

# FIREMASTER 1

## FIREMASTER PROGRAMMABLE CONTROL SYSTEM

The Firemaster is a new development in electronics, fully adjustable temperature controllers. It has a delay on timer, two separately adjustable rates of temperature increase up to independently adjustable set temperatures and a timed soak but has additional design features:-

- (1) Designed specifically for use in ceramics.
- (2) Continuous large red digital temperature display.
- (3) Very easy to understand and operate.
- (4) You can easily program your own firing cycle consisting of two adjustable ramps (rate of temperature increase) up to 1300°C followed by an adjustable timed soak.

This program can be stored in memory and run at the touch of a switch, or erased after use.

- (5) Delay-on facility enabling firing to start automatically at future time to take advantage of off-peak electricity etc.
- (6) Four 'fixed' programs also available at touch of button as follows:-

- Program 1 - 1000°C for biscuit.
- Program 2 - 1120°C for earthenware glaze firing or high temperature biscuit and once-fired earthenware.
- Program 3 - 1080°C industrial earthenware glaze firings.
- Program 4 - 1260°C stoneware glaze firings.

Each of these firings cycles consists of two ramps and a short soaking period. They are permanently fixed in the Firemaster and require only the touch of a button to run. Simplicity itself!

- (7) Over-temperature (heat-fuse) protection included. Will automatically cut off kiln if built in safety shut off temperature is exceeded. No need for a separate heat fuse.
- (8) Automatically shuts down in event of thermocouple malfunction.
- (9) LED light display shows stages of firing on mimic firing cycle.
- (10) Controlled cooling down to adjustable temperature followed by timed soak is possible. Useful for production of crystal glazes.
- (11) Removable key to prevent unauthorised operation or adjustment. However, if it is desirable to amend a program being run, this can be done by switching to 'set' and amending the program required. Switching to 'run' will immediately run the amended program.

The Firemaster is supplied in an attractive box for wall mounting and complete with instructions.

The instrument can, in its wall mounting box, be alternatively supplied with attached multicore cable and plug with separate plug socket. The socket is identical to that used on our Silver Kilns and thus the Firemaster can simply be plugged into position on the kiln. Alternatively the socket supplied can be connected to any kiln and the Firemaster then plugged into this. It is designed for use with 13% Plat/Rhodium thermocouples (type R) but can also be supplied suitable for others (type S and K).

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### FIREMASTER PROGRAMMABLE TEMPERATURE CONTROLLER

#### Introduction

The Potclays "Firemaster" is a sophisticated microprocessor base programmable temperature controller which allows the user to control all critical parameters of a firing.

The Firemaster incorporates a completely separate over-temperature protection circuit which protects the kiln from malfunction and does away with the need for unreliable heat fuses or expensive "policeman" temperature controllers.

As an additional safeguard, the Firemaster incorporates a special supervisory circuit which continuously monitors the performance of the microprocessor. In the event of a malfunction, the circuit automatically rests the instrument.

The controller uses a sealed membrane keyboard for data entry and is housed in a wall mounting plastic enclosure.

#### Controller Operation

Prior to application of the mains supply to the instrument the key switch should be set to the OFF position. When the instrument is powered up, the display will show 88.88 and all lights will be illuminated on the keyboard etc. This is a display test function and lasts for approximately 3 seconds.

Following the display test phase the cool light will flash (indicating that power is applied to the instrument). All other displays and lights will be extinguished.

The operator can then go into the SET mode or the RUN mode by turning the keyswitch to the appropriate position.

#### Set Mode

Turning the keyswitch to the SET position allows the user to enter the program to be run. The Firemaster has 4 fixed programs and one user adjustable program.

When the user selects the SET mode the display will show the program that is being used (0 initially). If a program has already been selected, the display will show the appropriate program number and the relevant program switch will be illuminated.

The preset programs are numbered 1 to 4 inclusive. The user adjustable program number is 0.

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The preset programmes are as follows:-

**Prog.1 -** (suitable for biscuit firings)

Rate 1	= 80°C/hour
Set Point 1	= 200°C
Rate 2	= 115°C/hour
Set Point 2	= 1000°C
Soak Time	= 15 minutes

**Prog.2 -** (suitable for earthenware glost, high biscuit, once fired earthenware).

Rate 1	= 80°C/hour
Set Point 2	= 160°C
Rate 2	= 113°C/hour
Set Point 2	= 1122°C
Soak Time	= 20 minutes

**Prog.3 -** (suitable for earthenware glost)

Rate 1	= 100°C/hour
Set Point 1	= 100°C
Rate 2	= 115°C/hour
Set Point 2	= 1080°C
Soak Time	= 15 minutes

**Prog.4 -** (suitable for stoneware and porcelain glost)

Rate 1	= 120°C/hour
Set Point 1	= 840°C
Rate 2	= 100°C/hour
Set Point 2	= 1260°C
Soak Time	= 25 minutes

To select one of the above firing cycles, press the appropriate switch on the keyboard. The switch will then illuminate to indicate that it has been selected and the program number will be displayed. To select a different firing cycle press the relevant switch. Similarly to cancel a particular program, press the switch again; this will cause the indicator to be extinguished and the program number to revert to program 0.

Once a particular pre-set program has been selected, the only parameter which needs to be set before a run is commenced is the delay time. This is achieved by pressing the ENTER key. The display will show the previously set delay time associated with that particular program in hours and minutes (initially 00.00). The delay light will flash indicating that this parameter is being set. The delay time is altered using the and keys and can be set to a maximum of 99 hours, 59 minutes, i.e. 99.59.

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The up and down keys increase or decrease the displayed value at an increasing speed depending on how long the key is pressed.

When the required delay time has been set, it is entered by pressing the ENTER key. The program is now ready to run with the delay time being activated by the keyswitch being turned to the RUN position. If a delay time of 00.00 is set, the program will run immediately the keyswitch is turned to the RUN position.

### Special Program (Prog. 0)

By selecting Program 0 the user can enter a special firing cycle. The user is stepped through the various parameters to be set as follows:-

- 1) Select Prog. 0 and press ENTER to initiate data entry.
- 2) The delay light will start flashing indicating that this parameter is to be set. Alter the delay time (as above) using the and keys to the required setting.
- 3) Press ENTER to enter the delay time. The ramp light will then flash indicating that this parameter is to be set.
- 4) Set the value for ramp 1 in °C/hr - Press ENTER.
- 5) Set point 1 ramp flashes - enter the value in °C. Press ENTER.
- 6) Continue the data entry as above for ramp 2 and set point 2.
- 7) Soak is entered as above in hours and minutes - format = hh.mm.
- 8) When the soak period has been entered, the display will revert to showing the program under (0). The whole process can be repeated, either for examination or modification, by pressing ENTER again.

The range of settings allowed for the various parameters are as follows:-

Delay/Soak time = 00.00 to 99.59 (hh.mm)

Ramp 1/Ramp 2 = 00.00 to 1000°C/hr

Set Point 1/Set Point 2 = 00.00 to 1305°C

N.B. In the event of a power failure, the program stored in Prog. 0 will be lost and all parameters will be set to 0. A record of the program set should therefore always be kept.

Controlled cooling.

The Firemaster can achieve accurate controlled cooling. This is set by making Set Point 1 higher than Set Point 2. The rate of cooling will be dictated by the rate set in Ramp 2.

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### Run Mode

When the required program has been selected, it can be run at any time by turning the keyswitch to the RUN position.

When the keyswitch is turned to the RUN position, the display will indicate the kiln temperature and the delay light will be on. The delay will then start to time out.

When the required delay time has elapsed, the Ramp 1 light will be on the Set Point 1 light will flash (to indicate that it is aiming for SP1 but has not yet achieved it). The controller will then control the kiln temperature to the required ramp rate.

When the kiln temperature reaches SP1 the Ramp 1 light will be extinguished SP1 light will be on (showing the temperature has been reached), SP2 will be flashing (not yet reached) and Ramp 2 will be on.

When SP2 is reached SP1 and Ramp 2 will be extinguished, SP2 will be on (temp. reached) and the soak light will be on.

When the set soak period has timed out, all lights except the cool light will be extinguished. The cool light will remain on and the temperature will be displayed until the kiln temperature reaches 100°C. After this the cool light will flash (power on indicator) and the display will be blank.

In the event of a power failure during a run, the controller will automatically reset in Prog. 0 which itself will have been reset to 0 in all parameters. Since the keyswitch will be in the RUN position this will therefore cause Prog. 0 to be run. However because this is now all zeroes, it will have the effect of aborting the run.

### Special hardware Configurations

Special configurations can be incorporated into the controller at the time of manufacture. Please consult the factory for price and for availability.

Over temperature trip setting.

The over temperature trip is normally set to 1310°C and is intended to protect the kiln. If the controller is to be only used on low temperature firings it may be desirable to set the trip to a lower temperature to protect the ware.

The trip circuit can be used for alternative purposes such as damper control. For these applications please consult the factory.

The over temperature trip will normally be used with the main controller thermocouple. In high security applications it may be desirable to run the trip circuit from a separate, isolated thermocouple. This can be configured at the time of manufacture (see wiring diagram).

### Thermocouple Types

The standard Firemaster, is configured to operate from a type R (Pt/Pt Rh 13%) thermocouple. However the instrument can be configured to operate from either a type S or type K thermocouple.

### Special Programmes

The four fixed programs have been chosen for their wide applicability. However special programs can be entered into the controllers fixed programs (Prog 1 to Prog 4). Please consult the factory.

Similarly, and parameter can be altered to allow higher than standard parameters to be set e.g. temps 1305°C, rates 1000°C/hr.

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IMPORTANT - When using programme 4 (1260°C) on Firemaster Controller or when setting high temperature programme on other controllers.

It is sometimes found that kilns fire up to cone 9 or 10 or perhaps higher when set to fire to 1260°C (associated with cone 8 to 9).

Kilns which are heavily loaded with ware and/or kiln furniture tend to give a greater difference between temperature (instrument) and cone readings than kilns which are lightly loaded. Also kilns which have a 'hot spot' (due to shelf or ware loading differences, aging differences in elements etc) will give higher cone readings not just at that 'spot' but generally (as the hot spot gives up its heat to other areas of the kiln).

It should always be remembered that the control instrument measures the difference in temperature between the thermocouple tip and the 'cold junction' i.e. the connection at the instrument. If the instrument is mounted in a position where it becomes excessively warm (as can easily arise when it is mounted near or above a top loading kiln firing to stoneware) then the instrument reading may be affected.

Also, if the thermocouple head attains a temperature greater than 60°C an error signal may result.

In both cases the instrument will read lower than the actual temperature in the kiln.

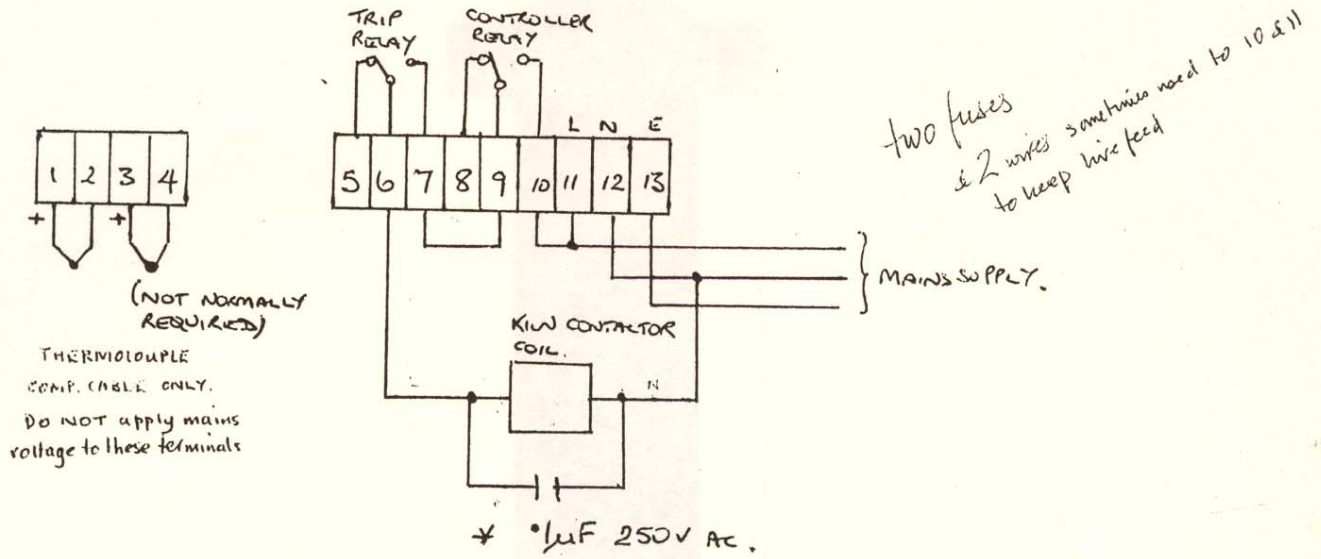
For these reasons it is very important that cones be used to control the finishing point of all high temperature firings using the instrument only as a reference until, by experience, a programme set into an instrument can be 'relied' upon. It may be that users find it preferable to set and use their own programme for stoneware firings instead of using one fixed into the control instrument. Even then it is recommended that cones continue to be used for reference purposes and to detect hot or cool spots arising in the kiln (as may happen if the kiln is unevenly loaded or there is differential aging of the elements). Remember that instruments can fail or errors can be induced into electronic control systems - and there is no warranty to cover against overfirings.

Incidentally, if hot spots do arise in kilns fitted with multiple energy regulators it will be appreciated that the regulators controlling the hottest zone can be set back to give a lower energy input to that zone and thus reduce the temperature variance.

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Electrical.

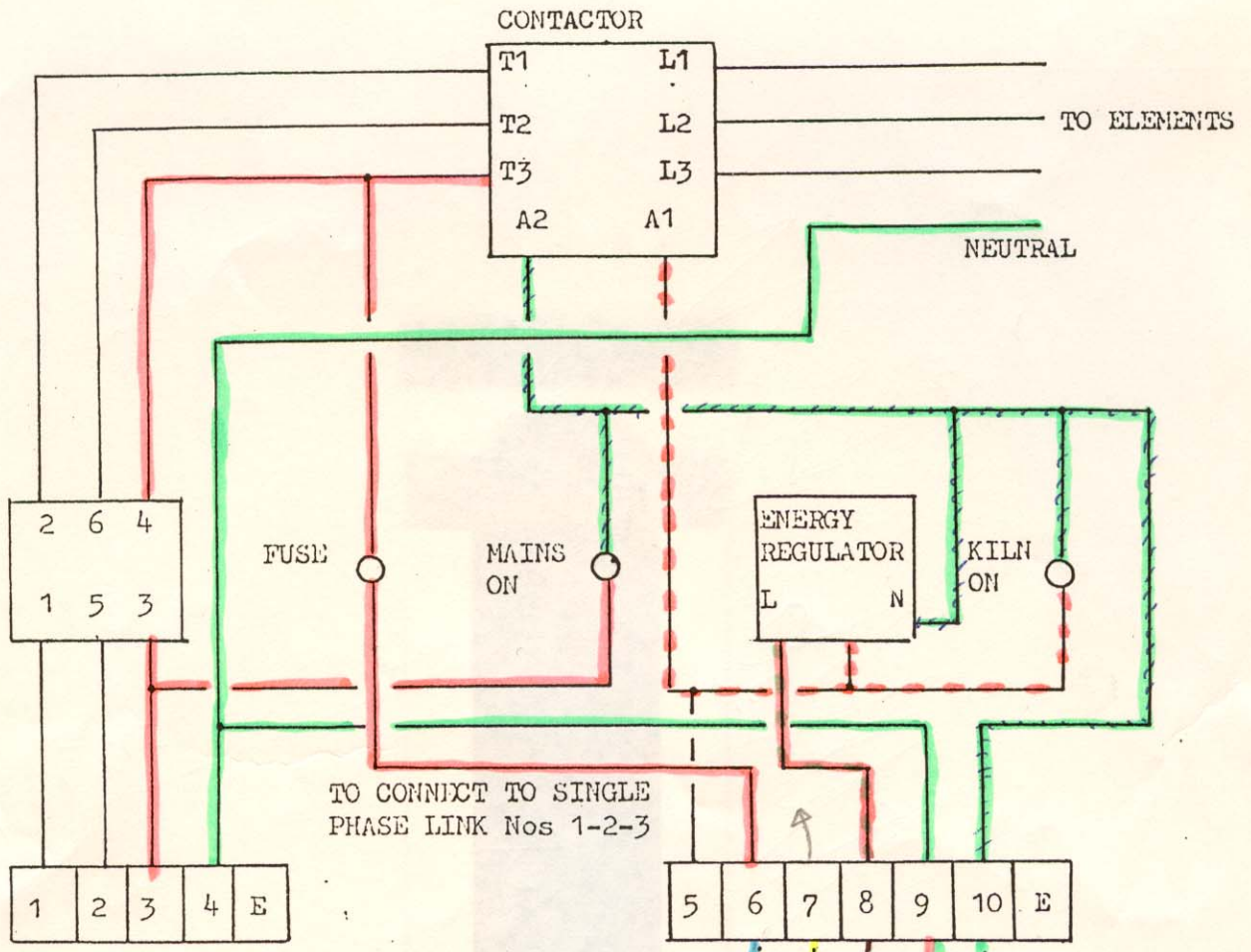
Connection Diagram.



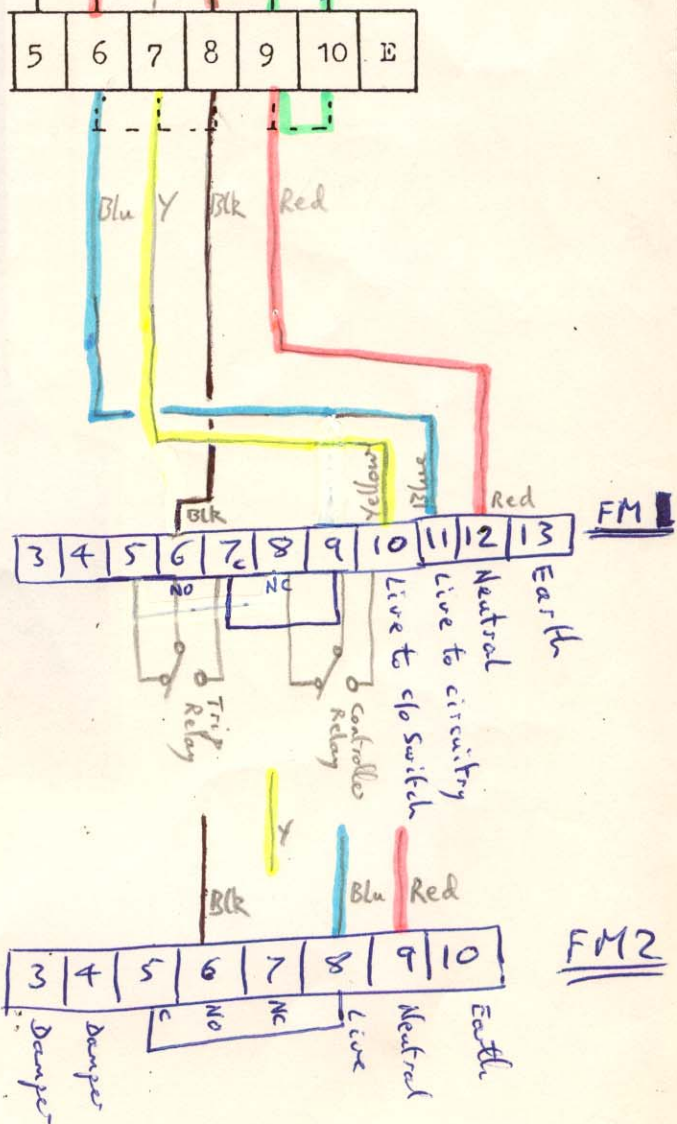
\* A CAPACITOR MUST BE CONNECTED ACROSS ALL INDUCTIVE LOADS AS SHOWN TO ENSURE CORRECT OPERATION.

RELAYS RATED AT 1A 250V AC.





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 £10/hr

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