

# Continuous Emission Monitoring Systems (CEMS)

Innovative product solutions keeping you compliant and operational for over 50 years

Our goal is to make cost-effective CEM products and solutions delivering highly accurate and repeatable measurements that just work, all the time – so you can focus on your business

Measurement made easy



## Introduction

This publication provides an overview of the following Continuous Emission Monitoring (CEM) solutions offered by ABB Inc.:

- LGR cavity enhanced absorption analyzer
- ACF5000 multi-component FTIR CEMS
- AO2000 series continuous gas analyzers
- EL3000 series continuous gas analyzers
- AZ20 Zirconia O<sub>2</sub> probe
- FPD580 Stack DP flow measurement

## For more information

Further details of the ABB CEM solutions are available for free download from [www.abb.com/analytical](http://www.abb.com/analytical) or by scanning this code:



<b>LGR</b> 	<b>ACF5000</b> 
<b>AO2000</b> 	<b>EL3000</b> 
<b>AZ20</b> 	<b>FPD580</b> 

# Continuous Emission Monitoring Systems (CEMS)

## Innovative product solutions keeping you compliant and operational for over 50 years

Regulations recently promulgated by the US EPA require qualifying Power and Portland Cement plants to monitor Hydrogen Chloride (HCl) along with other toxic air pollutants:

- MATS for Power Plants is a new rule aiming to reduce mercury & other toxins at all coal- and oil-fired units with a capacity of 25 megawatts or greater.
- NESHAP for Portland Cement Plants sets new emission limits for Hg, THC, PM and HCl from new and existing cement kilns.

Whether you plan to retrofit HCl measurement to your existing system or install a new multi-component CEMS, ABB offers very compelling solutions.

### LGR cavity enhanced absorption

The acquisition of Los Gatos Research (LGR) in 2013 added a new line of high-performance and innovative laser-based analyzers to ABB's product offering.

- Trace level measurement (0.2 ppb detection limit)
- Compatible with dilution-extractive systems
- Ideal for HCl measurement on exhaust stacks
- Combination with NH<sub>3</sub> also possible in one unit
- Very robust – exact alignment, gas pressure, gas temperature are not critical
- Mirrors may be cleaned anywhere by anyone
- Portable and 19 in. rack mount packaging options

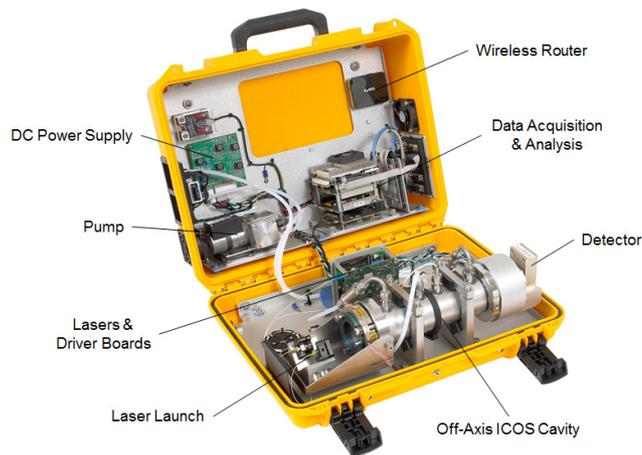


Fig. 1: LGR cavity enhanced absorption analyzer

### ACF5000 multi-component FTIR

ABB were the pioneers of FTIR based CEMS introducing the first system to the market in 1993 and now with over 1500 installations worldwide:

- Pre-engineered system based on >20 yrs experience
- Close-coupled design ensures no cold spots
- No heated pump; injector with no moving parts
- Automatic emergency purge to protect system
- High resolution spectrometer (1 cm<sup>-1</sup>) and TE-cooled DTGS detector offer improved sensitivity
- Long-life laser (20 yrs) and IR source (>5 yrs)
- Full remote system control via cellular network

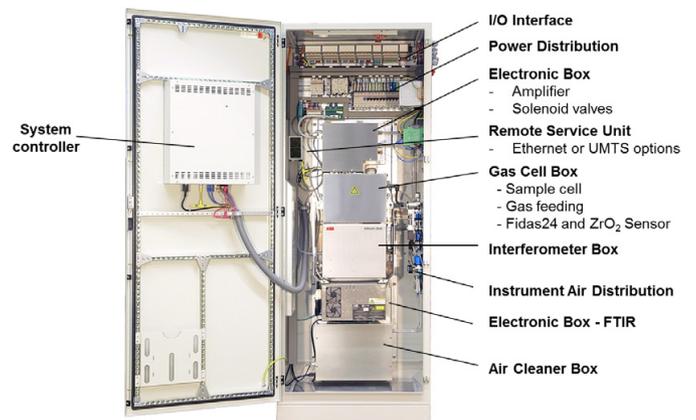


Fig. 2: ACF5000 multi-component FTIR CEMS

ABB is the world's leading manufacturer in the field of continuous gas analyzers – formerly known as Hartmann & Braun. ABB offers two series of source level extractive gas analyzers utilizing a range of measuring principles (e.g. NDIR, NDUV, Paramagnetic, FID). ABB also offers TDL absorption spectroscopy analyzers that measure in situ, directly at the stack or process line.

Analyzers will be delivered with an unrivaled range of innovative measurement technology, easy operation, simplified calibration and outstanding possibilities for integration in digital networks.

### EL3000 continuous gas analyzers

The EasyLine series is both a powerful and affordable line of instruments based on the same proven and reliable measuring technology used in all ABB continuous gas analyzers.

- Powerful and affordable line of instruments
- Easy operation, configuration and maintenance
- Combine 2 analyzers inside one housing
- Measure up to 5 components in one unit
- Internal sample pump and flow sensor option
- Automatic calibration without test gas cylinders



Fig. 3: EasyLine continuous gas analyzers

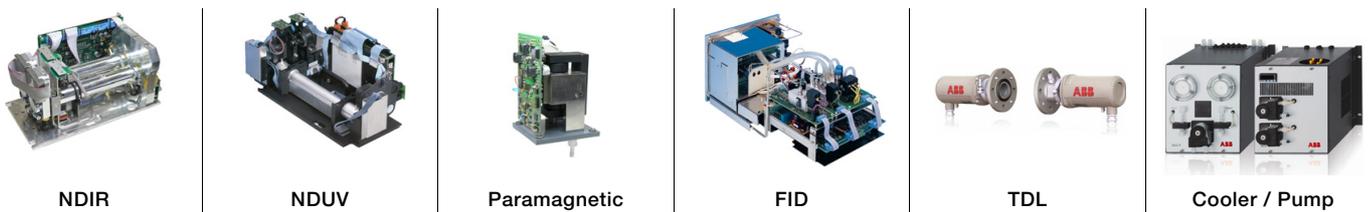
### AO2000 continuous gas analyzers

The Advance Optima series combine advanced technologies with market leading measuring technology which is based on over 75 years of experience in continuous gas analysis.

- Integrated system concept - modular analyzers and sample conditioning connected on network
- High level of performance, highly configurable
- 4 analyzers connected to one central unit
- Measure up to 6 components in one system
- Internal PLC functionality



Fig. 4: Advance Optima continuous gas analyzers



## AZ20 Zirconia O<sub>2</sub> probe

- Ultra low-drift sensor <0.2% of O<sub>2</sub> range / month
- Unique integrated auto-calibration feature
- Fully site-serviceable without special tools
- High temperature variant up to 2500 °F



Fig. 5: AZ20 Zirconia O<sub>2</sub> probe

## StackFlowMaster DP flow measurement

- Continuous volume / mass flow and velocity
- Compensated for pressure and temperature
- Optional meter purging and auto. zero / span
- Suitable for 3.3 to 26.5 ft stack diameters and gas temperatures up to 2192 °F



Fig. 6: StackFlowMaster DP flow measurement

## Contact us

To find your local ABB contact visit:  
[www.abb.com/contacts](http://www.abb.com/contacts)

For more information visit:  
[www.abb.com/analytical](http://www.abb.com/analytical)

### ABB Inc.

3700 West Sam Houston Pkwy S  
Houston  
TX 77042  
USA  
Sales: 713 587 8000  
Service: 1-800-HELP-365

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EPA: MATS  
for Power



EPA: Portland  
Cement



Measurement & Analytics - Measurement made easy

# ABB Analyzer systems integration

## Complete process analyzer and emission monitoring solutions

# Measurement made easy

## Complete analyzer systems capabilities

ABB offers complete analytical solutions from initial engineering through manufacturing, testing, field start-up and support. ABB is dedicated to providing the process industry with quality built systems, delivered on time, on budget and supported by experienced professionals.

ABB's resources include complete, functional and spacious manufacturing facilities, in Houston Texas U.S.A. The Houston facility is specifically designed for assembling and testing analyzer systems. The building covers over 40,000 square feet, with two large rear doors for convenient loading and shipping of any size analyzer shelter. All work is performed in this enclosed air conditioned area.

System Integration is available globally at other ABB facilities as projects require.

## Single source responsibility

ABB assumes total system responsibility. All project requirements are provided by ABB.

Each project is led by a seasoned Project Manager, who guides an assigned execution team for engineering, design, document control, supply chain, inspection, and logistics from start to finish. This model offers customers the ease of a single point of contact and insures that the analyzer systems truly meet all project requirements.

This approach results in efficiently executed projects that are on time, on budget, and in compliance with customer requirements.



## Quality designs and packaging

ABB's technical staff has current and thorough knowledge of global electrical and instrument codes, purging requirements, and all technical aspects of packaging. Project drawings are generated with reliable CAD software and project documentation is comprehensive. Quality assurance is applied to all aspects of each project and thorough testing is standard.

ABB guarantees the technical completeness, crafted quality, maintainability, and certification of every system it delivers. ABB employees are dedicated to delivering on this guarantee.

ABB's complete capabilities, single source responsibility, technical expertise and quality assurance, combine to produce the most important customer value...lower total cost of ownership.



**As a single source provider, ABB can guarantee the certification of your CEMS.**

ABB combines the best systems practices, with conformance to government environmental requirements, to produce Continuous Emissions Monitoring Systems that pass certification and comply with plant requirements for analyzer systems.

ABB provides CEMS that meet plant area electrical classification requirements and systems with multiple streams. ABB also builds systems that are packaged in air conditioned shelters.

ABB also offers wide flexibility in system packaging, data acquisition and reporting systems, field start up and calibration services.

**ABB Analytical Products and Partnership**

ABB has direct access to the industry's most complete source for high quality process analyzers and process analyzer applications technology.

ABB Measurement & Analytics manufactures over fifty process analyzer products, including Gas Chromatographs, Continuous Liquid and Continuous Gas Analyzers, Reid Vapor Pressure Analyzers, TDL Analyzers, and FTIR Analyzers. ABB is always developing new and more powerful analyzer products, and creating more effective applications technology.

ABB Analyzer Systems Integration has full access to ABB's analytical products, technology and resources offering the analyzer system customer a remarkable advantage.

When it serves the customer's objectives, ABB also employs quality products from other manufacturers. The customer's needs take top priority on ABB projects.



**Contact ABB, the Analytical System Integration experts for all your analytical needs:**

**Prepackaged Analyzer Systems**

- Engineering and Design
- Sample Conditioning Systems
- Analyzer Buildings and Shelters
- Comprehensive Supply Chain Management
- Complete System Assembly
- Comprehensive System Testing

**Complete Documentation**

- Drawings on Auto-CAD
- Analyzer and Systems Manuals
- Start-up Procedures
- Maintenance Procedures

**Emissions Monitoring systems**

- For Regulatory Compliance
- CO - O<sub>2</sub> - NO<sub>x</sub> - SO<sub>x</sub> -CO<sub>2</sub> - Opacity - HCl - NH<sub>3</sub> HRVOC's - Sulfur - H<sub>2</sub>S - BTU
- Complete, Integrated Field Packages
- Field Certification - Quarterly Audits
- Data-Acquisition Systems

**Complete Services**

- Applications and Solutions
- Installation and Supervision
- Pre-Commissioning and Start Up
- Maintenance and Service
- Training - Classroom and Field
- Analyzer Field Surveys



# Contact us

## **ABB Analytical Systems Integration**

6820 Willowbrook Park  
Houston, TX 77066 USA  
Phone: +1 713 587 8058  
Fax: +1 713 266 4082  
E-Mail: [abb.sendrfq@us.abb.com](mailto:abb.sendrfq@us.abb.com)

**[www.abb.com/measurement](http://www.abb.com/measurement)**

Contact your local sales representative

**[www.abb.com/contacts](http://www.abb.com/contacts)**

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# Endura AZ20 oxygen monitor Combustion gas analysis

Superior technology and quality from the world leader in oxygen measurement



#### Advanced design and precision manufacturing

- robust, long-life probe for process temperatures up to 800 °C (1472 °F)
- proven cell design from over 50 years experience
- fast response to process variations
- stable and accurate oxygen measurement

#### Unique integrated auto-calibration system

- easy compliance for emission monitoring regulation
- reduced installation costs; eliminates requirement for expensive external calibration panel
- reduced maintenance costs

#### Probe lengths up to 4.0 m (13.1 ft.) and industry-standard flange configurations

- suitable for a wide range of applications
- extensive installation options

#### Easy cell release

- fully site-serviceable probe
- easy access to internal components

#### Advanced transmitters

- easy configuration, monitoring and intuitive HMI
- HART communications
- cell performance logging and diagnostics

## Endura AZ20 oxygen monitor

Combustion gas analysis

### Introduction

The Endura AZ20 is the latest in a long line of high-quality, combustion gas analyzers from ABB.

The sensor, based on a zirconium oxide cell, is mounted at the tip of the probe that is inserted in the flue duct. The resulting direct, in situ measurement provides accurate and rapid oxygen reading for combustion control optimization and emissions monitoring.

### Probe Lengths up to 4.0 m (13.1 ft.)

A wide range of probe insertion lengths from 0.5 to 4.0 m (1.7 to 13.1 ft.) enable installation to the optimum measuring point for accurate oxygen measurement within the duct; even in the largest flue gas ducts and stacks.

A comprehensive range of mounting flanges provide simple installation when plant-wide standard flanges are required or when replacing existing probes.

The transmitter can be probe- or remote-mounted at distances of up to 100 m (328 ft.), thus providing versatile system options for all applications. The probe-mounted transmitter option provides the lowest cost of installation. However, the remote-mounted transmitter provides flexibility when the operationally ideal probe location does not provide easy access for the user.

### Advanced Design

Designed and manufactured to exacting standards, the Endura AZ20 ensures long periods of trouble-free operation in even the most arduous of applications.

The operating process temperature of up to 800 °C (1472 °F) extends system suitability into previously impossible applications and enables optimum probe location within the process.

The modular design, with reduced component count, improves the robustness and reliability of the system and simplifies routine maintenance and servicing.

Complete traceability ensures only the highest quality materials are used in the analyzer's construction and rigorous manufacturing, inspection and testing procedures (to international standard ISO 9001) result in a monitor of superior quality with prolonged probe life.



*Probe and Remote-mounted Transmitter*



*Probe and Probe-mounted Transmitter*



*Modular Construction*

## Endura AZ20 oxygen monitor

Combustion gas analysis

### Easy Cell Release

The Endura AZ20 probe has retained the easy-access cell arrangement of the previous generation ZFG2 probes. Cell replacement can be performed on-site using basic hand tools; even after long periods of high temperature operation where screw threads have 'seized' and can no longer be released.

Kits containing all the parts needed to complete maintenance are available from ABB to ensure a technician can perform services quickly, efficiently and at minimum cost.

### Proven Cell Design

ABB's metallurgically bonded, multi-layer electrode technology increases the cell's resistance to sulphurous and reducing atmospheres and high temperature operation. This extends the life-cycle of the cell in the most arduous applications such as sulphur recovery processes, crematoria and industrial/clinical waste incineration.



*Zirconia Cell*

### Optional Flow Rate Control to the Sensor

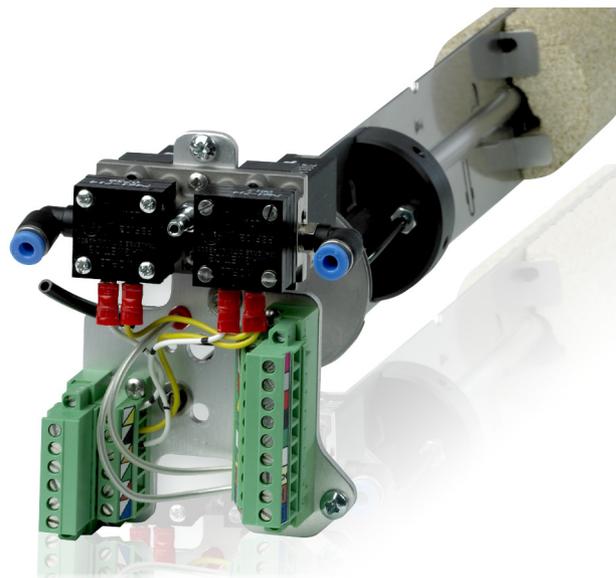
The correct flow rate of test gas and reference air is essential to ensure the accurate operation of Zirconia-based AZ20 oxygen analyzers.

This is achieved using one of two options:

- using flow restrictors (no flowmeters required):
  - flow restrictors fitted in the sensor head guarantee the correct flow of test gases and reference air by applying the gases / air to the probe at a fixed pressure of 15 psi (1.0 bar)
- using flowmeters (no restrictors):
  - the Endura AZ20 uses flow meters with flow control valves to regulate the flow of test gases and reference air into the sensor

### Unique Integrated Automatic Calibration

The all new Endura AZ20 automatic calibration system eliminates the need for the expensive ancillary equipment required for automatic calibration on traditional flue gas oxygen analyzer systems. ABB's fully integrated, automatic calibration feature controls the test gas sequence and detects test gas availability, eliminating incorrect calibrations due to loss of test gas.



*Advanced Automatic Calibration Facility*

Integrated automatic calibration secures the oxygen measurement, providing complete confidence in the analyzer's performance.

Long-term operation without technician intervention minimizes operating costs, total cost-of-ownership, optimizes system accuracy and contributes to the CEMS (Continuous Emissions Monitoring Compliance). A significant proportion of service visits to an analyzer result in 'no fault found'. Endura AZ20's high-quality manufacture, advanced diagnostics and fully-integrated, automatic calibration is targeted at reducing this wasted effort and cost.

The AutoCal option can be used with or without the flow restrictors option.

## Advanced Transmitter

The Endura AZ20 transmitter incorporates the most up-to-date design and technology available today.

ABB's universal human/machine interface (HMI) with its large, clear, backlit graphical display, 'through-the-glass' control and intuitive menu structure simplifies transmitter configuration and operation.

The user-friendly interface enables fast, easy data entry for all parameters and the 'Easy Setup' menu speeds and simplifies system commissioning.

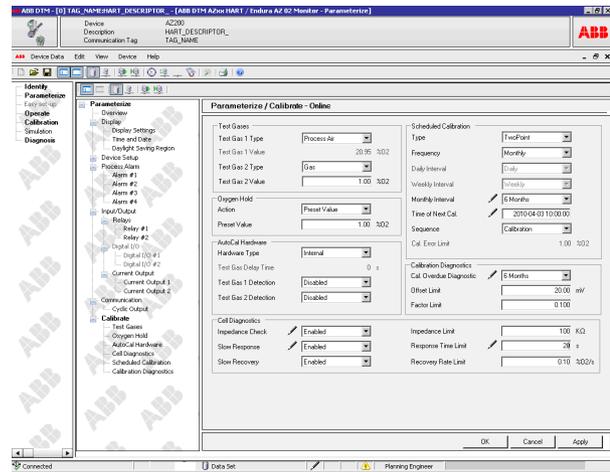
Advanced diagnostics, in accordance with NAMUR NE107, classify alarms and warnings as 'Maintenance Required', 'Check Function', 'Failure' and 'Out-of-Specification'. Cell performance is monitored by the transmitter; indicators such as cell impedance, rate-of-response to test gasses and changes in calibration offset/factor are recorded and analyzed. The current cell 'quality' is displayed by the transmitter as a visual indication of the measurement confidence; providing the operator all the information required to keep the monitor operating at peak performance.

The Performance Log holds up to 100 time-stamped events. When the log is full, the oldest data is overwritten by new entries. The log contains details of measurements and coefficients for all calibrations and accuracy checks.

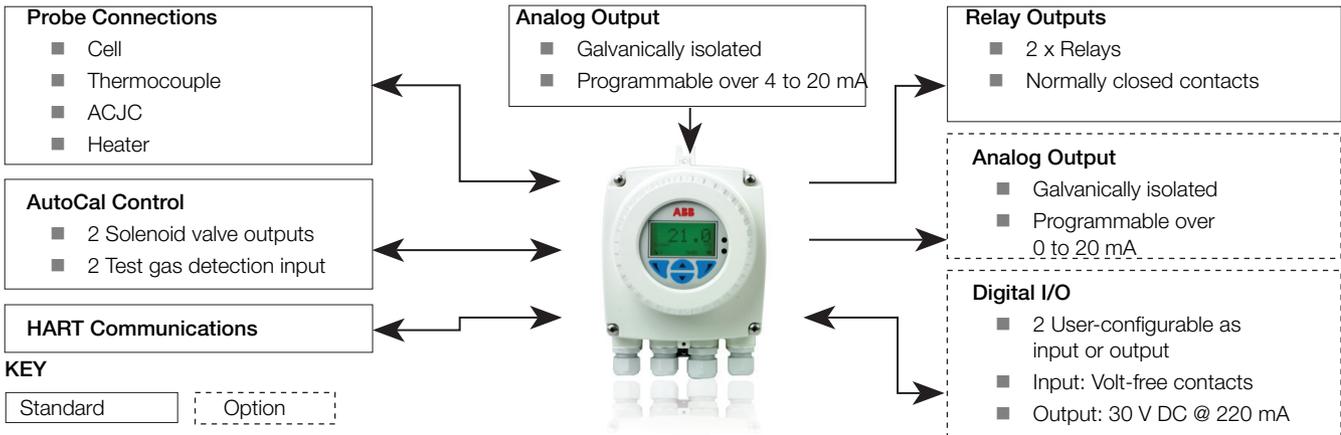
2 Relay outputs and a traditional analog output are fitted as standard, with the option of adding a second analog output or 2 digital inputs/outputs (I/O).

The Endura AZ20 transmitter is equipped with HART communication as standard, supported by a full Device Type Manager (DTM) to enable remote access to the analyzer through a user-friendly graphical interface. The DTM provides full access to the transmitter setup, logged data and diagnostics information as well as live data.

The IrDA standard infrared communication port can also be used with the DTM to upload and download device configurations. In addition, it enables data logged values and diagnostics to be viewed on a hyperterminal interface or a PC. The device's firmware can also be upgraded using this port.

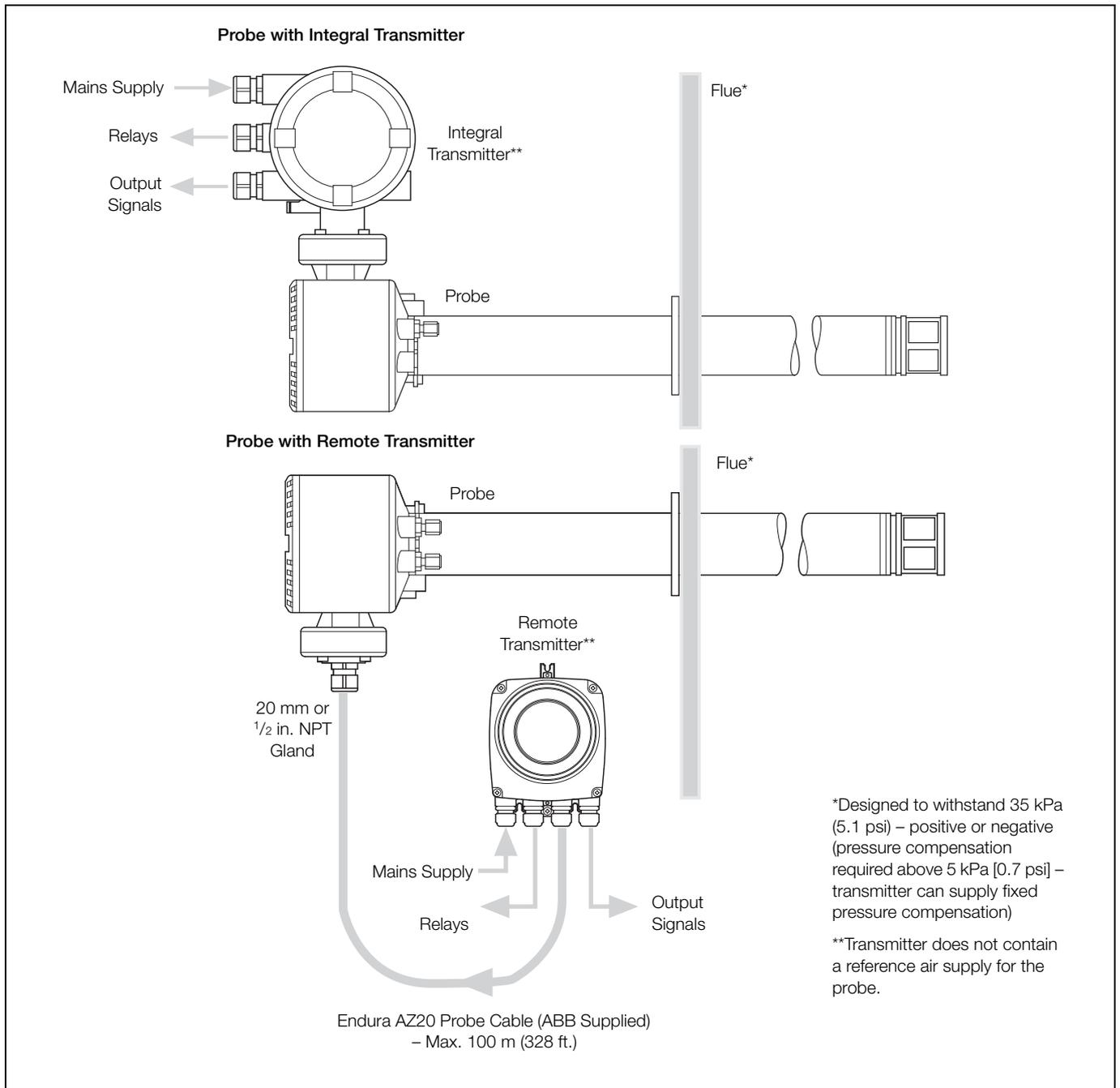


DTM Graphical Interface



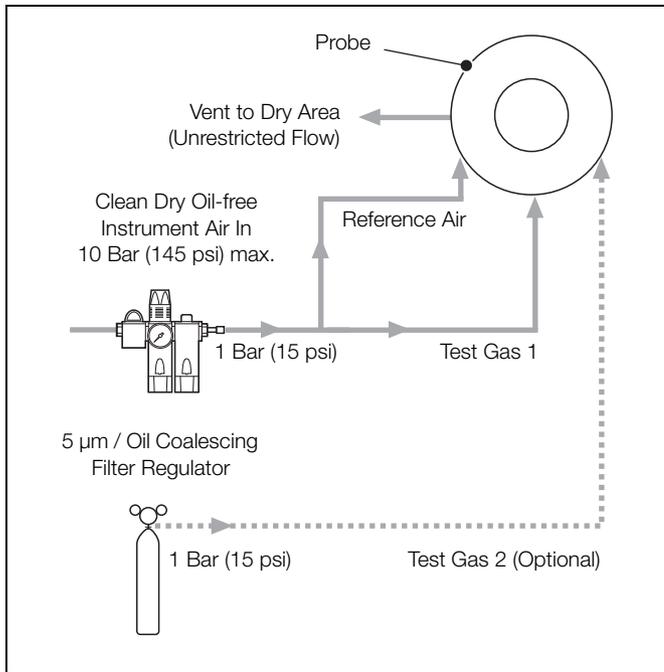
## Transmitter Options

There are 2 Endura AZ20 transmitter options – probe with integral transmitter and probe with remote transmitter:

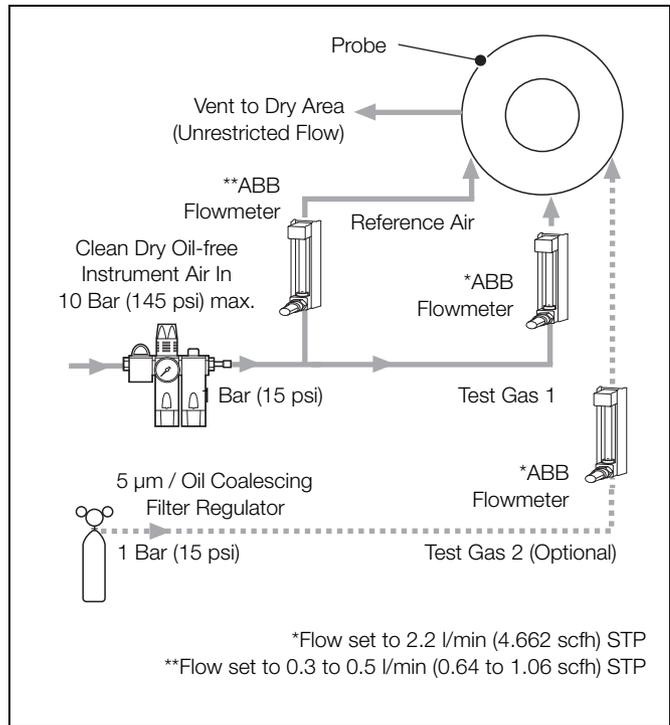


Endura AZ20 Transmitter Options

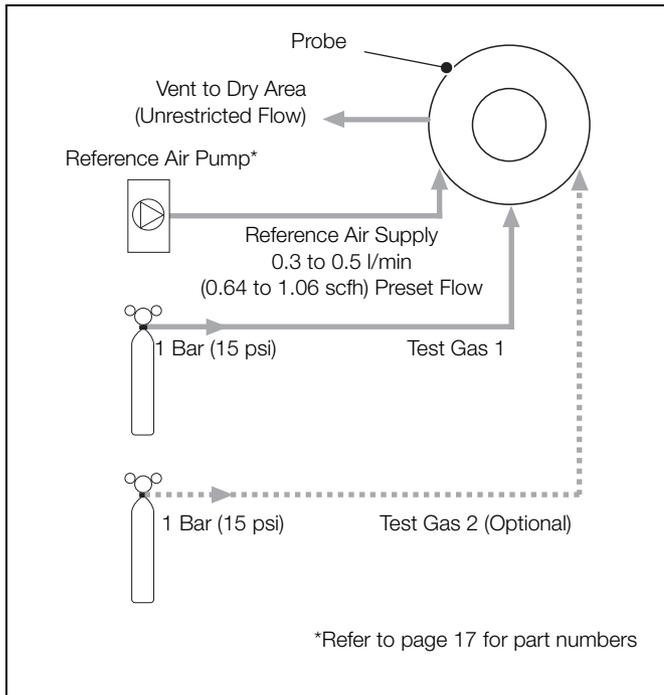
Test Gas and Reference Air Supply Configurations – Automatic Calibration (AutoCal) Systems



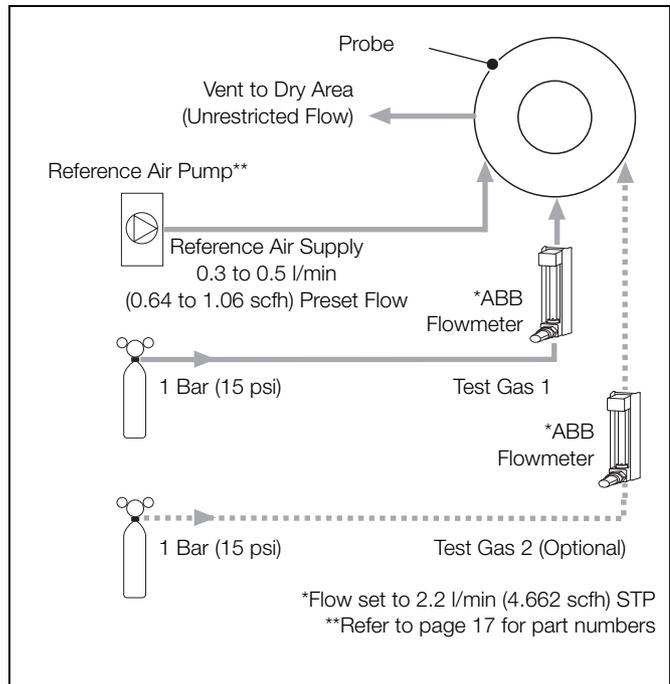
AutoCal with Air Supply and Restrictors



AutoCal with Air Supply and no Restrictors

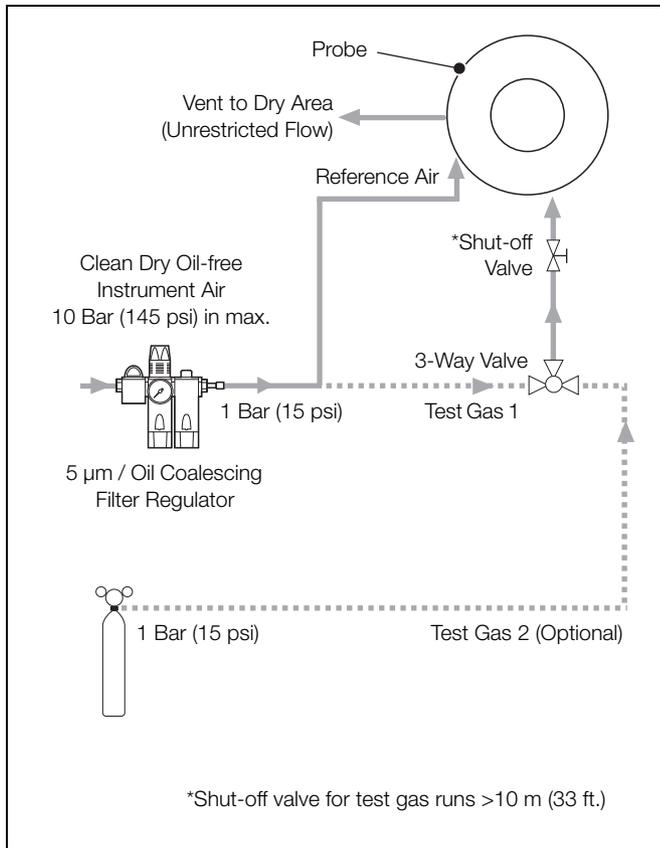


AutoCal with Test Gas(es) and Restrictors

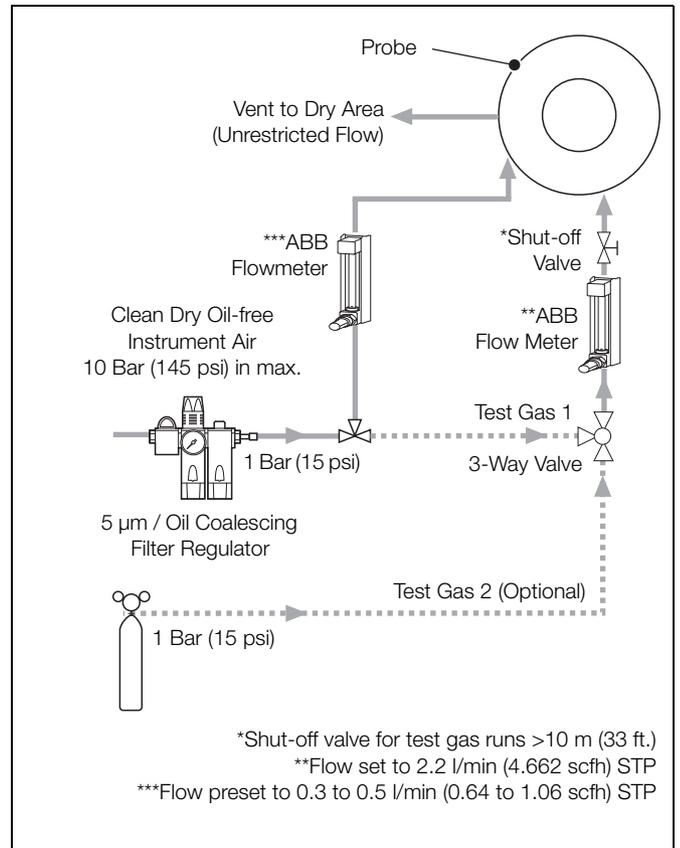


AutoCal with Test Gas(es) and no Restrictors

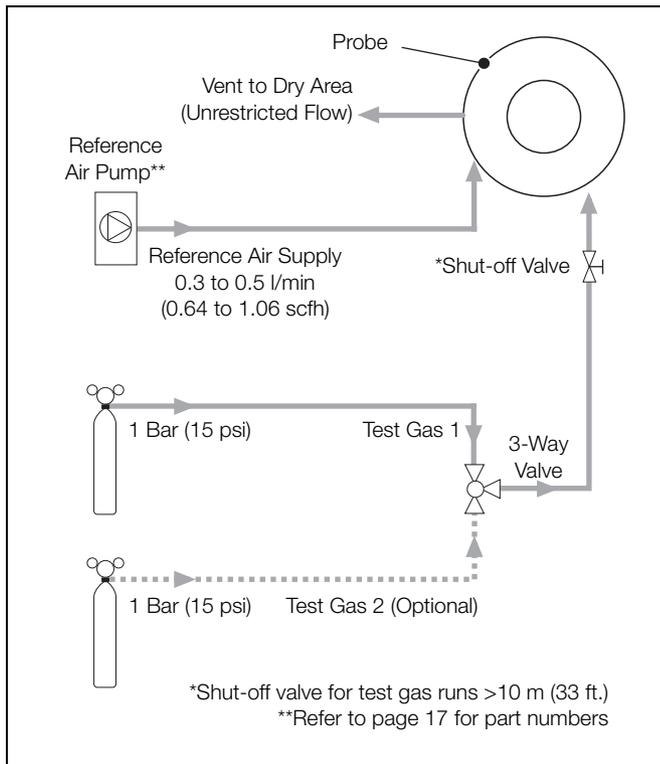
Test Gas and Reference Air Supply Configurations – Non-automatic Calibration (Non-AutoCal) Systems



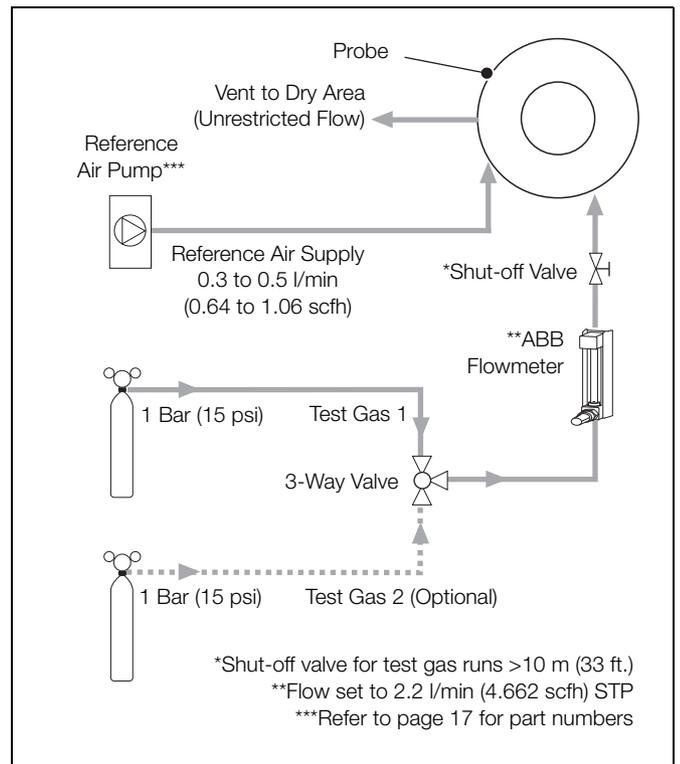
Non-AutoCal with Air Supply and Restrictors



Non-AutoCal with Air Supply and no Restrictors



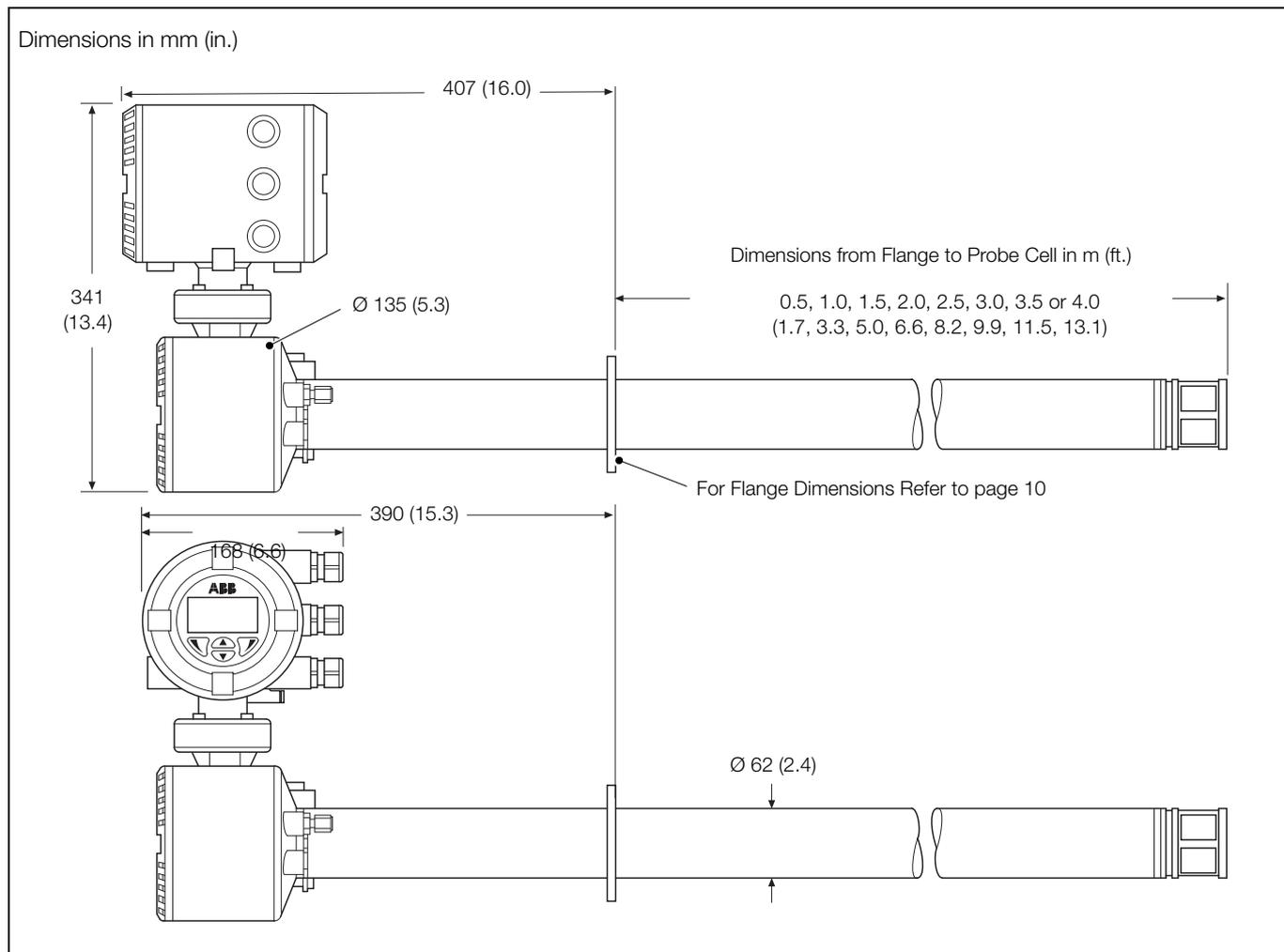
Non-AutoCal with Test Gas(es) and Restrictors



Non-AutoCal with Test Gas(es) and no Restrictors

## Overall Dimensions

### Probe and Integral Transmitter

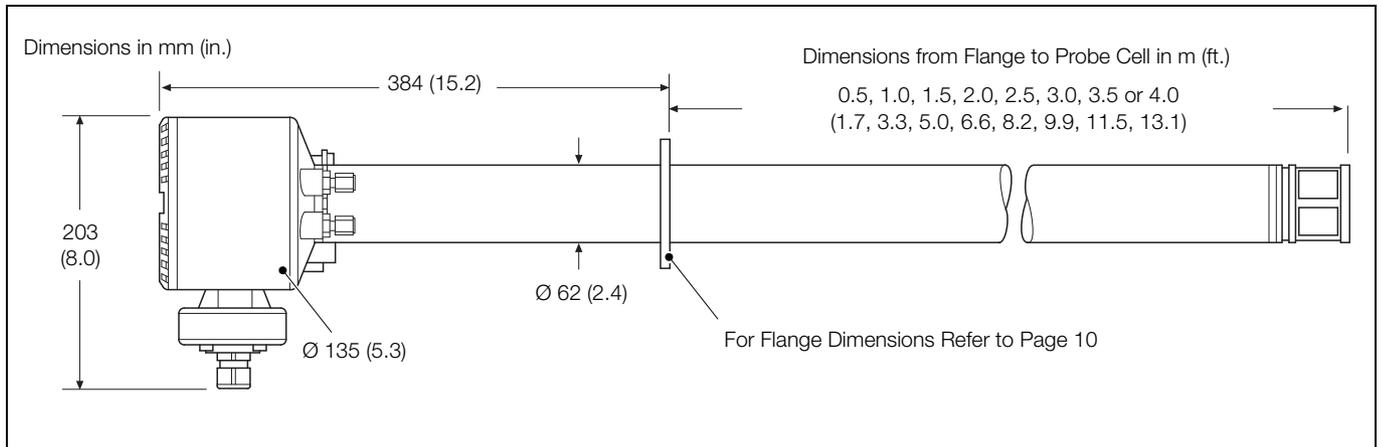


Overall Dimensions – Probe and Integral Transmitter

Length m (ft.)	Unpacked – kg (lb)	Packed – kg (lb)
0.5 (1.7)	12.5 (27.5)	17.72 (39.1)
1.0 (3.3)	14.8 (32.5)	21.43 (47.3)
1.5 (5.0)	17.0 (37.5)	25.14 (55.5)
2.0 (6.6)	19.3 (42.5)	28.35 (63.6)
2.5 (8.2)	21.5 (47.5)	34.17 (75.4)
3.0 (9.9)	23.8 (52.4)	37.38 (83.5)
3.5 (11.5)	26.0 (57.4)	41.59 (91.7)
4.0 (13.1)	28.3 (62.3)	45.30 (99.9)

Weights – Probe and Integral Transmitter

**Remote Probe**

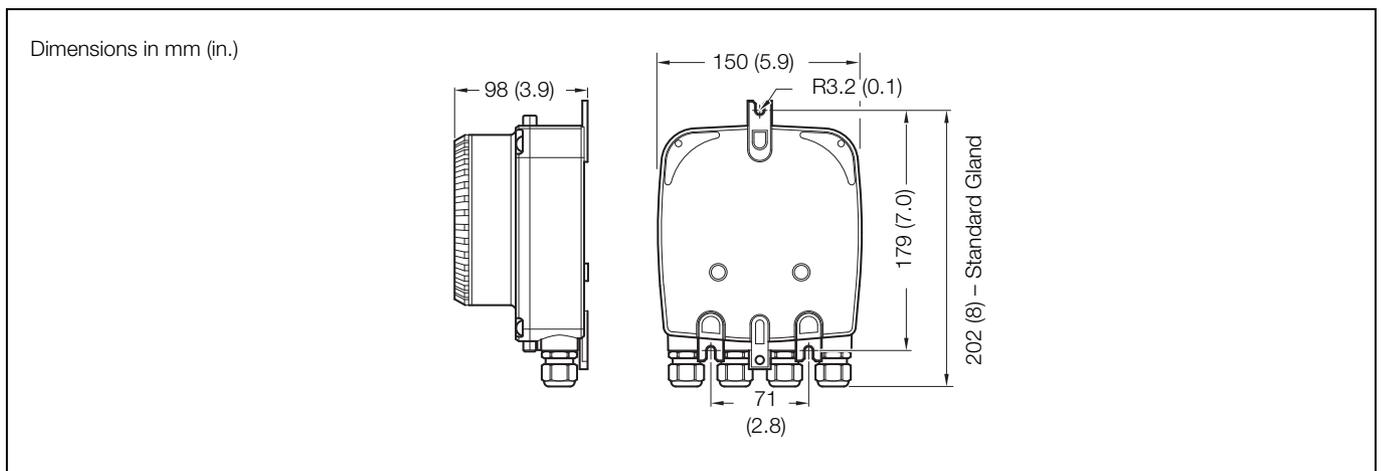


Overall Dimensions – Remote Probe

Length m (ft.)	Probe Only Unpacked – kg (lb)	Packed Only Packed – kg (lb)	Probe and Remote Transmitter Unpacked – kg (lb)	Probe and Remote Transmitter Packed – kg (lb)
0.5 (1.7)	9 (19.9)	14.2 (31.4)	11.5 (25.4)	16.7 (36.9)
1.0 (3.3)	11.3 (24.9)	17.9 (39.6)	13.6 (30.3)	20.5 (45.1)
1.5 (5.0)	13.5 (29.8)	21.7 (47.7)	16.0 (35.3)	24.2 (53.3)
2.0 (6.6)	15.8 (34.8)	25.4 (55.9)	18.3 (40.3)	27.9 (61.4)
2.5 (8.2)	18 (39.7)	30.7 (67.7)	20.5 (42.2)	33.2 (73.2)
3.0 (9.9)	20.3 (44.7)	34.4 (75.8)	22.8 (50.2)	36.9 (81.3)
3.5 (11.5)	22.5 (49.6)	38.1 (84.0)	25.0 (55.2)	40.6 (89.5)
4.0 (13.1)	24.8 (54.6)	41.8 (92.2)	27.3 (60.1)	44.3 (97.7)

Weights – Remote Probe

**Remote Transmitter**



Overall Dimensions – Remote Transmitter (Standard Gland Shown)

## Probe Flanges (All Probe Lengths) and Mounting Plates for Standard Probe Flanges

Dimensions in mm (in).

**Note.** The pressure ratings for these flanges do not apply.

Flange Type	A	B	C (Ø)	D (PCD)
ABB Standard (0.5 m [1.7 ft.] probes only)	101 (3.97)	6 (0.24)	7.3 (0.29)	80 (3.15)
ABB Standard	165 (6.50)	12 (0.47)	12.5 (0.50)	140 (5.51)

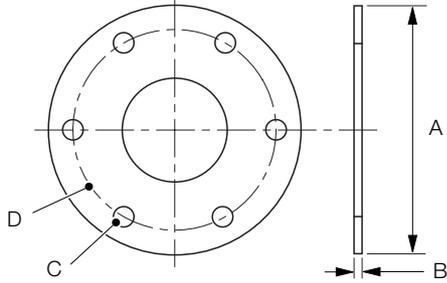
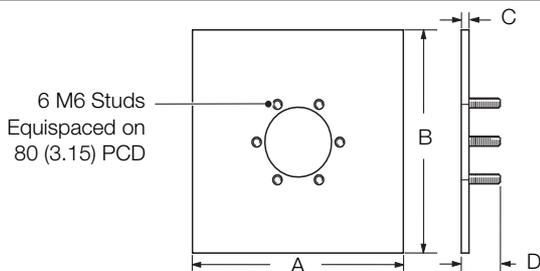


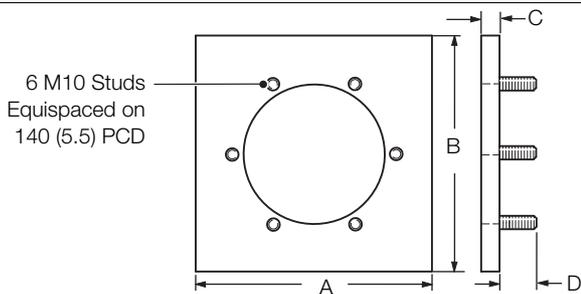
ABB Probe Flange Types, Dimensions

Mounting Plate	A	B	C	D
0.5 m (1.7 ft.)	160 (6.3)	160 (6.3)	7 (0.27)	16 (0.63)
1.0 to 4.0 m (3.3 to 13.1 ft.)	203 (8.0)	203 (8.0)	20 (0.79)	32 (1.26)

Comprising: mounting plate, gasket, 6 each: M6/M10 shakeproof washers, plain washers and nuts.



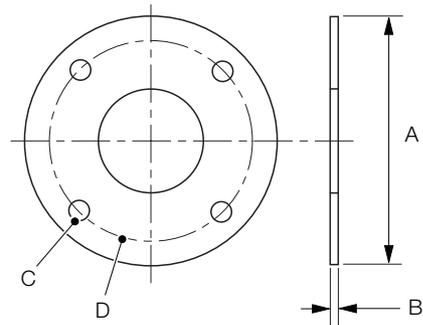
Standard mounting plate for 0.5 m (1.7 ft.) probe – Part No. AZ200 796



Standard mounting plate for 1.0 to 4 m (3.3 to 13.1 ft.) probes – Part No. AZ200 795

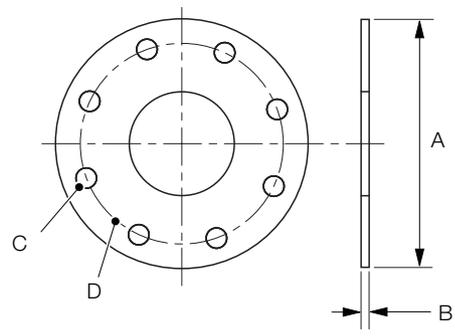
ABB Flange Mounting Plates

Flange Type	A	B	C (Ø)	D (PCD)
ANSI 2 in 150	152.4 (6.00)	12 (0.47)	19 (0.75)	120.6 (4.75)
ANSI 2.5 in 150	177.8 (7.00)	12 (0.47)	19 (0.75)	139.7 (5.50)
ANSI 3 in 150	190.5 (7.50)	12 (0.47)	19 (0.75)	152.4 (6.00)
DIN 65 PN16	185 (7.28)	12 (0.47)	18 (0.70)	145 (5.70)
JIS 65 5K	155 (6.10)	12 (0.47)	15 (0.59)	130 (5.12)
JIS 80 5K	180 (7.08)	12 (0.47)	19 (0.75)	145 (5.71)



4-Hole Probe Flange Types and Dimensions

Flange Type	A	B	C (Ø)	D (PCD)
ANSI 4 in 150	228.6 (9.0)	12 (0.47)	19 (0.75)	190.5 (7.50)
DIN 80 PN16	200 (7.87)	12 (0.47)	18 (0.70)	160 (6.30)
DIN 100 PN16	220 (8.66)	12 (0.47)	18 (0.70)	180 (7.08)
JIS 100 5K	200 (7.87)	12 (0.47)	19 (0.75)	165 (6.50)

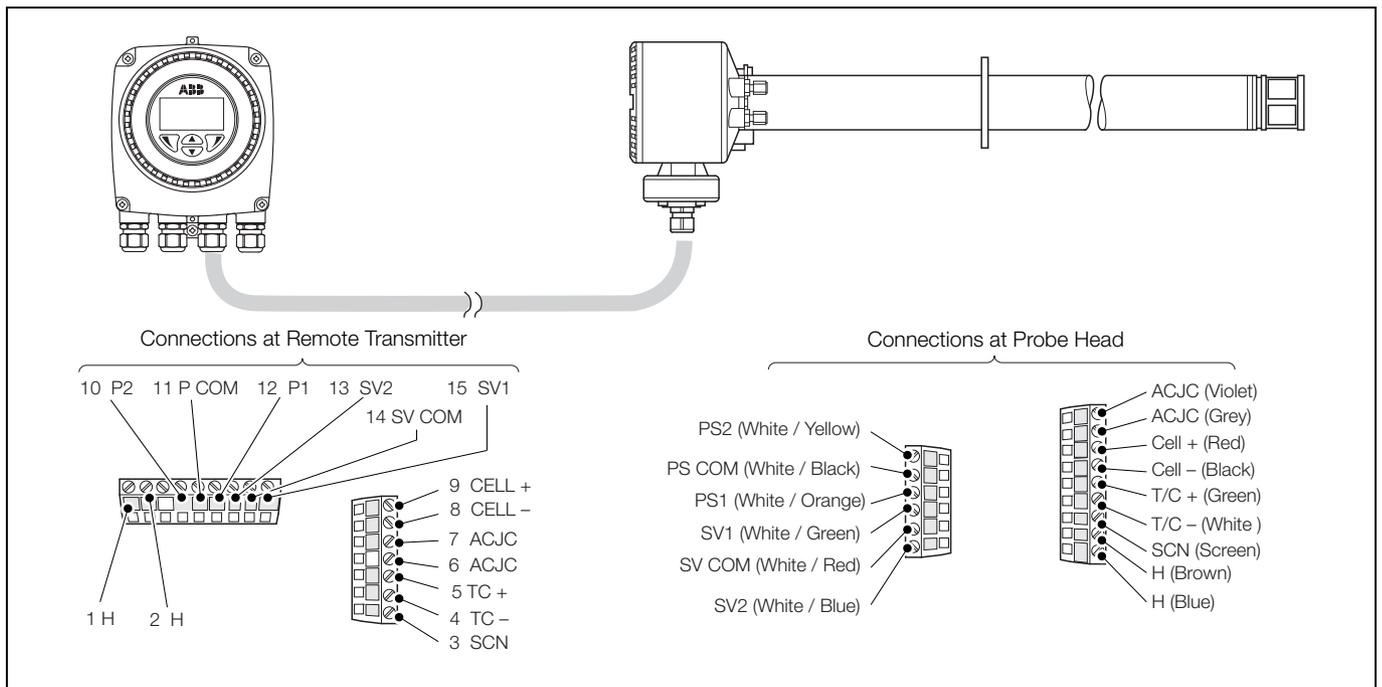


8-Hole Probe Flange Types and Dimensions

### Electrical Connections – Remote Transmitter to Probe

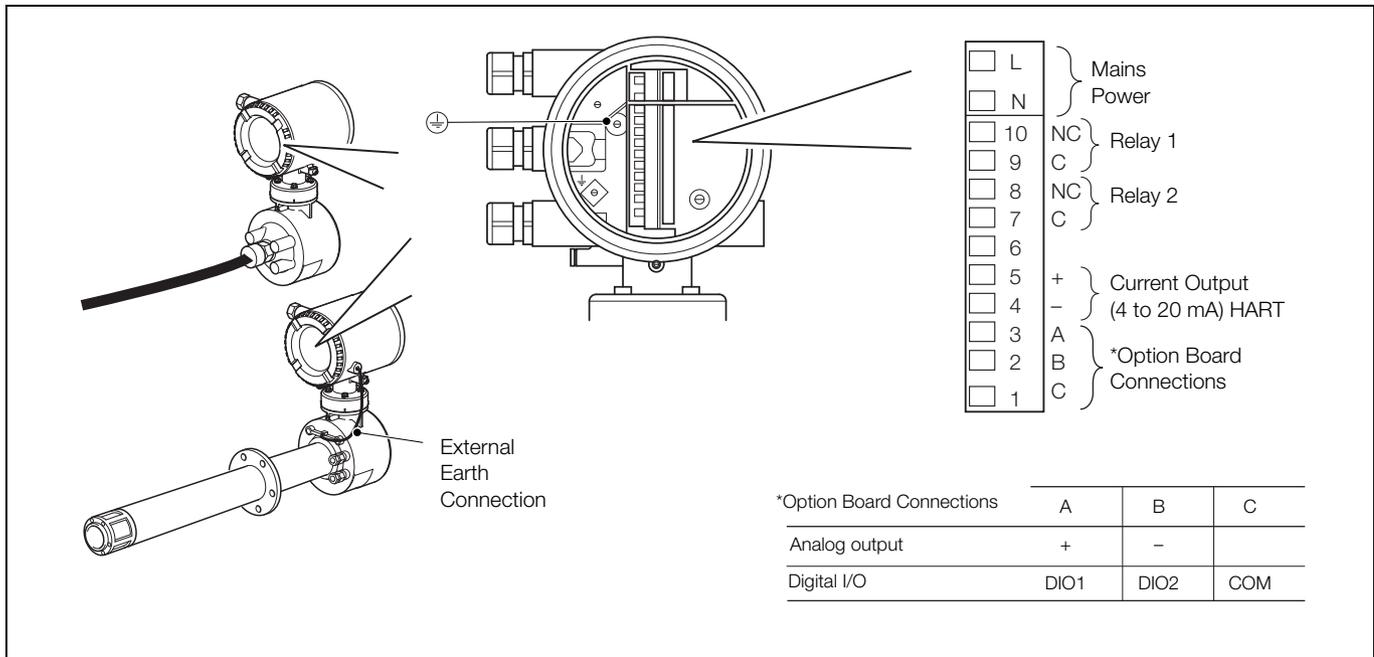
Transmitter Terminal No.	Probe Terminal Color Label	Tag ID	Connection Type	Cable Color Code
1	Brown	H	Heater	Brown
2	Blue	H	Heater	Blue
3	Light Yellow (SCN)	SCN	Screen	Screens
4	White	T/C –	Thermocouple (–ve)	White
5	Green	TC+	Thermocouple (+ve)	Green
6	Grey	ACJC	PT1000 Cold Junction Compensation	Grey
7	Violet	ACJC		Violet
8	Black	CELL –	Oxygen Input (–ve)	Black
9	Red	CELL +	Oxygen Input (+ve)	Red
10	White/Yellow	PS2	Pressure Switch – Gas 2	White/Yellow
11	White/Black	P COM	Pressure Switch – Common	White/Black
12	White/Orange	PS1	Pressure Switch – Gas 1	White/Orange
13	White/Blue	SV2	Solenoid Valve – Gas 2	White/Blue
14	White/Red	SV COM	Solenoid Valve – Common	White/Red
15	White/Green	SV1	Solenoid Valve – Gas 1	White/Green

Transmitter to Probe Connections



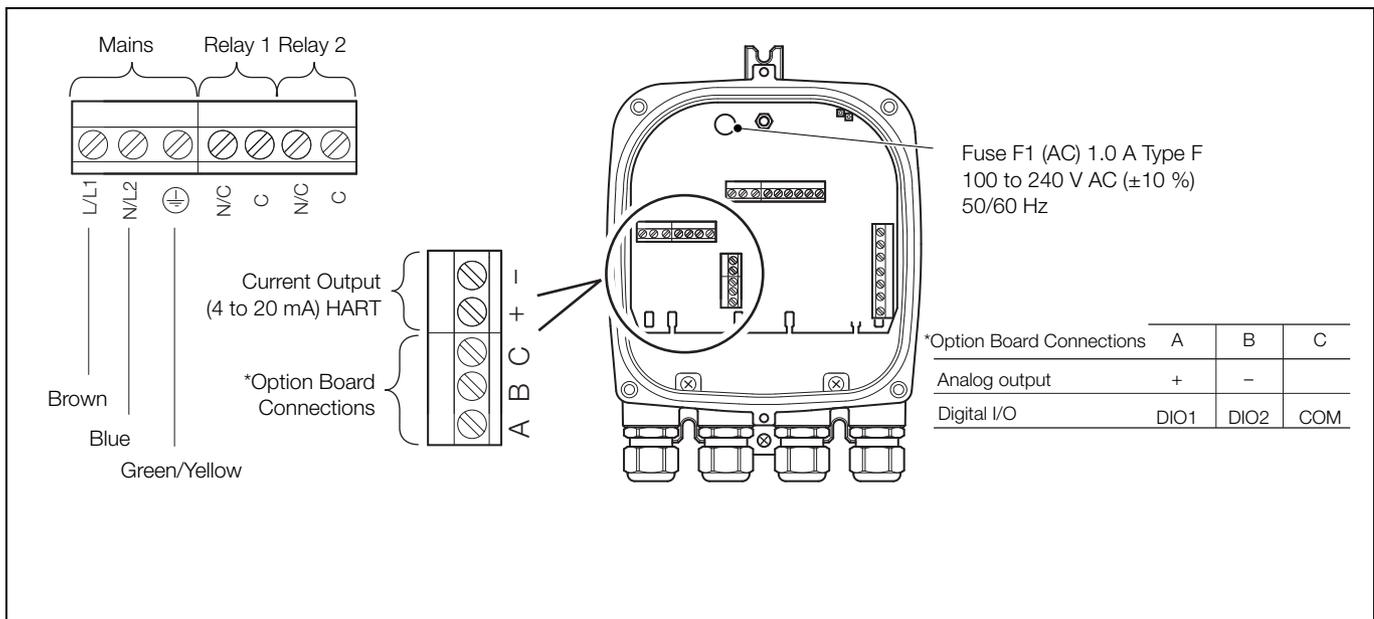
Electrical Connections – Remote Transmitter and Probe

## Integral Transmitter – Power Supply and Output Connections



Integral Transmitter – Power Supply and Output Connections

## Remote Transmitter – Power Supply and Output Connections



Remote Transmitter – Power Supply and Output Connections

## System Specification

---

### Measurement Performance

#### Range

0.01 to 100 % O<sub>2</sub>

#### Test gas response time

Initial dead time 3 seconds

T90 < 10 seconds

#### System accuracy

< ±0.75 % of reading or 0.05 % O<sub>2</sub>, whichever is the greater, based on a nominal range of 0.01 to 25 % O<sub>2</sub> or 20 to 100 % O<sub>2</sub>

#### Drift

< ± 1 % maximum % O<sub>2</sub> range value per month (without calibration)

< ± 0.2 % typical

---

### Environmental Data

#### Ambient operating temperature

Transmitter -20 to 55 °C (-4 to 131 °F)

Probe -20 to 70°C (-4 to 158 °F)

#### Storage temperature

-40 to 85 °C (-40 to 185 °F)

#### Operating humidity

Up to 95 % RH, non-condensing

#### Sunlight

Store and operate out of direct sunlight

#### Ingress protection

Probe (excludes remote/integral transmitter) IP66 (NEMA 4X)

Electronics enclosures – remote and integral IP66 (NEMA 4X)

---

### Power Supply

#### AC power supply

100 to 240 V AC ±10 % (90 V min. to 264 V max.) 50 / 60 Hz

#### Electronics

< 10 W

#### Probe heater

< 100 W

---

### EMC

#### Emissions and immunity

Conforms to EN61326-1:2006

---

### Safety

#### General safety

Conforms to EN61010-1: 2001

#### Approvals and safety certification

CE mark

## Probe Specification

### Physical

#### Probe insertion lengths

0.5 m (1.7 ft.)	2.5 m (8.2 ft.)
1.0 m (3.3 ft.)	3.0 m (9.9 ft.)
1.5 m (5.0 ft.)	3.5 m (11.5 ft.)
2.0 m (6.6 ft.)	4.0 m (13.1 ft.)

#### Process connection

All probe lengths:  
ANSI B16.5 150 lb  
2, 2.5, 3, 4 in  
DIN2501 Part 1  
65, 80, 100 mm  
JIS B2238 5K  
NPT  
(flange pressure ratings do not apply)

0.5 m (1.7 ft.) probes	ABB 500 mm (19.7 in) standard flange
1.0 m (3.3 ft.) and longer	ABB 1000 mm (39.4 in) standard flange

#### Probe body material

316L stainless steel

#### Mounting angle

Horizontal to vertically down

**Note.** Horizontally-mounted probes greater than 2.0 m (6.6 ft.) in length may need to be supported.

### Process Conditions

#### Standard process temperature

All probe lengths\*      -20 to 800 °C (-4 to 1472 °F)

#### Process pressure

Designed to withstand 35 kPa (5.1 psi) – positive or negative  
(pressure compensation required above 5 kPa (0.7 psi) – transmitter  
can apply fixed pressure compensation)

\* For > 2 m (6.6 ft.) probes, special conditions may apply

### Operating requirements

#### Reference air

Regulated supply	Probes with restrictors	1 bar (15 psi), flowmeters not required
	Probes without restrictors	1 bar (15 psi) flowmeters required with flow set to 0.3 to 0.5 l/min (0.64 to 1.06 scfh)
Pumped supply	Probes with / without restrictors	Preset flow 0.3 to 0.5 l/min (0.64 to 1.06 scfh)

#### Test gas

User-selectable, 100 to 0.1 % O<sub>2</sub> balance N<sub>2</sub> and/or air  
(air is recommended as one of the test gases)

Probes with restrictors	1 bar (15 psi) – flowmeters not required as restrictors preset flow to 2.2 l/min (4.662 scfh)
Probes without restrictors	1 bar (15 psi) flowmeters required, set to 2.2 l/min (4.662 scfh) flow

#### Calibration

Manual, semi-automatic or automatic  
(controlled by Endura AZ20 transmitter)

### Automatic calibration

#### AutoCal hardware

Optional built-in solenoid valves for control of test gas flow  
Built-in pressure switches to detect presence of test gases

### Heater Operational Requirements

#### AZ20 Probe

Nominally 190 Ω, 70 W at 115 V AC – power is limited to 70 W max.  
by AZ20 transmitter over an 85 to 265 V AC range

#### AZ20 / ZFG2 Replacement Probe

Nominally 25 Ω, 120 W at 55 V AC – for use only with a ZDT analyzer  
or ZMT transmitter

## Transmitter Specification

---

### Transmitter enclosures

#### Remote

- Wall-, pipe- or stand-mounted
- 4 gland entries
- Optional 1/2 in NPT, M20

#### Integral

- Head-mounted
- 3 gland entries
- Optional 1/2 in NPT, M20

---

### Automatic calibration

#### AutoCal hardware

- Isolated solenoid valve control as standard, 24 V @ 2 W per valve\*
- Dedicated isolated digital inputs to monitor pressure switch contacts as standard – voltage-free, normally closed with gas present

---

### Display and switches

#### Display type

- Graphical 128 x 64 pixel LCD

#### Display backlight

- Green LED

#### Operator switches

- 4 capacitive switches  
(operated through the front glass)

---

### Relay outputs

#### Number

- 2 standard

#### Type

- Normally closed
- 5 A @ 230 V AC or 30 V DC (non-inductive)

#### Functions

- User-configurable – can be activated by one or more of the following signals:

- Process alarm 1, 2, 3, 4
- Calibration in progress
- Calibration failed
- Out of test gas 1, 2
- Test gas 1 valve control
- Test gas 2 valve control
- Failure diagnostic
- Out-of-specification diagnostic
- Maintenance required diagnostic
- Function check diagnostic

\*For driving internal automatic calibration (AutoCal) probes or can be used to drive external calibration units on remote transmitters only.

---

### Analog outputs

#### Standard

- 1 isolated current output
- Programmable to retransmit oxygen (linear or logarithmic) or temperature
- Programmable over 4 to 20 mA
- Over-range capability to indicate system failure programmable from 4 to 22 mA

#### Optional

- 1 isolated current output
- Programmable to retransmit oxygen (linear or logarithmic) or temperature
- Programmable over 0 to 20 mA
- Over-range capability to indicate system failure programmable from 0 to 22 mA

---

### Digital inputs/outputs

#### Number

- 2 (optional)

#### Type

- User-configurable as either input or output

#### Input

- Volt-free contact

#### Output

- Transistor switch capable of sinking 220 mA
- Low output, < 2 V DC
- Switch voltage 30 V DC maximum

#### Isolation

- Not isolated from each other or from other circuitry

#### Input functions

- User-configurable for:
  - Automatic calibration start
  - Automatic calibration stop
  - Automatic calibration start/stop

#### Functions

- User-configurable – can be activated by one or more of the following signals:
  - Process alarm 1, 2, 3, 4
  - Calibration in progress
  - Calibration failed
  - Out of test gas 1
  - Out of test gas 2
  - Test gas 1 valve control
  - Test gas 2 valve control
  - Failure diagnostic
  - Out-of-specification diagnostic
  - Maintenance required diagnostic
  - Function check diagnostic

## ...Transmitter Specification

### Hart communications

#### Version

5.7 as standard

#### Integration

Device Type Manager (DTM) and Electronic Device Description (EDD)  
Provide online/offline device configuration, online monitoring of measurement values and diagnostic states

#### DTM

FDT v1.2.1 compliant  
Works with FDT framework packages  
(for example, ABB Asset Vision Basic)

#### EDD

Compliant with suitable framework tools  
(for example, SDC 625 and Simatic PDM tools)

### Infrared service port

#### Accessibility

Through front face

#### Type

IrDA standard

#### Baud rate

Up to 115K baud

#### Functions

Firmware update  
Remote HMI  
Diagnostic log download  
Datalog output  
HART via IrDA

### Languages

English

### Calibration

#### Manual calibration

1 point (offset)  
1 point (factor)  
2 point (offset + factor)

#### Automatic calibration

1 point (offset)  
2 point (offset + factor)

#### Calibration control

Front panel controls  
Digital inputs  
HART commands  
User-defined schedule

#### Calibration scheduler

User-defined schedule enables automatic calibration frequency to be set from 1 day to 12 months

## Part Numbers for Endura AZ20 and AZ20/ ZFG2 Replacement Heaters, Thermocouple / Electrode Assemblies & ABB Flowmeters

Probe Length	Part Number
0.5 m (1.7 ft.)	AZ200 710
1.0 m (3.3 ft.)	AZ200 711
1.5 m (5.0 ft.)	AZ200 712
2.0 m (6.6 ft.)	AZ200 713
2.5 m (8.2 ft.)	AZ200 714
3.0 m (9.9 ft.)	AZ200 715
3.5 m (11.5 ft.)	AZ200 716
4.0 m (13.1 ft.)	AZ200 717

Endura AZ20 – Standard Heater Assembly

Probe Length	Part Number
0.5 m (1.7 ft.)	AZ200 701
1.0 m (3.3 ft.)	AZ200 702
1.5 m (5.0 ft.)	AZ200 703
2.0 m (6.6 ft.)	AZ200 704
2.5 m (8.2 ft.)	AZ200 705
3.0 m (9.9 ft.)	AZ200 706
3.5 m (11.5 ft.)	AZ200 707
4.0 m (13.1 ft.)	AZ200 708

Thermocouple / Electrode Assembly

Probe Length	Part Number
0.5 m (1.7 ft.)	AZ200 720
1.0 m (3.3 ft.)	AZ200 721
1.5 m (5.0 ft.)	AZ200 722
2.0 m (6.6 ft.)	AZ200 723

Endura AZ20 / ZFG2 Replacement Probe – Heater Assembly

Flowmeter Type	Part Number
<sup>1</sup> / <sub>4</sub> NPT Flowmeter (Reference Air): 0.1 to 0.85 l/min (0.21 to 1.8 scfh) STP	AZ200 786
<sup>1</sup> / <sub>4</sub> BSP Flowmeter (Reference Air): 0.1 to 0.85 l/min (0.21 to 1.8 scfh) STP	AZ200 787
<sup>1</sup> / <sub>4</sub> NPT Flowmeter (Test Gas): 0.6 to 4.4 l/min (1.27 to 9.32 scfh) STP	AZ200 788
<sup>1</sup> / <sub>4</sub> BSP Flowmeter (Test Gas): 0.6 to 4.4 l/min (1.27 to 9.32 scfh) STP	AZ200 789

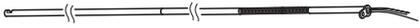
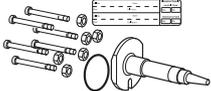
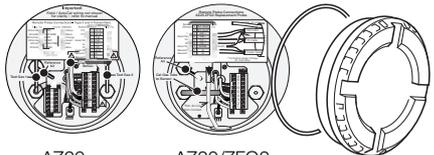
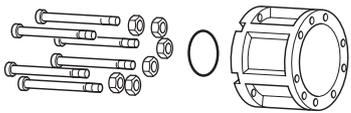
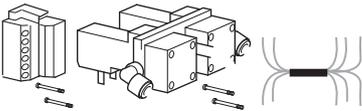
ABB Flowmeters NPT/BSP

## Spares and Accessories

### Documentation and Software

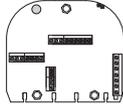
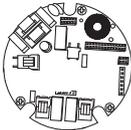
Part No.	Description
IM/AZ20M-EN	<p>Maintenance Guide</p>  <p>Download* the guide from: <a href="http://www.ABB.com/analytical-instruments">www.ABB.com/analytical-instruments</a></p> <p>*Enter this address in your browser and then type <b>IM/AZ20M-EN</b> in the search box – the Maintenance Guide is the top link.</p>
AZ20 DTM Software	Device Type Manager – please contact ABB for details

### Probe Spares

Part No.	Description
Length dependant – see page 16 for part numbers	<p>Thermocouple / Electrode Assembly</p> 
Length dependant – see page 16 for part numbers	<p>AZ20 Standard Heater Assembly AZ20/ZFG2 Replacement Heater Assembly</p> 
AZ200 700	<p>Cell Assembly – includes C-ring and Commissioning label</p> 
AZ200 727	<p>Restrictor Upgrade Kit</p> 
AZ200 728	<p>Probe End Cap – includes wiring labels</p>  <p>AZ20 Version      AZ20/ZFG2 Replacement Version</p>
AZ200 729	<p>Diffuser Flame Arrestor Assembly – includes C-ring</p> 
AZ200 730	<p>AutoCal Upgrade Assembly</p> 

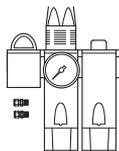
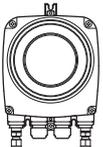
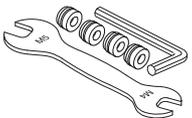
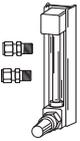
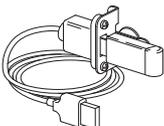
### Transmitter Spares

Part No.	Description
AZ200 750	Standard
AZ200 751	Standard + Analog O/P
AZ200 752	Standard + Digital O/P
AZ200 758	Remote (Type 4) Transmitter Backplane
AZ200 757	Integral (Type 3) Transmitter Backplane

### Accessories

Part No.	Description
AZ200 731	Coalescing Filter-Regulator
AZ200 732	1/4 NPT 5 µm
AZ200 770	ABB Reference Air Pump
AZ200 771	1/4 BSP (Metric) 230 V AC 50 / 60 Hz
AZ200 772	1/4 NPT (Imperial) 230 V AC 50 / 60 Hz
AZ200 773	1/4 NPT (Imperial) 115 V AC 50 / 60 Hz
AZ200 798	Probe Tool Kit* NPT (AZ20)
AZ200 799	BSP (AZ20) *Included with probe as standard
Application dependant – see page 16 for part numbers	ABB Flowmeter
AZ200 785	USB to IrDA Adaptor Kit

## Ordering information – Endura AZ20 Probe/Transmitter

	AZ20/	Tx			Probe													/STD
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
<b>Transmitter Options</b>																		
None	0																	
Standard	1																	
Standard + 2 <sup>nd</sup> analog output	2																	
Standard + 2 digital inputs/outputs	3																	
<b>Transmitter Entry Type</b>																		
None (no transmitter required)	0																	
Metric (M20)	1																	
Imperial (NPT)	2																	
<b>Transmitter System Type</b>																		
None (no transmitter required)	0																	
Integral	1																	
Remote	2																	
<b>Probe Type</b>																		
None (no probe required)	0																	
Standard	1																	
<b>Probe Entry Type</b>																		
None (no probe required)	0																	
Metric (M20)	1																	
Imperial (NPT)	2																	
<b>Probe System Type</b>																		
None (no probe required)	0																	
Integral	1																	
Remote	2																	
<b>Automatic Calibration</b>																		
None (no probe required)	0																	
No automatic calibration (with flow restrictors)	1																	
No automatic calibration (without flow restrictors)	2																	
Automatic calibration (with flow restrictors)	3																	
Automatic calibration (without flow restrictors)	4																	
<b>Insertion Length</b>																		
None (no probe required)	0	2.5 m (8.2 ft.)		5														
0.5 m (1.7 ft.)	1	3.0 m (9.9 ft.)		6														
1.0 m (3.3 ft.)	2	3.5 m (11.5 ft.)		7														
1.5 m (5.0 ft.)	3	4.0 m (13.1 ft.)		8														
2.0 m (6.6 ft.)	4																	
<b>Flange Type</b>																		
None (no probe required)	0	ANSI 2.5 in flange		6														
ABB standard flange	1	ANSI 3 in flange		7														
DIN 65 mm flange	2	ANSI 4 in flange		8														
DIN 80 mm flange	3	JIS 65 mm flange		9														
DIN 100 mm flange	4	JIS 80 mm flange		A														
ANSI 2 in flange	5	JIS 100 mm flange		B														
<b>Thermocouple Type</b>																		
None (no probe required)	0																	
Type K	1																	
<b>Cell Options</b>																		
None (no probe required)	0																	
Standard cell	1																	
<b>Cable Length</b>																		
None	0	50 m (164 ft.)		4														
5 m (16 ft.)	1	75 m (246 ft.)		5														
10 m (33 ft.)	2	100 m (328 ft.)		6														
25 m (82 ft.)	3																	
<b>Cable Type</b>																		
None	0																	
Standard	1																	
CSA	2																	
<b>Reserved</b>																		
																		0
<b>Certification Option</b>																		
None	0																	
Mcert	4																	
<b>Language</b>																		
English																		
German																		
French																		
Spanish																		
Italian																		

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## Ordering information – ZFG2 Replacement Probe

AZ20/	0	0	0	2	X	2	2	X	X	1	1	X	X	X	X	/STD
<b>Transmitter Options</b>																
None (no transmitter required)	0															
<b>Transmitter Entry Type</b>																
None (no transmitter required)	0															
<b>Transmitter System Type</b>																
None (no transmitter required)	0															
<b>Probe Type</b>																
ZFG2 replacement			2													
<b>Probe Entry Type</b>																
Metric (M20)					1											
Imperial (NPT)					2											
<b>Probe System Type</b>																
Remote						2										
<b>Automatic Calibration</b>																
No automatic calibration (without flow restrictors)							2									
<b>Insertion Length</b>																
0.5 m (1.7 ft.)											1					
1.0 m (3.3 ft.)											2					
1.5 m (5.0 ft.)											3					
2.0 m (6.6 ft.)											4					
<b>Flange Type</b>																
None (no probe required)	0															6
ABB standard flange	1															7
DIN 65 mm flange	2															8
DIN 80 mm flange	3															9
DIN 100 mm flange	4															A
ANSI 2 in flange	5															B
<b>Thermocouple Type</b>																
Type K											1					
<b>Cell Options</b>																
Standard cell																1
<b>Conduit</b>																
None																7
6 metres (20 ft) conduit for ZFG2 replacement probe																8
10 metres (33 ft) conduit for ZFG2 replacement probe																
<b>Reserved</b>																
																0
<b>Certification Option</b>																
None																0
Mcert																4
<b>Language</b>																
English																
German																
French																
Spanish																
Italian																

## Acknowledgements

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HART Communication Foundation

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA722211R1001



Sales



Service



Software

# Endura AZ30 Combustion oxygen monitor

Proven technology for use in hazardous area gases and dusts



## Hazardous area designations – system

### Certification

- ATEX and IECEX
  - Certified for use in Class I Zone 1 and Zone 2 – gas groups IIA, IIB + H<sub>2</sub>, Class II Zone 21 and Zone 22 – dust group IIIC
- FM USA and Canada
  - Certified for use in Class I Division 1 gas groups BCD, Class II Division 1 dust groups EFG

## Low surface temperature

- Safe T4 135 °C (275 °F) surface temperature rating

## Advanced transmitters

- Easy configuration, monitoring and intuitive HMI
- HART communications
- Cell performance logging and diagnostics

## Advanced design and precision manufacturing

- Robust, long-life probe for process temperatures up to 700 °C (1292 °F)
- Proven cell design from over 50 years experience
- Fast response to process variations
- Stable and accurate oxygen measurement

## Unique integrated auto-calibration system

- Easy compliance for emission monitoring regulation
- Reduced installation costs; eliminates requirement for expensive external calibration panel
- Reduced maintenance costs

## Probe lengths up to 2.0 m (6.6 ft.) and industry-standard flange configurations

- Suitable for a wide range of applications
- Extensive installation options

## Easy cell release

- Fully site-serviceable probe
- Easy access to internal components

# Endura AZ30

## Combustion oxygen monitor

### Introduction

The Endura AZ30 is an explosion-proof / flameproof combustion gas analyzer system designed for use in Hazardous Areas. Certification covers not only the terminal housing, but the complete system.

The sensor, based on a zirconium oxide cell, is mounted at the tip of the probe that is inserted in the flue duct. The resulting direct, in situ measurement provides accurate and rapid oxygen reading for combustion control optimization and emissions monitoring.

### Probe lengths up to 2.0 m (6.6 ft.)

A wide range of probe insertion lengths from 0.5 to 2.0 m (1.7 to 6.6 ft.) enable installation to the optimum measuring point for accurate oxygen measurement within the duct.

A comprehensive range of mounting flanges provide simple installation when plant-wide standard flanges are required or when replacing existing probes.

The transmitter can be probe- or remote-mounted at distances of up to 100 m (328 ft.), providing versatile system options for all applications. The probe-mounted transmitter option provides the lowest cost of installation. However, the remote-mounted transmitter provides flexibility when the operationally ideal probe location does not provide easy access for the user.



Fig. 1: Probe and probe-mounted transmitter

### Advanced design

Designed and manufactured to exacting standards, the Endura AZ30 ensures long periods of trouble-free operation in even the most arduous of applications.

The operating process temperature of up to 700 °C (1292 °F) extends system suitability into previously impossible applications and enables optimum probe location within the process.

The modular design, with reduced component count, improves the robustness and reliability of the system and simplifies routine maintenance and servicing.

Complete traceability ensures only the highest quality materials are used in the system's construction and rigorous manufacturing, inspection and testing procedures (to international standard ISO 9001) result in a monitor of superior quality with prolonged probe life.



Fig. 2: Probe and remote-mounted transmitter

## Easy cell release

The Endura AZ30 probe has retained the easy-access cell arrangement of the previous generation ZFG2 probes. Cell replacement can be performed on-site using basic hand tools; even after long periods of high temperature operation where screw threads have 'seized' and can no longer be released. Kits containing all the parts needed to complete maintenance are available from ABB to ensure a technician can perform services quickly, efficiently and at minimum cost.

### Proven cell design

ABB's metallurgically-bonded, multi-layer electrode technology increases the cell's resistance to sulphurous and reducing atmospheres and high temperature operation. This extends the lifecycle of the cell in the most arduous applications such as sulphur recovery processes, crematoria and industrial / clinical waste incineration.



Fig. 3: Zirconia cell

### Test gas / reference air flow rate control using factory-fitted flow restrictors

The factory-fitted flow restrictors regulate the flow rate of test gases and reference air to the sensor by using a fixed supply pressure of 1 bar (15 psi)  $\pm 12\%$ .

The flow restrictors ensure the following conditions:

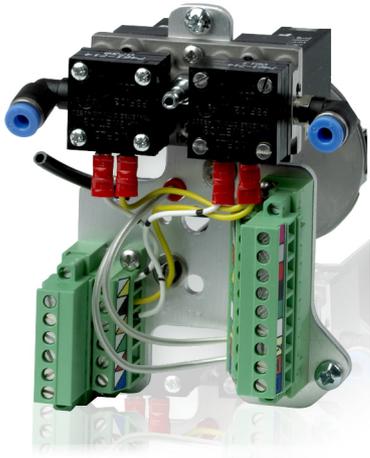
- the correct flow of test gases and reference air into the sensor for correct sensor operation
- prevention of pressurization of the sensor's internal volume above 1.1 bar absolute (44 in. WG) under fault conditions such as internal leaks from the gas lines for certification compliance

# Endura AZ30

## Combustion oxygen monitor

### Unique integrated automatic calibration

The optional automatic calibration system eliminates the need for the expensive ancillary equipment required for automatic calibration on traditional flue gas oxygen analyzer systems. ABB's fully integrated, automatic calibration feature controls the test gas sequence and detects test gas availability, eliminating incorrect calibrations due to loss of test gas.



**Fig. 4: Advanced automatic calibration (AutoCal) system**

Integrated automatic calibration secures the oxygen measurement, providing complete confidence in the monitor's performance.

Long-term operation without technician intervention minimizes operating costs, total cost-of-ownership, optimizes system accuracy and contributes to the CEMS (Continuous Emissions Monitoring Compliance). A significant proportion of service visits to an analyzer result in 'no fault found'. Endura AZ30's high-quality manufacture, advanced diagnostics and fully-integrated, automatic calibration is targeted at reducing this wasted effort and cost.

### Advanced transmitter

The Endura AZ30 transmitter incorporates the most up-to-date design and technology available today.

ABB's universal human machine interface (HMI) with its large, clear, backlit graphical display, 'through-the-glass' control and intuitive menu structure simplifies transmitter configuration and operation.

The user-friendly interface enables fast, easy data entry for all parameters and the 'Easy Setup' menu speeds and simplifies system commissioning.

Advanced diagnostics, in accordance with NAMUR NE107, classify alarms and warnings as 'Maintenance Required', 'Check Function', 'Failure' and 'Out-of-Specification'. Cell performance is monitored by the transmitter; indicators such as cell impedance, rate-of-response to test gasses and changes in calibration offset / factor are recorded and analyzed. The current cell 'quality' is displayed by the transmitter as a visual indication of the measurement confidence; providing the operator all the information required to keep the monitor operating at peak performance.

The Performance Log holds up to 100 time-stamped events. When the log is full, the oldest data is overwritten by new entries. The log contains details of measurements and coefficients for all calibrations and accuracy checks.

2 Relay outputs and a traditional analog output are fitted as standard, with the option of adding a second analog output or 2 digital inputs / outputs (I/O).

The Endura AZ30 transmitter is equipped with HART communication as standard, supported by a full Device Type Manager (DTM) to enable remote access to the analyzer through a user-friendly graphical interface. The DTM provides full access to the transmitter setup, logged data and diagnostics information as well as live data. The IrDA standard infrared communication port can also be used with the DTM to upload and download device configurations. In addition, it enables data-logged values and diagnostics to be viewed on a hyperterminal interface or a PC. The transmitter's firmware can also be upgraded using this port.

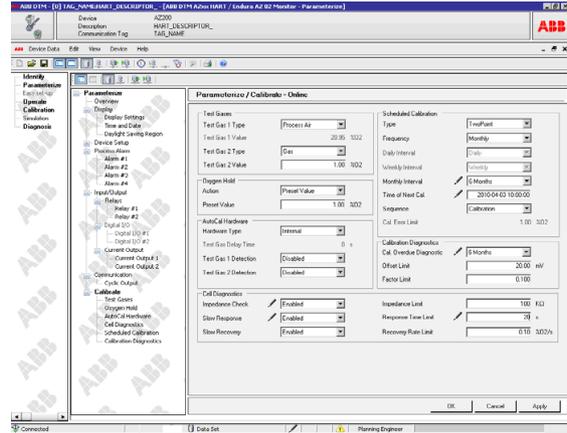
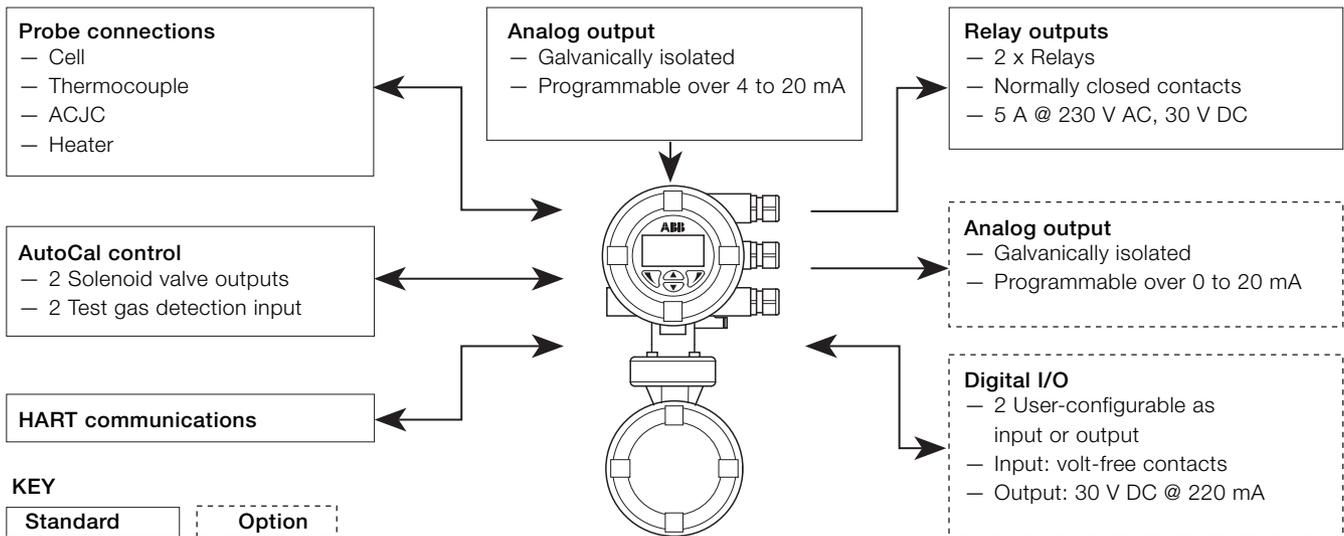


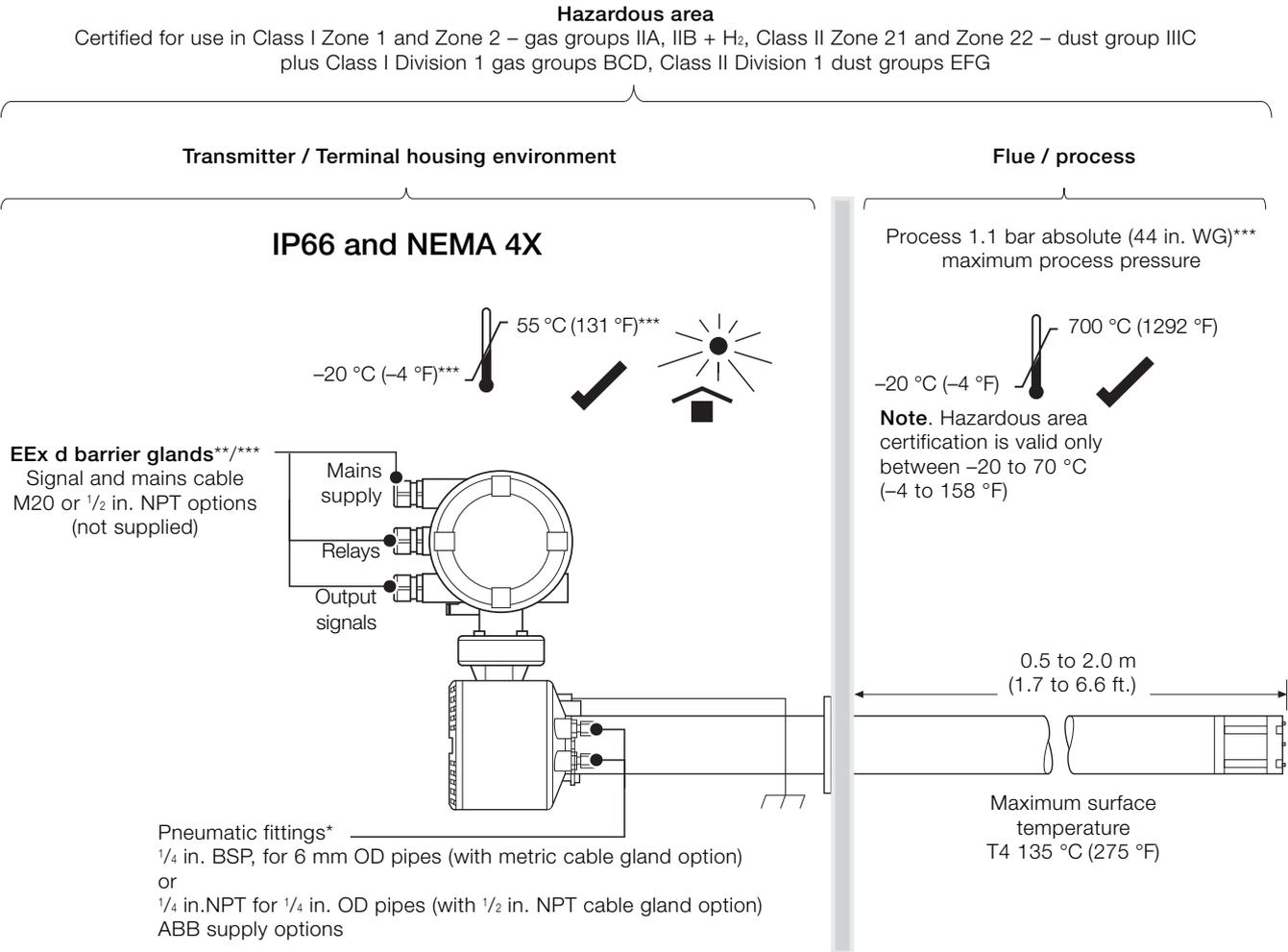
Fig. 5: DTM graphical interface



# Endura AZ30 Combustion oxygen monitor

## AZ30 system options

### Schematic – probe with integral transmitter

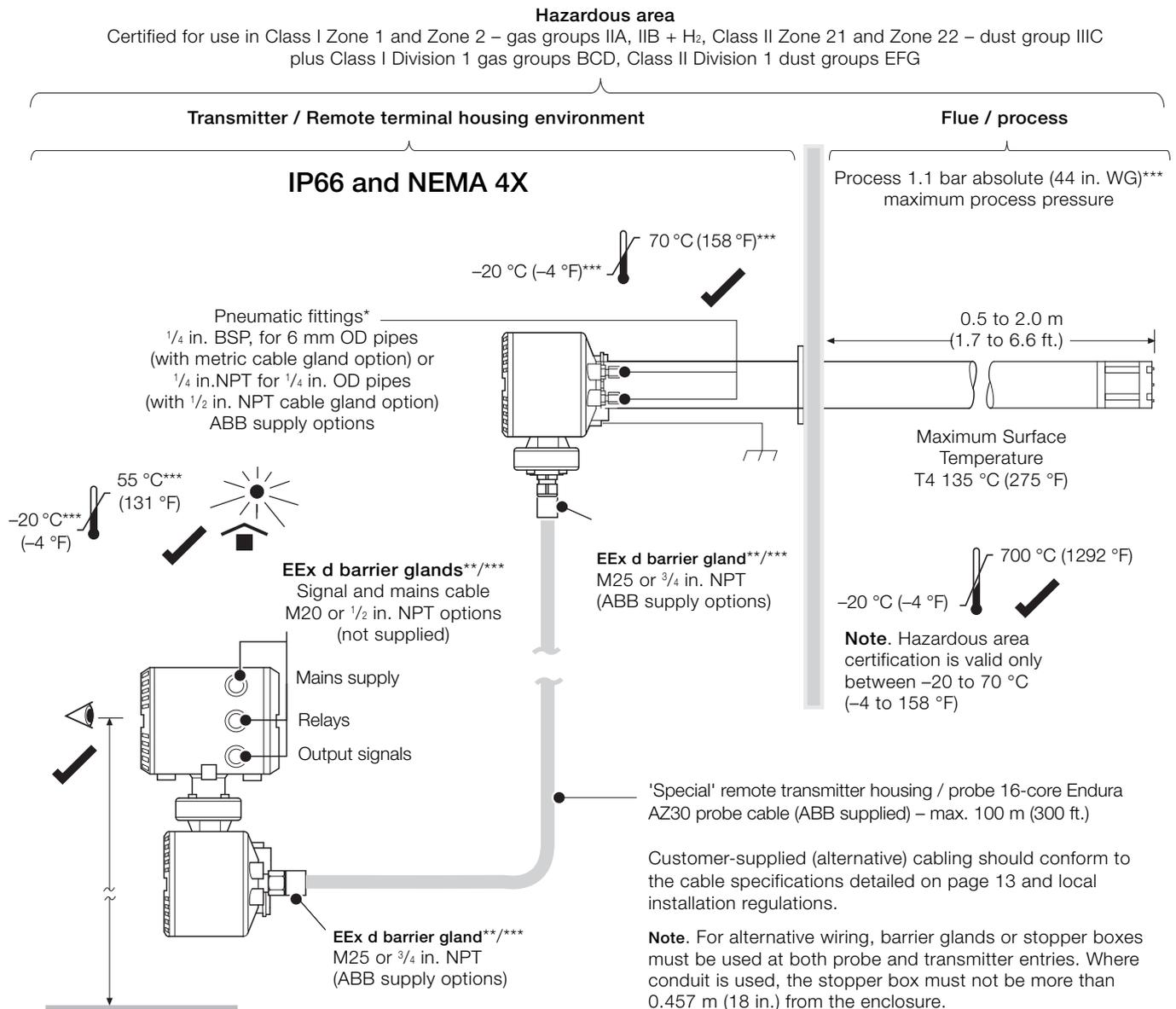


\*Transmitters do not contain a reference air supply for the probe. All external pneumatic fittings may be exchanged – they do not form part of the certified enclosure.

\*\*Refer to page 12 for barrier gland requirements.

\*\*\*Required for certification.

## Schematic – probe with remote transmitter / terminal housing



\*Transmitters do not contain a reference air supply for the probe. All external pneumatic fittings may be exchanged – they do not form part of the certified enclosure.

\*\*Refer to page 12 for barrier gland requirements.

\*\*\*Required for certification.

# Endura AZ30

## Combustion oxygen monitor

Test gas and reference air supply configurations – automatic calibration (AutoCal) systems

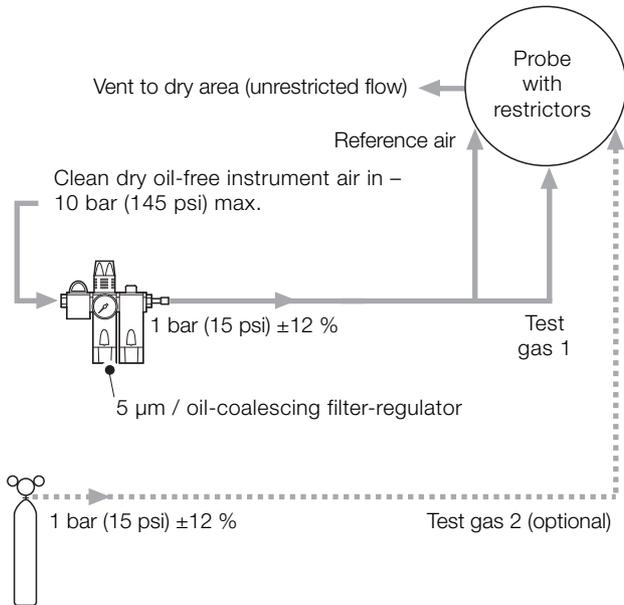


Fig. 6: AutoCal with air as test gas 1

Test gas and reference air supply configurations – non-automatic calibration (non-AutoCal) systems

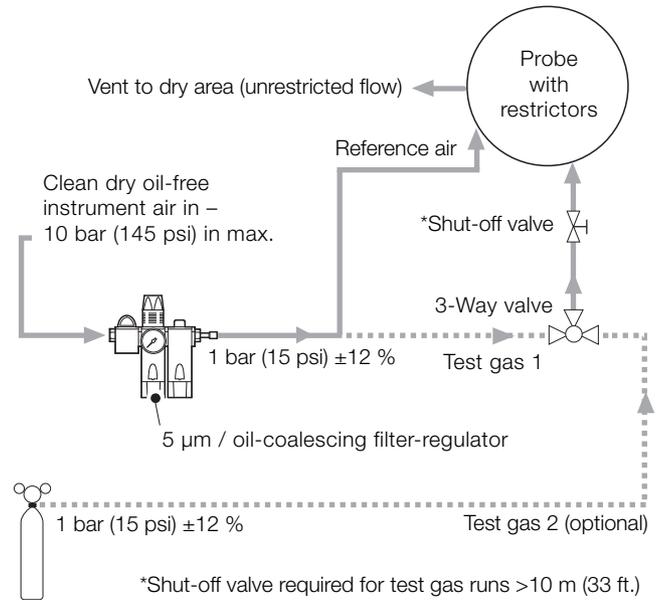


Fig. 8: Non-AutoCal with air as test gas 1

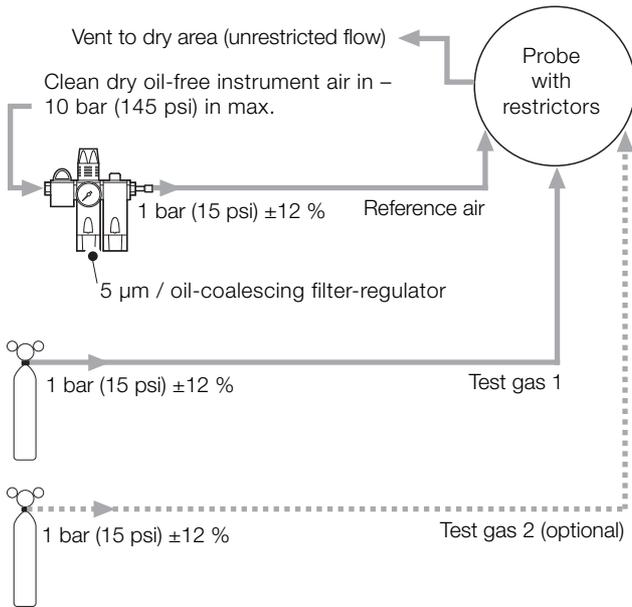


Fig. 7: AutoCal with 2 test gases

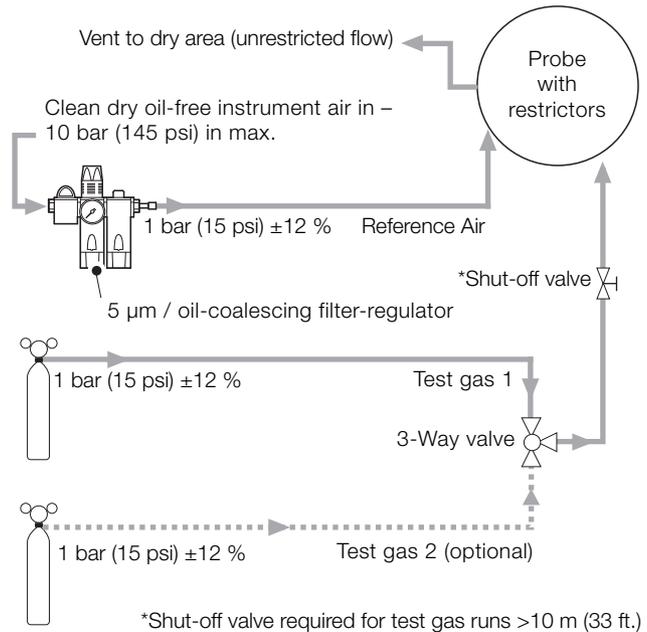
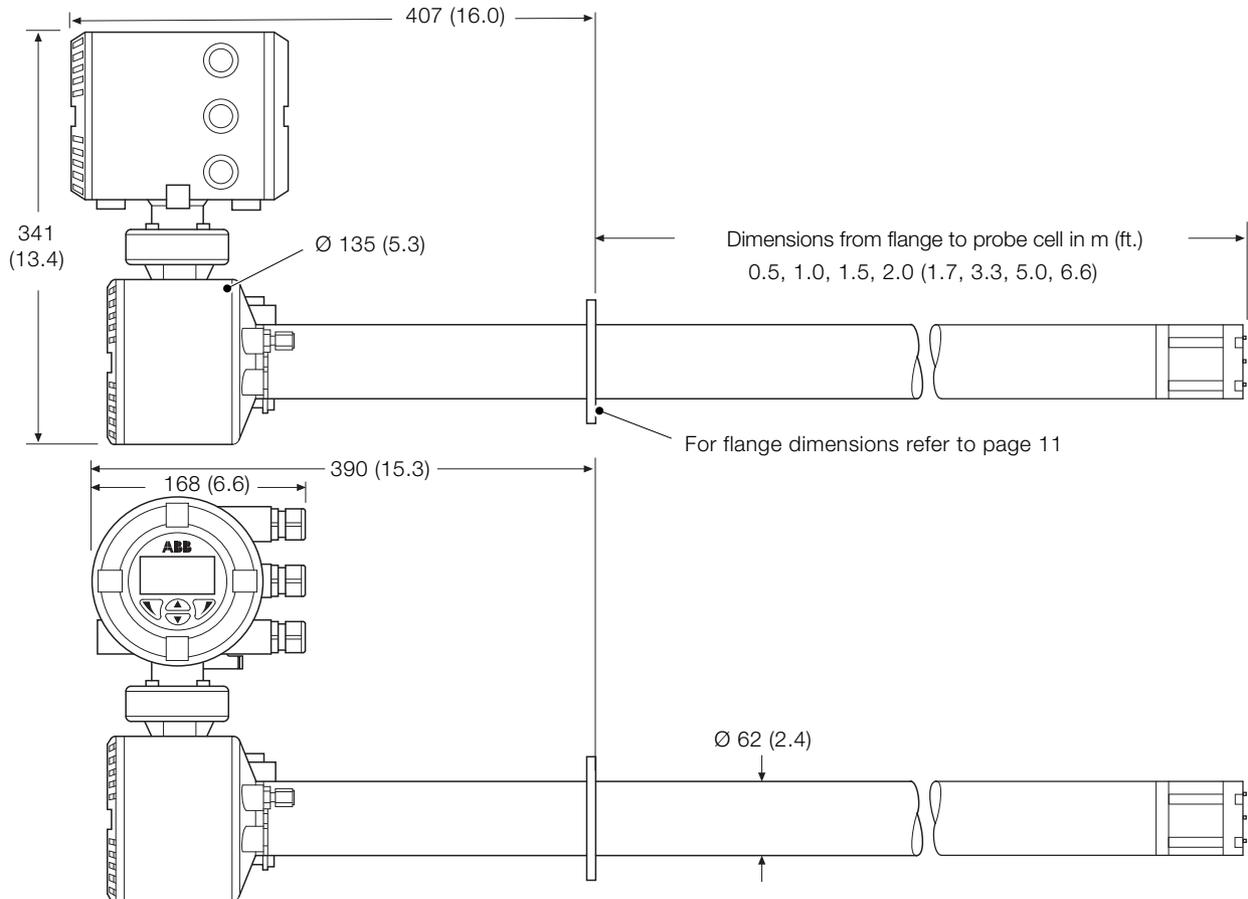


Fig. 9: Non-AutoCal with 2 test gases

# Overall dimensions and weights

## Probe and integral transmitter dimensions

Dimensions in mm (in.)



## Probe and integral transmitter weights

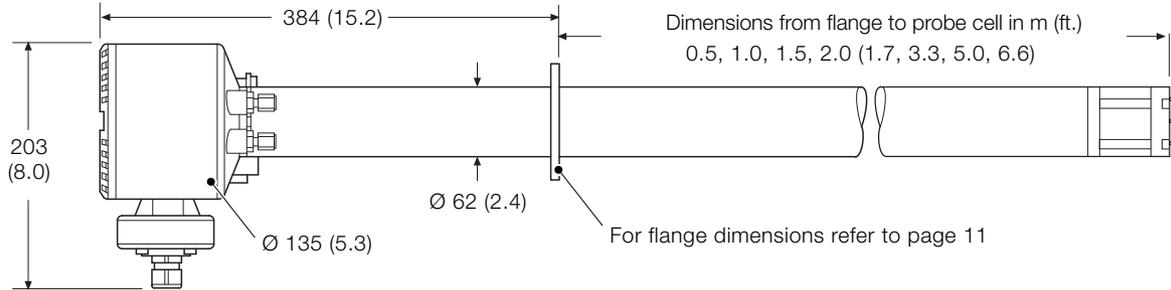
Length m (ft.)	Unpacked – kg (lb)	Packed – kg (lb)
0.5 (1.7)	13.32 (29.36)	18.54 (40.87)
1.0 (3.3)	16.44 (36.24)	23.07 (50.86)
1.5 (5.0)	17.0 (42.90)	27.86 (61.42)
2.0 (6.6)	19.3 (49.78)	31.63 (69.73)

# Endura AZ30

## Combustion oxygen monitor

### Remote probe dimensions

Dimensions in mm (in.)

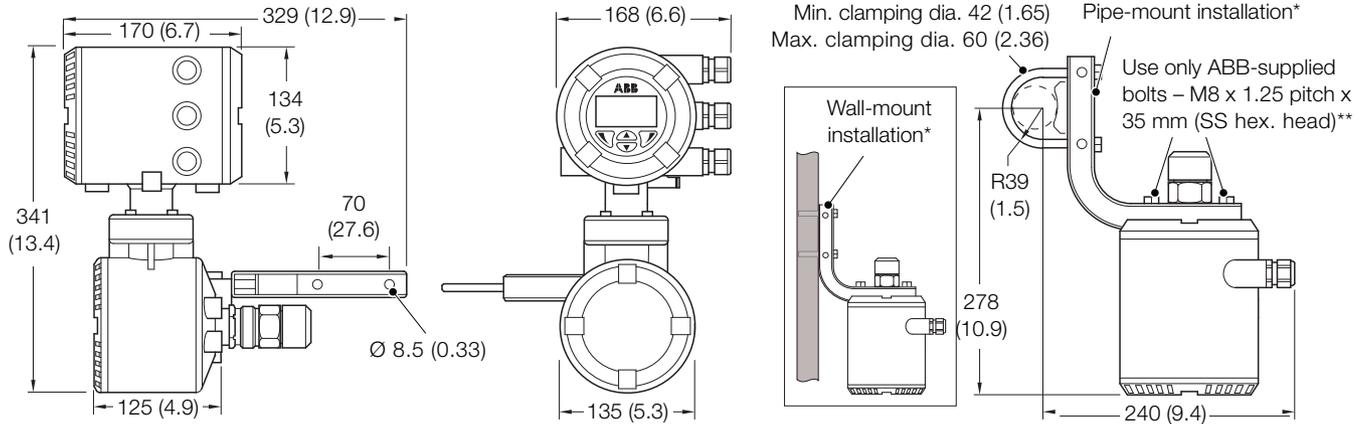


### Remote probe weights

Length m (ft.)	Probe only unpacked – kg (lb)	Probe only packed – kg (lb)
0.5 (1.7)	9.82 (21.65)	15.02 (33.11)
1.0 (3.3)	12.94 (28.53)	19.54 (43.08)
1.5 (5.0)	15.96 (35.18)	24.16 (53.26)
2.0 (6.6)	19.18 (42.28)	28.68 (63.23)

### Remote transmitter dimensions

Dimensions in mm (in.)



\*Wall- / Pipe-mount bracket plus U-bolt, pipe clamp and M8 fixings supplied as standard

\*\*Certification requirement

### Remote transmitter weights

Remote transmitter unpacked – kg (lb)	Remote transmitter packed – kg (lb)
9.5 (20.94)	12.5 (27.55)

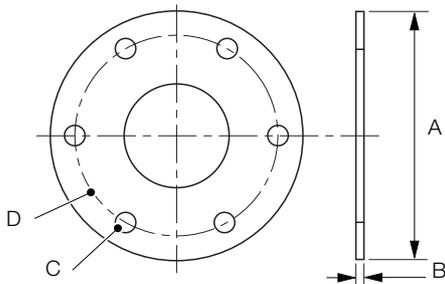
**Probe flanges (all probe lengths) and mounting plates for standard probe flanges**

Dimensions in mm (in.).

**Note.** The pressure ratings for these flanges do not apply.

**ABB probe flange types and dimensions**

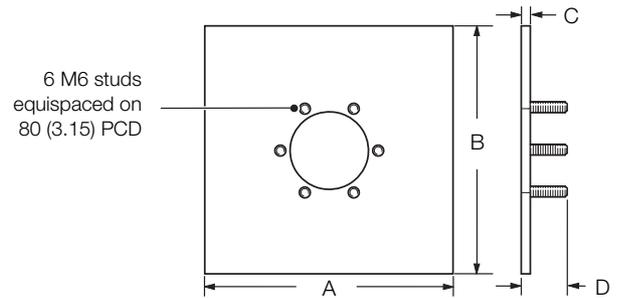
Flange type	A	B	C (Ø)	D (PCD)
ABB Standard (0.5 m [1.7 ft.] probes only)	101 (3.97)	6 (0.24)	7.3 (0.29)	80 (3.15)
ABB Standard	165 (6.50)	12 (0.47)	12.5 (0.50)	140 (5.51)



**ABB flange mounting plates\***

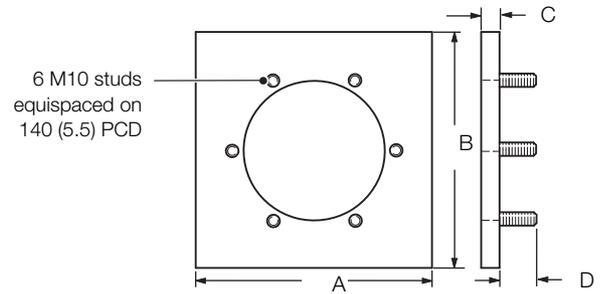
Mounting Plate	A	B	C	D
0.5 m (1.7 ft.)	160 (6.3)	160 (6.3)	7 (0.27)	16 (0.63)
1.0 to 2.0 m (3.3 to 6.6 ft.)	203 (8.0)	203 (8.0)	20 (0.79)	32 (1.26)

Standard mounting plate for 0.5 m (1.7 ft.) probe – part no. AZ200 796



Standard mounting plate for 1.0 to 2 m (3.3 to 6.6 ft.) probes –

Part No. AZ200 795



\*Comprising:

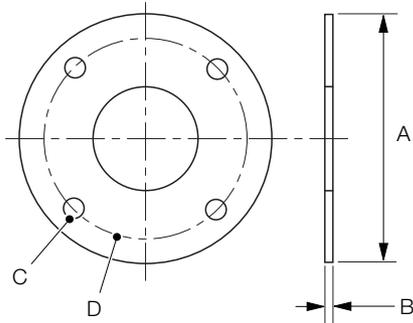
- Mounting plate
- Gaskets
- 6 Each:
  - M6 / M10 shakeproof washers
  - M6 / M10 plain washers
  - M6 / M10 nuts

# Endura AZ30

## Combustion oxygen monitor

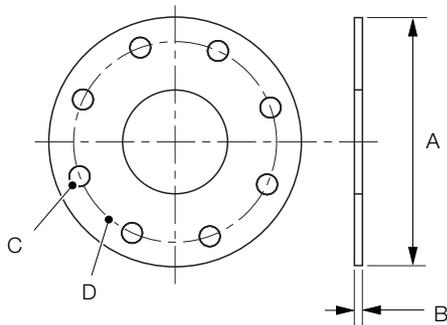
### 4-hole probe flange types and dimensions

Flange Type	A	B	C (Ø)	D (PCD)
ANSI 2 in 150	152.4 (6.00)	12 (0.47)	19 (0.75)	120.6 (4.75)
ANSI 2.5 in 150	177.8 (7.00)	12 (0.47)	19 (0.75)	139.7 (5.50)
ANSI 3 in 150	190.5 (7.50)	12 (0.47)	19 (0.75)	152.4 (6.00)
DIN 65 PN16	185 (7.28)	12 (0.47)	18 (0.70)	145 (5.70)
JIS 65 5K	155 (6.10)	12 (0.47)	15 (0.59)	130 (5.12)
JIS 80 5K	180 (7.08)	12 (0.47)	19 (0.75)	145 (5.71)



### 8-hole probe flange types and dimensions

Flange Type	A	B	C (Ø)	D (PCD)
ANSI 4 in 150	228.6 (9.0)	12 (0.47)	19 (0.75)	190.5 (7.50)
DIN 80 PN16	200 (7.87)	12 (0.47)	18 (0.70)	160 (6.30)
DIN 100 PN16	220 (8.66)	12 (0.47)	18 (0.70)	180 (7.08)
JIS 100 5K	200 (7.87)	12 (0.47)	19 (0.75)	165 (6.50)



### Barrier gland requirements

#### M25 (or 3/4 in NPT) probe cable glands

If the optional ABB-supplied barrier glands are not used, any M25 or 3/4 in NPT cable glands selected must be of the barrier type, approved for use in hazardous areas and certified suitable for use in Zone 1 and Zone 2 Gas groups IIA, IIB + H<sub>2</sub>, Zone 21, Zone 22 Dust groups IIIC and / or Class I Division 1 Gas groups BCD, Class II Division 1 Dust groups EFG.

- The M25 (or 3/4 in. NPT) barrier cable gland must be suitable for use with the ABB 'special' 16-core cable if ordered with the AZ30 system or for any alternative cable to our specifications – see page 13.
- The M25 (or 3/4 in. NPT) barrier cable gland must provide a standard seal for non-armored cable – refer to cable specifications on page 13.
- An alternative to barrier glands is the use of stopper boxes where local regulations permit.

#### Mains, relay and output signals cable glands – M20 (or 1/2 in NPT)

The M20 (or 1/2 in. NPT) cable glands used on the transmitter must be of the EEx d barrier type, approved for use in hazardous areas. and certified suitable for use in Zone 1 and Zone 2 Gas groups IIA, IIB + H<sub>2</sub>, Zone 21, Zone 22 Dust groups IIIC and / or Class I Division 1 Gas groups BCD, Class II Division 1 Dust groups EFG.

## Probe cable connections – remote transmitter terminal housing to probe

### Standard ABB cable specifications

Tx wire ident number	Terminal label color	(Position) Terminal block connection	Cable color	Cable requirement
Separately screened heater supply				
1	Blue	(1) Heater	Blue	0.75 mm <sup>2</sup>
2	Brown	(2) Heater	Brown	0.75 mm <sup>2</sup>
Heater screen / drain				0.5 mm <sup>2</sup>
Separately screened signal cables				
Chassis earth				0.5 mm <sup>2</sup>
4	White	(4) Thermocouple (negative)	White	0.5 mm <sup>2</sup>
5	Green	(5) Thermocouple (positive)	Green	0.5 mm <sup>2</sup>
6	Black	(6) Oxygen input (negative)	Black	0.5 mm <sup>2</sup>
7	Red	(7) Oxygen input (positive)	Red	0.5 mm <sup>2</sup>
8	Grey	(8) PT1000 Cold Junction Compensation	Grey	0.5 mm <sup>2</sup>
9	Violet	(9) PT1000 Cold Junction Compensation	Violet	0.5 mm <sup>2</sup>
10	White / Yellow	(10) Pressure Switch(1) Gas 2	White / Yellow	0.5 mm <sup>2</sup>
11	White /Black	(11) Pressure Switch / Common	White / Black	0.5 mm <sup>2</sup>
12	White / Orange	(12) Pressure Switch / Gas 1	White / Orange	0.5 mm <sup>2</sup>
13	White / Green	(13) Solenoid Valve / Gas 1	White / Green	0.5 mm <sup>2</sup>
14	White / Red	(14) Solenoid Valve / Common	White / Red	0.5 mm <sup>2</sup>
15	White / Blue	(15) Solenoid Valve / Gas 2	White / Blue	0.5 mm <sup>2</sup>
Signal cables screen / drain				0.5 mm <sup>2</sup>

### Requirements for non-ABB supplied cable / conduit

#### Screens and drains:

Heater wires must be sleeved separately from the screened signal cables.

#### Heater cores (items 1 and 2) and heater drain

Heater cores: 0.75 mm<sup>2</sup>, 24/0.2 CU wire, resistance (20C) 26 Ω/km max.

Heater drain: 0.5 mm<sup>2</sup>, 16/0.2 CU wire, resistance (20C) 39 Ω/km max.

#### Signal cores (items 3, 15) and signal drain

Signal cores / signal drain: 0.5 mm<sup>2</sup>, 16/0.2 CU wire, resistance (20C) 39 Ω/Km max.

#### Voltage rating

300 V to earth.

500 V between cores.

#### Cable (non-ABB supply) operating temperature requirements

-20 °C (-4 °F) min.; 80 °C (176 °F) max.

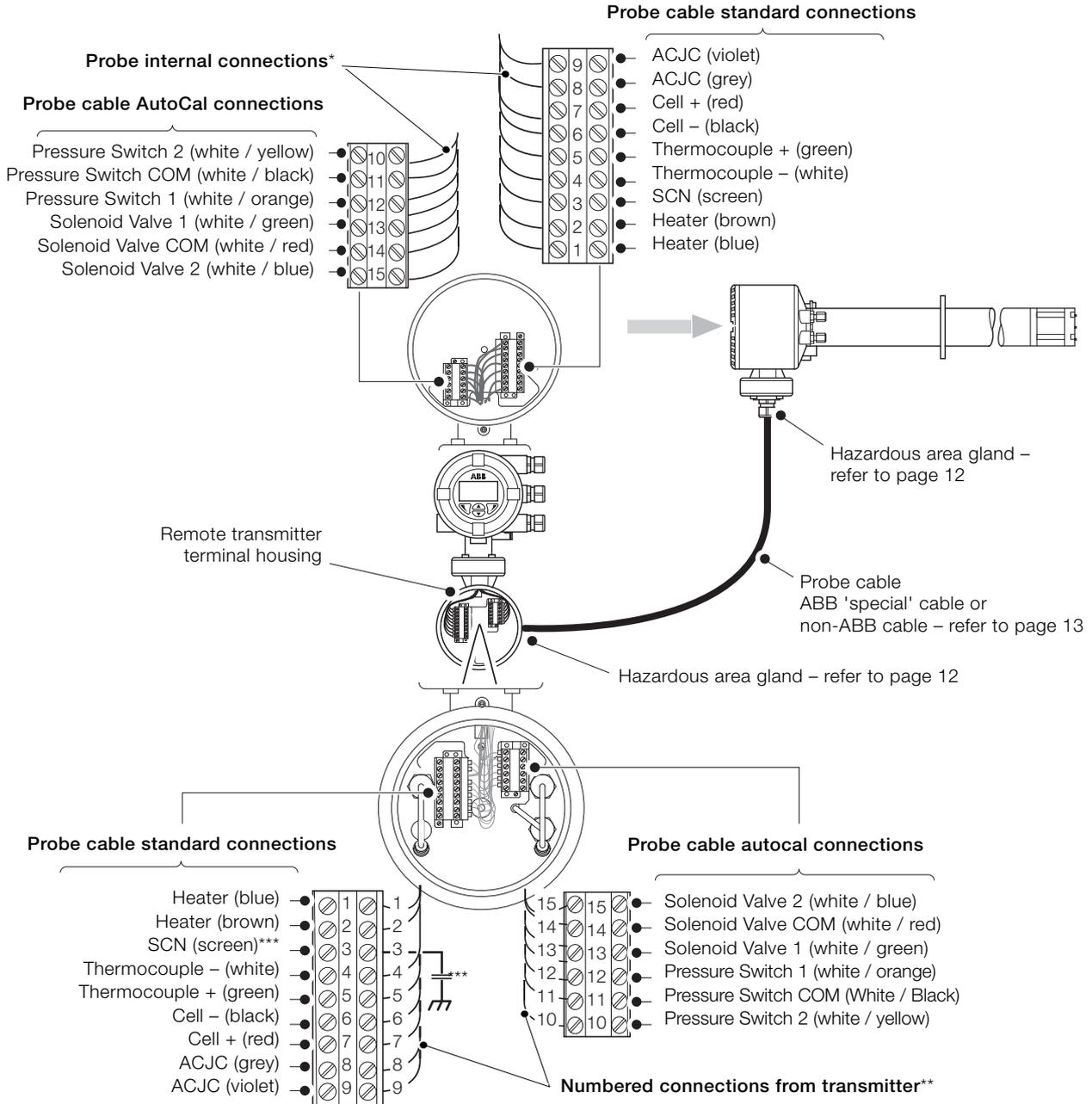
#### Cable conduit (non-ABB supply)

Stainless-steel (for alternative wiring, barrier glands or stopper boxes must be used at both probe and transmitter entries).

Where conduit is used, the stopper box must not be more than 0.457 m (18 in.) from the enclosure (remote terminal housing or integral probe).

# Endura AZ30 Combustion oxygen monitor

## Probe cable connections – remote transmitter terminal housing to probe



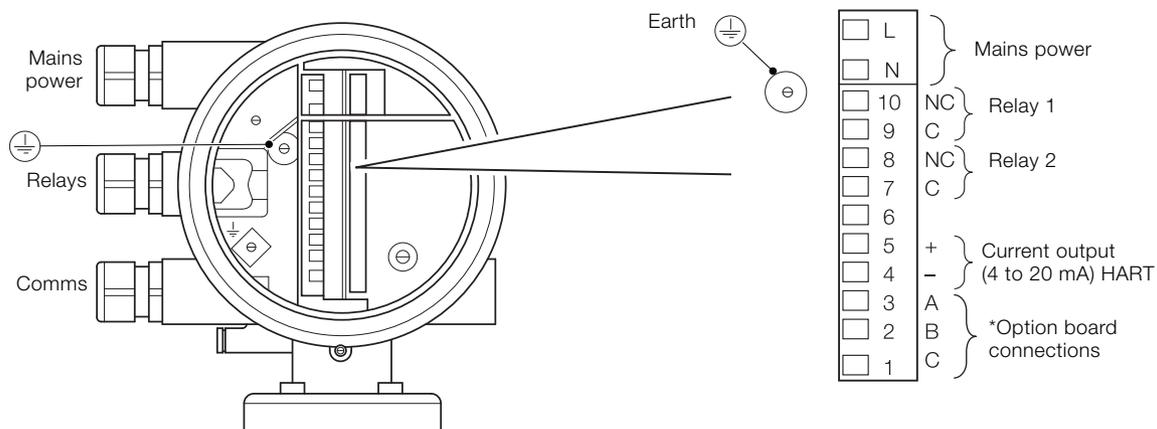
\*Probe internal connections already made at the factory.

\*\*Numbered connections from the transmitter to the transmitter's terminal housing already made at the factory.

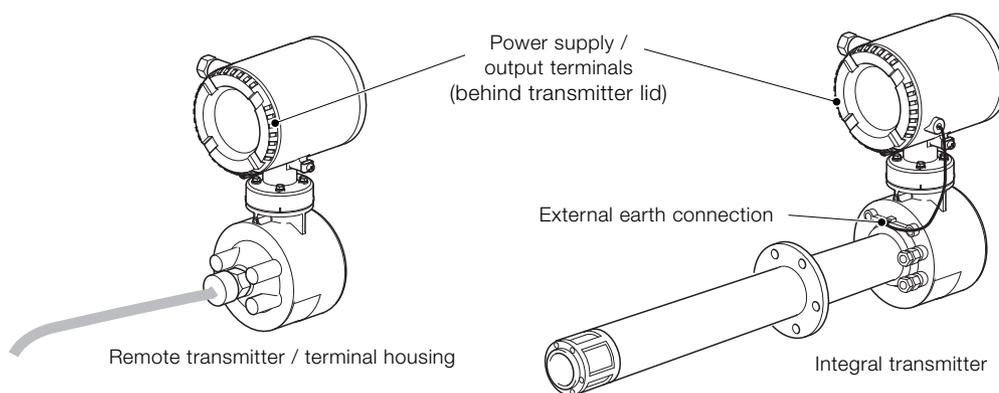
\*\*\*Screens must be connected to terminal 3 in the remote terminal housing where they are earthed via a de-coupling capacitor.

Screens must not be connected directly to earth elsewhere.

## Transmitter power supply and output connections



*Option board connections	A	B	C
Analog output	+	-	
Digital I/O	DIO1	DIO2	COM



# Endura AZ30

## Combustion oxygen monitor

### System specification

#### Hazardous area certifications

##### ATEX and IECEx:

- Certified for use in Class I Zone 1 and Zone 2 – gas groups IIA, IIB + H2, Class II Zone 21 and Zone 22 – dust group IIIC

##### FM

- Certified for use in Class I Division 1 gas groups BCD, Class II Division 1 dust groups EFG

#### Measurement performance

##### Range:

- 0 to 20.95 % O<sub>2</sub> max. (condition of certification)

##### Test gas response time:

- initial dead time 3 seconds
- T90 < 10 seconds

##### System accuracy:

- < ±0.75 % of reading or 0.05 % O<sub>2</sub>

##### Drift:

- < ± 1 % maximum % O<sub>2</sub> range value per month (without calibration)
- < ± 0.2 % typical

#### Environmental data

##### Ambient operating temperature:

- transmitter: -20 to 55 °C (-4 to 131 °F)
- probe: -20 to 70 °C (-4 to 158 °F)  
(hazardous area certification is valid only between -20 to 70 °C [-4 to 158 °F])

##### Storage temperature:

- -40 to 85 °C (-40 to 185 °F)

##### Operating humidity:

- up to 95 % RH, non-condensing

##### Sunlight:

- store and operate out of direct sunlight

##### Ingress protection:

- probe (excludes process side of mounting flange) IP66 and NEMA 4X
- electronics enclosures (remote and integral) IP66 and NEMA 4X

#### Power supply

##### AC power supply:

- 100 to 240 V AC ±10 %  
(90 V min. to 264 V max.) 50 / 60 Hz
- Maximum current 1.2 A

##### Electronics:

- < 10 W

##### Probe heater:

- < 100 W

#### EMC

##### Emissions and immunity:

- conforms to EN61326-1:2006

#### Safety

##### General safety:

- conforms to EN61010-1: 2001

##### Approvals and safety certification:

- CE mark
- cFMus
- ATEX

## Probe specification

### Hazardous area certifications

- Ex II 2 GD
- Ex d IIB +H<sub>2</sub> T4 Gb (Ta -20°C to 70°C)
- Ex tb IIIC T135°C Db (Ta -20°C to +70°C) IP66
- Cert. No IECEx BAS12.0048X
- ATEX Cert No. Baseefa12ATEX0076X
  
- Class I Division 1 Groups BCD T4
- Class I Zone 1 AEx/Ex d IIB+H<sub>2</sub> T4
- Class II Division 1 Groups EFG T4 (Ta -20 °C to +70 °C) Type 4X
- Max Working Pressure 1.1bar absolute
- FM Certificate No. 3039243

### Physical

Probe insertion lengths:

- 0.5 m (1.7 ft.)
- 1.0 m (3.3 ft.)
- 1.5 m (5.0 ft.)
- 2.0 m (6.6 ft.)

Process connection:

- All probe lengths (flange pressure ratings do not apply):
  - ANSI B16.5 150 lb
  - 2, 2.5, 3, 4 in
  - DIN2501 Part 1
  - 65, 80, 100 mm
  - JIS B2238 5K

- 0.5 m (1.7 ft.) probes: ABB standard small flange
- 1.0 m (3.3 ft.): ABB standard large flange

Probe body material:

- 316 stainless steel

Mounting angle:

- Horizontal to vertically down

### Threaded entries

Gland entry (certified):

- probe cable gland entry: 1 x M25 or (optional) 3/4 in. NPT (remote probe only)

Pneumatic entries (not certified):

- 4 fittings supplied with AutoCal options or 3 fittings and 1 blanking plug supplied with non-AutoCal options. Size options: 1/4 in. BSP for 6 mm OD pipe (with M20 cable gland option) or 1/4 in. NPT for 1/4 in. OD pipe (with 1/2 in. NPT option)

### Automatic calibration

AutoCal hardware:

- optional built-in solenoid valves for control of test gas flow
- built-in pressure switches to detect presence of test gases

### Process conditions

Standard process temperature:

- all probe lengths -20 to 700 °C (-4 to 1292 °F)

Process:

- this probe is certified for use in non oxygen-enriched atmospheres, 0 to 20.95 % air only and a maximum pressure of 1.1 bar absolute (44 in. WG)

### Operating requirements

Reference air (clean dry instrument air free from oil):

- regulated supply: 1 bar (15 psi) ±12 %\*

Test gases – regulated to 1 bar (15 psi) ±12 %\*:

- user-selectable, 100 to 0.1 % O<sub>2</sub> balance N<sub>2</sub> and / or air (air is recommended as one of the test gases)

Calibration:

- manual, semi-automatic or automatic (controlled by Endura AZ30 transmitter)

### Heater operational requirements

Nominally 190 W, 70 W at 115 V AC – power is limited to 70 W max. by AZ30 transmitter over an 85 to 265 V AC range

\*Condition of certification

# Endura AZ30

## Combustion oxygen monitor

### Transmitter specification

#### Hazardous area certifications

##### Transmitter

-  II 2 GD
- Ex d IIB +H<sub>2</sub> T6 Gb (Ta -20°C to 55°C)
- Ex tb IIIC T85°C Db IP66 (Ta -20°C to 55°C)
- Certified component
- IECEx BAS12.0050U
- Baseefa12ATEX0078U

- Class I Division 1 Groups BCD T6
- Class I Zone 1 AEx/Ex d IIB+H<sub>2</sub> T6
- Class II Division 1 Groups EFG T6 (Ta -20 °C to +55 °C) Type 4X
- FM Certificate No. 3039243
- Max Current 1.2A

##### Remote terminal housing

-  II 2 GD
- Ex d IIB +H<sub>2</sub> T6 Gb (Ta -20°C to 70°C)
- Ex tb IIIC T85°C Db (Ta -20°C to +70°C) IP66
- Cert. No IECEx BAS12.0049X
- ATEX Cert No. Baseefa12ATEX0077X

- Class I Division 1 Groups BCD T6
- Class I Zone 1 AEx/Ex d IIB+H<sub>2</sub> T6
- Class II Division 1 Groups EFG T6 (Ta -20 °C to +70 °C) Type 4X
- FM Certificate No. 3039243

#### Transmitter enclosures

##### Remote transmitter (mounted to remote terminal housing):

- wall-, pipe- or stand-mounted (mounting bracket supplied)

##### Integral transmitter:

- head-mounted to probe

#### Physical

##### Remote transmitter:

- aluminium (EN AC44200 or 47000)

##### Remote terminal housing:

- 316 stainless steel

##### Integral transmitter:

- aluminium transmitter housing / stainless steel probe and terminal housing

#### Threaded entries

##### Gland entries (certified):

- power and signals gland entries:
  - 3 x M20 or (optional) 1/2 in. NPT
- remote terminal housing cable gland entry:
  - 1 x M25 or (optional) 3/4 in. NPT (remote system only)

##### Pneumatic entries (not certified):

- 4 fittings supplied with AutoCal options or 3 fittings and 1 blanking plug supplied with non-AutoCal options. Size options: 1/4 in. BSP for 6 mm OD pipe (with M20 cable gland option) or 1/4 in. NPT for 1/4 in. OD pipe (with 1/2 in. NPT option)

#### Automatic calibration

##### AutoCal hardware:

- isolated solenoid valve control as standard, 24 V @ 2 W per valve\*
- dedicated isolated digital inputs to monitor pressure switch contacts as standard: voltage-free, normally closed with gas present

#### Display and switches

##### Display type:

- graphical 128 x 64 pixel LCD

##### Display backlight

- green LED

##### Operator switches

- 4 capacitive switches (operated through the front glass)

\*For driving internal automatic calibration (AutoCal) probes or can be used to drive external calibration units on remote transmitters only.

## Relay outputs

Number:

—2 standard

Type:

—normally closed

5 A @ 230 V AC or 30 V DC (non-inductive)

Functions

User-configurable: can be activated by 1 or more of the following signals:

- process alarm 1, 2, 3, 4
- calibration in progress
- calibration failed
- out of test gas 1, 2
- test gas 1 valve control
- test gas 2 valve control
- failure diagnostic
- out-of-specification diagnostic
- maintenance required diagnostic
- function check diagnostic

## Digital inputs / outputs

Number:

—2 (optional)

Type:

—user-configurable as either input or output

Input:

—voltage-free contact

Output:

- transistor switch capable of sinking 220 mA
- low output, < 2 V DC
- switch voltage 30 V DC maximum

Isolation:

—not isolated from each other or from other circuitry

Input functions:

- user-configurable for:
  - automatic calibration start
  - automatic calibration stop
  - automatic calibration start / stop

Functions

—user-configurable, can be activated by one or more of the following signals:

- process alarm 1, 2, 3, 4
- calibration in progress
- calibration failed
- out of test gas 1
- out of test gas 2
- test gas 1 valve control
- test gas 2 valve control
- failure diagnostic
- out-of-specification diagnostic
- maintenance required diagnostic
- function check diagnostic

## Analog outputs

Standard:

- 1 isolated current output
- programmable to retransmit oxygen (linear or logarithmic) or temperature
- programmable over 4 to 20 mA
- over-range capability to indicate system failure programmable from 4 to 22 mA

Optional:

- 1 isolated current output
- programmable to retransmit oxygen (linear or logarithmic) or temperature
- programmable over 0 to 20 mA
- over-range capability to indicate system failure programmable from 0 to 22 mA

# Endura AZ30

## Combustion oxygen monitor

### Hart communications

Version:

- 5.7 as standard

Integration:

- Device Type Manager (DTM) and Electronic Device Description (EDD)
- provide online / offline device configuration, online monitoring of measurement values and diagnostic states

DTM

- FDT v1.2.1 compliant
- works with FDT framework packages (for example, ABB Asset Vision Basic)

EDD

- compliant with suitable framework tools (for example, SDC 625 and Simatic PDM tools)

### Infrared service port

Accessibility:

- through front face

Type:

- IrDA standard

Baud rate:

- up to 115 K baud

Functions:

- firmware update
- remote HMI
- diagnostic log download
- datalog output
- HART via IrDA

### Languages

- English
- French
- German
- Italian
- Spanish

### Calibration

Manual calibration

- 1 point (offset)
- 1 point (factor)
- 2 point (offset + factor)

Automatic calibration:

- 1 point (offset)
- 2 point (offset + factor)

Calibration control:

- front panel controls
- digital inputs
- HART commands
- user-defined schedule

Calibration scheduler:

- user-defined schedule enables automatic calibration frequency to be set from 1 day to 12 months

## Spares and accessories

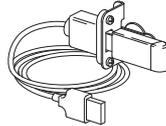
### Documentation and software

Part number	Description
MI/AZ30M-EN	Maintenance Guide – download* from: <a href="http://www.ABB.com/analytical-instruments">www.ABB.com/analytical-instruments</a> *Enter this address in your browser and search <b>MI/AZ30M-EN</b> – the Maintenance Guide is the top link.
AZ30 DTM Software	Device Type Manager – contact ABB for details



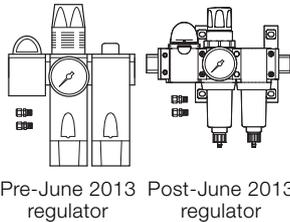
### Transmitter spares

Part number	Description
AZ200 750	AZ30 Transmitter cartridge – Standard
AZ200 751	– Standard + Analog O/P
AZ200 752	– Standard + Digital O/P
AZ200 757	Transmitter backplane
AZ200 785	USB to IrDA adaptor kit



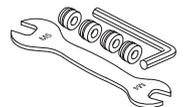
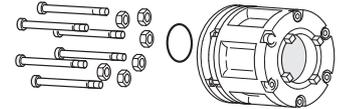
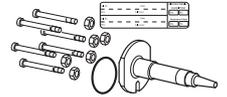
### Accessories

Part number	Description
AZ200 731 AZ200 732	Coalescing filter-regulator* – 1/4 NPT 5 µm – 1/4 BSP 5 µm *Required for Reference and test gas air
AZ200 740 AZ200 741	Filter elements for pre-June 2013 regulator: 5µm filter element Oil coalescing filter element
AW200 742 AW200 743	Filter elements for post-June 2013 regulator 5µm filter cartridge Oil coalescing filter cartridge



### Probe spares

Part number	Description
Length dependant – see below	Thermocouple / electrode assembly
<b>Probe length</b> 0.5 m (1.7 ft.) 1.0 m (3.3 ft.) 1.5 m (5.0 ft.) 2.0 m (6.6 ft.)	 <b>Part number</b> AZ200 701 AZ200 702 AZ200 703 AZ200 704
AZ300 745	Cell assembly – includes C-ring and Commissioning label
AZ200 727	Restrictor spares kit
AZ300 746	Diffuser flame arrestor assembly – includes C-ring
AZ200 798 AZ200 799	Probe tool kit* NPT (AZ30) BSP (AZ30)



\*Included with probe as standard

# Endura AZ30

## Combustion oxygen monitor

### Ordering information

Endura AZ30 probe / transmitterAZ30/	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	STD
<b>Transmitter options</b>																		
None	0																	
Standard	1																	
Standard + 2 <sup>nd</sup> analog output	2																	
Standard + 2 digital inputs / outputs	3																	
<b>Transmitter entry type</b>																		
None (no transmitter required)		0																
Metric (M20)		1																
Imperial (NPT)		2																
<b>Transmitter system type</b>																		
None (no transmitter required)			0															
Integral			1															
Remote			2															
<b>Probe type</b>																		
None (no probe required)				0														
Standard				1														
<b>Probe entry type</b>																		
None (no probe required)					0													
Metric (M20)					1													
Imperial (NPT)					2													
<b>Probe system type</b>																		
None (no probe required)						0												
Integral						1												
Remote						2												
<b>Automatic calibration</b>																		
None (no probe required)							0											
No automatic calibration							1											
Automatic calibration							3											
<b>Insertion length</b>																		
None (no probe required)								0										
0.5 m (1.7 ft.)								1										
1.0 m (3.3 ft.)								2										
1.5 m (5.0 ft.)								3										
2.0 m (6.6 ft.)								4										

Endura AZ30 probe / transmitterAZ30/		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	STD
<b>Flange type</b>																		
None (no probe required)	0	ANSI 2.5 in flange		6														
ABB standard flange	1	ANSI 3 in flange		7														
DIN 65 mm flange	2	ANSI 4 in flange		8														
DIN 80 mm flange	3	JIS 65 mm flange		9														
DIN 100 mm flange	4	JIS 80 mm flange		A														
ANSI 2 in flange	5	JIS 100 mm flange		B														
<b>Thermocouple type</b>																		
None (no probe required)										0								
Type K										1								
<b>Cell options</b>																		
None (no probe required)										0								
Standard cell										1								
<b>Cable (excludes barrier glands)</b>																		
None												0						
5 m (16 ft.)												1						
10 m (33 ft.)												2						
25 m (82 ft.)												3						
50 m (164 ft.)												4						
75 m (246 ft.)												5						
100 m (328 ft.)												6						
<b>Cable type</b>																		
None													0					
STD													1					
CSA													2					
<b>Ex gland option</b>																		
None														0				
M25														1				
3/4 in. NPT														2				
<b>Certification option</b>																		
ATEX / IECEx																	1	
FMus																	2	
cFM																	3	
<b>Language</b>																		
English																		E
German																		G
French																		F
Spanish																		S
Italian																		I

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# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA722301R1001



Sales



Service



Software

# Advance Optima AO2000 Series Continuous gas analyzers Models AO2020, AO2040

Measurement made easy

Modular continuous gas  
analyzers



One central unit and various analyzer modules

Common controls, common connection technology,  
common system housing

Analyzer modules with different measurement principles  
for all process and emissions monitoring applications

Multiple analyzer systems with up to four analyzer  
modules handling a total of six sample components

Extensive automatic calibration with air or integral  
calibration cells eliminating the need for test gas cylinders

“Safety Concept” for measuring flammable gases in  
Zone 2 and for measuring corrosive and toxic gases

Simultaneous digital and analog display of measured  
values on a large graphics panel

Menu-driven operator interface

Clear-text status messages

Multiple interfaces for communication with host and  
associated systems

Flexibly configurable analog and digital inputs and  
outputs on various input/output modules

Optional integrated pneumatics module

Housing design for 19-inch rack mounting  
(Model AO2020) or wall mounting (Model AO2040)

Modular design for ease of service

Self-monitoring function indicates when maintenance is  
required

# Modular analyzer product line

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## Overview

Advance Optima AO2000 Series is a line of modules used for continuous process gas analysis.

The product line consists of the following modules:

- Analyzer modules
- Pneumatics module
- Electronics module
- I/O modules
- Housing with display and control unit
- System bus

The modules can be arranged in various ways to form single or multiple analyzer systems.

The electronics module, power supply and housing with display and control unit are also collectively referred to as the “central unit”.

## Analyzer modules

Analyzer modules:

- Uras26 Infrared analyzer module
- Limas11 Process photometer analyzer module
- Magnos206 Oxygen analyzer module
- Magnos27 Oxygen analyzer module
- ZO23 Trace oxygen analyzer module
- Caldos25 Thermal conductivity analyzer module
- Caldos27 Thermal conductivity analyzer module
- Fidas24 FID analyzer module
- MultiFID14 FID analyzer module
- MultiFID14 NMHC FID analyzer module
- LS25 Laser analyzer module

Each analyzer module consists of the sensor and associated electronics having its own processor. The analyzer modules are linked to the system controller via the system bus. The laser analyzer module is linked to the central unit via Ethernet.

The analyzer modules are supplied with 24-VDC from an integral power supply or an external unit.

The electrochemical oxygen sensor is available as an option in combination with an analyzer module.

## Pneumatics module

The pneumatics module contains the following elements when fully equipped:

- One or three solenoids to control test gas supply
- One or two disposable elements for fine filtration
- One gas supply pump with coarse filter and capillary
- One or two flow monitors

The pneumatics module is always associated with an analyzer module and installed in the same housing as the analyzer module.

## Electronics module, interfaces

The electronics module incorporates the system controller with the I/O modules.

The **system controller** carries out the following functions:

- Processing and communicating the measured values supplied by the analyzer module sensor electronics

- Compensating measured values, e.g. cross sensitivity correction
- Controlling system functions, e.g. calibration
- Display and control functions
- Controlling associated systems, e.g. gas supply
- Communicating with external systems

The system controller communicates with the other functional units of the gas analyzer (e.g. the analyzer modules) via the system bus.

Interfaces for controlling associated systems and for communicating with external systems are located on the system controller (Ethernet 10/100/1000BASE-T interface) and on the I/O modules.

The **I/O modules** are attached and directly connected to the system controller board. There are various types of I/O modules:

- 2-way analog output modules have two analog outputs.
- 4-way analog output modules have four analog outputs.
- 4-way analog input modules have four analog inputs.
- Digital I/O modules have four digital inputs and four digital outputs.
- Modbus modules have one RS485 and one RS232 interface.
- Profibus modules have one RS485 and one MBP interface (not intrinsically safe).

Examples of I/O module applications include:

- Output of measured values
- Output of status and alarm signals
- Calibration control
- Control of external solenoid valves and pumps
- Measurement range switching and feedback
- Feed of current or status signals from external analyzers
- Feed of status signals from peripherals

## Housing

The housing is available as a 19-inch (model AO2020) or wall-mount (model AO2040) unit with IP20 or IP54 protection. IP54 housing versions can be purged. The display and control unit is located on the front panel of the housing when the electronics module is installed.

## System bus

The gas analyzer's functional units are interconnected via the system bus. The system bus structure is linear with a maximum length of 350 meters. Only one electronics module with up to five I/O modules should be connected to a system bus structure.

## Connection of sample gas conditioning modules

The SCC-F sample gas feed unit and the SCC-C sample gas cooler can be connected to the gas analyzer via the system bus by means of an I/O board installed in the sample gas feed unit. Thus it is possible to display, monitor and control individual sample gas conditioning functions in the gas analyzer such as cooler temperature or condensate and flow status. For further information please refer to the “System components and accessories for sample gas conditioning” data sheet.

# Configuration of analyzer units and multiple analyzer systems

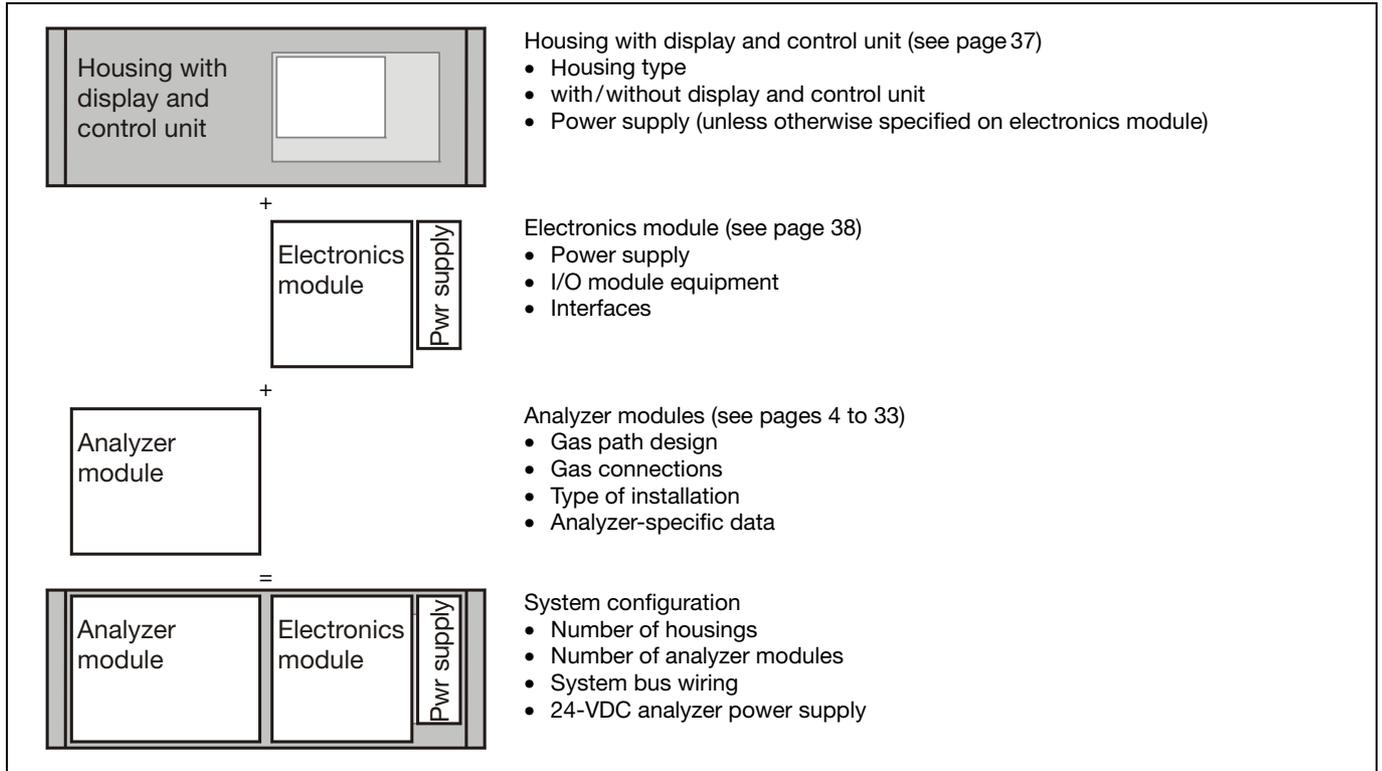
This data sheet contains specifications for all modules and components in the Advance Optima AO2000 Series modular product line.

This data sheet was not intended to be used for configuring an analyzer unit or a multiple analyzer system. For a quotation please contact your ABB Analytical representative who can also provide advice and support.

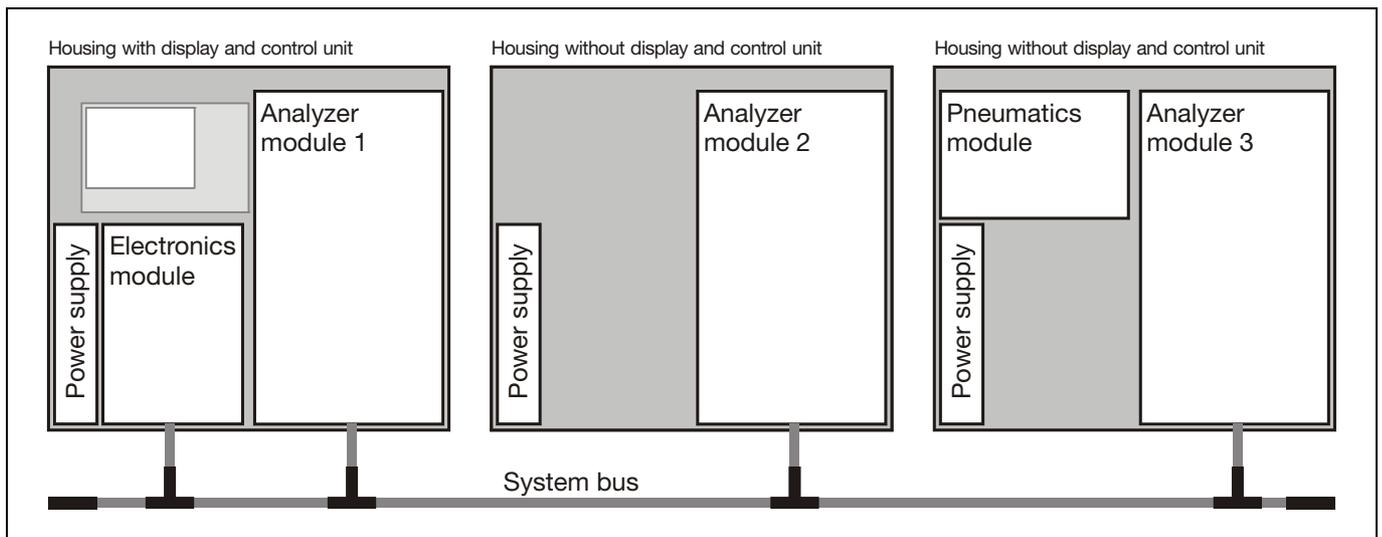
Example 1 shows the modules and components that normally make up an analyzer unit as well as the possibilities for configuring an analyzer unit.

The modular product line allows modules and components to be formed into an analyzer unit (see example 1) or into multiple analyzer systems (see example 2).

## Example 1: Analyzer unit configuration (19-inch housing)



## Example 2: Multiple analyzer system variant (wall-mount housings)



# Infrared analyzer module Uras26

## Measurement principle

Non-dispersive infrared absorption in the  $\lambda = 2.5$  to  $8 \mu\text{m}$  wavelength range

Photometer to measure from 1 to 4 components with 1 or 2 beam paths and 1 or 2 receivers in each beam path

## Sample components and measurement ranges

The Uras26 analyzer module has one physical measurement range per sample component. As an option, smaller measurement ranges can be electronically derived from the physical measurement range. The smallest range is measurement range 1.

The smallest measurement ranges shown in the following table are based on the first sample component in beam path 1.

Sample component	Smallest class 1 range	Smallest class 2 range	Smallest class 2 range with calibration cell	Gas group <sup>1)</sup>
CO	0– 50 ppm	0– 10 ppm	0– 50 ppm <sup>2)</sup>	A
CO <sub>2</sub>	0– 50 ppm	0– 5 ppm	0– 25 ppm <sup>2)</sup>	A
NO	0– 75 ppm	0– 75 ppm	0– 75 ppm <sup>2)</sup>	A
SO <sub>2</sub>	0– 100 ppm	0– 25 ppm	0– 25 ppm <sup>2)</sup>	A
N <sub>2</sub> O	0– 50 ppm	0– 20 ppm	0– 50 ppm <sup>2)</sup>	A
CH <sub>4</sub>	0– 100 ppm	0– 50 ppm	0– 50 ppm <sup>2)</sup>	A
NH <sub>3</sub>	0– 500 ppm	0– 30 ppm	–	B
C <sub>2</sub> H <sub>2</sub>	0– 200 ppm	0– 100 ppm	0– 100 ppm	B
C <sub>2</sub> H <sub>4</sub>	0– 500 ppm	0– 300 ppm	0– 300 ppm	B
C <sub>2</sub> H <sub>6</sub>	0– 100 ppm	0– 50 ppm	0– 50 ppm <sup>2)</sup>	B
C <sub>3</sub> H <sub>6</sub>	0– 250 ppm	0– 100 ppm	0– 100 ppm <sup>2)</sup>	B
C <sub>3</sub> H <sub>8</sub>	0– 100 ppm	0– 50 ppm	0– 50 ppm <sup>2)</sup>	B
C <sub>4</sub> H <sub>10</sub>	0– 100 ppm	0– 50 ppm	0– 50 ppm <sup>2)</sup>	B
C <sub>6</sub> H <sub>14</sub>	0– 500 ppm	0– 100 ppm	0– 100 ppm <sup>2)</sup>	B
R 134a	0– 100 ppm	0– 50 ppm	0– 50 ppm <sup>2)</sup>	B
SF <sub>6</sub>	0– 5 ppm	0– 4 ppm	–	B
H <sub>2</sub> O	0– 1000 ppm	0– 500 ppm	0– 500 ppm	C

1) See price information

2) The smallest measurement range 1 is shown. The largest measurement range should be at least four times larger.

Other sample components on request.

Measurement range quantity

1 to 4 ranges per sample component

Largest measurement range

0 to 100 vol.% or 0 vol.% to saturation or 0 vol.% to LEL

Measurement ranges within ignition limits cannot be provided.

Measurement range ratio

$\leq 1:20$

Measurement ranges with suppressed zero-point

Electronic zero-point suppression or differential measurement based on a base level  $> 0$  with flowing reference gas, max. suppression ratio of 1:10

## Stability

The following data apply to measurement range 1 in a delivered analyzer module.

Linearity deviation

$\leq 1\%$  of span

Option: Linearization according to EPA specifications for automobile exhaust gas measurement

Repeatability

$\leq 0.5\%$  of span

Zero drift

$\leq 1\%$  of span per week;

for ranges smaller than class 1 to class 2:

$\leq 3\%$  of span per week

Sensitivity drift

$\leq 1\%$  of measured value per week

Output fluctuation ( $2\sigma$ )

$\leq 0.2\%$  of span at electronic T90 time = 5 sec (class 1) or = 15 sec (class 2)

Detection limit ( $4\sigma$ )

$\leq 0.4\%$  of span at electronic T90 time = 5 sec (class 1) or = 15 sec (class 2)

## Influence effects

Flow effect

Flow rate in the 20 to 100 l/h range: Within detection limits

Associated gas effect/cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional): Incorporation of interference filters or filter vessels, internal electronic cross-sensitivity correction or carrier gas correction for a sample component by other sample components measured with the Uras26.

Temperature effect

Ambient temperature in permissible range

– At zero-point:  $\leq 1\%$  of span per  $10^\circ\text{C}$ ;  
for ranges smaller than class 1 to class 2:  
 $\leq 2\%$  of span per  $10^\circ\text{C}$

– On sensitivity with temperature compensation:  
 $\leq 3\%$  of measured value per  $10^\circ\text{C}$

– On sensitivity with thermostat effect at  $55^\circ\text{C}$  (optional):  
 $\leq 1\%$  of measured value per  $10^\circ\text{C}$

Air pressure effect

– At zero-point: No effect

– On sensitivity with pressure correction by means of integral pressure sensor:  $\leq 0.2\%$  of measured value per  $1\%$  air pressure change

The pressure sensor is located in the sample gas path if hoses are used as the internal gas lines.

If tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.

Pressure sensor working range:  $p_{\text{abs}} = 600$  to  $1250$  hPa

Power supply effect

$24$  VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span

# Infrared analyzer module Uras26

## Dynamic response

### Warm-up time

Approx. 30 minutes without thermostat; approx. 2 hours with thermostat

### 90% response time

$T_{90} = 2.5$  sec for measurement cell length = 200 mm and sample gas flow = 60 l/h without signal damping (low pass filter). Low-pass time constant adjustable from 0 to 60 sec.

## Calibration

### Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component.

### End-point calibration

With gas-filled calibration cells (optional) or with test gas mixtures. It is recommended to verify the calibration cell set values once a year.

During calibration of a multi-component analyzer, possible cross-sensitivity and/or carrier gas corrections by internal or external measurement components are switched off.

Therefore, corrected measurement components should be calibrated only using a test gas consisting of the measurement component and an inert gas like nitrogen.

## Materials in contact with the sample medium

### Analyzer (sample cells)

Tubing: Aluminum or gold-plated aluminum. Window:  $\text{CaF}_2$ , option:  $\text{BaF}_2$ . Connectors: Rust- and acid-resistant steel 1.4571 (SAE 316Ti).

### Gas lines and connectors

FPM hoses and PTFE tubing with stainless steel connectors. Option: Rust- and acid-resistant steel tubes 1.4571 (SAE 316Ti).

## Sample gas inlet conditions

### Temperature

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

### Inlet pressure

$p_e = 2$  to 500 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

20 to 100 l/h

### Corrosive gases

Highly corrosive associated gas components, e.g. chlorine ( $\text{Cl}_2$ ) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption. Provide for housing purge.

### Flammable gases

The analyzer module is suitable for measuring flammable gases and vapors under atmospheric conditions ( $p_{\text{abs}} \leq 1.1$  bar, oxygen content  $\leq 21$  vol.%). Temperature class: T4. The

sample gas must not be explosive under normal conditions. If the sample gas is explosive in the event of a sample gas supply failure, then only seldom and briefly (in accordance with zone 2). Pressure in the sample gas path in normal operation  $p_e \leq 100$  hPa; in case of a sample gas supply failure the pressure must not exceed the maximum value  $p_e = 500$  hPa.

The version with gas paths designed as stainless steel tubes should be selected and housing purge with nitrogen should be provided when measuring flammable gases and vapors.

Before using the analyzer module the corrosion resistance against the specific sample gas must be checked.

Version in category 3G see page 34

## Gas connections

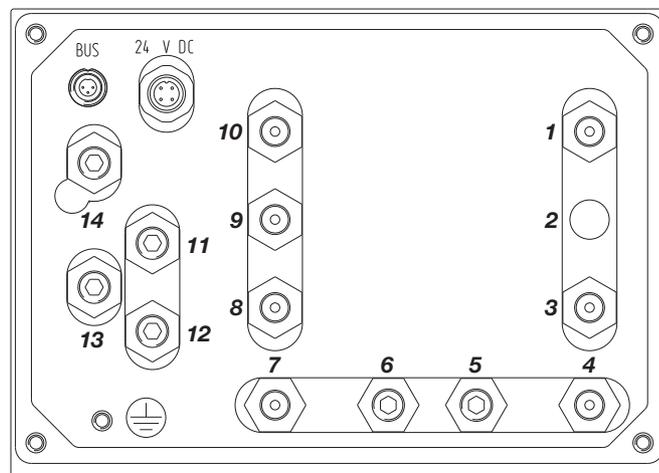
The drawing below shows the gas connection arrangement in an exemplary manner for the three variants:

**A** 1 gas path with 1 sample cell,

**B** 1 gas path with 2 sample cells in series and

**C** 2 separate gas paths with 1 sample cell each.

The actual gas connection arrangement of an analyzer module is found in the analyzer data sheet for the delivered instrument.



**1** Pressure sensor for external pressure measurement <sup>1)</sup>

**2** –

**3** Sample gas inlet **A** or **B** or **C** gas path 1

**4** Sample gas outlet **A** or **C** gas path 1

**5** Purge gas inlet housing <sup>1)</sup>

**6** Purge gas outlet housing <sup>1)</sup> (also with flow sensor)

**7** Sample gas inlet **C** gas path 2 <sup>1)</sup>

**8** Sample gas outlet **B** or **C** gas path 2 <sup>1)</sup>

**9** Reference gas inlet gas path 1 <sup>1)</sup>

**10** Reference gas outlet gas path 1 <sup>1)</sup>

Pneumatics module <sup>1)</sup>:

**11** Sample gas inlet **A** or **B** or **C** gas path 1

**12** End point gas inlet (with 3 solenoids) or sample gas inlet **C** gas path 2 (only with flow sensor)

**13** Test gas/zero-point gas inlet (with 1 or 3 solenoids) or sample gas inlet **C** gas path 2 (only with flow sensor) – in this case connect with sample gas inlet **7**

**14** Sample gas outlet **A** or **B** or **C** gas path 1 – connect with sample gas inlet **3**

1) Option

# Process photometer analyzer module Limas11

## Measurement principle

Gas filter correlation or wavelength comparison in ultraviolet and visible spectrum range  $\lambda = 200$  to  $600$  nm (Limas11 UV) and in infrared spectrum range  $\lambda = 2.5$  to  $10$   $\mu\text{m}$  (Limas11 IR)

Photometer to measure from 1 to 4 components

Sample cells made from various materials are available for measuring in corrosive, toxic and flammable gases (see page 8)

## Sample components and measurement ranges

The Limas11 analyzer module has one physical measurement range per sample component. As an option, smaller measurement ranges can be electronically derived from the physical measurement range. The smallest range is measurement range 1.

Sample component	Smallest class 1 range	Smallest class 2 range	Gas group <sup>1)</sup>
Limas11 UV:			
NO <sup>2)</sup>	0– 50 ppm	0– 10 ppm	A
SO <sub>2</sub>	0– 150 ppm	0– 25 ppm	A
NO <sub>2</sub>	0– 250 ppm	0– 50 ppm	B
NH <sub>3</sub>	0– 100 ppm	0– 30 ppm	B
H <sub>2</sub> S	0– 50 ppm	0– 25 ppm	B
Cl <sub>2</sub>	0– 250 ppm	0– 100 ppm	D
CS <sub>2</sub>	0– 100 ppm	0– 50 ppm	C
COS	0– 500 ppm	0– 250 ppm	C
Limas11 IR:			
CO	0–1000 ppm	0– 500 ppm	A
CO <sub>2</sub>	0– 300 ppm	0– 150 ppm	A
HCl	0–5000 ppm	0–2500 ppm	D
CH <sub>4</sub>	0–2000 ppm	0–1000 ppm	A
C <sub>2</sub> H <sub>2</sub>	0–2500 ppm	0–1250 ppm	B
C <sub>2</sub> H <sub>4</sub>	0–3000 ppm	0–1500 ppm	B
C <sub>2</sub> H <sub>6</sub>	0– 500 ppm	0– 250 ppm	B
C <sub>3</sub> H <sub>6</sub>	0–1000 ppm	0– 500 ppm	B
C <sub>3</sub> H <sub>8</sub>	0– 300 ppm	0– 150 ppm	B
C <sub>4</sub> H <sub>10</sub>	0– 500 ppm	0– 250 ppm	B

1) See price information

2) The UV-RAS (ultra-violet resonant absorption spectroscopy) method is used to make the analyzer selective to the sample component NO.

Other sample components on request.

Measurement range quantity  
1 to 4 ranges per sample component

Largest measurement range  
0 to 100 vol.% or 0 vol.% to saturation or 0 vol.% to LEL  
Measurement ranges within ignition limits cannot be provided.

Measurement range ratio  
Measurement ranges freely adjustable within a range ratio of 1:20 relative to the factory-set reference measurement range.

Measurement ranges with suppressed zero-point  
Electronic zero-point suppression, max. suppression ratio of 1:10

## Stability

The following data apply to measurement range 1 in a delivered analyzer module.

Linearity deviation  
 $\leq 1\%$  of span

Option: Linearization acc. to EPA specifications for automotive exhaust gas measurement

Repeatability  
 $\leq 0.5\%$  of span

Zero drift  
 $\leq 2\%$  of span per week;  
for ranges smaller than class 1 to class 2:  $\leq 1.5\%$  of span per day (Recommendation: daily automatic zero-point calibration)

Sensitivity drift  
 $\leq 1\%$  of measured value per week

Output fluctuation ( $2\sigma$ )  
Limas11 UV:  $\leq 0.5\%$  of span at electronic T90 time = 10 sec;  
Limas11 IR:  $\leq 0.5\%$  of span at electronic T90 time (static/dynamic) = 60/5 sec;  
for ranges smaller than class 1 to class 2:  $\leq 1\%$  of span

Detection limit ( $4\sigma$ )  
 $\leq 1\%$  of span;  
for ranges smaller than class 1 to class 2:  $\leq 2\%$  of span

## Influence effects

Flow effect  
Flow rate in the 20 to 100 l/h range: Within detection limits

Associated gas effect/cross sensitivity  
The knowledge of the sample gas composition is necessary for the analyzer configuration.  
Selectivity measures to reduce associated gas effect (optional): Incorporation of filters cells or internal electronic cross-sensitivity correction or carrier gas correction for a sample component by other sample components measured with the Limas11.

Temperature effect  
Ambient temperature in permissible range,  
Sample cell thermostat control to  $+60$  °C  
– At zero-point:  $\leq 1\%$  of span per  $10$  °C; for ranges smaller than class 1 to class 2:  $\leq 2\%$  of span per  $10$  °C  
– On sensitivity:  $\leq 1\%$  of measured value per  $10$  °C

Air pressure effect  
– At zero-point: No effect  
– On sensitivity with pressure correction by means of integral pressure sensor:  $\leq 0.2\%$  of measured value per  $1\%$  air pressure change  
The pressure sensor is located in the sample gas path if hoses are used as the internal gas lines.  
If tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.  
Pressure sensor working range:  $p_{\text{abs}} = 600$  to  $1250$  hPa

Power supply effect  
 $24$  VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span

# Process photometer analyzer module Limas11

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## Dynamic response

Warm-up time

Approx. 2.5 hours

90% response time

$T_{90}$  = 4 sec for measurement cell length = 262 mm and sample gas flow = 60 l/h without signal damping (low pass filter).

Low-pass time constant adjustable from 0 to 60 sec

## Calibration

Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component

End-point calibration

With gas-filled calibration cells (optional) or with test gas.

It is recommended to verify the calibration cell set values once a year.

During calibration of a multi-component analyzer, possible cross-sensitivity and/or carrier gas corrections by internal or external measurement components are switched off.

Therefore, corrected measurement components should be calibrated only using a test gas consisting of the measurement component and an inert gas like nitrogen.

## Sample gas inlet conditions

Temperature

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Inlet pressure

$p_s$  = 2 to 500 hPa (maximum pressure see page 8)

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet pressure

Atmospheric pressure

Flow rate

20 to 100 l/h

Corrosive, toxic and flammable gases

See page 8

Purge gas

See page 8

## Gas connections

See page 9

## Materials in contact with the sample medium

See page 8

# Process photometer analyzer module Limas11

## Sample cells

	Standard cell	Quartz cell	Safety cell
Application	Standard applications	Corrosive gases	Corrosive, toxic and flammable gases
Wavelength range	200 to 10000 nm	200 to 4000 nm	CaF <sub>2</sub> window: 200 to 10000 nm SiO <sub>2</sub> window: 200 to 4000 nm
Resistance <sup>1)</sup>			
Suitable for measurement of ...	Non-corrosive gases	Corrosive gases, e.g. wet Cl <sub>2</sub> , wet HCl, H <sub>2</sub> SO <sub>4</sub> , SO <sub>3</sub> , ozone	Corrosive gases, e.g. dry HCl, dry COCl <sub>2</sub> (< 50 ppm H <sub>2</sub> O)
Not suitable for measurement of ...	Highly corrosive gases, e.g. gases containing chlorine, H <sub>2</sub> SO <sub>4</sub> , SO <sub>3</sub> , fluorine compounds	Fluorine compounds	Wet gases containing chlorine, H <sub>2</sub> SO <sub>4</sub> , SO <sub>3</sub> , fluorine compounds
Safety principle			
Toxic gases	Housing purge (≤ 20 l/h) with sample component-free air or with N <sub>2</sub>	Housing purge (≤ 20 l/h) with sample component-free air or with N <sub>2</sub>	Cell purge <sup>2)</sup> with N <sub>2</sub> or with sample component-free air with negative pressure and flow monitoring; additional monitoring for sample gas traces possible
Corrosive gases	PTFE gas lines, housing purge (≤ 20 l/h) with sample component-free air or with N <sub>2</sub>	Housing purge (≤ 20 l/h) with sample component-free air or with N <sub>2</sub>	Cell purge <sup>2)</sup> with N <sub>2</sub> or with sample component-free air with excess pressure <sup>3)</sup> and flow monitoring
Flammable gases <sup>4)</sup>	Stainless steel gas lines, housing purge (≤ 20 l/h) with N <sub>2</sub>	Housing purge (≤ 20 l/h) with N <sub>2</sub>	Cell purge <sup>2)</sup> with N <sub>2</sub>
Category 3G flammable gases	–	–	Cell purge <sup>2)</sup> with N <sub>2</sub> with excess pressure <sup>3)</sup> and flow monitoring
Seal integrity	< 1 x 10 <sup>-3</sup> hPa l/s	< 1 x 10 <sup>-6</sup> hPa l/s	< 1 x 10 <sup>-6</sup> hPa l/s
Pressure rating			
Continuous	p <sub>e</sub> < 500 hPa	p <sub>e</sub> < 500 hPa	p <sub>e</sub> < 500 hPa
Spike	–	p <sub>abs</sub> < 300 kPa	p <sub>abs</sub> < 500 kPa
Sample cell material			
Cell tube	Aluminum	Silica glass (SiO <sub>2</sub> )	Stainless steel 1.4571 (SAE 316Ti)
Window	CaF <sub>2</sub> , adhesive fastening	Silica glass	CaF <sub>2</sub> or SiO <sub>2</sub> , threaded fastening
Seal	–	FFKM75	FFKM70
Connectors	SS 1.4571 (SAE 316Ti)	PFA	SS 1.4571 (SAE 316Ti)
Gas line materials	FPM or PTFE	PFA	SS 1.4571 (SAE 316Ti)
Gas connector materials	SS 1.4571 (SAE 316Ti)	PFA	SS 1.4571 (SAE 316Ti)
Sample gas connection design (connection drawings see page 9)	Connectors with 1/8 NPT internal threads	Pipes 6/4 mm	Pipes with 4 mm outer diameter

1) see page 7  
“Sample gas inlet conditions”

2) purge curtain

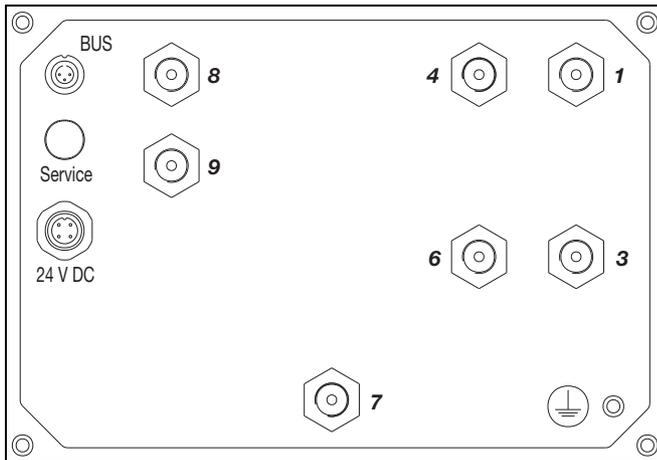
3) p<sub>e</sub> = 7 to 20 hPa, 15 to 20 l/h

4) The analyzer module is suitable for measuring flammable gases and vapors under atmospheric conditions (p<sub>abs</sub> ≤ 1.1 bar, oxygen content ≤ 21 vol. %). Temperature class: T4. The sample gas must not be explosive under normal conditions. If the sample gas is explosive in the event of a sample gas supply failure, then only seldom and briefly (in accordance with zone 2). Pressure in the sample gas path in normal operation p<sub>e</sub> ≤ 100 hPa; in case of a sample gas supply failure the pressure must not exceed the maximum value p<sub>e</sub> = 500 hPa. Before using the analyzer module the corrosion resistance against the specific sample gas must be checked.

# Process photometer analyzer modules Limas11, Limas11 HW

## Gas connections

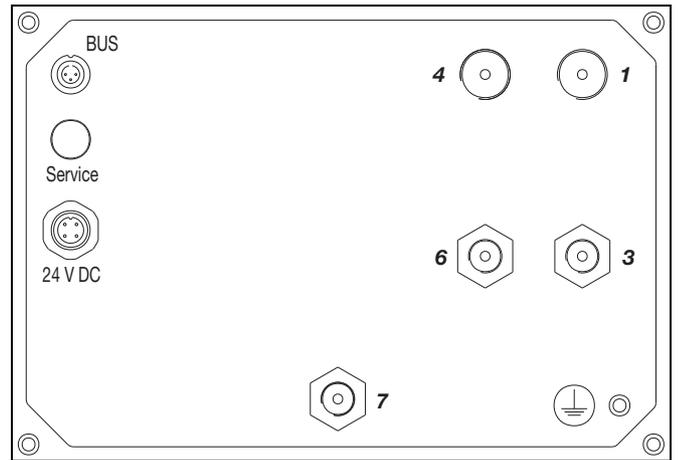
**Limas11: Standard cell with FPM or PTFE hoses, Quartz cell with FPM hoses, Center connection cell made of aluminum or quartz**



- 1 Sample gas inlet
- 3 Purge gas inlet housing <sup>1)</sup>
- 4 Sample gas outlet
- 6 Purge gas outlet housing <sup>1)</sup>
- 7 Pressure sensor <sup>2)</sup>
- 8 End-point gas inlet (with 3 solenoids) <sup>1) 3)</sup>
- 9 Zero-point gas inlet (with 1 or 3 solenoids) <sup>1) 3)</sup>

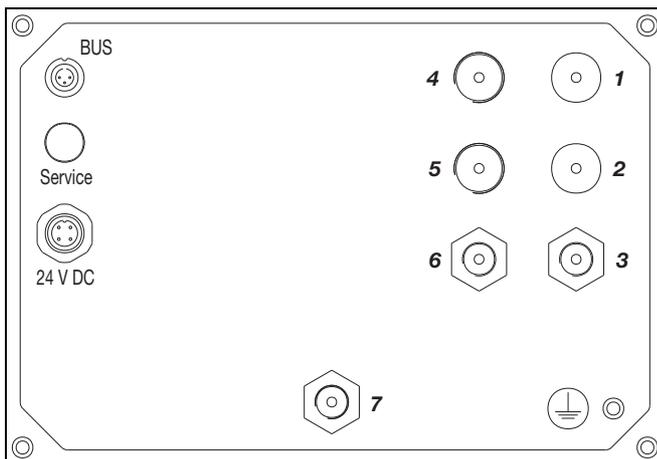
- 1) Option
- 2) external connection, not for standard cell with FPM hoses
- 3) not for version with PTFE hoses

**Limas11: Quartz cell with PFA tubes**



- 1 Sample gas inlet
  - 3 Purge gas inlet housing <sup>1)</sup>
  - 4 Sample gas outlet
  - 6 Purge gas outlet housing <sup>1)</sup>
  - 7 Pressure sensor
- 1) Option

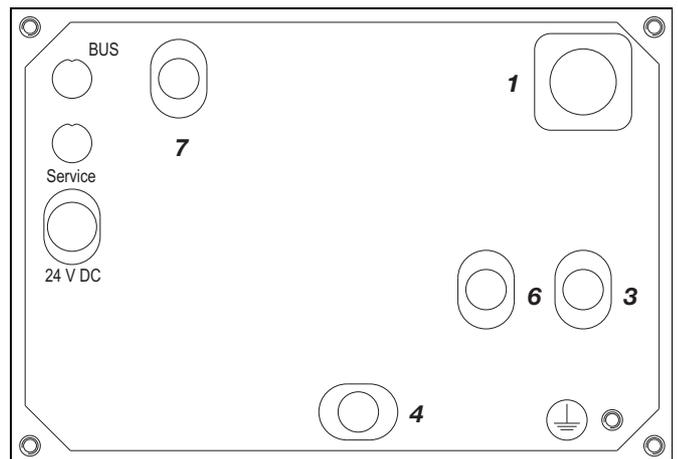
**Limas11: Safety cell**



- 1 Sample gas inlet
- 2 Sample gas outlet
- 3 Purge gas inlet housing <sup>1)</sup>
- 4 Purge gas inlet sample cell
- 5 Purge gas outlet sample cell
- 6 Purge gas outlet housing <sup>1)</sup>
- 7 Pressure sensor

- 1) Option

**Limas11 HW**



- 1 Sample gas inlet
- 3 Purge gas inlet housing
- 4 Sample gas outlet
- 6 Purge gas outlet housing
- 7 Pressure sensor

# Process photometer analyzer module Limas11 HW

## Measurement principle and application

Limas11 HW is a multi-component analyzer for simultaneous measurement of nitrogen compounds in wet sulfur-free flue gas without converter.

### Measurement principle

Photometer to measure from 1 to 4 components such as NO, NO<sub>2</sub> and NH<sub>3</sub>.

Wavelength comparison in ultraviolet spectrum range  $\lambda = 200$  to 600 nm for sample components NO<sub>2</sub> and NH<sub>3</sub>.

The UV-RAS method (ultra-violet resonant absorption spectroscopy) is used to make the analyzer selective to the sample component NO.

### Applications

**Exhaust gas measurement** for the development of combustion engines and methods for exhaust gas after-treatment, in particular for pure gas measurement after catalyst in

- Four-stroke gasoline and diesel engines,
- Catalysts for nitrogen oxide reduction.

**Process measurement** for flue gas scrubbing systems in gas turbines and gas-fired burners, in particular for monitoring, controlling and optimizing DeNO<sub>x</sub> SCR processes.

## Sample components and measurement ranges (recommendations), stability data

### Exhaust gas measurement for four-stroke gasoline and diesel engines

Sample component	Smallest range	Largest range
NO	0–100 ppm	0–5000 ppm
NO <sub>2</sub>	0–100 ppm	0–2500 ppm

Linearity deviation  
≤ 1 % of span, ≤ 2 % of measured value acc. to EPA specifications for automotive exhaust gas measurement

Repeatability  
≤ 0.25 % of span

Zero drift  
≤ 1 ppm or ≤ 1 % of span per 24 hours based on the smallest recommended measurement range (daily automatic zero-point calibration recommended)

Sensitivity drift  
≤ 1 % of measured value per week

Output fluctuation (2  $\sigma$ )  
≤ 400 ppb or ≤ 0.4 % of span at electronic T90 time = 5 sec

Detection limit (4  $\sigma$ )  
≤ 800 ppb or ≤ 0.8 % of span at electronic T90 time = 5 sec

### Diluted exhaust gas measurement for four-stroke gasoline and diesel engines, bag measurement

Sample component	Smallest range	Largest range
NO	0–10 ppm	0–500 ppm
NO <sub>2</sub>	0–10 ppm	0–500 ppm

Linearity deviation  
≤ 1 % of span, ≤ 2 % of measured value acc. to EPA specifications for automotive exhaust gas measurement

Repeatability  
≤ 0.25 % of span

Zero drift  
≤ 250 ppb or ≤ 2 % of span per 8 hours based on the smallest recommended measurement range (daily automatic zero-point calibration recommended)

Sensitivity drift  
≤ 1 % of measured value per week

Output fluctuation (2  $\sigma$ )  
NO ≤ 50 ppb, NO<sub>2</sub> ≤ 60 ppb at electronic T90 time = 15 sec

Detection limit (4  $\sigma$ )  
NO ≤ 100 ppb or ≤ 1 % of span, NO<sub>2</sub> ≤ 120 ppb or ≤ 1 % of span at electronic T90 time = 15 sec

### Process measurement

Sample Component	Smallest Range	Largest Range
NO	0–100 ppm	0–1000 ppm
NO <sub>2</sub>	0–100 ppm	0– 500 ppm
NH <sub>3</sub>	0–100 ppm	0– 500 ppm

Linearity deviation  
≤ 1 % of span

Repeatability  
≤ 0.25 % of span

Zero drift  
≤ 1 ppm or ≤ 1 % of span per 24 hours based on the smallest recommended measurement range (daily automatic zero-point calibration recommended)

Sensitivity drift  
≤ 1 % of measured value per week

Output fluctuation (2  $\sigma$ )  
≤ 150 ppb or ≤ 0.15 % of span at electronic T90 time = 30 sec

Detection limit (4  $\sigma$ )  
≤ 300 ppb or ≤ 0.3 % of span at electronic T90 time = 30 sec

## Measurement ranges

Quantity  
1 to 4 ranges per sample component

Measurement range ratio  
Max. 1:20. Measurement ranges are freely adjustable within a range ratio of 1:20 relative to the factory-set reference measurement range.

Max. 1:50 for fixed measurement ranges acc. to EPA specifications for automotive exhaust gas measurement

# Process photometer analyzer module Limas11 HW

## Influence effects

### Flow effect

Flow rate in the 20 to 90 l/h range: within detection limits

### Associated gas effect/cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect: Internal electronic cross-sensitivity correction or carrier gas correction for a sample component by other sample components measured with the Limas11 HW.

### Temperature effect

Ambient temperature in permissible range,

Sample cell thermostat control to +80 °C

– At zero-point:  $\leq 2\%$  of span per 10 °C

– On sensitivity:  $\leq 2\%$  of measured value per 10 °C

### Air pressure effect

– At zero-point: No effect

– On sensitivity with pressure correction by means of integral pressure sensor:  $\leq 0.2\%$  of measured value per 1% air pressure change

The pressure sensor is routed to the outside via a hose.

Pressure sensor working range:  $p_{abs} = 600$  to 1250 hPa

### Power supply effect

24 VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span

## Dynamic response

### Warm-up time

Approx. 4 hours

### 90% response time

$T_{90} \leq 5$  sec for measurement cell length = 260 mm and sample gas flow = 60 l/h with non-linear filter (static/dynamic) = 15/1 sec.

Low-pass time constant adjustable from 0 to 30 sec.

## Calibration

### Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component

### End-point calibration

With gas-filled calibration cells (optional) or with test gas.

It is recommended to verify the calibration cell set values once a year.

During calibration of a multi-component analyzer, possible cross-sensitivity and/or carrier gas corrections by internal or external measurement components are switched off.

Therefore, corrected measurement components should be calibrated only using a test gas consisting of the measurement component and an inert gas like nitrogen.

## Materials in contact with the sample medium

### Sample cell

Tubing and window: Silica glass, Screw connection: PVDF;

Connectors: PTFE

### Gas lines and connectors

Stainless steel 1.4305 (SAE 303), 1.4571 (SAE 316Ti)

## Housing purge

### Purge gas

Sample component-free air or nitrogen

Purge gas flow rate  $\leq 10$  l/h

## Sample gas inlet conditions

### Sample gas composition

Sulfur-free exhaust gas of combustors,

SO<sub>2</sub> concentration  $< 25$  ppm, H<sub>2</sub>O  $< 20$  vol.%,

filtered with pore width  $\leq 0.5$   $\mu$ m

### Temperature

Sample gas dew point  $\leq 65$  °C

### Inlet pressure

$p_e = 2$  to 500 hPa. Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

20 to 90 l/h

## Gas connections

See page 9

## Notes

The analyzer module Limas11 HW can only be mounted in the 19-inch housing.

SO<sub>2</sub> influences the NH<sub>3</sub> reading. If the sample gas mixture contains SO<sub>2</sub>, the requirement of internal corrections must be scrutinized.

When ordering the average water vapor concentration has to be specified. The influence is corrected internally.

## Sample conditioning system requirements

### Sample gas feed-in

The various applications require the sample gas feed-in to the gas analyzer at temperatures of 150 to 190 °C. It is imperative to eliminate condensation and sublimation since NH<sub>3</sub> and NO<sub>2</sub> are easy soluble in water and can result in salification. It is also imperative to prevent condensation of potentially present low-boiling hydrocarbons.

### Sample gas inlet temperature (on the process side)

150 to 190 °C

### Sample gas filter

For NO and NO<sub>2</sub> measurement: Sintered metal; for NH<sub>3</sub> measurement: Ceramics; pore width  $\leq 0.5$   $\mu$ m

### Materials in contact with the sample medium

PTFE, PVDF or Silicosteel

### Exhaust gas conditions

Outlet pressure = atmospheric pressure, no resistance in the gas outlet.

### Installation note

Route the exhaust gas line declining to allow for condensate drain-off.

## Measurement principle

Paramagnetic behavior of oxygen

Magnetomechanical analyzer; short 90% response time

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>)

Smallest measurement range

0 to 0.5 vol.% O<sub>2</sub>

Measurement range quantity and limits

4 measurement ranges

Measurement ranges are freely adjustable; they are factory-set to 0 to 10/15/25/100 vol.% O<sub>2</sub> or per order.

Largest measurement range

0 to 100 vol.% O<sub>2</sub>

Measurement ranges within ignition limits cannot be provided.

Measurement ranges with suppressed zero-point

Max. measurement range suppression 1: 100, e.g.

99 to 100 vol.% O<sub>2</sub>. Highly suppressed measurement ranges (≥95 to 100 vol.% O<sub>2</sub>) and initial measurement ranges in the same analyzer should be avoided. Pressure correction by means of pressure sensor required.

## Stability

Linearity deviation

≤ 0.5 % of span, minimum 0.005 vol.% O<sub>2</sub>

Repeatability

≤ 50 ppm O<sub>2</sub> (time base for gas exchange ≥ 5 minutes)

Zero drift

≤ 3 % of span of the smallest measurement range (per order) per week, minimum 300 ppm O<sub>2</sub> per week; following prolonged transport and storage time the drift can be higher during the first weeks of operation.

Sensitivity drift

≤ 0.1 vol.% O<sub>2</sub> per week or ≤ 1 % of measured value per week (not cumulative), whichever is smaller.

≤ 0.25 % of measured value per year, minimum 0.05 vol.% O<sub>2</sub> per year

Output fluctuation (2 σ)

≤ 25 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

Detection limit (4 σ)

≤ 50 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

## Influence effects

Flow effect

≤ 0.1 vol.% O<sub>2</sub> in permissible range

Associated gas effect

Data regarding the effect of associated gases can be found in IEC 61207-3:2002 "Gas analyzers – Expression of performance – Part 3: Paramagnetic oxygen analyzers".

Temperature effect

Ambient temperature in permissible range

– At zero-point: ≤ 0.02 vol.% O<sub>2</sub> per 10 °C

– On sensitivity: ≤ 0.1 % of measured value per 10 °C

Thermostat temperature = 64 °C

Air pressure effect

– At zero-point: No effect

– On sensitivity without pressure correction:

≤ 1 % of measured value per 1 % air pressure change

– On sensitivity with pressure correction using integrated pressure sensor (optional):

≤ 0.1 % of measured value per 1 % air pressure change;

for highly suppressed measurement ranges

≤ 0.01 % of measured value per 1 % air pressure change or

≤ 0.002 vol.% O<sub>2</sub> per 1 % air pressure change, whichever is greater.

Pressure sensor working range: p<sub>abs</sub> = 600 to 1250 hPa

Power supply effect

24 VDC ± 5 %: ≤ 0.4 % of span

Position effect

Zero-point shift ≤ 0.05 vol.% O<sub>2</sub> per 1° deviation from horizontal location. Position has no effect on the hard-mounted unit.

## Dynamic response

Warm-up time

< 1 hour

90% response time

T<sub>90</sub> ≤ 3.5 to 10 sec at a sample gas flow of 90 l/h and electronic T90 time (static/dynamic) = 3/0 sec, gas change from nitrogen to air (applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration

With oxygen-free process gas or substitute gas

End-point calibration

With process gas with a known oxygen concentration or a substitute gas such as dried air

Single-point calibration

For measurement ranges from 0 to 5 vol.% O<sub>2</sub> to 0 to 25 vol.% O<sub>2</sub>:

Zero-point calibration with any oxygen concentration, e.g. with nitrogen or ambient air, processed through a cooler or H<sub>2</sub>O absorber.

Pressure correction by means of pressure sensor is recommended for single-point calibration with air.

Depending on the measurement task involved, the zero- and end-points should be verified periodically (recommendation: once a year).

Calibration of measurement ranges with suppressed zero-point

Highly suppressed measurement ranges (≥95 to 100 vol.% O<sub>2</sub>) should only be calibrated with test gases with concentrations in the selected measurement range.

Single-point calibration can also be done within a suppressed measurement range. The O<sub>2</sub> concentration of the test gas must lie within the measurement range.

# Oxygen analyzer module Magnos206

## Materials in contact with the sample medium

### Analyzer

Rust- and acid-resistant steel 1.4305 (SAE 303), glass, platinum, rhodium, epoxy resin; FPM seals, optional: FFKM75

### Pressure sensor

Silicon gel, plastics, FPM

## Sample gas inlet conditions

### Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Water vapor content variations cause volume errors.

### Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

30 to 90 l/h

Abrupt changes in gas flow rates should be avoided when using highly suppressed measurement ranges.

### Corrosive gases

Consultation with ABB Analytical is required if the sample gas contains  $Cl_2$ , HCl, HF or other corrosive components.

FFKM75 seals must be used if the sample gas contains  $NH_3$ .

In this case the pneumatics module cannot be connected to the analyzer module.

### Flammable gases

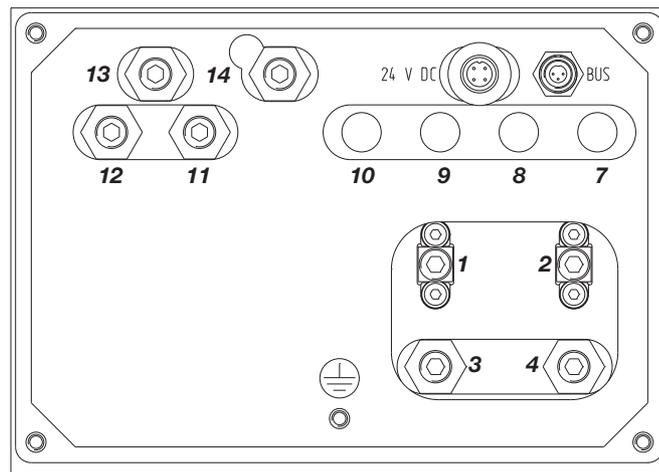
The analyzer module is suitable for measuring flammable gases and vapors under atmospheric conditions ( $p_{abs} \leq 1.1$  bar, oxygen content  $\leq 21$  vol.%). Temperature class: T4. The sample gas must not be explosive under normal conditions. If the sample gas is explosive in the event of a sample gas supply failure, then only seldom and briefly (in accordance with zone 2). Pressure in the sample gas path in normal operation  $p_e \leq 100$  hPa; in case of a sample gas supply failure the pressure must not exceed the maximum value  $p_e = 500$  hPa. Before using the analyzer module the corrosion resistance against the specific sample gas must be checked.

Housing purge with nitrogen should be provided when measuring flammable gases and vapors. Flame barriers can be used as an option (except for the "safety concept" version, see page 34). Pressure drop at the flame barriers approx. 40 hPa for a sample gas flow rate of 50 l/h. Material of the flame barriers: Stainless steel 1.4571 (SAE 316Ti).

Version in category 3G see page 34

## Gas connections

The sample cell is connected directly to the gas ports.



- 1** Sample gas inlet
  - 2** Sample gas outlet
  - 3** Purge gas inlet analyzer<sup>2)</sup>
  - 4** Purge gas outlet analyzer<sup>2)</sup>
  - 7** Purge gas inlet housing<sup>1)</sup>
  - 8** Purge gas outlet housing<sup>1)</sup> (also with flow sensor)
  - 9** Pressure sensor 1<sup>1)</sup>
  - 10** Pressure sensor 2<sup>1)</sup>
- Pneumatics module<sup>1)</sup>:
- 11** Sample gas inlet
  - 12** End point gas inlet (with 3 solenoids)
  - 13** Test gas/zero-point gas inlet (with 1 or 3 solenoids)
  - 14** Sample gas outlet – connect with inlet **1**
- 1) Option  
2) not in version with performance test for emission monitoring

# Oxygen analyzer module Magnos27

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## Measurement principle

Paramagnetic behavior of oxygen  
Heavy-duty thermomagnetic analyzer

## Sample component and measurement ranges

Sample component  
Oxygen (O<sub>2</sub>) in flue gas or in nitrogen

Smallest measurement range  
0 to 3 vol.% O<sub>2</sub>

Measurement range quantity  
1 to 4 measurement ranges  
Ranges are factory-set per customer order.

Largest measurement range  
0 to 100 vol.% O<sub>2</sub>  
Measurement ranges within ignition limits cannot be provided.

## Stability

Linearity deviation  
≤ 2 % of span

Repeatability  
≤ 1 % of span

Zero drift  
≤ 1 % of span per week

Sensitivity drift  
≤ 2 % of measured value per week

Output fluctuation (2 σ)  
≤ 0.5 % of smallest measurement range span at electronic  
T<sub>90</sub> time = 0 sec

Detection limit (4 σ)  
≤ 1 % of smallest measurement range span at electronic  
T<sub>90</sub> time = 0 sec

## Influence effects

Flow effect  
≤ 1 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect  
Magnos27 calibration applies only to the sample gas shown on the identification plate (= sample component + associated gas).

Temperature effect  
Ambient temperature in permissible range  
– At zero-point: ≤ 2 % of span per 10 °C  
– On sensitivity: ≤ 0.5 % of measured value per 10 °C relative to temperature at the time of calibration  
Thermostat temperature = 63 °C

Air pressure effect  
– At zero-point: < 0.05 vol.% O<sub>2</sub> per 1 % air pressure change  
– On sensitivity without pressure correction:  
≤ 1.5 % of measured value per 1 % air pressure change  
– On sensitivity with pressure correction:  
≤ 0.25 % of measured value per 1 % air pressure change  
Option: Operating altitude over 2000 m

Power supply effect  
24 VDC ± 5 %: ≤ 0.2 % of span

Position effect  
Approx. 3 % of smallest measurement range span per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

## Dynamic response

Warm-up time  
2 to 4 hours

90% response time  
T<sub>90</sub> = 10 to 22 sec, depending on sample gas flow and on measurement cell connection (see "Gas connections", applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration  
With oxygen-free process gas or substitute gas

End-point calibration  
With process gas having a known oxygen concentration or with substitute gas

# Oxygen analyzer module Magnos27

## Materials in contact with the sample medium

### Analyzer

Rust- and acid-resistant steel 1.4580 (SAE 316Cb) and 1.4305 (SAE 303), glass

### Gas lines and connectors

Rust- and acid-resistant steel 1.4571 (SAE 316Ti) and 1.4305 (SAE 303), PVC-C, FPM

## Sample gas inlet conditions

### Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

### Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

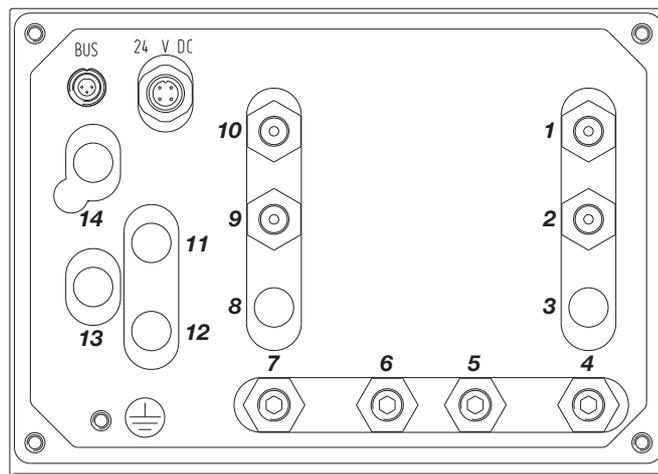
20 to 90 l/h

### Flammable gases

Measurement of flammable gases is not possible.

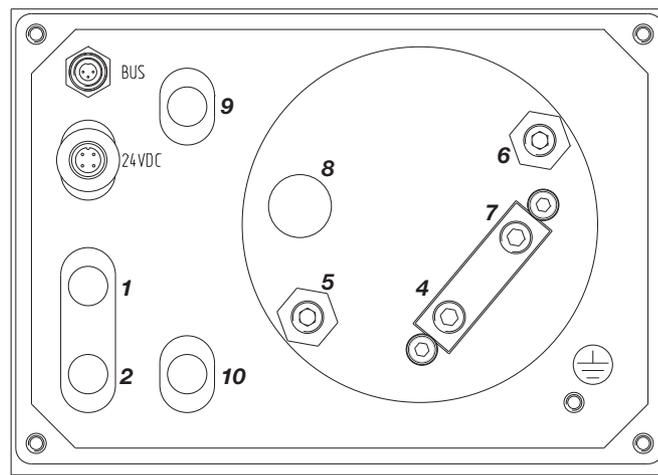
## Gas connections

### Sample cell connection by means of FPM hoses



### Sample cell direct connection

The sample cell is connected directly to the gas ports (for wall-mount housing only). Application e.g. when external gas supply is connected and for short  $T_{90}$  times.



- 1 Purge gas inlet housing <sup>1)</sup>
  - 2 Purge gas outlet housing <sup>1)</sup> (also with flow sensor)
  - 3 –
  - 4 Sample gas inlet
  - 5 Purge gas inlet analyzer
  - 6 Purge gas outlet analyzer
  - 7 Sample gas outlet
  - 8 –
  - 9 Pressure sensor 1 <sup>1)</sup>
  - 10 Pressure sensor 2 <sup>1)</sup>
- Pneumatics module <sup>2)</sup>:
- 11 Sample gas inlet
  - 12 End point gas inlet (with 3 solenoids)
  - 13 Test gas/zero-point gas inlet (with 1 or 3 solenoids)
  - 14 Sample gas outlet – connect with sample gas inlet 4
- 1) Option  
2) Option – not in version with sample cell direct connection

## Measurement principle

Potentiometric measurement; zirconium dioxide cell for determination of the oxygen concentration in accordance with Nernst's equation; reference gas: ambient air.

The analyzer module is used for the continuous measurement of oxygen in pure gases (N<sub>2</sub>, CO<sub>2</sub>, Ar). The measuring cell is catalytically inactivated to the extent that flammable carrier components in stoichiometric concentrations only negligibly reduce the oxygen value.

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>)

Measurement range quantity and limits

4 measurement ranges

Measurement ranges are freely adjustable within the 0 to 1 ppm to 0 to 250,000 ppm O<sub>2</sub> range; they are factory-set to 0 to 1/10/100/1000 ppm O<sub>2</sub>

The following measurement data refer to a measurement span of 100 ppm O<sub>2</sub> with a regulated flow rate of 8 ± 0.2 l/h.

## Stability

Linearity

Owing to the measurement principle, zirconium dioxide cells are base linear.

Repeatability

< 1 % of the measurement range or 100 ppb O<sub>2</sub> (whichever is greater)

Zero drift

The zero point (reference point) is displayed if ambient air is present on the sample gas side. The value for air of 20.6 vol.% O<sub>2</sub> (for 25 °C and 50 % relative humidity) may deviate through aging of the cell.

< 1 % of the measurement range per week or 250 ppb O<sub>2</sub> (whichever is greater)

Sensitivity drift

Depends on possible interfering components (catalyst poisons) in the sample gas and the aging of the cell.

For pure gas measurements in N<sub>2</sub>, CO<sub>2</sub> and Ar: < 1 % of the measurement range per week or 250 ppb O<sub>2</sub> (whichever is greater)

Output fluctuation (2 σ)

< ±0.5 % of the measured value or 50 ppb O<sub>2</sub> (whichever is greater)

Detection limit (4 σ)

< ±1 % of the measured value or 100 ppb O<sub>2</sub> (whichever is greater)

## Influence effects

Flow effect

≤ 300 ppbv O<sub>2</sub> in the permissible range

Associated gas effect

Inert gases (Ar, CO<sub>2</sub>, N<sub>2</sub>) have no effect. Flammable gases (CO, H<sub>2</sub>, CH<sub>4</sub>) in stoichiometric concentrations to the oxygen content: Conversion of O<sub>2</sub> < 20 % of the stoichiometric conversion. If higher concentrations of flammable gases are present, higher O<sub>2</sub> conversions must be expected. The concentration of flammable gases in the sample gas must not exceed 100 ppm.

Temperature effect

The effect of the ambient temperature in the permissible range of +5 to +45 °C is < 2 % of the measured value or 50 ppb O<sub>2</sub> per 10 °C change in the ambient temperature (whichever is greater).

Air pressure effect

No effect through a change in air pressure; sample gas must flow out of the outlet without back pressure.

Power supply effect

24 VDC ± 5 %: no effect

Position effect

No position effect for permanently installed instruments

## Dynamic response

Warm-up time

The operating temperature of the cell is reached after approx. 15 min. Offset calibration with reference gas (ambient air) after 2 h flow. The measurement is ready-to-run after valves and lines have been purged with sample gas. Typical purging time for valves and lines: approx. 2 to 5 h.

90% response time

T<sub>90</sub> < 60 s for the alternation of 2 test gases in the measurement range 10 ppm with a sample gas flow rate = 8 l/h and electronic T90 time = 3 s

## Calibration

Offset calibration

The reference value for ambient air is calibrated at 20.6 vol.% O<sub>2</sub> by means of ambient air on the sample gas side.

End-point calibration

By means of test gas O<sub>2</sub> in N<sub>2</sub> (or in CO<sub>2</sub> or Ar); O<sub>2</sub> concentration in the measurement range, e.g. 10 ppm O<sub>2</sub>

## Function test

An extended response time or reduced sensitivity are dimensions for the correct functioning of the measuring cell. The function test can be carried out without any additional test gases by feeding the sample gas with constant concentration. On the basis of the progression of the test, it can be assessed whether the reaction time of the sensor lies within a specified tolerance. The function test is started manually and lasts approx. 15 min. An additional function block configuration is required for a cyclic scan.

# Trace oxygen analyzer module Z023

## Materials in contact with the sample medium

### Analyzer

Zirconium dioxide cell:  $ZrO_2$ , electrodes containing platinum;  
Dust filter (option): Flow sensor (option): on semiconductor basis, nickel-plated brass

### Gas lines and connectors

Stainless steel 1.4571 (SAE 316Ti), FPM and silicon hoses in the gas outlet; Gas connections: stainless steel 1.4401/1.4305 (SAE 316/SAE 303)

## Sample gas inlet conditions

The analyzer module must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

### Temperature

+5 to +50 °C

### Inlet pressure

$p_e \leq 70$  hPa

### Outlet pressure

Atmospheric pressure

### Flow rate

4 to 20 l/h. Use a metering valve to set the flow rate.

### Corrosive gases

The presence of corrosive gases and catalyst poisons, e.g. halogens, gases containing sulfur and heavy-metal dust, leads to faster aging and/or destruction of the  $ZrO_2$  cell.

### Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment. The concentration of flammable gases in the sample gas must not exceed 100 ppm.

### Purge gas

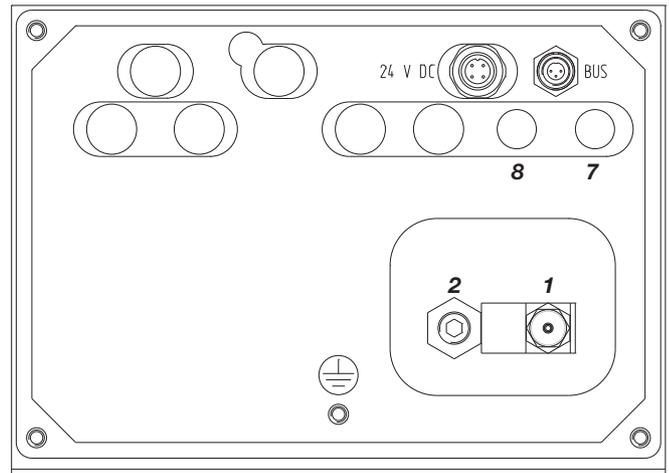
If case purging is selected, purging may only be carried out with air (not with nitrogen), since the ambient air is used as a reference gas.

## Note

The trace oxygen analyzer module cannot be connected to the pneumatics module.

## Gas connections

The measuring chamber is connected to the sample gas inlet connection via a stainless steel tube (inlet side) and to the sample gas outlet connection via a FPM hose (outlet side).



- 1** Sample gas inlet 3 mm Swagelok®
- 2** Sample gas outlet 1/8 NPT internal thread
- 7** Purge gas inlet housing (only for IP54 version)
- 8** Purge gas outlet housing (only for IP54 version)

# Thermal conductivity analyzer module Caldos25

## Measurement principle

Difference in thermal conductivity of various gases

Highly corrosion-resistant thermal conductivity analyzer, sample cells embedded in glass

## Sample components and measurement ranges

The Caldos25 is specifically designed for measurements of corrosive gas components.

Sample components and smallest measurement ranges (examples)

Component and associated gas	Smallest measurement range	Reference gas
H <sub>2</sub> in N <sub>2</sub> or air	0–0.5 vol. %	Air (sealed)
SO <sub>2</sub> in N <sub>2</sub> or air	0–1.5 vol. %	Air (sealed)
H <sub>2</sub> in Cl <sub>2</sub>	0–0.5 vol. %	Flowing

Measurement range quantity and limits

1 to 4 measurement ranges per sample component  
Ranges are factory-set per customer order.

Largest measurement range

0 to 100 vol. % or 0 vol. % to saturation  
Measurement ranges within ignition limits cannot be provided.

Measurement range switching ratio

≤ 1:20

Measurement ranges with suppressed zero-point

Span at least 2 vol. %, depending on application

## Stability

Linearity deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero drift

≤ 1 % of span per week

Sensitivity drift

≤ 1 % of measured value per week

Output fluctuation (2  $\sigma$ )

≤ 0.5 % of smallest measurement range span at electronic  
T<sub>90</sub> time = 0 sec

Detection limit (4  $\sigma$ )

≤ 1 % of smallest measurement range span at electronic  
T<sub>90</sub> time = 0 sec

## Influence effects

Flow effect

≤ 1 to 5 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect

Analyzer calibration should be based on an analysis of the sample gas. Measurement results can be greatly distorted by interfering components in complex (non-binary) gas mixtures.

Temperature effect

Ambient temperature in permissible range  
at each point in the measurement range: ≤ 1 % of span per 10 °C, based on temperature at the time of calibration  
Thermostat temperature = 60 °C

Air pressure effect

No effect in permissible operating condition range

Power supply effect

24 VDC ± 5 %: ≤ 0.2 % of span

Position effect

< 1 % of span up to 10° deviation from horizontal orientation

## Dynamic response

Warm-up time

1.5 hours

90% response time

Typical T<sub>90</sub> = 10 to 20 sec; optional: T<sub>90</sub> < 6 sec  
(applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration

With sample component-free process gas or substitute gas

End-point calibration

With process gas having a known sample gas concentration or with substitute gas

# Thermal conductivity analyzer module Caldos25

## Materials in contact with the sample medium

### Analyzer

Rust- and acid-resistant steel 1.4305 (SAE 303), glass

### Gas lines and connectors

For sealed reference gas: Rust- and acid-resistant steel 1.4305 (SAE 303);

For flowing reference gas: PVC-C, FPM seals;

For corrosive sample gas: PVC-C, FPM seals; if the sample gas contains  $\text{NH}_3$ , FFKM seals are used.

## Sample gas inlet conditions

### Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

### Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

10 to 90 l/h, max. 90 to 200 l/h for option  $T_{90} < 6$  sec

### Flowing reference gas

Gas inlet conditions same as sample gas

### Flammable gases

The analyzer module is suitable for measuring flammable gases and vapors under atmospheric conditions ( $p_{abs} \leq 1.1$  bar, oxygen content  $\leq 21$  vol.%). Temperature class: T4. The sample gas must not be explosive under normal conditions. If the sample gas is explosive in the event of a sample gas supply failure, then only seldom and briefly (in accordance with zone 2). Pressure in the sample gas path in normal operation  $p_e \leq 100$  hPa; in case of a sample gas supply failure the pressure must not exceed the maximum value  $p_e = 500$  hPa. Before using the analyzer module the corrosion resistance against the specific sample gas must be checked.

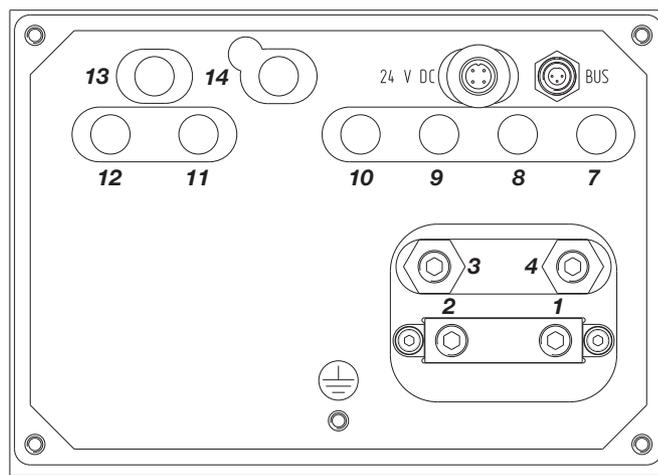
Housing purge with nitrogen should be provided when measuring flammable gases and vapors. Flame barriers can be used as an option (except for the "safety concept" version, see page 34). Pressure drop at the flame barriers approx. 40 hPa for a sample gas flow rate of 50 l/h. Material of the flame barriers: Stainless steel 1.4571 (SAE 316Ti).

Version in category 3G see page 34

## Gas connections

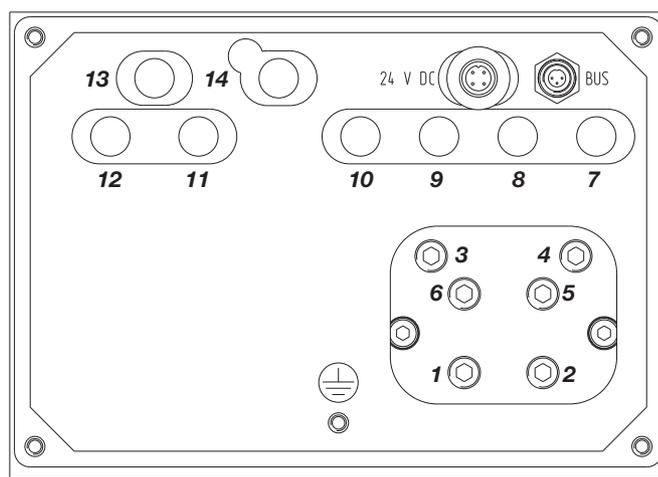
### Standard version

The sample cell is connected directly to the gas ports.



### Versions for corrosive sample gas or flowing reference gas

The sample cell is connected directly to the gas ports.



- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1 Sample gas inlet</li> <li>2 Sample gas outlet</li> <li>3 Purge gas inlet analyzer</li> <li>4 Purge gas outlet analyzer</li> <li>5 Reference gas inlet<sup>2)</sup></li> <li>6 Reference gas outlet<sup>2)</sup></li> <li>7 Purge gas inlet housing<sup>1)</sup></li> <li>8 Purge gas outlet housing<sup>1)</sup> (also with flow sensor)</li> <li>9 Pressure sensor 1<sup>1)</sup></li> <li>10 Pressure sensor 2<sup>1)</sup></li> <li>11 Sample gas inlet</li> <li>12 End point gas inlet (with 3 solenoids)</li> <li>13 Test gas/zero-point gas inlet (with 1 or 3 solenoids)</li> <li>14 Sample gas outlet – connect with sample gas inlet 1</li> </ul> | <p><b>Caution!</b></p> <p>In versions for corrosive sample gas or flowing reference gas, gas ports 1 to 6 are made of PVC-C. Do not use metal adapters or hose nozzles!</p> |
|---|---|
- 1) Option  
2) Not in version for corrosive sample gas

# Thermal conductivity analyzer module Caldos27

## Measurement principle

Difference in thermal conductivity of various gases

Micromechanical silicon sensor with especially short  $T_{90}$  time

## Sample components and measurement ranges

Sample components and smallest possible measurement ranges (examples)

Component and associated gas	Measurement ranges		Standard gas <sup>1)</sup> for calibration
	class 1	class 2	
Ar in O <sub>2</sub>	0–20	0–2	vol.% Air, N <sub>2</sub> , O <sub>2</sub>
H <sub>2</sub> in Ar	0–2.5	0–0.25	vol.% Air, N <sub>2</sub> , Ar
H <sub>2</sub> in N <sub>2</sub> /air	0–3	0–0.3	vol.% Air, N <sub>2</sub>
H <sub>2</sub> in stack gas	0–5	0–0.5	vol.% Air, N <sub>2</sub>
CH <sub>4</sub> in N <sub>2</sub>	0–20	0–2	vol.% Air, N <sub>2</sub>
CH <sub>4</sub> in air	0–4	0–2	vol.% Air, N <sub>2</sub>
CO <sub>2</sub> in N <sub>2</sub> /air	0–30	0–3	vol.% Air, N <sub>2</sub>
Ar in N <sub>2</sub>	75–100	97.5–100	vol.% Air, N <sub>2</sub> , Ar
H <sub>2</sub> in N <sub>2</sub>	90–100	97–100	vol.% N <sub>2</sub> , H <sub>2</sub>
		99–100 <sup>2)</sup>	vol.% N <sub>2</sub> , H <sub>2</sub>
CH <sub>4</sub> in N <sub>2</sub>	90–100	99–100	vol.% N <sub>2</sub> , CH <sub>4</sub>
He in N <sub>2</sub>	90–100	97–100	vol.% He

1) Only for measurement ranges  $\geq$  class 1

2) Daily zero-point check required

Sample components and measurement ranges for monitoring hydrogen-cooled turbo generators

Component and associated gas	Measurement range
CO <sub>2</sub> in air	0–100 vol.%
H <sub>2</sub> in CO <sub>2</sub>	100–0 vol.%
H <sub>2</sub> in air	100–80/90 vol.%

Other sample components on request.

Measurement range quantity and limits

1 to 4 measurement ranges per sample component. Range limits are freely adjustable. They are factory-calibrated for the largest possible measurement range.

Largest measurement range

0 to 100 vol.% or 0 vol.% to saturation, depending on measurement task. Measurement ranges within ignition limits cannot be provided.

Measurement range switching ratio

$\leq 1:20$

Measurement ranges with suppressed zero-point

See the table above for spans

## Stability

These data apply only to measurement ranges  $\geq$  class 2.

Linearity deviation

$\leq 2\%$  of span

Repeatability

$\leq 1\%$  of span

Zero drift

$\leq 2\%$  of smallest possible measurement range per week

Sensitivity drift

$\leq 0.5\%$  of smallest possible measurement range per week

Output fluctuation ( $2\sigma$ )

$\leq 0.5\%$  of smallest measurement range span at electronic  
 $T_{90}$  time = 0 sec

Detection limit ( $4\sigma$ )

$\leq 1\%$  of smallest measurement range span at electronic  
 $T_{90}$  time = 0 sec

## Influence effects

Flow effect

$\leq 0.5\%$  of span at a flow change of  $\pm 10$  l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Temperature effect

Ambient temperature in permissible range  
at each point in the measurement range:  $\leq 0.5\%$  of span per  $10^\circ\text{C}$ , based on temperature at the time of calibration  
Thermostat temperature =  $60^\circ\text{C}$

Air pressure effect

$\leq 0.25\%$  of span per 10 hPa for the smallest possible ranges given; for larger spans the effect is correspondingly lower.  
Pressure sensor working range:  $p_{\text{abs}} = 600$  to 1250 hPa  
Option: Operating altitude over 2000 m

Power supply effect

24 VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span

Position effect

$< 1\%$  of span up to  $30^\circ$  deviation from horizontal orientation

## Dynamic response

Warm-up time

Approx. 30/60minutes for class 1/2 measurement ranges

90% response time

$T_{90} \leq 2$  sec for direct sample cell connection and sample gas flow of 60 l/h  
(applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration

With test gas, measurement component-free process gas or substitute gas

End-point calibration

With test gas, process gas having a known sample gas concentration or substitute gas

Simplified calibration with standard gas

For measurement ranges  $\geq$  class 1, a single-point calibration can be performed with standard gas, since the zero- and end-points will not drift independently due to the sensor principle employed.

This technique leaves out safety-related measurements.

Depending on the measurement task involved, the zero- and end-points should be verified periodically (recommendation: once a year).

# Thermal conductivity analyzer module Caldos27

## Materials in contact with the sample medium

### Analyzer

Sample cell: Stainless steel 1.4305 (SAE 303); sensor: Gold, silicon oxo-nitride; seal: FFKM75

## Sample gas inlet conditions

### Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Water vapor content variations cause volume errors.

### Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

Normally 10 to 90 l/h, minimum 1 l/h

### Corrosive gases

Consultation with ABB Analytical is required if the sample gas contains  $Cl_2$ , HCl, HF,  $SO_2$ ,  $NH_3$ ,  $H_2S$  or other corrosive components.

FPM hoses should not be used if the sample gas contains  $NH_3$ . Instead, FFKM hoses should be used. In this case the pneumatics module cannot be connected to the analyzer module.

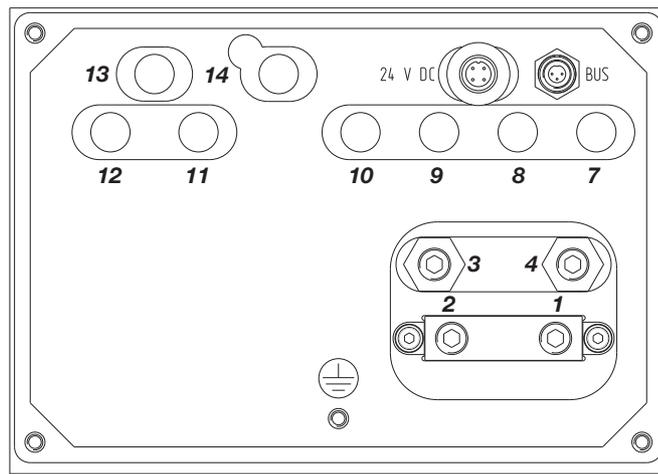
### Flammable gases

The analyzer module is suitable for measuring flammable gases and vapors under atmospheric conditions ( $p_{abs} \leq 1.1$  bar, oxygen content  $\leq 21$  vol.%). Temperature class: T4. The sample gas must not be explosive under normal conditions. If the sample gas is explosive in the event of a sample gas supply failure, then only seldom and briefly (in accordance with zone 2). Pressure in the sample gas path in normal operation  $p_e \leq 100$  hPa; in case of a sample gas supply failure the pressure must not exceed the maximum value  $p_e = 500$  hPa. Before using the analyzer module the corrosion resistance against the specific sample gas must be checked. Housing purge with nitrogen should be provided when measuring flammable gases and vapors. Flame barriers can be used as an option (except for the "safety concept" version, see page 34). Pressure drop at the flame barriers approx. 40 hPa for a sample gas flow rate of 50 l/h. Material of the flame barriers: Stainless steel 1.4571 (SAE 316Ti).

Version in category 3G see page 34

## Gas connections

The sample cell is connected directly to the gas ports.



- 1** Sample gas inlet
  - 2** Sample gas outlet
  - 3** Purge gas inlet analyzer
  - 4** Purge gas outlet analyzer
  - 7** Purge gas inlet housing <sup>1)</sup>
  - 8** Purge gas outlet housing <sup>1)</sup> (also with flow sensor)
  - 9** Pressure sensor 1
  - 10** Pressure sensor 2
  - Pneumatics module <sup>1)</sup>:
  - 11** Sample gas inlet
  - 12** End point gas inlet (with 3 solenoids)
  - 13** Test gas/zero-point gas inlet (with 1 or 3 solenoids)
  - 14** Sample gas outlet – connect with sample gas inlet **1**
- 1) Option

# FID analyzer module Fidas24

---

## Measurement principle

Flame-ionization detector

## Sample components and measurement ranges

Sample components

Hydrocarbons (THC)

Number of sample components

4 sample components

Smallest measurement range

0 to 5 mg org. C/m<sup>3</sup> or 0 to 10 ppm C1

Largest measurement range

0 to 50,000 mg org. C/m<sup>3</sup> or 0 to 10 vol.% C1

The sample component concentration in the sample gas should not exceed 100 % of the LEL.

Measurement range quantity and limits

1 to 4 measurement ranges

Ranges are factory-set per customer order.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They apply to measurement ranges  $\geq 50$  mg org. C/m<sup>3</sup>, for smaller ranges these only apply if they are factory-set per customer order.

Linearity deviation

$\leq 2$  % of the span to 5,000 mg org. C/m<sup>3</sup>

this value applies in one (calibrated) measurement range

Repeatability

$\leq 0.5$  % of measurement range

Zero-point and sensitivity drift

$\leq 0.5$  mg org. C/m<sup>3</sup> per week

Output fluctuation (2  $\sigma$ )

$\leq 0.5$  % of span at electronic T90 time = 20 sec,  
not smaller than 10  $\mu$ g org. C/m<sup>3</sup>

Detection limit (4  $\sigma$ )

$\leq 1$  % of span at electronic T90 time = 20 sec,  
not smaller than 20  $\mu$ g org. C/m<sup>3</sup>

## Influence effects

Oxygen dependence

$\leq 2$  % of measured value for 0 to 21 vol.% O<sub>2</sub> or  
 $\leq 0.3$  mg org. C/m<sup>3</sup>, the larger value applies

Temperature effect

Ambient temperature in permissible range  
at zero-point and on sensitivity:  $\leq 2$  % per 10 °C in  
measurement range of 0 to 15 mg org. C/m<sup>3</sup>

Power supply effect

24 VDC  $\pm 5$  %:  $\leq 0.2$  % of span or  
230 VAC  $\pm 10$  %:  $\leq 0.2$  % of span

## Dynamic response

Warm-up time

$\leq 2$  hours

90% response time

T<sub>90</sub> < 1.5 s at sample gas flow = 80 l/h and electronic T90 time  
= 1 sec

## Calibration

Zero-point calibration

With synthetic air or catalytically purified air or nitrogen,  
depending on application

Sensitivity calibration

With propane or another hydrocarbon (substitute gas) in air or  
nitrogen, depending on application

## Materials in contact with the sample medium

Analyzer, gas lines and connectors

Stainless steel 1.4305 (SAE 303) and 1.4571 (SAE 316Ti), FPM,  
PTFE, FFKM

## Operating gases and test gases

Instrument air

Quality per ISO 8573-1 class 2 (max. particle size 1  $\mu$ m, max.  
particle concentration 1 mg/m<sup>3</sup>, max. oil content 0.1 mg/m<sup>3</sup>,  
pressure dew point at least 10 °C below the lowest foreseeable  
ambient temperature)

Inlet pressure p<sub>e</sub> = 4000  $\pm$  500 hPa

Flow rate typically approx. 1500 l/h (1200 l/h for air injector and  
approx. 300 l/h for housing purge), maximum approx. 2300 l/h  
(1800 l/h + 500 l/h)

Combustion air

Synthetic air or catalytically purified air with an organic C  
content < 1 % span

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate < 20 l/h

Combustion gas

Hydrogen, grade 5.0, or H<sub>2</sub>/He mixture (40/60 %)

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate  $\leq 3$  l/h (H<sub>2</sub>) or approx. 10 l/h (H<sub>2</sub>/He)

A flow limiting device must be provided on the hydrogen  
supply (see section "Safe operation of the gas analyzer").

Test gases

Zero-point calibration: Nitrogen, grade 5.0, or synthetic air or  
catalytically purified air

Sensitivity calibration: Sample component or substitute gas  
component in Nitrogen or air

Inlet pressure p<sub>e</sub> = 1000  $\pm$  100 hPa

Flow rate 130 to 250 l/h

# FID analyzer module Fidas24

## Sample gas inlet conditions

The analyzer module must not be used for measurement of gases containing organometallic compounds, e.g. leaded gasoline additives or silicone oils.

### Temperature

≤ thermostat temperature

(Thermostat temperature for measurement gas path, detector and air injector ≤ 200 °C, factory-set to 180 °C)

### Inlet pressure

$p_{\text{abs}} = 800$  to 1200 hPa

### Outlet pressure

Atmospheric pressure

### Flow rate

Approx. 80 to 100 l/h at atmospheric pressure (1000 hPa)

### Flammable gases

The analyzer module can be used for measurement of flammable gases as long as the total flammable portion does not exceed 15 vol.% CH<sub>4</sub> or C1 equivalents.

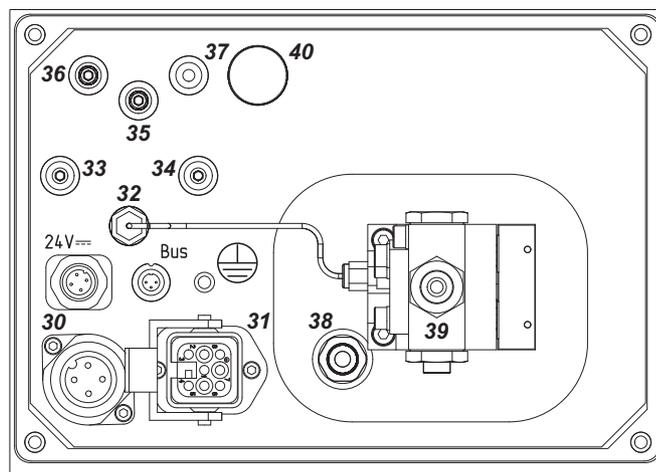
## Safe operation of the gas analyzer

The device concept ensures that a concentration of combustible gas or an explosive mixture of combustible gas and ambient air cannot occur in the interior of the gas analyzer during normal operation. The interior of the gas analyzer cannot be allocated to an (explosion protection) zone; an explosive gas mixture cannot escape to the outside.

The end user must make the following provisions to ensure safe operation of the gas analyzer:

- The gas analyzer is safe to operate even in case of a defect in the combustion gas feed path (e.g. a loose screw connection inside the gas analyzer) with an additional flow restriction in the combustion gas supply (outside the gas analyzer) of 10 l/h for H<sub>2</sub> or 25 l/h for an H<sub>2</sub>/He mixture.
- The installation of an external combustion gas shut-off valve must be provided. ABB recommends the automatic shut-off of the combustion gas supply in case the compressed air supply fails by the installation of a pneumatic valve, which controls the combustion gas supply and is actuated by the compressed air supply.

## Gas and electrical connections



- 30** Power supply 115 or 230 VAC for heating of detector and sample gas inlet (4-pin male plug, connecting cable supplied)
  - 31** Electrical connection to heated sample gas inlet (fixed)
  - 32** Test gas outlet
  - 33** Zero-point gas inlet
  - 34** End-point gas inlet
  - 35** Combustion air inlet
  - 36** Combustion gas inlet
  - 37** Instrument air inlet
  - 38** Exhaust outlet (Male fitting for connecting the exhaust air outlet tube: Stainless steel tube with outside diameter = 6 mm, included in the scope of supply and delivery of the gas analyzer. Permissible maximum length of 30 cm; after that point the inner diameter of the exhaust line should be increased to ≥ 10 mm.)
  - 39** Sample gas inlet, heated or unheated (Threaded connection for PTFE or stainless steel tubing with a 6-mm outer diameter)
  - 40** Pressure compensation opening with protection filter
- 24 V External power supply 24 VDC (4-pin male plug)  
Bus System bus (3-pin female plug)

### Sample gas line connection

To heated sample gas inlet:

- In wall-mount housing: bottom and right
- In 19-inch housing: back, top and bottom

To unheated sample gas inlet:

- In wall-mount and 19-inch housing: back

# FID analyzer module MultiFID14

## Measurement principle

Flame-ionization detector

## Sample components and measurement ranges

Sample components

Hydrocarbons

Smallest measurement range

0 to 5 mg org. C/m<sup>3</sup>

Largest measurement range

0 to 100,000 mg org. C/m<sup>3</sup>

The sample component concentration in the sample gas should not exceed 50 % of the LEL.

Measurement range quantity and limits

1 to 4 measurement ranges

Ranges are factory-set per customer order. They can be reduced or enlarged by a factor of max. 4 (to the smallest indicated measurement range).

## Stability

The following data apply to measurement ranges  $\geq 50$  mg org. C/m<sup>3</sup>, for smaller ranges these only apply if they are factory-set per customer order.

Linearity deviation

$\leq 2$  % of the span to 10,000 mg org. C/m<sup>3</sup>

this value applies in one (calibrated) measurement range

Repeatability

$\leq 0.5$  % of measurement range

Zero-point and sensitivity drift

$\leq 0.5$  mg org. C/m<sup>3</sup> per week

Output fluctuation (2  $\sigma$ )

$\leq 0.5$  % of span at electronic T90 time = 20 sec

Detection limit (4  $\sigma$ )

$\leq 1$  % of span at electronic T90 time = 20 sec

## Influence effects

O<sub>2</sub> dependence

$\leq 2$  % of measured value for 0 to 21 vol.% O<sub>2</sub> or

$\leq 0.3$  mg org. C/m<sup>3</sup>, the greater value applies

Temperature effect

Ambient temperature in permissible range

At zero-point and on sensitivity:  $\leq 2$  % per 10 °C in measurement range of 0 to 15 mg org. C/m<sup>3</sup>

Power supply effect

24 VDC  $\pm 5$  %:  $\leq 0.2$  % of span

## Dynamic response

Warm-up time

$\leq 2$  hours

90% response time

T<sub>90</sub> < 0.9 sec at sample gas flow = 80 l/h and electronic

T90 time = 1 sec (with unheated sample gas inlet; applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration

With synthetic air or catalytically purified air or nitrogen

Sensitivity calibration

With propane or another hydrocarbon (substitute gas) in air or nitrogen, depending on application

If an substitute gas curve is used during factory calibration, the measurement component response factors will also be calculated.

## Materials in contact with the sample medium

Analyzer, gas lines and connectors

Stainless steel, FPM, PTFE

## Operating gases and test gases

Instrument air

Quality per ISO 8573-1 class 2 (max. particle size 1  $\mu$ m, max. particle concentration 1 mg/m<sup>3</sup>, max. oil content 0.1 mg/m<sup>3</sup>, pressure dew point at least 10 °C below the lowest foreseeable ambient temperature)

Inlet pressure p<sub>e</sub> = 4000  $\pm$  500 hPa

Flow rate typically approx. 1500 l/h (1200 l/h for air injector and approx. 300 l/h for housing purge), maximum approx. 2300 l/h (1800 l/h + 500 l/h)

Combustion air

Synthetic air or catalytically purified air with an organic C content < 1 % span

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate < 40 l/h

Combustion gas

Hydrogen, grade 5.0, or H<sub>2</sub>/He mixture (40/60 %)

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate  $\leq 3$  l/h (H<sub>2</sub>) or approx. 8 l/h (H<sub>2</sub>/He)

A flow limiting device must be provided on the hydrogen supply (see section "Safe operation of the gas analyzer").

Test gases

Zero-point calibration: Nitrogen, grade 5.0, or synthetic air or catalytically purified air

Sensitivity calibration: Sample component or substitute gas component in nitrogen or air

Inlet pressure p<sub>e</sub> = 1000  $\pm$  100 hPa

Flow rate 130 to 250 l/h

# FID analyzer module MultiFID14

## Sample gas inlet conditions

The analyzer module must not be used for measurement of gases containing organometallic compounds, e.g. leaded gasoline additives or silicone oils.

The analyzer module must not be used for measurement of flammable gases

### Temperature

≤ Thermostat temperature

(Thermostat temperature for measurement gas path, detector and air injector ≤ 200 °C, factory-set to 180 °C)

### Inlet pressure

$p_{abs} = 800$  to 1200 hPa

### Outlet pressure

Atmospheric pressure

### Flow rate

Approx. 80 to 100 l/h at atmospheric pressure (1000 hPa)

## Safe operation of the gas analyzer

The device concept ensures that a concentration of combustible gas or an explosive mixture of combustible gas and ambient air cannot occur in the interior of the gas analyzer during normal operation. The interior of the gas analyzer cannot be allocated to an (explosion protection) zone; an explosive gas mixture cannot escape to the outside.

The end user must make the following provisions to ensure safe operation of the gas analyzer:

- The gas analyzer is safe to operate even in case of a defect in the combustion gas feed path (e.g. a loose screw connection inside the gas analyzer) with an additional flow restriction in the combustion gas supply (outside the gas analyzer) of 10 l/h for H<sub>2</sub> or 25 l/h for an H<sub>2</sub>/He mixture.
- The installation of an external combustion gas shut-off valve must be provided. ABB recommends the automatic shut-off of the combustion gas supply in case the compressed air supply fails by the installation of a pneumatic valve, which controls the combustion gas supply and is actuated by the compressed air supply.

## Category 3G version

The MultiFID14 analyzer module in the category 3G version is suited to measure hydrocarbons in a non-flammable sample gas mixture when installed in Zone 2 hazardous areas. The heated sample gas inlet is not available in the category 3G version.

### Designation

II 3G EEx nP II T3

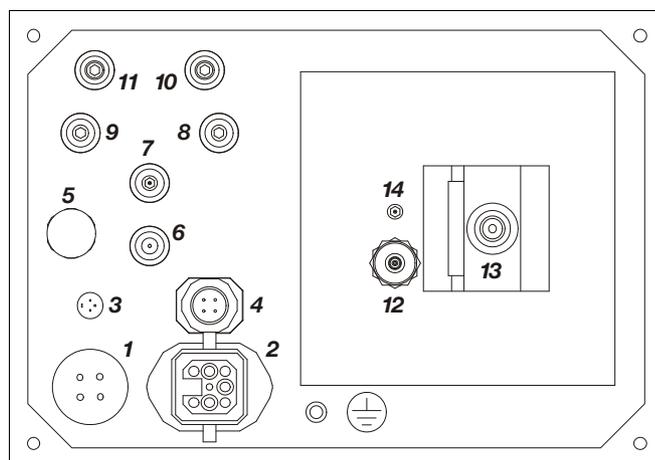
### Type examination certificate

DMT 01 E 126 X

### Housing protection type

IP54

## Gas and electrical connections



- 1 Power supply 115 or 230 VAC for heating of detector and sample gas inlet (4-pin male plug, connecting cable supplied)
- 2 Electrical connection to heated sample gas inlet (fixed)
- 3 System bus (3-pin female plug)
- 4 External power supply 24 VDC (4-pin male plug)
- 5 Pressure compensation opening with protection filter
- 6 Instrument air inlet
- 7 Test gas outlet
- 8 End-point gas inlet
- 9 Zero-point gas inlet
- 10 Combustion gas inlet
- 11 Combustion air inlet
- 12 Exhaust outlet (Threaded connection for 6-mm outer diameter tubing. Permissible maximum length of 30 cm; after that point the inner diameter of the exhaust line should be increased to ≥ 10 mm.)
- 13 Sample gas inlet, heated or unheated, with stainless steel filter (Threaded connection for PTFE or stainless steel tubing with a 6-mm outer diameter)
- 14 Bypass nozzle

### Sample gas line connection

To heated sample gas inlet:

- In wall-mount housing: bottom and right
- In 19-inch housing: back, top and bottom

To unheated sample gas inlet:

- In wall-mount and 19-inch housing: back

Version in category 3G:

- Only in wall-mount housing, unheated sample gas inlet with flame barrier, sample gas line connection on back

# FID analyzer module MultiFID14 NMHC

## Measurement principle

Flame-ionization detector for non-methane hydrocarbon (NMHC) measurement

## Sample components and measurement ranges

Sample components

Hydrocarbons

The CH<sub>4</sub>:NMHC ratio must be in the 1:9 to 9:1 range.

Smallest measurement range

0 to 5 mg org. C/m<sup>3</sup>

Largest measurement range

0 to 5,000 mg org. C/m<sup>3</sup>

The sample component concentration in the sample gas should not exceed 50 % of the LEL.

Measurement range quantity

1 measurement range

The range is factory-set per customer order.

Display

The display shows the sample components C<sub>n</sub>H<sub>m</sub>, CH<sub>4</sub> and NMHC.

## Stability

The following data apply to measurement ranges  $\geq 50$  mg org. C/m<sup>3</sup>, for smaller ranges these only apply if they are factory-set per customer order.

Linearity deviation

$\leq 2\%$  of the span to 5,000 mg org. C/m<sup>3</sup>

this value applies in one (calibrated) measurement range

Repeatability

$\leq 0.5\%$  of measurement range

Zero-point and sensitivity drift

$\leq 0.5$  mg org. C/m<sup>3</sup> per week

Output fluctuation (2  $\sigma$ )

$\leq 0.5\%$  of span at electronic T90 time = 20 sec

Detection limit (4  $\sigma$ )

$\leq 1\%$  of span at electronic T90 time = 20 sec

## Influence effects

O<sub>2</sub> dependence

$\leq 2\%$  of measured value for 0 to 21 vol.% O<sub>2</sub> or

$\leq 0.3$  mg org. C/m<sup>3</sup>, the greater value applies

Temperature effect

Ambient temperature in permissible range

At zero-point and on sensitivity:  $\leq 2\%$  per 10 °C in measurement range of 0 to 15 mg org. C/m<sup>3</sup>

Power supply effect

24 VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span

## Dynamic response

Warm-up time

$\leq 2$  hours

90% response time

T<sub>90</sub> < 3 sec at sample gas flow = 80 l/h and electronic

T90 time = 1 sec (with unheated sample gas inlet; applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration

With synthetic air or catalytically purified air or nitrogen, depending on application

Sensitivity calibration

With propane or methane in air or in nitrogen, depending on application

## Catalyst

Effectiveness

CH<sub>4</sub>: > 85 %, C<sub>2</sub>H<sub>6</sub>: < 2 %, C<sub>3</sub>H<sub>8</sub>: < 2 %

Switchover time

Typically 30 to 120 s

Catalyst poisons (e.g. SO<sub>2</sub>, NO<sub>x</sub>, HCl, H<sub>2</sub>S, halogenated hydrocarbons) will shorten the catalyst service life. Their respective concentration should always be < 20 mg/m<sup>3</sup>.

## Materials in contact with the sample medium

Analyzer, gas lines and connectors

Stainless steel, FPM, PTFE, PEEK

## Operating gases and test gases

Instrument air

Quality per ISO 8573-1 class 2 (max. particle size 1  $\mu$ m, max. particle concentration 1 mg/m<sup>3</sup>, max. oil content 0.1 mg/m<sup>3</sup>, pressure dew point at least 10 °C below the lowest foreseeable ambient temperature)

Inlet pressure p<sub>e</sub> = 4000  $\pm$  500 hPa

Flow rate typically approx. 1500 l/h (1200 l/h for air injector and approx. 300 l/h for housing purge), maximum approx. 2300 l/h (1800 l/h + 500 l/h)

Combustion air

Synthetic air or catalytically purified air with an organic C content < 1 % span

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate < 40 l/h

Combustion gas

Hydrogen, grade 5.0, or H<sub>2</sub>/He mixture (40/60 %)

Inlet pressure p<sub>e</sub> = 1200  $\pm$  100 hPa

Flow rate  $\leq 4$  l/h (H<sub>2</sub>) or approx. 10 l/h (H<sub>2</sub>/He)

A flow limiting device must be provided on the hydrogen supply (see section "Safe operation of the gas analyzer").

Test gases

Zero-point calibration: Nitrogen, grade 5.0, or synthetic air or catalytically purified air

Sensitivity calibration: Sample component or substitute gas component in nitrogen or air

Inlet pressure p<sub>e</sub> = 1000  $\pm$  100 hPa

Flow rate 130 to 250 l/h

Test gases for catalyst effectiveness testing

Propane and methane in nitrogen or in air (separate test gas bottles)

Zero pressure via bypass

Flow rate 130 to 250 l/h

# FID analyzer module MultiFID14 NMHC

## Sample gas inlet conditions

The analyzer module must not be used for measurement of gases containing organometallic compounds, e.g. leaded gasoline additives or silicone oils.

The analyzer module must not be used for measurement of flammable gases

### Temperature

≤ Thermostat temperature

(Thermostat temperature for measurement gas path, detector and air injector ≤ 200 °C, factory-set to 180 °C)

### Inlet pressure

$p_{\text{abs}} = 850$  to 1100 hPa

### Outlet pressure

Atmospheric pressure

### Flow rate

Approx. 80 to 100 l/h at atmospheric pressure (1000 hPa)

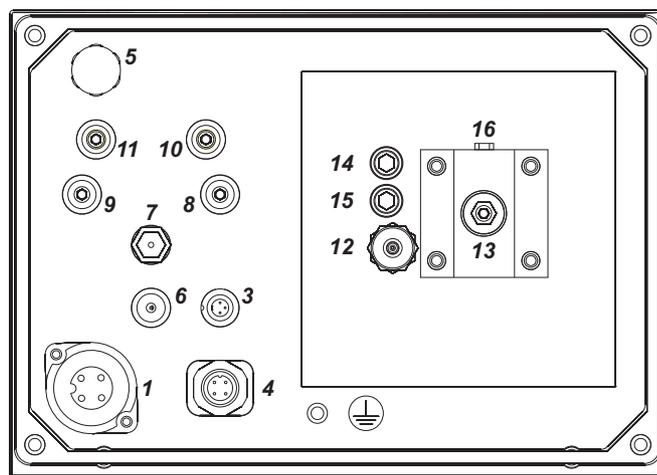
## Safe operation of the gas analyzer

The device concept ensures that a concentration of combustible gas or an explosive mixture of combustible gas and ambient air cannot occur in the interior of the gas analyzer during normal operation. The interior of the gas analyzer cannot be allocated to an (explosion protection) zone; an explosive gas mixture cannot escape to the outside.

The end user must make the following provisions to ensure safe operation of the gas analyzer:

- The gas analyzer is safe to operate even in case of a defect in the combustion gas feed path (e.g. a loose screw connection inside the gas analyzer) with an additional flow restriction in the combustion gas supply (outside the gas analyzer) of 10 l/h for H<sub>2</sub> or 25 l/h for an H<sub>2</sub>/He mixture.
- The installation of an external combustion gas shut-off valve must be provided. ABB recommends the automatic shut-off of the combustion gas supply in case the compressed air supply fails by the installation of a pneumatic valve, which controls the combustion gas supply and is actuated by the compressed air supply.

## Gas and electrical connections



- 1** Power supply 115 or 230 VAC for heating of the detector (4-pin male plug, connecting cable supplied)
- 3** System bus (3-pin female plug)
- 4** External power supply 24 VDC (4-pin male plug)
- 5** Pressure compensation opening with protection filter
- 6** Instrument air inlet
- 7** Test gas outlet
- 8** End-point gas inlet
- 9** Zero-point gas inlet
- 10** Combustion gas inlet
- 11** Combustion air inlet
- 12** Exhaust outlet (Threaded connection for 6-mm outer diameter tubing. Permissible maximum length of 30 cm; after that point the inner diameter of the exhaust line should be increased to ≥ 10 mm)
- 13** Sample gas inlet, heated (with external temperature controller Pt 100) or unheated, with stainless steel filter (Threaded connection for PTFE or stainless steel tubing with a 6-mm outer diameter)
- 14** Bypass nozzle 1
- 15** Bypass nozzle 2
- 16** Test gas inlet at sample gas connection (connected to **7** if applicable)

### Sample gas line connection

To heated sample gas inlet:

- In wall-mount housing: bottom and right
- In 19-inch housing: back, top and bottom

To unheated sample gas inlet:

- In wall-mount and 19-inch housing: back

# Laser analyzer module LS25

## Measurement principle

The LS25 laser analyzer module is based on a measuring principle called single-line spectroscopy. One single target gas absorption line with no interference is chosen in the near infrared spectral range. A single mode diode laser operating around room temperature scans this single absorption line. A detector diametrically opposite detects the light and the absorption caused only by the target gas molecules. Once the absorption by the target gas molecules is detected, the gas concentration is calculated. Automatic corrections for temperature and pressure variations are included.

## Sample components and measurement ranges

The LS25 laser analyzer module has one physical measurement range per sample component. The indicated measurement range can be freely adjusted within the physical measurement range. The smallest detection limits and corresponding measurement ranges are shown in the table below:

Sample component	Min. measurement range	Max. abs. pressure	Max. temperature
O <sub>2</sub>	0– 1 vol. %	20 bar	1500 °C
O <sub>2</sub>	0– 5 vol. %	4 bar	1500 °C
NH <sub>3</sub>	0– 15 ppm	2 bar	600 °C
HCl	0– 5 ppm	2 bar	600 °C
HF	0– 1.5 ppm	2 bar	400 °C
H <sub>2</sub> S	0– 300 ppm	2 bar	300 °C
H <sub>2</sub> O	0– 5 ppm	2 bar	400 °C
H <sub>2</sub> O	0– 0.5 vol. %	5 bar	1500 °C
CO	0– 30 ppm	5 bar	1500 °C
CO	0– 0.3 vol. %	2 bar	1500 °C
CO <sub>2</sub>	0– 100 ppm	2 bar	300 °C
CO <sub>2</sub>	0– 0.3 vol. %	2 bar	1200 °C
NO	0– 1000 ppm	2 bar	300 °C
N <sub>2</sub> O	0– 1500 ppm	2 bar	200 °C
HCN	0– 30 ppm	2 bar	300 °C
CH <sub>4</sub>	0– 20 ppm	3 bar	300 °C
C <sub>2</sub> H <sub>2</sub>	0– 10 ppm	2 bar	200 °C
C <sub>3</sub> H <sub>6</sub>	0– 1 vol. %	3 bar	200 °C
CH <sub>3</sub> I	0– 300 ppm	2 bar	200 °C
CH <sub>2</sub> O	0– 50 ppm	1.5 bar	200 °C
C <sub>2</sub> H <sub>4</sub>	0– 10 vol. %	2 bar	200 °C
NH <sub>3</sub> + H <sub>2</sub> O	0– 20 ppm 0– 5 vol. %	1.5 bar	600 °C
HCl + H <sub>2</sub> O	0– 10 ppm 0– 10 vol. %	1.5 bar	600 °C
HF + H <sub>2</sub> O	0– 2 ppm 0– 1 vol. %	1.5 bar	400 °C
CO + CO <sub>2</sub>	0– 1 vol. % 0– 1 vol. %	1.5 bar	600 °C
HCl + CH <sub>4</sub>	0– 50 ppm 0– 2000 ppm	1.5 bar	200 °C
CO + CH <sub>4</sub>	0– 50 ppm 0– 200 ppm	1.5 bar	200 °C
CO + H <sub>2</sub> O	0– 200 ppm 0– 5 vol. %	1.5 bar	200 °C
CO + H <sub>2</sub> O	0– 10 vol. % 0– 10 vol. %	1.5 bar	1300 °C
O <sub>2</sub> + temp.	0– 5 vol. %	1.5 bar	1500 °C

Other sample components on request.

All specifications refer to an optical path length (OPL) of 1 meter, tested in ABB's test/calibration jig. The standard optical path length ranges from 0.5 to 6 m (larger OPL on request). Application-dependent variations may occur. To obtain minimum measurement ranges in some cases additional measures have to be taken: Low level O<sub>2</sub> and H<sub>2</sub>O require instrument and process purging with nitrogen. Actual detection limit for a specific application will depend on the gas conditions (pressure, temperature and gas composition) and optical path length. If more than one min. measurement range is shown there are different instrument versions available.

Min. measurement range, max. pressure and max. temperature cannot necessarily be realized simultaneously. The maximum pressure and temperature given are physical (spectroscopic) limits. Applications with increased temperature or pressure or with toxic or flammable gas may require additional equipment.

Measurement range quantity

1 range per sample component, 1 x transmission

Largest measurement range

Largest measurement range is generally 100 times the minimum measurement range for the same conditions. Larger measurement ranges are normally possible by adaptation of measuring path and choice of a weaker absorption line.

## Stability

Repeatability

± detection limit or ± 1 % of reading, whichever is greater

Zero drift

< 2 % of smallest possible measurement range per 6 months

Span drift

< 4 % of measurement range per 6 months

Output fluctuation (2 σ)

≤ 0.5 % of smallest measurement range

Detection limit (4 σ)

≤ 1 % of smallest measurement range

## Influence effects

Flow effect

No effect on the measurement, but the flow will determine the amount of purge gas needed.

Associated gas effect/cross sensitivity

No cross sensitivity within normal operation conditions.

Temperature effect

- Ambient temperature in permissible range: No significant effect
- Gas temperature effect: Typically ≤ 2 % of measured value per 10 °C (dependent on type of gas and gas conditions). For large variations in gas temperature (> ±20 °C) separate temperature measurement for compensation is recommended.

Pressure effect

- At zero-point: No effect.
- Automatic compensation for large variations in sample gas pressure by measurement of absorption line width, alternatively by input from pressure sensor.

Power supply effect

24 VDC ± 5 %: ≤ 0.2 % of span

# Laser analyzer module LS25

## Dynamic response

Warm-up time

Approx. 1 hour

Response time

Less than 2 seconds without signal averaging

## Calibration

Maintenance interval

Depending on application and dust load. Typically between every 6 months and once a year.

Zero-point check

With inert gas, e.g. nitrogen, or with ambient air free of the sample component. The zero point cannot be calibrated. Due to the measurement principle, there is no zero-point drift.

Calibration

With test gas and a flow-through test cell. Calibration interval typically between every 6 months and once a year. Recommended calibration interval will be stated in calibration certificate which accompanies delivery.

## Materials in contact with the process gas

Purge and alignment unit

316 SS

Windows

BK7 glass, optional: fused silica, for HF: sapphire

## Mounting

Available flanges

DN50/PN10, DN80/PN10; ANSI 2"/150 lbs, ANSI 2"/300 lbs, ANSI 3"/150 lbs, ANSI 3"/300 lbs

Alignment tolerances

Flanges parallel within 1.5°

Purging of windows

Dry and oil-free pressurized air or gas, or by fan

Gas ports for purging

Standard: 3/8-inch hose nozzle for hoses with 10 mm inner diameter. See page 30 for connection drawing.

Weight

Transmitter unit plus flange with purging unit: 9.5 (6.3 + 3.2) kg

Receiver unit plus flange with purging unit: 7.2 (4.0 + 3.2) kg

Flow-through test cell: 3.8 kg

## Electrical connections on transmitter unit

Connection to central unit

Ethernet 10/100BASE-T, RJ45 connector;

Cable length: Standard 15 m, max. 100 m

Connection to receiver unit

15-pin female Sub-D connector;

Cable length: Standard 5 m, max. 150 m

Power supply, external pressure and temperature signals

15-pin male Sub-D connector;

Cable length laser unit–power supply: Standard 3 m, max.

100 m; Cable length power supply–plug: 3 m

Service computer

RS232, 9-pin female Sub-D connector; Ethernet

See page 31 for connection drawing.

## Process gas properties

Maximum process gas temperature and pressure are given in the “Sample components and measurement ranges” table. Quantification of dust/particle concentration is necessary in order to determine max OPL. The maximum dust concentration must be checked by ABB Analytical.

## Purge gas requirements

The purge gas should not contain any sample gas components and must be oil- and dust-free.

## Power supply

Input voltage

24 VDC  $\pm$  5 % from an external power supply unit 115/230 V AC (part of the delivery for general purpose applications)

Power consumption

approx. 20 W

## Installation site requirements

The mounting location strongly influences the measurement result. The measurement gas must be well stirred at the selected location to produce a representative measurement result. Stratification in the measurement gas path results in erroneous measurement. If the measurement gas is charged with dust, the LS25 must be mounted at right angles to the process gas flow.

## Performance test

The AO2000-LS25 analyzer module (sample components H<sub>2</sub>O, NH<sub>3</sub>) is suitable for use in facilities requiring approval and facilities of the 27<sup>th</sup> BImSchV (German Federal Immissions Control Ordinance). The requirements of QAL1 according to EN 15267-3 and EN 14181 are fulfilled.

Publication: Federal Gazette of March 11, 2009, No. 38, page 903. Report No. 936/21211189/A of April 24, 2009.

## Explosion-proof versions

The AO2000-LS25 Ex analyzer module is suited for use in areas in which explosive atmospheres caused by vapors, gases, mists, or air/dust mixtures are likely to occur.

### “Intrinsically optical safe” version for use in zone 1

Designations

 II 2 G Ex px II T5

 II 2 D Ex pD 21 IP66 T64°C

 II (2) G [Ex op is T4 Gb] IIC

EC-Type examination certificates

DNV-2006-OSL-ATEX-0042X Rev. 2, DNV 09 ATEX 64813

Housing protection type

IP66

### “Intrinsically optical safe” version for use in zone 2

Designations

 II 3 G Ex nA nC op is Gc IIC T4  $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq +55^{\circ}\text{C}$

 II 3 D Ex tD A22 IP65 T100°C

EC-Type examination certificate

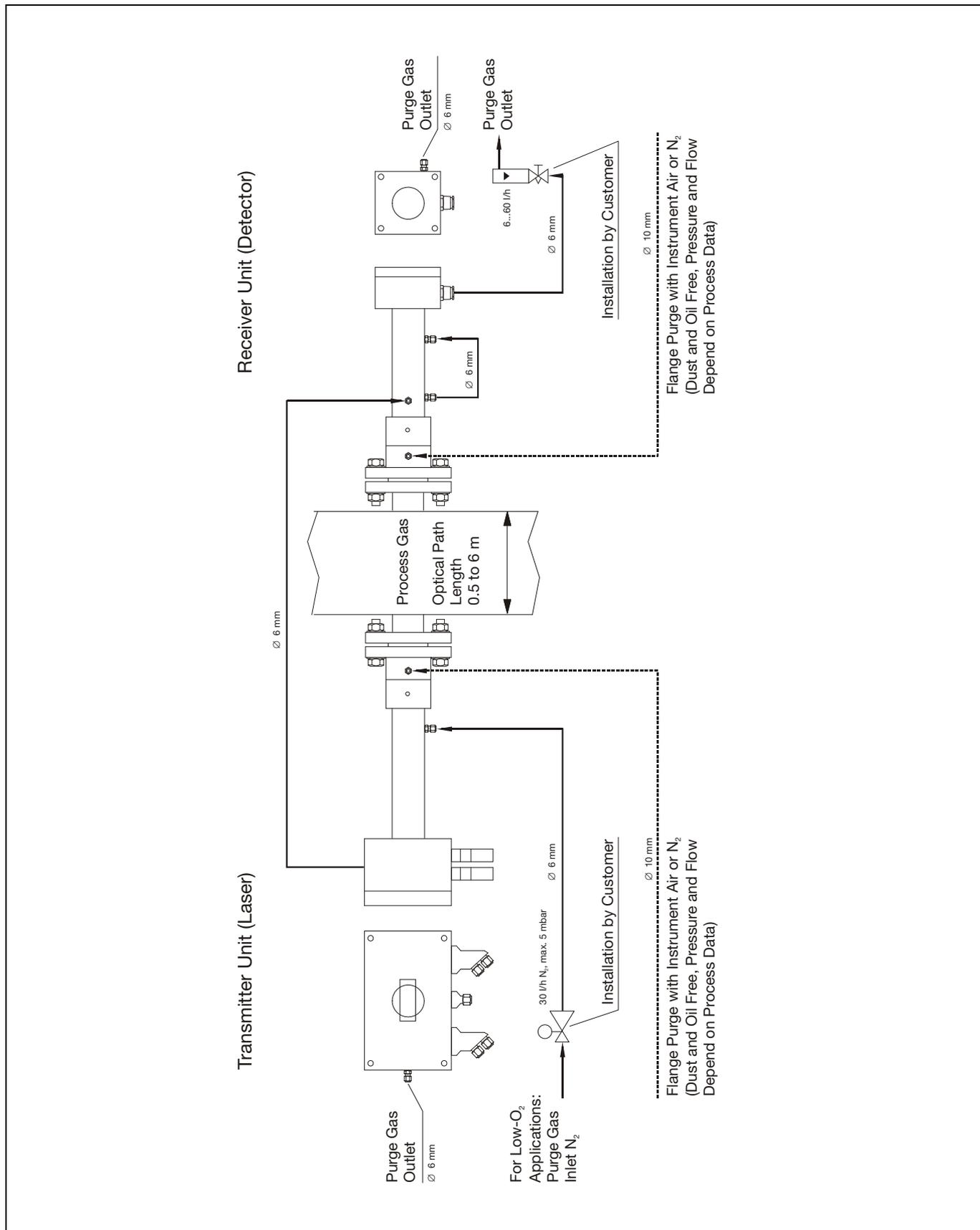
DNV-2008-OSL-ATEX-21837 Rev. 4

Housing protection type

IP66

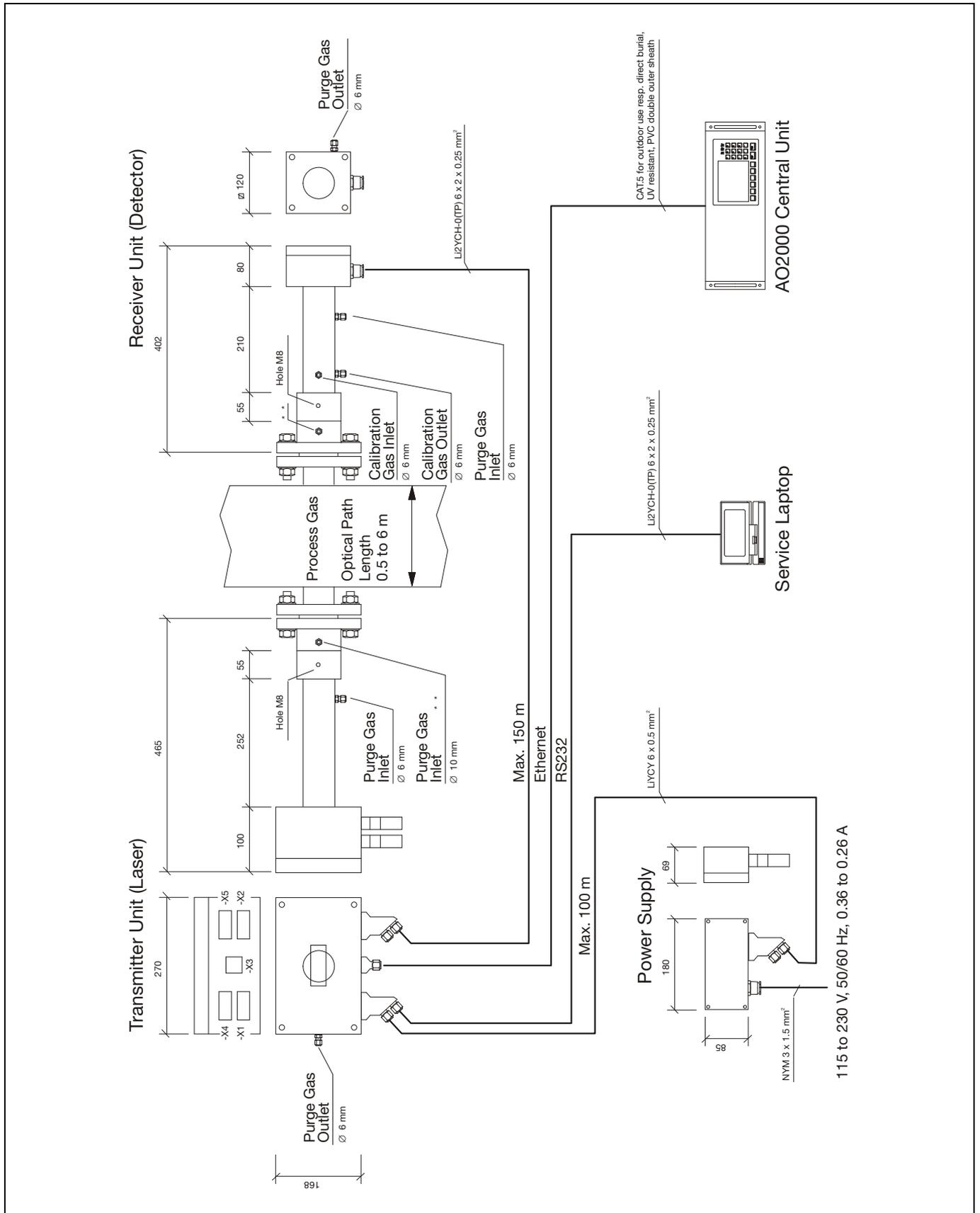
# Laser analyzer module LS25

## Gas connections (general purpose application)



# Laser analyzer module LS25

## Dimensions and electrical connections (general purpose application)



# Electrochemical oxygen sensor

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## Measurement principle

Electrochemical oxygen sensor

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>)

Measurement range quantity and limits

1 to 2 measurement ranges

Adjustable from 0 to 5 vol.% O<sub>2</sub> to 0 to 25 vol.% O<sub>2</sub>

Measurement range 2

Set to 0 to 25 vol.% O<sub>2</sub>

## Stability

Linearity deviation

Linear in the range > 1 vol.% O<sub>2</sub>

Repeatability

≤ 0.5 % of span

Zero drift

Stable over long-term due to absolute zero point

Sensitivity drift

≤ 1 % of the measurement range per week

Output fluctuation (2 σ)

≤ 0.2 % of the measurement range at electronic T90 time  
(static/dynamic) = 5/0 sec

Detection limit (4 σ)

≤ 0.4 % of the measurement range at electronic T90 time  
(static/dynamic) = 5/0 sec

## Influence effects

Flow effect

Flow rate in the 20 to 100 l/h range:  
≤ 2 % of the measurement range

Temperature effect

Ambient temperature in permissible range:  
≤ 0.2 vol.% O<sub>2</sub> per 10 °C

Air pressure effect

- At zero-point: No effect
- On sensitivity with no pressure correction:  
≤ 1 % of the measured value per 1 % air pressure change
- On sensitivity with pressure correction:  
≤ 0.2 % of the measured value per 1 % air pressure change  
Pressure correction is only possible if the oxygen sensor is connected to an analyzer module with an integral pressure sensor.

Power supply effect

Voltage and frequency in the permissible range: ≤ 0.2 % of span

## Dynamic response

90% response time

T<sub>90</sub> ≤ 30 sec, depending on sample gas flow and system layout

## Calibration

Zero-point calibration

The oxygen sensor zero is not calibrated since it is fundamentally stable.

End-point calibration

With ambient air at 20.96 vol.% O<sub>2</sub>

## Materials in contact with the sample medium

Sensor: Polystyrol-ABS, PTFE, FPM

Housing body: PVC-U, FPM seals

Gas ports: Rust- and acid-resistant steel 1.4571 (SAE 316Ti)

## Sample gas inlet conditions

The oxygen sensor must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Moisture content

H<sub>2</sub>O dew point ≥ 2 °C

The oxygen sensor should not be used with dry sample gas.

Inlet pressure

p<sub>e</sub> = 2 to 500 hPa

Outlet pressure

Atmospheric pressure

Flow rate

20 to 100 l/h

Associated gas

The oxygen sensor should not be used if the associated gas contains the following components: H<sub>2</sub>S, chlorine or fluorine compounds, heavy metals, aerosols, mercaptane, alkaline components.

## Notes

The oxygen sensor is always associated with an analyzer module and must be installed in the same housing with that analyzer module.

The oxygen sensor cannot be used with the following analyzer modules:

- Limas11 with stainless steel, PFA or PTFE gas connections
- Fidas24
- MultiFID14
- Analyzer modules for measuring corrosive gases
- Analyzer modules in category 2G

# Pneumatics module

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## Test gas supply

### Type

One or three 3/2-way solenoid valves

### Power consumption

Approx. 3 W per solenoid valve

### Materials in contact with the sample medium

PVDF, FPM, aluminum, stainless steel 1.4305 (SAE 303)

## Fine filtration

### Type

Disposable filter with borosilicate glass microfiber filter element

### Retention rate

99.99 % for particles > 0.1  $\mu\text{m}$

### Materials in contact with the sample medium

Polyamide, borosilicate glass with PVDF binder

## Gas supply

### Type

Magnetic piston pump

### Feed rate

Max. of 60 l/h, depending on analyzer module and inlet/outlet pressure

### Flow rate

Adjustable

### Power consumption

Approx. 10 W

### Materials in contact with the sample medium

PVDF, EPDM, stainless steel 1.4571 (SAE 316Ti)

## Flow monitoring

### Type

Miniature flow sensor

### Readout and limit value monitoring

Configurable

### Materials in contact with the sample medium

$\text{Al}_2\text{O}_3$ , silicon, gold, GFK

## Pressure monitoring

### Pressure sensor

(Option) for additional monitoring tasks, e.g. pressure measurement in the 2<sup>nd</sup> gas path of the Uras26 analyzer module

## Sample gas inlet conditions

The pneumatics module must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

### Temperature

+5 to +45 °C

The sample gas dew point should be at least 5 °C below the ambient temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

### Inlet pressure

$p_e = -80$  to +20 hPa

### Flow rate

30 to 60 l/h

### Corrosive gases

Corrosive associated gas components and aerosols must be cooled or undergo prior absorption.

## Notes

The pneumatics module is always associated with an analyzer module and must be installed in the same housing with that analyzer module.

The pneumatics module cannot be used when stainless steel tubes are used for the internal gas lines.

The pneumatics module cannot be used with the following analyzer modules:

- Limas11 with stainless steel, PFA or PTFE gas lines
- Fidas24
- MultiFID14
- Analyzer modules in category 2G

# Explosion protected versions in category 3G

## Version in category 3G for measurement of flammable and non-flammable gases (“Safety concept”)

The “safety concept” gas analyzers include:

- Uras26 in the version with safety cell and purged sample cell windows
- Magnos206, Caldos25 and Caldos27 in the version with direct sample cell connection and purged thermostat housing.

Monitoring of the purge gas flow rate is a feature of the “safety concept”. It is fully integrated into the gas analyzer, together with the controls and signal processing.

The version complies with the Directive 94/9/EC (ATEX Directive). There are the following explosion protection measures in the gas analyzer:

- Non-arcing assemblies and components/non-hot components/sealed (arcing) devices per EN 60079-15 and
- Simplified positive pressure containment per EN 60079-2.

Designation

 II 3G Ex nA py II T4

Type examination certificate

BVS 07 ATEX E 013 X

Housing protection type

IP54

## Sample gas inlet conditions

Sample gas

Flammable and non-flammable gases and vapors

- under atmospheric conditions ( $p_{abs} \leq 1.1$  bar, oxygen content  $\leq 21$  vol.%),
- Temperature class T4,
- not potentially explosive under normal conditions,
- if potentially explosive in the event of a fault, then only seldom and briefly (in accordance with zone 2).

If the sample gas is a mixture only of oxygen and flammable gases and vapors, it must not be explosive under any conditions. As a rule this can be achieved by limiting the oxygen content to a maximum of 2 vol.%.

Flammable gases and vapors that are explosive under the conditions encountered in analysis even when oxygen is excluded should be present in the mixture only in concentrations that are not critical to safety.

Pressure

At sample gas inlet: positive pressure  $p_e \leq 3$  hPa,  
at sample gas outlet: atmospheric

Flow rate

Max. 40 l/h

## Inert gas curtain/purge gas/ (Simplified) pressurized enclosure

Purge gas

Inert gas (nitrogen)

Pressure

Positive operating pressure  $p_e \geq$  sample gas pressure + 0.5 hPa

Flow rate

During operation: 15 to 20 l/h, during initial purge: 15 to 50 l/h

Initial purge

Manually controlled, initial purge duration:

Uras26: 1.6 minutes at min. 15 l/h

Magnos206, Caldos25, Caldos27: 18 minutes at min. 15 l/h or 6 minutes at min. 50 l/h

Alarm

When flow rate drops below a minimum value of 15 l/h (corresponds to approx. 7 hPa) and when flow rate exceeds a maximum value of 50 l/h (corresponds to approx. 60 hPa)

## Category 3G version for measurement of non-flammable gases

The analyzer modules Uras26, Limas11, Magnos206, Magnos27, Caldos25 und Caldos27 are suitable for measuring non-flammable gases. The analyzer modules are mounted in the central unit housing or in a separate housing (either wall-mount or 19-inch rack unit).

The version complies with the Directive 94/9/EC (ATEX Directive).

The gas analyzer is protected by provisions according to EN 60079-15 (non-arcing electrical equipment, sealed arcing devices).

In undisturbed operation there cannot be any sparking, arcing or impermissible temperatures inside the device. During operation, all unused gas ports should be plugged.

Designation

 II 3G Ex nAc nCc IIC T4

Housing protection type

IP54

## MultiFID14 analyzer module in category 3G version

The MultiFID14 analyzer module in the category 3G version is suited to measure hydrocarbons in a non-flammable sample gas mixture when installed in Zone 2 hazardous areas. The heated sample gas inlet is not available in the category 3G version.

Designation

 II 3G EEx nP II T3

Type examination certificate

DMT 01 E 126 X

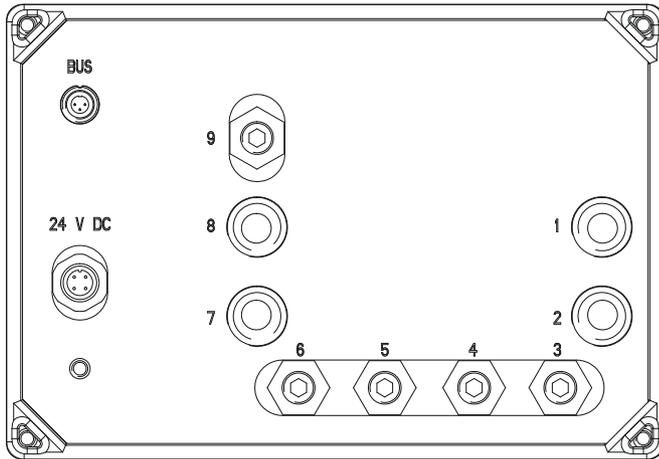
Housing protection type

IP54

# Explosion protected versions in category 3G

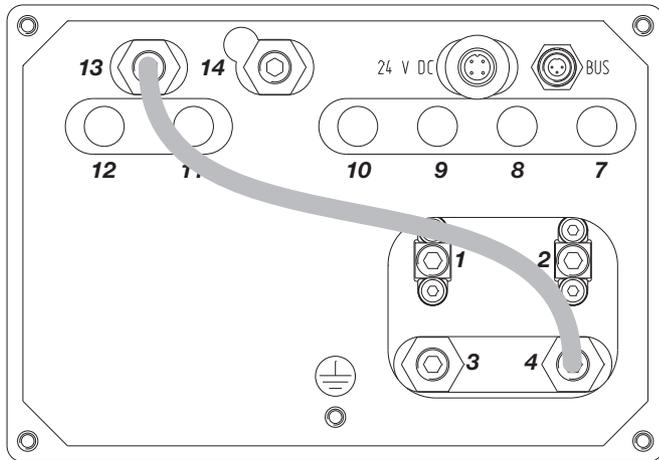
## Gas connections “Safety concept”

### Uras26



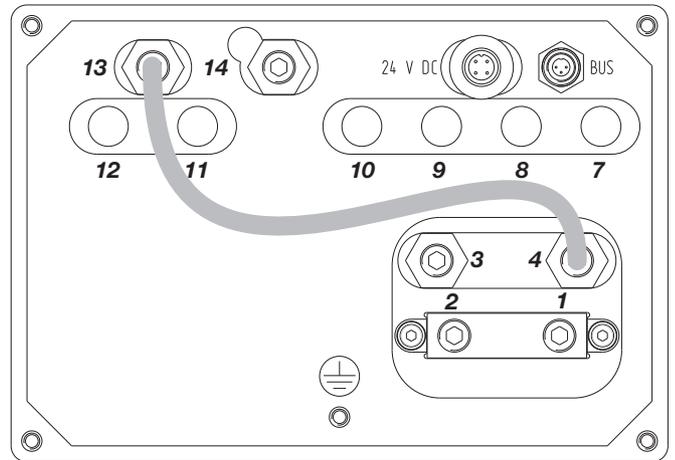
- 1 Sample gas inlet gas path 1
- 2 Sample gas outlet gas path 1
- 3 Purge gas inlet sample cell windows “Analyzer purge in”
- 4 Purge gas inlet housing
- 5 Purge gas outlet housing
- 6 Purge gas outlet flow rate monitor “Analyzer purge out”
- 7 Sample gas outlet gas path 2
- 8 Sample gas inlet gas path 2
- 9 Pressure sensor (option)

### Magnos206



- 1 Sample gas inlet
- 2 Sample gas outlet
- 3 Purge gas inlet thermostat chamber “Analyzer purge in”
- 4 Purge gas outlet thermostat chamber (rigid tubed with 13)
- 7 Purge gas inlet housing
- 8 Purge gas outlet housing
- 9 Pressure sensor 1
- 10 Pressure sensor 2
- 11 not used, sealed
- 12 not used, sealed
- 13 Purge gas inlet flow rate monitor (rigid tubed with 4)
- 14 Purge gas outlet flow rate monitor “Analyzer purge out”

### Caldos25, Caldos27



- 1 Sample gas inlet
- 2 Sample gas outlet
- 3 Purge gas inlet thermostat chamber “Analyzer purge in”
- 4 Purge gas outlet thermostat chamber (rigid tubed with 13)
- 7 Purge gas inlet housing
- 8 Purge gas outlet housing
- 9 Pressure sensor 1
- 10 Pressure sensor 2
- 11 not used, sealed
- 12 not used, sealed
- 13 Purge gas inlet flow rate monitor (rigid tubed with 4)
- 14 Purge gas outlet flow rate monitor “Analyzer purge out”

# General data

---

## Display and operation

### Display

Backlit graphics display, 320 x 240-pixel resolution

### Measured value display

Digits with unit and bar graph; simultaneous display of up to 6 measured values, configurable

### Units of measure

Selectable in physical units, e.g. ppm, vol.%, mg/m<sup>3</sup> or g/m<sup>3</sup>, as well as in % of span or mA

### Digital value resolution

Better than 0.2 % of span

### Status indication

Green LED: Power supply on  
Yellow LED: Maintenance request  
Red LED: Failure

### Status messages

Plain text

### Operation

Panel with six softkeys, two cancel keys and 10-digit keypad; menu-driven interface, various languages available

### Measuring range switch-over and feedback

There are three ways of executing the measuring range switch-over:

- Manually on the gas analyzer
- Automatically (autorange) by means of appropriate configured switch-over thresholds
- Externally controlled via appropriately configured digital inputs.

The measuring range feedback can be implemented via appropriately configured digital outputs; it is independent of the selected type of measuring range switch-over.

### Limit value monitoring

Limit values can be set during the gas analyzer configuration. The limit value signals (alarms) are output via digital outputs.

## Housing

### Versions

19-inch housing (model AO2020) or  
Wall-mount housing (model AO2040)

### Housing protection type

IP65 without power supply and without display/control unit  
IP54 with display/control unit and connection box  
IP20 without connection box per EN 60529

### Housing purge

Possible with IP54 version with connection box. Purge version can be fitted with screwed cable glands (per EN) or with conduit connections (per CSA). Purge gas flow during operation max. 20 l/h (MultiFID14: approx. 300 l/h), purge gas pressure  $p_e = 2$  to 4 hPa. The purge gas should not contain any sample gas components.

### Housing materials

Housing: stainless steel 1.4016 (SAE 430), module rear panel: aluminum, keypad sheet: Polyester

### Housing color

Light gray (RAL 7035), basalt gray (RAL 7012)

### Weight

Analyzer unit with one analyzer module: 18 to 23 kg

### Dimensions

See dimensional drawings on page 42 and page 43

## Gas connections

### Layout

Gas ports on back (19-inch rack housing) or bottom (wall-mount housing) of the analyzer module

### Design

1/8 NPT internal threads for commercially available adapters, e.g. Swagelok®, unless other versions are specified in the technical data of the individual analyzer modules.

## Electrical connections

### Central unit

Power supply: 3-pin plug per EN 60320/C14, connecting cable supplied;  
Ethernet: Two 8-pin RJ45 plugs;  
System bus: 3-pin female plug

### Analyzer modules

External power supply: 4-pin male plug;  
Heating of detector and sample gas inlet (FID analyzer modules): 4-pin male plug, connecting cable supplied;  
System bus: 3-pin female plug

## Electrical safety

Tested per EN 61010-1:2001

### Protection class

I for central unit with electronics module (power supply);  
III for analyzer modules without electronics module (power supply)

### Overvoltage category/pollution degree

Power supply: III/2, other circuits: II/2

### Safe isolation

The power supply is galvanically isolated from other circuits by means of reinforced or double insulation. Protective extra-low voltage (PELV) on low-voltage side

## Electromagnetic compatibility

### Noise immunity

Tested to EN 61326-1:2006.  
Inspection severity: Industrial area, fulfills at least the rating "continuously monitored operation" to table 2 of EN 61326.

### Emitted interference

Tested to EN 61326-1:2006, EN 61000-3-2:2006 and EN 61000-3-3:1995 + A1:2001 + A2:2005.  
Limit value class B for interference field strength and interference voltage is met.

## Mechanical stress

### Transport

Vibration test to EN 60068-2-6:1996, shock test to EN 60068-2-27:1995. In its original packaging, the gas analyzer will withstand normal shipping conditions.

# General data

## Installation site requirements

### Installation location

The gas analyzer is intended for indoor installation only.  
Altitude max. 2000 m, MultiFID14 NMHC: max. 1500 m above sea level

### Vibration

Analyzer unit only:

Uras26:	Max. $\pm 0.04$ mm at 5 to 55 Hz, 0.5 g at 55 to 150 Hz, slight transient effect on sample value in the region of the beam modulation frequency
Limas11:	Max. $\pm 0.04$ mm at 5 to 55 Hz, 0.5 g at 55 to 150 Hz
Limas11 HW:	Max. $\pm 0.04$ mm/0.5 g at 5 to 150 Hz
Magnos206:	Max. $\pm 0.04$ mm at 5 to 20 Hz
Magnos27:	Max. $\pm 0.04$ mm at 5 to 60 Hz
ZO23:	Max. $\pm 0.04$ mm at 5 to 55 Hz, 0.5 g at 55 to 150 Hz
Caldos25:	Max. $\pm 0.04$ mm at 5 to 30 Hz
Caldos27:	Max. $\pm 0.04$ mm at 5 to 55 Hz, 0.5 g at 55 to 150 Hz
Fidas24:	Max. 0.5 g, max. 150 Hz
LS25:	Max. $\pm 0.6$ mm around the optical axis, max. 500 Hz

Analyzer unit installed in cabinet (analyzer system): Max. acceleration  $0.01 \text{ ms}^{-2}$  in a frequency range of 0.1 to 200 Hz. Compliance with the metrological data can only be assured if data on vibration amplitude and frequency range at the installation site are available and suitable means are employed to decouple the analyzer.

### Ambient temperature

Operation:	When installed in housing with electronics module	without electronics module
Uras26:	+5 to +40 °C	+5 to +45 °C
Limas11:	+5 to +40/45 °C with/without I/O cards	+5 to +45 °C
Limas11 HW:	+15 to +35 °C	+15 to +35 °C
Magnos206:	+5 to +45 °C	+5 to +50 °C
Magnos27:	+5 to +45 °C	+5 to +45 °C, +5 to +50 °C with direct sample cell connection and when installed in housing without Uras26
ZO23:	+5 to +45 °C	+5 to +45 °C
Caldos25:	+5 to +45 °C	+5 to +45 °C
Caldos27:	+5 to +45 °C	+5 to +50 °C
Fidas24:	+5 to +45 °C	+5 to +45 °C
MultiFID14:	+5 to +45 °C	+5 to +45 °C
MultiFID14 NMHC:	+5 to +40 °C when two MultiFID14 are installed in one housing	+5 to +38 °C
LS25:	+5 to +38 °C	+5 to +38 °C
Oxygen sensor:	-20 to +55 °C, no direct solar irradiation	
	+5 to +40 °C in 19-inch housing,	
	+5 to +35 °C in wall-mount housing	

Storage and transport: -25 to +65 °C, oxygen sensor: -20 to +60 °C

### Relative humidity

< 75 %, no condensation

### Climate class

3K3 for IP20 housing (non-condensing),  
3K4 for IP54 housing (condensing) per EN 60721-3-3

### Air circulation

For sufficient air circulation, multiple housings in a 19-inch rack must be installed with a separation of at least one height unit between housings.

## Power supply

### Power supply unit

#### Input voltage

100 to 240 VAC, -15 %, +10 %, max. 2.2 A, 50 to 60 Hz  $\pm 3$  Hz

#### Power consumption

Max. 187 W

#### Output voltage

24 VDC  $\pm 5$  % to supply the electronics module and one analyzer module installed in the central unit or (optionally) one external analyzer module

### Fidas24, MultiFID14, MultiFID14 NMHC: Heating of detector and sample gas inlet

#### Input voltage

115 VAC or 230 VAC,  $\pm 15$  % (max. 250 VAC), 47 to 63 Hz

#### Power consumption

Fidas24:	125 VA for detector 125 VA for sample gas inlet (option)
MultiFID14:	120 VA for detector 100 VA for sample gas inlet (option)
MultiFID14 NMHC:	Approx. 200 VA

## Analyzer modules

### Input voltage

24 V DC  $\pm 5$  %

### Power consumption

Uras26:	Max. 95 W
Limas11:	Max. 85 W
Limas11 HW:	Max. 85 W
Magnos206:	Max. 50 W
Magnos27:	Max. 35 W
ZO23:	Approx. 12 W in continuous operation, approx. 35 W during start-up
Caldos25:	Max. 25 W
Caldos27:	Max. 12 W
Fidas24:	Max. 65 W
MultiFID14:	Max. 65 W
MultiFID14 NMHC:	Max. 65 W
LS25:	Approx. 20 W

## Note regarding the analyzer module performance characteristics

The analyzer module performance characteristics indicated apply only when operated in conjunction with the central unit. They have been determined according to IEC 61207-1:2010 "Expression of performance of gas analyzers – Part 1: General". They are based on nitrogen as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.

# Electronics module

## Processing of measured values and signals

Processor system with buffered real-time clock and non-volatile memory for firmware and device data.

Software updates can be obtained via the Ethernet interface.

## I/O modules

Number of Slots

5 slots (see "Electrical connections")

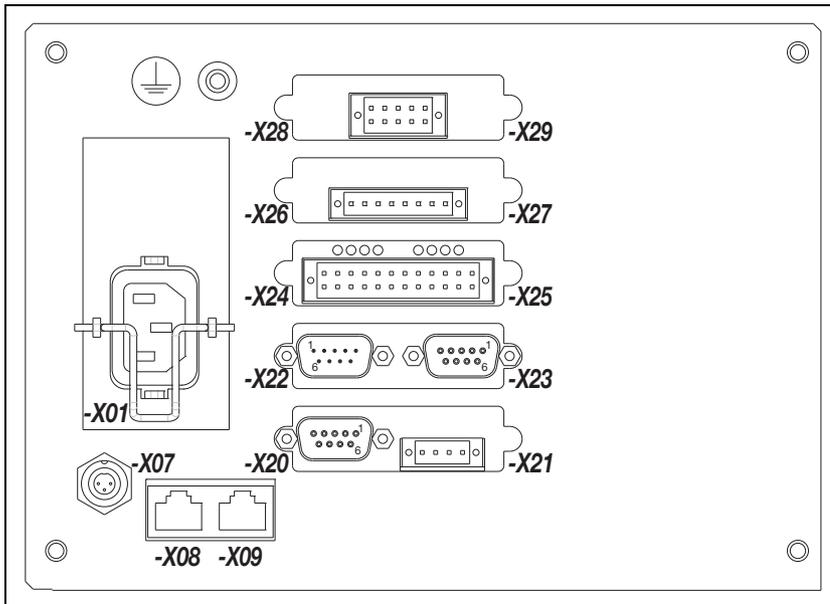
Technical data

see pages 39 to 41

Notes regarding conductor section

- The maximum capacity of terminals for stranded or solid conductors is 1 mm<sup>2</sup> (17 AWG).
- The stranded conductor may be tinned on the tip or twisted for simplified connection.
- When using wire end ferrules the total section should not exceed 1 mm<sup>2</sup>, i.e. the maximum stranded conductor section is 0.5 mm<sup>2</sup>. The Weidmüller PZ 6/5 crimping tool must be used for crimping the ferrules.

## Electrical connections



- X01 Power supply connection
  - X07 System bus connection
  - X08, Ethernet 10/100/1000BASE-T interfaces
  - X09
  - X20 I/O modules (5 slots), options:
    - to – Profibus module
    - X29 – Modbus module
    - Digital I/O module
    - 2-way analog output module
    - 4-way analog output module
    - 4-way analog input module
- Connection diagrams see pages 39 to 41

### Note:

The drawing shows an example for the I/O modules equipment.

## Interfaces

Ethernet

To connect the gas analyzer to Ethernet networks. TCP/IP protocol and Modbus TCP/IP protocol via 10/100/1000BASE-T interface. Electrical connections: Two 8-pin RJ45 plugs

System bus

Internal bus for communication between the gas analyzer's functional units. Electrical connections: 3-pin female plug

## Power supply

Input voltage

24 VDC ± 5 % from the built-in power supply (see page 37)

Power consumption

approx. 15 W without I/O modules

# I/O modules

## Profibus module

### Application

Integration of AO2000 into PROFIBUS PA and PROFIBUS DP networks for transfer of measured values and status signals as well as analog inputs, digital inputs and digital outputs. Digital data transmission certified according to guideline VDI 4201, Sheets 1 and 2.

### Electrical connections

#### RS485 interface:

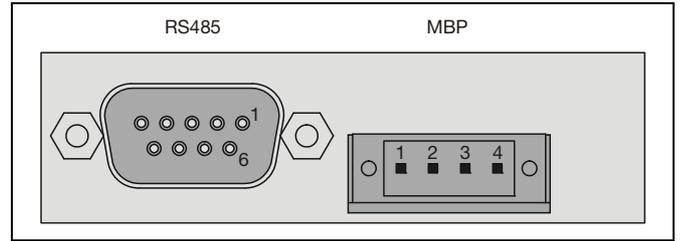
- 1 – not used
  - 2 M24 24 V output ground, max. 0.2 A
  - 3 RxD/TxD-P Receive/transmit data plus, B-line
  - 4 – not used
  - 5 DGND Data transmission potential (Ref. pot. for VP)
  - 6 VP Supply voltage plus (5 V)
  - 7 P24 24 V output voltage plus
  - 8 RxD/TxD-N Receive/transmit data N, A-line
  - 9 – not used
- Design: 9-pin Sub-D female connector

#### MBP interface (non-intrinsically safe):

- 1 +
- 2 Shield
- 3 –
- 4 not used

Design: 4-pin terminal strip. Observe the information regarding conductor section (see page 38).

### Connection diagram



## Modbus module

### Application

Transfers measured values and status signals as well as analog inputs, digital inputs and digital outputs to host systems, e.g. to standard Windows applications via M-DDE Server; Modbus slave protocol in RTU (remote terminal unit) mode or via RS485 or RS232 interface (configurable).

### Electrical connections

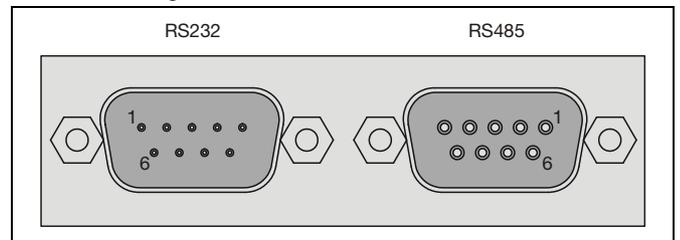
#### RS232 interface:

- 2 RxD
  - 3 TxD
  - 5 GND
- Design:  
9-pin Sub-D male connector

#### RS485 interface:

- 2 RTxD–
  - 3 RTxD+
  - 5 GND
- Design:  
9-pin Sub-D female connector

### Connection diagram



# I/O modules

## Digital I/O module

### 4 Digital inputs (DI1 to DI4)

Optocouplers with internal 24 VDC power supply. Control with floating contacts, with external voltage 12 to 24 VDC or with open collector drivers PNP or NPN.

### 4 Digital outputs (DO1 to DO4)

Floating double-throw contacts, max. contact load rating 30 VDC/1 A

Relays must at all times be operated within the specified data range. Inductive or capacitive loads are to be connected with suitable protective measures (self-induction recuperation diodes for inductive loads and series resistors for capacitive loads).

### Standard function block applications

#### Status signals/externally controlled calibration:

- DO1 Failure/collective status
- DO2 Maintenance mode/limit value
- DO3 Maintenance request/limit value
- DO4 External solenoid valve
- DI1 Start automatic calibration
- DI2 Inhibit automatic calibration
- DI3 Adjust zero-point
- DI4 Adjust end-point

#### Measurement range control:

- DO1 Measurement range feedback
- DO2 Measurement range feedback
- DO3 Measurement range feedback
- DO4 Measurement range feedback
- DI1 Measurement range switchover
- DI2 Measurement range switchover
- DI3 Measurement range switchover
- DI4 Measurement range switchover

#### Limit values:

- DO1 Limit value
- DO2 Limit value
- DO3 Limit value
- DO4 Limit value
- DI1 Calibration cells in/out
- DI2 Hold current output
- DI3 Pump on/off
- DI4 External failure

#### Calibration control:

- DO1 External solenoid valve sample gas
- DO2 External solenoid valve zero gas
- DO3 External solenoid valve span gas
- DO4 External pump on/off
- DI1 Pump on/off
- DI2 External failure
- DI3 External failure
- DI4 External failure

### Electrical connections

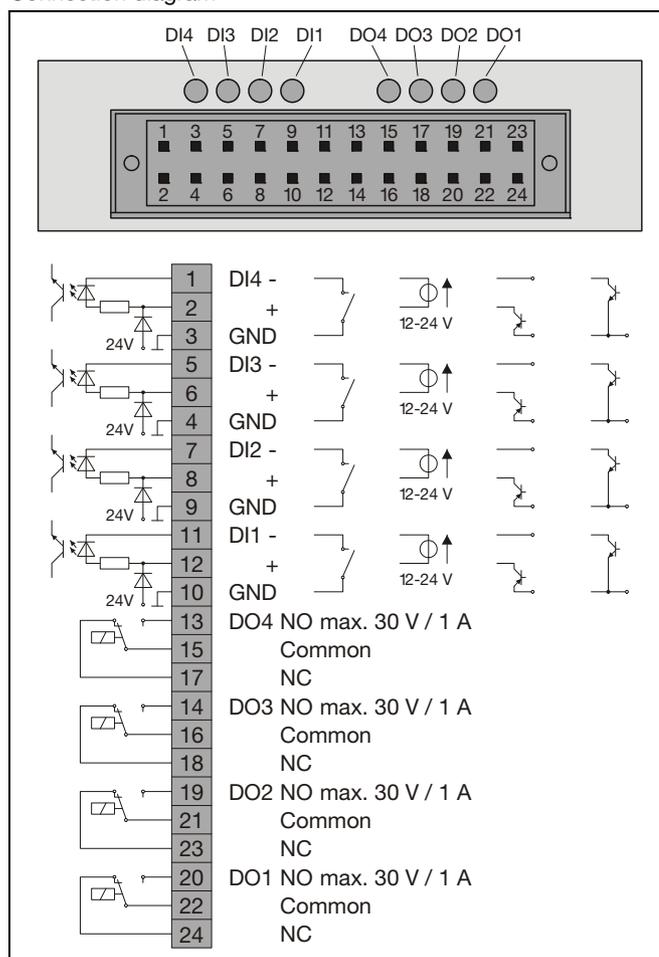
See connection diagram

Design: 2x12-pin terminal strip. Observe the information regarding conductor section (see page 38).

The pin layout in a delivered gas analyzer will be shown in the applicable "Analyzer data sheet".

Relays are shown in the unpowered state. The unpowered state is the failure mode.

### Connection diagram



# I/O modules

## 2-way analog output module

2 analog outputs (AO1, AO2)

0/4 to 20 mA (configurable, factory-set to 4 to 20 mA), common negative pole, galvanically isolated from ground, freely connectable to ground, max. gain relative to protective ground potential 50 V, max. working resistance 750 Ω. Resolution 16 bit. The output signal cannot be lower than 0 mA.

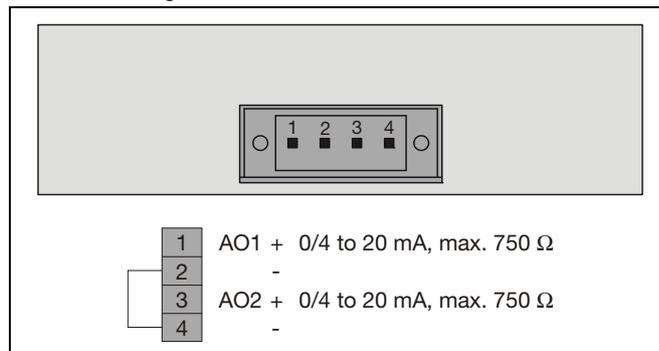
### Electrical connections

See connection diagram

Design: 4-pin terminal strip. Observe the information regarding conductor section (see page 38).

The pin layout in a delivered gas analyzer will be shown in the applicable "Analyzer data sheet".

Connection diagram



## 4-way analog output module

4 analog outputs (AO1 to AO4)

0/4 to 20 mA (configurable, factory-set to 4 to 20 mA), common negative pole, galvanically isolated from ground, freely connectable to ground, max. gain relative to protective ground potential 50 V, max. working resistance 750 Ω. Resolution 16 bit. The output signal cannot be lower than 0 mA.

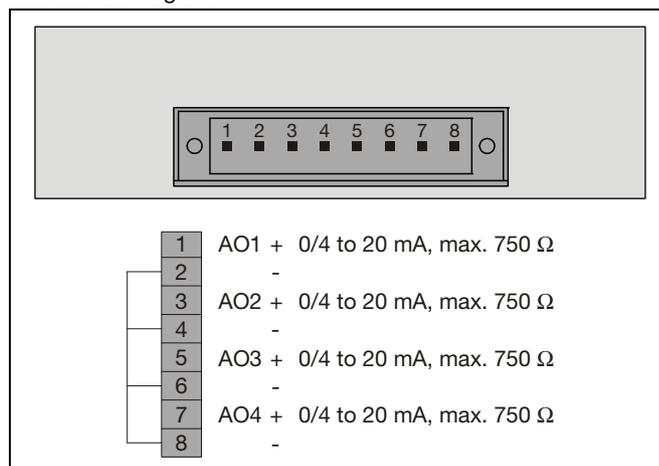
### Electrical connections

See connection diagram

Design: 8-pin terminal strip. Observe the information regarding conductor section (see page 38).

The pin layout in a delivered gas analyzer will be shown in the applicable "Analyzer data sheet".

Connection diagram



## 4-way analog input module

4 analog inputs (AI1 to AI4)

0 to 20 mA into 50 Ω

### Current output

+24 VDC for supply of an external sensor, fused with 100 mA (resettable fuse)

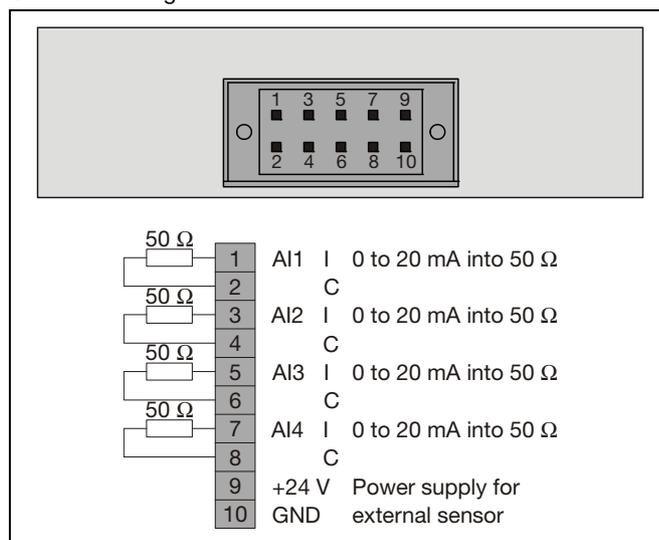
### Electrical connections

See connection diagram

Design: 2x5-pin terminal strip. Observe the information regarding conductor section (see page 38).

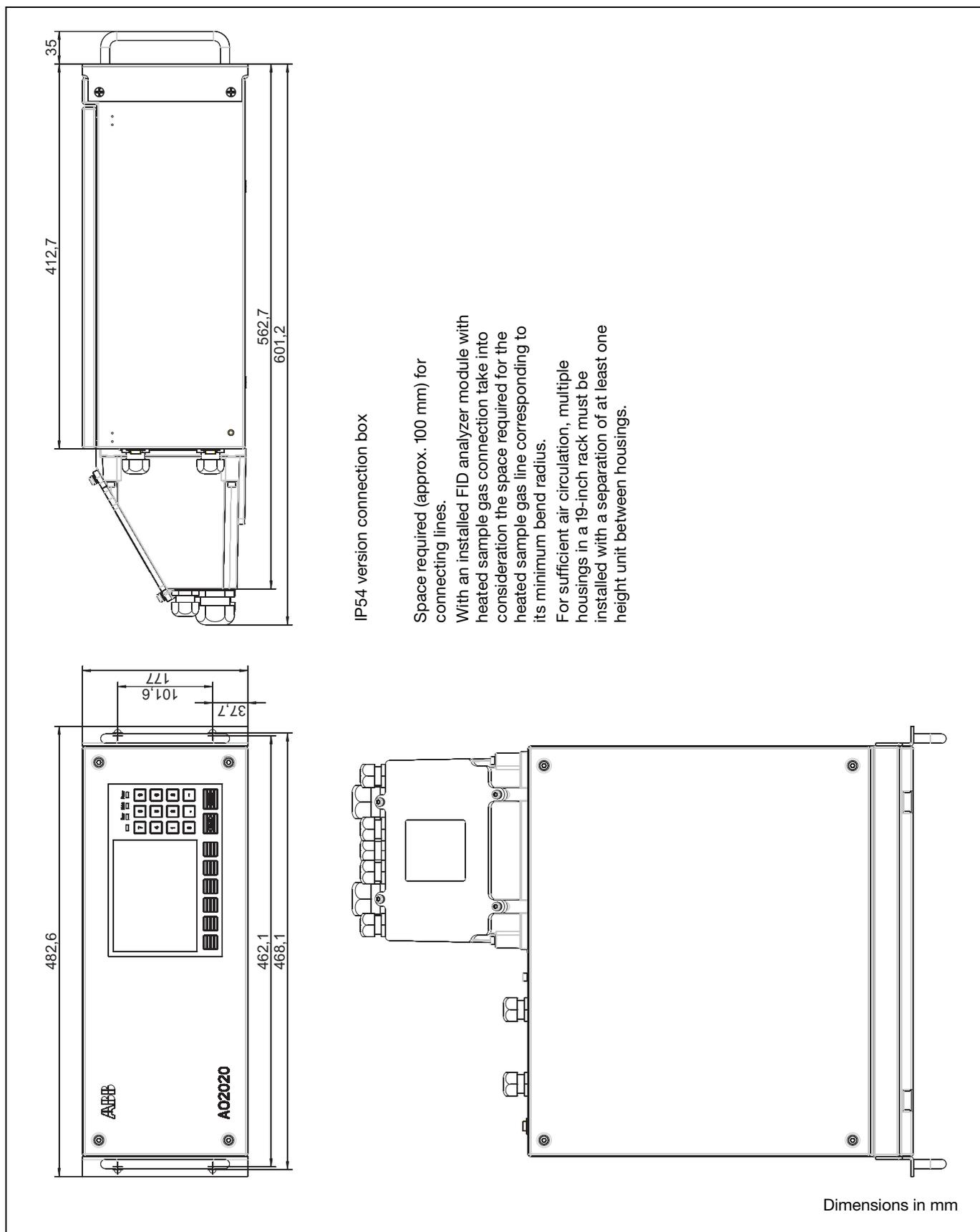
The pin layout in a delivered gas analyzer will be shown in the applicable "Analyzer data sheet".

Connection diagram



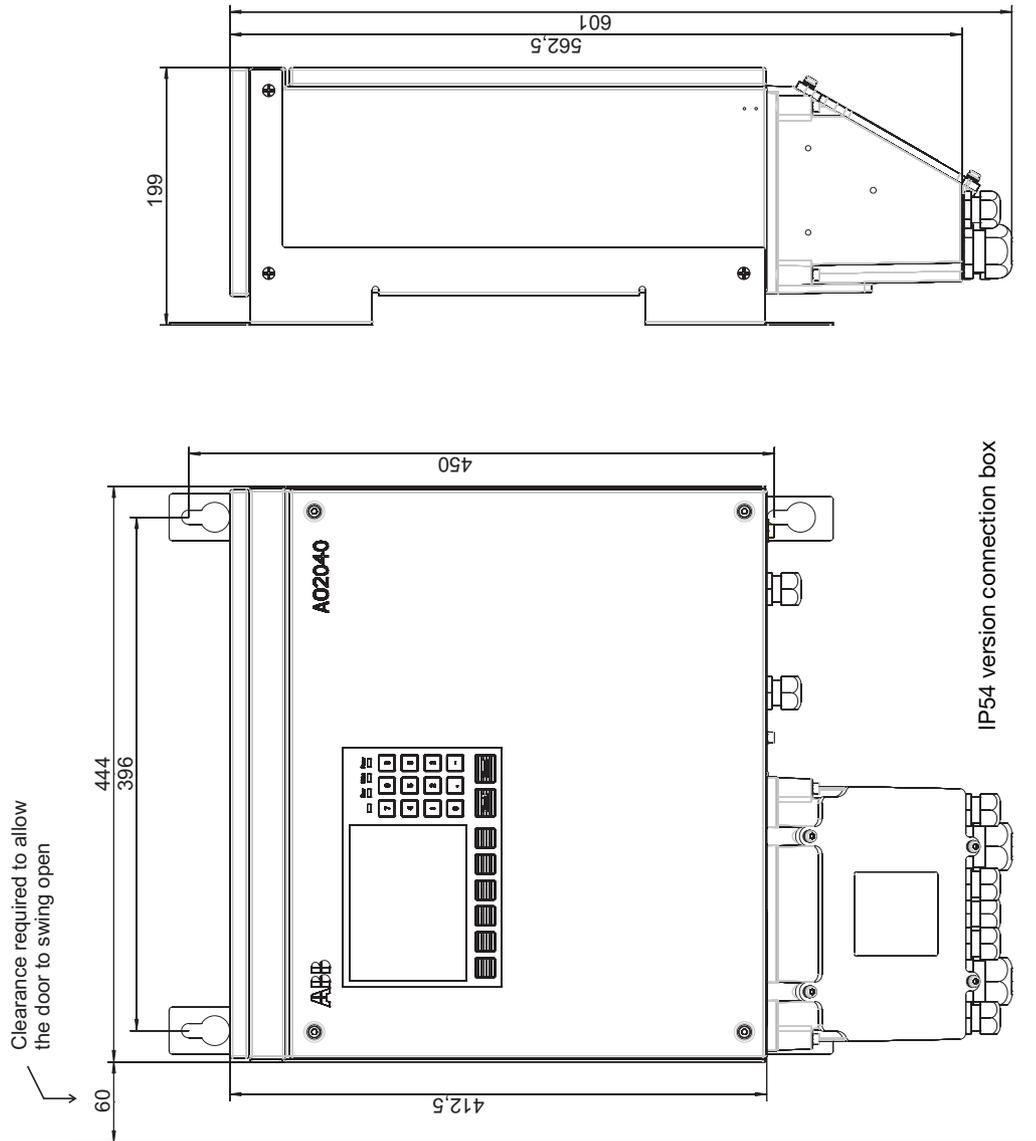
# Dimensional drawings

## 19-inch rack housing (model AO2020)



# Dimensional drawings

## Wall-mount housing (model AO2040)



Space required (approx. 100 mm) for connecting lines.  
 With an installed FID analyzer module with heated sample gas connection take into consideration the space required for the heated sample gas line corresponding to its minimum bend radius.  
 With an installed FID analyzer module additional clearance (approx. 300 mm) is required since some assemblies can only be accessed from above.

Dimensions in mm

# Certifications

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## CE conformity

The AO2000 series gas analyzers satisfy the requirements of the European directives 2006/95/EC (Low voltage directive), 2004/108/EC (EMC directive) and 94/9/EC (ATEX directive – explosion protected versions only).

Compliance with the requirements of directive 2006/95/EC is evidenced by full compliance with European standards EN 61010-1:2001, EN 60825-1:1994 (LS25).

Compliance with the requirements of directive 2004/108/EC is evidenced by full compliance with European standards EN 61326-1:2006, EN 61000-3-2:2006, EN 61000-3-3:1995 + A1:2001 + A2:2005.

Compliance of the explosion protected versions with the requirements of directive 94/9/EC is evidenced by full compliance with the European standards listed in the “Explosion protection to European standards” section (see page 45).

## Performance test

The AO2000 series gas analyzers Uras26 (sample components CO, NO, SO<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>O), Magnos206 (sample component O<sub>2</sub>) and electrochemical oxygen sensor (sample component O<sub>2</sub>) are certified for use in facilities requiring approval according to European directive 2001/80/EG and 2000/76/EG and meet the requirements of the 27<sup>th</sup>/30<sup>th</sup> BImSchV (German Federal Immissions Control Ordinance) and TA-Luft (German Technical Instructions on Air Quality) regulations. The requirements of QAL1 according to EN 15267 and EN 14181 are fulfilled.

Report No. 821029 of June 30, 2006. Notification: Federal Gazette of October 14, 2006, No. 194, page 6715

Report No. 1249694 of March 30, 2009. Notification: Federal Gazette of August 25, 2009, No. 125, page 2932.

Report No. 1710933 of September 30, 2011. Notification: Federal Gazette of March 2, 2012, No. 36, page 923.

Report No. 936/21217137/A of October 14, 2011. Notification: Federal Gazette of March 2, 2012, No. 36, page 922.

## Approval for USA and Canada – CSA

The AO2000 series gas analyzers are certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 and UL Std. No. 61010-1 (2<sup>nd</sup> Edition).

Certificate No. 1714030

## Approval for Russian Federation – GOST-R

The AO2000 series gas analyzers including the “safety concept” version are certified for use in general purpose environment. The following documents are available:

GOST-R certificate No. POCC DE.HO03.H04298 and No. POCC DE.ГБ04.В01888,

Rostekhnadzor operation permission No. PPC 00-39671, Pattern approval certificate No. DE.C.31.004.A No. 37985.

# Certifications

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## Explosion protection to European standards

The AO2000 series gas analyzers with Uras26, Magnos206, Caldos25 and Caldos27 in category 3G for measurement of flammable and non-flammable sample gas (“safety concept”) satisfy the European standards EN 60079-15:2005, EN 60079-2.

Designation:

 II 3G Ex nA py II T4

EC-Type examination certificate No. BVS 07 ATEX E 013 X

The AO2000 series gas analyzers with Uras26, Limas11, Magnos206, Magnos27, Caldos25 and Caldos27 in category 3G for measurement of non-flammable sample gas satisfy the European standard EN 60079-15:2010.

Designation:

 II 3G Ex nAc nCc IIC T4

LS25 analyzer module for use in zone 1 satisfies the European standards EN 60079-0:2006, EN 60079-2:2007, EN 60079-28:2007, EN 61241-0:2006, EN 61241-4:2006.

Designations:

 II 2 G Ex px II T5,

 II 2 D Ex pD 21 IP66 T64°C,

 II (2) G [Ex op is T4 Gb] IIC

EC-Type examination certificates No. DNV-2006-OSL-ATEX-0042X Rev. 2, DNV 09 ATEX 64813

LS25 analyzer module for use in zone 2 satisfies the European standards EN 60079-0:2006, EN 60079-15:2005, EN 60079-28:2007, EN 61241-0:2006, EN 61241-1:2004.

Designations:

 II 3 G Ex nA nC op is Gc IIC T4  $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq +55^{\circ}\text{C}$ ,

 II 3 D Ex tD A22 IP65 T100°C

EC-Type examination certificate No. DNV-2008-OSL-ATEX-21837 Rev. 4

## Explosion protection to U.S. and Canadian standards – CSA

The AO2000 series gas analyzers are certified for use in Class 1, Div. 2, Groups A, B, C, and D, Temperature code T4, max. ambient temperature +50 °C (+55 °C for LS25) explosion hazard areas.

Housing versions not equipped with conduit entries must be installed in a suitable enclosure, cabinet or rack with provision for connection of Div. 2 wiring methods, acceptable to the local inspection authority having jurisdiction.

Certificate No. 1105720

## Explosion protection for China – NEPSI

The AO2000 series gas analyzers with Uras26, Limas11, Magnos206, Caldos25, Caldos27 and MultiFID14 are certified for use in hazardous locations. The gas analyzers may be used for measurement of non-flammable gases and vapors. They are marked with Ex nAC II CT4 (MultiFID14: Ex nz II T3).

Certificate No. GYJ101333X

The AO2000 series gas analyzers with Uras26, Limas11, Magnos206, Caldos25 and Caldos27 are certified for use in hazardous locations. The gas analyzers may be used for measurement of flammable gases and vapors. They are marked with Ex nAC py IIC T4/T6.

Certificate No. GYJ101332X

The gas analyzer AO2000-LS25 Ex is certified for use in hazardous locations. The gas analyzer may be used for measurement of non-flammable gases and vapors. It is marked with Ex nAC IIC T5.

Certificate No. GYJ111061X

## Sample components and analyzer modules

The following table lists the sample components that can be measured with the AO2000 Series gas analyzers (other sample components available on request).

In each case, the smallest measurement range and the appropriate analyzer module are given. Please see the specifications of the individual analyzer modules.

Sample component	Requirements (examples)	Smallest meas. range	Analyzer module	Data	
Acetylene	C <sub>2</sub> H <sub>2</sub>	Small meas. ranges, selective measurement	0–100 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–1250 ppm	Limas11 IR	Page 6
Ammonia	NH <sub>3</sub>	Process measurement	0–30 ppm	Uras26	Page 4
		Combustion exhaust gas	0–100 ppm	Limas11 HW	Page 10
Argon	Ar in N <sub>2</sub>	Especially short T <sub>90</sub> time	97.5–100 vol. %	Caldos27	Page 20
	Ar in O <sub>2</sub>	Especially short T <sub>90</sub> time	0–2 vol. %	Caldos27	Page 20
Butane	C <sub>4</sub> H <sub>10</sub>	Small meas. ranges, selective measurement	0–50 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–250 ppm	Limas11 IR	Page 6
Chlorine	Cl <sub>2</sub>	Corrosive gases	0–100 ppm	Limas11 UV	Page 6
Nitrous oxide	N <sub>2</sub> O	Small measurement ranges	0–20 ppm	Uras26	Page 4
Ethane	C <sub>2</sub> H <sub>6</sub>	Small meas. ranges, selective measurement	0–50 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–250 ppm	Limas11 IR	Page 6
Ethylene	C <sub>2</sub> H <sub>4</sub>	Small meas. ranges, selective measurement	0–300 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–1500 ppm	Limas11 IR	Page 6
Helium	He in N <sub>2</sub>	Especially short T <sub>90</sub> time	97–100 vol. %	Caldos27	Page 20
Hexane	C <sub>6</sub> H <sub>14</sub>	Selective measurement	0–100 ppm	Uras26	Page 4
Refrigerant	R 134a	Small measurement ranges	0–50 ppm	Uras26	Page 4
Carbon dioxide	CO <sub>2</sub>	Small measurement ranges	0–5 ppm	Uras26	Page 4
		Corrosive/toxic/flammable gases	0–150 ppm	Limas11 IR	Page 6
	CO <sub>2</sub> in N <sub>2</sub> or air	Especially short T <sub>90</sub> time	0–3 vol. %	Caldos27	Page 20
Carbon disulfide	CS <sub>2</sub>	Toxic/flammable gases	0–50 ppm	Limas11 UV	Page 6
Carbon monoxide	CO	Small meas. ranges, emission measurement	0–10 ppm	Uras26	Page 4
		Toxic/flammable gases, process measurement	0–500 ppm	Limas11 IR	Page 6
Carbon oxide Sulfide	COS	Toxic/flammable gases	0–250 ppm	Limas11 UV	Page 6
Hydrocarbons	Total	Fast hot measurement	0–5 mg C/m <sup>3</sup>	Fidas24	Page 22
	C <sub>n</sub> H <sub>m</sub> – CH <sub>4</sub>	Non-methane measurement	0–5 mg C/m <sup>3</sup>	MultiFID14 NMHC	Page 26
Methane	CH <sub>4</sub>	Small meas. ranges, selective measurement	0–50 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–1000 ppm	Limas11 IR	Page 6
	CH <sub>4</sub> in N <sub>2</sub>	Especially short T <sub>90</sub> time	99–100 vol. %	Caldos27	Page 20
	CH <sub>4</sub> in N <sub>2</sub> or air	Especially short T <sub>90</sub> time	0–2 vol. %	Caldos27	Page 20
Propane	C <sub>3</sub> H <sub>8</sub>	Small meas. ranges, selective measurement	0–50 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–150 ppm	Limas11 IR	Page 6
Propylene	C <sub>3</sub> H <sub>6</sub>	Small meas. ranges, selective measurement	0–100 ppm	Uras26	Page 4
		Flammable gases, selective measurement	0–500 ppm	Limas11 IR	Page 6
Hydrochloric acid	HCl	Corrosive gases	0–2500 ppm	Limas11 IR	Page 6
Oxygen	O <sub>2</sub>	Magnetomechanical measurement principle	0–0.5 vol. %	Magnos206	Page 12
		Trace measurement with ZrO <sub>2</sub> cell	0–1 ppm	ZO23	Page 16
		Electrochemical measurement principle	0–5 vol. %	Oxygen sensor	Page 32
	O <sub>2</sub> in N <sub>2</sub>	Thermomagnetic measurement principle	0–3 vol. %	Magnos27	Page 14
	O <sub>2</sub> in flue gas	Thermomagnetic measurement principle	0–3 vol. %	Magnos27	Page 14
Sulfur dioxide	SO <sub>2</sub>	Emission measurement	0–25 ppm	Uras26	Page 4
		Corrosive gases	0–25 ppm	Limas11 UV	Page 6
	SO <sub>2</sub> in N <sub>2</sub> or air	Corrosive gases	0–1.5 vol. %	Caldos25	Page 18
Hydrogen Sulfide	H <sub>2</sub> S	Exhaust gas, process measurement	0–25 ppm	Limas11 UV	Page 6
Nitrogen dioxide	NO <sub>2</sub>	Corrosive gases	0–50 ppm	Limas11 UV	Page 6
		Combustion exhaust gas	0–10 ppm	Limas11 HW	Page 10
Nitrogen monoxide	NO	Emission measurement	0–75 ppm	Uras26	Page 4
		Small measurement ranges	0–10 ppm	Limas11 UV	Page 6
		Combustion exhaust gas	0–10 ppm	Limas11 HW	Page 10
Hydrogen	H <sub>2</sub> in Ar	Especially short T <sub>90</sub> time	0–0.25 vol. %	Caldos27	Page 20
	H <sub>2</sub> in Cl <sub>2</sub>	Corrosive gases	0–0.5 vol. %	Caldos25	Page 18
	H <sub>2</sub> in stack gas	Especially short T <sub>90</sub> time	0–0.5 vol. %	Caldos27	Page 20
	H <sub>2</sub> in N <sub>2</sub>	Especially short T <sub>90</sub> time	99–100 vol. %	Caldos27	Page 20
	H <sub>2</sub> in N <sub>2</sub> or air	Corrosive gases	0–0.5 vol. %	Caldos25	Page 18
		Especially short T <sub>90</sub> time	0–0.3 vol. %	Caldos27	Page 20

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# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
GL10 3TA Stonehouse  
Gloucestershire, United Kingdom  
Phone: +44 1 453 826661  
Fax: +44 1 453 829671

## **ABB Pte. Ltd.**

### **Process Automation**

2 Ayer Rajah Crescent  
139935 Singapore, Singapore  
Phone: +65 6773 5961  
Fax: +65 6778 0222

## **ABB Engineering Ltd.**

### **Process Automation**

10 Jiuxianqiao Lu  
100015 Beijing, China  
Phone: +86 10 84566688 Ext. 6217  
Fax: +86 10 84567650

## **ABB Inc.**

### **Process Automation**

3700 W Sam Houston Parkway South,  
Suite 600, Houston, TX 77042, USA  
Phone: +1 713 587 8000

[www.abb.com/analytical](http://www.abb.com/analytical)

## **ABB Australia Pty Limited**

### **Process Automation**

Bapaume Road  
2170 Moorebank  
New South Wales, Australia  
Phone: +61 2 9821 0968  
Fax: +61 2 9400 7050

## **ABB Ltd.**

### **Process Automation**

14 Mathura Road  
121003 Faridabad, Haryana, India  
Phone: +91 129 2279627  
Fax: +91 129 2279692

## **ABB Automation GmbH**

### **Process Automation**

Stierstaedter Strasse 5  
60488 Frankfurt am Main, Germany  
Fax: +49 69 7930-4566  
E-mail: [cga@de.abb.com](mailto:cga@de.abb.com)

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Sales



Service

# EasyLine EL3000 Series Continuous Gas Analyzers Models EL3020, EL3040

## Measurement made easy



Detectors with different measurement principles for numerous process and emission monitoring applications

Up to five measurement components per gas analyzer

Suitable for measuring flammable gases

Version with protection type II 3G for measurement of non-flammable gases

Performance-tested versions for emission monitoring according to Directive 2001/80/EC

QAL3 monitoring according to EN 14181 (optional)

Automatic calibration including pump and valve control

Simplified calibration with air or integral calibration cells eliminating the need for test gas cylinders

Customizable analog outputs, digital inputs and digital outputs

Modbus and Profibus interfaces

Simple menu-driven operator interface

Clear-text status messages

Configuration of rarely required functions with included configuration program

Self-monitoring function indicates when maintenance is required

Housing versions for 19-inch rack mounting (Model EL3020) and wall mounting (Model EL3040)

Integral gas feed (optional in Model EL3020)

# Overview of the gas analyzers

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## Measuring technology (analyzers)

The following analyzers are available for selection:

- Uras26 infrared photometer for the measurement of infrared-active gas components e.g. CO, NO, SO<sub>2</sub>
- Limas23 ultraviolet photometer for the measurement of NO, NO<sub>2</sub> and SO<sub>2</sub>
- Magnos206 oxygen analyzer for the measurement of O<sub>2</sub> in process gas or in N<sub>2</sub>
- Magnos27 oxygen analyzer for the measurement of O<sub>2</sub> in flue gas or in N<sub>2</sub>
- ZO23 trace oxygen analyzer for the measurement of O<sub>2</sub> in pure gases (N<sub>2</sub>, CO<sub>2</sub>, Ar)
- Caldos27 thermal conductivity analyzer for the measurement of binary gas mixtures with different thermal conductivity e.g. Ar in O<sub>2</sub>, H<sub>2</sub> in Ar, CH<sub>4</sub> in N<sub>2</sub>
- Fidas24 flame-ionization detector for the measurement of hydrocarbons
- Electrochemical oxygen sensor for the measurement of O<sub>2</sub>

Magnos206 can also be used in combination with Uras26 or Limas23.

Magnos27 and Caldos27 can also be used in combination with Uras26.

Fidas24 and ZO23 cannot be used in combination with one of the other analyzers. Only one ZO23 can be installed in the gas analyzer.

The electrochemical oxygen sensor can only be used in combination with Uras26 or Limas23. Two electrochemical oxygen sensors can be used in combination with Uras26 with separate gas paths (only in model EL3020).

Each analyzer has one physical measurement range per sample component. A section of the physical measurement range can be mapped to the current output (analog output) by on-site configuration.

Calibration is always executed in the physical measurement range. The permissible measurement range limits are given by the specification of the smallest and largest measurement ranges for the individual analyzers.

A total of up to five measurement components can be measured with one gas analyzer.

## Calibration

Calibration can be performed automatically or manually. Automatic calibration – for all sample components together – is normally started on a cyclically time-controlled basis; it can also be started by an external control signal or via the Modbus as well as manually on the display and operator control unit of the gas analyzer.

Normally, simplified calibration methods with the built-in calibration cells or the so-called single-point calibration are used for automatic calibration. If calibration with test gases is required the control of solenoid valves for switching on five test gases, zero gas and sample gas via digital outputs can be configured.

## QAL3 monitoring

QAL3 monitoring is available as an option in the gas analyzer. It is used to fulfill the requirements according to EN 14181 for storage and analysis of device adjustment data. The QAL3 monitoring option features the following functions:

- Automatic acquisition, verification and documentation of drift and precision at zero and reference points
- Reporting via CUSUM and Shewhart control charts
- QAL3 data storage in the gas analyzer (maximum 1 year)
- QAL3 data display and read-out as well as parameter setting via web browser
- Status messages on deviations beyond requirements
- Data export for further processing with spreadsheet programs

# Overview of the gas analyzers

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## Electrical interfaces

The electrical interfaces for the output of measured values and communication with external systems include

- The integrated Ethernet-10/100BASE-T interface (for gas analyzer configuration, software update and QAL3 data transfer)

as well as the integrated I/O modules depending on the functional range and order

- 2-way and 4-way analog output modules with two or four analog outputs,
- Digital I/O module with four digital inputs and four digital outputs,
- Modbus module with one RS485 and one RS232 interface,
- Profibus module with one RS485 and one MBP interface.

## Integral gas feed

The integral gas feed (optional in model EL3020) is available in two versions. It includes

- either the solenoid valve, pump, coarse filter, capillary tube and flow sensor modules
- or a flow sensor module.

## Housing design

The housing for the EL3020 gas analyzer model is designed as 19-inch housing with 3 height units (4 height units with Magnos27) and degree of protection IP20.

The housing for the EL3040 gas analyzer model is designed as wall-mount housing with degree of protection IP65.

# Infrared photometer Uras26

## Measurement principle

Non-dispersive infrared absorption

Photometer with 1 or 2 beam paths (gas paths) to measure up to 4 components

## Sample components and measurement ranges

Sample components and smallest measurement ranges

Sample component	Smallest measurement range
CO	0–100 ppm
CO <sub>2</sub>	0–100 ppm
NO	0–150 ppm
SO <sub>2</sub>	0–100 ppm
N <sub>2</sub> O	0–100 ppm
CH <sub>4</sub>	0–100 ppm

Measurement range quantity  
2 measurement ranges

Measurement range limits

Smallest measurement range	Largest measurement range
0–100 ppm (NO: 0–150 ppm)	0–500 ppm (NO: 0–750 ppm)
0–200 ppm	0–1000 ppm
0–600 ppm	0–3000 ppm
0–2000 ppm	0–10000 ppm
0–0.6 vol. %	0–3 vol. %
0–2 vol. %	0–10 vol. %
0–6 vol. %	0–30 vol. %
0–20 vol. %	0–100 vol. %

An individual measurement range within the limits shown in the table can be factory-set on special order.

Measurement ranges are freely adjustable within the limits shown in the table.

Measurement ranges should not be set within ignition limits.

Version for use in air separation units

Only for binary gas mixtures consisting of the sample component in Ar, N<sub>2</sub> or O<sub>2</sub>

Sample component	Smallest/Largest measurement range
CO	0–10 ppm / 0–50 ppm
CO <sub>2</sub>	0–5 ppm / 0–25 ppm
N <sub>2</sub> O	0–10 ppm / 0–50 ppm
CH <sub>4</sub>	0–20 ppm / 0–100 ppm

Other than the data valid for the standard version the following data apply for this version (in % of the smallest measurement range shown in the table):

Zero drift: ≤ 1.5 % per day

Sensitivity drift: ≤ 1 % per week

Output fluctuation (2 σ): ≤ 0.5 % at T<sub>90</sub> = 15 s

Temperature effect: ≤ 2 % per 10 °C

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement range.

Linearity deviation

≤ 1 % of span

Repeatability

≤ 0.5 % of span

Zero drift

≤ 1 % of span per week

Sensitivity drift

≤ 1 % of measured value per week

Output fluctuation (2 σ)

≤ 0.2 % of span at electronic T<sub>90</sub> time (static/dynamic)  
= 5/0 sec

Detection limit (4 σ)

≤ 0.4 % of span at electronic T<sub>90</sub> time (static/dynamic)  
= 5/0 sec

## Influence effects

Flow effect

Flow rate in the 20 to 100 l/h range: within detection limits

Associated gas effect/cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional):

Incorporation of interference filters or filter cells, internal electronic cross-sensitivity correction for one sample component by other sample components measured with the gas analyzer.

Temperature effect

Ambient temperature in permissible range

– At zero-point: ≤ 2 % of span per 10 °C

– On sensitivity without thermostat:

≤ 3 % of measured value per 10 °C

– On sensitivity with thermostat (optional):

≤ 2 % of measured value per 10 °C

Thermostat temperature = 55 °C

Air pressure effect

– At zero-point: No effect

– On sensitivity with pressure correction by means of integral pressure sensor: ≤ 0.2 % of measured value per 1 % barometric pressure change

The pressure sensor is located in the sample gas path if hoses are used as the internal gas lines.

If stainless-steel tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.

Pressure sensor working range: p<sub>abs</sub> = 600 to 1250 hPa

Power supply effect

Voltage and frequency in the permissible range: No effect

# Infrared photometer Uras26

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## Dynamic response

### Warm-up time

Approx. 30 minutes without thermostat; approx. 2 hours with thermostat

### 90% response time

$T_{90} = 2.5$  sec for measurement cell length = 175 mm, sample gas flow = 60 l/h and electronic T90 time (static/dynamic) = 5/0 sec

## Calibration

### Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component.

### End-point calibration

With gas-filled calibration cells (optional) or with test gas mixtures. It is recommended to verify the calibration cell set values once a year.

## Materials in contact with the sample medium

### Analyzer (sample cells)

Tubing: aluminum; windows:  $\text{CaF}_2$  or  $\text{BaF}_2$ ; connectors: stainless steel 1.4305 (SAE 303)

### Gas lines and connectors

Gas lines: FPM hoses or PTFE tubes; connectors: stainless steel 1.4305 (SAE 303); solenoid valve (option in model EL3020): PVDF.

When flammable components are present in the sample gas:

Gas lines: stainless steel tubes 1.4571 (SAE 316Ti); connectors: stainless steel 1.4305 (SAE 303).

## Gas connections

See page 25 and page 26

## Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

### Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

### Inlet pressure

$p_e = 2$  to 500 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

20 to 100 l/h

### Corrosive gases

Highly corrosive associated gas components, e.g. chlorine ( $\text{Cl}_2$ ) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption.

### Flammable gases

In the version with gas lines and connectors made of stainless steel the analyzer is suitable for measuring flammable gases in general purpose environment (see page 20).

# Ultraviolet photometer Limas23

## Measurement principle

UV-RAS (UV Resonance Absorption Spectroscopy) method for sample component NO,  
NDUV (Interference filter correlation) method for sample components NO<sub>2</sub> and SO<sub>2</sub>

Photometer to measure up to 3 components

## Sample components and measurement ranges

Sample components and measurement ranges

Sample component	Smallest/Largest measurement range
NO	0–50 ppm / 0–5000 ppm
NO <sub>2</sub>	0–50 ppm / 0–500 ppm
SO <sub>2</sub>	0–100 ppm / 0–5 vol.%

The NO<sub>x</sub> measurement value can be evaluated as the sum of the NO and NO<sub>2</sub> measurement values and output at an analog output. The NO<sub>x</sub> measurement range results from the sum of the NO and NO<sub>2</sub> measurement ranges.

NO processed through a converter can be indicated as sample component "NO<sub>x</sub>" on the display (factory-set).

For indication of the NO<sub>x</sub> measurement value in mg/m<sup>3</sup>, the factor 1.53 is taken into account for conversion of NO to NO<sub>x</sub> (factory-set).

Measurement range quantity  
2 measurement ranges

Measurement range limits

Smallest measurement range	Largest measurement range
0–50 ppm	0–250 ppm
0–100 ppm	0–500 ppm
0–200 ppm	0–1000 ppm
0–400 ppm	0–2000 ppm
0–1000 ppm	0–5000 ppm
0–4000 ppm	0–20000 ppm
0–1 vol.%	0–5 vol.%

An individual measurement range within the limits shown in the table can be factory-set on special order.

Measurement ranges are freely adjustable within the limits shown in the table.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement range.

Linearity deviation  
≤ 1 % of span

Repeatability  
≤ 0.5 % of span

Zero drift

- For NO: ≤ 2 % of span per week
- For NO<sub>2</sub> and SO<sub>2</sub>: ≤ 3 ppm per week for measurement ranges ≤ 100 ppm (daily automatic baseline check is recommended), ≤ 2.5 % of span per week for measurement ranges > 100 ppm

Sensitivity drift  
≤ 1 % of measured value per week

Output fluctuation (2 σ)  
≤ 0.5 % of span at electronic T90 time = 20 sec

Detection limit (4 σ)  
≤ 1 % of span at electronic T90 time = 20 sec

## Influence effects

Flow effect

Flow rate in the 20 to 100 l/h range: within detection limits

Associated gas effect / cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional): Internal adjustment or internal electronic cross-sensitivity correction for one sample component by other sample components measured with the gas analyzer.

Temperature effect

- Ambient temperature in permissible range
- At zero-point: ≤ 1 % of span per 10 °C
- On sensitivity: ≤ 1.5 % of measured value per 10 °C

Air pressure effect

- At zero-point: No effect
- On sensitivity with pressure correction by means of integral pressure sensor: ≤ 0.2 % of measured value per 1 % barometric pressure change

The pressure sensor is located in the sample gas path.  
Pressure sensor working range: p<sub>abs</sub> = 600 to 1250 hPa

Power supply effect

Voltage and frequency in the permissible range: No effect

# Ultraviolet photometer Limas23

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## Dynamic response

Warm-up time

Approx. 2 hours

90% response time

$T_{90} \leq 3$  sec for measurement cell length = 220 mm, sample gas flow = 60 l/h and electronic T90 time = 0 sec

## Calibration

Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component.

End-point calibration

With gas-filled calibration cells (optional) or with test gases (for each sample component). It is recommended to verify the calibration cell set values once a year.

## Materials in contact with the sample medium

Analyzer (sample cell)

Tubing: aluminum; windows:  $\text{CaF}_2$ ; connectors: stainless steel 1.4305 (SAE 303). Option: Tubing, windows and connectors made of quartz glass.

Gas lines and connectors

Gas lines: FPM hoses; gas connectors: stainless steel 1.4305 (SAE 303)

## Gas connections

See page 27

## Sample gas inlet conditions

The analyzer must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

The internal temperature of the gas analyzer is at least 10 °C above ambient temperature.

Inlet pressure

$p_e = 2$  to 500 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet pressure

Atmospheric pressure

Flow rate

20 to 100 l/h

Corrosive gases

Highly corrosive associated gas components, e.g. chlorine ( $\text{Cl}_2$ ) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption.

## Note

The analyzer cannot be used in combination with the integral gas feed.

## Measurement principle

Paramagnetic behavior of oxygen

Magnetomechanical oxygen analyzer; short 90% response time

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>)

Smallest measurement range

0 to 2 vol.% O<sub>2</sub>

Measurement range quantity and limits

2 measurement ranges

Measurement ranges are freely adjustable; they are factory-set per order to 0 to 5 or 0 to 100 or 98 to 100 vol.% O<sub>2</sub>.

Largest measurement range

0 to 100 vol.% O<sub>2</sub>

Measurement ranges should not be set within ignition limits.

Measurement ranges with suppressed zero-point

Suppressed measurement ranges are freely adjustable in the range 0 to 100 vol.% O<sub>2</sub>. Smallest span 2 vol.% O<sub>2</sub>. The combination of a suppressed and an initial measurement range is not possible.

Pressure correction with a pressure sensor is required.

A pressure sensor is installed when the analyzer has been ordered with suppressed measurement range.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They are based on a span of 2 vol.% O<sub>2</sub>.

Linearity deviation

≤ 0.5 % of span

Repeatability

≤ 50 ppm O<sub>2</sub> (time base for gas exchange ≥ 5 minutes)

Zero drift

≤ 3 % of span of the smallest measurement range (per order) per week, minimum 300 ppm O<sub>2</sub> per week; following prolonged transport and storage time the drift can be higher during the first weeks of operation.

Sensitivity drift

≤ 0.1 vol.% O<sub>2</sub> per week or ≤ 1 % of measured value per week (not cumulative), whichever is smaller.

≤ 0.25 % of measured value per year, minimum 0.05 vol.% O<sub>2</sub> per year

Output fluctuation (2 σ)

≤ 25 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

Detection limit (4 σ)

≤ 50 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

## Influence effects

Flow effect

≤ 0.1 vol.% O<sub>2</sub> in the 30 to 90 l/h range

Associated gas effect

Data regarding the effect of associated gases can be found in IEC 61207-3:2002 "Gas analyzers – Expression of performance – Part 3: Paramagnetic oxygen analyzers".

Temperature effect

Ambient temperature in the permissible range

- At zero-point: ≤ 1% of span per 10 °C, ≤ 2 % of span per 10 °C in combination with Uras26
  - On sensitivity: ≤ 0.2 % of measured value per 10 °C
- Thermostat temperature = 64 °C

Air pressure effect

- At zero-point: No effect
  - On sensitivity with no pressure correction: ≤ 1% of measured value per 1% air pressure change
  - On sensitivity with pressure correction using integrated pressure sensor (optional): ≤ 0.01 % of measured value per 1% pressure change or ≤ 0.002 vol.% O<sub>2</sub> per 1% pressure change, whichever is greater
- Pressure sensor working range: p<sub>abs</sub> = 600 to 1250 hPa

Power supply effect

Voltage and frequency in the permissible range: ≤ 0.2 % of span

Position effect

Zero-point shift ≤ 0.05 vol.% O<sub>2</sub> per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

# Oxygen analyzer Magnos206

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## Dynamic response

Warm-up time  
< 1 hour

90% response time

$T_{90}$  approx. 4 sec at a sample gas flow of 90 l/h and electronic  
 $T_{90}$  time (static/dynamic) = 3/0 sec, gas change from nitrogen  
to air

## Calibration

Zero-point calibration

With oxygen-free process gas or substitute gas

End-point calibration

With process gas with a known oxygen concentration or a  
substitute gas such as dried air

Single-point calibration

Zero-point calibration with any oxygen concentration, e.g. with  
nitrogen or ambient air, processed through a cooler or H<sub>2</sub>O  
absorber.

Pressure correction by means of pressure sensor is recom-  
mended for single-point calibration with air.

Depending on the measurement task involved, the zero- and  
end-points should be verified periodically (recommendation:  
once a year).

Calibration of measurement ranges with suppressed zero-point

Highly suppressed measurement ranges ( $\geq 95$  to 100 vol.% O<sub>2</sub>)  
should only be calibrated with test gases with concentrations in  
the selected measurement range.

## Materials in contact with the sample medium

Analyzer

Sample chamber (direct connection): stainless steel 1.4305  
(SAE 303), glass, platinum, rhodium, epoxy resin; seals: FPM  
(Fluorocarbon rubber), PEEK, FFKM

Gas connectors of the solenoid valve (option in model EL3020)

PVDF

## Gas connections

See page 28

## Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air  
or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the  
temperature throughout the sample gas path. Otherwise a  
sample gas cooler or condensate trap is required. Water vapor  
content variations cause volume errors.

Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher  
pressures require a pressure reducer.

Outlet pressure

Atmospheric pressure

Flow rate

30 to 90 l/h

Abrupt changes in gas flow rates should be avoided when using  
highly suppressed measurement ranges.

Corrosive gases

Consultation with ABB Analytical is required if the sample gas  
contains Cl<sub>2</sub>, HCl, HF or other corrosive components.

The AO2000-Magnos206 analyzer should be used if the sample  
gas contains NH<sub>3</sub>.

Flammable gases

The analyzer is suitable for measuring flammable gases in  
general purpose environment (see page 20).

## Measurement principle

Paramagnetic behavior of oxygen  
Heavy-duty thermomagnetic analyzer

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>) in flue gas or in nitrogen (N<sub>2</sub>)

Smallest measurement range

0 to 10 vol.% O<sub>2</sub>

Measurement range quantity

1 measurement range

The measurement range is factory-set per customer order.

Largest measurement range

0 to 100 vol.% O<sub>2</sub>

Measurement ranges within ignition limits cannot be provided.

## Stability

Linearity deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero drift

≤ 1 % of span per week

Sensitivity drift

≤ 2 % of measured value per week

Output fluctuation (2  $\sigma$ )

≤ 0.5 % of smallest measurement range span at electronic T90  
time = 0 sec

Detection limit (4  $\sigma$ )

≤ 1 % of smallest measurement range span at electronic  
T90 time = 0 sec

## Influence effects

Flow effect

≤ 1 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect

Magnos27 calibration applies only to the sample gas shown on the identification plate (= sample component + associated gas).

Temperature effect

Ambient temperature in permissible range

- At zero-point: ≤ 2 % of span per 10 °C
  - On sensitivity: ≤ 0.5 % of measured value per 10 °C relative to temperature at the time of calibration
- Thermostat temperature = 63 °C

Air pressure effect

- At zero-point: < 0.05 vol.% O<sub>2</sub> per 1 % air pressure change
  - On sensitivity without pressure correction: ≤ 1.5 % of measured value per 1 % air pressure change
  - On sensitivity with pressure correction using integrated pressure sensor (optional): ≤ 0.25 % of measured value per 1 % air pressure change
- Option: Operating altitude over 2000 m

Power supply effect

24 VDC ± 5 %: ≤ 0.2 % of span

Position effect

Approx. 3 % of smallest measurement range span per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

# Oxygen analyzer Magnos27

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## Dynamic response

Warm-up time  
2 to 4 hours

90% response time  
 $T_{90}$  = 10 to 22 sec, depending on sample gas flow and on measurement cell connection (see "Gas connections", applies to an analyzer unit with 1 analyzer module)

## Calibration

Zero-point calibration  
With oxygen-free process gas or substitute gas

End-point calibration  
With process gas having a known oxygen concentration or with substitute gas

## Materials in contact with the sample medium

Analyzer  
Rust- and acid-resistant steel 1.4580 (SAE 316Cb) and 1.4305 (SAE 303), glass

Gas lines and connectors  
Rust- and acid-resistant steel 1.4571 (SAE 316Ti) and 1.4305 (SAE 303), PVC-C, FPM

## Gas connections

See page 29

## Sample gas inlet conditions

The analyzer must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

### Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

### Inlet pressure

$p_e$  = 2 to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

### Outlet pressure

Atmospheric pressure

### Flow rate

20 to 90 l/h

## Note

The analyzer can only be mounted in the 19-inch housing (dimensional drawing see page 29). The analyzer cannot be used in combination with the integral gas feed.

## Measurement principle

Potentiometric measurement; zirconium dioxide cell for determination of the oxygen concentration in accordance with Nernst's equation; reference gas: ambient air.

The analyzer is used for the continuous measurement of oxygen in pure gases (N<sub>2</sub>, CO<sub>2</sub>, Ar). The measuring cell is catalytically inactivated to the extent that flammable carrier components in stoichiometric concentrations only negligibly reduce the oxygen value.

## Sample component and measurement ranges

Sample component

Oxygen (O<sub>2</sub>)

Measurement range quantity and limits

2 measurement ranges

Measurement ranges are freely adjustable within the range 0 to 1 ppm to 0 to 250,000 ppm O<sub>2</sub>; they are factory-set to 0 to 1/0 to 10 ppm O<sub>2</sub>.

The following measurement data refer to a measurement span of 100 ppm O<sub>2</sub> with a regulated flow rate of 8 ± 0.2 l/h.

## Stability

Linearity

Owing to the measurement principle, zirconium dioxide cells are base linear.

Repeatability

< 1 % of the measurement range or 100 ppb O<sub>2</sub> (whichever is greater)

Zero drift

The zero point (reference point) is displayed if ambient air is present on the sample gas side. The value for air of 20.6 % vol. of O<sub>2</sub> (for 25 °C and 50 % relative humidity) may deviate through aging of the cell.

< 1 % of the measurement range per week or 250 ppb O<sub>2</sub> (whichever is greater)

Sensitivity drift

Depends on possible interfering components (catalyst poisons) in the sample gas and the aging of the cell.

For pure gas measurements in N<sub>2</sub> and Ar:

< 1 % of the measurement range per week or 250 ppb O<sub>2</sub> (whichever is greater)

Output fluctuation (2 σ)

< ±0.5 % of the measured value or 50 ppb O<sub>2</sub> (whichever is greater)

## Influence effects

Flow effect

≤ 300 ppbv O<sub>2</sub> in the permissible range

Associated gas effect

Inert gases (Ar, CO<sub>2</sub>, N<sub>2</sub>) have no effect. Flammable gases (CO, H<sub>2</sub>, CH<sub>4</sub>) in stoichiometric concentrations to the oxygen content: Conversion of O<sub>2</sub> < 20 % of the stoichiometric conversion. If higher concentrations of flammable gases are present, higher O<sub>2</sub> conversions must be expected. The concentration of flammable gases in the sample gas must not exceed 100 ppm.

Temperature effect

The effect of the ambient temperature in the permissible range of +5 to +45 °C is < 2 % of the measured value or 50 ppb O<sub>2</sub> per 10 °C change in the ambient temperature (whichever is greater).

Air pressure effect

No effect through a change in air pressure; the sample gas must flow out of the outlet without back pressure.

Power supply effect

24 V DC ± 5 %: no effect

Position effect

No position effect for permanently installed instruments

# Trace oxygen analyzer Z023

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## Dynamic response

### Warm-up time

The operating temperature of the cell is reached after approx. 15 minutes. Offset calibration with reference gas (ambient air) after 2 hours flow. The measurement is ready-to-run after valves and lines have been purged with sample gas. Typical purging time for valves and lines: approx. 2 to 5 hours.

### 90% response time

$T_{90} < 60$  sec for the alternation of 2 test gases in the measurement range 10 ppm with a sample gas flow rate = 8 l/h and electronic T90 time = 3 sec

## Calibration

### Offset calibration

The reference value for ambient air is calibrated at 20.6 vol.% O<sub>2</sub> by means of ambient air on the sample gas side.

### End-point calibration

By means of test gas O<sub>2</sub> in N<sub>2</sub> (or in CO<sub>2</sub> or in Ar);  
O<sub>2</sub> concentration in the measurement range, e.g. 10 ppm O<sub>2</sub>

## Function test

An extended response time or reduced sensitivity are dimensions for the correct functioning of the measuring cell. The function test can be carried out by feeding the sample gas without any additional test gases. On the basis of the progression of the test, it can be assessed whether the reaction time of the sensor lies within a specified tolerance. The function test is started manually and lasts approx. 15 min.

## Materials in contact with the sample medium

### Analyzer

Zirconium dioxide cell: ZrO<sub>2</sub>, electrodes containing platinum;  
dust filter (option): PP; flow sensor (option): on semiconductor basis, nickel-plated brass

### Gas lines and connectors

Stainless steel 1.4571 (SAE 316Ti), FPM and silicon hoses in the gas outlet; gas connections: stainless steel 1.4401 (SAE 316)/1.4305 (SAE 303)

## Gas connections

See page 30

## Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature  
+5 to +50 °C

Inlet pressure  
 $p_e \leq 70$  hPa

Outlet pressure  
Atmospheric pressure

Flow rate  
4 to 20 l/h. Use a metering valve to set the flow rate.

### Corrosive gases

The presence of corrosive gases and catalyst poisons, e.g. halogens, gases containing sulfur and heavy-metal dust, leads to faster aging and/or destruction of the ZrO<sub>2</sub> cell.

### Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment (see page 20). The concentration of flammable gases in the sample gas must not exceed 100 ppm.

### Purge gas

If case purging is selected, purging may only be carried out with air (not with nitrogen), since the ambient air is used as a reference gas.

## Note

The analyzer cannot be used in combination with the integral gas feed.

# Thermal conductivity analyzer Caldos27

## Measurement principle

Difference in thermal conductivity of various gases  
Micromechanical silicon sensor with especially short  $T_{90}$  time

## Sample components and measurement ranges

Sample component and associated gas	Smallest Meas. range	Smallest meas. range with suppr. zero-point
Air in Ar	0– 6 Vol.-%	94–100 Vol.-%
Ar in air	0– 6 Vol.-%	94–100 Vol.-%
Air in CO <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
CO <sub>2</sub> in air	0–10 Vol.-%	90–100 Vol.-%
Air in H <sub>2</sub>	0– 3 Vol.-%	–
H <sub>2</sub> in air	0– 1 Vol.-%	–
Air in He	0– 3 Vol.-%	98–100 Vol.-%
He in air	0– 2 Vol.-%	97–100 Vol.-%
Ar in CO <sub>2</sub>	–	50–100 Vol.-%
CO <sub>2</sub> in Ar	0–50 Vol.-%	–
Ar in H <sub>2</sub>	0– 3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in Ar	0– 1 Vol.-%	97–100 Vol.-%
Ar in He	0– 3 Vol.-%	99–100 Vol.-%
He in Ar	0– 1 Vol.-%	97–100 Vol.-%
Ar in N <sub>2</sub>	0– 6 Vol.-%	94–100 Vol.-%
N <sub>2</sub> in Ar	0– 6 Vol.-%	94–100 Vol.-%
Ar in O <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
O <sub>2</sub> in Ar	0–10 Vol.-%	90–100 Vol.-%
CH <sub>4</sub> in H <sub>2</sub>	0– 4 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CH <sub>4</sub>	0– 1 Vol.-%	96–100 Vol.-%
CH <sub>4</sub> in N <sub>2</sub>	0– 6 Vol.-%	94–100 Vol.-%
N <sub>2</sub> in CH <sub>4</sub>	0– 6 Vol.-%	94–100 Vol.-%
CO in H <sub>2</sub>	0– 3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CO	0– 1 Vol.-%	97–100 Vol.-%
CO <sub>2</sub> in H <sub>2</sub>	0– 3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CO <sub>2</sub>	0– 1 Vol.-%	97–100 Vol.-%
CO <sub>2</sub> in N <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
N <sub>2</sub> in CO <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
H <sub>2</sub> in N <sub>2</sub>	0– 1 Vol.-%	97–100 Vol.-%
N <sub>2</sub> in H <sub>2</sub>	0– 3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in NH <sub>3</sub>	0–10 Vol.-%	90–100 Vol.-%
NH <sub>3</sub> in H <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
He in N <sub>2</sub>	0– 2 Vol.-%	97–100 Vol.-%
N <sub>2</sub> in He	0– 3 Vol.-%	98–100 Vol.-%

Sample components and measurement ranges for monitoring hydrogen-cooled turbo generators

Sample component and associated gas	Measurement range
CO <sub>2</sub> in air or Ar in air	0–100 vol.%
H <sub>2</sub> in CO <sub>2</sub> or H <sub>2</sub> in Ar	100–0 vol.%
H <sub>2</sub> in air	100–80 vol.%

Other sample components on request.

Measurement range quantity and limits

2 measurement ranges. Measurement ranges are freely adjustable within the limits shown in the table.

Largest measurement range

0 to 100 vol.% or 0 vol.% to saturation, depending on measurement task

Measurement ranges should not be set within ignition limits.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement ranges given in the table. The deviations may be larger for smaller measurement ranges.

Linearity deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero drift

≤ 2 % of smallest possible measurement range per week

Sensitivity drift

≤ 0.5 % of smallest possible measurement range per week

Output fluctuation (2  $\sigma$ )

≤ 0.5 % of smallest measurement range span at electronic T90 time = 0 sec

Detection limit (4  $\sigma$ )

≤ 1 % of smallest measurement range span at electronic T90 time = 0 sec

## Influence effects

The following data relate to smallest measurement ranges given in the table. The influence effects will be larger at operating altitudes > 2000 meters.

Flow effect

≤ 0.5 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect

The knowledge of the sample gas composition is necessary for the analyzer configuration. If the sample gas contains components in addition to the sample component and associated gas (binary gas mixture), this will result in erroneous measurements.

Temperature effect

Ambient temperature in the permissible range at each point in the measurement range: ≤ 1 % of span per 10 °C, based on temperature at the time of calibration  
Thermostat temperature = 60 °C

Air pressure effect

≤ 0.25 % of span per 10 hPa for the smallest possible ranges given; for larger spans the effect is correspondingly lower.  
Pressure sensor working range:  $p_{abs}$  = 600 to 1250 hPa

Power supply effect

Voltage and frequency in the permissible range: ≤ 0.2 % of span

Position effect

< 1 % of span up to 30° deviation from horizontal orientation

# Thermal conductivity analyzer Caldos27

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## Dynamic response

Warm-up time

Approx. 30 minutes

90% response time

$T_{90} \leq 2$  sec at sample gas flow of 60 l/h and electronic T90 time (static/dynamic) = 0/0 sec

## Calibration

Zero-point calibration

With test gas, measurement component-free process gas or substitute gas

End-point calibration

With test gas, process gas having a known sample gas concentration or substitute gas

Single-point calibration

A single-point calibration can be performed with standard gas, since the zero- and end-points will not drift independently due to the sensor principle employed. This technique leaves out safety-related measurements. Depending on the measurement task involved, the zero- and end-points should be verified periodically (recommendation: once a year).

## Materials in contact with the sample medium

Analyzer

Sample chamber (direct connection): stainless steel 1.4305 (SAE 303); sensor: gold, silicon oxo-nitride; seal: FFKM75 (Perfluoro rubber)

Gas connectors of the solenoid valve (option in model EL3020)

PVDF

## Gas connections

See page 31

## Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

Inlet pressure

$p_e = 2$  to 100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet pressure

Atmospheric pressure

Flow rate

Normally 10 to 90 l/h, minimum 1 l/h

Pressure drop

< 2 hPa at 60 l/h nitrogen

Corrosive gases

Consultation with ABB Analytical is required if the sample gas contains  $Cl_2$ , HCl, HF,  $SO_2$ ,  $NH_3$ ,  $H_2S$  or other corrosive components.

Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment (see page 20).

## Measurement principle

Flame-ionization detector

## Sample components and measurement ranges

Sample components

Hydrocarbons (THC)

Number of sample components

1 sample component

Smallest measurement range

0 to 5 mg org. C/m<sup>3</sup> or

0 to 10 ppm C1

Largest measurement range

0 to 5 g org. C/m<sup>3</sup> or

0 to 1 vol.% C1

The sample component concentration in the sample gas should not exceed 100 % of the LEL.

Measurement range quantity

2 measurement ranges

Measurement ranges are factory-set per customer order.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They apply to measurement ranges  $\geq 50$  mg org. C/m<sup>3</sup>, for smaller ranges these only apply if they are factory-set per customer order.

Linearity deviation

$\leq 2\%$  of the span to 5000 mg org. C/m<sup>3</sup>

this value applies in one (calibrated) measurement range

Repeatability

$\leq 0.5\%$  of measurement range

Zero-point and sensitivity drift

$\leq 0.5$  mg org. C/m<sup>3</sup> per week

Output fluctuation (2  $\sigma$ )

$\leq 0.5\%$  of span at electronic T90 time = 20 sec,

not smaller than 10  $\mu$ g org. C/m<sup>3</sup>

Detection limit (4  $\sigma$ )

$\leq 1\%$  of span at electronic T90 time = 20 sec,

not smaller than 20  $\mu$ g org. C/m<sup>3</sup>

## Influence effects

Oxygen dependence

$\leq 2\%$  of measured value for 0 to 21 vol.% O<sub>2</sub> or

$\leq 0.3$  mg org. C/m<sup>3</sup>, the larger value applies

Temperature effect

Ambient temperature in permissible range

at zero-point and on sensitivity:  $\leq 2\%$  per 10 °C in measurement range of 0 to 15 mg org. C/m<sup>3</sup>

Power supply effect

24 VDC  $\pm 5\%$ :  $\leq 0.2\%$  of span or

230 VAC  $\pm 10\%$ :  $\leq 0.2\%$  of span

# Flame-ionization detector Fidas24

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## Dynamic response

Warm-up time  
≤ 2 hours

90% response time

$T_{90} < 1.5$  s at sample gas flow = 80 l/h and electronic T90 time = 1 sec

## Calibration

Zero-point calibration

With synthetic air or catalytically purified air or nitrogen, depending on application

Sensitivity calibration

With propane or another hydrocarbon (substitute gas) in air or nitrogen, depending on application

## Materials in contact with the sample medium

Analyzer, gas lines and connectors

Stainless steel 1.4305 (SAE 303) and 1.4571 (SAE 316Ti), FPM, PTFE, FFKM

## Gas connections

See page 32

## Operating gases and test gases

Instrument air

Quality per ISO 8573-1 class 2 (max. particle size 1  $\mu\text{m}$ , max. particle concentration 1  $\text{mg}/\text{m}^3$ , max. oil content 0.1  $\text{mg}/\text{m}^3$ , pressure dew point at least 10 °C below the lowest foreseeable ambient temperature)

Inlet pressure  $p_e = 4000 \pm 500$  hPa

Flow rate typically approx. 1500 l/h (1200 l/h for air injector and approx. 300 l/h for housing purge), maximum approx. 2300 l/h (1800 l/h + 500 l/h)

Combustion air

Synthetic air or catalytically purified air with an organic C content < 1% span

Inlet pressure  $p_e = 1200 \pm 100$  hPa

Flow rate < 20 l/h

Combustion gas

Hydrogen, grade 5.0, or H<sub>2</sub>/He mixture (40/60%)

Inlet pressure  $p_e = 1200 \pm 100$  hPa

Flow rate ≤ 3 l/h (H<sub>2</sub>) or approx. 10 l/h (H<sub>2</sub>/He)

A flow limiting device must be provided on the hydrogen supply (see section "Safe operation of the gas analyzer").

Test gases

Zero-point calibration: Nitrogen, grade 5.0, or synthetic air or catalytically purified air

Sensitivity calibration: Sample component or substitute gas component in nitrogen or air

Inlet pressure  $p_e = 1000 \pm 100$  hPa

Flow rate 130 to 250 l/h

## Sample gas inlet conditions

Temperature

≤ thermostat temperature

(Thermostat temperature for measurement gas path, detector and air injector ≤ 200 °C, factory-set to 180 °C)

Inlet pressure

$p_{\text{abs}} = 800$  to 1200 hPa

Outlet pressure

Atmospheric pressure

Flow rate

Approx. 80 to 100 l/h at atmospheric pressure (1000 hPa)

Flammable gases

The analyzer can be used for measurement of flammable gases as long as the total flammable portion does not exceed 15 vol.% CH<sub>4</sub> or C1 equivalents.

## Note

The analyzer cannot be used in combination with the integral gas feed.

## Safe operation of the gas analyzer

The device concept ensures that a concentration of combustible gas or an explosive mixture of combustible gas and ambient air cannot occur in the interior of the gas analyzer during normal operation. The interior of the gas analyzer cannot be allocated to an (explosion protection) zone; an explosive gas mixture cannot escape to the outside.

The end user must make the following provisions to ensure safe operation of the gas analyzer:

- The gas analyzer is safe to operate even in case of a defect in the combustion gas feed path (e.g. a loose screw connection inside the gas analyzer) with an additional flow restriction in the combustion gas supply (outside the gas analyzer) of 10 l/h for H<sub>2</sub> or 25 l/h for an H<sub>2</sub>/He mixture.
- The installation of an external combustion gas shut-off valve must be provided. ABB recommends the automatic shut-off of the combustion gas supply in case the instrument air supply fails by the installation of a pneumatic valve, which controls the combustion gas supply and is actuated by the instrument air supply.

# Electrochemical oxygen sensor

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## Measurement principle

Electrochemical oxygen sensor

## Sample component and measurement range

Sample component

Oxygen (O<sub>2</sub>)

Smallest measurement range

0 to 5 vol.% O<sub>2</sub>

Measurement range

Factory-set to 0 to 25 vol.% O<sub>2</sub>.

Adjustable from 0 to 5 vol.% O<sub>2</sub> to 0 to 25 vol.% O<sub>2</sub>

## Stability

Linearity deviation

Linear in the range > 1 vol.% O<sub>2</sub>

Repeatability

≤ 0.5 % of span

Zero drift

Stable over long-term due to absolute zero point

Sensitivity drift

≤ 1 % of the measurement range per week

Output fluctuation (2 σ)

≤ 0.2 % of the measurement range at electronic T90 time  
(static/dynamic) = 5/0 sec

Detection limit (4 σ)

≤ 0.4 % of the measurement range at electronic T90 time  
(static/dynamic) = 5/0 sec

## Influence effects

Flow effect

Flow rate in the 20 to 100 l/h range:  
≤ 2 % of the measurement range

Temperature effect

Ambient temperature in the +5 to +40 °C range:  
≤ 0.2 vol.% O<sub>2</sub> per 10 °C

Air pressure effect

- At zero-point: No effect
- On sensitivity with no pressure correction:  
≤ 1 % of measured value per 1 % air pressure change
- On sensitivity with pressure correction:  
≤ 0.2 % of sample value per 1 % air pressure change  
Pressure correction is only possible if the oxygen sensor is connected to the Uras26 infrared photometer with an integral pressure sensor.

Power supply effect

Voltage and frequency in the permissible range: ≤ 0.2 % of span

## Dynamic response

90% response time

T<sub>90</sub> ≤ 30 sec at sample gas flow of 60 l/h and electronic T90 time  
(static/dynamic) = 5/0 sec

## Calibration

Zero-point calibration

The oxygen sensor zero is not calibrated since it is fundamentally stable.

End-point calibration

With ambient air at 20.96 vol.% O<sub>2</sub>

## Materials in contact with the sample medium

Sensor: Polystyrol-ABS, PTFE, FPM (Fluorocarbon rubber);

Housing body: PVC, FPM (Fluorocarbon rubber) seals;

Gas ports: Stainless steel 1.4571 (SAE 316Ti)

## Sample gas inlet conditions

The oxygen sensor must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Moisture content

H<sub>2</sub>O dew point ≥ 2 °C

The oxygen sensor should not be used with dry sample gas.

Inlet pressure

p<sub>e</sub> = 2 to 500 hPa

Outlet pressure

Atmospheric pressure

Flow rate

20 to 100 l/h

Associated gas

The oxygen sensor must not be used if the associated gas contains the following components: H<sub>2</sub>S, chlorine or fluorine compounds, heavy metals, aerosols, mercaptans, and alkaline components.

## Note

The oxygen sensor can only be used in combination with Uras26 or Limas23. Two oxygen sensors can be used in combination with Uras26 with separate gas paths (only in model EL3020).

The oxygen sensor cannot be used when the internal gas lines in the Uras26 are made up of stainless steel or PTFE pipes.

# Integral gas feed

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## Versions

The integral gas feed (optional in model EL3020) is available in two versions. It includes

- either the solenoid valve, pump, coarse filter, capillary tube and flow sensor modules
- or the flow sensor module.

## Test gas supply

Type

3/2-way solenoid valve

Power consumption

Approx. 3 W

Materials in contact with the sample medium

PVDF, FPM

## Gas feed

Type

Magnetic piston pump

Feed rate

Max. 60 l/h, depending on the analyzer type and inlet/outlet pressure

Flow rate

Adjustable

Power consumption

Approx. 10 W

Materials in contact with the sample medium

PVDF, EPDM, stainless steel 1.4571 (SAE 316Ti)

## Flow monitor

Type

Miniature flow sensor

Materials in contact with the sample medium

Al<sub>2</sub>O<sub>3</sub>, silicon, gold, GRP

## Sample gas inlet conditions

The integral gas feed modules must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

+5 to +45 °C

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Flow rate

30 to 60 l/h

Corrosive gases

Corrosive associated gas components and aerosols must be cooled or undergo prior absorption.

## Note

The integral gas feed cannot be used when the internal gas lines are made up of stainless steel or PTFE pipes. It cannot be used in combination with Limas23, Magnos27, ZO23 or Fidas24.

## Special versions

### Version for measurement of flammable gases

In the version with gas lines and connectors made of stainless steel the gas analyzer (Models EL3020 and EL3040) with Uras26, Magnos206, Caldos27 and ZO23 (concentration max. 100 ppm) is suitable for measuring flammable gases in general purpose environment.

In model EL3040, housing purge with nitrogen (ZO23: with air) must be provided.

The positive pressure in the sample gas feed path may not exceed a maximum value of 100 hPa in normal operation and a maximum value of 500 hPa in the event of a fault.

The special requirements must be observed (see operator's manual).

### Version with protection type II 3G for installation in hazardous location for measurement of non-flammable gases and vapors

The gas analyzer (Model EL3040) with Uras26, Limas23, Magnos206 and Caldos27 is tested for explosion protection. It is suitable for installation in hazardous locations when the technical data and the special requirements (see operator's manual) are observed.

The gas analyzer may be used for measurement of non-flammable gases and vapors. It is marked according to the European directive 94/9/EC with

 II 3G Ex nAC II T4 X

In undisturbed operation there cannot be any sparking, arcing or impermissible temperatures inside the device. Explosion protection through: Non-sparking instruments and devices with low power consumption; sealed or encapsulated devices

Judgment according to EN 60079-15:2005: Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection “n”, sections 1 to 16, 19, 20, 22, 23, 29

Marking according to EN 60079-15:2005, section 35

Housing degree of protection IP65

The special requirements must be observed (see operator's manual).

## General data

### Display and operation

#### Display

Backlit graphics display with 240 x 160-pixel resolution

#### Measured value display

- Numerical value with physical unit, also with bar graph indication in single display
- Resolution better than 0.2 % of the measurement span
- Simultaneous display of up to 5 measured values
- Flow: bar graph indication

#### Status display

Symbols in the display; the active status messages can be accessed directly from the measured value display

#### Operation

5 keys (cursor cross and OK); menu-assisted operation

#### Concept of operation

The functions required in normal operation are operated and configured directly on the gas analyzer. The functions which are only seldom required, e.g. during start-up, are configured offline using the configuration software ECT (“EasyLine Configuration Tool” on the enclosed CD-ROM) and then loaded into the gas analyzer.

#### Measuring range switch-over and feedback

There are three ways of executing the measuring range switch-over:

- Manually on the gas analyzer
- Automatically (autorange) by means of appropriate configured switch-over thresholds
- Externally controlled via appropriately configured digital inputs.

The measuring range feedback can be implemented via appropriately configured digital outputs; it is independent of the selected type of measuring range switch-over.

The gas analyzer is set ex works to measuring range 2 and to manual measuring range switch-over.

#### Limit value monitoring

Limit values can be set using the configuration software ECT. The limit value signals (alarms) are output via digital outputs.

### Housing

	Model EL3020	Model EL3040
Version	19-inch housing	Wall-mount housing
Protection type	IP20	IP65
Materials		
Housing	Galvanized sheet steel	Stainless steel 1.4016 (SAE 430)
	Outer surfaces varnished	
Analyzer rear panel	Aluminum, PVC-C	Aluminum, PVC-C
Keypad sheet	Polyester	Polyester
Colors	Light gray (RAL 7035), basalt gray (RAL 7012)	
Weight	Approx. 7 to 15 kg	Approx. 13 to 21 kg
Dimensions	See page 33	See page 34

#### Housing purge

Possible only with model EL3040 (wall-mount housing).

Housing purge is mandatory when measuring flammable gases (see page 20). Purge gas flow during operation min. 10 l/h, max. 20 l/h. Purge gas pressure  $p_e = 2$  to 4 hPa.

# General data

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## Pressure sensor

### Use

Standard: with Uras26, Limas23, Caldos27,  
Option: with Magnos206 and Magnos27

### Materials in contact with the sample medium

Silicone gel, plastics, FPM (Fluorocarbon rubber)

## Fine filtration

### Version

Disposable filter with borosilicate glass microfiber filter element  
(supplied as accessory)

### Retention rate

99.99 % for particles > 0.1 µm

### Materials in contact with the sample medium

Polyamide, borosilicate glass with PVDF binder

## Electrical safety

Tested per EN 61010-1:2001

Protection class I

Overvoltage category/pollution degree

Power supply: III/2, other circuits: II/2

### Safe isolation

The power supply is galvanically isolated from other circuits by means of reinforced or double insulation. Protective extra-low voltage (PELV) on low-voltage side

## Electromagnetic compatibility

### Noise immunity

Tested to EN 61326-1:2006. Inspection severity: Industrial area, fulfills at least the rating "continuously monitored operation" to table 2 of EN 61326.

### Emitted interference

Tested to EN 61326-1:2006, EN 61000-3-2:2006 and EN 61000-3-3:1995 + A1:2001 + A2:2005. Limit value class B for interference field strength and interference voltage is met.

## Mechanical stress

### Operation

Vibration test to EN 60068-2-6:1996  
Vibrations up to 0.5g/150 Hz have no influence on the measured value. In Uras26, slight transient effects on the measured value can occur in the region of the modulation frequency.

### Transport

Vibration test to EN 60068-2-6:1996,  
shock test to EN 60068-2-27:1995  
In its original packaging, the gas analyzer will withstand normal shipping conditions.

## Installation site requirements

### Installation location

The gas analyzer is intended for indoor installation only. Installation location altitude max. 2000 m above sea level (over 2000 m on request)

### Ambient temperature

Operation: +5 to +45 °C  
Uras26 in combination  
with another analyzer,  
Limas23, Fidas24: +5 to +40 °C  
Storage and transport: -25 to +65 °C

### Relative humidity

< 75 %, slight condensation allowed

### Air circulation

For sufficient air circulation, multiple housings in a 19-inch rack must be installed with a separation of at least one height unit between housings.

## Power supply

### Input voltage

100 to 240 V AC - 15/+ 10 %, 50 to 60 Hz ± 3 Hz

### Power consumption

Max. 187 VA

### Connection

3-pin plug per EN 60320-1/C14; connection cable supplied.  
Connection diagrams see page 22.

## Fidas24: Heating of detector and sample gas inlet

### Input voltage

115 VAC or 230 VAC, ± 15 % (max. 250 VAC), 47 to 63 Hz

### Power consumption

125 VA for detector heating,  
125 VA for heated sample gas inlet (optional)

### Connection

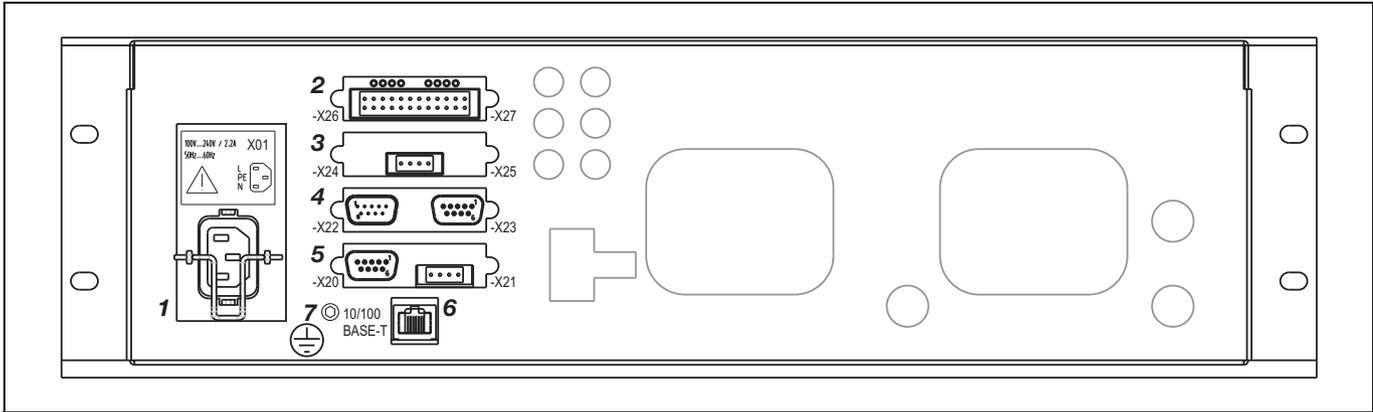
4-pin plug; connection cable supplied.  
Connection diagrams see page 32.

## Note regarding the analyzers performance characteristics

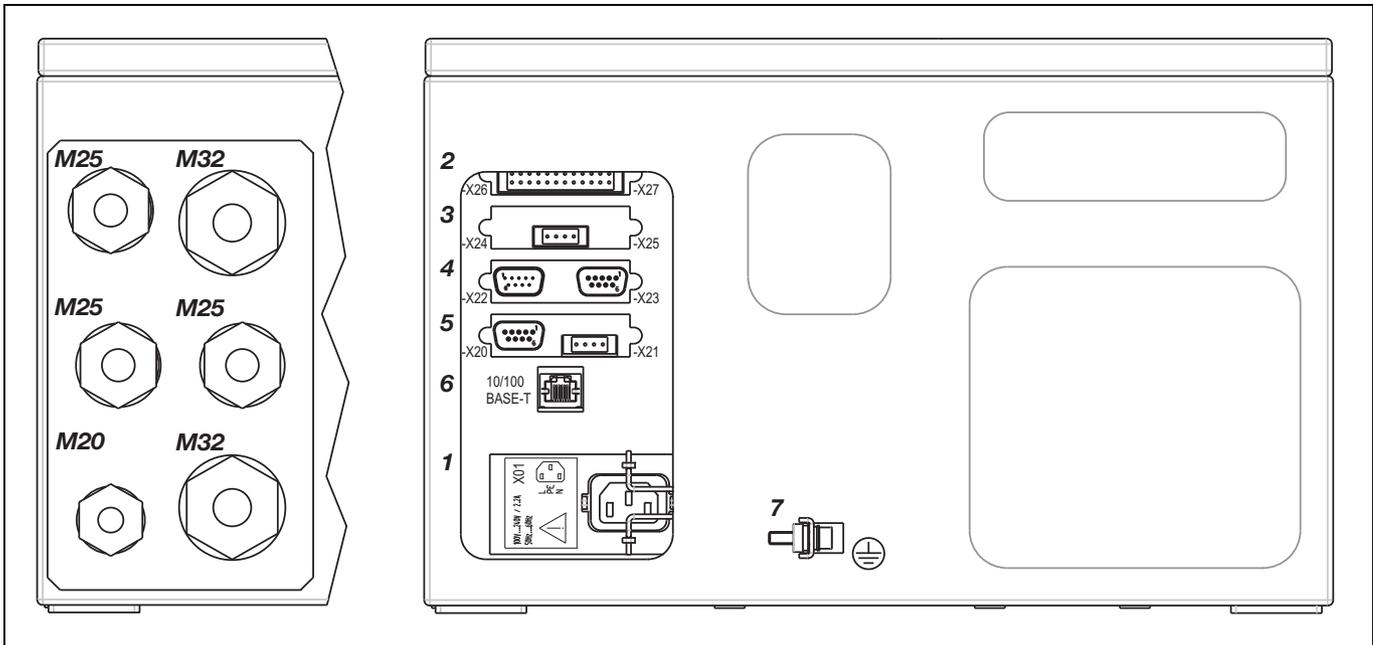
The performance characteristics of the analyzers have been determined according to IEC 61207-1:2010 "Expression of performance of gas analyzers – Part 1: General". They are based on nitrogen as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.

# Electrical connections

## Power supply and signal lines model EL3020 (view from behind)



## Power supply and signal lines model EL3040 (view from below)



- 1 Power supply connection  
(3-pin plug per EN 60320-1/C14; connection cable supplied)
- 2 I/O modules (4 slots), options:
- 3 Digital I/O module (max. 3 modules, see page 24)
- 4 Analog output module (max. 2 modules, see page 23)
- 5 Modbus module (RS232 & RS485 interface, see page 23)
- 6 Profibus module (RS485 & MBP interface, see page 23)
- 7 Ethernet-10/100BASE-T interface (8-pin RJ45 plug)
- 8 Potential compensation connection (max. 4 mm<sup>2</sup>)

Screwed cable glands for cable diameter:

<b>M20</b> Power supply	5–13 mm
<b>M25</b> Modbus/Profibus	8–17 mm
<b>M25</b> Network	8–17 mm
<b>M25</b> Analog outputs	8–17 mm
<b>M32</b> Digital inputs/outputs	12–21 mm
<b>M32</b> Digital inputs/outputs	12–21 mm

### Notes

Both drawings show examples for the I/O modules equipment.

I/O module connection:

- The maximum capacity of terminals for stranded or solid conductors is 1 mm<sup>2</sup> (17 AWG).
- The stranded conductor may be tinned on the tip or twisted for simplified connection.
- When using wire end ferrules the total section should not exceed 1 mm<sup>2</sup>, i.e. the maximum stranded conductor section is 0.5 mm<sup>2</sup>. The Weidmüller PZ 6/5 crimping tool must be used for crimping the ferrules.

Functional scope of the Ethernet interface:

- Communication with configuration software ECT for gas analyzer configuration and software update,
- QAL3 data transfer if the QAL3 monitoring option is integrated in the gas analyzer.

# I/O modules

## Profibus module

### Electrical connections

#### RS485 interface:

- 1 – Not used
- 2 M24 24 V output ground, max. 0.2 A
- 3 RxD/TxD-P Receive/transmit data plus, B-line
- 4 – Not used
- 5 DGND Data transmission potential (Ref. pot. for VP)
- 6 VP Supply voltage plus (5 V)
- 7 P24 24 V output voltage plus
- 8 RxD/TxD-N Receive/transmit data N, A-line
- 9 – Not used

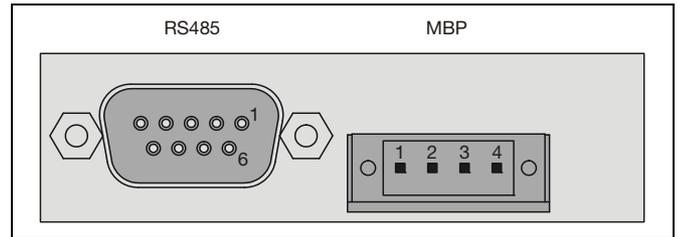
Design: 9-pin sub-D female connector

#### MBP interface (non-intrinsically safe):

- 1 +
- 2 Shield
- 3 –
- 4 Not used

Design: 4-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!

### Connection diagram



## Modbus module

### Electrical connections

#### RS232 interface:

- 2 RxD
- 3 TxD
- 5 GND

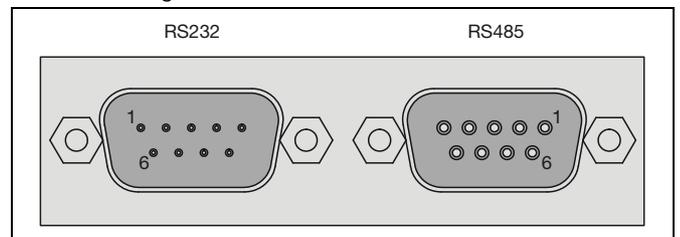
Design: 9-pin sub-D male connector

#### RS485 interface:

- 2 RTxD-
- 3 RTxD+
- 5 GND

Design: 9-pin sub-D female connector

### Connection diagram



## Analog output modules

### Analog outputs (AO1 to AO4)

0/4 to 20 mA (configurable, factory-set to 4 to 20 mA), common negative pole, galvanically isolated from ground, freely connectable to ground, max. gain relative to protective ground potential 50 V, max. working resistance 750 Ω. Resolution 16 bit. The output signal cannot be lower than 0 mA.

### Terminal assignment

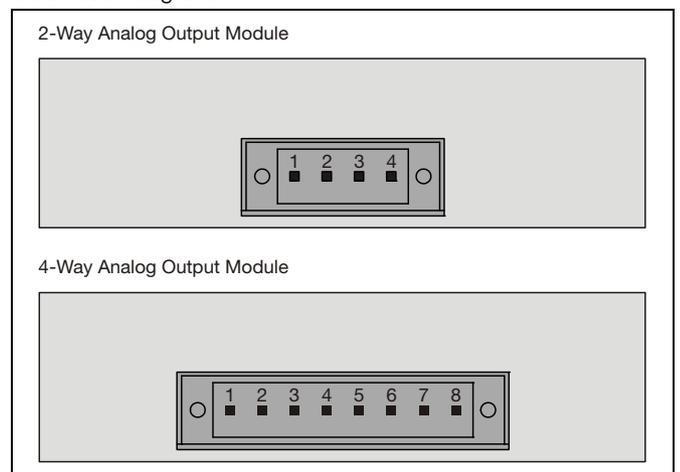
An analog output is allocated in the sequence of the sample components for each sample component. The sequence of the sample components is documented in the analyzer data sheet and on the type plate.

### Electrical connections

- 1 AO1+ } for 2-way analog output module and
- 2 AO1- } 4-way analog output module
- 3 AO2+ } 4-way analog output module
- 4 AO2- } 4-way analog output module
- 5 AO3+ } only for
- 6 AO3- } 4-way analog output module
- 7 AO4+ } 4-way analog output module
- 8 AO4- } 4-way analog output module

Design: 4-pin or 8-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!

### Connection diagrams



# I/O modules

## Digital I/O module

### Digital inputs (DI1 to DI4)

Optocouplers with internal 24 VDC power supply. Control with floating contacts, with external voltage 12 to 24 VDC or with open collector drivers PNP or NPN.

### Digital outputs (DO1 to DO4)

Floating double-throw contacts, max. contact load rating 30 VDC/1 A

Relays must at all times be operated within the specified data range. Inductive or capacitive loads are to be connected with suitable protective measures (self-induction recuperation diodes for inductive loads and series resistors for capacitive loads).

### Terminal assignment

Digital input and output signals	Standard assignment <sup>1)</sup> digital I/O module	
	1	2
Failure		
Maintenance request		
Maintenance mode		
Overall status	DO1	
Start automatic calibration	DI1	
Stop automatic calibration		
Disable automatic calibration	DI2	
Sample gas valve	DO4	
Zero gas valve		
Span gas valves 1 to 5		
Pump on/off <sup>2)</sup>		
Limit 1	DO2	
Limit 2	DO3	
Limit 3		DO1
Limit 4		DO2
Limit 5		DO3
Limit 6		DO4
Limit 7		
Limit 8		
Limit 9		
Limit 10		
Measuring range switch-over		
Measuring range feedback		
Measuring component switch-over		
Measuring component feedback		
Bus DI 1 to 8		
External failure <sup>3)</sup>	DI3	
External maintenance request <sup>3)</sup>	DI4	

- 1) Factory-set, can be changed by on-site configuration
- 2) When a pump (integral gas feed) is installed
- 3) Multiple external status signals can be configured depending on the number of free digital inputs.

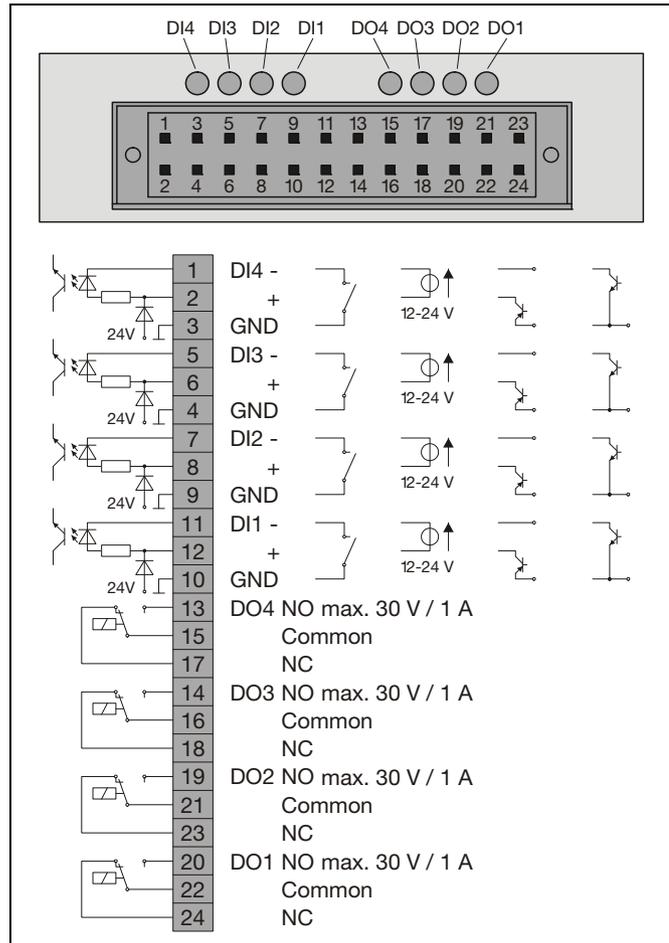
### Electrical connections

See connection diagram

Design: 2x12-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!

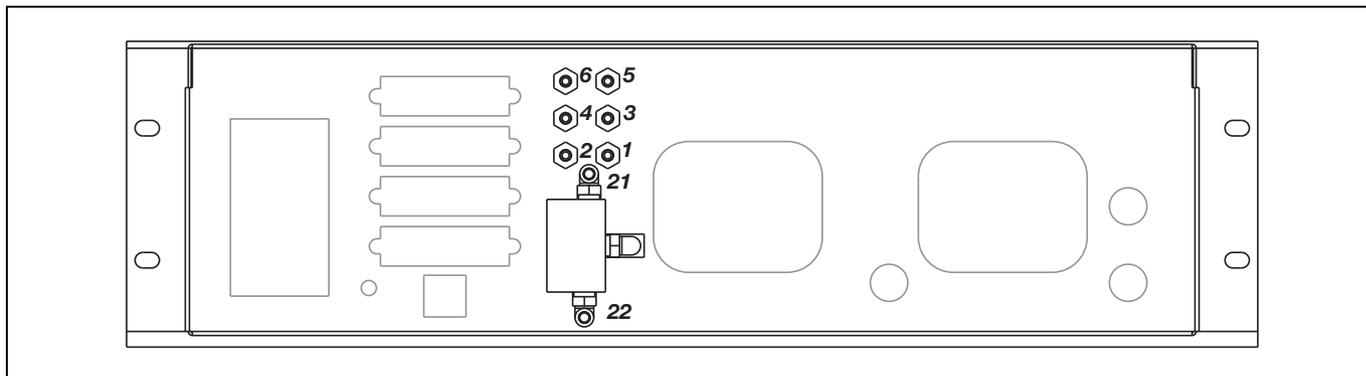
Relays are shown in the unpowered state. The unpowered state is the failure mode.

### Connection diagram



# Gas connections Uras26

## Model EL3020 (Internal gas lines: FPM hoses)



- 1** Sample gas inlet gas path 1 without "Integral gas feed" option
- 2** Sample gas outlet gas path 1 connected to sample gas inlet of Magnos206 or Caldos27 if applicable
- 3** Sample gas outlet for "Integral gas feed" option, factory-connected to sample gas inlet gas path 1
- 4** Sample gas inlet for "Integral gas feed" option with flow sensor only (without solenoid valve)
- 5** Sample gas inlet gas path 2
- 6** Sample gas outlet gas path 2

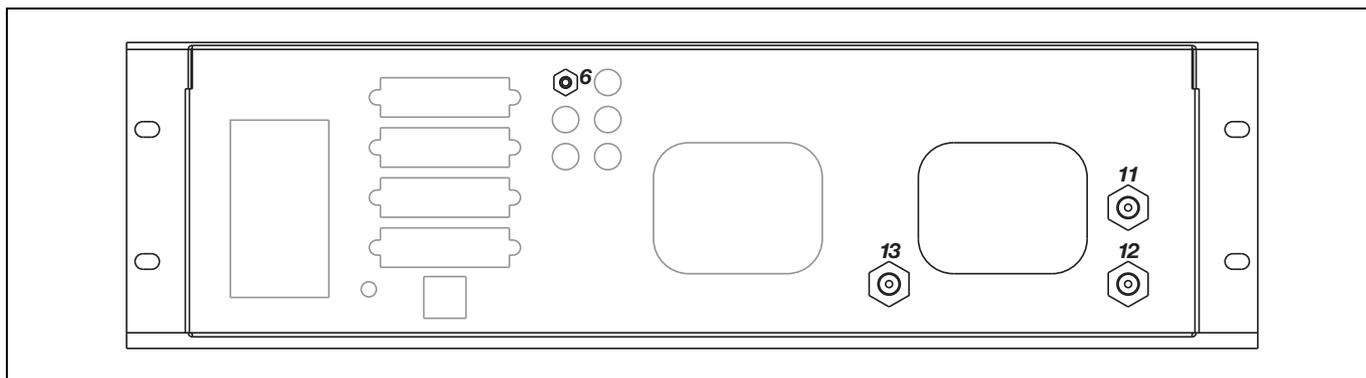
Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

- 21** Sample gas inlet at solenoid valve } for "Integral gas feed" option with
- 22** Test gas inlet at solenoid valve } solenoid valve, pump, filter, capillary and flow sensor

Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

Note: Pressure sensor (standard) and O<sub>2</sub> sensor (option) are connected internally as follows:  
 downstream the sample cell 1 outlet for one sample cell or for two separate gas paths,  
 downstream the sample cell 2 outlet for two sample cells in series.  
 The second O<sub>2</sub> sensor (option for version with two separate gas paths) is connected downstream the sample cell 2.

## Model EL3020 (Internal gas lines: PTFE or stainless steel pipes)



- 6** Pressure sensor

Design: Screwed fitting with hose nozzle (stainless steel 1.4305/SAE 303) for hose with 4 mm inner diameter (supplied)

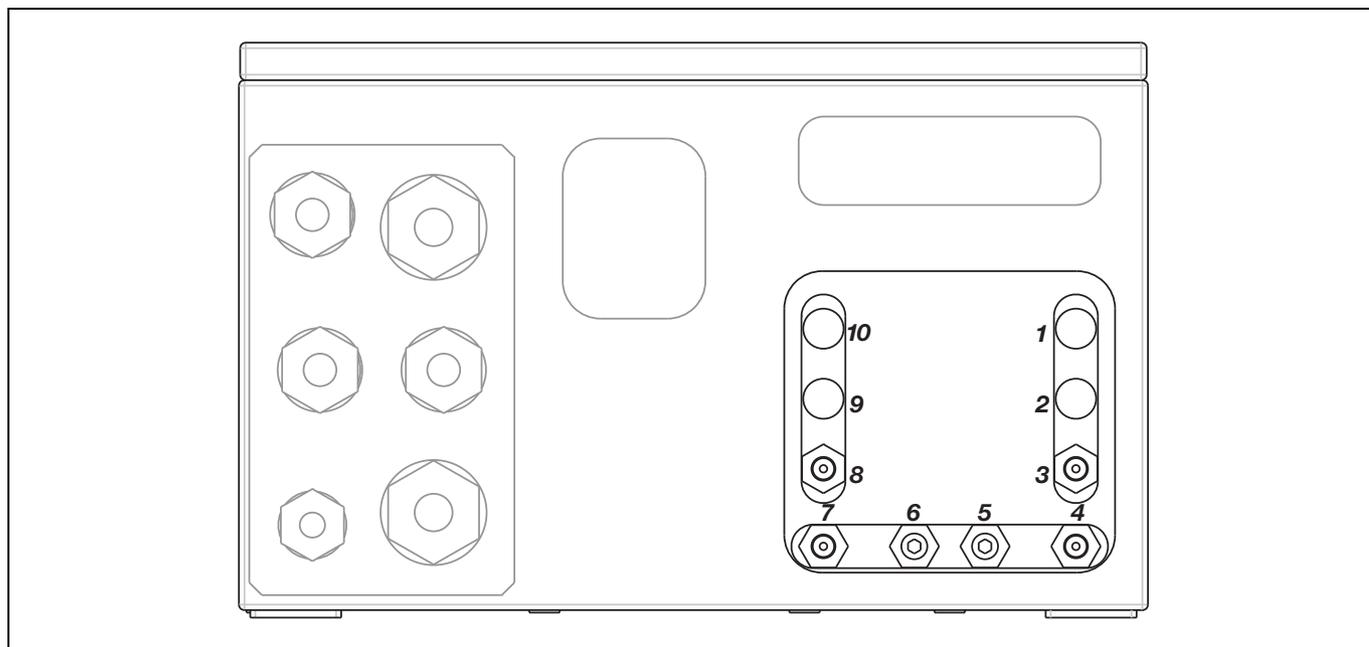
- 11** Sample gas inlet
- 12** Sample gas outlet for one sample cell } connected to sample gas inlet of
- 13** Sample gas outlet for two sample cells in series } Caldos27 or Magnos206 if applicable

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied)

Notes: O<sub>2</sub> sensor, "Integral gas feed" option and version with two separate gas paths cannot be provided.

## Gas connections Uras26

Model EL3040 (Internal gas lines: FPM hoses or PTFE or stainless steel pipes)



### One gas path with one sample cell or two sample cells in series

- 1** not used
- 2** not used
- 3** Sample gas inlet
- 4** Sample gas outlet for one sample cell
- 5** Purge gas inlet housing
- 6** Purge gas outlet housing
- 7** not used
- 8** Sample gas outlet for two sample cells in series
- 9** Pressure sensor (internal gas paths: PTFE or stainless steel pipes)
- 10** not used

### Two separate gas paths with one sample cell each

- 1** not used
- 2** not used
- 3** Sample gas inlet gas path 1
- 4** Sample gas outlet gas path 1
- 5** Purge gas inlet housing
- 6** Purge gas outlet housing
- 7** Sample gas inlet gas path 2
- 8** Sample gas outlet gas path 2
- 9** not used
- 10** not used

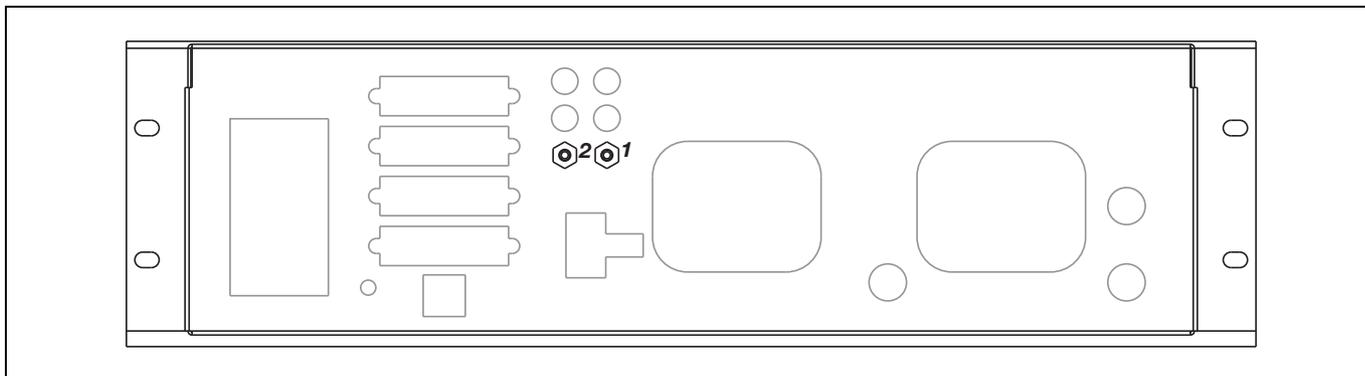
Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied for purge gas connections and for sample gas connections when internal gas paths are made up of FPM hoses.)

Notes: When the internal gas paths are made up of FPM hoses, pressure sensor (standard) and O<sub>2</sub> sensor (option) are connected internally as follows:  
downstream the sample cell 1 outlet for one sample cell or for two separate gas paths,  
downstream the sample cell 2 outlet for two sample cells in series.

When the internal gas paths are made up of PTFE or stainless steel pipes, the O<sub>2</sub> sensor cannot be provided.

## Gas connections Limas23

### Model EL3020



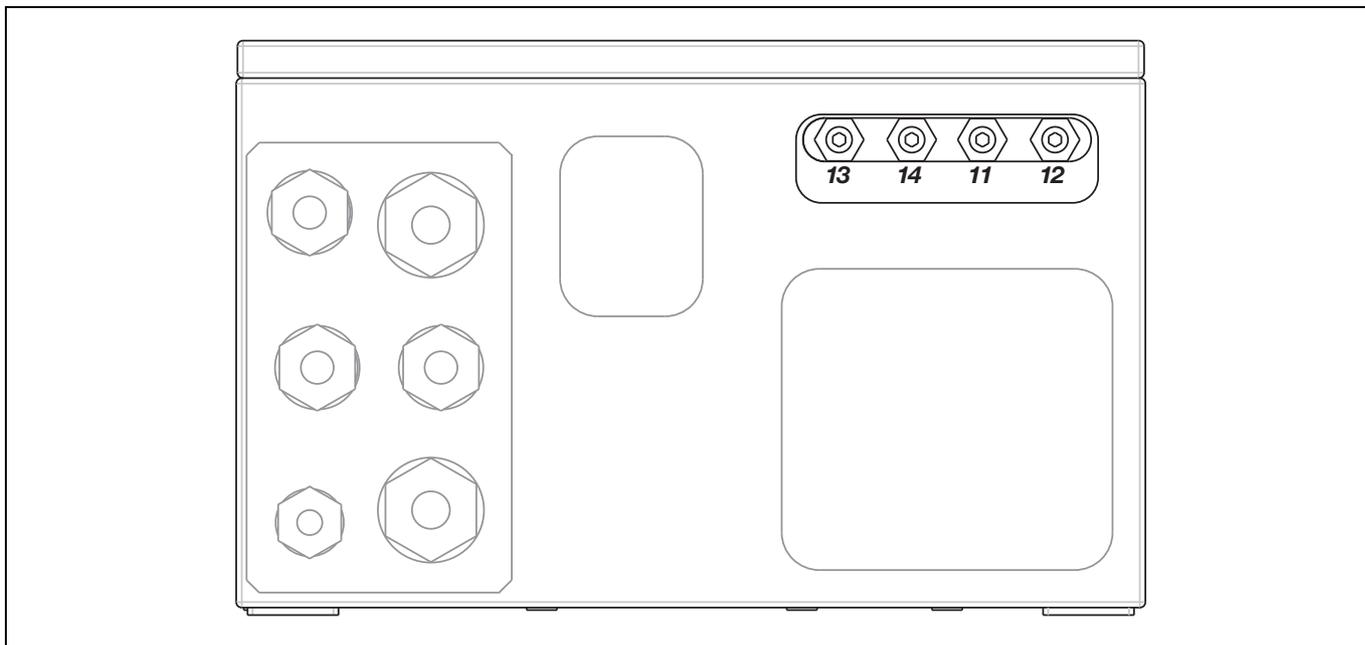
**1** Sample gas inlet

**2** Sample gas outlet (connected to sample gas inlet of Magnos206 if applicable)

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

Note: Pressure sensor (standard) and O<sub>2</sub> sensor (option) are connected internally downstream the sample cell.

### Model EL3040



**13** Sample gas inlet

**14** Sample gas outlet (connected to sample gas inlet of Magnos206 if applicable)

**11** Purge gas inlet housing

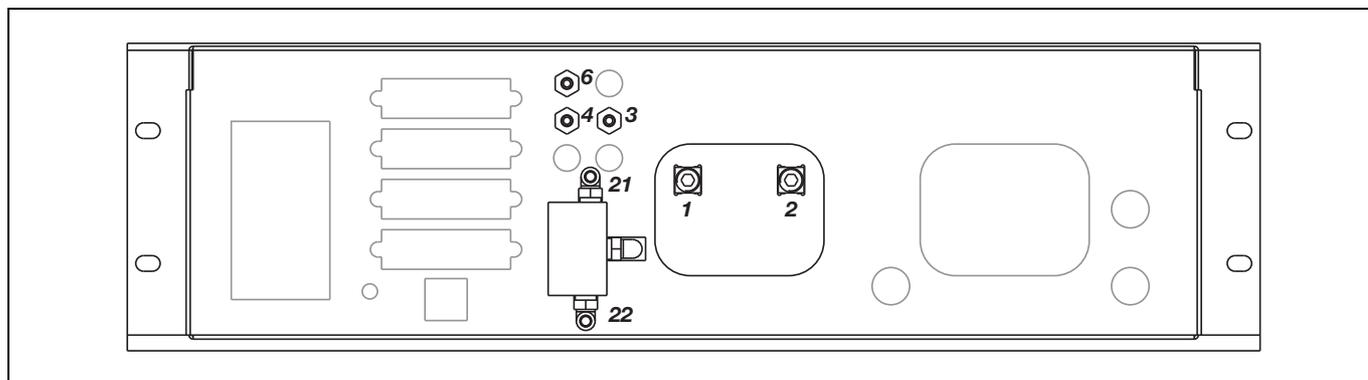
**12** Purge gas outlet housing

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied);  
screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

Note: Pressure sensor (standard) and O<sub>2</sub> sensor (option) are connected internally downstream the sample cell.

# Gas connections Magnos206

## Model EL3020



**1** Sample gas inlet

**2** Sample gas outlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

**3** Sample gas outlet for "Integral gas feed" option, factory-connected to **1** sample gas inlet

**4** Sample gas inlet for "Integral gas feed" option with flow sensor only (without solenoid valve)

**6** Pressure sensor (option)

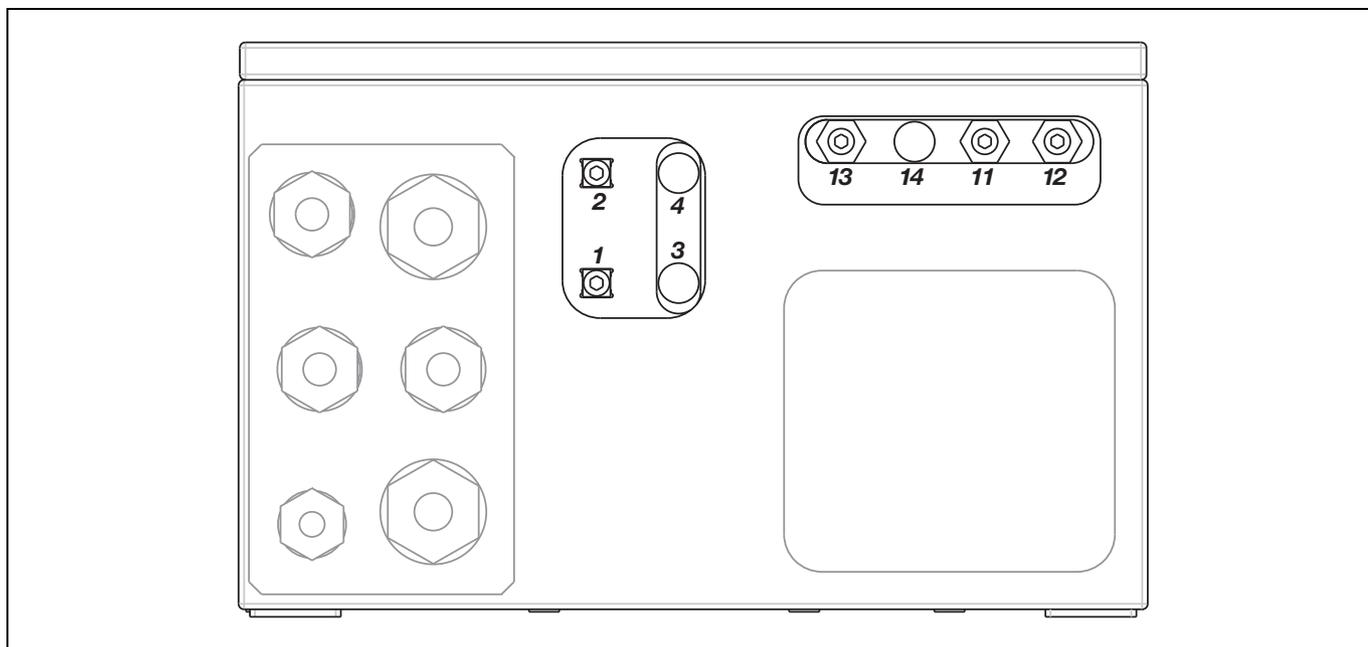
Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

**21** Sample gas inlet at solenoid valve } for "Integral gas feed" option with

**22** Test gas inlet at solenoid valve } solenoid valve, pump, filter, capillary and flow sensor

Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

## Model EL3040



**1** Sample gas inlet

**2** Sample gas outlet

**3** not used

**4** not used

**11** Purge gas inlet housing

**12** Purge gas outlet housing

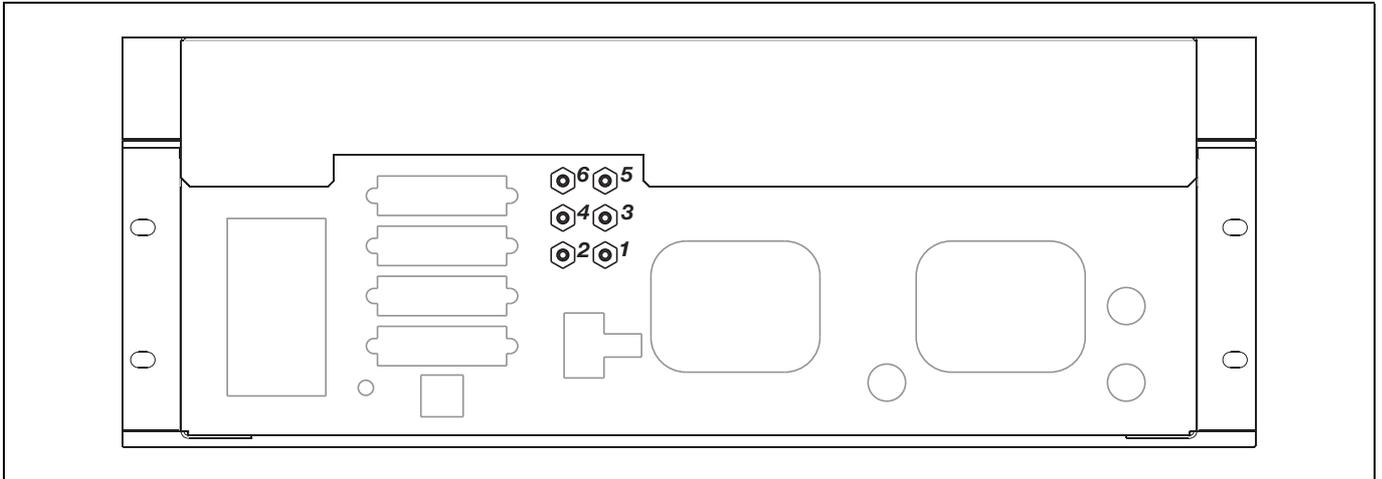
**13** Pressure sensor (option)

**14** not used

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

# Gas connections and dimensional drawing Magnos27

## Gas connections



### Magnos27

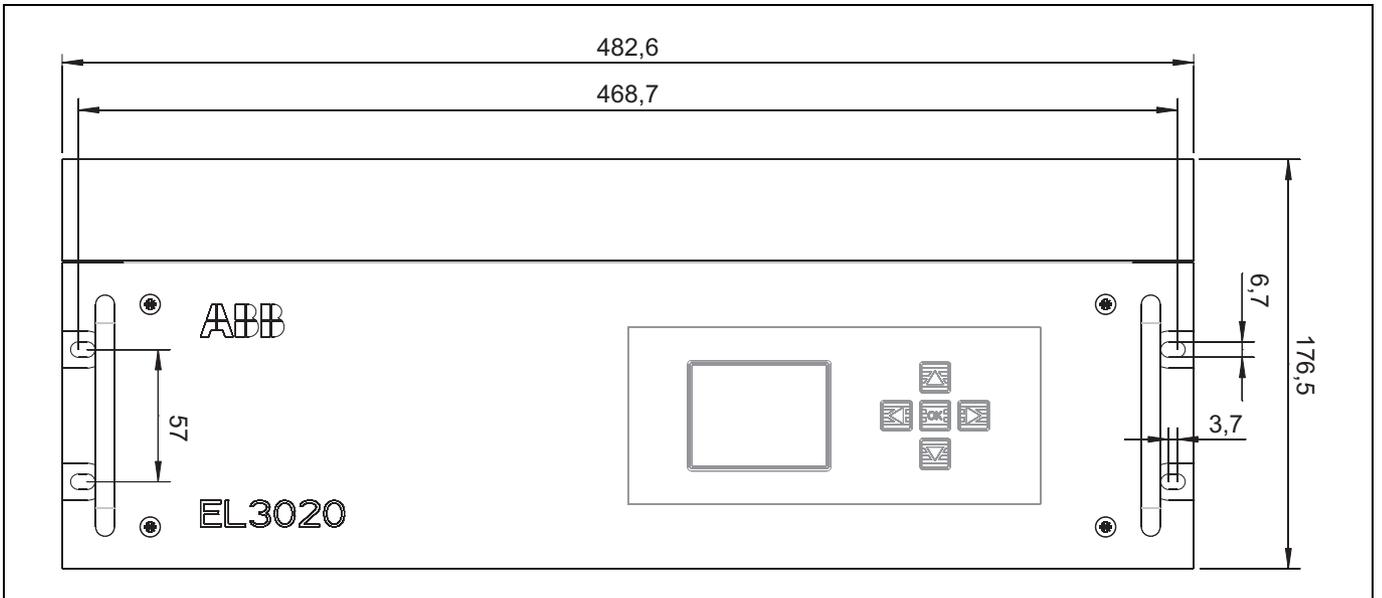
- 1 Pressure sensor (option)
- 2 not used
- 3 Sample gas inlet
- 4 Sample gas outlet
- 5 Purge gas inlet analyzer
- 6 Purge gas outlet analyzer

### Magnos27 in combination with Uras26 (one gas path, internal gas lines: FPM hoses)

- 1 Sample gas inlet Uras26
- 2 Sample gas outlet Uras26
- 3 Sample gas inlet Magnos27
- 4 Sample gas outlet Magnos27
- 5 Purge gas inlet Magnos27
- 6 Purge gas outlet Magnos27

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

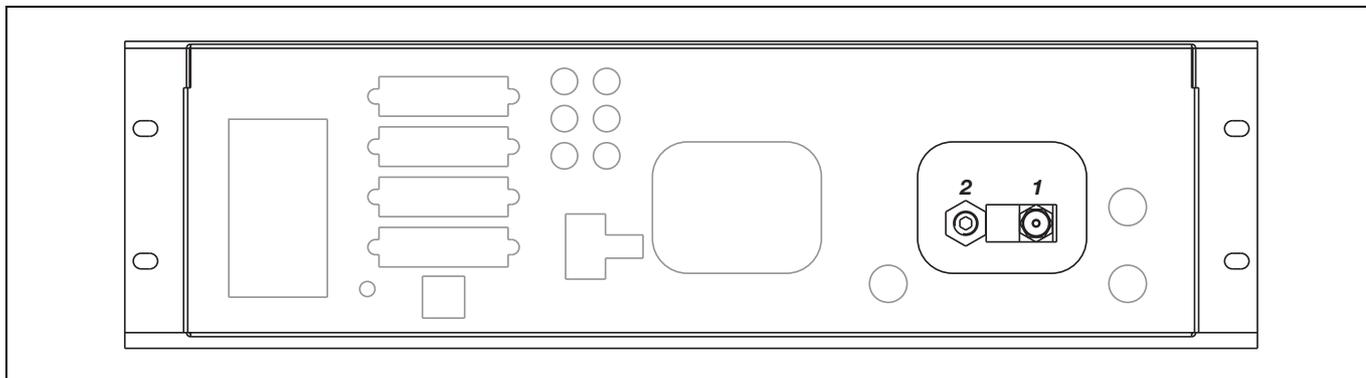
## Dimensional drawing



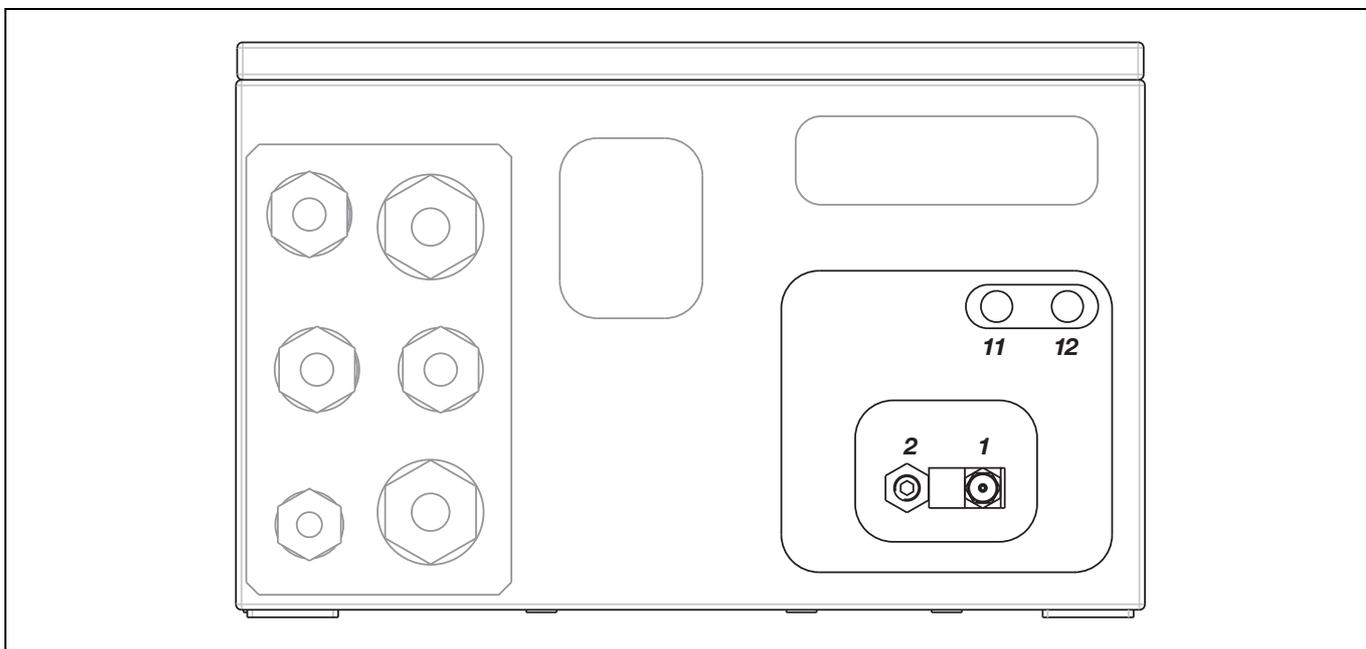
Note: Only the front view of the housing (with its height differing from the standard dimension) is depicted in this dimensional drawing. Refer to the dimensional drawing on page 33 for other views and dimensions of the housing.

## Gas connections Z023

### Model EL3020



### Model EL3040

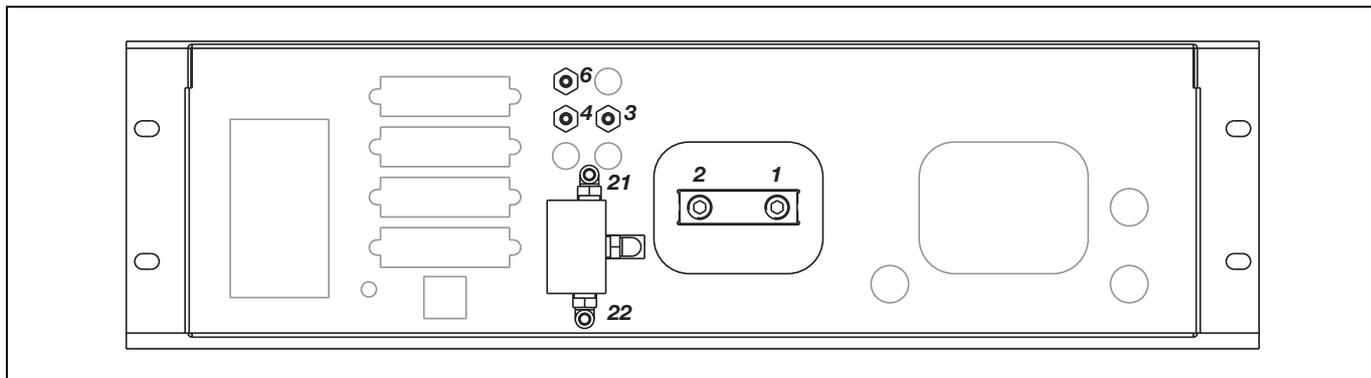


- 1** Sample gas inlet
- 2** Sample gas outlet
- 11** Purge gas inlet housing
- 12** Purge gas outlet housing

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied),  
sample gas inlet 3 mm Swagelok® (stainless steel 1.4401/SAE 316)

# Gas connections Caldos27

## Model EL3020



- 1** Sample gas inlet
- 2** Sample gas outlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied);  
screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

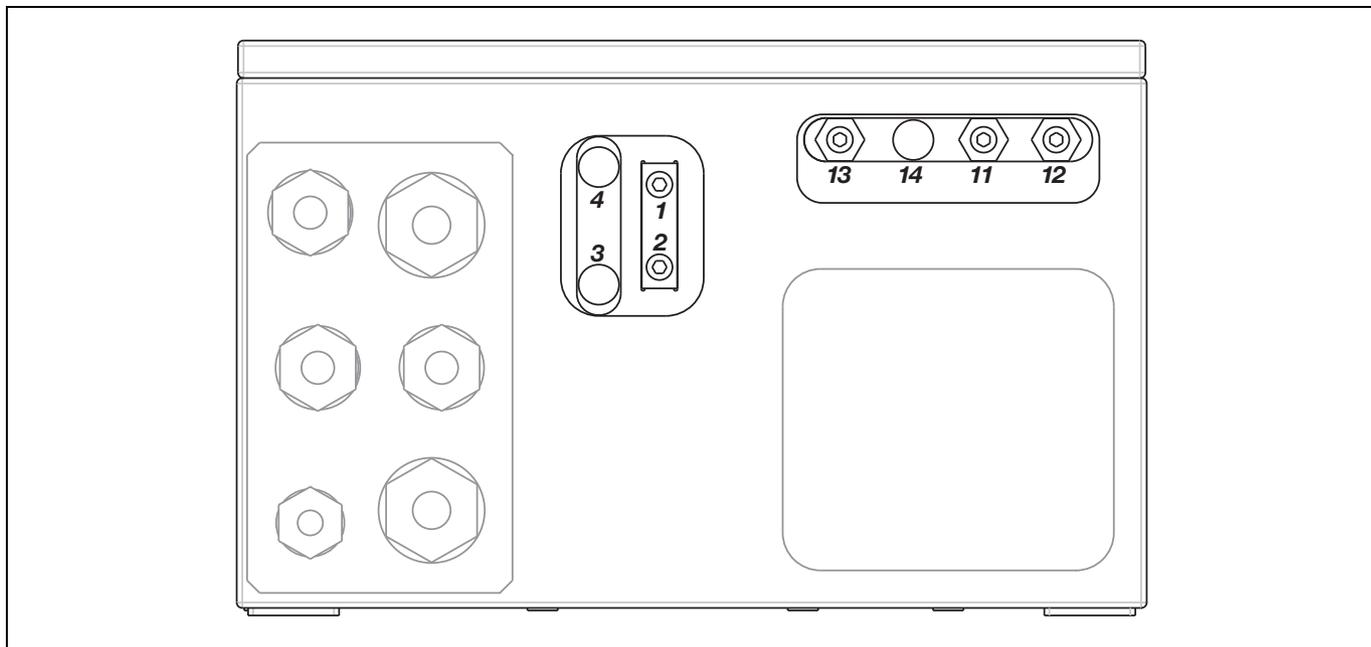
- 3** Sample gas outlet for "Integral gas feed" option, factory-connected to **1** sample gas inlet
- 4** Sample gas inlet for "Integral gas feed" option with flow sensor only (without solenoid valve)
- 6** Pressure sensor

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

- 21** Sample gas inlet at solenoid valve } for "Integral gas feed" option with
- 22** Test gas inlet at solenoid valve } solenoid valve, pump, filter, capillary and flow sensor

Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

## Model EL3040

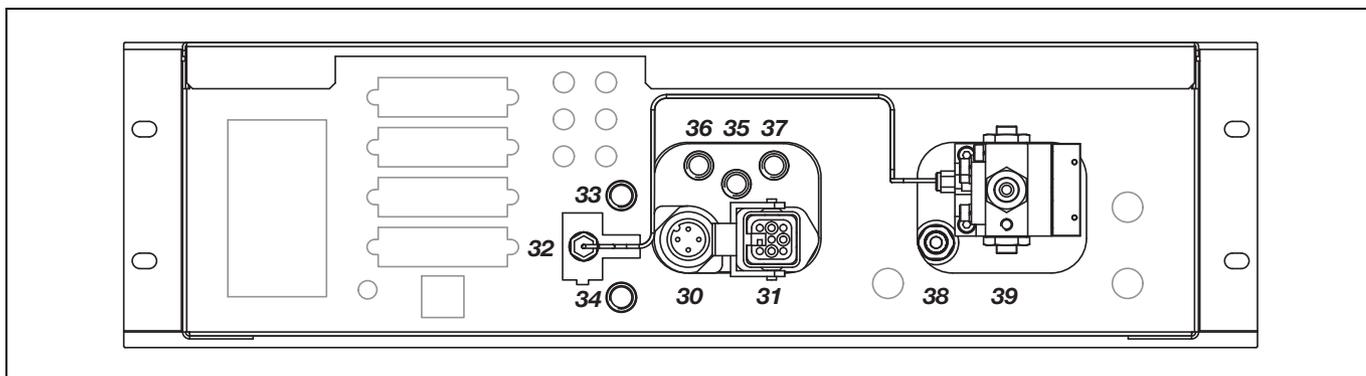


- 1** Sample gas inlet
- 2** Sample gas outlet
- 3** not used
- 4** not used
- 11** Purge gas inlet housing
- 12** Purge gas outlet housing
- 13** Pressure sensor
- 14** not used

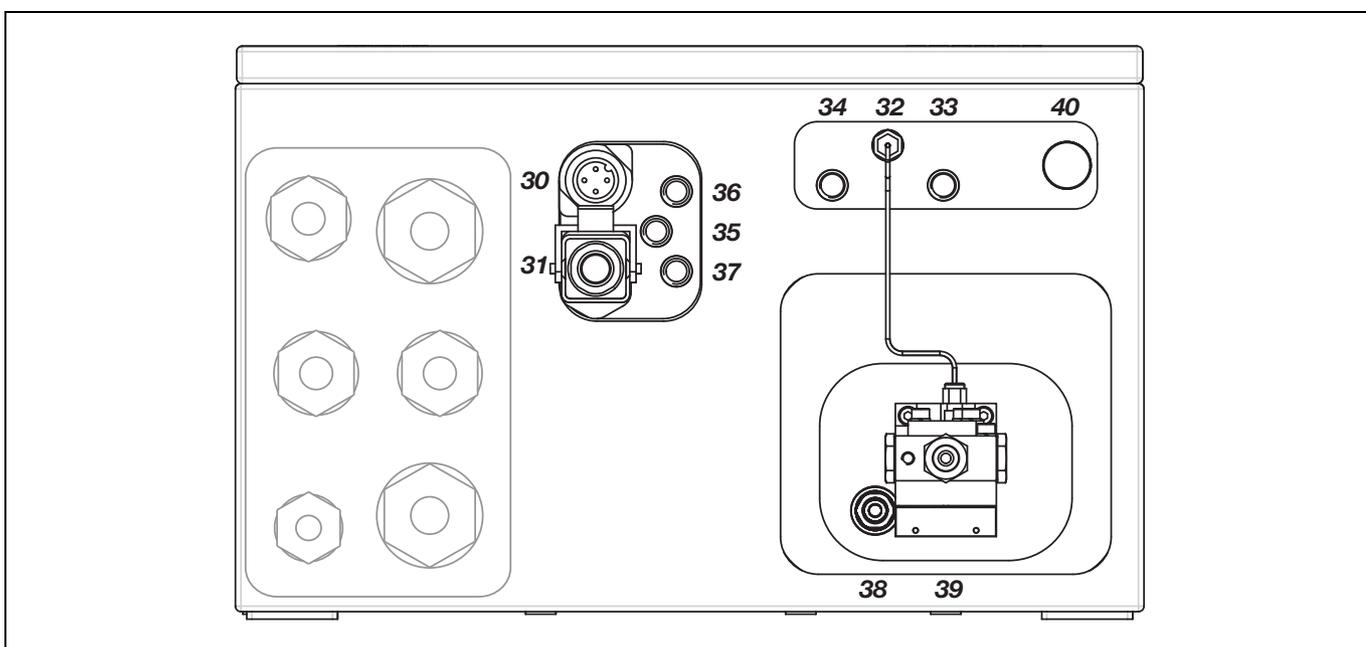
Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied);  
screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

# Gas connections and electrical connections Fidas24

## Model EL3020



## Model EL3040



**30** Power supply 115 VAC or 230 VAC for heating of detector and sample gas inlet (4-pin male plug, connecting cable supplied)

**31** Electrical connection to heated sample gas inlet (fixed)

**32** Test gas outlet

**33** Zero-point gas inlet

**34** End-point gas inlet

**35** Combustion air inlet

**36** Combustion gas inlet

**37** Instrument air inlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied)

**38** Exhaust outlet

Design: Threaded connection for 6-mm outer diameter tubing, permissible maximum length of 30 cm; after that point the inner diameter of the exhaust line should be increased to  $\geq 10$  mm.

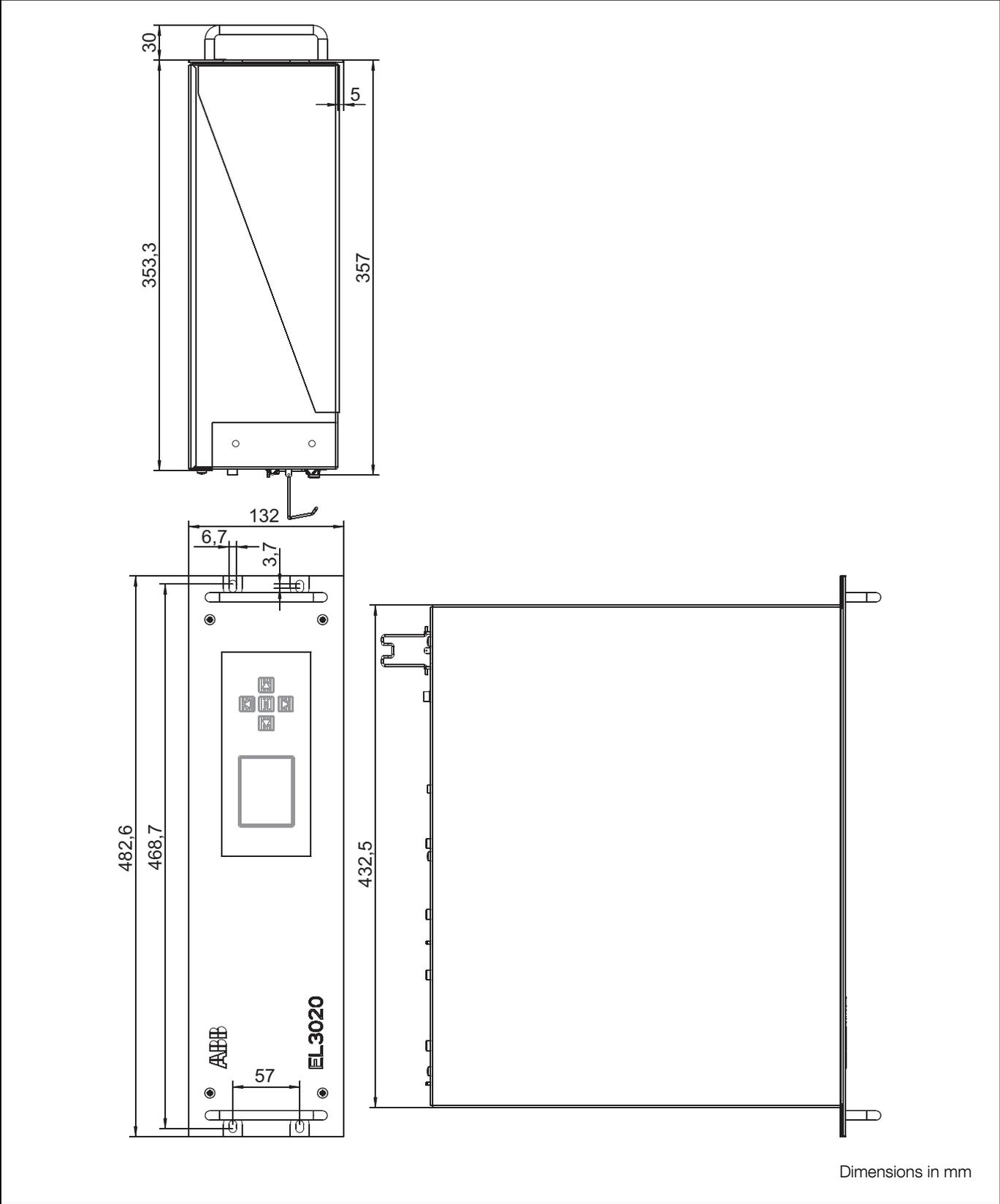
**39** Sample gas inlet, heated or unheated

Design: Threaded connection for PTFE or stainless steel tubing with a 6-mm outer diameter

**40** Pressure compensation opening with protection filter (only in wall-mount housing)

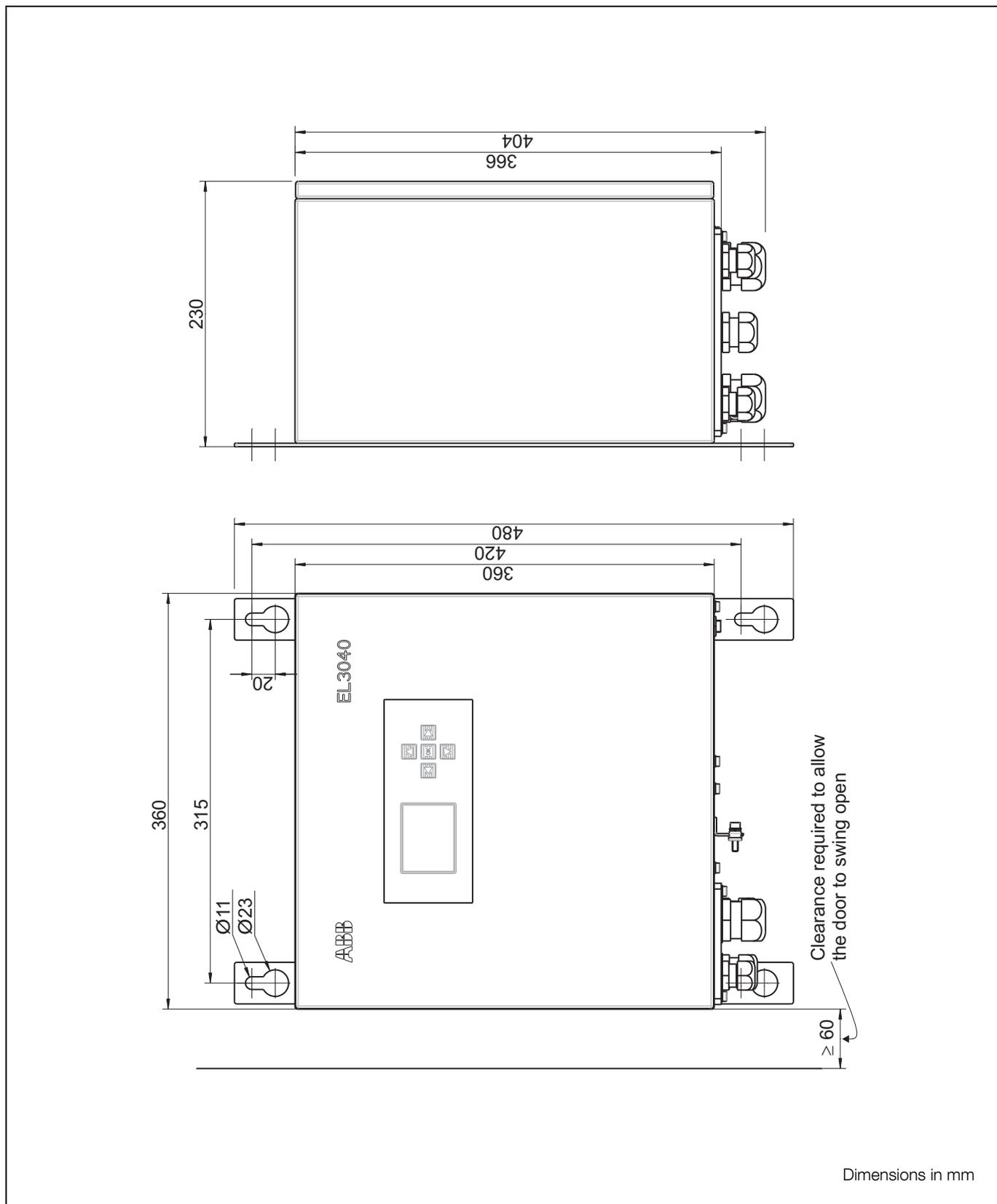
# Dimensional drawings

## 19-inch rack housing (model EL3020)



# Dimensional drawings

## Wall-mount housing (model EL3040)



# Certifications

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## CE conformity

The EL3000 series gas analyzers satisfy the requirements of the European directives 2006/95/EC (Low voltage directive), 2004/108/EC (EMC directive) and 94/9/EC (ATEX directive).

Compliance with the requirements of directive 2006/95/EC is evidenced by full compliance with European standard EN 61010-1:2001.

Compliance with the requirements of directive 2004/108/EC is evidenced by full compliance with European standards EN 61326-1:2006, EN 61000-3-2:2006, EN 61000-3-3:1995 + A1:2001 + A2:2005.

Compliance of the version in category 3G for measurement of non-flammable gases and vapors with the requirements of directive 94/9/EC is evidenced by full compliance with European standard EN 60079-15:2005.

## Performance test

The EL3000 series gas analyzers Uras26 (sample components CO, NO, SO<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>O), Magnos206 (sample component O<sub>2</sub>) and electrochemical oxygen sensor (sample component O<sub>2</sub>) are certified for use in facilities requiring approval according to European directive 2001/80/EG and meet the requirements of the 27<sup>th</sup>/30<sup>th</sup> BImSchV (Federal Immissions Control Ordinance) and TA-Luft (Technical Instructions on Air Quality) regulations. The requirements of QAL1 according to EN 15267 and EN 14181 are fulfilled.

Report No. 691317 of June 30, 2006. Notification:  
Federal Gazette of October 14, 2006, No. 194, page 6715

Report No. 1669640 of September 30, 2011. Notification:  
Federal Gazette of March 2, 2012, No. 36, page 925

Report No. 936/21217137/B of October 14, 2011. Notification:  
Federal Gazette of March 2, 2012, No. 36, page 924

## Approval for USA and Canada – CSA

The EL3000 series gas analyzers are certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 and UL Std. No. 61010-1 (2<sup>nd</sup> Edition).

Certificate No. 1714030

## Approval for Russian Federation – GOST-R

The EL3000 series gas analyzers are certified for use in general purpose environment. The following documents are available:  
GOST-R certificate No. POCC DE.HO03.H04298,  
Rostekhnadzor operation permission No. PPC 00-39671,  
Pattern approval certificate No. DE.C.31.004.A No. 37984.

## Explosion protection for China – NEPSI

The gas analyzer model EL3040 with Uras26, Limas23, Magnos206 and Caldos27 is certified for use in hazardous locations. The gas analyzer may be used for measurement of non-flammable gases and vapors. It is marked with Ex nAC II CT4.  
Certificate No. GYJ101401X

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
GL10 3TA Stonehouse  
Gloucestershire, United Kingdom  
Phone: +44 1 453 826661  
Fax: +44 1 453 829671

## **ABB Pte. Ltd.**

### **Process Automation**

2 Ayer Rajah Crescent  
139935 Singapore, Singapore  
Phone: +65 6773 5961  
Fax: +65 6778 0222

## **ABB Engineering Ltd.**

### **Process Automation**

10 Jiuxianqiao Lu  
100015 Beijing, China  
Phone: +86 10 84566688 Ext. 6217  
Fax: +86 10 84567650

## **ABB Inc.**

### **Process Automation**

3700 W Sam Houston Parkway South,  
Suite 600, Houston, TX 77042, USA  
Phone: +1 713 587 8000

[www.abb.com/analytical](http://www.abb.com/analytical)

## **ABB Australia Pty Limited**

### **Process Automation**

Bapaume Road  
2170 Moorebank  
New South Wales, Australia  
Phone: +61 2 9821 0968  
Fax: +61 2 9400 7050

## **ABB Ltd.**

### **Process Automation**

14 Mathura Road  
121003 Faridabad, Haryana, India  
Phone: +91 129 2279627  
Fax: +91 129 2279692

## **ABB Automation GmbH**

### **Process Automation**

Stierstaedter Strasse 5  
60488 Frankfurt am Main, Germany  
Fax: +49 69 7930-4566  
E-mail: [cga@de.abb.com](mailto:cga@de.abb.com)

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Sales



Service

# EasyLine EL3060 Series Continuous Gas Analyzers in Category II 2G Version



Proven measuring technology from Advance Optima, operator-friendliness and functional capabilities of EasyLine

Flameproof Enclosure, therefore safe and uncomplicated explosion protection

Category II 2G, hence suitable for use in hazardous areas of Zone 1 and Zone 2

Rugged field housing with degree of protection IP65

Safe terminal box with Increased Safety for the electrical connections on the user side

Combinable analyzers with up to five sample components and two measuring ranges

Automatic calibration, simplified calibration with calibration cells and with single-point calibration

Simple menu-driven operator interface

Output of measured values, alarm value and status signals via individually configurable analog and digital outputs

Modbus and Profibus interfaces

Simple installation

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### Application

The Category II 2G gas analyzers of the EL3060 series are suitable for measuring flammable and non-flammable gases under atmospheric conditions which may occasionally be potentially explosive (Zone 1).

### Gas Analyzers of the EL3060 Series

The EL3060 series includes the following analyzers

- Uras26 infrared photometer
- Magnos206 oxygen analyzer
- Caldos27 thermal conductivity analyzer
- Caldos25 thermal conductivity analyzer

as well as the

- EL3060-CU control unit

An EL3060 gas analyzer consists of the control unit and one or two analyzers.

The analyzers Magnos206, Caldos27 and Caldos25 are installed in the housing of the control unit. The analyzer Uras26 is installed in a separate housing; it is connected to the control unit via a data transmission cable and a power supply cable.

The analyzers Magnos206, Caldos27 and Caldos25 can also be used in combination with the analyzer Uras26.

### Housing – Explosion Protection

The housing of the EL3060-CU control unit is designed as a field housing of die-cast aluminum in the type of protection “Flameproof Enclosure ‘d’” to EN 60079-1 and in the degree of protection for the housing of IP65. The display and operator control unit is installed behind a glass viewing window on the front of the housing.

A terminal housing in the type of protection “Increased Safety ‘e’” to EN 60079-7, in which the terminal strip for the electrical connections is installed, is flange-mounted on the underside of the explosion-proof housing. Certified electrical conductor bushings in increased safety are installed between the interior of the explosion housing and the terminal housing.

The housing of the Uras26 analyzer is executed as a cylindrical field housing of die-cast aluminum in the type of protection “Flameproof Enclosure ‘d’” to EN 60079-1 and in the degree of protection of housing of IP54. The data transmission cable and the power supply cable for connection to the control unit are permanently connected at the factory and led through flameproof cable glands on the underside of the housing.

The housings of the gas analyzers comply with the requirements of the explosion group IIC. As a result, the gas analyzers can also be used in hydrogen- or acetylene-containing atmospheres.

The housing can be purged with air from the non-hazardous area or with inert gas to protect the gas analyzers in a corrosive environment or with corrosive sample or associated gases.

All gas connections are led through flame barriers.

# Overview of the Gas Analyzers

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## Analyzers – Measuring Technology

The Uras26 infrared photometer operates according to the NDIR process (Non-Dispersive Infrared-Absorption).

The measurement technique of the Magnos206 oxygen analyzer is based on the specific paramagnetic behavior of oxygen.

The thermal conductivity analyzers Caldos27 and Caldos25 make use of the differing thermal conductivity of the individual gases. The Caldos25 analyzer is especially suitable for the measurement of corrosive gases.

Each analyzer has one physical measurement range per sample component. A section of the physical measurement range can be mapped to the current output (analog output) by on-site configuration. Calibration is always executed in the physical measurement range. The permissible measurement range limits are given by the specification of the smallest and largest measurement ranges for the individual analyzers.

The performance characteristics of the analyzers have been determined according to the international standard IEC 1207-1: 1994 "Expression of performance of gas analyzers". They are based on N<sub>2</sub> as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.

## Calibration

The Uras26 infrared photometer can be equipped with gas-filled calibration cells as an option; this allows test gas cylinders to be dispensed with to a large extent.

Owing to its very low sensitivity drift, the Magnos206 oxygen analyzer can be routinely calibrated solely at the zero point by means of single-point calibration, provided that the measuring range is more than 0–5 % Vol. of O<sub>2</sub>; nitrogen or ambient air is used for this purpose.

Calibration can be performed automatically or manually. Automatic calibration – for all sample components together – is normally started on a cyclically time-controlled basis; it can also be started by an external control signal or via the Modbus as well as manually on the display and operator control unit of the gas analyzer.

## Control Unit

The EL3060-CU control unit performs the following functions:

- Processing and transmitting measured values provided by the analyzer's sensor electronics,
- Correcting measured values, e.g. cross-sensitivity correction,
- Controlling device functions, e.g. calibration,
- Display and control functions,
- Communicating with external systems.

## Operation

Five touch screen fields accessible through the control unit viewing glass allow safe operation of the gas analyzer without opening the housing.

The menu-driven control system is uniform for all gas analyzers.

## Electrical Interfaces

The electrical interfaces for the output of measured values and communication with external systems include

- The integrated Ethernet-10/100BASE-T interface (for configuration and software update)

as well as the I/O modules

- Analog output module with four analog outputs,
- Digital I/O module with four digital inputs and four digital outputs,
- Modbus module with one RS485 and one RS232 interface,
- Profibus module with one RS485 and one MBP interface.

A maximum of three I/O modules can be integrated in the gas analyzer. The following combinations of I/O modules are allowed, depending on the functional range and order:

- 1 analog output module and 1 digital I/O module (standard),
- 1 analog output module and 2 digital I/O modules,
- 1 analog output module, 1 digital I/O module and either 1 Modbus module or 1 Profibus module,
- 1 Modbus module,
- 1 Profibus module.

# Infrared Photometer Uras26

## Measurement Principle

Non-dispersive infrared absorption

## Sample Components and Measurement Ranges

Sample Component <sup>1)</sup>	Class 1 Range	Class 2 Range	Class 2 Range with Calibration Cell	Gas Group <sup>2)</sup>
CO	0–50 ppm	0–10 ppm	0–50 ppm <sup>3)</sup>	A
CO <sub>2</sub>	0–50 ppm	0–5 ppm	0–25 ppm <sup>3)</sup>	A
NO	0–150 ppm	0–75 ppm	0–75 ppm <sup>3)</sup>	A
SO <sub>2</sub>	0–100 ppm	0–25 ppm	0–25 ppm <sup>3)</sup>	A
N <sub>2</sub> O	0–50 ppm	0–20 ppm	0–50 ppm <sup>3)</sup>	A
CH <sub>4</sub>	0–100 ppm	0–50 ppm	0–50 ppm <sup>3)</sup>	A
NH <sub>3</sub>	0–500 ppm	0–30 ppm	–	B
C <sub>2</sub> H <sub>2</sub>	0–200 ppm	0–100 ppm	0–100 ppm	B
C <sub>2</sub> H <sub>4</sub>	0–500 ppm	0–300 ppm	0–300 ppm	B
C <sub>2</sub> H <sub>6</sub>	0–100 ppm	0–50 ppm	0–50 ppm <sup>3)</sup>	B
C <sub>3</sub> H <sub>6</sub>	0–250 ppm	0–100 ppm	0–100 ppm <sup>3)</sup>	B
C <sub>3</sub> H <sub>8</sub>	0–100 ppm	0–50 ppm	0–50 ppm <sup>3)</sup>	B
C <sub>4</sub> H <sub>10</sub>	0–100 ppm	0–50 ppm	0–50 ppm <sup>3)</sup>	B
C <sub>6</sub> H <sub>14</sub>	0–500 ppm	0–100 ppm	0–100 ppm <sup>3)</sup>	B
R 134a	0–100 ppm	0–50 ppm	0–50 ppm <sup>3)</sup>	B
SF <sub>6</sub>	0–2000 ppm	0–1900 ppm	0–2000 ppm	B
H <sub>2</sub> O	0–1000 ppm	0–500 ppm	0–500 ppm	C

The smallest measurement ranges shown in the table are based on the first sample component in a beam path.

- 1) Other sample components on request
- 2) See price information
- 3) The smallest measurement range 1 is shown.

### Number of Sample Components

1 to 4 components with 1 or 2 beam paths and 1 or 2 receivers in each beam path

### Number of Measurement Ranges

2 ranges per sample component

### Largest Measurement Range

0 to 100 Vol.-% or 0 Vol.-% to saturation or 0 Vol.-% to LEL  
Measurement ranges within ignition limits cannot be provided.

### Measurement Range Ratio

≤ 1:10 to 1:20 depending on measurement range

The following data apply to measurement range 1 in a delivered analyzer.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant.

### Linearity Deviation

≤ 1 % of span

### Repeatability

≤ 0.5 % of span

### Zero Drift

≤ 1 % of span per week; for ranges smaller than Class 1 to Class 2: ≤ 3 % of span per week

### Sensitivity Drift

≤ 1 % of measured value per week

### Output Fluctuation (2 σ)

≤ 0.2 % of span at electronic T90 time = 5 sec (Class 1) or = 15 sec (Class 2)

### Detection Limit (4 σ)

≤ 0.4 % of span at electronic T90 time = 5 sec (Class 1) or = 15 sec (Class 2)

## Influence Effects

### Flow Effect

Flow rate in the 20–100 l/h range: ≤ 1 % of span at a flow rate change of ±10 l/h

### Associated Gas Effect/Cross Sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional): Incorporation of interference filters or filter cells, internal electronic cross-sensitivity correction for one sample component by other sample components measured with the Uras26.

### Temperature Effect

Ambient temperature in permissible range

- At zero-point: ≤ 1 % of span per 10 °C; for ranges smaller than Class 1 to Class 2: ≤ 2 % of span
- On sensitivity with temperature compensation: ≤ 3 % of measured value per 10 °C
- On sensitivity with thermostat (optional): ≤ 2 % of measured value per 10 °C

### Air Pressure Effect

- At zero-point: No effect
- On sensitivity with pressure correction by means of integral pressure sensor: ≤ 0.2 % of measured value per 1 % barometric pressure change

# Infrared Photometer Uras26

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## Dynamic Response

### Warm-Up Time

Approx. 30 minutes without thermostat; approx. 2.5 hours with thermostat

### 90% Response Time

$T_{90}$  = 2.5 sec for measurement cell length = 200 mm, sample gas flow = 60 l/h, electronic T90 time = 0 sec

## Calibration

### Zero-Point Calibration

With inert gas, e.g.  $N_2$ , or with ambient air that is free of the sample component.

### End-Point Calibration

With gas-filled calibration cells (optional) or with test gas mixtures. It is recommended to verify the calibration cell set values once a year.

During calibration of a multi-component analyzer, possible cross-sensitivity and/or carrier gas corrections by internal or external measurement components are switched off.

Therefore, corrected measurement components should be calibrated only using a test gas consisting of the measurement component and an inert gas like  $N_2$ .

## Materials in Contact with the Sample Medium

### Analyzer (Sample Cells)

Tubing: Aluminum or gold-plated aluminum;

Window:  $CaF_2$ , Option:  $BaF_2$ ;

Connectors: Rust- and acid-resistant steel 1.4571 (SAE 316Ti)

### Gas Lines, Connectors and Flame Barriers

Rust- and acid-resistant steel 1.4571 (SAE 316Ti)

# Oxygen Analyzer Magnos206

## Measurement Principle

Paramagnetic behavior of oxygen

Magnetomechanical oxygen analyzer; short 90% response time

## Sample Component and Measurement Ranges

Sample Component  
Oxygen (O<sub>2</sub>)

Smallest Measurement Range  
0–0.5 Vol.-% O<sub>2</sub>

Quantity and Measurement Range Limits  
2 measurement ranges  
Measurement ranges are freely adjustable; they are factory-set to 0–25/100 Vol.-% O<sub>2</sub> or per order.

Largest Measurement Range  
0–100 Vol.-% O<sub>2</sub>  
Measurement ranges within ignition limits cannot be provided.

Measurement Ranges with Suppressed Zero-Point  
Suppression ratio max. 1:10, e.g. 19–21 Vol.-% O<sub>2</sub>.  
Pressure correction with pressure sensor is required.

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant.

Linearity Deviation  
≤ 50 ppm O<sub>2</sub>

Repeatability  
≤ 50 ppm O<sub>2</sub> (time base for gas exchange ≥ 5 minutes)

Zero Drift  
≤ 0.03 Vol.-% O<sub>2</sub> per week; following prolonged transport and storage time the drift can be higher during the first weeks of operation.

Sensitivity Drift  
≤ 0.1 Vol.-% O<sub>2</sub> per week or ≤ 1% of measured value per week (not cumulative), whichever is smaller.  
≤ 0.25 % of measured value per year

Output Fluctuation (2 σ)  
≤ 25 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

Detection Limit (4 σ)  
≤ 50 ppm O<sub>2</sub> at electronic T90 time (static/dynamic) = 3/0 sec

## Influence Effects

### Flow Effect

Sample gas air: 0.1 Vol.-% O<sub>2</sub> at a flow rate change of ±10 l/h;  
sample gas N<sub>2</sub>: ≤ 0.1 Vol.-% O<sub>2</sub> in permissible range

### Associated Gas Effect

The effect of associated gases as a shift of the zero-point – expressed in Vol.-% O<sub>2</sub> – can be estimated using the approximate values in the following table:

Associated Gas Concentration 100 Vol.-%		Zero-Point Shift in Vol.-% O <sub>2</sub>
Hydrogen	H <sub>2</sub>	+0.28
Hydrogen Sulfide	H <sub>2</sub> S	-0.45
Argon	Ar	-0.26
Helium	He	+0.30
Neon	Ne	+0.13
Nitrogen	N <sub>2</sub>	0
Nitrogen Oxide	NO	+43
Nitrogen Dioxide	NO <sub>2</sub>	+28
Nitrous Oxide	N <sub>2</sub> O	-0.20
Carbon Monoxide	CO	-0.01
Carbon Dioxide	CO <sub>2</sub>	-0.32
Carbon Oxysulfide	COS	-0.90
Ethane	C <sub>2</sub> H <sub>6</sub>	-0.46
Ethylene	C <sub>2</sub> H <sub>4</sub>	-0.29
Methane	CH <sub>4</sub>	-0.24
Propane	C <sub>3</sub> H <sub>8</sub>	-0.98
Propylene	C <sub>3</sub> H <sub>6</sub>	-0.55
Trichloroethane	C <sub>2</sub> HCl <sub>3</sub>	-2.17
Vinyl Chloride	CH <sub>2</sub> CHCl	-0.75

For further associated gases refer to EN 61207-3

### Temperature Effect

Ambient temperature in the permissible range  
– At zero-point: ≤ 0.02 Vol.-% O<sub>2</sub> per 10 °C  
– On sensitivity: ≤ 0.1% of measured value per 10 °C

### Air Pressure Effect

– At zero-point: No effect  
– On sensitivity with no pressure correction:  
≤ 1% of measured value per 1% air pressure change  
– On sensitivity with pressure correction using integrated pressure sensor (optional):  
≤ 0.1% of measured value per 1% pressure change

### Position Effect

Zero-point shift ≤ 0.05 Vol.-% O<sub>2</sub> per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

# Oxygen Analyzer Magnos206

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## Dynamic Response

Warm-Up Time

< 2 hours

90% Response Time

$T_{90} \leq 4$  sec at a sample gas flow of 90 l/h and electronic T90 time (static/dynamic) = 3/0 sec, gas change from N<sub>2</sub> to air

## Calibration

Zero-Point Calibration

With oxygen-free process gas or substitute gas

End-Point Calibration

With process gas with a known oxygen concentration or a substitute gas such as dried air

Single-Point Calibration

For measurement ranges from 0 to 5 Vol.-% O<sub>2</sub> to 0 to 25 Vol.-% O<sub>2</sub>

Zero-point calibration with any oxygen concentration, e.g. with nitrogen (N<sub>2</sub>) or ambient air, processed through a cooler or H<sub>2</sub>O absorber.

Pressure correction by means of pressure sensor is recommended for single-point calibration with air.

Depending on the measurement task involved, the zero- and end-points should be verified periodically (Recommendation: once a year).

Calibration of Measurement Ranges with Suppressed Zero-Point

Single-point calibration is possible for suppressed measurement ranges with a suppression ratio  $\leq 1:5$ . The oxygen concentration of the test gas must be within the measurement range.

## Materials in Contact with the Sample Medium

Analyzer (Sample Chamber)

Rust- and acid-resistant steel 1.4305 (SAE 303), glass, platinum, rhodium, epoxy resin;

Seals: FPM (Fluorocarbon rubber), Option: FFKM75

Gas Lines, Connectors and Flame Barriers

Rust- and acid-resistant steel 1.4305 (SAE 303), 1.4571 (SAE 316Ti)

# Thermal Conductivity Analyzer Caldos27

## Measurement Principle

Difference in thermal conductivity of various gases

Micromechanical silicon sensor with especially short  $T_{90}$  time

## Sample Components and Measurement Ranges

Sample Component and Associated Gas	Smallest Meas. Range	Smallest Meas. Range with Suppr. Zero-Point
Air in Ar	0–6 Vol.-%	94–100 Vol.-%
Ar in air	0–6 Vol.-%	94–100 Vol.-%
Air in CO <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
CO <sub>2</sub> in air	0–10 Vol.-%	90–100 Vol.-%
Air in H <sub>2</sub>	0–3 Vol.-%	–
H <sub>2</sub> in air	0–1 Vol.-%	–
Air in He	0–3 Vol.-%	98–100 Vol.-%
He in air	0–2 Vol.-%	97–100 Vol.-%
Ar in CO <sub>2</sub>	–	50–100 Vol.-%
CO <sub>2</sub> in Ar	0–50 Vol.-%	–
Ar in H <sub>2</sub>	0–3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in Ar	0–1 Vol.-%	97–100 Vol.-%
Ar in He	0–3 Vol.-%	99–100 Vol.-%
He in Ar	0–1 Vol.-%	97–100 Vol.-%
Ar in N <sub>2</sub>	0–6 Vol.-%	94–100 Vol.-%
N <sub>2</sub> in Ar	0–6 Vol.-%	94–100 Vol.-%
Ar in O <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
O <sub>2</sub> in Ar	0–10 Vol.-%	90–100 Vol.-%
CH <sub>4</sub> in H <sub>2</sub>	0–3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CH <sub>4</sub>	0–1 Vol.-%	97–100 Vol.-%
CH <sub>4</sub> in N <sub>2</sub>	0–6 Vol.-%	94–100 Vol.-%
N <sub>2</sub> in CH <sub>4</sub>	0–6 Vol.-%	94–100 Vol.-%
CO in H <sub>2</sub>	0–3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CO	0–1 Vol.-%	97–100 Vol.-%
CO <sub>2</sub> in H <sub>2</sub>	0–3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in CO <sub>2</sub>	0–1 Vol.-%	97–100 Vol.-%
CO <sub>2</sub> in N <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
N <sub>2</sub> in CO <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
H <sub>2</sub> in N <sub>2</sub>	0–1 Vol.-%	97–100 Vol.-%
N <sub>2</sub> in H <sub>2</sub>	0–3 Vol.-%	99–100 Vol.-%
H <sub>2</sub> in NH <sub>3</sub>	0–10 Vol.-%	90–100 Vol.-%
NH <sub>3</sub> in H <sub>2</sub>	0–10 Vol.-%	90–100 Vol.-%
He in N <sub>2</sub>	0–2 Vol.-%	97–100 Vol.-%
N <sub>2</sub> in He	0–3 Vol.-%	98–100 Vol.-%

Other sample components on request.

Special Version with Sample Components and Measurement Ranges for Monitoring Hydrogen-Cooled Turbo Generators

Sample Component and Associated Gas	Measurement Range
CO <sub>2</sub> in air	0–100 Vol.-%
H <sub>2</sub> in CO <sub>2</sub>	100–0 Vol.-%
H <sub>2</sub> in air	100–80/90 Vol.-%

Number of Sample Components

1–4 sample components, manual switchover

Quantity and Measurement Range Limits

2 measurement ranges per sample component

Measurement ranges are freely adjustable within the limits shown in the table. They are factory-calibrated for the largest possible measurement range.

Largest Measurement Range

0–100 Vol.-% or 0 Vol.-% to saturation

Measurement ranges within ignition limits cannot be provided.

Measurement Ranges with Suppressed Zero-Point

See the adjacent table for spans

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to smallest measurement ranges given in the table. The deviations may be larger for smaller measurement ranges.

Linearity Deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero Drift

≤ 2 % of smallest possible measurement range per week

Sensitivity Drift

≤ 0.5 % of smallest possible measurement range per week

Output Fluctuation (2  $\sigma$ )

≤ 0.5 % of smallest measurement range span at electronic T90 time = 0 sec

Detection Limit (4  $\sigma$ )

≤ 1 % of smallest measurement range span at electronic T90 time = 0 sec

## Influence Effects

Flow Effect

≤ 0.5 to 2.5 % of span at a flow change of  $\pm 10$  l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated Gas Effect

The knowledge of the sample gas composition is necessary for the analyzer configuration. If the sample gas contains components in addition to the sample component and associated gas (binary gas mixture), this will result in erroneous measurements.

Temperature Effect

Ambient temperature in the permissible range at each point in the measurement range: ≤ 1 % of span per 10 °C, based on temperature at the time of calibration

Air Pressure Effect

≤ 0.25 % of span per 10 hPa for the smallest possible ranges given; for larger spans the effect is correspondingly lower. Option: Operating altitude over 2000 m

Position Effect

< 1 % of span up to 30° deviation from horizontal orientation

# Thermal Conductivity Analyzer Caldos27

---

## Dynamic Response

### Warm-Up Time

Approx. 30 minutes

### 90% Response Time

$T_{90} \leq 2$  sec at sample gas flow of 60 l/h

## Calibration

### Zero-Point Calibration

With test gas, measurement component-free process gas or substitute gas

### End-Point Calibration

With test gas, process gas having a known sample gas concentration or substitute gas

### Single-Point Calibration

A single-point calibration can be performed with standard gas, since the zero- and end-points will not drift independently due to the sensor principle employed. This technique leaves out safety-related measurements. Depending on the measurement task involved, the zero- and end-points should be verified periodically (Recommendation: once a year).

## Materials in Contact with the Sample Medium

### Analyzer

Sensor: Gold, silicon oxi-nitride; Sample chamber: Rust- and acid-resistant steel 1.4305 (SAE 303); Seal: FFKM75 (Perfluoro rubber)

### Gas Lines, Connectors and Flame Barriers

Rust- and acid-resistant steel 1.4305 (SAE 303), 1.4571 (SAE 316Ti)

# Thermal Conductivity Analyzer Caldos25

---

## Measurement Principle

Difference in thermal conductivity of various gases

Thermal conductivity analyzer, sample cells embedded in glass

## Sample Components and Measurement Ranges

Component and Associated Gas	Smallest Measurement Range	Reference Gas
H <sub>2</sub> in N <sub>2</sub> or air	0–0.5 Vol.-%	Air (sealed)
SO <sub>2</sub> in N <sub>2</sub> or air	0–1.5 Vol.-%	Air (sealed)

Other sample components on request.

Number of Sample Components

1–3 sample components, manual switchover

Number of Measurement Ranges

1 measurement range per sample component

The measurement range is factory-set per order and cannot be changed.

Largest Measurement Range

0–100 Vol.-% or 0 Vol.-% to saturation

Measurement ranges within ignition limits cannot be provided.

Measurement Ranges with Suppressed Zero-Point

Span at least 2 Vol.-%, depending on application

## Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant.

Linearity Deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero Drift

≤ 1 % of span per week

Sensitivity Drift

≤ 1 % of measured value per week

Output Fluctuation (2  $\sigma$ )

≤ 0.5 % of smallest measurement range span at electronic

T<sub>90</sub> time = 0 sec

Detection Limit (4  $\sigma$ )

≤ 1 % of smallest measurement range span at electronic

T<sub>90</sub> time = 0 sec

## Influence Effects

Flow Effect

≤ 1 to 5 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated Gas Effect

The knowledge of the sample gas composition is necessary for the analyzer configuration. If the sample gas contains components in addition to the sample component and associated gas (binary gas mixture), this will result in erroneous measurements.

Temperature Effect

Ambient temperature in permissible range

at each point in the measurement range: ≤ 1 % of span per 10 °C, based on temperature at the time of calibration

Position Effect

< 1 % of span up to 10° deviation from horizontal orientation

## Dynamic Response

Warm-Up Time

2–4 hours, depending on measurement range

90% Response Time

T<sub>90</sub> = 10–20 sec; optional: T<sub>90</sub> < 6 sec

## Calibration

Zero-Point Calibration

With sample component-free process gas or substitute gas

End-Point Calibration

With process gas having a known sample gas concentration or with substitute gas

## Materials in Contact with the Sample Medium

Analyzer

Rust- and acid-resistant steel 1.4305 (SAE 303), glass

Gas Lines, Connectors and Flame Barriers

Rust- and acid-resistant steel 1.4305 (SAE 303), 1.4571 (SAE 316Ti)

# General Data

---

## Housing – Explosion Protection

### Control Unit

(With or without Magnos206, Caldos25 or Caldos27 analyzer)

### Version

Flameproof enclosure with a glass viewing window and a flange-mounted terminal housing

### Type of Protection

Housing: Flameproof Enclosure “d” per EN 60079-1,  
Junction Box: Increased Safety “e” per EN 60079-7

### Designation

 II 2G Ex de IIC T4

### EC Type Examination Certificate

BVS 08 ATEX E 048 X

### Housing Protection Type

IP65 per EN 60529

### Materials

Aluminum, Glass

### Color

Light gray (RAL 7035)

### Weight

Approx. 20 kg

### Dimensions

Dimensional drawing see page 14

## Uras26 Analyzer Unit

### Version

Flameproof enclosure (cylinder)

### Type of Protection

Flameproof enclosure “d” per EN 60079-1

### Designation

 II 2G Ex d IIC T4

### EC Type Examination Certificate

BVS 08 ATEX E 055 X

### Housing Protection Type

IP54 per EN 60529 (O-ring seals required when mounted horizontally)

### Material

Aluminum

### Color

Light gray (RAL 7035)

### Weight

Approx. 25 kg

### Dimensions

Dimensional drawing see page 15

## Housing Purge

### Use

To protect the gas analyzers in corrosive environments or when using corrosive sample or associated gases an option is available to allow the housings of the central unit and the Uras26 analyzer unit to be purged.

### Purge Gas

Clean instrument air from non-explosive areas or inert gas. The purge gas for purging the Uras26 analyzer unit must not contain any sample gas components.

### Purge Gas Pressure

$p_{abs} \leq 1080$  hPa

### Purge Gas Flow

During operation  $\leq 10$  l/h

### Pressure Drop at Flame Barriers

Approx. 20 hPa at a flow rate of 10 l/h

## Display and Operation

### Display

Backlit graphics display with 240 x 160-pixel resolution

### Measured Value Display

- Numerical value with physical unit, also with bar graph indication in single display
- Resolution better than 0.2 % of the measurement span
- Simultaneous display of up to 5 measured values

### Status Display

Symbols in the display; the active status messages can be accessed directly from the measured value display

### Operation

5 keys (cursor cross and OK); menu-assisted operation

### Concept of Operation

The functions required in normal operation are operated and configured directly on the gas analyzer. The functions which are only seldom required, e.g. during start-up, are configured offline using the software tool ECT (“EasyLine Configuration Tool” on the enclosed CD-ROM) and then loaded into the gas analyzer.

### Measuring Range Switch-Over and Feedback

There are three ways of executing the measuring range switch-over:

- Manually on the gas analyzer
- Automatically (autorange) by means of appropriate configured switch-over thresholds
- Externally controlled via appropriately configured digital inputs.

The measuring range feedback can be implemented via appropriately configured digital outputs; it is independent of the selected type of measuring range switch-over.

The gas analyzer is set ex works to measuring range 2 and to manual measuring range switch-over.

### Limit Value Monitoring

Limit values can be set using the software tool ECT. The limit value signals (alarms) are output via digital outputs.

# General Data

## Pressure Sensor

### Use

Standard equipment in the Uras26 and Caldos27, optional in the Magnos206. The pressure sensor measures the air pressure inside the housing as standard. As an option, the connection of the pressure sensor is led outside to a flame barrier; it may not be connected to the sample gas feed path when measuring flammable gases.

Pressure sensor working range:  $p_{\text{abs}} = 600\text{--}1250$  hPa

### Materials in Contact with the Sample Medium

Silicon gel, plastics, FPM (Fluorocarbon rubber);

Flame barrier: Rust- and acid-resistant steel 1.4571 (SAE 316Ti)

## Gas Inlet Conditions

### Flammable Gases

The gas analyzers are capable of measuring flammable and non-flammable gases under atmospheric conditions which can form an explosive environment.

The maximum oxygen content of the sample gas mixture should be 21 Vol.-%, corresponding to atmospheric conditions.

If the sample gas is a mixture only of oxygen and flammable gases and vapors, it must not be explosive under any conditions. As a rule this can be achieved by limiting the oxygen content to a maximum of 2 Vol.-%.

Flammable gases that are explosive under the conditions encountered in analysis even when oxygen is excluded should be present in the mixture only in concentrations that are not critical to safety.

### Corrosive Gases

The gas analyzers must not be used to measure gases which attack the materials in contact with the sample medium (e.g. chlorine-containing gases).

### Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

### Inlet Pressure

$p_e \leq 100$  hPa /  $p_{\text{abs}} \leq 1100$  hPa

### Flow Rate

Uras26	20–100 l/h
Magnos206	30–90 l/h
Caldos25	max. 100 l/h
Caldos27	max. 100 l/h

### Pressure Drop at Flame Barriers

Approx. 40 hPa at a flow rate of 50 l/h

### Outlet Pressure

The outlet pressure must be the same as the atmospheric pressure.

## Power Supply

### Input Voltage

100–240 V AC, 50–60 Hz  $\pm$  3 Hz

### Power Consumption

Max. 187 VA

## Electromagnetic Compatibility

### Noise Immunity

Tested to EN 61326-1:2006. Inspection severity: Industrial area, fulfills at least the rating "continuously monitored operation" to Table 2 of EN 61326.

### Emitted Interference

Tested to EN 61326-1:2006, EN 61000-3-2:2006 and EN 61000-3-3:1995 + A1:2001 + A2:2005. Limit value class B for interference field strength and interference voltage is met.

## Electrical Safety

Tested per EN 61010-1:2001

Protection Class I

Overload Category/Pollution Level

Power supply, signal inputs and outputs: III/2

Safe Isolation

The power supply is galvanically isolated from other circuits by means of reinforced or double insulation. Operational low voltage (PELV) on low-voltage side

## Mechanical Stress

### Operation

Vibration test to EN 60068-2-6:1996

Vibrations up to 0.5g/150 Hz have no influence on the measured value. In Uras26, slight transient effects on the measured value can occur in the region of the modulation frequency.

### Transport

Vibration test to EN 60068-2-6:1996,

shock test to EN 60068-2-27:1995

In its original packaging, the gas analyzer will withstand normal shipping conditions.

## Ambient Conditions

The gas analyzer is intended for indoor installation only.

### Ambient Temperature

Control Unit with or without built-in analyzer +5 to +50 °C

Uras26 with or without another analyzer: +5 to +45 °C

Storage and transport: –25 to +65 °C

The explosion protection is not impaired if the gas analyzer is operated at temperatures less than +5 °C and down to –20 °C. However in this temperature range the compliance with the metrological data cannot be guaranteed.

### Relative Humidity

< 75 %, slight condensation allowed

### Installation Location Altitude

Max. 2000 m above sea level (over 2000 m on request)

# Electrical Connections

## Power Supply and Signal Lines

Digital Inputs Digital I/O Module 1		Digital Inputs Digital I/O Module 2		Digital Outputs Digital I/O Module 1		Digital Outputs Digital I/O Module 2		Analog Outputs		Modbus RS232		Modbus RS485		Profibus RS485		Profibus MBP		Power Supply EL3060-Uras26		Power Supply 100–240 VAC 50–60 Hz ± 3 Hz	
1	DI1 –	35	GND	9	DO1 Common	17	AO1 +	51	AO1 –	55	RxD	58	RTxD–	61	RxD/TxD-P	64	+	67	GND	L	
2	DI2 –	36	GND	10	DO2 NO	18	AO2 +	18	AO2 –	56	TxD	59	RTxD+	62	DGND	65	–	68	+24V	N	
3	DI3 –	37	GND	11	DO3 NO	19	AO3 +	53	AO3 –	57	GND	60	GND	29	RxD/TxD-N	31	TD–			PE	
4	DI4 –	38	GND	12	DO4 NO					58	RTxD–	21	SPI 1			32	RD+				
5	DI1 –	39	GND	13	DO1 NO					59	RTxD+	22	SPI 2	Data Transmission EL3060-Uras26							
6	DI2 –	40	GND	14	DO2 NO					60	GND	23	SPI 3	Ethernet							
7	DI3 –	41	GND	15	DO3 NO					61	RxD/TxD-P	24	SPI 4								
8	DI4 –	42	GND	16	DO4 NO					62	DGND	25	SPI 5								
9	DO1 Common	43	DO1 Common	17	AO1 +					63	RxD/TxD-N	26	SPI 6								
10	DO2 Common	44	DO2 Common	18	AO2 +					64	+	30	TD+								
11	DO3 Common	45	DO3 Common	19	AO3 +					65	–	31	TD–								
12	DO4 Common	46	DO4 Common	20	AO4 +					66	GND	32	RD+								
13	DO1 Common	47	DO1 Common							67	GND	33	RD–								
14	DO2 Common	48	DO2 Common							68	+24V	34	GND								
15	DO3 Common	49	DO3 Common																		
16	DO4 Common	50	DO4 Common																		

### Analog Outputs

0/4–20 mA (configurable, factory-set to 4–20 mA), common negative pole, galvanically isolated from ground, freely connectable to ground, max. gain relative to protective ground potential 50 V, max. working resistance 750 Ω. Resolution 16 bit. The output signal cannot be lower than 0 mA.

### Digital Inputs

Optocouplers with internal 24 VDC power supply. Control with floating contacts or with open collector drivers NPN.

### Digital Outputs

Floating double-throw contacts, max. contact load rating 30 VDC/1 A. Relays must at all times be operated within the specified data range. Inductive or capacitive loads are to be connected with suitable protective measures (self-induction recuperation diodes for inductive loads and series resistors for capacitive loads).

### Modbus, Profibus

Either the Modbus module or the Profibus module can be installed in the gas analyzer as an option.

### Ethernet Interface

- For communication with configuration software ECT for gas analyzer configuration and software update and
- For QAL3 data transfer if the QAL3 monitoring option is integrated in the gas analyzer.

### Design of the Electrical Connections

Terminal blocks with screw connection, conductor size single-core 0.2–4 mm<sup>2</sup>, stranded 0.22–2.5 mm<sup>2</sup> (22–12 AWG)

Note: Not all signal inputs and outputs are actually used, depending on the configuration of the gas analyzer.

### Digital Input and Output Signals

Standard Assignment<sup>1)</sup>  
Digital I/O Module  
1 2 (Option)

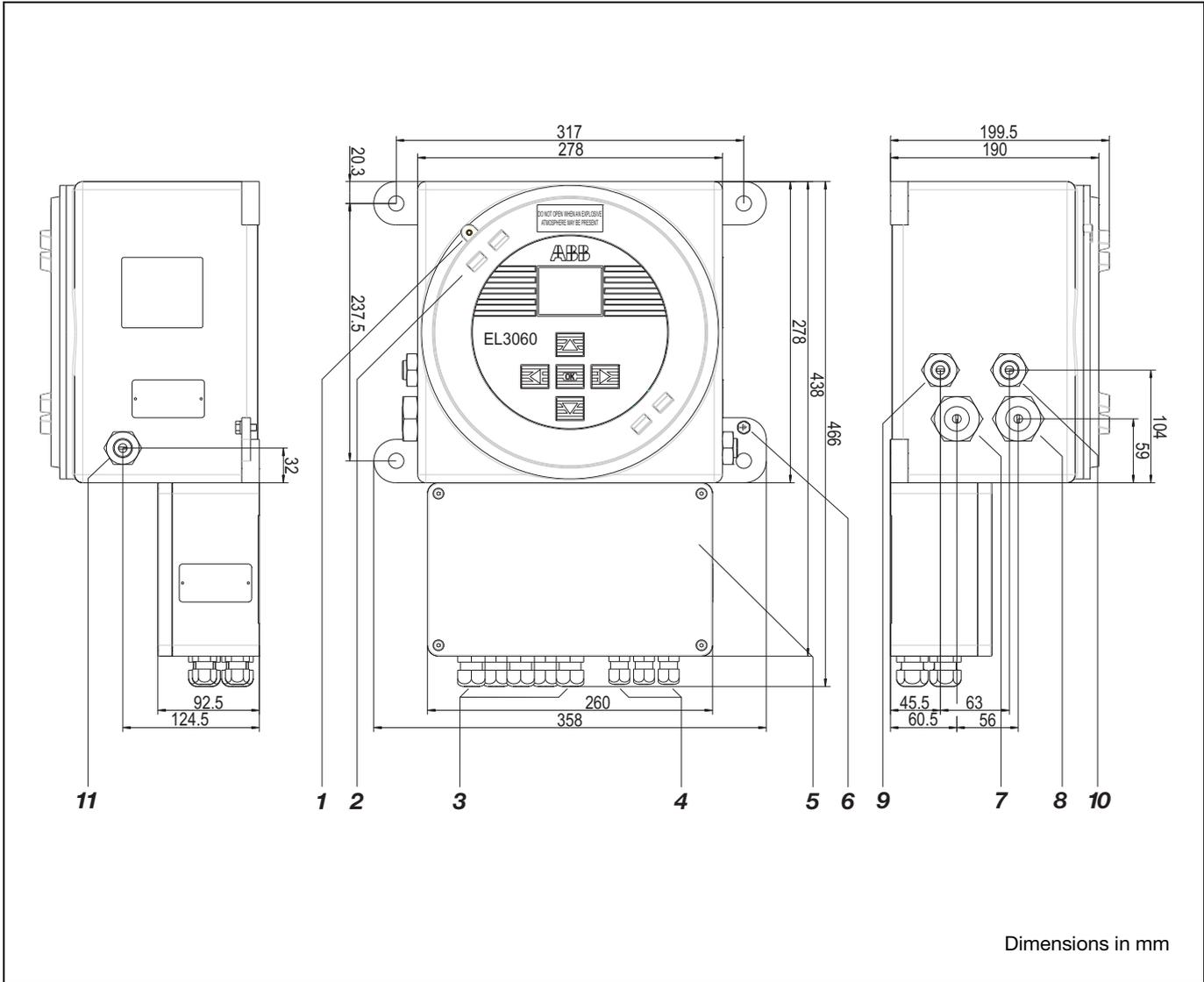
Error	
Maintenance request	
Maintenance mode	
Overall status	DO1
Start automatic calibration	DI1
Stop automatic calibration	
Disable automatic calibration	DI2
Sample gas valve	DO4
Zero gas valve	
Span gas valve	
Limit 1	DO2
Limit 2	DO3
Limit 3	DO1
Limit 4	DO2
Limit 5	DO3
Limit 6	DO4
Limit 7	
Limit 8	
Limit 9	
Limit 10	
Measuring range switchover	
Measuring range feedback	
Bus DI 1–8	
External failure <sup>2)</sup>	DI3
External maintenance request <sup>2)</sup>	DI4

1) Factory-set, can be changed by on-site configuration.

2) Multiple external status signals can be configured depending on the number of free digital inputs.

# Dimensional Drawings, Gas Connections

## Control Unit EL3060-CU



- 1** Hex Socket Head Screw to Secure the Housing Cover
- 2** Housing Cover
- 3** Cable Connections M20: 2 x Metal, 3 x Plastic
- 4** Cable Connections M16: 2 x Metal, 1 x Plastic
- 5** Cable Compartment (Junction Box) with Terminal Strip (electrical connections see page 13)
- 6** Potential Compensation Connection
- 7** Sample Gas Inlet <sup>1)</sup>
- 8** Sample Gas Outlet <sup>1)</sup>
- 9** Purge Gas Inlet <sup>2)</sup>
- 10** Purge Gas Outlet <sup>2)</sup>
- 11** Pressure Sensor Port <sup>3)</sup>

- 1) When an analyzer is installed in the control unit
- 2) Option
- 3) Option. The pressure sensor port must not be connected to the sample gas path when measuring flammable gases.

### Design of the Gas Connections

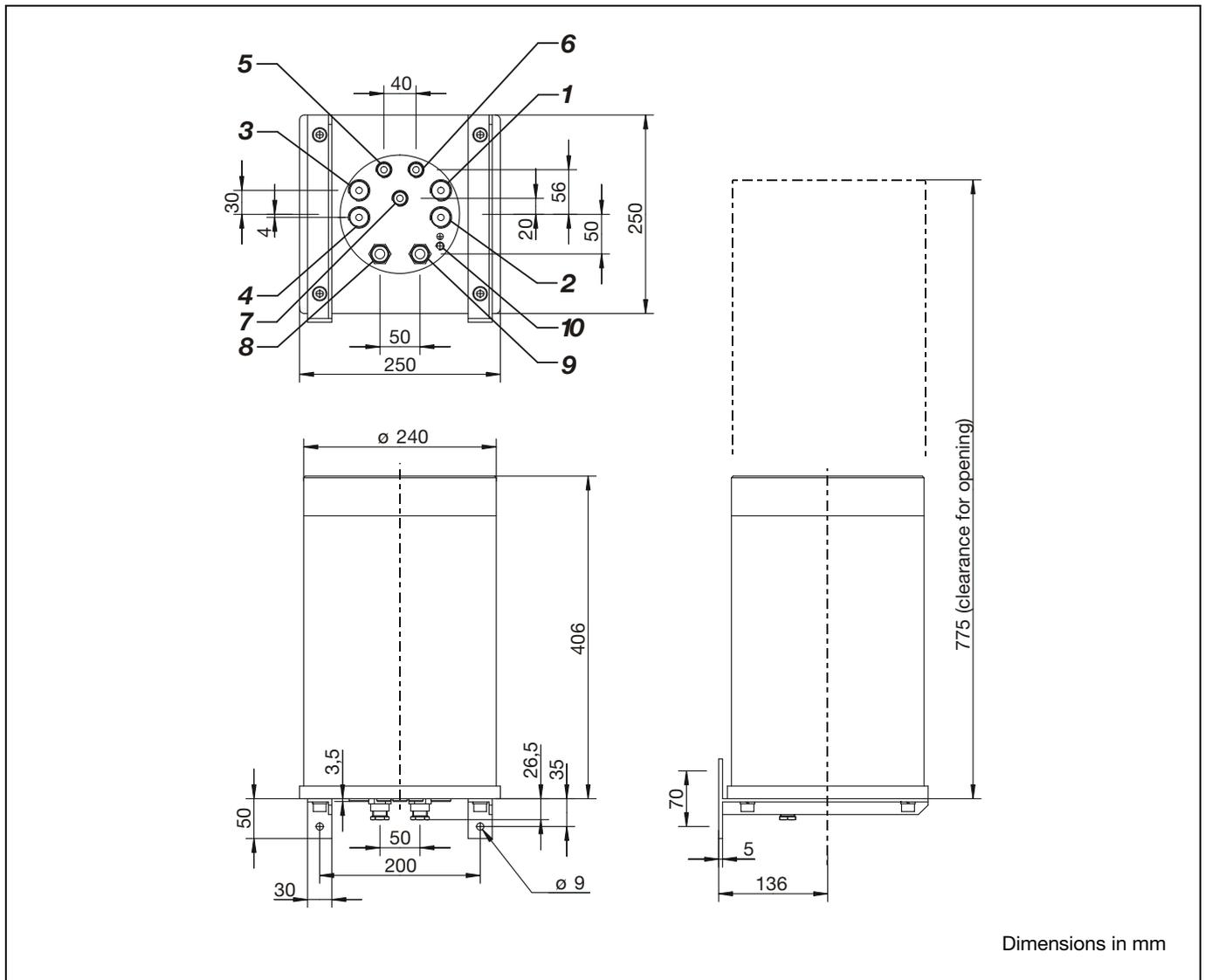
Internal flame barriers of rust- and acid-resistant steel 1.4571 (SAE 316Ti) with 1/8 NPT female thread

### Space Requirements

Note the additional space requirements to the left and to the right of the housing as well as beneath the housing for connection lines (each approx. 10 cm).

# Dimensional Drawings, Gas Connections

## Analyzer Unit Uras26



- 1** | Assignment of the
  - 2** | Gas Connections
  - 3** | See Analyzer Data Sheet
  - 4** | (Provided with the Gas Analyzer)
  - 5** Purge Gas Inlet<sup>1)</sup>
  - 6** Purge Gas Outlet<sup>1)</sup>
  - 7** Pressure Sensor Port<sup>1) 2)</sup>
  - 8** Data Transmission Cable Opening
  - 9** 24 VDC Connection Cable Opening
  - 10** Potential Compensation Connection
- 1) Option  
2) The pressure sensor port must not be connected to the sample gas path when measuring flammable gases.

### Design of the Gas Connections

Internal flame barriers of rust- and acid-resistant steel 1.4571 (SAE 316Ti) with 1/8 NPT female thread

### Connecting Cables

The permanently connected connecting cables for data transmission and 24 V DC supply are integral components of the flameproof enclosure of the analyzer unit. Both of them are 10 m long and may not be shortened to a length of less than 1 m.

### Space Requirements

Note the additional space requirements beneath the analyzer unit for connection lines (approx. 10 cm) and above the analyzer unit for opening the housing (approx. 40 cm).

# Certifications

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## CE Declaration of Conformity

The EL3060 Series gas analyzers satisfy the provisions of the following European directives:

2006/95/EC Low Voltage Directive  
2004/108/EC EMC Directive  
94/9/EC ATEX Directive

Compliance with the provisions of directive 2006/95/EC is evidenced by full compliance with European standard:

EN 61010-1:2001

Compliance with the provisions of directive 2004/108/EC is evidenced by full compliance with European standards:

EN 61326-1:2006, EN 61000-3-2:2006 and EN 61000-3-3:1995  
+ A1:2001 + A2:2005

Compliance with the provisions of directive 94/9/EC is evidenced by full compliance with European standards:

EN 60079-0 General Requirements  
EN 60079-1 Flameproof Enclosures "d"  
EN 60079-7 Increased Safety "e"







# Contact us

## **ABB Automation GmbH**

### **Process Automation**

Stierstaedter Strasse 5  
60488 Frankfurt am Main, Germany  
Fax: +49 69 7930-4566  
E-mail: [cga@de.abb.com](mailto:cga@de.abb.com)

## **ABB Limited**

### **Process Automation**

Oldends Lane  
GL10 3TA Stonehouse  
Gloucestershire, United Kingdom  
Phone: +44 1 453 826661  
Fax: +44 1 453 829671

## **ABB Pte. Ltd.**

### **Process Automation**

2 Ayer Rajah Crescent  
139935 Singapore, Singapore  
Phone: +65 6773 5961  
Fax: +65 6778 0222

## **ABB Inc.**

### **Process Automation**

3700 W Sam Houston Parkway South,  
Suite 600, Houston, TX 77042, USA  
Phone: +1 713 587 8000

## **ABB Ltd.**

### **Process Automation**

14 Mathura Road  
121003 Faridabad, Haryana, India  
Phone: +91 129 2279627  
Fax: +91 129 2279692

## **ABB Australia Pty Limited**

### **Process Automation**

Bapaume Road  
2170 Moorebank  
New South Wales, Australia  
Phone: +61 2 9821 0968  
Fax: +61 2 9400 7050

## **ABB Engineering Ltd.**

### **Process Automation**

10 Jiuxianqiao Lu  
100015 Beijing, China  
Phone: +86 10 84566688 Ext. 6217  
Fax: +86 10 84567650

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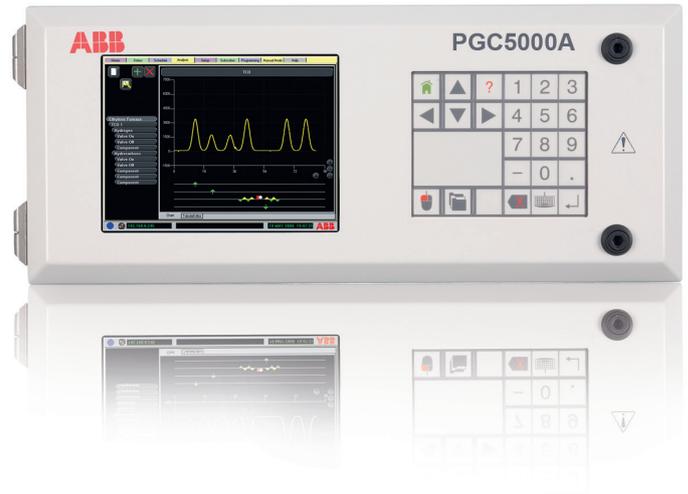
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# PGC5000A Master Controller Internal analog output arrangement

Measurement made easy



## Introduction

An expanded use of the internal input/output (I/O) function within the PGC5000A Master Controller can reduce or eliminate the need for an external I/O Enclosure (EIO5000).

The PGC5000A internal I/O function can contain up to four I/O modules, which potentially allows for up to 16 analog outputs. If more than 16 analog output channels are required, then a “stream ID” function can be used. To utilize a stream ID feature, a dedicated digital output module can be used in the place of one of the analog output modules. This stream ID feature is predicated on not all components being measured at the same time. If only one stream is measured at a time, then each stream can measure a total of 12 components. Thus you will now be able to use more than 16 analog outputs with a stream ID and eliminate the need for the external I/O enclosure (EIO5000).

## Implementation

This approach utilizes up to three four-channel analog output modules and one four-channel 24V digital output module. Each analog output module measures four components, providing the necessary 12 component total for a given stream. The single digital output module provides stream identification, allowing the analyzer to report up to 48 components. Figure 1 illustrates the maximum potential of this approach. Other digital output – analog output combinations are allowed to suit specific requirements, as well as adding a “Come Read” functionality.

4 Channel Analog Output

4 Channel Analog Output

4 Channel Analog Output

4 Channel Digital Output

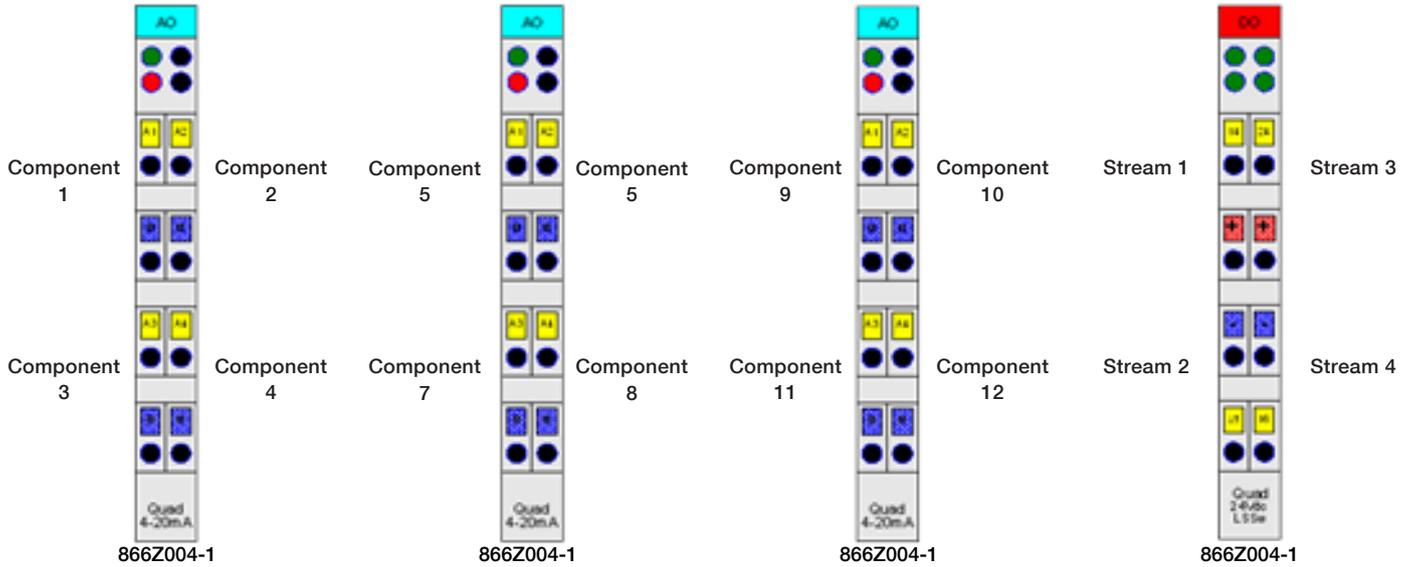


Figure 1

**ABB Inc.  
Process Automation  
Analytical Measurements**

843 N. Jefferson Street  
Lewisburg, WV 24901  
USA

Tel.: 1 304 647 4358  
Fax: 1 304 645 4236

[www.abb.com/analytical](http://www.abb.com/analytical)

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Sales



Service

# NGC 8206

## Natural gas chromatograph

The NGC 8206 is a field mounted GC which sets a new standard for determining the heating value of natural gas. The NGC combines simplicity with low installation costs and unmatched performance, making it the ideal solution for natural gas custody transfer.

### Benefits

The NGC (Natural Gas Chromatograph) performs on-site gas analysis and heating value computation where current chromatograph technology has been either impractical or unaffordable. This truly "transmitter-like" GC takes up no more room on the pipeline than most multivariable transmitters. The fast analysis cycle and automatic setup features make installation and maintenance unusually easy.

The state-of-the-art built-in 32 bit digital controller, the dual electronic carrier pressure regulators, oven-mounted sensors, and other lownoise electronics provide unparalleled sensitivity and months between calibrations.

- New design, more compact, more reliable, more precise
- Custody transfer/metrology quality GC for heating value and composition
- Lower cost to buy, install and operate



# NGC 8206

## Natural gas chromatograph



### Standard features

#### Modular design includes

- Modular software – application based plug in software modules
  - Manifold module (internal tubing now replaced by manifold)
  - Analysis section contains stream selection solenoids, pressure regulation, 32 bit digital detector electronics and a dual-train chromatograph in a single, replaceable module
  - 32 bit digital, low-power controlling electronics, using Windows CE® (internal to GC unit)
  - Microsoft® Windows® based man-machine interface software (PCCU 32)
  - Lithium battery-backed RAM
  - Two remote serial digital communications ports; one local port
  - Comprehensive diagnostics and wizards available to users
  - Three-level security for user access control
  - Audit-quality historical data; date and time stamped
- Detectors - constant temperature, glass encapsulated thermister beads for rugged service and long life. Will not burn out on loss of carrier.
  - Dual 10 port valves have no moving metal parts.
  - Low utility usage - low-power, low-carrier, no instrument air required
  - On demand or scheduled automatic calibration and diagnostics

#### Calibration options

- Exponential
- Linear
- Multi-point (6 points)

#### Auto-start cycle automatically

- Stabilizes oven temperature
  - Confirms modules' functions
  - Sets valve operation times
  - Locates natural gas components
  - Sets carrier gas pressures
  - Gates natural gas components
  - Validates/calibrates
  - Returns to pipeline streams
  - Operational alarms and events, time, and data stamped in a log.
  - Memory: up to 2.052 GB
- Sample Conditioning System
  - On board digital ¼ VGA display with multiple screen access
  - USB (Host and Client) and Ethernet ports
  - Calculation packages (eg, V.O.S., HCDP, Etc.)
  - SD memory cards (up to 2 GB)
  - Feed-through heater
  - C7+, C9+ analysis
  - Optional: AI/DI, AO/DO per customer requirements
  - Optional: 24 hour temperature testing

### Standard options

## Description

The NGC 8206 analyzes each sample utilizing established chromatographic techniques. The resulting information consists of mole percent values for the following:

- “Air” (Contains N<sub>2</sub>, Ar, CO and O<sub>2</sub> but not CO<sub>2</sub>)
- C1 CO<sub>2</sub> C2 C3 IC4 NC4
- NeoC5 IC5 NC5 C6+

Using process chromatographic techniques, the columns are back flushed so that the NGC 8206 measures a C<sub>6</sub>+ peak.

Users may input the results of a comprehensive lab analysis that reflects the split or ratio of C<sub>6</sub> through C<sub>10</sub> components.

This ratio can be used in subsequent analysis and energy calculations. Calculated values include:

- Gas compressibility per AGA 8
- Real Relative Density (Specific Gravity)
- Btu/CV Value
- GPM (gallons of liquid per thousand cubic ft)
- Wobbe Index
- Methane Number
- Optional calculations can include: AGA 10 speed of sound, Hydrocarbon Dew Point

## Installation

The NGC 8206 is a weatherproof device designed for installation “on the pipe” near to the sampling point. This means it is acceptable to mount outside - in a temperature range of 0°F to 130°F (–18°C to 55°C) [provides reliable operation for –20°F to 130°F (–29°C to 55°C) with low temperature option] onto a pipeline with 2” to 12” pipe sizes or with an optional pole mount configuration. A cold weather enclosure is also available if ambient conditions are below either the sampled gas dew point or the operational specifications of the unit.

## Sample conditioning system

The integral stream selector for the NGC 8206 allows sampling up to four (4) different natural gas streams. Up to two of these sample streams can be designated as the “calibration/validation sample”. Optional sample conditioning modules are available to address natural gas streams that need additional filtering and “speed loops” to reduce sample transport lag times.

## Operator interface

Functional setup and operation of the NGC 8206 is accomplished by using a graphical user’s interface software package called PCCU 32 (supplied with each unit) operating on a laptop PC in a Microsoft® Windows® environment. The “Windows®” utilities, combined with software designed specifically for the NGC 8206, provide a powerful tool for operations, diagnostics, and downstream data handling. The PC can be directly connected to the NGC 8206 via an RS-232, USB, or Ethernet connection, or indirectly by remote telemetry (phone modem, radio, cell phone, satellite, etc.). The user is prompted through push-buttons, drop-down boxes, wizards, and dialog boxes for setup, operations, data collection and monitoring.

In addition, the unit has an optional ¼ VGA interactive display screen allowing the user access to basic analysis data. The user can also accomplish most of the “operator” functions from the front panel display with out the use of a laptop PC. The “Run-Hold-Calibrate” functions can be done via a magnet interface through the explosion proof glass in the display.

# NGC 8206

## Natural gas chromatograph

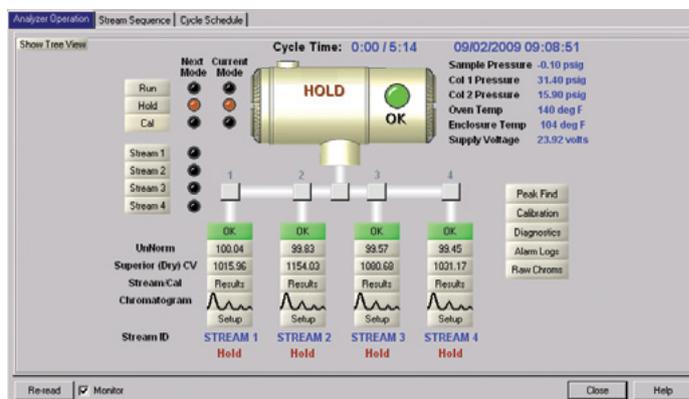
### Maintenance

The NGC 8206 was designed from the ground up to be maintained by personnel with little or no prior knowledge of Gas Chromatography. Both hardware and software are designed to provide low maintenance through easily replaceable electro-mechanical modules such as:

- NGC termination panel
- NGC analytical module, an easily removable chromatograph subassembly, containing:
  - NGC manifold
  - Stream selector solenoid valves
  - GC module
  - Dual electronic carrier pressure regulator valves
  - Chromatograph pilot valve
- NGC analytical processor
- NGC feed-through (heater optional)
- Sample conditioning module (SCM)
- NGC controller, (32 bit processor)
- NGC ¼ VGA display (optional)

### Other maintenance support features

- Intuitive Local Operator Interface (PCCU 32) running Microsoft® Windows® environment
- Diagnostic software and wizards for maintenance
- Diagnostic file output system for e-mail support
- Digitized detector output (chromatogram) to PCCU 32
- Remote or local operation of PCCU 32
- Quick Start guide, Start up manual and Start up video



## Historical data

The NGC 8206 is designed to retain historical data. This data can be used for custody transfer needs, verify transmitter operation over time, and provide a limited data backup for communication link reliability.

The user is allowed to configure the period of the data retained by the NGC 8206 via the Operator Interface. The default1 memory configuration provides the most recent 480 analysis cycles containing:

- Normalized components
- Un-normalized components
- Ideal Btu/CV
- Real Btu (wet and dry) / CV (superior and inferior)
- Relative density (specific gravity)
- Density
- GPM
- Wobbe index
- Alarms

Stream averages for the (default1) 840 last hours, 35 last days and the most recent last month analyses. Operational Parameters for the (default1) last 480 cycles (Diagnostics Report):

- Selected peak times
- Selected peak areas
- Ideal Btu/CV
- Carrier regulator pressure
- Oven temperature
- Ambient temperature
- Sample pressure
- Detector noise values
- Detector balance values

Audit logs (default1)

- Last 480 alarms
- Last 480 events

Data retained by the NGC 8206 can be collected via a remote communication link or by the laptop PC local operator interface PCCU 32.

## Available accessories

- 120/240 V AC to 12 V DC GP and Exp power supplies
- Pole or pipeline mounting kits
- Cold weather enclosure (also available in pipe mount configuration)
- Cold weather thermal jacket (future)
- Modular Sample System Conditioner options for
  - Non-pipeline quality natural gas sample
  - Sample transport lag-time needs
- Probes
  - Temperature compensating fixed
  - Temperature compensating retractable
  - Liquid rejection
  - Electrically heated, retractable
- Regulators (carrier and calibration blend)
- Start-up calibration/validation gas sample ( $\pm 2\%$  blend)
- Carrier Gas: 99.995% pure helium (chromatographic grade)
- Hydrogen carrier (optional)
- SD memory card
- Export crating
- Tool kit
- Welker liquid shut-offs
- Various maintenance kits
- Customer factory acceptance test (FAT)

(Default1) The default memory configuration will provide for the data storage above. User may reallocate the memory that is available.

# NGC 8206

## Natural gas chromatograph

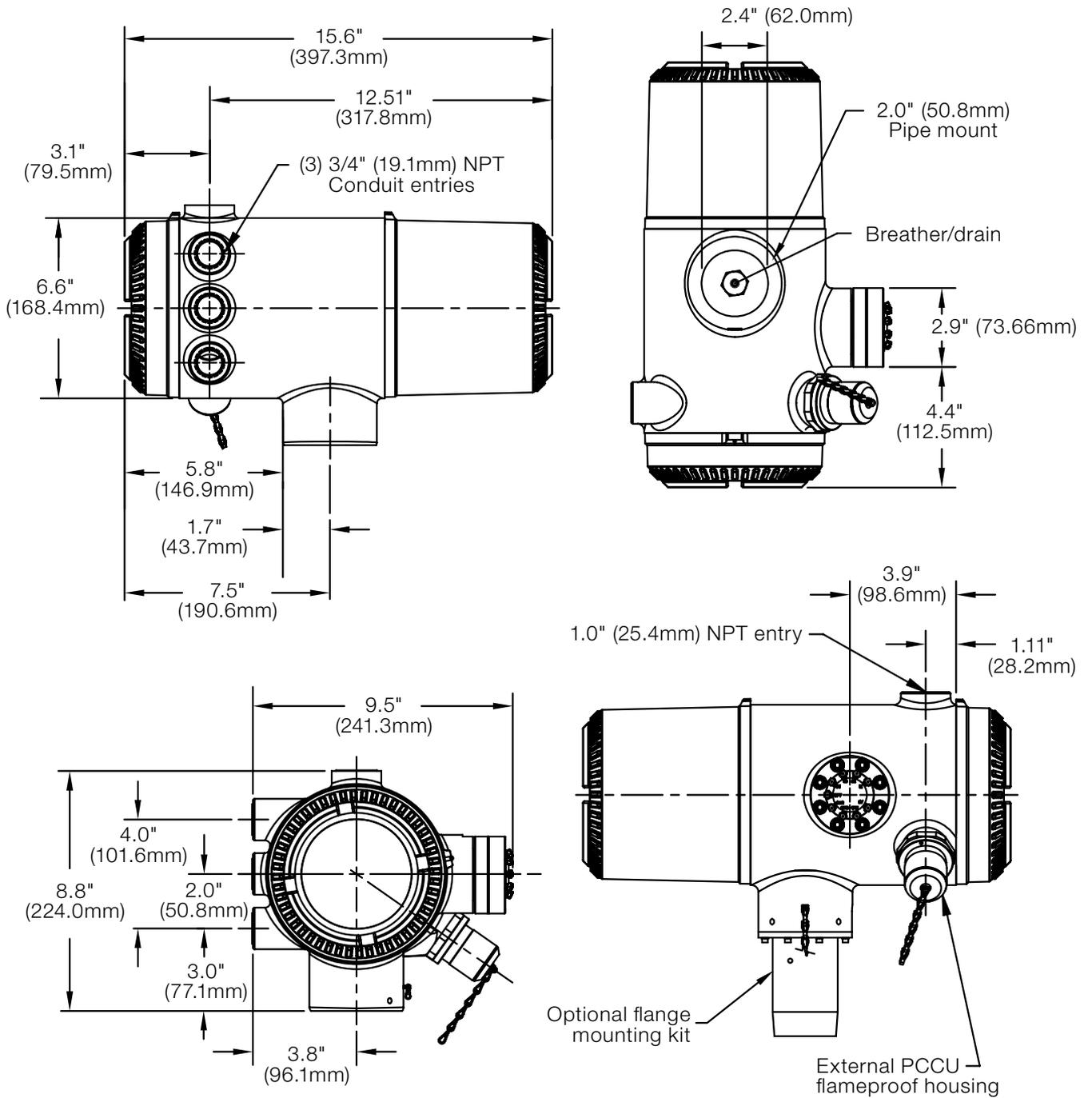
### Specifications

- Designed for Pipeline-Quality Natural Gas. 800 to 1500 Btu per standard cubic foot (29.8 to 55.9 megajoules/meter<sup>3</sup>) with less than 100 PPM H<sub>2</sub>S
- Calculations Per: GPA 2172-96 (Z by AGA 8 or ISO 6976-95; ISO 12213 (by AGA8); in the future – ASTM D 3588, GOST or ISO mass
- Environmental Temperature
- Meet or exceeds GPA 2261-99 for linearity
- Four stream capability. Manual calibration required with 4 sample streams.
- Single auto calibration stream and 3 sample streams, or 2 auto calibration streams and 2 sample streams.

<b>Dimensions</b>	6.75" diameter x 16" long x 9.00" tall (17.1 cm x 40.6 cm x 22.9 cm)
<b>Weight</b>	Approximately 28 lb. (12.7 Kg) Shipping Weight: 47 lb. (21.3 Kg)
<b>Weatherproof construction</b>	CSA Type 4X, IECEx IP56, ATEX Type 4X (IP66 Equivalent), aluminum alloy with white polyester powder coating.
<b>Carrier gas</b>	Helium 1 large helium bottle should last between 9 months to 1 year
<b>Analysis time</b>	Approximately five (5) minutes; cycles may be scheduled by user
<b>Repeatability</b>	± 0.125 Btu @ 1,000 Btu (± 0.0125%) @ ambient ± 0.25 Btu @ 1,000 Btu (± 0.025%) over temperature range
<b>Temperature range (storage)</b>	-22°F to +140°F (-30°C to 60°C)
<b>Temperature range (normal)</b>	0°F to 130°F (-18°C to 55°C)
<b>with cold weather enclosure</b>	-40°F to +130°F (-40°C to 55°C)
<b>Moisture</b>	95% Relative Humidity Non-Condensing
<b>Supply voltage</b>	10.5 to 16 V DC Optional: 21 to 28 V DC

<b>Power consumption</b>	Nominal operation @ 0°F (-18°C) = 7 Watts; (650 mA) Start up @ less than 3 amps (45 Watts @ 15 V DC)
<b>Certifications</b>	NEC & CEC Class I, Div. 1, Groups B, C and D, T6; CFR 47, Part 15: IECEx Exd IIB + H2 T6; Class I Zone 1: INMETRO Exd 11B + H2 T6; Class 1 Zone 1:  ATEX  II 2G : Ex d, IIB+H2 T6; Class I, Zone 1: EMC - EMI/RFI: EN 55022, EN 61000-6-1, EN 61000-4-2, 4-3, 4-4, 4-6, 4-8: CISPR 22-2004
<b>Miscellaneous type approvals</b>	Industry Canada, MI (Netherlands), BRML (Romania), China Weight & Measures
<b>Communications supported</b>	Two serial digital ports, software selectable for RS-232, RS-485, or RS-422. One USB MMI (RS-232 or USB). Optional USB hub (host and client) and Ethernet ports.
<b>Protocols supported</b>	Totalflow Remote / Local MMI Totalflow / TCP Modbus / TCP Server Modbus / TCP Client, Modbus ASCII or RTU (Modicon, WordSwap, or Danalyzer) DSFG (future)
<b>Memory</b>	Up to a total 2.052 GB of RAM. CPU RAM Memory 20 MB. Nand Flash 32 MB. Data Storage 128 MB to 2 GB

## Installation dimensions



# Contact us

**ABB Inc.**  
**Process Automation**  
**Main Office**  
7051 Industrial Boulevard  
Bartlesville, OK 74006  
USA  
Tel: +1 918 338 4888  
+1 800 341 3009  
Fax: +1 918 338 4699

**ABB Inc.**  
**Process Automation**  
3700 W Sam Houston Parkway  
South, Ste. 600  
Houston, TX 77042  
USA  
Tel: +1 713 587 8000  
Fax: +1 713 266 4335

**ABB Inc.**  
**Process Automation**  
3900 S. County Rd. 1290  
Odessa, TX 79765  
USA  
Tel: +1 432 563 5144  
Fax: +1 432 563 8043

**ABB Inc.**  
**Process Automation**  
2 Acee Dr.  
Natrona Heights, PA 15065  
USA  
Tel: +1 724 295 6100  
Fax: +1 724 295 6560

**ABB Inc.**  
**Process Automation**  
4300 Stine Rd.  
Ste. 405-407  
Bakersfield, CA 93313  
USA  
Tel: +1 661 833 2030  
Fax: +1 661 833 2034

**ABB Inc.**  
**Process Automation**  
2705 Centennial  
Liberal, KS 67901  
USA  
Tel: +1 620 626 4352  
Fax: +1 620 626 4354

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Sales



Service



Software

## 4670 series High range turbidity systems

Long-term, reliable  
performance turbidity systems  
with low cost of ownership



### Choice of flow-through and dip turbidity systems

- easy installation in open channels or tanks
- suitable for turbidity measurements up to 2000 FTU

### Automatic sensor cleaning

- reduces maintenance requirements
- optimizes performance sensitivity

### Secondary standards for calibration

- accurate, repeatable, simple, safe
- realize significant cost savings by reducing the use of primary standards

### Reliable and accurate measurement

- unaffected by ambient light
- automatic bubble rejection to compensate for erroneous readings due to degassing

# 4670 series

## High range turbidity systems

### ABB's 4670 range of turbidity systems

ABB's 4670 series turbidity systems are available as in-situ dip systems suitable for turbidity measurement in open channels and tanks, or as a flow-through design suitable for water applications that have high turbidity values.

Measurement ranges are configurable between 0 and 100 FTU and between 0 and 2000 FTU. The systems can also be configured to display readings in mg/l or ppm for suspended solids measurement in addition to FTU.

All systems are provided with ABB's auto-cleaning function and are available with dry secondary calibration standards for accurate reliable turbidity measurement with reduced cost of ownership.

### Applications

Typical applications for the 4670 range of high range turbidity systems include:

- Suspended solids / turbidity measurement in industrial effluent discharges
- Suspended solids / turbidity measurement of effluent discharge from sewage treatment works
- Turbidity level monitoring in the outflow channel from sludge dewatering plants

For low range turbidity applications (for example, potable water turbidity monitoring) refer to ABB's 4690 range of turbidity systems (see data sheet [DS/4690-EN](#)).



Fig. 1: High range turbidity flow-through system

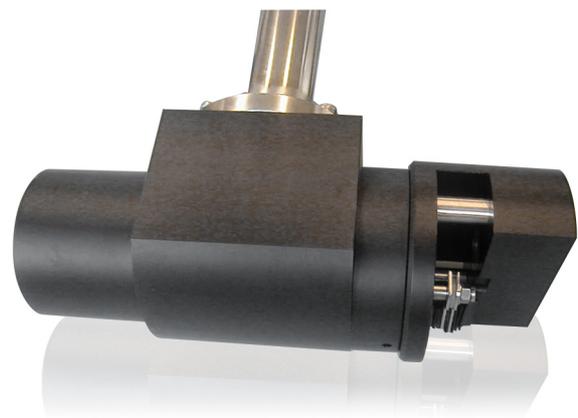


Fig. 2: High range turbidity dip system

## Reliable measurement

ABB's 4670 range of turbidity systems are designed for reliability, ease-of-use and maintenance simplicity. The sensors are available in flow and dip versions and are supplied with auto-cleaning to minimize maintenance, overcome optical fouling and optimize performance.

## Measurement technique

The 4670 series of high range turbidity sensors measure turbidity by absorption (or attenuation) of a light beam passing through the sample.

This is probably the most straightforward method of measuring turbidity. A light beam is transmitted through the sample, the intensities of which are measured by a photodetector in line with the light source. The measurement of turbidity using Absorptimeters can be affected by the presence of dissolved colour. However, such effects are minimized by performing the measurement at a wavelength of 880 nm which is in the infrared region.

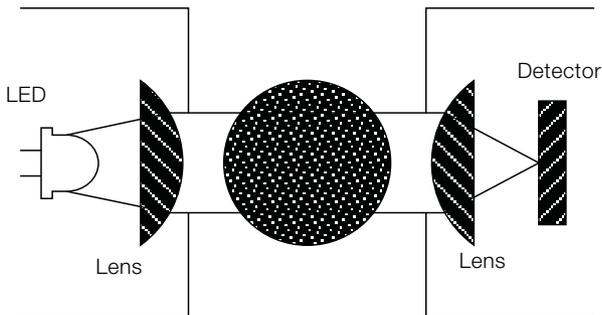


Fig. 3: Absorption turbidity monitor

## Automatic cell cleaning

The 4670 range of turbidity sensors feature an auto-clean system. This feature consists of a mechanical wiper assembly that physically wipes clean the optical cell at user-programmable intervals from every 15 minutes up to every 24 hours.

The highly efficient automatic cleaning process overcomes the problem of optical fouling and ensures that performance can be maintained for long periods without the need for manual intervention.

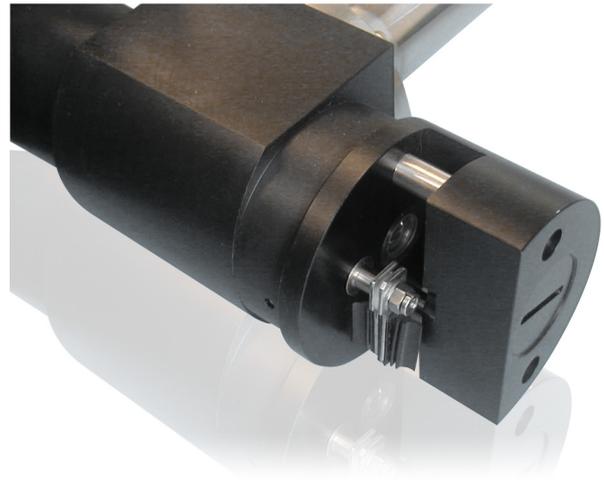


Fig. 4: Auto-clean system on 4670 dip sensor

## Automatic bubble rejection

Turbidity readings can be affected by short-term spikes, usually due to the effect of the sample degassing. The 4670 analyzer has an automatic bubble rejection feature that, when enabled, applies a digital filter to the measured results removing spurious high readings.

# 4670 series

## High range turbidity systems

### Simple to calibrate

The 4670 can be calibrated either by using a chemical standard such as Formazine, or by using the optional secondary calibration device.

The dry secondary calibration standard is a key feature of the 4670 turbidity systems that simplifies routine instrument verification and removes the need for the use of chemical standards.

Each secondary standard is supplied factory-certified against a primary formazine standard.



Fig. 5: Auto-clean system on 4670 dip sensor

### Benefits of using ABB's secondary standards

#### Minimum analyzer downtime

– Simple and fast procedure to verify analyzer performance.

#### Low cost of ownership

– Reduce usage of consumable chemical standards and the time taken to prepare such standards.

#### Minimize employees' exposure to Formazine

– Formazin is highly toxic and a suspected carcinogen

#### Repeatable and reliable

– Removes any chemical standard preparation errors

#### Simple to use

– The secondary standard is simply inserted into the sensor assembly optical light path enabling the pre-calibrated optomechanical filter to divert a fixed quantity of light to the detector that corresponds to the calibrated turbidity value

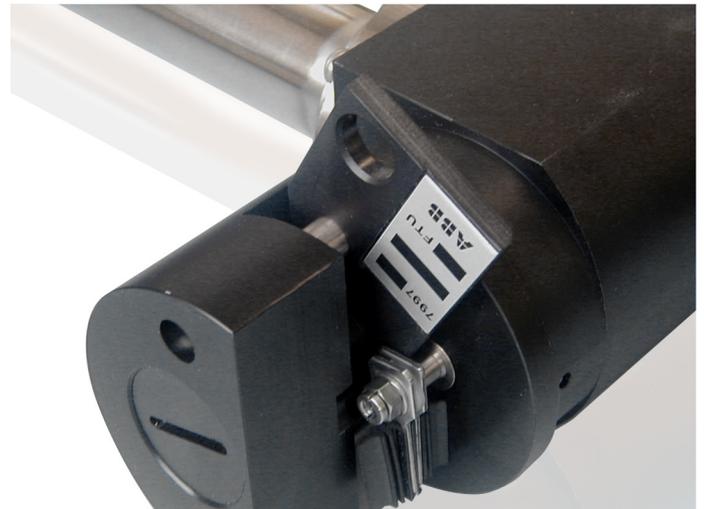


Fig. 6: Dry standard calibration

## Flexible installation

A choice of in situ dip and flow-through sensor designs together with panel- and wall-mount transmitter options makes it flexible to install for a variety of applications

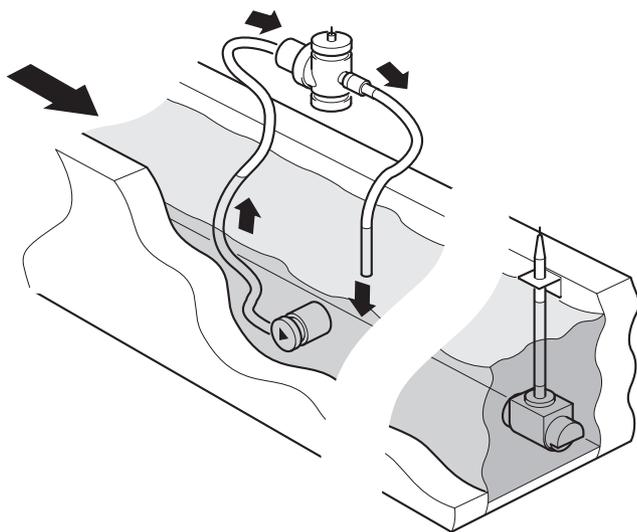


Fig. 7: 4670 installation options

## Simple to maintain

As with all analyzers, the key to success is the reliability of the sensing device coupled with simple maintenance procedures.

The 4670 turbidity sensing systems are designed to be as maintenance-free as possible. The inherent product design and auto-clean feature minimize the amount of maintenance required to regular calibration verification checks and periodic replacement of the wiper blade. All the sensing systems can be site-serviced without the need of a skilled technician.

## Confidence in service

To complement the system's well proven design, unrivalled accuracy and reliability in service, the entire sensing loop is regularly self-monitored to ensure the light source is operating within specification, thereby eliminating the risk of electrical drift. In addition, the function of the wiper module is continuously validated, thereby assuring the correct performance of the cleaning function.

# 4670 series

## High range turbidity systems

### 7997-400, 7997-401 dip and 7997-405 flow turbidity sensors specification

#### Range

Programmable 0...100 to 0...1000 FTU and 0...2000 mg/l

The maximum range for suspended solids measurement is dependent upon the coefficient value of the sample.

#### Extended range

0...2000 FTU

#### Measurement principle

Transmitted light

#### Measurement characteristic

Logarithmic, based on Formazine

#### Resolution

1 FTU

#### Repeatability

Better than 1 % of span

#### Accuracy (0 to 1000 FTU)

±2 % FSD

(limited by the uncertainty of Formazine)

#### Accuracy (0 to 2000 FTU)

Better than ±10 % of span

#### Temperature drift

0.2 FTU/°C (0.1 FTU/°F)

#### Flow rate (7997-405 only)

0.5...2 l/min<sup>-1</sup>

#### Integral wiper cleaning system

Programmable operational frequency every 0.25 hour,

0.5 hour, 0.75 hour or in multiples of 1 hour up to 24 hours

#### Sample operating temperature

0...50 °C (32...122 °F)

#### Dip stem length

7997-400 1 m (3.3 ft)

7997-401 2 m (6.6 ft)

#### Pressure (7997-405 only)

Up to 3 bar (43.5 psi)

## 4670 transmitter specification

### General

#### Measured value

5-digit x 7-segment backlit LCD

#### Information

16-character, single line, dot matrix, backlit LCD

#### Units of measurement

All models: NTU and FNU  
mg/l and ppm for high range models

#### Accuracy

±0.2 % of reading, ±1 digit

#### Linearity

±0.1 % FSD

#### Auto-clean timing (7998011, 7998012)

Programmable 15 min, 30 min, 45 min or 1 hour up to 24 hours in 1 hour increments

#### Environmental data

##### Operating temperature limits

-20...55 °C (-4...131 °F)

##### Storage temperature limits

-25...55 °C (-13...131 °F)

##### Operating humidity limits

Up to 95 % RH non-condensing

### Power supply

#### Voltage requirements

100...130 V, 200...260 V, 50/60 Hz

#### Power consumption

< 6 VA AC

#### Error due to power supply variation

Less than 0.1 % for +6 % -20 % variation from nominal supply

#### Insulation

Mains to earth (line to ground) 2 kV RMS

#### Relay outputs and set points

##### No. of relays

Two

##### Relay contacts

Single pole changeover

Rating: 250 V AC, 250 V DC max.  
3 A AC, 3 A DC max.

Loading:

(non-inductive): 750 VA 30 W max.

(inductive): 750 VA 3 W max.

#### Insulation

2 kV RMS contacts to earth (ground)

#### No. of set points

Two

#### Set point adjustment

Programmable

#### Set point hysteresis

±1 % fixed

#### Local set point annunciation

Red LED

# 4670 series

## High range turbidity systems

### Retransmission

#### No. of retransmission signals

One fully isolated programmable 0...10 mA, 0...20 mA or 4...20 mA optional second current output

#### Accuracy

$\pm 0.25$  % FSD  $\pm 0.5$  % reading

#### Resolution

0.1 % at 10 A, 0.05 % at 20 mA

#### Max. load resistance

750  $\Omega$  (20 A max.)

### Mechanical data

#### Model 4670 Wall- / Pipe-mount transmitter

Wall-mounting

Protection IP66 / NEMA4X

Dimensions 160 mm (6.30 in.) wide x 214 mm  
(8.43 in.) high x 68 mm (2.68 in.) deep

Weight 2 kg (4 $\frac{1}{2}$  lb)

#### Model 4675 Panel-mount transmitter

Panel-mounting (1/4 DIN)

Protection IP66 / NEMA4X front

Dimensions 96 mm (3.78 in.) wide x 96 mm (3.78 in.)  
high x 191 mm (7.52 in.) deep

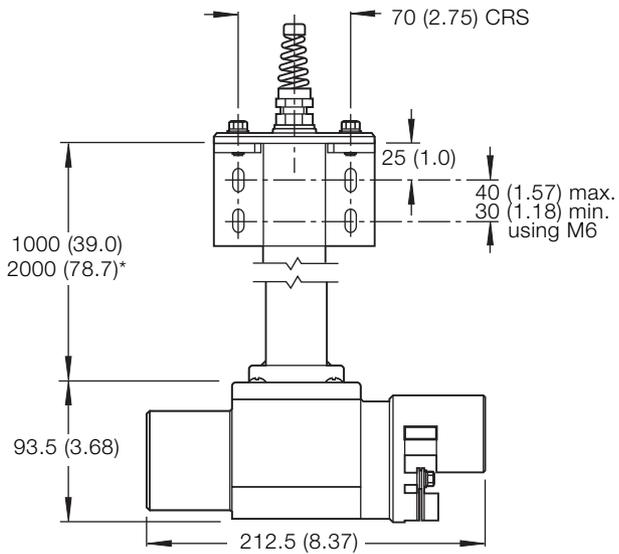
Weight 1.5 kg (3 $\frac{1}{4}$  lb)

Panel cut-out:  $92^{+0.8}_{-0}$  mm x  $92^{+0.8}_{-0}$  mm  
( $3.62^{+0.03}_{-0}$  in. x  $3.62^{+0.03}_{-0}$  in.)

## Overall dimensions

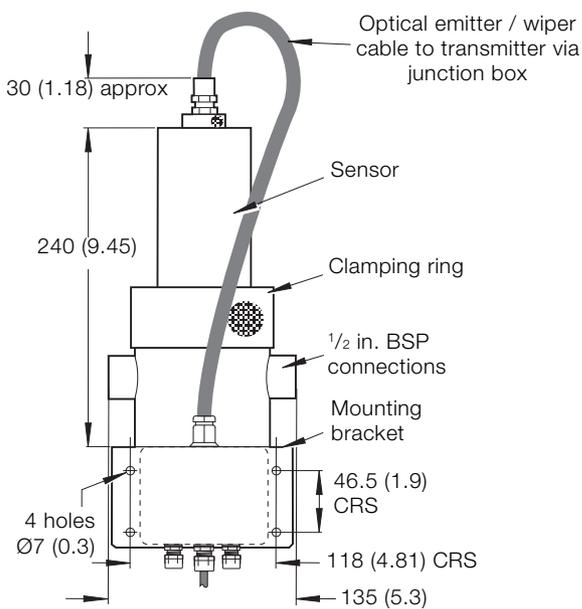
### 7997-400 & 7997-401 Sensors

Dimensions in mm (in.)



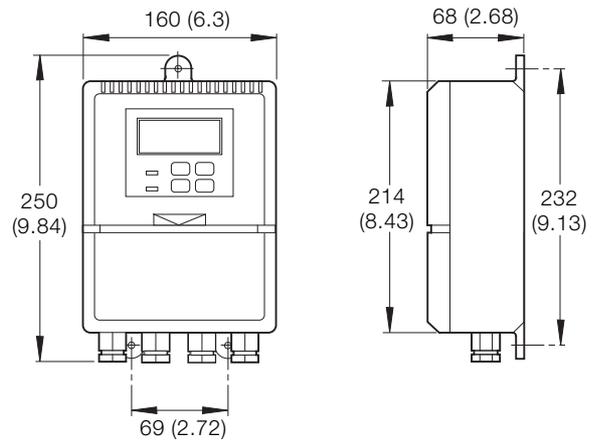
### 7997-405 Sensor

Dimensions in mm (in.)



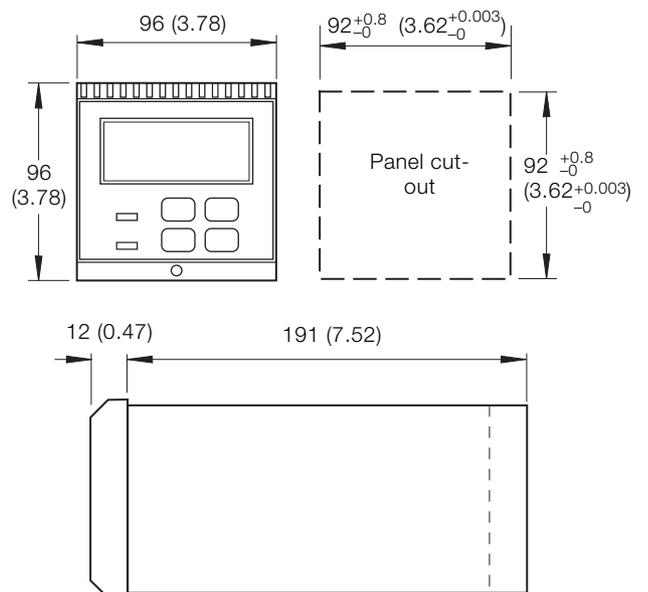
### 4670 wall- / pipe-mount transmitter

Dimensions in mm (in.)



### 4675 panel-mount transmitter

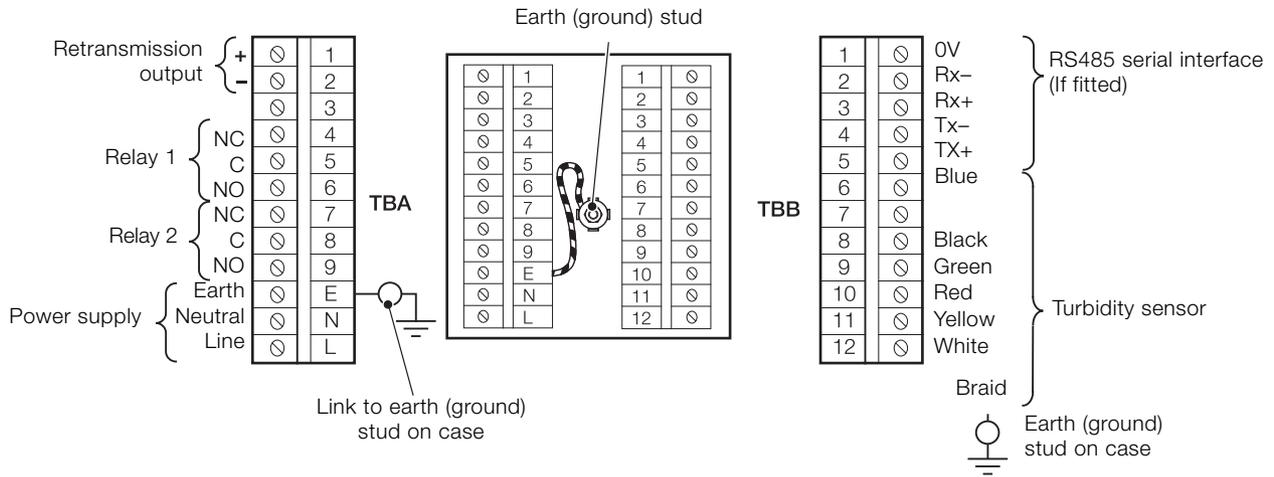
Dimensions in mm (in.)



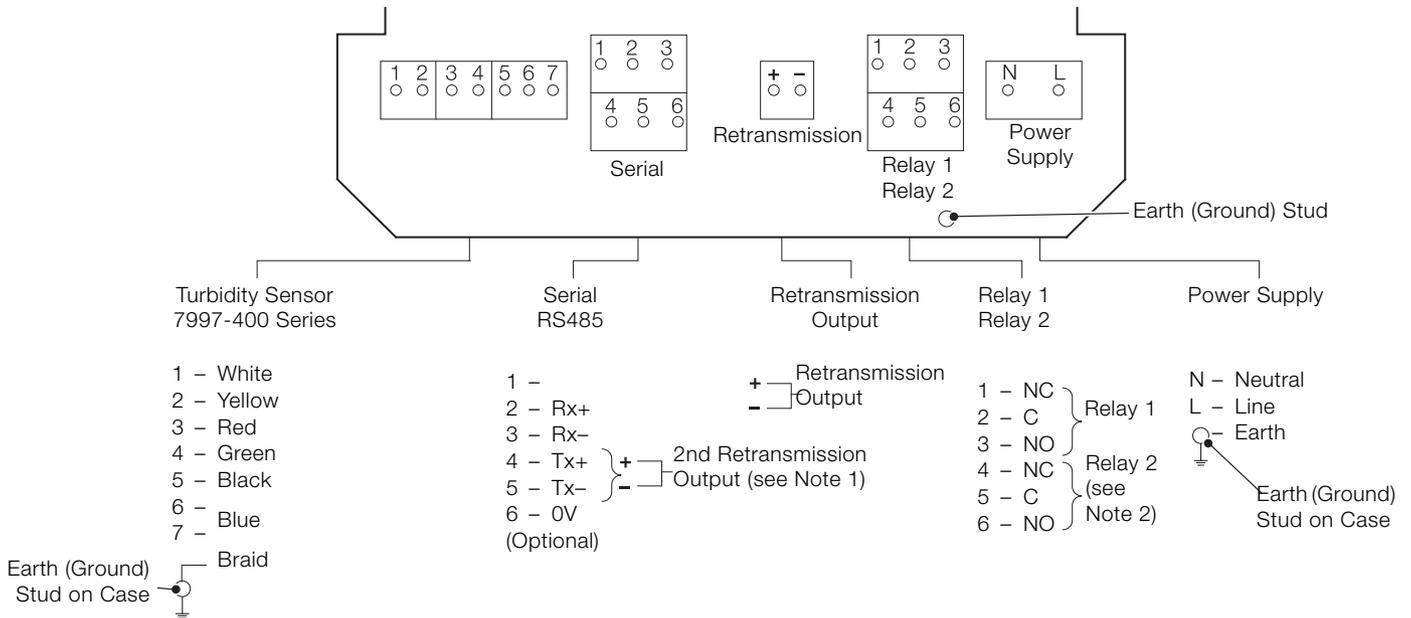
# 4670 series High range turbidity systems

## Electrical connections

### Panel-mount transmitter connections



### Wall- / Pipe-mount transmitter connections



Mounting	Terminal Number						
Wall	1	2	3	4	5	6	7
Panel	12	11	10	9	8	7	6
	Cleaner initiate pulse	+12 V switched emitter supply	+12 V cleaner/receiver supply	Signal input	Cleaner detect signal		0 V common

## Ordering information

<b>Turbidity system</b>	<b>467</b>	<b>X/</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Wall-mounting transmitter (IP66/NEMA4X)</b>					
Range programmable from 0...1 NTU to 0...250 NTU or 0...50 FTU to 0...1000 FTU (extended range 0...2000 FTU). Complete with high and low alarm relays and isolated current output (programmable 0...10 mA, 0...20 mA or 4...20 mA) and auto-clean. Power supply 110/240 V AC		0			
As above with 2 outputs		1			
As above with Modbus		6			
<b>Panel-mounting transmitter (IP66/NEMA4X 96 x 96 mm DIN case)</b>					
Range programmable from 0...1 NTU to 0...250 NTU or 0...50 FTU to 0...1000 FTU (extended range 0...2000 FTU). Complete with high and low alarm relays and isolated current output (programmable 0...10 mA, 0...20 mA or 4...20 mA) and auto-clean. Power supply 110/240 V AC		5			
As above with 2 outputs		2			
As above with Modbus		7			
<b>Sensor type</b>					
1 m Dip system, range 0...1000 FTU max. (extended range 0...2000 FTU), 0...100 FTU min., 0...2000 mg/l utilizing light absorption. Process connections, N/A. Complete with auto-clean. (7997-400 sensor).		4	0		
2 m Dip system, range 0...1000 FTU max. (extended range 0...2000 FTU) 0...100 FTU min., 0...2000 mg/l utilizing light absorption. Process connections, N/A. Complete with auto-clean. (7997-401 sensor).		4	1		
Flow-through system, range 0...1000 FTU max. (extended range 0 to 2000 FTU) 0...100 FTU min., 0...2000 mg/l utilizing light absorption. Process connections, ½ in. BSP. Complete with auto-clean. (7997-405 sensor).		4	5		
<b>Documentation language</b>					
English					1
German					2
French					3
Spanish					4

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA867001R1001

# AC200 Series Industrial 2-Electrode Conductivity Cells with Rapid Temperature Response

Rugged sensors, rapid  
response



#### Safe operation and high process resistance

- 316L stainless steel body and PEEK insulator operates to 20 bar (290 psi) and 200°C (392°F)
- Epoxy body and carbon electrodes to 6.6 bar (100 psi) and 100°C (212°F)

#### Easy installation and operation

- insertion, flow-through, immersion and submersible types

#### Problem-free cable connection

- plug-in connector eliminates incorrect connection and tangled cables
- terminal head version for on-site adjustment of cable length

#### Excellent for rapid changing processes

- fast integral temperature sensor
- $T_{90}$  under 30 seconds

#### Reduced maintenance

- easy to clean, removable electrode sheath

#### Wide range of applications

- power plants
- water treatment
- de-mineralization
- semiconductors
- pulp & paper

## Safe Operation and High Process Resistance

The AC200 series of cells provide highly accurate and reliable in-line conductivity measurements up to 20 bar (290 psi) and 200°C (392°F). Typical applications are power plants, ion-exchangers, reverse osmosis and chip cleaning.

AC210 cells are available as screw-in, flow-through, immersion and submersible types to permit installation in the majority of industrial applications.

The series comprises two essential variants: AC210 with electrodes of high-density graphite (for 0.1 and 1.0 cell constants); and AC220 stainless steel (for 0.01 and 0.1 cell constants).

A range of cell constants ( $k$  values) is provided to measure a wide range of process media from 10,000  $\mu\text{S cm}^{-1}$  down to 0.055  $\mu\text{S cm}^{-1}$  (or 18.2  $\text{M}\Omega\cdot\text{cm}$ ).

All AC200 cells are manufactured to highly exacting standards. Traceable certificates of cell constant accuracy can be supplied on request.



*Detachable Connector for Easy Installation*

## Flexibility of Cable Connection

A choice of sensor cable interconnection methods is provided in order to suit a wide variety of needs. The detachable cable connector ensures easy installation and eliminates the possibility of making a wrong connection or tangling cables.

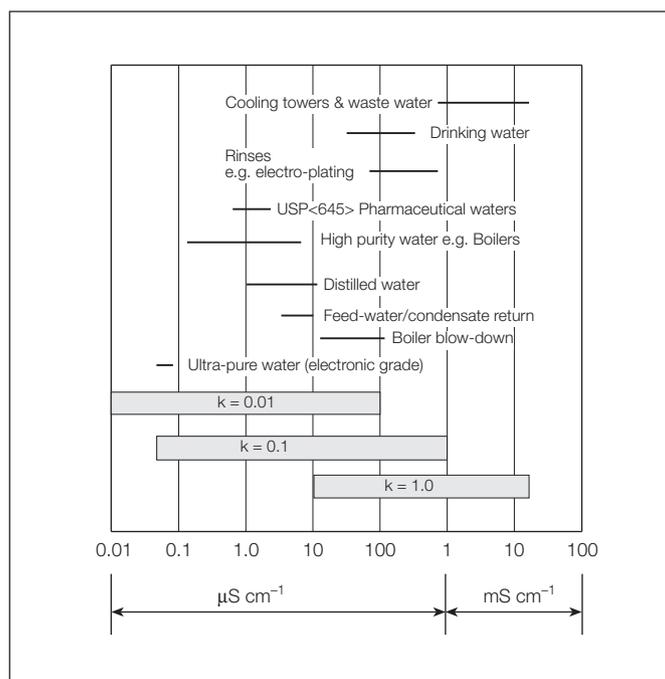
For user flexibility, a terminal head version enables on-site adjustment of cable length and cell stocking, while direct fixed integral cable mounting is provided for the simplest, problem-free connection.

## Rapid Integral Temperature Sensor

Temperature compensation is critical for conductivity measurement, particularly where a wide variation of temperatures is expected.

In addition, detection of cooling water failure can be critical on high temperature sampled systems in the modern power plant.

All AC220 stainless steel cells are equipped with a very fast temperature compensator with  $T_{90}$  of under 30s. This enables accurate temperature compensation and use as a separate temperature measurement for output from the analyzer.



*Process Solutions and Cell Constants*

## Simple Maintenance Easy-to-Clean Cells

Some ultra-pure water processes can contain contaminants that periodically could coat electrodes and reduce measurement accuracy. This can occur during commissioning of new plant or with on-demand power plant where the process does not run continually.

To make maintenance easier all AC220 cells have a removable outer sheath making access for cleaning very simple.

## Easy Installation and Operation

### Insertion, Flow, Immersion and Submersion

The AC200 is designed to make installation easy and operation simple. These sensors have been designed for mounting in-line, immersed in tanks or directly submerged. The comprehensive range easily meets actual process needs

### AC210 Graphite/Epoxy Cells

AC210 sensors are constructed of high-density graphite electrodes mounted in loaded epoxy resin. This provides excellent polarisation resistance at higher conductivities and exceptional chemical resistance.

### AC211 Screw-in Insertion Cells

The AC211 sensor is designed to be screwed directly in-line and is rated to 100°C (212°F) and 7 bar (100 psi). The process connection is a G 1 in. (BSP) or NPT male thread.

IP68 cable connection options include fixed cable, terminal head and a detachable connector.



AC211 Screw-in Cells

### AC212 Flow-through Cell

The AC212 cell is an integral, flow-through design reducing outlay and easing installation in small-bore lines. The sensor is suitable for operation to 100°C (212°F) and 7 bar (100 psi).

Process connections are Rp 1/2 in. (BSP parallel) and NPT female threads.

Connection of cable is achieved via the integrated IP67 terminal head.



AC212 Flow-through Cell for small bore lines

### AC213 Immersion and Submersible Cells

Installation in open channels and tanks is easily achieved with the AC213 polypropylene immersion (dip) system in either 1m (3.3 ft) or 2m (6.6 ft) length. Actual dip length is adjustable on site enabling the system to match actual process needs.

Longer dip lengths are accommodated with the submersible version mounted in a dip tube provided by the user. IP68 protection of the integral, potted-in cable makes it perfectly suited for direct submersion in open channels and bore holes.



AC213/0 Submersible and AC213/1 Immersion Cells

### AC220 Stainless Steel Cells

The AC220 series comprises dedicated screw-in cells that can be inserted directly in-line or screwed into a flow-chamber.

AC220 steel cells are rated to 20 bar (290 psi) and 200°C (392°F) when using the terminal head version with ABB high temperature cable. All other types are suitable for operation to 110°C (230°F).



AC221 Stainless Steel Cells

## Specification

### AC210 Carbon Cells

#### Wetted parts

Electrodes	Carbon
Cell body	Loaded epoxy resin
Mounting boss (AC211)	316L stainless steel
Immersion tube (AC213/1 and /2)	Glass reinforced polypropylene
Submersible shroud and cable (AC213/0)	PVC and cross-linked polyolefin

#### Temperature and Pressure limits

##### Insertion and flow-through variants

Max. operating temperature	100°C (212°F)
Max. operating pressure (absolute)	7 bar (700 kPa, 100 psi)

##### Immersion (dip) variant

Max. operating temperature	90°C (194°F)
Max. operating pressure (absolute)	2m water head (0.2bar)

##### Submersible variant

Max. operating temperature	80°C (176°F)
Max. operating pressure (absolute)	10m water head (1bar)

#### Ingress protection

IP68	all variants except flow-through
IP67	flow-through

#### Available cell constants

0.10 and 1.00

#### Temperature element

Integral Pt100 (3-wire) in sensor body

#### Sensor cable terminations

(a) Integral, potted-in cable	On insertion, immersion and submersible models
(b) Terminal head	On insertion and flow-through models
(c) Detachable cable	On insertion models

#### Available cable lengths

1m (3.3 ft), 2m (6.6 ft), 5m (16 ft), 10m (33 ft), 15m (49 ft) and 20m (66 ft)

## Process connections

#### Screw-in Insertion

- (a) G1 in. (BSP parallel) thread
- (b) 1 in. NPT thread

#### Flow-through

- (a) Rp 1/2 in. (BSP parallel) thread
- (b) 1/2 in. NPT thread

#### Immersion (Dip) mount

- (a) 1 m (3.3 ft) and 2 m (6.6 ft) immersion lengths, site adjustable
- (b) Non pressure-bearing flange with DN10/ANSI 1 1/2 in. 150lb mounting holes
- (c) Mounting bracket (optional)

#### Replacement immersion cell

1 in. NPT rear thread to fit ABB or user-own dip tube

#### Submersible

Suspended in process by the sensor cable

### AC220 Stainless Steel Cells

#### Wetted parts

Electrodes and cell body	316L Stainless steel
Insulator	PEEK

#### Max. operating temperature

Terminal head version	200°C (392°F) when used with ABB high-temperature cable Pt. no. 4TB3004-0008
Fixed and detachable cable and terminal head versions	110°C (230°F)

#### Max. operating pressure (absolute)

20 bar (2000kpa, 290 psi)

#### Ingress protection

IP68

#### Cell constants

0.01 and 0.10

#### Temperature element

Integral Pt100 (3-wire) in sensor body

#### Temperature response, T<sub>90</sub>

< 30s

#### Sensor cable terminations

- (a) Integral, potted-in cable
- (b) Terminal head
- (c) Detachable cable

#### Available cable lengths

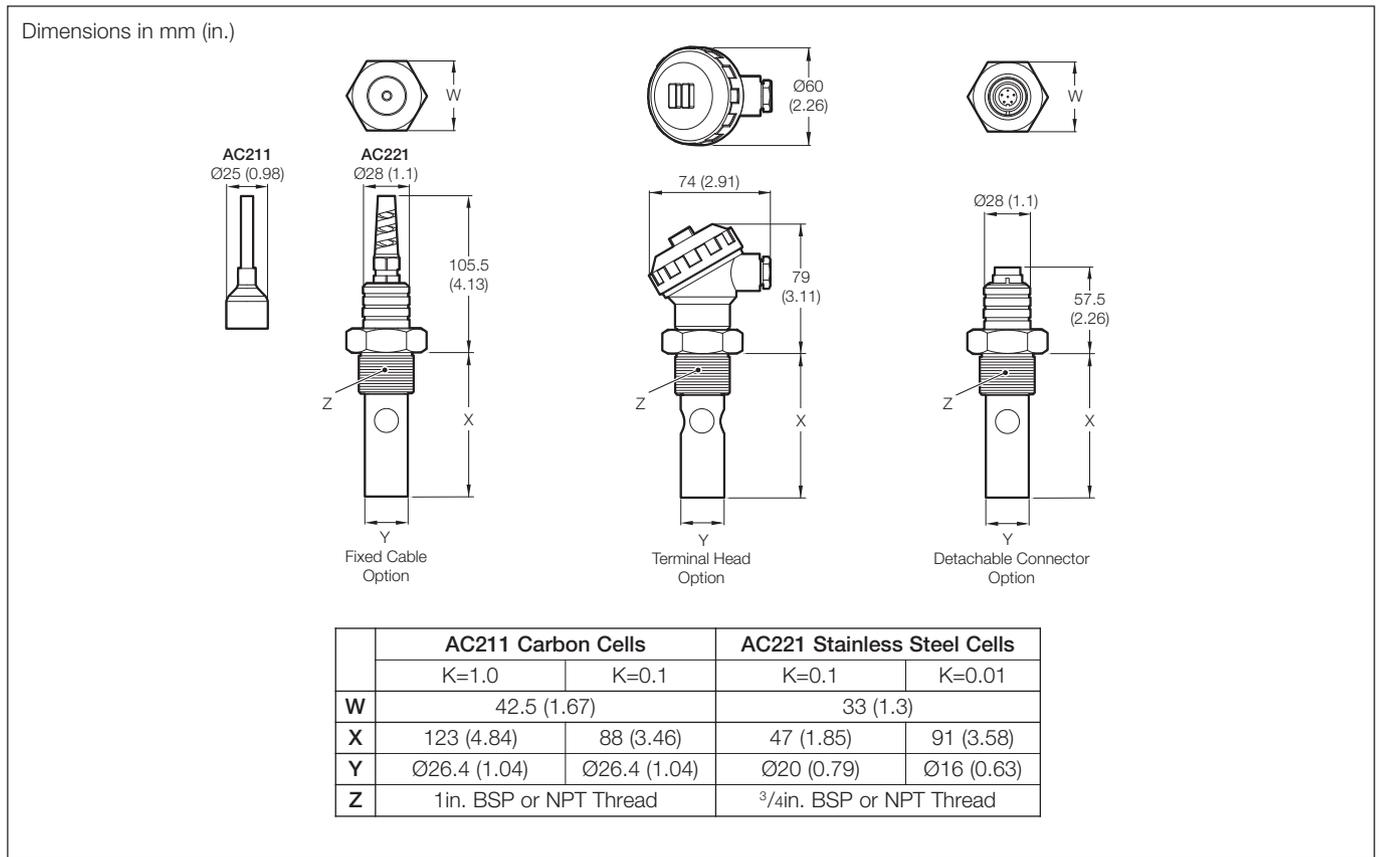
1m (3.3 ft), 2m (6.6 ft), 5m (16 ft), 10m (33 ft), 15m (49 ft), 20m (66 ft)

## Process connections

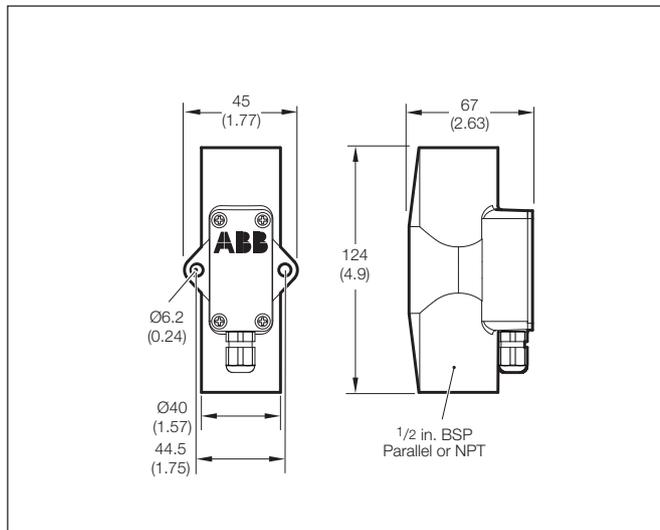
#### Screw-in insertion

- (a) G<sup>3</sup>/<sub>4</sub> in. (BSP parallel) thread
- (b) <sup>3</sup>/<sub>4</sub> in. NPT thread

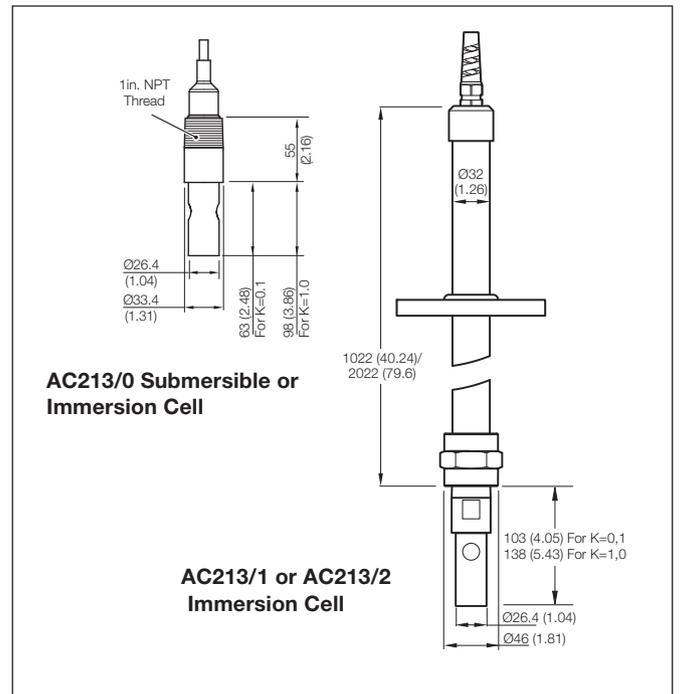
**Overall Dimensions**



AC211 and AC221 Cells



AC212 Flow-through Cell



AC213 Submersible and Immersion Cells

**Ordering Information**

AC210 Series 2-Electrode Carbon Cells	AC21	X	/X		X	X	X	X
<b>Insertion Cells</b>								
G 1 in. (BSP parallel) thread		1	/3					
1 in. NPT thread		1	/4					
<b>Flow-Through Cells</b>								
Rp 1/2 in. (BSP parallel) thread		2	/1					
1/2 in. NPT thread		2	/2					
<b>Dip (Immersion) and Submersible Cells</b>								
Submersible Cell – requires dip holder for immersion		3	/0					
Polypropylene dip, length 1m (3.3 ft) with fitted AC213 cell		3	/1					
Polypropylene dip, length 2m (6.6 ft) with fitted AC213 cell		3	/2					
<b>Cell Constant</b>								
0.10				3				
1.00				4				
<b>Temperature Compensator</b>								
Pt100					1			
<b>Cable Connection Method</b>								
Fixed cable (not for AC212)						1		
Terminal head (not for AC213)						2		
Detachable connector (not for AC212 or AC213)						3		
<b>Cable Length</b>								
None							0	
1m (3.3 ft)							1	
2m (6.6 ft)							2	
5m (16 ft)							3	
10m (33 ft)							4	
15m (49 ft)							5	
20m (66 ft)							6	
Other lengths (terminal head version only) – consult factory							9	
<b>Language (Manual)</b>								
English								1
French								2
Italian								3
German								4
Spanish								5

<b>AC220 Series 2-Electrode Stainless Steel Cells</b>	<b>AC22</b>	X	/X	X	X	X	X	X
<b>Insertion Cell</b>								
G 3/4 in. (BSP parallel) thread	1	/1						
3/4 in. NPT thread	1	/2						
<b>Cell Constant</b>								
0.01				1				
0.10				3				
<b>Temperature Compensator</b>								
Pt100						1		
<b>Cable Connection Method</b>								
Fixed cable							1	
Terminal head							2	
Detachable connector							3	
<b>Cable Length</b>								
None								0
1m (3.3 ft)								1
2m (6.6 ft)								2
5m (16 ft)								3
10m (33 ft)								4
15m (49 ft)								5
20m (66 ft)								6
Other lengths (terminal head version only) – consult factory								9
<b>Language (Manual)</b>								
English								1
French								2
Italian								3
German								4
Spanish								5

**Accessories**

<b>AC200 Replacement/Extension Cables</b>	<b>AC200</b>	<b>XXX</b>	<b>X</b>
<b>Cell Extension Cable</b>			
For Terminal Head versions AC2xx/xxx2		018	
For Detachable Connector versions AC2xx/xxx3		008	
<b>Cable Length</b>			
None			0
1m (3.3 ft)			1
2m (6.6 ft)			2
5m (16 ft)			3
10m (33 ft)			4
15m (49 ft)			5
20m (66 ft)			6
Other length – consult factory			9

**2998 Series Flow Chambers for AC221 Stainless Steel Cells**

	Cell Connection	Inlet/Outlet Connection
2998/350	3/4 in. BSP	3/8 in. NPT
2998/360	3/4 in. BSP	3/8 in. BSP

**Immersion (Dip) Mounting Bracket for AC213/1 and AC213/2 Sensor Systems**

Part no. AC200/0123  
 Material 316L Stainless Steel

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA111201R1001

DS/AC2CO-EN Rev. D 12.2010

## AP200 Series

# Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

## Ruggedness without compromise



### Safe operation and high process resistance

- PPS Ryton™ body operates to 6 bar (90 psi) and 130 °C (266 °F)

### Empowers just-in-time maintenance

- integral solution earth rod for sensor diagnostics with advanced instrumentation

### Reduced maintenance costs

- incorporated jet-wash enables autocleaning

### Reduced running costs

- solid electrolyte provides high resistance to poisoning, plugging and pumping

### High assurance of operation and calibration

- rapid integral temperature sensor
- balanced sensor element positioning

### Increased user-flexibility

- industry standard VarioPin connection permits simple interchange of sensors

### Wide range of applicability

- chemicals & petrochemicals
- pharmaceuticals
- pulp & paper
- water and waste-water treatment
- food & beverage

## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

### Rugged Sensor System with Low Cost of Ownership

The AP200 pH/Redox system is designed to provide high reliability and withstand the toughest environments for process monitoring and control.

The rugged assembly is built to bear the rigours of weather and process. Parts in contact with the process comprise chemically resistant PPS Ryton™ and stainless steel, or PPS Ryton™ and Hastelloy C. Flow-through holders are available in polypropylene, while the PPS Ryton™ insertion adapter enables installation in alternative material pipelines.

Insertion and Flow-through systems tolerate temperatures up to 130 °C (266 °F) and pressures up to 6 bar (90 psi). The inner electrode connections are ingress-protected to IP67/NEMA 6P (exceeds NEMA 4X).

The heartbeat of the AP200 System is the AP120 Series combination electrode. With high process integrity it delivers low running costs and low replacement outlay.

### Just-in-time Maintenance

One of the most vulnerable times for a pH electrode is during reintroduction into the line. Analyzers with advanced diagnostic facilities, such as ABB's TB8xPH or AX400 Series, can detect sensor breakages as they occur. In addition, they can detect sensors 'out-of-process' and several reference faults. These valuable facilities enable just-in-time maintenance.

The AP200 holder is equipped with an integral solution earth facility. This provides high stability of measurement and enables the transmitter to supply full sensor diagnostics.

### Reduced Maintenance through In-line Cleaning

50% of pH sensors in chemical processes benefit from regular cleaning. When done manually, this can be laborious and costly – so is often ignored. The AP200 makes it possible to automate sensor cleaning, driven by advanced Analyzers such as ABB's AX400 or TB84PH.

The AP200 system earth rod also serves as a jet-spray head enabling the user to supply a periodic burst of cleaning agent across the sensor. This is delivered through two nozzles, one directed at the measuring element and the other at the reference junction.

An aggressive, but little-and-often approach, keeps the sensor in prime condition, even in gypsum-laden scrubber applications.

Generally, water is a good solvent but, on other occasions, use of an acid, alkali or even detergent is beneficial.

### Simple Handling without Special Tools

Each sensor system is protected from the elements by a flip-top cap. Simple click-to-lock or dismount provides quick access to the electrode cable and optional cleaning agent delivery tube.

Attachment to process lines is simply performed with the union nut mechanism. Integral lugs facilitate dismantling without handling the pH electrode and bayonet connectors fix the sheath in place. No special tools are required.

The inner core is an electrode block common to all formats of holder system; insertion, immersion and flow-through. This enables easy interchanging and simplifies stocking.



*Solution Earth Rod for Sensor Diagnostics*



*Dual Jet-spray Enables Auto-Cleaning*



*Easy Access without Special Tools*

## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

### pH/Redox (ORP) Combination Sensor with Rapid Temperature Response for Critical Processes – Series AP120

The AP120 is a series of highly process-resistant 12mm combination pH/Redox (ORP) electrodes used in the AP200 System. Some of the benefits available to users are:

- Exceptional resistance to poisoning and pressure
- IP67 (NEMA 6P) Ingress Protection
- High corrosion resistance and steam sterilizability
- Assured high accuracy of calibration and operation
- Rapid response enabling tighter process control
- Unparalleled resistance to plugging
- Extended life and improved performance

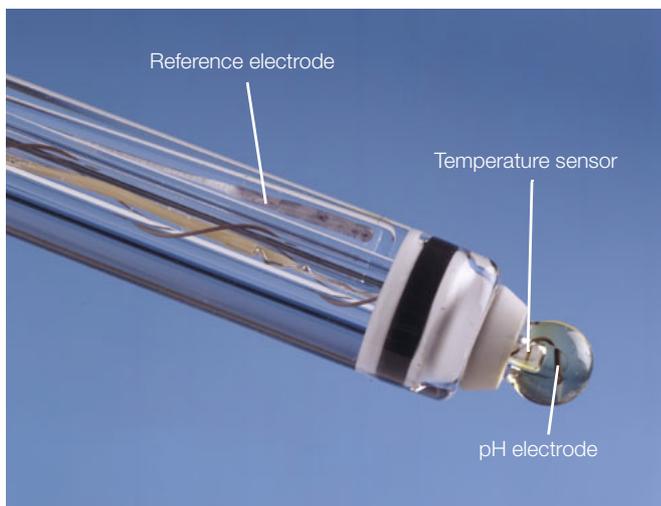
### Exceptional Process Resistance

AP120 electrodes are equipped with a rugged solid electrolyte providing effective resistance to process poisons and fluctuating pressures. This far outstrips the performance of lesser, gelled-slurry type electrodes. The sensor is also backed with an annular, PTFE junction giving excellent dirt-repellence.

### Balanced pH, Reference and Temperature

pH electrodes use temperature compensation for both measuring and reference elements. The location of the compensator is often a compromise, being either close to one element or the other. Plastic-shafted sensors, with the compensator at the rear, often have very slow responses – up to 30 minutes. This means that a calibration performed immediately after removal from a hot process could be incorrect.

The AP120 electrode has all three elements very closely located and a very fast temperature response. This ensures high integrity of calibration and leads to tighter control.



*Balanced Position of Sensing Elements*



*The Series AP120 pH/Redox (ORP) Combination Sensor*

### Industry-standard VarioPin Cable Connector

Already a number of years in service, the proven multi-pole VP connector facilitates easy connection and disconnection of multi-parameter sensor signals.

Protected to IP67/NEMA 6P (exceeds NEMA 4X), and suitable for steam sterilization, the sensor connector is a real tough performer.

Having been adopted by a number of analytical sensor suppliers, the high-integrity connection enables easy interchangeability of supply.



*High-integrity Multi-parameter Connector*

## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

### Model AP201 Insertion System

AP201 is an in-line insertion system for pipes and tanks. Process connection is achieved with an R1<sup>1</sup>/<sub>4</sub> in. (tapered BSP male) or NPT male adapter. Process-wetted parts are PPS Ryton™ and stainless steel. Maintenance access is by G1<sup>1</sup>/<sub>4</sub> in. (BSP) union nut and bayonet fittings.



Model AP201 Insertion System

### Model AP202 Flow-through System

AP202 provides an additional polypropylene flow-through holder for installation in bypass lines.

The unit is equipped with Rp1 in. (BSP female) process connections.

Maintenance access is by union nut and bayonet fittings without special tools.



Model AP202 Flow-through System

### Model AP203 Immersion (Dip) System

Mounting in tanks and channels is achieved with AP203 polypropylene immersion holder systems in 1, 2 or 3 m (3.3, 6.6 or 10 ft) lengths. Dip length is adjustable on-site enabling the system to match actual process needs. Two flange-mounted locking screws enable the holder to be decoupled from the process without detaching the flange.

The mounting flange has both DN50 and ANSI 2 in. mounting holes providing flexibility of installation possibilities.

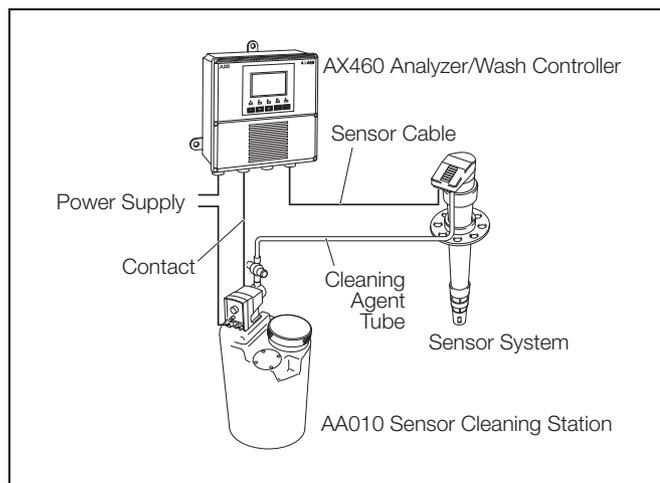
A dip guard protects the electrode from damage during maintenance. When removed, in the reverse position it provides a key to detach the electrode block from the system without the operator handling the electrode.



Model AP203 Immersion (Dip) System

### AA010 Sensor Cleaning Station

The AA010 Cleaning Station provides everything in one neat package to deliver powerful, chemical or water, jet-wash cleaning for your AP200 system. It includes a chemical dosing pump with fault-indicating relay (N/C) and pressure relief valve. The cleaning fluid is delivered from a 60l polyethylene tank via 10m (32.5 ft) of 6 mm (0.24 in.) OD PE tubing and injection valve to the sensor system.



Model AA010 Sensor Cleaning Station

## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

### Specification

#### All Systems

##### Materials

Shaft and cap	Polypropylene
Sensor body	Ryton™ PPS
Ground rod/Spray tube	316 Stainless steel

##### Jet-wash facility

Non-return function	Integral one-way valve
Spray tube connection	6mm compression fitting
Recommended operating pressure	Min. 1 bar (15 psi) over process pressure

##### Certification

The systems comply with SEP (Safe Engineering Practice) level Pressure Equipment Directive 97123/EC

---

#### AP201 Insertion System

##### Maximum Temperature

130 °C (266 °F)	PPS and steel adapters
90 °C (194 °F)	Polypropylene adapter

##### Maximum Pressure

6 bar (90 psi) @ 25°C (77°F)

##### Process Connections

Union nutG	1 <sup>1</sup> / <sub>4</sub> in. (BSP)
PPS process adapter	R1 <sup>1</sup> / <sub>4</sub> in. (tapered BSP male)
PP process adapters	R1 <sup>1</sup> / <sub>4</sub> in. 1 <sup>1</sup> / <sub>4</sub> in. NPT
Stainless steel adapters	R1 in. (tapered BSP male) 1 in. NPT
Stainless steel sockets	Angled DN25 Straight DN25

---

#### AP202 Flow-through System

##### Materials

Flow-cells	Polypropylene Stainless steel
------------	----------------------------------

##### Maximum Temperature

90 °C (194 °F)	Polypropylene flow cell
130 °C (266 °F)	Stainless steel flow cell

##### Maximum Pressure

6 bar (90 psi) @ 25°C (77°F)

##### Process Connections

Union nut	G1 <sup>1</sup> / <sub>4</sub> in. (BSP)
Flow-cell inlet & outlet	Rp1 in. (BSP female) or 1 in. NPT

#### AP203 Immersion (Dip) System

##### Materials

Guard, shaft and cap	Polypropylene
----------------------	---------------

##### Maximum Temperature

90 °C (194 °F)

##### Maximum Pressure

Not applicable

##### Process Connections

Sliding flange	Composite DIN & ANSI DN50 / ANSI 2 in.
Immersion lengths	1 m (3.3 ft) 2 m (6.6 ft) 3 m (10 ft)

---

#### AP120 Combination Sensor

##### Measuring Ranges

AP121/0 General Process	0 to 14 pH 0 to +100 °C (32 to 212 °F)
AP121/1 High Temp/Alkali	0 to 14 pH 10 to 130 °C (50 to 266 °F)
AP121/2 Low Resistance	0 to 10 pH -5 to 50 °C (23 to 122 °F)
AP121/6 Pt Redox (ORP)	± 2000mV 0 to 130 °C (32 to 266 °F)

##### Reference Electrode System

Primary Electrolyte	Solid, Ag-free Gel with KCl charge
Inner reference system	Ag/AgCl
JunctionAnnular	PTFE, sterilizable
Nominal zero point, E <sub>0</sub>	7 pH
Minimum Conductivity	> 50 µS/cm

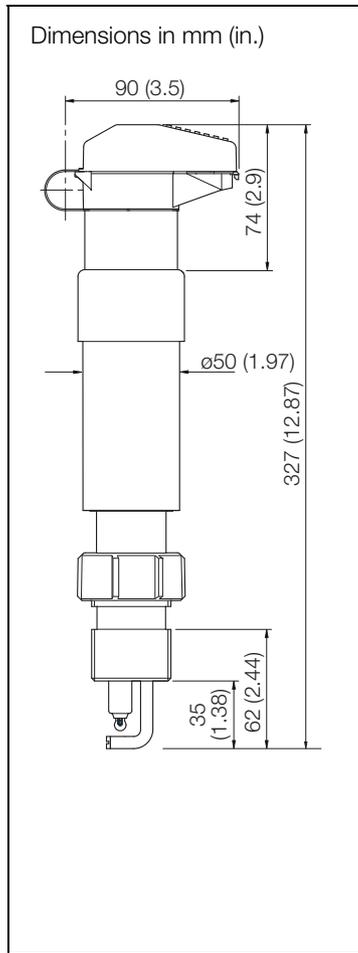
##### General Data

Temperature Sensor	(pH only) Integral Pt100
Temperature response	T <sub>90</sub> <70s
Electrode Shaft Length	120 mm
Max. Pressure	6 bar (90 psi)
Ingress Protection	IP67/NEMA 6P (exceeds NEMA4X)
Connection head	Sterilizable VP (VarioPin) connector with PG13.5 thread

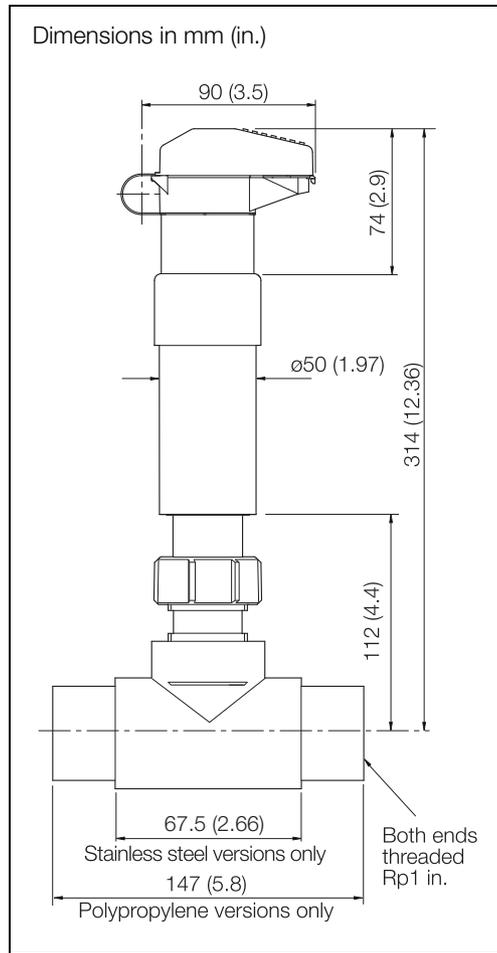
## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

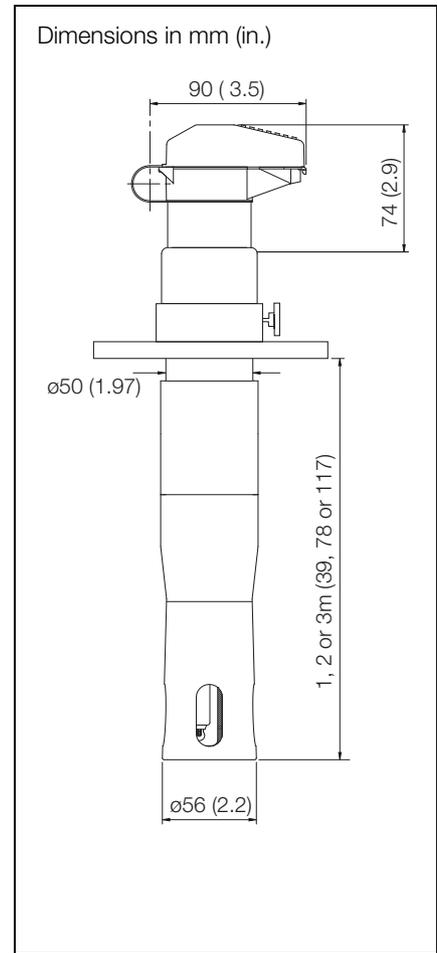
### Overall Dimensions



Model AP201  
Insertion System

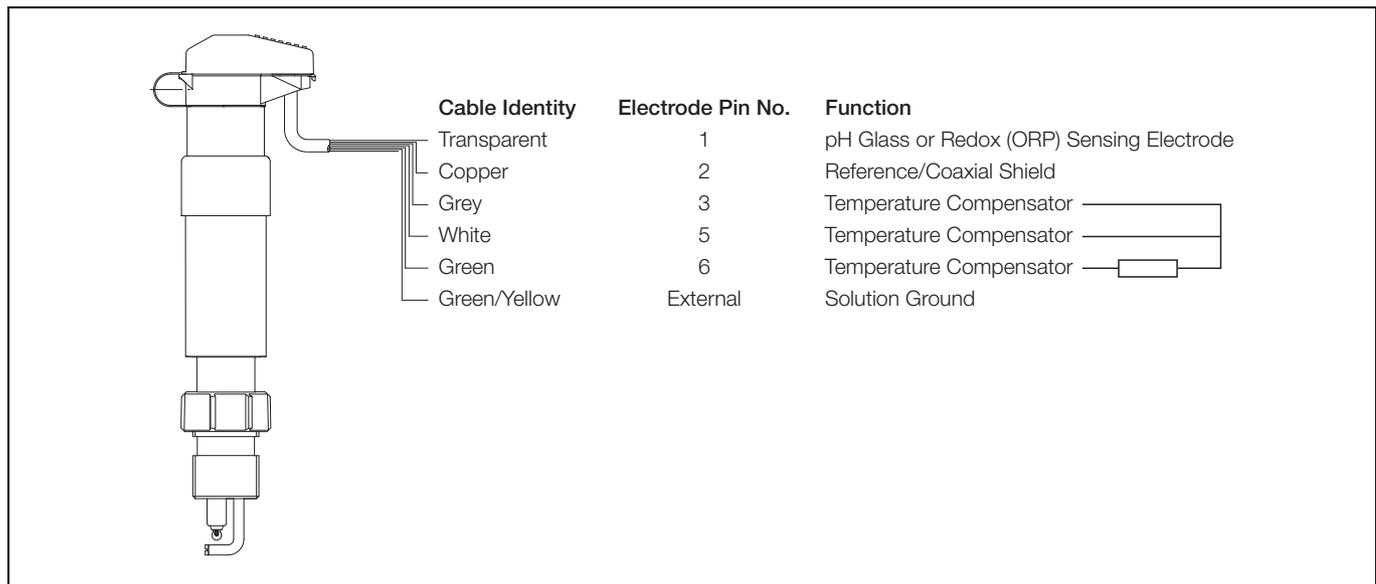


Model AP202  
Flow-through System



Model AP203  
Immersion (Dip) System

### Sensor Cable Terminations



## AP200 Series

Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

### Ordering Information – Sensor System

pH/Redox (ORP) Combination Sensor	AP20	X/	XX	X	0	X	X	X
<b>Process Connection Type</b>								
<b>Insertion Systems</b>								
	1							
PPS Ryton™ : R1 1/4 in. BSPT male adapter (7690 130)								05
Polypropylene 1 1/4 in. NPT male adapter (7690 134)								06
Polypropylene R1 1/4 in. BSPT male adapter (7690 129)								12
316SS: DN25, angled socket (7690 133)								07
316SS: DN25, straight socket (7690 132)								08
316SS: R1 in. (BSP taper) male adapter (7690 128)								09
316SS: 1 in. NPT male adapter (7690 131)								10
<b>Flow-Through Systems</b>								
	2							
Polypropylene system Rp1 in. (BSP Female) inlet & outlet								11
Stainless steel Rp1 in.								14
Stainless steel 1 in. NPT								18
<b>Immersion (Dip) Systems</b>								
	3							
Length 1 m (3.3 ft)								01
Length 2 m (6.6 ft)								02
Length 3 m (10 ft)								03
<b>Earth rod/Spray Jet</b>								
316SS earth rod only								0
316SS earth rod/spray jet								1
316SS earth rod/spray jet + cleaning tube								2
<b>Reserved</b>								
								0
<b>Electrode Type</b>								
None								0
pH General Process, 0 to 14 pH, 0 to 100 °C								1
pH High Temperature, 0 to 14 pH, 10 to 130 °C								2
pH Low Temperature, 0 to 10 pH, -5 to 50 °C								3
Redox (ORP) Platinum 10 to 130 °C								6
<b>Length of Cable (and Cleaning Tube if fitted)</b>								
None supplied								00
5 m (16 ft)								05
10 m (33 ft)								10
15 m (49 ft)								15
20 m (66 ft)								20
Other length								99
<b>Manual</b>								
None								0
English								1
German								2
French								3
Spanish								4

### Ordering Information – Spare Electrode and Cable

#### pH Electrodes with integral Pt100\*

Electrode Type	Part Number
Yellow glass (A12) – General Process	AP121/11000
White glass (GHS) – High Temperature/Alkali	AP121/21000
Blue glass (C1B) – Low Resistance	AP121/31000

\*Note. AP121 electrodes also available with integral Pt1000 – consult factory.

#### Platinum Redox (ORP) Electrodes

Electrode Type	Part Number
Platinum pin Redox (ORP)	AP121/60000

#### Detachable Cables

Cable Length	Part Number
5 m (16 ft)	7690050
10 m (33 ft)	7690051
15 m (49 ft)	7690052
20 m (60 ft)	7690053

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA163201R1001

DS/AP200-EN Rev. J 07.2014

# AV410, AV411, AV420, AV412 and AV422 Single and dual input dissolved organics monitor

A robust, easy-to-use range of continuous on-line monitors



**Dual input enables two measurements from one instrument, each input can be either high range or low range**

- cost effective

**Surrogate color measurement**

- significant savings on operational costs through lower maintenance requirements

**Savings on alum or ferric are achieved on potable water treatment plants**

- coagulation control cost saving

**Less alum, less sludge**

- reduced sludge disposal costs

**THM (trihalomethanes) precursor alert**

- provides advanced warning of increased risk of THM development

**Automatic compensation for turbidity**

- reduces initial capital expenditure, minimizing operational costs

**Reagentless operation**

- significant savings in operational expenditure

**On-line diagnostics**

- cleaner failure, loss of signal, out of sample

## AV400 Series Dissolved Organics Monitors

Many dissolved organic carbon compounds (DOC) commonly found in potable water absorb ultraviolet radiation. These include Humic and Fulvic Acids that gives water a characteristic yellow color. Dissolved organics can also result in the formation of Trihalomethanes (THMs) as a by-product of chlorination.

The AV400 Series of monitors are designed for optimizing the performance of potable water treatment plants, providing significant cost savings and ensuring the quality of the final treated water.

**AV410/AV411** Single and Dual Low Range Dissolved Organics Monitors (0 to 20mg<sup>-1</sup>C) are designed for use on potable water treatment plants. In particular, they can be used to monitor the quality of the outlet from sand and carbon filters to provide a THM precursor measurement. Long term field trials have shown that maintenance demands on these applications are minimal.

**AV420/AV422** Single and Dual High Range Dissolved Organics Monitors (0 to 100mg<sup>-1</sup>C) are specifically designed to provide surrogate color monitoring on the incoming raw water in potable water treatment plants for predictive control of the coagulant. They can also be used to detect the rise in dissolved organic carbon from algal bloom toxins in rivers and reservoirs to provide intake protection on potable water applications .

**AV412** Dual High and Low Range Dissolved Organics Monitor conveniently combines the high and low range measurements so that both the pre-coagulation and post sand filter samples can be monitored.

The measured value is updated every 2 seconds when the lamp is flashed and is calculated from over 200 readings that are taken during the brief flash duration. This technique has demonstrated, during extensive field trials, superior sensitivity and performance when compared with traditional color measurement methods.

## Turbidity Compensation

In addition to the absorption measurement at 254nm, a second measurement at 400nm enables the monitor to compensate automatically for fluctuations in turbidity. The significant benefits of a straight-through system, without the need for expensive and maintenance-intensive sample filter systems, ensures long-term reliability, essential for on-line control.

## Reagentless Operation

The monitor uses no chemical reagents during operation, reducing cost of ownership to an absolute minimum. When compared to a color monitor (the traditional method of coagulation control), the cost of ownership, together with the initial capital purchase cost, can be recovered in 2 years.

## Maintenance

Minimal maintenance is required due to the simplicity of the monitor. Apart from periodic validation of the calibration of the monitor and annual replacement of the wiper blades, there is no need for manual intervention.

## Calibration

Calibration is a simple procedure using high-quality demineralized water for zero and a suitable phthalate calibration standard to adjust the span.

The monitor design ensures that the system is extremely stable and calibration needs to be performed only once or twice a year.

## Installation of the Sensor

A wall-mount bracket is supplied as standard to enable the flow-through sensor to be mounted on the back-plate.

## Alarms

Three alarms are supplied as standard. These can be configured as high or low programmable alarms or as a status alarm.

## Light Source

The light source is monitored continuously for correct operation and is operated at a fraction of the normal frequency of the operating voltage intended by the manufacturer. Only 13% of the rated lamp life is used in 10 years. This results in a very stable light source, keeping operating costs to a minimum.

## Auto-Cleaning

Optical cleaning is a key feature, ensuring optimum performance with the minimum of manual intervention. The cleaning interval is programmable to accommodate varying sample conditions.



*Auto-cleaning Mechanism*

## AV400 Series Transmitter

The transmitter incorporates the latest technology to provide a highly reliable, yet flexible, feature-packed device designed to satisfy a diverse range of process monitoring and control applications. On dual-input monitors both measured parameters are displayed simultaneously.

### High Functionality as Standard

The display can show inferred values, enabling the monitor to be configured to provide the information most valuable to the user. A correction factor must be provided and entered by the user to make inferred units useful. The inferred units include:

- Absorbance units/meter
- Color (H)
- Coagulant Dose (mg/l)
- TOC (mg/l)
- User Defined

All versions are supplied with two fully isolated current outputs as standard. Both outputs can be ranged independently on single input versions. Each one can be assigned to either sensor input on dual input versions.

Three programmable relay set points are available that can also be assigned as required.

Innovative features such as a power saving display and a diagnostic current output option all contribute to a low cost of ownership.



*Dissolved Organic Display*

### Significantly Reduced Maintenance Costs

The transmitters are supplied as standard for 85 to 265V AC operation. There are no inner switches to be set.

The transmitters can also be provided for 9 to 36V DC operation that reduces maintenance costs significantly by removing the need for costly, annual safety tests to ensure compliance with safety procedures.

### Energy Saving Display

The backlit display is designed to operate in all types of environment and shows the measured parameter(s) and, on a separate 16-character display line, diagnostic and computed information.

For energy conservation, the backlight can be set to switch off automatically after 60 seconds of inactivity.



*Backlight Can Be Set to Switch-off When Inactive*

### Easy Access Installation Terminals

Easy access to the terminations ensures rapid and cost-effective installation. The wall-/pipe-mount version is designed to ensure that cable connection is simple and convenient. Ingress protection of the electronics section is retained even when the terminal compartment is opened.



*AV400 Termination Chamber Makes Access Easy*

**Applications**

There are many applications where the AV400 Dissolved Organics Monitor can be used to improve on more traditional methods of measurement and control of water quality.

**Surrogate Color Monitor for Coagulation Control**

Extensive field trials have established that the AV400 High Range Dissolved Organics Monitor performs well as a surrogate color monitor on applications where the major color constituents of the raw water are humic and fulvic acids. These acids are organic compounds that readily absorb at 254nm.

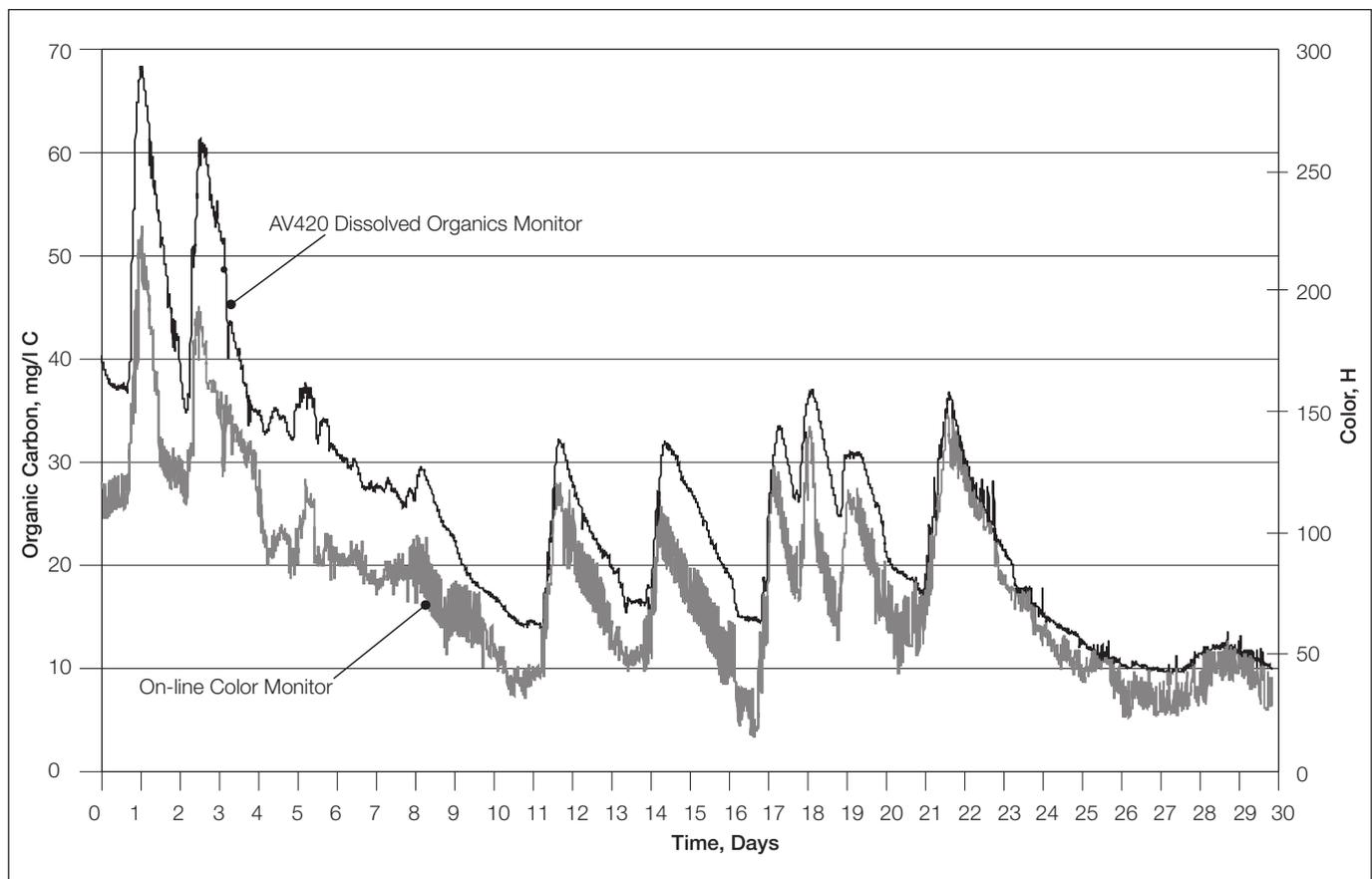
Reliable and extremely cost-effective on-line control can be achieved using this compact and simple-to-install monitor.

Benefits:

- Reagentless operation
- Automatic cleaning
- Virtually maintenance-free
- Long lamp life
- High stability
- Improved water quality

Potential cost savings:

- Reduced manpower
- Improved process control
- Reduced sludge disposal costs



Typical Correlation Between True Color and Absorbance at 254nm in Potable Water

### **Algal Bloom Toxins**

The formation of toxins as a result of the decomposition of algal blooms, that die out during cold periods, frequently cause taste and odor problems and a risk of THMs (Trihalomethanes) in the final treated water. It has been shown that monitoring the DOC (dissolved organic carbon compounds) in the raw water gives an early warning of these events so the appropriate action can be taken. This often involves the addition of powdered activated carbon at the coagulant dosing point.

### **Trihalomethanes (THMs)**

The water reaching the disinfection stage of the potable treatment process may contain organic compounds from any of three sources:

Humic and fulvic acid breakthrough from the coagulation and filtration stage of the plant

Organic compounds from the decomposition of dead algal blooms

Organic compounds from industrial effluent and sewage discharges into the raw water source.

These pass through the coagulation stage but can be removed by an activated carbon stage.

These sources can give rise to a range of organic compounds that, if conditions are right, will react with the chlorine used for disinfection to form THMs. The organic compounds are referred to as THM precursors. THMs are recognized carcinogens, they are known to cause miscarriages, and are also linked to heart, lung, kidney, liver, and central nervous system damage.

Increasing concerns over THMs have resulted in the need for advance warning of the unfavourable conditions that could encourage the development of THMs in drinking water.

When used on final chlorinated water, the monitor provides advance warning of any increase in dissolved organic carbon, thereby enabling rapid corrective action to reduce the risk. Under such clean water conditions the maintenance becomes virtually zero.

Many of the low-range monitors are now used for this increasingly critical application, often in conjunction with turbidity measurement.

## Specification

### General

#### Sensor range

(Based on potassium hydrogen phthalate calibration standards)

AV410/411 Low range 0 to 20mg<sup>l</sup>-1 C

AV420/422 High range 0 to 100mg<sup>l</sup>-1 C

#### Linearity

Low range ±2% of reading or 0.15mg<sup>l</sup>-1 C whichever is the greater

High range ±2% of reading or 0.5mg<sup>l</sup>-1 C whichever is the greater

#### Reproducibility

Low range ±0.15mg<sup>l</sup>-1 C

High range ±0.5mg<sup>l</sup>-1 C

#### Inferred units

Absorbance units/metre

Color (°H)

Coagulant dose (mg<sup>l</sup>-1)

TOC (mg<sup>l</sup>-1)

User Defined

#### Maximum current output scale expansion

Low range 0 to 2mg<sup>l</sup>-1 C

High range 0 to 20mg<sup>l</sup>-1 C

#### Response time

Normally three minutes for 90% step change depending on damping factor

#### Lamp life

Rated by the manufacturer at 1.2 x 10<sup>9</sup> flashes (10 years continuous operation at the rate of one flash at 2s intervals [typical] equates to 13.1% of the rated lamp life)

#### Internal wiper cleaning system

Programmable, operation frequency 15, 30, 45 and 60 minutes 2, 4, 6, 12 and 24 hours

#### Maximum distance between transmitter and sensor

750mm (29.5 in.)

### Sample

#### Flow rate

0.5 to 5l min<sup>-1</sup> (free of air bubbles).

A higher flow rate is required at high turbidity levels

#### Temperature

0 to 40°C (32 to 104°F)

#### Pressure

The sensor should be operated at atmospheric pressure but can withstand 3bar (43.4 psi) max.

### Display

#### Type

Dual 4 1/2-digit, 7-segment backlit LCD

#### Information

16-character, single line dot matrix

#### Resolution

Low range 0.01mg<sup>l</sup>-1

High range 0.1mg<sup>l</sup>-1

#### Energy saving function

Backlit LCD configurable as ON or Auto Off after 60 seconds

#### Logbook

Electronic record of major events and calibration data

#### Real-time clock

Records time for logbook and auto cleaning

#### Diagnostics

Out of sample

Lamp disabled

Loss of signal

Electronic failure

#### Languages

English

French

German

Italian

Spanish

### Outputs

#### Current Outputs

##### Number of signals

2 fully isolated current outputs supplied as standard, configurable to one or both sensor outputs

Current outputs also programmable to any value between 0 and 22mA to indicate system failure

##### Output current

0 to 10mA, 0 to 20mA or 4 to 20mA

##### Maximum load resistance

750Ω at 20mA

##### Accuracy

±0.25% FSD ±5% of reading

##### Resolution

0.1% at 10mA, 0.05 at 20mA

##### Serial communication

PROFIBUS

## ...Specification

### Relay outputs

#### Number of relays

Three supplied as standard,  
configurable to one or both sensor inputs or status

#### Set point adjustment

Fully programmable as normal or failsafe, high/low or status

#### Hysteresis

Programmable 0 to 5% in 0.1% increments

#### Delay

Programmable 0 to 100 minutes in 1 minute intervals

#### Relay contacts

Single-pole changeover

Rating 5A 115/230V AC, 5A DC

#### Insulation

2kV RMS contacts to earth/ground

---

### Power supply

#### Voltage requirements

100 to 240 V AC, 50/60 Hz  
(90 V Min. to 264 V Max. AC)

Optional 12 to 30 V DC

#### Power consumption

20 W

#### Insulation

Mains to earth (line to ground) 2kV RMS

### Mechanical Data

#### Transmitter

IP65 (not evaluated under UL certification)

Dimensions 192mm (7.56 in.) high x 230mm (9.06 in.) wide x  
94mm (3.7 in.) deep

Weight 1kg (2.2 lb)

#### Sensor

Low Range Dimensions 327mm (12.87 in.) wide  
x 410mm (16.14 in.) high x 162mm (6.38 in) deep

High Range Dimensions 405mm (15.94 in.) wide  
x 373mm (14.68 in.) high x 136mm (5.35 in) deep

Weight 6kg (13.2 lb)

#### Cable entry types

Standard 5 or 7 x M20 cable glands

N. American 7 x knockouts suitable for 1/2 in. Hubble gland

---

### Environmental Data

#### Operating temperature limits

0 to 50°C (32 to 122°F)

#### Storage temperature limits

-25 to 75°C (-13 to 167°F)

#### Operating humidity limits

Up to 95%RH non-condensing

#### EMC emissions and immunity

Meets requirements of:

EN61326 (for an industrial environment)

EN50081-2

EN50082-2

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### Approvals, Certification and Safety

#### Safety approval

UL

#### CE Mark

Covers EMC & LV Directives (including latest version EN 61010)

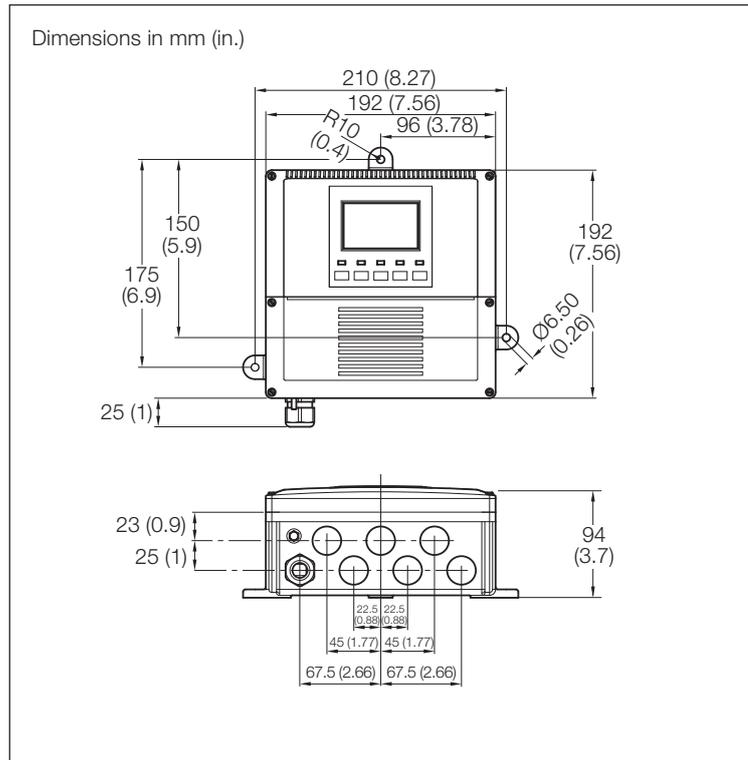
#### General safety

EN61010-1

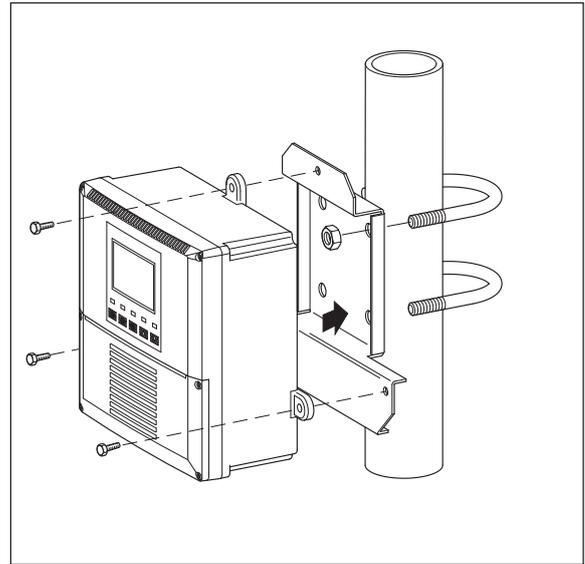
Overvoltage Class II on inputs and outputs

Pollution Category 2

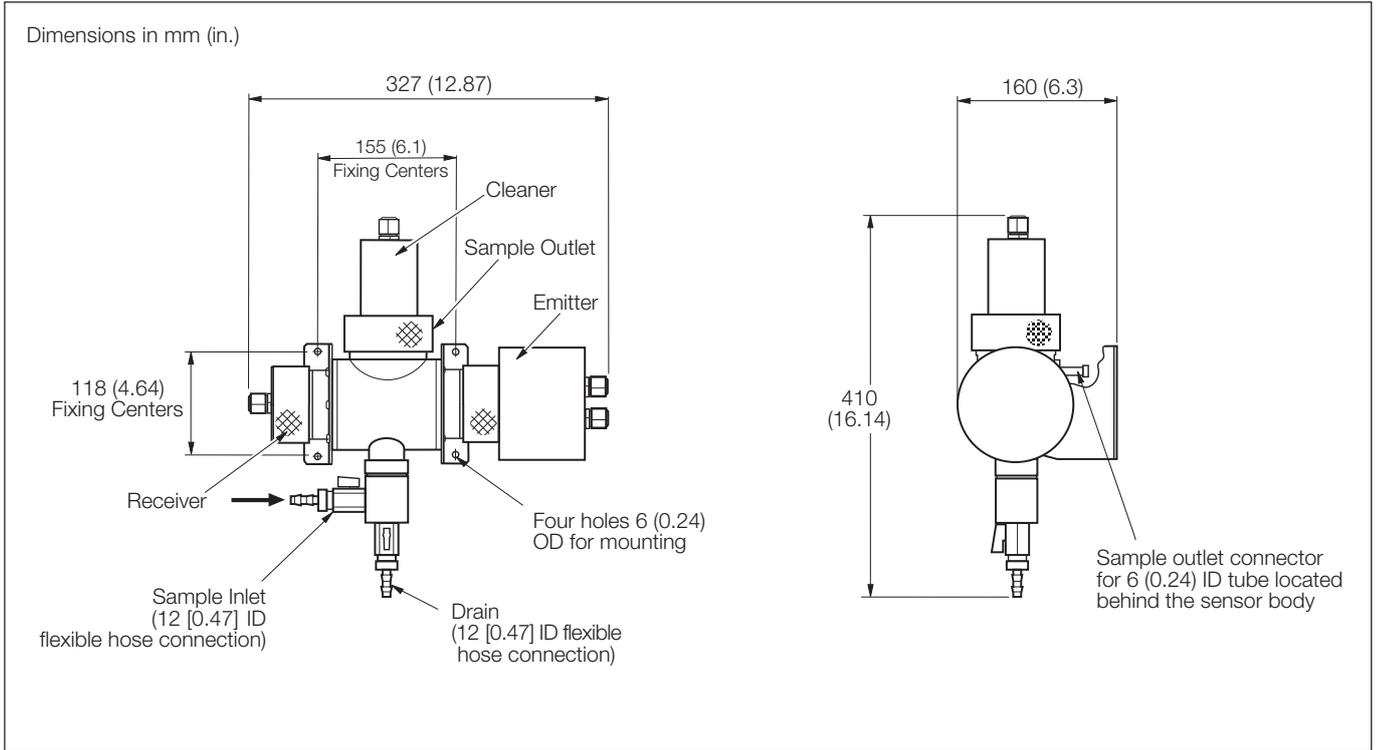
## Overall Dimensions



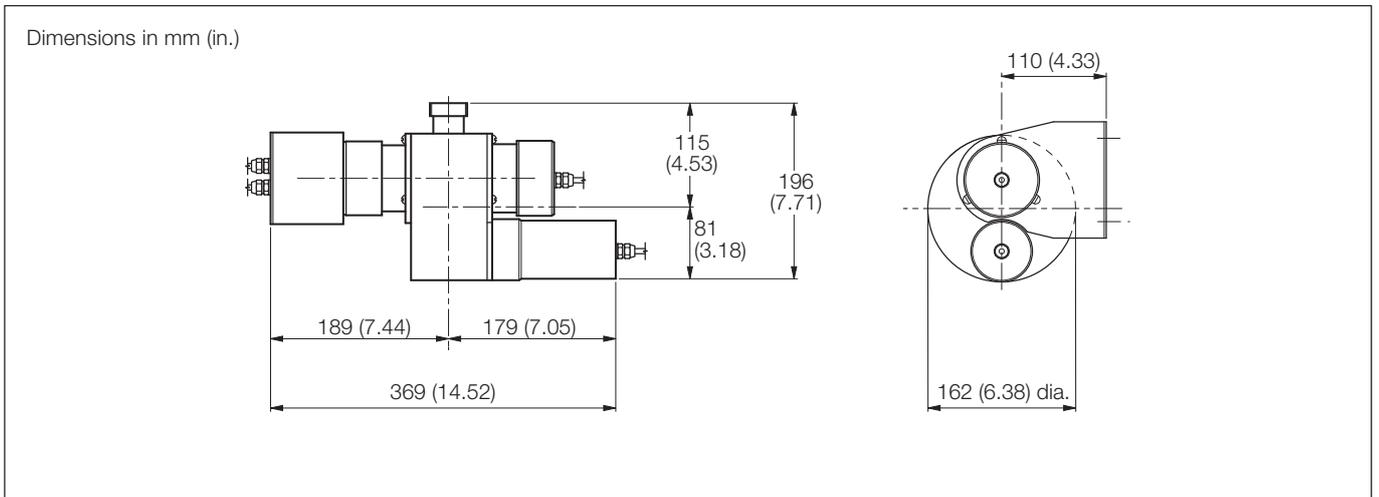
Transmitter



Pipe-mount Details

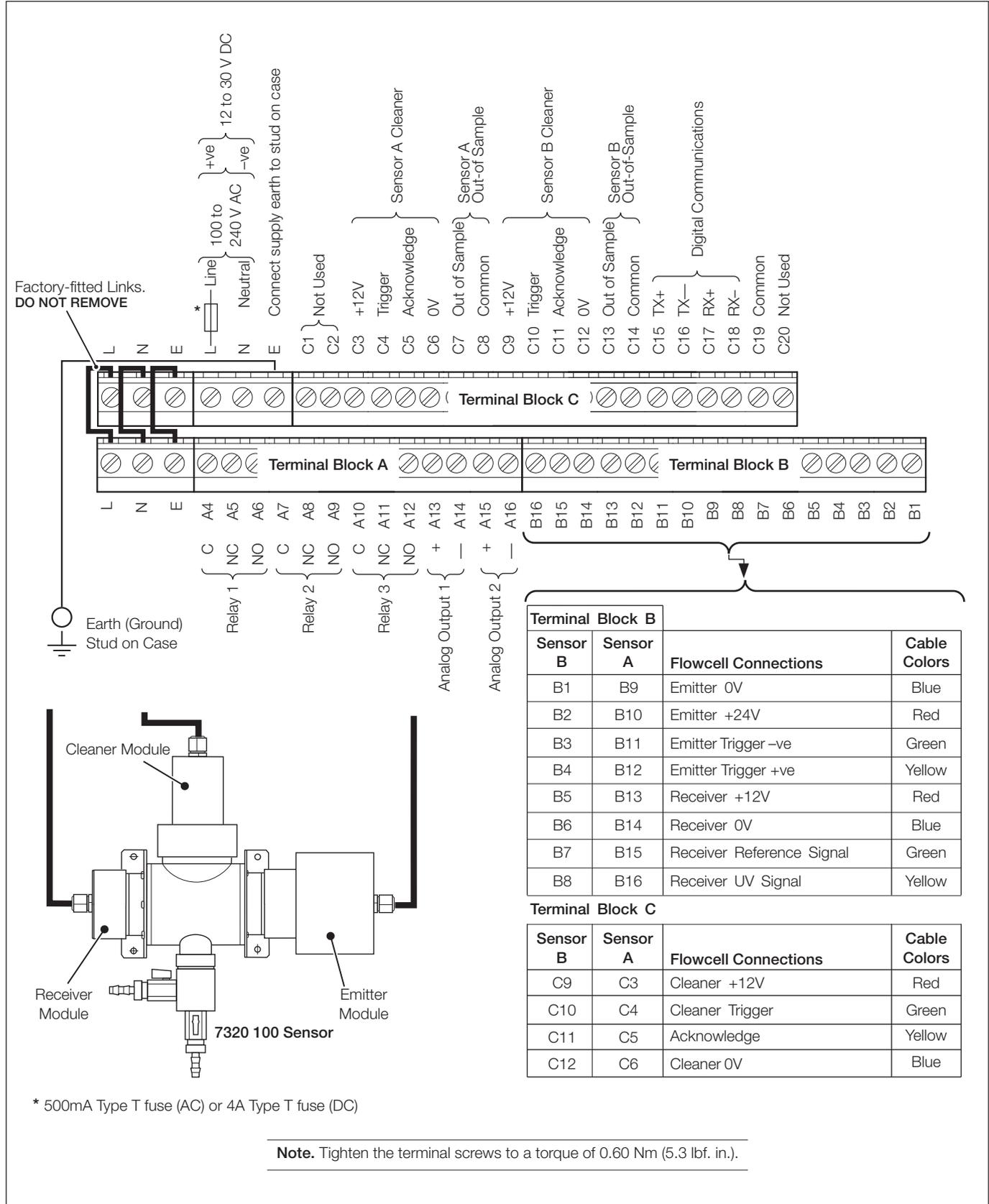


*Low Range Sensor*



*High Range Sensor*

**Electrical Connections**



### Ordering Information

Single & Dual Dissolved Organics Monitors for Potable Water Treatment AV410, AV411, AV420, AV412 & AV422		AV4	X	X	/X	X	X	0	X
<b>Parameter 1</b>									
Low range dissolved organics			1						
High range dissolved organics			2						
<b>Parameter 2</b>									
None				0					
Low range dissolved organics*				1					
High range dissolved organics				2					
<b>Transmitter Enclosure Types</b>									
<b>Wall – IP65 General</b>									
Wall-mount – cable glands fitted					/1				
Wall-mount – cable glands fitted, complete with pipe-mount bracket					/2				
<b>Wall – IP65 N. American</b>									
Wall-mount					/6				
Wall-mount complete with pipe-mount bracket					/7				
<b>Serial Communications</b>									
None							0		
PROFIBUS (pending)							2		
<b>Power Supply</b>									
100 to 240 V AC, 50 to 60 Hz								0	
12 to 30 V DC								1	
Reserved									0
<b>Manual</b>									
English									1
French									2
Italian									3
German									4
Spanish									5

\* Not available when High range dissolved organics selected for Parameter 1.

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA873402R1001

DS/AV4ORG-EN Rev. D 03.2011

# AW400 Residual chlorine monitor

For the measurement of Free and Total Residual Chlorine, Chlorine Dioxide or Ozone in water



#### Total and Free Residual Chlorine Measurement

- add potassium iodide to reagent to convert free chlorine measurement to total chlorine

#### Reagentless Operation

- reduced operating costs with reagentless operation at a pH of 7.5 or less

#### Multiple Sensor Input Capability

- reduced installation costs for multiple point monitoring operations

#### Self Cleaning Sensor Assembly

- prolongs sensor life and maintains accuracy

#### Fast Response Time

- instant response to changes of residual chlorine, unlike batch/DPD methods

#### Pressure Regulated Sample Flow

- no additional plumbing required to ensure optimum sample delivery rate and pressure

## Introduction

Residual chlorine is one of the most important measurements for the effective monitoring of cooling, potable and industrial water treatment processes. ABB's new AW400 Residual Chlorine Monitoring System incorporates the features our customers need to monitor and control residual chlorine levels accurately and affordably. The design enables users to either connect up to three residual chlorine monitoring sensors to the system or to combine pH, ORP and residual chlorine sensors; thus reducing the cost of each measurement considerably.

Low cost of purchase is only part of the answer to providing value to our customers; low cost of ownership is also required. For the majority of waters with pH lower than 7.5, ABB's residual chlorine monitors can measure free chlorine, chlorine dioxide and ozone without the need for expensive reagents and the manpower needed to maintain those reagents. For residual total chlorine, reagents of Acetic Acid and Potassium Iodide are added with a simple-to-maintain peristaltic pump. This keeps costs low and provides up to 60 days un-supervised operation. The AW400 employs a unique 'Vortex Cleaning' system to clean the electrodes. Unlike many sensors on the market that require problematic electric motors to mix the reagents and sample, as well as keep the electrodes clean, the AW400's Vortex Cleaning System induces a spiral flow of fine corundum sand through the cell to scour the electrodes, thus eliminating the need for electric motors. The AW400 is an easy-to-use device; process connections are simple and the user menus are easy to follow for fast setup.

The AW400 is compatible with ABB's 17XX pH and ORP sensors and can be equipped with PID control for feed-forward dosing applications.

When it comes to meeting our customer's demands for accurate, affordable residual chlorine measurement, ABB's AW400 exceeds expectations.



## Measurement Principle

The sensor is an amperometric cell comprising two concentric electrodes; an inner, spiral, gold measuring electrode and an outer copper cylinder – the 'counter-electrode'. Sample water flows into the electrode chamber through nozzles located in the measuring cell. The cell also contains a small amount of a special corundum sand that is circulated by the water and acts as an abrasive on the electrodes, keeping them at peak sensitivity. The AW400 measuring cell is polarized because of the normal potential of these two different metal electrodes in water. When oxidizing substances such as chlorine, chlorine dioxide, ozone or their derivatives are present in the sample between the electrodes, the measuring (gold) electrode is depolarized and the counter electrode (copper electrode) dissolves as  $\text{Cu}^{++}$ . This electron flow generates a signal (current), that is proportional to the oxidizing agent concentration in the sample. The signal is compensated for temperature variations via software in the AW400 transmitter through a PT100 thermistor.

## Applications

Here are just a few of the common residual chlorine level monitoring applications for which the AW400 is ideally suited:

- drinking water
- cooling water for power stations and industrial facilities
- fruit and vegetable disinfection baths
- tertiary treated waste water
- swimming pools and spas

The choice is yours, you choose the disinfectant... we'll measure it! Regardless of the disinfectant used at your site, Chlorine, Chlorine Dioxide, Bromine or Ozone, the ABB AW400 is ready for use; simply select the disinfectant from the user-menu on the monitor.

## Non-recommended applications

Meat and poultry 'red water' disinfection baths, saltwater waste waters with high oil/fat contents and processes with fibrous sediment that could plug the water flow through the system are all applications where the use of the AW400 is not recommended.

## Specification

### Measurement Range

Chlorine, Chlorine Dioxide,  
Ozone 0 to 20 ppm (mg/l)

### Measurement Mode

Measurement technology Amperometric cell  
Measurement interval Continuous

### Measurement Performance

Accuracy Unbuffered: 2% or  $\pm 0.01$  10ppb, whichever is the greater at pH <7.5  
Buffered: 2% or  $\pm 10$ ppb, whichever is the greater at <pH 10

Sensitivity 0.001 ppm

Minimum Detection Limit 0.005 ppm

Drift Zero drift:  $\pm 1\%$  over 30 days Max.  
Span drift:  $-5\%$  over 30 days Max.

Response Time 90% in less than 90 seconds

Interferences Samples containing high concentrations of metal ions or other strong oxidants may affect analyzer operation

### Environmental Data

Ambient Operating Temperature  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$

Ambient Operating Humidity 80% RH at  $31^{\circ}\text{C}$ , with linear decrease down to 50% RH at  $40^{\circ}\text{C}$

Sample Temperature Compensated between 2 and  $50^{\circ}\text{C}$  ( $36^{\circ}\text{F}$  and  $122^{\circ}\text{F}$ ).

Sample Inlet Pressure 0.2 to 4.0 bar (3 to 60 psi).  
For pressures over 4 bar (60 psi) install a pressure reducing valve.  
Recommended operating pressure is 2 bar (30 psi)

Sample Outlet Pressure Pressureless

Sample Flow Continuous, 60 - 75 l/hr

Sample pH Value 4 to 7.5 (Buffer feed assembly available for pH greater than 7.5). No correction is needed when measuring chlorine dioxide and ozone.

### Maintenance

Maintenance Interval Recommended annual replacement of O-rings and electrodes

Calibration single or two-point manual calibration  
Comparison of lab method with process sample or de-chlorinated

### Cell Construction Material

Electrodes Gold / Copper

Electrode chamber plexiglas

Differential pressure regulator PVC

### Mechanical Data

Ingress Protection

Transmitter IP65

Measurement Cell IP64

Sample connections

Inlet/Outlet:  $3/8"$  OD polyethylene or flexible PVC tubing

### Electrical

Mains voltage 115 Vac,  $\pm 10\%$ , 50/60 Hz  
230 Vac,  $\pm 10\%$ , 50/60 Hz

Maximum Consumption 20 VA

### Certifications

CE

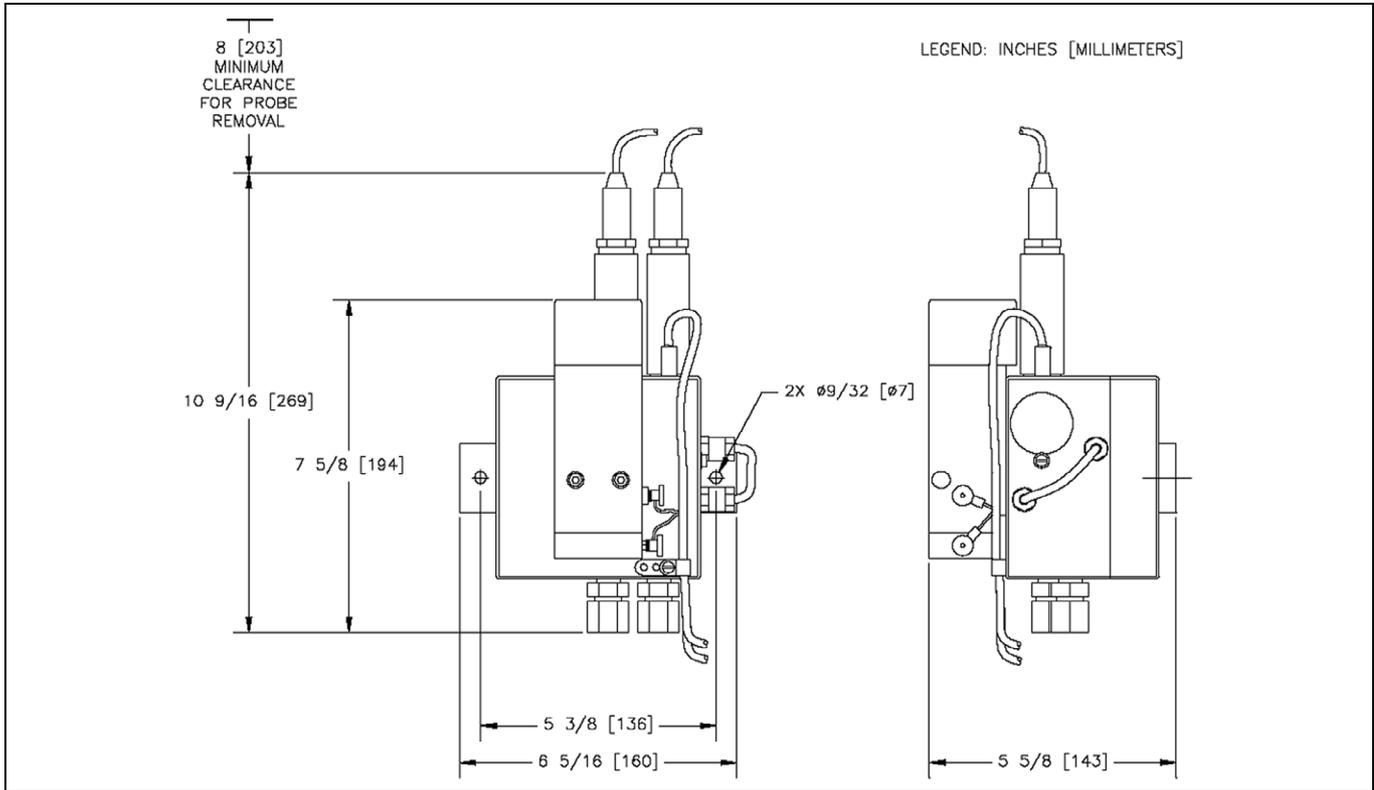
### Installation Guidelines

The AW400 performs best when installed following these simple guidelines:

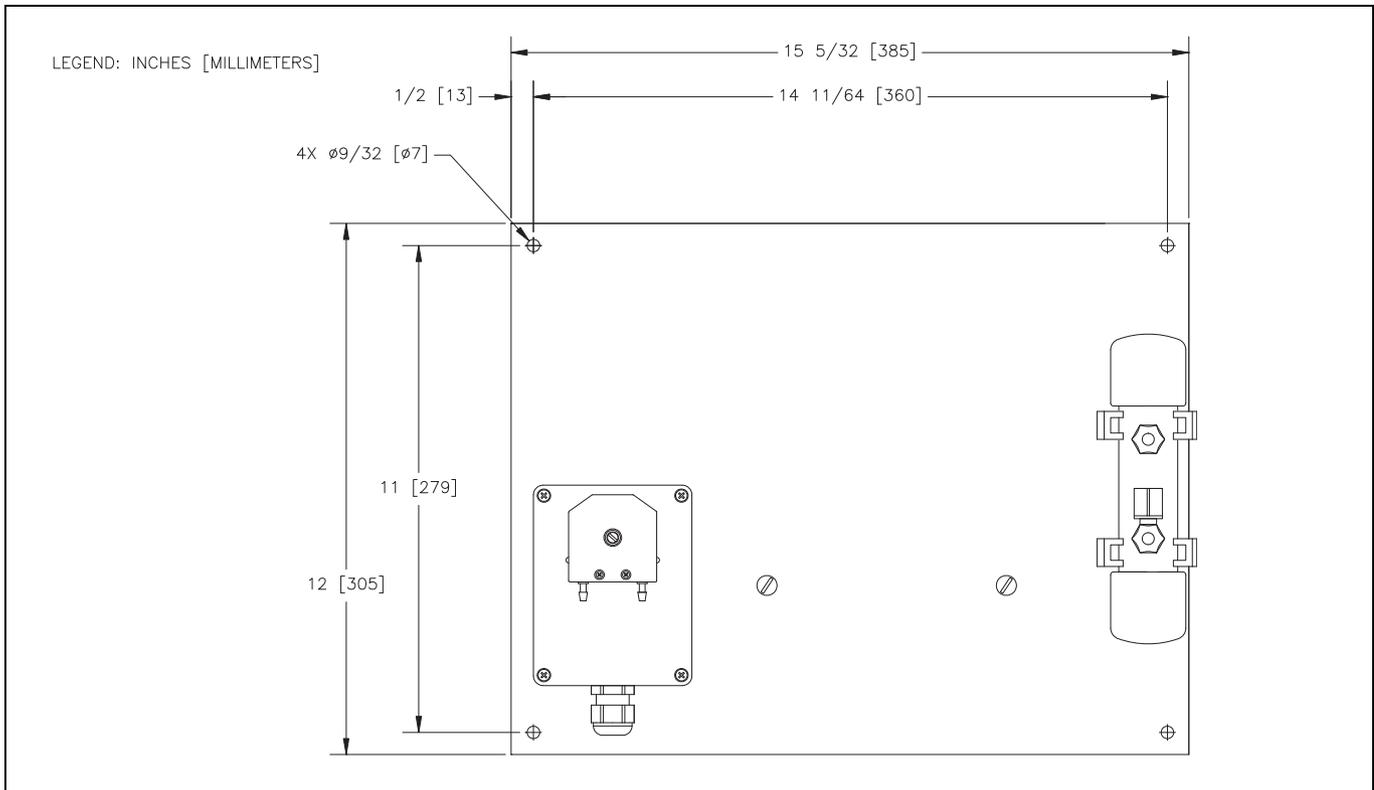
1. Do not allow the cell to be exposed to direct sunlight.
2. Use a sampling point that is significant for the process control.
3. Allow sufficient access for maintenance operations.
4. Install in an area that is completely free of vibration.
5. Install in an area that is as far as possible from rotating or electrical commutation devices.
6. Ensure air bubbles in the sample are kept to a minimum. Frequent and large air bubbles will make the reading unstable.
7. Ensure calibration is performed on the complete system i.e. the monitor and measuring cell(s).
8. Use polyethylene or PVC tubing for delivery of the water sample.
9. Do not shorten the soft overflow tube and ensure it can drain freely without back pressure.

**Note.** It is advisable that sample drain into a non-metallic pipe due to the corrosive nature of chlorinated, ozonated and bromated waters.

**Dimensions**

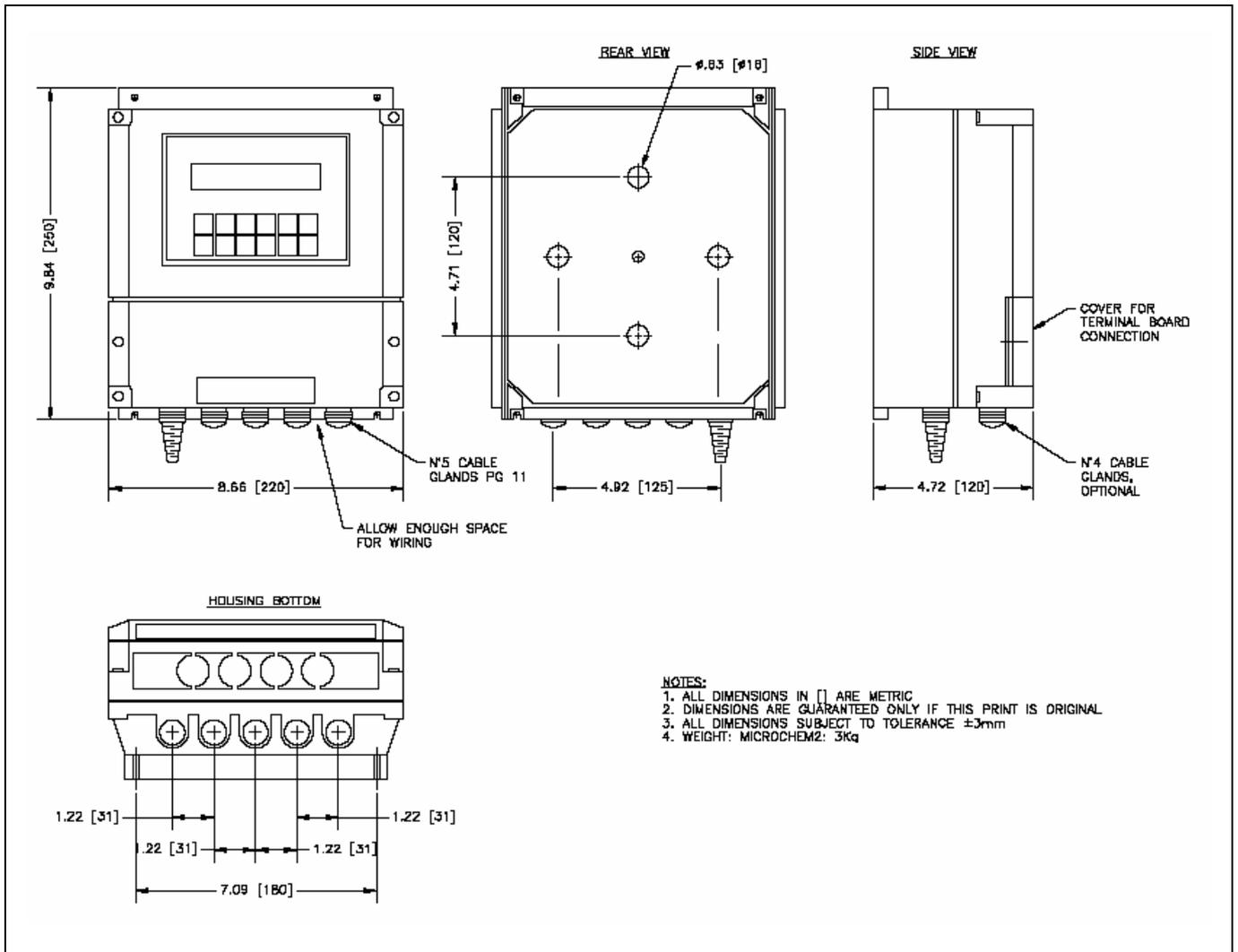


*Mounting Dimensions – AW400 Cell*



*Mounting Dimensions – Reagent Feed Pump*

**AW400**  
Residual Chlorine Monitor



Mounting Dimensions – Transmitter

**AW400**  
Residual chlorine monitor

**Ordering Information**

Residual Chlorine Monitor	AW4	XX/	X	X	X	X
<b>Transmitter Type</b>						
Transmitter		01				
Transmitter with PID Control (Channel 1 only)		02				
<b>Sensor Type Channel 1</b>						
Chlorine Cell			1			
<b>Sensor Type Channel 2</b>						
No second input channel				0		
Chlorine Cell				1		
pH				6		
ORP				7		
Additional 4-20mA input/output (re-transmission or flow input)				8		
<b>Sensor Type Channel 3</b>						
No third input channel					0	
Chlorine Cell					1	
pH					6	
ORP					7	
<b>Transmitter Voltage</b>						
115V AC 50/60 Hz						1
230V AC 50/60 Hz						2

**Accessories**

**Residual Chlorine Reagent Feeder Assemblies\***

Reagent Feeder Assembly (Free Chlorine 115V AC) AW401 011

Reagent Feeder Assembly (Free Chlorine 230V AC) AW401 012

Reagent Feeder Assembly (Total Chlorine 115V AC) AW401 013

Reagent Feeder Assembly (Total Chlorine 230V AC) AW401 014

\*Comes complete with tubing and reagent bottles

## Benefits Summary

- **Total and Free Residual Chlorine Measurement**
  - add potassium iodide to reagent to convert free chlorine measurement to total chlorine
- **Reagentless Operation**
  - reduced operating costs with reagentless operation at a pH of 7.5 or less
- **Multiple Sensor Input Capability**
  - reduced installation costs for multiple point monitoring operations
- **Self Cleaning Sensor Assembly**
  - prolongs sensor life and maintains accuracy
- **Fast Response Time**
  - instant response to changes of residual chlorine, unlike batch/DPD methods
- **Pressure Regulated Sample Flow**
  - no additional plumbing required to ensure optimum sample delivery rate and pressure
- **PID Control Available**
  - no costly separate controllers needed
- **Field Changeable Configuration**
  - easily reconfigured in the field from a single input device to a two or three input device
- **Minimal Sample Consumption**
  - less than 1 liter (0.22 galls) per minute flow rate required for accurate operation
- **Automatic Temperature Compensation**
  - ensures accuracy and repeatability

# Contact us

## **ABB Limited**

### **Process Automation**

Oldends Lane  
Stonehouse  
Gloucestershire GL10 3TA  
UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Inc.**

### **Process Automation**

125 E. County Line Road  
Warminster  
PA 18974  
USA

Tel: +1 215 674 6000

Fax: +1 215 674 7183

[www.abb.com](http://www.abb.com)

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3KXA843401R1001

DS/AW400-EN Rev. D 12.2010

# TB82

## Conductivity transmitters

### 2-Wire

Loop-powered transmitters  
that reduce installation costs in  
hazardous areas



#### Intuitive user interface

- Easy to use menus guide the operator through set-up, calibration and maintenance

#### Full range of conductivity sensors

- Make measurements in ultra-pure or high conductivity applications

#### Advanced Digital Communications

- Available with PROFIBUS® PA, FOUNDATION™ Fieldbus or HART communications

#### Hazardous area transmitters

- Withstand the harshest environments
- NEMA 4X / IP65 housings

#### Large, Easy-to-Read Display

- Shows primary measurement along with user-selectable secondary display (temperature, output current or sensor input)

#### Programmable Security Codes

- Prevents unauthorized modifications to transmitter configuration and calibration

#### Intrinsically Safe, Non-incendive Design

- Permits use in hazardous areas

## General Description

The ABB TB82 Series of two-wire conductivity transmitters are available in three base configurations to utilize ABB's two-electrode, four-electrode or toroidal (electrodeless) sensors, allowing for installations ranging from ultra-pure water to the most difficult chemical applications.

The TB82 Series is available with traditional programmable outputs or with advanced digital communications utilizing FOUNDATION Fieldbus (FF), PROFIBUS PA (PA) or HART.

Setup, maintenance and operation in the field is simple. Easy to follow instructions appear above each Smart Key. The user-friendly interface provides for straightforward transmitter configuration and calibration.

A unique secondary display clearly defines each menu option when programming the transmitters. During normal operation, the secondary display may be configured to show process temperature, current output, concentration type, raw conductivity or software revision depending upon configuration.

The TB82 series transmitters meet current CE, NEMA 4X, IP65, CSA, FM, ATEX and FISCO requirements.

## Sensor Compatibility and Ranges

Sensor compatibility is determined by the TB82 model number. The TB82 Series is available in three base configurations. The TB82TE connects to ABB 2-electrode sensors, TB82EC to ABB 4-electrode sensors, and TB82TC to ABB toroidal sensors. A menu choice during programming makes changing from one cell constant or sensor group simple; no jumpers or manual adjustments required.

## Temperature Compensation

The TB82 is compatible with a variety of automatic temperature compensation elements. See Specification section.

## Programmable Security Code

The transmitter has a three-digit security code to prevent unauthorized modifications that may be applied to any combination of the following menus: Calibration, Output/Hold, Security, and Configure.

## Basic or Advanced Programming Modes

(FOUNDATION Fieldbus, PROFIBUS PA models and HART available in Advanced mode only)

Available with either Basic or Advanced programming modes at time of purchase, the Advanced mode offers an expanded feature set for more complex operations, such as:

- **Nonlinear and concentration analyzer modes**

Available Mode	TB82TE	TB82EC	TB82TC
0 to 15% NaOH		•	•
0 to 20% NaCl		•	•
0 to 18% HCl		•	•
0 to 20% H <sub>2</sub> SO <sub>4</sub>		•	•
User-defined	•	•	•

- **Advance temperature compensation modes**

Available Mode	TB82TE	TB82EC	TB82TC
0 to 15% NaOH		•	•
0 to 20% NaCl		•	•
0 to 18% HCl		•	•
0 to 20% H <sub>2</sub> SO <sub>4</sub>		•	•
User-defined	•	•	•
Pure water neutral salt	•	•	
Pure water trace base	•	•	
Pure water trace acid	•	•	

- **Analog pulse diagnostic output**

Impresses a user-defined 0.16 to 16 mA pulse on the 4 to 20 mA output to alert operator of a fault condition. (Not available on transmitters with digital communication.)

## Diagnostics

The transmitter constantly monitors both itself and the sensor to ensure reliability and accuracy. Upon detection of a diagnostic condition, the transmitter provides diagnostic notification by flashing FAULT on the display and supplying a pulse on the analog output (if activated on non-HART devices).

Transmitters equipped with Foundation Fieldbus or PROFIBUS PA send a complete diagnostic description over the network to the controller. This allows for easy, immediate troubleshooting. Pressing FAULT info on the transmitter provides a short description and fault codes on the secondary display. The FAULT icon remains active until problem has been resolved.

## Adjustable Damping

Damping is helpful in process environments where noise is present. It is a capacitive type lag where reaction to any signal change is slowed according to the entered time constant. For example, the response to a step input change reaches approximately 63 percent of its final value in five seconds for five seconds of damping.

## Communications

**FOUNDATION Fieldbus (FF)** addresses modern instrument users' needs for flexibility and cost savings, while providing a whole host of additional features.

- Measurement variable quality and diagnostic conditions transmitted during each scheduled data transfer
- Easily configured remotely or locally
- Transmission of multiple process variables utilizes two Analog Input Blocks (AI)
- Transmitter characteristics such as device name, manufacturer and serial number via a Standard Resource Block
- Configuration and calibration capability via custom Enhanced Transducer Block
- Provides calibration Methods on supported host tools and systems

**PROFIBUS PA (PA)** is a standardized, open, digital communications system for process automation.

- Configuration, calibration and trending available via a Device Type Manager (DTM) when used on compatible host tools and systems
- Measurement variable quality and diagnostic conditions transmitted during each scheduled data transfer
- Remote and local configuration capability
- Choice of Standard Analyzer Profile or Manufacturer Specific Profile — conforms to PROFIBUS PA Profile requirements v. 3.0
- GSD files available on all product variations
- Utilizes one Physical, one Transducer, and two

**HART** communications protocol provide remote programming via any HART compatible primary or secondary communications device.

- Digital communications through a low-level modulation superimposed on the standard 4-to-20 mA current loop
- Accommodates Universal, Common Practice and Device Specific Command Sets for functionality within HART networks and for use with HART hand-held terminals
- Driver files for various host systems and tools available

### Calibration

The TB82 features a simple and straightforward one-point or two-point calibration of the primary process variable and temperature. Calibration data may be manually edited.

### Specifications

#### Type

- 2-wire Conductivity Transmitter:
- 2-Electrode Model TB82TE
  - 4-Electrode Model TB82EC
  - Toroidal Model TB82TC

#### Input Sensor Types

- TB82TE: ABB 2-electrode sensors
- TB82EC: ABB 4-electrode sensors
- TB82TC: ABB toroidal sensors

### Input Temperature Compensation Types

Temperature Element	TB82TE	TB82EC	TB82TC
Pt 100	•	•	•
Pt 1000	•		•
3 kΩ RTD		•	•
4.75 kΩ RTD		•	

### Temperature Display Range

-20° to 300°C (-4° to 572°F)

### Advance Temperature Compensation Modes

Mode	TB82TE	TB82EC	TB82TC
0 to 15% NaOH		•	•
0 to 20% NaCl		•	•
0 to 18% HCl		•	•
0 to 20% H <sub>2</sub> SO <sub>4</sub>		•	•
User-defined	•	•	•
Pure water neutral salt	•	•	
Pure water trace base	•	•	
Pure water trace acie	•	•	

## Measurement Ranges

### 2-Electrode Conductivity - Model (TB82TE)

Cell Constant	Measurement Range	Display Resolution	Auto-range
0.01	0 to 199.9 $\mu\text{S/cm}$	0.001 $\mu\text{S/cm}$	0 to 1,999 $\mu\text{S/cm}$ 0 to 19.99 $\mu\text{S/cm}$ 0 to 199.9 $\mu\text{S/cm}$
0.10	0 to 1999 $\mu\text{S/cm}$	0.01 $\mu\text{S/cm}$	0 to 19.99 $\mu\text{S/cm}$ 0 to 199.9 $\mu\text{S/cm}$ 0 to 1,999 $\mu\text{S/cm}$
1.00	0 to 19.99 $\text{mS/cm}$	0.1 $\mu\text{S/cm}$	0 to 199.9 $\mu\text{S/cm}$ 0 to 1,999 $\mu\text{S/cm}$ 0 to 19.99 $\text{mS/cm}$

### 4-Electrode Conductivity - Model TB82EC

Sensor Group	Measurement Range	Display Resolution	Auto-range
A	0 to 1999 $\text{mS/cm}$	0.1 $\mu\text{S/cm}$	0 to 199.9 $\mu\text{S/cm}$ , 0 to 1,999 $\mu\text{S/cm}$ 0 to 19.99 $\text{mS/cm}$ , 0 to 199.9 $\text{mS/cm}$ 0 to 1,999 $\text{mS/cm}$
B	0 to 1999 $\mu\text{S/cm}$	0.01 $\mu\text{S/cm}$	0 to 19.9 $\mu\text{S/cm}$ , 0 to 199.9 $\mu\text{S/cm}$ 0 to 1,999 $\mu\text{S/cm}$

### Toroidal Conductivity - Model TB82TC

Sensor Group	Measurement Range	Display Resolution	Auto-range
Toroidal	0 to 1999 $\text{mS/cm}$	0.1 $\mu\text{S/cm}$	0 to 199.9 $\mu\text{S/cm}$ , 0 to 1,999 $\mu\text{S/cm}$ 0 to 19.99 $\text{mS/cm}$ , 0 to 199.9 $\text{mS/cm}$ 0 to 1,999 $\text{mS/cm}$

### Accuracy

Display:  $\pm 0.5\%$  of measurement range per decade (TB82EC,TC)  
 $\pm 1.0\%$  of measurement range per decade (TB82TE)

Output:  $\pm 0.02$  mA

Temperature:  $1^\circ\text{C}$  or  $1^\circ\text{F}$

### Repeatability

Display:  $\pm 0.5\%$  of measurement range per decade (TB82EC & TC)  
 $\pm 1.0\%$  of measurement range per decade (TB82TE)

Output:  $\pm 0.02$  mA

Temperature:  $1^\circ\text{C}$  to  $1^\circ\text{F}$

### Stability

Display:  $\pm 2$  LSD typical,  $\pm 5$  LSD max

Output:  $\pm 0.01$  mA

Temperature:  $1^\circ\text{C}$  or  $1^\circ\text{F}$

### Output

Isolated 4-20 mA, Linear and Non-linear (non-fieldbus models)

### Output Minimum Span

Sensor	TB82TE	TB82EC	TB82TC
Cell Constant 0.01	1 $\mu\text{S/cm}$		
Cell Constant 0.10	10 $\mu\text{S/cm}$		
Cell Constant 1.00	100 $\mu\text{S/cm}$		
Group A		100 $\mu\text{S/cm}$	
Group B		10 $\mu\text{S/cm}$	
Toroidal			100 $\mu\text{S/cm}$

Concentration: 5% of maximum configured concentration

### Output Maximim Span (Full scale settings)

Sensor	TB82TE	TB82EC	TB82TC
Cell Constant 0.01	199.9 $\mu\text{S/cm}$		
Cell Constant 0.10	1999 $\mu\text{S/cm}$		
Cell Constant 1.00	19.99 $\text{mS/cm}$		
Group A		1999 $\text{mS/cm}$	
Group B		1999 $\mu\text{S/cm}$	
Toroidal			1999 $\text{mS/cm}$

Concentration: 1999 digits

### Damping

Adjustable: 0.0 to 99.9 seconds

### Environmental (Temperature)

Operating:  $-20^\circ$  to  $60^\circ\text{C}$  ( $-4^\circ$  to  $140^\circ\text{F}$ )

LCD:  $-20^\circ$  to  $60^\circ\text{C}$  ( $-4^\circ$  to  $140^\circ\text{F}$ )

Storage:  $-40^\circ$  to  $70^\circ\text{C}$  ( $-40^\circ$  to  $158^\circ\text{F}$ )

Humidity: up to 95% RH

### Enclosure

NEMA 4X and IP65, anodized aluminum alloy with polyester powder coating

### Size (1/2 DIN)

H x W x D: 144.0 x 144.0 x 171.0 mm  
(5.67 x 5.67 x 6.73 in.)

Min. panel depths: 144.8 mm (5.70 in.)

Max. panel thickness: 9.5 mm (0.38 in.)

Panel cutout:  
135.4 [+1.3, -0.8] by 135.4 [+1.3, -0.8] mm  
(5.33 [+0.05, -0.03] by 5.33 [+0.05, -0.03] in.)

Weight: 1.9 kg (4.2 lb)  
3.4 kg (7.5 lb) with pipe mounting hardware

### Conduit Connections

Two (2) each: 22.2 mm (0.875 in.) holes in enclosure that accepts 1/2 inch hubs

### Lightning Suppressor

Installed integral to the transmitter to suppress lightning induced transients. Tested to suppress 10 successive 8 by 20- $\mu\text{sec}$  pulses with a peak value of 20 kA (reference IEEE C62.41)

## Power Requirements

Standard:	14.0 to 53 VDC (14.0-42 VDC for certified applications)
HART:	14 to 53 VDC (14-42 VDC for certified applications). For HART communication, a 250 $\Omega$ resistor is required; 19 VDC minimum voltage required. 14 VDC required for liftoff
Foundation Fieldbus & PROFIBUS PA bus powered:	9-32 VDC (non-I.S. model) 9-24 VDC (I.S. model) 15 mA quiescent current consumption

## Agency Certifications

### ATEX 100A

ATEX Category II 1G; EEX ia, Zone 1; Group IIC, T4 when used with appropriate barriers

### Canadian Standards Association (CSA)

Intrinsic safety: Class I, II, III; Division 1; applicable Groups A, B, C, D, E, F and G; when used with appropriate barriers. T3C

Non-incendive: Class I, Division 2, Groups A, B, C, and D. Class II, Division 2, Groups E, F and G. Class III, Division 2

### Factory Mutual (FM)

Intrinsic Safety: Class I, II, III; Division 2; applicable Groups A, B, C, D, E, F and G; when used with appropriate barriers. T3C (Max ambient Temperature: 60° C

Non-incendive: Class I, Division 2, Groups A, B, C, and D. Class II, Division 2, Groups F and G. Class III, Division 2. T5

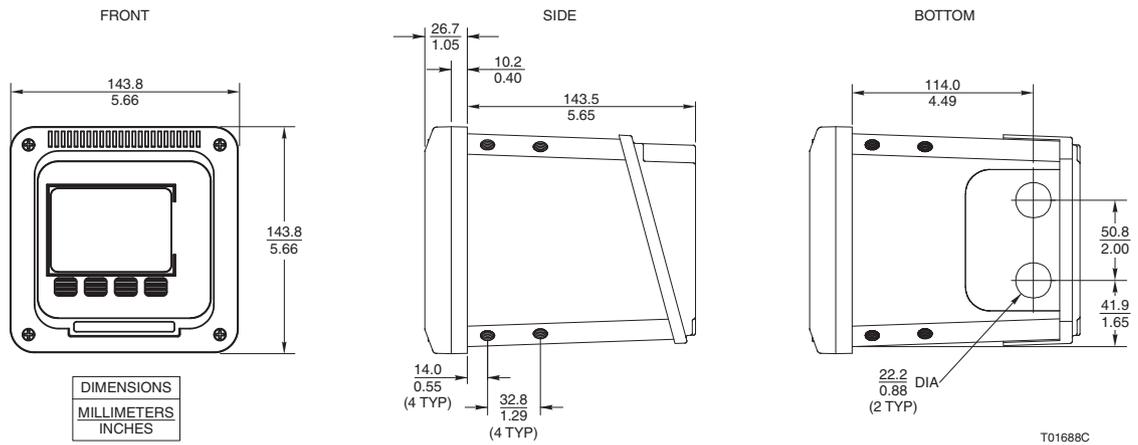
### Fieldbus Intrinsically Safe Concept (FISCO)

Fieldbus products (FF and PA) meets the requirements for the FISCO model

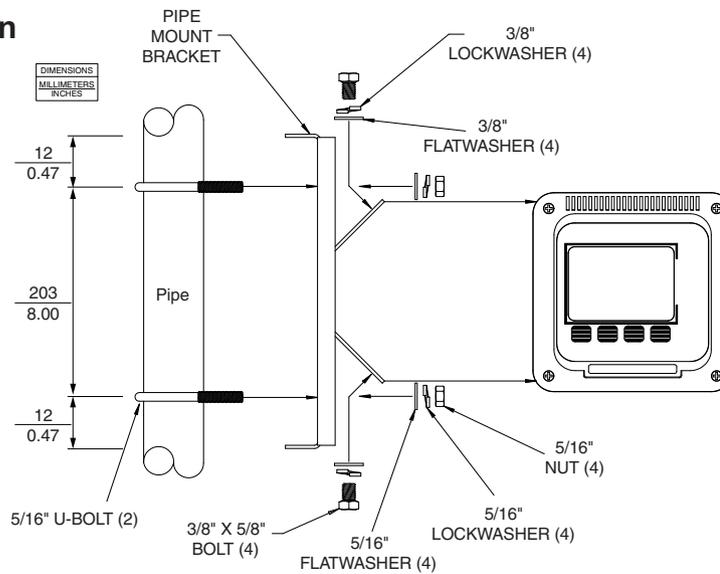
### EMC Requirements

CE Certified — complies with all applicable European Community product requirements, specifically those required to display the CE markings on the product nameplate.

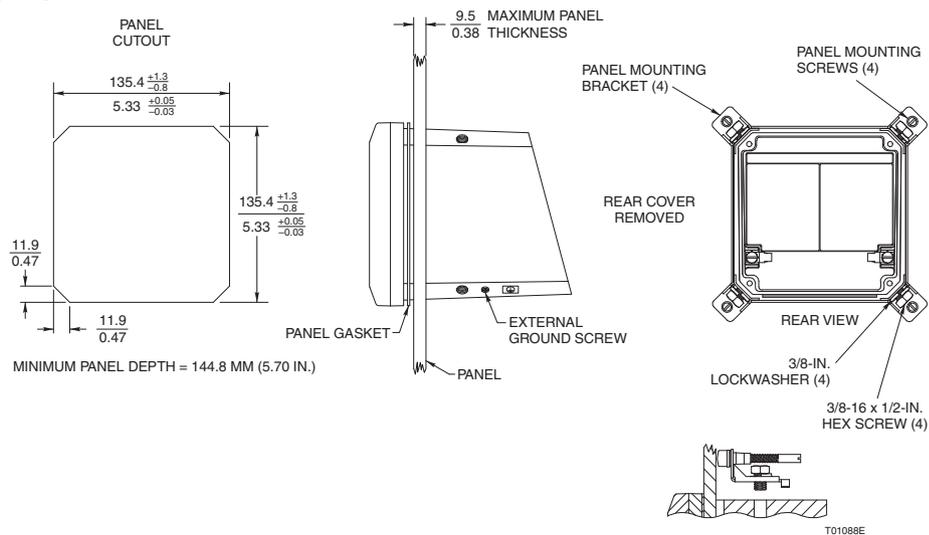
## Overall Dimensions



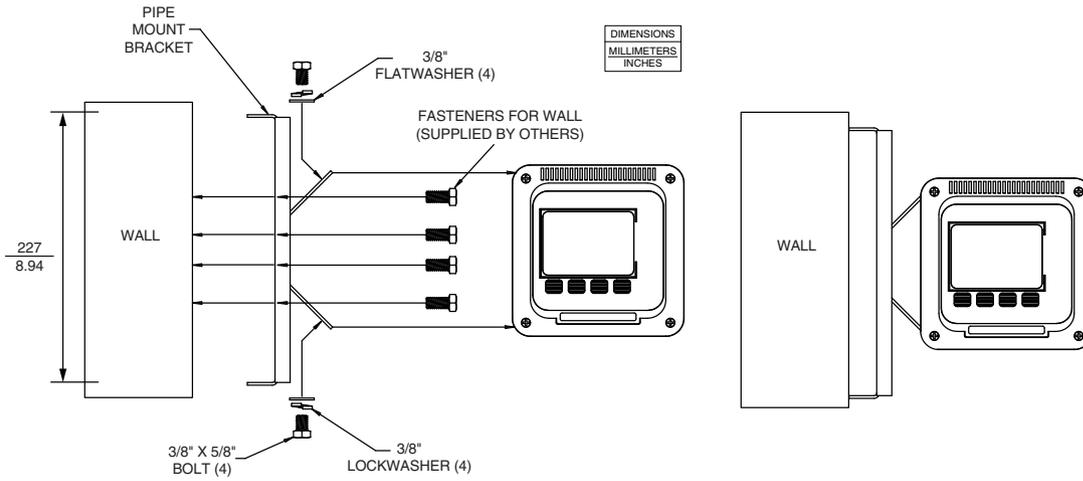
## Pipe Mounting Option



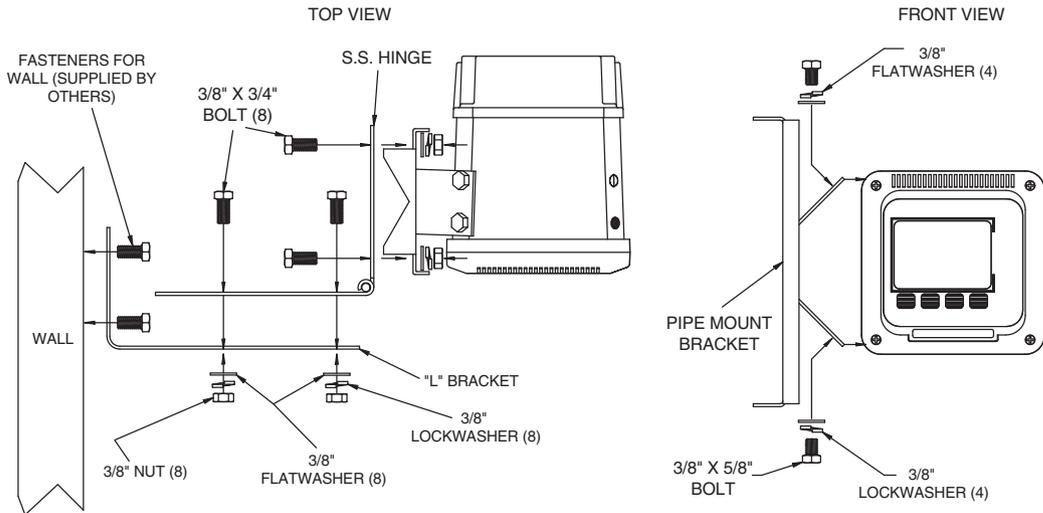
## Panel Mounting Option



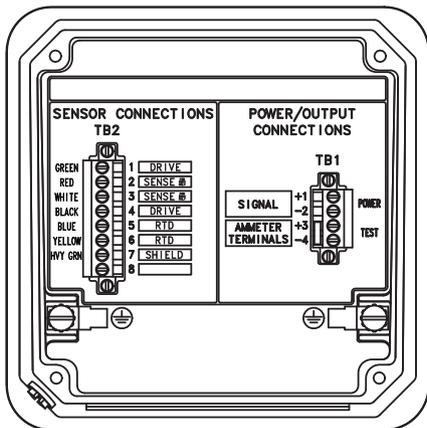
### Wall (Side) Mounting Option



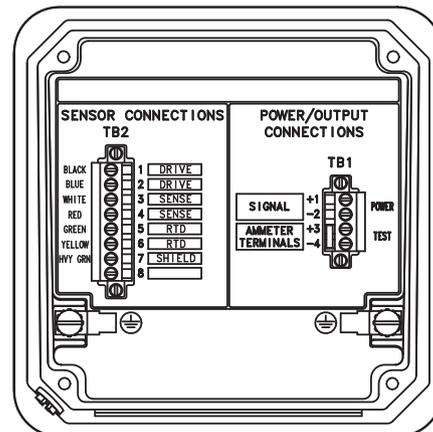
### Wall/Hinge (Rear) Mounting Option



### Terminal Blocks



TB82EC and TB82TE  
2-electrode & 4-electrode



TB82TC  
Toroidal (Electrodeless)

	Model TB82	XX	X	X	1	0	X	X	X
<b>Base Model</b>	T B 8 2								
<b>Input Type</b>									
2-Electrode		T							
4-Electrode		E							
Toroidal (Electrodeless)		C							
		T							
		C							
<b>Programming Option<sup>1</sup></b>									
Basic			1						
Advanced			2						
<b>Digital Communications Option</b>									
None (Analog Only)				0					
HART				1					
FOUNDATION Fieldbus				2					
PROFIBUS PA				3					
<b>Lightning Suppressor</b>									
Included					1				
<b>Housing Type</b>									
Powder Coated Aluminum						0			
<b>Mounting Options</b>									
None							0		
Pipe							1		
Wall/Hinge (Rear Mount)							2		
Panel							3		
Wall (Side Mount)							4		
<b>Agency Approvals</b>									
None								0	
FM (Factory Mutual)								1	
CSA (Canadian Standards Association)								2	
ATEX 100A								3	
<b>Tag</b>									
None									0
Stainless									1
Mylar									2

**Accessories:**

Part Number	Description
4TB9515-0123	Panel Mounting Kit
4TB9515-0124	Pipe Mounting Kit
4TB9515-0125	Hinge Mounting Kit
4TB9515-0156	Wall Mounting Kit

**Product Instruction Manuals:** (One copy supplied with instrument at no charge)

Notes:

- Advanced *Programming Option* must be selected for HART, FOUNDATION Fieldbus or PROFIBUS PA *Digital Communication Option*



TB82EC 4-Electrode Transmitter

TB82TC Toroidal Transmitter

TB82TE 2-Electrode Transmitter

**Notes**

# Contact us

## **ABB Inc.**

### **Process Automation**

843 N Jefferson Street

PO Box 831

Lewisburg 24901-9509

USA

Tel: +1 800 HELP 365 (435 7365)

Fax: +1 304 647 1862

## **ABB Limited**

### **Process Automation**

Oldends Lane

Stonehouse

Gloucestershire GL10 3TA

UK

Tel: +44 1453 826 661

Fax: +44 1453 829 671

## **ABB Engineering (Shanghai) Ltd.**

### **Process Automation**

No. 5, Lane 369, Chuangye Road

201319, Shanghai,

P.R. China

Phone: +86 (0) 21 6105 6666

Fax: +86 (0) 21 6105 6992

Mail: china.instrumentation@cn.abb.com

**[www.abb.com](http://www.abb.com)**

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