple (approximately 90 Deg F because of the thermocouple offsets).

2) If it does read room temperature then the thermocouple is probably bad and needs to be replaced. If the control does not read room temperature then there is either a bad thermocouple wire in the Control Thermocouple Harness or the control is bad.

3) Redo the test by putting a small jumper like a paperclip across the thermocouple terminals directly on the DynaTrol board. If the control now will read room temperature then you have a bad thermocouple wire. If it does not read room temperature then the control is definitely bad and needs to be replaced. See this: ***hotkilns.com/replace-dynatrol***

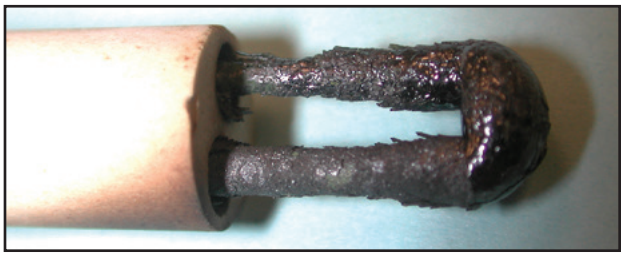
EASY-FIRE DISPLAY READS 2400 or CPLt WHEN IT STARTS UP

Even though you know the kiln is not that hot. This indicates thermocouple circuit failure.

TECHNICAL NOTE: This is called thermocouple upscale protection. If the control senses a lack of milivoltage (an open circuit) it interprets this as the highest temperature the control could reach. This automatically ensures that the control will not call for power.

1) Check thermocouple end. Examine end carefully. Sometimes there can be a crack that opens up while the kiln is hot but appears to be normal when the kiln is cold. If the end of the thermocouple looks severely corroded and you are getting Error codes then it is best to replace the thermocouple. NOTE: You have to open up the Element Cover Box and remove the thermocouples to check the ends.

A thermocouple end that will still work but is getting close to creating a problem.



2) Check thermocouple circuit. For instance check to make sure that all the thermocouple lead wires are firmly connected to the Thermocouple Terminal Strip. Check where the thermocouple lead wires go into the ends of the thermocouples. Are the wires loose? Tighten the screws on the ends of the thermocouples to be sure you have a tight connection. Check for corrosion. Check where the thermocouples connect to the DynaTrol. Try pulling off each connection and reseating it. This can scrape away corrosion that may have built up. Check for melted wires inside the Element Cover Box.

3) A very easy check is to check resistance (ohms) right on the Thermocouple Terminal Strip. Unplug kiln or disconnect from live power by turning off circuit breaker or fused disconnect switch. Open panel. You don't even have to remove the thermocouple wires. Just touch the terminal strip itself with your probes (terminals #1 & #2 for TC1, terminals #3 & #4 for TC2 and terminals #5 & #6 for TC3). If the thermocouples and circuit is normal then you will see a resistance of about .9 or 1.0. If you see an **OL** in your meter then you have an open circuit somewhere which is probably a bad thermocouple.

4) If you have a bad thermocouple replace it with a new one. Although you may be able to "make it work" by twisting the ends of the wire together this could easily fail during an important load and could also be extremely inaccurate.

ONE-TOUCH CONTROL DISPLAY READS FAIL

Usually `FAIL` will be seen flashing along with a `tC` indicating the thermocouple has failed.

1) Check thermocouple end. Examine end carefully. Sometimes there can be a crack that opens up while the kiln is hot but appears to be normal when the kiln is cold. If the end of the thermocouple looks severely corroded and you are getting Error codes then it is best to replace the thermocouple. NOTE: You have to open up the Element Cover Box and remove the thermocouple to check the end.

See this to replace thermocouple: ***hotkilns.com/change-thermocouple***

2) Check thermocouple circuit. For instance check to make sure that all the thermocouple lead wires are firmly connected to the Thermocouple Terminal Strip. Check where the thermocouple lead wires go into the ends of the thermocouples. Are the wires loose? Tighten the screws on the ends of the thermocouples to be sure you have a tight connection. Check for corrosion. Check where the thermocouples connect to the DynaTrol. Try pulling off each connection and reseating it. This can scrape away corrosion that may have built up. Check for melted wires inside the Element Cover Box.

3) A very easy check is to check resistance (ohms) right on the Thermocouple Terminal Strip. Unplug kiln or disconnect from live power by turning off circuit breaker or fused disconnect switch. Open panel. You don't even have to remove the thermocouple wires. Just touch the terminal strip itself with your probes (terminals #1 & #2 for TC1, terminals #3 & #4 for TC2 and terminals #5 & #6 for TC3). If the thermocouples and circuit is normal then you will see a resistance of about .9 or 1.0. If you see an **OL** in your meter then you have an open circuit somewhere which is probably a bad thermocouple.

4) If you have a bad thermocouple replace it with a new one. Although you may be able to "make it work" by twisting the ends of the wire together this could easily fail during an important load and could also be extremely inaccurate.

DISPLAY IS NORMAL BUT KILN WON'T HEAT UP

Programming

1) Make sure you have programmed the kiln properly and it is supposed to be firing. Do you have a **Delay Time** or a **Preheat Time** in your program? (Hit the **Review Prog** button on the Easy-Fire or hold down the **Custom/Review** button on the School-Master to find out).

Wiring

1) Unplug kiln or disconnect from live power by turning off circuit breaker or fused disconnect switch. Open panel. Check all power wires for firm connections. Using your multimeter set on resistance you can check continuity of each element circuit by pacing the probes on each set of outputs on each Power Relay or right at the Power Terminal Strip (as shown below).

Picture showing a Multimeter testing for continuity in an element circuit.

2) Visually inspect the power wires coming from the Power Terminal Block to the inputs of the Power Relays. Reseat all the spade connectors to rub off any oxides and to ensure a good connection.

EASY-FIRE Control Board Outputs

1) It is possible that the internal switches on the DynaTrol control board could be bad. You can test that by checking to see if you find voltage (12 volts DC) between any of the output contacts on the control board (where the orange, blue and purple wires come out) to ground (any green wire). CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers. See this video: ***hotkilns.com/ check-switches-dynatrol***

ONE-TOUCH Control Board Outputs

1) It is possible that the internal switches on the One-Touch™ control board could be bad. You can test that by checking to see if you find voltage (12 volts DC) between the output contacts (AC1 & AC2 marked on the control board) to ground (any green wire). CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.

Bad Power Relays

See this video: ***hotkilns.com/checking-relay*** and ***hotkilns.com/change-relay***

1) You should be able to hear contactors going on and off with a soft clicking noise when you first turn on the kiln and it is supposed to be heating up. If not try turning the kiln off and then back on again and restarting the program. Of course if you don't hear the relays it only tells you that they aren't firing. The problem could be in the control for instance not telling the relays to fire. If you do hear relays and the kiln is not heating then you know the problem is in the power circuit AFTER the relays.

2) With power on and panel open check voltage before and after each of the contactors while the kiln is firing. CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.

Bad Elements

See next section.

Run a Simple Paper Test

This will tell you if all kiln sections are firing. If they are not it could be a bad relay or maybe a bad internal switch on the control.

1. Place a little piece of paper in each element.
2. Then run a Fast Glaze (or turn the manual switches to Hi on a manual kiln) while you watch the papers.
3. They begin to smolder in about 2 minutes. After 3 or 4 minutes shut the kiln off.
4. This shows you if the elements are operating (or which ones are and which ones are not).

KILN FIRES UNEVENLY

Peepholes

1) Plug up Peephole holes in the kiln to prevent drafts.

Lid Seal

1) Check to make sure that door/lid is sealing properly. If door/lid is not sealing against top brick correctly a bright red glow will be visible around the door/lid seal when kiln is operating. (A little of this is OK). Also excessive heat loss can be felt around seal. Rub seal high points down with

sandpaper until no more than l/l6 of an inch gap is found at any point along seal. Note that the gap at the top will definitely appear larger than any gap you see between the kiln sections. This is partly because the lid actually bows down in the center of the lid when it heats up and the edges consequently rise slightly. Just check for an UNEVENESS in this gap which will cause an excessive heat loss.

2) If door/lid is excessively cracked or worn or has holes in it this may cause drafts in the kiln. Replace lid.

See the TROUBLESHOOTING AND FIXING BRICK PROBLEMS section in the TROUBLESHOOTING tab of your instruction manual or ***hotkilns.com/brick-troubleshooting***

Elements

1) Elements may have differentially changed in resistance which will also have an effect on uniformity. The three zone control mostly compensates for this but there are limits. Check element resistance (see section at end of this Troubleshooting Guide called "CHECKING ELEMENT OHMS").

2) Empty the kiln. Then turn kiln on using a fast program like FAST GLAZE until elements are red. Open the door carefully and observe the elements to see if they all seem to be glowing about the same amount. CAUTION: The power does not turn off when you open the lid. Be careful not to put your hand inside the kiln while it is on. Dangerous electric shock could result if you touch an element.

RUN AN EASY-FIRE DIAGNOSTIC

There is a useful diagnostic program within the DynaTrol on Easy-Fire Kilns. This is handy to use when your kiln is first delivered and set up to make sure it was done properly. It can also be useful in seeing if an element has burned out. To use this diagnostic program enter the following sequence when the display says IdlE.

1) Press **OTHER, 4, 4, 3.**

2) Keep pressing **OTHER** to cycle through the menu options until you get to dIAG and then press **ENTER**.

3) Open the lid of your kiln. You will see each zone of the kiln turn on for one minute each, starting with zone #1, the top zone. The control will display OUt1, then OUt2, then **OUt3** as it cycles through this sequence. **CAUTION: The power does not turn off when you open the lid. Be careful not to put your hand inside the kiln while it is on. Dangerous electric shock could result.** This will tell you if the kiln sections are in the wrong order or if the wires are somehow crossed in the control panel. If this is the case the zones will not turn on in the proper 1, 2, 3, order.

Loading

The Dynamic Zone Control of the EASY-FIRE kilns can compensate for many uneven loading situations. The SCHOOL-MASTER kilns, however, do not employ Zone Control so pay particularly close attention to the following steps.

1) If you are having a problem with uneven firing try to vary the way you load it to match the firing characteristics of the kiln. For instance if it typically fires hot at the top them put more weight in the top to absorb that heat. You can discern how your kiln fires in each section by using cones.

2) Be sure to put posts under the bottom shelf. The bottom shelf should be at least 1/2" to 1-1/2" above the floor of the kiln.

Firing with Cones

1) Run an empty kiln with three cone packs top- middle - bottom. This will tell you if the load contributes to the problem.

2) Try using cone packs in all sections (top, center, bottom) of the kiln during loaded firings and keep records of what happens. See the TROUBLESHOOTING KILN FIRING WITH CONE PACKS in the LOG, CONES,TIPS, CERAMIC PROCESS tab or ***hotkilns.com/troubleshooting-cones.***

EASY-FIRE Thermocouple Offsets

Thermocouples can drift in their accuracy over time and this can happen at different rates for each thermocouple. If one thermocouple reads at a different temperature than another thermocouple this can cause uneveness in the kiln. You may need to adjust the offsets to trick the kiln into firing hotter or cooler in certain zones. Read about Thermocouple Offset in section 9.9 of the DYNATROL 700 INSTRUCTIONS FOR L&L KILNS in the CONTROL section of the Instruction Manual and the and the CALIBRATING THE CONTROL section in the BASIC OPERATION OF L&L KILNS WITH A DYNATROL 700 in the OPERATION section of the manual. Also see this: ***hotkilns.com/calibrating-kiln.***

ONE-TOUCH Thermocouple Offsets

Thermocouples can drift in their accuracy over time and this can cause inaccurate firings in the kiln. You may need to adjust the offset to trick the kiln into firing hotter or cooler. Read about THERMOCOUPLE OFFSET in the OPTIONS Section of the OPERATION OF L&L KILNS WITH A ONE-TOUCH™ (Deg F) in the OPERATION tab in your instruction manual. Also see this: ***hotkilns.com/calibrating-kiln.***

Vent System

1) Is your vent system on and pulling air? You can check this with a source of smoke in a cold kiln. (If you burn a small piece of paper near the holes on the bottom of the kiln with the vent on and THE KILN OFF you can see if the smoke is being drawn into the holes. You can also check this by feeling the output of the vent when the kiln is at high temperatures. The air coming out should be quite warm to the touch (about 110°F to 140°F). The Vent-Sure will aid in keeping your kiln uniform by drawing hot air from the top of the kiln towards the bottom. It counteracts the natural rising of the heat.

2) If you want to increase draw first close the Bypass valve on the Bypass Collection Box under the kiln. You can also increase the size of the vent holes in the bottom of the kiln. You can also try taking out the top peephole plug. See the L&L VENT-SURE DOWNDRAFT KILN VENT INSTRUCTIONS in the VENT section of your instruction manual or ***hotkilns.com/vent-sure-instructions***.

KILN FIRES TOO HOT OR COLD

Firing with Cones

Try using cone packs in all sections (top, center, bottom) of the kiln and keep records of what happens. See the TROUBLESHOOTING KILN FIRING WITH CONE PACKS in the LOG, CONES,TIPS, CERAMIC PROCESS tab or ***hotkilns.com/troubleshooting-cones.***

Easy-Fire vs Vary-Fire (on DynaTrol)

Keep in mind that the Easy-Fire programs feature Orton software that adjusts the final temperature based on the speed of firing. This in effect adjusts the heat-work and hence the actual cone that the kiln fires to. This applies to Easy-Fire and cone-fire Vary-Fire programs.

Be Careful with Hold Times

Be very careful with hold times. Even a fairly short hold time of 10 minutes can dramatically increase the amount of heat work and hence the cone that the kiln fires to. On the other hand you can use the hold time to increase the heat-work to compensate for underfired work. Just test this in small increments.

Control Settings

1) The ceramic thermocouple protection tubes introduce a known error into the system. This is covered in the Operational Instructions but bears repeating here. The temperature that is measured by the tip of the thermocouple is approximately 18 Deg F cooler than the actual kiln temperature. We have found through extensive testing that the best way to compensate for this is to put in a Thermocouple Offset of + 18 Deg on each thermocouple. The specific setting is 0018 on Easy-Fire kilns, along with a Cone Offset of -20 (setting is 9020) for EACH cone that you fire to on the Easy-Fire Programs (or 9030 on cones 022 to 017).

2) We have already programmed the control with this information so that you don't have to do it. However, we also provide step-by-step instructions on how to do it in BASIC OPERATION OF L&L KILNS WITH A DYNATROL 700 in the OPERATION tab of your manual (or ***hotkilns.com/basic-operation-dynatrol***) and the OPERATION OF L&L KILNS WITH A ONE-TOUCH™ (Deg F) in the OPERATION tab of the School-Master instruction manual (or ***hotkilns.com/basic-one-touch-f***) If you are using the VARY-FIRE programming on an Easy-Fire kiln then use a Thermocouple Offset of plus 70 (setting is 0070).

Thermocouple Drift

Thermocouples drift in their accuracy with time. You may have to make further adjustments in the Thermocouple Offset or Cone Offset settings over time. **You should change all thermocouples when you change elements because they age at approximately the same rate.**

KILN STALLS

1) The kiln may refuse to increase in temperature, and the kiln will just run on and on. If it is re-started it may work fine for a while. The most likely cause is old or failing elements or relays. An issue in one circuit/section/zone can cause the whole kiln to stall as it waits for the problem section to "catch up". Check the temperatures in all zones to see if one zone is lagging behind and test elements and relays.

2) Thermocouples close to end of their useful life can cause some of these same problems.

3) Sometimes excessive ambient temperatures (over 125°F) around the control can cause stalling too.

4) Corroded connection points can also cause stalling.

5) Generally you will see the error message Err1 when this happens.

KILN FIRES SLOWLY - BOTH SERIES

Run a Simple Paper Test

This will tell you if all kiln sections are firing. If they are not it could be a bad relay or maybe a bad internal switch on the control.

1. Place a little piece of paper in each element.
2. Then run a Fast Glaze (or turn the manual switches to Hi on a manual kiln) while you watch the papers.
3. They begin to smolder in about 2 minutes. After 3 or 4 minutes shut the kiln off.
4. This shows you if the elements are operating (or which ones are and which ones are not).

Bad or Wrong Voltage

1) Check your voltage. Do this at the kiln at the Power Terminal Block with the control panel open or check it at your fused disconnect box. **CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers.** You need to see what the voltage is when the kiln is firing. Low voltage will make the kiln fire considerably slower. For instance a kiln designed for 240 volts will have 25% less power when operated on 208 volts. Check voltage at your panel and where the kiln is connected. Check the voltage when the kiln is firing and when it is not firing. Sometimes the high amperage draw of the kiln will cause a voltage drop at the kiln. A voltage drop of 5 to 10 volts is not uncommon and is to be expected. If your voltage drop is more than that then you may have a problem with your electrical supply.

2) Make sure no other large electrical appliances such as a clothes dryer or electric oven are on when you are operating your kiln. This may cause a voltage drop which would slow the kiln down.

3) Voltage may vary in your area depending on season and time of day. Frequently there are “brown outs” during the summer months in some areas. This is when the electric utility reduces the voltage. Try firing at night after peak electrical use hours. You can use your Delay feature to do this easily. Find out from your local utility company when the end of the peak period of electrical use is. Some utilities offer preferential rates for using electricity at night because it is cheaper for them.

4) Check to see what the wire size of your circuit is. If it is very long (more than 50 feet) from your main circuit box then the wire size might need to be higher (e.g. #8 instead of #10 wire).

Element Aging

1) Elements both age and increase in resistance when fired. When they increase in resistance the amount of power they develop decreases. See the section on “CHECKING ELEMENT RESISTANCE” at the end of this guide.

2) Replacing only one element per section or zone may cause an unbalance in firing. In Easy-Fire kilns the multi-zone control will compensate for much of this imbalance automatically, however, this will not be the case in School-Master kilns.

3) Use original L&L parts for satisfactory maintenance. (Elements, in particular, provided by other vendors may not work well in your L&L kiln. Some of our customers have found this out the hard way and thought it was an L&L problem. Only L&L has the design information to make our elements properly).

4) Empty the kiln. Then turn kiln on until elements are red. Open the door carefully and observe the elements to see if they all seem to be glowing about the same amount. CAUTION: The power does not turn off when you open the lid. Be careful not to put your hand inside the kiln while it is on. Dangerous electric shock could result. See the diagnostic program described in the earlier section called KILN FIRES UNEVENLY.

5) Elements expand and grow with age. If you fire low-fire clay and glazes and never get above cone 05 or so, your elements will last a long time, especially if you are only bisque firing. This is good, to a point. If you only low-fire, the problem you are most likely to encounter over many years is that the elements will expand as they age. The length and the coil diameter increase. Meanwhile the atmosphere in the kiln slowly eats away at the metal of the element. Although the total resistance usually increases as the elements age, sometimes it decreases, or reverses itself. This usually only happens when the elements are very old but have not yet failed completely. As the element expands, it binds up in the corners. This can make the individual coils push together and touch each other in the corners, making a short cut for the electricity, reducing the amount of element material the electricity must pass through, and therefore reducing the resistance in the whole element. This may make it hotter in the kiln, but if there is a lot of element material jammed in the corners there will not be enough material left in the coiled form to radiate the heat generated by the increased amperage and decreased resistance. Only the parts of the wire not touching the coils on either side of them will emit heat. More amperage through the electrical components in the control could cause damage if the situation continues or

the resistance drops far enough. In addition, the expanding diameter of an element can make it difficult to get it out of the holder. Usually this will not happen to those firing to higher temperatures because the maximum temperature of the kiln is quickly compromised by increases in the resistance, requiring the elements to be changed long before they can jam up in the corners. Also, high temperatures and glaze firings are more prone to eating through the element, causing it to fail, before the element can expand enough to cause the problems mentioned above. Visually inspect your elements for the above conditions and do a resistance check. If you see this it may be time to change elements.

Power Relays

As mechanical switches, power relays will fail over time. In particular, the coil which actuates the switch closure increases in resistance to the point where it no longer has the power to close, especially as it gets hot. This means that a relay can work at low temps but fail at elevated ones, making it more difficult to diagnose.

WIRES WILL GET HOT

Unlike many other appliances that use electricity (like motors) kilns are called a “resistive load.” This means that there will be a continuous pull of steady electrical power for many hours. Even with properly sized wire this will generate SOME heat in the wires. This is one reason we recommend against using aluminum wire for a power feed. If you look carefully you will see that we have OVERSIZED our internal power wires far in excess of their rated capacity. In addition all our power wire is rated for very high temperatures. The larger the wires the less resistance in the wires and the cooler they will operate.

Bad Wiring

1) Have an electrician check your wiring. We have seen aluminum wire cause intermittent problems with allowing enough voltage through. We do not recommend aluminum wiring although some electricians will swear by it. The problem with it is that aluminum oxide, which is formed from heat, is a resistor while copper oxide is not a resistor. With kilns you will often develop some heat in the electrical lines. If all connections are perfect and the wire is oversized you probably will not have a problem - but why take that chance? Make sure your wires are of the proper size and that all connections are good.

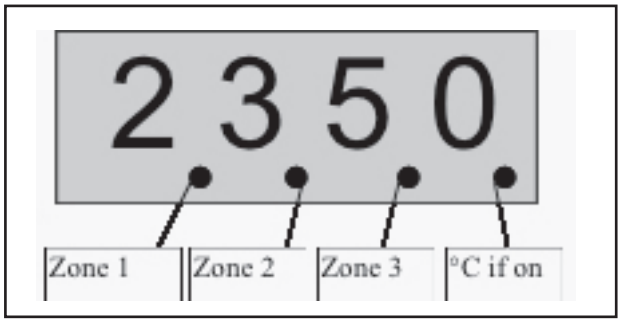
2) Check your circuit breaker for proper operation. These sometimes go bad over time.

3) If all the elements are firing and the kiln is still firing too slow check the amperage draw of the kiln under a full load. CAUTION: This test should only be done by an experienced person familiar with electricity and its dangers. You need to see what the voltage is when the kiln is firing.

Check amperage under load with an amp-probe.

3) To check to see if all zones are firing on an Easy-Fire kiln, press the number 8 on the control numeric pad. You will see one little light per zone under the numbers on the control display. If you see two dots on an e18S, e23S, or e28S then you are firing at full load. If you see three dots on an e18T, e23T, or e28T then you are firing at full load. See if the amperage drawn is the same as what the kiln is rated for. See the product literature and/or data nameplate on the kiln for the rated amperage draw. There is also a complete table of this information in the Installation Instructions part of this manual. For instance, a model e23T rated for 240 volts, Single Phase should draw 48.0 amps. If it is substantially less than the rated amperage draw and your voltage is within 5% of the rated voltage (for instance 230 volts for a 240 volt unit), then chances are the elements have changed in resistance. This will require element replacement.

Pressing the number ”8” will turn on 2 or 3 small LEDs that indicate whether the various zones are firing.



Wiring in the Kiln

1) Unplug kiln.

2) Trace wiring for missing or bad connections.

3) Check wiring against wiring diagram.

4) Check for corroded connectors or connectors that have frayed wires. Replace if you see this.

Element Connections

1) The holes where the elements go through the firebrick walls are too large. This could cause too much heat to escape from the kiln thereby overheating the element terminals. This can be remedied by lightly stuffing non-RCF ceramic fiber in the element holes. (See ***hotkilns.com/non-rcf-fiber-blanket*** for non-RCF fiber). You can stuff this in from the inside of the kiln using a sharp tool like a very small screw driver.

2) Check to see if the element ends are twisted properly. They should be twisted clockwise around the terminal screw. If the twist is too loose this could generate extra heat at the element ends. Check for corrosion on the terminal. If there is corrosion sometimes you can remove it with a wire brush.

3) The element connection hardware may not be tight enough. A loose connection can generate heat and cause oxidation of the hardware which in turn will cause a worse electrical connection (because of resistance) and more heat. Replace with new terminal hardware. See ***hotkilns.com/parts*** and filter for **Model Series** and **Elements (Terminals)**

Heat Leakage & Vents

1) Make sure peephole plugs are in.

2) Make sure hole for vent is proper. Check Vent-Sure instructions for proper hole sizes.

3) If you are using a different brand of vent make sure it is the appropriate size for your kiln. Check with the vent manufacturer and tell them how many cubic feet are in your kiln.

4) If your lid or bottom is cracked check to see if it seems to be leaking much heat at high temperatures. Patch or replace if extreme. (SOME IS OK).

Adding More Insulation

1) In L&L's top loading kilns an additional bottom may be placed under the original bottom. This will improve the insulation in the kiln, thereby slowing heat loss and speeding the firing time. You can also put a 2" layer of calcium silicate on top of the stand beneath the bottom of the kiln.

2) Also try raising the height of the kiln from the floor or putting a reflective stainless steel or aluminum sheet under the kiln. All these things keep the floor from absorbing the radiant energy from the kiln and will improve heat up times (as well as bottom of the kiln uniformity).

3) Put a 1" layer of non-RCF ceramic fiber on the lid. This is completely non-hazardous which is important in this application because you will be releasing fibers into the air when you move it while loading. While this is a somewhat extreme measure we have found that a disproportionate amount of the heat loss from a kiln is through the top. Non-RCF ceramic fiber is soluble in the body and is considered totally safe.

4) Whatever you do be sure NOT to put the kiln directly on the floor. If the floor is cement or other hard non-flammable material it will absorb the heat from the kiln. If the floor is wood or other flammable material you will create a very DANGEROUS situation which could cause a serious fire.

KILN FIRES SLOWLY - EASY-FIRE

Single vs Three Zone Control

1) Three zone control will slow a kiln down. It helps even out the temperatures in a kiln by shutting off one or more zones while firing. In addition zone control introduces other issues like LAG that sometimes complicate a firing. The first thing to try if you are getting a slow firing is to switch the kiln to single zone operation. That may get you back into operation quickly. Then, if that makes the problem go away you can fine tune the specific issue within the zone system that is causing the problem.

2) Normally models e23S and e28S are programmed to have two zones and models e23T and e28T are programmed to have three zone control. You can easily change this to be single zone operation.

3) Press **OTHER, 4, 4, 3**

4) The display says notC This stands for "number of thermocouples".

5) To run the kiln using only one thermocouple press **ENTER** at the notC prompt. You will then see 0003 or 0002 (depending on whether it is currently programmed for three zones or two zones). Then press **1**, then **ENTER**. The display will then say StOP. All the zones of the kiln will turn on and off simultaneously when you program the DynaTrol to use only one thermocouple.

ShtO (SHUT-OFF) SETTING

1) This option is used to shut off the automatic feature in the DynaTrol that holds the hottest part of the kiln at each segment's set point until the average of the three (or two) thermocouples reaches that set point. This can have a dramatic effect on speed of firing and is worth trying to see if it helps you if you are having a problem.

2) When you press **OTHER, 4, 4, 3**.

3) Press **OTHER** until ShtO is displayed.

4) Pressing **ENTER** here allows you to toggle, using any number key, between On and OFF.

5) On means that as soon as the hottest zone gets to the segment's set point the entire kiln switches to either the "hold time" or the next segment. This will result in a quicker firing.

6) OFF means that the DynaTrol will not let the hottest zone's temperature rise until the average temperature of the three zones reaches that segment's set point. Then the kiln can begin the "hold time" or the next segment. This will result in more even firing.

7) When you have the setting you want shown in the display (On or OFF) press **ENTER**. CPL will display for a few seconds and then IdLE , tC2 and current temperature.

Pld SETTING

1) This setting generally should be left at its factory default because it is hard to predict the changes that it will create in your firing. However, a full explanation is given for more advanced users who want to experiment with this.

2) This setting comes pre-programmed at the factory for 65%. Basically this setting determines how much help the middle zone of the kiln gives the bottom zone of the kiln when the bottom zone is lagging behind during heating. This comes into play when the bottom zone is on 100% of the time. With this feature, the middle zone of the kiln will come on the programmed percent (Pld) of the time that the TOP zone comes on, if the bottom zone is on all the time. Tests showed that if the bottom was on 100% of the time, the top zone was generally on 90% of the time, but the middle zone was on only about 40% of the time. By programming a higher percent you can greatly speed up your firings. (you will have to experiment, try the factory setting 65% then try maybe 100% and compare your results). Basically the higher the PId setting the faster the firing at the potential price of uneveness.

3) As your elements age firing by firing, this setting will activate earlier and earlier in the firing because the bottom will be working at 100% earlier and earlier. This will allow the artificial inflation of the center's temperature sooner and sooner. Because this center is heating based on mathematics now and not it's own thermocouple's reading, it will have a longer and longer period of time to get hotter than the top and the bottom. In some cases this can lead to gross uneveness. You may find yourself dialing down the PId to something like 50% or 60%. Remember that if it is set around 40% (it's normal operating percentage) or below, the thermocouple's reading then will be the control for that section, not the mathematics of the PId feature.

4) When display flashes IdLe, tC2 press **OTHER** see rSEt. Press **4, 4, 3.** See notC

5) Keep pressing **OTHER** to cycle through the menu options until you get to PId.

6) Press **ENTER**. See PCt, 0085 cycling.

7) Press any number from **0** to **150**, see the number you have entered preceded by a zero like 0120 if you entered 120. Press **ENTER**, see CPL or StOP for a few seconds, then IdLE, etc.

8) Pressing **ENTER** here allows you set another percent setting that can help a slow, heavily loaded kiln fire faster.

Change elements to graded elements.

This is an extreme solution for Easy-fire kilns but can be effective. Contact factory.

KILN HEATS TOO FAST

Relays

1) A stuck relay, meaning that the power relay is stuck closed, delivering constant power to the elements, can cause the kiln to heat uncontrolled. If the kiln is still heating even when no program is firing or even the toggle switch is off, then you have a stuck relay. Whichever section is still heating, that is the relay that needs replacing.

Voltage

1) Check your voltage. Some people may have high voltage like 245 volts where you should nominally have 240 volts.

2) Make sure you don't have a 208 volt kiln hooked up to a 240 volt circuit. This is dangerous because the kiln will draw more amps than it is rated for which will overload the power wires and other components and could cause a fire.

Elements

1) Check element ohms and compare with factory values. (See CHECKING ELEMENT OHMS later in this section).

2.) Make sure the elements are wired properly. Check the wiring diagram.

EASY-FIRE ERROR MESSAGES

See this for a complete description on the web: ***hotkilns.com/error-codes.*** You can also see more information in the instruction manual in the CONTROL section: Appendix E in DYNATROL 700 INSTRUCTIONS FOR L&L KILNS.

Error codes can appear at any time during the firing. They always refer to a problem that, if allowed to continue, could end with unknown or even disastrous results. Errd, Err1, ErrP and the FAIL message make the most frequent appearances. Errd means there is a temperature difference of more than 50 degrees between the zones. **Err1** indicates that the kiln is climbing too slowly in an Easy-Fire program. ErrP indicates that there was either a very quick power outage (ErrP will flash along with the temperature and the kiln will still be heating), or there was a longer power outage (PF will be the only thing in the display and the kiln will not be heating). FAIL refers to a specific thermocouple failure. It will appear after displaying a 'tC' (thermocouple) number 1, 2 or 3.

Errd

1) If the kiln was just re-assembled and Errd is the error code, then double-check that the element connection wires go to their proper power relays and that the thermocouple wires are connected to the proper zones.

2) If you are sure the kiln is set up properly, nothing is out of place and none of the thermocouples are partially out of the kiln, then one of the following situations may apply:

3) You were firing with the lid open and you got Errd either while the lid was open or right after you closed it. For drying with the lid open, only about two inches is needed to adequately vent off water vapor. This is plenty if all the peep holes are open. The DynaTrol will attempt to compensate for the heat loss, and it usually can. The trouble may happen when you close the lid. The elements in the top of the kiln are already much hotter than the ones nearer the bottom due to their need to compensate for the heat loss from the top. When you close the lid it can take as long as eight seconds for the DynaTrol to respond to the rise in temperature in the top of the kiln, and shut off those elements. This can quickly cause an uneven temperature in the kiln, which will usually result in Errd (possibly an Err2 in a smaller kiln -Err2 is when the entire kiln temperature is more than 50°F over the hold time's temperature for longer than 18 seconds).

4) There was a lot of air being exhausted from your kiln when Errd appeared. If a vent system pulls too much air from just one point in the kiln, say, to down-ramp the load very quickly to a lower hold time for crystal formation, an uneven temperature can result. The firing will go slowly as it will be difficult to compensate for the heat loss; eventually, however, the Errd (or Err1) can appear.

5) Something is too close to, or is touching, TC# in the kiln. Allow almost an inch between everything for thermal expansion. Fix and re-fire the kiln.

6) A thermocouple wire has melted against the kiln case. The wire must be replaced.

7) A thermocouple is about to fail. Perform a physical inspection if possible, or just re-start the kiln and monitor it carefully.

8) Element(s) just burned out. Perform an ohms test for more information.

9) A relay has just failed. Perform a voltage test.

10) There is a bad connection point somewhere. This will become more of a possibility as the kiln ages. Examine all points carefully for melting, corrosion, and discoloration.

Err1

1) If Err1 is the error code on the screen when you check on the firing, then for some reason the kiln could not generate enough heat to counter the heat loss. If the kiln can get no hotter (even though all the elements appear to be on and the program is not holding), then Err1 is what you will see. If one of the elements or one of the circuits in the control fails while the kiln is at a high enough temperature then it will probably display an Err8 code (which means temperature is falling when it should be rising) Err1 or Err8 can mean either you need new elements or a new component in one of the circuits. An ohms test and a voltage test can tell you which it is. If you recently changed locations, power supplies, elements, or did any repairs, then closely examine what changed between your last successful firing and this one. There may be some other issue besides bad elements or a bad component.

2) A new location can mean a 208 volt power supply rather than a 240 volt supply (about 25% less power).

3) In re-wiring the power supply you may not have used thick enough copper wire (line, conduit and connection points will be very hot).

4) The elements are the wrong resistance. Check new elements with your multimeter just to be safe. Mistakes can happen.

5) If you rewire anything improperly or incorrectly the potential for anything from a blown breaker to just no power at all is possible. (Using wire with a temperature rating of less than 150°C for the power wiring can seriously limit the life of the circuitry and can be dangerous as well, especially when the wires are close to the kiln.) Use a wire diagram and trace every wire to check yourself. You can buy high temperature wire from L&L (see the Parts List).

Err2

During a hold segment the temperature rises to greater than 50 degrees above the hold temperature which was set. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.

Err3

During a hold segment the temperature is more than 50 degrees below the hold temperature which was set. The temperature must stay 50 degrees below this set temperature for 18 seconds before the error is displayed.

Err4

The temperature is more than 50 degrees above the previous hold temperature during a ramp segment where the temperature is programmed to decrease. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.

Err5

The temperature is more than 50 degrees below the local setpoint temperature during a ramp segment where the temperature is programmed to decrease. The temperature must stay 50 degrees below this set temperature for 18 seconds before the error is displayed.

Err6

A Negative temperature is displayed. This generally indicates the thermocouple is connected incorrectly. To correct this situation, ensure the red and yellow wires are connected correctly to the controller and at all junctions. You can identify the red lead on an unmarked thermocouple with a magnet because a magnet will be attracted to the red lead.

Err7

The temperature is more than 50 degrees above the local setpoint temperature during a ramp segment where the temperature is programmed to increase. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.

Err8

When using the Easy Fire Mode, the temperature is decreasing during the last ramp segment. This could indicate that the lid was up or the peepholes open or some other physical thing is causing the kiln to decrease in temperature.

ErrP + PF

Continuous PF in display. Indicates a long term power outage. The kiln has been shut down. Press **1** to clear the display.

ErrP and the current temperature are alternately flashing. To clear the display, press the **1** key. If a firing was in progress, the kiln will continue to fire even though this message is flashing. This error can also happen as a result of RF (radio frequency) noise that resets the microprocessor. If this is suspected, the control panel should be returned to L&L for testing and possible modification. Also see ***hotkilns.com/noise***

Err-

The Err with a dash indicates there was a power loss to the controller while writing a program to the non-volatile memory chip. Recheck the selected program, and reprogram if necessary.

FAIL

1) If, upon inspection, the error code FAIL turns out to be a burned out thermocouple then replace it. You typically will not need to replace the mullite protection tube - just the internal thermocouple “element” (see ***hotkilns.com thermocouple-k-standard***). You should not mix unsheathed thermocouples with sheathed ones. (because their response rates are slightly different). A spare on hand is a good idea as well.

2) If the TCs are not bad (you just replaced them and they worked fine for at least one complete firing) but the FAIL message still appears, it may be that the TC wire is bad (melted or broken at a point) or the electronics have partially failed.

A) Turn OFF the power at the Disconnect Switch or Circuit Breaker and/or unplug the kiln.

B) Open the cover of the control.

C) Remove the Thermocouple wires from the DynaTrol and the Thermocouple Terminal Strip. Take out of the Control Box and set aside.

D) Make tiny “U” shaped jumper wires from paperclips and jumper between each of the + and - connections on the

DynaTrol board.

E) You are simply completing each TC circuit without using the TC wire or the TC. Do not let the 'U's touch anything other than the TC connection points. Note: the fact that a paperclip is not the proper type of metal to use in a Type K TC circuit is not an issue for a test like this.

F) Close up the Control Box and turn the unit on. If it still says FAIL then the electronic board has failed. If it reads room temperature then the TC wire or the TC has failed.

G) If it reads room temperature with these jumpers in, and you are not sure if it is the TC or the TC wire, just re-attach TC2's wire to TC3 and re-attach TC3's wire to TC2. If the FAIL message is still on TC2 then it is the wire, not the TC. If it says that the FAIL is now at TC3, then you know it is the TC, not the wire (there are many other ways to determine this as well).

Turning Error Codes On or Off

1) When you receive your DynaTrol the error codes are turned on. In most cases, you will want the error codes on. They can be turned off if you are doing special firings, such as jewelry or glass firing where the kiln is opened while hot. Turning the error codes off turns off the dynamic zone control feature that keeps the temperature in the kiln even top to bottom. It eliminates nuisance shut downs but side steps built in fail-safe measures.

2) The only Error codes that this can not turn off are Err6, FAIL, and ErrP in both the "Easy Fire" and "Vary Fire" modes. In addition Err1 and Err8 are not turned off in the last segment of an "Easy Fire" program. This is because the built in calculations would make no sense if the kiln were firing too slowly.

3) To turn Error Codes off do the following:

4) Press the **OTHER** button several times until you see ErCd.

5) Press **ENTER**

6) Display will say On (which indicates that the error codes are turned on) or OFF (which indicates that the Error Codes are Off). You can toggle back and forth between on and off by pressing the **1** key.

7) Hit **ENTER** when you see On or OFF and you want to keep that setting

8) CPL will display for a few seconds. IdLE, tC2, and the current temperature then cycle in the display.

Can you restart the kiln after it stops because of Error Codes?

You can try to restart the kiln after getting an error code. Some messages, like flashing ErrP and FAIL, will not necessarily turn off the kiln. Depending on the problem though, re-starting it may or may not let it finish the firing, or even start up again. An Errd will usually not re-start easily because the temperature top to bottom is drastically different. An Err1 at the end of the firing will re-start but will probably re-occur in about 22 minutes. A FAIL message will not go away even if the problem is fixed during the firing. The kiln can still be firing with the FAIL message flashing along with the number of the TC that failed. Stopping and then re-starting the kiln after fixing the problem with the TC circuit is the only way to erase the FAIL message. ErrP flashing with the temperature means that the kiln is still firing, after just a short power outage or interference. Just press any number to clear the ErrP. An ErrP which is not flashing must be re-started.

Worst Case Scenario for Restarting After an Error Code

Keep in mind that you run the risk of over-firing if you re-start while the kiln is very close to the final temperature. A pyrometric cone melts with the proper combination of time and temperature. Add more time and you don't need as high a temperature, go to a higher temperature and you don't need as much time. When an error code shuts down the kiln near your final temperature (within about 50 degrees) and you do not know exactly how long it has been cooling, or what temperature it reached before the error code appeared, you run the risk of having too much unaccounted for time in your time-temperature equation. The DynaTrol calculates this equation automatically after determining how many degrees per hour the kiln is climbing (time) and to what temperature it is climbing to (temperature). However, it cannot do this accurately after a high temperature re-start.

If you have cones in the kiln that you can see through the peepholes, then use these after you re-start and turn off the kiln manually when the target cone bends over.

If you do not have cones visible then you can gamble and estimate a final temperature based on how many degrees per hour the kiln has risen, including the time it was off.

For example, you come in and the control says tC2, 2200 (degrees F) and everything seems fine in your slow glaze to cone 6 firing. But twenty-five minutes later you come back and see Err1.

The first thing you want to do is press 1 to clear the error

code. Look for tC2's temperature and write it down. It might be 2175. You have no cones in the kiln but you really need these pieces fired.

Wait a few seconds until you see "IdLE, tC2, 2175". Press **START** to re-start the program and note the time on your watch. Note the 25 minutes the kiln was "holding" from the last time you saw it at 2200°F until this time, where it says 2175. It must have continued to climb somewhat, but because the Err1 will appear after 22.5 minutes of holding when the kiln is programmed to be climbing, it probably never got over 2210°F. So the kiln has held at an average of about 2195°F for about 25 minutes, instead of continuing on to 2232°F (cone 6) to finish the firing.

The relationship between time and temperature allows you to estimate how much hold time to add to get the same amount of heat work as the kiln would have achieved by climbing to 2232°F. Assuming a 108°F per hour temperature rise, a good rule of thumb is to add about a 20 minute hold to the maximum temperature; this will allow you to lower the final temperature by about 20°F. An hour hold time would mean a final temperature of about 40°F lower. A two hour hold time would be about 60°F lower.

In this example, the kiln has already held at about 35 degrees lower than the final temperature for 25 minutes. It would need another 25 minutes of holding to give the ware the same amount of heat work that 2232°F (cone 6) would have.

In reality, however, an Err1 that close to the end of a firing probably means you need new elements. So re-starting the kiln will probably not enable it to climb much higher in temperature. Keeping track of the time, let it run, and when it shows Err1 again just keep re-starting it until the firing finishes. Meanwhile call and order new elements.

Be very careful if you try this method. On loads that are very important always use cones you can see through the peepholes in case of a failure of some kind. If you have to use this method without the cones, remember that almost all your calculations are based on estimates and the results could be disastrous to your ware and/or the kiln if you are not accurate enough. The further away the temperature that the kiln is holding at is from the cone that the firing was trying to get to, the less accurate an estimated amount of time will be to achieve the amount of heat work necessary. If you can wait and re-fire from room temperature, you should. If you depend in any way on your kiln you should keep spare parts around for it. You could replace the elements easily yourself after the kiln cools and then re-load it and re-fire it to the proper cone without losing much time at all. Or consider that most glazes have an entire cone's temperature range that they can mature within. Weigh your options and decide.

In general though, Error Codes mostly appear after the kiln has been disassembled and set back up improperly, has had its power supply altered (like moving to a new studio with different voltage), or has had an element, a relay, or a thermocouple burn out.

ONE-TOUCH ERROR MESSAGES

Error codes can appear at any time during the firing. They always refer to a problem that, if allowed to continue, could end with unknown or even disastrous results. Errd, Err1, ErrP and the FAIL message make the most frequent appearances.

Errd

Error d indicates that the kiln temperature is 100°F above the traveling set-point, which is the current desired temperature in the kiln. The traveling set-point will increase or decrease according to the programmed rate.

1) Something is too close to, or is touching the thermocouple. Allow almost an inch between everything for thermal expansion. Fix and re-fire the kiln.

2) The Thermocouple Lead Wire has melted against the kiln case. The wire must be replaced.

3) The thermocouple is about to fail. Perform a physical inspection, or just re-start the kiln and monitor it carefully.

4) Element(s) just burned out. Perform an ohms test for more information.

5) The relay has just failed.

6) There is a bad connection point somewhere. This will become more of a possibility as the kiln ages. Examine all points carefully for melting, corrosion, and/or discoloration.

Err1

Error 1 indicates the temperature in the kiln is rising during an up ramp slower than 15°F/hr. If this rate continues for 8 minutes the firing will be stopped. Err1 may be an indication that the elements are worn or that a relay has stopped working.

1) If Err1 is the error code on the screen when you check on the firing, then for some reason the kiln could not generate enough heat to counter the heat loss. If the kiln can get no hotter (even though all the elements appear to be on and the program is not holding), then Err1 is

what you will see. Err1 can mean either you need new elements or a new relay. An ohms test and a voltage test can tell you which it is. If you recently changed locations, power supplies, elements, or did any repairs, then closely examine what changed between your last successful firing and this one. There may be some other issue besides bad elements or a bad component.

2) A new location can mean a 208 volt power supply rather than a 240 volt supply (about 25% less power).

3) In re-wiring the power supply you may not have used thick enough copper wire (line, conduit and connection points will be very hot).

4) The elements are the wrong resistance. Check new elements with your multimeter just to be safe. Mistakes can happen.

5) If you rewire anything improperly or incorrectly the potential for anything from a blown breaker to just no power at all is possible. (Using wire with a temperature rating of less than 150°C for the power wiring can seriously limit the life of the circuitry and can be dangerous as well, especially when the wires are close to the kiln. Use a wire diagram and trace every wire to check yourself). You can buy high temperature wire from L&L (see the Parts List).

ErrP

ErrP is displayed whenever there is a power interruption that is long enough to stop the firing. If the power interruption is brief the kiln will continue to fire when power is restored; in this case there will no indication of a power failure. To clear the error, press any key.

This error can also happen as a result of RF (radio frequency) noise that resets the microprocessor. See ***hotkilns.com/noise***

ErrF

ErrF indicates the temperature in the kiln is decreasing during a down ramp less than 15°F/hr. If this rate continues for 8 minutes the firing will be stopped. ErrF may be an indication that a relay has stuck in the on position.

tC-

tC- indicates that the red and yellow thermocouple wires are reversed. Make sure they are right all the way through the circuit.

FAIL

See the section in these Troubleshooting Instructions called DISPLAY READS FAIL and tC.

Can you restart the kiln after it stops because of Error Codes?

You can try to restart the kiln after getting an error code. Some messages, like flashing ErrP and FAIL, will not necessarily turn off the kiln. Depending on the problem though, re-starting it may or may not let it finish the firing, or even start up again. An Err1 at the end of the firing will re-start but will probably re-occur in about 22 minutes.

Worst Case Scenario for Restarting After an Error Code

Keep in mind that you run the risk of over-firing if you re-start while the kiln is very close to the final temperature. A pyrometric cone melts with the proper combination of time and temperature. Add more time and you don't need as high a temperature, go to a higher temperature and you don't need as much time. When an error code shuts down the kiln near your final temperature (within about 50 degrees) and you do not know exactly how long it has been cooling, or what temperature it reached before the error code appeared, you run the risk of having too much unaccounted for time in your time-temperature equation.

If you have cones in the kiln that you can see through the peepholes, then use these after you re-start and turn off the kiln manually when the target cone bends over.

If you do not have cones visible then you can gamble and estimate a final temperature based on how many degrees per hour the kiln has risen, including the time it was off.

For example, you come in and the control says 2200 (degrees F) and everything seems fine in your slow glaze to cone 6 firing. But twenty-five minutes later you come back and see Err1.

The first thing you want to do is press **1** to clear the error code. Look for the temperature and write it down. It might be 2175. You have no cones in the kiln but you really need these pieces fired.

Wait a few seconds until you see "IdLE, 2175". Press **START** to re-start the program and note the time on your watch. Note the 25 minutes the kiln was "holding" from the last time you saw it at 2200°F until this time, where it says 2175. It must have continued to climb somewhat, but because the Err1 will appear after 22.5 minutes of holding when the kiln is programmed to be climbing, it probably never got over 2210°F. So the kiln has held at an average of about 2195°F for about 25 minutes, instead of continuing on to 2232°F (cone 6) to finish the firing.

The relationship between time and temperature allows you to estimate how much hold time to add to get the same

amount of heat work as the kiln would have achieved by climbing to 2232°F. Assuming a 108°F per hour temperature rise, a good rule of thumb is to add about a 20 minute hold to the maximum temperature; this will allow you to lower the final temperature by about 20°F. An hour hold time would mean a final temperature of about 40°F lower. A two hour hold time would be about 60°F lower.

In this example, the kiln has already held at about 35 degrees lower than the final temperature for 25 minutes. It would need another 25 minutes of holding to give the ware the same amount of heat work that 2232°F (cone 6) would have.

In reality, however, an Err1 that close to the end of a firing probably means you need new elements. So re-starting the kiln will probably not enable it to climb much higher in temperature. Keeping track of the time, let it run, and when it shows Err1 again just keep re-starting it until the firing finishes. Meanwhile call and order new elements.

Be very careful if you try this method. On loads that are very important always use cones you can see through the peepholes in case of a failure of some kind. If you have to use this method without the cones, remember that almost all your calculations are based on estimates and the results could be disastrous to your ware and/or the kiln if you are not accurate enough. The further away the temperature that the kiln is holding at is from the cone that the firing was trying to get to, the less accurate an estimated amount of time will be to achieve the amount of heat work necessary. If you can wait and re-fire from room temperature, you should. If you depend in any way on your kiln you should keep spare parts around for it. You could replace the elements easily yourself after the kiln cools and then re-load it and re-fire it to the proper cone without losing much time at all. Or consider that most glazes have an entire cone's temperature range that they can mature within. Weigh your options and decide.

In general though, Error Codes mostly appear after the kiln has been disassembled and set back up improperly, has had its power supply altered (like moving to a new studio with different voltage), or has had an element or a thermocouple burn out.

SERVICE FOR YOUR KILN

WHERE TO GET SERVICE

See the SERVICE Section of your Instruction manual or see ***hotkilns.com/technical-support***

WHERE TO BUY PARTS

You can order parts for your L&L Kiln through L&L or your local distributor. See the Parts List that pertains to your particular kiln model. Our on-line parts list is easy to navigate. See ***hotkilns.com/parts***. Standard Parts are typically shipped the day after an order is placed. Rush service is available.

REPLACEMENT ELEMENTS

Replacement Elements made by L&L Kiln Mfg., Inc. are designed for each individual model for long life and superior performance. Good element design is a complex balance of watt density, design voltage, stretch ratio, wire gauge, element length and material. It takes many hours and years of experience to design a good element for each model. Do not expect an outside supplier with no interest in your kiln performance or long experience with L&L kilns to spend the necessary time to do this right. In the end you will not save

NOTE: Many of these procedures have accompanying instructional videos. Look out for the video links in each section or go to hotkilns.com/videos for more.

REMOVING PANEL FOR SERVICE

1) It is easy to access the inside of the control panel for troubleshooting. In addition it is easy to remove this panel and send it back to the factory for inspection and/or repair.

2) Disconnect power and unplug the kiln.

3) Follow the instructions in ASSEMBLY INSTRUCTIONS FOR in the ASSEMBLY tab of your instruction manual or see ***hotkilns.com/assemble-easy-school*** in order to remove the Control Box for Easy-Fire and School-Master kilns.

4) Pack the control panel with cushioning material such as bubble wrap, balled-up newspaper or foam in a cardboard box and follow instructions from the factory or your local distributor about where to send it. DO NOT SEND A CONTROL PANEL WITHOUT CALLING FIRST.

CAUTION: The controller contains electronic components which are sensitive to static electricity. Before handling the controller dissipate any static charge you may have by touching metal or a screw on the controller panel, the electrical box, the kiln lid, or some other grounded object.

REPLACING DYNATROL

See this video: ***hotkilns.com/replace-dynatrol***

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Remove the four #6 screws that hold the DynaTrol in place from the front face of the control panel.

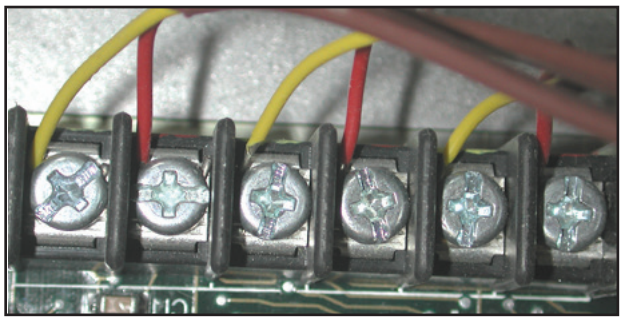
3) Open up the control box and hinge down for access (as shown on page 2)

4) Pull off the spade connectors from all the connection points on the back of the control. Loosen the screws that hold down the thermocouple wires and pull out the wires from under the screw heads. It is OK to remove the screws if this is easier for you. First note where all the wires go. These are all clearly marked with color coding on the Wiring Diagram.

5) Pull old control out. Put new control in and screw in place with the #6 mounting screws. Replace wires on proper connectors.

6) Be careful to get the Red or Yellow of the thermocouple wires to match the colors painted on the DynaTrol board.

Picture showing thermocouple wires installed on DynaTrol. There is no need to wrap the thermocouple wire around the screw head- although it is OK to do so. However, do make sure the wire is tight and secure UNDER the screw head.



7) Double check that the proper color coded wire goes to the proper terminal.

Orange = OUT 1

Blue = OUT 2

Purple = OUT 3 (not on e18S, e23S, and e28S)

Gray = AC1

Green = CT

Brown = AC2

TC1 = TC1

TC2 = TC2

TC3 = TC3 (not on e18S, e23S, and e28S)

REPLACING ONE-TOUCH™

See this video: ***hotkilns.com/replace-dynatrol*** (Note the process of changing a DynaTrol is very similar)

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Remove the four #6 screws that hold the One-Touch™ in place from the front face of the control panel.

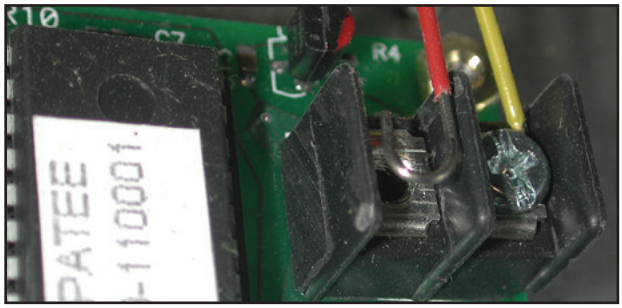
3) Open up the control box and hinge down for access (as shown on page 3)

4) Pull off the spade connectors from all the connection points on the back of the control. Loosen the screws that hold down the thermocouple wires and pull out the wires from under the screw heads. It is OK to remove the screws if this is easier for you. First note where all the wires go. These are all clearly marked with color coding on the Wiring Diagram.

5) Pull old control out. Put new control in and screw in place with the #6 mounting screws. Replace wires on proper connectors.

6) Be careful to get the Red or Yellow of the thermocouple wires to match the colors painted on the control board.

Picture showing thermocouple wires installed on Control. One screw is removed to show how the TC wire should be prepared with a "U" shape.



7) Double check that the proper color coded wire goes to the proper terminal.

Orange = J5

Gray = J2

Green/Yellow= J4

Brown = J3

REPLACING TRANSFORMER

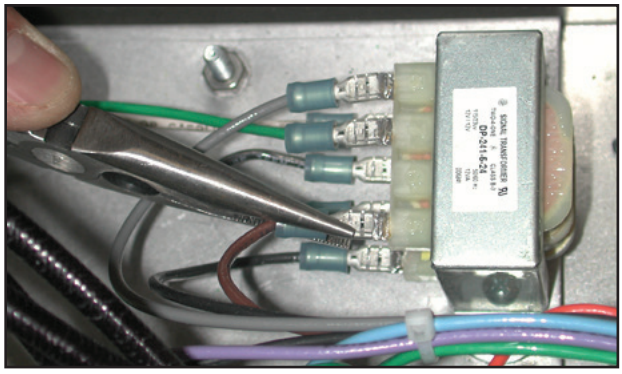
See this video: ***hotkilns.com/change-transformer***

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Open up the control box and hinge down for access (as shown on page 2).

3) Using needle nose pliers pull off the wires from the transformer. THIS CAN BE TRICKY. It can take a good bit of force sometimes to remove these little spade connectors. You will probably not be able to do it with just your hands. Also the spade connectors on the transformer are not very strong. Take your time. Of course, if you are replacing a bad transformer it doesn't matter if you damage it.

Showswires being pulled off the control transformer.



4) Unscrew the two #8 screws that hold the control transformer onto the Contactor Panel and remove the transformer.

5) Before installing the new transformer put the small jumper wire onto terminals #2 and #3 on the bottom row of terminals. Note the little numbers by the contacts.

REPLACING POWER RELAYS

See this video: ***hotkilns.com/change-relay***

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Open up the control box and hinge down for access (as shown on page 2).

3) Pull off the wires to the relay(s) that you are replacing. Everything is color coded and marked so you can refer to the wiring diagram when replacing if you forget where the wires go. The wire lengths also don't give you much choice and will help keep you from making a mistake.

4) Unscrew the #8 screws that hold the relays in place. Remove old relay and replace with new one.

5) Visually inspect the wire connectors. Do they look corroded or "cooked"? Are the wires frayed? Any corrosion on the wire itself? If any of this is questionable you may need to replace the appropriate wire harness.

6) Reconnect all wires. Visually inspect to make sure the spade connectors are down as far as they can go and feel to see that they are tight (a gentle tug should not remove one). If they are loose for some reason remove the wire and slightly squeeze the spade connector with pliers to tighten it.

IMPORTANT: The slip on wire connectors can not be loose or corroded. If there is a bad connection then heat will be generated and the component that they slip onto (relay, terminal strip, etc) may overheat and fail. If you squeeze the slip on terminal to make it tighter - be sure to squeeze it evenly so that one side is not tight and the other loose. If there are any doubts about the integretity of the wire or the connector replace the whole wire or harness.

REPLACING FUSE HOLDER

See this video: ***hotkilns.com/change-fuse-holder***

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Open up the control box and hinge down for access (as shown on page 2).

3) Remove the wire connectors from the end of the fuse

holder on the inside of the panel.

4) Unscrew the nut that holds the fuse holder in place.

5) Remove and replace with a new fuse holder. Reconnect wires.

REPLACING THERMOCOUPLES

See this video: ***hotkilns.com/change-thermocouple***

1) Unplug kiln or turn off the kiln at the fused disconnect switch.

2) Remove the Control Box and Element Terminal Box as shown in the Assembly Instructions.

3) Remove the Thermocouple Lead Wires.

4) Unscrew the Thermocouple from the kiln (these are #6 x 1-1/2" screws)

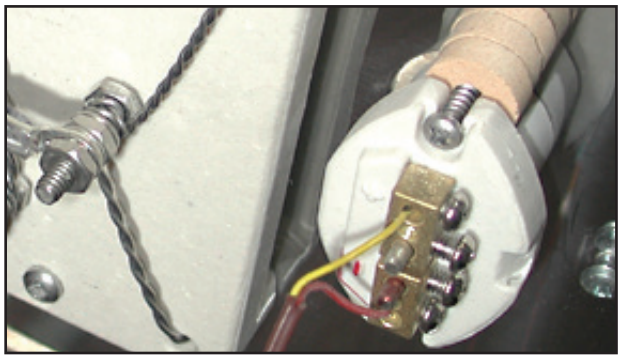
5) Remove Thermocouple.

6) Remove Thermocouple Protection Tube. Shake it and dump out the oxide powder that has accumulated inside the tube. Then reinsert the tube into the hole in the kiln.

7) Install a new Thermocouple and screw in place.

8) Replace Thermocouple Lead Wires and tighten. Be sure to get Red matched to the Minus (-) sign and the Yellow matched to the Plus (+) sign.

Picture showing end of thermocouple.



CHECKING ELEMENT OHMS

See this video: ***hotkilns.com/test-resistance-ez***

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (ELEMENT TROUBLESHOOTING & INSTALLATION INSTRUCTIONS)or here: ***hotkilns.com/element-troubleshooting***

Element Ohm Charts

Check your wiring diagram for resistence values for your kiln. (Note - only some popular models are listed here.)

Easy-Fire Element Ohm Chart

MODEL	VOLTS/ PHASE	ELEMENT OHMS	CIRCUIT OHMS
e18S-240	240/1	9.6	4.8
e18S-208	208/1	8.3	4.2
e18S-220	220/1 (non-US)	8.8	4.4
e18T-240	240/1	9.9	5.0
e18T-208	208/1	7.4	3.7
e18T-220	220/1 (non-US)	8.3	4.2
e18T-240-3P	240/3	9.9	5.0
e18T-208-3P	208/3	7.4	3.7
e18T-380-3P	380/3 (non-US)	8.3	4.2
e23S-240	240/1	23.5	11.8
e23S-208	208/1	20.0	10.0
e23S-220	220/1 (non-US)	21.5	10.8
e23T-240	240/1	28.9	14.5
e23T-208	208/1	25.0	12.5
e23T-220	220/1 (non-US)	26.5	13.3
e23T-240-3P	240/3	28.9	14.5
e23T-208-3P	208/3	22.7	11.4
e23T-380-3P	380/3 (non-US)	24.5	12.3
e28S-240	240/1	19.3	9.7
e28S-208	208/1	16.7	8.4
e28S-220	220/1 (non-US)	17.2	8.6
e28T-240	240/1	28.9	14.5
e28T-208	208/1	25.0	12.5
e28T-220	220/1 (non-US)	26.5	13.3
e28T-240-3P	240/3	20.0	10.0
e28T-208-3P	208/3	17.4	8.7
e28T-380-3P	380/3 (non-US)	15.1	7.6

School-Master Top Element Ohm Chart

MODEL	VOLTS/ PHASE	ELEMENT OHMS	CIRCUIT OHMS
SM23T-240	240/1	29.3	14.7
SM23T-208	208/1	25.3	12.7
SM23T-220	220/1 (non-US)	26.8	13.4
SM23T-240-3P	240/3	29.25	14.7
SM23T-208-3P	208/3	23.0	11.5
SM23T-380-3P	380/3 (non-US)	24.8	12.4
SM28T-240	240/1	29.3	14.7
SM28T-208	208/1	25.3	12.7
SM28T-220	220/1 (non-US)	26.8	13.4
SM28T-240-3P	240/3	20.2	10.1
SM28T-208-3P	208/3	17.6	8.8
SM28T-380-3P	380/3 (non-US)	18.8	9.4

School-Master Bottom Element Ohm Chart

MODEL	VOLTS/ PHASE	ELEMENT OHMS	CIRCUIT OHMS
SM23T-240	240/1	28.3	14.2
SM23T-208	208/1	24.5	12.3
SM23T-220	220/1 (non-US)	25.9	13.0
SM23T-240-3P	240/3	28.3	14.2
SM23T-208-3P	208/3	22.2	11.1
SM23T-380-3P	380/3 (non-US)	24.0	12.0
SM28T-240	240/1	28.3	14.2
SM28T-208	208/1	24.5	12.3
SM28T-220	220/1 (non-US)	25.9	13.0
SM28T-240-3P	240/3	19.6	9.8
SM28T-208-3P	208/3	17.0	8.5
SM28T-380-3P	380/3 (non-US)	18.2	9.1

CHANGING ELEMENTS

SEE THESE VIDEOS FIRST

For most top loading kilns:
hotkilns.com/change-elements-ez

For kilns with Quad elements:
hotkilns.com/change-element-quad

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (ELEMENT TROUBLESHOOTING & INSTALLATION INSTRUCTIONS) or here: ***hotkilns.com/element-troubleshooting***

REPLACING ELEMENT HOLDERS

See this video: ***hotkilns.com/change-element-holder***

1) When ordering a new holder provide model number of kiln and length of the element holder. See the Parts List for this information.

2) Note that if the holder has melted badly you may need to either replace the brick that holds it or at least patch the brick with our Brick Repair Kit.

See the extensive instructions in the TROUBLESHOOTING Section of your instruction Manual or here: ***hotkilns.com/element-troubleshooting***

CRACKS IN THE LID & BOTTOM

See these videos for bad cracks:
hotkilns.com/fix-cracks-front-load
and ***hotkilns.com/repair-cracked-top***

See this video for hairline cracks:
hotkilns.com/repair-hairline-cracks

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS)or here: ***hotkilns.com/brick-troubleshooting***

TIGHTENING STAINLESS BANDS

See these videos:
hotkilns.com/replace-side-brick-kiln
h***otkilns.com/replace-side-brick-davinci***

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS)or here: ***hotkilns.com/brick-troubleshooting***

REPLACING FIREBRICK IN SIDES

See these videos:
hotkilns.com/replace-side-brick-kiln
h***otkilns.com/replace-side-brick-davinci***

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS) or here: ***hotkilns.com/brick-troubleshooting***

DRILLING OUT HOLES FOR PEEPHOLES

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS) or here: ***hotkilns.com/brick-troubleshooting***

DRILLING OUT FOR ELEMENT CONNECTIONS

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS) or here: ***hotkilns.com/brick-troubleshooting***

REPLACING BOTTOMS

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS) or here: ***hotkilns.com/brick-troubleshooting***

REPLACING LIDS

See the instructions in the TROUBLESHOOTING Section of your instruction Manual (TROUBLESHOOTING & FIXING BRICK PROBLEMS) or here: ***hotkilns.com/brick-troubleshooting***

MORE ABOUT TROUBLESHOOTING CERAMIC PROBLEMS

1) We provide many firing tip brochures from Orton in the pdf library on our website. For a more in depth explanation Orton has a great booklet called Successful Firing Practices. They also have a number of other booklets available such as Cones and Firing (20 pages), Using Orton Cones/Temperature Charts, Kiln Safety Booklet, Kiln-Sitter Maintenance & Repair and Porcelain Firing Guide. Contact Orton at 614-895-2663 for more information. See ortonceramic.com for lots of very helpful information on how to use cones and for many firing tips and great information on firing kilns.

2) Check out a book called Electric Kiln Ceramics written by Richard Zakin, a book called What Every Potter Should Know by Jeff Zamek and Mastering Cone 6 Glazes by Ron Roy and John Hesselberth. Check out a book called “Ceramic Faults and their remedies” by Harry Fraser, A&C Black, London.

4) The magazines Ceramics Monthly (***ceramicsmonthly.org***) and Clay Times (claytimes.com) have many good articals and resources.

5) Also check out the great web resource, the Clayart discussion group at ***potters.org***.

6) Check the links page on our web site.

7) Your ceramic supplier is a good source of knowledge and will have a wide variety of helpful books and videos as well

Photo of a 1-phase control panel for a three section Easy-Fire kiln

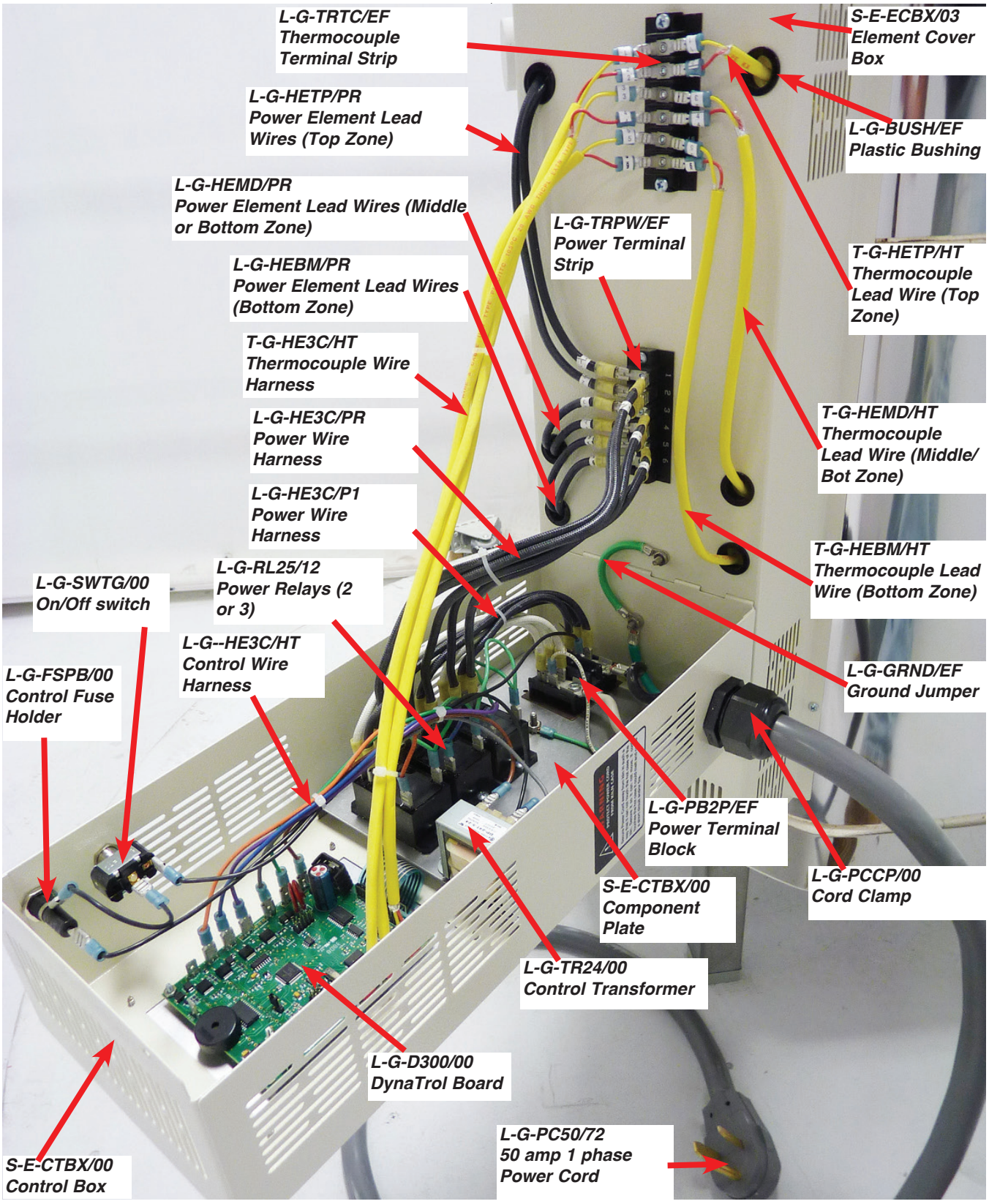


Photo of a 3-phase control panel for a three section School-Master kiln