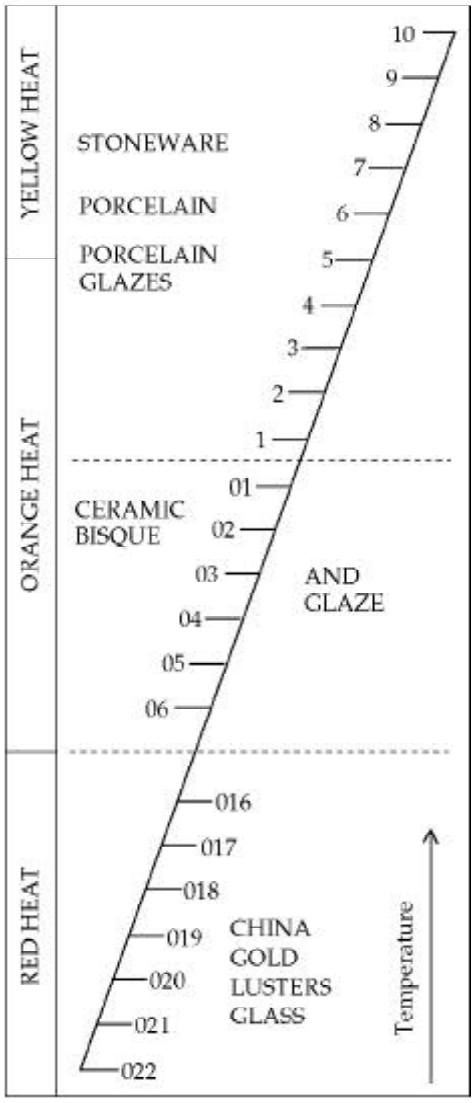
Firing glass.

Sagging of sheet glass and bottles is carried out in terra cotta molds dusted with whiting (calcium carbonate) or one of several similar tradename separators. Use the Ramp/Hold Mode for glass sagging. This will allow you to program your own specific rate of climb and hold temperatures.

Glass decoration can often be carried out with conventional china paints, metallics, and lusters when the glass is being fired to sagging temperatures. Freestanding tumblers and other vessels can rarely be taken above Cone 022 without wilting, so at such low temperatures the special glass stains, golds and lusters produce more dependable results.

Quick Reference Chart



The KilnMaster Controller

During the Firing.

What you'll see is the internal temperature of the kiln displayed in the window of the controller as the temperature increases. The options available during the firing are:

- **Review** program at any time.
- **View** Current Segment of Ramp/Hold Program.
- Press **Stop** to interrupt a firing for any reason.

Please refer to the Key Functions section of the manual for detailed explanations of the functions.

After Each Firing.

1. When the firing is completed, the display will alternately indicate "CPLt" for complete and show the firing time in hours and minutes. Press **Enter** to display the current internal temperature.

   The KilnMaster will adjust the shutoff temperature to correspond to the actual heating rate the kiln can achieve. This may or may not be the programmed value. To see the adjusted value, press **Review** immediately after activating the touch pad.
2. Allow the kiln to cool naturally. Never unplug other peepholes or post the lid until the ware is cool enough for barehanded unloading, about 130½F.
3. When unloading, be sure to examine the Self-Supporting Cones on the shelf to determine if the kiln is firing correctly.

Cone Fire Mode

Description

The Cone Fire mode is extremely easy to use but gives you access to many advanced features. You only have to enter three pieces of information—cone number, speed, and hold time. Cone values range from Cone 022 through Cone 10. Entering a cone number causes the controller to look up the final temperature in a 108^{0}F/hr Cone Table. You have three speeds to choose from, slow, medium, or fast. The speed chooses a ramp profile as described below. Lastly, the Cone Fire mode allows you to specify a hold time at the final cone temperature.

The Cone Fire mode uses a method patented by The Edward Orton Jr. Ceramics Foundation that measures the rate of firing during the last hour of the firing and adjusts the final temperature to the correct cone temperature based on the observed firing rate. This will insure consistent results as the kiln elements become weaker with normal wear from repeated firing.

PROFILES

Cone Fire–Slow

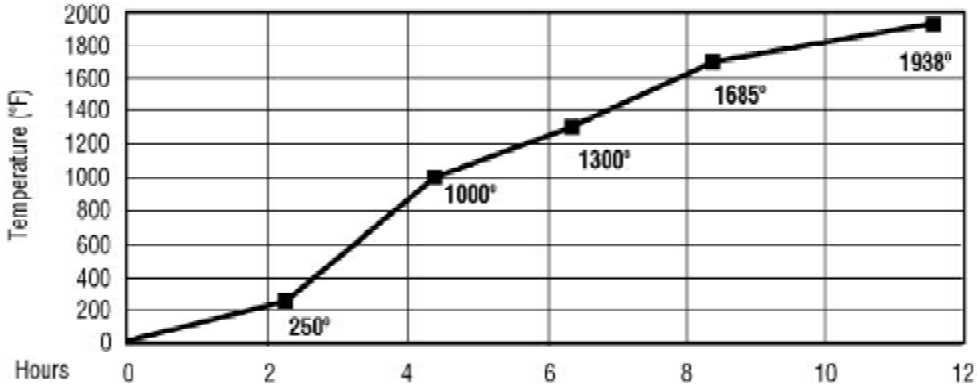
Slow is for hand thrown pottery, porcelain, and stoneware. The firing will take 12 hours* to complete. If you were to program the segments for this firing, they would look like the chart at right; however, they are automatic.

The graph at right illustrates the segments of a cone 04 firing in Cone Fire mode, slow speed. The firing will take approximately 12 hours to complete. The heating rates are the same for all cones. The temperature in segment 4 is 250^0 less than the final temperature for the cone.

**Firing times are approximate, based on a beginning temperature of 70^{0}F/21^{0}C firing to Cone 04.*

Segment	Rate	Temperature	Hold
1	80½/hr	250½ F	0
2	250½/hr	1000½ F	0
3	150½/hr	1300½ F	0
4	180½/hr	1685½ F	0

Cone 04, Slow Speed



Cone Fire–Medium

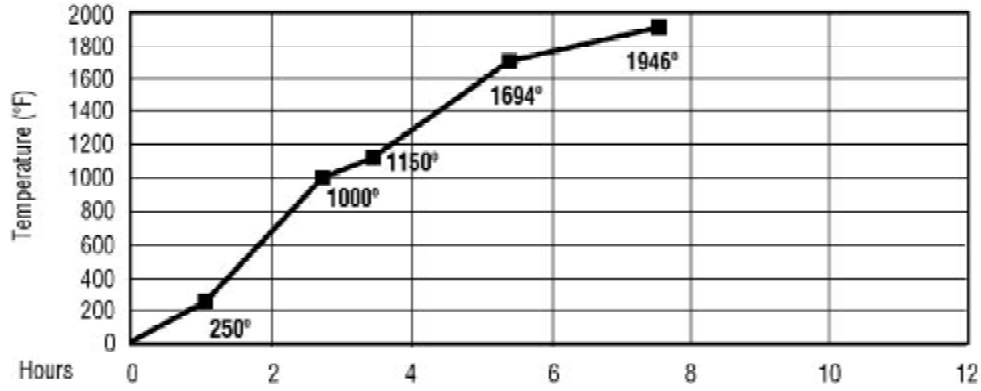
Medium is the speed you will probably use for your firings of cast earthenware and low-fire glazed pieces. It will take approximately 7.5 hours* to fire. The actual time is dependent on the selected cone value. Use this speed when the kiln is packed tighter or your greenware has thicker sides or a higher moisture content. If you were to program the segments for this firing, they would look like the chart at right.

The graph at right illustrates the segments of a cone 04 firing in Cone Fire mode, medium speed. The firing will take approximately 7.5 hours to complete. The heating rates are the same for all cones. The temperature in segment 4 is 250^0 less than the final temperature for the cone.

**Firing times are approximate, based on a beginning temperature of 70^0F/21^0C firing to Cone 04.*

Segment	Rate	Temperature	Hold
1	200½/hr	250½ F	0
2	400½/hr	1000½ F	0
3	180½/hr	1150½ F	0
4	300½/hr	1694½ F	0

Cone 04, Medium Speed



Cone Fire–Fast

Fast is a speed that will take approximately 4 hours* firing depending on the cone selected. Fast speed is probably not the best choice to use during a bisque firing as it does not allow enough time for the physical water to burn off and the structural changes to occur. If you were to program the segments for this firing, they would look like the chart at right:

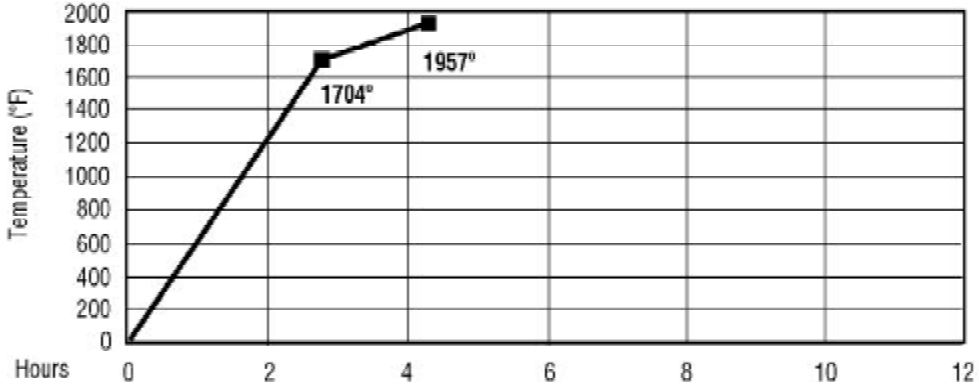
The graph at right illustrates the segments of a cone 04 firing in Cone Fire mode, fast speed. The firing will take approximately 4 hours to complete.

If Review is pressed near the end of the firing (within one hour of completion) an adjusted cone temperature of 1937^{0}for Cone 04 will be displayed. For more explanation, see Appendix 2, Cone Chart and Heat Work. This section explains why the end temperature may be higher or lower than the cone table indicated.

**Firing times are approximate, based on a beginning temperature of 70½F/21½C firing to Cone 04.*

Segment	Rate	Temperature	Hold
1	570½/hr	1704½ F	0

Cone 04, Fast Speed



Programming in the Cone Fire Mode.

Messages and prompts in the Cone Fire Mode.

A word about the funny digital characters: they may seem unreadable now, but you'll get used to them.

PF Power Failure, may indicate that the controller was just plugged in. Press Enter to clear the PF message and display internal kiln temperature.

HOLd Hold time desired at end of firing is entered in hours and minutes up to a maximum of 99 hrs. 99 mins. To enter, numbers on the right of the decimal are minutes, to the left are hours. The default setting is 00 hrs. 00 mins.

ConE Requests firing cone number. Be sure to enter the correct number keeping in mind that cooler firing temperatures have a "0" in front of the number.

SPd Requests the speed of firing, either slow, medium or fast.

(Continued overleaf)

CPLt Indicates that the firing cycle is complete. Elapsed firing time in hours and minutes is displayed.

-ON- Briefly displayed indicating that the kiln has started.

deLA Indicates the amount of time in hours and minutes to delay the start of firing. A maximum of 99 hrs. 99 mins. is allowed. Digits to the right of the decimal are minutes, to the left are hours.

ALAr Signals the operator that the kiln has reached a pre-programmed temperature. The default setting is 9999^{0}F for no alarm.

- - - - Flashes while the kiln is processing.

A Sample Cone 06 Firing, Medium Speed

At right is a sample of keystrokes for a Cone 06 firing with medium speed and no hold.

Helpful hint: If you make a mistake when entering a cone number, don't be discouraged. Simply clear the display by pressing all zeroes. Press Enter. This will take you back to ConE. The display will flash the last value that was input correctly. Enter the correct value and Press Enter. If a number was incorrectly entered for HOLd, deLA or ALAr, clear the display by entering all zeros. Enter the correct digit(s) for the step being programmed. Press Enter. If you have already pressed Enter, you must go back through the program by pressing Enter until you reach the point where the mistake was made.

Step	*Press*	*Action*	*Display*
1	**Cone Fire**	Enters Cone Fire Mode	ConE
2	**0 6**	Enters Cone number desired*	06
3	**Enter**	Stores new Cone number	SPd
4	**Med**	Enters speed desired	MED
5	**Enter**	Stores new speed	HOLd
6	**5**	Enters new hold time	.05
7	**Enter**	Stores new hold time	(Kiln Temp.)
8	**Review**	Reviews program segments to ensure accuracy*	(All segments)
9	*Set options if desired:*		
	Delay	Enter delay of start of firing (eg: 1/2 hr. = 00.30)	00.30
	Alarm	Enter temperature at which alarm sounds (1500)	1500½F
	Review	Reviews all programmed instructions	ConE, SPd, HOLd, deLA, ALAr (followed by their values)
10	**Start**	Begins firing sequence (or Delay countdown)	-ON-

**Caution: Be sure you have entered the correct Cone number. 06 is much different from 6! If you are not certain of the difference, check the Cone and temperature with the Cone Chart in Appendix 3.*

Ramp/Hold Mode

An important note

To effectively use Ramp/Hold firing programs, it is imperative to understand heat work theory. See Appendix 2 for further details.

Description

The Ramp/Hold mode allows you to create your own firing profile. The profile can consist of 1 to 8 segments. Each segment consists of three parameters: the **rate** of temperature rising or cooling in ^{0}F or ^{0}C per hour; the **temperature** to fire to during that segment in ^{0}F or ^{0}C; and **hold time** at the designated temperature for that segment. The user can program an **alarm** to sound when a given temperature is reached.

Rate

Rate can vary from 13^0 to 9999^{0}F/hr. For comparison, in the Cone Fire mode Slow rate, the initial rate is 80^{0}F/hr and in Medium the initial rate is 200^{0}F/hr. In Ramp/Hold mode, you decide how fast you want the kiln to rise in temperature. Segment 1 will always have a heating rate.

Note: If you should program an unachievable heating rate such as 9999^{0}F/hour, the kiln cannot heat that fast and will turn On and stay On, effectively duplicating a High setting on a switch. The actual rate of heating will be the maximum that particular kiln can achieve on High. Generally, the maximum heating rate in a fully loaded kiln is about 100^0 F per hour as it approaches the top cone rating for the kiln.

Temperature

Temperature is the heat you want to reach before holding or proceeding to the next rate. The maximum temperature is 2400^{0}F (1300^{0}C). If a Hold temperature is less than the previous temperature entered, the controller will ensure that the kiln will not cool faster than the programmed rate. Read Appendix 3 on heat work before you use rate and temperature to emulate a cone firing.

Hold

Hold is the amount of time in hours and minutes you want to sustain at a given temperature before it continues to the next segment. Hold can be from zero to 99 hours 99 minutes. For example, a hold of 15 minutes will appear in the display as 00.15. Digits to the right of the decimal are minutes; digits to the left are hours.

Segment	Rate	Temperature	Hold
2			
3			
4			
5			
6			
7			
8			

Recording your USEr programs

Before you begin input, copy this page or create a chart to include all of the segments you plan to program. You may have 1 to 8 segments. Each segment may have three components as shown in the blank chart above.

Calibration for critical work

For those who are doing critical work which needs exact temperatures, periodically check the accuracy of the thermocouple by placing witness cones on the shelves. Observe the deformation of the Self-Supporting Cones at the end of the firing. If the shelf cone bends to maturity before the kiln turns off, press **Stop** and make a note of the internal temperature.

Adjust the programmed cone or end firing temperature using the knowledge gained from the cones from the previous firing. Make a note of any adjustments you have made so that your future firings will be more accurate.

Inspect the thermocouple element regularly and replace it as described on page 7 (wall-mounted controller) or 35 (KM kilns) if it shows signs of flaking or thinning.

PROGRAMMING IN RAMP/HOLD MODE.

Messages and prompts in the Ramp/Hold Mode.

Some of the characters may appear funny to you now, but soon you won't even notice.

PF Power Failure, also displays when the controller has just been just plugged in. Press Enter to clear the message and display the internal kiln temperature.

SEGS (May look like 5E65.) Asks for the number of segments in the USEr profile.

rA 1-8 Rate for each segment 1-8.

F 1-8 Temperature for each segment 1 through 8. Cone Table can be used to look up cone equivalent values while programming. Please keep in mind the Time/Temperature equation regarding heat work discussed in Appendix 2

HLd 1-8 Hold for each segment, 1-8.

USEr Refers to the program you wish to run or retrieve. As many as six programs may be stored in permanent memory.

CPLt Indicates that the firing is completed for the number of segments requested. Firing time in hours and minutes is displayed.

-ON- Indicates that the kiln has started.

deLA Indicates the amount of time to delay the start of firing. Digits to the right of the decimal are minutes, to the left are hours.

ALAr Signals the operator that the kiln has reached a pre-programmed temperature. The default setting is 9999^{0}F for no alarm.

- - - - Will flash twice at the end of programming, followed by the internal temperature of the kiln. The internal temperature will continue to flash until Start is pressed.

Storing and retrieving programs.

USEr is the first prompt you encounter when entering a Ramp/Hold program. A number between 1 and 6 alternately flashes along with the USEr prompt, which represents the last program which was fired.

Keep a log near the kiln that tells which USEr numbers are in use and records the details of each ramp and hold segment. If you want to modify or overwrite an existing program, select that number.

If several people in your studio fire the kiln, it is always a good idea to review a stored program and check to be sure that no one has modified it since you last used it.

After you have entered all the parameters of your firing profile, you may review it by pressing Review. The program will remain in the KilnMaster memory until changed. You can either leave the USEr program for later use, or begin firing by pressing Start. The examples at right give specific instructions on programming and retrieving USEr programs..

Segment	Rate	Temperature	Hold
1	570½/hr	1694½ F	0

A Sample 2-Segment Cone 04 Firing.

This Cone 04 firing at fast speed in Cone Fire mode contains 2 segments. The keystrokes needed to duplicate this 04 firing in Ramp/Hold mode are shown at right.

For comparison, this Ramp/Hold program emulates the Cone Fire–Fast speed Cone 04 segments shown earlier in the manual. The difference is that you are entering each piece of data.

Use the two-segment firing chart at right as your programming reference.

Helpful hint: When programming a segment, if you make a mistake entering a number, don't be discouraged. Simply clear the display by pressing all zeros, then enter the correct digits for the step you are programming. If you have already pressed Enter, you must go back through the program by pressing Enter until you reach the point where the mistake was made.

Step	*Press*	*Action*	*Display*
1	**Enter**	Clears PF-message and displays kiln temperature	Kiln Temp.
2	**Ramp/Hold**	Enters Ramp/Hold Mode	USEr / No.
3	**1**	Selects USEr profile number 1	1
4	**Enter**	Opens the USEr profile to receive data	SEGs / No.
5	**2**	Enters number of segments in profile	2
6	**Enter**	Stores the number of segments entered	rA1 / No.
7	**5 7 0**	Enters the heating rate per hour of segment 1	570
8	**Enter**	Stores the segment 1 heating rate	½F 1 / No.
9	**1 6 9 4**	Enters the ½F temperature to reach in this segment	1694
10	**Enter**	Stores the target temperature for segment 1	HLd1 / No.
11	**0**	Enters no hold time	00.00
12	**Enter**	Stores the hold time for segment 1	rA2 / No.
13	**1 0 8**	Enters the heating rate per hour of segment 2	108
14	**Enter**	Stores the segment 2 heating rate	½F 2 / No.
15	**1 9 4 4**	Enters the ½F temperature to reach in this segment	1944
16	**Enter**	Stores the target temperature for segment 2	HLd2 / No.
17	**0**	Enters no hold time	00.00
18	**Enter**	Stores the hold time for segment 2	HLd2 / No.
19	**9999**	Enters temperature to sound alarm (no alarm)	9999
20	**Enter**	Stores the alarm temperature	- - - - / Temp.
		The display will flash "- - - -" twice after programming is complete. Then it will begin flashing the internal temperature.	
21	*Set options if desired:*		
	Delay	Enter delay of start of firing (eg. 1/2 hr. = 00.30)	00.30
	Alarm	Enter temperature at which alarm sounds (1500)	1500½F
	Review	Reviews all programmed instructions	SEGS, rA1,F 1, HLd1, rA 2,F 2, HLd2, deLA, ALAr
22	**Start**	Begins firing sequence (or Delay countdown)	-ON- / Temp.)

Quickly accessing a stored program.
If you know that a program you wish to use has not been modified since you last fired with it, you do not have to review all the programming steps.

The instructions below show the details on quickly accessing a stored program. This is especially useful for production studios which need both repeatability and productivity.

Step	*Press*	*Action*	*Display*
1	**Ramp/Hold**	Enters Ramp/Hold Mode	USEr / No.
2	**1 to 6**	Selects one of your 6 USEr profiles	1 to 6
3	**Enter**	Opens the USEr profile to receive data	SEGs / No.
4	**Stop**	Closes and stores the USEr program selected *Note: Stop only has an effect at this point in the program. If you start programming, you must press Enter to all prompts and go through the programming cycle.*	- - - -
5	**Review**	Reviews that all of the information is input	SEGS, rA1,½F
1,	(Optional)	correctly and the proper program is selected	HLd1, rA 2,F 2, HLd2, deLA, ALAr
6	**Start**	Begins firing sequence (or Delay countdown)	-ON- (then Kiln

The Skip Step advanced feature.
Advanced KilnMaster users asked us for the ability to skip the rest of a step in Ramp/Hold mode. This is useful if you know from experience or by viewing cones through a peep hole that the heat work is complete for that segment. You can skip the balance of that segment and go on to the next one.

To skip the balance of a segment:

1. Press **View**, then **Enter** in quick succession.
2. The display will show SStP (Skip Step).
3. Press **Enter** again.
4. The display will show the new segment number.

This feature is not available in Cone Fire Mode.

SAMPLE RAMP/HOLD PROGRAMS

You may find the following examples of Ramp/Hold programs helpful. If nothing else, they will serve as a guide for developing your own programs. Label your new program and keep it handy for quick reference on a 3x5 file card or a photocopy of the blank Ramp/Hold table on page 23.

Candling

This Cone 10 firing demonstrates a slow firing with holds at the lower temperatures. This profile would be gentle and safe for pottery firing of ware which had not dried sufficiently before firing. With modification to the final firing temperatures, this procedure may be used with other types of clay.

Segment	Rate	Temperature	Hold
1	50⁰ / hr	150⁰F	6.00
2	150⁰ / hr	1100⁰F	2.00
3	570⁰ / hr	2100⁰F	0
4	108⁰ / hr	2345⁰F	0

Controlled Cooling

Normal firing to cone 5, rapid* cooling to 1950⁰ with a 30 minute hold. Slow cooled to 1100⁰, then normal cooling to room temperature. This is a useful profile when glaze firing to ensure gentle cooling and avoid cracking or crazing.

Segment	Rate	Temperature	Hold
1	300⁰/hr	1100⁰ F	0
2	500⁰/hr	1915⁰ F	0
3	108⁰/hr	2165⁰ F	0
4	9999⁰/hr*	1950⁰ F	.30
5		1100⁰ F	0

Quick Fire

A fast fire to Cone 018, rapid* cooling to 1100⁰ with a 30 minute hold, then normal cooling to room temperature. A simple approach to firing overglazes and china paints.

Segment	Rate	Temperature	Hold
1	9999⁰/hr*	1314⁰F	0
2	9999⁰/hr*	1100⁰F	.30

**9999 is the default for the maximum heating or cooling rate. The actual rate will vary with the kiln model, density of the load, air circulation, and the room temperature.*

Porcelain Fire

This Cone 5 firing of appproximately10 hours is just one example of a porcelain fire with rates calculated to produce a desirable temperature profile.

Segment	Rate	Temperature	Hold
1	150⁰/hr	250⁰F	.10
2	250⁰/hr	1000⁰F	.10
3	180⁰/hr	1150⁰F	0
4	300⁰/hr	1915⁰F	.10
5	108⁰/hr	2165⁰F	0

Crystalline Glaze

This example is fired to Cone 10, taking approximately 11.5 hours to fire, with a rapid drop in temperature to 2050½ and a hold of 3 hours. To assist with rapid cooling from peak temperature to hold temperature, one may pull peep plugs. Replace peep plugs when hold temperature is reached.

Segment	Rate	Temperature	Hold
1	200⁰/hr	800⁰F	0
2	150⁰/hr	1250⁰F	0
3	300⁰/hr	2100⁰F	0
4	108⁰/hr	2330⁰F	0
5	9999⁰/hr*	2050⁰F	3.00

Glass Fusing

Glass firing is specialized and will require some experimentation to arrive at the perfect program for your kiln and glass products. However, this will give you a place to start experimenting.

Segment	Rate	Temperature	Hold
1	300⁰/hr	900⁰ F	.30
2	500⁰/hr	1450⁰ F	.30
3	9999⁰/hr*	1025⁰ F	.30
4	60½/hr	800⁰ F	

**9999 is the default for the maximum heating or cooling rate. The actual rate will vary with the kiln model, density of the load, air circulation, and the room temperature.*