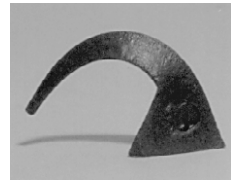




Sentry 2.0



Digital Temperature Controller Cone-Fire / Ramp-Hold Operating Instructions

Cone-Fire (pg 10-13) See pages 34 - 35 for instructions on upgrading your DTC From IdLE, press 1. 100, 600, 800 or 1000 series board to the Sentry.

Enter cone number, speed, pre-heat, hold, and slow cool.

Ramp-Hold (pg 14-18) From IdLE, press 4. Select stored program (1 - 4). Enter rate, temperature, and hold for each segment.

Edit Ramp-Hold (pg 7) During firing, press 4. Change the current segment temperature. Press Enter. Change the hold. Press Enter. The kiln will continue firing.

Alarm (pg 7) From IdLE or during firing, press 7. Enter a temperature. When alarm sounds during firing, press Enter.

Enter/Start
1) Press Enter/Start after each step in programming a firing.
2) Press Enter/Start once from IdLE to begin firing.

Options
From IdLE, press 0. Press Enter for option displayed.

Cone-Fire Options
SPd Speed Change the speed of a Cone-Fire program beyond the Fast, Medium, or Slow. (Pg 19)

OFST Cone Offset Adjust controller to a witness cone. (Pg 20)

FAN Vent Fan Selects when the vent fan will operate. (Special option not on all kilns.) (Page 21)

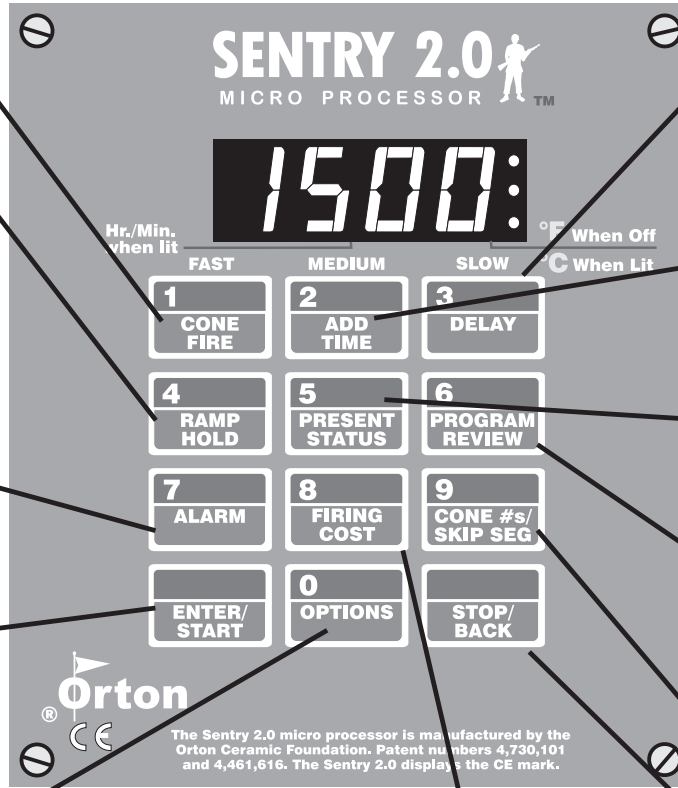
Standard Options

TCOS Thermocouple Offset Change the thermocouple temperature. (Pg 21)

CHG- Select °F or °C. (Pg 22)

TC Thermocouple Type Select Type K, S or R. (Pg 22)

AOP 1 **AOP 2** **AOP** Outlet Select vent fan or alarm if your kiln has an auxiliary output. This is a special-order feature. (Pg 22)



Delay (pg 7) From IdLE, press 3. Enter time in hours:minutes. Delays the start of firing.

Add Time (pg 6) During firing, press 2. Each additional key press adds five minutes to a hold. It works in both Ramp-Hold and Cone-Fire.

Present Status (pg 7) During firing, press 5. Shows the segment that is currently firing. Works in both Ramp-Hold and Cone-Fire.

Program Review (pg 7) From IdLE or during firing, press 6. Shows the program that is loaded in memory and ready to fire, or the one that is firing.

Cone Table & Skip Segment (pg 8) From IdLE or during firing, press 9.

1) From IdLE, shows temperature for the cone you enter.
2) While firing in Ramp-Hold, skips to the next ramp.
3) While firing In Cone-Fire, skips out of Pre-Heat or Hold.

Stop/Back (pg 9) Press during firing or programming.
1) Stops a firing.
2) In Options, takes you back to IdLE.
3) During programming, takes you back one step each time key is pressed.

RATE Rate Calculation Type Shows factory setting. (Pg 23)

COST Electric Rate Enter rate shown on electric bill. (Pg 23)

KW The Cost to Fire Kiln Enter your kiln's wattage. (Pg 23)

Id Computer ID Select identification number for output to a computer. (Pg 24)

TEdE Temperature Deviation Set temperature sensitivity for FTH, FTC & LTdE errors. (Pg 24)

SFTY Maximum temp. (P 24)

ELEC Electronics Temp. Check for overheating. (Pg 24)

LOCK Program Lock Make a program tamper-proof. (Pg 24)

CFG Configuration Code For technicians. (Pg 25)

SOFT Software Version (Pg 25)

Firing Cost (pg 8) Press 8 after the kiln fires to completion.

The cost of the last firing will appear. (First enter electrical cost in the **COST** option and kiln wattage in the **KW** option, pg 23.)

TEST Element Test Diagnostics tool. (Pg 25)

RST Reset Removes thermocouple offset and returns the board to factory defaults. (Pg 25)

Multiple Zone Options

DIFF Difference Largest temperature difference between any 2 zones. (Pg 25)

T123 Zone Temperatures Shows temperature of each zone. (Pg 25)



Introduction

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

Thank you for purchasing the Sentry micro processor, our most advanced generation of digital temperature controllers. As you read the manual, have your controller in front of you so that you can try out the keys.

The controller display messages are limited to four characters. For this reason, the messages appear cryptic: IdLE instead of “Ready to begin,” CPLT instead of “Fired successfully to completion,” RA1 instead of “Enter rate for first segment.” If at any time you are confused by these messages, turn to Appendix A: Display Messages on pages 30 - 31.

The front cover is a quick guided tour of the controller. The back cover is a quick guide to programming, to be used after you have learned the programming instructions on pages 11 and 15.

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

The warranty on your Sentry 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 end of the firing.

The Sentry operates in Cone-Fire and Ramp-Hold similar to the earlier DTC 600, 800, and 1000 series. If you are familiar with the earlier controllers, you can follow many of the same operating procedures with the Sentry.

If you purchased the TnF 2 portable controller, you should find a TnF 2 installation instruction sheet in addition to these instructions.

Instructions for multiple-zone kilns are included in this manual. If you are not sure whether your kiln is multiple-zone, look into the firing chamber. If you see two or three thermocouple tips, your kiln is multiple-zone. If you see only one thermocouple, skip multiple-zone instructions.

New features introduced with Sentry software version 18D: The Rate option (page 23), Ramp-Hold rate shown in Present Status (page 7), firing cost calculation (page 8), TCL alarm (page 27), PF1 alarm (page 27), and 2 segments added to the User 1 program for a total of 20 (page 14). To check the software version of your Sentry, press the OPTIONS key repeatedly until SOFT appears. Press ENTER. Your controller’s software version will appear. 18D and later versions include the new features.

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

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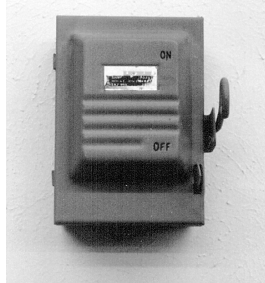
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Safety

The warranty on your Sentry 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 end of the firing.

Follow these safety rules in addition to the ones in your kiln or furnace manual:



- When the kiln is not in use, disconnect the power and keep the lid or door closed. (For larger kilns with heavy cordsets, we recommend a power disconnect box near the kiln.)
- Do not leave the kiln unattended, especially near the expected shut-off time. Do not leave a kiln turned on at your studio while you are at home sleeping.
- Wear firing safety glasses when looking into the peephole of a hot kiln.
- Do not touch hot sides of kiln or furnace. Keep unsupervised children away.
- Install your kiln or furnace at least 12 inches from any wall or combustible surface. (See manufacturer's recommendation for your model.)
- Do not open lid or door until kiln or furnace has cooled and all switches are off.
- Fire only in a well-ventilated, covered and protected area away from flammable materials. Keep cordset away from hot sides of kiln or furnace.
- **DANGEROUS VOLTAGE!** Do not touch heating elements with anything. Disconnect kiln or furnace before servicing.
- Do not operate if the controller itself is hotter than 158°F / 70°C. (See instructions on page 24 for checking circuit board temperature.) Never allow the firing room temperature to exceed 110°F / 43°C. (Measure room temperature three feet from the kiln.)
- Stop a firing by pressing the STOP button, not by disconnecting the power. In certain condi-

tions, the controller will interpret a power interruption as a power failure and turn the kiln back on when you reconnect the power.

- Place the kiln on the stand recommended by the manufacturer. When a kiln is safety tested by UL, the lab fires the kiln on the stand designed for the kiln. Cinder blocks or bricks can inhibit the flow of air under the kiln. They can also change the kiln's heating characteristics.
- Place the kiln on a non-combustible surface.
- Keep the kiln lid or door closed when the kiln is not in use. This keeps dust out of the kiln. Also, should someone turn on the kiln while you are away, the closed lid will keep the heat safely inside the firing chamber.
- Never place anything on the kiln lid, even when the kiln is idle. If people become accustomed to placing papers and other objects on the kiln, they may forget and do that while the kiln is firing.
- Remove all tripping hazards from around the kiln. Keep the kiln's supply cord out of traffic areas.
- Avoid extension cords.
- Never fire tempered glass inside a kiln. It could explode.
- Greenware, which is unfired clay, must be bone dry before firing. Moist greenware can explode inside the kiln, damaging the ware and the kiln. Place a piece of greenware against the inside of your wrist. If it feels cool, it is too wet to fire.
- Store kiln shelves in a dry area. Moist shelves can explode inside a kiln.
- If you smell burning plastic, turn the kiln off. Examine the wall outlet and supply cord for signs of burning.
- Never place extra insulation around the kiln in an attempt to conserve energy. The extra insulation can cause the wiring and the steel case to over-heat.





Chapter 1 Basic Pointers

Two Firing Modes

The Sentry fires in two modes:

- **Ceramic Cone-Fire**, based on pyrometric cones (page 10). Quickly program a firing by selecting a cone number and firing speed.
- **Ramp-Hold** with custom firing rates and target temperatures is for ceramists who want to design their own firing schedules (page 14).

Ceramic kilns use both Cone-Fire and Ramp-Hold. Heat treating, glass fusing, and enameling furnaces and kilns come with Ramp-Hold only.

1 From **IdLE** display, press **1**. If **CONE** appears, you have Cone-Fire mode. If the **1** key does not respond, you have Ramp-Hold mode only.

2 Press **STOP** to bring the controller back to **IdLE**.

If you have Ramp-Hold only, skip pages 10 - 13.

Room Temperature and Humidity

It is okay to store the Sentry at sub-zero temperatures. But before operating, raise the room temperature to at least 32°F / 0°C.

Note: *The Sentry will register sub-zero °F/°C temperatures. However, 32°F / 0°C is the lowest recommended operating temperature.*

The circuit board is rated for 176°F / 80°C maximum operating temperature. However, the maximum recommended temperature is 158°F / 70°C, measured at the controller inside the kiln switch box. To lower the temperature,

open windows and use a fan to blow air across the kiln's switch box louvers. (See page 24 to check circuit board temperature.)

High humidity will not adversely affect the Sentry unless water condenses on the circuit board. In this case, do not fire the kiln until the moisture has evaporated from the board.

Thunder Storms and Power Surges

Unplug the kiln when 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 may be okay to continue the firing. When the kiln shuts off, disconnect the power.

CAUTION: *When firing the kiln during a storm, do not leave the kiln unattended!*

Time and Temperature Display

Center Dot: Time

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



Three-Light Display

The Sentry turns on the heating elements intermittently through relays. Power output lights appear in the right side of the display when the Sentry sends a signal to turn on the relays.



■ **Single-Zone Kiln** When the Sentry sends a signal to the relays, all three lights appear.

■ **Multiple-Zone Kiln** The top light indicates power to the top section of the kiln, the middle light power to the middle section, and the bottom light power to the bottom section. (Two-zone kilns: Ignore the center light.)

Note: *Though power output lights are on, mechanical problems can prevent the relays from turning on.*

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 22.



Operation Begins from the IdLE Display

The controller displays **IdLE** when you first apply power to the kiln. Operation begins from **IdLE**. You can't fire the kiln until **IdLE** appears.



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

■ If the display shows an error message such as **FAIL** instead of **IdLE**, see pages 26 - 28.

■ **CPLT** (firing completed) appears at the end of a firing. To make **IdLE** appear, press any key.

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

CPLT Message: Firing Completed

When the firing has successfully completed, the Sentry will shut off power to the elements. Then four messages will cycle one after the other:

- 1 **CPLT** (complete)
- 2 Firing time in hours and minutes
- 3 The temperature reached during the last segment
- 4 The current kiln temperature

Note: After the kiln fires to completion, disconnect the power. It is okay to turn off the power to the controller while the kiln cools to room temperature.

Note: **Pre-18D software version controllers:** (See page 25 to find version) If **CPLT** appears immediately after you press **START**, it is because all programmed temperatures are lower than the current kiln temperature. If the alarm sounds (see page 12), and then the kiln fires to completion, you will see **ALAR** instead of **CPLT**. Press **ENTER**. **CPLT** will appear.

Repeat Firings

To repeat the last firing, press **ENTER** from **IdLE**. The kiln will begin firing. This works in both Cone-Fire and Ramp-Hold. But first, make sure you are repeating the correct firing by using Program Review (see page 7). For repeat firings that you don't want to inadvertently change, see Program Lock, page 24.

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! The controller does not contain an alarm to detect this type of failure. Bumping the thermocouple could also cause inaccurate readings.*

Thermocouples come in different widths. The wider the thermocouple, the farther it should extend into the firing chamber. A 1/2" - 3/4" diameter thermocouple should extend into the firing chamber about 1". A 1/8" thermocouple should extend into the chamber 1/2" - 5/8". (Do not be concerned if your thermocouple extends into the firing chamber even farther.)

Keep shelves, posts and ware 1" - 1 1/2" away from the thermocouple. Keep an extra thermocouple on hand, especially if you fire hotter than 2000°F / 1093°C.

If you are using a portable, separate controller, you will need to install the thermocouple onto the kiln. See the separate TnF 2 installation instructions.

Preventing an Overfire

Even though a digital controller turns off the kiln automatically, you should monitor the kiln during firing. This is to prevent a possible overfire.

- 1 Remain nearby while the kiln is firing. Check the kiln occasionally.
- 2 Set the temperature alarm (page 7) to remind yourself to check the kiln. If you are too far away to hear the alarm, you might try using a baby monitor.
- 3 After the kiln fires to completion, disconnect the power. It is okay to turn off the power to the controller while the kiln cools to room temperature.



Chapter 2 The Keys

Correcting Entries

If you enter the wrong temperature, cone, time, etc., while programming, enter 0000. Then enter the correct numbers before pressing **ENTER**. See also the Stop/Back Key, page 9.

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**.

1

**CONE
FIRE**

1 / Cone-Fire

Cone-Fire is a method of firing ceramics to a pyrometric cone. See Chapter 3, page 10, for details. To find out if your Sentry includes Cone-Fire:

- 1 From **IdLE** display, press **1**. If **CONE** appears, you have Cone-Fire mode. If the **1** key does not respond, you have Ramp-Hold mode only.
- 2 Press **STOP** to bring the controller back to **IdLE**.

2

**ADD
TIME**

2 / Add Time

This key adds five 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 **2**. **HOLD**, and time in hold, will appear.
- 2 Press **2** again. The time shown will increase by 5 minutes.
- 3 To return to the temperature display, press **START** or wait 1 minute.

Note: *Add Time will add 5 minutes to hold even if no hold had been programmed. After hold time displays, 5 minutes are added with each press of the key.*

With the Add Time (2) button, you can add time to a hold. With the editing feature (4), you can change both target temperature and hold.

3

DELAY

3 / Delay Fire

This delays the start of the firing by the amount of time entered. Use it to fit a firing into your schedule or to take advantage of lower electric rates at night. Delay zeroes out after each firing. Therefore, it must be programmed again for each firing. The maximum delay is 99 hours and 59 minutes.

Though delay can turn on the kiln while you are away, you should not leave a kiln unattended during firing.

- 1 First, enter the the Cone-Fire or Ramp-Hold program you are going to fire.
- 2 From **IdLE** press **3**. Enter delay time (i.e., 5 ½ hours = 05.30). Press **ENTER**.
- 3 To begin Delay, press **ENTER** once from **IdLE**. A Delay count-down timer will appear.

Note: Press **START** during delay to end the delay and begin the firing. (You could also press **STOP** to end the delay and then **START** to begin the firing.)

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. The operator assumes full responsibility for shutting the kiln off at the proper time.

4

RAMP HOLD

4 / Ramp-Hold / Edit

Ramp-Hold fires the kiln to the temperature you specify, whereas Cone-Fire fires to a pyrometric cone. Press **4** from **IdLE** to program a firing or to select a stored program. See “Ramp-Hold,” page 14.

Editing the Current Segment During Ramp-Hold Firing

Note: This feature works only in Ramp-Hold, not in Cone-Fire.

While the kiln is firing in Ramp-Hold, you can change the target temperature and hold time of the current segment. (You can edit only the segment that is firing. 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 tem-

perature at the original rate. (You cannot edit the rate, however.)

- 1 During firing, press **4**.
- 2 The display will show the target temperature of the current segment. Use the number keys to change the temperature. Then press **ENTER**.
- 3 The display will then show the hold time of the current segment (or 00.00 if there is no hold time). Change the time, if needed, and press **ENTER**. The kiln will resume firing.

5

PRESENT STATUS

5 / Present Status

Press **5** during a firing to display the current segment that is firing. (See page 14 for the definition of segments, rate, and hold.) The messages that can appear in Present Status:

- **RA** , the segment number, and rate: The Sentry is in the ramp part of a segment.
- **Hd** and segment number: The Sentry is in the hold part of a segment.
- **PRHT** Cone-Fire Pre-Heat (see page 12).
- **COOL** Cone-Fire Slow Cooling (see page 12).

Uses for Present Status:

- You are firing a program that contains several heating and cooling segments. Without Present Status, it would be easy to lose track of which segment is firing.
- In Cone-Fire, you may think the kiln has fired too long when it is actually only in a slow cooling.

Note: Present Status shows the actual firing rate of the current segment instead of only the rate you programmed.

6

PROGRAM REVIEW

6 / Program Review

When you press **ENTER** to begin firing, the controller will fire the program that is in active memory. Program Review shows the values for that program. The program in active memory is—

- The program that was fired last, or
- The program that was selected since the last firing.

Start Program Review from **IdLE**, or while firing, by pressing **6**.

Note: In Program Review, Cone-Fire Fast speed displays as **F 20**. Slow speed displays as **S 20**. (These speeds are 20% faster and slower than the standard speed.) See page 12.

7

ALARM

7 / Temperature Alarm

The alarm sounds and **ALAR** flashes when the kiln reaches the alarm temperature that you enter. Use the alarm to alert you to—

- Lower the lid from venting position.
- Check the witness cone near shut-off time.
- 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. The alarm is designed only for higher temperatures and not for cooling temperatures.*

After the alarm beeps, the alarm temperature will stay in memory for future firings until you replace it with a new temperature.

Monitoring the Alarm from a Distance

Place an inexpensive baby monitor near the kiln. From another location in your building, you will be able to hear the temperature alarm beeping and the the relays clicking.

Setting the Alarm From Idle

- 1 From **IdLE**, press **7**. **ALAR** will appear alternating with the last alarm temperature entered.
- 2 Enter alarm temperature. Press **ENTER**. **IdLE** will appear. (If you do not want to use the alarm, set the alarm temperature to **0**. This setting will disable the alarm.)

Note: *Your controller's maximum temperature is shown in the **SFTY** option (page 24). If you enter an alarm temperature that is higher than the maximum temperature, the alarm temperature will automatically change to the controller's maximum temperature.*

Use the alarm to remind yourself that the kiln is getting close to the shut-off temperature. Always check the kiln before it shuts off.

If the alarm sounds as soon as firing begins, it is because the alarm was set to a temperature below the current temperature.

When the alarm sounds, shut it off by pressing any key except **STOP**. (Pressing **STOP** while an alarm sounds will shut off the kiln.)

Note: *If the alarm sounds as soon as firing begins, it is because the alarm was set to a temperature below the current temperature.*

Setting the Alarm During Firing

- 1 The alarm beeps while the kiln is firing. Press **7**.
- 2 Enter the new temperature.
- 3 Press **ENTER**. The kiln will continue firing.

If you touch **7**, enter a new temperature, and forget to press **ENTER**, the controller will merely continue firing without resetting the alarm.

8

FIRING COST

8 / Estimating the Firing Cost

Note: *This feature is included with software version 18D and newer controllers. To look up your software version, see page 25.*

The Sentry controller can figure the electrical cost of a firing. Set up the controller as follows:

In the **COST** option, enter the cost of a kilowatt-hour of electricity. See page 23.

In the **KW** option, enter the wattage for your kiln. See page 23.

After the kiln fires to completion, **CPLt** will flash. Press the **8** key. The cost of electricity to fire the last load will appear. To return to temperature display, press **ENTER**.

Note: *If you enter the kiln wattage in the **KW** option but you do not enter cost per kilowatt-hour in the **COST** option, the controller will display kilowatt-hours instead of firing cost.*

9

CONE #s/ SKIP SEG

9 / Cone Numbers & Skip Segment

Cone Table

Look up a cone temperature with the **9** key. (See page 10 for information on cones.)

- 1 From **IdLE**, press **9**. **CONE** will appear, then the cone, if any, currently programmed in Cone-Fire.
- 2 Enter a pyrometric cone number. Press **ENTER**. The display will show the cone temperature. If you enter a non-existent cone number, the display will show **CONE**, ready for you to enter a different cone number.

Note: Do not be concerned if the actual cone shut-off temperature does not match the Cone Table. The temperature of a cone varies with firing speed. The cone temperatures in Cone Table are for self-supporting cones fired at a rate of 108°F / 60°C per hour during the last hour of firing.

Skip Segment

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

To skip a segment, press **9**. **SKIP** will appear, then the current segment. Press **ENTER**. (If you change your mind and don't want to skip that segment, don't press **ENTER** after **SKIP** appears. Instead, press **9** again. The firing will continue in the same segment.)

Skip Segment in Cone-Fire

In Cone-Fire, Skip Segment works in Pre-Heat and Hold:

- To skip out of Pre-Heat and begin the cone firing.
- To skip out of Cone-Fire Hold. Slow Cooling will begin. (If the firing does not include Slow Cooling, Skip Segment will not end a Hold. Press **STOP** to end the firing.)
- If you press **9** during a cone firing when the kiln is not in Pre-Heat or Hold, the cone number and cone temperature will appear in the display.

Skip Segment in Ramp-Hold

In Ramp-Hold, the firing will skip to the ramp of the next segment from either a ramp or hold of the current segment. (See page 14 for details on ramps, holds, and segments.)

Note: Skip Segment does not skip from a ramp to a hold. It skips to the next segment.

Skip Segment Examples

For additional examples, see pages 17 - 18.

Cone-Fire

- In Cone-Fire you are firing to an 05 witness cone for the first time. You select cone 04 with a 60 minute hold and a slow cooling. After 30 minutes in hold, the 05 witness cone bends to maturity. Use Skip Segment to end the hold and begin Slow Cooling.

Note: Once you know how much hold time will bend the witness cone, program that much hold for the next firing.

Ramp-Hold

- **Skipping to a Cooling Segment:** You have programmed 2167°F for a cone 5 glaze firing, followed by a segment for controlled cooling. Watching the witness cone through the peephole, you notice that cone 5 is

bending at 2150°F. Use Skip Segment to end the firing segment and begin the one for slow cooling.

Note: Make a note of the temperature at which the cone bent. Program that temperature for the next firing.



Enter/Start

- Press **ENTER** after each step in programming a firing.
- From **IdLE** press **ENTER** once to begin firing.



0 / The Options Key

See Chapter 6, page 19.



The Stop/Back Key

You can stop a firing at any time by pressing **STOP**. If you inadvertently enter Ramp-Hold or Options, you do not have to go through all the prompts to get back out. Press **STOP** to go to **IdLE**.

The **STOP/BACK** key is also like the Back button on an Internet browser. It works in Cone-Fire and Ramp-Hold programming. It will take you back one step with each key press. It is easy to make programming corrections.

If you make a mistake during programming, you can press the STOP / BACK key to go back one step.



Chapter 3 Cone-Fire

1
CONE
FIRE

Cone-Fire mode is based on pyrometric cones. It is not designed for heat treating, glass fusing and enameling. For these firings, see “Ramp-Hold,” page 14. Use Ramp-Hold to fire ceramic pieces that require a custom firing schedule, such as some types of stoneware sculpture or crystalline glaze.

Before using Cone-Fire, read all of this chapter. Have your controller in front of you so that you can try out the keys as you read. For more information on pyrometric cones and venting, please see your kiln’s instruction manual.

Pyrometric Witness Cones

The Sentry shuts off automatically without cones. Nevertheless, every ceramic firing should include at least one witness cone (also called the shelf cone). The witness cone is the most accurate measurement of heat work in a ceramic firing.

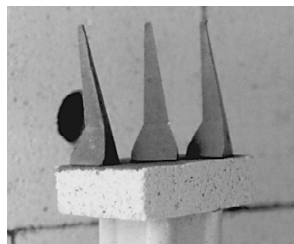
If you fire the same size load and type of ware regularly, the witness cones let you compare one firing to the next and alert you when something is wrong. For example, if the witness cone bends less and less with each consecutive firing, this may indicate thermocouple temperature drift.

Note: *If the bending of the witness cone does not match the Cone-Fire shut-off, you may want to adjust Cone Offset or Thermocouple Offset. See pages 20 - 21. If the witness cones bend inconsistently from one firing to another, see “Sentry Troubleshooter,” a separate publication.*

How to Position Cones on the Shelf

Position the witness cones so that you can see them through a peephole during firing. If the kiln takes longer than usual to fire, you may wonder if something has gone wrong and the kiln is over-firing. But by

Position witness cones inside the kiln so that you can see them through a peephole. Always use firing safety glasses.



Use self-supporting witness cones on the shelf. They stand upright without cone holders.

seeing the cones, you will know how the firing is actually progressing.

If you follow these guidelines, you should be able to see the cones even at cone 10:

- 1 Place the cones 8” - 12” away from a peephole. Positioning them closer makes them difficult to see.
- 2 Have enough space around the cones to keep them from touching a piece of ware when they bend.
- 3 Position cones so that when viewed from the peephole, they are silhouetted by an element on the opposite kiln wall. (Keep cones at least 2” from an element.)
- 4 The element that silhouettes the cones should be level with the lower part of the cone. If the element is in line with the upper part of the cone, you won’t be able to see the cone when it bends.
- 5 If you use the three cone system, always have the higher temperature cone on the same side in every firing. Otherwise you can lose track of which cone is which.
- 6 Wear kiln firing safety glasses when viewing the cones through the peephole.

See your dealer if in doubt about which cone number to use with each clay and glaze.

Firing Schedules

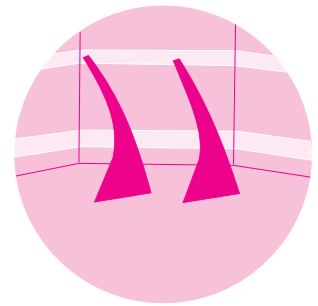
Cone-Fire uses three firing schedules:

- Low fire cones 022 - 011
- Medium fire cones 010 - 01
- High fire cones 1 - 10

The firing schedules programmed into Cone-Fire are listed in Appendix B, pages 32 - 33. Should you ever want to customize a Cone-Fire program, transfer the firing schedule to Ramp-Hold (page 14). Then make the desired changes to the firing schedule.

During a cone firing, press **5** (Present Status) to see which stage, or segment, of the firing the kiln has reached. The number displayed will be a segment number from one of these firing schedules.

Note: *Pre-Heat shows in Present Status as **PRHT**. It is not given a separate segment number.*



Silhouette the lower part of the cone against an element. Keep the cone 8” - 12” away from the peephole.

Firing time in each segment is approximate and depends on the age of elements, voltage, size of load, and the firing speed you have chosen.

CAUTION: Cone numbers beginning with 0 are lower in temperature than those without the 0. When programming a Cone-Fire, be sure you know the difference between an 05 and 5. See “Temperature Equivalents Chart for Orton Self-Supporting Pyrometric Cones,” Appendix D, page 36.

Low Fire Cones 022 - 011

This range includes decals, over-decorations, lusters, and golds. The firing can be fast. Good venting is important, because oils and other organics burn off. Do not close the lid from the vented position until all odor has disappeared.

Low Fire Cones 022 - 011 Standard Schedule

Segment	Rate Per Hour	Time in Segment
1	396°F/220°C	2 hours
2	108°F/60°C	1 hour

Firing time is 3 to 5 hours, depending on the cone and speed.

Middle Fire Cones 010 - 01

Use this range for earthenware and commercial low-fire glazes. Glazes fired on bisque ware (ware that has already been fired) can be fired faster than the unfired greenware. In this cone range, slow firings can produce poor quality glazes.

In the Cone-Fire schedule, the firing is slowed during the silica phase change (1063°F/573°C).

Earthenware and clays that contain ball clays, talc, and kaolin will burn off water, carbon, and sulfur. This reduces weight by 10%.

Cooling too fast can produce glaze pinholes, blisters, and craters.

We recommend a 10 - 20 minute hold when firing lead-free glazes.

Middle Fire Cones 010 - 01 Standard Schedule

Segment	Rate Per Hour	Time in Segment
1	324°F/180°C	2 hours, 30 minutes
2	153°F/85°C	35 minutes
3	180°F/100°C	2 hours, 40 minutes
4	108°F/60°C	1 hour, 30 minutes

Firing time is 6 to 8 hours, depending on the cone and speed.

1

**CONE
FIRE**

Cone-Fire Programming

Use these instructions for your first firings. Later you may prefer “Cone-Fire Shorthand Programming,” page 40.

As the Sentry prompts for cone, speed, pre-heat, hold, and slow cooling, values entered for the last firing will appear. To use these values again, press **ENTER**.

To fire without Delay or Alarm: Follow steps 1 through 7 below. Then from **IdLE** press **START**. To use Delay or Alarm, see also pages 7 - 8.

- 1 Apply power to the kiln. **8888** then **IdLE** will appear. (Press **ENTER** if **IdLE** does not appear.)
- 2 Press **1**. **CONE** will appear. Enter cone number. (If the **1** key does not respond, your controller has Ramp-Hold only.)
- 3 Press **ENTER**. **SPd** will appear. Enter speed: FAST (**1**), MEDIUM (**2**), SLOW (**3**). (Medium speed will display as **Std**.)
- 4 Press **ENTER**. **PRHT** will appear. To use Pre-Heat (p. 12), enter time. Otherwise enter **0**.
- 5 Press **ENTER**. **HOLD** will appear (pg 13). To soak the ware at the end of firing, enter a hold time. Otherwise enter **0**.
- 6 Press **ENTER**. **COOL** will appear (pg 13). To use Slow Cooling, enter cooling rate as degrees per hour. (180°F/82°C is the maximum cooling rate. Press **0** to turn Slow Cooling off.)
- 7 Press **ENTER**. **IdLE** will appear.
- 8 **To set Alarm:** Press **7**. **ALAR** will appear. Enter alarm temperature. (Press **0** to turn alarm off.) Then press **ENTER**.
- 9 **To set Delay:** Press **3**. **dELA** will appear. Enter delay time. Press **ENTER**. (Delay zeroes out after each firing.)
- 10 To start program, press **ENTER** once. **STRT** will appear, then temperature. If Delay was programmed, **DELA** will appear, then time remaining until start. To stop the program during firing, press **STOP**.

When program fires to completion, **CPLT** will appear. Press **ENTER**. **IdLE** will appear. To shut off the alarm when it sounds during a firing, press **ENTER**.

High Fire Cones 1 -10

This is the firing range for porcelain and stoneware. These bodies fire nearly to vitrification and can shrink up to 16%. Water, carbon and sulfur burn out during the early stages and must be vented. The amount of oxygen in the kiln affects the color of the fired clay. The high fire schedule below slows down during the last 210°F/100°C to produce better density in the ware.

Typical porcelain clays are formulated from kaolin, feldspars, silica and ball clays. Weight loss is 10 - 12% and shrinkage is as high as 20%. If over-fired, porcelain may warp or blister. The Cone-fire Hold option usually enhances porcelain.

High Fire Cones 1 - 10 Standard Schedule

Segment	Rate Per Hour	Time in Segment
1	324°F/180°C	2 hours, 30 minutes
2	153°F/85°C	35 minutes
3	162°F/90°C	4 hours, 35 minutes
4	108°F/60°C	2 hours

Firing time is 9 hours, 30 minutes to 11 hours, depending on the cone and speed.

Cone-Fire Features

Speed (SPd)

The Cone-Fire schedules shown on pages 11 - 12 are standard. When you select Medium speed in a Cone-Fire program, the kiln uses these standard firing schedules. When you select Fast (1), the standard schedule fires 20% faster. On Slow (3), it fires 20% slower.

You can also alter the firing speed even more under Speed (SPd) in Options. You can increase or decrease the firing time of a standard schedule by up to 40%. For instance, if you are on a tight deadline, you can reduce a 7 hour fast cone firing to 5 ½ hours.

Pre-Heat (PRHT)

Moist greenware can explode during firing. This happens when the moisture in the clay turns to steam rapidly and cannot escape fast enough. The Sentry Pre-Heat feature dries the ware at low temperature before the moisture can turn to steam.

Pre-Heat is sometimes necessary when firing thick greenware, such as stoneware. It may also be necessary in humid weather, which inhibits drying. If possible, however, avoid using Pre-Heat to dry greenware. If the greenware feels damp or cool when you touch it to your cheek, dry it longer before firing. Use a dehumidifier in humid weather. Drying greenware in the kiln tends to rust the kiln.

Note: During Pre-Heat, vent the lid or use the optional Orton Vent Master. Otherwise the firebricks will

absorb moisture, leading to rust behind the steel case. Moisture in the firebricks can also slow the firing to a crawl.

CAUTION: Venting the lid during Pre-Heat is so important that some ceramists use the extended vent position or even leave the lid open. If you do this, you must be near your kiln at the end of Pre-Heat to lower the lid.

Pre-Heat raises the temperature 60°F/33°C per hour to 200°F/93°C. Then it holds at 200°F/93°C for the time you specify. Pre-Heat works in Cone-Fire only. After Pre-Heat is finished, the kiln will automatically begin firing to the cone you have selected.

Note: Above an altitude of 6,000 feet, water boils at a lower temperature. This may cause moisture in the ware to turn to steam even during Pre-Heat.

Mirror Test

This test will help you determine how much Pre-Heat to use.

Occasionally during Pre-Heat, hold a mirror near the top peephole. (Be careful to avoid burns.) The mirror must be at room temperature, not hot, so hold it near the peephole for only several seconds.



Vent the kiln until moisture no longer fogs a mirror.

If the mirror fogs, moisture is still escaping from the ware. When the mirror no longer fogs, you can exit Pre-Heat and begin the firing.

To interrupt Pre-Heat and begin firing to the cone in Cone-Fire, press **9** (Skip Segment). **SKIP**, alternating with **1**, will appear. Press **ENTER**. Segment 1 of the firing will now begin. (See Cone-Fire firing schedules, pages 11 - 12.)

Note: If you are using a vent fan, such as the Orton Vent Master, leave the fan on during Pre-Heat. The fan will help to remove moisture. (AOP Fan users: see the Fan option, page 21.)

How to Use Pre-Heat When Kiln is Above 200°F/93°C at Beginning of Firing

If you begin firing with Pre-Heat in a kiln that is already hotter than Pre-Heat temperature, the kiln will skip Pre-Heat and begin firing to the cone. There are two ways to use Pre-Heat in this situation:

- Wait until the kiln cools below 200°F before starting the firing. This is the preferred method.
- Load the kiln and start the firing, but include enough time in Delay for the kiln to cool below 200°F before Pre-Heat begins.

If Cone-Fire Fast speed is too slow, use the SPd Option to increase firing speed. (page 19)

Hold (HOLd)

Cone-Fire Hold heat-soaks the ware at the cone temperature at the end of the firing. Without Hold, the kiln shuts off after it reaches the cone temperature. Hold maintains the cone temperature for the period you specify. Hold helps even out the temperature throughout the kiln. It also helps the heat to penetrate completely into the clay. (Rapid firing is like cooking: the turkey will be done on the outside but not on the inside.) Hold helps glaze absorb china paint. It may heal glaze defects such as bubbles. A little hold time can yield dramatic results.

CAUTION: *Too much hold time can overfire your ware and burn out colors.*

One way to add Hold time without over-firing is to fire to one cone cooler than needed. Then add enough hold time to bend the next hotter cone. Hold time needed to bend the next cone will vary. As a rule of thumb, 45 - 60 minutes of hold = one cone of heat work.

Example: to fire to cone 05, program Cone-Fire for 06 and add 45-60 minutes of hold time.

Watch the pyrometric witness cones through the peephole. Press **STOP** when the correct witness cone bends, noting how much Hold time was needed. Program that much Hold time the next time you fire the same type of ware loaded to the same capacity.

Note: *During Hold, the display temperature will alternate with time left in Hold. To figure hold time for the next firing, subtract time left in Hold from the total Hold time entered.*

When Hold is set to 99.99 hours, the Sentry will remain at that temperature indefinitely, until you press **STOP**.

Slow Cooling (COOL)

Slow cooling enhances the quality of some ceramic glazes and may heal glaze bubbles. Slow cooling encourages crystal development, deeper gloss, and sometimes startling color shifts. Iron red glazes seem to respond well to slow cooling. For these reasons we have added a Slow Cooling feature to Cone-Fire.

- Slow Cooling begins after the cone firing (and Hold, if any) and ends at 392°F/200°C.
- When **COOL** appears in Cone-Fire programming, enter a cooling rate between 1°F/C to 180°F / 82°C per hour. A good starting point is a rate of 90°F / 50°C per hour.
- Enter a rate of 0 to turn Slow Cooling off.

Do not leave the kiln unattended, especially near the expected shut-off time. Be there to make sure the kiln turns off.

Note: *Slow Cooling can extend the firing time by many hours. For instance, if the cone shutoff temperature is 1945°F / 1063°C, and the cooling rate is 100°F / 55°C, the kiln will take 15 ½ hours to reach 392°F / 200°C.*

When the Kiln Shuts Off Too Soon

If the kiln shuts off before the pyrometric witness cone bends, you can turn the kiln back on and keep firing. Simply program the next hotter cone in Cone-Fire. Then from **IdLE**, press **START**. The kiln will begin firing, taking up where it left off.

Note: *Look at the witness cones through a peephole to know if the kiln shuts off too soon.*

If the kiln shuts off within 100°F/55°C of maturity, and the temperature drops 50°F/28°C or more after the kiln shuts off, do not depend on the witness cones. Once they cool 50°F/28°C after they have been heated to within 100°F/55°C of maturity, they will not bend properly. This is because they form a hard shell.

Wrong Thermocouple Type

If a Type-K thermocouple is installed on your kiln, but your controller is set for Type-S, the kiln will continually underfire by a wide margin. See page 22 to check the thermocouple type.

For Kilns with AOP Outlet

The AOP (auxiliary output) is a special-order receptacle mounted in the kiln switch box. The Sentry controls power to the AOP receptacle. The AOP is usually used to power a kiln vent.

The Fan option, which is accessed through the **OPTIONS** key, determines when an AOP-powered kiln vent will operate during Cone-Fire.

Before the Fan option will appear on the Options list, (1) you must enter a Cone-Fire program in active memory and (2) you must select VFAN in the AOP1 or AOP2 option. (See page 22 for instructions on selecting VFAN.)

- 1 From **IdLE**, press **OPTIONS** repeatedly until **FAN** appears.
- 2 Press **ENTER**. Use the **1** and **2** keys to select one of these settings:
 - **ON** The vent is on during Pre-Heat, the cone firing, and Slow Cooling. It turns off at 212°F/100°C.
 - **OPT** The vent is on during Pre-Heat and the cone firing. It is off during Slow Cooling.
 - **OFF** The vent is off all the time.
- 3 After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.



Chapter 4 Ramp-Hold

4
RAMP
HOLD

Before using Ramp-Hold, read all of this chapter. Have your controller in front of you so that you can try out the keys as you read.

Theory of Ramp-Hold Operation

The temperature you are firing to in Ramp-Hold is called the target temperature. After the Sentry reaches the target temperature, it can also hold that temperature.

The Sentry 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, Ramp-Hold mode does three basic tasks:

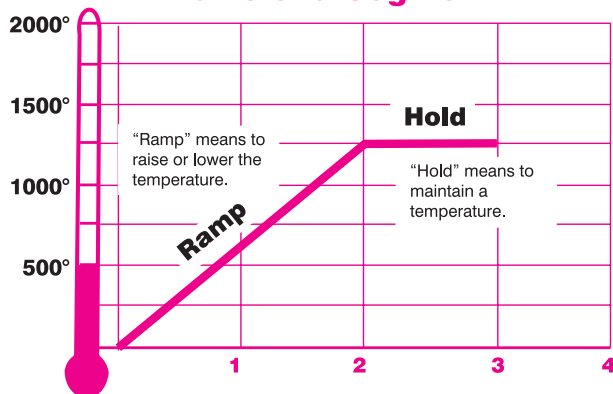
- 1) It fires at a controlled heating rate, or speed, measured in degrees of temperature change per hour.
- 2) It fires to a target temperature.
- 3) It can hold the target temperature.

The Sentry fires in segments, or stages. A segment is a controlled heating rate to a target temperature. A segment can also have a hold. Shown in the chart below is a segment with a target temperature of 1250°, a rate of 625°, and a hold of one hour.

The two parts of a segment:

- **Ramp:** The temperature changes.
- **Hold:** The temperature remains the same.

Parts of a Segment



This segment will reach the target temperature of 1250° in 2 hours, then hold that temperature for 1 hour.

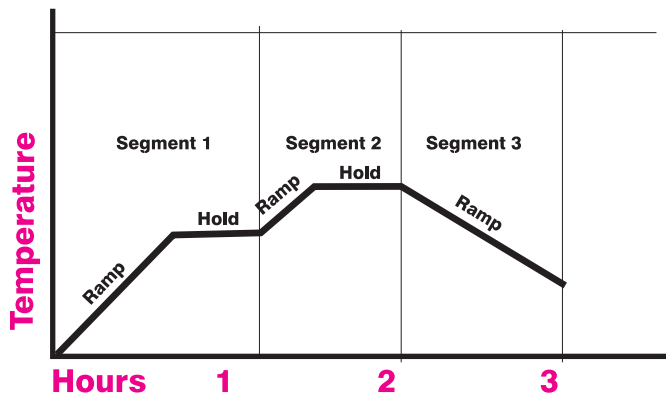
Heating rate is figured in degrees per hour. The recommended heating rate for the material you are firing is usually available from your supplier. It also varies depending on the thickness of the material.

A segment can have only one ramp and only one hold. Therefore, if you need more than one hold, you will have to add additional segments to the firing. Firing to a temperature at a single rate would need only one segment. Reasons to add more segments:

- To change the heating rate
- To add a hold somewhere below the shut-off temperature
- To control the cooling rate.

The diagram below shows a 3 segment firing. Two segments were used on the way up in temperature. Another segment was added for controlled cooling.

To figure how many hours a segment will take to fire, subtract the current temperature from the target temperature and divide the result by the heating rate. In the diagram in the left column, the firing time is $1250^\circ - 80^\circ$ (room temperature) = $1170 \div 625 = 1.87$ hours.



Here is a simple 3-segment program. Segments 1 and 2 each have a hold. Segment 3 is a controlled cooling segment.

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

Storing “User” Programs

To program the controller in Ramp-Hold, **IdLE** must appear. From **IdLE** press **4**. **USER** will appear. The controller is ready for you to choose a stored program or to enter a new one. (See next page for programming instructions.)

The controller can hold 9 programs in memory. They stay in memory even when the power is turned off. Stored programs are numbered 1 through 9. User program 1 can have up to 20 segments. User programs 2 - 9 can have 10 segments each. You don't have to use all the segments available—use only the number needed. Sometimes one segment is all you will need.

When you program a Ramp-Hold firing, you will be asked to enter a rate for each segment. Step 7, Programming Instructions, next page, shows you how to zero out the segments you don't need.

When entering a Ramp-Hold program for the first time, press **1** after **USER** appears. Your first firing will be stored as Program 1.

Each time you store another program, select the next available number, such as 2, at the **USER** prompt. Selecting a number for a new program over-writes (erases) any program stored there. Write down your user programs for quick reference. (Make copies of the blank form on page 37.)

Note: For repeat firings that you don't want to inadvertently change, see *Program Lock*, page 24.

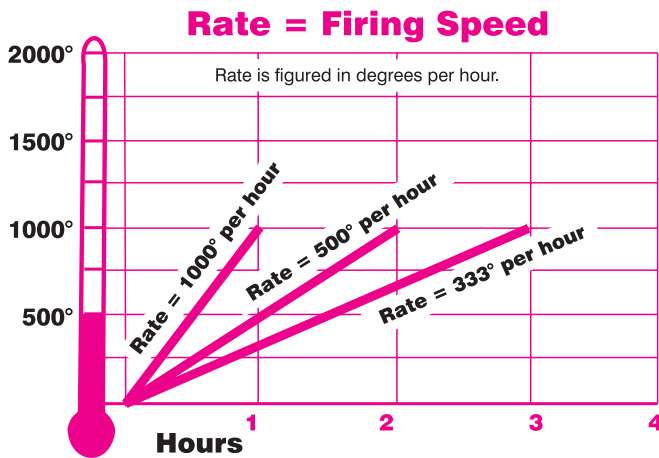
Firing a Stored User Program

After you enter a new program and the display shows **IdLE**, the new program is in memory and ready to fire.

Selecting a different stored program takes only seconds:

- 1 From **IdLE** press **4**.
- 2 **USER** will appear. Enter the program number (1 - 9).
- 3 If there are no changes to the program, press **STOP** twice. **IdLE** will appear. The controller is ready to fire your selected program. To begin firing, press **ENTER** once.

Note: Use *Program Review*, page 7, before firing. See also "Repeat Firings," page 6.



Rate

Each segment must include a rate, which is the firing speed of that segment. We measure rate as degrees per hour. This is similar to miles per hour; just replace miles with degrees. During programming, enter the rate when **rA** appears. (**rA** will also include the segment number: **rA 1** **rA 2** etc.)

The diagram above shows three rates. A rate of 1000° per hour will reach 1000° in 1 hour. A rate of 500° will reach 1000° in 2 hours. A rate of 333° will reach 1000° in 3 hours.

If you want the kiln to fire at full speed, enter a rate of 9999. See step 3, next column.

Ramp-Hold Programming

4
RAMP
HOLD

Use these instructions for your first firings. Later you may prefer "Ramp-Hold Shorthand Instructions," back cover.

As you follow these steps, you will see values (temperatures, rates, etc.) from the last firing. To use these again, press **ENTER**. To program a controlled cooling, set the segment to a lower target temperature than that of the preceding segment.

To fire without Alarm or Delay: Follow steps 1 through 7. Then press **START** once.

- 1 Apply power to the kiln. **8888** then **IdLE** will appear. (Press **ENTER** if **IdLE** does not appear.)
- 2 Press **4**. **USER** will appear. Enter a program number from 1 to 9.
- 3 Press **ENTER**. **rA 1** will appear. Enter firing rate for segment 1 (temperature change per hour: from 1° to 9999°).
- 4 Press **ENTER**. **°F 1** (or **°C 1**) will appear. Enter the target temperature of segment 1.
- 5 Press **ENTER**. **Hd 1** will appear. Enter segment 1 hold time in hours / minutes (e.g. 12 hours, 30 minutes = 12.30). No hold = 00.00.
- 6 Press **ENTER**. If **FN 1** appears, and you have an AOP receptacle on your kiln, use the 1 or 2 key to select ON or OFF. Press **ENTER**. (For more details on AOP, see page 16.)
- 7 Continue entering values for the segments needed. When **RA** appears for the first segment you don't need, press **0**, then **ENTER**. **IdLE** will appear. The kiln is ready to fire.
- 8 **To set Alarm:** press **7**. **ALAR** will appear. Enter alarm temperature. (Enter **0** to turn alarm off.) Then press **ENTER**. **IdLE** will appear.
- 9 **To set Delay:** press **3**. **dELA** will appear. Enter delay time (i.e. 12 hours, 30 minutes = 12.30). Then press **ENTER**. **IdLE** will appear. (Delay zeroes out after each completed firing.)
- 10 **To start program:** From **IdLE** press **ENTER** once. **STRT** will appear, then kiln temperature. If a delay was programmed, **DELA** will appear, then time remaining until start. To stop the firing at any time, press **STOP**.

We recommend using *Program Review* (page 7) before firing. When program fires to completion, **CPLT** will appear. Press **ENTER**. **IdLE** will appear.

Note: In Program Review, a heating rate of 9999 is displayed as **FULL**. When a kiln is heated at full power, it may overshoot the target temperature, especially in the lower range. To avoid this, add an extra segment with a slower rate for the last 50 degrees of temperature rise.

CAUTION: The Sentry includes error messages to warn you when the kiln is at the wrong temperature. Firing the kiln at full rate turns off some of these warnings. See TEdE, Temperature Deviation, page 24, and HTdE, High Temperature Deviation, page 27.

If you are not sure how fast to fire, remember an old firing adage: When in doubt, slow it down.

Note: At the time that you purchase the controller, the factory can set up your controller to calculate rate in one of three ways: 1) degrees of temperature change per hour 2) degrees of temperature change per minute, or 3) elapsed time needed to reach a temperature. The normal setting is degrees per hour. If you are having problems entering rate, check the RATE option to be sure your controller is set for degrees per hour, page 23. (This note applies only to 18D and later software versions. All pre-18D controllers figure rate only as degrees per hour. See page 25, SOFT option, to look up software version.)

Hold (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 gives the temperature time to become more even throughout the kiln. Hold can be used in either heating-up or cooling-down segments.

Ceramics: Wearing firing safety glasses, watch the witness cone near the end of the firing. (See page 10.) When the witness cone bends, note the hold time. The next time you fire the same type of ware loaded to the same capacity, program that amount of hold time.

Note: When the Sentry is in hold during a firing, the display will alternate between time left in hold and the temperature. To figure hold time needed for the next firing, subtract time left in hold from total hold time entered.

In programming step 5, page 15, enter hold time. When hold is set to 99.99 hours, the Sentry will remain at that temperature indefinitely until you press **STOP**.

AOP Fan

The optional AOP (auxiliary output) is a special-order electric receptacle mounted in the kiln's switch box. This receptacle can power a kiln vent or external alarm. (See Options, page 22.) During programming, **FN** will appear for each segment (**FN 1 FN 2 FN 3** etc.). Use the 1 and 2 keys

to select On or Off for each segment. **FN** will appear only if the AOP has been activated in the AOP Option.

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. Then 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 a rate of 9999. 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: See Temperature Deviation (TEdE), page 24, for information on error codes that may appear during "crash" cooling. To turn these codes off, program a crash cooling rate of 9999. This turns off TEdE error codes only for that particular segment. The TEdE codes still work on the hold and the other segments.

Suppose you enter a cooling rate that is faster than the kiln can cool? Depending on the rate you enter, you may get an alarm message. (Press **ENTER** to turn off the alarm.) **The controller, of course, cannot speed cooling beyond the kiln's natural cooling rate.**

Temperature Overshoot

When a kiln is heated too fast, it may overshoot the target temperature, especially in small kilns at lower temperatures. To avoid this, add an extra segment to slow the firing. The segment with the slower rate should begin approximately 40° - 60° below the final target temperature.

A Practice Program

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

"Rate" is how many degrees per hour the kiln will climb in temperature. (Or how fast it cools during a controlled cooling.)

Using the programming instructions on page 15, enter this firing schedule. Then use Program Review to check for accuracy.

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

USER = 1
RA1 = 250
°F 1 = 750
Hd 1 = 00.00
RA2 = 900
°F 2 = 1425
Hd 2 = 00.30
RA3 = 150
°F 3 = 750
Hd 3 = 00.00
RA4 = 0

If you fire at a very rapid rate, the kiln may momentarily overshoot the programmed target temperature. To avoid that, use a slower rate.

Note: Enter 0 for the rate in segment 4. This zeroes out all the segments past segment 3.

Sample Firing Schedules

These sample firing schedules illustrate different ways to program the Sentry. When designing a firing schedule for materials you are unfamiliar with, or when using one of these schedules, always test-fire samples first. This is because these generalized schedules may not suit the clay or glass that you use.

For practice, you might want to enter these programs even though you may never actually use them.

Cone-Fire Program Customized in Ramp-Hold

This is the cone 04 Cone-Fire schedule at standard (Medium) speed with an added slow-cooling segment. (See Cone-Fire schedules on pages 32 - 33.)

Segment	Rate °F/°C	Temp. °F/°C	Hold
1	324/180	1022/550	00.00
2	153/85	1112/600	00.00
3	180/100	1837/1003	00.00
4	108/60	1945/1063	00.00
5	150/83	1000/537	00.00

In this schedule, the kiln will cool at 150°F/83°C per hour to 1000°F/537°C. Some ceramists use slow cooling to enhance certain glazes.

Sculptured Stoneware Bisque Firing Schedule, Cone 04

Segment	Rate °F/°C	Temp. °F/°C	Hold
1	60/33	200/93	03.00
2	80/44	700/371	02.00
3	80/44	1100/593	00.00
4	108/60	1945/1062	00.00
5	150/83	1400/760	00.00

This slow firing is for thick stoneware. Change the target temperature in segment 4 when firing to a different pyrometric cone. The ware should be bone dry. Test samples until you are sure the schedule works for your ware.

If you are not using a kiln vent, leave peephole plugs out and vent the lid. Set the alarm to 1000°F. When the alarm sounds, close the lid from venting position.

Set the alarm again, this time to 1850° F. When it sounds, check the witness cone through the peephole. When the cone bends to six o'clock, write down the temperature. (Use that temperature in segment 4 on your next firing of the same type of ware.) Then press 9, ENTER (Skip Segment).

This will advance you to segment 5, a slow cooling segment. Do not open the lid until the kiln has cooled to room temperature.

Glass Fusing Firing Schedule

Segment	Rate °F / °C	Temp. °F / °C	Hold
1	250 / 138	750 / 398	00.00
2	900 / 500	1425 / 773	00.30
3	9999 / 9999	1050 / 565	00.00
4	150 / 83	750 / 398	00.00

Stained glass, 1/8", 2 layers, full fuse. The fusing temperature will vary depending on the brand of glass, the batch, and even the color. Vent the lid. Set the alarm to 500°F. When the alarm sounds, close the lid from venting position and insert peephole plugs.

Set the alarm again, this time to 1350°F. When it sounds, check the glass through the peephole. When the glass fuses to your satisfaction, write down the temperature and hold time for future firings, and press 9, then **ENTER** (Skip Segment).

This will advance the kiln to segment 3, a flash cooling segment. Lift the kiln lid slightly or open the door ajar until the temperature drops to 1050° F. Then close the door / lid. The kiln will cool slowly through the annealing range, then turn off.

Note: A cooling rate of 9999 (FULL) shuts off the warning alarm (error message) that sometimes sounds during rapid cooling. This turns off the alarm only for that particular ramp. The alarm codes still work on the hold and the other programmed segments. For details about error messages, see pages 26 - 28.

Glass Slumping Firing Schedule

Segment	Rate °F / °C	Temp. °F / °C	Hold
1	250 / 138	750 / 398	00.00
2	900 / 500	1250 / 676	00.30
3	9999 / 9999	1050 / 565	00.00
4	150 / 83	750 / 398	00.00

Stained glass, 1/8", 2 fused layers, 12" circular pieces, slumped into a bowl. Set the alarm to 500° F. When the alarm sounds, close the lid from venting position and insert peephole plugs.

Set the alarm again, this time to 1150° F. When it sounds, check the glass through the peephole. When the glass slumps into the bowl, write down the temperature and hold time for future firings, and press **9**, then **ENTER** (Skip Segment).

This will advance the kiln to segment 3, a flash cooling segment. Lift the kiln lid slightly or open the door ajar until the temperature drops to 1050° F. Then close the door/lid. The kiln will cool slowly through the annealing range. Then it will turn off and cool to room temperature.

Note: A cooling rate of 9999 (FULL) shuts off the warning alarm (error message) that sometimes sounds during rapid cooling. This turns off the alarm only for that particular ramp. The alarm codes still work on the hold and the other programmed segments. For details about error messages, see pages 26 - 28.

Starting a Firing in a Hot Kiln

Sometimes a firing begins in a hot kiln after a power failure or other interruption. In this case, the Sentry will begin firing from the first segment that matches the current temperature. See Power Failures, page 28.

When the Kiln Shuts Off Too Soon

Ceramic Firings

If the kiln fires to completion before the pyrometric witness cone bends, you can turn the kiln back on and keep firing. First, program a hotter temperature. Then from **IdLE**, press **START**. The kiln will begin firing, taking up where it left off.

Note: By looking at the witness cones through a peephole, you will know if the kiln shuts off too soon.

If the kiln shuts off within 100°F/55°C of maturity, and the temperature drops 50°F/28°C or more after the kiln shuts off, do not depend on the witness cones. Once they cool 50°F/28°C after they have been heated to within 100°F/55°C of maturity, they will not bend properly. This is because they form a hard shell.

Wrong Thermocouple Type

If a Type-K thermocouple is installed on your kiln, but Type-S is selected in Options, the kiln will continually underfire by a wide margin. (The kiln will overfire if Type-S is installed and Type-K is selected.) See page 22 to check the thermocouple type selected in Options.



Chapter 5 Multiple Zone Kilns

Note: See also *Multiple Zone Options*, page 25.

An Overview of Multiple-Zone Firing

If you are not sure how many zones your kiln has, look into the firing chamber. The number of thermocouple tips indicates the number of zones.

Look into the firing chamber. The number of thermocouple tips indicates the number of zones.

In single-zone kilns, the Sentry measures temperature from one location. When the controller turns on the heat, all the elements turn on.

With two and three zone kilns, the Sentry measures temperature from each individual zone. It then adjusts

the heat separately for each zone to improve temperature uniformity.

To maintain even temperature, the Sentry calculates not only temperature difference between zones, but also length of time needed to change temperature. By carefully timing heat output, it maintains even temperature with a minimal loss in firing speed.

Note: Multiple-zone kilns use the same Cone-Fire and Ramp-Hold programming instructions as single-zone kilns.

Note: Firing a Ramp-Hold program at FULL rate (9999) shuts off multiple-zone control for that firing. The kiln then fires as a single-zone kiln.

Keep a record of your stored programs and all your firings. Write down the results of each firing. This may become invaluable later.

Thermocouple Failure In a Multiple-Zone Kiln

In a multiple-zone kiln, if a thermocouple fails, the firing will continue as a single-zone kiln so long as one thermocouple still operates. **FAIL** will appear, alternating with the thermocouple that failed. (See page 26 for multiple-zone thermocouple error messages.)

Power Output Lights

The three lights on the right of the temperature display turn on when the controller sends a signal to the relays.

- **Single-Zone Kiln** When the Sentry sends a signal to the relays, all three lights appear.



- **Two-Zone Kiln** The top light indicates power to the top section of the kiln. The bottom light indicates power to the bottom section. Ignore the center light.

- **Three-Zone Kiln** The top light indicates power to the top section, the middle light is power to the middle section, and the bottom light is power to the bottom section.

When a zone temperature is too low, its indicator light will flash rapidly. The heating elements in that zone will stay on continuously, and the controller will attempt to balance the heat in the other two zones.

The Sentry is packed with features. Do not let this intimidate you. Become familiar with only the features you need; ignore the rest.

Testing Multiple-Zone Elements

When relays or thermocouples are connected to the wrong controller terminals, zones will show a wide temperature difference. To wire the kiln properly, trace the switch box wiring with the kiln's wiring diagram. Also, see "Element Test," page 25.

Your kiln or furnace will eventually develop fine cracks in the firing chamber. This is normal. The cracks close at high temperatures.



Chapter 6 The Options Key



The Options key gives you access to a list of special features. With each press of the Options key, you will see the display code for the next option.

- 1 When you find the option you want to use, press **ENTER**.
 - 2 Use the **1** and **2** keys to select changes within the option.
 - 3 After making a selection for an option, press **ENTER**. The display code for the option you just changed will appear. You are then ready to go to the next option.
- In Cone-Fire mode, you will see more options than in Ramp-Hold mode.
 - If you select a change for an option but don't press **ENTER**, the change will not go into effect.

There are two ways to get out of Options and back to **IdLE**:

- 1 Press **STOP**.
- 2 Do nothing for 60 seconds in Options. You will automatically be taken out of the Options display and back to **IdLE**.

Note: *If you are firing the kiln while in Options, pressing **STOP** takes you out of Options and back to the firing display. But it does not stop the firing.*

Cone-Fire Options

These options appear only if a Cone-Fire program has been selected. If your controller has Ramp-Hold mode only, skip to General Options, page 21.

SPd / Cone-Fire Speed

Adjust Cone-Fire Speed Beyond Slow, Medium & Fast

There are two ways to adjust the speed of a cone fire:

- 1 Select Fast (1), Medium (2), or Slow (3) when programming a firing.
- 2 Alter a speed in the Speed (Spd) option.

Every cone has a standard firing schedule. Select Medium speed (the 2 key) during Cone-Fire programming, and the cone will fire to the standard schedule. Select Fast (1), and the standard schedule will speed up by 20%. Select Slow (3), and the standard schedule will slow down by 20%.

In the Speed option, you can further adjust the speed of a standard schedule 10 - 40% slower or faster:

- 1 First, program a Cone-Fire.
- 2 After programming a Cone-Fire, **IdLE** will appear. From **IdLE**, press **OPTIONS** until **SPd** appears.
- 3 Press **ENTER**. Use the **1** or **2** key to scroll through this selection:

Std Same as Medium in cone programming

F10 10% faster than standard

F20 Same as Fast in cone programming

F30 30% faster than standard

F40 40% faster than standard

S40 40% slower than standard

S30 30% slower than standard

S20 Same as Slow in cone programming

S10 10% slower than standard

When the speed of choice appears, press **ENTER**.

- 4 To go back to **IdLE**, press **STOP**.

The kiln is now ready to fire with the new speed.

OFST / Cone Offset

Calibrate Cone-Fire to a Shelf Cone

Sometimes the pyrometric cone programmed in Cone-Fire does not match the bending of the witness cone. Cone Offset will adjust Cone-Fire to fire hotter or cooler.

Each time you use Cone Offset, you alter the temperature for only one of the three ranges of cones:

- Low fire cones 022 - 011
- Medium fire cones 010 - 01
- High fire cones 1 - 10

The range of cones affected by Cone Offset is determined by the cone programmed to fire when you enter Cone Offset.

Example: You have programmed an 05 cone in Cone-Fire. By changing Cone Offset, you change not only the firing of the 05 cone, but all medium fire cones from 010 to 01.

Adjusting one range of cones has no effect on the other two. To adjust all the cones equally, use Thermocouple Offsets, page 21.

Note: Use Cone Offset to adjust one particular temperature range of cones. Use Thermocouple Offset to make an overall adjustment for all firings in both Cone-Fire and Ramp-Hold.

Follow these guidelines before deciding that you need to use Cone Offset:

- The thermocouple must protrude into the firing chamber the correct distance: about 1" for 1/4" wide thermocouples, 1/2" - 5/8" for 1/8" wide thermocouples.

- Keep shelves 1" - 1 1/2" away from the thermocouple.
- Keep witness cones at least 2" away from heating elements.
- Place witness cones in several locations in the kiln.

How to Use Cone Offset

Cone Offset changes the shut-off point of the cone by the degrees of temperature shown in the chart below.

- 1 First, program a Cone-Fire.
- 2 From **IdLE**, press **OPTIONS** until **OFST** appears.
- 3 Press **ENTER**. The current Cone Offset adjustment number will appear.
- 4 Using the **1** and **2** keys, select a new adjustment number (see chart below). Then press **ENTER**. **OFST** will appear. To return to **IdLE**, press **STOP**.

Cone Offset Settings

Note: select a cone in Cone-Fire before changing Cone Offset.

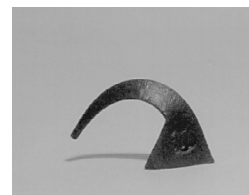
°F Setting	°C Setting	Result
0	0	No adjustment
5	3	Kiln will fire hotter
10	6	Kiln will fire hotter
15	8	Kiln will fire hotter
20	11	Kiln will fire hotter
-5	-3	Kiln will fire cooler
-10	-6	Kiln will fire cooler
-15	-8	Kiln will fire cooler
-20	-11	Kiln will fire cooler

Cone Offsets remain in memory for future firings unless you use the Reset option (page 25).

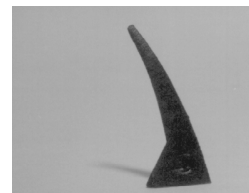
Interpreting Cone Bending

Position the witness cone in the kiln according to instructions on page 10.

The cone bent to 6 o'clock: No calibration in Cone Offset needed. The self-supporting cone has fired to maturity when the tip is even with the cone base as shown.



The cone did not bend far enough: Use a positive Cone Offset number for a hotter firing, such as 10 (°F).



The cone bent too far: Use a negative Cone Offset for a cooler firing, such as -10 (°F).

Note: Do not be overly concerned with achieving an exact 6 o'clock bend. The difference between a 3 o'clock and a 6 o'clock bend is only a few degrees.



When Cone Temperature Is Off More Than 20°F/11°C

The maximum amount that Cone Offset can change the temperature is 20°F/11°C. When the temperature is off more than that amount, correct with Thermocouple Offset.

FAN

Control the Optional AOP Receptacle in Cone-Fire

The AOP (auxiliary output) is a special-order kiln switch box receptacle. The Sentry controls the power to the AOP receptacle. The AOP is usually used to power a kiln vent. In the Fan option, select when an AOP-powered kiln vent will turn on during Cone-Fire.

Before the Fan option will appear on the Options list, (1) you must enter a Cone-Fire program in active memory and (2) you must select **VFAN** in the AOP1 or AOP2 option. (See page 22 for instructions on selecting **VFAN**.)

- 1 From **IdLE**, press **OPTIONS** repeatedly until **FAN** appears.
- 2 Press **ENTER**. Use the **1** and **2** keys to select one of these settings:
 - **ON** The vent is on during Pre-Heat, the cone firing, and Slow Cooling. It turns off at 212°F/100°C.
 - **OPT** The vent is on during Pre-Heat and the cone firing. Then it shuts off. (It is off during Slow Cooling.)
 - **OFF** The vent is off all the time.
- 3 After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.

Note: If the temperature is above 1650°F/900°C and the kiln is struggling to reach temperature, the vent fan will automatically turn off.

General Options

General options are available on all Sentry controllers.

TCOS / Thermocouple Offset Calibrate the Thermocouple(s)

The thermocouple is the rod protruding into the firing chamber. It measures temperature. Thermocouples can “drift” as they age, causing a shift in temperature readings. Thermocouple Offset calibrates the controller to compensate for drift.

Note: The thermocouple must protrude into the firing chamber the correct distance: 1” for 1/4” wide thermocouples, 1/2” - 5/8” for 1/8” wide thermocouples.

Thermocouple Offset for Ceramic Firings

In ceramics, Cone Offset (see page 20) adjusts only one range of pyrometric cones without affecting the other cones. Thermocouple Offset, on the other hand, affects all cones and all Ramp-Hold firings equally. For example, a 5° hotter setting in Thermocouple Offset fires everything 5° hotter.

Note: If you find that all your cones are consistently under- or over-firing, adjust Thermocouple Offset. If you need to adjust only a particular cone, use Cone Offset.

Calibrating Thermocouple Offset With a Digital Pyrometer

You can calibrate Thermocouple Offset using a calibrated digital pyrometer. One way to calibrate your pyrometer is to take it to a heat treater or other location that has a calibrated controller you can trust. Take a reading from a furnace with your pyrometer. Either zero it out to match the calibrated controller on the furnace, or write down the temperature difference between your pyrometer and the reliable source. Store your pyrometer. Use it only for calibrating controllers. Thus, it remains a reliable calibration standard.

Note: The temperature at which you calibrated your digital pyrometer should be the same temperature you use to check the controller's temperature readout. Example: If you took a reading from a reliable source at 2000°F, you should check the controller reading at around 2000°F.

Mount the thermocouple of the calibrated pyrometer in the firing chamber near the Sentry's thermocouple. With the Sentry on Hold, compare readings between the Sentry and the calibrated pyrometer. Adjust Thermocouple Offset to compensate for any temperature difference between them.

Note: You can also return your controller to the factory to have it calibrated on certified test equipment.

Setting Thermocouple Offset

You can enter a temperature change up to 45°F/25°C higher or lower than the zero factory setting.

- 1 From **IdLE**, press **OPTIONS** repeatedly until **TCOS** appears.
- 2 Press **ENTER**. **CO**, or a Thermocouple Offset, will appear.
- 3 Using the **1** and **2** keys, enter the new offset. (See chart on next page.) Press **ENTER**. **TCOS** will appear. To return to **IdLE**, press **STOP**.

Cone Offset affects a range of cones in Cone-Fire mode. Thermocouple Offset affects all firings in both modes.

Thermocouple Offset Settings

°F Setting	°C Setting	Result
C 0	C 0	No adjustment
H 1-45	H 1-25	Kiln will fire hotter
C 1-45	C 1-25	Kiln will fire cooler

Thermocouple Offset Examples

Setting	Result
H 1	Kiln will fire 1° hotter
H 17	Kiln will fire 17° hotter
C 12	Kiln will fire 12° cooler

Multiple-Zone Thermocouple Offset

- From **IdLE**, press **OPTIONS** repeatedly until **TCOS** appears.
 - Press **ENTER**. **TC1** (top thermocouple) will appear.
 - While **TC1** displays, press **OPTIONS**. The other thermocouple(s), then **TCOS**, will appear with each press of the **OPTIONS** key.
- 3 zone kilns: **TC1** **TC2** **TC3** **TCOS**
 2 zone kilns: **TC 1** **TC3** **TCOS**
- When the correct thermocouple appears, press **ENTER**.
 - Using the **1** and **2** keys, enter the new offset. (See charts above.) Press **ENTER**. The thermocouple you adjusted (i.e. **TC**) will appear. Select another thermocouple, or return to **IdLE** by pressing **STOP**.

CHG- / Selecting °F or °C

The controller operates in your choice of Fahrenheit or Celsius temperature. In °C display, a lighted dot appears in the lower right. In °F, it disappears. To switch from °F to °C or vice versa:

- From **IdLE**, press **OPTIONS** repeatedly until **CHG-** appears.
- Press **ENTER**. Use the **1** and **2** keys to select **°F** or **°C**.
- After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.

°F/°C Temperature Conversion Formulas

Below are formulas for converting temperature between °F and °C. Converting a firing rate requires a different formula than converting a firing temperature:

Firing to a Temperature

(i.e. "Fire to 1600°F." 1600°F = 871°C)

$$(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$$

$$(^{\circ}\text{F} - 32) \div 1.8 = ^{\circ}\text{C}$$

Firing Rate or Temperature Change

(i.e. "Fire at 200°F per hour" or "Fire 200°F hotter." 200°F = 111°C)

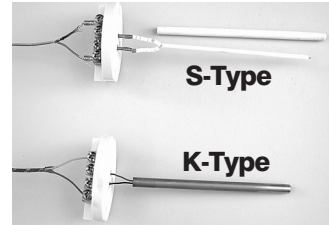
$$^{\circ}\text{C} \times 1.8 = ^{\circ}\text{F}$$

$$^{\circ}\text{F} \div 1.8 = ^{\circ}\text{C}$$

TC / Thermocouple Type

Select Type-K, -S or -R Thermocouple

The Sentry can use Type-K, -S or -R thermocouples. If you specialize in firings above 2200°F / 1204°C, you should use the Type-S or -R. Type-K is best suited for temperatures below 2200°F / 1204°C.



The S-Type thermocouple has a ceramic sheath. Most K-Type thermocouples have a metal sheath.

The controller cannot detect the type of thermocouple installed in your kiln. So if you change the thermocouple to a different type, be sure to select the new thermocouple type in TC option.

Note: Ask your kiln supplier if you are not sure about the type of thermocouple in your kiln.

CAUTION: Be careful about changing the thermocouple type! If you select Type-S or -R, but your kiln is wired with a Type-K, your kiln will underfire. If you select Type-K and your kiln is wired with a Type-S or -R, your kiln will OVERFIRE. After using the Reset (RST) option (page 25), use the TC option to select the correct thermocouple. Reset changes the thermocouple selection to Type-S.

- From **IdLE**, press **OPTIONS** repeatedly until **TC** appears.
- Press **ENTER**. Use the **1** and **2** keys to select **TC K**, **TC R** or **TC S**.
- After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.

AOP1, AOP2 / Auxiliary Outlets

Select Vent Fan or Alarm for the Auxiliary Outputs

The optional AOP1 and AOP2 (Auxiliary Outputs) are for electrical receptacles mounted in the kiln's switch box. The outlets can each power a kiln vent or an external alarm, such as a bell. (The AOP outlet is a special-order option that might not be included on your kiln.)

The choices in the AOP1 and AOP2 options:

- **ALRM Alarm:** This choice sends power to the AOP receptacle whenever the alarm sounds. (See Temperature Alarm, page 8.) Plug in a loud bell to alert you, from a distance, that the kiln has reached the alarm temperature. (Controllers with pre-20A software: Select **F2A3**.)
- **NONE None:** Use this setting if your kiln does not have the AOP outlet.
- **VFAN Kiln Vent or Gas Outlet:** This option adds a prompt for fan (**FN**) to each segment during Ramp-Hold programming (page 15). (Controllers with

pre-20A software: Select **A2F3** or **FAN3**—whichever appears.)

- 1 From **IdLE**, press **OPTIONS** repeatedly until **AOP1** or **AOP2** appears.
- 2 Press **ENTER**. Use the **1** and **2** keys to select **VFAN**, **ALRM** or **NONE**.
- 3 After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.

RATE / Types of Rates

Note: This feature is included on controllers with software version 18D or newer. To look up your software version, see the *SOFT* option, page 25.

The standard method of programming firing rate is degrees of temperature change per HOUR. At the factory, we can set up your controller to calculate rate instead as degrees of temperature change per MINUTE, or as ELAPSED TIME needed to reach a temperature. The RATE option shows you which method your controller uses:

- 1 From **IdLE**, press **OPTIONS** repeatedly until **RATE** appears.
- 2 Press **ENTER**. You will see one of the following:
HOUR (Degrees of temperature change per hour)
MIN (Degrees of temperature change per minute)
TIME (Elapsed time needed to reach a temperature)

Only the factory can change the type of rate used in your controller.

Note: If your controller uses *TIME* rate, enter the hours/minutes that each segment will take to reach its target temperature. (Example: 1 hour, 30 minutes = 01.30.)

COST / Electric Cost Per Kilowatt-Hour

Note: This feature is included on controllers with software version 18D or newer. To look up your software version, see the *SOFT* option, page 25.

The controller can figure the cost of a firing if you enter the cost of electricity for your area (and kiln wattage—see next option). The cost of electricity is figured in kilowatt-hours (KWh). A kilowatt-hour is 1,000 watts of electricity running for 1 hour. (10 – 100-watt light bulbs glowing for one hour consume 1 KWh of electricity.)

To find what the power company charges you for a kilowatt-hour, look at your electric bill, call your power company, or visit their website. The electric rate may vary depending on the time of year and amount of electricity you use. In the summer, rates in some areas are higher. Also, add the other costs listed on your electric bill, such as power transmission charges, taxes, etc.

- 1 From **IdLE**, press **OPTIONS** repeatedly until **COST** appears. Press **ENTER**.
- 2 From an electric bill, enter the cost of a kilowatt-hour. Place cents to the right of the decimal. Round off fractions. (Example: Enter 9.25 cents per kilowatt-hour as 00.09.) Press **ENTER**.
- 3 Press **STOP** to return to **IdLE**.

Note: You can enter the cost in U. S., Canadian, or Euro cents, British pence, Indian paisas, or any other money system that is based upon 100 units (i.e. 100 cents = 1 dollar.) If your system is based upon 1000 units, such as the Libyan dirham, the Oman baiza, or the Kuwait fil, divide the cost by 10. Example: Enter 140 as 00.14. Then multiply by 10 the cost of a firing shown in the controller display.

KW / Kilowatts Used to Calculate Firing Cost

Note: This feature is included on controllers with software version 18D or newer. To look up your software version, see the *SOFT* option, page 25.

To figure the cost to fire your kiln, the controller needs to know how many kilowatts your kiln uses. Look at your kiln's electrical data plate. It is usually on the side of the switch box. The data plate lists the watts, amps, and volts. If watts are not listed, multiply amps x volts. (Example: 15 amps x 240 volts = 3,600 watts.)

Divide the wattage of your kiln by 1000, which gives the kilowatts. (Move the decimal point 3 spaces to the left.)

Examples:

$$10,800 \text{ watts} \div 1000 = 010.8$$

$$4,800 \text{ watts} \div 1000 = 004.8$$

$$800 \text{ watts} \div 1000 = 000.8$$

Enter that amount in the KW option:

- 1 From **IdLE**, press **OPTIONS** repeatedly until **KW** appears. Press **ENTER**.
- 2 The controller shows 4 digits for entering kilowatts: **000.0**. Enter kilowatts for your kiln.
- 3 Press **ENTER**.
- 4 Press **STOP** to return to **IdLE**.

Note: Please do not confuse kilowatts with kilowatt-hours. A kilowatt is 1,000 watts. A kilowatt-hour is 1,000 watts powered for one hour.

To view the cost of a firing, press the **8** key after the kiln has fired to completion and **CPLT** flashes.

Id / Computer ID

Enter an ID Number for Connection to a Computer

This feature is for assigning an identification number, from 1 to 15, to the controller. It is used only for hookup to a personal computer, which requires an optional kit.

- 1 From **IdLE**, press **OPTIONS** repeatedly until **Id** appears.
- 2 Press **ENTER**. Use the **1** and **2** keys to select an ID number from 1 to 15. Press **ENTER**. Press **STOP** to return to **IdLE**.

TEdE / Temperature Deviation

Adjust Temperature Sensitivity of Error Codes

The temperature that the controller is trying to reach, at any given time, is called the set point. During heating or cooling, the set point changes at the rate you programmed. During a hold, the set point remains steady.

The Sentry shows error messages when it can't maintain the set point temperature. The cushion, or leeway, allowed before an error message flashes is called Temperature Deviation. When the temperature is off target by more than the Temperature Deviation setting, the alarm sounds. Temperature Deviation affects these error messages (see page 26):

FTH Fail to Heat

FTC Fail to Cool

LTdE Low Temperature Deviation

Note: *On controllers that have pre-18D software, the TEdE setting also affects the HTdE High Temperature Deviation alarm (page 27). On 18D and later controllers, the HTdE setting is always 100°F / 56°C.*

Some people worry when **FTH**, **FTC** or **LTdE** appears. They wonder if something is wrong with the kiln. Here are four ways to stop the alarm messages from appearing during routine firings:

Method 1: Test your kiln to find its fastest firing rate and its slowest cooling rate. Then program the controller using rates within the range of the kiln's heating/cooling capacity. Example: If your fastest heating rate is 600° per hour, enter a rate no faster than 600°.

Method 2: Set the deviation temperature to a higher number in the TEdE option. The higher the number, the less likely that an alarm message will appear.

Method 3: Set the deviation temperature to 0 in the TEdE option. This turns off the FTH, FTC and LTdE alarms (page 26). We do not recommend a 0 setting.

Method 4: Program a segment at FULL rate (9999°). This will shut off the deviation alarms for that segment. (However, deviation alarms will continue to work during the hold and all other segments with slower rates.)

CAUTION: *The High Temperature Deviation (HTdE) alarm shuts off the kiln to prevent an overfire. On controllers with pre-18D software, entering a tem-*

perature deviation of 0 turns off this important alarm! On all controllers, entering a FULL rate also turns off this alarm for the segment with the FULL rate.

Changing the Deviation Temperature

- 1 From **IdLE**, press **OPTIONS** repeatedly until **TEdE** appears.
- 2 Press **ENTER**. Change the deviation temperature. The higher the number, the less likely you will activate the alarms.
- 3 Press **ENTER**. Press **STOP** to return to **IdLE**.

Note: *The factory default TEdE setting is 100°F / 56°C.*

Example: The Fail to Heat code **FTH** appears during a firing when the kiln cannot heat as fast as programmed. The Temperature Deviation **TEdE** is set to 100°F / 56°C. The Fail to Heat code will appear if the temperature is 100°F / 56°C or more below the set point.

SFTY / Maximum Temperature

View the Kiln's Maximum Operating Temperature

From **IdLE**, press **OPTIONS** repeatedly until **SFTY** appears. Press **ENTER**. The temperature displayed is the maximum operating temperature programmed in the Sentry for your kiln. (This temperature is also shown on the kiln's electrical data plate.) It can be altered only at the factory. The controller will not fire hotter than that temperature. Press **ENTER**. Press **STOP** to return to **IdLE**.

ELEC / Electronics Temperature

Check the Circuit Board Temperature

High temperatures in the switch box can damage the controller circuit board, which is rated for 176°F / 80°C maximum operating temperature. To lower 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.) When firing several kilns, position them at least three feet apart to allow adequate air circulation.

From **IdLE** or while firing, press **OPTIONS** repeatedly until **ELEC** appears. Press **ENTER**. The temperature of the circuit board will appear. Press **ENTER**. Press **STOP** to return to **IdLE**.

CAUTION: *Do not operate the kiln if the ELEC display is above 158°F / 70°C.*

If you repeat the same firing program often, use Program Lock so that it cannot be inadvertently changed.

LOCK / Program Lock

Make a Program Tamper-Proof

With Program Lock activated, a stored Cone-Fire or Ramp-Hold program cannot be altered or removed from memory. Use Program Lock for repeat firings that you don't want to inadvertently change.

Note: Program Lock does not save a Delay setting. While a program is locked, you can enter a new Delay.

- 1 From **IdLE**, press **OPTIONS** repeatedly until **LOCK** appears.
- 2 Press **ENTER**. **LO** (locked) or **UN** (unlocked) will appear.
- 3 To change the setting, press **DELAY** 3 times.
- 4 Press **ENTER**. Press **STOP** to return to **IdLE**.

CFG / Configuration Code

From **IdLE**, press **OPTIONS** repeatedly until **CFG** appears. Press **ENTER**. The factory configuration code will appear. Press **ENTER**. Press **STOP** to return to **IdLE**. The configuration code can be changed only at the factory.

SOFT / Software Version

From **IdLE**, press **OPTIONS** repeatedly until **SOFT** appears. Press **ENTER**. The software version will appear. Press **ENTER**. Press **STOP** to return to **IdLE**. The software version can be changed only at the factory.

TEST / Element Test

Test the Heating Elements and Relays

This test is useful when measuring the wall receptacle voltage under load, and amperage with an ammeter. On a multiple-zone kiln, the test helps determine if the relays and thermocouples are wired to the correct zones. If you test thermocouples with a cigarette lighter or other heat source, use this option.

Single-Zone Kiln

- 1 From **IdLE**, press **OPTIONS** repeatedly until **TEST** appears.
- 2 Press **ENTER**. **POWR** will appear, alternating with kiln temperature. The elements will turn on for two minutes. Press any key to abort the test.

Multiple-Zone Kiln

- 1 From **IdLE** press **OPTIONS** repeatedly until **TEST** appears.
- 2 Press **ENTER**. **TOP** will appear, alternating with the temperature of the top zone. The elements will turn on for two minutes. Then **MID** will appear, with temperature for the middle zone, and **BOT** with temperature for the bottom zone. (A two-zone kiln shows **TOP** and **BOT** displays only.)
- 3 During the two-minute test, press any key to end a zone test. The controller will then begin to test the next zone.

AOP Outlet

After the above test, kilns equipped with the AOP outlet will display **J3-3** for two minutes to test power to the AOP outlet.

RST / Reset

Reset the Controller to Most Factory Defaults: Perform Only When Requested by a Technician

Reset does the following:

- Selects Type-S thermocouple.
- Selects °F.
- Erases Cone offsets.
- Erases any thermocouple offset.
- Erases Ramp-Hold User programs stored in memory.
- Changes Temperature Deviation (TEdE) back to the factory setting of 100°F / 56°C.

CAUTION: If your kiln uses a Type-K thermocouple, the Sentry will underfire after a reset! Use the Thermocouple Option (page 22) to select Type-K again.

- 1 From **IdLE**, press **OPTIONS** repeatedly until **RST** appears.
- 2 Press **ENTER**. Use the **1** or **2** key to select **NO** or **YES**.
- 3 After selecting one of the above, press **ENTER**. Press **STOP** to return to **IdLE**.

Multiple-Zone Options

These options appear only on multiple-zone kilns.

DIFF / Zone Temperature Difference

View Maximum Temperature Spread

For a two-zone kiln, this option shows temperature difference between the zones. For a three-zone kiln, it shows the highest temperature difference between any two zones. If the temperature shown is larger than expected, go to option T123 to view the temperature of each zone.

- 1 Press **OPTIONS** repeatedly until **DIFF** appears. Press **ENTER**.
- 2 The maximum difference in temperature between any zones will display. (Example: **-003** = 3°)

T123 / Zone Temperature Display

View Temperature of Each Zone

- 1 Press **OPTIONS** repeatedly until **T123** appears. Press **ENTER**.
- 2 The temperature for each zone will display one after the other, cycling for one minute. Then normal temperature display will return. For example:
 - Top zone: **TC 1** | **1250**
 - Middle zone: **TC 2** | **1251**
 - Bottom zone: **TC 3** | **1249**



Chapter 7 Error Messages

- Error messages are accompanied by an alarm.
- Non-interrupting messages do not stop the firing. Terminating error messages do.
- FTH, FTC, and LTdE error messages are based upon the adjustable setting in the Temperature Deviation (TEdE) option (page 24).

Note: On controllers with pre-18D software, the HTdE error message is also based on the TEdE option.

Non-Interrupting Error Messages

Press **ENTER** to silence the alarm. (Do not press **STOP** to silence the alarm.) The error message will remain but the kiln will continue firing. Even though the following error messages appear, the kiln will continue its normal operation. The messages are only to alert you that the kiln could not cool or heat as fast as you had programmed. But they will not shut off the kiln or affect the firing in any way.

Definition of “Set Point”

The temperature that the controller is trying to reach, at any given time, is called the set point. During heating or cooling, the set point changes at the rate you programmed. During a hold, the set point remains steady.

FTC / Failed to Cool

- During a cooling-down ramp, the programmed rate is faster than the kiln can cool. The temperature is above the set point temperature by more than the deviation setting. (See Temperature Deviation, page 24.) Program a slower cooling rate.

Note: On controllers with 18D and later software: Use Present Status to compare the actual rate of the current Ramp-Hold segment with the rate you programmed. (See page 7.)

FTH / Failed to Heat

- During a heating-up ramp, the programmed rate is faster than the kiln can heat. The temperature is below the set point temperature by more than the deviation setting. (See Temperature Deviation, page 24.)

Program a slower rate. Or check for worn or burned out elements, defective relays, low voltage and defective thermocouple.

Note: On controllers with 18D and later software: Use Present Status to compare the actual rate of the

current Ramp-Hold segment with the rate you programmed. (See page 7.)

LTdE / Low Temperature Deviation

- During a cooling-down ramp or a hold, the temperature is below the set point temperature by more than the deviation setting. (See Temperature Deviation, page 24.) Check for worn or burned out elements, defective relays, low voltage and defective thermocouple.

Note: During a firing, Present Status shows the actual firing rate of the current Ramp-Hold segment instead of the rate you programmed. If you think your kiln is heating or cooling too slowly, compare the rate shown in Present Status with the rate you programmed for that segment. This is another reason you should always keep a written record of your firing programs. (Pre-18D software versions show the programmed rate in Present Status rather than the actual rate. See page 25, SOFT option, to look up the software version.)

If you keep getting error codes such as FTH or FTC, see Temperature Deviation on page 24.

PF / Power Failure

PF alternating with normal display means the power failed during firing. After power was restored, the firing resumed.

TC with Lines / Multiple-Zone Kiln Thermocouple Failure

The kiln will continue to fire as long as at least one thermocouple is working. The lines following “TC” represent the position inside the kiln of the thermocouple(s) that failed.

Top line = top thermocouple

Middle line = middle thermocouple

Bottom line = bottom thermocouple

TC Top thermocouple failed

TC Middle thermocouple failed

TC Bottom thermocouple failed

TC= Top and middle thermocouples failed

TC Top and bottom thermocouples failed

TC= Top, bottom and middle thermocouples failed

On Sentry controllers with pre-18D software, “TC” is followed by a number and a line. You can check the software version of your controller by using the SOFT Option. See page 25.

Multiple-zone controllers with 18D or earlier software:

TC 1 Top Thermocouple Failed

TC 2 Middle Thermocouple Failed

TC 3 Bottom Thermocouple Failed

Terminating Error Messages

HTdE, **ETH**, **FAIL**, **FTL** and **TCdE** error messages turn off the kiln and flash the following:

- Total firing time in hours and minutes
- The kiln shutoff temperature
- The current kiln temperature

---- / No Thermocouple

After the controller was plugged in, it could not detect a thermocouple.

BAdP / Bad Programming

Causes:

- A program has been entered with 0 rate in the first segment of a Ramp-Hold firing.
- When you press **START**, all programmed temperatures are below the current kiln temperature of a Ramp-Hold firing.

ETH / Electronics Too Hot

- The circuit board temperature is above 176°F / 80°C.

To lower 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 3 feet away from the kiln.)

FAIL / Thermocouple Failure

The controller is no longer receiving voltage from the thermocouple. Causes:

- Defective thermocouple
- Disconnected thermocouple lead wires
- Defective board
- Electrical noise

FTL / Firing Too Long

- The temperature change is less than 27°F / 15°C per hour and the firing time is two hours longer than the current segment was programmed to fire. This message can appear during heating-up or cooling-down segments. **FTL** sometimes appears because the cooling segment was programmed faster than the kiln could naturally cool down.
- **FTL** will flash if you program a cooling segment temperature that is below room temperature. When **FTL** appears, press **STOP**.

Check for worn or burned out elements, defective relays, low voltage and defective thermocouple. Reprogram a slower rate in heating-up and cooling-down segments.

Note: To avoid **FTL** messages, try firing the kiln at a slower rate.

Note: During a Ramp-Hold firing, Present Status shows the actual firing rate of the current segment instead of the rate you programmed. If you think your kiln is heating or cooling too slowly, compare the rate shown in Present Status with the rate you programmed for that segment. This is another reason you should always keep a written record of your firing programs. (Pre-18D software versions show the programmed rate in Present Status rather than the actual rate. See page 25, SOFT option, to look up the software version.)

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 above the segment's starting temperature.
- A fast rate caused the controller to overshoot the target temperature.
- A relay is stuck in the closed position sending power to the elements.

See "Power Failures," next page.

Note: You can disable the HTdE alarm for a segment by programming a FULL rate (9999°). HTdE will continue to operate during the hold and in all other segments that have slower rates.

Lld / Missing Connector Pin

On the back of the Sentry circuit board, at the top right side, is a small two-pin terminal. If the connector on that terminal is missing, **Lld** will appear in the display during firing. The elements will not turn on. (If the two-pin connector is missing, you can buy another from a computer supply store.)

PF1 / Power Failure

The power failed during a controlled cooling segment. The kiln temperature was below the last active cooling segment temperature when the power came back on. The kiln will not resume firing. See "Power Failures," next page.

PF 2 / Power Failure

The power failed. The kiln temperature was below 212°F / 100°C when the power came back on. The kiln will not resume firing. See "Power Failures," next page.

PF 3 / Power Failure

The power failed. The temperature dropped 72°F / 40°C while the power was off. The kiln will not resume firing. See "Power Failures," next page.

TC 2 / Thermocouple Failure

The thermocouple of a single-zone kiln failed while the controller was at **ldLE**.

TCdE / Uneven Multiple-Zone Temperatures

The zones of a multiple-zone kiln are firing unevenly. Causes:

- A burned out element or relay
- The thermocouples and elements are improperly wired. A thermocouple is turning on the elements to the wrong zone. For instance, if the top thermocouple turns on the bottom elements, the kiln will fire out of balance. When zones are out of balance by 180°F / 100°C, **TCdE** will appear in the display.

Visually compare the wiring of the thermocouples, relays and elements in your kiln to the kiln's wiring diagram. Also, use the Element Test option shown on page 25.

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. The TCL becomes inactive above 500°F/260°C.

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. When **TCL** appears, press **STOP**.
- Check for worn or burned out elements, defective relays, low voltage and defective thermocouple.

Note: *The TCL alarm is available only on software version 18D or later. You can check the software version of your controller by using the SOFT Option. See page 25.*

TCR / Thermocouple Leads Reversed

Check that the thermocouple lead wires are connected to the correct terminals. See your wiring diagram.

Power Failures

The Sentry handles a power failure in two ways:

- 1 After a brief power failure, the controller continues firing as before. It shows a normal temperature display alternating with **PF**.
- 2 After an extended power failure, **PF 1**, **PF 2** or **PF 3** will appear. The kiln will NOT resume firing.

The kiln will remain turned off after a power failure under these conditions:

- The kiln will remain off if the temperature is below 212°F / 100°C when the power comes back on.
- The kiln will remain off if the temperature dropped 72°F / 40°C or more.

When the Sentry aborts a firing after a power failure, the display will show the following:

- **PF 1**, **PF 2** or **PF 3**
- Total firing time before power failed
- Temperature at the time of power failure
- Current kiln temperature

To resume firing, press **ENTER**. The kiln will begin firing again from its present temperature. For example, the kiln reached 1000°F / 538°C when power failed. The temperature is 800°F / 426°C when you turn the kiln back on. Firing will resume from 800°F / 426°C. You need not cool the kiln to room temperature before starting a ceramic firing over unless you decide to use new witness cones.

When you resume firing by pressing **ENTER**, the controller begins firing in the first segment that has a higher target temperature than the current kiln temperature. However, if the power failed during a ramping down (cooling) segment, the controller will resume firing from the same cooling segment.

Using Ceramic Shelf Cones After an Extended Power Failure

- **The firing was interrupted more than 100°F/56°C from the terminal temperature:** Fire the ware again. It is okay to use the same partially fired witness cones, even if they cooled back down to room temperature. So long as the cones did not heat to within 100°F/56°C of maturity, they can be used again.
- **The firing was interrupted less than 100°F/56°C from the terminal temperature:** Fire the ware again. If the kiln shuts off within 100°F / 55°C of maturity, and the temperature drops 50°F / 28°C or more after the kiln shuts off, do not depend on the witness cones. Once they cool 50°F / 28°C after they have been heated to within 100°F / 55°C of maturity, they will not bend properly. This is because they form a hard shell.

The warranty does not cover damage from over-firing. Please check the kiln to make sure it shuts off at the proper time.

Frequently Asked Questions

Does the increase in Ramp-Hold temperature assume a one hour time period?

Yes. When you program the rate, you are telling the controller how much the temperature needs to go up or down per hour. A car's speedometer measures speed in miles or kilometers per hour. To understand temperature rate, think of a speedometer that measures temperature change per hour instead of miles. This applies to both heating and cooling rate. At a rate of 100 degrees per hour, the kiln would take 10 hours to reach 1000 degrees.

It may be easier to understand the controller by drawing your program on graph paper. Show slanted lines for rates and horizontal lines for temperature holds.

When a digital kiln is taking longer than usual to complete a firing, how do you know whether something has gone wrong and the kiln is over-firing?

You should place pyrometric witness cones on the shelf so that you can see them through a peephole (page 10).

Another way to prevent an over-fire is to learn to estimate kiln temperature by the color of light showing around the lid and peepholes. That way, you can tell at a glance if all is well with your kiln. You could also use a pyrometer as a temperature reference.

Does the room temperature affect the accuracy of a digital controller? (For instance, does the controller's temperature change from summer to winter in an unheated building?)

The Sentry controllers compensate for room temperature as long as you stay within the range of 32°F – 158°F (0°C - 70°C). For instance, if your unheated room is 32°F / 0°C in the winter and 100°F / 38°C in the summer, the room temperature should have no effect on the way the controller reads the kiln's firing chamber.

I fire ceramics. When would I ever need to use Ramp-Hold mode instead of Cone-Fire?

Most people use Cone-Fire mode to fire ceramics. It is simple—just enter speed, cone, and hold time. Ramp-Hold mode, by comparison, seems complicated. Ramp-Hold divides the firing into segments, each with a rate, target temperature, and hold time.

But some people fire all their ceramics with Ramp-Hold instead of Cone-Fire. Their reasons:

1) If the witness cone doesn't bend to maturity (page 20) in Cone-Fire, you can adjust the shut-off point in the next firing by adding hold time or using the Cone Offset option (page 20).

To adjust a Ramp-Hold firing to make the witness cone bend to maturity, just alter the target temperature of the segment that fires the cone to maturity. That is simpler than correcting a Cone-Fire firing.

For example, the witness cone on the shelf needs to bend just a little farther. Merely add 10 degrees of temperature rise to the next Ramp-Hold firing. Instead of programming a target temperature of 2232° F for cone 6, program 2242°F. If the witness cone is bent slightly too far, you can easily back off 5 or 10 degrees the next time.

2) The Sentry includes candling and slow-cool in Cone-Fire mode. Candling helps dry the greenware; slow-cool gives certain glazes extra time for full development. In Ramp-Hold, you can program candling, slow cooling, and other features merely by adding more segments.

3) You learn more about firing when you program each step yourself.

4) You can experiment in Ramp-Hold more than you can in Cone-Fire. Ramp-Hold simplifies the firing of difficult glazes such as crystalline. If a friend or teacher gives you the firing schedule for a glaze, you can modify it easily in Ramp-Hold to obtain the best results for your kiln and materials.

Why does my controller begin the next segment even though the display is still a few degrees away from the correct temperature? For instance, the next segment starts at 1448 instead of the programmed temperature of 1450.

What you are describing is normal for a digital controller. There is a delay of several seconds between the actual kiln temperature and the temperature shown in the controller's display window.

Since the kiln reached the temperature that you programmed, the controller began the next segment even though the display window still showed a lower temperature. The controller didn't wait for the temperature in the display window to catch up with the kiln's actual temperature.

On multiple-zone kilns, the temperature display is an average of the temperatures from all zones, and the delay between the display temperature and the actual temperature is even longer.

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

The controller is limited by the heating capacity of each kiln. So, the maximum rate varies depending on type of kiln, density of load, etc.

The alarm on my Sentry sounds a minute into each firing. Why is the alarm going off?

The alarm was set to a temperature below the current temperature. To deactivate the alarm for your next firing, set it to 0.

Firing to cone 04 at Fast speed in Cone-Fire mode takes 7 ½ hours. Is there a way to speed up the firing for my thin, slip-cast ware?

After you program the firing, use the SPd option to make the kiln fire faster (page 19). You can shorten a 7 ½ hour firing to 5 ½ hours.

To fire even faster, use Ramp-Hold mode to program faster rates in the cone 04 firing schedule (pages 32 - 33).

Appendix A: Display Messages

Message	Definition	Page Reference	Message	Definition	Page Reference
AbRT	Abort	5	F 20	Fast Speed	7, 19
	The firing was stopped.			Cone-Fire fast speed shows in Program Review as F 20. This is also how Fast Speed is listed in the SPd Speed option.	
ALAR	Alarm	8, 11, 15, 29	FAIL	Thermocouple Failed	18, 27
	ALAR appears either when you are entering an alarm temperature or when the alarm is sounding during a firing. To stop an alarm, press any key except STOP. If the alarm goes off when you first begin firing, it is because it was set for a lower temperature than the present temperature.			The thermocouple failed. This can be due to a broken thermocouple, loose thermocouple connection on the back of the Sentry, disconnected thermocouple wire, or a defective controller.	
AOP	Auxiliary Output	22	FAN	Vent Fan	13, 21
	The AOP option is for kilns equipped with a special-order kiln switch box receptacle called the Auxiliary Output.			The Fan option, accessed through the OPTIONS key, is for kilns equipped with a special-order kiln switch box receptacle called the Auxiliary Output.	
bAdP	Bad Programming	27	FAST	Fast Speed	11
	This message appears when a Ramp-Hold firing has been programmed with 0 rate in the first segment or when all target temperatures are lower than the current kiln temperature.			In Cone-Fire programming, if you press ENTER when FAST appears, the kiln will program to fire at fast speed.	
CFG	Configuration Code	25	FN 1	Fan	15, 16
	This is an option that shows the factory configuration code for your Sentry. This is for technicians who call the factory for support.			If your kiln has the optional AOP outlet (for a kiln vent), the FN prompt will appear for each segment during Ramp-Hold programming. It is asking if you want the vent on or off for that segment.	
CHG-	Change °F / °C	22	FTC	Failed to Cool	24, 26
	Choose between operation in degrees F or degrees C.			This error message means the kiln cannot cool as fast as the cooling that you programmed.	
CONE	Cone-Fire	6, 8, 11	FTH	Failed to Heat	24, 26
	The Sentry is ready for you to enter a cone number.			The kiln cannot heat as fast as you programmed.	
COOL	Slow Cooling	11, 13	FTL	Firing Too Long	27
	In Cone-Fire programming, Slow Cooling is shown as COOL. To program a slow cooling, enter the cooling rate in degrees per hour. Leave the setting at 0 if you do not want a slow cooling.			The temperature rise is less than 27° / 15°C per hour and the firing time is two hours longer than the current segment was programmed.	
COST	Electrical Rate	8, 23	FULL	Full Speed	15, 16
	Enter the electric rate shown on your electric bill. Example: 10.25 cents per KWh is entered as 10.25.			The rate, or temperature change per hour, is maximum.	
CPLT	Completed Firing	5, 11, 15	Hd 1	Temperature Hold	15, 16
	This means the firing completed normally as programmed. These three messages will also cycle one after the other: firing time in hours and minutes, the temperature of the last segment, and the current kiln temperature.			When this message appears during Ramp-Hold programming, it is asking you if you want to hold, or maintain, the target temperature of that segment. If so, enter the length of hold time in hours and minutes (i.e. 1 hour 20 minutes = 01.20). The number after Hd is the segment number. Each segment in a Ramp-Hold firing is numbered.	
DELA	Delay	7, 11, 15	HOLD	Temperature Hold	11, 13
	DELA is a timer that starts the kiln later. Delay time appears in hours and minutes.			When this message appears during Cone-Fire programming, it is asking you if you want to hold, or maintain, the cone temperature at the end of the firing. If so, enter the length of hold time in hours and minutes (i.e. 1 hour 20 minutes = 01.20). When HOLD appears in program review, it is showing how much hold time has been entered.	
°F 1 or °C 1	Target Temperature	15	HtdE	High Temperature Deviation	27
	This prompt, which appears in Ramp-Hold programming, is asking for a target temperature. The number is the segment of the program.			During a heating-up ramp or a hold, the temperature is 100°F / 56°C above the programmed temperature.	
DIFF	Temperature Difference	25	ID	Computer ID	24
	This option shows the maximum temperature spread between zones in a multiple zone kiln.			The ID option is for connecting the Sentry to a personal computer.	
ELEC	Electronics Temperature	24	ldLE	Ready to Begin	11, 15
	The Sentry circuit board is rated for operation at temperatures up to 176°F / 80°C. When the circuit board gets hotter, the Sentry shuts off. The ELEC option shows you the temperature of the circuit board.			The Sentry must display the ldLE message before you can begin firing or programming.	
ETH	Electronics Too Hot	27			
	The Sentry circuit board is too hot, so the kiln shut off.				

Message	Definition	Page Reference
KW	Kilowatts	8, 23
	The controller can figure the cost to fire your kiln if you supply your kiln's wattage. (See the data plate on the switch box.) Divide wattage by 1000 to get kilowatts. Enter that amount: 10,800 watts ÷ 1000 = 10.8.	
Lld	Missing Pin	27
	When Lid appears, a two-pin connector on the back of the board is missing.	
LOCK	Program Lock	24
	With this option activated, a stored program cannot be altered or removed from memory.	
LTdE	Low Temperature Deviation	24, 26
	This message appears when the kiln is below the Temperature Deviation setting in the TEde option.	
OFST	Cone Offset	20
	Adjust a Cone-Fire program to bend the matching witness cone on the kiln shelf.	
PF 1	Power Failure	27, 28
	The power failed during a controlled cooling segment. The kiln temperature was below the last active cooling segment temperature when the power came back on.	
PF 2	Power Failure	27, 28
	The power failed. When power came back on, the temperature was below 212°F / 100°C.	
PF 3	Power Failure	27, 28
	The power failed and the temperature dropped 72°F/ 40°C.	
PF	Power Failure	26
	There was a power failure during firing. The kiln continued firing after the power came back on.	
PRHT	Pre-Heat	10, 11, 12
	In a Cone-Fire program, Pre-Heat heats the ware slowly to 200°F / 93°C for the length of time you specify. Pre-Heat is designed to remove moisture safely from greenware.	
RA 1	Rate	15
	RA 1, RA 2, RA 3, etc., appear in Ramp-Hold programming, Program Review, and Present Status. When RA 1, 2, 3, etc. appear during programming, the controller is asking you for firing rate for each segment. Rate means how fast the firing progresses, in degrees of temperature per hour. Every segment must have a firing rate. The number after RA is the segment number. Each segment in a Ramp-Hold firing is numbered. Program Review shows firing rate after RA 1, 2, 3, etc. In Present Status, RA 1, 2, 3, etc. means the segment that the firing is in at that moment.	
RST	Reset	25
	The RST option erases cone and thermocouple offsets, selects °F operation, erases stored programs in Ramp-Hold, and selects Type-S thermocouple. Note that if you use Reset, and your kiln is equipped with a Type-K thermocouple, you must use the TC option to select Type-K. (Reset selects Type-S as a safety precaution. If you had a Type-S thermocouple and Reset selected Type-K, your kiln would overfire. On the other hand, if you had a Type-K thermocouple, Type-S selected would underfire your kiln, which is better than overfiring it. The K-Type thermocouple is standard on most kilns.)	
S 20	Slow Speed	7, 19
	Cone-Fire slow speed shows in Program Review as S 20. This is also how slow speed is listed in the SPd Speed option.	
SFTY	Safety	24
	This is the maximum temperature the Sentry is programmed for your kiln. It can be altered only at the factory.	

Message	Definition	Page Reference
SKIP	Skip Segment	8, 12
	If you press the Skip Segment key during a firing, SKIP will appear. If you press the key again, the firing will skip to the next segment. In Cone-Fire, Skip Segment takes you only out of Pre-Heat or Hold.	
SLOW	Slow Speed	11
	In Cone-Fire programming, if you press ENTER when SLOW appears, the kiln will program to fire at slow speed.	
SOFT	Software Version	25
	This option gives the version of software loaded into your Sentry.	
SPd	Speed	11, 19
	The SPd message appears during Cone-Fire programming and in Options. 1) In the SPd option, accessed through the option key, change the speed of a Cone-Fire program beyond the standard fast, medium or slow. 2) While programming a firing for Cone-Fire, choose slow, medium or fast speed at the SPd prompt.	
STd	Standard Speed	11
	Cone-Fire medium speed appears in the Sentry as STd, or Standard. This is because medium speed is the standard firing program used in Cone-Fire. Fast and Slow speeds alter the standard firing program.	
STRT	Firing Started	11, 15
	This appears when firing begins. Do not be concerned if it takes a moment for the relays to turn on. The Sentry is processing data.	
T123	Zone Temperatures	25
	This option shows temperatures in each zone.	
TC	Thermocouple Type	22, 26, 27
	Choose between types K, S, or R thermocouple. It is important to select the correct type, or the controller will not read temperature accurately.	
TcdE	Uneven Temperature	27, 28
	This is an error message for multiple-zone kilns. It means the temperatures of the zones are out of balance by 180°F / 100°C. This is usually caused by a miswired kiln or by a defective relay.	
TCL	Thermocouple Lag	28
	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.	
TCOS	Thermocouple Offset	21
	Adjust the controller's temperature to compensate for temperature drift, or aging, of a thermocouple.	
TCR	Thermocouple Reversed	28
	The thermocouple wires are reversed.	
TEdE	Temperature Deviation	24
	The Sentry includes error messages to warn you that the kiln is not maintaining the programmed temperature. The sensitivity of the error messages is based on a temperature entered in the TEde option.	
TEST	Element Test	25
	This option is for testing the elements and thermocouples. If you test a thermocouple with a lighter, the temperature display responds faster during Test than during IdLE display.	
USER	User Program	14
	In Ramp-Hold programming, the USER prompt is asking you where you want to place the program in memory. The Sentry has 9 spaces in memory. Keep a written record of the programs 1 - 9 in memory.	

Appendix B: Preset Standard Cone-Fire Schedules - °F

These are the firing schedules programmed in Cone-Fire mode. To customize a schedule, write down your changes. Then load your new schedule into Ramp-Hold.

Low Fire Cones °F

Cone	Segment 1		Segment 2	
	Rate 1	Temp. 1	Rate 2	Temp. 2
022	396	979	108	1087
021	396	1004	108	1112
020	396	1051	108	1159
019	396	1144	108	1252
018	396	1211	108	1319
017	396	1252	108	1360
016	396	1314	108	1422
015	396	1348	108	1456
014	396	1377	108	1485
013	396	1431	108	1539
012	396	1474	108	1582
011	396	1499	108	1607

Medium Fire Cones °F

Cone	Segment 1		Segment 2		Segment 3		Segment 4	
	Rate 1	Temp. 1	Rate 2	Temp. 2	Rate 3	Temp. 3	Rate 4	Temp. 4
010	324	1022	153	1112	180	1549	108	1657
09	324	1022	153	1112	180	1580	108	1688
08	324	1022	153	1112	180	1620	108	1728
07	324	1022	153	1112	180	1681	108	1789
06	324	1022	153	1112	180	1720	108	1828
05	324	1022	153	1112	180	1780	108	1888
04	324	1022	153	1112	180	1837	108	1945
03	324	1022	153	1112	180	1879	108	1987
02	324	1022	153	1112	180	1908	108	2016
01	324	1022	153	1112	180	1938	108	2046

High Fire Cones °F

Cone	Segment 1		Segment 2		Segment 3		Segment 4	
	Rate 1	Temp. 1	Rate 2	Temp. 2	Rate 3	Temp. 3	Rate 4	Temp. 4
1	324	1022	153	1112	162	1863	108	2079
2	324	1022	153	1112	162	1872	108	2088
3	324	1022	153	1112	162	1890	108	2106
4	324	1022	153	1112	162	1908	108	2124
5	324	1022	153	1112	162	1951	108	2167
6	324	1022	153	1112	162	2016	108	2232
7	324	1022	153	1112	162	2046	108	2262
8	324	1022	153	1112	162	2064	108	2280
9	324	1022	153	1112	162	2084	108	2300
10	324	1022	153	1112	162	2129	108	2345

Appendix B: Preset Standard Cone-Fire Schedules - °C

These are the firing schedules programmed in Cone-Fire mode. To customize a schedule, write down your changes. Then load your new schedule into Ramp-Hold.

Low Fire Cones °C

Cone	Segment 1		Segment 2	
	Rate 1	Temp. 1	Rate 2	Temp. 2
022	220	526	60	586
021	220	540	60	600
020	220	566	60	626
019	220	618	60	678
018	220	655	60	715
017	220	678	60	738
016	220	712	60	772
015	220	731	60	791
014	220	747	60	807
013	220	777	60	837
012	220	801	60	861
011	220	815	60	875

Medium Fire Cones °C

Cone	Segment 1		Segment 2		Segment 3		Segment 4	
	Rate 1	Temp. 1	Rate 2	Temp. 2	Rate 3	Temp. 3	Rate 4	Temp. 4
010	180	550	85	600	100	843	60	903
09	180	550	85	600	100	860	60	920
08	180	550	85	600	100	882	60	942
07	180	550	85	600	100	916	60	976
06	180	550	85	600	100	938	60	998
05	180	550	85	600	100	971	60	1031
04	180	550	85	600	100	1003	60	1063
03	180	550	85	600	100	1026	60	1086
02	180	550	85	600	100	1042	60	1102
01	180	550	85	600	100	1059	60	1119

High Fire Cones °C

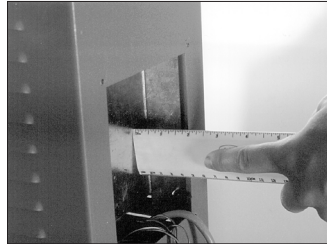
Cone	Segment 1		Segment 2		Segment 3		Segment 4	
	Rate 1	Temp. 1	Rate 2	Temp. 2	Rate 3	Temp. 3	Rate 4	Temp. 4
1	180	550	100	600	90	1017	60	1137
2	180	550	100	600	90	1022	60	1142
3	180	550	100	600	90	1032	60	1152
4	180	550	100	600	90	1042	60	1162
5	180	550	100	600	90	1066	60	1186
6	180	550	100	600	90	1102	60	1222
7	180	550	100	600	90	1119	60	1239
8	180	550	100	600	90	1129	60	1249
9	180	550	100	600	90	1140	60	1260
10	180	550	100	600	90	1165	60	1285

Appendix C: Upgrading Instructions

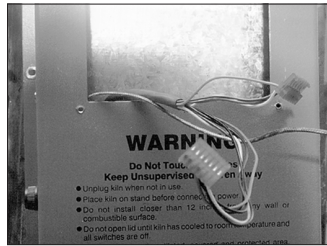
Upgrading the DTC 100, 600, 800 & 1000 Series to the Sentry

- 1 Unplug the kiln or disconnect the power. Remove the 4 screws holding the controller faceplate to the switch box. Gently remove the old controller.
- 2 Disconnect the wires from the old controller.

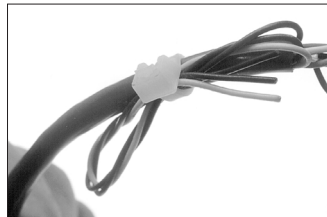
- 3 If your kiln is top-loading and originally came with a DTC 100 or 600, the heat shield inside the switch box may need to be moved to give more clearance for the new Sentry controller. Measure the space between the heat shield and the front of the box. If the space is less than 1 3/4", remove the screws that hold the bottom of the heat shield. These screws are on the sides near the louvers. Drill new holes in the switch box next to the bottom 2 holes used for the heat shield. Move the bottom of the heat shield back and fasten screws in the new holes.



- 4 Thread the Sentry wiring harness into the switch box by inserting it in the opening where the controller goes. Let the end with the plugs hang out of the box.



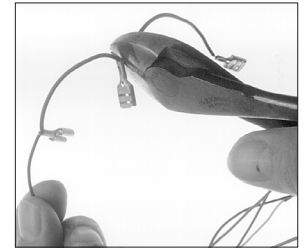
- 5 Remove the switch box from the kiln by removing the screws holding the box to the kiln.



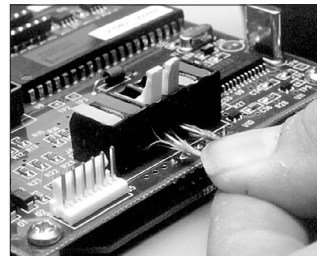
- 6 The red wire from the old controller connects to the relay(s). The red wire in the Sentry wiring harness goes to the same relay terminal. (See diagram, facing page.) You will notice that the red Sentry wire has 3 push-on connectors with jumper wires. If your kiln has 3 relays, you will use all 3 push-on connectors, 1 for each relay. If you have 2 relays, cut off the last terminal and jumper wire. If your kiln has 1 relay, cut off two push-on connectors. Cut the wire close to the terminal that remains (see next photo).

The extra wires tied to the harness are for multiple zone kilns and the optional AOP electrical outlet. The green grounding wire is connected only if you use a computer interface.

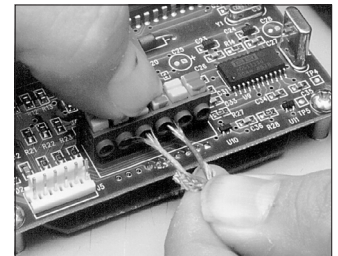
CAUTION: *Cut off the extra terminal(s) and jumper wire(s) unless they attach to relays. Unconnected wires that touch a grounded object can damage your controller!*



- 7 Attach the red wire terminal(s) to the relay(s). Follow steps 6 and 7 for the black wire, which also goes to the relays.
- 8 Note how the white, orange, and blue wires of the old controller are connected to the transformer. Removing and replacing one wire at a time, connect the Sentry white, orange, and blue wires to the transformer the same way. (See Transformers, next page. Cut off the extra blue wire terminal if your transformer doesn't need it.)
- 9 Remove the old wiring harness from the switch box. With the thermocouple wires and the Sentry connection plugs hanging out of the front of the switch box, move the box into place on the kiln. Arrange the wires so that when the switch box is fastened to the kiln, the wires and wire nuts will not touch an element connector or the kiln case. Install the screws that hold the switch box to the kiln.



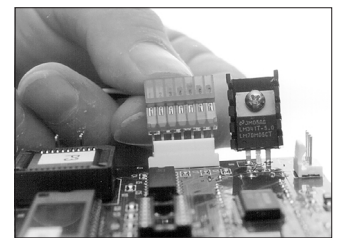
Lever type connectors: if the wire is too thick, it will break the lever. Do not force the lever downward.



The button-type thermocouple connector: press down, then insert wires.

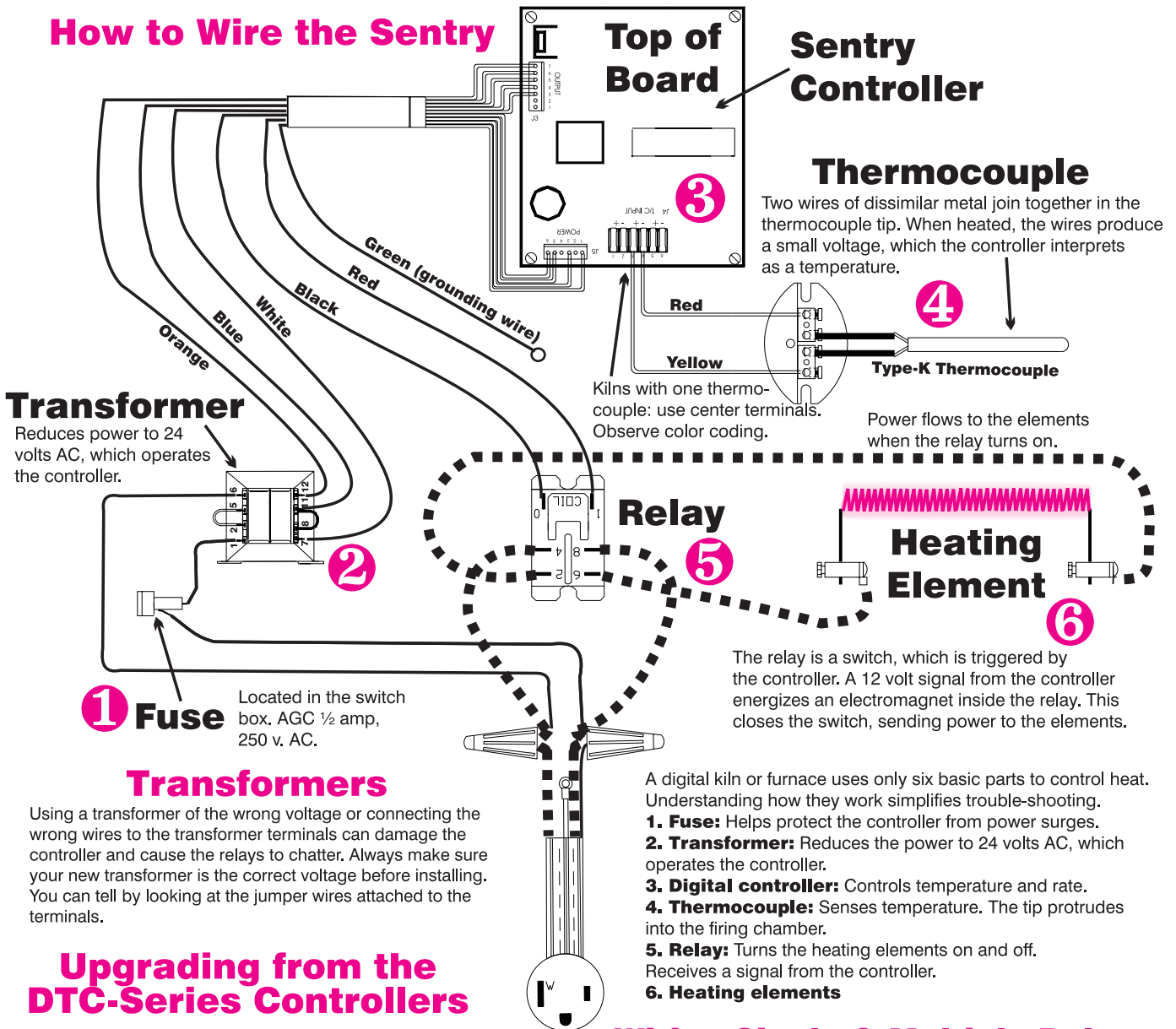
- 10 Straighten the ends of the thermocouple wires. Attach them to the thermocouple terminals on the bottom of the Sentry. (Use the center connectors if your kiln has only one thermocouple.) Make sure the thermocouple wires are tight and that there is no short.

- 11 Attach the two plugs to the back of the Sentry controller. Carefully insert the Sentry into the controller opening on the switch box. Install the 4 corner screws.

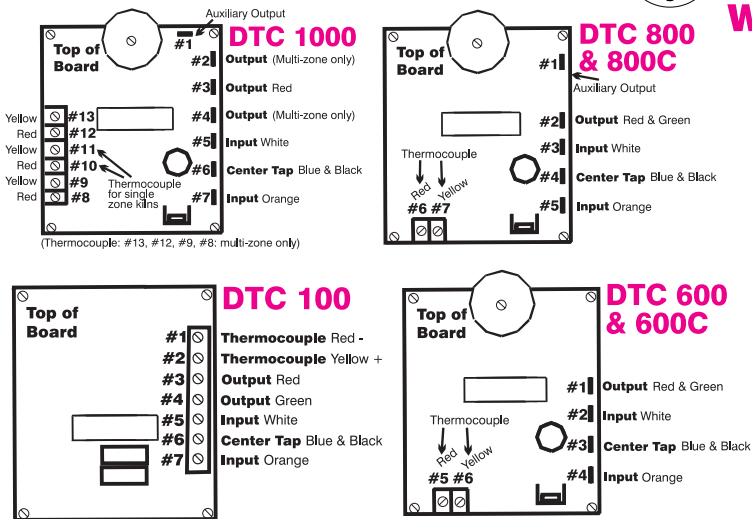


Inserting the plugs on the back of the Sentry.

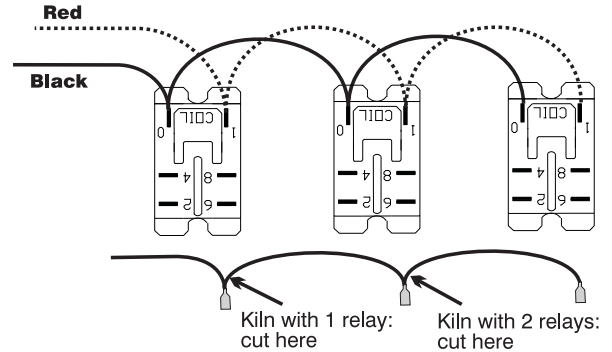
How to Wire the Sentry



Upgrading from the DTC-Series Controllers



Wiring Single & Multiple Relays



The red wire and black wire contain extra push-on terminals for kilns with three relays. If your kiln has one or two relays, cut off the extra terminal(s) and wire(s). Spare terminals or wires that touch a grounded object could damage your controller!

Appendix D: Temperature Equivalents For Orton Self-Supporting Pyrometric Cones

°F

Cone Number	Self-Supporting Cones			Pre-Fire Color
	Heated at: 27° F Per Hour*	108° F Per Hour*	270° F Per Hour*	
022	—	1087	1094	Green
021	—	1112	1143	Fuschia
020	—	1159	1180	Orange
019	1213	1252	1283	Yellow
018	1267	1319	1353	White
017	1301	1360	1405	Pink
016	1368	1422	1465	Light Blue
015	1382	1456	1504	Violet
014	1395	1485	1540	Gray
013	1485	1539	1582	Green
012	1549	1582	1620	Fuschia
011	1575	1607	1641	Orange
010	1636	1657	1679	Dark Red
09	1665	1688	1706	Dark Red
08	1692	1728	1753	Dark Red
07	1764	1789	1809	Dark Red
06	1798	1828	1855	Dark Red
05 1/2	1839	1859	1877	Dark Red
05	1870	1888	1911	Dark Red
04	1915	1945	1971	Dark Red
03	1960	1987	2019	Dark Red
02	1972	2016	2052	Dark Red
01	1999	2046	2080	Dark Red
1	2028	2079	2109	Dark Red
2	2034	2088	2127	Dark Red
3	2039	2106	2138	Dark Red
4	2086	2124	2161	Gray
5	2118	2167	2205	Green
5 1/2	2133	2197	2237	White
6	2165	2232	2269	Fuchsia
7	2194	2262	2295	Orange
8	2212	2280	2320	Yellow
9	2235	2300	2336	White
10	2284	2345	2381	Pink

*Rate of temperature increase during last 90 - 120 minutes of firing. Tables by courtesy of the Edward Orton, Jr. Ceramic Foundation.

°C

Cone Number	Self-Supporting Cones			Pre-Fire Color
	Heated at: 15° C Per Hour*	60° C Per Hour*	150° C Per Hour*	
022	—	586	590	Green
021	—	600	617	Fuschia
020	—	626	638	Orange
019	656	678	695	Yellow
018	686	715	734	White
017	705	738	763	Pink
016	742	772	796	Light Blue
015	750	791	818	Violet
014	757	807	838	Gray
013	807	837	861	Green
012	843	861	882	Fuschia
011	857	875	894	Orange
010	891	903	915	Dark Red
09	907	920	930	Dark Red
08	922	942	956	Dark Red
07	962	976	987	Dark Red
06	981	998	1013	Dark Red
05 1/2	1004	1015	1025	Dark Red
05	1021	1031	1044	Dark Red
04	1046	1063	1077	Dark Red
03	1071	1086	1104	Dark Red
02	1078	1102	1122	Dark Red
01	1093	1119	1138	Dark Red
1	1109	1137	1154	Dark Red
2	1112	1142	1164	Dark Red
3	1115	1152	1170	Dark Red
4	1141	1162	1183	Gray
5	1159	1186	1207	Green
5 1/2	1167	1203	1225	White
6	1185	1222	1243	Fuchsia
7	1201	1239	1257	Orange
8	1211	1249	1271	Yellow
9	1224	1260	1280	White
10	1251	1285	1305	Pink

*Rate of temperature increase during last 90 - 120 minutes of firing. Tables by courtesy of the Edward Orton, Jr. Ceramic Foundation.

Appendix E: User Program Records

Date _____

User Program 1

Rate %/Hour	Target Temperature	Hold Time Hours.Mins	Optional Fan On / Off
rA1	1	Hd1 .	
rA2	2	Hd2 .	
rA3	3	Hd3 .	
rA4	4	Hd4 .	
rA5	5	Hd5 .	
rA6	6	Hd6 .	
rA7	7	Hd7 .	
rA8	8	Hd8 .	
rA9	9	Hd9 .	
rA10	10	Hd10 .	
rA11	11	Hd11 .	
rA12	12	Hd12 .	
rA13	13	Hd13 .	
rA14	14	Hd14 .	
rA15	15	Hd15 .	
rA16	16	Hd16 .	
rA17	17	Hd17 .	
rA18	18	Hd18 .	
rA19	19	Hd19 .	
rA20	20	Hd20 .	

Date _____

User Program __

Rate %/Hour	Target Temperature	Hold Time Hours.Mins	Optional Fan On / Off
rA1	1	Hd1 .	
rA2	2	Hd2 .	
rA3	3	Hd3 .	
rA4	4	Hd4 .	
rA5	5	Hd5 .	
rA6	6	Hd6 .	
rA7	7	Hd7 .	
rA8	8	Hd8 .	
rA9	9	Hd9 .	
rA10	10	Hd10 .	

Date _____

User Program __

Rate %/Hour	Target Temperature	Hold Time Hours.Mins	Optional Fan On / Off
rA1	1	Hd1 .	
rA2	2	Hd2 .	
rA3	3	Hd3 .	
rA4	4	Hd4 .	
rA5	5	Hd5 .	
rA6	6	Hd6 .	
rA7	7	Hd7 .	
rA8	8	Hd8 .	
rA9	9	Hd9 .	
rA10	10	Hd10 .	

Date _____

User Program __

Rate %/Hour	Target Temperature	Hold Time Hours.Mins	Optional Fan On / Off
rA1	1	Hd1 .	
rA2	2	Hd2 .	
rA3	3	Hd3 .	
rA4	4	Hd4 .	
rA5	5	Hd5 .	
rA6	6	Hd6 .	
rA7	7	Hd7 .	
rA8	8	Hd8 .	
rA9	9	Hd9 .	
rA10	10	Hd10 .	

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Appendix F:

Sentry Ramp-Hold Shorthand Instructions

After you press the keys in the left column, the message to the right will appear. (See also page 15.)

KEYS TO PRESS	DISPLAY	COMMENTS
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PROGRAM AND FIRE THE KILN.

Apply power to kiln	IdLE	Press Enter if IdLE does not appear.
4	USER	Enter program number.
A number from 1 to 9	1	Program number appears.
ENTER	RA 1	Enter rate of segment 1.
Rate	0200	Rate appears.
ENTER	°F 1	Enter temperature of segment 1.
Temperature	2000	Temperature appears.
ENTER	Hd 1	Next, enter hold time.
Hold time (0 if none)	00.00	Hold time appears.

Repeat for other segments. Enter rate of 0 for 1st segment not needed.

ENTER	IdLE	The kiln is ready to fire.
ENTER	STRT	Kiln is now firing.

SELECT AND FIRE A STORED USER PROGRAM.

Apply power to kiln	IdLE	Press Enter if IdLE does not appear.
4	USER	Select a program number.
A number from 1 to 9	1	Displays the number you selected.
ENTER	RA 1	
STOP, STOP	IdLE	Selected program is ready to fire.
ENTER	STRT	

Kiln is now firing. (Use Program Review by pressing 6.)

Appendix G:

Sentry Cone-Fire Shorthand Programming

After you press the key(s) in the left column, the message to the right will appear. Press **1** from **IdLE**. If the **1** key does not respond, your controller does not have Cone-Fire. (See also page 11.)

KEYS TO PRESS	DISPLAY	COMMENTS
Apply power to kiln	IdLE	Press Enter if IdLE doesn't appear.
1	CONE	Enter the cone number.
Cone # (i.e. 05)	05	
ENTER	SPd	Enter the firing speed.
1 (Fast), 2 (Med.), or 3 (Slow)	FAST	The firing speed appears.
ENTER	PRHT	Enter Pre-heat time.
Pre-Heat time (0 if none)	00.00	Pre-heat time appears.
ENTER	HOLD	Enter hold time.
Hold time (0 if none)	00.00	Hold time appears.
ENTER	COOL	Enter slow cooling rate.
Slow cooling rate (0 if none)	0000	Shows degrees per hour.
ENTER	IdLE	Kiln is ready to fire.
ENTER	STRT	Kiln is now firing. Press 6 for Program Review.

The Kiln is now firing to the cone you selected.