Jen-Ken Kilns

Operating Manual

AF3P Pre-programmed 3-Key Controller
Version AF4X
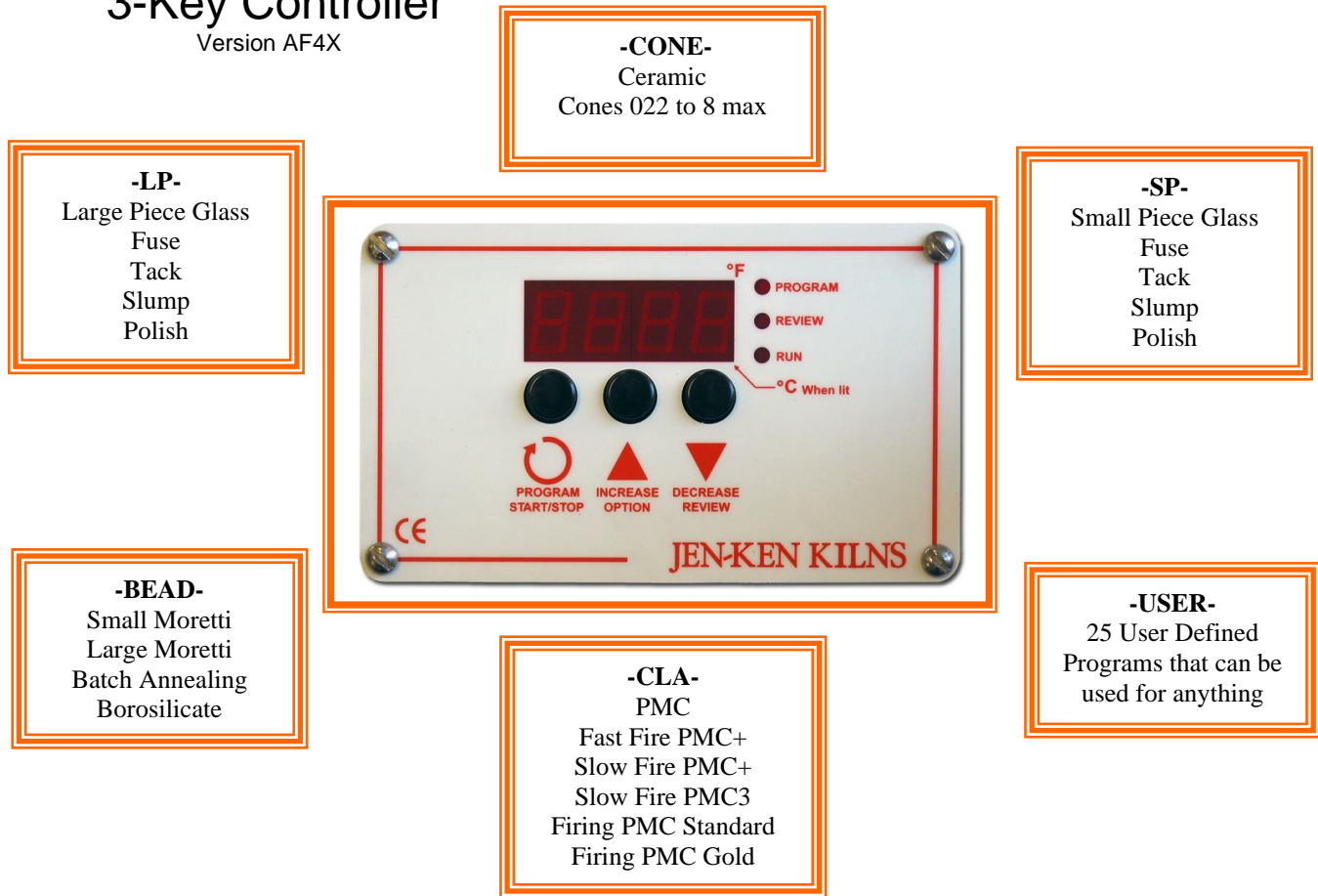
-CONE-
Ceramic
Cones 022 to 8 max

-LP-
Large Piece Glass
Fuse
Tack
Slump
Polish

-SP-
Small Piece Glass
Fuse
Tack
Slump
Polish

-BEAD-
Small Moretti
Large Moretti
Batch Annealing
Borosilicate

-CLA-
PMC
Fast Fire PMC+
Slow Fire PMC+
Slow Fire PMC3
Firing PMC Standard
Firing PMC Gold

-USER-
25 User Defined
Programs that can be
used for anything

Jen-Ken Kilns and Orton have produced the most user friendly and powerful, kiln controller for artists. If the Jen-Ken Kiln can perform all the above tasks, then all of the above settings will been turned on. The Chilipepper is a low firing annealing kiln and will only have the –BEAD- setting turned on. The AF4X Bead Annealer with flip door will have all of the above turned on except the Cone feature because the kiln cannot fire that hot. If the kiln is a glass kiln then the CONE feature will be turned off as well.

PLEASE DO NOT PROOGRAM A JEN-KEN KILN FOR GLASS OVER 1700°F AS YOU WILL DAMAGE THE KILN!

This manual contains instructions on the operation of our Jen-Ken Kilns with the AF4X Pre-programmed 3-Key Controller, that was made for us by Orton, as well as a discussion of general fusing procedures. It is not intended to replace a fusing class or comprehensive fusing instructional media. The products you put in the kiln to fire will come with or have available firing schedules for these products.

Jen-Ken Kilns wants you to have this manual to get you firing sooner and to see sample programs that you can use or modify the programs to match the one's for the items you are firing.

AF4X Kiln Controller
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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 M-F 8-4 Eastern Time

NEVER LEAVE A FIRING KILN UNATTEND. THIS MEANS TO NEVER RUN A KILN AND GO TO BED or LEAVE THE PREMESIS. RUN THE KILN WHEN YOU ARE ABLE TO CHECK ON THE KILN DURING THE FIRING AND AT COMPLETION OF THE FIRNG CYCLE.   THEN TURN THE KILN OFF AND ALLOW TO COOL, VERIFY THAT IT IS COOLING AND NO LIGHTS ARE ON THE PANEL.   UNPLUG IF NEEDED
SAFETY IS JOB ONE.
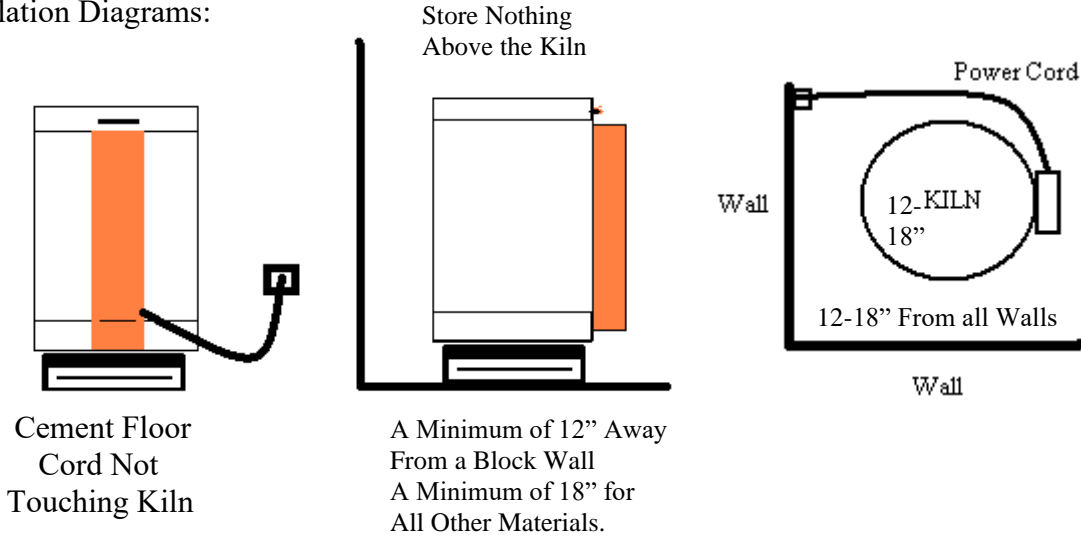
ABOUT YOUR KILN

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:

Store Nothing
Above the Kiln

Power Cord

Wall

12-KILN
18"

12-18" From all Walls

Wall

Cement Floor
Cord Not
Touching Kiln

A Minimum of 12" Away
From a Block Wall
A Minimum of 18" for
All Other Materials.

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 at 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 perform 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 CERAMIC KILNS

Models JK, FR & AF &AF3C	Voltage	Amperage Draw	Wire Size Required	Fuse Required	Receptacle
11/9	120	15	12	20	5-20R
11/9 17a Dedicated Circuit	120	17	12	20	5-20R
1513 (Emerge)	240	22	10	30	6-30R
1811	240	20	10	30	6-30R
1822	240	26	10	30	6-30R
1829	240	39	6	50	6-50R
2122	240	30	8	40	6-50R
2422	240	36	6	50	6-50R
2431	240	45	6	50	6-50R
2829*	240	45 OR 55	6	50 OR 60	6-50R OR DW
Oval 27	240	55	6	60	Direct Wire
(JK)^2 22	240	40	6	50	6-50R
(JK)^2 29	240	45 OR 55	6	50 OR 60	6-50R OR DW
Ceram-a-Glass 1513	240	20	6	30	6-30R
Ceram-a-Glass 1815	240	26	6	30	6-30R
Ceram-a-Glass 2422	240	45	6	50	6-50R
Ceram-a-Glass 2822	240	45	6	50	6-50R
Ceram-a-Glass (JK)^2 22	240	45	6	50	6-50R
Ceram-a-Glass Oval 18	240	48	6	50	6-50R
Mega Coil 1822 3"	240	30	6	40	6-50R
Mega Coil 2422 3"	240	36	6	50	6-50R
Mega Coil 2431 3"	240	45 or 55	6	50 or 60	6-50R OR DW
Mega Coil 2822 3"	240	42	6	50	6-50R
Mega Coil 2829 3"	240	55	6	60	6-50R OR DW

IF YOUR KILN IS OVER 40 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!!!!

* The 2829, Oval, JK Squared Series can be ordered as a 45-amp kiln or a high-fire 55-amp kiln, requiring direct wire installation. The higher amperage means the kiln con fire to higher cone numbers more times with the added power.

For kilns ordered with the 208-volt elements, the same amperages, wire size, breaker and receptacle should be followed as the 240 chart above.

JEN-KEN Glass Kilns

MODELS GS & Digitals	Voltage	Amperage Draw	Wire Size Required	Fuse Required	Receptacle
Chilipepper	120	8	14	15	5-15R
Fuse Box	120	8	14	15	5-15R
Cre-8	120	13	14	15	5-15R
Fuse-It	120	13	14	15	5-15R
Cube	120	15	14	20	5-15R
Vitri Graph or Vitri Barrel	120	15	12	20	5-15R
Cube 2 w/ 2" Flip Door	120	13	14	15	5-15R
Cube 4 w/ 4" Flip Door	120	13	14	15	5-15R
Bead Annealer 11/4.5 w/ or w/o 2" Flip Door	120	13	14	15	5-15R
Bead Annealer 11/9 w/ or w/o 4" Flip Door	120	13	14	15	5-15R
11/6	120	13	14	15	5-15R
11-E	120	15 or 17	12	20	5-20R
Bonnie Glo	120	13	14	15	5-15R
Bonnie Glo Tilt	120	13	15	15	5-15R
Bonnie Glo Tall	120	15	15	20	5-15R
15/6	120	15	12	20	5-15R
15/6 Glass Casting	120	15	12	20	5-20R
15/9 Glass Casting	120	17	12	20	6-20R
Profusion 16	120	15	12	20	5-15R
18-E	240	20	10	30	6-30R
18-E 15"	240	26	10	30	6-30R
1815 Glass Casting	240	26	10	30	6-30R
24-E	240	23	10	30	6-30R
24-E 15"	240	26	10	30	6-30R
2415 Glass Casting	240	26	10	30	6-30R
28-E	240	25	10	50	6-50R
28-E 15"	240	45	6	50	6-50R
2815 Glass Casting	240	45	6	50	6-50R
(JK)^2	240	36	8	50	6-50R
(JK)^2 15"	240	45	6	50	6-50R
(JK)^2 Glass Casting	240	45	6	50	6-50R
OVAL 9	240	36	8	50	6-50R
OVAL 13	240	45	6	50	6-50R
OVAL 13 Glass Casting	240	45	6	50	6-50R
OVAL 18"	240	45	6	50	6-50R
OVAL 18" Glass Casting	240	45	6	50	6-50R
Crucible 11	240	17	12	20	6-20R
Crucible 1813	240	39	6	50	6-50R
DW Crucible	240	45	6	50	6-50R
Pro Fusion 26	240	36	6	50	6-50R

Pro Fusion 26 Deep	240	36	6	50	6-50R
Pro Fusion 38	240	36	6	50	6-50R
Pro Fusion 38 Deep	240	36	6	50	6-50R
Pro Fusion 52	240	45	6	50	6-50R
Pro Fusion 52 Deep	240	45	6	50	6-50R
Wall Remote 120-15a	120	20	14	20	5-15R
Wall Remote 120-20a	120	20	12	20	5-20R
Wall Remote 240-20a	240	20	12	20	6-20R
Wall Remote 240-30a	240	30	10	30	6-30R
Wall Remote 240-50a	240	50	6	50	6-50R

IF YOUR KILN IS OVER 40 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!!!!

If your kiln in not listed call the factory and we will be glad to help you.
863-648-0585
Some kilns are special orders, some are over 30 to 60 years old or limited runs of a unique type of kiln.
So, if in doubt about anything, please call.

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:

SHELVES: Shelves help you make the most of the inside of your kiln. Shelves are sized a few inches smaller than the inside diameter of the kiln so that they can be placed in and out of the kiln easier. They are made of refractory material so that they should be handled carefully. Shelves come in full and half sizes. Half shelves enable you to fire tall pieces on one side of the kiln and smaller ones on the other side. Should a crack appear in a shelf, break the shelf along the crack and use it as two separate pieces. A good coat of kiln wash should ALWAYS be maintained on top of the shelves. Ceramics use ceramic kiln wash with silica in it and glass requires glass kiln wash with no silica in it to stick to your glass. Store shelves upright on edge leaning on a sturdy structure. Shelves stacked flat can put too much pressure on the bottom shelf and cause it to stress and crack. It usually breaks in the kiln during the next heating.

POSTS: Posts are also made from refractory material and should be handled carefully. Post sizes range in heights from ½" to 14". They are used to support the shelves in your kiln at different levels depending upon the height of the ware you are firing. Usually, three posts will allow you to level the shelf easier (though some prefer four). Glass kilns with lid elements usually only use one shelf at a time. The lid element does most of the work heating the one shelf and would not provide the direct radiant heat to a lower shelf. The top shelf would fire fine with the bottom shelf lagging behind by a large temperature differentiation. Posts do not need to be to the outer edge of the shelf. Move the posts in several inches so that the posts help support more of the middle of the shelf. This will help keep the middle of the shelf supported from underneath without a post there. For large shelves this is required so that the shelf is not supported at the edges, but more towards the center.

RECOMMENED ACCESSORIES:

CERAMIC KILN WASH: Ceramic kiln wash is a protective coating used to keep glazes and porcelain from sticking to the kiln shelf and the kiln floor. Mix the desired amount of dry, high fire kiln wash with water to the consistency of a thick cream and stir thoroughly. Apply several thin coats of kiln wash with a haike brush to the kiln floor and the tops of the shelves, alternating directions. Let dry. When areas wear thin they may be re-coated. If glazes have dripped onto the shelves or the kiln floor, chip the glazes off, sand and smooth the area then reapply the kiln wash. To test kiln wash, slide your hand over the surface of the kiln washed shelf. If you hand is white and powdery, the kiln wash is satisfactory. Perform this test periodically. When the palm of your hand is clean, then re-apply kiln wash to the shelf to prevent the ware from sticking.

Apply a thin coat of kiln wash to the cone supports on the kiln sitter and to the bottom of the sensing rod (where they come in contact with the cone). However, do NOT apply kiln wash to the cone or to the side of the porcelain tube.

GLASS KILN WASH: Glass kiln wash is a coat that keeps glass from adhering to the kiln shelf and the kiln floor in the event of a glass run. It is best to wear a dust mask while cleaning and working with the kiln wash.

First stir the dry kiln wash powder with a spoon to mix the clays. The add the kiln wash to water in a separate sealable container. The most common mixture is 4-5 cups of water to 1 cup of kiln wash powder. Stir well to get all the lumps out. Apply kiln wash using a soft bristled brush to the kiln shelf. Flow the first coat on in one long brush stroke. Repeat this with parallel brush strokes. Allow the shelf to absorb most of the moisture then apply another coat in a cross direction to the first. Between coats be sure to stir the kiln wash in a mixing container with the brush as this will keep the clays from settling. Repeat this for 8-10 THIN coats. If the kiln wash layers are too thick, it will crack when fired and will then need to be removed and reapplied.

Let the shelf stand for several days to dry or place it in the kiln and heat it up to 500°F with the lid propped open a few inches. If the shelf surface is not smooth when dried, use the palm of your hand and rub the kiln washed shelf gently in a circular motion till smooth.
 Also apply a protective coating of kiln wash to the floor of the kiln, as hot glass can create holes in the fire brick of the kiln. Store the unused kiln wash (liquid or powder) in a sealed container.

Over time the wash may begin to chip or crack, or if applied too thick then then you need to scrape the old kiln wash off with a putty knife and reapply another 8-10 layers.

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

o   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.

o   Remove all packaging from the kiln and place it on the stand. Do not plug it in yet.

o   Make sure that your kiln sits completely level. It may be necessary to use a level to determine

o   Open the lid of the kiln and inspect the interior looking for anything unusual like broken brick.

o   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.

o   Vacuum out the interior of your kiln and along the grooves in the lid to remove any debris that may come loose when you close the lid or during firing.

o   Carefully brush kiln wash on the floor of your kiln. This is preventive maintenance in case glass ends up the floor of the kiln. Do not brush kiln wash on either the sides or lid of the kiln. Do not get kiln wash on any heating elements.

o   Position the ½" kiln posts on the bottom of the kiln spaced out evenly to support the kiln shelf.

o   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. One of the PMC firing programs would offer the fastest firing schedule. (Such as **P-FS**, page 39, 40)

o   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.
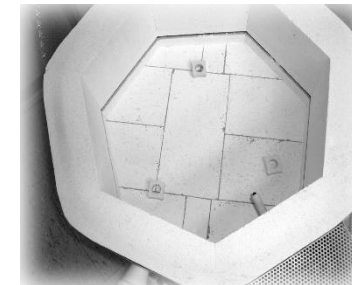
Make sure your kiln sits level.

Vacuum any loose debris
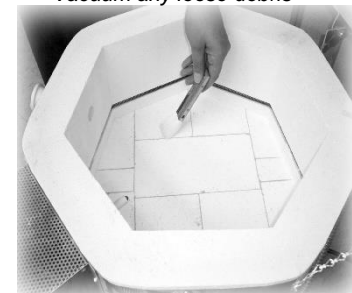
Brush kiln wash on the floor.

Position posts on the bottom.

QUICK START GUIDE

Enough of this reading stuff – I want to fire something!

For those of you who can't wait, here is a brief guide to get you up and running. It is strongly recommended that you do take time to look over the controller instructions as soon a possible.

Quick Start Guide:

Plug the Kiln in to an appropriate outlet and turn it on using the toggle switch on the side of the control box.

The display will first indicate **88.88** for about five seconds, then ----, then alternates between the internal kiln temperature and **IdLE.**

Programming and Changing the Firing Mode:

o   Press the (Program) button once to see the current mode.
o   Press the (Increase) button to see the available modes for this kiln.
o   Press the (Program) button to choose to the desired firing configuration,
o   Examples: (**-LP-. -SP-, bEAd, CLA,** or **USR**)
o   Press the (Increase) button to view the Options under the configuration.
o   Examples for -90- will be Fuse, TAC, Slump, & Polish.
o   Press the (Program) button to select to the desired firing configuration.
o   Then Press the Program button slowly and repeatedly to scroll through the program. (This is the time to alter the numbers if needed in the program, to tweak them).   RATE, TEMP, HOLD and RATE, TEMP, HOLD and so on until STRT and then once to --ON--.   The Controller will then pause and start cycling on and off to run the schedule.   To Stop the firing press the (Program) Button to Abort and again to return to the Idle resting mode.

Kilns with Mechanical Relays will click on and off as the kiln heats.

Kilns with Solid State Relays usually will flash quickly and with no noise as the kiln heats.

When the firing is complete, turn off the kiln with the toggle switch and let cool.   Then turn on the kiln hours later to see IDLE and the current temperate in the kiln.   Do not open the kiln until it has reached below 100 degrees F.

DON'T BE TEMPTED – DO NOT open the kiln until the display indicates that the kiln has reached room temperature!

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!

AF4X 3-Key Controller Instructions

Keypad Overview

 This key is for selecting a firing program and advancing through the programming steps. After programming is complete, use this button to Start and Stop the firing.

 This key is used to step forward the display values for specific program settings Also use this button for access to the option menu.

 This key is used to step backwards the display values for specific program settings. It is also used to activate the Program Review feature.

When using the Increase and Decrease keys to program number values, the values will change more rapidly if the key is held in.

In general, the user interface is very simple. Use the increase and decrease keys to change the display prompt, when you see what you want on the display, press the Program key.

Display Lights

The controller uses (4) numerical displays and 3 indicator lights. The bottom light tells when the controller is turning on the relays to power the heating elements. The top is lit when the controller is in programming mode, the middle light is lit when the controller is in Program review mode.

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.

Stopping 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**

Programming values

Whenever a change is made from the keys, you must press the *Program/Start* key to load the changes. If the key is not pressed, the controller will simply wait for your next selection. Pressing the *Program/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.

Program Review

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

Repeating a firing

If power is not cycled off to the controller, you can repeat a firing without viewing the entire program, simply press the *Decrease/review* key when the controller display is showing the desired program group. The controller will scroll through the program review and advance directly to the Start prompt. Press the *Program/Start* key to set a delay time and again to begin the firing.

Program Sets

The AF4X controller allows the operator to select 1 of 6 program modes for different glass art or craft applications.

The program mode is prompted on the controller display when the controller is turned on. The 6 available modes are:

     -LP-   For larger glass projects for the kiln (full shelf size and/or 3 or more layers)
     -SP-   For smaller glass projects (small pieces on the same shelf and/or 2 layers)
     bEAd For bead annealing projects

> **CONE** For Cone Firing of Ceramics (Only if kiln is rated for over 1800ºF and is not top firing)
>
> **CLA** For Metal Clay projects
>
> **USr** For custom firings

-LP- Large Piece Program Mode

-LP- Large Piece Program Mode   For pieces that are large in size for the shelf of the kiln (over 2/3 the shelf area and/or 3 or more layers thick). This is a good place to start for that large project knowing that you can speed up the rates (Ra) later if the piece turns out well.

The **L**arge **P**iece mode provides 4 preset firing schedules for glass forming and 4 optional User Programs for creating custom firing schedules. The 4 preset programs are recommended firing schedules that can also be customized if necessary. These programs provide the various heating and cooling steps for easy selection.

Full Fuse   Displayed as **FUSE**

This program heats at 200ºF/hour to 1000ºF and holds this temperature for 30 minutes.
Then heats at Full Power (fast as it can) to 1350ºF and holds this temperature for 30 minutes. Then heats at 500ºF/hour to 1425ºF and holds this temperature for 20 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 1.00 hour.
Then cools at 150ºF/hour to 700ºF with 0 hold and shuts off.

Tack Fuse   Displayed as **tAC**

This program heats at 200ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1250ºF and holds this temperature for 10 minutes.
Then heats at Full Power (fast as it can) to 950F and holds this temperature for 1.00 hour.
Then cools at 100ºF/hour to 700ºF with 0 hold and shuts off.

Slump   Displayed as **SLP**

This program heats at 200ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1280ºF and holds this temperature for 20 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 1.00 hour.
Then cools at 100ºF/hour to 700ºF with 0 hold and shuts off.

Fire Polish   Displayed as **POL**

This program heats at 200ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1200ºF and holds this temperature for 15 minutes.
Then heats at Full Power (fast as it can) to 950F and holds this temperature for 1.00 hour.
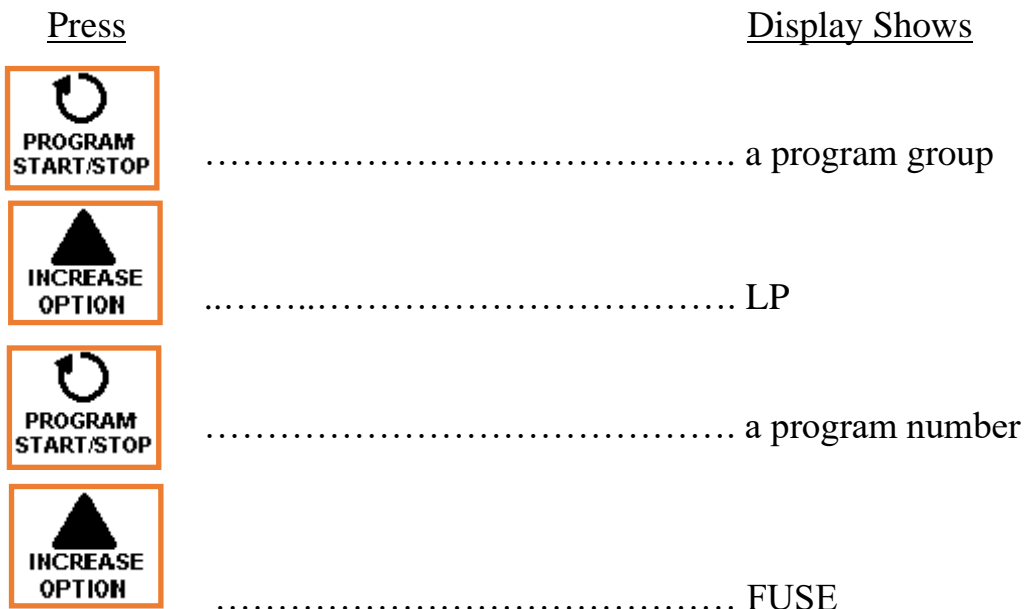Then cools at 100ºF/hour to 700ºF with 0 hold and shuts off.

-LP- Programs

-LP-	Program	Rate	Target	Hold
FUSE	Full Fuse	200.0F(111.1C)/hour *	1000.0F(537.7C) *	00.30 *
		FULL *	1350.0F(732.2C) *	00.30 *
		500.0F(277.7C)/hour *	1425.0F(773.8C) *	00.20 *
		FULL *	950.0F(510.0C) *	01.00 *
		100.0F(55.5C)/hour *	700.0F(371.1C) *	00.00 *
TAC	Tack Fuse	200.0F(111.1C)/hour *	1000.0F(537.7C) *	00.00 *
		500.0F(277.7C)/hour *	1250.0F(676.6C) *	00.10 *
		FULL *	950.0F(510.0C) *	01.00 *
		100.0F(55.5C)/hour *	700.0F(371.1C) *	00.00 *
SLP	Slump	200.0F(111.1C)/hour *	1000.0F(537.7C) *	00.00 *
		500.0F(277.7C)/hour *	1280.0F(693.3C) *	00.20 *
		FULL *	950.0F(510.0C)	01.00 *
		100.0F(55.5C)/hour *	700.0F(371.1C) *	00.00 *
POL	Fire Polish	200.0F(111.1C)/hour *	1000.0F(537.7C) *	00.00 *
		500.0F(277.7C)/hour *	1200.0F(648.8C) *	00.15 *
		FULL *	950.0F(510.0C) *	01.00 *
		100.0F(55.5C)/hour *	700.0F(371.1C) *	00.00 *

The preset Large Piece programs can be edited. Each program segment can be changed by the operator. To restore the factory values, enter a zero value for the first **rA1** segment of each program and press the Program button.

LP Program Example

To fire Full Fuse.

Follow these steps: starting with the controller displaying **IDLE**

Press   Display Shows

[PROGRAM START/STOP] …………………………………… a program group

[INCREASE OPTION] ……….………………………… LP

[PROGRAM START/STOP] ………………………………… a program number

[INCREASE OPTION] ………………………………… FUSE

 ………………………………… STRT

 …………………………………….... DELA / 00.00

 ……………..…………………….. -ON-

-SP- (Small Piece) Program Mode
For pieces that are smaller in size for the shelf of the kiln (less than 1/2 the shelf area and/or 2 layers thick). This is a good place to start for that large project knowing that you can speed up the rates (Ra) later if the piece turns out well.

The **S**mall **P**iece mode provides 4 preset firing schedules for glass forming and 4 optional User Programs for creating custom firing schedules. The 4 preset programs are recommended firing schedules that can also be customized if necessary. These programs provide the various heating and cooling steps for easy selection.

Full Fuse   Displayed as **FUSE**

This program heats at 300ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at Full Power (fast as it can) to 1350ºF and holds this temperature for 0 minutes. Then heats at 500ºF/hour to 1425ºF and holds this temperature for 10 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 30 minutes.

Tack Fuse   Displayed as **tAC**

This program heats at 300ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1250ºF and holds this temperature for 10 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 30 minutes.

Slump   Displayed as **SLP**

This program heats at 300ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1280ºF and holds this temperature for 20 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 30 minutes.
.

Fire Polish   Displayed as **POL**

This program heats at 300ºF/hour to 1000ºF and holds this temperature for 0 minutes.
Then heats at 500ºF/hour to 1200ºF and holds this temperature for 15 minutes.
Then heats at Full Power (fast as it can) to 950ºF and holds this temperature for 30 minutes.

-SP- Programs

-SP-	Program	Rate	Target	Hold
FUSE	Full Fuse	300.0F(166.6C)/hour * FULL * 500.0F(277.7C)/hour * FULL *	1000.0F(537.7C) * 1350.0F(732.2C) * 1425.0F(773.8C) * 950.0F(510.0C) *	00.00 * 00.00 * 00.10 * 00.30 *
TAC	Tack Fuse	300.0F(166.6C)/hour * 500.0F(277.7C)/hour * FULL *	1000.0F(537.7C) * 1250.0F(676.6C) * 950.0F(510.0C) *	00.00 * 00.10 * 00.30 *
SLP	Slump	300.0F(166.6C)/hour * 500.0F(277.7C)/hour * FULL *	1000.0F(537.7C) * 1280.0F(693.3C) * 950.0F(510.0C) *	00.00 * 00.20 * 00.30 *
POL	Fire Polish	300.0F(166.6C)/hour * 500.0F(277.7C)/hour * FULL *	1000.0F(537.7C) * 1200.0F(648.8C) * 950.0F(510.0C) *	00.00 * 00.15 * 00.30 *

The preset **S**mall **P**iece programs can be edited. Each program segment can be changed by the operator. To restore the factory values, enter a zero value for the first **rA1** segment of each program and press the Program button.

SP Program Example

To fire TAC Fuse.

Follow these steps: starting with the controller displaying **IDLE**

Press	Display Shows
PROGRAM START/STOP	……………………………………. a program group
INCREASE OPTION	...…….………………………… SP
PROGRAM START/STOP	……………………………………... a program number
INCREASE OPTION	…………………………………….. TAC
PROGRAM START/STOP	

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………   ……………………………………… STRT

PROGRAM START/STOP   ……………………………………….... DELA / 00.00

PROGRAM START/STOP   ………………...…………………….. -ON-

FUSED GLASS PROJECTS

**Working with Tested Compatible Glasses**

To ensure success when fusing glass, use glass that has been pre-tested by the manufacturer

How to prepare your glass project

- Select glass that is "tested compatible" and has the same COE (Coefficient of Expansion) for the entire project.
- Glass projects should be comprised of two or more layers of glass from edge to edge because at a full fuse, glass likes to be approximately ¼" (6mm) thick. The best designs are constructed using a single piece of glass for the base piece, with a cut design as the second layer. If you'd like you can add more detail to your design with frit, stringers, and confetti. During assembly, take the time to make sure your glass pieces fit well together. If necessary, use a glass grinder to aid with the fit. A helpful tip to reducing and eliminating grinder marks from showing up in your fused pieces is to use an extra fine grit grinder bit.
- Oil from your glass cutter, as well as oil from your fingers while handling the pieces, is left on the surface of the glass. Thoroughly clean your glass pieces with either a light detergent, like Dawn dishwashing detergent, and water or with denatured alcohol. If you did any heavy grinding, also use a soft bristled brush, like an old toothbrush, to scrub the edges and remove any residual ground glass debris. After the glass had been cleaned and dried well, only handle it by the edges when assembling your project.
- To make transporting your project between your workspace and the kiln easier, you can use water soluble glue. Use glue very sparingly on the backside of the glass. Allow the glue to completely dry before you try to move your piece.
- Before setting up your glass projects on the kiln shelf, first place the kiln shelf in the kiln. If you are planning to fire more than one piece at a time, make sure to position your glass projects no closer than ¾" to 1" to each other and also no closer to the edge than ¾".

Firing your Glass Project

When you first start fusing, the entire process may seem to be complicated, but it's really simpler than it may have originally sounded. Fusing is all about controlled heating and cooling of glasses in a kiln. As glass is being fired in a kiln it goes through many physical changes based on the temperature zone that it's in.
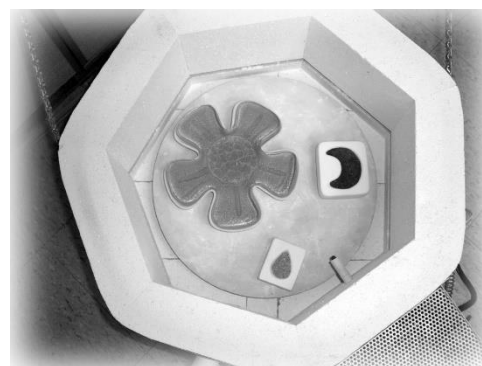
- Below 1000°F (538°C), glass is very rigid and is very susceptible to thermal shock, or breaking, if heated or cooled too quickly. Visually, the glass appears to be very rigid and it will look the same as if it were room temperature. Resist the temptation to open the kiln and peek inside, because glass is very fragile at this point and large temperature swings in the kiln will cause the glass to break.
- Between 1000°F and 1250°F (538°C – 677°C), the glass is softening, becoming more pliable, and starting to act more like a liquid and less like a solid. At the top end of this temperature range, glass will slump if held for a period of time. Visually the top layer of the glass will begin to soften and round over on the edges and the sides will start to become wet and glossy looking, or fire polished. At this point, the layers of glass haven't begun to stick together yet.
- Between 1250°F and 1350°F (577°C - 732°C), the glass is becoming even softer, and at the top end of this range will be fully slumped. It's not recommended to exceed 1350 F if you are slumping because at higher temperatures, there is a loss of control of the glass and it may slide down too far or unevenly into the mold. Visually the edges have softened and rounded even more and the surface is very glossy. If your project is held for an extended period of time in this temperature zone, it will be more prone to devitrify. Devitrification is the compositional change of the glass from an amorphous material to a more crystalline structure. As the molecules crystallize, devitrification appears to cloud the surface of the glass.
- Between 1350°F and 1400°F (732°C – 760°C), the glass will have very round edges on the surface and will stick together and become fully tack fused.
- Between 1400°F and 1500°F (760°C – 816°C) the glass becomes more fluid and fully melts together at the higher end of this temperature range, which is a full fuse.

Firing Process

In fusing, the fired appearance of the glass is referred to as the firing process for the purpose of a selecting a firing schedule.

Full Fuse: The glass has been completely melted together into one solid piece of glass that is smooth on the surface and all of the edges are well rounded.
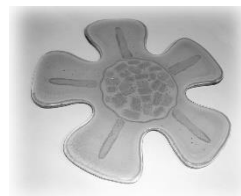
Tack Fuse: Glass has a textural feel on the surface. All the edges of the surface pieces are well rounded and fully attached to the base glass.

Slumping: The glass has been placed onto a mold and bent to shape and conform to the mold.
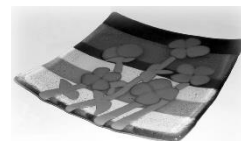
Fire polish: All surfaces of the glass have been fired to a glossy finish, yet the outside edges of the piece are crisp, clean, and somewhat square.
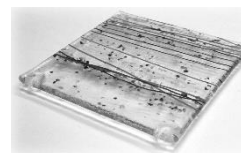
Firing stages

Initial Heating from Room Temperature (room temperature to 1200°F range): During the initial heating, the glass is very brittle and susceptible to breaking (thermal shock) if it's heated up too quickly. During this stage, it's best to take a conservative approach and slowly heat up the glass.   At the end of this range, it's a good idea to add a heat soaking period to allow the project to equalize to the same temperature throughout. Never peek in the kiln during this stage, or you risk thermal shock breakage.

Process Heating (1200°F to 1500°F range): The glass becomes softer and more fluid. During the process heating stage, the glass can be fired more quickly to the target temperature and soaked only long enough to achieve the desired look. It's important not to hold the project at these temperatures for a long period of time, or you run the risk of devitrification (a visible clouding of the glass surface due to crystallization).

Fast Cooling (1500°F to 1100°F range):   After the finished look has been achieved, it's important to cool the inside of the kiln and the glass as quickly as possible to stop the firing action so that it "freezes". During the fast cooling stage, the surface of the glass is cooler and it has contracted more than the heated center which remains expanded, thus introducing stress into the glass piece.

Annealing (1100°F to 700°F range): At the beginning of the annealing stage, it's necessary to heat soak the glass for an extended period of time to allow the glass to equalize in temperature throughout and release the stress that's in the glass. This makes the glass more stable. Then the glass is slowly cooled through the annealing temperature range to better ensure the glass piece is free of internal stresses and is physically stronger. NEVER OPEN THE KILN DURING THIS STAGE!

Cooling to Room Temperature (700°F to room temperature range): After the glass temperature has cooled below the annealing temperature zone, the kiln can be turned off to allow it to cool at it's own pace to around 150°F – 200°F. Again, to avoid thermal shock, do not open the kiln until it has cooled down to at least 200°F. Even at this temperature, the glass is very hot, so do not attempt to pick it up in your bare hands. Simply open up the lid of your kiln and allow the glass and the kiln shelf to cool down to room temperature.

Factors to consider before selecting a firing schedule

First envision what you want your finished piece to look like and ask yourself the following questions:

- What is the size (diameter) of the piece? How many layers thick will it be?
- What is the desired finished look?
- Will it be a full fuse, a more textural tack fuse, a combination of both?
- Will it be slumped or draped to become a more 3 dimensional and possibly functional piece?
- Will it be embellished with any surface decorations like enamels or metallic paints?

The size of your project is defined by both the diameter of the piece as well as the number of layers of glass. Glass as a material is a very poor heat conductor. The larger or thicker your project is, the more slowly it needs be fired so that the glass has more time to heat or cool evenly all of the way through.

Imagine that you are going to bake a cake. You have set your oven on preheat to heat it up quickly, put the cake into the oven to bake, and forgot to change the dial setting to bake. When the timer goes off, you look in the oven and discover that the cake is overcooked and possibly burned on the edges, yet the center is still sunken and uncooked.

It's just the same for glass. If you heat the glass too quickly, the edges may be fused to the desired finish you like, but the center hasn't finished fusing. One solution would be to soak the piece at the process temperature for a longer period of time, but you are also taking the risk that devitrification (visible clouding due to crystallization) on the surface or that the edges will over fire and have an unusual appearance.

Another possible scenario is that the edges of the glass have melted more quickly, trapping a large amount of air in the center of the piece which expands into large bubbles within the glass, thus distorting the design.

Both scenarios could have been avoided simply by slowing down the firing program.

Think about your finished piece again. You are creating a 10" bowl that will have a full fused appearance with some added textural design elements that will be added using liquid stringer. The finished appearance will also have Hanovia gold added as accents and be slumped into a 10" bowl mold.

Seldom can a fused piece be finished in one firing. It's usually necessary to fire your piece multiple times in order to achieve the finished look that you have envisioned. With this in mind, make a list of the steps that you will need to do to create this piece, then organize them in order by process temperature from the hottest to the coolest.

Process	Process Temperature	Program
Full Fuse	~ 1470°F	**FUSE**
Liquid Stringer	~ 1350°F	**tAC**
Slumping	~ 1250-1275°F	**SLP**
Hanovia Gold	~ 1180-1200°F	**POL**

By order of process, the full fuse is the hottest process and will be the first firing, followed by 3 different firings to create your original glass art piece.

BEADS for Chilipepper Kilns and Kilns with Flip Door

Never put a Metal Mandrel into a kiln from the top.

bEAd Program Mode

The bEAd mode provides 4 preset firing schedules for bead annealing and 4 optional User Programs for creating custom firing schedules. The 4 preset programs are recommended firing schedules that can also be customized if necessary. These programs provide the various heating and cooling steps for easy selection.

Ramp and Holding Working Programs are useful while beading and lampworking. When the program is started the kiln heats fast and then holds at an annealing temperature for the longest amount of time that is planned to work. In this case 4 hours and if the time to work suddenly becomes less, then use skip step feature (sstp) (the middle button once and the left button twice) to advance the segment of the program. This segment has the same annealing temperature to hold so that the last couple beads have a chance to anneal for a time before the kiln proceeds to lower in temperature at 100 degrees.

RECAP: If you plan on working for 8 hours making beads and you need to stop after 5 hours, then skip step will advance you to the next segment so that the last few beads inserted into the kiln will have a chance to anneal before the kiln starts to cool.

½" Beads Small Moretti   Displayed as **bd 1   Ramp and Hold Working Program**

This program heats at Full Power (fast as it can) to 960ºF and holds this temperature for 4 hours.
Then heats at Full Power (fast as it can) to 96º0F and holds this temperature for 30 minutes.
Then heats at 100ºF/hour to 500ºF and holds this temperature for 0 minutes.

1" Beads Large Moretti   Displayed as **bd 2   Ramp and Hold Working Program**

This program heats at Full Power (fast as it can) to 960ºF and holds this temperature for 4 hours.
Then heats at Full Power (fast as it can) to 960F and holds this temperature for 1 hour.
Then heats at 100ºF/hour to 500ºF and holds this temperature for 0 minutes.
.
Batch Anneal Moretti   Displayed as **bd 3   Batch Annealing From a Cold Start**

This program heats at 300ºF/hour to 960ºF and holds this temperature for 1 hour. Then cools at 100ºF/hour to 670ºF and shuts off.

Borosilicate Ramp and Hold   Displayed as **bd 4   Ramp and Hold Working Program**

This program heats at Full Power (fast as it can) to 1050ºF and holds this temperature for 4 hours.
Then heats at Full Power (fast as it can) to 940F and holds this temperature for 30 minutes.
Then heats at 100ºF/hour to 500ºF and holds this temperature for 0 minutes.
.
. **This program should only be used in kilns with a properly installed bead door to 'garage' hot projects.

bEAd Programs

bEAd	Program	Rate	Target	Hold
bd 1	Small Moretti	FULL*	960.0F(515.5C) *	04.00 *
		FULL*	960.0F(515.5C) *	00.30 *

		100.0F(55.5C)/hour *	500.0F(260.0C) *	00.00 *
		FULL*	960.0F(515.5C) *	04.00 *
bd 2	Large Moretti	FULL*	960.0F(515.5C) *	01.00 *
		100.0F(55.5C)/hour *	500.0F(260.0C) *	00.00 *
bd 3	Batch Anneal	300.0F(166.6C)/hour *	960.0F(515.5C) *	01.00 *
		FULL*	1050.0F(565.5C) *	04.00 *
bd 4	Borosilicate	FULL*	940.0F(504.4C) *	00.30 *
		100.0F(55.5C)/hour *	500.0F(260.0C) *	00.00 *

The preset bead programs can be edited. Each program segment can be changed by the operator. To restore the factory values, enter a zero value for the first **rA1** segment of each program and press the Program button.

bEAd Program Example

To fire Small Moretti.

Follow these steps: starting with the controller displaying **IDLE**

Press	Display Shows
PROGRAM START/STOP	………………………………………. a program group
INCREASE OPTION	..……..…………………………… bEAd
PROGRAM START/STOP	……………………….……………… a program number
INCREASE OPTION	………………………………………. bd1
PROGRAM START/STOP	……………………………………… STRT
PROGRAM START/STOP	………………………….…………… DELA / 00.00
PROGRAM START/STOP	…………………….…………………. -ON-
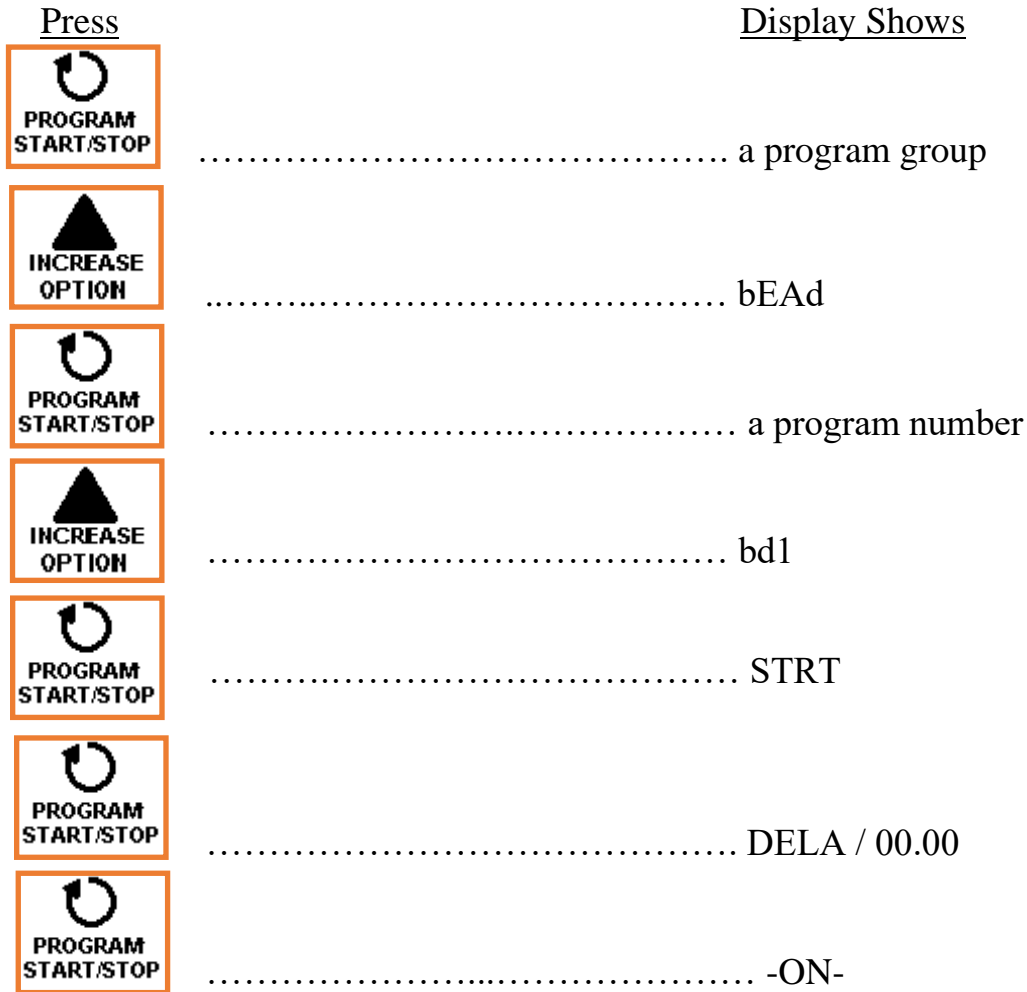
PMC Programs

5 preset firing schedules are available for Precious Metal Clay. The heating steps are preprogrammed. You can fire to a preset PMC schedule by simply selecting the PMC Program. These programs are not adjustable.
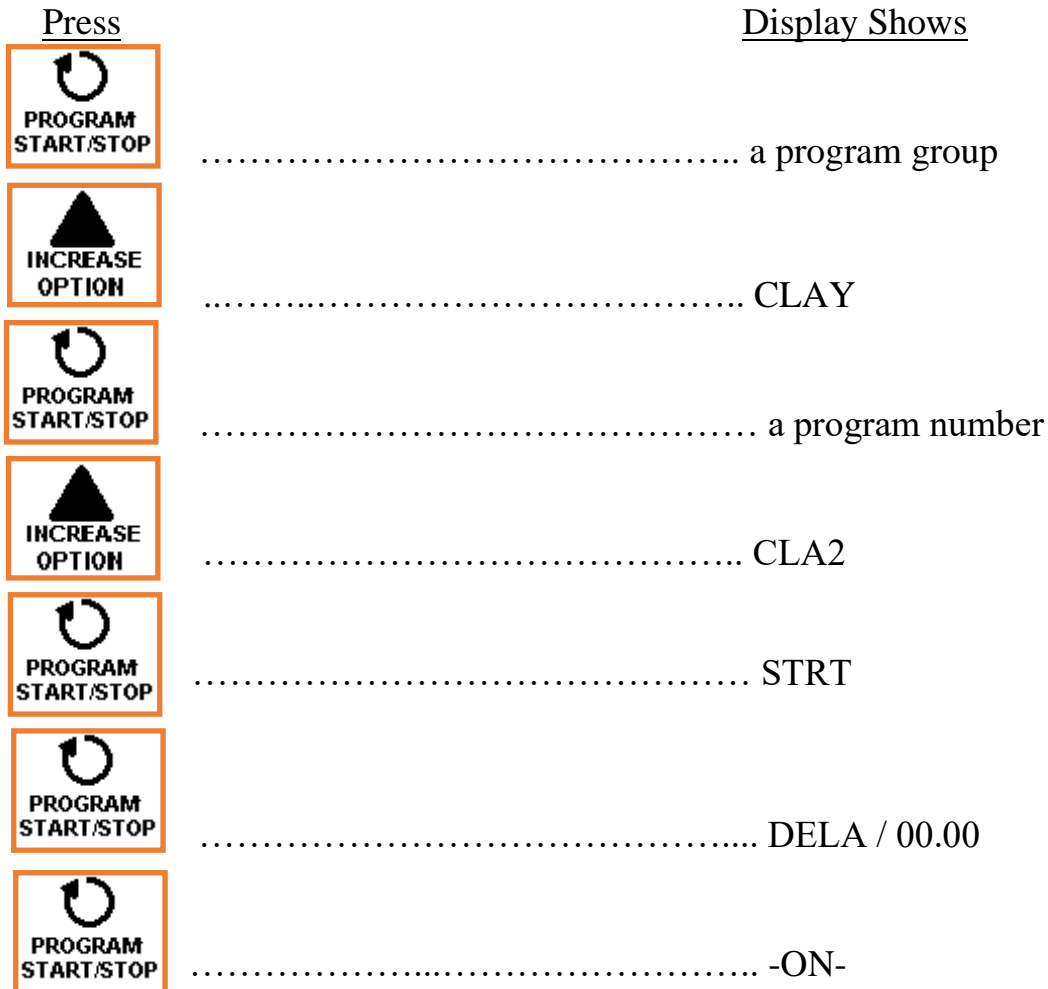
The 5 programs are;

Display code	Program	Rate	Target	Hold
CLA1	PMC+ Fast	FULL	1650°F(899°C)	00.10
CLA2	PMC+ Slow	1500°F(833°C)/hour	1470°F(799°C)	00.30
CLA3	PMC3 Slow	1500°F(833°C)/hour	1110°F(599°C)	00.45
CLA4	PMC	FULL	1650°F(899°C)	02.00
CLA5	PMC Gold	FULL	1290° F(699°C)	01.30

PMC Program Example

To fire PMC+ at a slow rate.

Follow these steps: starting with the controller displaying **IDLE**

Press	Display Shows

<u>Press</u>   <u>Display Shows</u>

PROGRAM START/STOP …………………………………….. a program group

INCREASE OPTION ..……..…………………………….. CLAY

PROGRAM START/STOP …………………….………….…………… a program number

INCREASE OPTION …………………….…………….…….. CLA2

PROGRAM START/STOP …………………….………….………… STRT

PROGRAM START/STOP …………………….………………….... DELA / 00.00

PROGRAM START/STOP …………………..……………………….. -ON-

FIRING METAL CLAY

Drying Time

Allow your pieces to be completely dried before firing them in the kiln to ensure that they don't warp.

Loading the kiln

If you fire both glass and metal clay in your kiln, it is recommended that you invest in a second shelf so that you can fire only glass on the glass kiln shelf, and only metal clay silver on the other kiln shelf. After firing your PMC piece, some of the metal particulates impregnate the kiln shelf and leave stains on the shelf's surface. If you fire glass on the very same shelf, there is a chance that glass and metal may have a reaction that will result in silver stains left permanently on the glass.

Pieces that have a flat side can be placed directly onto the kiln shelf. They can be positioned closely together, but they shouldn't touch.

Pieces that are rounded, hollow or very delicate in composition will need support while firing so they don't collapse. Pour alumina hydrate or vermiculite into an unglazed ceramic bisque bowl and carefully place the metal clay pieces onto the alumina hydrate/vermiculite. Again, they can be positioned closely together, but they shouldn't touch.

Begin in the IDLE mode

To begin programming the kiln, it must be in the **IdLE** mode. This can be determined by viewing the LED display. The display will alternately display both the current temperature and the **IdLE** message. When the kiln controller is first turned on, it will display the current firing configuration that it is in.

Press (Program) button to return to the **IdLE** mode.

Select the firing configuration

To determine the current firing configuration

Press (Increase) button and hold until the LED display shows **CFG**

Press (Program) button to display the current firing configuration.

To select the correct firing configuration:

Press (Increase) button to scroll to the correct configuration,

> **CLAY** Metal Clay

Press (Program) button to select this configuration.

Once completed the LED display will return to the **IdLE** mode.
Select firing program

To select the correct firing program,

Press (Program) button to display the current firing program

Press (Increase) button to scroll to the correct program for your project

> **CLA1** Fast Fire PMC+
> **CLA2** Slow Fire PMC+
> **CLA3** Slow Fire PMC3
> **CLA4** Firing PMC Standard
> **CLA5** Firing PMC Gold

Press (Decrease) button to select the firing program and once selected the LED light beside "Review" will light up. Additionally, the firing program selected will begin to display on the LED display beginning with **rA 1**. Once the review has been completed, the display will show **Strt**.

Press (Program) button and the display will show **–On-** and begin firing. Note: If you accidentally selected the wrong program or would like to stop the program, press (Program) button again and the display will show **Stop.**

Once the kiln has completed firing, the display will show **CPLt** and this message will alternate with the temperature display and the total firing time from start to finish. DO NOT open the kiln until it has completely cooled and the temperature shows room temperature.

User Programs

25 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.

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.

Heating/Cooling Rates

Each program step requires you to program the desired rate value.

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:

$$\textbf{212 - 75} \qquad = \qquad \textbf{137 degrees}$$

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)

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

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

The range of values available for a controlled ramp rate setting is 0-1798F per hour or 0-29.97F per minute.

To program a rate that heats or cools as fast as possible, Set the rate to **FULL**. **FULL** appears as a selection for 1799F/hour or 29.98F/min. Just above the maximum ramp rate. You can also find the **FULL** setting by pressing the *decrease/review* button one time when the display shows zero for the rate setting.

When the RATE option is set for TIME, the maximum ramp rate or **FULL** setting is 00.00, the range of controlled rates is 00.01 (1minute) to 99.58 (99hours.58minutes)

When the Ramp Rate is set to **FULL** 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 step, the controller will interpret the same values as <u>no</u> 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.

Target Temperatures

Each program step requires you to program a desired target temperature.

℉ or **℃** 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 **℉ 1** or **℃ 1**, the temperature for the second ramp step as **℉ 2** or **℃ 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.

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 *Program/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, use **CHGT** option. The controller will display the current setting and allow you to change it. See the Option menu section of this manual for more details.

Hold Time

Each program step requires you to program a desired 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 *Program/Stop* key is pressed.

Adding Time to a Hold

If the kiln is firing and you need to increase the hold time, use the **HLDT** option. The controller will display the current setting and allow you to change it. See the Option menu section of this manual for more details.

Shortening a Hold

To end a hold before the time has expired, use the **SKIP** option to advance to the next ramp. See the Option menu section of this manual for more details.

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 AOP1 output.

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.

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 *Program/Start* key. A program group will show on the display.

2. Press the *Increase/Option* key until the display shows **USER,** then press the *Program/Start* key.

3. Using the *Increase* or *Decrease* key, select the desired program number (PR01-PR25) then press the *Program/Start* key.

4. **RA 1** shows in the display indicating the rate value for the first ramp step. Use the *Increase* or *Decrease* keys to enter the desired heating rate. Then press *Program/Start* key.

5. **°F 1** or **°C 1** shows in the display indicating the target temperature for the first ramp step. Use the *Increase* or *Decrease* keys to enter the desired temperature. Then press *Program/Start* key.

6. **HD 1** shows in the display indicating the Hold time for the first ramp step. Use the *Increase* or *Decrease* keys to enter the desired time for the kiln to hold at the first target temperature. Time is entered as (<u>Hours. Minutes</u>). Then press *Program/Start* key.

7. **FN 1** shows in the display (if available). Use the *Increase* or *Decrease* key to select a fan setting; either **OFF** or **ON** for the first ramp. Then press *Program/Start* key. The Fan option will not appear unless the auxiliary output option for the controller has been configured.

8. Repeat steps 4 through 7 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 end the programming mode. For Time mode, the value should be set to 99.59.

    The controller will advance to **STRT***. The programmed firing schedule is automatically stored and ready to* START *the firing.*

9. If the Delay Start feature is active, the display will show **DELA** alternating with a Time value. use the *Increase* or *Decrease* key to set a time for the kiln firing to begin. Time is shown as (<u>Hours. Minutes</u>). If no Delay is needed, set zero hours and zero minutes (00.00). Then press the *Program/Start* key.

10. Press the *Program/Start* key to begin the firing.

USER Program Example

To Contour a piece smaller than 10 x 10.

Follow these steps: starting with the controller displaying **IDLE**

<u>Press</u>   <u>Display Shows</u>

PROGRAM START/STOP
INCREASE OPTION
……………………………………….. a program group

…………..……………………………… USER

PROGRAM START/STOP
………………………….……………. a program number

INCREASE OPTION
…………………….………………… PR03

PROGRAM START/STOP
…………..…………….……………… RA1

INCREASE OPTION
………………….……………………... 400

PROGRAM START/STOP
…………………..……………………....°**F 1** or °**C 1**

INCREASE OPTION
………………….………………….... 1170° **(632C)**

PROGRAM START/STOP
……….………………………………… HD1

INCREASE OPTION
………………….…………………….... 0.40

PROGRAM START/STOP

32

………..…………….……….………… RA2

 …………………………………….......... 500

 …………………..…………………….....°F 2 or °C 2

 ………………………………….......... 1400° (760C)

 ……..……………….………………….. HD2

 ………………………………….......... 0.10

 ..………………….…………………… RA3

 …………………………………….......... FULL

 ………………..…………………….... °F 3 or °C 3

 ……………… ……………….…………… 900° (482C)

 ………………………………….. HD3

 ………………………………........... 0.30

 …………………………………........... DELA / 00.00

…………….…………………………… -ON-

Erasing A User Program

If 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**.

Test Firing with Witness Cones

A test firing will help in learning the operation and features of the controller. Place a series of Orton Self-Supporting Cones on the middle shelf of your kiln so that they can be seen through a kiln peephole. Use a series of cones close to the final firing temperature (see Appendix C). For example, if firing to 1945°F (Cone 04), use a Cone 03, Cone 04, and Cone 05 for the test firing.

To evaluate heat distribution, place a set of cones on each shelf during the test firing. Most kilns fire more uniformly at Cone 06 than they do below Cone 06. Provide ventilation for the kiln in accordance with the kiln manual or Vent Master® instruction manual.

After the firing, examine the fired cones. Some variation in the bending of the cones may occur, depending on how the kiln was loaded and the location of the cones.

Cone-Fire – How it works

When firing to a cone number, the controller constantly monitors the actual heating rate of the kiln. If the kiln does not fire as rapidly as programmed, the controller re-calculates and adjusts the top firing temperature to compensate for the slower firing rate. This process more accurately fires to the cone number selected. When the heating rate slows, cones deform at slightly lower temperatures. At faster heating rates, cones deform at slightly higher temperatures. This ability to recalculate and to fire to a cone value is a unique, patented feature of all Orton controllers.

Orton Controllers contain three preset program groups for firing to a cone number – Low Fire, Mid Fire, and High Fire. Each of the programs can be adjusted for speed, hold time and cooling rate. The standard programs are designed to fire normal loads of thin ware ceramics. When a kiln is more heavily loaded or when thick ware is fired, additional firing time is needed. Experiment to determine the best firing conditions. The preset firing programs in the controller are:

Program	Product Fired	Cone Range	Firing Time
Low Fire	Decal, Luster, China	Cones 022 – 011	3 - 5 hours
Mid Fire	Glaze, Bisque, Earthenware	Cones 010 - 01	6 - 8 hours
High Fire	Stoneware, Porcelain	Cones 1 – 10	9 - 11 hours

LO FIRE PROGRAM	MID FIRE PROGRAM	HI FIRE PROGRAM
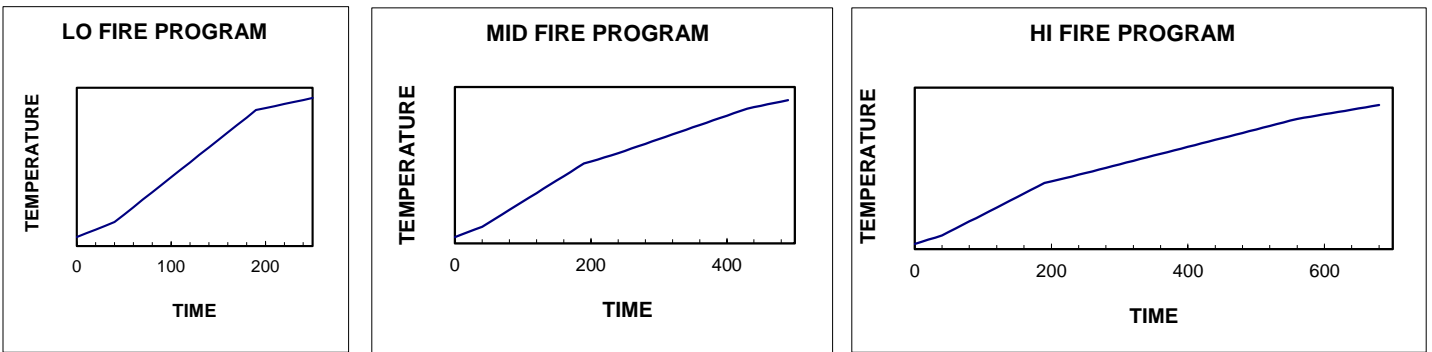
Note: the Cone fire Programs can be removed from the controller selections. To disable a program set, see the configuration appendix of this manual.

Cone-Fire Programs

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

1. Press the *Program/Start* key. A program group will show on the display.

2. 2Press the *Increase/Option* key until the display shows **CONE,** then press the *Program/Start* key.

3. 3Using the *Increase* or *Decrease* key, select the desired Cone number then press the *Program/Start* key.

4. **SPD** shows in the display indicating the Speed setting, use the *Increase* or *Decrease* key to select Fast, Standard or Slow then press the *Program/Start* key.

5. **HOLD** shows in the display indicating the optional Hold time at the end of the firing, **HOLD** will be alternating with a Time value. use the *Increase* or *Decrease* key to set a time for the kiln to hold at the top cone temperature. Time is shown as (Hours. Minutes). If no Hold is needed, set zero hours and zero minutes (00.00). Then press the *Program/Start* key.

6. **COOL** shows in the display indicating the optional Cooling ramp at the end of the firing, **COOL** will be alternating with a rate value. use the *Increase* or *Decrease* key to set a cooling rate for the kiln to cool to 392ºF(200ºC). The maximum cooling rate is limited to 180ºF(100ºC)/hour. If no controlled cooling is needed, set the rate value as zero. Then press the *Program/Start* key.

The controller will advance to **STRT**. *The programmed firing schedule is automatically stored and ready to* START *the firing.*

7. 7.If the Delay Start feature is active, the display will show **DELA** alternating with a Time value. use the *Increase* or *Decrease* key to set a time for the kiln firing to begin. Time is shown as (Hours. Minutes). If no Delay is needed, set zero hours and zero minutes (00.00). Then press the *Program/Start* key.

8. Press the *Program/Start* key to begin the firing.

Cone Fire Advanced Options

There is one Advanced Option available for Cone Fire programs only. It is *Cone Offset*.

Cone Offset - OFST

This offset feature allows you to adjust the final heating step of the Cone programs. This is useful when the kiln does not quite bend witness cones to the desired angle. Cone Offset is a calibration feature that allows a temperature offset for the final heating ramp of the cone program.

First, start a CONE program to make the **OFST** option appear in the option menu. Press the *Increase/Option* key until **OPT2** appears, then press *Program/Start* key, Press *Increase/Option* until **OFST** appears. Press *Program/Start* to see the setting. Use the *Increase* or *Decrease* key to edit the setting, then press *Program/Start* to exit the option menu.
OFST settings are stored in memory and will apply to all future Cone fire programs.

Settings (˚F)	*Settings (˚C)*	*Meaning*
-20	-11	Decreases final ramp temperatures
-15	-8	Decreases final ramp temperatures
-10	-6	Decreases final ramp temperatures
-5	-3	Decreases final ramp temperatures
0	0	No adjustment in temperatures
+5	+3	Increases final ramp temperatures
+10	+6	Increases final ramp temperatures
+15	+8	Increases final ramp temperatures
+20	+11	Increases final ramp temperatures

Cone Fire Example

To fire to Cone 06, Fast firing speed (20% faster), 15-minute hold at cone temperature, No controlled cooling

Follow these steps: starting with the controller displaying **IDLE**

<u>Press</u>   <u>Display Shows</u>

……………………………………….. A program group
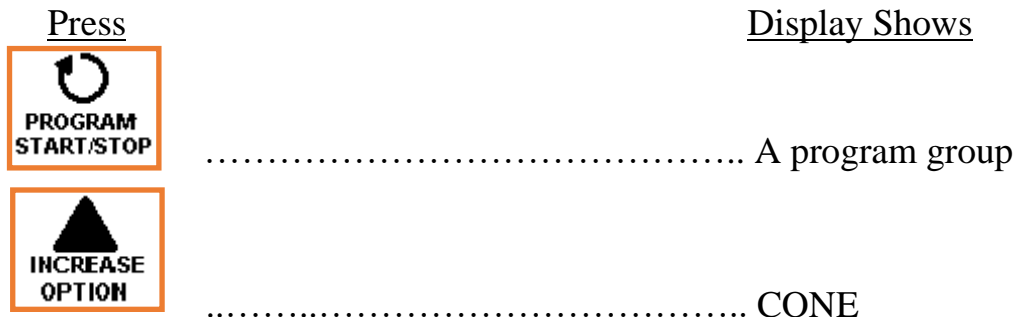
.……..……………………………….. CONE

 ……………….……………….. A cone number

 ……………….……………….. 06

 …………….……………….…… SPD / STD

 .………………………………….. FAST

 .………………..……………….. HOLD / 00.00

 ……………….………..…….. 00.15

 …………….……………….…… COOL / 0

 …………….……………….…… STRT

 …………….……………….….... DELA / 00.00

 …………….…..……………….. -ON-

Keeping a log

There is no "one program fits all" firing schedule for kilns. Even supposedly identical kilns behave slightly differently. Plugging the same kiln into different outlets in your house may also alter the firing schedule you need. Additionally, different size projects or different colors of glass will react differently, necessitating changes to your firing schedules. It is therefore very important for you to keep detailed firing logs whenever you do a new project or change any parameter in an existing project.

As you gain experience using your kiln, you may find that you need to use the "add hold time" or the "skip step" sequences to get exactly the results you want. If this is consistently the case for your particular project, you may want to generate a user program, written to your desired specifications or modify one of the pre-programmed firing schedules.

Alarm Display Codes

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 to 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

Reference Section

Appendix A – Low Fire Cone Programs

Cones O22 to O11

The low fire range is typically used to fire decals or decorations. Some decals, lusters, and gold have a limited firing range and may need to be fired more slowly.

The complete firing schedules for Cones **O22** to **O11** are shown below. The standard firing time is about 3-5 hours.

Degrees F

Low Fire	Ramp 1	Target	Ramp 2	Target
Cone #	Degrees/hour	°F	Degrees/hour	°F
022	396	979	108	1087
021	396	1004	108	1112
020	396	1051	108	1159
019	396	1144	108	1252
018	396	1211	108	1319
017	396	1252	108	1360
016	396	1314	108	1422
015	396	1348	108	1456
014	396	1377	108	1485
013	396	1431	108	1539
012	396	1474	108	1582
011	396	1499	108	1607

Degrees C

Low Fire	Ramp 1	Target	Ramp 2	Target
Cone #	Degrees/hour	°C	Degrees/hour	°C
022	220	526	60	586
021	220	540	60	600
020	220	566	60	626
019	220	618	60	678
018	220	655	60	715
017	220	678	60	738
016	220	712	60	772
015	220	731	60	791
014	220	747	60	807
013	220	777	60	837
012	220	801	60	861
011	220	815	60	875

Appendix B – Mid Fire Cone Programs

Cones O10 to O1

This firing range is used to fire earthenware and low temperature glazes. If the ware is not thoroughly dried, a preheat cycle can be added. With lead-free glazes, a 10 to 20-minute hold is beneficial.

Earthenware or other bodies containing ball clays, talc, and kaolin contain compounds such as water, carbon, and sulfur that are burned-off during the firing. The body will lose about 10% of its weight. In addition, a physical change in any silica present can cause cracking of ware unless the heating rate is slowed near 1063°F (573°C). This change occurs during both heating and cooling.

The complete firing schedules for Cones **O10** to **O1** are shown below. The standard firing time is about 7-9 hours.

Degrees F

Mid Fire	Ramp 1	Target	Ramp 2	Target	Ramp 3	Target	Ramp 4	Target
Cone #	Degrees/ hour	°F	Degrees/ hour	°F	Degrees/ hour	°F	Degrees/ hour	°F
010	324	1022	153	1112	180	1549	108	1657
09	324	1022	153	1112	180	1580	108	1688
08	324	1022	153	1112	180	1620	108	1728
07	324	1022	153	1112	180	1681	108	1789
06	324	1022	153	1112	180	1720	108	1828
05	324	1022	153	1112	180	1780	108	1888
04	324	1022	153	1112	180	1837	108	1945
03	324	1022	153	1112	180	1879	108	1987
02	324	1022	153	1112	180	1908	108	2016
01	324	1022	153	1112	180	1938	108	2046

Degrees C

Mid Fire	Ramp 1	Target	Ramp 2	Target	Ramp 3	Target	Ramp 4	Target
Cone #	Degrees/ hour	°C	Degrees/ hour	°C	Degrees/ hour	°C	Degrees/ hour	°C
010	180	550	85	600	100	843	60	903
09	180	550	85	600	100	860	60	920
08	180	550	85	600	100	882	60	942
07	180	550	85	600	100	916	60	976
06	180	550	85	600	100	938	60	998
05	180	550	85	600	100	971	60	1031
04	180	550	85	600	100	1003	60	1063
03	180	550	85	600	100	1026	60	1086
02	180	550	85	600	100	1042	60	1102
01	180	550	85	600	100	1059	60	1119

Appendix C – High Fire Cone Programs

Cones 1 to 10

The firing range of higher temperature bodies, such as stoneware and porcelain vary between Cone 4 and Cone 10. These bodies are fired nearly to vitrification and can shrink up to 16%. As with earthenware bodies, water, carbon, and sulfur are potential burnout materials and venting is important to remove gases generated. With the presence of silica, the firing needs to be slowed near 1063°F (573°C) to prevent cracking.

Typical porcelain bodies are formulated from kaolin, feldspars, silica, and ball clays. The weight loss during firing can be around 10 to 12% and shrinkage can approach 20%.

Porcelain bodies require good temperature uniformity at their final firing temperature. If slightly overfired, the body may warp or blister. On maturing, the body becomes its own "glaze." A hold time is usually desirable for best fired results.

The complete firing schedules for Cones **1** to **12** are shown below. The standard firing time is about 10-12 hours.

Degrees F

Hi Fire Cone #	Ramp 1 Degrees/ hour	Target °F	Ramp 2 Degrees/ hour	Target °F	Ramp 3 Degrees/ hour	Target °F	Ramp 4 Degrees/ hour	Target °F
1	324	1022	153	1112	162	1863	108	2079
2	324	1022	153	1112	162	1872	108	2088
3	324	1022	153	1112	162	1890	108	2106
4	324	1022	153	1112	162	1908	108	2124
5	324	1022	153	1112	162	1951	108	2167
6	324	1022	153	1112	162	2016	108	2232
7	324	1022	153	1112	162	2046	108	2262
8	324	1022	153	1112	162	2064	108	2280
9	324	1022	153	1112	162	2084	108	2300
10	324	1022	153	1112	162	2129	108	2345

Degrees C

Hi Fire Cone #	Ramp 1 Degrees/ hour	Target °C	Ramp 2 Degrees/ hour	Target °C	Ramp 3 Degrees/ hour	Target °C	Ramp 4 Degrees/ hour	Target °C
1	180	550	85	600	90	1017	60	1137
2	180	550	85	600	90	1022	60	1142
3	180	550	85	600	90	1032	60	1152
4	180	550	85	600	90	1042	60	1162
5	180	550	85	600	90	1066	60	1186
6	180	550	85	600	90	1102	60	1222
7	180	550	85	600	90	1119	60	1239
8	180	550	85	600	90	1129	60	1249
9	180	550	85	600	90	1140	60	1260
10	180	550	85	600	90	1165	60	1285

Appendix D – 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				

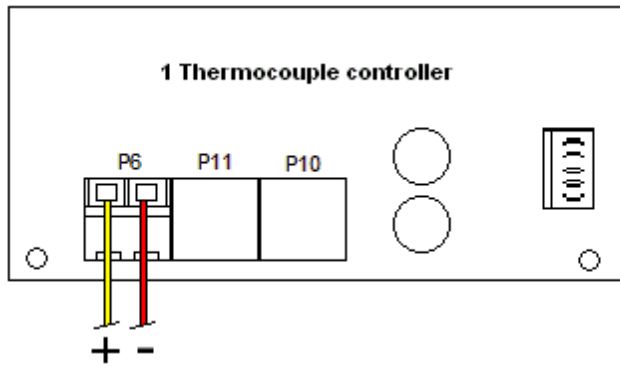# Appendix E – Connecting Thermocouples

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

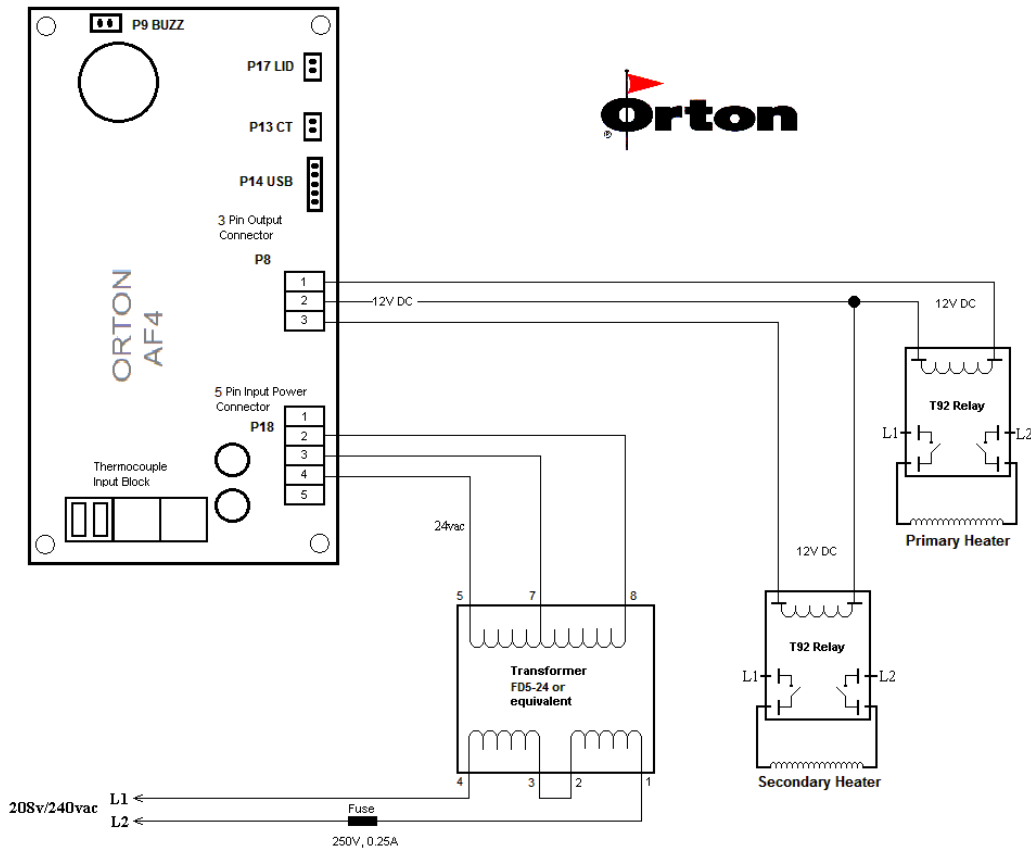For Type K, the positive leg is yellow.
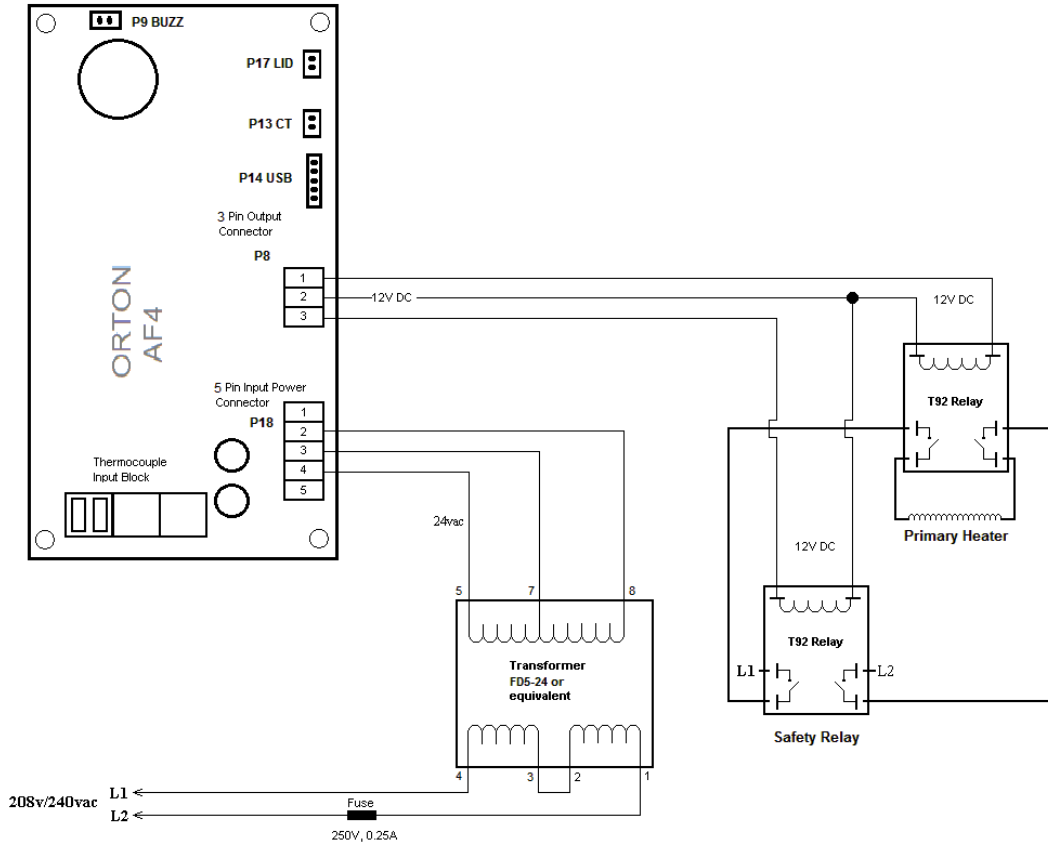For Type N, the positive leg is orange.
For Type S and Type R, the positive leg is black.

Appendix F – Typical Wiring Diagram, 2 Heaters

Appendix G – Typical Wiring Diagram, 1 Heater, 1 safety relay

The JEN-KEN SAMPLE PROGRAM THAT YOU CAN ADD IN THE USER MADE AS NEEDED.

The new AF4X controller software has undergone a major software update! The controller contains several sets of preset programs. Jen-Ken Kilns and Orton have produced the most user friendly and powerful, kiln controller for artists. If the Jen-Ken Kiln can perform all the above tasks then all of the above settings will be turned on. The Chilipepper is a low firing annealing kiln and will only have the –BEAD- setting turned on. The AF3P Bead Annealer with flip door will have all of the above turned on except the Clay and Cone feature because the kiln cannot fire that hot**. Program sets include: LP (Large Pieces) – SP (Small Pieces) – CLAY (PMC) – CONE (Ceramic) – BEAD - USER (custom)**

There are 25 User Programs available if you switch modes to the USER program set. The User Program mode allows you to customize your firing schedule and specify how fast the kiln heats or cools to any temperature. All 25 programs allow 20 ramp steps. Each ramp step consists of a heating rate (or cooling rate), a target temperature and a hold time. Once programmed they remain in the controller memory until you chose to change them. Here is a list of 25 programs created by us to assist you as you learn and grow as an artist! You can alter and change these programs as you progress as an artist. Once you program these schedules, they will remain in the USER program set of the controller memory until you chose to alter them.

Program 01 is a full fuse for pieces smaller than 10 x 10 and **program 02** is a full fuse for pieces larger than 10 x 10.

Program 03 is a contour fuse for pieces smaller than 10 x 10 and **program 04** is a contour fuse for pieces larger than 10 x 10.

Program 05 is a tack fuse for pieces smaller than 10 x 10 and **program 06** is a tack fuse for pieces larger than 10 x 10.

Program 07 is a fire polish for pieces smaller than 10 x 10 and **program 08** is a fire polish for pieces larger than 10 x 10.

Program 09 is a slump program for pieces smaller than 10 x10 and **program 10** is a slump program for pieces larger than 10 x 10.

Program 11 is a program for draping 2 layers of glass. Be sure to keep an eye on your glass when using this schedule!

Program 12 is a program for deep slumping or texture.

Program 13 is a fast fuse program for brick pieces smaller than 10 x 10 and **program 14** is a fast fuse for brick pieces larger than 10 x 10.

Program 15 is a fiber contour for small pieces and **program 16** is a fiber contour for large pieces. **Program 17** is a fast tack program. **Program 18** is for large fiber tack fusing. – This when using an all fiber kiln with a fiber shelf. For example: the JenKen Profusion 26.

Program 19 is for pot melts.

Programs 20 and **21** are for screen drips.

Program 22 is for fusing and annealing dammed thick slabs of glass.

Program 23 is for flatting bottles on the kiln shelf. **Program 24** is for then slumping bottles on a mold.

Finally, **program 25** is for open face mold casting.

We hope that you will find these programs useful in your journey into the fired arts! If you have any questions, please call us.

Note: Firing schedules may need to be adjusted as you learn how your kiln fires. These schedules are meant to be a starting point for you to learn from and adjust as you advance and your kiln ages

Program 01 Full Fuse < 10x10 Brick Brick

RAMP	°F	Hold
400	1170° (632C)	0.40
500	1480° (804C)	0.10
Full	900° (482C)	0.30
	OFF	

Program 02 – Full Fuse > 10x10

RAMP	°F	Hold
300	1170° (632C)	1.00
400	1480° (804C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 03 – Contour < 10x10 Brick Brick

RAMP	°F	Hold
400	1170° (632C)	0.40
500	1400° (760C)	0.10
Full	900° (482C)	0.30
	OFF	

Program 04 – Contour > 10x10

RAMP	°F	Hold
300	1170° (632C)	1.00
400	1400° (760C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 05 – Tack < 10x10 Brick

RAMP	°F	Hold
400	1170° (632C)	0.40
500	1350° (732C)	0.10
Full	900° (482C)	0.30
	OFF	

Program 06 – Tack > 10x10 Brick

RAMP	°F	Hold
300	1170° (632C)	1.00
400	1350° (732C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 07 – Fire Polish < 10x10 Brick Brick

RAMP	°F	Hold
300	1000° (538C)	0.00
500	1325° (718C)	0.05
Full	900° (482C)	0.30
	OFF	

Program 08 – Fire Polish > 10x10

RAMP	°F	Hold
250	1000° (583C)	0.00
400	1325° (718C)	.05
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 09 – Slump < 10x10 Brick Brick

RAMP	°F	Hold
300	1000° (583C)	0.00
400	1220° (660C)	0.20
Full	900° (482C)	0.30
	OFF	

Program 10 – Slump > 10x10

RAMP	°F	Hold
250	1000° (583C)	0.00
400	1220° (660C)	.20
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 11 – Drape 2 Layers

RAMP	°F	Hold
300	1000° (583C)	0.00
400	1170° (632C)	.15
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 12 – Deep Slump / Texture

RAMP	°F	Hold
300	1000° (583C)	0.00
400	1260° (682C)	0.30
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 13 – Fast Fuse < 10x10 Brick

RAMP	°F	Hold
500	1170° (632C)	0.20
Full	1480° (804C)	0.10
Full	900° (482C)	0.30
	OFF	

Program 14 – Fast Fuse > 10x10

RAMP	°F	Hold
400	1170° (632C)	0.40
500	1480° (804C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 15 – Fiber Contour Small Pieces Pieces

RAMP	°F	Hold
500	1170° (632C)	0.20
Full	1400° (760C)	0.10
Full	900° (482C)	0.40
	OFF	

Program 16 – Fiber Contour Large

RAMP	°F	Hold
400	1170° (632C)	0.40
500	1400° (760C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 17 – Fast Tack

RAMP	°F	Hold
500	1350° (732C)	0.10
Full	900° (482C)	0.30
	OFF	

Program 18 – Large Fiber Tack

RAMP	°F	Hold
400	1350° (732C)	0.10
Full	900° (482C)	1.00
100	700° (371C)	0.00
	OFF	

Program 19 – Pot Melt

RAMP	°F	Hold
500	1000° (538C)	0.00
Full	1600° (871C)	1.30
Full	1475° (802C)	0.30
Full	900° (482C)	1.00
100	600°(316C)	0.00
	OFF	

Program 20 – Screen 1st to Drip

RAMP	°F	Hold
500	1000° (538C)	0.00
Full	1600° (871C)	1.30
Full	1475° (802C)	0.30
Full	900° (482C)	1.00
100	600° (316C)	0.00
	OFF	

Program 21 – Screen 2 to Clean Edges

RAMP	°F	Hold
200	1000° (538C)	0.20
500	1475° (802C)	0.30
Full	900° (482C)	0.60
100	600° (316C)	0.00
	OFF	

Program 22 – Fusing/Annealing Dammed Thick Slabs < 1.25

RAMP	°F	Hold
300	1175° (635C)	1.00
400	1500° (816C)	0.10
Full	900° (482C)	3.50
24	700° (371C)	0.00
48	100° (38C)	0.00
	OFF	

Program 23 – Bottles Flat on a Shelf

RAMP	°F	Hold
300	1000° (538C)	0.00
500	1475° (802C)	0.15
Full	900° (482C)	0.40
	OFF	

Program 24 – Bottles in a Mold

RAMP	°F	Hold
300	1000° (538C)	0.00
500	1400° (706C)	0.15
Full	900° (482C)	0.40
	OFF	

Program 25 – Open Face Mold Casting

RAMP	°F	Hold
300	1000° (538C)	0.20
300	1400° (706C)	1.20
Full	900° (482C)	1.30
100	600 (316C)	0.00
	OFF	

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, <u>DOES NOT</u> 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

AF4X CONTROLLER Limited Warranty

This limited warranty is given only to the immediate purchaser ("Buyer") of the Autofire® Kiln Controller ("AF4X"). 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 WARANTIES 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, NEGLIENCE 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

The Edward Orton Jr. Ceramic Foundation
6991 Old 3C Highway
Westerville, Ohio 43082-9026
Telephone: (614) 895-2663
Fax: (614) 895-5610