Single-Speed / Ramp-Hold Version

🏃 Sentry Xpress
™

Digital Temperature Controller

15.02 °F

8 16. °C

°C Display Dot

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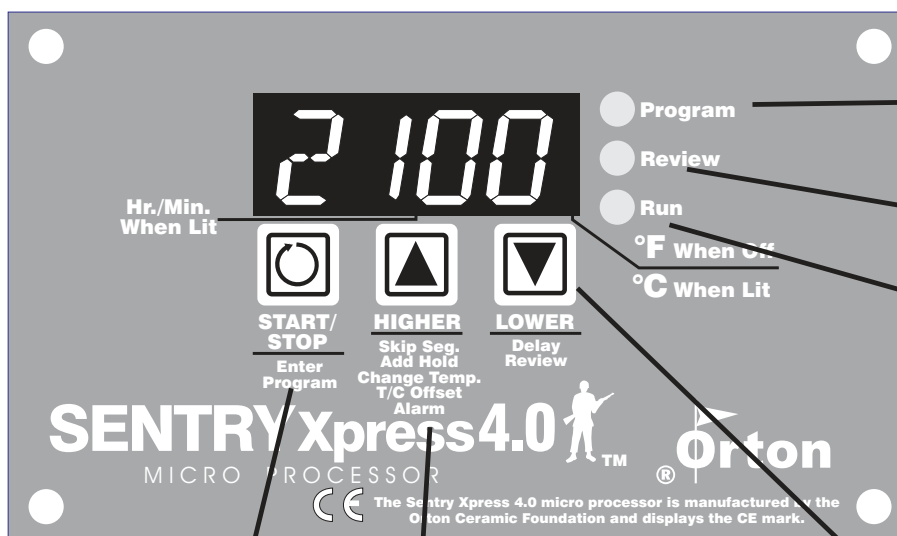**No Display Dot:** Temperature display is in °F.

Right-Hand Display Dot: Temperature display is in °C.

See page 12 for instructions on selecting °F or °C.

01.30

Time Display
Center Display Dot: Separates hours from minutes. Example: Display shown above is 1 hour and 30 minutes.

2100

Hr./Min. When Lit

Program
Review
Run
°F When Off
°C When Lit

START/STOP
Enter Program

HIGHER
Skip Seg.
Add Hold
Change Temp.
T/C Offset
Alarm

LOWER
Delay
Review

SENTRY Xpress 4.0 ™ ® Orton

MICRO PROCESSOR

C€

The Sentry Xpress 4.0 micro processor is manufactured by the Orton Ceramic Foundation and displays the CE mark.

Indicator Lights

Top: Light is on during programming.

Middle: Light is on during program review.

Bottom: Light blinks during firing.

START/STOP Key
1) On/Off: Starts and stops a firing.

2) Enter Data: Press after each programming step. It works like the Enter key on a computer.

Up Arrow Key
1) Raise Numbers

2) Select a Firing Mode: From **IdLE** press **START**. Press **Up Arrow** to select Single-Speed or Ramp-Hold. Pages 6, 8

3) Skip a Segment: During a Ramp-Hold 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 8

*4) Add Hold Time: During a Ramp-Hold 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 8

*5) Change Target Temperature: During a Ramp-Hold 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 9

*6) Set 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 9

*7) Adjust Thermocouple Offset: At the **Strt** display, press **Up Arrow**. **tCOS** will appear. Use arrow keys to adjust the controller to fire hotter or cooler. Press **START** to return to **Strt**. Page 12

Down Arrow Key
1) Lower Numbers

2) Repeat 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 4

3) Delay a Firing: From **Strt** press **Down Arrow**. Enter delay time. Press **START** twice. Page 4

4) Review a Program: During firing, press **Down Arrow**. The program you entered will appear one step at a time. Page 4

---

*These features are new with the Sentry Xpress 4.0. This manual, nevertheless, is backward compatible with earlier controllers.

Introduction

Thank you for buying the Sentry Xpress micro processor. We appreciate your business.

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

`8888`

`----` or a software code (such as 3F-1)

`IdLE`

If your controller shows `----` instead of a software code before `IdLE` appears, then the controller includes only Skip Segment from the "Advanced Features" on pages 8 - 9. If your controller shows a software code such as 3F-1 before `IdLE` appears, then the controller has all the features in this manual.

The code that appears when you first turn on the power to the controller is the software version installed in the memory chip. The code is not an error message and is not in the manual, because every time the software is updated, that code number changes.

Do not worry if you hear a clicking noise during operation. Mechanical relays click as they turn the heating elements on and off.

We are constantly trying to find better ways to make kilns, and your kiln is extremely reliable. Nevertheless, it contains mechanical parts that eventually wear out. In some cases, a parts failure can lead to a kiln overfire. Therefore it is important that you occasionally check on the kiln during operation. Although the kiln does not require constant attention, it should never be left unattended. Please check the kiln especially during the later stages of firing.

Please read the manual. Damage caused by failure to follow instructions is not covered by warranty.

Write notes on the controller features that you use. Then if you are away from your kiln for a period, you can review your notes to refresh your memory. When you need to use additional controller features, such as the temperature alarm, refer back to the instruction manual. The cover shows all the controller features at a glance.

Use Program Review (see page 4) every time you fire the kiln. This is your assurance that you are firing the correct program. If necessary, check the program in the display against a written copy.

We trust that you will enjoy your kiln. Once you learn the basic features of the Sentry Xpress, you will be able to control every stage of firing. This offers learning opportunities and convenience difficult to imagine with a manual-controlled kiln.

Contents

Safety

The warranty on your Sentry Xpress 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 green #3 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.

- When vacuuming the kiln, keep the nozzle away from the controller. Vacuum cleaners create a static charge that can damage the controller.

Question: Would unplugging the kiln erase the digital programs? Should the kiln be unplugged when not in use?

Answer: You can unplug the kiln. The digital programs will stay in memory even without power. For safety, you should unplug the kiln or disconnect the power when the kiln is not in use.

General Guidelines

Time and Temperature Displays

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.

`01.30`

The center display dot indicates time instead of temperature.

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 12.

`1502` °F

`816.` °C

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/STOP** key (the key with the circular arrow). **IdLE** will appear.

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

- If the display shows an error message such as **FAIL** instead of **IdLE**, see page 11.

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

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! Bumping the thermocouple could also cause inaccurate readings.*

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

- A ¼" diameter thermocouple should extend into the firing chamber ¾ - 1" or more.

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

Scrolling Numbers Rapidly

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 entered 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 and 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.*

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 72°F / 40°C while the power was off.

Power Failure Messages (see page 12)

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 72°F / 40°C by the time the power came back on.

CPLt Message: Firing Completed

When the firing has successfully completed, the Sentry Xpress 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

Press **START/STOP** to return to **IdLE**.

Adverse Weather

It is okay to store the controller at sub-zero temperatures. But before operating, raise the room temperature to at least 32°F / 0°C. Place a space heater within a couple of feet of the control panel and let the heater run for an hour or so. Or hang a shop light near the kiln to raise the 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.

Canceling a New Program

If you do not touch the keys for one minute during programming, the controller will go back to the **IdLE** display. The controller will also discard the program you were entering and will retain the previous program in memory.

This is useful if you change your mind during programming and decide to keep the previous program. Instead of completing the new program, wait a minute and let the controller return to **IdLE**.

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."

Parts of a Segment
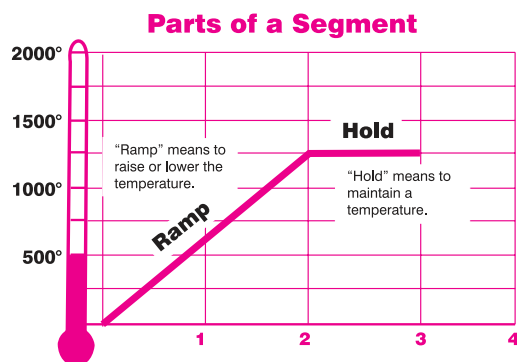
In summary, the controller does three basic tasks:

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.

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 rate of 625° per hour, a target temperature of 1250°, and 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. One segment is often all that is needed, though.

After the controller has finished firing the last segment, it will turn off power to the elements.

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
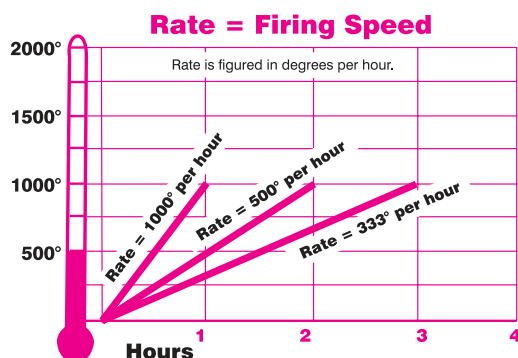
Hold

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 a Hold, the display flashes between the Hold temperature and time left in Hold.*

Two Firing Modes: Single-Speed and Ramp-Hold

To give you greater flexibility, your controller has two firing modes:

Single-Speed Mode (see next page)

Often times, all you will need is Single-Speed mode, which has one segment that includes a rate (temperature change per hour), a target temperature, and (if needed) hold time.

In Single-Speed mode, you can choose one of five firing speeds. Then enter the temperature you are firing to.

Ramp-Hold Mode (see page 7)

Ramp-Hold mode offers much greater flexibility than Single-Speed mode. Use Ramp-Hold to create custom firings with up to 8 segments. The controller can store 4 Ramp-Hold programs in memory. Programs are numbered Pro1 - Pro4.

Type of Firing	Suggested Firing Mode
Enameling	Single-Speed
Silver Clay	Single-Speed
Glass Bead Annealing	Ramp-Hold
Glass Fusing	Ramp-Hold
Glass Slumping	Ramp-Hold
Lost Wax	Ramp-Hold

Selecting a Firing Mode

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

2 Press the **Up Arrow** key several times. You will see the following display messages:

SPd1:
Single-Speed 1 / 200°F/111°C rate per hour

SPd2:
Single-Speed 2 / 500°F/277°C rate per hour

SPd3:
Single-Speed 3 / 1000°F/555°C rate per hour

SPd4:
Single-Speed 4 / 1500°F/833°C rate per hour

SPd5:
Single-Speed 5 / Maximum rate

PrO1:
Ramp-Hold, Program 1

PrO2:
Ramp-Hold, Program 2

PrO3:
Ramp-Hold, Program 3

PrO4:
Ramp-Hold, Program 4

> **Note:** *Your controller may have more Ramp-Hold programs than the 4 shown above.*

To select a firing mode, see the boxed programming instructions on this page and page 8. Or to get back to `IdLE`, press **START/STOP** several times until `IdLE` appears.

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 Ramp-Hold program to slow the firing. (See the next section.) The segment with the slower rate should begin approximately 40° - 60° below the target temperature.

Question: I programmed a FULL rate, yet my kiln heated at only 550°F per hour.

Answer: The controller is limited by the heating capacity of each kiln. Your kiln heated at 550° per hour because that is its maximum heating rate.

Single-Speed Programming Instructions

> **Note:** *Single-Speed firing is all you will ever need if you are only going to a temperature and holding.*

1 From `IdLE`, press **START** (the left button).

2 Use the **Up Arrow** key (not the **Down Arrow**) to select a firing rate (temperature rise per hour) from 1 through 5. (Ignore `PrO1` - `PrO4`.)

`SPd1` / (200°F or 111°C)

`SPd2` / (500°F or 277°C)

`SPd3` / (1000°F or 555°C)

`SPd4` / (1500°F or 833°C)

`SPd5` / (Full Power)

Then press **START**.

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

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

5 `Strt` will appear. Press **START** to begin firing. `-On-` will appear, the Run indicator light will begin blinking, and the kiln will begin firing.

To stop a firing before completion, press **START/STOP**. `StOP` will appear, alternating with total firing time and 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 firing speed you select (see step 2 above) is a pre-programmed speed. The kiln's actual firing speed may be less, depending on the kiln model, available voltage, and density of the load you are firing.*

When the kiln fires to completion, the controller 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**.

To fire the same program again, see "Program Review & Repeat Firing," page 4.

Ramp-Hold Mode

You can make your own firing programs and store them in the controller's memory. A firing program tells the kiln how fast to fire, and to what temperature. The simplest program is one segment. You can use up to 8 segments with your controller in Ramp-Hold mode.

Each segment includes a firing rate and firing temperature. You can also soak, or hold, the temperature for a specified period.

The Parts of a Segment

■ Rate (temperature change in degrees per hour)

■ Target temperature

■ Hold at the target temperature (not always used)

The controller can retain four programs in memory even when power is turned off. Programs are numbered Pro1 - Pro4.

The first message to appear after you plug in your Sentry Xpress is **IdLE**. Press **START**. Then use the **Up Arrow** key to scroll through these messages: **PrO1** **PrO2** **PrO3** **PrO4** **SPd1** **SPd2** **SPd3** **SPd4** **SPd5**.

To use Ramp-Hold mode for the first time, select **PrO1**. You do that by pressing the **START** key after **PrO1** appears. Then follow the boxed instructions on page 8 to enter temperature, heating rate, etc.

PrO1 is Program 1. When you fire the kiln again, you can repeat Program 1 by selecting **PrO1**. (See page 4.) When you are ready to fire a different program, select **PrO2**, which is Program 2. Then enter temperatures, heating rates, etc. Select Program 3 and 4 the same way.

A program can have up to 8 segments, but you don't have to use all 8 segments. Use only the number needed per firing. Often one segment is all you will need. Zero out the unused segments. The instructions on page 8 explain how to do that.

To over-write a program, select it and enter new rates and temperatures. This automatically over-writes the previous program. Write down your programs in a notebook and record firing results for all firings.

Programming a Cooling Segment

For controlled cooling, program a segment to a lower target temperature than that of the preceding segment.

Example: You fire at a rate of 500°F per hour to 1450°F with your first segment. You want the kiln to cool at a rate of 100°F per hour down to 700°F. Here is how you would program the two segments:

Segment	Rate °F/°C	Temp. °F/°C	Hold
1	500/277	1450/788	00.00
2	100/55	700/371	00.00

The first segment is the heating segment. The second one is the cooling segment. The controller does not use minus numbers for cooling. Just enter a lower target temperature than that of the previous segment.

If you prop the lid or door for a fast cooling, program a fast cooling rate for that segment. If you lower the temperature quickly by propping the lid but program a slow cooling rate, the controller will just raise the temperature again.

Example: Some glass artists flash-cool the glass just after it fuses. They open the door a few inches to remove heat, then close it again. This takes the glass down rapidly through the devitrification range. To program a flash-cool, use maximum rate. This shuts off the heating elements during that segment, allowing the kiln to cool rapidly.

> **Note:** *During fast cooling, do not open the door all the way. Do not force-cool the kiln with a fan.*

> **Note:** *You may get an FTL error message (page 11) if you program a cool-down target temperature that is close to room temperature. This is because the kiln cools more slowly as it approaches room temperature, causing the error code.*

A Ramp-Hold Practice Program

To practice using the controller, we will enter a program that includes three segments. The last segment is a cooling segment.

Using the programming instructions on the next page, enter this firing schedule. Then use Program Review (page 4) to check for accuracy.

Seg	Rate	Temp	Hold
1	250	750	—
2	900	1425	.30
3	150	750	—

Make a simple chart like the one above when planning a firing program.

PrO1
rA1 = 250
°F 1 = 750
HLd 1 = 00.00
rA2 = 900
°F 2 = 1425
HLd 2 = 00.30
rA3 = 150
°F 3 = 750
HLd 3 = 00.00
rA4 = 0000 (zeroes cancel segments 4-8)

Ramp-Hold Programming Instructions

Note: *You have up to 8 segments available in Ramp-Hold. If you don't need all 8, zero out the unused segments. (See step 6 below.)*

1 From `IdLE`, press **START** (the left button).

2 Press the **Up Arrow** key (not the **Down Arrow**). `PrO1` `PrO2` `PrO3` and `PrO4` are Ramp-Hold programs. When the one you want appears, press **START**. (Ignore `SPd1` - `SPd5`.)

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 (e.g. 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 will begin blinking. The kiln is now firing.

To stop a firing before completion, press **START/STOP**. `StOP` will appear, alternating with total firing time and 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 the 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**.

To fire the same program again, see "Program Review & Repeat Firing," page 4.

Advanced Features

Skip Segment works only in Ramp-Hold programs. Add Hold Time, Temperature Edit, and Alarm work in both Single-Speed and Ramp-Hold firings.

Skip Segment

Skip Segment jumps the firing from the current segment to the next one.

1 During a Ramp-Hold 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 a target temperature of 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 adds 5 minutes to a hold. It is designed for ceramists who watch witness cones and for glass artists who watch 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 Hold Time will add 5 minutes to a hold even if no hold had been programmed.*

Editing the Target Temperature

While the kiln is firing, you can change the target temperature of the current segment. (Ramp-Hold: 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. 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, and the kiln will begin firing to the new target temperature.

The Alarm

While the kiln is firing, you can set the alarm, which sounds when the kiln reaches the alarm temperature. Use the alarm as a reminder to look at the glass during fusing or slumping, to look at witness cones, to close the lid from vented position, etc.

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 any previous alarm temperature.

Note: *The alarm temperature that you set during a firing must be higher than the current display temperature. The alarm is designed only for higher temperatures and not for cooling temperatures.*

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 when it sounds, press any key.

Note: *If you do not want to use the alarm, set the alarm temperature to 32°F / 0°C. This setting will turn off the alarm feature.*

Lost Wax Burnout

CAUTION: *Only kilns with vent holes are designed for lost wax burnout. However, you may be able to 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

See instructions on page 8 to enter this 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 the kiln. Heat the kiln to 300°F / 148°C and hold it at that temperature for at least one hour.

> **CAUTION:** *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).

Display Messages

ALAr (Page 9) Ready for you to enter an alarm temperature. When the kiln reaches that temperature, the alarm will sound. (**ALAr** also flashes when the alarm sounds.)

CHGt (page 9) Ready for you to edit the target temperature of the current Ramp-Hold segment during firing. Example: You are fusing glass to a temperature of 1450°F. At 1445°F, you look at the glass through a peephole and realize that the glass will need at least another 50° to fuse fully. Change the target temperature to 1500° without having to turn off the kiln to reprogram it.

CPLt (page 4) Fired to completion.

dELA (page 4) Delay is a count-down timer that starts the firing when the time runs out.

°F 1 or **°C 1** (and temperature) (pages 6, 8) The controller is ready for you to enter the target temperature (the temperature that the kiln will fire to). Each segment in Ramp-Hold mode has a target temperature.

FULL Full power firing rate. At this setting the kiln will fire at its fastest rate. There are two ways to select full power:

1) Select **SPd5** in Single-Speed mode.

2) Select a rate of 1799°F/999°C at the **ra** prompt in Ramp-Hold mode. A fast way to do this is to press the **Down Arrow** key once from **0000** . **FULL** will appear.

HLd 1 (pages 6, 8) Hold time of a segment, shown in hours and minutes. (Example: 2 hours and 15 minutes = 02.15)

HLdt (Page 8) Add Hold Time: During a firing, you can extend the hold time of a segment without having to first stop the firing to reprogram the controller.

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** (pages 7, 8) These are Ramp-Hold programs stored in memory.

rA 1 **rA 2** etc. (Rate) (page 8) This appears in Ramp-Hold 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.

SPd1 **SPd2** **SPd3** **SPd4** **SPd5** (page 6) These are preset firing rates, or speeds, in Single-Speed mode.

SStP (Skip Step) (page 8) This message appears when you press the **Up Arrow** key during a Ramp-Hold firing. You can skip out of a segment into the next segment.

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

Strt The "Ready to Start" message appears after programming a firing. Press **START** to begin firing. Thermocouple Offset (press the **Up Arrow**) and Delay (press the **Down Arrow**) are accessed from the **Strt** message.

TCOS Thermocouple Offset (Page 12). Adjust the controller to fire hotter or cooler.

Error Messages

bAdP / Bad Programming

The kiln will not fire because a) the Ramp-Hold program just entered has a rate of 0000 in segment 1, or b) the target temperature in Single-Speed or segment 1 of Ramp-Hold is lower than the current temperature.

EtH / Electronics Too Hot

The circuit board temperature is above 176°F / 80°C. Press any key to return to **IdLE**.

To lower the board temperature, use a fan to blow air across the kiln switch box into the louvers. (But do not blow air into the kiln's peepholes.) If you have more than one kiln in the room, place them farther apart. Never allow the firing room temperature to exceed 110°F / 43°C. (Measure room temperature three feet away from the kiln.)

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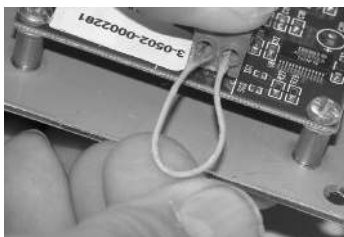
1 UNPLUG the kiln or disconnect the power. Remove the controller. Remove the two thermocouple wires from the back of the controller.

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.

3 Plug in the kiln. **FaiL** will appear. Press **START**. Test results:

A) If the controller displays room temperature and **IdLE** after you press **START**, replace the thermocouple.

B) If the display still shows **FaiL** after you press **START**, return the controller for repair or replacement.

FE Error Messages

Message	Problem
FE 1	Memory Read/Write Failure
FE 2	RAM Failure
FE 3	OEM Factory Data Corruption
FE 4	Thermocouple "Noise"
FE 5	Software Error

To return to IdLE from an FE code

Try pressing any key. If that doesn't work, turn the power off for 10 seconds. Call the factory if the error message remains when you turn the power back on.

If you get an **FE 4** message, check the wire connections going from the back of the controller to the thermocouple. A loose connection can cause the **FE 4** message.

FtL / Fired Too Long

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

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

■ The firing is 2 hours longer than programmed.

Programming a cooling segment target temperature that is below or even close to room temperature can also trigger the **FtL** message.

See "Controller display turns on. No heat in kiln," page 14.

Question: The controller on my Paragon SC-2 jewelry kiln flashes **FtL**, but only when I include a controlled cooling. What is happening?

Answer: **FtL** means "firing too long." But "firing too long" applies to cooling as well as to heating. **FtL** can appear if you program a segment for slow cooling and the kiln is taking too long to cool. Program a slower cooling rate. **FtL** will also appear if you program a cooling segment target temperature that is below or close to room temperature.

HtdE / High Temperature Deviation

Causes:

■ During a heating-up ramp or a hold, the temperature is 100°F / 56°C above the programmed temperature.

■ During a cooling-down segment, the temperature is 100°F / 56°C higher than the segment's starting temperature.

■ A fast rate caused the controller to overshoot the target temperature.

Also, check for a stuck relay.

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 212°F / 100°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 72°F / 40°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 11.

tCL / Thermocouple Lag

The heating rate is slower than 9°F / 5°C per hour and the actual kiln temperature is more than 100°F / 56°C away from the programmed temperature. The tCL alarm becomes inactive above 500°F. To return to the **IdLE** display, press any key. Causes:

■ Worn or burned out elements, defective relays, low voltage, and defective thermocouple.

■ On kilns that use a portable controller, the thermocouple has fallen 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.

■ You have programmed a cooling segment temperature that is below room temperature.

tCr / Thermocouple Reversed

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

■ The thermocouple may be starting to fail and is sending erratic signals to the controller.

■ The thermocouple inside the kiln is much colder than the controller circuit board.

Thermocouple Offset

You can adjust 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.

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 the 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.)
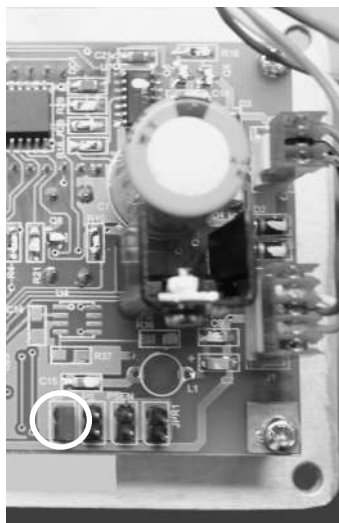
4 Install the controller being careful not to jar components on the back of the controller against the kiln case.

The C/F jumper terminal is on the back of the controller, circled above.

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 a 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
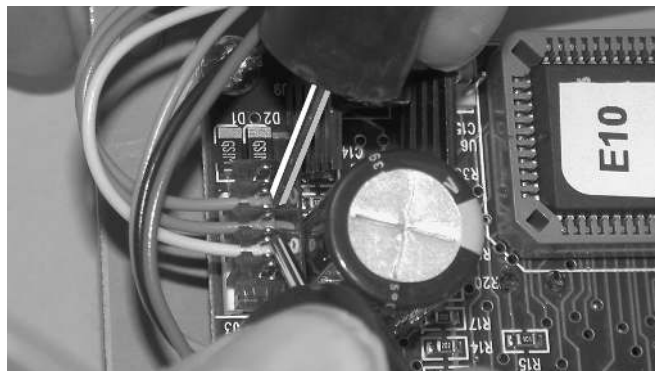
Touch the voltmeter probes to the white and orange wires to test voltage going to the controller. The voltmeter must be in AC mode.

(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 INPUT plug, which is the white, orange, and blue wires, from the back of the controller. Touch
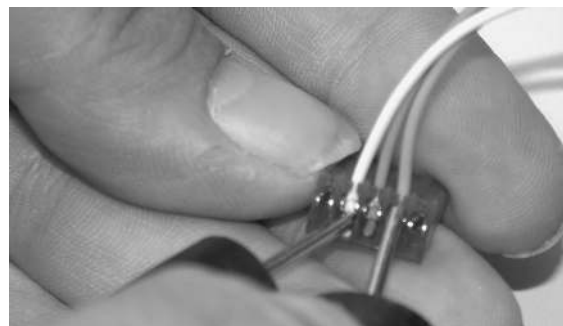
Input Test #2 with disconnected plug: Touch the voltmeter probes to the white and orange wires to test voltage going to the controller. The voltmeter must be in AC mode.

13–

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 13. 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 Ramp-Hold 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:
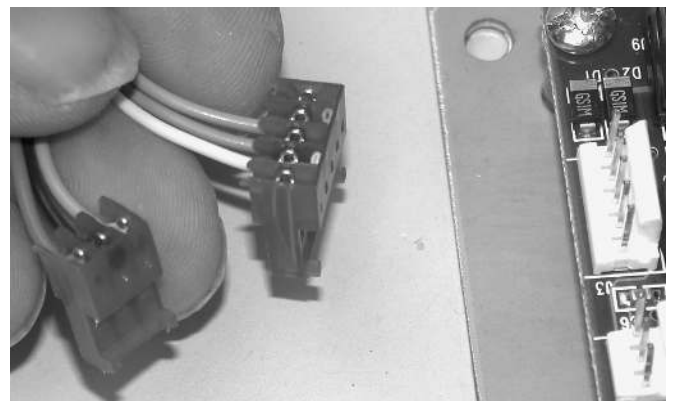
Kiln Switch Box ½ Amp Fuse Power Test

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. Disconnect both wire plugs from the back of the controller. Then plug the kiln back in. Apply power to kiln. If the ½ amp 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 and black wires). Program the controller to fire to 1000°F at FULL rate in Ramp-Hold mode. Press **START**. If the fuse blows, replace or service the board. (If the fuse does not blow, the problem is caused by a short in the coil of a relay. Go to step 3.)

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

Problem: The kiln overfires.

■ Did you see an error message such as **HTdE** ?

If not, the thermocouple gave a faulty reading, so the controller did not shut off the kiln. Sometimes a shelf can bump against the thermocouple and push it out of the firing chamber. Make sure the thermocouple is pushed far enough into the firing chamber.

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.

■ Do the elements stay on after you press **STOP**?

If so, the electrical contacts inside a relay are stuck in the closed position. This will also cause elements to turn on as soon as you plug in the kiln. Replace the relay.

Question: If you stop/abort a firing to change a temperature and then resume firing, do you need to skip segments to get back to where you were before?

Answer: When you press Stop during a firing, reprogram the controller, and then press Start, the controller will go to the first segment that matches the temperature inside the kiln. For instance, if segment 3 starts at 1200 and ends at 1700, and the kiln temperature is 1600 when you press Start, the controller will go directly to segment 3.

Question: Should a hold time be programmed as total number of minutes, or hours and minutes?

Answer: Program a hold as hours and minutes rather than the total number of minutes. (i.e., 90 minutes is programmed as 1:30.)

Question: What is the maximum number of times per minute that the Sentry Xpress controller can turn on the relay during a hold?

Answer: The maximum number of relay cycles is 6 times a minute.

Index

Shorthand Instructions

These instructions may be confusing until you have read more detailed instructions on Single-Speed, page 6, or Ramp-Hold, page 8. Read the safety guidelines, page 3. After pressing the keys in left column, the center message will appear.

Single-Speed

Keys to Press	Display
	IdLE
⟳	**SPd1** thru **PrO4**
▲ (Not Down Arrow) Select rate	**SPd1** (Sample rate)
⟳	**°F 1** or **°C 1**
▲ ▼ Enter temperature	**1900** (Sample temperature)
⟳	**HLd 1**
▲ ▼ Enter hold time	**00.00** (Or hold time)
⟳	**S t r t**
⟳	**-O n-** The kiln is now firing.

Ramp-Hold

Keys to Press	Display
	IdLE
⟳	**SPd1** thru **Pro4**
▲ (Not Down Arrow)	**Pro1** Select Program #1, 2, 3, or 4
⟳	**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.