

**The Jen-Ken Knife Kiln
&
AutoFire®4000 Kiln Controller
User's Guide**

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NEVER LEAVE THE KILN FIRING UNATTENDED!

SAFETY FIRST

Read and understand all operating instructions before operating your kiln.

SAFETY PRECAUTIONS: Kilns are as safe as any other electrical appliance when used under normal and proper operating conditions. All safety precautions throughout this manual should be observed.

1. Do Not install kiln closer than 12 inches from any surface. (Also, read first paragraph of page 2 “Choosing a Location”).
 2. Do Not place the kiln on any flammable surface (i.e. Carpet, Wood, Linoleum, etc.)
 3. Make sure all electrical specifications are followed. Use correct voltage, wire size and breaker. Make sure all connections are tight. Avoid using aluminum wire.
 4. Always use the proper receptacle.
 5. Install in covered, well-ventilated area. Fumes from the ware have to be vented to the outside. Never use your kiln outside! Avoid moisture.
 6. Always keep children and unsupervised personnel away. Surface will get hot and a burn could result. Be extremely careful when working near a kiln!
 7. Do not operate kiln over maximum temperature rating. (Ceramic to 2300°F, Glass to 1700°F)
 8. Fire clay, glaze, overglaze and glass only to the manufacturer’s recommended firing temperature. Improper fire temperatures could result in damage to your kiln.
 9. Replace any worn or defective parts with ONLY genuine *JEN-KEN Kiln* replacement parts.
 10. Never place anything above or under the kiln for storage, nor should anything be propped up against the kiln.
 11. Do not store or use flammable products near your kiln such as gasoline, paint, aerosol cans, paper, curtains, plastic, etc.
 12. A qualified electrician or service person should be used for all electrical service or repairs.
 13. If the kiln power cord becomes damaged or corroded, replace the cord immediately.
 14. Unplug the kiln before servicing or vacuuming.
 15. Always unplug the kiln when not in use or during a storm.
 16. Do not touch or attempt to replace the elements while the kiln is plugged in.
 17. Kiln must be properly grounded.
 18. Never allow the power cord to touch the kiln. Never use an extension cord.
 19. Do not drop or slam the lid shut.
 20. Let the kiln cool to room temperature before opening the lid.
 21. Make sure all switches are turned to “OFF” before opening the lid.
 22. **NEVER LEAVE THE KILN FIRING UNATTENDED.**
 23. Use common sense while installing and using.
-

NOTE: If you are in doubt about anything turn the kiln off, call your dealer or the factory at (863) 648-0585 T-F 7-4 Eastern Time

ABOUT YOUR KILN

CHOOSING A LOCATION:

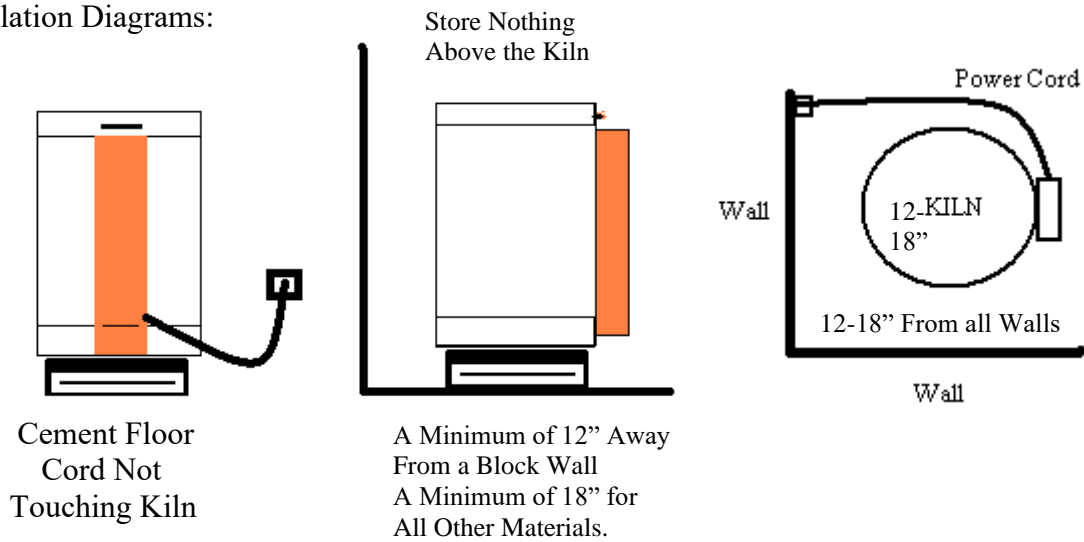
The proper location is as important as choosing the right kiln. Below are some safety guidelines:

- The best and safest place for your kiln is on a cement floor. (If not, some type of adequate fireproof material should be used beneath the kiln to prevent a possible fire hazard or prevent discoloration of the floor. i.e. stone tile or drywall)
- There must be an air space under all kilns. Concrete blocks may be used to raise the kiln or a metal stand that is available from *JEN-KEN* Kilns.
- Proper electrical service must be available. Refer to the section on Electrical Specifications.
- Area should be free from flammable or combustible materials such as gasoline, paper, paints, plastics, etc.
- Area should be covered, dry and with good ventilation to the outside. Kilns do not produce foul odors and fumes, however some products (like glazes, china paints, glue, decals and glass) go through a chemical change in the kiln. They could release fumes in the air, that with ample cross-ventilation to the outside, can be kept to a minimum. If ventilation is a problem, then call to see if an Orton Vent System is applicable.
- A minimum of 12 inches should be allowed between the kiln sides and the nearest non-combustible wall or object. If the kiln is for pottery or ceramics and the kiln is a 22" more in height the kiln will need 18" or more in wall distance for the additional heated area of the kiln. If the wall behind the kiln gets hot then the kiln is too close and should be moved.
- Never place the kiln in a small enclosed area (such as a closet, cabinet or very small room). The room a kiln is in should have an open front to dissipate the heat. The room temperature will increase past a reasonable level quickly. Air circulation and ventilation are needed to remove heat and vapors that may be released in the firing. In a larger room, the exterior of the kiln will stay cooler than in a very small room.
- Since the exterior of the kiln gets very hot, place the kiln out of the way of children, traffic and work areas.
- Never install a kiln outside and avoid undue moisture.
- Never let the power cord come in contact with the kiln. The kiln may need to be rotated a little for the cord not to touch the kiln. If the cord makes a right-angle cord to the plug, have the receptacle installed so that the cord goes down and not up. The cord should not make a loop in the air.
- Level the kiln using a level across the top of the open kiln.

The kiln receptacle should be located to the back right of the kiln, about 1 to 2 feet from the ground.

Review the diagram below

Installation Diagrams:



Kilns must also have an Air Space Under the Kiln. Kilns cannot sit directly on a floor or any surface. Use a kiln stand or concrete blocks with the holes up and down at a minimum. Small Table Top Kilns can be used with a kiln stand or the kiln bricks supplied, as long as the material under the kiln is not combustible. For kilns with base brick put a large smooth stepping stone on the table first, then the base bricks under the kiln to the outside, then the kiln on top of the base brick.



This Location has the kilns out of the way with a vent hood to remove fumes and heat from the room. Around the alcove cement board has been placed with an air space in between to reduce heat from the higher temperatures the ceramic kilns produce.

ELECTRICAL SPECIFICATIONS:

To operate the kiln safely and efficiently, your kiln needs the proper electrical outlet with the correct electrical capacity and voltage. The kiln should be on its own breaker/outlet with nothing else running on it when in operation! The chart below will assist you with the selection of the proper wire and breaker size for your *JEN-KEN* Kiln. A licensed electrician or the local power company should determine if you have the proper voltage. A kiln that is manufactured for 240 volts of service will not run properly on 208 volts. This difference of 32 volts is about a 25% reduction in power, which hinders a kiln from reaching high temperatures. Likewise, if you have 240 volts and you install a kiln manufactured for 208 volts, it will heat so rapidly it will hurt the ware in the kiln. Improper elements can be dangerous. Be sure to have the proper elements in your kiln to match the electrical service.

If you have 208 volts of service, you NEED 208 volt coils.

If you have 240 volts of service, you NEED 240 volt coils.

Any changes to your kiln or improper electrical installation will void the warranty.

ELEMENTS: Elements are the coils of wire that produce heat inside the kiln. They are made from a high quality, high-temperature wire. During the firing, they become very soft and when cool become brittle. Life expectancy of the elements will depend on the number of firings, the firing temperatures, and the products being fired. At lower temperatures, the elements will last longer than firing at higher temperatures. Long high firings such as pot melts and glass casting can shorten the element life and are best performed in a side firing style kiln. Care should be taken to make sure that no foreign matter (such as glass, glazes, clay or kiln wash) come in contact with the elements. This will greatly reduce their life expectancy. Regular vacuuming of the kiln lid, bottom and the element grooves is recommended.

In a digital kiln, the coils as a group turn on and off during firing. You will hear the clicking of the relays. It will click more if a slow rate of rise in temperature is used and less if the kiln is told to fire quickly. Your Jen-Ken Kiln has one relay in the single coil kilns and separate relays for the top and side elements models to increase the life of the relays.

Glass kilns that are small have one side coil that will fire the piece well because small pieces of glass do not care where the heat comes from. Larger glass kilns have coils in the lid and side walls. The lid coils do most of the work in the kiln and get the hottest to put an even blast of heat evenly across the shelf. Without the lid coil the piece would have to absorb the heat from the outside and pass it to the center that could cause it to thermal shock. Side coils are supplemental heat and help bring the kiln to temperature. It takes the side and the lid coils to bring the kiln to fusing temperatures.

JEN-KEN KILNS

MODELS AF3P, Auto Fire, and TAP	Voltage	Amperage Draw	Wire Size Required	Fuse Required	Receptacle
VAB 16	240	15	12	20	6-20R
VAB 21	240	23	10	30	6-30R
VAB 30	240	26	10	30	6-30R
VAB 48	240	36	8 to 6	40 to 50	6-50R
FFL 12	120	15	12	20	5-20R
FFL 18	240	17	12	20	6-20R
FFL 24	240	17	12	20	6-20R

IF YOUR KILN IS OVER 30 FEET FROM THE BREAKER YOU MAY HAVE TO GO TO THE NEXT HEAVY GAUGE OF WIRE, PLEASE CONSULT YOUR ELECTRICIAN.
THE FARTHER THE ELECTRICAL RUN THE HEAVIER THE WIRE HAS TO BE!!!!

KILN BRICK:

All **JEN-KEN KILNS** are made of hand selected 2300°F refractory brick. This brick is an insulating fire brick that has holes inside and throughout the brick to give it an insulating value. If it was solid brick it would not hold the heat inside the kiln but transfer the heat through the solid material to the outside. The brick is strong as a whole as has a very long life. The brick can chip easily, and care should be taken to avoid bumps while loading and unloading shelves. Frequently vacuum the brick lid, the grooves that the elements are in and the bottom of the kiln. This will remove the dust, sand and loose kiln wash from the kiln.

KILN JACKET:

Your **JEN-KEN KILN** is encased in a stainless-steel jacket and is also equipped with handles for easy moving. Due to the high temperatures, discoloration may appear on the stainless. A good metal polish can remove this discoloration, but most do not worry about the looks of the kiln after years of use.

ACCESSORIES:

Always wear **Safety Glasses** whenever you look into a hot kiln to protect your eyes from infrared and ultraviolet light. Hot gloves made of Kevlar and a Lid Lifter: An operating kiln is very hot. These items can help preclude burns. Caution: A hot handle looks like a cold handle and if the kiln is hot inside the handle is hot also.

SETTING UP YOUR KILN

- Assemble the kiln stand and place it on the floor in your work space. The round top carriage bolts are on top and the 8 hex head bolts are used on the side of the stand. Tighten all bolts and make sure the stand is sturdy before putting the kiln on top of the stand.
- Remove all packaging from the kiln and place it on the stand. Do not plug it in yet.
- Make sure that your kiln sits completely level.
- Open the lid of the kiln and inspect the interior looking for anything unusual like broken brick.
- Carefully inspect both the side and top heating element coils to make sure that they are seated back in the grooves. Try to avoid touching the coils with your fingers, as oil from your skin may cause premature element failure.
- Vacuum out the interior of your kiln and along the grooves in the lid to remove any debris that may have come loose when you close the lid or during firing.
- Your kiln has been pre-fired at the Jen-Ken factory and should not require a pre-firing prior to its first use. However, should you choose to do one anyway, you may select any of the built-in programs.
- You're now almost ready to plug in the kiln and fire it for the first time. Before we go there, however, it's important for you to get acquainted with your AF4X controller.

**NEVER FIRE A KILN UNATTENDED
NO MATTER WHAT BRAND KILN, MAKE, OR
MODEL**

LET THE KILN FIRE AND SHUT-OFF. IF THE KILN CANNOT BE MONITORED WHILE ON, THEN IT IS FAR BETTER TO TURN THE KILN OFF AND REFIRE AT A LATER TIME. THE ONCE THE KILN HAS SHUT DOWN AND IS COOLING AND POWER HAS BEEN SWITCHED OFF, THEN AND ONLY THEN, CAN THE KILN BE CONSIDERED READY TO BE UNMONITORED.

DO NOT LET ANYONE NEAR A HOT OR COOLING KILN.

KEEP ALL CHILDREN AWAY!

This User's Guide explains the features and operation of the Model AutoFire®4000 Controller.

The controller has 12 keys for programming.

Orton controllers use P-I-D control algorithms to tightly control kiln temperature. This eliminates temperature cycling. Cycling occurs when the controller turns the kiln on or off in a way where the actual temperature does not closely follow the desired firing schedule.

Orton controllers store the firing program information in memory when turned off. If power is lost during a firing, the controller remembers how far the firing has progressed and determines if it can resume the firing when power is restored.

Precautions

The controller is not a safety device. The controller operates relays to turn the kiln elements on and off. It is possible for relays to fail in the 'ON' position. The controller cannot protect against relay failure. To prevent over-firing, never leave the kiln unattended, especially at the end of a firing.

Controller accuracy and performance depends on the condition and position of the thermocouple sensors in use.

Getting Started

Read all precautions and instructions before using your controller.

If your kiln has manual control switches for the heating elements, turn all the dials to the highest settings.

Features

The AutoFire®4000 includes many standard features, a user-friendly keypad and robust temperature control software.

Firing Methods and Features

- **User Program** method: Create up to 35 custom firing schedules with unique heating and cooling rates, target temperatures and hold times. This method can be used for ceramics, heat treating, glass fusing, enameling or jewelry applications.
- **Delay start** - Use with either mode to delay start the kiln up to 100 hours (99hr.59min.)
- **Set-Point Control** - User Program option to hold kiln at temperature indefinitely.
- **Full On / Full Off** - User Program option to heat or cool the kiln as fast as possible.
- **Add Time** – Add additional hold time to firings already in progress.
- **Back** – Correct or make changes while programming without having to start over.
- **Program edit** – User Program option to change the active program settings during the firing without having to stop and restart the controller.

Advanced Options













- **Skip** - Skip ahead in the firing program
- **Alarm** - Program an alarm to sound when a specific temperature is reached.
- **Thermocouple Offset** - Adjust display temperature by as much as $\pm 25^{\circ}\text{C}$ ($\pm 45^{\circ}\text{F}$) to offset aging thermocouple(s).
- **Auxiliary Outputs** - Control a relay to switch on a vent fan or external alarm or safety relay.
- **Power Consumption** – Review the calculated cost or Kilowatt usage of the kiln firing.

Display Messages and Information

- **Program Review** - Review the current firing program before or during a firing.
- **Status** - Display the current status and actual heating/cooling rates of the firing.
- **Temperature Units** - Display Temperature in Fahrenheit ($^{\circ}\text{F}$) or Centigrade ($^{\circ}\text{C}$) Units
- **Computer Interface** – Monitor/Analyze kiln data from a PC using *AutofireDLS4* datalog software.

Keypad Overview

Numerical values for cone numbers, hold times, target temperatures and heating rates can be programmed by using the numerical keypad. Most keys have multiple functions for special features as described below.

	Acts as a scroll <u>UP</u> button to change Option settings Use to select Fast speed during Cone-fire programming
	Use to increase hold time for active firings Use to select Standard speed during Cone-fire programming
	Use to program a delay start time Acts as a scroll <u>DOWN</u> button to change Option settings Use to select Slow speed during Cone-fire programming
	Use to select a custom User Program Use to edit a User Program in progress
	Use to display current program segment during a firing Use to review the actual heating or cooling rate during a ramp segment
	Use to review the entire program before or during a firing
	Use to set a temperature for the alarm to sound
	Use to review the Kilowatt power consumption or cost of the kiln firing.
	Use to Skip ahead during a firing Use to look up cone temperatures before a firing
	Use during programming to enter values Use to Start the firing
	Use to access advanced controller options
	Use to back up during programming Use to Stop a firing or exit the options menu

Display Lights

The controller uses (4) numerical displays and 3 indicator lights. The 3 lights tell when the controller is turning on the relays to power the heating elements. The top light represents the top relay, the middle light represents the middle relay and the bottom light represents the bottom relay. For a single zone controller, if the controller is not configured for multiple relays, the middle light will represent all relays.



Two of the four decimal points on the display are also used as indicators. The decimal point on the far right is used to indicate if the controller is displaying temperature in degrees Fahrenheit (°F) or Centigrade (°C). If this decimal point is lit, the controller is set to display temperatures in °C.

The center decimal point (between the second and third digit) lights whenever the display is showing a time value. The decimal point separates Hours (on the left) from Minutes (on the right).

When the Controller is first turned on

The controller runs a brief self-diagnostic test. The display will light up and the audible alarm should beep. After a few seconds, the display will alternate between the kiln temperature and **IDLE**. **IDLE** is the mode where the controller is not actively firing the kiln or being programmed for a firing.

Starting a Firing



The display shows **-ON-** for 5 seconds when the firing begins. The display will show kiln temperature throughout the firing. The temperature display will alternate with alarm messages if any alarms occur. If the controller is programmed to hold at a specific temperature, the remaining Hold Time will alternate with the temperature during the active hold period.

Ending a Firing



When the controller completes the firing, the display alternates 4 messages: **CPLT** (Firing Complete); Firing Time (**hrs. mins**); Final Firing Temperature and Current Kiln Temperature. Press any key to return to **IDLE**. If you stop the firing before completion with the **Stop** key, the display will indicate **ABRT** (abort) in place of **CPLT**. Press **Stop** again to return to **IDLE**

Entering values



Whenever a change is made from the keypad, you must press the **Enter/Start** key to load the changes. If the key is not pressed, the controller will simply wait for your next selection. Pressing the **Enter/Start** key will advance you to the next option if you are setting up a program or changing settings.

Note: If you are programming the controller options and no keys are pressed for 90 seconds, the controller will exit the options menu automatically.

Threshold Alarm



To sound an audible alarm when the controller reaches a temperature, press the **#7/Alarm** key. **ALAR** shows in the display alternating with the alarm temperature. You can use the numerical keypad to enter a new alarm temperature or press **Enter** to keep the existing value. Setting the value to zero disables the alarm feature. When the kiln reaches the alarm temperature, the display will flash **ALAR** and the buzzer will sound. Silence the alarm by pressing any key except **Stop**. Pressing **Stop** ends the firing.

Use the alarm function in Cone-fire mode or User Program mode. You can program the Alarm before you start the firing or reset it during the firing.

Program Review



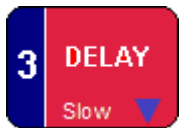
To review the current program in the controller memory before or during a firing, press the **#6/ProgReview** key. The entire program will automatically scroll through the display and then return to normal operation. Delay time and Preheat time are included in the review.

Power Consumption



To review the current power consumption during or after the kiln firing, press the **#8/Cost** key. The display will show the calculated electric usage for the firing if the option **KW** is programmed with a known wattage rating for the kiln. In addition, the display will show a calculated firing cost if the **CENT** option is programmed with a known price for KWHR usage. *Note: These calculations are estimates and are dependent on the accuracy of the values set by the operator.*

Delay Start



To program the controller to begin a firing at a later time, press the **#3/Delay** key. **DELA** shows in the display. Using the numeric keypad, enter a time delay in Hours.Minutes format and press **Enter**. Delay must be programmed before the firing is started. Once the firing is started, the remaining delay time will count down on the display.

Note: you can skip or end the Delay time once the delay period has started by pressing the **Enter/Start** key.

Status



To review the current status of the controller during a firing, press the **#5/Status** key. The current ramp segment is displayed. If the current status is a heating or cooling ramp, the display will also show the actual ramping rate. (See the **RATE** option for more information on how the actual ramp rate display can be modified) The controller returns to normal operation after 10 seconds.

Back



To step backwards during programming press the **Back/Stop** key. This will return you to the previous entry. The 'Back' feature can be used anytime during programming to make corrections. This prevents the need to start over when programming a User Program or Cone-fire program.

Repeating a firing

If power is not cycled off to the controller, you can repeat a firing without viewing the program, simply press **Start** when the controller is showing **IDLE**. Use the Program Review feature to verify that the program you want is loaded into memory.

User Programs

35 User Programs are available. The User Program mode allows you to customize your firing schedule and specify

how fast the kiln heats or cools to any temperature. All Programs allow 20 ramp steps. Each ramp step consists of a heating rate (or cooling rate), a target temperature and a hold time.



Press the **#4/UserProg** key to begin programming. The message **USER** appears in the display. Use the numeric keypad to select which program you wish to create or modify. Programs 1 – 12 are blank. You must key in 1 – 12 to create your own original programs. Then press **Enter**. Programs 13 – 33 are preprogrammed in the controller for you. You must key in 13-33 and then press **Enter**.

Temperature Units

If your controller is configured to display temperature values in °F, heating rates will be programmed as Degrees Fahrenheit per hour and target temperatures will be programmed as Degrees Fahrenheit. If your controller is configured to display temperature values in °C, heating rates will be programmed as Degrees Centigrade per hour and target temperatures will be programmed as Degrees Centigrade. To change the temperature units, see the *F/C* option.

User Program Heating/Cooling Rates

Rate is the speed of the ramp step. Rate is programmed as Degrees per Hour if the RATE option is set to HOUR. Some calculations may be required to determine your desired heating rate.

Example; if you know that you want to heat the kiln from room temperature (75°F) to 212°F over a 2-hour period, First determine the amount of temperature rise:

$$212 - 75 = 137 \text{ degrees}$$

Then divide the amount of temperature rise (or drop) by the number of hours you would like it to take to get there. (For Example, 2 hours)

$$137 / 2 = 68.5 \text{ degrees per hour}$$

Round the calculated rate to the nearest whole number and your heating rate would be 69 degrees/hour.

If you prefer to program heating and cooling rates in 'degrees per minute', adjust the RATE option in the options menu to MIN.

If you prefer to program heating and cooling rates in 'Hours and Minutes', adjust the RATE option in the option menu to TIME.

RA is the controller display for rate. Each rate segment will have its own number. The rate for the first ramp step will be displayed as **RA 1**, the rate for the second ramp as **RA 2** and so on.

Maximum Ramp Rate for User Programs

When the Ramp Rate is set to **9999** degrees per hour or **99.99** degrees per minute or **00.00** Time, the controller will interpret this as full power for a heating ramp. This will allow the kiln to heat as fast as possible to the target temperature without rate control. If the ramp is a cooling, the controller will interpret the same values as no power and allow the kiln to cool as fast as possible without rate control.

A Program Review will show the message **FULL** to indicate the uncontrolled rate. Deviation alarms will not be active during the heating/cooling ramp.

Caution: Overshoot in temperature may occur when a kiln is heating at full power, especially at lower temperatures.

User Program Target Temperatures

Each ramp step requires you to program the desired target temperature.

F or **C** is the controller display for target temperature. Like rate, each temperature segment will have its own number. The temperature for the first ramp step will be displayed as **F 1** or **C 1**, the temperature for the second ramp step as **F 2** or **C 2** and so on.

Caution: Do not program target temperatures that exceed the temperature rating for your kiln. The maximum programmable value for target temperatures can be viewed in the *SFTY* option.

User Program Cooling Ramps

Cooling ramps are programmed the same as heating ramps. You must program the Rate for the cooling and the target temperature. The criteria for a cooling ramp is the target temperature must be lower than the preceding target temperature.

If you program a target temperature at the end of the firing that is below your room temperature, the controller will never be able to complete the firing. This may result in an **FTL** alarm. To avoid this alarm, manually stop the firing by pressing the **Stop** key or program a higher temperature to complete the firing

Changing a Target Temperature During a Firing

If the kiln is firing and you need to modify the current ramp target temperature (or hold time), Press the **#4/UserProg** key. The controller will display the current target temperature and setting. Use the numeric keypad to change the temperature value and press **Enter**. The controller will next display the current ramp hold time and setting. This too can be modified if necessary. Press **Enter** again to exit the editing mode.

User Program Hold Time

Hold time refers to the amount of time you want the kiln to remain at the target temperature. Hold Time is often referred to as Soak or Dwell Time. Each ramp allows the option of programming a hold time. Hold time is programmed in Hours and Minutes. The decimal point light in the center of the controller display separates hours from minutes. The two digits to the left of the decimal point indicate hours while the right side indicates minutes.

Example; A 1 hour hold time should be programmed as **01.00**
 or A 30-minute hold time would be **00.30**

During a Hold time, the controller will count-down the remaining time of the Hold on the display.

HD is the controller display for hold time. Each Hold segment will have its own number. The hold time for the first ramp step will be displayed as **HD 1**, the hold time for the second ramp step as **HD 2** and so on.

Set-Point Hold

You can program the controller to hold at a temperature indefinitely by programming a Hold Time of **99.59**. The controller will hold the kiln temperature until the *Stop* key is pressed.

Adding Time to a Hold



If the kiln is firing and you need to add time to the current ramp hold time, press the *#2/AddTime* key. 5 minutes will be added to the hold time each time the key is pressed. If the firing is in the first ramp, you can only edit the first ramp hold time. To edit the second ramp hold time, wait until the firing has progressed into the second ramp.

Shortening a Hold



To end a hold before the time has expired, use the Skip Step function to advance to the next ramp. Press the *#9/Skip* key to select the next available ramp step and press *Enter*.

User Program Vent Fan (Optional)

If your controller has been configured to control an auxiliary vent fan, each ramp step will allow the fan to be turned on or off during the specified ramp. Refer to the Options section for additional details on the Auxiliary Output and Fan options.

FN is the controller display for vent fan. Each ramp will have its own fan setting. The fan setting for the first ramp step will be displayed as **FN 1**, the fan setting for the second ramp step as **FN 2** and so on.

To set the fan to **On** or **OFF**, press *#1* or *#3/Delay* key.

Programming User Programs



During programming, default values may appear in the display. If the controller was previously programmed, the last settings will appear.

1. Press the **#4/UserProg** key. **USER** shows in display.
2. Using the numeric keypad, select the desired user program number; 1 - 9. *For Example:* you would press the #1 key to enter a program or to modify the existing program stored in the User Program #1 location. Then press **Enter**
3. **RA 1** shows in the display indicating the rate value for the first ramp step. Use the numeric keypad to enter the desired heating rate. Then press **Enter**
4. **°F 1** or **°C 1** shows in the display indicating the target temperature for the first ramp step. Use the numeric keypad to enter the desired temperature. Then press **Enter**
5. **HD 1** shows in the display indicating the Hold time for the first ramp step. Use the numeric keypad to enter the desired time for the kiln to hold at the first target temperature. Time is entered as (Hours. Minutes). Then press **Enter**
6. **FN 1** shows in the display (if available). Use the **#1 or #3** key to select a fan setting; either **OFF** or **ON** for the first ramp. Then press **Enter**. The Fan option will not appear unless the auxiliary output option for the controller has been configured.
7. Repeat steps 3 through 6 to program additional ramp rates, temperatures and hold times. After you have programmed your final ramp, the controller should be displaying the next available **RA** number. If the value for the next available ramp rate is set to zero degrees per Hour or Minute, press **Enter**. The controller will automatically exit the programming mode. For Time mode, the value should be set to 99.99.

Note: If the user program that you are working with was previously programmed, the values that have been stored in memory will appear for all the ramp settings. Whenever you enter a zero value for a rate (**RA #**), all settings beyond that point will be erased. This feature can be used to erase an entire user program by entering a zero rate at **RA 1**.

8. When the controller has returned to **IDLE**, press **Enter/Start** to start the firing.

Selecting a Stored User Program

To select a stored User Program without making any changes to the ramps.

1. Press **#4/UserProg** key. **USER** will show in display.
2. Using the numeric keypad, select the desired User Program number; **1 - 35**.
3. Press the **Back/Stop** key to exit programming mode.
4. When the controller has returned to **IDLE**, press **Enter/Start** to start the firing.

User Program Example for # 32 for 440C HC

Use Program #32 – AIR QUENCH

To fire at Full °F/hour to 1275°F (691C) 10-minute hold at temperature (Full is to Heat as Fast as Possible)

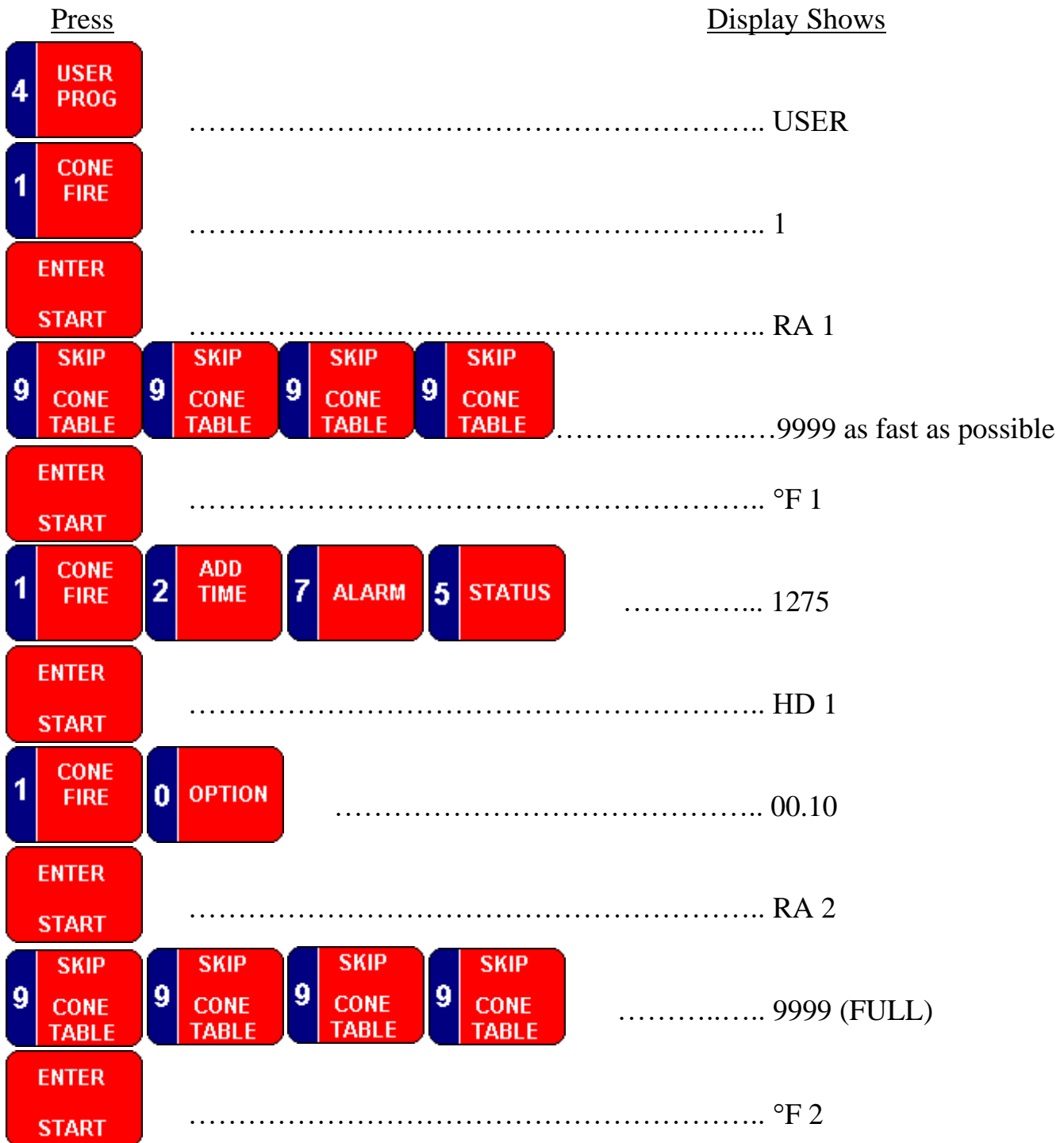
To fire at Full °F/hour to 1400°F (760C) 20-minute hold at temperature

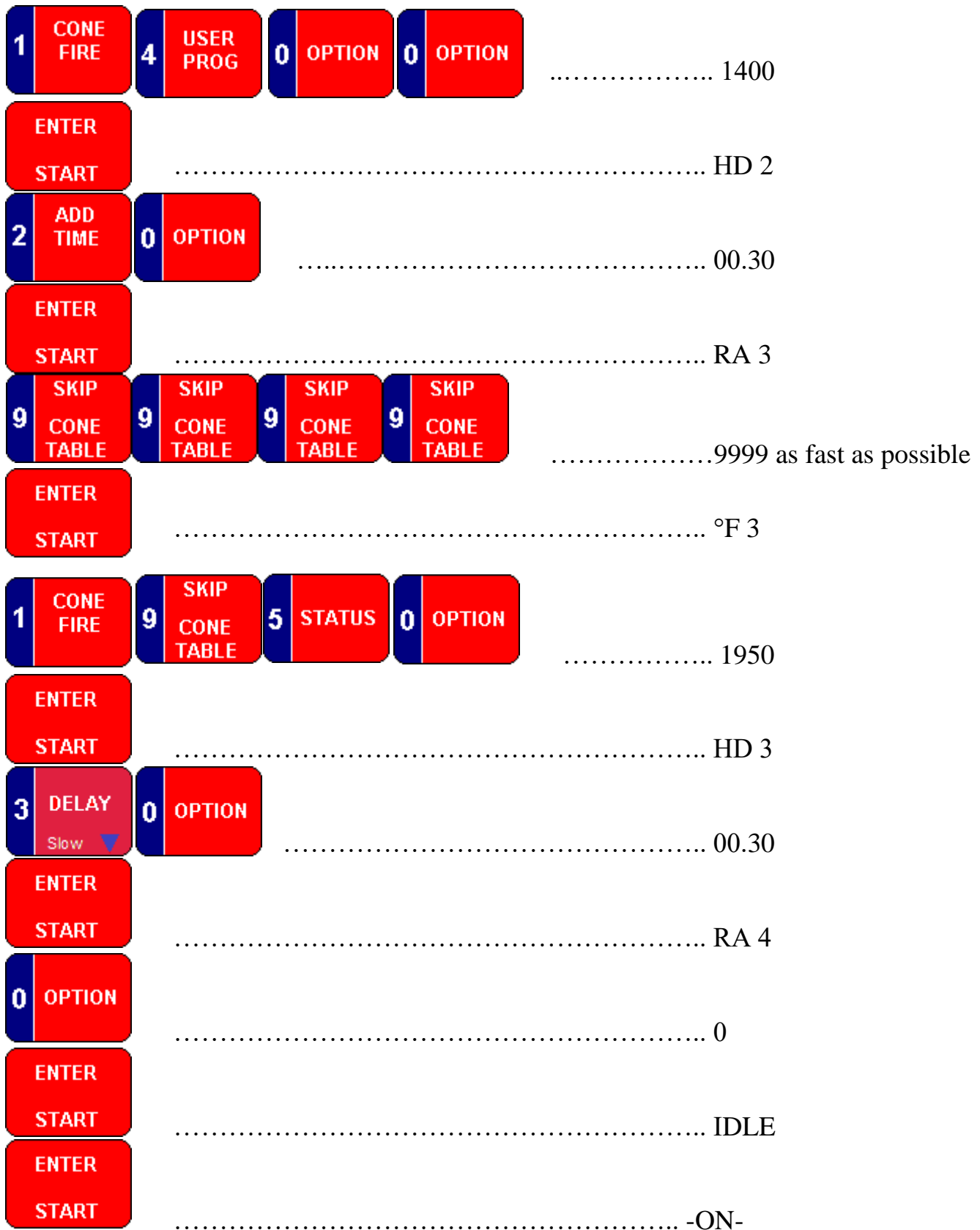
To fire at Full °F/hour to 1950°F (1066C) 30-minute hold at temperature

Shut off.

Here is program #32 written out to show you the steps you would need to go through if you had to enter in this program yourself. Refer back to this example when you are ready to begin creating your own programs.

Starting with the controller at IDLE





To stop the kiln anytime during the firing, press **Stop**. The controller display will indicate **ABRT** (Abort). Press **Stop** again to return to **IDLE**.

Alarms

Alarms are used to notify the operator of problems with the kiln performance or controller performance. Some alarms will terminate the kiln firing while others allow the firing to continue with the alarm condition on the display. Some alarms have no effect on the outcome of the kiln firing.

Thermocouple Alarms

- - - -	Thermocouple not detected during power up.
FAIL	Thermocouple failed during a firing, firing stopped
TC 2	Thermocouple failed while controller Idle
TCR	Thermocouple polarity reversed , firing stopped
LAG	Thermocouple temperature is lagging, firing stopped (kiln not heating)
OTL	Over Temperature Limit detected – firing stopped (check LIMIT option)
FTL	Firing too Long – kiln temperature has stalled, firing stopped

Deviation Alarms

See *TEDE* option to adjust Deviation

FTH	Fail to Heat - kiln is heating too slow, firing continues
FTC	Fail to Cool - kiln is cooling too slow, firing continues
LTDE	Low Temp Deviation - kiln is losing temperature, firing continues
HTDE	High Temp Deviation - kiln is overheating, firing stopped

Power Interruption Alarms

PF	Power failed, and firing was resumed
PF 1	Power failed during cooling and firing was stopped because cooling temperature exceeded
PF 2	Power failed during heating and firing was stopped because temperature was below 212°F
PF 3	Power failed during heating or hold, and firing was stopped because temperature dropped by 72°F

Diagnostic Alarms

BADP	Invalid User Program. Check current kiln temperature is below program temperature.
ETH	Electronics too Hot – controller temperature above 80°C, firing stopped
FE 1	Failed to read or write to memory device
FE 4	Errors detecting thermocouple input signal

Options Menu



Advanced settings and features are available through the Options menu. Press the **#0/Option** Key to advance through the options menu. During a firing, not all options can be changed. To exit Options, press the **Stop** key or wait 1 minute without pressing any key.

To view an Option setting, press **Enter** when the option code is displayed. Use the **#1/Cone Fire** key or **#3/Delay** key to change the setting for the option. Press **Enter** after making the change.

Option List

DIAG	Diagnostics	<i>View output amps</i>
TC	Thermocouple Type	<i>Select thermocouple type (Type K, N, S or R</i>
DIFF	Temperature Difference	<i>Displays difference between thermocouples (multi-zone only)</i>
F/C	Temperature Units	<i>Change temperature units to °F or °C</i>
TCOS	Thermocouple Offset	<i>Change a thermocouple temperature reading by ±25 °C</i>
AOPI	Auxiliary Output #1	<i>Enable a vent fan, external alarm or safety relay output on Output 1</i>
AOP2	Auxiliary Output #2	<i>Enable a vent fan, external alarm or safety relay output on Output 2</i>
RATE	Ramp Rate units	<i>Select ramp rate units of degrees per hour, minute or Time</i>
CENT	Cost per Kilowatt Hour	<i>Set firing cost for Kilowatt Hours</i>
KW	Kiln Power Rating	<i>Set power consumption Kilowatts</i>
TEDE	Temperature Deviation	<i>Deviation value for alarms FTH, FTC, and LTDE</i>
HTDE	High Temperature Deviation	<i>Deviation value for alarm HTDE</i>
BAL	Power Balance	<i>Change power between top and bottom heating zones (if available)</i>
CADJ	Center Power Adjust	<i>Adjusts power to middle heating zone (if available)</i>
SFTY	Safety Temperature	<i>Displays maximum programmable temperature</i>
LIM	Over-Temperature Limit	<i>Set the maximum limit temperature</i>
T123	Thermocouple Temperatures	<i>Displays individual thermocouple temperatures (multi-zone)</i>
ELEC	Electronics Temperature	<i>Displays temperature of the electronics</i>
LOCK	Program Lock	<i>Lock or Unlock the programs to prevent changes</i>
CFG	Configuration Number	<i>Displays factory configuration #</i>
SOFT	Software Version	<i>Displays factory software version</i>
TEST	Test System	<i>Test controller inputs and outputs</i>
RST	Factory Reset	<i>Reset all values to OEM settings.</i>

The options list will vary depending on the controller configuration. Multi-zone options do not appear in single zone controllers. If the program loaded into memory is a User Program, Cone fire options do not appear.

Options Descriptions

Diagnosics - DIAG

Diagnosics allows the operator to check the current draw on the main supply line. The accuracy is +/-1amp. To accomplish this, the relays are switched on for a brief time period to get a measurement. independent relays are switched on at time intervals to test each heating zone.

If multiple AMP readings are available, the controller display will test each relay for 10seconds before automatically advancing to the next test cycle. The operator can also press ENTER to advance thru the test cycles.

During a firing, the test cycle is limited to full load amps with all relays energized.

Note: the controller must be equipped with a current transformer to achieve a result.

Thermocouple Type - TC

The TC Option allows Type “K”, “N”, “S”, or “R” thermocouples. The setting must match the actual thermocouples in use.

<u>Settings</u>	<u>Meaning</u>
K	Type K
N	Type N
S	Type S
R	Type R

Press the #0/*Option* key until TC appears. Press *Enter* and use the #1 or #3 key to change the setting.

Temperature Difference - DIFF

The DIFF Option displays the temperature difference between the top and bottom thermocouples for multi-zone controllers. This feature is useful in determining temperature uniformity within a kiln during a firing.

Press the #0/*Option* key until DIFF appears. Press *Enter* to view the result.

Change Temperature Units – F/C

The F/C Option allows the temperature units to be displayed in either degrees Fahrenheit (°F) or degrees Centigrade (°C).

Press the #0/*Option* key until F/C appears. Press *Enter* and use the #1 or #3 key to change the setting.

Thermocouple Offset - TCOS

This offset adjusts the thermocouple reading on the controller up to ± 45°F(25°C). TCOS can be used to compensate for inaccurate temperature readings resulting from aged or poorly positioned thermocouples. Temperature offset applies to all firings.

To Program the offset, Press #0/*Option* key until the display shows TCOS and press *Enter*

If you want the kiln to fire Hotter, press #1/*Cone Fire* key and the display will show H-1. Continue pressing #1 until the desired thermocouple offset shows in the display (e.g. H-15 for a 15° offset) and press *Enter*.

If you want the kiln to fire Cooler, press #3/*Delay* key and the display will show C-1. Continue pressing #2 until the desired thermocouple offset shows in the display (e.g. C-10 for a 10° offset) and press *Enter*.

Multi-zone: A separate offset can be selected for individual thermocouples: TC 1 (top), TC 2 (middle) and TC 3 (bottom)

Auxiliary Output 1 - AOP1

The **AOP1** Option sets the Auxiliary relay output on Output #1 to the desired functions for controlling a Vent fan, External alarm or Safety relay. Setting the **AOP1** option to **VFAN** enables the **FAN** option for cone Fire programs and the **FN** ramp segment for User Programs.

<u>Settings</u>	<u>Meaning</u>
NONE	No external relay functions
VFAN	Vent fan is enabled on output pin 3
ALRM	Alarm is enabled on output pin 3
SAFE	Safety Relay is enabled on output pin 3
CPT	output pin 3 enabled during CPLT message only

Press the **#0/Option** key until **AOP1** appears. Press **Enter** and use the **#1** or **#3** key to change the setting.

Auxiliary Output 2 - AOP2

The **AOP2** Option sets the Auxiliary relay output on Output #2 to the desired functions for controlling a Vent fan, External alarm or Safety relay. Setting the **AOP2** option to **VFAN** enables the **FAN** option for cone Fire programs and the **FN** ramp segment for User Programs.

<u>Settings</u>	<u>Meaning</u>
NONE	No external relay functions
VFAN	Vent fan is enabled on output pin 2
ALRM	Alarm is enabled on output pin 2
SAFE	Safety Relay is enabled on output pin 2
CPT	output pin 2 enabled during CPLT message only

Press the **#0/Option** key until **AOP2** appears. Press **Enter** and use the **#1** or **#3** key to change the setting.

Ramp Rate Units - RATE

The **RATE** Option sets the units for programming and review of heating and cooling rates. The factory default setting is for Degrees per Hour.

<u>Settings</u>	<u>Meaning</u>	<u>MAX 'FULL' rate</u>
HOUR	Degrees per Hour	999°C (1799°F)/Hour
MIN	Degrees per Minute	16.65°C (29.97°F)/Minute
TIME	Time to Temperature (Hours. Minutes)	00.00 (Hours. Minutes)

Press the **#0/Option** key until **RATE** appears. Press **Enter** and use the **#1** or **#3** key to change the setting.

Kilowatt Hour Cost - CENT

The **CENT** Option allows the operator to set a value for the Kilowatt Hour usage of the electric service. This value is used to calculate a firing cost for review on the controller display. The value must be entered by the user, it can usually be found on your electric bill. Cost calculations first require a second value entry in the KW option. Cost calculations are only as accurate as the programmed variables. To view the **COST** calculations, press the **#8** key during or after the kiln firing.

Press the **#0/Option** key until **CENT** appears. Press **Enter** and use the numeric keypad to enter the value, then press **Enter** to save.

Kilowatt rating - KW

The **KW** Option allows the operator to set a value for the Kilowatt rating of the kiln. This value is used to calculate a Kilowatt/Hour usage for review on the controller display. The wattage rating must be entered by the user, it can usually be found on the kiln manufacturer label. **KWHR** and **COST** calculations are only as accurate as the programmed **KW** value. To view the **KWHR** or **COST** calculations, press the **#8** key during or after the kiln firing.

Press the **#0/Option** key until **KW** appears. Press **Enter** and use the numeric keypad to enter the value, then press **Enter** to save.

Temperature Deviation - TEDE

The **TEDE** Option sets a temperature deviation value to activate an audible and visual alarm. The temperature deviation applies to the following alarms - **FTH**, **FTC** and **LTDE**. The factory setting is 100°F (56°C). The alarms can be disabled by setting the value to zero. Use the numeric keypad to enter the desired deviation value and press **Enter**.

Press the **#0/Option** key until **TEDE** appears. Press **Enter** and use the numeric keypad to enter the value, then press **Enter to save**.

High Temperature Deviation - HTDE

The **HTDE** Option sets a temperature deviation value to abort the kiln firing. The temperature deviation applies only to the **HTDE** alarm. The factory setting is 100°F (56°C). The alarm cannot be disabled. Use the numeric keypad to enter the desired deviation value between 18°F – 200°F (10°C - 111°C) and press **Enter**.

Press the **#0/Option** key until **HTDE** appears. Press **Enter** and use the numeric keypad to enter the value, then press **Enter to save**.

Top/Bottom Balance - BAL

The **BAL** option is only available on single zone controllers that have been configured to operate independent relays for the top and bottom kiln sections. **BAL** changes the amount of power being supplied to the top and bottom heating elements by selecting a power percentage between 0% and 200%. This is the percentage of power going to the top heating elements. Values less than 100 reduce power to the top, while higher values increase power to the top. The Power to the bottom heating element is automatically changed. This feature can be used if the kiln is not heating uniformly.

100% is the factory default. This applies 100% of available power to both the top and bottom elements. Changing the setting to 150% would increase the power to the top elements by 50%, while decreasing power to the bottom elements by 50%. The **BAL** setting can be changed in increments of 10%

Press the **#0/Option** key until **BAL** appears. Press **Enter** and use the **#1** or **#3** key to change the setting.

Center Zone Adjustment - CADJ

The **CADJ** option is available on single zone controllers that have been configured to operate an independent relay for the center kiln section. **CADJ** allows changes in the amount of power supplied to the middle heating elements of the kiln by selecting a power percentage between 0% and 200%. Values less than 100 reduce the power to the center zone, while values greater than 100 will increase the power. This feature can be used if the kiln is not heating uniformly. 95 is the factory setting. The **CADJ** setting can be changed in increments of 10%.

Press the **#0/Option** key until **CADJ** appears. Press **Enter** and use the **#1** or **#3** key to change the setting.

Safety Temperature - SFTY

This option displays the maximum programmable temperature allowed by the controller.

Press the **#0/Option** key until **SFTY** appears. Press **Enter** to view the setting.

Over-temperature Limit - LIM

The **LIM** Option allows the operator to set a value for the maximum temperature of the kiln. This option is only available when the AOP1 or AOP2 option is configured for a safety relay operation. The operator can set a value as low as 32F or as high as the Safety Temperature **SFTY** temperature.

The controller will abort the kiln firing with alarm **OTL** if the actual thermocouple temperature is detected 1 degree above the **LIM** setting.

Press the **#0/Option** key until **LIM** appears. Press **Enter** and use the numeric keypad to enter the value, then press **Enter to save**.

Thermocouple Temperatures – T123

T123 displays the independent temperature readings for *Multi-Zone* controllers. These are **TC 1** for the top, **TC 2** for the middle and **TC 3** for the bottom thermocouple. For multi zone controllers, the average temperature reading is reported on the display during normal operation. This option can be used to verify temperature uniformity throughout the kiln. The message [- - -] indicates no temperature reading found.

Press the **#0/Option** key until **T123** appears. Press **Enter** to view the results.

Electronics Temperature - ELEC

ELEC displays the controller electronics temperature. This can be useful in monitoring the electronics temperature in hot environments or for diagnosing a controller problem. The **ETH** alarm will activate if the controller temperature is above 80°C (176°F)

Press the **#0/Option** key until **ELEC** appears. Press **Enter** to view the results.

Program Lock Mode - LOCK

The **LOCK** Option allows individual User Programs or a Cone Fire programs to be locked into memory, preventing the settings to be changed from the keypad. This feature is useful when only one particular program is used repeatedly to fire the kiln.

LOCK requires a passcode to enable this feature, the default passcode is '3'. Once enabled, the user can set a new passcode that is private. Lock options will appear at the end of each program sequence. If the passcode is entered during the program sequence, the program will no longer be available for editing without the passcode.

To turn off the lock feature, the passcode must be re-entered. To reset the passcode, see *RST* option

Press the **#0/Option** key until **LOCK** appears. Press **Enter** to see PASS, use the numeric keypad to enter the passcode, then press **Enter**. use the **#1** or **#3** key to change the setting or to set a new passcode, then press **Enter**.

Configuration Number - CFG

CFG displays the factory configuration number. this identifies the controller model.

Press the **#0/Option** key until **CFG** appears. Press **Enter** to view the results.

Software Version - SOFT

SOFT displays the factory software version of the controller.

Press the **#0/Option** key until **SOFT** appears. Press **Enter** to view the results.

Test Inputs and Outputs - TEST

The **TEST** Option allows the heating elements for each zone to be turned on independently for 2 minutes while monitoring the thermocouple temperatures for each zone. In sequence, each zone turns on and displays the temperature for the corresponding thermocouple. You can Press **Enter** to advance to the next zone before the 2 minutes expires. **TEST** will also activate the Auxiliary outputs identified as **AOP1** and **AOP2**.

Reset - RST

The **RST** feature restores the original OEM values supplied with the controller. Do not perform a reset unless all other efforts to correct faults with the controller have failed. A reset may change important option settings for your kiln. Before attempting a reset, you should become familiar with the correct option settings for your controller. Most important is the **TC** option setting.

To reset, press the **#0/Option** key until **RST** is displayed and press **Enter**. Use the **#1** or **#3** key to change the setting from **NO** to **YES** and press **Enter**. This will reset the controller settings. Verify the controller is accurately displaying temperature after the reset. You may need to adjust the **TC** setting for the thermocouple and the **F/C** setting for the display temperature.

Multi-Zone Control

Multi-zone controllers use more than one thermocouple to separately monitor and control different sections of the kiln. The temperature on the display represents the average temperature between the multiple thermocouples.

A multi zone controller can continue to operate as long as one thermocouple signal is present. However, thermocouple alarm messages should not be ignored. The controller can only perform zone control if all the thermocouple signals are available. If only one thermocouple signal is available, the controller will automatically switch to single-zone control.

Additional Alarms are available with Multi-zone controllers;

TC 1	Top Thermocouple detected missing
TC 2	Middle Thermocouple detected missing
TC 3	Bottom Thermocouple detected missing
TCR1	Top Thermocouple reversed
TCR2	Middle Thermocouple reversed
TCR3	Bottom Thermocouple reversed
TCDE	Thermocouple Deviation - 180°F (100°C) deviation between two thermocouples, firing stopped
Flashing Lights	Indicates section of kiln with low power, firing continues without zone control

Hardware Options

Audible alarm buzzer

The audible alarm can be disabled by removing the circuit board jumper on the back side of the controller. remove the jumper shunt labeled BUZZ ENABLE along the top edge of the circuit board.

Door/Lid switch

An optional door switch can be installed and connected to the controller. If not used, a jumper shunt is placed at circuit board location labeled LID.

LID is also a display alarm that indicates when the switch connection is open.

The door switch acts as an optional safety device to prevent the relay outputs from being energized whenever the kiln door or lid is open.

Computer software

Computer software is available for remote monitoring and datalogging. The controller has a USB interface that outputs TIME, Temperature and Setpoint data. For more information on the optional computer software, contact Orton or visit www.ortonceramic.com

Appendix A – User Program Charts

User Program # 1

Ramp #	Rate: °/hr	Temperature	Hold Time	Vent Fan: on/off
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

User Program # 2

Ramp #	Rate: °/hr	Temperature	Hold Time	Vent Fan: on/off
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

User Program # 3

Ramp #	Rate: °/hr	Temperature	Hold Time	Vent Fan: on/off
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

User Program # 4

Ramp #	Rate: °/hr	Temperature	Hold Time	Vent Fan: on/off
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

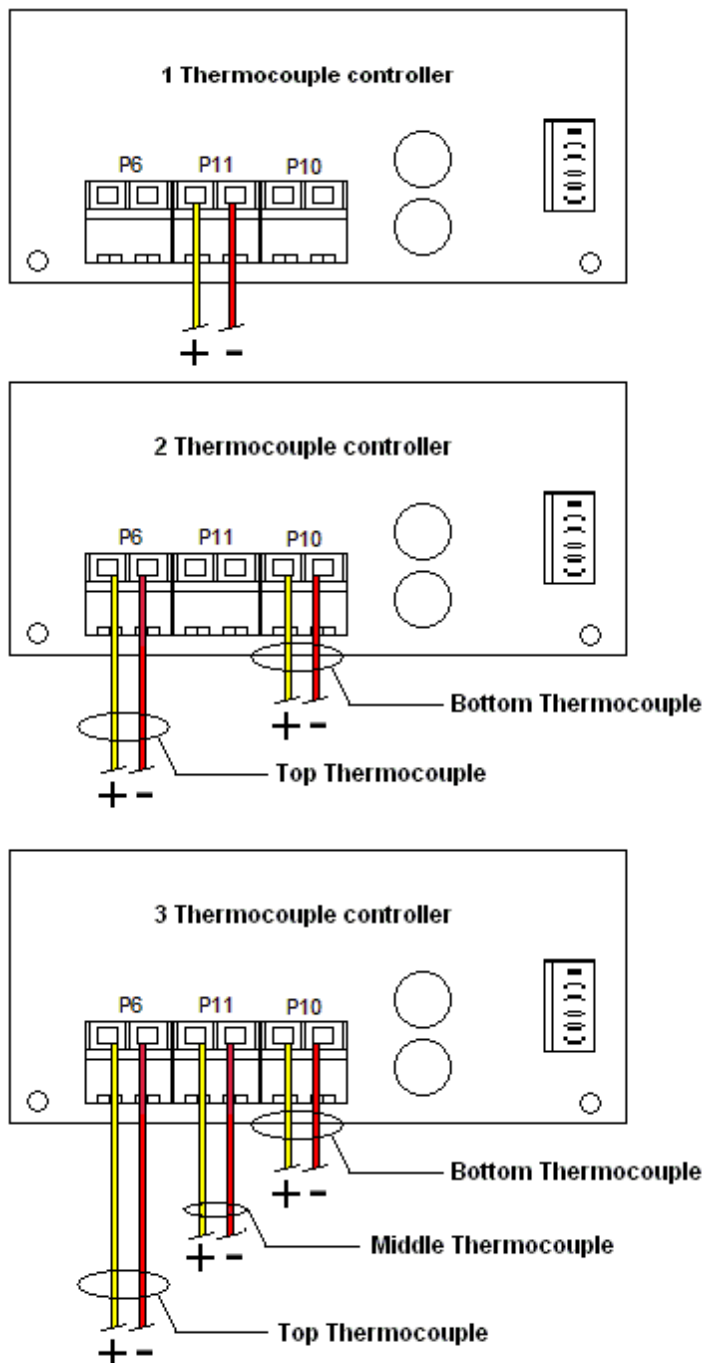
Appendix B – Connecting Thermocouples

For thermocouples, the color-coded wires should always include a red wire. The red wire is the negative leg.

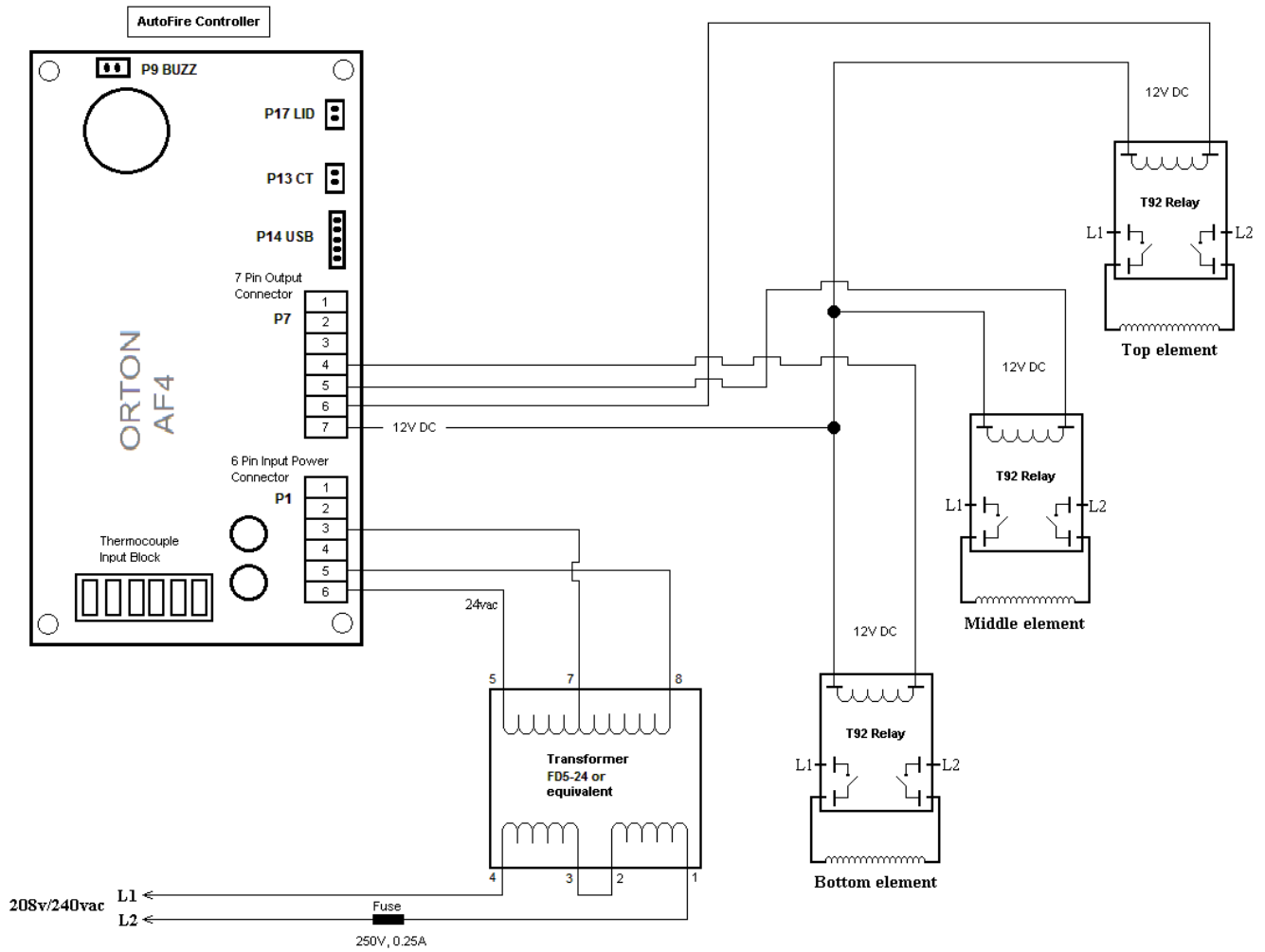
For Type K, the positive leg is yellow.

For Type N, the positive leg is orange.

For Type S and Type R, the positive leg is black.



Appendix C – Typical Wiring Diagram



The following programs were made available to us by DogHouse Forge, Lakeland, Florida

All hardening hold times are listed without additional working time. Users will need to adjust final hold length based on oven load size and speed of processing.

This information should be used as a guideline for processing blade steel. Users will need to adjust for oil speed, oven load size, and personal experience. DHF recommends running complete thermal cycling and grain refinement programs with all high carbon blade steels to achieve the highest quality results.

High Carbon Blade Steel standards

1084

1095

5210

5160

440C

Hold Time- Key Temps

Hold times are an important part of the firing cycle. These are temps that are used repeatedly in the firing process. “Speed Dial” type control or access would be ideal.

1275° - General Destress with a 10-minute hold

Used repeatedly throughout the process. Hold times not needed longer than 10 minutes

1400° to 1450° - Are the general midpoint temps for all grain refinement programs with 10-minute holds (used on all “10 series” steels)

Used on all “10 Series” Steels. Longer hold times not needed.

1475° - Is the steel hardening temp for most carbon steels with a hold time of 30-minutes (30-minutes allows for temperature equalization and added work time when cycling multiple batches of blades)

30 minutes allows for temperature equalization and added work time when cycling multiple blade batches

1550° - Is a high hardening temp with a 30-minute hold (30-minutes allows For temperature equalization and added work time when cycling multiple batches of blades)

30 Minutes allows for temperature equalization and added work time when cycling multiple blade batches

2000° - Is a stainless-steel start point

350°, 400°, 450°, 500° - are standard tempering temp with 2 hour holds

Normalization –

Part 1 Full ramp to 1600° (871C) with a 5-minute hold. Cool to 800° in air

Part 2 Full ramp to 1475° (802C) with a 5-minute hold. Cool to 800° in air

Part 3 Full ramp to 1425° (774C) with a 5-minute hold. Cool to 800° in air

Stress Relieving –

Full ramp to 1275° (691C) with no hold. Repeat as needed.

Hardening –

Option 1 - Full ramp to 1450° (788C) with 10-minute hold for equalization

Option 2 – Full ramp to 1490° (810C) with 10-minute hold for equalization

-Forge Oven- Programs For 1084HC

FO	Program	Rate	Temp	Hold	Quench
PR13	1084HC Normalization Part 1	Full	1600° (871C)	00.05	Cool in air to 800°
PR14	1084HC Normalization Part 2	Full	1475° (802C)	00.05	Cool in air to 800°
PR15	1084HC Normalization Part 3	Full	1425° (774C)	00.05	Cool in air to 800°
PR16	1084HC Stress Relief	Full	1275° (691C)	00.00	Repeat as needed
PR17	1084HC Hardening Option 1 - with Normalization Cycle Done	Full	1450° (788C)	00.10	Quench
PR18	1084HC Hardening Option 2 - with Normalization Cycle Done	Full	1490° (810C)	00.10	Quench

1084 Tempering - As Quenched 65

Degree Fahrenheit	Resulting Hardness HRC
300°	65
350°	63
400°	60
450°	57
500°	55

1095HC

Normalization –

- Part 1 Full ramp to 1575° (857C) with a 5-minute hold. Cool to 800° in air
- Part 2 Full ramp to 1450° (788C) with a 5-minute hold. Cool to 800° in air
- Part 3 Full ramp to 1400° (760C) with a 5-minute hold. Cool to 800° in air

Stress Relieving –

- Full ramp to 1275° (691C) with no hold. Repeat as needed.

Hardening –

- Option 1 - Full ramp to 1450° (788C) with a 10-minute hold for equalization
- Option 2 – Full ramp to 1500° (816C) with a 10-minute hold for equalization

-Forge Oven- Programs For 1095HC

FO	Program	Rate	Temp	Hold	Quench
PR19	1095HC Normalization Part 1	Full	1575° (857C)	00.05	Cool in air to 800°
PR20	1095HC Normalization Part 2	Full	1450° (788C)	00.05	Cool in air to 800°
PR21	1095HC Normalization Part 3	Full	1400° (760C)	00.05	Cool in air to 800°
PR22	1095HC Stress Relief	Full	1275° (691C)	00.00	Repeat as needed
PR23	1095HC Hardening Option 1 - with Normalization Cycle Done	Full	1450° (788C)	00.10	Quench
PR24	1095HC Hardening Option 2 - with Normalization Cycle Done	Full	1500° (816C)	00.10	Quench

1095 Tempering - As Quenched 66 HRC

Degree Fahrenheit	Resulting Hardness HRC
300°	65
350°	63
400°	62
450°	61
500°	59

5210HC

Normalization –

Part 1 Full ramp to 1625° (885C) with a 5-minute hold. Cool to 800° in air

Stress Relieving –

Full ramp to 1275° (691C). Repeat as needed.

Hardening –

Option 1 - Full ramp to 1550° (843C) with 10-minute hold for equalization

Option 2 - Full ramp to 1580° (860C) with 10-minute hold for equalization

-Forge Oven- Programs For 5210HC

FO	Program	Rate	Temp	Hold	Quench
PR25	5210HC Normalization	Full	1625° (885C)	00.05	Cool in air to 800°
PR26	5210HC Stress Relief	Full	1275° (691C)	00.00	Repeat as needed
PR27	5210HC Hardening	Full	1580° (860C)	00.10	Quench

5210 Tempering - As hardened 65/67 HRC

Degree Fahrenheit	Resulting Hardness HRC
300°	63
350°	61
400°	60
450°	58
500°	55

5160HC

Normalize –

Part 1 Full ramp to 1600° (871C) with a 5-minute hold. Cool to 800° in air

Stress Relieving –

Full ramp to 1275° (691C). Repeat as needed.

Hardening –

Full ramp to 1525° (829C), with 10-minute hold for equalization. Quench.

-Forge Oven- Programs For 5160HC

FO	Program	Rate	Temp	Hold	Quench
PR29	5160HC Normalize	Full	1600° (871C)	00.05	Cool in air to 800°
PR30	5160HC Stress Relieving	Full	1275° (691C)	00.00	Repeat as needed
PR31	5160HC Hardening	Full	1525° (829C)	00.10	Quench

5160 Tempering - As hardened 63 HRC

Degree Fahrenheit	Resulting Hardness HRC
300°	60
350°	59
400°	58
450°	57
500°	56

440C HC

Air Quench –

Step 1– Full ramp to 1275° (691C), with a 10-minute hold.
 Step 2 – Full ramp to 1400° (670C), with a 20-minute hold.
 Step 3 – Full ramp to 1900° (1066C), with a 30-minute hold.
 Quench – air. Cool to 150°

Oil Quench –

Step 1– Full ramp to 1275° (691C), with a 10-minute hold.
 Step 2 – Full ramp to 1400° (760C), with a 20-minute hold.
 Step 3 – Full ramp to 2000° (1093C), with a 30-minute hold.
 Quench – oil. Cool to 150°

-Forge Oven- Programs For 440C HC

FO	Program	Rate	Target	Hold	Quench
PR32	440C HC Air Quench Stainless Step 1	Full	1275° (691C)	00.10	
	440C HC Air Quench Stainless Step 2	Full	1400° (670C)	00.20	
	440C HC Air Quench Stainless Step 3	Full	1950° (1066C)	00.30	Air
PR33	440C HC Oil Quench Stainless Step 1	Full	1275° (691C)	00.10	
	440C HC Oil Quench Stainless Step 2	Full	1400° (670C)	00.20	
	440C HC Oil Quench Stainless Step 3	Full	2000° (1093C)	00.30	Oil

AS Quenched 440C - 59 HRC

Degree Fahrenheit	Resulting Hardness HRC
300°	NOT RECOMMENED
350°	59
400°	58
450°	57
500°	56

Programs 1 through 12 are left blank for you to create your own firing schedules. Listed below are

programs 13 through 33 which have been created and preprogrammed into the controller for your use.

Jen-Ken 12key	Program	description	Rates	Targets	Hold
PR13	1084HC	Normalize Part 1	FULL	1600F(871C)	00.05
PR14	1084HC	Normalize Part 2	FULL	1475F(802C)	00.05
PR15	1084HC	Normalize Part 3	FULL	1425F(774C)	00.05
PR16	1084HC	Stress Relief	FULL	1275F(691C)	00.00
PR17	1084HC	Hardening Option 1	FULL	1450F(788C)	00.10
PR18	1084HC	Hardening Option 2	FULL	1490F(810C)	00.10
PR19	1095HC	Normalize Part 1	FULL	1575F(857C)	00.05
PR20	1095HC	Normalize Part 2	FULL	1450F(788C)	00.05
PR21	1095HC	Normalize Part 3	FULL	1400F(760C)	00.05
PR22	1095HC	Stress Relief	FULL	1275F(691C)	00.00
PR23	1095HC	Hardening Option 1	FULL	1450F(788C)	00.10
PR24	1095HC	Hardening Option 2	FULL	1500F(816C)	00.10
PR25	52100HC	Normalize	FULL	1625F(885C)	00.05
PR26	52100HC	Stress Relief	FULL	1275F(691C)	00.00
PR27	52100HC	Hardening Option 1	FULL	1550F(843C)	00.10
PR28	52100HC	Hardening Option 2	FULL	1580F(860C)	00.10
PR29	5160HC	Normalize	FULL	1600F(871C)	00.05
PR30	5160HC	Stress Relief	FULL	1275F(691C)	00.00
PR31	5160HC	Hardening Option 1	FULL	1525F(829C)	00.10
PR32	440C HC	Air Quench	FULL FULL FULL	1275F(691C) 1400F(760C) 1950F(1066C)	00.10 00.20 00.30
PR33	440C HC	Oil Quench	FULL FULL FULL	1275F(691C) 1400F(760C) 2000F(1093C)	00.10 00.20 00.30

JEN-KEN KILN LIMITED WARRANTY

JEN-KEN KILNS are warranted to the original purchaser to be free from defects in materials and workmanship when used under normal and proper conditions for the periods specified below. The warranty period begins at the date of original purchase from **JEN-KEN KILNS**, a **JEN-KEN KILN** authorized distributor or dealer.

Brick Kilns are warranted for 2 years from the date of purchase.

All **120v fiber kilns** are warranted for 1 year from the date of purchase. (chilipepper, bonnie glo, profusion16, etc.)

Orton AF4X panels are warranted by a separate 1-year plan from the manufacturer, Orton Ceramics.

Orton AutoFire4000 are warranted by a separate 2-year plan by the manufacturer, Orton Ceramics.

TAP Touch Screen controllers are warranted by a separate 1-year warranty by the manufacturer, SDS Industries.

To Claim under the Warranty, the purchaser must:

- 1) Provide *written* proof of the date of purchase.
- 2) Notify **JEN-KEN KILN** (or the distributor/dealer) from whom the kiln was purchased.
- 3) Make the kiln immediately available for inspection. Photos may be required!

FOR WARRANTY REPAIRS:

- 1) Warranty repairs should be handled from where you purchased the kiln and they will arrange for any repairs or replacement of parts under the terms of the warranty and upon receipt of the kiln or defective part(s). Warranty work, other than that performed at the factory, **DOES NOT** include labor, just parts. The defective parts may be returned to **JEN-KEN KILNS** (postage prepaid) 3615 Ventura Drive West, Lakeland, Florida USA 33811. Include your name and address, a letter of explanation and the name and address from where you purchased the kiln. If, after factory examination the part is found to be defective, a new or repaired part will be sent prepaid by **JEN-KEN KILNS**.
- 2) If the entire kiln is to be returned to the factory, all transportation costs are the responsibility of the purchaser. The purchaser should notify **JEN-KEN KILNS** (863) 648-0585 prior to shipping. We will advise the best shipping method and if it is necessary to return the whole kiln or only certain parts. Factory warranty work will be performed within 30 days after the defective part is returned to the factory.
- 3) **JEN-KEN KILN** reserves the right, as its option, to replace the entire kiln or any part of it in order to fulfill its obligation under this warranty.

This Warranty DOES NOT Cover:

- 1) Freight damage. If kiln or crating is damaged in shipping to do not sign for it. Refuse shipment and have it returned. Then contact the distributor/dealer and Jen-Ken regarding the issue.
- 2) Kilns altered in any way after leaving our factory, without our explicit instruction.
- 3) Abuse or neglect, moisture damage, or damage due to improper storage.
- 4) Improper installation.
- 5) Kiln Overfires (exceeding the melting temperatures of the materials being fired) regardless of the cause of the overfire. (This does not occur in kiln that are monitored while firing. If in doubt during a firing, turn the kiln off and unplug. Do not operate again until kiln has been serviced!)
- 6) Dawson Kiln Sitter or Limit Timer.
- 7) Kilns operated on incorrect voltage.
- 8) Improper electrical installation.
- 9) Kiln furniture or wares.
- 10) Kiln used for reduction or salt firing.
- 11) Kilns used for purposes other than firing ceramic or glass materials.
- 12) Kilns operated in excess of the temperature rating of the kiln.
- 13) Damage that may occur to property or personal injury from kilns that are fired on or near combustible materials (i.e.: wood floors).
- 14) Damage that may occur to property or personal injury due to improper ventilation of the work area or building.

Warranty coverage extends only to the original purchaser and does not cover replacement of parts that are, by their nature expendable. This warranty is voided if the product is adversely affected by attaching any feature or device to it, is in any way tampered with, modified or used in any manner not intended without the express written permission from **JEN-KEN KILN**.

This Warranty is in lieu of all other warranties, expressed or implied. **JEN-KEN KILN** neither assumes nor authorizes any distributor, dealer, retailer or employee to assume for it any other obligation of liabilities in connection with **JEN-KEN KILNS**.

This warranty is limited, as specified above and excludes incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific rights and you may also have other rights why vary from state to state.

JEN-KEN KILNS
Manufactured by
Sir Ramic Porcelain, Inc.
3615 Ventura Drive West
Lakeland, Florida USA 33811
(863) 648-0585

Autofire® Kiln Controller

Limited Warranty

This limited warranty is given only to the immediate purchaser (“Buyer”) of the Autofire® Kiln Controller (“AF4000”). This limited warranty is not transferable. The Edward Orton Jr. Ceramic Foundation (“Orton”) warrants the controller motherboard and keypad installed on the Autofire® Kiln Controller (“Warranted Components”) to be in good working order under normal operating conditions for a period of two (2) year from the date of purchase. Should the Warranted Components fail to be in good working order at any time during the stated two (2) year period, Orton will, at its option, repair or replace the Warranted Components as set forth below. The liability of Orton is limited to replacement and/or repair at its factory of the Warranted Components that does not remain in good working order. Repair parts or replacement products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts or products become the property of Orton. Following receipt of notice from Buyer of a valid warranty claim and the Autofire® Kiln Controller containing the Warranted Components, Orton will perform its obligations under this limited warranty within 10 business days.

Limited warranty service may be obtained by delivering the Autofire® Kiln Controller during the warranty period to your Orton Autofire® Supplier or to The Edward Orton Jr. Ceramic Foundation, 6991 Old 3C Highway, Westerville, Ohio 43082 and providing written proof of purchase and a description of the defect or problem. Buyer must insure the shipment of the Autofire® Kiln Controller or assume the risk of loss or damage in transit, prepay shipping charges to the service location, and use the original shipping container or equivalent. Buyer will be responsible for shipping and handling charges in excess of US \$50.00 incurred by Orton in returning the Autofire® Kiln Controller to the Buyer after completion of limited warranty service.

This warranty does not apply to any damage to the Autofire® Kiln Controller resulting from:

1. Operation beyond electrical rating.
2. External sources including, but not limited to, chemicals, heat abuse and improper care.
3. Improper or inadequate maintenance by Buyer.
4. Parts or equipment not supplied by Orton.
5. Unauthorized modification or misuse.
6. Operation outside environmental specifications.
7. Improper installation.
8. Over firing (melting of materials being fired) regardless of the cause of the over firing.

Warranted Components returned for service where no warranted defect is found will be subject to service, and shipping and handling fees.

If the Warranted Components are not in good working order as warranted above, Buyer’s sole remedy shall be repair or replacement of the Warranted Components as provided above. To the extent permitted by law, ALL EXPRESS AND IMPLIED WARRANTIES FOR THE WARRANTED COMPONENTS INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE TWO-YEAR WARRANTY PERIOD COMMENCING ON THE DATE OF PURCHASE, AND NO OTHER WARRANTY WHETHER EXPRESS OR IMPLIED WILL APPLY TO THIS PERIOD. To the extent permitted by law, ORTON’S REMEDY AND BUYER’S SOLE REMEDY IS LIMITED SOLELY AND EXCLUSIVELY TO REPAIR OR REPLACEMENT AS SET FORTH HEREIN. ORTON SHALL NOT BE LIABLE FOR, AND BUYER’S REMEDY SHALL NOT INCLUDE ANY INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES OF ANY KIND WHATSOEVER, WHETHER A CLAIM IS BASED UPON THEORY OF CONTRACT, NEGLIGENCE OR TORT. Buyer shall determine suitability of the Autofire® Kiln Controller for the intended use and assume all risk and liability therewith. Some states do not allow this exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

The above limitation does not apply in the event that any Warranted Components are determined by a court of competent jurisdiction to be defective and to have directly caused bodily injury, death or property damage; provided that in no event shall Orton’s liability exceed the greater of \$1,000.00 or the purchase price of the specific Autofire® Kiln Controller that caused such damage.

Service may also be obtained on Warranted Components no longer under warranty by returning the Autofire® Kiln Controller prepaid to Orton with a description of the problem and Buyer’s name and contact information. Buyer will be contacted with an estimate of services charges before any work is performed.

Customer Satisfaction Policy

If for any reason you are not completely satisfied with the performance of the Orton Autofire® Kiln Controller or the conditions of this warranty, return the Autofire® Kiln Controller in good working condition, transportation and insurance prepaid, within 30 days of purchase date to your Orton Autofire® Kiln Controller supplier or The Edward Orton Jr. Ceramic Foundation, 6991 Old 3C Highway, Westerville, Ohio 43082 and your purchase price will be refunded. Prior to returning your Autofire® Kiln Controller contact Orton for an authorization number and include with your shipment. For Autofire® Kiln Controllers ordered in error, a restocking charge will apply.

Customer Support

Orton technicians are available by phone for support and troubleshooting. If you have questions regarding the performance or operation of the kiln controller. Contact your kiln supplier, kiln manufacturer or Orton directly at 614-895-2663. Tech Support hours are Monday-Friday 8:00AM – 4:30PM EST