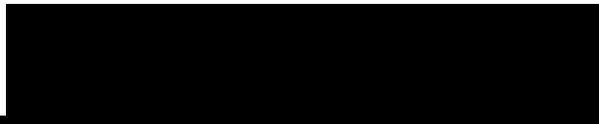# CARBOLITE GERO 30-3000°C

Installation, Operation and Maintenance Instructions

Controller Manual
301 Controller

301 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.

CARBOLITE
GERO **30-3000°C**

1.0   301 Controller

Due to the complex nature of the 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".

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   Basic Operation of the 301 Controller
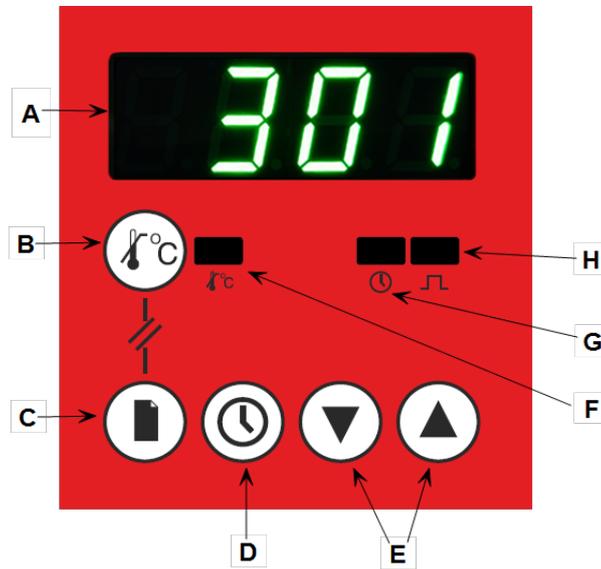
	Key	Description
A	Display	
B	Over-Temperature Key (if fitted)	The Over-Temperature key is used to access the over-temperature menu. Note: Over-Temperature is an option.
C	Page Key	The Page key is used to scroll through the parameters and switch between menus.
D	Timer Key	The Timer key is used to start, view, pause and reset the timer.
E	Arrow Keys	The Arrow keys are used to adjust the value of the selected parameter and pause the output power.
F	Over-Temperature Indicator (if fitted)	The Over-Temperature indicator shows green in normal use. It flashes red when over-temperature is triggered and is constantly red when over-temperature is reset and waiting for the temperature to drop.

G	Timer Indicator	The Timer indicator shows when the timer is active.
H	Output Indicator	The Output indicator shows when the controller is switching on the heating elements.

1.2.1   Menu System

The 301 Controller is divided into two menus; the Home Menu and the Setup Menu. The Home Menu contains all the basic operating controls: setpoint, setpoint ramp rate and timer time. The Setup menu contains all the set up features: timer type, timer band, output power and customer calibration. The features available vary depending on operator input or product specification.

1.2.2   Navigation Diagram

The following diagram details how to navigate to the various menu options within the 301 Controller. At each option, values can be set using the arrow keys.

CARBOLITE GERO 30-3000°C

HM — 301

OTHM

OtLimit → Ot

PU → CLSt

OTSM

SM

SP°C
SPrr
t1

ttYP → tbnd
OPHi
CLSt

FAct
PASS → S2S

CCL1
CCL2
FAct

OFSt

CALL
OFSL
CALH
OFSH
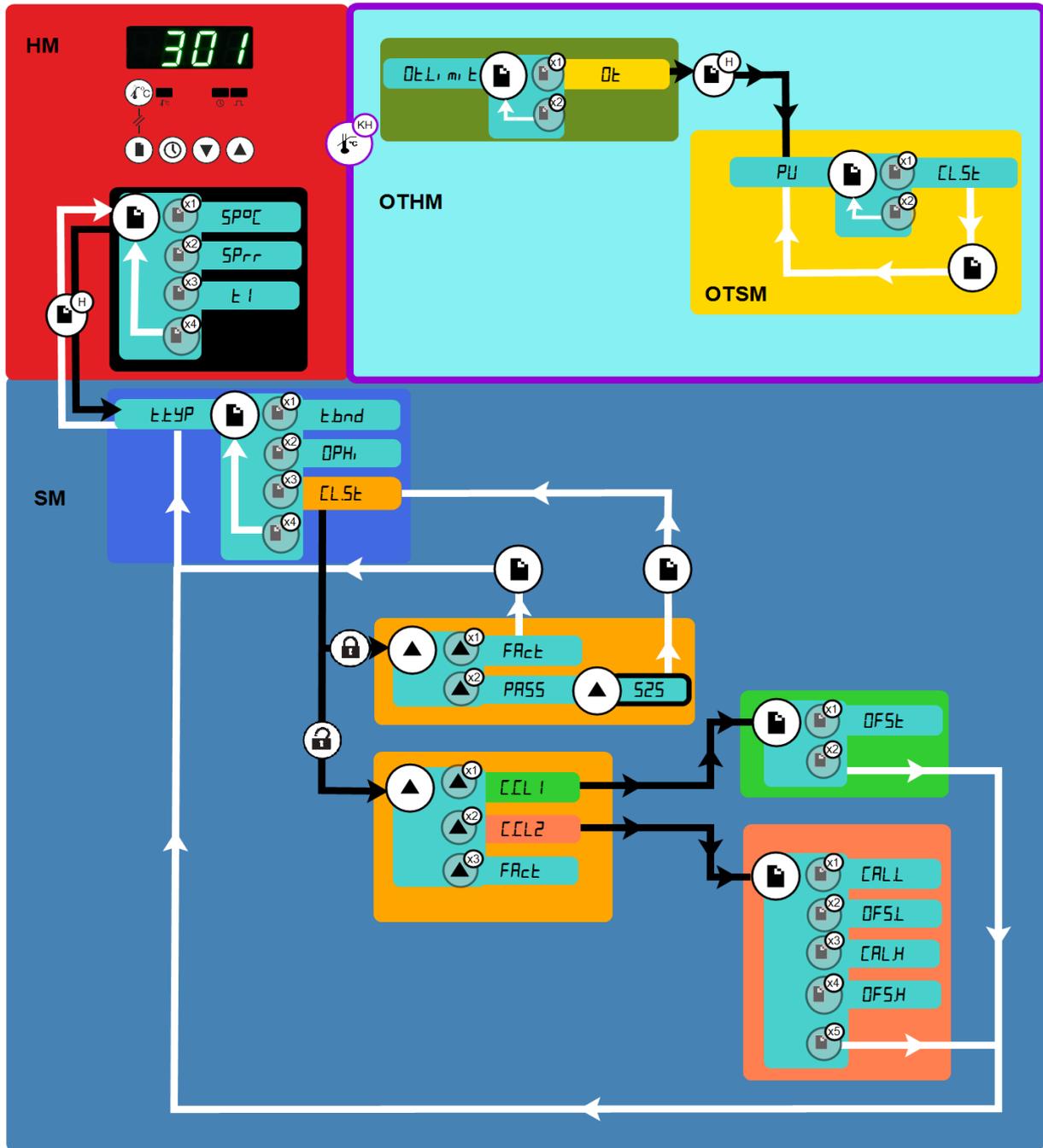
HM	Home Menu		Page Key		Black = Progress
SM	Setup Menu	H	Hold for 1.5 seconds		White = Return
OTHM	Over-Temperature Home Menu	KH	Keep Held		
OTSM	Over-Temperature Setup Menu	x1	Press Page Key multiple times		

Please note that the Over-Temperature Menu is only available when the Over-Temperature Protection option is fitted.

1.2.3 Basic Function Guide

|	
HOLd	Used to pause the current program and set new parameters.
SP°C	Used to set the desired temperature (setpoint) of the product (°C).
SPrr	Used to set the heating rate of the product, e.g. increase by 5°C per minute.
t1, t2, t3, t4, t5	Indicates the timer type in use. See section 1.5 for more details.
ttYP	Used to set the timer type.
tbnd	Available when t1 or t4 is in use. Allows the timer to start the countdown before the desired setpoint is reached.
rSt	Used to reset the timer.
OPHi	Used to set the maximum output power.
CL.St	Used to set the customer calibration type.
FAct	Used to select the factory calibration settings.
PASS	Flashes when a password is required to access further options.
CCL1	Select to access the single point calibration option.
CCL2	Select to access the dual point calibration options.
OFSt	Used to set the single point calibration offset temperature (°C).
CALL	Used to set the low temperature point (°C) for dual point calibration.
CALH	Used to set the high temperature point (°C) for dual point calibration.
OFSL	Used to set the offset value for the low temperature point (°C) for dual point calibration.
OFSH	Used to set the offset value for the high temperature point (°C) for dual point calibration.
Ot	Used to set the Over-Temperature limit (°C).
Ott	Displayed when the Over-Temperature protection has been activated.
PU	Displayed before the current temperature when checking the Over-Temperature sensor temperature.

1.2.4   Home Display

The Home Display is the first display you see when the controller is switched on, it shows the actual temperature of the product. When entering the menus, the controller will automatically return to the Home Display if no keys are pressed for 30 seconds.

Finding the Home Display
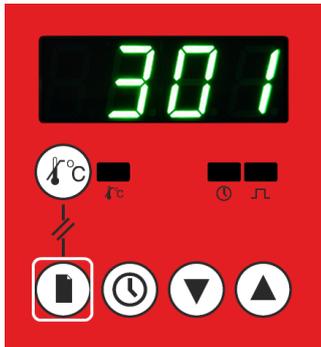
- To find the Home Display from the Home Menu, press the Page key until the current temperature is shown on the display.
- To find the Home Display from the Setup Menu, press and hold the Page key for 1.5 seconds.

1.2.5   Hold Mode

'Hold' mode turns the output off; this allows parameters to be set without the controller instantly trying to control at the new settings.

When the output indicator is off, the Home Display flashes between the current temperature and $HOLd$.
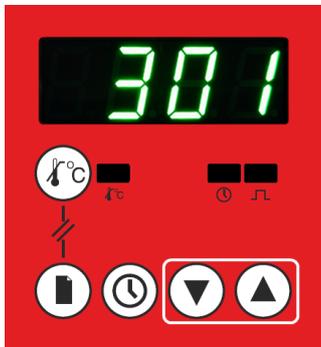
To enter 'Hold' mode:

- Start at the Home Display.
- Press and hold the up and down Arrow keys together for 1.5 seconds
- The display will flash $HOLd$ to show that 'Hold' mode has been entered.
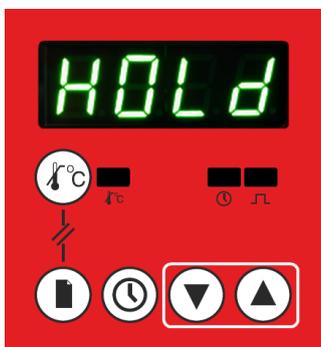
To exit 'Hold' mode:

- Start at the Home Display.
- Press and hold the up and down Arrow keys together for 1.5 seconds OR start the timer (See "The Timer ").
- Note: The 'Hold' mode function is disabled when the timer function is operating.

1.2.6   Checking the Temperature Setpoint from the Home Display

- Start at the Home Display.
- Press either the up or down Arrow key.
- The setpoint will show on the display for 3 seconds before returning to the home display.

1.2.7   Changing the Temperature Setpoint

- Start at the Home Display.
- Repeatedly press the Page key to scroll through the Home Menu until 5P°C is displayed.
- Use the up and down Arrow keys to alter the value.
- A single press of the up or down Arrow key shows the current setting.
- To alter this, either keep the key pressed or press it again. The value will then be stored without any further input.
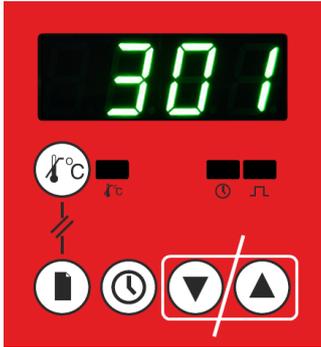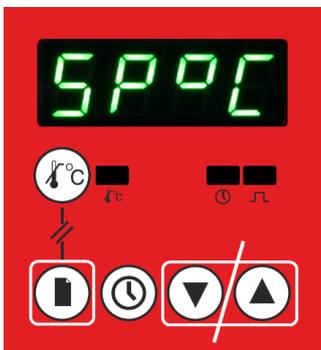
1.2.8   Changing the Temperature Setpoint Ramp Rate
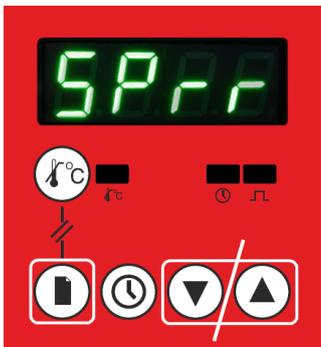
- Start at the Home Display.
- Repeatedly press the Page key to scroll through home menu until 5Prr is displayed.
- Use the up and down Arrow keys to turn off or alter the value.
- A single press of either the up or down Arrow key shows the current setting. To alter, either keep pressed or press again. The value will then be stored without any further input.
- See section 1.4 for more information.

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.

CARBOLITE GERO 30-3000°C

1.2.9 Changing the Timer Time

- Start at the Home Display.
- Repeatedly press the Page key to scroll through the Home Menu until $t1$, $t2$, $t3$, $t4$ or $t5$ shows on the display.
- Use the up and down Arrow keys to turn off, or alter the value.
- A single press of either the up or down Arrow key shows the current setting (Hr:Min).
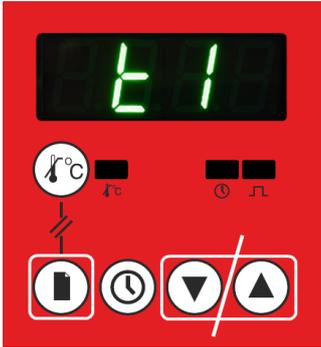- To alter this, either keep pressed or press again.The value will then be stored without any further input.
- See 1.5 for more information.

1.3 Advanced Operation

1.3.1 Entering the Setup menu
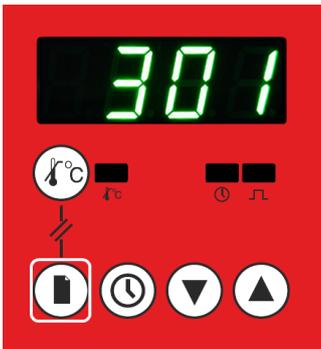
- Start at the Home Display.
- Press and hold the Page key for 1.5 seconds
- The display will change to the first parameter in the Setup Menu.

1.3.2 Changing the Timer Type
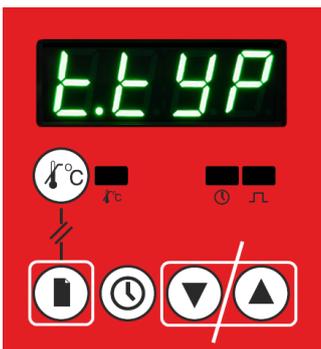
- Start at the Home Display.
- Hold the Page key for 1.5 seconds to enter the set-up menu.
- Once entered, repeatedly press the Page key until $t.tYP$ is displayed.
- Use the up and down Arrow keys to alter the value.

To alter this, either keep pressed or press again. The value will then be stored without any further input. A single press of the up or down key shows the current setting.

Note: This function is disabled when the timer is operating. see section 1.5 for more information on the timer types and functions.

1.3.3   Changing the Timer Band

- Start at the Home Display.
- Hold the Page key for 1.5 seconds to enter the Setup Menu.
- Once entered, repeatedly press the Page key until *t.bnd* is displayed.
- Use the up and down Arrow keys to turn off or alter the value.

A single press of the up or down key shows the current setting. To alter this, either keep pressed or press again. The value will then be stored without any further input. see section 1.5 for more information .

Note: This is only available when timer type 1 or 4 is selected.

1.3.4   Changing the Maximum Output Power

Note: Output Power is a product specific setting and will not appear on all furnaces and ovens.

- Start at the Home Display.
- Hold the Page key for 1.5 seconds to enter the set-up menu.
- Once entered, repeatedly press the Page key until *OPH1* is displayed.
- Use the up and down Arrow keys to alter the value.

A single press shows the current setting. To alter this, either keep pressed or press again. The value will then be stored without any further input.

Caution: Do not increase the power limit value to a value above the design level for the oven or furnace model, or to a value above that correctly calculated for silicon carbide elements. The heating elements could burn out, or other damage could be caused. Refer to the Fuses and Power Settings section of your product manual for more information on power limits.
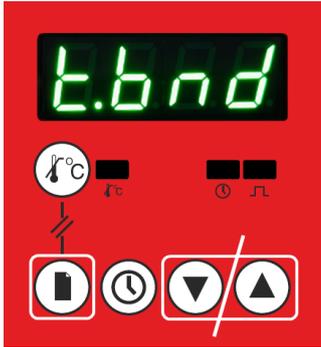
1.3.5 Changing the Customer Calibration Type

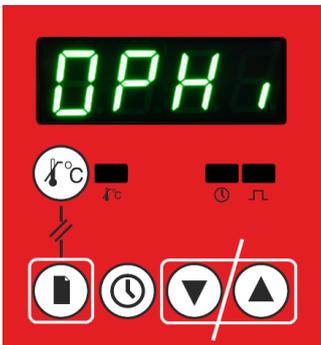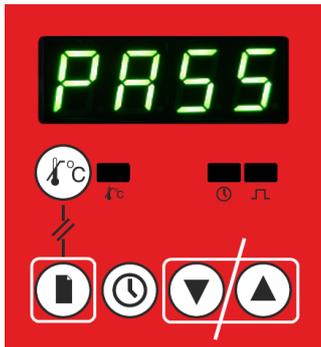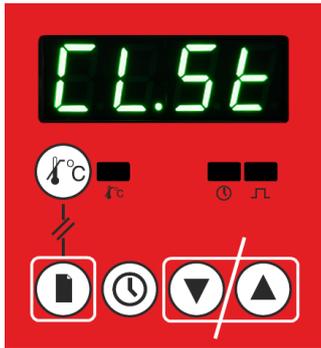- Start at the Home Display.
- Hold page key for 1.5 seconds to enter the set-up menu.
- Once entered, repeatedly press page key until *CL.St* is displayed.
- Use the up and down Arrow keys to display the current calibration type.
- Use the up and down Arrow keys to display the password screen.
- Use the up and down Arrow keys to enter the Calibration Password (see 1.3.6).
- Press the page key to confirm password. The value will then be stored without any further input.
- See section 1.8 for more information.

1.3.6 Calibration Password

Once entered the calibration password remains active for 30 seconds after leaving the set up menu to allow time to revisit if necessary.

The Calibration Password for this instrument is: **525**

1.4 Temperature Setpoint Ramp Rate

1.4.1 Setpoint Ramp Rate

The SPrr controls the rate at which the temperature in a furnace or oven changes per minute. When SPrr has a numeric value, e.g. 5 °C/ min, the product will attempt to heat or cool at that rate. When the value of Sprr = off, the product will heat or cool as quickly as possible.

Setpoint ramp rate is useful when materials susceptible to thermal shock are being heated.

1.4.2 Limitations of Setpoint Ramp Rate

The setpoint ramp rate should not be set higher than the maximum heat up or cool down rate of the furnace or oven.

The setpoint ramp rate only resets its start position when the ramp rate is changed or the controller is taken out of 'Hold' mode.

Changes in the temperature setpoint do not affect the ramp rate.

If the temperature is set below the current temperature of the furnace or oven then after a period of time adjusted to a temperature higher than the current temperature

without adjustment of the ramp rate, the controller can become out of step and appear to switch off.

Putting the controller into, then out of 'Hold' mode will reset the ramp rate and force the controller back into control.

1.5   The Timer

1.5.1   Starting the Timer
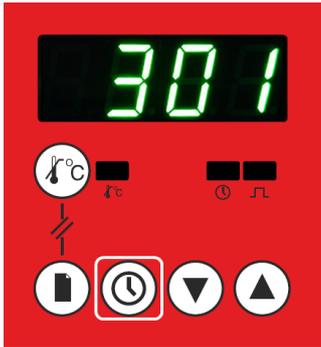
- Start at the Home Display.
- Press the Timer key once to start the timer.

If the 301 Controller is in 'Hold' mode, pressing the Timer key will automatically exit 'Hold' mode and the controller will start to operate.

1.5.2   Checking the Time Remaining
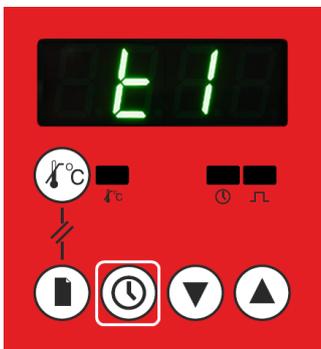
- Start at the Home Display
- Press the Timer key once to check the time remaining.
- The display will flash t- 3 times.
- It will return to the Home Display automatically.

1.5.3   Pausing the Timer
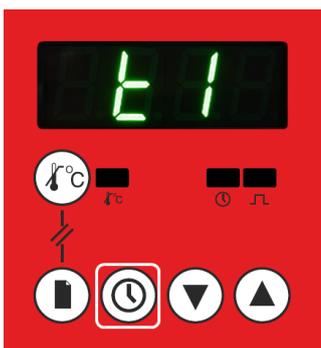
- Start at the Home Display
- Press and hold the Timer key for 1.5 seconds; the display alternately shows $t1$ and the current temperature.
- To resume the timer, press the Timer key once.

1.5.4   Resetting the Timer
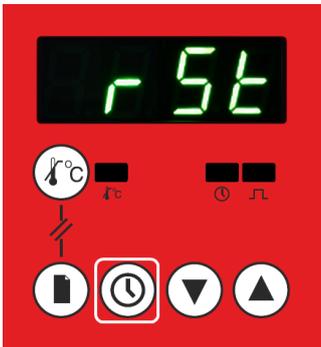
- When the timer count has ended, or the timer is paused, start at the Home Display.
- Press and hold the Timer key for 1.5 seconds.
- r5t is displayed to indicate timer reset.

1.5.5   Timer Function Description

The 301 Controller has an in-built timer, which can be set to one of five types:

Timer Type t1

On pressing the Timer key; 'Timer Type 1' waits for the setpoint to be reached, then begins the countdown. On completion of the countdown, the product switches off power to the elements ('End' flashes on the display).

Timer Type t2

On pressing the Timer key; 'Timer Type 2' starts the countdown immediately. On completion of the countdown, the product switches off power to the elements ('End' flashes on the display).

Timer Type t3

On pressing the Timer key; 'Timer Type 3' immediately switches the product heating off and starts to countdown. On completion of the countdown, the furnace or oven switches on the power to the elements. This can be used to delay the start of heating.

Timer Type t4

On pressing the Timer key; 'Timer Type 4' waits for the setpoint to be reached, then begins the countdown. On completion of the countdown, the product continues to control as normal ('End' flashes on the display).

Timer Type $t5$

On pressing the Timer key; 'Timer Type 5' starts the countdown immediately. On completion of the countdown, the product continues to control as normal ('End' flashes on the display).

1.5.6   The Timer Temperature Band

Timer type $t1$ or $t4$ starts the countdown when the setpoint temperature is reached. It is possible to set the timer running before the setpoint is reached by adjustment of the timer temperature band '$t.bnd$', e.g. '$t.bnd$' set to a value of 3 will result in the timer starting to countdown 3°C before the temperature setpoint is reached. This is useful when furnaces or ovens that take a long time to reach setpoint, are at a sufficiently high temperature for a specific customer process to occur.

1.5.7 Timer Function Table				
t.typ		**On Pressing the Timer Key**	**During the Countdown**	**Completion of the Countdown**
t1	Heating	ON	ON	OFF
	Timer	Starts when setpoint reached	Counts Down	OFF
	Display	Flashes t1 3 times. Shows Time remaining.	Current Temperature	Cycling Current Temperature/ End
	Timer Indicator	Flashing until setpoint reached	ON	OFF
t2	Heating	ON	ON	OFF
	Timer	Start Immediately	Counts Down	OFF
	Display	Flashes t2 3 times Shows Time remaining.	Current Temperature	Cycling Current Temperature/ End
	Timer Indicator	ON	ON	OFF
t3	Output	OFF	OFF	ON
	Timer	Starts Immediately	Counts Down	OFF
	Display	Flashes t3 3 times Shows Time remaining	Time Remaining	END shows for 3 seconds then the Current Temperature.
	Indicator	ON	ON	OFF
t4	Heating	ON	ON	ON
	Timer	Starts when setpoint reached	Counts Down	OFF
	Display	Flashes t4 3 times Shows time remaining	Current Temperature	Cycling Current Temperature/ End
	Timer Indicator	ON	ON	OFF
t5	Heating	ON	ON	ON
	Timer	Starts Immediately	Counts Down	OFF
	Display	Flashes t 3 times Shows Time remaining	Current Temperature	Cycling Current Temperature/ End
	Timer Indicator	ON	ON	OFF

1.6   Ramp Dwell Programming

The 301 Controller has the capability to follow a Ramp Dwell program.
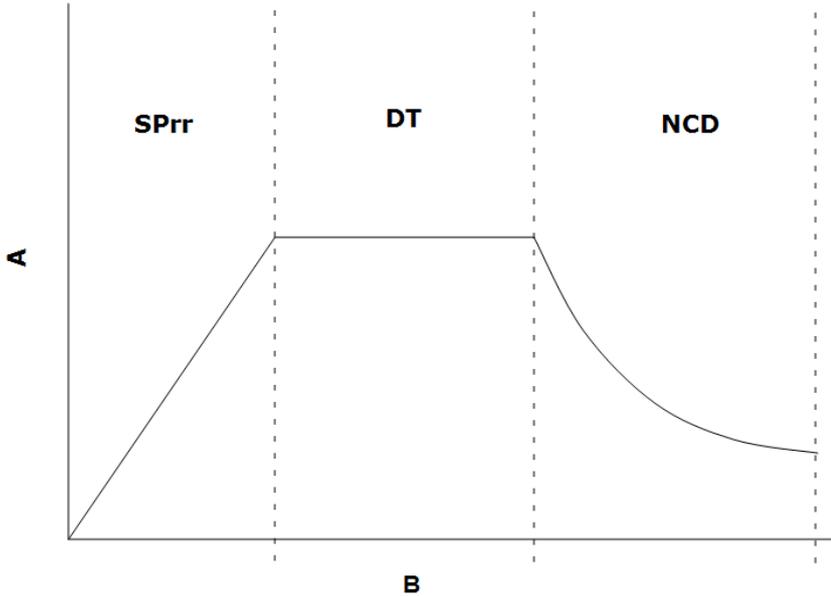
Key	
A	Temperature
B	Time
SPrr	Setpoint Ramp Rate (SPrr)
DT	Dwell Time t1
NCD	Natural Cool Down

1.6.1   Setting up a Ramp Dwell program

<u>Set the Controller to Hold Mode:</u>
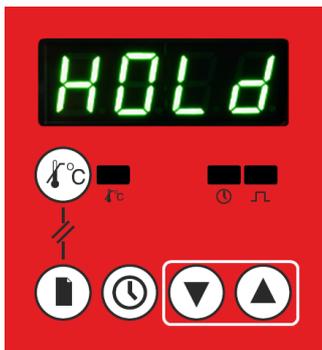
- Start at the home display
- Press and hold the up and down keys together for 1.5 seconds.
- The display will flash *HOLd* to show that 'Hold' mode has been entered.

Set the Timer Type to t 1
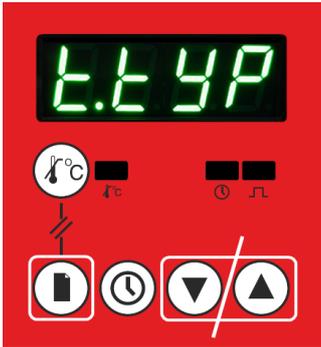
- Start at the home display
- Press and hold the Page key for 1.5 seconds to enter the Setup Menu.
- Repeatedly press the Page key until t t Y P shows on the display.
- Use the up and down Arrow keys to set the value to t 1.
- The value will then be stored without any further input.
- See the 1.5 for more information.
- Press and hold down the page key for 1.5 seconds to return to Home Menu.

Set the Temperature Setpoint
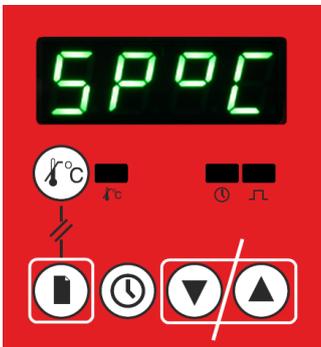
- Start at the Home Display.
- Repeatedly press the Page key until SP°C shows on the display.
- Use the up and down Arrow keys to alter the value (°C).
- The value will then be stored without any further input.
- Press and hold down the Page key for 1.5 seconds to return to the Home Menu.

Set the Setpoint Ramp Rate
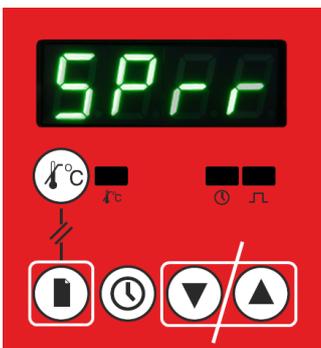
- Start at the Home Display.
- Repeatedly press the Page key until SPrr shows on the display.
- Use the up and down Arrow keys to alter the value (°C/ Min).
- The value will then be stored without any further input
- Press and hold down the Page key for 1.5 seconds to return to the Home Menu.

Set the Dwell Time
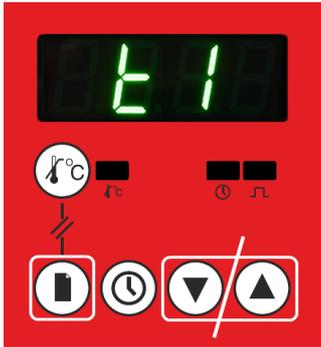
- Start at the Home Display.
- Repeatedly press the Page key until $t\,1$ shows on the display.
- Use the up and down Arrow keys to either switch off or alter the value (Hr:Min)
- The value will then be stored without any further input.
- Press and hold down the Page key for 1.5 seconds to return to the Home Menu.

Start the Timer
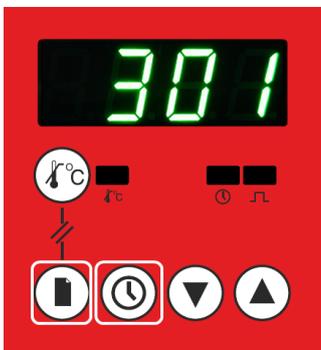
- Start at the Home Display.
- Pressing the Timer key starts the program.
- Pressing the Timer key will automatically exit 'Hold' mode if set (see section 1.2.5 for more information) and the controller will start to operate.
- Press and hold down the Page key for 1.5 seconds to return to the Home Menu.

1.7   Maximum Output Setting

Depending on the furnace or oven model the maximum output power setting OP.Hi may be accessible or hidden.

For silicon carbide heated furnaces the parameter is accessible to allow compensation for element ageing, see the Fuses and Power Settings section of your product manual for more information on power limits.

In many models the maximum output power setting depends on the supply voltage, refer to the Fuses and Power Settings section of your product manual .

1.8   Customer Calibration

The controller is calibrated for life at manufacture, there may however be sensor or other system errors which affect the accuracy of the measured temperature. Customer calibration is used to compensate for these errors. Access to this function is disabled when the timer is operating.

The 301 Controller has three types of customer calibration: factory calibration, single point calibration and dual point calibration. See sections1.3.5 & 1.3.6 to access these.

1.8.1   Factory Calibration - FAct

Factory calibration is the default setting, which has no offset adjustment. It simply displays the temperature measured by the control thermocouple.

1.8.2 Single Point Calibration - $CCL1$

Single point calibration uses an offset value to adjust the temperature over its whole range.

Single point calibration accurately sets the temperature for setpoint values close to the temperature at which the calibration offset is made. The accuracy is reduced for setpoint temperatures which are significantly higher or lower then the calibration offset.

Table showing examples of how to determine offset values:

Measured Calibration Temp (°C)	Displayed Temp (°C)	Old Offset Value (°C)	New Offset Adjustment	New Offset Value (°C)
252	250	0	2	2
248	250	0	-2	-2
252	250	2	2	4

The calibration temperature may be measured at the centre of the chamber or through a specially fitted port.

New Offset Value = Old Offset Value + New Offset adjustment

New Offset Adjustment = Measured Calibration Temperature – Displayed Temperature

> ⚠ Caution! - The procedure to determine the calibration temperature at the centre of a chamber is not covered in these instructions. If you are unsure how to do this safely, then seek advice as there is a risk of electric shock if done incorrectly.

1.8.3 Changing the Single Point Calibration Offset - $OFSt$
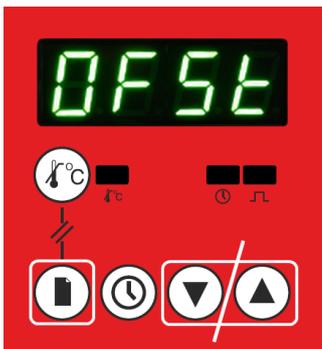
- Start at the home display.
- Hold the Page Key for 1.5 seconds to access the Setup Menu.
- Repeatedly press the Page key until $CL.St$ is displayed.
- Press the up or down Arrow keys to display the current calibration offset.
- If a password is required to access $CCL1$, enter the password using the up and down Arrow keys and press the Page key to accept. You will be returned to $CL.St$.
- Use the up and down Arrow keys to scroll to $CCL1$.
- Press the Page key to access $OFSt$.
- Press the up or down Arrow keys to change the offset value.
- The value will then be stored without any further input.

Once $CCL1$ has been selected as the customer calibration type, it is possible to start from the home display and go to $OFSt$ directly, and enter the password at this point when the calibration adjustment is required again.

1.8.4 Dual Point Calibration - $CCL2$

Dual point calibration uses two offset values at two corresponding temperatures to progressively change the calibration as the temperature increases or decreases. This is a more accurate representation of how the temperature difference will occur.

> ⚠ Caution! - Do not make $CAL.L$ and $CAL.H$ the same value as the controller will not work correctly and could cause the furnace or oven to overheat.

1.8.5 Changing the Calibration, Low Temperature - $CAL.L$

- Start at the home display.
- Hold the Page Key for 1.5 seconds to access the Setup Menu.
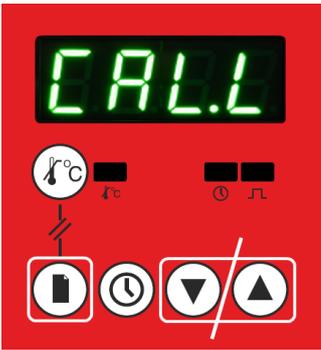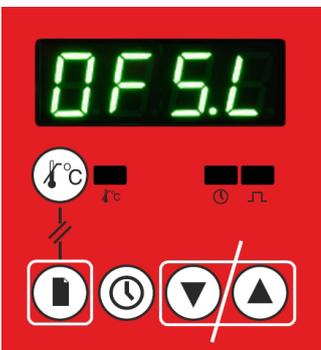- Press the Page key until $CL.St$ is displayed.
- Press the up or down Arrow keys to display the current calibration offset.
- If a password is required to access $CCL2$, enter the password using the up and down Arrow keys and press the Page key to accept. You will be returned to $CL.St$.
- Use the up and down Arrow keys to scroll to $CCL2$.
- Press the Page key to access $CAL.L$.
- Press the up or down Arrow keys to change the offset value.
- The value will then be stored without any further input.

Once $CCL2$ has been selected as the customer calibration type, it is possible to start from the home display and go to $CAL.L$ directly (or any of the other settings in $CCL2$) and enter the password at this point when calibration adjustment is required again.

1.8.6 Changing the Calibration, Low Temperature Offset - $OFS.L$

- Start at the home display.
- Hold the Page Key for 1.5 seconds to access the Setup Menu.
- Repeatedly press the Page key until $CL.St$ is displayed.
- Press the up or down Arrow keys to display the current calibration offset.
- If a password is required to access $CCL2$, enter the password using the up and down Arrow keys and press the Page key to accept. You will be returned to $CL.St$.
- Use the up and down Arrow keys to scroll to $CCL2$.
- Press the Page key twice to access $OFS.L$.
- Press the up or down Arrow keys to change the offset value.
- The value will then be stored without any further input.

1.8.7 Changing the Calibration, High Temperature - $CAL.H$

- Start at the home display.
- Hold the Page Key for 1.5 seconds to access the Setup Menu.
- Repeatedly press the Page key until $CL.St$ is displayed.
- Press the up or down Arrow keys to display the current calibration offset.
- If a password is required to access $CCL2$, enter the password using the up and down Arrow keys and press the Page key to accept. You will be returned to $CL.St$.
- Use the up and down Arrow keys to scroll to $CCL2$.
- Press the Page key three times to access $CAL.H$.
- Press the up or down Arrow keys to change the offset value.

- The value will then be stored without any further input.

1.8.8 Changing the Calibration, High Temperature Offset - $OFS.H$

- Start at the home display.
- Hold the Page Key for 1.5 seconds to access the Setup Menu.
- Repeatedly press the Page key until $CL.St$ is displayed.
- Press the up or down Arrow keys to display the current calibration offset.
- If a password is required to access $CCL2$, enter the password using the up and down Arrow keys and press the Page key to accept. You will be returned to $CL.St$.
- Use the up and down Arrow keys to scroll to $CCL2$.
- Press the Page key four times to access $OFS.H$.
- Press the up or down Arrow keys to change the offset value.
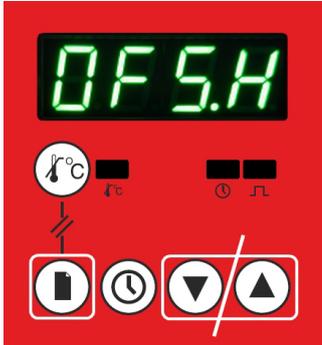- The value will then be stored without any further input.

1.9 Over-Temperature Protection
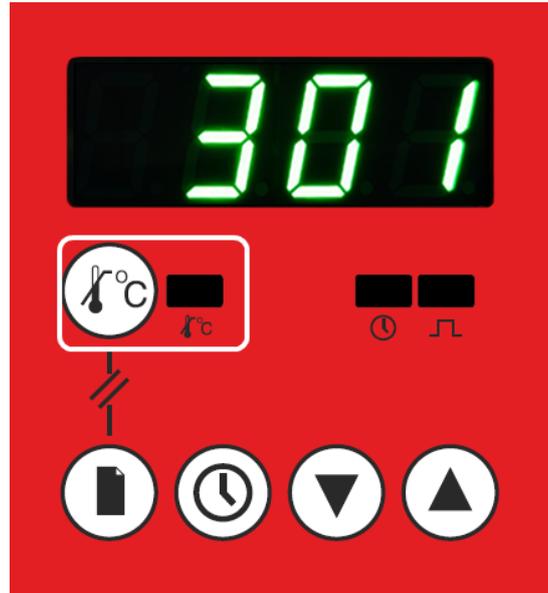
This controller may be fitted with the over-temperature protection option. If the over-temperature option is fitted the 301 display will include the Over-Temperature key and indicator (as shown in the diagram above). An independent control circuit and temperature sensor provide the over-temperature protection.

There are two uses for over-temperature protection:

1. To prevent a sample being heated in a furnace or oven from over-heating.
2. To provide an extra safety system to prevent the furnace or oven from heating in the event of a fault.

1.9.1 Over-Temperature (O/T) home display

When the Over-Temperature key is pressed and held the O/T home display is shown.

The home display shows the over-temperature limit setting.
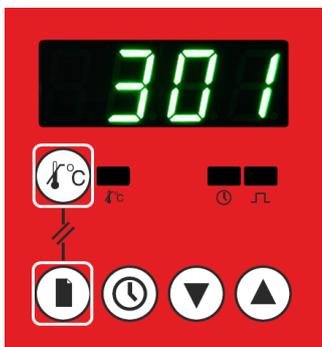
Finding the O/T home display from the O/T Home Menu:

- Press and hold the Over-Temperature key.
- Repeatedly press the Page key until the O/T limit value shows on the display.

Finding the O/T home display from the O/T Setup Menu:

- Press and hold the Over-Temperature key.
- Press and hold the Page key for 1.5 seconds.

1.9.2   Changing the Over-Temperature Limit

Note: If protection of the sample being processed is required, the over-temperature limit is normally set 15 °C above the temperature setpoint of the controller. If protection of the furnace or oven is required, the over-temperature limit is normally set 15 °C above the maximum setpoint of the furnace or oven.
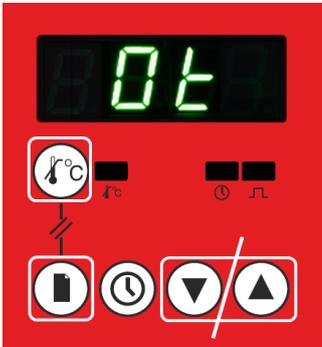
- Start at the home display.
- Press and hold the Over-Temperature key.
- Repeatedly press the Page key until Ot shows on the display.
- Use the up and down Arrow keys to change the offset value.

A single press shows the current setting. To alter either keep pressed or press again. The value will then be stored without any further input.

1.9.3   Checking the Over-Temperature Sensor Temperature
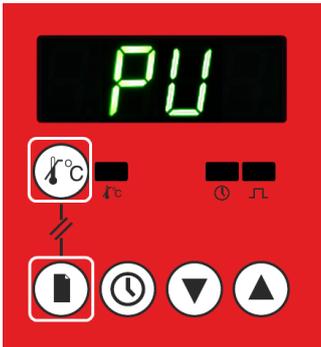
- Start at the home display.
- Press and hold the Over-Temperature key.
- Press and hold the Page key for 1.5 seconds.
- Current temperature (PU) is displayed for 1 second, followed by the over-temperature sensor value for 3 seconds; this sequence is then repeated.

1.9.4   Over-Temperature Protection Calibration

The over-temperature protection circuit can be calibrated in the same way as the main controller. However, this is not normally necessary as the level of accuracy required for over-temperature protection is not as critical as it is for the main control temperature.
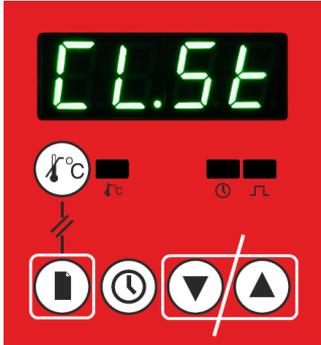
- Start at the home display.
- Press and hold the Over-Temperature key.
- Press and hold the Page key for 1.5 seconds.
- Repeatedly press the Page key until $CL.St$ is displayed.

Now follow the procedure in "Customer Calibration".

1.9.5   Over-Temperature Activation

During normal operation, the over-temperature indicator is green. If the temperature of the furnace or oven goes above the over-temperature limit, the over-temperature circuit activates. The power supply to the heating elements is switched off and the over-temperature indicator changes to flashing red.

Pressing the over-temperature key shows Ott in the display to indicate that the over-temperature has been triggered.

The reason for the over-temperature activation must be investigated; an incorrect setting in the over-temperature limit is may be the cause. When you are satisfied with the reason for the over-temperature activation it can be reset.

1.9.6   Resetting Over-Temperature Activation
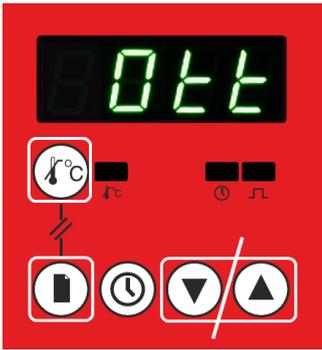
- Start at the home display.
- Press and hold the Over-Temperature key until Ott is displayed.
- Repeatedly press the Page key until Ot is displayed and the red indicator stops flashing.
- Press the up or down Arrow key to check the over-temperature limit value.
- Press the up or down Arrow key to alter the value if necessary.
- Press the Page key to return to the over-temperature display.

The over-temperature has now been reset.

If the temperature is still above the over-temperature setpoint then over-temperature indicator will be red but not flashing.

When the temperature falls below the over-temperature limit, the indicator changes back to green.

When the current temperature falls below the over-temperature setpoint, the furnace/oven starts to heat again.

1.10   RS232 Communication Option

The 301 Controller can be supplied with the capability to communicate with other devices via an RS232 link. If this option has been ordered, the furnace or oven will be supplied with a 9 pin 'D' socket for connecting to an external device. Plugging this into a computer will allow the controller to be accessed from that computer. The computer must have appropriate communication software installed such as Eurotherm's 'i-Tools'.

RS232 Communication Addressing:

Modbus Address (Main)	= 2
Modbus Address (O/Temp)	= 3
Baud Rate	= 9600
Byte Format	= 8

RS232 Communication Cables

Connecting the furnace or oven to a computer is done via a "straight" cable as follows:

Product end of cable female 9-pin		**RS232 Cable: product to PC**	Computer end of cable 9-pin male	
Rx	3	———————	3	Tx
Tx	2	———————	2	Rx
Com	5	———————	5	Com

1.11   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.

If the temperature controller is fitted to the back of the control panel it can be separated from the base by removal of the screws. If the temperature controller is fitted inside the product base it can be separated from the top by removal of the screws.

1.12   Glossary of Terms

Setpoint (SP)	The target temperature the furnace or oven is trying to reach.	°C
Setpoint Ramp Rate (SPrr)	The speed at which the furnace or oven is allowed to heat up or cool down	°C/ Min
Element	The heating device used in the furnace or oven.	-
Thermocouple	A thermoelectric device for measuring temperature.	-
PID	Proportional Integral Derivative: the control system used by the controller	-
Over-Temperature	The condition which a furnace or oven may enter if part of the main control circuit fails.	-
Over-Temperature Protection	A system to prevent the product or process being damaged if it has gone into an Over-Temperature condition.	-
Furnace or Oven	This refers to the product purchased from Carbolite Gero	-

1.13   Controller Fault

Fault Code Diagnostic Table

Error Code	Explanation	Actions
Sbr	Temperature sensor failure	Check all terminal connections between the temperature sensor (thermocouple) and temperature controller. It is recommended to loosen then tighten the screws in the terminal blocks in case the connections are oxidised. If this does not correct the error then replace the furnace or oven temperature sensor (thermocouple).
oooo	Input over range	
-ooo	Input under range	
E- followed by numerical code	Controller Error	Turn the furnace or oven off and back on to see if this clears the error. If not contact Carbolite Gero Service – (see back cover)

Notes

....
....
....
....
....
....
....
....
....
....
....
....

Service Record

Engineer Name	Date	Record of Work

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.

For preventive maintenance, repair and calibration of all furnace and oven products, please contact:

Carbolite Gero Service

Telephone: + 44 (0) 1433 624242

Fax: +44 (0) 1433 624243

Email: ServiceUK@carbolite-gero.com

CARBOLITE GERO 30-3000°C

Carbolite Gero Ltd,

Parsons Lane, Hope, Hope Valley, S33 6RB, England.

Telephone: + 44 (0) 1433 620011

Fax: + 44 (0) 1433 621198

Email: Info@carbolite-gero.com

www.carbolite-gero.com