

### **Installation, Operation and Maintenance Instructions** 1200 °C Thermocouple Calibration Furnace - PTC Model: 12/20 2132 Controller

PTC 12/20/150 + 2132 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.



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.

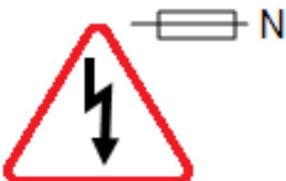


DANGER – Hot surface. Read any warning printed next to this symbol.

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

Unpack the product and remove the transit clamp from the working end of the product as follows:

- loosen the locking nut on the central clamp bolt;
- turn the bolt clockwise with a screwdriver to release the force on the clamping device;
- remove the two screws which hold the transit clamp to the product;
- carefully withdraw the transit clamp;
- retain the clamp.

If at any time the product is returned for repair or otherwise subject to arduous travel, refit the transit clamp. The product must be cold before the clamp is fitted.

Underneath the product is a dual voltage switch. Set this correctly for the electrical supply to be used: 115 V for 110 - 120 V, 230 V for 220 - 240 V.



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.

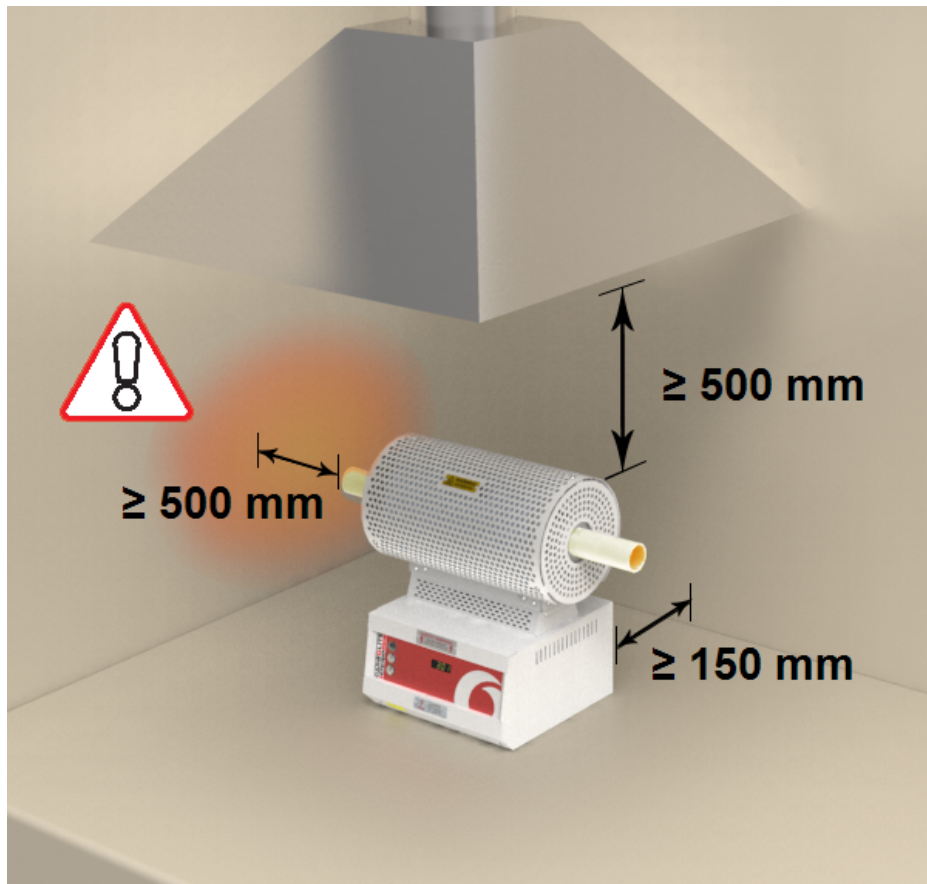
Unless otherwise stated elsewhere in this manual, ensure that there is **at least 150 mm** of free space around the back and sides of the product. Clear space is required above the product to dissipate heat.

#### Work tubes:



It is recommended that the work tube has either insulation plugs or radiation shields fitted to minimise heat loss from both ends of the work tube. If the work tube has open ends, a significant amount of energy could be radiated from the ends of the work tube. Adjacent surfaces should always be made from a non-flammable material.

Ensure that the ends of the work tube are positioned **at least 500 mm** away from any adjacent surface so that any energy radiated cannot heat an adjacent surface to a dangerous temperature.



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.

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. For further information, please see wiring diagram 02047-5001.

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 2132 Controller

### 3.1 Description

The 2132 Controller is made by Eurotherm, and is fitted and configured by Carbolite Gero for immediate use. It is a digital instrument with PID control algorithms.

The 2132 Controller features:

- Easy use as a simple temperature controller, where on setting the required temperature the controller immediately attempts to reach and maintain it.
- A ramp-to-setpoint feature, which may be used to limit the heating (or cooling).
- A timer function which allows for heating for a predetermined time, either from start or from reaching temperature; or alternatively for delaying the start of heating.
- An alarm output which may be used in conjunction with the timer, for example to give an audible alarm at the end of the timing period.

### 3.2 2132 Controller Operation

#### 3.2.1 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.





### 3.2.2 2132 Controller 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 0.1.

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.






### 3.2.3 Basic Operation

Normally no operator action is required other than entering the setpoint, as the controller starts to control on being switched on, as described above.

### 3.2.4 Altering the Setpoint

With the display at 'Home', showing the measured temperature, press down  or up  once to display the setpoint; press again or hold down to adjust it. The display returns to the measured temperature when no key is pressed for 30 seconds.

### 3.2.5 Stopping and Starting Control




It is possible to stop and start the controller without altering the setpoint. Press scroll  until the legend 'm-A' (manual/ auto) appears. In this controller, manual means OFF and auto means ON. Press down  or up  once to show the current on/ off state: 'mAn' for OFF and 'Auto' for ON. Press down  or up  to change between manual and auto (off and on) as required.

Note that timer modes 1 & 3 set the controller to 'mAn' at the end of the timing period. If the controller unexpectedly does not control it may be in manual, possibly as the result of previous use of the timer function.

### 3.2.6 Altering the Ramp Rate

It is only possible to limit the rate of heating by setting a ramp rate if the timer feature is not in use.

To enable direct setting of the ramp rate, first ensure that the 'StAt' parameter and 'dwEll' parameter are both set to OFF (see sections 3.3.1 and 3.3.2).

Press scroll  until 'SPrr' (setpoint ramp rate) is displayed. Use down  or up  to display and adjust the value.



The ramp rate sets the maximum rate of heating or cooling in degrees per minute. A value of OFF cancels the ramp rate, allowing heating and cooling at the maximum rate. When this feature is in use, there is a "working setpoint" which can be viewed at any time by scrolling to 'w.SP' and pressing  or .

Fig 1 and fig 2 indicate the possible difference between operating without and with a ramp-to-setpoint value (depending on the load and the value used).

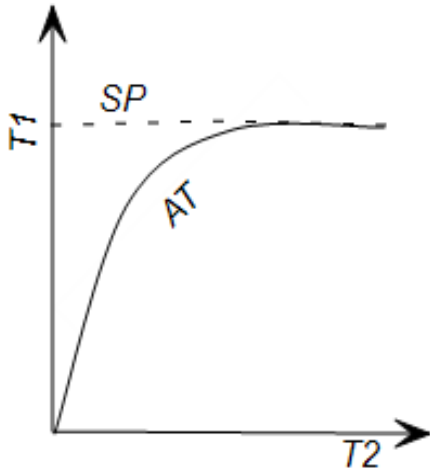


Fig 1 - Control without Ramp-to-Setpoint

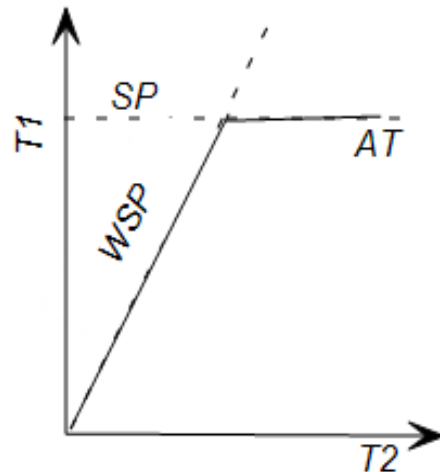


Fig 2 - Control with Ramp-to-Setpoint

Key	
T1	Temperature
T2	Time
SP	Setpoint
WSP	Working Setpoint
AT	Actual Temperature

### 3.3 Operating with the Timer

This controller can be used as a process timer allowing timed heating or timed delay, according to the options in the table. There are 5 timer modes, but 2 of them are affected by whether the setpoint ramp rate feature is being used, making 7 entries in the table. The table also shows the status of the timer light on the controller. A visual impression of the different modes is given in fig 3.

Timer Mode	Description	Timer Light
mode 1 Timed dwell and switch off	The timer starts timing when the actual temperature is within 1 °C of the setpoint. At the end of the timing period, control switches off (i.e. goes into Manual) to allow cooling and 'End' flashes on the display.	On while temperature is reaching setpoint. On during the timing period. Off from the end of the timing period.
mode 2 Timed dwell and stay on	The timer starts timing when the actual temperature is within 1 °C of the setpoint. At the end of the timing period, control remains on, maintaining the setpoint temperature and 'End' flashes on the display	On while temperature is reaching setpoint. On during the timing period. Off from the end of the timing period.
mode 3, with SPrr off Time from cold and switch off	The timer starts timing immediately. At the end of the timing period, control switches off (i.e. goes into Manual) to allow cooling and 'End' flashes on the display.	On during the timing period. Off from the end of the timing period.
mode 3, with SPrr active Dwell from working setpoint and switch off	The timer starts timing when the working setpoint is within 1 °C of the setpoint. At the end of the timing period, control switches off (i.e. goes into Manual) to allow cooling and 'End' flashes on the display.	On during the timing period. Off from the end of the timing period.
mode 4, with SPrr off Time from cold and stay on	The timer starts timing immediately. At the end of the timing period, control remains on, maintaining the setpoint temperature and 'End' flashes on the display.	On during the timing period. Off from the end of the timing period.
mode 4, with SPrr active Dwell from working setpoint and stay on	The timer starts timing when the working setpoint is within 1 °C of the setpoint. At the end of the timing period, control remains on, maintaining the setpoint temperature and 'End' flashes on the display.	On during the timing period. Off from the end of the timing period.
mode 5 Delayed switch on	The timer starts timing immediately and control starts at the end of the timing period. There is no 'End' condition in this mode.	On during the timing period. Off from the end of the timing period.

### 3.3.1 Setting the Timer Mode

Scroll to 'tm.OP'; use ▲ or ▼ to view and alter the mode. The mode shows as 'Opt.1' to 'Opt.5'.

It is not possible to alter the mode while the timer is operating; if the mode cannot be altered, scroll to the 'StAt' parameter and set its value to OFF.

### 3.3.2 Setting the Time Period

#### Method 1

Scroll to 'tmr' (time remaining). Use ▲ or ▼ to view the remaining time; the units are always in minutes. Use ▲ or ▼ to set or alter the time. Setting 'tmr' automatically activates the timer; the 'm-A' parameter changes to 'Auto' and the 'StAt' parameter changes to run.

Note that the 'tmr' display shows 0 (zero) during the last minute of timing and also shows 0 when the time has expired. The timer light indicates whether timing is still in progress.

#### Method 2

Scroll to 'dwEll' and use ▲ or ▼ to set the timing duration. The advantage of method 2 is that 'dwEll' need only be set once if repeated use of the same time period is required.

Scroll to 'StAt' and use ▲ or ▼ to set the parameter value to run. This copies the dwell time into 'tmr' and activates the timer as in method 1.

### 3.3.3 Running with the Timer

Once the timer is activated by method 1 or 2 above, the control sequence depends on the 'Timer' mode, as previously given in the table. Fig 3 gives another representation of the timer action.

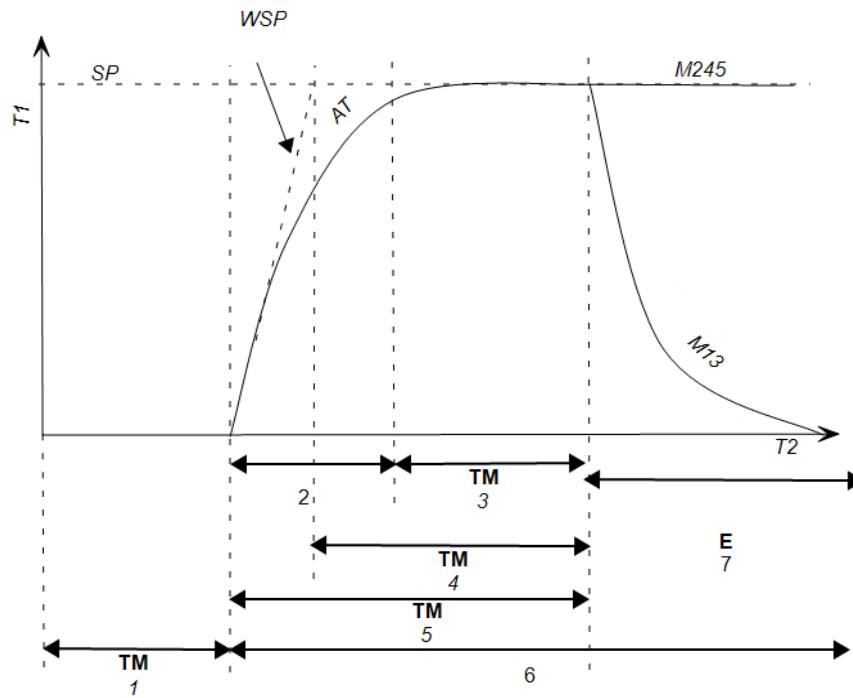


Fig 3 - Timer Modes

Key	
T1	Temperature
T2	Time
SP	Setpoint
WSP	Working Setpoint (if setpoint ramp rate active)
AT	Actual Temperature
M245	Modes 2, 4 & 5
M13	Modes 1 & 3
TM	Timing
E	End
1	Mode 5
2	Reaching Temperature Modes 1 & 2
3	Modes 1 & 2
4	Modes 3 & 4 with setpoint ramp rate
5	Modes 3 & 4 with setpoint ramp rate off
6	Reaching temperature and continuing temperature Mode 5
7	Continuing at temperature modes 2 & 4, or cooling down modes 1 & 3

### 3.3.4 Stopping the Timer

To stop the timer at any time while it is operating, change the 'StAt User Calibration' parameter to OFF. This is the same as reducing 'tmr' to zero. The controller then acts as

though it has reached the end of the time period.

### 3.3.5 End of Time Period

Modes 1 and 3: heating stops at the end of timing; the 'm-A' parameter changes to 'mAn'.

Modes 2 and 4: heating continues at the end of timing; the 'm-A' parameter remains at 'Auto'.

Mode 5: heating starts at the end of the timing period; the 'm-A' parameter remains at 'Auto'.

In modes 1 to 4 the alarm message 'End' flashes on the display at the end of timing; the 'StAt' parameter remains at run.

In mode 5 there is no 'End' message; the 'StAt' parameter changes to OFF at the end of timing.

### 3.3.6 Cancelling the Alarm

To acknowledge (cancel) the 'End' alarm, press page and scroll together; the 'StAt' parameter changes to OFF.

Alternatively cancel the alarm by directly changing the 'StAt' parameter from run to OFF.

### 3.3.7 Program Example

To heat up at 10 °C per minute to 500 °C; to hold at 500 °C for 1 hour; then to allow to cool down.

(This example uses timing mode 1, as on the first row of the timer table, but also includes the use of ramp rate).

*To create this program*

1. Start with display at home; use arrow keys to alter the setpoint to 500.
2. Press scroll until 'sp.rr' shows; use arrow key to set value to 10 (if you do not want to limit the ramp rate, ignore this step or set the value to OFF)
3. Press scroll until 'tm.op' shows; use arrow key to set value to opt.1
4. Press scroll until 'dwell' shows; use arrow key to set value to 60

*To operate this program*

5. Press scroll until 'stat' shows; use arrow key to set value to run
  - heating starts when run is set;
  - timing starts when the working setpoint reaches 499 °C;
  - heating stops 61\* minutes later and 'End' flashes on the display.
6. Cancel 'End' by pressing page and scroll together.

\* note that the timer runs for an extra minute, when tmr has counted down to zero; allow for this when testing the system with short durations such as 1 or 2 minutes.

## 3.4 Altering Power Limit

### Overview

Depending on the furnace or oven model the power limit parameter OP.Hi (Output High) may be accessible or hidden.







For silicon carbide heated furnaces the parameter is accessible to allow for compensation for element ageing. In wire-heated chamber or tube furnaces, reducing the power limit is a convenient method of improving control at low temperatures, as outlined below.

The power limit may be set to zero to permit demonstration of the controls without heating.

In many models the power limit setting depends on the supply voltage; usually the furnace or oven manual contains details: if in doubt, contact Carbolite Gero for advice.

The power limit parameter does not apply to the over-temperature controller, if fitted.

### Altering the value

Press page  until oP (output list) is displayed. Press scroll  until OP.Hi (Output High) is displayed. Press down  or up  once to display the value of OP.Hi and write down the value. To alter the value, use down  or up .

Note: setting the value to zero prevents the furnace or oven from heating.



Caution: Do not increase the power limit value to a value above the design level for the oven or furnace model, or to a value above that correctly calculated for silicon carbide elements. The heating elements could burn out, or other damage could be caused.

### Control at Low Temperatures

If a product is to be used at temperatures much lower than its design maximum, control stability can often be improved by reducing the power limit. Remember to make a record of the original setting before altering the power limit.

Example: It is desired to operate a 1200 °C furnace at 300 °C. The normal control settings can be expected to cause excessive overshoot as the furnace reaches temperature. If the power limit OP.Hi is normally set to 100%, try a setting of 40%. This should greatly reduce the overshoot. (There is no firm calculation rule to get this example setting of 40% – experimentation may be required to achieve a good result. Avoid power limits below approximately 30% – control accuracy is reduced at such levels.)

Depending on the furnace or oven model the power limit parameter OP.Hi (Output High) may be accessible or hidden.

For silicon carbide heated furnaces the parameter is accessible to allow for compensation for element ageing. In wire-heated chamber or tube furnaces, reducing the power limit is a convenient method of improving control at low temperatures, as outlined above.

The power limit may be set to zero to permit demonstration of the controls without heating.

In many models the power limit setting depends on the supply voltage; usually the furnace or oven manual contains details: if in doubt, contact Carbolite Gero for advice.



## User Calibration

The controller is calibrated for life at manufacture against known reference sources, but there may be sensor errors or other system errors. User calibration allows compensation for such errors and this controller allows for a user 2-point calibration. This setting is password protected to avoid accidental alteration.

Page to iP, scroll to CAL.P and use up ▲ to alter the password. The password is 3. If the correct password is entered, the display shows PASS. Scroll to CAL and use up ▲ or down ▼ to observe the setting FACT (factory values, as manufactured) or USEr (user values). Change to USEr.

NOTE: before checking the calibration of the controller, or of the complete system, remember to reset the controller to factory calibration values by setting the CAL.P parameter to FACT.

To enter a user calibration, scroll to each of the following parameters in turn and set the desired values.

Pnt.L low temperature for which an offset is to be entered

OFS.L offset value for the low temperature

Pnt.H high temperature for which an offset is to be entered

OFS.H offset value for the high temperature

Example: the controller reads 3 °C low at 400 °C and 5 °C low at 1000 °C. The parameter values should be Pnt.L=400, OFS.L=3, Pnt.H=1000, OFS.H=5.

Negative or positive values can be entered: if the controller is reading high, negative offsets would be appropriate.

Fig 4 gives a graphical representation of the 2-point calibration.

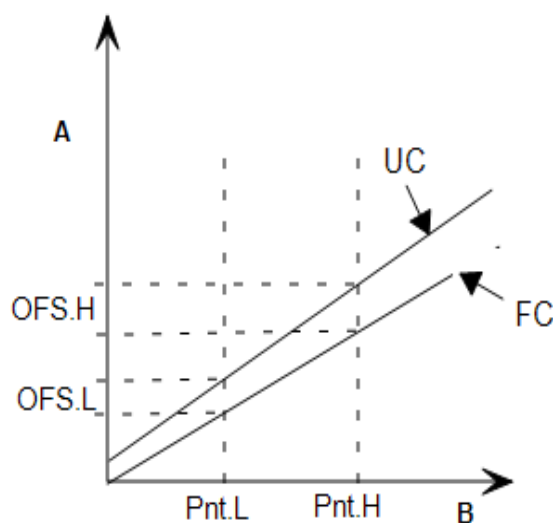


Fig 4 - 2-Point Calibration

Key	
A	User Temperature Reading
B	Factory Temperature Reading
UC	User Calibration
UF	Factory Calibration

### 3.5 Audible Alarm

If an audible alarm is supplied for use with the timer function, then it is normally configured to sound at the 'End' condition and to go off when the alarm is acknowledged as given in section 3.3.6.

It is not feasible to cover all possible alarm features which may be included by customer special order, within this manual.

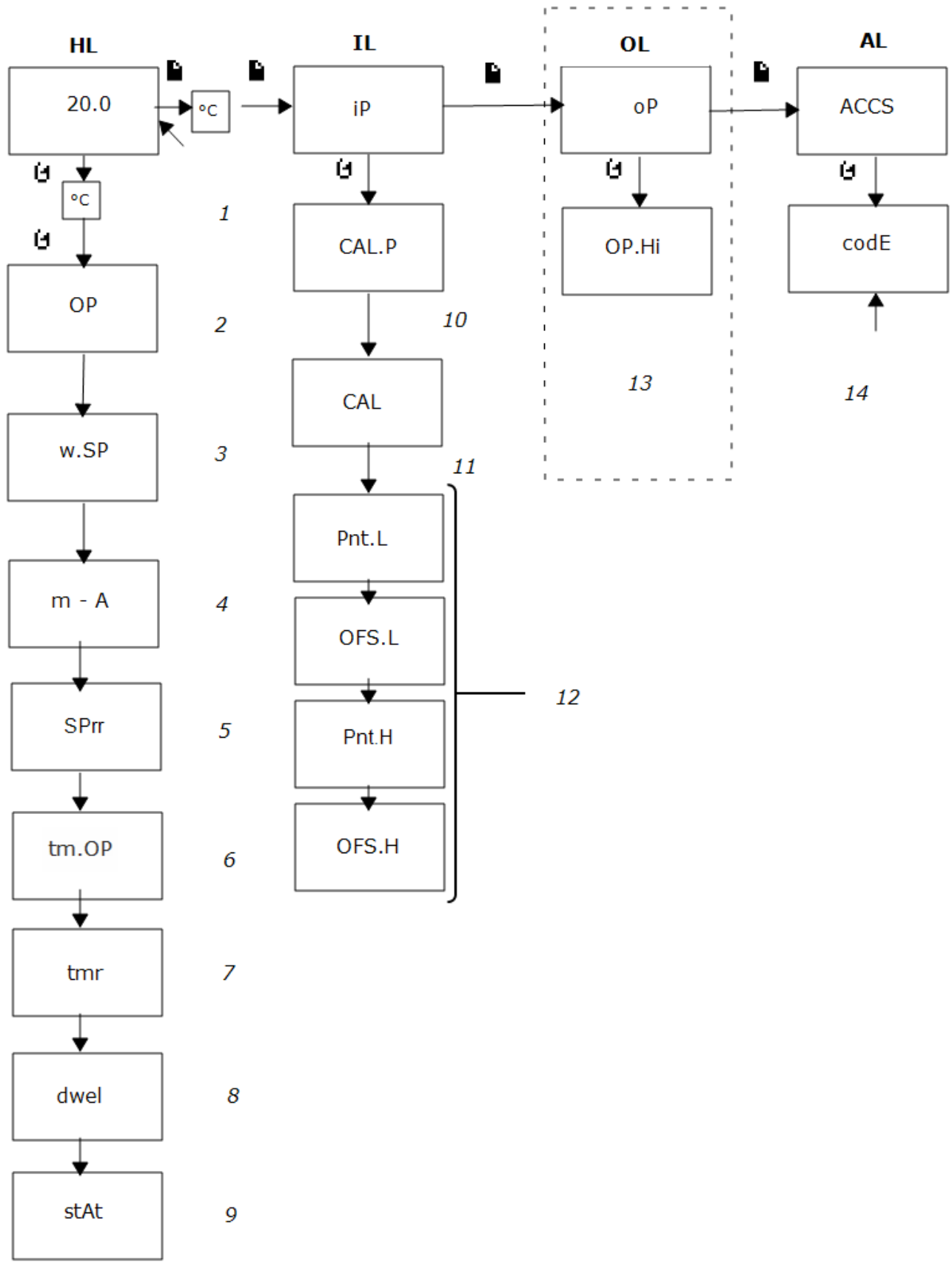
### 3.6 Temperature Controller Replacement



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.

### 3.7 Navigation Diagram



Key	
HL	Home List
IL	Input List
OL	Output List
AL	Access List
1	Measured temperature; use arrow keys to access setpoint
2	Output power (read only)
3	Present only if SPrr in use
4	Manual/Auto (mAn = off, Auto = on)
5	Setpoint ramp rate OFF or value
6	Timer mode
7	Time remaining
8	Dwell time for timer
9	Timer status run or OFF
10	Enter password
11	If User Calibration
12	User 2-Point Calibration
13	Power limit setting, if present
14	For factory access to lists and parameters not available to the operator

## 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.

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

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.

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 General Operating Advice



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 10.0 towards the back of this manual.



Lightweight ceramic fibre insulation can easily be marked by accidental contact. Some fine cracks may develop in the surface of the insulation due to the progressive shrinkage of the insulation materials. Cracks are not usually detrimental to the functioning or the safety of the product.

### 4.3 Operator Safety



The ceramic materials used in the product manufacture become electrically conductive to some extent at high temperatures. **DO NOT** use any conductive tools within the product without isolating it. If a metal work tube is used, it must be earthed (grounded).



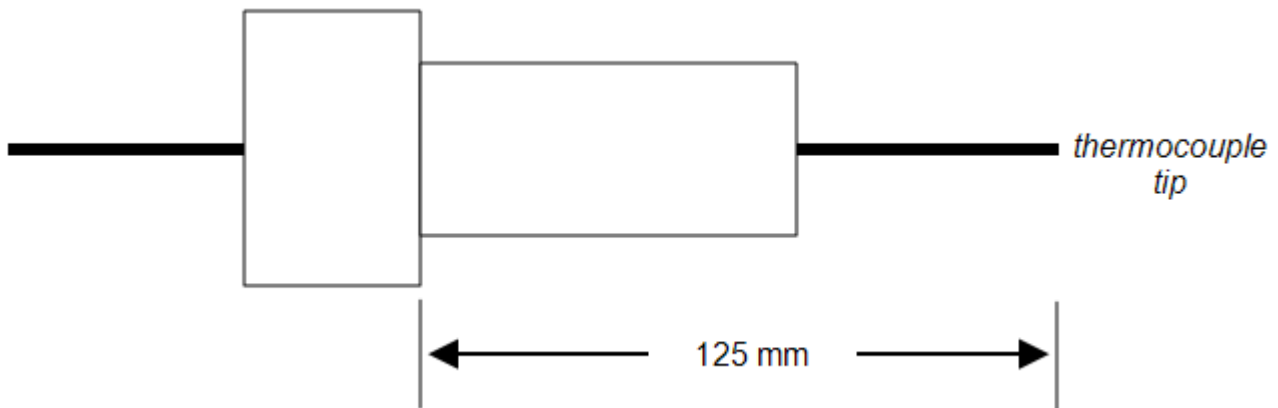
Switch off the heater switch whenever loading or unloading the product. The elements are isolated when the heater switch is OFF. This switch cuts both sides of the circuit via a contactor.

#### 4.4 Instructions for Use as a Calibration Furnace

The PTC 12/20/150 is designed for calibration by the comparison method, which consists of comparing the thermocouple under test with a reference thermocouple. This reference thermocouple can have traceability to national standards, either if it is ordered with this requirement, or by getting it independently calibrated.

In the PTC 12/20/150 the reference thermocouple is built in and has its own indicator marked Reference Temperature. It is located within the work tube such that its tip is positioned close to that of the thermocouple to be tested in the part of the tube which has the most uniform temperature.

The thermocouple to be calibrated should be passed through an end plug with a suitable size hole, with the tip 120 to 130 mm from the step in the plug.



If thermocouples with different outer diameters are to be calibrated then end plugs with different size holes should be used. These may be ordered from Carbolite Gero. The maximum recommended diameter is 7.5 mm - larger diameters may experience too much heat conduction and give an incorrect calibration.

Insert the thermocouple and end plug and support the cold end to ensure that the assembly lines up with the axis of the furnace tube.

Switch on the instrument switch and set the desired temperature on the controller. Allow the unit to warm up and stabilise. The reference temperature may be slightly lower than the control temperature so adjustment can be made to the control setting to bring the reference temperature to the exact temperature if desired; allow it to stabilise.

Either the output of the thermocouple or an indicated temperature can be checked against the reference temperature and any error noted. This error can now be used to correct any readings taken by the thermocouple. The noted error is the calibration of the thermocouple. Remember to include the reference thermocouple error in calculating the calibration - see the reference thermocouple certificate.

The calibration should be made at temperatures at which the thermocouple is to be used. If it is to be used over a range of temperatures then calibrate it at a number of points over the range (for example at every 100°), and plot a graph of error against temperature. A curve drawn through the points can then be used to find the error at any temperature.

## 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
<b>Safety</b>						
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 					
Safety Switch Function (split models only)	Set a safe temperature above ambient, and open the furnace to see if the heater light goes out					
Safety Switch Function (split models only)	Electrical measurement 					
Electrical Safety (external)	Visual check of external cables and plugs					
Electrical Safety (internal)	Physically check all connections and cleaning of the power plate area					
<b>Function</b>						
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					
Work Tube Position	Visually check that the tube is central to the heated zone (horizontally / vertically)					
End Plugs / Radiation Shields	Visual check for damage or wear, and correct positioning					

Seals (if fitted)	Check all seals and O-rings and clamps					
<b>Performance</b>						
Element Circuit	Electrical measurement 					
Power Consumption	Measure the current drawn on each phase / circuit					
Cooling Fans (if fitted)	Check whether the cooling fans are working					



### 5.2.1 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.

## 5.3 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.

## 5.4 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.

## 5.5 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 pair of thermocouples, one solid state relay and one heating element.

Ceramic end plugs with a variety of centre holes can also be obtained from Carbolite Gero.

## 5.6 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 9.0 for details of power limit settings.

## 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](http://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 Temperature Controller Replacement

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

## 6.4 Solid-State Relay Replacement



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

Make a note of the wire 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 it has good thermal contact with the base panel or aluminium plate.

Replace the access panel.

## 6.5 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:

thermocouple leg	colour
positive (type N)	pink
negative	white

Disconnect the thermocouple to be replaced from its terminal block and withdraw it.

Re-assemble the new thermocouple observing the colour coding.

Refit the element access panel, control panel .

## 6.6 Element Replacement



**See section 6.2 - wearing a face mask is required.**

This involves dismantling the outer case, disconnecting the electrical leads and removing the inner product chamber. Make a sketch of the layout inside the back panel before attempting this. It is recommended that you contact Carbolite Gero for advice before starting the operation.

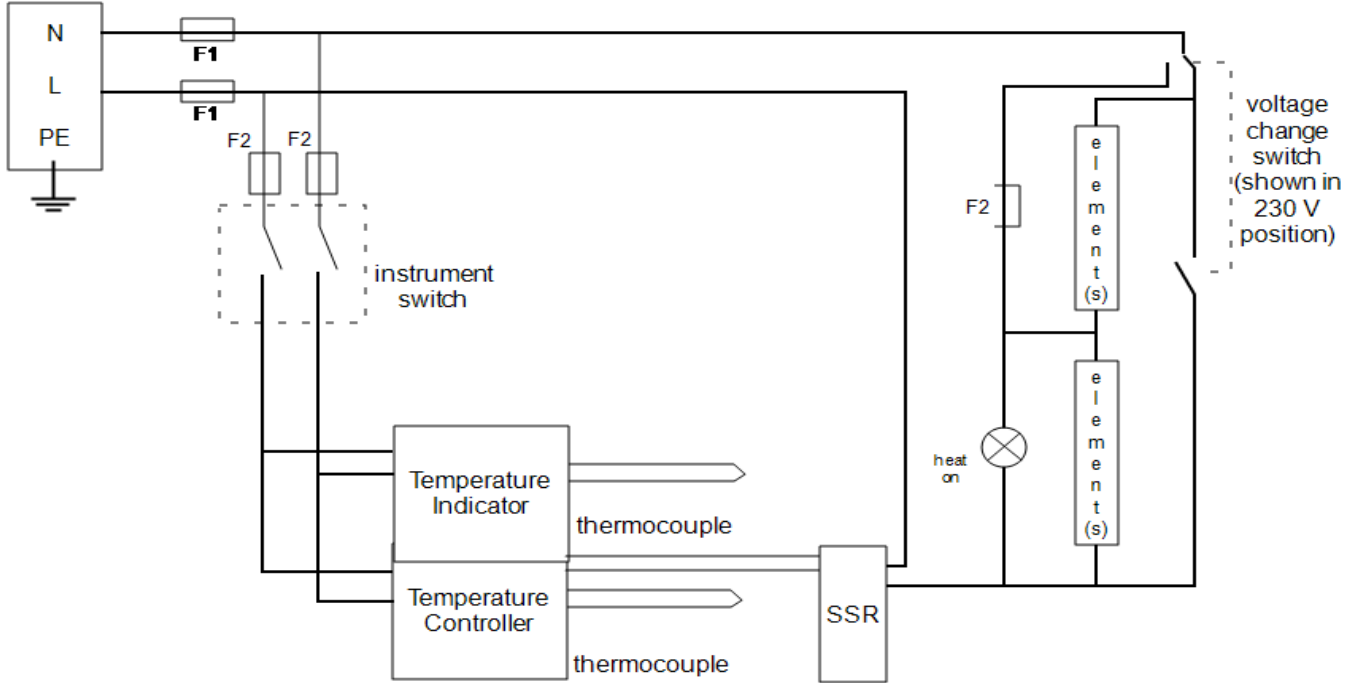
## 7.0 Fault Analysis

A. Furnace Does Not Heat Up				
1.	The HEAT light is ON	▶	The heating element has failed	▶ Check also that the SSR is working correctly
2.	The HEAT light is OFF	▶	The controller shows a very high temperature or code such as S.br	▶ The thermocouple has broken or has a wiring fault
		▶	The controller shows a low temperature	▶ The door switch(es) (if fitted) may be faulty or need adjustment
				▶ The contactor/relay (if fitted) may be faulty
				▶ The heater switch (if fitted) may be faulty or need adjustment
				▶ 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	▶ Check the supply fuses and any fuses in the furnace control compartment
				▶ The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault.

<b>B. Product Overheats</b>					
1.	Product 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 be faulty or may have been removed out of the heating chamber
				▶	The thermocouple may be connected the wrong way around
				▶	The controller may be faulty
2.	Product 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

## 8.0 Wiring Diagrams

### 8.1 183/4/1006



## 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	Protection Fuse	Access by removing the holder underneath the furnace using a screwdriver	20 mm x 5 mm type FF (ultra rapid)

The purpose of the Protection Fuse is to ensure immediate power cut off if the voltage change switch is in the 115 V position and the furnace is connected to a 220-240 V supply.

Model	Phases	Volts	Supply Fuse
PTC 12/20/150	1-phase	220-240	10 A

### 9.2 Power Settings

The setting for the power limit parameter in the controller (OP.Hi) should be 100% for the model listed in this manual.

Please refer to the rating label for product specific information.



## 10.0 Specifications

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

Model	Max Temp (°C)	Max Power (kW)	Work Tube Bore (mm)	Work Tube Length (mm)	Net Weight (kg)
Thermocouple Calibration Furnace					
PTC 12/20/150	1200	1.2	25	195	9

### 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:

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