CARBOLITE

Operating Instructions

Temperature Controller

Type 302P4

English
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1 Introduction to the Controller and Manual

1.1 Using This Manual
This manual aims to explain how to set up and operate the Carbolite Gero 302P controller; it must be read in conjunction with the product main manual.

Due to the complex nature of furnace control the use of technical terms throughout this manual is unavoidable. Explanations of these terms can be found in the ‘Glossary of Terms’ at the back of this manual.

This manual covers the operation of:

1.2 302P - Controller
The 302P is a digital temperature controller which uses PID algorithms to give excellent temperature control when properly set. This controller can store 4 programs of 4 ramp/dwell segments. Programs 1,2& 3 are protected by password and program 4 is open to edit.

1.3 PID Control
The 302P4 controller use PID (Proportional, Integral, Derivative) temperature control. This type of control uses a complex mathematical control system to adjust the power being sent to the elements and to hold the furnace or oven at the desired temperature.
2 Basic Operation

2.1 Controller Layout

- Power Output Indicator Lamp
- Setpoint Temperature (Lower Display)
- Measured Temperature (Upper Display)
- Power Output Indicator Lamp
- Run Indicator Lamp
- Function Key
- Run Key
- Down Key
- Up Key
### 2.2 Keys

| Function Key || | The Page key is used to: |
|---------------|-----------------|--------------------------|
|               |                 | • Scroll down parameters. |
|               |                 | • Store modified parameters. |
|               |                 | • Review program parameters in basic operation mode. |
| Run Key ᵇ | The Run key is used to: |
|             |                 | • Start the program cycle when pressed for more than 1.5 seconds. |
|             |                 | • Hold program cycle when pressed for more than 1.5 seconds while program is running. |
|             |                 | • Stop program when pressed for more than 5 seconds while program is running or in hold. |
|             |                 | • Scroll up parameters in set up operator mode or configuration mode. |
| Function + Run | When pressed simultaneously for more than 3 seconds is used to: |
| || ᵇ | • Start the procedure to select operating mode. |
| Arrow Keys ᵇ U | The arrow keys are used: |
| λ U | • individually to adjust the selected parameters. |
| Down + Function λ + || When pressed simultaneously: |
| | • are used to enable “lamp test” in Basic mode |
| Down + Run λ ᵇ | When pressed simultaneously: |
| | • Used to reach minimum value during parameter modify |
| Up + Run U ᵇ | When pressed simultaneously: |
| | • Used to reach maximum value during parameter modify |

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

### 3 Quick Start Guide

#### 3.1 Home Display

When switched on, the controller goes through a short lamp test routine and then displays the process value in the upper display and “rdY” in the lower display. This is known as the “Home Display”.
3.2  Selecting a program
With basic operator mode selected \( OP.b \) (see section 3.6) press the function key \( \| \) once to display \( nPrE \) in the lower display and the program number in the upper display. Select the required program number using the Down \( \downarrow \) or Up \( \uparrow \). After selection press the function key \( \| \) to store the parameter.

3.3  Starting the program Cycle
To start the program the “Run” \( \text{Run} \) button must be pressed and held down for 1.5 seconds. After 1.5 seconds the lower run indicator lamp will be lit continually and the displays will show the program setpoint (PSP); lower display, process value (PV); upper display.

3.4  Program Cycle
Once the program has been started, the heat light (situated below the power switch) and the upper power output indicator lamp will initially display a long pulse at a continuous cycle rate, these display pulses will reduce within the same cycle rate, as the furnace approaches the desired temperature or a program setpoint.

As the program is running the lower indicator lamp will be lit continuously.

When the program has finished its cycle the lower indicator lamp will be switched off and the lower display will show \( End \).

3.5  Program Hold and Cancel
To hold the program, the “Run” \( \text{Run} \) button must be pressed and held down for 1.5 seconds, while the program is running. When the program is in hold, the lower display will flash between the word “\( \text{hoLd} \)” and current Program set point and the lower indicator lamp will flash continually.

To remove the hold status, the “Run” \( \text{Run} \) button must be pressed and held down for 1.5 seconds. After 1.5 seconds the lower display will no longer display hold and the lower indicator lamp will be lit continually. The program will then continue from the current process value indicated on the upper display.

To cancel a program, either while the program is running or in the hold condition, the “Run” \( \text{Run} \) button must be pressed and held down for 5 seconds. After 5 seconds the lower indicator lamp will switch off, the lower display will show “\( r d y \)”, and the upper display will show the current process value.

To restart the program refer to section 3.3

3.6  Understanding Operator Levels
There are three user levels in the controller; Op.b (Basic Operator Mode) OP.E (Enhanced Mode) and OP.P (Program Edit Mode).
There are also three further engineering levels indicated by OPS, CP1 and CnF which are factory set and not covered within this manual.
Op.b (Basic Operator Mode) is for running the program only. No other parameters are available.

OP.E (Enhanced Mode) is for calibration and address assignment. Access to these is protected by security code = 17.

OP.P (Program editing mode). Provides access to programming parameters. Access to these is protected by security code = 4

To Enter OP.E (Enhanced mode) starting from Basic operator mode (OP.b).

1. From the home display press and hold the Function and Run keys || simultaneously for more than 3 seconds.

2. The display will show \text{OPr} lower display and \text{OP.b} upper display (\text{OP.b} being the current active mode)

3. Press the Up \uparrow or Down \downarrow to choose \text{OP.E}

4. Press || to enter selected level.

5. The word \text{PASS} will be shown on the bottom display and ---- on the top display. This will time out after 10 seconds, during this period the password should be selected using the Up \uparrow or Down \downarrow

6. Press || to enter the password.

7. When the correct password has been entered the upper display will flash \text{PASS}. If an incorrect password is entered the upper display will flash \text{Err} and then return to the home display.

Once in Enhanced mode, the parameters within this level can be accessed by pressing page || to descend the list, or run \textcircled{1} to ascend the list.

When OP.E operations have been completed, OP.b mode must be returned to manually as outlined below.
Quick Start Guide

To Enter OP.P (Program Editing Mode).

8. From the home display press and hold the Function and Run keys ||  ⚪ simultaneously for more than 3 seconds.

9. The display will show OP$_P$ lower display and OP$_b$ upper display (OP$_b$ being the current active mode)

10. Press the Up ▲ or Down ▼ to choose OP$_P$

11. Press || to enter selected level.

12. The word PASS will be shown on the bottom display and ---- on the top display. This will time out after 10 seconds, during this period the password should be selected using the Up ▲ or Down ▼

13. Press || to enter the password.

14. When the correct password has been entered the upper display will flash PASS. If an incorrect password is entered the upper display will flash Err and then return to the home display.

15. Once in the program edit mode the parameters within this mode can be accessed by pressing page || to descend the list, or run ⚪ to ascend the list.

Note: There is no time out or power cycling function, whereby the instrument automatically returns to a lower operating mode.
When OP.P operations have been completed, OP.b mode must be returned to manually as outlined below.

To exit OP.E (Enhanced mode) or OP.P (Program Editing Mode) and return to OP.b (Basic operator mode).

1. Return to the top level home display of the OP.E or OP.s list. This will be where the displays show the, program setpoint (PSP) in the lower display and process value (PV) in the upper display. This can be done either by leaving the current selected parameter to time out after 10 seconds, or by pressing the page || or Run ⚪ to scroll through the parameter list and return to the top level home display.

2. Press and hold Function and Run ||  ⚪ simultaneously for more than 3 seconds.

3. The display will show OP$_P$ lower display and OP.E or OP.P upper display (OP.E or OP.P being the current active mode)

4. Press the Up ▲ or Down ▼ to choose OP$_b$

5. Press || to enter selected level.
6. No password is required to enter a lower level of operation, therefore the display will return to basic operator mode and show the, program setpoint (PSP); lower display and process value (PV); upper display. Check that no parameters are not available by pressing the page or run keys.
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<th>ENHANCED OPR MODE</th>
<th>Program Editing Mode</th>
<th>DESCRIPTION</th>
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<td>OFFSET FOR 1 POINT CALIBRATION or COEFFICIENT “b”</td>
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<tr>
<td>SLOP</td>
<td>COEFFICIENT “a” (Slope)”</td>
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</tr>
<tr>
<td>CAL.L</td>
<td>LOW POINT FOR 2 POINT CALIBRATION</td>
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</tr>
<tr>
<td>OFS.L</td>
<td>OFFSET ON LOW POINT FOR 2 POINT CALIBRATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAL.H</td>
<td>HIGH POINT FOR 2 POINT CALIBRATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFS.H</td>
<td>OFFSET ON HIGH POINT FOR 2 POINT CALIBRATION</td>
<td></td>
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</tr>
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<td></td>
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</tr>
<tr>
<td>nPrG</td>
<td>SELECTED PROGRAM</td>
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<td>SEG</td>
<td>SEGMENT IN EXECUTION</td>
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</tr>
<tr>
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<td>REPETITIONS REMAINING TO THE END</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rr.PE</td>
<td>TIME REMAINING UNTIL THE END</td>
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</tr>
<tr>
<td>ESP#</td>
<td>INITIAL SET POINT</td>
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<td>SP.1#</td>
<td>SEGMENT 1 TARGET SET POINT</td>
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<tr>
<td>rr.1#</td>
<td>SEGMENT 1 RAMP RATE TO SP 1</td>
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<td>EH.1#</td>
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<td>SEGMENT 3 TARGET SET POINT</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>EH.3#</td>
<td>SEGMENT 3 TIME HELD AT SP 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP.4#</td>
<td>SEGMENT 4 TARGET SET POINT</td>
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<td>rr.4#</td>
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</tr>
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<td></td>
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</tr>
<tr>
<td>CET#</td>
<td>CYCLE END THRESHOLD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# NOTE: In basic mode these parameters are not alterable
4 Programming

4.1 Program Parameters

In the basic operator mode – the below list of parameters are available.

**nPrg**
Meaning: number of the selected program
Range: from 1 to 3 fixed and password protected. Program 4 editable
Available: Always
Alterable: only when the programmer state is idle

**SEG**
Meaning: number of the segment in execution
Range: from “1 r” to “4 d”
The segment number is followed by the segment stage, “r” for ramp and “d” for dwell. Example:
1 r: ramp stage of the first segment
4 d: dwell stage of the fourth segment
Available: only when the programmer state is run or hold
Alterable: never

**rE**
Meaning: time remaining to the end of the program
This value refers to the time remaining to the end of the current execution, regardless the programmed number of executions.
Range: - from 1 second to 99 min 59 sec
   - the upper display shows **12:30** (12 min 30 sec)
   - the lower display shows **rE5**
   - from 1 h 40 min to 99 h 59 min
   - the upper display shows **18:45** (18 h 45 min)
   - the lower display shows **rEH**
   - from 100 to 9999 hours
   - the upper display shows **125** (125 h)
   - the lower display shows **rEH**
   - over 9999 hours
   - the upper display shows **0000**
   - the lower display shows **rEH**
Available: only when the programmer state is run or hold
Alterable: never
### Programming

**r. r**

**Meaning:** repetitions remaining to the end

**Range:** - from 0 to 9999 and then `r.F`

The figure shows the remaining repetitions after the current execution.

For example 0 means that the program stops at the end of the current execution, while `r.F` means that the device is set for endless repetitions.

**Available:** only when the programmer state is run or hold and the “Program execution repetitions” parameter is different from 0

**Alterable:** never

**rP**

**Meaning:** time remaining to the end of the program, considering also the remaining repetitions

**Range:** - from 1 second to 99 min 59 sec

- the upper display shows **12.30** (12 min 30 sec)
  - the lower display shows **r.P.E**

- from 1 h 40 min to 99 h 59 min

- the upper display shows **18.45** (18 h 45 min)
  - the lower display shows **r.P.H**

- from 100 to 9999 hours

- the upper display shows **125** (125 h)
  - the lower display shows **r.P.H**

- over 9999 hours

- the upper display shows **%%%%**
  - the lower display shows **r.P.H**

**Available:** only when the programmer state is run or hold and the “Program execution repetitions” parameter is different from 0

**Alterable:** never


**Available:** only when the programmer state is run or hold for review only.

**Alterable:** only in OP.P mode

#### 4.2 Program editing

To select the program to edit, change the `nPFG` parameter to show the program you wish to edit.

Then access the Program edit operative mode **OP.P** to address the below parameters:

(The normal 10 s timeout is removed during monitor / modify the program parameters)

**PASS**

**Meaning:** password to enable editing of program 1, 2, 3

**Range:** 0 up to 999

**Available:** The programmer state is idle and program select is 1 or 2 or 3 alterable:
itSp
Meaning: initial set point, it is the set point used by the programmer during the "idle" state
Range: OFF, and then from 0°C – 1500°C
The OFF value means that the control output(s) will be disabled during the "idle" state; at program start up the setpoint will be aligned to measure value and then ramps to SP. 1.
Available: always
Alterable: only when the programmer state is idle or, for program 1-2-3, if the edit is enabled

SP. 1
Meaning: target set point of the first segment
Range: 0°C – 1500°C
Available: always
Alterable: only when the programmer state is idle and, for program 1-2-3, the edit is enabled

rr. 1
Meaning: ramp rate to SP1.
Range: from 0.1 to 12°C (Engineering units (°C) per minute)
Available: always
Alterable: only when the programmer state is idle and, for program 1-2-3, the edit is enabled

tH. 1
Meaning: time held (dwell) at SP1
Range: from 0 min to 99 h 59 min
Available: always
Alterable: only when the programmer state is idle and, for program 1-2-3, the edit is enabled

SP. 2
Meaning: target set point of the second segment
Range: End, and then from 0°C – 1500°C
The End value, selectable from the second to the fourth set point, is used to end the program before the last – fourth - segment. This avoid to edit unnecessary parameters for programs shorter than four segments.
Available: always
Alterable: only when the programmer state is idle and, for program 1-2-3, the edit is enabled

Then rr. 2, tH. 2, SP. 3, rr. 3, tH. 3, SP. 4, rr. 4, tH. 4 as above.
### Programming

**$r^P_E$**

**Meaning:** number of program repetitions of the selected program

**Range:** from 0 to 9999 and then $i \; n^F$

The figure expresses the repetitions after the first execution. For example, if 2 is selected, the program will be executed 3 times, while $i \; n^F$ means that the device is set for endless repetitions.

**Available:** always

**Alterable:** only when the programmer state is idle and, for program 1-2-3, the edit is enabled

**$c^E_E$**

**Meaning:** cycle end temperature

**Range:** $OFF$, and then from 0°C (low scale range value) to 1530°C (high scale range value)

**Available:** always

**Alterable:** only, in “Program Edit” mode, when the programmer state is idle or, for program 1-2-3, if the edit is enabled

**Note:** See “Program End Feature” for operation description

### 4.3 Creating a program

Programs are created in the programming level “OP.P”. There are 4 programs available. Programs 1, 2, 3 are protected by security code = 6. Program 4 has no password protection.

Each of the 4 programs contains 4 ramp/dwell pairs.

### 4.4 Enter Program Edit level

Press and hold the Function and run keys $||$ simultaneously for more than 3 seconds.

The display will show $OP_r$ lower display and $OP_b$ upper display ($OP_b$ being the current active mode)

Press the Up $\uparrow$ or Down $\downarrow$ to choose $OPP$

Press $||$ to enter selected level.

The word $PASS$ will be shown on the bottom display and $----$ on the top display. This will time out after 10 seconds, during this period the password should be selected using the Up $\uparrow$ or Down $\downarrow$

Press $||$ to enter the password.

When the correct password has been entered the upper display will flash $PASS$. If an incorrect password is entered the upper display will flash $Err$ and then return to the home display.
4.5 Programming
Note: the normal 10 seconds timeout is removed while editing the program list.

Program Number
Press function \( \| \) to show \( nPrG \) lower display and the program number in the upper display.

Press the Up \( \uparrow \) or Down \( \downarrow \) to choose the program number.

Press \( \| \) to enter the selected program number.

Password Protection program 1, 2, 3
After confirming selection of program 1, 2 or 3, the word PASS will be shown on the bottom display and \( \cdots \cdots \) on the top display. This will time out after 10 seconds, during this period the password should be selected using the Up \( \uparrow \) or Down \( \downarrow \).

Press \( \| \) to confirm password and enter selected program.

When the correct password has been entered the upper display will flash PASS. If an incorrect password is entered the upper display will flash Err and then return to the home display.

Initial Set Point
After confirming password for program 1, 2, 3 or selecting program 4, the display will then show, \( \^SP \) lower display and the value in the upper display.

Use the Up \( \uparrow \) or Down \( \downarrow \) to select the initial set point.

NOTE: It is recommended that this value is set to “off” for the controller to display “rdy” in the home menu (see section 3.1) If a value is assigned, the display will show this value in place of “rdy”.

Press \( \| \) to confirm.

Set Point 1
After confirming selection, the display will then show, \( SP.1 \) lower display and the value in the upper display.

Use the Up \( \uparrow \) or Down \( \downarrow \) to select set point 1.

Press \( \| \) to confirm.

Ramp Rate
After confirming selection, the display will then show, \( rr.1 \) lower display and the value in the upper display.

Use the Up \( \uparrow \) or Down \( \downarrow \) to select a value for ramp rate.
Press || to confirm

**Time Held (Dwell)**
After confirming selection, the display will then show, $tH_l$ lower display and the value in the upper display.

Use the Up $\uparrow$ or Down $\downarrow$ to select a value for time held (dwell).

Press || to confirm

**Set Point 2 onwards**
After confirming selection, the display will then show, $SP_2$ lower display and the value in the upper display.

Use the Up $\uparrow$ or Down $\downarrow$ to select a value for set point 1, or reduce the value to below the minimum to select $End$, if no further segments are required

Press || to confirm.

This Process is repeated for each of the 4 segments of the program.

**Repeat Program**
After confirming selection, of the last parameter in the program, the display will then show, $rP_E$ lower display and the value in the upper display.

Use the Up $\uparrow$ or Down $\downarrow$ to select how many times the program requires repeating

Press || to confirm

**Cycle End Temperature**
After confirming selection, of the last parameter in the program, the display will then show, $CEt$ lower display and the value in the upper display.

Use the Up $\uparrow$ or Down $\downarrow$ to select the temperature at which the program cycle will end.

Note: Below Zero the cycle end temperature will display $\textit{off}$, when set at this value the program will display $\textit{End}$ after last dwell period.

Press || to confirm

Program Review
Programs 1,2,3,4 can be reviewed without password access while in the program level.

Note: the normal 10 seconds timeout is removed while reviewing the program list.

At the home display of the programming level, press function || to show $nPrG$ lower display and the program number in the upper display.
Press the Up or Down to choose the program number.

Press || to select the required program number.

Press the Up or Down to choose the program number.

Press || and the display will show PASS lower display and ---- in the upper display.

NO PASSWORD IS REQUIRED. If an incorrect attempt is made at a password, the upper display will show Err and the display will return to the program home menu.

Press || to ignore the password level

Subsequent presses of || will scroll through each segment of the program.

Note: If the user tries to modify a segment while reviewing programs 1,2,3, the upper display will show Loc.

4.6 Exit Program level

There is no time out or power cycling function, whereby the instrument automatically exits to a lower operating mode.

When OP.P functions have been completed, OP.b mode must be returned to manually as outlined below.

Return to the top level home display of the OP.P list. This will be where the displays show the, program setpoint (PSP); lower display and process value (PV); upper display. This can be done either by leaving the current selected parameter to time out after 10 seconds, or by pressing the Page || or Run to scroll through the parameter list and return to the top level home display.

Press and hold Function and Run simultaneously for more than 3 seconds.

The display will show OP lower display and OPP upper display.

Press the Up or Down to choose OP.b

Press || to enter selected level.

No password is required to enter a lower level of operation, therefore the display will return to basic operator mode and and show the, program setpoint (PSP); lower display and process value (PV); upper display.

Check that no parameters are not available by pressing the page or run keys.

4.7 Running a program

Ensure the controller is in the basic operator mode parameter OP.b.
Programming

Press function || to show nPrG lower display and the program number in the upper display.

Press the Up or Down λ to choose the program number.

Press || to enter to select the required program number.

Table below shows the key presses to run a program

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<tr>
<th>Operation</th>
<th>Action</th>
<th>Indication</th>
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</thead>
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<td>Run indicator = On</td>
</tr>
<tr>
<td>To HOLD a program</td>
<td>Press  for more than 1.5 seconds.</td>
<td>Run indicator = On, Lower Display = HOLD</td>
</tr>
<tr>
<td>To CANCEL a program</td>
<td>Press  for more than 5 seconds.</td>
<td>Run indicator = Off</td>
</tr>
<tr>
<td>To RESET after a program has completed</td>
<td>Press or</td>
<td></td>
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### 4.8 Program Status

The controller can be in one of the following states

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<td>Allowed</td>
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<tr>
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<td>SP, steady</td>
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<td>Blink SP / ErRc</td>
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</tr>
<tr>
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<td>Ramps to dwell SP</td>
<td>ON</td>
<td>Blink SP / rEC</td>
<td></td>
</tr>
<tr>
<td>Natural Cool</td>
<td>Power OFF</td>
<td>ON</td>
<td>Cool</td>
<td></td>
</tr>
<tr>
<td>Hold</td>
<td>Pauses the program</td>
<td>Blink</td>
<td>Blink SP / Hold</td>
<td></td>
</tr>
</tbody>
</table>

The program status can be changed by “RUN” key only if device is in “Normal display mode”.

*The wait and recovery states are not under the control of the operator.
The wait state is entered/exited automatically by the relationship between the SP and PV values. The instrument will go into the recovery state, until setpoint is achieved, after a power failure, during a dwell or after using hold

**Program Review**

While the program is running and the controller is in the basic operator mode the status of the program can be observed by pressing the function key ||
From the home display, press || to cycle through each of the following parameters (for details see section 4.1):

nPrG, SEG, rT 5, rPrT, rPt, tSP, SP. 1, rr. 1, tH. 1, SP 2, tH. 2, SP. 3, rr. 3, tH. 3, SP. 4, rr. 4, tH. 4, rPt, CET

Note: Review of the program parameters while the program is in the run status, can only be accessed sequentially using the function key ||

4.9 Program End Feature

A program can end in one of two ways, either after the unit temperature has dropped below the cycle end threshold “CET” which is the general method for most programs or after the last program repetition, if “CET” has been set to “off”.

Program end with a cycle end threshold value

When a program has a cycle end threshold value assigned and the last program repetition is finished the device is turned off and naturally cooled until the temperature value is less than threshold established by “CET”. During this phase the lower display shows “Cool” while the upper display shows the temperature value.

After this period, when the temperature value is less than the cycle end threshold the unit will still cool naturally to ambient but the display will show “End” on the lower display and the temperature value on the upper display, indicating that the full program cycle is completed.

Note: It is recommended that the cycle end threshold is no greater than 600°C. This maybe less, depending on the workpiece.

Program end with cycle end threshold set to off.

If a program has the cycle end threshold set to “OFF” the natural cool phase is removed, which means when the last program repetition is finished, the controller immediately displays “End” the device is then turned off and will naturally cool to ambient.

Note: There is no cool period indicated with this method and therefore the furnace door may inadvertently be opened straight after a high temperature cycle, causing damage to the workpiece and/or elements. It is therefore recommended that the cycle end threshold has a value set to it.

In either of the above cases the display will continue to display “End” until it has been acknowledged by pressing any of the four controller keys. After pressing one of the keys the display will show “rdy” on the lower display and the temperature value on the upper display, indicating that the program is ready to be run.

4.10 Program Example

Once the password has been correctly entered the following sequence of entries creates the program shown graphically below.

1. Press || until the lower display shows tSP. Select 10.
2. Press \(\text{||}\) until the lower display shows SP. 1. Select 600
3. Press \(\text{||}\) until the lower display shows \(rr.\) 1. Select 8
4. Press \(\text{||}\) until the lower display shows \(tH.\) 1. Select 30
5. Press \(\text{||}\) until the lower display shows SP. 2. Select 900
6. Press \(\text{||}\) until the lower display shows \(rr.\) 2. Select 12
7. Press \(\text{||}\) until the lower display shows \(tH.\) 2. Select 30
8. Press \(\text{||}\) until the lower display shows SP. 3. Select 1450
9. Press \(\text{||}\) until the lower display shows \(rr.\) 3. Select 12
10. Press \(\text{||}\) until the lower display shows \(tH.\) 3. Select 60
11. Press \(\text{||}\) until the lower display shows SP. 4. Select End
12. Press \(\text{||}\) until the lower display shows \(rPt.\) Select 1
13. Press \(\text{||}\) until the lower display shows \(CEt.\) Select 200
14. Press \(\text{||}\) until the lower display shows the home display

---

<table>
<thead>
<tr>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
<th>Segment 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP. 1 = 6.1</td>
<td>SP. 2 = 900°C</td>
<td>SP. 3 = 1450°C</td>
<td>SP. 4 = END</td>
</tr>
<tr>
<td>(tH.) 1 = 30 Min</td>
<td>(rr.) 2 = 12°C</td>
<td>(rr.) 3 = 12°C</td>
<td>(CEt = 200)</td>
</tr>
<tr>
<td>8°C/Min</td>
<td>12°C/Min</td>
<td>12°C/Min</td>
<td>12°C/Min</td>
</tr>
<tr>
<td>600°C</td>
<td>900°C</td>
<td>1450°C</td>
<td>END</td>
</tr>
<tr>
<td>30 Min</td>
<td>30 Min</td>
<td>60 Min</td>
<td></td>
</tr>
</tbody>
</table>

---

End Flag Set By Cycle
End Threshold “\(CEt\)”
5 Enhanced Mode

In enhanced mode the following parameters are available.

CUSTOMER CALIBRATION TYPE SELECTION

Identification code: $\text{CL.ST}$
Range: $\text{FACT}$  Factory calibration  \((a = 1 \ b = 0)\)
$\text{C.CL1}$  1 point calibration  \((a = 1 \ b = \text{OFSt})\)
$\text{C.CL2}$  2 point calibration  \((a = x \ b = x)\)
$\text{C.CL3}$  2 coefficients calibration  \((a = \text{SLOP} \ b = \text{OFSt})\)

OFFSET
(This parameter is always available but can be modified only if $\text{CL.ST} = \text{C.CL1}, \text{C.CL3}$)
Identification code: $\text{OFSt}$
Range: -199.9 / 199.9

SLOPE
(This parameter is always available but can be modified only if $\text{CL.ST} = \text{C.CL3}$)
Identification code: $\text{SLOP}$
Range: 0.500 / 2.000

LOW POINT CALIBRATION
(This parameter is available only if $\text{CL.ST} = \text{C.CL2}$)
Identification code: $\text{CaL.L}$
Range: Value in engineering units between min / max range value

OFFSET ON LOW POINT
(This parameter is available only if $\text{CL.ST} = \text{C.CL2}$)
Identification code: $\text{OFSL}$
Range: -199.9 / 199.9

HIGH POINT CALIBRATION
(This parameter is available only if $\text{CL.ST} = \text{C.CL2}$)
Identification code: $\text{CaL.H}$
Range: Value in engineering units between min / max range value

OFFSET ON HIGH POINT
(This parameter is available only if $\text{CL.ST} = \text{C.CL2}$)
Identification code: $\text{OFSH}$
Range: -199.9 / 199.9

MODBUS ADDRESS
Identification code: $\text{adr}$
Range: 0 (Interface disable) 1 up to 254
5.1 Customer Calibration

The 302P controller is calibrated for life at manufacture, there may however be sensor or other system errors, which affect the accuracy of the measured temperature. Customer calibration can be used to compensate for these errors.

Ensure the controller is in the Enhanced mode OP.E

1 Point Calibration $CL.S_1 = C.LL_1$

1 point calibration uses one offset value across the temperature range.

Clear any previous coefficient adjustment.

Press function $||$ until $CL.S_1$ is shown in the lower display

Press the Up $\uparrow$ or Down $\downarrow$ to $C.LL_1$ in the upper display

Press function $||$ to confirm selection and display $OFSt$

Press the Up $\uparrow$ or Down $\downarrow$ to enter the offset value required across the temperature range. This can be a negative or positive value.

Press function $||$ to confirm selection.

2 Point Calibration $CL.S_2 = C.LL_2$

2 point calibration uses two offset values at two corresponding temperatures; this changes the calibration linearly as the temperature increases or decreases.

Clear any previous coefficient adjustment.

Press function $||$ until $CL.S_2$ is shown in the lower display

Press the Up $\uparrow$ or Down $\downarrow$ to $C.LL_2$ in the upper display

Press function $||$ until $CAL.L$ is displayed

Press the Up $\uparrow$ or Down $\downarrow$ to enter the lower calibration temperature to which the offset is to be applied. Example. 300°C.

Press function $||$ until $OFSL$ is displayed
Press the Up ‼️ or Down ➧ to enter the offset to be applied to the lower calibration temperature. Example: If at the calibrated temperature of 300°C the controller is reading 296.7, the offset will be 3.3°C (300-296.7 = 3.3)

Press function || until **CALH** is displayed

Press the Up ‼️ or Down ➧ to enter the lower calibration temperature to which the offset is to be applied. Example. 1400°C

Press function || until **DFS.H** is displayed

Press the Up ‼️ or Down ➧ to enter the offset to be applied to the lower calibration temperature. Example: If at the calibrated temperature of 1400°C the controller is reading 1402.1, the offset will be -2.1°C (1402.1-1400 = 2.1)

Press function || to confirm selection.

**Slope and offset calibration CL.St = CCL₃**

**To calculate an offset and slope.**

Select two points within the measure range. In these points the error will be zeroed by the offset and slope adjustment procedure. Mark the co-ordinates of the two points.

![Diagram of two points with offset and slope calculation](image)

If **CL.St** is set to **CCL₃** compute and set the “**SLOP**” and “**OFST**” values using the below formulas

```
"SLOP" = (Y₂ - Y₁) / (X₂ - X₁)
"OFST" = Y₁ - X₁ * (Y₂ - Y₁) / (X₂ - X₁)
```

or the below spreadsheet with same examples:

<table>
<thead>
<tr>
<th>Point 1</th>
<th>X1</th>
<th>20</th>
<th>20</th>
<th>0</th>
<th>20.1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Y1</td>
<td>20</td>
<td>24</td>
<td>0</td>
<td>18.5</td>
</tr>
<tr>
<td>Point 2</td>
<td>X2</td>
<td>90</td>
<td>90</td>
<td>70</td>
<td>80.4</td>
</tr>
<tr>
<td></td>
<td>Y2</td>
<td>90</td>
<td>94</td>
<td>77</td>
<td>85.3</td>
</tr>
</tbody>
</table>

| Coefficient | "OFST" | 0.0 | 4.0 | 0.0 | -3.8 |
To adjust both offset and slope.

Clear any previous coefficient adjustment.

Press function || until CL.ST is shown in the lower display.

Press the Up U or Down λ to C.CL3 in the upper display.

Press function || to confirm selection and display OFST.

Press the Up U or Down λ to enter the offset value required across the temperature range (see above formula). This can be a negative or positive value.

Press function || to confirm selection and display SLOP.

Press the Up U or Down λ to enter the slope value required (see above formula).

Press function || to confirm.
6 Navigation Diagram
7 Controller Fault

7.1 Fault Code Diagnostic Table

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Explanation</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ooooo</td>
<td>Temperature sensor failure</td>
<td>Check connections of the furnace Temperature Sensor (Thermocouple)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace the Furnace Temperature Sensor (Thermocouple)</td>
</tr>
</tbody>
</table>

8 Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Value (PV)</td>
<td>The actual temperature of the furnace or oven.</td>
<td>°C</td>
</tr>
<tr>
<td>Setpoint (SP)</td>
<td>The target temperature the furnace is trying to reach.</td>
<td>°C</td>
</tr>
<tr>
<td>Program Setpoint (PSP)</td>
<td>The target temperature the furnace is trying to reach, set by the program.</td>
<td>°C</td>
</tr>
<tr>
<td>Ramp Rate</td>
<td>The speed at which the furnace or oven is allowed to heat up or cool down.</td>
<td>°C/Min</td>
</tr>
<tr>
<td>Element</td>
<td>The heating device used in the furnace.</td>
<td>-</td>
</tr>
<tr>
<td>Thermocouple</td>
<td>The temperature-measuring device used in the furnace or oven.</td>
<td>-</td>
</tr>
<tr>
<td>PID</td>
<td>Proportional Integral Derivative: the control system used by the controller.</td>
<td>-</td>
</tr>
<tr>
<td>Program</td>
<td>A sequence of stored Parameters set by the operator, which will run automatically when started.</td>
<td>-</td>
</tr>
<tr>
<td>Power Cycling</td>
<td>The Power to the controller is turned off and then back on.</td>
<td>-</td>
</tr>
<tr>
<td>Home Display</td>
<td>The first level of any operative mode</td>
<td>-</td>
</tr>
</tbody>
</table>
For preventive maintenance, repair and calibration of all Furnace and Oven products, please contact:

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**Fax:** +44 (0)1433 624243
**Email:** ServiceUK@carbolite-gero.com