1. 2704CP FURNACE ATMOSPHERE CONTROLLER/PROG2

1. 2704CP Furnace Atmosphere Controller/Prog

1.1 INTRODUCTION

The 2704CP Furnace Atmosphere Controller/Programmer is a fully programmable controller suitable for precision control of temperature, carbon potential, dewpoint and oxygen in atmosphere heat treatment applications. It may be supplied with the following clone files:-

Clone File Name	Function
27CP-CXX-V1.xx.UIC	carbon potential only
27CP-DXX-V1.xx.UIC	dewpoint only
27CP-OXX-V1.xx.UIC	oxygen only
27CP-CTX-V1.xx.UIC	carbon potential plus temperature
27CP-DTX-V1.xx.UIC	dewpoint plus temperature
27CP-OTX-V1.xx.UIC	oxygen plus temperature
27CP-CTP-V1.xx.UIC	carbon potential plus temperature programmer
27CP-DTP-V1.xx.UIC	dewpoint plus temperature programmer
27CP-OTP-V1.xx.UIC	oxygen plus temperature programmer

These files are included in the iTools CD. iTools is the software which may be used for configuration of 2000 series instruments.

The order code for your controller is identified on a label fixed to the side of the instrument. This can be checked against the explanation of the order code given at the end of this supplement.

Instrument views shown in this handbook are typical but may vary in detail depending on the clone file loaded or the state of certain parameters.

1.1.1 Related Handbooks

For further details not described in this supplement please refer to the following handbooks where this symbol is shown ☞:-

- 2704 Installation and Operation Handbook Part No. HA026502
- 2704 Engineering Handbook Part No. HA026933
- iTools User Handbook Part No. HA026179
- I/O Expander Handbook Part No. HA026893

All handbooks are available on the Eurotherm web site www.eurotherm.co.uk.

Select Documentation → Document Library DATABASE → Keyword (eg 2704) → Choose the handbook and DOWNLOAD. The documents are in pdf format.

1.2 WHAT IS CARBON POTENTIAL CONTROL

Carburizing may be used to provide a hard surface to steel after it has been formed. It is produced by placing the steel in a furnace with a carbon atmosphere and holding it at a temperature of between about 800 and 1100°C for a period of time.

As the carbon is absorbed into the steel the carbon potential controller will admit a carbon rich gas from an endothermic generator or air into the furnace atmosphere to maintain the desired carbon potential setpoint.

Carbon potential cannot be measured directly and so must be inferred using other measurements. The most common of these uses a Zirconia probe.

1.2.1 Zirconia Probe

The zirconia probe actually measures the oxygen content and generates a mV signal based on the ratio of oxygen concentration between the reference air side of the probe (outside the furnace) and the amount of oxygen actually inside the furnace. The temperature and the CO content of the furnace atmosphere are also measured and from all of these measurements the carbon content can be calculated. Each manufacturer of zirconia probes may use a different algorithm for calculating the carbon content and the 2704CP controller may be configured for the type in use.

1.2.2 Dewpoint

In this application the zirconia probe measures the actual dewpoint of the gas. For both oxygen and dewpoint measurement the CO level of the sample gas is assumed to be constant at 40%. The dewpoint is then directly related to the carbon content. An increasing dewpoint represents a decreasing carbon content.

The diagram below shows a typical 2704CP applied to the control of temperature and carbon in a furnace.

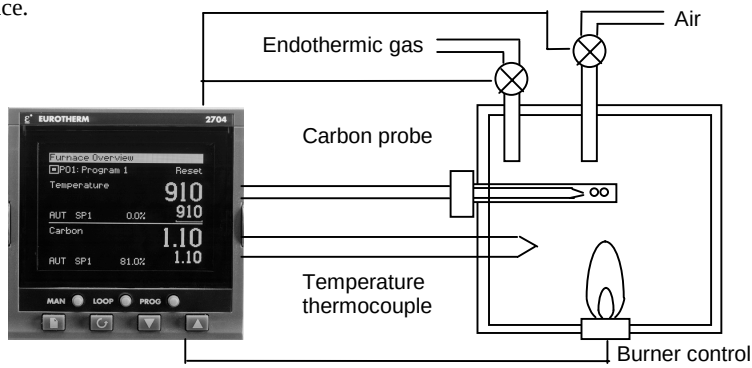


Figure 1-1: Temperature/Carbon Control Loop

1.2.3 Sooting Alarm and Probe Burn Off

Because of the harsh atmosphere in the furnace the probe can become contaminated. When this occurs the 2704CP initiates an alarm and this can turn on a solenoid to admit air down the ceramic tube of the probe. The air on the heated surface creates an intense burning action which cleans the tip of the probe. The burn off can also be initiated at regular intervals by the 2704CP controller and the duration of the admittance of the air can also be set.

1.3 TYPICAL FUNCTION BLOCK DIAGRAM

The block diagram below shows a simplified overview of the carbon potential controller when integrated with temperature programmer.

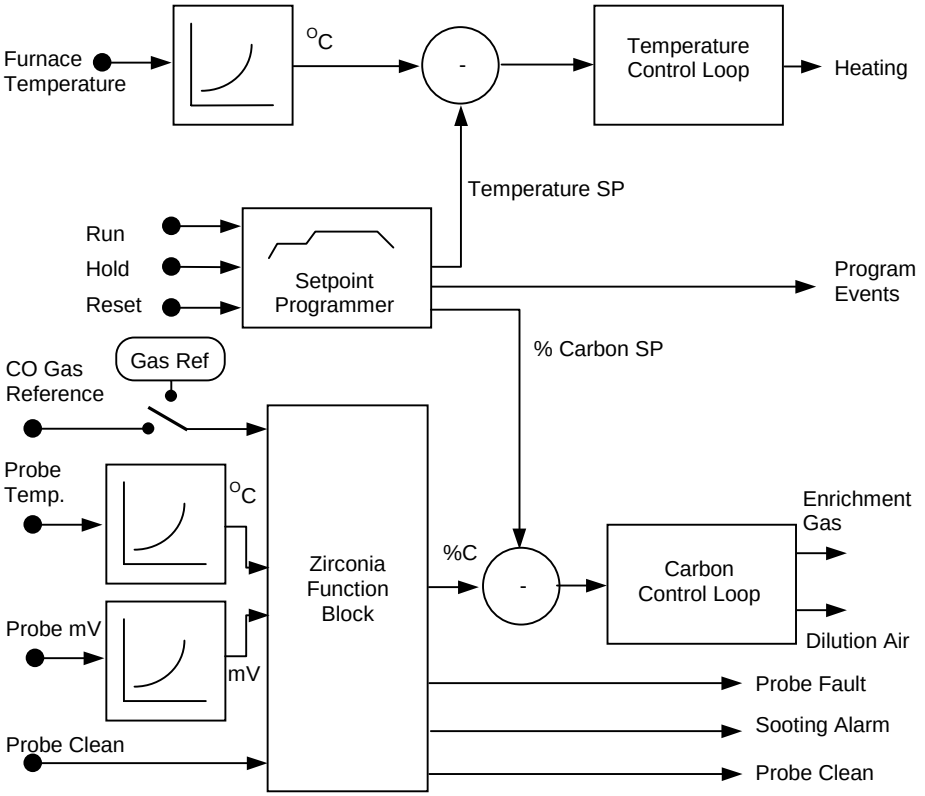


Figure 1-2: Typical Furnace Atmosphere Controller/Programmer Block Diagram

1.4 INSTALLATION

The 2704CP Furnace Atmosphere Controller/Programmer should be installed as described in Chapter 2 of the Installation and Operation Handbook.

WARNING

You must ensure that the controller is correctly configured for your application. Incorrect configuration could result in damage to the process being controlled, and/or personal injury. It is your responsibility, as the installer, to ensure that the configuration is correct. See 2704 Engineering Handbook for details.

1.5 WIRING CONNECTIONS

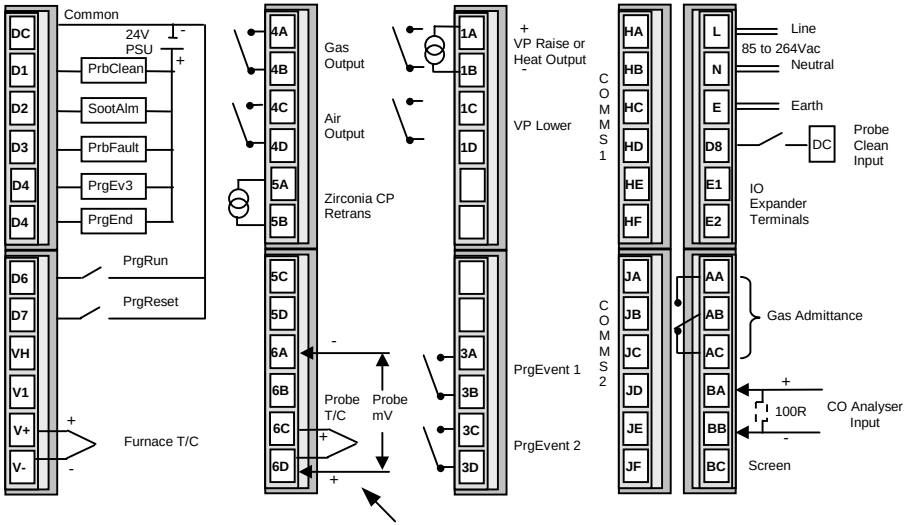
☞ **Before proceeding further, please read Appendix B, Safety and EMC information, in the above handbooks.**

This controller has the following configuration depending on the order code:-

- Temperature control loop, 50 single profile programs, four events
- Zirconia control loop (Carbon, Dewpoint, Oxygen)
- Toolkit functions including mathematical calculations, combination logic, real time clock, timer function
- Dual relay (part no. AH025246U002) or DC control output module (part no. AH025728U003) fitted in slot 1 provides temperature control output
- Dual relay output module (part no. AH025246U002) fitted in slot 3 provides programmer event outputs
- Dual relay output module (part no. AH025246U002) fitted in slot 4 provides time proportion outputs for both gas and air
- Analogue input module (part no. AH025728U002) fitted in slot 5 to provide dc retransmission
- Dual analogue input module (part no. AH026359) fitted in slot 6 provides temperature and probe input for the Zirconia sensor
- Optional communications module fitted in slot H
- Standard toolkit functions

The following connection diagrams are shown for the above configuration.

1.5.1 Controller Connections to Plant Devices



Note
Thermocouple negative connected to 6D
Probe positive connected to 6D

The Furnace thermocouple measures the temperature of the furnace

The Probe thermocouple measures the temperature at the zirconia probe

The Probe Thermocouple input and Probe mV input are not isolated from each other, although they are isolated from all other I/O.

Figure 1-3: Controller Terminals

1.5.2 IO Expander Connections to Plant Devices

☞ See IO Expander Handbook for further details.

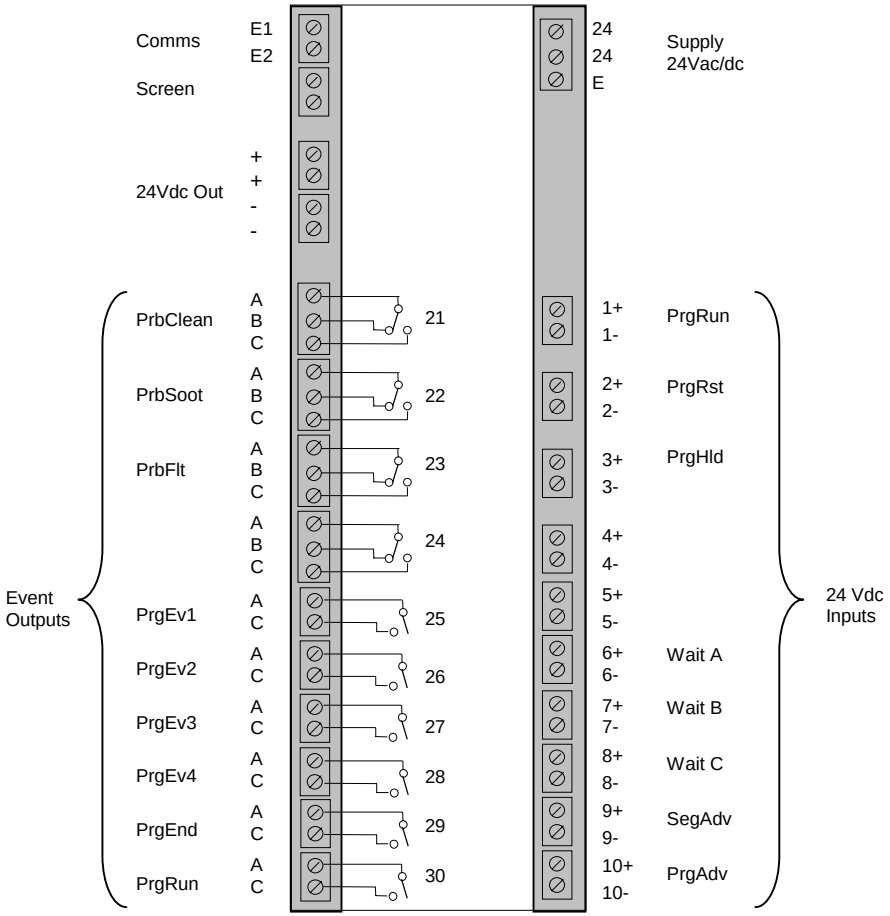


Figure 1-4: IO Expander Terminals

1.6 TEMPERATURE/ZIRCONIA CONTROL

Switch on the controller. After a brief self-test sequence, during which the controller displays the software version number, you will see an overview display. The display shown below is the overview for a temperature/carbon controller/programmer. The displays and operating procedures for carbon, dewpoint and oxygen are basically the same. Differences are highlighted where applicable.

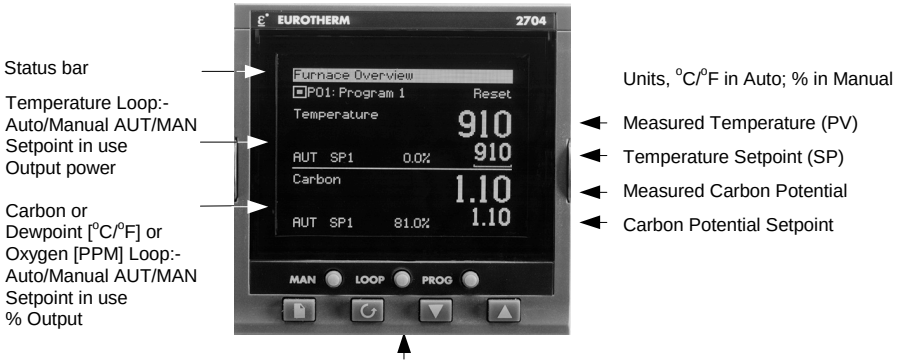


Figure 1-5: Temperature/Carbon Display

1.6.1 To Change Temperature Setpoint

From the above view the parameter value which can be changed is indicated by a flashing underline.

Press ▲ or ▼ to increase or decrease the temperature setpoint.

1.6.2 To Select Auto or Manual Operation (Temperature)

From the above view, press MAN ◉ . AUT on the Overview display will change to MAN.

The Output Power will be shown with a flashing underline.

Press ▲ or ▼ to increase or decrease the output power.

1.6.3 To Change Carbon Setpoint

From the above view press ↻ to select between the temperature loop and the carbon loop. The carbon setpoint parameter will be shown with the flashing underline.

Press ▲ or ▼ to increase or decrease the carbon potential setpoint.

1.6.4 To Select Auto or Manual Operation (Carbon)

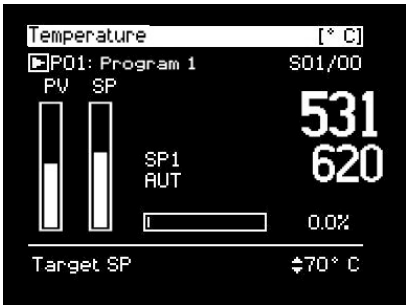
From the above view, repeat 1.6.2. for the carbon loop.

1.6.5To Select Alternative Overviews

Press LOOP .

The views below show examples of alternative overview displays with each press of LOOP .

Temperature



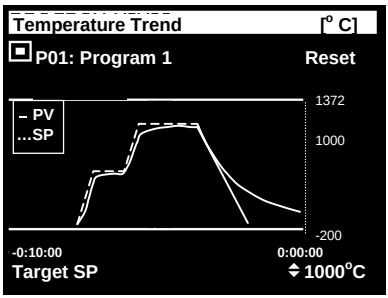
Shows a summary of the temperature control loop

Press to scroll through the list of commonly used parameters promoted to the bottom section of the display. These are:-

Target SP	Setpoint when the programmer is in Reset.
	Alterable in Auto
Target OP	Output demand signal
	Alterable in Manual

Any parameter preceded by ⇕ may be changed

Temperature Trend

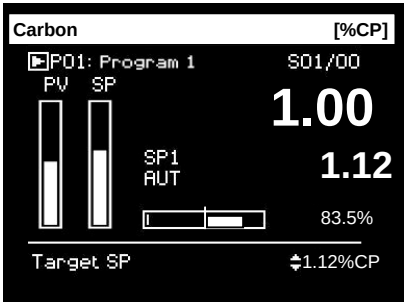


Shows a time/temperature graph of the process

Press to scroll through the list of commonly used parameters. These are:-

Target SP	Setpoint when the programmer is in Reset.
	Alterable in Auto
Target OP	Output demand signal
	Alterable in Manual
Timebase	To set the time axis

Carbon/Dewpoint/Oxygen



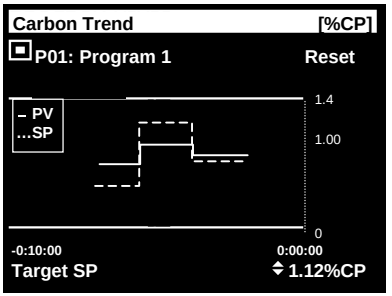
Shows a summary of the carbon or dewpoint or oxygen control loops depending on the variable.

Units are %CP for carbon (as shown), °F or °C for dewpoint, PPM for oxygen

Press to scroll through the list of commonly used parameters. These are:-

Target SP	Setpoint when the programmer is in Reset.
	Alterable in Auto
Target OP	Output demand signal
	Alterable in Manual

Carbon/Dewpoint/Oxygen Trend

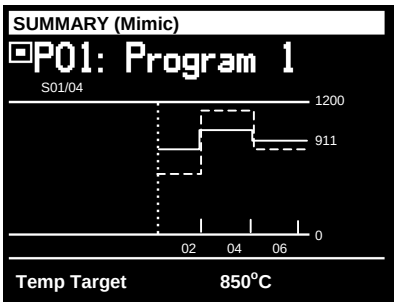


Shows a trend chart for carbon potential, dewpoint or oxygen measured values depending on the variable being controlled

Press [↻] to scroll through the list of commonly used parameters. These are:-

Target SP	Setpoint when the programmer is in Reset. Alterable in Auto
Target OP	Output demand signal Alterable in Manual
Timebase	To set the time axis

SUMMARY (Mimic)



A time/temperature chart showing the furnace temperature during a running program

Press [↻] to scroll through the list of commonly used parameters. These are all read only:-

Temp Target	Temperature to which the programmer is heading
Carbon Target	Carbon potential to which the programmer is heading
Prog Dos	State of the digital outputs in the current segment

1.6.6 Alarm Messages

If alarms occur an alarm message, in the format shown below, will be shown across the overview display. Acknowledge as instructed. Any further alarms will also need to be acknowledged before the overview can be seen.

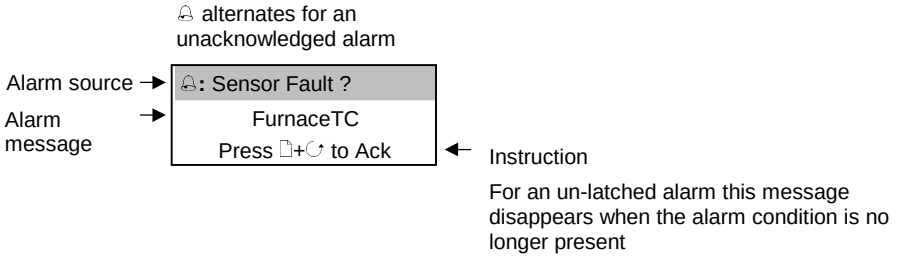
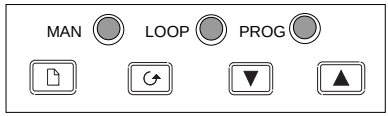


Figure 1-6: Alarm Message Banner

1.6.7 Operator Buttons



AUTO 	Auto/Manual button	When pressed, this toggles between automatic and manual mode: ▪ If the controller is in automatic mode 'AUT' is displayed ▪ If the controller is in manual mode, 'MAN' is displayed In manual mode the output power of either the temperature or carbon loops can be adjusted by the operator.
LOOP 	Loop select button	Each press selects a different overview display *The overview name is shown in the banner at the top of the display*
PROG 	Programmer button This button is only applicable if the programmer version is supplied	• Press once to display a pop up window  The pop up window will remain for approximately 6 seconds and during this period:- • Press PROG again to RUN a program  • Press PROG again to HOLD a program  • Press PROG again to toggle between RUN & HOLD • Press PROG and hold for two seconds to reset 
	Page button	Press to select the Page Header 'Menu'.
	Scroll button	Press to select a new parameter from the page heading. If held down it will continuously scroll through the parameters.
	Down button	Press to decrease an analogue value, or to change the state of a digital value
	Up button	Press to increase an analogue value, or to change the state of a digital value

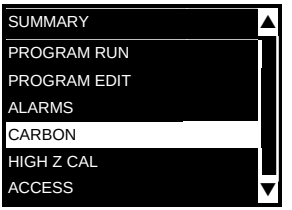
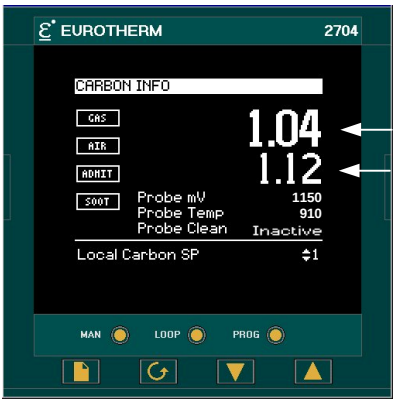
Figure 1-7: Operator Buttons

1.7 CARBON CONTROL

1.7.1 Carbon Control User Screen

This is a customised screen which displays information about the carbon control loop.

To access this view:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to scroll to **'CARBON'**		This view is available at access level 1. For further information on Access Levels see the Engineering Handbook.
3. Press [↻] to display information about the carbon loop. 4. Press [↻] to scroll through the list of commonly used parameters promoted to the bottom section of the display. These are:-		Zirconia control PV Target SP

Local Carbon SP	Carbon setpoint when the programmer is in Reset. Alterable in Auto
Internal %CO Val	This value is used in the calculation for the probe. It is normally set to 40% but can be changed in level 3
%CO Input Select	Select between Internal and Remote
Remote %CO Val	Read only
Clean Frequency	To set the time between cleans
Clean Duration	To set the time taken for the clean
High Z SP(kohm)	Set point to define probe impedance failure
Sooting Alarm	Select between Disabled and Enabled

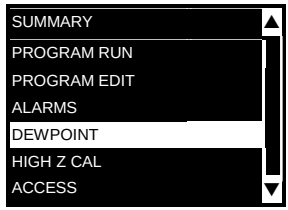
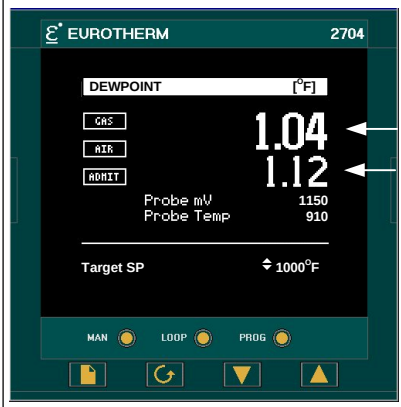
Any parameter preceded by ⇕ may be changed

1.8 DEWPOINT CONTROL

1.8.1 Dewpoint Control User Screen

This is a customised screen which displays information about the dewpoint control loop.

To access this view:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to scroll to **'DEWPOINT'**		This view is available at access level 1. For further information on Access Levels see the Engineering Handbook.
3. Press [↻] to display information about the dewpoint loop. 4. Press [↻] to scroll through the list of commonly used parameters promoted to the bottom section of the display. These are:-		Zirconia control PV Target SP The admittance temperature of the endothermic gas from the generator must be greater than a set value to prevent damage. In the 2704CP this value is pre-set to 1850°F, 1010°C

Target SP	Dewpoint setpoint when the programmer is in Reset. Alterable in Auto If the SP is set to the Low Limit the outputs are set to zero
Internal %H Val	This value is used in the calculation for the probe. It is normally set to 40% but can be changed in level 3
%H Input Select	Select between Internal and Remote
Remote %H Val	Read only
High Z SP(kohm)	Set point to define probe impedance failure
Admit Gas SP	To set the level of the admittance gas

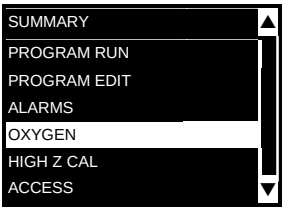
Any parameter preceded by ⬍ may be changed

1.9 OXYGEN CONTROL

1.9.1 Oxygen Control User Screen

This is a customised screen which displays information about the oxygen control loop.

To access this view:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to scroll to **'OXYGEN'**		This view is available at access level 1. For further information on Access Levels see the Engineering Handbook.
3. Press [scroll] to display information about the oxygen loop. 4. Press [scroll] to scroll through the list of commonly used parameters promoted to the bottom section of the display. These are:-		Zirconia control PV Target SP

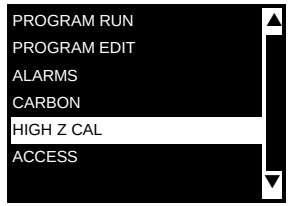
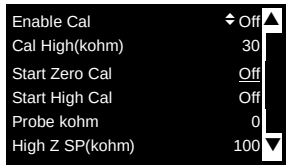
Target SP	Oxygen setpoint when the programmer is in Reset. Alterable in Auto If the SP is set to the Low Limit the outputs are set to zero
Probe kohm	Probe resistance. Read only
High Z SP(kohm)	Set point to define probe impedance failure
Min Cal Temp	Minimum calibration temperature
Admit Gas SP	To set the level of the admittance gas

Any parameter preceded by ⬍ may be changed

1.10 PROBE IMPEDANCE

When the output impedance of a zirconia probe increases above a certain level, it indicates that the performance of the probe has deteriorated, and should be replaced. The 2704CP controller has the ability to measure the impedance of the sensor connected to its input, and in conjunction with User Alarms an alarm strategy created to alert the operator.

1.10.1 To Calibrate High Impedance Input

Do This	This Is The Display You Should See	Additional Notes
	Calibrate the Low Point	
1. With the probe disconnected, place a shorting link across the input terminals 6A and 6D 2. From any display press [page] as many times as necessary until the '**HIGH Z CAL'** page header is displayed.		
3. Press [scroll] to select sub-headers 4. Press [scroll] again to edit **'Enable Cal'** 5. Press [▲] or [▼] to **'On'**		
6. Press [scroll] to scroll to **'Start Zero Cal'** 7. Press [▲] or [▼] to **'On'**		Press [page] + [scroll] as directed to start the zero point calibration. When this has been completed the 'On' message reverts to 'Off'

Calibrate the High Point

8. Remove the shorting link and replace with a calibration resistor value approximately 30KΩ

9. Scroll back to **'Cal High(kohm)'** and use ▲ or ▼ to enter the same value as the calibration resistor

The value of the resistor is not critical but the 'Cal High(kohm)' value must be set to the chosen resistor value.

This value is measured by the parameter **'Probe kohm'**

10. Press ⟳ to scroll to **'Start High Cal'**

11. Press ⟳ to select sub-headers

12. Remove the calibration resistor and re-connect the probe

13. Press ⟳ again to scroll to **'Enable Cal'**

14. Press ▲ or ▼ to **'Off'**

Press 🗋 + ↻ as directed to start the zero point calibration.

When this has been completed the 'On' message reverts to 'Off'

If the calibration fails, due for example to an incorrect value of calibration resistor being used, then the message:-

Txdcr1 Failed
Press 🗋 + ↻ to Ack

will appear

Set the Probe Impedance Failure Threshold

10. Press ⟳ to scroll to **'High Z SP(kohm)'**

11. Press ▲ or ▼ to set the threshold

In this view the probe impedance is set to 100KΩ.
If the probe impedance exceeds this value an alarm is produced

1.10.2 Alarm Inhibition

Zirconia probes have an extremely high impedance at lower temperatures. For this reason the probe temperature measurement is used to inhibit alarms at temperatures below 850°C.

1.10.3 Impedance Measurement Filter

The probe impedance measurement is inherently noisy. The 2704CP uses a Toolkit block to apply internal filtering to the input.

1.11 SETPOINT PROGRAMMER

This section describes how to create, edit and run programs in controllers fitted with this option.

The programmer has two setpoint profiles for temperature and carbon, connected to control loops 1 and 2 respectively. Digital inputs are available for Run, Reset and Hold on IO expander inputs 1, 2 or 3. Run and Reset are also available on controller terminals D6 and D7. Four digital event outputs are pre-configured – more can be added by the user (see Engineering Handbook). Event outputs 1 and 2 are available on terminals 3A and 3C. Event 3 is available on D4 and event 4 is wired to start a probe clean cycle.

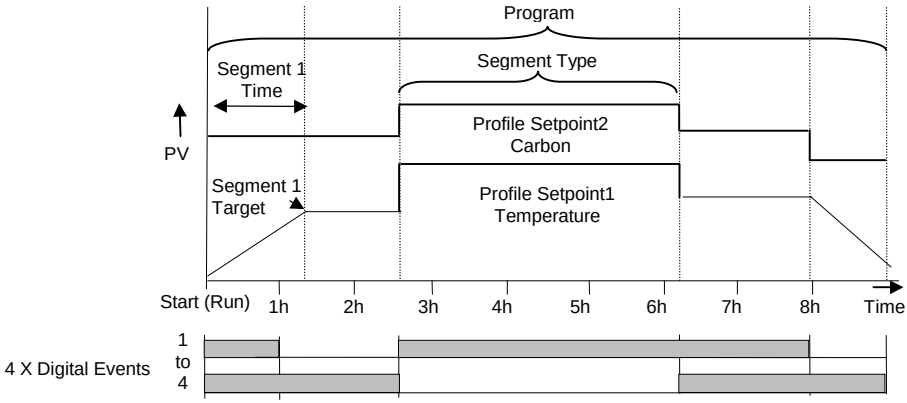


Figure 1-8: Example of a Carbon/Temperature Profile

1.11.1 Setpoint Programmer Block Diagram

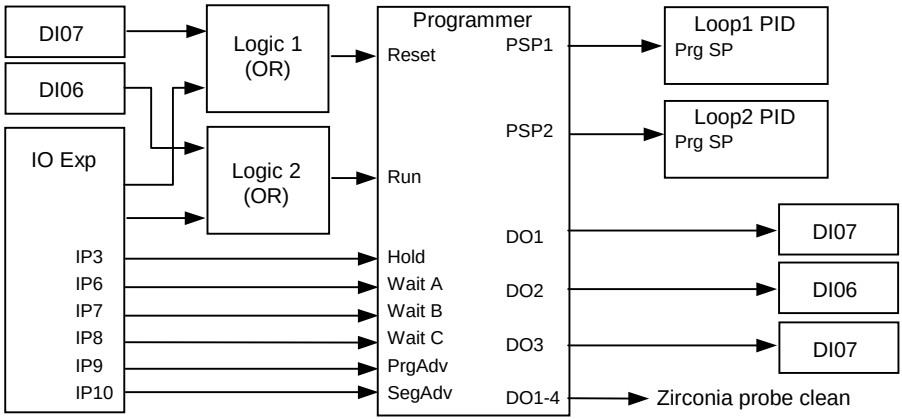


Figure 1-9: Programmer Block Diagram

1.11.2 Programmer Type

The programmer type is configured as Time to Target.

Each segment consists of a **single duration parameter** and a set of **target values** for the profiled variables.

1. The **duration** specifies the time that the segment takes to change the profiled variables from their current values to the new targets.
2. A **dwell** type segment is set up by leaving the target setpoint at the previous value.
3. A **Step** type segment is set up by setting the segment time to zero.

The operating descriptions which follow are specific to the 2704CP clone files. For a general description of operation refer to the 2704 Installation or Engineering Handbooks.

1.11.3 To Select, Run, Hold or Reset a Program

Press PROG button. A banner appears →

Press ▲ or ▼ to select the program number to be run

Press PROG button to select Run. In run the programmer varies the setpoint in accordance with the profile set in the active program.

Press PROG button again to Hold the program if required. In hold the programmer is frozen at its current point. In this state you can make temporary changes to program parameters such as a target setpoint, ramp rates and dwells. Such changes can only be made in the current or subsequent segments and will only remain effective until the end of the currently running segment, when they will be overwritten by the stored program values.

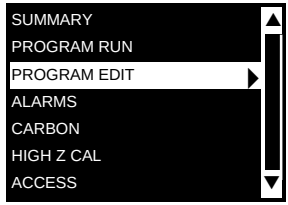
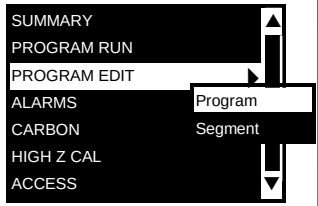
Press PROG button again to Reset the program. In reset the programmer is inactive and the controller behaves as a standard controller, with the setpoint determined by the raise/lower buttons.

A list of parameters available for a running program is available under the page header PROGRAM RUN. Refer to section 1.10.12.

External run, reset or hold inputs are available on the IO Expander. If this has been supplied and wired to external buttons then the program may be operated from these buttons.

1.11.4 To Create or Edit a Program

The programmer parameters are grouped under page headings in exactly the same way as other parameters.

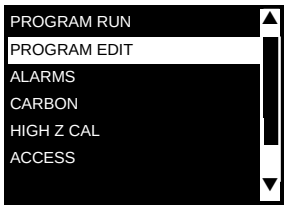
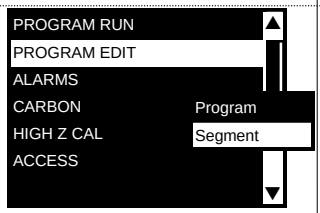
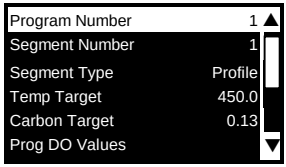
Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to select **'PROGRAM EDIT'**		This is access level 1 view
3. Press [↺] to display sub-headers		
4. Press [↺] to select parameters for the overall program 5. Press [↺] again to edit the value of any parameter 6. Press [▲] or [▼] to change the value		

The following table shows the full list of parameters in this page together with a description of their functions.

1.11.5 PROGRAM EDIT (Program Page) Parameters

Table Number: 1.11.5.	These parameters affect the overall program. All parameters are available at Level 1. To hide parameters refer to the Engineering Handbook		PROGRAM EDIT (Program Page)
Parameter Name	**Parameter Description**	**Value**	**Default**
Program Number	Selects the program number to be edited.	1 to 50	1
Hbk Mode See also Note 2 in section 1.7.7.	Holdback mode None = no holdback Per prog = applied over the whole program Per seg = active in every segment	 None Per Program Per Segment	Per Segment
Temp HBk Type Only displayed if Per Program configured	Holdback type for Temperature program These are deviations between SP and PV Fine and course holdback allows two levels of holdback to be applied to different segments.	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off
Temp FineHBk	Fine holdback value for the Temperature program	Display range	0
Temp CoarseHBk	Course holdback value for the Temperature program	Display range	0
The above two parameters are only displayed if Hbk Mode = Per Segment. They are repeated for the carbon loop.			
Program Cycles	The number of times a program repeats.	Cont. to 999	Cont.
End Action	Defines the action in the end segment. Dwell - the program will dwell indefinitely at the conditions set in the end segment. Reset - the program will reset to the start conditions.	 Dwell Reset	
Program Name	Displays the name of the program		Program 1

1.11.6 To Set Up Each Segment of a Program

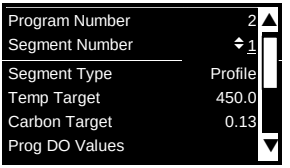
Do This	This Is The Display You Should See	Additional Notes
1. From any display press [D] to access the page header menu. 2. Press [▲] or [▼] to select '**PROGRAM EDIT'**		This is access level 1 view
3. Press [↵] to show sub-headers 4. Press [▲] or [▼] (if necessary) to select **'Segment'**		
	Select a Program	
5. Press [↵] to show segment parameters 6. Press [▲] or [▼] to scroll up or down the list of parameters		If the program exists, the segment details are displayed
7. Press [↵] again to edit the selected parameter 8. The value or state of a parameter prefixed by ⬍ can be changed using [▲] or [▼]		→ If the program selected is new, confirm as instructed on the display Create Prg: 2? [D]→Cancel [↵]→OK

Tip ☺ A back and forward scroll is available by holding down [↵] and pressing [▲] or [▼] respectively

Alternatively, press [D] to return to the highlighted bar and use [▲] or [▼]

9. Press [scroll] to scroll to and edit the **'Segment Number'**

10. Press [▲] or [▼] to choose the **'segment number'**



If the segment selected is new, confirm as instructed on the display.

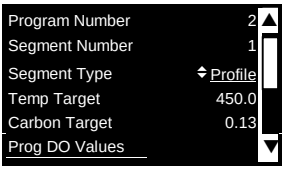
Not applicable to segment 1

Create Seg 2?
→Cancel →OK

Up to 100 segments are available per program

11. Press [scroll] to scroll to and edit the **'Segment Type'**

12. Press [▲] or [▼] to change the segment type



The choices are:-

Profile

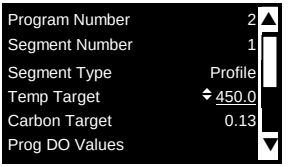
Go Back

End Segment

See the Program Edit Parameter tables for an explanation

13. Press [scroll] to scroll to and edit '**Temp Target'**

14. Press [▲] or [▼] to set the target value

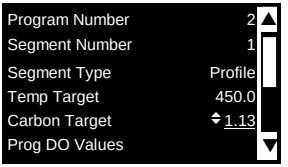


The target temperature for the segment can be set between the upper and lower limits of the temperature range pre-set in configuration level.

0 – 1200°C by default

15. Press [scroll] to scroll to and edit '**Carbon Target'**

16. Press [▲] or [▼] to set the target value



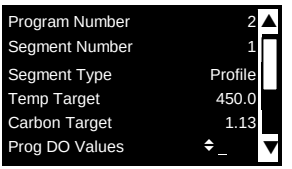
The target carbon for the segment can be set between the upper and lower limits of the carbon range pre-set in configuration level.

0 – 1.40 by default

17. Press [scroll] to scroll to and edit '**Prog DO Values'**

18. Press [▲] or [▼] to turn each program event output on or off in turn

19. Repeat the above steps for all required segments



Up to four digital outputs can be set to operate in each segment. If the IO Expander is being used these outputs switch relays to operate external devices.

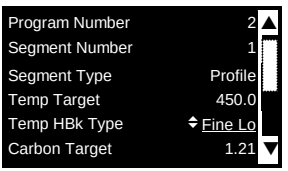
□ = Off in the selected segment

▮ = On in the selected segment

20. Press [↻] to scroll to and edit the **'HBk Type'**

21. Press [▲] or [▼] to type of holdback

Holdback Type



If 'Holdback Type' has been configured in the **PROGRAM EDIT Program Page** as **Holdback per Segment** then each segment will contain a holdback parameter

A full explanation of Holdback Type is given in the following section Note 1.

The choices are:-

Off

Fine Lo

Fine Hi

Fine Band

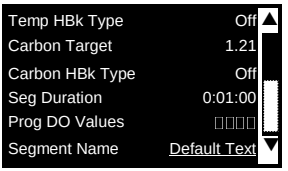
Course Lo

Course Hi

Course Band

22. Press [↻] to scroll to and edit the **'Segment Name'**

Segment Name



Each segment can be allocated a name. 'Default Text' means that no name has been allocated.

Pressing [▲] or [▼] will scroll through a list of pre-prepared user text names.

User text names can be changed in configuration mode but it is not recommended since this text is used elsewhere in the controller.

Carbon/Dewpoint/Oxygen Programmer

The following three or four parameters which follow are to set up the program segment for the carbon, dewpoint or oxygen controller depending on which clone file has been supplied.

They are set up using the same procedure as described above.

Further Segments

Up to 100 segments can be set up in any program. Scroll back to 'Segment Number' and select the next segment. Then repeat the procedure above.

The following table gives a summary of all parameters which appear in the Program Edit list.

1.11.7 PROGRAM EDIT (Segment) Parameters

Table Number: 1.11.7.	These parameters allow you to set up each segment in the program		PROGRAM EDIT (Segment)
Parameter Name	**Parameter Description**	**Value**	**Default**
Program Number	Selects the program number to be edited	1 to 50	
Segment Number	Selects the segment number to be edited	1 to 100	
Segment Type	Segment type	Profile End Segment Go Back	Profile
	Profile = a segment which has a time period End Segment = the last segment in the program (press ↵ to confirm) Go Back = repeat part of program. Not shown for segment 1.		
Temp Target	The temperature which the program is heading for in the selected segment	Temp lo limit to Temp hi limit	0 –1200°C
Temp HBk Type	Temperature holdback type Not shown if Segment Type = End Segment A full description of holdback is given in Note 1 after this table	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off
The following parameters depend on the type of variable. This may be Carbon, Dewpoint or Oxygen control			
Carbon/Oxygen/ Dewpoint Target	The Carbon Potential/ Oxygen/Dewpoint value which the program is heading for	PSP2 lo limit to PSP2 hi limit	0
Carbon/Oxygen/ Dewpoint Dwell Time	The time for which the temperature will remain at its current value Only appears if 'Carbon/Oxygen/Dewpoint Type' = 'Dwell'	hrs:mins:secs	
Carbon/Oxygen/ Dewpoint HBk Type	Holdback type for the application in use Not shown if Segment Type = End Segment A full description of holdback is given in Note 1 after this table	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off

The final two parameters apply to any segment for any variable Temperature, Carbon, Oxygen or Dewpoint			
Prog DO Values	Sets programmer event outputs on or off	□/▮ = Off/On in the selected segment	4
Segment Name	Allows a user defined name to be chosen from a stored name in User Text - (Set in INSTRUMENT User Text – configuration mode only)	Default Text to 50:Usr 50	Default Text

Note 1 Holdback Type defines how holdback operates. It may apply when:

- The PV is below the SP by a pre-set value (Lo),
- The PV is above the SP by a pre-set value(Hi)
- The PV is below or above the SP by a pre-set value (Band).

In addition two levels of holdback are available per profile setpoint, per program. These are defined as 'Fine' and 'Course'.

Holdback freezes the program if the process value does not track the setpoint by an amount which can be set by the user.

During a period when the setpoint is changing it indicates that the process value is lagging the setpoint by more than a pre-set amount and that the program is waiting for the process to catch up.

During a period when the setpoint is constant it will freeze the time if the difference between SP and PV exceeds pre-set limits.

In both cases it guarantees the correct time period for the product.

Holdback (PROGRAM EDIT Program page) may be configured in three modes:

- OFF - holdback does not operate
- Applied to the complete program. Holdback operates the same way in every segment
- To each individual segment. A different holdback type can be applied to each segment

Example:

Holdback, operating in each segment, is often used in a temperature control application as detailed below:-

During a 'ramp up' period the holdback type may be set to deviation low. If the Process Value lags the programmed rate of rise, holdback will stop the program until the PV catches up. This prevents the set program from entering the next segment until the PV has attained the correct temperature.

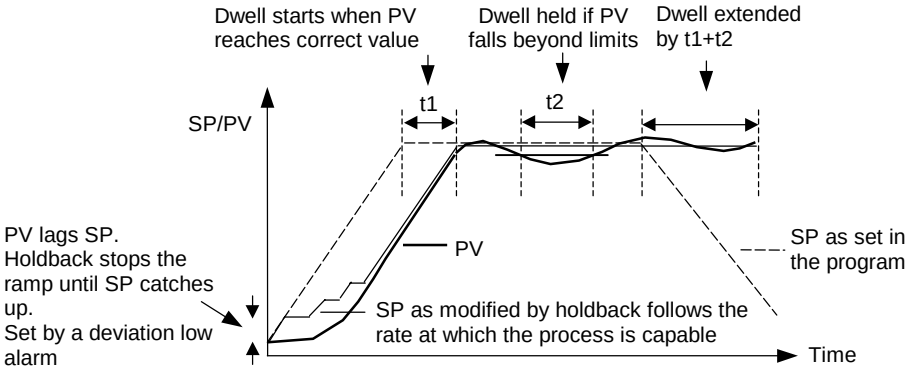


Figure 1-10: Effect of Holdback to Produce Guaranteed soak

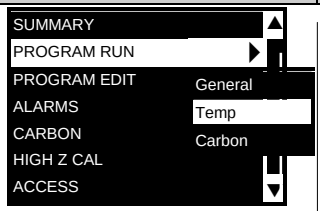
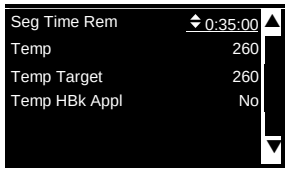
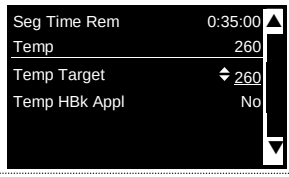
1.11.8 To Edit A Running Program

From time to time it may be necessary to make temporary changes to the currently running program, for example, to change the target setpoint or to add time to a segment. The current running program can only be edited under the following conditions:-

- The program must be put into **'Hold'**
- Changes to the currently running segment are temporary and apply only to the current run
- Permanent changes should be made in the 'PROGRAM EDIT' pages, see previous section.
- Other programs can be created or edited when another program is running

1.11.8.1 Example: To Change Current Segment Time or Target Setpoint

Place the program in **'Hold'**. Then:-

Do This	This Is The Display You Should See	Additional Notes
1. Select the '**PROGRAM RUN (Temp SP)'** page		This is access level 1 view
2. Press [↻] to select the list of parameters for the running temperature program. 3. Press [↻] to edit **'Seg Time Rem'** 4. Press [▲] or [▼] to increase or decrease the time remaining in the current segment		
5. Press [↻] to scroll to **'Temp Target'** 6. Press [▲] or [▼] to change the value		Temp Target can be set between the high and low limits set in configuration level, see Engineering Handbook

Now place the programmer in Run

1.11.9 Run Parameters

General Page

Table Number: 1.11.9.	**These parameters show the state of a running program.** All parameters are available at Level 1. To hide parameters refer to the Engineering Handbook		**PROGRAM RUN (General Page)**
Parameter Name	**Parameter Description**	**Value**	**Default**
Program Status	Shows the status of the program	Run Reset Hold	
Prog Cycles Rem	Remaining number of cycles before the program is complete	1 to 999	Only shown if 'Prog Cycles' > 1
Total Segments	Number of segments in the running program	0 to 100	R/O
Segment Number	The number of the current segment	1 to 100	
Segment Type	The current segment type	Profile End Segment Go Back	R/O
Segment Name	A user defined mane for the current segment	Default or from User Text	R/O
Seg Time Rem	Time remaining in the current segment	h:m:s	
End Action	The state set in the end segment	Dwell Reset	R/O
Prog Reset DO	The state of the digital events in reset □/▮ = Off/On in the segment	□□□□	

Temp Page

Table Number: 1.11.9.	These parameters show the state of the temperature parameters in a running program. All parameters are available at Level 1. To hide parameters refer to the Engineering Handbook The current program and segment is shown in the upper right hand corner of the display	PROGRAM RUN (Temp Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**
Seg Time Rem	Time remaining in the current segment	hrs:mins:secs	
Temp	The current temperature		
Temp Target	The current target temperature		
Temp SP HBk Appl	Holdback applied in the current segment	No Yes	R/O

Carbon, Oxygen or Dewpoint Page

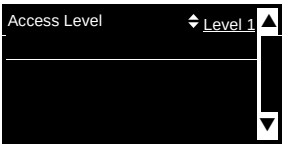
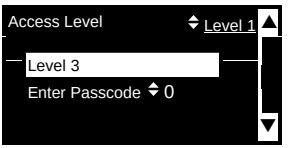
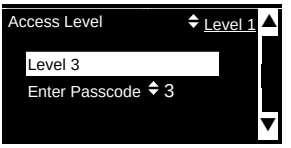
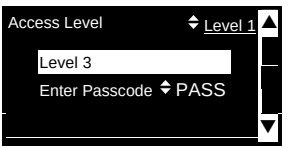
If the variable being controlled is Carbon Potential, Oxygen or Dewpoint a separate page is available which list the running parameters for this variable. The type of variable depends on the particular clone file loaded.

The parameters are the same as those listed above for temperature but the term temperature is replaced by the name of the variable (carbon, oxygen or dewpoint).

1.12 ACCESS

In normal operation the controller will start up in Level 1. This gives access to parameters which have been described in previous sections. In certain cases, for example when commissioning the controller, it may be necessary to gain access to further parameters.

1.12.1 To Select Access Level 3

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary until the '**ACCESS'** page header is displayed		
2. Press [scroll] to select **'Access Level'**		
3. Press [▲] or [▼] to select the required access level. E.g. '**Level 3'**		The default passcode of a new controller is 3 to enter level 3. If a new passcode has been previously entered it will be in the form 0 to 9999.
4. Press [▲] or [▼] to enter the passcode.		If an incorrect passcode is entered, the display returns to 0.
5. When the correct passcode is entered the display momentarily changes to PASS, then back to the start level to confirm correct entry.	 	Note: In the special case that the passcode has been configured as 'None', the display will blink momentarily when Level 3 is selected and Level 3 will be entered immediately

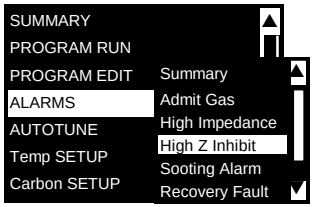
1.13 ALARMS

The following alarms have been configured:-

Name	Type	Description
Admit Gas	Full scale high event	Triggered when the temperature measured by the probe exceeds a set value (default 760°C for carbon). Delay 10 seconds
High Impedance	Full scale high	Alarm to indicate probe failure Delay 10 seconds
High Z Inhibit	Full scale high event	Inhibits the High Impedance alarm when the probe temperature is below 800°C
Sooting Alarm	Full scale high	Triggered by the zirconia probe sooting alarm delay 10 seconds
Recovery Fault	Full scale high	Triggered by the zirconia status

1.13.1 To Activate/Deactivate Alarms

Any of the above alarms may be activated or deactivated **in operating Level 3**. The following example deactivates the High Z Inhibit alarm:-

Do This	This Is The Display You Should See	Additional Notes
3. Select the '**ALARMS'** page 4. Press [↵] to select the alarm sub-headings 5. Press [▲] or [▼] to scroll to **'High Z Inhibit'**		This is an access level 3 view These views may differ slightly depending upon whether the controller is being used for carbon, oxygen or dewpoint
6. Press [↵] to select the list of parameters for this alarm 7. Press [▲] or [▼] to scroll to **'Inhibit'** 8. Press [↵] to edit to **'Inhibit'** 9. Press [▲] or [▼] to select **'Yes'**		

1.14 ORDERING CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14

1. Controller Type	
2704CP	2704 Standard
2704CPF	2704 Profibus

2. Supply Voltage	
VH	85-264Vac
VL	20-29Vac/dc

3. Controller Function	
CXX	Carbon
DXX	Dewpoint
OXX	Oxygen
DTX	Dewpoint/Temp
OTX	Oxygen/Temp
CTX	Carbon/Temp
CTP	Carbon/Temp Programmer
DTP	Dewpoint/Temp Programmer
OTP	Oxygen/Temp Programmer

4. Furnace Control Sensor	
X	Unconfigured
K	Type K
N	Type N
R	Type R
S	Type S
B	Type B

5. Temp Control Output	
XX	Not Fitted
TP	Time proportioning
VP	Valve position
OF	On/Off
4mA20	4-20mA
0mA20	0-20mA
0V10	0-10Vdc
0V5	0-5Vdc
1V5	1-5Vdc

6. Zirconia Probe Type	
MV	Probe millivolts
DP	Dewpoint
OX	% Oxygen
OP	PPM Oxygen
BC	Barber Colman
DR	Drayton
MC	MMI Carbon
MD	MMI Dewpoint
AC	Accucarb
SS	SSI
MD	Macdhui
AA	AACC
BH	Bosch Carbon
BO	Bosch Oxygen

7. Probe Thermocouple	
X	Unconfigured
K	Type K
N	Type N
R	Type R
S	Type S
B	Type B

8. Gas Control Output	
TP	Time proportioning
OF	On/Off

9. Zirconia Retransmission	
XX	Not Fitted
4mA20	4-20mA
0mA20	0-20mA
0V10	0-10Vdc
0V5	0-5Vdc
1V5	1-5Vdc

10. CO Analyser Input	
XX	Not Fitted
4mA20	4-20mA
0mA20	0-20mA
0V10	0-10Vdc
0V5	0-5Vdc
1V5	1-5Vdc

11. H Comms Slot	
XX	Not Fitted
A2	232 Modbus
Y2	2-wire 485 Modbus
F2	4-wire 485 Modbus
AE	232 Bisynch
YE	2-wire 485 Bisynch
FE	4-wire 485 Bisynch
PB	Profibus
DN	Devicenet

12. J Comms Slot	
XX	Not Fitted
A2	232 Modbus
Y2	2-wire 485 Modbus
F2	4-wire 485 Modbus
M1	232 Master
M2	2-wire 485 Master
M3	4-wire 485 Master

13. Toolkit Blocks	
XX	Standard
U1	Toolkit Level 1
U2	Toolkit Level 2

14. Manual	
ENG	English
FRA	French
GER	German

1.14.1 Ordering Code for the IO Expander

IO Expander			
2000IO	2	3	4

2. Supply	
VL	Low voltage

3. IO Set 1	
IOLR	10 Logic in/ 10 Logic out

4. IO Set 2	
XXXX	None fitted
IOLR	10 Logic in/ 10 Logic out