

Operation Manual

KilnStar
Controller

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Introduction

This manual covers the operation of the Kiln Star kiln controller. The Kiln Star is a versatile controller that regulates the temperature in your kiln so you can fire a variety of products like ceramics, glass, or jewelry. The experienced operator can go straight to the quick start guide. The novice can learn more about different types of firing by reading the programming sections of the manual.

In the following pages:

First Firing steps you through the initial firing for new kilns to “season” the elements.

Controller Front Panel is a visual table-of-contents for the function of each key on the face-plate.

Cone Fire is the quick, easy method of programming for ceramics.

Vary Fire (also known as ramp-hold) is the versatile programming method for writing your own profiles for glass, jewelry and ceramics.

The other sections of the manual will answer questions about what to expect during a firing.

Precautions

The controller is used to control temperature; it is not a safety device.

Do not operate the controller in temperatures above 125° F.

Always supervise your kiln during a firing.

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

Always check the position of the thermocouple probe before starting a firing. The current temperature displayed on the controller is measured at the end of the thermocouple which must be in the firing chamber about 1” to 1-1/2”. Seal the opening around the thermocouple with kaowool or similar material if necessary.

Always review the current program (by pressing Review Program) before firing to ensure the correct profile is programmed.

Ensure the kiln and the areas around the kiln are clear of combustible material. See kiln manufacturer’s recommendation on required clearances.

BASIC OPERATION OF OLYMPIC KILNS WITH A KILN STAR CONTROLLER

Press the **START/START** button to start firing the program you have selected. You can also stop a program from firing.

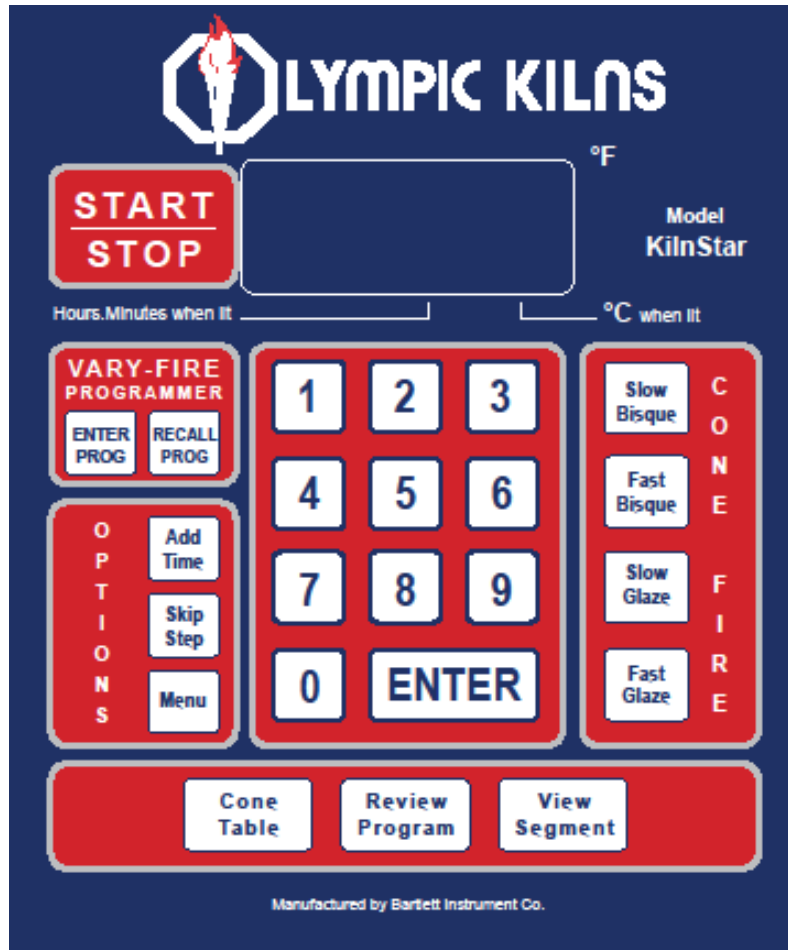
The **Vary-Fire** section is used for glass or ramp hold firing.

Press **Add Time** to add 5 minutes during a hold.

Press **Skip Step** when firing a Vary-Fire program to move to the next programmed segment.

Press **Menu** to use options such as Cone Fire preheat, cone offsets, thermocouple offsets, etc.

Cone Table allows you to see the temperature for a selected cone number.



The display area provides information such as temperatures, program prompts, etc.

Use the number pad to enter numeric information such as, cone numbers, hold times, and ramp hold data.

Cone Fire programs are preprogrammed firings for pottery and ceramics

Review Program allows you to see what program you are running and to make sure you have the proper information entered.

View Segment allows you to see what segment of the program is currently firing.

Quick Start

1. Read all precautions before using your controller.
 2. Apply power to the kiln/controller.
 3. Clear the display and get to the idle mode by pressing ENTER. Program the controller.
 4. Review the program before firing to ensure the correct program is ready to fire.
 5. Press Start. -On- will be displayed and then the kiln temperature. The relays and elements will be cycled on and off to regulate the temperature according to the program.
 6. At the end of the firing the controller will flash the current temperature, firing time, and CPLt. Press ENTER to return to the IdLE state.
- **IMPORTANT PROGRAMMING NOTE:** Before initiating a firing profile or performing any other function, the controller must be at IdLE. Pressing the ENTER key will clear the display of errors (E-) or FAIL.
 - In most cases when programming, you will choose an option, then press ENTER to accept the option.
 - With the display flashing IdLE alternating with the current temperature, you are ready to proceed with programming.
 - The CONE FIRE mode uses a patented method to achieve correct heat-work so it is ideal for firing ceramics. The advantage of using the CONE FIRE method is that a very complicated firing profile may be chosen with just a few key strokes.
 - The CONE FIRE method helps protect against over and under firing by carefully tracking and controlling the temperature at the end of the firing as the cone temperature is approached. The final temperature is adjusted according to the final firing rate. For example, as the heating elements age and the heating rate slows, the final temperature will be adjusted downward to ensure the correct amount of heat-work.
 - The VARY-FIRE mode can be used for ceramics, glass, jewelry, glazes, decals, etc. It allows you to create your own firing profiles which can be saved and used over and over.
 - If there is a kiln sitter on the kiln it must be set according to the manufacturer's directions. Insert a cone in the sitter that is one or two cones hotter than the controller setting.

First Firing of the Kiln

The purpose of the first firing is to put a protective oxide layer on the elements and thermocouple. The first firing is done without ware in the kiln that might give off fumes that contaminate the elements. This first firing should have shelves and witness cones. The witness cones should be on the middle of the shelf nearest the center of the kiln. If your kiln is supplied with cones, the programmed cone number should match the cones provided. You may use a cone of your own choice for the first firing. Our example calls for a cone 04 firing, but, if you use a cone different than 04, substitute that cone number in the programming.

The first firing should be done according to the kiln manufacturer's specifications if they are different from these instructions.

1. Apply power to the kiln/controller. The display will show **WAIT**, and then go to **IdLE**.
2. If the display shows **PF** press **ENTER** to proceed to the **IdLE** state.

Program The Controller

This example is for a Fast Glaze to cone 04 with no hold time at the end of firing.

1. Press **Fast Glaze** – display shows **F-GL**.
2. Press **Enter**– display will show **PrHt** and alternate with a number – enter
3. Press **Enter** – display will show **CONE** and alternate with a number – enter 04
4. Press **Enter** – display shows **HOLD** and alternate with a number – enter 00.00
5. Press **Enter** – programing is complete, and the screen will return to **Idle**.
6. To start your firing press Start/Stop button. The screen will display - - **ON** - -, your kiln is now firing.
** This firing will take approximately 4 hours to complete

Review The Sample Program Before Firing

Press **Review Program** key, the display will cycle through the following information.

F-GL – Firing speed, fast glaze

PRHT/0.00 – shows zero preheat time

CONE/ 04 – Programed for cone 04

°F/ 1945 – median temperature for cone 04

CNOS/ 0 – shows 0°F cone offset

HOLD/ 0- indicates zero hold at top temperature

DELA/ 0.00 – indicates delay start of 0

ALRM/ 9999 – alarm is disabled

ERCD/ on – error detection is enabled

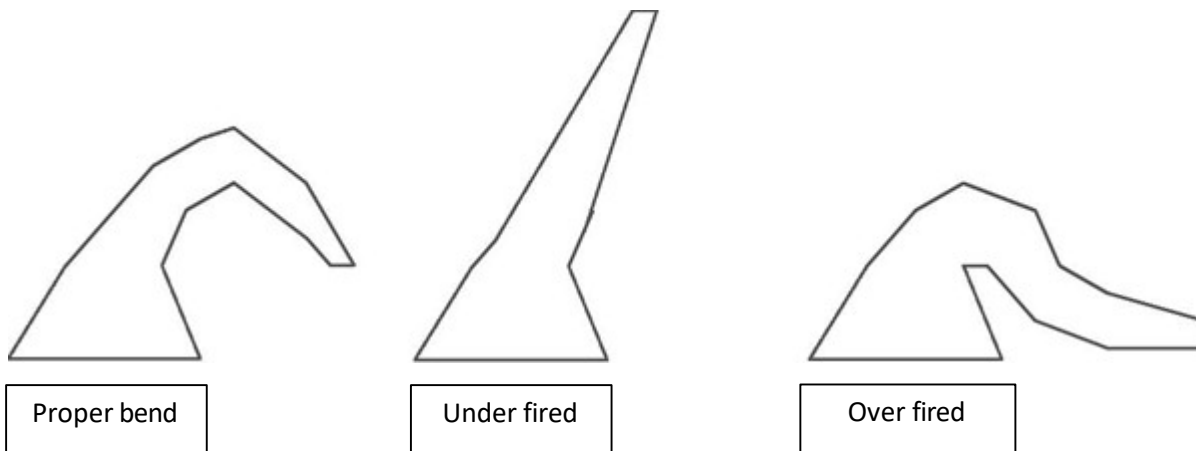
FIRE/ xxxx – shows the number of firing done with the controller

Start the Firing

Press start to begin the firing	The display will show –ON- then the current temperature. You will hear clicking when the relays cycle power to the elements to regulate the temperature. This firing will take around 6 to 7 hours.
End of firing CPLT	At the end of the firing, the display will flash between CPLT / Firing time / kiln temperature
Press ENTER to return to IdLE	The display will now flash IdLE / kiln temperature. You may open the kiln when the temperature has cooled to 150°F.

Review the Results

A properly bent cone indicates that the kiln is functioning properly and accurately. The tip of the cone will be level with the top of the cone's base when fired properly. The diagrams below will give you an idea of a properly fired, under fired and over fired cone. Some variation from a proper bend is expected and can be compensated for.



Cone Fire programing

This is the quickest and easiest method to program the controller to fire ceramics. Programing consists of choosing the firing speed and entering the clay or glaze's cone number. The firing speed is chosen by the type of firing, thickness of the clay, and the manufacturers suggested firing methods. The bisque firings include water smoking and carbon burn-out stages. The glaze speeds allow for faster firings. All 4 speeds will calculate the firing rate at the end of a firing and adjust the final temperature for correct heat-work.

Quick guide

1. Choose cone fire speed on right side of control board :
 - A. Press Slow Bisque – display shows **S-bC**. Slow bisque is used for thicker hand thrown ware. Giving extra time for release of water and carbon burnout typical firing time 13-17 hours.
 - B. Press Fast Bisque – display shows **F-bC**. Fast bisque is used for thinner ware that requires less time for water and carbon burn out. Typical firing time is 9-11 hours.
 - C. Press Slow Glaze – display shows **S-GL**. Slow glaze is used for firing glaze on thicker ware or for bisque firing very thin ware. Typical firing time is 6-8 hours
 - D. Press Fast Glaze – display shows **F-GL**. Fast glaze is the fastest speed and is used for glaze firing on thin ware, china painting, and decal firings. Typical firing time is 4-6 hours.
2. Press **Enter**– display will show **PrHt** and alternate with a number – enter the amount of time to hold your firing at a preheat temperature. Hours are to the left of the decimal and minutes to the right. HH.MM
 - *When a preheat time is entered, the temperature ramps up at 60°F/ hour (33°C) and then holds at 200°F (93°C) for the amount of time programed. Preheat is automatically set to zero at the end of each firing. Therefore, if a preheat is desired, it must be programed for each firing. Time is programed with hours to the left of the decimal and minutes to the right. HH.MM
3. Press **Enter**– display will show **CONE** and alternate with a number – enter your desired cone number
 - *Remember, cone numbers starting with a 0 are a lower temperature than those not starting with a 0. For example, don't mistake cone 6 for cone 06.
4. Press **Enter** – display shows **HOLd** and alternate with a number – enter the amount of time to hold at your top temperature.
 - *Most firings are left with a 0 hold time. If a hold time is needed for your clay or glaze hours are to the left of the decimal and minutes to the right. HH.MM
5. Press **Enter** – programing is complete, and the screen will return to Idle.
6. To start your firing press **Start/Stop** button. The screen will display - - **ON** - -, your kiln is now firing.

Temperature Reached at the End of a Cone Fire Program:

When the display is at **IdLE**, pressing Review Program will show the heat-work adjusted temperature that was reached. The temperature is displayed after °F in review program. This temperature will remain until the controller is reprogrammed. Record this temperature in your log after each cone firing.

VARY-FIRE Programing

Also known as ramp-hold programing, the Kiln Star has 6 vary-fire user programs to store and reuse. This is ideal for glass, jewelry, decals, PMC, etc. Each program has from 1 to 8 segments (2 to 16 segments if 16-S option is on). Each segment has a firing rate, a soak temperature, and a hold time. The default programs are listed in appendix F in the full operating manual.

Vary-Fire Programming Steps

1. Press “**Enter Prog**” to start Vary-Fire programming – the display will show **USER/#**
2. Select User number – Press a number key 1-6 then **ENTER**. – the display will show **SEGS** alternating with a number.
3. Enter number of segments – Press a number key 1-8 then **ENTER** – the display will show **RA1** alternating with a number.
4. Enter the ramp rate for Segment 1 – type ramp rate then press **ENTER** (rates of 1 - 9999°F/Hr. are valid. See full manual for calculating ramp rate) – the display will show **°F 1** alternating with a number
5. Enter the target hold temperature for Segment 1 – type hold temperature then press **ENTER** (valid temperatures from 1°F – Max kiln temperature) – the display will show **HLd 1** alternating with a number.
6. Enter the hold time for segment 1 – Type hold time then press **ENTER** (Displayed time is in HH.MM format. Hours to the left of the decimal and minutes to the right of the decimal)
7. Repeat steps 4 – 6 for each segment of the program.
8. Enter an alarm temperature – Screen will display **ALRM** and alternate with a number (alarm is set for a temperature not a time. The alarm set to 9999 is turned off)

Recall Programing steps

Recall program is used to recall a previously programmed firing profile.

Example: To recall user program #5, use the following:

1. Press **Recall Prog** – display will alternate showing **USER** and a number.
2. Press 5 – Display show 5 this indicates the program number selected.
3. Press Enter – display will return to **IdIE**
4. Press Start to begin firing.

Start the Firing

Press Start to begin the firing. The display will show **–ON–** and then the current temperature. The relays will begin to cycle power to the elements to regulate the temperature according to the program.

NOTES: For Vary-Fire programming

The following are notes to help with Vary-Fire programming.

PARTS OF A SEGMENT

Each segment of a program has three parts:

- **Ramp** – The ramp is the rate of rise calculated in degrees per hour.
 - **°F** – The target temperature desired.
 - **Hold** – The amount of time you want to hold at the target temperature
-
- The first ramp rate of any user program must be an increasing ramp which means the segment temperature must be greater than the starting kiln temperature.
 - To ramp up or down at the maximum rate, enter a rate of 9999.
 - To program a down ramp, you enter the rate/hour then a temperature below the previous segment's temperature.
 - It is best to write out the firing profile that you plan to program before you begin programming. At the end of the Operation Manual there is a blank form for writing your firing programs. Photo-copy as needed.

Calculating Ramp Rates For VARY Fire

If you want to go from room temperature to 750°F in 3 hours, here is how to calculate the ramp rate. Take the temperature that you want to go to (750°F) minus the starting temperature (70°F - approximate room temperature) to get the number of degrees you want to increase in 3 hours (750 - 70 = 680). Divide this number by the time you want to get to 750 to give you the ramp rate (680°F ÷ 3 hrs = 227°F/hr). If you want to add another segment to go from 750°F to 1000°F in 4 hours, the same procedure is used. Take the end temperature minus the starting temperature (1000 - 750 = 250) and divide this number by the number of hours to reach 1000°F (250°F ÷ 4 hrs = 63°F/hr).

Write Your Own Cone Fire Program

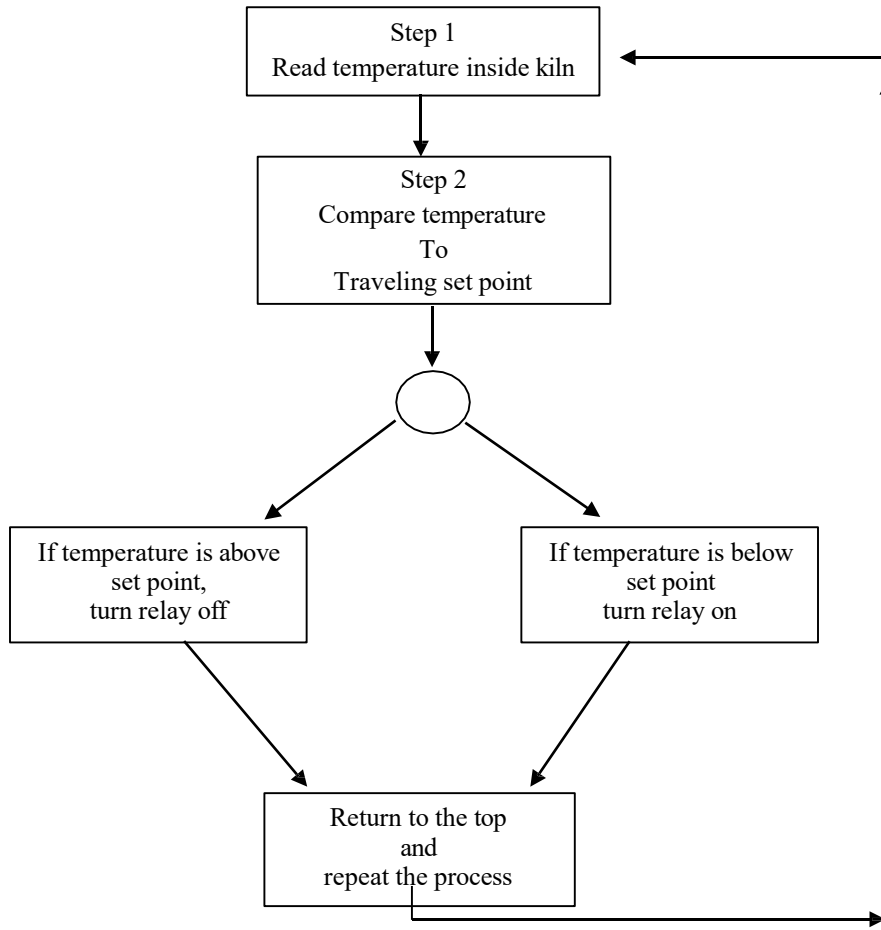
Writing your own cone fire program combines the versatility of the Vary-Fire program and the heat-work calculation of a cone fire program. It is a great way to get custom heating and cooling rates and still have the controller do the heat-work calculation to get the correct cone bend regardless of firing rate. The steps to write your own cone fire are the same as entering a Vary-Fire program except when you are programming the top temperature press the CONE TABLE key and enter the desired cone number then press ENTER. The cone number and cone temperature will be displayed in the program review. The cone temperature can be entered into any segment so you can also have cool down segments in the program.

*Appendix A: Cone Fire Profiles can be used as a starting point for a Vary-Fire program for ceramics.

*Appendix F: Vary-Fire Default Programs can be used as a starting point for glass fusing schedules.

Operation of the Controller During A Firing

The Kiln Star controller eliminates much of the “babysitting” that is required with a manual kiln. To ensure the most consistent results from one firing to the next, you should understand how the controller operates and monitor the firing to ensure proper operation. The flow chart below shows the basic operations of a kiln’s control system.



The flow chart shows that the kiln control system, in its simplest form, works like your thermostat at home – when the temperature is too cool the heater comes on; when the temperature is too hot the heater turns off. The major components of the control system are the Kiln Star controller, thermocouple temperature sensor, relay switch, power source and heating elements. The controller is the brain of the operation; the controller adjusts the traveling set point according to your program, reads the temperature in the kiln, cycles the relay on or off and determines when to end the program.

The thermocouple (t/c) sensor is the first part to inspect when loading the kiln. The tip of the t/c should protrude 1" to 2" into the firing chamber. Next, “**START**” is pressed, the controller reads the kiln temperature and uses that temperature as a starting point for a traveling set-point (also called the local set-point). The displayed temperature is the temperature inside the kiln. You should then hear the relay(s) start cycling on and off to keep the temperature near the traveling set point. As the firing progresses the controller moves the traveling set-point according to the programmed firing rate. The displayed temperature should increase with the traveling set-point and the relay will be “on” longer. This sequence continues until the final temperature is reached and the controller turns off the kiln. The display reads “**CPLT**”.

End Of Firing - CPLT

At the end of the firing, the display will flash between **CPLT**/ firing time/ kiln temperature.

Press **ENTER** to return to **IdLE**. The display will now flash **IdLE**/ kiln temperature. You may open the kiln when the temperature has cooled to 150°F.

Review the Results

After a firing, record the firing time and load size. In your log keep any repair information. If cones are placed in the kiln, record the amount of bending that took place.

A properly bent cone indicates that the kiln is functioning properly and accurately. The tip of the cone will be level with the top of the cone's base when fired properly.. Some variation from a proper bend is expected and can be compensated for with adjustments to your firing or offset adjustments in the controller based on test firings.

NOTE – An error code (E-) in the display indicates an abnormal end to a firing. See the Error code section to help determine the reason for the error code.

VIEW SECTION

View Section - Contains buttons to look up cone temperatures, review programs, and view the current segment firing.

Cone Table -Used to look up the temperature of various cone numbers. The temperature that is displayed is for self-supporting cones with a heating rate of 108°F/hr. To use, press Cone Table, enter the cone number you want to look up, press ENTER; the cone temperature will be displayed then the controller returns to IdLE.

Review Program - The information displayed when Review Program is pressed varies depending on whether you are using Cone Fire or Vary Fire. When Review Program is pressed, each of the steps in the current firing profile is displayed one after another changing every ½ second.

In **Cone Fire Mode** - The display will show the selected firing profile in the following order (the example used is a fast glaze to cone 04):

CONE/ 04 – programmed for cone 04

°F/ 1945 – top temperature for cone 04

F-GL – firing speed, Fast Glaze

HOLD/ HH.MM – indicates hold at top temperature

PRHT/ HH.MM – indicates amount of preheat time at 200°F

DELA/ HH.MM – amount of time programed to delay the start of the firing

ALRM/ 9999 – temperature programed for an alarm – default to disable is 9999

ERCD/on – error detection is enabled

COST/ \$00.00 – this will display the cost of your firing after the firing is completed, if you have programed your cost per KW hour in the controller

FIRE/xxxx – shows the number of firings with this controller.

In **Vary Fire Mode** - The display will show in the following order:

USER/ # - the user program selected

SEGS/ # - the number of segments in the program

RA 1/ #### - 1st segment ramp rate in °F per hour

°F 1/ #### - 1st segment target temperature

Hd 1/ HH.MM - 1st segment hold time in hours and minutes (If there is more than 1 segment, then the ramp rate, segment temperature, and hold time of each of the other segments will be displayed in order.)

DELA/ HH.MM – amount of time programed to delay the start of the firing

ALRM/ 9999 – temperature programed for an alarm – default to disable is 9999

ERCd / on – error detection is enabled

COST – this will display the cost of your firing after the firing is completed

FIRE/# - shows the number of firings with this controller

View Segment (Only functions when a firing is in progress.) - View segment is used to view the currently firing segment. When View Segment is pressed during a firing the following three items are displayed in this order, the current segment of the firing, the traveling set point (SETP, the traveling set point should be near the current kiln temperature), and the circuit board temperature. If view segment is pressed during IdLE, STOP is displayed then the current temperature.

Options Section

Skip Step (SKIP) – The skip step feature is only available during VARY-FIRE programs. It is used when enough heat work has been done at the current segment and you want to immediately go the next ramp rate. To skip to the next ramp, press the Skip Step button then enter

Add Time – Pressing the “Add Time” button during a hold period adds 5 extra minutes to the hold period. To add time, press the “Add Time”, TIME will be displayed, then the temperature alternating with the new hold time.

Menu - The menu is a list of options that allow you to add segments to a firing (16-S), adjust calibration (CNOS, TCOS), change settings (CHG°, Id, RSET, ERCd), or check board temperature (bd T). Navigate forward through the menu by pressing MENU and navigate backwards through the menu by pressing Skip Step. To Exit this menu without selecting any option, press **STOP**.

Menu options

- **RSET** – Resets the T/C offset to 0 and sets error codes to on. Press **MENU** until **RSET** is displayed and then press **ENTER** to activate the reset.
- **Id** - Identification number for KISS computer interface
- **16-S** – Is the only in the menu when a cone fire or User 5 is programmed. This option connects User 5 or a cone fire program to User 6. 16-S/ on flashes during program review when this option is enabled. See notes on page 14 for programing.
- **CNOS** - Adjusts the heat-work for each cone number individually. This affects only the cone number adjusted. See page 16 for programing
- **CHG°** - Switches between °F and °C
- **ERCd** – Allows the error checking of the controller to be turned on or off.
- **TCOS** – Adjusts the calibration of the temperature readings. This adjustment affects all cone numbers and user programs. See page 17 for programing.
- **bdT** – Displaying the board temperature is a diagnostic function to check the operation of the board. Used to ensure a **FAIL** message is due to a bad T/C and not due to a faulty controller. Press Menu until “**bdT**” is displayed then press **ENTER**. The temperature measured at the circuit board will be displayed for about 1 second. If you get a **FAIL** message and board temperature is approximately room temperature, then the thermocouple is faulty.
- **ARM** – Used to allow remote start from KISS
- **COST** – Used to calculate the cost per firing. See notes on next page for programing
- **dELA** – Allows the operator to program a time to delay the start of the firing. See notes on page 14 for programing
- **ALAR** – Allows the operator to set a temperature alarm. The controller will sound an alarm notifying the operator when the temperature has been reached. It has no effect on the firing. See notes on page 15 for programing.

16-S (16 segment program) Activate the 16-segment option by pressing the Menu key to display "16-S". Press ENTER to accept the option. Press "1" until the display shows "On". Press ENTER to complete activation.

In the vary-fire mode, programs 5 and 6 can be combined into a 16-segment program. To combine User 5 and 6, first program user 5 then program user 6 (each program can have from 1 to 8 segments). Next, recall user 5 then activate the 16-segment option in the menu. Press Start and the controller will fire user 5 then it will fire user 6.

****NOTE: In the vary fire mode, the first segment of user 6 must be an up ramp or the segment will be skipped.**

In the cone-fire mode, a cone-fire program is connected to the vary-fire User 6 program. To combine a cone fire program with User 6, first, program User 6 then program a cone fire. Next, activate the 16-segment option in the Menu. This is a great way to add multiple cooling segments to a cone fire profile.

Important Note: In the cone-fire mode, the controller uses the first segment of user 6 to transition from the cone fire program to User 6 so the first segment of User 6 is ignored by the controller. This means that when you program the number of segments, you must enter 1 greater than the actual number of segments you need. You then start the actual programming with segment number 2. The controller will ignore any information you input into segment 1 so as you program user 6 and the display shows RA 1, press ENTER, ENTER, ENTER to get to RA 2.

NOTE: 16-S will appear in REVIEW PROGRAM if it is activated.

Delay – Allows the operator to program an amount of time to delay the start of the programmed firing.

1. Press the Menu button until **dELA** appears on the screen.
2. Press enter and the screen will alternate between dELA and 00.00
3. Use the number pad to enter the hours and minutes you want to delay the beginning of the firing. For example if you want the kiln to start firing in 3 hours and 45 minutes, you will enter 3.45. Hours are to the left of the decimal and minutes to the right. HH.MM
4. Press enter and the screen will return to IdLE.
5. To start the firing press the Start/Stop button. The screen will read - - ON - - and then display the delay time. Once the delay time has expired the kiln will start firing.

****CAUTION****

Make sure the kiln area will stay clear and safe through out the delay and firing time.

Alarm – Allows the operator to set the high or low temperature alarm. The alarm may be set before or during a firing. When the alarm temperature is reached, a buzzer will sound. It has no other effect on the firing.

To turn the alarm off use 9999.

Program before a firing:

1. Press the menu button until **ALAR** appears on the screen.
2. Press enter and the screen will alternate between **ALRM** and 9999
3. Use the number pad to enter the temperature you want the alarm to sound at. For example, to set the alarm for 1450 °F press 1450 then press enter.
4. The screen will return to **IdLE**. Press start to begin your firing.

Program during a firing:

1. Press the menu button and **ALRM** appears on the screen alternating with 9999.
2. Use the number pad to enter the temperature you want the alarm to sound at. For example, to set the alarm for 1450 °F press 1450 then press enter. If no temperature is entered after 10 seconds the display will return to the current temperature.
3. Press enter and the screen will return the current temperature.

ERCd - Used to turn on or turn off the error codes. When you receive your controller the error codes are turned on. In most cases, you want the error codes on to protect your firings. They can be turned off if you are doing special firings, such as jewelry or glass firing where the kiln is left open. They may also be turned off when troubleshooting kiln problems.

Example: Turn the error codes off.

Step	Press	Display	Comment
1	Menu, Menu	ERCd	If “ERCd” does not show on the display, press the “Menu” key until “ERCd” displays.
2	ENTER	ON	Indicates that the error codes are turned on. You can toggle back and forth between on and off by pressing the “1” key.
3	1	OFF	Displays “OFF” indicating the error codes will be turned off.
4	ENTER	IdLE	Error codes are off. The controller returns to IdLE and the current temperature.

Adjusting Cone Offset and Thermocouple (T/C) Offset.

	CONE Offset CNOS	T/C Offset TCOS
To Correct Under-firing	Set positive (00) cone offset	Set negative (90) t/c offset
To Correct Over-firing	Set negative (90) cone offset	Set positive (00) t/c offset

CNOS (Cone Offset) - Used to raise or lower the final cone temperature. The final cone temperature can be raised or lowered a maximum of 50°F (28°C). When entering the offset temperature, the following convention is used: the left two digits designate whether to raise (00) or lower (90) the cone temperature, that is, “00” means plus (+) and “90” means minus (-). The right two digits are the number of degrees the cone temperature will be raised or lowered.

Examples:

Number	Meaning
0020	Raise the final cone temperature by 20°F increases heat work
0040	Raise the final cone temperature by 40°F increases heat work
0015	Raise the final cone temperature by 15°F increases heat work
9030	Lower the final cone temperature by 30°F decreases heat work
9005	Lower the final cone temperature by 5°F decreases heat work
9045	Lower the final cone temperature by 45°F decreases heat work

The following apply to cone offsets:

- The final temperature is affected only for the cone number that you change and no other cone numbers.
- The cone offset will remain for that specific cone number until it is changed again.
- Typing just the offset amount will raise the final temperature and INCREASE the amount of heat work.
- Typing “90” before the desired offset amount will lower the final temperature and DECREASE the amount of heat work.
- The maximum number of degrees that can be raised or lowered is 50°F (28°C)
- Cone offsets do not affect the VARY-FIRE mode.

Cone Offset Example: Adjust cone 6 to shut off the kiln at 30 F below the prescribed cone temperature.

Step	Press	Display	Comment
1	Menu (Repeatedly)	CNOS	Press the Menu key until CNOS displays.
2	ENTER	Alternately flashing: ConE & #	Cone Offset has been selected; the word CONE and the last entered cone number will alternately flash on the display. Now enter the cone number which you want to adjust the kiln to (This example: cone 6)
3	6	6	“6” will be displayed. If you type a wrong number, press zero 3 times, and then type the correct number.
4	ENTER	Alternately flashing: °FOS & number	°FOS and the previous offset alternately flash. Enter the new offset amount using the rules above, in this example, “9030”.
5	9, 0, 3, 0	9030	The selected offset temperature is displayed. If you type a wrong number, press zero 4 times, then type the correct number.
6	ENTER	The display returns to IdLE	The temperature adjustment has been accepted. The current temperature then flashes in the display. A cone 6 program will now fire 30° cooler.

TCOS (Thermocouple Offset) - Used to raise or lower the temperature indicated by the thermocouples. This is generally used to balance the heat-work in a zone controlled kiln. The maximum offset is 50°F (28°C). A positive offset displays only the amount and a negative offset is preceded by “90”. A negative offset will lower the indicated temperature reading and cause more heat-work. **When TCOS is displayed, press ENTER and the current offset for the thermocouple will be displayed. Press ENTER when the correct offset is displayed.**

The following apply to thermocouple (T/C) offsets:

- The final temperature is affected for all CONE FIRE and all VARY-FIRE programs.
- The thermocouple offset will remain for that T/C until it is changed again.
- Typing only the offset amount will raise the indicated temperature but it will lower the actual temperature in the kiln and LOWER the amount of heat work.
- Typing “90” before the desired offset temperature will lower the indicated temperature but it will increase the actual temperature in the kiln and INCREASE the amount of heat work.
- The maximum number of degrees that can be raised or lowered is 50°F (28°C).

One-Touch Information Keys – These keys will give quick access to firing and diagnostic information during a firing.

Key to touch	Description of information displayed
5	Displays the rate of temperature rise over the last 22.5 minutes of the firing. Diagnostic tool used to check if the firing is keeping up with the programmed rate.
8	Output indicator lights. This diagnostic routine uses the decimal points to indicate which section the controller is trying to heat. The left most decimal point is the top section, 2 nd decimal from left is the middle section, and 3 rd decimal from left is the bottom section. If the kiln has only one t/c then all 3 decimals come on simultaneously.
0	Shows the elapsed time of a firing. Helps track the progress of a firing. Hours are to the left of the decimal and minutes to the right.

ZONE CONTROL

Your kiln must have multiple thermocouples and be wired for multiple zones to take advantage of these features.

1. FEATURES AND ENHANCEMENTS

- 3 separately controlled zones (3 t/c inputs, 3 outputs)
- Adjustable offsets for each thermocouple (t/c)
- Continues to fire with 1 or 2 failed thermocouples (t/c's)
- Slow ramping when any zone lags the set-point
- Reset function which zeros the t/c offsets, turns the errors on, and sets the lag to 13 degrees

2. GENERAL DESCRIPTION

The Kiln Star advanced 3-zone control system is programmed the same as the single zone control but it has features to ensure even firing from the top to the bottom of the kiln. A 3-zone control has 3 temperature sensor inputs (thermocouples) and 3 independent outputs so the kiln can have 3 separately controlled sections (zones). The controller senses the temperature in each section of the kiln, compares the temperature to the desired temperature (traveling set-point) and adjusts the power going to each section separately giving each just the right amount of power to keep the temperature at the correct setting. The single zone controller only measures the temperature at the center of the kiln and gives all sections the same amount of power.

3. AUTOMATIC LAG FUNCTION

Lag refers to when the temperature of a kiln's section "lags" behind the traveling set point because the programmed ramp rate is faster than the kiln's temperature can rise. The Kiln Star will slow the ramp rate when a section of the kiln lags. The ramp rate determines the amount of "lagging" that is allowed before the firing rate is slowed. Fast ramp rates (>500 °F/hr) will allow the greatest temperature difference between sections. Slow ramp rates (<70 °F/hr) will have the smallest temperature difference between sections. Therefore, when the controller is programmed to go fast it will sacrifice evenness to obtain speed. Likewise, when the controller is programmed to go slow, the controller will maintain tighter control. The controller will try to balance speed and tight control when a medium speed is programmed.

4. THERMOCOUPLE OFFSETS

(See T/C offsets and Cone offsets in the OPTIONS SECTION for more information)

Normal variation in thermocouples (t/c) can cause a section to fire too hot or too cool. The zone control has an offset feature to adjust the reading of each thermocouple to compensate for any error. For example, if shelf cones indicate that the bottom section is under firing, it means that the controller thinks the bottom section actually reached the ending temperature when it really was below the ending temperature. To correct this problem, a negative thermocouple offset is required. This offset will be subtracted from the actual reading and will lower the temperature reading in that section. A negative offset will cause a section to fire to a higher temperature increasing the heat-work for that section. A positive offset will cause a section to fire to a lower temperature decreasing the heat-work for that section. To return all t/c offsets to zero, press Menu, "RSET" will be displayed, press ENTER; RSET also turns the error codes (ERCd) on.

5. THREE THERMOCOUPLES

Besides better measuring of the temperature, the zone control also offers security through its three thermocouples. With a single zone controller, a firing will be stopped if the thermocouple (t/c) fails. The zone control with 3 t/c's, will continue to fire if one or two of its thermocouples fail during a firing. If the top or bottom thermocouple fails, that section will be controlled by the middle t/c. If the middle thermocouple fails the middle section will be controlled by the top t/c. If the controller is at "IdLE" and a t/c fails, the display will alternate between FAIL and the number of the failed t/c (1,2,3).

The display, when using three thermocouples, defaults to showing the temperature in zone 2, by displaying **TC2**, alternating with the temperature in that zone. The temperature of each zone can be viewed. The temperature will alternately flash with the currently selected zone. To select zone 1, press the "1" key and **TC1** will alternate with the current zone 1 temperature. For zone 3, press "3" key.

APPENDIX A: CONE FIRE TEMPERATURE PROFILES

Firing Profiles for cone 04, temperature 1945°F (1063°C)

<u>Slow Bisque</u>					<u>Slow Glaze</u>				
Segment	Rate	°F	Temperature	Stage	Segment	Rate	°F	Temperature	Stage
	/hr			Time		/hr			Time
3	80		250	2.25	5	150		250	1.20
4	200		1000	3.75	6	400		1695	3.61
5	100		1100	1.00	7	120		1945	2.08
6	180		1695	3.31					
7	80		1945	3.13					
13 hrs	26 mins		Total Time	13.43	6 hrs	54 mins		Total Time	6.90

<u>Fast Bisque</u>					<u>Fast Glaze</u>				
Segment	Rate	°F	Temperature	Stage	Segment	Rate	°F	Temperature	Stage
	/hr			Time		/hr			Time
3	120		250	1.50	6	570		1695	2.85
4	300		1000	2.50	7	200		1945	1.25
5	150		1100	0.67					
6	180		1695	3.31					
7	108		1945	2.31					
10 hrs	17 mins		Total Time	10.29	4 hrs	6 mins		Total Time	4.10

Firing Profiles for cone 6, temperature 2232°F (1222°C)

<u>Slow Bisque</u>					<u>Slow Glaze</u>				
Segment	Rate	°F	Temperature	Stage	Segment	Rate	°F	Temperature	Stage
	/hr			Time		/hr			Time
3	80		250	2.25	5	150		250	1.20
4	200		1000	3.75	6	400		1982	4.33
5	100		1100	1.00	7	120		2232	2.08
6	180		1982	4.90					
7	80		2232	3.13					
15 hrs	2 mins		Total Time	15.03	7 hrs	37 mins		Total Time	7.61

<u>Fast Bisque</u>					<u>Fast Glaze</u>				
Segment	Rate	°F	Temperature	Stage	Segment	Rate	°F	Temperature	Stage
	/hr			Time		/hr			Time
3	120		250	1.50	6	570		1982	3.35
4	300		1000	2.50	7	200		2232	1.25
5	150		1100	0.67					
6	225		1982	3.92					
7	108		2232	2.31					
10 hrs	54 mins		Total Time	10.90	4 hrs	36 mins		Total Time	4.60

These charts show the segments for the four cone fire speeds for cone 04 and cone 6. Notice that the firing profiles all end with segment 7 but they do not start at segment 1. The cone fire programs all end with segment 7 and count back to get to the beginning segment which is not segment 1. If you program a vary-fire program to mimic these profiles you would start numbering with segment 1, so for a Slow Glaze firing you would have only 3 segments, 1, 2, and 3. The firing rates for cone numbers other than cones 04 & 6 are the same as these but the end and final segment temperatures are different. The last segment (segment 7 in the cone fire profiles) always starts 250°F below the final cone temperature. The actual temperature reached during a cone fire program will vary based on the rate of temperature rise during the last segment. This ensures the correct amount of heat-work is done with each cone fire program. You can see the shut-off temperature by pressing "Review Program" after the firing has gone to CPLT. The temperature displayed after the cone number is the actual temperature that the kiln shut off.

APPENDIX B: Error Codes

The error codes are displayed as an “E” followed by a “-” then a number or letter. For example “E-1” stands for error one.

NOTE: If you get an error code it is important to note the error letter or number. It will help in diagnosing any problem with the kiln.

The list of error codes follows:

THESE ERRORS WILL ONLY BE DETECTED IF ERROR CODES (ERCD) ARE ON:

Error Code	Description	Possible Causes
E-1	Kiln temperature increasing slower than 12°F per hour when ramping up	This is a kiln heating problem, not a controller problem. Do the Full Power Test to check elements and relays. Low or dropping voltage to the kiln could also be the cause. A thermocouple reading incorrectly or improperly placed may also be the cause.
E-2	Kiln temperature 50°F above hold temperature	A relay latched in the “on” position may cause this error. Another possible cause is if the kiln lid is opened for rapid cooling, then closed, such as for glass firings.
E-3	Kiln temperature 50°F below hold temperature	Relay failure.
E-4	Kiln temperature 50°F above previous hold when ramping down	Same causes as for E-2.
E-5	Kiln temperature 50°F below traveling set point when ramping down.	Relay failure.
E-d	Kiln temperature 50°F above traveling set point	Stuck relay or stuck output. If using zone control, then the outputs or t/c’s may be in the wrong zones.

THE ERROR CODE SETTING DOES NOT AFFECT THESE ERRORS:

Error Code	Description	Possible Causes and/or Corrections
E-0	Software error	Check the selected program and reprogram, if necessary. If error persists or program does not hold in memory, controller may need to be returned to factory for service.
E-6	Problem with thermocouple leads	This generally indicates the thermocouple is connected incorrectly, possibly reversed. Ensure the thermocouple extension wires are connected correctly to the controller and at all connection blocks back to the thermocouple.
E-8	In cone fire mode, temperature decreasing in last segment	If the kiln has a kiln-sitter, it may have turned the kiln off before the controller did. Other possible causes are broken element or relay failure.
E-9	Software thermocouple selection does not match the hardware thermocouple jumper selection	The jumper on the circuit board and the setting for thermocouple TYPE in the software do not match.
E-22 or E-26	Error in readings.	Check for reversed thermocouple leads. If leads are correct, then the analog to digital converter on the circuit board may not be functioning and the controller may need to be returned to the factory for service.

E--	Power loss during EEprom write	Turn the controller off and back on. Recheck the selected program and reprogram, if necessary.
E-A	Invalid program variable	Reprogram all eight segments of the program being fired. If error persists, controller may need to be returned to factory for service.
E-bd	Board temperature too high	The control box temperature may be too hot or the limit temperature may need to be reset. If the room temperature is very hot, aiming a fan at the control box may decrease the temperature.
E-E	Hardware error	Controller will need to be returned to the factory for service.
E-R	Microprocessor memory does not match program storage memory (EEprom)	Reprogram and try to fire again. If error persists, controller may need to be returned to factory for service.
E-U	Invalid 16-segment firing attempted.	Reprogram and restart firing.
ERRP	ERRP and the current temperature are alternately flashing. To clear the display, press the "1" key. The firing in progress will continue.	Power outage; kiln is still firing.
FAIL	Steady FAIL indicates all t/c's have failed. If FAIL alternately flashes with TC 1 , then t/c one (top section) has failed. If FAIL alternately flashes with TC 2 , then t/c two (middle section) has failed. If FAIL alternately flashes with TC 3 , then t/c three (bottom section) has failed.	Check the board temperature in the Menu. If board temp displayed with bd T is approximately room temperature, then the t/c is defective. If bd T display shows a high temperature or FAIL without showing room temperature, circuit board is defective.
P-F	Power failure. Firing has stopped.	Power was lost during a firing and the kiln temperature was below 140°F or the kiln temperature dropped more than 250 degrees during the power outage.
STUC	Key was held too long or is stuck.	If problem persists after releasing key, controller may need to be returned to the factory for keypad replacement.

Full Power Test

The full power test is used to check the relays and elements of the kiln. Program a 1-segment Ramp-Hold program to go up as fast as possible to 1000°F with no hold (1 segment, RA1 9999, °F1 1000, HLd1 0000) or program a Fast Glaze program to cone 04. Leave the lid of the kiln open and start the firing. Visually inspect the elements after the kiln has fired for 10 to 20 minutes. Observe each element from where it comes into the kiln all the way around to see that it is equally bright throughout. The following observations are possible:

One section of the kiln is dark and not going on. This indicates a defective relay since there is usually one relay per section.

One element is not glowing at all. This indicates a broken element.

There are darker (cool) spots along the elements. This indicates worn elements.

The top and bottom elements appear brighter. This is normal for many kilns that have hotter elements in the top and bottom.

After you have made your observations, turn off the kiln.

APPENDIX C: Common Questions and Situations

Q. During programming of a firing, I typed a wrong number. How do I correct this?

- A.** Before pressing ENTER, enter zero until all zeros are displayed, then enter the correct number. If you have already pressed ENTER, you must press enter to progress through to the end of the program then start the program again.

Q. How do I clear the “PF” from the display?

- A.** Press the “1” key. After several seconds the current temperature will be displayed. Several other numbers or STOP may be displayed before the current temperature.

Q. What does it mean when “FAIL” is displayed?

- A.** Most likely the t/c (thermocouple) is defective. See P. 20 ("bd T", board temperature) to determine if the t/c or circuit board is at fault. If the t/c is faulty, it may actually be poor connections on any extension wire rather than the t/c itself. For type K thermocouples check all connections and ensure that yellow wires are connected to yellow wires and red to red all the way from the circuit board to the t/c in the kiln. It is a good idea to loosen the screw connections and then retighten them to break any oxide that may have built up. When connecting the thermocouple, connect the RED wire to the connector with RED dot and connect the YELLOW wire to the connector with the “+”. On type "K" thermocouples, the RED wire is always negative, and the YELLOW wire is positive. On type “S” thermocouples the RED wire is negative and the BLACK wire is positive.

Q. How can I find out the final temperature that was reached during a cone firing?

- A.** At the end of a cone fire, the firing time and CPLt will be flashing alternately in the display. Press “STOP”. Then press “Review Program”, the final temperature will display after oF. This final temperature will be retained until the next firing or until the controller is reprogrammed or turned off.

Q. What is a segment?

- A.** A segment is the basic building block of a program either in cone-fire or vary-fire (ramp/hold). Each segment consists of a ramp rate in degrees per hour, a temperature you want to achieve, and whether you want to hold there or not. For example, a program for drying ware going at 60°/hour to 200°F and holding for 2 hours would be a one segment firing, the ramp is 60, the temperature is 200, and the hold is 2.00.

Q. Do I need to use witness cones for each firing?

- A.** After checking your kiln with witness cones for the first few firings, if you are satisfied with the results you are getting and how even the kiln is from top to bottom then you do not need to use cones in each firing. It is a good practice to periodically place witness cones in the kiln to check for proper firing. If you suspect a problem or your results have changed then it is a good idea to check the operation of the kiln with witness cones.

APPENDIX D: Firing Program Blank

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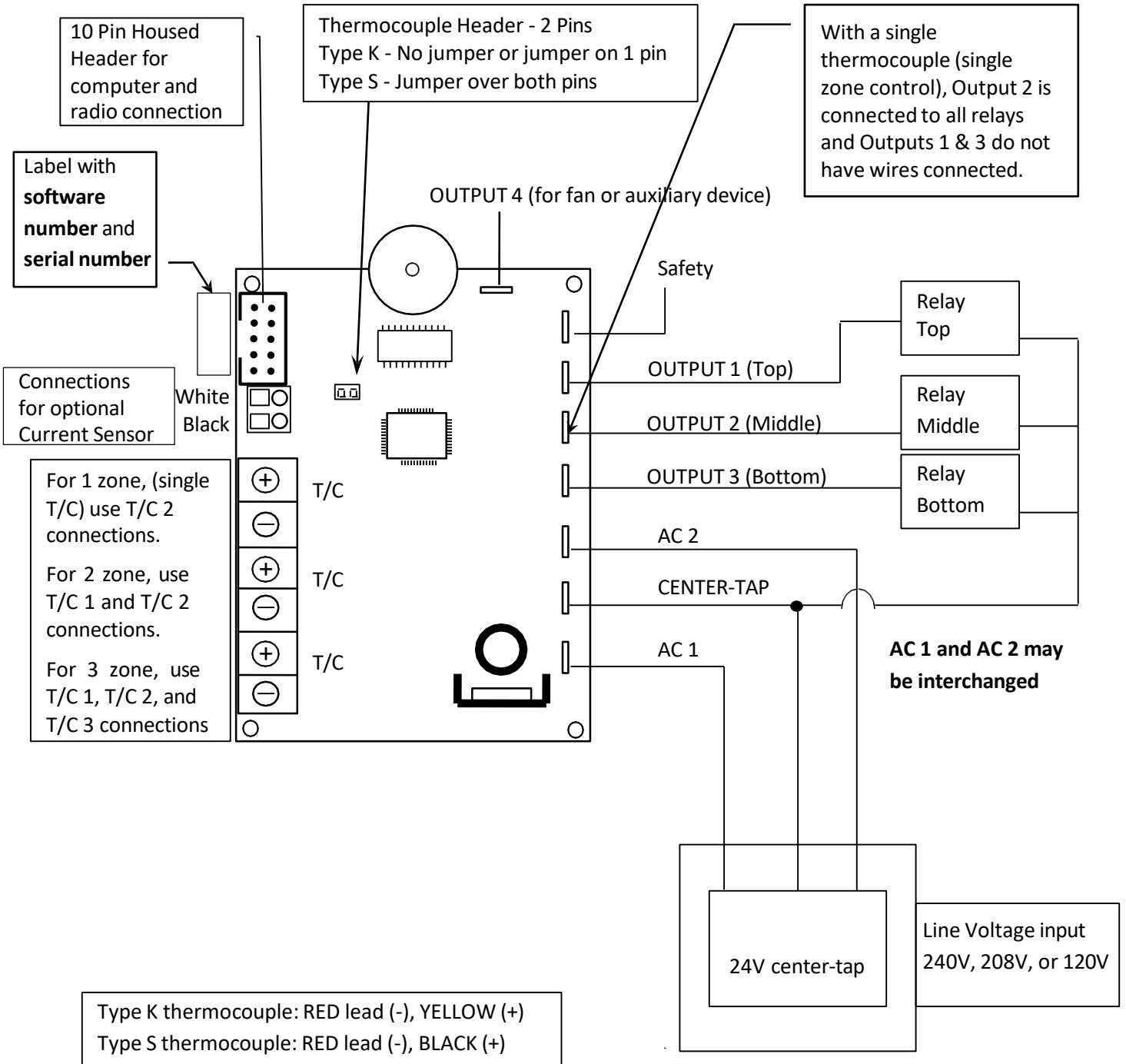
Firing Program Number: _____

Segment	Rate per Hour	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

Firing Program Number: _____

Segment	Rate per Hour	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

APPENDIX E: Connection Diagram



APPENDIX F: Vary Fire Default Programs

These Vary-Fire programs are preloaded into the controller. You can write over them to create your own programs. If you have changed these programs they can be stored by pressing Menu then 4, 4, 3. Then press Menu again until "REST" is displayed, press ENTER. The original programs will be restored.

For all the programs the alarm is set to off (9999).

User 1 Glass Slump, medium speed

Seg	Rate	Temperature	Hold
1	500	250	00.12
2	500	500	00.12
3	500	750	00.12
4	600	1100	00.05
5	600	1220	00.05
6	9999	1000	01.00
7	90	970	01.00
8	120	750	00.01

User 2 Glass Tac Fuse, medium speed

Seg	Rate	Temperature	Hold
1	500	250	00.12
2	500	500	00.12
3	500	750	00.12
4	600	1250	00.20
5	600	1350	00.10
6	9999	1000	01.00
7	90	970	01.00
8	120	750	00.01

User 3 Glass Full Fuse, medium speed

Seg	Rate	Temperature	Hold
1	500	250	00.12
2	500	500	00.12
3	500	750	00.12
4	600	1250	00.20
5	600	1480	00.15
6	9999	1000	01.00
7	90	970	01.00
8	120	750	00.01

User 4 Bead Annealing

Seg	Rate	Temperature	Hold
1	9999	960	08.00
2	9999	960	00.40

User 5 Jewelry, wax burn-out

Seg	Rate	Temperature	Hold
1	9999	300	01.00
2	100	350	00.30
3	350	1350	01.30
4	300	900	99.99

User 6 Cone 6 cool down

Seg	Rate	Temperature	Hold
1	9999	2232	00.00
2	9999	1900	00.00
3	150	1500	00.00

Notes

Notes