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PERFECT-FIRE FEATURES

The PERFECT-FIRE is a digitally programmable temperature controller. It allows the user to specify the rate of temperature increase, final firing temperature (set point) and a hold or soak time at the set point. It also offers special features such as firing by cone number, "Soft Fire" and a delay start. The PERFECT-FIRE incorporates sealed, membrane switches to help keep dirt out and quality in. Its large 4 digit display is easily seen from a distance. Programming is easy with simple keystrokes. A group of LED's indicate the exact position during the programming and firing modes.

The rate at which the temperature increases can be very important. Glass artists need a controlled rate to avoid breakage, porcelain artists typically fire slowly and the heat-treater must follow close specifications. The PERFECT-FIRE satisfies these needs by allowing the ramp rate to program at any speed between 10 and 3999 degrees per hour in either temperature or cone modes.

The final firing temperature or setpoint can be programmed to any temperature, in 1 degree increments, up to 2400°F (1315°C). This option allows heat-treaters and glass artists as well as those working with clay bodies to select the temperature at which to fire. It also enables the ceramic and porcelain artists to "split" cones. The "Soft Fire" feature can be used with this option.

The set point can also be programmed using a cone number. This option addresses the preference of firing to a cone number and finds its use primarily in ceramic and porcelain work. The PERFECT-FIRE contains data on the typical firing range of cones: 022 to 10. The user merely chooses the cone number at which to fire and the PERFECT-FIRE does the rest. It should be noted that firing by cone is best accomplished using the "Soft Fire" feature.

Many processes include maintaining the set point temperature for a period of time. This is referred to as Soak or Hold time. The PERFECT-FIRE has the ability to maintain the final temperature from 1 minute to 40 hours !! This feature is very handy for those doing heat treating and some glass work.

The PERFECT-FIRE employs a feature we call "Soft Fire". It was designed to work in conjunction with the cone mode to best mimic a cone firing, but it can also be used when firing to a temperature. This feature slows down the latter portion of the firing automatically and maintains a predetermined time/temperature rate. Its use is recommended for ceramic and porcelain.

A delay start feature is also incorporated into the PERFECT-FIRE. This allows the user to start the firing process at a later time. This feature finds use in areas where energy costs are less at particular times during the day. A maximum delay start of 40 hours is possible.

The PERFECT-FIRE is very simple to program and use.

> ❖ A simple series of keystrokes is used to choose and store all data.

> ❖ The four digit display is large and can be seen from a distance.

> ❖ A group of LED's indicate exact position during programming and firing.

Temperatures are displayed in either Fahrenheit or Celsius. This is indicated on the 4 digit display with either an F or C respectively. This option has been factory set.

KEY AND LED FUNCTIONS

KEY FUNCTIONS

Six keys are needed to operate the PERFECT-FIRE.

❖ **START**   The START key is a multi-function key. It starts as well as stops the firing process and can be used to override any programmed delay or hold times.

◆ Pressing the START key, while the program is not running (Off indicator light will be on), will start the firing process.

◆ Pressing the START key, while the program is running (Off indicator light is off), will force the program to go to the next position in the firing program and override any predetermined delay or hold times. Repeated pressing will stop the firing process (Off indicator light will be on).

❖ **SELECT**   The SELECT key is used when programming in firing data. It scrolls the program to each of the four positions to allow for data entry. The four positions include Temperature, Delay Time, Rate °/Hour and Hold Time.

❖ **ENTER**   The ENTER key is used to store the programmed data in the controllers memory. When using the ENTER key it is necessary to press and hold the key down until the display flashes off and back on again. This indicates the data has been stored.

❖ **CONE**   The CONE key is used when it is desired to fire to a cone number instead of a temperature. When pressed, C --- will appear in the display. The typical ceramic and porcelain range of 022 to 10 is available. The user simply chooses the cone number and the controller does the rest. See the Cone Firing section for temperature equivalents of pre-programmed cone numbers.

❖   **&**   The up and down arrows are used to change the values in the display during programming. When held down, the speed at which the values change increases. If tapped, speed remains the same. If left released for a brief period, speed decreases.

KEY AND LED FUNCTIONS

LED INDICATORS

There are five LED indicators that are used in the programming and run modes.

❖ **Temp/Off**   ◆ Flashes while in the programming mode indicating that final temperature (set point) data is now being programmed. While at this position, the user has the choice of programming using temperature or cone number.

◆ On steady indicates that the unit is off.

❖ **Delay Time**   ◆ Flashes while in the programming mode indicating that delay start time data is now being programmed.

◆ On steady while in the run mode and indicates the controller is counting down the delay start time.

❖ **Rate °/Hr**   ◆ Flashes while in the programming mode indicating that rate per hour data is now being programmed.

◆ On steady while in the run mode indicating the controller is ramping up at the programmed rate to the set point.

❖ **Hold Time**   ◆ Flashes while in the programming mode indicating that "Soft Fire" or hold time data is now being programmed.

◆ On steady while in the run mode indicating the controller is holding the (set point) for time programmed or is operating the Soft Fire feature.

❖ **HEATING**   ◆ This LED will turn "on" and "off" during the firing. It indicates when power is being applied to the heating elements. When "on", power is being applied. When "off", power is not being applied.

PROGRAMMING

CHOOSING THE FIRING DATA

There are four specific pieces of information that must be determined before programming the PERFECT-FIRE: Final Temperature (set point), Delay Start Time, Rate of Temperature Increase and Hold Time/Soft Fire. These pieces of information are called firing data.

❖ **Final Temperature (set point)**

This is the end or final temperature that the kiln will achieve. The final temperature is often referred to as the set point. This data can be entered in two ways: by temperature or by cone number. To program the temperature directly, the user chooses any temperature up to 2400°F or 1315 °C. This is accomplished using the arrow keys. To program by cone number, the user chooses any cone number between 022 and 10. See the Cone Firing section for temperature equivalents of pre-programmed cone numbers. This is accomplished using the cone and arrow keys. To find out what final temperature or cone number to use, consult the dealer or manufacturer of the product.

❖ **Delay Time**

The delay time is a special feature that allows the user to delay the actual start of the firing. This feature finds use where power costs are lower at different times of the day. The delay start is programmable in 15 minute increments up to 40 hours, use the arrows keys to set. If no delay is desired, set delay to 0. It should be noted at this point that a kiln or oven should not be fired unattended.

❖ **Rate of Temperature Increase**

Most fired items demand a controlled temperature increase. Typical rates include: Porcelain @ 300°F (148°C) per hour, Ceramic @ 400 to 500°F (204 to 260°C) per hour, Glass @ 500 to 1200°F (260 to 649°C) per hour or faster depending on glass, Metals vary depending on type and process. Use the arrow keys to set. These rates are typical and can be changed to suit the products and desired outcome.

❖ **Hold Time/Soft Fire**

Known also as soak time, Hold Time allows the user to maintain the final temperature or set point for a given period of time. Hold time is programmable from 0 to 40 hours in 1 minute increments. Typical hold times include: Metals - vary depending on type and process, Ceramic, Porcelain and Glass - many find a 10 minute hold beneficial on low fires such as decal work. Use arrow keys to set. The Soft Fire feature is also programmable at this point. Unlike the hold, the soft fire slows the firing rate down as it gets close to the final temperature. It is recommended that all ceramic and porcelain firings use this soft fire feature in combination with cone programming except where noted. Metal and glass firings should avoid this soft fire feature in general. Use down arrow to set. When programming using cone, Soft Fire is chosen automatically.

PROGRAMMING

PROGRAMMING MODE (entering the firing data)

Once the firing data has been determined it can now be put into the PERFECT-FIRE. This is done in what is called the programming mode. Before entering the firing data, the PERFECT-FIRE must be in the Off position: *Off light should be on.*

1. Press and release the Select key. The Temp/Off LED will be flashing. The previous final temperature or set point will be displayed. At this point the user has two choices: firing by temperature (A) or firing by cone number (B).

   A. Firing by temperature.
      a. Press the arrow keys to raise or lower the displayed temperature. Maximum programmable temperature is 2400°F or 1315°C. Do not exceed the rated temperature of the kiln or oven.
      b. Press and hold the Enter key momentarily to store the temperature data.

   B. Firing by cone number.
      a. Press the Cone key. The display will show C ---.
      b. Press the arrow keys to choose cone number between 022 and 10. Do not exceed the rated temperature of the kiln or oven. *It is very important that the correct cone be chosen. Firing to an 06 cone is not the same as firing to a 6 cone!! The user must be familiar with cones regardingthis point.See the Cone Firing section for temperature equivalents of pre-programmed cone numbers.*
      c. Press and hold the enter key momentarily to store the cone data.
      d. The display will show the cone equivalent in degrees. Check this against the cone chart included in this manual to verify.

2. Press and release the Select key. The Delay Time LED will be flashing. The previously used delay time will be displayed. Press the arrow keys to choose the desired delay start time, if any. Delay time is set in 15 minute increments with a maximum delay of 40 hours. This value may be left at zero if no delay is needed. Press and hold the Enter key momentarily to store the delay time data.

3. Press and release the Select key. The Rate °/Hr LED will be flashing. The previously used rate per hour will be displayed. Press the arrow keys to change this rate if desired. The rate can be programmed between 10 and 3999 degrees per hour. It should be noted that a particular type of kiln or oven can only heat so fast. Programming in a faster rate than the kiln can maintain will result in a basically "full on" setting. Press and hold the Enter key momentarily to store the rate per hour data.

4. Press and release the Select key. The Hold Time LED will be flashing. The previously used hold time or soft fire will be displayed. Press the arrow keys to change this hold time or soft fire if desired. The hold time can be programmed from 0 minutes (no hold) to 40 hours. To use the soft fire option, press the down arrow key. Soft Fire is located just below 0. Press and hold the enter key momentarily to store the hold time data.

5. Press and release the Select key. The Time/Off LED will be on and the temperature of the kiln or oven will be displayed. Programming of the firing data is now complete.

PROGRAMMING

REVIEWING AND CHANGING THE FIRING DATA

Once all of the firing data is entered it is now possible to go back through each of the four positions and review the data for errors and make corrections if necessary.

❖ Press and release the Select key. The Temp/Off LED will begin flashing. Check the final temperature for accuracy. If the temperature data is incorrect, use the arrows and/or cone keys to correct it and press the Enter key. If the data is correct, or was corrected, press the Select key. Use this same procedure to review and correct the remaining positions.

RUN MODE (running the program)

The run mode essentially means the PERFECT-FIRE is using the programmed firing data to operate the kiln or oven. During the run mode the temperature is displayed continually while the lights indicate the position within the firing. The heat light will also be turning "on" and "off" to indicate when power is supplied to the heating elements.

❖ With the PERFECT-FIRE in the off position (Off light on), press and release the Start key.

The PERFECT-FIRE is now in the run mode. It first checks the Delay Time position. If a delay start time was programmed the Delay Time light will be on and the display will show time remaining before start up. If no Delay Time was programmed, or when the delay time has timed out, the controller moves to the Rate°/Hr position. This is indicated by the Rate°/Hr light being on. Once in the Rate°/Hr position, the PERFECT-FIRE will increase the temperature in the kiln or oven at the rate programmed until it reaches the final temperature or set point. Once at the set point the PERFECT-FIRE will check the Hold Time position. The Hold Time light will be on indicating the temperature is being maintained for the programmed amount of time or operating the soft fire. If no hold or soft fire was chosen the PERFECT-FIRE will move on to the next position which is Off. The Temp/Off light will be on. The firing cycle is then complete.

TO MANUALLY STOP THE FIRING

As noted previously, the PERFECT-FIRE will complete the firing and return to the off position automatically. In some cases it is also necessary to stop the firing manually, i.e. leaving the kiln unattended. To stop the firing:

❖ Press the Start key until the Temp/Off light comes on.

The Start key is a multi functional switch. It is used to start the program, stop the program, and can be used to bypass any programmed delay or hold times.

SAMPLE PROGRAMS

FIRING TO A CONE 06 USING THE CONE FEATURE

This sample firing involves firing to a cone 06, no delay start time, 400ºF (204ºC) per hour while using the Soft Fire feature.

1. Press Select. The Temp/Off light will be flashing.

2. Press Cone. C --- will be displayed. Use down arrow until display reads 06.

3. Press Enter and hold momentarily until display flashes on and off.

4. Press Select. The Delay Time light will be flashing. Use down arrow to choose 0.

5. Press Enter and hold momentarily until display flashes on and off.

6. Press Select. The Rateº/Hr light will be flashing. Use arrow keys to choose 400 (204).

7. Press Enter and hold momentarily until display flashes on and off.

8. Press Select. The Hold Time light will be flashing. "Soft" (Soft Fire) is chosen automatically when firing by cone.

9. Press Select. The Temp/Off light will be on. Programming is complete.

10. Press Start to run the program.

FIRING TO 1830F (999C) USING TEMPERATURE

This sample firing involves firing to 1830ºF (999ºC), no delay start time, 400ºF (204ºC) per hour with no hold time. This sample is basically the same sample as that seen above, except that the set point is chosen using temperature instead of cone.

1. Press Select. The Temp/Off light will be flashing. Use arrows to choose 1830 (999).

2. Press Enter and hold momentarily until display flashes on and off.

3. Press Select. The Delay Time light will be flashing. Use down arrow to choose 0.

4. Press Enter and hold momentarily until display flashes on and off.

5. Press Select. The Rateº/Hr light will be flashing. Use arrow keys to choose 400 (204).

6. Press Enter and hold momentarily until display flashes on and off.

7. Press Select. The Hold Time light will be flashing. Use down arrow to choose 0.

8. Press Select. The Temp/Off light will be on. Programming is complete.

9. Press Start to run the program.

SAMPLE PROGRAMS

FAST FIRE WITH A HOLD AT THE SET POINT

This sample firing involves firing to 1875°F (1024°C), no delay start, 3999 degrees per hour with a 15 minute hold time at the set point. As noted, the kiln or oven is not likely to respond to 3999 degrees per hour. This setting is used to take the temperature of the unit up as fast as possible, or what is commonly referred to as a fast fire.

1. Press Select. The Temp/Off light will be flashing. Use arrows to choose 1875 (1024).

2. Press Enter and hold momentarily until display flashes on and off.

3. Press Select. The Delay Time light will be flashing. Use down arrow to choose 0.

4. Press Enter and hold momentarily until display flashes on and off.

5. Press Select. The Rate°/Hr light will be flashing. Use up arrow to choose 3999.

6. Press Enter and hold momentarily until display flashes on and off.

7. Press Select. The Hold Time light will be flashing. Use down arrow to choose 15.

8. Press Select. The Temp/Off light will be on. Programming is complete.

9. Press Start to run the program.

HINTS, SHORTCUTS AND SUGGESTIONS

❖ To review the programmed firing data just press the Select key repeatedly. After data has been reviewed return to the off position.

❖ While reviewing you can change any firing data you wish. Use the arrow keys to change and press enter. Continue to review until you are satisfied with programmed data.

❖ It is suggested that you review the firing data before every firing to verify its contents. It only takes about five seconds. It's much easier to make program changes before the firing than after!!

❖ If you want to bypass the delay time and start firing immediately, just press the Start key once. The PERFECT-FIRE will go directly to Rate°/Hr and start firing. The same can be said for the Hold Time. If you want to end the firing without completing the hold, just press Start one time and the PERFECT-FIRE will go to   the off position.

❖ We ask that you please understand the cone chart and know which cone you are firing. As stated before, a cone 06 is not the same as a cone 6. If you program a cone 6 for an 06 you will most likely end up with an overfired mess and a big headache. Please avoid this by knowing to which cone your ware is fired and program accordingly.

❖ The Soft Fire feature can be used when programming by temperature and by cone number. Its use is highly recommended for clay bodies but not glass and metals.

HINTS, SHORTCUTS AND SUGGESTIONS

❖ The devise that senses the temperature is called the thermocouple. It is inserted into the kiln chamber and produces a small signal relative to temperature. This signal is seen by the PERFECT-FIRE and converted to a temperature. It is important that care be taken to avoid damaging this devise when working near and loading or unloading the kiln or oven.

❖ The temperature accuracy of the PERFECT-FIRE is).5% of the span. This makes for very accurate and repeatable firings. It should be noted that the size or mass of the load can effect the final outcome, particularly in ceramics and porcelain. In such cases it may be necessary to decrease or increase the set point. Typically 5 to 10 degrees will suffice.

❖ Always turn the power off when firing is complete or when leaving the kiln or oven unattended.

ERROR MESSAGES

❖ EEEE   This error code indicates a thermocouple problem. The thermocouple is either destroyed or connected improperly. Check thermocouple and all thermocouple connections thoroughly.

❖Err2   This error indicates invalid data has been detected. This forces the unit to shut down and display this error code. To reset the unit, remove and reapply power.

SPECIFICATIONS

Power Requirements . . . . 115 VAC)5%, 208 VAC)10%, 230 VAC)10% @ 50-60 Hz
Thermocouple . . . . 14 gauge, Type K
Operating Temperature Range . . . . 0 to 100°F (-17 to 38°C)
Display Resolution . . . . 1°
Ramp Rate (degrees/hour) . . . . 1°/hour min. to 3999°/hour max.
Ramp Time . . . . 40 hour max.
Hold Period . . . . 40 hour max.
Set Point Range . . . . 0 to 2400°F (-17 to 1315°C)

Temperatures in this manual are quoted in both Fahrenheit and Celsius. Celsius temperatures are those in parenthesis. The PERFECT-FIRE has been factory set for either Fahrenheit or Celsius scales depending upon requests and final destination. Contact your dealer/distributor if a change in scale is needed. The following conversion formulas give a very close approximation.

◆ To convert Fahrenheit to Celsius. $°C = (°F - 32) \times 5/9$

   example: $(2000°F -32) \times 5/9 = 1968 \times 5/9 = 1093°C$

◆ To convert Celsius to Fahrenheit. $°F = (°C \times 9/5) + 32$

   example: $(1093°C \times 9/5) + 32 = 1967 + 32 = 1999°F$

CHOOSING TEMPERATURE/CONE

TEMPERATURE FIRINGS

Given the multitude of products and processes it is impossible to give specifications regarding final firing temperatures. This information is available from the supplier or manufacturer of the particular product. Many products are labeled or contain information in the packaging relating to the specific firing needs. If in doubt, it is suggested that contact be made with the supplier/manufacturer.

CONE FIRINGS

The cone temperature equivalents shown in the *With Soft Fire* column are those chosen automatically by the PERFECT-FIRE when programmed using the cone feature. The Soft Fire feature is chosen automatically when firing by cone. You do not have to use the Soft Fire option when firing by cone, however, it is recommended.

The cone temperature equivalents shown in *Without Soft Fire* can be used when it is desired to fire to a cone number without using the Soft Fire feature. These temperatures must be entered manually and are not chosen automatically by the PERFECT-FIRE. It should be noted again that the relative size of the load can effect the results of the firing and that adjustment of the set point may be necessary.

CONE NUMBER	WITH SOFT FIRE °F (°C)	WITHOUT SOFT FIRE °F (°C)
022	1069 (576)	1086 (586)
021	1116 (602)	1137 (614)
020	1157 (624)	1175 (635)
019	1234 (667)	1261 (683)
018	1285 (696)	1323 (717)
017	1341 (727)	1377 (747)
016	1407 (763)	1458 (792)
015	1454 (789)	1479 (804)
014	1533 (833)	1540 (838)
013	1596 (868)	1566 (852)
012	1591 (866)	1623 (884)
011	1627 (886)	1641 (894)
010	1629 (887)	1641 (894)
09	1679 (914)	1693 (923)
08	1733 (944)	1751 (955)
07	1783 (972)	1803 (984)
06	1816 (991)	1830 (999)
05	1888 (1031)	1915 (1046)
04	1922 (1049)	1940 (1060)
03	1987 (1086)	2014 (1101)
02	2014 (1101)	2048 (1120)
01	2043 (1117)	2079 (1137)
1	2077 (1136)	2109 (1154)
2	2088 (1142)	2124 (1162)
3	2106 (1152)	2134 (1168)
4	2134 (1167)	2167 (1186)
5	2151 (1177)	2185 (1196)
6	2194 (1201)	2232 (1222)
7	2219 (1214)	2264 (1240)
8	2257 (1236)	2305 (1263)
9	2300 (1259)	2336 (1280)
10	2345 (1284)	2381 (1305)