CARBOLITE GERO

30-3000°C

Installation, Operation and Maintenance Instructions

200°C Coal Drying Oven - CDHT Model: 450 Litres
2416 Controller

CDHT 450 + 2416 Controller

Contents

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

1.0 Symbols and Warnings

1.1 Switches and Lights

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

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 or moving the product, always lift by its base; do not use the door or any other projecting cover or component to support the equipment when moving it. Use a fork lift or pallet truck to move the product; position the product on a level surface and use an adequate number of personnel to safely move the product into position.

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

Locate the shelves as required.

Some models may be lifted by fitting lifting bolts to captive threads which are fitted in the top of the case, whilst others may have welded on lifting eyes.

> 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.
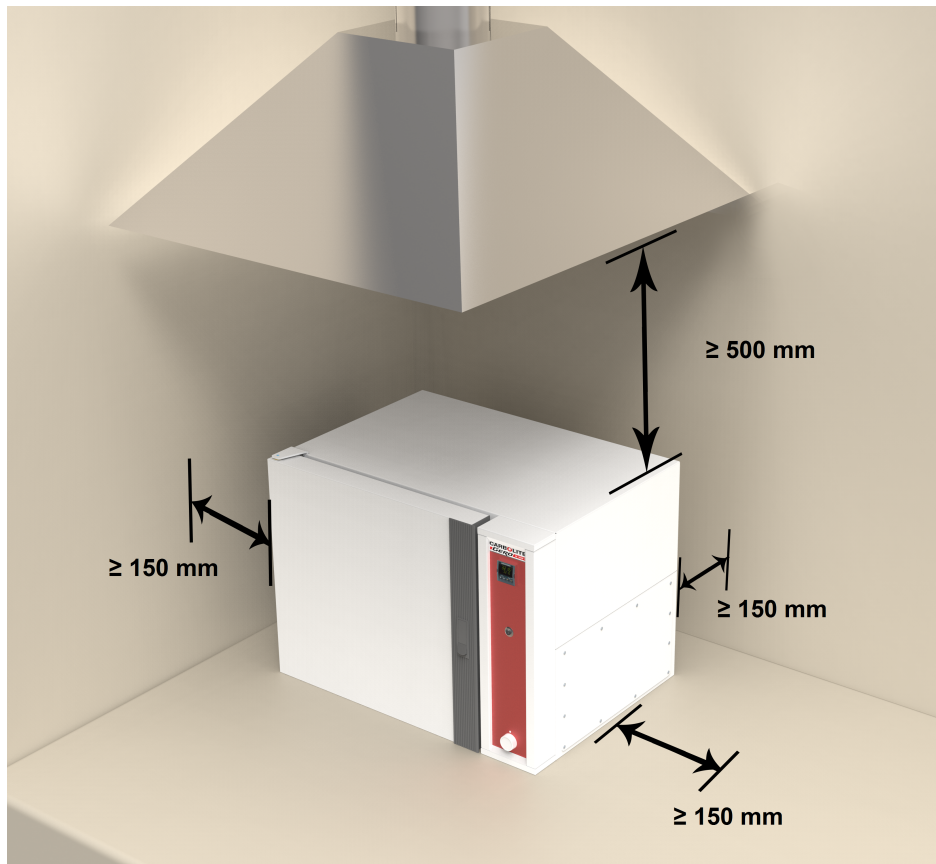
Depending on the application of the product, it may be appropriate to position it under an extraction hood. Ensure the extraction hood is switched on during use.

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   Electrical Connections

Connection by a qualified electrician is recommended.

The product covered by this manual usually requires a single phase A.C. supply, which may be Live to Neutral non-reversible, Live to Neutral reversible or Live to Live. Some models may be ordered for 3-phase use, which may be star or delta.

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

A table of the most common fuse ratings is also given in section 8.0 towards the back of this manual. Ensure that the correct fuse is used for the product supplied. When the mains cable is factory fitted internal fuses are also fitted. Customer fusing is essential.

Product with supply cable: either wire directly to an isolator or fit with a line plug.

Product without supply cable: a permanent connection to a fused and isolated supply should be made to the internal terminals after temporary removal of the product access panel. The access panel is located at the top of the 'A' models and the right hand side of the 'B' models.

Connection by line plug: the plug should be within reach of the operator and should be easy to remove.

Connection to isolating switch: this should operate on both conductors (single phase) or on all live conductors (three phase), and should be within reach of the operator.

The electrical supply MUST incorporate an earth (ground).

Electrical Connection Details:

Supply	Terminal Label	Cable Colour	Supply Types	
			Live - Neutral	Reversible or Live-Live
1-phase	L	Brown	to live	to either power conductor (For USA 200-240V, connect L1)
	N	Blue	to neutral	to the other power conductor (For USA 200-240V, connect L2)
	PE	Green/ Yellow	to earth (ground)	to earth (ground)

3-phase	L1	Black	to phase 1	
	L2	Black	to phase 2	
	L3	Black	to phase 3	
	N	Light Blue	to neutral (**except delta**)	
	PE	Green/ Yellow	to earth (**ground**)	

DO NOT connect a product ordered for three phase use to a single phase supply or to the wrong type of three phase supply.

3.0   2416 Controller

3.1   Description

This manual applies to the 2416, 2416CG and 2416P8 controllers.

Special customer requirements may result in changes to the available parameters and the navigation diagram. It is not possible to list all the possibilities in this manual.

2416CG Controller

The Eurotherm model 2416CG is a digital instrument with PID control algorithms which may be used as a simple controller or an 8-segment programmer. The 2416P8 is an eight-program model in which the programs can be stored independently or can be linked by a "call" parameter to form a single long program.

The 2416 Controller features:

- Easy use as a simple temperature controller, where on setting the required temperature the controller immediately attempts to reach and maintain it. Fig.1 indicates the type of temperature response when used in this way.
- By using one program segment, the control can be extended to include ramp-to-setpoint. Fig.2 shows the effect.
- Alternatively, the 2416 Controller may be used as an 8-segment programmer, with each segment being a "Ramp", a "Step", a "Dwell", or "End". The program can be set to cycle if required. See fig. 3.
- Optional "modules" are available, in particular:
- RS232 and RS432/485 digital communications modules;
- Analogue communication modules;
- "PDSIO" modules for communication with other controllers of similar or higher specification, for example, to allow cascade control;
- Alarm modules, which can be used to drive visible or audible alarms, or to provide volt-free contacts for customer use.
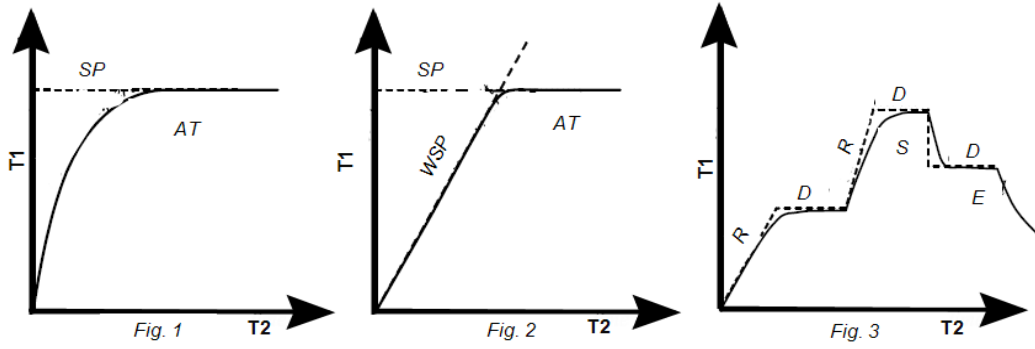
Fig 1 -Simple Control

Fig 2 - Control with Ramp-to-Setpoint
Seg 1 = Ramp
Sep 2 = End (Dwell)

Fig 3 - A Program

| Key	
T1	Temperature
T2	Time
SP	Setpoint
AT	Actual Temperature
WSP	Working Setpoint
R	Ramp
D	Dwell
S	Step
E	End

3.2   Operation

Most Carbolite Gero products are fitted with an instrument switch which cuts off power to the controller and other parts of the control circuit. See section 5.0 for operating instructions.

To operate the 2416 Controller there must be power to the furnace or oven and the instrument switch must be on. If a time switch is included in the furnace or oven circuit, this must be in an ON position.

2416CG - Operation

When switched on, the controller lights up, goes through a short test routine and then displays the measured temperature and setpoint. Depending on its state when it was last switched off, it may start to control to the current setpoint of program. The output light glows or flashes to indicate that the control is occurring.

The buttons and indicators are used for the following purposes:
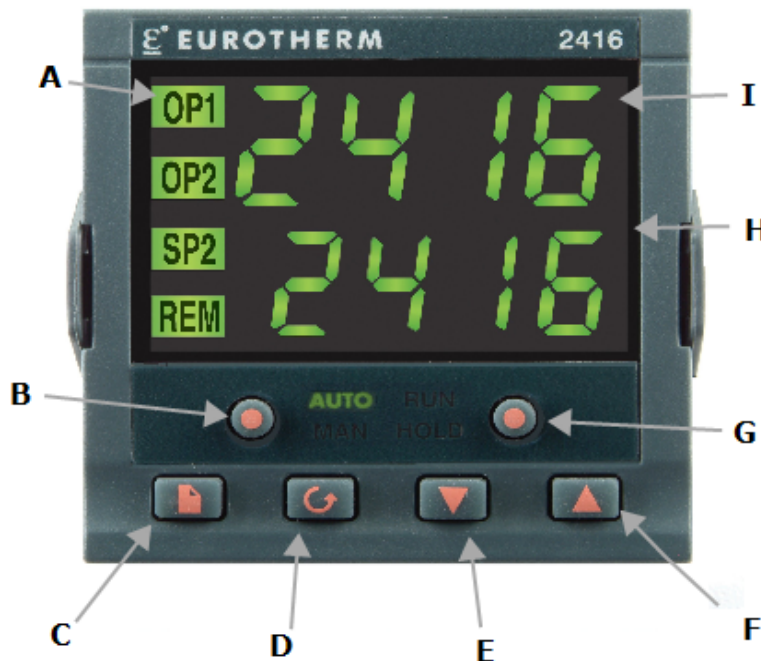
Key	
A	Output Light
B	Not Used
C	Page
D	Scroll
E	Down
F	Up
G	Run/Hold
H	Setpoint Temperature (SP)
I	Measured Temperature

Auto/ Manual	Disabled.	The unit is always in 'Auto' mode
RUN/HOLD	-	Used to start, stop or pause a program. Short presses cause it to alternate between 'Run' and 'Hold', but if it is held for 2 seconds the programmer goes into 'Reset' mode where it behaves as a simple controller.
Up + Down	▲ + ▼	To adjust the value of a parameter. Used to change the setpoint when the unit is being used as a simple controller ('Reset' mode). Holding down gives an accelerated parameter change.
Page	🗎	Allows access to the parameters within the controller; most lists and parameters are hidden from the operator as they contain factory-set values which should not be altered. A single press of the page key shows the temperature units, normally °C; further presses reveal the lists indicated in the Navigation Diagram.
Scroll	🔄	Allows access to the parameters within a list. A single press displays the temperature units; further presses reveal the parameters in the current list. Some parameters are display-only, others may be altered by the operator.
Page + Scroll	🗎 + 🔄	Press together to cause an immediate return to the 'Home List'
Run & Hold		Indicate the current mode: 'Run', 'Hold', or 'Reset' (Reset: both lights off). 'Run' flashes at the end of a program. 'Hold' flashes during holdback (when the program is paused to allow the temperature to catch up with a heating or cooling rate which is too fast).
Output Indicator		OP1 indicates that the programmer is calling for heat to be supplied. OP2 is not used.
SP2 and REM		Not generally used; indicate 'Second' or 'Remote' setpoint in use.

Operation as a Simple Controller

Press RUN/HOLD for 2 seconds to go into 'Reset' mode. Use down ▼ or up ▲ from the 'Home List' (i.e. when the temperature is displayed) to adjust the setpoint. The unit starts to control in the way indicated in Fig. 1.

> Note that to use the Ramp Rate feature, as in Fig. 2, it is necessary to create a program. See the following sections.

3.3   Programming

Note that a currently active segment cannot be altered - put the programmer into 'Hold' or 'Reset' whenever it is necessary to do so to alter a parameter. Go into 'Reset' mode (i.e. press RUN/HOLD for 2 seconds) before starting to create or modify a program.

Press page ▮ until 'ProG LiSt' is displayed.

Press scroll ⏏ to reveal the 'Holdback' and 'Loop Count' parameters. See sections 3.3.3 and 3.3.4 for a description of these.

Press scroll ⏏ to display 'SEG.n' (segment number); use down ▼ or up ▲ to move to the segment to be adjusted or created.

Press scroll ⏏ to see the 'tYPE' (segment type); use down ▼ or up ▲ to change the required segment type – see the table below.

Press scroll ⏏ to access the parameters appropriate to the type of segment chosen –

see the following table – and use down ▼ or up ▲ to alter the values.

The final segment should be of type 'End', unless all program segments are used. Segments after 'End' are ignored.

Segment Type	Parameter	Function
RmP.r	TGt	The target setpoint for this segment
	rATE	The ramp rate (rate of temperature change) in °/ minute
RmP.t	TGt	The target setpoint for this segment
	dur	The duration of the segment. The controller calculates the rate of temperature rise necessary to achieve this duration.
Dwel	dur	The time in minutes to remain at the previous target temperature. 10ths of a minutes are allowed.
SteP	tGt	A new target temperature to be achieved as quickly as possible.
CaLL	PrG.n cyc.n	Only applicable to 2416P8. Calls another stored program given by 'PrG.n' as a subroutine, running it the number of times given by 'cyc.n".
End	End.t	'Dwel' holds the temperature at the last target value. 'RSET' returns to simple controller operation; if the setpoint is set to zero then this effectively turns the heating off. 'SoP' sets the power to 0% – use of this is not recommended.

3.3.1   Programming Tips

Make sure the basic setpoint is set to zero to avoid unexpected heating at the end of a program.

If all segments are used so that there is no 'End' segment, then on completion the program automatically goes into 'Dwell'.

Dwell segments of length zero can be included. This is a way of allowing space for future program changes.

For an example of program creation, see section 3.3.6.

3.3.2   Multi-program model (2416P8)

The 'Program Edit' list contains the extra parameter 'PrG.n' and the 'Run' list contains the extra parameter 'PrG'. These features allow selection of the program to be edited or to be operated.

The extra segment type 'cALL' allows one program to call another as a subroutine; use this feature to create one or more long programs.

3.3.3   Holdback

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

In the program list, scroll 🔄 to the 'Holdback' parameter and use down ▼ or up ▲ to set the holdback type as follows:

Band	Holdback applies to both heating and cooling
Lo	Holdback applies to heating only
Hi	Holdback applies to cooling only
Off	Holdback is off

Set 'Hb.V' to the value in °C beyond which holdback is to operate. Type 'BAnd' and a value of 10 °C is often a suitable combination, if holdback is required. In this case, if the actual temperature deviates outside ±10 °C from the working setpoint, the holdback lamp of the front of the controller flashes and the program is held up until the temperature comes within range again.

The standard setting for holdback is OFF.

3.3.4   Program Cycling

The 'Loop Count' parameter 'CYC.n' can be set to control the number of times the program is run.

If 'CYC.n' = 1, the program stops at the end segment.

If 'CYC.n' = 5 (for example), the program runs 5 times: at the 'End' segment it returns to segment 1, until the 5th time through when it stops.

If 'CYC.n' = cont, the program never ends: it cycles continuously.

3.3.5   Running a Program

Press Run/ Hold to light up the 'Run' light. The program starts to operate.

To view the progress of a program from the 'Home' list, press scroll 🔄 to reveal the current segment ('SEG') and the total program time remaining in hours ('PrG.t').

For a more detailed view, press page 🗎 to access the 'Run' list page and scroll 🗗 to see its contents as shown in the Navigation Diagram below. Provided the unit is first put into 'Hold' mode, temporary changes may be made to parameters; these apply only until the program ends or is reset.

To pause a program, press Run/ Hold; the 'Hold' light comes on. To terminate a program, press Run/ Hold for 2 seconds; the 'Run' and 'Hold' lights go out.

While the program is operating, the working setpoint is shown in the lower display.

3.3.6   Program example

The following sequence of entries creates and runs the program.

1. Press page 🗎 key until 'ProG LiSt' is displayed.
2. Press scroll 🗗 until 'CYC.n' is displayed and use the arrow key to select 1.
3. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 1.
4. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select rmP.r.
5. Press scroll 🗗 until 'tGt' is displayed and use the arrow key to select 600.
6. Press scroll 🗗 until 'rAtE' is displayed and use the arrow key to select 5.0.
7. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 2.
8. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select dwEl.
9. Press scroll 🗗 until 'dur' is displayed and use the arrow key to select 60.0.
10. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 3.
11. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select rmP.t.
12. Press scroll 🗗 until 'tGt' is displayed and use the arrow key to select 400.
13. Press scroll 🗗 until 'dur' is displayed and use the arrow key to select 60.0.
14. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 4.
15. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select 'dwEll'.
16. Press scroll 🗗 until 'dur' is displayed and use the arrow key to select 30.
17. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 5.
18. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select rmP.r.
19. Press scroll 🗗 until 'tGt' is displayed and use the arrow key to select 30.
20. Press scroll 🗗 until 'rAtE' is displayed and use the arrow key to select 5.0.
21. Press scroll 🗗 until 'SEG.n' is displayed and use the arrow key to select 6.
22. Press scroll 🗗 until 'tYPE' is displayed and use the arrow key to select 'End'.
23. Press scroll 🗗 until 'End.t' is displayed and use the arrow key to select 'dwEll'.
24. Press the page 🗎 key until you return to the main display.
25. Press the 'Run' key. The program operates.

3.4   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.

3.4.1   Digital Communications - RS232

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

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

3.4.2   Digital Communications - RS485

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

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

3.4.3   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.

3.4.4   Alarm Option

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

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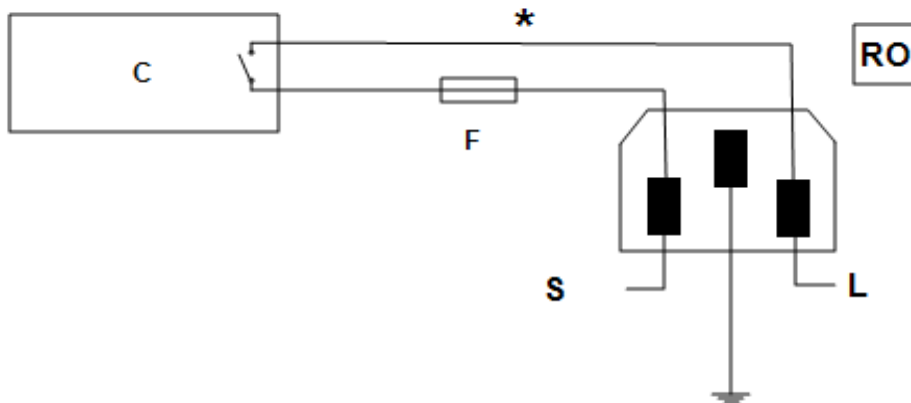
Key	
C	Temperature Controller
F	Fuse (2A)
S	Supply
L	Load
*	Normally open relay contacts
RO	Relay Output 240V 2A MAX

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

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

3.5   Temperature Controller Replacement

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

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

3.6   Navigation Diagram
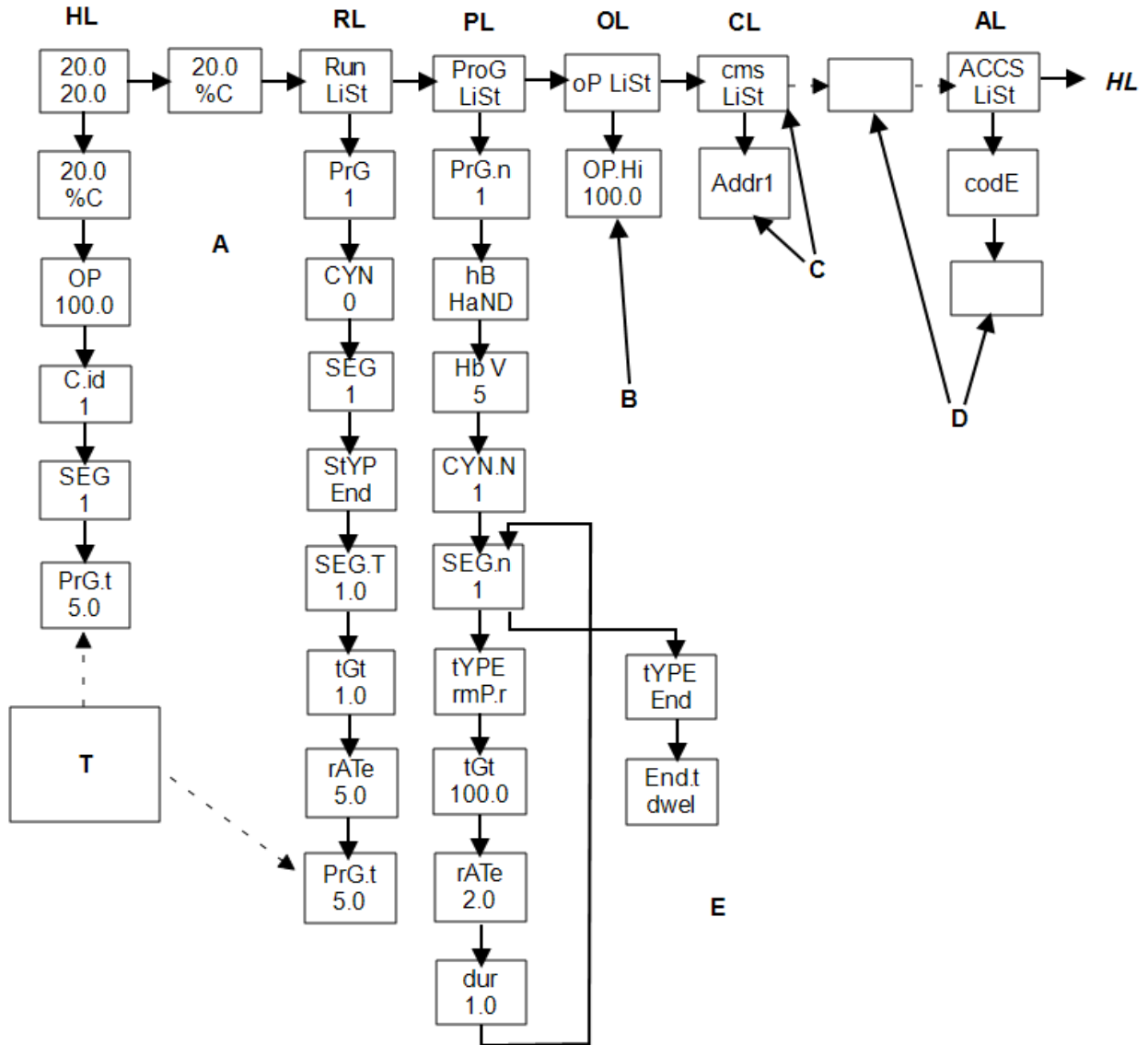
4.0   2132 Over-Temperature Controller Description (if fitted)

4.1   Description

Key	
A	Alarm Light
B	Page
C	Scroll
D	Down
E	Up
F	Display

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. See section 4.4.

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
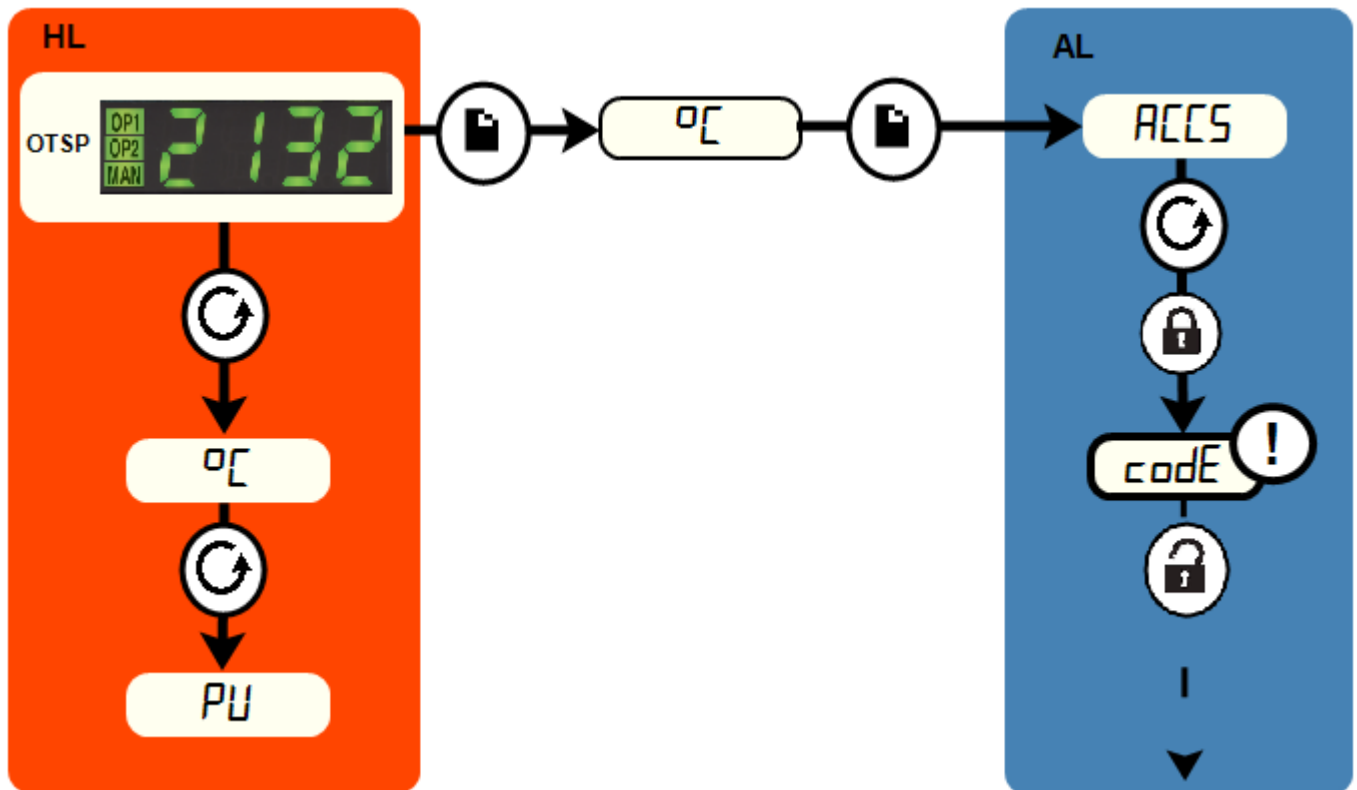
HL	Home List		Page Key		Black = Progress
OTSP	Over-Temperature Setpoint		Scroll Key		
AL	Access List		For factory access to list and parameters not available to the operator.		Dashed = Through to other options

5.0 Operation

5.1 Operating Cycle

The product is fitted with an instrument switch. The switch cuts off power to the controllers and elements. The circulation fan will operate when the instrument switch is on. An optional door switch may be fitted. If so, ensure that the door is closed to operate the fans and heating elements.

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.

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 switch the product off, turn off the instrument switch. If the product is to be left unattended, isolate the electricity supply.

DO NOT switch off if the temperature is above 100 °C - damage could be caused to the fan and motor. Adjust the controller to allow the temperature to fall.

5.2 Over–Temperature Control (if fitted)

The over-temperature controller should typically be set at 15 °C above the main controller. If an over-temperature condition occurs, check the main controller is functioning correctly.

An over-temperature condition cuts off power to the heating elements. A light in the over-temperature controller flashes. To reset this, refer to the over-temperature control section of this manual.

5.3 Explosive Vapours

Unless your product includes the stoving and curing option, this model is not suitable for drying or heat treatment applications where vapours are released that are combustible or which can form explosive mixtures with air. Carbolite Gero manufactures other products suitable for these applications.

5.4   Cool Drying Application

The CDHT is designed to operate at typically 150°C - 200°C to dry and test coal samples in accordance with international standards.

The oven has air inlet and outlet vents designed to ensure a constant flow of fresh air to dry the samples and carry moisture away.

Open the inlet and outlet vents to the minimum amount required to ensure consistent drying results.

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

CUSTOMER

QUALIFIED PERSONNEL

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

Maintenance Procedure	Method	Frequency				
		Daily	Weekly	Monthly	Bi-Annually	Annually
Safety						
Over-Temperature Safety Circuit (if fitted)	Set an over-temperature setpoint lower than the displayed temperature and check for an over-temperature alarm as detailed in this manual		■			
Over-Temperature Safety Circuit (if fitted)	Electrical measurement ⚠					🔴
Door Seal	Visual inspection - check for splits or fraying		■			
Door Seal	Replacement					🔴
Air Vent	Check and clean if necessary			■		🔴
Electrical Safety (external)	Visual check of external cables and plugs			■		
Electrical Safety (internal)	Physically check all connections and cleaning of the power plate area					🔴
Function						
Temperature Calibration	Tested using certified equipment, frequency dependent on the standard required			■	■	🔴
Operational Check	Check that all functions are working normally	■				
Operational Check	Thorough inspection and report incorporating a test of all functions					🔴
Performance						

Cooling Fans (if fitted)	Check whether the cooling fans are working	■				
Circulating Fan (if fitted)	Visual check to see if it is running		■			
Circulating Fan (if fitted)	Check bearings and replace if necessary					⚠
Element Circuit	Electrical measurement ⚠					⚠
Power Consumption	Measure the current drawn on each phase / circuit					⚠
Shelves	Visual check for fit and damage	■				

6.2.1 Cleaning

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.

> ⚠ 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.

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 a fan and motor assembly, a thermocouple, a solid state relay, an element (or set of elements) and a door seal. Individual spare parts are also available.

When ordering spare parts please quote the model details as requested above.

6.6   Power Adjustment

The control system incorporates electronic power limiting, but for the model listed in this manual the power limit is set to 100%. The power limit parameter OP.Hi may be accessible to the operator, but should not generally be altered.

In some cases the supply voltage may be outside the range 220-240 V or the 3-phase equivalent, the power limit parameter may be set to a value other than 100%. Do not increase the value to 100%, see section 8.0 for details of power limit settings.

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   Panel Removal

Disconnect the product from the electrical supply.

Remove the screws holding the panel. Do not disconnect any wiring without first making a careful note of all the connections.

For the internal element cover. Open the door. Remove any screws holding the panel and any clips holding thermocouples in position. Remove the cover.

7.4   Temperature Controller Replacement

Refer to the controller instructions for more information on how to replace the temperature controller.

7.5   Fuse Replacement

Fuses are accessed by removal of the panel as explained in 'Panel Removal' section. Depending on the model, supply fuses and control circuit fuses may be mounted in their own holders, or may be on a circuit board that contains an EMC filter. The fuses are marked with their ratings.

Take care not to disconnect the wires leading from the EMC filter without first recording their positions: they must be reconnected to the correct terminals.

7.6   Element Replacement

- Remove the cover plate over the element tails on top of the oven.
- Open the door and remove the shelves and the element cover. The elements will be directly in front of you.
- Release the gland nut on the compression fitting holding the element, and remove the element.
- Fit the new element using new olives.
- Refit the electrical connections and covers.

7.7   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:

Thermocouple leg	Colour
positive (type K)	green
negative	white

Undo any clips holding the thermocouple. Remove the air guide from the oven chamber. Disconnect the thermocouple from its terminal block. Unscrew the compression fitting inside the chamber and pull the thermocouple into the chamber. Cut through the thermocouple behind the olive and remove the two parts. Loosely assemble compression fitting with a new ferrule. Feed in new thermocouple through from the

back. Tighten the compression fitting. Refit the air guide. Bend the thermocouple to match the shape of the previous part and refit any clips.

Refit the element access panel.

Compression fittings are only fitted to moisture extraction and stoving and curing products. If fitted, ferrules need replacing.

7.8   Solid-state Relay Replacement

Disconnect the product from the electrical supply and remove the product's access panel. The access panel is located at the top of 'A' models and the right hand side of 'B' models.

Make a note of the wiring connections to the solid state relay and disconnect them.

Remove the solid state relay from the base panel or aluminium plate.

Replace and reconnect the solid state relay ensuring that the bottom of the solid state relay connects securely to the base panel or aluminium plate, as good thermal contact is required.

Replace the removed panel.

8.0   Fuses and Power Settings

8.1   Fuses

F1 - F2: Refer to the circuit diagrams.

F1	Internal Supply Fuses	Fitted if supply cable fitted. Fitted on board to some types of EMC filter.	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)
F2	Auxiliary Circuit Fuses	Fitted on board to some types of EMC filter. May be omitted up to 25 Amp/ phase supply rating.	2 Amps glass type F On board: 20 mm x 5 mm Other: 32 mm x 6 mm
	Customer Fuses	Required if no supply cable fitted. Recommended if cable fitted.	See rating label for current; See table below for fuse rating.

Model	Phases	Volts	Supply Fuse Rating (Amps) F1
CDHT/450	3 Phase + No Neutral	208V	32 A

8.2   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.

Please refer to the rating label for product specific information.

9.0 Fault Analysis

A.	Oven Does Not Heat Up				
1.	The temperature controller is OFF	▶	No power from supply	▶	Check the fuses in the supply line
2.	The temperature controller is ON	▶	The controller shows a very high temperature or a code such as EEE or --- or S.br	▶	The temperature sensor has broken or has a wiring fault
		▶	The controller shows a low temperature	▶	The SSR could be failing to switch on due to internal failure, faulty logic wiring from the controller, or faulty controller
		▶	There are no lights glowing on the controller	▶	The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault

B.	Oven Overheats				
1.	Oven only heats up when the instrument switch is ON	▶	The controller shows a very high temperature	▶	The controller is faulty
		▶	The controller shows a low temperature	▶	The thermocouple may have been shorted out or may have been moved out of the oven
				▶	The thermocouple may be connected the wrong way round
				▶	The controller may be faulty
2.	Oven heats up when the instrument switch is OFF	▶	The SSR has failed "ON"	▶	Replace the SSR. Check for an accidental wiring fault which could have overloaded the SSR

10.0   Wiring Diagrams

For wiring diagrams, please contact Carbolite Gero Service. Please quote the serial number and model.

11.0 Specifications

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

Model	Max Temp (°C)	Max Power (kW)	Chamber Size			Approx Capacity (l)	Net Weight (kg)
			H	W	D		
CD Range Ovens for Coal Drying							
CDHT/450	200	9	610	610	1220	454	400

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

Notes

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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:

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