Rio Grande
Digital Temperature Controller

1502 **°F**

Temperature Display
No Display Dot: Temperature display is in °F.
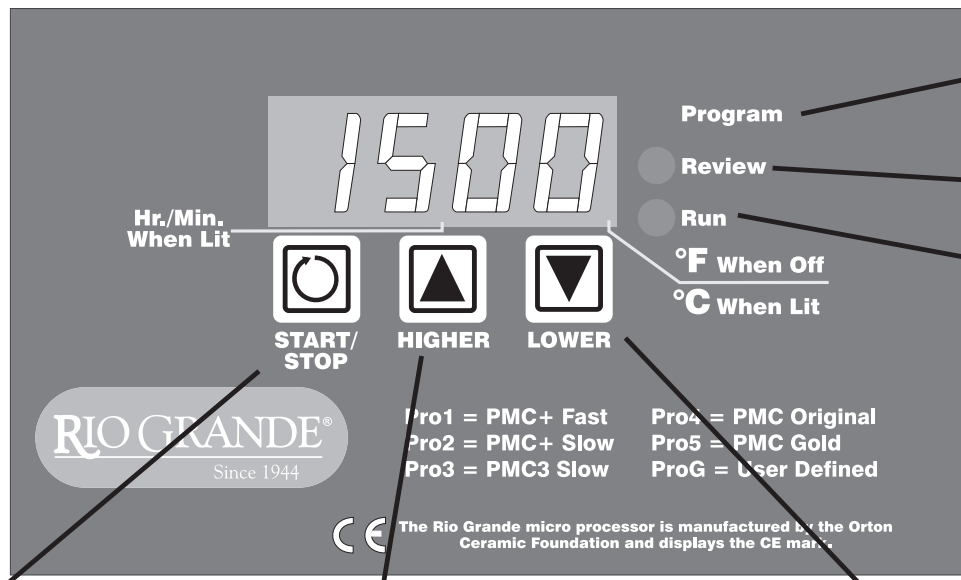
8 16. **°C**

Right Display Dot: Temperature display is in °C.

See page 9 for instructions on selecting °F and °C.

Display Dot

01.30

Time Display
Center Display Dot: Separates hours from minutes. Example: Display shown above is 1 hour and 2 minutes

Indicator Lights

Top: On during programming.

Middle: On during program review.

Bottom: Blinks during firing.

1500

Program
Review
Run

Hr./Min. When Lit

°F When Off
°C When Lit

START/ STOP   HIGHER   LOWER

RIO GRANDE®
Since 1944

Pro1 = PMC+ Fast   Pro4 = PMC Original
Pro2 = PMC+ Slow   Pro5 = PMC Gold
Pro3 = PMC3 Slow   ProG = User Defined

CE   The Rio Grande micro processor is manufactured by the Orton
Ceramic Foundation and displays the CE mark.

START/STOP Key
1) On/Off: Starts and stops a firing.
2) Enters Data: Press after each programming step.

Up Arrow Key
1) Raises Numbers

2) Selects a Program: From `IdLE` press **START**. Press **UP ARROW** to select a program.

3) Skips a Segment: During a User Defined firing, press the **UP ARROW**. `SStP` will appear. Press **START**. The current segment ramp or hold number will appear. To skip, press **START** again. Page 6

4) Calibrates the Controller: At the `Strt` display, press **UP ARROW**. `tCOS` will appear. Use arrow keys to calibrate the controller to fire hotter or cooler. Press **START** to return to `Strt`. Page 9

5) Adds Hold Time: During a User Defined firing, press **UP ARROW** repeatedly until `HLdt` appears. Press **START**. Each time you press the **UP ARROW**, the hold time for the current segment will increase by 5 minutes. Then press **START**. Page 6

6) Changes Target Temperature: During a User Defined firing, press **UP ARROW** repeatedly until `CHGt` appears. Press **START**. Use the arrow keys to change the target temperature for the current segment. Then press **START**. Page 6

7) Sets the Alarm: During a firing, press **UP ARROW** repeatedly until `ALAr` appears. Press **START**. Use the arrow keys to change the alarm temperature. Press **START**. To silence the alarm, press any key. Page 7

Down Arrow Key
1) Lowers Numbers

2) Repeats the Last Firing: From `IdLE` press **DOWN ARROW**. The program you have selected will appear one step at a time. When `Strt` appears, press **START**. Page 3

3) Delays a Firing: From `Strt` press **DOWN ARROW**. Enter delay time. Press **START**. Page 3

4) Reviews a Program: During firing, press **DOWN ARROW**. The program you entered will appear one step at a time. Page 3

Contents

Safety

The warranty on your Rio Grande controller does not cover damage from overfiring, regardless of the circumstances. It is the operator's responsibility to make sure the kiln turns off at the proper time.

- When the kiln is not in use, disconnect the power.

- Do not leave the kiln unattended, especially near the expected shut-off time.

- Wear firing safety glasses when looking into the firing chamber of a hot kiln.

- Do not touch hot sides of kiln. Keep unsupervised children away.

- Install your kiln at least 12 inches from any wall or combustible surface.

- Do not open lid or door until kiln has cooled and all switches are off.

- Fire only in a well-ventilated, covered and protected area away from combustible materials.

- Keep cordset away from hot sides of kiln or furnace.

- DANGEROUS VOLTAGE! Do not touch heating elements with anything. Disconnect before servicing.

Which Instructions Apply to Your Controller

When you first connect the power, the controller will display these messages, one after the other:

`8888`

`----` or a software code

`IdLE`

If your controller shows `----` instead of a software code before `IdLE` appears, then the controller includes only Skip Segment from "Advanced Features" on pages 6 - 7. If your controller shows a software code before `IdLE` appears, then the controller has all the features in this manual.

General Guidelines

Time and Temperature Display

Center Dot: Time

A center dot appears during time display. It separates hours from minutes. (Example: 1 hour, 30 minutes displays as 01.30.) During temperature display, the dot disappears.

Single Right-Hand Dot: °C

When temperature is displayed in °C, a dot appears in the lower right. In °F display, it disappears. You can choose between Fahrenheit and Celsius display. See page 9.

Operation Begins from the IdLE Display

IdLE must appear before you can fire the kiln.

■ If **CPLt**, **STOP**, or other message appears instead of **IdLE** when the kiln is first turned on, press the **START** key (the key with the circular arrow). **IdLE** will appear.

■ If you press **STOP** during a firing, **STOP** will appear. To get back to **IdLE**, press **START** again.

■ If the display shows an error message such as **FAIL** instead of **IdLE**, see page 8.

■ **CPLt** (firing completed) appears at the end of a firing. To make **IdLE** appear, press **START**.

Thermocouple Inspection

The small rod protruding into the firing chamber is the temperature sensor, or thermocouple.

> **Caution:** Bumping the thermocouple can push it out of the firing chamber. This could cause an overfire!

■ A 1/8" diameter thermocouple should extend into the firing chamber ½" - ⅝".

■ A ¼" diameter thermocouple should extend into the firing chamber 1" or more.

■ Keep shelves, posts and ware 1" - 1 ½" away from the thermocouple.

A Rapid Way to Scroll Numbers

During programming, hold an arrow key down several seconds, and numbers will begin to scroll rapidly. Ordinarily, you would press **UP ARROW** to raise a number and **DOWN ARROW** to lower it. But sometimes it is faster to press the opposite key. This is because the numbers scroll below 0000 to the highest number, and vice versa. Examples:

■ To program a 99.59 hour Hold when the display shows 00.00, press the **DOWN ARROW** once.

■ To program a FULL rate when the display shows 0000, press the **DOWN ARROW** once.

■ To program a temperature of 200°F when the display shows 1800°F, press the **UP ARROW**. That is faster than pressing the **DOWN ARROW**.

Program Review & Repeat Firing

Program Review lets you check that the information programmed into the controller is correct. Program Review shows the values for the program in active memory. Use Program Review from **IdLE** to repeat the last program you fired.

■ **Using Program Review during firing:** Press the **DOWN ARROW** key. The rate, temperature, hold, etc. will display one after the other. Firing will continue.

■ **To repeat a firing, use Program Review from IdLE:** Press the **DOWN ARROW** key. After rate, temperature, hold, etc., **Strt** will appear. Press **START**. **-On-** will appear, and the kiln will begin firing the program just reviewed.

Delay

Delay is a count-down timer. The kiln begins firing when the timer runs out of time. Use Delay to fit a firing into your schedule.

> **Caution:** For safety, do not leave the kiln alone during a delay or a firing. We cannot guarantee your kiln against overfiring even though the controller is automatic.

1 After you have selected a program and the controller is ready to begin firing, **Strt** will appear.

2 Press the **DOWN ARROW** key once. **dELA** will appear, alternating with **00.00**.

3 Use the arrow keys to enter delay time. (The decimal separates hours and minutes. Example: 1 hour 10 minutes = 01.10) Then press **START** twice. **dELA** will appear, alternating with time left until the firing begins.

> **Note:** Press **START** during delay to end the delay and begin the firing. The maximum delay is 99 hours and 59 minutes.

Power Failures

After a power failure, the controller will continue firing provided that:

■ The kiln temperature is above 212°F/100°C when the power comes back on.

■ The temperature dropped no more than 180°F/100°C while the power was off.

Power Failure Messages

PF 1 The power failed during a cooling segment, and the kiln cooled past the target temperature while the power was off.

PF 2 The power failed during firing and kiln temperature was below 212°F / 100°C when the power came back on.

PF 3 The power failed during firing and temperature dropped more than 180°F / 100°C by the time the power came back on.

CPLT Message: Firing Completed

CPLT

When the firing has successfully completed, the controller will shut off power to the elements and sound an alarm for 30 seconds. Then three messages will cycle one after the other:

1 **CPLT** (complete)

2 Firing time in hours and minutes

3 The current kiln temperature

Thunder Storms and Power Surges

Unplug the kiln or disconnect the power when the kiln is not in use, especially during thunder storms and in areas with frequent power surges. If the kiln is part way through a firing when a storm begins, it is probably okay to continue the firing with close supervision. Do not leave the kiln unattended.

Selecting a Program

PMC Programs Stored in Memory

Five PMC programs are stored in memory. You can also program custom firings. Shown below are the heating rate, temperature, and temperature hold time for each stored program. (See "Theory of Operation," next page, to learn more about rate, temperature, and hold.)

Program 1: PMC Plus Fast
Heating rate per hour: Full
Temperature: 1650°F
Hold: 10 minutes

Program 2: PMC Plus Slow
Heating rate per hour: 1500°F
Temperature: 1470°F
Hold: 30 minutes

Program 3: PMC3 Slow
Heating rate per hour: 1500°F
Temperature: 1110°F
Hold: 45 minutes

Program 4: PMC Original
Heating rate per hour: Full
Temperature: 1650°F
Hold: 2 hours

Program 5: PMC Gold
Heating rate per hour: Full
Temperature: 1830°F
Hold: 2 hours

Program 6: User Defined program
Program custom rates, temperatures, and hold times.

Selecting and Firing a PMC Program

1 From **IdLE**, press **START**.

2 Press the **UP ARROW** key (not the **DOWN ARROW**). Each time you press the **UP ARROW**, a different program will appear:

PrO1 PMC Plus Fast

PrO2 PMC Plus Slow

PrO3 PMC3 Slow

PrO4 PMC Original

PrO5 PMC Gold

PrO6 User Defined custom programming

3 When the PMC program you want appears, press **START**. **Strt** will appear. Press **START** to begin firing. **-On-** will appear and the Run indicator light with begin blinking. The kiln is now firing.

To stop a firing before completion, press **STOP**. **StOP** will appear, alternating with kiln temperature.

Note: Do not be concerned if your kiln makes a clicking sound during firing. Kilns use relays to power the elements. The relays click each time their electrical contacts come together.

Note: The kiln's actual firing rate may be less than the rate you programmed, depending on the kiln model, available voltage, and density of load you are firing.

When the kiln fires to completion, it will beep for 30 seconds. The display will show the following:

■ Firing time

■ Present temperature

■ **CPLt** (fired to completion)

To return to **IdLE**, press **START**.

User Defined Programs

Theory of Operation

The temperature you are firing to is called the target temperature. After the controller reaches the target temperature, it can also hold that temperature.

The controller fires at a controlled heating rate. The rate is figured in degrees per hour. If you selected a rate of 100° per hour, it would take 10 hours for the kiln to reach 1000°. Rate is similar to "miles per hour."

In summary, the controller does three basic tasks:

1) It fires at a controlled heating rate, or speed, measured in degrees of temperature change per hour.

2) It fires to a target temperature.

3) It can hold the target temperature.

Parts of a Segment
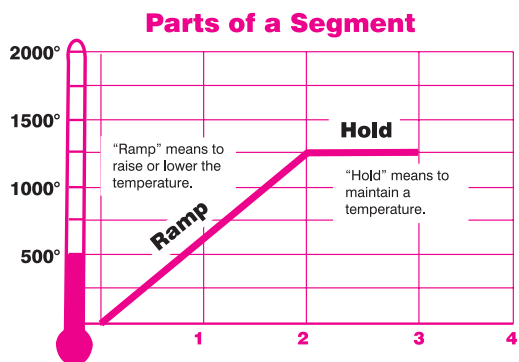
The controller fires in segments, or stages. A segment is a given heating rate to a target temperature. Shown above is a segment with a target temperature of 1250° and a rate of 625°, with a hold of one hour.

Heating rate is figured in degrees per hour. The recommended heating rate for the material you are firing is usually available from your supplier. It also varies depending on the thickness of the material.

To figure how long a firing segment will take, subtract the current temperature from the target temperature and divide the resultant temperature by the heating rate. In the diagram above, the firing time is 1250° - 80° (room temperature) = 1170 ÷ 625 = 1.87 hours.

The controller can fire up to 8 segments per firing in a User Defined program. One segment is often all that is needed, though.

After the controller has finished firing the last segment of a User Defined program, it will turn off power to the kiln.

> **Note:** If you enter a rate of 0000 in segment 1, or if the target temperature in segment 1 is lower than the current temperature, **badP** will appear in the display.

Rate

Each segment must include a rate, which is degrees of temperature change per hour.

The kiln will fire at full power when the rate is 1799°F/999°C. Full power displays as **FULL**.

> **Note:** To enter full power from **0000**, press the **DOWN ARROW** key once.

Rate = Firing Speed
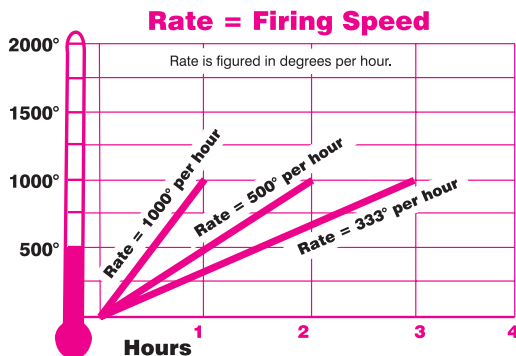
Hold

Hold is the length of time that you want the kiln to remain at the target temperature. Hold is also called soak or dwell time. Hold maintains a steady temperature for the length of time you specify. You can use Hold in both heating up and cooling down segments.

When Hold is set to 99.59 hours, the controller will remain at that temperature indefinitely, until you press **STOP**. To enter a 99.59 hour Hold, press the **DOWN ARROW** once from 00.00 during programming.

> **Note:** During firing, the display shows Hold temperature and time left in Hold.

Temperature Over-Shoot

When a kiln is heated too fast, it may over-shoot the target temperature, especially in small kilns at lower temperatures. To avoid this, add an extra segment in a User Defined program to slow the firing.

User Defined Programming Instructions

Note: You have up to 8 segments available in a User Defined program. If you don't need all 8, zero out the unused segments. See step 6 below.

1 From `IdLE`, press **START**.

2 Press the **UP ARROW** key (not the **DOWN ARROW**). When `PrO6` appears, press **START**. (Ignore `PrO1` - `PrO5`.)

3 `rA 1` will appear. Enter firing rate (temperature change per hour) for segment 1. (1° = slowest rate. 1799°F/999°C = full power.) Then press **START**.

4 `°F 1` or `°C 1` and the target temperature from the last firing will appear. Use the arrow keys to change the temperature. Then press **START**.

5 `HLd 1` and the hold time from the last firing will appear (Example: 1 hour 10 minutes = 01.10). Use the arrow keys to change the hold time. Then press **START**. (No hold = 00.00.)

6 Continue entering values for the segments needed. When `rA _` appears for the next segment that you don't need, select 0000. Then press **ENTER**. This will zero out the remaining segments. (Example: You need only 1 segment. When `rA 2` appears, enter 0000.)

7 `Strt` will appear. Press **START** to begin firing. `-On-` will appear and the Run indicator light with begin blinking. The kiln is now firing.

To stop a firing before completion, press **STOP**. `StOP` will appear, alternating with kiln temperature.

Note: Do not be concerned if your kiln makes a clicking sound during firing. Kilns use relays to power the elements. The relays click each time their electrical contacts come together.

Note: The kiln's actual firing rate may be less than the rate you programmed, depending on the kiln model, available voltage, and density of load you are firing.

When the kiln fires to completion, it will beep for 30 seconds. The display will show the following:

■ Firing time

■ Present temperature

■ `CPLt` = Fired to completion

To return to `IdLE`, press **START**.

Advanced Features

Note: All the features in this section are available in a User Defined program. The alarm is the only feature in this section that is available in a PMC program. This is because PMC programs cannot be altered.

Skip Segment

Skip Segment works only during a User Defined firing. It jumps the firing from the current segment to the next one.

1 During firing, press the **UP ARROW**.

2 `SStP` will appear.

3 Press **START**. The current segment ramp or hold number will appear.

4 Press **START** again. (If you change your mind and don't want to skip that segment, don't press **START** after `SStP` appears. The firing will continue in the same segment and the temperature will appear after one minute.)

Skip Segment skips to the ramp of the next segment from either a ramp or hold of the current segment. (Skip Segment does nothing during the final segment. To end the final segment, press **STOP**.)

Skip Segment Example

Skipping to a Cooling Segment: You have programmed 1425°F for glass fusing, followed by a segment for controlled cooling. Watching the glass through the peephole, you notice that the glass edges have rounded nicely at 1315°. Use Skip Segment to end the firing segment and to begin the one for slow cooling.

Note: Make a note of the temperature at which the glass fused. Program that temperature for the next firing of that type of glass.

Add Hold Time

Add Hold Time works only during a User Defined firing. It adds 5 minutes to a hold. It is designed for ceramists who watch witness cones and for glass artists who inspect the glass near the end of firing.

1 During a firing, press the **UP ARROW** repeatedly until `HLdt` appears.

2 Press **START**. The hold time for the current segment will appear.

3 Press the **UP ARROW**. Each time you press the **UP ARROW**, the hold time will increase by 5 minutes.

4 Press **START**. The normal temperature will appear.

Note: Add Time will add 5 minutes to a hold even if no hold had been programmed.

Editing the Current Segment Target Temperature During Firing

While the kiln is firing a User Defined program, you can change the target temperature of the current segment. You can edit only the segment that is firing. So if the first segment is the current one, you can edit only the first segment. To edit other segments, wait until the firing has progressed to those segments.

Even if the current segment has already started its hold time, you can still edit the segment's target temperature. You can raise or lower the target temperature. The controller will go back out of hold and fire to the new target temperature at the original rate. (You cannot edit the rate, however.)

1 During a firing, press the **UP ARROW** repeatedly until `CHGt` appears.

2 Press **START**. The target temperature for the current segment will appear.

3 Use the arrow keys to change the target temperature.

4 Press **START**. The normal kiln temperature will appear.

The Alarm

The alarm works in both PMC and User Defined programs.

While the kiln is firing, you can set the alarm, which sounds when the kiln reaches the alarm temperature. Use the alarm to alert you to check the fusing or slumping of glass.

You can enter only one alarm temperature at a time. However, after the alarm beeps, you can set the alarm for another temperature, as many times as you want, during the firing. Entering an alarm temperature automatically erases the previous alarm temperature.

> **Note:** The alarm temperature that you set during a firing must be higher than the current display temperature.

1 During a firing, press the **UP ARROW** repeatedly until `ALAr` appears.

2 Press **START**. The current alarm temperature will appear.

3 Use the arrow keys to change the alarm temperature.

4 Press **START**. The normal kiln temperature will appear.

To silence the alarm, press any key.

An alarm temperature of 32°F / 0°C will turn off the alarm.

Lost Wax Burnout

Caution: Only kilns with vent holes are designed for lost wax burnout. However, you can use a kiln without the vent hole provided that you open the door ½" during venting.

Caution: Always use a wax tray.

Note: These instructions apply to injection wax that melts at 200°F, not pattern waxes and plastics that melt at higher temperatures. If smoke appears during wax elimination, turn off the kiln. Smoking wax means the kiln fired hotter than 300°/148°C.

Overview

Lost wax casting is the process of carving a shape in wax, making a mold, and then casting that shape in metal. After the wax has been carved, a mold is made of the wax shape. The mold is a negative image of the wax. The wax is later melted out of the mold through hollow channels called sprues.

Lost wax burnout is the process of preparing a casting mold for the melted metal that will be poured into it. The steps in lost wax burnout:

1 Melt the wax from the mold.

2 Remove wax from the kiln before raising the temperature higher than 300°F/148°C.

3 Harden the mold at high temperature.

4 Maintain the mold at the casting temperature recommended for the type of metal that will be poured into the mold.

> **Caution:** Prevent wax or carbon from contacting the kiln's walls and elements. Carbon build-up inside a kiln ruins the interior. Carbon conducts electricity and causes elements to short circuit. Damage to elements from contact with foreign materials is not covered by warranty.

A Sample Program

Segment	Rate °F/°C	Temp. °F/°C	Hold
1	500/277	300/148	01.00
2	500/277	1350/732	01.00
3	450/250	800/426	02.00

Segment 1 heats the wax to 300°F/148°C and holds it for one hour, allowing it to drip from the mold.

Segment 2 hardens the mold.

Segment 3 lowers temperature to 800°F/426°C, the typical casting temperature for silver. (Most types of gold cast at 900°F/482°C.)

> **Note:** Casting temperature depends on the size of the mold. The temperatures above are only a guide.

See your jewelry supply dealer for temperature recommendations.

Burnout Instructions

1 Place a metal tray inside the kiln on three ½" posts. Place the mold on a wire mesh screen on top of the tray. The mold's sprue hole should be down. The tray will catch melting wax as it drips from the sprue hole.

2 Keep the kiln's vent hole(s), if any, open during wax elimination. If the kiln has no vent hole, leave the door open ½". This allows fumes to escape from the kiln. Heat the kiln to 300°F/148°C and hold it at that temperature for at least one hour.

Note: Do NOT heat the wax above 300°F/148°C. Hold at 300°F/148°C for at least one hour. During this hour, the wax will melt from the mold and drip into the tray. If the kiln gets hotter than 300°F/148°C, the wax may smoke and deposit carbon inside your kiln, causing expensive damage.

3 After one hour at 300°F/148°C, open the kiln. Remove the mold and wax tray. Pour the wax from the tray and leave the tray out of the kiln until your next wax elimination. (Do not leave the tray in the kiln!)

4 Heat the mold to the temperature recommended by your jewelers' supply house where you purchased the mold material. This is usually around 1350°F/732°C.

5 Lower the temperature to the casting temperature of the metal. Hold at that temperature until you are ready to begin casting. Remove the mold with tongs. Wear protective gloves and safety glasses.

Saving a Carbon-Damaged Kiln

If you follow the above directions, your kiln should be safe from wax damage. In some cases, a small amount of carbon may form on the walls over a period of time. This is due to the burning of wax residue that was left in the mold. For this reason we recommend that you periodically fire the kiln to 1500°F/815°C as follows:

1 Open the vent cover(s) or leave the door ajar ½".

2 Fire the kiln empty to 1500°F/815°C at a rate of 300°F/166°C with a one hour hold (01.00).

Error Messages

bAdP / Bad Programming

The kiln will not fire the because the User Defined program just entered has 1) a rate of 0000 in segment 1, or 2) the target temperature in segment 1 is lower than the current temperature.

EtH / Electronics Too Hot

The temperature of the electronic circuit board is above 185°F/85°C. This could damage the controller, so the firing has been stopped. To prevent this, keep the firing room cooler. Use better ventilation.

FaIL / Thermocouple Failure

The thermocouple, or temperature sensor, failed during firing. Causes:

■ Defective thermocouple or disconnected/loose wires

■ Defective controller

■ Electrical noise

Thermocouple Paperclip Test

Check the thermocouple wire connections. (See your kiln instruction manual.) If connections are tight, perform this test:

1 UNPLUG the kiln or disconnect the power. Remove the controller. Remove the two thermocouple wires from the back of the controller.

2 Cut a thin paperclip in half. Insert a U-shaped paperclip piece, or other piece of thin wire, where you removed the thermocouple wires.

4 Plug in the kiln. If the controller displays room temperature, replace the thermocouple. If it shows **FaIL**, replace the controller.
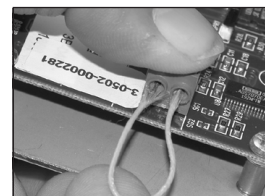
tCR / Thermocouple Reversed

Thermocouple lead wires are reversed. Check that the thermocouple lead wires are connected to the correct terminals. See your kiln's wiring diagram.

FtL / Fired Too Long

This message appears when both of the following conditions are met:

■ The temperature rise is less than 27°F/15°C per hour

■ The firing is 2 hours longer than programmed

PF 1 / Power Failure

The power failed during a cooling segment, and the kiln cooled past the target temperature while the power was off. The kiln will not resume firing. To return to the **IdLE** display, press any key.

PF 2 / Power Failure

The power failed during firing and kiln temperature was below 72°F / 40°C when the power came back on. The kiln will not resume firing. To return to the `IdLE` display, press any key.

PF 3 / Power Failure

The power failed during firing and temperature dropped more than 180°F / 100°C by the time the power came back on. The kiln will not resume firing. To return to the `IdLE` display, press any key.

tC / Thermocouple Failure

The thermocouple failed during the `IdLE` display. See the "paperclip" test under "FaIL," page 8.

tCL / Thermocouple Lag

The heating rate is slower than 9°F / 5°C per hour and the kiln temperature is more than 100°F / 56°C away from the programmed temperature. To return to the `IdLE` display, press any key. Causes:

■ On kilns that use a portable controller, the thermocouple fell out of the firing chamber.

■ A bare spot on the thermocouple lead wires has touched a grounded object inside the kiln switch box causing the thermocouple to short out.

■ `tCL` will flash if you program a cooling segment temperature that is below room temperature.

Check for worn or burned out elements, defective relays, low voltage and defective thermocouple.

Calibrating the Controller

You can calibrate the controller to fire up to 20°F/11°C hotter or cooler than the zero factory setting.

1 From `IdLE`, press the **DOWN ARROW** key. After rate, temperature, hold, etc., `Strt` will appear.

2 With `Strt` shown in the display, press the **UP ARROW** key.

3 `tCOS` will appear. Press the arrow keys to change the controller temperature. (Lower numbers include a "-".)

4 Press the **START** key to return to the `Strt` display.

5 To fire the controller, press **START**. `-On-` will appear. Or to return to `IdLE`, press **START** two more times.

Selecting °F or °C Display

The controller can display temperature in either °F or °C. If your controller shows a small display dot in the lower right corner of the display, the temperature shown is °C. No dot means °F. To change temperature display:

1 UNPLUG kiln or disconnect power.

2 Remove the four screws that hold the controller to the front of the kiln. Carefully remove the controller from the kiln. Leave wires attached to the controller.

3 Look at the back of the controller. You will find a set of connector pins near the bottom labeled "C/F." When a jumper is placed on the C/F pins, the display reads °F. When the jumper is removed, display reads °C. Remove or insert the jumper as desired. (You can purchase the jumper from a computer supply store if necessary.)

4 Install the controller being careful not to jar components on the back of the controller against the kiln case.
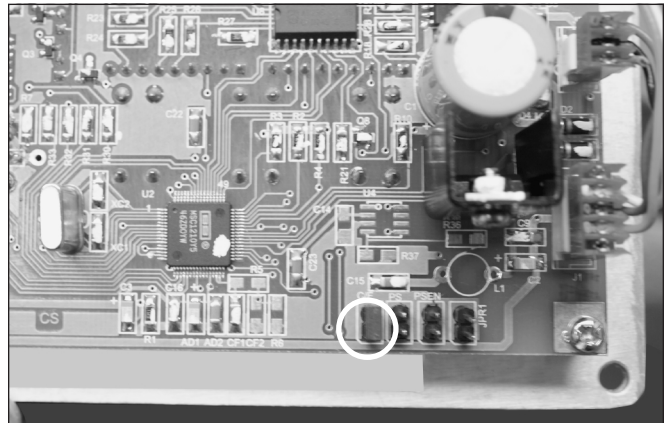
The C/F jumper terminal is on the back of the controller, circled above.

Display Messages

Abrt The firing was stopped.

ALAr (Page 7) Ready for you to enter an alarm temperature. When the kiln reaches that temperature, the alarm will sound.

CHGt During a User Defined firing, you can change the target temperature of a segment without having to first stop the firing.

CPLt Fired to completion. If the kiln is already hotter than the programmed target temperature when you begin firing, **CPLt** will appear immediately after you begin firing.

dELA (page 3) Delay is a count-down timer that starts the kiln when the time runs out.

°F 1 or **°C 1** (and temperature) (page 6) The target temperature (the temperature that the kiln will fire to). Each segment in a User Defined program has a target temperature.

FULL Full power firing rate. At this setting the kiln will fire at its fastest rate. To select Full power, select a rate of 1799°F/999°C at the **ra** prompt in a User Defined program. A fast way to do this is to press the **Down Arrow** key once from **0000**. **FULL** will appear.

HLd (pages 5 & 6) Hold time of a segment, shown in hours and minutes. (i.e. 2 hours 15 minutes = 02.15.)

HLdt (Page 7) During a User Defined firing, you can extend the hold time to a segment without having to first stop the firing.

IdLE (page 3) The controller is ready for you to enter a program or to begin a repeat firing.

-On- Firing has begun. A moment after **-On-** appears, you will hear the relay(s) clicking.

PrO1, **PrO2**, **PrO3**, **PrO4**, **PrO5** (page 4) These are PMC programs stored in memory.

Pro6 (User Defined Program) (page 5) Select this option to program a custom firing.

rA 1, **rA 2**, etc. (Rate) (page 6) This appears in User Defined programming for each segment. 1, 2, etc. are segment numbers. Enter the rate of temperature change for that segment. Rate is figured in degrees of temperature change per hour. Example:

A temperature rise of 100° in two hours = 50° rate.
A temperature drop of 200° in one hour = 200° rate.

SStP (Skip Step) (page 5) This message appears when you press the **Up Arrow** key during a User Defined firing. If you press the **Up Arrow** key again, the firing will skip to the next segment.

StOP The firing was stopped by pressing **STOP**.

Strt The "Ready to Start" message appears after programming a firing. Press **START** to begin firing. Controller Calibration (press the **UP ARROW**) and Delay (press the **DOWN ARROW**) are accessed from the **Strt** message.

TCOS (Page 9) Calibrate the controller to fire hotter or cooler.

Trouble Shooter

Problem: Controller display is blank. No heat in kiln.

- Is the kiln connected to the power?
- Has the circuit breaker tripped or fuse blown?
- Is power reaching the wall receptacle?
  Test with a voltmeter or test light if you are not sure.
- Has the kiln switch box ½ amp fuse blown?

The kiln's ½ amp fuse is located in the kiln switch box. Remove by pressing 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:
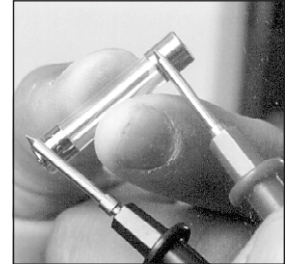
AGC 1/2 A 250V AC

- Is the controller receiving power? Test the power IN-PUT connections on the back of the controller with a voltmeter.

Controller Power Input Test

Unplug the kiln. Remove the 4 screws holding the controller 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).
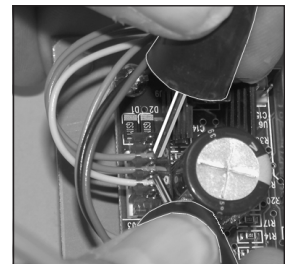
Caution: Do not let the back of the board touch a grounded object. Make sure the voltmeter is in the AC mode when placing the probes on INPUT connections.

Controller Power Input Test Result: No voltage

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

Controller Power Input Test Result: 20 - 24 volts AC

Correct current is reaching the board from the transformer. But since the board is not lighting up, it is probably defective. Return the controller for repair or replacement.

Controller Power Input Test Result: less than 20 volts

Did you recently replace the transformer? It may be the wrong voltage. The voltage is below 20, which is not enough

power for the controller. To find out the cause of low voltage, continue below:

Controller Input Test #2

The back of the board is still facing you and the kiln is plugged in. Remove the IN-PUT plug, which is the white, orange, and blue wires, from the back of the controller. Touch a voltmeter probe to the white wire and the other probe to the orange wire.
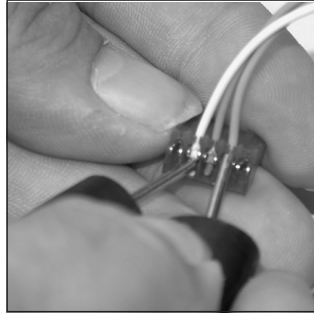
Input Test #2 Result: Less than 20 Volts AC

There are two possible reasons: 1) Low voltage at the wall receptacle; 2) defective transformer. If wall receptacle voltage is correct, replace the transformer.

Input Test #2 Result: 20 - 24 Volts AC

The transformer is sending correct voltage to the controller. Yet when the INPUT plug was connected to the controller, voltage was less than 20. This means the controller is draining the voltage and may be defective. Return the controller for repair or replacement.

Problem: Controller display turns on. No heat in kiln.

■ Is the relay making its normal clicking sound?

Yes, the relay is clicking.

Test the elements with an ohmmeter:

Element Resistance Test

1 UNPLUG kiln/disconnect the power. Open the kiln's switch box. Make sure the wires connecting the relay to the elements are secure. If connections are okay, continue to step 2:

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.

If the elements check out okay, replace the relay.

Note: To replace relay, see your kiln's instruction and service manual.

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 10. If your controller passes the input test, perform the "Controller Power Output Test":

Controller Power Output Test

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

1 UNPLUG the kiln/disconnect the power. Remove the 4 screws holding the controller faceplate to the

switch box. Lift faceplate out of box and let the controller 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 FULL rate in User Defined program mode. Press **START**.

2 Put the voltmeter in DC mode. (It must be in DC mode when testing OUTPUT voltage.) Touch probes to the red wire and black wire connections. Measure voltage when the relay clicks on.

Output Test Result: No voltage at red and black wires

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

Output Test Result: 10 - 14 v. at red and black wires

The controller is sending correct power to the relay. Unplug kiln/disconnect power. Remove the kiln switch box. Look for disconnected wires between the controller, relay 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, replace the relay.

**Note:** To replace relay, see your kiln's instruction and service manual.

Problem: Kiln switch box ½ amp fuses keep blowing.

■ What size fuse are you using? Correct fuse: AGC ½ A 250V AC.

If the fuse is the correct size, perform the following test:

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 both wire plugs from the back of the controller. 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 INPUT plug (orange, blue, and white wires) to the board again. Leave off the OUTPUT wire plug (the one with the red, green and black wires). Program the controller to fire to 1000°F at FULL rate in User Defined firing 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.)

3 UNPLUG kiln/disconnect power. Reconnect the OUTPUT wire plug. Reinstall the board in the switch box. Replace the relay.
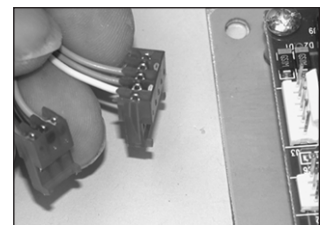
Shorthand Instructions

To avoid confusion, read the manual before using these quick shorthand instructions. After pressing the keys in the left column, the message in the center will appear.

Selecting a Stored PMC Program

Keys to Press	Shown in the Display
	IdLE
⟳	**PrO1** through **PrO6**
▲ (Not Down Arrow)	**PrO6** (Select Program 1, 2, 3, 4, or 5)
⟳	**S t r t**
⟳	**-O n-** The kiln is now firing.

The User Defined Program

Keys to Press	Display
	IdLE
⟳	**PrO1** through **PrO6**
▲ (Not Down Arrow) Select PrO6	**PrO6**
⟳	**rA 1**
▲ ▼ Enter Segment 1 Rate	**500** (Sample rate)
⟳	**°F 1** or **°C 1**
▲ ▼ Enter Temperature	**1900** (Sample temperature)
⟳	**HLd1**
▲ ▼ Enter Hold Time	**00.00** (Or hold time)

First segment not needed: enter a rate of 0000.

⟳	**S t r t**
⟳	**-O n-** The kiln is now firing.