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.

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1.0 Symbols and Warnings

1.1 Switches and Lights

Instrument switch: when the instrument switch is operated the temperature control circuit is energised.

Heat light: the adjacent light glows or flashes to indicate that power is being supplied to the elements.

1.2 General Warnings

DANGER – Electric shock. Read any warning printed next to this symbol.
WARNING: Risk of fatal injury.

DANGER – Hot surface. Read any warning printed next to this symbol.
WARNING: All surfaces of a product may be hot.

DANGER – Read any warning printed next to this symbol.

Caution – Double Pole/Neutral Fusing
2.0 Installation

2.1 Unpacking and Handling

When unpacking and handling the product, always lift it by its base. Do not use the door or any other projecting cover or component to support the equipment when moving it. Use two or more people to carry the product where possible.

Carefully remove any packing material from inside and around the product before use. Avoid damaging the surrounding insulation when removing packing materials.

NOTE: This product contains Refractory Ceramic Fibre (also known as Alumino Silicate Wool - ASW). For precautions and advice on handling this material see section 7.2.

2.2 Siting and Setting Up

Place the product on a level surface in a well ventilated area.

Site away from other sources of heat and on a non-flammable surface that is resistant to accidental spillage or hot materials.

The surface on which the equipment is mounted should be stable and not subject to movement or vibrations.

The height of the mounting surface is important to avoid operator strain when loading and unloading samples.

Unless otherwise stated elsewhere in this manual, ensure that there is at least 150 mm of free space around the back and sides of the product. Clear space is required above the product to dissipate heat.
Depending on the application of the product, it may be appropriate to position it under an extraction hood. Ensure the extraction hood is switched on during use. Ensure that the product is placed in such a way that it can be quickly switched off or disconnected from the electrical supply.

Under no circumstances should any objects be placed on top of the product. Always ensure that any vents on the top of the product are clear of any obstruction. Always ensure all cooling vents and cooling fans (if fitted) are clear of any obstruction.

2.3 Chimney

The chimney is a length of tubing. If it is supplied unfitted, then fit it through the hole in the top of the case.

If the product is to be used to heat substances that emit fumes, a fume extraction duct of approximately 75 mm - 150 mm inlet diameter may be placed directly above the chimney outlet.

Do not make a sealed connection to the product chimney as this causes excessive airflow through the chamber and results in poor temperature uniformity.
2.0 Installation

Key

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Duct (75mm-150mm diameter)</td>
</tr>
<tr>
<td>B</td>
<td>Ambient air is drawn into duct</td>
</tr>
<tr>
<td>C</td>
<td>Chimney</td>
</tr>
<tr>
<td>D</td>
<td>25mm vertical gap between chimney and duct</td>
</tr>
</tbody>
</table>

2.4 Electrical Connections

Connection by a qualified electrician is recommended.

This product requires a single-phase A.C. supply with earth (ground), which may be Live to Neutral non-reversible (polarised), Live to Neutral reversible (non-polarised), or Live to Live.

Check the product rating label before connection. The supply voltage should agree with the voltage on the label and the supply capacity should be sufficient for the current on the label.

The supply should be fused at the next size equal to, or higher than the current on the label. A table of the most common fuse ratings is also given towards the back of this manual. When the mains cable is factory fitted, internal fuses are also fitted. It is essential that the operator ensures that the product is correctly fused.

Products with a factory fitted supply cable are designed to be wired directly to an isolator or fitted with a line plug.

Products without a factory fitted supply cable require a permanent connection to a fused and isolated supply. The product’s electrical access panel should be temporarily removed, and connections made to the internal terminals.

If the product is to be connected by line plug. The plug should be within reach of the operator and should be easy to remove.

When connecting the product to an isolating switch ensure that both conductors (single phase) or on all live conductors (three phase), and should be within reach of the operator.

The supply MUST incorporate an earth (ground).
### Electrical Connection Details:

<table>
<thead>
<tr>
<th>Supply</th>
<th>Terminal Label</th>
<th>Cable Colour</th>
<th>Supply Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-phase</td>
<td>L</td>
<td>Brown</td>
<td>Reversible or Live-Live to either power conductor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(For USA 200-240V, connect L1)</td>
</tr>
<tr>
<td>N</td>
<td>Blue</td>
<td>to neutral</td>
<td>to the other power conductor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(For USA 200-240V, connect L2)</td>
</tr>
<tr>
<td>PE</td>
<td>Green/Yellow</td>
<td>to earth (ground)</td>
<td>to earth (ground)</td>
</tr>
</tbody>
</table>
2.0 Installation

2.5 Balance and Weighing Platform

1. Assemble the balance unit as shown below:

2. Ensure that the furnace is on a stable, level surface.
3. Place the balance on the support plate below the furnace chamber, ensuring the front legs are located in the slots on the support plate.

4. Level the balance as detailed in the balance manufacturer’s instruction manual.
5. Open the furnace door.
6. One by one, insert the 3 ceramic tubes through the holes in the hearth, and locate them over the three corresponding placement guides on the top of the balance.
   **Note:** Due to the secure fit, you may need to twist the tubes down the guides in order for them to make full contact with the weighing platform.

7. If required, loosen the bolts securing the bottom support plate, and adjust positioning to move the balance.
8. Carefully position the Silicon Carbide weighing platform onto the top of the ceramic tubes.

9. Connect the DC power lead and RS-232 plug at the rear of the balance.

10. Before turning on the power supply, connect the earth cable to the earthing bolt on the support plate.

**Important Note:** The balance will not stabilise if the ceramic tubes touch the sides of the holes in the hearth.
3.0 3216CC Controller

3.1 3216CC

The 3216CC Controller is a digital temperature controller which uses PID algorithms to give excellent temperature control when properly set. This controller can only be used as a simple temperature controller, it cannot be programmed.

3.2 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.

3.3 Operation

3.3.1 Controller Layout

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Power Output Indicator</td>
</tr>
<tr>
<td>B</td>
<td>Alarm Indicator</td>
</tr>
<tr>
<td>C</td>
<td>Remote Indicator (when configured)</td>
</tr>
<tr>
<td>D</td>
<td>Page</td>
</tr>
<tr>
<td>E</td>
<td>Scroll</td>
</tr>
<tr>
<td>F</td>
<td>Down</td>
</tr>
<tr>
<td>G</td>
<td>Up</td>
</tr>
<tr>
<td>H</td>
<td>Run Indicator</td>
</tr>
<tr>
<td>I</td>
<td>Hold Indicator</td>
</tr>
<tr>
<td>J</td>
<td>Setpoint Temperature (SP)</td>
</tr>
<tr>
<td>K</td>
<td>Measurement Temperature</td>
</tr>
</tbody>
</table>
3.3.2 Keys

**Page Key**

The page key is used to access level 2 when held down for 3 seconds.

**Scroll Key**

The scroll key is used to scroll through parameters.

**Ack**

When pressed simultaneously the ACK function is used to:

- Return to the Home Menu
- Acknowledge an alarm if activated.
- Reset a program after the program has ended.

**Page and Scroll**

The arrow keys are used individually to adjust the selected parameters and in combinations to operate a program.

**Arrow Keys**

Note: If a parameter is selected and no further action is taken, the display will time out and revert back to the home display in its working level after approximately 1 minute.

### 3.4 Quick Start Guide

#### 3.4.1 Operation as a simple controller

When switched on, the controller goes through a short test routine and then shows the measured temperature (PV = Process Value) in the upper part of the display and below it, the desired temperature (Setpoint).

#### 3.4.2 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 in the top left corner of the display, indicating that the controller is calling for power (giving an output).

The controller will immediately attempt to reach the setpoint and then 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.

#### 3.4.3 Using the Controller

The parameters in the controller are first shown by a short code (mnemonic). After 5 Seconds a description of the parameter will scroll once along the display and then revert back to the mnemonic. The scrolling text can be interrupted at any time by a single press of any of the buttons, but will not scroll again until the parameter is returned to. In this manual the mnemonic will be shown first, followed by the scrolling text in brackets; e.g. PROG <PROGRAM NUMBER>
3.0 3216CC Controller

3.4.4 Understanding User Levels
There are two user levels in the controller; Level 1 (Operator) and Level 2 (Supervisor). Level 1 (Operator) is for the day to day operation of the controller. These parameters are not protected by a security code.
Level 2 (Supervisor) provides access to additional parameters. Access to this level protected by a security code.

**To Enter Level 2**

1. Press and hold the page key for 3 seconds.
2. The display will show LEu 1 GOTO
3. Release the page Key
4. Press the up ▲ or down ▼ to choose LEu 2 (level 2)
5. Press the up ▲ or down ▼ to enter the code (Level 2 Code = 9).
If the correct code is entered, PASS should momentarily be displayed and then revert to the level 2 home display.
If an incorrect code is entered the display reverts back to Level 1 home display.
When level 2 operations have been completed, the supervisor must return to Level 1 either manually or by switching the instrument off and back on. There is no time out function.

**To Return to Level 1**

1. Press and hold the page Key
2. Press down ▼ to select LEu 1
It is not necessary to enter a code when going from a higher level to a lower level.
When level 1 is selected, the display reverts to the home display (See Controller Layout)

Table showing parameters accessible in level 1 and Level 2

<table>
<thead>
<tr>
<th>Operator LEVEL 1</th>
<th>Supervisor LEVEL 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>home display</td>
<td>home display</td>
</tr>
<tr>
<td>Programming</td>
<td></td>
</tr>
<tr>
<td>Program Status</td>
<td></td>
</tr>
<tr>
<td>Alarms (if configured)</td>
<td></td>
</tr>
<tr>
<td>Current Transformer Input (if configured)</td>
<td></td>
</tr>
<tr>
<td>Comms (if configured)</td>
<td></td>
</tr>
<tr>
<td>Controller set up (if configured)</td>
<td></td>
</tr>
<tr>
<td>Customer Calibration (if configured)</td>
<td></td>
</tr>
</tbody>
</table>

TIP
If while navigating the controller, a parameter has been passed or you need to access parameters which would be at the end of a scroll list, press and hold scroll ▲ and use up ▲ to return to a previous parameter.

3.5 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 (Level 2).

3.5.1 Setpoint Ramp Rate

To control the rate at which the temperature rises to setpoint, the SP.RATE function is used.

Before setting the ramp rate, it is advisable to set the setpoint to a low value, preferably 0 °C (see section 3.4). Once the ramp rate has been set, the required setpoint can be entered from the home menu. Doing so will activate the ramp rate, which can be identified with the run indicator showing on the bottom of the display. While the ramp rate is active the working setpoint will be shown on the lower temperature display (this is the setpoint, set by the ramp rate).

When the process temperature has reached the setpoint value at the given ramp rate, the run indicator will turn off and the instrument will control at the required setpoint temperature.

Any further modifications to setpoint will cause the ramp rate to be activated and the instrument to control as described above.

NOTE: Ensure timer configuration is set to 'none' (see section 3.6) to use the setpoint ramp rate feature without any timer functions.

3.5.1.1 Setting Setpoint Ramp Rate

In supervisor level (level 2).

Press scroll ▲ until the display shows SP.Rate <setpoint rate limit>. Using up ▲ and down ▼ select the ramp rate required, in °C/ Min.

3.5.1.2 Running with Ramp Rate

Press the up ▲ and down ▼ keys at the same time to activate the ramp rate. The "Run" indicator will illuminate and the scrolling text will read <RAMPING> to show the ramp rate is active. The ramp rate will then start from the current process temperature.

When the ramp reaches the setpoint temperature, the "Run" indicator will turn off and the instrument will maintain control at the setpoint.

To put the ramp rate into a hold condition, press the up ▲ and down ▼ keys and release. The "Run" indicator will flash and the scrolling text will read <HOLD> to show the ramp rate is on hold.
To cancel the ramp rate, press and hold the up ▲ and down ▼ keys until the "Run" indicator turns off.

3.5.2 Maximum Output Power

Press scroll ⬇️ until the display shows OP.HI <OUTPUT HIGH>. Use the up ▲ and down ▼ keys to select the output power required as a percentage. Once the setting is made, turn the instrument switch off and on to power cycle the temperature controller.

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

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

In many models the maximum output power setting depends on the supply voltage, see section 10.0.

3.5.3 Customer ID

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

Press scroll ⬇️ until the display shows ID <CUSTOMER ID>. Use the up ▲ and down ▼ keys to enter your own identification number. This can range from 1-9999.

3.5.4 Units

Press scroll ⬇️ until the display shows UNITS <DISPLAY UNITS>. Use the up ▲ or down ▼ keys to select the required units.

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>No units (Default °C)</td>
</tr>
<tr>
<td>°C</td>
<td>Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>°K</td>
<td>Kelvin</td>
</tr>
<tr>
<td>PERC</td>
<td>% (shows °C value)</td>
</tr>
</tbody>
</table>

3.5.5 Language

The scrolling text on the 3216 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.

3.6 Timer

3.6.1 Setting the Timer

A timer can be configured to operate in four different modes. These can be selected in level 2 (supervisor level) using the TM.CFG parameter as:-

- None
- Dwell Timer
• Delayed switch on timer
• Soft start timer

None

The timer is turned off, no timer configurations are available, the instrument works as a simple setpoint controller.

Press scroll ▼ until the display shows TM.CFG <TIMER CONFIGURATION>. Using the up ▲ down ▼ selectNONE.

3.6.2 Dwell Timer

A dwell timer is used to control a process at a fixed temperature for a defined period. At the end of the time period the controller will switch off the output power to the elements.

Press scroll ▼ until the display shows TM.CFG <TIMER CONFIGURATION>. Using the up ▲ down ▼ select Dwell.

When Dwell parameter is selected, the Timer resolution (TM.RES), Time duration (DWELL) and Timer Threshold (THRES) functions become available.

Press scroll ▼ until the display shows TM.RES < Time resolution >. Use the up ▲ down ▼ to select the timer units in Min or Hours.

Press scroll ▼ until the display shows DWELL < SET TIME DURATION >. Use the up ▲ down ▼ to enter the time duration required.

Press scroll ▼ until the display shows THres < TIMER THRESHOLD >. Use the up ▲ down ▼ to select the temperature threshold that you require the timer to start at.

The threshold value is ±n around the setpoint (n=threshold value).

Example: If the setpoint is set to 800 °C and the timer threshold is set to 2, after the timer is activated it will not start until the process value reaches 798 °C if ramping up or 802 °C if it is cooling.

Note: If the threshold is set to OFF, the timer will either; start to count down as soon as it is activated with the mode keys or if a ramp rate has been set (see section 3.5.1), the timer will start as soon as the ramp reaches the setpoint. (see section 3.7.1)

3.6.3 Delayed Switch On Timer

The delayed switch on timer is used to switch on the output power to the elements after a set time period.

Press scroll ▼ until the display shows TM.CFG <TIMER CONFIGURATION>. Using the up ▲ down ▼ select dELY.

When delay parameter is selected, the Timer Resolution (TM.RES) and Time Duration (DWELL) functions become available.

Press scroll ▼ until the display shows TM.RES < Time Resolution >. Use the up ▲ down ▼ to select the timer units in Min or Hours.
Press scroll ▲ until the display shows Dwell < SET TIME DURATION >. Use the up ▲ down ▼ to enter the time duration required before the output power switches on. 

3.6.4 Soft Start Timer

The Soft Start Timer is used to start a process at a reduced setpoint and power. The Soft Start Setpoint is used as a threshold only and is not a control point.

Example: Main Setpoint = 800 °C
Max power limit = 75% (This may be set at the factory)
Soft Start Setpoint = 600 °C (Threshold)
Soft Start Power Limit = 50% (Cannot be set above max power Limit)

When the timer is running, the maximum power is controlled by the Soft Start Setpoint of 600 °C and the Soft Start Power limit of 50%. This will continue until the timer ends or the current temperature exceeds the Soft Start Setpoint.

When the timer ends or the current temperature exceeds the Soft Start Setpoint, the instrument will start to control using the main setpoint of 800 °C and the Max Power Limit of 75%.

Press scroll ▲ until the display shows TM.CFG <TIMER CONFIGURATION>. Using the up ▲ down ▼ select SF.st.

When Soft Start parameter is selected, the Timer Resolution (TM.RES), Time Duration (Dwell), Soft Start Setpoint (SS.SP) and Soft Start Power Limit (SS.PWR) functions become available.

Press scroll ▲ until the display shows TM.RES < Time resolution >. Use the up ▲ down ▼ to select the timer units in minutes or hours.

Press scroll ▲ until the display shows Dwell < SET TIME DURATION >. Use the up ▲ down ▼ to enter the time duration required, before the main instrument starts to control using the main setpoint and max power.

Press scroll ▲ until the display shows SS.SP < Soft Start Setpoint >. Use the up ▲ down ▼ to enter the Soft Start Setpoint.

Press scroll ▲ until the display shows SS.PWR < Soft Start Power Limit >. Use the up ▲ down ▼ to enter the Soft Start Power Limit.

3.7 Running a Timer

- **Run.** This starts the timer.
- **Hold.** This stops the timer at the elapsed time. It will start again from the elapsed time when Run is selected again.
- **Reset.** This sets the timer back to zero. It can be operated again from this state.
- **End** cannot be set – it occurs automatically when the timer has counted down to zero.
• **Acknowledge** any timer after a timer has timed out using ACK function (see section 3.3.2) by pressing the ▲ and ▼ simultaneously.

### 3.7.1 Dwell Timer

<table>
<thead>
<tr>
<th>Operation</th>
<th>Action</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>To RUN Timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = ON&lt;br&gt;Scrolling Display – Timer Running</td>
</tr>
<tr>
<td>To HOLD timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = Flashing&lt;br&gt;Scrolling Display – Timer Hold</td>
</tr>
<tr>
<td>To switch off Timer / Cancel</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = OFF&lt;br&gt;Scrolling Display – None&lt;br&gt;Static Text - OFF</td>
</tr>
<tr>
<td>To return to home after reset</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = OFF&lt;br&gt;Display – A-M &lt;LOOP MODE- AUTO MANUAL OFF&gt; &lt;br&gt;Use the up ▲ or down ▼ to select AUTO</td>
</tr>
<tr>
<td>Timer Ended</td>
<td></td>
<td>Indicator – RUN = OFF&lt;br&gt;Scrolling Text – Timer End&lt;br&gt;Static Text - OFF</td>
</tr>
<tr>
<td>To re-RUN Timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = ON&lt;br&gt;Scrolling Display – Timer Running</td>
</tr>
<tr>
<td>To RESET timer and return to home menu after timer end</td>
<td>Press and quickly release Ack ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = OFF&lt;br&gt;Scrolling Display - None&lt;br&gt;Display – A-M &lt;LOOP MODE- AUTO MANUAL OFF&gt; &lt;br&gt;Use the up ▲ down ▼ to select Auto</td>
</tr>
</tbody>
</table>

### 3.7.2 Power Failure While Using Dwell Timer

If there is a power failure while the timer is operating and the power is subsequently restored, the timer will reset and the static text will display “OFF” until the ▲ + ▼ keys are pressed to re-run the timer.
3.7.3 Running Dwell Timer with Ramp Rate

Set the ramp rate as outlined in section 3.5.1
Set the dwell time as outlined in section 3.6.2.

When the timer is set to operate with a set ramp rate, the timer will not start to count down until the setpoint has been reached with the ramp, at which time the timer will begin time count down.

The scrolling display will indicate “timer running” and the run indicator will be illuminated while the ramp rate is active and during the timer count down, after which the display will indicate the instrument has switched off power to the elements (see section 3.7.7), and the run indicator will switch off.

3.7.4 Running Dwell Timer with Ramp Rate & Threshold

Set the ramp rate as outlined in section 3.5.1.
Set the dwell time as outlined in section 3.6.2.
Set the threshold as outlined in section 3.6.3.

When the timer is set to operate with a set ramp rate and threshold, the timer will not start to count down until the process temperature has reached the threshold value (see example 3.6.3).

The scrolling display will indicate “timer running” and the run indicator will be illuminated while the ramp rate is active, while the process value is reaching the threshold value and during the timer count down, after which the display will indicate the instrument has switched off power to the elements (see section 3.7.1).

3.7.5 Delayed Switch on Timer

<table>
<thead>
<tr>
<th>Operation</th>
<th>Action</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>To RUN Timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = ON Scrolling Display – Timer Running Static Text - OFF</td>
</tr>
<tr>
<td>To HOLD timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = Flashing Scrolling Display – Timer Hold Static Text - OFF</td>
</tr>
<tr>
<td>To switch off Timer / Cancel</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Scrolling Display – None Static Text - OFF</td>
</tr>
<tr>
<td>To return to home menu. After</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = Off Display – A-M &lt;LOOP MODE-AUTO MANUAL OFF&gt;</td>
</tr>
<tr>
<td>resetting timer</td>
<td></td>
<td>Use the up ▲ or down ▼ to select <strong>Auto</strong></td>
</tr>
</tbody>
</table>
3.7.6 Running Delay Timer with Ramp Rate

Set the ramp rate as outlined in section 3.5.1.
Set the delay time as outlined in section 3.6.3.

When ramp rate is active with a delay timer the run indicator serves two functions:
- Indicates timer is running
- Indicates ramp rate is active

This means that when the timer has timed out the run indicator will still be illuminated if the ramp rate is still active and will continue to be illuminated until the ramp reaches setpoint, at which time it will switch off.

A characteristic of these combinations of parameters is that the scrolling text will continue to indicate timer running when the timer has timed out. Checking whether the timer has timed out or not can be done with the 'T.REMN' function. (see section 3.7.12)

The delay timer with ramp rate will function as outlined in the table above with the addition of the functions in the following table.

3.7.7 Delay timer with ramp rate functions

<table>
<thead>
<tr>
<th></th>
<th>Timer Ended</th>
<th>Indicator – RUN = ON - if ramp rate active</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When ramp rate active</td>
<td>Scrolling Text – Timer Running</td>
</tr>
<tr>
<td>To HOLD timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = Flashing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scrolling Display – Timer Hold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Static Text - OFF</td>
</tr>
<tr>
<td>To switch off</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = ON - if ramp rate active</td>
</tr>
<tr>
<td>Timer / Cancel</td>
<td></td>
<td>Scrolling Display – None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Static Text - OFF</td>
</tr>
<tr>
<td>To re-RUN Timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scrolling Display – Timer Running</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Static Text – OFF</td>
</tr>
</tbody>
</table>
### 3.7.8 Power Failure While Using Delay Timer

If there is a power failure while the timer is operating and the power is subsequently restored, the timer will reset and will re-run from the power on time.

### 3.7.9 Soft start Timer

<table>
<thead>
<tr>
<th>Operation</th>
<th>Action</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>To RUN Timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = ON&lt;br&gt;Scrolling Display – Timer Running&lt;br&gt;Static Text - OFF</td>
</tr>
<tr>
<td>To HOLD timer</td>
<td>Press and quickly release ▲ + ▼</td>
<td>Indicator – RUN = Flashing&lt;br&gt;Scrolling Display – Timer Hold&lt;br&gt;Static Text - OFF</td>
</tr>
<tr>
<td>To switch off</td>
<td>Press and hold ▲ + ▼ for more than 1 second</td>
<td>Indicator – RUN = OFF&lt;br&gt;Scrolling Display – None&lt;br&gt;Static Text - OFF</td>
</tr>
<tr>
<td>Timer/ Cancel</td>
<td>Timer Ended</td>
<td>Indicator – RUN = OFF&lt;br&gt;Scrolling Text – Timer End&lt;br&gt;Running Soft Start Timer</td>
</tr>
</tbody>
</table>

When the soft start timer is set to operate, the scrolling display will indicate “timer running” and the setpoint temperature, not the soft start setpoint.

### 3.7.10 Power Failure While Using Soft Start Timer

If there is a power failure while the timer is operating and the power is subsequently restored, the timer will reset and will re-run from the power on time.

### 3.7.11 Ramp Rate with Soft Start Timer

It is not recommended that the ramp rate function be used with a soft start timer.

**Note:** If the temperature is already above the threshold when the timer is set to operate, the timer will time out immediately.

### 3.7.12 Time Remaining

The time remaining of any 'Timer' mode can be checked at any time while a timer is active.

To view the time remaining, press scroll ▶️ until the display shows T.REMN <TIME REMAINING>.

**Note:** The time remaining can be modified at any time while the count down timer is operating by pressing the up ▲ or down ▼ key while the time remaining function is active.
3.7.13 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 scrolling message on the display and a flashing red ALM (Alarm) indicator. The alarm may also switch an output – usually a relay to allow external devices to be operated when an alarm occurs. Alarms only operate if they have been configured and are dependant 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 (see section 3.3.2) before it is reset.

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

To Acknowledge an alarm and cancel the “ALM” indicator, press ACK function.

Note: The alarm indicator may seem to be permanently on when viewed from above. When an alarm is active the indicator should only be flashing, to confirm this, the controller must be viewed directly from the front.

3.8 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.

3.8.1 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.

<table>
<thead>
<tr>
<th>Product end of cable female (25-pin) 9-pin</th>
<th>RS232 Cable: product to PC</th>
<th>Computer end of cable 9-pin (25-pin) male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx (2)</td>
<td>3</td>
<td>(2) Tx</td>
</tr>
<tr>
<td>Tx (3)</td>
<td>2</td>
<td>(3) Rx</td>
</tr>
<tr>
<td>Com (7)</td>
<td>5</td>
<td>(7) Com</td>
</tr>
<tr>
<td></td>
<td>7,8 1,4,6</td>
<td>(4,5) Link together</td>
</tr>
<tr>
<td></td>
<td>6,8,20</td>
<td>Link together</td>
</tr>
</tbody>
</table>
3.8.2 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
  - (2) 3
  - (3) 2
  - (7) 5

- RS485 Cable: product to PC

- Computer end of cable 9-pin (25-pin) female
  - 3 (2) Tx
  - 2 (3) Rx
  - 5 (7) Com

3.8.3 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.

3.8.4 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:

- 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.

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.

### 3.9 3216CC Navigation Diagram

**LEVEL 1**
- PV
- SP
- WRK.OP
  - Dwell
  - T.REMN
  - ID

**LEVEL 2**
- PV
- SP
- WRK.OP
- SP.RAT
- TM.CFG
- TM.RES
- DWELL
- SS.SP
- SS.PWR
- THRES
- T.REMN
- OP.HI
- ADDR
- ID
- UNITS

**ACCESS**
- LEV
- GOTO
- STBY.T

3 Sec

Passcode: 9

Depending on Timer Configuration

Do not raise the power limit (if accessible) above the design level for the product.
4.0 2132 Over-Temperature Controller Description (if fitted)

4.1 Description

This over-temperature controller is fitted and supplied ready to use by Carbolite Gero. It is a digital instrument with a latching alarm, requiring no additional panel controls. The controller features easy setting of over-temperature setpoint and reading of current temperature by the over-temperature sensor.

4.2 Operation

4.2.1 Controls

Most Carbolite Gero products are fitted with an instrument switch which cuts off power to the controller and other parts of the control circuit.

To operate the controller, power must be supplied to the product and the instrument switch must be on. If a time switch is included in the product circuit, this must be in the 'ON' position.

When an over-temperature condition occurs, the controller cuts the power to a contactor, which in turn cuts power to the heating elements. Power is not restored until the controller is 'reset'.

Some components will operate after the over-temperature feature isolates the power supply e.g. cooling fans will continue to operate, provided that there is a power supply to the product. In some cases the product may not do so, if other options (such as a door switch) are fitted.
4.2.2 Operation

When switched on, the controller lights up, goes through a short test routine and then displays the measured temperature or the over-temperature setpoint.

The page key allows access to parameter lists within the controller.

A single press of the page key displays the temperature units, normally set to °C; further presses reveal the lists indicated in the navigation diagram.

The scroll key allows access to the parameters within a list. Some parameters are display-only; others may be altered by the operator.

A single press of the scroll key in the 'Home' list displays the temperature units; further presses reveal the parameters in the current list indicated in the navigation diagram.

To return to the 'Home' list at any time, press page and scroll together, or wait for 45 seconds.

The down and up keys are used to alter the setpoint or other parameter values.

4.2.3 Over-Temperature Operation

Use down and up to alter the over-temperature setpoint. This should normally be set a little above the working temperature (for example 15 °C above). The product is supplied with the over-temperature set at 15 °C above the furnace or oven maximum working temperature.

Press scroll twice view the present temperature as measured by the over-temperature controller. Press it twice, the first press shows the temperature units (°C).

4.2.4 Over-Temperature Alarm

If an over-temperature condition occurs, the OP2 indicator flashes and an alarm message 2FSH also flashes, alternating with the setpoint. Power to the heating elements is disconnected.

4.2.5 Resetting the Over-Temperature Alarm

To acknowledge the alarm press scroll and page together.

If the alarm is acknowledged while there is still an over-temperature condition, the OP2 indicator stops flashing but continues to glow. The 2FSH alarm continues to flash until the over-temperature condition is cleared (by the temperature falling), when normal operation resumes.

If the alarm is acknowledged when the temperature has dropped (or after the over-temperature setpoint has been raised) so that the over-temperature condition no longer exists, then the furnace or oven immediately resumes normal operation.

4.2.6 Sensor Break

The over-temperature cut-out system also operates if the over-temperature control thermocouple breaks or becomes disconnected. The message S.br flashes where the measured temperature is normally displayed.
4.3 Audible Alarm

If an audible alarm is supplied for use with the over-temperature controller, it is normally configured to sound on over-temperature condition and to stop sounding when the alarm is acknowledged as given in section 4.2.

Note: the alarm may sound during controller start-up.

4.4 Navigation Diagram

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HL</strong></td>
<td><strong>OTSP</strong></td>
</tr>
<tr>
<td>Home List</td>
<td>Over-Temperature Setpoint</td>
</tr>
<tr>
<td><img src="image" alt="Page Key" /></td>
<td><img src="image" alt="Scroll Key" /></td>
</tr>
<tr>
<td><img src="image" alt="Black = Progress" /></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>AL</strong></td>
</tr>
<tr>
<td>Access List</td>
<td><img src="image" alt="For factory access to list and parameters not available to the operator." /></td>
</tr>
<tr>
<td><img src="image" alt="Dashed = Through to other options" /></td>
<td></td>
</tr>
</tbody>
</table>
5.0 Operation

5.1 Operating Cycle

This product is fitted with an instrument switch which cuts off power to the control circuit.

Connect the product to the electrical supply.

Turn on the instrument switch to activate the temperature controllers. The controllers illuminate and go through a short test cycle.

Over-Temperature option only. If the digital over-temperature option has not yet been set as required, set and activate it according to the over-temperature controller instructions.

The product will heat up according to the controller setpoint or program, unless a time switch is fitted and switched off.

As the product heats up, the heat light glows steadily at first and then flashes as the product approaches the desired temperature. For more information on temperature control see the controller instructions.

Over-Temperature option only. If the over-temperature circuit has tripped, an indicator on the over-temperature controller flashes and the heating elements are isolated. Find and correct the cause before resetting the over-temperature controller according to the instructions supplied.

To turn the product off, set the instrument switch to its off position. The controller display will go blank. If the product is to be left unattended, isolate it from the electrical supply.

5.2 General Operating Notes

Heating element life is shortened by overheating. Do not leave the product at high temperature when it is not required. The maximum temperature is shown on the product rating label and in section 11.0 towards the back of this manual.

When heating large objects, in particular poor conductors, avoid shielding the thermocouple from the heating elements. The thermocouple is intended to sense the temperature near the heating elements. However, if a large object is placed in the chamber it may record the average temperature of the object and the elements, this can lead to overheating of the elements. Allow large objects to gain heat at a lower temperature and then reset the controller to a temperature close to the desired maximum, or heat using a slowly controlled ramp rate. For more information refer to the controller instructions.

When heating materials that produce smoke or fumes, the chimney must be correctly fitted and unobstructed. If not, soot will accumulate in the chamber and could possibly cause an electrical breakdown of the heating element. If the furnace is used to heat materials that emit smoke or fumes, regularly heat it up to maximum temperature for one hour with the chamber empty to burn away the soot.
5.0 Operation

Materials such as case hardening compounds and other reactive salts may penetrate the furnace chamber lining and attack the wire elements, causing premature failure. Use of a hearth tile may be advisable: please consult the Carbolite Gero technical department.

5.3 Use of Probes

Any metal object used to probe into the product chamber while the product is connected to the electrical supply must be earthed. This applies in particular to metal sheathed thermocouples, where the sheaths must be earthed. The refractory material of the chamber lining becomes partly conductive at high temperatures and the electric potential inside the chamber can be at any value between zero and the supply voltage. Unearthed probes can cause serious electric shock.

5.4 Atmospheres

When an optional gas inlet is fitted, there is a label near the inlet saying "INERT GAS ONLY". In practice, inert or oxidising gases may be used, but not combustible or toxic gases.

The chamber is not gas tight, the gas usage may be high and the chamber is always likely to contain some air. Residual oxygen of approximately 1% to 2% is to be expected.

5.5 Operator Safety

This product incorporates a safety switch which interrupts the heating element circuit when the furnace is opened. This prevents the operator touching a live heating element and also prevents the product from heating up if the furnace is left open. The operation of this switch should be checked periodically.

Depending on use, the surfaces in the working chamber and the chamber load may still be very hot after the appliance is switched off. Touching these surfaces may cause burns. Use suitable personal protective equipment or wait until the appliance cools down to ambient temperature.

Before removing a hot object from the product, make sure there is a safe place to put it down. If necessary use tongs, face masks and heat resistant gloves. Heat resistant clothing and face protection can guard against the effects of radiated heat when the furnace is open.

When the product is opened during operation there is considerable radiated heat. Do not keep any flammable objects near the product, nor objects which could be damaged by radiated heat.
5.6 Power Adjustment

The product control system incorporates electronic power limiting. Depending on the model and the destination country the power limit maybe set to 100% or a lower figure. Where appropriate the power limit parameter OP.Hi is accessible to the operator, but it should not generally be altered.

See section 10.0 for details of the power limit settings. DO NOT adjust the power to a level higher than the design level states; this may cause a fuse to blow and could damage the heating elements.

The power limit may be set to a lower limit if the product is to be used at a low temperature only: this may give better control stability. It may be set to zero to permit demonstration of the controls without the heating elements taking power; to resume heating reset it to its standard value.
6.0 Maintenance

6.1 General Maintenance
Preventive rather than reactive maintenance is recommended. The type and frequency depends on the product use; the following are recommended.

6.2 Maintenance Schedule

DANGER! ELECTRIC SHOCK. Risk of fatal injury. Only electrically qualified personnel should attempt these maintenance procedures.

<table>
<thead>
<tr>
<th>Maintenance Procedure</th>
<th>Method</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Switch Function</td>
<td>Set a safe temperature above ambient, and open the door to see if the heater light goes out</td>
<td></td>
</tr>
<tr>
<td>Safety Switch Function</td>
<td>Electrical measurement</td>
<td></td>
</tr>
<tr>
<td>Over-Temperature Safety Circuit (if fitted)</td>
<td>Set an over-temperature setpoint lower than the displayed temperature and check for an over-temperature alarm as detailed in this manual</td>
<td></td>
</tr>
<tr>
<td>Over-Temperature Safety Circuit (if fitted)</td>
<td>Electrical measurement</td>
<td></td>
</tr>
<tr>
<td>Door Plug</td>
<td>Visual inspection, checking the seal and whether it is free of damage</td>
<td></td>
</tr>
<tr>
<td>Door Plug</td>
<td>Replacement where necessary</td>
<td></td>
</tr>
<tr>
<td>Chimney / Extraction</td>
<td>Check and clean if necessary</td>
<td></td>
</tr>
<tr>
<td>Electrical Safety (external)</td>
<td>Visual check of external cables and plugs</td>
<td></td>
</tr>
<tr>
<td>Electrical Safety (internal)</td>
<td>Physically check all connections and cleaning of the power plate area</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>Tested using certified equipment, frequency dependent on the standard required</td>
<td></td>
</tr>
</tbody>
</table>
### Operational Check
- Check that all functions are working normally
- Thorough inspection and report incorporating a test of all functions

### Performance
- **Element Circuit**
  - Electrical measurement
- **Power Consumption**
  - Measure the current drawn on each phase / circuit
- **Hearth**
  - Visual check for fit and damage
- **Cooling Fans (if fitted)**
  - Check whether the cooling fans are working
6.0 Maintenance

6.2.1 Cleaning
Soot deposits may form inside the furnace, depending on the process. At appropriate intervals remove these by heating as indicated in the General Operation Notes.

The product's outer surface may be cleaned with a damp cloth. Do not allow water to enter the interior of the case or chamber. Do not clean with organic solvents.

6.2.2 Safety Switch
When correctly functioning, the safety switch will isolate all live conductors (live and neutral connections) within the heating element circuit(s) when the product door is opened. The safety switch should be checked regularly to ensure that this occurs.

The safety switch should not fail under normal working conditions, however rough handling, exposure to corrosive materials/environments, or exceptionally frequent use, could compromise the safety system.

Weekly check:
The following check can be carried out by a general operator:

- On the temperature controller, set a safe temperature above ambient. The heater lights should illuminate.
- Open the door and check the heater lights. They should no longer be illuminated.

If the heater lights remain illuminated when the door is open, discontinue use and contact Carbolite Gero Service.

Annual check:
The following checks should be carried out by a qualified electrician, as specified in the "Maintenance Schedule" section of this manual:

- Remove the element access panel and take a voltage measurement from the heating element terminals. Do not attempt to take a reading from the heating element itself as surface oxidation will give an unreliable contact.
- Ensure that power to the heating elements is switched off when the door is opened.

Contact Carbolite Gero Service and discontinue use of the product if it is found that the heating elements are not fully isolated during these checks.

6.3 Calibration
After prolonged use, the controller and/or thermocouple may require recalibration. This is important for processes that require accurate temperature readings or for those that use the product close to its maximum temperature. A quick check using an independent
thermocouple and temperature indicator should be made from time to time to determine whether full calibration is required. Carbolite Gero can supply these items. Depending on the controller fitted, the controller instructions may contain calibration instructions.

6.4 After-Sales Service

Carbolite Gero Service has a team of Service Engineers who can offer repair, calibration and preventive maintenance of furnace and oven products both at the Carbolite Gero factory and at customers’ premises throughout the world. A telephone call or email often enables a fault to be diagnosed and the necessary parts to be despatched.

In all correspondence please quote the serial number and model type given on the rating label of the product. The serial number and model type are also given on the back of this manual when supplied with the product.

Carbolite Gero Service and Carbolite Gero contact information can be found on the back page of this manual.

6.5 Recommended Spare Parts and Spare Parts Kit

Carbolite Gero can supply individual spare parts or a kit of the items most likely to be required. Ordering a kit in advance can save time in the event of a breakdown.

Each kit consists of one thermocouple, one sheath, one solid state relay, one door insulation piece and a set of elements.

When ordering spare parts please quote the model details and serial number as requested above.
7.0 Repairs and Replacements

7.1 Safety Warning - Disconnection from Power Supply

Immediately switch the product off in the event of unforeseen circumstances (e.g. large amount of smoke). Allow the product to return to room temperature before inspection.

Always ensure that the product is disconnected from the electrical supply before repair work is carried out.

**Caution:** Double pole/neutral fusing may be used in this product.

7.2 Safety Warning - Refractory Fibre Insulation

Insulation made from High Temperature Insulation Wool

Refractory Ceramic Fibre, better known as (Alumina silicate wool - ASW).

This product contains *alumino silicate wool* products in its thermal insulation. These materials may be in the form of blanket or felt, formed board or shapes, slab or loose fill wool.

Typical use does not result in any significant level of airborne dust from these materials, but much higher levels may be encountered during maintenance or repair.

Whilst there is no evidence of any long term health hazards, it is strongly recommended that safety precautions are taken whenever the materials are handled.

**Exposure to fibre dust may cause respiratory disease.**

When handling the material, always use approved respiratory protection equipment (RPE-eg. FFP3), eye protection, gloves and long sleeved clothing.

Avoid breaking up waste material. Dispose of waste in sealed containers.

After handling, rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.

Before commencing any major repairs it is recommended to make reference to the European Association representing the High Temperature Insulation Wool industry (www.ecfia.eu).

Further information can be provided on request. Alternatively, Carbolite Gero Service can quote for any repairs to be carried out either on site or at the Carbolite Gero factory.

7.3 Temperature Controller Replacement

Refer to the controller instructions for more information on how to replace the temperature controller.
7.4 Solid-State Relay Replacement

Disconnect the product from the power supply and remove the appropriate cover as given above.

1. Make a note of the wire connections to the solid state relay, then disconnect them.
2. Remove the solid state relay from the base panel or aluminium plate.
3. Replace and reconnect the solid state relay ensuring that the bottom of it has good thermal contact with the base panel or aluminium plate.
4. Replace the access panel.

7.5 Thermocouple Replacement

Disconnect the product from the power supply. Remove terminal cover to gain access to the thermocouple connections. Make a note of the thermocouple connections.

Thermocouple cable colour codings are:

<table>
<thead>
<tr>
<th>Thermocouple Leg</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive (type K)</td>
<td>green</td>
</tr>
<tr>
<td>negative</td>
<td>white</td>
</tr>
</tbody>
</table>

Disconnect the thermocouple from its terminal block and withdraw the thermocouple from its sheath by bending the metal tag or releasing the screw to release. It is also advisable to remove the sheath and shake out any broken pieces of thermocouple.

Re-assemble with a new thermocouple, observing the colour coding, ensuring that the thermocouple is not twisted as it is being inserted and that the metal tag is bent back to grip the sheath.

Refit the element access panel.

7.6 Panel Element Replacement

See section 7.2 - wearing a face mask is required.

The chambers have two side-mounted refractory panels in which coiled heating elements are inserted, normally out of sight behind silicon carbide chamber walls.

Disconnect the product from the electrical supply and remove the products back panel.

Make a written plan showing ALL the element and thermocouple connections. It is important to make this plan for each individual product.

Disconnect all the element wire tails and thermocouple cables from their terminal blocks.

Straighten all the element tails. Note that these become brittle with use.
Unscrew the screws fixing the metal back piece to the insulation assembly, and carefully remove it, complete with thermocouple(s) and sheath(s).

⚠️ Withdraw the back insulation piece. Handle with care.

Remove the silicon carbide chamber side walls, then withdraw the old element(s), and insert the new. Note that the ceramic element carriers are in two pieces, front and back: take care when handling them.

Replace the back insulation piece and metal piece together with the thermocouple(s) and sheath(s).

As necessary, shorten the element tails by clipping to length.

Remake all the thermocouple and element connections according to the individual plan.

Refit the back panel and operate the furnace for 30 minutes at 800 °C without interruption to ensure complete burn-off of any organic binders. Some smoke may be observed during this process, which should be carried out in a well ventilated area.

Check that the furnace is controlling properly to rule out the possibility that previous element failed because of a fault elsewhere in the control circuit.
7.7  Door Plug Replacement

See section 7.2 - wearing a face mask is required.

Open the door and remove the door cover from the plug carrier assembly. Remove the old door plug by sliding it upwards out of its carrier. Slide the new plug into the carrier assembly making sure that the plug is the correct way up. Refit the door cover.

When first heating the furnace after a replacement, ensure that the ventilation is good: emission of some fumes is to be expected.

7.8  Fuse Replacement

Fuses are marked on the wiring diagram with type codes, e.g. F1, F2. For more information on fuses refer to section 10.0.

Depending on model and voltage, the different fuse types may or may not be fitted.
If any fuse has failed, it is advisable for an electrician to check the internal circuits. Replace any failed fuses with the correct type. For safety reasons do not fit larger capacity fuses without first consulting Carbolite Gero.

The fuses are located at the cable entry point. Remove the back panel or control box back panel to gain access to the fuses.
## 8.0 Fault Analysis

### A. Furnace Does Not Heat Up

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The HEAT light is ON</td>
<td>The heating element has failed</td>
<td>Check also that the SSR is working correctly</td>
</tr>
<tr>
<td>2. The HEAT light is OFF</td>
<td>The controller shows a very high temperature or code such as S.br</td>
<td>The thermocouple has broken or has a wiring fault</td>
</tr>
<tr>
<td></td>
<td>The controller shows a low temperature</td>
<td>The door switch(es) (if fitted) may be faulty or need adjustment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The contactor/relay (if fitted) may be faulty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The heater switch (if fitted) may be faulty or need adjustment</td>
</tr>
<tr>
<td></td>
<td>There are no lights glowing on the controller</td>
<td>The SSR could be failing to switch on due to internal failure, faulty logic wiring from the controller, or faulty controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the supply fuses and any fuses in the furnace control compartment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault.</td>
</tr>
</tbody>
</table>
### B. Product Overheats

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Product only heats up when the instrument switch is ON</td>
<td>The controller shows a very high temperature</td>
<td>The controller is faulty</td>
</tr>
<tr>
<td></td>
<td>The controller shows a low temperature</td>
<td>The thermocouple may be faulty or may have been removed out of the heating chamber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The thermocouple may be connected the wrong way around</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The controller may be faulty</td>
</tr>
<tr>
<td><strong>2.</strong> Product heats up when the instrument switch is OFF</td>
<td>The SSR has failed &quot;ON&quot;</td>
<td>Check for an accidental wiring fault that could have overloaded the SSR</td>
</tr>
</tbody>
</table>
9.0 Wiring Diagrams
9.1 WA-U3-30
Connections below show 3-phase +N with indirect safety switches.

Safety switch examples:
- Chamber furnaces - door switch
- Tube furnaces - heater switch

See below for other configurations
### Key

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1, F2, F3</td>
<td>Fuses</td>
</tr>
<tr>
<td>FIL</td>
<td>Filter (if fitted)</td>
</tr>
<tr>
<td>C</td>
<td>Controller</td>
</tr>
<tr>
<td>TC</td>
<td>Control Thermocouple</td>
</tr>
<tr>
<td>R1, R2, R3</td>
<td>Relay</td>
</tr>
<tr>
<td>R1/1, R1/2, R2/1, R2/2, R3/1, R3/2</td>
<td>Relay contactor</td>
</tr>
<tr>
<td>SW</td>
<td>Instrument Switch(es)</td>
</tr>
<tr>
<td>SSW</td>
<td>Safety Switch</td>
</tr>
<tr>
<td>EL</td>
<td>Element</td>
</tr>
<tr>
<td>SSR</td>
<td>Solid State Relay</td>
</tr>
<tr>
<td>N</td>
<td>Neutral</td>
</tr>
<tr>
<td>L</td>
<td>Live</td>
</tr>
<tr>
<td>PE</td>
<td>Earth</td>
</tr>
</tbody>
</table>

### Cables

<table>
<thead>
<tr>
<th>Cables</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU</td>
<td>Blue</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>BL</td>
<td>Black</td>
</tr>
<tr>
<td>GR/Y</td>
<td>Green + Yellow</td>
</tr>
<tr>
<td>G</td>
<td>Grey</td>
</tr>
<tr>
<td>P</td>
<td>Pink</td>
</tr>
</tbody>
</table>

Products with this wiring arrangement may be converted between the following supply voltages (please refer to the table within section 10.0 for compatible phases with the product):

- 3-phase + neutral in the range 380/220 V - 415/240 V
- 3-phase delta in the range 220 V - 240 V
- Single phase in the range 220 V - 240 V
- **208 V model: can be converted between 208 V delta and 208 V 1-phase**

Please contact Carbolite Gero Service for details.
9.0 Wiring Diagrams

9.2 WA-U3-31

Connections below show 3-phase +N with safety switches and over-temperature control.

See below for other configurations

Single Phase Connections

Delta Connections

Not used
Products with this wiring arrangement may be converted between the following supply voltages (please refer to the table within section 10.0 for compatible phases with the product):

- 3-phase + neutral in the range 380/220 V - 415/240 V
- 3-phase delta in the range 220 V - 240 V
- Single phase in the range 220 V - 240 V
- **208 V model: can be converted between 208 V delta and 208 V 1-phase**

Please contact Carbolite Gero Service for details.
10.0 Fuses and Power Settings

10.1 Fuses

F1-F3: Refer to the circuit diagrams.

<table>
<thead>
<tr>
<th></th>
<th>Internal Supply Fuses</th>
<th>Fitted if supply cable fitted. Fitted on board to some types of EMC filter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>GEC Safeclip of the type shown (glass type F up to 16 A) 38 mm x 10 mm type F fitted on EMC filter circuit board(s)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Auxiliary Circuit Fuses</th>
<th>Fitted on board to some types of EMC filter. May be omitted up to 25 Amp/phase supply rating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>2 Amps glass type F On board: 20 mm x 5 mm Other: 32 mm x 6 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Heat Light Fuses</th>
<th>May be omitted up to 25 Amp/phase supply rating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3</td>
<td>2 Amps glass type F 32 mm x 6 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Customer Fuses</th>
<th>Required if no supply cable fitted. Recommended if cable fitted.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>See rating label for current; See table below for fuse rating.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Phases</th>
<th>Volts</th>
<th>Supply Fuse Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAF-BAL 11/17</td>
<td>1-phase</td>
<td>200-208</td>
<td>16 A</td>
</tr>
<tr>
<td>AAF-BAL 11/17</td>
<td>1-phase</td>
<td>220-240</td>
<td>63 A</td>
</tr>
<tr>
<td>AAF-BAL 11/17</td>
<td>3-phase delta</td>
<td>220-240</td>
<td>12 A per phase</td>
</tr>
<tr>
<td>AAF-BAL 11/17</td>
<td>3-phase no Neutral</td>
<td>380-415</td>
<td>12 A per phase</td>
</tr>
</tbody>
</table>

10.2 Power Settings

The power limit settings (parameter OP.Hi) for this model are voltage dependant. The figures represent the maximum percentage of time that controlled power is supplied to the elements. Do not attempt to “improve performance” by setting a value higher than the recommended values. To adjust the parameter refer to the "Changing the Maximum Output Power" of the control section of the manual.

<table>
<thead>
<tr>
<th>Volts</th>
<th>110 V</th>
<th>200 V</th>
<th>208 V</th>
<th>220 V</th>
<th>230 V</th>
<th>240 V</th>
<th>415 V</th>
<th>254 V</th>
<th>440 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power (%)</td>
<td>-</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>94</td>
<td>83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please refer to the rating label for product specific information.
11.0 Specifications

Carbolite Gero reserves the right to change the specification without notice.

<table>
<thead>
<tr>
<th>Model</th>
<th>Max Temp (°C)</th>
<th>Max Power (kW)</th>
<th>External Size (mm)</th>
<th>Chamber Size (mm)</th>
<th>Net Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>H W D</td>
<td>H W D</td>
<td></td>
</tr>
<tr>
<td>Ashing Burn-off and Coal and Coke Testing Furnace</td>
<td>1100</td>
<td>7.08</td>
<td>705 505 675</td>
<td>215 196 400</td>
<td>70</td>
</tr>
</tbody>
</table>

11.1 Environment

The models listed in this manual contains electrical parts and should be stored and used in indoor conditions as follows:

Temperature: 5 °C - 40 °C

Relative humidity: Maximum 80 % up to 31 °C decreasing linearly to 50 % at 40 °C
<table>
<thead>
<tr>
<th>Engineer Name</th>
<th>Date</th>
<th>Record of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
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:

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Fax: +44 (0) 1433 624243  
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