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# RAMPMASTER FEATURES

The RAMPMASTER is a digitally programmable temperature controller. It offers eight programmable ramp rate/set point/soak segments. The ramp portion of each segment can be either ascending or descending. These segments are the heart of the controller. They allow the user to program up to eight different rates and temperatures for a complete firing.

Although the RAMPMASTER can use eight segments for a complete firing, it's not necessary to use all eight. Simple firing profiles or schedules consisting of a few segments are also possible.

A powerful feature of the RAMPMASTER is its ability to start at any of the eight segments. This feature will allow the programming of many simple firing schedules. This means the RAMPMASTER can operate as a multi-program controller as well.

In some instances, it is necessary to hold the temperature of the kiln at its present value. This procedure is common to glass work. A pause feature allows the user to "creep up" on a temperature to achieve the desired result. When used, the pause interrupts and stops the current program while it maintains the present temperature of the kiln. The temperature is maintained until the pause is disabled, at which point the current program begins running again. This procedure can be repeated as needed.

Separate from, but commonly used with the pause, is the skip feature. As its name implies, this feature skips to any segment. This allows the firing to jump to a segment without completing the current segment. Its value is fully realized when used with the pause feature: *creep up with the pause until desired results are achieved then skip to the next needed segment.*

The RAMPMASTER display and keyboard keeps the user informed of vital information throughout the firing.

- ❖ The temperature of the kiln is displayed at all times via a large 4 digit LED display.
  - ❖ A group of 4 LED's indicate the position of the program in each segment: ramp, soak. These will also display program end and power output.
- ❖ A simple keystroke will display the current running segment.

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.

The RAMPMASTER has built in diagnostics to insure proper operation. The microprocessor scans all data, including thermocouple input, once per second. If invalid data is seen, the RAMPMASTER will display an error message while shutting down the process.

The RAMPMASTER has been tuned to perform accurately at various temperatures and load sizes. We have included a program that will allow you to adjust this tuning, if needed. Tuning should be attempted only by those familiar with this procedure. For those unfamiliar with tuning, it is suggested that contact be made with the factory for guidance.

# KEY AND LED FUNCTIONS

## KEY FUNCTIONS

Only six keys are needed to operate the RAMPMASTER.

❖ **START**The START key starts and stops the operation of the program. It is a dual function switch.

- ◆ Pressing the START key, while the program is not running ( OFF indicator light will be on ), will start the program running at segment 1 ( S--1 ).

- ◆ Pressing the START key, while the program is running, ( OFF indicator light is off ), will stop the program.

❖ **SELECT** When pressed, the SELECT key scrolls the program through each position of each segment to allow for data entry. Indicator lights will flash to show which position is being programmed. Holding this key down during this selection process will display the current segment being programmed.

❖ **ENTER**The ENTER key is used to store the desired firing data into memory. When pressed and released the display will go blank and return, the data will then be stored.

❖ **SEG**SEG stands for segment. The SEG key is a multi function key. It is used to indicate current running segment along with performing special functions such as hold , skip and starting at segments other than one. See the PROGRAMMING section for information and specific key-strokes to accomplish these tasks.

❖ **&** The UP and Down arrows are used to change the values in the display during programming and special operations. 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. Most serve multiple functions.

❖ **Event-E Out** ♦ Flashes slowly in the programming mode indicating a choice of whether to continue to the next segment or end segment string.

❖ **deg/Hr-Ramp** ♦ Flashes slowly in the programming mode indicating a choice of rate of temperature increase or decrease to the set point in the current segment.

♦ On steady when in the run mode and indicates ramping to the set point in the current segment.

❖ **Soak-Soak** ♦ Flashes slowly in the programming mode indicating a choice of soak time at the set point in the current segment.

♦ On steady when in the run mode and indicates soaking at the set point in the current segment

❖ **Temp-Off** ♦ Flashes slowly in the programming mode indicating a choice for the set point in the current segment.

♦ On steady indicates that the unit is off.

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

# PROGRAMMING

## OPERATION IN A NUTSHELL

The RAMPMASTER is an eight segment digital controller. It has the ability to run very simple to very complicated firing schedules. This is accomplished by programming in values at each of the segments to be used. These segments are linked together much like a chain.

When the program is in the run mode, it will control the kiln using the data contained in the beginning segment: ramp rate, soak and set point. Once it has fulfilled the requirements of the beginning segment, it moves on to run the next segment using the data that has been selected for that segment. The controller will continue to operate in this fashion until the string of segments is complete or the user intervenes.

Take note that the RAMPMASTER completes the segments in sequential order. It cannot be programmed to operate the segments in a random order. To operate in this way requires the user to intervene using the special functions.

## THE FIRING SCHEDULE

The first step in operating the RAMPMASTER involves the design of a firing schedule. This is a pencil and paper operation. The firing schedule is made up of three parameters:

1. Rate of temperature increases or decreases, also referred to as ramp rate.
2. Soak times, if any, at the set point temperatures.
3. Set point temperatures.

We have included a firing schedule worksheet for your convenience. Please feel free to make copies. The firing schedule depends upon the product you are firing. If you are unsure about the firing schedule of a certain product, it is suggested that contact be made with the manufacturer of the product.

# PROGRAMMING

## RAMP, SOAK AND SETPOINT SPECIFICATIONS

The slowest rate of temperature change is 1°F/hour. The fastest rate of temperature change is 4000 °F/hour. A "full on" setting is also available that will allow the temperature to go directly to the set point as fast as possible. The total time for a single ramp to take place must not exceed 40 hours. The ramp rate uses the degrees/hour format for all ramping information. In many instances, specifications are given in the degrees/minute format. Converting degrees/minute to degrees/hour is accomplished by multiplying degrees/minute by 60.

Soak time allows the set point temperature to be maintained for a given period of time. This time period is programmed in hours and minutes. The minimum soak period is 0 minutes while the maximum soak period is 40 hours.

The set point is the end temperature of the segment. The minimum set point temperature is 0°F while the maximum set point is 2500 °F. It should be noted that although the maximum set point temperature is 2500 °F, the maximum temperature rating of the kiln should not be exceeded!!

## PROGRAMMING MODE ( entering the firing data )

When completed, the written firing schedule will include the necessary firing data. This data must now be entered into the RAMPMASTER. This is done in what is called the "programming mode". This is done using the Select key.

1. Press and hold down the Select key. The controller is now in the programming mode. The display will read S--1. This denotes that segment one is the current segment being programmed. Release the Select key, the prompt Cont or End is displayed and the top Event LED will be flashing to indicate the Event position in the segment.

2. The Event prompt is asking whether the firing schedule program should continue ( Cont ) into this segment or whether the firing schedule has been completely programmed and should end ( End ). Use the up and down arrows to change this prompt. The RAMPMASTER will always ask about the Event at the beginning of a new segment. It wants to know if it should continue to operate into this segment. After choosing either prompt, press and release the Enter key. This will store this data in the memory. If the wrong data is entered, simply correct it with the up and down arrows and press Enter again.

# PROGRAMMING

## PROGRAMMING MODE ( cont. )

3. Press and release the Select key. Notice that while the Select key was pressed the display read S--1, this again, is the current segment being programmed. The select key may be held down during this selection process to allow more time to read the display. This allows the user to know exactly what segment is being programmed.

4. The display will now show a value between 1 and 4000 or FULL. The deg/Hr LED will be flashing slowly to indicate that programming of the ramp data is required. Use the up and down arrows to change as needed. Press and release Enter to store the data in memory. If the wrong data is entered, simply correct it with the up and down arrows and press Enter again.

5. Press the Select key. Again, notice the display indicated current segment number when the Select key was pressed. The display will now show a value between 0 and 40:00. The Soak LED will be flashing slowly to indicate that programming of the soak data is required. Use the up and down arrows to change, as needed. Press and release Enter to store data in memory. If the wrong data is entered, simply correct it with the up and down arrows and press Enter again.

6. Press the Select key. The display will show a value between -20 and 2500. The Temp LED will be flashing slowly to indicate that programming of the set point data is required. Use the up and down arrows to change as needed. Press and release Enter to store data in memory. If the wrong data is entered, simply correct it with the up and down arrows and press Enter again.

7. Press and hold down the Select key. The display shows S--2 which indicates that all data has been programmed into segment 1 and segment 2 is now the current segment to be programmed. Release the Select key, the Event LED is flashing and Cont or End is displayed. Once again, the controller is asking whether programming of the firing schedule should continue into this segment or whether it should End without using this or following segments.

8. Repeat these procedures until all firing data is entered in the required segments. When complete data is entered, press the SEG key twice to exit from the programming mode. The RAMPMASTER will display S--0 ( segment off ) with the first press and kiln temperature on the second press. The Off LED will be "on", indicating the controller is off.

9. Pressing the Select key will take you back through each segment to review the data. Any incorrect data can be changed directly as if programming the first time.

# PROGRAMMING

## RUN MODE ( running the program )

The run mode essentially means the RAMPMASTER is using the programmed data to operate the kiln. During the run mode the kiln temperature is displayed continually while the LED's are indicating the position of the firing schedule within the current segment. The Heat LED will also be turning "on" and "off" to indicate when power is applied to the heating elements.

1. With the Off LED on, press and release the Start key. The RAMPMASTER is now in the run mode. The Ramp LED will go on, indicating the controller is ramping to the set point in the segment. As it completes the ramp, the controller moves to the soak segment to check for any soak time. If the current segment contains a soak, the Soak LED will remain on until the soak is complete. Once complete, it checks to see if next segment has been chosen to run. If so, the Ramp LED comes on indicating ramping to the setpoint in this segment. This routine continues until the program meets an End at an Event prompt or all eight segments have been completed. It will then exit the run mode and indicate "off".

## SPECIAL FUNCTIONS

The RAMPMASTER employs a number of special functions that allow the user to perform a variety of maneuvers. These maneuvers include: displaying current running segment, skipping segments, starting at segments other than segment one and temperature pause.

### ♦ Displaying Current Running Segment and Temperature Pause

These two special functions use the same keystrokes to accomplish. Pressing the SEG key, while in the run mode, will suspend the operation of the run mode and maintain the current temperature ( pause ). This will also force the display to indicate current running segment. Pressing the SEG key again will return the controller back to the run mode exactly where it left off.



# PROGRAMMING

## SPECIAL FUNCTIONS (cont.)

### ◆ Skipping Segments

This special function allows the user to stop running the current segment and skip to, and begin running, any of the remaining seven segments. While in the run mode, press the SEG key. The controller will enter the pause function and display the current running segment. Use the up or down arrow to choose the segment that is to be skipped to. Press the enter key to store the data. This will also put the controller back into the run mode. Press the Seg key to display the kiln temperature. Note that the controller will not only run the segment that is skipped to, but also any following segments. It will do so until it reaches segment eight or until it reads an End at the Event position. The user also can intervene by pressing the start key to exit the run mode or reprogram.

### ◆ Starting at Segments other than Segment One

This special function allows the user to start the run mode at any of the eight segments. While the unit is off, press the Seg key to display S--0. Use the up and down arrows to choose at which segment to start. Press the Enter key to store the data. This will also put the controller into the run mode. Press the Seg key to display the kiln temperature. The controller will now start the run mode at the chosen segment and continue to operate until segment eight is reached or until it reads an End at the Event position. The user can also intervene by pressing the start key to exit the run mode or reprogram.

# SAMPLE PROGRAMS

The following sample programs demonstrate actual keystrokes. These samples include single and multi segment programs along with special functions.

## SINGLE RAMP/SOAK PROGRAM

This sample firing involves firing at 300 °F/hour to 2232 °F with no soaking time at the set point. The RAMPMASTER should be in the off position when programming. "Off" LED will be on.

1. Press Select. The "Off" LED is off and the Event LED is flashing. Use up arrow to display Cont. Press Enter to store.
2. Press Select. Ramp LED is flashing. Use arrows to display 300. Press Enter to store.
3. Press Select. Soak LED is flashing. Use arrows to display 0. Press Enter to store.
4. Press Select. Temp LED is flashing. Use arrows to display 2232. Press Enter to store.
5. Press Select. Event LED is flashing. All firing data has been entered. We do not want the controller to continue into this segment. Use down arrow to display End. Press Enter to store.
6. Press Start. Controller is now in the run mode and is starting at segment one. Verify this by pressing the Seg key to display current running segment. Press again to return to the run mode.
7. To stop the program ( exit run mode ), press the Start key until the "Off" LED is on.

# SAMPLE PROGRAMS

## MULTIPLE RAMP/SOAK PROGRAM

This sample firing involves firing at 16 degrees/minute to 1000 °F with no soak, then 25 degrees/minute to 1250 °F with no soak, then full on to 1565 °F with a five minute soak, then full "off" to 1100 °F no soak, then 1 °F degrees/minute to 650 °F with no soak.

1. Press Select. S--1 is displayed briefly followed by the Event position Cont or End. Event LED flashing. Up arrow to display Cont. Press Enter to store.
2. Press Select. Deg/Hr LED flashing. Multiply 16 x 60 to calculate degrees/hour. Use arrows to display 960. Press Enter to store.
3. Press Select. Soak LED flashing. Use arrows to display 0. Press Enter to store.
4. Press Select. Temp LED flashing. Use arrows to display 1000. Press Enter to store.
5. Press Select. Event LED flashing. The program needs to use this segment, therefore Cont is chosen. Use up arrow to display Cont. Press Enter to store.
6. Press Select. Deg/Hr LED is flashing. Use arrows to display 1500, ( 25 x 60 = 1500 ). Press Enter to store.
7. Press Select. Soak LED is flashing. Use arrows to display 0. Press Enter to store.
8. Press Select. Temp LED is flashing. Use arrows to display 1250. Press Enter to store.
9. Press Select. Event LED is flashing. Use up arrow to display Cont. Press Enter to store.
10. Press Select. Ramp LED is flashing. Use down arrow to display FULL. Press Enter to store.
11. Press Select. Soak LED is flashing. Use arrows to display 5. Press Enter to store.
12. Press Select. Temp LED is flashing. Use arrows to display 1565. Press Enter to store.
13. Press Select. Event LED is flashing. Use up arrow to display Cont. Press Enter to store.
14. Press Select. Deg/Hr LED is flashing. Use down arrow to display FULL. Press Enter to store.
15. Press Select. Soak LED is flashing. Use arrows to display 0. Press Enter to store.

# SAMPLE PROGRAMS

## MULTIPLE RAMP/SOAK PROGRAM (cont.)

16. Press Select. Temp LED is flashing. Use arrows to display 1100. Press Enter to store.
17. Press Select. Event LED is flashing. Use up arrow to display Cont. Press Enter to store.
18. Press Select. Ramp Led is flashing. Use arrows to display 60. Press Enter to store.
19. Press Select. Soak LED is flashing. Use arrows to display 0. Press Enter to store.
20. Press Select. Temp LED is flashing. Use arrows to display 650. Press Enter to store.
21. Press Select. Event LED is flashing. All firing data has been entered. We do not want the controller to continue into this segment. Use down arrow to display End. Press Enter to store.
22. Press Start. Controller is now in the run mode and is starting at segment 1. Verify this by pressing the Seg Key to display current running segment. Press again to return to the run mode.
23. To stop the program ( exit run mode ), press the Start key until the Off LED is on.

## USING THE SKIP FEATURE

Let's say you are running the multi segment sample program. You notice at 1545 °F that desired results have been achieved and you do not want to finish the segment at 1565 °F. Instead, you want to go directly to the cooling segment.

1. Press Seg. Use arrows to display desired segment, in this case segment four. Press Enter to store.
2. Press Seg. This displays temperature again. You are now running segment four. In this case, FULL cooling ( no elements on ) to 1100 °F where it will pick up segment five and complete the program.

# SAMPLE PROGRAMS

## STARTING AT SEGMENTS OTHER THAN ONE

Let's say you have many simple firing schedules like that seen in the first sample. You use segment one for a single ramp/soak program, segments three and four for a two ramp/soak program and segments six, seven and eight for yet another program. What you now basically have is three separate firing schedules. You can choose to run any of the three individually.

Notice that we did not use segments two and five. We have used these segments to separate the individual programs by programming in End at their Event prompts. This way the RAMPMASTER will stop at these segments without going into the next individual program!

To run the two segment program that starts on segment three.

1. Press Seg. Use arrows to display desired segment, in this case segment three. Press enter to store.
2. Press Seg. This displays temperature again. You are now running segment three. When segment three completes, segment four will run. When segment four completes, the RAMPMASTER will see End at segment five and exit the run mode.

# MISCELLANEOUS INFORMATION

## ERROR MESSAGES

- ❖ EEEE This error code indicates a thermocouple problem. The thermocouple is either destroyed or connected improperly. Check thoroughly.
- ❖ Err1 This error code indicates that power has been applied to the heating elements continuously (100%) for more than two hours. This forces the unit to shut down and display this error code. To reset the unit, remove and reapply power.
- ❖ 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.

## PID TUNING

To access the PID time constants, press and hold the Enter key for at least 3 seconds. The top led will begin flashing rapidly and the display will show the P band in degrees. This can be set from 0 to 1000 degrees. If set to 0, the controller will use an ON/OFF control algorithm with a deadband rather than PID control. The I time constant can be set from 0 to 3600 seconds. If set to 0, integral action is disabled. Note that Event code G must be used if integral action is disabled ( using PID control ) since there is no guarantee that the temperature will reach the set point using P or PD control. The D constant may be set from 0 to 1000 seconds. Setting it to 0 disables the rate action. Factory settings are 60 °F or 30 °C for the P band, 240 seconds for I and 60 seconds for D.

## SPECIFICATIONS

Power Requirements.....	120VAC ±5%, 208 VAC ±5%, 230 VAC ±10% @ 50-60Hz
Thermocouple .....	14 gauge, Type K
Operating Temperature Range .....	0 to 100°F
Display Resolution .....	1°
Ramp Rate ( degrees/hour ) .....	1°/hour min. - 4000°/hour or Full max.
Ramp Time .....	40 hour max. per segment
Soak Period .....	40 hour max. per segment
Set Point Range .....	0 to 2500°F (-17 to 1371°C)

