EPC3000 Dew Point Control Supplement

EPC3008, EPC3004

HA032994ENG Issue 1

Date (May 2017)

Eurotherm®

by Schneider Electric

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Introduction

This document is a supplement to the EPC3000 Series User Manual Part Number HA032842. Please read it together with the User Manual which is available from www.eurotherm.co.uk.

The EPC3000 series of controllers are application based. The user may order the controller with the application already configured or it may be selected by the ’Quick Configuration Codes’ when the controller is new by selecting ’D’ in Set 1/App. This application provides a starting point for the user to customise a specific process.

Dew Point control is available in EPC3008 and EPC3004 only.

This application provides a starting point for a dew point controller as often found in an endothermic gas generator. This particular application does not contain a PV analogue retransmission, although it can be easily added if needed.

It is a dual-channel controller for enrich/dilute where IO1 provides the 'enrich' output and IO2 provides the 'dilute' output. IO4 provides an output for a probe burnoff air solenoid. Contact inputs to start probe cleaning and impedance checks are on LA and LB respectively.

Remote Setpoints can be written to Modbus address 277.

What’s in this supplement

Inputs and outputs fitted

General description of dew point control

Terminal connections

Soft wiring

Configuration parameters

I/O Fitted

When ordered as a Dew Point controller the following inputs and outputs should be fitted by default.

Location	Default option	Non-default option *	Application use
I/O1	Relay	Triac or Logic	Enrich relay configured for time proportioning output
I/O2	Relay	Triac or Logic	Dilute output relay configured for time proportioning output
I/O3	Relay		General alarm relay configured for On/Off output
I/O4	Relay		Burnoff air output relay configured for On/Off output
D1	IE option board (4 X Digital I/O + Ethernet + Second PV input)	I8 option board (8 x Digital IO + Second PV Input)	General notification output
LA	Logic IP		Start probe clean contact input
LB	Logic IP		Start probe check contact input
IP1	Thermocouple		Temperature input
IP2	Linear mV		Zirconia

*The fitting of non-default I/O will require adjustments to the default application configuration.

Dew Point Control

Function

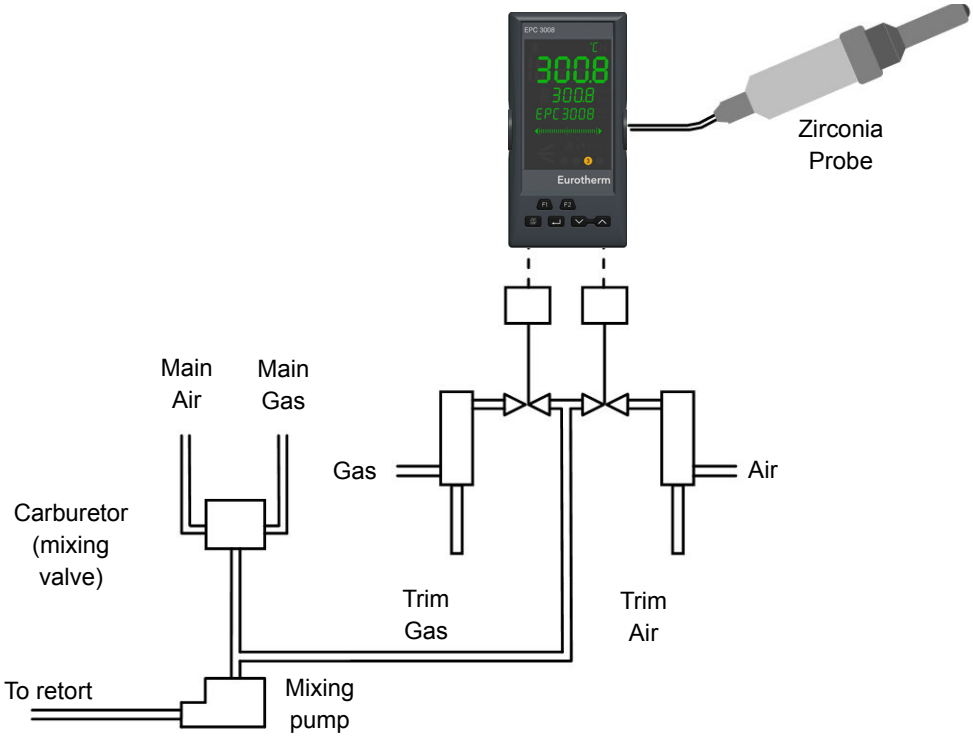
The zirconia function block is used to control the Dew Point in processes such as endothermic gas generators.

- Dew point. The dew point of a gas mixture is the temperature at which condensation and evaporation of its water vapour content are in equilibrium (at constant pressure).

There are two common arrangements for a dew point controlled endothermic gas generator.

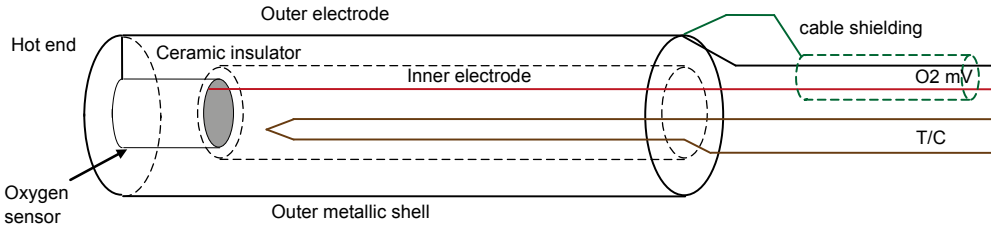
1. A mechanically fixed ratio of air and gas is fed to the generator. The controller then time proportions a trim air and trim gas valve, similar to a furnace. This arrangement may already be in use using the 2400 series controller and the EPC3008/04 is intended as a replacement for the 2400 series.
2. Mass flow measurements of air and gas allow a ratio controller to precisely control the ratio. This is a form of cascade control and may already be in use using a 2700 series controller. The EPC3000 series can only perform the ratio trim part.

The dew point application fitted in the EPC3000 series specifically caters for scenario number 1.



Connections

The diagram below gives a schematic representation of a zirconia oxygen probe.



If the probe is situated in an area of high interference, it is preferable to use shielded wires for the voltage source of the probe (oxygen sensor) and the shielding connected to the outer metallic shell of the probe.

By default the temperature sensor (thermocouple) of the probe should be connected to:

- Sensor input IP1 (terminals V+ and V-).

The voltage source (oxygen sensor) of the probe should be connected to:

- Sensor input IP2 (terminals S+ and S-).

The zirconia probe generates a millivolt signal based on the ratio of oxygen concentrations on the reference side of the probe (outside the furnace) to the amount of oxygen in the furnace.

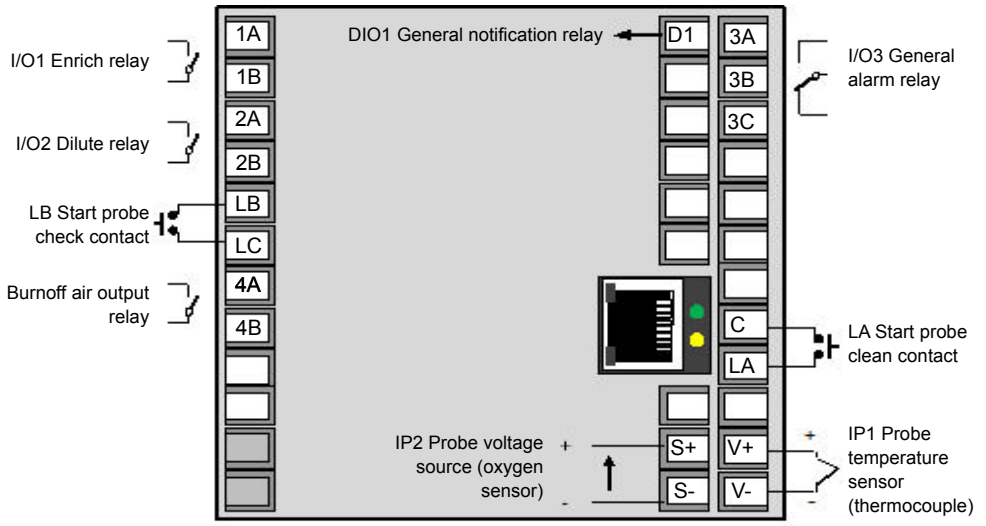
The controller uses the temperature and oxygen concentration signals to calculate the dew point of the furnace atmosphere. There are two outputs. One output is connected to a valve which controls the amount of an enrichment gas supplied to the furnace. The second output controls the level of dilution air.

These connections are illustrated in the schematics below.

Physical Connections

The I/O assignment corresponds with the soft wiring shown in section "Soft Wiring" on page 9.

Default Connections to EPC3004 or EPC3008



’Probe Clean Start' and 'Probe Check Start' contact inputs

Contact inputs are assigned to start probe cleaning and probe impedance check routines.

Probe cleaning is not often used in endothermic gas generators but carrying out regular probe impedance checks can help ensure that a failing probe is detected early.

Home Screen Bar Graph

The bar graph on the home screen displays the loop Working Output, in %. It is ranged from -100 to +100%, where negative values signify dilution and positive values signify enrichment.

Comms Remote Setpoint

If a remote setpoint (RSP) is configured, the value can be written over digital communications to Modbus address 277.

When the loop is in remote auto mode, the RSP must be written at least once every second. If updates stop then an alarm will trip and the loop will fallback to forced local auto.

Alarms

For the purposes of this application, alarms are defined as conditions or events which occur in the process.

There are 6 alarms configured in this application. If an alarm is not needed for a given process, it can be disabled by setting its ’Type’ parameter to 'Off'. Both continuous and batch processes have been allowed for.

The alarms are split into two groups, by severity, and each group causes a different output to operate.

- Alarms 1, 2 and 3 will cause the changeover relay at IO3 to become de-energised (this relay will also be de-energised if the power to the controller is removed). This relay indicates out-of-control conditions and can therefore be used to trigger process interlocks.
- Alarms 4, 5 and 6 will cause the digital open-collector output at OptionDI1 to become closed. This is intended as a 'notification' output and is used for the less critical situations, where the controller can carry on controlling but the operator should be aware of a particular condition.

The following alarms are configured in this application.

Alarm	Function
1	**Soot alarm** The soot alarm will trip whenever the calculated carbon saturation limit is exceeded for more than 1 minute. *Process action:* While this alarm is active, the control loop will be put into Forced Manual mode. This causes enrichment to cease immediately until the process is below the saturation limit and the alarm has been acknowledged. *Designed suppression:* The soot alarm is suppressed if either of the probe input statuses report ’bad’ (detect on open circuit or high resistance). In such cases the sensor break alarm will trip.
2	**Minimum temperature alarm** The minimum temperature alarm will trip whenever the probe temperature goes below the minimum operating temperature specified in the zirconia block. This implies loss of control over the process. *Process action:* While below minimum operating temperature, the loop PV status will change to ’bad’, and the control loop will enter forced manual mode. By default, all enrichment and dilution additions will cease. *Designed suppression:* The minimum temperature alarm is suppressed whenever the probe thermocouple is broken (in which circumstance the sensor break alarm will trip). It is also suppressed while the 'inhibit carbon control' contact input is closed.
3	**Sensor break alarm** The sensor break alarm will trip if either the zirconia cell or probe thermocouple input statuses report ’bad’. This signifies no control of the process. *Process action:* While a sensor break persists, the loop PV status will change to ’bad’ and the control loop will enter forced manual mode. By default, all enrichment and dilution additions will cease. *Designed suppression:* The sensor break alarm is never suppressed

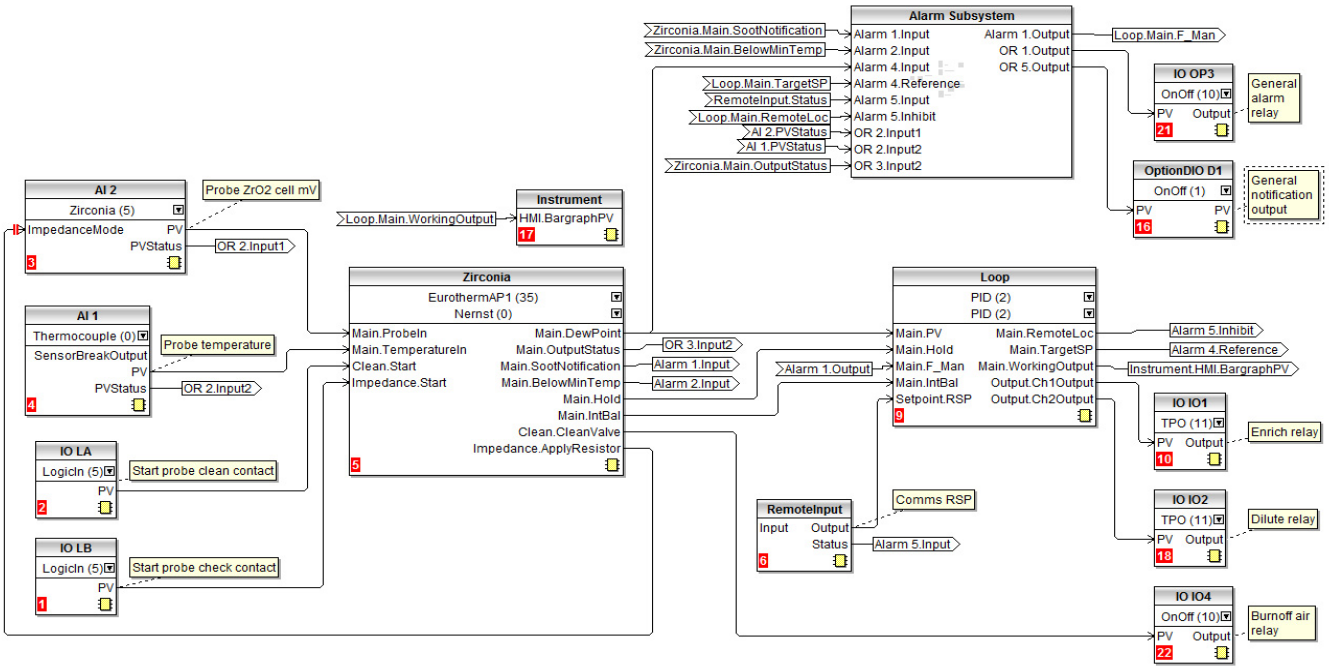
Alarm	Function
4	**Process deviation band alarm** The process deviation alarm will trip whenever the loop PV (the calculated carbon potential) deviates outside of a given band around the working setpoint. By default, the width of the band is +/- 2^{o}C. The process deviation band alarm has blocking enabled, which means that the PV must first have entered the deviation band before the alarm can trip. *Process action:* None. *Designed suppression:* The process deviation alarm is suppressed whenever there is a sensor break. It is also suppressed while the 'inhibit carbon control' contact is closed and while the instrument is in the configuration access level.
5	**Remote Setpoint alarm** The RSP alarm will trip whenever updates to the RSP stop. This indicates loss of communications. By default, the RSP must be written every 1 second to help to help prevent this alarm from tripping. *Process action:* When this alarm is active, the RSP status will change to ’bad’ and the control loop will fallback to using the local setpoint. RSP tracking is enabled by default and, therefore, the operating point will be maintained. *Designed suppression:* The RSP alarm is suppressed whenever remote auto mode has not been requested. It is also suppressed while the instrument is in the configuration access level.

Soft Wiring

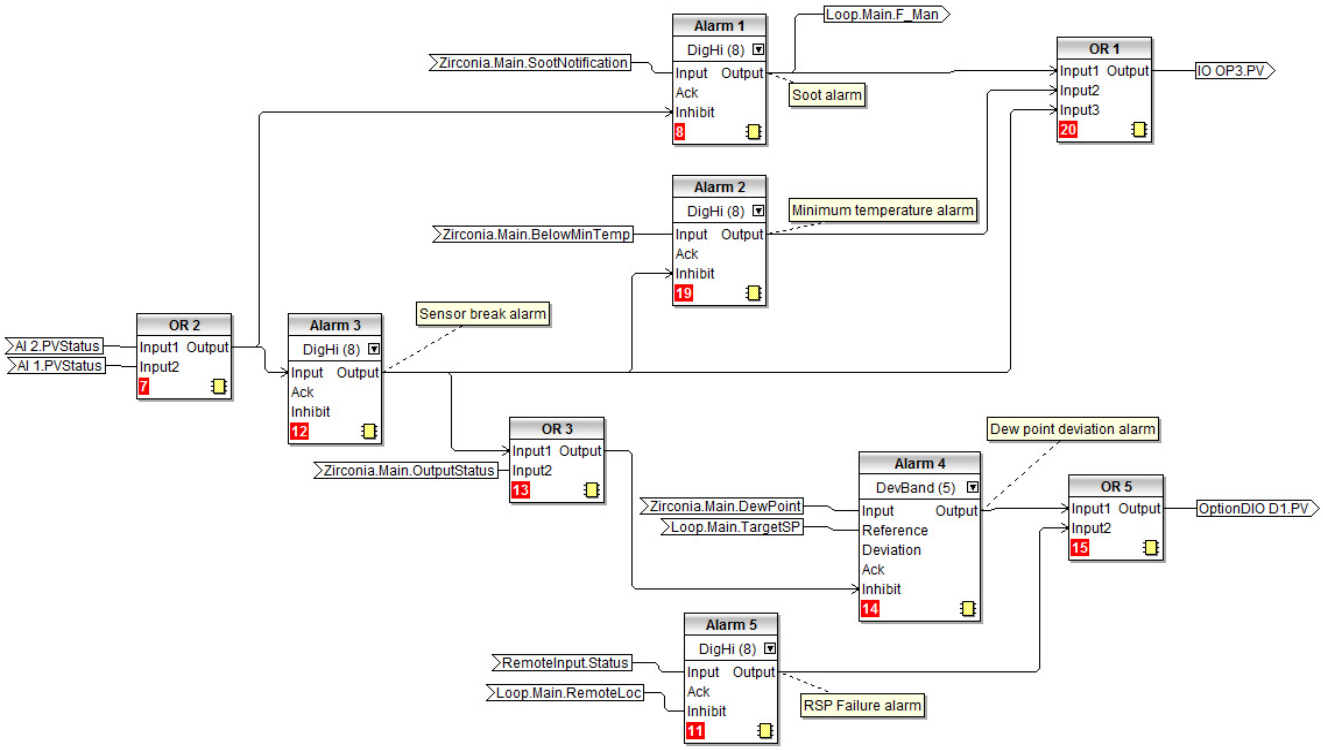
Soft wiring is carried out using iTools configuration software and for further information please refer to the iTools chapter in the User Manual HA032842. The following diagrams can be found by opening the Graphical Wiring tab in iTools.

Controller

The diagram shows the wiring of the control function applicable to this application. It can be modified by the user if required.



Alarm Subsystem



⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Hardware Interlocks
This soft-wiring is not a substitute for hardware interlocks where any level of safety is required. It should be used in conjunction with separately included hardware interlocks.

Failure to follow these instructions can result in injury or equipment damage.

Non-default Parameter Settings

This table lists all instrument parameters that are changed from their coldstart defaults.

Parameter	Value
AI.2.Type	Zirconia (5)
AI.2.Resolution	X (0)
AI.1.Resolution	XX (1)
AI.1.RangeHigh	600.0
AI.1.SensorBreakType	Low (1)
RemoteInput.1.RangeHi	160.0
RemoteInput.1.RangeLo	-60.0
RemoteInput.1.ScaleHi	160.0
RemoteInput.1.ScaleLo	-60.0
RemoteInput.1.Resolution	XX (1)
RemoteInput.1.Units	C_F_K_Temp (1)
Loop.1.Config.Ch2ControlType	PID (2)
Loop.1.Config.PropBandUnits	EngUnits (0)
Loop.1.Setpoint.RangeHigh	160.0
Loop.1.Setpoint.RangeLow	-60.0
Loop.1.Setpoint.SPHighLimit	160.0
Loop.1.Setpoint.SPLowLimit	-60.0
Loop.1.Setpoint.RSP_En	On (1)
Loop.1.Setpoint.SPTracksRSP	On (1)
OptionDIO.1.Type	OnOff(1)
IO.4.Type	DCOP (4)
IO.4.DemandHigh	500.0
IO.4.DemandLow	0.0
IO.4.OutputHigh	20.0
IO.4.OutputLow	4.0
Alarm.3.Type	DigHi (8)
Alarm.3.Latch	Auto (1)
Alarm.1.Type	DigHi (8)
Alarm.1.Latch	Auto (1)
Alarm.1.Delay	60.0
Alarm.2.Type	DigHi (8)
Alarm.2.Latch	Auto (1)
Alarm.2.StandbyInhibit	On (1)
Alarm.4.Type	DevBand (5)
Alarm.4.Latch	Auto (1)

Parameter	Value
Alarm.4.Block	On (1)
Alarm.4.StandbyInhibit	On (1)
Alarm.4.Deviation	5.0
Alarm.4.Hysteresis	0.5
Alarm.5.Type	DigHi (8)
Alarm.5.StandbyInhibit	On (1)
Alarm.6.Type	DigHi (8)

Messages

The following process messages may be displayed:

#	Message	Parameter	Op	Val	Prio
1	SOOT ALARM	Instrument.Diagnostics.AlarmStatusWord	M	1	H
2	MIN TEMPERATURE ALARM	Instrument.Diagnostics.AlarmStatusWord	M	4	H
3	SENSOR BREAK ALARM	Instrument.Diagnostics.AlarmStatusWord	M	16	H
4	DEVIATION ALARM	Instrument.Diagnostics.AlarmStatusWord	M	64	H
5	RSP FAILURE ALARM	Instrument.Diagnostics.AlarmStatusWord	M	256	H
6	CLEAN RECOVERY FAILURE	Zirconia.Clean.RecoveryWarn	<>	0	L
7	CLEAN TEMPERATURE EXCEEDED	Zirconia.Clean.TempExceeded	<>	0	L
8	PROBE IMPEDANCE HIGH	Zirconia.Impedance.ImpedanceWarn	<>	0	L
9	PROBE CHECK RECOVERY FAILURE	Zirconia.Impedance.RecoveryWarn	<>	0	L
10	BURNOFF IN PROGRESS	Zirconia.Main.ProbeState	=	1	L
11	PROBE RECOVERING	Zirconia.Main.ProbeState	=	2	L
12	PROBE CHECK IN PROGRESS	Zirconia.Main.ProbeState	=	3	L
13	PROBE RECOVERING	Zirconia.Main.ProbeState	=	4	L

Parameter Promotion Tables

A complete list of parameters which may be promoted to operator levels 1/2 is shown in the following table:

#	Mnemonic	Level	Access	Parameter/Scrolling Display
1	C.POT	1 + 2	Read only	Zirconia.Main Carbon Potential
2	PRB.IN	1 + 2	Read only	Zirconia.Main Probe mV Input
3	TMP.IN	1 + 2	Read only	Zirconia.Main Temperature Input
4	W.OUT	1 + 2	Read only	Loop.Main Working Output
5	PF	2	Read/Write	Zirconia.Main Process Factor
6	H2F	2	Read/Write	Zirconia.Main H2 Factor
7	COF	2	Read/Write	Zirconia.Main CO Factor
8	R-L	1 + 2	Read/Write	Loop.Main Remote-Local select
9	SP.HI	2	Read/Write	Loop.Setpoint Setpoint High Limit
10	SP.LO	2	Read/Write	Loop.Setpoint.Setpoint Low Limit
11	SP1	1 + 2	Read/Write	Loop.Setpoint Setpoint 1
12	SP2	1 + 2	Read/Write	Loop.Setpoint Setpoint 2
13	C.TMR	1 + 2	Read only	Zirconia.Clean Time To Clean
14	CLEAN	1 + 2	Read/Write	Zirconia.Clean Start Clean
15	ABRT.C	1 + 2	Read/Write	Zirconia.Clean Abort Clean
16	C.RST	1 + 2	Read/Write	Zirconia.Clean Clean Message Reset
17	Z.STRT	1 + 2	Read/Write	Zirconia.Impedance Start Probe Check
18	IMPED	1 + 2	Read/Write	Zirconia.Impedance Probe Impedance Val
19	Z.ABRT	1 + 2	Read/Write	Zirconia.Impedance Abort Probe Check
20	Z.RST	1 + 2	Read/Write	Zirconia.Impedance Probe Check Message Reset
21	TUNE	2	Read/Write	Loop.Autotune Autotune Enable
22	PB.H	2	Read/Write	Loop.PID Ch1 Proportional Band
23	PB.C	2	Read/Write	Loop.PID Ch2 Proportional Band
24	TI	2	Read/Write	Loop.PID Integral Time
25	TD	2	Read/Write	Loop.PID Derivative Time
26	MR	2	Read/Write	Loop.PID Manual Reset
27	CBH	2	Read/Write	Loop.PID Cutback High Threshold
28	CBL	2	Read/Write	Loop.PID Cutback Low Threshold
29	OUT.LO	2	Read/Write	Loop.Output Output High Limit
30	OUT.HI	2	Read/Write	Loop.Output Output Low Limit
31	CS.ID	2	Read/Write	Intrument.Info Customer ID

For more information on parameter promotion please refer to the User Manual HA032842.

Configuration Parameters

Zirconia List (ZI rC)

The Zirconia list allows you to set up the parameters associated with a dew point controller.

It contains algorithms for working with several commercially available oxygen probes. Supported probes are:

- AccuCarb probe by Furnace Control Corp (FCC) (United Process Controls).
- Advanced Atmosphere Control Corp (AACC) probes.
- AGA/Ferronova.
- Bosch lambda-style probes.
- Drayton (Therser) probes.
- Eurotherm (including Barber Coleman) probes.
- MacDhui (Australian Oxytrol) probes.
- Marathon Monitors (United Process Controls) probes.
- SSi (Super Systems Inc.) probes.

To Access the Zirconia List

The Zirconia list is available in Level 3 or Configuration level. To enter these levels refer to the User Manual part number HA032842.

Access to the Zirconia list is summarised below.

1. Press  to show the 'ZIRCONIA PROBE' list (ZI rC). From this list you can configure the zirconia function block. There are four sub-lists - Main, Set-up, Clean and Impedance.
2. Press  to select the first sub-list (mAI n)
3. Press  or  to scroll between the sub-lists, (mAI n, CONF, CLn, I mP)
4. When the required sub-list has been selected, press  to scroll through the parameters in this list

Notes:

1. In the following lists, analogue values shown in the 'Value' column are generally defaults.
2. R/W = Read and write in the level stated or all higher levels (if no level is stated then the parameter is always R/W)
3. R/O = Read only in the level stated or all higher levels (if no level is stated then the parameter is always R/O)

Main Sub-list (Zirconia Header)

Parameter Mnemonic Press ↻ to select in turn	Parameter Name	Value Press ▲ or ▼ to change values (if read/write, R/W)		Description	Access
STATE	PROBE STATE			Indicates the probe and function block's current operating state.	L3 R/O
		mEAS	0	Measuring. The probe is good and the controller is calculating the properties of the atmosphere (carbon potential, dew point and oxygen concentration).	
		burn	1	Burnoff. A probe clean sequence is in progress. The burnoff air valve is open.	
		CLnF	2	Cleaning Recovery. A probe clean sequence is in progress. The block is waiting for the zirconia probe to recover from burnoff. The burnoff air valve has closed.	
		ImP	3	Impedance Check. A probe check sequence is in progress. The load resistor is applied and the block is waiting for the measurement to settle.	
		ImPF	4	Impedance Recovery. A probe check sequence is in progress. The load resistor has been removed and the block is waiting for the zirconia probe to recover.	
		mi nt	5	Below Min Temp. The probe temperature is below the configured minimum temperature. All calculated outputs are set to 0.0. Cleaning and probe checks are inhibited.	
		bAd	6	Input Bad. The temperature and/or probe mV input is not indicating correctly. All calculated outputs are set to 0.0. Cleaning and probe checks are inhibited.	
C POT	CARBON POTENTIAL			The calculated carbon potential, in wt%C. Carbon Potential is a measure of the ability of a given atmosphere composition to diffuse carbon into a heated steel workpiece, expressed as a percentage of carbon in the steel (by weight). The value is clipped in the range from 0 to 2.55wt%C.	L3 R/O
DEW PT	DEW POINT			The calculated dew point (in the configured instrument temperature units). The dew point of a gas mixture is the temperature at which condensation and evaporation of its water vapour content are in equilibrium (at constant pressure). Dew point is often used as a process variable for control of an endothermic gas generator. The value is clipped in the range equivalent to −60°C to +160°C.	L3 R/O
O2	OXYGEN			The calculated concentration of oxygen in the measured atmosphere (expressed in the units configured by the 'Oxygen Units' parameter).	L3 R/O
SAT LM	SATURATION LIMIT			The calculated carbon potential in wt%C above which soot deposits are likely to form on surfaces in the furnace. This value is sometimes referred to as the 'soot line'.	L3 R/O
OUT ST	OUTPUT STATUS	Good	0	This reports that the status of the Carbon Potential, Dew Point and Oxygen calculated outputs is correct.	L3 R/O
		bAd	1	If the status is Bad, the values should not be relied upon.	
SOOT	SOOT NOTIFICATION	YES	1	This flag is set to Yes if the following condition is met: Carbon Potential > (Saturation Limit × Soot Scalar) That is, if the carbon potential in the furnace becomes high enough to potentially cause a deposit of soot on surfaces in the furnace. The 'Soot Scalar' parameter allows a degree of tolerance to be defined. Typically this could be wired to a digital alarm.	L3 R/O
		no	0	The furnace is operating normally below the carbon saturation limit	
COF	CO FACTOR	20.0		Defines the 'CO Factor' in %CO. The default value is 20.0%. This factor is used in the calculation of the carbon potential. Nominally, it represents the percentage of carbon monoxide in the furnace atmosphere, by volume. In practice, however, it is often used as a general compensation factor, to bring the calculated carbon potential into agreement with the value determined by shim stock or multi-gas analysis. To help prevent harsh changes in controller output, an integral balance will be issued whenever this value is changed.	L3 R/W

Parameter Mnemonic	Parameter Name	Value		Description	Access
Press ↻ to select in turn		Press ▲ or ▼ to change values (if read/write, R/W)			
H2F	H2 FACTOR	40.0		Defines the 'H_2 Factor' in %H_2. The default value is 40.0%. This factor is used in the calculation of the dew point. Nominally, it represents the percentage of hydrogen in the furnace atmosphere, by volume. In practice, however, it is often used as a general compensation factor, to bring the calculated dew point into agreement with observed values. To help prevent harsh changes in controller output, an integral balance will be issued whenever this value is changed.	L3 R/W
PF	PROCESS FACTOR			This value is only used if the 'Probe Type' is set to MMI. It defines a 'Process Factor' which is used as a general 'rolled-up' compensation factor to take into account the various parameters of the furnace, its atmosphere and the load being treated. It is often used to bring the calculated carbon potential and/or dew point into agreement with observed values.	L2 R/W
PRB IN	PROBE MV INPUT			Voltage reading from the zirconia probe (in millivolts). Acceptable range is from 0mV to 1800mV. If required, a compensation offset can be applied to this value by setting the 'Probe Offset' parameter.	L1 R/O
TMP IN	TEMPERATURE INPUT			The temperature of the measured atmosphere. This will often come from the thermocouple at the zirconia probe tip. If required, a compensation offset can be applied to this value by setting the 'Temp Offset' parameter.	L1 R/O
P BIAS	PROBE OFFSET	0		If required, an offset value can be specified here (in mV). It acts as a compensation factor for the incoming 'Probe mV Input' signal.	L3 R/W
T BIAS	TEMPERATURE OFFSET	0.0		If required, a temperature offset can be specified. It is applied to the incoming 'Temperature Input' signal.	L3 R/W
	Hold	YES No	1 0	This flag is set to Yes when the block is carrying out probe cleaning or a probe impedance check. Typically, in a control strategy, this output can be used to switch the control loop into HOLD mode.	Available in iTools only
	IntBal	YES No	1 0	Typically, in a control strategy, this output may be used to trigger an integral balance, in order to avoid step changes in the process variable from causing discontinuities ('bumps') in the control loop output. Connect this output to the IntBal input on the Loop block. Certain events will cause the zirconia block to request an integral balance, for example changing the gas factors or when transitioning into the Measuring state.	Available in iTools only
	BelowMinTemp	Yes No	1 0	This flag is asserted whenever the probe temperature input is below the 'Minimum Temperature parameter'. This is often used to inhibit alarms and similar.	Available in iTools only

Conf Sub-List

Parameter Mnemonic Press ↻ to select in turn	Parameter Name	Value Press ▲ or ▼ to change values (if read/write, R/W)		Description	Access
PROBE	PROBE TYPE			Selects the probe type	Conf R/W L3 R/O
		mmi	25	Probes by Marathon Monitors (MMI) (United Process Controls).	
		AACC	26	Probes by the former Advanced Atmosphere Control Corp. (AACC)	
		drAY	27	Probes by Drayton Probes	
		Accu	28	Probes by Furnace Control Corp. (FCC) (United Process Controls).	
		SSi	29	Probes by Super Systems Inc. (SSi).	
		mAc.d	30	Probes by MacDhui (Australian Oxytrol).	
		boSh	31	Bosch lambda style probes.	
		bArC	32	Probes by Barber Coleman.	
		FErr	33	Calculations by AGA/Ferronova.	
		mU	34	No calculation. The probe voltage will be passed straight to the CarbonPotential output.	
		API	35	API series probes by Eurotherm by Schneider Electric	
		ACP	36	ACP series probes by Eurotherm by Schneider Electric	
		O2	3	Probe is used for oxygen measurement only. Disables Carbon Potential and Dew Point calculations. For example, use this option for an oxygen trim controller in a combustion system.	
O2 TYP	OXYGEN CALCULATION			Selects the methodology for calculating the oxygen concentration. For most probes, the Nernst equation is most suitable. Different methodologies for Bosch lambda probes and by AGA/Ferronova are also provided. Alternatively, the option to back-calculate the oxygen concentration from a calculated carbon potential is available (NernstCP).	Conf R/W L3 R/O
		nErn	0	The standard Nernst equation.	
		boSh	1	A modified Nernst equation suitable for Bosch lambda style probes.	
		FErr	3	An alternative method by AGA/Ferronova based on empirical data.	
		CP	4	The oxygen concentration will be back-calculated from the Carbon Potential and an 'ideal' CO concentration.	
O2 UNT	OXYGEN UNITS			Selects how the proportion of O_2 in the measured atmosphere is expressed.	Conf R/W L3 R/O
		PPrS	0	Partial pressure	
		Pcnt	2	Percent	
		PPm	6	Parts per million	
CO IDL	IDEAL CO	20.0		This input is only used if Oxygen Calculation is set to CP. It represents the percentage of carbon monoxide in the furnace atmosphere by volume. The function block uses the supplied value as a calibration factor when back-calculating the oxygen concentration from the calculated carbon potential.	L3 R/W
MIN T	MINIMUM TEMPERATURE	720.0		Defines a minimum operating temperature for the zirconia probe. If Temperature Input < Minimum Temperature, the block will not perform any calculations, cleaning or impedance testing	L3 R/W
SOOT K	SOOT SCALAR	1.00		This is a multiplicative scaling factor which can be used to raise or lower the calculated sooting threshold. This flag will be set to Yes if the following condition is met: Carbon Potential > (Saturation Limit × Soot Scalar) Different values of 'Soot Scalar' may be appropriate for different alloys. It could also be used to approximate the carbide limit	L3 R/W

Clean Sub-List

Parameter Mnemonic	Parameter Name	Value		Description	Access
Press ↻ to select in turn		Press ▲ or ▼ to change values (if read/write, R/W)			
CLN EN	ENABLE CLEANING	On OFF	1 0	Set to On to enable automatic probe cleaning or Off to disable it. A clean can always be started using the 'Start Clean' input regardless of this setting	L3 R/W
CLEAN	START CLEAN	no YES	0 1	A rising-edge will begin a probe cleaning sequence	L2 R/W
ABRT C	ABORT CLEAN	no YES	0 1	A rising-edge will abort a probe burnoff. Measurement will resume once the probe recovers.	L2 R/W
	Clean Valve	oN OFF	0 1	Control output for the burnoff air valve. Off = valve closed, On = valve open. Typically this will be wired to a digital or relay output.	Available in iTools only
C TMR	TIME TO CLEAN	04:00		Time remaining until the next automatic probe cleaning sequence is due to start. Default 4 hours.	L1 R/O
C MV	LAST PROBE MV	0		The probe mV reading at the end of the last burnoff. If the value is greater than 200mV, this may indicate deterioration or poor adjustment of the burnoff air supply or probe degradation due to heavy sooting.	L3 R/O
C RCOV	LAST RECOVERY TIME	0.0		Time taken for the probe mV to return to 95% of its value before the last burnoff began	L3 R/O
	RecoveryWarn	No Yes	0 1	Indicates probe degradation. This is a flag which is set to Yes if the probe mV reading does not return to 95% of its pre-burnoff value within the permitted recovery time (set by 'Max Clean Recovery Time').	Available in iTools only
	Temp exceeded	No Yes	0 1	This is a flag which is set to Yes if the temperature of the probe exceeds the configured maximum ('Maximum Temperature') during the last burnoff. This could indicate a potentially damaging exothermic reaction on the probe surface.	Available in iTools only
	Aborted	No Yes	0 1	This is a flag which is set to Yes if the last burnoff was aborted before it could finish.	Available in iTools only
C RST	CLEAN MESSAGE RESET	no YES	0 1	A rising-edge on this input will reset the 'RecoveryWarn', 'Temp exceeded' and 'Aborted' status flags	L2 R/W
BRNOF	BURN OFF TIME	180.0		Configures the duration of the burnoff phase of the probe cleaning sequence. Default 3 minutes.	L3 R/W
C FRQ	CLEAN FREQUENCY	04:00		Configures the interval between automatic probe cleans. Default 4 hours.	L3 R/W
MAX T	MAXIMUM TEMPERATURE	1100.0		Sets the maximum temperature allowed during probe burnoff. The burnoff is aborted if exceeded. Default 1100°C.	L3 R/W
C MIN R	MIN CLEAN RECOVERY TIME	1.0		Sets the minimum recovery time allowed after burnoff, before measurement resumes. Range 0 to 90 seconds. Default 1 second.	L3 R/W
C MAX R	MAX CLEAN RECOVERY TIME	90.0		Sets the maximum recovery time allowed after burnoff, before measurement resumes. If the probe has still not recovered within this amount of time then measurement will be forced to resume and the RecoveryWarn flag will be set. Default 90.0 seconds. Maximum range 499h:59m:59s	L3 R/W

Impedance Sub-List

Parameter Mnemonic Press ↻ to select in turn	Parameter Name	Value Press ▲ or ▼ to change values (if read/write, R/W)		Description	Access
Z RUN	START PROBE CHECK	no YES	0 1	A rising-edge will begin a probe impedance check. Ensure that the atmosphere and temperature are stable before starting a test otherwise a false reading may result. Probe impedance testing is a useful indication of probe health. Your probe manufacturer's recommendations should be followed. However, as a general guideline it is recommended to test a probe's impedance on at least a weekly basis, and more frequently as the probe approaches its end of life. Typically a probe impedance of greater than 50kΩ indicates that the probe should be replaced.	L3 R/W
Z ABRT	ABORT PROBE CHECK	no YES	0 1	A rising-edge will abort a running probe impedance check. Normal operation will resume once the probe recovers.	L3 R/W
IMPED	PROBE IMPEDANCE	0.0		The measured probe impedance (in kΩ)	L1 R/O
	apply resistor	No Yes	0 1	Control output for applying the test resistor across the probe. No = no resistor, Yes = apply resistor. The controller has a resistor built into the analogue input for this purpose. This output should be connected to the ApplyResistor input on the appropriate Analogue Input block.	Available in iTools only
	impedance warn	No Yes	0 1	This flag is set to Yes if the probe's measured impedance exceeds the Impedance Threshold	Available in iTools only
	lasr rcov time			The time taken for the probe mV reading to return to 99% of its pre-check value.	Available in iTools only
	Recovery notification	No Yes	0 1	This flag is set to Yes if the probe mV reading does not return to 99% of its pre-check value within the permitted recovery time (set by 'Max Check Recovery Time')	Available in iTools only
	aborted	No Yes	0 1	This flag is set to Yes if the last impedance check was aborted before it could finish	Available in iTools only
Z MAX R	MAX CHECK RECOVERY TIME	30.0		Maximum recovery time allowed after the test resistor has been removed and before measurement resumes	L3 R/W
Z THRS	IMPEDANCE THRESHOLD	50.0		Defines a alarm threshold for the probe impedance (in kΩ). If the measured probe impedance exceeds this value, then the 'Impedance Warn' parameter is set to Yes.	L3 R/W
Z RST	PROBE CHECK MESSAGE RESET	no YES	0 1	A rising-edge on this input will reset the ImpedanceWarn, RecoveryWarn and Aborted status flags	L3 R/W

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As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

HA032994ENG Issue 1 CN35524