Notes

SPS5.7

Operating Instructions

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Quick Start Guide

Switch on & wait for **READY** display
To run a firing program set up previously press the **RUN/HALT** key
To stop the firing at any time press the **RUN/HALT** key again
To alter firing data press the **SET** key to enter the setting menu
- to choose a program choose **SELECT PROGRAM** with the ➡ key *(see page 9 for details)*
- to change the program's firing data choose **PROGRAM DATA** with the ➡ key *(see page 15 for details)*
- to set up a delayed start for the firing choose **START DELAY** with the ➡ key *(see page 10 for details)*
- to check the contents of the firing program choose **CHECK** with the ➡ key *(see page 17 for details)*
To exit a menu at any time press the **SET** key

Notes

Error Displays

Permanent Errors

These errors cause the controller to lock up with the indicated error displayed & heating power turned off. The power to the controller & the kiln should be turned off and the indicated fault rectified.

THERMOCOUPLE OPEN CIRCUIT!

This indicates a broken thermocouple or a bad connection in the thermocouple circuit.

NO TEMP FALL CONTACT FAILURE?

This indicates an electrical fault in the control circuit. The temperature is rising when zero power is applied. Control contacts may have failed closed. **TURN OFF THE KILN!** If an auxiliary control relay configured as an over-temperature O/P is fitted the contacts will open.

NO TEMP INCREASE HEATER FAILURE?

This indicates a kiln fault. There is insufficient heating capability. Possible problems are: the kiln door or lid may not be closed properly, a heater element may have failed, (on a 3 phase kiln) one of the power phases may be missing, the control relay or contactor has failed open or the thermocouple wiring is short circuit.

Other Errors

The controller continually monitors its internal operation. It also interprets improbable temperature readings. If a problem is found an error message is displayed for 1 minute then the controller resets itself in an attempt to clear the fault. If the fault clears then the controller continues the firing normally. If the error persists then service is required.

Examples

THERMOCOUPLE REVERSED!

A temperature of less than -50°C has been measured. This is interpreted as the thermocouple wiring being reversed

TEMPERATURE TOO HIGH!

A temperature of greater than 1350°C has been measured.

Contents

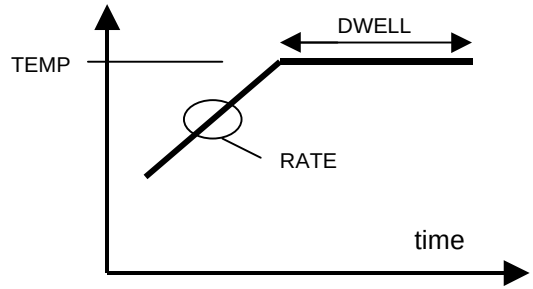
Features

- **Simple to use with large alphabetic menu display**
- **10 fully-adjustable programs**
- **9 segments per program**
- **Each segment specifies a temperature ramp and a dwell (soak)**
- **Temperatures from 0 to 1310°C**
- **Dwell times up to 100 hours**
- **Ramp rates from 1 to 999°C/hour**
- **Controlled ramps for heating & cooling**
- **Delayed start facility (up to 100 hours)**
- **Up to 9 programs can be linked in any order**
- **Program check facility**
- **Power failure recovery**
- **R,K,N & S type thermocouple selection**
- **Power consumption display**
- **Optional internal over-temperature trip**
- **Optional multi-function auxiliary control relay**

Programs

Program Segments

A program segment is a temperature ramp to a soak temperature followed by a dwell (soak) at this temperature.



A firing program on the SPS5.7 comprises 1 to 9 segments.

Segment temperatures are adjustable in the range 0 to 1310°C, ramp rates in the range 0 to 998°C/hour (+ full) & dwell times in the range 00:00 to 99:59 (hours:mins).

The SPS5.7 has 10 fully-adjustable programs and a program linking feature useful for complex firings where up to 9 programs can be linked together (in any order) to give a maximum firing complexity of 81 ramp/ soak segments.

Notes
Both controlled heating & controlled cooling ramps are possible.
If the required heating rate is greater than maximum heating power can achieve then a controlled heating ramp will not be possible. The load will be heated at full power until the required temperature is reached. The ramp time will be extended as necessary.
If the required cooling rate is greater than the natural cooling rate of the load then controlled cooling will not be possible. The load will cool naturally with the heat set to zero power. The cooling ramp time will be extended as necessary.
All program data is retained when the controller is powered off.

Firing Displays

RAMPING POSITIVE KILN TEMP 147°C	This shows that the controller is executing a positive (heating) ramp
RAMPING NEGATIVE KILN TEMP 1007°C	This shows that the controller is performing a negative (cooling) ramp
SOAKING... KILN TEMP 500°C	This shows that the controller is soaking at a constant temperature
COOLING... HOT! KILN TEMP 172°C	The firing program is finished & the load is cooling naturally
COOL KILN TEMP 96°C	The load has cooled to less than 100°C
READY KILN TEMP 32°C	The load has cooled to less than 40°C

Every minute during firing status information is sequentially displayed on the top line of the display.

This status display can be repeated at any time during firing by pressing the ➡ key

Trip

If the optional over-temperature trip module is installed a red FAULT lamp illuminates when an over-temperature error condition occurs. The trip turns off heating power. Turn off mains power to the kiln & controller & investigate the cause of the error. The trip is automatically reset by removal of the mains supply to the controller. If the fault is still present the trip will operate again about 5 seconds after re-powering the controller.

Auxiliary Output Options

General

The auxiliary control relay (if fitted) can be configured at the time of installation to have one of the following functions: Automatic damper control output, Event output or Set Point Alarm / Over-temperature output (see SPS5.7 Installation Instructions for configuration details).

Damper Control Output

SET DAMPER → NEXT ↑	If a damper control output is configured then this extra main menu item is available
DAMPER CLOSES ABOVE 0200°C↑→	The damper closing temperature can be set with the ⬆ & ➡ keys.
DAMPER OPENS BELOW 0500°C↑→	The damper opening temperature can be set with the ⬆ & ➡ keys.
STORING...	This indicates that the damper control temperatures have been stored.

Prior to commencement of firing the damper will be open. The damper will close the first time that the kiln temperature exceeds the 'DAMPER CLOSES ABOVE' temperature. It will remain closed until the kiln is naturally cooling at the end of a firing and the kiln temperature has fallen to below the 'DAMPER OPENS BELOW' temperature.

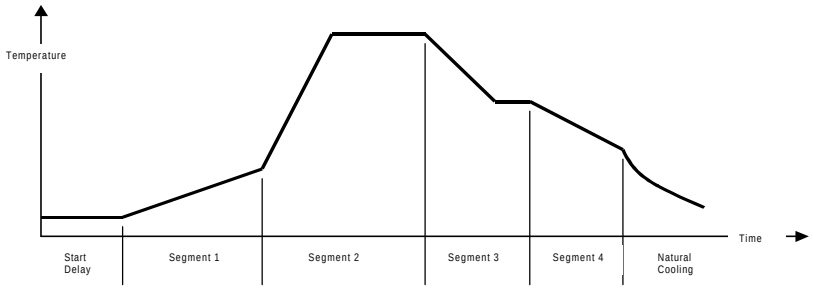
Event Output

PROG:03 SEG:1 EVENT OFF ↑→	If an event output is configured then this additional screen will appear during program data entry (after the segment dwell time screen). EVENT can be turned OFF or ON in each segment. If EVENT is set to OFF the auxiliary relay contacts will be open during the indicated segment. If EVENT is ON the relay contacts will be closed. The relay contacts are open both prior to commencement of firing & during natural cooling at the end of a firing.

Set Point Alarm / Over-temperature Output

The auxiliary relay contacts close at the start of a firing and open at the end of the firing. The contacts also open in the event of an over-temperature condition as indicated by the 'NO TEMP FALL – CONTACT FAILURE?' error message (see page 22). This output can be used to control a secondary heater contactor wired in series with the main heater contactor. This security feature will cut off kiln heating.

Firing Program Example



In the above example program segments 1 to 4 are used. Segments 5-9 are spare. Natural cooling occurs after execution of the final program segment. Dwell (soak) times for segments 1 & 4 are shown set to 00:00.

Programs

There are 10 fully adjustable programs - numbered 01 to 10. The programs have been factory set to the sample programs shown in the table on page 6. These sample programs have been carefully chosen to give safe repeatable results over a wide range of sizes, sections & clay types. These sample programs can be over-written or altered as required.

Linked Chain Program

The SPS5.7 has a linking program - numbered 11. This allows from 2 to 9 programs to be linked together and run as a continuous firing sequence. Any program can be linked in any order. Programs can be repeated. See page 19 for details.

Sample Programs

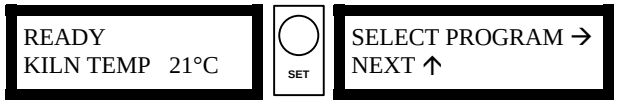
No	Name	Seg 1	Seg 2	Seg 3
01	Low Biscuit	TEMP: 200°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 70°C/hr DWELL: 00:00	TEMP: 960°C RATE: 999°C/hr DWELL: 00:15
02	Normal Biscuit	TEMP: 200°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 70°C/hr DWELL: 00:00	TEMP: 1000°C RATE: 999°C/hr DWELL: 00:15
03	High Biscuit	TEMP: 200°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 70°C/hr DWELL: 00:00	TEMP: 1160°C RATE: 999°C/hr DWELL: 00:15
04	Earthenware Low Temperature Glaze	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 960°C RATE: 999°C/hr DWELL: 00:30
05	Earthenware Mid Temperature Glaze	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 1040°C RATE: 999°C/hr DWELL: 00:30
06	Earthenware High Temperature Glaze	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 1140°C RATE: 999°C/hr DWELL: 00:30
07	Stoneware Glaze	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 1250°C RATE: 999°C/hr DWELL: 00:30
08	On Glaze Enamel	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 780°C RATE: 999°C/hr DWELL: 00:30
09	Heavy Sculpture	TEMP: 150°C RATE: 20°C/hr DWELL: 00:30	TEMP: 300°C RATE: 50°C/hr DWELL: 00:30	TEMP: 1000°C RATE: 70°C/hr DWELL: 00:30
10	Lustre	TEMP: 150°C RATE: 30°C/hr DWELL: 00:00	TEMP: 600°C RATE: 90°C/hr DWELL: 00:00	TEMP: 750°C RATE: 999°C/hr DWELL: 00:00

Notes
Earthenware High Temperature Glaze is also suitable for Stoneware Low Temperature Glaze.
Stoneware Glaze is also suitable for Porcelain.
On Glaze Enamel is also suitable for some enamelling work.
Heavy Sculpture is also suitable for Terracotta.

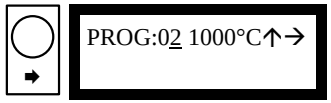
Program Linking

Up to 9 programs can be linked together to form a continuous sequence. Programs can be linked in any order. Programs can be repeated.

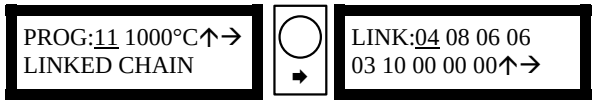
Linking is available via the use of program number 11 which stores the programs to be linked together.



To select the linking program press the **SET** key while the **READY** screen is displayed. This enters the setting menu. Choose the **SELECT PROGRAM** item on this menu with the ➡ key.



A flashing cursor will appear at the program number position. *Use the ⬆ key to increment the display to program number 11 then select this with the ➡ key.*



Use the ⬆ & ➡ keys to select program numbers for linking in the range 01 to 10. Linking is terminated either by entering program number 00 & selecting this with the ➡ key or entering the 9th program number & selecting it with the ➡ key. The programs will be executed sequentially as shown on the list i.e. 4,8,6,6,3,10 in the above example.

The display now indicates that the linking program data is being stored.

The program data select screen now appears again. *See note 1.*

To cancel data entry press the **SET** key at any time. The **SET** key can always be used to escape from the menu system.

Notes
1. The temperature shown on the top line of the display is that of the highest temperature segment of all of the programs in the linked chain.

Energy Used

From the **READY** display the energy used during the previous firing can be obtained. Press the **SET** key to enter the setting menu, then press the ⬆ key as required to navigate to the **ENERGY USED** item.

Choose the **ENERGY USED** item on the menu with the ➡ key. Return to the menu or the **READY** display with the **SET** key.

Power Failure Handling

In the event of power failure followed by power restoration, the instrument takes recovery actions to avoid a firing being aborted. The recovery action taken depends on where the instrument had reached in the firing sequence prior to power failure as detailed below:-

Before Power Failure	After Power Failure
In **READY** mode	In **READY** mode
Timing delayed start	Immediate start as if the end of delay time reached
Ramping approaching soak temperature	Ramp will be restarted at the previous ramp rate from the present temperature
Soaking	Temperature will be ramped at the previous ramp rate to the soak temperature. The full soak period will then be re-applied
Cooling after firing complete	Cooling continues

Operation

Running a program

To start a firing program press the **RUN/HALT** key when the **READY** screen is displayed. The program that will be run is the currently selected program. This currently selected program is stored in continuous memory & so is not lost when the power is turned off. *See note 1.*

Halting a program

To abort a firing press the **RUN/HALT** key while the SPS5.7 is firing. The **READY** screen will again be displayed & the load will cool naturally. *See note 2.*

Firing Status

During firing status information is displayed on the top line of the display at 1 minute intervals. This gives a sequential display of the program & segment currently being executed together with other status information. The ➡ key can also be used to obtain a status information display - even when the control keys are locked.

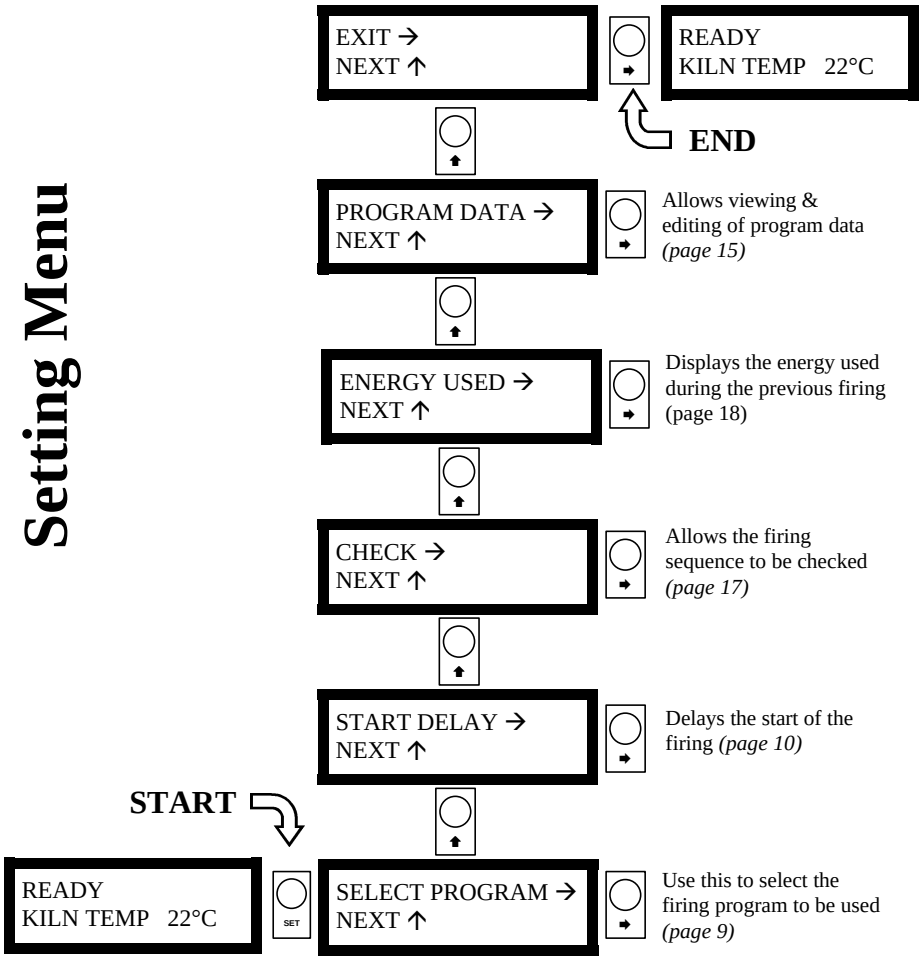
Notes

*1. Firing will commence immediately if the **START DELAY** is set to 00:00 otherwise the start of firing will be delayed - see page 10.*

*2. If the kiln temperature is more than 40°C when the firing is aborted then a temperature warning will be displayed. Press the **RUN/HALT** key again to obtain a **READY** display.*

Setting Menu

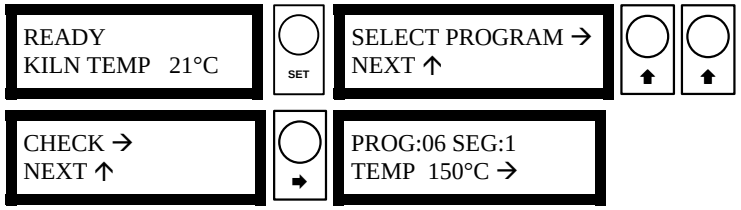
The firing parameters of the SPS5.7 can be set up by pressing the **SET** key when **READY** is displayed. This enters a setting menu. To exit this menu press the **SET** key again.



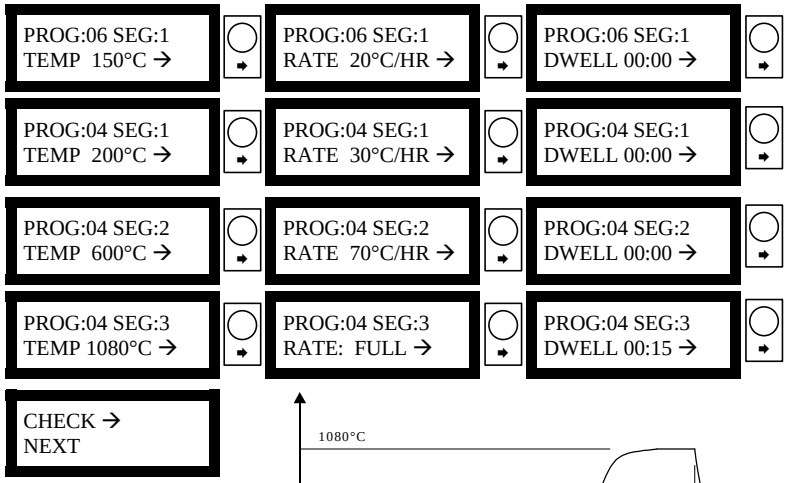
Check Facility

This facility allows the checking of program or linked program content prior to firing. Each segment of the program(s) can be sequentially stepped through to check that the desired program(s) have been selected & that they have been correctly programmed.

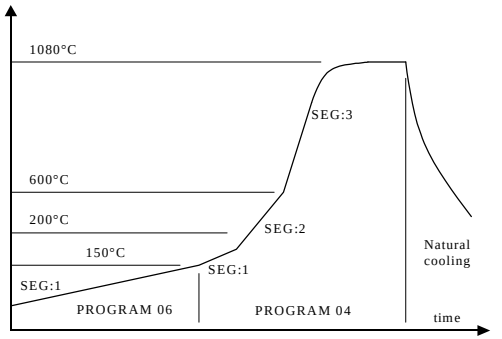
From the **READY** display press the **SET** key to enter the setting menu, then press the ⬆ key as required to navigate to the **CHECK** menu item.



The ➡ key is now used to step through each segment of each program in the order in which they will be executed as shown in this example:-



In the above example programs 6 & 4 are linked together. The ramp rate for segment 3 is shown as FULL because this has been set to 999ºC/hour.



PROG:01 SEG:2 TEMP 0000°C↑→

The temperature entry screen for segment 2 is now displayed.

Program data entry continues either until data for segment 9 (the last segment) is selected with the ➡ key or until 0000 is selected as a segment temperature with the ➡ key.

STORING...

The display now indicates that the program data is being stored.

PROG:01 200°C↑→

The program data select screen now appears again allowing another program to be selected for editing. *See note 1.*

If a mistake is made during data entry press the **SET** key as many times as required to reverse through the program data entry system.

Notes

1. The temperature shown on the top line of the display is that of the highest temperature segment in the program just entered.

Program Selection

READY KILN TEMP 21°C	SET	SELECT PROGRAM → NEXT ↑

To select a firing program press the **SET** key while the **READY** screen is displayed. This enters the setting menu. Choose the **SELECT PROGRAM** item on this menu with the ➡ key.

➡	PROG:02 1000°C↑→

A flashing cursor will appear at the program number position. *The temperature shown on the top line of the display is that of the highest temperature segment in the program.*

Use the ⬆ key to increment the display to the required program number then select this with the ➡ key.

STORING...

The display now indicates that the program selected is being stored.

SELECT PROGRAM → NEXT ↑	SET	READY KILN TEMP 21°C

After storing, the **SELECT PROGRAM** item on the setting menu is again displayed. The setting menu can be quitted by pressing the **SET** key to return to the **READY** display.

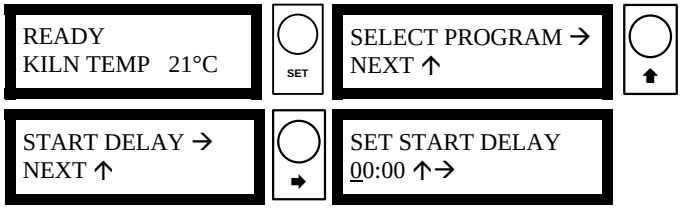
Note

Program 11 is a special linking program. See page 19 for details.

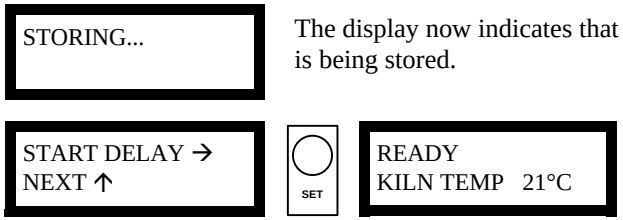
Start Delay

This feature enables the start of firing to be delayed - to enable firing overnight for example - possibly on low-tariff electricity. To disable this feature set the start delay to 00:00.

From the **READY** display press the **SET** key to enter the setting menu, then press the ⬆ key as required to navigate to the **START DELAY** menu item.



Choose the **START DELAY** item on the menu with the ➡ key. Set the required delay in the range 00:00 to 99:59 (hours:mins) with the ⬆ & ➡ keys. Select this with the ➡ key.



The display now indicates that the start delay is being stored.

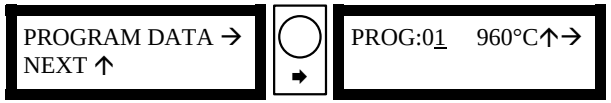
After storing, the **START DELAY** item on the setting menu is again displayed. Press the **SET** key to return to the **READY** display.

If a non-zero start delay time is set then a timer screen will be shown when the **RUN/HALT** key is pressed. This counts down once per minute & the firing commences when the time left is 00:00.

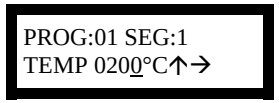
Program Data

The firing data in the programs can be viewed & changed as often as necessary. The data is stored in on-volatile memory and so is not lost when the power is turned off.

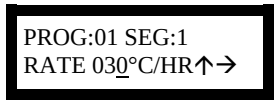
From the **READY** display press the **SET** key to enter the setting menu, then press the ⬆ key as required to navigate to the **PROGRAM DATA** menu item.



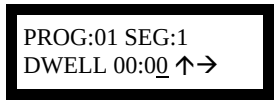
A flashing cursor will appear at the program number position. The program number initially shown is the currently selected program. *See note 1.* Use the ⬆ key to increment the display to the required program number then select this with the ➡ key.



The segment temperature for segment 1 is displayed. With the aid of a flashing cursor this can be changed as necessary in the range 0 to 1310°C with the ⬆ & ➡ keys. Select the temperature with the ➡ key.



The ramp rate to reach segment 1's temperature is now displayed. This can be entered in the range 1 to 999°C/hour with the ⬆ & ➡ keys. *See note 2.* Select the ramp rate with the ➡ key.



The dwell (soak) time for segment 1 is now displayed. This can be changed in the range 00:00 to 99:59 hours:mins with the ⬆ & ➡ keys. Select the dwell time with the ➡ key.

To correct mistakes during data entry press the **SET** key

Notes

1. The temperature shown on the top line of the display is that of the highest temperature segment in the program.

2. A ramp rate of 999°C/hour is treated as a requirement for full power for positive ramps or zero power for negative ramps – the actual ramp rate achieved will depend on the performance of the kiln.

Program Record Sheet

Program No.	Date:
Operator:	Time:
Comments	

Segment Number	Temperature °C	Ramp Rate °C/hour	Dwell (Soak) hours:mins
1			
2			
3			
4			
5			
6			
7			
8			
9			

Program Record Sheet

Program No.	Date:
Operator:	Time:
Comments	

Segment Number	Temperature °C	Ramp Rate °C/hour	Dwell (Soak) hours:mins
1			
2			
3			
4			
5			
6			
7			
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9			

Program Record Sheet

Program No.	Date:
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1			
2			
3			
4			
5			
6			
7			
8			
9			

Program Record Sheet

Program No.	Date:
Operator:	Time:
Comments	

Segment Number	Temperature °C	Ramp Rate °C/hour	Dwell (Soak) hours:mins
1			
2			
3			
4			
5			
6			
7			
8			
9			