

CROMARTIE KILNS LIMITED

...at the centre of ceramics

Customer Safety Instructions

Safefire 3000

Kiln Controller

This Document should be read carefully before using your new Cromartie Controller.

The New Safefire 3000 controller is a combined programmer and temperature controller using state of the art microprocessor technology. It has been designed specifically for use with pottery kilns. The controller has a wide range of extra facilities which provide the user with a versatile, easy to use instrument. Control of the entire firing cycle is fully automatic, to give both accurate and repeatable firings. The controller contains a mimic display as a guide for both firing and programming, and to enable the user to determine what stage the controller is at whilst the program is in operation.

Programs are retained in memory for up to 10 years.

Another useful feature is the automatic continuation of a firing after a power cut. If a power cut occurs during a firing, the program will re-start as long as there has not been a temperature drop in the kiln over 100°C. If there has been a significant drop in temperature of more than 100°C. Then the Safefire 3000 will display an error code of EER 2 and the ramp in which the firing had reached will be shown by xxxx. By pressing start/stop A the instrument will reset its self and display the temperature in the kiln, if you would like to know the temperature the kiln had reached then press the *secret key* located behind the cromartie logo.

Principal features include the following.

- Delay start facility, 0 to 99Hr. 59 mins.
- 3 Heating/Cooling ramps, 1 to 1000°C per hour, to fully adjustable 'Set Points'.
- Soak period, 00:00 to 99Hr. 59 mins.
- 10 fully adjustable programmes.
- Program linking option.
- Electronic coded lock.
- Alarm relay.
- Damper control option. (Events / Multi zone options)
- Multi zone control. (multi zone controller option)

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Explanation of Graphical Symbols:



The lighting flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of non insulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING

To prevent fire or electrical shock hazard, Do not expose this unit to rain or moisture.

PLEASE...



Familiarise yourself:

Scan the contents list and look through the manual, note sections of interest.



Controller connections to the kiln must be made in a workmanlike manner. Failure may result in damage to the controller or kiln.

Such damage is not covered by warranty.

Manufactured
in the UK



Installation



Check that the Safefire 3000 and thermocouple type are the same, otherwise proper control will not be possible. The letter prefix of the serial number of the instrument (R,S,K or N) indicates the thermocouple type. Check also that the Safefire 3000 if fitted with a plug is compatible to the kiln, check with kiln manufacturer.

Note! Failure to do this may result in your controller being damaged.

The Safefire 3000 should be fixed to a wall near the kiln using the bracket found on the back of the instrument, number 8 screws should be used (not supplied).

Do not position closer than 600mm to the kiln or above the kiln, (so that the unit is not damaged by heat from the kiln).

N.B. Always isolate from the mains supply before opening the case (Note there are no user alterations that can be made inside the instrument and damage could be caused by unskilled tampering).



2 Connection to the Kiln

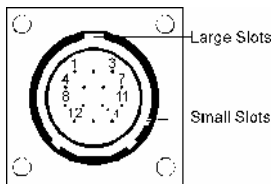
Ensure the Controller and Kiln are compatible, and simply plug the connection lead into the kiln. (If no plug is provided see below) If in doubt contact your kiln supplier or Cromartie. Connection to the kiln must only be carried out by a qualified electrician.

If no plug is provided connect as follows:-

Wire Colour	Mains Supply		T/Couple	
	PCB Terminals	Function	Colour	Polarity
Brown	L	Supply	White	+
Green	E	Earth	Blue	-
Blue	N	Supply		
Black	C	Common		
White	1	Contact/Relay		
Yellow	2	Relay		

Standard Control Socket

Pin Connections



- Pin 1. Thermocouple +
- Pin 2. Thermocouple -
- Pin 8. Live
- Pin 9. Neutral
- Pin 10. Earth
- Pin 13. Coil
- Pin 14. Coil

3 Front Panel

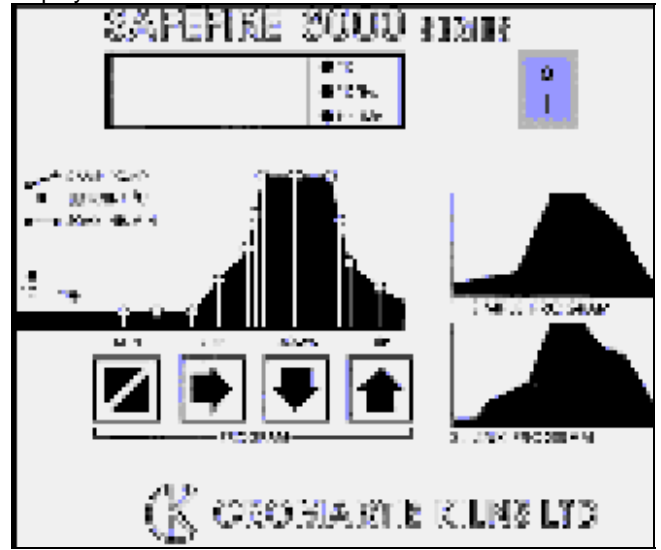
Digital Display and Indicator LED's.

The four-digit display gives numerical values;

- a. When the °C LED light is lit then the display = degrees centigrade.

- b. When the °C/Hr LED light is lit then the display = degrees centigrade per hour.
- c. When the Hr.Mins LED light is lit then the display = hour & minutes.

During normal operation, the kiln temperature is constantly displayed.



4 Display Keys

Key	Function	Explanation
A	Start/Stop:	Stop and Start firing sequences or clear program or display.
B	Step:	Step between cycle stages in review mode or modification of a program.
C	Down:	Step down through program for modification.
D	Up:	Step up through program for modification.

5 Mimic Diagram (Graph)

In normal operation, green LED's show the stage reached in the firing cycle, red LED's are used to highlight the relevant steps when reviewing or modifying the program.

Below are listed the mimic display light sequences displayed during the programming running modes.

Programming Mode

Delay	LED's	Colour
Delay	1 & 3	Red
1st Ramp Rate	3 & 5	Red
1st Set Point	5	Red
2nd Ramp Rate	5 & 7	Red
2nd Set Point	7	Red
Soak Time	7 & 9	Red
3rd Ramp Rate	9 & 11	Red
End	12	Green

Running Mode

Delay	LED's	Colour
Delay	2	Green
1st Ramp	4	Green
2nd Ramp	6	Green
Soak	8	Green
3rd Ramp	11	Green
End	12	Green

Whilst programming this display is invaluable as it will help to know what value you are about to program in.

6 Set Up of Basic Firing Sequences

On all but the single program versions, up to ten firing sequences (programs) can be set, up in memory and quickly recalled for use. Each offers in order, a delay before firing begins, two independent heating ramps followed by a soak period before a third heating or cooling ramp followed by kiln cut off. The Safefire 3000 is supplied with Ten sample programs stored in memory, which may be either used as they are, or modified to suit the needs of the user. These are listed below:-

Values For Supplied Programs

Program Type	Slow	Normal	High	Stone-	Porc-
	Biscuit	Biscuit	Biscuit	ware	elain
Program No.	Pn.01	Pn.02	Pn.03	Pn.04	Pn.05
Delay (Hr.Min)	0	0	0	0	0
Ramp 1 rate (°C/Hr)	50	100	100	100	100
1st Set Point (°C)	200	600	600	200	200
Ramp 2 rate (°C/Hr)	250	250	250	250	150
2nd Set Point (°C)	1020	1020	1160	1260	1290
Soak time (Hr/Min)	0	0.10	0	0.10	0
3rd Ramp Rate (°C/Hr)	Pass	Pass	Pass	Pass	Pass
3rd Set Point (°C)	-	-	-	-	-
Program Link	Ln 00	Ln 00	Ln 00	Ln 00	Ln 00

(only On 3000 MPL)

Program Type	Low	Med	High	Lustre	
	Enam				
	Temp	Temp	Temp		
	Glaze	Glaze	Glaze		
Program No.	Pn.06	Pn.07	Pn.08	Pn.09	Pn.10
Delay (Hr.Min)	0	0	0	0	0
Ramp 1 rate (°C/Hr)	150	150	150	0	0
1st Set Point (°C)	500	500	500	0	0
Ramp 2 rate (°C/Hr)	250	250	250	125	120
2nd Set Point (°C)	960	1070	1120	750	800
Soak time (Hr/Min)	0.10	0	0	0	0
3rd Ramp Rate (°C/Hr)	Pass	Pass	Pass	Pass	Pass
3rd Set Point (°C)	-	-	-	-	-
Program Link	Ln 00	Ln 00	Ln 00	Ln 00	Ln 00

(only On 3000 MPL)

Familiarity with the operation of the Controller is best gained by reviewing the programs already stored. This will quickly demonstrate both the function of the front panel displayed and the mimic diagram.

Note! The 10 preset programs are only as a guide. Consult your clay/glaze supplier for specific temperatures and firing cycles.

Important ! When switched on your SF3000 will display a series of digits; The first digit denotes the thermocouple type compatible with your instrument, you MUST ensure that the thermocouple indicated is correct for your kiln.

Failure to do this may result in a serious overfire.

7 View an Existing Setting

Once switched on, the Safefire 3000 will display the kilns ambient temperature. Should any other LED'S be lit, these should be cleared by pressing the stop/start A key.

Press the Step/Enter key and a display of the program number (Pn01) will be shown by the digital display. Use the up and down keys D C to select the program number to be inspected. Press the Step/Enter B key

to display any delay time. Press again to see the Rate in °C/Hr that the kiln will climb in the first ramp. Press Step/Enter B again to see the temperature to which this rate of climb will continue to. Continual pressing of the Step/Enter B key will enable you to see the rest of the program.

8 Ten Minute Programming Guide

Turn on Power. (Note! A number will briefly appear on the display) Temperature Displayed (Ambient).

- B Pn-01. Use D or C to change number.
- B Delay 00:00. Use D or C to change.
- B 1st Ramp 50°C/Hr. Use D or C to change.
- B 1st 'Set Point' 200°C. Use D or C to change.
- B 2nd Ramp 250°C/Hr. Use D or C to change.
- B Top Temperature 1020°C. Use D or C to change.
- B Soak 00:00. Use D or C to change.
- B 3rd Ramp Pass. Use D or C to change.
- B 3rd 'Set Point' Pass. Use D or C to change.
- B End.
- B Temperature displayed (Ambient).
- A Start (2nd light from left comes on if delay has been selected, or 4th light if no delay has been selected).

9A Programming Your Controller

1. Connect controller to kiln.
2. Switch power on the kiln. (Note! A number will briefly appear on the display) Set energy regulators to full if fitted. The kilns ambient temperature is now shown on the display.
3. (Not applicable for single program versions). Press "Step/Enter" B button to display Pn-01 or the program number last used. To change the program number use the Up/Down D or C buttons to display the number of the program to be changed..
4. Press "Step/Enter" B button. Set delay you require in hours and minutes by using the up and down keys D or C e.g. At 11:45pm, a delay time of 5 hours and 15 minutes. If no delay is required then ensure that the display shows 00.00
5. Press "Step" B button, and by means of the Up/Down keys D or C set the ramp rate in °C/Hr. Any value from 0°C to 1000°C / Full. If the word PASS is shown this indicates that no ramp rate has been selected and that this section of the program will be passed. The first setpoint will also be bypassed if "Pass" is selected.
6. Press "Step" B button. Use Up/Down keys D or C to set the target temperature. This will be the temperature at the end of the first ramp.
7. Press "Step" B button. Use Up/Down keys D or C to set the ramp rate in °C. Any value from 1°C to 1000°C / Full. or or or butt
8. Press "Step" B button. Use Up/Down keys D or C to set the target temperature.
9. Press "Step" B button. Use Up/Down D or C button to set the soak temperature. In Hrs & Mins.
10. Press "Step" B button. Use Up/Down D or C button to set the third ramp rate. This is not required then set the rate to PASS.
11. Press "Step" B button. And END will be displayed.

9B Link Feature Safefire 3000MPL or Higher

To carry out linking:- when end is displayed as an instruction press and hold down the secret key behind the Cromartie kilns logo. Whilst doing this use the up or down D or C keys to select the program you wish to link to. Please note that when linking programs. The delay section of

the second or subsequent programs must be set to zero.

9C Relay / Auto Damper (MPL Events)

After the last ramp the aux relay is prompted by "rLy"

Press Up/Down D or C buttons to select.

- rL-t Temperature relay. (For Auto Damper Operation)
- rL-E Event (segment) relay.
- rLy No operation.

Event Mode:-

1. Having selected rL-E press "Step" B button. Red LED's on mimic show segment to be amended. Green LED's on mimic show when relay is turned on.
2. Step through each segment and turn on/off green LED using Up/Down D or C buttons.

Note! All segments may be individually set including END i.e. if END LED only is on **event** energises when program has finished.

Temperature Mode (for auto damper):-

1. Having selected rL-t press "Step" B button. Red LED's on mimic show segment to be amended. Green LED's on mimic show where a switching action occurs.

Note! Since a change in temperature is required to operate the relay only the ramps are available for temperature events. Only one ON and OFF may be set, If a duplicate action is attempted the previously set action will be cancelled!

2. To set an ON event press "Down" C button whilst the Red LED's show the destined segment. ON is displayed.
3. Press the secret key and use the Up/Down keys D or C keys to set the ON temperature.
4. To remove an ON segment either enter an ON command in another segment, or press the C key in an existing ON segment. (Relay ON closes the damper; relay OFF opens).

Note! Use the same procedure for ON/OFF action using the Up/Down keys D or C key to set/clear.

Note! To open the damper during cooling a cooling ramp MUST be entered. (only the ramps programmed are available for damper operation)

button

9D Multi zone (only)

Monitoring of zone temperatures during a firing cycle. The controller will constantly display the temperature in the master zone (bottom). Whilst a program is running it is possible to check the program being fired and each individual zone this is shown below.

1. Press "Down" C button. Pn-?? Program number will be displayed.
2. Press "Down" C button. The bottom zone temperature will be displayed.
3. Press "Down" C button. The middle zone temperature will be displayed.
4. Press "Down" C button. The top zone temperature will be displayed.
5. Press "Down" C button to return to normal display.

N.B. A 2 zone control may be implemented by not using the 3rd zone. The unwanted zone must have it's

thermocouple linked out to prevent the controller reading an open circuit thermocouple.

Purpose of Set Points / Ramps

The first ramp is normal set at a slow rate of climb to enable moisture/air to escape if the rate of climb is too steep the ware in the kiln may crack or even explode. This slow rate of climb, however, is only needed to a low temperature, i.e. 600°C as once the ware has reached this temperature all the moisture has been eradicated. The temperature at which the kiln changes to a higher rate of climb is called a 'Set Point' and the faster climb is called a 2nd ramp.

10 During The Firing

During the firing it is possible to jump to the next step of the cycle, e.g. from one ramp to the next, this can be done by pressing the Up (D)key once. The controller will work out the new rate of climb from the temperature in the kiln and the program requirements. The mimic display will show that the change has taken place by the lit LED's in the new section of the program. During the 2nd ramp the rate can be switched to full power so as to reach the set point temperature as fast as possible. This is done by pressing the Up key.

Whilst your kiln is firing you will notice a red dot intermitantly flash at the bottom righthand side of the display, this indicates the elements are receiving power. If a red dot appears in the bottom lefthand side of the display, this indicates that the kiln could not follow the program set.

11 Security Lock

This feature is available only on the multiprogram versions of the Safefire 3000. The electronic lock inhibits unauthorised use of the controller by requiring a code number to be entered prior to starting a firing cycle or modifying a program. Access codes can be entered, amended or, if security is not required, can be omitted.

To instigate the security lock press and hold down the switch hidden behind the logo of Cromartie for 30 seconds. The display will either indicate No. 00 or the current Lock number. You can enter or change a Lock code number using the Up/Down (D or C) keys by setting a number between 0 and 99.

Once the hidden switch is released, the code number will be stored. The operation of the Stop/Start or Step B button will result in the word "Lock" being displayed. By holding the button and entering your personal number the instrument will either start/stop the firing or allow you to alter your firing and/or select the new program number.

If you leave the lock number at 00 or change it back to 00 this will allow free access to the operation of the controller.

12. Over temperature relay.

All cromartie Safefire 3000 controllers are fitted with a relay for driving a safety contactor which will activate should the kiln exceed it's top temperature setpoint by more than 20°C.

13 Error Messages

Error No	Error Code	Message
1	OPEN	Thermocouple open circuit.
2	FAIL	Thermocouple connection reversed.
3	Err3	Not in use.
4	Err4	Process temperature has exceeded target by more than 20°C.
5	Err5	Contact Cromartie.
6	Err6	Contact Cromartie.

General Methods of Operation for Cromartie Kiln Controllers

The thermocouple generates a signal in electrical current which is detected by the controller. This signal is electrically converted into a temperature measurement in degrees centigrade which the controller reads and, according to the instructions given out, the controller will switch the mains contactor on and off as required. When the controller is told to give full power the contactor is permanently 'on'. When top temperature is reached the contactor is switched off. In soak mode the contactor will be switch on and off to maintain the kiln at the temperature desired by the user.

Our controllers derive their power from the kiln via the multi-pin plug and socket supplied.

Technical Specifications

Supply	230 volts \pm 15% 50 Hz ~
Thermocouple	Type R, S,K or N indicated by first letter of serial number.
Output	Single pole 3A rated relay to operate kiln controller.
Temperature display	0-1400°C (Types R&S) 0-1300°C (Type N).
Delay and soak times	0-99 hrs 59 min.
Temperature ramps	1-1000°C/Hr.
Set point temperature	0-1400°C (Type R&S) 0-1300°C (Type N).
Programs	Ten stored in non-volatile memory - all variables user selectable.
Case Dimensions	215mm x 164mm x 65mm.

14 Glossary of Terms

Ambient Temperature	The temperature inside the firing chamber of the kiln.
Contactors	An electrical device used for switching electrical supply on and off to elements. It is energised and controlled from the temperature controller. It is also known as a relay.
Delay Time	This is a time period in hours and minutes which, when fed into a controller with this facility, will switch the kiln on at the appropriate time. E.G. If you want your kiln to fire overnight and should start firing at 11.00 pm you can switch everything on at 5.00 pm with a delay time of 6 hours put in to the controller and everything starts to fire at 11.00 pm.
LED	Light Emitting Diode, a small bulb-like device which lights up to indicate a function or warning.
Non-Volatile Memory	Memory in controller where programs are stored. Non-Volatile memory stays resident even when controller is switched off, therefore you don't lose your program.
Ramp	This term is used to describe the rate of rise of temperature when firing. Some controllers do this in degrees per hour, others as a percentage of full power.
Soak Time	The term 'soak' in this context is an old pottery term used to describe the holding of a particular temperature at a

steady level to 'soak' the products to be fired to ensure

Cont'd even heat distribution and maturity of glaze body or colour.

Set Point This is a temperature at which a controller changes from one mode to another determined by the user e.g. for changing from ramp control to full power or from full power to soak.

Thermocouple A temperature sensing device located in the kiln wall protruding into the kiln. Its outer space is a high temperature ceramic tube. Inside the tube is a fine element consisting of two wires made of a mixture of platinum and rhodium. They are welded together at the end. This mixture of metals produces a minute electric current which varies with temperature. This current can be measured and translated electrically into a temperature read-out.

Volatile Memory Memory whose contents is lost when power supply is cut off.

15 Appendix

Below is a table detailing the information concerning the Safefire 3000 internal test procedure.

Prefix description

Example

S.1.2.2.

S = Thermocouple type.

1.2. = Software version.

2. = Controller option i.e. Multi program version

S.1.2.1. = Single program version.

S.1.2.2. = Multi program version.

S.1.2.3. = Multi program with link.

S.1.2.4. = Multi program with links & events.

S.1.2.5. = Multi zone

Note! Please check the thermocouple type selected on your new controller.

Cromarties standard is "S" type unless otherwise specified. If in doubt please consult our technical department.

Important Warranty Notes

Tampering inside controllers invalidates any warranty. Suspected faults should be reported to the company.



CROMARTIE KILNS LIMITED

...at the centre of ceramics

Park Hall Road
Longton
Stoke-on-Trent
Staffordshire
ST3 5AY

Tel 01782 313947
Fax 01782 599723

Agent

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