

Installation, Operation and Maintenance Instructions

250°C Laboratory Fan Ovens - Apex Range: 120 Litres
R38 Controller

AX 120 + R38 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.

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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.

1.2 General Warnings



DANGER – Electric shock. Read any warning printed next to this symbol.

WARNING: Risk of fatal injury.

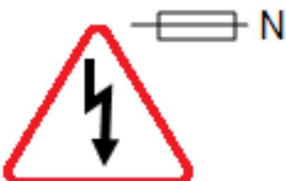


DANGER – Hot surface. Read any warning printed next to this symbol.

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

Remove the shelves and runners from the packaging before attempting to move the equipment.

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.

Locate the shelves and runners as required.



NOTE: This product contains Refractory Ceramic Fibre (also known as Alumino Silicate Wool - ASW). For precautions and advice on handling this material see section 6.2.

2.2 Siting and Setting Up

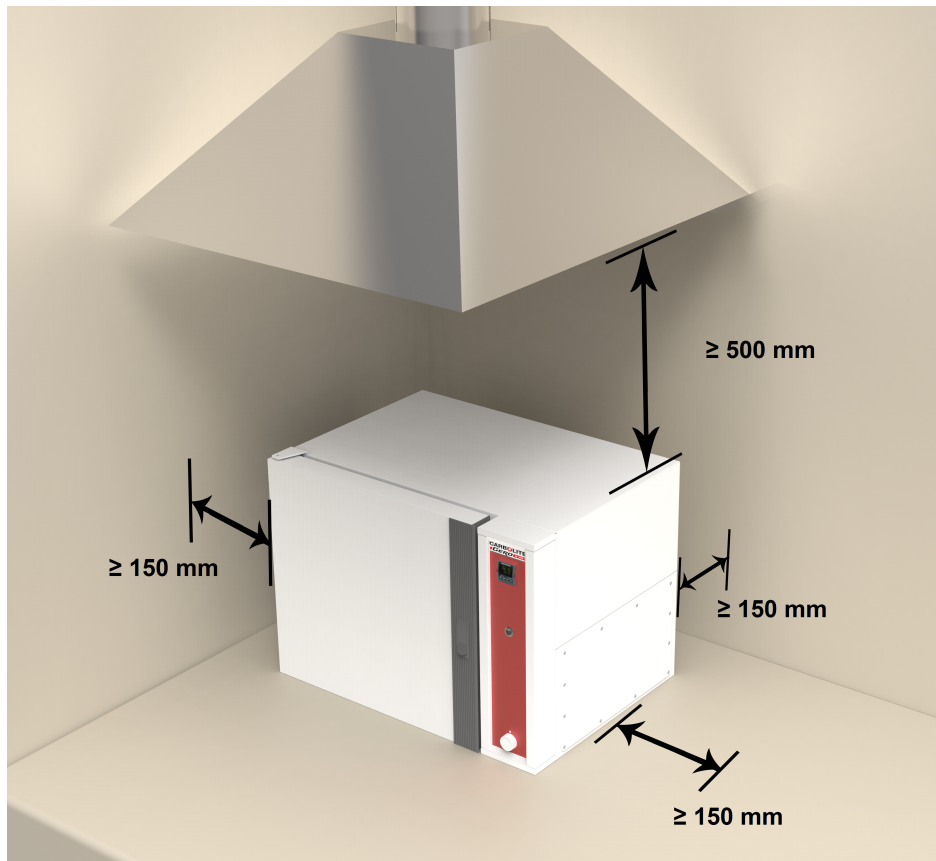
Place the product on a level surface in a well ventilated area.

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.



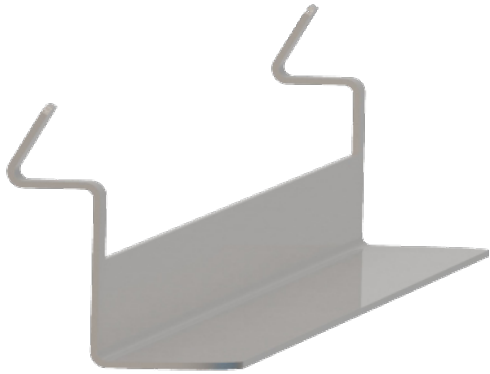
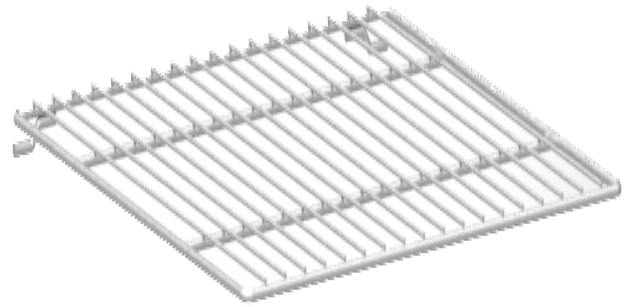
Ensure that the product is placed in such a way that it can be quickly switched off or disconnected from the electrical supply.



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.

If the over-temperature option is not fitted, ensure that the unit can be directly observed.

2.2.1 Shelf Fitting

*Runner**Shelf*

To fit the shelves:

1. Insert the runner into the slots in the side of the oven chamber, as shown in figures 1 and 2
2. Rotate the runner downwards by 90° so that the runner hooks into place and creates a level surface upon which the shelf can securely rest, as shown in figures 3 and 4
3. Repeat this process on both sides of the oven chamber
4. Slide the shelves onto the runners so that the spur is positioned on the underside of the runner towards the back of the chamber (see figure 5). This will prevent the shelf from tilting forwards when it is partially withdrawn

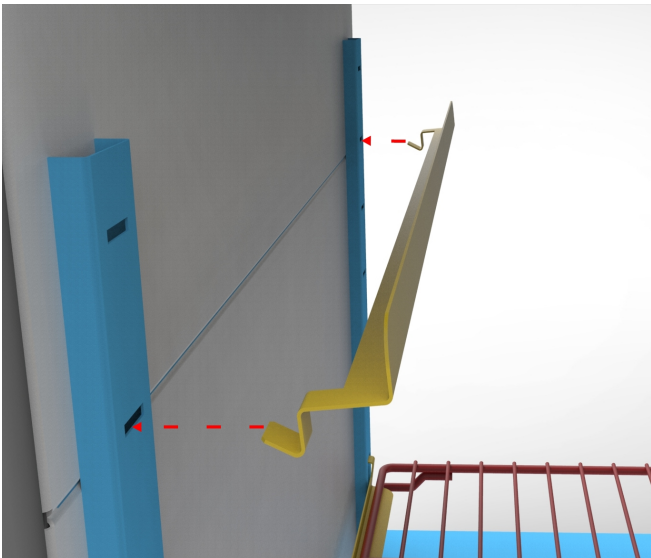


Figure 1:
Runner

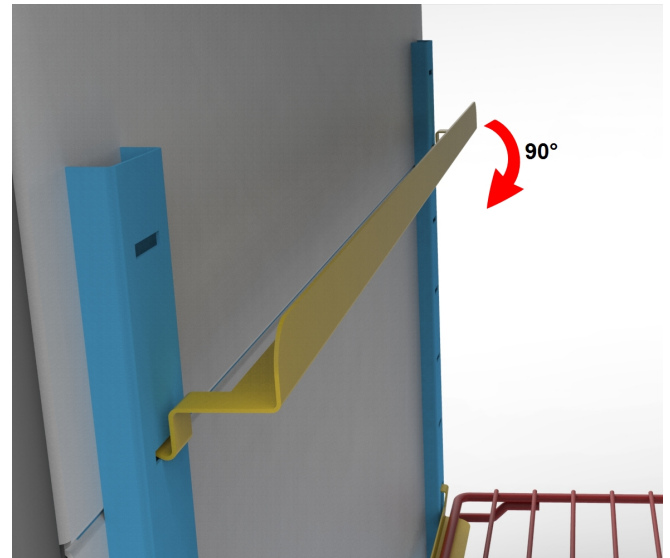


Figure 2:
Runner inserted into slots in the side of chamber

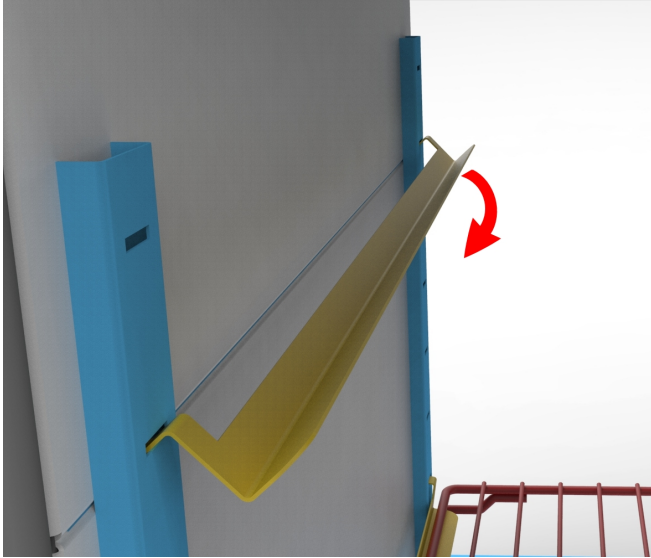


Figure 3:
Rotating runner into position



Figure 4:
Runner in position

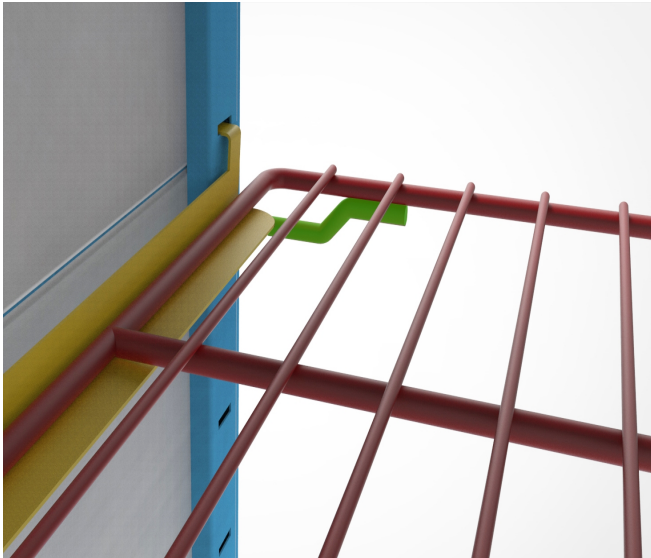


Figure 5:
Shelf resting on runners with spur at rear of chamber
(highlighted in green)

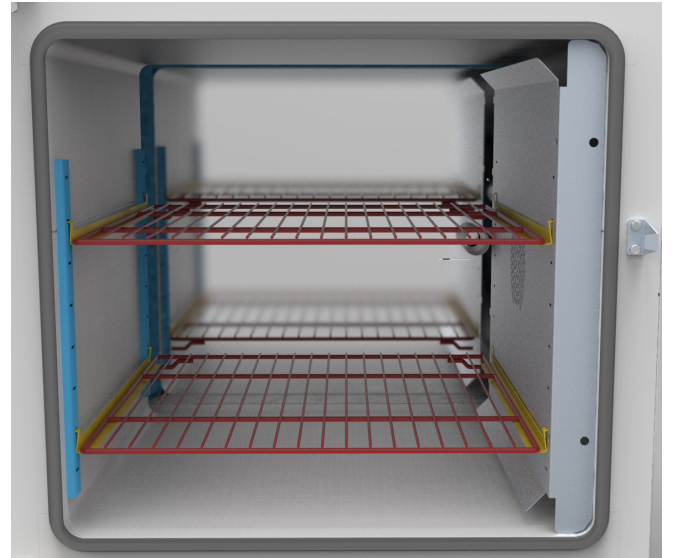


Figure 6:
Shelves fitted

2.3 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.

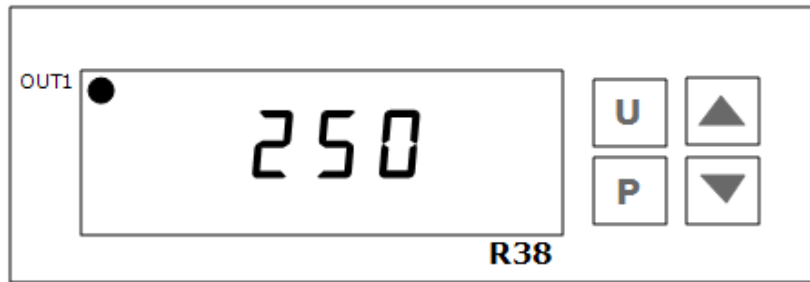
When connecting the product to an isolating switch ensure that both conductors (single phase) or on all live conductors (three phase), and should be within reach of the operator.

The supply **MUST** incorporate an earth (ground).

Electrical Connection Details:

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)

3.0 R38 Controller



3.1 PID control

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

3.2 Controller Operation

When switched on, the controller lights up, goes through a short test routine and then displays the measured temperature and starts to control. The output light OUT1 indicates when heating is occurring.

To alter the setpoint, press the down arrow key once, "SPI" flashes. Then use the up and down arrow keys to adjust the setpoint. Press the P key to accept.

3.3 R38 Over-Temperature Controller

When an R38 Controller is fitted to be used as an over-temperature controller, to configure the setpoint:

- Press and hold the 'P' key until the display flashes 'SP'.
- Press the 'down' arrow key until the display shows 'AL'.
- Press the 'P' key to enable the setpoint option.
- Use the 'up' and 'down' arrow keys to select the required setpoint. The display will flash between 'AL' and the setpoint value during this process.
- Once you have input the required setpoint, press the 'P' key, followed by the 'U' key to accept.
- The display will flash 'AL' for 30 seconds before the setpoint is accepted.

Note that if the 'P' and 'U' keys are not pressed, the setpoint will be automatically accepted after 30 seconds.

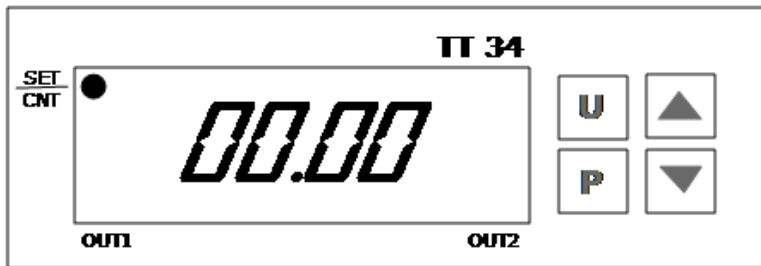
Over-Temperature Alarm

If the over-temperature alarm is tripped, then the 'OUT2' and 'AL' lights will illuminate in the bottom right-hand corner of the controller.

Resetting the Over-Temperature

To reset the over-temperature controller, power cycle the product by turning the instrument switch off, then on again.

3.4 Process Timer (if fitted)



To set a process time:

Press the P key; t1 shows momentarily on the display and the SET/ CNT light flashes quickly. Use the arrow keys to adjust the process time, which is in hours and minutes (hr.mn). Wait 5 seconds without pressing a key, or press the U key once and the display returns to normal.

If a process time of zero is set then the timer is disabled and the controller operates as though the timer is not present.

To start the timer:

Press the U key once. Timing starts. The SET/ CNT light flashes slowly while timing is in progress and the display counts down (at the end of each minute).

At the end of timing the OUT light comes on continuously and power to the temperature controller is cut off.

To reset the timer after timing has finished:

Press the U key once. The timer is now idle: it is not stopping the oven from heating, nor is it timing.

Power is only supplied to the temperature controller when the timer is reset or is timing.

To stop the timer during timing: press U during count down to stop the timer. The temperature controller remains on. It is not possible to resume timing: pressing U again will reset the timer.

3.5 Calibration

If the process requires an accurate temperature display it is possible to calibrate the controller by entering a single temperature offset value as follows:

Please contact Carbolite Gero Service for detailed instructions on entering an offset in the R38 Controller.

3.6 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.

3.7 Controller Replacement

If the over-temperature trip operates, a click occurs and a warning light near the thermostat lights up; the reset button on the thermostat pops out. The reset button is hidden behind the control dial. To reset the oven it is necessary to turn the thermostat dial until the hole lines up with the reset button and press it using a small diameter rod.

3.8 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.

Disconnect the product from the electrical supply and remove the cover (see section 6.0).

Make a note of all the wiring connections before disconnecting the wires. Loosen the screw that holds the controller body clamp in place. Use a flat screwdriver or similar object to ease apart the two plastic lugs on the side of the clamp and pull the instrument forward out of the front control panel.

Reconnect the wires according to the notes made – or see section 8.0 for wiring details.

Note: If the product features an R38 over-temperature controller, then this should be replaced using the same method described.

4.0 Operation

4.1 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.

This product has fan-assisted circulation; the fan is on when the instrument switch is on.

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

If a process timer is not fitted, the controller becomes illuminated and goes through a short test cycle according to the controller setpoint or program. If a timer is fitted, the controller may not become illuminated when the unit is switched on – to start the controller, press the U button on the timer once (see section 3.4).

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.

Unless a process timer is fitted and is off, the product starts to heat up according to the controller set point.

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

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.

4.2 The Oven Door and Chamber

It is recommended that the instrument switch is turned off if the oven door is to be opened when the temperature is below 120 °C. If the door is opened when on and the set temperature is below approximately 120 °C, then the controller will attempt to compensate for the drop in temperature and the actual temperature may exceed the set temperature when the door is closed again.

Please note that the fan is on when the instrument switch is on. Opening the door does not switch off the fan.

The tip of the temperature sensor is visible on the right of the chamber, below the fan. It is not electrically live, but it is delicate and should not be touched.

4.3 Loading and Unloading the Chamber

Where accurate temperature control of the load is important, use the central part of the chamber and distribute the load to allow free air circulation. Do not place loads on the chamber floor; use the bottom shelf.



Remember that the shelves and work pieces may be hot; use suitable gloves or other handling equipment.

Have a heat-resistant surface available on which to place hot materials.

There is no physical stop to prevent shelf removal; take care not to pull out a shelf accidentally.

Additional shelves may be obtained from Carbolite Gero. The maximum load for each shelf is 10 kg.

The maximum number of shelves and the maximum load for the oven are listed below:

model	maximum number of shelves	maximum load per shelf	maximum load for product
AX 120	8	10 kg	40 kg

4.4 Vents



On the back of the product are two vents, covered by a sliding baffle plate. The inlet vent is permanently open, while the outlet may be opened or closed by means of the sliding plate.

The sliding plate gets hot. Do not touch it when the product is hot. Make adjustments when the product is cold.

4.5 Temperature Control

The temperature is controlled by an easy-to-operate digital unit. The oven temperature range is from 40 °C to 250 °C, though the minimum temperature may be higher if the ambient temperature is above 30 °C.

A matching digital timer is available to order, or may be retro-fitted. A second option is an over-temperature control device. There is also the option of a locking handle.

Temperature accuracy is enhanced by the use of a Type K thermocouple as the temperature control sensor. A simple air-flow adjustment may be made by movement of a sliding vent control mounted at the back of the oven. Typical air-flow with the vent open is 1850 litres/ hour at 100 °C, giving exchanges in chamber volumes per hour of 65 (AX 30), 28 (AX 60) or 14 (AX 120).

4.6 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.

5.0 Maintenance

5.1 General Maintenance

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















5.2 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					6
Element Circuit	Electrical measurement 					6
Power Consumption	Measure the current drawn on each phase / circuit					6
Shelves	Visual check for fit and damage					

5.2.1 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.

5.3 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.

5.4 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 control sensor, a solid state relay, an element or set of elements, a door seal and a fan kit (fan and motor assembly). Individual spare kits are also available.

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

5.5 Retrofit Kits

Kits for process timer, over-temperature and locking handle are available. Instructions for fitting these are supplied with the kits.

6.0 Repairs and Replacements

6.1 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.

6.2 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.

6.3 Panel Removal



Disconnect the product from the electrical supply.

Side Cover. The complete right-hand side cover may be removed. Remove the screws at the back that fasten the side cover to the rest of the casing. Push the section backwards a few millimetres only, then ease it sideways (to the right) off the main case. Disconnect the earth (ground) wire.

When reassembling take time and care in locating the tabs on the right of the front control panel into the matching slots in the side cover. Remember to reconnect the earth wire.

Internal Element Cover. Open the door. Loosen the screw holding the internal side cover. Pull the cover forward a few millimetres and lift it off to the left.

6.4 Temperature Controller Replacement

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

6.5 Control Sensor Replacement

Disconnect the product from the electrical supply and remove the side cover and internal element cover. See section 6.3.

Make a note of the connections to the temperature controller. Disconnect the connections.

Disconnect any fixing clips or screws inside the product's chamber and remove the sensor.

Re-assemble with the new sensor. Take care not to damage the head by rough handling.

Check that the product is controlling properly, ensuring that the original fault was with the temperature sensor.

6.6 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.

6.7 Fuse Replacement

Fuses are marked on the wiring diagram with type codes, e.g. F1, F2. For more information on fuses refer to section 9.0.

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.

6.8 Element Replacement

Disconnect the product from the supply and remove the side cover and internal element cover. See section 6.3. The element terminals are low down in the side compartment.

- Disconnect the wires from the heating element terminals.
- Remove any starlock washers - these may need to be cut with wire cutters.
- Remove any clips holding the element inside the chamber and withdraw the element.
- Reverse the procedure when fitting the new heating element.
- To find out whether the heating element failure was caused by a fault in the control circuit, operate the product at a low temperature and check that it is functioning correctly.

7.0 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

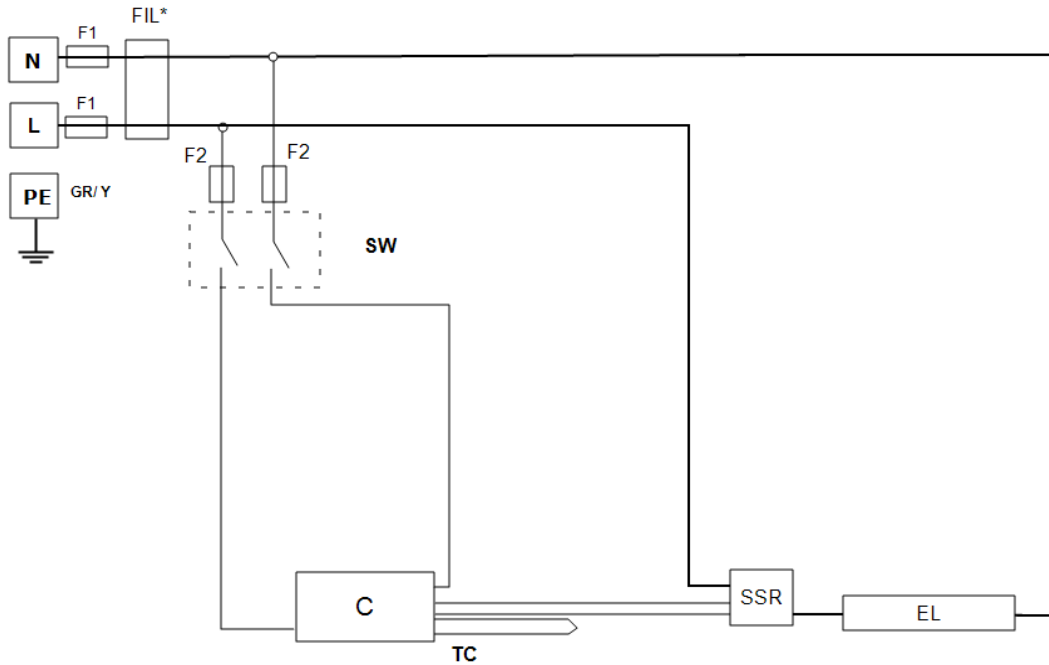
B. Oven Overheats					
1.	Oven only heats up when the instrument switch is ON	▶	The controller shows a very high temperature	▶	The controller is faulty
		▶	The controller shows a low temperature	▶	The temperature sensor may not be positioned in the oven correctly.
				▶	The controller may be faulty
2.	Oven heats up when the instrument switch is OFF	▶	The SSR has failed "ON"	▶	Check for an accidental wiring fault that could have overloaded the SSR

C. Process Timer					
1.	Oven will not heat	▶	Temperature Controller does not light up	▶	Process timer has not been reset
		▶	Resetting the timer has no effect	▶	Process timer is faulty (relay stuck open)
2.	Oven continues to heat at end of process time	▶	Process timer OUT light is continuously on	▶	Process timer is faulty (relay stuck closed)
		▶	OUT light flashing or off	▶	not a process timer fault

8.0 Wiring Diagrams

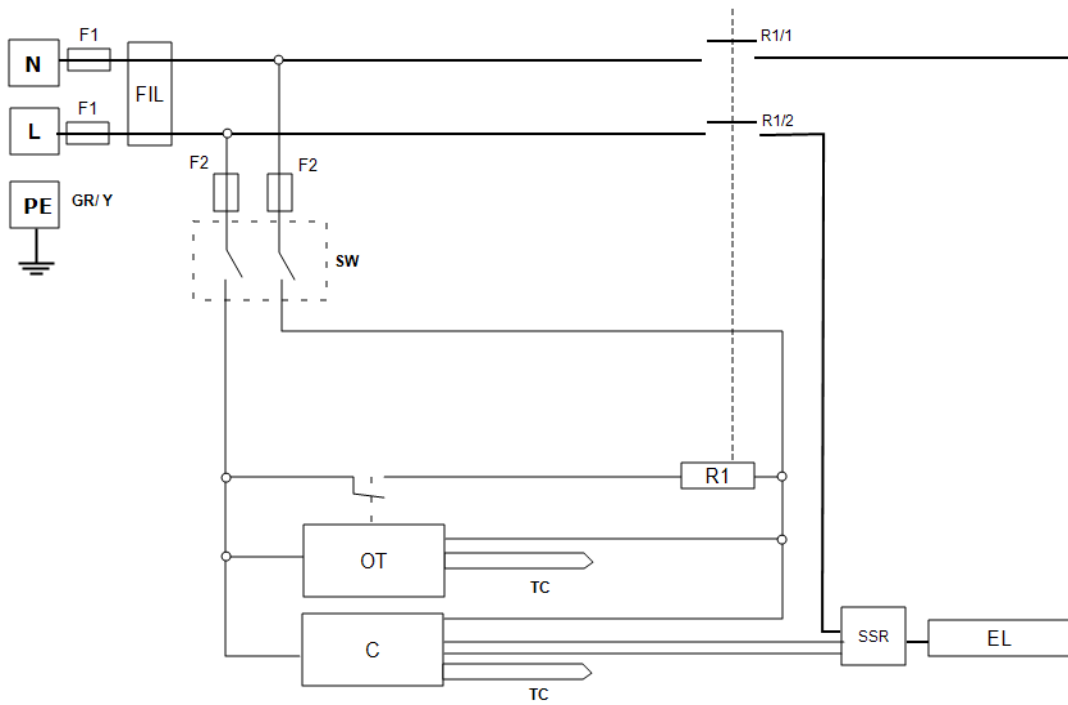
8.1 WV-11-00

Connections below show single phase with instrument switch(es).



Key	
F1, F2	Fuses
FIL	Filter
SW	Instrument Switch
C	Temperature Controller
TC	Thermocouple
SSR	Solid State Relay
EL	Element(s)
*	If Fitted
L	Live
N	Neutral
PE (GR/Y)	Earth (Green+Yellow)

8.2 WV-11-01



Key	
F1, F2	Fuses
FIL	Filter
SW	Instrument Switch
R1	Relay (Coil)
R1/1, R1/2	Relay Contactor
C	Temperature Controller
OT	Over-Temperature Controller
TC	Thermocouple
SSR	Solid State Relay
EL	Element(s)
*	If Fitted
L	Live
N	Neutral
PE (GR/Y)	Earth (Green+Yellow)

9.0 Fuses and Power Settings

9.1 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	Volts	Supply Fuse Rating	Control Fuse
AX 120	110-120 V	20 A	2 A
AX 120	220-240 V	10 A	2 A

9.2 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.

Volts	120 V	208 V	220 V	230 V	240 V
Power (%)	100	89	100	100	100

Please refer to the rating label for product specific information.

10.0 Specifications

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

Apex range of fan assisted laboratory ovens.										
Model	Max Temp (°C)	Max Power (kW)	Chamber Size (mm)			Approx Capacity (l)	Overall Size (mm)			Net Weight (kg)
			H	W	D		H	W	D	
AX 120	250	2.0	495	500	420	128	640	790	565	55

10.1 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

ProductLabel

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

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

Carbolite Gero Service

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Fax: +44 (0) 1433 624243

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