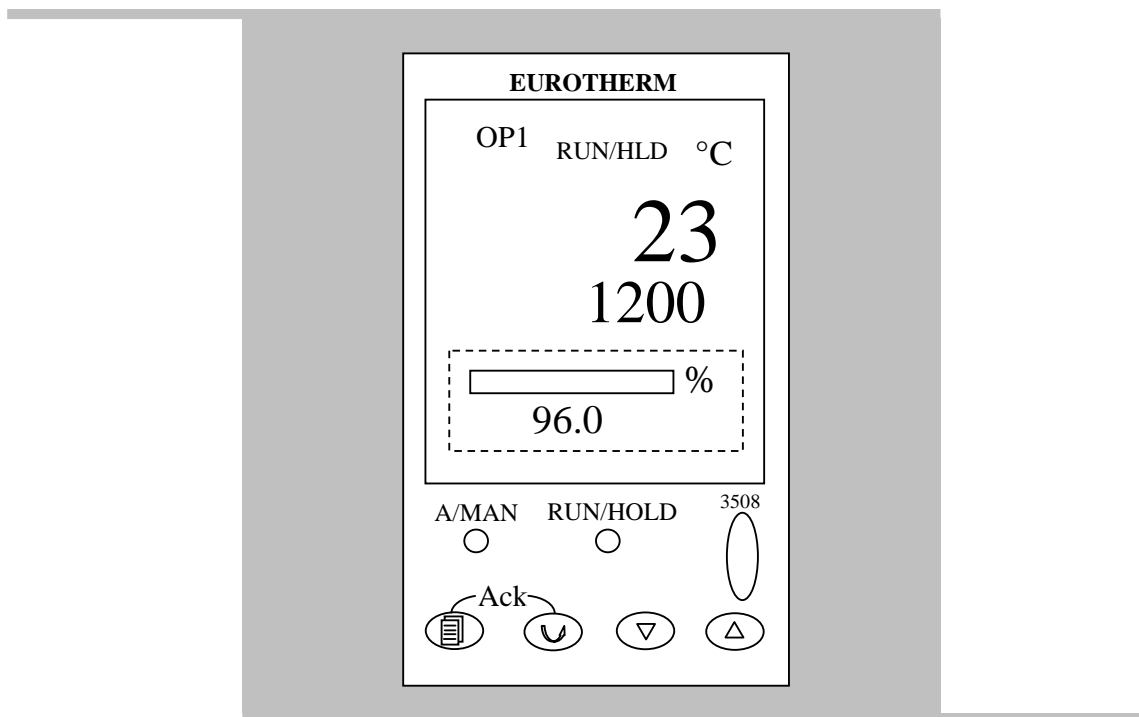




Operating Instructions

Temperature Controller



Type 3508

English

Note: For the purposes of this manual the Eurotherm 3504 range is functionally identical to the 3508 range.

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Introduction to the Controller and Manual

1.1 Using This Manual

This manual aims to explain how to set up and operate the Eurotherm 3508 series of controllers; it must be read in conjunction with the product main manual.

Due to the complex nature of furnace or oven control the use of technical terms throughout this manual is unavoidable. Explanations of these terms can be found in the 'Glossary of Terms' at the back of this manual.

This manual covers the operation of:

3508 P1 – Controller/Programmer

The 3508 P1 is a digital temperature controller which uses PID algorithms to give excellent temperature control when properly set. This controller can store and run a single program of up to 20 segments. The 3508P1 can also be used as a simple temperature controller.

3508P10 – Controller/Programmer

The 3508 P10 is a digital temperature controller which uses PID algorithms to give excellent temperature control when properly set. This controller can store 10 programs of up to 50 segments each. Programs can be run individually or linked by a Call parameter as sub-programs or to form single long programs. The 3508P10 can also be used as a simple temperature controller.

3508P25 – Controller/Programmer

The 3508 P25 is a digital temperature controller which uses PID algorithms to give excellent temperature control when properly set. This controller has a maximum of 500 segments or 25 programs; each program has a maximum of 50 segments. For example a 3508P25 could store 10 programs with 50 segments or 25 programs with 20 segments. Programs can be run individually or linked by a Call parameter as sub-programs or to form single long programs. The 3508P25 can also be used as a simple temperature controller.

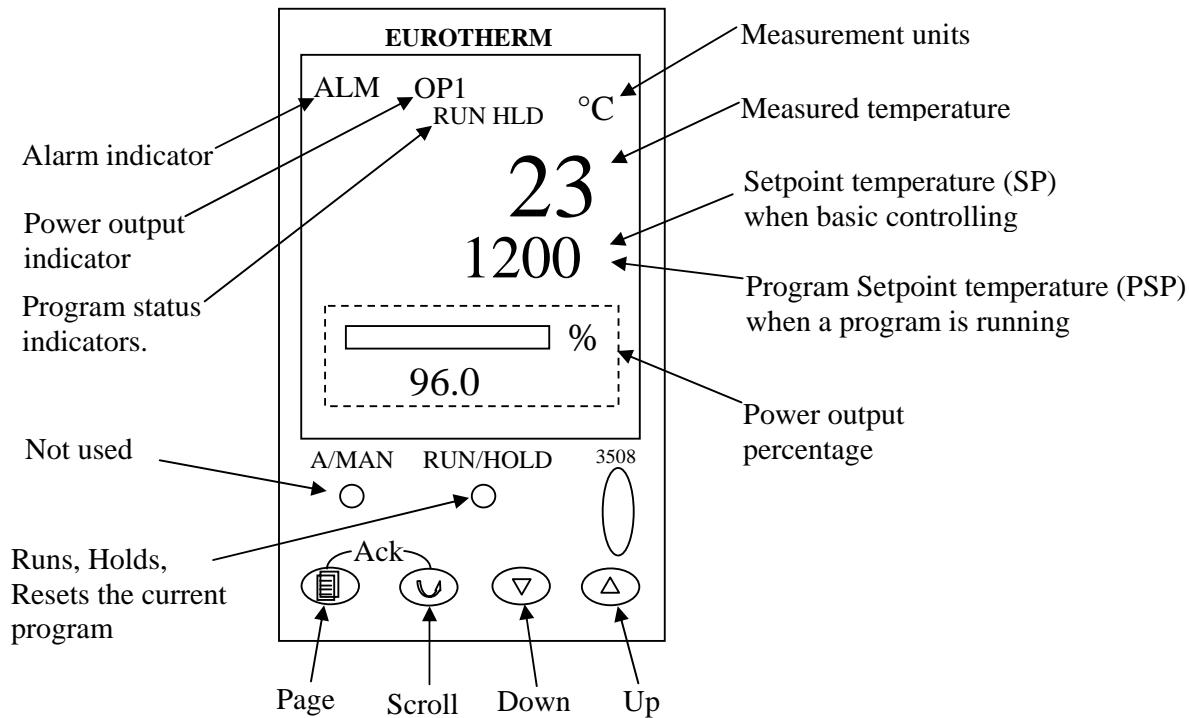
The 3508 does not contain a real-time calendar.

1.2 PID Control

The 3508 series of controllers use PID (Proportional Integral Derivative) temperature control. This type of control uses a complex mathematical control system to adjust the power being sent to the elements and hold the furnace or oven at the desired temperature.

2 Basic Operation

2.1 Controller Layout (Home display)



2.2 Keys

A/Man	-	Disabled
RUN/HOLD	-	Runs, Holds or Resets the current program. Hold down for 3 seconds to Reset.
Page key	P	Scrolls through the page headings. Hold down for 3 seconds to access further levels, pass codes are required.
Scroll key	S	Scrolls through parameters listed on pages.
Arrow keys	U & D	Adjust parameter values
Page and scroll together	P+S	Press together to return to the home display or to acknowledge an alarm
Page and up arrow together	P+U	Press together quickly to scroll back up the page headings
Scroll and up arrow together	S+U	Press together quickly to scroll back up a parameter list
Pressing any other combination of keys together has no effect		

Note: If no keys are pressed for 1 minute, the display returns to Home.

3 Quick Start Guide

3.1 Operation as a simple controller

When switched on the controller goes through a short test routine and then shows the measured temperature. Below it is shown the setpoint temperature (SP) and percentage of power output.

3.2 Changing the Setpoint

Press up **U** down **D** to select the required SP. If the SP is higher than the measured temperature, the OP1 indicator will illuminate at the top of the display, indicating that the controller is calling for power (giving an output).

The controller will immediately attempt to reach the set temperature and maintain it.

3.3 Resetting the programmer

To reset the programmer to simple controller mode, press RUN/HOLD for 2 seconds.

3.4 Operating the current program

- To avoid unwanted heating at the end of a program, set the SP temperature to zero before running a program.
- Ensure the programmer is reset to simple controller mode before starting a program, by pressing RUN/HOLD for 2 seconds.
- To start the program, press RUN/HOLD again, RUN will light up on the display.

The displayed Program Setpoint (PSP) follows ramps, dwells and steps as the program runs. The SP temperature of the controller does not apply when a program is running.

- To pause the program, press RUN/HOLD.
- To stop the program and return to simple controlling (reset), press RUN/HOLD for 2 seconds.

When the program ends, the programmer will either:

- Automatically reset to operation as a simple controller.
- Dwell at the last temperature of the program (with the RUN indicator flashing), until the operator presses RUN/HOLD for 2 seconds to manually reset, or presses RUN/HOLD once to restart the program.

3.5 Understanding User Levels

There are two levels in the controller; Level 1 (Operator) and Level 2 (Supervisor).

Level 1 (Operator) is for the day-to-day operation of the controller and parameters are not protected by a security code. There are 2 pages at this level. Page 1 shows the current program status, page 2 is for writing and viewing programs.

Level 2 (Supervisor) provides access to additional parameters and access to these is protected by a security code. A further 4 pages are accessible in this level as follows; Customer identity, Control Output percentage, Communications addresses, Units.

To Enter Level 2:

1. Press and hold page **F** for 3 seconds. The display will show "Access Goto Level 1"
2. Press up **U** to select level 2. After a short pause the display will show "Access Pass code".
3. Press up **U** or down **D** to enter the pass code 9, Pass is momentarily displayed. After a short pause the display will return to home, the controller is now in level 2.

When Level 2 operations have been completed the supervisor must return to Level 1 manually. It is not necessary to enter a code when going from a higher level to a lower level.

To Return to Level 1:

1. Press and hold page **F** for 3 seconds. The display will show "Access Goto Level 2.
2. Press down **D** to go to level 1. After a short pause the display will revert to home, the controller is now in level 1.

4 Setting up the controller

Before using the controller (or during its lifetime) certain parameters may have to be set, depending on specific requirements. To do this the Controller must be set to supervisor Level 2, see section 3.5.

4.1 Maximum output power setting

Press page **F** until Control Output Hi is displayed. Press up **U** or down **D** to adjust the value. Depending on the furnace or oven model, the maximum power output setting may be accessible or locked.

For Silicon Carbide heated furnaces the parameter is accessible to allow compensation for element ageing. Refer to the product manual for details.

In many models the maximum power output setting depends on the supply voltage, refer to the product manual for details.

4.2 Customer ID.

A furnace or oven identity number can be entered if required. This may be used to identify one of many units, for production or quality control systems.

Press page **F** until Customer Identity is displayed. Press up **U** or down **D** to select a number.

4.3 Units

Press page **F** until Units is displayed. Press up **U** or down **D** to select:

C	Celsius
F	Fahrenheit
K	Kelvin

4.4 Language

The text on the 3508 can be shown in different languages, this can only be set at the factory and therefore must be specified at the time of placing an order.

5 Programming

5.1 Programming Notes

Programs can be created in Level 1 or Level 2 of the 3508.

For the P10 and P25, new programs can be created while the current program is running.

To avoid unwanted heating at the end of a program, set the controller SP temperature to zero before running a program.

All new unused programs show only 1 segment of type End.

The minimum number of segments for a program is 2. The second being an End type.

Ramp-to-setpoint control. To achieve this, create a two segment program. Set the first segment type as Rate or Time. Set the second segment type End type Dwell.

For the P10 and P25, programs can be linked together using a “Call” segment. However a lower number program can not be called and a program can not be ended with a call segment.

A program can be ended in three ways:

1. To dwell at the PSP of the last segment (RUN indicator flashes), until the programmer is reset. To do this set the End segment type to Dwell.
2. To automatically reset to basic controlling, where the controller will try to reach and maintain the Setpoint temperature. To do this set the End segment type to Reset.
3. With power to the elements turned off. To do this set the Setpoint temperature to “0”.

To reduce the number of segments in a program, change the last required segment to an End type. You will be asked to press **S** for OK or **P** to cancel.

To cancel all segments in a program, change the first segment to an End type.

To alter parameters or segments of the current program, press RUN/HOLD to pause the program, or press RUN/HOLD for 2 seconds to reset.

Note: It is possible to write programs to go above the maximum temperature limit of the furnace or oven, though the actual temperature will not exceed the limit, but remain there until the program sequence comes back down below the limit. If holdback is used in this situation, it will hold indefinitely at the limit.

Time display.

5.2 Holdback

Holdback can be used to prevent the program from running ahead of the actual heating or cooling.

The Holdback value is the amount, in degrees, by which the Program Setpoint can run ahead of the measured temperature before Holdback operates. The value applies to a whole program.

To set the value press page **P** twice, press scroll **S** until Holdback Value appears and press up **U** or down **D** to set.

Holdback can be used in Rate, Time, Step and Dwell segments.

- For Rate and Time segments Holdback will operate during the segment.
- For a Step segment Holdback delays continuation to the next segment until the step target is reached.
- For a dwell segment Holdback delays the start of the programmed dwell time, until the Target Setpoint of the previous segment is reached.

The Holdback Type can be set as follows:

- Low Applies to heating only
- High Applies to cooling only
- Band Applies to both heating and cooling
- Off Holdback is off

To set the Holdback type press page **P** twice, then press scroll **S** until the display shows Holdback Type for each segment and press up **U** or down **D** to set.

The default setting for Holdback is Off.

5.3 Program Cycling

The Cycles parameter sets the number of times the program will run.

The default setting is 1 cycle.

To change the number of cycles, press page **P** twice, then press scroll **S** until the display shows Prog Cycles, then press up **U** to set a finite number of cycles up to 999. Or press down **D** to set cycling to continuous.

5.4 Creating a Program

From the home display, press page **F** twice to get to the programming page, the display will show “Prog **UD** 1” and “Segments Used”.

Program number

On P10 or P25 models press up **U** or down **D** to select a new program number. The display will show that new programs have only one segment.

Holdback Value

Press scroll **S** until the display shows “Holdback Value”. If required: Press up **U** or down **D** to set a value. This value will be used in any segment where a Holdback Type is set.

Ramp Units

These apply to Rate segments only. Press scroll **S** until the display shows “Ramp Units”. Press up **U** or down **D** to select the ramp units of degrees per Hour, Min or Sec.

Number of program cycles

Press scroll **S** until the display shows “Prog Cycles”. Press up **U** or down **D** to select more than one cycle.

Now create all the segments for your program, finishing with an End segment. When parameters for each segment have been entered the display goes to the next segment number.

Segment Type

Press scroll **S** until the display shows “Segment Type”. Press up **U** or down **D** to select Rate, Time, Dwell, Step, Call or End.

Holdback Type

Press scroll **S** until the display shows “Holdback Type”. If required, press up **U** or down **D** to select Off, Low, High or Band.

Target Setpoint (Visible only for Rate, Time and Step segments)

Press scroll **S** until the display shows “Target SP”. Press up **U** or down **D** to set a value.

Ramp Rate (Visible only for Rate segments)

Press scroll **S** until the display shows “Ramp Rate”. Press up **U** or down **D** to set the number of degrees per Ramp Unit as set above.

Duration (Visible only for Time and Dwell segments)

Press scroll **S** until the display shows “Duration”. Press up **U** or down **D** to set a value.

Call Program (Visible only for call segments)

Press scroll **S** until the display shows “Call Program”. Press up **U** or down **D** to select another program. Only higher number programs can be selected.

Call Cycles (Visible only for call segments)

Press scroll **S** until the display shows “Call Cycles”. Press up **U** or down **D** to set a value.

End Type (Visible only for End segments)

Press scroll **S** until the display shows “End Type”. Press up **U** or down **D** to select Dwell or Reset.

5.5 Running a Program

The current program can be started from the home display by pressing RUN/HOLD. Or by pressing page **F** once, then scroll **S** once (twice for P10 and P25), then press up **U** or down **D** to change the status to Run.

5.6 To pause (hold) a program

Press RUN/HOLD

or

Press page **F** until Program Status Reset appears

Press scroll **S** until the cursor moves to Reset

Press up **U** or down **D** to select Hold

RUN/HLD will be displayed

5.7 To stop and reset a program

Press and hold RUN/HOLD

or

Press page **F** until Program Status Reset appears

Press scroll **S** until the cursor moves to Reset

Press up **U** or down **D** to select Reset

5.8 To run a different program (P10 and P25)

To select a program

Press page **F** until Program Status Reset appears

Press scroll **S** then up **U** or down **D** to select a program number

To run the program

Press RUN/HOLD

or

Press scroll **S** until the cursor moves to Reset

Press up **U** or down **D** to select Run

Run will be displayed

5.9 Program Status

While a program is running the home display shows 3 values:

Top: Measured temperature
 Centre: Program setpoint (PSP)
 Bottom: Power output percentage

To see more detail:

Press page **F** once to go to the program status page. The top and centre values from the home page remain on the display. The lower half of the screen now shows:

Current program number (P10 and P25 only)
Current segment number
Time remaining for that segment

Further presses of the scroll **S** key while a program is running will reveal additional information:

S Status. This can be changed to Hold, Reset or Run by pressing up **U** or down **D**.
S Program setpoint (PSP)
S Current Segment Type. Step and Call segments are instant, so are only flashed on the screen, unless Holdback is operating on that segment.
S Target Setpoint }
S Segment Rate } For Rate, Time and Step segments only
S Cycles left
S Program Time Left

Program hold with holdback

If a holdback value has been set (see “Programming”) and the program goes into a hold state, the red HLD indicator will flash, until the measured temperature catches up.

If while in this condition the program itself is put into hold by pressing the RUN/HLD button, the “HLD” indicator will stop flashing and remain on with the “RUN” indicator. When the program is started again by pressing the “RUN/HLD” button, the “HLD” indicator will flash again if the measured temperature has not caught up with the program.

Programming note:

For P10 and P25 models you can create or change other programs while the current program is running, go to operator Page 2.

Power Failure Recovery

If there is a power interruption to the controller during a program, when power is restored the controller pauses the program, then ramps the temperature back up to the current Program Setpoint (PSP) before continuing the program.

- Power fail during ramp segments: The ramp rate will be that of the current ramp segment.
- Power fail during Dwell segments: The ramp rate will be that of the previous ramp segment. If a previous ramp segment does not exist, then the dwell will continue at the current measured temperature.

- Power fail during Time-to-target segments: The ramp rate will be that of the current segment. The ramp rate is maintained, but the time remaining is recalculated.

If there is a power interruption while controlling to Setpoint, when power is restored the controller automatically calls for maximum power.

Alarms

Alarms are used to alert the operator when a pre-set level has been exceeded or a function error has occurred such as a sensor break. They are indicated by a flashing red ALM (Alarm) indicator. The alarm may also switch an output – usually a relay to allow external devices to operate when an alarm occurs. Alarms only operate if they have been configured and are dependent on customer requirements.

How to acknowledge an alarm will depend on the type of latching which has been configured. A non-latched alarm will reset itself when the alarm condition is removed. A latched alarm requires acknowledgement with the “ACK” function (section 2.1) before it is reset.

If an alarm has been activated the red “ALM” indicator will flash and the text will indicate the type of alarm.

To acknowledge an alarm and cancel the “ALM” indicator, press **P** and **S** together.

5.10 Example of a Basic Program

The following sequence of entries creates and runs the program shown graphically below.

1. Turn the controller SP down to '0' by pressing down **D**.
2. Press page **P** until Prog, Segments Used is displayed. On P10 or P25 models press up **U** or down **D** to select a new program number, (a program with only 1 segment).
3. Press scroll **S** until Holdback Value is displayed. Default '0' degrees.
4. Press scroll **S** until Ramp Units is displayed. Press up **U** or down **D** to set to 'Min'
5. Press scroll **S** until Cycles is displayed. Default '1'
6. Press scroll **S** until Segment 1 is displayed
7. Press scroll **S** until Segment Type is displayed. Press up **U** or down **D** to select 'Rate'
8. Press scroll **S** until Holdback Type is displayed. Default 'Off'
9. Press scroll **S** until Target SP is displayed. Press up **U** or down **D** to set to '400' degrees.
10. Press scroll **S** until Ramp Rate is displayed. Press up **U** or down **D** to set to '5.0' degrees per minute.

Repeat steps 6 to 10 for 4 more segments. Set Holdback to the default 'Off'. Enter the following parameters and values:

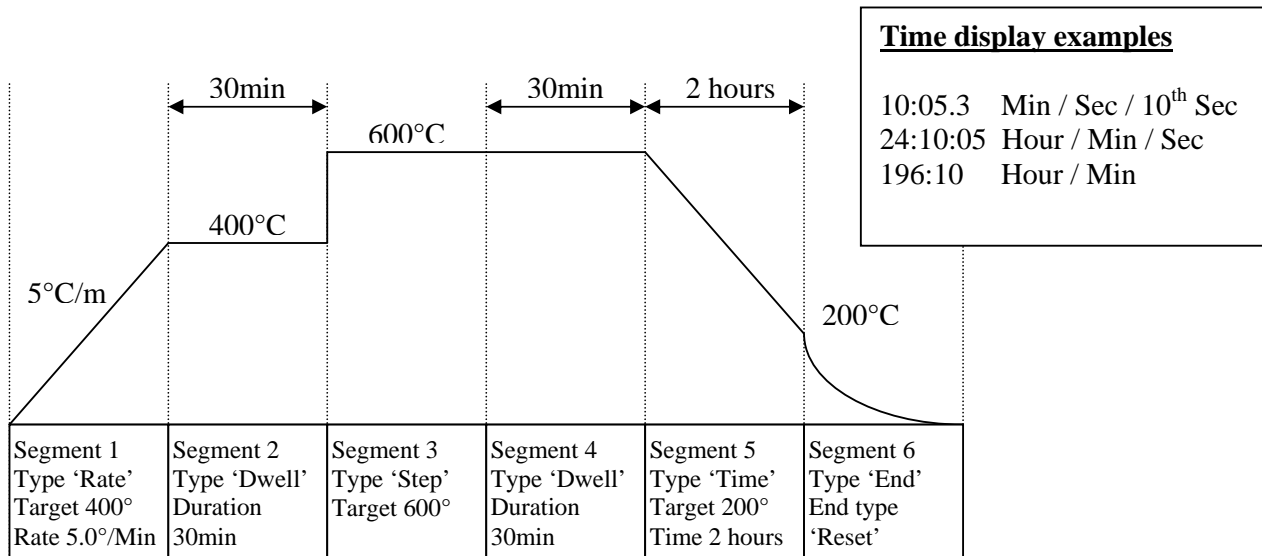
Segment Type Dwell Duration '30:00.0' minutes
 Segment Type Step Target SP '600' degrees
 Segment Type Dwell Duration '30:00.0' minutes
 Segment Type Time Target SP '200' degrees, Duration '2:00:0' hours

Finish the program with an End segment:

11. Press scroll **S** until Segment Type is displayed. Press up **U** or down **D** to select 'End'
12. Press scroll **S** until End Type is displayed. Press up **U** or down **D** to select 'Reset'
13. Press page **P** and scroll **S** together to return to the home display.

To run the program either press RUN/HOLD or:

14. Press page **P** until Program Status is displayed
15. Press scroll **S** until the cursor moves to the program status of 'Reset'
16. Press **U** to select 'Run'.



5.11 Example of an Advanced Program

The following sequence of entries creates and runs the program shown graphically below.

1. Turn the Setpoint to '0' by Pressing down **D**
2. Press page **P** until Prog, Segments Used is displayed. On P10 and P25 models press up **U** or down **D** to select a new program number, (a program with only 1 segment).
3. Press scroll **S** until Holdback Value is displayed. Press up **U** or down **D** to set to '5' degrees
4. Press scroll **S** until Ramp Units is displayed. Press up **U** or down **D** to set to 'Min'
5. Press scroll **S** until Cycles is displayed. Default '1'
6. Press scroll **S** until Segment 1 is displayed
7. Press scroll **S** until Segment Type is displayed. Press up **U** or down **D** to select 'Time'
8. Press scroll **S** until Holdback Type is displayed. Default 'Off'
9. Press scroll **S** until Target SP is displayed. Press up **U** or down **D** to set to '600' degrees
10. Press scroll **S** until Duration is displayed. Press up **U** or down **D** to set to '30:00.0' minutes

Repeat steps 6 to 10 for 4 more segments. Enter the following parameters and values:

Note: Call segments are not available on single program models.

Segment Type Rate Target SP '400' degrees. Ramp Rate '2.0' degrees per minute

Segment Type Step Target SP '200' degrees

Segment Type Dwell Holdback 'High'. Duration '30:00.0' minutes

Segment Type Call Call Prog 'next number'. Call Cycles '2'

Finish the program with an End segment:

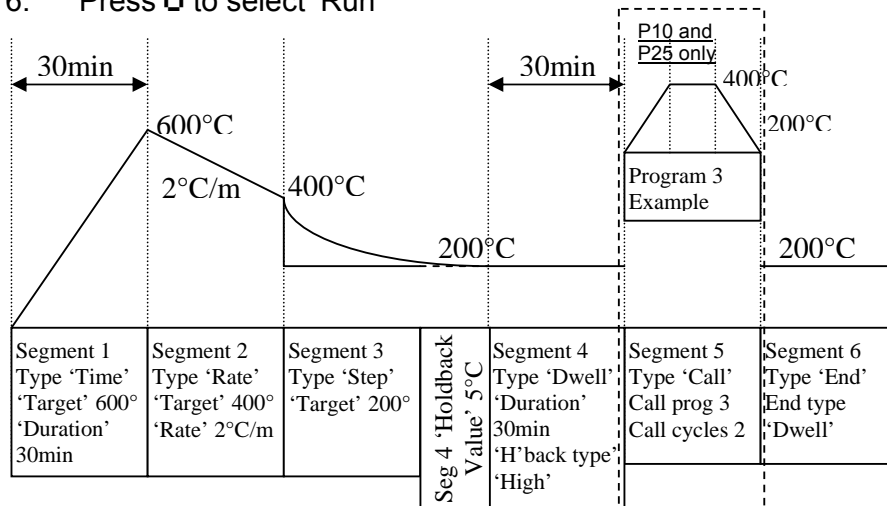
11. Press scroll **S** until Segment Type is displayed. Press up **U** or down **D** to select 'End'
12. Press scroll **S** until End Type is displayed. Press up **U** or down **D** to select 'Dwell'

Repeat the sequence to create a short program '3' as suggested in the diagram.

13. Press page **P** and scroll **S** together to return to the home display

To run the program either press RUN/HOLD or

14. Press page **P** until Program Status is displayed
15. Press scroll **S** until the cursor moves to the program status of 'Reset'
16. Press **U** to select 'Run'



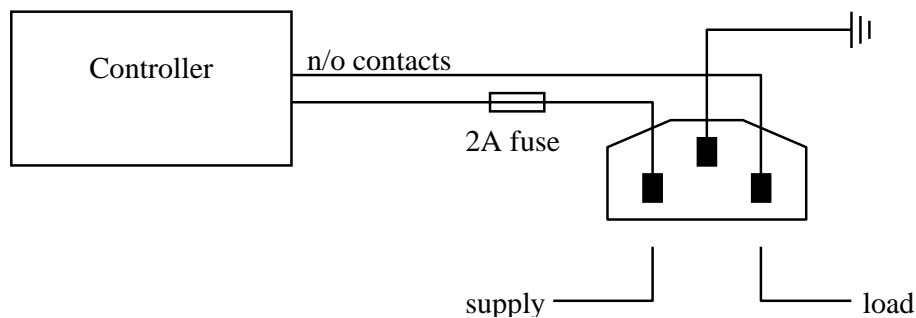
6.3 Comms Address

Typically the comms address is set to 1, but this can be changed. In the case of RS485 and multiple instruments it is necessary to set different addresses.

To change the address value access the level 2 list. In level 2 press the page key until the COMMS parameter is displayed. Press up **U** or down **D** to change the address value.

6.4 Alarm Option

When an alarm board is fitted with free contacts for customer use, the contacts are taken to a panel plug on the control panel, wired as indicated:

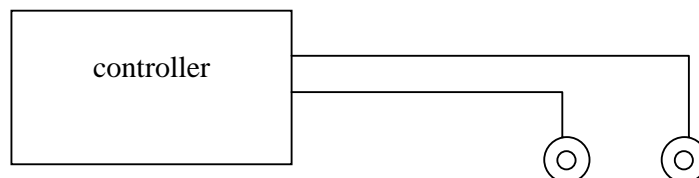


The purpose of the 2 amp fuse is to protect the internal circuitry from excess electrical current.

The instrument configuration, and parameters available to the operator, depend on the customer requirements.

6.5 Remote Input and Output (Analogue Communications)

When analogue communications are fitted, the contacts are taken to “banana plug” sockets on the control panel.



Controller configuration depends on customer requirements.

Remote input (when specified) may be switched on and off using the Remote setpoint enable parameter in the controller level 2, if this was made available for a particular application. In level 2 press page **F** until 'REM SP Enable' is displayed, press up **U** or down **D** to select SP1 (the normal controller setpoint) or SP2 (the remote input setpoint), 'SPX' will appear in the top left corner of the display.

Remote output does not require switching on and off.

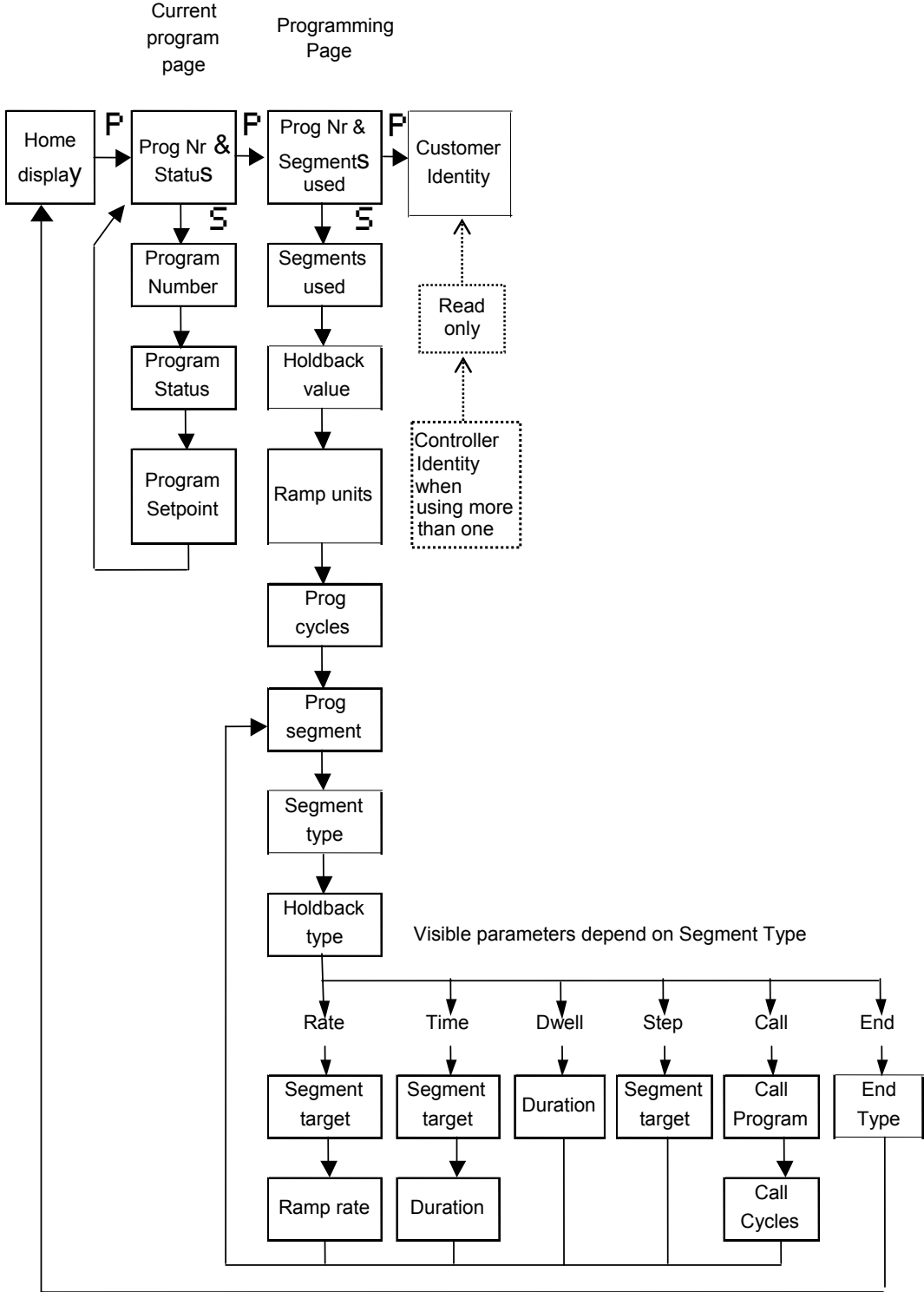
6.6 Program segment output

When the customer requirement is for program segment output, an extra parameter is revealed in the PROG list. For each program segment, after the segment type and settings, the parameter EVENT OUTS appears. This has values *on* and *off*. If the value is set to *on*, then the relay closes during the segment and a small 1 appears in the top left of the screen.

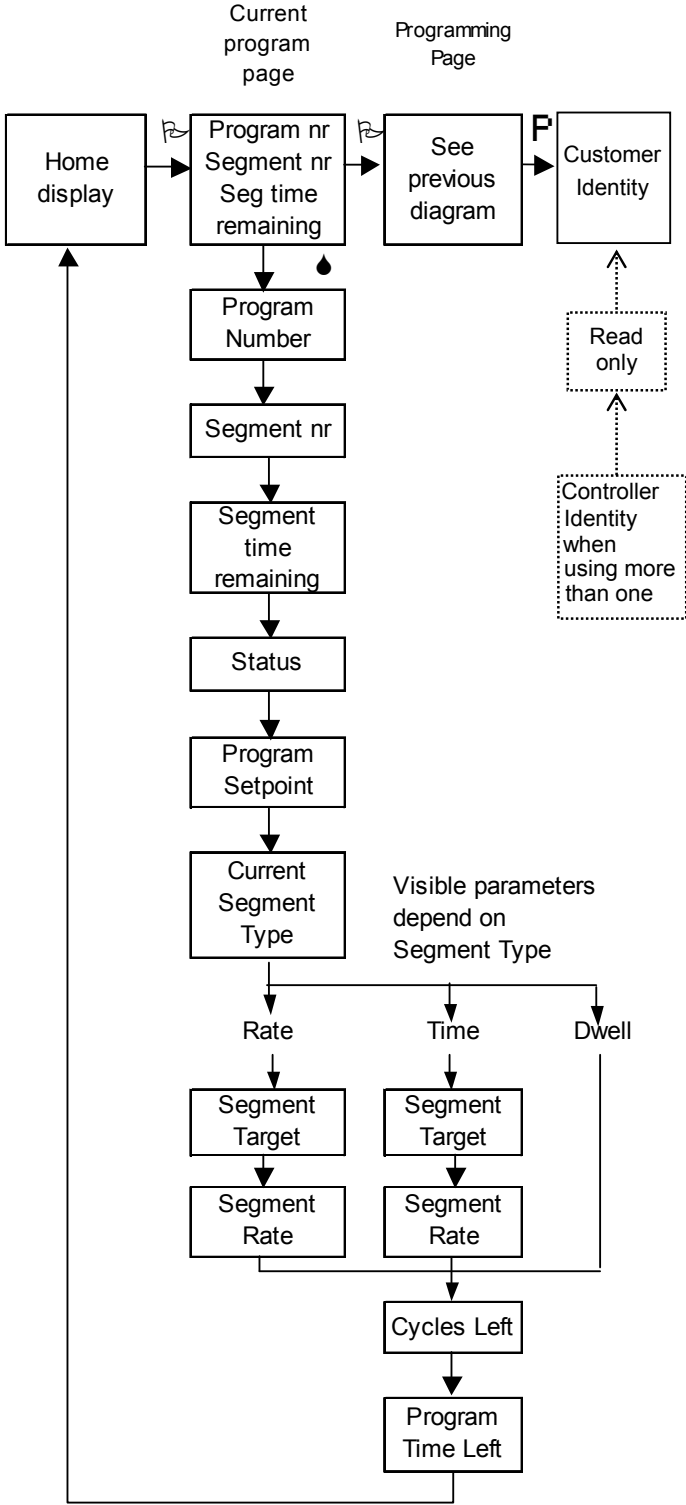
If more than one program segment output is fitted, then there are extra boxes depending on how many event outputs there are.

7 Navigation Diagrams

7.1 Operator Level 1 - No Program Running

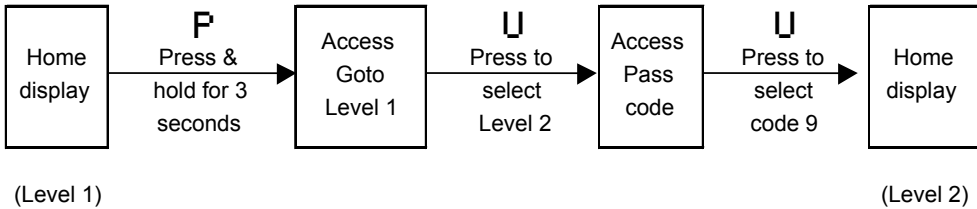


7.2 Operator Level 1 - Program Running

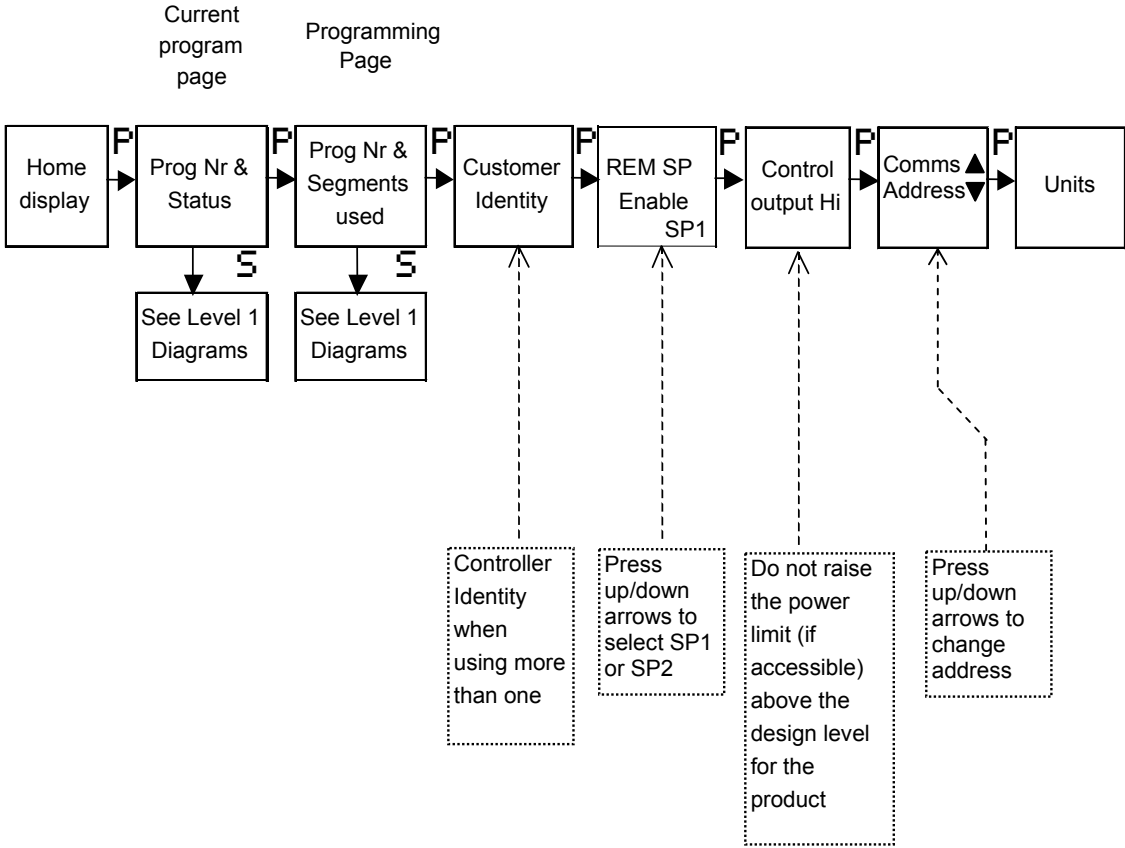


7.3 Supervisor Level 2

To enter Level 2



Level 2



8 Controller Fault

8.1 Fault Code Diagnostic Table

Error Code	Explanation	Actions
S.br	Temperature sensor failure	Replace the Furnace or Oven Temperature Sensor

9 Glossary of Terms

Home display	The first display of the controller screen, to which it returns when no keys are pressed.
PID	Proportional, Integral, Derivative: the control system used by the controller.
Parameter	A temperature or time value, or program action.
Segment	A program section in which a group of parameters are set.
Program	A pre-set sequence of segments to control temperature changes and time periods.
Measured temperature	The actual temperature of the furnace or oven.
Setpoint temperature (SP)	The target temperature when operating as a controller.
Program setpoint temperature (PSP)	The target temperature as a program proceeds.
Reset	A single action by the operator to stop a program running and return to simple controller mode.
Holdback	Holdback can be used to prevent the PSP from running ahead of the actual heating or cooling.
Ramp	The Program Setpoint temperature rises or falls over a period of time.
Rate	The rate; in degrees per second, min or hour, of the Program Setpoint temperature rise or fall.
Time	A set time period for the Program Setpoint temperature to rise or fall.
Step	An immediate rise or fall in the Program Setpoint temperature.
Dwell	Time period during which the PSP is fixed.
Call	Interrupts a program to run another program, then returns to continue
End	A segment type to end a program by either: Going into Reset and controlling to the SP. Or to Dwell at the last PSP value until Reset is pressed.
Element	The heating device used in the furnace or oven.
Thermocouple	The temperature sensing device used in the furnace or oven.
Furnace or Oven	This refers to the product purchased from Carbolite.

*For preventive maintenance, repair and calibration of all Furnace
and Oven products, please contact:*

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MC19-C -V1.07

5/6/07

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