

CARBOLITE

IGERO 30-3000°C

Installation, Operation and Maintenance Instructions Controller Manual 3508 Controller

3508 Controller

Contents

This manual is for guidance on the use of the Carbolite Gero product specified on the front cover. This manual should be read thoroughly before unpacking and using the furnace or oven. The model details and serial number are shown on the back of this manual. Use the product for the purpose for which it is intended.

1.0	3508 Controller	4
1.1	PID control	4
1.2	3508P1	4
1.3	3508P10	4
1.4	3508P25	4
1.5	Basic Operation	5
1.5.1	Controller Layout	6
1.5.2	Keys	6
1.6	Quick Start Guide	6
1.6.1	Operation as a simple controller	6
1.6.2	Changing the Setpoint	6
1.6.3	Resetting the programmer	7
1.6.4	Understanding User Levels	7
1.7	Setting Up Controller	8
1.7.1	Maximum output power setting	8
1.7.2	Customer ID.	8
1.7.3	Units	9
1.7.4	Language	9
1.8	Programming	9
1.8.1	Programming Notes	9
1.8.2	Holdback	10
1.8.3	Wait Segments	10
1.8.4	Program Cycling	11
1.8.5	Creating a Program	11
1.8.6	Running a Program	12
1.8.7	To pause (hold) a program	13
1.8.8	To stop and reset a program	13
1.8.9	To run a different program (P10 and P25)	13
1.8.10	Program Status	13
1.8.11	Program Hold with Holdback	14
1.8.12	Power Failure Recovery	14
1.8.13	Alarms	15
1.8.14	Program Example 1	15
1.8.15	Program Example 2	17
1.9	Controller Options	19

1.9.1	Digital Communications - RS232	19
1.9.2	Digital Communications - RS485	19
1.9.3	Comms Address	19
1.9.4	Alarm Option	20
1.9.5	Remote Input and Output (Analogue Communications)	20
1.9.6	Program segment output	21
1.10	Temperature Controller Replacement	21
1.11	Controller Navigation Diagrams	21
1.11.1	Operator Level 1 - No Program Running	21
1.11.2	Operator Level 1 - Program Running	23
1.11.3	Supervisor Level 2	23
2.0	3508 Dual Loop Cascade Control (if fitted)	25
2.1	Principle of Cascade Control	25
2.2	Operation of Cascade Control	25
2.3	Bypassing Cascade Control	29
2.4	3508P1 Element Loop (Loop 2)	29
2.5	Caution	29
2.6	Over-Temperature Control	29

1.0 3508 Controller

1.1 PID control

This controller uses PID (Proportional Integral Derivative) temperature control. This type of control uses a complex mathematical control system to adjust the heating power and achieve the desired temperature.

1.2 3508P1

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

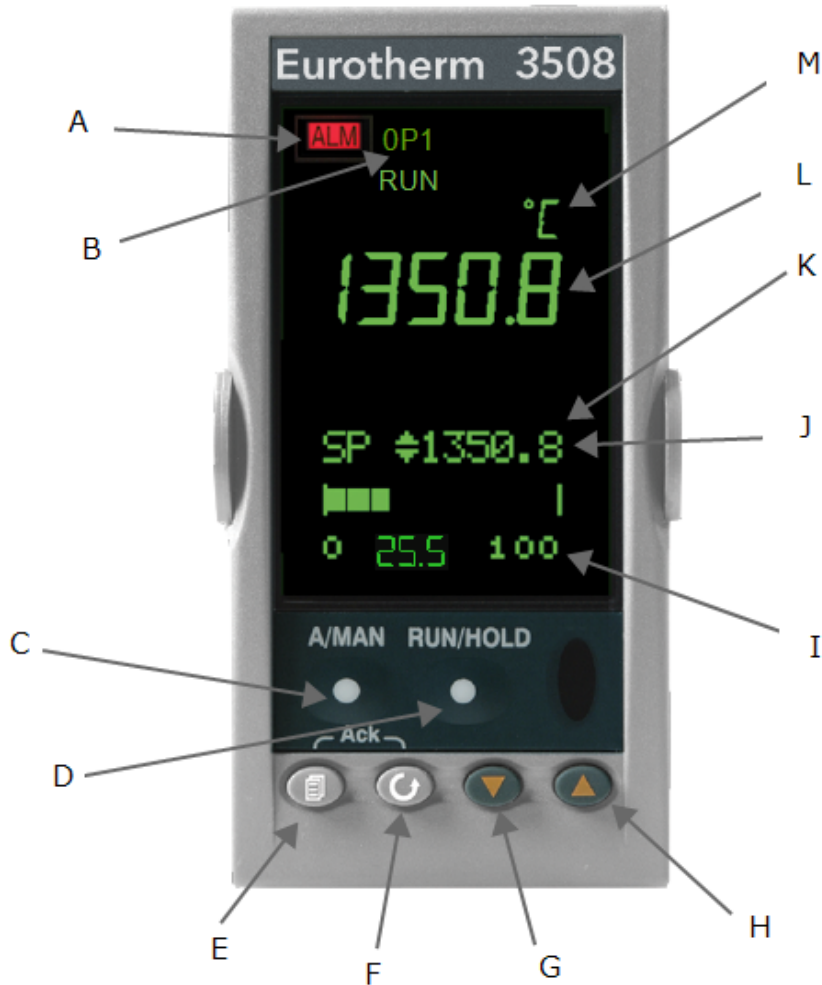
1.3 3508P10

The 3508P10 is a digital 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 operated 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.

1.4 3508P25

The 3508P25 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 3508P25 could store 10 programs with 50 segments or 25 programs with 20 segments. Programs can be operated 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.

1.5 Basic Operation



Key	
A	Alarm Indicator
B	Power Output Indicator
C	Not Used
D	Runs, Holds, Resets the current program
E	Page
F	Scroll
G	Down
H	Up
I	Power Output Percentage
J	Program Setpoint Temperature (PSP) when a program is running
K	Setpoint Temperature (SP) when basic controlling
L	Measurement Temperature

M	Measurement Units
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1.5.1 Controller Layout

1.5.2 Keys

A/ Man	-	Disabled
RUN/ HOLD	-	Runs, Holds or Resets the current program. Hold down for 3 seconds to Reset.
Page Key		Scrolls through the page headings. Hold down for 3 seconds to access further levels, pass codes are required.
Scroll Key		Scrolls through parameters listed on pages.
Arrow Keys		Adjust parameter values.
Page and Scroll together		Press together to return to the home display or to acknowledge an alarm.
Page and Up together		Press together quickly to scroll back up the page headings.
Scroll and Up together		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.

1.6 Quick Start Guide

1.6.1 Operation as a simple controller

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

The controller will immediately attempt to reach the set temperature and maintain it. This will cause the product to heat as quickly as possible which may not be appropriate where the product contains sensitive ceramic components. For products with ceramic components, e.g. a tube furnaces fitted with a long ceramic work tube, use the ramp rate feature set with a low heating rate such as 5°C per minute (300°C per hour), to prevent damage.

1.6.2 Changing the Setpoint

Press up or down 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.

This will cause the product to heat as quickly as possible which may not be appropriate where the product contains sensitive ceramic components. For products with ceramic components, e.g. a tube furnaces fitted with a long ceramic work tube, use the ramp rate feature set with a low heating rate such as 5°C per minute (300°C per hour), to prevent damage.

1.6.3 Resetting the programmer

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

Operating the current program

- To avoid unwanted heating at the end of a program, set the SP temperature to zero before operating 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 twice, 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 operating.

- 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.
- Turn power to the elements down to zero.





1.6.4 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 is not protected by a security code. There are 3 pages at this level. Page 1, Customer Identity, can only be altered in level 2. Page 2 shows the current program status. Page 3 is for writing and viewing programs.



Level 2 (Supervisor) requires a security code to enter, but once enable, provides access to additional parameters. A further 4 pages are accessible in this level as follows; Home , Customer identity, Control Output Hi percentage, Units.

To Enter Level 2:

1. Press and hold page  for 3 seconds. The display will show "Access Goto Level 1"
2. Press up  to select level 2. After a short pause the display will show "Access Pass code".
3. Press up  or down  to enter the pass code. 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  for 3 seconds. The display will show "Access Goto Level 2."
2. Press down  to go to level 1. After a short pause the display will revert to home, the controller is now in level 1.

1.7 Setting Up 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 "Controller Navigation Diagrams".

1.7.1 Maximum output power setting

Press page  until "Control Output Hi" is displayed. Press up  or down  to adjust the value.




Depending on the product model, the maximum power output setting may be accessible or locked.

For silicon carbide heated products the parameter is accessible to allow compensation for element ageing.




In many models the maximum power output setting depends on the electrical supply voltage, refer to section 1.0.

1.7.2 Customer ID.

A product 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  until "Customer Identity" is displayed. Press up  or down  to select a number.

1.7.3 Units

Press page  until "Units" is displayed. Press up  or down  to select:

C	Celsius
F	Fahrenheit
K	Kelvin

1.7.4 Language

The text on the 3508 Controller 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.

1.8 Programming

1.8.1 Programming Notes

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

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

To avoid unwanted heating at the end of a program, set the controller setpoint temperature to zero before operating 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 four ways:

1. With 'End' segment set to S.OP the power to the elements is turned down to 0%, no matter what the 'Setpoint' temperature is.
2. With 'End' segment set to 'Reset' and the 'Setpoint' temperature turned down to zero, power to the elements will be 0%. To do this set the 'Setpoint' temperature to the minimum possible. For type B thermocouples this will be below zero.
3. With the 'End' segment set to 'Reset'. The controller will try to reach and maintain the 'Setpoint' temperature in place before the program started.
4. With the 'End' segment set to 'Dwell'. The controller will dwell at the 'PSP' of the last segment ("RUN" indicator flashes), until it is reset.

To reduce the number of segments in a program, change the last required segment to an 'End' type.

You will be asked to press  to cancel or  for OK.





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

To alter parameters or segments of an operating program, this program must be held or reset. Press RUN/ HOLD to pause the program, or press RUN/ HOLD for 2 seconds to reset.

1.8.2 Holdback

Holdback can be used to prevent the program from operating 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  twice, press scroll  until 'Holdback Value' appears and press up  or down  to set.

Holdback can be used in 'Rate', 'Time' and 'Step' 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.

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 switched off

To set the holdback type, press page  twice, then press scroll  until the display shows 'Holdback Type' for each segment and press up  or down  to set.

The default setting for holdback is 'OFF'.

1.8.3 Wait Segments

Wait prevents the program proceeding to the next segment, in a similar way to holdback, until the selected 'Wait-For' parameter has been met. There are 5 'Wait For' parameters. The first 4 only work if there are configured inputs to the controller.

1. PrgIn1 Wait until Input 1 is true
2. PrgIn2 Wait until Input 2 is true
3. PrgIn 1&2 Wait until Inputs 1 AND 2 are true
4. PrgIn 1or2 Wait until Inputs 1 OR 2 is true
5. PVWaitIP Wait until the measured temperature reaches a threshold value before continuing. It can operate in one of 4 ways:
 1. 'Abs Hi' Wait until the measured temperature is greater than or equal to a value 'WaitVal' set for that segment.
 2. 'Abs Lo' Wait until the measured temperature is less than or equal to a value 'WaitVal' set for that segment.





3. 'Dev Hi' Wait until the measured temperature exceeds a fixed* threshold by an amount 'WaitVal' set for that segment.
4. 'Dev Lo' Wait until the measured temperature drops below a fixed* threshold by an amount 'WaitVal' set for that segment.

* The fixed threshold used by deviation parameters is set in the configuration level of the programmer and if required should be requested when purchasing a product from Carbolite Gero.




1.8.4 Program Cycling

The 'Cycles' parameter sets the number of times the program will operate.

The default setting is 1 cycle.

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




1.8.5 Creating a Program

From the home display, press page  three times to get to the programming page, the display will show "ProgEdit   1".

Program number


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

Holdback Value




Press scroll  until the display shows 'Holdback Value". If required: Press up  or down  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 until the display shows 'Ramp Units'.


Press up  or down  to select the ramp units of degrees per Hour, Min or Sec.

Number of program cycles




Press scroll  until the display shows 'Cycles'. Press up  or down  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  until the display shows 'Segment Type'. Press up  or down  to select 'Rate', 'Time', 'Dwell', 'Step', 'Wait', 'GoBack', 'Call' or 'End'.




Holdback Type

Press scroll  until the display shows 'Holdback Type'. If required, press up  or down  to select 'Off', 'Low', 'High' or 'Band'.




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

Press scroll  until the display shows 'Target SP'. Press up  or down  to set a value.




Ramp Rate (Visible only for Rate segments)

Press scroll  until the display shows 'Ramp Rate'. Press up  or down  to set the number of degrees per 'Ramp Unit' as set above.



Duration (Visible only for Time and Dwell segments)

Press scroll  until the display shows 'Duration". Press up  or down  to set a value.

Wait For (Visible only for Wait segments)

Press scroll  until the display shows 'Wait For'. Press up  or down  to select: PrgIn1, PrgIn2, PrgIn1In2, PrgIn1orIn2, PVWaitIP.


GoBack to segment number (visible only for GoBack segments)

Press scroll  until the display shows 'GoBack Seg'. Press down  to select a segment number to go back to.




GoBack Cycles (visible only for GoBack segments)

Press scroll  until the display shows 'GoBack Cycles'. Press up  or down  to set a value.





Call Cycles (Visible only for call segments)

Press scroll  until the display shows 'Call Cycles'. Press up  or down  to set a value.

End Type (Visible only for End segments)

Press scroll  until the display shows 'End Type'. Press up  or down  to select: 'Reset', 'Dwell' or 'SafeOp'.


1.8.6 Running a Program


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

1.8.7 To pause (hold) a program

Press RUN/HOLD

or

Press page  until 'Program Status Reset' appears

Press scroll  until the cursor moves to 'Reset'

Press up  or down  to select 'Hold'

RUN/HLD will be displayed



1.8.8 To stop and reset a program

Press and hold RUN/HOLD

or

Press page  until 'Program Status Reset' appears

Press scroll  until the cursor moves to 'Reset'

Press up  or down  to select 'Reset'

1.8.9 To run a different program (P10 and P25)

To select a program


Press page  until 'Program Status Reset' appears


Press scroll  then up  or down  to select a program number

To operate the program

Press RUN/HOLD

or

Press scroll  until the cursor moves to 'Reset'

Press up  or down  to select 'Run'


Run will be displayed

1.8.10 Program Status


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








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

To see more detail:

Press page  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  key while a program is operating will reveal additional information:

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

1.8.11 Program Hold with Holdback

If a holdback value has been set and the program goes into a hold state, the green HLD indicator will flash until the measured temperature catches up.

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, other programs can be created or changed whilst the current program is operating.

1.8.12 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 failure during ramp segments: The ramp rate will be that of the current ramp segment.
- Power failure 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 failure 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.

1.8.13 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 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  and  together.

1.8.14 Program Example 1

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

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

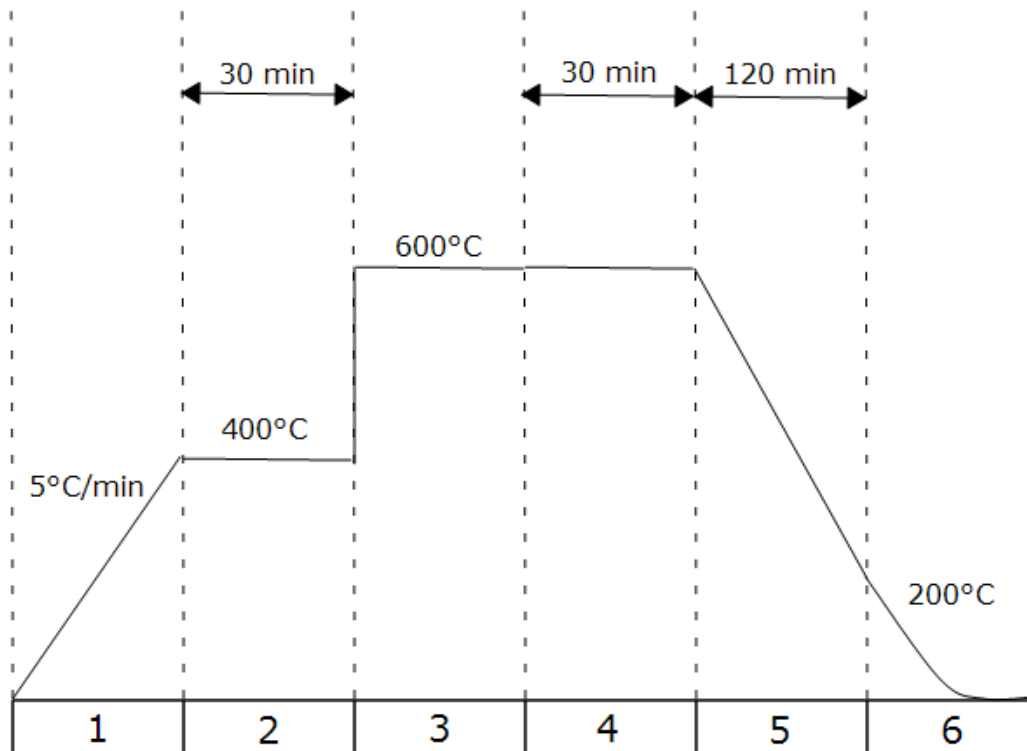
11. Press scroll  until 'Segment Type' is displayed. Press up  or down  to select 'End'
12. Press scroll  until 'End Type' is displayed. Press up  or down  to select 'Reset'
13. Press page  and scroll  together to return to the home display.
To run the program either press RUN/HOLD or:
14. Press page  until 'Program Status' is displayed
15. Press scroll  until the cursor moves to the program status of 'Reset'
16. Press  to select 'Run'.

Time Display Examples

10:05:3 Min/Sec/10th Sec

21:10:05 Hour/Min/Sec










196:10 Hour/Min



Segment					
1	2	3	4	5	6
Type 'Rate'	Type 'Dwell'	Type 'Step'	Type 'Dwell'	Type 'Time'	Type 'End'
Target 400°C	Duration 30 min	Target 600°	Duration 30 min	Target 200°	End Type 'Reset'
Rate 5.0°/Min				Time 120 min	

1.8.15 Program Example 2












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

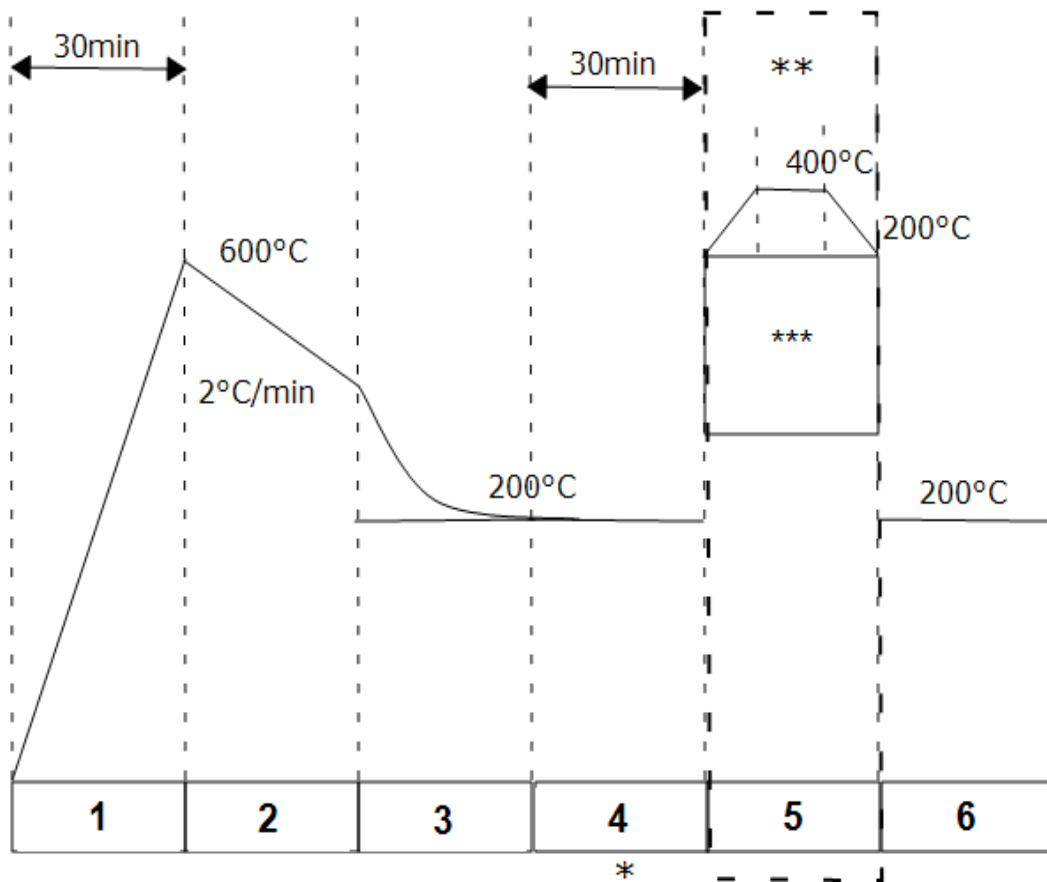
1. Turn the 'Setpoint' to '0' by pressing down ▼
2. Press page  until 'Prog Segments Used' is displayed. On P10 and P25 models press up ▲ or down ▼ to select a new program number, (a program with only 1 segment).
3. Press scroll  until 'Holdback Value' is displayed. Press up ▲ or down ▼ to set to '5' degrees
4. Press scroll  until 'Ramp Units' is displayed. Press up ▲ or down ▼ to set to 'Min'
5. Press scroll  until 'Cycles' is displayed. Default '1'
6. Press scroll  until 'Segment 1' is displayed
7. Press scroll  until 'Segment Type' is displayed. Press up ▲ or down ▼ to select 'Time'
8. Press scroll  until 'Holdback Type' is displayed. Default 'Off'
9. Press scroll  until 'Target SP' is displayed. Press up ▲ or down ▼ to set to '600' degrees
10. Press scroll  until 'Duration' is displayed. Press up ▲ or down ▼ 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  until 'Segment Type' is displayed. Press up  or down  to select 'End'
12. Press scroll  until 'End Type' is displayed. Press up  or down  to select 'Dwell'
Repeat the sequence to create a short program '3' as suggested in the diagram.
13. Press page  and scroll  together to return to the home display
To operate the program either press RUN/HOLD or
14. Press page  until 'Program Status' is displayed
15. Press scroll  until the cursor moves to the program status of 'Reset'
16. Press  to select 'Run'



Segment					
1	2	3	4	5	6
Type 'Time'	Type 'Rate'	Type 'Step'	Type 'Dwell'	Type 'Call'	Type 'End'
Target 600°C	Target 400°C	Target 200°C	Duration 30 min	Call prog 3	End Type 'Dwell'

Duration 30min	Rate 2°C/min		H back type 'High'	Call cycles 2n	
			* Segment 4 'Holdback Value' 5°C	** P10 and P25 only	
				*** Program 3 Example	

1.9 Controller Options

As options can be ordered in a variety of combinations and for a variety of purposes, exact instructions are not given here. The full Eurotherm manual may be required to determine customer parameter settings. To reveal or hide parameters in the controllers it is necessary to go into configuration mode, a security code is needed. Please consult Carbolite Gero.

1.9.1 Digital Communications - RS232

If the RS232 option is supplied, the furnace is fitted with one sub-miniature D-socket connected to the controller comms module. RS232 is suitable for direct connection to a personal computer (PC) using a "straight through" cable as follows (the linked pins at the computer end are recommended but may not be necessary). The cable is usually 9-pin at the furnace end and 9-pin at the computer, but other alternatives are shown in parentheses.

Product end of cable female (25-pin) 9-pin			RS232 Cable: product to PC	Computer end of cable 9-pin (25-pin) male		
Rx	(2)	3	_____	3	(2)	Tx
Tx	(3)	2	_____	2	(3)	Rx
Com	(7)	5	_____	5	(7)	Com
				7,8	(4,5)	Link together
				1,4,6	(6,8,20)	Link together

1.9.2 Digital Communications - RS485

If an RS485 option is supplied, the furnace is fitted with two D-sockets. Connection between products is by "straight" cable as follows:

Product end of cable female (25-pin) 9-pin			RS485 Cable: product to PC	Computer end of cable 9-pin (25-pin) female		
-	(2)	3	=====	3	(2)	Tx
+	(3)	2		2	(3)	Rx
Com	(7)	5	_____	5	(7)	Com

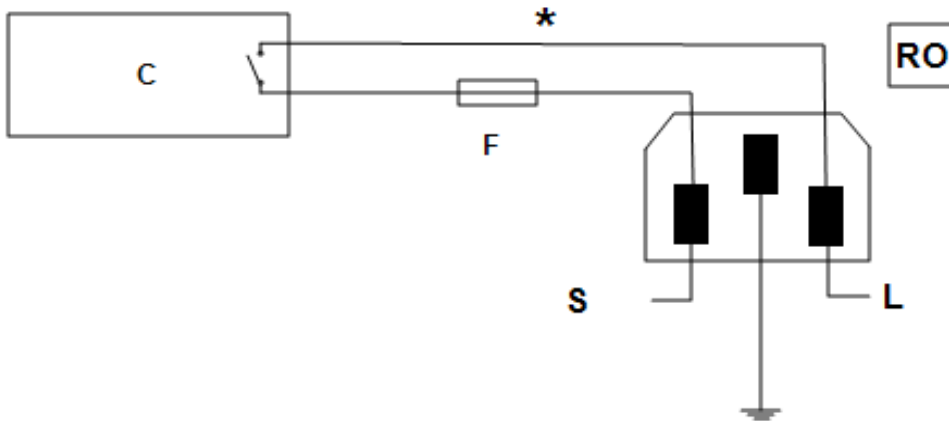
1.9.3 Comms Address

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 ▲ down ▼ to select the address value.

1.9.4 Alarm Option

When an alarm board is fitted, which consists of a relay with voltage free contacts, for operator use, the contacts are taken to a panel plug on the control panel, wired as indicated:



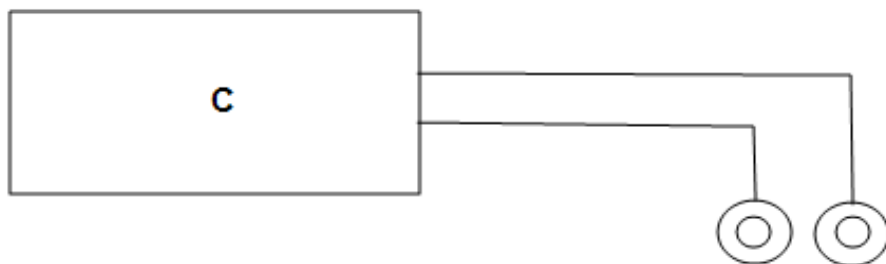
Key	
C	Temperature Controller
F	Fuse (2A)
S	Supply
L	Load
*	Normally open relay contacts
RO	Relay Output 240V 2A MAX

The purpose of the 2 amp fuse is to break the circuit to prevent overloading on the circuit due to high voltage.

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

1.9.5 Remote Input and Output (Analogue Communications)

When analogue communications are fitted, the contacts are taken to insulated terminal sockets on the control panel.



Key	
C	Controller

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 [key] until 'REM SP Enable' is displayed, press up ▲ or

down ▼ 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.

1.9.6 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.

1.10 Temperature Controller Replacement



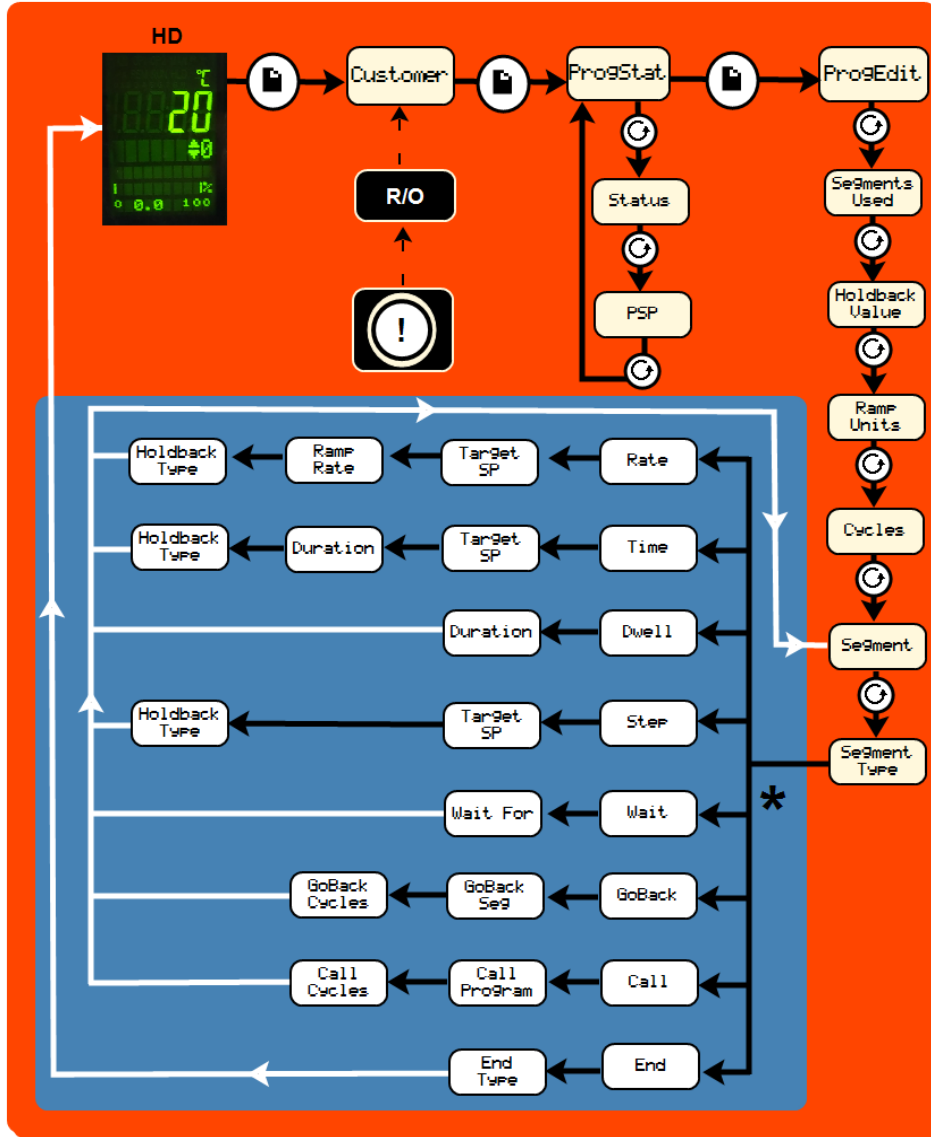
Before handling the controller: wear an anti-static wrist strap or otherwise avoid any possibility of damage to the unit by static electricity. Refer to the detailed instructions supplied with the replacement controller.

Ease apart the two lugs at the side; grip the instrument and withdraw it from its sleeve; push in the replacement.

1.11 Controller Navigation Diagrams

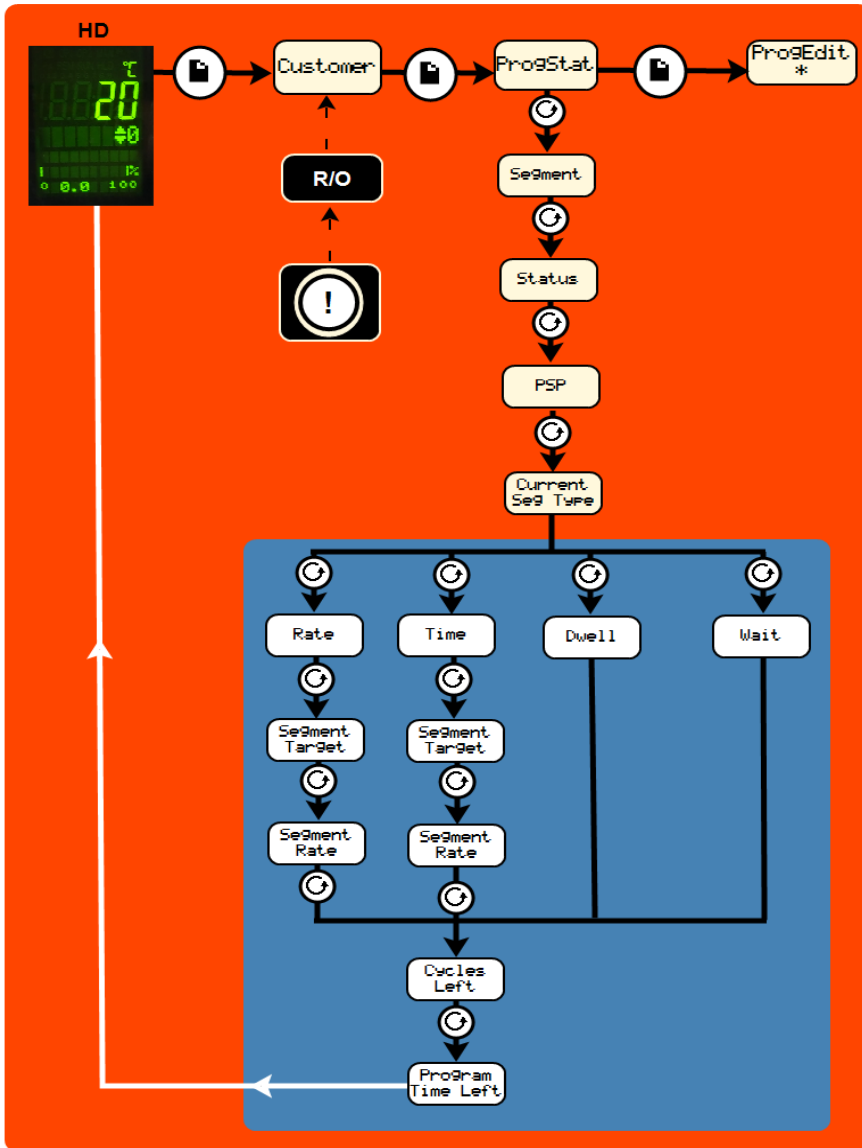
The following diagrams detail how to navigate to the various menu options within the 3508 Controller. At each option, values can be set using the arrow keys.

1.11.1 Operator Level 1 - No Program Running



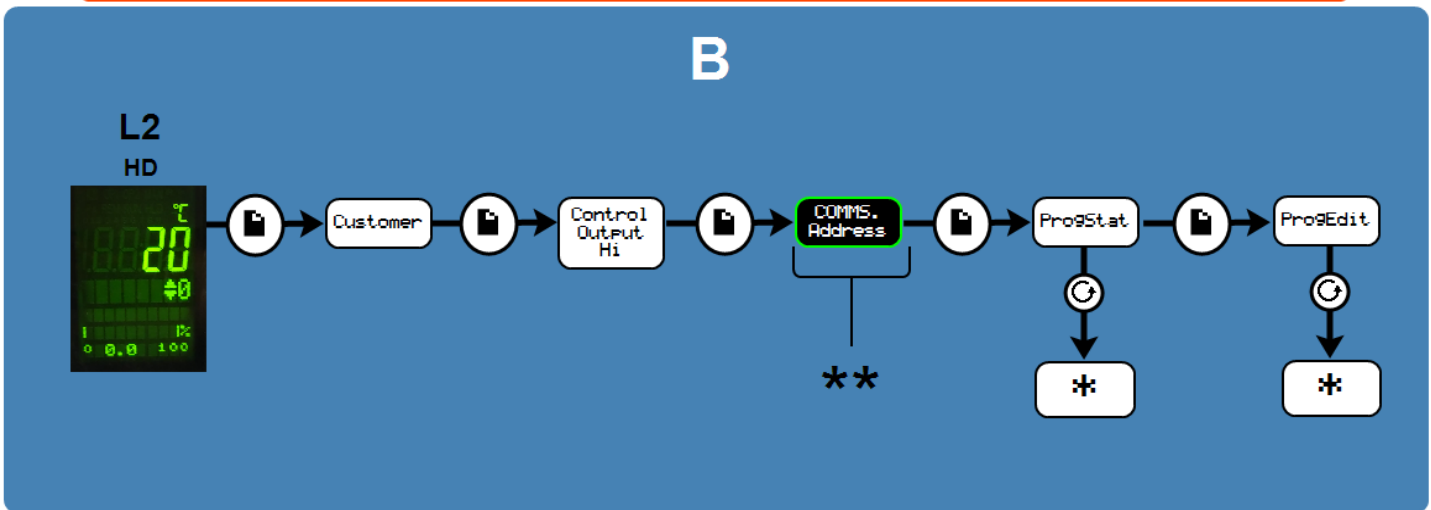
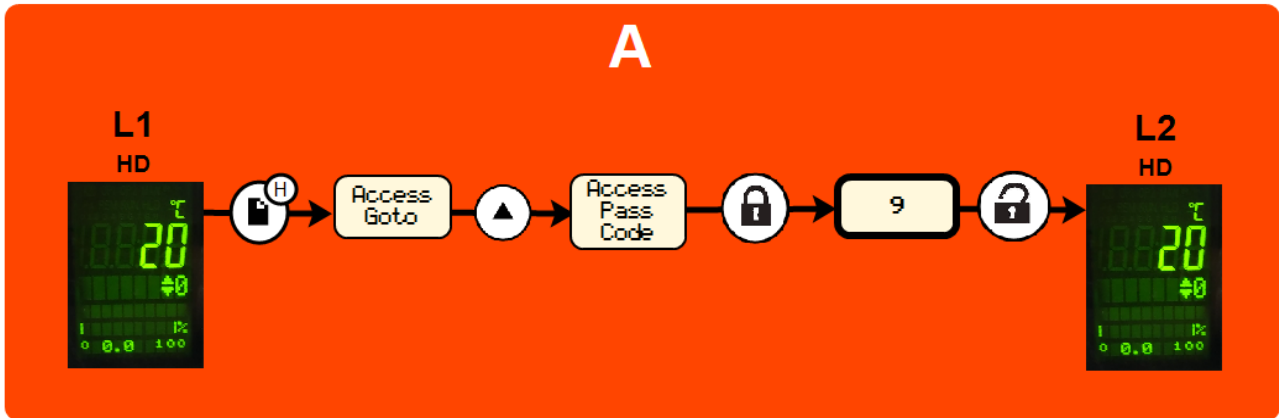
HD	Home Display		Controller identity when using more than one controller
R/O	Read Only		Black = Progress
	Page Key		White = Return
	Scroll Key	*	Visible Parameters depend on the Segment Type

1.11.2 Operator Level 1 - Program Running



HD	Home Display		Controller identity when using more than one controller
R/O	Read Only		Black = Progress
	Page Key		White = Return
	Scroll Key	*	See previous diagram: Operator Level 1- No Program Running

1.11.3 Supervisor Level 2



A	To enter Level 2		Scroll Key		Arrow Key
B	Level 2		Locked before Pass Code entered		
L1	Level 1 Home Display		Unlocked		
L2	Level 2 Home Display		Black = Progress		
	Page Key		See previous diagram: Operator Level 1- No Program Running		
	Hold Page Key for 3 seconds	**	If configured		

2.0 3508 Dual Loop Cascade Control (if fitted)

2.1 Principle of Cascade Control

When cascade control is fitted, the Load Loop 3508 senses the temperature of the workload, and the Element Loop 3508 senses the element temperature. Depending on the oven or furnace model, the Load Thermocouple may be in a fixed position, or may be movable. The Element Thermocouple is fixed in a predetermined position near the heating elements. The Load Thermocouple should be placed as near as possible to the work to be heated.

The Load Loop communicates with the Element Loop, calling for heat according to the load temperature and the current program or set point. The Element Loop regulates the heat according to element temperature and the requests from the Load Loop.

The element temperature could, in principle, vary between the furnace or oven maximum and minimum, regardless of the working temperature of the load. In practice, the cascade control system is configured to limit the element temperature to a band around the load temperature, typically of $\pm 10\%$ of the set-point temperature.

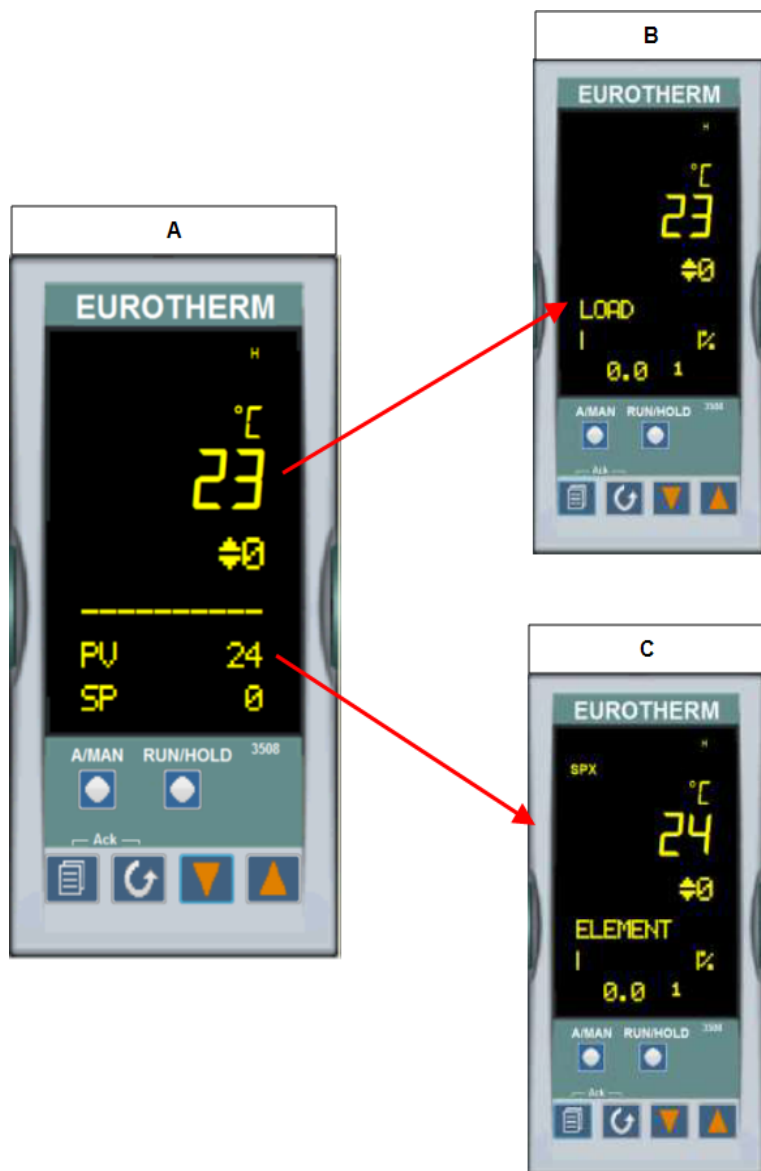
The set point of the load loop, shown at the top of the display, can be adjusted by the operator. The Element Loop, shown at the bottom of the display, should not be adjusted by the operator & will automatically regulate the element temperature to achieve the Load set temperature.

In a three-zone furnace for which the "three zone cascade" option has been ordered the centre zone is a 3508 Dual Loop & separate end zone controls are fitted. The operator sets the Load loop set point on the 3508 centre zone. The end zone controllers work automatically & need no adjustment by the operator.

2.2 Operation of Cascade Control

The operator may ignore all the complications of the system, and program the Load Loop according to the standard instructions for that controller. The home display shows the load loop at the top of the display and the Element loop at the bottom. By pressing the page key, separate views of load and element loops will be shown.

Key	
A	Home Display View
B	Load Loop View
C	Element Loop View



The Element Loop should never be adjusted. Note that the elements usually run at a higher temperature than the load.

Because the details of the customer's cascade application (in particular the nature of the load) are generally not known, the feed forward parameter (FF Trim) is made easily accessible in level 2 (Refer to instrument operating instructions). Its default setting is 2%. If overshoot of the load temperature occurs – often a problem at low temperatures – then FF Trim can be reduced in order to limit the amount of overshoot. However, if FF trim is reduced too much, the load may not reach the desired temperature. If the load does not reach the desired temperature or is slow in the final stages, FF Trim can be increased: a maximum of 10% is suggested.



Feed Forward View

When attempting to control at very low temperatures it can become a problem to achieve stable control because of excessive power being supplied during heating. The available power can be limited using the power limit parameter OP.Hi, make a note of the original settings before adjusting. For power settings please refer to the fuse and power section at the back of the manual. If the parameter is normally set to 100%, try initially setting it to 50% to improve stability. Avoid settings below 40% where possible (though some furnaces require low settings for reasons unconnected with cascade control).



Power Limit View

2.3 Bypassing Cascade Control

This applies where the Control Thermocouple is a removal probe (e.g. in a tube furnace), or where for other reasons it may be required to operate the furnace or oven directly from the Element Loop.

To operate without Cascade Control the load thermocouple has to remain connected at all time; or a link has to be made across the thermocouple input connections.

2.4 3508P1 Element Loop (Loop 2)

In these circumstances the Element Controller is configured with the local/remote parameter, accessible in level 2 (Refer to instrument operating instructions).

To switch cascade control on or off. In Level 2, press Scroll until the display shows L-r.

Using the up ▲ down ▼ set:

- *SP2* = cascade control on
- *SP1* = cascade control off

The top left hand side of the screen will show *SPX* when *SP2* is enabled. The instrument operates as an independent Programmer/Controller when L-r is set to *SP1*. To return to cascade control, change the L-r parameter to *SP2*. Also note that cooling at low temperatures takes longer per degree than it does at high temperatures.

2.5 Caution



If the Load Thermocouple is removable, leave it in the furnace or oven chamber whenever possible. Operating with the Cascade Control active and with the Load Thermocouple in an unheated position (such as lying on the work bench) may cause the furnace or oven to heat up to its maximum temperature, wasting power and possibly shortening element life.

2.6 Over-Temperature Control

Where over-temperature control is fitted, it normally protects against failure of the control system or of a component such as a power control relay. The over-temperature controller must be set at a level higher than the greatest element temperature, typically 15 °C above maximum.

If the working temperature is less than the maximum temperature, then it may be possible to set the over-temperature limit as follows:

$$\text{working temperature} + (\text{maximum temperature} \times \text{FF}/100) + 15 \text{ °C}$$

where FF is the Feed Forward percent parameter value (e.g. 10)

Example: for working at 800 °C in a 1200 °C product, the over-temperature limit could be set to $800+120+15=935$.

ProductLabel

The products covered in this manual are only a small part of the wide range of ovens, chamber furnaces and tube furnaces manufactured by Carbolite Gero for laboratory and industrial use. For further details of our standard or custom built products please contact us at the address below, or ask your nearest stockist.

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