

# Endura AZ40

## Oxygen and carbon monoxide equivalent (COe) analyzer



Communications supplement

Measurement made easy

Oxygen and carbon  
monoxide equivalent  
analyzer

### Introduction

The Endura AZ40 extends the range of combustion gas analyzers from ABB, trusted sensor technology with contemporary electronics.

This Communications supplement provides MODBUS® connection/configuration details together with MODBUS reference tables for the Endura AZ40 analyzer.

### For more information

Further publications for the Endura AZ40 analyzer are available for free download from: [www.abb.com/analytical](http://www.abb.com/analytical)

(see links and reference numbers below) or by scanning this code:



Search for or click on

Data Sheet Endura AZ40 Oxygen and carbon monoxide equivalent (COe) analyzer	<a href="#">DS/AZ40-EN</a>
Commissioning Instruction Endura AZ40 Oxygen and carbon monoxide equivalent (COe) analyzer	<a href="#">CI/AZ40-EN</a>
Operating Instruction Endura AZ40 Oxygen and carbon monoxide equivalent (COe) analyzer	<a href="#">OI/AZ40-EN</a>

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# 1 Health & Safety

## 1.1 Document symbols

Symbols that appear in this document are explained below:



### **DANGER – Serious damage to health / risk to life**

This symbol in conjunction with the signal word 'DANGER' indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



### **DANGER – Serious damage to health / risk to life**

This symbol in conjunction with the signal word 'DANGER' indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



### **WARNING – Bodily injury**

This symbol in conjunction with the signal word 'WARNING' indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.



### **WARNING – Bodily injury**

This symbol in conjunction with the signal word 'WARNING' indicates a potential electrical hazard. Failure to observe this safety information will result in death or severe injury.



### **WARNING – Bodily injury High temperature**

This symbol in conjunction with the signal word 'WARNING' indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.



### **WARNING – Bodily injury Pressurized equipment**

Installation, operation, maintenance and servicing of pressurized equipment must be performed:

- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations



### **IMPORTANT (NOTE)**

This symbol indicates operator tips, particularly useful information or important information about the product or its further uses. The signal word 'IMPORTANT (NOTE)' does not indicate a dangerous or harmful situation.

## 1.2 Safety precautions

Be sure to read, understand and follow the instructions contained within this manual before and during use of the equipment. Failure to do so could result in bodily harm or damage to the equipment.



### **WARNING – Bodily injury** Installation, operation, maintenance and servicing must be performed:

- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations

## 1.3 Potential safety hazards

### 1.3.1 Process conditions and requirements



### **WARNING – Bodily injury Environmental conditions**



- High air / equipment / structure temperatures, poor air quality and adverse environmental conditions may be present when the process is running.
- It is recommended that the process is shut down before performing these procedures.
- The process must be cool enough to enable shutdown, disconnection and removal of the sensor in a safe manner and in accordance with relevant local regulations.
- Appropriate PPE, including mask and goggles must be worn when preparing the process for these procedures.

### 1.3.2 Endura AZ40 sensor – fibrous material in probe assembly



#### WARNING – Bodily injury

##### Fibrous material



- The sensor and probe assemblies (standard and high temperature versions) contain fibrous material that can be a health hazard if airborne.
- The material, predominantly – aluminosilicate refractory fibres, CAS 142844-00-6. Refractory ceramic fibres (RCF) are classified as:
  - Category 1B carcinogen under regulation (EC) No 1272/2008 – the classification, labelling and packaging regulations.
  - Category 2B carcinogen by inhalation by The International Agency for Research on Cancer (IARC).
- When removing the sensor cover and subsequent maintenance activities, exposure to the airborne fibres could occur. ABB have conducted air sampling assessments within the breathing zone of the operator and have identified that an exposure limit of 1 fibre / cubic centimetre is unlikely to occur.
- Exposure to any carcinogen must be kept as low as reasonably practicable.
- Appropriate PPE defined below, must be worn when working with probe assemblies (all installation, replacement, maintenance procedures):
  - A face fit tested, half mask conforming to EN140 (or equivalent) with a level 3 particulate filter conforming to EN 143 (or equivalent).
  - Disposable protective coveralls in accordance with Type 5 ISO 13982-1:2004 (or equivalent).
  - Goggles and gloves.

### 1.3.3 Endura AZ40 sensor / probe – installation to pressurized process



#### DANGER – Serious damage to health / risk to life Pressurized equipment – do not install / remove / the sensor / probe if the process is at positive pressure

Installation, operation, maintenance and servicing of pressurized equipment must be performed:

- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations
- when process conditions are suitable to allow enough to enable installation / maintenance

### 1.3.4 Endura AZ40 sensor – high operational temperature on exposed parts



#### WARNING – Bodily injury

##### High temperature on exposed surfaces

- During operation, exposed sensor surfaces can reach 200 °C (392 °F).
- Ensure suitable PPE is available and is worn before handling the sensor.
- Do not touch exposed surfaces until the sensor / probe is cool enough to handle with PPE.

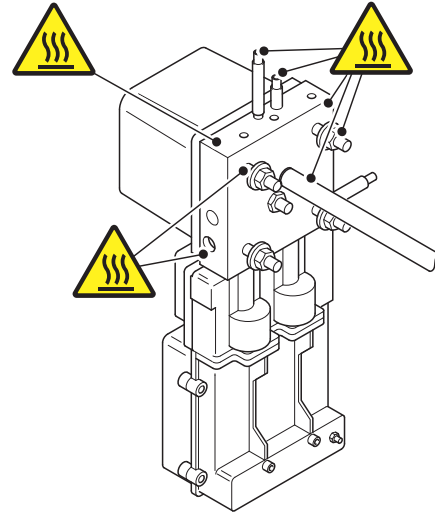


Fig. 1.1: High temperature points on exposed sensor surfaces during operation

### 1.3.5 Endura AZ40 sensor – weight



#### WARNING – Bodily injury

- The sensor weighs 9.0 kg (20 lb). When fitted with a probe / filter assembly, the combined sensor / probe weight is dependent on probe length / type plus filter option – refer to the Operating instruction (OI/AZ40-EN) for weight details.
- The sensor / probe assembly must be mounted in accordance with the information supplied in the Operating instruction (OI/AZ40-EN).
- Suitable lifting equipment must be available when installing / removing the sensor / probe from the process.

### 1.3.6 Endura AZ40 analyzer – electrical



#### WARNING – Bodily injury

To ensure safe use when operating this equipment, the following points must be observed:

- up to 240 V AC may be present. Ensure the supply is isolated before removing the terminal cover
- normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature

Safety advice concerning the use of the equipment described in this manual or any relevant Material Safety Data Sheets (where applicable) can be obtained from the Company, together with servicing and spares information.

### 1.3.7 Endura AZ40 transmitter – weight



#### WARNING – Bodily injury

- The transmitter weighs 7.6 kg (17 lb) and must be mounted in accordance with the information supplied in the Operating instruction (OI/AZ40-EN).
- Suitable lifting equipment must be available when installing / removing the transmitter from the mounting.

### 1.4 Safety standards

This product has been designed to satisfy the requirements of IEC61010-1:2010 3rd edition 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500, NIST and OSHA.

### 1.5 Product symbols

Symbols that appear on this product are shown below:

	Protective earth (ground) terminal.
	Functional earth (ground) terminal.
	Alternating current supply only.
	This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	This symbol, when noted on a product, indicates a high temperature hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and / or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.
	Recycle separately from general waste under the WEEE directive.

## 1.6 Product recycling and disposal (Europe only)



Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. To conform to European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user. ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible.

**i IMPORTANT (NOTE)** For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

### 1.6.1 End-of-life battery disposal

The transmitter contains a small lithium battery (located on the processor / display board) that must be removed and disposed of responsibly in accordance with local environmental regulations.

## 1.7 Restriction of Hazardous Substances (RoHS)



The European Union RoHS Directive and subsequent regulations introduced in member states and other countries limits the use of six hazardous substances used in the manufacturing of electrical and electronic equipment. Currently, monitoring and control instruments do not fall within the scope of the RoHS Directive, however ABB has taken the decision to adopt the recommendations in the Directive as the target for all future product design and component purchasing.

## 2 Communications overview

Extensive communication options enable the Endura AZ40 transmitter to be integrated into larger control systems easily or connected to other process instrumentation.



### 2.1 RS485 MODBUS

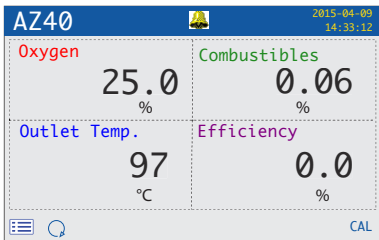
Using RS485 MODBUS, values and status can be communicated between a master (or host) computer and the AZ40 in real-time via an RS485 connection.

### 3 Communication level

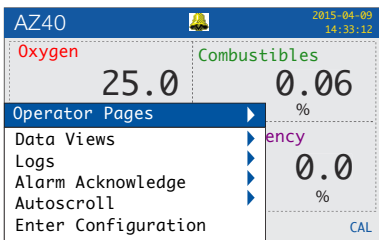
**i IMPORTANT (NOTE)** *Communication* level menus are enabled only if an optional communications module is fitted and the parameters displayed are specific to the type of module fitted. For example, if a MODBUS module is fitted, MODBUS parameters are enabled, but Ethernet parameters are neither enabled nor displayed.



The *Communication* level is accessed from the *Advanced* access level. To access the communication level and the configuration parameters for the communications module fitted:

1. Press the  key (below the  icon on any *Operator* page).

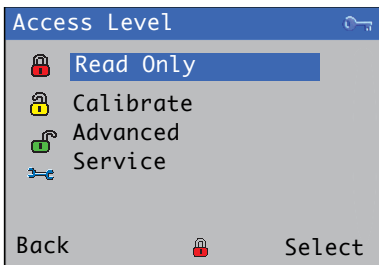




The *Operator* menu is displayed:





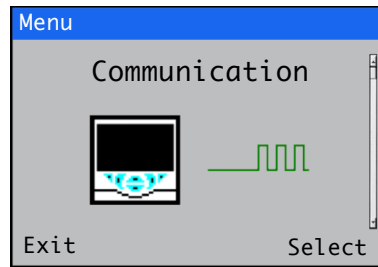
2. Press the  key to scroll to *Enter Configuration* and press the  key.

The *Access Level* page is displayed:



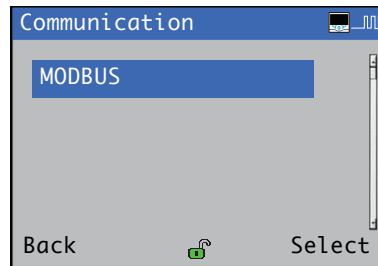
3. Use the  key to scroll to *Advanced* and press the  key (below the **Select** prompt).

4. Use the  and  keys to scroll to the *Communication* level:



5. Press the  key (below the **Select** prompt).

The *Communication* page appropriate to the communication module fitted is displayed:



MODBUS – refer to Section 4, page 8.

## 4 MODBUS communications

### **i** IMPORTANT (NOTE)

MODBUS menus are enabled only if a MODBUS communications module is fitted.

This section describes the connection of serial data cables between the master (host computer) and slave (Endura AZ40 transmitter) on a MODBUS serial link.

Menu	Comment	Default
<b>MODBUS</b>		
<b>Device Address</b>	Set a device-specific address (from 1 to 247) to identify the transmitter on a MODBUS link.	
<b>RS485 Setup</b>		
<b>Mode</b>	Select the MODBUS serial communication serial link type: <i>2 Wire, 4 Wire or Off</i>	4 Wire
<b>Baud Rate</b>	Select a communication transfer rate: <i>1200, 2400, 4800, 9600, 19200, 38400 or 115200</i> baud.	19200
<b>Parity</b>	Select the parity bit (transmission error-checking) condition: <i>No Parity, Odd Parity or Even Parity</i>	No Parity
<b>Tx Delay</b>	Set a delay to the response from the transmitter in milliseconds. Maximum delay 100 ms.	50 ms

### 4.1 Host computer serial communications

The serial interface option module operates using the MODBUS Remote Terminal Unit (RTU) Master / Slave protocol. An appropriate RS422 / 485 communications driver must be fitted to the host (master) computer. It is strongly recommended that the interface has galvanic isolation to protect the computer from lightning damage and to increase signal immunity to noise pick-up.



### **DANGER – Serious damage to health / risk to life**

Refer to the Endura AZ40 Operating instruction (OI/AZ40-EN) before making electrical connections.

### **i** IMPORTANT (NOTE)

The MODBUS option provides the following facilities:

- Standard RS422/485 communications.
- MODBUS RTU protocol – the transmitter is designed to operate as a Remote Terminal Unit (RTU) slave when communicating with a master (host) system.
- 500V DC isolation from external connections to the instrument.
- 2- or 4-wire communication (selected at the *RS485 Setup / Mode* parameter).
- 1200, 2400, 4800, 9600, 19200, 38400, or 115200 baud transmission rate.
- Parity-checking (odd, even or none).



#### 4.2 Two-wire and four-wire connection

MODBUS serial communications can be configured as either 2-wire or 4-wire serial links – see Fig. 4.1. The transmitter must be added to the link configuration on the host system – refer to information supplied with the host system.

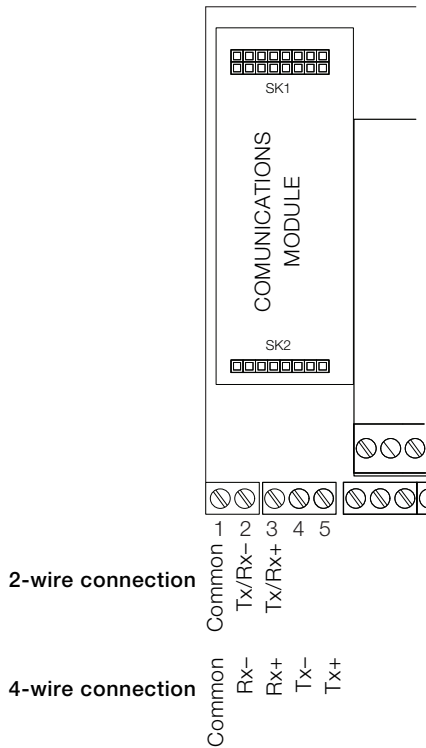


Fig. 4.1: 2-wire and 4-wire MODBUS serial links

#### 4.3 Pull-up and pull-down resistors

To prevent false triggering of slaves when the master (host computer) is inactive, fit pull-up and pull-down resistors to the RS422/485 interface in the host computer.

Resistors are normally connected to the interface by hard-wired links or switches – refer to the manufacturer's instructions

#### 4.4 Termination resistor

For long transmission lines, fit 120 Ω termination resistors to the last slave in the chain and the master receiver – see Fig. 4.2.

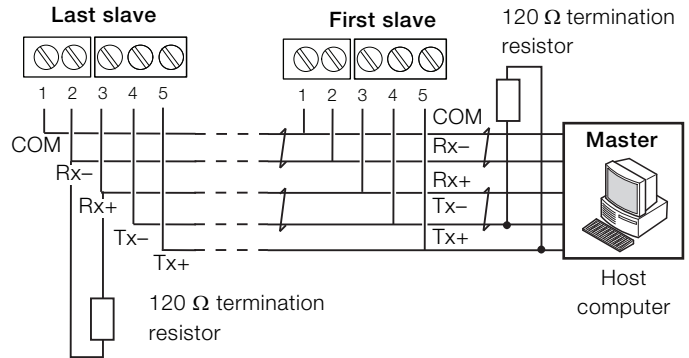


Fig. 4.2: Connecting multiple slaves

#### 4.5 Serial connections

Make connections to the MODBUS serial board as shown in Fig. 4.1. On systems with multiple slaves, make connections to two- or four-wire link configurations in parallel as shown in Fig. 4.2. When connecting cable screens, ensure that ground loops are not introduced.

The maximum serial data transmission line length for both RS422 and RS485 systems is 1200 m (3937 ft.).

The types of cable that can be used are determined by the total line length:

- Up to 6 m (19.7 ft.) – standard screened or twisted pair cable.
- Up to 300 m (984 ft.) – twin twisted pair with overall foil screen and an integral drain wire.
- Up to 1200 m (3937 ft.) – twin twisted pair with separate foil screens and integral drain wires.

# Appendix A – MODBUS tables

## A.1 Digital inputs

### A.1.1 Sensor reading diagnostics

MODBUS coil	Description
0	Oxygen concentration value status
1	COe concentration value status
2	Inlet temperature value status
3	Outlet temperature value status
4	Outlet / Inlet temperature value status
5	Efficiency value status

### A.1.2 Transmitter function diagnostics

MODBUS coil	Description
6	Transmitter failure diagnostic
7	Transmitter out of specification diagnostic
8	Transmitter maintenance diagnostic
9	Transmitter function check diagnostic
10	Sensor failure diagnostic
11	Sensor out of specification diagnostic
12	Sensor maintenance diagnostic
13	Sensor function check diagnostic
14	Active failure alarm
15	Calibration in progress
16	Blowback in progress
17	Zero gas valve check
18	Span gas valve check
19	Test gas valve check mode
20	Sample flow rate test mode

### A.1.3 Transmitter and sensor diagnostic failure alarms

MODBUS coil	Description	Diagnostic alarm no.
21	ADC Failed	0
22	Sensor electronics cold junction failed	1
23	Oxygen heater failed	2
24	Flange block thermocouple failed	3
25	COe block thermocouple failed	4
26	Inlet thermocouple failed	5
27	Outlet thermocouple failed	6
28	Sensor non-volatile memory failed	7
29	Processor board non-volatile memory failed	8
30	Main board non-volatile memory failed	9
31	Reserved	10
32	Reserved	11
33	Comms board non-volatile memory failed	12
34	S/W key 1 non-volatile memory failed	13
35	Reserved	14
36	Reserved	15
37	Internal communication failure between transmitter and sensor	16
38	Over temperature trip	17

### A.1.4 Transmitter and sensor diagnostic function alarms

MODBUS coil	Description	Diagnostic alarm no.
39	Flange, COe and oxygen heaters warming up	18
40	Flange, COe and oxygen heaters stabilizing	19
41	Calibrating	20
42	Blowback in progress	21
43	Sample flow rate test in progress	22
44	Manual valve test in progress	23
45	Remote zero gas test in progress	24
46	Remote span gas test in progress	25
47	Recovery stage after calibration / blowback / manual valve test / flow rate test	26
48	In hold mode	27
49	In simulation mode	28

### A.1.5 Transmitter and sensor diagnostic out of specification alarms

MODBUS coil	Description	Diagnostic alarm no.
50	Last sensor calibration failed	29
51	Process value out of range	30
52	Temperature value out of range	31
53	Flange block temperature is high	32
54	Flange block temperature is low	33
55	COe block temperature is high	34
56	COe block temperature is low	35
57	Oxygen heater current is high	36
58	Oxygen heater current is low	37

### A.1.6 Transmitter and sensor diagnostic maintenance alarms

MODBUS coil	Description	Diagnostic alarm no.
59	Transmitter internal ambient temperature is high	38
60	Transmitter internal ambient temperature is low	39
61	Sensor CJC temperature is high	40
62	Sensor CJC temperature is low	41
63	Sensor ECJC temperature is high	42
64	Sensor ECJC temperature is low	43
65	Sensor power is turned off via SW1	44
66	Sensor mains selection is in the wrong position	45

### A.1.7 Media card diagnostics

MODBUS coil	Description
67	Media device unit fitted
68	Media online
69	Media logging enabled

### A.1.8 Relay state diagnostics

MODBUS coil	Description
70	Relay 1 state
71	Relay 2 state
72	Relay 3 state
73	Relay 4 state
74	Relay 5 state
75	Relay 6 state

### A.1.9 Alarm state diagnostics

MODBUS coil	Description
76	Alarm 1 state
77	Alarm 2 state
78	Alarm 3 state
79	Alarm 4 state
80	Alarm 5 state
81	Alarm 6 state
82	Alarm 7 state
83	Alarm 8 state

## A.2 Digital outputs

### A.2.1 Alarm acknowledgement

MODBUS coil	Description
0	Alarm 1 acknowledge state
1	Alarm 2 acknowledge state
2	Alarm 3 acknowledge state
3	Alarm 4 acknowledge state
4	Alarm 5 acknowledge state
5	Alarm 6 acknowledge state
6	Alarm 7 acknowledge state
7	Alarm 8 acknowledge state
8	Acknowledge alarm 1
9	Acknowledge alarm 2
10	Acknowledge alarm 3
11	Acknowledge alarm 4
12	Acknowledge alarm 5
13	Acknowledge alarm 6
14	Acknowledge alarm 7
15	Acknowledge alarm 8

## A.3 Read-only, single precision float

### A.3.1 Measurement values

See engineering ranges table – Section A.13, page 17.

MODBUS address	Description
30000	Oxygen concentration value
30002	COe concentration value
30004	Inlet temperature value
30006	Outlet temperature value
30008	Outlet / Inlet temperature value
30010	Efficiency value

### A.3.2 Measurement range limits

MODBUS address	Description
30012	Oxygen concentration – Engineering range high
30014	Oxygen concentration – Engineering range low
30016	COe concentration – Engineering range low
30018	COe concentration – Engineering range high
30020	Inlet temperature – Engineering range high
30022	Inlet temperature – Engineering range low
30024	Outlet temperature – Engineering range high
30026	Outlet temperature – Engineering range low
30028	Outlet – Inlet temperature – Engineering range high
30030	Outlet – Inlet temperature – Engineering range low
30032	Efficiency – Engineering range high
30034	Efficiency – Engineering range low

### A.3.3 Sensor signals view – heater signals view page 1

MODBUS address	Description
30036	View 1 – Flange block temperature
30038	View 2 – Flange block proportional control (%)
30040	View 3 – Sensor cold junction temperature
30042	View 4 – Oxygen heater current
30044	View 5 – Oxygen heater voltage
30046	View 6 – Oxygen heater power
30048	View 7 – COe block temperature
30050	View 8 – COe block proportional control (%)

### A.3.4 Sensor signals view – oxygen signals view page 2

MODBUS address	Description
30052	View 1 – Oxygen concentration (%)
30054	View 2 – Oxygen sensor output (mV)
30056	View 3 – Oxygen sensor last zero
30058	View 4 – Oxygen sensor last span
30060	View 5 – Oxygen sensor active zero
30062	View 6 – Oxygen sensor active span
30064	View 7 – Reserved
30066	View 8 – Reserved

### A.3.5 Sensor signals view – COe signals view page 3

MODBUS address	Description
30068	View 1 – COe concentration
30070	View 2 – COe element temperature difference (°)
30072	View 3 – COe active element temperature (°)
30074	View 4 – COe reference element temperature (°)
30076	View 5 – COe sensor last zero
30078	View 6 – COe sensor last span
30080	View 7 – COe sensor active zero
30082	View 8 – COe sensor active span

### A.3.6 Sensor signals view – raw signals view page 4

MODBUS address	Description
30084	View 1 – Oxygen sensor output (mV)
30086	View 2 – Flange block (mV)
30088	View 3 – COe block (mV)
30090	View 4 – Inlet temperature
30092	View 5 – Outlet temperature
30094	View 6 – Transmitter temperature (°)
30096	View 7 – Sensor cold junction temperature (°)
30098	View 8 – Electrical cold junction temperature (°)

### A.3.7 Calibration timer

MODBUS address	Description
30100	Calibration progress (% completion)

### A.3.8 Analog outputs

MODBUS address	Description
30102	Analog output value (mA) AOUT1
30104	Analog output value (mA) AOUT2
30106	Analog output value (mA) AOUT3
30108	Analog output value (mA) AOUT4
30110	Analog output % of full scale AOUT1
30112	Analog output % of full scale AOUT2
30114	Analog output % of full scale AOUT3
30116	Analog output % of full scale AOUT4

### A.4 Read only 32 bits

#### A.4.1 Transmitter date

Number of seconds since 01/01/2000

MODBUS address	Description
31000	Transmitter – Date of manufacture

#### A.4.2 Scheduled events

number of seconds since 01/01/2000

MODBUS address	Description
31002	Sensor – Date of manufacture
31004	Scheduled calibration start time
31006	Scheduled blowback start time
31008	Next scheduled calibration time
31010	Next scheduled blowback time

### A.5 Read only 16 bits

#### A.5.1 Sensor hardware version

Valid range 1 to 9.

MODBUS address	Description
32000	Sensor – Hardware version number

#### A.5.2 Mains voltage

MODBUS address	Description
32001	Mains voltage selection (0 = Not Set, 1 = 115V, 2 = 230V)

### A.6 Read-only 8 bits

#### A.6.1 Sensor type

MODBUS address	Description	Definitions
33000	Blowback fitted	0 = Not Fitted 1 = Continuous 2 = Pulsed
33001	Sensor type	0 = Unrecognized 140 = Oxygen 141 = Oxygen + COe 255 = None
33002	Sensor calibration error	

#### A.6.2 Media card version

MODBUS address	Description
33003	Media card percentage full
33004	Media card hardware version number

### A.7 Read-only strings

MODBUS address	Description	No. of Bytes
34000	Transmitter hardware revision number	2
34002	Transmitter software revision number	19
34021	Transmitter serial number	14
34035	Sensor software revision number	19
34054	Sensor serial number	15
34069	Media unit software revision number	19

## A.8 Writable floats

### A.8.1 Alarm settings

MODBUS address	Description
40000	Alarm 1 – Trip point
40002	Alarm 2 – Trip point
40004	Alarm 3 – Trip point
40006	Alarm 4 – Trip point
40008	Alarm 5 – Trip point
40010	Alarm 6 – Trip point
40012	Alarm 7 – Trip point
40014	Alarm 8 – Trip point
40016	Alarm 1 – Hysteresis
40018	Alarm 2 – Hysteresis
40020	Alarm 3 – Hysteresis
40022	Alarm 4 – Hysteresis
40024	Alarm 5 – Hysteresis
40026	Alarm 6 – Hysteresis
40028	Alarm 7 – Hysteresis
40030	Alarm 8 – Hysteresis

### A.8.2 Analog output settings

see engineering ranges table – Section A.13, page 17.

MODBUS address	Description
40032	Analog output 1 – Electrical range high
40034	Analog output 1 – Electrical range low
40036	Analog output 1 – Engineering range high
40038	Analog output 1 – Engineering range low
40040	Analog output 2 – Electrical range high
40042	Analog output 2 – Electrical range low
40044	Analog output 2 – Engineering range high
40046	Analog output 2 – Engineering range low
40048	Analog output 3 – Electrical range high
40050	Analog output 3 – Electrical range low
40052	Analog output 3 – Engineering range high
40054	Analog output 3 – Engineering range low
40056	Analog output 4 – Electrical range high
40058	Analog output 4 – Electrical range low
40060	Analog output 4 – Engineering range high
40062	Analog output 4 – Engineering range low
40064	Analog output 1 – Failure current
40066	Analog output 2 – Failure current
40068	Analog output 3 – Failure current
40070	Analog output 4 – Failure current

### A.8.3 Sensor calibration standards

MODBUS address	Description
40072	COe calibration standard zero
40074	COe calibration standard span
40076	Oxygen calibration standard zero
40078	Oxygen calibration standard span

## A.9 Writable 32 bits

### A.9.1 Scheduled calibration events

Number of seconds since 01/01/2000.

MODBUS address	Description
41000	Next scheduled calibration time
41002	Next scheduled blowback time

## A.10 Writable 16 bits

### A.10.1 Alarm time hysteresis

Valid range 0 to 9999 seconds.

MODBUS address	Description
42000	Zero calibration duration (minutes)
42001	Span calibration duration (minutes)
42002	Calibration recovery duration (seconds)
42003	Damping time (seconds) – 0
42004	Damping time (seconds) – 1
42005	Damping time (seconds) – 2
42006	Damping time (seconds) – 3
42007	Blowback on time (seconds)
42008	Blowback off time (seconds)
42009	Blowback frequency
42010	Blowback recovery duration (seconds)
42011	Alarm 1 – Time hysteresis
42012	Alarm 2 – Time hysteresis
42013	Alarm 3 – Time hysteresis
42014	Alarm 4 – Time hysteresis
42015	Alarm 5 – Time hysteresis
42016	Alarm 6 – Time hysteresis
42017	Alarm 7 – Time hysteresis
42018	Alarm 8 – Time hysteresis

## A.11 Writable 8 bits

### A.11.1 Measurement units

MODBUS address	Description	Valid range			
43000	Transmitter – temperature units	4 – Deg.C	5 – Deg. F		
43001	Sensor 1 – filter type	0 – Off 4 – Sliding average	1 – Minimum value	2 – Maximum value	3 – Average value
43002	Fuel type	0 – Gas 4 – Bituminous	1 – Light oil 5 – Lignite	2 – Heavy oil	3 – Anthracite
43003	COe units	2 – %	3 – ppm		
43004	Inlet thermocouple types	0 – None	1 – Type B	2 – Type E	3 – Type J
43005	Outlet thermocouple types	4 – Type K 8 – Type T	5 – Type N	6 – Type R	7 – Type S
43006	Efficiency calculation	0 – Disabled	1 – Enabled		
43007	Blowback interval	0 – Off	1 – 24 hours		
43008	Reserved				
43009	Scheduled calibration frequency units	1 – Off	1 – Daily	2 – Weekly	3 – Monthly
43010	Scheduled calibration frequency	0 – 30 (days)			
43011	Scheduled calibration frequency	0 – 7 (weeks)			
43012	Scheduled calibration frequency (months)	0 = 1 4 = 6	1 = 2 5 = 12	2 = 3	3 = 4

### A.11.2 Operator page templates

MODBUS address	Description	Valid range	
43013	Operator page 2 template	0 – Off	
43014	Operator page 3 template	1 – Oxygen	2 – Combustibles
43015	Operator page 4 template	3 – Temperature	4 – Efficiency
43016	Operator page 5 template		

### A.11.3 Data view / log enables

MODBUS address	Description	Valid range	
43017	Diagnostics view	0 – Disabled	1 – Enabled
43018	Signals view		
43019	Chart view		
43020	Alarm view		
43021	Analog output view		
43022	Calibration log		
43023	Alarm log		
43024	Audit log		
43025	Diagnostics log		

#### A.11.4 Date display settings

MODBUS address	Description	Valid range
43026	Date format	0 – dd/mm/yyyy 1 – mm/dd/yyyy 2 – yyyy/mm/dd
43027	Daylight saving – region	0 – Daylight saving is off 1 – Europe 2 – USA 3 – Custom
43028	Daylight saving – start hour for daylight saving	0 to 23
43029	Daylight saving – start occurrence for daylight saving	1 – First 2 – Second 3 – Third 4 – Fourth 5 – Last
43030	Daylight saving – start day for daylight saving	1 to 7 where 1 = Sunday and 7 = Saturday
43031	Daylight saving – start month for daylight saving	1 to 12 where 1 = January and 12 = December
43032	Daylight saving – end hour for daylight saving	0 to 23
43033	Daylight saving – end occurrence for daylight saving	1 – First 2 – Second 3 – Third 4 – Fourth 5 – Last
43034	Daylight saving – end day for daylight saving	1 to 7 where 1 = Sunday and 7 = Saturday
43035	Daylight saving – end month for daylight saving	1 to 12 where 1 = January and 12 = December

#### A.11.5 Alarm settings

MODBUS address	Description	Valid range
43036	Alarm 1 – Type	0 – Off 1 – High process 2 – Low process 3 – High latch 4 – Low latch
43037	Alarm 1 – Source	0 – None 1 – Oxygen high
43038	Alarm 2 – Type	See Alarm 1 – Type
43039	Alarm 2 – Source	0 – None 1 – Oxygen low
43040	Alarm 3 – Type	See Alarm 1 – Type
43041	Alarm 3 – Source	0 – None 2 – Combustibles high
43042	Alarm 4 – Type	See Alarm 1 – Type
43043	Alarm 4 – Source	0 – None 2 – Combustibles low
43044	Alarm 5 – Type	See Alarm 1 – Type
43045	Alarm 5 – Source	0 – None 5 – Temperature high
43046	Alarm 6 – Type	See Alarm 1 – Type
43047	Alarm 6 – Source	0 – None 5 – Temperature low
43048	Alarm 7 – Type	See Alarm 1 – Type
43049	Alarm 7 – Source	0 – None 6 – Efficiency high
43050	Alarm 8 – Type	See Alarm 1 – Type
43051	Alarm 8 – Source	0 – None 6 – Efficiency low

### A.11.6 Analog output settings

MODBUS address	Description	Valid range	
43052	Analog output 1 – Source	0 – None	1 – Oxygen
43053	Analog output 1 – Polarity	0 – Inverted	1 – Non-Inverted
43054	Analog output 1 – Failure current enable	0 – Disabled	1 – Enabled
43055	Analog output 2 – Source	0 – None	2 – Combustibles
43056	Analog output 2 – Polarity	0 – Inverted	1 – Non-Inverted
43057	Analog Output 2 – Failure current enable	0 – Disabled	1 – Enabled
43058	Analog Output 3 – Source	0 – None	5 – Temperature
43059	Analog output 3 – Polarity	0 – Inverted	1 – Non-Inverted
43060	Analog output 3 – Failure current enable	0 – Disabled	1 – Enabled
43061	Analog output 4 – Source	0 – None	6 – Efficiency
43062	Analog output 4 – Polarity	0 – Inverted	1 – Non-Inverted
43063	Analog Output 4 – Failure current enable	0 – Disabled	1 – Enabled

### A.11.7 Digital I/O (relay) settings

MODBUS address	Description	Valid range	
43064	DO 1: Oxygen – source	15 – Alarm 1/2 state	
43065	DO 1: Oxygen – polarity	0 – Inverted	1 – Non-inverted
43066	DO 2: Combustibles – source	16 – Alarm 3/4 state	
43067	DO 2: Combustibles – polarity	0 – Inverted	1 – Non-inverted
43068	DO 3: Temperature – source	17 – Alarm 5/6 state	
43069	DO 3: Temperature – polarity	0 – Inverted	1 – Non-inverted
43070	DO 4: Efficiency – source	18 – Alarm 7/8 state	
43071	DO 4: Efficiency – polarity	0 – Inverted	1 – Non-inverted
43072	DO 5: Fault – source	28 – Analyzer fault	
43073	DO 5: Fault – polarity	0 – Inverted	1 – Non-inverted
43074	DO 6: Calibration – source	27 – Calibration in progress	
43075	DO 6: Calibration – polarity	0 – Inverted	1 – Non-inverted



## A.12 Writable strings

### A.12.1 16 Byte strings

MODBUS address	Description	Default
44000	Instrument tag	AZ40/000000000000
44016	Process tag 1	Tag 1
44032	Process tag 2	Tag 2
44048	Process tag 3	Tag 3
44064	Process tag 4	Tag 4
44080	Alarm 1 tag	Alarm 1
44096	Alarm 2 tag	Alarm 2
44112	Alarm 3 tag	Alarm 3
44128	Alarm 4 tag	Alarm 4
44144	Alarm 5 tag	Alarm 5
44160	Alarm 6 tag	Alarm 6
44176	Alarm 7 tag	Alarm 7
44192	Alarm 8 tag	Alarm 8

### A.12.2 3 Byte strings

MODBUS address	Description	Default
44208	Chart config tag 1	Ch 1
44211	Chart config tag 2	Ch 2
44214	Chart config tag 3	Ch 3
44217	Chart config tag 4	Ch 4

## A.13 Engineering ranges

Source	Range low	Range high	Units
Oxygen concentration	0.0	25.0	%
Combustibles (COe)	0.0 (0.0)	20000 (2.0)	ppm (%)
Temperature	-46 (-50)	1649 (3000)	° C (° F)
Efficiency	0.0	100.0	%
Analog output electrical range	0.0 (-2 % underrange)	22.0 (+2 % overrange)	mA

## Appendix B – Acknowledgements

MODBUS is a registered trademark of the Modbus-IDA organization

# Notes

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