

**POTCLAYS**

LIMITED

**FIREMASTER 2**

**TEMPERATURE CONTROL**

**SYSTEM**

# FIREMASTER II MENU SELECTION

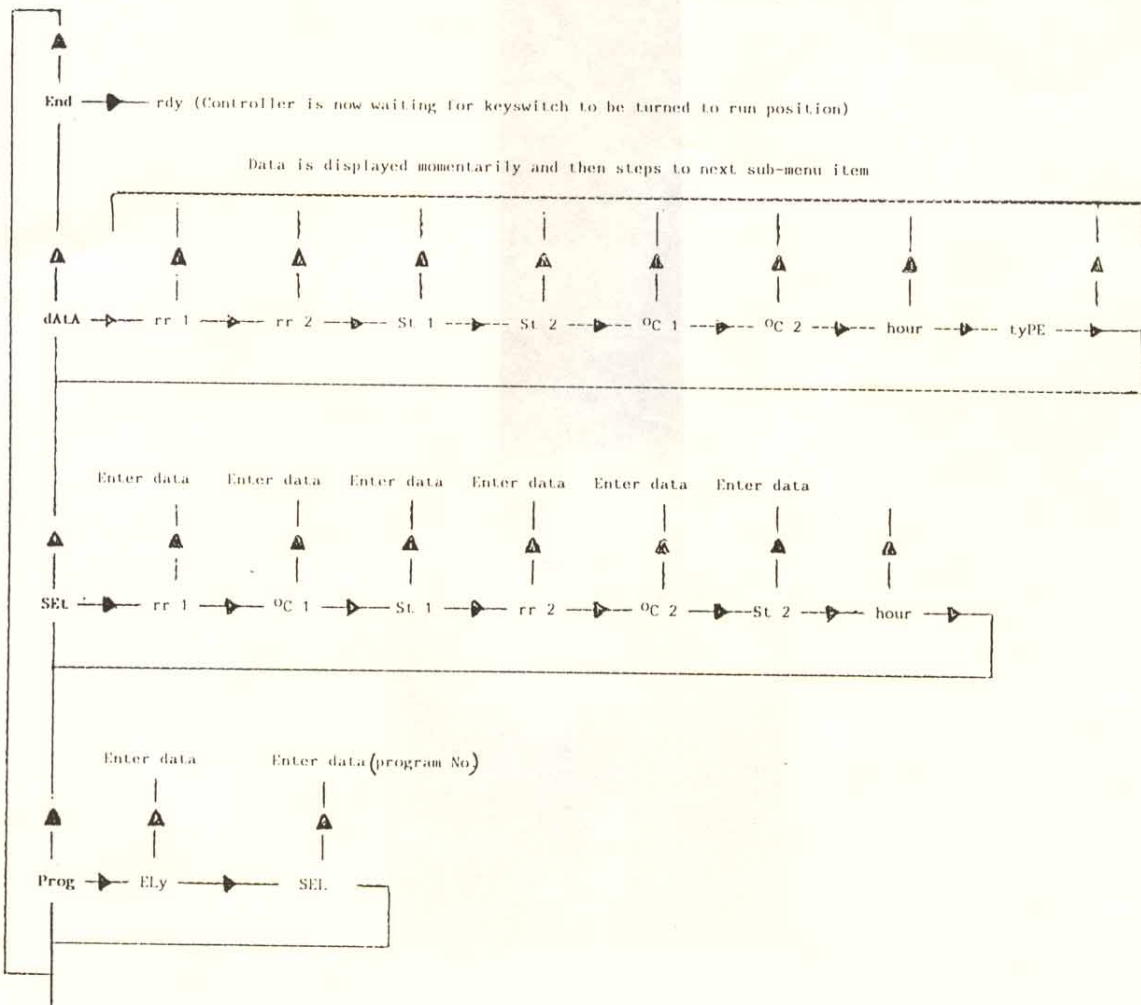
Note that repeated pressing of the upward arrow  $\blacktriangle$  steps through the main menu of Prog, SET, dAtA and End. At each of these stages, pressing the horizontal arrow  $\blacktriangleright$  takes you into the sub-menu associated with the main menu stage.

The sub-menu associated with 'Prog' enables the delay-on-time (dELy) and program number to be selected (SEL).

The sub-menu associated with SET is for entering ramp rate (in degrees centigrade per hour) for ramp1 (rr1), the temperature in °C that this ramp is to be taken to (°C1), the soak time at the end of this first ramp (St1), the ramp rate for the second ramp (rr2) and the temperature that this is to be taken to (°C2), the soak time at this temperature (St2) and finally the maximum permissible number of hours firing time (hour).

The sub-menu associated with dAtA enables you to check view what has been programmed including the type of thermocouple the instrument is calibrated for.

The sub-menu for End confirms the program is ready to run.



Menu starts here  
Entering data

## General

The Firemaster 11 when first switched on goes through an initialisation procedure, during which it carries out a display test. The displays are all turned on (both the digits and the mimic display) with the exception of the **Trip Fail** indicator which only illuminates when a fault exists.

## Programming the controller

The Firemaster 11 uses a simple hierarchal menu system to allow the user to programme the instrument. A main menu allows certain functional blocks to be selected and its sub menus can then be selected.

Looking at the menu diagram, the main menu (consisting of **Prog**, **SEt**, **dAtA** and **End**) are on the vertical path and can be stepped to using the **▲** key. Pressing **▲** after **End** will roll round to the start again (ie. **Prog**).

To select one of these menu items, the **▶** key is pressed which will then allow the user to step through the sub-menu associated with the main menu item.

### **Prog**

The **Prog** menu allows the user to select the programme to be run and to set the delay time.

Pressing the **▶** key when on the **Prog** menu will enter the sub-menu. This consists of two items - **dELy** (delay) and **SEL** (Select). The sub-menu can be stepped through using the **▶** key and the item to be changed is selected using the **▲** key.

Selecting **dELy** allows the start time delay to be programmed in hours and minutes (hhmm) up to a maximum of 99hours 59min. When selected the display will initially show 0???; use the **▲** key to increment the first digit to the required value and then step to the next digit using the **▶** key. Repeat until all four digits have been set and on the last press of the **▶** key the data will have been accepted and the display will step on to the next sub menu (in this case **SEL**).

Selecting **SEL** allows the programme to be run to be selected. The Firemaster 11 has five fixed programmes (5 - 9) and 5 user adjustable programmes (0-4). For further details see the instrument front panel.

Selecting **SEL** using the **▲** key will cause the right hand display to show the currently selected programme (initially ? - see below). Further presses of the **▲** key will increment the programme number; when the required programme has been selected use the **▶** key to accept it. The display will momentarily show **donE** to indicate that it has been accepted.

A valid programme number must always be selected prior to a run or in the case of a user adjustable programme, before any changes are made. On initial power-up, the Firemaster 11 will display a programme number of ?. This is to ensure that the user always selects a programme before running - failure to do so will cause the controller to display **StoP** when run.

### **SEt**

The **SEt** menu allows the user to enter the parameters for the user adjustable menus (0 to 4). If the user has selected a programme in the range 5 to 9 (or ?) from the **Prog** menu, the **SEt** menu will not allow the parameters to be altered.

Assuming a programme number in the range 0 to 4 has been selected in **Prog**, the user can step to **SEt** in the main menu and select this using the **▲** key.



The menu will then show the sub menus which can be stepped through using the ► key and selected with the ▲ key. As the sub-menus are stepped through, the mimic display will also step through giving a visual representation of what parameter is being set.

The following parameters can be entered for each programme:

rr 1	Ramp rate 1. (maximum 600 °C/hr)
St 1	Soak time 1. (maximum 240 mins)
°C 1	First stage temperature. (maximum 1315°C)
rr 2	Ramp Rate 2. maximum 600 °C/hr)
St 2	Soak time 2. (maximum 240 mins)
°C 2	Second stage temperature. (maximum 1315°C)
hour	Total permissible firing time. (See 'Important Notes', page 8)

As before, the ▲ key increments the digit and the ► key selects the next digit.

If the second stage temperature is below the first stage temperature, the second ramp will be negative going and will thus provide a controlled cooling.

### **dAtA**

The **dAtA** menu item allows the user to examine the contents of a programme (0-9) without altering it. The user must first select the programme number from **Prog.** The **dAtA** menu is then selected as usual with the ▲ key and the user can then step through the **dAtA** menu items using the ► key, selecting those items of interest using the ▲ key.

The **dAtA** menu shows the same parameters as the **SEt** menu except that there are some extra items. **d on** and **doff** are damper set-points and only affect those instruments fitted with the optional damper control. The other item displayed in **dAtA** is **type**; this displays the thermocouple type number and is for reference only.

### **End**

When all parameters have been set and the delay time and programme selected, the **End** menu can be selected using the ► key. After a few seconds, the display will show **rdy** (ready) which indicates that the controller is ready to run; turning the keyswitch to the run position will indicate a run.

If a programme has not been selected (ie. you are trying to run programme ?), the display will show **StoP.** This forces you to return to the menu and select a programme (see below).

### Running the controller.

When the controller is displaying **rdy**, it is waiting for the keyswitch to be turned to the run position.

When this is done the display will show the time left to run before the kiln starts its firing and the mimic display will show the controller in the delay mode.

When the delay time has elapsed, the controller will begin the firing cycle as selected. The mimic display will continually show the state of the firing and the display will show the temperature. During the cooling phase, the display will continue to indicate the temperature down to 100°C - at this point the display will show the message **Cool** to show that the kiln is safe to open.

If at any time the user wishes to abort a run, the keyswitch can be turned back to the **SET** position and the display will alternate **Stop** with the temperature.

### Getting out of problems

If, for whatever reason, the user wishes to return to the menu and is in **rdy**, **StoP** or **Cool** mode, pressing both the **▲** and **▶** switches simultaneously for approximately 1.5 seconds will cause the controller to execute a strt-up procedure (displays all on) after which it will enter the main menu. The keyswitch must of course be in the **SET** position.

The only time this will not work is when the display is showing a permanent **StoP** message (due to a short circuit thermocouple). This can only be reset by powering down the instrument and then repowering it (with the keyswitch in the **SET** position. The thermocouple problem should of course be fixed first.

### Run time considerations.

The Firemaster 11 is equipped with an over-temperature protection circuit which is set at approximately 1310°C. This is intended to protect the kiln only.

If the user always operates at lower temperatures and wishes to protect the ware, the trip can be adjusted. Please contact Potclays for further details.

The trip circuit will operate if the input goes open circuit (for whatever reason) or the temperature exceeds the set-point. Whenever the trip operates, the Trip Fail indicator will be on and the kiln will fail to operate. To reset the trip (after removing the fault condition), power down the instrument for approximately 2 minutes. The trip will automatically reset on power up.

The Firemaster 11 has an over-time lockout which prevents the kiln from firing for more than 17 hours. This is to prevent a kiln from becoming heat soaked in the event of an element failure. If the user wishes to run the controller on very long firing cycles, a special version of the Firemaster 11 is available with an adjustable over-time lockout period. With this verion an additional stage displayed as 'hour' has been added to the sub menu (after St2). The required over-time lockout period can thus be set in hours.

The Firemaster 11 is specially programmed to detect possible short circuit thermocouples by ensuring that the temperature rises when required. If this condition is breached, the controller will abort the firing and will permanently display **StoP**. This can only be cleared by turning the keyswitch to **SET** and re-powering the instrument (having first cleared the problem.



## Program Example

### Firemaster 2 Control System.

#### To set a program 0-4

Suppose we want to have a firing to 1260°C at a rate of 90°C per hour up to 200°C and then at 120°C per hour to 1260°C with 20 minute soak at 1260°C. Suppose we then want to run this program immediately (i.e. no delay time) and to call this program No.1.

#### Method

Power up the instrument. It shows 8888 for a while and then may show **rdy** or other display. Press both **▲** and **▶** buttons simultaneously to clear the display. After some seconds it will display **prog** and you are ready to begin.

Look at the schematic diagram headed 'Firemaster 2 Menu Section'. You will see that pressing the upward arrow **▲** steps through a main menu sequence of **Prog, Set, dAtA** and **End**. At each of these points, pressing the horizontal arrow **▶** steps you through the sub-menu associated with the main menu item.

As you follow the instructions given below it is important that you refer to the schematic diagram at each step. You will learn more quickly this way how to program the instrument.

Press **▶** to show **dELy**. Use **▲** to enter the first digit (0) of the delay time. Pressing **▶** to move to the second digit (0) and **▲** to enter the information and continue using both keys until 4 zeros have been entered.

Press **▶** again and **SEL** shows. Press **▲** to key in the required program No. (in this case 1).

Press **▶** gives 'donE' display and then 'prog' again.

Press **▲** to show 'SEt' and then **▶** to give **rr1** (ramp rate 1). Using both **▲** and **▶** enter 90°C. If you go wrong, repeatedly pressing the horizontal arrow **▶** will step through the various stages of the sub menu and will bring you back to **SEt** and **rr1** again.

Using the **▶** to step along the sub menu and **▲** to enter the required information, proceed through "C1 (enter 200 being the temperature required at the end of the first ramp), then the Soak time **St1** (set this at zero), ramp rate 2 **rr2** (set this at 120°C), "C2 (set this at 1260°C) and **St2** (set this soak time at 30 minus, i.e. '030').

Pressing **▶** again will then show 'hour'. This should be set for one or two hours more than the anticipated firing time. (The instrument will cut off the firing if the kiln is still being energised after the number of hours you have now programmed into it).

Pressing **▶** will bring the program back to 'SEt' on the main menu.

Press **▲** to show 'dAtA' on the main menu. Press **▶** to show **rr1**. If you now press **▲** it will show 90°C being the ramp rate you set on ramp 1. The instrument will then automatically step to **rr2**. Pressing **▲** again will display 120°C and the instrument then automatically steps to **St1** (soak time 1, which you programmed as zero). Pressing **▲** will confirm this.

Thus repeatedly pressing the **▲** upward arrow in this **dAtA** sub menu enables you to check what you have entered into instrument program.

After checking the 'hour' increment the instrument then shows 'type' and pressing **▲** again shows the code number appropriate to the thermocouple type for which the instrument is calibrated (e.g tc-1 for K type thermocouples). The instrument then resets to **data** on the main memory.

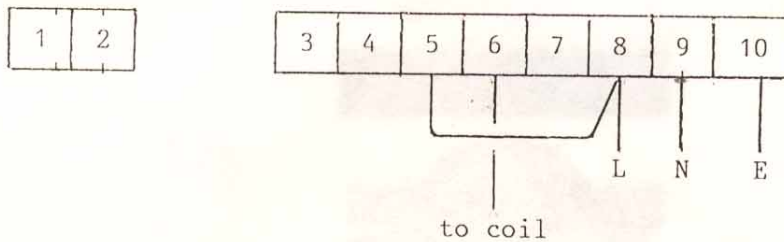
Pressing **▲** shows **End?**. If the data previously checked is what you require then press **▶** and 'rdy' (ready) is displayed.

#### Note:

If the data is not correct you must press **▲** after 'End' which takes you back to **Prog**. Pressing **▲** again will move to **SEt** on the main menu and by pressing **▶** you can step into the sub menu and amend any incorrect item.

In the **rdy** position, switching the keyswitch to **RUN** will start the program. Note that there may be a delay before the kiln starts up even if a delay time has been programmed, if the kiln ambient temperature is above normal.

Wiring diagram : Firemaster 2



- 1 Thermocouple + ve
- 2 Thermocouple - ve
- 3 Damper contact
- 4 Damper contact
- 5 Control relay common
- 6 Control relay NO
- 7 Control relay NC
- 8 Live
- 9 Neutral
- 10 Earth

Note

To facilitate easy wire connections, each terminal strip is in the form of a multiplug. The upper plug strip can be removed by pulling it from its socket.

Electrical Installation.

Note that the power supply is taken to terminal 8 and a 'loop' connection must then be made to terminal 5 from 8.

The 'output' from terminal No 6 is taken to the kiln contactor coil/energy regulator circuits.

IMPORTANT

- 1) Ensure incoming power supply is correct polarity (i.e. Live and Neutral not reversed).
- 2) Do not apply power to thermocouple connections.

In both cases serious damage to the instrument will result.



### Important Notes.

- 1) If the maximum firing speed of the kiln is lower than the program speed then the firing time will extend until the temperature set point is reached. The soak time will be unaltered.

The above programs assume an ambient temperature of 20°C. If the kiln is hotter than this at start up, the firing time will be less than indicated above.

- 2) Note that the 'Stoneware' program is set to a temperature of 1255°C with a 20 minute soak. With small kilns this will correspond very approximately to Orton Cone 8 down. With larger kiln the extra heat work from the greater ware mass will usually cause cone 9 to bend over (and perhaps more). Consequently it is important to use cones in your kiln and to fire to these at least on the first few firings so as to check whether the stoneware program gives you the heat work result you require. If not you can of course set your own program into the instrument and run this.

- 3) It is important to appreciate that cones measure heat work whereas the instrument measures temperature. There will consequently usually be a difference between the temperature indicated by the instrument and the 'apparent temperature' indicated by the bending over of an Orton or other cone or minibar.

- 4) Although the Firemaster 2 is such an outstanding temperature controller we nevertheless recommend that Orton cones also be used in kiln firings. Not only will these provide an indication of heat work but also they will indicate the present or development of hotter or cooler spots in your kiln (if periodically spread through the kiln load). Bear in mind that the Firemaster control system accurately measures temperature at one point only: the location of the thermocouple.

- 5) Maximum firing time

One useful 'hidden' feature is that the kiln will shut down if the firing time exceeds a certain limit. This feature is included because of the possibility of an element failure occurring during a firing and thus preventing the kiln from attaining the maximum required temperature on the program being run. In that event the kiln could remain firing indefinitely and become 'heat-soaked' (with possible damage to electrical components) until manually switched off. To avoid this a maximum firing time (see 'hour' facility) has to be entered when programming a user-adjustable program (0 to 4). This time run starts immediately after the delay-on time has expired ie as soon as the kiln starts firing. The fixed programs (5 to 9) have a 17 hour 'timer' included which cannot be changed. Nevertheless, ~~do~~ manually check that a kiln firing has been completed.

*Note that the maximum firing time automatically resets to 17 hours after running any program 0 to 4. It will therefore need to be inputted each time if a time other than 17 hours is required.*